

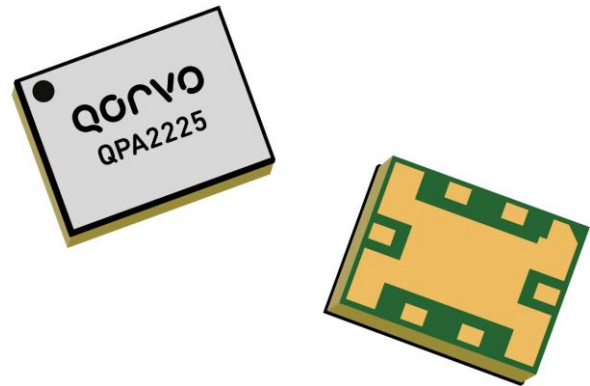
### Product Overview

Qorvo’s QPA2225 is a wide band driver amplifier fabricated on Qorvo’s production 0.15  $\mu\text{m}$  GaN on SiC process (QGaN15). Covering 28–38 GHz, the QPA2225 provides > 0.4 W of saturated output power with >22 dB of small-signal gain.

The QPA2225 dimensions are 4 x 3 x 2 mm. It can support a variety of operating conditions to best support system requirements. With good thermal properties, it can support a range of bias voltages.

The QPA2225 has DC blocking capacitors on both RF ports, which are matched to 50 ohms.

The QPA2225 is ideal for supporting communications and radar applications in both commercial and military markets.



### Key Features

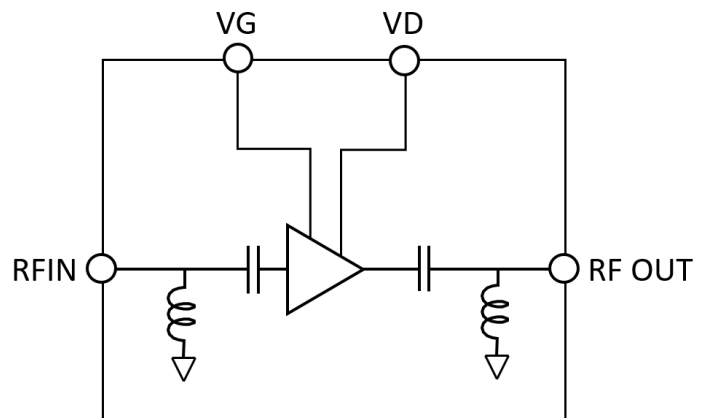
- Frequency Range: 28 – 40 GHz
- Power ( $P_{in} = 14 \text{ dBm}$ ): 26 dBm
- Large Signal Gain ( $P_{in} = 14 \text{ dBm}$ ): 12 dB
- Small Signal Gain: 22 dB
- IM3 ( $P_{out} / \text{Tone} = 20 \text{ dBm}$ ): - 20 dBc
- Bias:  $V_D = +20 \text{ V}$ ,  $I_{DQ} = 64 \text{ mA}$ ,  $V_G = - 2.5 \text{ V typ.}$
- Package Dimensions: 4 x 3 x 2 mm

*Performance is typical across frequency. Refer to electrical specification table and data plots for more details.*

### Applications

- Wide Band Communications
- Radar
- Satellite Communications
- Electronic Warfare

### Functional Block Diagram



### Ordering Information

Part No.	Description
QPA2225	QPA2225 Waffle Pack, Qty 50
QPA2225TR7	Tape & Reel, 7" reel, Qty 250
QPA2225EVB	Evaluation Board, Qty 1

## Absolute Maximum Ratings

Parameter	Min Value	Max Value	Units
Drain Voltage (VD)	-	29.5	V
Gate Voltage Range (VG)	-5	0	V
Drain Current (ID)	-	516	mA
Gate Current (IG)	-	24	mA
Input Power (Pin), CW, 85 °C	-	18	dBm
Input Power (Pin), CW, 3:1 VSWR, 85 °C	-	18	dBm
Mounting Temperature	-	260	°C
Storage Temperature	-55	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. Extended application of Absolute Maximum Rating conditions may reduce device reliability.

## Recommended Operating Conditions

Parameter	Min	Typ.	Max	Units
Drain Voltage (VD)		20	22	V
Drain Current, (IDQ)		64		mA
Gate Voltage (VG, typical, can be adjusted)		-2.5		V
Ambient Temperature Range	-40		+85	°C

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

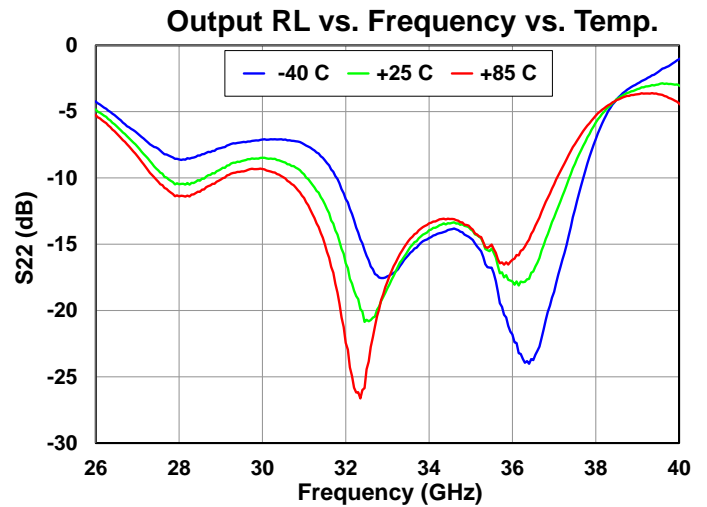
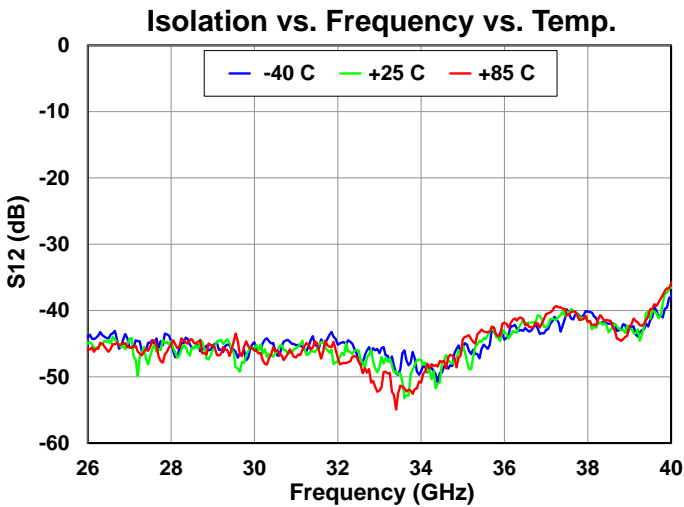
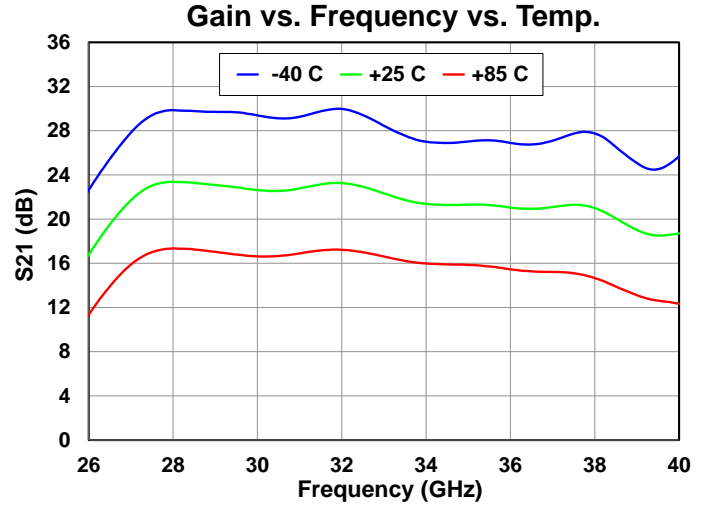
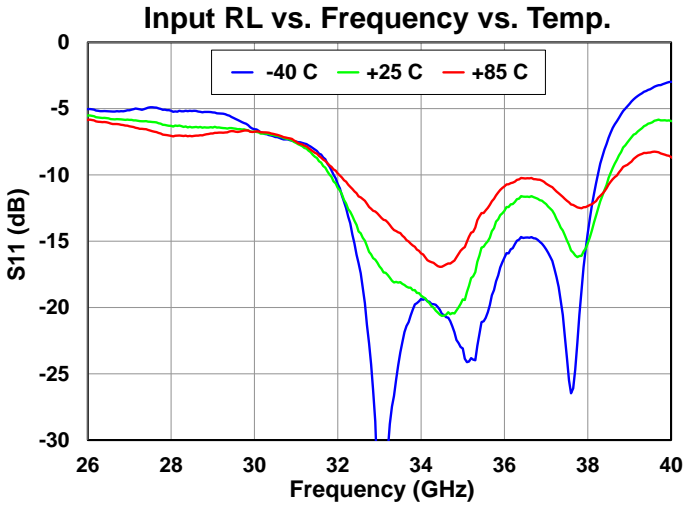
## Electrical Specifications

Parameter	Conditions <sup>(1)</sup>	Min	Typ.	Max	Units
Operational Frequency Range		28		38	GHz
Small Signal Gain			22		dB
Input Return Loss			8		dB
Output Return Loss			8		dB
Output Power at Saturation	P <sub>IN</sub> = 14 dBm, CW		26		dBm
Large Signal Gain	P <sub>IN</sub> = 14 dBm, CW		12		dB
Power Added Efficiency	P <sub>IN</sub> = 14 dBm, CW		10		%
3 <sup>RD</sup> Intermodulation Products	P <sub>OUT</sub> /Tone = 20 dBm; Δf = 100 MHz		-20		dBc
Gate Leakage	VD = 10V, VG = - 4.0 V	-0.7			mA
Gain Temperature Coefficient			-0.08		dB/°C

1. Nominal bias, data de-embedded of fixture losses.

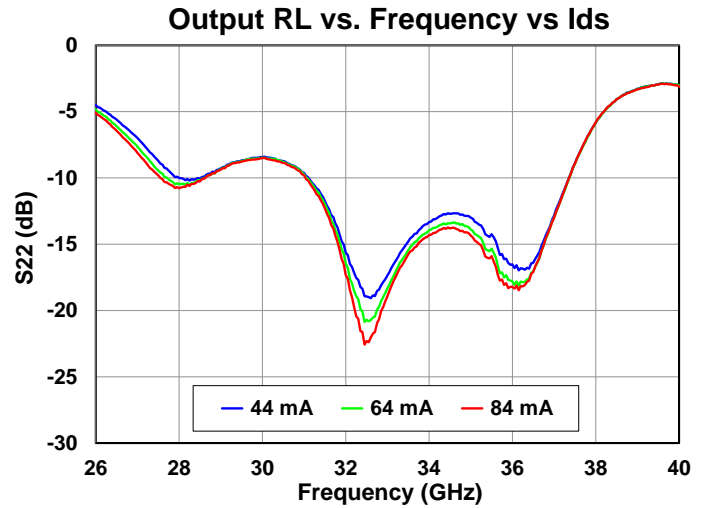
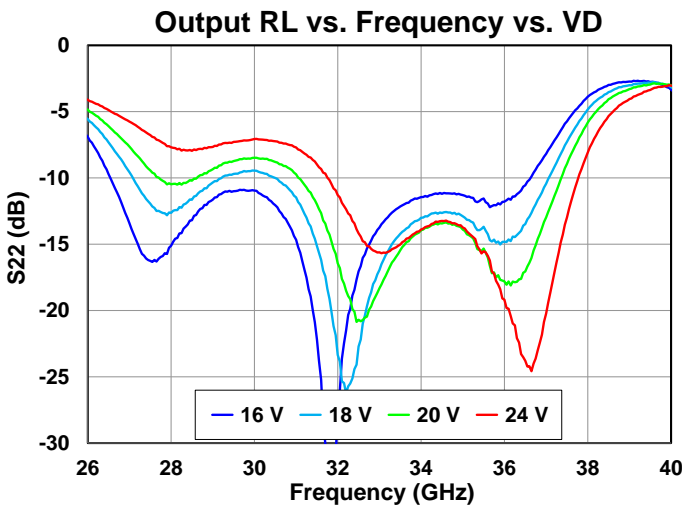
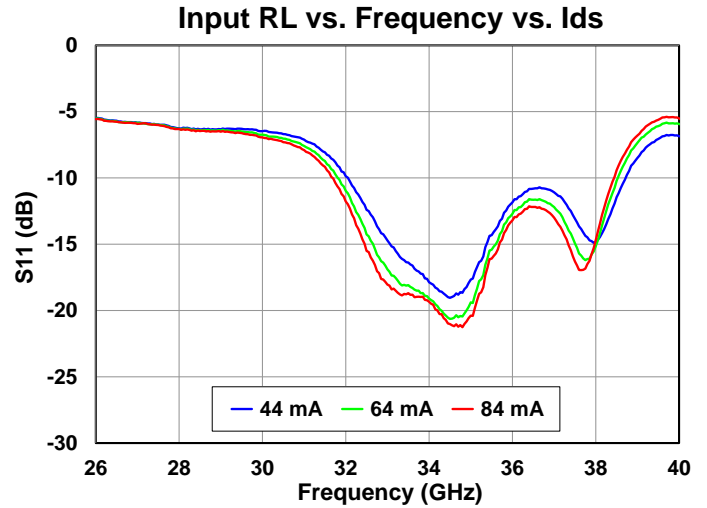
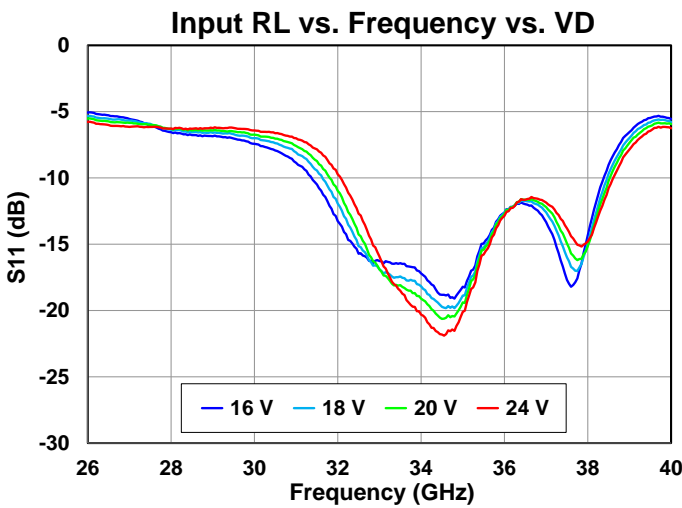
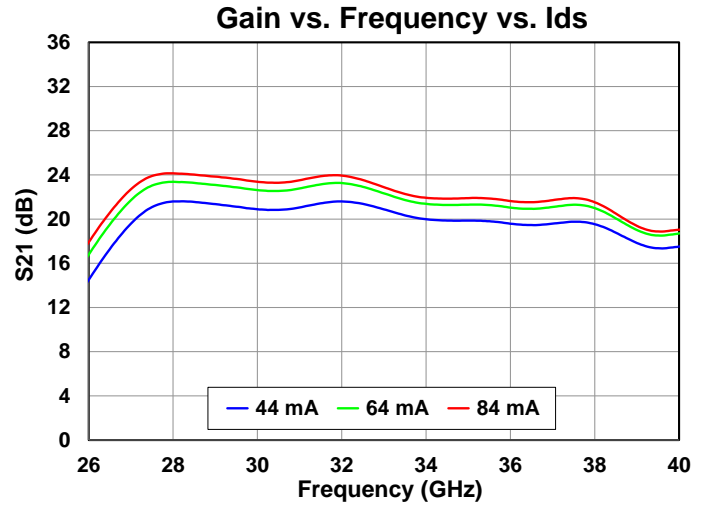
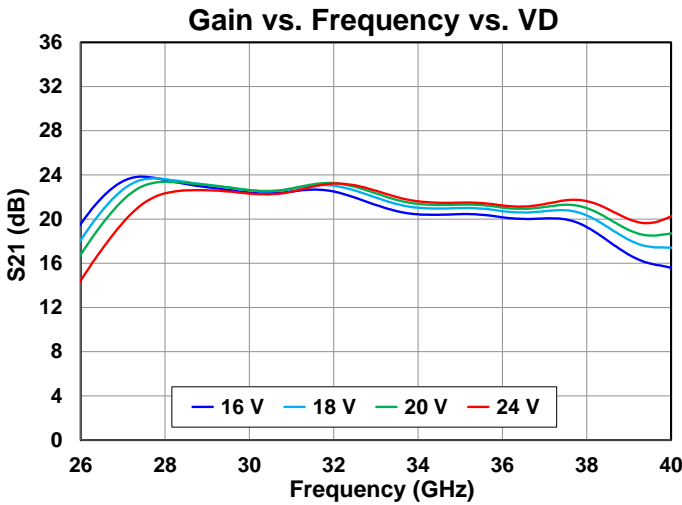
**Performance Plots – Small Signal**

