

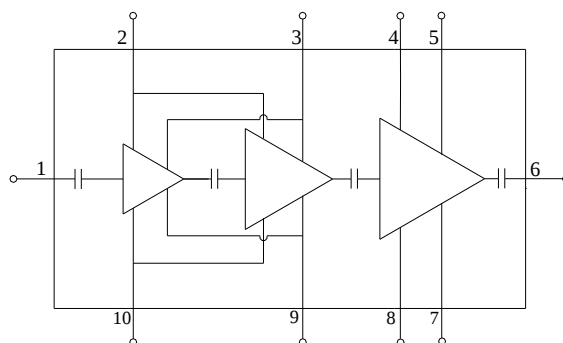
### Applications

- X-band radar

### Product Features

- Frequency Range: 10 – 11GHz
- $P_{SAT}$ : 45.5dBm @  $P_{IN} = 18\text{dBm}$
- $P_{1dB}$ : 41dBm @ Midband
- PAE: >47% @  $P_{IN} = 18\text{dBm}$
- Large Signal Gain: 27.5dB
- Small Signal Gain: 35dB
- Bias:  $V_D = 28\text{V}$ ,  $I_{DQ} = 290\text{mA}$ ,  $V_G = -2.7\text{V}$  Typical
- Pulsed  $V_D$ :  $PW = 100\mu\text{s}$  and  $DC = 10\%$
- Chip Dimensions: 5.0 x 4.86 x 0.10 mm

### Functional Block Diagram



### General Description

TriQuint's TGA2623 is an x-band, high power MMIC amplifier fabricated on TriQuint's production 0.25um GaN on SiC process. The TGA2623 operates from 10 – 11GHz and provides a superior combination of power, gain and efficiency. Achieving 35W of saturated output power with 27.5dB of large signal gain and 47% power-added efficiency, the TGA2623 provides the level of performance demanded by today's system architectures. Depending on the system requirements, the TGA2623 can support cost saving initiatives on existing systems while supporting next generation systems with increased performance.

Lead-free and RoHS compliant.

Evaluation boards are available upon request.

### Pad Configuration

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

### Ordering Information

| Part    | ECCN        | Description                        |
|---------|-------------|------------------------------------|
| TGA2623 | 3A001.b.2.b | 10 – 11GHz 35W GaN Power Amplifier |

### Absolute Maximum Ratings

| Parameter                                                  | Value          |
|------------------------------------------------------------|----------------|
| Drain Voltage ( $V_D$ )                                    | 40V            |
| Gate Voltage Range ( $V_G$ )                               | -10 to -2V     |
| Drain Current ( $I_{D1-2}$ )                               | 2.3A           |
| Drain Current ( $I_{D3}$ )                                 | 4.3A           |
| Gate Current ( $I_{G1-2}$ )                                | -3.5 to 17.5mA |
| Gate Current ( $I_{G3}$ )                                  | -11 to 28mA    |
| Power Dissipation ( $P_{DISS}$ ), 85°C, CW                 | 96W            |
| Input Power ( $P_{IN}$ ), CW, 50Ω, $V_D = 28V$ , 85°C      | 24dBm          |
| Input Power ( $P_{IN}$ ), CW, VSWR 6:1, $V_D = 28V$ , 85°C | 20dBm          |
| 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 ( $V_D$ )    | 28V           |
| Drain Current ( $I_{DQ}$ ) | 290mA (Total) |
| Gate Voltage ( $V_G$ )     | -2.7V (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,  $V_D = 28V$ ,  $I_{DQ} = 290mA$ ,  $V_G = -2.7V$  Typical, Pulsed  $V_D$ : PW = 100us, DC = 10%

| Parameter                                   | Min | Typical     | Max | Units |
|---------------------------------------------|-----|-------------|-----|-------|
| Operational Frequency Range                 | 10  |             | 11  | GHz   |
| Small Signal Gain                           |     | 35          |     | dB    |
| Input Return Loss                           |     | >15         |     | dB    |
| Output Return Loss                          |     | >10         |     | dB    |
| Power Gain ( $P_{in} = 18dBm$ )             |     | 27.5        |     | dB    |
| Output Power ( $P_{in} = 18dBm$ )           |     | 45.5        |     | dBm   |
| Power Added Efficiency ( $P_{in} = 18dBm$ ) |     | >47         |     | %     |
| Power @ 1dB Compression ( $P_{1dB}$ )       |     | 41@ Midband |     | dB    |
| Small Signal Gain Temperature Coefficient   |     | -0.075      |     | dB/°C |
| Recommended Operating Voltage:              | 20  | 28          | 32  | V     |

### Thermal and Reliability Information

| Parameter                                           | Test Conditions                                                                                                                                                       | Value                 | Units                |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup> | $T_{base} = 85^{\circ}\text{C}$ , Pulsed $V_D$ : PW = 100us, DC = 10%                                                                                                 | 1.14                  | $^{\circ}\text{C/W}$ |
| Channel Temperature ( $T_{CH}$ ) (Under RF drive)   | $T_{base} = 85^{\circ}\text{C}$ , $V_D = 28\text{V}$ , $I_{D\_Drive} = 3\text{A}$ ,<br>$P_{IN} = 22\text{dBm}$ , $P_{OUT} = 45.3\text{dBm}$ , $P_{DISS} = 51\text{W}$ | 143                   | $^{\circ}\text{C}$   |
| Median Lifetime ( $T_M$ )                           |                                                                                                                                                                       | $3.85 \times 10^{10}$ | Hrs                  |

