



**RoHS compliant  
CWDM Transceiver, 36dB margin  
Small Form Pluggable (SFP), 3.3V  
1.0625Gbd Fiber Channel/1.25 Gigabit Ethernet, DDM**



### Features

- Up to 1.25Gb/s data links
- DFB laser transmitter and APD receiver
- Up to 160km on 9/125 $\mu$ m SMF
- Hot-pluggable SFP footprint
- Duplex LC/UPC type pluggable optical interface
- Low power dissipation
- Metal enclosure, for lower EMI
- RoHS compliant and lead-free
- Single +3.3V power supply
- Support Digital Diagnostic Monitoring interface
- Compliant with SFF-8472
- Case operating temperature: 0°C to +70°C

### Application

- Distributed multi-processing
- Switch to switch interface
- High speed I/O for file server
- Bus extension application
- Channel extender, data storage

### Ordering Information

PART NUMBER	WAVELENGTH	INPUT/OUTPUT	SIGNAL DETECT	VOLTAGE	TEMPERATURE
CL-SFP-C36-L245	1450 nm	AC/AC	TTL	3.3V/5V	0°C to 70 °C
CL-SFP-C36-L247	1470 nm	AC/AC	TTL	3.3V/5V	0°C to 70 °C
CL-SFP-C36-L249	1490 nm	AC/AC	TTL	3.3V/5V	0°C to 70 °C
CL-SFP-C36-L251	1510 nm	AC/AC	TTL	3.3V/5V	0°C to 70 °C
CL-SFP-C36-L253	1530 nm	AC/AC	TTL	3.3V/5V	0°C to 70 °C
CL-SFP-C36-L255	1550 nm	AC/AC	TTL	3.3V/5V	0°C to 70 °C
CL-SFP-C36-L257	1570 nm	AC/AC	TTL	3.3V/5V	0°C to 70 °C
CL-SFP-C36-L259	1590 nm	AC/AC	TTL	3.3V/5V	0°C to 70 °C
CL-SFP-C36-L261	1610 nm	AC/AC	TTL	3.3V/5V	0°C to 70 °C



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CL-SFP-C36-L245i	1450 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C36-L247i	1470 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C36-L249i	1490 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C36-L251i	1510 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C36-L253i	1530 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C36-L255i	1550 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C36-L257i	1570 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C36-L259i	1590 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C36-L261i	1610 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C



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## I. Pin Descriptions

Pin	Symbol	Name/Description	Ref.
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault. Not supported.	
3	T <sub>DIS</sub>	Transmitter Disable. Laser output disabled on high or open.	2
4	MOD_DEF(2)	Module Definition 2. Data line for Serial ID.	3
5	MOD_DEF(1)	Module Definition 1. Clock line for Serial ID.	3
6	MOD_DEF(0)	Module Definition 0. Grounded within the module.	3
7	Rate Select	No connection required	4
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
9	V <sub>EEER</sub>	Receiver Ground (Common with Transmitter Ground)	1
10	V <sub>EEER</sub>	Receiver Ground (Common with Transmitter Ground)	1
11	V <sub>EEER</sub>	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	V <sub>EEER</sub>	Receiver Ground (Common with Transmitter Ground)	1
15	V <sub>CCR</sub>	Receiver Power Supply	
16	V <sub>CCT</sub>	Transmitter Power Supply	
17	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1

### Notes:

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k - 10kohms on host board to a voltage between 2.0V and 3.6V. MOD\_DEF (0) pulls line low to indicate module is plugged in.
4. This is an optional input used to control the receiver bandwidth for compatibility with multiple data rates (most likely Fiber Channel 1x and 2x Rates). If implemented, the input will be internally pulled down with > 30kΩ resistor. The input states are:
  - Low (0 – 0.8V): Reduced Bandwidth
  - (>0.8, < 2.0V): Undefined
  - High (2.0 – 3.465V): Full Bandwidth
  - Open: Reduced Bandwidth
5. LOS is open collector output should be pulled up with 4.7k - 10kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.



