

10Gb/s 1310nm XFP Transceiver

RTXX0SS1



Applications

- SONET OC-192 SR-1 / SDH STM I-64.1
- 10GBASE-LR/LW Ethernet
- 1200-SM-LL-L 10G FC
- G.709 OUT-2
- 10GBASE-LR/LW 10G Ethernet with G.709 OUT2-FEC

Features

- RoHS compliant
- Up to 10km optical links
- Compliant with XFP MSA
- Support multi protocol from 9.9Gb/s to 11.1Gb/s
- Uncooled 1310nm DFB laser transmitter
- LC duplex connector
- Digital Diagnostic functions implemented
- Metal package for lower EMI
- Hot pluggable 30 pin connector
- XFI electrical interface with AC coupling
- Power dissipation: <2.5W
- Three optional operating temperature ranges :
 - Option ST : 0°C to 70°C
 - Option ET : -5°C to 85°C
 - Option IT : -40°C to 85°C

Description

OE Solutions' XFP transceivers are designed to be compatible with the XFP 30pin Multi-Source Agreement (MSA). RTXX0SS1 comply with SONET OC-192 SR-1 / SDH STM I-64.1, IEEE 802.3ae 10GBASE-LR/LW and 10G Fiber Channel 1200-SM-LL-L. It also complies with G.709 OUT-2 and G.709 OTU2-FEC.

Advanced Digital Diagnostics functions are available via the 2-wire serial bus specified in the XFP MSA. The transmitter and receiver features ac-coupled differential data inputs and outputs, and an LVTTL for Tx disable input and Tx fault output. Software TX disable is also implemented. The receiver features differential ac-coupled data outputs and LVTTL for LOS (Loss of Signal) output.

1. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Absolute Supply Voltage	Vcc3_max	0	-	4.0	V	-
	Vcc5_max	0	-	6.0	V	-
Operating Case Temperature	Top	-40	-	85	°C	-
Storage Temperature	Tst	-40	-	85	°C	-

2. General Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Bit Rate	B	9.9	10.3	11.1	Gb/s	-
Bit Error Rate	BER	-	-	10 ⁻¹²	-	-
Maximum Transmission Distance	Dmax	-	2	-	km	-
Operating Voltage	Vcc3	3.135	-	3.465	V	-
	Vcc5	4.75	-	5.25	V	-
Operating Case Temperature	Top	-40	-	85	°C	1,2
Power supply current_VCC3	ICC3	-	-	200	mA	-
Power supply current_VCC5	ICC5	-	-	300	mA	-

Notes : 1. Measured on bottom side front center of XFP module
 2. There are three options of operating maximum temperature:
Option ST: standard temperature from 0°C to 70°C ,
Option ET: extended temperature from -5°C to 85°C
Option IT: extended temperature from -40°C to 85°C

3. Electrical Specifications**3.1 Module Electrical Specifications (Over Operating Case Temperature and Power Supply Range)**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
XFP Interrupt, Mod_NR	Vol	0.0	-	0.4	V	-
	Voh	Vcc-0.5	-	Vcc+0.3	V	1
P_Down/RST	Vil	-0.3	-	0.8	-	-
	Vih	2.0	-	Vcc3+0.3	-	-
Interrupt Assert Delay	Interrupt_on	-	-	200	ms	-
Interrupt Negate Delay	Interrupt_off	-	-	500	μs	-
Mod_NR Assert / Negate Delay	-	-	-	1	ms	-
P-Down Reset Time	-	10	-	-	μs	-

Note : 1. Vcc is the voltage of host board

3.2 Transmitter Electrical Specifications (Over Operating Case Temperature and Power Supply Range)

Electrical Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Differential Input Impedance	R _{in}	-	100	-	Ω	-
Differential Data Input Swing	V _{in,pp}	150	-	1000	mVp-p	-
Tx Disable Voltage	V _d	2.0	-	-	V _{cc} +0.3	-
Tx Enable Voltage	V _{en}	0	-	0.8	V	-
Tx Disable Assert Time	T _{off}	-	-	10	μs	-
Tx Enable Assert Time	T _{on}	-	-	2	ms	-
Initialization Time	T _{start}	-	-	300	ms	-