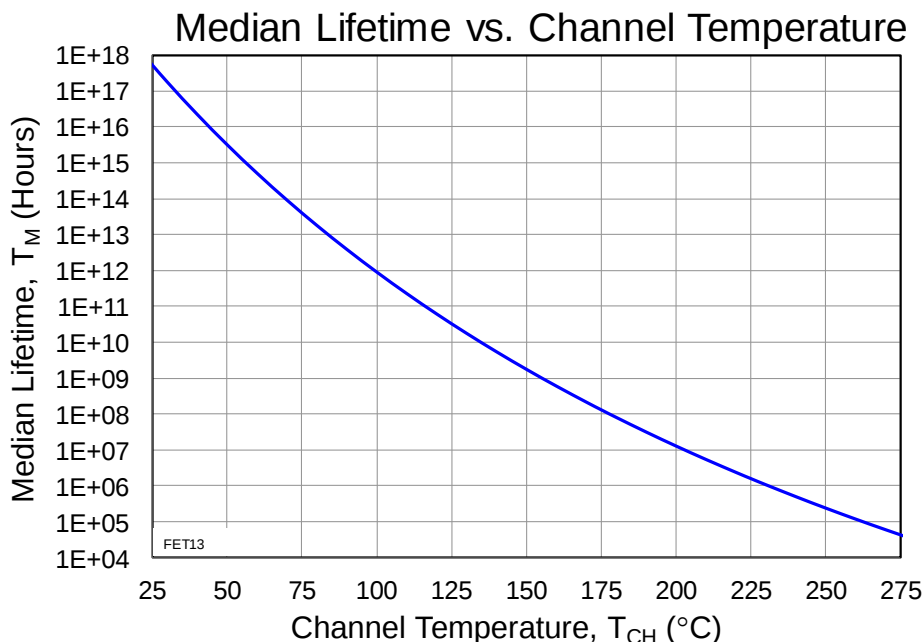
|                                                     |                                                                                                                                                                          |                    |                      |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------|
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup> | $T_{base} = 85^{\circ}\text{C}$ , CW                                                                                                                                     | 1.97               | $^{\circ}\text{C/W}$ |
| Channel Temperature ( $T_{CH}$ ) (Under RF drive)   | $T_{base} = 85^{\circ}\text{C}$ , $V_D = 28\text{V}$ , $I_{D\_Drive} = 2.94\text{A}$ ,<br>$P_{IN} = 22\text{dBm}$ , $P_{OUT} = 44.9\text{dBm}$ , $P_{DISS} = 52\text{W}$ | 187                | $^{\circ}\text{C}$   |
| Median Lifetime ( $T_M$ )                           |                                                                                                                                                                          | $4.12 \times 10^7$ | Hrs                  |

#### Notes:

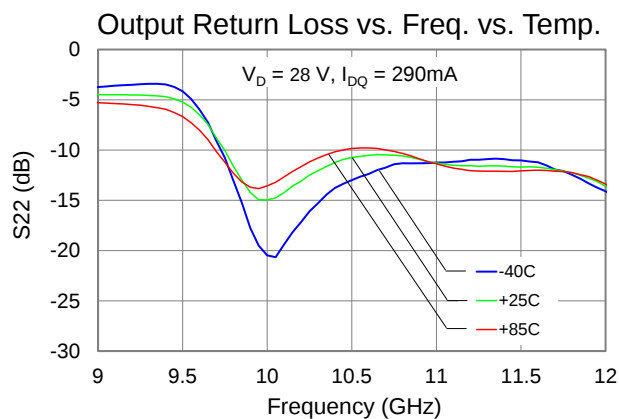
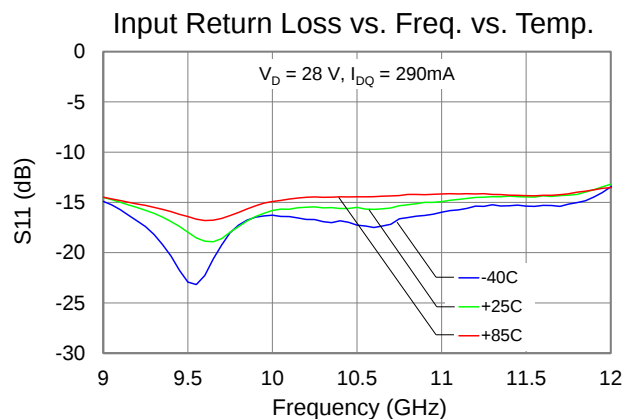
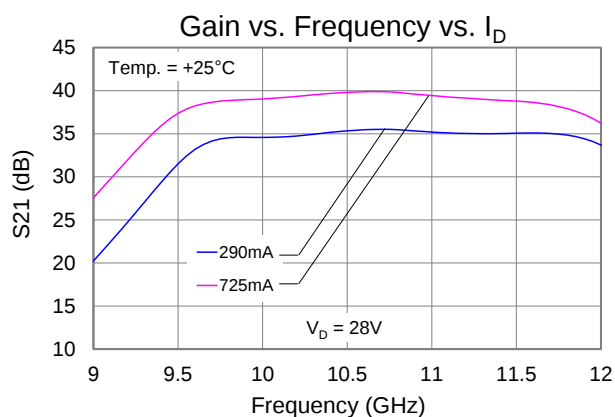
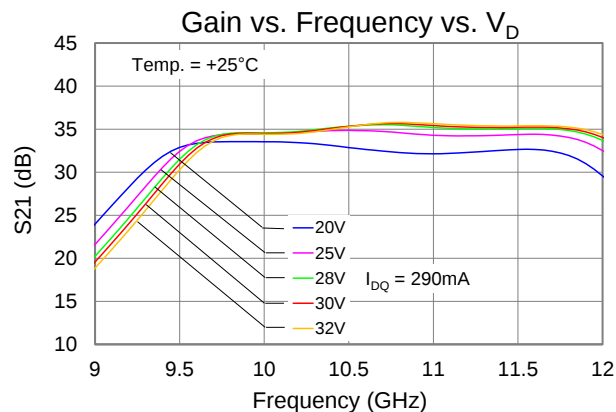
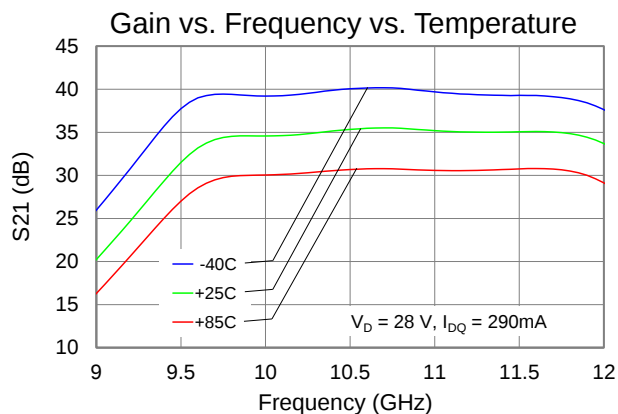
- Thermal resistance measured to back of carrier plate. MMIC mounted on 40 mils CuM0 (80/20) carrier using 1.5 mil AuSn.

