

LIGHTNING SERIES

MIL-DTL-38999 OPTICAL TRANSCEIVER, FC, ETHERNET AND sFPDP APPLICATIONS, MULTIMODE, 850 nM VCSELS



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 850 nM 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 bulkhead optical transceivers is a 0.050" x 0.100" solder pin header enabling connection to a rigid or flexible printed circuit assembly.

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

5xTX/3xRX LIGHTNING SERIES MIL-DTL-38999 OPTICAL TRANSCEIVER, FAST ETHERNET, GBE, 1X/2XFC AND SERIAL FPDP APPLICATIONS, MULTIMODE, 850 NM VCSELs

5x TX/3x RX, Flange Receptacle

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

FEATURES

- Suitable for Fast or Gigabit Ethernet, 1x/2x Fibre Channel and sFPDP applications from 50 Mbps to 3.2 Gbps
- Optical fiber link distances up to 550 meters (50/125 μ 500 MHz*Km MMF)
- Maximum optical channel bit error rate less than 1×10^{-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 requirements
- Aluminum alloy MIL-DTL-38999 housings are strong, durable, corrosion resistant and light weight
- MIL-T-29504 compliant optical fiber connector interface

APPLICATIONS

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

- Fibre Channel switches and peripherals
- sFPDP data links
- Video displays

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 quadrax copper conductors unacceptable.

ORDERING INFORMATION

Application	Part Number
Fast or Gigabit Ethernet, 1x/2xFC	P38F-531D-HW
sFPDP (2.5 Gbps to 3.125 Gbps)	P38F-531E-HW

See page 11 for complete ordering options.

5xTX/3xRX LIGHTNING SERIES MIL-DTL-38999 OPTICAL TRANSCEIVER, FAST ETHERNET, GBE, 1X/2XFC AND SERIAL FPDP APPLICATIONS, MULTIMODE, 850 NM 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
TX_DIS Input Voltage	V_I	-0.5		$V_{CC} + 0.5$	V
Differential Input Voltage (p-p)	V_D			2.2	V
RX Output Current	I_O			50	mA

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
TX Common Mode Voltage	V_{CM}		2.0		V
TX Differential Input Voltage (p-p)	V_D	0.25		2.2	V
Power Supply Noise (p-p)	N_P			200	mV

DESIGNED TO SPECIFICATIONS COMPLIANCE

Requirement	Feature	Condition	Notes
MIL-STD-883	ESD	Class II	2200 V
MIL-STD-810	Vibration	3.8g ² / Hz	43 G rms
MIL-STD-810	Shock	40.0 g	6-9 mS
MIL-STD-810	Immersion	1.0 Meter	2.0 Hours
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	<0.5 dB Change
FDA / CDRH / IEC-825-1	Eye Safety	Class 1	No Safety Interlocks Required

MATERIALS

Item	Detail	Notes
Shell	Aluminum Alloy	
Shell Plating	Olive Drap 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} = 3.135 V TO 3.465 V

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Optical Output Power (BER<10 ⁻¹²)	P_o	-9.5		-4.0	dBm
Optical Output Wavelength	λ_{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} = 3.135 V TO 3.465 V

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Optical Sensitivity (BER<10 ⁻¹² , ER=9.0)	P_i	-17.0		0.0	dBm
P38x-xS1D-xx @ 125 Mbps to 1.25 Gbps		-15.0			
P38x-xS1E-xx @ 2.5 Gbps to 3.2 Gbps		-14.0			
Optical Wavelength	λ_{IN}	770		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} = 3.135 V TO 3.465 V

