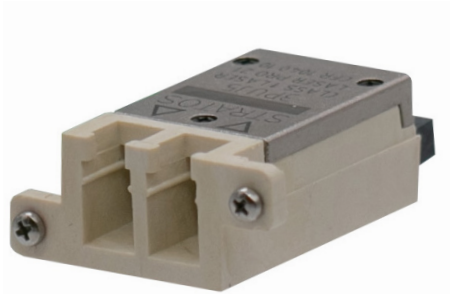
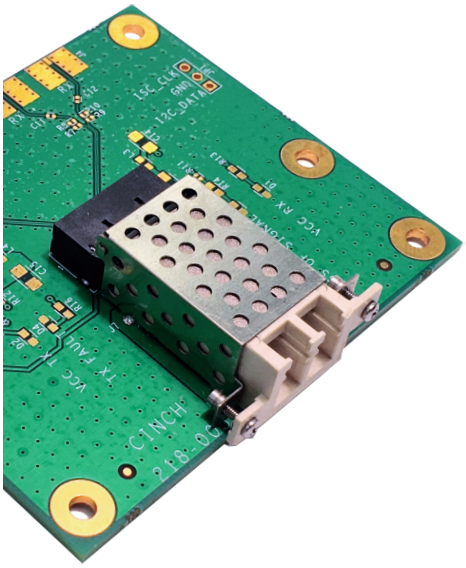
STRATOS
optical technologies

FNK-LT12x

Front Load Pluggable Optical Transceiver





The FNK-LT12 singlemode optical fiber transceivers provide low profile, cost effective solutions for Gigabit Ethernet and 1x Fiber Channel optical fiber data links with a duplex LC connector interface. These transceivers are fully compliant with the IEEE Gigabit Ethernet and ANSI 1x Fiber Channel standards but can be used for any other data communications purpose within their operating parameters.

This transceiver consist of transmitter and receiver functions combined in a Low Profile RJ module. The optical transmitter is a high output 1310 nm FP laser. The transmitter input lines are driven with differential LVPECL signals applied to the Transmit (TX+ and TX-) pins. These signals are internally converted to a suitable modulation current by a CMOS integrated circuit. The optical transmitter can be disabled by applying an LVTTL signal to the Transmit Disable (TDIS) pin.

The optical receivers consist of PIN and Preamplifier assemblies and CMOS limiting post-amplifier integrated circuits. Outputs from the receivers consist of differential CML data signals on the Receive (RX+ and RX-) pins and a single ended LVTTL loss of signal function on Loss of Signal (LOS) pin. The RX data is squelched (JAM) upon LOS Assert to prevent garbage data output when no optical signal is present.

Features & Benefits

- Gigabit Ethernet and 1x FC Applications, up to 10 km
- 3.3 V, 1310 nm, FP, Singlemode
- Front load pluggable miniature transceiver
- MSA height, but half the footprint
- MSA compliant Digital Diagnostics
- Surface Mount I/O pins for high speed signal integrity
- Industrial Temp Range, Vibration tolerant design
- Individual (separate) +3.3 V power supply per port
- Industry standard duplex multimode LC receptacle
- Full compliance to IEEE and ANSI requirements
- EN-60825 / IEC-825 / CDRH Class 1 Compliant

cinch
CONNECTIVITY SOLUTIONS
a bel group

belfuse.com/cinch

Please read our datasheet & drawing disclaimer here.

