



#### Features

- ☑ Up to 70km with Single Mode Fiber
- ☑ Eight (8) Wavelength CWDM Transceivers
- ☑ 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-CWDM-I product family of GBICs provides long haul, single mode solutions for 1000BASE-LX Gigabit Ethernet ports in a networking switch. The transceivers are offered with two optical link power budget options to support 62km (H7) and 70km (H8) in the networking infrastructure and are available in eight (8) wavelengths: 1470nm, 1490nm, 1510nm, 1530nm, 1550nm, 1570nm, 1590nm and 1610nm. Both options use 1550nm DFB lasers to provide minimum optical link power budgets of 22dB and 24dB. They correspond to transmission distances of 62km and 70km, respectively, assuming a total connector/splice/CWDM mux and demux loss of 4.5dB, allocated system penalty of 2dB and fiber

loss of 0.25dB/km. All transceivers are Class I Laser products per U.S. FDA/CDRH standards. The “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-CWDM-I 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-CWDM-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>	H7	$P_o$	- 2.0	-	+ 3.0	dBm
	H8		0	-	+ 5.0	
Center Wavelength	1470	$\lambda_c$	1464	1470	1477.5	nm
	1490		1484	1490	1497.5	
	1510		1504	1510	1517.5	
	1530		1524	1530	1537.5	
	1550		1544	1550	1557.5	
	1570		1564	1570	1577.5	
	1590		1584	1590	1597.5	
	1610		1604	1610	1617.5	
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>		-	-	-	1.5	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<sup>7</sup>-1 PRBS at 1250Mb/s.  
<sup>3</sup>Specified at 1360ps/nm (H7) and 1540ps/nm (H8) dispersion, which corresponds to the approximate worst-case dispersion for 62km and 70km G652 fiber respectively over the wavelength range of 1464 to 1617.5nm.

## 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>		$P_{min}$	- 24.0	-	-	dBm
Maximum Input Optical Power (10 <sup>-12</sup> BER) <sup>2</sup>		$P_{max}$	- 3.0	-	-	dBm
RX_LOS Thresholds	Increasing Light Input	$P_{los+}$	-	-	- 24.0	dBm
	Decreasing Light Input	$P_{los-}$	- 35.0	-	-	
RX_LOS Timing Delay	Increasing Light Input	$t_{loss\_off}$	-	-	100	$\mu$ s
	Decreasing Light Input	$t_{loss\_on}$	-	-	100	
RX_LOS Hysteresis		-	0.5	-	-	dB
Deterministic Jitter		$DJ$	-	-	170	ps
Total Jitter		$TJ$	-	-	266	ps
Wavelength of Operation		$\lambda$	1260	-	1620	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<sup>7</sup>-1 PRBS.

**Laser Safety:** All transceivers are Class I Laser products per FDA/CDRH standards. The 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-CWDM-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	-	$V_{DD} + 0.3$	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	$I_{DD}$	-	200	270	mA

## Module Definition

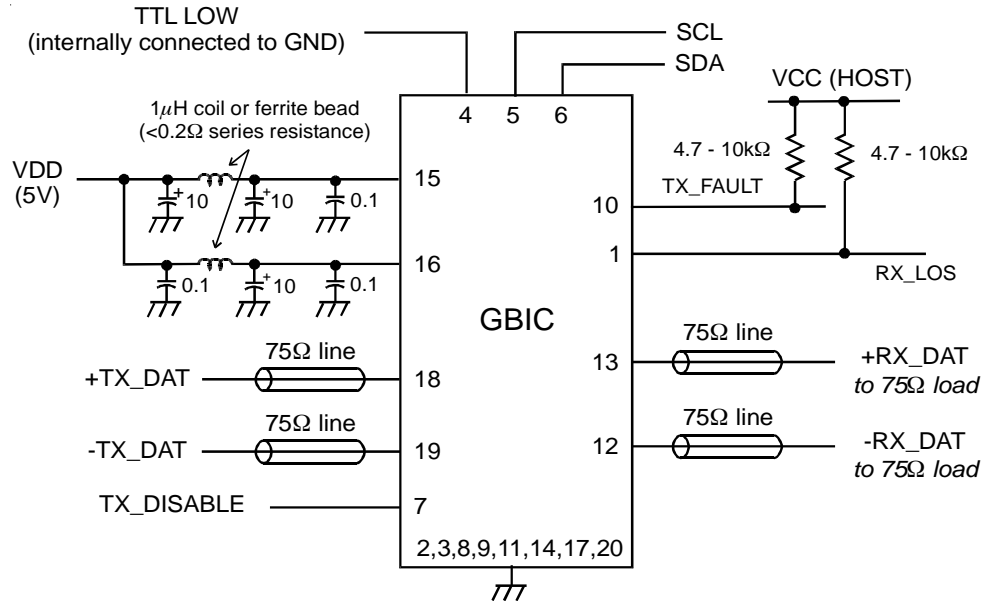
Module Definition	MOD_DEF(0) pin 4	MOD_DEF(1) pin 5	MOD_DEF(2) pin 6	Interpretation by Host
4	TTL LOW	SCL	SDA	Serial module definition protocol

## 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)

# DTR-1250-SM-GB-CWDM-I

## 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-CWDM-I transceivers are compliant with Annex D (Module Definition 4) of the GBIC specification, Rev. 5.5, which defines the Serial Identification Protocol.

