QSFP28-100G-DCO-0DBM-C

MSA (with select systems) TAA 100GBase-ZR QSFP28 Transceiver (SMF, 1528.77nm to 1567.13nm, 80km, LC, DOM, 0 to 70C) 0dbm

Features:

- Hot-Pluggable QSFP28 Form Factor
- IEEE 100G Ethernet (CAUI-4) Compliant Host Interface
- High Tx Output Power 0dBm for Compatibility with ROADM Line Systems
- Full C-Band Tunable, 50GHz/100GHz Spacing
- Operating Temperature: 0 to 70 Celsius
- Power Dissipation: 6.0W
- RoHS Compliant and Lead-Free
- Tuning box is required for operation
- Please contact your sales representative for specific system information

Applications:

- 100GBase Ethernet
- Duplex Mux

Product Description

This MSA compliant (with select systems) high Tx power 0dBm QSFP28 transceiver provides 100GBase-ZR throughput up to 80km over single-mode fiber (SMF) using a wavelength of 1528.77nm to 1567.13nm via an LC connector. It can operate at temperatures between 0 and 70C. It has been programmed, uniquely serialized, and tested for data-traffic and application to ensure that it will initialize and perform identically. All of our transceivers comply with Multi-Source Agreement (MSA) standards to provide seamless network integration. Additional product features include Digital Optical Monitoring (DOM) support which allows access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

ProLabs' transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S.-made or designated country end products.")

TAA COMPLIANT

Rev. 012026

Absolute Maximum Ratings

Parameter		Symbol	Min.	Typ.	Max.	Unit	Notes
DC Supply Voltage		Vcc	-0.3		3.6	V	
Low-Speed I/O Voltages			-0.3		3.6	V	
Storage Temperature		Tstg	-40		85	°C	
Operating Case Temperature	**Long-Term**	Tc	0		70	°C	1
	Short-Term <96 Hours		-5		75	°C	
Operating Relative Humidity		RH	5		95	%	
Rx Input Power		PRx,in			10	dBm	
ESD Damage Threshold Human Body Model (HBM)	**DC Pins**		2000			V	
	RF Pins		1000			V	

Notes:

1. Central office applications.
2. Stresses in excess of the Absolute Maximum Ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the datasheet. Exposure to Absolute Maximum Ratings for extended periods of time can adversely affect device reliability. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Host Interface Modes

Host Interface ID [18]	Host Interface Description [18]	Modulation	Forward Error Correction Code	Nominal Symbol Rate (GBd)	Supported Line Interface IDs [18]
65 [8]	CAUI-4 C2M without FEC	NRZ	None	25.78125	68, 192, 193
66 [8]	CAUI-4 C2M with RS(528,514) FEC	NRZ	RS(528,514)	25.78125	68, 192, 193

Electrical Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply – General							
Power Supply Voltage			3.135	3.3	3.465	V	Including ripple, droop, and noise below 100kHz
Host RMS Noise Output					25	mV	10Hz - 10MHz
Module RMS Noise Output					15	mV	10Hz - 10MHz
Module Supply Noise Tolerance		PSNRmod			66	mV	10Hz - 10MHz, peak-to-peak
Module In-Rush		Tip			50	µs	Instantaneous peak duration
		Tinit			500	ms	Initialization time
Power Supply – Low-Power Mode							
Power Dissipation		Plp			1.5	W	
Power Supply Current		Icc,ip,lp			600	mA	Instantaneous peak current
		Icc,sp,lp			495	mA	Sustained peak current
		Icc,lp			478	mA	1, Steady state current
Power Supply – High-Power Mode – 2.4ns/nm CD							
Power Dissipation		Php		5.5	6.2	W	
Power Supply Current		Icc,ip,hp			2480	mA	Instantaneous peak current
		Icc,sp,hp			2046	mA	Sustained peak current
		Icc,hp			1978	mA	1, Steady state current
Low-Speed I/O							
Clock Frequency (SCL)		f_{SCL}		400		kHz	Default
				1000			Fast-mode+
Output Voltage (SCL and SDA)		V_{OL}	0.0		0.4		Output low
		V_{OH}	Vcc-0.5		Vcc+0.3		Output high
Input Voltage (SCL and SDA)		V_{IL}	-0.3		0.3×Vcc	V	Input low
		V_{IH}	0.7×Vcc		Vcc+0.5		Input high
Capacitance for SCL and SDA I/O Signal		Ci			14	pF	
Total Bus Capacitive Load for SCL and SDA	**400kHz Clock Rate**	Cb			100	pF	2, 3.0kΩ pull-up resistor, maximum
					200		2, 1.6kΩ pull-up resistor, maximum
Input Voltage/Current, LPMode/TxDis, ResetL, and ModSelL		V_{IL}	-0.3		0.8	V	Input voltage, low
		V_{IH}	2.0		Vcc+0.3		Input voltage, high
		Iin	-365		125	µA	Input current, 0V < VIN < Vcc
Output Voltage, ModPrsL, and IntL/RxLOSL		V_{OL}	0.0		0.4	V	Output low, I_{OL} = 2mA
		V_{OH}	Vcc-0.5		Vcc+0.3		Output high, 10kΩ pull-up resistor to Host_Vcc