3.3. Receiver Electrical Specifications (Over Operating Case Temperature and Power Supply Range)

Electrical Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Rate	B	9.9	10.3	11.1	GBd	-
Differential Output Impedance	R _{out}	-	100	-	Ω	-
Differential Data Output Swing	V _{out}	300	600	750	mVp-p	-
Data Output Rise/Fall Time	tr/tf	-	-	45	ps	-
LOS Output High Voltage	V _{losh}	V _{cc} -0.5		V _{cc} -0.3		1
LOS Output Low Voltage	V _{losl}	-	-	0.5	V	-
LOS Assert/Deassert Time Delay	T _{los_onoff}	-	-	100	μs	

Note : 1. V_{cc} is the voltage of host board

4. Optical Specifications**4.1 Transmitter Optical Specifications** (Over Operating Case Temperature and Power Supply Range)

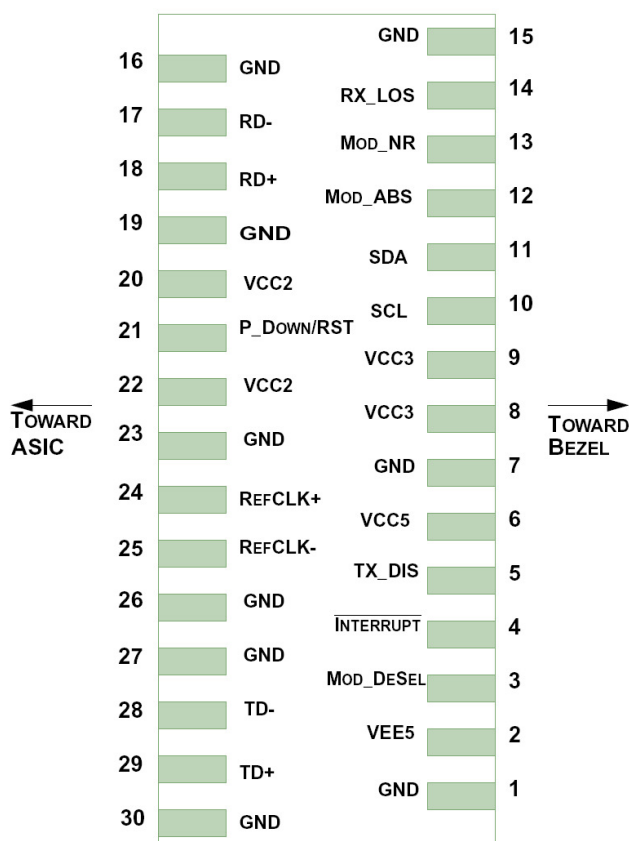
Optical Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Optical Power	P _{out}	-6	-	-1	dBm	1
Optical Modulation Amplitude	OMA	-5.2	-	-	dBm	-
Optical Extinction Ratio	ER	6	-	-	dB	-
Optical Wavelength	λ	1290	1310	1330	nm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Spectral Width	Δλ	-	-	1	nm	-
Optical power of OFF transmitter	P _{out-off}	-	-	-30	dBm	-
Relative Intensity Noise	RIN ₁₂ OMA	-	-	-128	dB/Hz	-
Optical Return Loss Tolerance	-	-	-	12	dB	-
Optical Path Penalty	-	-	-	1	dB	-

Laser Safety: All transceivers in this datasheet are Class I Laser products per FDA/CDRH and IEC-825 standards. They must be operated under specified operating conditions.

