

EOLP-1396-40

1310nm SFP+ single-Mode Transceiver, With Diagnostic Monitoring 10G BASE-EW/ER

Duplex SFP+ Transceiver, RoHS 6 Compliant

Features

- ◆ Operating data rate up to 11.3Gbps
- ◆ 1310nm DFB-LD Transmitter
- ◆ Distance up to 40km
- ◆ Single 3.3V Power supply and TTL Logic Interface
- ◆ Duplex LC Connector Interface
- ♦ Hot Pluggable
- ◆ Power Dissipation < 1.5W
- Compliant with MSA SFP+ Specification SFF-8431
- ◆ Compliant with IEEE 802.3ae 10GBASE-ER/EW
- ◆ Operating Case Temperature

Standard: 0°C~+70°C

Industrial: -40°C~+85°C



Applications

- ♦ 10GBASE-ER at 10.31Gbps
- ◆ 10GBASE-EW at 9.95Gbps
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s,
 1.536 Gb/s, 0.768Gb/s
- CPRI rates 10.138Gb/s ,9.830
 Gb/s,7.373Gb/s, 6.144 Gb/s, 4.915
 Gb/s, 2.458 Gb/s, 1.229 Gb/s,
 0.614Gb/s
- Other optical links

Ordering information

Part No.	Data Rate	Laser	Fiber Type	Distance	Optical Interface	Temp.	DDMI
EOLP-1396-40*	0.614Gbps to 11.3Gbps	1310nm DFB	SMF	40km	LC	Standard	YES
EOLP-1396-40-I	0.614Gbps to 11.3Gbps	1310nm DFB	SMF	40km	LC	Industrial	YES

^{*}The product image only for reference purpose.



Regulatory Compliance*

Product Certificate	Certificate Number	Applicable Standard
		EN 60950-1:2006+A11+A1+A12+A2
TUV	R50135086	EN 60825-1:2014
		EN 60825-2:2004+A1+A2
1.11	F247227	UL 60950-1
UL	E317337	CSA C22.2 No. 60950-1-07
EMC CE	AE 50285865 0001	EN 55022:2010
EIVIC CE	AE 30203003 0001	EN 55024:2010
FCC	WTF14F0514417E	47 CFR PART 15 OCT., 2013
FDA	1	CDRH 1040.10
ROHS	1	2011/65/EU

^{*}The above certificate number updated to June 2014, because some certificate will be updated every year, such as FDA and ROHS. For the latest certification information, please check with Eoptolink.

Product Description

The EOLP-1396-40 series single mode transceiver is small form factor pluggable module for serial optical data communications such as IEEE 802.3ae 10GBASE-ER/EW. It is with the SFP+ 20-pin connector to allow hot plug capability.

This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.

The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	V _{CC}	-0.5	3.6	V
Input Voltage	Vin	-0.5	Vcc	V
Output Current	lo	-	50	mA

Recommended Operating Conditions

Parameter		Symbol		Typical	Max.	Unit
Operating Case	Tc	EOLP-1396-40	0		+70	°C
Temperature	I C	EOLP-1396-40-I	-40		+85	
Power Supply Voltage		Vcc		3.3	3.45	V
Power Supply Current		Icc			430	mA
Surge Current	Surge				+30	mA
Baud Rate					11.3	Gbps



Performance Specifications – Electrical

Parameter	Symbol	Min.	Тур.	Max	Unit	Notes
	Tran	smitter				
CML Inputs(Differential)	Vin	150		1200	mVpp	AC coupled inputs
Input AC Common Mode Voltage		0		25	mV	RMS
Input Impedance (Differential)	Zin	85	100	115	ohm	Rin > 100 kohms @ DC
Differential Input S-parameter	S _{DD} 11	-	-	-10	dB	
Differential to Common Mode Conversion	S _{CD} 11	-	-	-10	dB	
Tx_DISABLE Input Voltage – High		2		3.45	V	
Tx_DISABLE Input Voltage – Low		0		0.8	V	
Tx_FAULT Output Voltage – High		2		Vcc+0.3	V	Io = 400µA; Host Vcc
Tx_FAULT Output Voltage – Low		0		0.5	V	Io = -4.0mA
	Red	ceiver				
CML Outputs (Differential)	Vout	350		700	mVpp	AC coupled outputs
Output AC Common Mode Voltage		0		15	mV	RMS
Output Impedance (Differential)	Zout	90	100	110	ohm	
Differential Output S-parameter	S _D 22	-	-	-10	dB	
Rx_LOS Output Voltage – High		2		Vcc+0.3	V	lo = 400μA; Host Vcc
Rx_LOS Output Voltage – Low		0		0.8	V	lo = -4.0mA
MOD DEF (0:2)	VoH	2.5			V	With Serial ID
IVIOD_DEF (0.2)	VoL	0		0.5	V	WILLI SCHALID

