

### Product Description

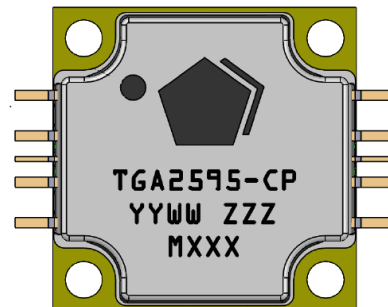
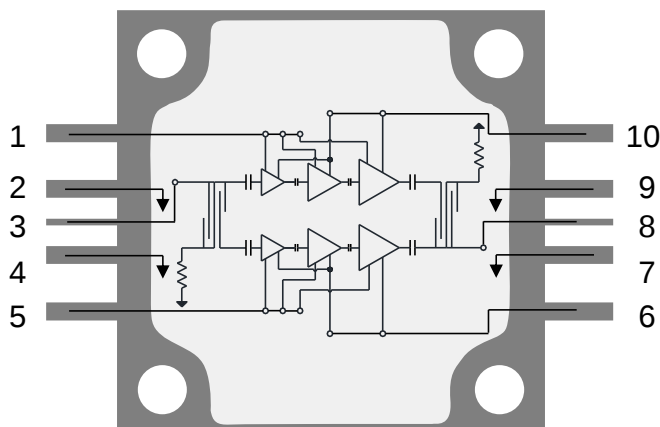
Qorvo's TGA2595-CP is a balanced Ka-Band power amplifier fabricated on Qorvo's QGaN15 0.15  $\mu\text{m}$  GaN on SiC process. The balanced configuration supports low return loss and improves robustness into non-ideal loads. Operating from 27.5 to 31 GHz, the TGA2595-CP achieves 39 dBm saturated output power with power-added efficiency of  $> 22\%$  and power gain of 21 dB.

The TGA2595-CP is packaged in a 10-lead 15x15 mm bolt-down package with a Cu base for superior thermal management. To simplify system integration, the TGA2595-CP is fully matched to 50 ohms with integrated DC blocking capacitors on both I/O ports.

The TGA2595-CP is ideally suited for both commercial and defense satellite communications.

Lead free and RoHS compliant.

### Functional Block Diagram



### Product Features

- Frequency Range: 27.5 – 31 GHz
- $P_{OUT}$ : 39 dBm ( $P_{IN} = 18$  dBm)
- PAE:  $> 22\%$  ( $P_{IN} = 18$  dBm)
- Power Gain: 21 dB ( $P_{IN} = 18$  dBm)
- IM3 @ 30 dBm/Tone = -27 dBc
- IM5 @ 30 dBm/Tone = -46 dBc
- Bias:  $V_D = +20$  V,  $I_{DQ} = 560$  mA,  $V_G = -2.5$  V typical
- Package Dimensions: 15.2 x 15.2 x 5.2 mm
- Package base is pure Cu offering superior thermal management

### Applications

- Satellite Communications

### Ordering Information

| Part No.   | Description                           |
|------------|---------------------------------------|
| TGA2595-CP | 27.5 – 31 GHz 8 W GaN Power Amplifier |
| 1095829    | TGA2595-CP Evaluation Board           |



# TGA2595-CP

## 27.5 – 31 GHz 8 W GaN Power Amplifier

### Absolute Maximum Ratings

| Parameter                                                     | Value / Range       |
|---------------------------------------------------------------|---------------------|
| Drain Voltage ( $V_D$ )                                       | 29.5 V              |
| Gate Voltage Range ( $V_G$ )                                  | -5 to 0 V           |
| Drain Current ( $I_D$ )                                       | 2.8 A               |
| Gate Current ( $I_G$ )                                        | See plot at page 10 |
| Power Dissipation ( $P_{DISS}$ ), 85 °C                       | 48 W                |
| Input Power, CW, 50 $\Omega$ , ( $P_{IN}$ )                   | 30 dBm              |
| Input Power, CW, VSWR 6:1, $V_D = +22$ V, 85 °C, ( $P_{IN}$ ) | 25 dBm              |
| Channel Temperature ( $T_{CH}$ )                              | 275 °C              |
| Soldering Temperature (30 Seconds)                            | 260 °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                            | Min              | Typ. | Max | Units |
|--------------------------------------|------------------|------|-----|-------|
| Drain Voltage ( $V_D$ )              |                  | +20  |     | V     |
| Drain Current, ( $I_{DQ}$ )          |                  | 560  |     | mA    |
| Drain Current, RF ( $I_{D\_Drive}$ ) | See chart page 5 |      |     | mA    |
| Gate Voltage Range ( $V_G$ )         | -2 to -2.9       |      |     | V     |
| Gate Current, RF ( $I_{G\_Drive}$ )  | See chart page 5 |      |     | mA    |
| $T_{BASE}$ Range                     | -40              |      | +85 | °C    |

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

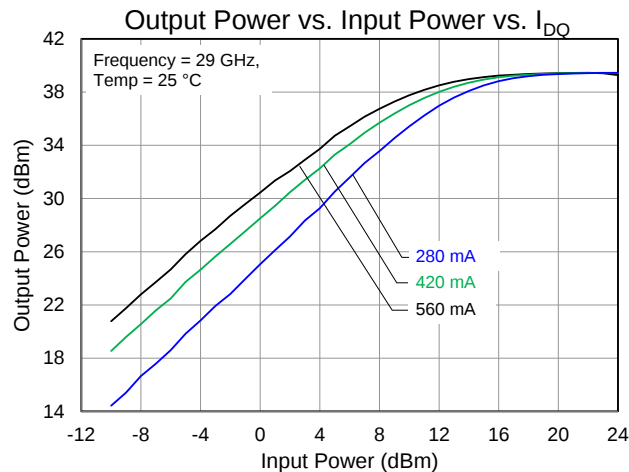
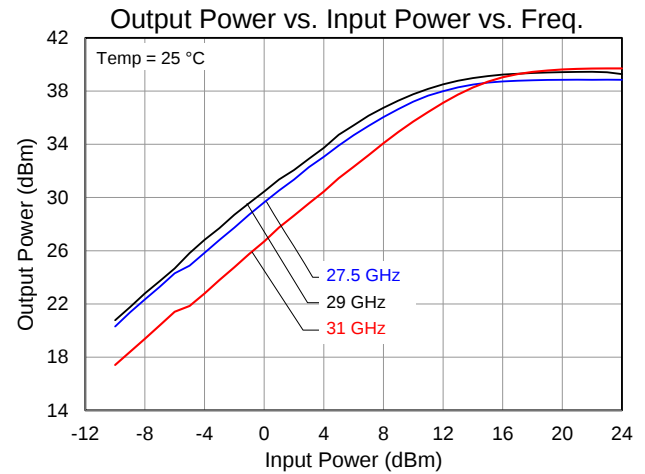
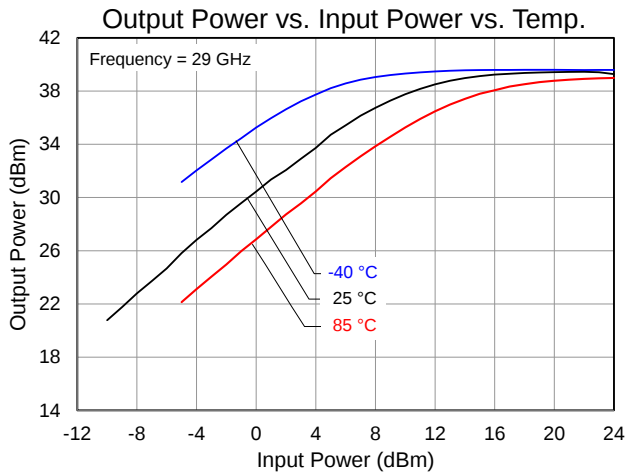
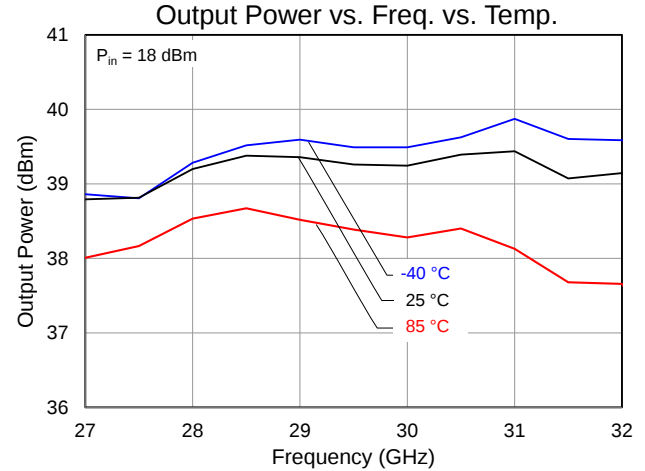
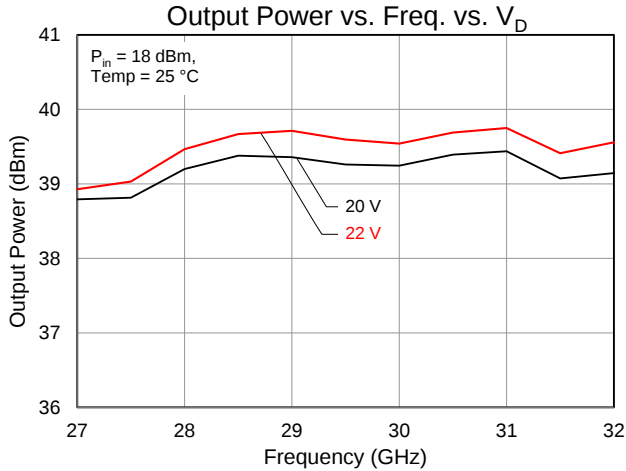
### Electrical Specifications

