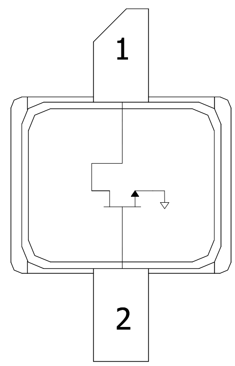
## Applications

- Military radar
- Civilian radar
- Professional and military radio communications
- Test instrumentation
- Wideband or narrowband amplifiers
- Jammers


## Product Features

- Frequency: DC to 6 GHz
- Output Power ($P_{3dB}$): 42.7 W at 3 GHz
- Linear Gain: >14 dB at 3 GHz
- Operating Voltage: 28 V
- Low thermal resistance package

## Functional Block Diagram




## General Description

The Qorvo T2G6003028-FS is a 30W ($P_{3dB}$) discrete GaN on SiC HEMT which operates from DC to 6 GHz. The device is constructed with Qorvo's proven QGaN25 process, which features advanced field plate techniques to optimize power and efficiency at high drain bias operating conditions. This optimization can potentially lower system costs in terms of fewer amplifier line-ups and lower thermal management costs.

Lead-free and ROHS compliant

Evaluation boards are available upon request.

## Pin Configuration

| Pin No. | Label |
|---|---|
| 1 | $V_D$ / RF OUT |
| 2 | $V_G$ / RF IN |
| Flange | Source |

## Ordering Information

| Part | ECCN | Description |
|---|---|---|
| T2G6003028-FS | EAR99 | Packaged part Flangeless |
| T2G6003028-FS-EVB1 | EAR99 | 5.4 – 5.9 GHz Evaluation Board |
| T2G6003028-FS-EVB2 | EAR99 | 1.3 – 1.9 GHz Evaluation Board |

## Absolute Maximum Ratings

| Parameter | Value |
|---|---|
| Breakdown Voltage ($BV_{DG}$) | 100 V |
| Gate Voltage Range ($V_G$) | -7 to 0 V |
| Drain Current ($I_D$) | 5.5 A |
| Gate Current ($I_G$) | -10 to 28 mA |
| Power Dissipation ($P_D$) | 47.5 W |
| RF Input Power, CW, T = 25°C ($P_{IN}$) | 40 dBm |
| Channel Temperature ($T_{CH}$) | 275 °C |
| Mounting Temperature (30 Seconds) | 320 °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.

## Recommended Operating Conditions[1]

| Parameter | Value |
|---|---|
| Drain Voltage Range ($V_D$) | 12 - 40 V |
| Drain Quiescent Current ($I_{DQ}$) | 200 mA (Typ.) |
| Peak Drain Current ( $I_D$) | 1.7 A (Typ.) |
| Gate Voltage ($V_G$) | -3.3 V (Typ.) |
| Channel Temperature ($T_{CH}$) | 225 °C (Max) |
| Power Dissipation, CW ($P_D$) | 35 W (Max) |
| Power Dissipation, Pulse ($P_D$) [2] | 40 W (Max) |

1. Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.
2. Pulse Width = 380 uS, Duty Cycle = 50%

## RF Characterization – Optimum Power Tuned Load Pull Performance

Test conditions unless otherwise noted: T = 25°C.

| Parameter | Typical Value | | | | | | Units |
|---|---|---|---|---|---|---|---|
| Frequency (F) | 1 | 2 | 3 | 4 | 5 | 6 | GHz |
| Drain Voltage ($V_D$) | 28 | 28 | 28 | 28 | 28 | 28 | V |
| Bias Current ($I_{DQ}$) | 200 | 200 | 200 | 200 | 200 | 200 | mA |
| Output P3dB ($P_{3dB}$) | 45.7 | 46 | 46.3 | 46.5 | 46.8 | 46.2 | dBm |
| PAE @ $P_{3dB}$ ($PAE_{3dB}$) | 64.9 | 64.2 | 68.1 | 54.6 | 55.9 | 54.7 | % |
| Gain @ P3dB ($G_{3dB}$) | 19.9 | 15.7 | 11.3 | 10.1 | 10.7 | 12.1 | dB |

Notes:
1. Vd = 28 V, Idq = 200 mA, Pulse Width = 100 uS, Duty Cycle = 20%
2. Characteristic Impedance (Zo) = 10 Ω. See pg. 18 for Load Pull Reference Planes.

## RF Characterization – Optimum Efficiency Tune Load Pull Performance

Test conditions unless otherwise noted: T = 25°C.

| Parameter | Typical Value | | | | | | Units |
|---|---|---|---|---|---|---|---|
| Frequency (F) | 1 | 2 | 3 | 4 | 5 | 6 | GHz |
| Drain Voltage ($V_D$) | 28 | 28 | 28 | 28 | 28 | 28 | V |
| Bias Current ($I_{DQ}$) | 200 | 200 | 200 | 200 | 200 | 200 | mA |
| Output P3dB ($P_{3dB}$) | 43.1 | 43.1 | 44.6 | 44.1 | 44.9 | 45.7 | dBm |
| PAE @ $P_{3dB}$ ($PAE_{3dB}$) | 73 | 76 | 46.1 | 65.1 | 69.5 | 60 | % |
| Gain @ P3dB ($G_{3dB}$) | 19.7 | 16.2 | 11.7 | 10.8 | 12.4 | 12.9 | dB |

Notes:
1. Vd = 28 V, Idq = 200 mA, Pulse Width = 100 uS, Duty Cycle = 20%.
2. Characteristic Impedance (Zo) = 10 Ω. See pg. 18 for Load Pull Reference Planes.

## RF Characterization – Performance at 5.6 GHz (1, 2)

| Symbol | Parameter | Min | Typical | Max | Units |
|---|---|---|---|---|---|
| $G_{LIN}$ | Linear Gain | 12.0 | 14.0 | 17.0 | dB |
| $P_{3dB}$ | Output Power at 3 dB Gain Compression | 43.0 | 44.6 | 46.0 | dBm |
| $DE_{3dB}$ | Drain Efficiency at 3 dB Gain Compression | 45.0 | 54.0 | 70.0 | % |
| $G_{3dB}$ | Gain at 3 dB Compression | 9.0 | 11.0 | 14.0 | dB |

Notes:
1. Performance at 5.6 GHz in the 5.4 to 5.9 GHz Evaluation Board
2. $V_{DS}$ = 28 V, $I_{DQ}$ = 200 mA; Pulse: 100µs, 20%

## RF Characterization – Mismatch Ruggedness at 5.6 GHz (1)

Test conditions unless otherwise noted: $T_A$ = 25 °C, $V_D$ = 28 V, $I_{DQ}$ = 200 mA

| Symbol | Parameter | Typical |
|---|---|---|
| VSWR | Impedance Mismatch Ruggedness | 10:1 |

Notes:
1. $P_{1dB}$ CW Input Power under matched condition.

## Thermal and Reliability - CW (1)

| Parameter | Test Conditions | Value | Units |
|---|---|---|---|
| Thermal Resistance, $\theta_{JC}$ | $P_D$ = 30 W, Tbase = 85°C | 3.82 | °C/W |
| Maximum Channel Temperature, $T_{CH}$ | | 200 | °C |
| Median Lifetime, $T_M$ | | 1.54E7 | Hrs |
| Thermal Resistance, $\theta_{JC}$ | $P_D$ = 35 W, Tbase = 85°C | 4.01 | °C/W |
| Maximum Channel Temperature, $T_{CH}$ | | 225 | °C |
| Median Lifetime, $T_M$ | | 1.80E6 | Hrs |
| Thermal Resistance, $\theta_{JC}$ | $P_D$ = 40 W, Tbase = 85°C | 4.22 | °C/W |
| Maximum Channel Temperature, $T_{CH}$ | | 254 | °C |
| Median Lifetime, $T_M$ | | 1.93E5 | Hrs |
| Thermal Resistance, $\theta_{JC}$ | $P_D$ = 45 W, Tbase = 85°C | 4.43 | °C/W |
| Maximum Channel Temperature, $T_{CH}$ | | 284 | °C |
| Median Lifetime, $T_M$ | | 2.41E4 | Hrs |

