



# DTR-2488-SM-LC/LS-W-G-CWDM

## OC-48/STM-16 2x5 SFF Single Mode CWDM Transceivers



### Features

- ☑ Eight (8) Wavelength CWDM Transceivers
- ☑ Compliant with SONET/SDH OC-48/STM-16 IR-2/S-16.2 & LR-2/L-16.2 Specifications
- ☑ Eye Safe (Class I Laser Safety)
- ☑ Multi-sourced 2x5 Package Style
- ☑ Duplex LC Optical Interface
- ☑ AC Coupling or DC Coupling Option to LV-PECL DATA Compatible Interface
- ☑ LV-TTL SIGNAL DETECT Output
- ☑ Metal Package for Excellent EMI Shielding
- ☑ Single +3.3V Power Supply

### Description

The DTR-2488-SM-LC/LS-W-G-CWDM SFF series of fiber optic transceivers provide a quick and reliable interface for intermediate reach (IR-2) and long reach (LR-2) applications. Products under this series are compliant with SONET/SDH OC-48/STM-16 (2.488Gb/s) standards for IR-2/S-16.2 intermediate reach and LR-2/L-16.2 long reach applications, and are available in eight (8) wavelengths: 1470nm, 1490nm, 1510nm, 1530nm, 1550nm, 1570nm, 1590nm and 1610nm. Two performance options are available. In option L0, a guaranteed minimum optical power of -5dBm is offered with a PIN receiver that corresponds to a link distance of 15km (assuming fiber loss of 0.25dB/km). In option HP, a guaranteed minimum optical power of -2dBm is offered with an APD receiver that corresponds to a link distance of 80km (assuming fiber loss of 0.25dB/km). All modules satisfy Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-60825 standards. The transmit and receive functions are contained in a narrow

width two-row, 10-pin (2x5) package with a duplex LC optical interface. The receptacle fits into an RJ-45 form factor outline. The 10-pin configuration is in conformance to the SFF MSA.

The transmitter design incorporates the necessary control and driver circuitry for converting differential data to light. The receiver uses an InGaAs/InP PIN photodiode for IR-2 applications and an APD photodiode for LR-2 applications to convert the light signal into an electrical current which is amplified and regenerated into differential data outputs. AC-coupled transmit and receive DATA interface is recommended for compatibility with LV-PECL signal levels. An option for DC-coupled interface is also available. LV-TTL SIGNAL DETECT function is provided to indicate optical input loss.

The transceivers operate from a single +3.3V power supply over an operating case temperature range of -5°C to +70°C. The housing is made of metal to enhance EMI immunity.

### Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	$T_{st}$	- 40	+ 85	°C
Operating Case Temperature	$T_{op}$	- 5	+ 70	°C
Maximum Input Optical Power (LR-2 only, 60 seconds max.)	$P_{in, max}$	-	+ 3.0	dBm
Supply Voltage	$V_{CC}$	0	+ 4.5	V
Input Voltage	$V_{in}$	0	$V_{CC}$	V
Output Current	$I_O$	-	50	mA
Lead Soldering Temperature & Time	-	-	260°C, 10 seconds	

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## Transmitter Performance Characteristics (Over Operating Case Temperature Range, $V_{CC} = 3.13$ to $3.47V$ ) All parameters guaranteed only at typical data rate

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate <sup>1</sup>		$B$	-	2.488	-	Gb/s
Average Optical Output Power (coupled into single mode fiber) 50% duty cycle	L0	$P_o$	- 5.0	- 2.0	0	dBm
	HP		- 2.0	0	+ 3.0	
Extinction Ratio		$P_{hi}/P_{lo}$	8.2	-	-	dB
Center Wavelength	1470	$\lambda_c$	1464	1470	1477.5	nm
	1490		1484	1490	1497.5	
	1510		1504	1510	1517.5	
	1530		1524	1530	1537.5	
	1550		1544	1550	1557.5	
	1570		1564	1570	1577.5	
	1590		1584	1590	1597.5	
	1610		1604	1610	1617.5	
Spectral Width (-20dB)		$\Delta\lambda_{20}$	-	-	1.0	nm
Side Mode Suppression Ratio		$SMSR$	30	-	-	dB
Dispersion Penalty	IR-2	-	-	-	1.0	dB
	LR-2 <sup>2</sup>		-	-	2.0	
Optical Output Eye		Compliant with Telcordia GR-253-CORE and ITU-T Recommendation G.957				
<sup>1</sup> Data rate ranges from 155Mb/s to 2.7Gb/s. However, some degradation may be incurred in overall performance.						
<sup>2</sup> Specified at 1600ps/nm dispersion, which corresponds to the approximate worst-case dispersion for 80km G.652/G.654 fiber over the wavelength range of 1464 - 1617.5nm.						