Notes:

1. The module will stay within its advertised power class for all supply voltages.
2. For 1000kHz clock rate.

Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply – General						
Symbol Rate	Rbaud		27.95		GBd	
Modulation Format			DP-DQPSK			
Channel Frequency Range	Vc	191.4	193.7	196.1	THz	100GHz grid
	Vc	191.35	193.7	196.1	THz	50GHz grid
Channel Spacing	ΔVc		100		GHz	100GHz grid
	ΔVc		50		GHz	50GHz grid
Frequency Accuracy	δVc	-1.8		1.8	GHz	
Laser Intrinsic Linewidth	LW			500	kHz	Calculated based on FM noise Power Spectral Density (PSD) measurement
Side-Mode Suppression Ratio	SMSR	40			dB	No modulation
Relative Intensity Noise	RIN			-140	dB/Hz	Peak over 0.2GHz < f < 10GHz
Transmitter						
Tx Output Power	PTx,out	0			dBm	
Tx Output Power Monitor Range	PTx,mon	-2		4	dBm	
Tx Output Power Monitor Accuracy	δPTx,mon	-1.5		1.5	dB	Tx optical power monitor reading relative to actual Tx output power
Tx Output Power During Tuning or When Tx is Disabled	PTx,dark			-35	dBm	
Tx Spectral Excursion		-15		15	GHz	ITU-T G.698.2 §7.2.3 [11]
Tx Output Power Imbalance Between X and Y Polarizations	ΔPX/Y			1.5	dB	
Tx XY Skew				6.0	ps	
Tx IQ Offset				-25	dB	
Tx IQ Imbalance				1.0	dB	
Tx Quadrature Error		-7.0		7.0	°	
Tx IQ Skew				1.5	ps	
Tx Error Vector Magnitude Mask Ratio				23	%	ITU-T G.698.2 §7.2.12 [11], with 24dB/12.5GHz noise loading
Tx In-Band Optical Signal to Noise Ratio	OSNRin	39			dB/12.5GHz	Under modulation, |Δf|<60GHz
Tx Out-of-Band Optical Signal to Noise Ratio	OSNRout	30			dB/12.5GHz	Under modulation, |Δf|>150GHz
Tx Reflectance				-20	dB	
Receiver						
Rx Total Input Power	PRx,tot	-30		3	dBm	Broadband
Rx Signal Input Power (Amplified)	PRx,sig	-18		1	dBm	Full Rx OSNR tolerance
		-22		3	dBm	1