Test conditions unless otherwise noted: VD = 20 V, IDQ = 64 mA, +25 °C



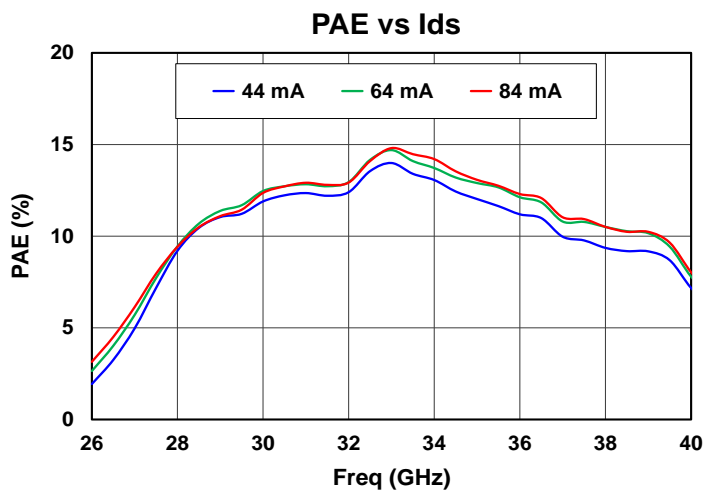
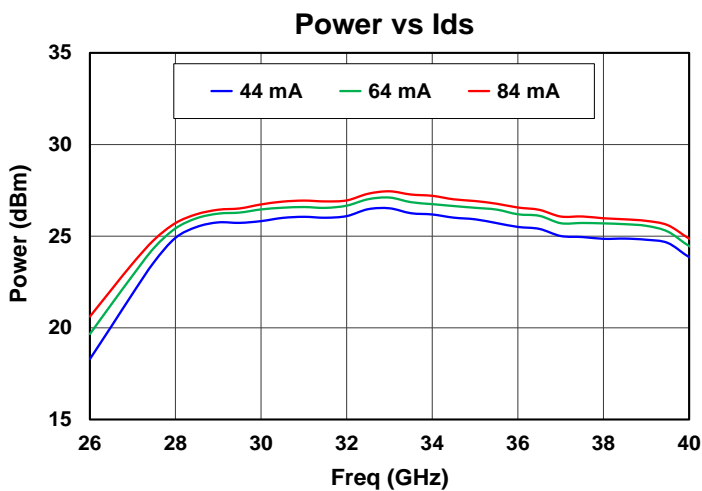
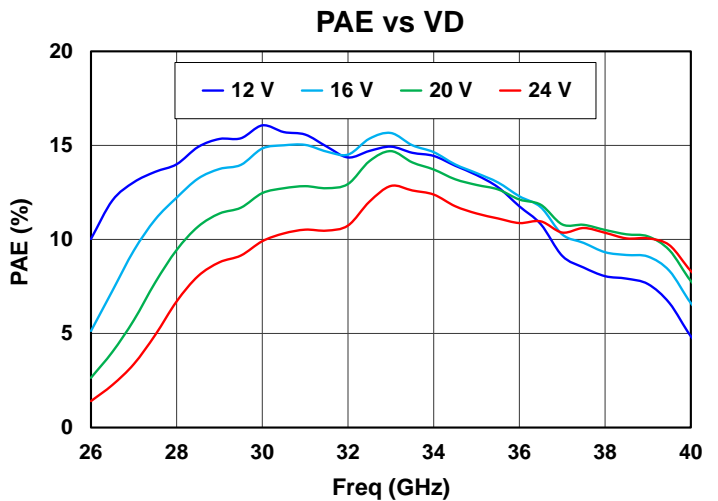
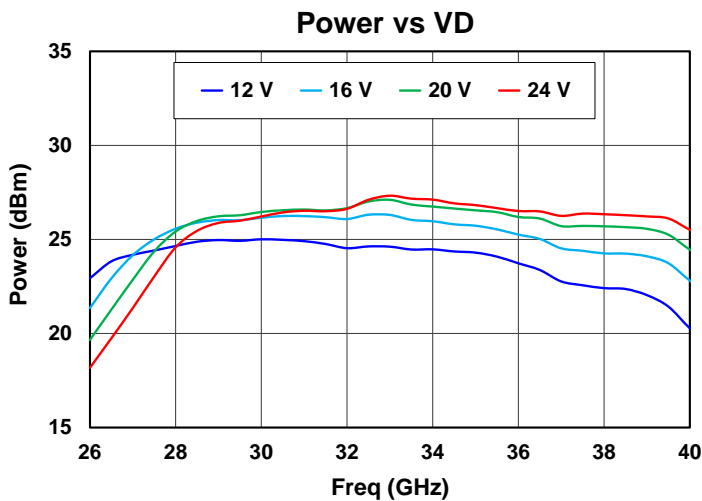
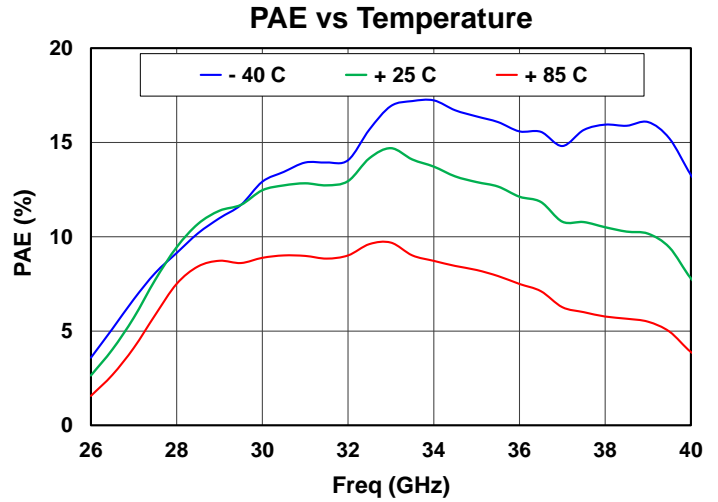
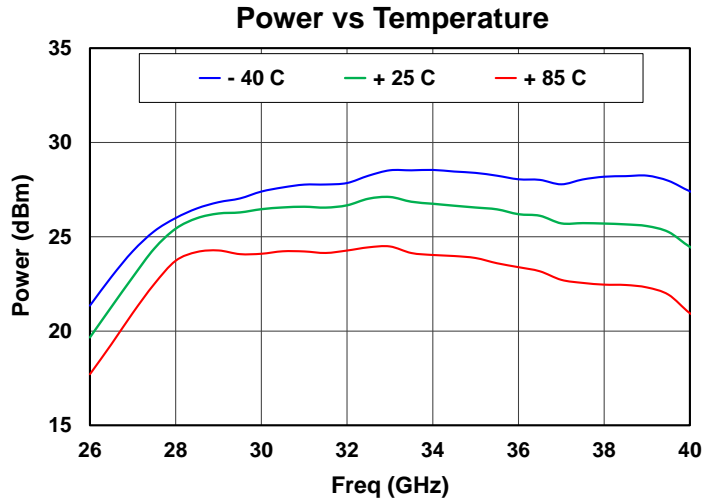
**Performance Plots – Small Signal**

Test conditions unless otherwise noted:  $V_D = 20\text{ V}$ ,  $I_{DQ} = 64\text{ mA}$ ,  $+25\text{ }^\circ\text{C}$



