

## YQ21H-3180

### Features

- ✓ Supports line rates from 103.125 Gb/s to 111.81 Gb/s OTU4
- ✓ Compliant to Ethernet 100GBASE-ZR4
- ✓ 4x25Gbps LAN-WDM EML laser  
TOSA (1295.56, 1300.05, 1304.58, 1309.14nm)
- ✓ PIN receiver with SOA
- ✓ Up to 80km reach for G.652 SMF
- ✓ Duplex LC optical receptacles
- ✓ Hot pluggable QSFP28 form factor
- ✓ Power dissipation < 6.5W
- ✓ Single +3.3V power supply
- ✓ RoH-10 compliant (lead free)
- ✓ Operating case temperature:  
Commercial: 0°C to +70°C  
Extended: -10 °C to +80°C  
Industrial: -40 °C to +85°C



### Applications

- ✓ 100GBASE-ZR4 Ethernet Links
- ✓ Infiniband QDR and DDR interconnects
- ✓ Telecom networking

### Standards

- ✓ Compliant with QSFP28 MSA
- ✓ Compliant with SFF-8636
- ✓ Compatible with IEEE802.3ba

### Description

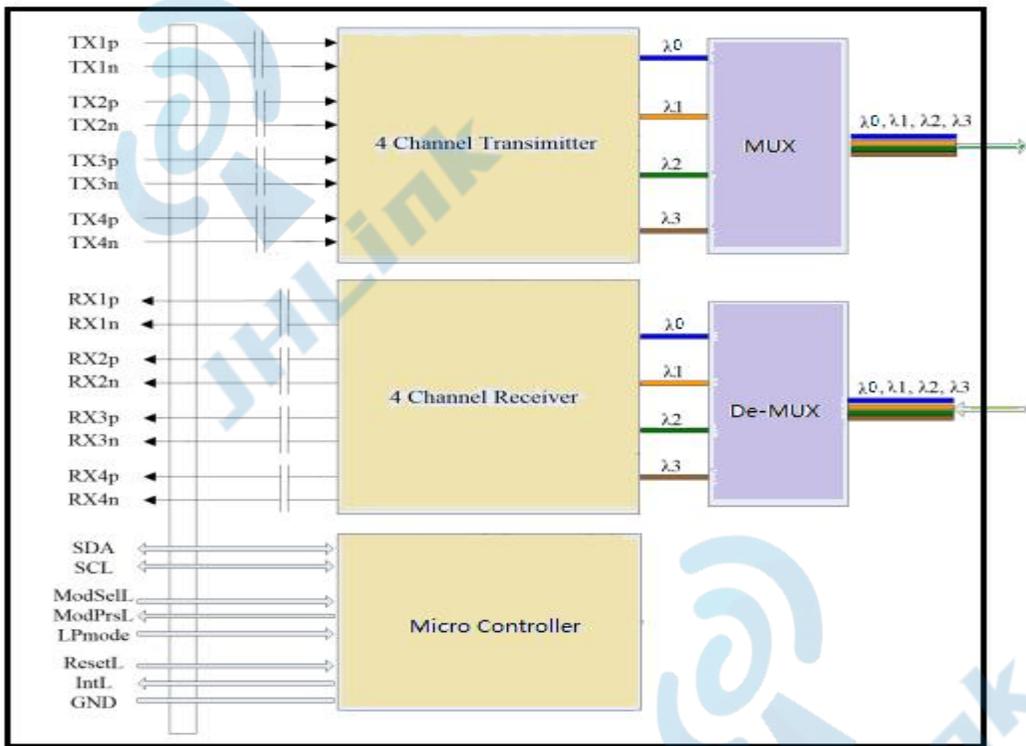
The QSFP28 transceivers are designed for use in 100-Gigabit Ethernet links up to 80km over Single Mode Fiber. The transceivers are compatible with QSFP28 MSA and SFF-8636. For further information, please refer to QSFP28 MSA and SFF-8636.