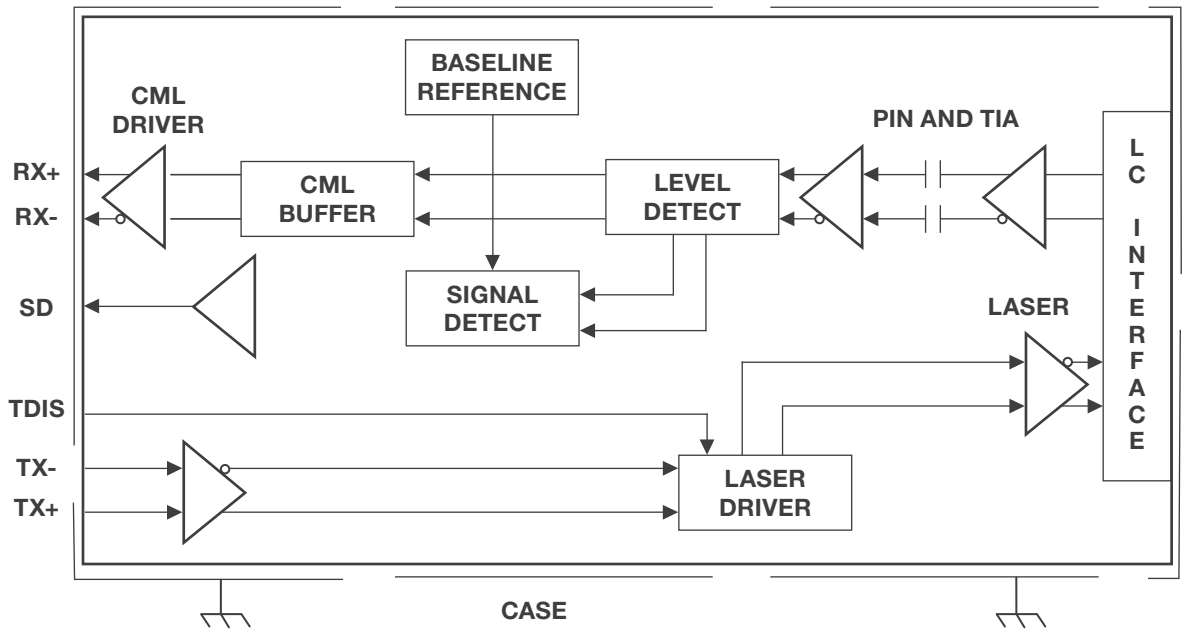
FNK-LT12x
Ordering Information

STRATOS optical technologies

F N K -LT12 H

F	= Front Load Low Rider
N	= No GND Tabs
K	= Fast Ethernet
H	= No Conf Coat
M	= Conf Coat
LT12	= SM 1310nm

Block Diagram



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	Min	Typical	Max	Unit
Storage Temperature	T_S	-55		+100	°C
Lead Hand Soldering Temperature[1]	T_{SOLD}			+260	°C
Lead Soldering Time[1]	t_{SOLD}			10	Second
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
Output Current	I_O			50	mA

[1] The Front Load Pluggable Optical Transceiver is not soldered, rather it is the Cage and Connector that are soldered to the application card. Therefore, these Solder specifications apply only for the Cage and Connector

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Operating Temperature Limit	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	0.35		1.25	V
Rx Data Output Load	R_L		50		W

Transmitter

Parameter[2]	Symbol	Min	Typical	Max	Unit
Optical Output Power[1]	P_O	-9.5		-3.0	dBm
Optical Output Wavelength	λ_{OUT}	1285	1310	1343	nm
Spectral Width (RMS)	$\Delta\lambda_{RMS}$			4	nm
Extinction Ratio	ER	9			dB
Supply Current	I_{CC}		120	160	mA
Optical Rise/Fall Time (20% - 80%)	$t_{R,F}$			0.26	ns
Relative Intensity Noise	RIN		120	-116	dB/Hz
Total Jitter	T_j			153	ps
Transmit Disable Voltage	V_D	2.0	120	V_{CC}	V
Transmit Enable Voltage	V_{EN}	V_{EE}		0.8	V

[1] BER = 10^{-10} @ 125 Mbps, PRBS 2^7-1, NRZ, Compliant with IEEE-802.3z and ANSI X3.297 / FC-PH-2

[2] Vcc Tx = 3.15 – 3.45 V, T_A = Operating temperature range

Receiver

Parameter	Symbol	Min	Typical	Max	Unit
Optical Sensitivity[1]	P_I	-20.0		0.0	dBm
Optical Input Wavelength	λ_{IN}	1270		1355	nm
Optical Return Loss	ORL	12			dB
Supply Current	I_{CC}		70	120	mA
Loss of Signal Assert Time	T_{LOSAS}		<10	100	µs
Loss of Signal Deassert Time	T_{LOSDS}		<10	350	µs
Loss of Signal Deassert Level[2]	LOS_{ON}	-30			dBm
Loss of Signal Assert Level	LOS_{OFF}			-20	dBm
Loss of Signal Hysteresis	HYS	1.5	2.25	3.5	dB
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

[1] BER = 10^{-10} @ 1.25 Gbps, PRBS 27-1, NRZ, Compliant with IEEE-802.3z and ANSI X3.297 / FC-PH-2

[2] Rx Data output are squelched when Loss of Signal is asserted to prevent garbage data output when no optical signal is present

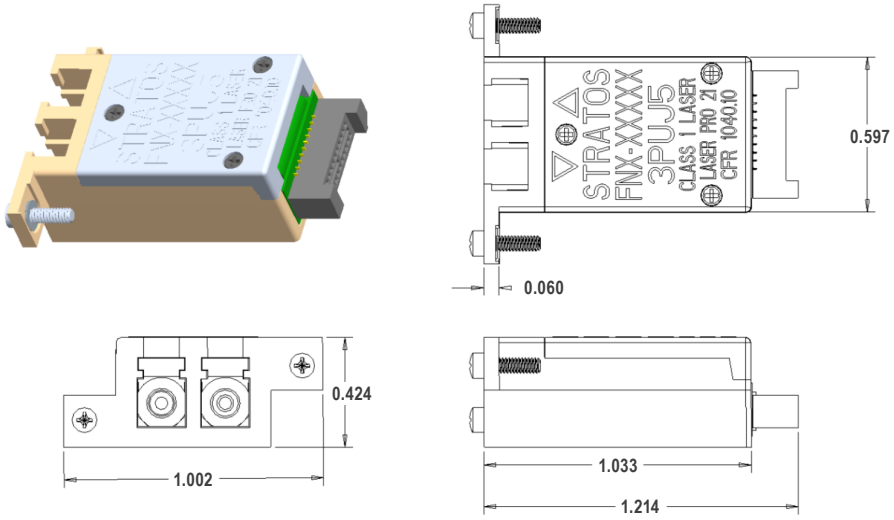
Conformal Coating Option

Parameter	Value
Specification	MIL-I-46058C, Type XY
Coating	Parylene type C
Deposition	Vacuum deposited
Film Thickness	1 MIL +/- 0.0002”

