



Features

- ☑ Compliant with SFF MSA 10-pin Package Style
- ☑ Compliant with SONET/SDH OC-3/STM-1 (155Mb/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 +3.3V Power Supply
- ☑ Option of Internal 100Ω Differential Termination for Transmitter Input Data Lines

Description

The DTR-xxx-SM-LC-W and DTR-xxx-SM-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 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 a highly reliable 1310nm or 1550nm InGaAsP laser and an integrated 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 an 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	- 40	+ 85	°C
	"Blank" option	- 5.0	+ 70	
Supply Voltage	V_{CC}	0	+ 6.0	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 LC Single Mode Transceiver: DTR-156-SM-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	L3	- 15.0	- 11.0	- 8.0	dBm
	L0	- 5.0	- 3.0	0	
Extinction Ratio	P_{hi}/P_{lo}	10	-	-	dB
Center Wavelength	IR-1	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 Telcordia GR-253-CORE 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_off}	-	100	μs
	Decreasing Light Input	t_{sd_on}	2.3	100	
Signal Detect Hysteresis	-	0.5	1.5	-	dB
Wavelength of Operation	λ	1100	-	1600	nm
Receiver Reflectance (LR-2)	-	-	-	- 25	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 LR-2.					

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

OC-12/STM-4 LC Single Mode Transceiver: DTR-622-SM-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	-	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	
	LR-1		1293	1310	1334	
	LR-2		1480	1550	1580	
Spectral Width (RMS) ²	SR-1	$\Delta\lambda_{RMS}$	-	-	4.0	nm
	IR-1		-	-	2.5 or 4.0	
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 Telcordia GR-253-CORE and ITU-T Recommendation G.957					

¹Data rate ranges from 50Mb/s to 700Mb/s. However, some degradation may be incurred in overall performance.
²For 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_off}	-	-	100	μs
	Decreasing Light Input	t_{sd_on}	2.3	-	100	
Signal Detect Hysteresis		-	0.5	1.5	-	dB
Wavelength of Operation		λ	1100	-	1600	nm
Receiver Reflectance (LR-2)		-	-	-	- 27	dB

¹Data rate ranges from 50Mb/s to 700Mb/s. However, some degradation may be incurred in overall performance.
²Specified in average optical input power and measured with 2²³-1 PRBS at 622Mb/s and 1310nm for SR-1, IR-1 and LR-1, 1550nm for LR-2.

DTR-xxx-SM-LC-W & DTR-xxx-SM-LS-W

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}	$V_{CC} - 1.165$	-	$V_{CC} - 0.700$	V
Input LOW Voltage	V_{IL}	$V_{CC} - 1.950$	-	$V_{CC} - 1.475$	V
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, $V_{CC} = 3.13$ to $3.47V$)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output HIGH Voltage (LV-PECL) ¹	V_{OH}	$V_{CC} - 1.10$	-	$V_{CC} - 0.90$	V
Output LOW Voltage (LV-PECL) ¹	V_{OL}	$V_{CC} - 1.84$	-	$V_{CC} - 1.60$	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

¹With 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	mA
	RX	$I_{CC,RX}$	-	70	

¹Supply current does not include termination resistor current.

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 has two options for input termination. With “WS” and “WSE” versions, the transmitter input interface is standard LV-PECL (i.e. normal resistor termination needs to be provided externally by the user). With the “W” and “WE” version, an internal differential 100Ω resistor termination is provided at the transmitter input interface for convenience (see circuit diagrams on page 5).

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 circuit diagram on page 5). 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.

