



#### Features

- ☑ Compliant with GBIC Specification, Rev. 5.5
- ☑ Compliant with IEEE 802.3z 1000BASE-LX Specifications for Gigabit Ethernet (except for higher TX optical power and 1550nm center wavelength option)
- ☑ Compliant with Optical Interface Requirements in Annex F of GBIC Specification, Rev. 5.5 (except for higher TX optical power and 1550nm center wavelength option)
- ☑ Compliant with GBIC Serial Module Definition Protocol (Module Definition 4 in Annex D)
- ☑ Hot-pluggable
- ☑ Four Distance Options with Single Mode Fiber: 42km, 68km, 72km and 80km (Please see note on Distance in Ordering Information section)
- ☑ Excellent EMI & ESD Protection
- ☑ Eye Safe (Class I or 1M Laser Safety)

#### Description

The DTR-1250-SM-GB-I product family of GBICs provides long haul, single mode solutions for 1000BASE-LX Gigabit Ethernet ports in a networking switch. OCP offers four distance options to support 42km, 68km, 72km and 80km links in the networking infrastructure. Option “H3” uses a 1310nm DFB laser and provides a minimum optical link budget of 19dB, corresponding to a minimum distance of 42km, assuming fiber loss of 0.35dB/km. Options “H5”, “H7” and “H8” use 1550nm DFB lasers, and provide minimum optical link budgets of 21dB, 22dB and 24dB respectively. Each corresponds to minimum distances of 68km, 72km and 80km respectively, assuming fiber loss of 0.25dB/km. All transceivers are Class I Laser products per U.S. FDA/CDRH standards. The “H3”, “H5” and “H7” transceivers are Class I Laser products while the “H8”

transceivers are Class 1M Laser products per international IEC-825 standards.

The DTR-1250-SM-GB-I transceivers are fully compliant with Annex F of GBIC specification, Rev. 5.5 (except for higher TX optical power and 1550nm center wavelength option).

The transceivers connect to standard 20-pad GBIC connectors for hot plug capability. This allows the system designer to make configuration changes or maintenance by simply plugging in different types of GBICs without removing the power supply from the host system.

The transceivers operate from a single +5V power supply over an operating case temperature range of -5°C to +70°C.

#### Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	$T_{st}$	- 40	+ 85	°C
Operating Case Temperature	$T_{op}$	- 5	+ 70	°C
Supply Voltage	$V_{DD}$	0	+ 6.0	V
Input Voltage	$V_{in}$	0	$V_{DD}$	V

# DTR-1250-SM-GB-I

## Transmitter Performance Characteristics (over Operating Case Temperature, $V_{CC} = 4.75$ to $5.25V$ ) All parameters guaranteed only at typical data rate

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate <sup>1</sup>		$B$	-	1250	-	Mb/s
Optical Output Power <sup>2</sup>	H3	$P_o$	- 4.0	-	+ 1.0	dBm
	H5, H7		- 2.0	-	+ 3.0	
	H8		0	-	+ 5.0	
Center Wavelength	H3	$\lambda_c$	1280	1310	1335	nm
	H5, H7, H8		1500	1550	1580	
Spectral Width (-20dB)		$\Delta\lambda_{20}$	-	-	1.0	nm
Extinction Ratio		$P_{hi}/P_{lo}$	9	-	-	dB
Transmitter Disabled Optical Output Power <sup>2</sup>		$P_{dis}$	-	-	- 35.0	dBm
Deterministic Jitter		$DJ$	-	-	80	ps
Total Jitter		$TJ$	-	-	227	ps
Relative Intensity Noise		$RIN$	-	-	- 120	dB/Hz
Dispersion Penalty <sup>3</sup>	H5, H7	-	-	-	1.2	dB
	H8		-	-	1.5	
Transmitter Output Eye		Compliant with Eye Mask Defined in IEEE 802.3z standard				
<sup>1</sup> Data rate ranges from 125Mb/s to 1300Mb/s. However, some degradation may be incurred in overall performance. <sup>2</sup> Measured average power coupled into single mode fiber with $2^7-1$ PRBS at 1250Mb/s. <sup>3</sup> Specified at 1360ps/nm (for H5), 1440ps/nm (for H7) and 1600ps/nm (for H8) dispersion, which corresponds to the approximate worst-case dispersion for 68km, 72km and 80km G.652/G.654 fiber respectively over the wavelength range of 1500 to 1580nm.						

