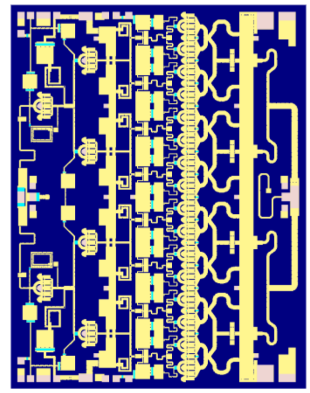
## Applications

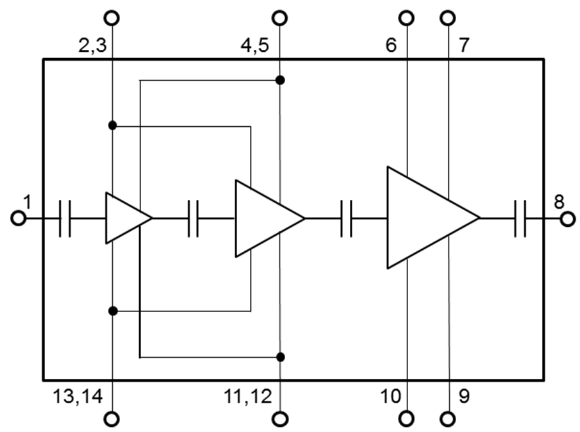
- Electronic Warfare
- Commercial and Military Radar



## Product Features

- Frequency Range: 6 - 12 GHz
- Output Power: > 45 dBm ($P_{IN}$ = 23 dBm)
- PAE: > 25 % ($P_{IN}$ = 23 dBm)
- Large Signal Gain: > 22.0 dB
- $V_D$ = 20 V, $I_{DQ}$ = 2.0 A, $V_G$ = -2.4 V typ.
- Chip Dimensions: 5.4 mm x 7.0 mm x 0.10 mm

## Functional Block Diagram




## General Description

TriQuint's TGA2590 is a wideband power amplifier fabricated on TriQuint's production 0.25um GaN on SiC process. The TGA2590 operates from 6 - 12GHz and provides greater than 30W of saturated output power with greater than 22 dB of large signal gain and greater than 25% power-added efficiency.

The TGA2590 is fully matched to 50Ω with DC blocking caps at both RF ports allowing for simple system integration. The broadband performance supports electronic warfare and radar across defense and commercial markets.

Lead-free and RoHS compliant.

Evaluation boards are available upon request.

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## Pad Configuration

| Pad No. | Symbol |
|---|---|
| 1 | RF In |
| 2, 14 | $V_{G1}$ |
| 3, 13 | $V_{G2}$ |
| 4, 12 | $V_{D1}$ |
| 5, 11 | $V_{D2}$ |
| 6, 10 | $V_{G3}$ |
| 7, 9 | $V_{D3}$ |
| 8 | RF Out |

## Ordering Information

| Part | ECCN | Description |
|---|---|---|
| TGA2590 | 3A001.b.2.b | 6-12 GHz 30W PA |

## Absolute Maximum Ratings

| Parameter | Value |
|---|---|
| Drain Voltage ($V_D$) | 40 V |
| Gate Voltage Range ($V_G$) | -8 to 0 V |
| Drain Current w/ RF Drive ($I_{D\_DRIVE}$) | 8.0 |
| Gate Current ($I_G$) | -20 to 60 mA |
| Power Dissipation ($P_{DISS}$) | 115 W |
| Input Power, CW, 50 Ω, 85 °C ($P_{IN}$) | 30 dBm |
| Input Power, CW, 6:1 VSWR, 85 °C ($P_{IN}$) | 27 dBm |
| Channel temperature ($T_{CH}$) | 275 °C |
| Mounting Temperature (30 Seconds maximum) | 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 ($V_D$) | 20 V |
| Drain Current ($I_{DQ}$) | 2.0 A |
| Drain Current w/ RF Drive ($I_{D\_DRIVE}$) | < 7.0 A |
| Gate Voltage ($V_G$), typ. | - 2.4 V |
| Input Power ($P_{IN}$) | +17 to +25 dBm |
| Load VSWR | < 2.0:1 |

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

## Electrical Specifications

Test conditions unless otherwise noted: 25 °C, $V_D$ = 20 V, $I_{DQ}$ = 2.0 A, $V_G$ = -2.4 V typ.

| Parameter | Min | Typical | Max | Units |
|---|---|---|---|---|
| Operational Frequency Range | 6.0 | | 12.0 | GHz |
| Output Power ($P_{IN}$ = 23 dBm) | | 46.0 | | dBm |
| Power Added Efficiency ($P_{IN}$ = 23 dBm) | | 32.5 | | % |
| Input Return Loss | | 13.0 | | dB |
| Output Return Loss | | 11.0 | | dB |
| Output Power Temperature Coefficient | | -0.02 | | dBm/ °C |
| Input Power | 17.0 | | 25.0 | dBm |
| Load VSWR | | | 2.0:1 | |

