DWDM SFP Transceiver Multi-rate 100 Mb/s to 2.67Gb/s 200km

IGP-28211J-xx

Features:

- Up to 2.67Gb/s data rate
- +3dBm typical optical power output
- 200km (4000ps/nm) transmission compliant to V-16.2
- DWDM SFP MSA compatible
- 100GHz channel spacing
- C- and L-Band coverage
- High accuracy thermal wavelength management
- Extended APD-based receiver sensitivity
- Typically 880mW power consumption
- Single +3.3V power supply
- 0°C to +70°C operating case temperature range
- Hot Pluggable
- Duplex LC connector
- Enhanced digital diagnostics
- Low EMI

Compliance:

- CDRH & IEC Laser Safety
- FCC Class B EMI
- MIL-STD-883 ESD
- IEC/EN60950 Product Safety
- RoHS compliant

Applications:

- OC-48/STM-16/OTN-1 DWDM Metro/Access Networks
- Ethernet Transport, Ethernet/Fibre Channel over WDM
- Ethernet IEEE 802.3ae

The Oclaro IGP-28211J optical transceiver is a high performance, cost effective module for serial optical data communication applications up to 2.67Gb/s. The IGP-28211J is designed to accept DWDM SONET/SDH (with or without FEC) for 200km.

The product is designed for single mode fibre and operate at ITU wavelengths across the C- and L-band.

The modules aid system hardware engineers in implementing low-cost DWDM solutions, which are protocol transparent. The "hot pluggable" feature built into every module reduces manufacturing and inventory costs allowing optical port upgrades at the customer premises. Built-in remote monitoring via diagnostic monitoring allows user access to static and dynamic data as well as module condition.

The IGP-28211J uses the established Oclaro Buried Heterostructure Directly Modulated Laser (BH DML) packaged in a compact cooled TOSA. The transmitter has full IEC608251:2001 and CDRH Class I laser safety certification.

The Oclaro IGP-28211J module has been extensively tested utilizing industry standard single mode fibres in order to ensure compatibility with SONET-grade enterprise, access and metro systems. Additionally, all Oclaro products are UL, CAN/CSA, FCC, IEC, and CDRH compliant.

Absolute maximum ratings

Parameter	Symbol	Min	Max	Unit
Storage Temperature	T_{STG}	-40	85	°C
Supply Voltage	V_{CC}	-0.3	4.0	V
Data AC Voltage	Tx+, Tx-		2.4	V_{PP}
Data DC Voltage	Tx+, Tx-	-0.5	3.47	V
Optical Input Received Power	P_{IN}		+5	dBm

Operating conditions

Paramter	Symbol	Min	Typical	Max	Unit
Case temperature	T_{CASE}	0		70	°C
Supply Voltage	V_{CC}	3.13	3.30	3.47	V
Supply Current[1]	I_{CC}		265	418	mA
Module Power Dissipation	P		0.88	1.45	W
In-rush Current[2]	$I_{IN-RUSH}$			100	mA

Notes:
[1] Supply current is shared between V_{CCTX} and V_{CCRX}.
[2] $I_{IN-RUSH}$ is defined as current level above steady state current requirements.

Transmitter Operating Specifications – Optical

All specifications relate to End of Life (EOL) values over temperature and supply voltage, unless otherwise stated.

Parameter	Symbol	Value			Units	Notes
		Min	Typical	Max		
Data Rate	BR	0.1		2.67	Gb/s	
ITU-T Center Wavelength	λ_C	1528		1606	nm	Refer to Table 6 & Table 7 for details
Center Wavelength (SOL)	λ_{SOL}	$\lambda_C - 0.05$	$\lambda_C - 0.02$	λ_C	nm	Where λ_C is a defined ITU-T wavelength
Wavelength Stability	$\Delta\lambda_C$	$\lambda_C - 0.1$	λ_C	$\lambda_C + 0.1$	nm	
Optical Transmit Power	P_O	+2	+3	+4	dBm	Modulated at 2.488Gb/s
Optical Transmit Power (disabled)	$P_{TX\_DISABLE}$			-40	dBm	
Spectral Width	$\Delta\lambda_{20}$		0.1	0.3	nm	20dB down from peak using 10pm RBW
SMSR		40			dB	
Extinction Ratio	ER	8.2			dB	Filtered eye Modulated at 2.488Gb/s
Dispersion Tolerance	DT	-1200		4000	ps/nm	Modulated at 2.488Gb/s
Dispersion Penalty	DP			2	dB	Modulated at 2.488Gb/s
Jitter Generation (SOL)	TJ_{RMS}			10	mUI	SONET/SDH only
Jitter Generation (SOL)	TJ_{P-P}			70	mUI	SONET/SDH only
Output Optical Eye	Compliant with Bellcore GR-253-CORE & ITU G.957 for SONET/SDH and with IEEE 802.3ae for Ethernet and Fibre Channel					

APD Receiver Operating Specifications – Optical

All specifications relate to End of Life (EOL) values over temperature and supply voltage, unless otherwise stated.

