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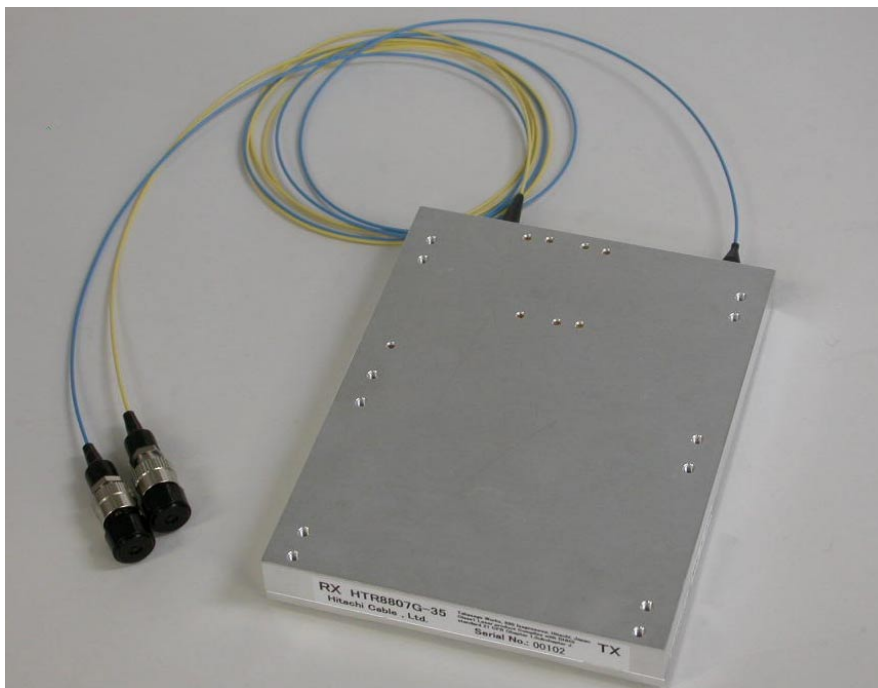
PRODUCT DATA SHEET


10G TRANSPONDER

for SONET/SDH and 10GbE

HTR8807 Series

for OC-192 LR-2 (up to 80km)



 **Hitachi Cable, Ltd.** <http://www.hitachi-cable.co.jp/>

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1. General

This specification covers a fiber optic transponder for a DWDM 10Gbps rates. The light source is a wavelength-locked CW-LD with a Lithium Niobate modulator and the photo detector is an APD. The transponder covers ITU-T specified C-band wavelength channels with 50GHz spacing. The two digits xx after the part number denotes the operating wavelength sub-band. The part number is assigned as follows:

HTR8807G-XX----- without heat sink

HTR8807G-XX/HS---- with heat sink

xx	Frequency [THz]	Wavelength [nm]	xx	Frequency [THz]	Wavelength [nm]
59 (B1)	195.90	1530.334	39 (B5)	193.90	1546.119
	195.85	1530.725		193.85	1546.518
	195.80	1531.116		193.80	1546.917
	195.75	1531.507		193.75	1547.316
	195.70	1531.898		193.70	1547.715
	195.65	1532.290		193.65	1548.115
	195.60	1532.681		193.60	1548.515
	195.55	1533.073		193.55	1548.915
55	195.50	1533.465	35	193.50	1549.315
	195.45	1533.858		193.45	1549.715
	195.40	1534.250		193.40	1550.116
	195.35	1534.643		193.35	1550.517
	195.30	1535.036		193.30	1550.918
	195.25	1535.429		193.25	1551.319
	195.20	1535.822		193.20	1551.721
	195.15	1536.216		193.15	1552.122
51	195.10	1536.609	31	193.10	1552.524
	195.05	1537.003		193.05	1552.926
	195.00	1537.397		193.00	1553.329
	194.95	1537.792		192.95	1553.731
	194.90	1538.186		192.90	1554.134
	194.85	1538.581		192.85	1554.537
	194.80	1538.976		192.80	1554.940
	194.75	1539.371		192.75	1555.343
47	194.70	1539.766	27	192.70	1555.747
	194.65	1540.162		192.65	1556.151
	194.60	1540.557		192.60	1556.555
	194.55	1540.953		192.55	1556.959
	194.50	1541.349		192.50	1557.363
	194.45	1541.746		192.45	1557.768
	194.40	1542.142		192.40	1558.173
	194.35	1542.539		192.35	1558.578
43	194.30	1542.936	23	192.30	1558.983
	194.25	1543.333		192.25	1559.389
	194.20	1543.730		192.20	1559.794
	194.15	1544.128		192.15	1560.200
	194.10	1544.526		192.10	1560.606
	194.05	1544.924		192.05	1561.013
	194.00	1545.322		192.00	1561.419
	193.95	1545.720		191.95	1561.826

2. Caution

- (1) Do not stare into beam or view directly with optical instruments although this product, which incorporates semiconductor laser diode as light source, is maintained class 1 laser radiation of FDA 21 CFR and IEC60825.
- (2) A glass-fiber is attached on the product. Handle with care.
 - Do not bend the fiber less than a radius of 25mm.
 - Put dust cap on the optical connector and electrical 300-pin connector when the product is not using.
 - When the fiber is broken or damaged, handle carefully to avoid injury from the damaged part of fragment.
- (3) This product use the device which contains gallium arsenide, GaAs.
Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.
- (4) HTR8807 can not accept a power supply voltage by electrical hot-plug-in method.
- (5) HTR8807 needs Tx data input (duty 50%) for the modulator bias controlling. When there is no data input, the optical output cannot be controlled normally. Refer to the LsENABLE function of table 5.
- (6) Don't wash HTR8807 with any method in danger of not operating normally.
- (7) Handling guideline: See Appendix A and B.

3. Specifications

3.1 Absolute Maximum Ratings

Absolute maximum ratings are shown in Table 1.

Table 1 Absolute Maximum Ratings

Parameter	Symbol	Min.	max.	Unit	Remark
Power Supply Voltage	V _{cc1.8}	0	2.0	V	-
	V _{cc3.3}	0	3.6		-
	V _{EE}	-6.0	0		-
Storage Temperature	T _{stg}	-40	85	deg. C	-
Optical Input Power	P _i	-	0	dBm	-
Electrostatic Discharge	ESD	-	500	V	HBM
LVDS Input voltage	V _{LVDS-in}	0	2.7	V	-
TTL Input voltage	V _{TTL-in}	0	3.6	V	

(Caution) Stresses above those listed under absolute maximum ratings may cause permanent damage to the transponder. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect the transponder reliability.

3.2 Recommended Operating Conditions

Recommended Operating Conditions are shown in Table 2.

The noise ripple on both positive and negative voltage power supply rails are required to be under 50mVp-p.