4.2. Receiver Optical Specifications (Over Operating Case Temperature and Power Supply Range)**Optical Characteristics**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Optical Wavelength	λ	1270	1310	1610	nm	-
Receiver Sensitivity@10.7Gb/s	RSSENS1	-	-17	-14.4	dBm	1
Receiver Sensitivity@11.1Gb/s	RSSENS2	-	-	-13.3	dBm	1
Maximum Input Power	Pol	0.5	-	-	dBm	-
Receiver Reflectance	-	-	-	-14	dB	-
LOS Assert	LOS_A	-30	-	-	dBm	-
LOS De-assert	LOS_D	-	-	-16	dBm	-
LOS Hysteresis	-	-	2	5	dB	-

Notes : 1. Measured with a PRBS of $2^{31}-1$ at 1×10^{-12} BER and 6 dB extinction ratio

5. Pin Descriptions**XFP Transceiver Electrical Pad Layout**

Pin Descriptions (continued)

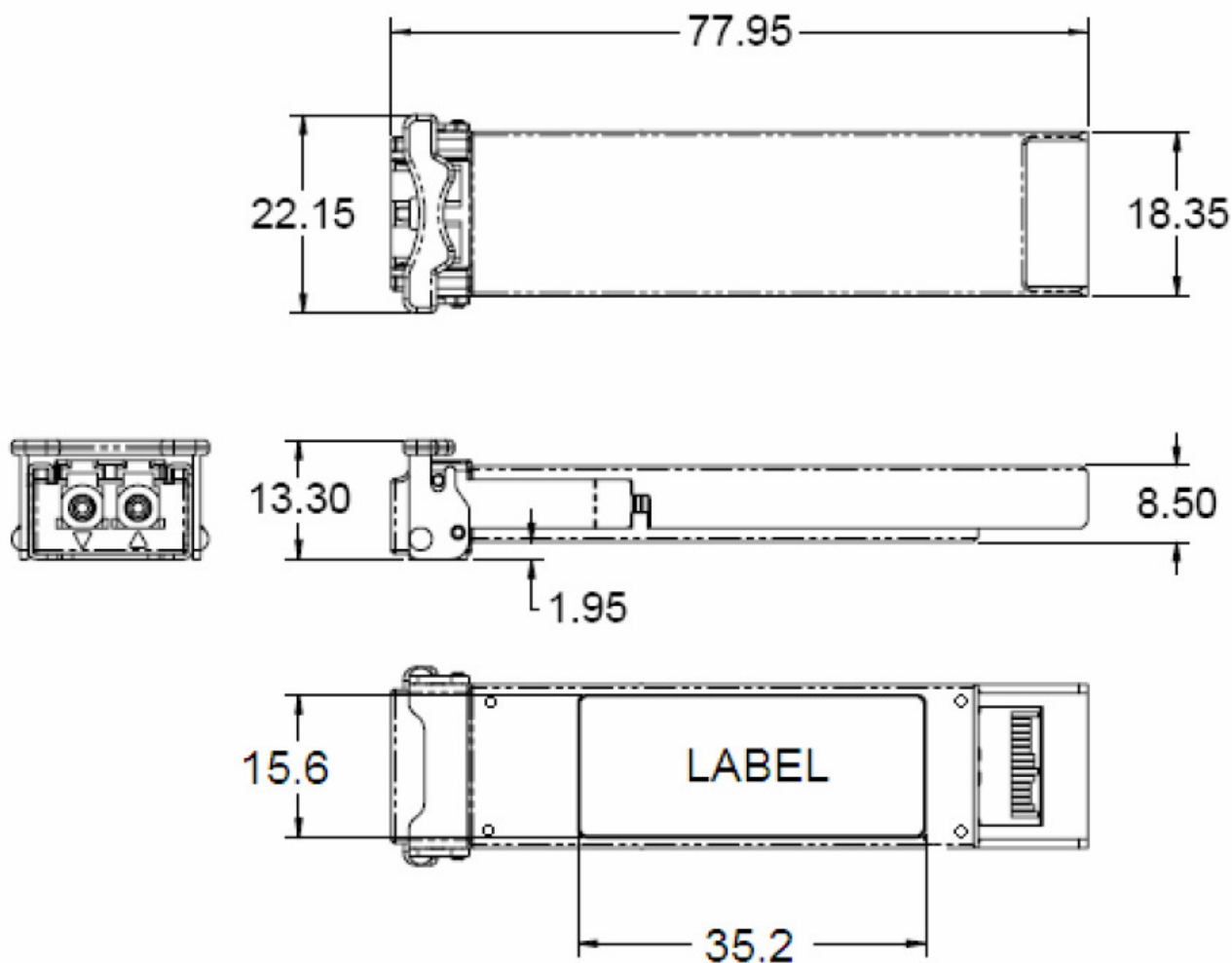
Pin	Logic	Symbol	Description	Notes
1	-	GND	Module Ground	1
2	-	VEE5	Not required	
3	LVTTL-I	Mod_DeSel	Module De-select; When held low allows module to respond to 2-wire serial interface	
4	LVTTL-O	Interrupt	Interrupt; Indicates presence of an important condition which can be read over the 2-wire serial interface	2
5	LVTTL-I	TX_DIS	Transmitter Disable; Turns off transmitter laser output	
6	-	VCC5	+5V Power Supply	
7	-	GND	Module Ground	1
8	-	VCC3	+3.3V Power Supply	
9	-	VCC3	+3.3V Power Supply	
10	LVTTL-I/O	SCL	2-Wire Serial Interface Clock	2
11	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
12	LVTTL-O	Mod_Abs	Indicates Module is not present. Grounded in the Module	2
13	LVTTL-O	Mod_NR	Module Not Ready; Indicating Module Operational Fault	2
14	LVTTL-O	RX_LOS	Receiver Loss Of Signal Indicator	2
15	-	GND	Module Ground	1
16	-	GND	Module Ground	1
17	CML-O	RD-	Receiver Inverted Data Output, AC coupled in the module	
18	CML-O	RD+	Receiver Non-Inverted Data Output, AC coupled in the module	
19	-	GND	Module Ground	1
20	-	VCC2	Not required	3
21	LVTTL-I	P_Down/RST	Power down; When high, requires the module to limit power consumption to 1.5W or below. 2-Wire serial interface must be functional in the low power mode. Reset; The falling edge initiates a complete reset of the module including the 2-wire serial interface, equivalent to a power cycle.	
22	-	VCC2	Not required	3
23	-	GND	Module Ground	1
24	PECL-I	RefCLK+	Not required	
25	PECL-I	RefCLK-	Not required	
26	-	GND	Module Ground	1
27	-	GND	Module Ground	1
28	CML-I	TD-	Transmitter Inverted Data Input, AC coupled in the module	
29	CML-I	TD+	Transmitter Non-Inverted Data Input, AC coupled in the module	
30	-	GND	Module Ground	1