## Receiver Performance Characteristics (Over Operating Case Temperature Range, $V_{CC} = 3.13$ to $3.47V$ ) All parameters guaranteed only at typical data rate

Parameter		Symbol	Minimum	Typical	Maximum	Units	
Operating Data Rate <sup>1</sup>		$B$	-	2.488	-	Gb/s	
Receiver Sensitivity ( $10^{-10}$ BER) <sup>2</sup>	IR-2	$P_{min}$	- 19.0	-	-	dBm	
	LR-2		- 29.0	- 31.0	-		
Maximum Input Optical Power ( $10^{-10}$ BER) <sup>2</sup>	IR-2	$P_{max}$	0	+ 1.0	-	dBm	
	LR-2		- 8.0	-	-		
SIGNAL DETECT Thresholds	IR-2	Increasing Light input	$P_{sd+}$	-	-	- 19.0	dBm
		Decreasing Light Input	$P_{sd-}$	- 42.0	-	-	
	LR-2	Increasing Light input	$P_{sd+}$	-	-	- 29.0	
		Decreasing Light Input	$P_{sd-}$	- 42.0	-	-	
SIGNAL DETECT Timing		-	3.0	-	100	$\mu$ s	
SIGNAL DETECT Hysteresis		-	0.5	1.0	-	dB	
Wavelength of Operation		$\lambda$	1260	-	1620	nm	
<sup>1</sup> Data rate ranges from 155Mb/s to 2.7Gb/s. However, some degradation may be incurred in overall performance.							
<sup>2</sup> Specified in average optical input power and measured at 2.488Gb/s and 1550nm with 2 <sup>23</sup> -1 PRBS.							

**Laser Safety:** All transmitters are Class I Laser products per FDA/CDRH and IEC-60825 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**

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## Transmitter Electrical Interface (Over Operating Case Temperature Range, $V_{CC} = 3.13$ to $3.47V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing between DATA+ & DATA-	$V_{INDIF}$	0.30	0.80	1.60	$V_{P-P}$
Input Impedance	$Z_{IL}$	-	50	-	$\Omega$
Transmitter Disable Voltage	$V_{DIS}$	$V_{CC} - 1.3$	-	$V_{CC}$	V
Transmitter Enable Voltage	$V_{EN}$	0	-	0.8	V

## Receiver Electrical Interface (Over Operating Case Temperature Range, $V_{CC} = 3.13$ to $3.47V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output HIGH Voltage (LV-PECL) <sup>1,2</sup>	$V_{OH}$	$V_{CC} - 1.10$	-	$V_{CC} - 0.90$	V
Output LOW Voltage (LV-PECL) <sup>1,2</sup>	$V_{OL}$	$V_{CC} - 1.84$	-	$V_{CC} - 1.60$	V
Output Current	$I_O$	-	-	25	mA
Output HIGH Voltage (LV-TTL)	$V_{OH}$	2.0	-	$V_{CC}$	V
Output LOW Voltage (LV-TTL)	$V_{OL}$	0	-	0.4	V

<sup>1</sup>With  $50\Omega$  terminated to  $V_{CC} - 2V$  (for DC-coupled modules).

<sup>2</sup>For AC-coupled modules, the output voltage swing into  $50\Omega$  load is  $0.3V$  minimum and  $0.8V$  maximum single-ended.

