



#### Features

- ☑ Up to 120km with Single Mode Fiber
- ☑ APD Receiver
- ☑ Compliant with GBIC Specification, Rev. 5.5
- ☑ Compatible with IEEE 802.3z 1000BASE-LX Specifications for Gigabit Ethernet
- ☑ Compatible with Optical Interface Requirements in Annex F of GBIC Specification, Rev. 5.5
- ☑ Compliant with GBIC Serial Module Definition Protocol (Module Definition 4 in Annex D)
- ☑ Hot-pluggable
- ☑ Excellent EMI & ESD Protection
- ☑ Eye Safe (Class I or 1M Laser Safety)
- ☑ Duplex SC Optical Interface
- ☑ Single +5V Power Supply
- ☑ Up to 1250Mb/s Bi-directional Data Links

#### Description

The DTR-1250-SM-GB-HS product family of GBICs provides very long haul, single mode solutions for 1000BASE-LX Gigabit Ethernet ports in a networking switch. OCP offers two optical link power budget options to support 110km (H7) and 120km (H8) in the networking infrastructure. Both options use 1550nm DFB lasers and ultra high sensitivity Avalanche Photodiode (APD) receivers to provide minimum optical link power budgets of 30dB and 32dB. They correspond to transmission distances of 110km and 120km, respectively, assuming a total connector and splice loss of 2dB, total system penalty of 3dB and fiber loss of 0.22dB/km. All transceivers are

Class I Laser products per U.S. FDA/CDRH standards. The “H7” transceiver is Class I Laser product while the “H8” transceiver is Class 1M Laser product per international IEC-825 standards.

The DTR-1250-SM-GB-HS 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	+ 7.0	V
Maximum Input Optical Power (30 seconds max.)	$P_{in}$	-	+ 3.0	dBm

# DTR-1250-SM-GB-HS

## 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>	H7	- 2.0	-	+ 3.0	dBm
	H8	0	-	+ 5.0	
Center Wavelength	$\lambda_c$	1500	1550	1580	nm
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>	-	-	-	2.0	dB
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 2200ps/nm (H7) and 2400ps/nm (H8) dispersion, which corresponds to the approximate worst-case dispersion for 110km and 120km G652 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 ( $10^{-12}$ BER) <sup>2</sup>	$P_{min}$	- 32.0	- 35.0	-	dBm
Maximum Input Optical Power ( $10^{-12}$ BER) <sup>2</sup>	$P_{max}$	- 8.0	-	-	dBm
RX_LOS Thresholds	Increasing Light Input	-	-	- 32.0	dBm
	Decreasing Light Input	- 45.0	-	-	
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	$ORL$	12	-	-	dB
Electrical 3dB Upper Cutoff Frequency	-	-	-	1500	MHz

<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 and 1550nm wavelength.

**Laser Safety:** All transceivers are Class I Laser products per FDA/CDRH. The H7 transceiver is Class I Laser product while the H8 transceiver is 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-HS

## 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	-	$V_{DD} + 0.3$	V
Input LOW Voltage (TX_DISABLE) <sup>2</sup>	$V_{IL}$	0	-	0.5	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 across external 150 $\Omega$  load.

<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	$I_{DD}$	-	230	300	mA

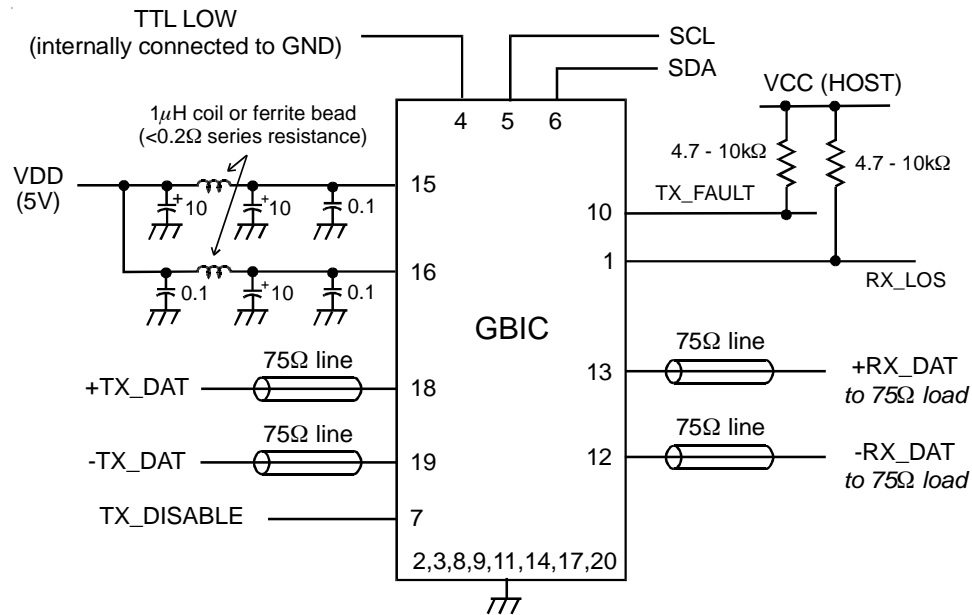
## Module Definition

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.

