EOLP-1696-14XXN series

SFP+ Single-Mode for DWDM Application
Duplex SFP+ Transceiver
Digital Diagnostic Function
0.6~10Gb/s CPRI/OBSAI
RoHS6 Compliant

Features

- Available in all C-Band Wavelengths on the 100GHz DWDM ITU Grid
- Temperature-Stabilized DWDM EML Transmitter
- Duplex LC Connector
- Power Dissipation < 2.0W
- Dispersion tolerance from -300ps/nm to 800ps/nm
- Hot-Pluggable SFP+ Footprint
- Compliant with SFF-8431 MSA
- Compliant with SFF-8432 MSA
- Operating Case Temperature

  Standard: 0°C to 70°C
  Industrial: -40°C to 85℃

Applications

- 10GBASE-ER/EW
- 10G FC
- 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	Power budget	CDR	Case Temperature
EOLP-1696-14XXN*(note1)	0.6Gbps to 11.3Gbps	DWDM EML	14dB	NO	Standard
EOLP-1696-14XXIN*(note1)	0.6Gbps to 11.3Gbps	DWDM EML	14dB	NO	Industrial

Note1: XX refers to DWDM Wavelength channel as ITU-T specified, please refer the following table for detailed center wavelength information.

*The product image only for reference purpose.

XX- Channel refers to the following table:

Channel (X)*Note2	Part NO.	Frequency (THz)	Center Wavelength (nm)
15	EOLP-1696-1415N	191.5	1565.50
16	EOLP-1696-1416N	191.6	1564.68
17	EOLP-1696-1417N	191.7	1563.86
18	EOLP-1696-1418N	191.8	1563.05
19	EOLP-1696-1419N	191.9	1562.23
20	EOLP-1696-1420N	192.0	1561.42
21	EOLP-1696-1421N	192.1	1560.61
22	EOLP-1696-1422N	192.2	1559.79
23	EOLP-1696-1423N	192.3	1558.98
24	EOLP-1696-1424N	192.4	1558.17
25	EOLP-1696-1425N	192.5	1557.36
26	EOLP-1696-1426N	192.6	1556.55
27	EOLP-1696-1427N	192.7	1555.75
28	EOLP-1696-1428N	192.8	1554.94
29	EOLP-1696-1429N	192.9	1554.13
30	EOLP-1696-1430N	193.0	1553.33
31	EOLP-1696-1431N	193.1	1552.52
32	EOLP-1696-1432N	193.2	1551.72
33	EOLP-1696-1433N	193.3	1550.92
34	EOLP-1696-1434N	193.4	1550.12
35	EOLP-1696-1435N	193.5	1549.32
36	EOLP-1696-1436N	193.6	1548.51
37	EOLP-1696-1437N	193.7	1547.72
38	EOLP-1696-1438N	193.8	1546.92
39	EOLP-1696-1439N	193.9	1546.12
40	EOLP-1696-1440N	194.0	1545.32
41	EOLP-1696-1441N	194.1	1544.53
42	EOLP-1696-1442N	194.2	1543.73
43	EOLP-1696-1443N	194.3	1542.94
44	EOLP-1696-1444N	194.4	1542.14
45	EOLP-1696-1445N	194.5	1541.35
46	EOLP-1696-1446N	194.6	1540.56
47	EOLP-1696-1447N	194.7	1539.77
48	EOLP-1696-1448N	194.8	1538.98
49	EOLP-1696-1449N	194.9	1538.19
50	EOLP-1696-1450N	195.0	1537.40
51	EOLP-1696-1451N	195.1	1536.61
52	EOLP-1696-1452N	195.2	1535.82
53	EOLP-1696-1453N	195.3	1535.04

54	EOLP-1696-1454N	195.4	1534.25
55	EOLP-1696-1455N	195.5	1533.47
56	EOLP-1696-1456N	195.6	1532.68
57	EOLP-1696-1457N	195.7	1531.90
58	EOLP-1696-1458N	195.8	1531.12
59	EOLP-1696-1459N	195.9	1530.33
60	EOLP-1696-1460N	196.0	1529.55
61	EOLP-1696-1461N	196.1	1528.77

*Note2: Please contact with EOPTOLINK for the channel availability.

