

## DATA SHEET

### MODULETEK –SFP-GE-CWDM-xxxx-38DB-C10

1.25Gb/s SFP (Small Form Pluggable) CWDM (1470nm –1610nm) Transceiver

#### SFP-GE-CWDM-xxxx-38DB-C10 Overview

ModuleTek' s SFP-GE-CWDM-xxxx-38DB-C10 CWDM SFP optical transceivers are designed for operation in Metro Access Rings and Point to Point networks using Gigabit Ethernet and Fiber Channel networking equipment. They are available in 8 different CWDM wavelengths, from 1470nm to 1610nm. Digital diagnostics functions are available via a 2-wire serial bus. In addition, they comply with the small form factor pluggable multi-source agreement (MSA) and SFF-8472.

#### Product Features

- Up to 1.25 Gb/s bi-directional data links
- Compliant with IEEE 802.3z Gigabit Ethernet standard
- Compliant with Fiber Channel 100-SM-LL-V standard
- Compliant with SFP MSA
- Hot-pluggable SFP footprint
- Uncooled DFB laser transmitter in 8 possible CWDM wavelengths
- Receiver with APD
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 160km on 9/125um SMF
- Single power supply 3.3V
- RoHS Compliant
- Class 1 laser product complies with EN 60825–1
- Operating temperature range: 0°C to 70°C

#### Applications

- 1.25 Gb/s Gigabit Ethernet
- 1.063 Gb/s Fiber Channel

## Ordering Information

Part Number	Description	Color on Clasp
SFP-GE-CWDM-1470-38DB-C10	GE/GE/FC SFP CWDM 1470nm SMF 38dB 160km with DOM function	Gray
SFP-GE-CWDM-1490-38DB-C10	GE/GE/FC SFP CWDM 1490nm SMF 38dB 160km with DOM function	Violet
SFP-GE-CWDM-1510-38DB-C10	GE/FC SFP CWDM 1510nm SMF 38dB 160km with DOM function	Blue
SFP-GE-CWDM-1530-38DB-C10	GE/FC SFP CWDM 1530nm SMF 38dB 160km with DOM function	Green
SFP-GE-CWDM-1550-38DB-C10	GE/FC SFP CWDM 1550nm SMF 38dB 160km with DOM function	Yellow
SFP-GE-CWDM-1570-38DB-C10	GE/FC SFP CWDM 1570nm SMF 38dB 160km with DOM function	Orange
SFP-GE-CWDM-1590-38DB-C10	GE/FC SFP CWDM 1590nm SMF 38dB 160km with DOM function	Red
SFP-GE-CWDM-1610-38DB-C10	GE/FC SFP CWDM 1610nm SMF 38dB 160km with DOM function	Brown
<b>For More Information:</b> ModuleTek Limited Web: <a href="http://www.moduletek.com">www.moduletek.com</a> Email: <a href="mailto:sales@moduletek.com">sales@moduletek.com</a>		

## General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR	0.622		1.25	Gb/s	
Bit Error Rate	BER			$10^{-12}$		
Operating Temperature	T <sub>OP</sub>	0		70	°C	1
Storage Temperature	T <sub>STO</sub>	-40		85	°C	2
Supply Current	I <sub>S</sub>		200	300	mA	3
Input Voltage	V <sub>CC</sub>	3.14	3.3	3.46	V	
Maximum Voltage	V <sub>MAX</sub>	-0.5		4	V	3

### Notes:

1. Case temperature
2. Ambient temperature

3. For electrical power interface

### Optical Characteristics – Transmitter

$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=0^{\circ}C$  to  $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Output Optical Power	$P_{TX}$	0		5	dBm	1
Optical Center Wavelength – 1470nm	$\lambda_c$	1466	1471	1477	nm	
Optical Center Wavelength – 1490nm		1486	1491	1497	nm	
Optical Center Wavelength – 1510nm		1506	1511	1517	nm	
Optical Center Wavelength – 1530nm		1526	1531	1537	nm	
Optical Center Wavelength – 1550nm		1546	1551	1557	nm	
Optical Center Wavelength – 1570nm		1566	1571	1577	nm	
Optical Center Wavelength – 1590nm		1586	1591	1597	nm	
Optical Center Wavelength – 1610nm		1606	1611	1617	nm	
Wavelength Temperature Dependence			0.08	0.125	nm/ $^{\circ}C$	
Extinction Ratio	ER	9			dB	
Side Mode Suppression Ratio	SMSR	30			dB	
Spectral Width (–20dB)	$\Delta\lambda$			1	nm	
Optical Rise/Fall Time (20%-80%)	$t_r / t_f$			180	ps	
Relative Intensity Noise	RIN			–120	dB/Hz	
Transmitter Jitter (peak to peak)	TJ			130	ps	
Output Eye	Compliant with IEEE 802.3z					

