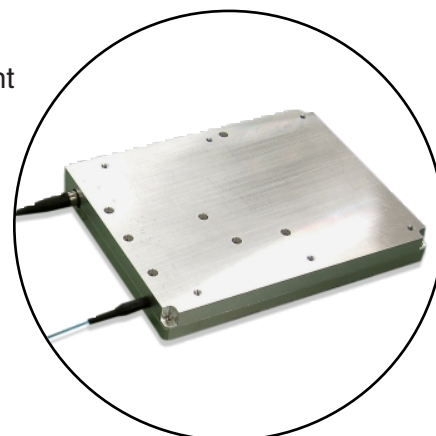


10Gb/s Optical Transponder for DWDM

FIM83010

FEATURES

- 300-pin MSA compliant
- SONET OC-192, SDH STM-64, 10G Ethernet and FEC rate compliant (9.953Gbps/10.313Gbps/10.71Gbps)
- Tunable wavelength locker LD module can select one wavelength from four wavelengths with 100GHz space as specified in ITU-T grid
- Tunable wavelength locker LD module, Lithium Niobate (LiNbO₃) modulator and APD
- 16:1 MUX and 1:16 DEMUX integrated with OIF-SFI4-P1 compliant interface
- Compact size (4.5"L x 3.5"W x 0.53"H)



DESCRIPTION

Fujitsu has developed a product line of serial 10Gbps transponders that incorporate all of the features required by the 300-pin Multi-Source Agreement and Optical Internetworking Forum (OIF-SFI4_01.0) specification.

The FIM83010 is a 4 ITU-T channel tunable 10Gbps Dense Wavelength Multiplexing (DWDM) Optical Transponder that focuses on Metro network and Long Haul applications. Modules are available to cover all wavelengths in the C band. The transponder includes a Tunable wavelength locker LD, Lithium Niobate modulator and APD with a 16 bit parallel electrical interface. The Fujitsu FIM83010 can be operated at any one of three different data rates, 9.953Gbps(SONET OC-192)/10.313Gbps (Ethernet IEEE802.3ae)/10.709Gbps(ITU-T G.709).

ABSOLUTE MAXIMUM RATINGS (Tc=25°C, Unless otherwise specified)

Parameter	Symbol	Limits			Unit	Remarks
		Min.	Typ.	Max.		
Supply Voltage	VCC	0.0	-	+6.0	V	+5.0V
	VDD1	-0.3	-	+3.6	V	+3.3V
	VDD2	-0.5	-	+2.0	V	+1.8V
	VEE	-6.0	-	0.0	V	-5.2V
Storage Temperature	T _{stg}	-40	-	85	°C	
Storage Humidity		See Fig. 1			%	
Optical Input Power	P _{in}	-	-	+3	dBm	Peak Power
Electrostatic Discharge	ESD	-	-	500	V	Human Body Model
LVDS Input Voltage	I _{LVDS-in}	0	-	2.7	V	
LVDS Output Voltage	I _{LVDS-out}	0	-	2.0	V	
TTL Input Voltage	V _{TTL-in}	0	-	3.6	V	

MENU

Menu	Data Rate	Description
1	9.953Gbps	SONET OC-192/SDH STM-64
2	10.313Gbps	10GBE (IEEE802.3ae)
3	10.709Gbps	ITU-T G.709

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Limits			Unit	Remarks
		Min.	Typ.	Max.		
Supply Voltage	VCC	4.75	5.0	5.25	V	
	VDD1	3.13	3.3	3.47	V	
	VDD2	1.71	1.8	1.89	V	
	VEE	-5.46	-5.2	-4.94	V	
Supply Current	ICC	-	150	700	mA	<ul style="list-style-type: none"> • Typical condition: Ta=Room Temp. • Maximum condition: Tc=-5 or 70°C • Under power supply startup
	IDD1	-	350	500	mA	
	IDD2	-	920	1200	mA	
	IEE	-	950	1900	mA	
Case Temperature	Tc	-5	-	70	°C	
Power Dissipation	Pd	-	8.5	12.0	W	
Operating Humidity	See Fig. 2				%	

