DTR-1250-SM

1x9 Gigabit Ethernet 1300 nm & 1550 nm Laser Transceivers

Features

- ☑ *Compliant with IEEE 802.3z Draft D5.0 1000BASE-LX specifications for Gigabit Ethernet*
- ☑ *Distance options of 10 km, 25 km, 40 km and 70 km using DFB lasers also available*
- ☑ *Eye Safe (Class I Laser Safety)*
- ☑ *Excellent EMI & ESD protection (optional extra EMI shield also available)*
- ☑ *Multi-sourced 1x9 package with Duplex SC interface (ST or FC connector also available)*
- ☑ *PCI-mezzanine-compliant package (9.8 mm maximum height)*
- ☑ *Single +5 V supply & PECL interface (AC coupling option also available)*
- ☑ *Conductive Plastic or Metal package*
- ☑ *Wave Solder Process Compatible*

Description

The DTR-1250-SM fiber optic transceiver offers a simple and convenient way to interface 1000BASE-LX Gigabit Ethernet boards running at 1.25 Gbaud to single mode and multimode fiber optic cables. In addition to option "L2" for the 5 km distance specified in IEEE 802.3z Draft D5.0, five other options with longer distance capability with single mode fibers are offered. In option "L1", a 1300 nm Fabry Perot laser with higher power and narrower spectral width and center wavelength range is used to increase the distance to at least 10 km. In option "L0", an even higher power 1300 nm Fabry Perot laser is used to offer more optical power budget. In option "H3", a 1300 nm DFB laser and a high sensitivity receiver are used to increase the distance to over 25 km or 30 km (assuming worst case fiber loss of 0.4 dB/km and 0.35 dB/km respectively). In option "H5", a 1550 nm DFB laser and a high sensitivity receiver are used to increase the distance to over 35 km or 40 km (assuming worst case fiber loss of 0.3 and 0.25 dB/km respectively). Finally, in option "H7", a high power 1550 nm DFB laser and an ultra high sensitivity receiver are used to increase the distance to 70 km (assuming fiber loss of 0.2 to 0.25 dB/km). All modules satisfy Class I Laser Safety requirements in accordance with the US FDA/CDRH and international IEC-825 standards.

All transceiver modules are housed in a PCI-mezzanine-compliant (9.8 mm maximum height) one-row, 9-pin (1x9) package with Duplex SC connector interface. The transceiver package is made of *conductive* plastic to obtain excellent EMI shielding. An optional EMI shield for making direct contact from the SC connector to the equipment chassis opening is also available. The transceiver is also offered in a metal package with ST or FC connector interface.

The transmitter and receiver DATA interface are differential direct-coupled PECL. An alternate version with AC coupling interface is also available. The receiver Signal Detect output interface is direct-coupled PECL.

The transceiver operates from a single +5V power supply over an operating temperature range of 0°C to +70°C. A low power consumption version with 3.3 V supply voltage is also offered. Please refer to the DTR-1250-3.3-SM data sheet.

Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	T_{st}	- 40	+ 85	°C
Operating Temperature	T_{op}	0	+ 70	°C
Supply Voltage	V_{CC}	- 0.5	+ 6.0	V
Input Voltage	V_{in}	- 0.5	V_{CC}	V
Output Current	I_O	-	50	mA
Lead Soldering Temperature & Time	-	-	260°C, 10 sec	

Transmitter Electrical Interface (over Operating Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input HIGH Voltage [1]	V_{IH}	V_{CC} - 1.165	-	V_{CC} - 0.700	V
Input LOW Voltage [1]	V_{IL}	V_{CC} - 1.890	-	V_{CC} - 1.475	V
Data Input Current - HIGH	I_H	-	-	350	μA
Data Input Current - LOW	I_L	-	-	250	μA

[1] For AC-coupled modules, the input voltage swing is 0.3 V minimum and 1.2 V maximum.

