

# Lightning Series

MIL-DTL-38999 Optical Transceiver,  
FC, Ethernet & sFPDP Applications,  
Multimode, 850nm VCSELs

**5xTX / 3xRX, Receptacle**

## FEATURES

- Suitable for Gigabit Ethernet, 1x/2xFibre Channel, ARINC 818 and sFPDP applications from 50Mbps to 3.2Gbps
- Optical fiber link distances up to 550 Meters (50/125µ 500MHz\*Km MMF)
- Maximum optical channel bit error rate less than  $1 \times 10^{-12}$
- Operating temperature range from -40°C to +85°C
- Shock, vibration and immersion resistant per MIL-STD-810
- Olive drab cadmium over electroless nickel plating meets stringent corrosion resistance specifications
- Aluminum alloy MIL-DTL-38999 housings are strong, durable, and light weight
- MIL-T-29504 compliant optical fiber connector interface
- Samtec EQCD Series electrical connector for SMT interface

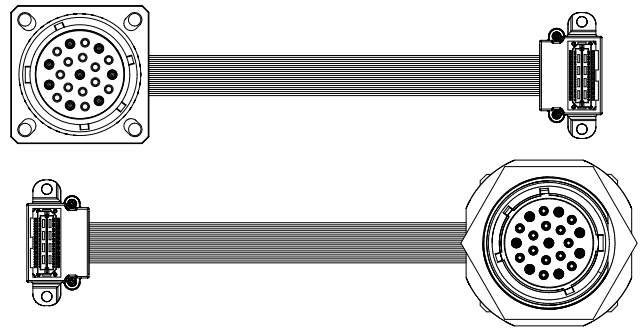
## APPLICATIONS

Lightning series bulkhead mounted optical transceivers enable high speed network communications over long distances in harsh environments.

- Fast or Gigabit Ethernet switches and peripherals
- Fibre Channel switches and peripherals
- sFPDP data links
- ARINC 818 Video displays and drivers

The MIL-DTL-38999, Series III shell provides a sealed optical interface that is water-tight to MIL-STD-810 / IP67 / NEMA-4x when mated.

The multimode optical fiber interface supports applications where copper cable link distance, bandwidth, weight or bulk make the use of twisted pair, twinax or quadrx copper conductors unacceptable.



Five TX & Three RX Ports Operating from 50Mbps to 3.2Gbps

## DESCRIPTION

Lightning series optical fiber transceivers consist of optoelectronic transmitter and receiver functions integrated into a bulkhead mounted MIL-DTL-38999, Series III receptacle connector. The optical transmitters are 850nm VCSEL lasers. The transmitter input lines are driven with differential CML signals applied to the transmitter (TX+ and TX-) lines. Dual loop, temperature compensated, VCSEL drivers convert the transmitter input signals to suitable VCSEL bias and modulation currents.

The optical receivers consist of PIN and preamplifier assemblies and limiting post-amplifiers. Outputs from the receivers consist of differential CML data signals on the receiver (RX+ and RX-) lines and single ended CMOS indicator functions on the Loss of Signal (LOS) lines. The receiver data lines are squelched upon LOS assertion, preventing errant data generation when an invalid incoming optical signal is presented to the transceiver.

The electrical interface to the Lightning series optical transceivers is a ribbon coax to Samtec EQCD high density cable assembly enabling SMT interconnection to a customer's backplane, motherboard or daughtercard.

Lightning series optical fiber transceivers are vibration isolated, environmentally hardened components designed for use in harsh environment applications.

## ORDERING INFORMATION

Application	Part Number
50Mbps to 2.49Gbps, Flange	P38F-531D-HW-Lxxx
2.5Gbps to 3.2Gbps, Flange	P38F-531E-HW-Lxxx
50Mbps to 2.49Gbps, Jam Nut	P38J-531D-HW-Lxxx
2.5Gbps to 3.2Gbps, Jam Nut	P38J-531E-HW-Lxxx

See page 6 for standard part number / cable length options

5xTX / 3xRX Lightning Series MIL-DTL-38999 Optical Transceiver  
50Mbps to 3.2Gbps Applications, Multimode, 850nm VCSELs

## ABSOLUTE MAXIMUM RATINGS

Absolute maximum limits mean that no catastrophic damage will occur if the product is subjected to these ratings for short periods, provided each limiting parameter is in isolation and all other parameters have values within the performance specification. It should not be assumed that limiting values of more than one parameter can be applied to the product at the same time.