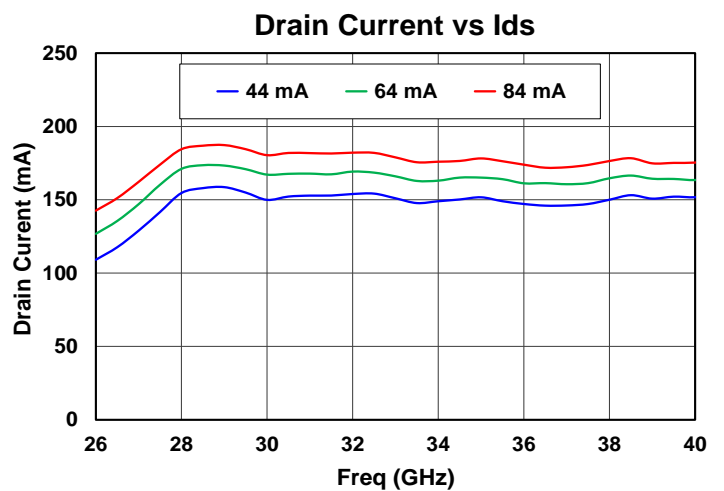
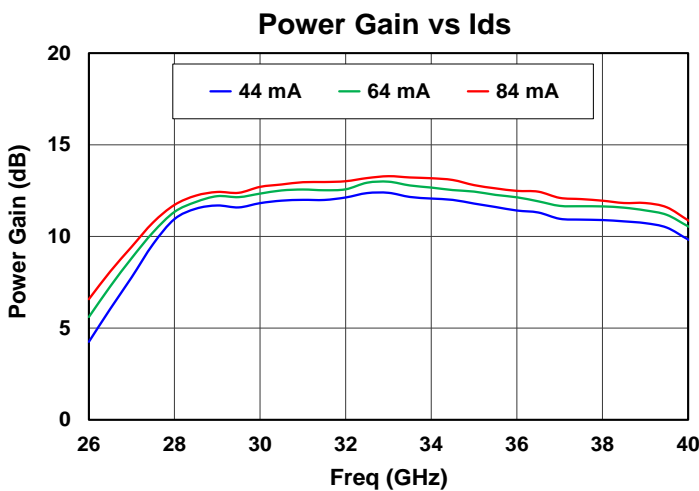
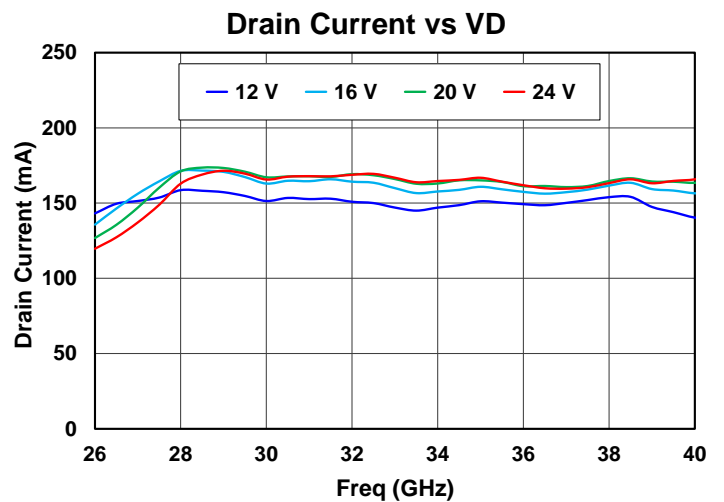
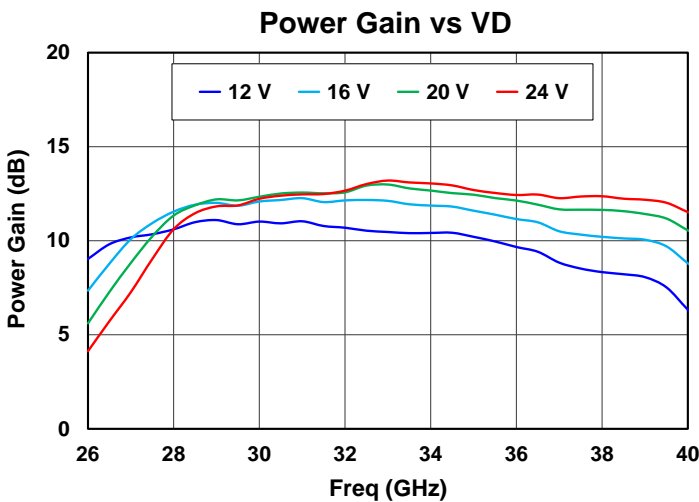
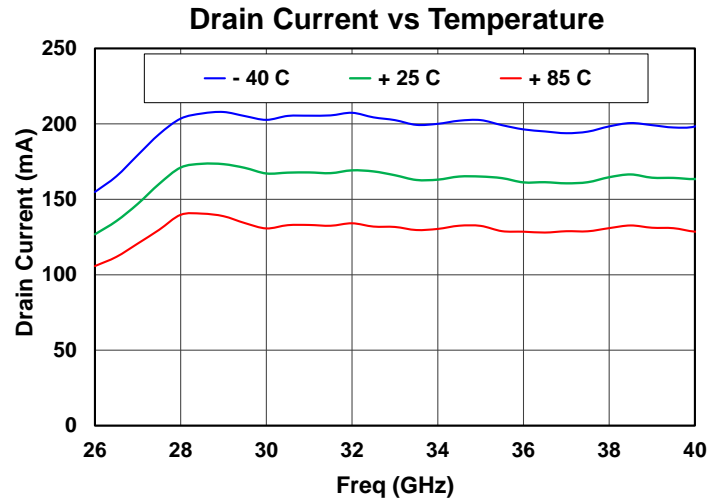
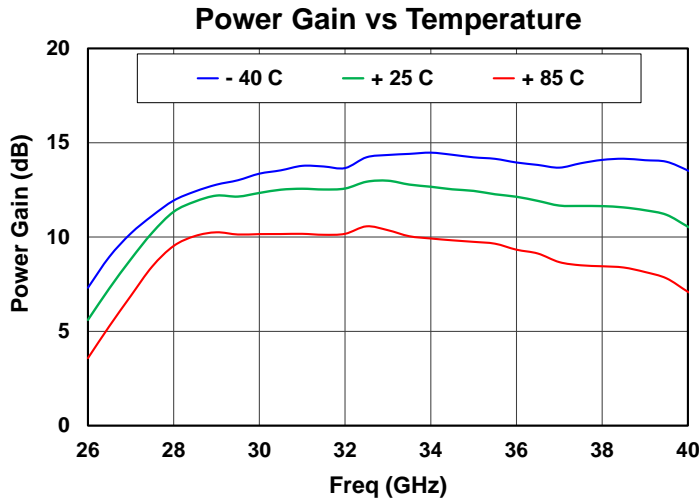
Performance Plots – Large Signal (CW)

Test conditions unless otherwise noted: VD = 20 V, IDQ = 64 mA, Pin = +14dBm, +25 °C



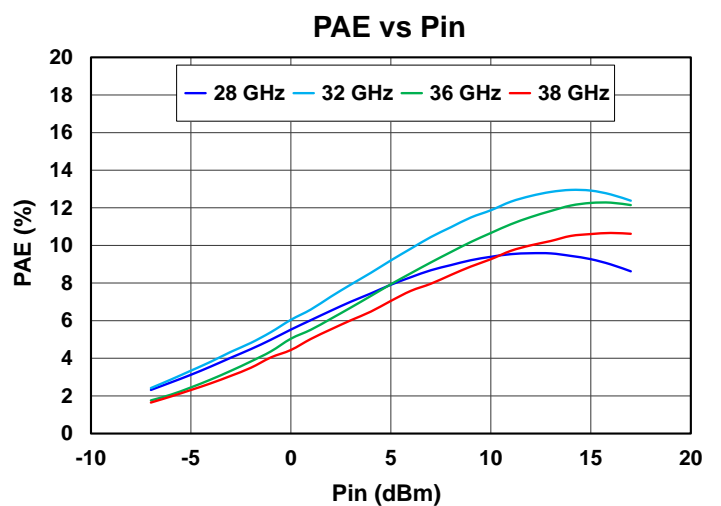
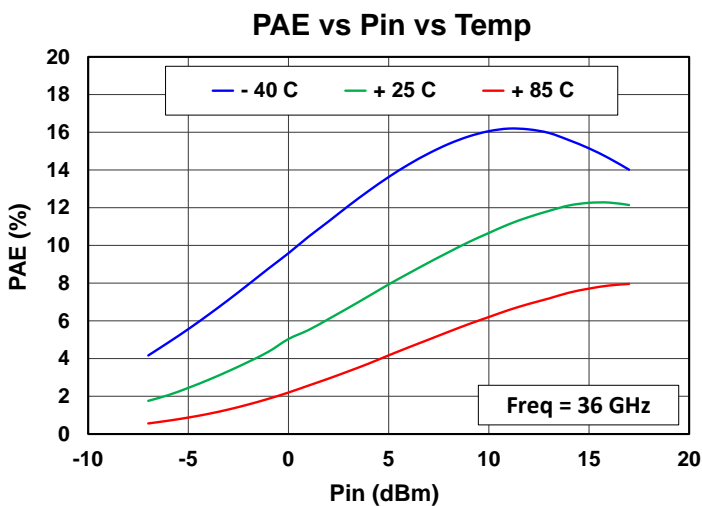
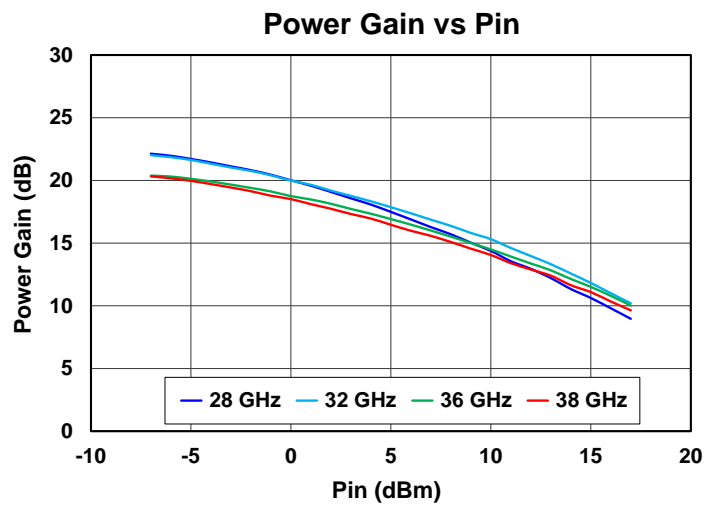
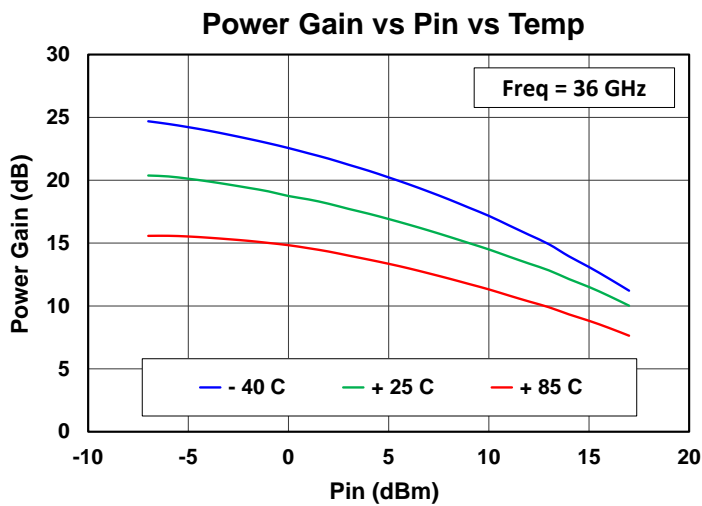
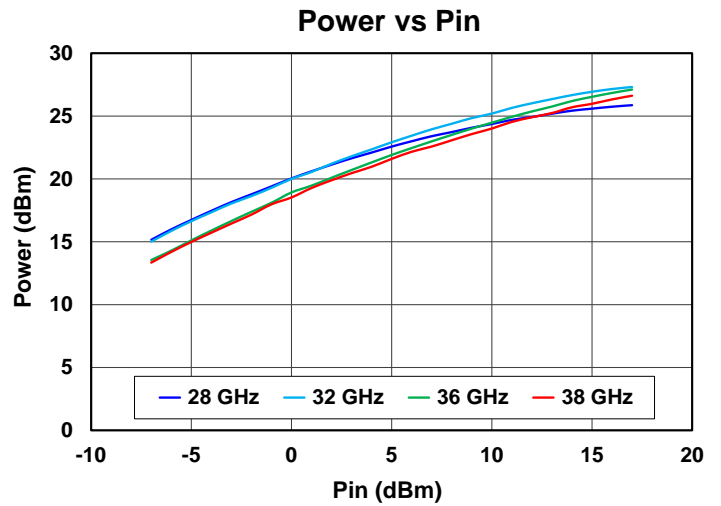
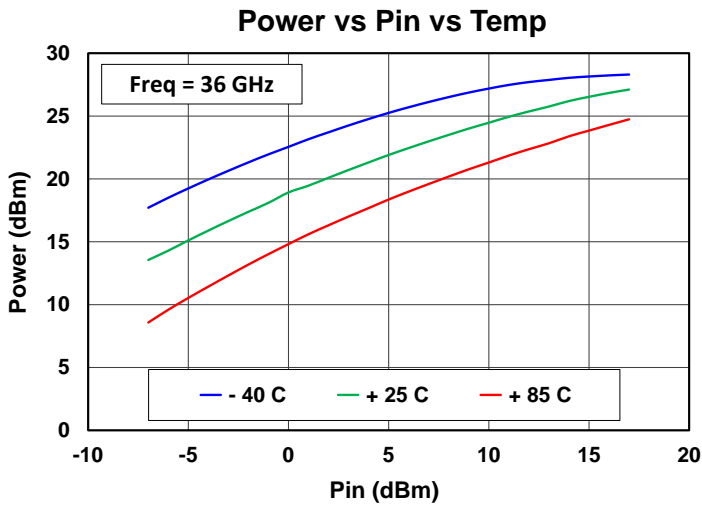
Performance Plots – Large Signal (CW)

Test conditions unless otherwise noted: VD = 20 V, IDQ = 64 mA, Pin = +14dBm, +25 °C



