

## P/N: AE-SFP+-LRM

10GBASE-LRM SFP+ Transceiver Module, Multimode, 1310nm, 220m Reach

### Features

- Supports up to 10.7Gbps bit rates
- Hot-pluggable SFP+ footprint
- Compliant with SFP+ MSA and SFF-8472
- 1310nm FP laser transmitter, PIN photodiode
- Distance up to 220m transmission on OM3 MMF
- Duplex LC connector
- Built-in digital diagnostic functions
- Single +3.3V power supply
- Metal enclosure, for lower EMI
- ROHS compliant and lead-free
- Operating Temperature: Standard 0~70°C, Extended -10~85°C, Industrial -40~85°C

### Applications

- 10GBASE-LRM at 10.3125Gbps
- 10G Fibre Channel
- 10G Data Center Switches and Routers
- 10G Network interface cards and Fiber Media Converters
- LTE systems
- Other Optical Links

### Description

AERECH's AE-SFP+-LRM is a high performance and cost-effective 10GBASE-LRM SFP+ transceiver module for 10 Gigabit Ethernet links up to 220m over multimode fiber. The transceiver features a highly reliable 1310nm FP transmitter and PIN photo-detector into duplex LC optical connector. It complies with SFP+ MSA specifications (SFF-8431, SFF-8432), 10 Gigabit Ethernet specifications (10GBASE-LRM per IEEE 802.3ae ), and 10G Fibre Channel (1200-MX-SN-I). It's suitable for use in 10G Ethernet switches, routers, network interface cards (NICs), fiber media converters and storage networking equipment.

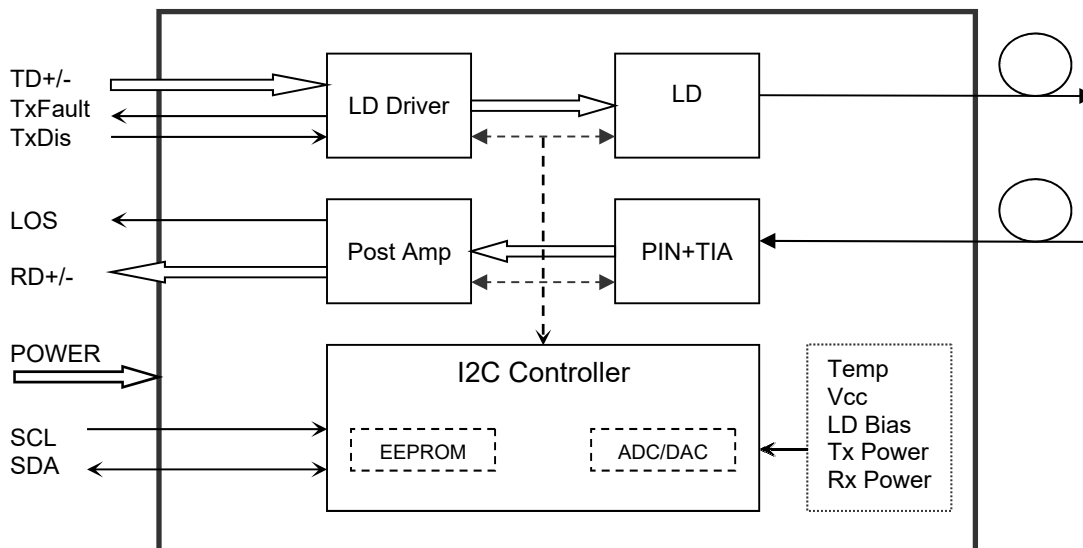
Additionally, the 10GBASE-LRM SFP+ transceiver has been integrated with an enhanced digital diagnostic monitoring interface (DDMI) per SFF-8472, which provides real-time monitoring of the transceiver temperature, laser bias current, optical power, received optical power and transceiver supply voltage. All transceivers are Class 1 laser products comply with FDA/CDRH and IEC-60825 standards.

