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PRODUCT CATALOG

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Transceivers
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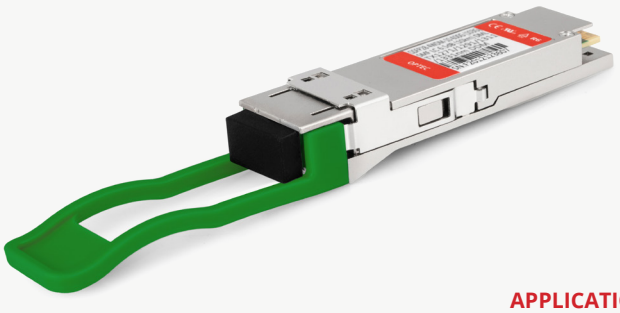
TRANSCEIVERS

QSFP28-DD OPTEC, 4x100G, SM LC, DDM, SERIES

QSFP28-400G-SM-0XX-LC



QSFP28-DD OPTEC, 4x100G, SM LC, DDM, SERIES - the transceiver modules are designed for use in 400 Gigabit Ethernet links on up to 500m/2km/10km of single mode fiber. They are compliant with the QSFP-DD MSA, QSFP28 MSA1, IEEE P802.3cu7 specifications and portions of the P802.3bs8 specification. Digital diagnostic functions are available via the I2C interface, as specified by the QSFP28 MSA and Finisar Application Note AN-20xx5 specs. The transceiver is RoHS-6 compliant per Directive 2011/65/EU4 and Finisar Application Note AN-20385.

APPLICATIONS

400G FR4 applications with FEC •

FEATURES

- Hot-pluggable QSFP-DD type 2 form factor
- Supports 425Gb/s aggregate bit rate
- Power dissipation < 12W
- RoHS-6 compliant (lead-free)
- Operating Temperature: Standard: 0°C to +70 °C
- Single 3.3V power supply
- Aligned with IEEE P802.3cu
- 4x100Gb/s PAM4 serial lanes
- Duplex LC receptacles
- I2C interface with integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP28-DD OPTEC, 4x100G, SM LC, DDM, SERIES	400Gbps	SMF	500m/2km/10km	LC	Standard	YES

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.3	4.0	V
Operating Relative Humidity	RH	15	85	%

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
Power Supply Voltage	V_{CC}		3.135	3.3	3.465	V
Power Dissipation	P_D		-	-	12.0	W

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Differential Input amplitude	-	900	-	-	mV	-
Differential input return loss	-	Per equation (83E–5) IEEE802.3bm			dB	-
Differential to common mode input return loss	-	Per equation (83E–6) IEEE802.3bm			dB	-
Differential termination mismatch	-	-	-	10	%	-
Module stress input test	-	Per 120E.3.4.1 IEEE802.3bs			dB	-
Single-ended voltage tolerance range	-	-0.4	-	3.3	V	-
DC common mode voltage	-	-350	-	2850	mV	-

RECEIVER						
AC common-mode output voltage (RMS)	-	-	-	17.5	mV	-
Differential output voltage	-	-	-	900	mV	-
Near-end ESMW (Eye symmetry mask width)	-	0.265	-	-	UI	-
Near-end Eye height, differential (min)	-	70.0	-	-	mV	-
Far-end ESMW (Eye symmetry mask width)	-	0.2	-	-	UI	-
Far-end Eye height, differential (min)	-	30.0	-	-	mV	-
Far-end pre-cursor ISI ratio	-	-4.5	-	2.5	dB	-
Differential output return loss	-	Per equation 83E-2 IEEE802.3bm			-	-
Common to differential mode conversion return loss	-	Per equation 83E-3 IEEE802.3bm			-	-
Differential termination mismatch	-	-	-	10	%	-
Transition time (min, 20% to 80%)	-	9.5	-	-	ps	-
DC common mode voltage (min)	-	-350	-	2850	mV	-

Optical Characteristics

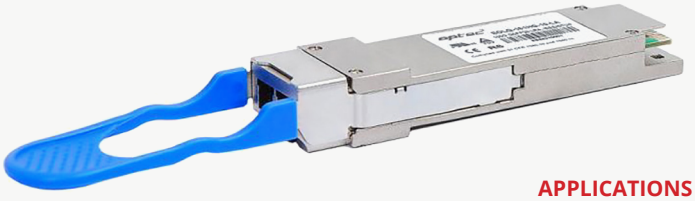
Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITTER					
Side-mode suppression ratio (SMSR)	-	30	-	-	dB
Total average launch power	-	-	-	10.4	dBm
Average launch power, each lane	-	-	-	4.4	dBm
Average launch power, each lane	-	-3.2	-	-	dBm
Difference in launch power between any two lanes (OMAouter) max	-	-	-	3.9	dBm
Launch power in OMAouter minus TDECQ, each lane	-	-1.7	-	-	dBm
Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane	-	-	-	3.4	dB
Transmitter eye closure for PAM4 (TECQ), each lane	-	-	-	3.4	dB
TDECQ – TECQ	-	-	-	2.5	dB
Average launch power of OFF transmitter, each lane	-	-	-	-16.0	dBm
Extinction ratio	3.5	-	-	-	dB
Transmitter transition time	-	-	-	17.0	pS
Transmitter over/under-shoot	-	-	-	22.0	dB
Transmitter power excursion	-	-	-	1.8	pS
Optical return loss tolerance	-	-	-	17.1	dB
Transmitter reflectance	-	-	-	-26.0	dBm
RECEIVER					
Damage threshold, each lane	-		5.4		dBm
Average receive power, each lane		-7.2	-	4.4	dBm
Receive power (OMAouter), each lane	-	-	-	3.7	dBm
Difference in receive power between any two lanes (OMAouter)		-	-	4.1	dB
Receiver reflectance	-	-	-	-26	dB
Receiver sensitivity (OMAouter), each lane		-	-	-2.6	dBm
Conditions of stressed receiver sensitivity test:					
Stressed eye closure for PAM4 (SECQ), lane under test	-		3.4		dB
OMAouter of each aggressor lane	-		1.5		dBm

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
ROHS	2011/65/EU

QSFP28 CWDM4 OPTEC, 100G, SM LC, 2KM, TX1330/1310/1290/1270, DDM (QSFP28-100GBASE-CLR4)

QSFP28-100G-SM-002-LC-CLR4



QSFP28 CWDM4 OPTEC, 100G, SM LC, 2KM, TX1330/1310/1290/1270, DDM (QSFP28-100GBASE-CLR4) transceiver module is designed for use in 103 Gigabit Ethernet links over 2Km single mode fiber. They are compliant with the IEEE 802.3ba. Digital diagnostics functions are available via an I2C interface

APPLICATIONS

- 100G Ethernet
- Data center

FEATURES

- Supports 103Gbps
- Single 3.3V Power Supply and Power dissipation < 3.5W
- Up to 2km over SMF
- RoHS-6 compliant (lead-free)
- Commercial case temperature range of 0°C to 70°C
- Four 25Gbps DFB base CWDM channels on transmitter side
- PIN and TIA array on the receiver side
- 4x25G electrical interface
- Duplex LC receptacles
- I^2C interface with integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP28 CWDM4 OPTEC, 100G, SM LC, 2KM, TX1330/1310/1290/1270, DDM (QSFP28-100GBASE-CLR4)	103Gbps	SMF	2km	LC	0°C~+70°C	YES

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	85	°C
Supply Voltage	Vcc	0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	0		70	°C
Power Supply Voltage	V_{cc}	3.15	3.3	3.45	V
Power Dissipation	P_D	5	-	-	W

Performance Specifications - Electrical

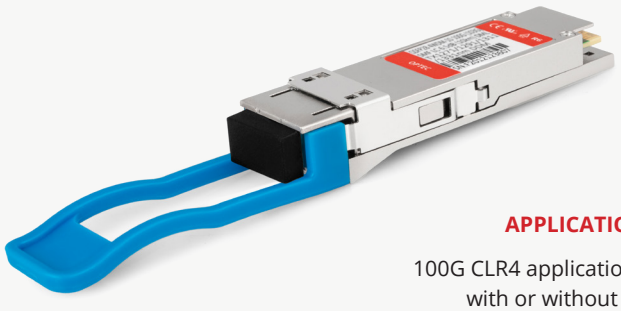
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
TRANSMITTER						
Differential Input amplitude	-	150	-	1050	mv_{p-p}	
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC
RECEIVER						
Differential output amplitude	-	200	-	1100	mv_{p-p}	
Output Rise/Fall Time	Zout	85	100	115	ohms	
Output Rise/Fall Time	tr/tf	24	-	-	ps	10%~90%

Optical Characteristics / 100GBASE-LR4 Operation					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Lane_0 Center Wavelength	λ_{C0}	1264.5		1277.5	nm
Lane_1 Center Wavelength	λ_{C1}	1284.5		1297.5	nm
Lane_2 Center Wavelength	λ_{C2}	1304.5		1317.5	nm
Lane_3 Center Wavelength	λ_{C3}	1324.5		1337.5	nm
Total Average Output Power*(Note3)	Po			8.5	dBm
Average Launch Power per Lane	Peach	-6.5		2.5	dBm
Optical modulation amplitude	Poma	-4.0		2.5	dBm
Side Mode Suppression Ratio	SMSR	30			dB
Optical Return Loss Tolerance				20	dB
Extinction Ratio*(Note4)	ER	3.5			dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}*(Note7)			IEEE 802.3		
RECEIVER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Damage threshold	Rdam	5.5			dBm
Lane_0 Center Wavelength	λ_{C0}	1264.5		1277.5	nm
Lane_1 Center Wavelength	λ_{C1}	1284.5		1297.5	nm
Lane_2 Center Wavelength	λ_{C2}	1304.5		1317.5	nm
Lane_3 Center Wavelength	λ_{C3}	1324.5		1337.5	nm
Average Receive Power per Lane	Rpow	-11.5		2.5	dBm
Receive Sensitivity in OMA per Lane*(Note5)	Pmin			-10	dBm
Optical Return Loss	ORL			-26	dB
LOS Assert	LOSA	-20.6			dBm
LOS De-Assert	LOSD			-11.6	dBm
LOS Hysteresis*(Note7)		0.5			dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

QSFP28 OPTEC, 100G, SM LC, 2km, TX1271/1291/1311/1331, DML, DDM (QSFP28-100GBASE-CLR4)

QSFP28-100G-SM-002-LC-CLR4



QSFP28 OPTEC, 100G, SM LC, 10KM, 4XTX1310-DML, DDM (QSFP28-100GBASE-LR4) transceiver module is designed for use in 100 Gigabit Ethernet links over 2km single mode fiber. They are compliant with the QSFP28 MSA, CWDM4 MSA, 100G-CLR4, and portions of IEEE 802.3bm.

APPLICATIONS

100G CLR4 applications • with or without FEC

FEATURES

- Supports 103Gbps
- Single 3.3V Power Supply and Power dissipation < 3.5W
- Up to 2km over SMF
- RoHS-6 compliant (lead-free)
- Commercial case temperature range of 0°C to 70°C
- 4*25Gbps DFB-based CWDM transmitter
- PIN and TIA array on the receiver side
- 4x25G electrical interface
- Duplex LC receptacles

I2C interface with integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP28 OPTEC, 100G, SM LC, 2KM, TX1271/1291/1311/1331, DML, DDM (QSFP28-100GBASE-CLR4)	103Gbps	SMF	2km	LC	Standard	YES

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	25	70	°C
Power Supply Voltage	V_{CC}		3.135	3.3	3.465	V
Power Dissipation	P_D				3.5	W

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Differential data input swing per lane				900	mv_{p-p}	
Input Impedance (Differential)	Zin			10	%	
Stressed input parameters						
Eye width		0.46			UI	
Applied pk-pk sinusoidal jitter		IEEE 802.3bm Table 88-13				
Eye height		95			mv	
DC common mode voltage		-350		2850	mv	

RECEIVER

Differential output amplitude		200		900	mv_{p-p}	
Output Impedance (Differential)	Zout			10	%	

Output Rise/Fall Time	tr/tf	12			ps	20%~80%
Eye width		0.57			UI	
Eye height (Differential)		228			mv	
Vertical eye closure				5.5	dB	

Optical Characteristics / 100GBASE-LR4 Operation

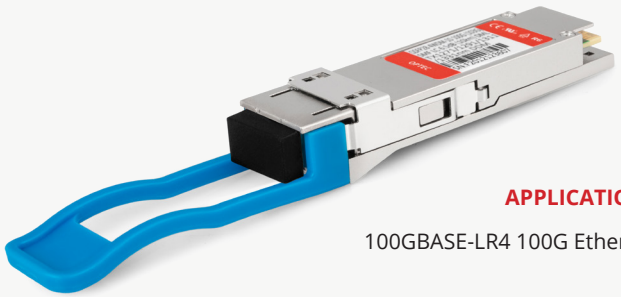
Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Lane_0 Center Wavelength	λ_{C0}	1264.5		1277.5	nm
Lane_1 Center Wavelength	λ_{C1}	1284.5		1297.5	nm
Lane_2 Center Wavelength	λ_{C2}	1304.5		1317.5	nm
Lane_3 Center Wavelength	λ_{C3}	1324.5		1337.5	nm
Total Average Output Power*(Note3)	Po			8.3	dBm
Average Launch Power per Lane	Peach	-6.5		2.3	dBm
Transmit OMA each Lane	TxOMA	-4.0		2.5	dBm
Launch power in OMA minus TDP, each lane	OMA-TDP	-5.0			dBm
Transmitter and Dispersion Penalty per Lane	TDP			3.0	dBm
Average launch power of OFF transmitter per lane				-30.0	dBm
Side Mode Suppression Ratio	SMSR	30			dBm
Optical Return Loss Tolerance				20.0	dB
Transmitter Reflectance				-12.0	dB
Extinction Ratio	ER	3.5			dB
RIN OMA	RIN			-130.0	dB/Hz
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}			
RECEIVER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Damage threshold	Rxdmg	3.3			dBm
Lane_0 Center Wavelength	λ_{C0}	1264.5		1277.5	nm
Lane_1 Center Wavelength	λ_{C1}	1284.5		1297.5	nm
Lane_2 Center Wavelength	λ_{C2}	1324.5		1317.5	nm
Lane_3 Center Wavelength	λ_{C3}	1299.02		1337.5	nm
Average receive power	Rxpow	-10		2.3	dBm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Receive Power (OMA) per Lane	RxOMA			2.5	dBm
Unstressed Receiver Sensitivity (OMA) per Lanewith FEC	Rxsens_F			-11.0	dBm
Unstressed Receiver Sensitivity (OMA) per Lane without FEC	Rxsens			-8.5	dBm
Stressed Receiver Sensitivity (OMA) per Lane with FEC	RXSRS_FEC			-8.5	dBm
Stressed Receiver Sensitivity (OMA) per Lane without FEC	RXSRS			-6.0	dB
Optical Return Loss	ORL			-26.0	dBm

Conditions of stressed receiver sensitivity test					
Stressed J2 Jitter with FEC	J2			TBD	dBm
Stressed J4 Jitter with FEC	J4			TBD	dB
Stressed J2 Jitter without FEC	J2			0.3	dBm
Stressed J9 Jitter without FEC	J9			0.47	dB
LOS Assert	LOSA	-25			dBm
LOS De-Assert	LOSD			-12	dBm
LOS Hysteresis		0.5			dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

QSFP28 OPTEC, 100G, SM LC, 10km, 4xTX29-31-DML, DDM (QSFP28-100GBASE-LR4)

QSFP28-100G-SM-010-LC-LR4



QSFP28 OPTEC, 100G, SM LC, 10km, 4xTX1310-DML, DDM (QSFP28-100GBASE-LR4) transceiver module is designed for 103Gigabit Ethernet links over 10km single mode fiber. It is compliant with IEEE 802.3ba 100GBASE-LR4/. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+MSA.

APPLICATIONS

100GBASE-LR4 100G Ethernet

FEATURES

- Supports 103Gbps
- Single 3.3V Power Supply and Power dissipation < 3.5W
- Up to 10km over SMF
- RoHS-6 compliant (lead-free)
- Commercial case temperature range of 0°C to 70°C
- Four 25Gbps DML LAN-WDM channels on transmitter side
- PIN and TIA array on the receiver side
- 4x25G electrical interface
- Duplex LC receptacles

I2C interface with integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP28 OPTEC, 100G, SM LC, 10KM, 4xTX29-31-DML, DDM (QSFP28-100GBASE-LR4)	103Gbps	SMF	10km	LC	Standard	YES

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0		70	°C
Power Supply Voltage	V_{CC}		3.135	3.3	3.465	V
Power Dissipation	P_D				3.5	W

Performance Specifications - Electrical

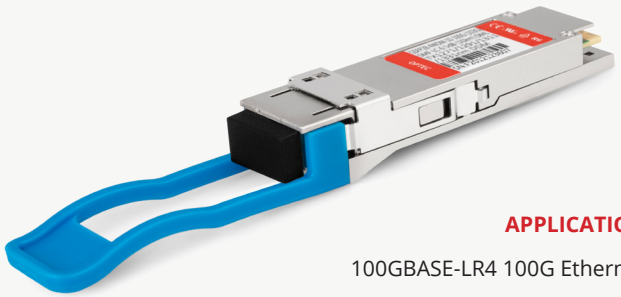
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
TRANSMITTER						
Input Amplitude (Differential)		150		1200	mv_{p-p}	
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC
RECEIVER						
Differential output amplitude		200		1100	mv_{p-p}	
Output Rise/Fall Time	Zout	85	100	115	ohms	
Output Rise/Fall Time	tr/tf		12		ps	10%~90%

Optical Characteristics / 100GBASE-LR4 Operation					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Total Average Output Power*(Note3)	Po			10.5	dBm
Average Launch Power per Lane	Peach	-4.3		4.5	dBm
Average launch power of OFF transmitter per lane				-30	dBm
Optical modulation amplitude	Poma	-1.3		4.5	dBm
Optical Return Loss Tolerance				20	dB
Extinction Ratio*(Note4)	ER	4			dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}*(Note7)		IEEE 802.3 Clause 88 100Gbase-LR4			
RECEIVER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Damage threshold	Rdam	4.5			dBm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Average Receive Power per Lane	Rpow	-10.6		4.5	dBm
Receive Sensitivity in OMA per Lane*(Note5)	Pmin			-8.6	dBm
Optical Return Loss	ORL			-26	dB
LOS Assert	LOSA	-25			dBm
LOS De-Assert	LOSD			-11.6	dBm
LOS Hysteresis*(Note7)		0.5			dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

QSFP28 OPTEC, 100G, SM LC, 20km, 4xTX29-31-DML, DDM (QSFP28-100GBASE-ELR4+)

QSFP28-100G-SM-020-LC-ELR4+



QSFP28 OPTEC, 100G, SM LC, 20KM, 4XTX1310-DML, DDM (QSFP28-100GBASE-LR4) transceiver module is designed for use in 100 Gigabit Ethernet links over 20km single mode fiber. They are compliant with the QSFP28 MSA, CWDM4 MSA, 100G-CLR4, and portions of IEEE 802.3bm.

APPLICATIONS

100GBASE-LR4 100G Ethernet •

FEATURES

- Supports 103Gbps
- Single 3.3V Power Supply and Power dissipation < 3.5W
- Up to 20km over SMF
- RoHS-6 compliant (lead-free)
- Commercial case temperature range of 0°C to 70°C
- Four 25Gbps DML LAN-WDM channels on transmitter side
- PIN and TIA array on the receiver side
- 4x25G electrical interface
- Duplex LC receptacles

I2C interface with integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP28 OPTEC, 100G, SM LC, 2KM, 4xTX29-31-DML, DDM (QSFP28-100GBASE-CLR4)	103Gbps	SMF	20km	LC	Standard	YES

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0		70	°C
Power Supply Voltage	V_{CC}		3.135	3.3	3.465	V
Power Dissipation	P_D				3.5	W

Performance Specifications - Electrical

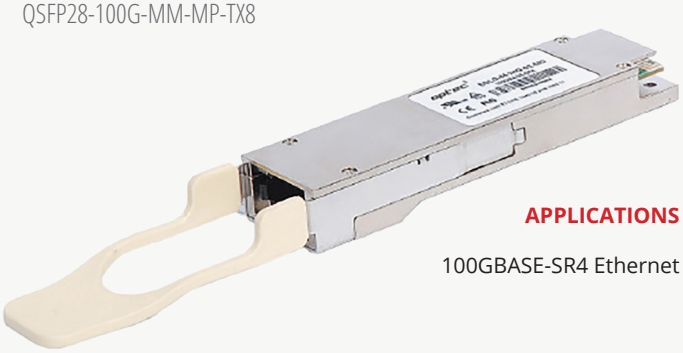
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
TRANSMITTER						
Differential Input amplitude		150		1200	mv_{p-p}	
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @DC
RECEIVER						
Differential output amplitude		200		1100	mv_{p-p}	
Output Impedance (Differential)	Zout	85	100	115	ohms	
Output Rise/Fall Time	tr/tf		12		ps	10%~90%

Optical Characteristics / 100GBASE-LR4 Operation					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Total Average Output Power*(Note3)	Po			10.5	dBm
Average Launch Power per Lane	Peach	-2.5		4.5	dBm
Optical modulation amplitude	Poma	-1.3		4.5	dBm
Average launch power of OFF transmitter per lane				-30.0	dBm
Side Mode Suppression Ratio	SMSR	30			dBm
Optical Return Loss Tolerance				20.0	dB
Extinction Ratio	ER	4.0			dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}			IEEE 802.3 Clause 88 100Gbase-LR4		
RECEIVER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Damage threshold	Rdam	4.5			dBm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Average Receive Power per Lane	Rpow	-10.6		4.5	dBm
Receive Sensitivity in OMA per Lane	Pmin			-8.6	dBm
Optical Return Loss	ORL			-26	dBm
LOS Assert	LOSA	-25			dBm
LOS De-Assert	LOSD			-11.6	dBm
LOS Hysteresis		0.5			dB
Optical Return Loss	ORL			-26.0	dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

QSFP28 OPTEC, 100G, MM MPO/MPT, 100/70M, TX850, DDM (QSFP28-100GBASE-SR4)

QSFP28-100G-MM-MP-TX8



QSFP28 OPTEC, 100G, MM MPO/MPT, 100/70M, TX850, DDM (QSFP28-100GBASE-SR4) transceiver module is designed for 103Gigabit Ethernet links over 100m multi mode fiber. It is compliant with IEEE 802.3ba 100GBASE-SR4/. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+MSA.

APPLICATIONS

100GBASE-SR4 Ethernet

FEATURES

- Supports 103.1Gbps aggregate bit rates
- Single 3.3V Power Supply and Power dissipation < 3.5W
- Up to 70m transmission on MMF OM3 and 100m transmission on MMF OM4
- Hot-Pluggable QSFP28 Footprint
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- RoHS6 Compliant
- Operating Case Temperature Standard: 0°C~+70°C
- Compliant with QSFP28 MSA Specification
- I^2C interface with integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP28 OPTEC, 100G, MM MPO/MPT, 100/70M, TX850, DDM (QSFP28-100GBASE-SR4)	103.1Gbps	MMF	MMF OM3 for 70m MMF OM4 for 100m	MPO/MPT	Standard	YES

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0		70	°C
Power Supply Voltage	V_{cc}		3.135	3.3	3.465	V
Power Dissipation	P				3.5	W

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
TRANSMITTER						
Input Amplitude (Differential)		150		1050	mv_{p-p}	AC coupled inputs*(Note6)
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC
RECEIVER						
Differential output amplitude	Vout	200		1100	mv_{p-p}	AC coupled outputs*(Note6)
Output Rise/Fall Time	Zout	85	100	115	ohms	
Output Rise/Fall Time	tr/tf		12		ps	10%~80%

Optical Characteristics / 100GBASE-LR4 Operation					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Center Wavelength	λ_{C0}	840	850	860	nm
Average Launch Power, Each Lane*(note2)	Pout/lane			2.4	dBm
Optical modulation amplitude	Poma			3	dBm
Extinction Ratio*(Note3)	ER	2			dB
Total Average Output Power*(Note3)	Po			10.5	dBm
Transmitter eye mask definition {X1, X2, X3, Y1, Y2,Y3}*(Note4)			IEEE 802.3bm 100Gbase-SR4		dBm
RECEIVER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Damage threshold	Rdam	4.5			dBm
Center Wavelength	λ_C	840	850	860	nm
Average Receive Power per Lane	R_{pow}			2.4	dBm
Receive Sensitivity in OMA per Lane*(Note5)	P_{min}			-5.2	dBm
LOS Assert	LOSA	-13			dBm
LOS De-Assert	LOSD			-9.5	dBm
LOS Hysteresis*(Note7)		0.5			dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

CFP4 OPTEC, 100G, SM LC, 10KM, TX1310, DDM (CFP4-100GBASE-LR4)

CFP4-100G-SM-LC-TX31-DDM

CFP4 OPTEC, 100G, SM LC, 10KM, TX1310, DDM (CFP4-100GBASE-LR4) transceiver module supports a link length of 10 kilometers on standard single mode fiber (SMF, G.652). 100 Gigabit Ethernet signal is carried over four wavelengths. Multiplexing and demultiplexing of the four wavelengths are managed within the device.

APPLICATIONS

100GBASE-LR4 Ethernet

OTU4 4I1-9D1F

FEATURES

- Supports 103Gbps and 112Gbps aggregate bitrates
- Single 3.3V Power Supply and Power dissipation < 5.5W
- Up to 10km transmission on SMF
- Hot-Pluggable CFP4 Footprint Duplex LC Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- RoHS6 Compliant
- Operating Case Temperature Standard: -5℃+75℃
- Compliant with CFP4 MSA Specification
- MDIO interface with integrated Digital Diagnostic Monitoring
- No external reference clock

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
CFP4 OPTEC, 100G, SM LC, 10KM, TX1310, DDM (CFP4-100GBASE-LR4)	112Gbps	SMF	10km	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

Note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	-5		75	°C
Power Supply Voltage	V_{CC}		3.135	3.3	3.465	V
Power Dissipation	P				5.5	W

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
TRANSMITTER						
Input Amplitude (Differential)	Vin	150		1050	mv_{p-p}	AC coupled inputs
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC
RECEIVER						
Differential output amplitude	Vout	360		770	mv_{p-p}	AC coupled outputs
Output Rise/Fall Time	Zout	85	100	115	ohms	
Output Rise/Fall Time	tr/tf	24			ps	20%~80%

Optical Characteristics / OTU4 4I1-9D1F Operation					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Signaling Speed per Lane	BR_{AVE}		27.95		Gbps
Data Rate Variation		-20		+20	ppm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Total Average Output Power*(Note3)	Po			10	dBm
Average Launch Power per Lane	Peach	-0.6		4.0	dBm
Side Mode Suppression Ratio	SMSR	30			
Optical Return Loss Tolerance				20	dB
Extinction Ratio	ER	4			dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}*(Note7)			G.959.1 Compliant		
TX Disable Assert Time	t_off			100	us
RECEIVER					
Signaling Speed per Lane	BR_{AVE}		27.95		Gbps
Data Rate Variation		-20		+20	ppm
Damage threshold	Rdam	5.5			dBm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Average Receive Power per Lane	Rpow	-6.9		4.0	dBm
Equivalent Receive Sensitivity per Lane	Pmin			-8.4	dBm
Maximum optical path penalty				1.5	dB
Optical Return Loss	ORL			-26	dB
LOS Assert	LOSA	-20.6			dBm
LOS De-Assert	LOSD			-9.4	dBm
LOS Hysteresis		0.5			dB

Optical Characteristics / 100GBASE-LR4 Operation					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Total Average Output Power*(Note3)	Po			10.5	dBm
Average Launch Power per Lane	Peach	-4.3		4.5	dBm
Average launch power of OFF transmitter per lane				-30	dBm
Optical modulation amplitude	Poma	-1.3		4.5	dBm
Side Mode Suppression Ratio	SMSR	30			

Optical Return Loss Tolerance				20	dB
Extinction Ratio	ER	4			dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}*(Note7)		IEEE 802.3 Clause 88 100Gbase-LR4			
TX Disable Assert Time	t_off			100	us
RECEIVER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Damage threshold	Rdam	5.5			dBm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Average Receive Power per Lane	Rpow	-10.6		4.5	dBm
Receive Sensitivity in OMA per Lane*(Note5)	Pmin			-8.6	dBm
Optical Return Loss	ORL			-26	dB
Stressed Sensitivity per lane	SRS			-6.8	dBm
LOS Assert	LOSA	-20.6			dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

CFP2 OPTEC, 100G, SM LC, 10KM, TX1310, DDM (CFP2-100GBASE-LR4)

CFP2-100G-SM-LC-TX31-DDM

CFP2 OPTEC, 100G, SM LC, 10KM, TX1310, DDM (CFP2-100GBASE-LR4) transceiver module supports a link length of 10 kilometers on standard single mode fiber (SMF, G.652). 100 Gigabit Ethernet signal is carried over four wavelengths. Multiplexing and demultiplexing of the four wavelengths are managed within the device.

APPLICATIONS

100GBASE-LR4 Ethernet

OTU4 4I1-9D1F

FEATURES

- Supports 103Gbps and 112Gbps aggregate bit rates
- Single 3.3V Power Supply and Power dissipation < 9W
- Up to 10km transmission on SMF
- Hot-Pluggable CFP2 Footprint Duplex LC Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- RoHS6 Compliant
- Operating Case Temperature Standard: 0~+70
- Compliant with CFP2 MSA Specification
- MDIO interface with integrated Digital Diagnostic Monitoring
- 4 x 28G electrical interface

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
CFP2 OPTEC, 100G, SM LC, 10KM, TX1310, DDM (CFP2-100GBASE-LR4)	112Gbps	SMF	10km	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
Power Supply Voltage	V_{CC}		3.2	3.3	3.4	V
Power Consumption	P			-	9	W

Performance Specifications - Electrical

TRANSMITTER Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Input Amplitude (Differential)	-	-	-	1050	mVpp	AC coupled inputs
Input Impedance (Differential)	Zin	80	100	120	ohms	Rin > 100 kohms @ DC
RECEIVER						
Output Amplitude (Differential)	Vout	360	-	770	mVpp	AC coupled outputs
Output Impedance (Differential)	Zout	80	100	120	ohms	
Output Rise/Fall Time	tr/tf	24	-	-	ps	20%~80%

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITTER					
Signaling Speed per Lane	BR_{AVE}	-	27.95	-	Gbps
Data Rate Variation		-100		+100	ppm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Total Average Output Power	Po	-	-	8.9	dBm
Average Launch Power per Lane	Peach	-2.5	-	2.9	dBm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Optical Return Loss Tolerance	-	-	-	20	dB
Extinction Ratio	ER	7		-	dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}			G.959.1 Compliant		
TX Disable Assert Time	t_off	-	-	100	us
RECEIVER					
Signaling Speed per Lane	BR_{AVE}	-	27.95	-	Gbps
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Average Receive Power per Lane*note2	Rpow	-10.6	-	4.5	dBm
Average Receive Power per Lane*note3	Rpow	-8.8		2.9	dBm
Receive Sensitivity per Lane*note4	Pmin1	-	-	-10.6	dBm
Receive Sensitivity per Lane*note5	Pmin2	-	-	-10.3	dBm
Receiver Overload per Lane	Pmax	4.5	-		dBm
Optical Return Loss	ORL		-	-26	dB
LOS Assert	LOSA	-21	-		dBm
LOS De-Assert	LOSD		-	-11	dBm
LOS Hysteresis*(Note7)	-	0.5	-	--	dB

Note2: CFP transceiver works in 100GBASE-LR4 mode.
Note3: CFP transceiver works in OTU4 4I1-9D1F mode.
Note4: Minimum average optical power measured at BER less than 1E-12, with a 2^{31}-1 PRBS@25.78Gbps.
Note5: Minimum average optical power measured at BER less than 1E-12, with a 2^{31}-1 PRBS@27.95Gbps.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

CFP OPTEC, 100G, SM LC, 10KM, TX1310, DDM (CFP-100GBASE-LR4)

CFP-100G-SM-LC-TX31-DDM

CFP OPTEC, 100G, SM LC, 10KM, TX1310, DDM (CFP-100GBASE-LR4) transceiver module supports a link length of 10 kilometers on standard single mode fiber (SMF, G.652). 100 Gigabit Ethernet signal is carried over four wavelengths. Multiplexing and demultiplexing of the four wavelengths are managed within the device.

APPLICATIONS

100GBASE-LR4 Ethernet

Data Center

FEATURES

- Supports 103Gbps and 112Gbps aggregate bit rates
- Single 3.3V Power Supply and Power dissipation < 16W
- Up to 10km transmission on SMF
- Hot-Pluggable CFP Footprint Duplex LC Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- RoHS6 Compliant
- Operating Case Temperature Extended: -10°C ~+75°C
- Compliant with CFP MSA Specification
- MDIO interface with integrated Digital Diagnostic Monitoring
- CAUI electrical interface

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
CFP OPTEC, 100G, SM LC, 10KM, TX1310, DDM (CFP-100GBASE-LR4)	112Gbps	SMF	10km	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	-10	-	75	°C
Power Supply Voltage	V_{CC}		3.2	3.3	3.4	V
Power Supply Current	I_{cc}			4000		mA

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
TRANSMITTER						
Input Amplitude (Differential)	Vin	-	-	1050	mVpp	AC coupled inputs
Input Impedance (Differential)	Zin	80	100	120	ohms	Rin > 100 kohms @ DC
RECEIVER						
Output Amplitude (Differential)	Vout	360		770	mVpp	AC coupled outputs
Output Impedance (Differential)	Zout	80	100	120	ohms	

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Data Rate Variation		-100		+100	ppm
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Total Average Output Power	Po			10.5	dBm
Average Launch Power per Lane	Peach	-4.3		4.5	dBm
Side Mode Suppression Ratio	SMSR	30			dB
Optical Return Loss Tolerance				20	dB
Extinction Ratio	ER	4			dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}		IEEE 802.3ba-2010 Compliant			
TX Disable Assert Time	t_off			100	us
RECEIVER					
Signaling Speed per Lane	BR_{AVE}		25.78		Gbps
Lane_0 Center Wavelength	λ_{C0}	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_{C1}	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_{C2}	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_{C3}	1308.09	1309.14	1310.19	nm
Average Receive Power per Lane	Rpow	-10.6		4.5	dBm
Receiver Overload per Lane	Pmax	4.5			dBm
Optical Return Loss	ORL			-26	dB
LOS Assert	LOSA	-22			dBm
LOS De-Assert	LOSD			-12	dBm
LOS Hysteresis		0.5			dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

CFP OPTEC, 100G, MM MPO, 150/100M, TX850, DDM (CFP-100GBASE-SR10)

CFP-100G-MM-MPO-TX85-DDM

CFP OPTEC, 100G, MM MPO, 150/100M, TX850, DDM (CFP-100GBASE-SR10) transceiver module supports a link length of 100m(OM3) and 150m(OM4) on standard multi mode fiber (MMF, G.652). 100 Gigabit Ethernet signal is carried over four wavelengths. Multiplexing and demultiplexing of the four wavelengths are managed within the device.