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Storage Temperature	$T_s$	-55		+100	°C
Supply Voltage	$V_{CC}$	-0.5		+4.5	V
Data Input Voltage	$V_I$	-0.5		$V_{CC}$	V
Differential Input Voltage (p-p)	$V_D$			2.0	V

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Operating Temperature	$T_A$	-40		+85	°C
Supply Voltage	$V_{CC}$	+3.135		+3.465	V
Power Supply Noise (p-p)	$N_P$			200	mV

## SPECIFICATIONS COMPLIANCE

Requirement	Feature	Condition	Notes
MIL-STD-883	ESD	Class II	2200V
MIL-STD-810	Vibration	3.8g <sup>2</sup> /Hz	43G rms
MIL-STD-810	Shock	40.0g	6-9mS
MIL-STD-810	Immersion	1.0 meter	2 .0Hours
MIL-STD-1344	Flame Resistance	Method 1012	30 Seconds
MIL-STD-1344	Damp Heat	10 Cycles	24 Hours
MIL-STD-38999	Mating Durability	500 Cycles	<0.5dB Change
MIL-STD 810	Salt Fog	7 Days	5 wt. %
FDA / CDRH / IEC-825-1	Eye Safety	Class 1	No Safety Interlocks Required

## MATERIALS

Item	Detail	Notes
Shell	Aluminum Alloy	
Shell Plating	Olive Drab Cadmium over Nickel	QQ-P-416, QQ-N-290
Insert	Thermoplastic	
Interfacial Seal	Elastomer	
Alignment Sleeves	Composite Polymer	
Printed Circuits	Polyimide / FR-4	Mil-P-31032 Type 4

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**OPTICAL TRANSMITTERS  $T_A$  = Operating Temperature Range,  $V_{CC}$  = 3.135V to 3.465V**

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Optical Output Power (BER<10 <sup>-12</sup> )	$P_o$	-9.5		-4.0	dBm
Optical Output Wavelength	$\lambda_{OUT}$	830	850	860	nM
Spectral Width	$\Delta\lambda_{RMS}$			0.85	nM
Extinction Ratio	ER	6.0			dB
Optical Rise, Fall Time (20% to 80%)	$t_{R,F}$			150	ps

**OPTICAL RECEIVERS  $T_A$  = Operating Temperature Range,  $V_{CC}$  = 3.135V to 3.465V**

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Optical Sensitivity (BER<10 <sup>-12</sup> , ER=9.0) P38x-xxxD-xx @ 125Mbps to 1.25Gbps P38x-xxxD-xx @ 2.125Gbps P38x-xxxE-xx @ 2.5Gbps to 3.2Gbps	$P_i$	-17.0 -15.0 -14.0		0.0	dBm
Optical Wavelength	$\lambda_{IN}$	830		860	nM
RX Data Output - Low	$V_{OL} - V_{CC}$	-1.810		-1.475	V
RX Data Output - High	$V_{OH} - V_{CC}$	-1.165		-0.880	V

**POWER SUPPLY CURRENT  $T_A$  = Operating Temperature Range,  $V_{CC}$  = 3.135V to 3.465V**

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Supply Current per Port	$I_{CCT}$		100	140	mA