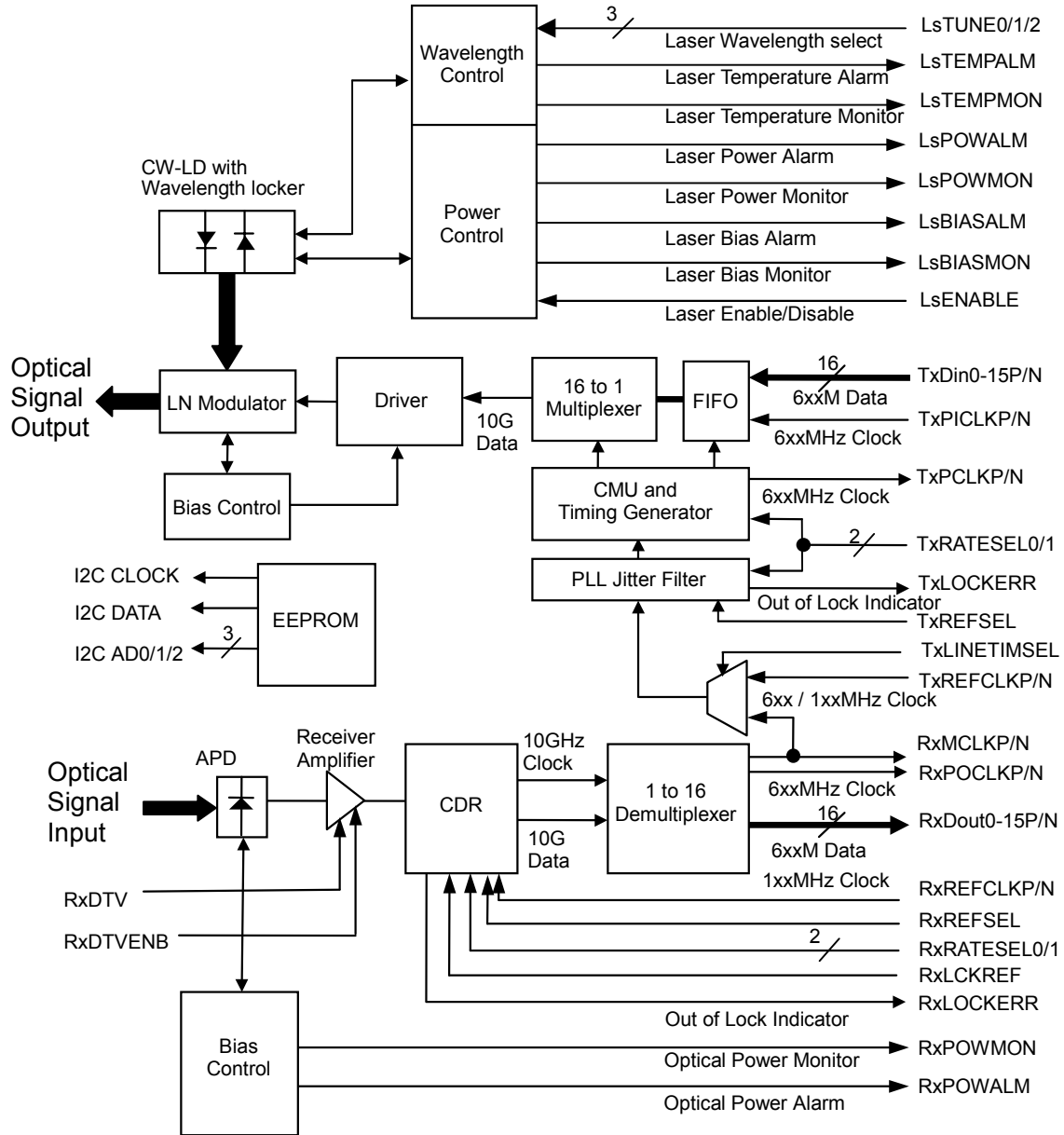
Table 2 Recommended Operating Conditions

Parameter	Symbol	min.	Typ.	max.	Unit	Remark
Power Supply Voltage	V _{cc1.8}	1.71	1.8	1.89	V	-
	V _{cc3.3}	3.135	3.3	3.465		-
	V _{EE}	-5.46	-5.2	-4.94		-
Power Supply Current	I _{CC1.8}	-	850	1100	mA	-
	I _{CC3.3}	-	500	800		-
	I _{EE}	-1500	-400	-		-
Operating Case Temperature	T _C	-5	-	70	deg.C	-
Power Dissipation	P _d	-	5	12	W	-

3.3 Construction

3.3.1 Block Diagram

Figure 1 shows the block diagram of the transponder.



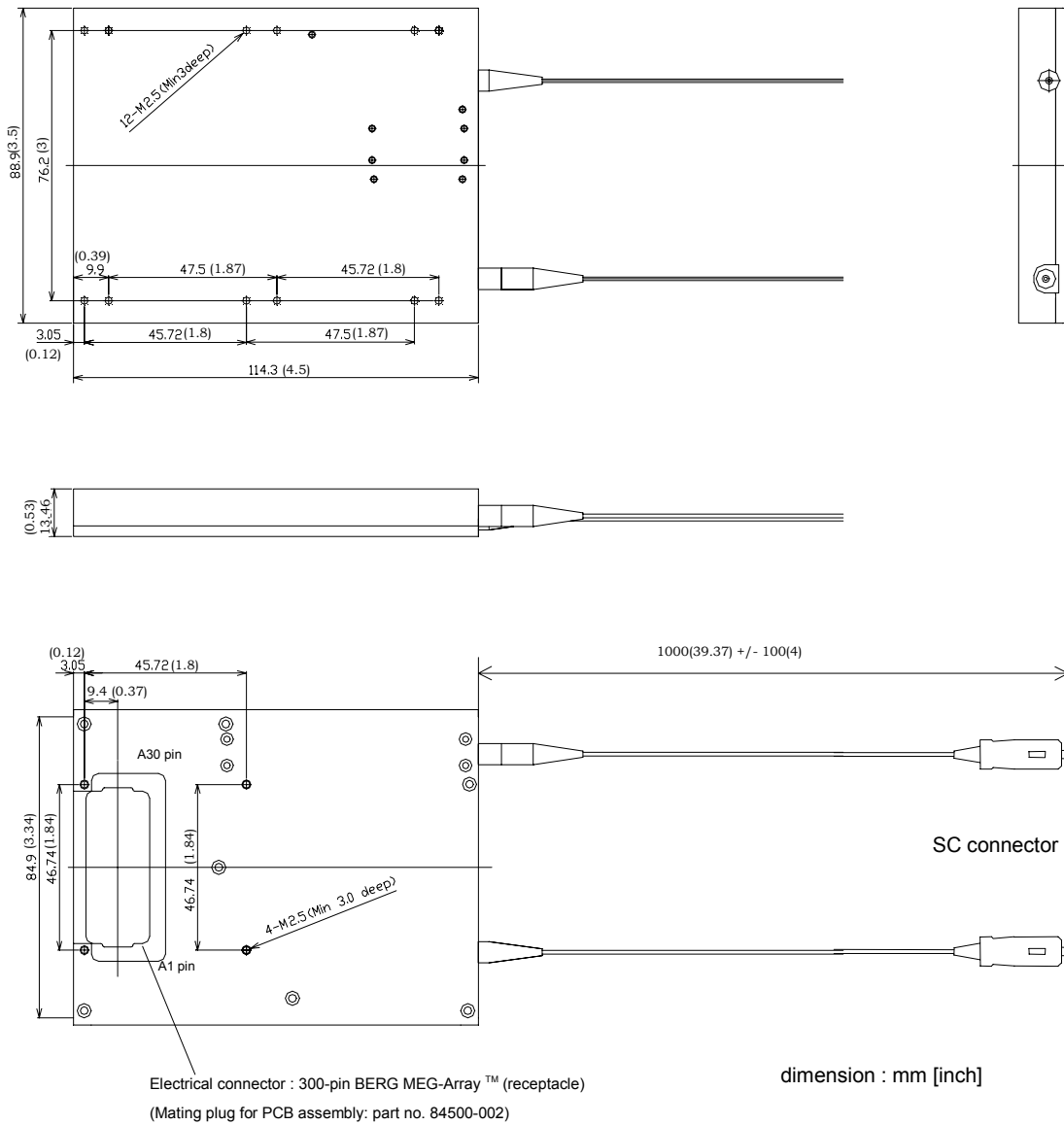
Option pins:

TxMCLKP/N, RxSIGALM, RxALMINT, TxALMINT, TxFIFOERR, TxFIFOES, ALMINT

Figure 1 Block Diagram of Transponder

3.3.2 Dimensions and Pin Assignment

Figure 2 illustrates the transponder outline, and Table 3 shows a pin assignment.



Note: An external heat sink can be attached to the top surface with 6 x M2.5 bolts, in order to improve the cooling capability. The recommended heat sink is shown in appendix.

Caution: Length of these bolts entering the case inside should be equal to or less than 3mm.