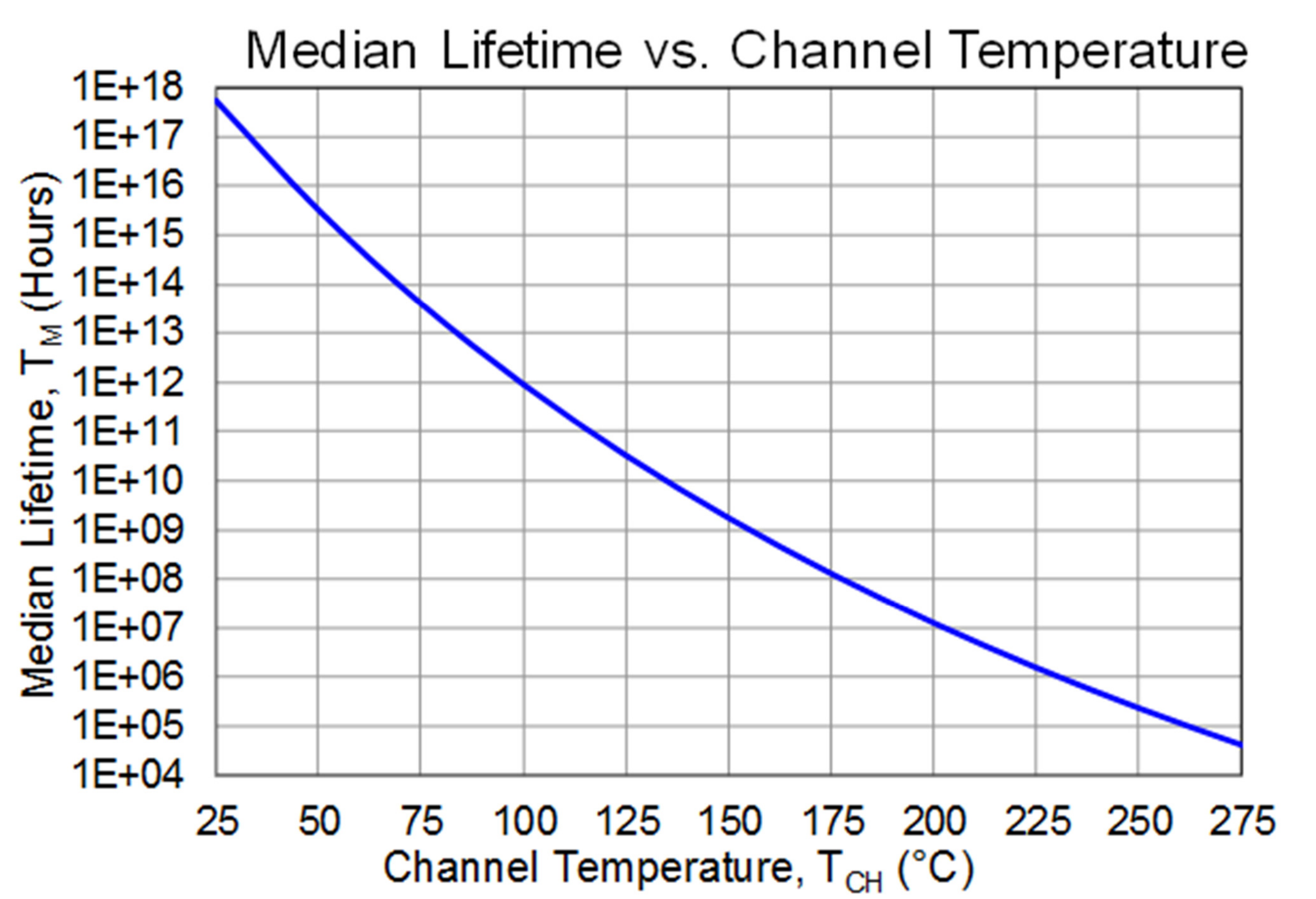
Notes:
1. Thermal resistance calculated to bottom of package.

## Thermal and Reliability - Pulsed (1)

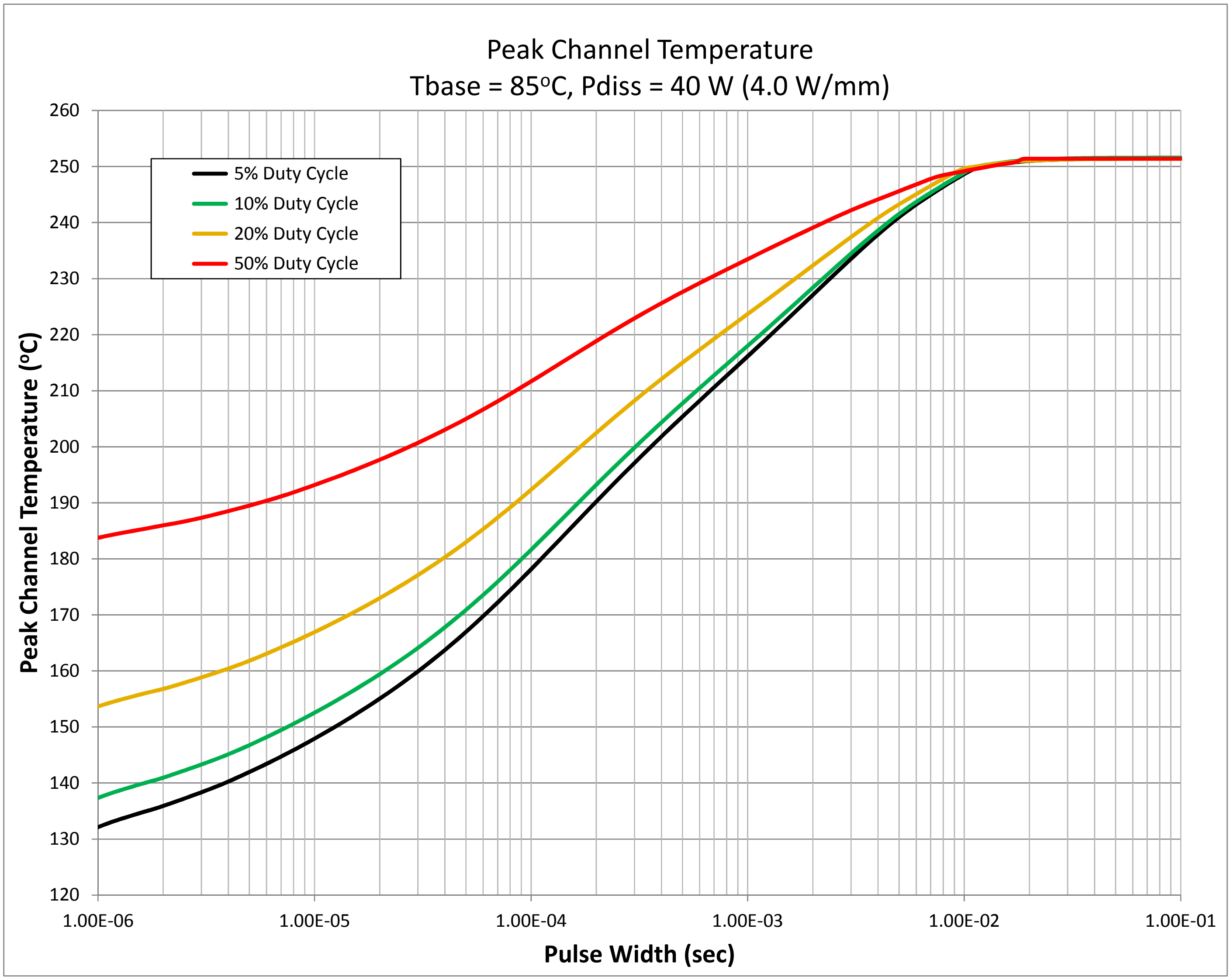
| Parameter | Test Conditions | Value | Units |
|---|---|---|---|
| Thermal Resistance, $\theta_{JC}$ | $P_D$ = 40 W, Tbase = 85°C<br>Pulse Width = 100 uS<br>Duty Cycle = 5% | 2.33 | °C/W |
| Peak Channel Temperature, $T_{CH}$ | | 178 | °C |
| Median Lifetime, $T_M$ | | 2.52E9 | Hrs |
| Thermal Resistance, $\theta_{JC}$ | $P_D$ = 40 W, Tbase = 85°C<br>Pulse Width = 100 uS<br>Duty Cycle = 10% | 2.43 | °C/W |
| Peak Channel Temperature, $T_{CH}$ | | 182 | °C |
| Median Lifetime, $T_M$ | | 8.60E8 | Hrs |
| Thermal Resistance, $\theta_{JC}$ | $P_D$ = 40 W, Tbase = 85°C<br>Pulse Width = 100 uS<br>Duty Cycle = 20% | 2.68 | °C/W |
| Peak Channel Temperature, $T_{CH}$ | | 192 | °C |
| Median Lifetime, $T_M$ | | 1.65E8 | Hrs |
| Thermal Resistance, $\theta_{JC}$ | $P_D$ = 40 W, Tbase = 85°C<br>Pulse Width = 100 uS<br>Duty Cycle = 50% | 3.18 | °C/W |
| Peak Channel Temperature, $T_{CH}$ | | 212 | °C |
| Median Lifetime, $T_M$ | | 1.10E7 | Hrs |

Notes:
2. Thermal resistance calculated to bottom of package.

