Applications

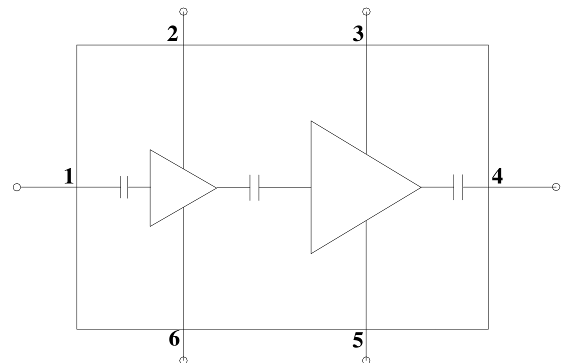
p

- Commercial and military radar
- Communications
- Electronic Warfare (EW)

Product Features

- Frequency Range: 6 – 12GHz
- P_{SAT}: >33dBm
- PAE: >31%
- Small Signal Gain: >21dB
- Input Return Loss: >9dB
- Output Return Loss: >11dB
- Bias: V_D = 25V, I_{DQ} = 100mA, V_G = -2.6V Typical
- Chip Dimensions: 2.14 x 1.11 x 0.10 mm

Functional Block Diagram



General Description

TriQuint's TGA2598 is a broadband MMIC driver amplifier fabricated on TriQuint's production 0.25um GaN on SiC process (TQGaN25). Covering 6-12GHz, the TGA2598 provides more than 33dBm of saturated output power and 21dB of small signal gain while achieving more than 31% power-added efficiency.

The TGA2598 is an ideal choice to drive TriQuint's high performing x-band GaN HPAs allowing the user to run both driver and HPA off the same voltage rail.

Fully matched to 50Ω with integrated DC blocking capacitors on both I/O ports, the TGA2598 is ideally suited for both military and commercial radar and communications applications .

Lead-free and RoHS compliant.

Evaluation boards are available upon request.

Pad Configuration

Pad No.	Symbol
1	RF In
2	V_{D1}
3	V_{D2}
4	RF Out
5	V_{G2}
6	V_{G1}

Ordering Information

Part	ECCN	Description
TGA2598	EAR99	6 – 12GHz 2W GaN Driver Amplifier

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Absolute Maximum Ratings

Parameter	Value
Drain Voltage (V_D)	40V
Gate Voltage Range (V_G)	-8 to 0V
Drain Current (I_{D1})	128mA
Drain Current (I_{D2})	260mA
Gate Current (I_{G1})	-0.2 to 1.4mA
Gate Current (I_{G2})	-0.6 to 2.8mA
Power Dissipation (P_{DISS}), 85°C	6W
Input Power (P_{IN}), CW, 50 Ω, V_D=25V, I_{DQ}=100mA, 85°C,	30dBm
Input Power (P_{IN}), CW, VSWR 10:1, V_D=25V, I_{DQ}=100mA, 85°C	30dBm
Channel Temperature (T_{CH})	275°C
Mounting Temperature (30 Seconds)	320°C
Storage Temperature	-55 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.

Recommended Operating Conditions

Parameter	Value
Drain Voltage (V_D)	25V
Drain Current (I_{DQ})	100mA (Total)
Gate Voltage (V_G)	-2.6V (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^{0}C, V_D = 25V, I_{DQ} = 100mA, V_G = -2.6V Typical, CW

Parameter	Min	Typical	Max	Units
Operational Frequency Range	6		12	GHz
Small Signal Gain		>21		dB
Input Return Loss		>9		dB
Output Return Loss		>11		dB
Output Power (P_{SAT})		>33		dBm
Power Added Efficiency (P_{SAT})		>31		%
Small Signal Gain Temperature Coefficient		-0.05		dB/°C
Output Power Temperature Coefficient		-0.01		dBm/°C
Recommended Operating Voltage:		25	30	V

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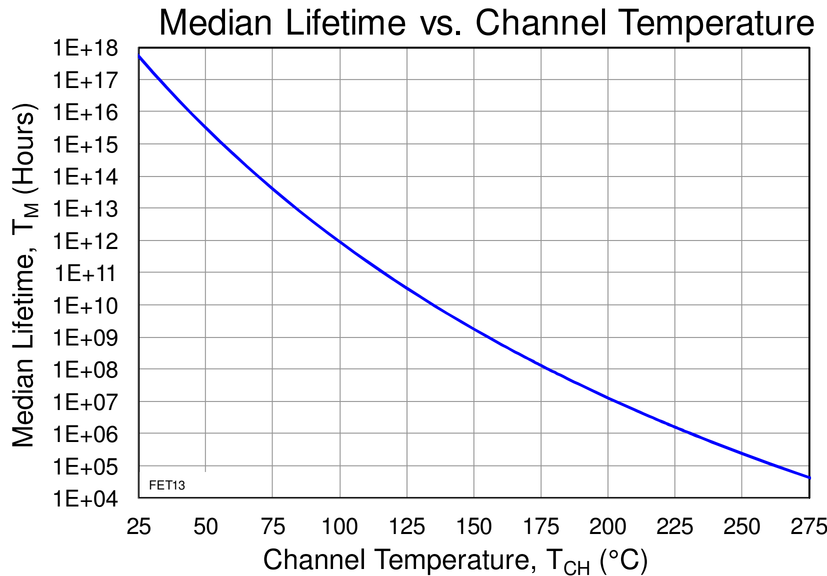
Thermal and Reliability Information