**RX\_LOS:** The RX 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-HS transceivers are compliant with Annex D (Module Definition 4) of the GBIC specification, Rev. 5.5, which defines the Serial Identification Protocol.

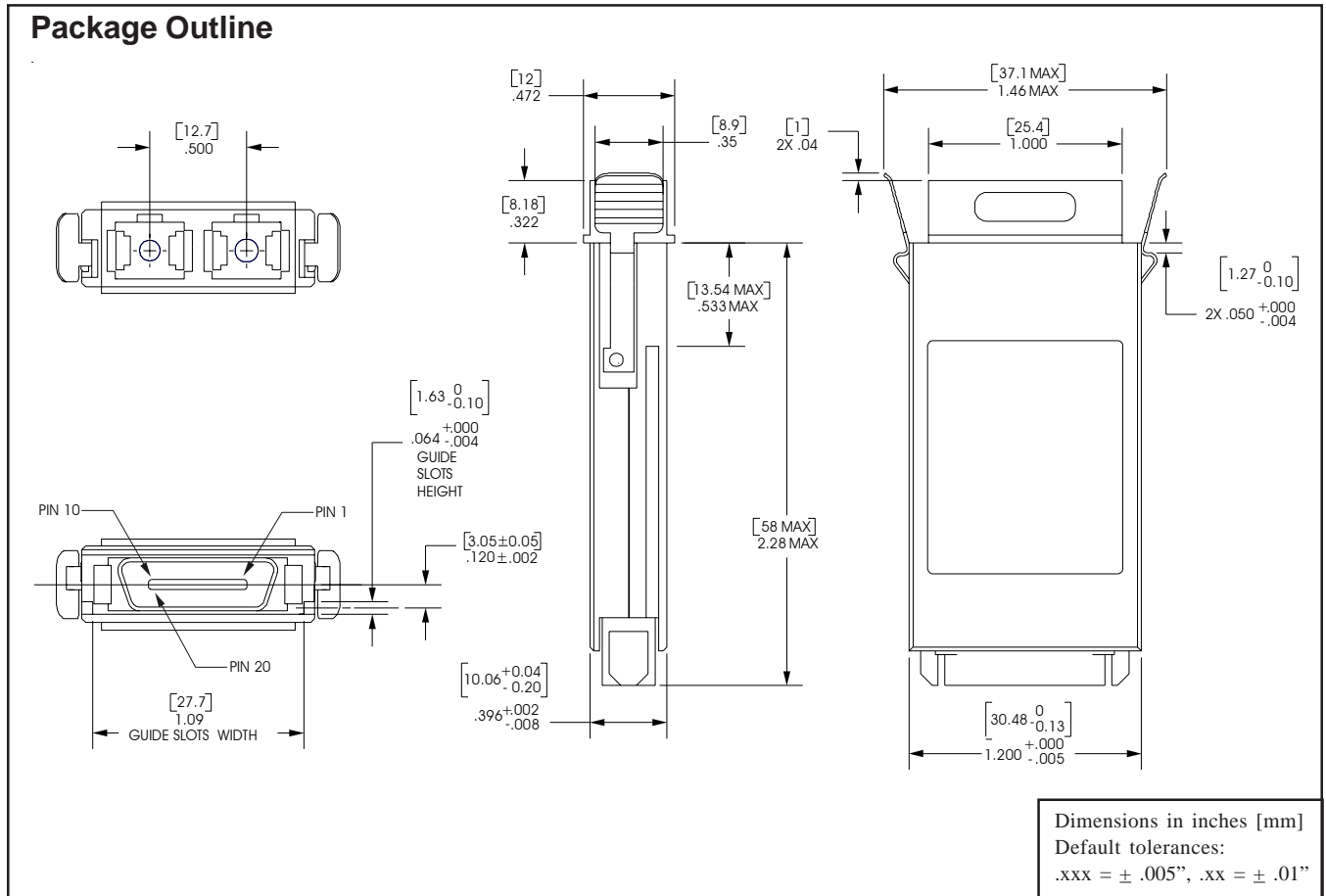
The module definition of GBIC is indicated by the three module definition pins, MOD\_DEF(0), MOD\_DEF(1) and MOD\_DEF(2). Module Definition 4 specifies a serial definition protocol with a two-wire I<sup>2</sup>C serial interface; upon power up, MOD\_DEF(1:2) appear as NC (no connection), and MOD\_DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol and generates the serial clock signal (SCL). The negative edge clocks data from the GBIC EEPROM.

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-HS



## Ordering Information

Model Name	Nominal Wavelength	Optical Link Power Budget	Distance <sup>1</sup>
DTR-1250-SM-GB-H7-HS	1550nm	30dB min.	110km <sup>2</sup>
DTR-1250-SM-GB-H8-HS	1550nm	32dB min.	120km <sup>2</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 3dB and fiber loss of 0.22dB/km.

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