DTR-xxx-SM2-LC/LS-W

OC-3/STM-1 & OC-12/STM-4 SFF Single Mode Transceivers

Features

- ☑ *Compliant with SFF MSA 20-pin Package Style*
- ☑ *Compliant with SONET/SDH OC-3/STM-1 (156Mb/s) & OC-12/STM-4 (622Mb/s)*
- ☑ *SONET/SDH Reaches (SR-1, IR-1, LR-1 & LR-2)*
- ☑ *Eye Safe (Class I Laser Safety)*
- ☑ *Duplex LC Optical Interface*
- ☑ *-40°C to +85°C Operating Case Temperature Option*
- ☑ *Excellent EMI & ESD Protection*
- ☑ *Single +3.3 Power Supply*
- ☑ *LV-PECL DATA Interface*
- ☑ *Option for LV-TTL or LV-PECL Signal Detect*

Description

The DTR-xxx-SM2-LC-W and DTR-xxx-SM2-LS-W series of fiber optic transceivers provide a quick and reliable interface for short reach (SR), intermediate reach (IR) and long reach (LR) applications. Available products under this series are compliant with SONET/SDH standards for OC-3/STM-1 and OC-12/STM-4. All modules satisfy Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-825 standards.

The transmit and receive functions are contained in a narrow width two-row, 20-pin (2x10) package with a duplex LC optical interface. The receptacle fits into an RJ-45 form factor outline. The 20-pin configuration is in conformance to the SFF MSA.

The transmitter design incorporates a highly reliable 1310nm or 1550nm InGaAsP laser and an driver circuit. The receiver features a transimpedance amplifier IC optimized for high sensitivity and wide dynamic range. The signal detect status output is provided and can be either LV-TTL or LV-PECL.

The transceivers operate from a single +3.3V power supply over operating case temperature range of -5°C to +70°C or -40°C to +85°C ("A" option). The housing is made of metal for excellent EMI immunity.

Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature		T_{st}	- 40	+ 85	°C
Operating Case Temperature	"A" option	T_{op}	- 40	+ 85	°C
	"Blank" option		- 5.0	+ 70	
Supply Voltage		V_{CC}	0	+ 5.0	V
Input Voltage		V_{in}	0	V_{CC}	V
Output Current		I_O	-	50	mA
Lead Soldering Temperature & Time		-	-	260°C, 10 sec	

OC-3/STM-1 Single Mode Transceivers: DTR-156-SM2-LC/LS-W

Transmitter Performance Characteristics (over Operating Case Temperature, V_{CC} = 3.13 to 3.47V)

All parameters guaranteed only at typical data rate

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate[1]		B	-	156	-	Mb/s
Average Optical Output Power (coupled into single mode fiber), 50% duty cycle	IR-1	P_o	- 15.0	- 11.0	- 8.0	dBm
	LR-1 & LR-2		- 5.0	- 3.0	0	
Extinction Ratio		P_{hi}/P_{lo}	10	-	-	dB
Center Wavelength	IR-1	λ_c	1261	1310	1360	nm
	LR-1		1270	1310	1360	
	LR-2		1480	1550	1580	
Spectral Width (RMS)	IR-1 & LR-1	$\Delta\lambda_{RMS}$	-	-	3	nm
Spectral Width (-20dB)	LR-2	$\Delta\lambda_{20}$	-	-	1	
Side Mode Suppression Ratio	LR-2	$SMSR$	30	-	-	dB
Optical Output Eye	Compliant with Bellcore TR-NWT-000253 and ITU-T Recommendation G.957					

[1]Data rate ranges from 50Mb/s to 266Mb/s. However, some degradation may be incurred in overall performance.