Figure 2 Transponder Outline

Table 3 Pin Assignment

	K	J	H	G	F	E	D	C	B	A
1	NC	NC	GND	RxDout12P	Rx(+1.8V)Digital	RxDout8P	GND	RxDout4P	GND	RxDout0P
2	NC	NC	GND	RxDout12N	Rx(+1.8V)Digital	RxDout8N	GND	RxDout4N	GND	RxDout0N
3	RxRATESEL0	RxRATESEL1	RxDTVENB	GND	RxPOWMON	GND	I2CAD0	GND	RxDTV	GND
4	Rx(+/-)3.3V Analog	NUC	GND	RxDout13P	Rx(+/-)3.3V Digital	RxDout9P	GND	RxDout5P	GND	RxDout1P
5	Rx(+/-)3.3V Analog	NUC	GND	RxDout13N	Rx(+/-)3.3V Digital	RxDout9N	GND	RxDout5N	GND	RxDout1N
6	RxRESET	NUC	NC	GND	RxPOWALM	GND	I2CAD1	GND	NC	GND
7	NC	NC	GND	RxDout14P	Rx(+/-)3.3V Digital	RxDout10P	GND	RxDout6P	GND	RxDout2P
8	NC	NC	GND	RxDout14N	Rx(+/-)3.3V Digital	RxDout10N	GND	RxDout6N	GND	RxDout2N
9	NC	NUC	NC	GND	NC	GND	I2CAD2	GND	RxLCKREF	GND
10	Rx(-)5.2V Analog	FFU	GND	RxDout15P	NC	RxDout11P	GND	RxDout7P	GND	RxDout3P
11	Rx(-)5.2V Analog	FFU	GND	RxDout15N	NC	RxDout11N	GND	RxDout7N	GND	RxDout3N
12	NC	NUC	NC	GND	RxSIGALM	GND	NC	GND	NC	GND
13	Rx(-)5.2V Analog	NC	GND	NC	NC	RxPOCLKP	GND	RxMCLKP	GND	RxREFCLKP
14	Rx(-)5.2V Analog	RxALMINT	GND	NC	NC	RxPOCLKN	GND	RxMCLKN	GND	RxREFCLKN
15	I2CCLOCK	NUC	ALMINT	GND	RxREFSEL	GND	NC	GND	RxLOCKERR	GND
16	NC	TxALMINT	GND	TxDin12P	Tx(+1.8V)Digital	TxDin8P	GND	TxDin4P	GND	TxDin0P
17	NC	FFU	GND	TxDin12N	Tx(+1.8V)Digital	TxDin8N	GND	TxDin4N	GND	TxDin0N
18	I2CDATA	NUC	LsTUNE0	GND	LsBIASMON	GND	LsPOWMON	GND	NC	GND
19	Tx(+/-)3.3V Analog	NC	GND	TxDin13P	Tx(+/-)3.3V Digital	TxDin9P	GND	TxDin5P	GND	TxDin1P
20	Tx(+/-)3.3V Analog	NC	GND	TxDin13N	Tx(+/-)3.3V Digital	TxDin9N	GND	TxDin5N	GND	TxDin1N
21	TxRATESEL0	TxRATESEL1	LsTUNE1	GND	LsENABLE	GND	LsTEMPMON	GND	NC	GND
22	Tx(+/-)3.3V Analog	NC	GND	TxDin14P	Tx(+/-)3.3V Digital	TxDin10P	GND	TxDin6P	GND	TxDin2P
23	Tx(+/-)3.3V Analog	FFU	GND	TxDin14N	Tx(+/-)3.3V Digital	TxDin10N	GND	TxDin6N	GND	TxDin2N
24	TxRESET	NUC	LsTUNE2	GND	LsBIASALM	GND	NC	GND	NC	GND
25	Tx(-)5.2V Analog	NUC	GND	TxDin15P	Tx(-)5.2V Digital	TxDin11P	GND	TxDin7P	GND	TxDin3P
26	Tx(-)5.2V Analog	NUC	GND	TxDin15N	Tx(-)5.2V Digital	TxDin11N	GND	TxDin7N	GND	TxDin3N
27	Tx/FIFO RES	NUC	NC	GND	LsTEMPALM	GND	NC	GND	NC	GND
28	Tx(-)5.2V Analog	NC	GND	TxPICLK	Tx(-)5.2V Digital	TxPCLKP	GND	TxMCLKP	GND	TxREFCLKP
29	Tx(-)5.2V Analog	NC	GND	TxPICLKN	Tx(-)5.2V Digital	TxPCLKN	GND	TxMCLKN	GND	TxREFCLKN
30	Tx/FIFO ERR	NUC	TxLINTIMSEL	GND	TxREFSEL	GND	LsPOWALM	GND	TxLOCKERR	GND

Note: NUC: no user connection NC: No internal Connection FFU: reserved for future use *Ita/ics*: optional feature

3.4 Optical Specifications

The optical interface specifications are shown in Table 4.

Note: The specified values described in Table4 are met under the conditions where the signal is transmitted between the Tx and Rx of two HTR8807's.

In the case where the signal is sent from Tx and Rx of HTR8807 and other transponders, there is the possibility of not meeting the specified values described below. In the use of this case, it is recommended to check the transmitting the signal between the HTR8807 and other transponders for customers.

Table 4 Optical Transmitter and Receiver Specifications

Parameter		min.	typ.	max.	Unit	Remark
1	Nominal Bit Rate	-100ppm	9953.2	+100ppm	Mbaud	-
		-100ppm	10312.5	+100ppm		-
		-100ppm	10709.2	+100ppm		See Note [1]
		-100ppm	11095.7	+100ppm		See Note [1]
Transmitter						
2	Optical Source	CW-LD with LN-MOD			-	-
3	Average Launched Power	+4	-	+7	dBm	-
4	Center Wavelength	1529	-	1562	nm	50GHz spacing See page1 for frequency plan.
5	Center Wavelength Tunability	-	8	-	-	
6	Wavelength Accuracy	-25	-	+25	pm	-
7	Extinction Ratio	10	-	-	dB	See Note [3]
		11	-	-	dB	See Note [4]
8	Eye-Crossing	45	50	55	%	-
9	Eye Mask	Compliant with GR-253				- See Note [5]
10	Side Mode Suppression Ratio	30	-	-	dB	-
11	SPD	-	-	0.1	mW/MHz	-
Receiver						
12	$P_{in}@ BER<10^{-12}$	-8 to -23			dBm	@9.95 ~ 11.1Gbps
13	Dispersion penalty @BER<10 ⁻¹²	-	-	3	dB	See Note [2]
14	Received Wavelength	1529	-	1562	nm	-
15	Receive Reflectance	-	-	-27	dB	-
Optical Path						
16	Chromatic Dispersion	-	-	1600	ps/nm	@9.95 ~ 11.1Gbps

17	Optical Path Reflectance	-	-	-27	dB	-
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Note: [1] Tx PLL jitter filter is not supported.

Note: [2] Average power, PRBS $2^{31}-1$, RxDTVEN=1

Note: [3] @9.95Gbps, DCA filter ON

Note: [4] @11.1Gbps, DCA filter OFF

Note: [5] For 10.709Gb/s scale $\Delta X= 93.38\text{ps}$, for 10.31Gb/s scale $\Delta X= 96.97\text{ps}$, for 11.09Gb/s scale $\Delta X= 90.12\text{ps}$

3.5 Definition of Functional Lead

3.5.1 Transmitter Functional Lead

Definition of transmitter functional lead is shown in Table 5.

Table 5 Definition of Transmitter Functional Lead

Pin Name	I/O	Level	Pin#	Description
TxDin0-15P/N	I	LVDS	See Table 3	Transmit parallel data input. TxDin15P/N is transmitted first.
TxPICKLP/N	I	LVDS	G28/ G29	A 6xxMHz Tx source synchronous parallel input clock. The rising edge of the TxPICKLP samples and aligns the transmit data. Refer to section 3.6.2.
TxREFCLKP/N	I	differential LVPECL	A28/ A29	A 6xxMHz/1xxMHz Tx reference input clock. AC coupled differential LVPECL input. Terminated internally with 100 ohm resistor.
TxPCLKP/N	O	LVDS	E28/ E29	A 6xxMHz Tx parallel output clock. This clock can be used as a reference clock for the Framer.
TxREFSEL	I	LVTTL	F30	Selects Tx reference input clock frequency. See Note [6]. With pull-up resistor (>10kohm) in transponder. Logic 0: 1xxMHz Logic 1: 6xxMHz (MSA standard)
TxLINETIMSEL	I	LVTTL	H30	Selects system timing mode. See Note [6]. With pull-up resistor (>10kohm) in transponder. Logic 0: lime timing mode (RxMCLK as a ref.). Logic 1: source timing mode (TxREFCLK as a ref.).
TxRESET	I	LVTTL	K24	Master reset for the Tx control loops and the MUX(including the FIFO). Active low. By activating for one TxPICKLP cycle, the MUX is reset. With pull-up resistor (>10kohm) in transponder. (During normal operation, users are not required to activate the pin.)
LsENABLE	I	LVTTL	F21	Enables laser output and starts the modulator bias control. Active low. Before LsENABLE is active, this transponder requires the TxDin0-15P/N data input (duty 50%) for the modulator bias control. With pull-down resistor (>10kohm) in transponder.
TxLOCKERR	O	LVTTL	B30	Tx clock loss of lock indicator. When low, the transmit PLL is out of lock condition.
LsBIASMON	O	Analog	F18	Laser bias current monitor output. Output voltage is proportional to the laser bias current (10mV/mA).
LsBIASALM	O	LVTTL	F24	Laser bias current alarm. Active Low when laser bias current exceeds 140% of BOL level. When the LsENABLE is inactive (LD shut down), LsBIASALM is low level.

