

# CWDM OPTICAL TRANSCEIVER

TRPV3GKERx000xxG



## Product Description

The TRPV3GKERx000xxG is an optical transceiver module designed to transmit and receive electrical and optical serial digital signals as defined in SMPTE 297-2006. The TRPV3GKERx000xxG 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 transmitter uses CWDM DFB lasers with wavelength options ranging from 1271nm to 1611nm to provide error-free transmission of signals from 50Mbps to 3Gbps over single mode fiber.

Diagnostics monitoring functionality (alarm and warning features) are integrated into the design via an I<sup>2</sup>C serial interface per the Multi-Source Agreement (MSA) SFF-8472, Rev. 9.4.

Configured for video pin-outs, these multi-rate transceivers connect to standard 20-pad SFP 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.

All modules satisfy Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-60825 standards.



## Features

- CWDM (1271 to 1611nm) transmitter with a PIN ROSA in one SFP transceiver package
- Standard video pin-out
- Robust error-free transmission of signals from 50Mbps to 3Gbps for up to 50km (single-mode fiber)
- Excellent optical receive sensitivity with video pathological patterns for SD-SDI, HD-SDI and 3G-SDI
- Digital diagnostics and control via I<sup>2</sup>C interface
- Low power consumption
- RoHS compliant
- SMPTE 297-2006 compatible

## Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature Range	$T_{ST}$	- 40	+ 85	°C
Case Operating Temperature <sup>1</sup>	"Commercial"	- 5	+ 70	°C
	"Extended"	- 5	+ 85	°C
Operating Relative Humidity <sup>2</sup>	$RH$	5	95	%
Supply Voltage Range	$V_{CC}$	- 0.5	+ 4	V

<sup>1</sup> Measured on top side of SFP module at the front center vent hole of the cage.

<sup>2</sup> Non condensing

**Transmitter Performance Characteristics** (Over Operating Case Temperature.  $V_{cc} = 3.13$  to  $3.47V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units	
Operating Data Rate	$B$	0.05	-	3	Gb/s	
Average Optical Output Power with 50% duty cycle (coupled into single mode fiber)	$P_0$	0	-	+ 5.0	dBm	
Extinction Ratio	$ER$	8.2	-	-	dB	
Center Wavelength	$\lambda_c$	1264.5	1271	1277.5	nm	
		1284.5	1291	1297.5		
		1304.5	1311	1317.5		
		1324.5	1331	1337.5		
		1344.5	1351	1357.5		
		1364.5	1371	1377.5		
		1384.5	1391	1397.5		
		1404.5	1411	1417.5		
		1424.5	1431	1437.5		
		1444.5	1451	1457.5		
		1464.5	1471	1477.5		
		1484.5	1491	1497.5		
		1504.5	1511	1517.5		
		1524.5	1531	1537.5		
		1544.5	1551	1557.5		
		1564.5	1571	1577.5		
1584.5	1591	1597.5				
1604.5	1611	1617.5				
Spectral Width (- 20dB)	$\Delta\lambda_{20}$	-	-	1.0	nm	
Side Mode Suppression Ratio	$SMSR$	30	-	-	dB	
Optical Signal Intrinsic Jitter <sup>1</sup>	2.97Gb/s, 1.485Gb/s, 270Mb/s, PRBS 2 <sup>23</sup> -1	$JG$	-	40	60	ps
	2.97Gb/s SMPTE 424M Pathological		-	50	90	
	1.485Gb/s SMPTE 292M Pathological		-	60	120	
	270Mb/s, SMPTE 259M Pathological		-	110	200	
Optical Signal Rise Time (20% to 80%) <sup>2</sup>	SMPTE 424M 2.97Gb/s	$tr$	-	130	180	ps
	SMPTE 292M 1.485Gb/s		-	175	270	
	SMPTE 259M 270Mb/s		-	300	800	
Optical Signal Fall Time (20% to 80%) <sup>2</sup>	SMPTE 424M 2.97Gb/s	$tf$	-	130	180	ps
	SMPTE 292M 1.485Gb/s		-	175	270	
	SMPTE 259M 270Mb/s		-	300	800	
Relative Intensity Noise	$RIN$	-	-	- 117	dB/Hz	
Dispersion Penalty <sup>3</sup>	-	-	-	2.0	dB	