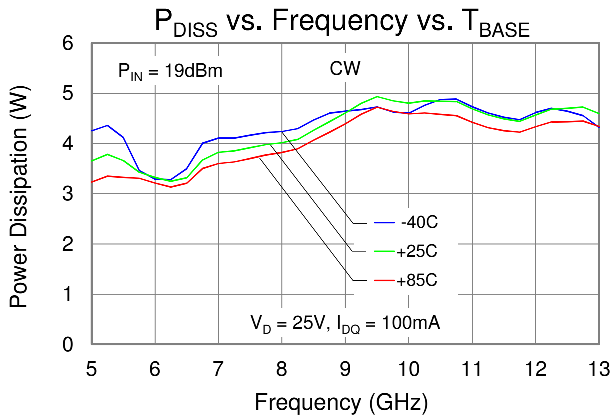
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85°C, V_D = 25V, I_{DQ} = 100mA, CW	21.84	ºC/W
Channel Temperature (T_{CH}) (Under RF drive)	T_{base} = 85°C, V_D = 25V, I_{D_Drive} = 285mA, P_{IN} = 20dBm, P_{OUT} = 33.5dBm, P_{DISS} = 4.8 W	190	°C
Median Lifetime (T_M)		3.12 x 10^7	Hrs

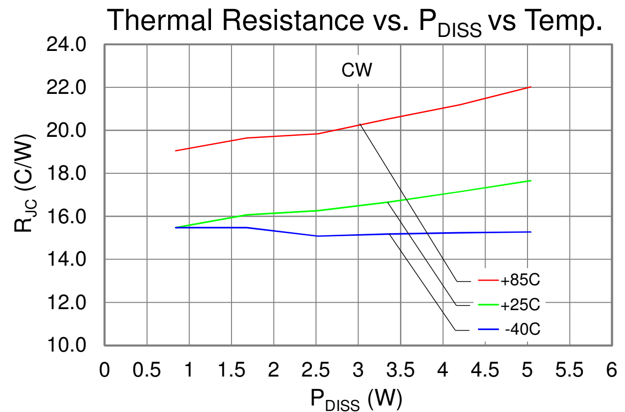
Notes:

1. Thermal resistance measured to back of carrier plate. MMIC mounted on 20 mils CuMo (85/15) carrier using 4 mil AuSn.

Test Conditions: V_D = 40 V; Failure Criteria = 10% reduction in I_{D_MAX}







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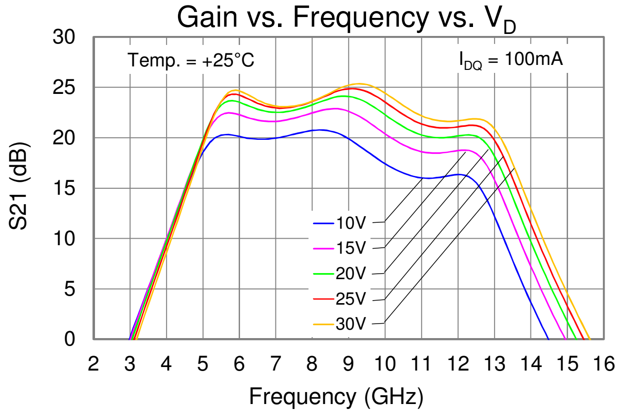
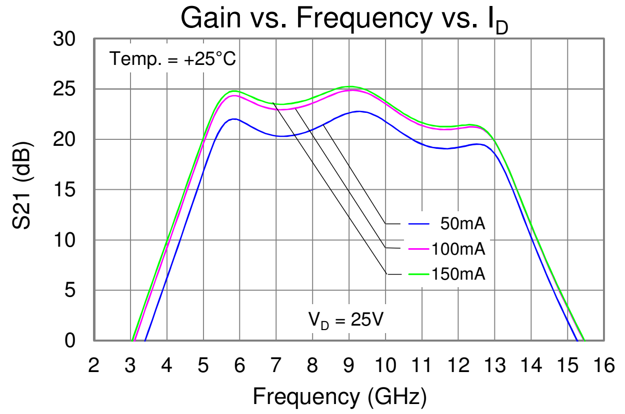
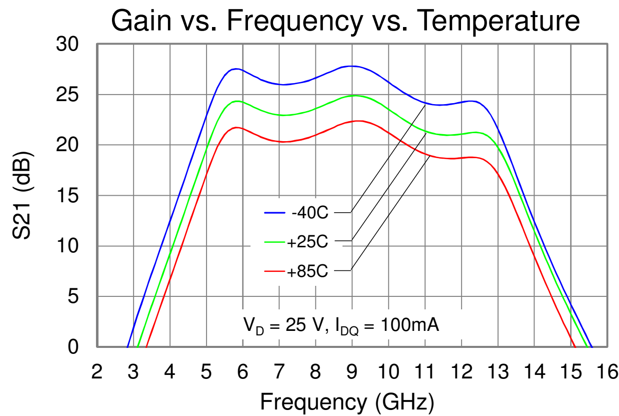
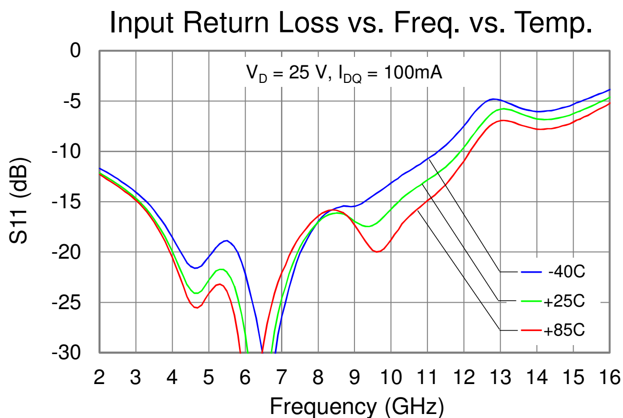
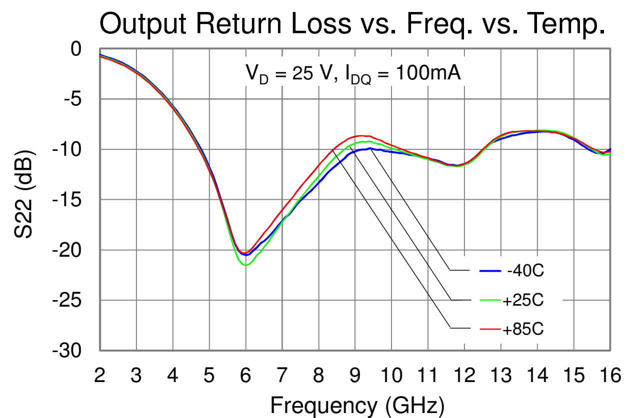
Typical Performance (Small Signal)