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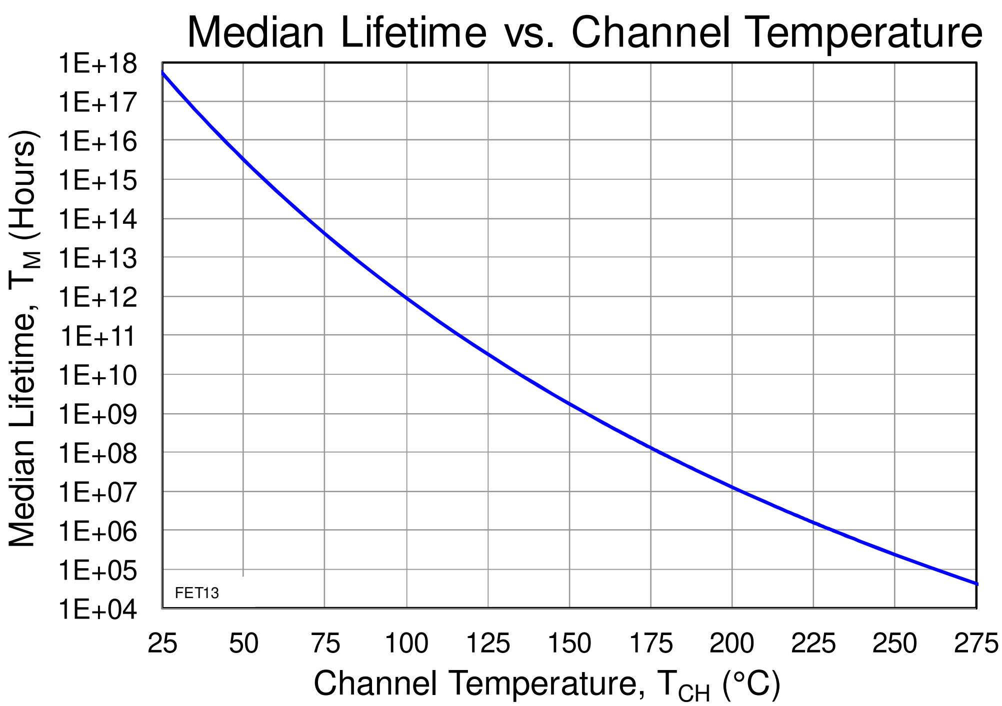
## Thermal and Reliability Information

| Parameter | Test Conditions | Value | Units |
|---|---|---|---|
| Thermal Resistance ($\theta_{JC}$) [1] | $T_{BASE}$ = 85°C, $V_D$ = 20V, $I_{D\_Drive}$ = 5.5 A, $P_{IN}$ = 23 dBm, $P_{OUT}$ = 44 dBm, $P_{DISS}$ = 85 W | 1.3 | ºC/W |
| Channel Temperature ($T_{CH}$) | | 201 | °C |
| Median Lifetime ($T_M$) | | 1.16E7 | Hrs |
| Thermal Resistance ($\theta_{JC}$) [1] | $T_{BASE}$ = 85°C, $V_D$ = 25V, $I_{D\_Drive}$ = 5.8 A, $P_{IN}$ = 23 dBm, $P_{OUT}$ = 45.6 dBm, $P_{DISS}$ = 109 W | 1.4 | ºC/W |
| Channel Temperature ($T_{CH}$) | | 237 | °C |
| Median Lifetime ($T_M$) | | 6.15E5 | Hrs |

Notes:
1. MMIC soldered to 20 mil thick Cu-Mo carrier plate using 1.5 mil thick AuSn solder. Thermal resistance is determined from the channel to the back of the carrier plate (fixed 85 °C temp.).