Notes :

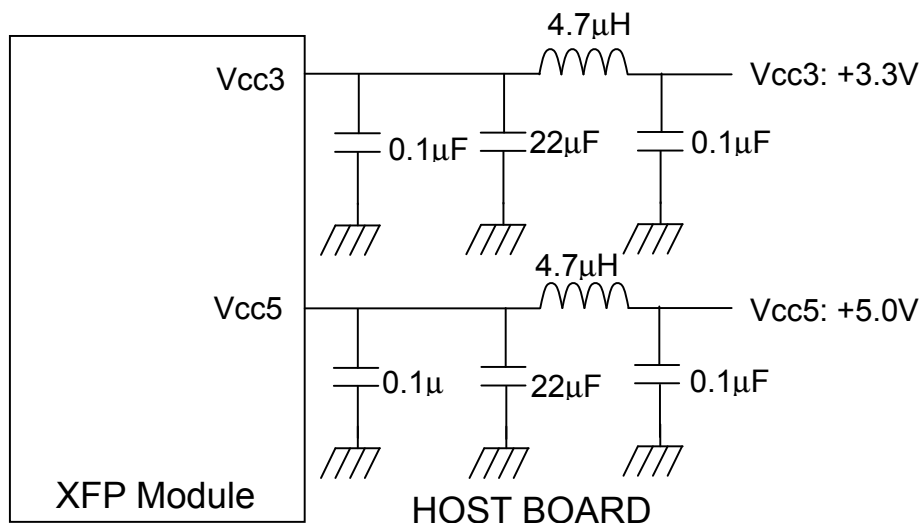
1. Module ground pins Gnd are isolated from the module case and chassis ground within the module.
2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.
3. The 1.8 V power supply can be optionally programmed to voltages lower than 1.8 V in modules supporting the variable power supply.

