



## 3Gbps Video SFP Optical Receiver With Digital Diagnostic Monitoring **FRR-3G-xxxD**

### Features

- ◆ HD-SDI SFP Receiver available
- ◆ SD-SDI SFP Receiver available
- ◆ 3G-SDI SFP Receiver available
- ◆ SMPTE 297-2006 Compatible.
- ◆ Metal enclosure for Lower EMI
- ◆ PIN photodetector
- ◆ Supports video pathological patterns for SD-SDI, HD-SDI and 3G-SDI
- ◆ Digital Diagnostic functions available through the I2C interface
- ◆ Compatible with RoHS
- ◆ +3.3V single power supply
- ◆ Operating case temperature:  
Standard : 0 to +70°C



### Applications

- ◆ SMPTE 297-2006 Compatible Electrical-to-Optical Interfaces.
- ◆ HDTV/SDTV Service Interfaces.

### Description

The video series transceivers are high performance, cost effective modules for duplex video transmission application over single mode fiber.

The receiver is designed to receive data rates from 50Mbps to 2.97Gbps and is specifically designed for robust performance in the presence of SDI pathological patterns for SMPTE 259M, SMPTE 344M, SMPTE 292M and SMPTE 424M serial rates. The module is fully compliant with SMPTE 297M-2006.

The receiver is consists of two sections: a PIN photodiode integrated with a trans-impedance



preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety requirements.

### Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	Vcc	-0.5	4.5	V
Storage Temperature	Ts	-40	+85	°C
Operating Humidity	-	5	85	%

### Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	Standard	0		+70	°C
					°C
Power Supply Voltage	Vcc	3.13	3.3	3.47	V
Power Supply Current	Icc			150	mA
Data Rate			3		Gbps

### Optical and Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Receiver						
Rise/Fall Time (20%~80%)	SD-SDI			1500		1
	HD-SDI			270	ps	
	3G-SDI			135		
Total Output Jitter	PRBS and colour bar	SD-SDI	70	200	ps	
		HD-SDI	50	135		
		3G-SDI	70	100		
	pathological	SD-SDI	200	300		
		HD-SDI	115			



		3G-SDI	120			
Centre Wavelength		$\lambda_c$	1260		1580	nm
Receiver Sensitivity (PRBS)	SD-SDI				-22	dBm
	HD-SDI				-22	dBm
	3G-SDI				-22	dBm
Receiver Sensitivity (Pathological)	SD-SDI				-20	dBm
	HD-SDI				-22	dBm
	3G-SDI				-22	dBm
Receiver Overload			0			dBm 3
LOS De-Assert		LOS <sub>D</sub>			-22	dBm
LOS Assert		LOS <sub>A</sub>	-29			dBm
LOS Hysteresis			1		4	dB
Data Output Swing Differential		V <sub>out</sub>	650	800	1000	mV 2
LOS		High	2.0		V <sub>cc</sub>	V
		Low			0.8	V

**Notes:**

1. Rise and fall times, 20% to 80%, are measured following a fourth-order Bessel-Thompson filter with a bandwidth of 0.75 x clock frequency corresponding to the serial data rate
2. PECL input, internally AC-coupled and terminated.
3. Internally AC-coupled.

**Timing and Electrical**

Parameter	Symbol	Min	Typical	Max	Unit
LOS Assert Time	t <sub>loss_on</sub>			100	μs
LOS De-assert Time	t <sub>loss_off</sub>			100	μs
Serial ID Clock Rate	f <sub>serial_clock</sub>			280	KHz
MOD_DEF (0:2)-High	V <sub>H</sub>	2		V <sub>cc</sub>	V
MOD_DEF (0:2)-Low	V <sub>L</sub>			0.8	V

**Diagnostics**



Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to +70	°C	±3°C	Internal / External
Voltage	3.0 to 3.6	V	±3%	Internal / External
RX Power	-20 to -6	dBm	±3dB	Internal / External