Regulatory Compliance*Note3

Product Certificate	Certificate Number	Applicable Standard
TUV	R50135086	EN 60950-1:2006+A11+A1+A12+A2
		EN 60825-1:2014
		EN 60825-2:2004+A1+A2
UL	E317337	UL 60950-1
		CSA C22.2 No. 60950-1-07
EMC CE	AE 50384190 0001	EN 55032:2012
		EN 55032:2015
		EN 55024:2010
		EN 55024:2010+A1
‘FCC	WTF14F0514417E	47 CFR PART 15 OCT., 2013
FDA	/	CDRH 1040.10
ROHS	/	2011/65/EU

Note3: The above certificate number updated to June 2018, 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-1696-14XXN series single mode transceiver is small form factor pluggable module for duplex optical data communications. This module is designed for single mode fiber and operates at a nominal DWDM wavelength from 1528nm to 1566nm as specified by the ITU-T. It is designed to deploy in the DWDM networking equipment in metropolitan access and core networks.

It is with the SFP+ 20-pin connector to allow hot plug capability. The transmitter section uses a DWDM EML laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses a PIN detector and a limiting post-amplifier IC.

The EOLP-1696-14XXN series are designed to be compliant with SFP+ Multi-Source Agreement (MSA) Specification SFF-8431.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity		-	85	%

*Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	Standard	0		+70	°C
		Industrial	-40		+85	°C
Power Supply Voltage	Vcc		3.135	3.3	3.465	V
Power Supply Current*Note4	Icc (0°C to 70°C)				455	mA
	Icc (-40°C to 85°C)				606	mA
Data Rate	DR		0.6	10.3	11.3	Gbps

Note4: The maximum current is calculated according to the 3.3V voltage.

Performance Specifications – Electrical

Parameter		Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter							
CML Inputs(Differential)		Vin	250		1000	mVpp	AC coupled input*(note5)
Input Impedance (Differential)		Zin	85	100	115	ohm	Rin > 100 kohm @ DC
TX_Dis	Disable		2		Vcc+0.3	V	
	Enable		0		0.8		
TX_FAULT	Fault		2		Vcc+0.3	V	
	Normal		0		0.5		
Receiver							
CML Outputs (Differential)		Vout	350		700	mVpp	AC coupled output*(note5)
Output Impedance (Differential)		Zout	85	100	115	ohm	
RX_LOS	LOS		2		Vcc+0.3	V	
	Normal		0		0.8	V	
MOD_DEF (0:2)		VoH	2.5			V	With Serial ID
		VoL	0		0.5	V	

Note6: CML logic, internally AC coupled.