## Receiver Performance Characteristics (over Operating Case Temperature, $V_{CC} = 4.75$ to $5.25V$ ) All parameters guaranteed only at typical data rate

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate <sup>1</sup>		$B$	-	1250	-	Mb/s
Minimum Input Optical Power (10 <sup>-12</sup> BER) <sup>2</sup>	H3, H5	$P_{min}$	- 23.0	-	-	dBm
	H7, H8		- 24.0	-	-	
Maximum Input Optical Power (10 <sup>-12</sup> BER) <sup>2</sup>		$P_{max}$	- 3.0	-	-	dBm
RX_LOS Thresholds	Increasing Light Input	$P_{los+}$	-	-	- 23.0	dBm
			-	-	- 24.0	
	Decreasing Light Input		$P_{los-}$	- 35.0	-	-
RX_LOS Hysteresis		-	0.5	-	-	dB
Deterministic Jitter		$DJ$	-	-	170	ps
Total Jitter		$TJ$	-	-	266	ps
Wavelength of Operation		$\lambda$	1100	-	1600	nm
Optical Return Loss		-	12	-	-	dB
Stressed Receiver Sensitivity		Compliant with IEEE 802.3z standard				
<sup>1</sup> Data rate ranges from 125Mb/s to 1300Mb/s. However, some degradation may be incurred in overall performance. <sup>2</sup> Measured with $2^7-1$ PRBS at 1250Mb/s at 1310nm for H3, 1550nm for H5, H7 and H8.						

**Laser Safety:** All transceivers are Class I Laser products per FDA/CDRH standards. The H3, H5 and H7 transceivers are Class I Laser products while the H8 transceivers are Class 1M Laser products per 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

# DTR-1250-SM-GB-I

## Transmitter Electrical Interface (over Operating Case Temperature, $V_{CC} = 4.75$ to $5.25V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing (+TX_DAT & -TX_DAT) <sup>1</sup>	$V_{PP-DIF}$	0.65	-	2.0	V
Input HIGH Voltage (TX_DISABLE) <sup>2</sup>	$V_{IH}$	2.0	-	$V_{DD} + 0.3$	V
Input LOW Voltage (TX_DISABLE) <sup>2</sup>	$V_{IL}$	0	-	0.8	V
Output HIGH Voltage (TX_FAULT) <sup>3</sup>	$V_{OH}$	$V_{CC} - 0.5$	-	$V_{CC} + 0.3$	V
Output LOW Voltage (TX_FAULT) <sup>3</sup>	$V_{OL}$	0	-	0.5	V

<sup>1</sup>Differential peak-to-peak voltage.  
<sup>2</sup>There is an internal 5.1k $\Omega$  pull-up resistor to  $V_{DDT}$ .  
<sup>3</sup>Open collector compatible, 4.7 to 10k $\Omega$  pull-up resistor to  $V_{CC}$  (Host Supply Voltage).

## Receiver Electrical Interface (over Operating Case Temperature, $V_{CC} = 4.75$ to $5.25V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output Voltage Swing (+RX_DAT & -RX_DAT) <sup>1</sup>	$V_{PP-DIF}$	0.60	-	2.0	Vp-p
Output HIGH Voltage (RX_LOS) <sup>2</sup>	$V_{OH}$	$V_{CC} - 0.5$	-	$V_{CC} + 0.3$	V
Output LOW Voltage (RX_LOS) <sup>2</sup>	$V_{OL}$	0	-	0.5	V

<sup>1</sup>Differential peak-to-peak voltage.  
<sup>2</sup>Open collector compatible, 4.7 to 10k $\Omega$  pull-up resistor to  $V_{CC}$  (Host Supply Voltage).

## Electrical Power Supply Characteristics (over Operating Case Temperature, $V_{CC} = 4.75$ to $5.25V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	$V_{DD}$	4.75	5.0	5.25	V
Supply Current	$I_{DD}$	-	200	270	mA