## Median Lifetime

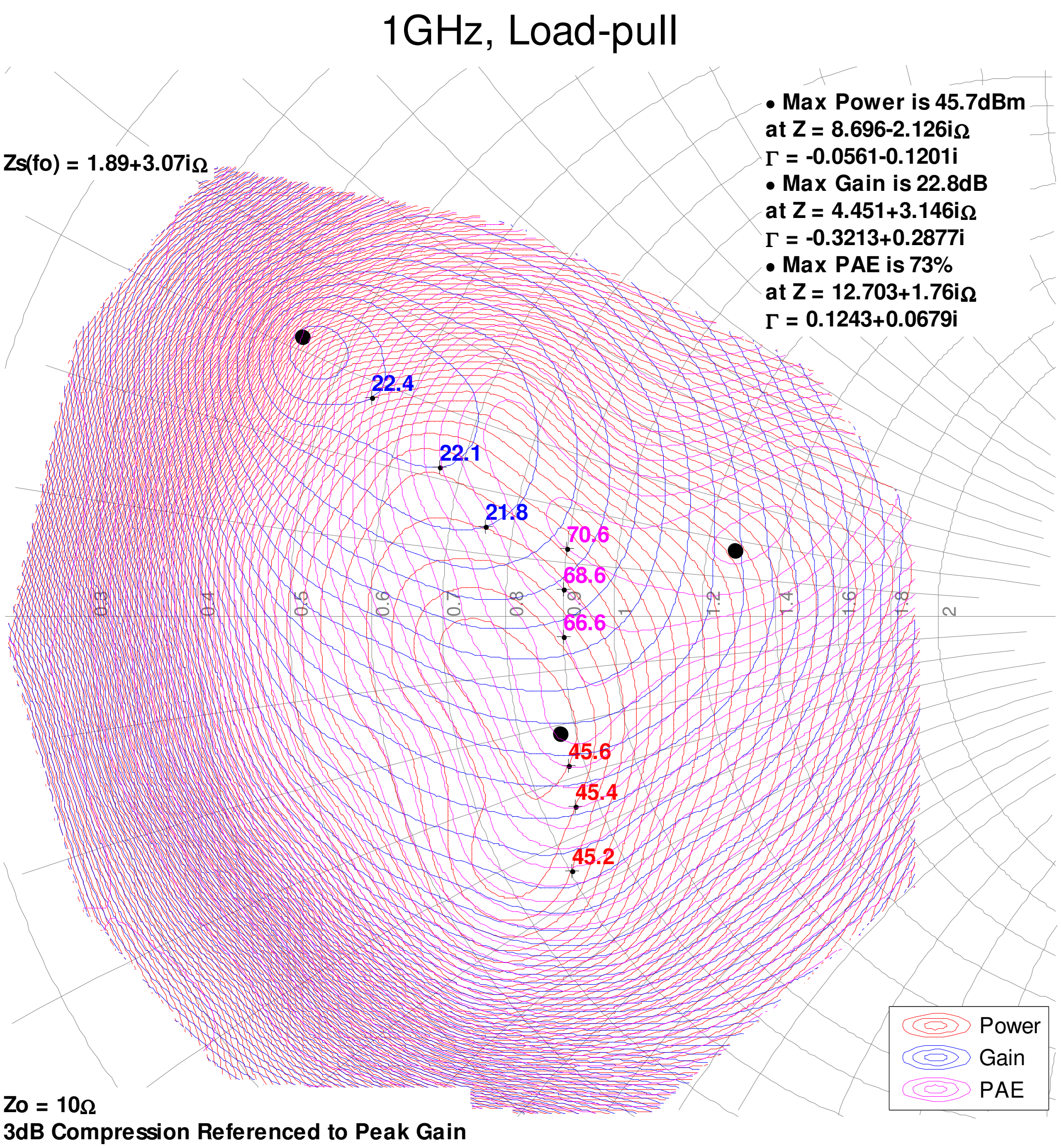


## Maximum Channel Temperature



## Load Pull Smith Charts (1, 2, 3)

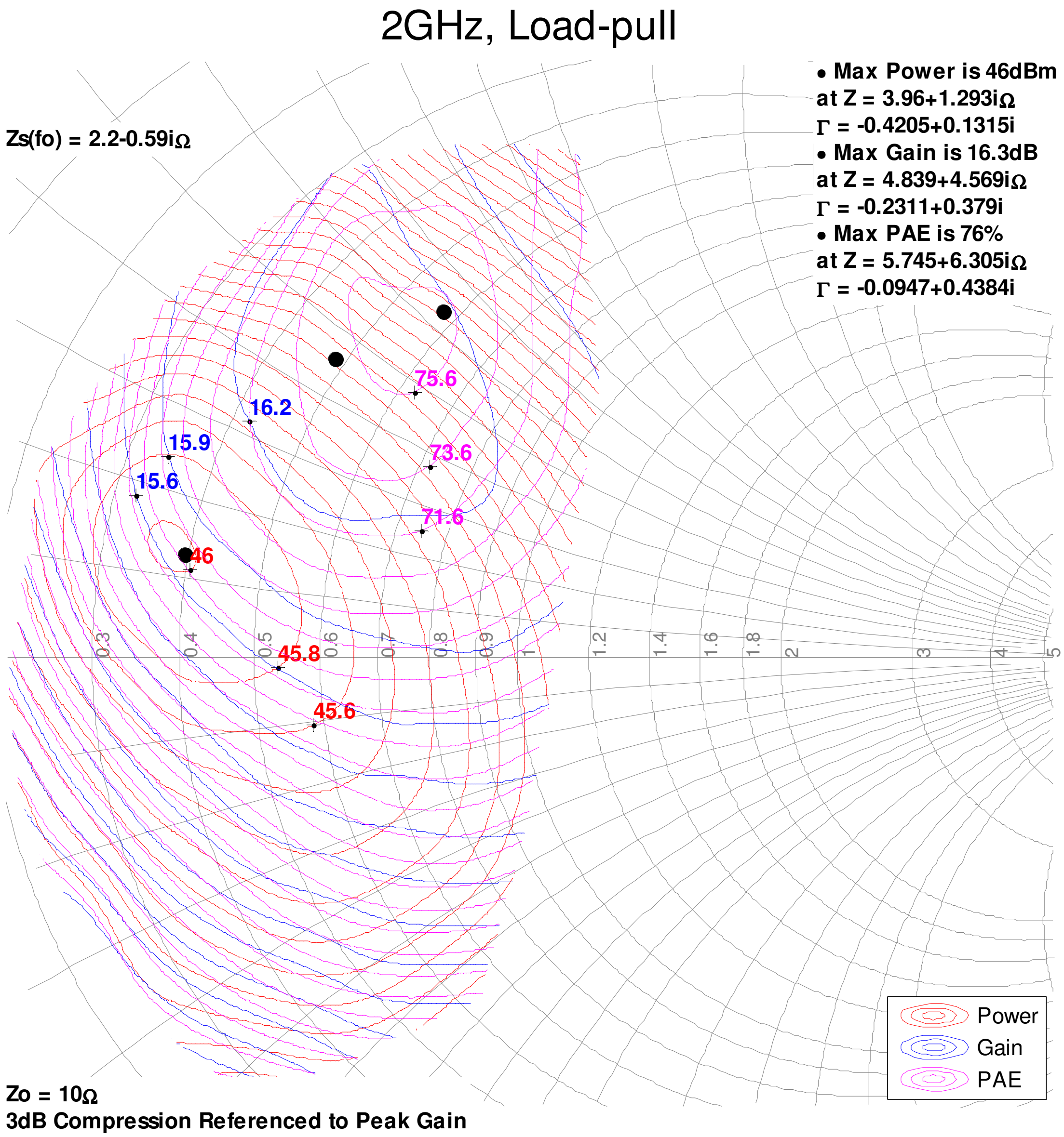
Notes:
1. Test Conditions: $V_{DS}$ = 28 V, $I_{DQ}$ = 200 mA
2. Test Signal: Pulse Width = 100 µsec, Duty Cycle = 20%
3. See pg. 18 for load pull reference planes.



## Load Pull Smith Charts (1, 2, 3)

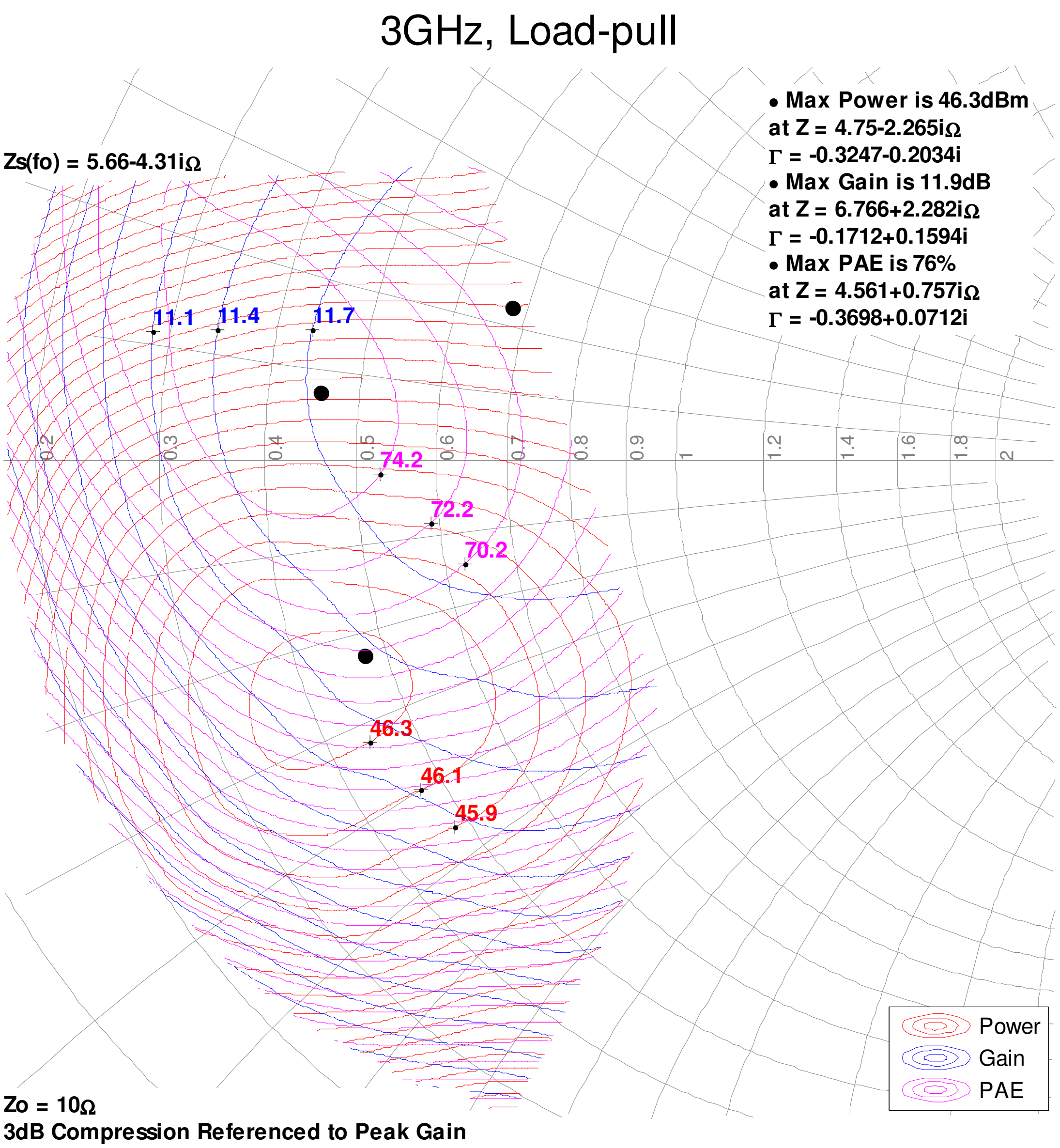
Notes:

1. Test Conditions: $V_{DS}$ = 28 V, $I_{DQ}$ = 200 mA
2. Test Signal: Pulse Width = 100 µsec, Duty Cycle = 20%
3. See pg. 18 for load pull reference planes.



