

## OPB155-45(54)A2xxR

155Mb/s Bi-Directional SFP Transceiver, SMF, Tx1490/Rx1550nm or Tx1550/Rx1490nm, 120km

### Features

- Supports 155Mbps bit rates
- Bi-Directional LC connector
- Hot pluggable SFP footprint
- 1490nm DFB laser and 1550nm PIN photo detector
- 1550nm DFB laser and 1490nm PIN photo detector
- Applicable for 120km SMF connection
- Low power consumption, < 1.2W
- Compliant with SFP MSA and SFF-8472
- Very low EMI and excellent ESD protection
- ROHS compliant and Lead Free
- Operating Temperature: Standard 0~70°C    Extended -10~85°C    Industrial -40~85°C
- Optional Digital Diagnostic Monitor Interface



### Applications

- Fast Ethernet 100 Mb/s Links
- SDH STM-1
- SONET OC-3
- Other WDM optical transmission systems

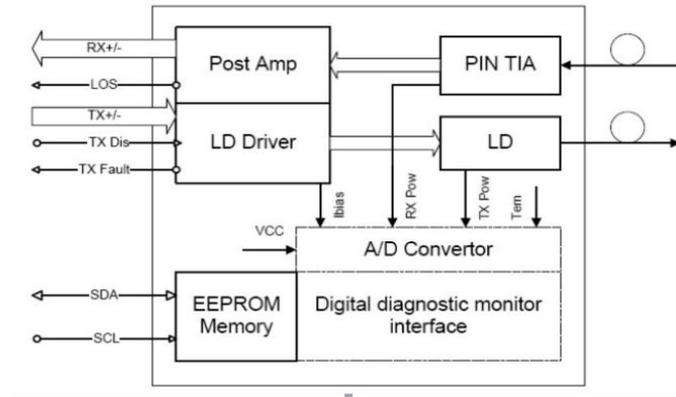
### Description

Optcore's OPB155-45(54)A2xxR is a small form factor pluggable (SFP) Bi-Directional transceiver module for duplex optical data communications such as 100BASE-BX120 Fast Ethernet and 155Mbps SDH STM-1/SONET OC-3 LR-2. This BiDi SFP module provides 100km to 120km transmission distance over single strand of single mode fiber. Compared with commonly used dual fiber SFP modules, this bi-directional (BiDi) transceiver allows end users to reduce the total cost on fiber cabling infrastructure by requiring half of fiber cables, providing increased transmission capacity very convenient without installing new fibers.

The transmitter section uses a 1490nm ( or 1550nm) DFB laser that is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses a high-speed 1550nm ( or 1490nm) InGaAs PIN photodiode (PD) integrated with a trans-impedance preamplifier (TIA). The module is fully compliant with SFP Multi-Sourcing Agreement (MSA) and SFF-8472. For further information, please see SFP MSA and SFF-8472 standard.

There are three versions of the series 155M SFP BiDi optical transceiver modules 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.

### Functional Diagram



**Absolute Maximum Ratings**

Parameter	Symbol	Min	Max	Unit	Notes
Maximum Supply Voltage	Vcc	-0.5	4.0	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			300	mA	
Case Operating Temperature	T <sub>c</sub>	0		70	°C	Standard
		-10		85	°C	Extended
		-40		85	°C	Industrial
Data Rate	DR		155		Mbps	OC-3/STM-1
			100			100M
Transmission Distance			100	120	km	9/125µm SMF

**Optical Characteristics**

Parameter	Symbol	Min.	Typ	Max.	Unit	Note
<b>Transmitter</b>						
Operating Wavelength	λ	1270	1490	1360	nm	OPB155-45A2xxR
		1510	1550	1570		OPB155-54A2xxR
Ave. output power (Enabled)	P <sub>AVE</sub>	-2		3	dBm	1
Extinction Ratio	ER	10			dB	1
RMS spectral width	Δλ			1	nm	
Rise/Fall time (20%~80%)	Tr/Tf			0.26	ns	2
Dispersion penalty	TDP			3.9	dB	
Output Optical Eye	Compliant with IEEE802.3 z (class 1 Laser safety)					
<b>Receiver</b>						
Operating Wavelength	λ	1510	1550	1570	nm	OPB155-45A2xxR

		1270	1490	1360		OPB155-54A2xxR
Receiver Sensitivity	P <sub>SEN1</sub>			-34	dBm	3
Overload	P <sub>AVE</sub>	-3			dBm	3
LOS Assert	Pa	-45			dBm	
LOS De-assert	Pd			-36	dBm	
LOS Hysteresis	Pd-Pa	0.5			dB	

**Note :**

- 1.Measured at 155Mb/s with PRBS 2<sup>23</sup> – 1NRZ test pattern.
- 2.Unfiltered, measured with a PRBS2<sup>23</sup> – 1 test pattern @155Mbps
- 3.Measured at 155Mb/s with PRBS 2<sup>23</sup> – 1 NRZ test pattern for BER < 1x10<sup>-12</sup>

