molex **ParaLink-1.6G**

Features

- Separate transmitter and receiver modules
- Data rate up to 1.6Gbps per channel with total throughput 19 Gbps
- 12 Asynchronous AC coupled channels
- Link distance up to 200m over 62.5 μm multimode ribbon fiber
- 3.3V low power operation
- LVDS electrical interface

Applications

- Digital optical cross connect switches
- Add/Drop multiplexers
- Terabit routers
- 10G-VSR
- SAN switches
- Server clusters and high performance computers

Description

The Molex ParaLink™ is a high speed parallel optical link.   It consists of separate 12 channel parallel transmitter and receiver modules. The link is completed by connecting 12 fiber multi-mode ribbon cable. The optical interface is a MT ferrule based SMC connector. The 86991-0200 & 86991-0300 series operate up to 1.6Gbps data rate per channel.
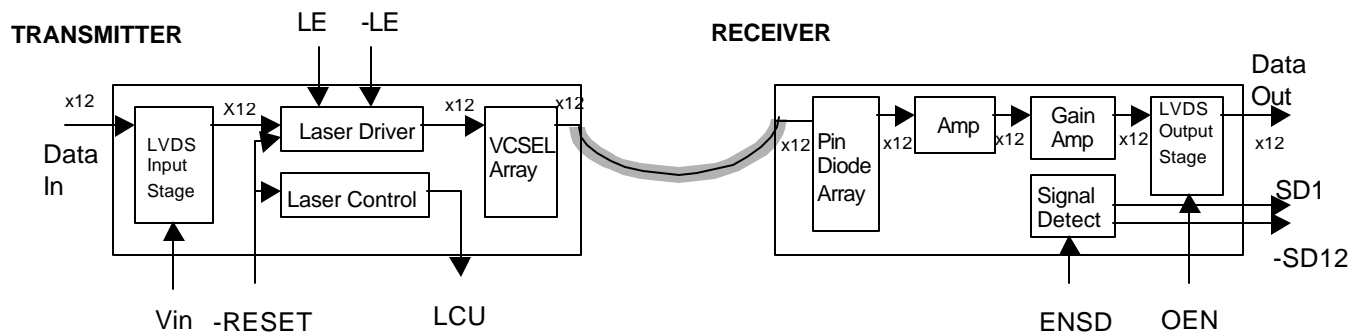
The transmitter module consists of a 12 channel VCSEL array and parallel laser driver circuitry which converts 12 parallel electrical data inputs to 12 parallel optical data output signals.   The module is compatible with low voltage differential signal data inputs (LVDS).   The receiver module inputs 12 parallel optical signals and converts these into 12 parallel LVDS electrical data signals through an PIN photodetector array and receiver circuitry.

Molex ParaLink modules are fully compatible and interoperable with Infineon PAROLI modules.

Ordering Information

Molex Part Number	Data Rate (Gbps)	TX/RX	Data Voltage Level
86991-0200	1.6 x 12	TX	LVDS
86991-0300	1.6 x 12	RX	LVDS

Block Diagram

MOLEX FIBER OPTICS DIVISION 5224 Katrine Avenue, Downers Grove, IL 60515 / Tel: 800-A!-FIBER or 1-630-512-8787   Web: www.molex.com

86001-0152, rev.1.2   USA/30MFO/2001.09   1

Transmitter Specifications
Molex p/n 86991-0200

Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Comments
Supply Voltage	V	-0.3		4.5	V	Vcc-Vee
Data Control Input Levels	V_{IN}	-0.5		Vcc+0.5	V	
LVDS Input Differential Voltage	$|V_{ID}|$			2.0	V	
Operating Case Temperature	Tcase	0		80	C	
Storage Ambient Temperature	Tstorage	-20		100	C	