## Median Lifetime

Test Conditions: 40 V; Failure Criteria = 10% reduction in $I_{D\ MAX}$

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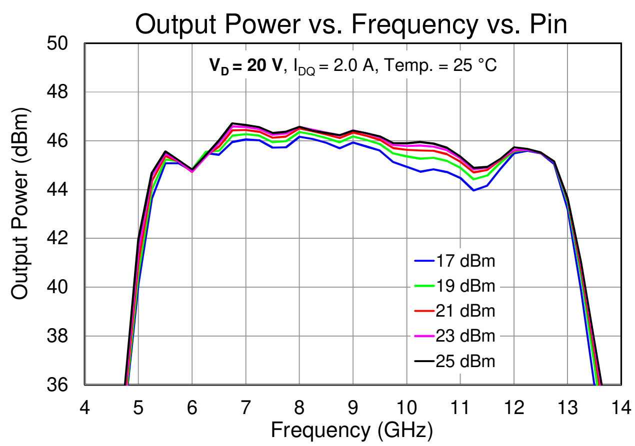
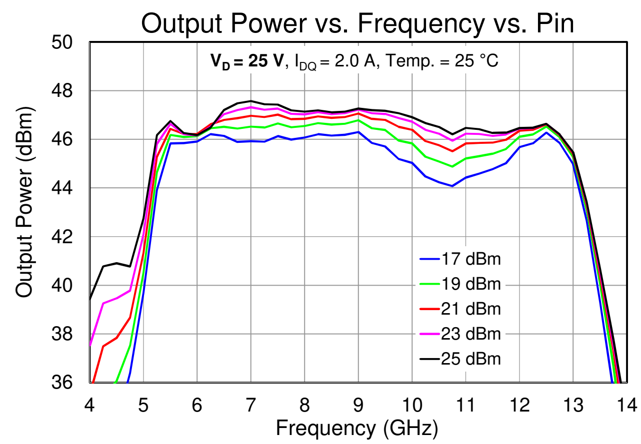
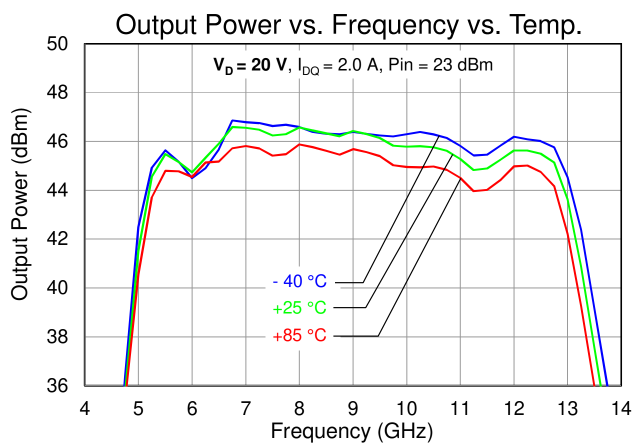
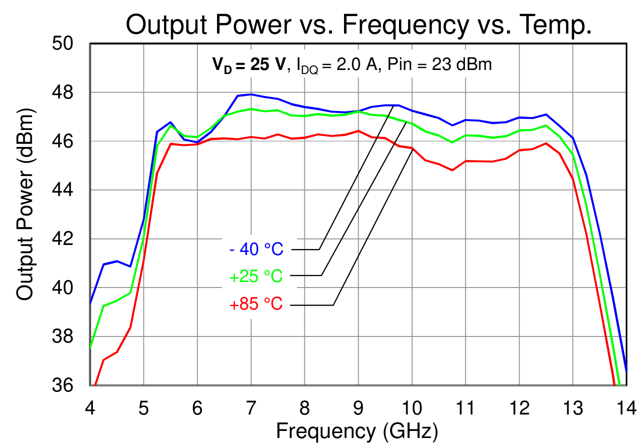
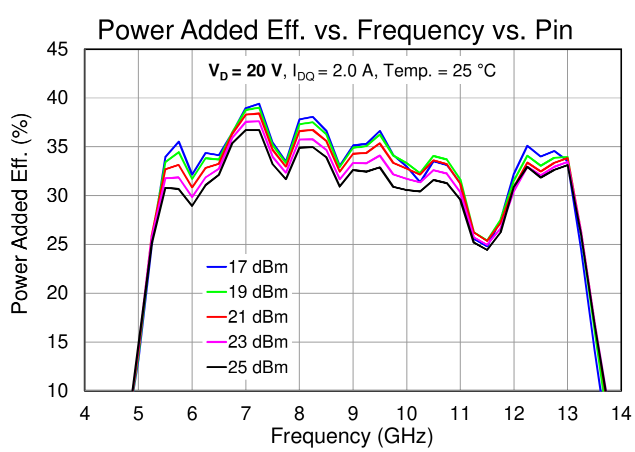
## Typical Performance