APPLICATIONS

100GBE and 10GBE • interconnects

Datacom/Telecom • switch & router connections

Data aggregation • and backplane applications

Proprietary protocol • and density application

FEATURES

- Compliant to the IEEE 802.3ba(100GBASE-SR10)
- Support interoperability with IEEE 802.3ae 10GBASE-SR modules of various form factors such as SFP+, XFP, X2
- Compliant to the CFP MSA Specification
- Up to 100m on OM3 and 150m on OM4 MMF
- VCSEL array transmitter and PIN array receiver
- Single 3.3V Power Supply and Power dissipation ≤ 8W
- Operates at 10.3125Gbps per channel
- Operating Case Temperature: 0℃ ~+70℃
- MDIO digital diagnostic interface and control capabilities
- Utilizes a standard 24/20 lane optical fiber with MPO connector

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
CFP OPTEC, 100G, MM MPO, 150/100M, TX850, DDM (CFP-100GBASE-SR10)	100Gbps	MMF	OM3 for 100m OM4 for 150m	MPO	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+75	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
Power Supply Voltage	V_{CC}		3.2	3.3	3.4	V
Power Dissipation	Pm		-	-	8	W
Low Power Mode Dissipation	P_{LOW}		-	-	2	w
Aggregate Bit Rate	BR_{AGGR}		-	103.125	-	Gbps
Lane Bit Rate	BR_{LANE}		-	10.3125	-	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
AC common mode input voltage tolerance		-	-	20	mV	RMS
Input Impedance (Differential)	Z_{IN}	90	100	110	ohms	
Input High Voltage	V_{IH}	2	-	Vcc+0.3	V	3.3V LVCMOS
		0.84	-	1.5	V	1.2V LVCMOS
Input Low Voltage	V_{IL}	-0.3	-	0.8	V	3.3V LVCMOS
		-0.3	-	0.36	V	1.2V LVCMOS

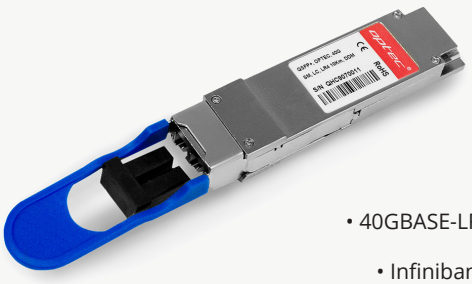
RECEIVER						
Differential output voltage, peak-to-peak		-	-	760	mV	
AC common mode output voltage		-	-	15	mV	RMS
Termination mismatch at 1MHz		-	-	5	%	
Output impedance (Differential)	Zout	90	100	110	ohms	
Output rise and fall time		24			ps	20%~80%
Output High Voltage	V_{OH}	Vcc-0.2	-	-	V	3.3V LVCMOS (I_{OH}= -100uA)
		1.0	-	1.5	V	1.2V LVCMOS
Output Low Voltage	V_{OL}	-	-	0.2	V	3.3V LVCMOS (I_{OL}= 100uA)
		-0.3	-	0.2	V	1.2V LVCMOS

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
OM3 MMF	L	0.5	-	100	m
Aggregate Bit Rate	BRAggr	-	103.125	-	Gbps
Per Lane Bit Rate	BR_{LANE}	-	10.3125	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	840	850	860	nm
RMS spectral width	RMS	-	-	0.65	nm
Average Launch Power, Each Lane	Pout/lane	-7.6	-	2.4	dBm
Transmit OMA, per Lane	TX_OMA/lane	-5.6	-	3	dBm
Difference in launch power between any two lanes(OMA)		-	-	4	dB
Peak power, each lane		-	-	4	dBm
Transmitter and dispersion penalty, each lane	TDP/lane	-	-	3.5	dB
Extinction Ratio	ER	3	-	-	dB
Optical Return Loss Tolerance		-	-	12	dB
Average launch power of OFF transmitter, each lane		-	-	-30	dBm
Output Optical Eye	IEEE 802.3ba-2010 Compliant				
RECEIVER					
Center Wavelength	λ_C	840	850	860	nm
Damage Threshold	-	3.4	-	-	dBm
Optical modulation amplitude, each lane	-	-	-	3	dBm
Stressed receiver sensitivity in OMA, each lane	-	-	-	-5.4	dBm
Average power at receiver input, each lane	RX/lane	-9.5	-	+2.4	dBm
Peak power, each lane		-	-	4	dBm
Receiver reflectance	Rr	-	-	-12	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

QSFP+ OPTEC, 40G, SM LC, 10KM, TX1330/1310/1290/1270, DDM (QSFP-40GBASE-LR4)

QSFP+-40G-DF-SM-010-LC-TX2



QSFP+ OPTEC, 40G, SM LC, 10KM, TX1330/1310/1290/1270, DDM (QSFP-40GBASE-LR4) transceiver module It is designed to operate over singlemode fiber system using four 10Gbps CWDM channel in 1300 band. Which is based on two LC connectors for optical connectivity and supports 40Gbps data rate links of up to 10km.

APPLICATIONS

- 40GBASE-LR4 Ethernet links
- Infiniband QDR and DDR interconnects Client-side
- 40G Telecom connections

FEATURES

- Compliant to the IEEE 802.3ba(40GBASE-LR4)
- Compliant to the QSFP+ MSA SFF-8436 Specification
- Up to 10km over SMF
- DFBs and PIN monitor photodiodes array for transmitter section
- PIN detectors and TIAs array for receiver section
- Four 10Gbps CWDM channels in the 1300nm band
- I^2C interface with integrated Digital Diagnostic Monitoring
- Utilizes two standard LC optical connector
- Operating Case Temperature: -10℃~+70℃

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP+ OPTEC, 40G, SM LC, 10KM, TX1330/1310/1290/1270, DDM (QSFP-40GBASE-LR4)	40Gbps	SMF	10km	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+75	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	-10	-	70	°C
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	1000	mA
Power Dissipation	P_D		-	-	3.5	W
Aggregate Bit Rate	BR_{AVE}		-	41.25	-	Gbps
Lane Bit Rate	BR_{LANE}		-	10.3125	-	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Single ended input voltage tolerance		-	-0.3	-	4	V	Referred toTP1 signal common
AC common mode input voltage tolerance		-	15	-	-	mV	RMS
Input Impedance (Differential)		Z_{IN}	85	100	115	ohms	Rin > 100 kohms @ DC
TX Disable	Disable	V_{IH}	2	-	Vcc+0.3	V	-
	Enable	VIH	0	-	0.8	V	-

TX FAULT	Fault	V_{OH}	2.4	-	Vcc+0.3	V	-
	Normal	V_{OL}	0	-	0.8	V	
RECEIVER							
Single ended output voltage		-	-0.3	-	4	V	Referred to signal common
AC common mode voltage		-	-	-	7.5	mV	RMS
Termination mismatch at 1MHz			-	-	5	%	-
Output impedance (Differential)		Zout	85	100	115	ohms	-
Output rise and fall time		tr/tf	30	-	-	ps	10%~90%
RX_LOS	LOS	V_{OH}	2.4	-	Vcc+0.3	V	-
	Normal	V_{OL}	0	-	0.8	V	-

Optical Characteristics

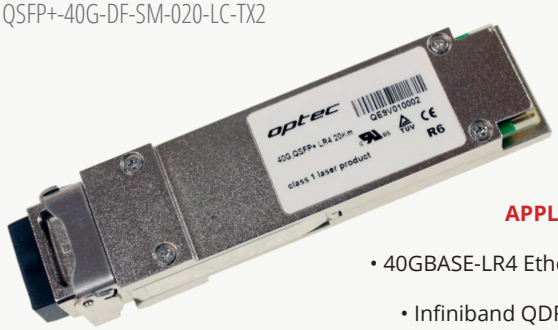
Parameter	Symbol	Min.	Typical	Max.	Unit
SMF	L	-	10	-	km
Aggregate Bit Rate	BR_{AVE}	-	41.25	-	Gbps
Per Lane Bit Rate	BR_{LANE}	-	10.3125	-	Gbps
TRANSMITTER					
Channels wavelength	λ_C	1264.5	1271	1277.5	nm
		1284.5	1291	1297.5	
		1304.5	1311	1317.5	
		1324.5	1331	1337.5	
-20dB spectral width	Δλ	-	-	1	nm
Average Launch Power, Each Lane	Pout/lane	-7	-	2.3	dBm
Extinction Ratio	ER	3.5	-	-	dB
Output Optical Eye	IEEE 802.3ba-2010 Compliant				
Transmit OMA, per Lane	TX_OMA/lane	-4	-	3.5	dBm
RECEIVER					
Channels wavelength	λ_C	1264.5	1271	1277.5	nm
		1284.5	1291	1297.5	
		1304.5	1311	1317.5	
		1324.5	1331	1337.5	
Damage Threshold	-	3.3	-	-	dBm
Receiver sensitivity in OMA, each lane	Pmins	-	-	-11.5	dBm
Maximum Receive Power, each lane	Pmax	2.3	-	-	dBm
Receiver reflectance	Rr	-	-	-26	dB
LOS De-Assert	LOS_D	-	-	-11.5	dBm
LOS Assert	LOS_A	-20	-	-	dBm

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

QSFP+ OPTEC, 40G, SM LC, 20KM, TX1330/1310/1290/1270, DDM (QSFP-40GBASE-LR4)

QSFP+-40G-DF-SM-020-LC-TX2



QSFP+ OPTEC, 40G, SM LC, 20KM, TX1330/1310/1290/1270, DDM (QSFP-40GBASE-LR4) transceiver module It is designed to operate over singlemode fiber system using four 10Gbps CWDM channel in 1300 band. Which is based on two LC connectors for optical connectivity and supports 40Gbps data rate links of up to 20km.

APPLICATIONS

- 40GBASE-LR4 Ethernet links
- Infiniband QDR and DDR interconnects Client-side
- 40G Telecom connections

FEATURES

- Compliant to the IEEE 802.3ba(40GBASE-LR4)
- Compliant to the QSFP+ MSA SFF-8436 Specification
- Up to 20km over SMF
- DFBs and PIN monitor photodiodes array for transmitter section
- PIN detectors and TIAs array for receiver section
- Four 10Gbps CWDM channels in the 1300nm band
- I^2C interface with integrated Digital Diagnostic Monitoring
- Utilizes two standard LC optical connector
- Operating Case Temperature: -10℃~+70℃

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP+ OPTEC, 40G, SM LC, 20KM, TX1330/1310/1290/1270, DDM (QSFP-40GBASE-LR4)	40Gbps	SMF	20km	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+75	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	-10	-	70	°C
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	1000	mA
Power Dissipation	P_D		-	-	3.5	W
Aggregate Bit Rate	BR_{AVE}		-	41.25	-	Gbps
Lane Bit Rate	BR_{LANE}		-	10.3125	-	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Single ended input voltage tolerance		-	-0.3	-	4	V	Referred toTP1 signal common
AC common mode input voltage tolerance		-	15	-	-	mV	RMS
Input Impedance (Differential)		Z_{IN}	85	100	115	ohms	Rin > 100 kohms @ DC
TX Disable	Disable	V_{IH}	2	-	Vcc+0.3	V	-
	Enable	VIH	0	-	0.8	V	-

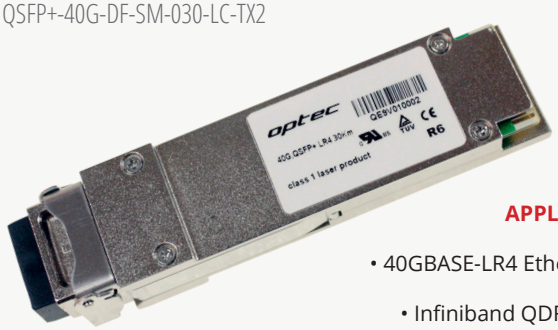
TX FAULT	Fault	V_{OH}	2.4	-	Vcc+0.3	V	-
	Normal	V_{OL}	0	-	0.8	V	
RECEIVER							
Single ended output voltage		-	-0.3	-	4	V	Referred to signal common
AC common mode voltage		-	-	-	7.5	mV	RMS
Termination mismatch at 1MHz			-	-	5	%	-
Output impedance (Differential)		Zout	85	100	115	ohms	-
Output rise and fall time		tr/tf	30	-		ps	10%~90%
RX_LOS	LOS	V_{OH}	2.4	-	Vcc+0.3	V	-
	Normal	V_{OL}	0	-	0.8	V	-

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
SMF	L	-	10	-	km
Aggregate Bit Rate	BR_{AVE}	-	41.25	-	Gbps
Per Lane Bit Rate	BR_{LANE}	-	10.3125	-	Gbps
TRANSMITTER					
Channels wavelength	λ_C	1264.5	1271	1277.5	nm
		1284.5	1291	1297.5	
		1304.5	1311	1317.5	
		1324.5	1331	1337.5	
-20dB spectral width	Δλ	-	-	1	nm
Average Launch Power, Each Lane	Pout/lane	-4	-	2.3	dBm
Extinction Ratio	ER	3.5	-	-	dB
Output Optical Eye	IEEE 802.3ba-2010 Compliant				
RECEIVER					
Channels wavelength	λ_C	1264.5	1271	1277.5	nm
		1284.5	1291	1297.5	
		1304.5	1311	1317.5	
		1324.5	1331	1337.5	
Damage Threshold	-	3.3	-	-	dBm
Receiver sensitivity in OMA, each lane	Pmins	-	-	-11.5	dBm
Maximum Receive Power, each lane	Pmax	2.3	-	-	dBm
Receiver reflectance	Rr	-	-	-26	dB
LOS De-Assert	LOS_D	-	-	-11.5	dBm
LOS Assert	LOS_A	-20	-	-	dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

QSFP+ OPTEC, 40G, SM LC, 30KM, TX1330/1310/1290/1270, DDM (QSFP-40GBASE-LR4)

QSFP+-40G-DF-SM-030-LC-TX2



QSFP+ OPTEC, 40G, SM LC, 10KM, TX1330/1310/1290/1270, DDM (QSFP-40GBASE-LR4) transceiver module It is designed to operate over singlemode fiber system using four 10Gbps CWDM channel in 1300 band. Which is based on two LC connectors for optical connectivity and supports 40Gbps data rate links of up to 30km.

APPLICATIONS

- 40GBASE-LR4 Ethernet links
- Infiniband QDR and DDR interconnects Client-side
- 40G Telecom connections

FEATURES

- Compliant to the IEEE 802.3ba(40GBASE-LR4)
- Compliant to the QSFP+ MSA SFF-8436 Specification
- Up to 30km over SMF
- DFBs and PIN monitor photodiodes array for transmitter section
- PIN detectors and TIAs array for receiver section
- Four 10Gbps CWDM channels in the 1300nm band
- I^2C interface with integrated Digital Diagnostic Monitoring
- Utilizes two standard LC optical connector
- Operating Case Temperature: -10℃~+70℃

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP+ OPTEC, 40G, SM LC, 30KM, TX1330/1310/1290/1270, DDM (QSFP-40GBASE-LR4)	40Gbps	SMF	30km	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+75	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	-10	-	70	°C
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	1000	mA
Power Dissipation	P_D		-	-	3.5	W
Aggregate Bit Rate	BR_{AVE}		-	41.25	-	Gbps
Lane Bit Rate	BR_{LANE}		-	10.3125	-	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Single ended input voltage tolerance		-	-0.3	-	4	V	Referred toTP1 signal common
AC common mode input voltage tolerance		-	15	-	-	mV	RMS
Input Impedance (Differential)		Z_{IN}	85	100	115	ohms	Rin > 100 kohms @ DC
TX Disable	Disable	V_{IH}	2	-	Vcc+0.3	V	-
	Enable	VIH	0	-	0.8	V	-

TX FAULT	Fault	V_{OH}	2.4	-	Vcc+0.3	V	-
	Normal	V_{OL}	0	-	0.8	V	
RECEIVER							
Single ended output voltage		-	-0.3	-	4	V	Referred to signal common
AC common mode voltage		-	-	-	7.5	mV	RMS
Termination mismatch at 1MHz			-	-	5	%	-
Output impedance (Differential)		Zout	85	100	115	ohms	-
Output rise and fall time		tr/tf	30	-	-	ps	10%~90%
RX_LOS	LOS	V_{OH}	2.4	-	Vcc+0.3	V	-
	Normal	V_{OL}	0	-	0.8	V	-

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
SMF	L	-	10	-	km
Aggregate Bit Rate	BR_{AVE}	-	41.25	-	Gbps
Per Lane Bit Rate	BR_{LANE}	-	10.3125	-	Gbps
TRANSMITTER					
Channels wavelength	λ_C	1264.5	1271	1277.5	nm
		1284.5	1291	1297.5	
		1304.5	1311	1317.5	
		1324.5	1331	1337.5	
-20dB spectral width	Δλ	-	-	1	nm
Average Launch Power, Each Lane	Pout/lane	-2	-	2.3	dBm
Extinction Ratio	ER	3.5	-	-	dB
Output Optical Eye	IEEE 802.3ba-2010 Compliant				
Transmit OMA, per Lane	TX_OMA/lane	-3.7	-	4.5	dBm
RECEIVER					
Channels wavelength	λ_C	1264.5	1271	1277.5	nm
		1284.5	1291	1297.5	
		1304.5	1311	1317.5	
		1324.5	1331	1337.5	
Damage Threshold	-	3.3	-	-	dBm
Receiver sensitivity in OMA, each lane	Pmins	-	-	-11.5	dBm
Maximum Receive Power, each lane	Pmax	2.3	-	-	dBm
Receiver reflectance	Rr	-	-	-26	dB
LOS De-Assert	LOS_D	-	-	-11.5	dBm
LOS Assert	LOS_A	-20	-	-	dBm

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

QSFP+ OPTEC, 40G, SM LC, 40KM, TX1271/1291/1311/1331, DDM (QSFP-40GBASE-LR4)

QSFP+40G-DF-SM-040-LC-TX2

QSFP+ OPTEC, 40G, SM LC, 40KM, TX1271/1291/1311/1331, DDM (QSFP-40GBASE-LR4) transceiver module is designed for 100 Gigabit Ethernet links over 40Km single mode fiber. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+ MSA. And compliant with 100G 4WDM-40 MSA.

APPLICATIONS

- 100G 40km applications with FEC on host side
- 100G Datac om&Telecom connections

FEATURES

- Supports 103Gbps
- Single 3.3V Power Supply
- Power dissipation < 5W
- Up to 40km over SMF
- Commercial case temperature range of 0°C to 70°C
- Four 25 Gbps EML LAN WDM lasers on transmitter side
- APD and TIA array on the receiver side
- 4x25 G electrical interface
- Duplex LC receptacles
- I²C interface with integrated Digital D iagnostic Monitoring
- Safety Certification: TUV/UL/FDA
- RoHS Compliant

Product Information						
Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP+ OPTEC, 40G, SM LC, 40KM, TX1271/1291/1311/1331, DDM (QSFP-40GBASE-LR4)	103 Gbps	SMF	40km	LC	Standard	YES

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions					
Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T_C Standard	0	-	70	°C
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V
Commercial Power Dissipation	P_D	-	-	5	W

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
TRANSMITTER						
Differential data input swing per lane	-	-	-	900	V	-
Input Impedance (Differential)	Zin	-	-	10	%	-
Stressed input parameters						
Eye width	-	0.46	-	-	UI	-
Applied pk-pk sinusoidal jitter	-	Applied pk-pk sinusoidal jitter			-	-
Eye height	-	95	-	-	mv	-
DC common mode voltage	-	-350	-	2850	mv	-

RECEIVER						
Differential output amplitude	-	200	-	900	mVp-p	-
Output Impedance (Differential)	Zout	-	-	10	%	-
Eye width	-	0.57	-	110	UI	-
Eye height differential	-	228	-	-	mv	-
Vertical eye closure	-	-	-	5.5	dB	-

Optical Characteristics

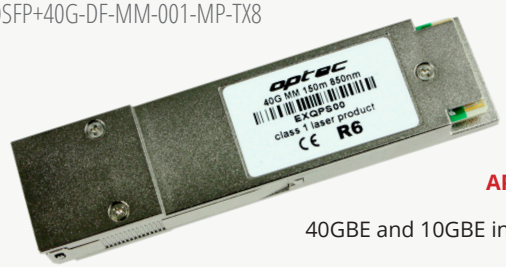
Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITTER					
Channels wavelength	λ_C	1294.53	1295.56	1296.59	nm
		1299.02	1300.05	1301.09	
		1303.54	1304.58	1305.63	
		1308.09	1309.14	1310.19	
Signaling Speed per Lane	BR_{AVE}	-	25.78125	-	Gbps
Data Rate Variation	-	-100	-	100	dB
Spectral Width (-20dB)	Δλ	-	-	1	nm
Total Average Output Power	Po	-	-	12.5	dBm
Average Launch Power per Lane	Peach	-2.5	-	6.5	dBm
Optical Modulation Amplitude (OMA), each lane	Peach (OMA)	0.5	-	6.5	dBm
Average launch power of OFF transmitter per lane	Poff	-	-	-30	dBm
Side-mode suppression ratio	SMSR	30	-	-	dB
Transmitter dispersion penalty, each lane	TDP	-	-	2.0	dB
Difference in launch power between any two lanes (OMA)	-	-	-	4	dB
Optical Return Loss Tolerance	-	-	-	20	dB
Transmitter reflectance	-	-	-	-26	dB
Extinction Ratio	ER	4.5	-	-	dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	-	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}	-	-	-
RECEIVER					
Channels wavelength	λ_C	1294.53	1295.56	1296.59	nm
		1299.02	1300.05	1301.09	
		1303.54	1304.58	1305.63	
		1308.09	1309.14	1310.19	
Signaling Speed per Lane	BR_{AVE}	-	25.78125	-	Gbps
Data Rate Variation	-	-100	-	+100	ppm
Damage threshold	Rdam	3.8	-	-	dBm
Average Receive Power per Lane	Rpow	21.2	-	-4.5	dBm
Receiver Sensitivity in OMA per Lane	P_{min}	-	-	-19	dBm
Stressed Receiver Sensitivity (OMA) per Lane	RX_{SRS}	-	-	-16-8	dBm
Signaling Speed per Lane	BR_{AVE}	-	10.3125	-	Gbps
Vertical Eye Closure Penalty	VECP	-	2.2	-	dB
Stressed J2 Jitter	J2	-	0.3	-	UI

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

QSFP+ OPTEC, 40G, MM MPO/MPT, 150M, TX850, DDM (QSFP-40GBASE-SR4)

QSFP+40G-DF-MM-001-MP-TX8



QSFP+ OPTEC, 40G, MM MPO/MPT, 150M, TX850, DDM (QSFP-40GBASE-SR4) transceiver module is designed to operate over multimode fiber systems using a nominal wavelength of 850nm. The electrical interface uses a 38 contact edge type connector. The optical interface uses an 8 or 12 fiber MTP (MPO) connector.

APPLICATIONS

40GBE and 10GBE interconnects •

Datacom/Telecom switch & router • connections

Data aggregation and backplane • applications

Proprietary protocol and density application •

FEATURES

- Compliant to the IEEE 802.3ba(40GBASE-SR4)
- Support interoperability with IEEE 802.3ae 10GBASE-SR modules of various form factors such as SFP+, XFP, X2
- Compliant to the QSFP+ MSA SFF-8436 Specification
- Up to 100m on OM3 and 150m on OM4 MMF
- VCSEL array transmitter and PIN array receiver
- Single 3.3V Power Supply and Power dissipation < 1.5W
- Operates at 10.3125Gbps per channel
- Operating Case Temperature: 0℃~+70℃
- I²C interface with integrated Digital Diagnostic Monitoring
- Utilizes a standard 12/8 lane optical fiber with MPO connector

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP+ OPTEC, 40G, MM MPO/MPT, 150M, TX850, DDM (QSFP-40GBASE-SR4)	40Gbps	MMF	100m/150m	MPO	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	I_{CC}		-	-	475	mA
Aggregate Bit Rate	BR_{AVE}		-	41.25	-	Gbps
Lane Bit Rate	BR_{LANE}		-	10.3125	-	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Single ended input voltage tolerance		-	-0.3	-	4	V	Referred to TP1 signal common
AC common mode input voltage tolerance		-	15	-	-	mV	RMS
Input Impedance (Differential)		Z_{IN}	85	100	115	ohms	Rin > 100 kohms @ DC
TX Disable	Disable	V_{IH}	2	-	Vcc+0.3	V	
	Enable	V_{IL}	0	-	0.8	V	
TX FAULT	Fault	V_{OH}	2.4	-	Vcc+0.3	V	
	Normal	V_{OL}	0	-	0.5	V	

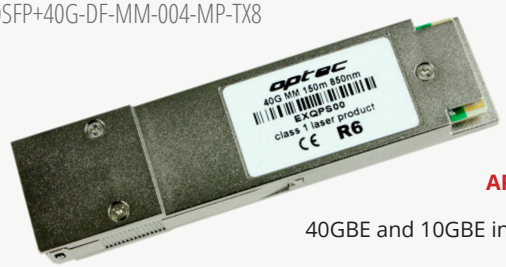
RECEIVER							
Single ended output voltage		-	-0.3	-	4	V	-
AC common mode voltage		-	-	-	7.5	mV	RMS
Termination mismatch at 1MHz		-	-	-	5	%	-
Output impedance (Differential)		Zout	85	100	115	ohms	-
Output Rise/Fall Time		tr/tf	30	-	-	ps	10%~90%
RX_LOS	LOS	V_{OH}	2.4	-	Vcc+0.3	V	-
	Normal	V_{OL}	0	-	0.8	V	-

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
OM3 MMF	L	0.5	-	300	m
Aggregate Bit Rate	BRAggr	-	40	-	Gbps
Per Lane Bit Rate	BR_{LANE}	-	10.3125	-	Gbps
TRANSMITER					
Center Wavelength	λ_c	840	850	860	nm
RMS spectral width	RMS	-	-	0.65	nm
Average Launch Power, Each Lane	Pout/lane	-7.6	-	2.4	dBm
Transmit OMA, per Lane	TX_OMA/lane	-5.6	-	3	dBm
Difference in launch power between any two lanes(OMA)	-	-	-	4	dB
Peak power, each lane	-	-	-	4	dBm
Transmitter and dispersion penalty, each lane	TDP/lane	-	-	3.5	dB
Extinction Ratio	ER	3	-	-	dB
Optical Return Loss Tolerance	-	-	-	12	dB
Average launch power of OFF transmitter, each lane	-	-	-	-30	dBm
Output Optical Eye	IEEE 802.3ba-2010 Compliant				
TX Disable Assert Time	t_off	-	-	100	us
RECEIVER					
Center Wavelength	λ_c	840	850	860	nm
Damage Threshold	-	3.4	-	-	dBm
Stressed receiver sensitivity in OMA, each lane	Pmins	-	-	-5.4	dBm
Maximum Receive Power, each lane	Pmax	-	-	2.4	dBm
Average power at receiver input, each lane	RX/lane	-7.9	-	+1.0	dBm
LOS De-Assert, OMA	LOSD	-	-	-7.5	dBm
Receiver reflectance	Rr	-	-	-12	dB
LOS Assert	LOSA	-30	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

QSFP+ OPTEC, 40G, MM MPO/MPT, 400/300M, TX850, DDM (QSFP-40GBASE-SR4)

QSFP+40G-DF-MM-004-MP-TX8



QSFP+ OPTEC, 40G, MM MPO/MPT, 400/300M, TX850, DDM (QSFP-40GBASE-SR4) transceiver module is designed to operate over multimode fiber systems using a nominal wavelength of 850nm. The electrical interface uses a 38 contact edge type connector. The optical interface uses an 8 or 12 fiber MTP (MPO) connector.

APPLICATIONS

40GBE and 10GBE interconnects • Datacom/Telecom switch & router • connections

Data aggregation and backplane • applications

FEATURES

- Compliant to the IEEE 802.3ba(40GBASE-SR4)
- Support interoperability with IEEE 802.3ae 10GBASE-SR modules of various form factors such as SFP+, XFP, X2
- Compliant to the QSFP+ MSA SFF-8436 Specification
- Up to 300m on OM3 and 400m on OM4 MMF
- VCSEL array transmitter and PIN array receiver
- Single 3.3V Power Supply and Power dissipation < 1.5W
- Operates at 10.3125Gbps per channel
- Operating Case Temperature: 0℃~+70℃
- I²C interface with integrated Digital Diagnostic Monitoring
- Utilizes a standard 12/8 lane optical fiber with MPO connector

Product Information

Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP+ OPTEC, 40G, MM MPO/MPT, 400/300M, TX850, DDM (QSFP-40GBASE-SR4)	40Gbps	MMF	OM3 for 300m OM4 for 400m	MPO	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	I_{CC}		-	-	475	mA
Aggregate Bit Rate	BR_{AVE}		-	41.25	-	Gbps
Lane Bit Rate	BR_{LANE}		-	10.3125	-	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Single ended input voltage tolerance		-	-0.3	-	4	V	Referred to TP1 signal common
AC common mode input voltage tolerance		-	15	-	-	mV	RMS
Input Impedance (Differential)		Z_{IN}	85	100	115	ohms	Rin > 100 kohms @ DC
TX Disable	Disable	V_{IH}	2	-	Vcc+0.3	V	
	Enable	V_{IL}	0	-	0.8	V	
TX FAULT	Fault	V_{OH}	2.4	-	Vcc+0.3	V	
	Normal	V_{OL}	0	-	0.5	V	

RECEIVER							
Single ended output voltage		-	-0.3	-	4	V	-
AC common mode voltage		-	-	-	7.5	mV	RMS
Termination mismatch at 1MHz		-	-	-	5	%	-
Output impedance (Differential)		Zout	85	100	115	ohms	-
Output Rise/Fall Time		tr/tf	30	-	-	ps	10%~90%
RX_LOS	LOS	V_{OH}	2.4	-	Vcc+0.3	V	-
	Normal	V_{OL}	0	-	0.8	V	-

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
OM3 MMF	L	0.5	-	300	m
Aggregate Bit Rate	BRAggr	-	40	-	Gbps
Per Lane Bit Rate	BR_{LANE}	-	10.3125	-	Gbps
TRANSMITER					
Center Wavelength	λ_c	840	850	860	nm
RMS spectral width	RMS	-	-	0.65	nm
Average Launch Power, Each Lane	Pout/lane	-7.6	-	2.4	dBm
Transmit OMA, per Lane	TX_OMA/lane	-5.6	-	3	dBm
Difference in launch power between any two lanes(OMA)	-	-	-	4	dB
Peak power, each lane	-	-	-	4	dBm
Transmitter and dispersion penalty, each lane	TDP/lane	-	-	3.5	dB
Extinction Ratio	ER	3	-	-	dB
Optical Return Loss Tolerance	-	-	-	12	dB
Average launch power of OFF transmitter, each lane	-	-	-	-30	dBm
Output Optical Eye	IEEE 802.3ba-2010 Compliant				
TX Disable Assert Time	t_off	-	-	100	us
RECEIVER					
Center Wavelength	λ_c	840	850	860	nm
Damage Threshold	-	3.4	-	-	dBm
Stressed receiver sensitivity in OMA, each lane	Pmins	-	-	-5.4	dBm
Maximum Receive Power, each lane	Pmax	-	-	2.4	dBm
Average power at receiver input, each lane	RX/lane	-9.5	-	+2.4	dBm
LOS De-Assert, OMA	LOSD	-	-	-7.5	dBm
Receiver reflectance	Rr	-	-	-12	dB
LOS Assert	LOSA	-30	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

QSFP+ OPTEC, 40G, AOC, 1-100M ACTIVE OPTICAL CABLE TO QSFP+

QSFP+40G-AOC-XM

QSFP+ OPTEC, 40G, AOC, 1-100M ACTIVE OPTICAL CABLE TO QSFP+ is a high performance integrated cable for short-range multi-lane data communication and interconnect applications. It integrates four data lanes in each direction with 40 Gbps aggregate bandwidth. Each lane can operate at 10 Gbps with lengths ranging from one to 100 m. These Active Optical Cables utilize multimode fiber using a nominal wavelength of 850nm.

APPLICATIONS

- InfiniBand QDR (4 x 10G), DDR (4 x 5G) andSDR (4 x2.5G) interconnects
- High Performance and High Productivity computer interconnects
- Data Aggregation, Backplane and Proprietary Density Applications
- PCI-Express, SAS/SATA, Fibre Channel compatible interconnect
- Datacom and Telecom switch and router backplane connections

FEATURES

- Compliant to the IEEE 802.3ba(40GBASE-SR4)
- 40Gbps aggregated bidirectional data throughput
- Compliant to the QSFP+ MSA SFF-8436 Specification
- Active Optical Cables Length up to 100m
- VCSEL array transmitter and PIN array receiver
- Low Power dissipation < 0.35W per channel
- Infiniband 4XQDR/40G Base-SR10 Compliant Laser Class 1
- Operating Case Temperature: 0℃~+70℃

Product Information

Product Name	Data Rate	Fiber	AOC Length*(note1)	Interface	Temp.	DDM
QSFP+ OPTEC, 40G, AOC, 1-100M ACTIVE OPTICAL CABLE TO QSFP+	40Gbps	MMF	1~100m	LC	Standard	YES

note1 - Length measured OM3 fiber. XX denotes the AOC length with unit meter. For example, 01 denotes 1m, 02 denote 2m ... 99 denote 99m and 1H denotes 100m.

Absolute Maximum Ratings*(note2)

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note2 - *Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

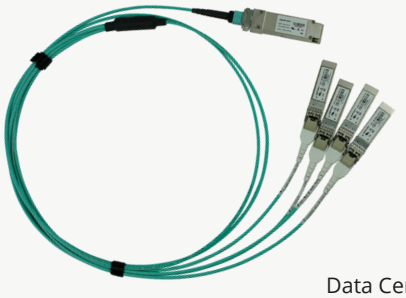
Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Aggregate Bit Rate	BR_{AVE}		-	41.25	-	Gbps
Lane Bit Rate	BR_{LANE}		-	10.3125	-	Gbps

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

QSFP+ OPTEC, 40G, AOC, 1-100M ACTIVE OPTICAL CABLE TO 4xSFP+

QSFP+40G-AOC-4XSFP+



QSFP+ OPTEC, 40G, AOC, 1-100M ACTIVE OPTICAL CABLE TO 4xSFP+ is a high performance integrated cable for short-range multi-lane data communication and interconnect applications. It integrates four data lanes in each direction with 40 Gbps aggregate bandwidth. Each lane can operate at 10 Gbps with lengths ranging from one to 100 m. These Active Optical Cables utilize multimode fiber using a nominal wavelength of 850nm.

APPLICATIONS

Data Centers with 10GbE • requirements with ToR and Aggregation Architectures

Network Switch Manufacturers • supporting 40/10 GbE

Server Manufactures supporting 10/40 GbE •

Manufactures of 10GbE Host Card • Adapters (HCA/NIC)

System Integrators •

FEATURES

- Supports 40G to 10G Ethernet interoperability
- No optical splices - seamless fiber from end-to-end
- Less cabling to order and manage
- Simplify cable installation
- Aggregate 4 discrete SFP+ 10G channels into single parallel QSFP+ 40G interface
- Optimize network cabling by offsetting the delta between switch and server ports (1:4)
- Light weight, very small fiber outer diameter
- Lengths up to 100 meters over OM3

Product Information

Product Name	Data Rate	Fiber	AOC Length*(note1)	Interface	Temp.	DDM
QSFP+ OPTEC, 40G, AOC, 1-100M ACTIVE OPTICAL CABLE TO 4xSFP+	40Gbps	MMF	1~100m	LC	Standard	YES

note1 - Length measured OM3 fiber. XX denotes the AOC length with unit meter. For example, 01 denotes 1m, 02 denote 2m ... 99 denote 99m and 1H denotes 100m.

Absolute Maximum Ratings*(note2)

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

note2 - *Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

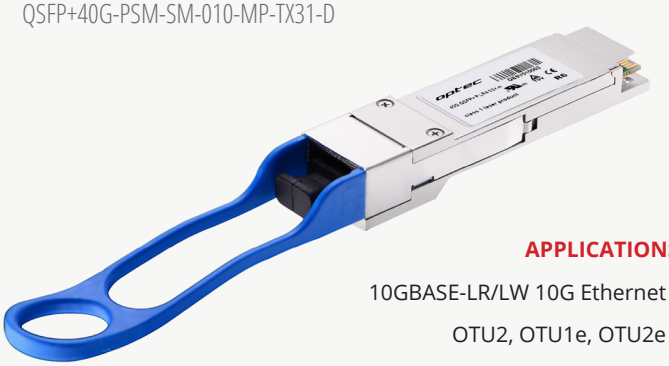
Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Aggregate Bit Rate	BR_{AVE}		-	41.25	-	Gbps
Lane Bit Rate	BR_{LANE}		-	10.3125	-	Gbps

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

QSFP+ PSM OPTEC, 40G, SM MPO/MPT, 10KM, 4XTX1310, DDM (QSFP-40GBASE-PLR4)

QSFP+40G-PSM-SM-010-MP-TX31-D



QSFP+ PSM OPTEC, 40G, SM MPO/MPT, 10km, 4xTX1310, DDM (QSFP-40GBASE-PLR4) transceiver modules are designed for use in high density 10 Gigabit Ethernet links over single mode fiber. They are compliant with the QSFP+ MSA, IEEE 802.3ae 10GBASE-LR/LW, and OTN data rates OTU2, OTU1e, and OTU2e per the ITU. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+ MSA. The transceiver is RoHS compliant per Directive 2011/65/EU5.