Regulatory Compliance

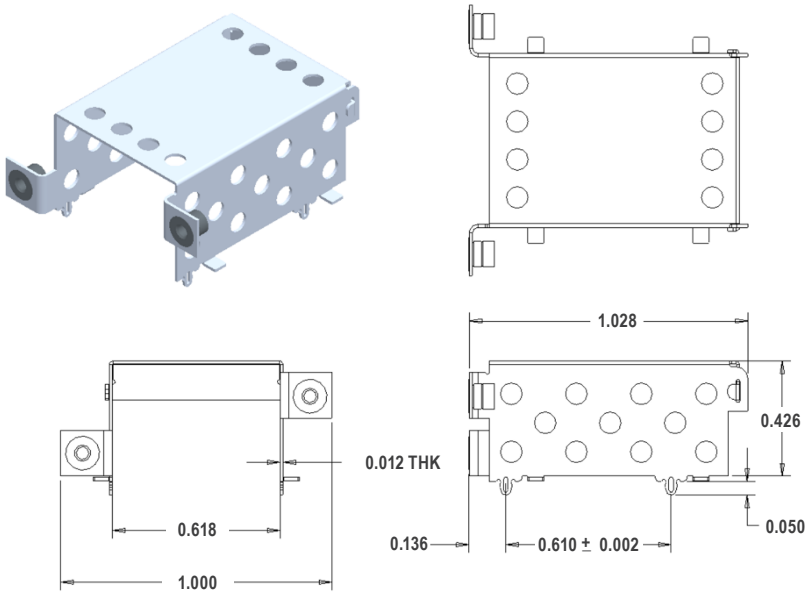
Requirement	Feature	Condition	Notes
MIL-STD-883-3015.7	ESD	Class II	2200 V
IEC-801-2	ESD	Human Body Model	25 kV
IEC-801-3	EMI	Immunity	10 V/m
FCC	EMI	Class B	>20 dB
EN 55022 (CISPR 22A)	EMI	Class B	10 V/m
IEC-825 issue 1993-11	Eye Safety	Class 1	TUV Certificate Number on File
FDA CDRH 21-CFR 1040	Eye Safety	Class 1	CDRH Accession Number on File

Front Loader



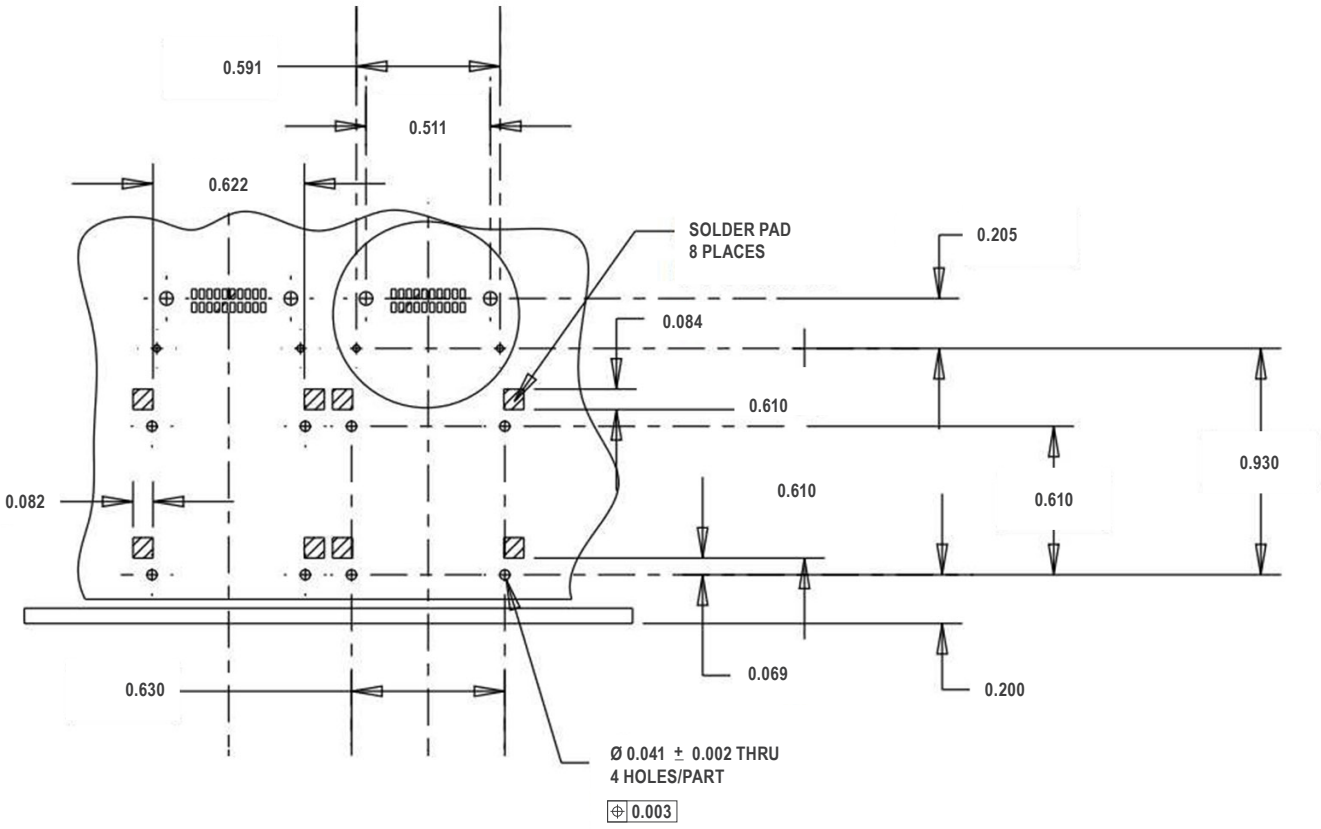
All dimensions in inches.
All dimensions +- 0.005", unless noted
Screw torque 0.50 +/- 0.10 in-lbs

