

**DATA SHEET**

**MODULETEK – SFP-GE-CWDM-xxxx-26DB-C10**

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

**SFP-GE-CWDM-xxxx-26DB-C10 Overview**

ModuleTek’s SFP-GE-CWDM-xxxx-26DB-C10 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 the 2-wire serial bus. In addition, they comply to 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
- Industry standard small form pluggable (SFP) package
- Compliant with SFP MSA
- Hot-pluggable SFP footprint
- Uncooled DFB laser transmitter in 8 possible CWDM wavelengths
- Receiver with PIN
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 80km 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

**Product Identify – By Color on Clasp**

SFP-GE-CWDM-xxxx-26DB-C10							
Wavelengths	Color	Wavelengths	Color	Wavelengths	Color	Wavelengths	Color
1470nm	Gray	1510nm	Blue	1550nm	Yellow	1590nm	Red
1490nm	Violet	1530nm	Green	1570nm	Orange	1610nm	Brown

**Ordering Information**

Part Number	Description
SFP-GE-CWDM-1470-26DB-C10	GE/FC SFP CWDM 1470nm SMF 80km with DOM function
SFP-GE-CWDM-1490-26DB-C10	GE/FC SFP CWDM 1490nm SMF 80km with DOM function

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SFP-GE-CWDM-1510-26DB-C10	GE/FC SFP CWDM 1510nm SMF 80km with DOM function
SFP-GE-CWDM-1530-26DB-C10	GE/FC SFP CWDM 1530nm SMF 80km with DOM function
SFP-GE-CWDM-1550-26DB-C10	GE/FC SFP CWDM 1550nm SMF 80km with DOM function
SFP-GE-CWDM-1570-26DB-C10	GE/FC SFP CWDM 1570nm SMF 80km with DOM function
SFP-GE-CWDM-1590-26DB-C10	GE/FC SFP CWDM 1590nm SMF 80km with DOM function
SFP-GE-CWDM-1610-26DB-C10	GE/FC SFP CWDM 1610nm SMF 80km with DOM function

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**For More Information:**

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### General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR	0.622		1.25	Gb/s	
Bit Error Rate	BER			10 <sup>-12</sup>		
Operating Temperature	T <sub>OP</sub>	0		70	°C	1
Storage Temperature	T <sub>STO</sub>	- 40		85	°C	2
Operating Current	I <sub>OP</sub>			400	mA	3
Supply Current	I <sub>S</sub>		200	300	mA	4
Input Voltage	V <sub>CC</sub>	3.14	3.3	3.46	V	
Maximum Voltage	V <sub>MAX</sub>	- 0.5		4	V	4

#### Notes:

1. Case temperature
2. Ambient temperature
3. Absolute Rating
4. For electrical power interface

### Optical Characteristics – Transmitter

V<sub>CC</sub>=3.14V to 3.46V, T<sub>C</sub>=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Output Optical Power	P <sub>TX</sub>	0		5	dBm	1
Optical Center Wavelength – 1470nm	λ <sub>c</sub>	1465	1471	1477	nm	
Optical Center Wavelength – 1490nm		1485	1491	1497	nm	
Optical Center Wavelength – 1510nm		1505	1511	1517	nm	
Optical Center Wavelength – 1530nm		1525	1531	1537	nm	
Optical Center Wavelength – 1550nm		1545	1551	1557	nm	
Optical Center Wavelength – 1570nm		1565	1571	1577	nm	
Optical Center Wavelength – 1590nm		1585	1591	1597	nm	
Optical Center Wavelength – 1610nm		1605	1611	1617	nm	
Wavelength Temperature Dependence			0.08	0.125	nm/°C	
Extinction Ratio	ER	9			dB	
Side Mode Suppression Ratio	SMSR	30			dB	
Spectral Width (- 20dB)	Δλ			1	nm	
Optical Rise/Fall Time (20% - 80%)	T <sub>RF_IN</sub>			180	ps	
Relative Intensity Noise	RIN			- 120	dB/Hz	
Transmitter Jitter (peak to peak)	TJ			100	ps	
Output Eye			Compliant with IEEE 802.3z			