Electro-optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Comments
Supply Voltage	Vcc	3.0	3.3	3.6	V	
Supply Current	Icc		350	450	mA	
Power Consumption	W		1.2	1.6	W	
Data Rate per Channel	DR	Note 1		1600	Mbps	12 channels
LVCMOS Output Voltage Low	$V_{LVCMOSOL}$			0.4	V	
LVCMOS Output Voltage High	$V_{LVCMOSOH}$	2.5			V	
LVCMOS Output Current High/Low	$I_{LVCMOSI}$	-500		500	μA	
LVCMOS Output Current High	$I_{LVCMOSOH}$			0.5	mA	Source current
LVCMOS Output Current Low	$I_{LVCMOSOL}$			4.0	mA	Sink current
LVDS Differential Input Impedance	Rin	80		120	Ω	LVDS Input Stage
LVDS Input Differential Current	$|I_i|$			5.0	mA	
Average Output Power	Pout	-11.0		-3.0	dBm	Max is class 1 eye safety limit
Center Wavelength	λc	820		860	nm	
Spectral Width (RMS)	Δλ			0.85	nm	
Optical Rise Time	t_R			400	ps	20%-80% level, measured
Optical Fall Time	t_F			400	ps	using gigabit ethernet filter
Deterministic Jitter	J_D			125	ps	
Random Jitter (14σ)	J_R			144	ps	50% duty cycle output pattern
Total Jitter	J_T			238	ps	
Channel to Channel Skew	t_{CSK}			75	ps	
Extinction Ratio	ER	6.0			dB	dynamic
Relative Intensity Noise	RIN			-116	dB/Hz	

Note 1: min data rate, DR_{min} depends on the disparity, *D*, of the data stream. The running disparity of a data stream is the difference of the number of 1s and 0s of that data stream. The disparity D is the maximum value of the running disparity for all possible starting points in the data stream. Running disparity is set to zero at the starting point. Run length is the maximum number of consecutive 1s or 0s in the data stream. For the transmitter $DR_{min} = D$(Mbps)

Timing Specifications

Parameter	Symbol	Min.	Max.
-RESET on delay time	t_1		100 ms
-RESET off delay time	t_2		50 μs
-RESET low duration	t_3	10 μs	
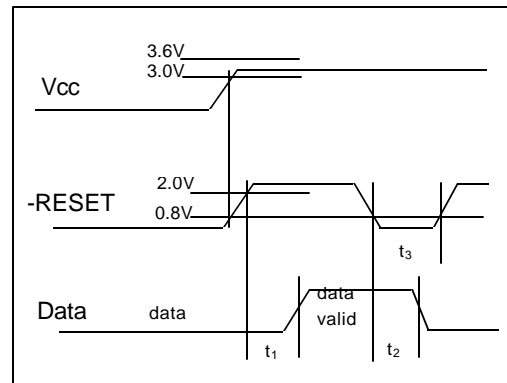
Receiver Specifications
p/n 86991-0300

Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Comments
Supply Voltage	V	-0.3		4.5	V	Vcc-Vee
Data Control Input Levels	V_{IN}	-0.5		Vcc+0.5	V	
LVDS Input Differential Voltage	$|V_{ID}|$			2.0	V	
Operating Case Temperature	Tcase	0		80	C	
Storage Ambient Temperature	Tstorage	-20		100	C	

Electro-optical Parameters

| Parameter	Symbol	Min	Typ	Max	Unit	Comments
Supply Voltage	Vcc	3.0	3.3	3.6	V	
Supply Current	Icc		250	350	mA	
Power Consumption	W		0.8	1.3	W	
Data Rate per Channel	DR	Note 1		1600	Mbps	12 channels
LVDS Output Low Voltage	V_{LVDSOL}	925			mV	
LVDS Output High Voltage	V_{LVDSOH}			1475	mV	
LVDS Output Differential Voltage	$|V_{OD}|$	250		400	mV	
LVDS Output Offset Voltage	Vos	1125		1275	MV	
LVDS Rise/Fall Time	t_R/t_F			400	ps	
LVCMOS Output Voltage Low	I_{LVDSOL}			400	mV	
LVCMOS Output Voltage High	I_{LVDSOH}	2500			mV	
LVCMOS Output Current High/Low	$I_{LVCMOSI}$	-500		500	µA	
LVCMOS Output Current High	$I_{LVCMOSOH}$			0.5	mA	Source current
LVCMOS Output Current Low	$I_{LVCMOSOL}$			4.0	mA	Sink current
Channel to Channel Skew	t_{CSK}			75	ps	
Receiver Sensitivity	Pin			-18	dBm	BER=10^{-12}, ER = infinite
Receiver Saturation	P_{SAT}	-3			dBm	BER=10^{-12}, ER = infinite
Signal Detect Assert Level	P_{SDA}			-19	dBm	
Signal Detect Reassert Level	P_{SDD}	-28				
Signal Detect Hysteresis	$P_{SDA} - P_{SDD}$	1.0	2.5	4.0	dB	
Return Loss of Receiver	A_{RL}	12			dB	

