

# 10GBASE-ZR SFP+ 1550nm 80Km DOM Transceiver

AA1403016-E6-LL



## Application

- 10G Ethernet ZR and 10G Fibre Channel
- OTN G.709 OTU1e/2/2e FEC bit rates
- 8.5Gb/s Fibre Channel

## Features

- Hot-pluggable SFP+ footprint
- Supports 8.5 and 9.95 to 11.3 Gb/s
- 80km link length
- 0/70° C case temperature range
- Cooled 1550nm EML laser
- Limiting electrical interface receiver
- Duplex LC connector
- Built-in digital diagnostic functions
- RoHS-6 compliant (lead-free)

## Description

10GGBASE-ZR SFP+ transceivers are Enhanced Small Form Factor Pluggable SFP+ transceivers designed for use in 10-Gigabit multi-rate links up to 80km of G.652 single mode fiber. They support 10G Ethernet ZR and 10G Fibre Channel.

Digital diagnostics functions are available via a 2-wire serial interface. The optical transceiver is compliant per the RoHS Directive 2011/65/EU.

## Product Specifications

### I.General Specifications

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
<b>Bit Rate</b>	BR	8.5		11.3168	Gb/s	1
<b>Max. Supported Link Length</b>	L <sub>MAX</sub>			80	km	2

#### Notes:

1. Tested with a 231 –1 PRBS pattern at the BER defined in Table IV.
2. Over G.652 single mode fiber.

### II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
<b>Maximum Supply Voltage</b>	V <sub>CC</sub>	-0.5		4.0	V	
<b>Storage Temperature</b>	T <sub>S</sub>	-40		85	° C	
<b>Case Operating Temperature</b>	T <sub>OP</sub>	0		70	° C	
<b>Relative Humidity</b>	RH	0		85	%	1
<b>Receiver Optical Damage Threshold</b>	RxDamage	5			dBm	

#### Note:

1. Non-condensing.

### III. Electrical Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
<b>Supply Voltage</b>	$V_{CC}$	3.13		3.30	V	
<b>Supply Current</b>	$P_{diss}$			1.5	W	1

#### Transmitter

<b>Input differential impedance</b>	$R_{in}$	80	100	110	$\Omega$	1
<b>Differential data input swing</b>	$V_{in,pp}$	120		850	mV	2
<b>Transmit Disable Voltage</b>	$V_D$	$V_{CC}-0.8$		$V_{CC}$	V	
<b>Transmit Enable Voltage</b>	$V_{EN}$	0		0.8	V	

#### Receiver

<b>Differential data output swing</b>	$V_{out,pp}$	300		850	mV	2
<b>Output rise time and fall time</b>	$R_{out}$	80	100	120	$\Omega$	
<b>LOS asserted</b>	$V_{LOS A}$	$V_{CC}-0.8$		$V_{CC}$	V	4
<b>LOS de-asserted</b>	$V_{LOS D}$	0		0.8	V	4
<b>Power Supply Noise Tolerance</b>	$V_{CC}/V_{CCR}$		Per SFF-8431 Rev 4.1		mVpp	5

#### Notes:

1. 70°C case temperature and beginning of life
2. Internally AC coupled.
3. 20°C–80%. Measured with Module Compliance Test Board and OMA test pattern. Use of four 1's and four 0's sequence in the PRBS 9 is an acceptable alternative. SFF-8431 Rev 4.1.
4. LOS is an open collector output. Should be pulled up with 4.7k $\Omega$ –10k $\Omega$  on the host board. Normal operation is logic 0; loss of signal is logic 1.
5. See Section 2.8.3 of SFF-8431 Rev 4.1.