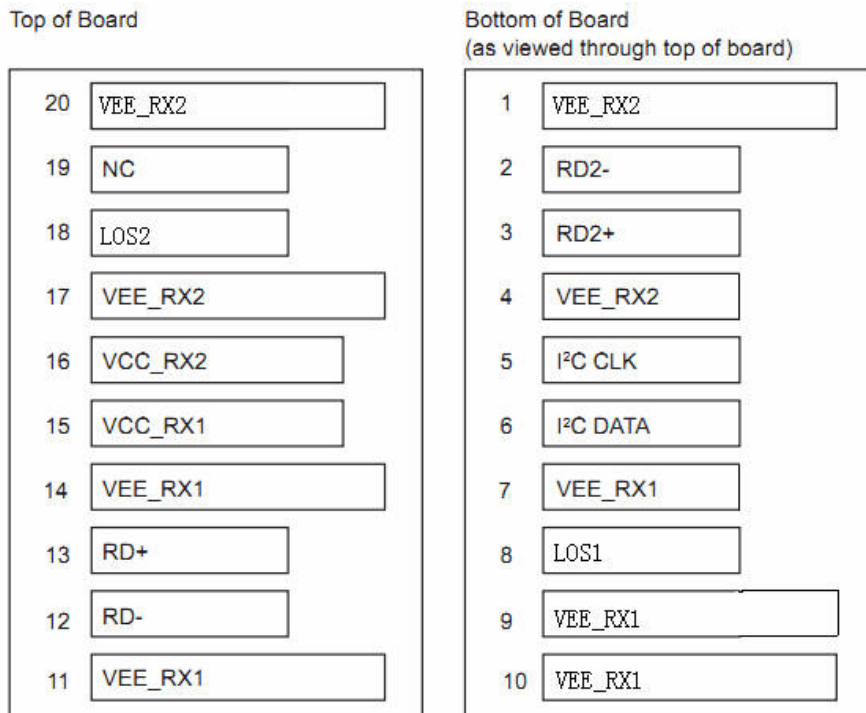
### I2C Bus Interface

The I2C bus interface uses the 2-wire serial CMOS E2PROM protocol. The serial interface meets the following specifications:

- 1.Support a maximum clock rate of 280Khz.
2. Input/Output levels comply with LVCMOS/LVTTL or compatible logics.  
Low: 0 – 0.8 V  
High: 2.0 – 3.3 V  
Undefined: 0.8 – 2.0 V

### Pin Definitions

#### Pin Diagram



### Pin Descriptions

Pin	Signal Name	Description	Plug Seq.	Notes
-----	-------------	-------------	-----------	-------



1	VEE_RX2	Receiver2 Ground	1	
2	RD2-	Inv. Received2 Data Out	3	Note 1
3	RD2+	Received2 Data Out	3	
4	VEE_RX2	Receiver2 Ground	3	
5	I2C CLK	SCL Serial Clock Signal	3	Note 3
6	I2C DATA	SDA Serial Data Signal	3	Note 3
7	VEE_RX1	Receiver1 Ground	3	
8	LOS1	Loss1 of Signal	3	Note 4
9	VEE_RX1	Receiver1 Ground	1	Note 4
10	VEE_RX1	Receiver1 ground	1	Note 2
11	VEE_RX1	Receiver1 ground	1	
12	RD-	Inv. Received Data Out	3	Note 1
13	RD+	Received Data Out	3	
14	VEE_RX1	Receiver1 ground	1	
15	VCC_RX1	Receiver1 Power Supply	2	
16	VCC_RX2	Receiver2 Power Supply	2	
17	VEE_RX2	Receiver2 Ground	1	
18	LOS2	Loss2 of Signal	3	Note 4
19	NC	Not Connected	3	Note 4
20	VEE_RX2	Receiver2 Ground	1	Note 2

**Notes:**

Plug Seq.: Pin engagement sequence during hot plugging.

- 1) These are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be VccR.  
I2C CLK is the clock line of two wire serial interface for serial ID  
I2C DATA is the data line of two wire serial interface for serial ID
- 2) LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. Pull up voltage between 2.0V and Vcc+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low state, the output will be pulled to less than 0.8V.
- 3) RD-/+: These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.

**Serial ID Field Memory Map**

The module serial Id and calibration information is stored in the E2PROM of the SFP supervising device using the address map.



Byte Addr	Bit Size	Name	Description	Value (hex)
0	1	Identifier	Type of transceiver	82
1	1	Ext. Identifier	Extended identifier of type of transceiver	04
2	1	Connector	Code for connector type	07
3	1	Standards Compliance	For SMPTE259M/344M/292M/424M and SMPTE 297M	41
4	7	Transceiver	Code for electronic or optical compatibility, Not applicable.	
5				
6				
7				
8				
9				
10				
11	1	Encoding	Code for serial encoding algorithm	30
12	1	BR, Nominal	Nominal signalling rate, units of 100MBd.	1E
13	1	Rate Identifier	Type of rate select functionality, Not applicable	
14	1	Length (SMF, km)	Link length supported for single mode fiber, units of km	14
15	1	Length (SMF)	Link length supported for single mode fiber, units of 100 m	00
16	1	Length (50um)	Link length supported for 50 um OM2 fiber, units of 10 m	00
17	1	Length (62.5um)	Link length supported for 62.5 um OM1 fiber, units of 10 m	00
18	1	Length (cable)	Link length supported for copper or direct attach cable, units of m	00
19	1	Length (OM3)	Link length supported for 50 um OM3 fiber, units of 10 m	00
20	16	Vendor name	SFP vendor name (ASCII)	X
21				X
22				X
23				X
24				X