This product is a 100Gb/s transceiver module designed for optical communication applications compliant to Ethernet 100GBASE-ZR4 standard. The module converts 4 input channels of 25Gb/s electrical data to 4 channels of LAN WDM optical signals and then multiplexes them into a single channel for 100Gb/s optical transmission. Reversely on the receiver side, the module de-multiplexes a 100Gb/s optical input into 4 channels of LAN WDM optical signals and then converts them to 4 output channels of electrical data.

The central wavelengths of the 4 LAN WDM channels are 1295.56, 1300.05, 1304.58 and 1309.14 nm as

members of the LAN WDM wavelength grid defined in IEEE 802.3ba. The high performance cooled LAN WDM EML transmitters and high sensitivity SOA receivers provide superior performance for 100Gigabit Ethernet applications up to 80km links.

### Module Block Diagram



### Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min.	Typical	Max.	Unit
Power Supply Voltage	V <sub>CC</sub>	0		4.0	V
Storage Temperature	T <sub>s</sub>	-40		+85	°C
Relative Humidity	RH	15		85	%
RX Input Average Power per Lane	P <sub>max</sub>	-		6.5	dBm

## Recommended Operating Environment

Parameter	Symbol	Min	Typic	Max	Unit	Notes
Operating Case	T <sub>OP</sub>	0		70	°C	commercial
		-10		80		extended
		-40		85		Industrial
Power Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V	
Data Rate, each Lane			25.78		Gb/s	
Control Input Voltage High		2		V <sub>CC</sub>	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			40	km	1

Notes:

1. Depending on actual fiber loss/km (link distance specified is for fiber insertion loss of 0.35dB/km)

## Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Sym	Min.	Typ.	Max	Un	Notes
Power Consumption	p			6.5	W	
Supply Current	I <sub>CC</sub>			1876	mA	
<b>Transmitter (each Lane)</b>						
Overload Differential Voltage pk-pk	TP1a			900	mV	
Common Mode Voltage (V <sub>cm</sub> )	TP1	-350		2850	mV	1
Differential Termination Resistance Mismatch	TP1			10	%	At 1MHz
Differential Return Loss (SDD11)	TP1			See CEI-28G -VSR Equation 13-19	dB	

Common Mode to Differential conversion and Differential to Common Mode conversion (SDC11, SCD11)	<b>TP1</b>			See CEI-28G -VSR Equation 13-20	<b>dB</b>	
Stressed Input Test	TP1a	See CEI-28G-VSR Section 13.3.1				
<b>Receiver</b>						
Differential Voltage, pk-pk	TP4			900	mV	
Common Mode Voltage (Vcm)	<b>TP4</b>	-350		2850	<b>mV</b>	1
Common Mode Noise, RMS	<b>TP4</b>			10	%	At 1MHz
Differential Return Loss (SDD22)	<b>TP4</b>			See CEI-28G -VSR Equation 13-19	<b>dB</b>	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC22, SCD22)	<b>TP4</b>			See CEI-28G -VSR Equation 13-21	<b>dB</b>	
Common Mode Return Loss (SCC22)	<b>TP4</b>			-2	<b>dB</b>	2
Transition Time, 20 to 80%	<b>TP4</b>	9.5			<b>ps</b>	
Vertical Eye Closure (VEC)	<b>TP4</b>			5.5	<b>dB</b>	
Eye Width at 10-15 probability (EW15)	<b>TP4</b>	0.57			<b>UI</b>	
Eye Height at 10-15 probability (EH15)	<b>TP4</b>	228			<b>mV</b>	

**Notes:**

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.
2. From 250MHz to 30GHz.