| Parameter                                                  | Min  | Typ   | Max | Units  |
|------------------------------------------------------------|------|-------|-----|--------|
| Operational Frequency Range                                | 27.5 | –     | 31  | GHz    |
| Small Signal Gain                                          | –    | > 25  | –   | dB     |
| Input Return Loss                                          | –    | > 12  | –   | dB     |
| Output Return Loss                                         | –    | > 13  | –   | dB     |
| Output Power (at $P_{IN} = 18$ dBm)                        | –    | 39    | –   | dBm    |
| Power Added Efficiency (at $P_{IN} = 18$ dBm)              | –    | > 22  | –   | %      |
| Power Gain (at $P_{IN} = 18$ dBm)                          | –    | 21    | –   | dB     |
| IM3 @ 30 dBm/Tone                                          | –    | -27   | –   | dBc    |
| IM5 @ 30 dBm/Tone                                          | –    | -46   | –   | dBc    |
| Output Power Temperature Coefficient (25 °C to 85 °C only) | –    | -0.01 | –   | dBm/°C |
| Recommended Operating Voltage                              | –    | 20    | 22  | V      |

Test conditions unless otherwise noted: 25 °C,  $V_D = +20$  V,  $I_{DQ} = 560$  mA,  $V_G = -2.5$  V typical.

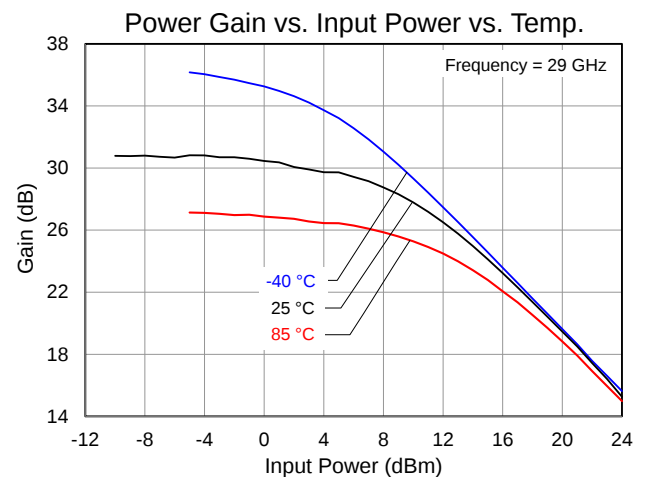
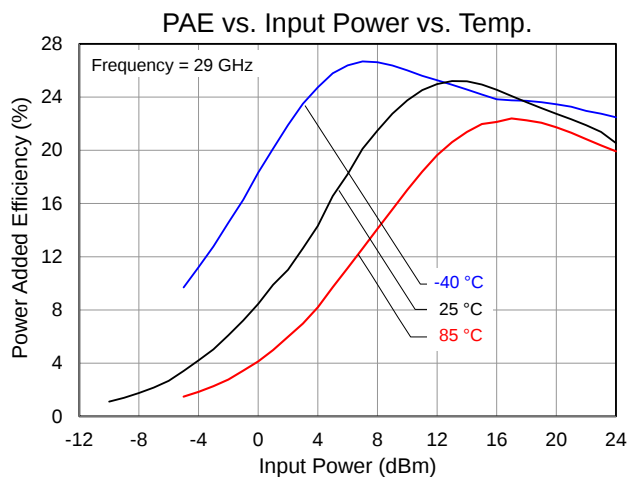
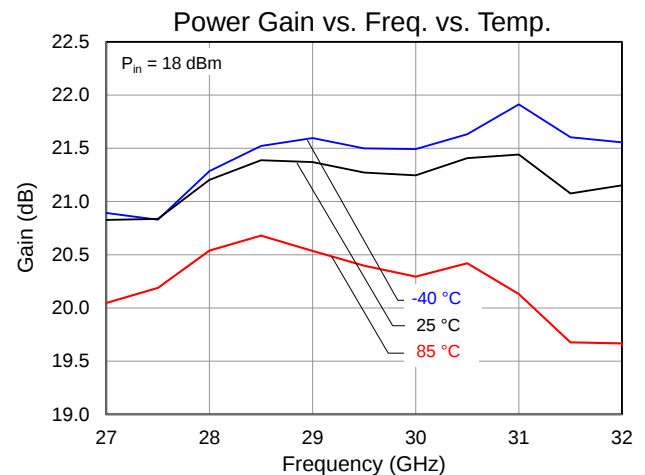
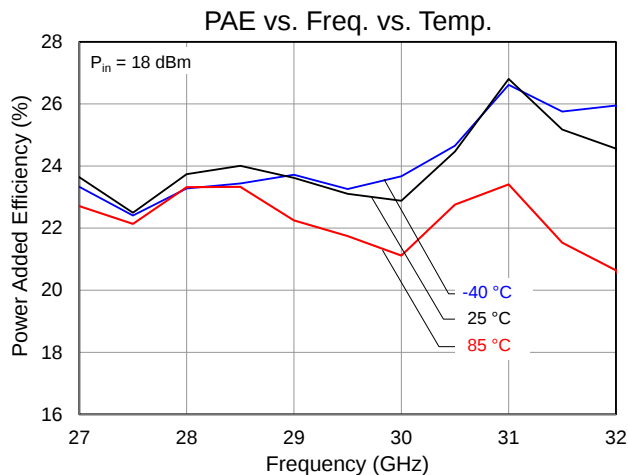
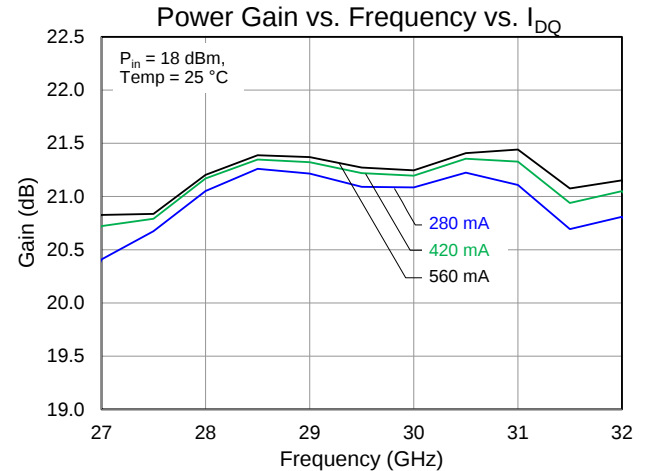
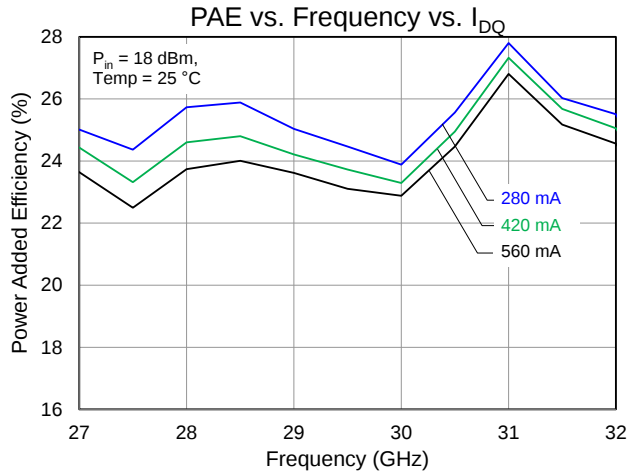
### Typical Performance – Large Signal