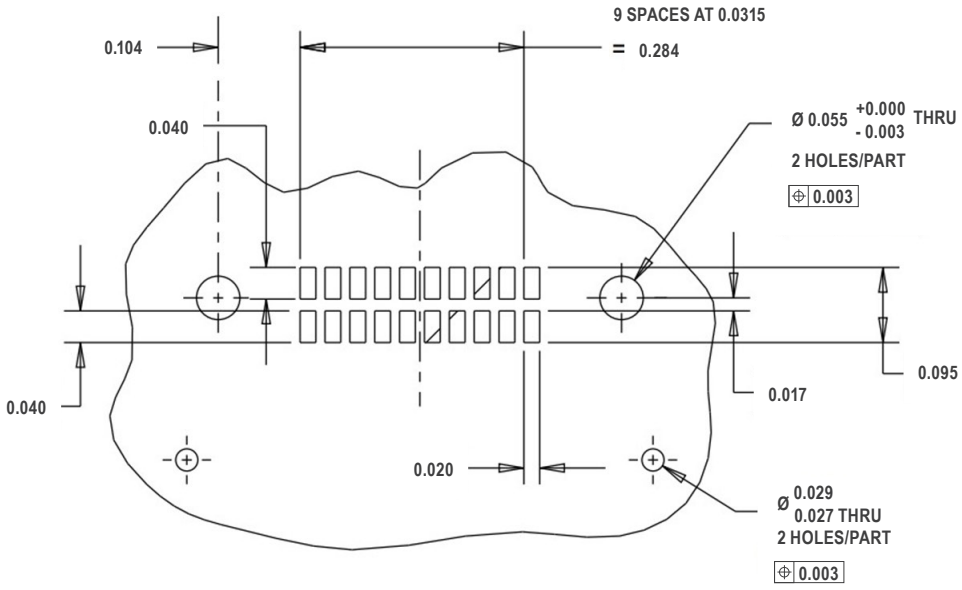
Front Loader Cage



All dimensions in inches.
All dimensions +- 0.005", unless noted
Screw torque 0.50 +/- 0.10 in-lbs