Receiver Performance Characteristics (over Operating Case Temperature, V_{CC} = 3.13 to 3.47V)

All parameters guaranteed only at typical data rate

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate[1]		B	-	156	-	Mb/s
Receiver Sensitivity (10^{-10} BER)[2]		P_{min}	- 34.0	- 36.0	-	dBm
Maximum Input Optical Power (10^{-10} BER)[2]		P_{max}	- 7.0	0	-	dBm
Signal Detect Thresholds	Increasing Light Input	P_{sd+}	-	-	- 34.0	dBm
	Decreasing Light Input	P_{sd-}	- 45.0	-	-	
Signal Detect Timing Delay	Increasing Light Input	t_{sd+}	-	-	100	μs
	Decreasing Light Input	t_{sd-}	2.3	-	100	
Signal Detect Hysteresis		-	0.5	1.5	-	dB
Wavelength of Operation		λ	1100	-	1600	nm
Receiver Reflectance (LR-2)		-	-	-	- 25.0	dB

[1]Data rate ranges from 50Mb/s to 266Mb/s. However, some degradation may be incurred in overall performance.
[2]Specified in average optical input power and measured with 2^{23}-1 PRBS at 156Mb/s and 1310nm for IR-1 and LR-1, 1550nm for LR2.

Laser Safety: All transmitters are Class I Laser products per FDA/CDRH and IEC-825 standards. They must be operated under specified operating conditions.

Optical Communication Products, Inc.
DATE OF MANUFACTURE:

MANUFACTURED IN THE USA
This product complies with
21 CFR 1040.10 and 1040.11
Meets Class I Laser Safety Requirements

Transmitter Performance Characteristics (over Operating Case Temperature, V_{CC} = 3.13 to 3.47V)

All parameters guaranteed only at typical data rate

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate[1]		B	-	622	-	Mb/s
Average Optical Output Power (coupled into single mode fiber), 50% duty cycle	SR-1 & IR-1	P_o	- 15.0	- 11.0	- 8.0	dBm
	LR-1 & LR-2		- 3.0	- 1.0	+ 2.0	
Extinction Ratio	SR-1 & IR-1	P_{hi}/P_{lo}	8.2	-	-	dB
	LR-1 & LR-2		10	-	-	
Center Wavelength[2]	SR-1	λ_c	1261	1310	1360	nm
	IR-1		1274	1310	1356	
			1293	1310	1334	
	LR-1		1280	1310	1335	
	LR-2		1480	1550	1580	
Spectral Width (RMS)[2]	SR-1	$\Delta\lambda_{RMS}$	-	-	4.0	nm
	IR-1		-	-	2.5 or 4.0[2]	
Spectral Width (-20dB)	LR-1 & LR-2	$\Delta\lambda_{20}$	-	-	1.0	
Side Mode Suppression Ratio	LR-1 & LR-2	$SMSR$	30	-	-	dB
Optical Output Eye	Compliant with Bellcore TR-NWT-000253 and ITU-T Recommendation G.957					

[1]Data rate ranges from 50Mb/s to 700Mb/s. However, some degradation may be incurred in overall performance.
[2]For intermediate reach version, the center wavelength is either 1274nm $\leq \lambda_c \leq$ 1356nm for $\Delta\lambda_{RMS} \leq$ 2.5nm
or 1293nm $\leq \lambda_c \leq$ 1334nm for $\Delta\lambda_{RMS} \leq$ 4.0nm.

Receiver Performance Characteristics (over Operating Case Temperature, V_{CC} = 3.13 to 3.47V)

All parameters guaranteed only at typical data rate

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate[1]		B	-	622	-	Mb/s
Receiver Sensitivity (10^{-10} BER)[2]		P_{min}	- 28.0	- 31.0	-	dBm
Maximum Input Optical Power (10^{-10} BER)[2]		P_{max}	- 7.0	- 3.0	-	dBm
Signal Detect Thresholds	Increasing Light Input	P_{sd+}	-	-	- 28.0	dBm
	Decreasing Light Input	P_{sd-}	- 45.0	-	-	
Signal Detect Timing Delay	Increasing Light Input	t_{sd+}	-	-	100	μs
	Decreasing Light Input	t_{sd-}	2.3	-	100	
Signal Detect Hysteresis		-	0.5	1.5	-	dB
Wavelength of Operation		λ	1100	-	1600	nm
Receiver Reflectance (LR-2)		-	-	-	- 27.0	dB

[1]Data rate ranges from 50Mb/s to 700Mb/s. However, some degradation may be incurred in overall performance.
[2]Specified in average optical input power and measured with 2^{23}-1 PRBS at 622Mb/s and 1310nm for SR-1, IR-1 and LR-1, 1550nm for LR-2.