APPLICATIONS

10GBASE-LR/LW 10G Ethernet •

OTU2, OTU1e, OTU2e •

FEATURES

- Hot-pluggable QSFP+ form factor
- Supports 4 independent streams of10G Ethernet or OTN data
- Power dissipation < 2.5W
- RoHS-6 compliant
- Commercial case temperaturerange 0°C to 70°C
- Single 3.3V power supply
- Maximum link length of 10km on Single Mode Fiber (SMF)
- XLPPI electrical interface
- MPO12 receptacle
- Built-in digital diagnostic functions,including Tx/Rx power monitoring

Product Information						
Product Name	Data Rate	Fiber	Distance	Interface	Temp.	DDM
QSFP+ PSM OPTEC, 40G, SM, MPO/MPT, 10km, 4xTX1310nm, DDM (QSFP-40GBASE-PLR4)	40Gbps	SMF	10km	MPO/MPT	Standard	YES

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	0	85	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions					
Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T_c Standard	0	-	70	°C

Performance Specifications - Electrical					
Parameter	Symbol	Min.	Typical	Max.	Unit
Supply Voltage	Vcc	3.1	-	3.47	V
Supply Current	Icc	-	-	1.13	A
Transmit turn-on time	-	-	-	2000	ms
TRANSMITTER					
Single ended input voltage tolerance	VinT	-0.3	-	4.0	V
Differential data input swing	Vin,pp	120	-	1200	mVpp
Differential input threshold	-	-	50	-	mV
AC common mode input voltage tolerance (RMS)	-	15	-	-	mV
Differential input return loss	Per IEEE P802.3ba,Section 86A.4.1.1				dB
J2 Jitter Tolerance	Jt2	0.17	-	-	UI
Differential input threshold	Jt9	0.29	-	-	UI
Data Dependent Pulse Width Shrinkage	DDPWS	0.07	-	-	UI

RECEIVER					
Single-ended output voltage	λ_C	-0.3	-	4.0	V
Differential data outputswing	Vout,pp	200	-	400	mVpp
		300	-	600	
		400	-	800	
		600	-	1200	
AC common mode output voltage (RMS)	-	-	-	7.5	mV
Termination mismatch at 1 MHx	-	-	-	5	%
Differential output return loss	Per IEEE P802.3ba,Section 86A.4.2.1				dB
Common mode output return loss	Per IEEE P802.3ba,Section 86A.4.2.2				dB
Output transition time, 20% to 80%	-	28	-	-	ps
J2 Jitter output	Jo2	-	-	0.42	UI
J9 Jitter output	Jo9	-	-	0.65	UI
Power Supply Ripple Tolerance	PSR	50	-	-	mVpp

Optical Characteristics

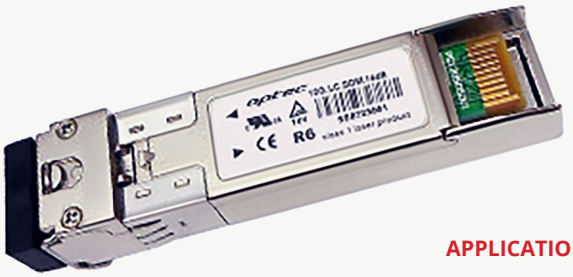
Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITTER					
Signaling Speed per Lane	-	9.95	-	10.095	GBd
Lane center wavelength	λ	1290	-	1330	-
Average Launch Power per Lane	TXPx	-6.0	-	-1.0	dBm
Transmit OMA per Lane	TxOMA	-5.2	-	3.0	dBm
Transmitter and Dispersion Penalty	TDP	-	-	3.2	dBm
Transmit OMA per lane minus TDP	-	-6.2	-	-	dB
Optical Extinction Ratio	ER	6.0	-	-	dB
Sidemode Suppression ratio	SSRmin	30	-	-	dB
Average launch power of OFF transmitter, per lane	-	-	-	-30	dBm
Relative Intensity Noise	RIN	-	-	-128	dB/Hz
Tx Jitter	Txj			-20	dB
Transmitter Reflectance	-	-	-	-12	dB
Transmitter eye mask definition	Per 802.3ae, G.693, and G.691				
RECEIVER					
Signaling Speed per Lane	-	9.95	-	10.095	GBd
Lane center wavelength	λ	1260	-	1355	-
Damage Threshold per Lane	P_{MAX}	-	-	1.5	dBm
Average Receive Power per Lane	RXPx	-14.4	-	0.5	dBm
Receiver Sensitivity (OMA) per Lane	Rxsens	-	-	-12.6	dBm
Stressed Receiver Sensitivity (OMA) per Lane	SRS	-	-	-10.3	dBm
Return Loss	RL	-	-	-14	dBm
Receive electrical 3 dB upper cutoff frequency, per lane	SRS	-	-	12.3	GHz
LOS De-Assert	LOS_D	-	-	-14	dBm
LOS Assert	LOS_A	-30	-	-17	GHz
LOS Hysteresis	-	-	0.5	-	dB

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

SFP+ DWDM OPTEC, 10G, SM LC, 14DB EML/PIN (40KM), TX1528.77-1565.50 (CH:15-61), DDM

SFP+DWDMSMLC-14DB-CH1761D



SFP+ DWDM OPTEC, 10G, SM LC, 14DB EML/PIN (40KM), TX1528.77-1565.50 (CH:15-61), DDM transceiver module is small form factor pluggable module for duplex optical data communications. It is designed for single mode fiber and operates at a nominal DWDM wavelength from 1528.77nm to 1565.50nm as specified by the ITU-T. It is designed to deploy in the DWDM networking equipment in metropolitan access and core networks.

APPLICATIONS

10GBASE-ER/EW •

10G FC •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s •

CPRI rates 9.830 Gb/s,7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s •

Other optical links •

FEATURES

- Available in all C-Band Wavelengths on the 100GHz DWDM ITU Grid
- Temperature-Stabilized DWDM EML Transmitter
- Duplex LC Connector
- Power Dissipation (0°C to 70°C) < 1.5W, Power Dissipation (-40°C to 70°C) < 1.8W
- Dispersion tolerance from -300ps/nm to 800ps/nm
- Hot-Pluggable SFP+ Footprint
- Compliant with SFF-8431 MSA
- Compliant with SFF-8432 MSA
- Operating Case Temperature Standard: 0°C to 70°C

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ DWDM OPTEC, 10G, SM LC, 14dB EML/PIN (40km), TX1528.77-1565.50 (ch:15-61), DDM	0.6Gbps to 11.3Gbps	SMF	14 dB	DWDM EML	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{cc}		3.15	3.3	3.45	V
Power Supply Current	Icc (0°C to 70°C)		-	350	455	mA
	Icc (-40°C to 85°C)		-	350	545	mA
Date Rate	DR		0.6	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	250	-	1000	mVpp	AC coupled inputs
Input Impedance (Differential)		Zin	85	100	115	ohms	Rin > 100 kohms @ DC
TX_Dis	Disable	-	2	-	Vcc+0.3	V	-
	Enable	-	0	-	0.8	V	-

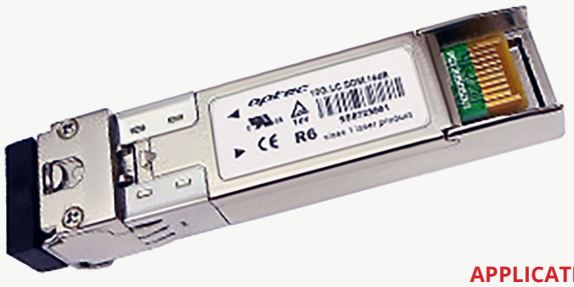
TX_FAULT	Fault	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.5	V	-
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	AC coupled outputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-
RX_LOS	LOS	-	2	-	Vcc+0.3	ohm	-
	Normal	-	0	-	0.8	V	-

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
Data Rate	-	0.6	-	11.3	Gbps
TRANSMITER					
Center Wavelength Spacing	-	-	100	-	GHz
	-	-	0.8	-	nm
Side Mode Suppression Ratio	SMSR	-100	-	+100	dB
Average Output Power	Pout	-1	-	4	dBm
Average Launch Power (Tx: OFF)	Poff	-	-	-30	dBm
Extinction Ratio	ER	3.5	-	-	dB
Transmitter Dispersion Penalty @800ps/nm	TDP	-	-	2	dB
P_{out}@TX Disable Asserted	Pout	-	-	-45	dBm
Relative Intensity Noise	RIN	-2.5		-128	dB/Hz
TX Jitter	TXj	Per 802.3ae requirements			
RECEIVER					
Receiver Sensitivity	Pmin	-	-	-15	dBm
Receiver Overload	Pmax	-1	-	-	dBm
LOS De-Assert	LOSD		-	-17	dBm
LOS Assert	LOSA	-29	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ DWDM OPTEC, 10G, SM LC, 23DB EML/APD (80KM), TX1528.77-1565.50 (CH:15-61), DDM

SFP+DWDMSMLC-23DB-CH1761D



SFP+ DWDM OPTEC, 10G, SM LC, 23dB EML/APD (80km), TX1528.77-1565.50 (ch:15-61), DDM transceiver module is small form factor pluggable module for duplex optical data communications. This module is designed for single mode fiber and operates at a nominal DWDM wavelength from 1528.77nm to 1565.50nm as specified by the ITU-T. It is designed to deploy in the DWDM networking equipment in metropolitan access and core networks.

APPLICATIONS

10GBASE-ZR/ZW •

10G FC •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s •

CPRI rates 9.830 Gb/s,7.373Gb/s, 6.144 Gb/s, • 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other optical links •

FEATURES

- Supports up to 11.3Gbps
- Available in all C-Band Wavelengths on the 100GHz DWDM ITU Grid
- Temperature-Stabilized DWDM EML Transmitter
- Duplex LC Connector
- Power Dissipation < 1.5W
- Dispersion tolerance from -500ps/nm to 1600ps/nm
- Hot-Pluggable SFP+ Footprint
- Compliant with SFF-8431 MSA and SFF-8432 MSA
- Operating Case Temperature Standard: 0°C to 70°C, Extended: -20°C to 75°C

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ DWDM OPTEC, 10G, SM LC, 23dB EML/APD (80km), TX1528.77-1565.50 (ch:15-61), DDM	0.6Gbps to 11.3Gbps	SMF	23 dB	DWDM EML	LC	Standard Extended	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
		Extended	-20	-	75	
Power Supply Voltage	V_{cc}		3.15	3.3	3.45	V
Power Supply Current	I_{cc}		-	300	430	mA
Date Rate	DR		0.6	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)	Vin	250	-	1000	mVpp	AC coupled inputs
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC

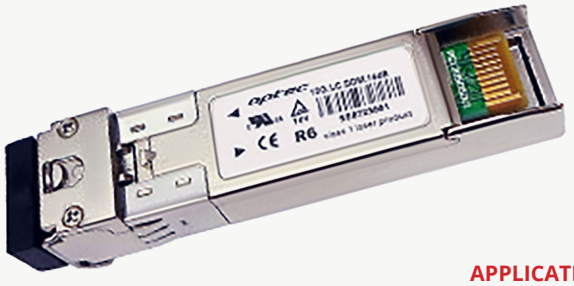
TX_Dis	Disable		2		Vcc+0.3	V	
	Enable		0		0.8	V	
TX_FAULT	LOS		2		Vcc+0.3	V	
	Normal		0		0.5	V	
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	AC coupled outputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
Data Rate		0.6	-	11.3	Gbps
TRANSMITER					
Center Wavelength Spacing	-	-	100	-	GHz
	-	-	0.8	-	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power	Pout	0	-	5	dBm
Average Launch Power (Tx: OFF)	Poff	-	-	-30	dBm
Extinction Ratio	ER	3.5	-	-	dB
Transmitter Dispersion Penalty @800ps/nm	TDP	-	-	3.5	dB
P_{out}@TX Disable Asserted	Pout	-	-	-45	dBm
Relative Intensity Noise	RIN	-		-128	dB/Hz
TX Jitter	TXj	Per 802.3ae requirements			
RECEIVER					
Receiver Sensitivity	Pmin	-	-	-23	dBm
Receiver Overload	Pmax	-6	-	-	dBm
LOS De-Assert	LOSD		-	-24	dBm
LOS Assert	LOSA	-40	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ DWDM OPTEC, 10G, SM LC, 14DB EML/PIN (40KM), 1529.94-1561.42 (CH:200-595), DDM

SFP+DWDMSMLC-14DB-CH1761D



SFP+ DWDM OPTEC, 10G, SM LC, 14dB EML/PIN (40km), TX1529.94-1561.42 (ch:200-595), DDM transceiver module is small form factor pluggable module for duplex optical data communications. This module is designed for single mode fiber and operates at a nominal DWDM wavelength from 1529.94nm to 1561.42nm as specified by the ITU-T. It is designed to deploy in the DWDM networking equipment in metropolitan access and core networks.

APPLICATIONS

10GBASE-ER/EW •

10G FC •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, •

1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, •

6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

FEATURES

- Available in all C-Band Wavelengths on the 50GHz DWDM ITU Grid
- Temperature-Stabilized DWDM EML Transmitter
- Duplex LC Connector
- Power Dissipation (0°C to 70°C) < 1.5W,
  Power Dissipation (-40°C to 85°C) < 1.8W
- Dispersion tolerance from -300ps/nm to 800ps/nm
- Hot-Pluggable SFP+ Footprint
- Compliant with SFF-8431 MSA and SFF-8432 MSA
- Compliant with Operating Case Temperature Standard: 0°C to 70°C

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ DWDM OPTEC, 10G, SM LC, 14dB EML/PIN (40km), TX1529.94-1561.42 (ch:200-595), DDM	0.6Gbps to 11.3Gbps	SMF	14 dB	DWDM EML	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	-	-	95	%

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{cc}		3.15	3.3	3.45	V
Power Supply Current	Icc (0°C to 70°C)		-	350	455	mA
	Icc (-40°C to 85°C)		-	350	545	mA
Date Rate	DR		0.6	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	250	-	1000	mVpp	AC coupled inputs
Input Impedance (Differential)		Zin	85	100	115	ohms	Rin > 100 kohms @ DC
TX_Dis	Disable	-	2	-	Vcc+0.3	V	-
	Enable	-	0	-	0.8	V	-
TX_FAULT	LOS	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.5	V	-

RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	AC coupled outputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-
RX_LOS	LOS	-	2	-	Vcc+0.3	ohm	-
	Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	-	With Serial ID
		VoL	0	-	0.5	-	

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
Data Rate		0.6	-	11.3	Gbps
TRANSMITER					
Center Wavelength Spacing	-	-	100	-	GHz
	-	-	0.8	-	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power	Pout	0	-	5	dBm
Average Launch Power (Tx: OFF)	Poff	-	-	-30	dBm
Extinction Ratio	ER	3.5	-	-	dB
Transmitter Dispersion Penalty @800ps/nm	TDP	-	-	3.5	dB
P_{out}@TX Disable Asserted	Pout	-	-	-45	dBm
Relative Intensity Noise	RIN	-		-128	dB/Hz
TX Jitter	TXj	Per 802.3ae requirements			
RECEIVER					
Receiver Sensitivity	Pmin	-	-	-23	dBm
Receiver Overload	Pmax	-6	-	-	dBm
LOS De-Assert	LOSD		-	-24	dBm
LOS Assert	LOSA	-40	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ DWDM OPTEC, 10G, SM LC, 23DB EML/APD (80KM), 1529.94-1561.42 (CH:200-595), DDM

SFP+DWDMSMLC-23DB-CH1761D

SFP+ DWDM OPTEC, 10G, SM LC, 23dB EML/APD (80km), TX1529.94-1561.42 (ch:200-595), DDM transceiver module is is small form factor pluggable module for duplex optical data communications. This module is designed for single mode fiber and operates at a nominal DWDM wavelength from 1529.94nm to 1561.42nm as specified by the ITU-T. It is designed to deploy in the DWDM networking equipment in metropolitan access and core networks.

APPLICATIONS

- 10GBASE-ZR/ZW
- 10G FC
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- CPRI rates 9.830 Gb/s,7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

FEATURES

- Support data rate up to 11.3Gbps
- Available in all C-Band Wavelengths on the 50GHz DWDM ITU Grid
- Temperature-Stabilized DWDM EML Transmitter
- Duplex LC Connector
- Power Dissipation < 1.5W
- Dispersion tolerance from -500ps/nm to 1600ps/nm
- Hot-Pluggable SFP+ Footprint
- Compliant with SFF-8431 MSA and Compliant with SFF-8432 MSA
- Operating Case Temperature Standard: 0°C to 70°C, Extended: -20°C to 75°C

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ DWDM OPTEC, 10G, SM LC, 23dB EML/APD (80km), TX1529.94-1561.42 (ch:200-595), DDM	0.6Gbps to 11.3Gbps	SMF	23 dB	DWDM EML	LC	Standard Extended	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
		Extended	-20	-	75	
Power Supply Voltage	V_{cc}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	300	430	mA
Date Rate	DR		0.614	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	250	-	1000	mVpp	AC coupled inputs
Input Impedance (Differential)		Zin	85	100	115	ohms	Rin > 100 kohms @ DC
TX_Dis	Disable		2		Vcc+0.3	V	
	Enable		0		0.8	V	

TX_FAULT	LOS		2		Vcc+0.3	V	
	Normal		0		0.5	V	
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	AC coupled outputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-
RX_LOS	LOS	-	2	-	Vcc+0.3	ohm	-
	Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	-	With Serial ID
		VoL	0	-	0.5	-	

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
Data Rate	-	0.614	-	11.3	Gbps
TRANSMITER					
Center Wavelength Spacing	-	-	50	-	GHz
	-	-	0.4	-	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power	Pout	0	-	5	dBm
Average Launch Power (Tx: OFF)	Poff	-	-	-30	dBm
Extinction Ratio	ER	3.5	-	-	dB
Transmitter Dispersion Penalty @800ps/nm	TDP	-	-	3.5	dB
P_{out}@TX Disable Asserted	Pout	-	-	-45	dBm
Relative Intensity Noise	RIN	-		-128	dB/Hz
TX Jitter	TXj	Per 802.3ae requirements			
RECEIVER					
Receiver Sensitivity	Pmin	-	-	-23	dBm
Receiver Overload	Pmax	-8	-	-	dBm
LOS De-Assert	LOSD		-	-24	dBm
LOS Assert	LOSA	-35	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ CWDM OPTEC, 10G, SM LC, 10DB DFB/PIN (10KM), TX1270-1610, DDM

SFP+CWDMSMLC-10DB-TX2761D

SFP+ CWDM OPTEC, 10G, SM LC, 10dB DFB/PIN (10km), TX1270-1610, DDM transceiver module is designed for fiber communications application such as 10G Ethernet (10GBASE-LR), which fully compliant with the specification of SFP+ MSA SFF-8431. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eighteen center wavelengths available from 1270nm to 1610nm, with each step 20nm. A guaranteed minimum optical link budget of 10 dB is offered.

APPLICATIONS

10GBASE-LR/LW 10G Ethernet •

10GBASE-LR at 10.31Gbps •

10GBASE-LW at 9.95Gbps •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, 6.144 Gb/s, • 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other optical links •

FEATURES

- Supports 9.95Gb/s to 11.3Gb/s bit rates
- Hot-Pluggable SFP+ footprint
- 18-Wavelength CWDM DFB Transmitter from 1270nm to 1610nm, with step 20nm
- 10dB Power Budget at LeasDuplex LC connector
- Duplex LC connector
- Power Dissipation < 1.2W
- Case operation temperature range -5°C to 70°C
- Compliant with SFP+ MSA Specification SFF-8431
- Build-in digital diagnostic functions
- Compliant with SFF-8472 MSA

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ CWDM OPTEC, 10G, SM LC, 10dB DFB/ PIN (10km), TX1270-1610, DDM	0.614Gbps to 11.3Gbps	SMF	10dB	CWDM DFB	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	V_{CC}	-0.5	4.0	V
Storage Temperature	T_S	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	-5	-	70	°C
Power Supply Voltage	V_{CC}		3.13	3.3	3.45	V
Power Supply Current	Icc		-	-	350	mA
Date Rate	-		0.614	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	150	-	1200	mVpp	After internal AC coupling
Input Impedance (Differential)		Zin	85	100	115	ohms	-
Tx_DISABLE Input Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-

Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	Reference the SFF-8472 MSA
		VoL	0	-	0.5	V	

Optical Characteristics						
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Note**
TRANSMITER						
Output Opt. Pwr: 9/125 SMF	Pout	-5	-	0	dBm	*1
Optical Extinction Ratio	ER	3.5	-	-	dB	-
Optical Wavelength	λ	λc−6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Transmitter and Dispersion Penalty	TDP	-	-	2	dB	-
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	-
TX Jitter Generation (Peak-to-Peak)	TXj	-	-	0.1	dB/Hz	-
TX Jitter Generation (RMS)	TXj RMS	-	-	0.01		-
RECEIVER						
Receiver Sensitivity @ 10.7Gb/s	Pmin	-	-	-15	dBm	*3
Maximum Input Power	Pmax	+0.5	-	-	dBm	-
Optical Center Wavelength	λ	1260	-	1620	nm	-
Receiver Reflectance	Rrf	-	-	-27	dB	-
LOS De-Assert	LOS_D	-	-	-16	dBm	-
LOS Assert	LOS_A	-28	-	-	dBm	-
LOS Hysteresis	-	1	-	-	dB	-

Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ CWDM OPTEC, 10G, SM LC, 14DB DFB/PIN (40KM), TX1270-1450, DDM

SFP+CWDMSMLC-14DB-TX2745D

SFP+ CWDM OPTEC, 10G, SM LC, 14dB DFB/PIN (40km), TXD1270-1450, DDM transceiver module is designed for fiber communications application such as 10G Ethernet (10GBASE-ER), which fully compliant with the specification of SFP+ MSA SFF-8431. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are ten center wavelengths available from 1270nm to 1450nm, with each step 20nm. A guaranteed minimum optical link budget of 14 dB is offered.

APPLICATIONS

10GBASE-ER/EW 10G Ethernet •

10GBASE-ER at 10.31Gbps •

10GBASE-EW at 9.95Gbps •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s,

1.229 Gb/s, 0.614Gb/s •

Other optical links •

FEATURES

- Up to 11.1Gb/s bit rates
- Hot-Pluggable SFP+ footprint
- 10-Wavelength CWDM DFB Transmitter from 1270nm to 1450nm, with step 20nm
- 14dB Power Budget
- Duplex LC connector
- Power Dissipation < 1.2W
- Case operation temperature range -5°C to 70°C
- Compliant with SFP+ MSA Specification SFF-8431
- Build-in digital diagnostic functions
- Compliant with SFF-8472 MSA

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ CWDM OPTEC, 10G, SM LC, 14dB DFB/ PIN (40km), TXD1270-1450, DDM	0.614Gbps to 11.1Gbps	SMF	14dB	CWDM DFB	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	V_{cc}	-0.5	4.0	V
Storage Temperature	T_s	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	-5	-	70	°C
Power Supply Voltage	V_{cc}		3.13	3.3	3.45	V
Power Supply Current	Icc		-	-	350	mA
Date Rate	-		-	-	11.1	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	150	-	1200	mVpp	After internal AC coupling
Input Impedance (Differential)		Zin	85	100	115	ohms	
Tx_DISABLE Input Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-

Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.5	V	-
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	Reference the SFF-8472 MSA
		VoL	0	-	0.5	V	

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITER						
Output Opt. Pwr: 9/125 SMF	Pout	-1	-	4	dBm	*1
Optical Extinction Ratio	ER	3.5	-	-	dB	
Optical Wavelength	λ	λc–6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Transmitter and Dispersion Penalty	TDP	-	-	2	dB	
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	
RECEIVER						
Receiver Sensitivity @ 10.5Gb/s	Pmin	-	-	-15	dBm	*3
Maximum Input Power	Pmax	+0.5	-	-	dBm	
Optical Center Wavelength	λ	1260	-	1460	nm	
Receiver Reflectance	Rrf	-	-	-27	dB	
LOS De-Assert	LOS_D	-	-	-16	dBm	
LOS Assert	LOS_A	-28	-	-	dBm	
LOS Hysteresis	-	1	-	-	dB	

Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ CWDM OPTEC, 10G, SM LC, 14DB EML/PIN (40KM), TX1470-1610, DDM

SFP+CWDMSMLC-14DB-TX4761D

SFP+ CWDM OPTEC, 10G, SM LC, 14dB EML/PIN (40km), TX1470-1610, DDM transceiver module is designed for fiber communications application up to 10G, which fully compliant with the specification of SFP+ MSA SFF-8431. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eight center wavelengths available from 1470nm to 1610nm, with each step 20nm. A guaranteed optical link budget of 14 dB is offered.

APPLICATIONS

10GBASE-ER/EW •

10G FC •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other optical links •

FEATURES

• Hot-Pluggable SFP+ Footprint

• 8-Wavelengths CWDM EML Transmitter from 1470nm to 1610nm, with step 20nm

• 14dB Power Budget

• Duplex LC connector

• Power Dissipation (0°C to 70°C) < 1.5W, (-40°C to 85°C) < 1.8W

• Dispersion tolerance 800ps/nm

• Case Operation Temperature: Standard: 0°C to 70°C, Industrial: -40°C to 85°C

• Compliant with SFF-8431 MSA and SFF-8432 MS

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ CWDM OPTEC, 10G, SM LC, 14dB EML/ PIN (40km), TX1470-1610, DDM	0.6Gbps to 11.3Gbps	SMF	14dB	CWDM DFB	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	V_{CC}	-0.5	4.0	V
Storage Temperature	T_S	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40	-	85	°C
Power Supply Voltage	V_{CC}		3.13	3.3	3.45	V
Power Supply Current	Icc (0°C to 70°C)		-	350	455	mA
	Icc (-40°C to 85°C)		-	350	545	mA
Date Rate	-		0.6	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	180	-	1000	mVpp	After internal AC coupling
Input Impedance (Differential)		Zin	85	100	115	ohms	
Tx_DISABLE Input Voltage	HIGH		2		Vcc+0.3	V	
	LOW		0		0.8	V	

Tx_FAULT Output Voltage	HIGH	-	2		Vcc+0.3	V	-
	LOW	-	0		0.8	V	-
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	Reference the SFF-8472 MSA
		VoL	0	-	0.5	V	

Optical Characteristics						
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Note**
TRANSMITER						
Output Opt. Pwr: 9/125 SMF	Pout	-1	-	+4	dBm	*1
Optical Extinction Ratio	ER	3.5	-	-	dB	-
Optical Wavelength	λ	λc−6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Transmitter and Dispersion Penalty	TDP	-	-	3	dB	-
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	-
TX Jitter Generation (Peak-to-Peak)	TXj	Per 802.3ae requirements				-
Relative Intensity Noise	RIN	-	-	-128	dB/Hz	-
RECEIVER						
Receiver Sensitivity	Pmin	-	-	-15.8	dBm	*3
Maximum Input Power	Pmax	-1	-	-	dBm	-
Optical Center Wavelength	λ	1460	-	1620	nm	-
Receiver Reflectance	Rrf	-	-	-12	dB	-
LOS De-Assert	LOS_D	-	-	-20	dBm	-
LOS Assert	LOS_A	-28	-	-	dBm	-
LOS Hysteresis	-	1	-	-	dB	

Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ CWDM OPTEC, 10G, SM LC, 23DB DFB/APD (60KM), TX1270-1450, DDM

SFP+CWDMSMLC-23DB-TX2745D

SFP+ CWDM OPTEC, 10G, SM LC, 23dB DFB/APD (60km), TX1270-1450, DDM transceiver module is designed for fiber communications application such as 10G Ethernet (10GBASE-ZR/ZW), which fully compliant with the specification of SFP+ MSA SFF-8431. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are ten center wavelengths available from 1270nm to 1450nm, with each step 20nm. A guaranteed optical link budget of 23 dB is offered.

APPLICATIONS

10G Ethernet •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other optical links •

FEATURES

• Supports 9.95Gb/s to 11.3Gb/s Bit Rates

• Hot-Pluggable SFP+ Footprint

• 10-Wavelengths CWDM DFB Transmitter from 1270nm to 1450nm, with step 20nm

• High Sensitivity APD for Receiver

• 23dB Power Budget

• Duplex LC connector

• Power Dissipation < 1.5W

• Case Operation Temperature Range: -5°C to 70°C

• Compliant with SFP+ MSA Specification SFF-8431

• Build-in Digital Diagnostic Functions Compliant with SFF-8472 MSA Specification

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ CWDM OPTEC, 10G, SM LC, 23dB DFB/ APD (60km), TX1270-1450, DDM	0.614Gbps to 11.1Gbps	SMF	23dB	CWDM DFB	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	V_{CC}	-0.5	4.0	V
Storage Temperature	T_s	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	-5	-	70	°C
Power Supply Voltage	V_{CC}		3.13	3.3	3.45	V
Power Supply Current	Icc		-	-	430	mA
Date Rate	-		0.614	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	180	-	1000	mVpp	After internal AC coupling
Input Impedance (Differential)		Zin	85	100	115	ohms	-
Tx_DISABLE Input Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-

Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	Reference the SFF-8472 MSA
		VoL	0	-	0.5	V	

Optical Characteristics						
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Note**
TRANSMITER						
Output Opt. Pwr: 9/125 SMF	Pout	2	-	+5	dBm	*1
Optical Extinction Ratio	ER	3.5	-	-	dB	-
Optical Wavelength	λ	λc–6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	-
TX Jitter	TXj	Per 802.3ae requirements				-
Relative Intensity Noise	RIN	-	-	-128	dB/Hz	-
RECEIVER						
Receiver Sensitivity @ 10.3125Gb/s	Pmin	-	-	-21	dBm	*3
Maximum Input Power	Pmax	-6	-	-	dBm	-
Optical Center Wavelength	λ	1260	-	1460	nm	-
Receiver Reflectance	Rrf	-	-	-12	dB	-
LOS De-Assert	LOS_D	-	-	-23	dBm	-
LOS Assert	LOS_A	-35	-	-	dBm	-
LOS Hysteresis	-	1	-	-	dB	-

Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ CWDM OPTEC, 10G, SM LC, 23DB EML/APD (70KM), TX1470-1610, DDM

SFP+CWDMSMLC-23DB-TX4761D

SFP+ CWDM OPTEC, 10G, SM LC, 23dB EML/APD (70km), TX1470-1610, DDM transceiver module is designed for fiber communications application up to 10G, which fully compliant with the specification of SFP+ MSA SFF-8431. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eight center wavelengths available from 1470nm to 1610nm, with each step 20nm. A guaranteed optical link budget of 23 dB is offered.

APPLICATIONS

10GBASE-ER/EW •

10G FC •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other optical links •

FEATURES

• Hot-Pluggable SFP+ Footprint

• 8-Wavelengths CWDM EML Transmitter from 1470nm to 1610nm, with step 20nm

• With High Sensitivity APD

• 23dB Power Budget

• Duplex LC connector

• Power Dissipation < 1.5W

• Dispersion tolerance 1600ps/nm

• Case Operation Temperature Standard: 0°C to 70°C, Extended: -20°C to 75°C

• Compliant with SFF-8431 MSA / SFF-8432 MSA / SFF-8472 MSA

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ CWDM OPTEC, 10G, SM LC, 23dB EML/APD (70km), TX1470-1610, DDM	0.6Gbps to 11.3Gbps	SMF	23dB	CWDM DFB	LC	Standard Extended	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	V_{CC}	-0.5	4.0	V
Storage Temperature	T_S	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
		Extended	-20	-	75	
Power Supply Voltage	V_{CC}		3.13	3.3	3.45	V
Power Supply Current	Icc		-	-	350	mA
Date Rate	-		0.6	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	180	-	1000	mVpp	After internal AC coupling
Input Impedance (Differential)		Zin	85	100	115	ohms	-
Tx_DISABLE Input Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-

Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	Reference the SFF-8472 MSA
		VoL	0	-	0.5	V	

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
Output Opt. Pwr: 9/125 SMF	Pout	0	-	-	dBm	*1
Optical Extinction Ratio	ER	3.5	-	-	dB	-
Optical Wavelength	λ	λc−6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	-
TX Jitter Generation (Peak-to-Peak)	TXj	Per 802.3ae requirements			dB/Hz	-
Relative Intensity Noise	RIN			-128	dB/Hz	-
RECEIVER						
Receiver Sensitivity	Pmin	-	-	-23	dBm	*3
Maximum Input Power	Pmax	-8	-	-	dBm	-
Optical Center Wavelength	λ	1260	-	1620	nm	-
Receiver Reflectance	Rrf	-	-	-12	dB	-
LOS De-Assert	LOS_D	-	-	-24	dBm	-
LOS Assert	LOS_A	-37	-	-	dBm	-
LOS Hysteresis	-	1	-	-	dB	-

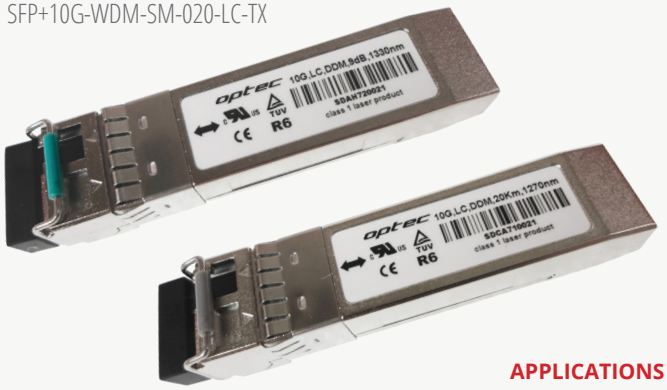
Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ WDM OPTEC, 10G, SM LC, 12DB DFB/PIN (20KM), TX1270/1330, DDM

SFP+10G-WDM-SM-020-LC-TX



APPLICATIONS

10GBASE-LR at 10.3125Gbps •

10GBASE-LW at 9.953Gbps •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other Optical Links •

SFP+ WDM OPTEC, 10G, SM LC, 12dB DFB/PIN (20km), TX1270/1330, DDM transceiver module is small form factor pluggable module for duplex optical data communications such as 10GBASE-LR/LW defined by IEEE 802.3ae. It is with the SFP+ 20-pin connector to allow hot plug capability. The transmitter section uses a multiple quantum well DFB, which is class 1 laser compliant according to International Safety Standard IEC-60825.