LsPOWMON	O	Analog	D18	Laser optical power monitor output. Output voltage is proportional to the laser optical power. Start of life laser power corresponds to 0.5V.
LsPOWALM	O	LVTTL	D30	Loss of laser average power alarm. Laser optical power alarm output at -3dB degradation from BOL. Active Low. When the LsENABLE is inactive (LD shut down), LsPOWALM is low level.
LsTEMPMON	O	Analog	D21	Laser temperature monitor output. Monitor output is the following relationship to the thermistor inside of the laser. Monitor output voltage = $2.5 * R_t / (R_t + R_r)$ [V] R _t : resistance value of the thermistor(10k ohm) R _r : resistance value of the reference resistor(10k ohm)
LsTEMPALM	O	LVTTL	F27	Laser temperature alarm indicator. Active Low, LsTEMPALM is active under the following condition: when the Peltier temperature gives a delta Laser wavelength (referred to nominal ITU) $\geq +200\text{pm}$ (+/-30pm) or $\leq -200\text{pm}$ (+/-30pm)
TxRATESEL 0	I	LVTTL	K21	Transmitter data rate select. See table A and Note [6]. With pull-up resistor (>10kohm) in transponder.
TxRATESEL 1	I	LVTTL	J21	
LsTUNE0	I	LVTTL	H18	Tx wavelength select. See table B and Note [6] With pull-down resistor (>10kohm) in transponder.
LsTUNE1	I	LVTTL	H21	
LsTUNE2	I	LVTTL	H24	

Note: [6] PINs to be read starting from LsENABLE=1 (laser disabled) with 0.2s (maximum) polling, until LsENABLE=0.

3.5.2 Receiver Functional Lead

Definition of receiver functional lead is shown in Table 6.

Table 6 Definition of Receiver Functional Lead

Pin Name	I/O	Level	Pin#	Description
RxDout0-15P/N	O	LVDS	See Table 3	Received parallel data output. RxDout15P/N is received first.
RxPOCLKP/N	O	LVDS	E13/ E14	A 6xxMHz Rx parallel output clock, synchronized to the parallel data output. Refer to section 3.6.2.
RxREFCLKP/N	I	differential LVPECL	A13/ A14	A 6xxMHz/1xxMHz Rx reference input clock. AC coupled differential LVPECL input. Terminated internally with 100 ohm resistor.
RxMCLKP/N	O	LVDS	C13/ C14	A 6xxMHz/1xxMHz Rx monitor output clock. The frequency is depend on the RxREFCLKP/N. Users must terminate the outputs with 100 ohm resistor.
RxLCKREF	I	LVTTL	B9	Forces to lock the CDR to RxREFCLK. Active low. When high, the CDR keeps trying to lock to the received optical signal. With pull-up resistor (>10kohm) in transponder.
RxREFSEL	I	LVTTL	F15	Selects Rx reference input clock frequency. With pull-down resistor (>10kohm) in transponder. Logic 0: 1xxMHz (MSA standard) Logic 1: 6xxMHz
RxDTV	I	analog	B3	Receiver decision threshold control voltage input. Input range is 0 to +2.0V.
RxDTVENB	I	LVTTL	H3	Enables/Disables receiver decision threshold adjustment input (RxDTV). See Note [6]. Logic 0: RxDTV enabled Logic 1: RxDTV disabled (Receiver decision threshold set to 50%)
RxRESET	I	LVTTL	K6	Master reset for the Rx control. Active low. With pull-up resistor (>10kohm) in transponder. (During normal operation, users are not required to activate the pin.)
RxLOCKERR	O	LVTTL	B15	Rx PLL clock recovery loss of lock indicator. When low, the CDR is out of lock condition.
RxPOWMON	O	Analog	F3	Received optical power monitor. Output voltage is proportional to the average input optical power (10V/mW).
RxPOWALM	O	LVTTL	F6	Loss of receiver average power alarm. Active low. The assert/de-assert level is -33dBm ~-30dBm.
RxRATESEL0	I	LVTTL	K3/	Receiver bit rate select. See table C and Note [6]. With pull-up resistor (>10kohm) in transponder.
RxRATESEL1	I	LVTTL	J3	

Table A Transmitter bit rate selection

TXRATESEL0 TXRATESEL1	0	1
0	10.3125Gbps	11.0957Gbps
1	10.7092Gbps	9.9532Gbps

Default bitrate: in case of no connection at pins TxRATESELX the module should start operating at the bit-rate 9.9532Gbps.

Table B ITU Wavelength selection

LsTUNE2	LsTUNE1	LsTUNE0	Wavelength
0	0	0	Select ITU Wavelength 1 in defined sub-band
0	0	1	Select ITU Wavelength 2 in defined sub-band
0	1	0	Select ITU Wavelength 3 in defined sub-band
0	1	1	Select ITU Wavelength 4 in defined sub-band
1	0	0	Select ITU Wavelength 5 in defined sub-band
1	0	1	Select ITU Wavelength 6 in defined sub-band
1	1	0	Select ITU Wavelength 7 in defined sub-band
1	1	1	Select ITU Wavelength 8 in defined sub-band

Default wavelength: in case of no connection at pins LsTuneX the module should start operating at the first lambda defined for the specific Sub-band (See page1).

Table C Receiver bit rate selection

RXRATESEL0 RXRATESEL1	0	1
0	10.3125Gbps	11.0957Gbps
1	10.7092Gbps	9.9532Gbps

Default bitrate: in case of no connection at pins RxRATESELX the module should start operating at the bit-rate 9.9532Gbps.

3.5.3 Common Functional Lead

Definition of common functional lead is shown in Table 7.

Table 7 Definition of Common Functional Lead

Pin Name	I/O	Level	Pin#	Description
I2CDATA	I/O	LVTTTL	K18	I2C data line. See Note [7].
I2CCLOCK	I/O	LVTTTL	K15	I2C clock line. See Note [7].
I2CAD0	I	LVTTTL	D3	I2C address input for module addressing(LSB) With pull-down resistor (>10kohm) in transponder. See Note [7].
I2CAD1	I	LVTTTL	D6	
I2CAD2	I	LVTTTL	D9	

Note: [7] I2C details are TBD.

3.5.4 Optional Lead

Definition of optional lead is shown in Table 8. These functions are not supported normally. When unused, they default to an inactive state.

Table 8 Definition of optional Lead

Pin Name	I/O	Level	Pin#	Description	When unused
TxMCLKP/N	O	LVDS	C28/ C29	A Tx monitor output clock.	No internal connection (NC)
TxFIFORES	I	LVTTTL	K27	MUX FIFO reset. Active low. With pull-up resistor (>10kohm) in transponder. See Note [8].	Users set open
TxFIFOERR	O	LVTTTL	K30	MUX FIFO error indicator. Active low. See Note [8].	Users set open
TxALMINT	O	Open drain /collector	J16	Electrical "OR" of all Tx alarms. Active low.	Users set open
RxSIGALM	O	LVTTTL	F12	Loss of receiver a.c. power alarm. Active low when optical signal is lost. The assert/de-assert level is FFS.	Users set open
RxALMINT	O	Open drain /collector	J14	Electrical "OR" of all Rx alarms. Active low.	Users set open
ALM INT	O	Open drain /collector	H15	Electrical "OR" of all Rx and Tx alarms. Active low.	Users set open

Note: [8] TxFIFOERR of the MUX-LSI is tied to TxFIFORES, and the FIFO is controlled internally.

3.5.5 No internal connection Lead

The list of No internal Connection (NC) lead is shown in Table 9. These leads which are defined in 300pin MSA are NC in this module.