FNK-LT12x
Footprint - PCB



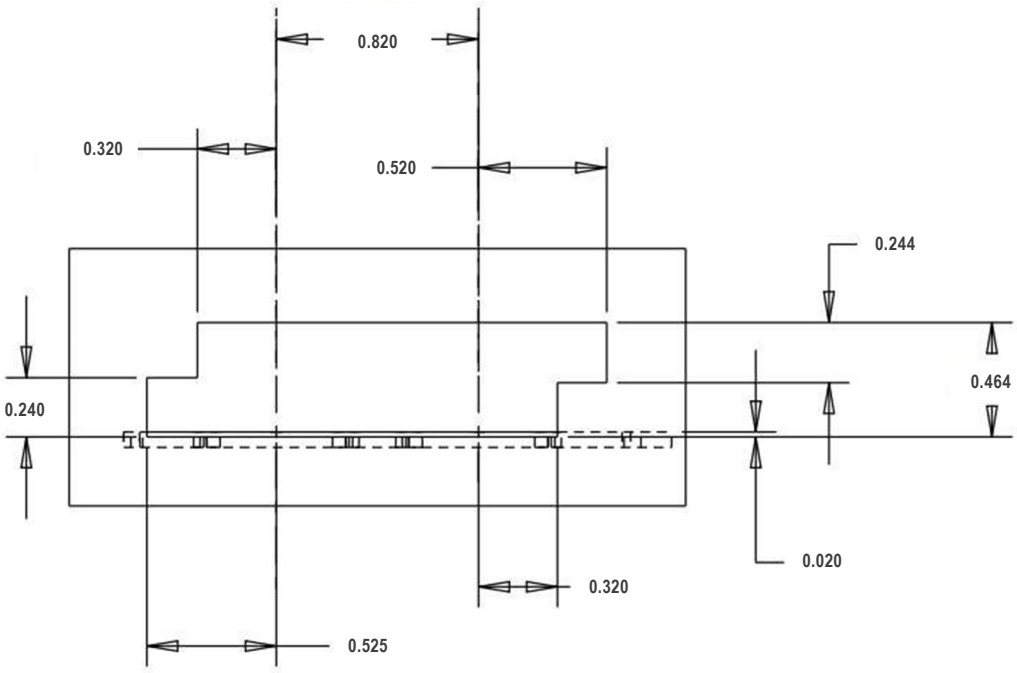


All dimensions in inches.
All dimensions +- 0.005", unless noted

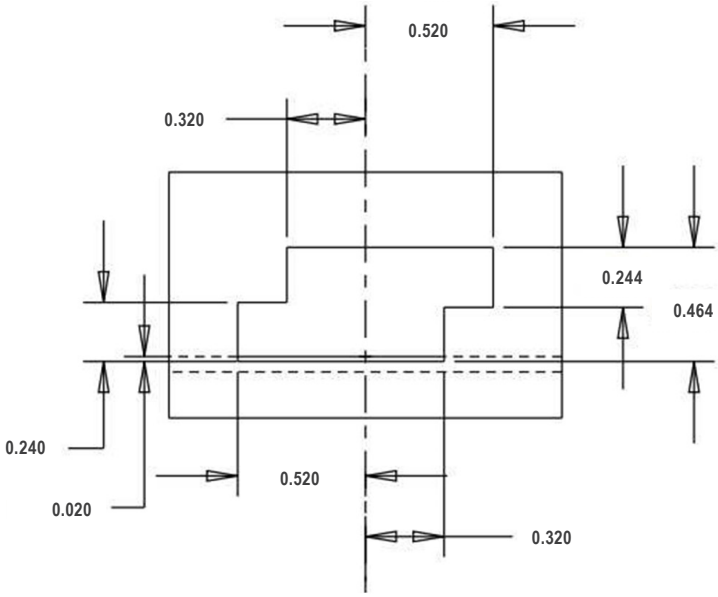
FNK-LT12x
Footprint - Panel Cut Out

STRATOS
optical technologies

Double

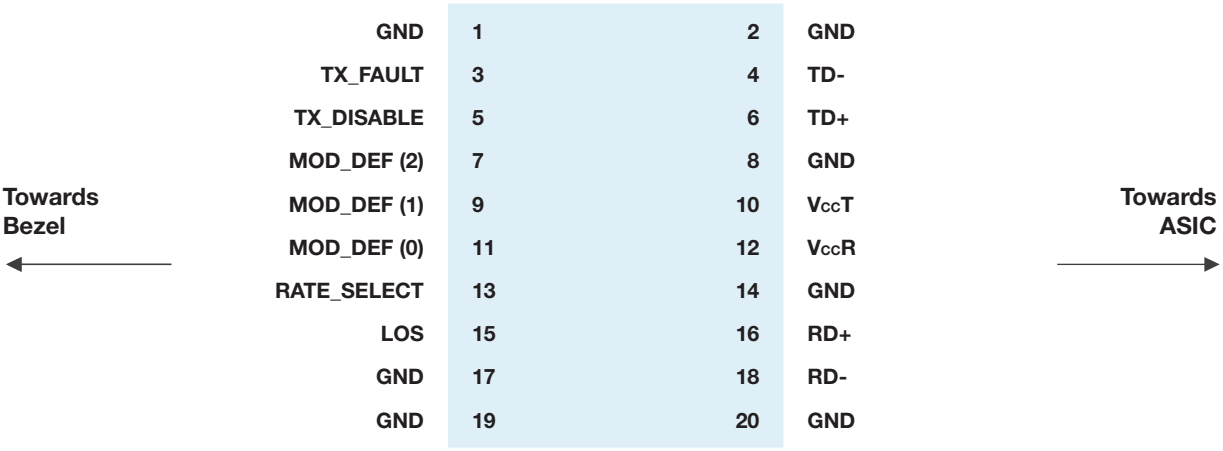


Single



All dimensions in inches.
All dimensions +- 0.005", unless noted

cinch
CONNECTIVITY SOLUTIONS
a bel group



Pin #	Name	Function	Notes
1	GND	Ground	
3	TX_FAULT	Transmitter Fault Indication	Note 3
5	TX_DISABLE	Transmitter Disable	Note 4: Transmitter disables on high
7	MOD_DEF (2)	Module Definition 2	Note 5, 2: Wire Serial Data Input
9	MOD_DEF (1)	Module Definition 1	Note 5, 1: Wire Serial Clock input
11	MOD_DEF (0)	Module Definition 0	Note 5, 0: Grounded in module
13	RATE SELECT	No Connect	Note 6
15	LOS	Loss of Signal	Note 7
17	GND	Ground	
19	GND	Ground	
2	GND	Ground	
4	TD-	Inverted Data In	Note 10
6	TD+	Non-Inverted Data In	Note 10
8	GND	Ground	
10	VccT	Transmitter Power	+3.3 V +-5%, Note 9
12	VccR	Receiver Power	+3.3 V +-5%, Note 9
14	GND	Ground	
16	RD+	Non-Inverted Receiver Data Out	Note 8
18	RD-	Inverted Receiver Data Out	Note 8
20	GND	Ground	

Note 1 Connector SAMTEC part number TEM-110-02-DH1-H-D-A

Note 2 Connector pin numbering matches SAMTEC pin numbering and are not the same pin numbers as defined in MSA SFP standards. However, the physical orientation of the electrical signals is the same as defined in MSA SFP standards

Note 3 **TX FAULT:** is an open collector/drain output which should be pulled up with a 4.7k – 10k Ω resistor on Host board. Pull up voltage between 2.0 V and VccT, R+0.3 V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8 V.

Note 4 **TX DISABLE**: is an input that is used to shut down the transmitter optical output. It is pulled down within the module with a 4.7k – 10k Ω resistor.

The states are: Low (0 - 0.8 V): Transmitter ON
(>0.8, <2.0 V): Undefined
High (2.0 - 3.465 V): Transmitter Disabled
Open: Transmitter Enabled

Note 5 **MOD-DEF 0,1,2:** These are the module definition pins. They should be pulled up with 4.7k – 10k Ω resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3 V

MOD-DEF 0 is grounded by the module to indicate that the module is present.
MOD-DEF 1 is the clock input of the 2-wire serial interface for serial ID and DDMI.