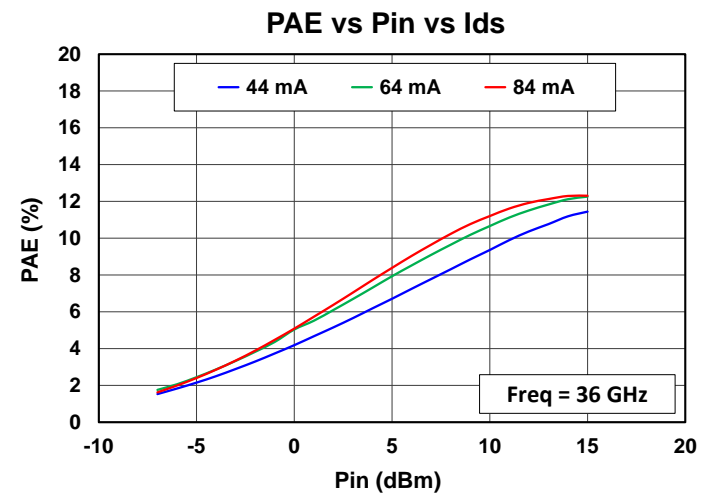
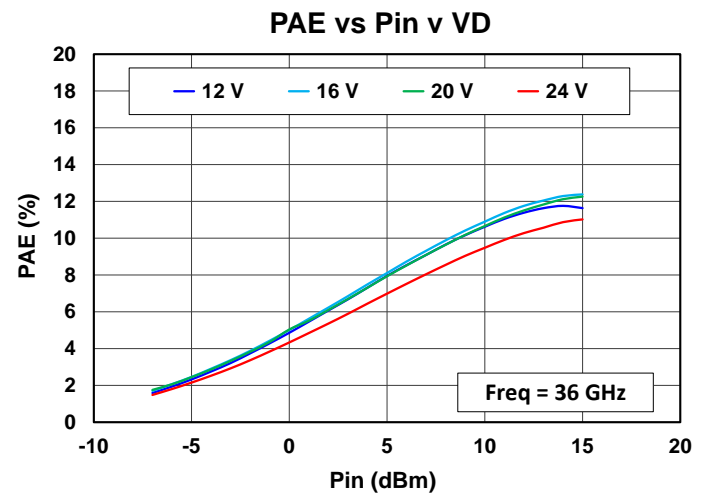
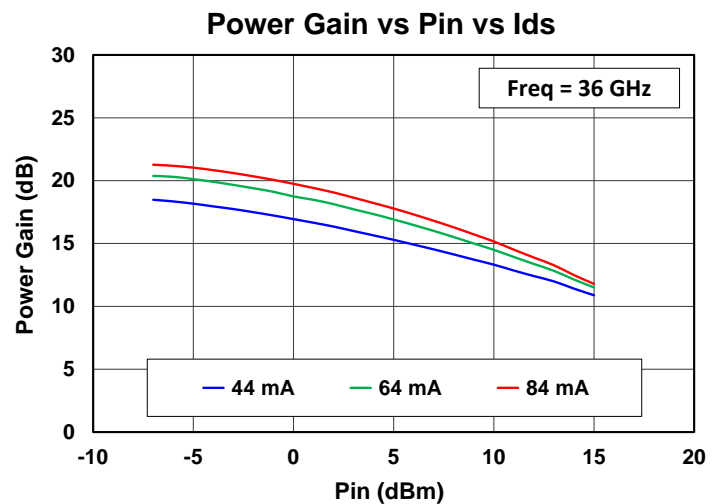
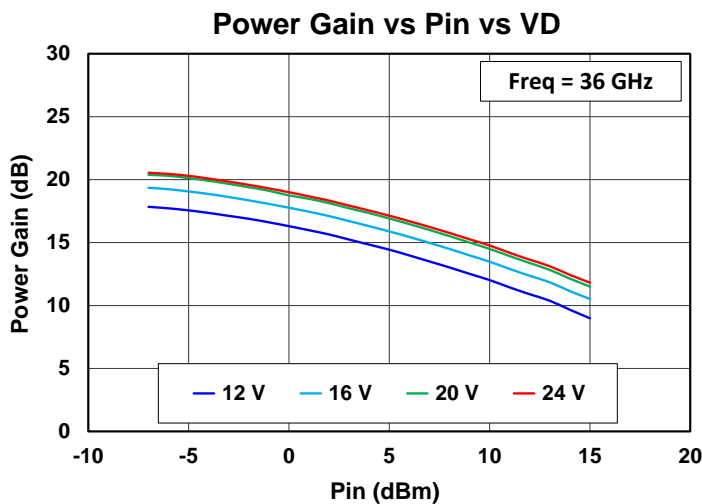
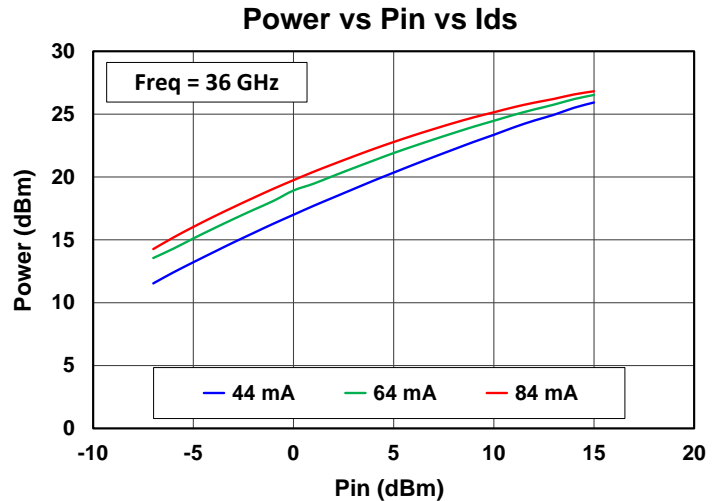
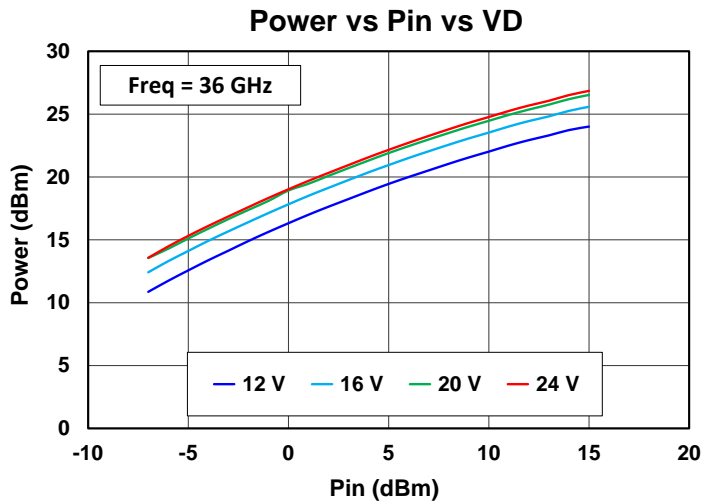
**Performance Plots – Large Signal (CW)**

Test conditions unless otherwise noted:  $V_D = 20\text{ V}$ ,  $I_{DQ} = 64\text{ mA}$ ,  $+25\text{ }^\circ\text{C}$



Performance Plots – Large Signal (CW)

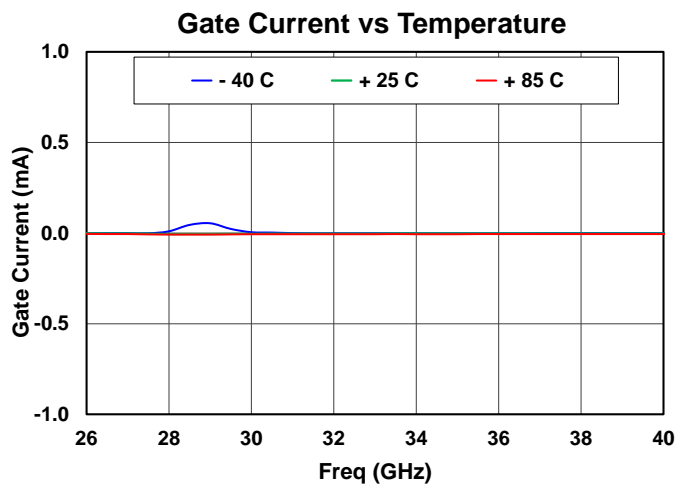
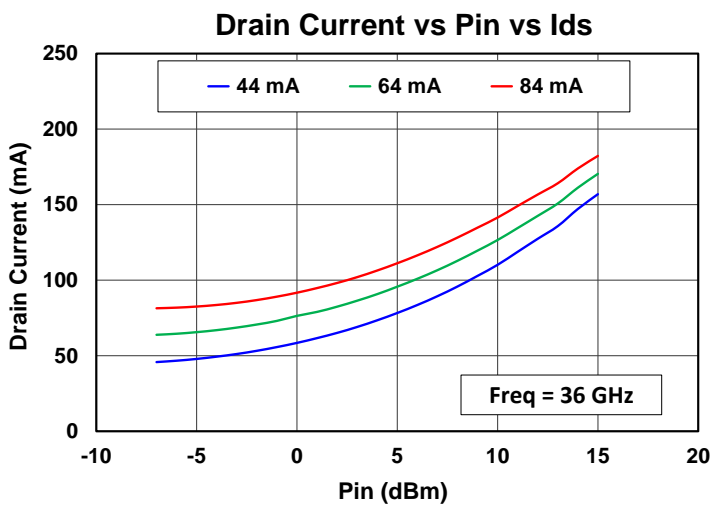
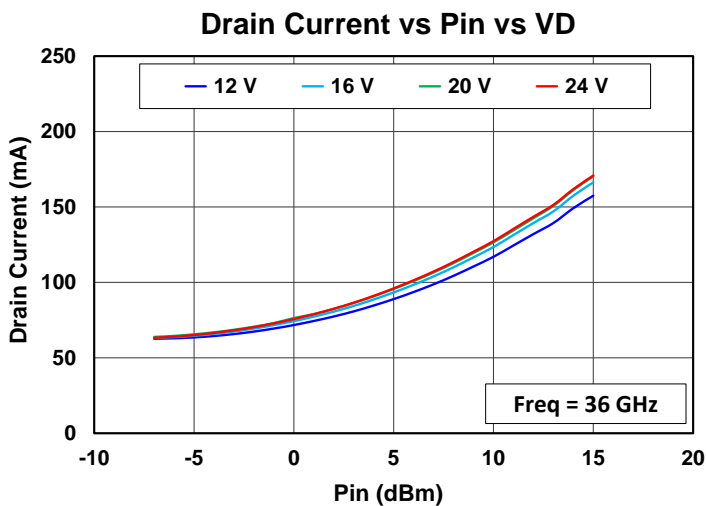
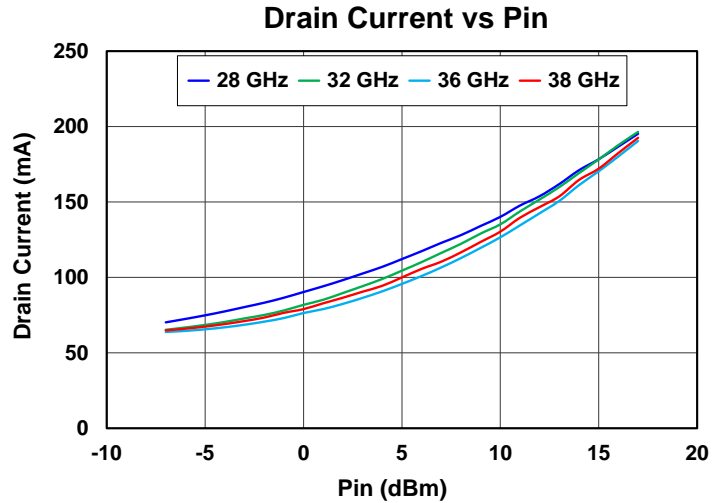
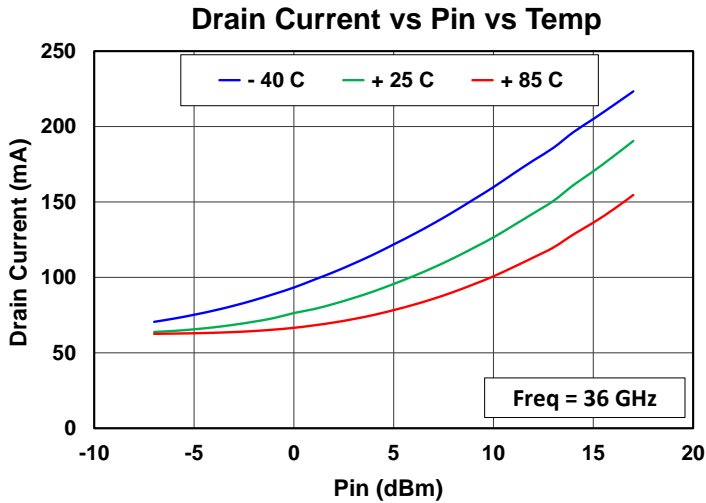
Test conditions unless otherwise noted:  $V_D = 20\text{ V}$ ,  $I_{DQ} = 64\text{ mA}$ ,  $+25\text{ }^\circ\text{C}$