## Electrical Power Supply Characteristics (Over Operating Case Temperature Range, $V_{CC} = 3.13$ to $3.47V$ )

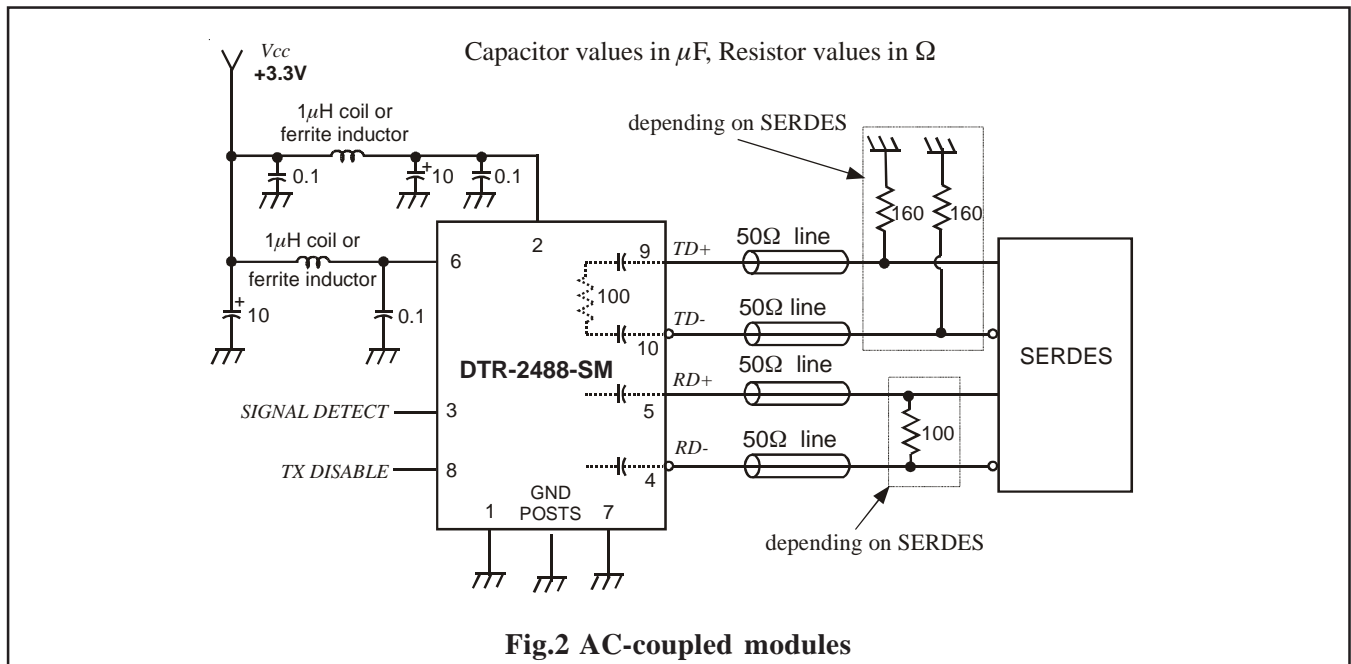
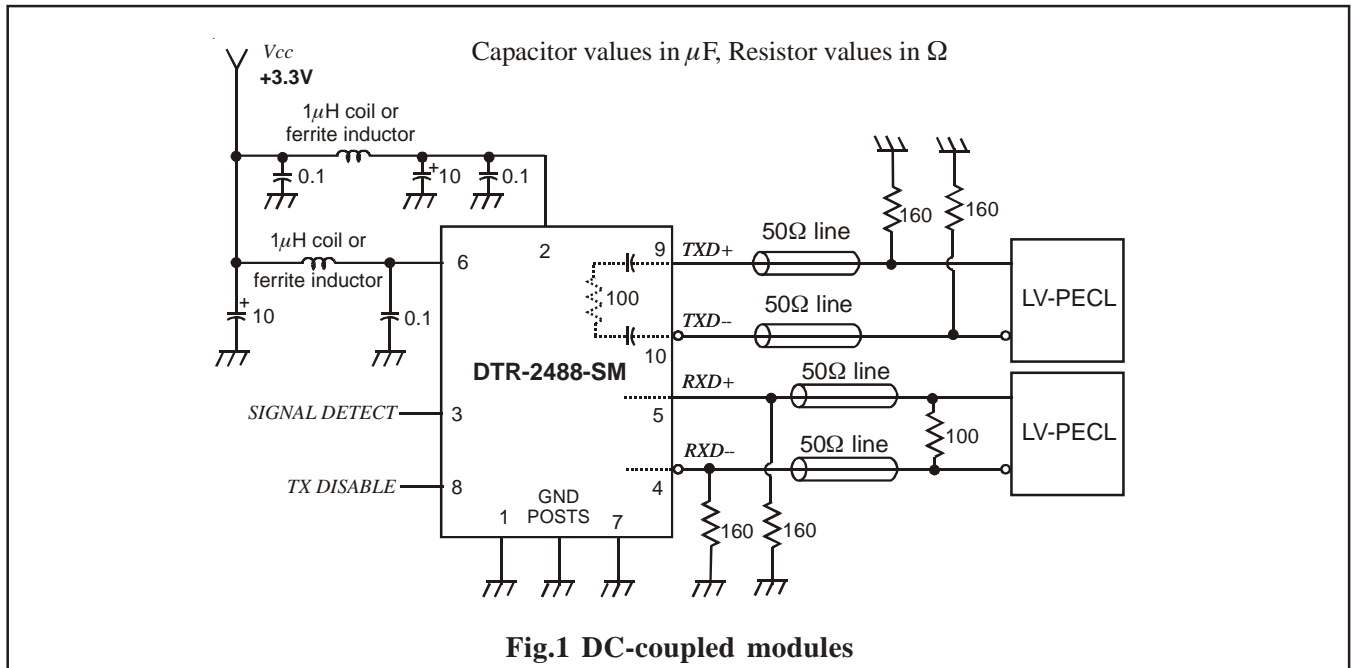
Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	$V_{CC}$	3.13	3.3	3.47	V
Supply Current <sup>1</sup>	AC-coupled modules	-	200	250	mA
	DC-coupled modules	-	180	230	