## Load Pull Smith Charts (1, 2, 3)

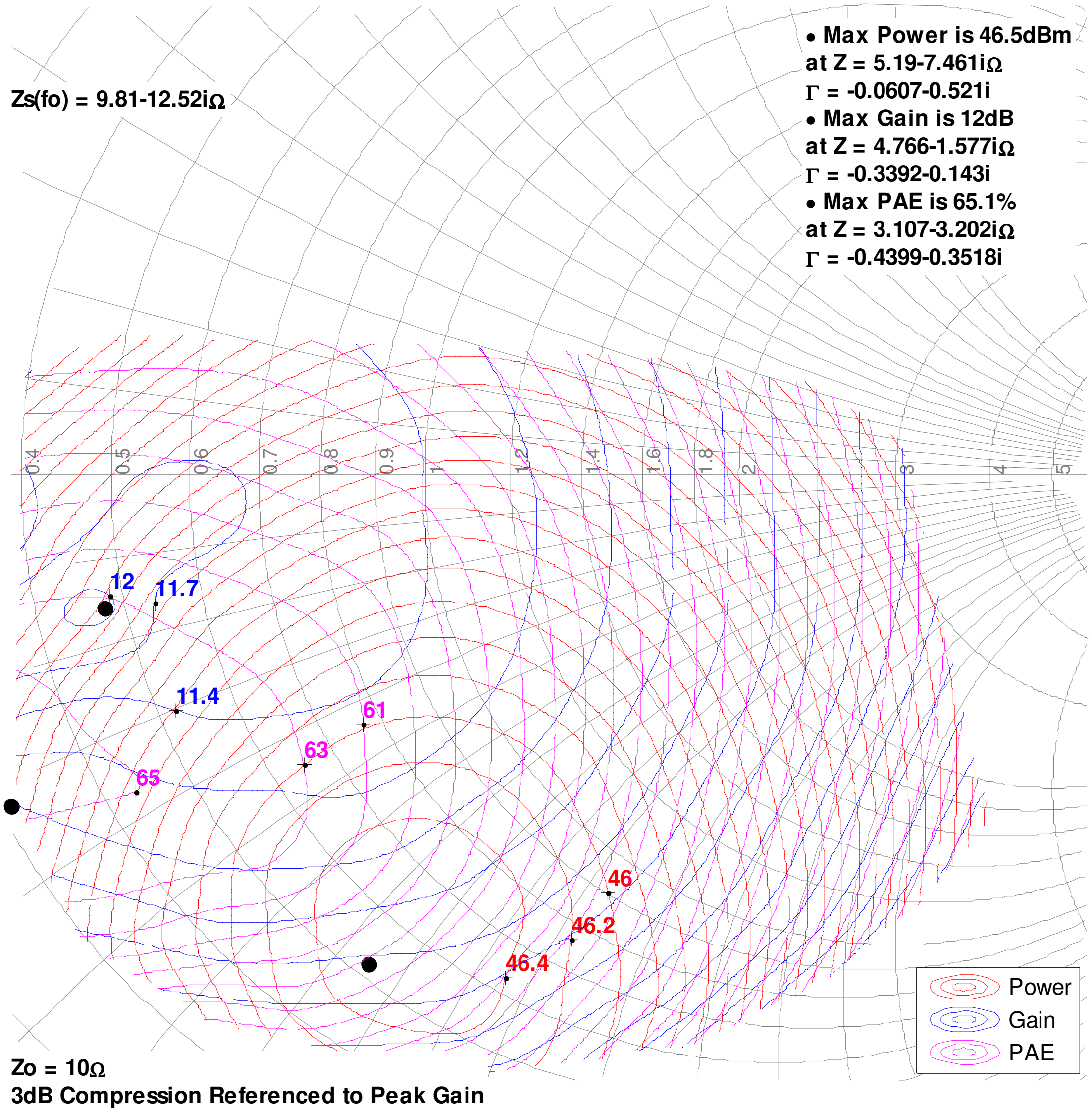
Notes:
1. Test Conditions: $V_{DS}$ = 28 V, $I_{DQ}$ = 200 mA
2. Test Signal: Pulse Width = 100 µsec, Duty Cycle = 20%
3. See pg. 18 for load pull reference planes.



## Load Pull Smith Charts (1, 2, 3)

Notes:
1. Test Conditions: $V_{DS}$ = 28 V, $I_{DQ}$ = 200 mA
2. Test Signal: Pulse Width = 100 µsec, Duty Cycle = 20%
3. See pg. 18 for load pull reference planes.