### Median Lifetime

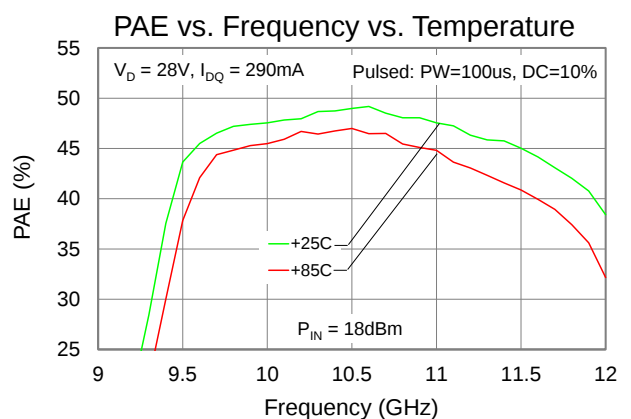
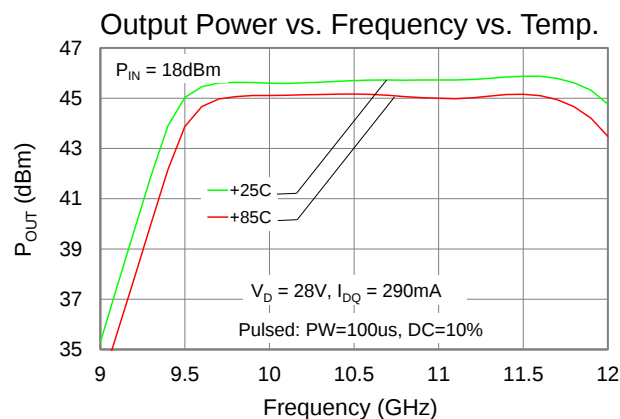
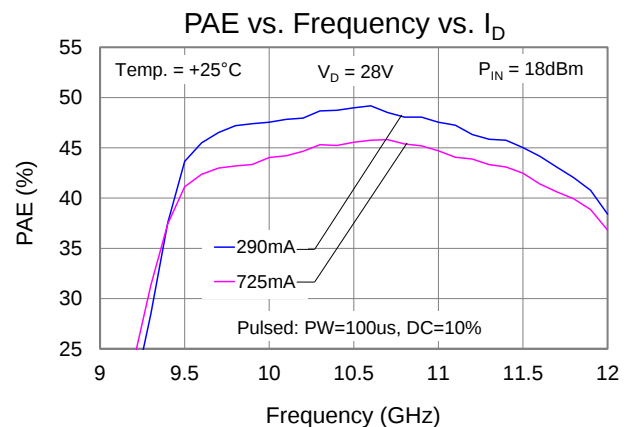
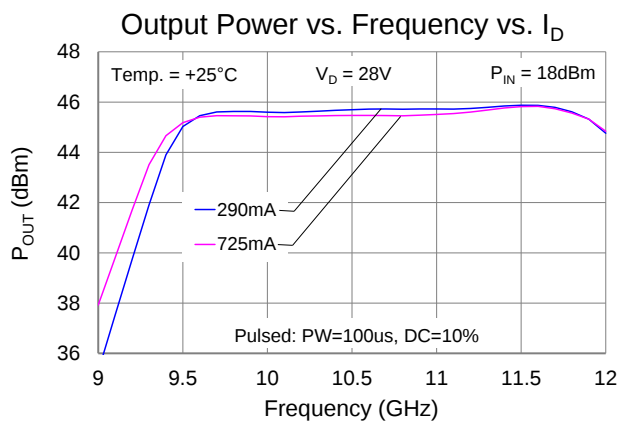
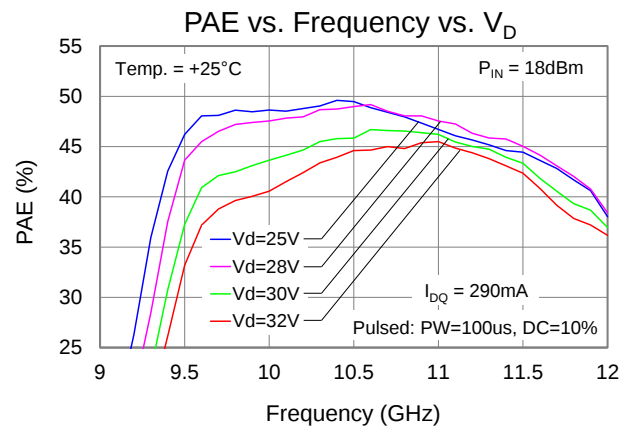
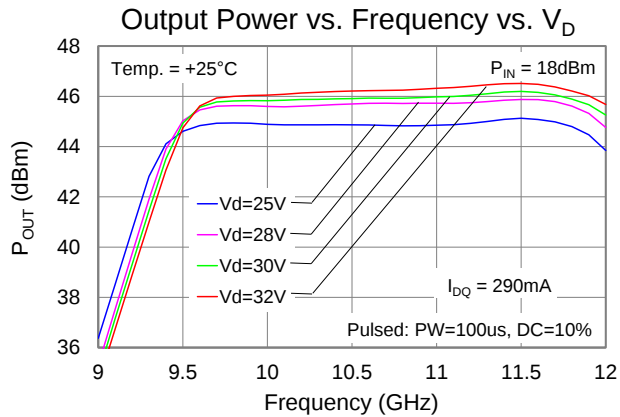
Test Conditions:  $V_D = 40\text{V}$ ; Failure Criteria = 10% reduction in  $I_{D\_MAX}$