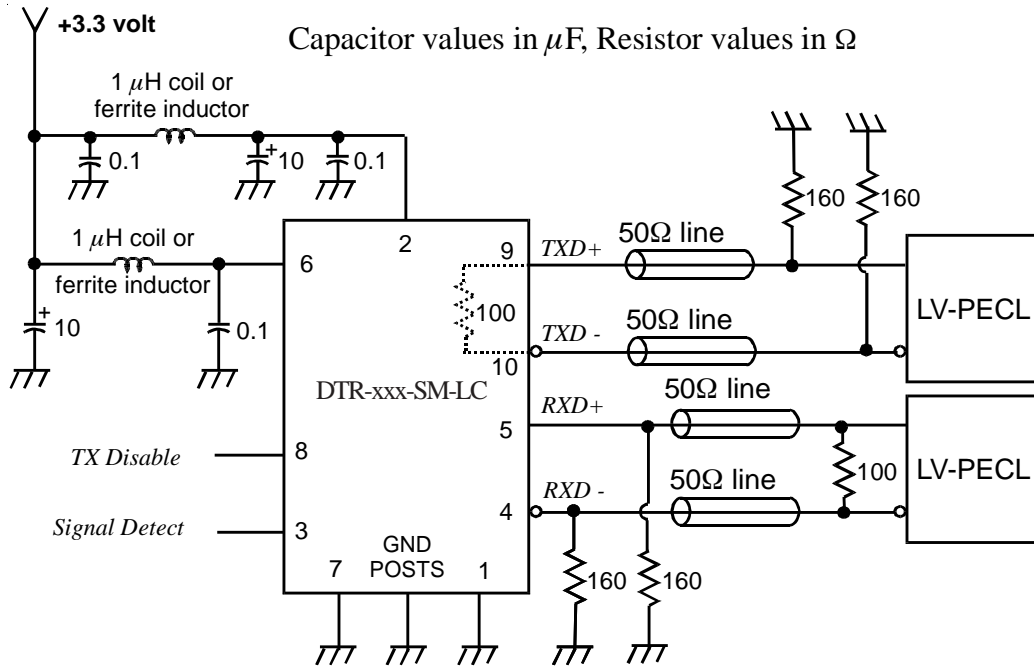
Interface circuit: The power supply line should be well-filtered. All $0.1\mu F$ power supply bypass capacitors should be as close to the DTR transceiver module as possible. The two front ground posts (mounting studs) should be grounded to circuit ground or chassis ground.

Pin Assignments

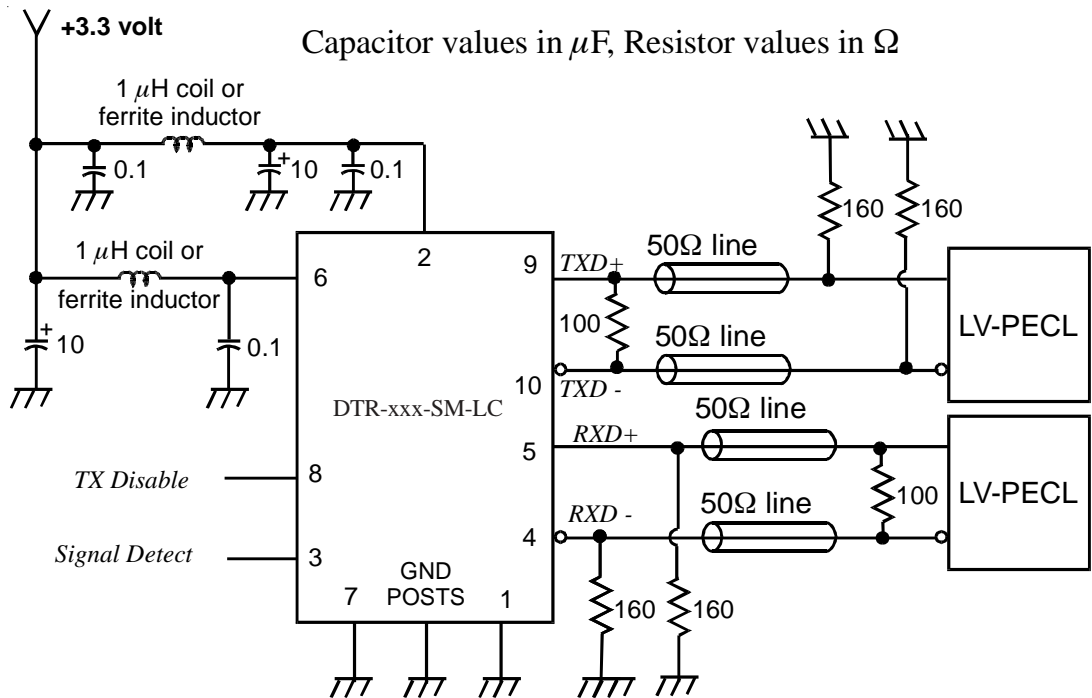
PIN	FUNCTION	LOGIC FAMILY
1	RX GND	-
2	V_{CCRX}	-
3	SD (RX SIGNAL DETECT)	LV-TTL
4	RD- (RX DATA OUT -)	LV-PECL
5	RD+ (RX DATA OUT +)	LV-PECL
6	V_{CCTX}	-
7	TX GND	-
8	TX DISABLE	LV-TTL
9	TD+ (TX DATA IN +)	LV-PECL
10	TD- (TX DATA IN -)	LV-PECL

