



### Features

- QSFP28 and SFP28 MSA compliant
- Four independent full-duplex channels
- Supports 103.1Gb/s aggregate bit rate
- Up to 100m OM4 MMF transmission
- Operating case temperature: 0 to 70oC
- Single 3.3V power supply
- 4x25G electrical interface (OIF CEI-28G-VSR) for QSFP28 terminal
- 25G electrical interface (OIF CEI-28G-VSR) for SFP28 terminal
- Maximum power consumption of 2.5W for QSFP28 terminal and 1.0W for each SFP28 terminal
- RoHS-6 compliant

### Applications

- 100G Ethernet
- Infiniband EDR

### Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Temperature	T <sub>s</sub>	-40	85	°C	
Operating Case Temperature	T <sub>OP</sub>	0	70	°C	
Power Supply Voltage	V <sub>CC</sub>	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	0	85	%	

**Recommended Operating Conditions**

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Typical</i>	<i>Max.</i>	<i>Units</i>	<i>Note</i>
Operating Case Temperature	$T_{OP}$	0		70	°C	
Power Supply Voltage	$V_{CC}$	3.135	3.3	3.465	V	
Data Rate, each Lane (QSFP28)			25.78125			
Data Rate, each Module (SFP28)			25.78125			
Data Rate Accuracy		-100		100	ppm	
Control Input Voltage High		2		$V_{CC}$	V	
Control Input Voltage Low		0		0.8	V	

## Electrical Characteristics

### QSFP28 Terminal

Parameter	Symbol	Min	Typ.	Max	Units	Notes
Power Consumption				2.5	W	
Supply Current	Icc			757	mA	
<b>Transmitter (each Lane)</b>						
Overload Differential Voltage pk-pk	TP1a	900			mV	
Common Mode Voltage (Vcm)	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)	TP1			See CEI-28G-VSR Equation 13-20	dB	
Stressed Input Test	TP1a	See CEI-28G-VSR Section 13.3.11.2.1				
<b>Receiver (each Lane)</b>						
Differential Voltage, pk-pk	TP4			900	mV	
Common Mode Voltage (Vcm)	TP4	-350		2850	mV	1
Common Mode Noise, RMS	TP4			17.5	mV	
Differential Termination Resistance Mismatch	TP4			10	%	At 1MHz
Differential Return Loss (SDD22)	TP4			See CEI-28G-VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC22, SCD22)	TP4			See CEI-28G-VSR Equation 13-21	dB	

Common Mode Return Loss (SCC22)	TP4	-2	dB	2
Transition Time, 20 to 80%	TP4	9.5	ps	
Vertical Eye Closure (VEC)	TP4	5.5	dB	
Eye Width at 10 <sup>-15</sup> probability (EW15)	TP4	0.57	UI	
Eye Height at 10 <sup>-15</sup> probability (EH15)	TP4	228	mV	

Notes:

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

**SFP28 Terminal**

Parameter	Symbol	Min	Typ.	Max	Units	Notes
Power Consumption				1.0	W	1
Supply Current	Icc			300	mA	1
<b>Transmitter</b>						
Overload Differential Voltage pk-pk	TP1a	900			mV	
Common Mode Voltage (Vcm)	TP1	-350		2850	mV	2
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)	TP1			See CEI-28G-VSR Equation 13-20	dB	
Stressed Input Test	TP1a		See CEI-28G-VSR Section 13.3.11.2.1			
<b>Receiver</b>						
Differential Voltage, pk-pk	TP4			900	mV	
Common Mode Voltage (Vcm)	TP4	-350		2850	mV	2
Common Mode Noise, RMS	TP4			17.5	mV	
Differential Termination Resistance Mismatch	TP4			10	%	At 1MHz
Differential Return Loss (SDD22)	TP4			See CEI-28G-VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC22, SCD22)	TP4			See CEI-28G-VSR Equation 13-21	dB	
Common Mode Return Loss (SCC22)	TP4			-2	dB	3