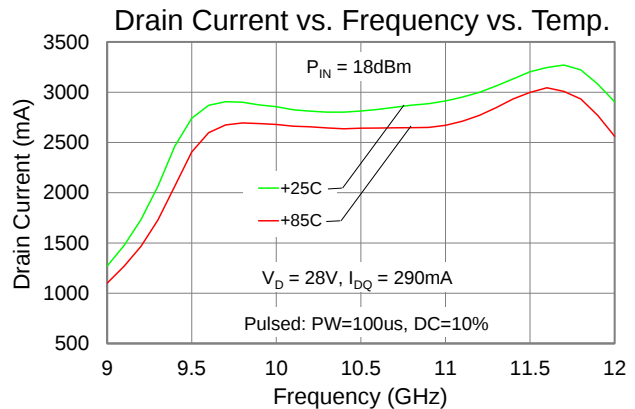
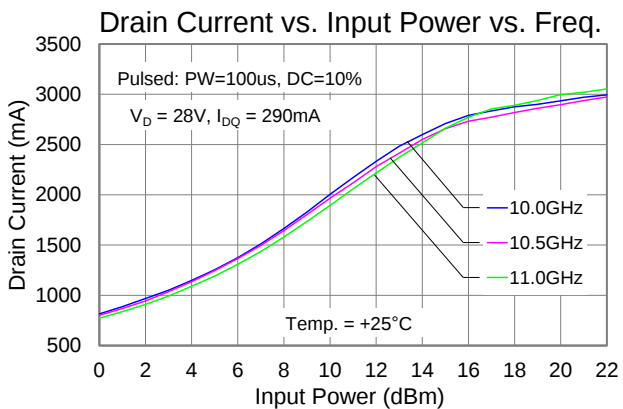
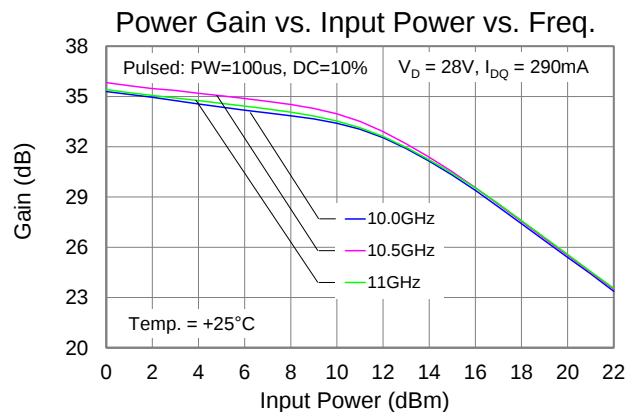
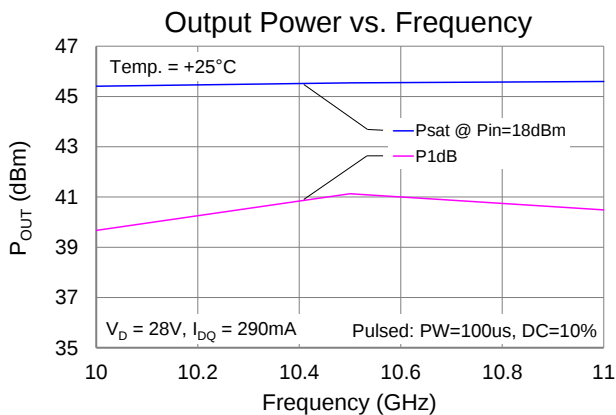
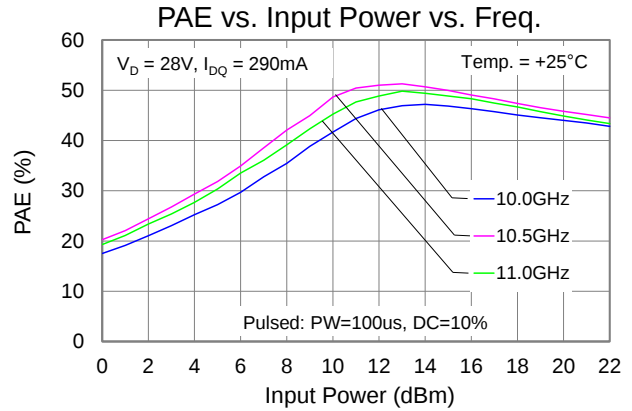
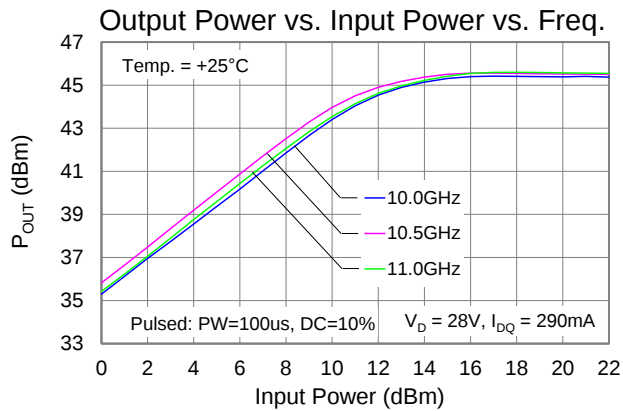
### Typical Performance (Small Signal)



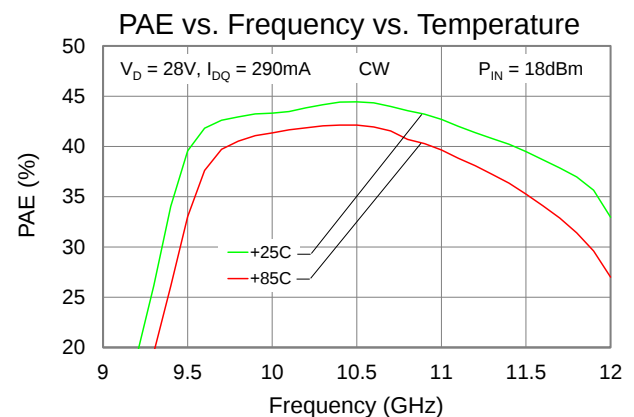
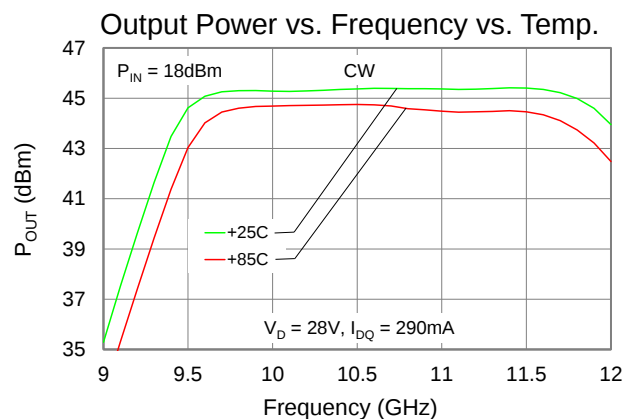
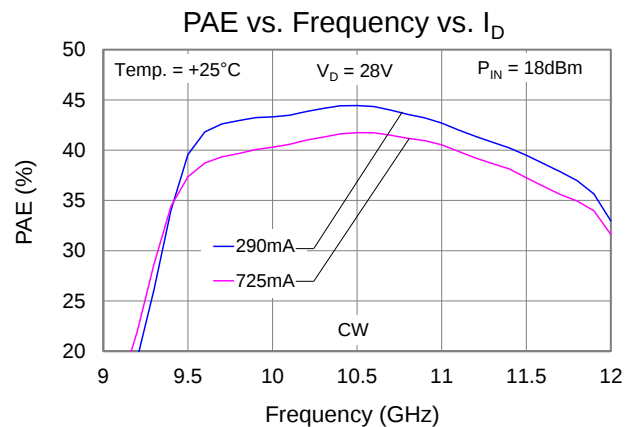
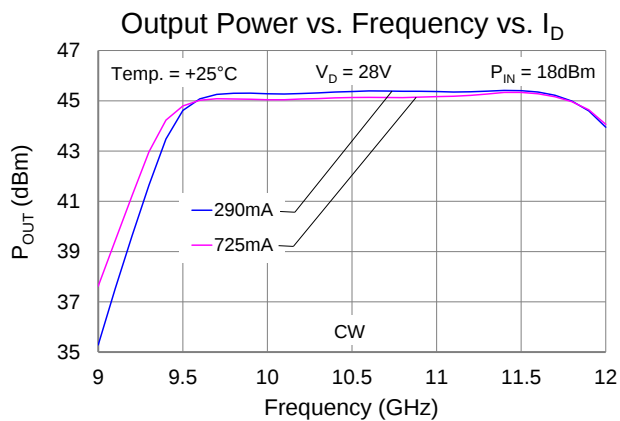
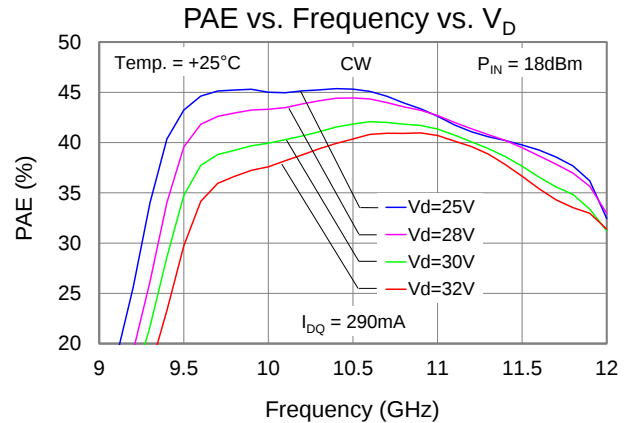
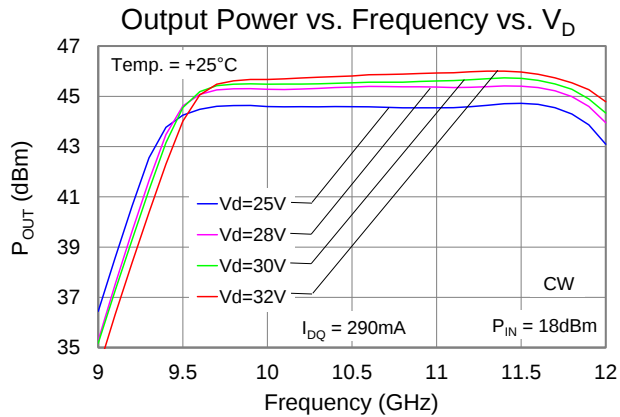
### Typical Performance (Pulsed Operation)