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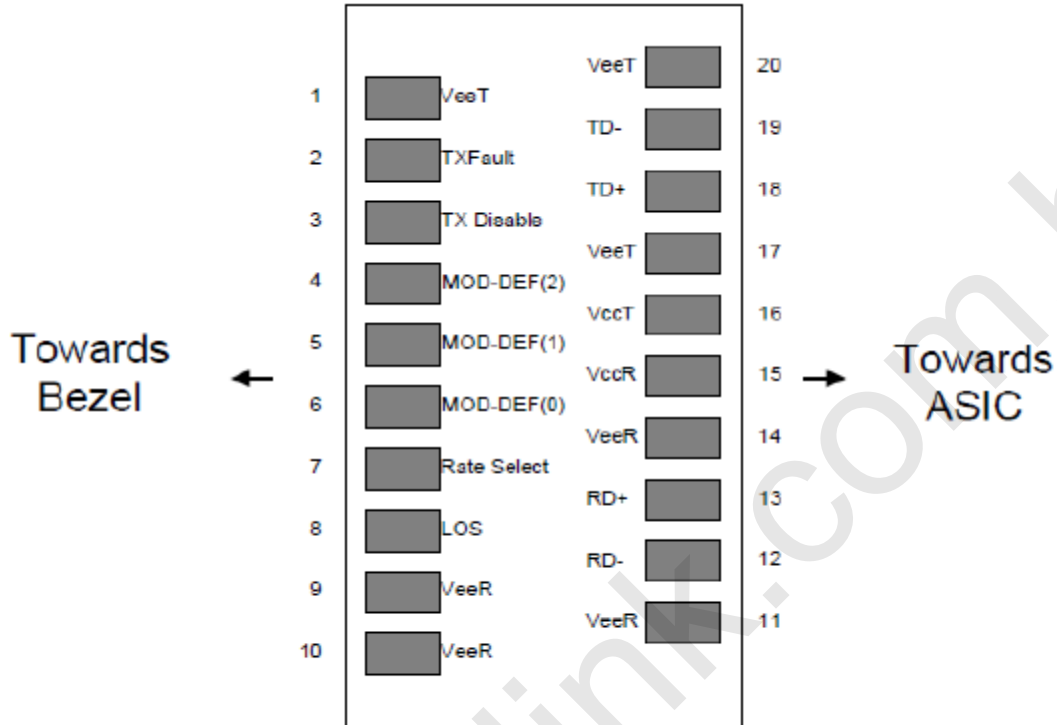


Figure2. Pin out of Connector Block on Host Board

## II. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Temperature	Ts	-40		85	°C	
Storage Ambient Humidity	HA	5		95	%	
Power Supply Voltage	VCC	-0.5		4	V	
Signal Input Voltage		-0.3		Vcc+0.3	V	
Receiver Damage Threshold		5			dBm	



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### III. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note	
Case Operating Temperature	T <sub>case</sub>	0		70	°C		
Ambient Humidity	HA	5		70	%	Non-condensing	
Power Supply Voltage	VCC	3.13	3.3	3.47	V		
Power Supply Current	ICC			300	mA		
Power Supply Noise Rejection				100	mVp-p	100Hz to 1MHz	
Data Rate			1250/1250		Mbps	TX Rate/RX Rate	
Transmission Distance				160	KM		
Coupled Fiber		Single mode fiber					9/125um SMF

### IV. Specification of Transmitter

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Average Output Power	P <sub>OUT</sub>	2		6	dBm	
Extinction Ratio	ER	9			dB	
Center Wavelength	$\lambda_c$	(1XX0)- $\Delta\lambda$	1XX0	(1XX0)+ $\Delta\lambda$	nm	DFB Laser Note (1)
Side Mode Suppression Ratio	SMSR	30			dB	
Spectrum Bandwidth(-20dB)	$\sigma$			1	nm	
Transmitter OFF Output Power	P <sub>OFF</sub>			-45	dBm	
Differential Line Input Impedance	R <sub>IN</sub>	90	100	110	Ohm	
Jitter Peak-Peak	t <sub>j</sub>			120	ps	Note (2)
Output Eye Mask	Compliant with IEEE802.3 z (class 1 laser safety)					Note (3)

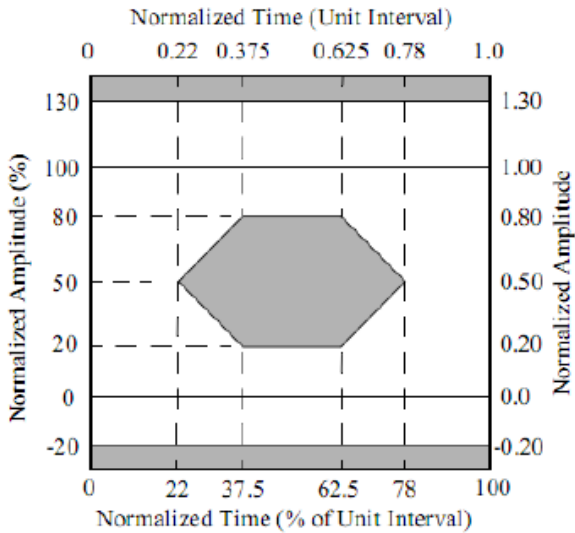
Note (1): "XX" is: 27,29,31,33,35,37,39,41,43,45,47,49,51,53,55,57,59 and 61; " $\Delta\lambda$ " is 7.5