Transmitter Electrical Interface (over Operating Case Temperature, V_{CC} = 3.13 to 3.47V)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input HIGH Voltage	V_{IH}	V_{CC} - 1.165	-	V_{CC} - 0.880	V
Input LOW Voltage	V_{IL}	V_{CC} - 1.810	-	V_{CC} - 1.475	V
Data Input Current - HIGH	I_H	-	-	150	μA
Data Input Current - LOW	I_L	0.5	-	-	μA
Transmitter Disable Voltage	V_{DIS}	2.0	-	V_{CC}	V
Transmitter Enable Voltage	V_{EN}	0	-	0.8	V
Differential Bias Monitor Voltage (T_a = 25°C)	V_{BM+} - V_{BM-}	0.02	-	0.25	V
Differential Back Facet Monitor Voltage	V_{FM+} - V_{FM-}	-	100	-	mV

Receiver Electrical Interface (over Operating Case Temperature, V_{CC} = 3.13 to 3.47V)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output HIGH Voltage (LV-PECL)[1]	V_{OH}	V_{CC} - 1.10	-	V_{CC} - 0.70	V
Output LOW Voltage (LV-PECL)[1]	V_{OL}	V_{CC} - 1.95	-	V_{CC} - 1.50	V
Output HIGH Voltage (LV-TTL)	V_{OH}	2.4	-	V_{CC}	V
Output LOW Voltage (LV-TTL)	V_{OL}	0	-	0.8	V
Output Current	I_O	-	-	25	mA

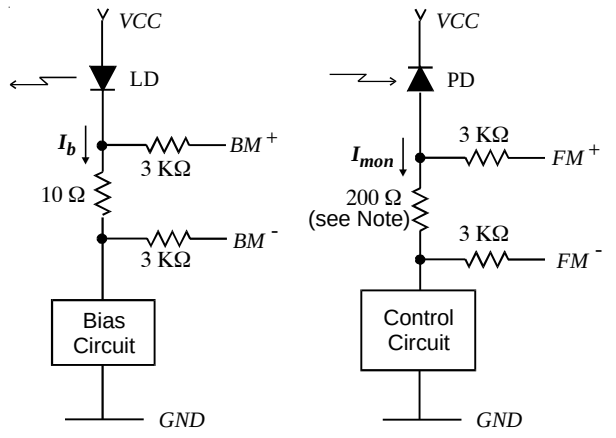
[1]With 50Ω terminated to V_{CC} - 2V.

Electrical Power Supply Characteristics (over Operating Case Temperature, V_{CC} = 3.13 to 3.47V)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Supply Voltage		V_{CC}	3.13	3.3	3.47	V
Supply Current[1]	TX	$I_{CC,TX}$	-	80	130	mA
	RX	$I_{CC,RX}$	-	75	100	

[1]Supply current does not include termination resistor current.

