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RAYCORE

Q3-S176 V3.3E

Specification of SFP Dual LC 1.25G

Transceiver

Part Number: ATRG-63xx-xxxDD-00

# M E L B Y E



For Multi Mode Fiber



For Single Mode Fiber-1310nm



For Single Mode Fiber-1550nm

The SFP transceivers are high performance, cost effective modules supporting dual data-rate of 1.25Gbps/1.0625Gbps and transmission with MMF or SMF.

The transceiver consists of three sections: a laser transmitter, a photodiode integrated and MCU control unit. All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP Multi-Source Agreement (MSA) and SFF-8472.

For further information, please refer to SFP MSA.

## Features

- Dual data-rate of 1.25Gbps/1.063Gbps operation
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature: Standard: -5 to +70°C, Industry: -40 to +85°C

## Applications

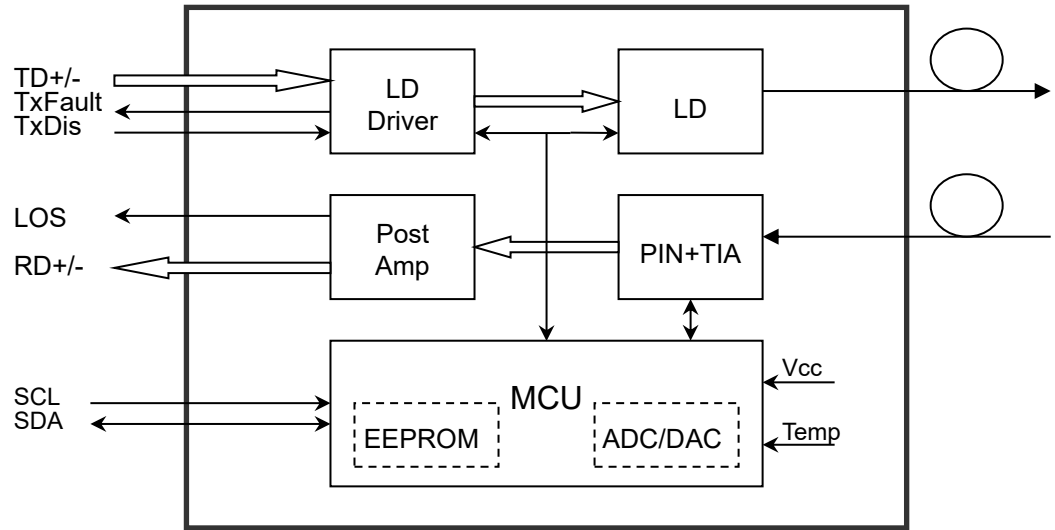
- Gigabit Ethernet (1.25Gbps)
- Fiber Channel 1xFC (1.0625Gbps)
- Switch to Switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission systems

**RAYCORE**

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# MELBYE



## 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	%

## Specifications

### Recommended Operating Conditions

Parameter		Symbol	Min	Typical	Max	Unit
Operating Case Temperature	Standard	Tc	-5		+70	°C
	Industry		-40		+85	
Power Supply Voltage		Vcc	3.13	3.3	3.47	V
Power Supply Current		Icc			300	mA
Data Rate	Gigabit Ethernet			1.25		Gbps
	Fiber Channel			1.063		



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Optical and Electrical Characteristics