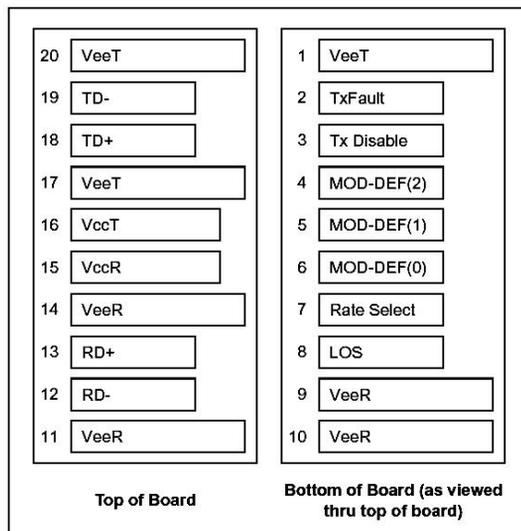
**Electrical Characteristics (T<sub>OP(C)</sub> = 0 to 70°C, T<sub>OP(I)</sub> = -40 to 85°C, V<sub>CC</sub> = 3.13 to 3.47 V)**

Parameter	Symbol	Min.	Typ	Max.	Unit	Note
<b>Transmitter</b>						
Differential data input swing	V <sub>IN,PP</sub>	120		820	mVpp	1
Tx Disable Input-High	V <sub>IH</sub>	2.0		V <sub>CC</sub> +0.3	V	
Tx Disable Input-Low	V <sub>IL</sub>	0		0.8	V	
Tx Fault Output-High	V <sub>OH</sub>	2.0		V <sub>CC</sub> +0.3	V	2
Tx Fault Output-Low	V <sub>OL</sub>	0		0.8	V	2
Input differential impedance	R <sub>in</sub>		100		Ω	
<b>Receiver</b>						
Differential data output swing	V <sub>out,pp</sub>	340	650	800	mVpp	3
Rx LOS Output-High	V <sub>ROH</sub>	2.0		V <sub>CC</sub> +0.3	V	2
Rx LOS Output-Low	V <sub>ROL</sub>	0		0.8	V	2

**Notes:**

1. TD+/- are internally AC coupled with 100Ω differential termination inside the module.
2. Tx Fault and Rx LOS are open collector outputs, which should be pulled up with 4.7k to 10kΩ resistors on the host board. Pull up voltage between 2.0V and V<sub>CC</sub>+0.3V.
- 3.RD+/- outputs are internally AC coupled, and should be terminated with 100Ω (differential) at the user SERDES.

**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	MOD_DEF(2)	SDA Serial Data Signal	3	Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	Note 3
6	MOD_DEF(0)	Model present indication	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	V <sub>EER</sub>	Receiver ground	1	
10	V <sub>EER</sub>	Receiver ground	1	
11	V <sub>EER</sub>	Receiver ground	1	
12	RD-	Inverse Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
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 6
19	TD-	Inv. Transmit Data In	3	Note 6
20	V <sub>EET</sub>	Transmitter Ground	1	

### Notes:

- 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<sub>cc</sub>+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.
- TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kΩ resistor. Its states are:  
 Low (0 to 0.8V): Transmitter on                      (>0.8V, < 2.0V): Undefined  
 High (2.0 to 3.465V): Transmitter Disabled      Open: Transmitter Disabled
- Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be V<sub>ccT</sub> or V<sub>ccR</sub>.  
 Mod-Def 0 is grounded by the module to indicate that the module is present  
 Mod-Def 1 is the clock line of two wire serial interface for serial ID  
 Mod-Def 2 is the data line of two wire serial interface for serial ID
- LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. Pull up voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low state, the output will be pulled to less than 0.8V.
- 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.
- TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω

differential termination inside the module.

### Digital Diagnostic Functions

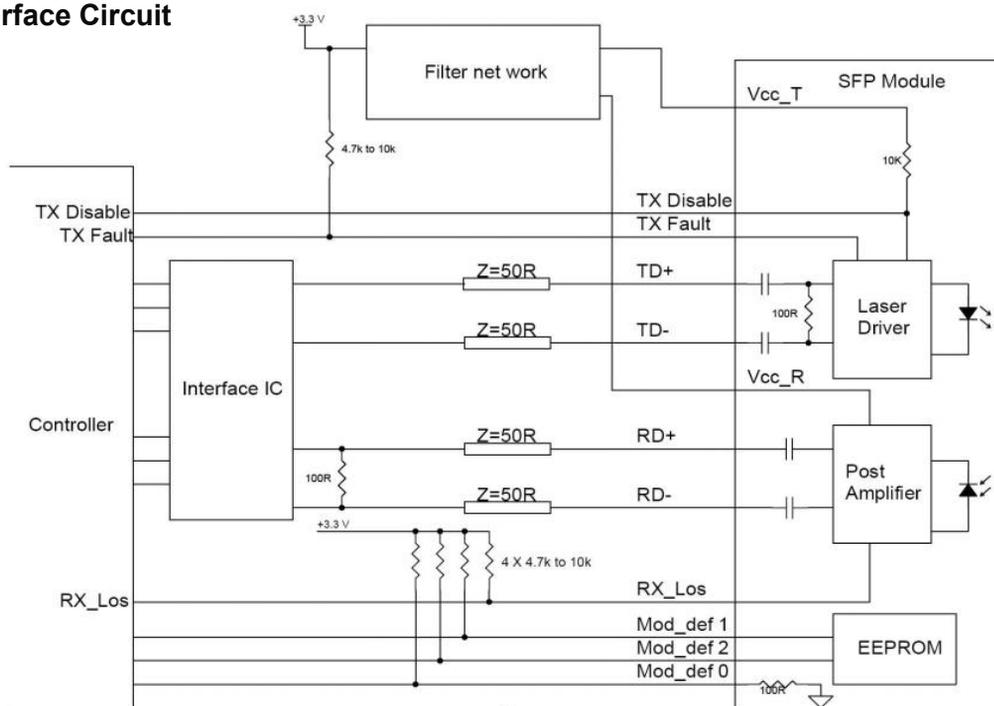
Optcore 155Mb/s SFP BiDi optical transceiver support the 2-wire serial communication protocol as defined in the SFP MSA. It is very closely related to the E2PROM defined in the GBIC standard, with the same electrical specifications. The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, Optcore 155Mb/s SFP BiDi optical transceiver provide an optional 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.