Laser bias & back facet monitor circuits

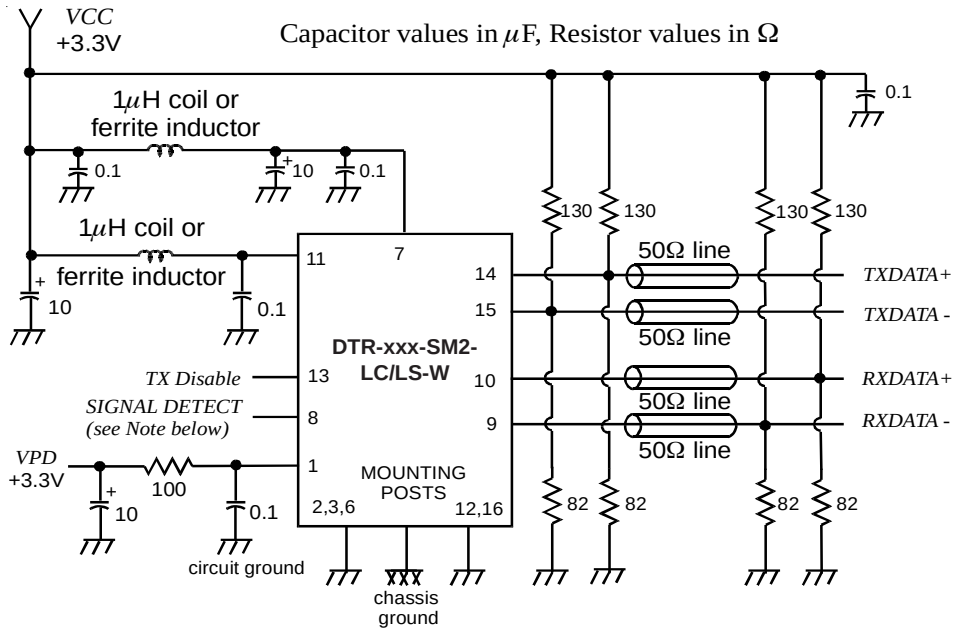


Note: For OC-12 LR-1 & LR-2, the value of the resistor is 1kΩ

Pin Assignments

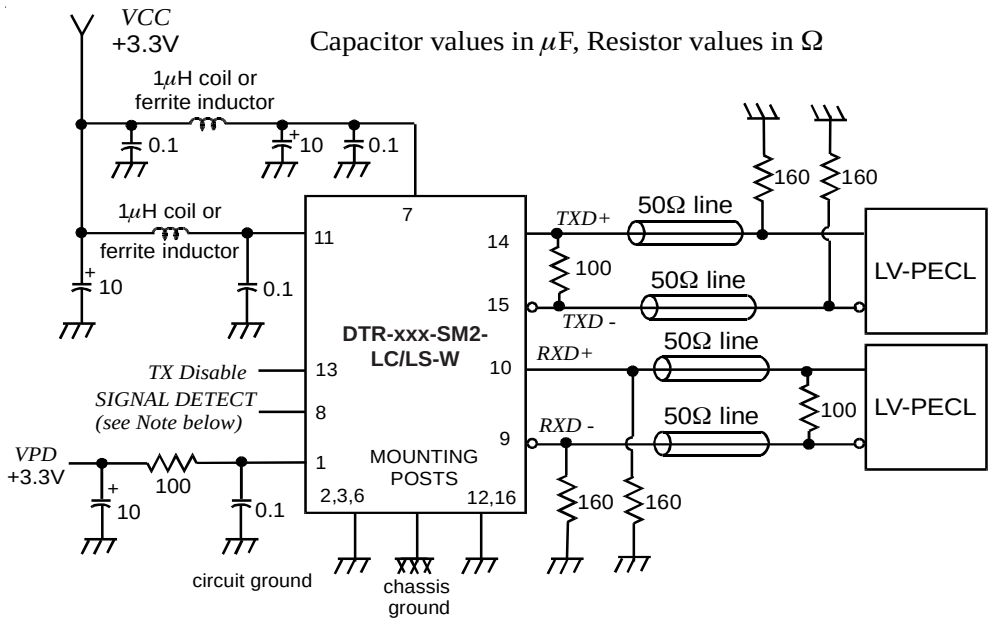
PIN	FUNCTION	PIN	FUNCTION
1	VPD	11	V_{CC}TX
2	RX GND	12	TX GND
3	RX GND	13	TX Disable
4	N/C	14	TD+ (TX DATA IN +)
5	N/C	15	TD- (TX DATA IN -)
6	RX GND	16	TX GND
7	V_{CC}RX	17	BM - (BIAS MONITOR -)
8	SD (RX SIGNAL DETECT)	18	BM + (BIAS MONITOR +)
9	RD- (RX DATA OUT-)	19	FM - (FACET MONITOR -)
10	RD+ (RX DATA OUT+)	20	FM + (FACET MONITOR +)

Interface circuit (DC-coupling)