Table 9 List of no internal connection(NC) lead

MSA Pin Name	I/O	Level	Pin#	Description in 300pin MSA
RxMUTE Dout	I	LVTTTL	B6	Mutes the data outputs of the DMUX.
RxMCLKSEL	I	LVTTTL	B12	Selects speed of output RxMCLK
TxSKEWSEL0	I	LVTTTL	B18	Adjusts skew of TxPICLK(LSB)
TxSKEWSEL1	I	LVTTTL	B21	Adjusts skew of TxPICLK(MSB)
LSWEAK	I	analog	B24	Laser fine tuning of DWDM wavelength
TxPICLKSEL	I	LVTTTL	B27	Selects speed of input TxPICLK
TxPHSADJ0	I	LVTTTL	D24	Adjusts phase of TxPCLK(LSB)
TxPHSADJ1	I	LVTTTL	D27	Adjusts phase of TxPCLK(MSB)
RxSIGMON	O	analog	F9	Receiver signal monitor (a.c. only)
DLOOPENB	I	LVTTTL	H6	Diagnostic loopback enable
LLOOPENB	I	LVTTTL	H27	Line loopback enable
RxTRACE	O	analog	J1	Low frequency PD output
LSWAVEMON	O	analog	J28	Laser wavelength monitor
TxTRACE	I	analog	J29	Low frequency transmitter input
RxMUTE POCLK	I	LVTTTL	K9	Mutes the RxPOCLK. Active low.
RxMUTE MCLK	I	LVTTTL	K12	Mutes the RxMCLK. Active low.
Rx(+) 5.0V Analog	I	Power	K1/K2	Power supply voltage +5.0V for receiver analog section
Rx(+) 3.3V Analog	I	Power	K7/K8	Part of the power supply voltage +3.3V for receiver analog section
Tx(+) 5.0V Analog	I	Power	K16/K17	Power supply voltage +5.0V for transmitter analog section
Rx (-) 5.2V Digital	I	Power	F10/F11/ F13/F14	Power supply voltage -5.2V for receiver digital section

3.5.6 Power Supply

Definition of power supply lead is shown in Table 10. They are independent of power up sequence except that the same supply voltages (for example, Tx (+) 3.3V Analog, Tx (+) 3.3V Digital, etc.) must be supplied at the same timing. The recommended power supply filter circuit is TBD.

Table 10 Definition of Power Supply Lead

Pin Name	I/O	Level	Pin#	Description
Tx (+) 1.8V Digital	I	Power	F16/F17	Power supply voltage +1.8V for transmitter section
Tx (+) 3.3V Analog	I	Power	K19/K20/ K22/K23	Power supply voltage +3.3V for transmitter analog section
Tx (+) 3.3V Digital	I	Power	F19/F20/ F22/F23	Power supply voltage +3.3V for transmitter digital section
Tx (-) 5.2V Analog	I	Power	K25/K26/ K28/K29	Power supply voltage -5.2V for transmitter analog section
Tx (-) 5.2V Digital	I	Power	F25/F26/ F28/F29	Power supply voltage -5.2V for transmitter digital section
Rx (+) 1.8V Digital	I	Power	F1/F2	Power supply voltage +1.8V for receiver section
Rx (+) 3.3V Analog	I	Power	K4/K5	Power supply voltage +3.3V for receiver analog section
Rx (+) 3.3V Digital	I	Power	F4/F5/ F7/F8	Power supply voltage +3.3V for receiver digital section
Rx (-) 5.2V Analog	I	Power	K10/K11/ K13/K14	Power supply voltage -5.2V for receiver analog section
GND	I	Power	See Table 3	Voltage 0V

3.6 Electrical Interface

3.6.1 Level Specification

LVTTL, LVDS and LVPECL level specifications are shown in Tables 11, 12 and 13, respectively.

Table 11 LVTTL Interface Specifications

Parameter	Symbol	min.	typ.	max.	Unit	Remark
Input High Voltage	V_{IH}	2.0	-	Vcc3.3	V	-
Input Low Voltage	V_{IL}	0	-	0.8	V	-
Input High Current	I_{IH}	-	-	300	uA	Vin=2.0V
Input Low Current	I_{IL}	-400	-	-	uA	Vin=0.8V
Output High Voltage	V_{OH}	2.4	-	Vcc3.3	V	$I_{OH}=-1mA$
Output Low Voltage	V_{OL}	0	-	0.4	V	$I_{OL}=1mA$

Table 12 LVDS Interface Specifications

Parameter	Symbol	min.	typ.	max.	Unit	Remark
Input High Voltage	V_{IH}	-	-	2.4	V	-
Input Low Voltage	V_{IL}	0.8	-	-	V	-
Input Differential Voltage	V_{IDIFF}	0.2	-	1.6	Vpp	-
Input Differential Resistance	R_{DIFF}	80	100	120	ohm	-
Output High Voltage	V_{OH}	-	-	1.6	V	-
Output Low Voltage	V_{OL}	0.8	-	-	V	-
Output Differential Voltage	V_{ODIFF}	0.5	-	1.2	Vpp	-

Note : Output loading is 100 ohm line-to-line.

Table 13 AC coupled LVPECL Interface Specifications

Parameter	Symbol	min.	typ.	max.	Unit	Remark
Input Differential Voltage	V_{IDIFF}	0.4	-	1.8	Vpp	Internally terminated
Input Differential Resistance	R_{DIFF}	80	100	120	ohm	-
Duty cycle		45	50	55	%	Tx/Rx reference clock

3.6.2 Timing Specification

TxPICKLP/N (transmit 6xxMHz clock input) and data specifications are shown in Table 14. As shown in Figure 3, setup/hold time of TxDin0-15P/N (transmit parallel data input) is defined with respect to the rising edge of TxPICKLP.

Table 14 TxPICKLP/N and TxDin0-15P/N Specifications

Parameter	Symbol	min.	typ.	max.	Unit	Remark
Frequency	f	-100ppm	622.08	+100ppm	MHz	-
		-100ppm	644.53	+100ppm		
		-100ppm	669.31	+100ppm		
		-100ppm	693.48	+100ppm		
Rise Time	t_r	100	-	300	ps	20-80%
Fall Time	t_f	100	-	300	ps	20-80%
TxPICKLP/N Duty Cycle	-	40	-	60	%	-
TxDin0-15P/N setup to TxPICKLP	t_s	300	-	-	ps	-
TxDin0-15P/N hold from TXPICKLP	t_h	300	-	-	ps	-

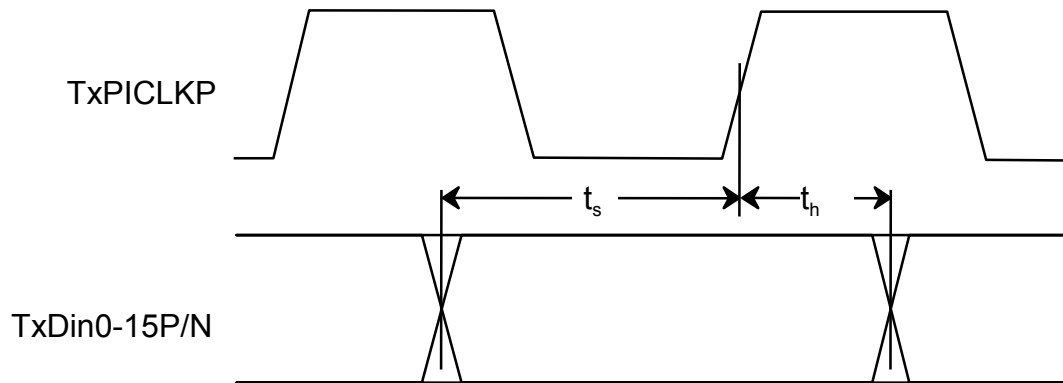


Figure 3 TxPICKLP/N and TxDin0-15P/N Timing

RxPOCLKP/N (receive 6xxMHz clock output) and data specifications are shown in Table 15. As shown in Figure 4, propagation delay time of RxDout0-15P/N (receive parallel data output) is defined with respect to the rising edge of the RxPOCLKP.