<sup>1</sup> As specified in SMPTE 259M, SMPTE 344M, SMPTE 292, or SMPTE 424M for the corresponding electrical signal. Test method shall conform to SMPTE RP 184

<sup>2</sup> Rise/fall times are measured following a fourth-order Bessel-Thompson filter with a 3dB point at 0.75 x data rate in MHz

<sup>3</sup> Specified at 1000ps/nm dispersion, which corresponds to the approximate worst-case dispersion for 50km G.652/G.654 fiber over the center wavelength range of 1464.5-1617.5nm.

**Receiver Performance Characteristics** (Over Operating Case Temperature.  $V_{CC} = 3.13$  to  $3.47V$ )

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		$B$	0.05	-	3	Gb/s
Center Wavelength		$\lambda_c$	1260	-	1620	nm
Sensitivity <sup>1</sup>	SMPTE 259M, SMPTE 344M, SMPTE 292M Pathological, SMPTE 424M Pathological and PRBS 2 <sup>23</sup> -1	$P_{min}$	-	-24	-21	dBm
Overload		$P_{max}$	0	-	-	dBm
LOS Thresholds <sup>1</sup>	Increasing Light Input	$P_{los+}$	-	-	-23	dBm
	Decreasing Light Input	$P_{los-}$	-31	-	-	dBm
LOS Hysteresis		-	0.5	-	6	dB
Maximum Back Reflection		-	-	-	-27	dB
Input Power Monitoring Accuracy		-	-2	-	+2	dB
<sup>1</sup> Specified at a BER of $10^{-12}$						
<sup>2</sup> Specified with PRBS 2.97Gb/s signal, ER= 7dB						

**Electrical Characteristics** (Over Operating Case Temperature.  $V_{CC} = 3.13$  to  $3.47V$ )

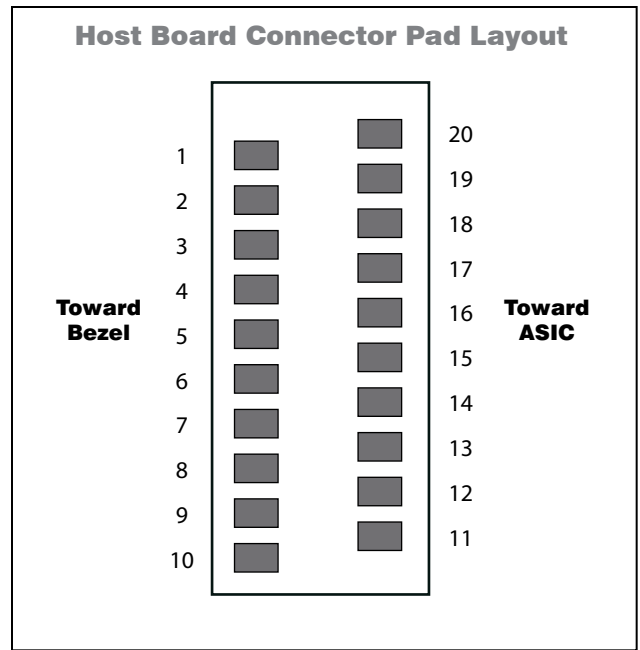
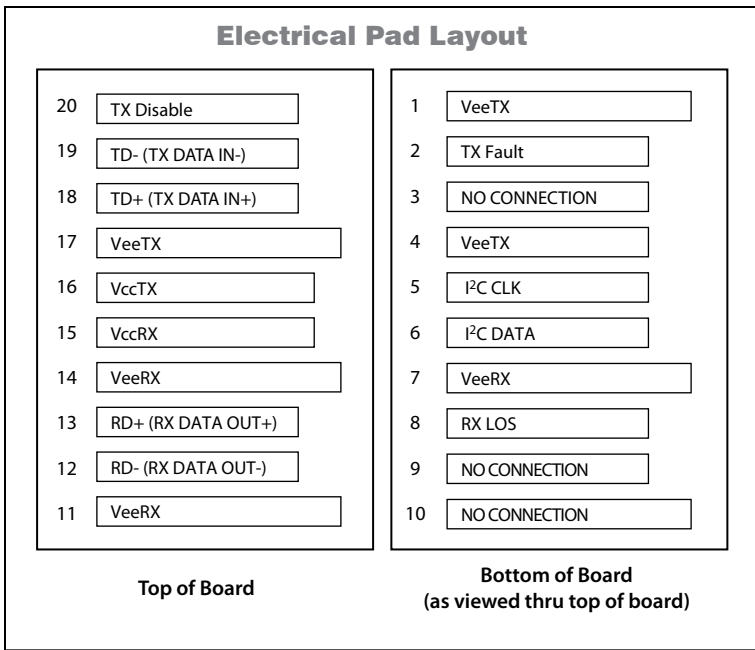
Parameter		Symbol	Minimum	Typical	Maximum	Units
Differential Input Voltage Swing		$V_{PP-DIFF}$	550	-	850	mV
Output Rise and Fall time 20% to 80%		$t_r, t_f$	-	-	135	ps
Input High Voltage		$V_{IH}$	2	-	$V_{CC}$	V
Input Low Voltage		$V_{IL}$	0	-	0.8	V
Output HIGH Voltage (LOS) <sup>1</sup>		$V_{OH}$	2	-	$V_{CC}$	V
Output LOW Voltage (LOS) <sup>1</sup>		$V_{OL}$	0	-	0.8	V
<sup>1</sup> Open collector compatible, 4.7k $\Omega$ to 10k $\Omega$ pull-up resistor to Vcc (Host Supply Voltage).						