**Optical Parameters**

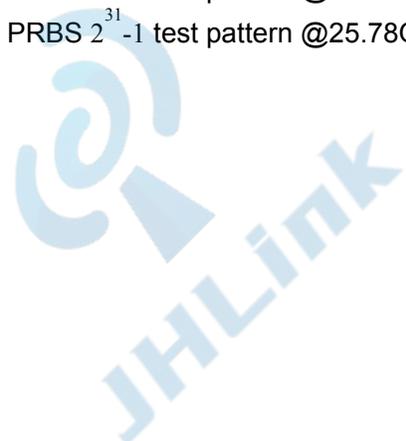
The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
<b>Transmitter Section</b>						
Lane Centre Wavelength (range)	$\lambda_0$	1294.53	1295.56	1296.59	nm	
	$\lambda_1$	1299.02	1300.05	1301.09	nm	
	$\lambda_2$	1303.54	1304.58	1305.63	nm	
	$\lambda_3$	1308.09	1309.14	1310.19	nm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Signaling rate, each lane			25.78125		GBd	
Total launch power	$P_T$	8.0		+12.5	dBm	
Average Optical Power per Lane	$P_{out}$	2.0		+4.5	dBm	1
Laser Off Power per Lane	$P_{off}$	-	-	-30	dBm	
Extinction Ratio	ER	6.0	-	-	dB	2
Difference in Launch Power between any Two Lanes (OMA)	$P_{tx,diff}$			3.6	dB	
Transmitter reflectance	$R_T$			-12	dB	
RIN20OMA	RIN	-	-	-130	dB/Hz	
Optical Return Loss Tolerance	TOL	-	-	20	dB	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				2
<b>Receiver Section</b>						
Lane Center Wavelength (range)	$\lambda_0$	1294.53		1296.59	nm	
	$\lambda_1$	1299.02		1301.09	nm	
	$\lambda_2$	1303.54		1305.63	nm	
	$\lambda_3$	1308.09		1310.19	nm	
Signaling rate, each lane			25.78125		GBd	
Average Receiver Power per Lane	$RXP_X$	-28		-7	dBm	
Receive Power (OMA), each Lane				-7	dBm	
OMA Sensitivity per Lane(for BER = $1 \times 10^{-12}$ )	$RX_{sens1}$			-20.9	dBm	3
OMA Sensitivity per Lane(for BER = $5 \times 10^{-5}$ )	$RX_{sens2}$			-28	dBm	4

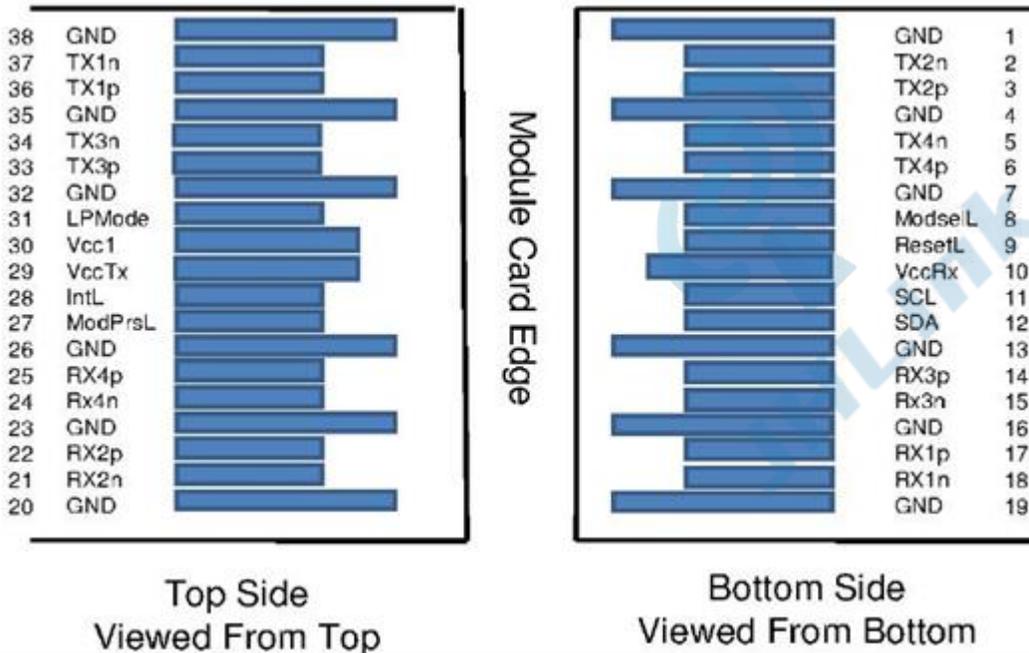
Difference in Receive Power between any Two Lanes (Average and OMA)	Ptx,diff			3.6	dB	
Los Assert	LOS <sub>A</sub>	-40	-	-	dBm	
Los Dessert	LOS <sub>D</sub>	-	-	-29	dBm	
Los Hysteresis	LOS <sub>H</sub>	0.5	-	-	dB	

