OCP©

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

3.3 Volt 2x5 LC connector OC-3 & OC-12 Single Mode Transceivers

Features

- ☑ *Designed for ATM/SONET/SDH OC-3 (156 Mb/s) & OC-12 (622 Mb/s)*
- ☑ *Long Reach 1310 nm (40 km distance) and 1550 nm (80 km) as well as Intermediate Reach (15 km)*
- ☑ *Eye Safe (Class I Laser Safety)*
- ☑ *Multi-sourced 10-pin (2x5) SFF (Small Form Factor) package style*
- ☑ *Duplex LC optical connector interface*
- ☑ *Excellent EMI & ESD protection*
- ☑ *- 40°C to +85°C Operating Temperature ("A" option)*
- ☑ *Single +3.3 V supply & LV-PECL DATA interface*
- ☑ *Option for transmitter internal termination of 100 Ω differential*

Description

The DTR-xxx-SM-LC and DTR-xxx-SM-LS fiber optic transceivers offer a simple, convenient way to interface PCBs to single mode fiber optic cables. Many performance versions are available which are fully compliant with SONET/SDH standards for OC-3/STM-1 and OC-12/STM-4 Long Reach (40 km and 80 km) and Intermediate Reach (15 km) specifications. All modules satisfy Class I Laser Safety requirements in accordance with the US FDA/ CDRH and international IEC-825 standards.

The transmit and receive functions are contained in a narrow width two-row, 10-pin (2x5) package with a Duplex LC connector interface. The receptacle fits into an RJ-45 form factor outline. The 10-pin configuration is in conformance to a Small Form Factor (SFF) multisource transceiver agreement.

The transmitter incorporates a highly reliable 1300 nm or 1550 nm InGaAsP Laser and a driver circuit which converts LV-PECL data to light. A LV-TTL Transmitter Disable control input is also provided. The receiver features a transimpedance amplifier IC with internal AGC for high sensitivity and wide dynamic range. The Signal Detect status output can be either LV-TTL or LV-PECL.

The transceiver operates from a single +3.3V power supply over an operating temperature range of 0°C to +70°C or - 40°C to +85°C ("A" option). The package is made of metal for excellent EMI shielding.

NOTE: Option for plastic housing is also available, please inquire with the sales representative.

Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature		T_{st}	- 40	+ 85	°C
Operating Temperature	"A" option	T_{op}	- 40	+ 85	°C
	"*Blank*" option		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

Transmitter Performance Characteristics (over Operating Case Temperature)

Parameter			Symbol	Minimum	Typical	Maximum	Units
Data Rate			B	50	156	300	Mb/s
Average Optical Output Power (coupled into single mode fiber), 50% duty cycle	L0		P_o	- 5.0	- 3.0	0	dBm
	L3			- 15.0	- 11.0	- 8.0	
Extinction Ratio			P_{hi}/P_{lo}	10	-	-	dB
Center Wavelength	IR (Intermediate Reach)		λ_c	1261	1310	1360	nm
	LR1 (Long Reach 1310 nm)			1280	1310	1335	
	LR2 (Long Reach 1550 nm)			1480	1550	1580	
Spectral Width (RMS)	LR1 (0°C to 70°C) & IR		$\Delta\lambda_{RMS}$	-	-	4	nm
Spectral Width (-20 dB)	LR1 (-40°C to 85°C) & LR2		$\Delta\lambda_{20}$	-	-	1	
Side Mode Suppression Ratio		LR1 (-40°C to 85°C) & LR2	$SMSR$	30	-	-	dB
Optical Output Eye	compliant with Bellcore TR-NWT-000253 and ITU-T Recommendation G.957						

Receiver Performance Characteristics (over Operating Case Temperature)

Parameter			Symbol	Minimum	Typical	Maximum	Units
Data Rate			B	50	156	266	Mb/s
Receiver Sensitivity (10^{-10} BER) [1]	IR (Intermediate Reach)		P_{min}	- 29.0	- 31.0	-	dBm
	LR1 or LR2 (Long Reach)			- 34.0	- 36.0	-	
Maximum Input Optical Power (10^{-10} BER) [1]			P_{max}	- 7.0	0	-	dBm
Signal Detect Thresholds	Increasing Light Input	IR	P_{sd+}	-	-	- 29.0	dBm
		LR1 or LR2		-	-	- 34.0	
	Decreasing Light Input		P_{sd-}	- 45.0	-	-	
Signal Detect Hysteresis			-	0.5	-	-	dB
Signal Detect Timing Delay	Increasing Light Input		t_{sd+}	-	-	100	μs
	Decreasing Light Input		t_{sd-}	-	-	100	
Wavelength of Operation			λ	1100	-	1600	nm

[1] Specified in Average Optical Input Power and measured at 1300 nm (1550 nm for LR2) wavelength with 2^{23}-1 PRBS.