6. Outline Drawings

Dimensions are in millimeters



8.2 Recommended Host Board Supply Filtering Network



9. Digital Diagnostic Monitoring and Serial ID Operation

Serial ID and Map: page A0h

Address	HEX	Name of Fields	Description
0	06	Identifier	[06h] XFP
1	00	Signal Conditioner Control Field [7-4] Data Rate Control [2] Lineside Loopback [1] XFI Loopback [0] Signal Conditioner Control	Signal Conditioner Control Field Data Rate Control(01[7:4]) = 9.50 Gb/s [0b] Normal Operation [0b] Normal Operation [0b] Normal Asynchronous REFCLK mode
2	50	Temp High Alarm MSB	ST:90[°C],ET,IT:110[°C]
3	00	Temp High Alarm LSB	
4	F6	Temp Low Alarm MSB	ST:-5[°C],ET:-10[°C],IT:-45[°C]
5	00	Temp Low Alarm LSB	
6	4B	Temp High Warning MSB	ST:80[°C],ET,IT:100[°C]
7	00	Temp High Warning LSB	
8	FB	Temp Low Warning MSB	ST:0[°C],ET:-5[°C],IT:-40[°C]
9	00	Temp Low Warning LSB	
10-17	00	Reserved A/D Flag Thresholds(10-17)	
18	9C	Bias High Alarm MSB	80.00 [mA]
19	40	Bias High Alarm LSB	
20	09	Bias Low Alarm MSB	5.00 [mA]
21	C4	Bias Low Alarm LSB	
22	88	Bias High Warning MSB	70.00 [mA]
23	B8	Bias High Warning LSB	
24	13	Bias Low Warning MSB	10.00 [mA]
25	88	Bias Low Warning LSB	
26	31	TX Power High Alarm MSB	0 [dBm]
27	2D	TX Power High Alarm LSB	
28	06	TX Power Low Alarm MSB	-7 [dBm]
29	F2	TX Power Low Alarm LSB	
30	27	TX Power High Warning MSB	-1 [dBm]
31	10	TX Power High Warning LSB	

