

DATA SHEET

MODULETEK –SFP10-DWDM-ER-xxxx-C10

10 Gigabit DWDM 40km SFP+ Transceiver

SFP10-DWDM-ER-xxxx-C10 Overview

ModuleTek' s SFP10-DWDM-ER-xx.xx-C10 DWDM SFP+ optical transceivers are based on 10G Ethernet and SFF-8431 standard, and provide a quick and reliable interface for the 10G DWDM application. The digital diagnostics functions are available via 2-wire serial bus specified in the SFF-8472.

Product Features

- Up to 11.3 Gb/s bi-directional data links
- Compliant with IEEE 802.3ae 10GBASE-ER/EW
- Compliant with 10GFC
- Compliant with SFF-8431
- Hot-pluggable SFP+ footprint
- Temperature-stabilized EML laser in DWDM wavelength
- 100GHz ITU Grid, C Band
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 40km on SMF
- Single power supply 3.3V
- RoHS Compliant
- Operating temperature range: 0°C to 70°C

Applications

- 10G Ethernet
- 4x, 8x and 10x Fibre Channel
- OTN G.709 OUT 1e/2/2e FEC bit rates
- CPRI option 2 through 8

Ordering Information

Part Number	Description	Color on Clasp
SFP10-DWDM-ER-xxxx-C10	10 Gigabit DWDM SFP+ Transceiver, Single Mode Fiber 40km (ITU 100GHz Grid)	Red
For More Information: ModuleTek Limited Web: www.moduletek.com Email: sales@moduletek.com		

Product Selection

Product number	Description	ITU channel
SFP10-DWDM-ER-60.61-C10	10GBASE-DWDM 40km, 1560.61 nm SFP+	21
SFP10-DWDM-ER-59.79-C10	10GBASE-DWDM 40km, 1559.79 nm SFP+	22
SFP10-DWDM-ER-58.98-C10	10GBASE-DWDM 40km, 1558.98 nm SFP+	23
SFP10-DWDM-ER-58.17-C10	10GBASE-DWDM 40km, 1558.17 nm SFP+	24
SFP10-DWDM-ER-57.36-C10	10GBASE-DWDM 40km, 1557.36 nm SFP+	25
SFP10-DWDM-ER-56.55-C10	10GBASE-DWDM 40km, 1556.55 nm SFP+	26
SFP10-DWDM-ER-55.75-C10	10GBASE-DWDM 40km, 1555.75 nm SFP+	27
SFP10-DWDM-ER-54.94-C10	10GBASE-DWDM 40km, 1554.94 nm SFP+	28
SFP10-DWDM-ER-54.13-C10	10GBASE-DWDM 40km, 1554.13 nm SFP+	29
SFP10-DWDM-ER-53.33-C10	10GBASE-DWDM 40km, 1553.33 nm SFP+	30
SFP10-DWDM-ER-52.52-C10	10GBASE-DWDM 40km, 1552.52 nm SFP+	31
SFP10-DWDM-ER-51.72-C10	10GBASE-DWDM 40km, 1551.72 nm SFP+	32
SFP10-DWDM-ER-50.92-C10	10GBASE-DWDM 40km, 1550.92 nm SFP+	33
SFP10-DWDM-ER-50.12-C10	10GBASE-DWDM 40km, 1550.12 nm SFP+	34
SFP10-DWDM-ER-49.32-C10	10GBASE-DWDM 40km, 1549.32 nm SFP+	35
SFP10-DWDM-ER-48.51-C10	10GBASE-DWDM 40km, 1548.51 nm SFP+	36
SFP10-DWDM-ER-47.72-C10	10GBASE-DWDM 40km, 1547.72 nm SFP+	37
SFP10-DWDM-ER-46.92-C10	10GBASE-DWDM 40km, 1546.92 nm SFP+	38
SFP10-DWDM-ER-46.12-C10	10GBASE-DWDM 40km, 1546.12 nm SFP+	39
SFP10-DWDM-ER-45.32-C10	10GBASE-DWDM 40km, 1545.32 nm SFP+	40
SFP10-DWDM-ER-44.53-C10	10GBASE-DWDM 40km, 1544.53 nm SFP+	41
SFP10-DWDM-ER-43.73-C10	10GBASE-DWDM 40km, 1543.73 nm SFP+	42
SFP10-DWDM-ER-42.94-C10	10GBASE-DWDM 40km, 1542.94 nm SFP+	43
SFP10-DWDM-ER-42.14-C10	10GBASE-DWDM 40km, 1542.14 nm SFP+	44