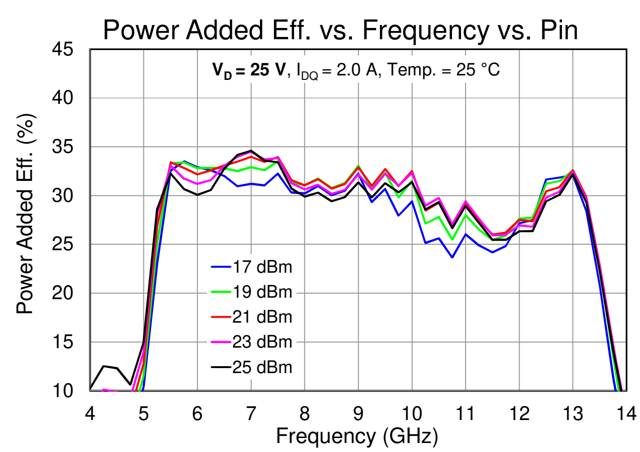
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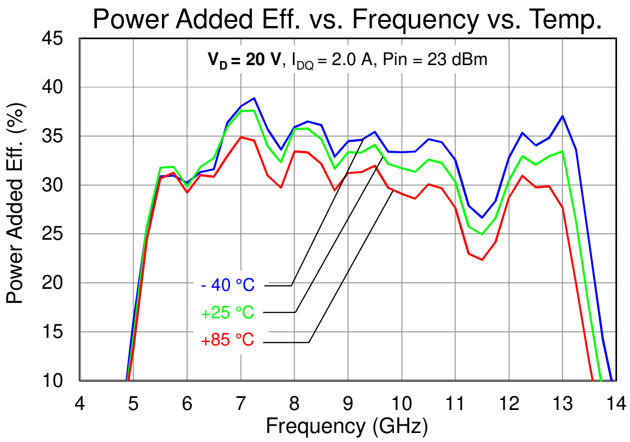
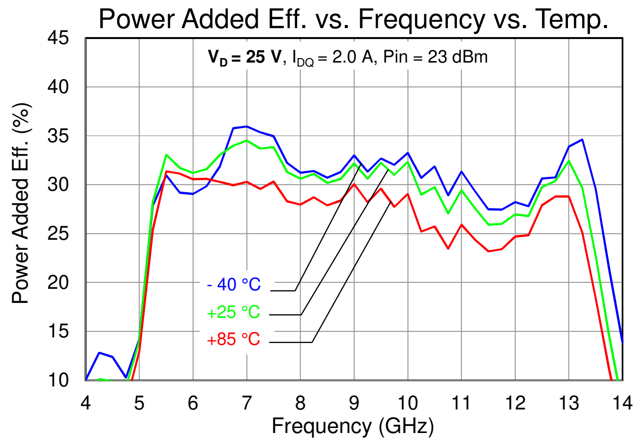
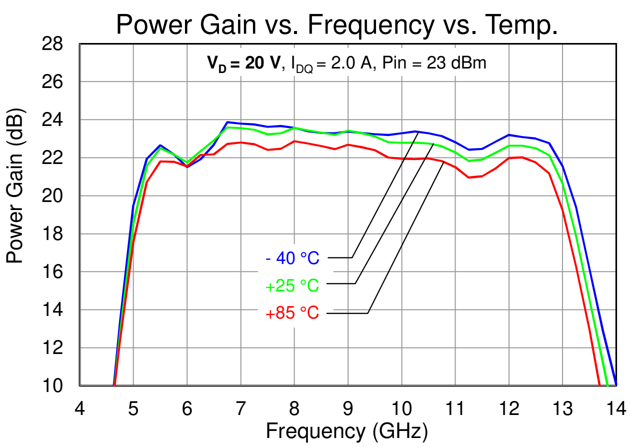
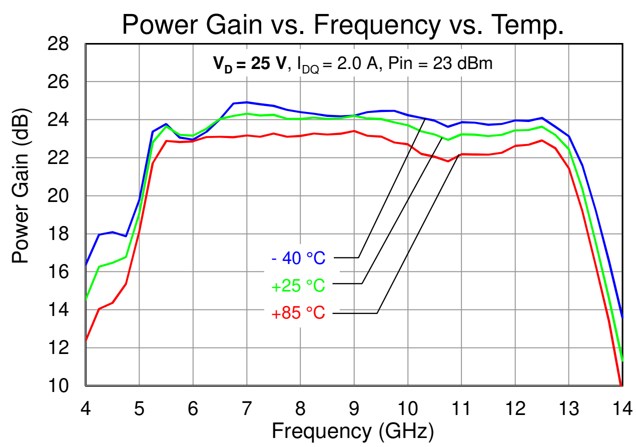
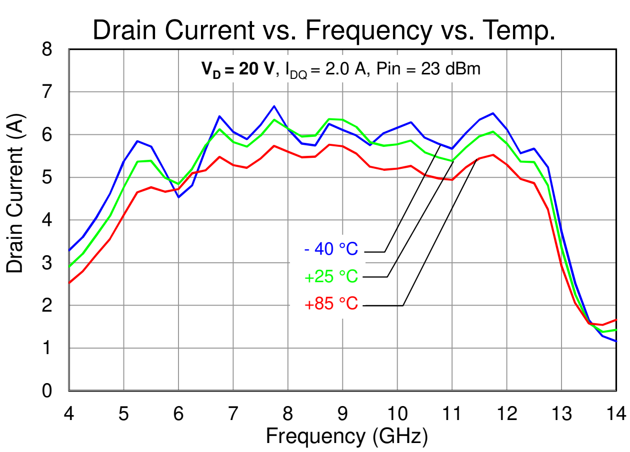
## Typical Performance