Note 1:   min data rate, DR_{min} depends on the disparity, D, of the data stream. The running disparity of a data stream is the difference of the number of 1s and 0s of that data stream. The disparity D is the maximum value of the running disparity for all possible starting points in the data stream. Running disparity is set to zero at the starting point. Run length is the maximum number of consecutive 1s or 0s in the data stream.
For the receiver $DR_{min} = 8 \times D$(Mbps)

Receiver Timing

Parameter	Symbol	Min.	Max.
Signal detect deassert	t_1	10 µs	
Signal detect assert	t_2	10 µs	
LVDS Output enable off delay time	t_3	20 ns	
LVDS Output enable on time	t_4	20 ns	
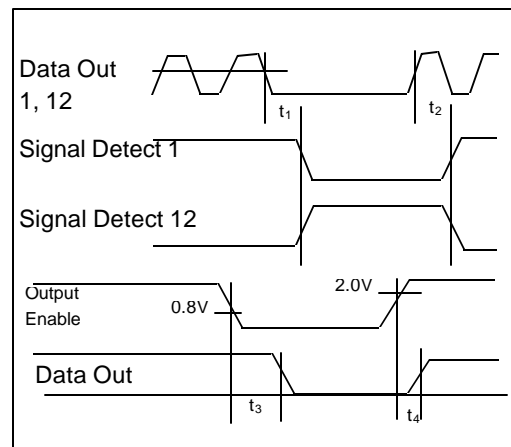
Laser Safety

This optoelectronic transmitter is a Class 1 Laser Product that complies with 21 CFR Subchapter J. According to classification methods specified in IEC 60825-1, Amendment 2, the product has an IEC laser classification of 1M.

The transmitter contains a VCSEL laser diode array which emits laser radiation in the range of 820 to 860 nm. Light from the laser diode is attenuated so that the optoelectronic transmitter conforms to the Class 1 limit. To avoid possible exposure to laser radiation, do not open or alter the sealed housing of the product.

No maintenance or service of the product may be performed.

Caution: The use of optical instruments with this product will increase eye hazard.
Invisible Laser Radiation. Do not stare into beam or view directly with optical instruments.

To ensure laser safety for all input data patterns, each channel is controlled internally and will be switched off if laser safety limits are exceeded. A channel alerter switches the respective data channel output off if the input duty cycle permanently exceeds 57%. The alerter will not disable the channel below an input duty cycle of 57% under all circumstances.   The minimum alerter response time is 1 us with a constant high input. This means in the input data bit stream, ones (1s) in excess of a 57% duty cycle, consecutive or non-consecutive, the time interval of excessive high input must not exceed 1 us, otherwise the respective channel will be switched off. The alterter switches the respective channel from off to on without the need of resetting the module.

All of the channel alerters operate independently. This means an alert within a channel does not affect the other channels. To decrease the power consumption of the module, the unused channel inputs can be tied to high input level.   This allows a portion of the supply current in this channel to be shut down by the corresponding alerter.

On the transmitter module pin #67 and #68, laser enable high and laser enable low, can be used to as an input for connection with an Open Fiber Control (OFC) circuit to configure an IEC Class 1 link.