There are three versions of the series 10GBASE-LRM SFP+ transceiver for different applications. The Standard grade (0~70°C) is for commonly commercial application, the Extended grade (-10~85°C) is for Extended temperature application, and the Industrial grade (-40~85°C) is made with robust and reliable components to meet the needs of Industrial Ethernet application under harsh environmental conditions.

This 10GBASE-LRM SFP+ module is required to use mode conditioning patch (MCP) cables when used with OM1 or

OM2 fiber to reach the maximum distance. The MCP cables are available in different connector and length and separately sold by AERECH.

### Transceiver functional diagram



### Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Maximum Supply Voltage	Vcc	-0.5	4.5	V	
Storage Temperature	T <sub>s</sub>	-40	85	°C	
Operating Humidity	RH	5	85	%	

### Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply Voltage	Vcc	3.13	3.3	3.47	V	
Power Supply Current	Icc			290	mA	
Case Operating Temperature	T <sub>c</sub>	0		70	°C	Standard
		-10		85	°C	Extended
		-40		85	°C	Industrial
Data Rate			10.3	10.7	Gbps	
Maximum Link Length	L <sub>MAX</sub>			220	m	OM3 MMF

### Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
<b>Transmitter</b>						
Centre Wavelength	λ <sub>c</sub>	1270	1310	1350	nm	
Spectral Width (-20dB)	Δλ			4	nm	
Side-Mode Suppression Ratio	SMSR	-	-		dB	

Average Output Power	P <sub>out</sub>	-6.0		0	dBm	1
Extinction Ratio	ER	3.5			dB	

Data Input Swing Differential	$V_{IN}$	180		850	mV	2
Input Differential Impedance	$Z_{IN}$	90	100	110	$\Omega$	
TX Disable	Disable		2.0	$V_{cc}$	V	
	Enable		0	0.8	V	
TX Fault	Fault		2.0	$V_{cc}$	V	
	Normal		0	0.8	V	
<b>Receiver</b>						
Centre Wavelength	$\lambda_c$	1260		1600	nm	
Receiver Sensitivity				-9.0	dBm	3
Receiver Overload		0.5			dBm	3
LOS De-Assert	$LOS_D$			-11	dBm	
LOS Assert	$LOS_A$	-30			dBm	
LOS Hysteresis		0.5			dB	
Data Output Swing Differential	$V_{out}$	300		900	mV	4
LOS	High	2.0		$V_{cc}$	V	
	Low			0.8	V	

**Note :**

1. The optical power is launched into MMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>31</sup>-1 test pattern @10312Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.

**Timing and Electrical**

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	$t_{on}$			1	ms
Tx Disable Assert Time	$t_{off}$			10	$\mu s$
Time To Initialize, including Reset of Tx Fault	$t_{init}$			300	ms
Tx Fault Assert Time	$t_{fault}$			100	$\mu s$
Tx Disable To Reset	$t_{reset}$	10			$\mu s$
LOS Assert Time	$t_{loss_{on}}$			100	$\mu s$
LOS De-assert Time	$t_{loss_{off}}$			100	$\mu s$
Serial ID Clock Rate	$f_{serial\_clock}$		100	400	KHz
MOD_DEF (0:2)-High	$V_H$	2		$V_{cc}$	V
MOD_DEF (0:2)-Low	$V_L$			0.8	V

**Diagnostics**

Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to +70	$^{\circ}C$	$\pm 3^{\circ}C$	Internal
	-10 to +85			

