# TGA2830-SM

## 2.7 to 3.5 GHz, 18 W GaN Power Amplifier

## Product Overview

Qorvo's TGA2830-SM is a packaged MMIC power amplifier which operates from 2.7 to 3.5 GHz. The TGA2830-SM is designed using Qorvo's TQGaN25 0.25-µm GaN on SiC process.

The TGA2830-SM typically provides more than 42.5 dBm of saturated output power, 54% power-added efficiency, and 30.5 dB small signal gain. It can operate under both pulse and CW conditions.

The TGA2830-SM is available in a low-cost, surface mount 24 lead 5 x 5 Overmold QFN. It is ideally suited to support both commercial and defense related radar applications.

Both RF ports have integrated DC blocking capacitors and are fully matched to 50 ohms.

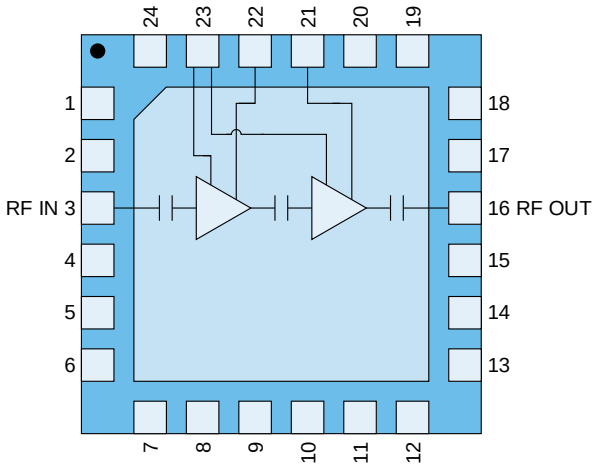
Lead-free and RoHS compliant


QFN 5x5 mm 24L

## Product Features

- Frequency Range: 2.7-3.5 GHz
- $P_{SAT}$: > 42.5 dBm ($P_{IN}$ = 18 dBm)
- PAE: > 54 % ($P_{IN}$ = 18 dBm)
- Small Signal Gain: > 30.5 dB
- Return Loss: > 11 dB
- Bias: $V_D$ = 20-32 V, $I_{DQ}$ = 225 mA
- Pulsed $V_D$: PW = 100 us, DC = 10 %
- Package Dimensions: 5.0 x 5.0 x 1.45 mm

## Functional Block Diagram




## Applications

- Commercial and Military Radar

## Ordering Information

| Part | Description |
|---|---|
| TGA2830-SM | 2.7-3.5 GHz, 18 W GaN Power Amplifier |
| TGA2830-SM_EVB | TGA2830-SM Evaluation Board |

## Absolute Maximum Ratings

| Parameter | Value/Range |
|---|---|
| Drain Voltage ($V_D$) | 40 V |
| Gate Voltage Range ($V_G$) | −8 to 0 V |
| Drain Current ($I_{D1}$) | 225 mA |
| Drain Current ($I_{D2}$) | 1250 mA |
| Gate Current ($I_G$) | See Graph (page 3) |
| Power Dissipation ($P_{DISS}$), 85 °C | 35 W |
| Input Power ($P_{IN}$), CW, 50 Ω, 85 °C | 30 dBm |
| Input Power ($P_{IN}$), CW, $V_{SWR}$ 10:1, $V_D$ = 28 V, 85 °C | 23 dBm |
| Mounting 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 | Value/Range |
|---|---|
| Drain Voltage ($V_D$) | 20–32 V |
| Drain Current ($I_{DQ}$) | 175–275 mA |
| Drain Current Under RF Drive ($I_{D\_DRIVE}$) | See plots p. 8 |
| Gate Voltage Range ($V_G$) | −2.9 to −2.0 V |
| Gate Current Under RF Drive ($I_{G\_DRIVE}$) | See plots p. 8 |
| Operating Temperature Range | −40 to +85 °C |

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

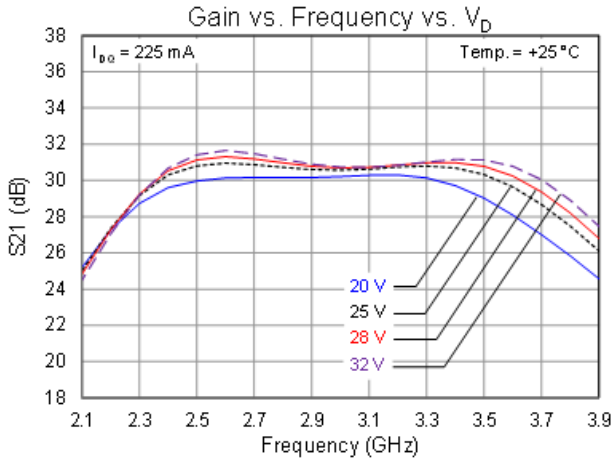
## Electrical Specifications

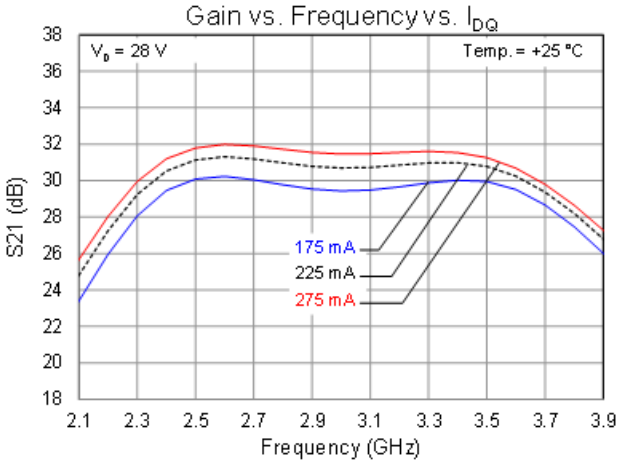
Test conditions unless otherwise noted: 25 °C, $V_D$ = 28 V, $I_{DQ}$ = 225 mA, Pulsed $V_D$: PW = 100 us, DC = 10 %

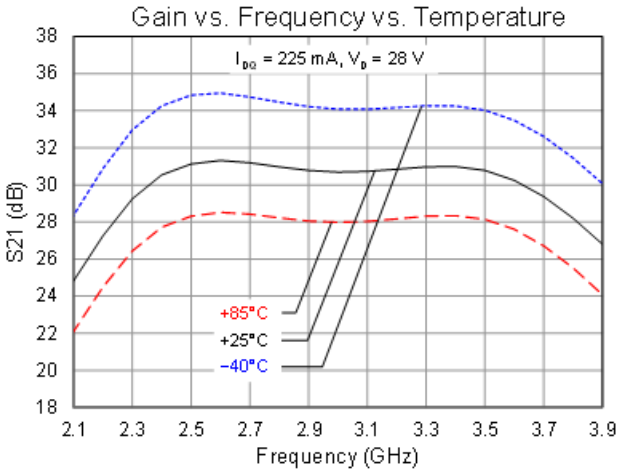
| Parameter | Min | Typical | Max | Units |
|---|---|---|---|---|
| Operational Frequency Range | 2.7 | | 3.5 | GHz |
| Small Signal Gain | | >30.5 | | dB |
| Input Return Loss | | >15 | | dB |
| Output Return Loss | | >11 | | dB |
| Output Power at Saturation ($P_{IN}$ = 18 dBm) | | >42.5 | | dBm |
| Power-Added Efficiency ($P_{IN}$ = 18 dBm) | | >54 | | % |
| Gate Leakage ($V_D$ = 10 V, $V_G$ = −3.7 V) | −7.83 | | −0.0001 | mA |
| Gain Temperature Coefficient | | −0.05 | | dB/°C |
| Power Temperature Coefficient | | −0.004 | | dBm/°C |

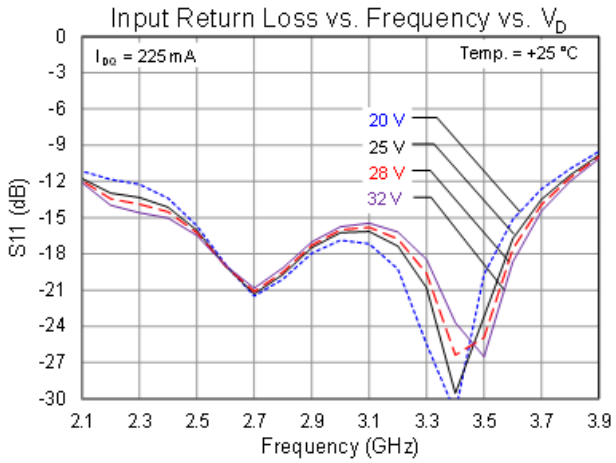
## Typical Performance (Small Signal)