Receiver Electrical Interface (over Operating Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output HIGH Voltage [1]	V_{OH}	V_{CC} - 1.035	-	V_{CC} - 0.700	V
Output LOW Voltage [1]	V_{OL}	V_{CC} - 1.950	-	V_{CC} - 1.595	V
Output Current	I_O	-	-	25	mA

[1] For AC-coupled modules, the output voltage swing into 50-ohm load is 0.3 V minimum and 1 V maximum.

Electrical Power Supply Characteristics (over Operating Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Supply Voltage		V_{CC}	4.75	5.0	5.25	V
Supply Current	DC-coupled module	I_{CC}	-	160	250	mA
	AC-coupled module	I_{CC}	-	180	270	mA

Application Notes

DATA interface (DC-coupled module): The interface circuit for the standard DC-coupled module with direct-coupled PECL interface is shown in Figure 1. The termination resistors for the transmitter should be close to the DTR transceiver module. The termination resistors for the receiver (50 ohms to V_{CC} - 2 volts or the Thevenin equivalent resistors shown) should be close to the PHY or SERDES IC (which receives the DATA outputs). When interfacing with 3.3 V SERDES IC, AC coupling can be used as shown in Figure 2. The termination resistors required by the SERDES are not shown in this figure.

The transmitter incorporates an Average Power Control (APC) loop to stabilize the average optical output power against temperature variation. 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" or "ON" level).

DATA interface (AC-coupled module): For modules with AC coupling option, both transmitter and receiver interface has internal bias, termination and AC coupling capacitor. The transmitter can be connected directly to the driving SERDES. The receiver can be connected directly to the external 50 ohm load (termination resistor of the SERDES).

SIGNAL DETECT: The Signal Detect circuit monitors the level of the incoming optical signal and generates a logic LOW signal when insufficient photocurrent is produced. The SIGNAL DETECT output is PECL level requiring termination (510 ohms to *GND* is recommended).

Power supply and grounding: 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 should be grounded to Circuit Ground or Chassis Ground.