**ATRG-6385-SxMDD-00: (VCSEL and PIN, 850nm, 0.55km MMF Reach)**

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Centre Wavelength	$\lambda_c$	830	850	860	nm	
Spectral Width (RMS)	$\Delta\lambda$			0.85	nm	
Average Output Power	P <sub>out</sub>	-9.5		-3.5	dBm	1
Extinction Ratio	ER	9			dB	
Optical Rise/Fall Time (20%~80%)	tr/tf			0.26	ns	
Data Input Swing Differential	V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	$\Omega$	
TX Disable	Disable		2.0		V <sub>cc</sub>	V
	Enable		0		0.8	V
TX Fault	Fault		2.0		V <sub>cc</sub>	V
	Normal		0		0.8	V
Receiver						
Centre Wavelength	$\lambda_c$	770	850	860	nm	
Receiver Sensitivity				-18	dBm	3
Receiver Overload		-3			dBm	3
Loss of Signal De-Assert	LOS <sub>D</sub>			-18	dBm	
Loss of Signal Assert	LOS <sub>A</sub>	-35			dBm	
Loss of Signal Hysteresis		0.5		4	dB	
Data Output Swing Differential	V <sub>out</sub>	400		1800	mV	4
Loss of Signal	High	2.0		V <sub>cc</sub>	V	
	Low			0.8	V	

Notes:

1. The optical power is launched into MMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 27-1 test pattern @1250Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.



ATRG-6313-MxSDD-00: (FP and PIN, 1310nm, 20km SMF Reach)

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Centre Wavelength	$\lambda_c$	1260	1310	1360	nm	
Spectral Width (RMS)	$\Delta\lambda$			4	nm	
Average Output Power	P <sub>out</sub>	-9		-3	dBm	1
Extinction Ratio	ER	9			dB	
Optical Rise/Fall Time (20%~80%)	t <sub>r</sub> /t <sub>f</sub>			0.26	ns	
Data Input Swing Differential	V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	$\Omega$	
TX Disable	Disable		2.0		V <sub>cc</sub>	V
	Enable		0		0.8	V
TX Fault	Fault		2.0		V <sub>cc</sub>	V
	Normal		0		0.8	V
Receiver						
Centre Wavelength	$\lambda_c$	1260	1310	1580	nm	
Receiver Sensitivity				-23	dBm	3
Receiver Overload		-3			dBm	3
Loss of Signal De-Assert	LOS <sub>D</sub>			-23	dBm	
Loss of Signal Assert	LOS <sub>A</sub>	-35			dBm	
Loss of Signal Hysteresis		0.5		4	dB	
Data Output Swing Differential	V <sub>OUT</sub>	400		1800	mV	4
Loss of Signal	High		2.0		V <sub>cc</sub>	V
	Low			0.8	V	V

Notes:

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>7</sup>-1 test pattern @1250Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.



ATRG-6313-DxSDD-00: (DFB and PIN, 1310nm, 40km SMF Reach)

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Centre Wavelength	$\lambda_c$	1260	1310	1360	nm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Output Power	P <sub>out</sub>	-5		0	dBm	1
Extinction Ratio	ER	9			dB	
Optical Rise/Fall Time (20%~80%)	tr/tf			0.26	ns	
Data Input Swing Differential	V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	$\Omega$	
TX Disable	Disable		2.0		V <sub>cc</sub>	V
	Enable		0		0.8	V
TX Fault	Fault		2.0		V <sub>cc</sub>	V
	Normal		0		0.8	V
Receiver						
Centre Wavelength	$\lambda_c$	1260	1310	1580	nm	
Receiver Sensitivity				-23	dBm	3
Receiver Overload		-3			dBm	3
Loss of Signal De-Assert	LOS <sub>D</sub>			-23	dBm	
Loss of Signal Assert	LOS <sub>A</sub>	-35			dBm	
Loss of Signal Hysteresis		0.5		4	dB	
Data Output Swing Differential	V <sub>OUT</sub>	400		1800	mV	4
Loss of Signal	High		2.0		V <sub>cc</sub>	V
	Low				0.8	V

Notes:

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>7</sup>-1 test pattern @1250Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.