**OPTICAL LINK DISTANCES**

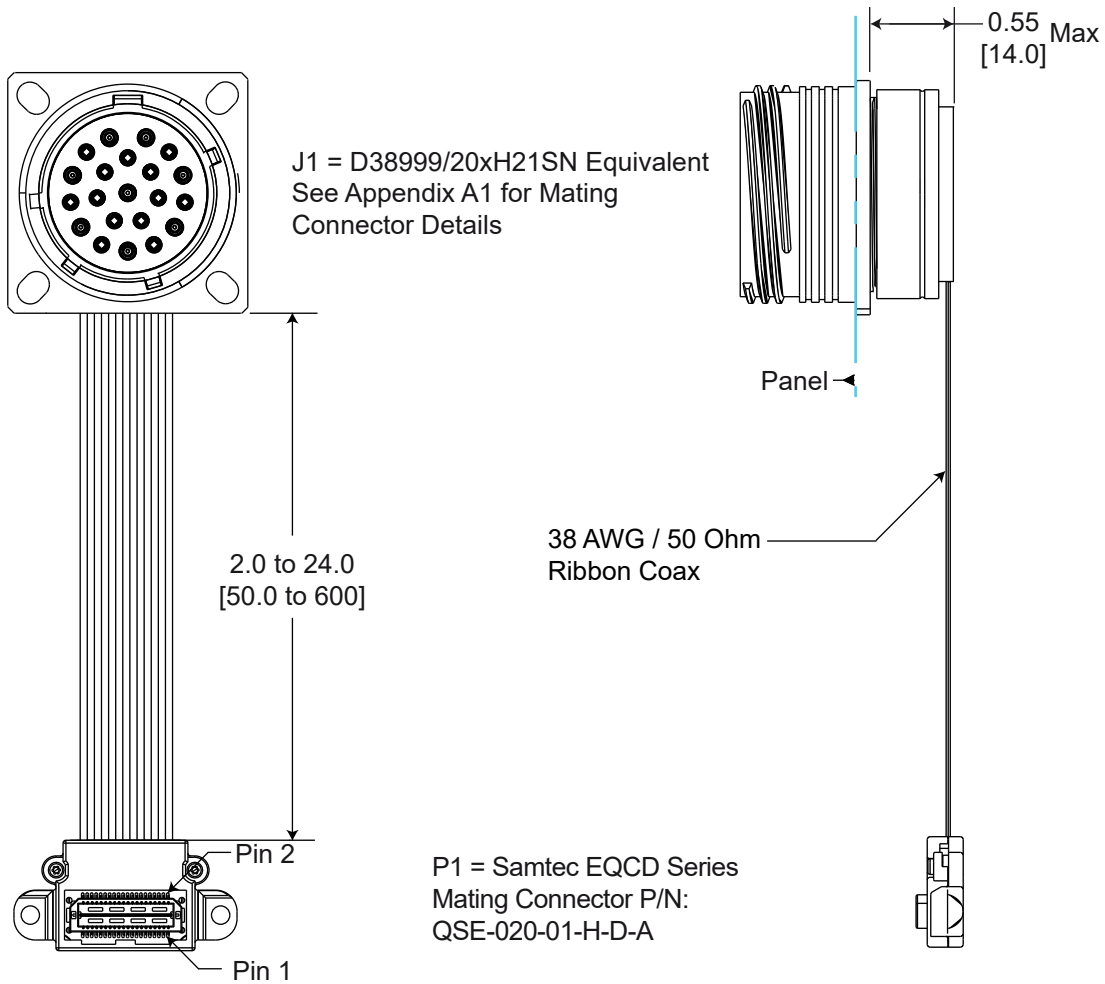
Protocol	62.5/125 $\mu$ 200MHz*Km	50/125 $\mu$ 500MHz*Km
2xFibre Channel - ANSI X3.297 FC-PI	150M	300M
Gigabit Ethernet - IEEE-802.3:2005	275M	550M
1xFibre Channel - ANSI X3.297 FC-PH-2	300M	500M

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**OUTLINE DRAWING**

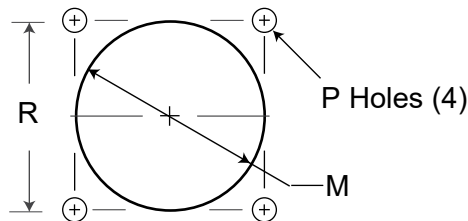
**Flange Mount Option**

Dimensions are shown as: inches [mm]



**Panel Cutout Dimensions**  
 Rear Panel Mounting Only

Shell Size Code	Shell Size	M Min	P Holes	R Bsc
H	23	1.547 [39.29]	0.159 [4.0] / 0.149 [3.8]	1.375 [34.9]



Part Number = \*P38F-xxxx-Hx-Lxxx

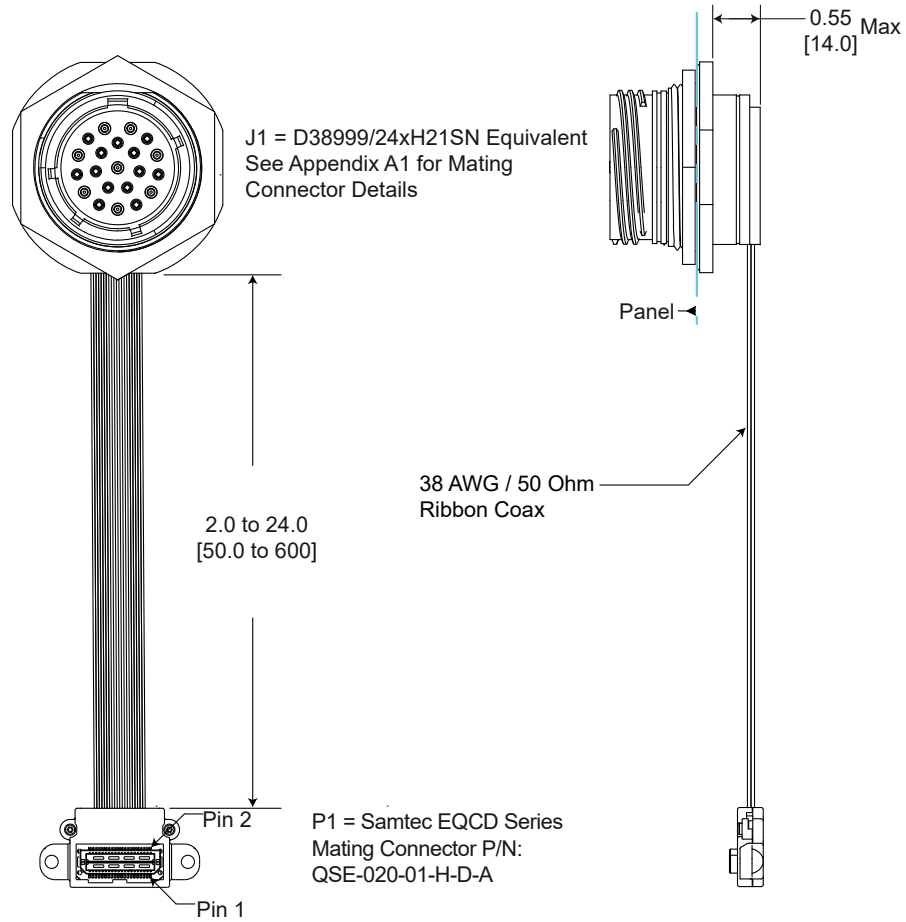
\*see page 6 for part number / cable length options and page 12 for complete ordering options