Ordering Information for "LC" modules for OC-3/STM-1 applications

MODULE NAME		SIGNAL DETECT	Transmitter Termination	SONET / SDH Standard	Distance [1]
0°C to 70°C Operating	-40°C to 85°C Operating				
DTR-156-SM-LC-L3-IR-M	DTR-156-SM-LC-A-L3-IR-M	LV-TTL	INTERNAL	IR 1310 nm / S-1.1	15 km
DTR-156-SM-LC-L0-LR1-M	DTR-156-SM-LC-A-L0-LR1-M	LV-TTL	INTERNAL	LR-1 1310 nm / L-1.1	40 km
DTR-156-SM-LC-L0-LR2-M	DTR-156-SM-LC-A-L0-LR2-M	LV-TTL	INTERNAL	LR-2 1550 nm / L-1.2	80 km
DTR-156-SM-LC-L3-IR-ME	DTR-156-SM-LC-A-L3-IR-ME	LV-PECL	INTERNAL	IR 1310 nm / S-1.1	15 km
DTR-156-SM-LC-L0-LR1-ME	DTR-156-SM-LC-A-L0-LR1-ME	LV-PECL	INTERNAL	LR-1 1310 nm / L-1.1	40 km
DTR-156-SM-LC-L0-LR2-ME	DTR-156-SM-LC-A-L0-LR2-ME	LV-PECL	INTERNAL	LR-2 1550 nm / L-1.2	80 km
DTR-156-SM-LC-L3-IR-MS	DTR-156-SM-LC-A-L3-IR-MS	LV-TTL	EXTERNAL	IR 1310 nm / S-1.1	15 km
DTR-156-SM-LC-L0-LR1-MS	DTR-156-SM-LC-A-L0-LR1-MS	LV-TTL	EXTERNAL	LR-1 1310 nm / L-1.1	40 km
DTR-156-SM-LC-L0-LR2-MS	DTR-156-SM-LC-A-L0-LR2-MS	LV-TTL	EXTERNAL	LR-2 1550 nm / L-1.2	80 km
DTR-156-SM-LC-L3-IR-MSE	DTR-156-SM-LC-A-L3-IR-MSE	LV-PECL	EXTERNAL	IR 1310 nm / S-1.1	15 km
DTR-156-SM-LC-L0-LR1-MSE	DTR-156-SM-LC-A-L0-LR1-MSE	LV-PECL	EXTERNAL	LR-1 1310 nm / L-1.1	40 km
DTR-156-SM-LC-L0-LR2-MSE	DTR-156-SM-LC-A-L0-LR2-MSE	LV-PECL	EXTERNAL	LR-2 1550 nm / L-1.2	80 km

[1] These are target distances to be used for classification and not for specification, per ITU-T Recommendation G.957

OC-12/STM-4 LC Single Mode Transceiver: DTR-622-SM-LC/LS

Transmitter Performance Characteristics (over Operating Case Temperature)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	50	622	700	Mb/s
Average Optical Output Power (coupled into single mode fiber), 50% duty cycle	HP	P_o	- 3.0	- 1.0	+2.0	dBm
	L3		- 15.0	- 11.0	- 8.0	
Extinction Ratio	SR & IR	P_{hi}/P_{lo}	8.2	-	-	dB
	LR1 & LR2		10	-	-	
Center Wavelength [1]	SR (Short Reach)	λ_c	1261	1310	1360	nm
	IR (Intermediate Reach)		1274	1310	1356	
			1293	1310	1334	
	LR1 (Long Reach 1310 nm)		1280	1310	1335	
	LR2 (Long Reach 1550 nm)		1480	1550	1580	
Spectral Width (RMS) [1]	SR (Short Reach)	$\Delta\lambda_{RMS}$	-	-	4.0	nm
	IR (Intermediate Reach)		-	-	2.5 or 4.0 [1]	
Spectral Width (-20 dB)	LR1 & LR2	$\Delta\lambda_{20}$	-	-	1.0	
Side Mode Suppression Ratio	LR1 & LR2	$SMSR$	30	-	-	dB
Optical Output Eye	compliant with Bellcore TR-NWT-000253 and ITU-T Recommendation G.957					

[1] For Intermediate Reach version, the Center Wavelength is either 1274 nm $\leq \lambda_c \leq$ 1356 nm for $\Delta\lambda_{RMS} \leq$ 2.5 nm
or 1293 nm $\leq \lambda_c \leq$ 1334 nm for $\Delta\lambda_{RMS} \leq$ 4.0 nm.

