Multi-rate 10-Gigabit CWDM 70km XFP Transceivers with Digital Diagnostics

TXC3XGJL2x

Product Description

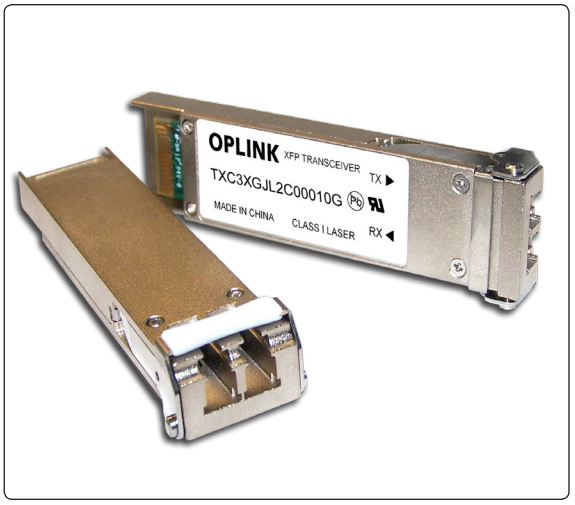
The TXC3XGJL2x CWDM XFP multi-rate fiber optic transceivers with digital diagnostics monitoring functionality provide a quick and reliable interface for 10Gbps CWDM applications. The diagnostic functions, alarm and warning features as described in the XFP Multi-Source Agreement (MSA) are provided via standard I^2C serial interface. The transceivers are compliant with the XFP Multi-Source Agreement and are designed to support SONET/SDH, 10G Ethernet, and 10G Fiber Channel data rates from 9.95Gb/s to 11.09Gb/s, and 8.5Gb/s through data rate selection feature.

Each transceiver utilizes an electro-absorption modulator integrated laser with an operating wavelength selectable to ITU-T standards covering CWDM grid wavelengths. The transceivers satisfy Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-60825 standards.

The transceivers connect to standard 30-pad XFP connectors for hot plug capability. This allows the system designer to make configuration changes or maintenance by simply plugging in different types of transceivers without removing the power supply from the host system.

The transmitter and receiver DATA interfaces are AC coupled Current Mode Logic (CML). LV-TTL Transmitter Disable control input and Loss of Signal output interfaces are also provided.

The transceivers operate from +3.3V and +5.0V power supplies over a operating case temperature range of -5°C to +70°C (Commercial), -5°C to +85°C (Extended), or -40°C to +85°C (Industrial).



Features

- ☑ Lead Free Design & Fully RoHS Compliant
- ☑ Compliant with XFP MSA
- ☑ Compliant with OC-192/STM-64
- ☑ Compliant with ITU-T G.709
- ☑ Support 10G Ethernet Applications
- ☑ Support 10G Fiber Channel Applications
- ☑ Compatible with ITU-T G.695
- ☑ Digital Diagnostics Monitoring
- ☑ Temperature-stabilized EML Transmitter
- ☑ Low Power Consumption
- ☑ Distance up to 70km with G.652 Fiber

Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature		T_{ST}	- 40	+ 85	°C
Case Operating Temperature [1]	Commercial	T_{OP}	- 5	+ 70	°C
	Extended		- 5	+ 85	
	Industrial		- 40	+ 85	
Supply Voltage		$V_{CC}3$	- 0.2	+ 3.6	V
		$V_{CC}5$	- 0.2	+ 6.0	
Operating Relative Humidity [2]		RH	0	85	%
Input Voltage		V_{IN}	0	V_{CC}	V

[1] Case temperature is measured on top side of XFP module.
[2] Non condensing

Transmitter Performance Characteristics (Over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate [1]		B	9.95	-	11.09	Gb/s
Average Optical Output Power (50% duty cycle)		P_O	0	-	+ 4.0	dBm
Transmitter OFF Power		P_{OFF}	-	-	- 45.0	dBm
Extinction Ratio @ 9.95Gb/s to 10.7Gb/s		ER	8.2	-	-	dB
Center Wavelength [2]		λ_C	*See Ordering Information Table*			nm
Spectral Width (-20dB)		$\Delta\lambda_{20}$	-	-	1.0	nm
Side Mode Suppression Ratio		$SMSR$	30	-	-	dB
Relative Intensity Noise		RIN	-	-	- 130	dB/Hz
Reflectance Tolerance		ref_T	-	-	- 27	dB
Jitter Generation [3]	20 kHz – 80 MHz	JG_{20K}	-	-	0.3	UI_{pp}
	4 MHz – 80 MHz	JG_{4M}	-	-	0.1	UI_{pp}
Optical Output Eye		*Compliant with GR253-CORE, IEEE 803.3ae , and ITU-T G.959*				