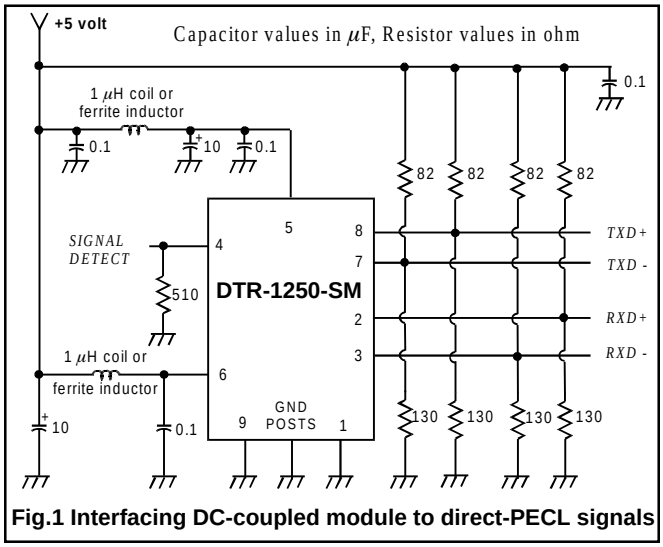


Fig.1 Interfacing DC-coupled module to direct-PECL signals

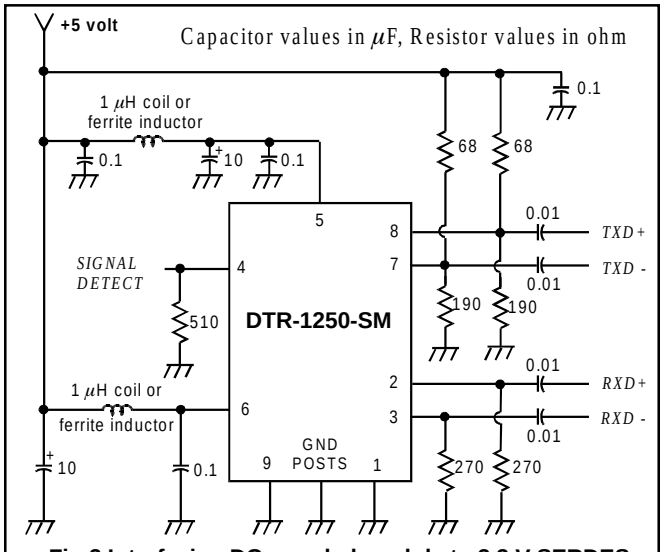


Fig.2 Interfacing DC-coupled module to 3.3 V SERDES

DTR-1250-SM

Transmitter Performance Characteristics (over Operating Temperature, V_{CC} = 4.75 to 5.25V)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	50	1250	1300	Mb/s
Optical Output Power [1]	L2	P_o	- 11.0	-	- 3.0	dBm
	L1		- 9.0	-	- 3.0	
	L0		- 5.0	-	0	
	H3, H5		- 4.0	-	1.0	
	H7		- 3.0	-	2.0	
Center Wavelength	L2	λ_c	1270	1310	1355	nm
	L1, L0		1285	1310	1345	
	H3		1280	1310	1335	
	H5, H7		1480	1550	1580	
Spectral Width (RMS) [1]	L2	$\Delta\lambda_{RMS}$	-	-	4.0	nm
	L1, L0		-	-	2.5	
Spectral Width (-20 dB)	H3, H5, H7	$\Delta\lambda_{20}$	-	-	1.0	
Extinction Ratio		P_{hi} / P_{lo}	9	-	-	dB
Deterministic Jitter		DJ	-	-	80	ps
Random Jitter		RJ	-	-	147	ps
Relative Intensity Noise		RIN	-	-	- 120	dB/Hz
Transmitter Output Eye		compliant with Eye Mask Defined in IEEE 802.3z standard				

[1] Measured average power coupled into single mode fiber (SMF). For50 μm or 62.5 μm multimode fiber (MMF) operation, the output power is 0.5 dB less and is measured after a single mode fiber offset-launch mode-conditioning patch cord as specified in IEEE 802.3z Draft 5.0.

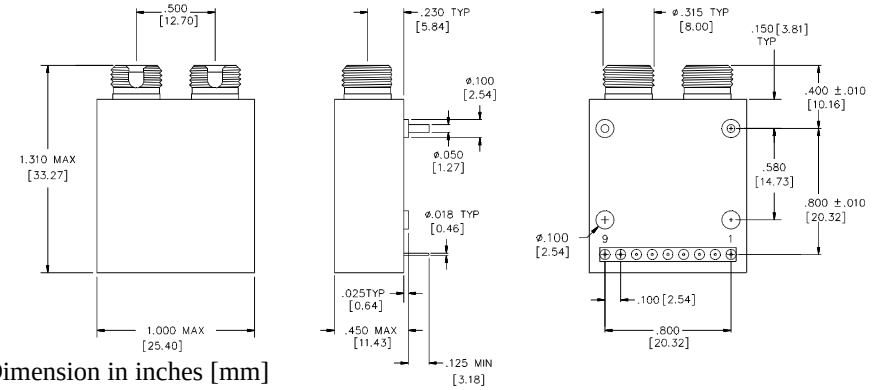
Receiver Performance Characteristics (over Operating Temperature, V_{CC} = 4.75 to 5.25V)