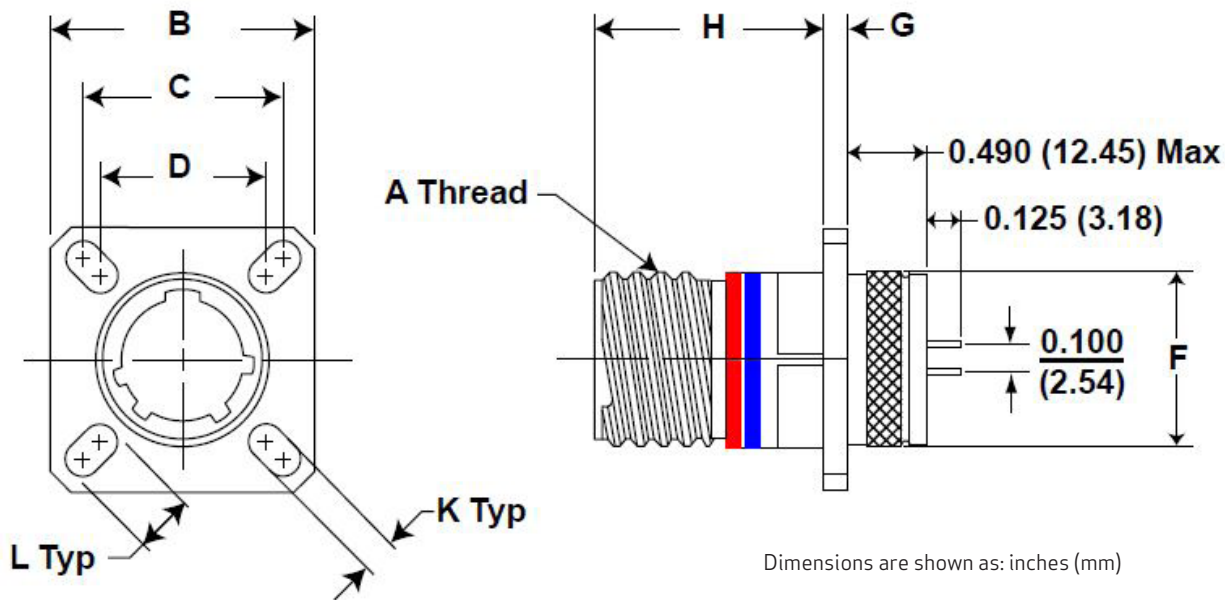
Parameter	Symbol	Minimum	Typical	Maximum	Unit
Supply Current per Port	I_{OCT}		100	140	mA

OPTICAL LINK DISTANCES

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

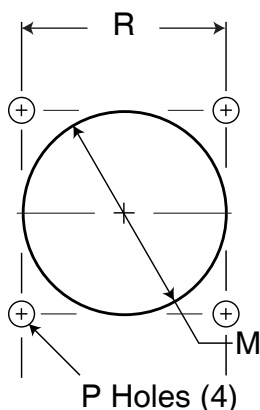
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FLANGE OUTLINE DRAWING



OUTLINE DIMENSIONS

Shell Size Code	Shell Size	A Thread	B Sq Max	C Bsc	D Bsc	F Max	G Max	H Max	K	L
H	23	1.5000-.1P-.3L-TS-2A	1.700 (43.2)	1.375 (34.90)	1.250 (31.8)	1.479 (37.57)	0.126 (3.2)	0.790 (20.1)	0.154 (3.9)	0.242 (6.2)



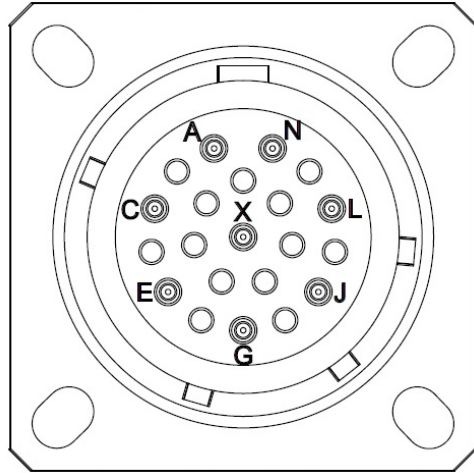
PANEL CUTOUT DIMENSIONS

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 (34.90)

5xTX/3xRX LIGHTNING SERIES MIL-DTL-38999 OPTICAL TRANSCEIVER, FAST ETHERNET, GBE, 1X/2XFC AND SERIAL FPDP APPLICATIONS, MULTIMODE, 850 NM VCSELs

