

GC1XX0-SFP-LC. 41dB/(WT)

**Single-Mode CWDM SFP 1.25Gbps FC/GBE
Duplex SFP Transceiver
RoHS6 Compliant**



Features

- ◆ Operating Data Rate up to 1.25Gbps
- ◆ 18-Wavelength CWDM DFB LD Transmitter from 1270nm to 1610nm, with Step 20nm
- ◆ Single 3.3V Power Supply and TTL Control Logic Interface
- ◆ Hot-Pluggable SFP Footprint Duplex LC Connector Interface
- ◆ Class 1 FDA and IEC60825-1 Laser Safety Compliant
- ◆ Operating Case Temperature
Standard: 0°C~+70°C
Extended: -20°C~+85°C
- ◆ Compliant with SFP MSA Specification
- ◆ Compliant with SFF-8472 Digital Diagnostic Monitor Interface

Applications

- ◆ Gigabit Ethernet Switches and Routers
- ◆ Fiber Channel Switch Infrastructure
- ◆ Other Optical Link

Ordering Information

Part No.	Data Rate	Fiber	Link Budget	Interface	Temperature	DDMI
GCxxx-SFP-LC.41dB	1.25Gbps	SMF	41dB	LC	Standard	YES
GCxxx-SFP-LC.41dB(WT)	1.25Gbps	SMF	41dB	LC	Extended	YES

Note1: Standard version, X refer to CWDM Wavelength range 1270nm to 1610nm;

*The product image only for reference purpose.

CWDM^{*NOTE2} Wavelength
Model Name : GCxxxx-SFP-LC41dB

Band	Wavelength(nm)		
	Min.	Typ. xxxx	Max.
O-band Original	1264	1270	1277.5
	1284	1290	1297.5
	1304	1310	1317.5
	1324	1330	1337.5
	1344	1350	1357.5
E-band Extended	1364	1370	1377.5
	1384	1390	1397.5
	1404	1410	1417.5
	1424	1430	1437.5
	1444	1450	1457.5
S-band Short Wavelength	1464	1470	1477.5
	1484	1490	1497.5
	1504	1510	1517.5
	1524	1530	1537.5
C-band Conventional	1544	1550	1557.5
L-band Long Wavelength	1564	1570	1577.5
	1584	1590	1597.5
	1604	1610	1617.5

Note2: Wavelengths from 1270 nm to 1610 nm, with 20 nm span. Please contact Data Controls Inc. to confirm the wavelength availability.

Regulatory Compliance*^{Note3}

Product Certificate	Certificate Number	Applicable Standard
TUV	R50135086	EN 60950-1:2006+A11+A1+A12+A2
		EN 60825-1:2014
		EN 60825-2:2004+A1+A2
UL	E317337	UL 60950-1
		CSA C22.2 No. 60950-1-07
EMC CE	AE 50384190 0001	EN 55032:2012
		EN 55032:2015
		EN 55024:2010
		EN 55024:2010+A1
'FCC	WTF14F0514417E	47 CFR PART 15 OCT., 2013
FDA	/	CDRH 1040.10
ROHS	/	2011/65/EU

Note3: The above certificate number updated to June 2018, because some certificate will be updated every year, such as FDA and ROHS. For the latest certification information, please check with Data Controls Inc..

Product Description

GC1XX0-SFP-LC.41dB single mode transceiver is small form factor pluggable module for duplex optical data communications such as Gigabit Ethernet 1000BASE-ZX and Fiber Channel 1x SM-LC-L FC-PI. It is with the SFP 20-pin connector to allow hot plug capability.

This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eighteen center wavelengths available from 1270nm to 1610nm, with each step 20nm.

The transmitter section uses a multiple quantum well CWDM DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

Absolute Maximum Ratings*

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity		-	95	%

*Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter		Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T _c	GC1XX0-SFP-LC.SXX	0	-	+70	°C
		GC1XX0-SFP-LC.SXX(WT)	-20	-	+85	
Power Supply Voltage		V _{cc}	3.15	3.3	3.45	V
Power Supply Current		I _{cc}	-	-	300	mA
Data Rate	GBE		-	1.25	-	Gbps
	FC		-	1.063	-	