Rx OSNR Tolerance	**100G DQPSK SC**		16.5			dB/12.5GHz	2
	100G DQPSK RS		21.5				
CD Tolerance					2.4	ns/nm	Default, OSNR penalty < 0.5dB
					6.0		3
PMD Tolerance					10	Ps	4
DGD Tolerance					30	Ps	4
Tolerance to Change in SOP					50	krad/s	4
PDL OSNR Penalty	**1dB PDL**				0.5	dB/12.5GHz	Change in principal state of polarization < 1rad/ms
	2dB PDL				1.0		
	4dB PDL				3.0		
Rx Signal Input Power Transient Amplitude			-3		3	dB	5
Rx Signal Input Power Transient Rise/Fall Time			100			µs	6
Colorless Drop OSNR Penalty					0.5	dB	7
Colorless Drop Adjacent Channel Crosstalk Penalty					0.2	dB	8
Rx Signal Input Power (Unamplified)	**100G DQPSK SC**		-30		1	dBm	OSNR > 35dB/12.5GHz
	100G DQPSK RS		-24		1		
Rx Signal Input Power Monitor Range		$P_{Rx,mon(s)}$	-21		3	dBm	
Rx Signal Input Power Monitor Accuracy		$\delta P_{Rx,mon(s)}$	-2.5		2.5	dB	
Rx Total Input Power Monitor Range		$P_{Rx,mon(t)}$	-21		6	dBm	
Rx Total Input Power Monitor Accuracy		$\delta P_{Rx,mon(t)}$	-2.0		2.0	dB	
Rx Reflectance					-20	dB	

Notes:

1. Extended range. Rx signal input power range over which performance can be guaranteed with <1dB OSNR penalty relative to the Rx OSNR tolerance limit.
2. Back-to-back, PRx,sig > -18dBm. Rx OSNR tolerance for Carrier Frequency Offset |CFO| < 1GHz. Up to 1dB penalty for worst-case |CFO| = 3.6GHz.
3. Extended, OSNR penalty < 1.0dB. Power dissipation will increase by approximately 0.2W if extended CD compensation is enabled.
4. OSNR penalty < 0.5dB.
5. Peak excursion from steady state, transient within Rx signal input power (amplified) range, and OSNR penalty <0.5dB.
6. Rise/fall time for the above peak excursion, OSNR penalty <0.5dB.
7. Rx total input power to signal input power ratio < 12dB. 4. Receiver is able to tolerate the specified ratio of total power of crosstalk channels and ASE to signal power with the specified OSNR penalty. Does not include contribution from adjacent channel crosstalk. No single channel power exceeding signal channel power by more than 1dB shall be included. Measured at Rx signal input power -6dBm.
8. Measured at the Rx OSNR limit, 50GHz channel spacing, both adjacent channels <1dB higher power than signal channel.