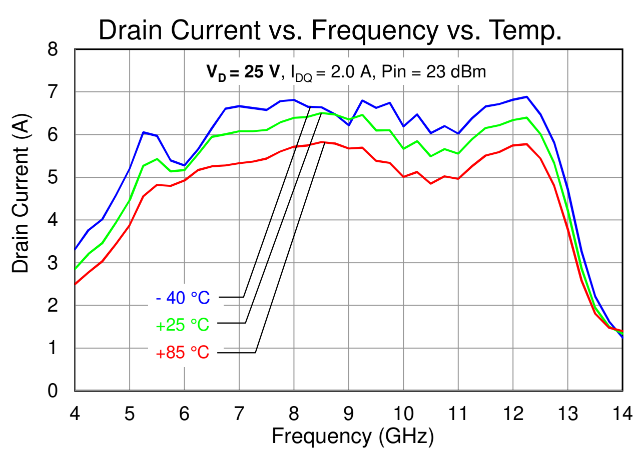
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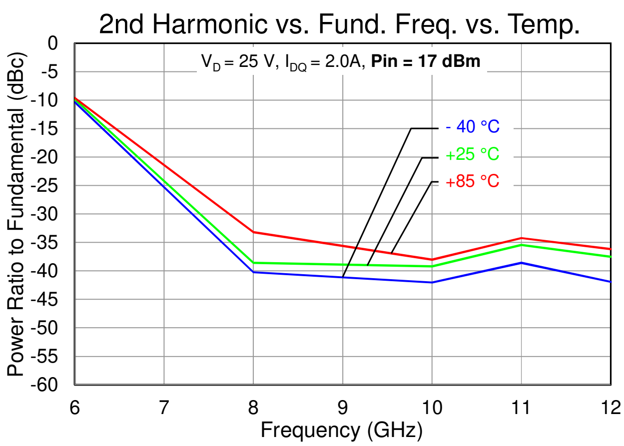
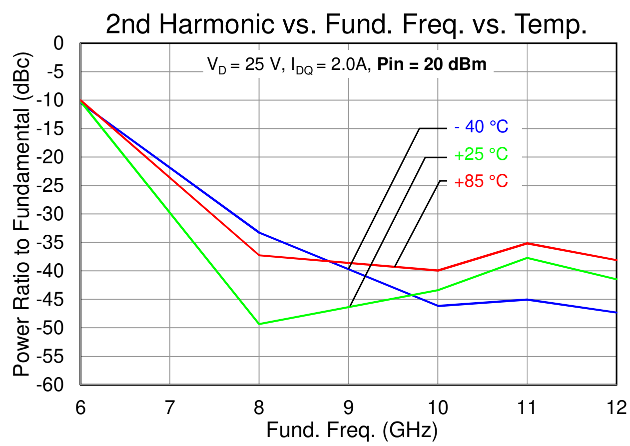
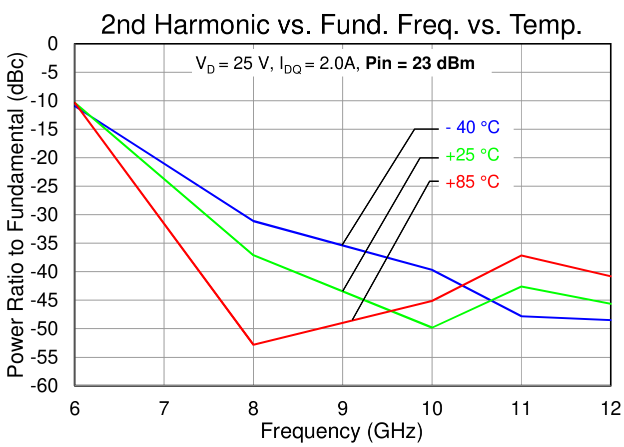
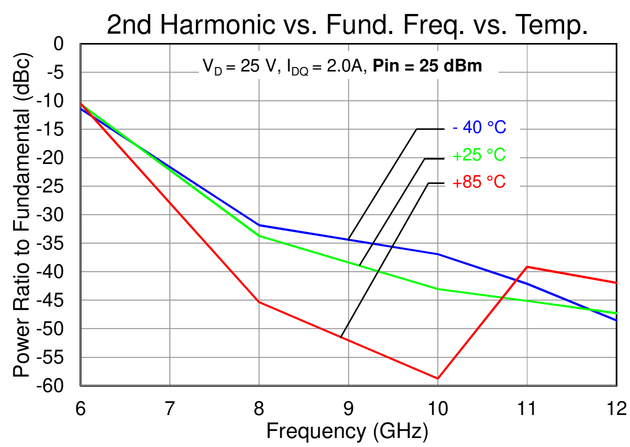