DTR-xxx-SM-LC-W & DTR-xxx-SM-LS-W

Internal Termination

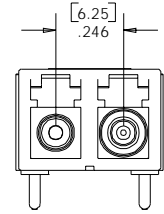
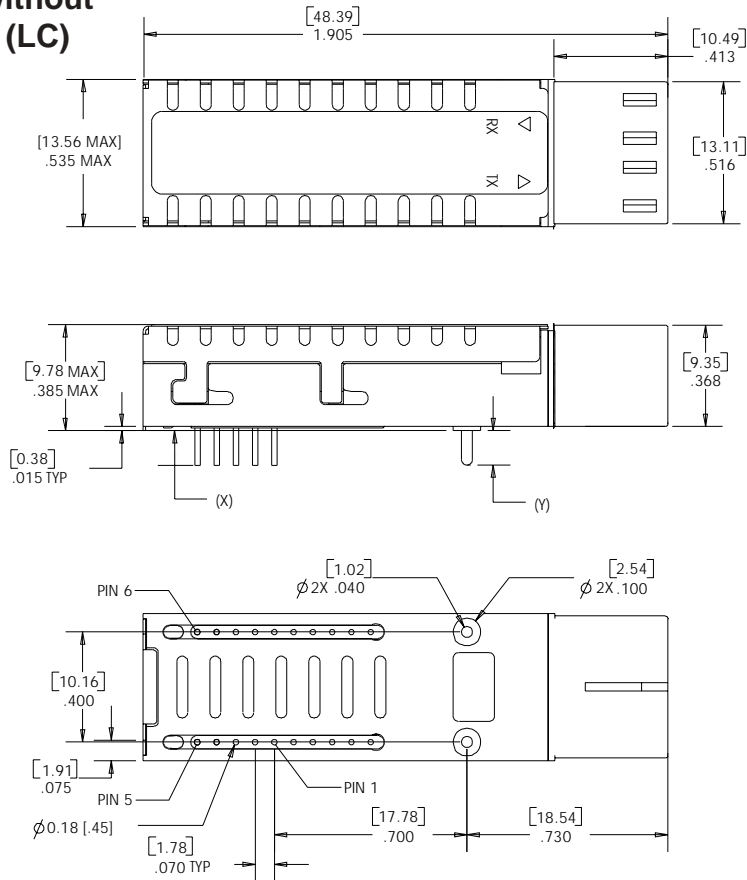