<sup>1</sup>Supply current does not include termination resistor current.

## Pin Assignment

PIN	FUNCTION	PIN	FUNCTION
1	RX GND	6	$V_{CC}TX$
2	$V_{CC}RX$	7	TX GND
3	SD (RX SIGNAL DETECT)	8	TX DISABLE
4	RD- (RX DATA OUT-)	9	TD+ (TX DATA IN+)
5	RD+ (RX DATA OUT+)	10	TD- (TX DATA IN-)

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## Application Notes

**DATA interface (DC-coupled modules):** The interface circuit for standard DC-coupled modules with direct-coupled LV-PECL interface is shown in Fig. 1. The transmitter input has internal  $50\Omega$  termination.

**DATA interface (AC-coupled modules):** For modules with AC coupling option, both transmitter and receiver interfaces have internal bias,  $50\Omega$  termination and AC coupling capacitors. The transmitter can be connected directly to the driving SERDES as shown in Fig. 2. The receiver can be connected directly to the external  $50\Omega$  loads (termination resistor of the SERDES). For best performance, both DATA+ & DATA- should be used.

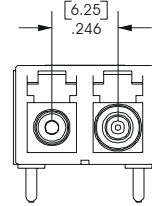
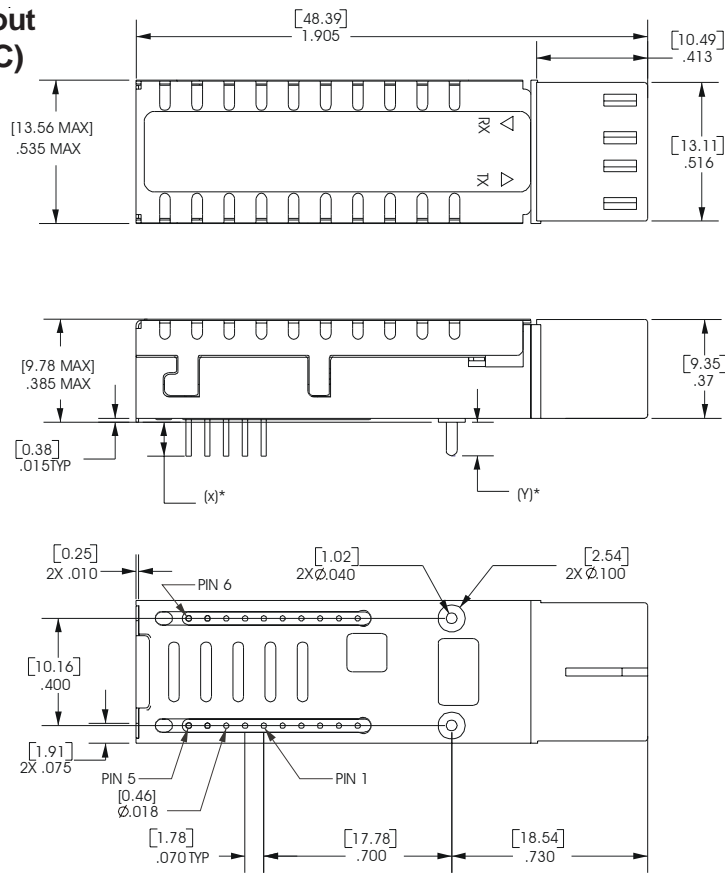
**SIGNAL DETECT:** The SIGNAL DETECT circuit monitors the incoming optical signal level and generates a logic LOW signal when an insufficient photocurrent is produced. The output is LV-TTL with no termination required.