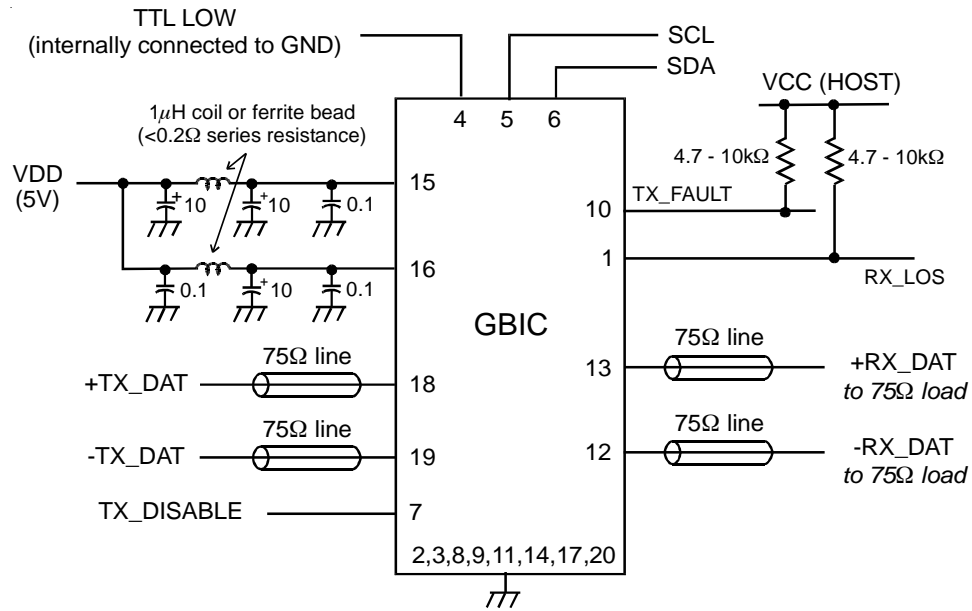
## Module Definition

Module Definition	MOD_DEF(0) pin 4	MOD_DEF(1) pin 5	MOD_DEF(2) pin 6	Interpretation by Host
4	TTL LOW	SCL	SDA	Serial module definition protocol

## Pin Assignments

PIN	FUNCTION	PIN	FUNCTION
1	RX_LOS (RX LOSS OF SIGNAL)	11	RGND (RX GROUND)
2	RGND (RX GROUND)	12	-RX_DAT (RX DATA OUT -)
3	RGND (RX GROUND)	13	+RX_DAT (RX DATA OUT +)
4	MOD_DEF(0)	14	RGND (RX GROUND)
5	MOD_DEF(1)	15	VDDR (RX SUPPLY VOLTAGE)
6	MOD_DEF(2)	16	VDDT (TX SUPPLY VOLTAGE)
7	TX_DISABLE	17	TGND (TX GROUND)
8	TGND (TX GROUND)	18	+TX_DAT (TX DATA IN +)
9	TGND (TX GROUND)	19	-TX_DAT (TX DATA IN -)
10	TX_FAULT	20	TGND (TX GROUND)

**Example of host board schematic**



**Application Notes**

**Connection of the GBIC transceiver to the host system:** The GBIC's 20-pad connector and two guide tabs connected to the transceiver's circuit ground connect the GBIC to the host system. The two ground tabs make contact to the host circuit ground before the connector pad and discharge any possible component-damaging static electricity. Additionally, surge currents are eliminated by using a special slow start circuit and two-stage contact sequence where operational signals and grounds make contact prior to the power supply (as specified in the GBIC specification, Rev. 5.5).

**Electrical interface:** All signal interfaces are compliant with the GBIC specification, Rev. 5.5. The high speed DATA interface is differential AC-coupled and can be directly connected to either a 5V or 3.3V SERDES IC. All low speed control and sense input/output signals are open collector TTL compatible and should be pulled up with a 4.7 - 10kΩ resistor on the host board.

**Loss of Signal (LOS):** The Loss of Signal circuit monitors the level of the incoming optical signal and generates a logic HIGH when an insufficient photocurrent is produced.

**TX\_FAULT:** The output indicates LOW when the transmitter is operating normally, and HIGH when the transmitter or laser current is excessive. TX\_FAULT is an open collector/drain output and should be pulled up with a 4.7 - 10kΩ resistor on the host board.

**TX\_DISABLE:** When the TX\_DISABLE pin is at logic HIGH, the transmitter optical output is disabled (less than -35dBm).

**Serial Identification:** The DTR-1250-SM-GB-I transceivers are compliant with Annex D (Module Definition 4) of the GBIC specification, Rev. 5.5, which defines the Serial Identification Protocol.

The module definition of GBIC is indicated by the three module definition pins, MOD\_DEF(0), MOD\_DEF(1) and MOD\_DEF(2). Module Definition 4 specifies a serial definition protocol with a two-wire I<sup>2</sup>C serial interface; upon power up, MOD\_DEF(1:2) appear as NC (no connection), and MOD\_DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol and generates the serial clock signal (SCL). The positive edge clocks data into the EEPROM segments of the GBIC that are not write protected, and the negative edge clocks data from the GBIC.