Pin Out Description
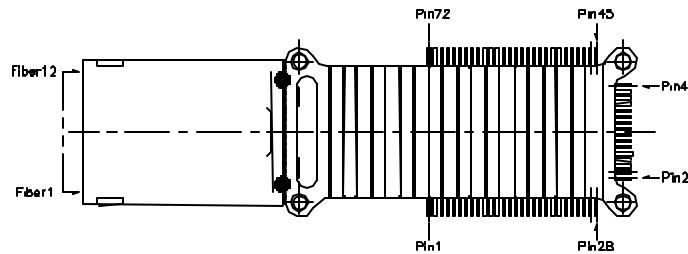
Pin Numbering System

1.6Gbps Receiver, p/n 86991-0300

Pin#	Name	Logic	Pin#	Name	Logic
1	GND		37	Dout7-	LVDS Out
2	Vcc		38	Dout7+	LVDS Out
3	Vcc		39	GND	
4	NC		40	GND	
5	OEN	LVCMOS In	41	Dout8+	LVDS Out
6	SD1	LVCMOS Out	42	Dout8-	LVDS Out
7	Vcco		43	GND	
8	GND		44	GND	
9	NC		45	GND	
10	GND		46	Dout9+	LVDS Out
11	GND		47	Dout9-	LVDS Out
12	GND		48	NC	
13	Dout1+	LVDS Out	49	GND	
14	Dout1-	LVDS Out	50	GND	
15	GND		51	Dout10+	LVDS Out
16	GND		52	Dout10-	LVDS Out
17	Dout2+	LVDS Out	53	GND	
18	Dout2-	LVDS Out	54	GND	
19	GND		55	Dout11+	LVDS Out
20	GND		56	Dout11-	LVDS Out
21	Dout3+	LVDS Out	57	GND	
22	Dout3-	LVDS Out	58	GND	
23	GND		59	Dout12+	LVDS Out
24	GND		60	Dout12-	LVDS Out
25	NC		61	GND	
26	Dout4+	LVDS Out	62	GND	
27	Dout4-	LVDS Out	63	GND	
28	GND		64	NC	
29	Dout5+	LVDS Out	65	GND	
30	Dout5-	LVDS Out	66	Vcoo	
31	GND		67	-SD12	LVCMOS Out
32	GND		68	ENSD	LVCMOS In
33	Dout6+	LVDS Out	69	NC	
34	Dout6-	LVDS Out	70	Vcc	
35	GND		71	Vcc	
36	GND		72	GND	

1.6Gbps Transmitter, p/n 86991-0200

Pin#	Name	Logic	Pin#	Name	Logic
1	Vcc		37	Din7-	LVDS In
2	NC		38	Din7+	LVDS In
3	NC		39	GND	
4	NC		40	GND	
5	NC		41	Din8-	LVDS In
6	LCU	LVCMOS Out	42	Din8+	LVDS In
7	GND		43	GND	
8	GND		44	GND	
9	NC		45	GND	
10	NC		46	Din9-	LVDS In
11	GND		47	Din9+	LVDS In
12	GND		48	NC	
13	Din1-	LVDS In	49	GND	
14	Din1+	LVDS In	50	GND	
15	GND		51	Din10-	LVDS In
16	GND		52	Din10+	LVDS In
17	Din2-	LVDS In	53	GND	
18	Din2+	LVDS In	54	GND	
19	GND		55	Din11-	LVDS In
20	GND		56	Din11+	LVDS In
21	Din3-	LVDS In	57	GND	
22	Din3+	LVDS In	58	GND	
23	GND		59	Din12-	LVDS In
24	GND		60	Din12+	LVDS In
25	NC		61	GND	
26	Din4-	LVDS In	62	GND	
27	Din4+	LVDS In	63	NC	
28	GND		64	-RESET	LVCMOS In
29	Din5-	LVDS In	65	GND	
30	Din5+	LVDS In	66	GND	
31	GND		67	LE	LVCMOS In
32	GND		68	-LE	LVCMOS In
33	Din6-	LVDS In	69	NC	
34	Din6+	LVDS In	70	NC	
35	GND		71	NC	
36	GND		72	Vcc	