SFP10-DWDM-ER-41.35-C10	10GBASE-DWDM 40km, 1541.35 nm SFP+	45
SFP10-DWDM-ER-40.56-C10	10GBASE-DWDM 40km, 1540.56 nm SFP+	46
SFP10-DWDM-ER-39.77-C10	10GBASE-DWDM 40km, 1539.77 nm SFP+	47
SFP10-DWDM-ER-38.98-C10	10GBASE-DWDM 40km, 1538.98 nm SFP+	48
SFP10-DWDM-ER-38.19-C10	10GBASE-DWDM 40km, 1538.19 nm SFP+	49
SFP10-DWDM-ER-37.40-C10	10GBASE-DWDM 40km, 1537.40 nm SFP+	50
SFP10-DWDM-ER-36.61-C10	10GBASE-DWDM 40km, 1536.61 nm SFP+	51
SFP10-DWDM-ER-35.82-C10	10GBASE-DWDM 40km, 1535.82 nm SFP+	52
SFP10-DWDM-ER-35.04-C10	10GBASE-DWDM 40km, 1535.04 nm SFP+	53
SFP10-DWDM-ER-34.25-C10	10GBASE-DWDM 40km, 1534.25 nm SFP+	54
SFP10-DWDM-ER-33.47-C10	10GBASE-DWDM 40km, 1533.47 nm SFP+	55
SFP10-DWDM-ER-32.68-C10	10GBASE-DWDM 40km, 1532.68 nm SFP+	56
SFP10-DWDM-ER-31.90-C10	10GBASE-DWDM 40km, 1531.90 nm SFP+	57
SFP10-DWDM-ER-31.12-C10	10GBASE-DWDM 40km, 1531.12 nm SFP+	58
SFP10-DWDM-ER-30.33-C10	10GBASE-DWDM 40km, 1530.33 nm SFP+	59

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR	1.2	10.3125	11.3	Gb/s	1
Bit Error Rate	BER			10^{-12}		
Operating Temperature	T _{OP}	0		70	°C	2
Storage Temperature	T _{STO}	-40		85	°C	3
Supply Current	I _S		400	450	mA	4
Input Voltage	V _{CC}	3.14	3.3	3.46	V	
Maximum Voltage	V _{MAX}	-0.5		4	V	4

Notes:

1. IEEE 802.3ae
2. Case temperature
3. Ambient temperature
4. For electrical power interface

Link Distances

Parameter	Fiber Type	Distance Range (km)
1.2–11.3 Gb/s	9/125um SMF	40

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}	-4		4	dBm	1
Optical Center Wavelength	λ_C	$\lambda_C-0.1$	λ_C	$\lambda_C+0.1$		2
Extinction Ratio	ER	8.2			dB	
Spectral Width (-20dB)	$\Delta\lambda$			0.6	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
Transmitter Dispersion Penalty	TDP			2	dB	
Transmitter Jitter						3
Launch Power of OFF Transmitter	P_{OUT_OFF}			-30	dBm	1

Notes:

1. Average
2. Per IEEE 802.3ae
3. According to IEEE 802.3ae requirement

Optical - Characteristics - Receiver

$V_{CC3}=3.14V$ to $3.46V$, $T_C=0^{\circ}C$ to $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Center Wavelength	λ_C	1260		1600	nm	
Optical Input Power	P_{RX}	-16		1	dBm	
Receiver Sensitivity (OMA)@10.3Gb/s	R_{X_SEN1}			-14.1	dBm	1
Stressed Receiver Sensitivity in OMA @10.3Gb/s	R_{X_SEN2}			-27	dBm	2
Receiver Reflectance	TR_{RX}			-27	dB	
LOS Assert	LOS_A	-25			dBm	
LOS De-Assert	LOS_D			-18	dBm	
LOS Hysteresis	LOS_H	0.5			dB	

Notes:

1. Average, Informative
2. Measured with worst ER: $BER < 10^{-12}$; $2^{31} - 1$ PRBS

Electrical - Characteristics - Transmitter

$V_{CC3}=3.14V$ 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		Ω	
Differential data input swing	V_{IN_PP}	300		850	mV	
Transmit Disable Voltage	V_D	2		V_{CC}	V	
Transmit Enable Voltage	V_{EN}	V_{EE}		$V_{EE}+0.8$	V	

Electrical - Characteristics - Receiver

$V_{CC3}=3.14V$ to $3.46V$, $T_C=0^{\circ}C$ to $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Differential data output swing	V_{OUT_PP}	300		850	mV	
Data output rise time (20%-80%)	T_R		30		ps	
Data output fall time(20%-80%)	T_F		30		ps	
LOS Fault	V_{LOS_A}	2		V_{CC_HOST}	V	
LOS Normal	V_{LOS_D}	V_{EE}		$V_{EE}+0.5$	V	

Digital Diagnostic Functions

SFP10-DWDM-ER-xx.xx-C10 support the 2-wire serial communication protocol as defined in the SFF 8472. Digital diagnostic information is accessible over the 2-wire interface at the address 0xA2. Digital diagnostics for SFP10-DWDM-ER-xx.xx-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 μ 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 μ 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 μ W. Data is assumed to be based on measurement of laser monitor photodiode current. Accuracy is better than ± 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 μ W. Accuracy is better than ± 3 dB over specified temperature and voltage.

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.

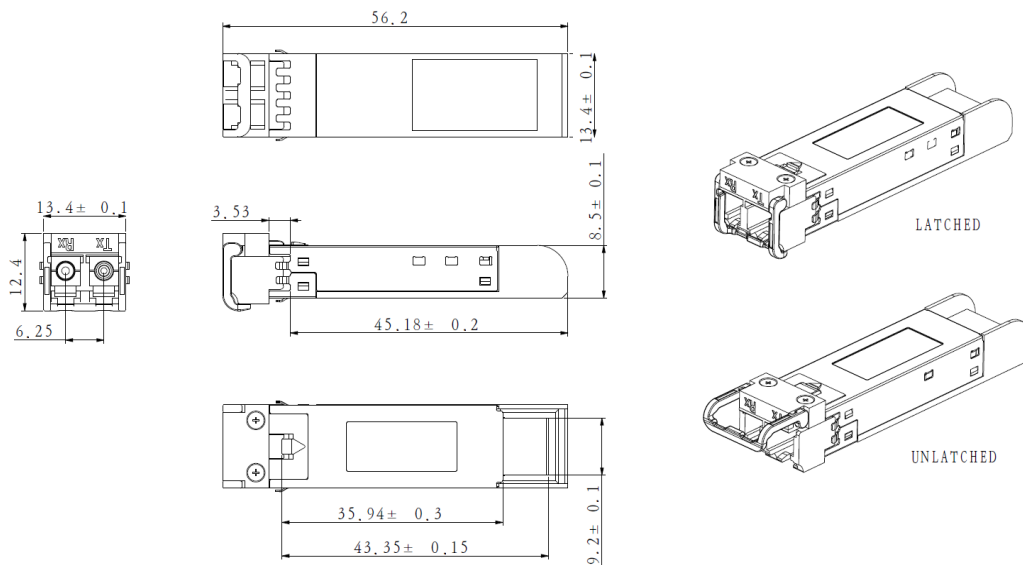
Receive (RX_LOS)