Parameter	Symbol	Value			Units	Notes
		Min	Typical	Max		
Receiver Sensitivity (OSNR = 30dB)	Rx_{SENS_1}			-28	dBm	Note 1,6
				-34	dBm	Note 2,6
Receiver Sensitivity (OSNR = 21dB)	Rx_{SENS_2}			-24	dBm	Note 3,6
Receiver Sensitivity (OSNR = 18dB)	Rx_{SENS_3}			-24	dBm	Note 4,6
Maximum Input Power	$Rx_{OVERLOAD}$	-7			dBm	Note 1
Input Operating Wavelength	λ_{RX}	1260		1610	nm	Note 5
Reflectance	R_{RX}			-27	dB	
Loss of Signal - Asserted	P_A	-40		-33	dBm	
Loss of Signal - Deasserted	P_D			-31	dBm	
Hysteresis	$P_A - P_D$	0.5		4	dB	

Notes:
[1] Average power at 1 x 10^{-12} BER and data rates of 100Mb/s to 2.67Gb/s using PRBS 2^{23}-1.
[2] Average power at 1 x 10^{-4} BER and a data rate of 2.67Gb/s using PRBS 2^{23}-1.
[3] Average power at 1 x 10^{-12} BER and a data rate of 2.67Gb/s over 200km fibre using PRBS 2^{23}-1.
[4] Average power at 1 x 10^{-10} BER and a data rate of 2.67Gb/s over 200km fibre using PRBS 2^{23}-1.
[5] Between 1260nm and 1470nm minimum receiver sensitivity is reduced by 2dB
[6] ONSR measurements are made using an optical spectrum analyser with a resolution bandwidth of 0.1nm and an optical passband filter with a 3dB bandwidth of 1nm.

Transmitter Operating Specifications – Electrical

Parameter	Symbol	Value			Units	Notes
		Min	Typical	Max		
Data Rate	BR	0.1		2.67	Gb/s	
Supply Voltage	V_{CCTX}	3.13	3.3	3.47	V	
PECL/CML Input	V_{TXDIFF}	500		1600	mV	Differential pk-pk. Note 1
Input Rise/Fall	T_R / T_F			160	ps	20% - 80% Note 1
TX_DISABLE (asserted)	V_{DH}	2		3.47	V	Input voltage high
TX_DISABLE (negated)	V_{DL}	-0.3		0.8	V	Input voltage low
TX_FAULT (asserted)	V_{FH}	2		3.47	V	Output voltage high
TX_FAULT (negated)	V_{FL}	-0.3		0.8	V	Output voltage low

Notes:
[1] Test conditions: 100Ω differential (from 100MHz to 2.5GHz); $V_{RXDIFF} = | (V_{RD+}) - (V_{RD-}) |$

APD Receiver Operating Specifications – Electrical

Parameter	Symbol	Value			Units	Notes
		Min	Typical	Max		
Data Rate	BR	0.1		2.67	Gb/s	
Supply Voltage	V_{CC_TX}	3.13	3.3	3.47	V	
Differential Output Swing	V_{RXDIFF}	370		2000	mV	Differential pk-pk. Note 1
Rise/Fall Time	T_R / T_F			140	ps	20% - 80% Note 1
Loss of Signal (Asserted)	V_{OH}	2		3.47	V	Output Voltage High
Loss of Signal (Negated)	V_{OL}	-0.3		0.8	V	Output Voltage Low

Notes:
[1] Test conditions: 100Ω differential (from 100MHz to 2.5GHz); V_{RXDIFF} = | (V_{RD+}) – (V_{RD-}) |

Low Speed Electrical Signal Timings

The DWDM SFP MSA document specifies the full details of the low speed electrical interface in Section 3, including timings and both AC and DC requirements.