#### IV. Optical Characteristics (TOP = 0 to 70 °C, VCC = 3.14 to 3.46 V)

Parameter	Symbol	Min	Typ.	Max	Unit	Note
<b>Transmitter (Tx)</b>						
<b>Average Launch Power</b>	$P_{OUT}$	0		5	dBm	
<b>Optical Wavelength</b>	$\lambda$	1530	1550	1565	nm	
<b>Side-Mode Suppression Ratio</b>	SMSR	30			dB	
<b>Optical Extinction Ratio</b>		9			dB	
<b>Average Launch power of OFF transmitter</b>	$P_{OFF}$			-30	dBm	
<b>Relative Intensity Noise</b>	RIN			-128	dB/Hz	
<b>Receiver (Rx)</b>						
<b>Optical Center Wavelength</b>	$\lambda_C$	1260		1600	dBm	4
<b>Overload (Average Power)</b>	$P_{AVE}$	-7			dBm	
<b>Receiver Reflectance</b>	$R_{rx}$				dB	
<b>LOS De-Assert LOS De-Assert</b>	$LOS_D$			-23.5	dBm	
<b>LOS Assert</b>	$LOS_A$	-37		-30	dBm	
<b>LOS Hysteresis</b>	$LOS_H$	0.5		6	dB	
<b>Rx Sensitivity</b>	$R_{SENS1}$			-23	dBm	

**Notes:**

1. Per Tradeoff Table 52.8, IEEE 802.3ae 2005
2. Average Power figures are informative only, per IEEE802.3ae.
3. Measured into Type A1a (50/125  $\mu$ m multimode) fiber per ANSI/TIA/EIA-455-203-2.
4. Measured with worst ER; BER<10<sup>-12</sup>; 231 – 1 PRBS.
5. Per IEEE 802.3ae.

**V. Digital Diagnostic Specifications**

10GBASE-ZR SFP+ transceivers can be used in host systems that require either internally or externally calibrated digital diagnostics.

Parameter	Symbol	Min	Max	Units	Accuracy	Ref.
<b>Transceiver temperature</b>	$\Delta DD_{Temp}$	-5	+70	°C	± 5°C	1
<b>Transceiver supply voltage</b>	$\Delta DD_{Voltage}$	-2.8	4.0	V	± 3%	
<b>Transmitter bias current</b>	$\Delta DD_{Bias}$	0	127	mA	± 10%	2
<b>Transmitter output power</b>	$\Delta DD_{Tx-Power}$	-1	+5	dBm	± 2dB	
<b>Receiver average optical input power</b>	$\Delta DD_{Rx-Powe}$	-28	-5	dBm	± 2dB	

**Notes:**

1. Internally measured.
2. The accuracy of the Tx bias current is 10% of the actual current from the laser driver to the laser.

Parameter	Symbol	Min	Typ.	Max	Units	Ref.
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### Dynamic Range for Rated Accuracy

<b>Internally measured transceiver temperature</b>	$DD_{Temp}$	-40		85	°C	
<b>Internally measured transceiver supply voltage</b>	$DD_{Voltage}$	3.14		3.46	V	
<b>Measured TX bias current</b>	$DD_{Bias}$	0		20	mA	
<b>Measured TX output power</b>	$DD_{Tx-Power}$	-9		-2.5	dBm	
<b>Measured RX received average optical power</b>	$DD_{Rx-Power}$	-20		0	dBm	

### Max Reporting Range

<b>Internally measured transceiver temperature</b>	$DD_{Temp}$	-40		125	°C	
<b>Internally measured transceiver supply voltage</b>	$DD_{Voltage}$	2.8		4.0	V	
<b>Measured TX bias current</b>	$DD_{Bias}$	0		20	mA	
<b>Measured TX output power</b>	$DD_{Tx-Power}$	-10		-3	dBm	
<b>Measured RX received average optical power</b>	$DD_{Rx-Powe}$	-22		0	dBm	