FEATURES

• Operating data rate up to 11.3Gbps

• Two types:

A: 1270nm DFB Transmitter/ 1330nm Receiver

B: 1330nm DFB Transmitter/ 1270nm Receiver

• Power budget up to 12dB

• Single 3.3V Power supply and TTL Logic Interface

• LC Connector Interface

• Hot Pluggable

• Power Dissipation < 1.5W

• Operating Case Temperature Standard: 0 to +70 ℃
Industrial: -40 to +85℃

• Compliant with SFP+ MSA Specification SFF-8431 / IEEE 802.3ae 10GBASE-LR / IEEE 802.3ae 10GBASE-LW / SFF-8472

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ WDM OPTEC, 10G, SM LC, 12dB DFB/PIN (20km), TX1270/1330, DDM	11.3Gbps	SMF	12dB	1270nm DFB	LC	Standard	YES
						Industrial	
SFP+ WDM OPTEC, 10G, SM LC, 12dB DFB/PIN (20km), TX1330/1270, DDM				1330nm DFB		Standard	
						Industrial	

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	V_{CC}	-0.5	3.6	V
Storage Temperature	T_s	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	430	mA
Surge Current	ISurge		-	-	+30	mA
Baud Rate	-		0.6	10.3125	11.3	GBaud

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)	Vin	150	-	1200	mVpp	After internal AC coupling
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC

Tx_DISABLE Input Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.5	V	Io = -4.0mA
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.8	V	Io = -4.0mA
MOD_DEF (2:0)		VoH	2.5	-	-	V	Reference the SFF-8472 MSA
		VoL	0	-	0.5	V	

Optical Characteristics						
Parameter		**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
Power budget		-	12	-	4	dB
Data Rate		-	0.6	10.3125	11.3	Gbps
TRANSMITTER						
Center Wavelength	1270nm	λ	1260	1270	1280	nm
	1330nm		1320	1330	1340	
-20dB Spectrum Width		Δλ	-	-	1	nm
Side Mode Suppression Ratio		SMSR	30	-	-	dB
Average Output Power		Pout, AVG	-2	-	3	dBm
Extinction Ratio		ER	3.5	-		dB
Average Power of OFF Transmitter		-	-	-	-30	dBm
Relative Intensity Noise		RIN	-	-	-128	dB/Hz
TX Disable Assert Time		t_off	-	-	10	us
RECEIVER						
Center Wavelength	1270nm	λ_C	1320	-	1340	nm
	1330nm		1260	-	1280	
Sensitivity		P_{IN}	-	-	-14	dBm
Receiver Overload		P_{MAX}	0.5	-	-	dBm
LOS De-Assert		LOS_D	-	-	-18	dB
LOS Assert		LOS_A	-30	-	-	dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ WDM OPTEC, 10G, SM LC, 16DB DFB/PIN (40KM), TX1270/1330, DDM

SFP+10G-WDM-SM-040-LC-TX

SFP+ WDM OPTEC, 10G, SM LC, 16dB DFB/PIN (40km), TX1270/1330, DDM transceiver module is small form factor pluggable module for duplex optical data communications such as 10GBASE-LR/LW defined by IEEE 802.3ae. It is with the SFP+ 20-pin connector to allow hot plug capability. The transmitter section uses a multiple quantum well DFB, which is class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

10GBASE-ER at 10.3125Gbps •

10GBASE-EW at 9.953Gbps •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other Optical Links •

FEATURES

• Operating data rate up to11.3Gbps

• Two types:

A: 1270nm DFB Transmitter/ 1330nm Receiver

B: 1330nm DFB Transmitter/ 1270nm Receiver

• Power budget 16dB at least

• Single 3.3V Power supply and TTL Logic Interface

• LC Connector Interface

• Hot Pluggable

• Power Dissipation < 1.5W

• Operating Case Temperature Standard: 0 to +70 ℃
Industrial: -40 to +85℃

• Compliant with SFP+ MSA Specification SFF-8431 / IEEE 802.3ae 10GBASE-ER / IEEE 802.3ae 10GBASE-EW / SFF-8472

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ WDM OPTEC, 10G, SM LC, 16dB DFB/PIN (40km), TX1270/1330, DDM	11.3Gbps	SMF	16dB	1270nm DFB	LC	Standard	YES
						Industrial	
SFP+ WDM OPTEC, 10G, SM LC, 16dB DFB/PIN (40km), TX1330/1270, DDM				1330nm DFB		Standard	
						Industrial	

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	V_{CC}	-0.5	3.6	V
Storage Temperature	T_S	-40	+85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	430	mA
Surge Current	ISurge		-	-	+30	mA
Baud Rate	-		0.6	10.3125	11.3	GBaud

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)	Vin	150	-	1200	mVpp	After internal AC coupling
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC

Tx_DISABLE Input Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.5	V	Io = -4.0mA
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.8	V	Io = -4.0mA
MOD_DEF (0:2)		VoH	2.5	-	-	V	Reference the SFF-8472 MSA
		VoL	0	-	0.5	V	

Optical Characteristics						
Parameter		**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
Power budget		-	16	-	-	dB
Data Rate		-	0.6	10.3125	11.3	Gbps
TRANSMITER						
Center Wavelength	1270nm	λ	1260	1270	1280	nm
	1330nm		1320	1330	1340	
-20dB Spectrum Width		Δλ	-	-	1	nm
Side Mode Suppression Ratio		SMSR	30	-	-	dB
Average Output Power		Pout, AVG	1	-	5	dBm
Extinction Ratio		ER	3.5	-		dB
Average Power of OFF Transmitter		-	-	-	-30	dBm
Relative Intensity Noise		RIN	-	-	-128	dB/Hz
TX Disable Assert Time		t_off	-	-	10	us
RECEIVER						
Center Wavelength	1270nm	λ_C	1320	-	1340	dBm
	1330nm		1260	-	1280	
Sensitivity		P_{IN}	-	-	-18	dBm
Receiver Overload		P_{MAX}	0.5	-	-	nm
LOS De-Assert		LOS_D	-	-	-18	dB
LOS Assert		LOS_A	-30	-	-	dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ WDM OPTEC, 10G, SM LC, 21DB DFB/APD (60KM), TX1270/1330, DDM

SFP+10G-WDM-SM-060-LC-TX

SFP+ WDM OPTEC, 10G, SM LC, 21dB DFB/APD (60km), TX1270/1330, DDM transceiver module is small form factor pluggable module for duplex optical data communications such as 10GBASE-LR/LW defined by IEEE 802.3ae. It is with the SFP+ 20-pin connector to allow hot plug capability. The transmitter section uses a multiple quantum well DFB, which is class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

10GBASE-ER at 10.3125Gbps •

10GBASE-EW at 9.953Gbps •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other Optical Links •

FEATURES

• Operating data rate up to11.3Gbps

• Two types:

A: 1270nm DFB Transmitter/ 1330nm Receiver

B: 1330nm DFB Transmitter/ 1270nm Receiver

• Power budget 16dB at least

• Single 3.3V Power supply and TTL Logic Interface

• LC Connector Interface

• Hot Pluggable

• Power Dissipation < 1.5W

• Operating Case Temperature Standard: 0 to +70 °C
Industrial: -40 to +85°C

• Compliant with SFP+ MSA Specification SFF-8431 / IEEE 802.3ae 10GBASE-ER / IEEE 802.3ae 10GBASE-EW

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
SFP+ WDM OPTEC, 10G, SM LC, 21dB DFB/ APD (60km), TX1270/1330, DDM	Up to 11.3Gbps	SMF	21dB	1270nm DFB	LC	Standard	YES
						Industrial	
SFP+ WDM OPTEC, 10G, SM LC, 21dB DFB/ APD (60km), TX1330/1270, DDM				1330nm DFB		Standard	
						Industrial	

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	V_{CC}	-0.5	3.6	V
Storage Temperature	T_S	-40	+85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	430	mA
Surge Current	ISurge		-	-	+30	mA
Baud Rate	-		0.6	10.3125	11.3	GBaud

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)	Vin	150	-	1200	mVpp	After internal AC coupling
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC

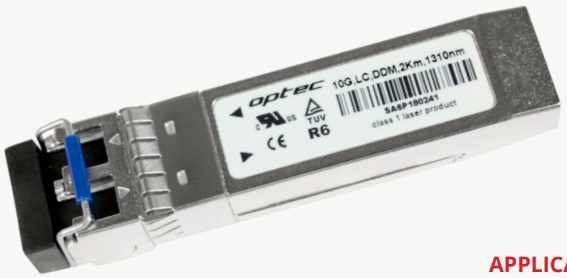
Tx_DISABLE Input Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.5	V	Io = -4.0mA
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.8	V	Io = -4.0mA
MOD_DEF (0:2)		VoH	2.5	-	-	V	Reference the SFF-8472 MSA
		VoL	0	-	0.5	V	

Optical Characteristics						
Parameter		**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
Power budget		-	21	-	-	dB
Data Rate		-	0.6	10.3125	11.3	Gbps
TRANSMITER						
Center Wavelength	1270nm	λ	1260	1270	1280	nm
	1330nm		1320	1330	1340	
-20dB Spectrum Width		Δλ	-	-	1	nm
Side Mode Suppression Ratio		SMSR	30	-	-	dB
Average Output Power		Pout, AVG	1	-	6	dBm
Extinction Ratio		ER	3.5	-		dB
Average Power of OFF Transmitter		-	-	-	-30	dBm
Relative Intensity Noise		RIN	-	-	-128	dB/Hz
TX Disable Assert Time		t_off	-	-	10	us
RECEIVER						
Center Wavelength	1270nm	λ_C	1320	-	1340	dBm
	1330nm		1260	-	1280	
Sensitivity		P_{IN}	-	-	-14	dBm
Receiver Overload		P_{MAX}	-6	-	-	nm
LOS De-Assert		LOS_D	-	-	-21	dB
LOS Assert		LOS_A	-30	-	-	dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ OPTEC, 10G, SM LC, 2KM, TX1310, DDM (SFP-10GBASE-LR)

SFP+10G-DF-SM-002-LC-TX31



SFP+ OPTEC, 10G, SM LC, 2km, TX1310, DDM (SFP-10GBASE-LR) transceiver module is small form factor pluggable module for serial optical data communications such as IEEE 802.3ae 10GBASE-LR/LW. It is with the SFP+ 20-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm multiple quantum well FP laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

- 10GBASE-LR at 10.31Gbps
- 10GBASE-LW at 9.95Gbps
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- CPRI rates 9.830 Gb/s,7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s
- Other optical links

FEATURES

- Operating data rate up to 11.3Gbps
- 1310nm FP-LD Transmitter
- Distance up to 2km
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface
- Hot Pluggable
- Power Dissipation < 1.0W
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- Operating Case Temperature Standard: 0 to +70 °C
  Industrial: -40 to +85°C

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
SFP+ OPTEC, 10G, SM LC, 2km, TX1310, DDM (SFP-10GBASE-LR)	0.614Gbps to 11.3Gbps	SMF	2km	1310nm FP	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_S	-40	+85	°C
Supply Voltage	V_{CC}	-0.5	3.6	V
Input Voltage	Vin	-0.5	Vcc	V
Output Current	Io	-	50	mA

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	300	mA
Surge Current	ISurge		-	-	+30	mA
Baud Rate	-		0.6	-	11.3	GBaud

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)	Vin	150	-	1200	mVpp	After internal AC coupling
Input AC Common Mode Voltage		0	-	25	mV	RMS
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC
Differential Input S-parameter	$S_{DD}11$	-	-	-10	dB	-
Differential to Common Mode Conversion	$S_{DD}11$	-	-	-10	dB	-

Tx_DISABLE Input Voltage	HIGH	-	2	-	3.45	V	-
	LOW	-	0	-	0.8	V	-
Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.5	V	Io = -4.0mA
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output AC Common Mode Voltage		-	0	-	15	mV	RMS
Output Impedance (Differential)		Zout	90	100	110	ohms	-
Differential Output S-parameter		S_D22	-	-	-10	dB	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.8	V	Io = -4.0mA
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	-	-	2	-	Km
Data Rate	-	0.6		11.3	Gbps
TRANSMITER					
Center Wavelength	λ	1270	1310	1355	nm
Spectral Width (RMS)	Δλ	-	-	3	nm
Average Output Power	Pout, AVG	-6	-	-1	dBm
Extinction Ratio	ER	3.5	-	-	dB
Average Power of OFF Transmitter	Poff	-	-	-30	dBm
Transmitter Dispersion Penalty	TDP	-	-	3.2	dB
TX Disable Assert Time	t_off	-	-	10	us
TX_DISABLE Negate Time	t_on	-	-	1	ms
TX_BISABLE time to start reset	t_reset	10	-	-	us
Time to initialize, include reset of TX_FAULT	t_init	1	-	300	ms
TX_FAULT from fault to assertion	t_fault	3.5	-	100	us
Total Jitter	TJ	-	-	0.28	UI(p-p)
Data Dependant Jitter	DDJ	-	-	0.1	UI(p-p)
Uncorrelated Jitter	UJ	-	-	0.023	RMS
RECEIVER					
Center Wavelength	λ_C	1260	-	1565	nm
Sensitivity	P_{MIN}	-	-	-14.4	dBm
Receiver Overload	P_{MAX}	0.5	-	-	dBm
Optical Return Loss	ORL	-	-	-12	dB
LOS De-Assert	LOS_D	-	-	-15	dBm
LOS Assert	LOS_A	-25	-	-	dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ OPTEC, 10G, SM LC, 6,2DB DFB/PIN (10KM), TX1310, DDM (SFP-10GBASE-LR)

SFP+10G-DF-SM-010-LC-TX31

SFP+ OPTEC, 10G, SM LC, 11,4dB DFB/PIN (10km), TX1310, DDM (SFP-10GBASE-LR) transceiver module is small form factor pluggable module for serial optical data communications such as IEEE 802.3ae 10GBASE-LR/LW. It is with the SFP+ 20-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

10GBASE-LR at 10.31Gbps •

10GBASE-LW at 9.95Gbps •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 10.138Gb/s, 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

FEATURES

- Operating data rate up to 11.3Gbps
- 1310nm FP-LD Transmitter
- Distance up to 10km
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface
- Hot Pluggable
- Power Dissipation < 1.0W
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- Operating Case Temperature Standard: 0 to +70 °C Industrial: -40 to +85°C

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
SFP+ OPTEC, 10G, SM LC, 6,2dB DFB/PIN (10km), TX1310, DDM (SFP-10GBASE-LR)	0.614Gbps to 11.3Gbps	SMF	10km	1310nm DFB	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_s	-40	+85	°C
Supply Voltage	V_{CC}	-0.5	3.6	V
Input Voltage	Vin	-0.5	Vcc	V

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	300	mA
Surge Current	ISurge		-	-	+30	mA
Baud Rate	-		0.6	-	11.3	GBaud

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	150	-	1200	mVpp	After internal AC coupling
Input AC Common Mode Voltage			0	-	25	mV	RMS
Input Impedance (Differential)		Zin	85	100	115	ohms	Rin > 100 kohms @ DC
Differential Input S-parameter		$S_{DD}11$	-	-	-10	dB	-
Differential to Common Mode Conversion		$S_{DD}11$	-	-	-10	dB	-
Tx_DISABLE Input Voltage	HIGH	-	2	-	3.45	V	-
	LOW	-	0	-	0.8	V	-

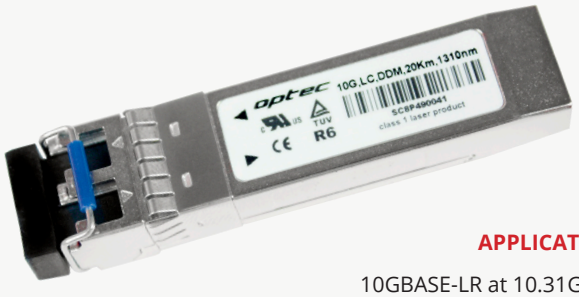
Tx_FAULT Output Voltage	HIGH		2		Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW		0		0.5	V	Io = -4.0mA
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output AC Common Mode Voltage		-	0	-	15	mV	RMS
Output Impedance (Differential)		Zout	90	100	110	ohms	-
Differential Output S-parameter		S_D22	-	-	-10	dB	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.8	V	Io = -4.0mA
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	-	-	10	-	Km
Data Rate	-	0.6	-	11.3	Gbps
TRANSMITER					
Center Wavelength	λ	1270	1310	1355	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dBm
Average Output Power	Pout	-8.2	-	+0.5	dBm
Extinction Ratio	ER	3.5	-	-	dB
Average Power of OFF Transmitter	Poff	-	-	-30	dBm
Transmitter Dispersion Penalty	TDP	-	-	3.2	dB
TX Disable Assert Time	t_off	-	-	10	us
TX_DISABLE Negate Time	t_on	-	-	1	ms
TX_BISABLE time to start reset	t_reset	10	-	-	us
Time to initialize, include reset of TX_FAULT	t_init	-	-	300	ms
TX_FAULT from fault to assertion	t_fault	-	-	100	us
Total Jitter	TJ	-	-	0.28	UI(p-p)
Data Dependant Jitter	DDJ	-	-	0.1	UI(p-p)
Uncorrelated Jitter	UJ	-	-	0.023	RMS
RECEIVER					
Center Wavelength	λ_C	1260	-	1565	nm
Sensitivity	P_{MIN}	-	-	-14.4	dBm
Receiver Overload	P_{MAX}	0.5	-	-	dBm
Optical Return Loss	ORL	-	-	-12	dB
LOS De-Assert	LOS_D	-	-	-16	dBm
LOS Assert	LOS_A	-28	-	-	dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ OPTEC, 10G, SM LC, 11,4DB DFB/PIN (20KM), TX1310, DDM (SFP-10GBASE-LR)

SFP+10G-DF-SM-020-LC-TX31



SFP+ OPTEC, 10G, SM LC, 11,4dB DFB/PIN (20km), TX1310, DDM (SFP-10GBASE-LR) transceiver module is small form factor pluggable module for serial optical data communications such as IEEE 802.3ae 10GBASE-LR/LW. It is with the SFP+ 20-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

- 10GBASE-LR at 10.31Gbps
- 10GBASE-LW at 9.95Gbps
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- CPRI rates 9.830 Gb/s,7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s
- Other optical links

FEATURES

- Operating data rate up to 11.3Gbps
- 1310nm FP-LD Transmitter
- Distance up to 20km
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface
- Hot Pluggable
- Power Dissipation < 1.0W
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- Operating Case Temperature Standard: 0 to +70 °C
  Industrial: -40 to +85°C

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
SFP+ OPTEC, 10G, SM LC, 11,4dB DFB/PIN (20km), TX1310, DDM (SFP-10GBASE-LR)	0.614Gbps to 11.3Gbps	SMF	20km	1310nm DFB	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_S	-40	+85	°C
Supply Voltage	V_{CC}	-0.5	3.6	V
Input Voltage	Vin	-0.5	Vcc	V
Output Current	Io	-	50	mA

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	300	mA
Surge Current	ISurge		-	-	+30	mA
Baud Rate	-		0.6	-	11.3	GBaud

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	150	-	1200	mVpp	After internal AC coupling
Input AC Common Mode Voltage			0	-	25	mV	RMS
Input Impedance (Differential)		Zin	85	100	115	ohms	Rin > 100 kohms @ DC
Differential Input S-parameter		$S_{DD}11$	-	-	-10	dB	-
Differential to Common Mode Conversion		$S_{DD}11$	-	-	-10	dB	-
Tx_DISABLE Input Voltage	HIGH	-	2	-	3.45	V	-
	LOW	-	0	-	0.8	V	-

Tx_FAULT Output Voltage	HIGH		2		Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW		0		0.5	V	Io = -4.0mA
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output AC Common Mode Voltage		-	0	-	15	mV	RMS
Output Impedance (Differential)		Zout	90	100	110	ohms	-
Differential Output S-parameter		S_D22	-	-	-10	dB	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.8	V	Io = -4.0mA
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

Optical Characteristics

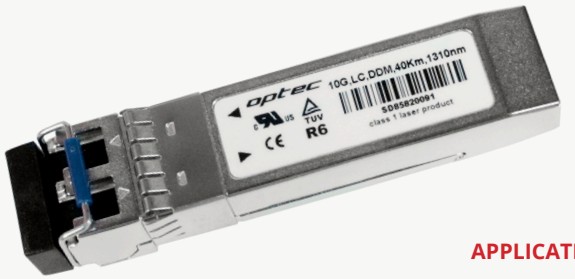
Parameter	Symbol	Min.	Typical	Max.	Unit
9μm Core Diameter SMF	-	-	20	-	Km
Data Rate	-	0.6		11.3	Gbps
TRANSMITER					
Center Wavelength	λ	1270	1310	1355	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dBm
Average Output Power	Pout	-3	-	1	dBm
Extinction Ratio	ER	3.5	-	-	dB
Average Power of OFF Transmitter	Poff	-	-	-30	dBm
Transmitter Dispersion Penalty	TDP	-	-	3	dB
TX Disable Assert Time	t_off	-	-	10	us
TX_DISABLE Negate Time	t_on	-	-	1	ms
TX_BISABLE time to start reset	t_reset	10	-	-	us
Time to initialize, include reset of TX_FAULT	t_init	-	-	300	ms
TX_FAULT from fault to assertion	t_fault	-	-	100	us
Total Jitter	TJ	-	-	0.28	UI(p-p)
Data Dependant Jitter	DDJ	-	-	0.1	UI(p-p)
Uncorrelated Jitter	UJ	-	-	0.023	RMS
RECEIVER					
Center Wavelength	λ_C	1260	-	1565	nm
Sensitivity	P_{MIN}	-	-	-14.4	dBm
Receiver Overload	P_{MAX}	0.5	-	-	dBm
Optical Return Loss	ORL	-	-	-12	dB
LOS De-Assert	LOS_D	-	-	-16	dBm
LOS Assert	LOS_A	-28	-	-	dBm

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ OPTEC, 10G, SM LC, 14DB DFB/PIN (40KM), TX1310, DDM (SFP-10GBASE-ER)

SFP+10G-DF-SM-040-LC-TX31



SFP+ OPTEC, 10G, SM LC, 14dB DFB/PIN (40km), TX1310, DDM (SFP-10GBASE-ER) transceiver module is small form factor pluggable module for serial optical data communications such as IEEE 802.3ae 10GBASE-ER/EW. It is with the SFP+ 20-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

10GBASE-ER at 10.31Gbps •

10GBASE-EW at 9.95Gbps •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other optical links •

FEATURES

- Operating data rate up to 11.3Gbps
- 1310nm FP-LD Transmitter
- Distance up to 40km
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface
- Hot Pluggable
- Power Dissipation < 1.5W
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- Operating Case Temperature Standard: 0 to +70 °C Industrial: -40 to +85°C

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
SFP+ OPTEC, 10G, SM LC, 14dB DFB/PIN (40km), TX1310, DDM (SFP-10GBASE-ER)	0.614Gbps to 11.3Gbps	SMF	40km	1310nm DFB	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_S	-40	+85	°C
Supply Voltage	V_{CC}	-0.5	3.6	V
Input Voltage	Vin	-0.5	Vcc	V
Output Current	Io	-	50	mA

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	430	mA
Surge Current	ISurge		-	-	+30	mA
Baud Rate	-		0.6	-	11.3	GBaud

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)	Vin	150	-	1200	mVpp	After internal AC coupling
Input AC Common Mode Voltage		0	-	25	mV	RMS
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC
Differential Input S-parameter	$S_{DD}11$	-	-	-10	dB	-
Differential to Common Mode Conversion	$S_{DD}11$	-	-	-10	dB	-

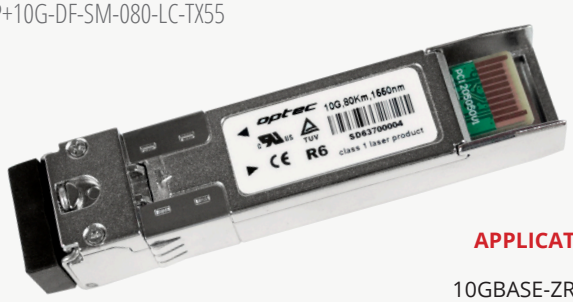
Tx_DISABLE Input Voltage	HIGH	-	2	-	3.45	V	-
	LOW	-	0	-	0.8	V	-
Tx_FAULT Output Voltage	HIGH		2		Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW		0		0.5	V	Io = -4.0mA
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output AC Common Mode Voltage		-	0	-	15	mV	RMS
Output Impedance (Differential)		Zout	90	100	110	ohms	-
Differential Output S-parameter		S_D22	-	-	-10	dB	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.8	V	Io = -4.0mA
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	-	-	40	-	Km
Data Rate	-	0.614		11.3	Gbps
TRANSMITER					
Center Wavelength	λ	1270	1310	1355	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dBm
Average Output Power	Pout	1	-	5	dBm
Extinction Ratio	ER	3.5	-	-	dB
Average Power of OFF Transmitter	Poff	-	-	-30	dBm
Transmitter Dispersion Penalty	TDP	-	-	2	dB
TX Disable Assert Time	t_off	-	-	10	us
TX_DISABLE Negate Time	t_on	-	-	1	ms
TX_BISABLE time to start reset	t_reset	10	-	-	us
Time to initialize, include reset of TX_FAULT	t_init	-	-	300	ms
TX_FAULT from fault to assertion	t_fault	-	-	100	us
Total Jitter	TJ	-	-	0.28	UI(p-p)
Data Dependant Jitter	DDJ	-	-	0.1	UI(p-p)
Uncorrelated Jitter	UJ	-	-	0.023	RMS
RECEIVER					
Center Wavelength	λ_C	1260	-	1565	nm
Sensitivity	P_{MIN}	-	-	-15	dBm
Receiver Overload	P_{MAX}	0.5	-	-	dBm
Optical Return Loss	ORL	-	-	-12	dB
LOS De-Assert	LOS_D	-	-	-16	dBm
LOS Assert	LOS_A	-25	-	-	dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ OPTEC, 10G, SM LC, 23DB EML/APD (80KM), TX1550, DDM (SFP-10GBASE-ZR)

SFP+10G-DF-SM-080-LC-TX55



SFP+ OPTEC, 10G, SM LC, 23dB EML/APD (80km), TX1550, DDM (SFP-10GBASE-ZR) transceiver module is small form factor pluggable module for duplex optical data communications of 10G. It is with the SFP+ 20-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of 1550 nm. The transmitter section uses a 1550nm EML, which is class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

10GBASE-ZR/EW •

10G FC •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other Optical Links •

FEATURES

- 1550nm cooled EML Transmitter
- High sensitivity APD Receiver
- Distance up to 80km over SMF
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface
- Hot Pluggable
- Power Dissipation < 1.5 W
- Dispersion Tolerance 1600ps/nm
- Compliant with SFF-8431 MSA / SFF-8432 MSA / SFF-8472 MSA
- Operating Case Temperature Standard: 0 to +70 ℃ Extended: -20 to +75℃

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
SFP+ OPTEC, 10G, SM LC, 23dB EML/APD (80km), TX1550, DDM (SFP-10GBASE-ZR)	0.6Gbps to 11.3Gbps	SMF	80km	1550nm EML	LC	Standard Extended	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_s	-40	+85	°C
Supply Voltage	V_{cc}	-0.5	3.6	V

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
		Extended	-20	-	75	
Power Supply Voltage	V_{cc}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	455	mA
Surge Current	ISurge		-	-	+30	mA
Baud Rate	-		0.6	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	150	-	1200	mVpp	After internal AC coupling
Input Impedance (Differential)		Zin	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_DISABLE Input Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-
Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.5	V	Io = -4.0mA

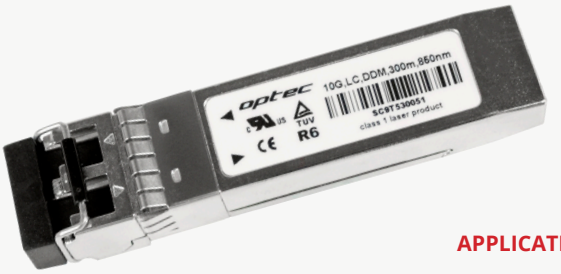
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400µA; Host Vcc
	LOW	-	0	-	0.8	V	Io = -4.0mA
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9µm Core Diameter SMF	-	-	40	-	Km
TRANSMITER					
Center Wavelength	λ	1270	1310	1355	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power	Pout, AVG	0	-	5	dBm
Extinction Ratio	ER	3.5	-	-	dB
Transmitter Dispersion Penalty	TDP	-	-	3	dB
Average Power of OFF Transmitter	-	-	-	-30	dBm
Relative Intensity Noise	RIN	-	-	-128	Db/Hz
Input Differential Impedance	Z_{IN}	90	100	110	Ω
TX Disable Assert Time	t_off	-	-	10	us
RECEIVER					
Center Wavelength	λ_C	1260	-	1600	nm
Sensitivity	P_{MIN}	-	-	-23	dBm
Receiver Overload	P_{MAX}	-8	-	-	dBm
Output Differential Impedance	P_{IN}	90	100	110	Ω
LOS De-Assert	LOS_D	-	-	-24	dBm
LOS Assert	LOS_A	-36	-	-	dBm

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ OPTEC, 10G, MM LC, 300M, TX850, DDM (SFP-10GBASE-SR)

SFP+10G-DF-MM-001-LC-TX85



SFP+ OPTEC, 10G, MM LC, 300m, TX850, DDM (SFP-10GBASE-SR) transceiver is module for duplex optical data communications such as 10GBASE-SR and 10GBASE-SW. It is with the SFP+ 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I²C. This module is designed for multi mode fiber and operates at a nominal wavelength of 850 nm. The transmitter section uses a Vertical Cavity Surface Emitted Laser (VCSEL) and is a Class 1 laser compliant according to International Safety Standard IEC 60825.

APPLICATIONS

10GBASE-SW at 9.953Gbps •

10GBASE-SR at 10.3125Gbps •

OBSAI rates 6.144 Gb/s, 3.072 Gb/s, • 1.536 Gb/s, 0.768Gb/s

CPRI rates 9.830 Gb/s,7.373Gb/s, • 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Other Optical Link •

FEATURES

- Operating data rate up to 11.3Gbps
- 850nm VCSEL Transmitter
- Distance up to 300m @50 / 125 um MMF
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface, Hot Pluggable
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-SR/SW
- Power Dissipation < 1.0W
- Dispersion tolerance up to 40ps/nm over G.651
- Operating Case Temperature Standard: 0 to +70 °C Industrial: -40 to +85°C

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
SFP+ OPTEC, 10G, MM LC, 300m, TX850, DDM (SFP-10GBASE-SR)	0.6Gbps to 11.3Gbps	MMF	300m	850nm VCSEL	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_s	-40	+85	°C
Supply Voltage	V_{cc}	-0.5	3.6	V
Input Voltage	Vin	-0.5	Vcc	V
Output Current	Io	-	50	mA

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Voltage	V_{cc}		3.15	3.3	3.45	V
Power Supply Current	Icc		-	-	455	mA
Surge Current	ISurge		-	-	+30	mA
Baud Rate	-		0.6	-	11.3	Gbps

Performance Specifications - Electrical

TRANSMITTER

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
CML Inputs(Differential)		Vin	150	-	1200	mVpp	After internal AC coupling
Input Impedance (Differential)		Zin	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_DISABLE Input Voltage	HIGH	-	2	-	Vcc+0.3	V	-
	LOW	-	0	-	0.8	V	-

Tx_FAULT Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.5	V	Io = -4.0mA
RECEIVER							
CML Outputs (Differential)		Vout	350	-	700	mVpp	After internal AC coupling
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS Output Voltage	HIGH	-	2	-	Vcc+0.3	V	Io = 400μA; Host Vcc
	LOW	-	0	-	0.8	V	Io = -4.0mA
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
50 / 125 um MMF	-	-	300	-	Km
Data Rate	-	0.6	-	11.3	Gbps
TRANSMITER					
Center Wavelength	λ	840	850	860	nm
Spectral Width (-20dB)	Δλ	-	-	0.45	nm
Average Output Power	Pout	-6	-	-1	dBm
Extinction Ratio	ER	3.0	5.0	-	dB
Output Optical Eye	-	IEEE 802.3-2005 Compliant			
Transmitter Dispersion Penalty	TDP	-	-	3.9	dB
TX_Disable Assert Time	t_off	-	-	10	us
TX_DISABLE Negate Time	t_on	-	-	1	ms
TX_BISABLE time to start reset	t_{reset}	10	-	-	us
Time to initialize, include reset of TX_FAULT	t_init	-	-	300	ms
TX_FAULT from fault to assertion	t_fault	-	-	100	us
Total Jitter	TJ	-	-	0.28	UI(p-p)
Data Dependant Jitter	$_{DDJ}$	-	-	0.1	UI(p-p)
Uncorrelated Jitter	UJ	-	-	0.023	RMS
RECEIVER					
Center Wavelength	λ_C	840	850	860	nm
Sensitivity	P_{MIN}	-	-	-11.1	dBm
Receiver Overload	P_{MAX}	-1	-	-	dBm
Optical Return Loss	$_{ORL}$	-	-	-12	Ω
LOS De-Assert	LOS_D	-	-	-12.5	dBm
LOS Assert	LOS_A	-25	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ RJ45 OPTEC, 10G, 20M (10GBASE-T)

SFP10G-RJ45

SFP+ RJ45 OPTEC, 10G, 20m (10GBase-T) - 10G BASE-T Copper Small Form Pluggable (SFP) modules are based on the SFP Multi Source Agreement (MSA). It is compliant with the 10G BASE-T,1000BASE-T, 100BASE-TX standards as specified in IEEE STD 802.3an, 802.3ab and 802.3au.

APPLICATIONS

- 10G BASE-T IEEE 802.3an
- 1000BASE-T IEEE 802.3ab
- 100BASE-TX IEEE 802.3u
- 5G MGBASE-T
- 2.5G MGBASE-T

FEATURES

- Support 10GBASE-T Operation in Host Systems
- Support RX_LOS as Link indication function
- Hot-Pluggable SFP Footprint
- Compact RJ-45 Connector Assembly
- Compliant with SFP MSA
- Operating Case Temperature: Standard 0℃~70℃

Product Information						
Product Name	Data Rate	Media Type	Distance	Interface	Temp.	DDM
SFP+ RJ45 OPTEC, 10G, 20m (10GBase-T)	10G	CAT6A/CAT7	20m	RJ45	Standard	NO

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4.0	V
Storage Temperature	Vcc	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions						
Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
Power Supply Voltage	V_{CC}		3.14	3.3	3.46	V

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
+3.3 Volt Electrical Power Interface						
Supply Current	Icc	-	-	800	mA	-
Input Voltage	Vcc	3.13	3.3	3.47	V	-
Low-Speed Signals, Electronic Characteristics						
SFP Output LOW	VOL	0	-	0.5	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector
SFP Output HIGH	VOH	host_Vcc – 0.5	-	host_Vcc + 0.3	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector

SFP Input LOW	VIL	0	-	0.8	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector
SFP Input HIGH	VIH	2	-	Vcc + 0.3	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector
High-Speed Electrical Interface, Transmission Line-SFP						
Tx Output impedance	Zout,TX	-	100	-	Ohm	Differential, for all frequencies between 1MHz and 125MHz
Rx Input Impedance	Zin,RX	-	100	-	Ohm	Differential, for all frequencies between 1MHz and 125MHz
High-Speed Electrical Interface, Host-SFP						
Single ended data input swing	Vin	250	-	1200	mV	Single ended
Single ended data output swing	Vout	350	-	800	mV	Single ended
Rise/Fall Time	Tr,Tf	-	20	-	psec	20%-80%
Tx Input Impedance	Zin	-	50	-	Ohm	Single ended

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP+ OPTEC, 10G, AOC, 1-100M ACTIVE OPTICAL CABLE TO SFP+ (SR4)

SFP+10G-COPP-ACT

SFP+ OPTEC, 10G, AOC, 1-100M ACTIVE OPTICAL CABLE TO SFP+ (SR4) is a 10Gbps solution to 10G Ethernet, and high-performance computing applications. The integrated cable transmits 10Gbps data in each direction over a loose tube fiber with distance up to 100m. The AOC is SFP+ MSA compliance, low power consumption and lightweight.

APPLICATIONS

- 10G Ethernet
- Datacom and Telecom switch or router backplane connection
- High performance computing interconnect

FEATURES

- Operating Case Temperature: -5 to +75 °C
- 10Gb/s serial optical interface
- 850nm high-speed VCSEL and PIN receiver
- Support 10Gb/s transmission distance up to 100 meters with OM2 MM fiber
- Single 3.3V power supply
- Mechanical specifications compliant with SFF-8432
- Electrical specifications compliant with SFF-8431
- Support digital diagnostics monitoring for module temperature, Vcc, Rx input power, Tx_Disable and Rx_LOS
- Typical power consumption 200mW
- I2C communication bus
- Hot pluggable
- RoHS-6 compliance

Product Information

Product Name	Data Rate	Fiber	Distance	Temp.	DDM
SFP+ OPTEC, 10G, AOC, 1-100M ACTIVE OPTICAL CABLE TO SFP+ (SR4)	10Gbps	MMF	1~100m	Standard	YES

Absolute Maximum Ratings*note1

Parameter		Symbol	Min.	Max.	Unit
Storage Temperature		T_s	-20	+85	°C
Storage Relative Humidity		RH	-	85	-
Supply Voltage		V_{cc}	-0.3	3.6	V
Supply Current		I_{cc}		450	mA
ESD (HBM)	High speed interfaces	VESD	-1000	+1000	V
	Others		-2000	+2000	

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	-5	-	75	°C
Power Supply Voltage	V_{cc}		3.13	3.3	3.47	V
Power Supply Current	Icc		-	60	-	mA
Power Supply Noise Tolerance	-		-	-	200	mVpp
Bit Rate	BR		-	10.3125	-	Gbps
Rate Tolerance	-		-100	-	+100	ppm

Performance Specifications - Electrical

TRANSMITTER

Parameter	Symbol	Min.	Typical	Max.	Unit
Input Differential Impedance	Rin	90	100	110	Ohm
Input AC Common Mode Voltage4	-	-	-	15	mV(RMS)

Differential Input S-Parameter	0.01 to 4.1GHz	SDD11	-	-	Note1, 2	Differential Input S-Parameter
	4.1 to 11.1 GHz		-	-	Note1, 2	-
Differential to Common Mode Conversion Loss	0.01 to 11GHz	SCD11	-	-	Note4	Differential to Common Mode Conversion Loss
Total Jitter at Tx Data Input		TJ Txin	-	-	0.28	UIp-p
Data Dependent Jitter at Tx Data Input		DDJ Txin	-	-	0.10	UIp-p
Data Dependent Pulse Width Shrinkage at Tx Data Input		DDPWS	-	-	0.055	UIp-p
Uncorrelated Jitter		UJ Txin	-	-	0.023	UIRMS
Eye Mask for Transmitter Input5		X1	0.12			UI
		X2	0.33			UI
		Y1	95			mV
		Y2	350			mV
RECEIVER						
Output Differential Impedance		Rin	90	100	110	Ohm
AC Common Mode Voltage output		VRX-AC_CM	-	-	7.5	mV(RMS)
Differential Output S-parameter	0 .01 to 4.1GHz	SDD22	-	-	Note1, 2	Differential Output S-parameter
	4.1 to 11.1 GHz		-	-	Note1, 3	
Common Mode Output Return Loss	0.01 to 2.5GHz	SCC22	-	-	Note4, 5	Common Mode Output Return Loss
	2.5 to 11.1GHz		-	-	Note4, 6	
Output rise time (20% to 80%)		Tr	28	-	-	ps
Output fall time (20% to 80%)		Tf	28	-	-	ps
Total Jitter at Rx Data Output		TJ Rxout	-	-	0.7	UIp-p
99% Jitter		J2 Rxout	-	-	0.42	UIp-p
Eye Mask for Receiver Output7		X1	0.35			UI
		Y1	150			mV
		Y2	425			mV

Note1 Reference differential impedance is 100 ohm. DUT is under powered up and DC isolated.
Note2 <-12+2*sqrt(f) with f in GHz
Note3 <-6.3+13.3*log10(f/5.5) with f in GHz
Note4 Common Mode Differential impedance is 25 Ohm.
Note5. <-12+2.8*f with f in GHz
Note6. <-5.2+0.08*f with f in GHz

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Optical Modulation Amplitude (OMA)	POMA	-	1.5	-	dBm
Average Launch Power	PAVE	-5	-	-1	dBm
Optical Wavelength	λ	840	850	860	nm
RMS Spectral Width	Δλ rms		-	0.45	dB
Optical Extinction Ratio	ER	3.0	5.5		dB
Transmitter and Dispersion Penalty	TDP	-	-	3.9	dB
Relative Intensity Noise	RIN12OMA	-	-	-128	dB/Hz
RECEIVER					
Receiver Sensitivity (OMA) @ 10.3Gb/s	RSENS1	-	-	-11.1	dBm
Stressed Receiver Sensitivity (OMA) @ 10.3Gb/s	RSENS2	-	-	-7.5	dBm
Maximum Input Power	P_{MAX}	+0.5	-		dBm
Wavelength Range	λC	840	-	860	nm
Receiver Reflectance	Rrx	-	-	-12	dB
LOS De-Assert	LOS_D	-	-	-14	dBm
LOS Assert	LOS_A	-30	-23	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

XFP DWDM OPTEC, 10G, SM LC, 14DB (40KM), TX1528.77-1563.86 (CH:17-61), DDM

XFP10G-DWDM-SM-014-LC-CH1

XFP DWDM OPTEC, 10G, SM LC, 14dB (40km), DDM transceiver module is available in channels defined in the ITU Grid (100 GHz spacing), from Channel 17 to Channel 61, or ITU Grid (50Ghz spacing), from channel 200 to 595ch. DWDM stands for Dense Wavelength-Division Multiplexing. It is a technology which multiplexes a number of different "colored" optical signals together. These systems are popular with telecommunications companies because they allow them to expand the capacity of the network without laying more fiber.