5xTX / 3xRX Lightning Series MIL-DTL-38999 Optical Transceiver  
 50Mbps to 3.2Gbps Applications, Multimode, 850nm VCSELs

**OUTLINE DRAWING**

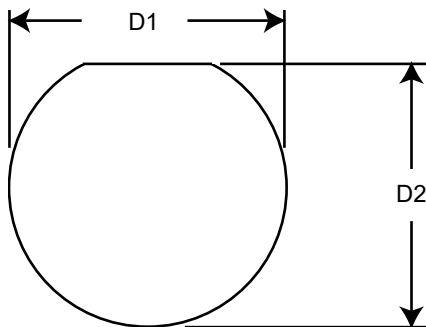
**Jam Nut Option**

Dimensions are shown as: inches [mm]



**Panel Cutout Dimensions**

Shell Size Code	Shell Size	D1 Min	D2 Min
H	23	1.635 [41.53]	1.585 [40.26]



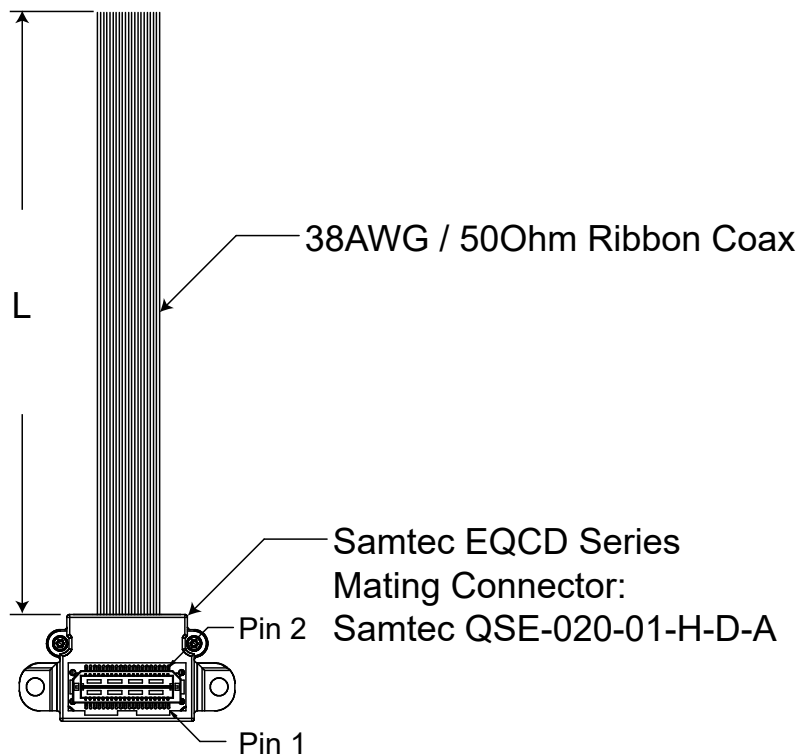
Part Number = \*P38J-xxxx-Hx-Lxxx

\*see page 6 for part number / cable length options and page 12 for complete ordering options

5xTX / 3xRX Lightning Series MIL-DTL-38999 Optical Transceiver  
50Mbps to 3.2Gbps Applications, Multimode, 850nm VCSELs

## OUTLINE DRAWING

Cable Length Options



### Ribbon Coax Cable Length Options

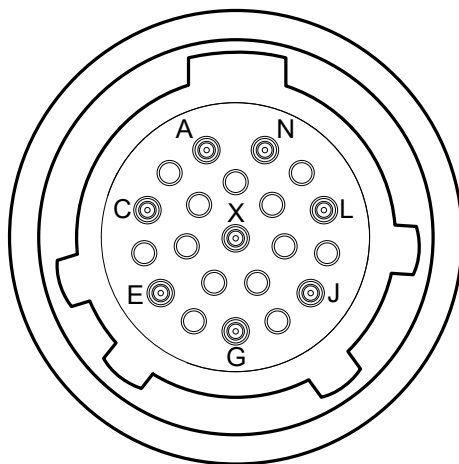
L (mm) +/- 6.0	ITEM #
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Cable options are available on page 12

