

Applications

- Commercial and Military Radar
- Communications



Functional Block Diagram

Product Features

- Frequency Range: 9 10 GHz
- P_{SAT :} 48 dBm
- PAE: 38%
- Small Signal Gain: 13 dB
- Bias: $V_D = 24$ V, $I_{DQ} = 2.4$ A, $V_G = -2.6$ V Typical
- Pulsed: PW = 100us, DC = 10%
- Integrated Thermistor Temperature Monitor
- Package Dimensions: 17.4 x 24.0 x 3.9 mm



General Description

TriQuint's TGA2312-FL is a high power amplifier operating between 9 and 10 GHz and typically providing 48dBm of saturated output power, 38% power-added efficiency and 13dB small signal gain.

Ideally suited for marine and weather radar, the TGA2312-FL is packaged in a CuW-base, flanged package for superior thermal management.

The TGA2312-FL uses TriQuint's 0.25um GaN on SiC technology which provides superior performance while maintaining high reliability. In addition, the use of SiC substrates provides optimum thermal performance necessary for reliable high power operation.

Lead-free and RoHS compliant.

Evaluation Boards are available upon request.

Pad Configuration

Pad No.	Symbol
1	V _G
2, 4, 7, 9	N/C
3	RF IN
5	Temp (Thermistor)
6	V _D
8	RF OUT
10	V _D

Ordering Information			
Part	ECCN	Description	
TGA2312-FL	3A001.b.3.b	GaN High Power Amplifier	



Absolute Maximum Ratings

Recommended Operating Conditions

Parameter	Value
Drain Voltage (V _D)	40 V
Drain to Gate Voltage $(V_D - V_G)$	100 V
Gate Voltage Range (V _G)	-5 to 0 V
Drain Current (I _D)	10 A
Gate Current (I _G)	-25 to 56 mA
Power Dissipation (P _{DISS})	225 W
RF Input Power, CW, 50 Ω, T = 25 °C (P_{IN})	+44 dBm
Channel Temperature (T _{CH})	275 °C
Mounting Temperature (30 Seconds)	260 °C
Storage Temperature	-40 to 150 °C

Operation of this device outside the parameter ranges given above may cause permanent damage. These are stress ratings only, and functional operation of the device at these conditions is not implied.

Parameter	Value
Drain Voltage (V _D)	24 V
Drain Current (I _{DQ})	2400 mA
Drain Current Under RF Drive (I _{D_Drive})	6360 mA
Gate Voltage (V _G)	-2.6 V (Typ.)

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Test conditions unless otherwise noted: 25 °C, V _D = 24 V, I _{DQ} = 2400 mA , Pulsed: PW = 100us, DC = 10%, V _G = -2.6 V				
Parameter	Min	Typical	Max	Units
Operational Frequency Range	9		10	GHz
Small Signal Gain		13		dB
Input Return Loss		15		dB
Output Return Loss		14		dB
Output Power at Saturation (Pin = 38dBm)		48		dBm
Power-Added Efficiency (Pin = 38dBm)		38		%
Output TOI		49		dBm
Gain Temperature Coefficient		-0.02		dB/°C
Power Temperature Coefficient		-0.001		dBm/°C
TOI Temperature Coefficient		-0.001		dBm/°C



Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance, $\theta_{JC(1)}$	Tbaseplate = 85 °C	0.85	°C/W
Channel Temperature, T_{CH} (Without RF Drive)	Tbaseplate = 85 °C, V_D = 24 V,	135	°C
Median Lifetime, T_M (Without RF Drive)	$I_{DQ} = 2400 \text{ mA}, P_{DISS} = 58 \text{ W},$ Pulsed: PW = 100us, DC = 10%	9.75 x 10^10	Hrs
Channel Temperature, T _{CH} (Under RF Drive)	Tbaseplate = 85 °C, V_D = 24 V, I_{D_Drive} =	158	°C
Median Lifetime, T_M (Under RF Drive)	6360 mA, $P_{OUT} = 48 \text{ dBm}, P_{DISS} = 87 \text{ W},$ Pulsed: PW = 100us, DC = 10%	7.38 x 10^9	Hrs
Channel Temperature, T_{CH} (Under RF Drive)	Tbaseplate = 85 °C, V_D = 30 V, I_{D_Drive} =	190	°C
Median Lifetime, T_M (Under RF Drive)	6670 mA, P _{OUT} = 48.8 dBm, P _{DISS} = 124 W, Pulsed: PW = 100us, DC = 10%	3.12 x 10^8	Hrs

Notes: (1) Thermal resistance measured at back of the package.