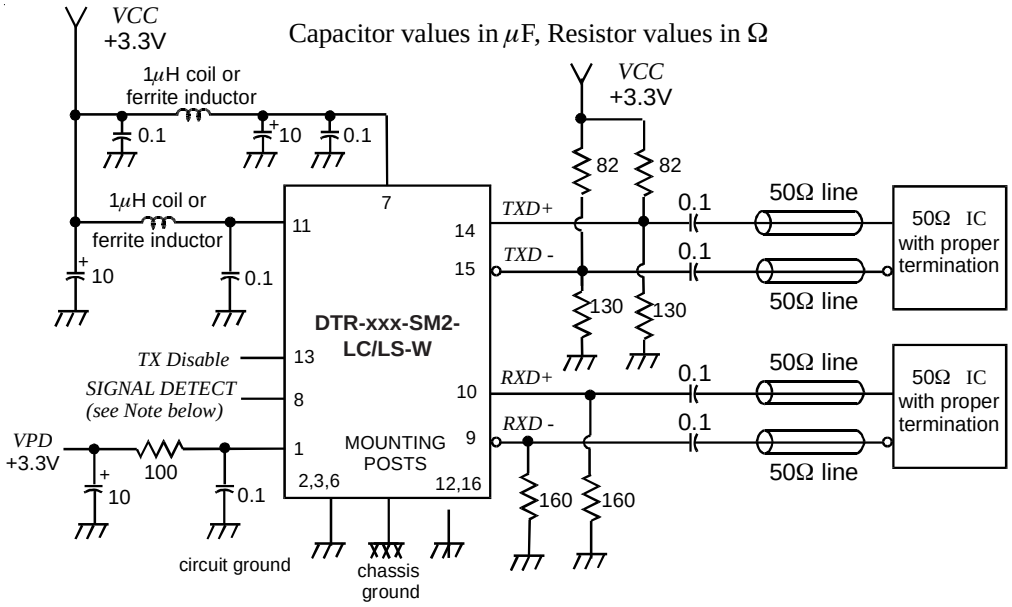
Note: If signal detect is LV-PECL, a termination resistor of 160Ω to GND is required

Interface circuit (DC-coupling)



Note: If signal detect is LV-PECL, a termination resistor of 160Ω to GND is required

Interface circuit (AC-coupling)



Note: If signal detect is LV-PECL, a termination resistor of 160Ω to GND is required

Application Notes

Transmitter: When the DATA+ input is at logic HIGH and DATA- input is at logic LOW, the laser diode is ON, and vice versa. The transmitter is normally enabled (i.e. when the TX Disable control input is not connected). When the TX Disable control input voltage is higher than V_{CC} - 1.3V, the laser is turned off independent of the input data.

The transmitter incorporates an Average Power Control (APC) loop to stabilize the transmitter average optical output power against temperature variation. The APC loop always acts to keep the transmitter average optical output power at a constant value; therefore, when the input data is all continuous "zeroes" or all continuous "ones", the transmitter optical output power is a constant level equal to the nominal average optical output power (not at the "OFF" level or at the "ON" level).

Receiver: Both differential DATA+ and DATA- outputs are LV-PECL levels requiring proper termination (see recommended interface circuits). For optimum performance, both outputs should be terminated in the same manner even if only one is used.