[1] 8.5Gb/s is supported through Data Rate Selection feature.
[2] Maximum wavelength deviation : +/-6.5nm.
[3] Jitter generation is compliant with GR-253 and G.8251.

Receiver Performance Characteristics (Over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate [1]		B	9.95	-	11.09	Gb/s
Wavelength of Operation		λ	1450	-	1620	nm
Receiver Sensitivity (1471nm~1571nm)	@ 9.95Gb/s (10^{-12} BER)	P_{min_BB}	-	-	- 24.0	dBm
	@ 11.09Gb/s (10^{-4} BER)		-	-	- 27.0	
Receiver Sensitivity (1591nm~1611nm)	@ 9.95Gb/s (10^{-12} BER)		-	-	- 22.0	dBm
	@ 11.09Gb/s (10^{-4} BER)		-	-	- 25.0	
Receiver Sensitivity with Fiber (1471nm~1571nm) [2]	@ 9.95Gb/s (10^{-12} BER)	P_{min_Fiber}	-	-	- 21.5	dBm
	@ 11.09Gb/s (10^{-4} BER)		-	-	- 24.0	
Receiver Sensitivity with Fiber (1591nm~1611nm) [2]	@ 9.95Gb/s (10^{-12} BER)		-	-	- 19.0	dBm
	@ 11.09Gb/s (10^{-4} BER)		-	-	- 22.0	
Maximum Input Power (10^{-12} BER)		P_{MAX}	- 7.0	-	-	dBm
LOS Thresholds	Increasing Light Input	P_{los+}	-	-	- 27.0	dBm
	Decreasing Light Input	P_{los-}	- 38.0	-	-	
LOS Hysteresis		-	0.5	-	-	dB
Receiver Reflectance		-	-	-	- 27	dB

[1] 8.5Gb/s is supported through Data Rate Selection feature.
[2] Specified over 70km fiber.

Laser Safety: All transceivers are Class 1 Laser products per FDA/CDRH and IEC-60825 standards. They must be operated under specified operating conditions.

TÜVRheinland CERTIFIED — Type Approved Safety Regular Production Surveillance — www.tuv.com ID 2000000000

c US

Oplink Communications, Inc.

This product complies with
21 CFR 1040.10 and 1040.11
Meets Class 1 Laser Safety Requirements

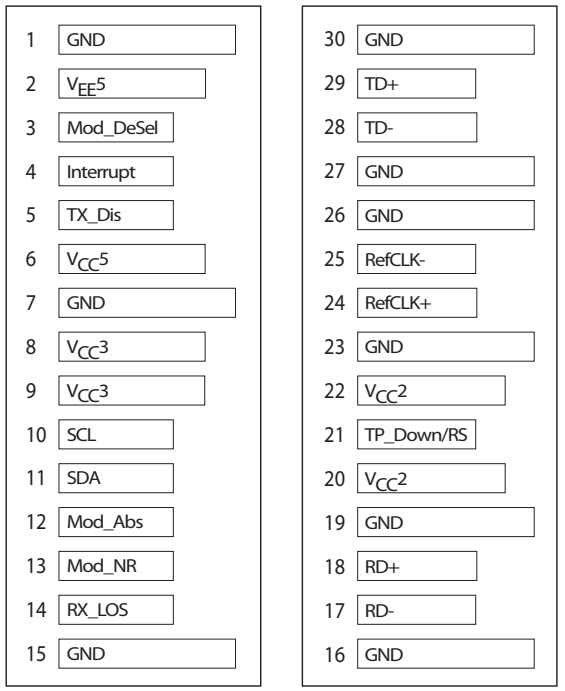
Electrical Interface (Over Operating Case Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Differential Impedance	Z_d	-	100	-	Ω
Differential Input Voltage Swing	$V_{pp,\ diff_in}$	120	-	820	mV
Differential Output Voltage Swing	$V_{pp,\ diff_out}$	340	550	850	mV
Output Rise/Fall Time (20 to 80%)	T_r /T_f	24	-	-	ps
TX_Dis, P_Down/RST	V_{IL}	- 0.3	-	0.8	V
	V_{IH}	2.0	-	V_{CC} + 0.3	
XFP Interrupt, Mod_NR, RX_LOS	V_{OL}	0	-	0.4	V
	V_{OH}	$host_V_{CC}$ - 0.5	-	$host_V_{CC}$ + 0.3	