MOD-DEF 2 is the data input of the 2-wire serial interface serial ID and DDMI.

Note 6 **RATE SELECT:** Not applicable for this design (leave Not Connected).

Note 7 **LOS:** is an LVTTL output. When high, this output indicates the received optical signal power is below the receiver sensitivity. Low indicates normal operation.

Note 8 **RD -/+:** These are the differential receiver signal outputs. They are 100 Ω differential lines which should be terminated with 100 Ω (differential) at the user SERDES. The voltage swing on these lines will be between 400 and 1200 mV p-p differential (200-600 mV p-p single ended) when properly terminated **(Figure 1)**.

Note 9 **VccR and VccT:** are the receiver and transmitter power supplies. They are defined as 3.3 V ± 5% at the FRONT LOAD PLUGGABLE connector pin. Recommended host board power supply filtering is shown in **Figure 2**. When the recommended supply filtering network is used, hot plugging of the FRONT LOAD PLUGGABLE module will result in an inrush current of no more than 30 mA greater than the steady state value. VccR and VccT may be internally connected within the FRONT LOAD PLUGGABLE module

Note 10 **TD -/+:** are the differential transmitter signal inputs. They are differential lines with a 100 Ω differential termination inside the module. The inputs will accept a swing of 400 - 2500 mV p-p differential (200-1250 mV p-p single ended), though it is recommended that values between 500 and 1200 mV p-p differential (250-600 mV p-p single ended) be used for best EMI performance.

Note 11 Consult the SERDES manufacturer's applications information for biasing required for Tx outputs. Some serializer outputs are internally biased and may not need external bias resistors.

Note 12 Consult SERDES manufacturer's data sheet and application data for appropriate receiver input biasing network. Some de-serializer inputs internally terminated.

Note 13 Use low ESR capacitors such as NPO or COG for AC coupling of the TD-/+ and RD -/+ data signals.

Inputs to the FNK-LT12 transmitter are internally terminated with 100 Ω differential. The input signal must have at least a 400mV peak-to-peak differential signal swing. Output from the receiver section of the module is expected to drive into a 100 Ω differential load. Different termination strategies may be required depending on the particular SERDES chip set used.