Note (2): Measure at 2<sup>-7</sup>-1 NRZ PRBS pattern

Note (3): Transmitter eye mask definition



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## V. Specification of Receiver

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Input Optical Wavelength	$\lambda_{IN}$	1270		1610	nm	APD
Receiver Sensitivity	$P_{IN}$			-35	dBm	Note (1)
Input Saturation Power (Overload)	$P_{SAT}$	-10			dBm	
Los Of Signal Assert	$P_A$			-36	dBm	
Los Of Signal De-assert	$P_D$	-42			dBm	Note (2)
LOS Hysteresis	$P_A-P_D$	0.5	2	6	dB	

Note (1): Measured with Light source 1XX0 nm, ER=9dB; BER  $\leq 10^{-12}$  @PRBS=2<sup>7</sup>-1 NRZ

Note (2): When LOS de-asserted, the RX data+/- output is High-level (fixed)



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## VI. Electrical Interface Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
<i>Transmitter</i>						
Total Supply Current	I <sub>CC</sub>			A	mA	Note (1)
Transmitter Disable Input-High	V <sub>DISH</sub>	2		V <sub>CC</sub> +0.3	V	
Transmitter Disable Input-Low	V <sub>DISL</sub>	0		0.8	V	
Transmitter Fault Input-High	V <sub>DISL</sub>	2		V <sub>CC</sub> +0.3	V	
Transmitter Fault Input-Low	V <sub>TRFH</sub>	0		0.8	V	
<i>Receiver</i>						
Total Supply Current	I <sub>CC</sub>			B	mA	Note (1)
LOSS Output Voltage-High	V <sub>LOSH</sub>	2		V <sub>CC</sub> +0.3	V	LVTTL
LOSS Output Voltage-Low	V <sub>LOSL</sub>	0		0.8	V	

Note (1): A (TX) + B (RX) = 300mA (Not include termination circuit)

## VII. Digital Diagnostic Functions

Carelink CL-SFP-C36-L2XX transceivers support the 2-wire serial communication protocol as defined in the SFP MSA. It is very closely related to the E2PROM defined in the GBIC standard, with the same electrical specifications.

The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, Carelink SFP transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

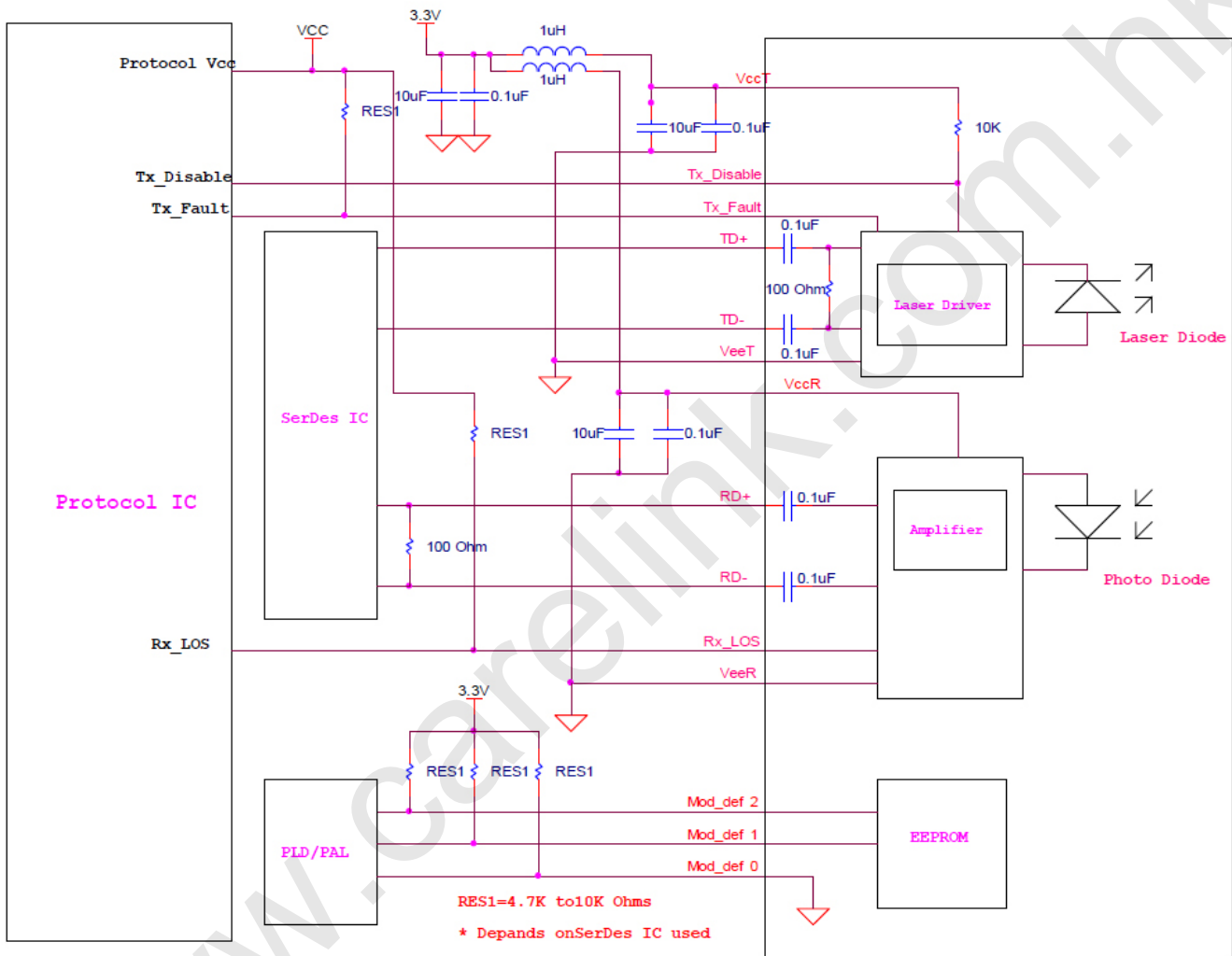
The SFP MSA defines a 256-byte memory map in E2PROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged. The interface is identical to, and is thus fully backward compatible with both the GBIC Specification and the SFP Multi Source Agreement.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) 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.