Parameter	Symbol	Min	Max	Unit	Notes
TX_DISABLE Assert Time	t_off		20	ms	Time from rising edge of TX_DISABLE to when the optical output falls below 10% of nominal
TX_DISABLE Negate Time	t_on		20	ms	Time from falling edge of TX_DISABLE to when the modulated optical output rises above 90% of nominal
Time to initialize, including reset of TX_FAULT	t_init		300	ms	From negation of TX_FAULT/INT using TX_DISABLE Optical power going to 90% of final value
Startup time	t_startup		90	s	From power on to negation of TX FAULT/INT, indicating laser temperature has stabilised to within operating range.
TX_FAULT/INT Assert Time	t_fault		50	ms	Time from fault to TX_FAULT/INT on.
TX_DISABLE to Reset	t_reset	10		ms	Time TX_DISABLE must be held high to reset TX_FAULT/INT
LOS Assert Time	t_los_on		100	us	Time from LOS state to RX LOS assert
LOS NegateTime	t_los_off		100	us	Time from non-LOS state to RX LOS deassert
Serial ID Clock Rate	f_serial_clock		100	kHz	

Table 1: I/O Timing for Hardware Control and Status Functions.

Electrical Pin-out Details

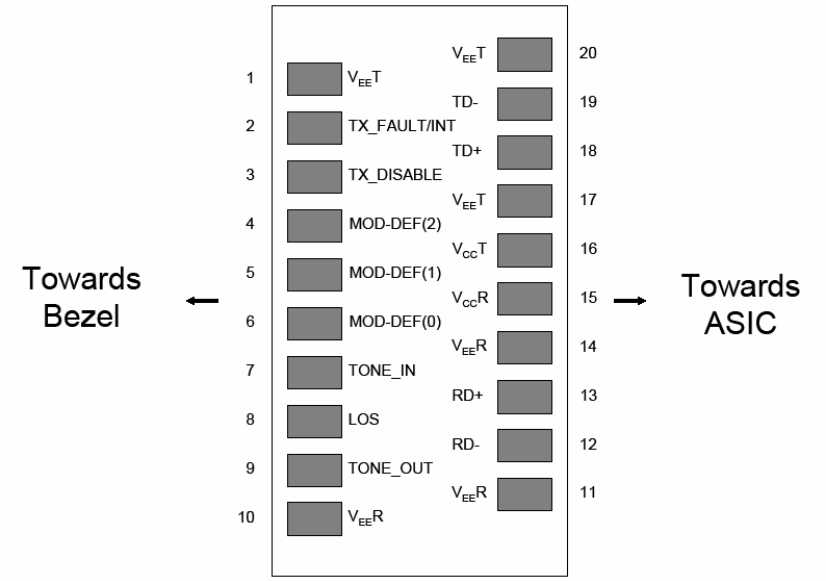


Figure 1: Diagram of Host Board Connector Block Pin Numbers and Names.

Pin Number	Name	Function	Plug Sequence
1	$V_{EE}T$	Transmitter Ground	1
2	TX_FAULT/INT	Transmitter Fault Indicator	3
3	TX_DISABLE	Transmitter Disable	3
4	MOD-DEF(2)	Module Definition 2	3
5	MOD-DEF(1)	Module Definition 1	3
6	MOD-DEF(0)	Module Definition 0	3
7	Tone in	Not Implemented. See note.	3
8	LOS	Loss of Signal	3
9	Tone out	Not Implemented. See note.	1
10	$V_{EE}R$	Receiver Ground	1
11	$V_{EE}R$	Receiver Ground	1
12	RD-	Inverted Received Data Out	3
13	RD+	Received Data Out	3
14	$V_{EE}R$	Receiver Ground	1
15	$V_{CC}R$	Receiver Power	2
16	$V_{CC}T$	Transmitter Power	2
17	$V_{EE}T$	Transmitter Ground	1
18	TD+	Transmit Data In	3
19	TD-	Inverted Transmit Data In	3
20	$V_{EE}T$	Transmitter Ground	1

Table 2: Pin Definitions and Connection Sequence during Hot Plugging.

Note: The DWDM MSA provisions for a supervisory tone via pin 7 and pin 9. However, the Oclaro DWDM SFP does not currently support this option.