Electrical Power Supply Characteristics (Over Operating Case Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply Voltage	$V_{CC}3$	3.13	3.3	3.47	V
	$V_{CC}5$	4.75	5.0	5.25	
Supply Current	$I_{CC}3$	-	-	750	mA
	$I_{CC}5$	-	-	500	
Power Dissipation	PW	-	-	3.5	W
P_Down Power Dissipation	PDW	-	-	1.5	W

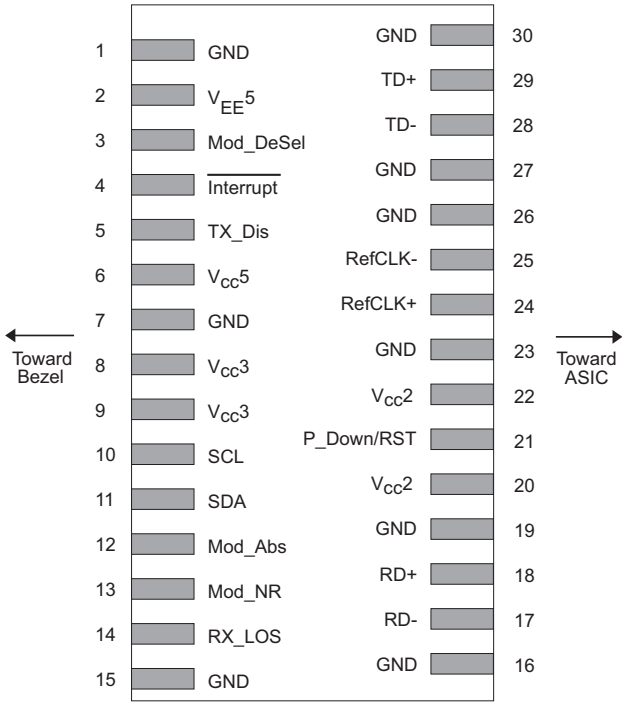
XFP Transceiver Electrical Pad Layout



Bottom of XFP Board
(as viewed thru top of board)

Top of XFP Board

Host Board Connector Pad Layout



Module Pin Description

Pin	Logic	Symbol	Description
1	-	*GND*	Module Ground
2	-	$V_{EE}5$	Optional -5.2V Power Supply (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*	$\overline{Interrupt}$	$\overline{\text{Interrupt}}$; Indicates presence of an important condition which can be read over the 2-wire serial Interface
5	*LVTTL-I*	*TX_Dis*	Transmitter Disable; Turns off transmitter laser output
6	-	$V_{CC}5$	+5V Power Supply
7	-	*GND*	Module Ground
8	-	$V_{CC}3$	+3.3V Power Supply
9	-	$V_{CC}3$	+3.3V Power Supply
10	*LVTTL-I/O*	*SCL*	2-Wire Serial Interface Clock
11	*LVTTL-I/O*	*SDA*	2-Wire Serial Interface Data Line
12	*LVTTL-O*	*Mod_Abs*	Indicates Module is not present. Grounded in the Module
13	*LVTTL-O*	*Mod_NR*	Module Not Ready; Indicating Module Operational Fault
14	*LVTTL-O*	*RX_LOS*	Receiver Loss Of Signal Indicator
15	-	*GND*	Module Ground
16	-	*GND*	Module Ground
17	*CML-O*	*RD-*	Receiver Inverted Data Output
18	*CML-O*	*RD+*	Receiver Non-Inverted Data Output
19	-	*GND*	Module Ground
20	-	$V_{CC}2$	Not Used
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	-	$V_{CC}2$	Not Used
23	-	*GND*	Module Ground
24	*PECL-I*	*RefCLK+*	Reference Clock Non-Inverted Input (Not Required)
25	*PECL-I*	*RefCLK-*	Reference Clock Inverted Input (Not Required)
26	-	*GND*	Module Ground
27	-	*GND*	Module Ground
28	*CML-I*	*TD-*	Transmitter Inverted Data Input
29	*CML-I*	*TD+*	Transmitter Non-Inverted Data Input
30	-	*GND*	Module Ground