Performance Specifications – Electrical

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter						
LVPECL Inputs(Differential)	V _{in}	400	-	2000	mVpp	AC coupled inputs*(Note6)
Input Impedance (Differential)	Z _{in}	85	100	115	ohm	R _{in} > 100 kohm @ DC
TX_Dis	Disable	2	-	V _{cc} +0.3	V	
	Enable	0	-	0.8		
TX_FAULT	Fault	2	-	V _{cc} +0.3	V	
	Normal	0	-	0.8		
Receiver						
LVPECL Outputs (Differential)	V _{out}	400	-	2000	mVpp	AC coupled outputs*(Note6)
Output Impedance (Differential)	Z _{out}	85	100	115	ohm	
RX_LOS	LOS	2	-	V _{cc} +0.3	V	
	Normal	0	-	0.8	V	
MOD_DEF (0:2)	VoH	2.5	-	-	V	With Serial ID
	VoL	0	-	0.5	V	

Optical and Electrical Characteristics
(GC1XX0-SFP-LC.41dB,CWDM DFB and APD, 41dB)

Parameter	Symbol	Min.	Typical	Max.	Unit
Link Budget		41	-	-	dB
Data Rate		-	1.063/1.25	-	Gbps
Transmitter					
Center Wavelength	λ _c	λ _c -6	λ _c	λ _c +7.5	nm
Spectral Width (-20dB)	Δλ	-	-	1	nm
Average Output Power*(Note4)	P _{out}	4	-	7	dBm
Side Mode Suppression Ratio	SMSR	30	-	-	dB

Extinction Ratio*(Note5)	ER	8.2	-	-	dB
Rise/Fall Time(20%~80%)	tr/tf	-	-	0.26	ns
Total Jitter	TJ	-	-	56.5	ps
Output Optical Eye*(Note5)	Compatible with IEEE 802.3ah-2004*(Note9)				
TX_Disable Assert Time	t_off	-	-	10	us
P _{out} @TX Disable Asserted	P _{out}	-	-	-45	dBm
Receiver					
Center Wavelength	λ_c	1260	-	1620	nm
Receiver Sensitivity*(Note7)	P _{min}	-	-	-37	dBm
Receiver Overload	P _{max}	-10	-	-	dBm
Return Loss		12	-	-	dB
Optical Path Penalty*(Note8)		-	-	1	dB
LOS De-Assert	LOSD	-	-	-38	dBm
LOS Assert	LOSA	-50	-	-	dBm
LOS Hysteresis*(Note10)		0.5	-	-	dB

Note4: Output is coupled into a 9/125 μ m single-mode fiber.

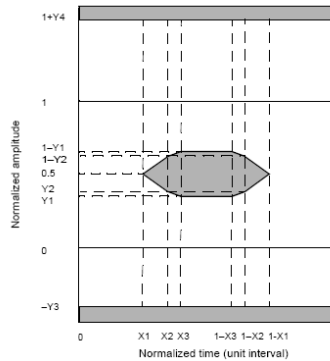
Note5: Filtered, measured with a PRBS 2⁷-1 test pattern @1.25Gbps

Note6: LVPECL logic, internally AC coupled.

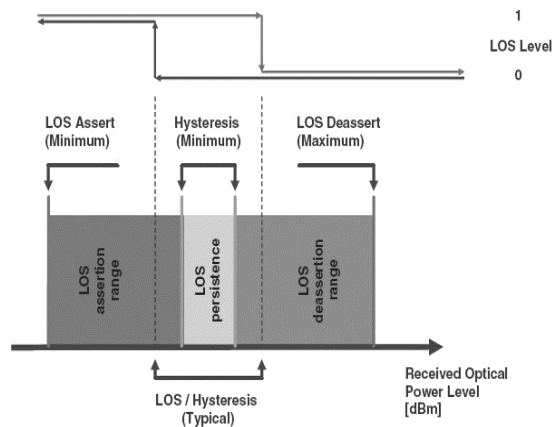
Note7: Minimum average optical power measured at BER less than 1E-12, with a 2⁷-1 PRBS and ER=9dB.

Note8: Measured with a PRBS 2⁷-1 test pattern @1.25Gbps, BER $\leq 1 \times 10^{-12}$.