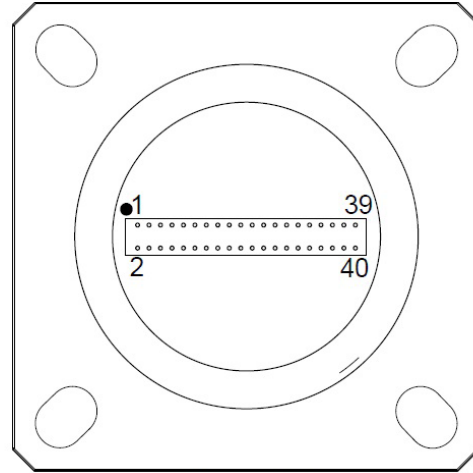
OPTICAL TRANSCEIVER INSERT ARRANGEMENT

TOP
Optical Interface



Front face of the optical transceiver insert shown, fiber optic cable plug opposite - see Appendix A2 for details

BOTTOM
Electrical Interface



Back face of the optical transceiver insert shown - see Printed Circuit Board Footprint and Electrical Pin Assignment pages for details

OPTICAL TRANSCEIVER RECEPTACLE PORT ASSIGNMENTS

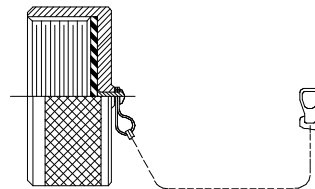
Port Number	Optical Pin Number	Electrical Pin Number (-,+)	Function
0	L	3,5	RX
1	J	7,9	TX
2	G	13,15	RX
3	N	17,19	TX
4	X	27,29	TX
5	A	23,25	RX
6	E	37,39	TX
7	C	33,35	TX

RECEPTACLE PROTECTION CAPS

*MIL-DTL-38999 / 33 PROTECTION CAP PART NUMBERS

MS Receptacle Cap P/N

*See Appendix A1



*See DSCC or SAE QPL for Approved Suppliers

5xTX/3xRX LIGHTNING SERIES MIL-DTL-38999 OPTICAL TRANSCEIVER, FAST ETHERNET, GBE, 1X/2XFC AND SERIAL FPDP APPLICATIONS, MULTIMODE, 850 NM VCSELs

ELECTRICAL PIN ASSIGNMENTS

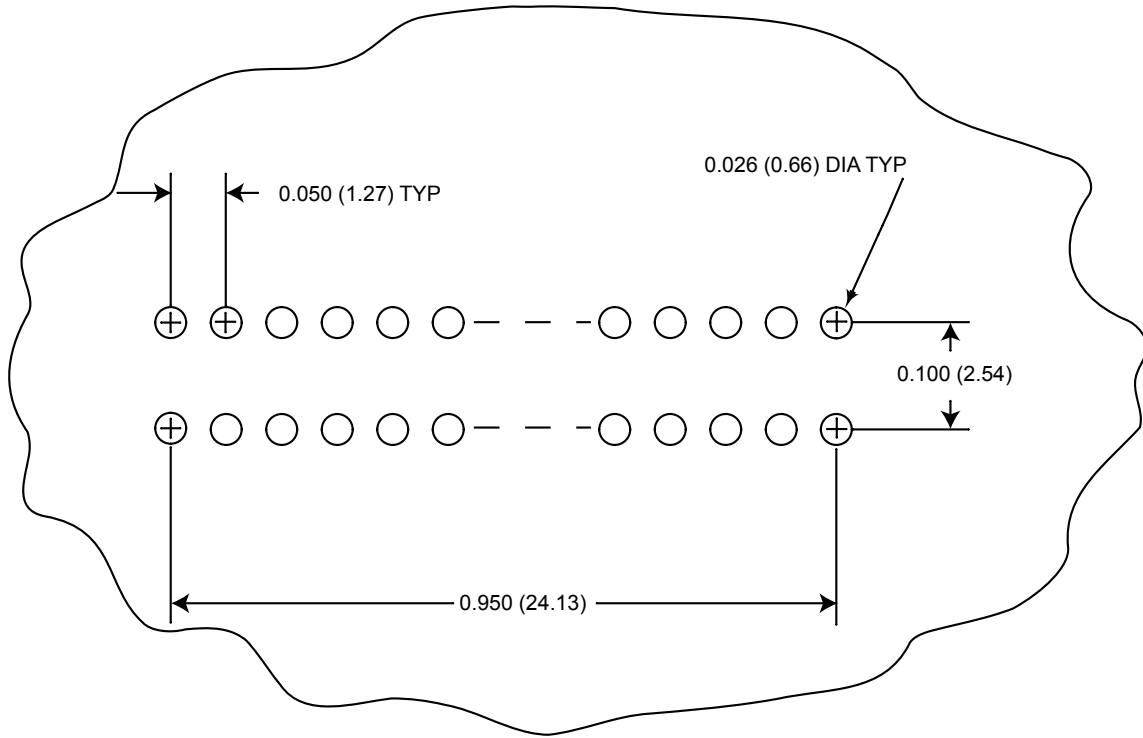
For All Loss of Signal (LOS) Functions: Satisfactory Optical Input: Logic "0" Output / Unsatisfactory Optical Input: Logic "1" Output
 For All Transmitter Disable (TX Dis) Functions: Logic 1 Input: Disable Optical Output / Logic 0 Input: Enable Optical Output