**Electrical Power Supply Characteristics** (Over Operating Case Temperature.  $V_{CC} = 3.13$  to  $3.47V$ )

Parameter		Symbol	Minimum	Typical	Maximum	Units
Power Supply Voltage		$V_{CC}$	3.13	3.3	3.47	V
DC Common Mode Voltage		$V_{CM}$	0	-	3.6	V
Power Consumption		$P_W$	-	-	1000	mW
Maximum Allowable Power Supply Noise	0.02-1000kHz	-	-	-	66	mV
	1000-10000kHz		-	-	99	

**Timing Specifications**

Parameter		Symbol	Minimum	Typical	Maximum	Units
Time to Initialize (from power on)		$t_{init}$	-	-	300	ms
LOS Assert Time		$t_{los\_on}$	-	-	10	ms
LOS Negate Time		$t_{los\_off}$	-	-	10	ms
I <sup>2</sup> C Clock Rate		-	0	-	400 <sup>1</sup>	kHz
<sup>1</sup> Clock stretching is used for I <sup>2</sup> C signals above the MSA defined 100kHz rate.						



## Application Notes

**Electrical Interface:** Signal interfaces are compatible with the SFP MSA specification. The high speed DATA interface is differential AC-coupled internally and can be directly connected to a 3.3V SERDES IC. All low speed control and sense output signals are open collector TTL compatible and should be pulled up with a 4.7 - 10kΩ resistor on the host board.

**Loss of Signal (LOS):** The Loss of Signal circuit monitors the level of the incoming optical signal and generates logic HIGH when an insufficient photocurrent is produced.

**Serial Identification and Monitoring:** The module definition of SFP is indicated by the MOD\_ABS pin and the 2-wire serial interface. Upon power up, the 2-wire interface appears as NC (no connection), and MOD\_ABS is TTL LOW. When the host system detects this condition, it activates the serial protocol (standard two-wire I<sup>2</sup>C serial interface) and generates the

serial clock signal (SCL). The positive edge clocks data into the EEPROM segments of the device that are not write protected, and the negative edge clocks data from the device. The serial data signal (SDA) is for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The supported monitoring functions are temperature, voltage, average receiver signal, all alarms and warnings, and software monitoring of LOS. The device is internally calibrated.

The data transfer protocol and the details of the mandatory and vendor specific data structures are defined in the SFP MSA, and SFF-8472, Rev. 9.4.