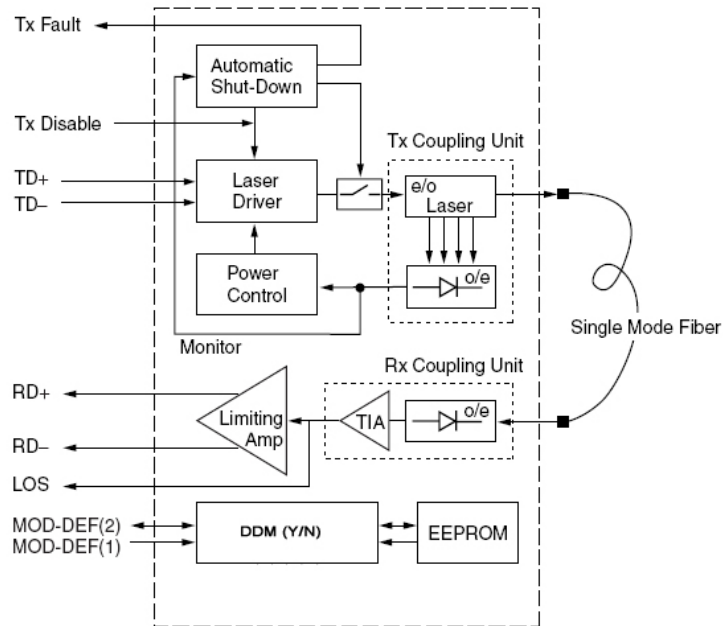
Note9: Eye Pattern Mask



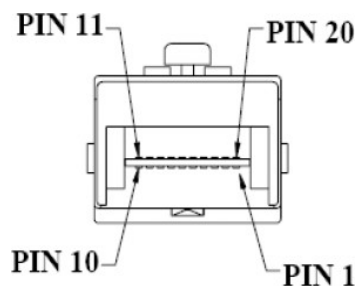
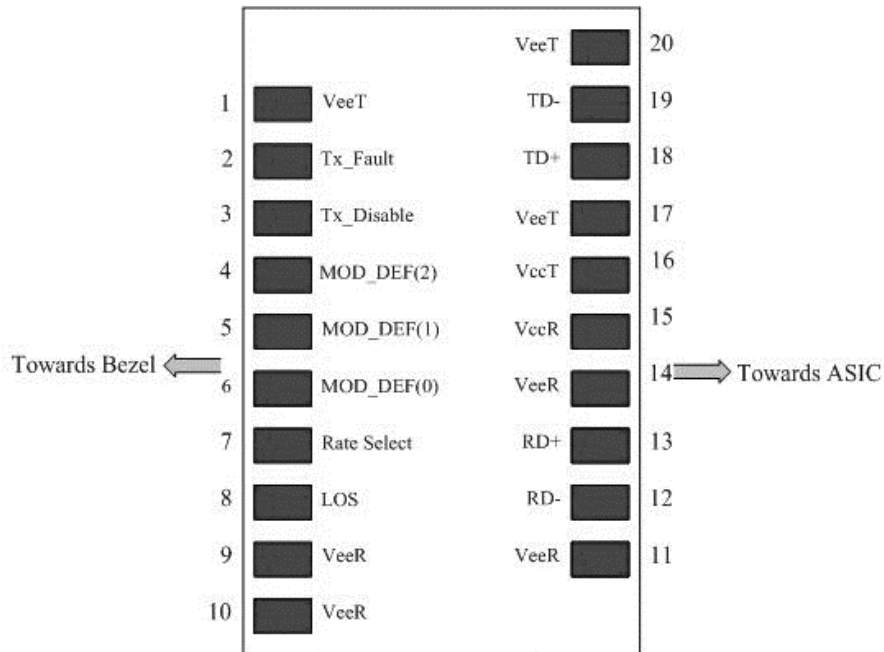
Note10: LOS Hysteresis



Functional Description of Transceiver



SFP Transceiver Electrical Pad Layout



Pin Function Definitions

Pin Num.	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	5)
2	TX Fault	Transmitter Fault Indication	3	1)
3	TX Disable	Transmitter Disable	3	2) Module disables on high or open
4	MOD-DEF2	Module Definition 2	3	3) 2 wire serial ID interface.
5	MOD-DEF1	Module Definition 1	3	3) 2 wire serial ID interface.
6	MOD-DEF0	Module Definition 0	3	3) Grounded within the module.
7	Rate Select	Not Connect	3	Function not available
8	LOS	Loss of Signal	3	4)
9	VeeR	Receiver Ground	1	5)
10	VeeR	Receiver Ground	1	5)
11	VeeR	Receiver Ground	1	5)
12	RD-	Inv. Received Data Out	3	6)
13	RD+	Received Data Out	3	6)
14	VeeR	Receiver Ground	1	5)
15	VccR	Receiver Power	2	7) 3.3 ± 5%
16	VccT	Transmitter Power	2	7) 3.3 ± 5%
17	VeeT	Transmitter Ground	1	5)
18	TD+	Transmit Data In	3	8)
19	TD-	Inv. Transmit Data In	3	8)
20	VeeT	Transmitter Ground	1	5)

Notes:

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

2) TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7 – 10 KΩ resistor. Its states are:

Low (0 – 0.8V): Transmitter on

(>0.8, < 2.0V): Undefined

High (2.0 – 3.465V): Transmitter Disabled

Open: Transmitter Disabled

3) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K – 10K resistor on the host board. The pull-up voltage shall be VccT or VccR .

