

# 10G CWDM SFP+ 1270nm~1450nm 40km DOM Transceiver

3HE00041AA-LL



## Application

- 10GBASE-ER/EW 10G Ethernet
- 10GBASE-ER at 10.31Gbps
- 10GBASE-EW at 9.95Gbps
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- CPRI rates 9.830 Gb/s,7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s
- Other optical links

## Features

- Hot-Pluggable SFP+ Footprint
- Duplex LC connector
- Commercial temperature range: 0° C to 70° C
- 10-Wavelengths CWDM DFB Transmitter from 1270nm to 1450nm, with step 20nm
- Power Dissipation <1.2W
- Compliant with SFP+ MSA Specification SFF-8431
- 14dB Power Budget
- Build-in digital diagnostic functions, including optical power monitoring
- Compliant with SFF-8472 MSA

## Description

The 3HE00041AA-LL series optical transceiver is designed for fiber communications application such as 10G Ethernet, which fully compliant with the specification of SFP+ MSA SFF-8431.

This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are ten center wavelengths available from 1270nm to 1450nm, with each step 20nm. A guaranteed optical link budget of 14 dB is offered.

The module is with the SFP+ connector to allow hot plug capability. Single 3.3V power supply is needed. The optical output can be disabled by LVTTTL logic high-level input of TX\_DIS. Loss of signal (RX\_LOS) output is provided to indicate the loss of an input optical signal of receiver.

This module provides digital diagnostic functions via a 2-wire serial interface as defined by the SFF-8472 specification.

## Product Specifications

### I. General Specifications

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
<b>Module Form Factor</b>	BR	9.95		10.5	Gb/s	1
<b>Number of Lanes</b>	BER			10 <sup>-12</sup>		2
<b>Maximum Aggregate Data Rate</b>	L <sub>max</sub>		40		km	

#### Notes:

- 10GBASE-ER, 10GBASE-EW, 1200-SM-LL-L 10GFC.
- Tested with a PRBS 2<sup>31</sup>-1 test pattern.

## CWDM Wavelength

18 Wavelengths from 1270nm to 1610nm, each step 20nm.

Band	Nomenclature	Wavelength(nm)		
		Min	Typ.	Max
<b>O-band Original</b>	A	1264	1270	1277.5
	B	1284	1290	1297.5
	C	1304	1310	1317.5
	D	1324	1330	1337.5
	E	1344	1350	1357.5
<b>E-band Extended</b>	F	1364	1370	1377.5
	G	1384	1390	1397.5
	H	1404	1410	1417.5
	I	1424	1430	1437.5
	J	1444	1450	1457.5
<b>S-band Short Wavelength</b>	K	1464	1470	1477.5
	L	1484	1490	1497.5
	M	1504	1510	1517.5
	N	1524	1530	1537.5
<b>C-band Conventional</b>	O	1544	1550	1557.5
<b>L-band Long Wavelength</b>	P	1564	1570	1577.5
	Q	1584	1590	1597.5
	R	1604	1610	1617.5

## II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit
<b>Maximum Supply Voltage</b> <sup>1</sup>	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>c</sub>	0		70	° C
<b>Supply Voltage</b>	V <sub>cc</sub>	3.13	3.3	3.45	V
<b>Supply Current</b>	I <sub>cc</sub> (0° C to 70° C)			350	mA

## III. Electrical Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit	Notes
<b>Transmitter</b>						
0	V <sub>in</sub>	150		1200	mVpp	1
Input Impedance (Differential)	Z <sub>in</sub>	85	100	115	ohm	
TX_DISABLE Input Voltage - High		2		V <sub>cc</sub> +0.3	V	
TX_DISABLE Input Voltage - Low		0		0.8	V	
TX_FAULT Output Voltage - High		2		V <sub>cc</sub> +0.3	V	
TX_FAULT Output Voltage - Low		0		0.5	V	

### Receiver

<b>CML Outputs (Differential)</b>	Vout	350		700	mVpp	1
<b>Output Impedance (Differential)</b>	Zout	85	100	115	ohm	
<b>RX_LOS Output Voltage - High</b>		2		Vcc+0.3	V	
<b>RX_LOS Output Voltage - Low</b>		0		0.8	V	
<b>MOD_DEF ( 2:0 )</b>	VoH	2.5			V	2
	VoL	0		0.5	V	

**Notes:**

1. After internal AC coupling.
2. Reference the SFF-8472 MSA.

## IV. Optical Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit	Notes
<b>Transmitter</b>						
<b>Optical Wavelength</b>	$\lambda$	$\lambda_c-6.5$	$\lambda_c$	$\lambda_c+6.5$	nm	2
<b>-20dB Spectrum Width</b>	$\Delta\lambda$			1	nm	
<b>Side Mode Suppression Ratio</b>	SMSR	30			dB	
<b>Output Opt. Pwr: 9/125 SMF</b>	P <sub>out</sub>	0		5	dBm	1
<b>Optical Extinction Ratio</b>	ER	3.5			dB	
<b>Average Launch Power of OFF Transmitter</b>	P <sub>OFF</sub>			-30	dBm	
<b>Transmitter Dispersion Penalty</b>	TDP			2	dB	