Mechanical Outline

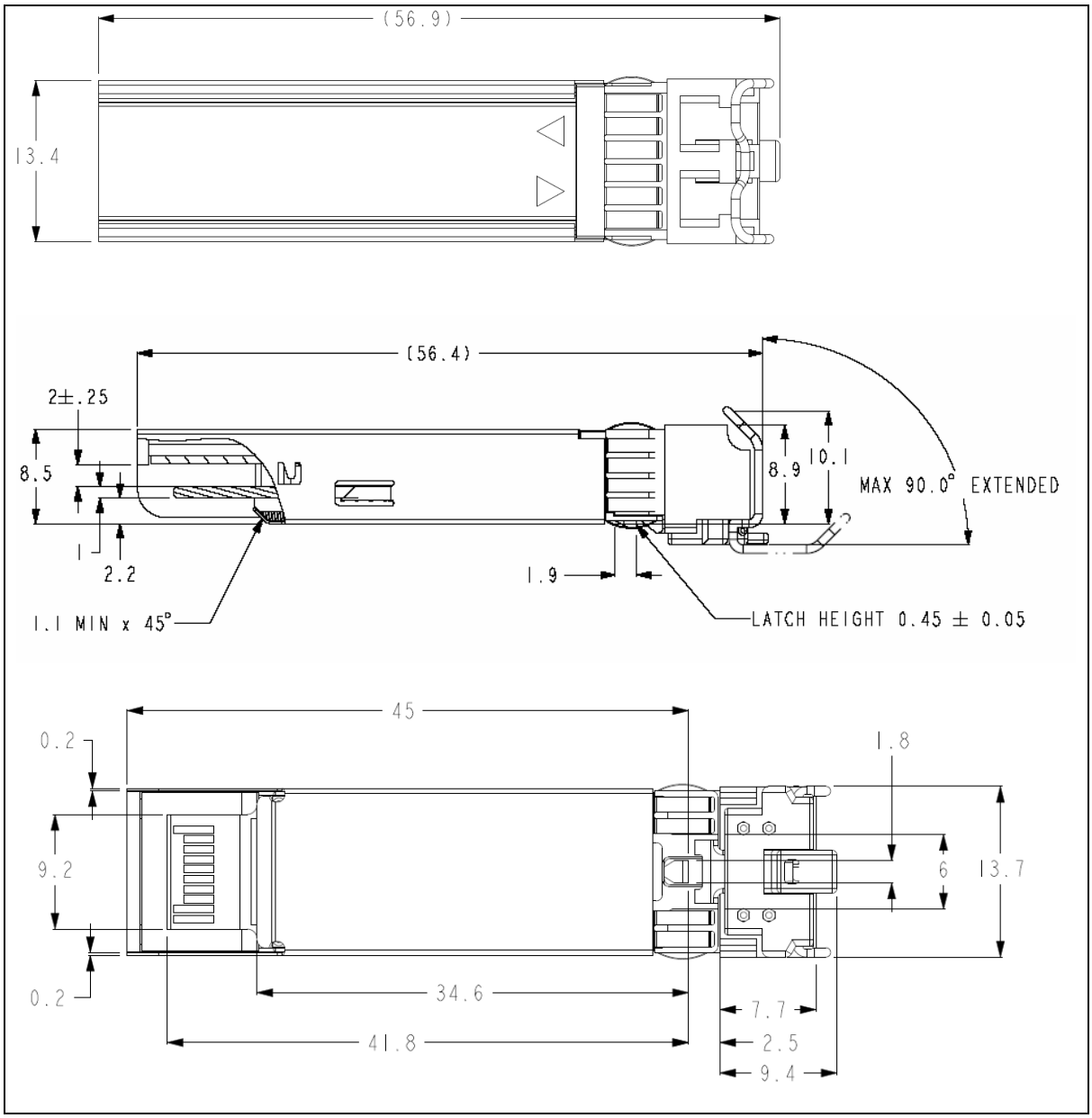


Figure 2: Mechanical outline drawing of DWDM SFP Transceiver.

User note: As per the above diagram, the user should not extend the bail latch past 90°