**Notes:**

1. The minimum average launch power spec is based on ER not exceeding 9.5dB and transmitter OMA higher than 0.1dBm.
2. Measured with a PRBS 2<sup>31</sup>-1 test pattern @25.78Gbps.
3. Measured with a PRBS 2<sup>31</sup>-1 test pattern @25.78Gbps, ER=5dB, BER < 10<sup>-12</sup>.
4. Measured with a PRBS 2<sup>31</sup>-1 test pattern @25.78Gbps, ER=5dB, BER < 10<sup>-6</sup>.



**Pin Definitions**



## Pin Descriptions

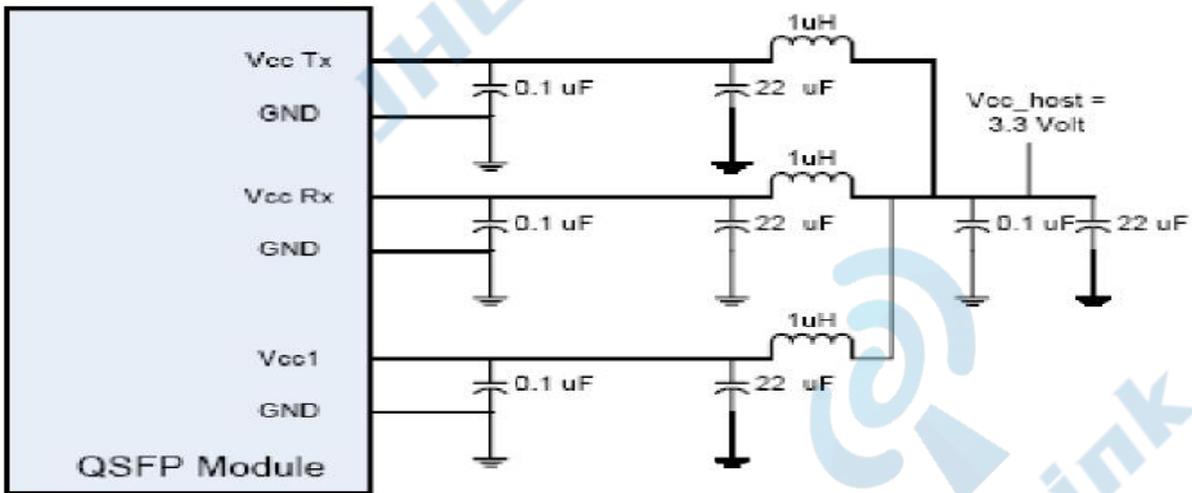
Pin	Symbol	Description	Plug Seq.	Notes
1	Ground	Ground	1	1
2	Tx2n	Transmitter Inverted Data Input	3	
3	Tx2p	Transmitter Non-Inverted Data Input	3	
4	Ground	Ground	1	1
5	Tx4n	Transmitter Inverted Data Input	3	
6	Tx4p	Transmitter Non-Inverted Data Input	3	
7	Ground	Ground	1	1
8	ModSelL	Module Select	3	
9	ResetL	Module Reset	3	
10	VccRx	+3.3 V Power supply receiver	2	2
11	SCL	2-wire serial interface clock	3	
12	SDA	2-wire serial interface data	3	
13	Ground	Ground	1	1
14	Rx3p	Transmitter Non-Inverted Data Input	3	
15	Rx3n	Transmitter Inverted Data Input	3	
16	Ground	Ground	1	1
17	Rx1p	Transmitter Non-Inverted Data Input	3	
18	Rx1n	Transmitter Inverted Data Input	3	
19	Ground	Ground	1	1
20	Ground	Ground	1	1
21	Rx2n	Transmitter Inverted Data Input	3	
22	Rx2p	Transmitter Non-Inverted Data Input	3	
23	Ground	Ground	1	1
24	Rx4n	Transmitter Inverted Data Input	3	
25	Rx4p	Transmitter Non-Inverted Data Input	3	
26	Ground	Ground	1	1
27	ModPrsL	Module Present	3	
28	IntL	Interrupt	3	
29	VccTx	+3.3 V Power supply transmitter	2	2
30	Vcc1	+3.3 V Power Supply	2	2
31	LPMODE	Low Power Mode	3	
32	Ground	Ground	1	1
33	Tx3p	Transmitter Non-Inverted Data Input	3	
34	Tx3n	Transmitter Inverted Data Input	3	
35	Ground	Ground	1	1
36	Tx1p	Transmitter Non-Inverted Data Input	3	
37	Tx1n	Transmitter Inverted Data Input	3	
38	Ground	Ground	1	1