Performance Specifications – Optical

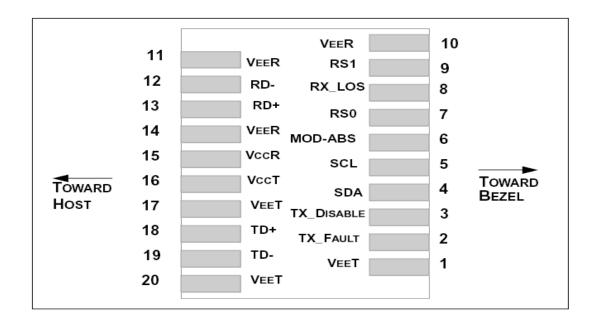
Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF			40		Km
Data Rate		0.614		11.3	Gbps
	Transmitter				
Centre Wavelength	λc	1270	1310	1355	nm
Spectral Width (-20dB)	Δλ			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power	Pout	+1		+5	dBm
Extinction Ratio	ER	3.5			dB
Average Power of OFF Transmitter	Poff			-30	dBm
Transmitter Dispersion Penalty	TDP			2	dB



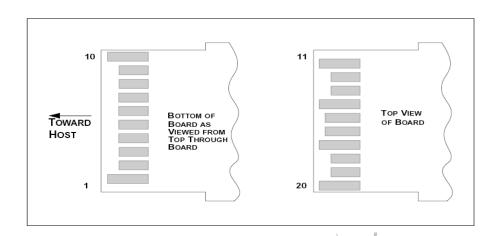
SFP+ Series

Input Diffe	Z _{IN}	90	100	110	Ω	
TX Disable	Disable		2.0		Vcc+0.3	V
1 A Disable	Enable		0		0.8	
TX Fault	Fault		2.0		V _{CC} +0.3	V
1 A Fault	Normal		0		0.8	V
TX Disa	ble Assert Time	t_off	-	-	10	us
TX_DISAI	BLE Negate Time	t_on	-	-	1	ms
TX_BISABL	E time to start reset	t_reset	10	-	-	us
Time to i	t_init	-	-	300	ms	
TX_FAULT fr	t_fault	-	-	100	us	
Т	TJ	-	-	0.28	UI(p-p)	
Data D	DDJ	-	-	0.1	UI(p-p)	
Unco	rrelated Jitter	UJ	-	-	0.023	RMS
		Receiver				
Centro	e Wavelength	λ	1260		1565	nm
Sensitivity		P _{min}			-15	dBm
Receiver Overload		P _{max}	0.5			dBm
Optical Return Loss		ORL			-12	dB
LOS	S De-Assert	LOSD			-16	dBm
LO	OS Assert	LOSA	-25			dBm

SFP+ Transceiver Electrical Pad Layout







Pin Function Definitions

Pin Num.	Name	FUNCTION	Plug Seq.	Notes		
1	VeeT	Transmitter Ground	1	Note 5		
2	TX Fault	Transmitter Fault Indication	3	Note 1		
3	TX Disable	Transmitter Disable	3	Note 2, Module disables on high or open		
4	SDA	Module Definition 2	3	Data line for Serial ID.		
5	SCL	Module Definition 1	3	Clock line for Serial ID.		
6	MOD-ABS	Module Definition 0	3	Note 3		
7	RS0	RX Rate Select (LVTTL).	3	No Function Implement		
8	LOS	Loss of Signal	3	Note 4		
9	RS1	TX Rate Select (LVTTL).	1	No Function Implement		
10	VeeR	Receiver Ground	1	Note 5		
11	VeeR	Receiver Ground	1	Note 5		
12	RD-	Inv. Received Data Out	3	Note 6		
13	RD+	Received Data Out	3	Note 7		
14	VeeR	Receiver Ground	1	Note 5		
15	VccR	Receiver Power	2	3.3V ± 5%, Note 7		
16	VccT	Transmitter Power	2	3.3V ± 5%, Note 7		
17	VeeT	Transmitter Ground	1	Note 5		
18	TD+	Transmit Data In	3	Note 8		
19	TD-	Inv. Transmit Data In	3	Note 8		
20	VeeT	Transmitter Ground	1	Note 5		

Notes

1) TX Fault is an open collector/drain output, which should be pulled up with a $4.7K-10K\Omega$ resistor on the host board. Pull up voltage between 2.0V and VccT/R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.



2) TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a $4.7K-10~K\Omega$ resistor. Its states are:

Low (0 - 0.8V): Transmitter on (>0.8, < 2.0V): Undefined

High (2.0 – 3.465V): Transmitter Disabled

Open: Transmitter Disabled

- 3) Module Absent, connected to VeeT or VeeR in the module.
- 4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K 10KΩ resistor. Pull up voltage between 2.0V and VccT/R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
- 5) VeeR and VeeT may be internally connected within the SFP+ module.
- 6) RD-/+: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.
- 7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP+ connector pin. Maximum supply current is 430mA. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP+ input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP+ transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP+ transceiver module.
- 8) TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

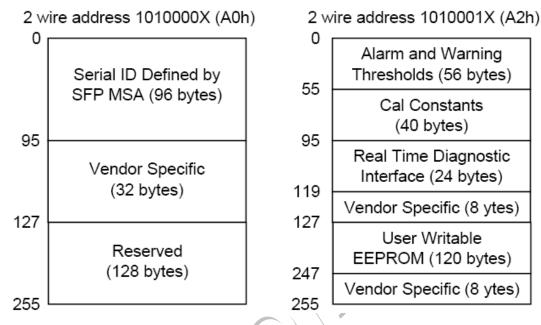
EEPROM

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not written protected within the SFP+ transceiver. The negative edge clocks data from the SFP+ transceiver. The serial data signal (SDA) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

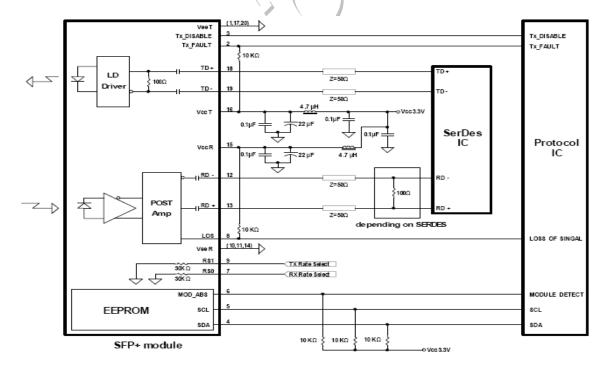
The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. If the module is defined as external calibrated, the diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in



EEPROM locations 56 - 95 at wire serial bus address A2h. The digital diagnostic memory map specific data field define as following .For detail EEPROM information, please refer to the related document of SFF 8472 Rev 10.2.

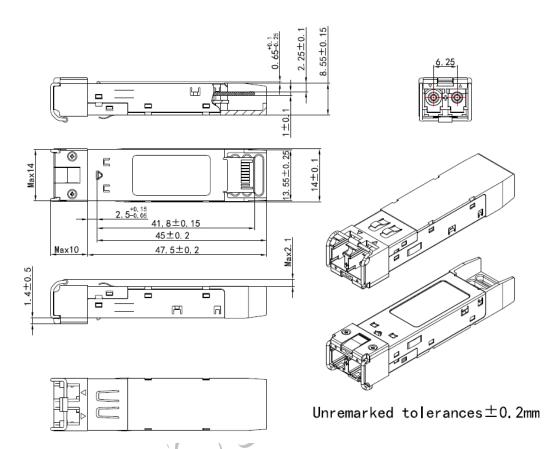


Recommend Circuit Schematic





Mechanical Specifications



*This 2D drawing only for reference, please check with Eoptolink before ordering.

Eye Safety

This single-mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

Obtaining Document

You can visit our website: http://www.eoptolink.com

Or contact Eoptolink Technology Inc., Ltd. Listed at the end of the documentation to get the latest document.

Revision History

Revision	Initiated	Reviewed	Approved	Revision History	Release Date
V1.a	Cathy			Released.	2010-12-7
V1.b	Cathy			Updated sensitivity.	2010-12-15
V1.c	Cathy			Updated output power value.	2010-11-3
V2.0	Alex/	Kelly.Cao		Update spelling mistake	Aug 10,