**TX DISABLE:** 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  $V_{CC} - 1.3\text{V}$ , the laser is turned off independent of the input data.

**Power supply and grounding:** The power supply line should be well-filtered. All  $0.1\mu\text{F}$  power supply bypass capacitors should be as close to the DTR transceiver module as possible. The module case ground is internally AC-coupled to the circuit ground.

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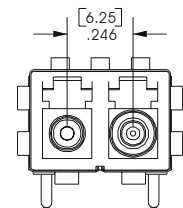
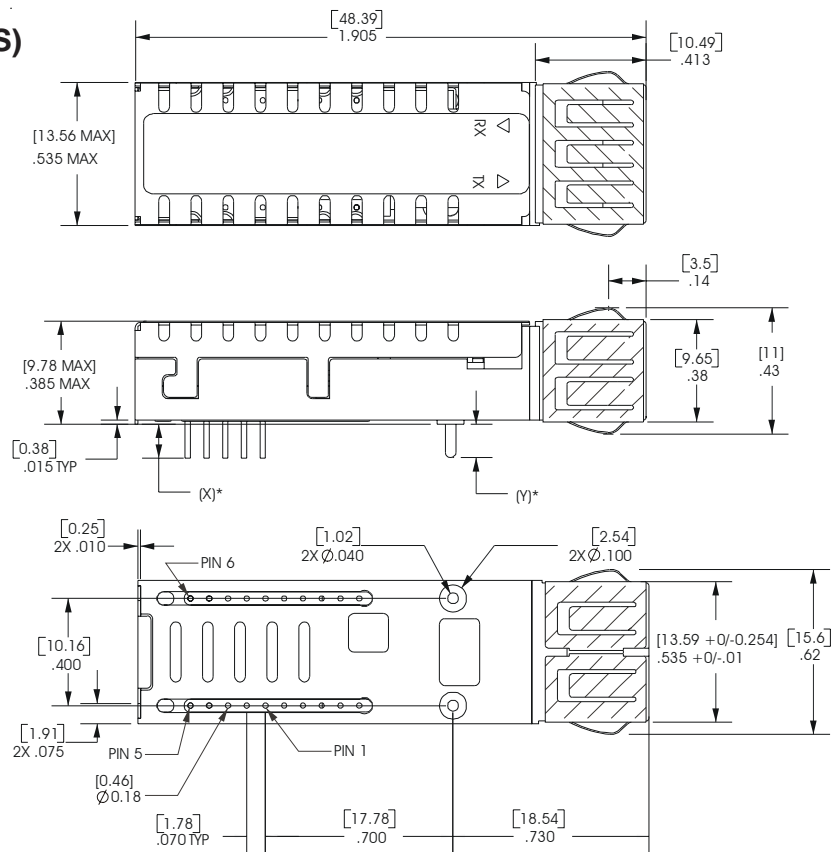
## Package without EMI Shield (LC)