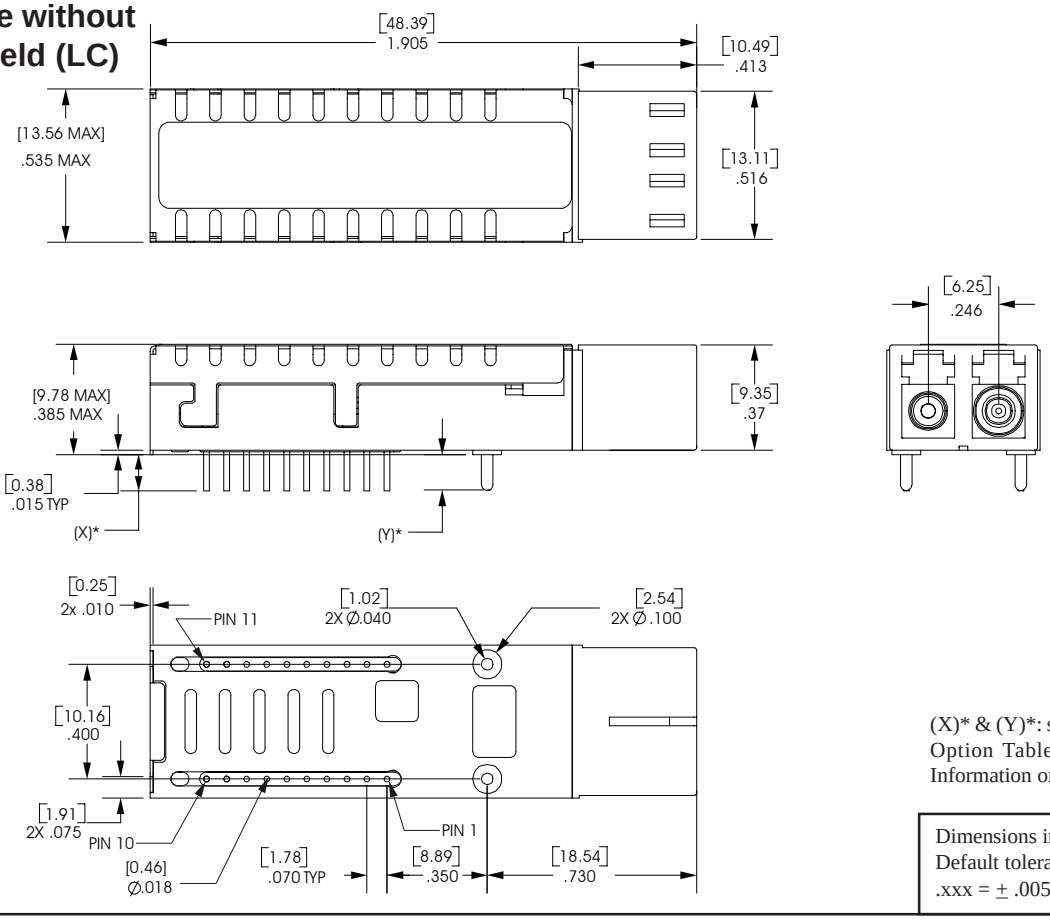
The signal detect circuit monitors the level of the incoming optical signal and generates a logic LOW signal when an insufficient photocurrent is produced. If the signal detect output is LV-TTL level, no termination is required. If the signal detect output is LV-PECL level, a termination resistor of 160Ω to GND is required.

Interface circuit: Three interface circuit options are shown, two with DC-coupling and one with AC-coupling.

The power supply line should be well-filtered. All 0.1μF power supply bypass capacitors should be as close to the transceiver module as possible. The two front GND posts (mounting studs) should be grounded to chassis ground. If chassis ground is not available, they should be connected to circuit ground.

DTR-xxx-SM2-LC-W & DTR-xxx-SM2-LS-W

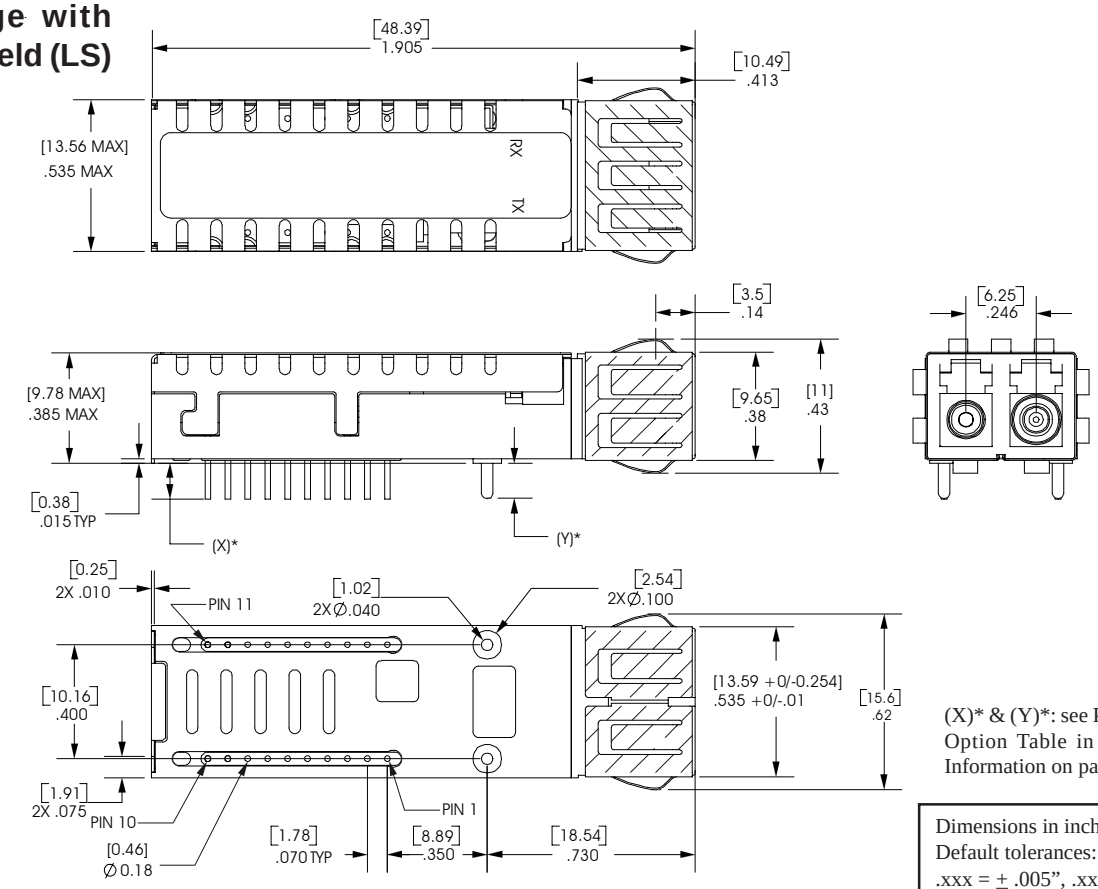
Package without EMI Shield (LC)