#### Notes:

1. Class 1 Product

### Optical Characteristics – Receiver

V<sub>CC</sub>=3.14V to 3.46V, T<sub>C</sub>=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Maximum Optical Receiver Power	P <sub>RX</sub>	0			dBm	
Optical Center Wavelength	λ <sub>c</sub>	1260		1620	nm	
Receiver Sensitivity @ 1.25Gb/s	R <sub>X_SEN</sub>			- 26	dBm	1
LOS Assert	P <sub>LOS_A</sub>	- 35			dBm	
LOS De-Assert	P <sub>LOS_D</sub>			- 26	dBm	
LOS Hysteresis			1		dB	

#### Notes:

1. Measured with a PRBS 2<sup>7</sup>-1 test pattern, @ 1.25Gb/s, BER<10<sup>-12</sup>

### Electrical Characteristics – Transmitter

V<sub>CC</sub>=3.14V to 3.46V, T<sub>C</sub>=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	R <sub>IN</sub>		100		Ω	1
Single ended data input swing	V <sub>IN_PP</sub>	250		1200	mV	
Transmit disable voltage	V <sub>D</sub>	V <sub>CC</sub> -1.3		V <sub>CC</sub>	V	
Transmit enable voltage	V <sub>EN</sub>	V <sub>EE</sub>		V <sub>EE</sub> +0.8	V	
Transmit disable assert time				10	us	

#### Notes:

1. AC Coupled

### Electrical Characteristics – Receiver

V<sub>CC</sub>=3.14V to 3.46V, T<sub>C</sub>=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Single ended data output swing	V <sub>OUT_PP</sub>	250		800	mV	
Data output rise/fall time (20%-80%)	T <sub>R</sub>		100	175	ps	
LOS Assert	V <sub>LOS_Fault</sub>	V <sub>CC</sub> -0.5		V <sub>CC_HOST</sub>	V	
LOS De-Assert	V <sub>LOS_Normal</sub>	V <sub>EE</sub>		V <sub>EE</sub> +0.5	V	

### Digital Diagnostic Functions

SFP-GE-CWDM-xxxx-26DB-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-26DB-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 ±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.

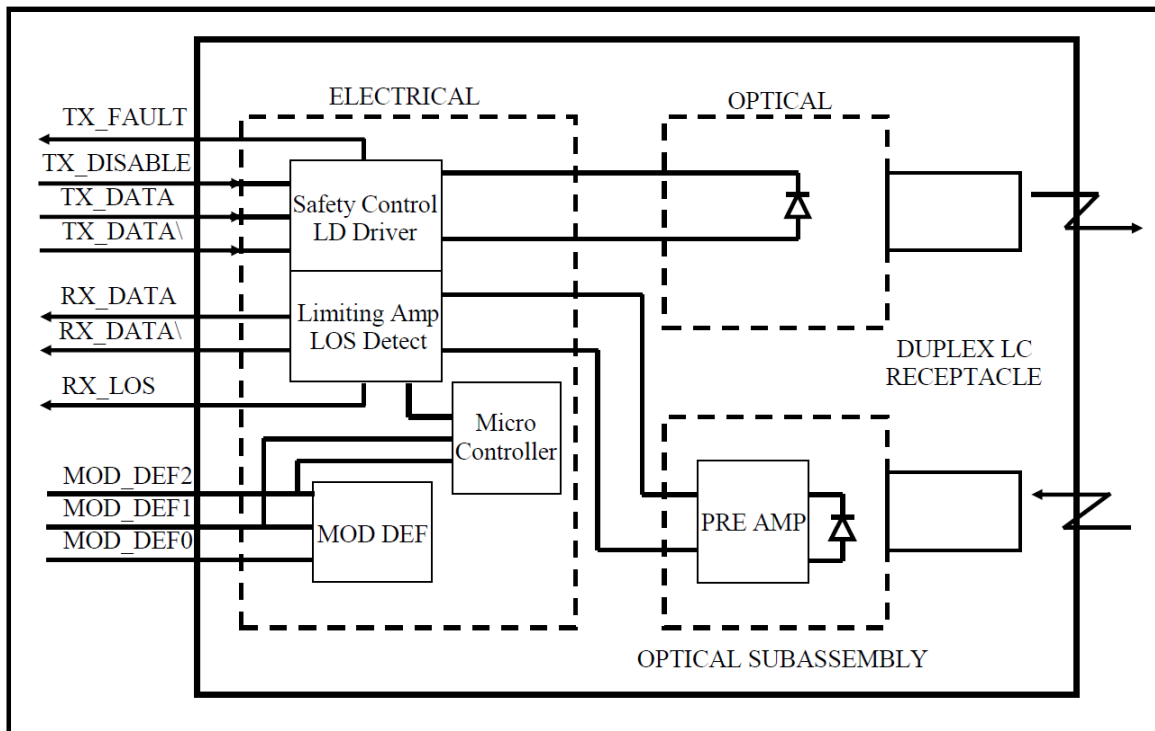
**Transceiver TX bias current**, internally measured, represented as a 16 bit unsigned integer with the current defined as the full 16 bit value (0 – 65535) with LSB equal to 2  $\mu$ A, yielding a total range of 0 to 131mA. Accuracy is better than  $\pm 10\%$  over specified operating temperature and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