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### VIII. Recommend Circuit Schematic

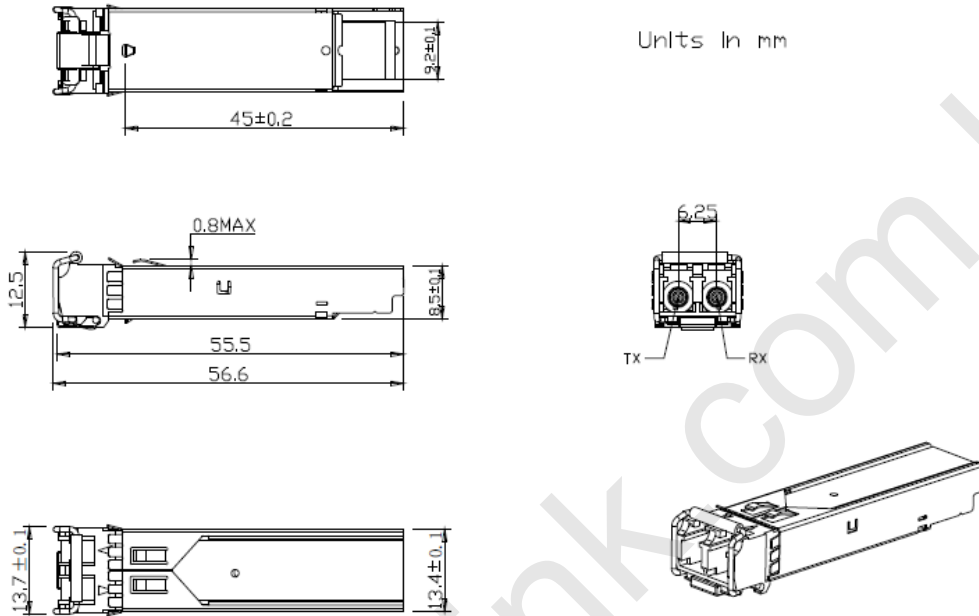






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**IX. Mechanical Specifications** (Unit: mm)



**X. Regulatory Compliance**

Feature	Reference	Performance
Electrostatic discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2	Class 1 laser product
Component Recognition	IEC/EN 60950 , UL	Compatible with standards
ROHS	2002/95/EC	Compatible with standards
EMC	EN61000-3	Compatible with standards



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### Eye Safety Mark

The LM2 series multimode transceiver is a class 1 laser product. It complies with EN 60825-1 and FDA 21 CFR 1040.10 and 1040.11. In order to meet laser safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.

**Caution**

All adjustments have been done at the factory before the shipment of the devices. No maintenance and user serviceable part is required. Tampering with and modifying the performance of the device will result in voided product warranty.

**Required Mark**

Class 1 Laser Product  
Complies with  
21 CFR 1040.10 and 1040.11

Note : All information contained in this document is subject to change without notice.