(X)* & (Y)*: see Pin Length Option Table in Ordering Information on page 9

Dimensions in inches [mm]
Default tolerances:
.xxx = ± .005", .xx = ± .01"

Package with EMI Shield (LS)



(X)* & (Y)*: see Pin Length Option Table in Ordering Information on page 9

Dimensions in inches [mm]
Default tolerances:
.xxx = ± .005", .xx = ± .01"

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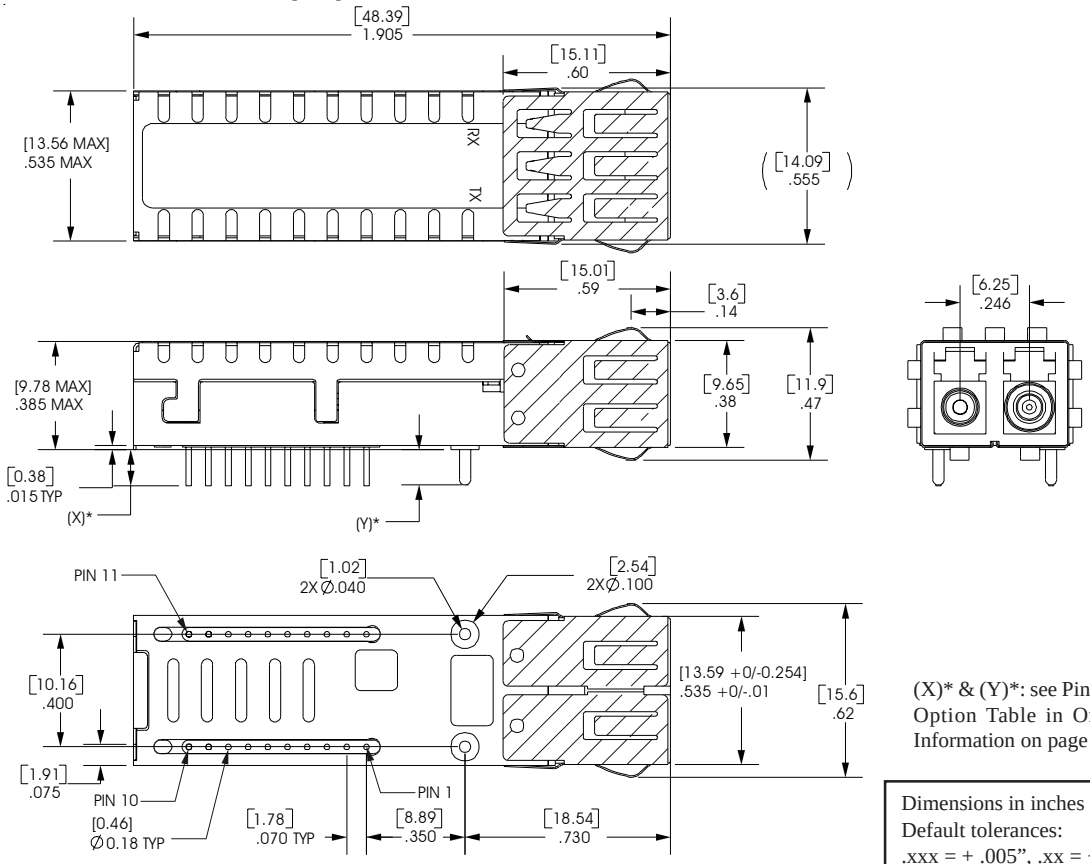
Package with S1 EMI Shield (S1)