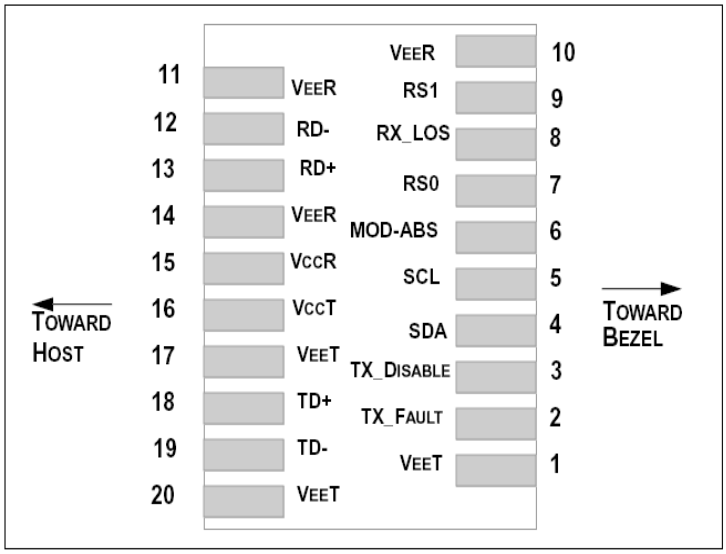
Performance Specifications – Optical

Parameter	Symbol	Min.	Typical	Max.	Unit
Data Rate		0.6	10.3	11.3	Gbps
Transmitter					
Center Wavelength Spacing			100		GHz
			0.8		nm
Spectral width(RMS)	Δλ		0.15	0.3	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power*(note6)	Pout	-1		4	dBm
Average Launch Power (Tx: OFF)	Poff			-30	dBm
Extinction Ratio	ER	3.5			dB
Transmitter Dispersion Penalty @800ps/nm	TDP			2	dB
P_{out}@TX Disable Asserted	Pout			-45	dBm
Relative Intensity Noise	RIN			-128	dB/Hz
TX Jitter	TXj	Per 802.3ae requirements			
Receiver					
Receiver Sensitivity*(note7)	Pmin			-15	dBm
Receiver Overload	Pmax	-1			dBm
LOS De-Assert	LOSD			-17	dBm
LOS Assert	LOSA	-29			dBm
LOS Hysteresis		1			dB

Note6: Output is coupled into a 9/125μm single-mode fiber.

Note7: Minimum average optical power measured at the BER less than 1E-12. The measure pattern is PRBS 2^{31}-1.

SFP+ Transceiver Electrical Pad Layout



Pin Function Definition

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	Note 3, Data line for Serial ID.
5	SCL	Module Definition 1	3	Note 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	3.3 ± 5%, Note 7
16	VccT	Transmitter Power	2	3.3 ± 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 – 10KΩ 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 4.7 – 10 KΩ 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 are 435mA/545mA(Standard/Industrial). 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**.**

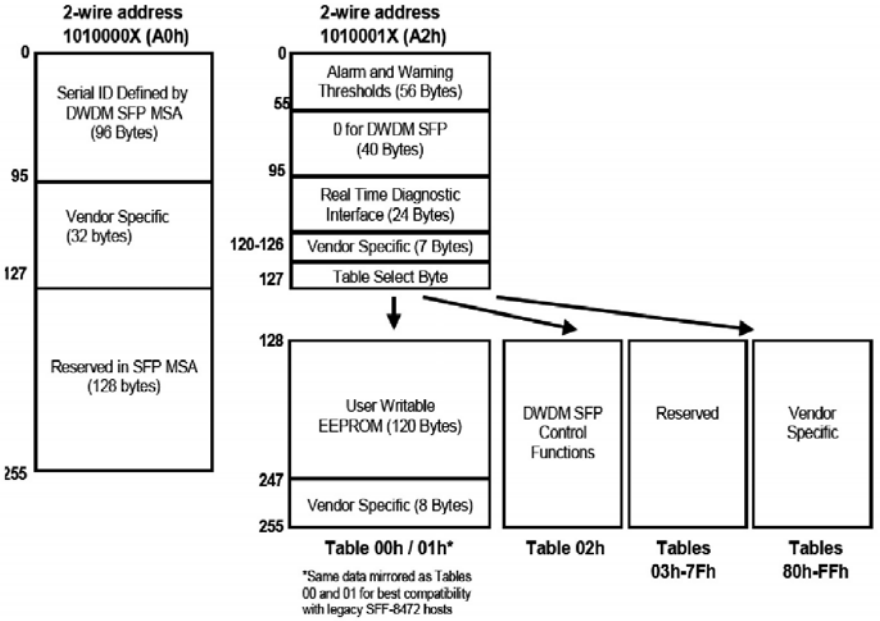
EEPROM

The optical transceiver contains an EEPROM. It provides access to sophisticated identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