5xTX / 3xRX Lightning Series MIL-DTL-38999 Optical Transceiver  
 50Mbps to 3.2Gbps Applications, Multimode, 850nm VCSELs

### J1 D38999 PIN and PORT ASSIGNMENTS

#### TOP Optical Interface



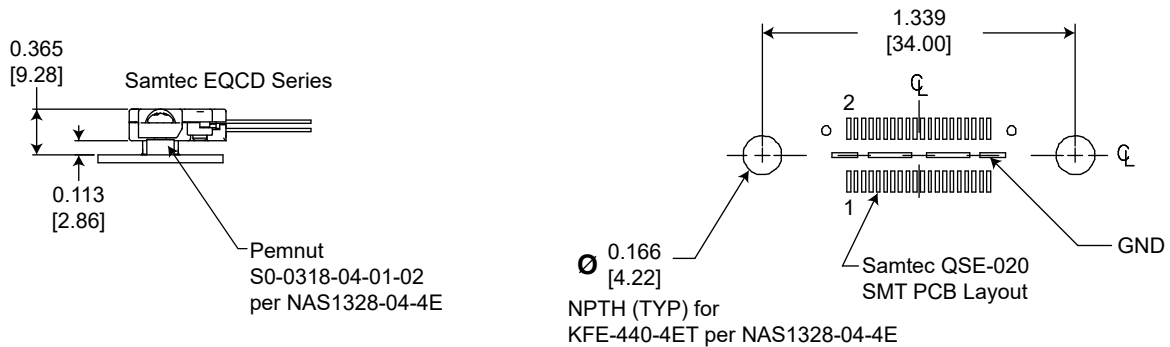
Front view of the D38999 optical insert shown, fiber optic cable plug opposite - see Appendix A1 for details

#### MIL-DTL-38999 OPTICAL INTERFACE

PORT NUMBER	PIN NUMBER	FUNCTION
0	L	RX
1	J	TX
2	G	RX
3	N	TX
4	X	TX
5	A	RX
6	E	TX
7	C	TX

5xTX / 3xRX Lightning Series MIL-DTL-38999 Optical Transceiver  
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**PRINTED CIRCUIT BOARD FOOTPRINT**

All dimensions shown are for reference only: inches [mm]



**SAMTEC EQCD PIN ASSIGNMENTS** - Continued on the next page

ELECTRICAL			PORT #	OPTICAL	
PIN #	FUNCTION	LOGIC FAMILY		PIN #	FUNCTION
1	LOS	Open Drain CMOS	0	L	RX
2	GND	NA	0-7	ALL	NA
3	RX-	CML	0	L	RX
4	N/C	NA	NA	NA	NA
5	RX+	CML	0	L	RX
6	TX_Dis	CMOS	1	J	TX
7	TX-	CML	1	J	TX
8	Vcc	NA	0-7	ALL	NA
9	TX+	CML	1	J	TX
10	Vcc	NA	0-7	ALL	NA
11	LOS	Open Drain CMOS	2	G	RX
12	GND	NA	0-7	ALL	NA
13	RX-	CML	2	G	RX
14	N/C	NA	NA	NA	NA
15	RX+	CML	2	G	RX
16	TX_Dis	CMOS	3	N	TX
17	TX-	CML	3	N	TX
18	Vcc	NA	0-7	ALL	NA
19	TX+	CML	3	N	TX
20	Vcc	NA	0-7	ALL	NA

Center slug is Ground.

TX\_Dis functions: Logic 1: Disable Optical Output, Logic 0: Enable Optical Output.

For All Loss of Signal (LOS) Functions: Satisfactory Optical Input: Logic "0" Output / Unsatisfactory Optical Input: Logic "1" Output.