## Typical Performance

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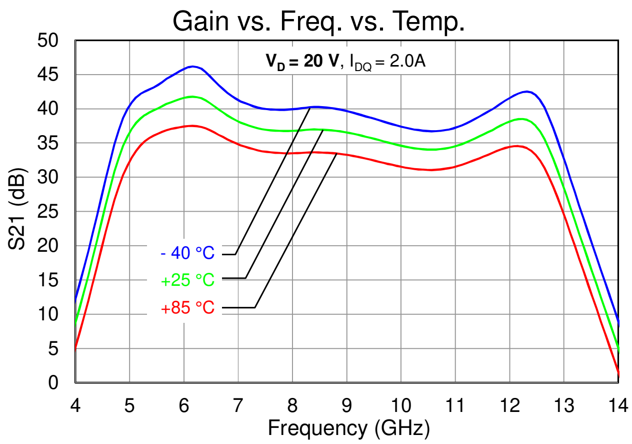
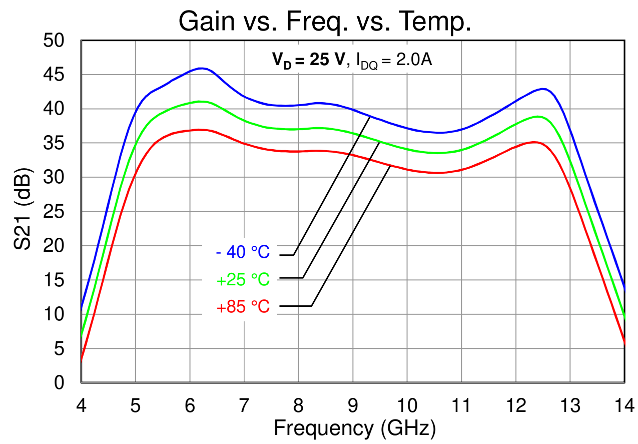
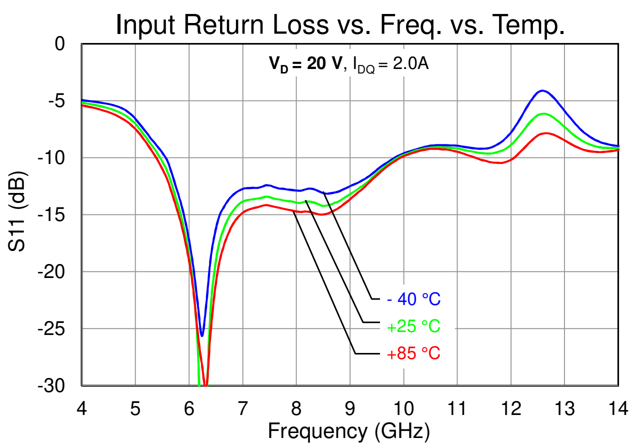
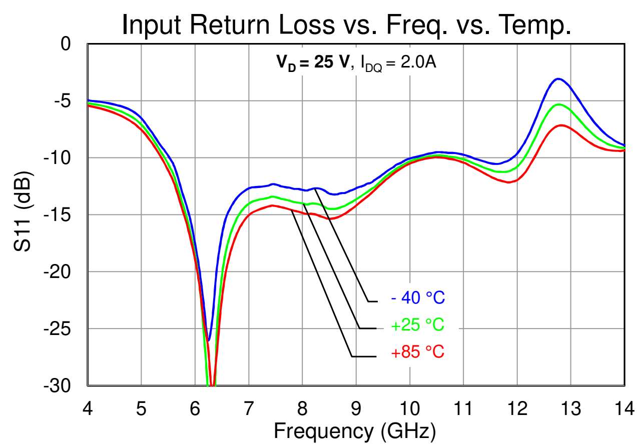
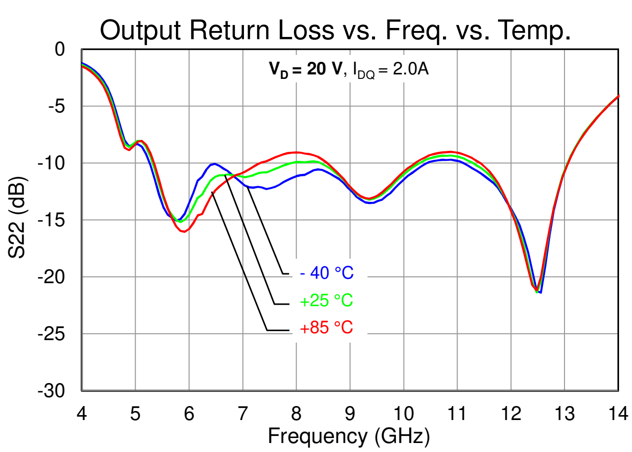
## Typical Performance