Pin Number	Symbol (Port)	Description	Logic Family
1	LOS (0)	Loss of Signal - Output	Open Drain CMOS
2	GND	Ground	N/A
3	RX- (0)	Receiver Data Output	CML (Internally AC Coupled)
4	N/C	Do Not Connect	N/A
5	RX+ (0)	Receiver Data Output	CML (Internally AC Coupled)
6	TX Dis (1)	Transmitter Disable Input	CMOS (Internal 4.7KΩ to 10.0KΩ pullup)
7	TX- (1)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
8	RX Vcc (0)	Receiver Power Supply	N/A
9	TX+ (1)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
10	TX Vcc (1)	Transmitter Power Supply	N/A
11	LOS (2)	Loss of Signal - Output	Open Drain CMOS
12	GND	Ground	N/A
13	RX- (2)	Receiver Data Output	CML (Internally AC Coupled)
14	N/C	Do Not Connect	N/A
15	RX+ (2)	Receiver Data Output	CML (Internally AC Coupled)
16	TX Dis (3)	Transmitter Disable Input	CMOS (Internal 4.7KΩ to 10.0KΩ pullup)
17	TX- (3)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
18	RX Vcc (2)	Receiver Power Supply	N/A
19	TX+ (3)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
20	TX Vcc (3)	Transmitter Power Supply	N/A
21	LOS (5)	Loss of Signal - Output	Open Drain CMOS
22	GND	Ground	N/A
23	RX- (5)	Receiver Data Output	CML (Internally AC Coupled)
24	N/C	Do Not Connect	N/A
25	RX+ (5)	Receiver Data Output	CML (Internally AC Coupled)
26	TX Dis (4)	Transmitter Disable Input	CMOS (Internal 4.7KΩ to 10.0KΩ pullup)
27	TX- (4)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
28	RX Vcc (5)	Receiver Power Supply	N/A
29	TX+ (4)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
30	TX Vcc (4)	Transmitter Power Supply	N/A
31	TX Dis (7)	Transmitter Disable Input	CMOS (Internal 4.7KΩ to 10.0KΩ pullup)
32	GND	Transmitter Signal Ground	N/A
33	TX- (7)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
34	N/C	Do Not Connect	N/A
35	TX+ (7)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
36	TX Dis (6)	Transmitter Disable Input	CMOS (Internal 4.7KΩ to 10.0KΩ pullup)
37	TX- (6)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
38	TX Vcc (7)	Receiver Power Supply	N/A
39	TX+ (6)	Transmitter Data Input	CML (Internally AC Coupled, Internal 100Ω differential termination)
40	TX Vcc (6)	Transmitter Power Supply	N/A