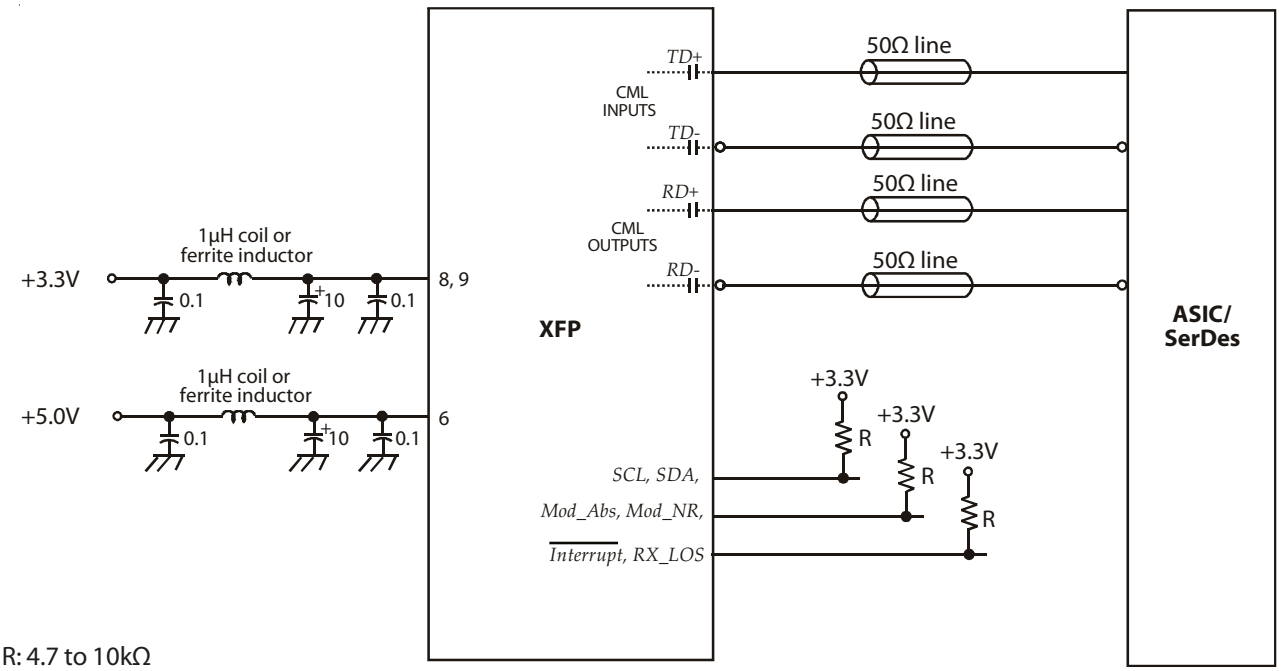
Data Rate Selection

The transceivers support data rates 8.5Gb/s and 9.95-11.09Gb/s. The data rate selection between 8.5Gb/s and 9.95-11.09Gb/s can be set by A0H byte 60 bit 0.

Rate Select Setting

A0H byte 60 bit 0	Rate
1	8.5Gb/s
0	9.95Gb/s to 11.09Gb/s
Factory default setting = 0; can be customized upon request.	

Host Board Termination & Coupling



R: 4.7 to 10kΩ

All caps are in units of µF

Application Notes

Electrical Interface: All signal interfaces are compliant with the XFP MSA specification. The high speed DATA interface is differential AC-coupled internally and can be directly connected to a 3.3V SERDES IC.