(X)* & (Y)*: see Pin Length Option Table in Ordering Information on page 9

Dimensions in inches [mm]
Default tolerances:
.xxx = ± .005", .xx = ± .01"

Ordering Information for OC-3/STM-1

DTR - 156 - SM2 - *Lx -T- Ln - D - Wpy - S1*

Connector
LC : w/o EMI Shield
LS : w/ EMI Shield

Temperature Range
"Blank" : -5°C to +70 °C
"A" : -40°C to +85°C

Light Output Option
L3 : -15dBm to -8dBm (IR-1)
L0 : -5dBm to 0dBm (LR-1 & LR-2)

Distance Option (see note)
IR : IR-1/S-1.1 (21/15km)
LR1 : LR-1/L-1.1 (50/40km)
LR2 : LR-2/L-1.2 (100/80km)

S1 EMI Shield Option
"Blank": LC or LS
S1 : Package with S1 Shield

Signal Detect Option
"Blank" : LV-TTL
"E" : LV-PECL

see Pin Length Option Table

Pin Length Option Table

Options (p)	Pin Length (x)		Post Length (y)	
	Inches	Millimeters	Inches	Millimeters
"blank"	0.140 ± 0.010	3.56 ± 0.250	0.125 + 0.010 - 0.005	3.17 + 0.250 - 0.125
5	0.155 ± 0.010	3.94 ± 0.250	0.155 + 0.010 - 0.005	3.94 + 0.250 - 0.125
8	0.180 ± 0.010	4.57 ± 0.250	0.180 + 0.010 - 0.005	4.57 + 0.250 - 0.125

NOTE:
1. These are target distances to be used for classification and not for specification, per Telcordia GR-253-CORE/ITU-T Recommendation G.957

Ordering Information for OC-12/STM-4

DTR - 622 - SM2 - *Lx -T- Ln - D - Wpy - S1*

Connector
LC : w/o EMI Shield
LS : w/ EMI Shield

Temperature Range
"Blank" : -5°C to +70°C
"A" : -40°C to +85°C

Light Output Option
L3 : -15dBm to -8dBm (SR-1 & IR-1)
HP : -3dBm to +2dBm (LR-1 & LR-2)

Distance Option (see note)
SR : SR-1/I-4 (12/2km)
IR : IR-1/S-4.1 (21/15km)
LR1 : LR-1/L-4.1 (42/40km)
LR2 : LR-2/L-4.2 (85/80km)

S1 EMI Shield Option
"Blank": LC or LS
S1 : Package with S1 Shield

Signal Detect Option
"Blank" : LV-TTL
"E" : LV-PECL

see Pin Length Option Table

Pin Length Option Table

Options (p)	Pin Length (x)		Post Length (y)	
	Inches	Millimeters	Inches	Millimeters
"blank"	0.140 ± 0.010	3.56 ± 0.250	0.125 + 0.010 - 0.005	3.17 + 0.250 - 0.125
5	0.155 ± 0.010	3.94 ± 0.250	0.155 + 0.010 - 0.005	3.94 + 0.250 - 0.125
8	0.180 ± 0.010	4.57 ± 0.250	0.180 + 0.010 - 0.005	4.57 + 0.250 - 0.125

NOTE:
1. These are target distances to be used for classification and not for specification, per Telcordia GR-253-CORE/ITU-T Recommendation G.957

Optical Communication Products, Inc.
6101Variel Avenue, Woodland Hills, CA 91367, Tel.: 818-251-7100, FAX: 818-251-7111, www.ocp-inc.com