Receiver Performance Characteristics (over Operating Case Temperature)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	50	622	700	Mb/s
Receiver Sensitivity (10^{-10} BER) [1]		P_{min}	- 28.0	- 31.0	-	dBm
Maximum Input Optical Power (10^{-10} BER) [1]		P_{max}	- 7.0	0	-	dBm
Signal Detect Thresholds	Increasing Light Input	P_{sd+}	-	-	- 28.0	dBm
	Decreasing Light Input	P_{sd-}	- 45.0	-	-	
Signal Detect Hysteresis		-	0.5	1.5	-	dB
Signal Detect Timing Delay	Increasing Light Input	t_{sd+}	-	-	100	μs
	Decreasing Light Input	t_{sd-}	-	-	100	
Wavelength of Operation		λ	1100	-	1600	nm

[1] Specified in Average Optical Input Power and measured at 622 Mb/s and 1300 nm (1550 nm for LR2) wavelength with 2^{23}-1 PRBS.

ORDERING INFORMATION FOR OC-12: MODULE NAME		SIGNAL DETECT	Transmitter Termination	SONET / SDH Standard	Distance [1]
0°C to 70°C Operating	-40°C to 85°C Operating				
DTR-622-SM-LC-L3-IR-M	DTR-622-SM-LC-A-L3-IR-M	LV-TTL	INTERNAL	IR 1310 nm / S-4.1	15 km
DTR-622-SM-LC-HP-LR1-M	DTR-622-SM-LC-A-HP-LR1-M	LV-TTL	INTERNAL	LR-1 1310 nm / L-4.1	40 km
DTR-622-SM-LC-HP-LR2-M	DTR-622-SM-LC-A-HP-LR2-M	LV-TTL	INTERNAL	LR-2 1550 nm / L-4.2	80 km
DTR-622-SM-LC-L3-IR-ME	DTR-622-SM-LC-A-L3-IR-ME	LV-PECL	INTERNAL	IR 1310 nm / S-4.1	15 km
DTR-622-SM-LC-HP-LR1-ME	DTR-622-SM-LC-A-HP-LR1-ME	LV-PECL	INTERNAL	LR-1 1310 nm / L-4.1	40 km
DTR-622-SM-LC-HP-LR2-ME	DTR-622-SM-LC-A-HP-LR2-ME	LV-PECL	INTERNAL	LR-2 1550 nm / L-4.2	80 km
DTR-622-SM-LC-L3-IR-MS	DTR-622-SM-LC-A-L3-IR-MS	LV-TTL	EXTERNAL	IR 1310 nm / S-4.1	15 km
DTR-622-SM-LC-HP-LR1-MS	DTR-622-SM-LC-A-HP-LR1-MS	LV-TTL	EXTERNAL	LR-1 1310 nm / L-4.1	40 km
DTR-622-SM-LC-HP-LR2-MS	DTR-622-SM-LC-A-HP-LR2-MS	LV-TTL	EXTERNAL	LR-2 1550 nm / L-4.2	80 km
DTR-622-SM-LC-L3-IR-MSE	DTR-622-SM-LC-A-L3-IR-MSE	LV-PECL	EXTERNAL	IR 1310 nm / S-4.1	15 km
DTR-622-SM-LC-HP-LR1-MSE	DTR-622-SM-LC-A-HP-LR1-MSE	LV-PECL	EXTERNAL	LR-1 1310 nm / L-4.1	40 km
DTR-622-SM-LC-HP-LR2-MSE	DTR-622-SM-LC-A-HP-LR2-MSE	LV-PECL	EXTERNAL	LR-2 1550 nm / L-4.2	80 km

[1] These are target distances to be used for classification and not for specification, per ITU-T Recommendation G.95757.