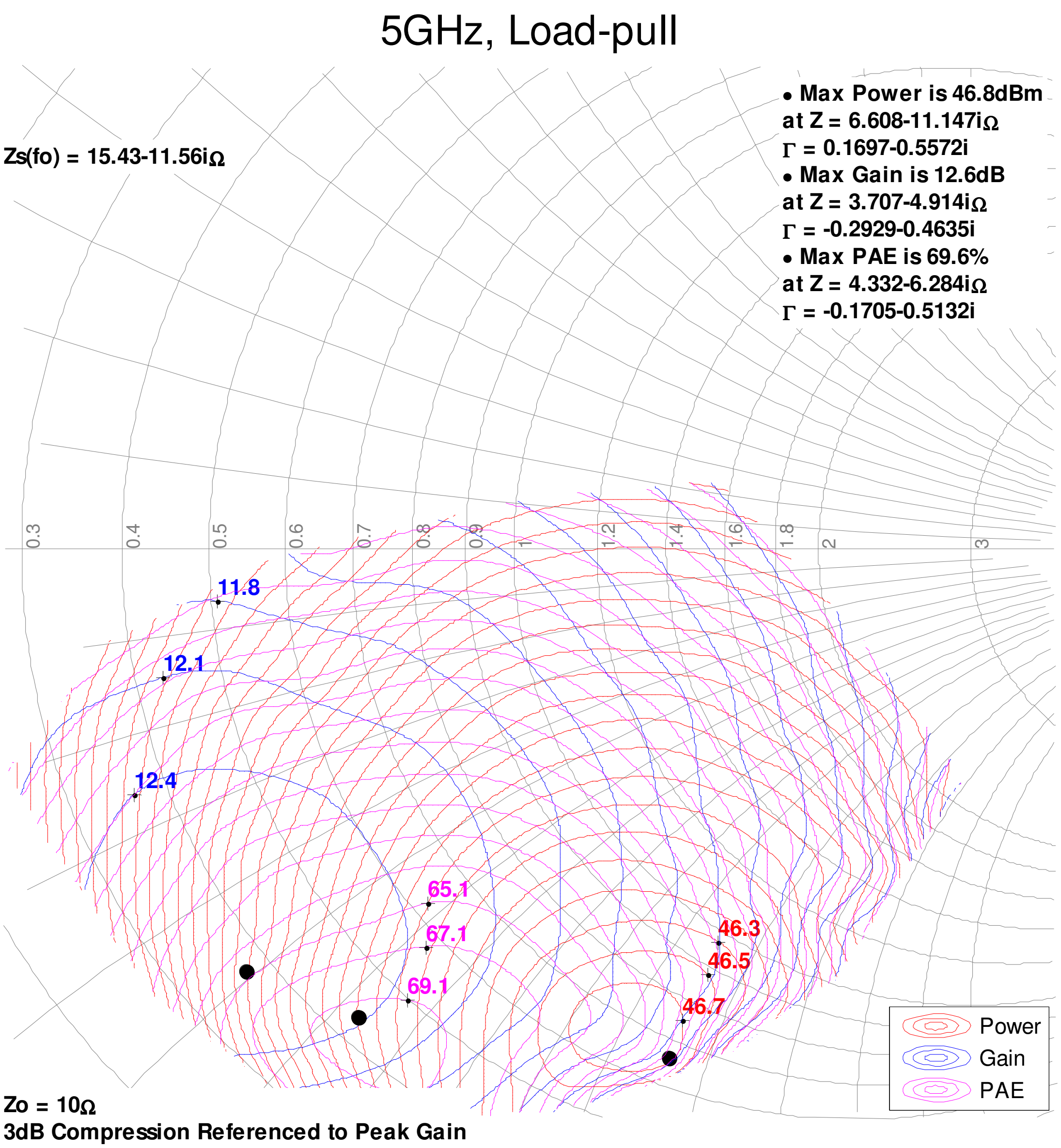
### 4GHz, Load-pull



## Load Pull Smith Charts [1, 2, 3]

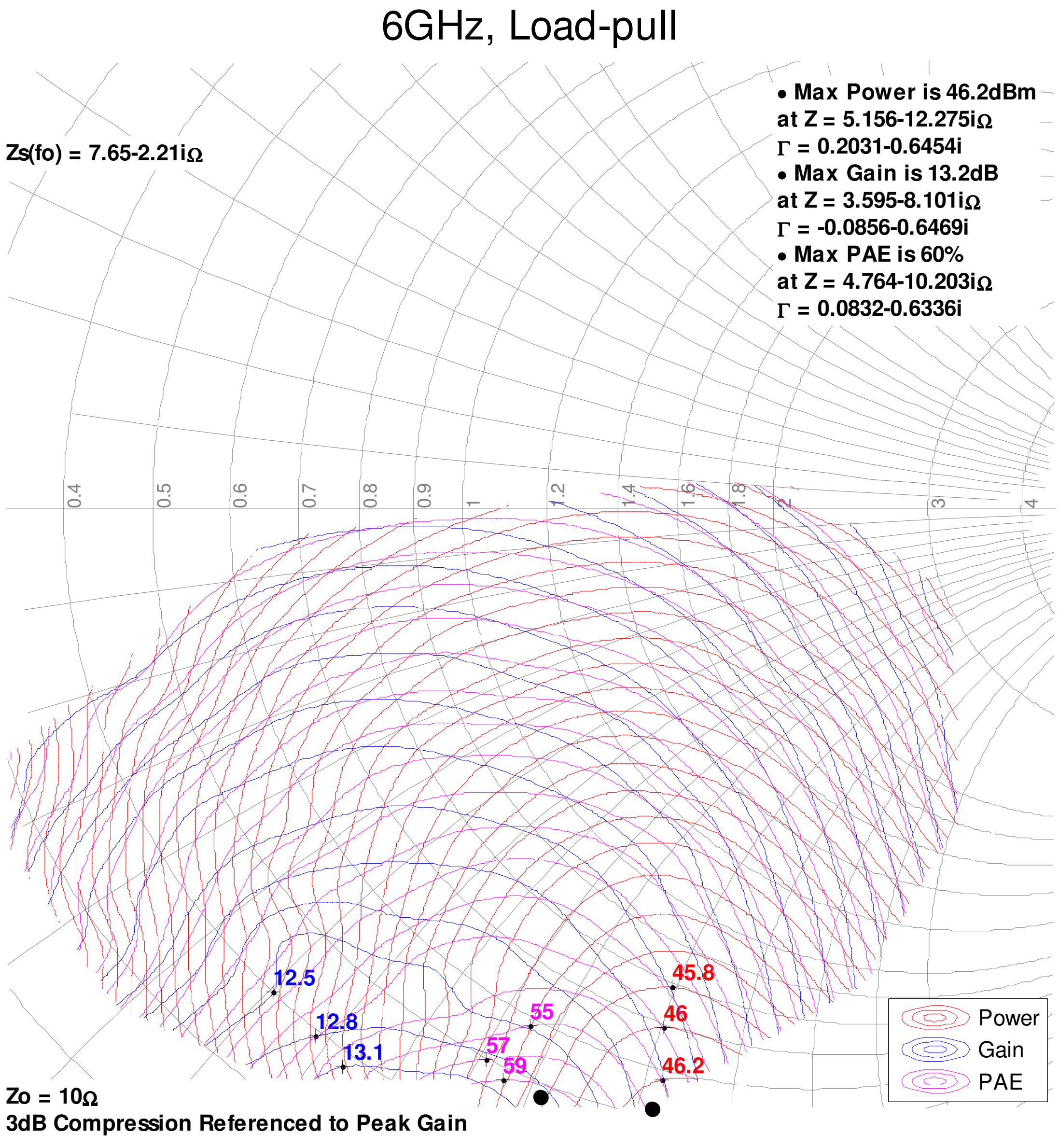
Notes:

1. Test Conditions: $V_{DS}$ = 28 V, $I_{DQ}$ = 200 mA
2. Test Signal: Pulse Width = 100 µsec, Duty Cycle = 20%
3. See pg. 18 for load pull reference planes.



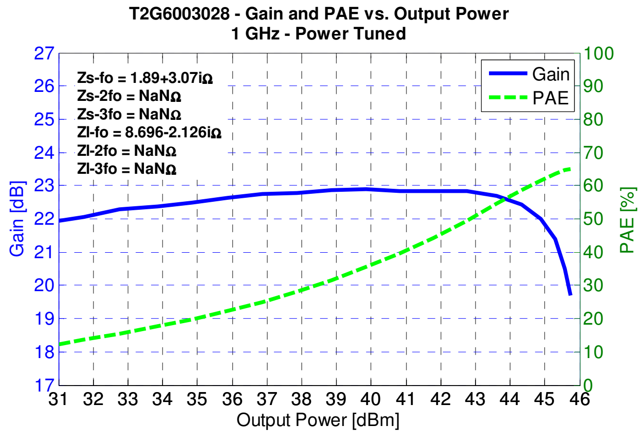
## Load Pull Smith Charts [1, 2, 3]

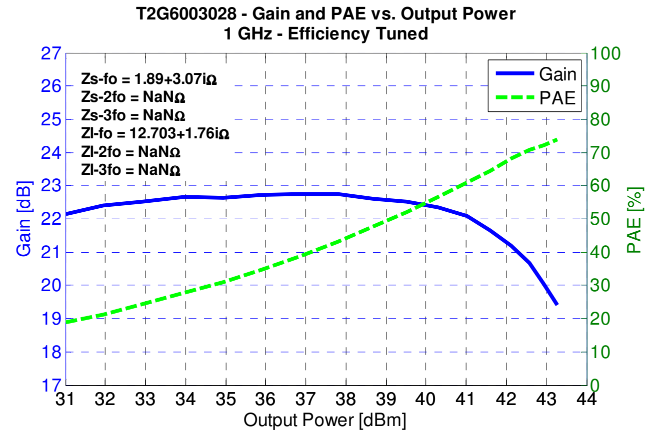
Notes:
1. Test Conditions: $V_{DS}$ = 28 V, $I_{DQ}$ = 200 mA
2. Test Signal: Pulse Width = 100 µsec, Duty Cycle = 20%
3. See pg. 18 for load pull reference planes.

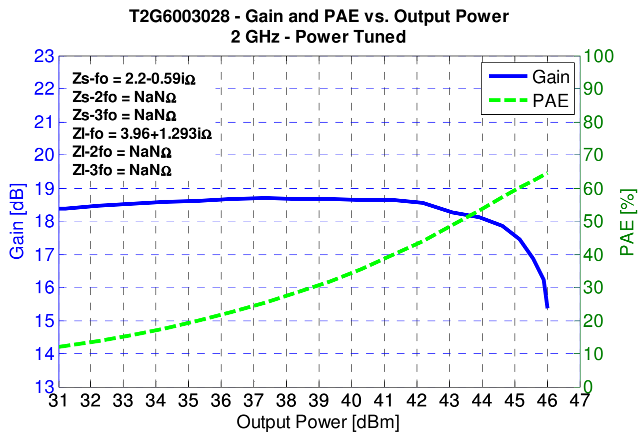


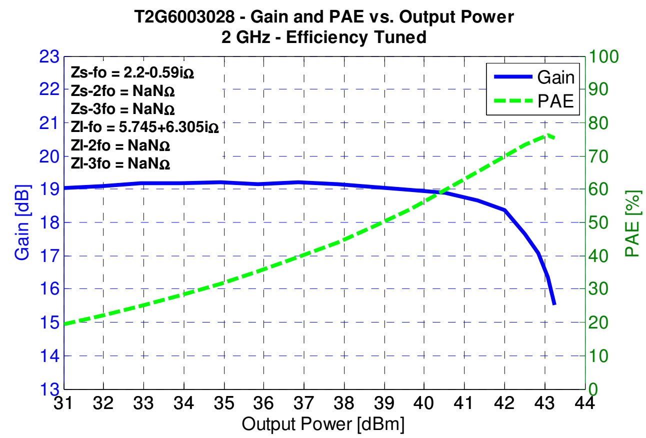
## Characterization Drive-up [1, 2]

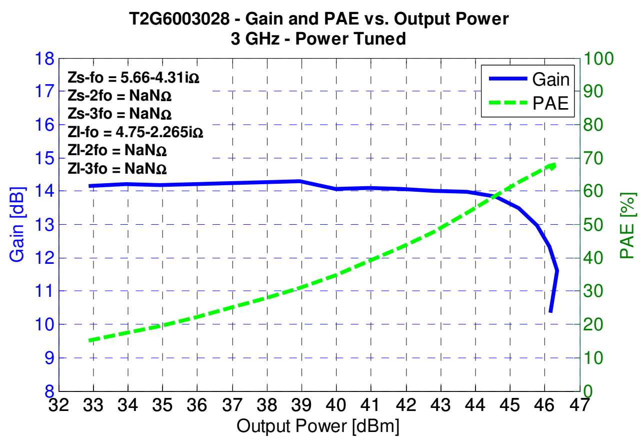
1. Vd = 28 V, Idq = 200 mA, Pulse Width = 100 uS, Duty Cycle = 20%
2. NaN means the parameter is either unavailable or undefined.