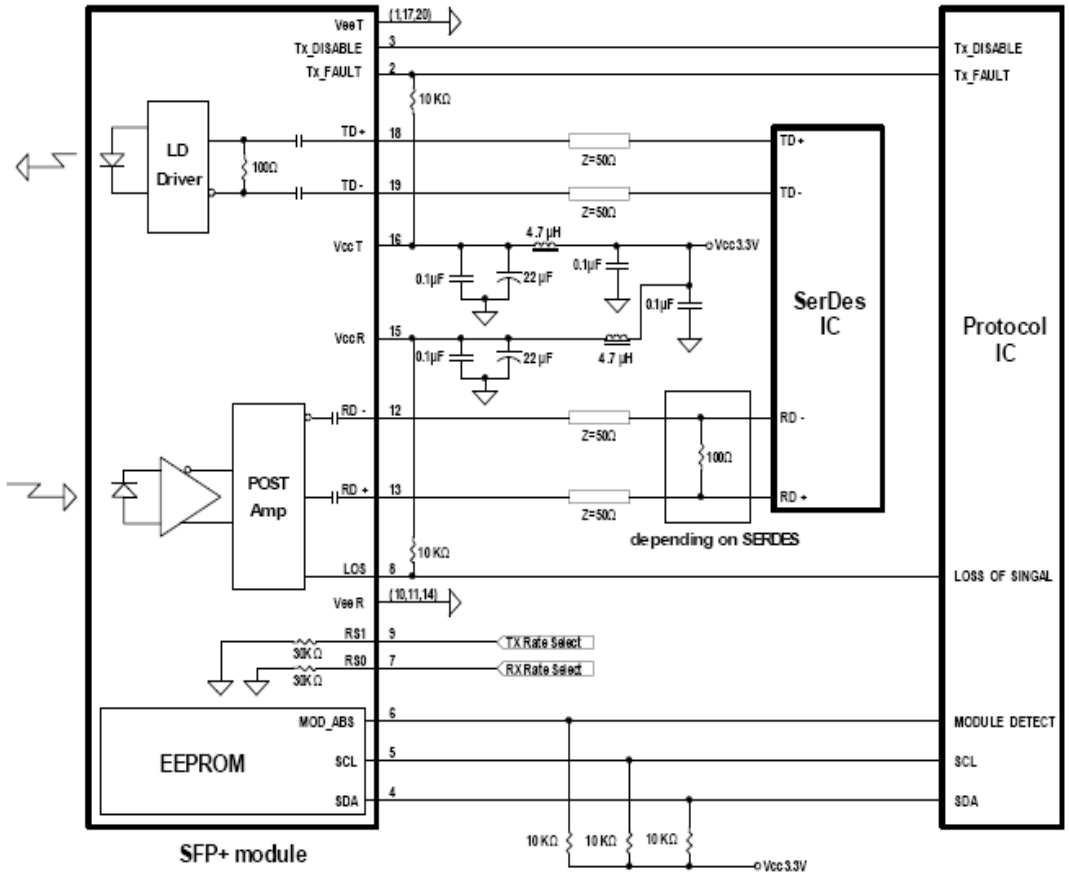
The serial interface uses the 2-wire serial CMOS EEPROM protocol. When the serial protocol is activated, the host generates the serial clock signal (SCL, Mod Def 1). The positive edge clocks data into those segments of the EEPROM that are not writing protected within the SFP+ transceiver. The negative edge clocks data from the SFP+ transceiver. The serial data signal (SDA, Mod Def 2) 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. Alarm/warning threshold data is written during device manufacture. TEC current monitoring, laser temperature monitoring, received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and transceiver temperature monitoring all are implemented. The diagnostic data are internal calibration and stored in memory locations 96 –