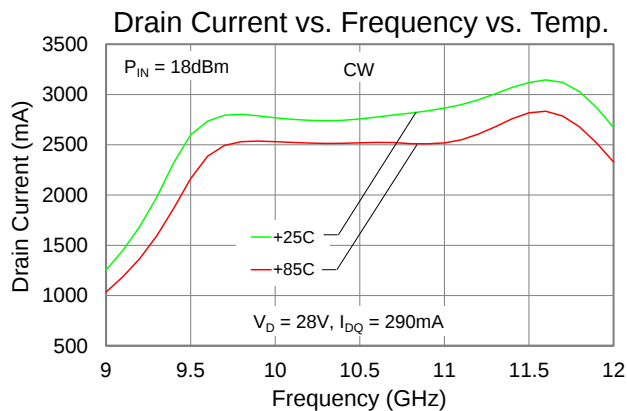
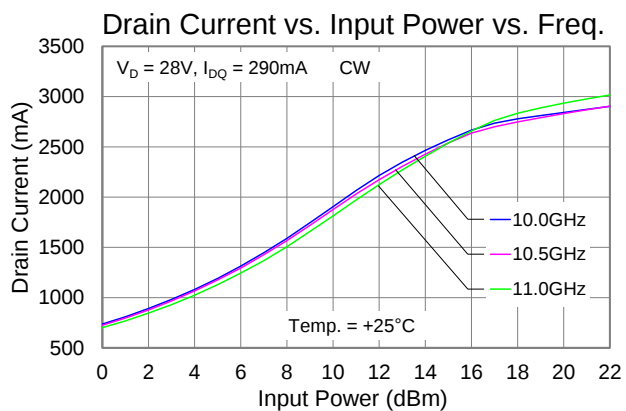
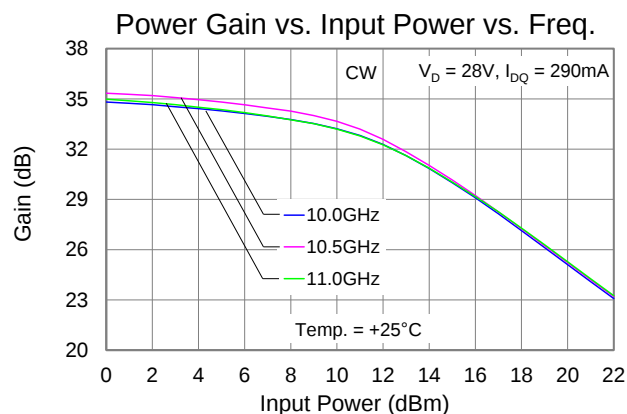
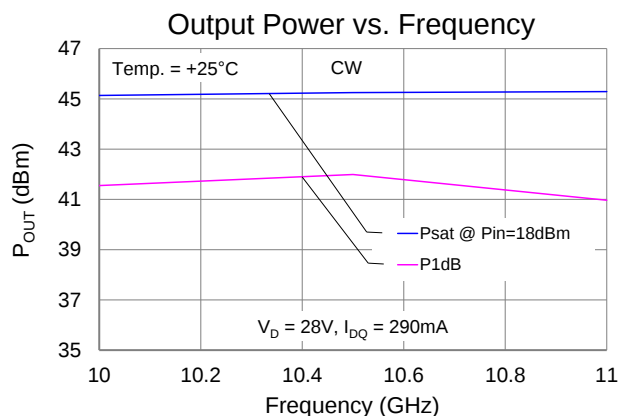
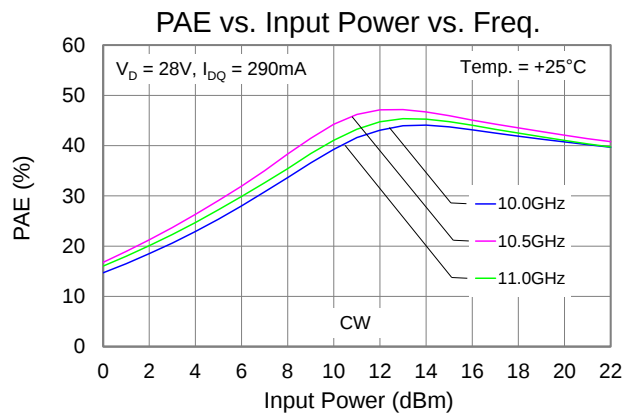
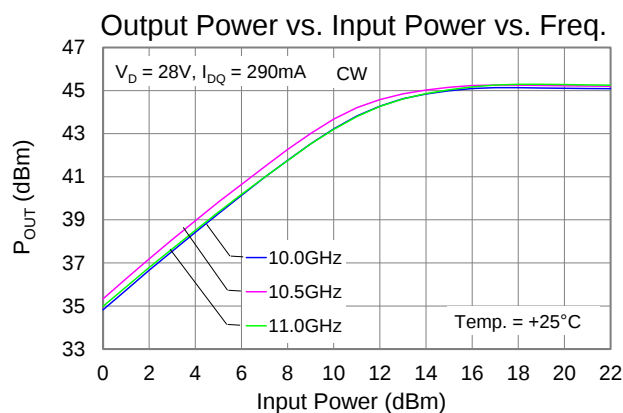
### Typical Performance (Pulsed Operation)