SFF-8636 Management Interface

Parameter	Symbol	Min.	Max.	Unit	Conditions	Notes
Initialization Time			120	s	Time from power on or hot plug until the module is fully functional (assuming LPMode pulled low by the host).	2, 3
Reset Init Assert Time		10		µs	Minimum pulse time on the ResetL signal to initiate a module reset.	
Serial Bus Hardware Ready Time			2	s	Time from power on until the module responds to data transmission over the 2-wire serial bus.	2
Monitor Data Ready Time			2	s	Time from power on to Data_Not_Ready, Byte 2 bit 0, cleared to 0, and IntL output pulled low.	2
Reset Assert Time			120	s	Time from a rising edge on the ResetL input until the module is fully functional.	3
LPMode/TxDis Mode Change Time			100	ms	Time to change between LPMode and TxDis modes of the dual-mode signal LPMode/TxDis.	
LPMode Assert Time			100	ms	Time from when the host releases LPMode to high until module power consumption reaches Power Class 1.	
LPMode De-Assert Time			120	s	Time from when the host pulls LPMode low until the module is fully functional.	3
IntL/RxLOSL Mode Change Time			100	ms	Time to change between IntL and RxLOSL modes of the dual-mode signal IntL/RxLOSL.	
IntL Assert Time			200	ms	Time from occurrence of condition triggering an interrupt until IntL is low.	
IntL De-Assert Time			500	µs	Time from clear on read operation of associated flag until module releases IntL to high. This includes the time to clear Rx LOS, Tx Fault, and other flag bits.	4
RxLOSL Assert Time			1	ms	Time from optical loss of signal to RxLOSL signal pulled low by the module.	
RxLOSL De-Assert Time			15	ms	Time from optical signal above the LOS de-assert threshold to when the module releases the RxLOSL signal to high.	
Tx Fault Assert Time			200	ms	Time from Tx Fault state to Tx Fault bit set to 1 and IntL pulled low by the module.	
Flag Assert Time			200	ms	Time from condition triggering flag to associated flag bit set to 1 and IntL pulled low by the module.	
Mask Assert Time			100	ms	Time from mask bit set to 1 until the module is prevented from pulling IntL low when the associated flag is set high.	1
Mask De-Assert Time			100	ms	Time from mask bit cleared to 0 until module is enabled to pull IntL low when the associated flag is set high.	1
I/O Timing for Squelch & Disable						
Rx Squelch Assert Time			15	ms	Time from loss of Rx input signal until the squelched output condition is reached.	
Rx Squelch De-Assert Time			15	ms	Time from resumption of Rx input signals until normal Rx output condition is reached.	
Tx Squelch Assert Time			400	ms	Time from loss of Tx input signal until the squelched output condition is reached.	
Tx Squelch De-Assert Time			10	s	Time from resumption of Tx input signal until the normal Tx output condition is reached.	
Tx Disable Assert Time			1	ms	Time from Tx_Disable bit is set to 1 until optical output falls below 10% of nominal.	1
Tx Disable De-Assert Time			10	s	Time from Tx Disable bit cleared to 0 until optical output rises above 90% of nominal.	1

Rx Output Disable Assert Time			100	ms	Time from Rx Output Disable bit set to 1 until Rx output falls below 10% of nominal.	1
Rx Output Disable De-Assert Time			100	ms	Time from Rx Output Disable bit cleared to 0 until Rx output rises above 90% of nominal.	1
Squelch Disable Assert Time			100	ms	This applies to Rx and Tx Squelch and is the time from bit cleared to 0 until squelch functionality is disabled.	1
Squelch Disable De-Assert Time			100	ms	This applies to Rx and Tx Squelch and is the time from bit set 1 until squelch functionality is enabled.	1

Notes:

1. Measured from the rising edge of SDA during STOP sequence of write transaction.
2. "Power On" is defined as the instant when supply voltages reach and remain at or above the minimum level specified.
3. "Fully Functional" is defined as the module being ready to transmit and receive valid signals and all management interface data, including monitors, being valid. It is indicated after "Reset" or "Hot Plug" by the module releasing IntL to "high" after the host has read a 0 from the Data_Not_Ready flag bit.
4. Measured from rising edge of the SDA during STOP sequence of read transaction.

Optical Timing Characteristics

Parameter	Symbol	Min.	Max.	Unit	Conditions	Notes
Tx Turn On Time			10	s	Warm Start	1
			120	s	Cold Start	
Rx Acquisition Time			30	ms	Warm Start	
			120	s	Cold Start	
Tx/Rx Channel Tuning Time		10	30	s		

Notes:

1. Assumes the Tx/Rx laser is already tuned to the correct frequency.

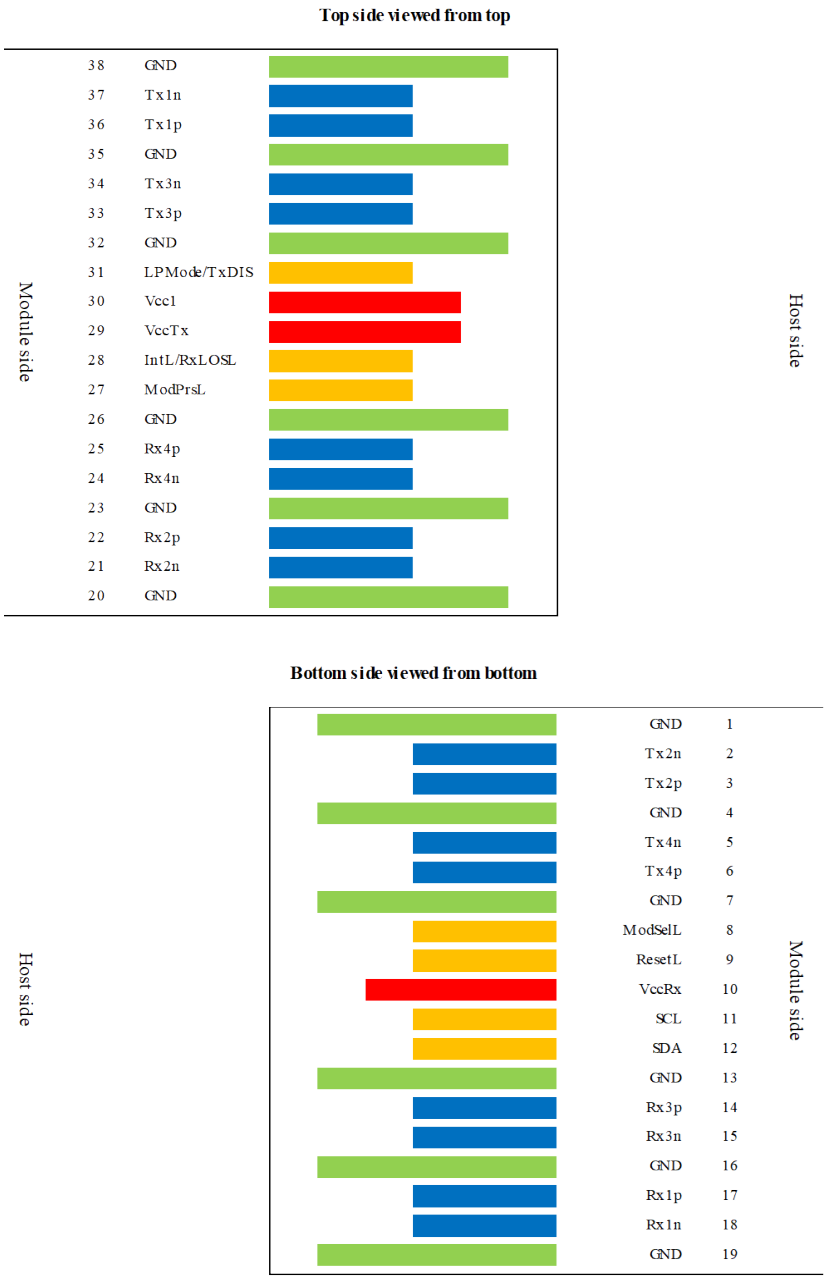
Pin Descriptions

Pin	Logic	Symbol	Name/Description	Plug Sequence	Notes
1		GND	Module Ground.	1	1
2	CML-I	Tx2-	Transmitter Inverted Data Input.	3	
3	CML-I	Tx2+	Transmitter Non-Inverted Data Input.	3	
4		GND	Module Ground.	1	1
5	CML-I	Tx4-	Transmitter Inverted Data Input.	3	
6	CML-I	Tx4+	Transmitter Non-Inverted Data Input.	3	
7		GND	Module Ground.	1	1
8	LVTTL-I	ModSelL	Module Select.	3	
9	LVTTL-I	ResetL	Module Reset.	3	
10		VccRx	+3.3V Receiver Power Supply.	2	2
11	LVCMOS-I/O	SCL	2-Wire Serial Interface Clock.	3	
12	LVCMOS-I/O	SDA	2-Wire Serial Interface Data.	3	
13		GND	Module Ground.	1	1
14	CML-O	Rx3+	Receiver Non-Inverted Data Output.	3	
15	CML-O	Rx3-	Receiver Inverted Data Output.	3	
16		GND	Module Ground.	1	1
17	CML-O	Rx1+	Receiver Non-Inverted Data Output.	3	
18	CML-O	Rx1-	Receiver Inverted Data Output.	3	
19		GND	Module Ground.	1	1
20		GND	Module Ground.	1	1
21	CML-O	Rx2-	Receiver Inverted Data Output.	3	
22	CML-O	Rx2+	Receiver Non-Inverted Data Output.	3	
23		GND	Module Ground.	1	1
24	CML-O	Rx4-	Receiver Inverted Data Output.	3	
25	CML-O	Rx4+	Receiver Non-Inverted Data Output.	3	
26		GND	Module Ground.	1	1
27	LVTTL-O	ModPrsL	Module Present.	3	
28	LVTTL-O	IntL/RxLOSL	Interrupt. Optionally configurable as RxLOSL via the management interface (SFF-8636).	3	
29		VccTx	+3.3V Transmitter Power Supply.	2	2
30		Vcc1	+3.3V Power Supply.	2	2
31	LVTTL-I	LPMode/TxDis	Low-Power Mode. Optionally configurable as TxDis via the management interface (SFF-8636).	3	
32		GND	Module Ground.	1	1
33	CML-I	Tx3+	Transmitter Non-Inverted Data Input.	3	
34	CML-I	Tx3-	Transmitter Inverted Data Input.	3	
35		GND	Module Ground.	1	1
36	CML-I	Tx1+	Transmitter Non-Inverted Data Input.	3	
37	CML-I	Tx1-	Transmitter Inverted Data Input.	3	
38		GND	Module Ground.	1	1