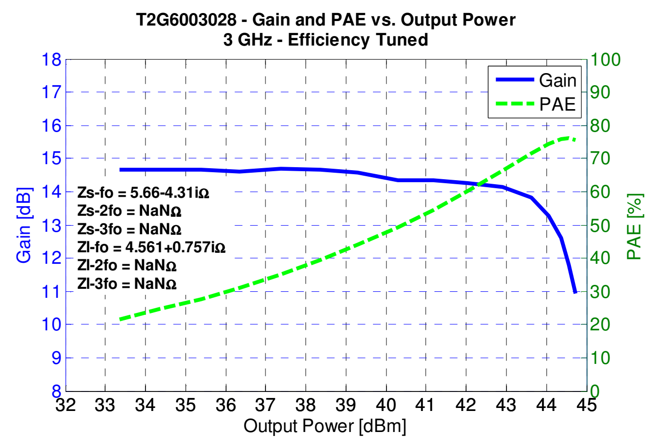


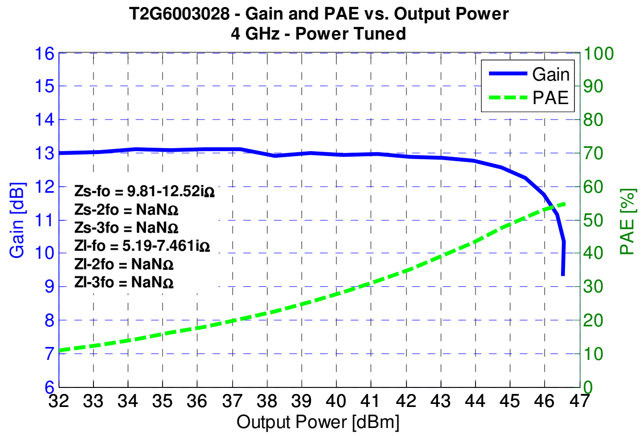



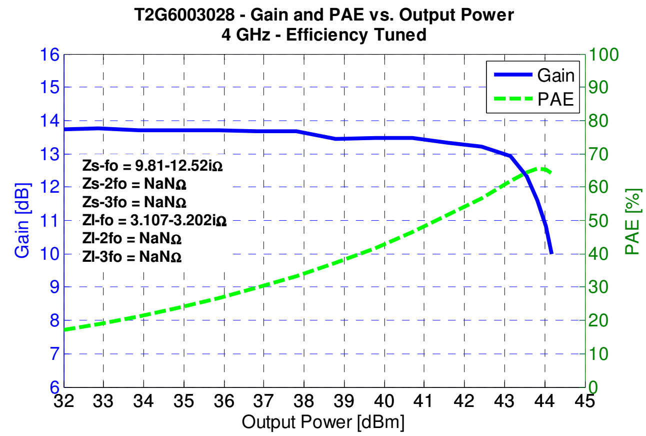



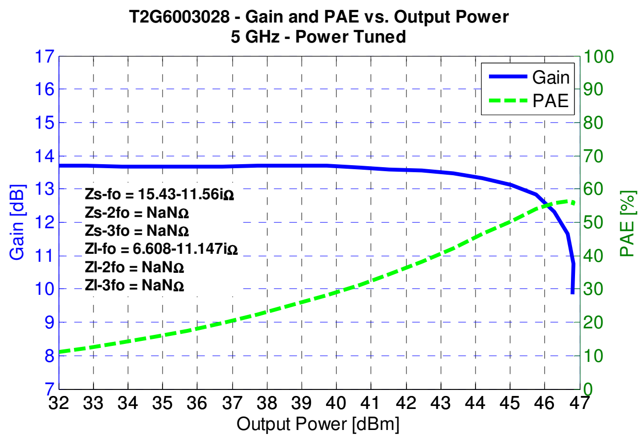



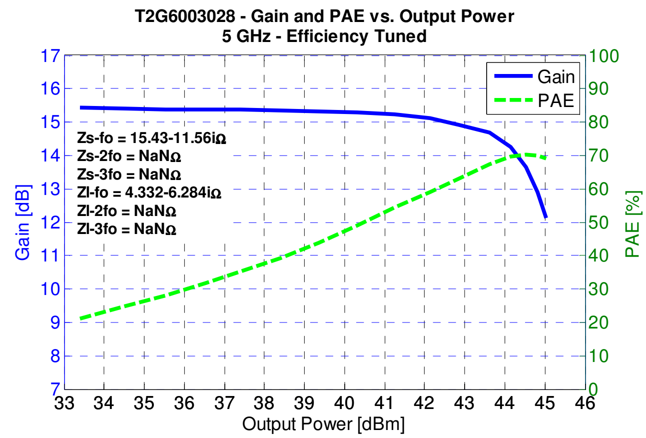
## Characterization Drive-up (1, 2)

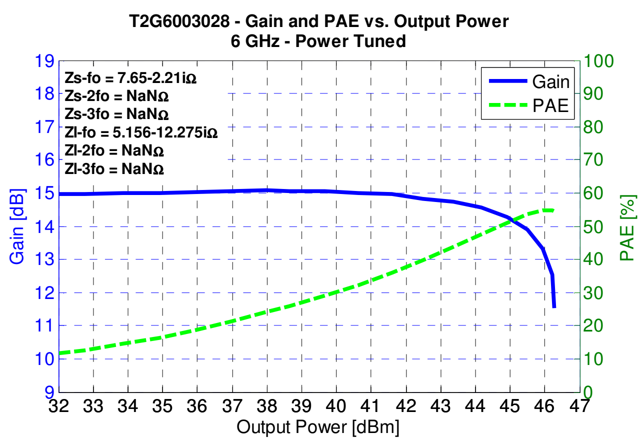
1. Vd = 28 V, Idq = 200 mA, Pulse Width = 100 uS, Duty Cycle = 20%
2. NaN means the parameter is either unavailable or undefined.

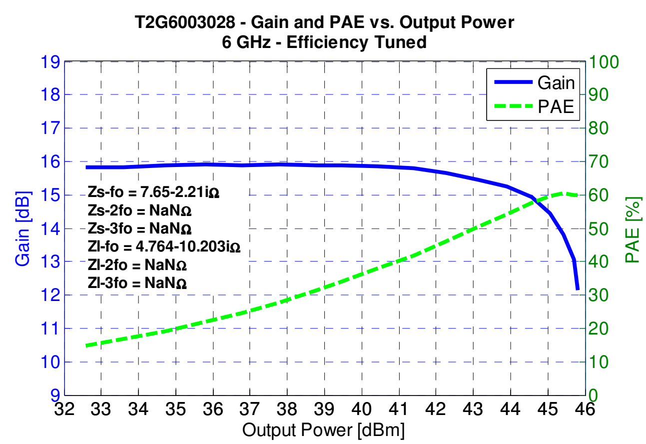


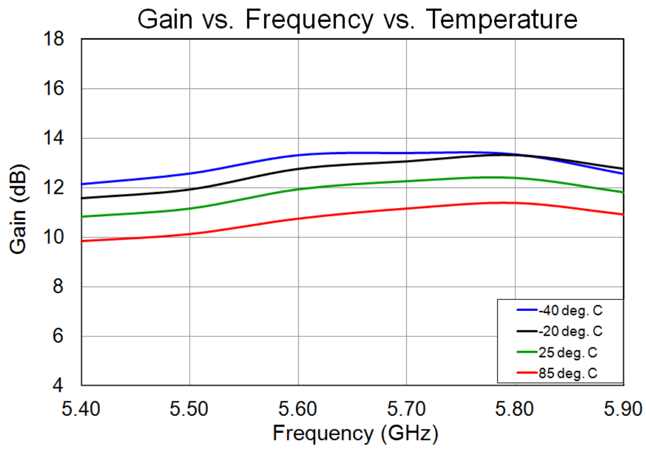



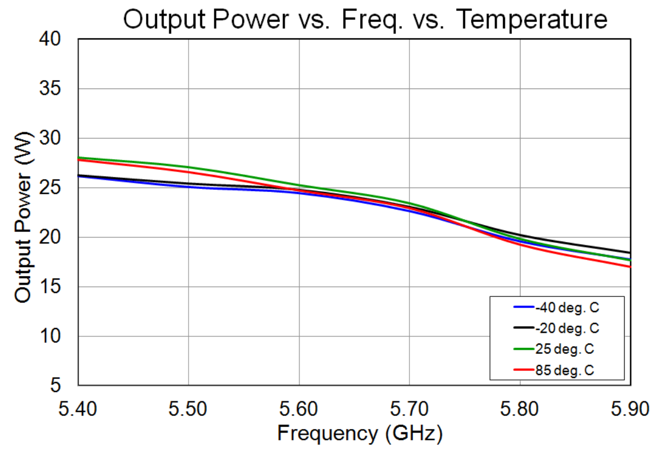



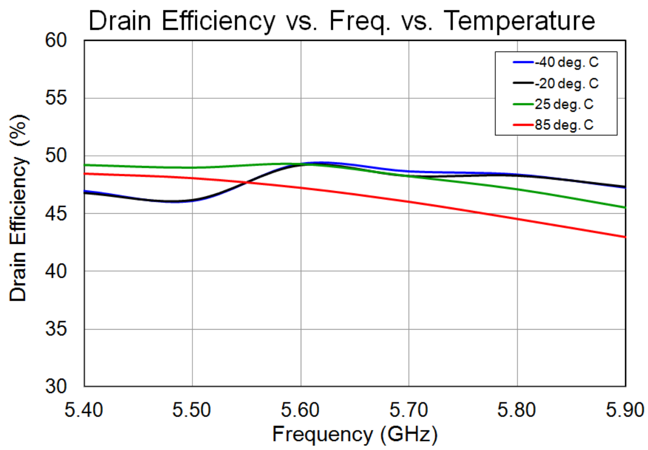



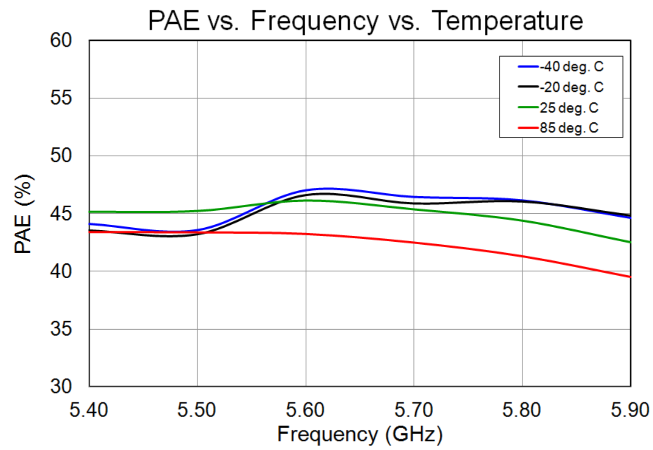
## Performance Over Temperature (1, 2)

Performance measured in Qorvo's 5.4 GHz to 5.9 GHz Evaluation Board at 3 dB compression.