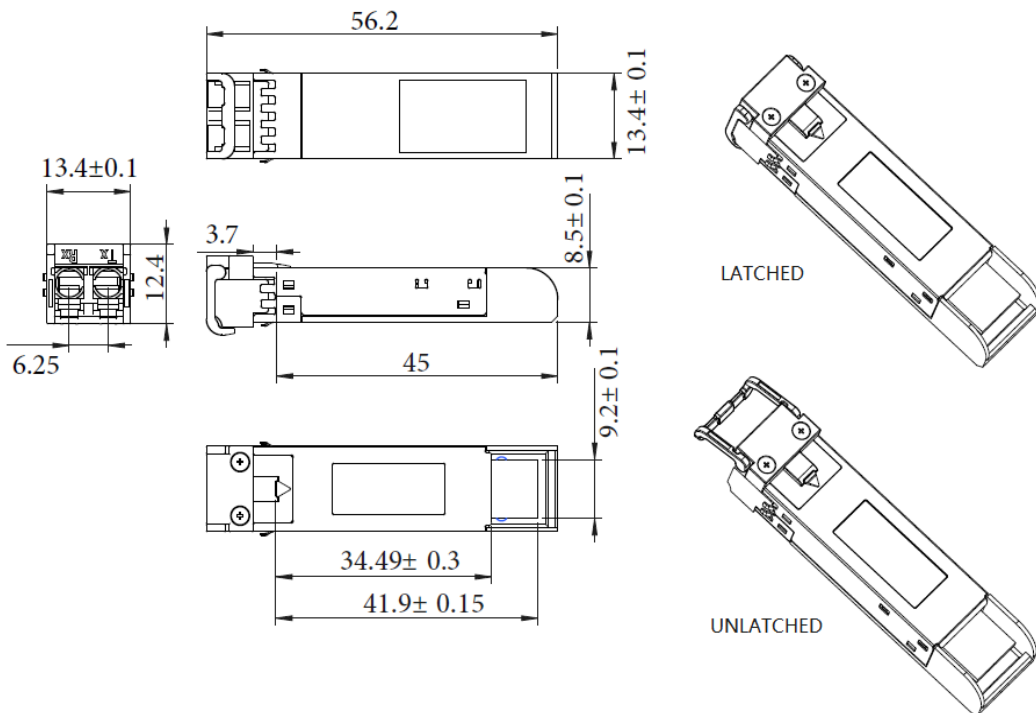
### Receive Loss (RX\_LOS)