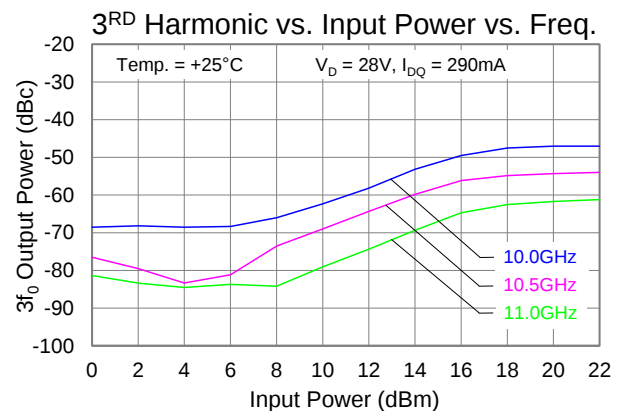
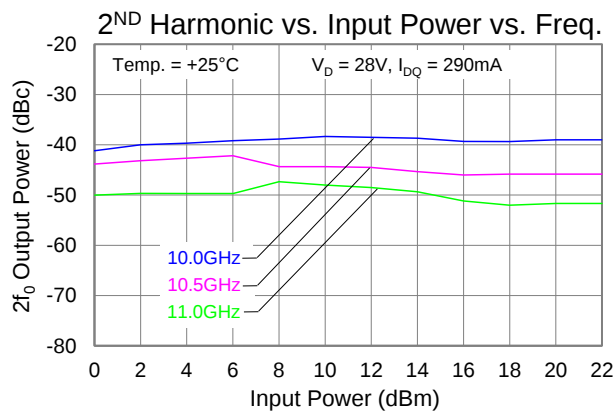
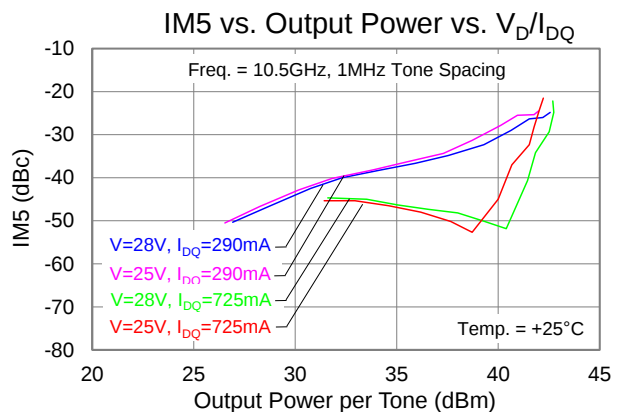
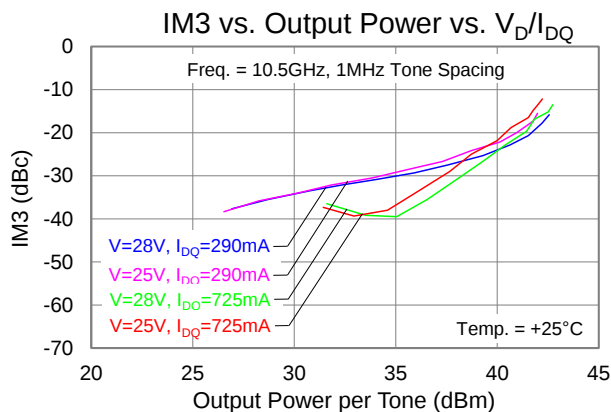
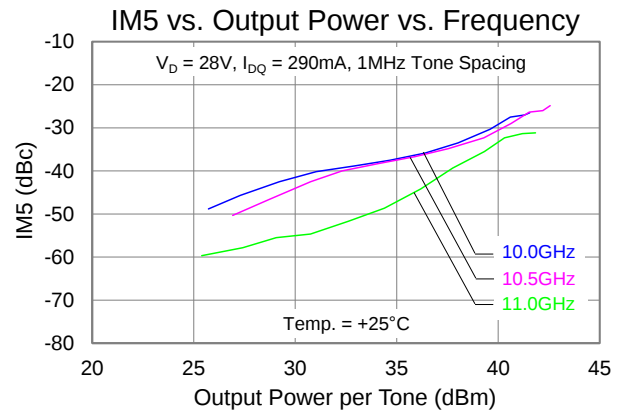
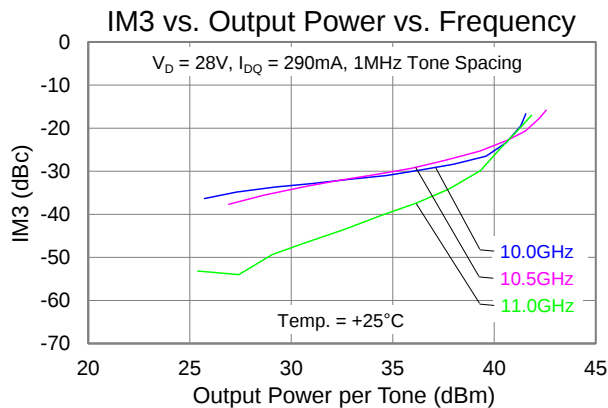
## Typical Performance (CW Operation)