Receiver Pin Nomenclature
Vcc   Power supply of pre-amp and analog circuitry
Vcoo   Power supply of output stage
Doutx+   Data channel output non-inverted
Doutx-   Data channel ouotput inverted
GND   Ground
NC   No connection
OEN   Output enable, high=normal operation
         Low = sets all data outputs
ENSD   High = SD1 and SD12 function enabled
         Low = SD1 and SD12 permanent active
SD1   signal detect on fiber 1
         High = signal of sufficient AC power on fiber 1
         Low = signal on fiber 1 is insufficient
SD12   Signal detect on fiber 12
         High = signal of sufficient AC power on fiber 12
         Low = signal on fiber 12 is insufficient.

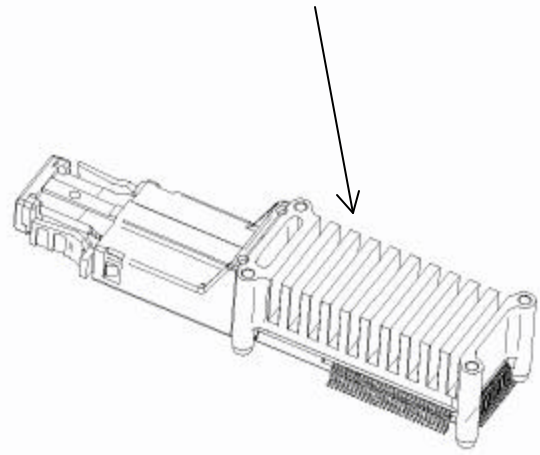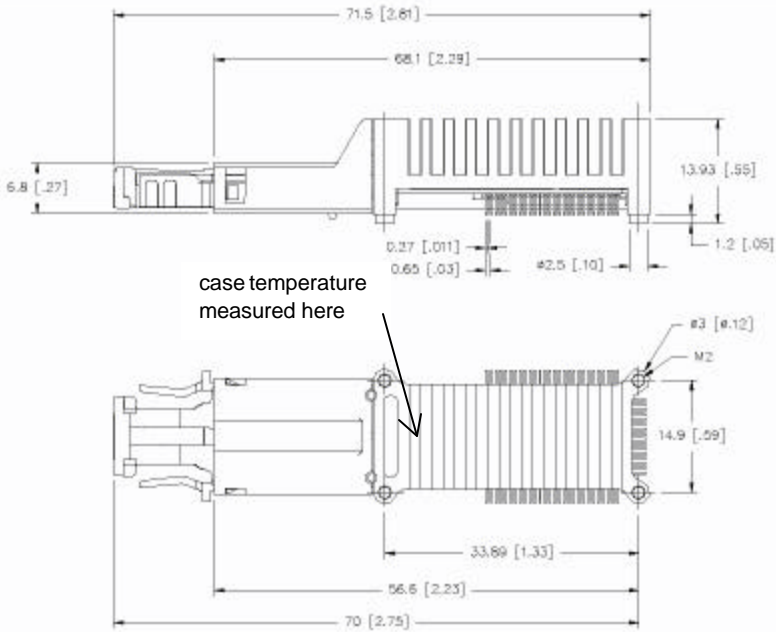Transmitter Pin Nomenclature
Vcc   Power supply of laser driver
Dinx+   Data channel input non-inverted
Dinx-   Data channel input inverted
GND   Ground
NC   No connection
LCU   Laser controller Up
         High = nornal operation, low= laser fault or reset low
RESET   High = laser array is active, low = switches laser array off
LE   Laser enable, high active
         High = laser array is on if –LE is also active
         Low = laser array is off
-LE   Laser enable, low active
         Low = laser array is on if LE is also active.
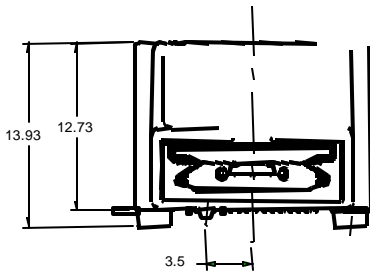
Mechanical Outline Dimensions