APPLICATIONS

10GBASE-ER/EW Ethernet •

1200-SM-LL-L 10G Fiber Channel •

SONET OC-192 IR-2 •

SDH STM S-64.2b •

SONET OC-192 IR-3 •

SDH STM S-64.3b •

ITU-T G.709 •

FEATURES

- Supports 9.95Gb/s to 11.1Gb/s bit Rates
- Hot-Pluggable XFP Footprint
- 14dB Power Budget
- Temperature-Stabilized DWDM Rated EML Transmitter
- 100GHz ITU Grid, C Band
- Duplex LC Connector
- Built-in Digital Diagnostic Functions
- Support Line Side Loopback and XFI Loopback
- Auxiliary 1 Monitoring Laser Temperature
- Auxiliary 2 Monitoring 5V Supply
- Operating Case Temperature: Standard: 0°C to 70°C

Extended: -20°C to 85°C

Product Information							
Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP DWDM OPTEC, 10G, SM LC, 14dB (40km), 1528.77-1563.86 (ch:17-61), DDM	10Gbps	SMF	14dB	EML EA	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage 1	Vcc3	-0.5	4	V
Maximum Supply Voltage 2	Vcc5	0.3	6	V
Storage Temperature	T_s	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions						
Parameter	Symbol		Min.	Typical	Max.	Unit
Supply Voltage 1	Vcc3		3.13	3.3	3.45	V
Supply Voltage 2	Vcc5		4.75	5	5.25	V
Case Operating Temperature	T_c	Standard	0	-	70	°C
		Industrial	-20	-	85	

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Main Supply Voltage	Vcc5	4.75	-	5.25	V	-
Supply Voltage #2	Vcc3	3.13	-	3.45	V	-
Supply Current – Vcc5 supply	Icc5	-	-	500	mA	-
Supply Current – Vcc3 supply	Icc3	-	-	750	mA	-
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	Internal AC coupling.

Differential Data Input Swing	Vin, pp	120	-	820	mV	-
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr		-	10	µs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	VccHOST	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	-
Power Supply Noise Rejection	PSNR	Compliant to Section 2.7.1 of XFP MSA				-

Note1 Loss Of Signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITER					
Output Opt. Pwr: 9/125 SMF	Pout	-1	-	4	dBm
Center Wavelength Spacing	-	-	100	-	dBm
			0.8		nm
Optical Wavelength-EOL	λ_C	X-100	X	X+100	nm
Transmitter Center Wavelength –BOL	λ_C	X-40	X	X+40	dB
Optical Extinction Ratio	ER	8.2	-	-	dB
Transmitter and Dispersion Penalty	TDP	-	-	2	dB
Side Mode Suppression Ratio	SMSR	30	-	-	dB/Hz
TX Jitter Generation (peak-to-peak)	TXj	-	-	0.1	dB
TX Jitter Generation (RMS)	TXj_{RMS}	-		0.01	dB/Hz
RECEIVER					
Receiver Sensitivity @ 10.7Gb/s	Pmin	-	-	-15	dBm
Maximum Input Power	Pmax	0.5	-	-	dBm
Optical Center Wavelength	λ_C	1270	-	1600	dBm
Path Penalty		-	-	2	nm
Receiver Reflectance	Rrx	-	-	-27	dB
LOS De-Assert	LOS_D	-		-17	dBm
LOS Assert	LOS_A	-29	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

XFP DWDM OPTEC, 10G, SM LC, 24DB (80KM), TX1528.77-1563.86 (CH:17-61), DDM

XFP10G-DWDM-SM-024-LC-CH1

XFP DWDM OPTEC, 10G, SM LC, 24dB (80km), DDM transceiver module is available in channels defined in the ITU Grid (100 GHz spacing), from Channel 17 to Channel 61, or ITU Grid (50Ghz spacing), from channel 200 to 595ch. DWDM stands for Dense Wavelength-Division Multiplexing. It is a technology which multiplexes a number of different “colored” optical signals together. These systems are popular with telecommunications companies because they allow them to expand the capacity of the network without laying more fiber.

APPLICATIONS

10GBASE-ZR/ZW •

1200-SM-LL-L 10G Fiber Channel •

SONET OC-192 •

SDH STM S-64 •

P1L1-2D2 •

ITU-T G.709 •

FEATURES

- Available in all C-Band Wavelength on the 100GHz ITU-T Grid
- Supports 9.95Gb/s to 11.1Gb/s Bit Rates
- Hot-pluggable XFP footprint
- Power Budget 24dB
- Temperature-Stabilized DWDM Rated EML Transmitter
- Duplex LC connector
- Built-in Digital Diagnostic Functions
- Support Line Side Loopback and XFI Loopback
- Auxiliary 1 Monitoring Laser Temperature
- Auxiliary 2 Monitoring 5V Supply
- Temperature Range -5°C to 70°C

Product Information							
Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP DWDM OPTEC, 10G, SM LC, 24dB (80km), 1528.77-1563.86 (ch:17-61), DDM	10Gbps	SMF	24dB	EML EA	LC	Standard	YES

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage 1	Vcc3	-0.5	4	V
Maximum Supply Voltage 2	Vcc5	-0.5	6	V
Storage Temperature	T_S	-40	85	°C
Case Operating Temperature	T_C	-5	70	V
Maximum Input Power	Pm	-	-8	dBm

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions						
Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_C	Standard	-5	-	70	°C
Supply Voltage 1	Vcc3		3.13	3.3	3.45	V
Supply Voltage 2	Vcc5		4.75	5	5.25	V

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Main Supply Voltage	Vcc5	4.75	-	5.25	V	-
Supply Voltage #2	Vcc3	3.13	-	3.45	V	-
Supply Current – Vcc5 supply	Icc5	-	-	400	mA	-
Supply Current – Vcc3 supply	Icc3	-	-	700	mA	-
Module Total Power	P	-	3.5	-	W	-
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	Internal AC coupling.

Differential Data Input Swing	Vin, pp	120	-	820	mV	-
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	µs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	39	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	VccHOST	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1

Note1 Loss of signal is open collector output. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

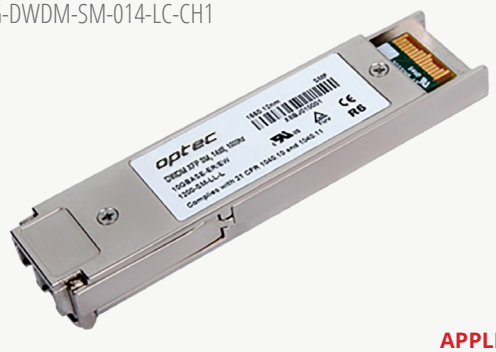
Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITER					
Output Opt. Pwr: 9/125 SMF	Pout	-1	-	4	dBm
Frequency Range	-	191.3	-	196.2	THz
Center Wavelength Spacing	λ_C	-	100	-	GHz
TCenter Frequency Spacing	fc		0.8	-	nm
Transmitter Center Wavelength End Of Life	λ	X-100	X	X+100	pm
Transmitter Center Wavelength Beginning Of Life	λ	X-25	X	X+25	pm
Optical Extinction Ratio	ER	9	-	-	dB
Dispersion Tolerance	DT	-	-	1600	ps/nm
Average Launch Power of OFF transmitter	POFF	-	-	-30	dB/Hz
TX Jitter Generation (Peak-to-Peak)	TXj	-	-	0.1	UI
TX Jitter Generation (RMS)	TXj_{RMS}	-	-	0.01	UI
RECEIVER					
Optical Center Wavelength	λ_C	1520	-	1600	nm
Receive Sensitivity @ 10.7Gbps	Pin		-	-24	dBm
Receive Overload @ 10.7Gbps	Pin	-7	-	-	dBm
Receiver Reflectance	Rrx	-	-	-27	dB
Dispersion Penalty	-	-	-	2	dB
LOS De-Assert	LOS_D	-		-26	dBm
LOS Assert	LOS_A	-38	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

XFP DWDM OPTEC, 10G, SM LC, 14DB EML/PIN (40KM), TX1529.94-1561.42 (CH:200-595), DDM

XFP10G-DWDM-SM-014-LC-CH1



XFP DWDM OPTEC, 10G, SM LC, 14dB EML/PIN (40km), DDM transceiver module is available in channels defined in the ITU Grid (100 GHz spacing), from Channel 17 to Channel 61, or ITU Grid (50Ghz spacing), from channel 200 to 595ch. DWDM stands for Dense Wavelength-Division Multiplexing. It is a technology which multiplexes a number of different "colored" optical signals together. These systems are popular with telecommunications companies because they allow them to expand the capacity of the network without laying more fiber.

APPLICATIONS

- 10GBASE-ER/EW Ethernet
- 1200-SM-LL-L 10G Fiber Channel
- SONET OC-192 IR-2
- SDH STM S-64.2b
- SONET OC-192 IR-3
- SDH STM S-64.3b
- ITU-T G.709

FEATURES

- Supports 9.95Gb/s to 11.1Gb/s bit Rates
- Hot-Pluggable XFP Footprint
- 14dB power budget at least
- Temperature-Stabilized DWDM Rated EML Transmitter
- 50GHz ITU Grid
- Duplex LC Connector
- Built-in Digital Diagnostic Functions
- Operating Case Temperature: Standard: -5°C to 70°C

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP DWDM OPTEC, 10G, SM LC, 14dB EML/PIN (40km), TX1529.94-1561.42 (ch:200-595), DDM	10Gbps	SMF	14dB	EML EA	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage 1	Vcc3	-0.5	4	V
Maximum Supply Voltage 2	Vcc5	-0.5	6	V
Storage Temperature	T_S	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_C	Standard	-5	-	70	°C
Supply Voltage 1	Vcc3		3.13	3.3	3.45	V
Supply Voltage 2	Vcc5		4.75	5	5.25	V

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Main Supply Voltage	Vcc5	4.75	-	5.25	V	-
Supply Voltage #2	Vcc3	3.13	-	3.45	V	-
Supply Current – Vcc5 supply	Icc5	-	-	400	mA	-
Supply Current – Vcc3 supply	Icc3	-	-	750	mA	-
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	Internal AC coupling.
Differential Data Input Swing	Vin, pp	120	-	820	mV	-
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-

Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	µs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	Vcc_{HOST}	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1
Power Supply Noise Rejection	PSNR	Compliant to Section 2.7.1 of XFP MSA				-

Note1 Los Of Signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITER					
Output Opt. Pwr: 9/125 SMF	Pout	-1	-	4	dBm
Frequency Range	-	191.3	-	196.2	THz
Center Wavelength Spacing	λ_C	-	100	-	GHz
TCenter Frequency Spacing	fc		0.8	-	nm
Transmitter Center Wavelength End Of Life	λ	X-100	X	X+100	pm
Transmitter Center Wavelength Beginning Of Life	λ	X-25	X	X+25	pm
Optical Extinction Ratio	ER	9	-	-	dB
Dispersion Tolerance	DT	-	-	1600	ps/nm
Average Launch Power of OFF transmitter	POFF	-	-	-30	dB/Hz
TX Jitter Generation (Peak-to-Peak)	TXj	-	-	0.1	UI
TX Jitter Generation (RMS)	TXj_{RMS}	-	-	0.01	UI
RECEIVER					
Optical Center Wavelength	λ_C	1520	-	1600	nm
Receive Sensitivity @ 10.7Gbps	Pin		-	-24	dBm
Receive Overload @ 10.7Gbps	Pin	-7	-	-	dBm
Receiver Reflectance	Rrx	-	-	-27	dB
Dispersion Penalty	-	-	-	2	dB
LOS De-Assert	LOS_D	-		-26	dBm
LOS Assert	LOS_A	-38	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

XFP DWDM OPTEC, 10G, SM LC, 23DB EML/APD (80KM), TX1529.94-1561.42 (CH:200-595), DDM

XFP10G-DWDM-SM-023-LC-CH1

XFP DWDM OPTEC, 10G, SM LC, 23dB EML/APD (80km), DDM transceiver module is available in channels defined in the ITU Grid (100 GHz spacing), from Channel 17 to Channel 61, or ITU Grid (50Ghz spacing), from channel 200 to 595ch. DWDM stands for Dense Wavelength-Division Multiplexing. It is a technology which multiplexes a number of different "colored" optical signals together. These systems are popular with telecommunications companies because they allow them to expand the capacity of the network without laying more fiber.

APPLICATIONS

- 10GBASE-ER/EW Ethernet
- 1200-SM-LL-L 10G Fiber Channel
- SONET OC-192 IR-2
- SDH STM S-64.2b
- SONET OC-192 IR-3
- SDH STM S-64.3b
- ITU-T G.709

FEATURES

- Supports 9.95Gb/s to 11.1Gb/s bit Rates
- Hot-Pluggable XFP Footprint
- 23dB power budget at least
- Temperature-Stabilized DWDM Rated EML Transmitter
- 50GHz ITU Grid
- Duplex LC Connector
- Built-in Digital Diagnostic Functions
- Operating Case Temperature: Standard: -5°C to 70°C

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP DWDM OPTEC, 10G, SM LC, 23dB EML/APD (80km), TX1529.94-1561.42 (ch:200-595), DDM	10Gbps	SMF	23dB	EML EA	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage 1	Vcc3	-0.5	4	V
Maximum Supply Voltage 2	Vcc5	-0.5	6	V
Storage Temperature	T_S	-40	85	°C
Case Operating Temperature	T_C	-5	70	°C
Maximum Input Power	Pm	–	-8	dBm

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_C	Standard	-5	-	70	°C
Supply Voltage 1	Vcc3		3.13	3.3	3.45	V
Supply Voltage 2	Vcc5		4.75	5	5.25	V

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Main Supply Voltage	Vcc5	4.75	-	5.25	V	-
Supply Voltage #2	Vcc3	3.13	-	3.45	V	-
Supply Current – Vcc5 supply	Icc5	-	-	400	mA	-
Supply Current – Vcc3 supply	Icc3	-	-	750	mA	-
Module Total Power	P	-	-	4.5	W	-

TRANSMITTER

Input Differential Impedance	Rin	-	100	-	Ω	
Differential Data Input Swing	Vin, pp	120	-	820	mV	Internal AC coupling
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	µs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	Internal AC coupling
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	39	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	Vcc_{HOST}	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1

Note1 Loss of signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITER					
Output Opt. Pwr: 9/125 SMF	Pout	-1	-	4	dBm
Center Wavelength Spacing	-	-	50	-	GHz
			0.4		nm
Transmitter Center Wavelength End Of Life	λ	X-100	X	X+100	pm
Transmitter Center Wavelength Beginning Of Life	λ	X-25	X	X+25	pm
Optical Extinction Ratio	ER	9	-	-	dB
Transmitter and Dispersion Penalty	TDP	-	-	1600	ps/nm
Average Launch Power of OFF transmitter	POFF	-	-	-30	dB/Hz
TX Jitter Generation (Peak-to-Peak)	TXj	-	-	0.1	UI
TX Jitter Generation (RMS)	TXj_{RMS}	-	-	0.01	UI
RECEIVER					
Receiver Sensitivity @ 10.7Gb/s	RSENS		-	-23	dBm
Overload Power	PMAX	-10	-	-	dBm
Optical Center Wavelength	λC	1520	-	1600	nm
Receiver Reflectance	Rrx	-	-	-27	dB
LOS De-Assert	LOS_D	-		-25	dBm
LOS Assert	LOS_A	-37	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

XFP CWDM OPTEC, 10G, SM LC, 10DB DFB (10KM), TX1270-1610, DDM

XFP10G-CWDM-SM-10DB-LC-TX27-61D

XFP CWDM OPTEC, 10G, SM LC, 10dB DFB (10km), TX1270-1610, DDM transceiver is designed for fiber communications application such as 10G Ethernet (10GBASE-ER/EW) and 10G Fiber Channel (1200-SM-LL-L), which fully compliant with the specification of XFP MSA Rev 4.5. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are twelve center wavelengths available from 1270nm to 1330nm and 1470nm to 1610nm, with each step 20nm. A guaranteed optical link budget of 10dB is offered.

APPLICATIONS

10GBASE-LR/LW 10G Ethernet •

1200-SM-LL-L 10G Fiber Channel •

10GE over G.709 at 11.09Gbps •

FEATURES

• Supports 9.95Gb/s to 11.1Gb/s Bit Rates

• Hot-Pluggable XFP Footprint

• Compliant with XFP MSA

• 18-Wavelengths CWDM DFB Transmitter from 1270nm to 1610nm, with Step 20nm

• 10dB power budget at least

• Duplex LC Connector

• Power Dissipation < 2.5W

• Case Operation Temperature Range -5°C to 70°C

• 2-Wire Interface for Integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP CWDM OPTEC, 10G, SM LC, 10dB DFB (10km), TX1270-1610, DDM	10Gbps	SMF	10dB	CWDM DFB	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4	V
Storage Temperature	T_S	-40	6	°C
Case Operating Temperature	T_C	-5	70	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Temperature	T_C	Standard	-5	-	70	°C
Supply Voltage	Vcc3		3.13	3.3	3.45	V
Supply Current	I_{CC}		-	-	750	mA
Module Total Power	P		-	-	2.5	W

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	-
Differential Data Input Swing	Vin, pp	120	-	820	mV	Internal AC coupling
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	µs	-

RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	Internal AC coupling
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	Vcc_{HOST}	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1
Power Supply Rejection	PSR	Reference the Section 2.7 of the XFP MSA Rev 4.5.				Reference the Section 2.7 of the XFP MSA Rev 4.5

Note1 Loss of signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics						
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Note**
TRANSMITER						
Output Opt. Pwr: 9/125 SMF	Pout	-5	-	0	dBm	*1
Optical Extinction Ratio	ER	3.5	-	-	dB	-
Optical Wavelength	λ	λc–6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Path Penalty	Pp	-	-	2	dB	-
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	-
TX Jitter Generation (Peak-to-Peak)	TXj	Per 802.3ae requirements			dB/Hz	-
Relative Intensity Noise	RIN			-128	dB/Hz	-
RECEIVER						
Receiver Sensitivity	Pmin	-	-	-15	dBm	*3
Maximum Input Power	Pmax	0.5	-	-	dBm	-
Optical Center Wavelength	λ	1260	-	1620	nm	-
Receiver Reflectance	Rrf	-	-	-12	dB	-
LOS De-Assert	LOS_D	-	-	-17	dBm	-
LOS Assert	LOS_A	-29	-	-	dBm	-
LOS Hysteresis	-	1	-	-	dB	-

Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance	
Product Certificate	**Applicable Standard**
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

XFP CWDM OPTEC, 10G, SM LC, 14DB DFB (40KM), TX1270-1450, DDM

XFP10G-CWDM-SM-14DB-LC-TX27-45D

XFP CWDM OPTEC, 10G, SM LC, 14dB DFB (40km), TX1270-1450, DDM transceiver is designed for fiber communications application such as 10G Ethernet (10GBASE-ER/EW) and 10G Fiber Channel (1200-SM-LL-L), which fully compliant with the specification of XFP MSA Rev 4.5. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are 10 center wavelengths available from 1270nm to 1450nm, with each step 20nm. A guaranteed optical link budget of 14dB is offered.

APPLICATIONS

10GBASE ER/EW 10G Ethernet •

1200-SM-LL-L 10G Fiber Channel •

10GE over G.709 at 11.09Gbps •

FEATURES

• Supports 9.95Gb/s to 11.1Gb/s Bit Rates

• Hot-Pluggable XFP Footprint

• Compliant with XFP MSA

• 10-Wavelengths CWDM DFB Transmitter from 1270nm to 1450nm, with Step 20nm

• 14dB power budget at least

• Duplex LC Connector

• Power Dissipation < 2.5W

• Case Operation Temperature Range -5°C to 70°C

• 2-Wire Interface for Integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP CWDM OPTEC, 10G, SM LC, 14dB DFB (40km), TX1270-1450, DDM	10Gbps	SMF	14dB	CWDM DFB	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4	V
Storage Temperature	T_S	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Temperature	T_C	Standard	-5	-	70	°C
Supply Voltage	Vcc3		3.13	3.3	3.45	V
Supply Current	I_{CC}		-	-	750	mA
Module Total Power	P		-	-	2.5	W

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	Internal AC coupling
Differential Data Input Swing	Vin, pp	180	-	820	mV	-
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	µs	-

RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	Internal AC coupling
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	Vcc_{HOST}	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1
Power Supply Rejection	PSR	Reference the Section 2.7 of the XFP MSA Rev 4.5.				Reference the Section 2.7 of the XFP MSA Rev 4.5

Note1 Loss of signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics						
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Note**
TRANSMITER						
Output Opt. Pwr: 9/125 SMF	Pout	-1.8	-	4	dBm	*1
Optical Extinction Ratio	ER	3.5	-	-	dB	-
Optical Wavelength	λ	λc–6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Path Penalty	Pp	-	-	2	dB	-
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	-
TX Jitter Generation (Peak-to-Peak)	TXj	Per 802.3ae requirements			dB/Hz	-
Relative Intensity Noise	RIN			-128	dB/Hz	-
RECEIVER						
Receiver Sensitivity	Pmin	-	-	-15.8	dBm	*3
Maximum Input Power	Pmax	-1	-	-	dBm	
Optical Center Wavelength	λ	1260	-	1620	nm	-
Receiver Reflectance	Rrf	-	-	-12	dB	-
LOS De-Assert	LOS_D	-	-	-17.8	dBm	-
LOS Assert	LOS_A	-29.8	-	-	dBm	-
LOS Hysteresis	-	1	-	-	dB	-

Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

XFP CWDM OPTEC, 10G, SM LC, 14DB DFB (40KM), TX1470-1610, DDM

XFP10G-CWDM-SM-14DB-LC-TX47-61D

XFP CWDM OPTEC, 10G, SM LC, 14dB DFB (40km), TX1470-1610, DDM transceiver is designed for fiber communications application such as 10G Ethernet (10GBASE-ER/EW) and 10G Fiber Channel (1200-SM-LL-L), which fully compliant with the specification of XFP MSA Rev 4.5. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eight center wavelengths available from 1470nm to 1610nm, with each step 20nm. A guaranteed optical link budget of 14dB is offered.

APPLICATIONS

SONET / SDH •

10GBASE-ER/EW 10G Ethernet •

1200-SM-LL-L 10G Fiber Channel •

10GE over G.709 at 11.09Gbps •

OC192 over FEC at 10.709Gbps •

FEATURES

• Supports 9.95Gb/s to 11.1Gb/s Bit Rates

• Hot-Pluggable XFP Footprint

• Compliant with XFP MSA

• 8-Wavelengths CWDM EML Transmitter from 1470nm to 1610nm, with Step 20nm

• 14dB power budget at least

• Duplex LC Connector

• Power Dissipation < 3.5W

• Case Operation Temperature Range -5°C to 70°C

• 2-Wire Interface for Integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP CWDM OPTEC, 10G, SM LC, 14dB DFB (40km), TX1470-1610, DDM	10Gbps	SMF	14dB	CWDM DFB	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4	V
Storage Temperature	T_s	-40	85	°C
Case Operating Temperature	T_c	-5	70	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Temperature	T_c	Standard	-5	-	70	°C
Supply Voltage 1	Vcc3		3.13	3.3	3.45	V
Supply Voltage 2	Vcc5		4.75	5	5.25	V
Supply Current-Vcc3 supply	I_{cc}		-	-	300	mA
Supply Current-Vcc5 supply	I_{cc}		-	-	750	mA
Module Total Power	P		-	-	3.5	W

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	Internal AC coupling
Differential Data Input Swing	Vin, pp	180	-	820	mV	-

Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	μs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	Internal AC coupling
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	Vcc_{HOST}	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1
Power Supply Rejection	PSR	Reference the Section 2.7 of the XFP MSA Rev 4.5.				Reference the Section 2.7 of the XFP MSA Rev 4.5

Note1 Loss of signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITER						
Optical Modulation Amplitude	P_{OMA}	-1	-	4.4	dBm	*1
Output Opt. Pwr: 9/125 SMF	Pout	-0.9	-	4	dBm	*1
Optical Extinction Ratio	ER	8.2	-	-	dB	
Optical Wavelength	λ	λc–6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Path Penalty	Pp	-	-	2.5	dB	
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	
TX Jitter Generation (Peak-to-Peak)	TXj	Per 802.3ae requirements			dB/Hz	
Relative Intensity Noise	RIN			-128	dB/Hz	
RECEIVER						
Receiver Sensitivity	Pmin	-	-	-15	dBm	*3
Maximum Input Power	Pmax	0.5	-	-	dBm	
Optical Center Wavelength	λ	1260	-	1620	nm	
Receiver Reflectance	Rrf	-	-	-12	dB	
LOS De-Assert	LOS_D	-	-	-17	dBm	
LOS Assert	LOS_A	-29	-	-	dBm	
LOS Hysteresis	-	1	-	-	dB	

Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

XFP CWDM OPTEC, 10G, SM LC, 23DB DFB (60KM), TX1270-1330, DDM

XFP10G-CWDM-SM-23DB-LC-TX27-33-D

XFP CWDM OPTEC, 10G, SM LC, 23dB DFB (60km), TX1270-1330, DDM is designed for fiber communications application such as SONET OC-192, STM-64, 10G Ethernet (10GBASE-ZR/ZW) and 10G Fiber Channel (1200-SM-LL-L), which fully compliant with the specification of XFP MSA Rev 4.5. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eight center wavelengths available from 1470nm to 1610nm, with each step 20nm.

APPLICATIONS

OC-192, STM-64 •

10GBASE-ZR/ZW 10G Ethernet •

1200-SM-LL-L 10G Fiber Channel •

10GE over G.709 at 11.09Gbps •

OC192 over FEC at 10.709Gbps •

FEATURES

- Supports 9.95Gb/s to 11.1Gb/s Bit Rates
- Hot-Pluggable XFP Footprint
- Compliant with XFP MSA
- 8-Wavelengths CWDM EML Transmitter from 1470nm to 1610nm, with Step 20nm
- Very Low TEC Power Consumption
- 23dB power budget at least
- Duplex LC Connector
- Power Dissipation < 3.5W
- Case Operation Temperature Range -5°C to 70°C
- 2-Wire Interface for Integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP CWDM OPTEC, 10G, SM LC, 23dB DFB (60km), TX1270-1330, DDM	10Gbps	SMF	23dB	CWDM DFB	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4	V
Storage Temperature	T_s	-40	85	°C
Case Operating Temperature	T_c	-5	70	°C
Maximum Input Power	Pm	-	-8	dBm

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Temperature	T_c	Standard	-5	-	70	°C
Supply Voltage	Vcc3		3.13	3.3	3.45	V
Supply Current	I_{cc}		-	-	750	mA
Module Total Power	P		-	-	2.5	W

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	Internal AC coupling
Differential Data Input Swing	Vin, pp	180	-	820	mV	-

Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	μs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	Internal AC coupling
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	Vcc_{HOST}	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1
Power Supply Rejection	PSR	Reference the Section 2.7 of the XFP MSA Rev 4.5.				Reference the Section 2.7 of the XFP MSA Rev 4.5

Note1 Loss of signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITER						
Output Opt. Pwr: 9/125 SMF	Pout	2	-	4	dBm	*1
Optical Extinction Ratio	ER	3.5	-	-	dB	-
Optical Wavelength	λ	λc–6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	-
Side Mode Suppression Ratio	SMSR	32	-	-	dB	-
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	-
TX Jitter Generation (Peak-to-Peak)	TXj	Per 802.3ae requirements			-	-
Relative Intensity Noise	RIN			-135	dB/Hz	-
RECEIVER						
Receiver Sensitivity	Pmin	-	-	-21	dBm	*3
Maximum Input Power	Pmax	0.5	-	-	dBm	-
Optical Center Wavelength	λ	1260	-	1600	nm	-
Receiver Reflectance	Rrf	-	-	-12	dB	-
LOS De-Assert	LOS_D	-	-	-23	dBm	-
LOS Assert	LOS_A	-35	-	-	dBm	-
LOS Hysteresis	-	1	-	-	dB	-

Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

XFP CWDM OPTEC, 10G, SM LC, 23DB EML (70KM), TX1470-1610, DDM

XFP10G-CWDM-SM-23DB-LC-TX47-61-D

XFP CWDM OPTEC, 10G, SM LC, 23dB EML (70km), TX1470-1610, DDM is designed for fiber communications application such as SONET OC-192, STM-64, 10G Ethernet (10GBASE-ZR/ZW) and 10G Fiber Channel (1200-SM-LL-L), which fully compliant with the specification of XFP MSA Rev 4.5. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are four center wavelengths available from 1270nm to 1330nm, with each step 20nm.

APPLICATIONS

10GBASE-ZR/ZW 10G Ethernet •

1200-SM-LL-L 10G Fiber Channel •

10GE over G.709 at 11.09Gbps •

FEATURES

- Supports 9.95Gb/s to 11.1Gb/s Bit Rates
- Hot-Pluggable XFP Footprint
- Compliant with XFP MSA
- 4-Wavelengths CWDM DFB Transmitter from 1270nm to 1330nm, with Step 20nm 23dB Power Budget
- Duplex LC Connector
- Power Dissipation < 2.5W
- Case Operation Temperature Range -5°C to 70°C
- 2-Wire Interface for Integrated Digital Diagnostic Monitoring

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP CWDM OPTEC, 10G, SM LC, 23dB EML (70km), TX1470-1610, DDM	10Gbps	SMF	23dB	CWDM DFB	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4	V
Storage Temperature	T_s	-40	85	°C
Case Operating Temperature	T_c	-5	70	°C
Maximum Input Power	Pm	-	-8	dBm

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Temperature	T_c	Standard	-5	-	70	°C
Supply Voltage 1	Vcc3		3.13	3.3	3.45	V
Supply Voltage 2	Vcc5		4.75	5	5.25	V
Supply Current-Vcc3 supply	I_{cc}		-	-	300	mA
Supply Current-Vcc5 supply	I_{cc}		-	-	750	mA
Module Total Power	P		-	-	3.5	W

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	Internal AC coupling
Differential Data Input Swing	Vin, pp	180	-	820	mV	-

Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	μs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	Internal AC coupling
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	Vcc_{HOST}	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1
Power Supply Rejection	PSR	Reference the Section 2.7 of the XFP MSA Rev 4.5.				Reference the Section 2.7 of the XFP MSA Rev 4.5

Note1 Loss of signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITER						
Output Opt. Pwr: 9/125 SMF	Pout	0	-	4	dBm	*1
Optical Extinction Ratio	ER	8.2	-	-	dB	
Optical Wavelength	λ	λc–6	λc	λc+7.5	dBm	*2
-20dB Spectrum Width	Δλ	-	-	1	dBm	
Side Mode Suppression Ratio	SMSR	32	-	-	dB	
Average Launch Power of OFF Transmitter	P_{OFF}	-	-	-30	dBm	
TX Jitter Generation (Peak-to-Peak)	TXj	Per 802.3ae requirements			-	
Relative Intensity Noise	RIN			-135	dB/Hz	
RECEIVER						
Receiver Sensitivity	Pmin	-	-	-23	dBm	*3
Maximum Input Power	Pmax	-10	-	-	dBm	
Optical Center Wavelength	λ	1260	-	1600	nm	
Receiver Reflectance	Rrf	-	-	-12	dB	
LOS De-Assert	LOS_D	-	-	-25	dBm	
LOS Assert	LOS_A	-37	-	-	dBm	
LOS Hysteresis	-	1	-	-	dB	

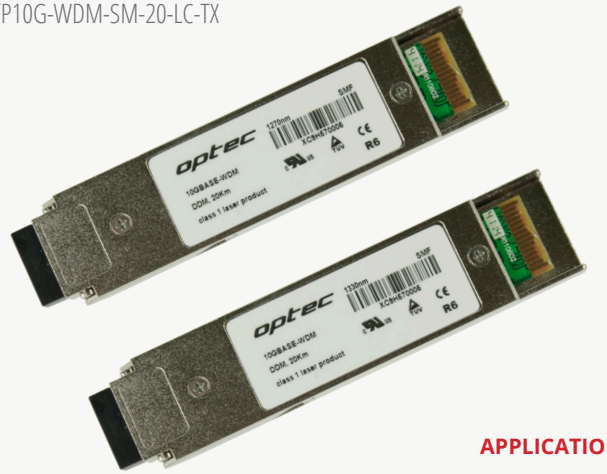
Note1 - Output power is coupled into a 9/125μm SMF.
Note2 - ITU-T G.694.2 CWDM wavelength from 1270nm to 1610nm, each step 20nm
Note3 - Average received power; BER less than 1E-12 and PRBS 2^{31}-1 test patter

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

XFP WDM OPTEC, 10G, SM LC, 12DB DFB (20KM), TX1270/1330, DDM

XFP10G-WDM-SM-20-LC-TX



APPLICATIONS

10GBASE-LR 10G Ethernet at 10.3125Gbps •

10GBASE-LW 10G Ethernet at 9.953Gbps •

1200-SM-LL-L 10G Fiber Channel at 10.51875Gbps •

XFP WDM OPTEC, 10G, SM LC, 12dB DFB (20km), TX1270/1330, DDM is small form factor pluggable module for duplex optical data communications such as 10GBASE-LR/LW defined by IEEE 802.3ae and 10G Fiber Channel 1200-SM LL-L. It is with the XFP 30-pin connector to allow hot plug capability. The transmitter section uses a multiple quantum well DFB, which is class 1 laser compliant according to International Safety Standard IEC-60825.