ATRG-6315-ZxSDD-00: (DFB and PIN, 1550nm, 80km SMF Reach)

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Centre Wavelength	$\lambda_c$	1520	1550	1580	nm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Output Power	P <sub>out</sub>	0		5	dBm	1
Extinction Ratio	ER	9			dB	
Optical Rise/Fall Time (20%~80%)	tr/tf			0.26	ns	
Data Input Swing Differential	V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	$\Omega$	
TX Disable	Disable		2.0		V <sub>cc</sub>	V
	Enable		0		0.8	V
TX Fault	Fault		2.0		V <sub>cc</sub>	V
	Normal		0		0.8	V
Receiver						
Centre Wavelength	$\lambda_c$	1260	1550	1580	nm	
Receiver Sensitivity				-23	dBm	3
Receiver Overload		-3			dBm	3
Loss of Signal De-Assert	LOS <sub>D</sub>			-23	dBm	
Loss of Signal Assert	LOS <sub>A</sub>	-35			dBm	
Loss of Signal Hysteresis		0.5		4	dB	
Data Output Swing Differential	V <sub>OUT</sub>	400		1800	mV	4
Loss of Signal	High		2.0		V <sub>cc</sub>	V
	Low				0.8	V

Notes:

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>7</sup>-1 test pattern @1250Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.



ATRG-6315-ExSDD-00: (DFB and APD, 1550nm, 120km SMF Reach)

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Centre Wavelength	$\lambda_c$	1520	1550	1580	nm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Output Power	P <sub>out</sub>	0		5	dBm	1
Extinction Ratio	ER	9			dB	
Optical Rise/Fall Time (20%~80%)	tr/tf			0.26	ns	
Data Input Swing Differential	V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	$\Omega$	
TX Disable	Disable		2.0		V <sub>cc</sub>	V
	Enable		0		0.8	V
TX Fault	Fault		2.0		V <sub>cc</sub>	V
	Normal		0		0.8	V
Receiver						
Centre Wavelength	$\lambda_c$	1260	1550	1580	nm	
Receiver Sensitivity				-31	dBm	3
Receiver Overload		-9			dBm	3
Loss of Signal De-Assert	LOS <sub>D</sub>			-31	dBm	
Loss of Signal Assert	LOS <sub>A</sub>	-45			dBm	
Loss of Signal Hysteresis		0.5		4	dB	
Data Output Swing Differential	V <sub>out</sub>	400		1800	mV	4
Loss of Signal	High		2.0		V <sub>cc</sub>	V
	Low				0.8	V

Notes:

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>7</sup>-1 test pattern @1250Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.





**Timing and Electrical**

Parameter	Symbol	Min	Typical	Max	Unit
TX Disable Negate Time	t_on			1	ms
TX Disable Assert Time	t_off			10	µs
Time To Initialize, including Reset of TX Fault	t_init			300	ms
TX Fault Assert Time	t_fault			100	µs
TX Disable To Reset	t_reset	10			µs
Loss of Signal Assert Time	t_loss_on			100	µs
Loss of Signal De-assert Time	t_loss_off			100	µs
Serial ID Clock Rate	f_serial_clock			400	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