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MULTIMODE, 850 NM VCSELs

PRINTED CIRCUIT BOARD FOOTPRINT

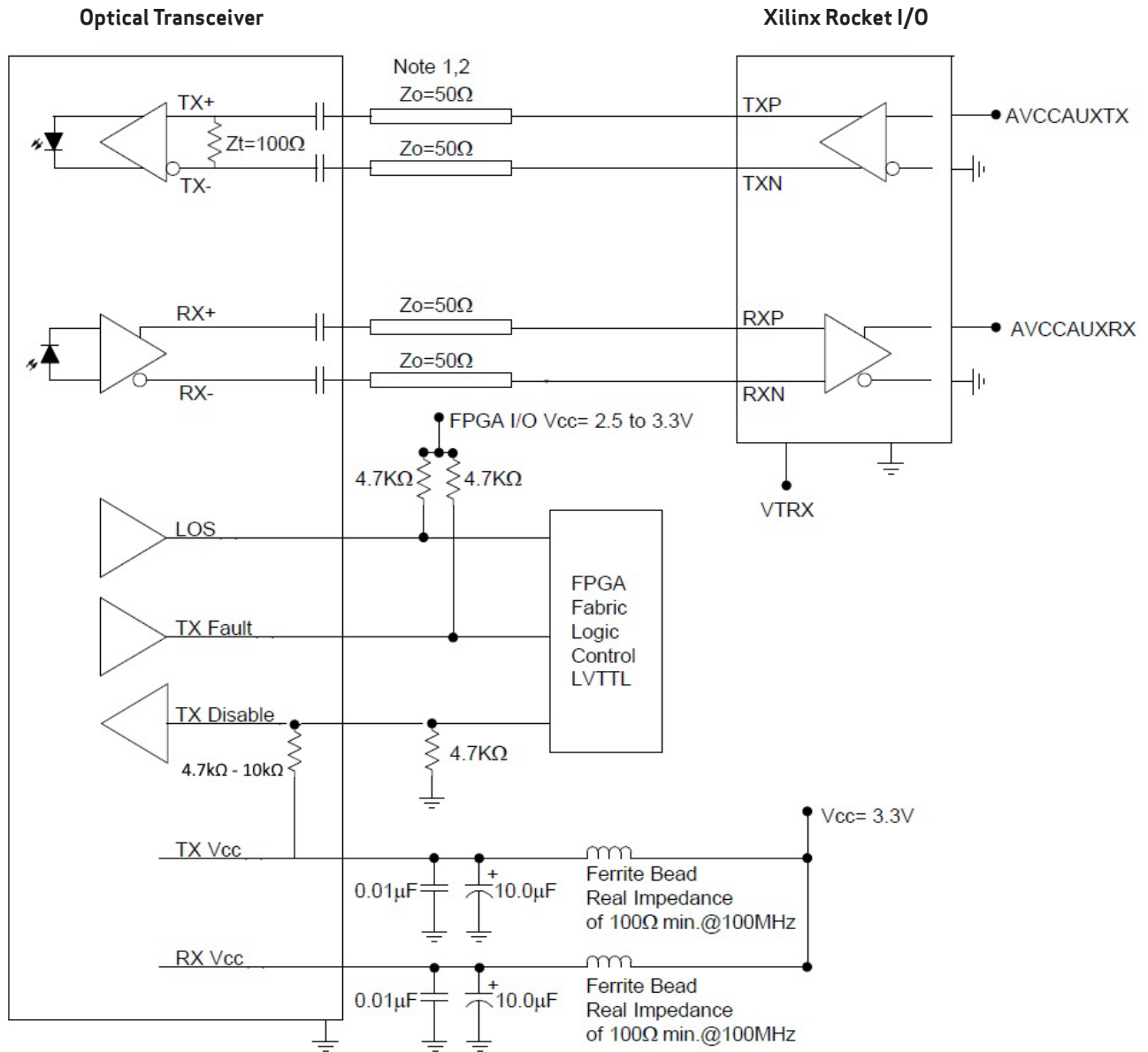
MIL-DTL-38999 Series III Size 23-21



Dimensions are shown as: inches (mm)

5xTX/3xRX LIGHTNING SERIES MIL-DTL-38999 OPTICAL TRANSCEIVER, FAST ETHERNET, GBE, 1X/2XFC AND SERIAL FPDP APPLICATIONS, MULTIMODE, 850 NM VCSELs

APPLICATION SCHEMATIC



Typical application schematic shown. For alternate applications or termination techniques, please consult the factory.