Parameter			Symbol	Minimum	Typical	Maximum	Units
Data Rate			B	1000	1250	1300	Mb/s
Minimum Input Optical Power (10^{-12} BER) [1]		L2, L1, L0	P_{min}	- 20.0	-	-	dBm
		H3, H5		- 21.0	-	-	
		H7		- 23.0	-	-	
Maximum Input Optical Power (10^{-12} BER) [1]			P_{max}	- 3.0	-	-	dBm
Signal Detect Thresholds	Increasing Light Input	L2, L1, L0	P_{sd+}	-	-	- 20.0	dBm
		H3, H5		-	-	- 21.0	
		H7		-	-	- 23.0	
	Decreasing Light Input		P_{sd-}	- 30.0	-	-	dBm
Signal Detect Hysteresis			-	0.5	-	-	dB
Deterministic Jitter			DJ	-	-	170	ps
Random Jitter			RJ	-	-	96	ps
Wavelength of Operation			λ	1100	-	1600	nm
Return Loss			-	12	-	-	dB
Electrical 3 dB upper cutoff frequency			-	-	-	1500	MHz
Stressed Receiver Sensitivity			compliant with IEEE 802.3z standard				

[1] Measured with 2^7-1 PRBS at 1250 Mb/s at 1300 nm wavelength.

FC Receptacle Package

(Refer to DTR-1250-MM data sheet for ST Receptacle Package Drawing)



Dimension in inches [mm]

Pin Assignments

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

21737-0304, Rev. F
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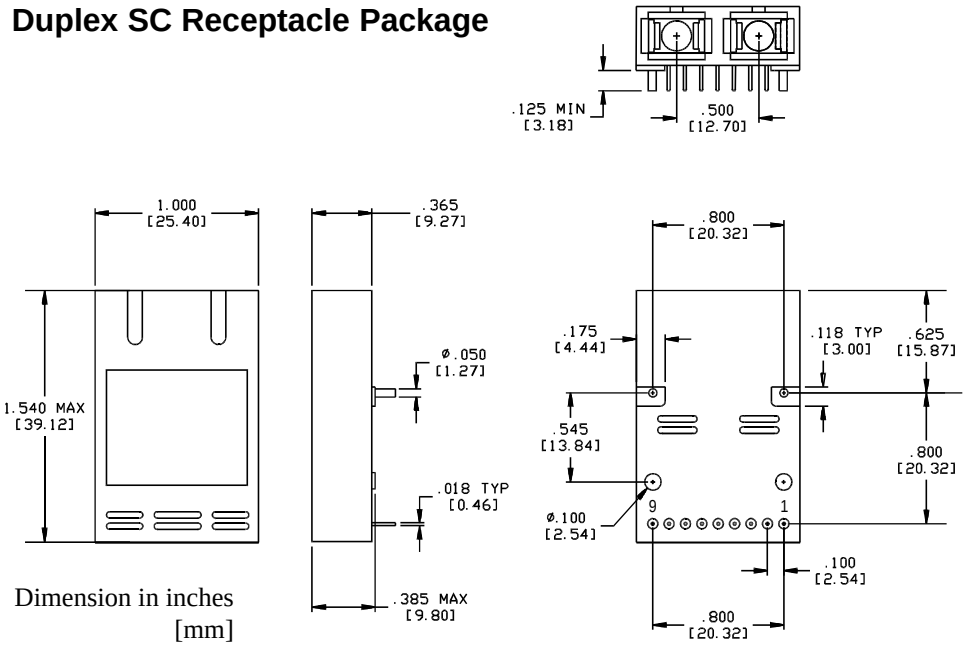
DTR-1250-SM