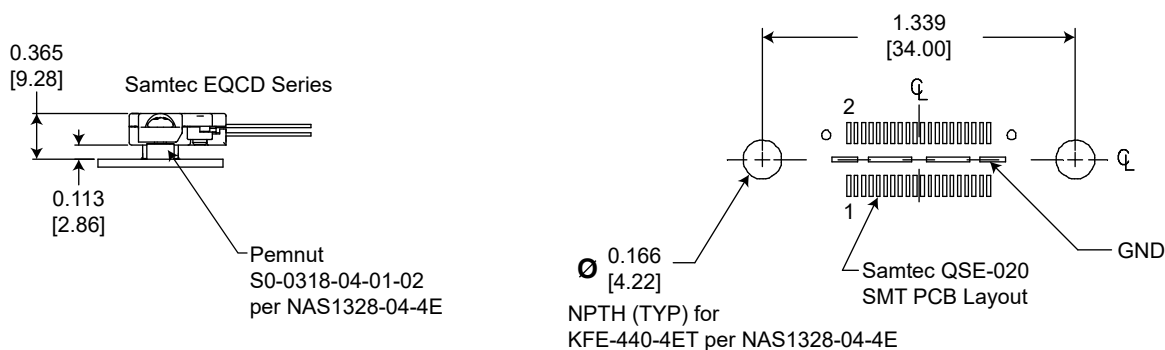
For All Transmitter Disable (TX Dis) Functions: Logic 1 Input: Disable Optical Output / Logic 0 Input: Enable Optical Output.

The TX\_Dis functions have internal 4.7KΩ to 10.0KΩ pullups.

All CML functions are internally AC coupled with 100Ω differential terminations.



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 50Mbps to 3.2Gbps Applications, Multimode, 850nm VCSELs  
**PRINTED CIRCUIT BOARD FOOTPRINT**  
 All dimensions shown are for reference only: inches [mm]



**SAMTEC EQCD PIN ASSIGNMENTS** - Continued from the previous page

ELECTRICAL			PORT #	OPTICAL	
PIN #	FUNCTION	LOGIC FAMILY		PIN #	FUNCTION
21	LOS	Open Drain CMOS	5	A	RX
22	GND	NA	0-7	ALL	NA
23	RX-	CML	5	A	RX
24	N/C	NA	NA	NA	NA
25	RX+	CML	5	A	RX
26	TX_Dis	CMOS	4	X	TX
27	TX-	CML	4	X	TX
28	Vcc	NA	0-7	ALL	NA
29	TX+	CML	4	X	TX
30	Vcc	NA	0-7	ALL	NA
31	TX_Dis	CMOS	7	C	TX
32	GND	NA	0-7	ALL	NA
33	TX-	CML	7	C	TX
34	N/C	NA	NA	NA	NA
35	TX+	CML	7	C	TX
36	TX_DIS	CMOS	6	E	TX
37	TX-	CML	6	E	TX
38	Vcc	NA	0-7	ALL	NA
39	TX+	CML	6	E	TX
40	Vcc	NA	0-7	ALL	NA

Center slug is Ground.

TX\_Dis functions: Logic 1: Disable Optical Output, Logic 0: Enable Optical Output.

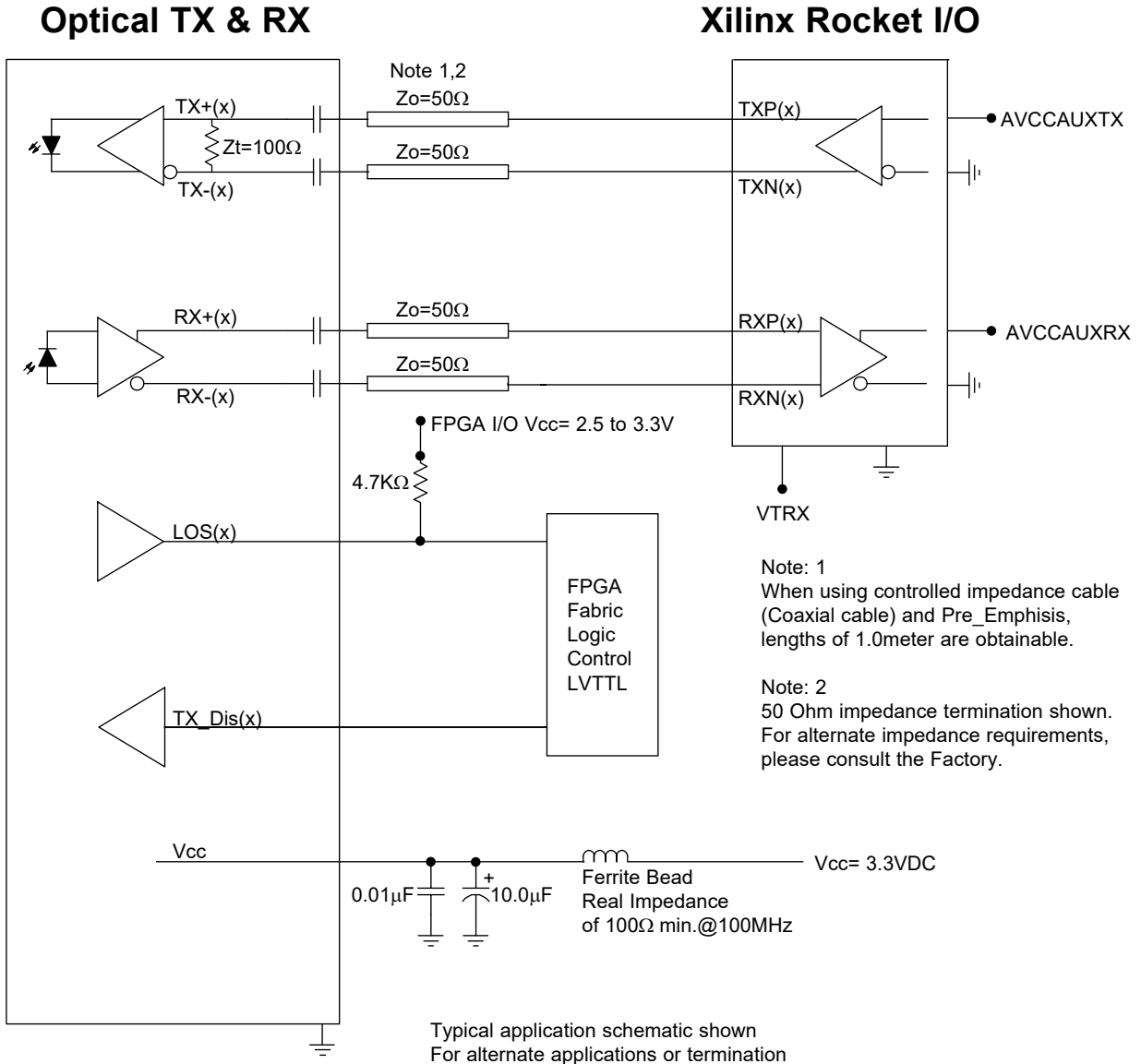
For All Loss of Signal (LOS) Functions: Satisfactory Optical Input: Logic "0" Output / Unsatisfactory Optical Input: Logic "1" Output.