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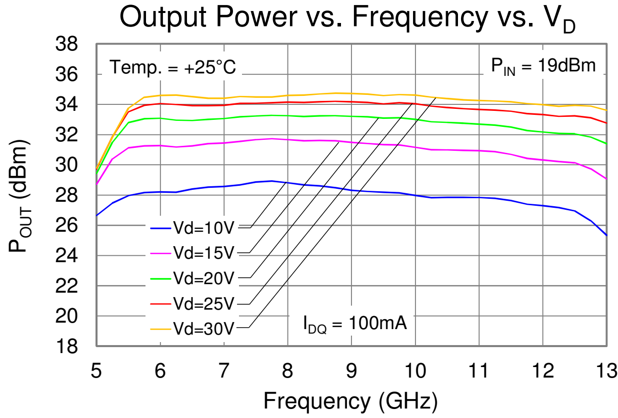
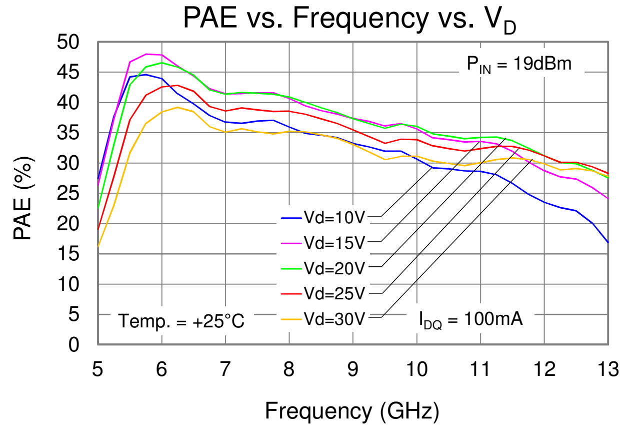
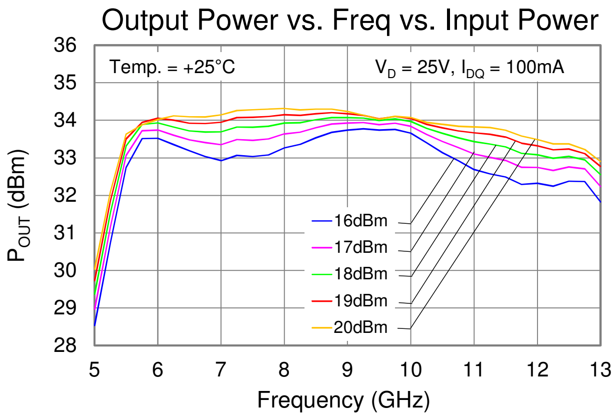
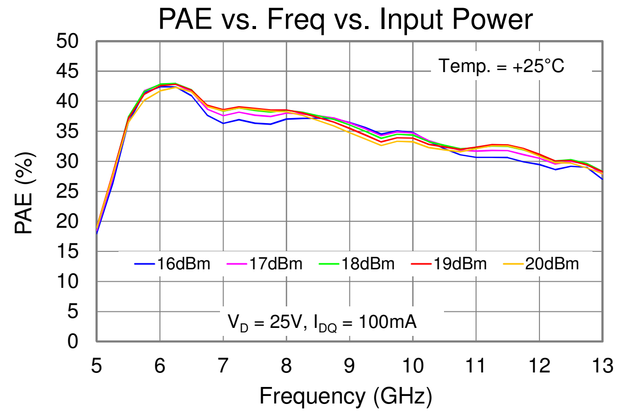
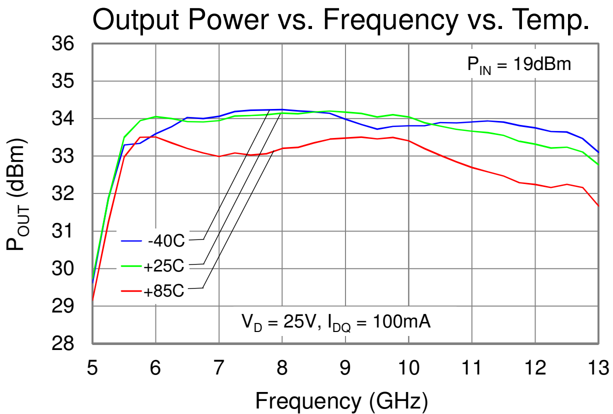
Typical Performance (Large Signal)