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32	08	TX Power Low Warning MSB	-6 [dBm]
33	BF	TX Power Low Warning LSB	
34	31	RX Power High Alarm MSB	1.00 [dBm]
35	2D	RX Power High Alarm LSB	
36	00	RX Power Low Alarm MSB	-18.00 [dBm]
37	7E	RX Power Low Alarm LSB	
38	27	RX Power High Warning MSB	0.5 [dBm]
39	10	RX Power High Warning LSB	
40	00	RX Power Low Warning MSB	-17 [dBm]
41	C8	RX Power Low Warning LSB	
42	8C	AUX 1 High Alarm MSB	3.60 [V]
43	A0	AUX 1 High Alarm LSB	
44	75	AUX 1 Low Alarm MSB	3.00 [V]
45	30	AUX 1 Low Alarm LSB	
46	88	AUX 1 High Warning MSB	3.50 [V]
47	B8	AUX 1 High Warning LSB	
48	79	AUX 1 Low Warning MSB	3.10 [V]
49	18	AUX 1 Low Warning LSB	
50	00	AUX 2 High Alarm MSB	5.35 [V]
51	00	AUX 2 High Alarm LSB	
52	00	AUX 2 Low Alarm MSB	4.6 [V]
53	00	AUX 2 Low Alarm LSB	
54	00	AUX 2 High Warning MSB	5.3 [V]
55	00	AUX 2 High Warning LSB	
56	00	AUX 2 Low Warning MSB	4.7 [V]
57	00	AUX 2 Low Warning LSB	
58	00	VPS Fields [7-4] Lowest Voltage Supported with an Operational LV Regulator [3-0] Voltage Supplied on the VCC2 Pins	
59	00	VPS Fields [7-4] Voltage Supported with a Bypassed Regulator [0] Regulator bypass mode	[0b] Mode disabled
60-69	00		
70	00	Acceptable BER	Not Supported
71	00	Actual BER	Not Supported
72	00	Wavelength Set MSB(72-73)	Not Supported
73	00		
74	00	Wavelength Error LSB(74-75)	Not Supported
75	00		
76	80	Amplitude Adjustment	0.00 [%]
77	00	Phase Adjustment	Not Supported
78	00	Reserved(78-79)	
79	00		
80	Varies	Latched Interrupt Flag Fields(80)	Varies
81	Varies	Latched Interrupt Flag Fields(81)	Varies
82	Varies	Latched Interrupt Flag Fields(82)	Varies
83	Varies	Latched Interrupt Flag Fields(83)	Varies
84	Varies	Latched Interrupt Flag Fields(84)	Varies
85	Varies	Latched Interrupt Flag Fields(85)	Varies
86	Varies	Latched Interrupt Flag Fields(86)	Varies
87	Varies	Latched Interrupt Flag Fields(87)	Varies
88	Varies	Interrupt Masking Bits(88)	Varies
89	Varies	Interrupt Masking Bits(89)	Varies
90	Varies	Interrupt Masking Bits(90)	Varies
91	Varies	Interrupt Masking Bits(91)	Varies
92	Varies	Interrupt Masking Bits(92)	Varies
93	Varies	Interrupt Masking Bits(93)	Varies
94	Varies	Interrupt Masking Bits(94)	Varies
95	Varies	Interrupt Masking Bits(95)	Varies
96	Varies	Temperature MSB	Varies
97	Varies	Temperature LSB	Varies

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98	00	Reserved(98-99)	
99	00		
100	Varies	TX Bias MSB	Varies
101	Varies	TX Bias LSB	Varies
102	Varies	TX Power MSB	Varies
103	Varies	TX Power LSB	Varies
104	Varies	RX Power MSB	Varies
105	Varies	RX Power LSB	Varies
106	Varies	AUX 1 MSB	Varies
107	Varies	AUX 1 LSB	Varies
108	00	AUX 2 MSB	
109	00	AUX 2 LSB	
110	Varies	Control/Status Bits [7] TX Disable State [6] Soft TX Disable [5] MOD_NR State [4] P_Down State [3] Soft P_Down [2] Interrupt [1] RX_LOS [0] Data_Not_Ready	Varies
111	Varies	Control/Status Bits [7] TX_NR State [6] TX_Fault [5] TX_CDR [4] RX_NR [3] RX_CDR	Varies
112-117	00		
118	00	Pcket Error Checking [0] Error Checking	[0b] Disable Packet Error Checking
119-127	00		
128	06	Identifier	[06h] XFP
129	10	Extended Identifier	[00b] Power Level 2 Module (2.5 W max.power dissipation.) [0] Module with CDR function [1] TX Ref Clock Input Not Required [0] No CLEI code present in Table 02h
130	07	Connector	[07h] LC
131	C0	Gigabit Ethernet Compliance	[7] 10GBASE-SR [6] 10GBASE-LR
132	40	Gigabit Fibre Channel Compliance	[6] 1200-SM-LL-L
133	00	Gigabit Copper Links	
134	00	Lower Speed Links	
135	00	SONET/SDH Codes -Interconnect	
136	00	SONET/SDH Codes Short Haul	I64-1,SR-1
137	00	SONET/SDH Codes Long Haul	
138	00	SONET/SDH Codes Very Long Haul	
139	50	Encoding	[6] 64B66B, [4] NRZ
140	63	BR,MINIMUM	9.900 [Gbits/s]
141	6F	BR,MAXIMUM	11.100 [Gbits/s]
142	0A	LENGTH (Km)	10 [Km]
143	00	LENGTH (EXT. 50 uM MULTIMODE FIBER)	0 [m]
144	00	LENGTH (50 uM MULTIMODE FIBER)	0 [m]
145	00	LENGTH (62.5 uM MULTIMODE FIBER)	0 [m]
146	00	LENGTH (COPPER)	0 [m]
147	40	Device Technology	[0100b] 1310 nm DFB [0b] Transmitter not Tunable [0b] PIN detector [0b] Uncooled transmitter device [0b] No wavelength control
148	4F	VENDOR NAME(148-163)	O (OE SOLUTIONS)
149	45		E
150	20		
151	53		S