---

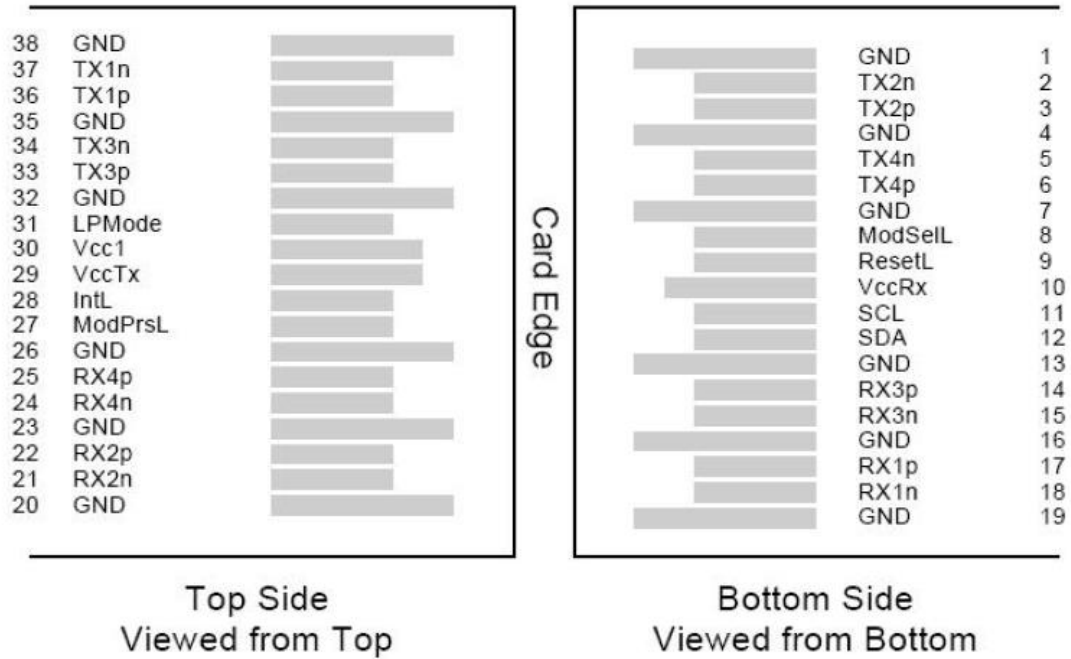
Transition Time, 20 to 80%	TP4	9.5		ps
Vertical Eye Closure (VEC)	TP4		5.5	dB
Eye Width at 10 <sup>-15</sup> probability (EW15)	TP4	0.57		UI
Eye Height at 10 <sup>-15</sup> probability (EH15)	TP4	228		mV

---

Notes:

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

**Pin Assignment – QSFP28 Terminal**



**Pin Description – QSFP28 Terminal**

Pin	Logic	Symbol	Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-inverted Data Input	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-inverted Data Input	
7		GND	Ground	1
8	LVTTL-I	ModSelL	Module Select	
9	LVTTL-I	ResetL	Module Reset	
10		VccRx	+3.3V Power Supply Receiver	2
11	LVCMOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVCMOS-I/O	SDA	2-Wire Serial Interface Data	
13		GND	Ground	
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
15	CML-O	Rx3n	Receiver Inverted Data Output	

