



10.7Gb/s Linear Optical Modulator Driver

TGA4819-SL

OC-192 Metro and Long Haul Applications Surface Mount Package



Description

The TriQuint TGA4819-SL is part of a series of optical driver amplifiers suitable for a variety of driver applications.

The TGA4819-SL is a medium power wideband AGC amplifier that typically provides 20dB small signal gain with 20dB AGC range.

The TGA4819-SL is an excellent choice for applications requiring high drive combined with high linearity. The TGA4819-SL has demonstrated capability to deliver 10Vpp while maintaining output harmonic levels near -30dBc for a 2GHz fundamental.

The TGA4819-SL requires a low frequency choke and control circuitry.

Key Features and Performance

- Up to 10 V_{PP} Linear Output Voltage
- 20 dB Gain
- Internal DC Blocks
- Single-ended Input / Output
- Small Form Factor
 - 11.4 x 8.9 x 2 mm
 - 0.450 x 0.350 x 0.080 inches

Primary Applications

 Mach-Zehnder Linear Modulator Driver for Metro and Long Haul

Preliminary Measured Performance

Bias Conditions: $V_D = 8V$, $V_{CTRI} = +1V$, $I_D = 310$ mA PRBS 2³¹-1; 10.7Gbps; Vin = 1Vpp; CPC = 50% File Control Setup Measure Calibrate Utilities Help 26 Mar 2004 12:08 Eve/Mask Eye Meas Msk Test 🔍 NRZ TXX Average Power *tX Crossing Percentage X Rise Time X leasure 🔅 current minimum <u>nax i mum</u> total meas Fall Time Setup & Info XT One Lev 1 Scale: 10.0 mV/div Offset:0.0 V 2 Offset:0.0 V 4 Scale: 10.0 mV/div Time: 20.0 ps/div Difset:0.0 V Delay: 200.847 ns Trigger Level 3 Scale:50 µW/div Offset:0.0 W

Note: This device is early in the characterization process prior to finalizing all electrical specifications. Specifications are subject to change without notice.



TABLE I MAXIMUM RATINGS

Symbol	Parameter	Value	Notes
VD	Drain Voltage	9 V	<u>1/2</u> /
V_{G}	Gate Voltage Range	-3V to 0V	<u>1</u> /
V _{CTRL}	Control Voltage Range	-3V to $V_D/2$	<u>1</u> /
I _D	Drain Supply Current (Quiescent)	400 mA	<u>1/2</u> /
I _G	Gate Supply Current	5 mA	<u>1</u> /
P _{IN}	Input Continuous Wave Power	23 dBm	<u>1/2</u> /
V _{IN}	10.7Gb/s PRBS Input Voltage	4 V _{PP}	<u>1/ 2</u> /
PD	Power Dissipation	3.1 W	<u>1/2/3</u> /
T _{CH}	Operating Channel Temperature	150 ⁰ C	<u>4</u> /
Тм	Mounting Temperature (10 Seconds)	230 ⁰ C	
T _{STG}	Storage Temperature	-65 to 150 °C	

- 1/ These ratings represent the maximum operable values for this device
- $\underline{2}$ / Combinations of supply voltage, supply current, input power, and output power shall not exceed P_D at a package base temperature of 70°C
- 3/ When operated at this bias condition with a baseplate temperature of 70°C, the MTTF is reduced to 1.0E+6 hours
- <u>4</u>/ Junction operating temperature will directly affect the device median time to failure (MTTF). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.

TABLE II THERMAL INFORMATION

Parameter	Test Conditions	Т _{сн} (°С)	R _{⊛JC} (°C/W)	MTTF (hrs)
R _{⊌JC} Thermal Resistance (Channel to Backside of Package)	$V_{D} = 8V$ $I_{D} = 350mA$ $P_{DISS} = 2.8W$ $T_{BASE} = 70^{\circ}C$	142.8	25.7	1.9E6

Note: Thermal transfer is conducted through the bottom of the TGA4819-SL package into the motherboard. The motherboard must be designed to assure adequate thermal transfer to the base plate.





TABLE III RF CHARACTERIZATION TABLE $(T_A = 25^{\circ}C, Nominal)$ $(V_D = 8V, V_{CTRL} = +1V, I_D = 310mA \pm 5\%, V_G \approx -0.3V)$

Parameter	Test Conditions	Тур	Units	Notes
Small Signal Bandwidth		8	GHz	
Small Signal Gain	100 MHz – 4 GHz 6 GHz 10 GHz 14 GHz	20 19 17 12	dB	<u>1/2</u> /
Input Return Loss	100 MHz – 14 GHz	15	dB	<u>1/2</u> /
Output Return Loss	100 MHz – 14 GHz	13	dB	<u>1/2</u> /
Small Signal AGC Range	Midband	20	dB	
Output Power @ P _{1dB}	2 GHz	25.5	dBm	<u>3</u> /

Note: Table III Lists the RF Characteristics of typical devices as determined by fixtured measurements.