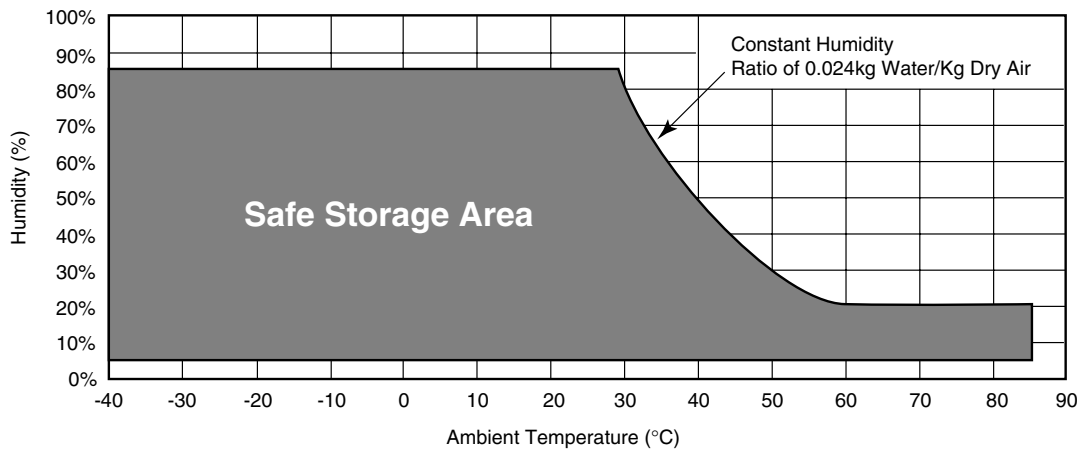


Fig. 1 Storage Humidity Criteria vs. Ambient Temperature