**Notes:**

1. Class 1 Product

## Optical Characteristics –Receiver

$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=0^{\circ}C$  to  $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Receiver Power	$P_{RX}$			-9	dBm	
Optical Center Wavelength	$\lambda_C$	1270		1620	nm	
Receiver Sensitivity @ 1.25Gb/s	$R_{X\_SEN}$			-35	dBm	1
Optical Return Loss	ORL	12			dB	
LOS Assert	$LOS_A$	-42			dBm	
LOS De-Assert	$LOS_D$			-36	dBm	
LOS Hysteresis	$LOS_H$	0.5			dB	
Receiver Jitter Generation@1.25Gb/s				160	ps	2

### Notes:

1. Measured with a  $2^7-1$  测 test pattern,@1.25Gb/s,  $BER < 10^{-12}$

## Electrical - Characteristics - Transmitter

$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=0^{\circ}C$  to  $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	$R_{IN}$		100		$\Omega$	1
Single ended data input swing	$V_{IN\_PP}$	250		1200	mV	
Transmit disable voltage	$V_D$	$V_{CC}-1.3$		$V_{CC}$	V	
Transmit enable voltage	$V_{EN}$	$V_{EE}$		$V_{EE}+0.8$	V	
Transmit disable assert time				10	$\mu S$	

## Electrical - Characteristics - Receiver

$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=0^{\circ}C$  to  $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Single ended data output swing	$V_{OUT\_PP}$	300	400	800	mV	
Data output rise/fall time (20%-80%)	$T_R/T_F$		100	175	ps	
LOS Assert	$V_{LOS\_A}$	$V_{CC}-0.5$		$V_{CC\_HOST}$	V	
LOS De-Assert	$V_{LOS\_D}$	$V_{EE}$		$V_{EE}+0.5$	V	

## Digital Diagnostic Functions

SFP-GE-CWDM-xxxx-38DB-C10 supports the 2-wire serial communication protocol as defined in the SFP MSA. Digital diagnostic information is accessible over the 2-wire interface at the address 0xA2. Digital diagnostics for SFP-GE-CWDM-xxxx-38DB-C10 are internally calibrated by default. A micro controller unit inside the transceiver gathers the monitoring information and reports the status of transceiver.

**Transceiver Temperature**, internally measured, represented as a 16 bit signed twos complement value in increments of 1/256 degrees Celsius, Temperature accuracy is better than  $\pm 3$  degrees Celsius over specified operating temperature and voltage.

**Transceiver Supply Power**, internally measured, represented as a 16 bit unsigned integer with the voltage defined as the full 16 bit value (0 – 65535) with LSB equal to 100  $\mu$ Volt, yielding a total range of 0 to +6.55 Volts.

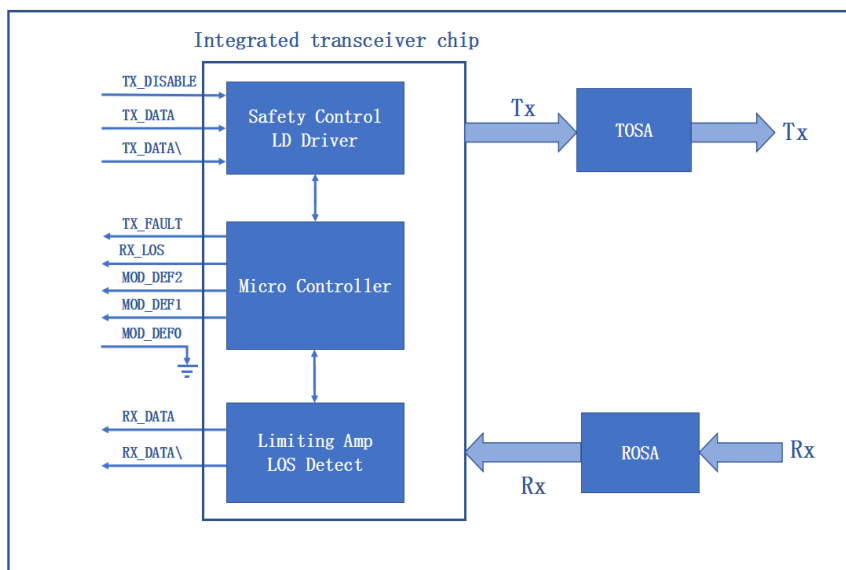
**Transceiver TX bias current**, internally measured, represented as a 16 bit unsigned integer with the current defined as the full 16 bit value (0 – 65535) with LSB equal to 2  $\mu$ A, yielding a total range of 0 to 131mA. Accuracy is better than  $\pm 10\%$  over specified operating temperature and voltage.