External Termination



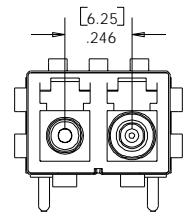
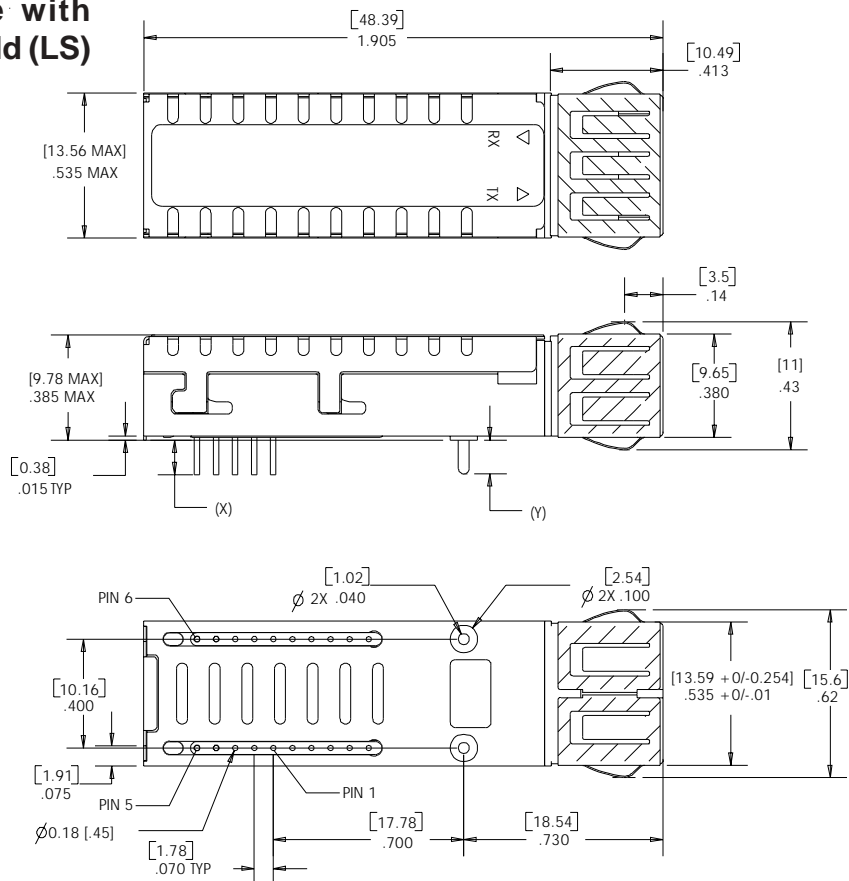
DTR-xxx-SM-LC-W & DTR-xxx-SM-LS-W

Package without EMI shield (LC)