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

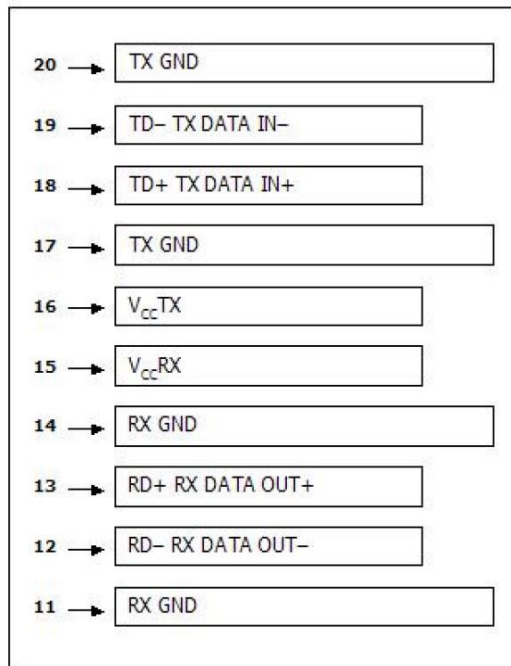
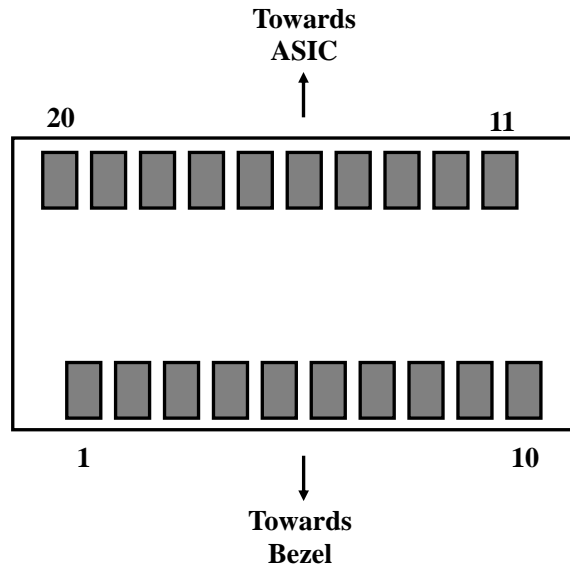
The micro controller unit monitors the operation information of LD driver and Limiting Amplifier. And report these status to the customer.

### Dimensions

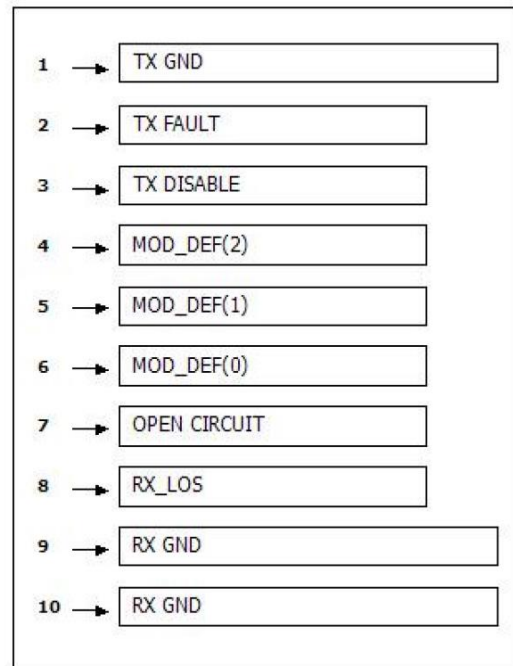


**ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED  
UNIT: mm**

## 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 <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	
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, 2002.
2. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.
3. Fiber Channel Draft Physical Interface Specification (FC-PI 10.0).
4. Digital Diagnostics Monitoring Interface for Optical Transceivers – SFF-8472.