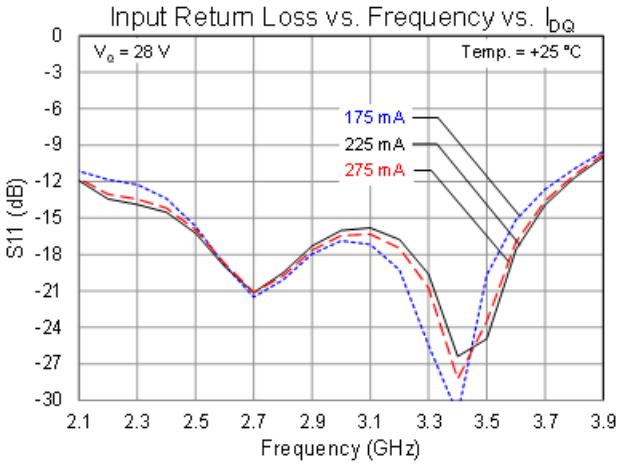
Condition: CW



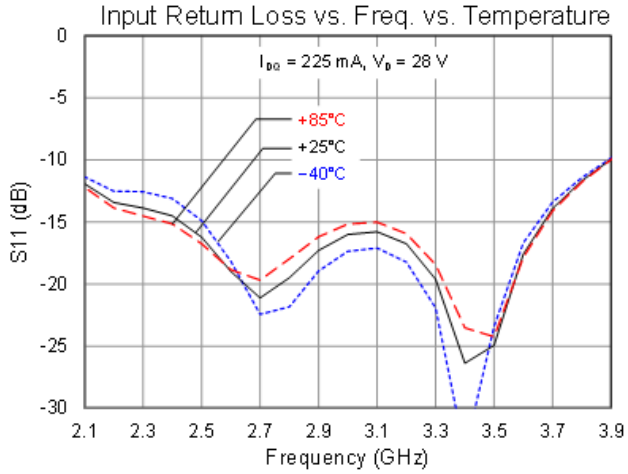



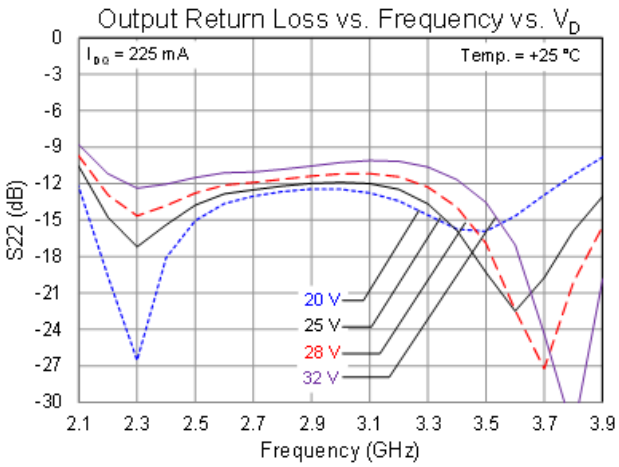



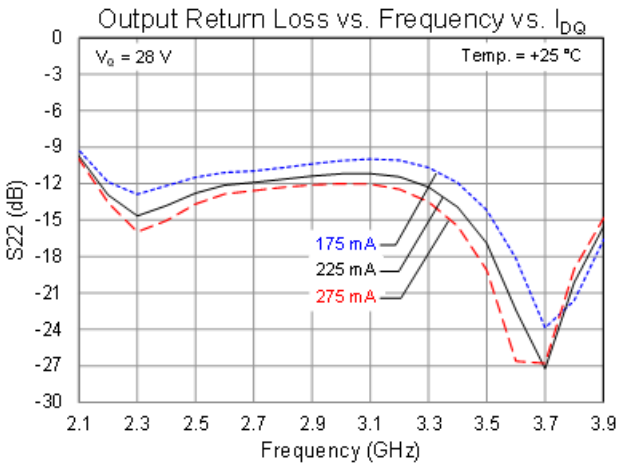



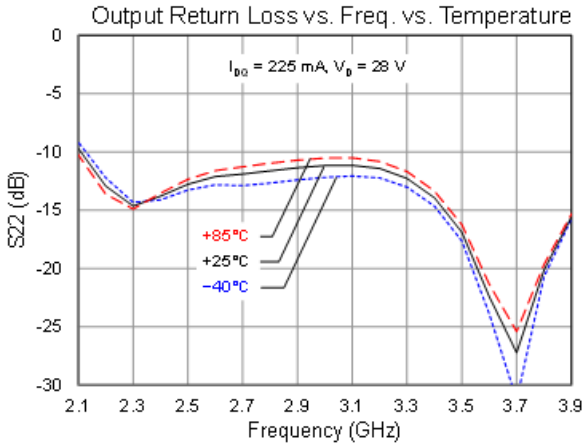
## Typical Performance: Small Signal

Condition: CW



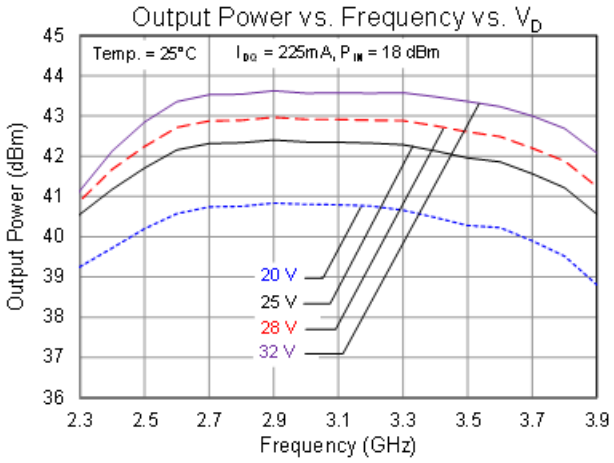



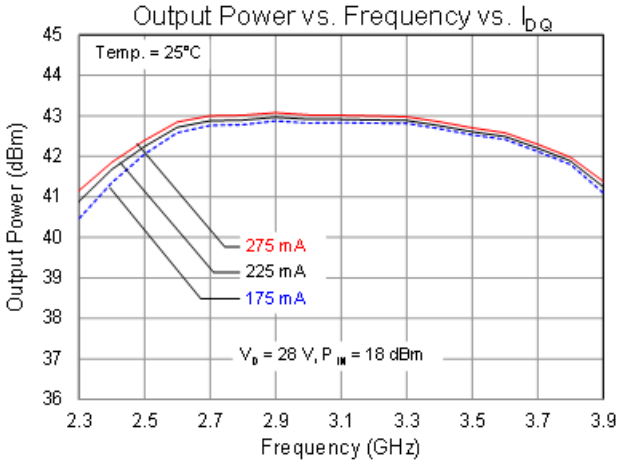



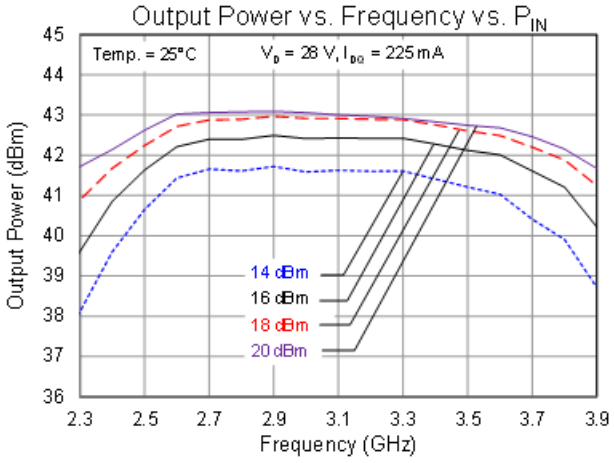



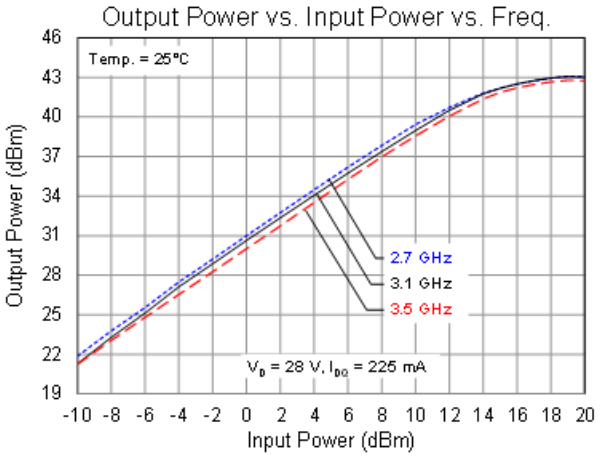
## Typical Performance: Large Signal

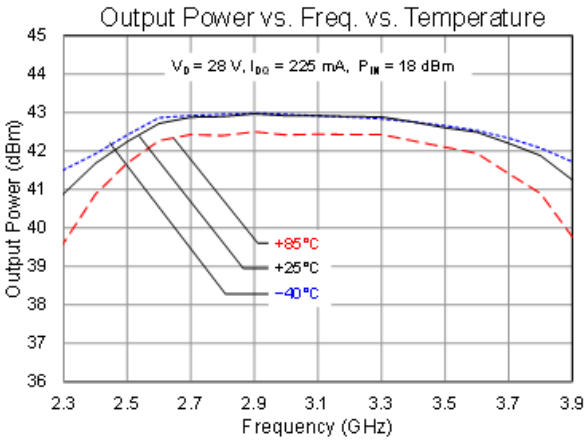
Condition: Pulsed $V_D$, Pulse Width = 100 us, Duty Cycle = 10%