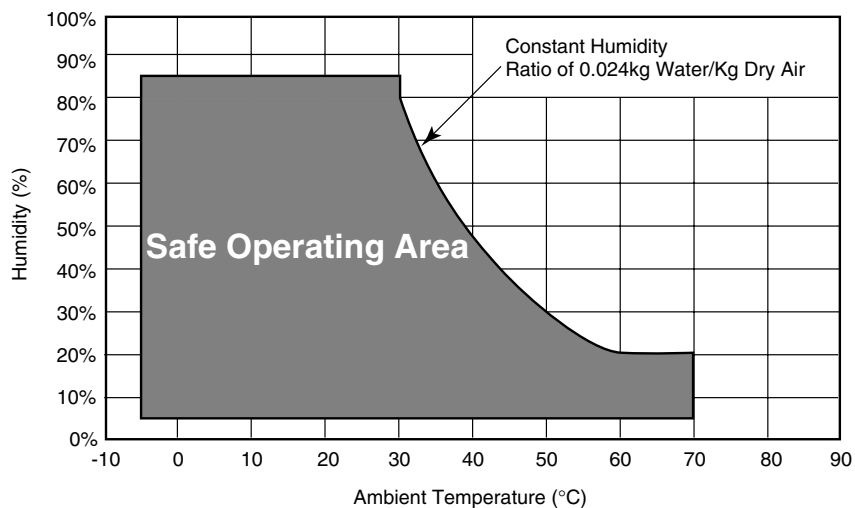
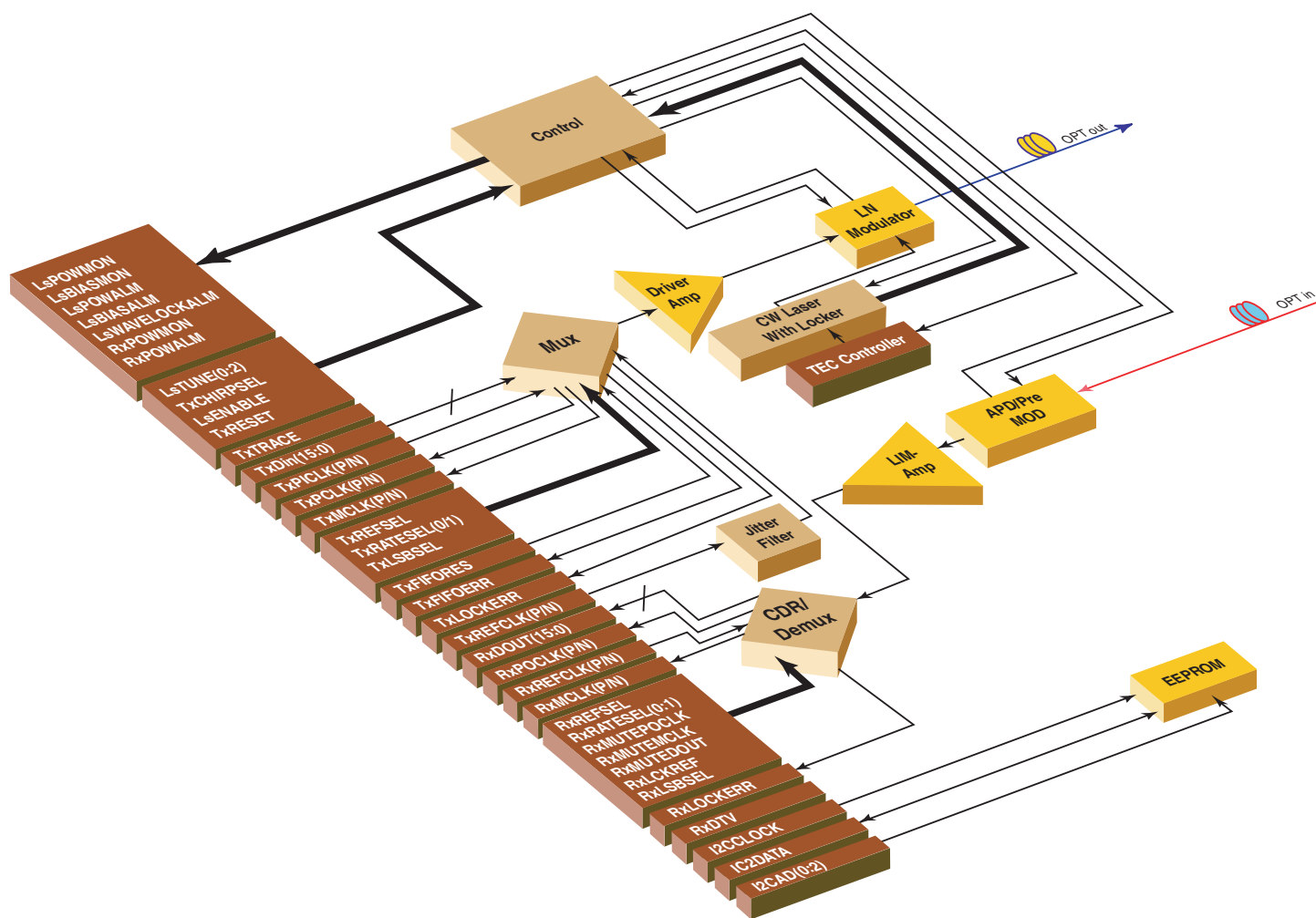