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

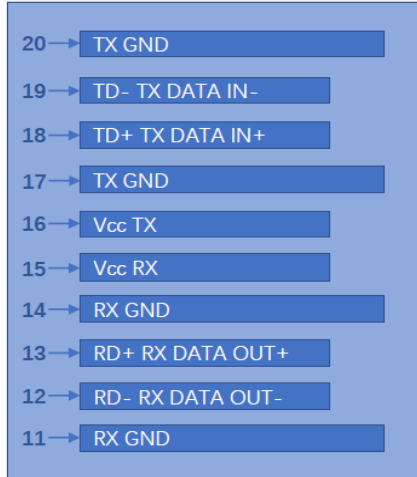
The micro controller unit monitors the operation information of LD driver and Limiting Amplifier. And report these status to the customer.

Dimensions

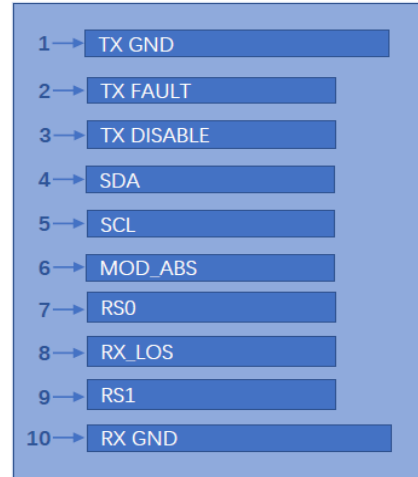
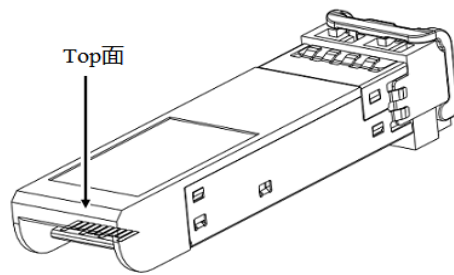


ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED
UNIT: mm

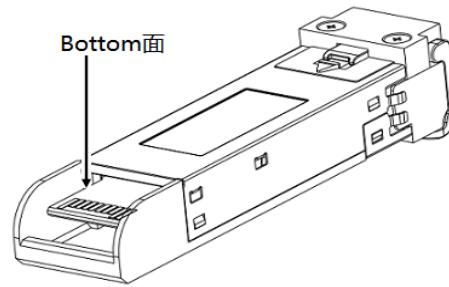
Electrical Pad Layout



Top of Board



Bottom of Board



Pin Assignment

PIN #	Symbol	Description	Remarks
1	V _{EET}	Transmitter ground (common with receiver ground)	1
2	T _{FAULT}	Transmitter Fault.	
3	T _{DIS}	Transmitter Disable. Laser output disabled on high or open	2
4	SDA	2-wire Serial Interface Data Line	3
5	SCL	2-wire Serial Interface Clock Line	3
6	MOD_ABS	Module Absent. Grounded within the module	3
7	RS0	Rate Select 0	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation	4
9	RS1	Rate Select 1	1
10	V _{EER}	Receiver ground (common with transmitter ground)	1
11	V _{EER}	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 _{EER}	Receiver ground (common with transmitter ground)	1
15	V _{CCR}	Receiver power supply	
16	V _{CCT}	Transmitter power supply	
17	V _{EET}	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 _{EET}	Transmitter ground (common with receiver ground)	1

Notes:

- 1.Circuit ground is isolated from chassis ground
- 2.Disabled: T_{DIS}>2Vor open, Enabled: T_{DIS}<0.8V
- 3.Should Be pulled up with 4.7k –10k ohm on host board to a voltage between 2V and 3.46V
- 4.LOS is open collector output

References

1. IEEE standard 802.3ae. IEEE Standard Department, 2005.
2. Enhanced 8.5 and 10 Gigabit Small Form Factor Pluggable Module “SFP+” –SFF-8431
3. Digital Diagnostics Monitoring Interface for Optical Transceivers –SFF-8472.