\*(x) & (y): See Pin Length Option Table in Ordering Information

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

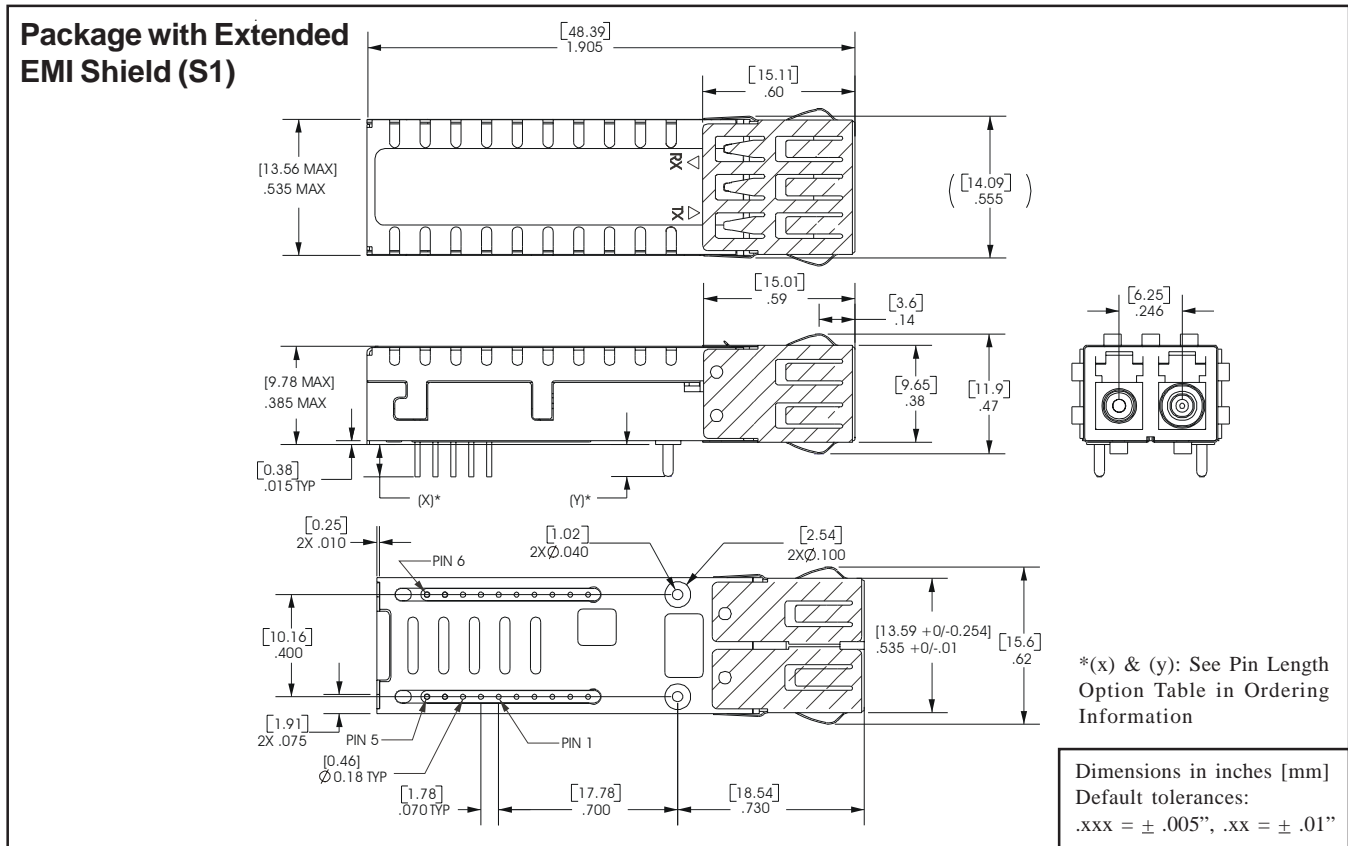
## Package with EMI Shield (LS)



\*(x) & (y): See Pin Length Option Table in Ordering Information

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

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## Ordering Information

**DTR - 2488 - SM - *Lx* - *Ln* - DR - *XX* - *Wp* - G - *Cxxx* - S1**

**Connector**  
 LC : w/o EMI Shield  
 LS : w/ EMI Shield  
 or w/ Extended S1 Shield

**Light Output Option**  
 L0 : -5 to 0dBm (IR-2)  
 HP : -2 to +3dBm (LR-2)

**Distance Option (see Note)**  
 IR2 : IR-2/S-16.2 (42/15km)  
 LR2 : LR-2/L-16.2 (80km)

**Extended Shield**  
 "Blank" : None  
 "S1" : Extended EMI Shield

**Center Wavelength**  
 C470: 1470nm  
 C490: 1490nm  
 C510: 1510nm  
 C530: 1530nm  
 C550: 1550nm  
 C570: 1570nm  
 C590: 1590nm  
 C610: 1610nm

**see Pin Length Option Table**

**Receiver Coupling Option**  
 "Blank" : DC Coupling  
 "AC" : AC Coupling

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

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