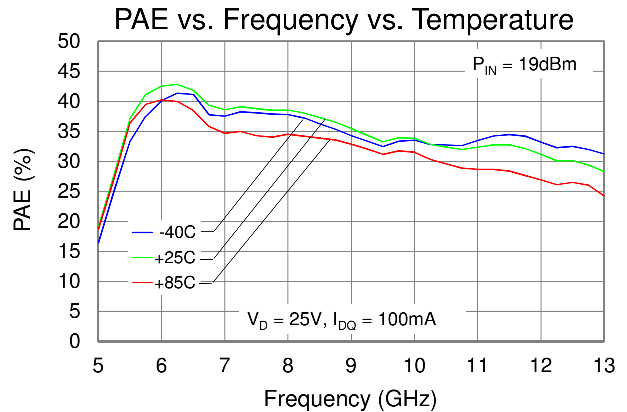












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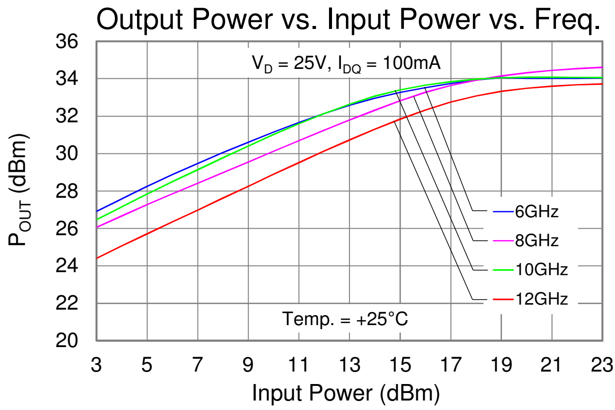
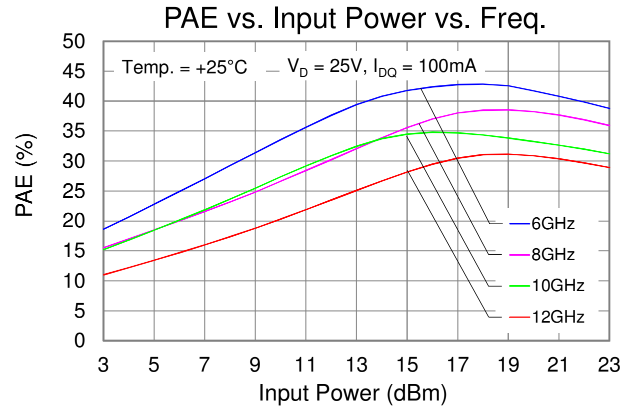
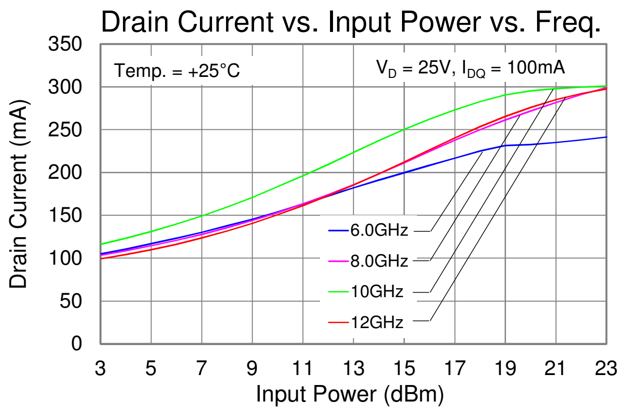
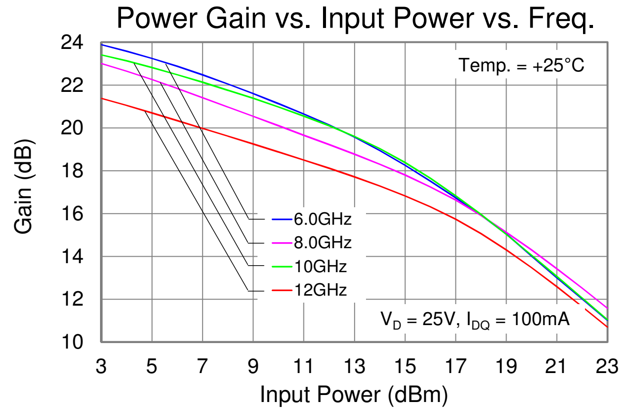
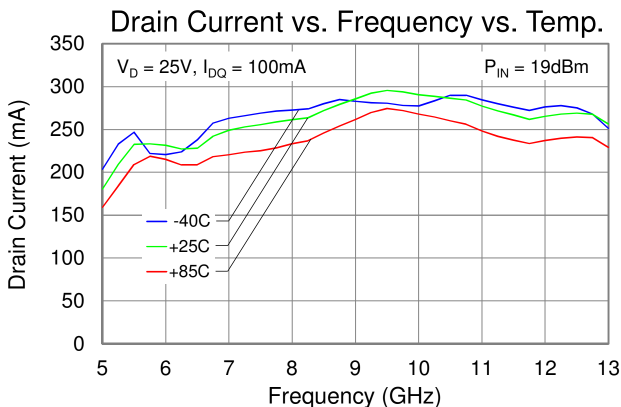
Typical Performance (Large Signal)