Mod-Def 0 is grounded by the module to indicate that the module is present

Mod-Def 1 is the clock line of two wire serial interface for serial ID

Mod-Def 2 is the data line of two wire serial interface for serial ID

4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10K Ω resistor. Pull up voltage between 2.0V and VccT, R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

5) VeeR and VeeT may be internally connected within the SFP module.

6) RD-/+ : These are the differential receiver outputs. They are AC coupled 100 Ω differential lines which should be terminated with 100 Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 400 and 2000mV differential (200 –1000mV single ended) when properly terminated.

7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V \pm 5% at the SFP connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.

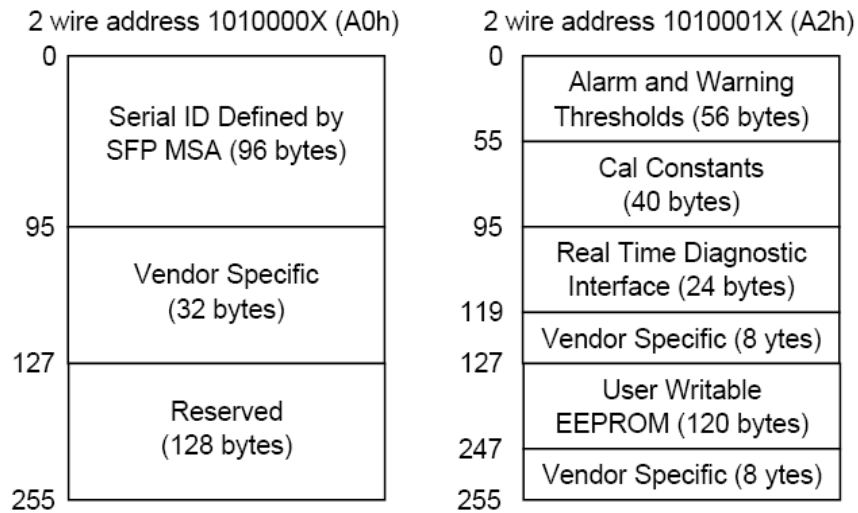
8) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 400 – 2000mV (200 – 1000mV single-ended).

EEPROM

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP transceiver. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. If the module is defined as external calibrated, the

diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2H. The digital diagnostic memory map specific data field define as following .For detail EEPROM information, please refer to the related document of SFF 8472 Rev 9.3.



EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X(A0H). Memory Contents of Serial ID are shown in Table 1. The following information is according to GC1XX0-SFP-LC.SXX.