RX_LOS: The Loss of Signal circuit monitors the level of the incoming optical signal and generates a logic HIGH when an insufficient photocurrent is produced.

TX_Dis: When the TX Disable pin is at logic HIGH, the transmitter optical output is disabled. (less than -45dBm).

P_Down: The Power Down Function pin, when held High by the host, places the module in the standby (Low Power) mode with a maximum power dissipation of 1.5W. This protects hosts which are not capable of cooling higher power modules which may be accidentally inserted. The module's 2-wire serial interface and all laser safety functions must be fully functional in this low power mode. During P_Down, the module shall still support the completion of reset Interrupt, as well as maintain functionality of the variable power supply.

Mod_NR: The Mod_NR is an output pin that when High, indicates that the module has detected a condition that renders transmitter and or receiver data invalid, shall consist of logical OR of the following signals:

- Transmit Signal Conditioner Loss of Lock
- Transmitter Laser Fault
- Receiver Signal Conditioner Loss of Lock

Other conditions deemed valuable to the detection of fault may be added to the Mod_NR. The Mod_NR output pin is an open collector and must be pulled to Host_Vcc on the host board.

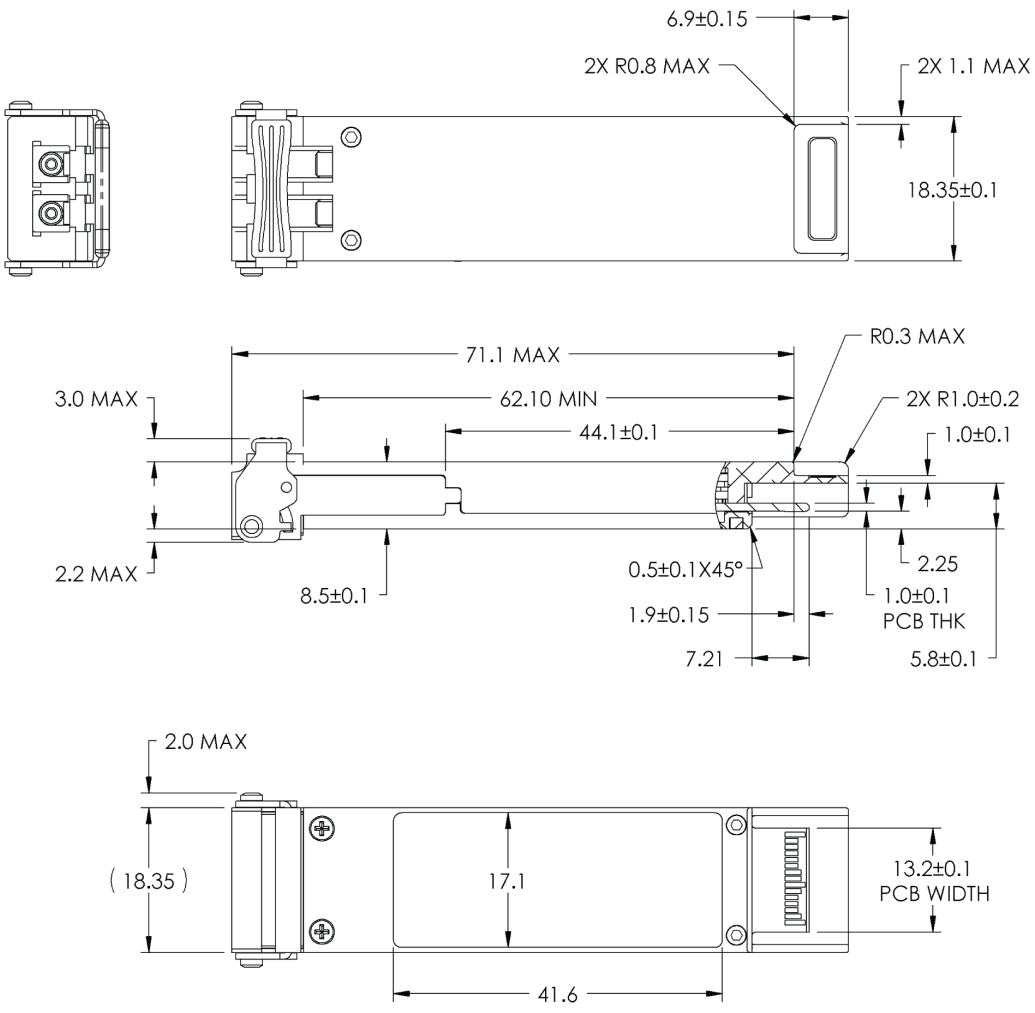
P_Down/RST: The negative edge of Reset Function signal initiates a complete module reset.