Note: The corresponding parts for Short Reach/ I-4 (2 km) standard are: DTR-622-SM-LC-L3-SR-M, DTR-622-SM-LC-L3-SR-ME, DTR-622-SM-LC-L3-SR-MSE, DTR-622-SM-LC-L3-SR-MSE and DTR-622-SM-LC-A-L3-SR-M, DTR-622-SM-LC-A-L3-SR-ME, etc...

Transmitter Electrical Interface (over Operating Case Temperature Range)

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 Range)

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}	
Output LOW Voltage (LV-TTL)	V_{OL}	0	-	0.8	
Output Current	I_O	-	-	25	mA

[1] With 50 ohm terminated to V_{CC} - 2 volts.

Electrical Power Supply Characteristics (over Operating Case Temperature Range)

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	120	mA
	RX	$I_{CC,RX}$	-	70	100	mA

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

Ordering Information for "LS" modules (with EMI shield)

The particular Module Name for "LS" modules (with EMI shield) can be obtained from the Ordering Information Table on page 2 and 3 for "LC" modules (without EMI shield) by replacing the "LC" characters by "LS". For example, the Ordering Information Table for "LS" modules (with EMI shield) for OC-12/STM-4 applications is shown below.

MODULE NAME		SIGNAL DETECT	Transmitter Termination	SONET / SDH Standard	Distance [1]
0°C to 70°C Operating	-40°C to 85°C Operating				
DTR-156-SM-LS-L3-IR-M	DTR-156-SM-LS-A-L3-IR-M	LV-TTL	INTERNAL	IR 1310 nm / S-1.1	15 km
DTR-156-SM-LS-L0-LR1-M	DTR-156-SM-LS-A-L0-LR1-M	LV-TTL	INTERNAL	LR-1 1310 nm / L-1.1	40 km
DTR-156-SM-LS-L0-LR2-M	DTR-156-SM-LS-A-L0-LR2-M	LV-TTL	INTERNAL	LR-2 1550 nm / L-1.2	80 km
DTR-156-SM-LS-L3-IR-ME	DTR-156-SM-LS-A-L3-IR-ME	LV-PECL	INTERNAL	IR 1310 nm / S-1.1	15 km
DTR-156-SM-LS-L0-LR1-ME	DTR-156-SM-LS-A-L0-LR1-ME	LV-PECL	INTERNAL	LR-1 1310 nm / L-1.1	40 km
DTR-156-SM-LS-L0-LR2-ME	DTR-156-SM-LS-A-L0-LR2-ME	LV-PECL	INTERNAL	LR-2 1550 nm / L-1.2	80 km
DTR-156-SM-LS-L3-IR-MS	DTR-156-SM-LS-A-L3-IR-MS	LV-TTL	EXTERNAL	IR 1310 nm / S-1.1	15 km
DTR-156-SM-LS-L0-LR1-MS	DTR-156-SM-LS-A-L0-LR1-MS	LV-TTL	EXTERNAL	LR-1 1310 nm / L-1.1	40 km
DTR-156-SM-LS-L0-LR2-MS	DTR-156-SM-LS-A-L0-LR2-MS	LV-TTL	EXTERNAL	LR-2 1550 nm / L-1.2	80 km
DTR-156-SM-LS-L3-IR-MSE	DTR-156-SM-LS-A-L3-IR-MSE	LV-PECL	EXTERNAL	IR 1310 nm / S-1.1	15 km
DTR-156-SM-LS-L0-LR1-MSE	DTR-156-SM-LS-A-L0-LR1-MSE	LV-PECL	EXTERNAL	LR-1 1310 nm / L-1.1	40 km
DTR-156-SM-LS-L0-LR2-MSE	DTR-156-SM-LS-A-L0-LR2-MSE	LV-PECL	EXTERNAL	LR-2 1550 nm / L-1.2	80 km

[1] These are target distances to be used for classification and not for specification, per ITU-T Recommendation G.957

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} - 1.3 V, the laser is turned off independent of the input data. The transmitter has two options for input termination. With "MS" and "MSE" versions, the transmitter input interface is standard LV-PECL (i.e. normal resistor termination needs to be provided externally by the user). With the "M" and "ME" version, an internal differential 100 ohm resistor termination is provided at the transmitter input interface for convenience (see circuit diagrams below).