#### Note:

1. Accuracy of Measured Tx Bias Current is 10% of the actual Bias Current from the laser driver to the laser.

## VI. Pin Description

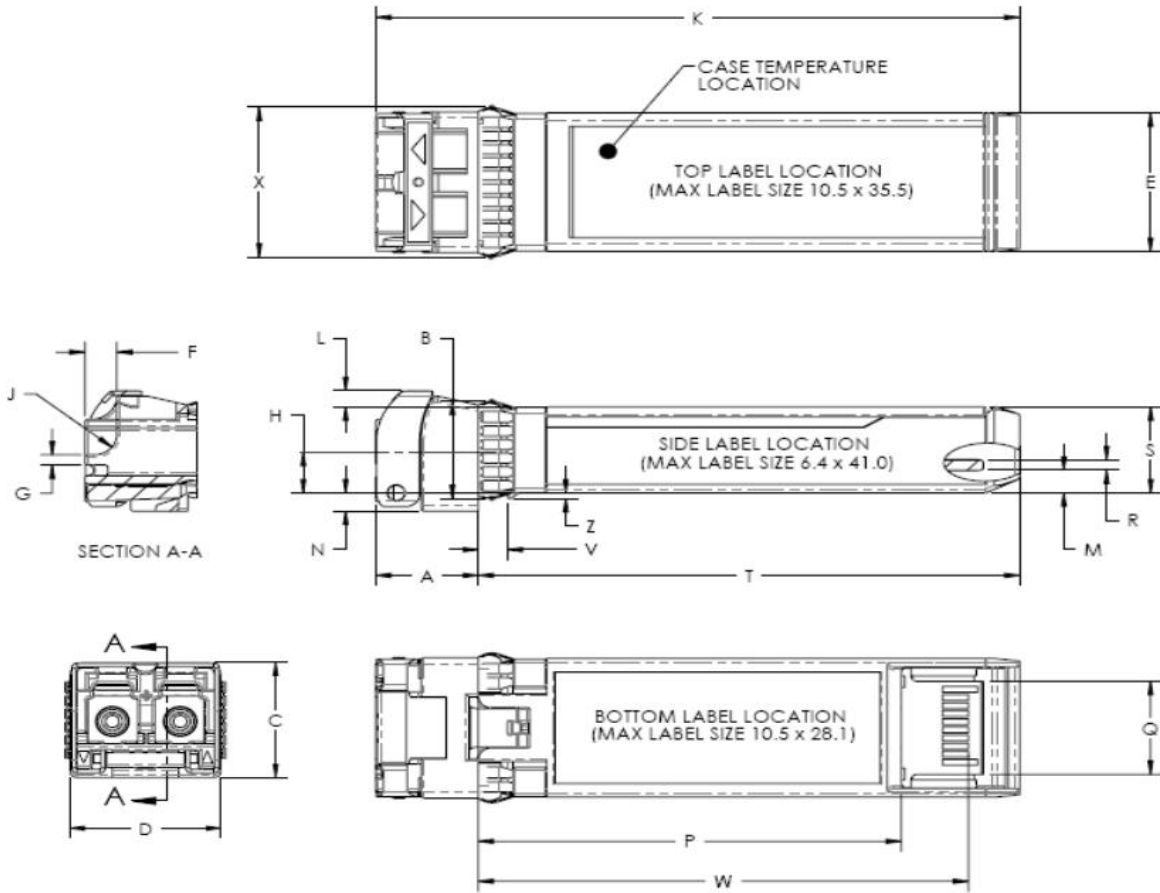
Pin	Symbol	Name/Description	Ref.
1	V <sub>EET</sub>	Transmitter Ground(Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault	2
3	T <sub>DIS</sub>	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	2
5	SCL	2-wire Serial Interface Clock Line	2
6	MOD_ABS	Module Absent. Grounded within the module	2
7	RS0	No connection required	4
8	RX_LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
9	RS1	No connection required	4
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 internally isolated from chassis ground.
2. T FAULT is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to  $V_{cc} + 0.3V$ . A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on T DIS >2.0V or open, enabled on T DIS <0.8V.
4. Should be pulled up with 4.7k $\Omega$  – 10k $\Omega$  on host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
5. LOS is open collector output. Should be pulled up with 4.7k $\Omega$  – 10k $\Omega$  on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.



## VII. Mechanical Specifications



**Note:**

- 1.The option of the label on the top side of the transceiver is not recommended.