FEATURES

• Supports 9.95Gb/s to 11.3Gb/s date rates

• Power budget up to 12dB

• Two types:

A: 1270nm DFB Transmitter/ 1330nm Receiver

B: 1330nm DFB Transmitter/ 1270nm Receiver

• LC Connector

• +3.3V power supply only

• Power dissipation <2W

• Built-in digital diagnostic functions

• Case temperature range: • Operating Case Temperature Standard: 0 to +70 °C Industrial: -40 to +85°C

• Complaint with XFP MSA / IEEE 802.3ae 10GBASE-LR/LW / 10GFC 1200-SM-LL-L

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP WDM OPTEC, 10G, SM LC, 12dB DFB (20km), TX1270/1330, DDM	Up to 11.3Gbps	SMF	12dB	1270nm DFB	LC	Standard	YES
						Industrial	
XFP WDM OPTEC, 10G, SM LC, 12dB DFB (20km), TX1330/1270, DDM				1330nm DFB		Standard	
						Industrial	

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4	V
Storage Temperature	T_s	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_c	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Current	Icc		-	-	580	mA
Supply Voltage	Vcc		3.13	-	3.45	°C

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
Data Rate		9.95	-	11.3	Gbps	-
Input Differential Impedance	Rin	90	100	110	Ω	-
Differential Data Input Swing	Vin, pp	120	-	820	mV	Internal AC coupling

Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	μs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	Internal AC coupling
Output Differential Impedance	P_{IN}	90	100	110	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	2.4	-	Vcc_{HOST}	V	-
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	-

Optical Characteristics

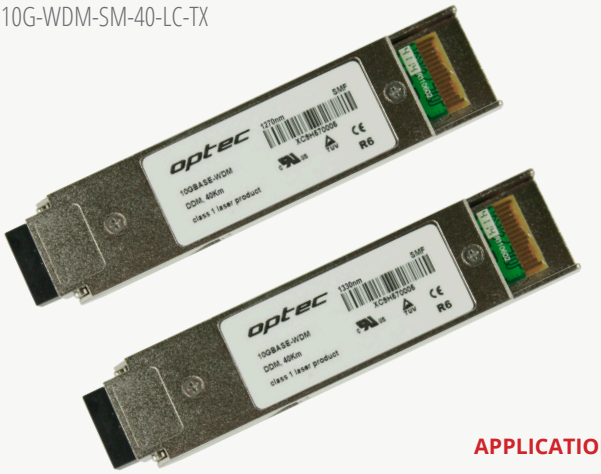
Parameter		Symbol	Min.	Typical	Max.	Unit
Power budget		-	12	-	-	dB
Data Rate		-	9.953	10.3125	11.3	Gbps
TRANSMITTER						
Center Wavelength	1270nm	λ	1260	1270	1280	nm
	1330nm		1320	1330	1340	
Spectral Width (-20dB)		Δλ	-	-	1	nm
Side Mode Suppression Ratio		SMSR	30	-	-	dBm
Average Output Power		Pout	-2	-	3	dBm
Extinction Ratio		ER	3.5	-	-	dB
Average Power of OFF Transmitter		Poff	-	-	-30	dBm
Relative Intensity Noise		RIN	-	-	-128	dB/Hz
TX Disable Assert Time		t_off	-	-	10	us
RECEIVER						
Center Wavelength		$λ_C$	1320	-	1340	nm
			1260	-	1280	
Sensitivity		P_{MIN}	-	-	-14	dBm
Receiver Overload		P_{MAX}	0.5	-	-	dBm
LOS De-Assert		LOS_D	-	-	-16	dBm
LOS Assert		LOS_A	-28	-	-	dBm

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

XFP WDM OPTEC, 10G, SM LC, 16DB DFB (40KM), TX1270/1330, DDM

XFP10G-WDM-SM-40-LC-TX



XFP WDM OPTEC, 10G, SM LC, 16dB DFB (40km), TX1270/1330, DDM is small form factor pluggable module for duplex optical data communications such as 10GBASE-ER/EW defined by IEEE 802.3ae and 10G Fiber Channel 1200-SM LL-L. It is with the XFP 30-pin connector to allow hot plug capability. The transmitter section uses a multiple quantum well DFB, which is class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

10GBASE-ER 10G Ethernet at 10.3125Gbps •

10GBASE-EW 10G Ethernet at 9.953Gbps •

1200-SM-LL-L 10G Fiber Channel at 10.51875Gbps •

FEATURES

• Supports 9.95Gb/s to 11.3Gb/s data rates

• Power budget 16dB at least

• Two types:

A: 1270nm DFB Transmitter/ 1330nm Receiver

B: 1330nm DFB Transmitter/ 1270nm Receiver

• LC Connector

• +3.3V power supply only

• Power dissipation < 2W

• Built-in digital diagnostic functions

• Case temperature range: • Operating Case Temperature Standard: 0 to +70 °C Industrial: -40 to +85°C

• Complaint with XFP MSA / IEEE 802.3ae 10GBASE-ER/EW / 10GFC 1200-SM-LL-L

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP WDM OPTEC, 10G, SM LC, 16dB DFB (40km), TX1270/1330, DDM	Up to 11.3Gbps	SMF	16dB	1270nm DFB	LC	Standard	YES
						Industrial	
XFP WDM OPTEC, 10G, SM LC, 16dB DFB (40km), TX1330/1270, DDM				1330nm DFB		Standard	
						Industrial	

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4	V
Storage Temperature	T_s	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_c	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Current	Icc			-	580	mA
Supply Voltage	Vcc			3.13	3.45	°C

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
Data Rate		9.95	-	11.3	Gbps	-
Input Differential Impedance	Rin	90	100	110	Ω	-
Differential Data Input Swing	Vin, pp	120	-	820	mV	Internal AC coupling

Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	μs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	Internal AC coupling
Output Differential Impedance	P_{IN}	90	100	110	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	2.4	-	Vcc_{HOST}	V	-
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	-

Optical Characteristics

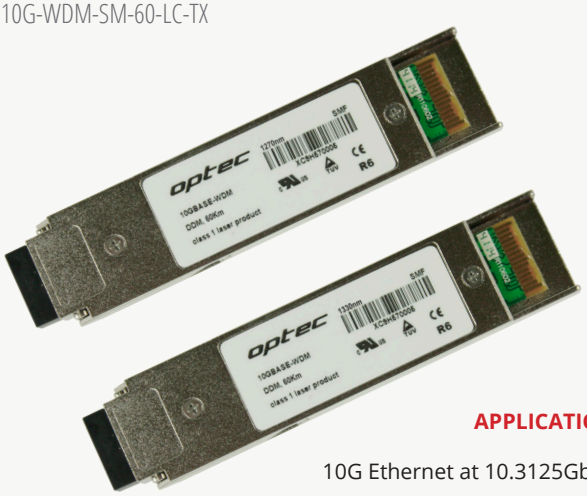
Parameter		Symbol	Min.	Typical	Max.	Unit
Power budget		-	12	-	-	Km
Data Rate		-	9.95	-	11.3	Gbps
TRANSMITER						
Center Wavelength	1270nm	λ	1260	1270	1280	nm
	1330nm		1320	1330	1340	
Spectral Width (-20dB)		Δλ	-	-	1	nm
Side Mode Suppression Ratio		SMSR	30	-	-	dBm
Average Output Power		Pout	-2	-	3	dBm
Extinction Ratio		ER	3.5	-	-	dB
Average Power of OFF Transmitter		Poff	-	-	-30	dBm
Relative Intensity Noise		RIN	-	-	-128	dB/Hz
TX Disable Assert Time		t_off	-	-	10	us
RECEIVER						
Center Wavelength		$λ_C$	1320	-	1340	nm
			1260	-	1280	
Sensitivity		P_{MIN}	-	-	-15	dBm
Receiver Overload		P_{MAX}	0.5	-	-	dBm
LOS De-Assert		LOS_D	-	-	-17	dBm
LOS Assert		LOS_A	-29	-	-	dBm

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

XFP WDM OPTEC, 10G, SM LC, 21DB DFB (60KM), TX1270/1330, DDM

XFP10G-WDM-SM-60-LC-TX



XFP WDM OPTEC, 10G, SM LC, 21dB DFB (60km), TX1270/1330, DDM is small form factor pluggable module for Bi-direction optical data communications such as 10 Gigabit Ethernet and 1200-SM-LL-L 10G Fiber Channel. It is with the XFP 30-pin connector to allow hot plug capability. The transmitter section uses a multiple quantum well DFB, which is class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

10G Ethernet at 10.3125Gbps •

10G Ethernet at 9.953Gbps •

1200-SM-LL-L 10G Fiber Channel at 10.51875Gbps •

FEATURES

• Supports 9.95Gb/s to 11.3Gb/s date rates

• Power budget 21dB at least

• Two types:

A: 1270nm DFB Transmitter/ 1330nm Receiver

B: 1330nm DFB Transmitter/ 1270nm Receiver

• LC Connector

• +3.3V power supply only

• Power dissipation < 2W

• Built-in digital diagnostic functions

• Case temperature range: • Operating Case Temperature Standard: 0 to +70 °C Industrial: -40 to +85°C

• Complaint with XFP MSA

Product Information

Product Name	Data Rate	Fiber	Power Budget	Laser	Interface	Temp.	DDM
XFP WDM OPTEC, 10G, SM LC, 21dB DFB (60km), TX1270/1330, DDM	Up to 11.3Gbps	SMF	21dB	1270nm DFB	LC	Standard	YES
						Industrial	
XFP WDM OPTEC, 10G, SM LC, 21dB DFB (60km), TX1330/1270, DDM				1330nm DFB		Standard	
						Industrial	

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4	V
Storage Temperature	T_s	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_c	Standard	0	-	70	°C
		Industrial	-40	-	85	
Power Supply Current	Icc			-	580	mA
Supply Voltage	Vcc			3.13	3.45	°C

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
Data Rate		9.953	10.3125	11.3	Gbps	-
Input Differential Impedance	Rin	90	100	110	Ω	-
Differential Data Input Swing	Vin, pp	120	-	820	mV	Internal AC coupling

Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	μs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	Internal AC coupling
Output Differential Impedance	P_{IN}	90	100	110	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	2.4	-	Vcc_{HOST}	V	-
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	-

Optical Characteristics

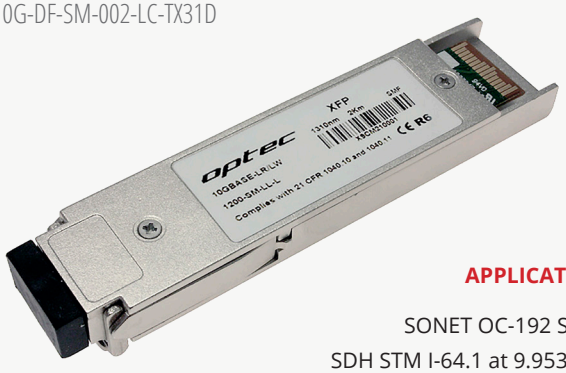
Parameter		Symbol	Min.	Typical	Max.	Unit
Power budget		-	21	-	-	Km
Data Rate		-	9.953	10.3125	11.3	Gbps
TRANSMITER						
Center Wavelength	1270nm	λ	1260	1270	1280	nm
	1330nm		1320	1330	1340	
Spectral Width (-20dB)		Δλ	-	-	1	nm
Side Mode Suppression Ratio		SMSR	30	-	-	dBm
Average Output Power		Pout	1	-	5	dBm
Extinction Ratio		ER	3.5	-	-	dB
Average Power of OFF Transmitter		Poff	-	-	-30	dBm
Relative Intensity Noise		RIN	-	-	-128	dB/Hz
TX Disable Assert Time		t_off	-	-	10	us
RECEIVER						
Center Wavelength		$λ_C$	1320	-	1340	nm
			1260	-	1280	
Sensitivity		P_{MIN}	-	-	-20	dBm
Receiver Overload		P_{MAX}	-6	-	-	dBm
LOS De-Assert		LOS_D	-	-	-22	dBm
LOS Assert		LOS_A	-34	-	-	dBm

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

XFP OPTEC, 10G, SM LC, 2KM, TX1310, DDM (XFP-10GBASE-LR)

XFP10G-DF-SM-002-LC-TX31D



XFP OPTEC, 10G, SM LC, 2km, TX1310, DDM (XFP-10GBASE-LR) transceiver is a high performance, cost effective module for serial optical data communications applications specified for signal rates of 9.95 Gb/s to 11.3 Gb/s. It is fully compliant to XFP MSA Rev 4.5. The modules are designed for single mode fiber. The receiver section uses PIN photodetector for low dark current and excellent responsivity or APD high sensetivity receiver.

APPLICATIONS

SONET OC-192 SR-1, • SDH STM I-64.1 at 9.953Gbps

10GBASE-LR/LW 10G Ethernet •

1200-SM-LL-L 10G Fiber Channel •

10GE over G.709 at 11.09Gbps •

OC192 over FEC at 10.709Gbps •

FEATURES

- Supports 9.95Gb/s to 11.1Gb/s bit rates
- Hot-Pluggable XFP Footprint
- Distance Up To 2km
- 1310nm FP Laser
- Duplex LC Connector
- Power Dissipation < 2.5W
- Built-in Digital Diagnostic Functions
- Case Operating Temperature: 0°C to 70°C
- Complaint with XFP MSA / IEEE 802.3ae 10GBASE-LR/LW / 10GFC 1200-SM-LL-L

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
XFP OPTEC, 10G, SM LC, 2km, TX1310, DDM (XFP-10GBASE-LR)	10Gbps	SMF	2km	FP	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage 1	Vcc3	-0.5	4	V
Maximum Supply Voltage 2	Vcc5	-0.5	6	V
Storage Temperature	T_S	-40	85	°C
Case Operating Temperature	T_C	0	70	V

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_C	Standard	-5	-	70	°C
Supply Voltage 1	Vcc3		3.13	-	3.45	V
Supply Voltage 2	Vcc5		4.75	-	5.25	V

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Supply Voltage #2	Vcc3	3.13	-	3.45	V	-
Supply Current – Vcc3 supply	Icc3	-	-	500	mA	-
TRANSMITTER						
Module Total Power	P	-	-	2.5	W	-
Input Differential Impedance	Rin	-	100	-	Ω	-
Differential Data Input Swing	Vin, pp	120	-	820	mV	Internal AC coupling
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-

Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	μs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	VccHOST	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1

Note1 Loss of signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITER					
Optical Output Power	Po	-5.2	-	0	dBm
Optical Wavelength	λ_C	1270	-	1355	nm
Spectrum Width (RMS)	Δλ	-	-	3	nm
Optical Extinction Ratio	ER	3.5	-	-	dB
Average Launch power of OFF transmitter	P_{OFF}	-	-	-30	pm
TX Jitter	Txj	Compliant with each standard			
RECEIVER					
Receiver Sensitivity @ 10.7Gb/s	Pmin	-	-	14.4	nm
Maximum Input Power	Pmax	0.5	-	-	dBm
Optical Center Wavelength	λ_C	1260	-	1565	nm
Receiver Reflectance	Rrx	-	-	-14	dB
LOS De-Assert	LOS_D	-		-16.4	dBm
LOS Assert	LOS_A	-28.4	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

XFP OPTEC, 10G, SM LC, 20KM, TX1310, DDM (XFP-10GBASE-LR)

XFP10G-DF-SM-020-LC-TX31D

APPLICATIONS

SONET OC-192 LR-1, •
SDH STM I-64.1 at 9.953Gbps

10GBASE-LR/LW 10G Ethernet •

1200-SM-LL-L 10G Fibre Channel •

10GE over G.709 at 11.09Gbps •

OC192 over FEC at 10.709Gbps •

XFP OPTEC, 10G, SM LC, 20km, TX1310, DDM (XFP-10GBASE-LR) transceiver is a high performance, cost effective module for serial optical data communications applications specified for signal rates of 9.95 Gb/s to 11.3 Gb/s. It is fully compliant to XFP MSA Rev 4.5. The modules are designed for single mode fiber. The receiver section uses PIN photodetector for low dark current and excellent responsivity or APD high sensetivity receiver.

FEATURES

- Supports 9.95Gb/s to 11.1Gb/s bit rates
- Hot-pluggable XFP footprint
- Maximum link length of 20km
- Uncooled 1310nm DFB laser
- Duplex LC connector
- Power dissipation < 2.5W
- Built-in digital diagnostic functions
- Case Operating Temperature: Standard: 0°C to 70°C Industrial: -40°C to 85°C
- Complaint with XFP MSA / IEEE 802.3ae 10GBASE-LR/LW / 10GFC 1200-SM-LL-L

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
XFP OPTEC, 10G, SM LC, 20km, TX1310, DDM (XFP-10GBASE-LR)	10Gbps	SMF	20km	DFB	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc3	-0.5	4	V
Storage Temperature	T_S	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40	-	85	
Supply Voltage 1	Vcc3		3.13	-	3.45	V

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Supply Voltage #2	Vcc3	3.13	-	3.45	V	-
Supply Current – Vcc3 supply	Icc3	-	-	500	mA	-
Module total power	P	-	-	2.5	W	-
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	-
Differential Data Input Swing	Vin, pp	120	-	820	mV	Internal AC coupling
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	µs	-

RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	VccHOST	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1
Power Supply Rejection	PSR	Per Section 2.7.1. in the XFP MSA Specification				

Note1 Loss of signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Optical Output Power	Po	-3	-	1	dBm
Launch power min (OMA)	P_{OMA}	-	-	-3.5	dBm
Optical Wavelength	λ_C	1270	-	1355	nm
Optical Extinction Ratio	ER	3.5	-	-	dB
Side Mode Supression ratio	SSRmin	-	-	30	dB
Average Launch power of OFF transmitter	P_{OFF}	-30	-	-	dBm
TX Jitter	Txj	Compliant with each standard requirements			
RECEIVER					
Receiver Sensitivity @ 10.7Gb/s	RSENS	-	-	-15	dBm
Maximum Input Power	Pmax	0.5	-	-	dBm
Optical Center Wavelength	λ_C	1270	-	1600	nm
Receiver Reflectance	Rrx	-	-	-14	dB
LOS De-Assert	LOS_D	-		-17	dBm
LOS Assert	LOS_A	-29	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

XFP OPTEC, 10G, SM LC, 40KM, TX1310, DDM (XFP-10GBASE-ER)

XFP10G-DF-SM-040-LC-TX31D

APPLICATIONS

SONET&, SDH •

10GBASE-LR/LW 10G Ethernet •

1200-SM-LL-L 10G Fibre Channel •

10GE over G.709 at 11.09Gbps •

OC192 over FEC at 10.709Gbps •

XFP OPTEC, 10G, SM LC, 40km, TX1310, DDM (XFP-10GBASE-ER) transceiver is a high performance, cost effective module for serial optical data communications applications specified for signal rates of 9.95 Gb/s to 11.3 Gb/s. It is fully compliant to XFP MSA Rev 4.5. The modules are designed for single mode fiber. The receiver section uses PIN photodetector for low dark current and excellent responsivity or APD high sensetivity receiver.

FEATURES

- Supports 9.95Gb/s to 11.1Gb/s bit rates
- Hot-pluggable XFP footprint
- Maximum link length of 40km
- Uncooled 1310nm DFB laser
- Duplex LC connector
- Power dissipation <2.5W
- Built-in digital diagnostic functions
- Case Operating Temperature: Standard: 0°C to 70°C Industrial: -40°C to 85°C
- Complaint with XFP MSA

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
XFP OPTEC, 10G, SM LC, 40km, TX1310, DDM (XFP-10GBASE-ER)	10Gbps	SMF	40km	DFB	LC	Standard Industrial	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc3	-0.5	4	V
Storage Temperature	T_S	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40	-	85	
Supply Voltage 1	Vcc3		3.13	-	3.45	V

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Supply Voltage #2	Vcc3	3.13	-	3.45	V	-
Supply Current – Vcc3 supply	Icc3	-	-	720	mA	-
Module total power	P	-	-	2.5	W	-
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	Internal AC coupling
Differential Data Input Swing	Vin, pp	120	-	820	mV	-
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-
Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	µs	-

RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	VccHOST	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1
Power Supply Rejection	PSR	Per Section 2.7.1. in the XFP MSA Specification.				

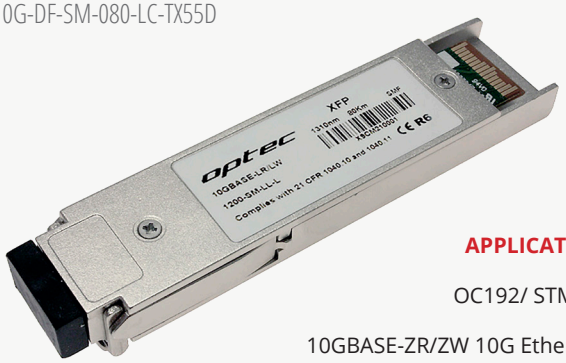
Note1 Loss of signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
TRANSMITER					
Optical Output Power	Po	0	-	4	dBm
Launch power min (OMA)	P_{OMA}	-	-	-3.5	dBm
Optical Wavelength	λ_C	1290	-	1330	nm
Optical Extinction Ratio	ER	6	-	-	dB
Side Mode Supression ratio	SSRmin	30	-	-	dB
Average Launch power of OFF transmitter	P_{OFF}	-30	-	-	dBm
TX Jitter	Txj	Compliant with each standard requirements			
RECEIVER					
Receiver Sensitivity @ 10.7Gb/s	RSENS	-	-	-16	dBm
Maximum Input Power	Pmax	0.5	-	-	dBm
Optical Center Wavelength	λ_C	1270	-	1600	nm
Receiver Reflectance	Rrx	-	-	-14	dB
LOS De-Assert	LOS_D	-		-18	dBm
LOS Assert	LOS_A	-30	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Regulatory Compliance	
Product Certificate	**Applicable Standard**
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

XFP OPTEC, 10G, SM LC, 80KM, TX1550, DDM (XFP-10GBASE-ZR)

XFP10G-DF-SM-080-LC-TX55D



APPLICATIONS

OC192/ STM 64 •

10GBASE-ZR/ZW 10G Ethernet •

1200-SM-LL-L 10G Fiber Channel •

P1L1-2D2 •

ITU-T G.709 •

XFP OPTEC, 10G, SM LC, 80km, TX1550, DDM (XFP-10GBASE-ZR) transceiver is small form factor pluggable module for duplex optical data communications such as 10GBASE-ZR/ZW defined by IEEE 802.3ae. It is with the XFP 30-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of 1550 nm. The transmitter section uses a 1550nm EML, which is class 1 laser compliant according to International Safety Standard IEC-60825.

FEATURES

- Supports 9.95Gb/s to 11.3Gb/s Bit Rates
- Hot-pluggable XFP Footprint
- Maximum Link Length up to 80km
- Temperature-Stabilized EML transmitter
- Duplex LC Connector
- Built-in Digital Diagnostic Functions
- Case Operating Temperature: Standard: 0°C to 70°C Extended: -20°C to 75°C
- No external clock required

Product Information							
Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
XFP OPTEC, 10G, SM LC, 80km, TX1550, DDM (XFP-10GBASE-ZR)	Up to11.3Gbps	SMF	80km	EML	LC	Standard Extended	YES

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage 1	Vcc3	-0.5	4	V
Maximum Supply Voltage 2	Vcc3	-0.5	4	V
Storage Temperature	T_S	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions						
Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_C	Standard	0	-	70	°C
		Extended	-20	-	75	
Supply Voltage 1	Vcc3		3.13	3.3	3.45	V
Supply Voltage 2	Vcc5		4.75	5	5.25	V

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Main Supply Voltage	Vcc5	4.75	-	5.25	V	-
Supply Voltage #2	Vcc3	3.13	-	3.45	V	-
Supply Current – Vcc3 supply	Icc3	-	-	500	mA	-
Supply Current – Vcc5 supply	Icc5	-	-	370	mA	-
Module total power	P	-	-	3.5	W	-
TRANSMITTER						
Input Differential Impedance	Rin	-	100	-	Ω	Internal AC coupling
Differential Data Input Swing	Vin, pp	120	-	820	mV	-
Transmit Disable Voltage	V_D	2.0	-	Vcc	V	-

Transmit Enable Voltage	V_{EN}	GND	-	GND+0.8	V	-
Transmit Disable Assert Time	Tr	-	-	10	μs	-
RECEIVER						
Differential Data Output Swing	Vout,pp	340	650	850	mV	-
Data Output Rise Time	Tr	-	-	38	ps	20% – 80%
Data Output Fall Time	Tf	-	-	38	ps	20% – 80%
LOS Fault	V_{LOS} Fault	Vcc – 0.5	-	VccHOST	V	note1
LOS Normal	V_{LOS} Normal	GND	-	GND+0.5	V	note1

Note1 Loss of signal is open collector. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
TRANSMITER					
Output Power @ 9/125 SMF	Po	0	-	4	dBm
Optical Wavelength	λ_C	1290	-	1330	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Optical Extinction Ratio@10.3Gb/s	ER	9	-	-	-
Average Launch power of OFF transmitter	-	-	-	-30	-
TX Jitter Generation (Peak-to-Peak)	-	-	-	0.1	-
TX Jitter Generation (RMS)	T_{XJRMS}	-	-	0.01	dBm
Relative Intensity Noise	RIN	-	-	-130	dBm
Eye Mask	Δλ	Compliant with ITU-T G.691			
RECEIVER					
Receiver Sensitivity@ 9.95Gb/s *Note5	Pmin	-	-	-24	dBm
Receiver Sensitivity @ 10.3Gb/s *Note5					
Overload Power	Pmax	-7	-	-	dBm
Optical Center Wavelength	λ_C	1270	1550	1600	nm
Receiver Reflectance	Rrx	-	-	-27	dB
LOS De-Assert	LOS_D	-	-	-26	dBm
LOS Assert	LOS_A	-38	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Regulatory Compliance

Product Certificate	Applicable Standard
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

XFP OPTEC, 10G, MM LC, 300M, TX850, DDM (XFP-10GBASE-SR)

XFP10G-DF-MM-001-LC-TX85D

APPLICATIONS

Vertical Cavity Surface Emitting • Laser at 850nm(VCSEL)

LC duplex connector •

XFI loopback supported •

Lead free and RoHS Compliant •

Excellent EMI performance •

High reliability •

XFP OPTEC, 10G, MM LC, 300m, TX850, DDM (XFP-10GBASE-SR) transceiver is a multi-purpose optical transceiver module for 10Gbit/s data transmission applications at 850nm. It is ideally suited for 10 GbE datacom (belly-to-belly for high density applications) and storage area network(SAN/NAS) applications based on the IEEE 802.3ae and Fibre Channel standards Designed for short range distances, the transceiver module comprises a transmitter with a vertical cavity surface emitting laser (VCSEL) and a receiver with a PIN photodiode.

FEATURES

- Fully compliant to XFP MSA Rev.4.5
- Supports 9.95Gb/s to 11.3Gb/s date rates
- Compliance to Fibre Channel 1200-M5-SN-I, 1200-M5E-SN-I, 1200-M6-SN-I at 10.51875Gbit/s
- Transmission distance up to 300m with OM3 MMF, 82m with OM2 MMF, 33m with OM1 MMF
- Low power consumption 1.5W(typ.)
- Wide operating temperature range: Standard: 0°C to +70°C
- Laser Class 1M compliant

Product Information

Product Name	Data Rate	Fiber	Distance	Laser	Interface	Temp.	DDM
XFP OPTEC, 10G, MM LC, 300m, TX850, DDM (XFP-10GBASE-SR)	10Gbps	MMF	300m	VCSEL	LC	Standard	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Storage Ambient Temperature Range	-	-40	+85	°C
Operating Relative Humidity	RH	8	80	%
Supply Voltage Range @ 5.0V	Vcc5	0.5	6.0	V
Supply Voltage Range @ 3.3V	Vcc3	0.5	3.6	V
Open Drain VCC level	V_{OD}	-	4.0	V

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_C	Standard	0	-	70	°C
Transceiver total Power Consumption	P_{TOT}		-	1.5	2.3	W
Supply Voltage 2	Vcc3		3.135	3.300	3.465	V
Supply Current	I_{Vcc3}		-	325	600	mA

High Speed Line Characteristics

Parameter	Conditions	Symbol	Min.	Typical	Max.	Unit
Baud Rate nominal	-	-	9.95	-	11.3	Gbd
Baud Rate Tolerance	-	-	-100	-	+100	ppm
OUTPUT-DC						
Single Ended Output Impedance	-	Z_{SE}	40	50	60	Ω
Differential Output Impedance	-	Z_{OD}	80	100	120	Ω
OUTPUT-AC						
Differential Output Amplitude	-	V_{OSPP}	340	-	850	mV
Output Common Mode	-	V_{CM}	0	-	3.6	V
Transition Time Low to High	-	-	-	-	-30	-
Transition Time High to Low		-	-	-	0.1	-

Differential Output Return Loss	0.05 - 0.1GHz	-	20	-	-	dB
	0.1 - 5.5GHz		8			
	5.5 - 12GHz		note1			
Common Mode Output Return Loss*note2	0.1 - 15GHz	SCC 22	3	-	-	dB
Total Peak-to-peak Jitter	-	Dj	-	-	0.34	UI
Output AC Common Mode Voltage	-	-	-	-	15	mV (RMS)
INPUT-DC						
Differential Output Impedance		R_{IND}	80	-	120	Ω
Input AC Common Mode Input Voltage		-	0	-	25	mV (RMS)
Source to Sink DC Potential Difference		V_{CM}	0	-	3.6	V
INPUT-AC						
Differential input Voltage Swing	-	V_{ID}	120 note2	-	-	mV
Differential Return Loss	0.05 - 0.1GHz	SDD11	20	-	-	dB
	0.1 - 5.5GHz		8			
	5.5 - 12GHz		note3			
Common Mode Return Loss	0.1 - 15GHz	SCC11	3	-	-	dB
Total Jitter	-	Tj	-	-	TBD	UI

note1 - SDD22(dB)=8-20.66 log10(f15.5) with fin GHz note2 - Common mode reference impedance is 25. Common mode return loss helps absorb reflection and noise improving EMI.
note3 - SDD11(dB)=8-20.66 log10(f15.5) with f in GHz note4 - Beneath this level the signal can't meet the specification

Optical Characteristics

Parameter	Conditions	Symbol	Min.	Typical	Max.	Unit
TRANSMITER						
Nominal Wavelength		λ_{TRP}	840	850	860	nm
Spectral Width		Δλ	-	0.4	0.45	nm
Operating Range	62.5/125μm MMF, 160 MHz*km	-	-	-	26	m
	50/125μm MMF, 400 MHz*km	-	-	-	66	
	62.5/125μm MMF, 200 MHz*km	-	-	-	33	
	50/125μm MMF, 500 MHz*km	-	-	-	82	
	50/125μm MMF, 2000MHz*km	-	-	-	300	
Nominal Signalling Speed		f_{OPT}	9.95	-	11.3	-
Average Launch Power		Po	-7.3	-2.6	-1	-
Extinction Ratio		ER	3.5	5.5	-	-
Transmitter and Dispersion Penalty		TDP	-	-	3.9	dBm
Relative Intensity Noise		RIN	-	-	-128	Db/Hz
RECEIVER						
Center Wavelength		λ_C	840	850	860	nm
Receiver Sensitivity	BER 10^{-12}@2^{31}-1^{1}	P_{IN}	-	-13.5	-11.1	dBm
Receiver Sensitivity	in OMA	Pmax	-	-	-11.1	
Stressed Receiver Sensitivity	in OMA	P_{IN}	-	-	-7.5	dBm
Saturation Input Power		P_{SAT}	1	-	-	dBm

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

X2 OPTEC, 10G, CONVERTER TO SFP+

X210G-CONV

X2 OPTEC, 10G, Converter To SFP+. It's converts a 10 Gigabit Ethernet X2 port into a 10 Gigabit Ethernet SFP+ port. With the converter module, customers have the flexibility to use the 10 Gigabit X2 interface port of a switch with X2 modules or SFP+ modules. This flexibility is critical when the specific type of interface is not available in one or the other form factor or when customers want to use the same form factor for interfaces across multiple platforms deployed in their network.

APPLICATIONS

Convert SFP+ port to X2 port •

FEATURES

• Compatible with X2 MSA Rev.2.0b

• Case Temperature Range: Standard: 0°C - 70°C

• Hot pluggable 70-pin connector with XAUI electrical interface

• Management and control via MDIO 2-wire interface

• Complaint with the EU RoHS 6 Environmental requirements

THERMAL MANAGEMENT

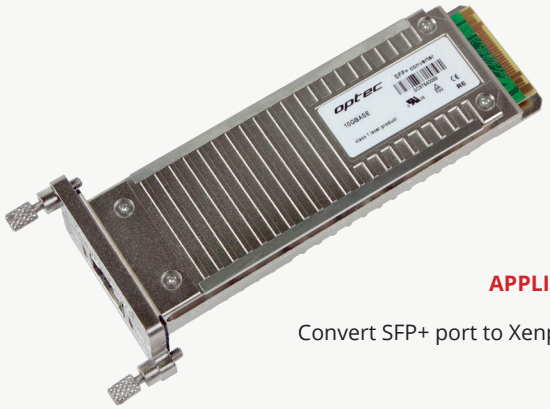
The converter is designed for an operation within a case temperature range between 0 to +70°C at an altitude of < 3km. The built in heatsink provides an optimized thermal performance. The user needs to guarantee per system design not to exceed this temperature range. It has to be considered that in case of usage of multiple modules on a single hostboard that there is a temperature rise among the modules hosted side by side. Airflow direction and air speed needs to be choosen accordingly. For further information it is referred to the MSA document

Electro Static Discharge (ESD)							
Product Name	Parameter	Conditions	Symbol	Min	Typ	Max.	Units
X2 OPTEC, 10G, Converter To SFP+	Static Discharge Voltage	MIL STD 883 Method	-	-	-	500	V

Regulatory Compliance	
Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

XENPAK OPTEC, 10G, CONVERTER TO SFP+

XPK10G-CONV



APPLICATIONS

Convert SFP+ port to Xenpak port •

XENPAK OPTEC, 10G, Converter To SFP+ - It's converts a 10 Gigabit Ethernet XENPAK port into a 10 Gigabit Ethernet SFP+ port. With the converter module, customers have the flexibility to use the 10 Gigabit XENPAK interface port of a switch with XENPAK modules or SFP+ modules. This flexibility is critical when the specific type of interface is not available in one or the other form factor or when customers want to use the same form factor for interfaces across multiple platforms deployed in their

FEATURES

- Compatible with XENPAK MSA
- Case Temperature Range: Standard: 0°C - 70°C
- Hot pluggable 70-pin connector with XAUI electrical interface
- Management and control via MDIO 2-wire interface
- Complaint with the EU RoHS 6 Environmental requirements

THERMAL MANAGEMENT

The transponder is designed for an operation within a case temperature range between 0 to +70°C at an altitude of < 3km. The built in heatsink provides an optimized thermal performance. The user needs to guarantee per system design not to exceed this temperature range. It has to be considered that in case of usage of multiple modules on a single hostboard that there is a temperature rise among the modules hosted side by side. Airflow direction and air speed needs to be choosen accordingly. For further information it is referred to the MSA document.

Electro Static Discharge (ESD)							
Product Name	Parameter	Conditions	Symbol	Min	Typ	Max.	Units
XENPAK OPTEC, 10G, Converter To SFP+	Static Discharge Voltage	MIL STD 883 Method	-	-	-	500	V

Regulatory Compliance	
Product Certificate	**Applicable Standard**
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

SFP DUAL OPTEC, 1.25G SM LC, 10-40KM TX1310, SERIES

SFP1G-DF-SM-XX-LC-TX31

SFP DUAL OPTEC, 1.25G SM LC, 10-40km TX1310, Series - series single mode transceivers are small form factor pluggable module for bi-directional serial optical data communications such as Gigabit Ethernet 1000BASE-LX and Fiber Channel 1x SM-LC-L FC-PI. It is with the SFP 20-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of 1310nm. The transmitter section uses a multiple quantum well 1310nm laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

APPLICATIONS

Gigabit Ethernet Switches and Routers •

Fiber Channel Switch Infrastructure •

Other Optical Links •

FEATURES

• Operating Data Rate up to 1.25Gbps

• 10km with 9/125 µm SMF

• 15km with 9/125 µm SMF

• 20km with 9/125 µm SMF

• 30km with 9/125 µm SMF

• 40Km with 9/125 µm SMF

• Single 3.3V Power Supply and TTL Logic Interface

• Hot-Pluggable SFP Footprint Duplex LC Connector Interface

• Class 1 FDA and IEC60825-1 Laser Safety Compliant

• Operating Temperature: Standard: 0°C to +70 °C
Industrial: -40°C to +85°C

• Compliant with MSA SFP Specification

Product Information

Product Name	Data Rate	Fiber	DIstance	Interface	Temp.	DDM
SFP DUAL OPTEC, 1.25G SM LC, 10km TX1310	1.25Gbps	SMF	10km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	
SFP DUAL OPTEC, 1.25G SM LC, 15km TX1310	1.25Gbps	SMF	15km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	
SFP DUAL OPTEC, 1.25G SM LC, 20km TX1310	1.25Gbps	SMF	20km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	
SFP DUAL OPTEC, 1.25G SM LC, 30km TX1310	1.25Gbps	SMF	30km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	
SFP DUAL OPTEC, 1.25G SM LC, 40km TX1310	1.25Gbps	SMF	40km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	

Absolute Maximum Ratings*note1				
Parameter	**Symbol**	**Min.**	**Max.**	**Unit**
Maximum Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions							
Parameter		**Symbol**		**Min.**	**Typical**	**Max.**	**Unit**
Case Operating Temperature		T_C	Standard	0	-	70	°C
			Industrial	-40	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	300	mA
Date Rate	GBE	-		-	1.25	-	°C
	FC	-		-	1.063	-	

Performance Specifications - Electrical						
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Note**
TRANSMITTER						
LVPECL Inputs(Differential)	VIN	400	-	2000	mVpp	AC coupled inputs
Input Impedance (Differential)	ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis — Disable	-	2	-	Vcc	V	-
Tx_Dis — Enable	-	0	-	0.8	V	-
Tx_FAULT — Fault	-	2	-	Vcc+0.3	V	-
Tx_FAULT — Normal	-	0	-	0.5	V	-
RECEIVER						
LVPECL Inputs(Differential)	Vout	400	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)	Zout	85	100	115	ohms	-
Rx_LOS — LOS	-	2	-	Vcc+0.3	V	-
Rx_LOS — Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)	VoH	2.5	-	-	V	With Serial ID
	VoL	0	-	0.5	V	

Optical Characteristics / 1310nm FP and PIN, 10km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9µm Core Diameter SMF	L	-	10	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (-20dB)	$\Delta\lambda$	-	-	4	nm
Average Output Power *Note4	Pout	-9	-	-3	dBm
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1320	-	1340	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-21	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert	LOS_D	-	-	-22	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Optical Characteristics / 1310nm FP and PIN, 15km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	15	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (-20dB)	Δλ	-	-	4	nm
Average Output Power *Note4	Pout	-8	-	-3	dBm
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-21	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert	LOS_D	-	-	-22	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Optical Characteristics / 1310nm FP and PIN, 20km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	20	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (-20dB)	Δλ	-	-	4	nm
Average Output Power *Note4	Pout	-8	-	-3	dBm
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-22	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert	LOS_D	-	-	-23	dBm
LOS Assert	LOS_A	-36	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Optical Characteristics / 1310nm FP and PIN, 30km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	30	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (-20dB)	Δλ	-	-	4	nm
Average Output Power *Note4	Pout	-5	-	0	dBm
Extinction Ratio *Note5	ER	9	-	-	dB

Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-24	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert	LOS_D	-	-	-25	dBm
LOS Assert	LOS_A	-38	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Optical Characteristics / 1310nm FP and PIN, 40km

Parameter	Symbol	Min.	Typical	Max.	Unit
9μm Core Diameter SMF	L	-	40	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Average Output Power *Note4	Pout	-2	-	3	dBm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-24	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert	LOS_D	-	-	-25	dBm
LOS Assert	LOS_A	-38	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Note4: Output is coupled into a 9/125m single mode fiber.
Note5: Filtered, measured with a PRBS 2^7-1 test pattern @1.25Gbps
Note6: LVPECL logic, internally AC coupled.
Note7: Minimum average optical power at BER less than 1E-12, with a 2^7-1 NRZ PRBS and ER=9 dB.