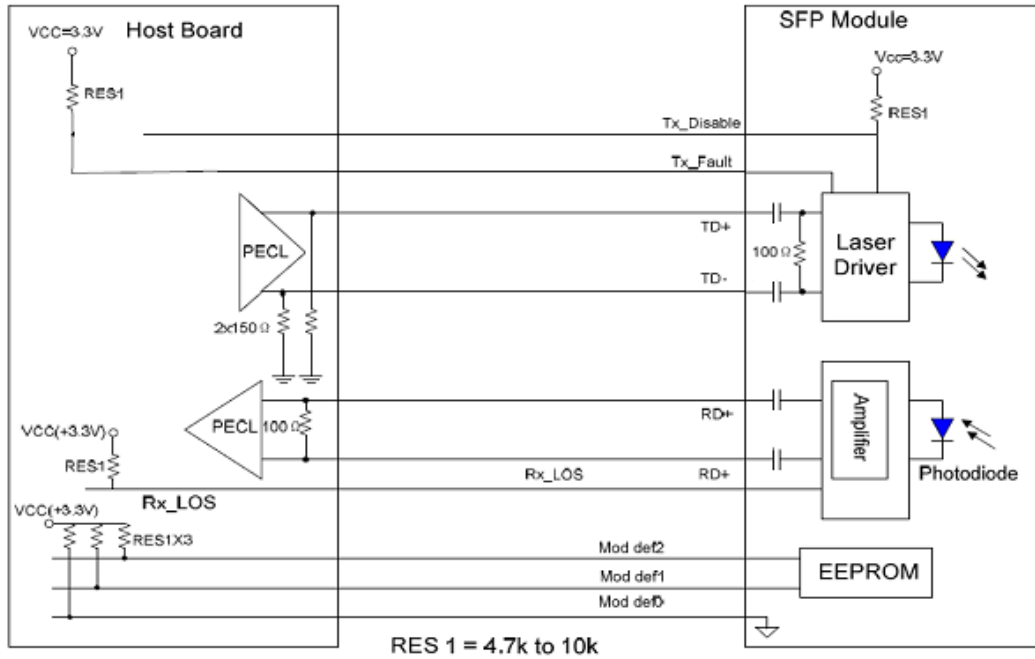
Table 1 Serial ID Memory Contents

Addr.	Size (Bytes)	Name of Field	Hex	Description
BASE ID FIELDS				
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	SFP function is defined by serial ID only
2	1	Connector	07	LC Connector
3-10	8	Transceiver	XX XX XX XX XX XX XX XX ^(note11)	Transmitter Code
11	1	Encoding	01	8B10B
12	1	BR, Nominal	0D	1.25Gbps
13	1	Reserved	00	
14	1	Length (9µm)km	XX	Transceiver transmit distance
15	1	Length(9µm)100m	XX	
16	1	Length (50µm) 10m	XX	
17	1	Length(62.5µm)10m	XX	
18	1	Length (Copper)	00	Not compliant
19	1	Reserved	00	

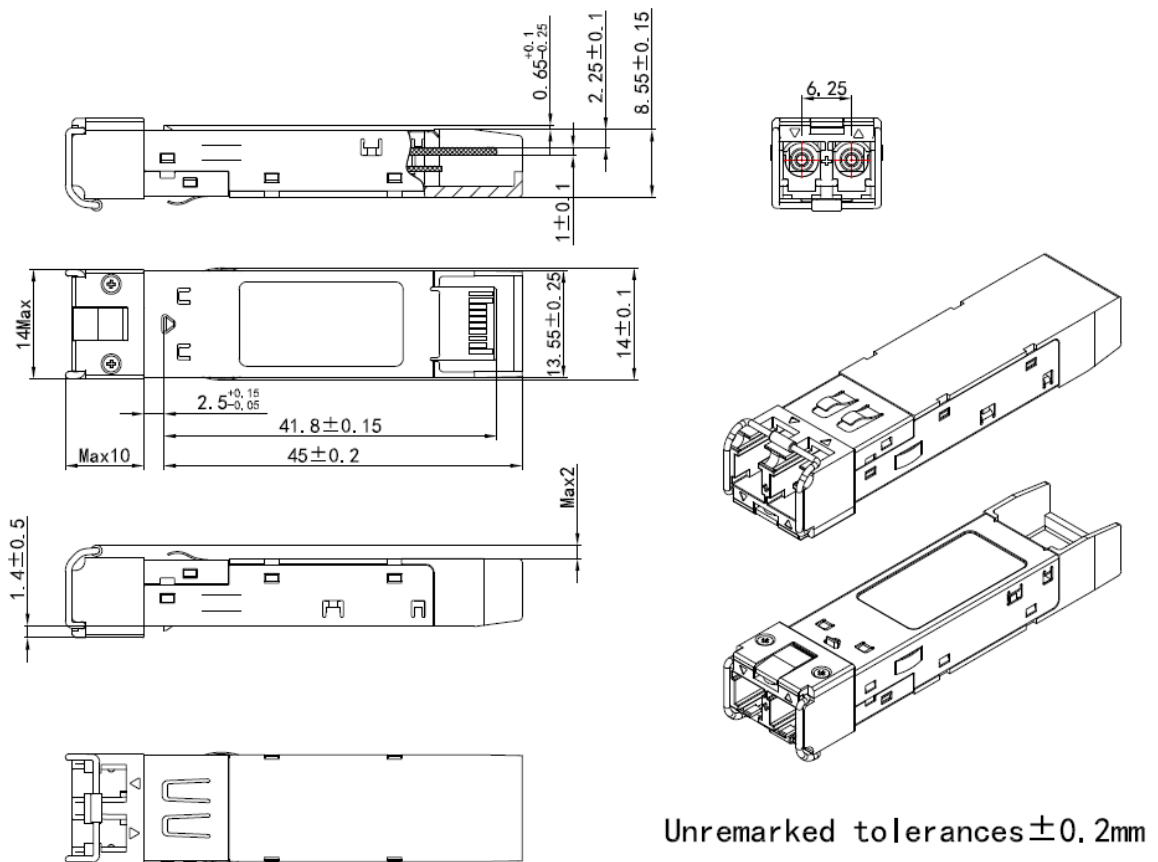
Note11: The “xx” byte should be filled in according to practical case. For more information, please refer to the related document of SFP Multi-Source Agreement (MSA).