SFP+ Series

Townie Add power dissipation and industrial product. Aug 23, 2011	,					
V2.a Iownie Kelly and industrial product. 2011 V2.b Kelly Add TDP. Sep 6, 2011 V2.c Kelly Add CDR products. Jun 5, 2012 Update Regulatory Compliance and Mechanical Specifications Feb 3, 2015 V2.e Angela Kelly/ JP/Vina Add CPRI/OBSAI application. Update temperature range and the tolerances of 2D drawing. V2.f Angela Kelly/Fing Update the Tx power. Jan 04,2016 V2.g Elaine Chao.Wang/ Kelly/William/ Tony/Vina/Peter Update the 2D drawing, the address and the contact information. Sep 25, 2017 V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and March 22, 2018		Townie				2011
V2.b Kelly Add TDP. Sep 6, 2011	\/2 a	Townic	Kolly		Add power dissipation	Aug 23,
V2.c Kelly V2.c Kelly V2.d Abby Kelly/Vina Kelly/Vina Kelly/Vina Kelly/Vina Kelly/ JP/Vina Kelly/ JP/Vina Kelly/Fing V2.d Angela Kelly/Fing V2.d Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang Kelly/Fing/JP/ Eason/William/ Chao.Wang Kelly/Fing/JP/ Eason/William/ Chao.Wang Kelly/Fing Add CDR products. Jun 5, 2012 Lydate Regulatory Compliance and Mechanical Specifications Add CPRI/OBSAI application. Update temperature range and the tolerances of 2D drawing. Update the Tx power. Jan 04,2016 Update the 2D drawing, the address and the contact information. Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and	VZ.a TOWING		IXCIIy		and industrial product.	2011
V2.c Kelly V2.d Abby Kelly/Vina Kelly/Vina Kelly/Vina Kelly/Vina Kelly/JP/Vina Kelly/Fing V2.g Elaine Kelly/Fing/JP/Eason/William/Chao.Wang Kelly/Fing/JP/Eason/William/Chao.Wang Kelly/Fing/JP/Eason/William/Chao.Wang Kelly/Fing Add CPRI/OBSAI Application. Update temperature range and the tolerances of 2D drawing. Update the Tx power. Jan 04,2016 Update the 2D drawing, the address and the contact information. Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and March 22, 2018	\/2 b	Kally			Add TDD	Sep 6,
V2.d Abby Kelly/Vina Update Regulatory Compliance and Mechanical Specifications V2.e Angela Kelly/ JP/Vina Angela Kelly/Fing V2.f Angela Chao.Wang/ Kelly/William/ Tony/Vina/Peter V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang V2.h Angela Kelly/Fing/JP/ Eason/William/ Phlio Chao.Wang V2.h Angela Kelly/Fing/JP/ Eason/William/ Phlio Update the CPRI data rates and RSO/RS1 Pin function definition notes. Update the picture and March 22, 2018	V2.D	Relly			Add TDF.	2011
V2.d Abby Kelly/Vina Compliance and Mechanical Specifications Feb 3, 2015 V2.e Angela Kelly/ JP/Vina Add CPRI/OBSAI application. Update temperature range and the tolerances of 2D drawing. July 03,2015 V2.f Angela Kelly/Fing Update the Tx power. Jan 04,2016 V2.g Elaine Chao.Wang/ Kelly/William/ Tony/Vina/Peter Update the 2D drawing, the address and the contact information. Sep 25, 2017 V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and March 22, 2018	V2.c	Kelly			Add CDR products.	Jun 5, 2012
V2.e Angela Kelly/Vina Mechanical Specifications Kelly/ JP/Vina Angela Kelly/Fing V2.f Angela Kelly/Fing V2.g Elaine Chao.Wang/ Kelly/William/ Tony/Vina/Peter V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang V2.h Langela Kelly/Fing/JP/ Eason/William/ Chao.Wang Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio Mechanical Specifications Add CPRI/OBSAI application. Update temperature range and the tolerances of 2D drawing. Update the Tx power. Update the 2D drawing, the address and the contact information. Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and					Update Regulatory	
V2.e Angela Kelly/ JP/Vina Kelly/ JP/Vina Angela Kelly/ V2.f Angela Kelly/Fing Update the Tx power. V2.g Elaine Chao.Wang/ Kelly/William/ Tony/Vina/Peter Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and March 22, 2018 Washing Specifications Add CPRI/OBSAI application. Update temperature range and the tolerances of 2D drawing. Update the Tx power. Update the 2D drawing, the address and the contact information. Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and	//2 d	Λhby	Kolly/Vina		Compliance and	Fob 3, 2015
V2.e Angela Kelly/ JP/Vina Kelly/ JP/Vina Lemperature range and the tolerances of 2D drawing. V2.f Angela Kelly/Fing Leason/William/ Tony/Vina/Peter Chao.Wang/ Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio	V2.u	Abby	Keliy/ Villa		Mechanical	1 60 3, 2013