Diagnostics specifications

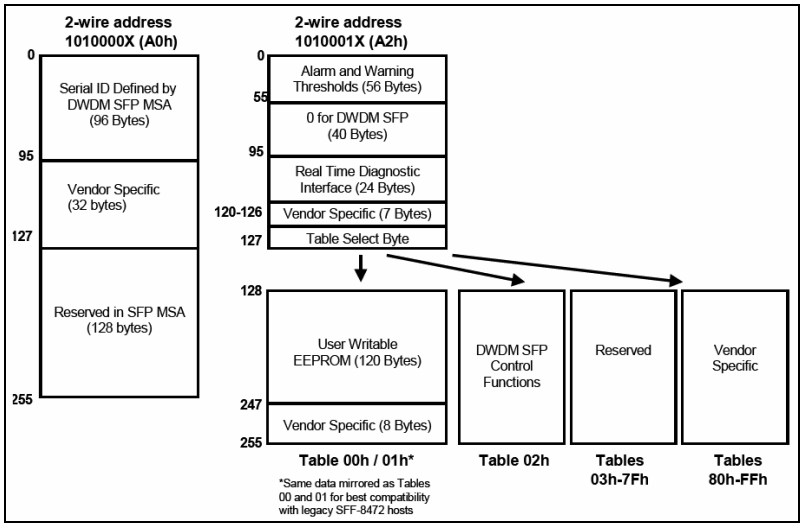
A diagnostic monitoring interface is available on Oclaro SFP transceivers as a 2-wire serial interface and provides user access to module identification data, customer specific data, link type, static and dynamic monitors and a check code mechanism for verifying accuracy in the data registers. These static and dynamic diagnostics allow users to remotely and accurately identify modules and their vendors, enquire about its compatibility with the system and also verify which enhanced diagnostics are supported. The user can also monitor module parameters to determine the module and link condition and provide hardware alerts upon an alarm or warning event.

The diagnostic monitoring provides real-time monitoring of receiver input power, transmitter power, internal module temperature, laser bias current and supply voltage parameters.

The 2-wire serial interface is defined by the GBIC (GigaBit Interface Converter) specification and the SFP MSA (Multi-Source Agreement) document dated September 14th, 2000. It is also compliant with the proposed DWDM SFP MSA Document. This interface allows read-only access to two separate memory locations starting at 1010000X (A0h) and 101000X (A2h). Table 3 and Table 4 contain address descriptions and register mapping information for both memory locations.

The memory location starting at A0h (data address 0 ~ 128) contains the Serial ID fields. This is a static data memory location for details such as vendor information, module identification, user specific data and a check code for verifying accuracy in the data registers.

The memory location starting at A2h (data address 0 ~ 255) contains Enhanced Diagnostics fields. The Enhanced Diagnostics are based on the SFF-8472 specification developed in the SFF (Small Form Factor) standards organization with an added TX_FAULT interrupt feature that provides a hardware alert upon reaching an alarm or warning condition on any, or all, of the diagnostics monitors. Enhanced Diagnostics provide a real-time indication of system and module condition, alerting the user to apparent or pending link or module problems. This is implemented through the use of alarm and warning registers that are updated approximately every 60 milliseconds. Data from these registers are internally calibrated over the specified operating ranges as described in this data sheet. Alarm and warning thresholds are factory preset values and are interpreted as real 16 bit data. The optional TX_FAULT interrupt feature, if activated, pulls the TX_FAULT pin (pin 2) high upon reaching an alarm or warning condition on the diagnostics monitors mentioned above. The masking feature allows any of the warning and alarm flags to be dynamically masked by the user.



Data Address (dec)	Field Size (Bytes)	Oclaro Module Data (hex)	Name of Field	Description of Field
0	1	0Bh	Identifier	Type of serial transceiver
1	1	27h	Ext. Identifier	Extended identifier of type of serial transceiver
2	1	07h	Connector	Code for connector type
3-10	8	00h,0Ch,44h,00h, 80h,10h,01h,05h	Transceiver	Code for electronic compatibility or optical compatibility
11	1	03h	Encoding	Code for serial encoding algorithm
12	1	19h	BR, Nominal	Nominal bit rate, units of 100 MBits/sec (2.5Gb/s)
13-14	2	00h, C8h	Length (9µm) – km	Link length supported for 9/125µm fiber, units in km (200km)
15	1	46h	Max Temp	Maximum operating case temperature in °C (70°C)
16	1	00h	Min Temp	Minimum operating case temperature in °C (0°C)
17	1	69h	Max Supply Current	Maximum supply current in units of 4mA
18	1	00h	Reserved	-
19	1	41h	Channel spacing and tuning	Channel spacing compatibility and number of ITU channels supported
20-35	16	42h,4Fh,4Fh, 4Bh,48h,41h,4Dh	Vendor Name	SFP transceiver vendor name (ASCII) – (BOOKHAM)
36	1	82h	Optional Features	Optional DWDM features
37-39	3	00h, 09h, A6h	Vendor OUI	SFP transceiver vendor IEEE company ID
40-55	16	Module dependent	Vendor PN	Part number provided by SFP transceiver vendor (ASCII)
56-59	4	31h, 20h, 20h, 20h	Vendor Rev	Revision level for part number provided by vendor (ASCII)
60-61	2	Module dependent	Wavelength	Laser wavelength (in nm)
62	1	Module dependent	Wavelength	Laser wavelength (fractional part in units of 10pm)
63	1	Module dependent	CC_BASE	Check code for Base ID Fields (addresses 0 – 62)
64-65	2	00h, 1Ah	Options	Indicates which optional transceiver signals are implemented
66	1	08h	BR, max	Upper bit rate margin, units in % (2.67 Gb/s)
67	1	60h	BR, min	Lower bit rate margin, units in % (100 Mb/s)
68-83	16	Module dependent	Vendor SN	Serial number provided by vendor (ASCII)
84-91	8	Module dependent	Date Code	Vendor's manufacturing date code
92	1	68h	Diagnostics Monitoring Type	Indicates the type of diagnostics implemented in the transceiver
93	1	F0h	Enhanced Options	Indicates which optional enhanced features are implemented
94	1	01h	SFF-8472 Compliance	Indicates which revision of SFF-8472 the transceiver complies with
95	1	Module dependent	CC_EXT	Check code for the Extended ID Fields (addresses 64-94)
96-127	32	-	Vendor Specific	Vendor Specific EEPROM (Vendor specific data; read only)
128-255	128	-	Reserved	Reserved for future use