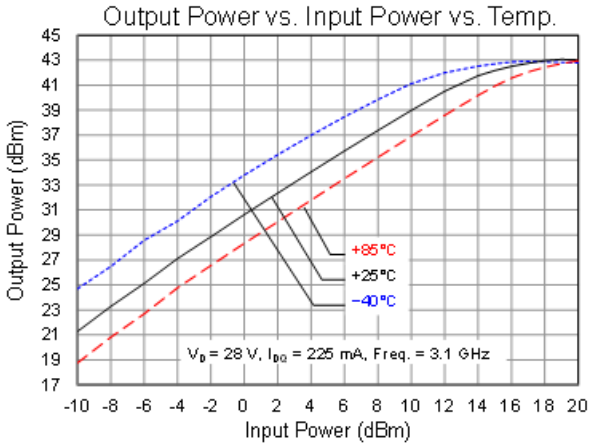


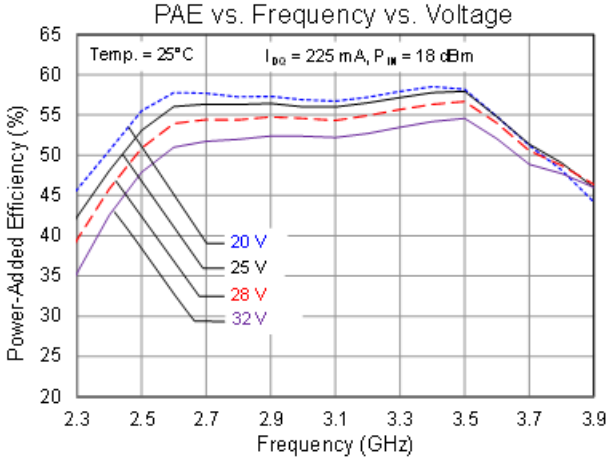



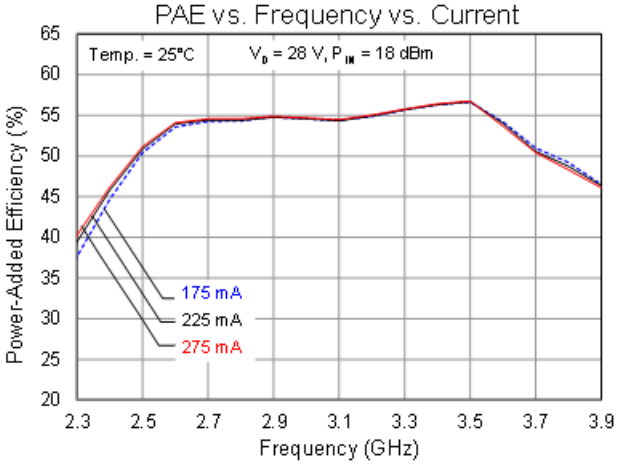
## Typical Performance: Large Signal

Condition: Pulsed $V_D$, Pulse Width = 100 us, Duty Cycle = 10%

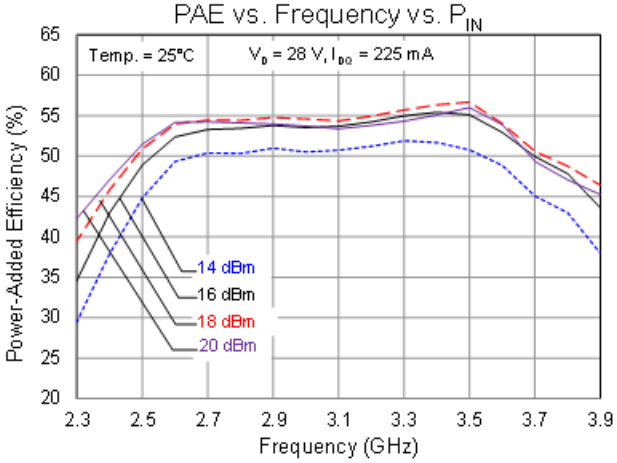
PAE vs. Frequency vs. Voltage



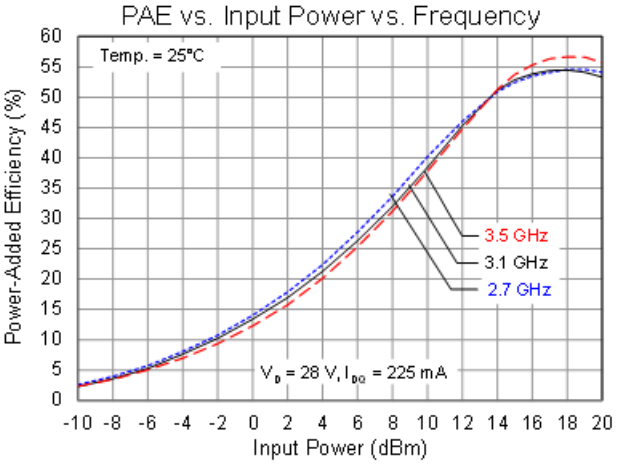

PAE vs. Frequency vs. Current



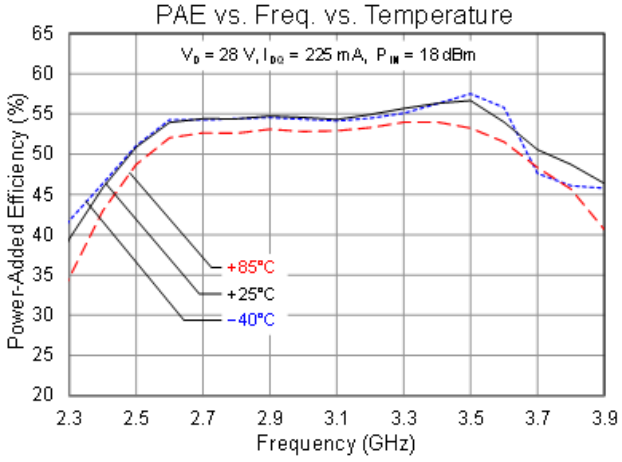

PAE vs. Frequency vs. $P_{IN}$