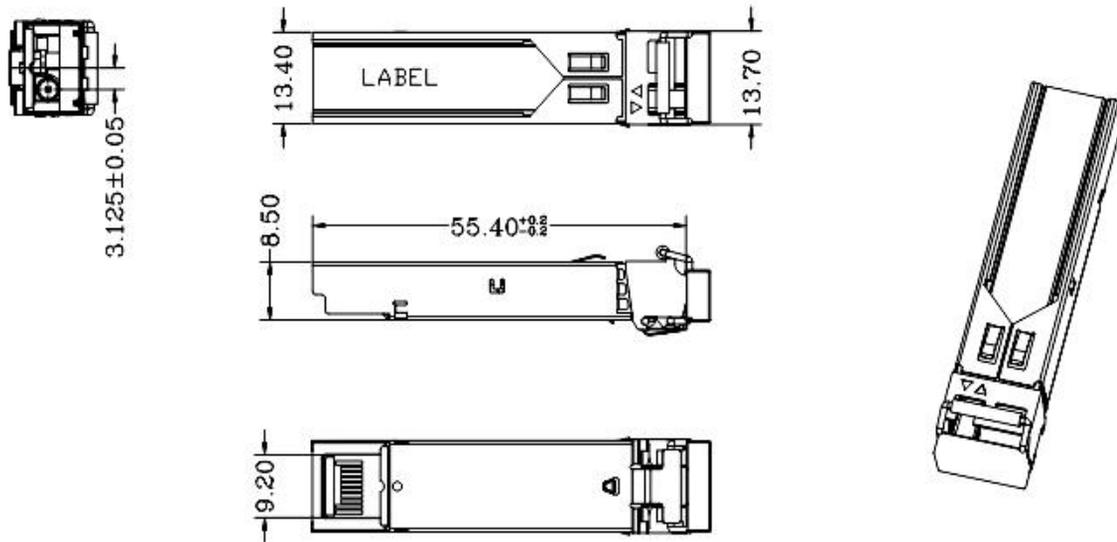
The SFP MSA defines a 256-byte memory map in E2PROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged. The interface 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 module. 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. Digital diagnostics for this 155M SFP BiDi optical transceiver is internally calibrated by default.

### Typical Interface Circuit



**Mechanical Dimensions**



Units in mm  
Tolerance without indication is ±0.1mm

**Ordering information**

Part number	Description
OPB155-45A2NCR	155M BiDi SFP Transceiver, SMF, Tx:1490nm/Rx:1550nm, 120km, LC, 0°C~+70°C
OPB155-54A2NCR	155M BiDi SFP Transceiver, SMF, Tx:1550nm/Rx:1490nm, 120km, LC, 0°C~+70°C
OPB155-45A2DCR	155M BiDi SFP Transceiver, SMF, Tx:1490nm/Rx:1550nm, 120km, LC, DDM, 0°C~+70°C
OPB155-54A2DCR	155M BiDi SFP Transceiver, SMF, Tx:1550nm/Rx:1490nm, 120km, LC, DDM, 0°C~+70°C
OPB155-45A2DER	155M BiDi SFP Transceiver, SMF, Tx:1490nm/Rx:1550nm, 120km, LC, DDM, -10°C~+85°C
OPB155-54A2DER	155M BiDi SFP Transceiver, SMF, Tx:1550nm/Rx:1490nm, 120km, LC, DDM, -10°C~+85°C
OPB155-45A2DTR	155M BiDi SFP Industrial Transceiver, SMF, Tx:1490nm/Rx:1550nm, 120km, LC, DDM, -40°C~+85°C
OPB155-54A2DTR	155M BiDi SFP Industrial Transceiver, SMF, Tx:1550nm/Rx:1490nm, 120km, LC, DDM, -40°C~+85°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.

For more product information, visit us on the web at [www.optcore.net](http://www.optcore.net)



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