Conditions unless otherwise specified:  $V_D = +20\text{ V}$ ,  $I_{DQ} = 560\text{ mA}$ ,  $V_G = -2.5\text{ V}$  typical, CW.



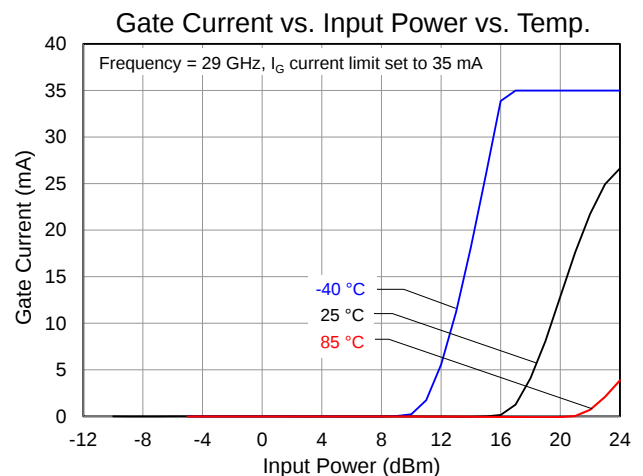
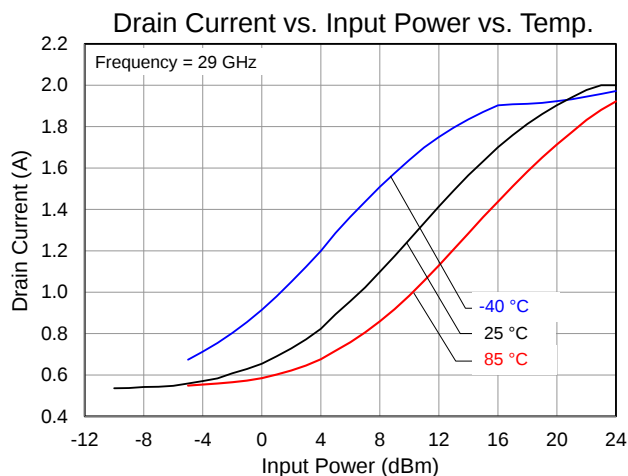
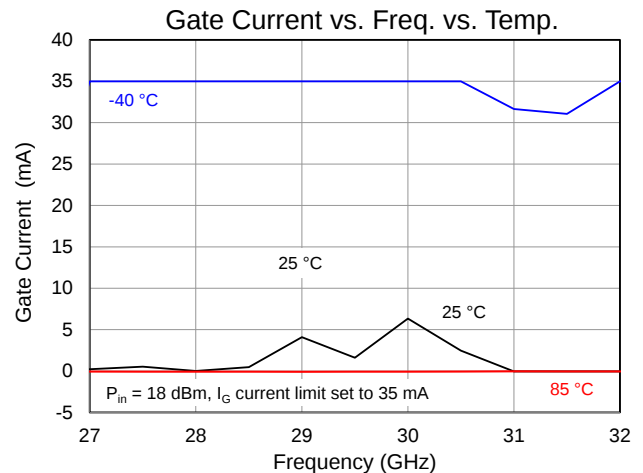
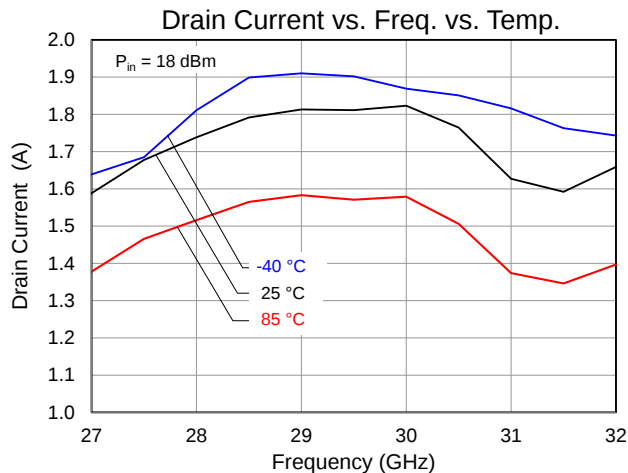
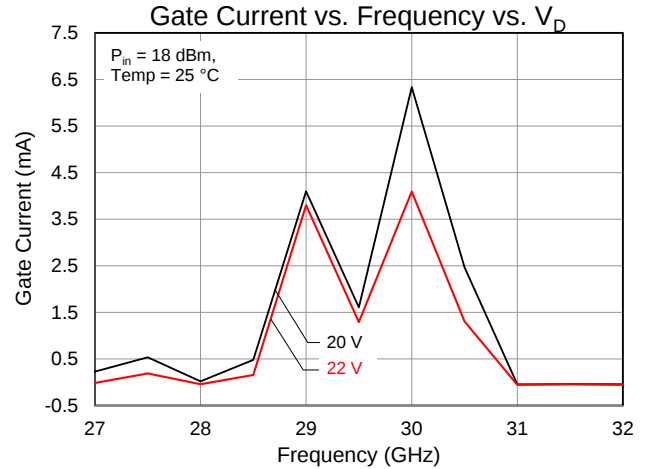
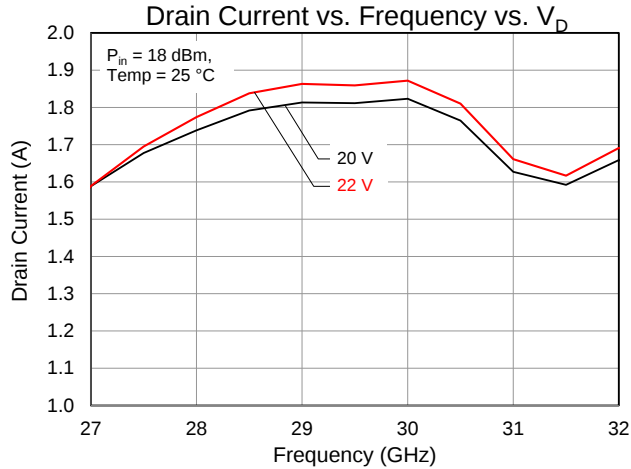
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Conditions unless otherwise specified:  $V_D = +20\text{ V}$ ,  $I_{DQ} = 560\text{ mA}$ ,  $V_G = -2.5\text{ V}$  typical, CW.