25				X
26				X
27				X
28				X
29				X
30				X
31				X
32				X
33				X
34				X
35				X
36	1	Reserved	Reserved	00
37				00
38	3	Vendor OUI	SFP vendor IEEE company ID	00
39				00
40				X
41				X
42				X
43				X
44				X
45				X
46				X
47	16	Vendor PN	Part number provided by SFP vendor (ASCII)	X
48				X
49				X
50				X
51				X
52				X
53				X
54				X
55				
56				
57	4	Vendor rev	Revision level for part number provided by vendor (ASCII)	X
58				
59				



60	2	Wavelength	Laser wavelength (Passive/Active Cable Specification Compliance)	
61				
62	1	Unallocated		
63	1	CC_BASE	Check code for Base ID Fields	
64	2	Options	Indicates which optional transceiver signals are implemented	
65				
66	1	BR, max	Upper bit rate margin, units of %	05
67	1	BR, min	Lower bit rate margin, units of %	5F
68	16	Vendor SN	Serial number provided by vendor (ASCII)	X
69				X
70				X
71				X
72				X
73				X
74				X
75				X
76				X
77				X
78				X
79				X
80				X
81				X
82				X
83				X
84	8	Date code	Vendor' s manufacturing date code	
85				
86				
87				
88				
89				
90				
91				
92	1	Diagnostic Monitoring Type	Indicates which type of diagnostic monitoring is implemented(if any) in the transceiver	28
93	1	Enhanced Options	Indicates which optional enhanced features are implemented(if any) in the transceiver	90
94	1	SFF-8472Compliance	Indicates which revision of SFF-8472 the transceiver complies with.	X





95	1	CC_EXT	Check code for the Extended ID Fields	
96	32	Vendor Specific	Vendor Specific EEPROM	0
97				0
98				0
99				0
100				0
101				0
102				0
103				0
104				0
105				0
106				0
107				0
108				0
109				0
110				0
111				0
112				0
113				0
114				0
115				0
116				0
117				0
118				0
119				0
120				0
121				0
122				0
123				0
124				0
125				0
126				0
127				0

**Digital Diagnostic Monitoring Interface (2-Wire Address A2H)**

Byte Addr	Bit Size	Name	Description and Value of the Field
00-01	2	Temp High Alarm	MSB at lower address. 100° C
02-03	2	Temp Low Alarm	MSB at lower address. -50° C



04-05	2	Temp High Warning	MSB at lower address. 95° C
06-07	2	Temp Low Warning	MSB at lower address. -45° C
08-09	2	Voltage High Alarm	MSB at lower address. 3.7V
10-11	2	Voltage Low Alarm	MSB at lower address. 2.9V
12-13	2	Voltage High Warning	MSB at lower address. 3.6V
14-15	2	Voltage Low Warning	MSB at lower address. 3.0V
16-17	2	Bias High Alarm	MSB at lower address. 70mA
18-19	2	Bias Low Alarm	MSB at lower address. 8mA
20-21	2	Bias High Warning	MSB at lower address. 65mA
22-23	2	Bias Low Warning	MSB at lower address. 9mA
24-25	2	RX2 Power High Alarm	MSB at lower address. 1dBm
26-27	2	RX2 Power Low Alarm	MSB at lower address. -25dBm
28-29	2	RX2 Power High Warning	MSB at lower address. 0dBm
30-31	2	RX2 Power Low Warning	MSB at lower address. -24dBm
32-33	2	RX1 Power High Alarm	MSB at lower address. 1dBm
34-35	2	RX1 Power Low Alarm	MSB at lower address. -25dBm
36-37	2	RX1 Power High Warning	MSB at lower address. 0dBm
38-39	2	RX1 Power Low Warning	MSB at lower address. -24dBm
40-55	16	Reserved	Reserved
56-59	4		
60-63	4		
64-67	4		
68-71	4		
72-75	4		
76-77	2	TX_I (Slope)	Set to 1 for “internally calibrated” devices.Value is 01 00.
78-79	2	TX_I (Offset)	Set to zero for “internally calibrated” devices.Value is 00 00.