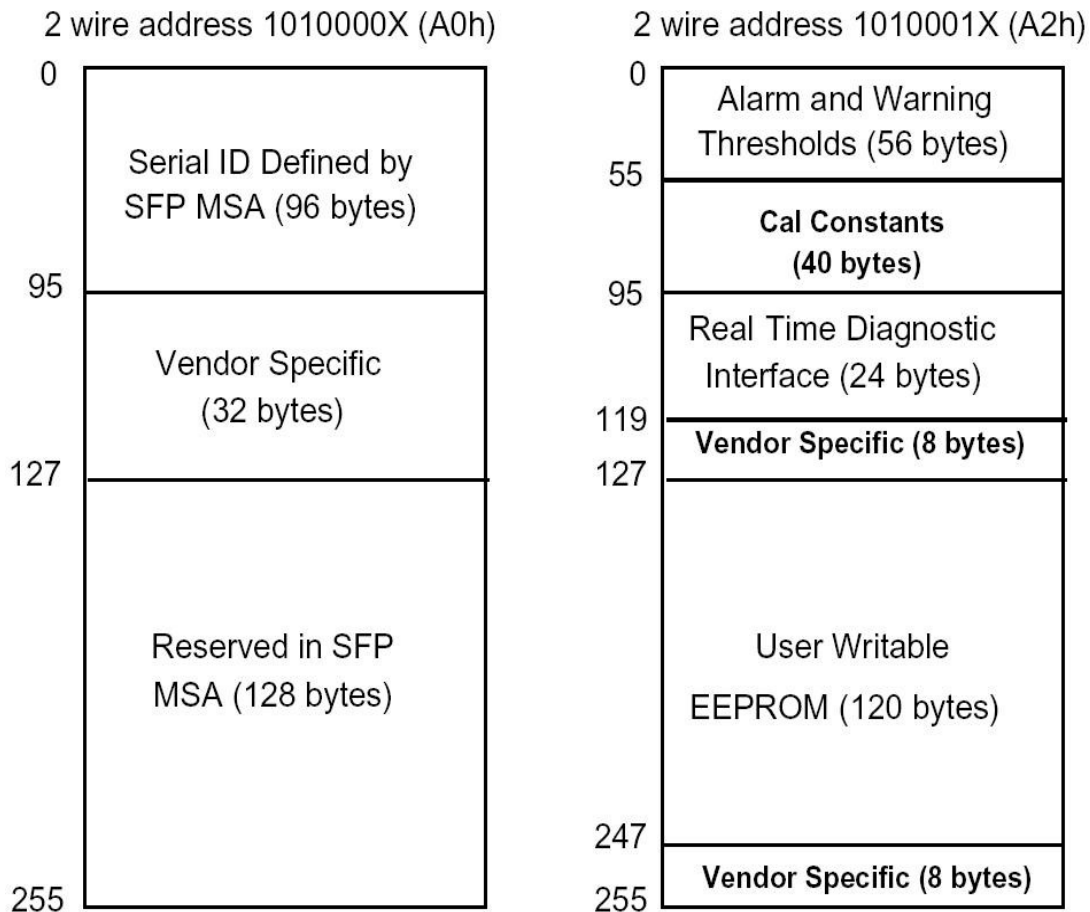
	-40 to +85			
Voltage	3.0 to 3.6	V	±3%	Internal
Bias Current	0 to 100	mA	±10%	Internal
TX Power	-6.0 to 0	dBm	±3dB	Internal
RX Power	-9 to 0	dBm	±3dB	Internal