For All Transmitter Disable (TX Dis) Functions: Logic 1 Input: Disable Optical Output / Logic 0 Input: Enable Optical Output.

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**APPLICATION SCHEMATIC**



## APPENDIX A1

### MIL-DTL-38999 FIBER OPTIC CABLE PLUG / MIL-T-29504 PIN TERMINI

\*See DSCC or SAE QPL for Approved Suppliers

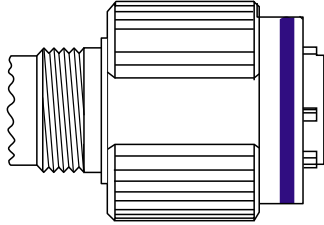
<http://www.dscclia.mil/programs/qmlqpl/QPLdetail.asp?QPL=38999>

#### \*D38999 PLUG - PIN INSERT

##### MIL-DTL-38999 CABLE PLUG

MS PLUG P/N

\*D38999/26MH21PN

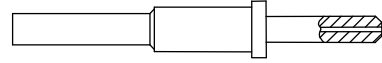


#### \*FIBER OPTIC PIN TERMINUS

##### MIL-T-29504 PIN TERMINUS

MS PIN TERMINUS P/N

\*M29504/04-xxxx\*\*



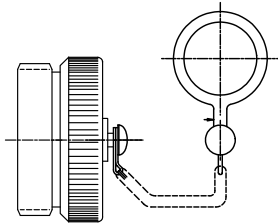
\*\*defined by fiber optic cable configuration

#### \*CABLE PROTECTION CAP

##### D38999/32 PLUG PROTECTION CAP

MS PLUG CAP P/N

\*D38999/32M23N

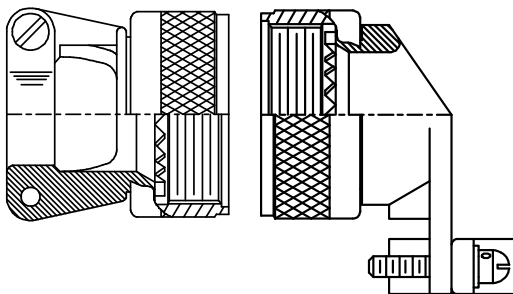


#### \*CABLE BACKSHELL

##### MIL-C-85049 CABLE BACKSHELL

MS BACKSHELL P/N

\*MS85049/xxxxxx\*\*



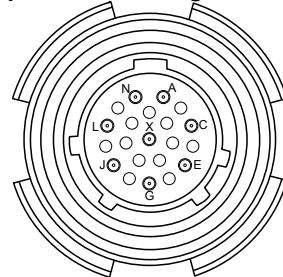
\*\*Straight or angled backshell - defined by application / mounting configuration