Regulatory Compliance

Product Certificate	Applicable Standard
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP DUAL OPTEC, 1.25G SM LC, 40-160KM TX1550, SERIES

SFP1G-DF-SM-XX-LC-TX55

SFP DUAL OPTEC, 1.25G SM LC, 40-160km TX1550, Series transceivers are small form factor pluggable modules for serial optical data communications such as Gigabit Ethernet 1000BASE-ZX and Fiber Channel 1x SM-LC-L FC-PI. It is with the SFP 20-pin connector to allow hot plug capability. This modules are designed for single mode fiber and operates at a nominal wavelength of 1550nm The transmitter section uses a multiple quantum well 1550nm DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses anintegrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

APPLICATIONS

Gigabit Ethernet Switches and Routers •

Fiber Channel Switch Infrastructure •

Other Optical Links •

FEATURES

- Operating Data Rate up to 1.25Gbps
- 1550nm DFB Laser Transmitter
- 40km with 9/125 µm SMF
- 60km with 9/125 µm SMF
- 80km with 9/125 µm SMF
- 100km with 9/125 µm SMF
- 120km with 9/125 µm SMF
- 160km with 9/125 µm SMF
- Single 3.3V Power Supply and LVTTL Logic Interface
- Hot-Pluggable SFP Footprint Duplex LC Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- Operating Temperature: Standard: 0°C to +70 °C Industrial: -40°C to +85°C
- Compliant with SFP MSA Specification
- Compliant with SFF-8472

Product Information

Product Name	Data Rate	Fiber	DIstance	Interface	Temp.	DDM
SFP DUAL OPTEC, 1.25G SM LC, 40km TX1550	1.25Gbps	SMF	40km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	
SFP DUAL OPTEC, 1.25G SM LC, 60km TX1550	1.25Gbps	SMF	60km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	
SFP DUAL OPTEC, 1.25G SM LC, 80km TX1550	1.25Gbps	SMF	80km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	
SFP DUAL OPTEC, 1.25G SM LC, 100km TX1550	1.25Gbps	SMF	100km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	
SFP DUAL OPTEC, 1.25G SM LC, 120km TX1550	1.25Gbps	SMF	120km	LC	Standard	YES
					Industrial	
SFP DUAL OPTEC, 1.25G SM LC, 160km TX1550	1.25Gbps	SMF	160km	LC	Standard	YES
					Industrial	

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions							
Parameter		Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature		T_C	Standard	0	-	70	°C
			Industrial	-40	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	300	mA
Date Rate	GBE	-		-	1.25	-	°C
	FC	-		-	1.063	-	

Performance Specifications - Electrical							
Parameter		Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER							
LVPECL Inputs(Differential)		VIN	500	-	2400	mVpp	AC coupled inputs
Input Impedance (Differential)		ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis	Disable	-	2	-	Vcc	V	-
	Enable	-	0	-	0.8	V	-
Tx_FAULT	Fault	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.5	V	-
RECEIVER							
LVPECL Inputs(Differential)		Vout	370	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS	LOS	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

Optical Characteristics / 1550nm DFB and PIN, 40km					
Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF	L	-	40	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_c	1500	1550	1580	nm
Spectral Width (-20dB)	$\Delta\lambda$	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power *Note4	Pout	-5	-	0	dBm
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-24	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm

Return Loss	P_{MAX}	12	-	-	dBm
Optical Path Penalty*note8	LOS_D	-	-	1	dBm
LOS De-Assert	LOS_D	-	-	-25	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB
Optical Characteristics / 1550nm DFB and PIN, 60km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9µm Core Diameter SMF	L	-	60	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1500	1550	1580	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power *Note4	Pout	-2	-	3	dBm
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5			Compliant with IEEE 802.3ah-2004		
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-24	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
Return Loss	P_{MAX}	12	-	-	dBm
Optical Path Penalty*note8	LOS_D	-	-	1	dBm
LOS De-Assert	LOS_D	-	-	-25	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB
Optical Characteristics / 1550nm DFB and PIN, 80km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9µm Core Diameter SMF	L	-	80	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1500	1550	1580	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power *Note4	Pout	0	-	5	dBm
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5			Compliant with IEEE 802.3ah-2004		
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-24	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
Return Loss	P_{MAX}	12	-	-	dBm
Optical Path Penalty*note8	LOS_D	-	-	1	dBm

LOS De-Assert	LOS_D	-	-	-25	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB
Optical Characteristics / 1550nm DFB and PIN, 100km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	100	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1500	1550	1580	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power *Note4	Pout	0	-	5	dBm
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5			Compliant with IEEE 802.3ah-2004		
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-28	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
Return Loss	P_{MAX}	12	-	-	dBm
Optical Path Penalty*note8	LOS_D	-	-	1	dBm
LOS De-Assert	LOS_D	-	-	-29	dBm
LOS Assert	LOS_A	-42	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Optical Characteristics / 1550nm DFB and PIN, 120km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	120	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1500	1550	1580	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power *Note4	Pout	0	-	5	dBm
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5			Compliant with IEEE 802.3ah-2004		
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-32	dBm
Receiver Overload	P_{MAX}	-10	-	-	dBm
Return Loss	P_{MAX}	12	-	-	dBm
Optical Path Penalty*note8	LOS_D	-	-	1	dBm
LOS De-Assert	LOS_D	-	-	-33	dBm

LOS Assert	LOS_A	-45	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB
Optical Characteristics / 1550nm DFB and PIN, 160km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	160	-	km
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1500	1550	1580	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Output Power *Note4	Pout	3	-	7	dBm
Extinction Ratio *Note5	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	0.43	UI
Output Optical Eye*Note5	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity*Note7	P_{MIN}	-	-	-37	dBm
Receiver Overload	P_{MAX}	-10	-	-	dBm
Return Loss	P_{MAX}	12	-	-	dBm
Optical Path Penalty*note8	LOS_D	-	-	1	dBm
LOS De-Assert	LOS_D	-	-	-38	dBm
LOS Assert	LOS_A	-45	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Note4: Output is coupled into a 9/125m single mode fiber.
Note5: Filtered, measured with a PRBS 2^7-1 test pattern @1.25Gbps
Note7: Minimum average optical power at BER less than 1E-12, with a 2^7-1 NRZ PRBS and ER=9 dB
Note8: Measured with a PRBS 2^7-1 test pattern @1.25Gbps, G.652 SMF, BER 1×10^{-10}

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP DUAL OPTEC, 1.25G, MM LC, (550M), TX850 (GLC-SX-MM)

SFP1G-DF-MM-001-LC-TX85

SFP Dual OPTEC, 1.25G, MM LC, (550m), TX850 (GLC-SX-MM) series multi mode transceivers are small form factor pluggable module for bi-directional serial optical data communications such as Gigabit Ethernet 1000BASE-SX and Fiber Channel FC-PH-2 for 100-M5-SN-1 and 100-M6-SN-1. It is with the SFP 20-pin connector to allow hot plug capability. This module is designed for multi mode fiber and operates at a nominal wavelength of 850nm. The transmitter section uses a Vertical Cavity Surface Emitted Laser (VCSEL) which is a Class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated GaAs detector preamplifier (IDP) mounted in an optical header and

APPLICATIONS

Gigabit Ethernet •

Fiber Channel •

Switch to Switch Interface •

Other Optical Link •

FEATURES

- Operating Data Rate up to 1.25Gbps
- 850nm VCSEL Laser Transmitter
- 550m with 50/125μm MMF 300m on 62.5/125μm MMF
- Single 3.3V Power Supply and LVTTL Logic Interface
- Hot-Pluggable SFP Footprint Duplex LC Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- Operating Temperature: Standard: 0°C to +70 °C Industrial: -40°C to +85°C
- Compliant with SFP MSA Specification

Product Information

Product Name	Data Rate	Fiber	DIstance	Interface	Temp.	DDM
SFP Dual OPTEC, 1.25G, MM LC, (550m), TX850 (GLC-SX-MM)	1.25Gbps	MMF	550m	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_s	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter		Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature		T_c	Standard	0	-	70	°C
			Industrial	-40	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	300	mA
Date Rate	GBE	-		-	1.25	-	°C
	FC	-		-	1.063	-	

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
LVPECL Inputs(Differential)	VIN	500	-	2400	mVpp	AC coupled inputs
Input Impedance (Differential)	ZIN	85	100	115	ohms	Rin > 100 kohms @ DC

Tx_Dis	Disable	-	2	-	Vcc	V	-
	Enable	-	0	-	0.8	V	-
Tx_FAULT	Fault	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.5	V	-
RECEIVER							
LVPECL Inputs(Differential)		Vout	370	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS	LOS	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
50μm Core Diameter MMF	L	-	550	-	m
Data Rate	-	-	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	830	850	860	nm
Spectral Width (-20dB)	Δλ	-	-	0.85	nm
Average Output Power *note1	Pout	-9.5	-	-3	dBm
Extinction Ratio*note2	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	260	ps
Total Jitter*note2	TJ	-	-	0.43	UI
Output Optical Eye*note2	IEEE802.3z and ANSI Fiber Channel Compliant				
TX_Disable Assert Time	t_off	-	-	10	us
RECEIVER					
Center Wavelength	λ	760	-	860	nm
Receiver Sensitivity*note3	P_{MIN}	-	-	-17	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert	LOS_D	-	-	-18	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Note1: Output is coupled into a 62.5/125 mm multi mode fiber.
Note2: Filtered, measured with a PRBS 27-1 test pattern @1.25Gbps
Note3: Minimum average optical power measured at BER less than 1E-12, with a 27-1 PRBS and ER=9 Db.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP DUAL OPTEC, 1.25G, MM LC, (550M/1KM), TX1310 (GLC-LX-MM)

SFP Dual OPTEC, 1.25G, MM LC, (550m/1km), TX1310 (GLC-LX-MM) series multi mode transceiver are small form factor pluggable modules for bi-directional serial optical data communications such as Ethernet and SDH/SONET. It is with the SFP 20-pin connector to allow hot plug capability. This module is designed for multi mode fiber and operates at a nominal wavelength of 1310nm. The transmitter section uses a multiple quantum well 1310nm laser and is a class 1 laser compliant according to International Safety Standard IEC 60825.The receiver section uses an integrated GaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

APPLICATIONS

- Fiber Channel Links
- Gigabit Ethernet Links
- Fast Ethernet Links
- Other Optical Links

FEATURES

- Operating data rate up to 1.25Gbps
- 1310nm FP laser transmitter
- 550m Reach for 62.5/125um(550MHz.km)
- 1km Reach for 50/125um(800MHz.km)
- Single 3.3V power supply and TTL Logic Interface
- Hot-pluggable SFP footprint duplex LC connector interface
- Class 1 FDA and IEC60825-1 laser safety compliant
- Operating Temperature: Standard: 0°C to +70 °C Industrial: -40°C to +85°C
- Compliant with SFP MSA
- Compliant with SFF-8472

Product Information

Product Name	Data Rate	Fiber	DIstance	Interface	Temp.	DDM
SFP Dual OPTEC, 1.25G, MM LC, (550m/1km), TX1310 (GLC-LX-MM)	1.25Gbps	MMF	550m/1km	LC	Standard	NO
					Industrial	
					Standard	YES
					Industrial	

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_s	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_c	Standard	0	-	70	°C
		Industrial	-40	-	85	
Supply Voltage	Vcc		3.15	3.3	3.45	°C
Power Supply Current	Icc			-	300	mA
Date Rate	-		-	-	1250	Mbps

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
LVPECL Inputs(Differential)	VIN	500	-	2400	mVpp	AC coupled inputs
Input Impedance (Differential)	ZIN	85	100	115	ohms	Rin > 100 kohms @ DC

Tx_Dis	Disable	-	2	-	Vcc	V	-
	Enable	-	0	-	0.8	V	-
Tx_FAULT	Fault	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.5	V	-
RECEIVER							
LVPECL Inputs(Differential)		Vout	370	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS	LOS	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

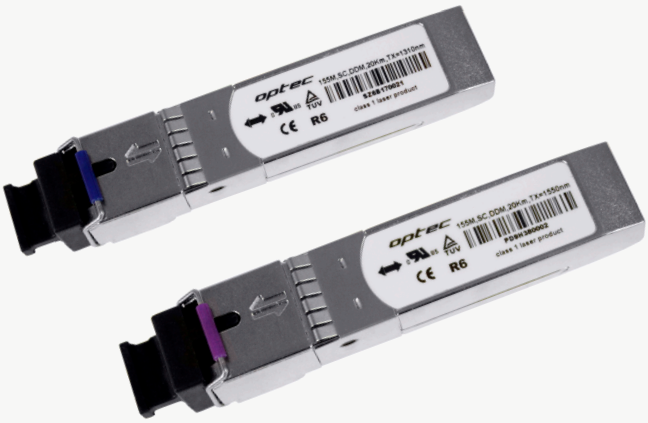
Optical Characteristics					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
50μm Core Diameter MMF(800MHz.km)	L	-	1000	-	m
62.5μm Core Diameter MMF(550MHz.km)	L	-	550	-	m
Data Rate	-	-	1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (RMS)	Δλ	-	-	5	nm
Average Output Power *note1	Pout	-9	-	-3	dBm
Extinction Ratio *note2	ER	9	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter *note2	TJ	-	-	0.43	UI
Output Optical Eye *note2	IEEE802.3ah-2004 Compliant				
TX_Disable Assert Time	t_off	-	-	10	us
RECEIVER					
Center Wavelength	λ	1260	-	1600	nm
Receiver Sensitivity *note3	P_{MIN}	-	-	-21	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
Return Loss	P_{MAX}	12	-	-	dBm
LOS De-Assert	LOS_D	-	-	-22	dB
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	1	-	-	dB

Note1: Output is coupled into a 62.5/125 mm multi mode fiber.
Note2: Filtered, measured with a PRBS 27-1 test pattern @1.25Gbps
Note3: Minimum average optical power measured at BER less than 1E-12, with a 2^7-1 PRBS and ER=9 Db.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP WDM OPTEC, 155M, SM, 16DB (20KM), TX1310/1550

SFP155M-WDM-SM-020-SC/LC-TX



SFP WDM OPTEC, 155M, SM, 16dB (20km), TX1310/1550 series is small form factor pluggable module for IEEE 802.3ah 100BASE-BX10 and OC-3/ STM-1 SONET/SDH single fiber applications by using 1310 nm/1550nm transmitter and 1550nm/1310nm receiver. It is with the SFP 20-pin connector to allow hot plug capability. The transmitter section uses a multiple quantum well A type / B type laser and is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated A type/ B type detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

APPLICATIONS

SONET OC-3 / SDH STM-1 •

WDM Fast Ethernet Links •

Other Optical Links •

FEATURES

- Support 155Mbps Data Links
- A type: 1310nm FP TX /1550nm RX
- B type: 1550nm DFB TX /1310nm RX
- 20km with 9/125 μm SMF
- Single 3. 3V Power supply and TTL Logic Interface
- Hot-Pluggable SFP Footprint SC/LC Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- Operating Temperature: Standard: 0°C to +70 °C Industrial: -40°C to +85°C
- Compliant with SFP MSA Specification
- Compliant with SFF 8472 MSA

Product Information

Product Name	Data Rate	Fiber	Wave-length	Inter-face	Temp.	DDM
SFP WDM OPTEC, 155M, SM SC, 16dB (20km), TX1310/RX1550, DDM (GLC BX-U)	100M~155Mbps	SMF	1310nm	SC	Standard	YES
SFP WDM OPTEC, 155M, SM SC, 16dB (20km), TX1550/RX1310, DDM (GLC-BX-D)			1550nm			
SFP WDM OPTEC, 155M, SM SC, 16dB (20km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	100M~155Mbps	SMF	1310nm	SC	Industrial	YES
SFP WDM OPTEC, 155M, SM SC, 16dB (20km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 155M, SM LC 16dB (20km), TX1310/RX1550, DDM (GLC BX-U)	100M~155Mbps	SMF	1310nm	LC	Standard	YES
SFP WDM OPTEC, 155M, SM LC, 16dB (20km), TX1550/RX1310, DDM (GLC BX-D)			1550nm			
SFP WDM OPTEC, 155M, SM LC, 16dB (20km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	100M~155Mbps	SMF	1310nm	LC	Industrial	YES
SFP WDM OPTEC, 155M, SM LC, 16dB (20km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions							
Parameter		Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature		T_C	Standard	0	-	70	°C
			Industrial	-40	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	300	mA
Date Rate	OC-3	-		-	155	-	Mbps
	100M	-		-	100	-	Mbps

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
LVPECL Inputs(Differential)	VIN	400	-	2000	mVpp	AC coupled inputs
Input Impedance (Differential)	ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis – Disable	-	2	-	Vcc+0.3	V	-
Tx_Dis – Enable	-	0	-	0.8	V	-
Tx_FAULT – Fault	-	2	-	Vcc+0.3	V	-
Tx_FAULT – Normal	-	0	-	0.5	V	-
RECEIVER						
LVPECL Inputs(Differential)	Vout	400	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)	Zout	85	100	115	ohms	-
Rx_LOS – LOS	-	2	-	Vcc+0.3	V	-
Rx_LOS – Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)	VoH	2.5	-	-	V	With Serial ID
	VoL	0	-	0.5	V	

Optical Characteristics / 1310nm FP and PIN, 20km					
Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF	L	-	20	-	km
Data Rate	-	100	155	-	Mbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (RMS)	Δλ	-	-	4	nm
Average Output Power*note1	Pout	-15	-	-8	dBm
Extinction Ratio@1250Mbps*note2	ER	8.2	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	2	ns
Output Optical Eye*note2	IUT-T G.957 Compliant				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm

RECEIVER						
Center Wavelength		λ_C	1500	1550	1600	nm
Receiver Sensitivity@1250Mbps*note3	OC-3	P_{MIN}	-	-	-28	dBm
	100M				-29	
Receiver Overload		P_{MAX}	-8	-	-	dBm
LOS De-Assert@1250Mbps		LOS_D	-	-	-30	dBm
LOS Assert		LOS_A	-42	-	-	dBm
LOS Hysteresis		-	0.5	-	-	dB

Optical Characteristics / 1550nm FP and PIN, 20km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	20	-	km
Data Rate	-	-	155	-	Mbps

TRANSMITER					
Center Wavelength	λ_C	1500	1550	1600	nm
Spectral Width (RMS)	$\Delta\lambda$	-	-	4	nm
Average Output Power *note1	Pout	-15	-	-8	dBm
Extinction Ratio@1250Mbps*note2	ER	8.2	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	2	ns
Output Optical Eye*note2	IUT-T G.957 Compliant				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm

RECEIVER						
Center Wavelength		λ_C	1260	1310	1360	nm
Receiver Sensitivity*note3	OC-3	P_{MIN}	-	-	-28	dBm
	100M				-29	
Receiver Overload		P_{MAX}	-8	-	-	dBm
LOS De-Assert		LOS_D	-	-	-30	dBm
LOS Assert		LOS_A	-42	-	-	dBm
LOS Hysteresis		-	0.5	-	-	dB

Note1: Output power is power coupled into a 9/125m single mode fiber.

Note2: Filtered, measured with a PRBS 2^7-1.

Note3: Measured at all data rates specified in Data Rate table with ER=9 dB, 2^7-1 PRBS data pattern, BER <1E-12.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

SFP WDM OPTEC, 1.25G, SM, 10DB (3KM), TX1310/1550

SFP1G-WDM-SM-003-SC-TX

SFP WDM OPTEC, 1.25G, SM, 10db (3km), tx1310/1550 series are small form factor pluggable modules for Gigabit Ethernet 1000BASE-BX and Fiber Channel single fiber applications by using 1310nm / 1550nm transmitter and 1550nm / 1310nm receiver. It is with the SFP 20-pin connector to allow hot plug capability. The transmitter section uses a multiple quantum well A type / B type laser and is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated B type / A type detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

APPLICATIONS

Fiber Channel Links •

Gigabit Ethernet •

Fast Ethernet •

WDM Gigabit Ethernet Links •

Other Optical Links •

FEATURES

- Up to 1.25Gbps Data Links
- A type: 1310nm FP TX /1550nm RX
- B type: 1550nm FP TX /1310nm RX
- 3km with 9/125 μm SMF
- Single 3.3V Power supply and TTL Logic Interface
- Hot-Pluggable SFP Footprint Simplex SC/LC Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- Operating Temperature: Standard: 0°C to +70 °C Industrial: -40°C to +85°C
- Compliant with SFP MSA Specification
- Compliant with Digital Diagnostic Monitor Interface SFF-8472

Product Information

Product Name	Data Rate	Fiber	Wave-length	Inter-face	Temp.	DDM
SFP WDM OPTEC, 1.25G, SM SC, 10dB (3km), TX1310/RX1550 (GLC BX-U)	125~1.25Gbps	SMF	1310nm	SC	Standard	NO
SFP WDM OPTEC, 1.25G, SM SC, 10dB (3km), TX1550/RX1310 (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM SC, 10dB (3km), TX1310/RX1550, Industrial (-40°C ~+85°C) (GLC BX-U)	125~1.25Gbps	SMF	1310nm	SC	Industrial	NO
SFP WDM OPTEC, 1.25G, SM SC, 10dB (3km), TX1550/RX1310, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM SC, 10dB (3km), TX1310/RX1550, DDM (GLC BX-U)	125~1.25Gbps	SMF	1310nm	SC	Standard	YES
SFP WDM OPTEC, 1.25G, SM SC, 10dB (3km), TX1550/RX1310, DDM (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM SC, 10dB (3km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	125~1.25Gbps	SMF	1310nm	SC	Industrial	YES
SFP WDM OPTEC, 1.25G, SM SC, 10dB (3km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC, 10dB (3km), TX1310/RX1550 (GLC BX-U)	125~1.25Gbps	SMF	1310nm	LC	Standard	NO
SFP WDM OPTEC, 1.25G, SM LC, 10dB (3km), TX1550/RX1310 (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC, 10dB (3km), TX1310/RX1550, Industrial (-40°C ~+85°C) (GLC BX-U)	125~1.25Gbps	SMF	1310nm	LC	Industrial	NO
SFP WDM OPTEC, 1.25G, SM LC, 10dB (3km), TX1550/RX1310, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC 10dB (3km), TX1310/RX1550, DDM (GLC BX-U)	125~1.25Gbps	SMF	1310nm	LC	Standard	YES
SFP WDM OPTEC, 1.25G, SM LC, 10dB (3km), TX1550/RX1310, DDM (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC, 10dB (3km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	125~1.25Gbps	SMF	1310nm	LC	Industrial	YES
SFP WDM OPTEC, 1.25G, SM LC, 10dB (3km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions							
Parameter		Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature		T_C	Standard	0	-	70	°C
			Industrial	-40	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	300	mA
Date Rate	FE	-		-	100	-	Mbps
	FC	-		-	1.063	-	Gbps
	GBE	-		-	1.25	-	Gbps

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
LVPECL Inputs(Differential)	VIN	400	-	2000	mVpp	AC coupled inputs
Input Impedance (Differential)	ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis – Disable	-	2	-	Vcc+0.3	V	-
Tx_Dis – Enable	-	0	-	0.8	V	-
Tx_FAULT – Fault	-	2	-	Vcc+0.3	V	-
Tx_FAULT – Normal	-	0	-	0.5	V	-
RECEIVER						
LVPECL Inputs(Differential)	Vout	400	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)	Zout	85	100	115	ohms	-
Rx_LOS – LOS	-	2	-	Vcc+0.3	V	-
Rx_LOS – Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)	VoH	2.5	-	-	V	With Serial ID
	VoL	0	-	0.5	V	

Optical Characteristics / 1310nm FP and PIN, 3km					
Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF	L	-	3	-	km
Data Rate	-	100	1063/1250	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (RMS)	Δλ	-	-	4	nm
Average Output Power*note1	Pout	-14	-	-8	dBm
Extinction Ratio*note2	ER	6	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter*note2	TJ	-	-	260	ps
Output Optical Eye*note2	Compliant with IEEE 802.3 ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm

RECEIVER					
Center Wavelength	λ_C	1500	1550	1580	nm
Receiver Sensitivity*note3	P_{MIN}	-	-	-22	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert@1250Mbps	LOS_D	-	-	-23	dBm
LOS De-Assert@100Mbps		-	-	-23	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

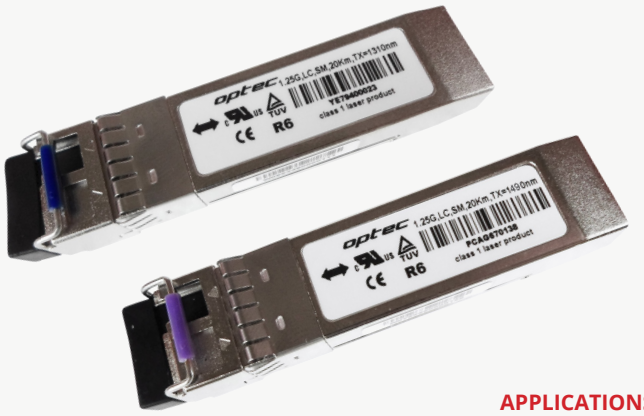
Optical Characteristics / 1550nm FP and PIN, 3km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	3	-	km
Data Rate	-	100	1063/1250	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1480	1550	1580	nm
Spectral Width (RMS)	Δλ	-	-	4	nm
Average Output Power *note1	Pout	-14	-	-8	dBm
Extinction Ratio*note2	ER	6	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Output Optical Eye*note2	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ_C	1260	-	1600	nm
Receiver Sensitivity*note3	P_{MIN}	-	-	-22	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
Return Loss	-	12	-	-	dBm
Optical Path Penalty	-	-	-	1	dBm
LOS De-Assert@1250Mbps	LOS_D	-	-	-23	dBm
LOS De-Assert@100Mbps		-	-	-23	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Note1: Output power is power coupled into a 9/125m single mode fiber.
Note2: Filtered, measured with a PRBS 2^7-1.
Note3: Minimum average optical power measured at BER less than 1E-12, with a 2^7-1 PRBS and ER=9 dB.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP WDM OPTEC, 1.25G, SM, 16DB (20KM), TX1310/1490

SFP1G-WDM-SM-020-SC/LC-TX



SFP WDM OPTEC, 1.25G, SM, 16dB (20km), TX1310/1490 series is small form factor pluggable module for Gigabit Ethernet 1000BASE-BX and Fiber Channel single fiber applications by using 1310nm / 1490nm transmitter and 1490nm / 1310nm receiver. It is with the SFP 20-pin connector to allow hot plug capability. The transmitter section uses a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated B type / A type detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

APPLICATIONS

Fiber Channel Links •

WDM Gigabit Ethernet Links •

Other Optical Links •

FTTX Application •

FEATURES

• Support 1.25Gbps Data Links

• A type: 1310nm FP TX /1490nm RX

• B type: 1490nm DFB TX /1310nm RX

• 20km with 9/125 μm SMF

• Single 3. 3V Power supply and TTL Logic Interface

• Hot-Pluggable SFP Footprint Simplex SC/LC Connector Interface

• Class 1 FDA and IEC60825-1 Laser Safety Compliant

• Operating Temperature: Standard: 0°C to +70 °C Industrial: -40°C to +85°C

• Compliant with SFP MSA Specification

• Compliant with Digital Diagnostic Monitor Interface SFF-8472

Product Information

Product Name	Data Rate	Fiber	Wave-length	Inter-face	Temp.	DDM
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1310/RX1490, DDM (GLC BX-U)	1.25Gbps	SMF	1310nm	SC	Standard	YES
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1490/RX1310, DDM (GLC-BX-D)			1490nm			
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1310/RX1490, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	1.25Gbps	SMF	1310nm	SC	Industrial	YES
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1490/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1490nm			
SFP WDM OPTEC, 1.25G, SM LC 16dB (20km), TX1310/RX1490, DDM (GLC BX-U)	1.25Gbps	SMF	1310nm	LC	Standard	YES
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1490/RX1310, DDM (GLC BX-D)			1490nm			
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1310/RX1490, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	1.25Gbps	SMF	1310nm	LC	Industrial	YES
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1490/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1490nm			

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions							
Parameter		Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature		T_C	Standard	0	-	70	°C
			Industrial	-40	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	300	mA
Date Rate	FC	-		-	1.063	-	Gbps
	GBE	-		-	1.25	-	Gbps

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
LVPECL Inputs(Differential)	VIN	400	-	2000	mVpp	AC coupled inputs
Input Impedance (Differential)	ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis – Disable	-	2	-	Vcc+0.3	V	-
Tx_Dis – Enable	-	0	-	0.8	V	-
Tx_FAULT – Fault	-	2	-	Vcc+0.3	V	-
Tx_FAULT – Normal	-	0	-	0.5	V	-
RECEIVER						
LVPECL Inputs(Differential)	Vout	400	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)	Zout	85	100	115	ohms	-
Rx_LOS – LOS	-	2	-	Vcc+0.3	V	-
Rx_LOS – Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)	VoH	2.5	-	-	V	With Serial ID
	VoL	0	-	0.5	V	

Optical Characteristics / 1310nm FP and PIN, 20km					
Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF	L	-	20	-	km
Data Rate	-	100	1063/1250	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1270	1310	1350	nm
Spectral Width (RMS)	Δλ	-	-	3.5	nm
Average Output Power*note1	Pout	-8	-	-3	dBm
Extinction Ratio@1250Mbps*note2	ER	6	9	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter*note2	TJ	-	-	260	ps
Output Optical Eye*note2	Compliant with IEEE 802.3z				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm

RECEIVER					
Center Wavelength	λ_C	1530	1550	1570	nm
Receiver Sensitivity@1250Mbps*note3	P_{MIN}	-	-	-22	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert@1250Mbps	LOS_D	-	-	-23	dBm
LOS Assert	LOS_A	-45	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

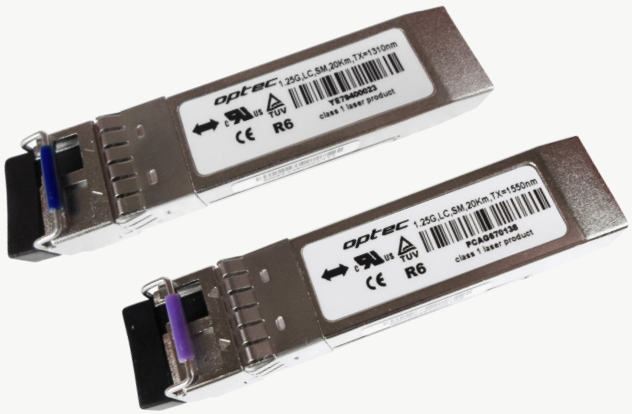
Optical Characteristics / 1490nm FP and PIN, 20km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	20	-	km
Data Rate	-	100	1063/1250	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1460	1490	1520	nm
Spectral Width (RMS)	Δλ	-	-	1	nm
Average Output Power *note1	Pout	-8	-	-3	dBm
Extinction Ratio@1250Mbps*note2	ER	6	9	-	dB
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	260	ps
Output Optical Eye*note2	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ_C	1260	-	1360	nm
Receiver Sensitivity*note3	P_{MIN}	-	-	-22	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
Return Loss	-	12	-	-	dBm
Optical Path Penalty	-	-	-	1	dBm
LOS De-Assert@1250Mbps	LOS_D	-	-	-23	dBm
LOS De-Assert@100Mbps		-	-	-23	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Note1: Output power is power coupled into a 9/125m single mode fiber.
Note2: Filtered, measured with a PRBS 2^7-1.
Note3: Measured at all data rates specified in Data Rate table with ER=9 dB, 2^7-1 PRBS data pattern, BER <1E-12.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP WDM OPTEC, 1.25G, SM, 16DB (20KM), TX1310/1550

SFP1G-WDM-SM-020-SC-TX



SFP WDM OPTEC, 1.25G, SM, 16dB (20km), TX1310/1550 series is small form factor pluggable module for Gigabit Ethernet 1000BASE-BX and Fiber Channel single fiber applications by using 1310nm / 1550nm transmitter and 1550nm / 1310nm receiver. It is with the SFP 20-pin connector to allow hot plug capability. The transmitter section uses a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated B type / A type detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

APPLICATIONS

Fiber Channel Links •

WDM Gigabit Ethernet Links •

Other Optical Links •

FTTX Application •

FEATURES

- Support 1.25Gbps Data Links
- A type: 1310nm FP TX /1550nm RX
- B type: 1550nm DFB TX /1310nm RX
- 20km with 9/125 μm SMF
- Single 3. 3V Power supply and TTL Logic Interface
- Hot-Pluggable SFP Footprint Simplex SC/LC Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- Operating Temperature: Standard: 0°C to +70 °C Industrial: -40°C to +85°C
- Compliant with SFP MSA Specification
- Compliant with Digital Diagnostic Monitor Interface SFF-8472

Product Information

Product Name	Data Rate	Fiber	Wave-length	Inter-face	Temp.	DDM
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1310/RX1550 (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	SC	Standard	NO
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1550/RX1310 (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1310/RX1550, Industrial (-40°C ~+85°C) (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	SC	Industrial	NO
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1550/RX1310, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1310/RX1550, DDM (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	SC	Standard	YES
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1550/RX1310, DDM (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	SC	Industrial	YES
SFP WDM OPTEC, 1.25G, SM SC, 16dB (20km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1310/RX1550 (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	LC	Standard	NO
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1550/RX1310 (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1310/RX1550, Industrial (-40°C ~+85°C) (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	LC	Industrial	NO
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1550/RX1310, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC 16dB (20km), TX1310/RX1550, DDM (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	LC	Standard	YES
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1550/RX1310, DDM (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	LC	Industrial	YES
SFP WDM OPTEC, 1.25G, SM LC, 16dB (20km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions							
Parameter		Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature		T_C	Standard	0	-	70	°C
			Industrial	-40	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	300	mA
Date Rate	FC	-		-	1.063	-	Gbps
	GBE	-		-	1.25	-	Gbps

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
LVPECL Inputs(Differential)	VIN	400	-	2000	mVpp	AC coupled inputs
Input Impedance (Differential)	ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis – Disable	-	2	-	Vcc+0.3	V	-
Tx_Dis – Enable	-	0	-	0.8	V	-
Tx_FAULT – Fault	-	2	-	Vcc+0.3	V	-
Tx_FAULT – Normal	-	0	-	0.5	V	-
RECEIVER						
LVPECL Inputs(Differential)	Vout	400	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)	Zout	85	100	115	ohms	-
Rx_LOS – LOS	-	2	-	Vcc+0.3	V	-
Rx_LOS – Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)	VoH	2.5	-	-	V	With Serial ID
	VoL	0	-	0.5	V	

Optical Characteristics / 1310nm FP and PIN, 20km					
Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF	L	-	20	-	km
Data Rate	-	100	1063/1250	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (RMS)	Δλ	-	-	3.5	nm
Average Output Power*note1	Pout	-8	-	-3	dBm
Extinction Ratio@1250Mbps*note2	ER	6	9	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter*note2	TJ	-	-	260	ps
Output Optical Eye*note2	Compliant with IEEE 802.3z				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm

RECEIVER					
Center Wavelength	λ_C	1530	1550	1570	nm
Receiver Sensitivity@1250Mbps*note3	P_{MIN}	-	-	-22	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert@1250Mbps	LOS_D	-	-	-23	dBm
LOS Assert	LOS_A	-45	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Optical Characteristics / 1550nm FP and PIN, 20km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	20	-	km
Data Rate	-	100	1063/1250	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1520	1550	1580	nm
Spectral Width (RMS)	Δλ	-	-	1	nm
Average Output Power *note1	Pout	-8	-	-3	dBm
Extinction Ratio@1250Mbps*note2	ER	6	9	-	dB
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	260	ps
Output Optical Eye*note2	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ_C	1260	-	1360	nm
Receiver Sensitivity*note3	P_{MIN}	-	-	-22	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
Return Loss	-	12	-	-	dBm
Optical Path Penalty	-	-	-	1	dBm
LOS De-Assert@1250Mbps	LOS_D	-	-	-23	dBm
LOS De-Assert@100Mbps		-	-	-23	dBm
LOS Assert	LOS_A	-45	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Note1: Output power is power coupled into a 9/125m single mode fiber.