20-35	16	Vendor name	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX ^(note11)	Vendor name
36	1	Reserved	00	
37-39	3	Vendor OUI	00 00 00	
40-55	16	Vendor PN	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX ^(note11)	Transceiver part number
56-59	4	Vendor rev	XX XX XX XX ^(note11)	
60-61	2	Wavelength	XX XX ^(note11)	Wavelength
62	1	Reserved	00	
63	1	CC_BASE	Check Sum (Variable)	Check code for Base ID Fields
EXTENDED ID FIELDS				
64-65	2	Options	00 1A	TX_DISABLE, TX_FAULT and Loss of Signal implemented.
66	1	BR, max	00	
67	1	BR, min	00	
68-83	16	Vendor SN	XX XX XX XXXX XX XX XX 20 20 20 20 20 20 20 20 ^(Note10)	Serial Number of transceiver (ASCII). For example “B000822”.
84-91	8	Date code	XX XX XX XX XX XX XX XX ^(Note10)	Manufactory date code. For example “080405”.
92	1	Diagnostic Monitoring Type	XX ^(Note10)	Digital diagnostic monitoring implemented
93	1	Enhanced Options	XX ^(Note10)	Optional flags
94	1	SFF_8472 Compliance	XX ^(Note10)	01 for Rev9.3 SFF-8472.
95	1	CC_EXT	Check Sum (Variable)	Check sum for Extended ID Field.
VENDOR SPECIFIC ID FIELDS				
96-127	32	Vendor Specific	Read only	Depends on customer information
128-255	128	Reserved	Read only	

Recommend Circuit Schematic



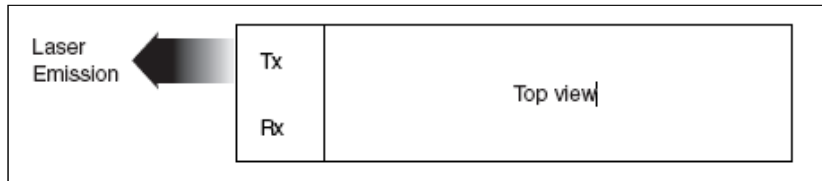
Mechanical Specifications



*This 2D drawing only for reference, please check with Data Controls Inc. before ordering.

Laser Emission Data

Wavelength	>1260nm
Total output power (as defined by FDA: 7mm aperture at 20cm distance)	<0.79Mw
Total output power (as defined by IEC: 7mm aperture at 10cm distance)	<10Mw
Beam divergence	12.5°

Laser Emission

Obtaining Document

You can visit our website: <https://www.dci.jp/>

Or contact Data Controls Inc. Listed at the end of the documentation to get the latest documents.

Revision History

Revision	Revision History	Release Date
V3.a	Released.	Sep 26, 2009
V3.b	Correct the PN in ordering information.	Sep 27, 2009
V3.c	Complete the CWDM wavelength & change logo.	Jan 20, 2010
V3.d	Updated PN.	January 18, 2011
V4.a	Update LOGO.	August 13, 2011
V4.b	Update temp. range.	Sep 21, 2011
V4.c	Update temp. range.	June 18, 2012
V4.d	Update pin definition notes	Jan 31, 2013
V4.e	Update the range of RX wavelength.	May 9, 2013
V4.f	Update regulatory compliance, LOSA&LOSD and the tolerances of mechanical spec.	Mar 20, 2015
V4.g	Add the 1625nm wavelength.	Mar 20, 2015
V4.h	Update the Tx Power, Rx sensitivity and LOSD of the 34dB products.	Mar 27, 2015
V4.i	Add 38dB budget. Update the regulatory compliance, 2D drawing and the contact information.	Oct 13, 2017
V4.j	Update the picture and 2D drawing.	March 27, 2018
V4.k	Deleted the 1625nm wavelength.	June 5, 2018
V4.l	Update the regulatory compliance and 2D drawing.	June 28, 2018

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