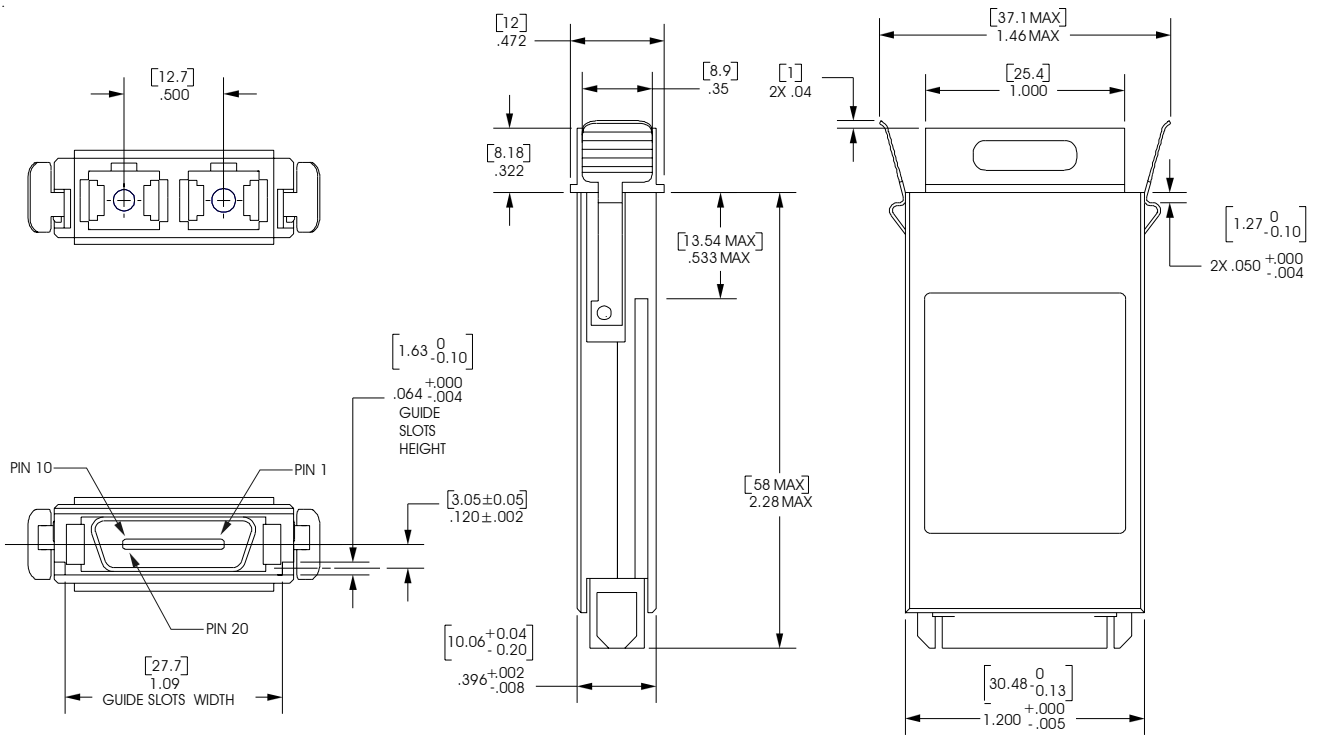
The serial data signal (SDA) is for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation.

The data transfer protocol and the details of the mandatory and vendor specific data structures are defined in Annex D of the GBIC specification, Rev. 5.5.

**Power supply and grounding:** The power supply line should be well-filtered. All 0.1µF power supply bypass capacitors should be as close to the GBIC transceiver module as possible.

# DTR-1250-SM-GB-I

## Package Outline



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

## Ordering Information

Model Name	Nominal Wavelength	Optical Link Power Budget	Distance <sup>1</sup>
DTR-1250-SM-GB-H3-I	1310nm	19dB min.	42km <sup>2</sup>
DTR-1250-SM-GB-H5-I	1550nm	21dB min.	68km <sup>3</sup>
DTR-1250-SM-GB-H7-I	1550nm	22dB min.	72km <sup>3</sup>
DTR-1250-SM-GB-H8-I	1550nm	24dB min.	80km <sup>3</sup>

<sup>1</sup>The indicated transmission distance is for guidelines only, not guaranteed. The exact distance is dependent on the fiber loss, connector and splice loss, and allocated system penalty. Longer distances can be supported if the optical link power budget is satisfied.

<sup>2</sup>Assuming a total connector and splice loss of 2dB, total system penalty of 2dB and fiber cable loss of 0.35dB/km.

<sup>3</sup>Assuming a total connector and splice loss of 2dB, total system penalty of 2dB and fiber cable loss of 0.25dB/km.

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