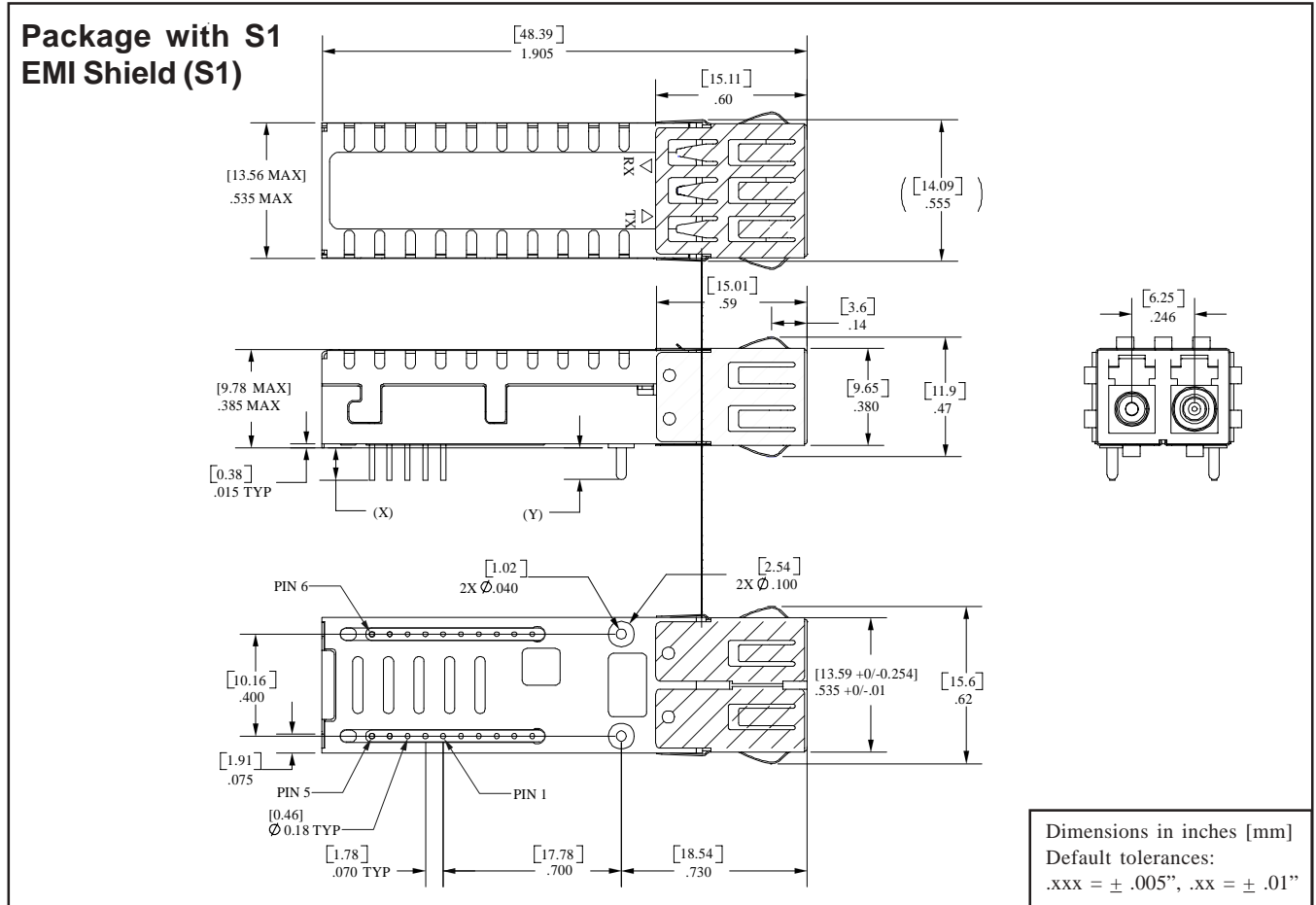
Dimensions in inches [mm]
 Default tolerances:
 .xxx = ± .005", .xx = ± .01"

Package with EMI Shield (LS)



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

DTR-xxx-SM-LC-W & DTR-xxx-SM-LS-W



DTR-xxx-SM-LC-W & DTR-xxx-SM-LS-W

Ordering Information for OC-3/STM-1

DTR - 156 - SM - Lx -T- Ln - D - Wpxy - 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 —————

L0: -5dBm to 0dBm
L3: -15dBm to -8dBm

Distance Option (see note) —————

specifies the range for Center Wavelength & Spectral Width to be compliant with SONET/SDH standard

IR : IR-1 / S-1.1 distance 21/15 km
LR1 : LR-1 / L-1.1 ” 50/40 km
LR2 : LR-2 / L-1.2 ” 100/80 km

S1 EMI Shield Option
“Blank”: LC or LS
S1 : Package with S1 Shield

Signal Detect Option
“Blank” : LV-TTL
“E” : LV-PECL

Transmitter Termination
“Blank” : Internal
“S” : External

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	4.57 ± 0.250

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 - SM - Lx -T- Ln - D - Wpxy - 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 —————

HP: -3dBm to -2dBm
L3: -15dBm to -8dBm

Distance Option (see note) —————

specifies the range for Center Wavelength & Spectral Width to be compliant with SONET/SDH standard

SR : SR-1 / I-4 distance 12/2 km
IR : IR-1 / S-4.1 ” 21/15 km
LR1 : LR-1 / L-4.1 ” 42/40 km
LR2 : LR-2 / L-4.2 ” 85/80 km

S1 EMI Shield Option
“Blank”: LC or LS
S1 : Package with S1 Shield

Signal Detect Option
“Blank” : LV-TTL
“E” : LV-PECL

Transmitter Termination
“Blank” : Internal
“S” : External

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	4.57 ± 0.250

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

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