**Notes:**

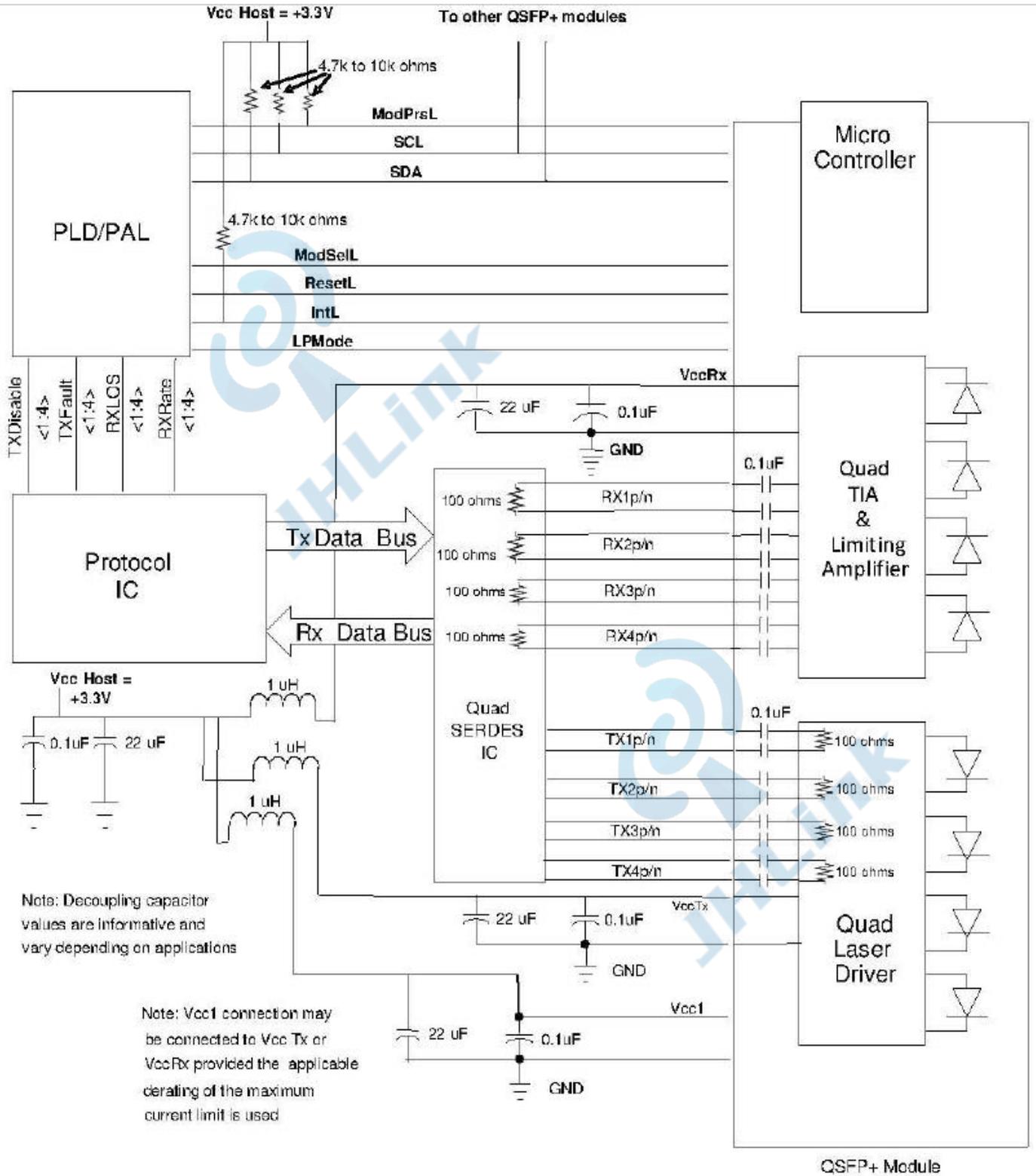
Plug Seq.: Pin engagement sequence during hot plugging.