Median Lifetime







Typical Performance

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 2.4 A, V_G = -2.6 V Typical





Preliminary Datasheet: Rev - 08-16-13 © 2013 TriQuint



8000

7000

5000

4000

Drain Cu Drain Cu Drain Cu

1000

0

10.5

10.5

 $P_{IN} = 38 dBm$

10

6000 g

urrent

Typical Performance

Conditions unless otherwise specified: $V_D = 24 \text{ V}$, $I_{DQ} = 2.4 \text{ A}$, $V_G = -2.6 \text{ V}$ Typical



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Typical Performance

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 2.4 A, V_G = -2.6 V Typical











Typical Performance

A 100K Ω thermistor is assembled inside the TGA2312-FL package. It doesn't monitor the maximum package temperature, but it is a useful indicator. Nominal resistance versus temperature is shown in the table below. The resistance measurement is taken between the Temp pin and ground.

deg C	R (Kohm)	deg C	R (Kohm)
0	378.80	65	17.89
5	284.71	70	14.84
10	216.16	75	12.37
15	165.70	80	10.37
20	128.17	85	8.74
25	100.00	90	7.40
30	78.66	95	6.29
35	62.36	100	5.37
40	49.81	105	4.61
45	40.06	110	3.96
50	32.44	115	3.43
55	26.44	120	2.97
60	21.68	125	2.59



Application Circuit



Note 1: One of these caps can be removed for drain pulsing Drain voltage can be applied to either Vd pins

Notes: To prevent damage to the device due to overshoot or oscillation issues, TriQuint recommends that current limits for all power supplies are set properly for each power supply before applying the voltage. The following are recommended current limits for each power supply:

Set 50 mA current limit to V_G Set 8 A current limit to V_D

Bias-up Procedure

- 1. Apply -5.0 V to V_G
- 2. Apply +24 V to V_{D.}
- 3. Adjust V_G until I_{DQ} = 2400 mA (V_G ~ -2.6 V Typ.)
- 4. Turn on RF supply.

Bias-down Procedure

- 1. Turn off RF supply.
- 2. Reduce V_G to -5.0 V. Ensure $I_{DQ} = 0$ mA
- 3. Set V_D to 0 V.
- 4. Set V_G to 0 V.



Recommended Board Layout Assembly

Top dielectric material is RO4350 0.020 inch thickness with 0.5 oz. copper.



Reference Design	Value	Description	Manufacturer	Part Number
C1	0.01 uF	Cap, 0603, 50V, 10%	Various	
C2, C5	1000 pF	Cap, 0603, 50V, 5%	Various	
C3	1.0 uF	Cap, 1206, 16V, 10%	Various	
C4	100 pF	Cap, 0603, 50V, 5%	Various	



Pin Layout



Pin Description

Pin	Symbol	Description
1	V _G	Gate voltage. Bias network is required. ⁽¹⁾
2, 4, 7, 9	N/C	No internal connection; must be grounded on PCB.
3	RF IN	RF input.
5	TEMP	Temperature sensing pin (Thermistor)
6	VD	Bottom Drain voltage. Bias network is required. ⁽¹⁾
8	RF OUT	RF output.
10	VD	Top Drain voltage Bias network is required. (1)

Notes:

1. See Application Circuit on page 8 as an example.



Mechanical Information

All dimensions are in inches. Unless specified otherwise.





Assembly Notes

- 1. Clean the board or module with alcohol. Allow it to fully dry.
- 2. Nylock screws are recommended for mounting the TGA2312-FL to the board.
- 3. To improve the thermal and RF performance, we recommend the followings:
 - a. Apply thermal compound or 4 mils Indium shim between the package and the board.
 - b. Attach a heat sink to the bottom of the board and apply thermal compound or 4 mils Indium shim between the heat sink and the board.
- 4. Apply solder to each pin of the TGA2312-FL.
- 5. Clean the assembly with alcohol.



This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous

Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

Halogen Free (Chlorine, Bromine)

TBBP-A (C₁₅H₁₂Br₄0₂) Free

Product Compliance Information

ESD Sensitivity Ratings



Caution! ESD-Sensitive Device

ESD Rating: TBD Value: TBD Test: Human Body Model (HBM) Standard: JEDEC Standard JESD22-A114

MSL Rating

Level:: TBD

ECCN

US Department of Commerce: 3A001.b.3.b

Contact Information

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RoHs Compliance

Lead Free

Antimony Free

PFOS Free SVHC Free

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