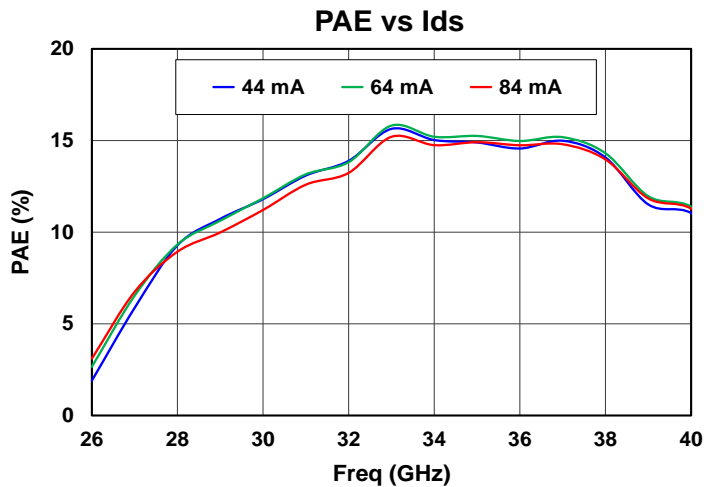
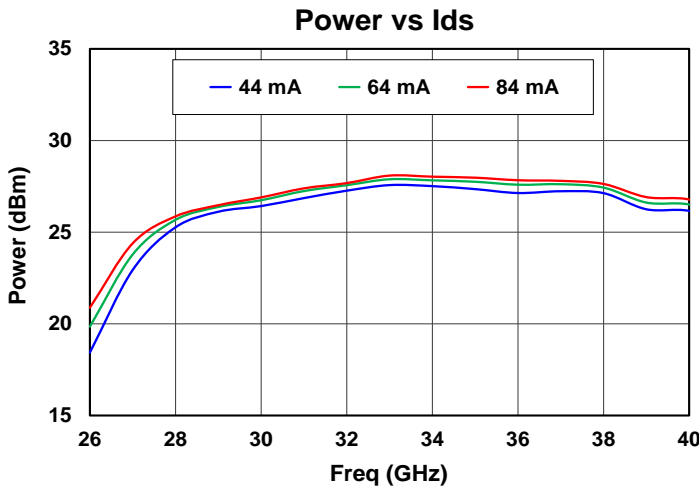
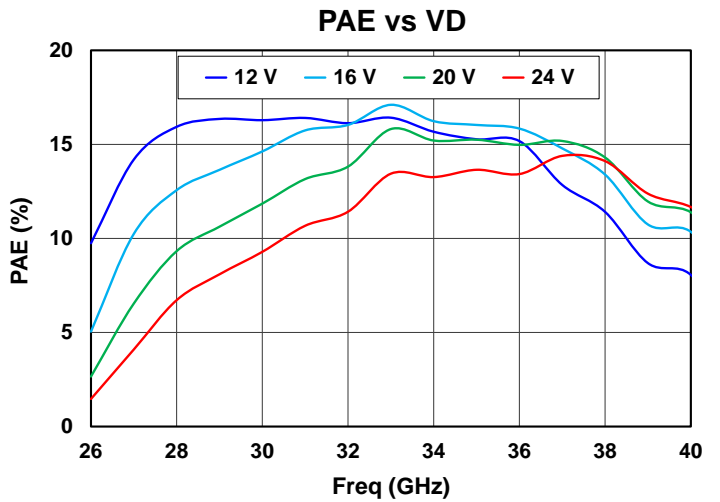
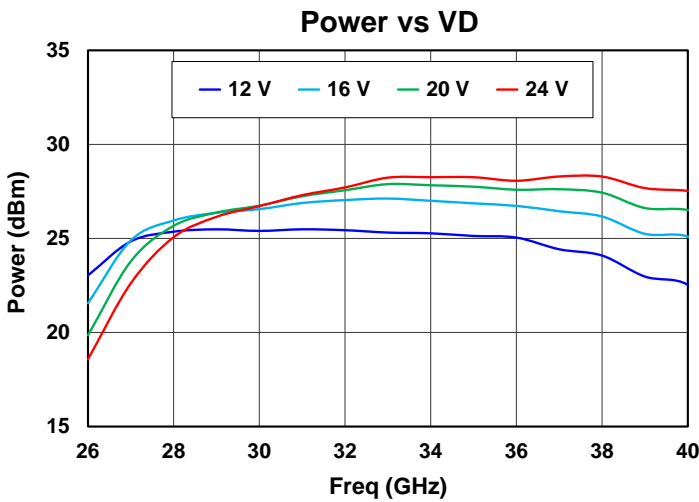
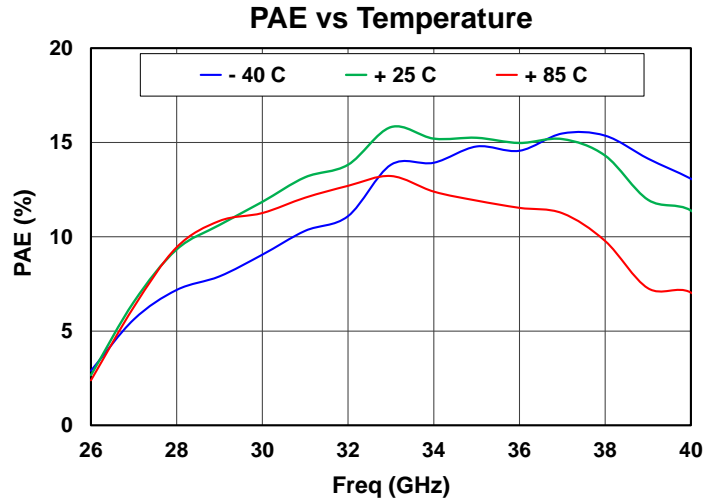
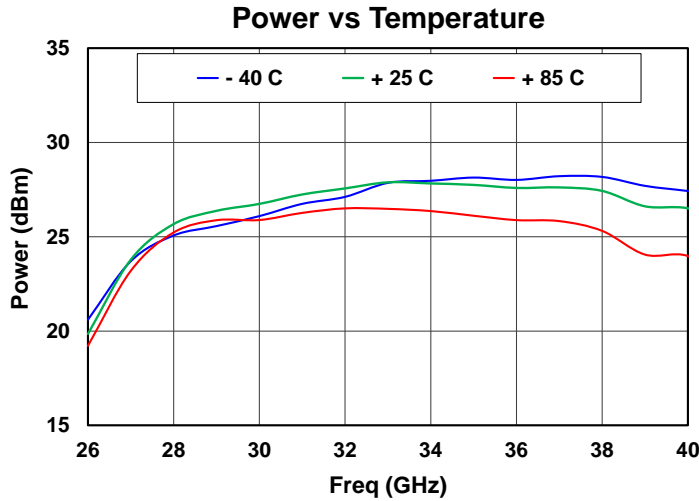
Performance Plots – Large Signal (CW)

Test conditions unless otherwise noted:  $V_D = 20\text{ V}$ ,  $I_{DQ} = 64\text{ mA}$ ,  $P_{in} = +14\text{ dBm}$ ,  $+25\text{ }^\circ\text{C}$



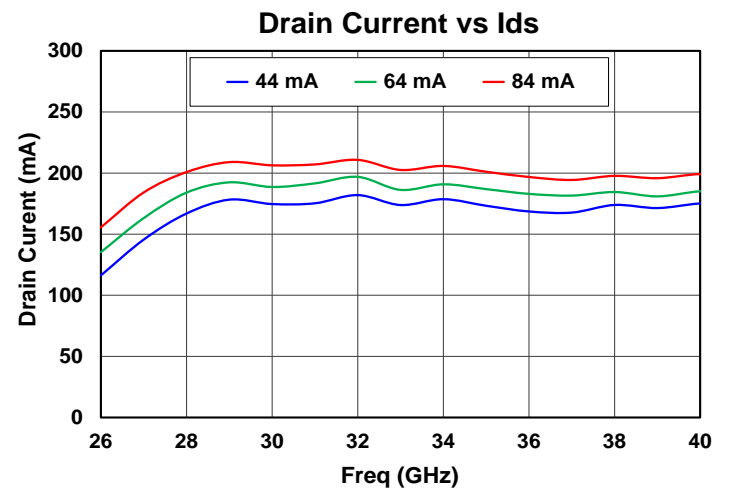
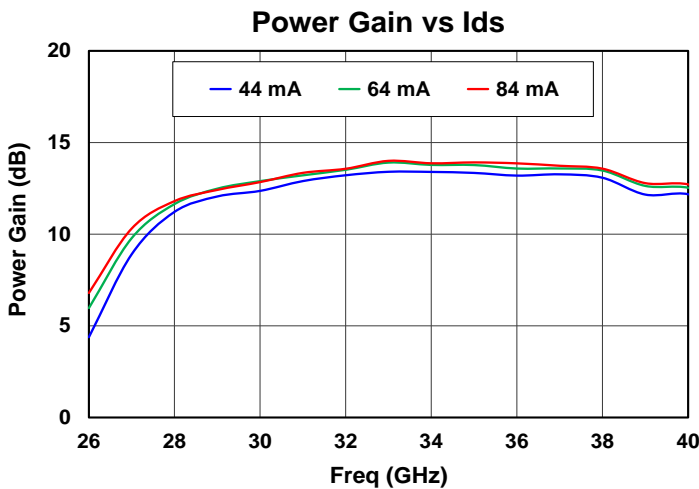
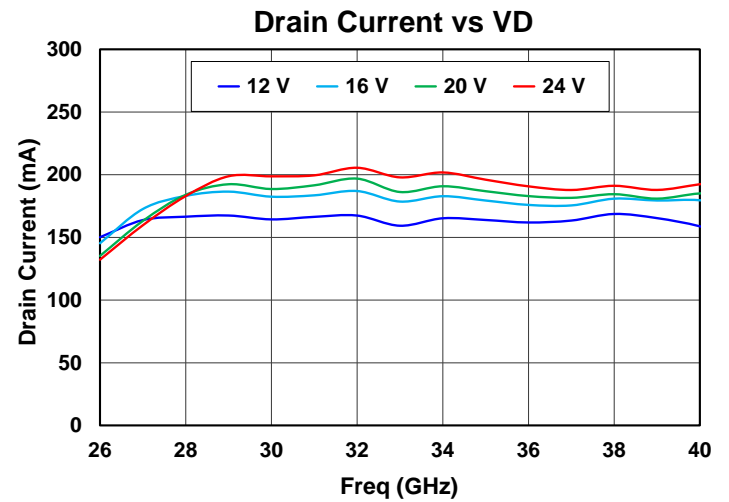
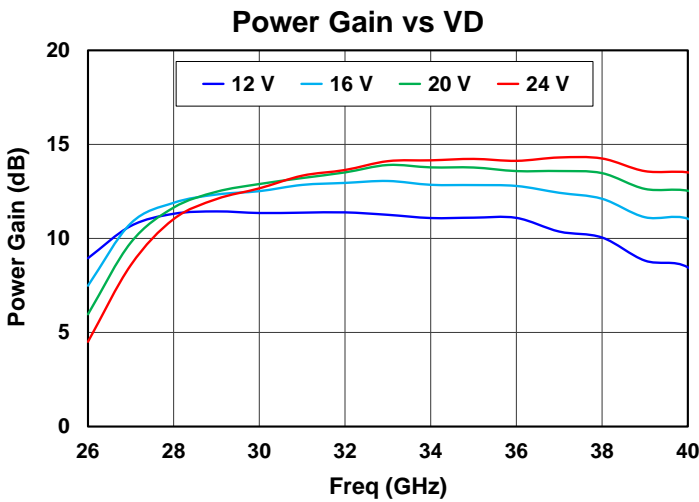
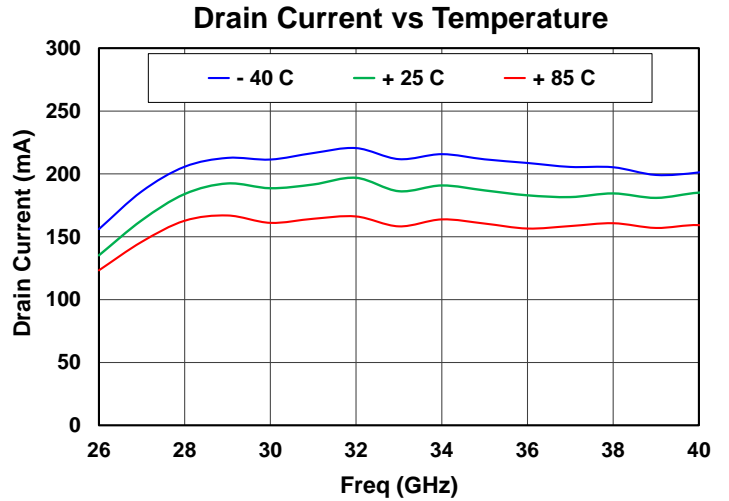
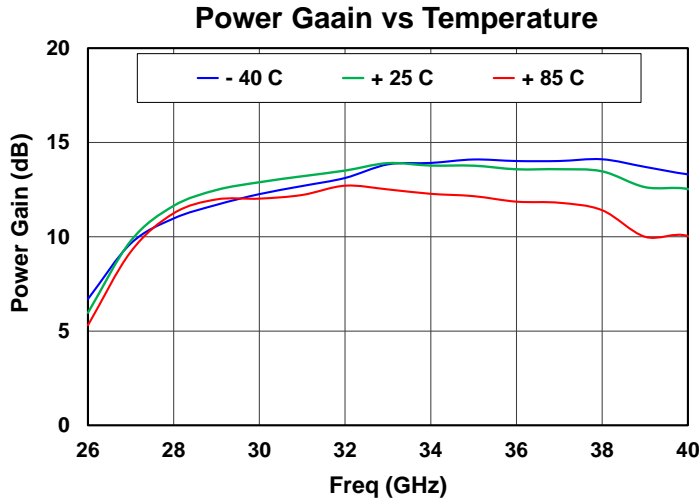
Performance Plots – Large Signal (Pulsed)

Test conditions unless otherwise noted: VD = 20 V, IDQ = 64 mA, PW = 100 μs, DC = 10%, Pin = +14dBm, +25 °C