Module Behavior During P_Down and RST: During execution of a reset (t_init) or while held in Power Down mode, a module may be unable to determine the correct value for Mod_NR and RX_LOS. These outputs as well as all interrupt related flags, except completion of Reset flag, shall be disregarded by the host. When the module completes a Reset and is not in Power Down mode, the module must represent the correct value of both signals on its outputs before posting a completion of reset interrupt to the host.

At no time shall a module cause spurious assertion of the $\overline{\text{Interrupt}}$ pin. When a host initially applies power to a module with the P_Down/RST signal asserted, a module comes up in power down mode. The module shall only assert the $\overline{\text{Interrupt}}$ signal pin to inform the host it has completed a reset. The completion of reset flag shall be the only interrupt source flag set during power down mode. The host is expected to clear this interrupt before releasing the module from the power down mode. The transition from power down mode to normal mode will trigger a reset of the module and result in a 2nd module reset and a 2nd reset completion interrupt to the host.

Power Supply and Grounding: The power supply line should be well-filtered. All 0.1µF power supply bypass capacitors should be as close to the transceiver module as possible.

Package Outline



DIMENSION IN MILLIMETERS
NOTES: UNLESS OTHERWISE SPECIFIED

Ordering Information

Oplink Part Number	Operating Temperature		Center Wavelength	Distance	Latch Color
TXC3XGJL2C00010G	- 5°C to +70°C	Commercial	1471nm	70km	White
TXC3XGJL2C00020G	- 5°C to +70°C	Commercial	1491nm	70km	White
TXC3XGJL2C00030G	- 5°C to +70°C	Commercial	1511nm	70km	White
TXC3XGJL2C00040G	- 5°C to +70°C	Commercial	1531nm	70km	White
TXC3XGJL2C00050G	- 5°C to +70°C	Commercial	1551nm	70km	White
TXC3XGJL2C00060G	- 5°C to +70°C	Commercial	1571nm	70km	White
TXC3XGJL2C00070G	- 5°C to +70°C	Commercial	1591nm	70km	White
TXC3XGJL2C00080G	- 5°C to +70°C	Commercial	1611nm	70km	White
TXC3XGJL2E00010G	- 5°C to +85°C	Extended	1471nm	70km	White
TXC3XGJL2E00020G	- 5°C to +85°C	Extended	1491nm	70km	White
TXC3XGJL2E00030G	- 5°C to +85°C	Extended	1511nm	70km	White
TXC3XGJL2E00040G	- 5°C to +85°C	Extended	1531nm	70km	White
TXC3XGJL2E00050G	- 5°C to +85°C	Extended	1551nm	70km	White
TXC3XGJL2E00060G	- 5°C to +85°C	Extended	1571nm	70km	White
TXC3XGJL2E00070G	- 5°C to +85°C	Extended	1591nm	70km	White
TXC3XGJL2E00080G	- 5°C to +85°C	Extended	1611nm	70km	White
TXC3XGJL2I00010G	- 40°C to +85°C	Industrial	1471nm	70km	White
TXC3XGJL2I00020G	- 40°C to +85°C	Industrial	1491nm	70km	White
TXC3XGJL2I00030G	- 40°C to +85°C	Industrial	1511nm	70km	White
TXC3XGJL2I00040G	- 40°C to +85°C	Industrial	1531nm	70km	White
TXC3XGJL2I00050G	- 40°C to +85°C	Industrial	1551nm	70km	White
TXC3XGJL2I00060G	- 40°C to +85°C	Industrial	1571nm	70km	White
TXC3XGJL2I00070G	- 40°C to +85°C	Industrial	1591nm	70km	White
TXC3XGJL2I00080G	- 40°C to +85°C	Industrial	1611nm	70km	White

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