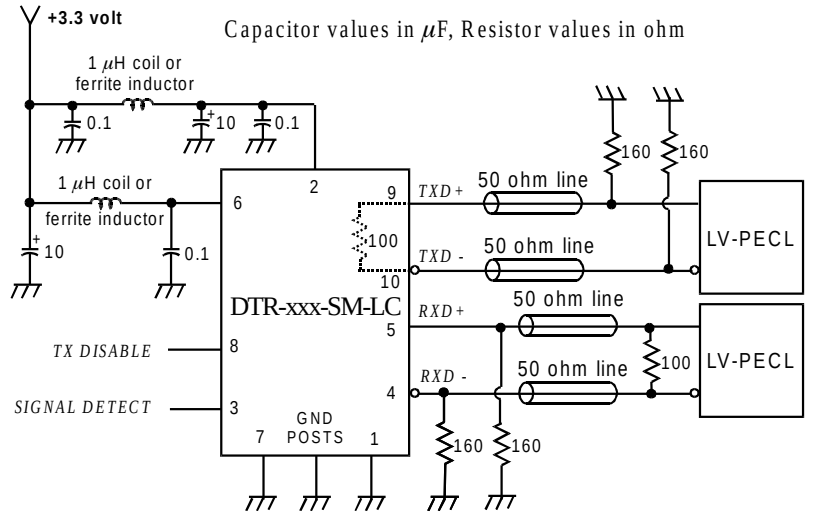
The transmitter incorporates an Average Power Control (APC) loop to stabilize the transmitter average optical output power against temperature variation. The APC loop always acts to keep the transmitter average optical output power at a constant value. Therefore, when the input data is all continuous "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 circuit). For optimum performance, both outputs should be terminated in the same manner, even if only one is used.

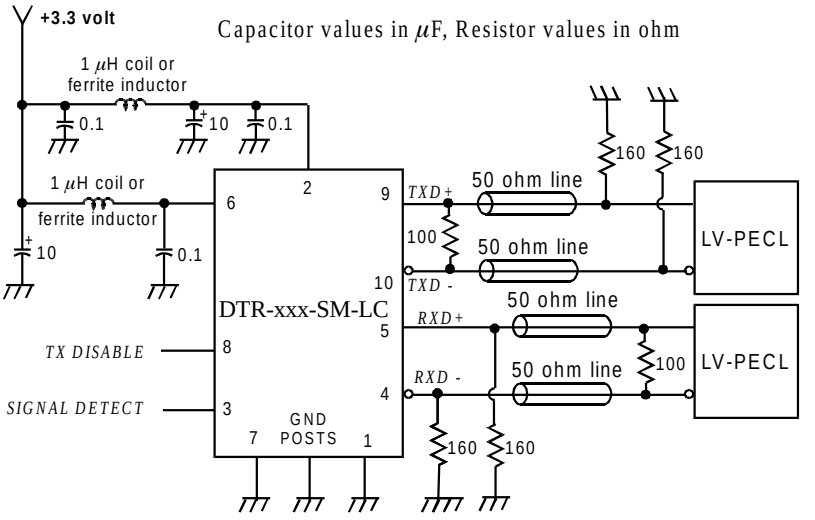
The Signal Detect circuit monitors the level of the incoming optical signal and generates a logic LOW signal when insufficient photocurrent is produced. If the SIGNAL DETECT output is LV-TTL level, no termination is required. If the SIGNAL DETECT output is LV-PECL level, a termination resistor of 160 ohms to *GND* is required.

Interface circuit: The power supply line should be well-filtered. All 0.1 μF power supply bypass capacitors should be as close to the DTR transceiver module as possible. The two front GND posts (mounting studs) should be grounded to Circuit Ground or Chassis Ground.