Table 15 RxPOCLKP/N and RxDout0-15P/N Specifications

Parameter	Symbol	min.	typ.	max.	Unit	Remark
Frequency	f	-100ppm	622.08	+100ppm	MHz	-
		-100ppm	644.53	+100ppm		
		-100ppm	669.31	+100ppm		
		-100ppm	693.48	+100ppm		
RxPOCLKP/N Duty Cycle	-	45	-	55	%	-
Rise Time	t_r	-	-	300	ps	20-80%
Fall Time	t_f	-	-	300	ps	20-80%
RxDout0-15P/N propagation delay	t_{pd}	-250	-	+250	ps	-

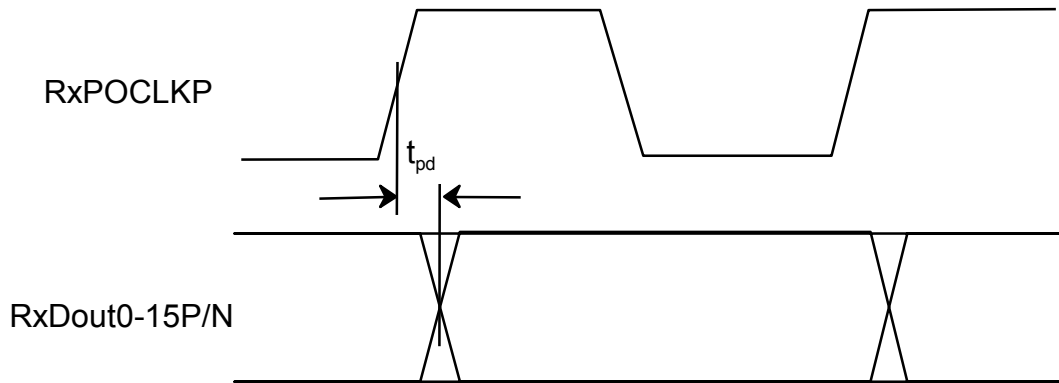


Figure 4 RxPOCLKP/N and RxDout0-15P/N Timing

3.6.3 LVDS Termination

Figures 5 and 6 show recommended LVDS termination.

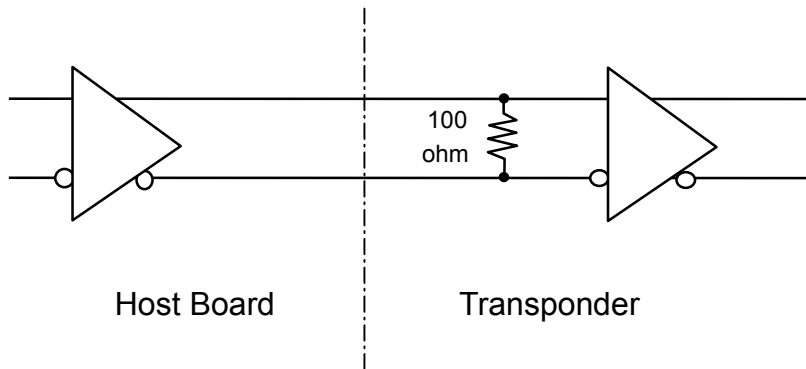


Figure 5 LVDS Input Interface

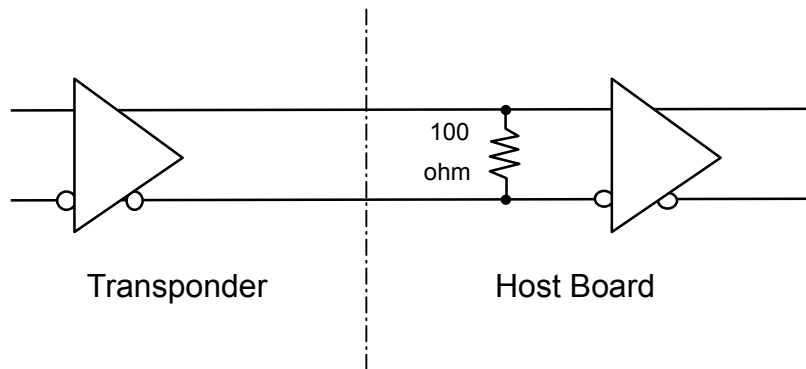


Figure 6 LVDS Output Interface

3.6.4 Analog signal characteristics

Analog signal characteristics are shown in Table 16.

Table 16 Analog signal characteristics

Parameter	Symbol	min.	typ.	max.	Unit	Remark
Normalized laser voltage monitor BOL	LsPOWMON	0.44	0.5	0.56	V	-
50% variation of laser power	LsPOWMON	-	0.25	-	V	Linear slope
Laser disable mode	LsPOWMON	-20	-	+20	mV	RL>100kohm
Laser monitor bias voltage slope	LsBIASMON	8.9	10	11.2	mV/mA	-
Laser monitor bias offset voltage	LsBIASMON	-20	-	+20	mV	RL>100kohm
Laser temperature monitor slope	LsTEMPMON	-	TBD	-	V/degC	-
Input power monitor voltage slope	RxPOWMON	8.0	10	12.6	V/mW	Wavelength at 1550nm
Input power monitor offset voltage	RxPOWMON	-20	-	+20	mV	RL>100kohm

3.6.5 Alarms and control response time

Alarms and control response time are shown in Table 17.

Table 17 Alarms and control response

Parameter	Symbol	min.	typ.	max.	Unit	Remark
Laser enable: switch-on time	LsENABLE	-	-	500	ms	Refer to section 3.8. and Note[9]
Laser enable: switch-off time	LsENABLE	-	-	1	ms	Power< -30dBm
Optical output power alarm activation time	LsPOWALM	-	-	10	ms	-
Optical output power alarm deactivation time	LsPOWALM	-	-	TBD	ms	-
Laser bias current alarm activation/deactivation time	LsBIASALM	-	-	10	ms	-
Laser temperature alarm activation/deactivation time	LsTEMPALM	-	-	10	ms	-
Tx loss of lock of TxPLL activation time	TxLOCKERR	-	-	100	ms	-
Tx loss of lock of TxPLL deactivation time	TxLOCKERR	-	-	250	ms	-
Tx error indicator activation/deactivation time	TxALMINT	-	-	TBD	ms	option
Rx loss of average optical power alarm activation time	RxPOWALM	-	-	1	ms	-
Rx loss of average optical power alarm deactivation time	RxPOWALM	-	-	10	ms	-
Rx loss of average optical power alarm assert/de-assert level	RxPOWALM	-33	-	-30	dBm	-
Rx loss of average optical power alarm level hysteresis	RxPOWALM	-	-	3	dB	-
Rx loss of a.c. optical power alarm deactivation time	RxSIGALM	-	-	TBD	ms	option
Rx loss of a.c. optical power alarm assert/de-assert level	RxSIGALM	TBD	-	TBD	dBm	option
Rx loss of a.c. optical power alarm level hysteresis	RxSIGALM	TBD	-	TBD	dB	option
Rx loss of lock of RxPOCLK activation time	RxLOCKERR	-	-	1	ms	-
Rx loss of lock of RxPOCLK deactivation time	RxLOCKERR	-	-	10	ms	-
Rx error indicator activation/deactivation time	RxALMINT	-	-	TBD	ms	option
Module error indicator activation/deactivation time	ALMINT	-	-	TBD	ms	option

Note: [9] When a change is detected in the LsTUNEx configuration the transponder switch from the operating ITU lambda to the new selected one according “cold start” procedure as per section 3.8.1.