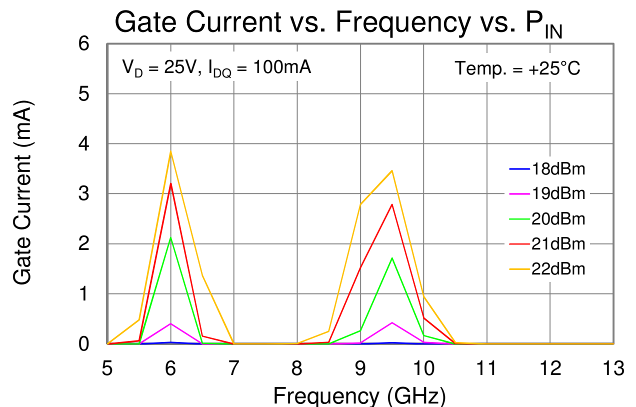












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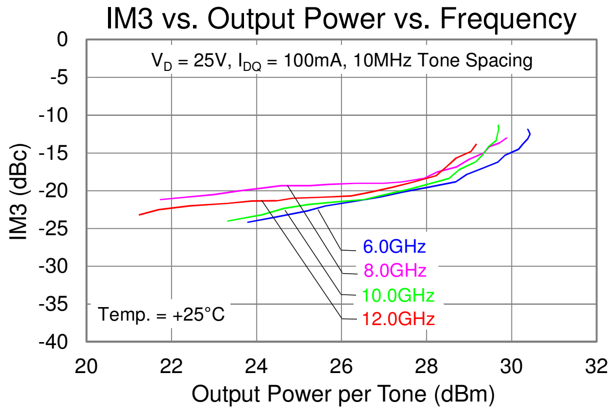
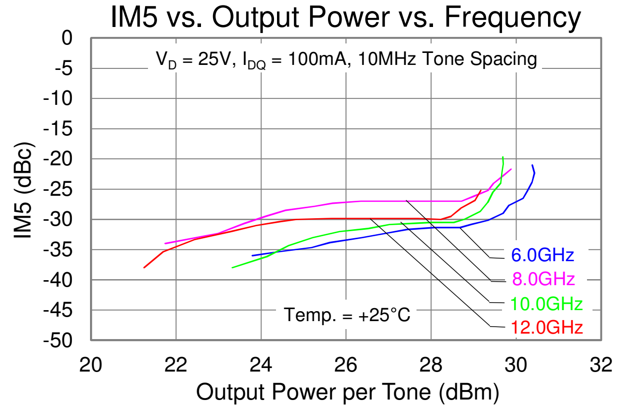
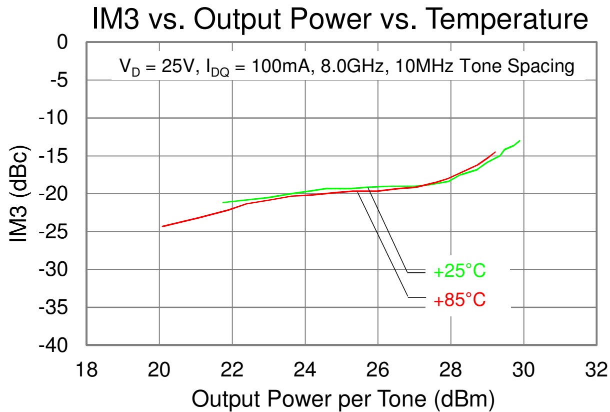
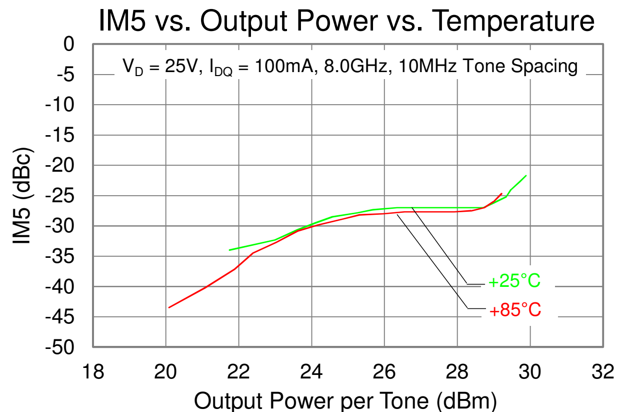
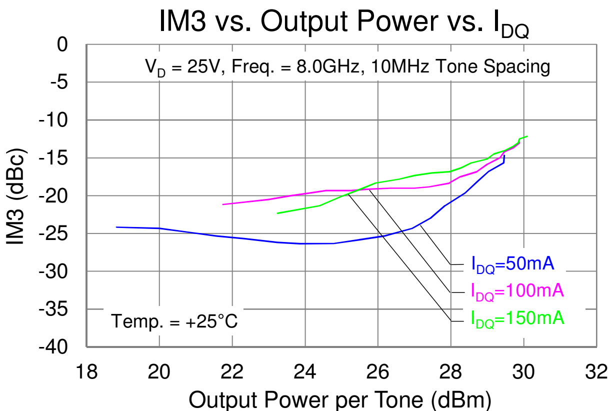
Typical Performance (Linearity)