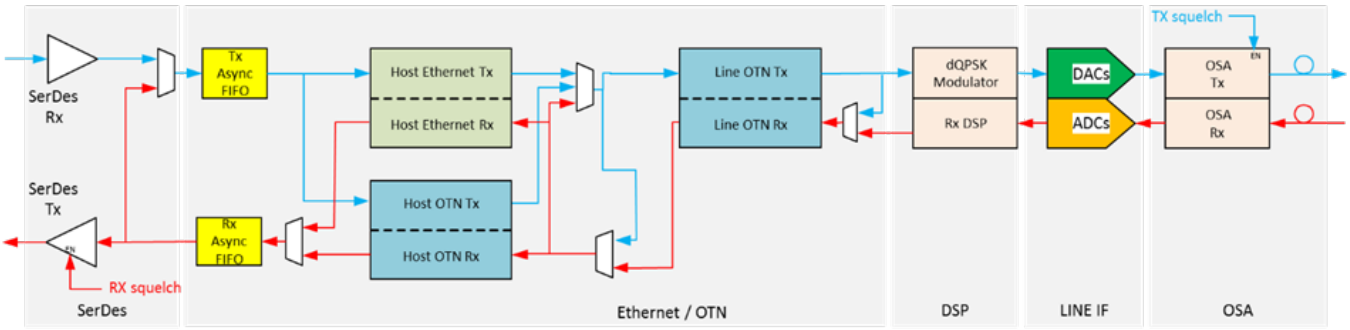
Notes:

1. GND is the symbol for signal and supply (power) common for the module. All are common within the module, and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
2. VccRx, Vcc1, and VccTx are applied concurrently and may be internally connected within the module in any combination.
3. Plug Sequence specifies the mating sequence of the host connector and module. The sequence is 1, 2, and 3. See figure below for pad locations.