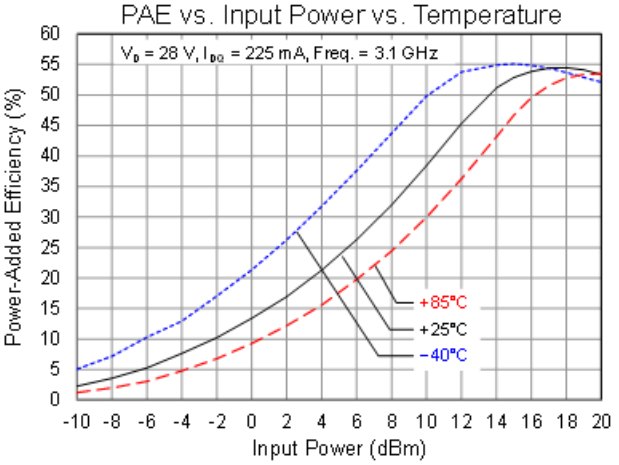

PAE vs. Input Power vs. Frequency




PAE vs. Freq. vs. Temperature

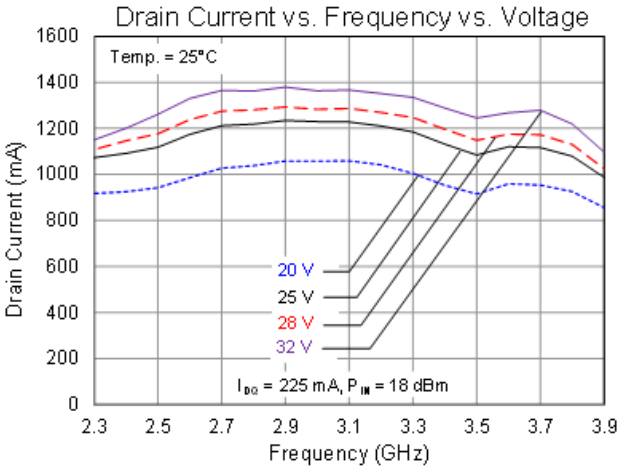


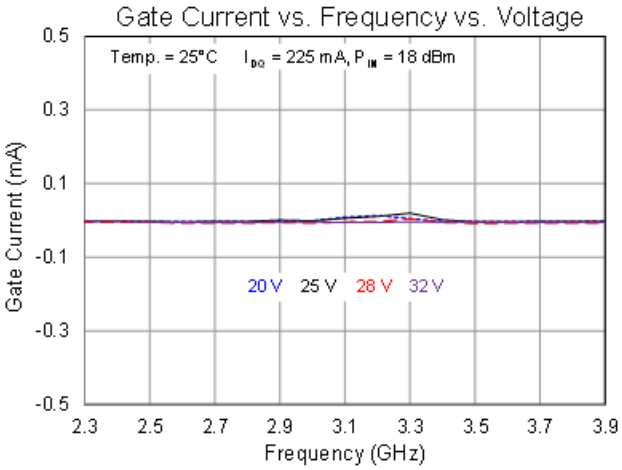

PAE vs. Input Power vs. Temperature

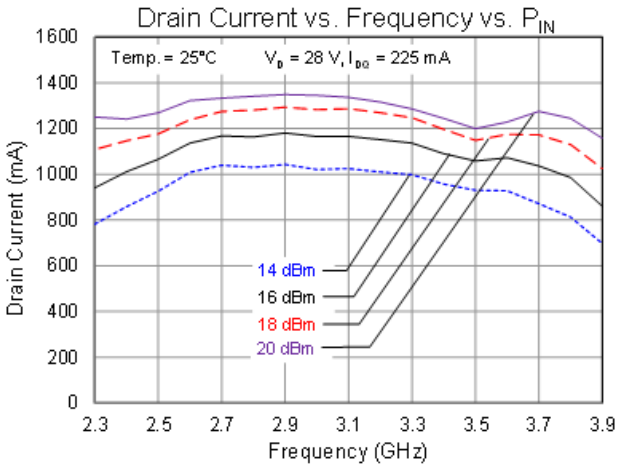


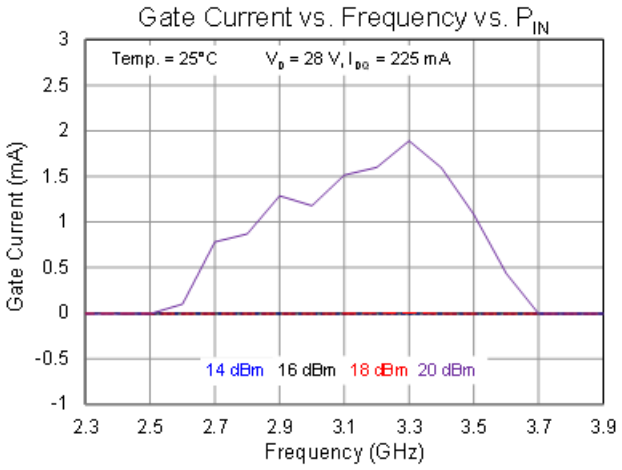
## Typical Performance: Large Signal

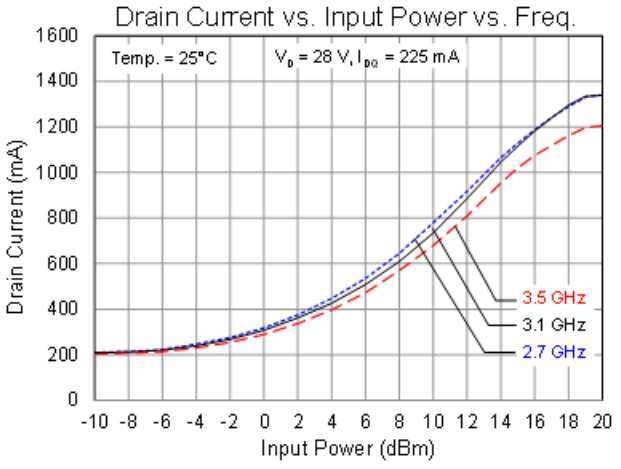
Condition: Pulsed $V_D$, Pulse Width = 100 us, Duty Cycle = 10%