Notes:

1. When using controlled impedance cable (Coaxial cable) and Pre_Empthesis, lengths of 1.0 meter are obtainable.
2. 50 ohm impedance termination shown. For other impedance requirements please consult the factory.

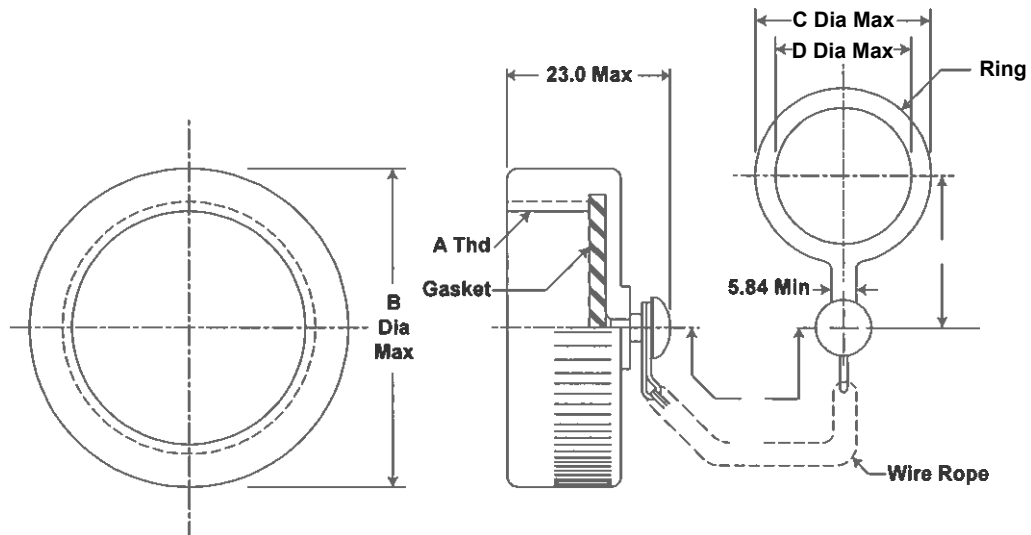
5xTX/3xRX LIGHTNING SERIES MIL-DTL-38999 OPTICAL TRANSCEIVER, FAST ETHERNET, GBE, 1X/2XFC AND SERIAL FPDP APPLICATIONS, MULTIMODE, 850 NM VCSELs

APPENDIX A1 - RECEPTACLE PROTECTION CAPS

*MIL-DTL-38999/33 PROTECTION CAP PART NUMBERS

MS RECEPTACLE CAP P/N

*D38999/33 x 23 R



*See DSCC or SAE QPL for Approved Suppliers
<http://www.dsccl.dla.mil/programs/qmlqpl/QPLdetail.asp?QPL=38999>

MIL-DTL-38999/33 OUTLINE DIMENSIONS - MM

Shell Size Code	Shell Size	A Thread (inches)	B Max. Dia.	C Max. Dia.	D Max. Dia.	E	F +13.0 -7.0
H	23	1.5000-0.1P-0.3L-TS	45.0	54.0	42.62	37.50 31.50	127.0

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APPENDIX A2

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

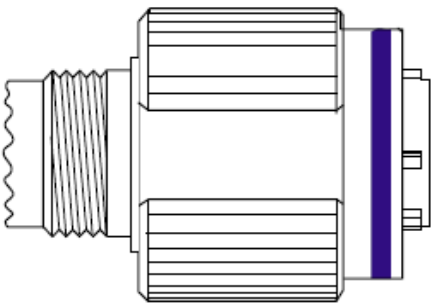
*See DSCC or SAE QPL for Approved Suppliers