3.7 Firmware Interface

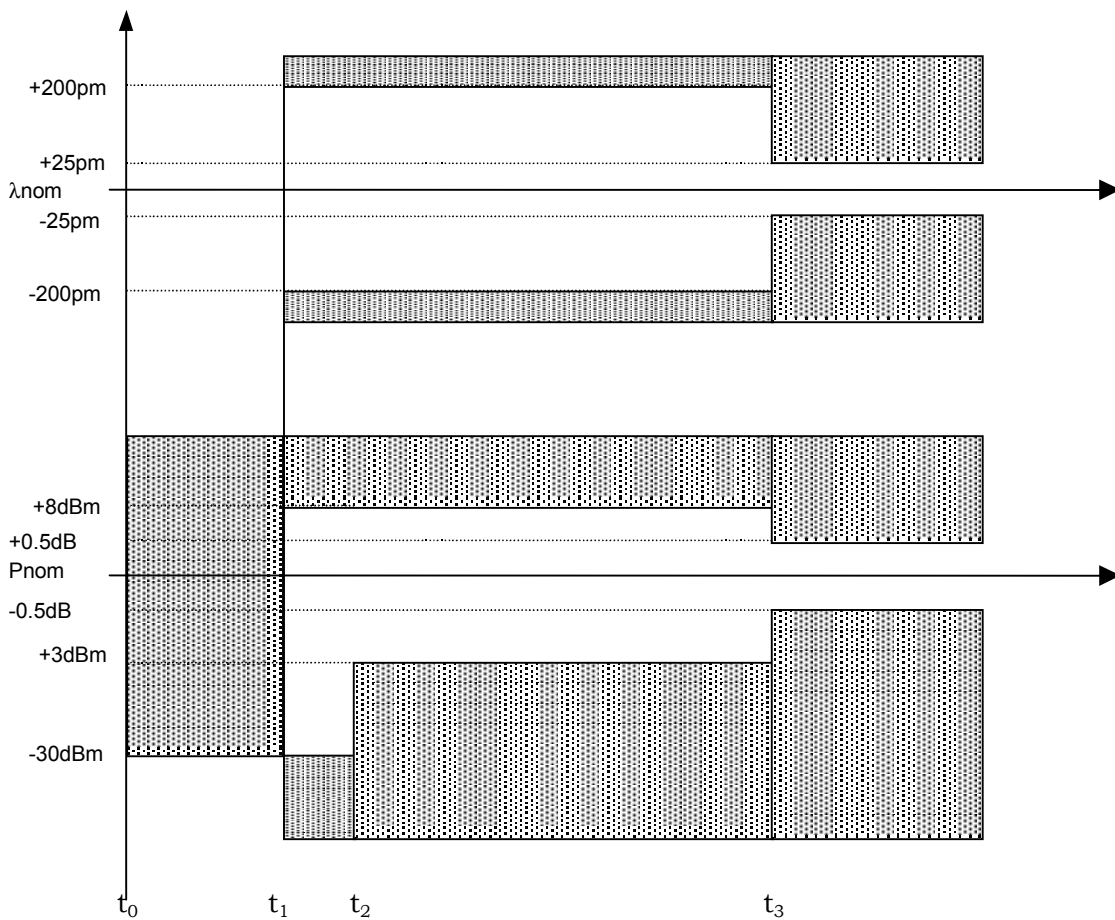
The firmware interface is T.B.D.

3.8 Start-up Timing

3.8.1 Cold start

The transponder operate with the timing defined in Figure 7.

The transponder operates in white area.



t_0 = power ON/TxRESET

t_1 = Laser turn ON time (assuming LSENABLE=0) \leq 40 seconds

t_2 = All loop locking in progress $\leq t_1 + 15$ seconds

t_3 = All loop locked (full performance achieved) $\leq t_2 + 5$ seconds

Figure 7 start up timing

3.8.2 Warm start (LSENABLE 1to 0)

The transponder starts from t_1 as per Figure 7 with a maximum delay (between LsENABLE falling edge and Transponder output power > -30dBm) of 500ms.

3.9 Protection condition

The Transponder automatically switch off the laser (protection condition) in presence of one of the following conditions:

LsBIASALM = alarm

LsTEMPALM = alarm

Once one of the causes has been verified the transponder remains in “protection condition” until occurs a power shutdown, or a reset, or a wavelength change.

4. Inspection

All transponders shall be inspected, after the following screening processes:

- 1) Heat cycle: $T_a = -20$ to 70 deg.C, 30 minutes at each temp., 10 times
- 2) High temperature operation : $T_c=70$ deg.C, 24 hours

Where inspection items are as follows:

1. Appearance
2. Dimensions
3. Optical characteristics in Table 4, such as launched power, eye opening, received power (min.) and received power (max.).
4. Function tests

5. Packing

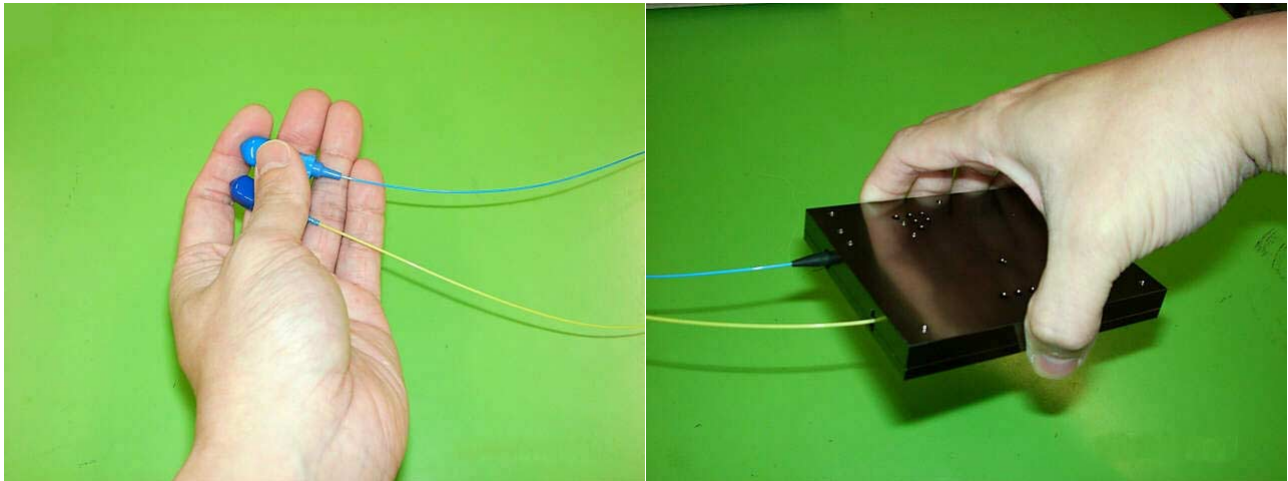
The transponders shall be packed in sturdy carton box(es).

End of specification

Handling Procedure on 10G Transceiver

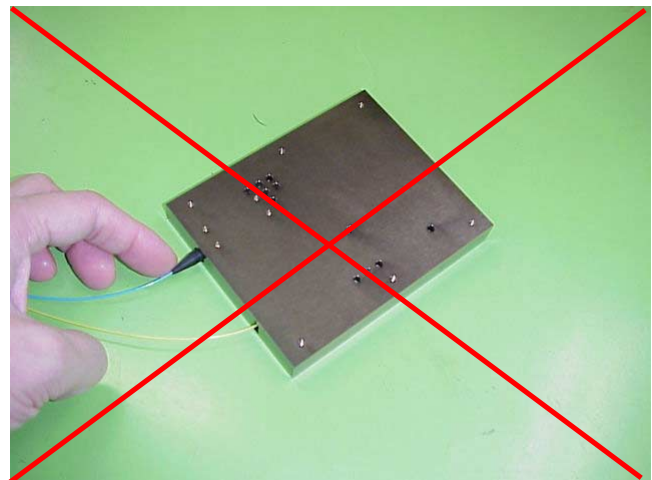
Correct Handling Procedure

When handling the transceiver, hold the main body with a hand, and hold the two optical connectors with the other hand.

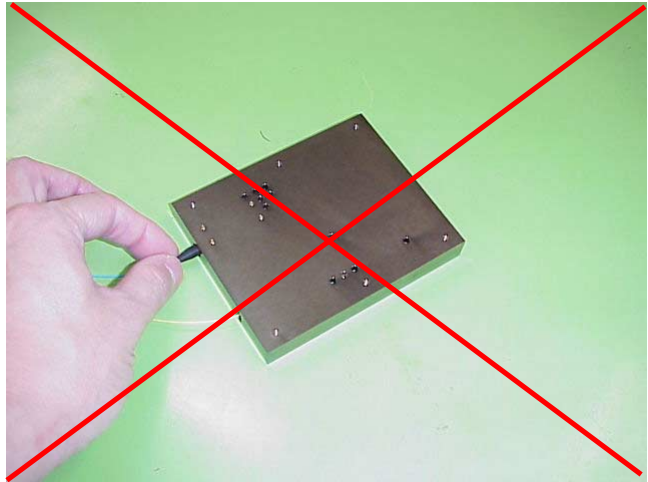


CAUTION !