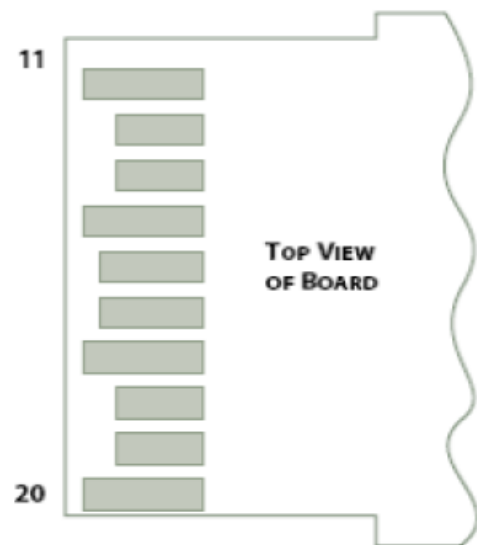
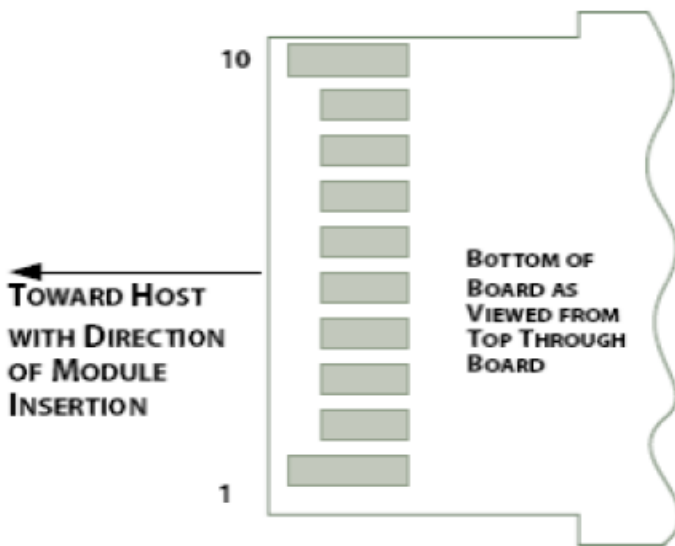
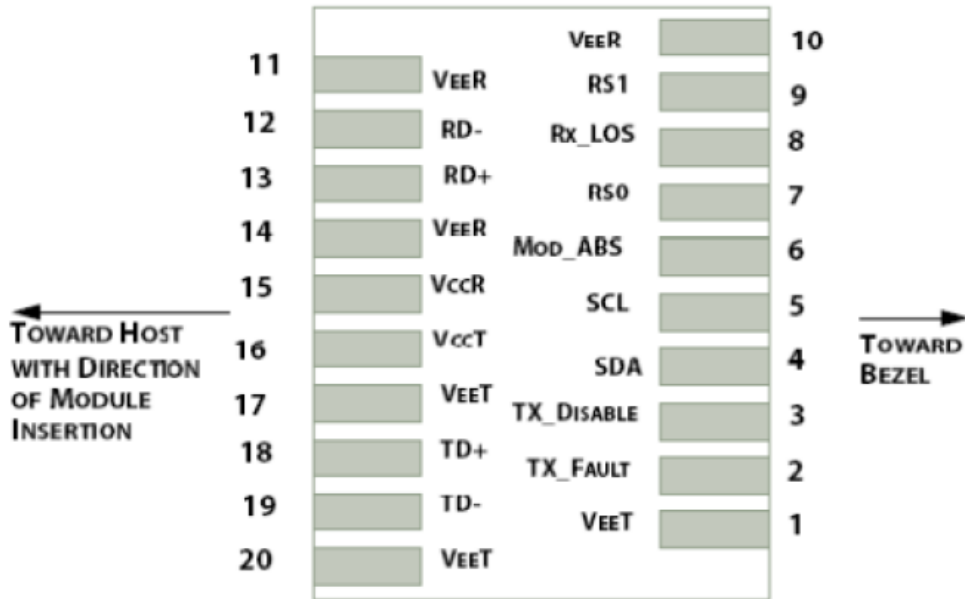
Pin	Logic	Symbol	Description	Note
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	1
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1
27	LVTTTL-O	ModPrsL	Module Present	
28	LVTTTL-O	IntL	Interrupt	
29		VccTx	+3.3V Power Supply Transmitter	2
30		Vcc1	+3.3V Power Supply	2
31	LVTTTL-1	LPMODE	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Input	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Input	
38		GND	Ground	1

Notes:

- GND is the symbol for signal and supply (power) common for QSFP28 modules. All are common within the QSFP28 module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
- VccRx, Vcc1 and VccTx are the receiving and transmission power suppliers and shall be applied concurrently. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP28 transceiver module in any combination. The connector pins are each rated for a maximum current of 1000mA.