1. Module ground pins GND are isolated from the module case.
2. VccRx, Vcc1 and VccTx are the receiver and transmitter power supplies and shall be applied concurrently.

**Recommended Power Interface Circuit**



## Recommended Interface Circuit



## Digital Diagnostic Functions

The QSFP28 transceivers support the 2-wire serial communication protocol as defined in the QSFP28 MSA, which allows real-time access to the following operating parameters:

- ✓ Transceiver temperature
- ✓ Laser bias current
- ✓ Transmitted optical power
- ✓ Received optical power
- ✓ Transceiver supply voltage

It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive edge clocks data into the QSFP28 transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the QSFP28 transceiver. The serial data signal (SDA pin) 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. The 2-wire serial interface provides sequential or random access to the 8 bit parameters, addressed from 00h to the maximum address of the memory.

This clause defines the Memory Map for QSFP28 transceiver used for serial ID, digital monitoring and certain control functions. The interface is mandatory for all QSFP28 devices. The memory map has been changed in order to accommodate 4 optical channels and limit the required memory space. The structure of the memory is shown in Figure 2 QSFP28 Memory Map. The memory space is arranged into a lower, single page, address space of 128 bytes and multiple upper address space pages. This structure permits timely access to addresses in the lower page, e.g. Interrupt Flags and Monitors. Less time critical entries, e.g. serial ID information and threshold settings, are available with the Page Select function. The structure also provides address expansion by adding additional upper pages as needed. For example, in Figure 2 upper pages 01 and 02 are optional. Upper page 01 allows implementation of Application Select Table, and upper page 02 provides user read/write space. The lower page and upper pages 00 and 03 are always implemented. The interface address used is A0 and is mainly used for time critical data like interrupt handling in order to enable a “one-time-read” for all data related to an interrupt situation. After an Interrupt, IntL, has been asserted, the host can read out the flag field to determine the effected channel and type of flag.

For more detailed information including memory map definitions, please see the QSFP28 MSA Specification.