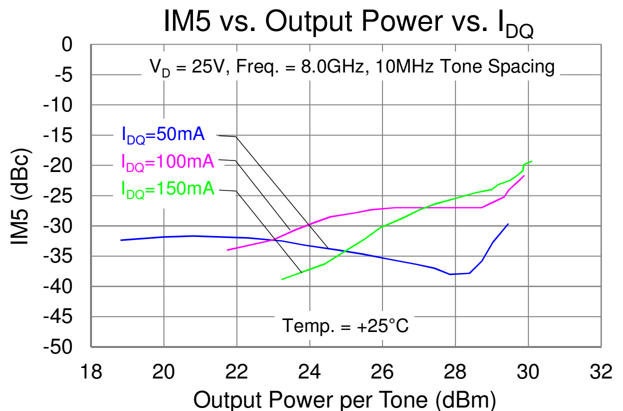












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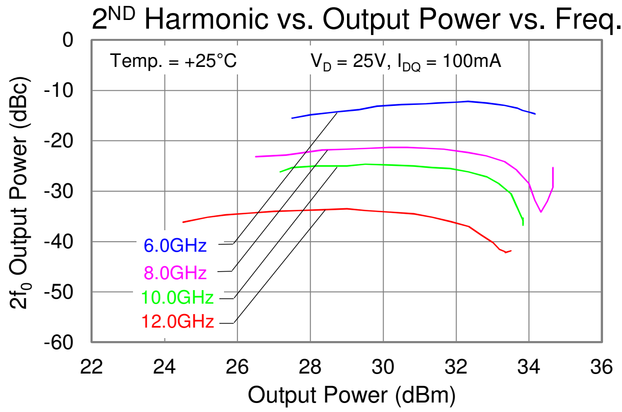