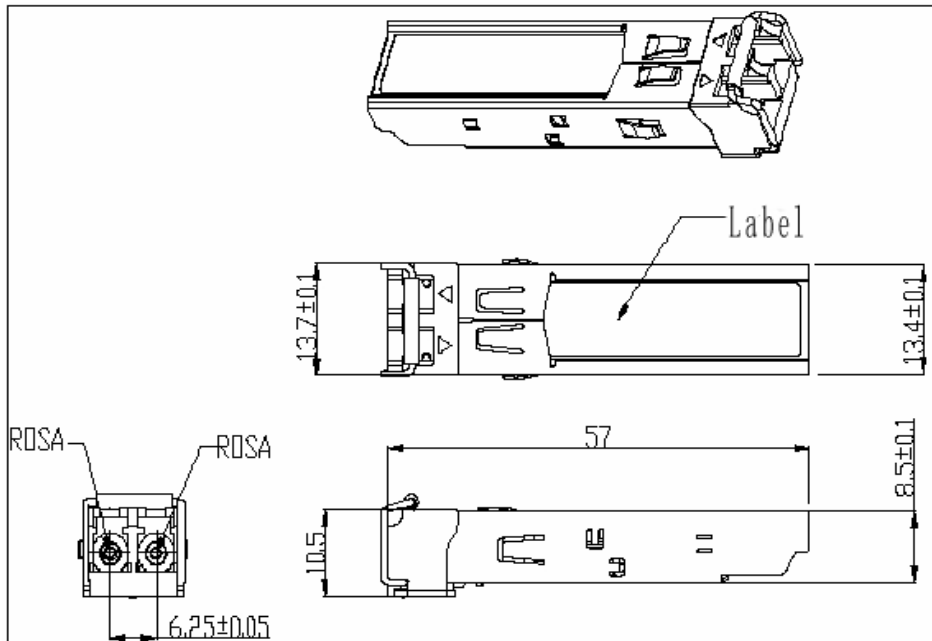


80-81	2	TX_PWR (Slope)	Set to 1 for “internally calibrated” devices.Value is 01 00.
82-83	2	TX_PWR (Offset)	Set to zero for “internally calibrated” devices.Value is 00 00.
84-85	2	T (Slope)	Set to 1 for “internally calibrated” devices.Value is 01 00.
86-87	2	T (Offset)	Set to zero for “internally calibrated” devices.Value is 00 00.
88-89	2	V (Slope)	Set to 1 for “internally calibrated” devices.Value is 01 00.
90-91	2	V (Offset)	Set to zero for “internally calibrated” devices.Value is 00 00.
92-94	3	Reserved	Reserved
95	1	Checksum	Checksum of bytes 0 - 94.
96-97	2	Temperature (MSB, LSB)	Internally measured module temperature
98-99	2	Supply Voltage (MSB, LSB)	Internally measured supply voltage in module
100-101	2	Bias1() (MSB, LSB)	Internally measured module bias1
102-103	2	Tx1 Power (MSB, LSB)	Internally measured Tx1 Power Current
104-105	2	Tx2 Power (MSB, LSB)	Internally Measured Tx2 Power Current
106-107	2	Bias2() (MSB, LSB)	Internally measured module bias2
108-109	2	Reserved	Reserved
110	Bit7	Tx Disable State	Digital state of the TX Disable Input Pin.
110	Bit6	Soft Tx Disable	Bit 6
110	Bit5-Bit3	Reserved	
110	Bit2	Tx Fault	Bit 2
110	Bit1		Bit1
110	Bit0	Data_Ready	Bit 0
111	1	Reserved	Reserved
112	1		
113	1		
114-115	Reserved		Reserved



116	1		
117	1		
118-119	2	Reserved	Reserved
120-127	8	Vendor specific	
128-247	120	User EEPROM	User writable EEPROM
248-255	8	Vendor Specific	Vendor specific control functions

### Mechanical Dimensions



### Ordering information

Part Number	Product Description
FRR-3G-XXCD	PIN, 3Gbps, 0°C ~ +70°C, With Digital Diagnostic Monitoring

### Important Notice

Performance figures, data and any illustrative material provided in this data sheet are typical and must be specifically confirmed in writing by FIBERER before they become applicable to any particular order or contract. In accordance with the FIBERER policy of continuous improvement specifications may change without notice.



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