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	°C	Over operating
Supply voltage monitor absolute error	DMI_VCC	-0.15	0.15	V	Full operating range
RX power monitor absolute error	DMI_RX	-3	3	dB	
Bias current monitor	DMI_bias	-10%	10%	mA	
TX power monitor absolute error	DMI_TX	-3	3	dB	

## Mechanical Dimensions

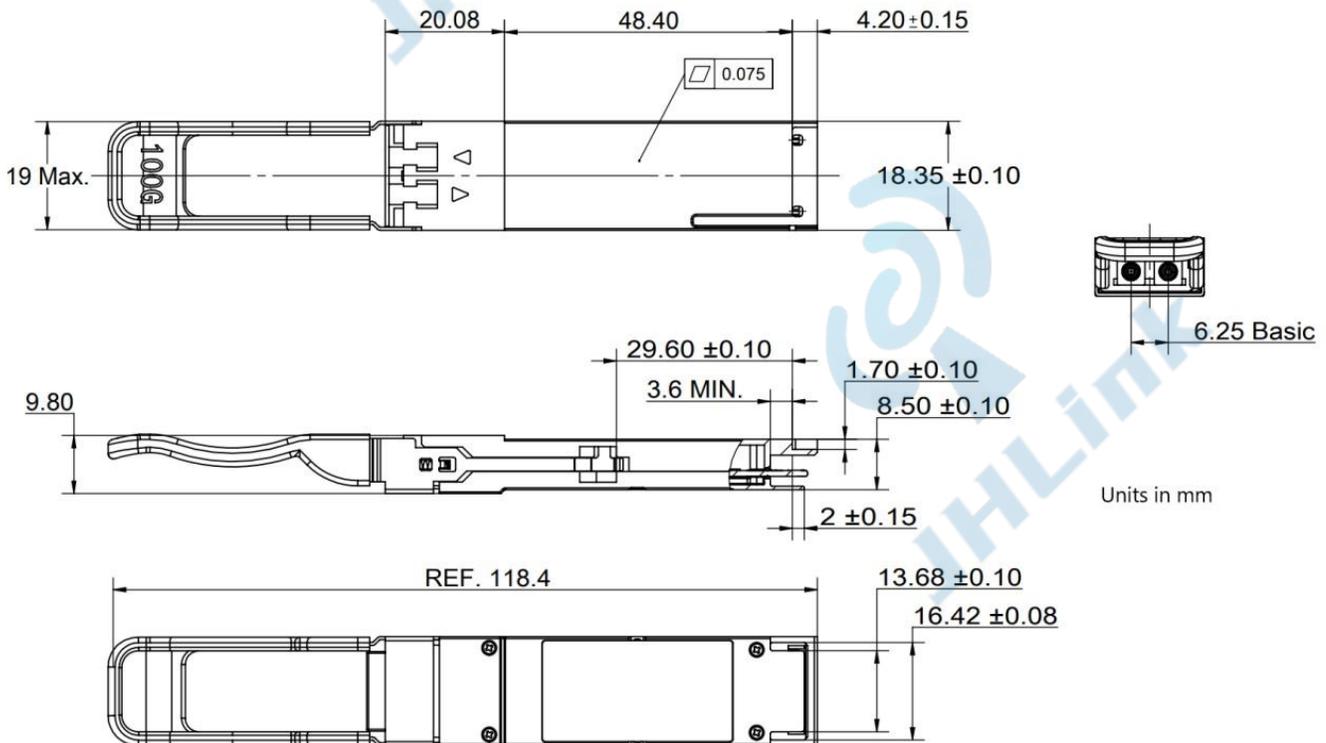


Figure2. Mechanical Outline

## Ordering information

Part Number	Product Description
YQ21H-3180	100Gbps QSFP28 ZR4, 80km on SMF, 0°C ~ +70°C, With DDM.
YQ21H-3180E	100Gbps QSFP28 ZR4, 80km on SMF, -10°C ~ +80°C, With DDM.
YQ21H-3180T	100Gbps QSFP28 ZR4, 80km on SMF, -40°C ~ +85°C, With DDM.

## References

1. QSFP28 MSA Specification for QSFP28 Copper and Optical Transceiver, Rev 4.7, February 2013.
2. SFF-8636 Specification for Management Interface for Cabled Environments, Rev 2.6, June 2015.
3. IEE 802.3ba - PMD Type 100GBASE-ZR4.

## Important Notice

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