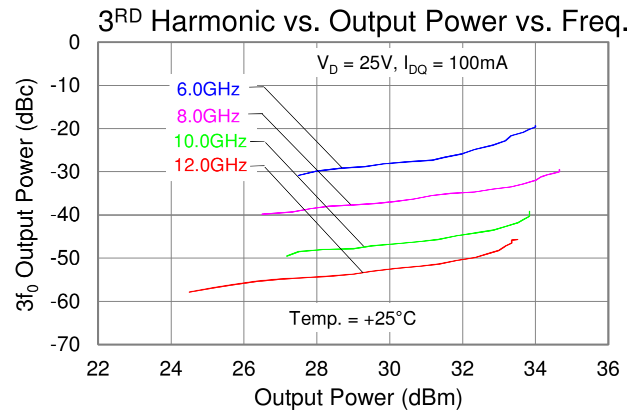

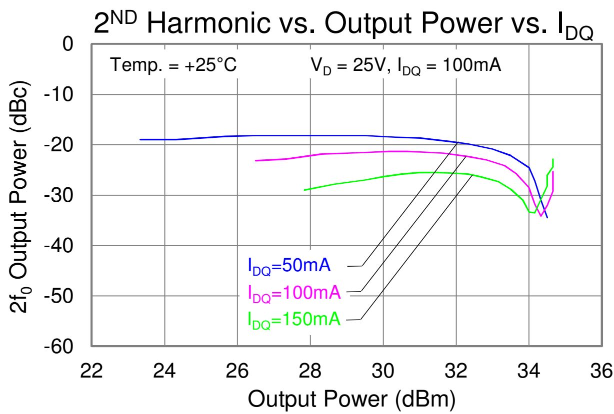

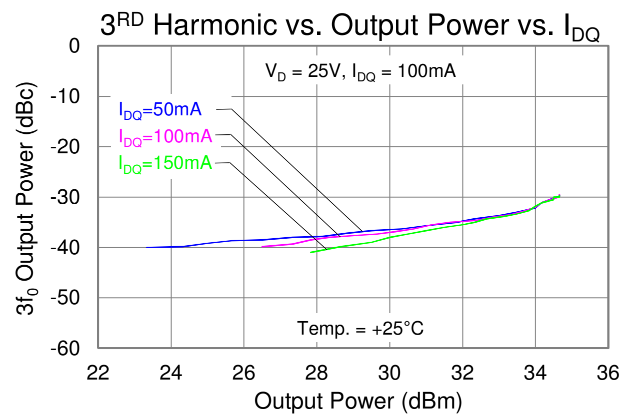

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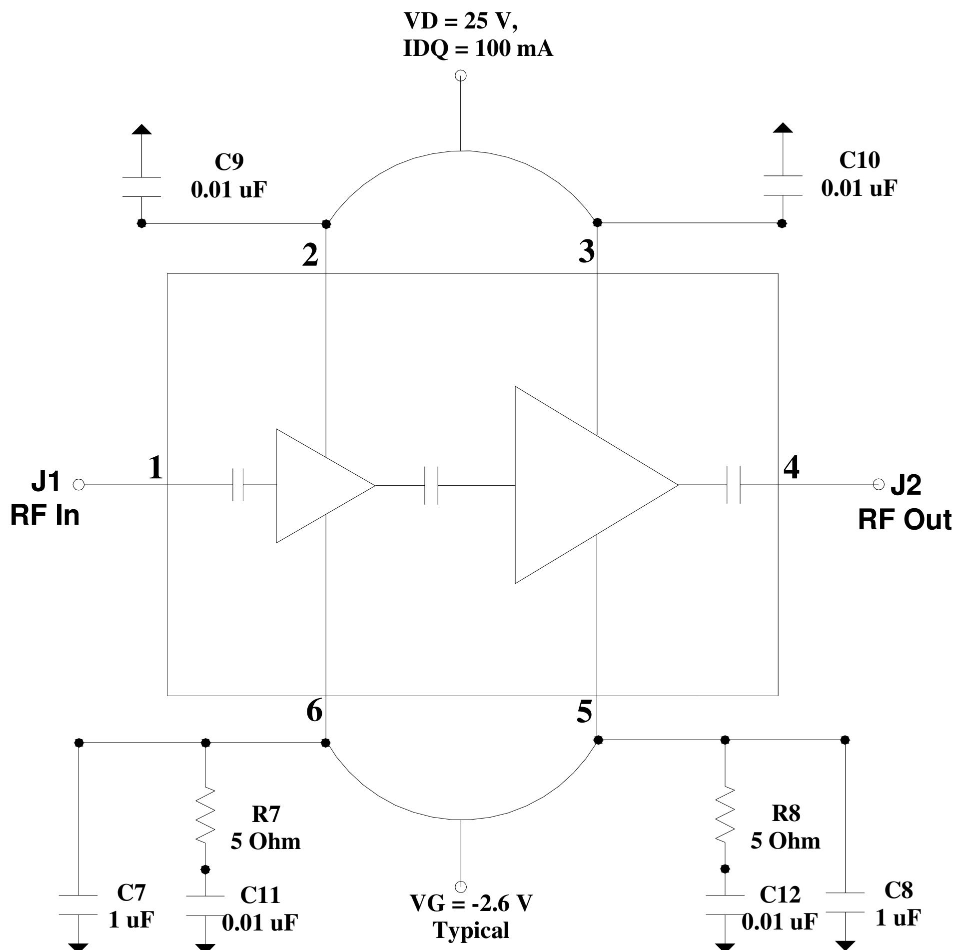
Application Circuit



Bias-up Procedure

1. Set I_D limit to 320mA, I_G limit to 4mA
2. Apply -5.0V to V_G
3. Apply +25V to V_D
4. Adjust V_G more positive until I_{DQ} = 100mA (V_G ~ -2.6 V Typical)
5. Apply RF signal

Bias-down Procedure

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

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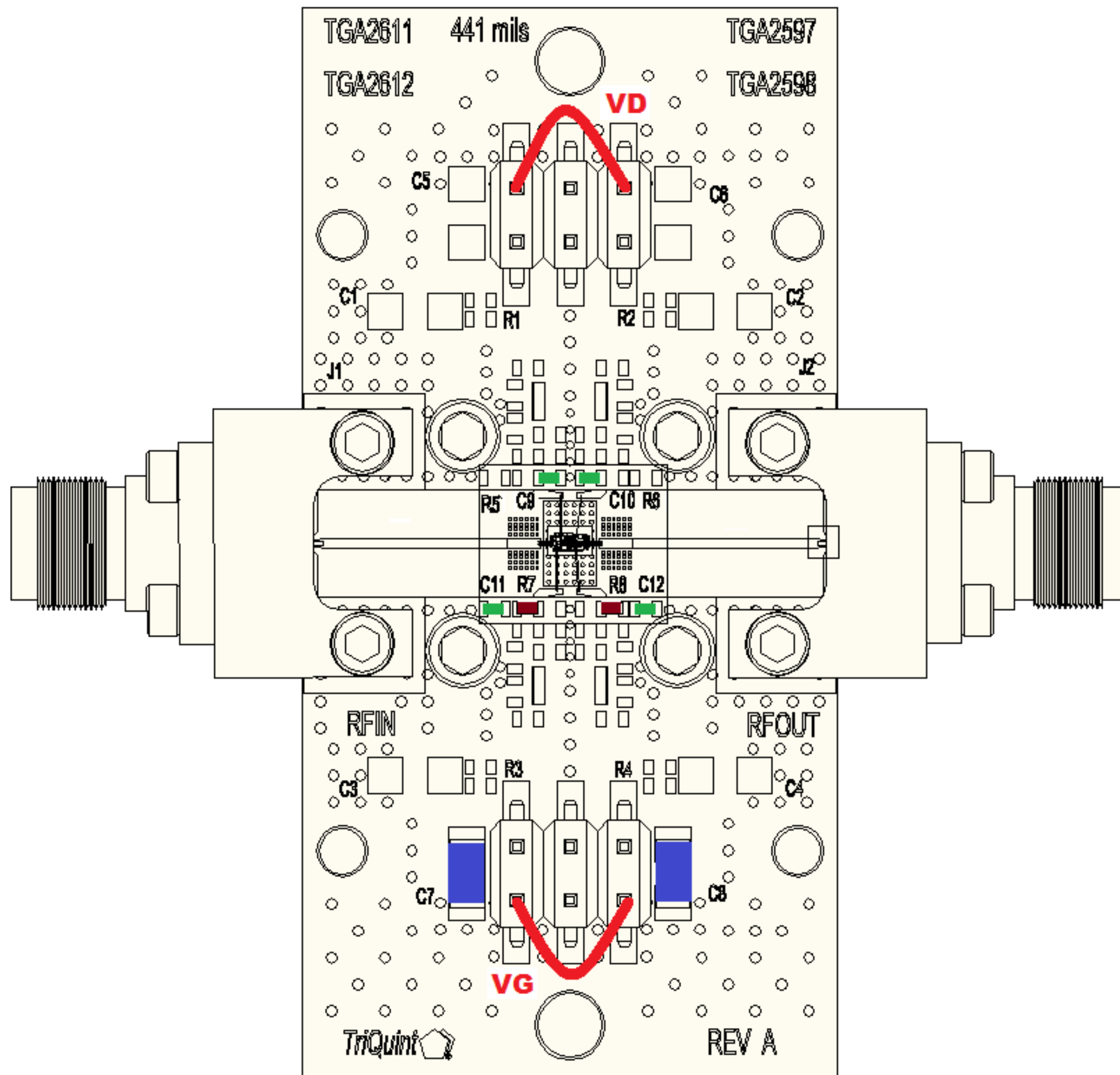
Assembly Drawing