**Pin Assignment – SFP28 Terminal**



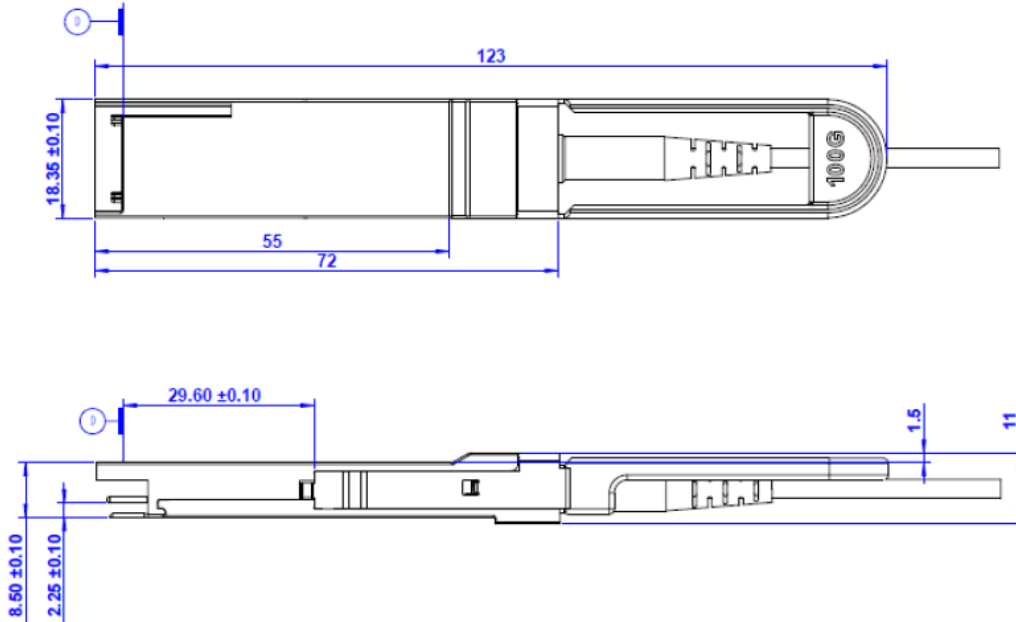
### Pin Description – SFP28 Terminal

Pin	Logic	Symbol	Description	Note
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	2
6		MOD_DEF0	Module Definition, Grounded in the module	
7	LVTTL-I	RS0	No connection required	
8	LVTTL-O	RX-LOS	Receiver Loss of Signal Indication. Logic 0 indicates normal operation	
9	LVTTL-I	RS1	No connection required	
10		VeeR	Module Receiver Ground	1
11		VeeR	Module Receiver Ground	1
12	CML-O	RD-	Receiver Inverted Data Output	
13	CML-O	RD+	Receiver Data Output	
14		VeeR	Module Receiver Ground	1
15		VccR	Module Receiver 3.3 V Supply	
16		VccT	Module Receiver 3.3 V Supply	
17		VeeT	Module Transmitter Ground	1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	
19	CML-I	TD-	Transmitter Inverted Data Input	
20		VeeT	Module Transmitter Ground	1

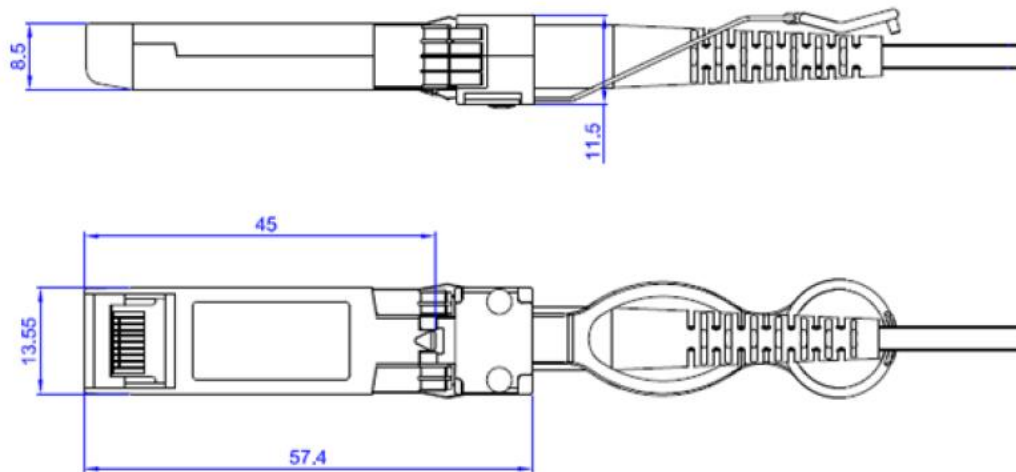
Notes:

1. Module ground pins GND are isolated from the module case.
2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.

**Dimensions**

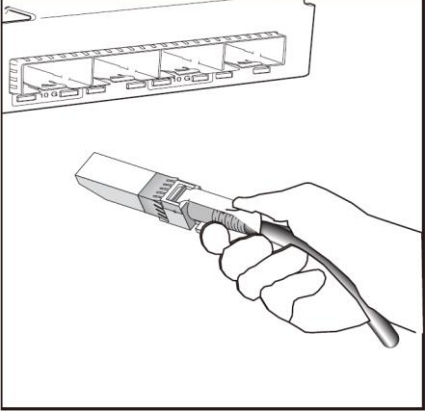
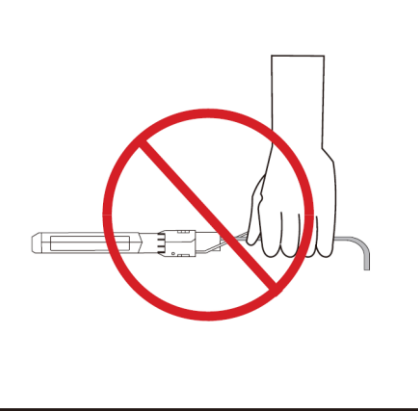
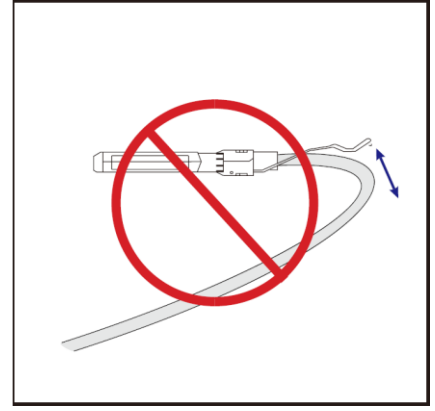
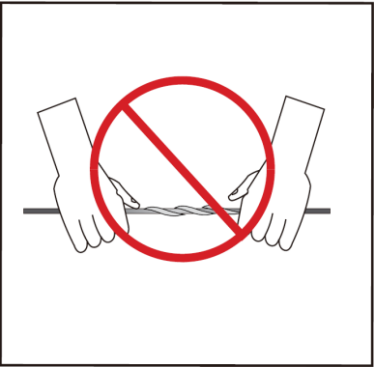