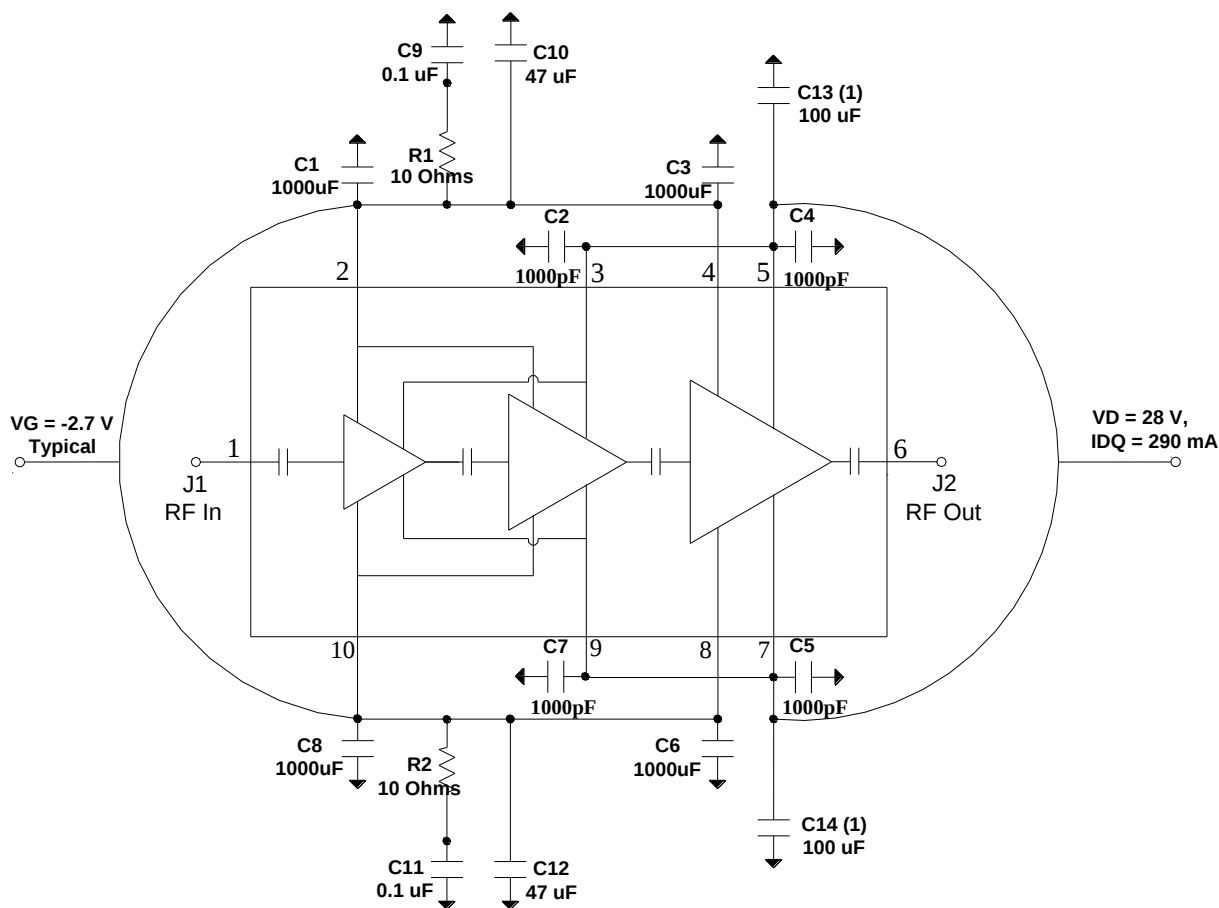
### Typical Performance (CW Operation)