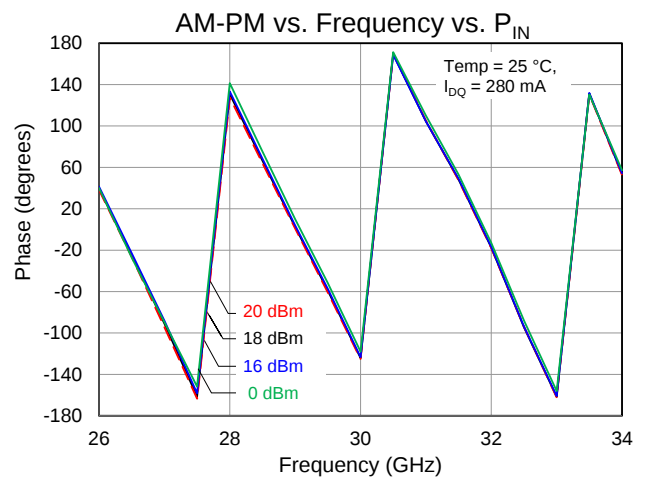
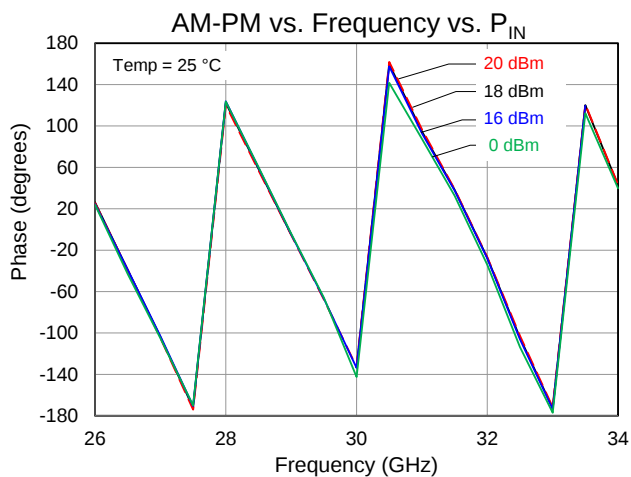
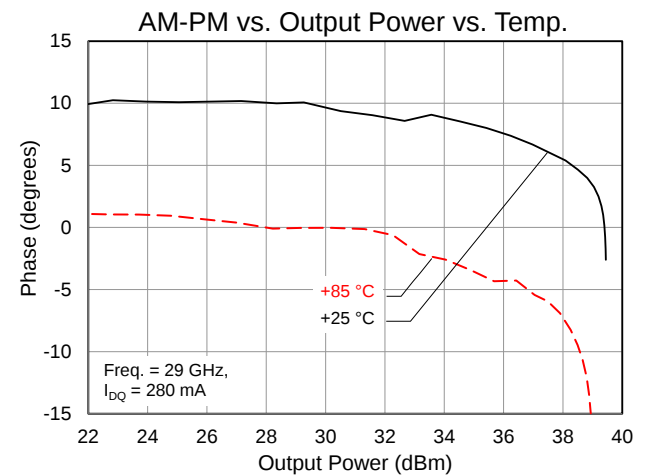
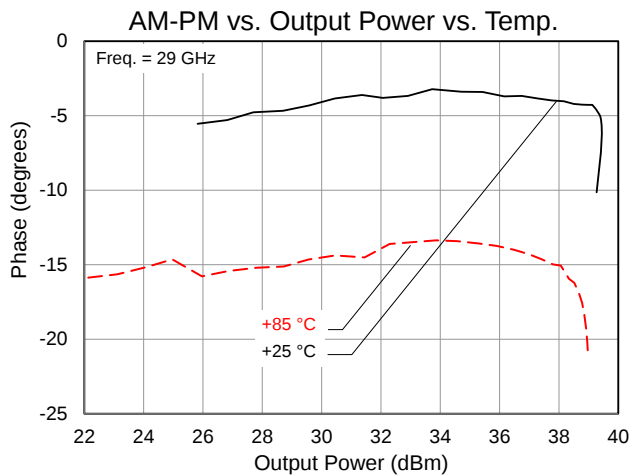
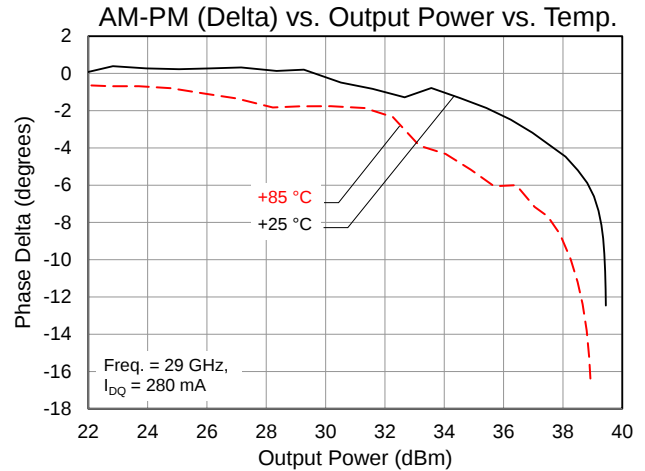
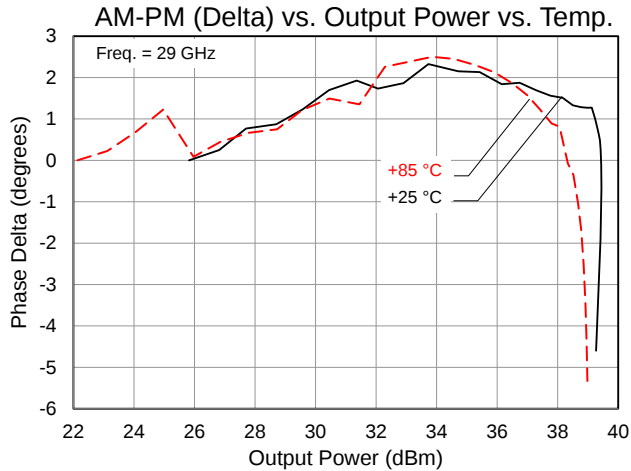
### Typical Performance – Large Signal

Conditions unless otherwise specified:  $V_D = +20\text{ V}$ ,  $I_{DQ} = 560\text{ mA}$ ,  $V_G = -2.5\text{ V}$  typical, CW.