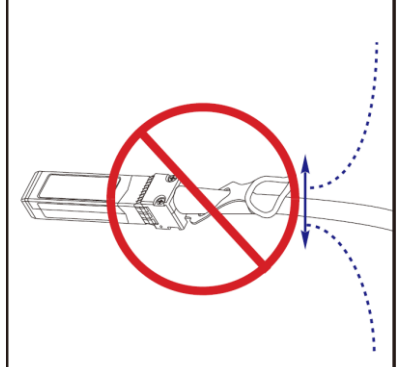


**Mechanical Outline of QSFP28 Terminal**

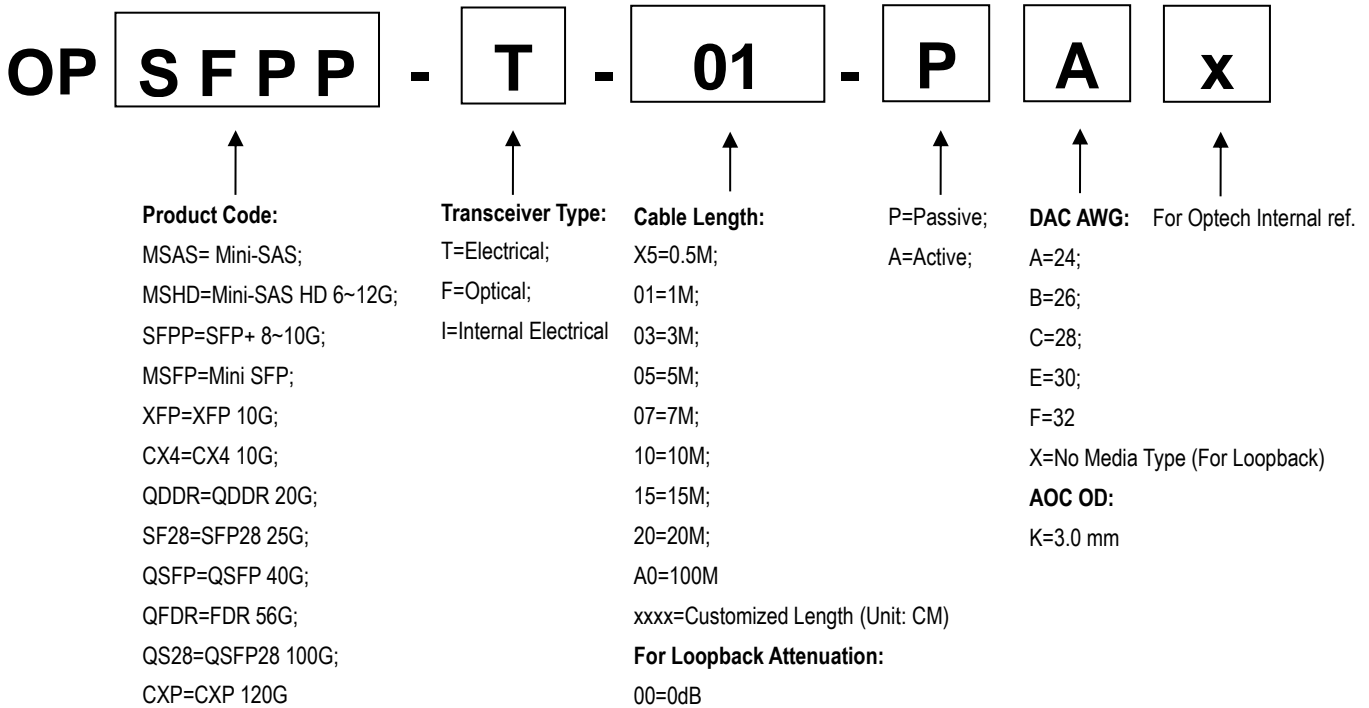


**Mechanical Outline of SFP28 Terminal**

**Important Notice**

		
<p>Holding the SFP+ connector by its sides, insert the connector into the port on the switch</p>	<p>Do not handle by cable</p>	<p>DO NOT Over-bend the cable behind the connector</p>
		
<p>DO NOT twist the cable</p>	<p>DO NOT kink the cable</p>	<p>DO NOT bend up and down the cable</p>

**Ordering Information**



Part Number	Model Number	Length (M)	Voltage	Temperature
OPQS28-F-01-A/SF28/4	Active Optical Cable	1	3.3V	0°C ~ 70°C
OPQS28-F-03-A/SF28/4	Active Optical Cable	3	3.3V	0°C ~ 70°C
OPQS28-F-05-A/SF28/4	Active Optical Cable	5	3.3V	0°C ~ 70°C
OPQS28-F-07-A/SF28/4	Active Optical Cable	7	3.3V	0°C ~ 70°C
OPQS28-F-10-A/SF28/4	Active Optical Cable	10	3.3V	0°C ~ 70°C
OPQS28-F-50-A/SF28/4	Active Optical Cable	50	3.3V	0°C ~ 70°C
OPQS28-F-A0-A/SF28/4	Active Optical Cable	100	3.3V	0°C ~ 70°C

**Note: All information contained in this document is subject to change without notice.**