- 1/ Verified at package level RF test
- $\overline{2}$ / Package RF Test Bias: V_D = 8V, V_{CTRL} = +1V, adjust V_G to achieve I_D=310 mA
- $\overline{3}$ / Verified at die level on-wafer probe



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4 Scale: 10.0 mV/div Offset:0.0 V Delay: 200.847 ns wit "

Setup & Info

Trigger Level

🔆 Eile Control Setup Measure Calibrate Utilities Help

Measured Performance $V_D = 8V; V_{CTRL} = +1V; I_D = 310mA; V_G \approx -0.3V$ PRBS 2³¹-1; 10.7Gbps; CPC = 50%

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Average Power

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Scale: 2.00 V/div Offset: 0.0 V









Input Signal Vin = 1V_{PP} Includes 8GHz Bessel Filter



Application Circuit



Note:

1. C1 extends low frequency performance to 30 KHz. For applications requiring low frequency performance to only 100 KHz, C1 may be omitted

2. C2 is a power supply decoupling capacitor and may be omitted when driven directly with an op-amp.



Application Circuit (Continued)

Recommended Components:

DESIGNATOR	DESCRIPTION	MANUFACTURER	PART NUMBER
C1, C3	10uF Capacitor MLC Ceramic	AVX	0802YC106KAT
C2	0.01 uFCapacitor MLC Ceramic	AVX	0603YC103KAT
C4	10 uF Capacitor Tantalum	AVX	TAJA106K016R
L1	220 uH Inductor	Belfuse	S581-4000-14
L2	330 nH Inductor	Panasonic Coilcraft	ELJ-FAR33MF2 0603LS-331XJB
R1, R2	274 Ω Resistor	Panasonic	ERJ-2RKF2740X



Laboratory - Bias ON/OFF Procedure Vd=8V, CPC=50%

Bias ON

- 1. Disable the output of the PPG
- 2. Set $V_D = 0V$, $V_{CTRL} = 0V \& V_G = 0V$
- 3. Set V_G = -1.5V
- 4. Increase V_D to 8V observing Id - Assure I_D = 0mA
- 5. Set V_{CTRL} = +1V - I_D should still be 0mA
- 6. Make V_{G} more positive until I_{D} = 310mA.
 - V_{G} will be approximately -0.3V.
- 7. Enable the output of the PPG.

8. <u>Output Swing Adjust</u>: Adjust \underline{V}_{CTRL} slightly positive to increase output swing or adjust V_{CTRL} slightly negative to decrease the output swing.

9. <u>Crossover Adjust</u>: Adjust $\underline{V}_{\underline{G}}$ slightly positive to push the crossover down or adjust $V_{\underline{G}}$ slightly negative to push the crossover up.

Bias OFF

- 1. Disable the output of the PPG
- 2. Set V_{CTRL} = 0V
- 3. Set $V_D = 0V$
- 4. Set V_G = 0V



Mechanical Drawing



- 1. Maximize number of vias on attachment area of PCB for Bond Pad #19. This is required electrical and thermal conduction
- 2. Pad sizes for RF input and output (#18, #9) are shown for soldermask opening. Solder should not be applied outside of this area.

Dimensions: Inches

Tolerances: Length & Width: ±0.003" Height: ±0.006" Adjacent Pad to Pad Spacing: ±0.0002" Pad Size: ±0.001"

Package Backside Material: Material: RO4003 (0.008" thk) w/ 0.5oz Cu (0.0007" thk) Plating: 100 - 350µin Ni underplate w/ 5 - 10µin Au overplate



Assembly of a TGA4819-SL Package onto a Motherboard

Manual Assembly for Prototypes

1. Clean the motherboard with Acetone and rinse with alcohol and DI water. Allow the motherboard to fully dry.

2. Using a standard SN63 or lead-free solder paste, dispense solder paste dots of 5 to 15 mil in diameter to the motherboard. Assure that there is a minimum of 5 mils and a maximum of 10 mils between the edge of each solder paste area and the closest edge of the ground pad.

3. Manually place a TGA4819-SL on the motherboard with correct orientation and good alignment. The alignment can be determined manually by centering the package on the motherboard. The RF traces (pin 1 and pin 10) are located along the center horizontal axis of the package.

4. Reflow the assembly on a hot plate with the surface temperature of the plate near 230 °C for 5 to 6 seconds (for SnPb).

- 5. Let the assembly completely cool down. This package has little or no tendency to self- align during the reflow.
- 6. Clean the assembly with acetone and rinse with alcohol and DI water.

Reflow Profile	SnPb	Pb Free
Ramp-up Rate	3 °C/sec	3 °C/sec
Activation Time and Temperature	60 – 120 sec @ 140 – 160 °C	60 – 180 sec @ 150 – 200 °C
Time above Melting Point	60 – 150 sec	60 – 150 sec
Max Peak Temperature	240 °C	260 °C
Time within 5 °C of Peak Temperature	10 – 20 sec	10 – 20 sec
Ramp-down Rate	4 – 6 °C/sec	4 – 6 °C/sec

Typical Solder Reflow Profiles

CAUTION: The TGA4819-SL contains GaAs MMIC devices that are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

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