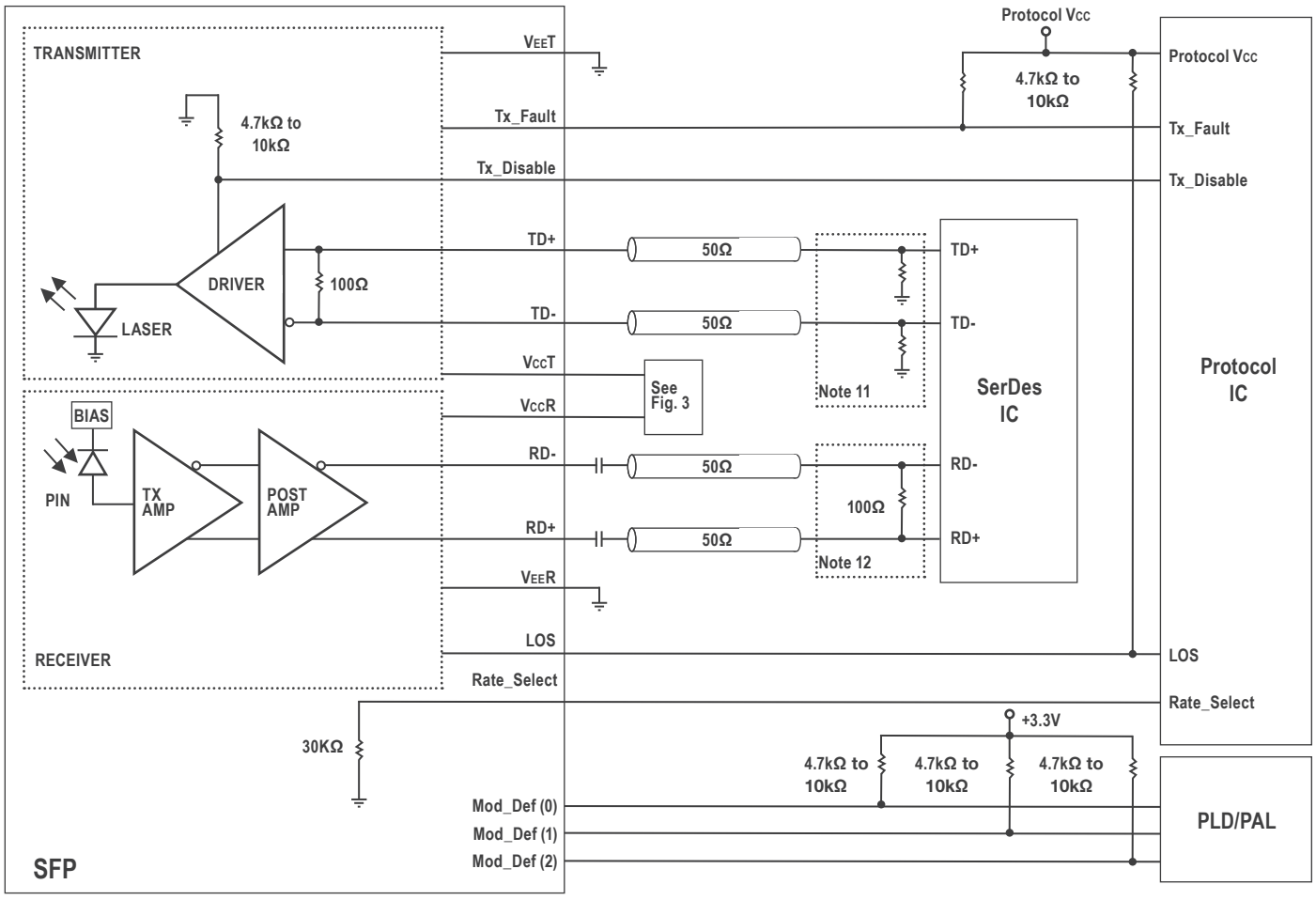


Figure 1 Illustrates the recommended transmit and receive data line terminations.

A suggested layout for power and ground connections is given in **Figure 2** below. Connections are made via separate voltage and ground planes. The mounting posts are at case ground and should not be connected to circuit ground. The ferrite bead should provide an impedance of 220 Ω at 100 MHz. Bypass capacitors should be placed as close to the 20 pin connector as possible.

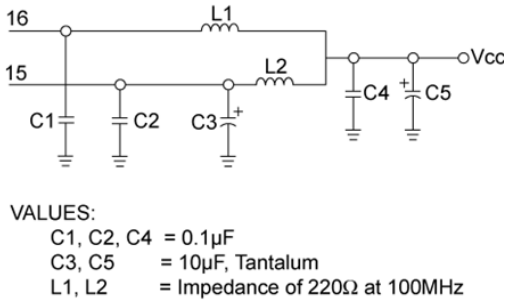


Figure 2 Shows the suggested layout for power and ground connections.