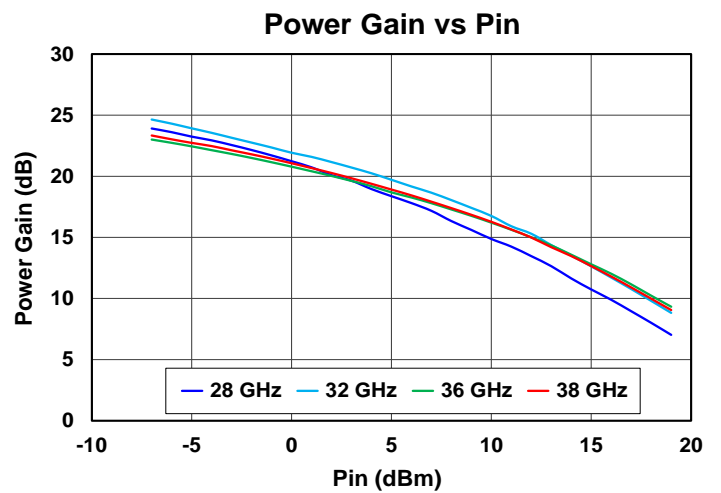
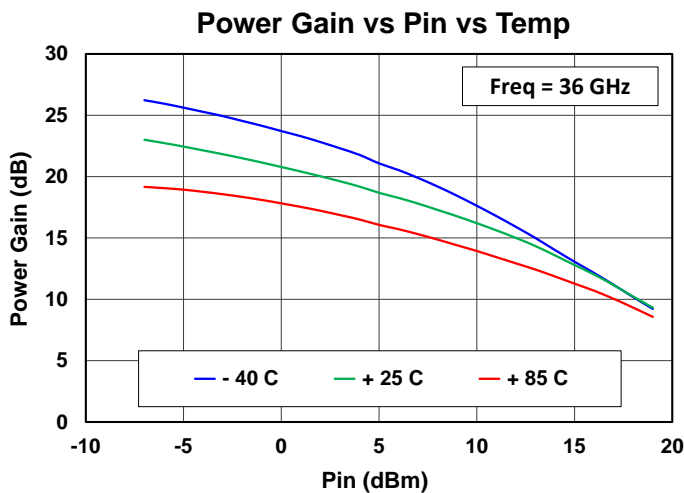
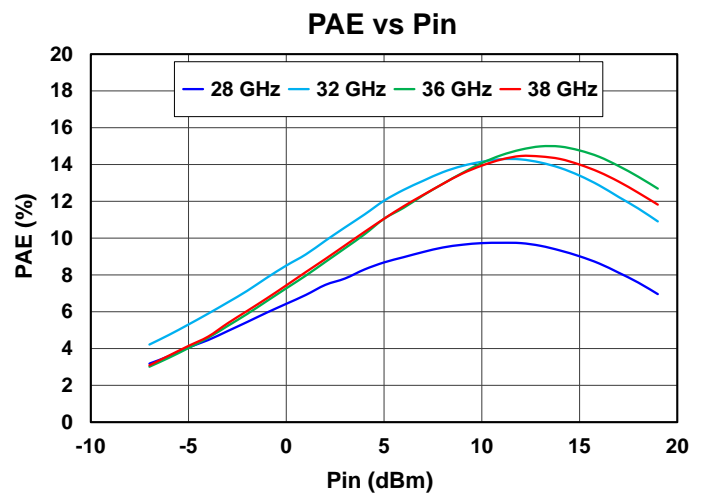
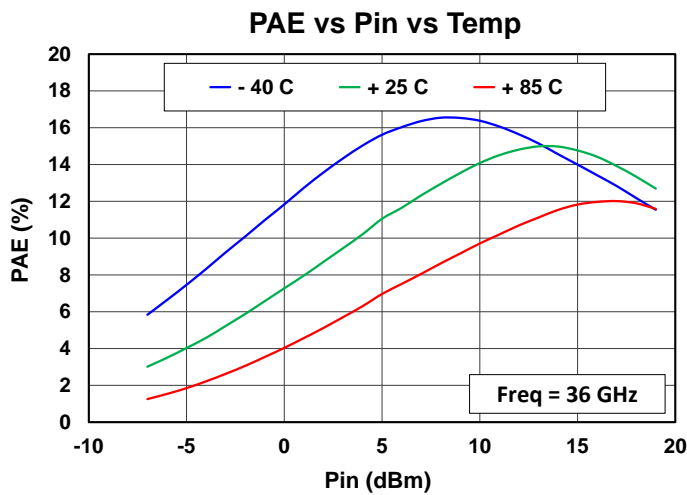
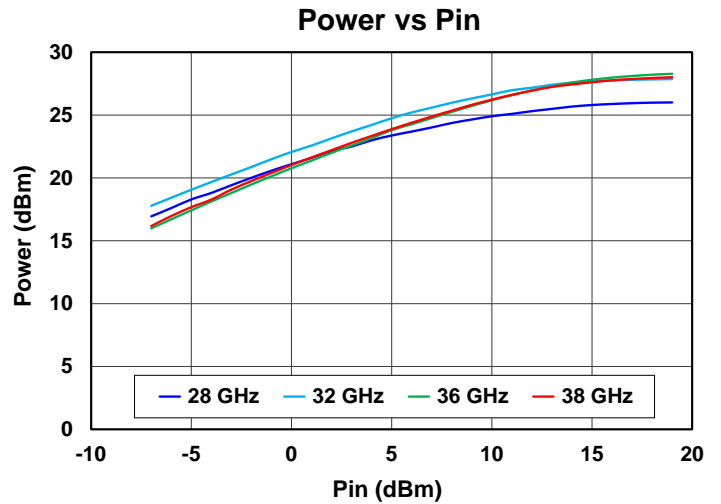
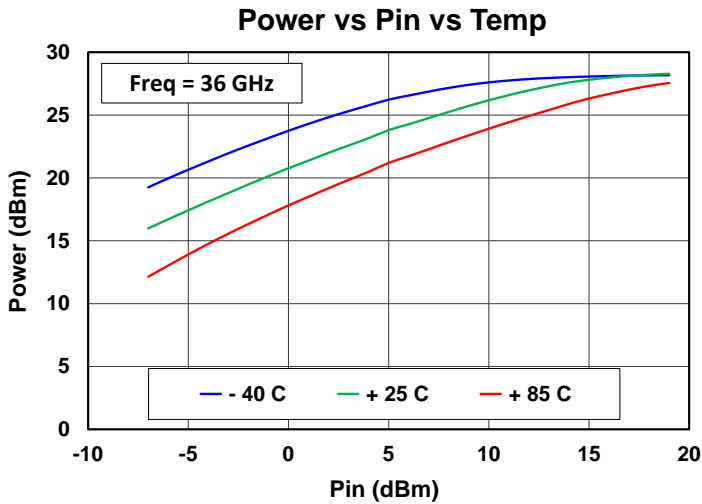
Performance Plots – Large Signal (Pulsed)

Test conditions unless otherwise noted:  $V_D = 20\text{ V}$ ,  $I_{DQ} = 64\text{ mA}$ ,  $PW = 100\text{ }\mu\text{s}$ ,  $DC = 10\%$ ,  $P_{in} = +14\text{ dBm}$ ,  $+25\text{ }^\circ\text{C}$



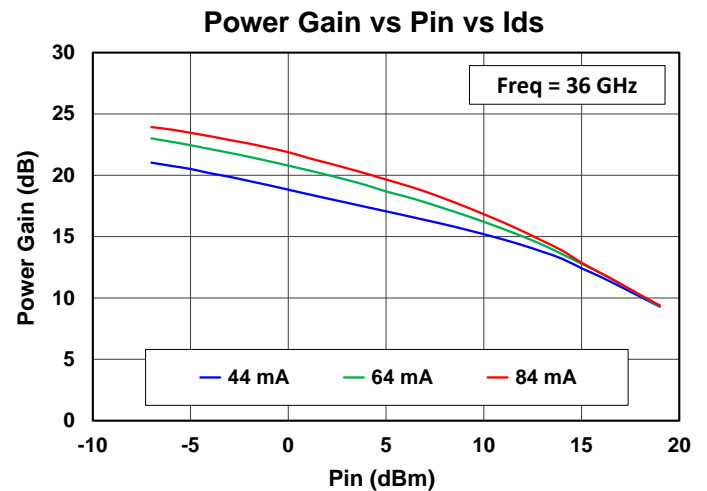
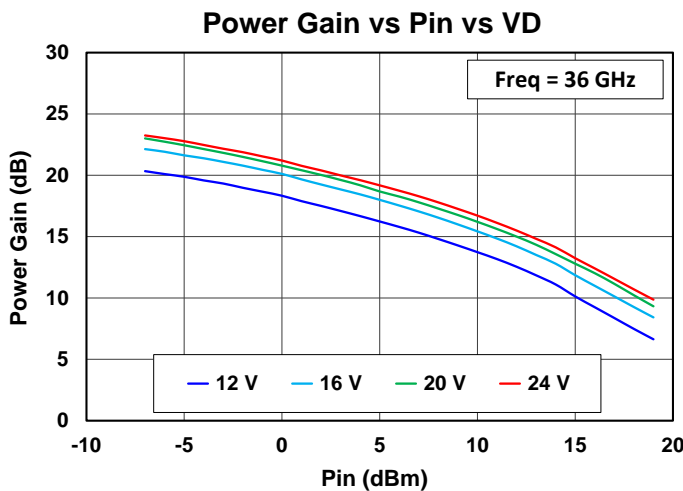
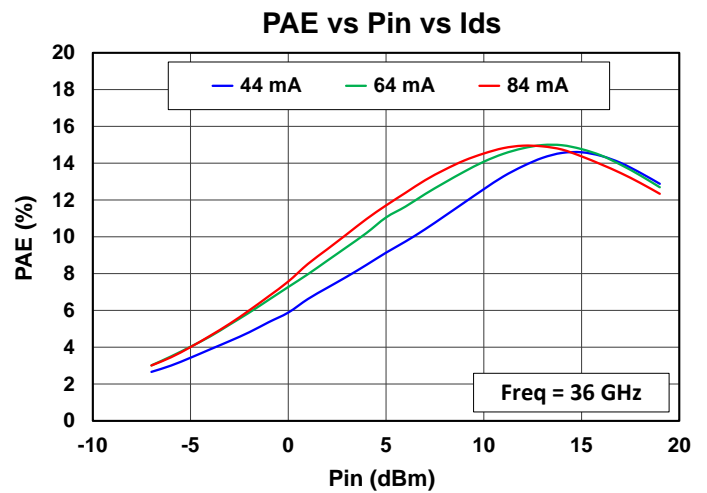
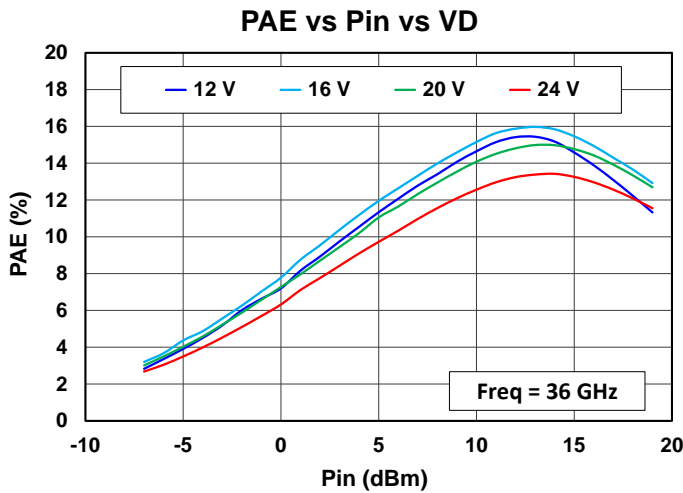
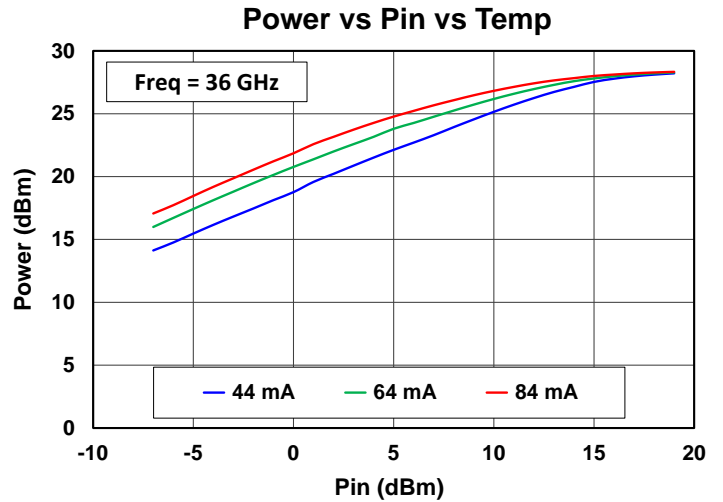
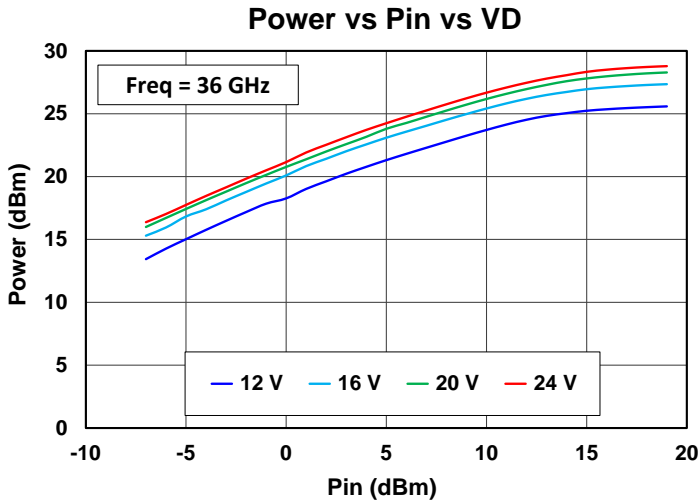
**Performance Plots – Large Signal (Pulsed)**

Test conditions unless otherwise noted: VD = 20 V, IDQ = 64 mA, PW = 100 μs, DC = 10%, Pin = +14dBm, +25 °C