Internal Termination



External Termination



Pin Assignments

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

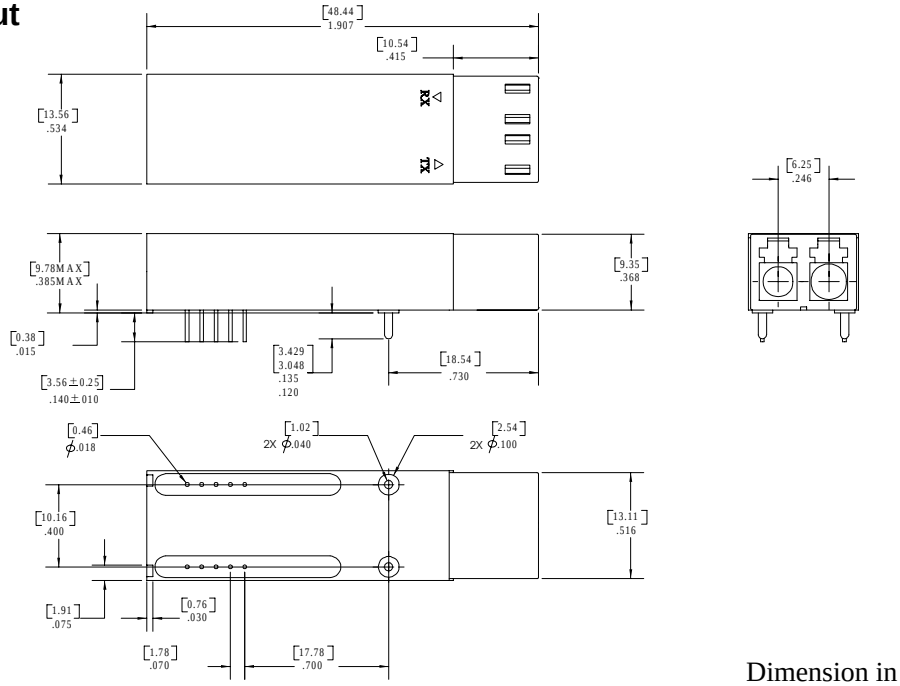
Ordering Information

Module Family	EMI Shield	SONET / SDH / Bit rate
DTR-156-SM-LC	NO	OC-3 / STM-1 / 156 Mbps
DTR-622-SM-LC	NO	OC-12 / STM-4 / 622 Mbps
DTR-156-SM-LS	YES	OC-3 / STM-1 / 156 Mbps
DTR-622-SM-LS	YES	OC-12 / STM-4 / 622 Mbps

See Ordering Information for each particular module (Distance or Reach, Operating Temperature Range, Metal Package, LVTTL or LVPECL SIGNAL DETECT from Tables on page 2, 3 and 4.)

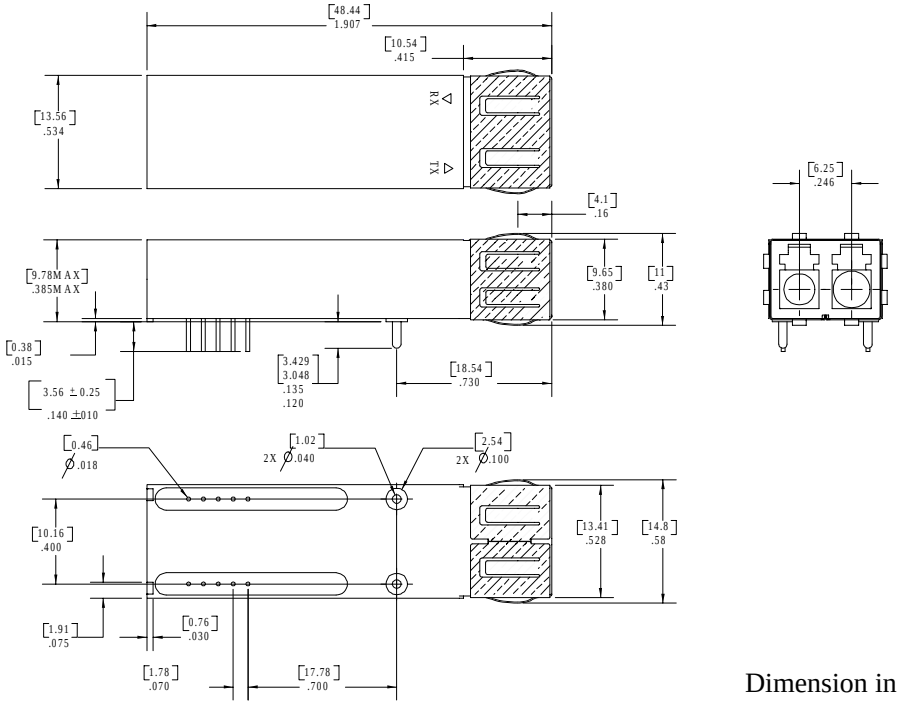
DTR-*xxx*-SM-LC & DTR-*xxx*-SM-LS

Package without EMI shield (LC)



Dimension in inches[mm]

Package with EMI Shield (LS)



Dimension in inches [mm]

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

Optical Communication Products, Inc.

20961 Knapp Street, Chatsworth, CA 91311, Tel.: 818-701-0164, FAX: 818-701-1468, http://www.ocp-inc.com

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