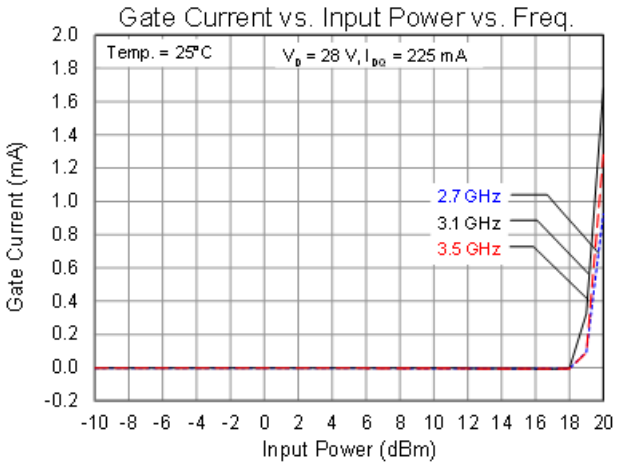


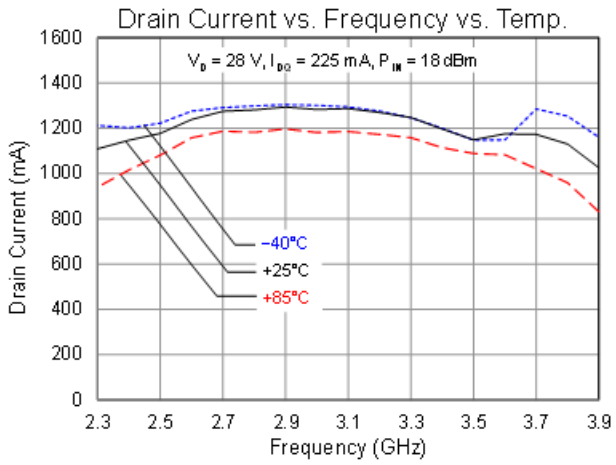



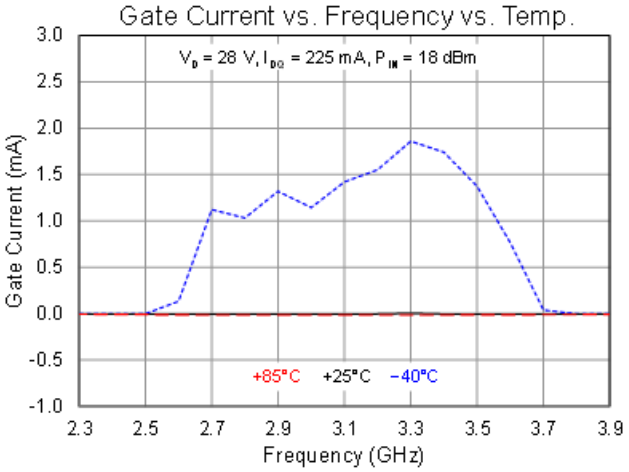



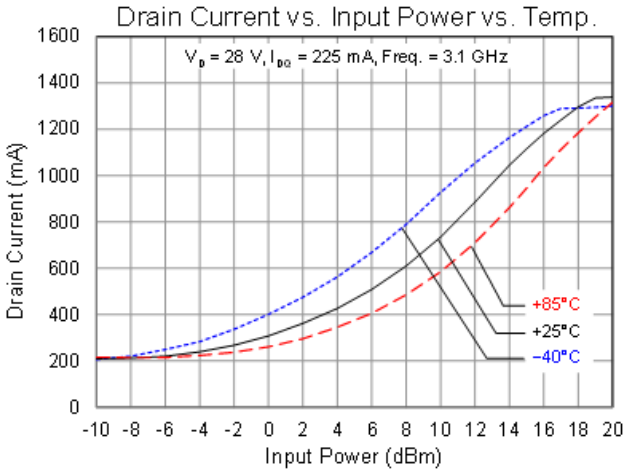



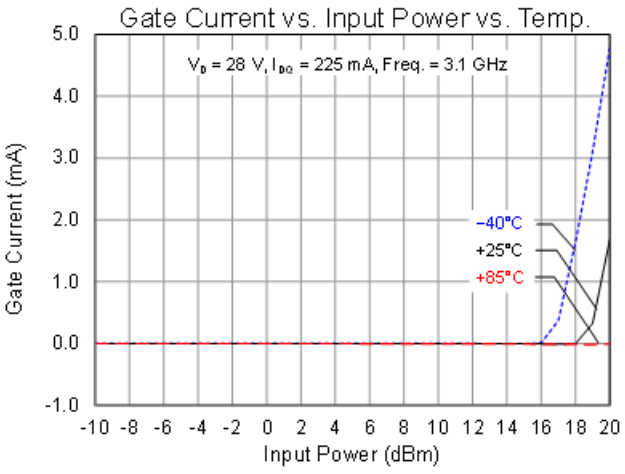
## Typical Performance: Large Signal

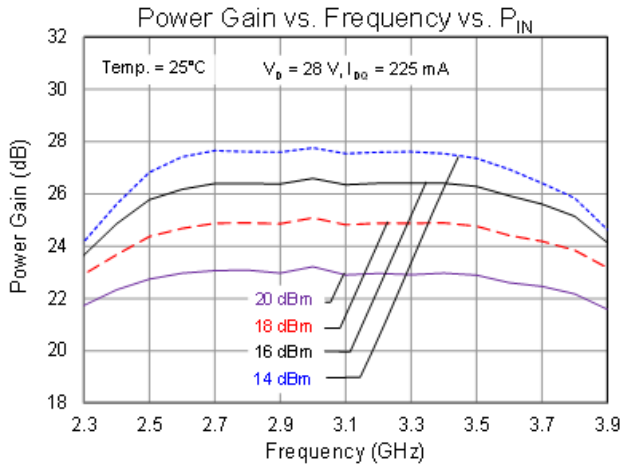
Condition: Pulsed $V_D$, Pulse Width = 100 us, Duty Cycle = 10%

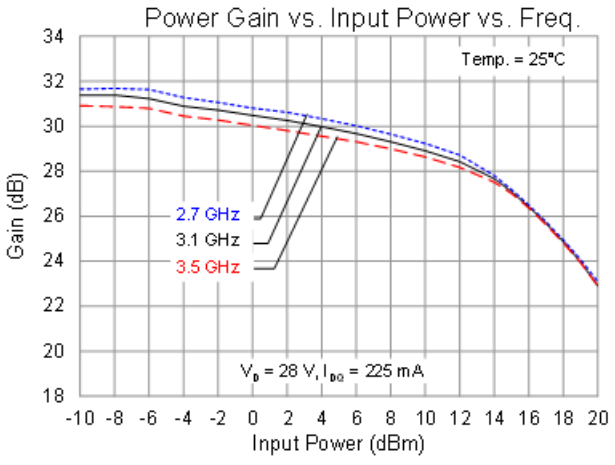


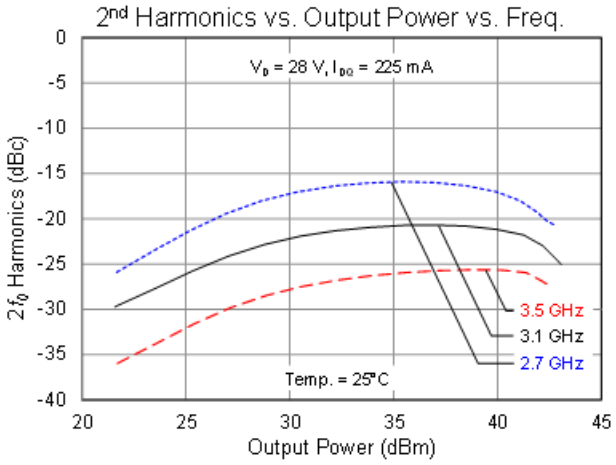



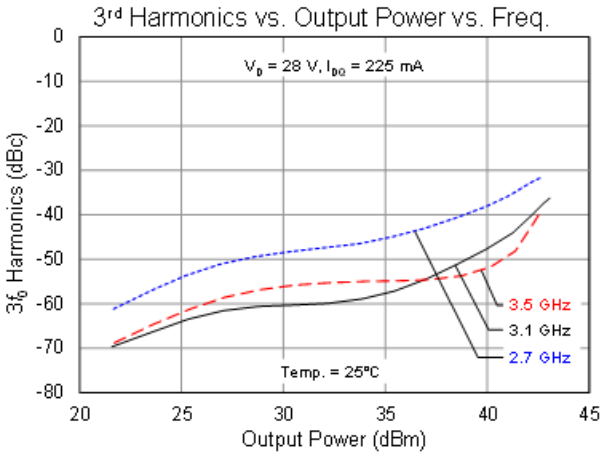



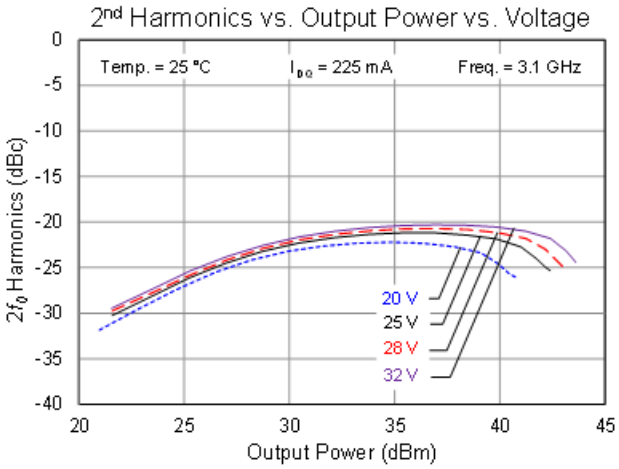



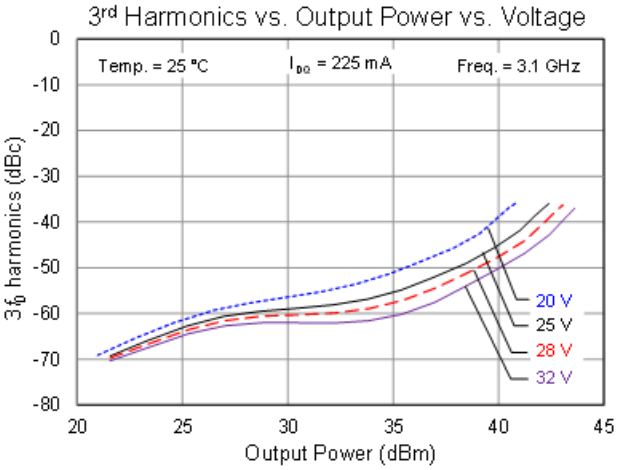
## Typical Performance: Large Signal and Linearity