V2.e Angela Kelly/ JP/Vina application. Update temperature range and the tolerances of 2D drawing. July 03,2015 V2.f Angela Kelly/Fing Update the Tx power. Jan 04,2016 V2.g Elaine Chao.Wang/Kelly/William/Tony/Vina/Peter Update the 2D drawing, the address and the contact information. Sep 25, 2017 V2.h Angela Kelly/Fing/JP/Eason/William/Chao.Wang Phlio function definition notes. Update the picture and March 22, 2018					Specifications	
V2.e Angela					Add CPRI/OBSAI	
V2.e Angela JP/Vina temperature range and the tolerances of 2D drawing. V2.f Angela Kelly/Fing Update the Tx power. V2.g Elaine Chao.Wang/ Kelly/William/ Tony/Vina/Peter V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang V2.h Lason/William/ Chao.Wang V2.h Lason/William/ Chao.Wang V2.h Lason/William/ Chao.Wang V3.h Lason/William/ Chao.Wang V4.h Lason/William/ Chao.Wang V5.h Lason/William/ Chao.Wang V6.h Lason/William/ Chao.Wang V6.h Lason/William/ Chao.Wang V7.h Lason/William/ Chao.Wang V8.h Lason/William/ Chao.Wang V8.h Lason/William/ Chao.Wang V8.h Lason/William/ Chao.Wang V9.h Lason/William/ Chao.Wang			Kolly/		application. Update	luly
V2.f Angela Kelly/Fing Update the Tx power. Jan 04,2016 V2.g Elaine Chao.Wang/ Kelly/William/ Tony/Vina/Peter Chao.Wang Phlio Chao.Wang Phlio Update the 2D drawing, the address and the contact information. V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and Update the picture and March 22, 2018	V2.e	Angela	1		temperature range and	
V2.f Angela Kelly/Fing Update the Tx power. Jan 04,2016 V2.g Elaine Chao.Wang/ Kelly/William/ Tony/Vina/Peter Update the 2D drawing, the address and the contact information. Sep 25, 2017 V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio function definition notes. Update the picture and March 22, 2018			JF/VIIIa		the tolerances of 2D	03,2015
V2.f Angela Kelly/Fing 04,2016 V2.g Elaine Chao.Wang/ Kelly/William/ Tony/Vina/Peter Chao.Wang/ Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio Chao.Wang Phlio Chao.Wang Phlio Update the CPRI data rates and RSO/RS1 Pin function definition notes. Update the picture and March 22, 2018					drawing.	
V2.g Elaine Chao.Wang/ Kelly/William/ Tony/Vina/Peter Chao.Wang/ V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio Gunction definition notes. Update the 2D drawing, the address and the contact information. Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and	\/2 f	Angela	Kelly/Fing		Update the Tx power.	Jan
V2.g Elaine Kelly/William/ Tony/Vina/Peter Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio Grawing, the address and the contact information. Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and March 22, 2018	V Z.1	Angela	Kelly/I IIIg			04,2016
V2.g Elaine Kelly/William/ Tony/Vina/Peter and the contact information. V2.h Angela Esson/William/ Chao.Wang Phlio drawing,the address and the contact information. Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and March 22, 2018			Chao Wang/		Update the 2D	
Tony/Vina/Peter Tony/Vina/Peter Tony/Vina/Peter Tony/Vina/Peter Tony/Vina/Peter Tony/Vina/Peter Tony/Vina/Peter Tony/Vina/Peter Information. Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and March 22, 2018	V/2 a	Flaine	_		drawing,the address	Sep 25,
V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio information. Update the CPRI data rates and RS0/RS1 Pin function definition notes. Update the picture and	VZ.g	Liairic	\		and the contact	2017
V2.h Angela Kelly/Fing/JP/ Eason/William/ Chao.Wang Phlio rates and RS0/RS1 Pin function definition notes. Update the picture and Update the picture and			Torry/ Viria/T CtCl		information.	
V2.h Angela Eason/William/ Phlio function definition notes. Chao.Wang Phlio function definition notes. Update the picture and					Update the CPRI data	
V2.h Angela Eason/William/ Phlio function definition notes. Chao.Wang Update the picture and			Kelly/Fing/JP/		rates and RS0/RS1 Pin	March 22
Chao.Wang Update the picture and	V2.h	Angela	Eason/William/	Phlio	function definition notes.	, i
2D drawing.		,	Chao.Wang		Update the picture and	2010
					2D drawing.	

Notice:

Eoptolink reserves the right to make changes to or discontinue any optical link product or service identified in this publication, without notice, in order to improve design and/or performance. Applications that are described herein for any of the optical link products are for illustrative purposes only. Eoptolink makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Contact:

Add: No.127 West Wulian Street, Gongxing Town, Shuangliu district, Chengdu City, Sichuan, China.

Tel: (+86) 028-67087999 Fax: (+86) 28-67087979-8010

Postal: 610213

E-mail:sales@eoptolink.com http://www.eoptolink.com