### Digital Diagnostic Memory Map

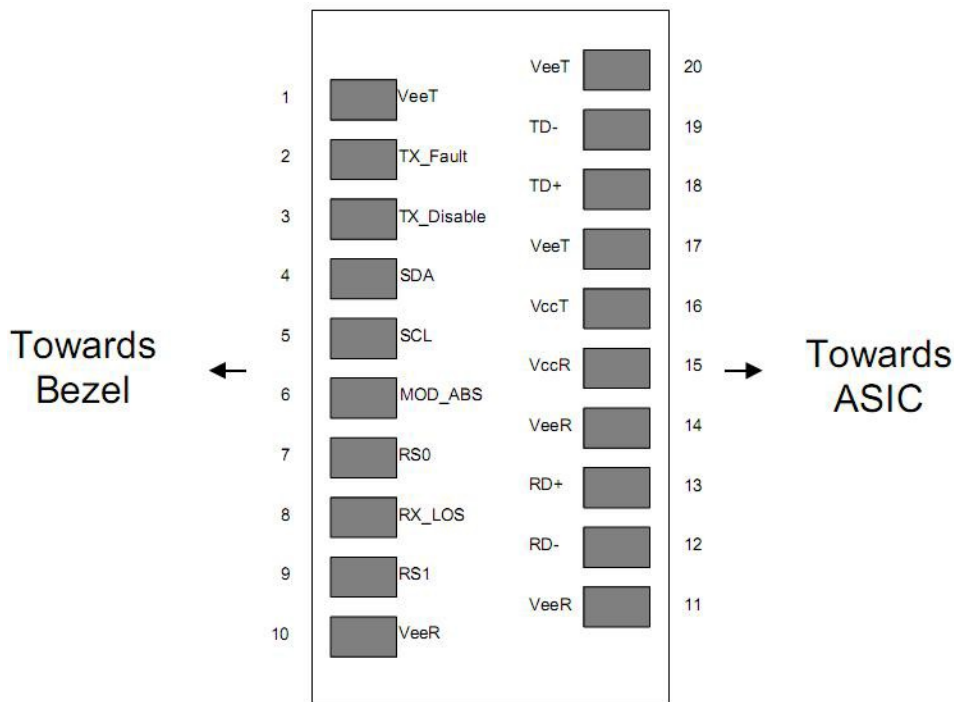
The 10GBASE-LR SFP+ transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

The digital diagnostic memory map specific data field defines as following.