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

*D38999 PLUG - PIN INSERT MIL-DTL-38999 CABLE PLUG

MS Plug P/N

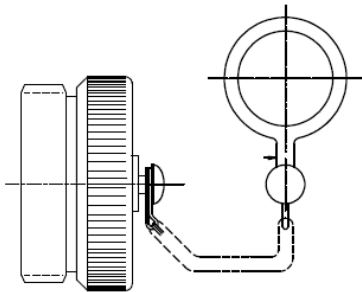
*D38999 / 26MH21PN



*CABLE PROTECTION CAP D38999 / 32 PLUG PROTECTION CAP

MS Plug Cap P/N

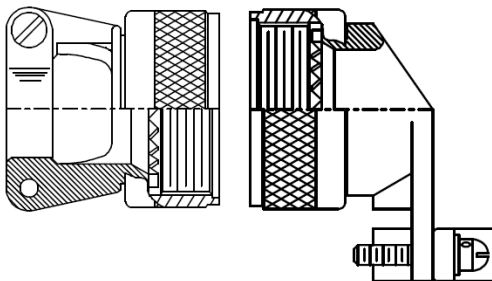
*D38999 / 32M23N



*CABLE BACKSHELL MIL-C-85049 CABLE BACKSHELL

MS Backshell P/N

*MS85049 / XXXXXX**

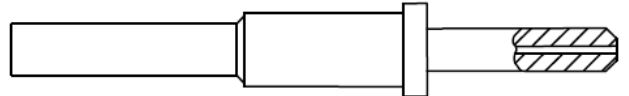


**Straight or angled backshell - defined by application / mounting configuration

*FIBER OPTIC PIN TERMINUS MIL-T-29504 PIN TERMINUS

MS Pin Terminus P/N

*M29504 / 04-XXX**

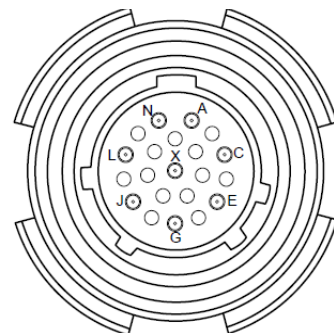


**Defined by fiber optic cable configuration

D38999 PLUG PORT ASSIGNMENTS

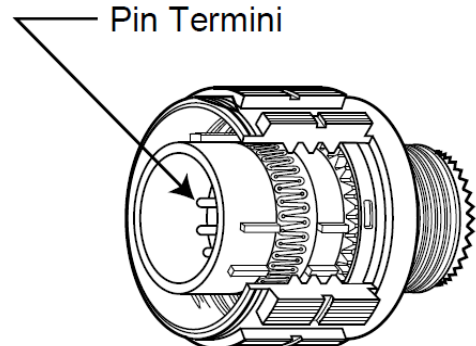
Port #	Optical Pin #	Function
0	L	RX
1	J	TX
2	G	RX
3	N	TX
4	X	TX
5	A	RX
6	E	TX
7	C	TX

TOP
Optical Cable Plug Interface



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

Pin Termini



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APPENDIX A3 PART NUMBER OPTIONS

5x TX + 3x RX, Flange, VCSEL

P38 F - 53 1 x - H x x

SHELL CONFIGURATION

P38 = 38999 Receptacle

SHELL CONFIGURATION

F = Square Flange

CHANNELS (TX+RX)

53 = 5x TX + 3x RX

CABLE MODE

1 = Multimode

FIBER OPTIC INTERFACE

D = 50 Mbps - 2.49 Gbps

E = 2.5 Gbps-3.2 Gbps

SHELL SIZE CODE

H = 23 - 21

SHELL PLATING

F = NI

W = OD CD / NI

POLARIZATION

(Leave blank) = N

A = A

B = B

C = C

D = D

Other wavelength, mounting and port count options are available.

Please consult the Protokraft website for alternate configurations.



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 moogprotokraft.com