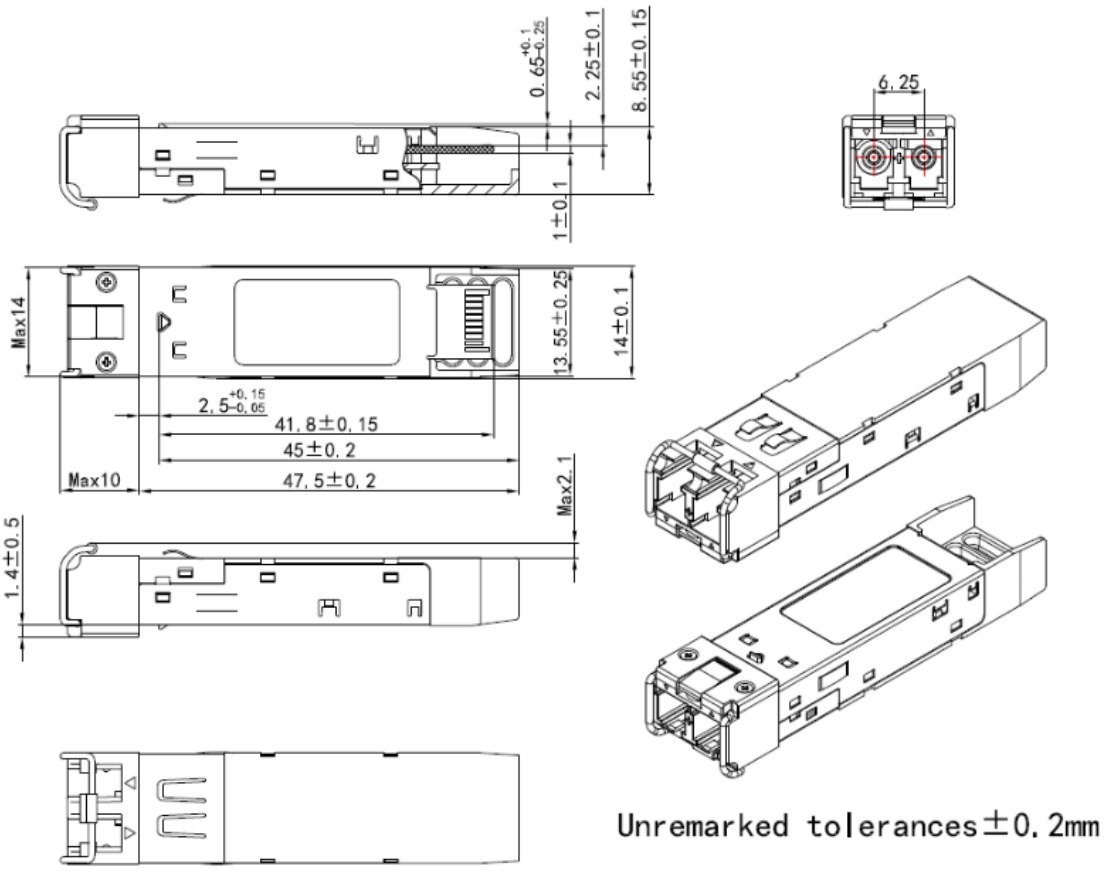
109 at wire serial bus address A2h. The transceiver memory map specific data field defines as following.



Recommend Circuit Schematic



Mechanical Specifications



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

Laser Emission

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 documents.

Revision History

Revision	Initiated	Reviewed	Approved	DCN	Release Date
V1.a	Alex	Kelly		New Released.	July 16, 2012
V1.b	Angela	Kelly		Update mechanical spec. & power dissipation & Er & application.	July 24, 2012
V1.c	Angela	Kelly		Update photo.	July 27, 2012
V1.d	Angela	Kelly		Update .Power Dissipation & Icc & Pout & Sen.	Aug 1, 2012
V1.e	Abby	Kelly, Fing	Richard	Update min. output power to -1dBm&pin definition notes	Mar 5, 2013
V1.f	Frank	Kelly, Fing		Update Data rate &Sen &LOSA & LOSD, correct PN on page2~3.	Mar 13, 2013
V1.g	Abby	Kelly/Vina		Update Regulatory Compliance and Mechanical Specifications	Feb 5, 2015
V1.h	Angela	Kelly/Vina		Update the tolerances of mechanical specification.	Mar 27,2015
V1.i	Angela	Vina/Fing/Jp/Eason/Jason		Add CPRI&OBSAI application and industrial temperature range. Update max data rate and the tolerances of 2D drawing.	April 21,2015
V1.j	Angela	Kelly/Vina		Correct the 2D drawing.	July 8, 2015
V1.k	Angela	Kelly/Fing/JP/Eason		Update the max power dissipation and regulatory compliance.	Dec 17,2015
V1.l	Angela	Kelly/Fing/JP/Eason/Torres/Marvin/Picard/Arion/Erik/ Tracy/Neal		Change the industrial temperature to extended temperature.	April 26,2016

V1.m	Angela	Fing/Eason/ Phlio/Kelly/ Vina/Dean		Add the spectral width and update 2D drawing.	July 19,2016
V1.n	Airon	Fing/Eason/JP/ Kelly/Angela		Change the extended temperature to industrial temperature,update the address and the contact information.	Sep 20, 2017
V1.o	Elaine	Kelly/Angela/Marvin/ Torres/Sky/William/ Chao.Wang		Update the CPRI data rates, the RS0/RS1 Pin function definition notes, picture and 2D drawing.	Mar 24, 2018
V1.p	Angela	Torres/Kelly /Fing/Eason/ Flagon		Update the regulatory compliance. Change the max power dissipation of industrial temperature series from 1.8W to 2.0W.	October 10, 2018

Notice:

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