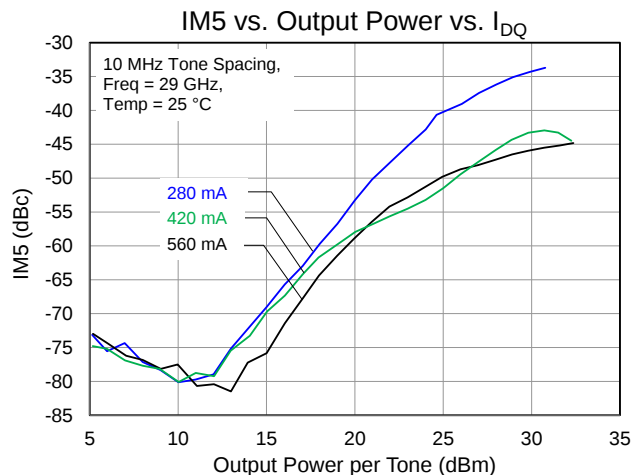
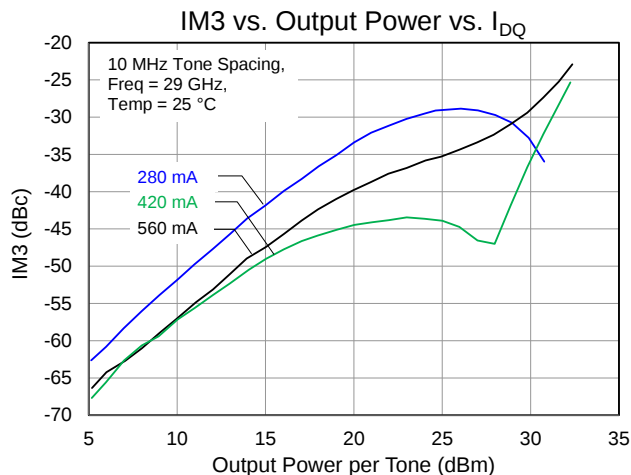
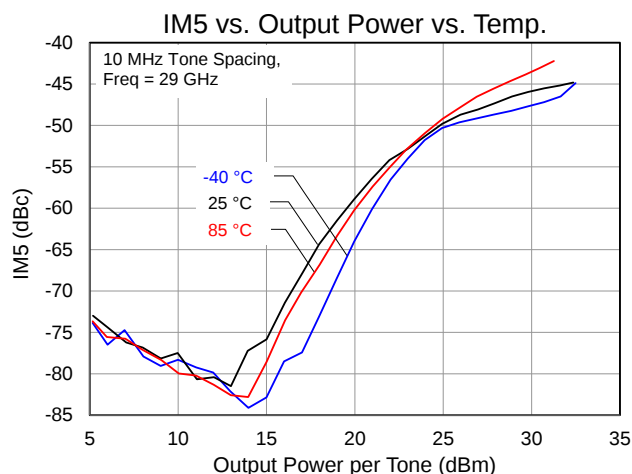
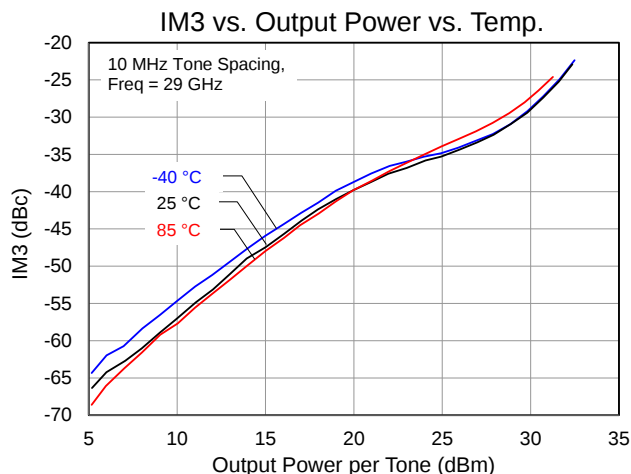
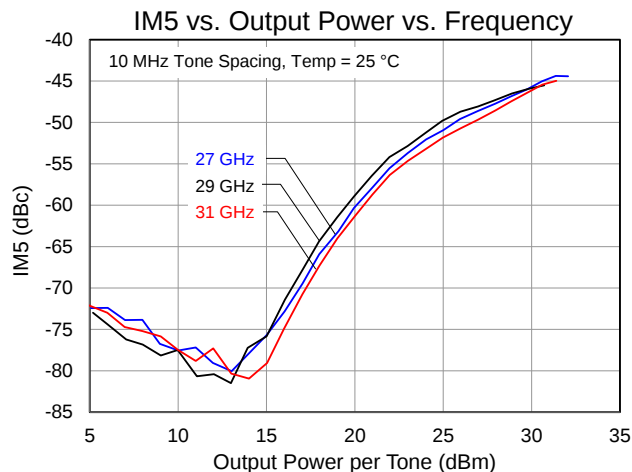
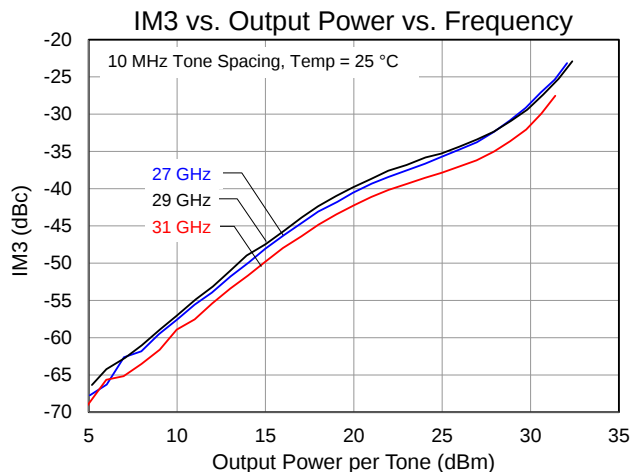
### Performance Plots – Large Signal

Conditions unless otherwise specified:  $V_D = +20\text{ V}$ ,  $I_{DQ} = 560\text{ mA}$ ,  $V_G = -2.5\text{ V}$  typical, CW.