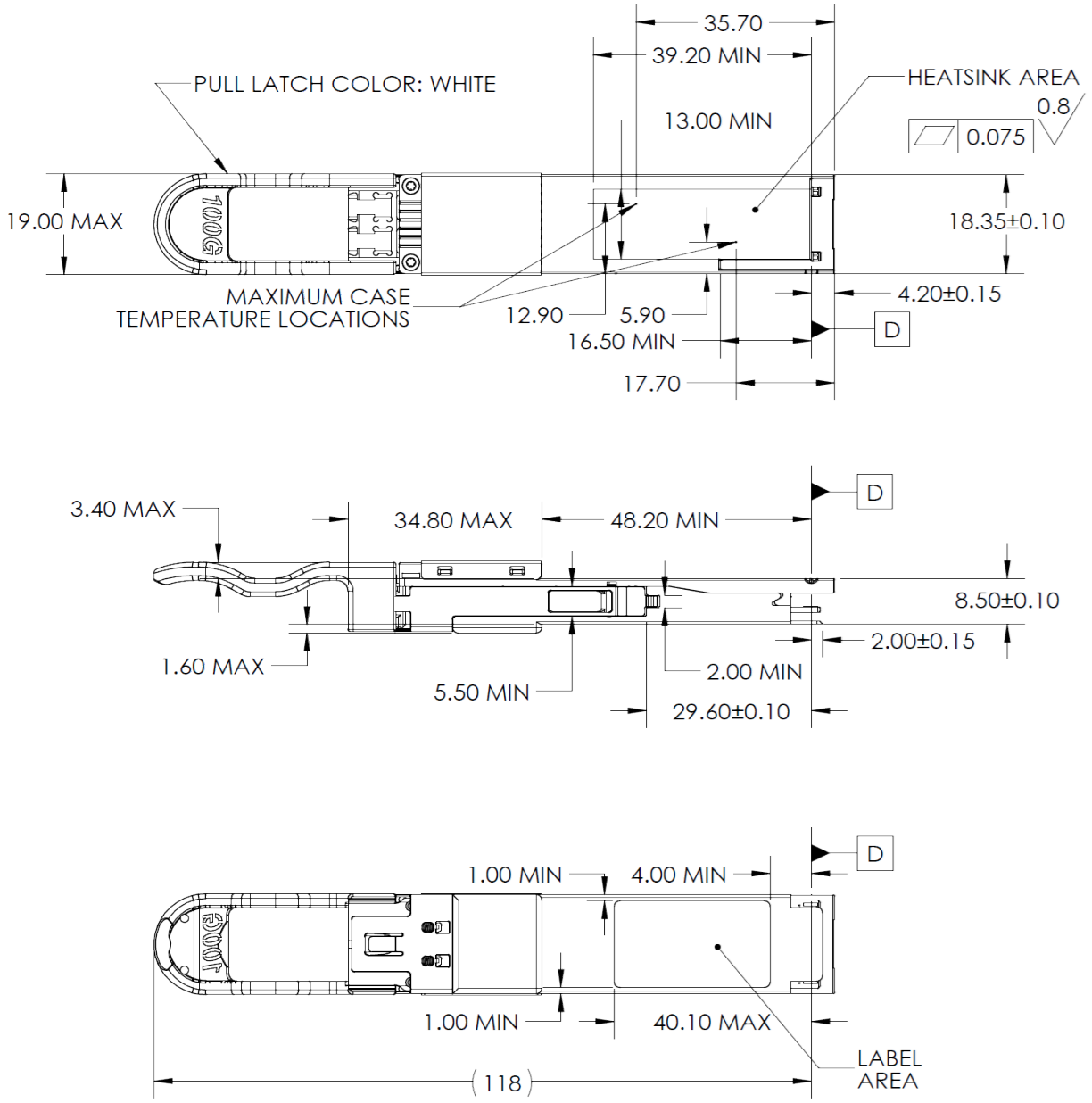
Electrical Pad Layout



Block Diagram



Mechanical Specifications



About ProLabs

Our extensive experience comes as standard. For over 20 years ProLabs has delivered optical connectivity solutions that give our customers freedom and choice through our ability to provide seamless interoperability. At the heart of our company is the ability to provide state-of-the-art optical transport and connectivity solutions that are compatible with more than 100 optical switching and transport platforms.

A Complete Portfolio of Network Solutions

ProLabs is focused on innovations in optical transport and connectivity. The combination of our knowledge of optics and networking equipment enables ProLabs to be your single source for optical transport and connectivity solutions from 100Mb to 1.6T while providing innovative solutions that increase network efficiency. We provide the optical connectivity expertise that is compatible with and enhances your switching and transport equipment.

The Trusted Partner

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure compatible products, and immediate answers to your questions. With Engineering and Manufacturing offices in the U.K. and U.S. augmented by field offices throughout the U.S., U.K. and Asia, ProLabs is able to be our customers best advocate 24 hours a day.

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