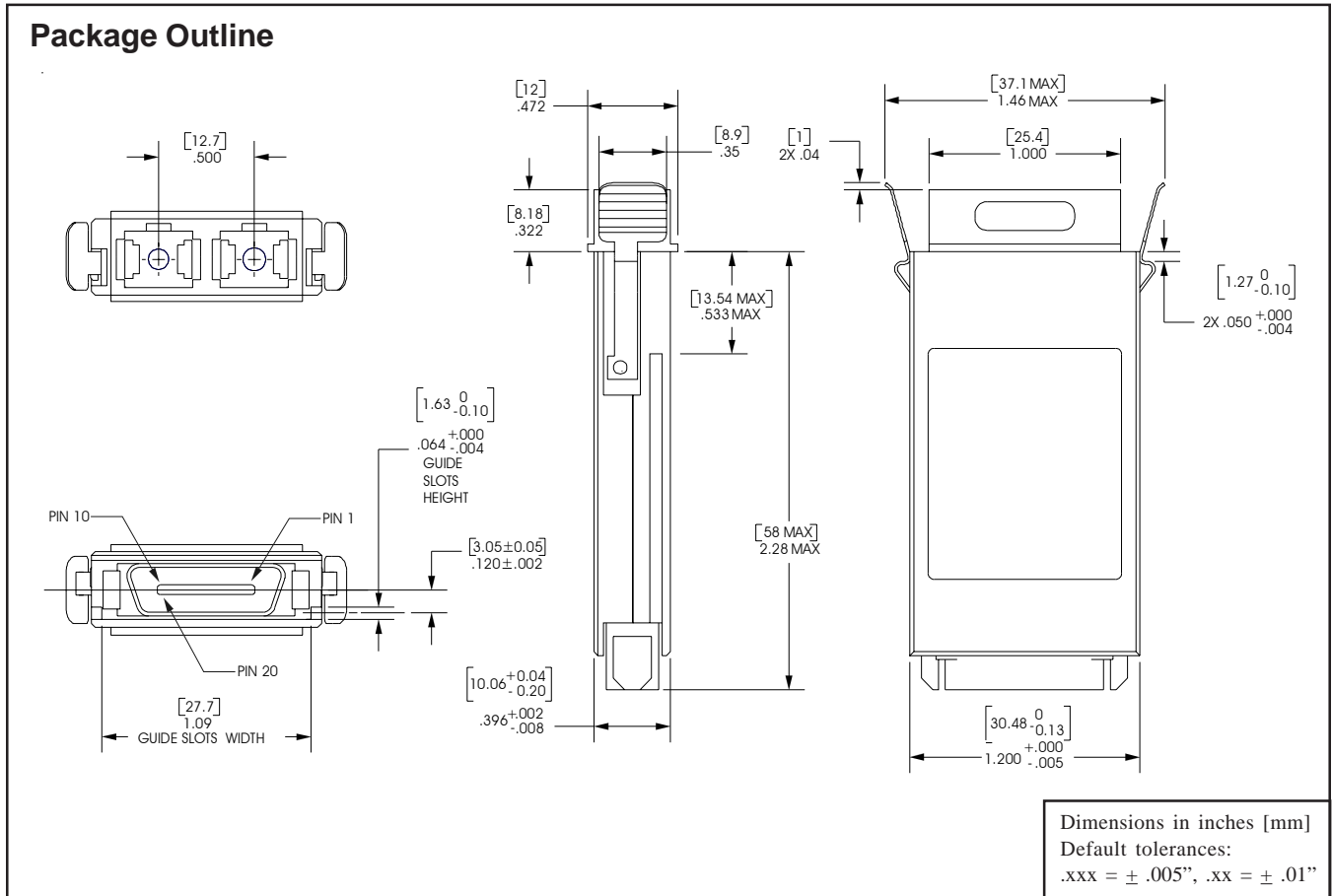
The module definition of GBIC is indicated by the three module definition pins, MOD\_DEF(0), MOD\_DEF(1) and MOD\_DEF(2). Module Definition 4 specifies a serial definition protocol with a two-wire I<sup>2</sup>C serial interface; upon power up, MOD\_DEF(1:2) appear as NC (no connection), and MOD\_DEF(0)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



## Ordering Information

Model Name		Nominal Wavelength (nm)
22dB Link Budget (62km Distance) <sup>1, 2</sup>	24dB Link Budget (70km Distance) <sup>1, 2</sup>	
DTR-1250-SM-GB-H7-C470-I	DTR-1250-SM-GB-H8-C470-I	1470
DTR-1250-SM-GB-H7-C490-I	DTR-1250-SM-GB-H8-C490-I	1490
DTR-1250-SM-GB-H7-C510-I	DTR-1250-SM-GB-H8-C510-I	1510
DTR-1250-SM-GB-H7-C530-I	DTR-1250-SM-GB-H8-C530-I	1530
DTR-1250-SM-GB-H7-C550-I	DTR-1250-SM-GB-H8-C550-I	1550
DTR-1250-SM-GB-H7-C570-I	DTR-1250-SM-GB-H8-C570-I	1570
DTR-1250-SM-GB-H7-C590-I	DTR-1250-SM-GB-H8-C590-I	1590
DTR-1250-SM-GB-H7-C610-I	DTR-1250-SM-GB-H8-C610-I	1610

<sup>1</sup>The indicated transmission distance is for guidelines only, not guaranteed. The exact distance is dependent on the fiber loss, connector/splice/CWDM mux and demux 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/splice/CWDM mux and demux loss of 4.5dB, allocated system penalty of 2dB and fiber loss of 0.25dB/km.

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