Note2: Filtered, measured with a PRBS 2^7-1.

Note3: Measured at all data rates specified in Data Rate table with ER=9 dB, 2^7-1 PRBS data pattern, BER <1E-12.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
Electrostatic Discharge (ESD) to the Electrical Pins	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	Compliant with standards
Electromagnetic Interference (EMI)	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/ receiver performance is detectable between these limits.
Laser Eye Safety	CDRH compliant and Class I laser product.
Component Recognition	CB scheme
RoHS6	Compliant with standards

SFP WDM OPTEC, 1.25G, SM, 22DB (40KM), TX1310/1550

SFP1G-WDM-SM-040-SC-TX

SFP WDM OPTEC, 1.25G, SM, 22dB (40km), TX1310/1550 series are small form factor pluggable modules for Gigabit Ethernet 1000BASE-BX and Fiber Channel single fiber applications by using 1310nm / 1550nm transmitter and 1550nm / 1310nm receiver. It is with the SFP 20-pin connector to allow hot plug capability. The transmitter section uses a distributed feedback laser and is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated A type / B type detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

APPLICATIONS

Fiber Channel Links •

Gigabit Ethernet •

Fast Ethernet •

WDM Gigabit Ethernet Links •

Other Optical Links •

FEATURES

- Up to1.25Gbps Data Links
- A type: 1310nmDFBTX/1550nmRX
- B type: 1550nmDFBTX/1310nmRX
- 40km with 9/125 µm SMF
- Single 3.3V Power supply and TTL Logic Interface
- Hot-Pluggable SFP Footprint Simplex SC/LC
- Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- Operating Temperature: Standard: 0°C to +70 °C Industrial: -40°C to +85°C
- Compliant with SFP MSA Specificationd
- Compliant with Digital Diagnostic Monitor Interface SFF-8472

Product Information

Product Name	Data Rate	Fiber	Wave-length	Inter-face	Temp.	DDM
SFP WDM OPTEC, 1.25G, SM SC, 22dB (40km), TX1310/RX1550 (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	SC	Standard	NO
SFP WDM OPTEC, 1.25G, SM SC, 22dB (40km), TX1550/RX1310 (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM SC, 22dB 40km), TX1310/RX1550, Industrial (-40°C ~+85°C) (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	SC	Industrial	NO
SFP WDM OPTEC, 1.25G, SM SC, 22dB (40km), TX1550/RX1310, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM SC, 22dB (40km), TX1310/RX1550, DDM (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	SC	Standard	YES
SFP WDM OPTEC, 1.25G, SM SC, 22dB (40km), TX1550/RX1310, DDM (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM SC, 22dB (40km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	SC	Industrial	YES
SFP WDM OPTEC, 1.25G, SM SC, 22dB (40km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC, 22dB (40km), TX1310/RX1550 (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	LC	Standard	NO
SFP WDM OPTEC, 1.25G, SM LC, 22dB (40km), TX1550/RX1310 (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC, 22dB (40km), TX1310/RX1550, Industrial (-40°C ~+85°C) (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	LC	Industrial	NO
SFP WDM OPTEC, 1.25G, SM LC, 22dB (40km), TX1550/RX1310, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC 22dB (40km), TX1310/RX1550, DDM (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	LC	Standard	YES
SFP WDM OPTEC, 1.25G, SM LC, 22dB (40km), TX1550/RX1310, DDM (GLC BX-D)			1550nm			
SFP WDM OPTEC, 1.25G, SM LC, 22dB (40km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	1.063/1.25Gbps	SMF	1310nm	LC	Industrial	YES
SFP WDM OPTEC, 1.25G, SM LC, 22dB (40km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)			1550nm			

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions							
Parameter		Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature		T_C	Standard	0	-	70	°C
			Industrial	-40	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	300	mA
Date Rate	FC	-		-	1.063	-	Gbps
	GBE	-		-	1.25	-	Gbps

Performance Specifications - Electrical						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER						
LVPECL Inputs(Differential)	VIN	400	-	2000	mVpp	AC coupled inputs
Input Impedance (Differential)	ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis – Disable	-	2	-	Vcc+0.3	V	-
Tx_Dis – Enable	-	0	-	0.8	V	-
Tx_FAULT – Fault	-	2	-	Vcc+0.3	V	-
Tx_FAULT – Normal	-	0	-	0.5	V	-
RECEIVER						
LVPECL Inputs(Differential)	Vout	400	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)	Zout	85	100	115	ohms	-
Rx_LOS – LOS	-	2	-	Vcc+0.3	V	-
Rx_LOS – Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)	VoH	2.5	-	-	V	With Serial ID
	VoL	0	-	0.5	V	

Optical Characteristics / 1310nm FP and PIN, 40km					
Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF	L	-	40	-	km
Data Rate	-	100	1250	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1290	1310	1330	nm
Spectral Width (RMS)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dBm
Average Output Power *note1	Pout	-3	-	2	dBm
Extinction Ratio@1250Mbps*note2	ER	8.2	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter*note2	TJ	-	-	260	ps
Output Optical Eye*note2	Compliant with IEEE 802.3 ah-2004*(				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm

RECEIVER					
Center Wavelength	λ_C	1480	1550	1580	nm
Receiver Sensitivity@1250Mbps*note3	P_{MIN}	-	-	-23	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert@1250Mbps	LOS_D	-	-	-24	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

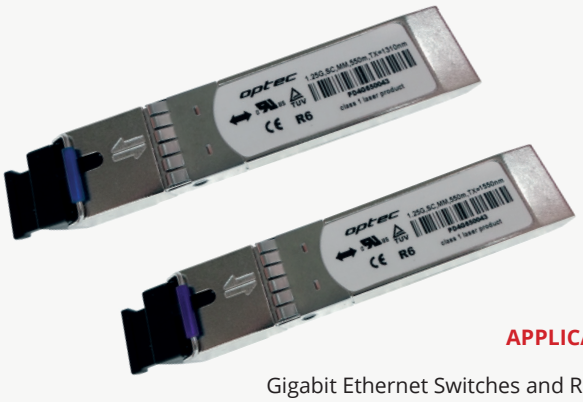
Optical Characteristics / 1550nm FP and PIN, 40km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
9μm Core Diameter SMF	L	-	40	-	km
Data Rate	-	100	1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1480	1550	1580	nm
Spectral Width (RMS)	Δλ	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dBm
Average Output Power *note1	Pout	-5	-	0	dBm
Extinction Ratio@1250Mbps*note2	ER	8.2	-	-	dB
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Output Optical Eye*note2			Compliant with IEEE 802.3ah-2004		
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ_C	1290	-	1330	nm
Receiver Sensitivity*note3	P_{MIN}	-	-	-23	dBm
Receiver Overload	P_{MAX}	-3	-	-	dBm
Return Loss	-	12	-	-	dBm
Optical Path Penalty	-	-	-	1	dBm
LOS De-Assert	LOS_D	-	-	-24	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Note1: Output power is power coupled into a 9/125m single mode fiber.
Note2: Filtered, measured with a PRBS 2^7-1.
Note3: Measured at all data rates specified in Data Rate table with ER=9 dB, 2^7-1 PRBS data pattern, BER <1E-12.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP WDM OPTEC, 1.25G, MM, 0.55-1KM, TX1310/1550

SFP1G-WDM-MM-001-SC-TX



SFP WDM OPTEC, 1.25G, SM, 0.55-1km, TX1310/1550 series are high performance multi-rate modules for Gigabit Ethernet fiber communications by using 1310nm/1550nm transmitter and 1550nm/1310nm receiver. It is with the SFP 20-pin connector to allow hot plug capability. The transmitter section uses a multiple quantum well A type/ B type laser and is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated B type/ A type detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

APPLICATIONS

Gigabit Ethernet Switches and Routers •

Fiber Channel Switch Infrastructure •

CPRI rate: 1.228Gbps •

FEATURES

- Support 1.25Gbps data links
- A type: 1310nm FP Tx/1550nmRx
- B type: 1550nm FP Tx/1310nmRx
- 1km with 50/125μm MMF (800Mhz*km)
- 550m with 62.5/125μm MMF (500Mhz*km)
- Single 3.3V Power supply and TTL Logic Interface
- Hot-Pluggable SFP Footprint Simplex SC/LC Connector Interface
- Class 1 FDA and IEC60825-1 laser safety compliant
- Operating Temperature: Standard: 0°C to +70 °C Industrial: -40°C to +85°C
- Compliant with SFP MSA and SFF-8472

Product Information

Product Name	Data Rate	Distance	Fiber	Wave-length	Inter-face	Temp.	DDM
SFP WDM OPTEC, 1.25G, MM SC, 7dB (1km), TX1310/RX1550 (GLC BX-U)	1.25Gbps	0.55~1km	MMF	1310nm	SC	Standard	NO
SFP WDM OPTEC, 1.25G, MM SC, 7dB (1km), TX1550/RX1310 (GLC BX-D)				1550nm			
SFP WDM OPTEC, 1.25G, MM SC, 7dB 1km), TX1310/RX1550, Industrial (-40°C ~+85°C) (GLC BX-U)	1.25Gbps	0.55~1km	MMF	1310nm	SC	Industrial	NO
SFP WDM OPTEC, 1.25G, MM SC, 7dB (1km), TX1550/RX1310, Industrial (-40°C ~+85°C) (GLC BX-D)				1550nm			
SFP WDM OPTEC, 1.25G, MM SC, 7dB (1km), TX1310/RX1550, DDM (GLC BX-U)	1.25Gbps	0.55~1km	MMF	1310nm	SC	Standard	YES
SFP WDM OPTEC, 1.25G, MM SC,7dB (1km), TX1550/RX1310, DDM (GLC BX-D)				1550nm			
SFP WDM OPTEC, 1.25G, MM SC, 7dB (1km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	1.25Gbps	0.55~1km	MMF	1310nm	SC	Industrial	YES
SFP WDM OPTEC, 1.25G, MM SC, 7dB (1km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)				1550nm			
SFP WDM OPTEC, 1.25G, MM LC, 7dB (1km), TX1310/RX1550 (GLC BX-U)	1.25Gbps	0.55~1km	MMF	1310nm	LC	Standard	NO
SFP WDM OPTEC, 1.25G, MM LC, 7dB (1km), TX1550/RX1310 (GLC BX-D)				1550nm			
SFP WDM OPTEC, 1.25G, MM LC, 7dB (1km), TX1310/RX1550, Industrial (-40°C ~+85°C) (GLC BX-U)	1.25Gbps	0.55~1km	MMF	1310nm	LC	Industrial	NO
SFP WDM OPTEC, 1.25G, MM LC, 7dB (1km), TX1550/RX1310, Industrial (-40°C ~+85°C) (GLC BX-D)				1550nm			
SFP WDM OPTEC, 1.25G, MM LC 7dB (1km), TX1310/RX1550, DDM (GLC BX-U)	1.25Gbps	0.55~1km	MMF	1310nm	LC	Standard	YES
SFP WDM OPTEC, 1.25G, MM LC,7dB (1km), TX1550/RX1310, DDM (GLC BX-D)				1550nm			
SFP WDM OPTEC, 1.25G, MM LC, 7dB (1km), TX1310/RX1550, DDM, Industrial (-40°C ~+85°C) (GLC BX-U)	1.25Gbps	0.55~1km	MMF	1310nm	LC	Industrial	YES
SFP WDM OPTEC, 1.25G, MM LC, 7dB (1km), TX1550/RX1310, DDM, Industrial (-40°C ~+85°C) (GLC BX-D)				1550nm			

Absolute Maximum Ratings*note1				
Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions							
Parameter		Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature		T_C	Standard	0	-	70	°C
			Industrial	-40	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	300	mA
Date Rate	FC	-		-	1.063	-	Gbps
	GBE	-		-	1.25	-	Gbps

Performance Specifications - Electrical							
Parameter		Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER							
LVPECL Inputs(Differential)		VIN	400	-	2000	mVpp	AC coupled inputs
Input Impedance (Differential)		ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis	Disable	-	2	-	Vcc+0.3	V	-
	Enable	-	0	-	0.8	V	-
Tx_FAULT	Fault	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.5	V	-
RECEIVER							
LVPECL Inputs(Differential)		Vout	400	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS	LOS	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.5	V	

Optical Characteristics / 1310nm FP and PIN, 0.55~1km					
Parameter	Symbol	Min.	Typical	Max.	Unit
50μm Core Diameter MMF(800Mhz*km)	L	-	-	1000	m
62.5 Core Diameter MMF(500Mhz*km)	L	-	-	550	m
Data Rate	-	100	1.063/1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (RMS)	Δλ	-	-	4	nm
Average Output Power *note1	Pout	-9.5	-	-3	dBm
Extinction Ratio@*note2	ER	6	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter*note2	TJ	-	-	56.5	ps
Output Optical Eye*note2	Compliant with IEEE 802.3 ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm

RECEIVER						
Center Wavelength		λ_C	1500	1550	1580	nm
Receiver Sensitivity*note3	GBE	P_{MIN}	-	-	-21	dBm
	FC				-22	
Receiver Overload		P_{MAX}	-3	-	-	dBm
LOS De-Assert@		LOS_D	-	-	-23	dBm
LOS Assert		LOS_A	-35	-	-	dBm
LOS Hysteresis		-	0.5	-	-	dB

Optical Characteristics / 1550nm FP and PIN, 0.55~1km					
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**
50μm Core Diameter MMF(800Mhz*km)	L	-	-	1000	m
50μm Core Diameter MMF(500Mhz*km)	L	-	-	550	m
Data Rate	-	-	1.25	-	Gbps
TRANSMITER					
Center Wavelength	λ_C	1500	1550	1580	nm
Spectral Width (RMS)	Δλ	-	-	4	nm
Average Output Power *note1	Pout	-9.5	-	-3	dBm
Extinction Ratio*note2	ER	8.2	-	-	dB
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	56.5	us
Output Optical Eye*note2	Compliant with IEEE 802.3ah-2004				
TX_Disable Assert Time	t_off	-	-	10	us
Pout@TX Disable Asserted	Pout	-	-	-45	dBm
RECEIVER					
Center Wavelength	λ_C	1260	1310	1360	nm
Receiver Sensitivity*note3 GBE	P_{MIN}	-	-	-21	dBm
Receiver Sensitivity*note3 FC				-22	
Receiver Overload	P_{MAX}	-3	-	-	dBm
LOS De-Assert	LOS_D	-	-	-23	dBm
LOS Assert	LOS_A	-35	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

Note1: Output power is power coupled into a 9/125m single mode fiber.
Note2: Filtered, measured with a PRBS 2^7-1.
Note3: Measured at all data rates specified in Data Rate table with ER=9 dB, 2^7-1 PRBS data pattern, BER <1E-12.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP CWDM OPTEC, 1.25G, SM LC, 28-41DB, SERIES

S1GCW-SMLC-XDB-TX-XD

SFP CWDM OPTEC, 1.25G, SM LC, 28-41dB, Series - single mode transceiver is small form factor pluggable module for duplex optical data communications such as Gigabit Ethernet 1000BASE-ZX and Fiber Channel 1x SM-LC-L FC-PI. It is with the SFP 20-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eighteen center wavelengths available from 1270nm to 1610nm, with each step 20nm.

APPLICATIONS

Gigabit Ethernet Switches and Routers•

Other Optical Links •

Fiber Channel Switch Infrastructure •

FEATURES

• Operating Data Rate up to 1.25Gbps

• 19-Wavelength CWDM DFB LD Transmitter from 1270nm to 1625nm, with Step 20nm

• Single 3.3V Power Supply and TTL Control Logic Interface

• Hot-Pluggable SFP Footprint Duplex LC Connector Interface

• Class 1 FDA and IEC60825-1 Laser Safety Compliant

• Compliant with SFP MSA Specification

• Compliant with SFF-8472 Digital Diagnostic Monitor Interface

Operating Case Temperature:

Standard: 0° to 70°C

Extended: -20° to 85°C

Product Information

Product Name	Data Rate	Fiber	Power Budget	Interface	Temp.	DDM
SFP CWDM OPTEC, 1.25G, SM LC, 28dB DFB/PIN, DDM	1.25Gbps	SMF	28dB	LC	Standard	YES
SFP CWDM OPTEC, 1.25G, SM LC, 28dB DFB/PIN Extended (-5° to 70°C), DDM	1.25Gbps	SMF	28dB	LC	Extended	YES
SFP CWDM OPTEC, 1.25G, SM LC, 34dB DFB/APD, DDM	1.25Gbps	SMF	34dB	LC	Standard	YES
SFP CWDM OPTEC, 1.25G, SM LC, 34dB DFB/APD Extended (-5° to 70°C), DDM	1.25Gbps	SMF	34dB	LC	Extended	YES
SFP CWDM OPTEC, 1.25G, SM LC, 37dB DFB/APD, DDM	1.25Gbps	SMF	37dB	LC	Standard	YES
SFP CWDM OPTEC, 1.25G, SM LC, 37dB DFB/APD Extended (-5° to 70°C), DDM	1.25Gbps	SMF	37dB	LC	Extended	YES
SFP CWDM OPTEC, 1.25G, SM LC, 41dB DFB/APD, DDM	1.25Gbps	SMF	41dB	LC	Standard	YES
SFP CWDM OPTEC, 1.25G, SM LC, 41dB DFB/APD Extended (-5° to 70°C), DDM	1.25Gbps	SMF	41dB	LC	Extended	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter		Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature		T_c	Standard	0	-	70	°C
			Extended	-20	-	85	
Supply Voltage		Vcc		3.15	3.3	3.45	°C
Power Supply Current		Icc			-	450	mA
Date Rate	GBE	-		-	1.25	-	Gbps
	FC				1.063		

Performance Specifications - Electrical

Parameter		Symbol	Min.	Typical	Max.	Unit	Note
TRANSMITTER							
LVPECL Inputs(Differential)		VIN	400	-	2000	mVpp	AC coupled inputs
Input Impedance (Differential)		ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis	Disable	-	2	-	Vcc	V	-
	Enable	-	0	-	0.8	V	-
Tx_FAULT	Fault	-	2	-	Vcc	V	-
	Normal	-	0	-	0.5	V	-
RECEIVER							
LVPECL Inputs(Differential)		Vout	370	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS	LOS	-	2	-	Vcc	V	-
	Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.8	V	

Optical Characteristics

Parameter	Symbol		Min.	Typical	Max.	Unit
Data Rate	-		-	1.25	-	Gbps
TRANSMITER						
Center Wavelength	λ_c		1528	-	1566	nm
Spectral Width (-20dB)	Δλ		-	-	0.3	nm
Average Output Power *note1	Pout	28dB/34dB	0	-	5	dBm
		37dB	2	-	5	
		41dB	4	-	7	
Side Mode Suppression Ratio	SMSR		30	-	-	dB
Extinction Ratio@ *note2	ER		8.2	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf		-	-	0.26	ns
Total Jitter *note2	TJ		-	-	56.5	ps
Output Optical Eye *note2	Compliant with IEEE 802.3 ah-2004					
TX_Disable Assert Time	t_off		-	-	10	us
Pout@TX Disable Asserted	Pout		-	-	-45	dBm
RECEIVER						
Center Wavelength	λ_c		1260	-	1635	nm
Receiver Sensitivity *note3	P_{MIN}	28dB	-	-	-28	dBm
		34dB	-	-	-34	
		37dB	-	-	-34	
		41dB	-	-	-37	
Receiver Overload	Pmax	24dB/28dB	-3	-	-	dBm
		34dB/37dB/41dB	-10			

Return Loss	-		12	-	-	dBm
Optical Path Penalty*notice4	-		-	-	1	dBm
LOS De-Assert@	LOS_D	28dB	-	-	-29	dBm
		34dB	-	-	-35	
		37dB	-	-	-38	
		41dB	-	-	-38	
LOS Assert	LOS_A	28dB	-42	-	-	dBm
		34dB	-45	-	-	
		37dB	-45	-	-	
		41dB	-50	-	-	
LOS Hysteresis	-		0.5	-	-	dB

Note1: Output is coupled into a 9/125μm single mode fiber.
Note2: Filtered, measured with a PRBS 2^7-1 test pattern @1.25Gbps
Note3: Minimum average optical power measured at BER less than 1E-12, with a 2^7-1 PRBS and ER=9dB.
Note4: Measured with a PRBS 2^7-1 test pattern @1.25Gbps, BER 1×10-12.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP DWDM OPTEC, 1.25G , SM LC 24-41DB, SERIES

S1GCW-SMLC-XDB-TX-XD

SFP DWDM OPTEC, 1.25G , SM LC 24-41dB, Series - small form factor pluggable module for duplex optical data communications. This module is designed for single mode fiber and operates at a nominal DWDM wavelength from 1528.77nm to 1565.50nm as specified by the ITU-T. It is designed to deploy in the DWDM networking equipment in metropolitan access and core networks. It is with the SFP 20-pin connector to allow hot plug capability. The transmitter section uses a DWDM multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.

APPLICATIONS

Amplified DWDM networks •

Ring topologies with fixed and reconfigurable OADMs •

Fast Ethernet, Giga Ethernet •

Fiber Channel •

CPRI rate: 1.229 Gb/s •

FEATURES

- Operating Data Rate up to 1.25Gbps
- Available in all C-Band Wavelengths on the 100GHz DWDM ITU Grid
- Single 3.3V Power Supply and TTL Logic Interface
- Hot-Pluggable SFP Footprint Duplex LC Connector Interface
- Compliant with Class 1 FDA and IEC60825-1 Laser Safety
- Compliant with SFP MSA
- Compliant with SFF-8472
- Operating Case Temperature: Standard: 0°C to 70°C, Extended: -5°C to 70°C

Product Information

Product Name	Data Rate	Fiber	Power Budget	Interface	Temp.	DDM
SFP DWDM OPTEC, 1.25G, SM LC, 24dB DFB/PIN, DDM	1.25Gbps	SMF	24dB	LC	Standard	YES
SFP DWDM OPTEC, 1.25G, SM LC, 24dB DFB/PIN Extended (-5°C ~+70°C), DDM	1.25Gbps	SMF	24dB	LC	Extended	YES
SFP DWDM OPTEC, 1.25G, SM LC, 28dB DFB/PIN, DDM	1.25Gbps	SMF	28dB	LC	Standard	YES
SFP DWDM OPTEC, 1.25G, SM LC, 28dB DFB/PIN Extended (-5°C ~+70°C), DDM	1.25Gbps	SMF	28dB	LC	Extended	YES
SFP DWDM OPTEC, 1.25G, SM LC, 32dB DFB/APD, DDM	1.25Gbps	SMF	32dB	LC	Standard	YES
SFP DWDM OPTEC, 1.25G, SM LC, 32dB DFB/APD Extended (-5°C ~+70°C), DDM	1.25Gbps	SMF	32dB	LC	Extended	YES
SFP DWDM OPTEC, 1.25G, SM LC, 41dB DFB/APD, DDM	1.25Gbps	SMF	41dB	LC	Standard	YES
SFP DWDM OPTEC, 1.25G, SM LC, 41dB DFB/APD Extended (-5°C ~+70°C), DDM	1.25Gbps	SMF	41dB	LC	Extended	YES

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	T_S	-40	85	°C
Operating Relative Humidity	-	-	95	%

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Case Operating Temperature	T_C	Standard	0	-	70	°C
		Extended	-5	-	70	
Supply Voltage	Vcc		3.15	3.3	3.45	°C
Power Supply Current	Icc			-	300	mA
Data Rate	-		-	-	1.25	Gbps

Performance Specifications - Electrical							
Parameter		**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Note**
TRANSMITTER							
LVPECL Inputs(Differential)		VIN	400	-	2000	mVpp	AC coupled inputs
Input Impedance (Differential)		ZIN	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_Dis	Disable	-	2	-	Vcc+0.3	V	-
	Enable	-	0	-	0.8	V	-
Tx_FAULT	Fault	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.8	V	-
RECEIVER							
LVPECL Inputs(Differential)		Vout	370	-	2000	mVpp	AC coupled inputs
Output Impedance (Differential)		Zout	85	100	115	ohms	-
Rx_LOS	LOS	-	2	-	Vcc+0.3	V	-
	Normal	-	0	-	0.8	V	-
MOD_DEF (0:2)		VoH	2.5	-	-	V	With Serial ID
		VoL	0	-	0.8	V	

Optical Characteristics						
Parameter	**Symbol**		**Min.**	**Typical**	**Max.**	**Unit**
Data Rate	-		-	1.25	-	Gbps
TRANSMITER						
Center Wavelength	λ_c		1528	-	1566	nm
Spectral Width (-20dB)	$\Delta\lambda$		-	-	0.3	nm
Side Mode Suppression Ratio	SMSR		30	-	-	dB
Channel Spacing	Δf		-	100	-	GHz
Deviation From Central Frequency@EOL	-		-12	-	12	GHz
Average Output Power*note1	Pout	24dB - 32dB	0	-	5	dBm
		37dB	2	-	5	
		41dB	4	-	7	
Average Launch Power (Tx: OFF)	Poff				-45	dBm
Extinction Ratio*note2	ER		8.2	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf		-	-	260	ps
Output Optical Eye*note2	Compatible with IEEE 802.3					
TX_Disable Assert Time	t_off		-	-	10	us
P_{out}@TX Disable Asserted	Pout				-45	dBm
Optical Signal Noise Ratio @ 0.1nm	OSNR		-	40	-	dB
Relative Intensity Noise	RIN		-	-	-135	dB/Hz
Dispersion Tolerance	DT	24dB	-	1760	-	ps/nm
		28dB	-	2080	-	
		32dB	-	2400	-	
		37dB	-	2800	-	
		41dB	-	2800	-	
RECEIVER						
Center Wavelength	λ_c		1528	-	1566	nm
Receiver Sensitivity*note3	P_{MIN}	24dB	-	-	-24	dBm
		28dB	-	-	-28	
		32dB	-	-	-32	
		37dB	-	-	-35	
		41dB	-		-37	

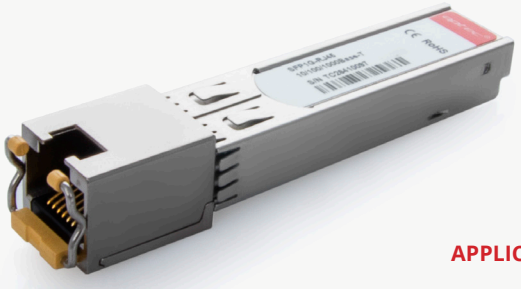
Receiver Overload	P_{MAX}	24dB - 28dB	-3	-	-	dBm
		32dB - 41dB	-10	-	-	
LOS De-Assert@	LOS_D	24dB	-	-	-25	dBm
		28dB	-	-	-29	
		32dB	-	-	-33	
		37dB	-	-	-36	
		41dB			-36	
LOS Assert	LOS_A	24dB	-35	-	-	dBm
		28dB	-42	-	-	
		32dB - 41dB	-45	-	-	
LOS Hysteresis	-		0.5	-	-	dB

Note1: Output is coupled into a 9/125μm single mode fiber.
Note2: Filtered, measured with a PRBS 2^7 -1 test pattern @1.25Gbps
Note3: Minimum average optical power measured at BER less than 1E-12, with a 2^7 -1 PRBS and ER=9dB.

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

SFP RJ45 OPTEC, 1.25G, 100m (10/100/1000BASE-T) (GLC-T)

SFP1G-RJ45



SFP RJ45 OPTEC, 1.25G, 100m (10/100/1000Base-T) (GLC-T) - is 10/100/ /1000BASE-T Copper Small Form Pluggable (SFP), which is based on the SFP Multi Source Agreement (MSA). It is compliant with the Gigabit Ethernet standard as specified in IEEE STD 802.3 and can fully satisfy the 10/100/1000BASE-T application.

APPLICATIONS

LAN 10/100/1000Base-T •

Gigabit Ethernet over Cat 5 Cable •

Switch to Switch Interface •

Router/Server Interface •

FEATURES

- Support 10/100/1000BASE-T Operation in Host Systems with SGMII interface
- 100m transmission over Cat 5 UTP Cable
- Hot-Pluggable SFP Footprint
- Fully metallic enclosure for low EMI
- Low power dissipation (1.05 W typical)
- Compact RJ-45 connector assembly
- Access to physical layer IC via 2-wire serial bus
- Detailed product information in EEPROM
- Operating Case Temperature
  - Standard 0°C~70°C
  - Industrial: -40°C~85°C
- Compliant with SFP MSA
- Compliant with IEEE Std 802.3

Product Information

Product Name	Data Rate	Media Type	Distance	Interface	Temp.	DDM
SFP RJ45 OPTEC, 1.25G, 100m (10/100/1000Base-T) (GLC-T)	10/100/1000BASE-T	Cat5	100m	RJ45	Standard Industrial	NO

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4.0	V
Storage Temperature	Vs	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	Standard	0	-	70	°C
		Industrial	-40		85	
Power Supply Voltage	V_{cc}		3.15	3.3	3.45	V
Data Rate	-		10	-	1000	Mbps

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
+3.3 Volt Electrical Power Interface						
Supply Current	Icc	-	300	350	mA	-
Input Voltage	Vcc	3.15	3.3	3.45	V	-
Surge Current	Isurge	-	-	30	mA	-
Low-Speed Signals, Electronic Characteristics						
SFP Output LOW	VOL	0	-	0.5	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector
SFP Output HIGH	VOH	host_Vcc – 0.5	-	host_Vcc + 0.3	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector

SFP Input LOW	VIL	0	-	0.8	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector
SFP Input HIGH	VIH	2	-	Vcc + 0.3	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector
High-Speed Electrical Interface, Transmission Line-SFP						
Line frequency	f_L	-	125	-	MHz	5-level encoding, per IEEE 802.3
Tx Output impedance	Zout,TX	-	100	-	Ohm	Differential, for all frequencies between 1MHz and 125MHz
Rx Input Impedance	Zin,RX	-	100	-	Ohm	Differential, for all frequencies between 1MHz and 125MHz
High-Speed Electrical Interface, Host-SFP						
Single ended data input swing	Vin	250	-	1200	mV	Single ended
Single ended data output swing	Vout	350	-	800	mV	Single ended
Rise/Fall Time	Tr,Tf	-	175	-	psec	20%-80%
Tx Input Impedance	Zin	-	50	-	Ohm	Single ended
Rx Output Impedance	Zout	-	50	-	Ohm	Single ended

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
FDA	CDRH 1040.10
ROHS	2011/65/EU

QUALITY

OPTEC Technology has passed many quality system verifications, established an internationally standardized quality assurance system and strictly implemented standardized management and control in the course of design, development, production, installation and service.

The certificate shows, that a component/subsystem can be used in a specific application according to a requirement class (RC) or a integrity level (SIL). The system integrator and end user must always be aware of how to use certified components/subsystems in safety-related function, respectively a safety instrumented system. Because of the many different possibilities, how to configure a safety system, the end user must get the related information from the manufacturer of the certified component/ subsystem. ISO 14001 is an international standard that specifies a process for controlling and improving a company's environmental performance.

Underwriters Laboratories Inc. (UL) is an independent product safety certification organization that has been testing products and writing Standards for Safety for over a century. UL evaluates more than 19, 000 types of products, components, materials and systems annually with 21 billion UL Marks appearing on 72, 000 manufacturers' products each year. UL's worldwide family of companies and network of service providers includes 62 laboratory, testing and certification facilities serving customers in 99 countries.

The certificate shows, that a component/subsystem can be used in a specific application according to a requirement class (RC) or a integrity level (SIL). The system integrator and end user must always be aware of how to use certified components/subsystems in safety-related function, respectively a safety instrumented system. Because of the many different possibilities, how to configure a safety system, the end user must get the related information from the manufacturer of the certified component/ subsystem.

The CE marking is a mandatory European marking for certain product groups to indicate conformity with the essential health and safety requirements set out in European Directivices. To permit the use of a CE mark on a product, proof that the item meets the relevant requirements must be documented.

Working in partnership with the policy lead at BERR (The Department for Business, Enterprise & Regulatory Reform), NWML is the UK Enforcement Authority for the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2008 (the "RoHS Regulations"). These Regulations implement EU Directive 2002/95 which bans the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. Manufacturers need to understand the requirements of the RoHS Directive to ensure that their products, and their components, comply.

FDA is an agency within the Department of Health and Human Services. The FDA is responsible for protecting the public health by assuring the safety, efficacy, and security of human.

The Federal Communications Commission (FCC) is an independent United States government agency. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC's jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions.

NOTES

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SFP RJ45 OPTEC, 155M, 100m (10/100BASE-T)

SFP1G-RJ45

Copper Small Form Pluggable (SFP) is based on the SFP Multi Source Agreement (MSA). It is a high performance, cost effective module compliant with the 100BASE-T standards as specified in IEEE 802.3-2002 and IEEE 802.3u, supporting 100Mbps up to 100 meters reach over unshielded twisted-pair category-5 cable. It is able to perform any necessary scrambling/descrambling between the 100Base-TX and 100Base-FX formats and support intelligent auto-negotiation 100BASE-T operation in host systems.

APPLICATIONS

- LAN 10/100Base-T
- Switch to Switch Interface
- Router/Server Interface
- Switched backplane applications

FEATURES

- Support 10/100BASE-T Operation in Host Systems
- For 100m Reach over Cat 5 UTP Cable
- Hot-Pluggable SFP Footprint
- Fully metallic enclosure for low EMI
- Low power dissipation
- Compact RJ-45 connector assembly
- Detailed product information in EEPROM
- Operating Case Temperature
  Standard: 0°C~70°C
  Industrial: -40°C~85°C
- Compliant with SFP MSA
- Compliant with IEEE Std 802.3
- Safety Certification: TUV/UL/FDA
- RoHS Compliant

Product Information

Product Name	Data Rate	Media Type	Distance	Interface	Temp.	DDM
SFP RJ45 OPTEC, 155M, 100m (10/100Base-T)	10/100BASE-T	Cat5	100m	RJ45	Standard Industrial	NO

Absolute Maximum Ratings*note1

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	-0.5	4.0	V
Storage Temperature	Vs	-40	85	°C

note1 - Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0	-	70	°C
		Industrial	-40		85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
+3.3 Volt Electrical Power Interface						
Supply Current	Icc	-	170	300	mA	-
Input Voltage	Vcc	3.13	3.3	3.47	V	-
Surge Current	Isurge	-	-	30	mA	-
Low-Speed Signals, Electronic Characteristics						
SFP Output LOW	V_{OL}	0	-	0.5	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector
SFP Output HIGH	V_{OH}	host_Vcc – 0.5	-	host_Vcc + 0.3	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector

SFP Input LOW	V_{IL}	0	-	0.8	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector
SFP Input HIGH	V_{IH}	2	-	Vcc + 0.3	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector
High-Speed Electrical Interface, Transmission Line-SFP						
Line frequency	f_L	-	125	-	MHz	5-level encoding, per IEEE 802.3
Tx Output impedance	Zout,TX	-	100	-	Ohm	Differential, for all frequencies between 1MHz and 125MHz
Rx Input Impedance	Zin,RX	-	100	-	Ohm	Differential, for all frequencies between 1MHz and 125MHz
High-Speed Electrical Interface, Host-SFP						
Single ended data input swing	Vin	250	-	1200	mV	Single ended
Single ended data output swing	Vout	300	-	1000	mV	Single ended
Rise/Fall Time	Tr,Tf	-	3	-	psec	20%-80%
Tx Input Impedance	Zin	-	50	-	Ohm	Single ended
Rx Output Impedance	Zout	-	50	-	Ohm	Single ended

Regulatory Compliance	
Product Certificate	**Applicable Standard**
TUV	EN 60950-1:2006+A11+A1+A12+A2
	EN 60825-1:2014
	EN 60825-2:2004+A1+A2
UL	UL 60950-1
	CSA C22.2 No. 60950-1-07
EMC CE	EN 55022:2010
	EN 55024:2010
CB	IEC 60825-1
	IEC 60950-1
FCC	47 CFR PART 15 OCT., 2013
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ROHS	2011/65/EU