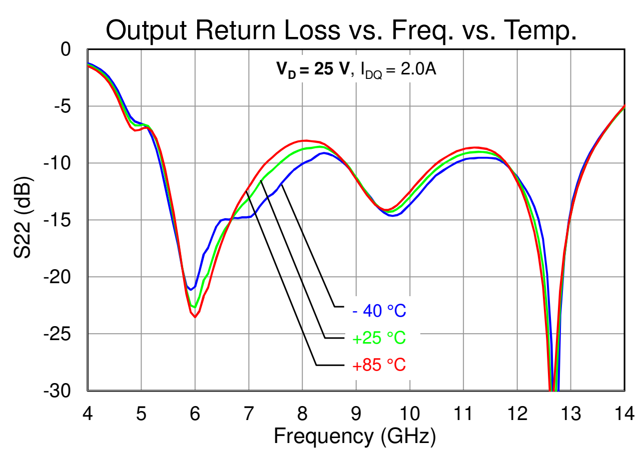
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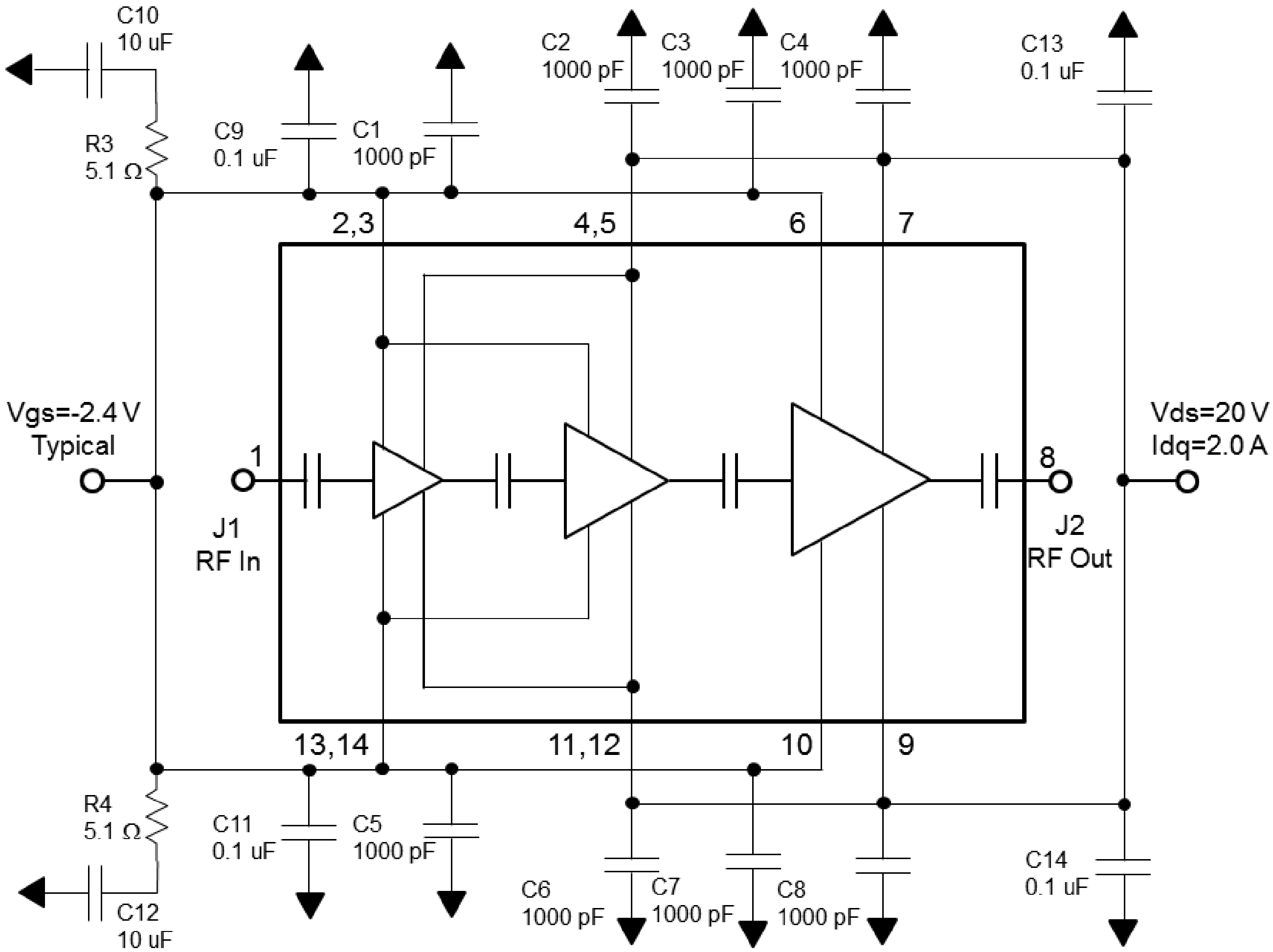
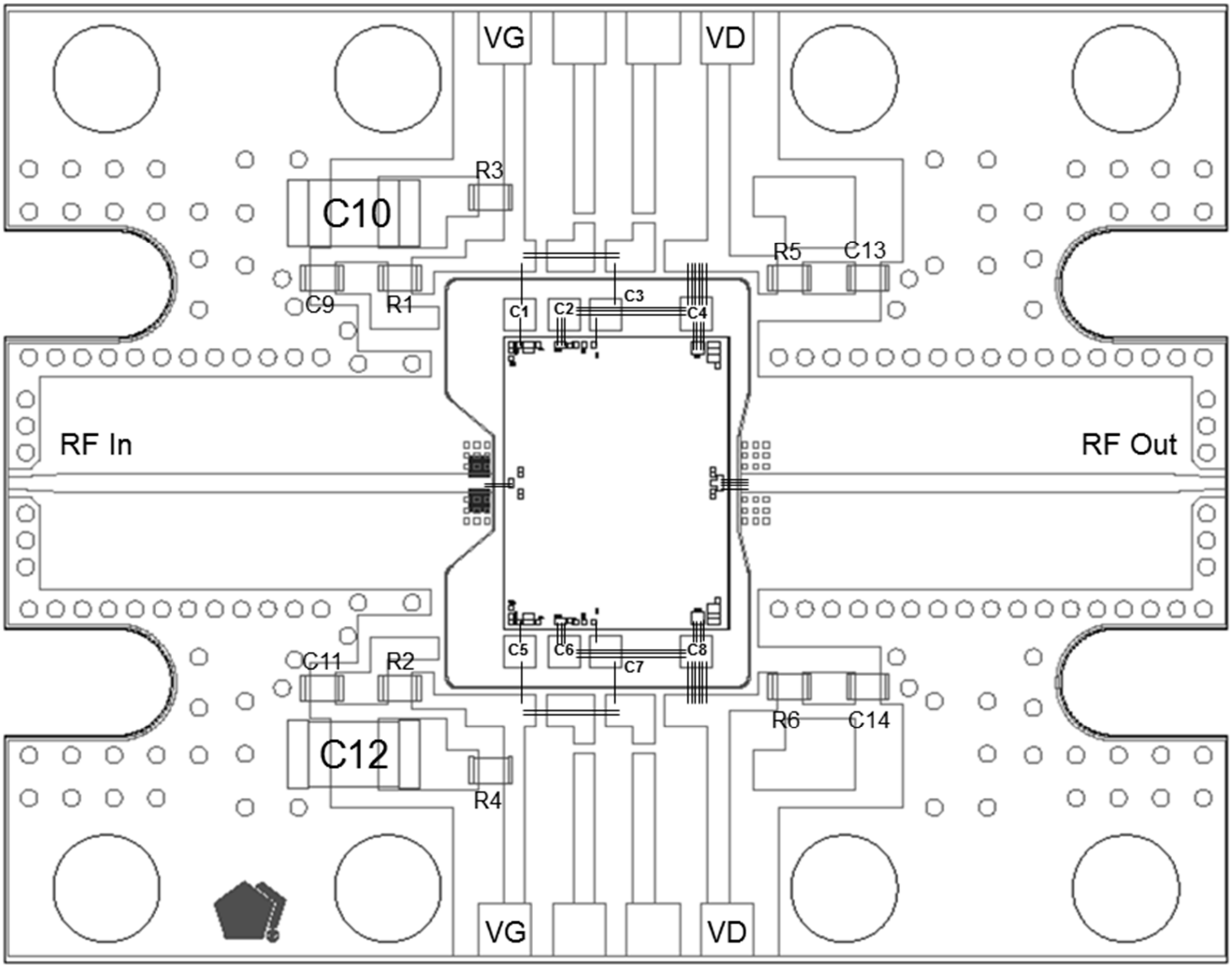
## Application Circuit