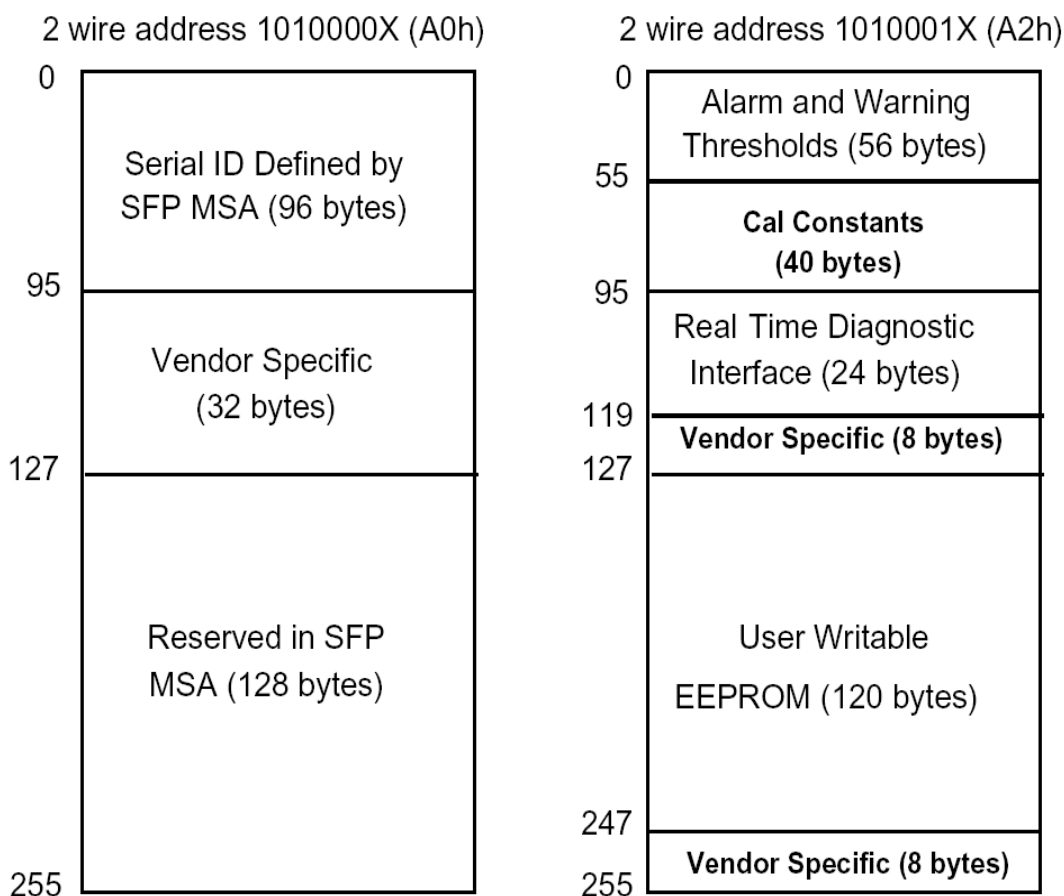
**Diagnostics**

Parameter	Range	Unit	Accuracy	Calibration
Temperature	-5 to +70	°C	±3°C	Internal/External
	-40 to +85			
Voltage	3.0 to 3.6	V	±3%	Internal/External
Bias Current	0 to 100	mA	±10%	Internal/External
TX Power	refer the spec.	dBm	±3dB	Internal/External
RX Power	refer the spec.	dBm	±3dB	Internal/External