#### D38999 PLUG PORT ASSIGNMENTS

PORT	PIN	PORT	PIN
0	L	4	X
1	J	5	A
2	G	6	E
3	N	7	C

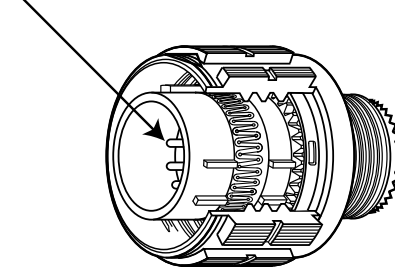
TOP

Optical Cable Plug Interface

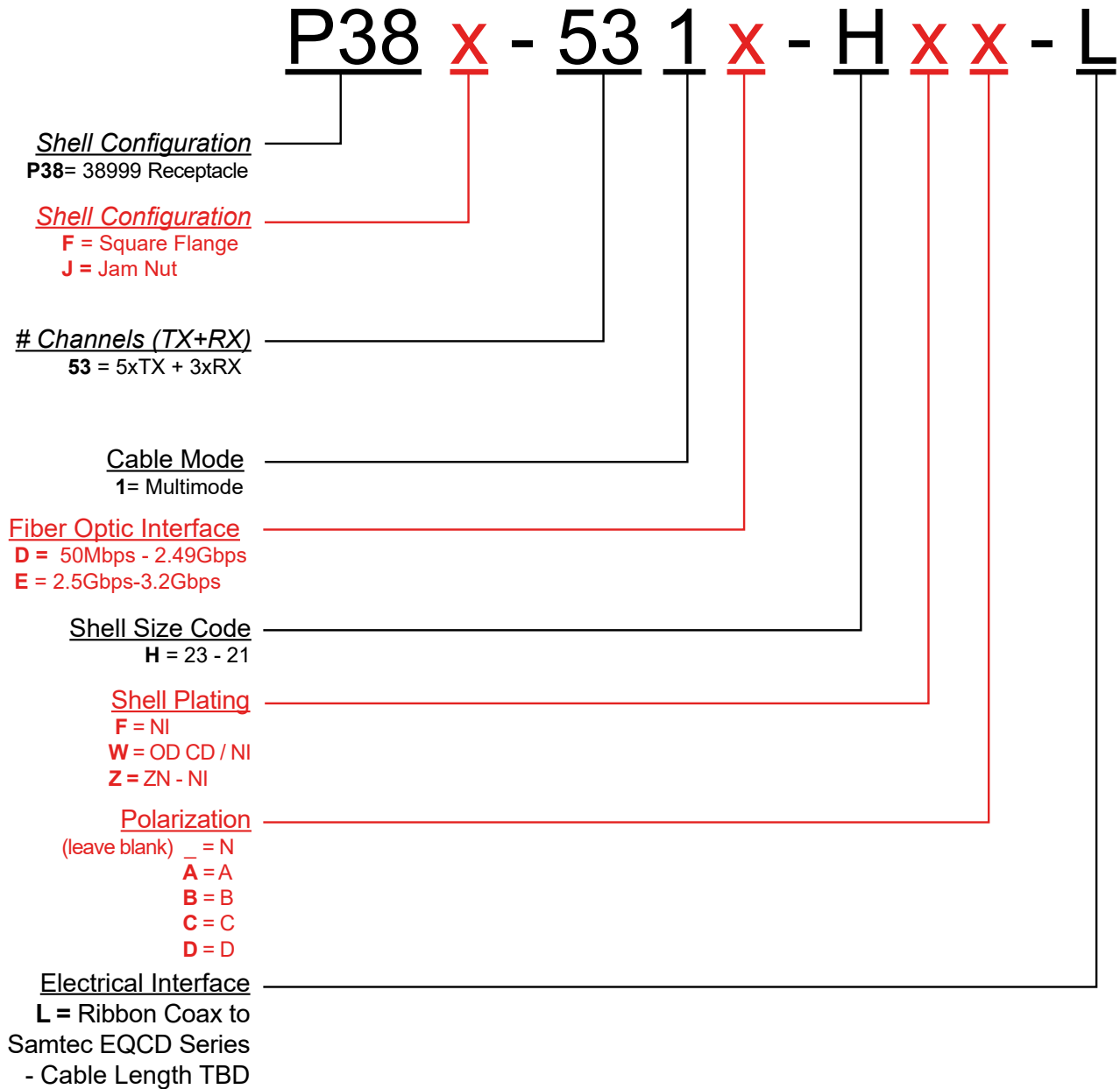


Front face of the optical cable plug pin insert shown. Transceiver insert opposite.

Pin Termini



**APPENDIX A2**  
**PART NUMBER OPTIONS**  
 5xTX + 3xRX, VCSEL



Other wavelength, mounting and port count options are available.  
 Please consult the Protokraft website for alternate configurations.



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