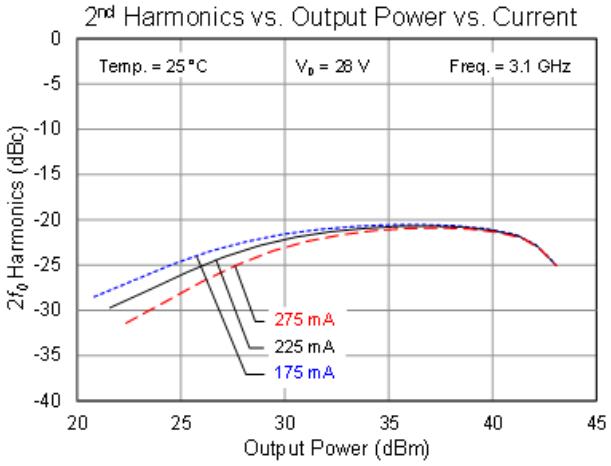
Condition: CW

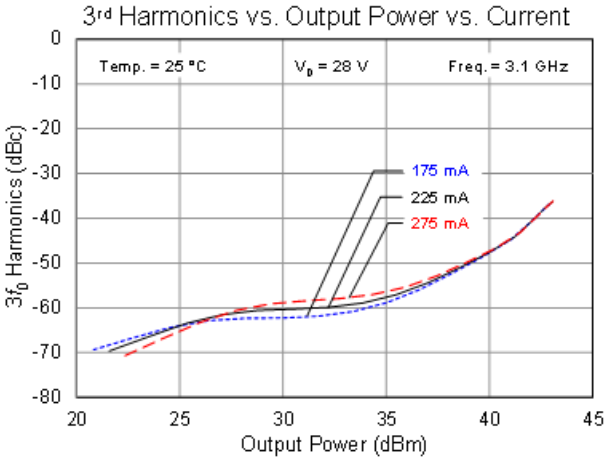


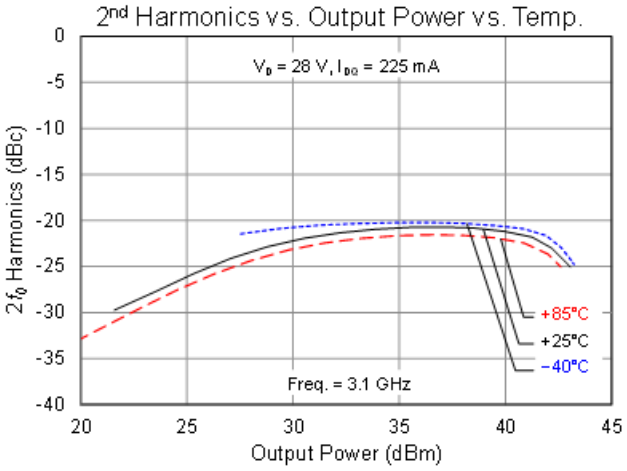



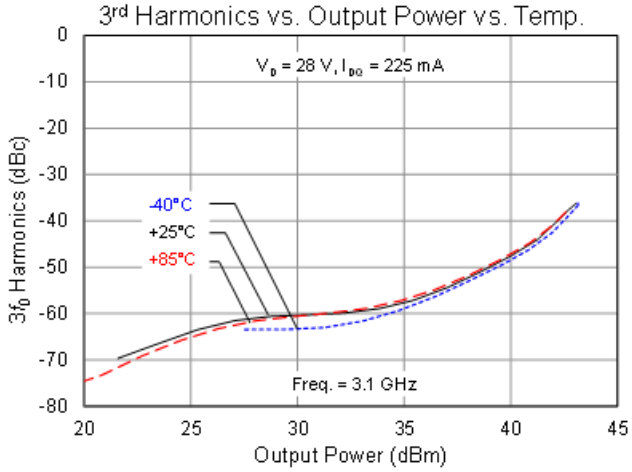



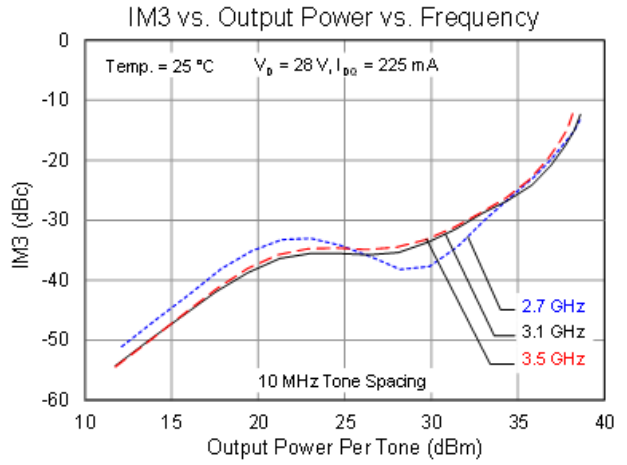



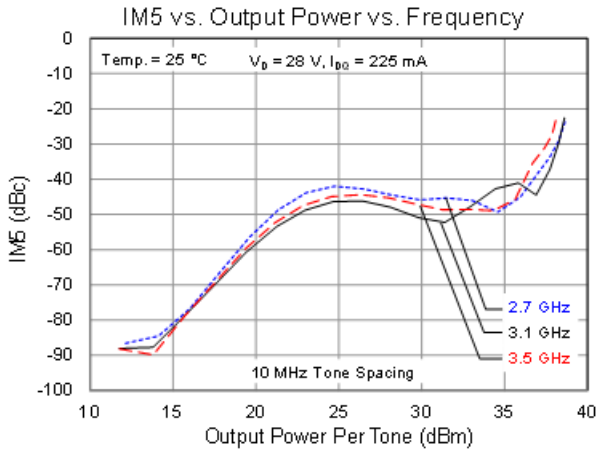
## Typical Performance: Large Signal & Linearity