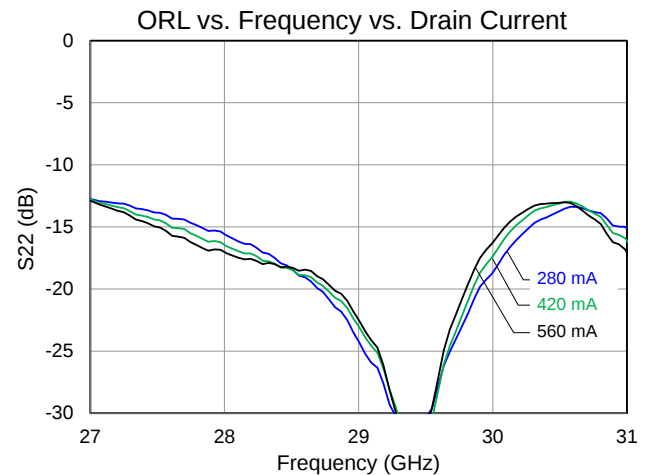
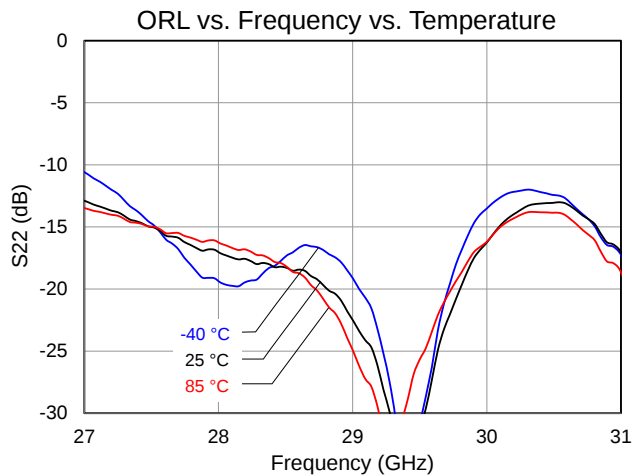
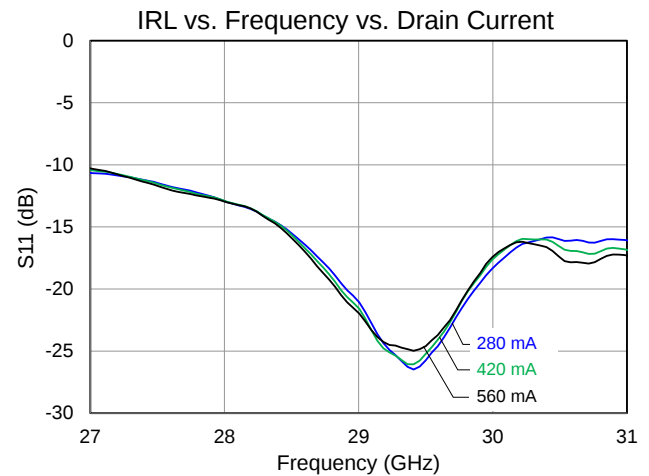
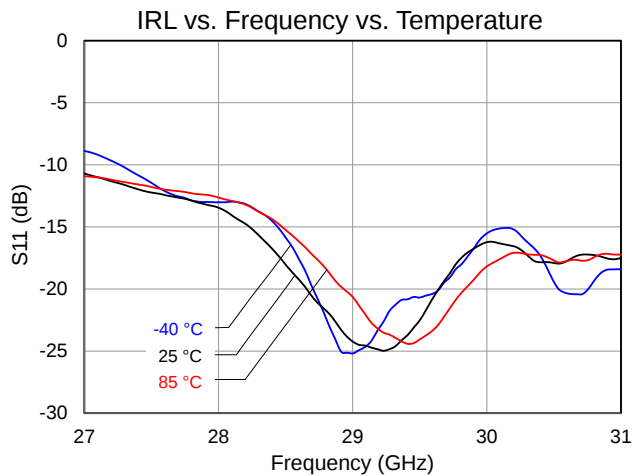
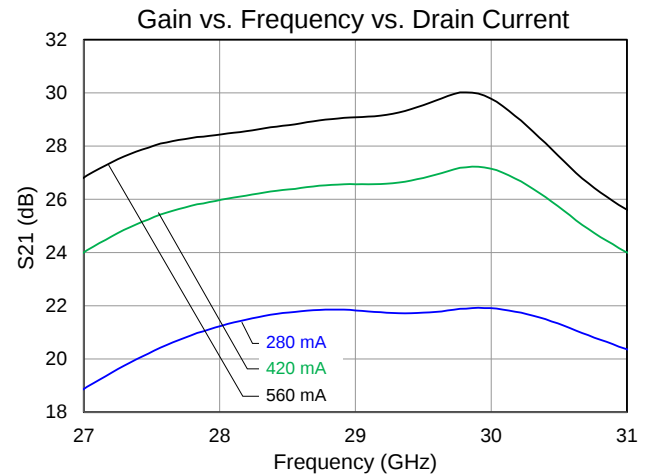
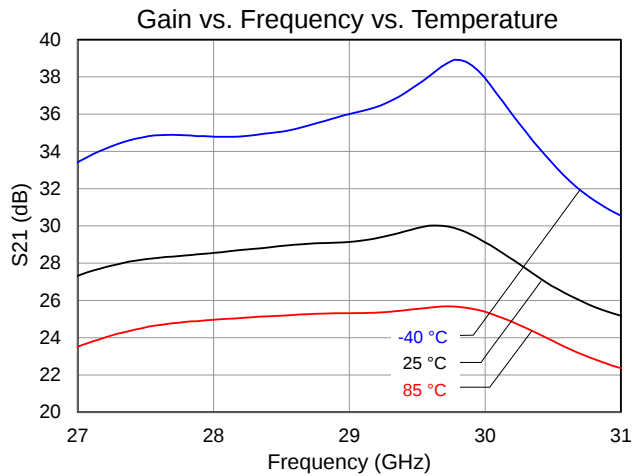
### Typical Performance – Linearity

Conditions unless otherwise specified:  $V_D = +20\text{ V}$ ,  $I_{DQ} = 560\text{ mA}$ ,  $V_G = -2.5\text{ V}$  typical, CW.



### Typical Performance – Small Signal

Conditions unless otherwise specified:  $V_D = +20\text{ V}$ ,  $I_{DQ} = 560\text{ mA}$ ,  $V_G = -2.5\text{ V}$  typical, CW.



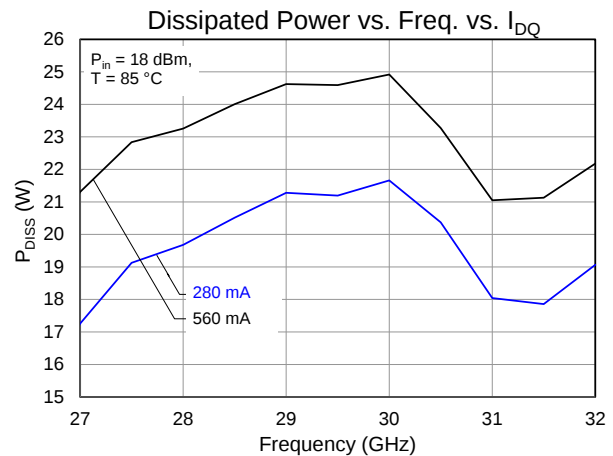
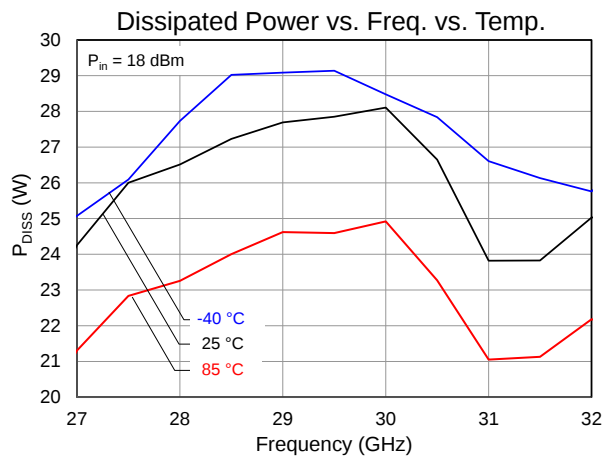
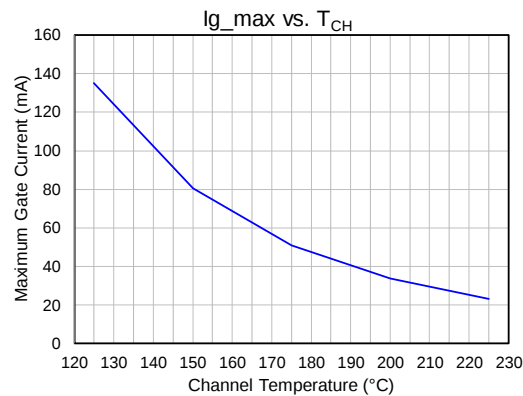
### Thermal and Reliability Information