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

### Laser Safety:

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



**Oplink Communications, Inc.**  
DATE OF MANUFACTURE:



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

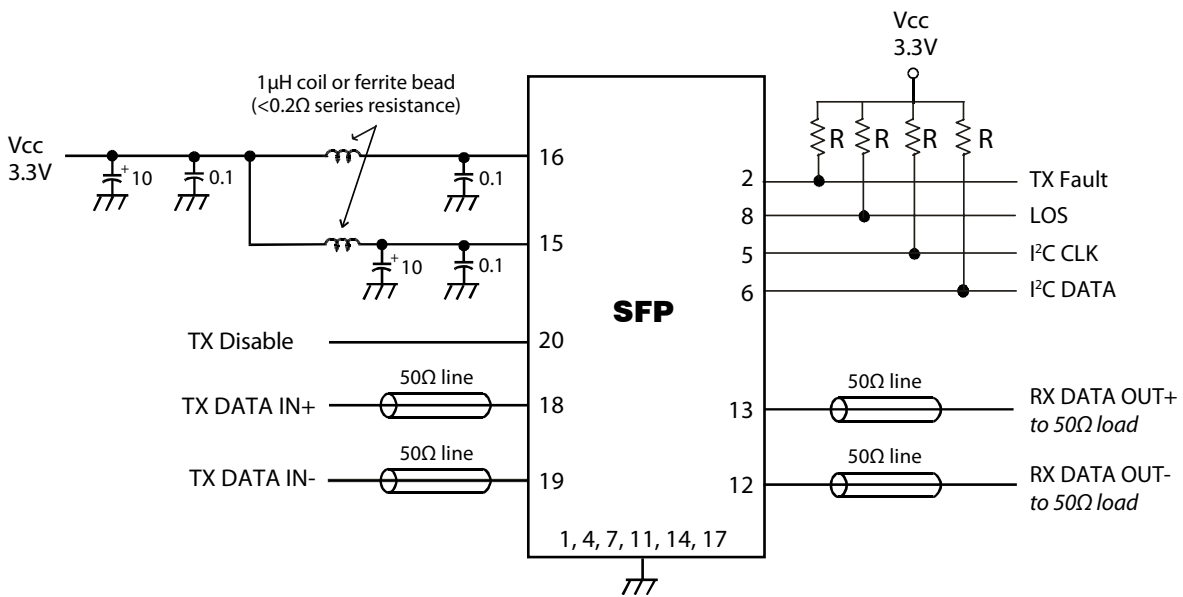
### Interfacing the Transceivers

Communication is via a serial 2-wire serial interface. As described in the document SFF-8472 (REV. 9.4) there are two distinct address spaces:

Base Address A0(hex)	
Byte Address	Content
0 – 95	Serial Transceiver ID as defined in SFP MSA
96 – 127	OPLINK Specific
128 – 255	Reserved