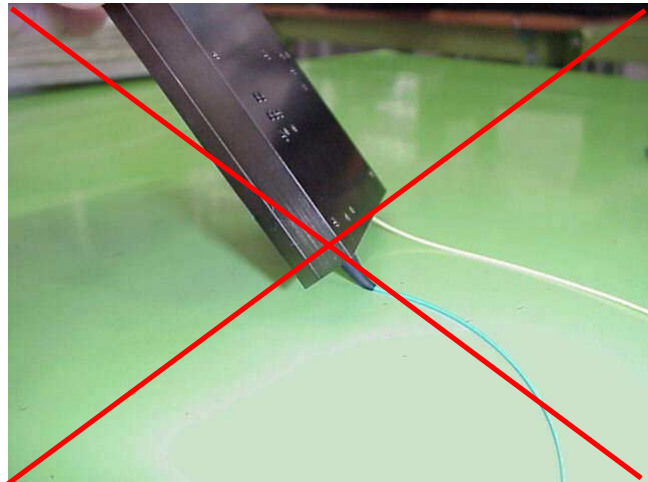
1. Do not touch the bend limiter.



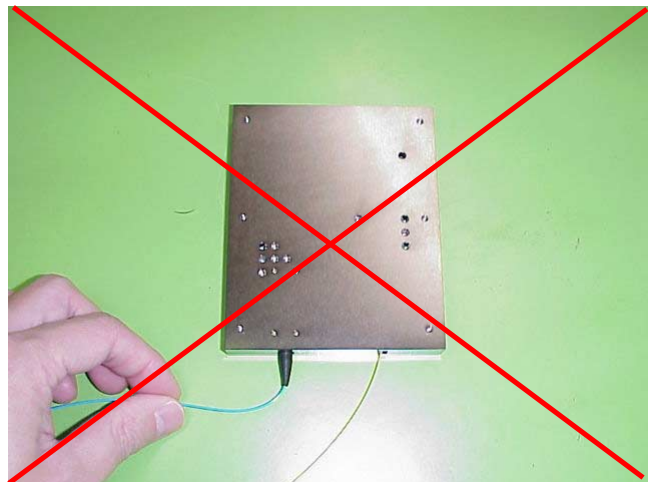
2. Do not hold the bend limiter.



3. Do not bend the bend limiter.



4. Do not pull the fiber with excessive side force.

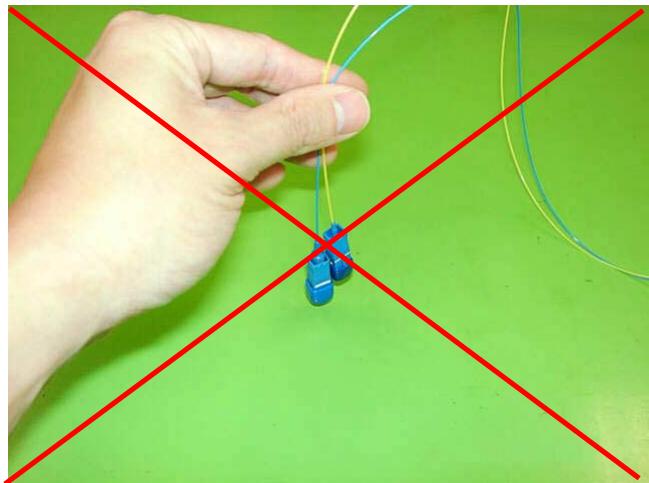


When handling the fiber, do not bend with bending radius of under 30mm, and do not pull with the force of over 1.96N [200gf].

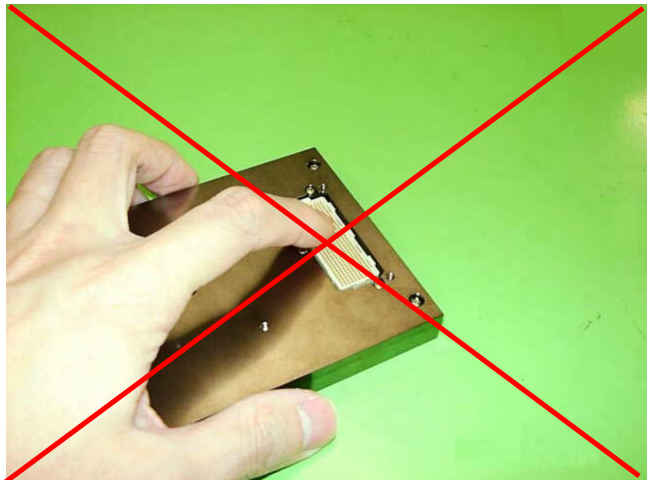
5. Do not pull the fiber without holding the transceiver.



6. Do not hold the fiber without holding the optical connectors.



7. Do not touch the electrode of the electric connector (MEG-Array™).



Note: About mounting instruction, see the separate document, "Mounting Instruction on 10G Transceiver" (No.TE02-317).

---End of Document---

Mounting Instruction on 10G Transceiver

The connector assembly needs to be clean and avoided giving some extra force. The following sequence describes the electrical connector mate / unmate manner.

[Mating]

1. Roughly align the connector, by matching one side of the plug slot (on the host board) with that of the receptacle key (on the transceiver) (See Figure 1, Figure 2)
2. Push the transceiver from one side above the connector (Figure 1 : side B), then push the other side (Figure 1 : side A).

[Unmating]

1. Pull the transceiver from the one side (Figure 3: Side A).

(Caution) Do not pull the transceiver from connector side or fiber pigtail side, or cause damage to the terminal contacts. (See figure 4)

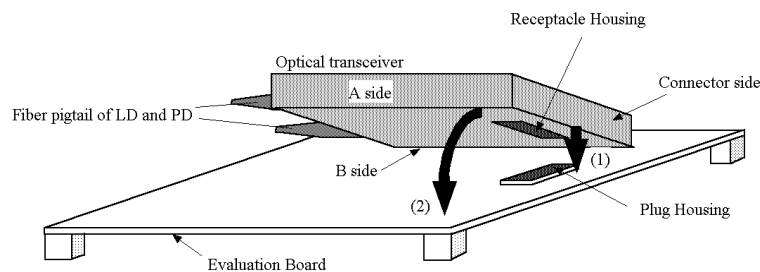


Figure 1 Mating Sequence

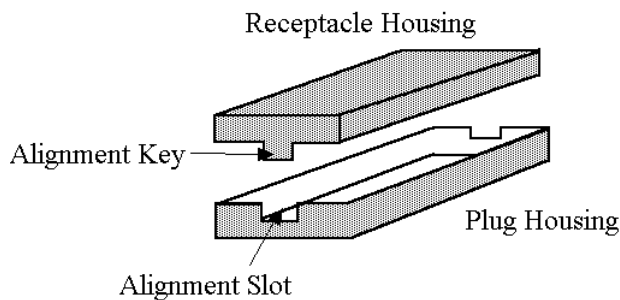


Figure 2 Details of connectors

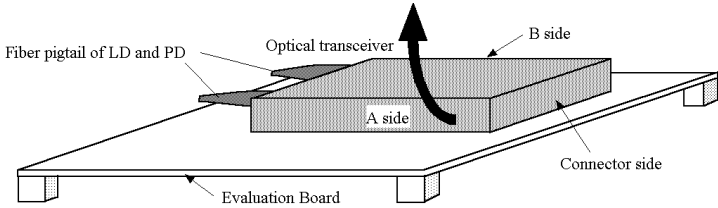


Figure 3 Unmating Sequence

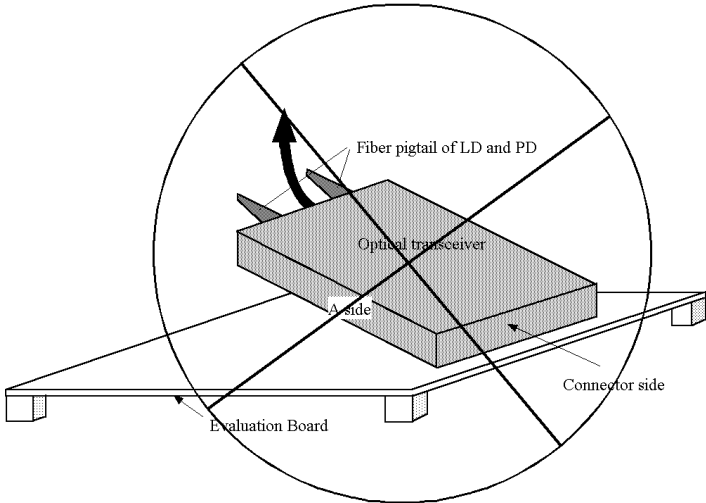


Figure 4 Wrong example of Unmating

= MEMO =

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