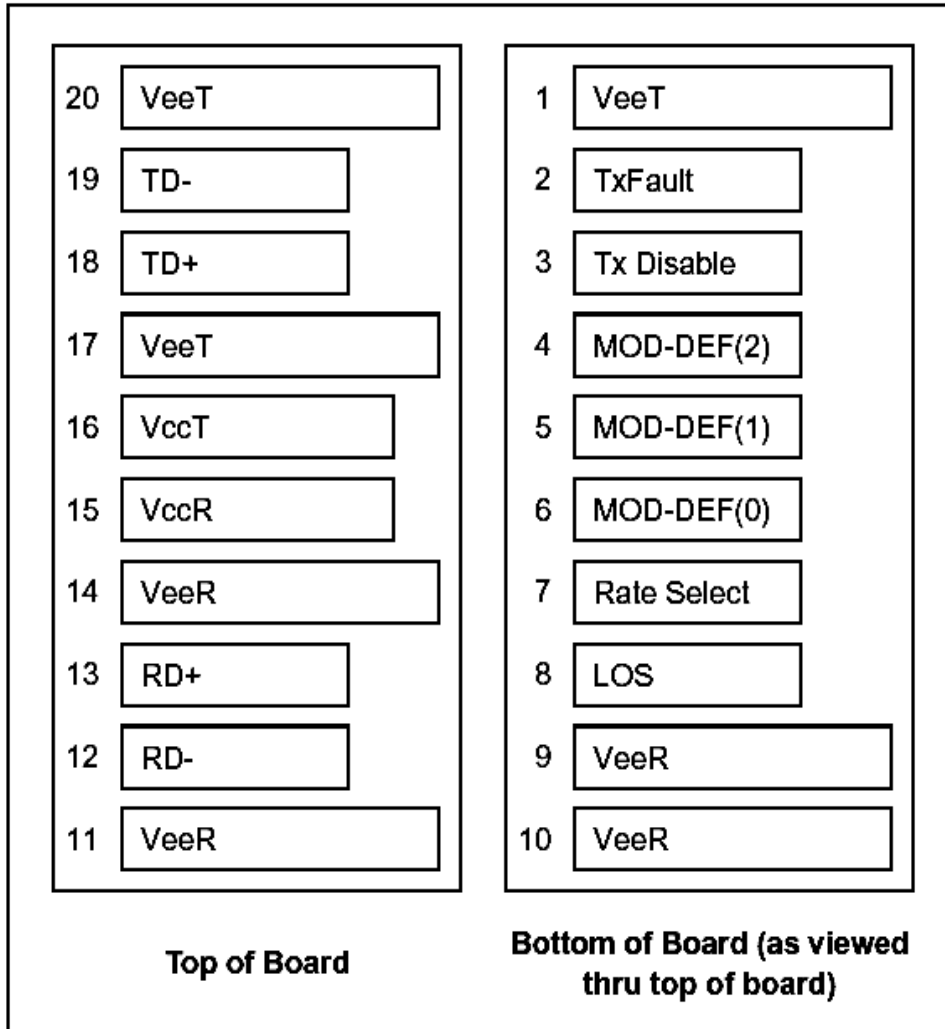
**Digital Diagnostic Memory Map**

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA). The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring. The digital diagnostic memory map specific data field defines as following.



Pin Definitions

Pin Diagram



Pin Descriptions

Pin	Signal Name	Description	Plug Seq.	Notes
1	V <sub>EET</sub>	Transmitter Ground	1	
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TX DISABLE	Transmitter Disable	3	Note 2
4	MOD_DEF(2)	SDA Serial Data Signal	3	Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	Note 3
6	MOD_DEF(0)	TTL Low	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	V <sub>EER</sub>	Receiver ground	1	
10	V <sub>EER</sub>	Receiver ground	1	
11	V <sub>EER</sub>	Receiver ground	1	
12	RD-	Inv. Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
14	V <sub>EER</sub>	Receiver ground	1	
15	V <sub>CCR</sub>	Receiver Power Supply	2	
16	V <sub>CCT</sub>	Transmitter Power Supply	2	
17	V <sub>EET</sub>	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 6
19	TD-	Inv. Transmit Data In	3	Note 6
20	V <sub>EET</sub>	Transmitter Ground	1	

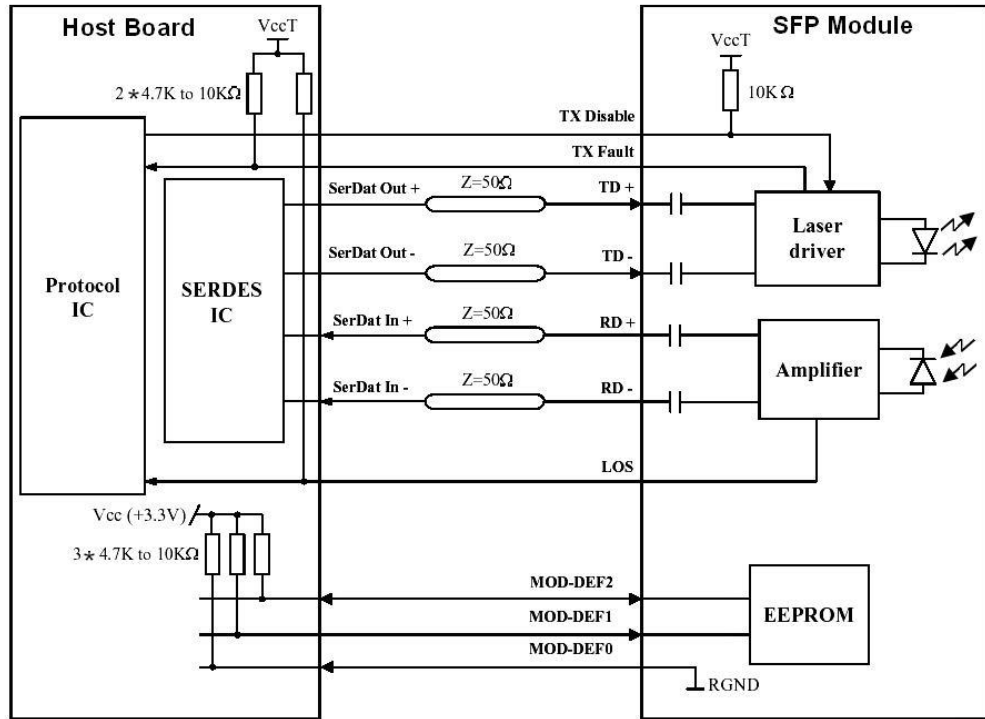
Notes:

Plug Seq.: Pin engagement sequence during hot plugging.

- TX Fault is an open collector output, which should be pulled up with a 4.7k~10kohms resistor on the host board to a voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kohms resistor. Its states are:  
 Low (0 to 0.8V): Transmitter on  
 (>0.8V, < 2.0V): Undefined  
 High (2.0 to 3.465V): Transmitter Disabled  
 Open: Transmitter Disabled
- Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7k~10ohms resistor on the host board. The pull-up voltage shall be V<sub>ccT</sub> or V<sub>ccR</sub>.  
 Mod-Def 0 is grounded by the module to indicate that the module is present  
 Mod-Def 1 is the clock line of two wire serial interface for serial ID  
 Mod-Def 2 is the data line of two wire serial interface for serial ID
- LOS is an open collector output, which should be pulled up with a 4.7k~10ohms resistor. Pull up voltage between 2.0V and V<sub>cc</sub>+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.
- RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100ohms (differential) at the user SERDES.
- TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100ohms differential termination inside the module.



Recommended Interface Circuit



Ordering information

Form Factor	Date Rate	Media	Distance	Wavelength	TX Power (dBm)	RX Sensitivity (dBm)	DDM (Y/N)	Temperature (°C)	Part Number
SFP-Dual-LC	1.25G	MMF	0.55km	850nm	-3 ~ -9.5	≤ -18	Y	-5 ~ +70	ATRG-6385-SBMDD-00
SFP-Dual-LC	1.25G	MMF	0.55km	850nm	-3 ~ -9.5	≤ -18	Y	-40 ~ +85	ATRG-6385-SMMDD-00
SFP-Dual-LC	1.25G	SMF	20km	1310nm	-3 ~ -9	≤ -23	Y	-5 ~ +70	ATRG-6313-MBSDD-00
SFP-Dual-LC	1.25G	SMF	20km	1310nm	-3 ~ -9	≤ -23	Y	-40 ~ +85	ATRG-6313-MMSDD-00
SFP-Dual-LC	1.25G	SMF	40km	1310nm	0 ~ -5	≤ -23	Y	-5 ~ +70	ATRG-6313-DBSDD-00
SFP-Dual-LC	1.25G	SMF	40km	1310nm	0 ~ -5	≤ -23	Y	-40 ~ +85	ATRG-6313-DMSDD-00
SFP-Dual-LC	1.25G	SMF	80km	1550nm	5 ~ 0	≤ -23	Y	-5 ~ +70	ATRG-6315-ZBSDD-00
SFP-Dual-LC	1.25G	SMF	80km	1550nm	5 ~ 0	≤ -23	Y	-40 ~ +85	ATRG-6315-ZMSDD-00
SFP-Dual-LC	1.25G	SMF	120km	1550nm	5 ~ 0	≤ -31	Y	-5 ~ +70	ATRG-6315-EBSDD-00
SFP-Dual-LC	1.25G	SMF	120km	1550nm	5 ~ 0	≤ -31	Y	-40 ~ +85	ATRG-6315-EMSDD-00