Timing Parameters

Parameter	Symbol	Min	Max	Unit	Conditions
TX_DISABLE assert time	t_off		10	µs	Timing for rising edge of TX_DISABLE to when the optical output falls below 10% of nominal
TX_DISABLE negate time	t_on		1	ms	Timing for falling edge of TX_DISABLE to when the modulated optical output rises above 90% of nominal
Time to initialize includes reset of TX_FAULT	t_init		300	ms	From power on or negation of TX_FAULT using TX_DISABLE
TX_FAULT Assert time	t_fault		100	µs	Time TX_DISABLE must be held high to reset TX_FAULT
TX_DISABLE to reset	t_reset	10		µs	Time TX Disable must be held high to reset TX_FAULT
RX_LOS Assert time	t_loss_on		100	µs	Time from LOS state to RX_LOS assert
RX_LOS deassert time	t_loss_off		100	µs	Time from non-LOS state to RX_LOS deassert
Rate-Select Change time	t_ratesel		10	µs	Timing from rising or falling edge of Rate Select input until receiver bandwidth is in conformance with appropriate specification
Serial ID Clock Rate	f_serial_clock		100	kHz	

FNK-LT12x
DIGITAL DIAGNOSTICS MONITORING INTERFACE – BASE ADDRESS A2h

Cinch Connectivity Solutions FRONT LOAD PLUGGABLE transceivers support the 2-wire serial communication protocol as defined in the SFP Multi- Source Agreement (MSA). The FNK-LT12 transceivers are provided with enhanced digital diagnostic monitoring interface (DDMI) which allows real-time access to device operating parameters such as transceiver temperature, laser bias current and transceiver supply voltage. It also defines a system of alarm flags that alerts end-users when particular operating parameters are outside of a factory set normal range. The FRONT LOAD PLUGGABLE with DDMI is fully compliant to the SFF-8472 Rev. 9.3 specification.

Cinch Connectivity Solutions FRONT LOAD PLUGGABLE with DDMI are internally calibrated (bit 5, address 92 @ 2-wire address A0h is set).

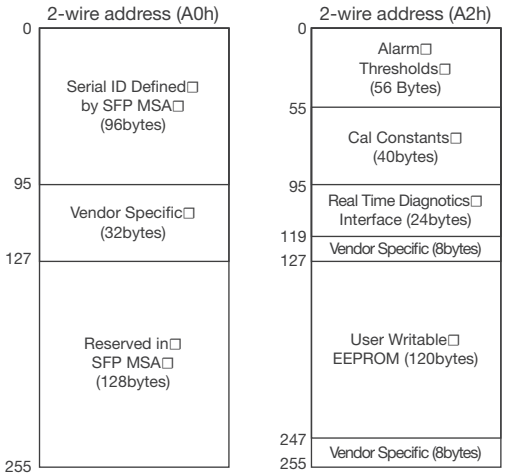


Figure 3 Digital diagnostic memory map specific data field descriptions.

Alarm and Warning Thresholds

Address	Parameter	Hex Code	Value
00-01	Temp High Alarm	5600	+86°C
02-03	Temp Low Alarm	D600	-42°C
04-05	Temp High Warning	5000	+80°C
06-07	Temp Low Warning	DC00	-36°C
08-09	Voltage High Alarm	8751	3.465 V
10-11	Voltage Low Alarm	7A76	3.135 V
12-13	Voltage High Warning	84D0	3.4 V
14-15	Voltage Low Warning	7D00	3.2 V
16-17	Bias High Alarm	88B8	70 mA
18-19	Bias Low Alarm	1388	10 mA
20-21	Bias High Warning	7EF4	65 mA
22-23	Bias Low Warning	1572	11 mA
24-25	TX Power High Alarm	1397	-3
26-27	TX Power Low Alarm	0462	-9.5
28-29	TX Power High Warning	1172	-3.5
30-31	TX Power Low Warning	04EA	-9
32-33	RX Power High Alarm	22E0	-0.5
34-35	RX Power Low Alarm	0052	-21
36-37	RX Power High Warning	1BA7	-1.5
38-39	RX Power Low Warning	006F	-19.5
40-55	Reserved		

Customer, Program: _____

Part Number: (if known) _____

Data Rate: _____

Wavelength:	☐ 850	☐ 1310
Mode:	☐ Singlemode	☐ Multimode
Conformal Coat:	☐ Yes	☐ No
Post:	☐ Screw Post	☐ Solder Post

Fiber Type:

- ☐ 62.5/125 µm Multimode: OCC AE001CWST5KM or equivalent
- ☐ 50/125 µm Multimode: OCC AE001CAST5KM or equivalent
- ☐ 9/125 µm Singlemode: OCC AE001CSLS5KM or equivalent
- ☐ Other:

RX Termini: _____

TX Termini: _____

RX Pigtail Length: _____

(+/- 0.5 inches is default)

(Not including transceiver body, to tip of termini)

TX Pigtail Length: _____

(+/- 0.5 inches is default)

(Not including transceiver body, to tip of termini)

Special Notes: _____

(Boot color, heatshrink, labels, special testing, shipping, etc.)

***Section to be completed by Cinch Connectivity Solutions**

Part Number	Assigned by	Date

cinch CONNECTIVITY SOLUTIONS a bel group

Asia Pacific
+86 21 5442 7668
ccs.asia.sales@as.cinch.com

Europe, Middle East & Africa
+44 (0) 1245 342060
CinchConnectivity@eu.cinch.com

North America
+1 321 308 4100
ccsorders@us.cinch.com

belfuse.com/cinch

© 2022 Cinch Connectivity Solutions