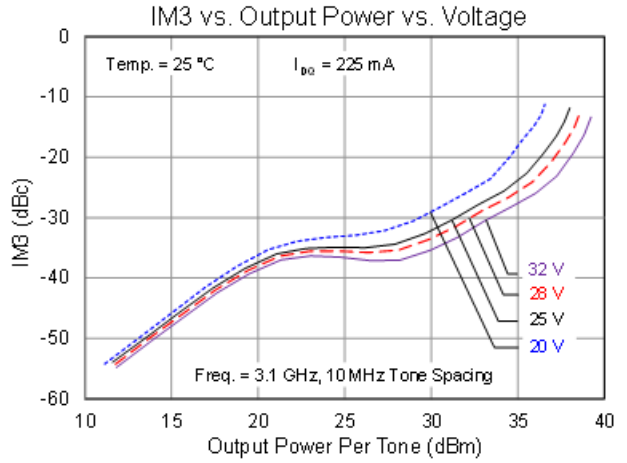
Condition: CW

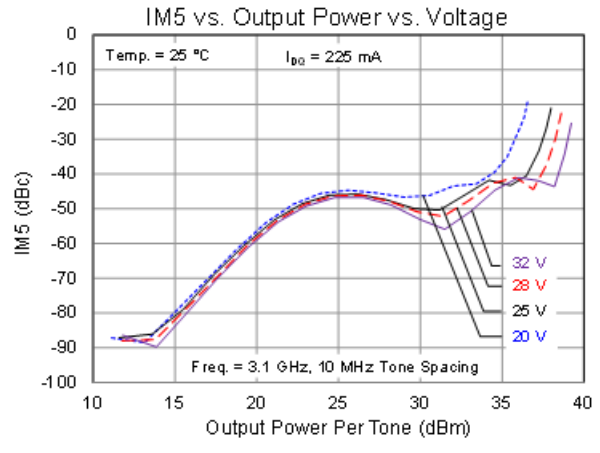


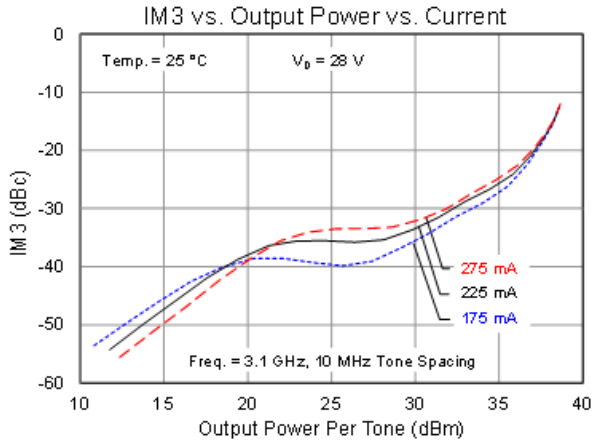



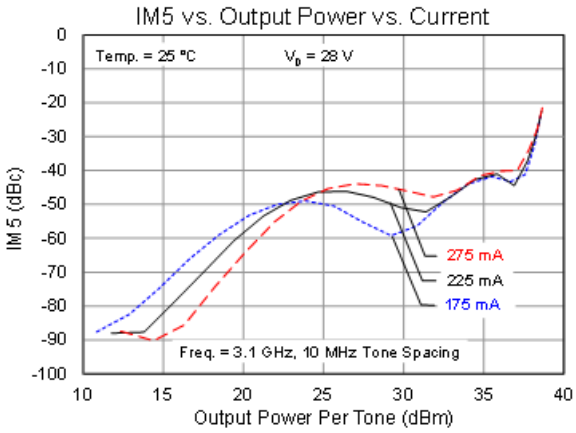



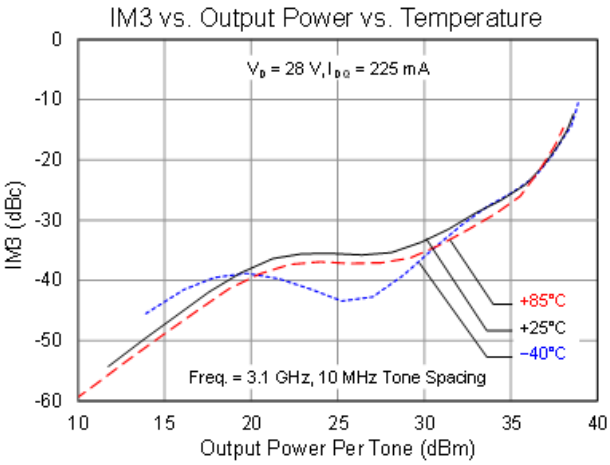



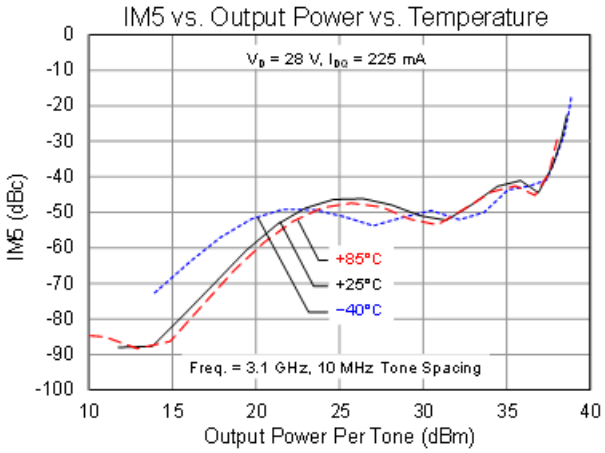
## Typical Performance: Large Signal & Linearity

Condition: CW



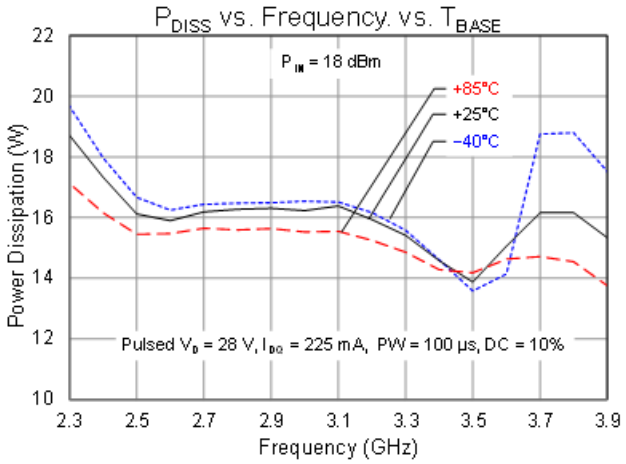



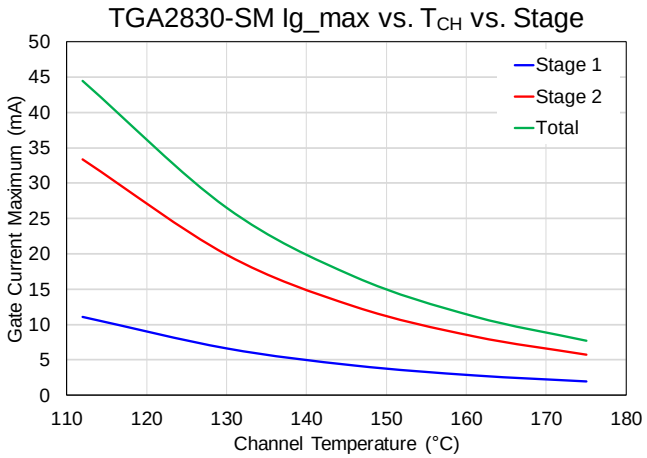
## Thermal and Reliability Information

| Parameter | Test Conditions | Value | Units |
|---|---|---|---|
| Thermal Resistance ($\theta_{JC}$)(1) | $T_{BASE}$ = 85 °C, $V_D$ = 28 V, $I_{DQ}$ = 225 mA (Quiescent DC, CW), $P_{DISS}$ = 6.3 W | 2.129 | °C/W |
| Channel Temperature ($T_{CH}$)(2) | | 98.4 | °C |
| Thermal Resistance ($\theta_{JC}$)(1) | $T_{BASE}$ = 85 °C, $V_D$ = 28 V, $I_{D\_Drive}$ = 1185 mA (PW = 100 µs, DC = 10%), Freq. = 3.1 GHz: $P_{IN}$ = 18 dBm, $P_{OUT}$ = 42.5 dBm, $P_{DISS}$ = 15 W | 1.825 | °C/W |
| Channel Temperature ($T_{CH}$) (Under RF drive)(2) | | 112.4 | °C |

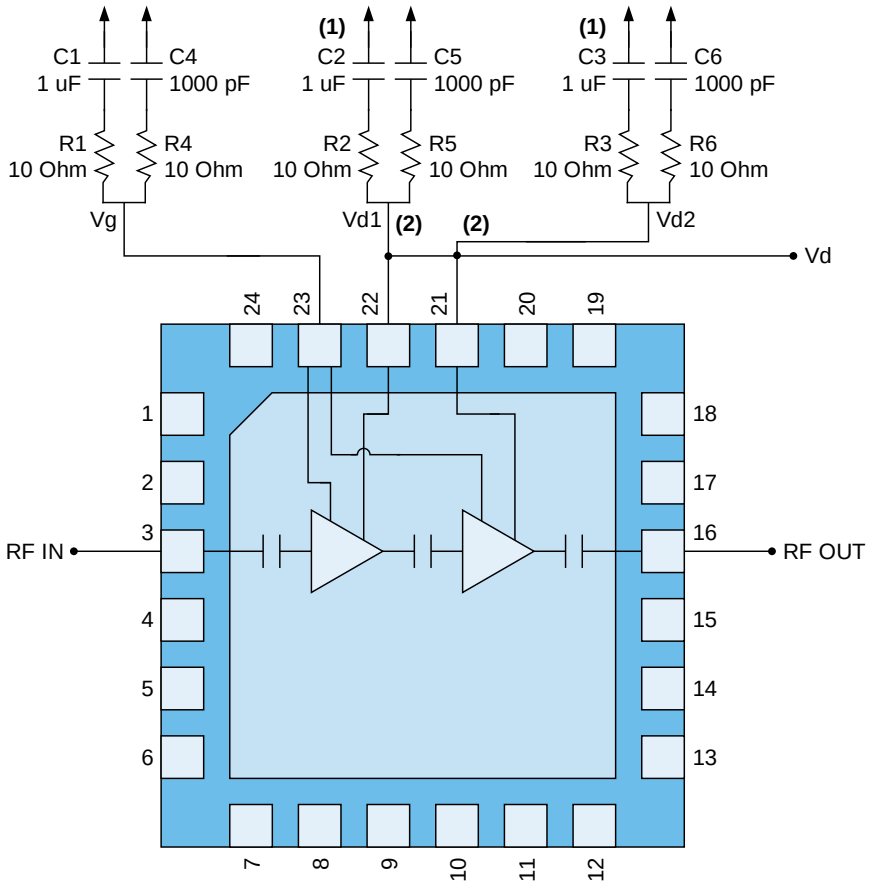
Notes:
1. Thermal resistance measured to back of package.
2. IR Scan equivalent temperatures. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