labeling

Molex - USA
ParaLink 1.6
P/N 86991-xxxx
S/N nnnnnnn-nnn
Class 1 Laser Product

case temperature measured here

Isometric view

Top view

End View-TX

End View-RX

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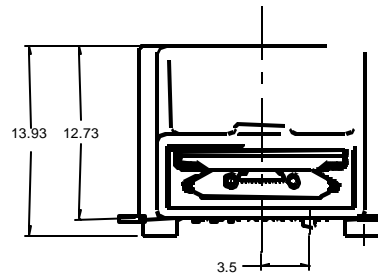
Recommended Circuit Board Layout
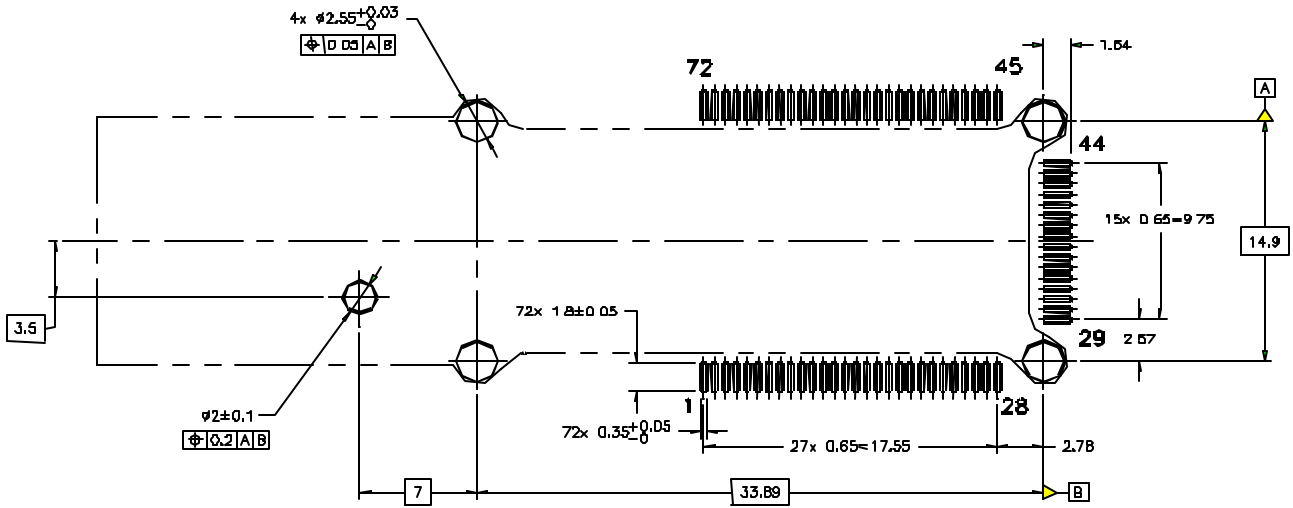
RECOMMENDED MOTHER BOARD FOOTPRINT (RECEIVER)
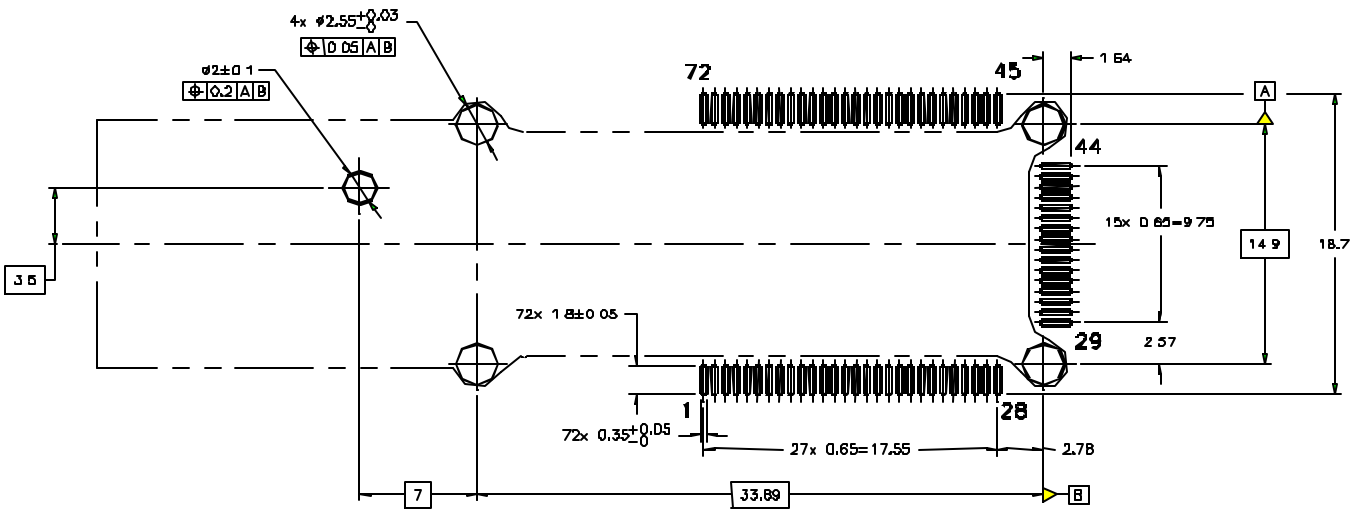
RECOMMENDED MOTHER BOARD FOOTPRINT (TRANSMITTER)