Duplex SC Receptacle Package

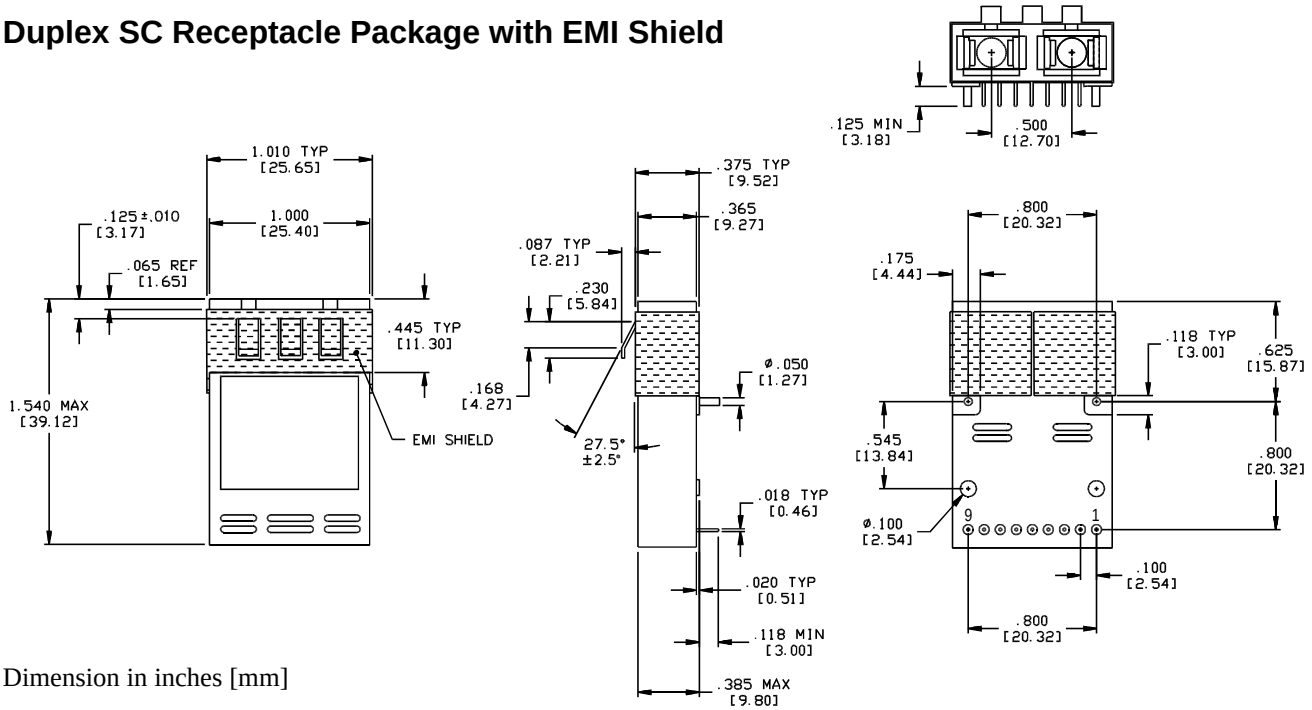


Dimension in inches [mm]

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

Duplex SC Receptacle Package with EMI Shield



Dimension in inches [mm]

Ordering Information

Module Name	Connector	EMI Shield	Coupling
DTR-1250-SM-*Yn*	SC	NO	DC
DTR-1250-SM-ES-*Yn*	SC	YES	DC
DTR-1250-SM-AC-*Yn*	SC	NO	AC
DTR-1250-SM-AE-*Yn*	SC	YES	AC

Module Name	Connector	EMI Shield	Coupling
DTR-1250-SM-ST-*Yn*	ST	NO	DC
DTR-1250-SM-SA-*Yn*	ST	NO	AC
DTR-1250-SM-FC-*Yn*	FC	NO	DC
DTR-1250-SM-FA-*Yn*	FC	NO	AC

Options for *Yn*: L2 (1000BASE-LX compliant), L1 (10 km), L0 (higher power Fabry Perot lasers), H3 (25 to 30 km with 1300 nm DFB laser), H5 (40 km with 1550 nm DFB laser), H7 (70 km with 1550 nm DFB laser)

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Contents

Description **1**
Absolute Maximum Ratings **1**
Transmitter Electrical Interface **2**
Receiver Electrical Interface **2**
Electrical Power Supply Characteristics **2**
Application Notes **2**
Transmitter Performance Characteristics **3**
Receiver Performance Characteristics **3**
FC Receptacle Package **3**
Duplex SC Receptacle Package **4**
Duplex SC Receptacle Package with EMI Shield **4**
Ordering Information **4**