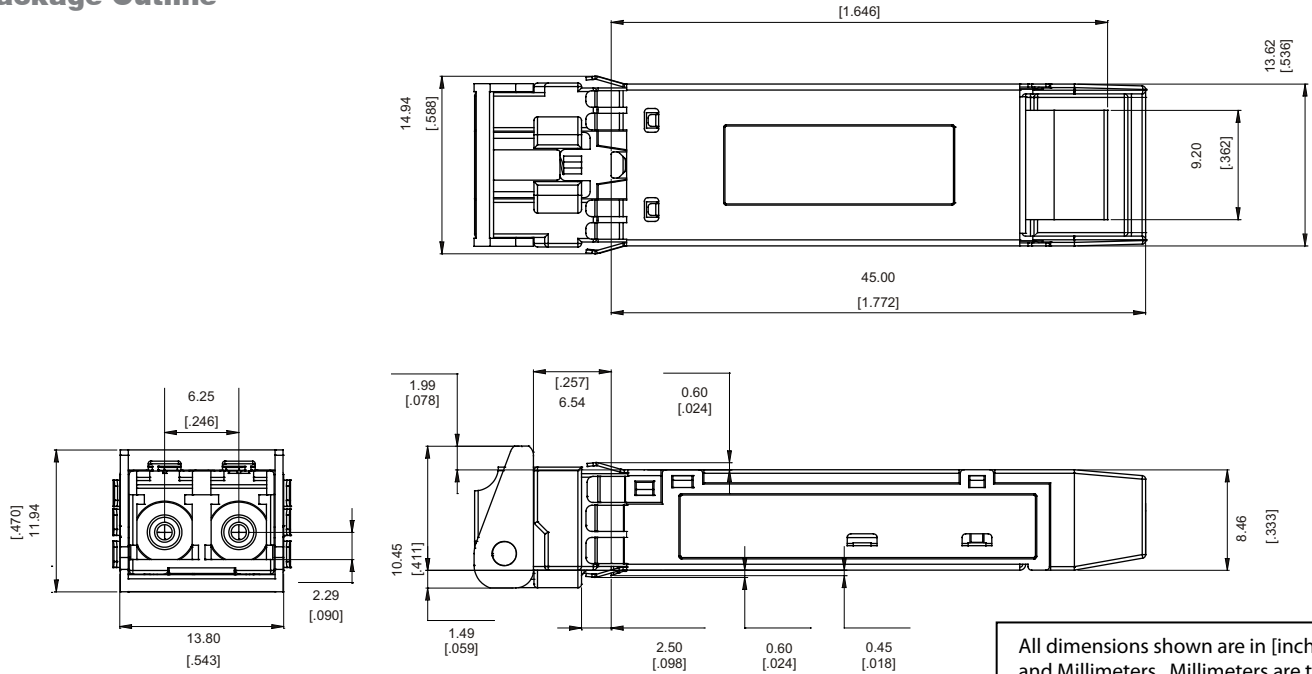
Base Address A2(hex)	
Byte Address	Content
0 - 55	Alarm & Warnings thresholds & limits
56 - 95	External calibration constants (not used)
96 – 119	Values from real time diagnostic monitoring
120 – 127	Not used
128 – 247	Customer specific, writable area
248 - 255	Not used

### Application Schematics



R: 4.7 to 10kΩ  
CAP Values in µF

No Connection: 3, 9, 10

**Package Outline**


All dimensions shown are in [inches] and Millimeters. Millimeters are the primary units. Tolerances are in accordance with SFF-8432 Rev.5.

**Ordering Information**

Model Name		Wavelength	Latch Color	Distance
- 5°C to +70°C	- 5°C to +85°C			
TRPV3GKER000L0G	TRPV3GKER000L0G	1271	Light Violet	50km
TRPV3GKER000K0G	TRPV3GKER000K0G	1291	Sky blue	50km
TRPV3GKER000J0G	TRPV3GKER000J0G	1311	Lime	50km
TRPV3GKER000H0G	TRPV3GKER000H0G	1331	Dark Green	50km
TRPV3GKER000G0G	TRPV3GKER000G0G	1351	Pink	50km
TRPV3GKER000F0G	TRPV3GKER000F0G	1371	Beige	50km
TRPV3GKER000D0G	TRPV3GKER000D0G	1391	White	50km
TRPV3GKER000C0G	TRPV3GKER000C0G	1411	Silver	50km
TRPV3GKER000B0G	TRPV3GKER000B0G	1431	Black	50km
TRPV3GKER000A0G	TRPV3GKER000A0G	1451	Magenta	50km
TRPV3GKER00010G	TRPV3GKER00010G	1471	Gray	50km
TRPV3GKER00020G	TRPV3GKER00020G	1491	Violet	50km
TRPV3GKER00030G	TRPV3GKER00030G	1511	Blue	50km
TRPV3GKER00040G	TRPV3GKER00040G	1531	Green	50km
TRPV3GKER00050G	TRPV3GKER00050G	1551	Yellow	50km
TRPV3GKER00060G	TRPV3GKER00060G	1571	Orange	50km
TRPV3GKER00070G	TRPV3GKER00070G	1591	Red	50km
TRPV3GKER00080G	TRPV3GKER00080G	1611	Brown	50km

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