Packaging Information

ParaLink Shipping
Tray Labeling

ParaLink High Speed Optical Link
Part Number: 86991-0200
Mfg. Location: *Downers Grove*   XXX
Quantity: *10*   XXX
Magazine No.:   MXXXXXXX   XXX

Molex Fiber Optics
5224 Katrine Ave.
Downers Grove, IL
60515   USA

UL Recognized Component

TUV and CB Scheme Certified

Class 1 Laser Product - Complies with 21 CFR Subchapter J,
EN 60950, EN 60825-1, EN 60825-2, UL 1950 3rd Edition, and CSA C22.2 950-95

ParaLink Shipping Tray
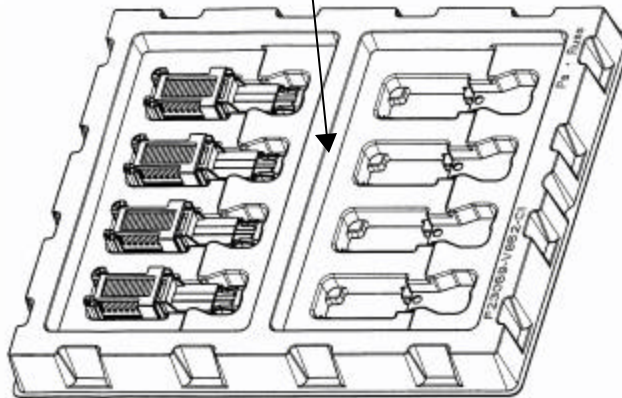
Product Limited Warranty
In the event of defect in materials or workmanship, Molex will repair or replace any purchased fiber optic product free of charge for one year from the date of original shipment. This warranty is extended only to the original purchaser and only covers failures due to defects in materials or workmanship and/or failures to meet the product specifications which occur under normal use. It does not cover damage which occurs in shipment, or failures which are caused by product not supplied by Molex or failures which result from accident, misuse, abuse, neglect, mishandling, misapplication, alteration, modification, or damage that is attributable to acts God. Molex shall replace only such quantitiy of the product proved to be defective.

There are no express warranties except those as listed above. Molex Incorporated, shall not be liable under any legal theory, including, but not limited to negligence or strict liability for any injury, loss or damage, direct or consequential arising out of the use of or misuse of the product. User shall determine the suitability of the product for users intended use, and the user assumes all risk and liability whatsoever in connection therewith.