Fig. 2 Operating Humidity Criteria vs. Ambient Temperature

SYSTEM APPLICATION


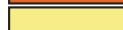

Parameter		Specifications
Data Rate		9.953Gbps, 10.313Gbps, 10.709Gbps
Optical Connector		SC-Advanced PC, LC-Advanced PC
Operating Wavelength Range	Tx	1528.77 ~ 1566.31nm
	Rx	1290 ~ 1608nm
Transmission Distance		80km

Optical Transponder Block Diagram



PIN Terminal Information

	K	J	H	G	F	E	D	C	B	A
1	VCC	FFU	GND	RxDout12P	VDD2	RxDout8P	GND	RxDout4P	GND	RxDout0P
2	VCC	FFU	GND	RxDout12N	VDD2	RxDout8N	GND	RxDout4N	GND	RxDout0N
3	RxRATESEL0	RxRATESEL1	FFU	GND	RxPOWMON	GND	I2CAD0	GND	RxDTV	GND
4	VDD1	NUC	GND	RxDout13P	VDD1	RxDout9P	GND	RxDout5P	GND	RxDout1P
5	VDD1	NUC	GND	RxDout13N	VDD1	RxDout9N	GND	RxDout5N	GND	RxDout1N
6	FFU	NUC	FFU	GND	RxPOWALM	GND	I2CAD1	GND	RxMUTEDOUT	GND
7	VDD1	FFU	GND	RxDout14P	VDD1	RxDout10P	GND	RxDout6P	GND	RxDout2P
8	VDD1	RxLSBSEL	GND	RxDout14N	VDD1	RxDout10N	GND	RxDout6N	GND	RxDout2N
9	RxMUTEPOCLK	NUC	FFU	GND	FFU	GND	I2CAD2	GND	RxLCKREF	GND
10	VEE	FFU	GND	RxDout15P	VEE	RxDout11P	GND	RxDout7P	GND	RxDout3P
11	VEE	FFU	GND	RxDout15N	VEE	RxDout11N	GND	RxDout7N	GND	RxDout3N
12	RxMUTEMCLK	NUC	FFU	GND	FFU	GND	FFU	GND	FFU	GND
13	VEE	FFU	GND	FFU	VEE	RxPOCLKP	GND	RxMCLKP	GND	RxREFCLKP
14	VEE	FFU	GND	FFU	VEE	RxPOCLKN	GND	RxMCLKN	GND	RxREFCLKN
15	I2CCLOCK	NUC	FFU	GND	RxREFSEL	GND	FFU	GND	RxLOCKERR	GND
16	VCC	FFU	GND	TxDin12P	VDD2	TxDin8P	GND	TxDin4P	GND	TxDin0P
17	VCC	FFU	GND	TxDin12N	VDD2	TxDin8N	GND	TxDin4N	GND	TxDin0N
18	I2CDATA	NUC	LsTUNE0	GND	LsBIASMON	GND	LsPOWMON	GND	NUC	GND
19	VDD1	FFU	GND	TxDin13P	VDD1	TxDin9P	GND	TxDin5P	GND	TxDin1P
20	VDD1	FFU	GND	TxDin13N	VDD1	TxDin9N	GND	TxDin5N	GND	TxDin1N
21	TxRATESEL0	TxRATESEL1	LsTUNE1	GND	LsENABLE	GND	FFU	GND	NUC	GND
22	VDD1	TxCHIRPSEL	GND	TxDin14P	VDD1	TxDin10P	GND	TxDin6P	GND	TxDin2P
23	VDD1	TxLSBSEL	GND	TxDin14N	VDD1	TxDin10N	GND	TxDin6N	GND	TxDin2N
24	TxRESET	NUC	LsTUNE2	GND	LsBIASALM	GND	FFU	GND	FFU	GND
25	VEE	NUC	GND	TxDin15P	VEE	TxDin11P	GND	TxDin7P	GND	TxDin3P
26	VEE	NUC	GND	TxDin15N	VEE	TxDin11N	GND	TxDin7N	GND	TxDin3N
27	TxFIFOES	NUC	FFU	GND	LsWAVELOCKALM	GND	FFU	GND	NUC	GND
28	VEE	FFU	GND	TxPICKLP	VEE	TxPCLKP	GND	TxMCLKP	GND	TxREFCLKP
29	VEE	TxTRACE	GND	TxPICKLN	VEE	TxPCLKN	GND	TxMCLKN	GND	TxREFCLKN
30	TxFIFOERR	NUC	FFU	GND	TxREFSEL	GND	LsPOWALM	GND	TxLOCKERR	GND

 Receiver Power & GND supplies
 Receiver DC Signals
 622 differential signals

 Transmitter Power & GND Supplies
 Transmitter DC signals

NUC: No User Connection
 FFU: Reserved for Future Use

Table 1 Wavelength Setting (C-Band)