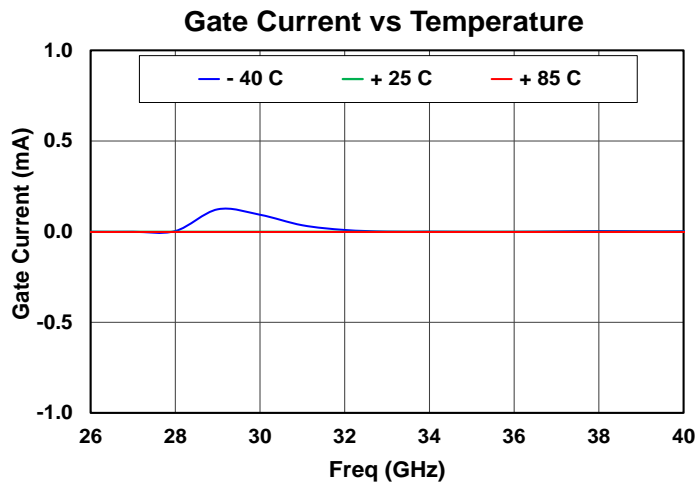
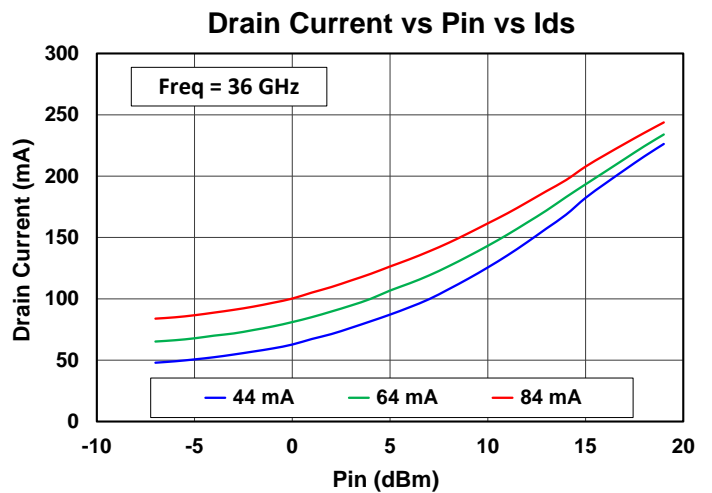
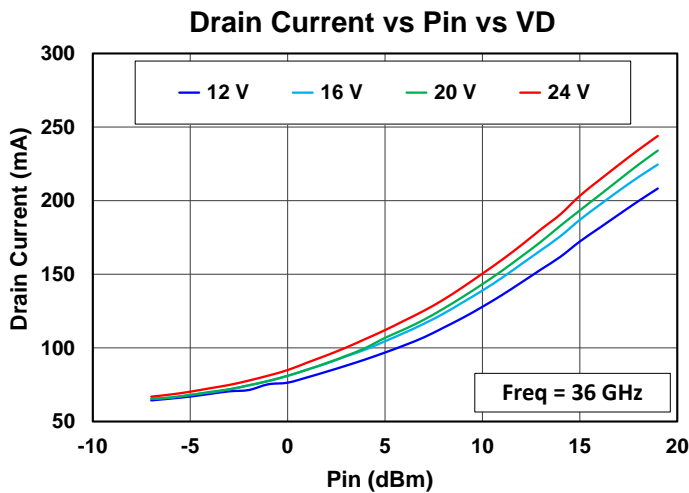
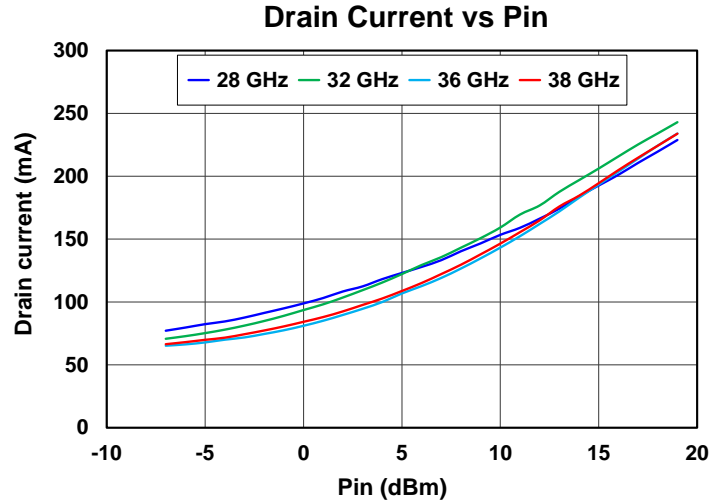
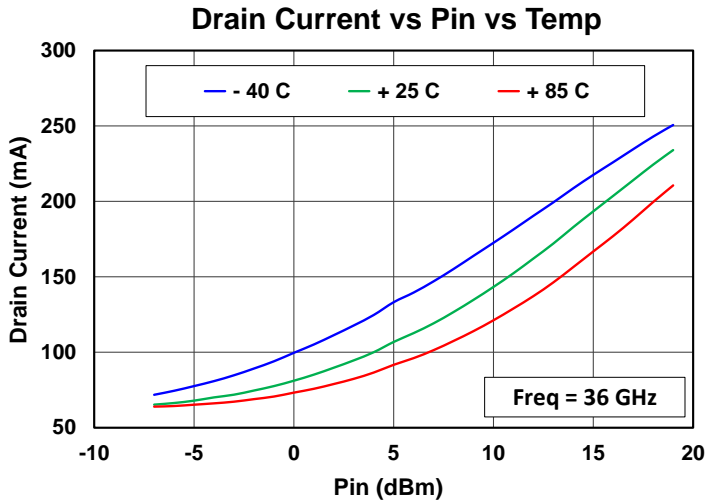
Performance Plots – Large Signal (Pulsed)

Test conditions unless otherwise noted: VD = 20 V, IDQ = 64 mA, PW = 100 μs, DC = 10%, Pin = +14dBm, +25 °C



Performance Plots – Large Signal (Pulsed)

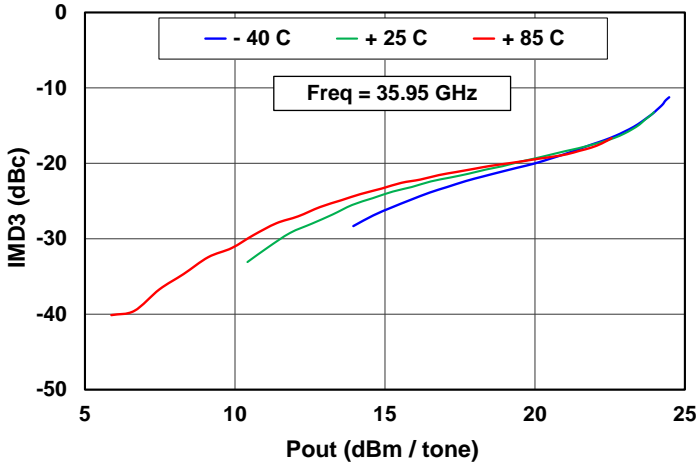
Test conditions unless otherwise noted:  $V_D = 20\text{ V}$ ,  $I_{DQ} = 64\text{ mA}$ ,  $PW = 100\ \mu\text{s}$ ,  $DC = 10\%$ ,  $P_{in} = +14\text{ dBm}$ ,  $+25\text{ }^\circ\text{C}$



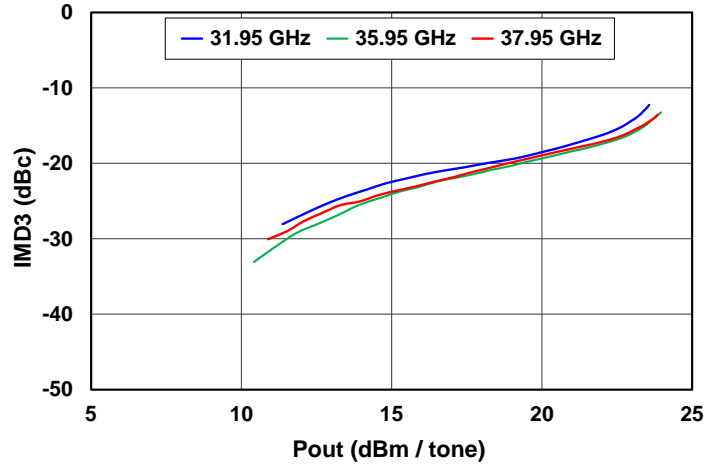
Performance Plots – Linearity

Test conditions unless otherwise noted: VD = 20 V, IDQ = 64 mA, Tone Spacing = 100 MHz, +25 °C

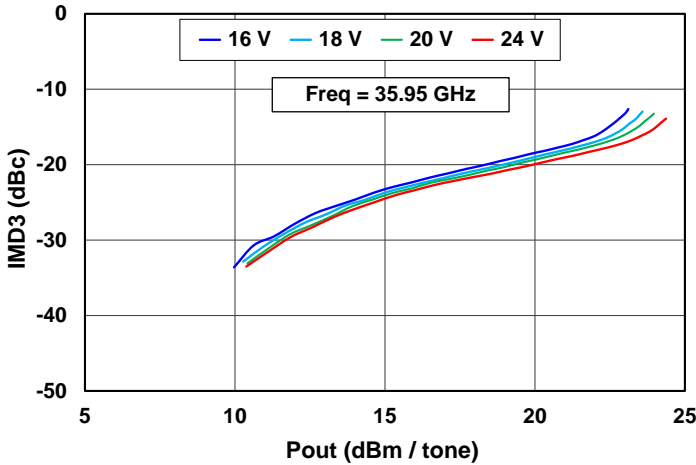
IMD3 vs Temperature



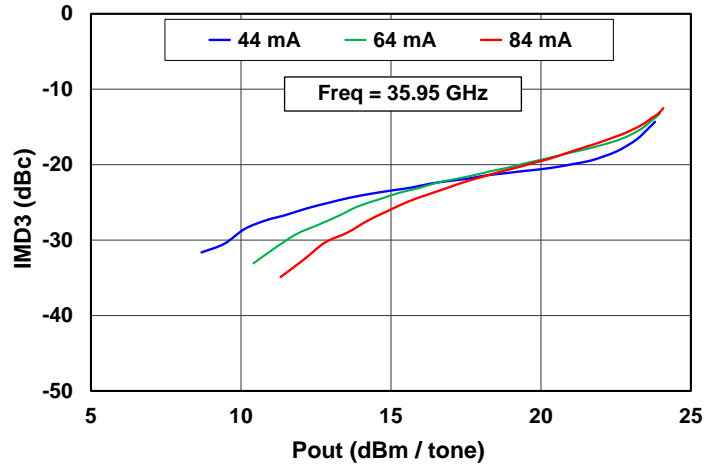
IMD3 vs Pout



IMD3 vs VD



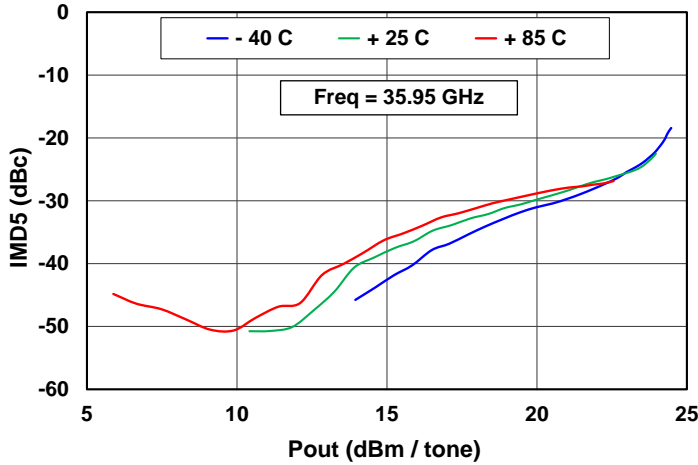
IMD3 vs Ids



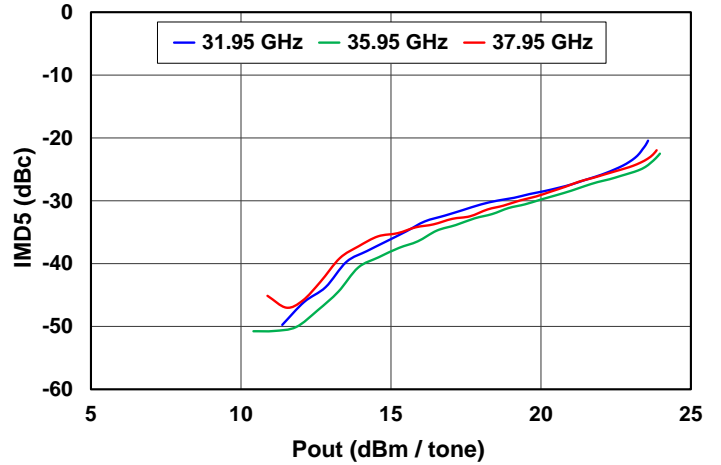
Performance Plots – Linearity

Test conditions unless otherwise noted: VD = 20 V, IDQ = 64 mA, Tone Spacing = 100 MHz, +25 °C