Bill of Material

Reference Des.	Value	Description	Manuf.	Part Number
C7 – C8	1uF	Cap, 1206, 16V, 20%, X5R	Various	
C9 – C12	0.01uF	Cap, 0402, 50V, 10%, X7R	Various	
R7 – R8	5Ω	Res, 0402, 5%	Various	

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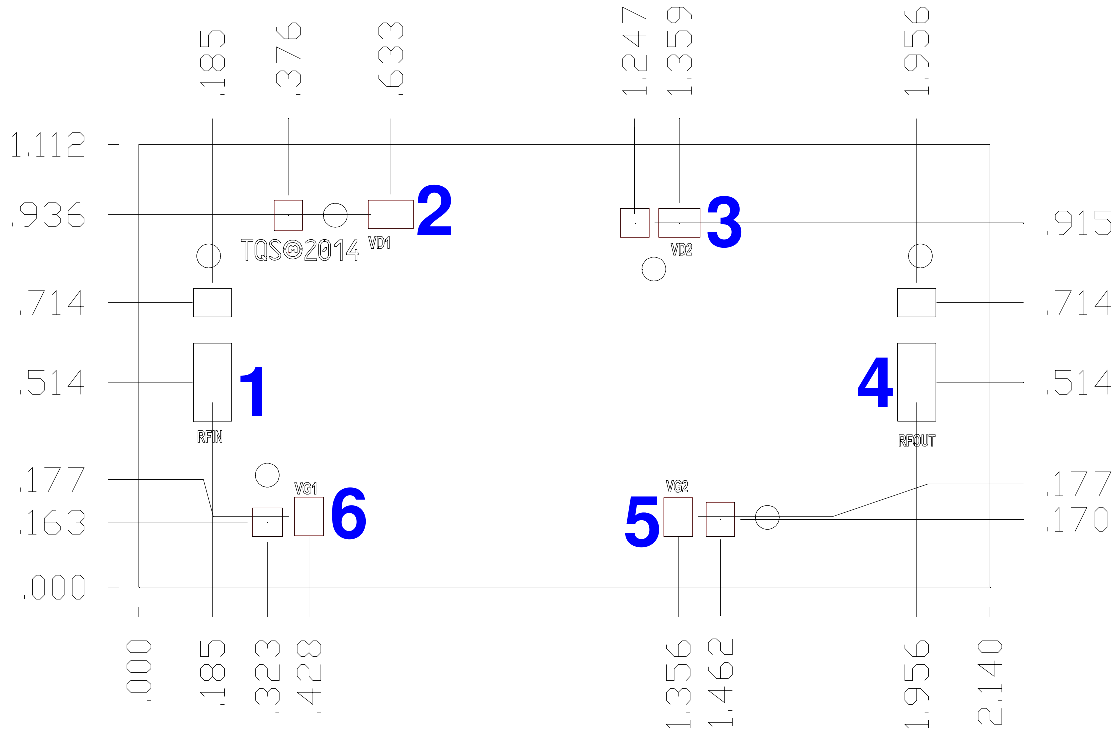
Mechanical Drawing & Bond Pad Description



Unit: millimeters
Thickness: 0.10
Die x, y size tolerance: +/- 0.050
Chip edge to bond pad dimensions are shown to center of pad
Ground is backside of die

Bond Pad	Symbol	Pad Size	Description
1	RF In	0.096 x 0.196	Input; matched to 50 ohms; DC blocked.
2	V_{D1}	0.113 x 0.072	Drain voltage 1, bias network is required; see Application Circuit on page 9 as an example
3	V_{D2}	0.104 x 0.072	Drain voltage 2, bias network is required; see Application Circuit on page 9 as an example.
4	RF Out	0.096 x 0.196	Output; matched to 50 ohms; DC blocked.
5	V_{G2}	0.072 x 0.098	Gate voltage 2, bias network is required; see Application Circuit on page 9 as an example.
6	V_{G1}	0.072 x 0.098	Gate voltage 1, bias network is required; see Application Circuit on page 9 as an example.

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Assembly Notes

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment (i.e. epoxy) can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300°C to 3-4 minutes, maximum.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonic are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.

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