Table 3: DWDM SFP MSA Serial Identification Data Fields (Location A0h).

Data Address (dec)	Field Size (Bytes)	Name of Field	Description of Field
A/D Table for Alarm and Warning Thresholds			
00-55	56	High/Low Alarm and Warning Levels	Specifies factory preset alarm and warning thresholds defined in Table 5
Calibration Constants for External Calibration Option			
56-94	39		Unused in DWDM devices. All Bytes Set to 0.
95	1	Checksum	Low order 8 bits of the sum of bytes 0-94
A/D Values and Status Bits			
96-109	8	A/D Values	Real-time A/D binary values of the following enhanced diagnostics: module temperature, supply voltage, laser bias current, transmit optical power, receive optical power, laser temperature and TEC current. These values are Internally calibrated absolute measurements. All diagnostic parameters implemented in these address locations have a corresponding high and low, alarm and warning thresholds assigned in address locations 00-55.
Optional Status/Control Bits			
110	1	Soft Control Signals	"Soft" control signals monitored over the 2-wire access port. Continuously updated real-time status of the following control signals: TX_FAULT, TX_DISABLE, Rate Select, and LOS. Last bit (LSB) indicates transceiver readiness to transmit data.
111	1	Reserved	Reserved
Reserved Optional Alarm and Warning Flag Bits			
112-117	5	Alarm & Warning Flags	Real time, single point bits indicating module parameters that are approaching or outside normal operating limits. Parameters monitored are: module temperature, supply voltage, laser bias current, transmit optical power, receive optical power, laser temperature and TEC current. The flags are internally calibrated thresholds with limits corresponding to levels detailed in addresses 00-39 above.
118-119	2	Warning Mask	Masking bits corresponding to Warning bits of bytes 116 and 117 respectively
Vendor Specific Memory Addresses			
120-126	8	Vendor Specific	Vendor specific data
Table Select Byte (2-wire Address A2h)			
127	1	Table Select	The byte value defines the Table location for subsequent reads and writes to bytes locations 128-255
User EEPROM			
128-247	120	User EEPROM	User writable EEPROM
248-255	8	Vendor Specific	Vendor specific control functions

Table 4: Enhanced Digital Diagnostics Data Fields (Location A2h).

Address (dec)	EEPROM Value (Hex)	Value	Description
00-01	55h, 00h	85 °C	Temp High Alarm
02-03	F6h, 00h	-10 °C	Temp Low Alarm
04-05	50h, 00h	80 °C	Temp High Warning
06-07	FBh, 00h	-5 °C	Temp Low Warning
08-09	8Dh, CCh	3.63 V	VCC High Alarm
10-11	74h, 04h	2.97 V	VCC Low Alarm
12-13	87h, 8Ch	3.47 V	VCC High Warning
14-15	7Ah, A8h	3.14 V	VCC Low Warning
16-17	Note [1]	Note [1]	Bias High Alarm
18-19	13h, 88h	10 mA	Bias Low Alarm
20-21	Note [2]	Note [2]	Bias High Warning
22-23	1Dh, 4Ch	15 mA	Bias Low Warning
24-25	7Bh, 84h	3162µW	Tx Power High Alarm
26-27	31h, 2Eh	1259µW	Tx Power Low Alarm