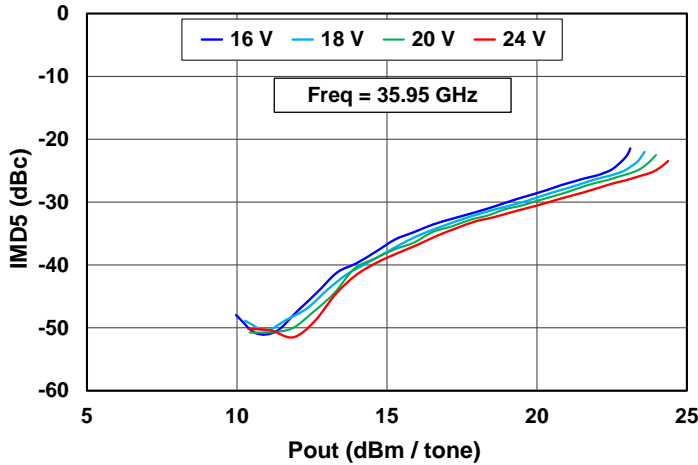
IMD5 vs Temperature



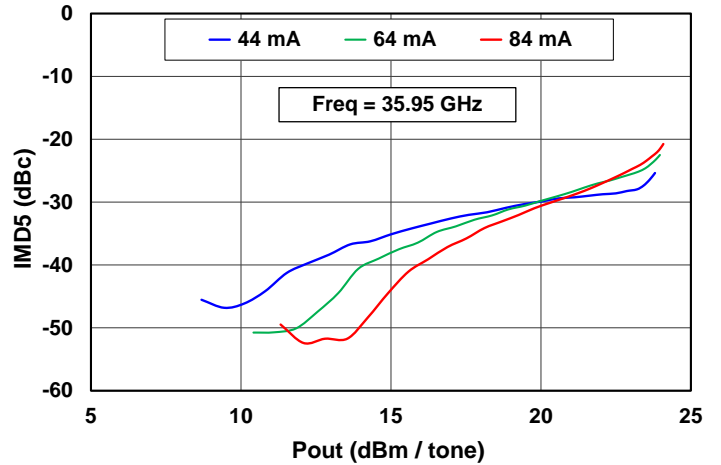
IMD5 vs Pout



IMD5 vs VD



IMD5 vs Ids





## Thermal and Reliability Information

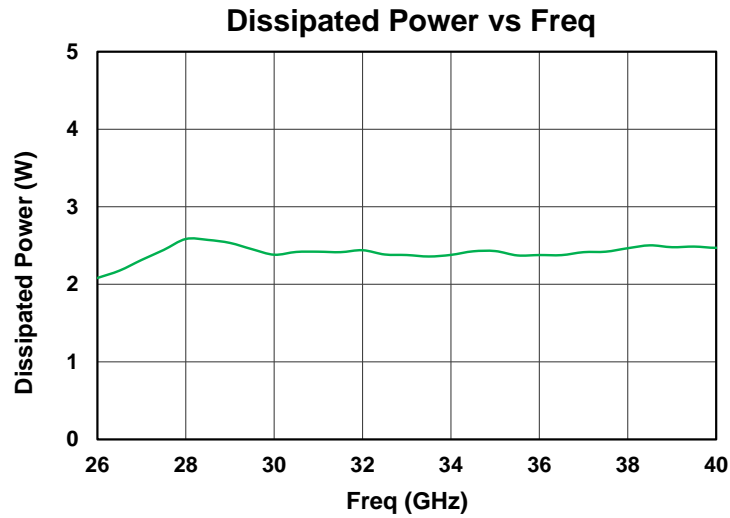
Parameter	Test Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	T <sub>base</sub> = 85 °C, VD = 20 V, IDQ = 64 mA P <sub>Diss</sub> = 1.28 W No RF (quiescent DC operation)	21.95	°C/W
Channel Temperature, T <sub>CH</sub> (No RF) <sup>(2)</sup>		113.1	°C
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	T <sub>base</sub> = 85 °C, VD = 20 V, IDQ = 64 mA Freq = 28 GHz, I <sub>D_Drive</sub> = 139.7 mA, Pin = 14 dBm P <sub>out</sub> = 23.73 dBm, P <sub>Diss</sub> = 2.59 W	23.17	°C/W
Channel Temperature, T <sub>CH</sub> (Under RF) <sup>(2)</sup>		145.0	°C

Notes:

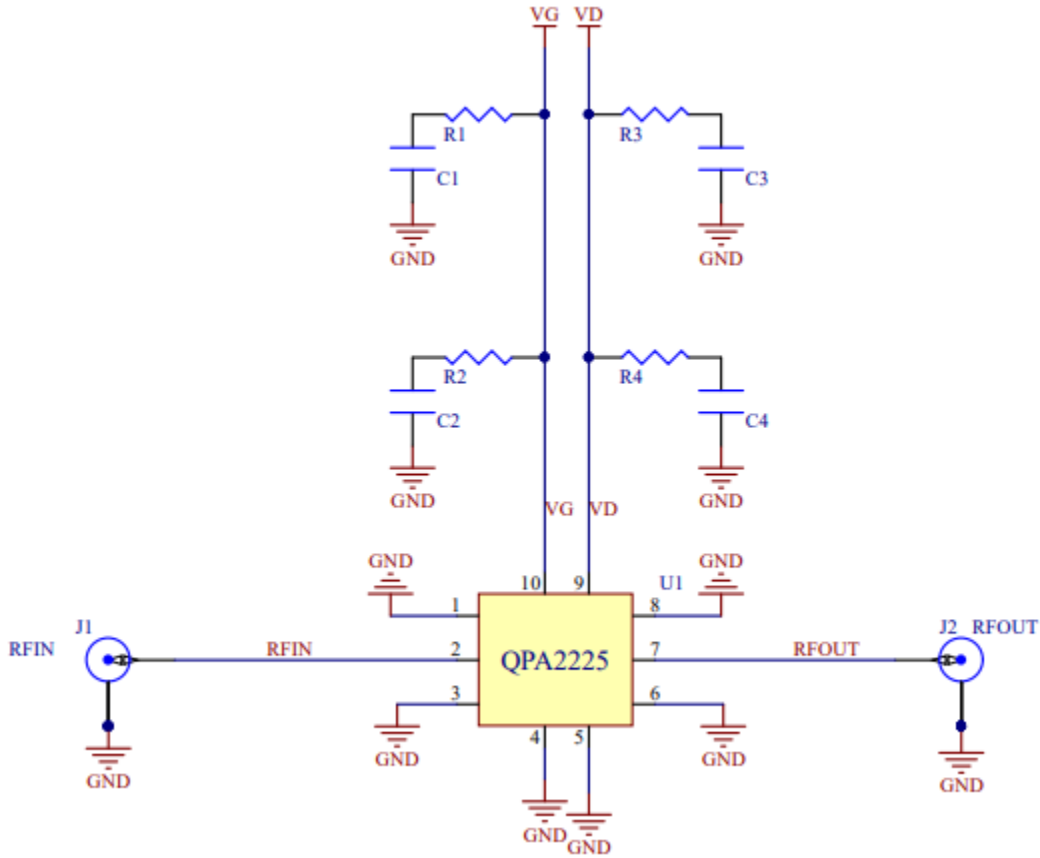
1. Thermal resistance referenced to the back side of package
2. Refer to the following document: [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

## Power Dissipation

Test conditions, unless otherwise noted: CW, VD = 20 V, IDQ = 64 mA, Pin = +14dBm, +85 °C



**Application Circuit**



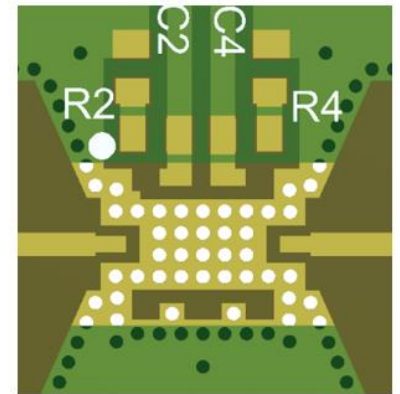
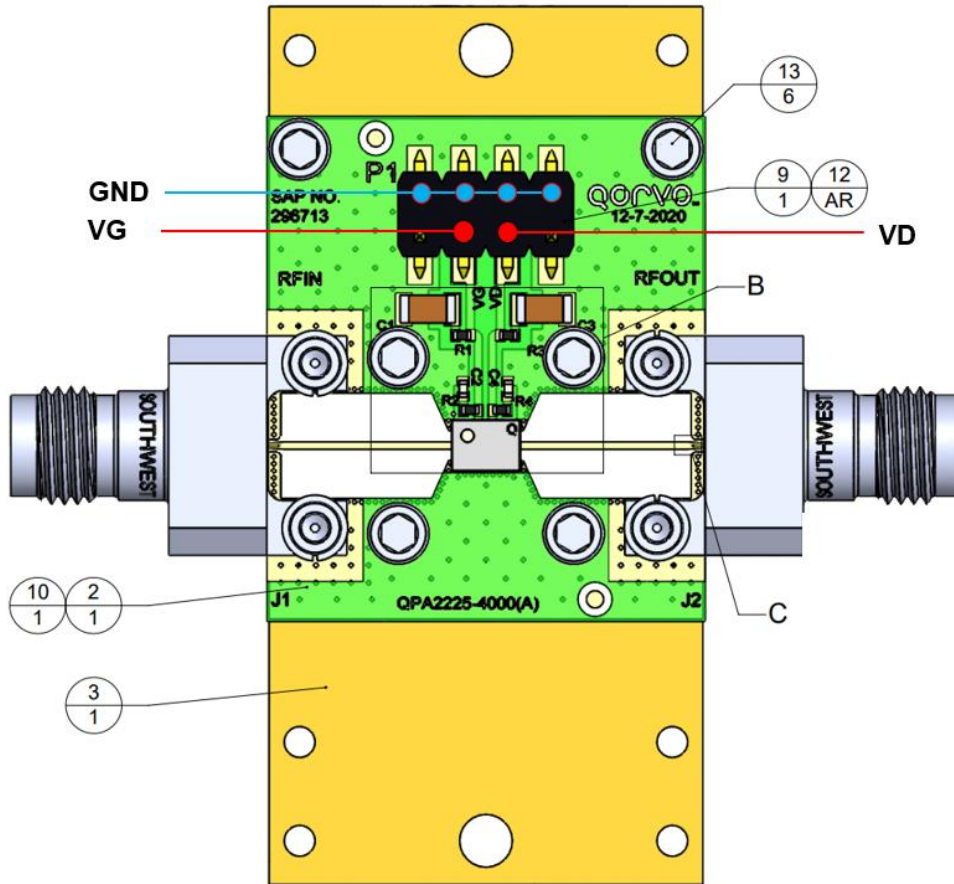
**Bias-Up Procedure**

1. Set drain current limit to 500 mA, gate limit to 10 mA
2. Set VG to -4.0 V
3. Set VD to +20 V
4. Adjust VG more positive until IDQ ≈ 64 mA
5. Apply RF signal

**Bias-Down Procedure**

1. Turn off RF signal
2. Reduce VG to -4.0 V. Ensure IDQ ~ 0 mA
4. Set VD to 0 V
4. Turn off VD supply
5. Turn off VG supply

Evaluation Board and Assembly

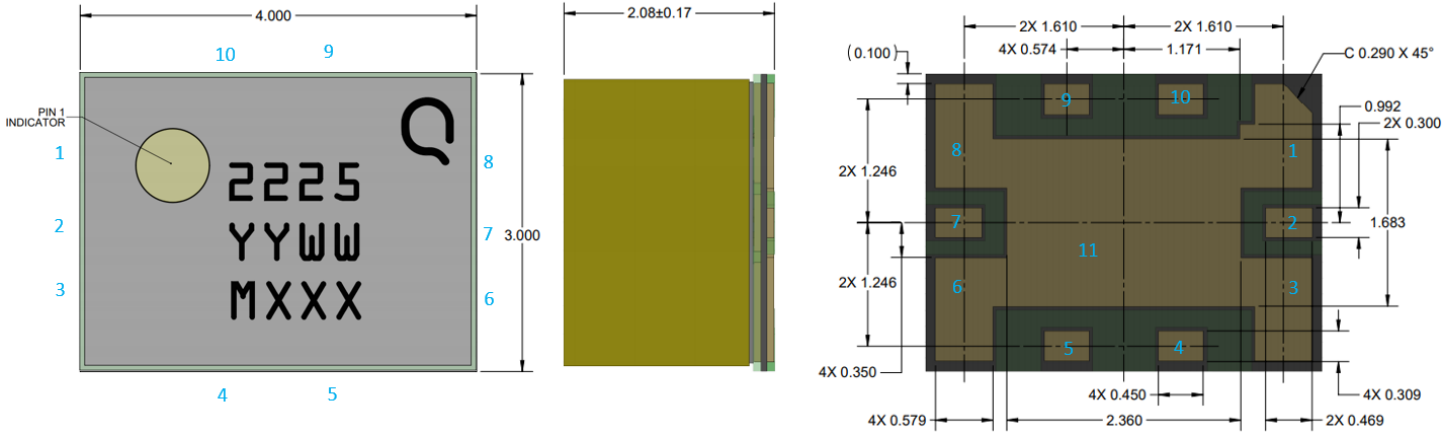


Mounting pad details

RF Layer is 0.008" thick Rogers Corp. RO4003C ( $\epsilon_r = 3.35$ ). Metal layers are 0.5 oz. copper. The microstrip line at the connector interface is optimized for the Southwest Microwave end launch connector 1092-01A-5.

Ref. Des.	Component	Value	Manuf.	Part Number
C1, C3	10 uF	CAP, 10 uF, 20%, 50 V, 20%, X5R, 1206	Various	
C2, C4	0.01 uF	CAP, 0.01 uF, 10%, 50 V, X7R, 0402	Various	
R1	5.1 $\Omega$	RES, 5.1 OHM, 5%, 50 V, 0402	Various	
R2, R3, R4	0 $\Omega$	RES, 0 OHM, JMPR, 0402	Various	
J1, J2	RF Connectors	CONN, 2.92mm, End Launch	Southwest Microwave	1092-01A-5

Mechanical Drawing & Pad Description



Dimensions in mm

Package is air cavity and non-hermetic, NiAu gold plated leads with minimum gold thickness of 0.1 um  
 Part Marking: QPA2225 = Part Number, YY = Part Assembly Year, WW = Part Assembly Week, MXXX = Batch ID

Pin Number	Label	Description
1, 3, 6, 8	GND	Ground
2	RFIN	RF input, DC grounded
4, 5	N/C	No internal connections, however <b>need</b> to be grounded
7	RFOUT	RF output, DC grounded
9	VD	Amplifier drain supply
10	VG	Amplifier gate control
11	GND	Bottom pad, ground

Solderability and Recommended Soldering Temperature Profile

- 1. Compatible with the latest version of J-STD-020, Lead-free solder, peak reflow temperature 260 °C.