No.	Part No.	Optical Frequency (THz)	Nominal Wavelength (nm)	Wavelength Select Pin		
				LsTune0	LsTune1	LsTune2
01	Mod 1 FIM83010/951 W9610	196.1	1528.77	1	0	0
02		196.0	1529.55	1	1	0
03		195.9	1530.33	1	0	1
04		195.8	1531.12	1	1	1
05	Mod 2 FIM83010/951 W9570	195.7	1531.90	1	0	0
06		195.6	1532.68	1	1	0
07		195.5	1533.47	1	0	1
08		195.4	1534.25	1	1	1
09	Mod 3 FIM83010/951 W9530	195.3	1535.04	1	0	0
10		195.2	1535.82	1	1	0
11		195.1	1536.61	1	0	1
12		195.0	1537.40	1	1	1
13	Mod 4 FIM83010/951 W9490	194.9	1538.19	1	0	0
14		194.8	1538.98	1	1	0
15		194.7	1539.77	1	0	1
16		194.6	1540.56	1	1	1
17	Mod 5 FIM83010/951 W9450	194.5	1541.35	1	0	0
18		194.4	1542.14	1	1	0
19		194.3	1542.94	1	0	1
20		194.2	1543.73	1	1	1
21	Mod 6 FIM83010/951 W9410	194.1	1544.53	1	0	0
22		194.0	1545.32	1	1	0
23		193.9	1546.12	1	0	1
24		193.8	1546.92	1	1	1
25	Mod 7 FIM83010/951 W9370	193.7	1547.72	1	0	0
26		193.6	1548.51	1	1	0
27		193.5	1549.32	1	0	1
28		193.4	1550.12	1	1	1
29	Mod 8 FIM83010/951 W9330	193.3	1550.92	1	0	0
30		193.2	1551.72	1	1	0
31		193.1	1552.52	1	0	1
32		193.0	1553.33	1	1	1
33	Mod 9 FIM83010/951 W9290	192.9	1554.13	1	0	0
34		192.8	1554.94	1	1	0
35		192.7	1555.75	1	0	1
36		192.6	1556.55	1	1	1
37	Mod 10 FIM83010/951 W9250	192.5	1557.36	1	0	0
38		192.4	1558.17	1	1	0
39		192.3	1558.98	1	0	1
40		192.2	1559.79	1	1	1
41	Mod 11 FIM83010/951 W9210	192.1	1560.61	1	0	0
42		192.0	1561.42	1	1	0
43		191.9	1562.23	1	0	1
44		191.8	1563.05	1	1	1
45	Mod 12 FIM83010/951 W9170	191.7	1563.86	1	0	0
46		191.6	1564.68	1	1	0
47		191.5	1565.50	1	0	1
48		191.4	1566.31	1	1	1

ALM Specifications

PIN Name	Pin No.	Spec			Unit	Note	Description
		min.	typ	max			
TxLOCKERR	B30	2.4		V _{DD1}	V	output high level	Transmitter PLL Lock error (condition: Note1) Active LOW
		GND		0.4	V	output low level	
RxLOCKERR	B15	2.4		V _{DD1}	V	output high level	Receiver PLL Lock error (condition: Note 2) Active LOW
		GND		0.4	V	output low level	
LsBIASALM	F24	2.4		V _{DD1}	V	output high level	Laser Degration ALM Active LOW ALM threshold: LsBIASMON=1.5V
		GND		0.4	V	output low level	
		-		10	ms	response time	
LsPOWALM	D30	2.4		V _{DD1}	V	output high level	Laser output power ALM (condition: Note 3) Active LOW ALM threshold: LsPOWMON=0.25V
		GND		0.4	V	output low level	
		-		10	ms	response time	
LsWAVELOCKALM	F27	2.4		V _{DD1}	V	output high level	Laser Wavelength Lock ALM (condition: Note 4) Active LOW ALM threshold: Within nominal grid±TBD
		GND		0.4	V	output low level	
		-		10	ms	response time	
RxPOWALM	F6	2.4		V _{DD1}	V	output high level	Receiver input power ALM(condition: Note 5) Active LOW
		GND		0.4	V	output low level	
		23		100	µs	response time	
TxFIFOERR	K30	2.4		V _{DD1}	V	output high level	MUX FIFO error Active: LOW ALM threshold: TBD, Response Time: TBD
		GND		0.4	V	output low level	

Note 1: The conditions of TxLOCKERR activation

- Under power supply startup

Note 2: The conditions of RxLOCKERR activation

- Under power supply startup
- No input of RxREFCLK

Note 3: The conditions of LsPOWALM activation

- When 3dB of laser back power is downed from an initial state
- Under power supply startup
- During wavelength changes

Note 4: LsWAVELOCKALM is surely active when output wavelength separates±TBD from ITU Grid

- The conditions of LsWAVELOCKALM activation
- Under power supply startup
- During wavelength changes

Note 5: The conditions of RxPOWALM activation

- Under power supply startup
- Optical signal input > -26dBm: "H"
- Optical signal input < -40dBm: "L"