| Bias-up Procedure |
|---|
| 1. Set $I_D$ limit to 8.0, $I_G$ limit to 150mA |
| 2. Set $V_G$ to -5.0V |
| 3. Set $V_D$ +20V |
| 4. Adjust $V_G$ more positive until $I_{DQ}$ = 2.0 A |
| 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 |

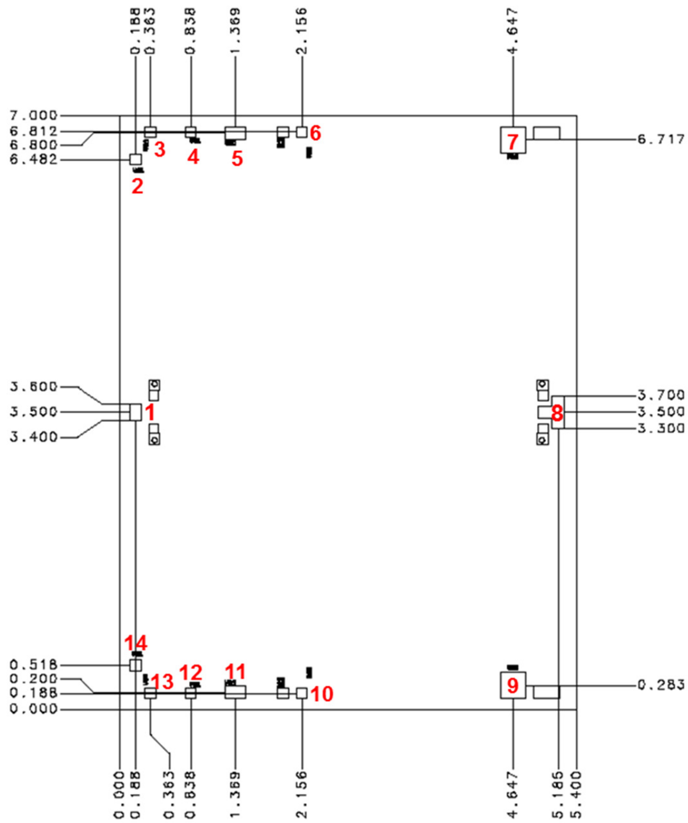
## Evaluation Board




## Bill of Materials

| Ref. Designation | Value | Description | Manufacturer | Part Number |
|---|---|---|---|---|
| C1 – C8 | 1000 pF | SLC, 50V | Various | |
| C9, C11, C13, C14 | 0.1 uF | Cap, 0402, 50V, 10%, X7R | Various | |
| C10, C12 | 10 uF | Cap, 1206, 50V, 10%, X7R | Various | |
| R1, R2, R5, R6 | 0 Ω | Res, 0402 | Various | |
| R3 – R4 | 5.1 Ω | Res, 0402 | Various | |

## 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 | Description |
|---|---|---|
| 1 | RF In | Input; matched to 50 ohms; AC coupled. |
| 2, 14 | $V_{G1}$ | Gate voltage, $V_{G1}$ top and bottom. $V_{G1}$ top (pad 2) internally connected to $V_{G2}$ top (pad 3); $V_{G1}$ bottom (pad 14) internally connected to $V_{G2}$ bottom (pad 13). |
| 3, 13 | $V_{G2}$ | Gate voltage, $V_{G2}$ top and bottom. Bias network required; must be biased from both sides. $V_{G1}$ top (pad 2) internally connected to $V_{G2}$ top (pad 3); $V_{G1}$ bottom (pad 14) internally connected to $V_{G2}$ bottom (pad 13). |
| 4, 12 | $V_{D1}$ | Drain voltage, $V_{D1}$ top and bottom. Bias network required; must be biased from both sides. |
| 5, 11 | $V_{D2}$ | Drain voltage, $V_{D2}$ top and bottom. Bias network required; must be biased from both sides. |
| 6, 10 | $V_{G3}$ | Gate voltage, $V_{G3}$ top and bottom. Bias network required; must be biased from both sides. |
| 7, 9 | $V_{D3}$ | Drain voltage, $V_{D3}$ top and bottom. Bias network required; must be biased from both sides. |
| 8 | RF Out | Output; matched to 50 ohms; AC coupled. |

## 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 ultrasonics are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.

## 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 |

### ECCN

US Department of State: 3A001.b.2.b

### Solderability

Use only AuSn (80/20) solder and limit exposure to temperatures above 300 °C to 3-4 minutes, maximum.

### RoHS-Compliance

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:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_{4}0_{2}$) Free
- PFOS Free
- SVHC Free

## Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

| | | | |
|---|---|---|---|
| **Web:** | www.triquint.com | **Tel:** | **+1.972.994.8465** |
| **Email:** | info-sales@triquint.com | **Fax:** | **+1.972.994.8504** |

For technical questions and application information: **Email:** info-products@triquint.com

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