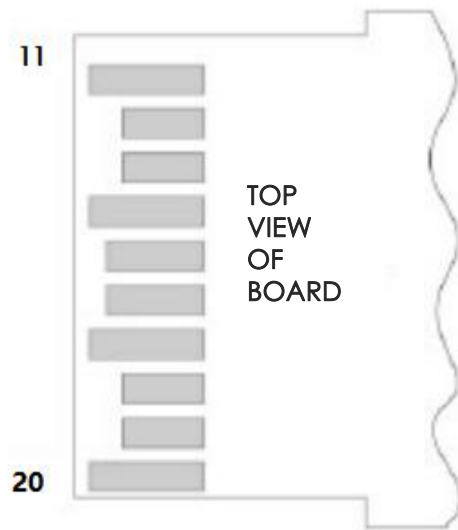
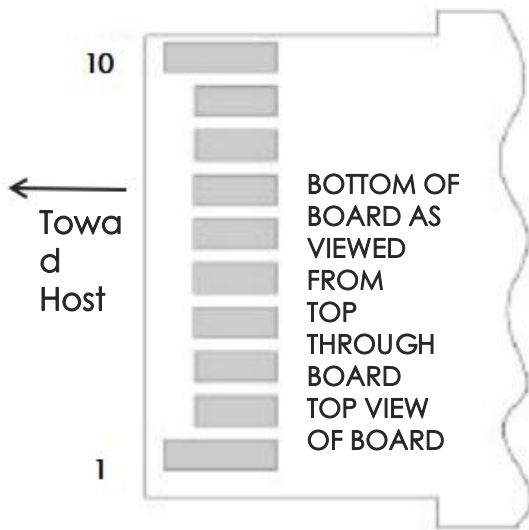
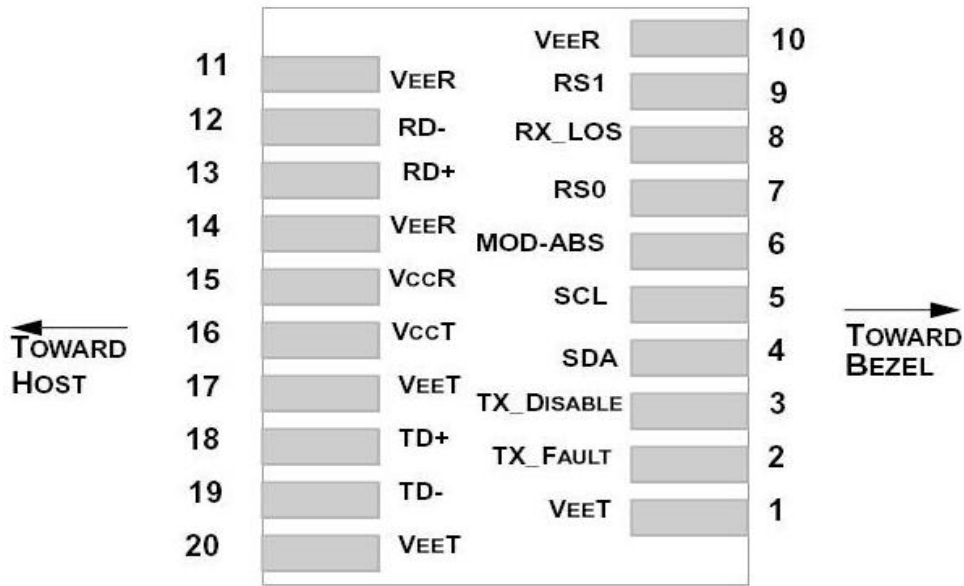
### Receiver

<b>Receiver Sensitivity @ 10.5Gb/s</b>	$P_{min}$			-16	dBm	3
<b>Maximum Input Power</b>	$P_{max}$	-0.5			dBm	
<b>Optical Center Wavelength</b>	$\lambda$	1260		1420	nm	
<b>Receiver Reflectance</b>	Rrf			-27	dB	
<b>LOS De-Assert</b>	$LOS_D$			-16	dBm	
<b>LOS Assert</b>	$LOS_A$	-28			dBm	
<b>LOS Hysteresis</b>		1			dB	

**Notes:**

1. Output power is coupled into a 9/125 $\mu$ m SMF.
2. ITU-T G.694.2 CWDM wavelength from 1470nm to 1610nm, each step 20nm.
3. Average received power; BER less than 1E-12 and PRBS 2<sup>31</sup>-1 test pattern.

### V. Pin Description



Pin Num.	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	Note 5
2	TX Fault	Transmitter Fault Indication	3	Note 1
3	TX Disable	Transmitter Disable	3	Note 2, Module disables on high or open
4	SDA	Module Definition 2	3	Data line for Serial ID.