Control Signal Specifications

PIN Name	Pin No.	Parameters	Spec			Unit	Note	Description		
			min.	typ	max					
TxRATESEL0/1	K21/J21	INF Lvl.	2		V _{DD1}	V	input high level	SEL1	SEL0	Rate
			GND		0.8	V	input low level	0	0	10.31Gbps
RxRATESEL0/1	K3/J3	INF Lvl.	2		V _{DD1}	V	input high level	0	1	TBD
			GND		0.8	V	input low level	1	0	10.71Gbps
TxREFSEL	F30	INF Lvl.	2		V _{DD1}	V	input high level	1	1	9.95Gbps (Note 1)
			GND		0.8	V	input low level	SEL	Rate	
RxREFSEL	F15	INF Lvl.	2		V _{DD1}	V	input high level	0	155.52/161.13MHz	
			GND		0.8	V	input low level	1	622.08/644.53MHz	* Only 622MHz can be selected
TxLSBSEL	J23	INF Lvl.	2		V _{DD1}	V	input high level	SEL	MSB of the first byte (Note 2)	
			GND		0.8	V	input low level	0	D15	
RxLSBSEL	J8	INF Lvl.	2		V _{DD1}	V	input high level	1	D0	
			GND		0.8	V	input low level	SEL	MSB of the first byte (Note 2)	
TxRESET	K24	INF Lvl.	2		V _{DD1}	V	input high level	0	Asynchronous Mux system reset	
			GND		0.8	V	input low level	1	Normal operation	
LsENABLE	F21	INF Lvl.	2		V _{DD1}	V	input high level	SEL	State	
			GND		0.8	V	input low level	0	Normal operation	
		Response Time			5	s	Laser on→Laser off	1	Laser disabled	
LsTune0/1/2	H18 H21 H24	INF Lvl.	2		V _{DD1}	V	input high level	ALMs (Note 3) are active		
			GND		0.8	V	input low level	See Wavelength Table 1		
		Response Time			70	s	Laser off→Laser on	ALMs (Note 3) are active		
TxFIFORES	K27	INF Lvl.	2		V _{DD1}	V	input high level	SEL	State	
			GND		0.8	V	input low level	0	Mux FIFO reset	
TxCHIRPSEL	J22	INF Lvl.	2		V _{DD1}	V	input high level	1	Normal operation	
			GND		0.8	V	input low level	Response Time: TBD		
		Response Time			3	s		SEL	State	
							0	Negative		
							1	Positive		
							ALMs(Note 3): active			

Control Signal Specifications(continued)

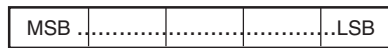
PIN Name	Pin No.	Parameters	Spec			Unit	Note	Description
			min.	typ	max			
RxMUTEPOCLK	K9	INF Lvl.	2		V _{DD1}	V	input high level	SEL1 State 0 mutes the RxPOCLK 1 normal operation Response Time: TBD
			GND		0.8	V	input low level	
RxMUTEMCLK	K12	INF Lvl.	2		V _{DD1}	V	input high level	SEL1 State 0 mutes the RxMCLK 1 normal operation Response Time: TBD
			GND		0.8	V	input low level	
RxMUTEDOUT	B6	INF Lvl.	2		V _{DD1}	V	input high level	SEL State 0 mutes the RxDOOUT(0:15) 1 normal operation Response Time:TBD
			GND		0.8	V	input low level	
RxLCKREF	B9	INF Lvl.	2		V _{DD1}	V	input high level	SEL State 0 Locks RxPOCLK to RxREFCLK 1 normal operation Response Time:TBD
			GND		0.8	V	input low level	
I2CAD0/1/2	D3/D6/ D9	INF Lvl.	2		V _{DD1}	V	input high level	I2C address input for module addressing
			GND		0.8	V	input low level	

Note 1: TxRATESEL0/1 and RxRATESEL0/1 should be compliant with "Data rate options" as specified in ordering information (page 10).

Part Numbering Information

P/N	Data rate options	TxRATESEL0/1
FIM83010	Selectable Multi-rate of 9.95/10.3/10.71Gbps without Jitter filter	Either Data rate can be selected.
FIM83012	Single rate of 9.95Gbps with Jitter filter	Only 9.95Gbps shall be selected
FIM83013	Single rate of 10.31Gbps with Jitter filter	Only 10.31Gbps shall be selected
FIM83014	Single rate of 10.71Gbps with Jitter filter	Only 10.71Gbps shall be selected

Note 2: The data bit ordering diagram is shown as follows:



↑: The first byte of Line data

Note 3: LsBIASALM, LsPOWALM, LsWAVELOCKALM

Monitor Specifications

PIN Name	Pin No.	min.	typ	max	Unit	Note	Description
LsBIASMON	F18	0.8	1.0	1.2	V	Laser monitor bias voltage slope	Normalized value output for each wavelength
LsPOWMON	D18	0.44	0.5	0.56	V	output high level	Normalized value output for each wavelength LsPOWMON monitors Laser back power
			0.25		V	Default Pout -3dB	
		-0.02	0	0.02	V	laser disable mode	
RxPOWMON	F3		10		V/mW	Monitor Voltage	APD typ slope is 10V/mW(APD)@-10dBm

10Gb/s Optical Transponder _____ FIM83010 for DWDM

Optical Transmitter and Receiver Specifications

Parameter		Min	Spec	Max	Unit	Note	
			Typ				
1	Nominal Bit Rate	-	9.953	-	Gbps	SONET OC-192/SDH STM 64, (Note 1)	
		-	10.313	-	Gbps	IEEE802.3ae, (Note 1)	
		-	10.709	-	Gbps	ITU-T G.709, (Note 1)	
2	Clock Tolerance	-100	-	+100	ppm	-	
TRANSMITTER							
3	Optical Source		SLM-LD		-	-	
4	Center Wavelength	1528.77	-	1566.31	nm	ITU-T Grid G692 (4λ tunable 100GHz span)	
5	Wavelength Accuracy	-60	ITU Grid	60	pm	EOL	
6	-3dB Spectral Width	-	-	50	MHz	-	
	-20dB Spectral Width		0.3		nm	0.1nm resolution	
7	Side Mode Suppression	30	-	-	dB	-	
8	Launched Power	+3	-	+7	dBm	EOL, average power (include connector loss 0.5dB) Fig. 3 1528-1565nm	
9	Extinction Ratio	10	-	-	dB	-	
10	Eye Mask	Compliant with GR-253					
11	Jitter Generation	Compliant with GR-253					
RECEIVER							
12	Receiver Type		APD				
13	Sensitivity			-22	dBm	OSNR=40dB(0.1nm RBW), (Note 2)	
14	Overload	-7	-	-	dBm	@9.95Gbps, FEC rate, (Note 2)	
15	Receiver Reflectance	-	-	-27	dB		
16	Jitter Tolerance and Jitter Transfer	Compliant with GR-253					
17	Received Wavelength	1290	-	1608	nm		
OPTICAL PATH							
18	Chromatic Dispersion	-100	-	1600	ps/nm	Negative Chirp, OSNR=40dB(0.1nmRBW)	
		-1600	-	100	ps/nm	Positive Chirp, OSNR=40dB(0.1nmRBW)	
19	Dispersion Robustness			-20	dBm	Dispersion 1600ps/nm, OSNR=40dB(0.1nmRBW)	