**Transceiver TX output power**, internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit value (0– 65535) with LSB equal to 0.1  $\mu$ W. Data is assumed to be based on measurement of laser monitor photodiode current. Accuracy is better than  $\pm 3$ dB over specified temperature and voltage. Data is not valid when the transmitter is disabled.

**Transceiver RX received optical power**, internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit 35 value (0 – 65535) with LSB equal to 0.1  $\mu$ W. Accuracy is better than  $\pm 3$ dB over specified temperature and voltage.

Parameter	Symbol	Accuracy	Units	Report Range		Unit	Remarks
Internal Calibration							
Temperature	T <sub>MON</sub>	$\pm 3$	$^{\circ}$ C	-40	95	$^{\circ}$ C	
Voltage	V <sub>MON</sub>	$\pm 0.1$	V	2.7	3.9	V	
Bias Current	I <sub>MON</sub>	$\pm 10$	%	1	80	mA	
Tx Power	P <sub>MON</sub>	$\pm 3$	dB	-5	5	dBm	
Rx Power	P <sub>MON</sub>	$\pm 3$	dB	-35	-5	dBm	

## Block-Diagram-of-Transceiver



### Transmitter Section

The DFB driver accepts differential input data and provide bias and modulation currents for driving a laser. An automatic power-control (APC) feedback loop is incorporated to maintain a constant average optical power. DFB laser in an eye safe optical subassembly (OSA) mates to the fiber cable.

### TX\_DISABLE

The TX\_DISABLE signal is high (TTL logic "1") to turn off the laser output. The laser will turn on within 1ms when TX\_DISABLE is low (TTL logic"0").

### TX\_FAULT

When the TX\_FAULT signal is high, output indicates a laser fault of some kind. Low indicates normal operation.

### Receiver Section

The receiver utilizes a APD detector integrated with a trans-impedance preamplifier in an OSA. This OSA is connected to a Limiting Amplifier which providing post-amplification quantization, and optical signal detection. The limiting Amplifier is AC-coupled to the transimpedance amplifier, with internal 100Ω differential termination.

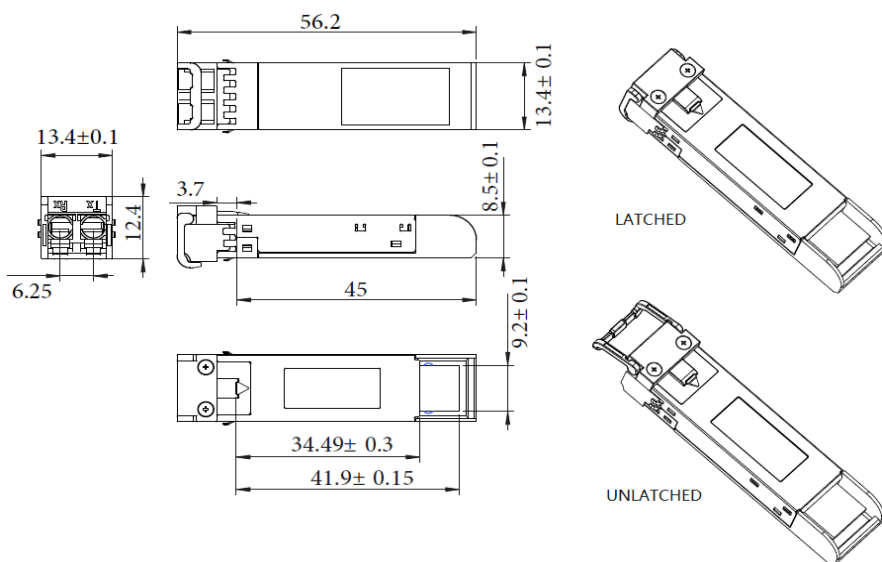
### Receive (RX\_LOS)

The RX\_LOS is high (logic "1") when there is no incoming light from the companion transceiver. This signal is normally used by the system for the diagnostic purpose. The signal is operated in TTL level.