| Parameter                                                   | Test Conditions                                                                                      | Value | Units |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------|-------|
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>         | CW, $V_D = +20$ V, $I_{DQ} = 560$ mA,                                                                | 2.23  | °C/W  |
| Channel Temperature ( $T_{CH}$ ) (Quiescent) <sup>(2)</sup> | $T_{BASE} = 85$ °C $P_{DISS} = 11.2$ W                                                               | 110   | °C    |
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>         | $V_D = +20$ V, $I_{DQ} = 280$ mA, $T_{BASE} = 85$ °C,                                                | 2.40  | °C/W  |
| Channel Temperature ( $T_{CH}$ ) (under RF) <sup>(2)</sup>  | Freq = 30 GHz, $P_{IN} = 18$ dBm, $P_{OUT} = 37.2$ dBm, $P_{DISS} = 21.7$ W, $I_{D\_Drive} = 1.38$ A | 137   | °C    |
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>         | $V_D = +20$ V, $I_{DQ} = 560$ mA, $T_{BASE} = 85$ °C,                                                | 2.45  | °C/W  |
| Channel Temperature ( $T_{CH}$ ) (RF drive) <sup>(2)</sup>  | Freq = 30 GHz, $P_{IN} = 18$ dBm, $P_{OUT} = 38.3$ dBm, $P_{DISS} = 24.9$ W, $I_{D\_Drive} = 1.58$ A | 146   | °C    |

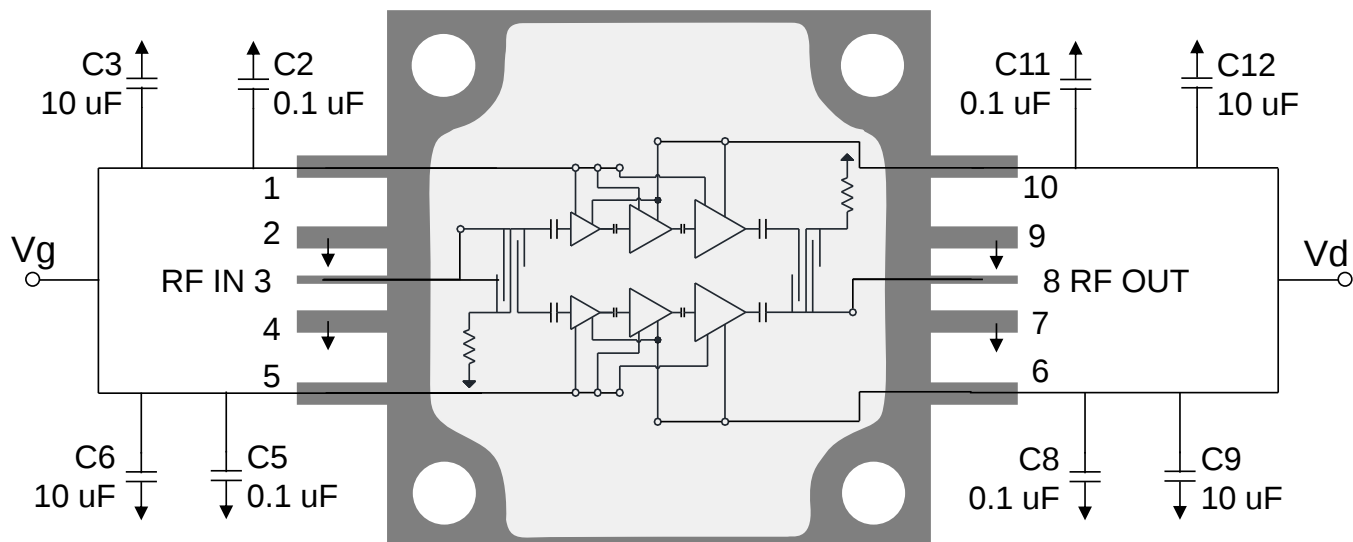
Notes:

1. Thermal resistance is referenced to the back of package (85 °C)
2. Refer to the following document: [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

### Dissipated Power and Maximum Gate Current



## Applications Information and Pin Layout



### Bias Up Procedure

1. Set  $I_D$  limit to 2 A,  $I_G$  limit to 35 mA
2. Apply -5 V to  $V_G$
3. Apply +20 V to  $V_D$ ; ensure  $I_{DQ}$  is approx. 0 mA
4. Adjust  $V_G$  until  $I_{DQ} = 560$  mA ( $V_G \sim -2.5$  V Typ.).
5. Turn on RF supply

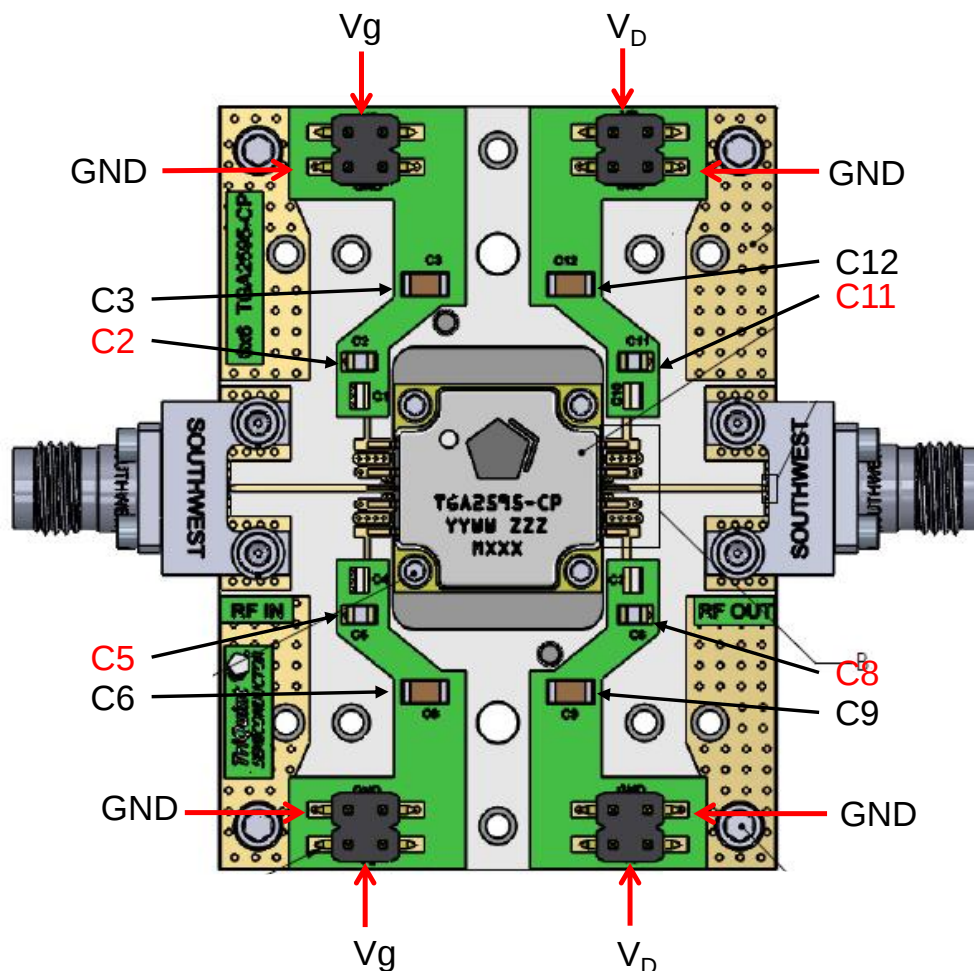
### Bias Down Procedure

1. Turn off RF supply
2. Reduce  $V_G$  to -5 V; ensure  $I_{DQ}$  is approx. 0 mA
3. Set  $V_D$  to 0 V
4. Turn off  $V_D$  supply
5. Turn off  $V_G$  supply