5	SCL	Module Definition 1	3	Clock line for Serial ID.
6	MOD-ABS	Module Definition 0	3	Note 3
7	RS0	RX Rate Select (LVTTTL).	3	This pin has an internal 30k pull down to ground. A signal on this pin will not affect module performance.
8	LOS	Loss of Signal	3	Note 4
9	RS1	TX Rate Select (LVTTTL).	1	This pin has an internal 30k pull down to ground. A signal on this pin will not affect module performance.
10	VeeR	Receiver Ground	1	Note 5
11	VeeR	Receiver Ground	1	Note 5
12	RD-	Inv. Received Data Out	3	Note 6
13	RD+	Received Data Out	3	Note 6
14	VeeR	Receiver Ground	1	Note 5
15	VccR	Receiver Power	2	3.3V ± 5%, Note 7
16	VccT	Transmitter Power	2	3.3V ± 5%, Note 7
17	VeeT	Transmitter Ground	1	Note 5
18	TD+	Transmit Data In	3	Note 8
19	TD-	Inv. Transmit Data In	3	Note 8
20	VeeT	Transmitter Ground	1	Note 5

**Notes:**

- TX Fault is an open collector/drain output, which should be pulled up with a 4.7K –10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT/R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 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~10 KΩ resistor. Its states are: Low (0 – 0.8V): Transmitter on (>0.8, < 2.0V): Undefined High (2.0 – 3.465V): Transmitter Disabled Open: Transmitter Disabled
- Module Absent, connected to VeeT or VeeR in the module.
- LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K –10 KΩ resistor on host board. Pull up voltage between 2.0V and VccT/R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.



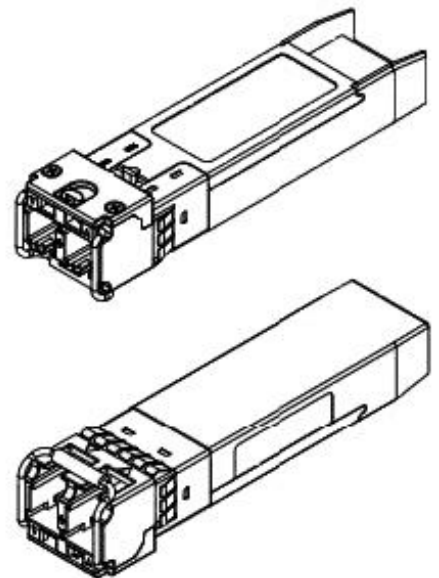
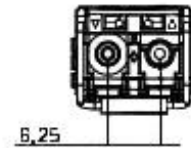
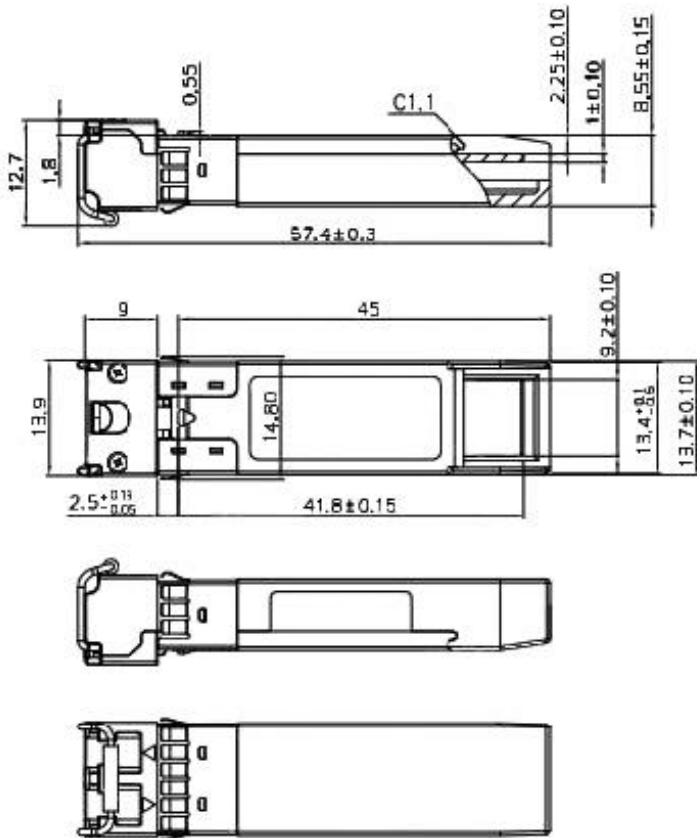
5. VeeR and VeeT may be internally connected within the SFP+ module.

6. RD-/+ : These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 370 and 700 mV differential (185 –350mV single ended) when properly terminated.

7. VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ± 5% at the SFP+ connector pin. Maximum supply current is 350mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP+ input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP+ transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP+ transceiver module.

8. TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 150 – 1200 mV (75 – 600mV single-ended), though it is recommended that values between 150 and 1200 mV differential (75 – 600mV single-ended) be used for best EMI performance.

## VI. Mechanical Specifications



Unremarked tolerances ±0.2mm