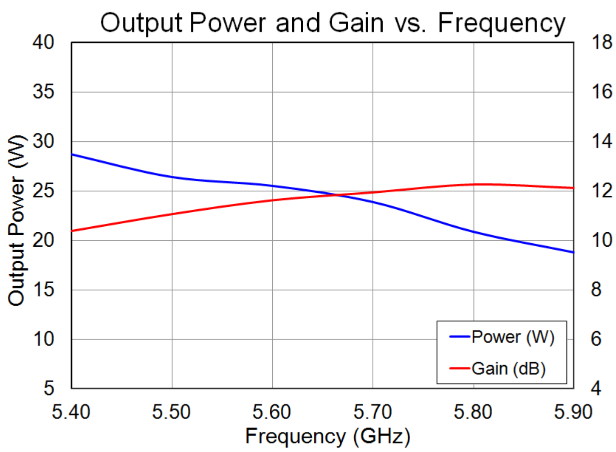



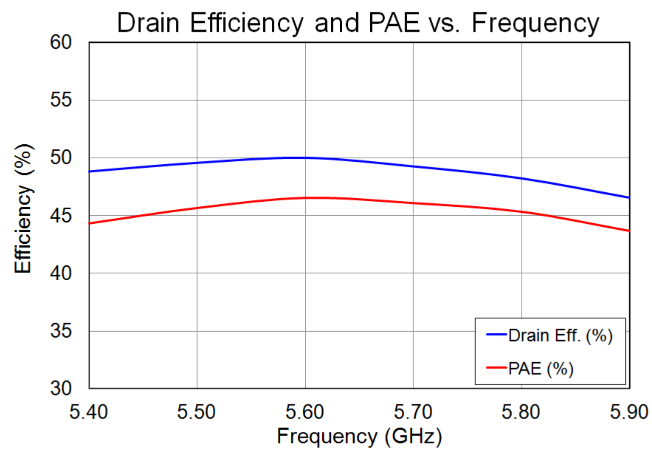

Notes:

1. Test Conditions: $V_{DS}$ = 28 V, $I_{DQ}$ = 200 mA
2. Test Signal: Pulse Width = 100 µs, Duty Cycle = 20%

## Evaluation Board Performance [1, 2]

Performance at 3 dB Compression

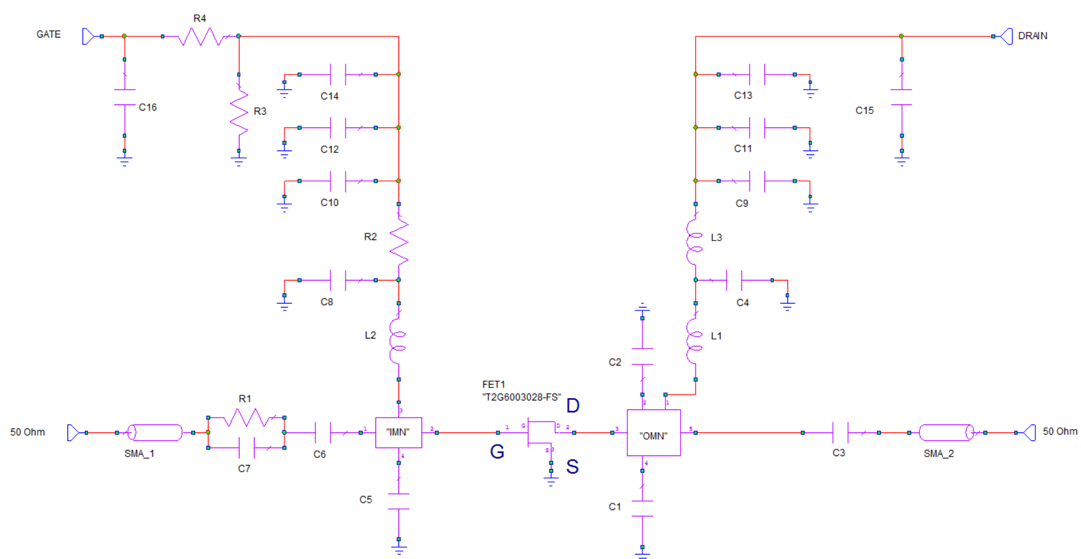



Notes:

1. Test Conditions: $V_{DS}$ = 28 V, $I_{DQ}$ = 200 mA
2. Test Signal: Pulse Width = 100 µs, Duty Cycle = 20 %

## Application Circuit




## Bias-up Procedure

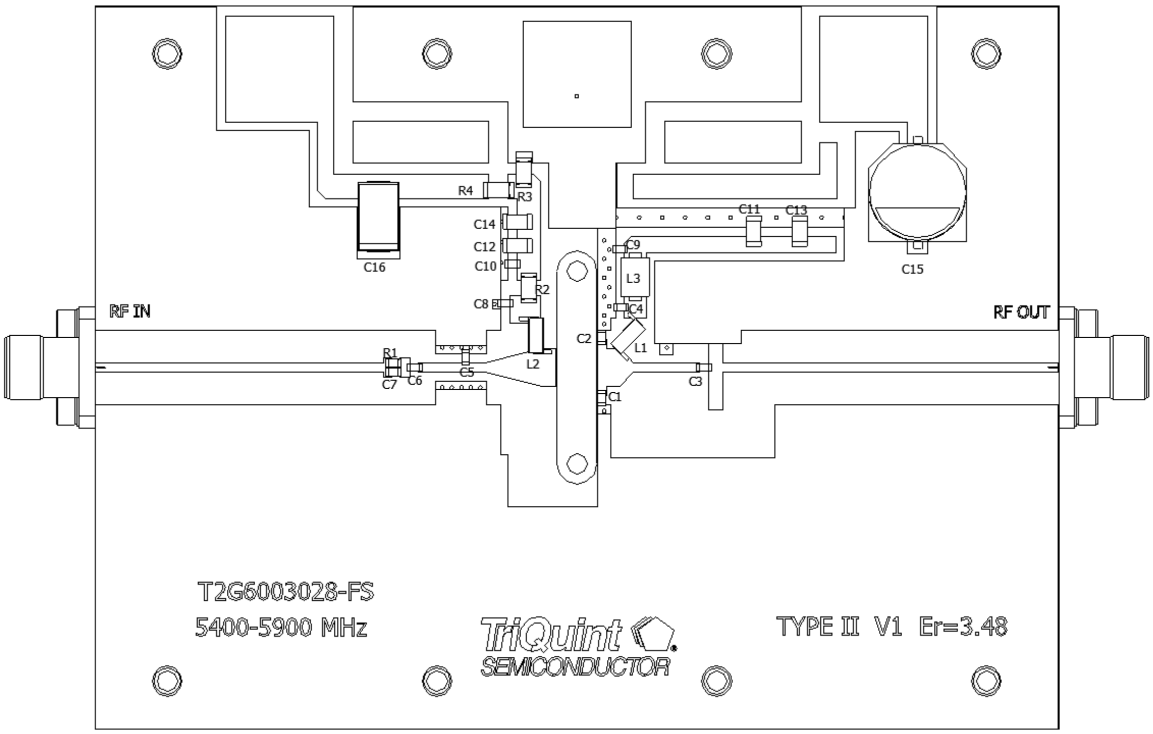
| |
|---|
| Set gate voltage ($V_G$) to -5.0V. |
| Set drain current ($I_D$) limit to 220 mA. |
| Set drain voltage ($V_D$) to 28 V |
| Slowly increase $V_G$ until quiescent $I_D$ is 200 mA. |
| Set drain current ($I_D$) to 2.8 A. |
| Apply RF signal. |

## Bias-down Procedure

| |
|---|
| Turn off RF signal. |
| Turn off $V_D$ and wait 1 second to allow drain capacitor discharge. |
| Turn off $V_G$. |