Address (dec)	EEPROM Value (Hex)	Value	Description
28-29	62h, 20h	2512µW	Tx Power High Warning
30-31	3Dh, EAh	1585µW	Tx Power Low Warning
32-33	06h, 31h	158.5µW	Rx Power High Alarm
34-35	00h, 0Ah	1µW	Rx Power Low Alarm
36-37	04h, EBh	125.9µW	Rx Power High Warning
38-39	00h, 10h	1.6µW	Rx Power Low Warning
40-41	3Ch, 00h	60 °C	Laser Temp High Alarm
42-43	1Eh, 00h	30 °C	Laser Temp Low Alarm
44-45	37h, 00h	55 °C	Laser Temp High Warning
46-47	23h, 00h	35 °C	Laser Temp Low Warning
48-49	17h, 70h	600 mA	TEC Current High Alarm
50-51	E8h, 90h	-600 mA	TEC Current Low Alarm
52-53	0Fh, A0h	400 mA	TEC Current High Warning
54-55	F0h, 60h	-400 mA	TEC Current Low Warning

Table 5: Alarm and Warning Thresholds.

[1] Definition of Bias High Alarm – The start of life laser bias varies from one module to the next. The laser bias high alarm is defined as: 1.5 * LD_{BIAS} at start of life.
[2] Definition of Bias High Warning – The start of life laser bias varies from one module to the next. The laser bias high alarm is defined as: (1.5 * LD_{BIAS} at start of life) – 5mA.

Regulatory Compliance

Oclaro IGP-28111J SFP transceiver is designed to be Class I Laser safety compliant and is certified per the following standards:

Feature	Agency	Standard	Certificate / Comments
Laser Safety	FDA/CDRH	CDRH 21J CFR1040.10	Pass. Accession no. 0522631-00
	TUV	IEC/EN60825-1:2001	US-TUVR-3209
		CAN/CSA-60825-1-03	CU7206220601
Product Safety	TUV	UL60950-1:2001	CU7206220601
		CAN/CSA-C22.2 No.60950-1-03	CU7206220601
		IEC/EN60950-1:2001	US-TUVR-3209
EMC	FCC	Title 47, Part 15, 1-12.5 GHz, Class B	Pass

RoHS Compliance

Oclaro is fully committed to environment protection and sustainable development and has set in place a comprehensive program for removing polluting and hazardous substances from all of its products. The relevant evidence of RoHS compliance is held as part of our controlled documentation for each of our compliant products. RoHS compliance parts are available to order, please refer to the ordering information section for further details.

Package and Handling Instructions

Process Plug

It is important to note that single mode optics, as with all optical devices are susceptible to contamination from air borne particles, human body oils, and mating connector particles. Care should be taken to protect all exposed optical interfaces with process plugs and dust covers. All Oclaro IGP-2000 SFP products are supplied with a process plug. This plug protects the transceiver's optics during standard handling and manufacturing processes. It is recommended that the process plug remain in the transceiver whenever an optical fibre connector is not inserted.

ESD Discharge (ESD)

Normal ESD precautions are required during the handling of this module. This transceiver is shipped in ESD protective packaging and it should not be removed from its packaging or otherwise handled unless in an ESD protected environment utilizing standard grounded benches, floor mats, and wrist straps.

Eye Safety

The Oclaro IGP-2000 Series SFP products are Class I laser products per IEC/EN60950-1:2001 and 60825-1:2001, and are certified per CDRH, 21 CFR 1040, Laser Safety Requirements. It is an eye safe device when operated within the limits of this specification. Operating this product in a manner inconsistent with intended usage and specification may result in hazardous radiation exposure. Tampering with this laser based product may warrant, under law, re-certification of the modified product as required by the U.S. Food and Drug Administration (21 CFR 1040).

Related Documents

1. DWDM SFP MSA (Multi-source Agreement), Revision 1.0, 19th September 2005.
2. SFP MSA (Multi-source Agreement), 14th September 2000.
3. Digital Diagnostics Monitoring Interface for Optical Transceivers. SFF Document Number SFF-8472, Rev 9.5.
4. Telcordia GR-253-CORE.
5. ITU G.957.
6. IEEE 802.3ae, 2000 Edition.
7. INCITS Fiber Channel Physical Interfaces (FC-PI-2), Rev 9.0

Ordering Information

The standard optical power (+3dBm) product order codes for each ITU-T 100GHz channel are defined below in Table 6 for C-Band and Table 7 for L-Band.