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152	4F		O
153	4C		L
154	55		U
155	54		T
156	49		I
157	4F		O
158	4E		N
159	53		S
160-163	20		
164	F8	CDR Support	[7] CDR support for 9.95 Gb/s [6] CDR support for 10.3 Gb/s [5] CDR support for 10.5 Gb/s [4] CDR support for 10.7 Gb/s [3] CDR support for 11.1 Gb/s
165	00	VENDOR OUI(165-167)	00
166	19		19
167	3A		3A
168	52	VENDOR PN(168-183)	R
169	54		T
170	58		X
171	58		X
172	30		0
173	53		S
174	53		S
175	31		1
176	2D		-
177	xx		S(53h), E(45h), I(49h)
178	54		T
179	33		3
180-183	20		
184	31	VENDOR REV(184-185)	1 (1)
185	20		
186	66	LASER WAVELENGTH(186-187)	1310.00 [nm]
187	58		
188	0F	WAVELENGTH TOLERANCE(188-189)	20.000 [nm]
189	A0		
190	46	MAXIMUM CASE TEMPERATURE	85 [°C]
191	xx	CC_BASE	Check code for addresses 120 to 190
192	4B	Maximum Power Dissipation	2500 mW
193	14	Maximum Total Power Dissipation in Power Down Mode	200 mW
194	05	[7-4] Maximum current required by +5V Supply. [3-0] Maximum current required by +3.3V Supply.	300mA 200 mA
195	00	[7-4] Maximum current required by +1.8V Supply. [3-0] Maximum current required by -5.2V Supply	0 mA 0 mA
196-211	Varies	VENDOR SN(196-211)	Varies
212-219	Varies	Date Code(212-219)	Varies
220	00	Diagnostic Monitoring Type [4] Module Respond to FEC BER [3] Received power measurement type	
221	60	Enhanced Options [7] Module Supports Optional VPS [6] Soft TX_DISABLE [5] Soft P_down [4] Supports VPS LV regulator mode [3] Supports VPS bypassed regulator Mode [2] Active FEC control functions [1] Wavelength tunability [0] Optional CMU Support Mode	[6] Optional Soft TX_DISABLE implemented [5] Optional Soft P_down

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222	70	Auxiliary A/D Types [7-4] Aux A/D Input 1 [3-0] Aux A/D Input 2	[0111b] +3.3V Supply Voltage [0000b] +5.0V Supply Voltage
223	xx	CC_EXT	Check code for addresses 192 to 222
224-255	FF	VENDOR SPECIFIC ID FIELD(224-255)	

10. Regulatory Compliance

The RTXX0SS1 comply with international Electromagnetic Compatibility (EMC) and international safety requirements and standards. EMC performance is dependent on the overall system design. The RTXX0SS1 is lead-free and RoHS-compliant per Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

11. Ordering Information

Model Name	OES P/C	Operating Case Temperature	Nominal Wavelength	Latch Color	Application	Distance
RTXX0SS1-ST3	T5600	0°C to 70°C	1310nm	Blue	SONET/SDH 10G GbE	10km
RTXX0SS1-ET3	T5700	-5°C to 85°C	1310nm	Blue	SONET/SDH 10G GbE	10km
RTXX0SS1-IT3	T5800	-40°C to 85°C	1310nm	Blue	SONET/SDH 10G GbE	10km

Revision history

Date	Rev. #	Description	Author
02/14/2009	Rev. 1.0	first released	MSPARK
04/28/2010	Rev. 1.1	revised as standard IT version	JSYU
01/03/2011	Rev.A.2	Distance: 2km → 10km	JSYU

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