## Evaluation Board Layout

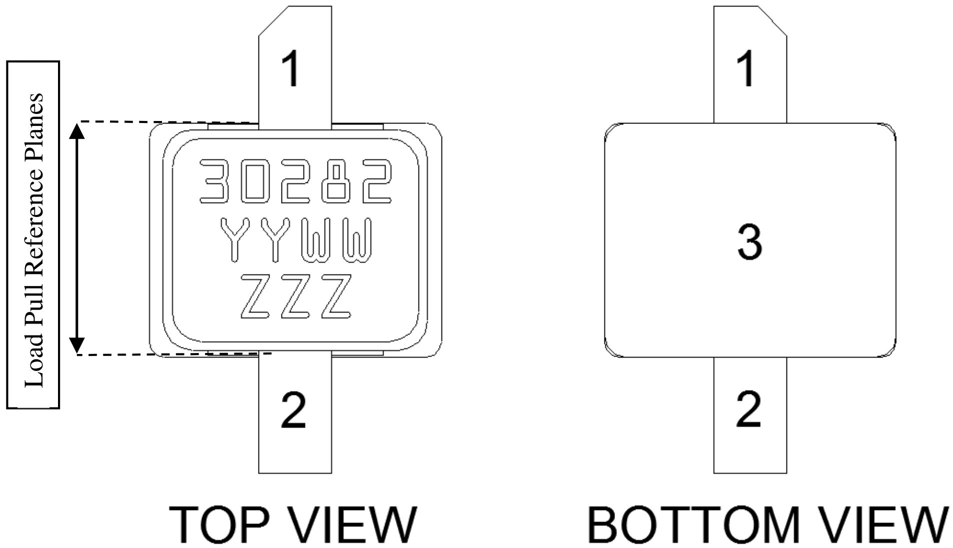
Top RF layer is 0.020" thick Rogers RO4350B, $\varepsilon_r = 3.48$. The pad pattern shown has been developed and tested for optimized assembly at Qorvo Semiconductor. The PCB land pattern has been developed to accommodate lead and package tolerances.




## Bill of Materials

| Reference Design | Value | Qty | Manufacturer | Part Number |
|---|---|---|---|---|
| C1 | 0.3 pF | 1 | ATC | ATC600S0R3 |
| C2 | 0.2 pF | 1 | ATC | ATC600S0R2 |
| L1, L2 | 8.8 NH | 2 | COILCRAFT | 1606-8 |
| C3, C4, C6, C7, C8 | 3 pF | 5 | ATC | ATC600S3R0 |
| C5 | 0.4 pF | 1 | ATC | ATC600S0R5 |
| R1 | 97.6 Ohms | 1 | Venkel | CR0604-16w-97R6FT |
| R2 | 4.7 Ohms | 1 | Newark | 37C0064 |
| R3 | 330 Ohms | 1 | Newark | TNPW1206330RBT9ET1-E3 |
| R4 | 50 Ohms | 1 | ATC | CRCW120651R0FKEA |
| C9, C10 | 220 pF | 2 | AVX | AVX06035C22KAT2A |
| C11, C12 | 2200 pF | 2 | Vitramon | VJ1206Y222KXA |
| C13, C14 | 22000 pF | 2 | Vitramon | VJ1206Y223KXA |
| C15 | 220 uF | 1 | United Chemi-Con | EMVY500ADA221MJA0G |
| C16 | 1.0 uF | 1 | Allied | 541-1231 |
| L3 | 48 Ohm | 1 | Ferrite, Laird Tech. | 28F0121-0SR-10 |

## Pin Layout




Note:
The T2G6003028-FS will be marked with the “30282” designator and a lot code marked below the part designator. The “YY” represents the last two digits of the calendar year the part was manufactured, the “WW” is the work week of the assembly lot start, and the “ZZZ” is an auto-generated number.

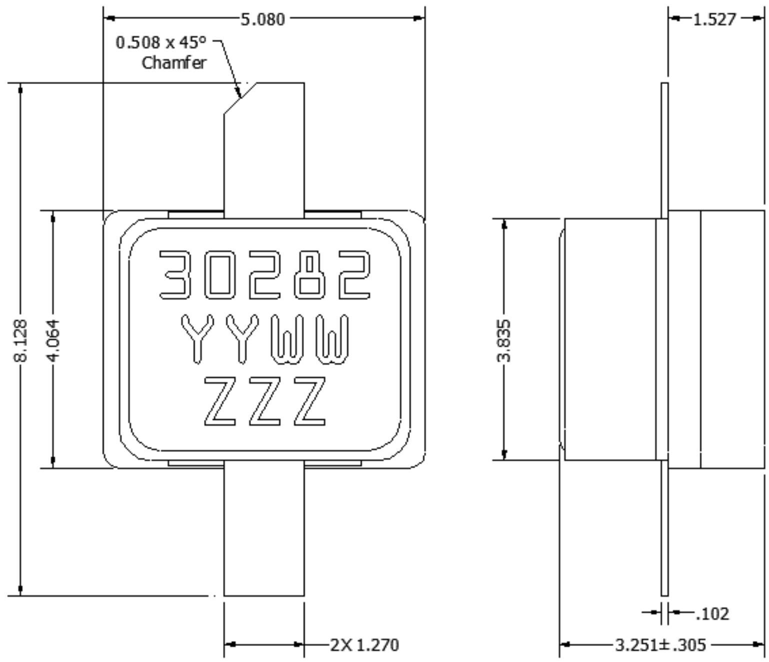
## Pin Description

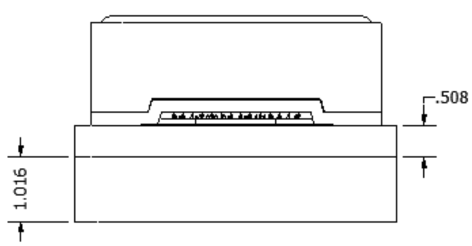
| Pin | Symbol | Description |
|---|---|---|
| 1 | $V_D$ / RF OUT | Drain voltage / RF Output matched to 50 ohms; see EVB Layout on page 17 as an example. |
| 2 | $V_G$ / RF IN | Gate voltage / RF Input matched to 50 ohms; see EVB Layout on page 17 as an example. |
| 3 | Flange | Source connected to ground; see EVB Layout on page 17 as an example. |

Notes:
Thermal resistance measured to bottom of package

## Mechanical Information

All dimensions are in millimeters.




Note:

This package is lead-free/RoHS-compliant. The plating material on the leads is NiAu. It is compatible with both lead-free (maximum 260 ℃ reflow temperature) and tin-lead (maximum 245℃ reflow temperature) soldering processes.

## Product Compliance Information

### ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: Class 1A
Value: Passes ≥ 250 V to < 500 V max.
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

### MSL Rating

Level 3 at +260 ℃ convection reflow
The part is rated Moisture Sensitivity Level 3 at 260℃ per JEDEC standard IPC/JEDEC J-STD-020.

### ECCN

US Department of Commerce EAR99

### Solderability

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

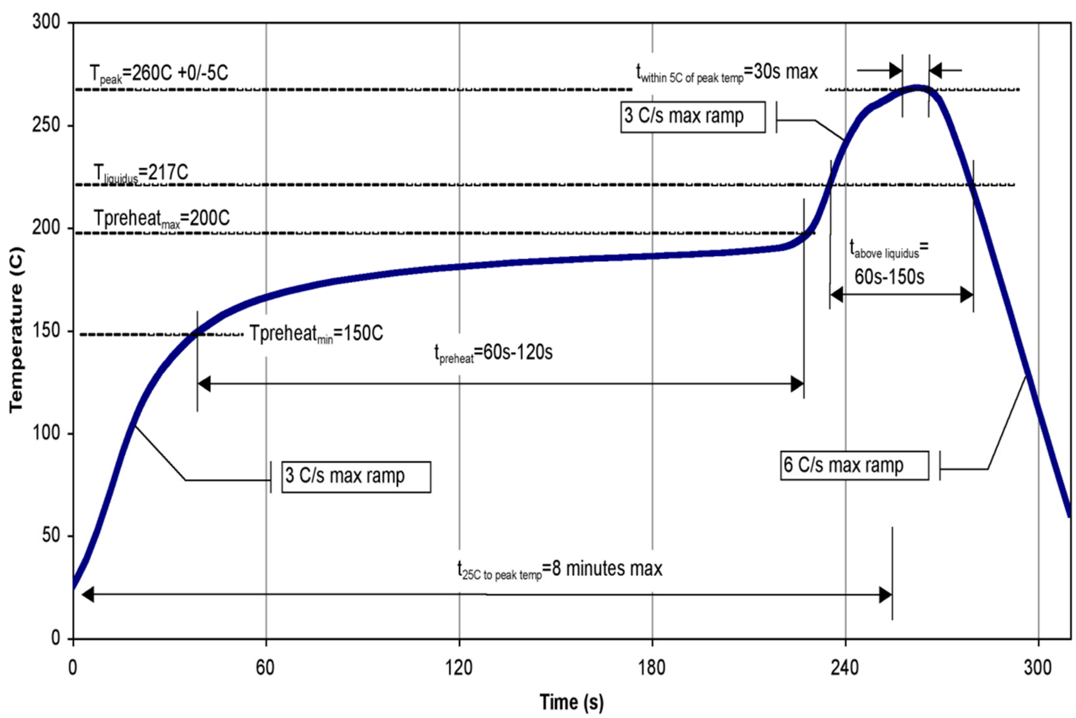
### RoHs Compliance

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 ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

## Recommended Soldering Temperature Profile



## Contact Information

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

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

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

## Important Notice

The information contained herein is believed to be reliable. Qorvo makes no warranties regarding the information contained herein. Qorvo assumes no responsibility or liability whatsoever for any of the information contained herein. Qorvo assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for Qorvo products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

Qorvo products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

**Данный компонент на территории Российской Федерации**

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

**Офис по работе с юридическими лицами:**

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9