Note 1: See ordering information

Note 2: ffs for the received wavelength of 1310nm

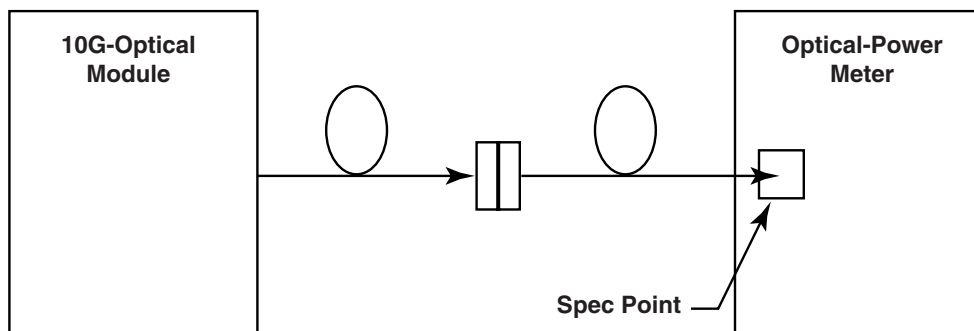


Fig. 3 Optical Output Power Definition Point

Ordering Information

(Example) **FIM83010-S**

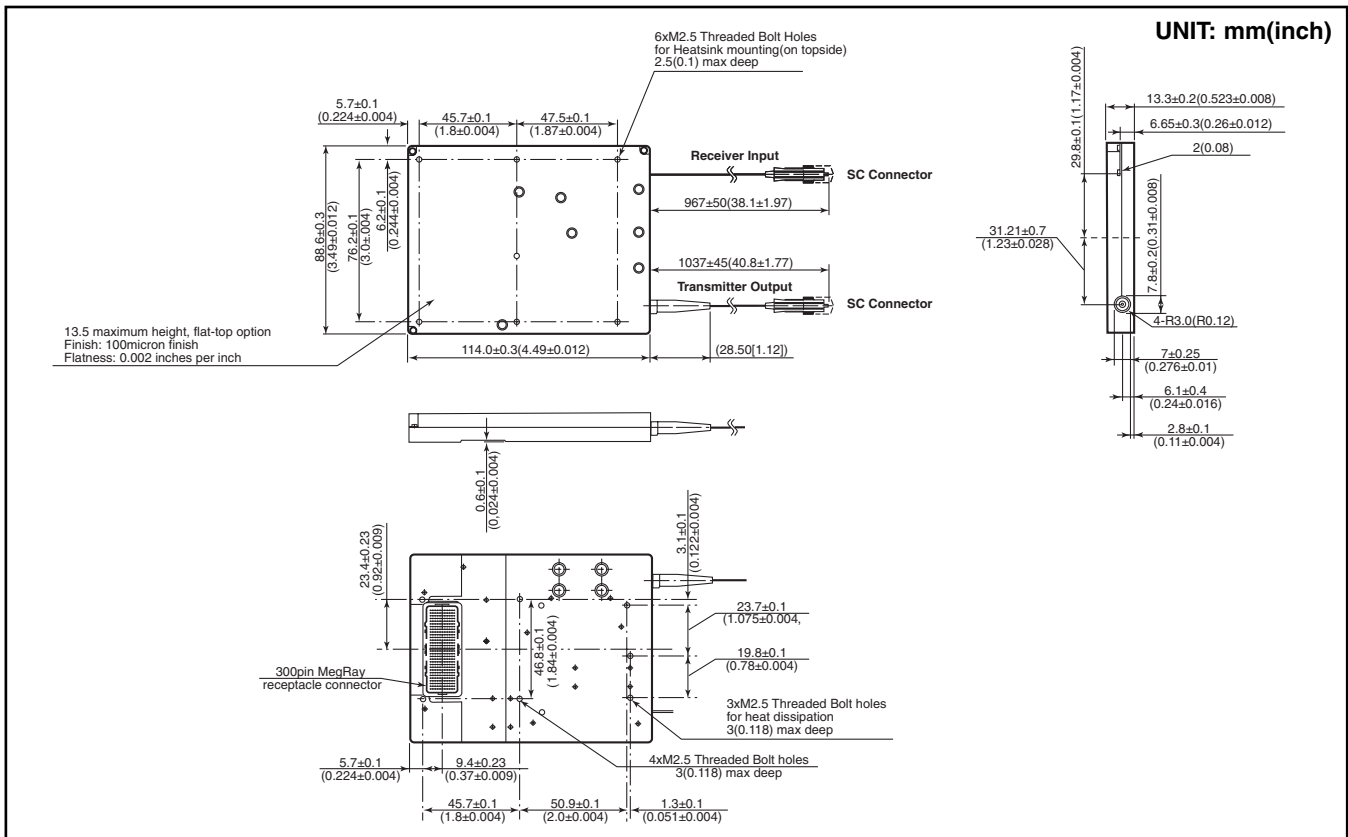
Module Type	Description
83010	$\alpha=\pm 0.7$ LN Multi-rate of 9.95/10.31/10.71Gbps without Jitter filter
83012	$\alpha=\pm 0.7$ LN Single-rate of 9.95Gbps with Jitter filter
83013	$\alpha=\pm 0.7$ LN Single-rate of 10.31Gbps with Jitter filter
83014	$\alpha=\pm 0.7$ LN Single-rate of 10.71Gbps with Jitter filter

Connector Type

S: SC Advanced-PC connector
L: LC Advanced-PC connector

10Gb/s Optical Transponder for DWDM

FIM83010



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CAUTION

Fujitsu Compound Semiconductor Products contain **gallium arsenide (GaAs)** which can be hazardous to the human body and the environment. For safety, observe the following procedures:

- Do not put this product into the mouth.
- Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.
- Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.

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