### Pin Definitions



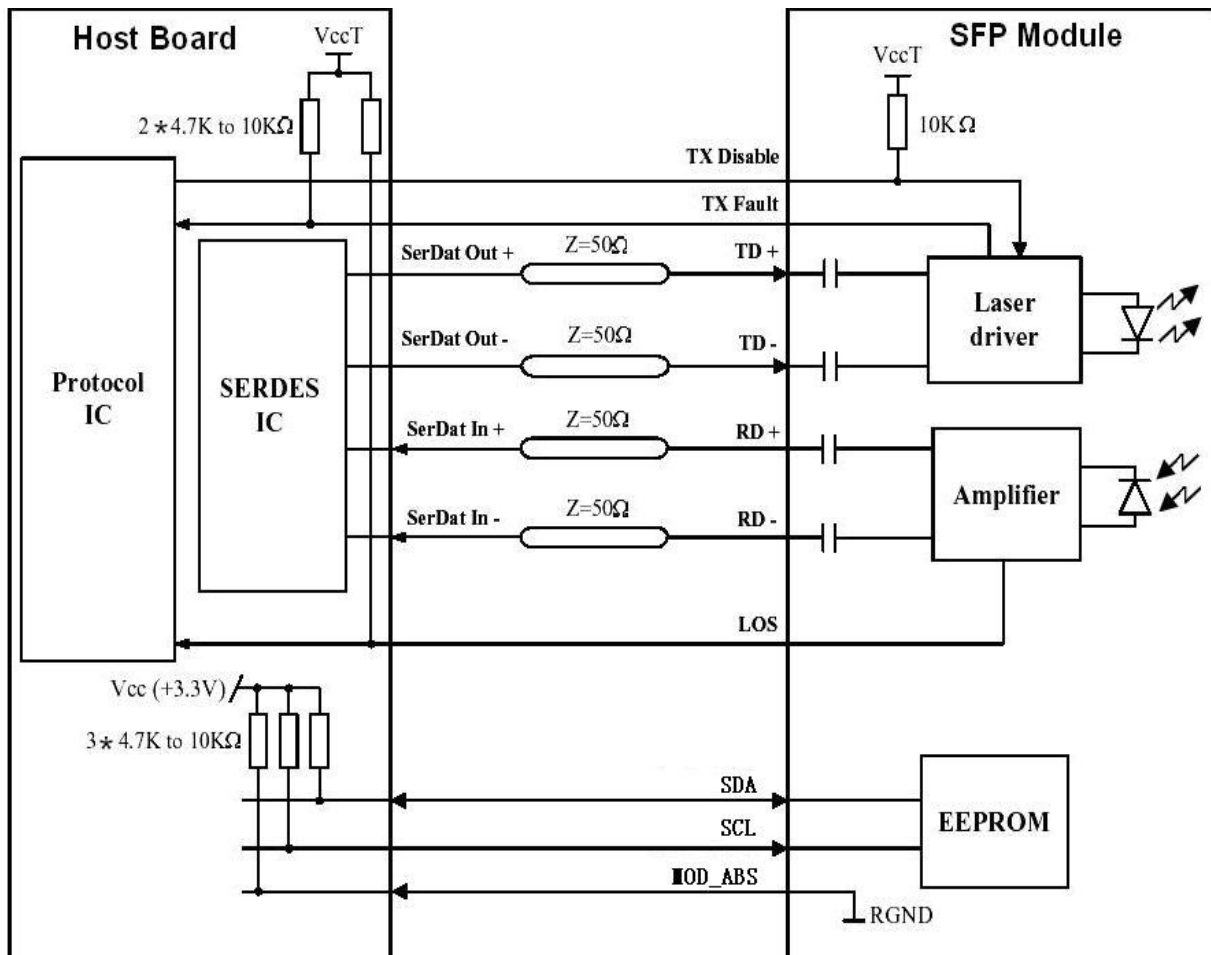
### Pin Descriptions

Pin	Signal Name	Description	Plug Seq.	Notes
1	V <sub>EET</sub>	Transmitter Ground	1	
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TX DISABLE	Transmitter Disable	3	Note 2
4	SDA	SDA Serial Data Signal	3	
5	SCL	SCL Serial Clock Signal	3	
6	MOD_ABS	Module Absent. Grounded within the module	3	
7	RS0	Not Connected	3	
8	LOS	Loss of Signal	3	Note 3
9	RS1	Not Connected	3	
10	V <sub>EER</sub>	Receiver ground	1	
11	V <sub>EER</sub>	Receiver ground	1	
12	RD-	Inv. Received Data Out	3	Note 4
13	RD+	Received Data Out	3	Note 4
14	V <sub>EER</sub>	Receiver ground	1	
15	V <sub>CCR</sub>	Receiver Power Supply	2	
16	V <sub>CCT</sub>	Transmitter Power Supply	2	
17	V <sub>EET</sub>	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 5
19	TD-	Inv. Transmit Data In	3	Note 5
20	V <sub>EET</sub>	Transmitter Ground	1	

**Notes:**

Plug Seq.: Pin engagement sequence during hot plugging.

1. TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and  $V_{cc}+0.3V$ . Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
2. Laser output disabled on  $TDIS > 2.0V$  or open, enabled on  $TDIS < 0.8V$ .
3. LOS is open collector output. Should be pulled up with 4.7k~10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
4. RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.
5. TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

**Recommended Interface Circuit**

**Ordering information**

Part number	Description
AE-SFP+-LRM	10GBASE-LRM SFP+ Transceiver, Multimode, 1310nm, 220m, LC, DDM, 0°C~+70°C

**Warnings*****Process plug***

The transceiver optics is supplied with a dust cover. This plug protects the transceiver optics during standard manufacturing processes by preventing contamination from air borne particles. It is recommended that the dust cover remain in the transceiver whenever an optical fiber connector is not inserted.

***Handling Precautions***

The transceiver optics is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

***Laser Safety***

The transceiver optics is a Class 1 laser product per international standard IEC 60825-1. Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.