Product Code	Frequency (THz)	Wavelength (nm)
IGP-28211J-61	196.10	1528.77
IGP-28211J-60	196.00	1529.55
IGP-28211J-59	195.90	1530.33
IGP-28211J-58	195.80	1531.12
IGP-28211J-57	195.70	1531.90
IGP-28211J-56	195.60	1532.68
IGP-28211J-55	195.50	1533.47
IGP-28211J-54	195.40	1534.25
IGP-28211J-53	195.30	1535.04
IGP-28211J-52	195.20	1535.82
IGP-28211J-51	195.10	1536.61
IGP-28211J-50	195.00	1537.40
IGP-28211J-49	194.90	1538.19
IGP-28211J-48	194.80	1538.98
IGP-28211J-47	194.70	1539.77
IGP-28211J-46	194.60	1540.56
IGP-28211J-45	194.50	1541.35
IGP-28211J-44	194.40	1542.14
IGP-28211J-43	194.30	1542.94
IGP-28211J-42	194.20	1543.73
IGP-28211J-41	194.10	1544.53
IGP-28211J-40	194.00	1545.32
IGP-28211J-39	193.90	1546.12
IGP-28211J-38	193.80	1546.92
IGP-28211J-37	193.70	1547.72
IGP-28211J-36	193.60	1548.51
IGP-28211J-35	193.50	1549.32
IGP-28211J-34	193.40	1550.12
IGP-28211J-33	193.30	1550.92
IGP-28211J-32	193.20	1551.72
IGP-28211J-31	193.10	1552.52
IGP-28211J-30	193.00	1553.33
IGP-28211J-29	192.90	1554.13
IGP-28211J-28	192.80	1554.94
IGP-28211J-27	192.70	1555.75
IGP-28211J-26	192.60	1556.55
IGP-28211J-25	192.50	1557.36
IGP-28211J-24	192.40	1558.17
IGP-28211J-23	192.30	1558.98
IGP-28211J-22	192.20	1559.79
IGP-28211J-21	192.10	1560.61
IGP-28211J-20	192.00	1561.42
IGP-28211J-19	191.90	1562.23
IGP-28211J-18	191.80	1563.05
IGP-28211J-17	191.70	1563.86
IGP-28211J-16	191.60	1564.68

Table 6: IGP-28211J Product Order Codes for C-Band Wavelengths

Product Code	Frequency (THz)	Wavelength (nm)
IGP-28211J-09	190.90	1570.42
IGP-28211J-08	190.80	1571.24
IGP-28211J-07	190.70	1572.06
IGP-28211J-06	190.60	1572.89
IGP-28211J-05	190.50	1573.71
IGP-28211J-04	190.40	1574.54
IGP-28211J-03	190.30	1575.37
IGP-28211J-02	190.20	1576.20
IGP-28211J-01	190.10	1577.03
IGP-28211J-00	190.00	1577.86
IGP-28211J-99	189.90	1578.69
IGP-28211J-98	189.80	1579.52
IGP-28211J-97	189.70	1580.35
IGP-28211J-96	189.60	1581.18
IGP-28211J-95	189.50	1582.02
IGP-28211J-94	189.40	1582.85
IGP-28211J-93	189.30	1583.69
IGP-28211J-92	189.20	1584.53
IGP-28211J-91	189.10	1585.37
IGP-28211J-90	189.00	1586.20
IGP-28211J-89	188.90	1587.04
IGP-28211J-88	188.80	1587.88
IGP-28211J-87	188.70	1588.73
IGP-28211J-86	188.60	1589.57
IGP-28211J-85	188.50	1590.41
IGP-28211J-84	188.40	1591.26
IGP-28211J-83	188.30	1592.10
IGP-28211J-82	188.20	1592.95
IGP-28211J-81	188.10	1593.79
IGP-28211J-80	188.00	1594.64
IGP-28211J-79	187.90	1595.49
IGP-28211J-78	187.80	1596.34
IGP-28211J-77	187.70	1597.19
IGP-28211J-76	187.60	1598.04
IGP-28211J-75	187.50	1598.89
IGP-28211J-74	187.40	1599.75
IGP-28211J-73	187.30	1600.60
IGP-28211J-72	187.20	1601.46
IGP-28211J-71	187.10	1602.31
IGP-28211J-70	187.00	1603.17
IGP-28211J-69	186.90	1604.03
IGP-28211J-68	186.80	1604.89
IGP-28211J-67	186.70	1605.74
IGP-28211J-66	186.60	1606.61

Table 7: IGP-28211J Product Order Codes for L-Band Wavelengths

Contact Information

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Important Notice

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STATIC SENSITIVE DEVICE
OBSERVE PRECAUTIONS

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