## Controller Section

The micro controller unit monitors the operation information of LD driver and Limiting Amplifier. And report these status to the customer.

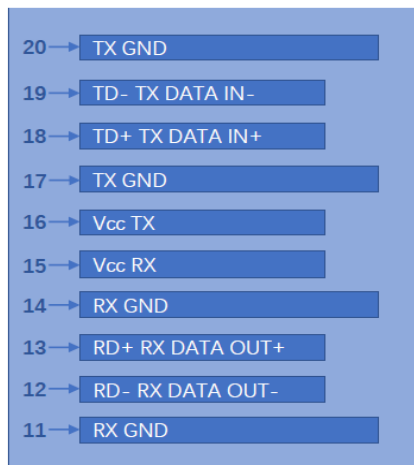
## Dimensions



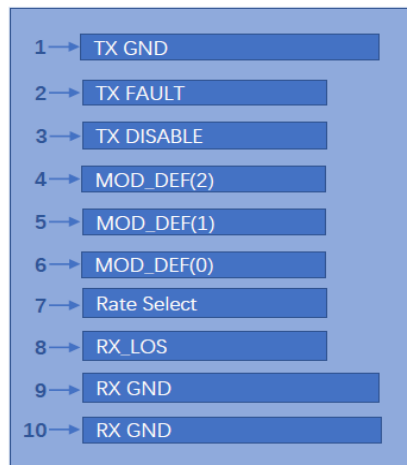
ALL DIMENSIONS ARE  $\pm 0.2$ mm UNLESS OTHERWISE SPECIFIED  
UNIT: mm



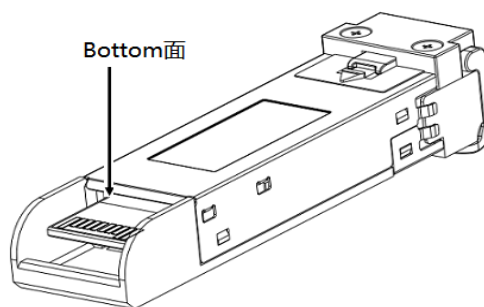
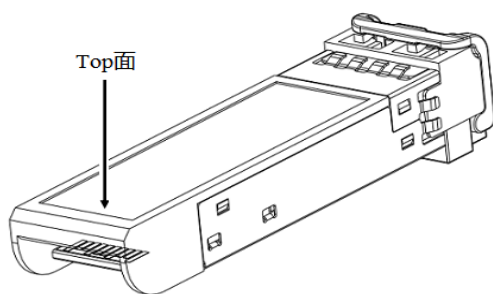
## Electrical Pad Layout



Top of Board



Bottom of Board



## Pin Assignment

PIN #	Symbol	Description	Remarks
1	V <sub>EET</sub>	Transmitter ground (common with receiver ground)	1
2	T_FAULT	Transmitter Fault. Not supported	
3	T_DIS	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	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation	4
9	V <sub>EER</sub>	Receiver ground (common with transmitter ground)	1
10	V <sub>EER</sub>	Receiver ground (common with transmitter ground)	1
11	V <sub>EER</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>EER</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 isolated from chassis ground
2. Disabled: T<sub>DIS</sub>>2V or open, Enabled: T<sub>DIS</sub><0.8V
3. Should Be pulled up with 4.7k -10k ohm on host board to a voltage between 2V and 3.6V
4. LOS is open collector output

## References

1. IEEE standard 802.3. IEEE Standard Department, 2005.
2. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), INF-8074i.
3. Fiber Channel Draft Physical Interface Specification (FC-PI-2 Rev7.0).
4. Digital Diagnostics Monitoring Interface for Optical Transceivers –SFF-8472.