### Pin Description

| Pad No. | Symbol     | Description                                                                                                             |
|---------|------------|-------------------------------------------------------------------------------------------------------------------------|
| 1,5     | $V_G$      | Gate Voltage; Bias network is required; must be biased from both sides; see recommended Application Information above.  |
| 3       | $RF_{IN}$  | Input; matched to 50 $\Omega$ ; DC blocked                                                                              |
| 2,4,7,9 | GND        | Must be grounded on the PCB.                                                                                            |
| 6,10    | $V_D$      | Drain voltage; Bias network is required; must be biased from both sides; see recommended Application Information above. |
| 8       | $RF_{OUT}$ | Output; matched to 50 $\Omega$ ; DC blocked                                                                             |

## Assembly Drawing



### PCB NOTES:

- (1) Both Top and Bottom  $V_d$  and  $V_g$  must be biased.
- (2) This PCB is non-standard, and requires PCB trace modification for 30 GHz performance optimization. See Gerber files for detailed information.

## Bill of Materials

| Reference Des.                 | Value       | Description                 | Manuf.  | Part Number |
|--------------------------------|-------------|-----------------------------|---------|-------------|
| C2, C5, C8, C11                | 0.1 $\mu$ F | Cap, 0603, +50 V, 10 %, X7R | Various | –           |
| C3, C6, C9, C12 <sup>(1)</sup> | 10 $\mu$ F  | Cap, 1206, +50 V, 20 %, X5R | Various | –           |

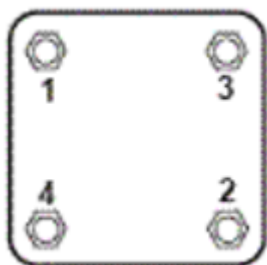
### Notes:

1. Capacitors in drain path should be removed for pulsed operation.

### Assembly Notes

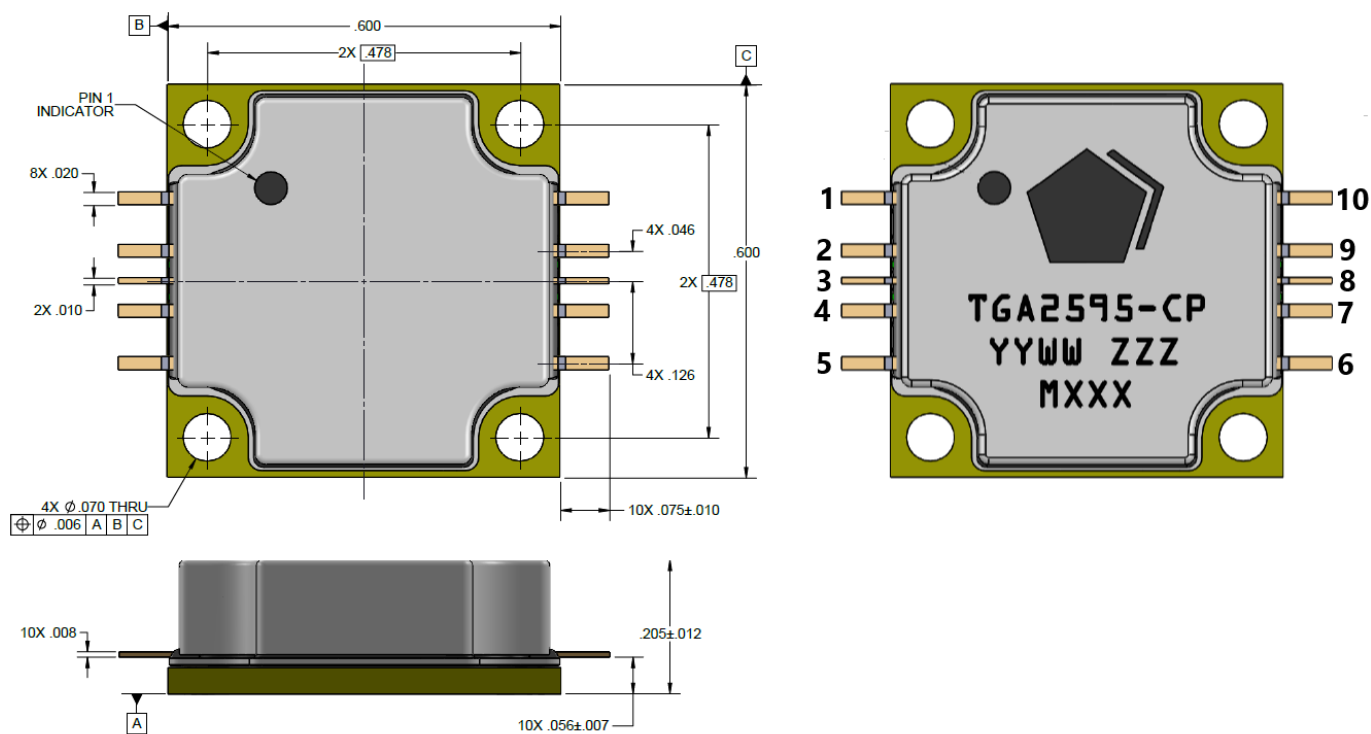
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1. Carefully clean the PC board and package leads with alcohol. Allow it to dry fully.
2. To improve the thermal and RF performance, Qorvo recommends attaching a heat sink to the bottom of the PCB and apply thermal compound (Arctic Silver 5 recommended) or 4 mil indium shim between the heat sink and the package.
3. (The following is for *information only*. There are many variables in a second level assembly that Qorvo does not control, so Qorvo does not recommend an absolute torque value.) Use screws to attach the component to the heat sink. A suggested torque value is 16 in-oz. for a 0-80 screw. Start with screws finger tight, then torque to 8 in-oz., then torque to final value. Use the following tightening pattern:



4. Apply no-flux solder to each pin of the TGA2595-CP. The component leads should be manually soldered, and the package cannot be subjected to conventional reflow processes. The use of no-clean solder to avoid washing after soldering is recommended.

## Mechanical Information and Marking



Units: inches

Tolerances unless specified:  $x.xxx = \pm 0.005$

Materials:

Base: Copper

Lead: Alloy 194

Lid: Plastic

All metalized features are gold plated

Part is epoxy sealed

Marking:

2595: Part number

YY: Part Assembly year

WW: Part Assembly week

ZZZ: Serial Number

MXXX: Batch ID

### Handling Precautions

| Parameter                        | Rating   | Standard                |
|----------------------------------|----------|-------------------------|
| ESD – Human Body Model (HBM)     | Class 1A | ANSI/ESD/JEDEC JS-001   |
| ESD – Charge Device Model (CDM)  | Class C2 | JESD22-C101             |
| MSL – Moisture Sensitivity Level | N/A      | Blank, null, no content |



Caution!  
ESD-Sensitive Device

### Solderability

Compatible with the latest version of J-STD-020, Lead-free solder, 260 °C

### RoHS Compliance

This product is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU. 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

### Contact Information

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

Web: [www.qorvo.com](http://www.qorvo.com)

Tel: 1-844-890-8163

Email: [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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