### Typical Performance (Linearity)



### Application Circuit



#### Notes:

1. Remove caps for pulse operation. These caps are part of the cable harness for CW operation.

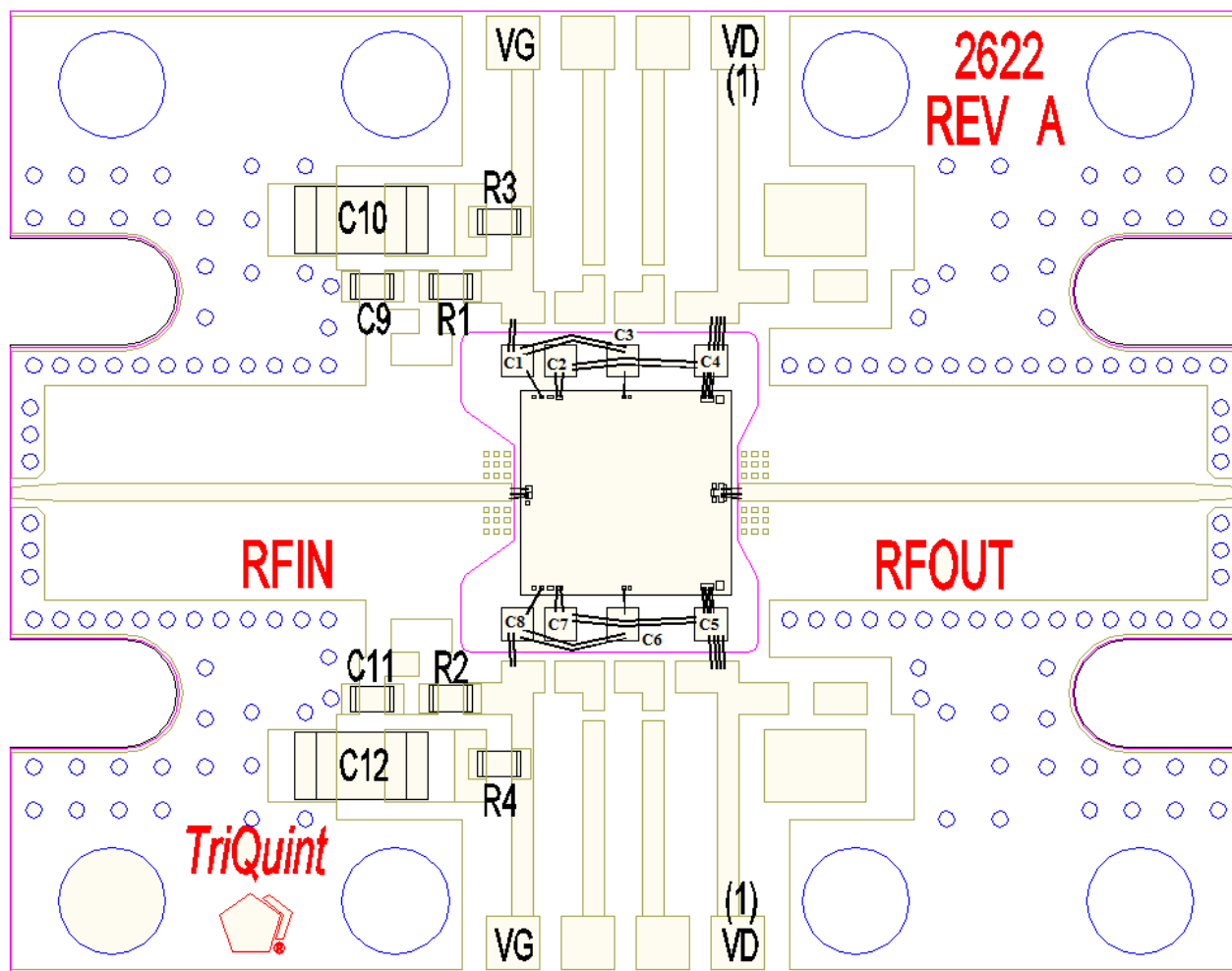
#### Bias-up Procedure

1. Set  $I_D$  limit to 3.5A,  $I_G$  limit to 10mA
2. Set  $V_G$  to -5.0V
3. Set  $V_D$  +28V
4. Adjust  $V_G$  more positive until  $I_{DQ} = 290mA$  ( $V_G \sim -2.7V$  Typical)
5. Apply RF signal

#### Bias-down Procedure

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

## Evaluation Board (EVB) Layout Assembly



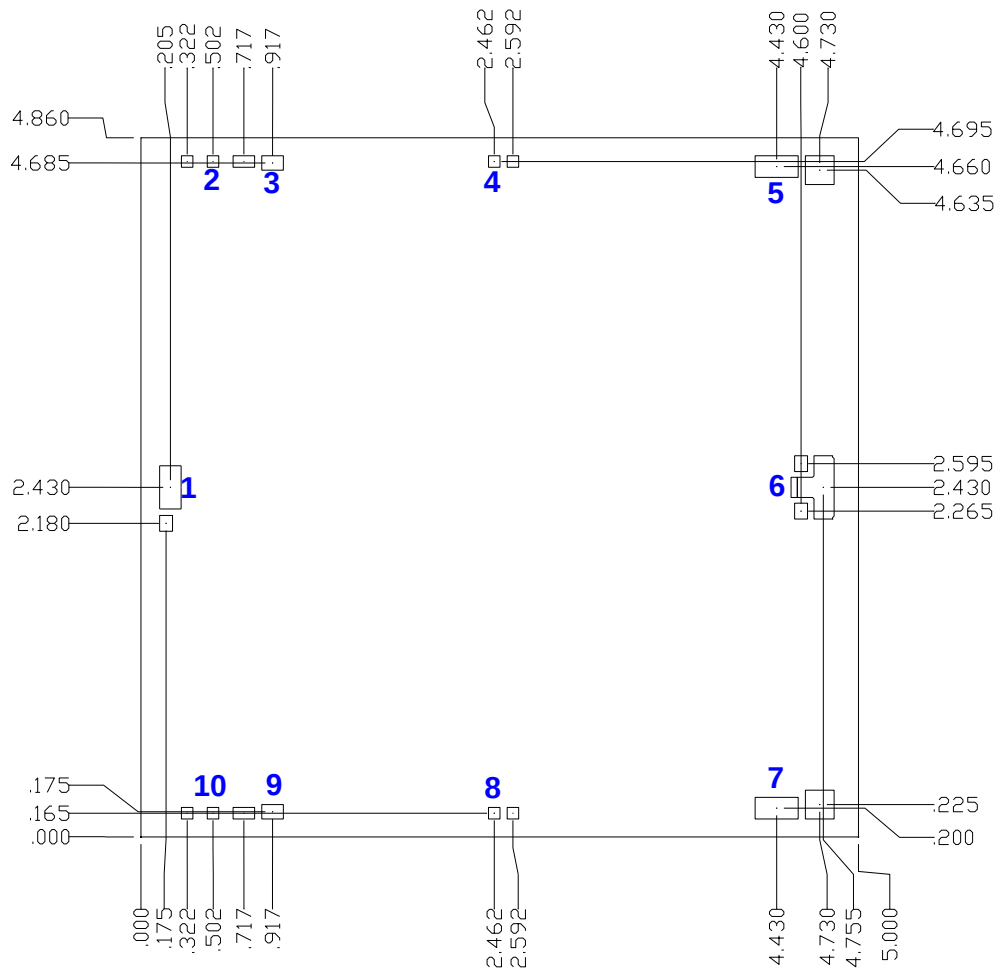
### Notes:

1. 100uF/100V charge storage cap is needed on the drain. For pulsed operation this cap must be on the supply-side of the pulse-modulator.

## Bill of Materials

| Reference Design | Value  | Description              | Manufacturer | Part Number |
|------------------|--------|--------------------------|--------------|-------------|
| C1 – C8          | 1000pF | SLC, 50V                 | Various      |             |
| C9, C11          | 0.1uF  | Cap, 0402, 50V, 10%, X7R | Various      |             |
| C10, C12         | 47uF   | Cap, 1206, 50V, 10%, X7R | Various      |             |
| R1 – R2          | 10Ω    | Res, 0402                | Various      |             |
| R3 – R4          | 0Ω     | 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 | Pad Size      | Description                                                                                  |
|----------|--------|---------------|----------------------------------------------------------------------------------------------|
| 1        | RF In  | 0.150 x 0.300 | RF Input; matched to 50Ω                                                                     |
| 2, 8     | VG1-2  | 0.080 x 0.080 | Gate voltage 1, bias network is required; see Application Circuit on page 10 as an example.  |
| 4,10     | VG3    | 0.080 x 0.080 | Gate voltage 3, bias network is required; see Application Circuit on page 10 as an example.  |
| 3, 9     | VD1-2  | 0.150 x 0.100 | Drain voltage 1, bias network is required; see Application Circuit on page 10 as an example. |
| 5, 7     | VD3    | 0.300 x 0.150 | Drain voltage 3, bias network is required; see Application Circuit on page 10 as an example. |
| 6        | RF Out | 0.140 x 0.400 | RF Output; matched to 50Ω                                                                    |

## 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.

## 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

### Solderability

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<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free

### ECCN

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

## Contact Information

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

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Tel: +1.972.994.8465  
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For technical questions and application information: Email: [info-products@triquint.com](mailto:info-products@triquint.com)

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