## Power Dissipation and Max. Gate Current



## Application Information

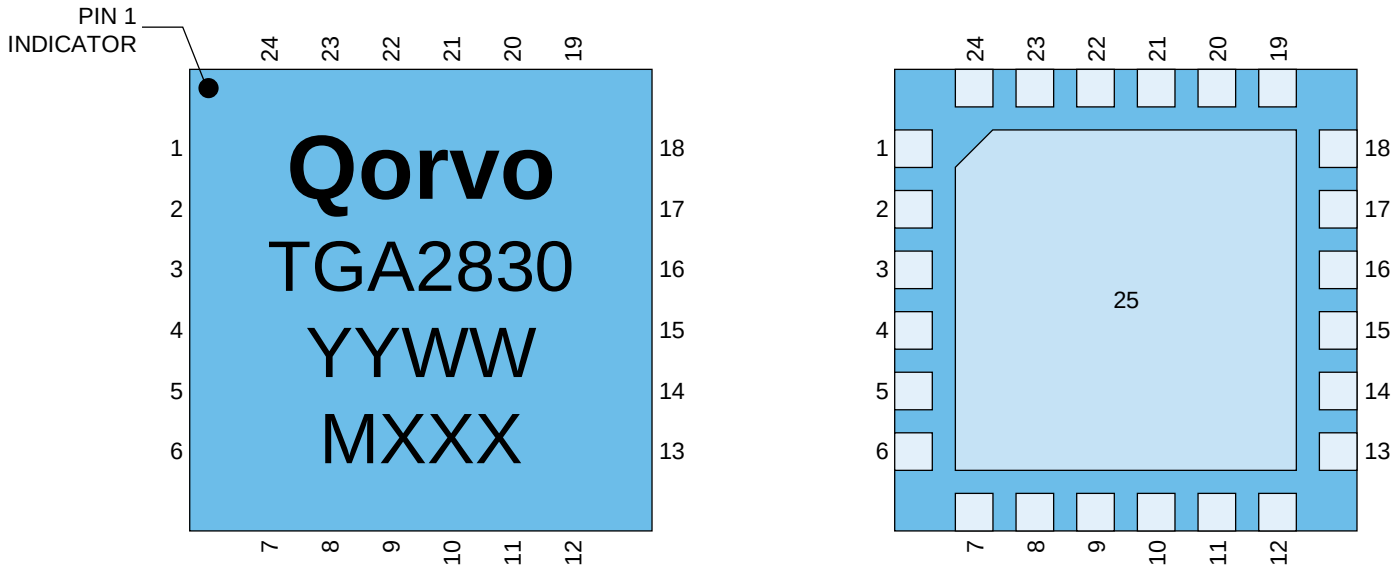



Notes:
1. Remove 1 uF capacitors if pulsing on drain
2. $V_D$: Tied $V_{D1}$ & $V_{D2}$ together

| Bias-up Procedure |
|---|
| Set $I_D$ limit to 1.4 A, $I_G$ limit to 8 mA |
| Apply −5 V to $V_G$ |
| Apply +28 V to $V_D$; ensure $I_{DQ}$ is approx. 0 mA |
| Adjust $V_G$ until $I_{DQ}$ = 225 mA |
| Turn on RF supply |

| Bias-down Procedure |
|---|
| Turn off RF supply |
| Reduce $V_G$ to −5 V; ensure $I_{DQ}$ is approx. 0 mA |
| Set $V_D$ to 0 V |
| Turn off $V_D$ supply |
| Turn off $V_G$ supply |

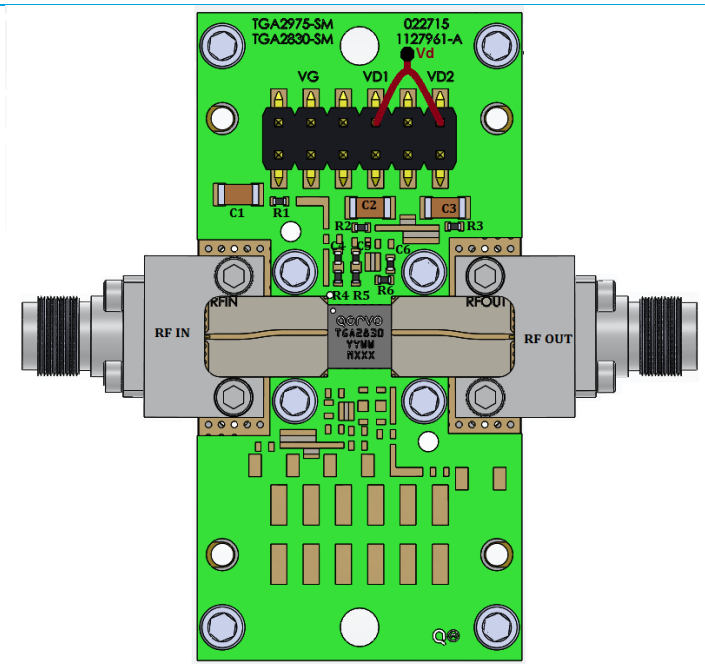
## Pin Layout




## Pin Description

| Pin No. | Symbol | Description |
|---|---|---|
| 1, 2, 4–15, 17–20, 24 | NC | No internal connection; can be grounded on PCB or left open |
| 3 | RF IN | Input; matched to 50 Ω; DC blocked |
| 16 | RF OUT | Output; matched to 50 Ω; DC blocked |
| 21 | DRAIN 2 | Drain voltage; bias network is required; see recommended Application Information on page 13 |
| 22 | DRAIN 1 | Drain voltage; bias network is required; see recommended Application Information on page 13 |
| 23 | GATE | Gate voltage; bias network is required; see recommended Application Information on page 13 |
| 25 | GND | Ground Paddle. Multiple vias should be employed to minimize inductance and thermal resistance. |

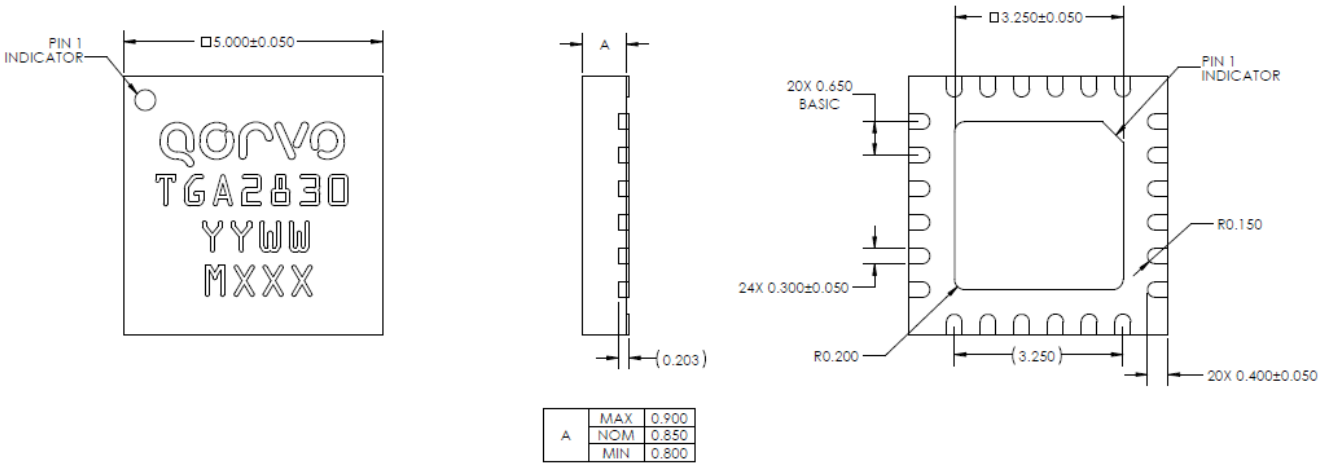
## Evaluation Board




## Bill of Materials

| Reference Des. | Value | Description | Manuf. | Part Number |
|---|---|---|---|---|
| C1–C3 | 1 µF | Cap, 1206, 50 V, 5%, X7R | Various | |
| C4 –C6 | 1000 pF | Cap, 0402, 100 V, 10%, X7R | Various | |
| R1–R6 | 10 Ω | Res, 0402, 5% | Various | |

## Mechanical Drawing




| | | |
|---|---|---|
| A | MAX | 0.900 |
| | NOM | 0.850 |
| | MIN | 0.800 |

Units: millimeter (mm)
Tolerances: unless specified
x.xx = ± 0.01
x.xxx = ± 0.005
Materials:
Package Leads are Gold Plated.
Part is Mold Encapsulated.
Marking:
2830: Part number
YY: Part Assembly year
WW: Part Assembly week
MXXX: Batch ID

## Recommended Soldering Temperature Profile