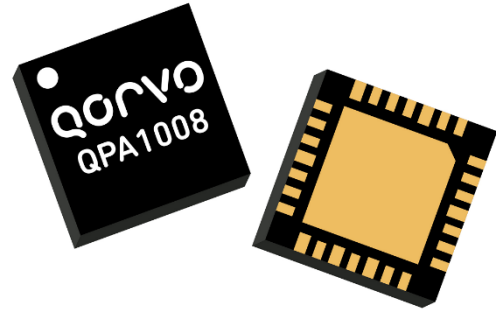


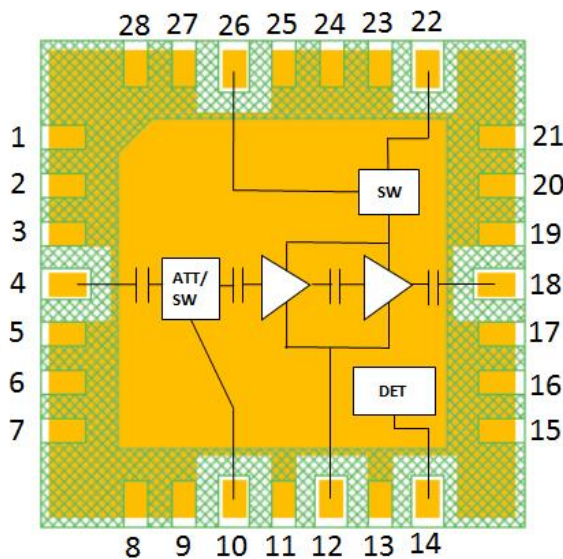
Product Description

Qorvo's QPA1008 is an S-band two stage variable gain driver amplifier in a 5x5 mm QFN. The QPA1008 operates from 2.7 to 3.8 GHz and provides 31dBm of P1dB output power with 26 dB of large signal gain and greater than 30% PAE. The QPA1008 includes a 30 dB attenuator at the input, and a simple resistively coupled (~20 dB coupling) power sampler detector at the output. The amplifier has a fast bias control switch for quick turn on and off operation.



5mm x 5mm 28 Lead OVM QFN

Functional Block Diagram



Product Features

- Frequency Range: 2.7 – 3.8 GHz
- Small Signal Gain: 28 dB
- Input Return Loss: 16 dB
- Output Return Loss: 15 dB
- 32dB Attenuation Range
- P1dB: 31dBm
- Large Signal Gain: 26 dB
- P1dB PAE: 35 %
- Bias Switching Speed: 20 nS
- Bias: $V_{CC} = 6 V$, $I_{CC} = 400 mA$
- Package Dimensions: 5.0 x 5.0 x 0.82 mm

Performance is typical across frequency. Please reference electrical specification table and data plots for more details.

Applications

- Commercial & Military Radar
- Communications
- Test Instrumentation

Ordering Information

| Part | Description |
|--------------|---|
| QPA1008SR | 2.7 – 3.8 GHz Driver Amplifier 100 Piece 7" Reel |
| QPA1008TR7 | 750 Piece 7" Reel |
| QPA1008EVB01 | Evaluation Board |

Absolute Maximum Ratings

| Parameter | Value / Range |
|---|-------------------------------|
| Collector Voltage (V_{CC}) | 3.3 V - 7 V |
| Collector Current (I_{CC}) | 1.2 A |
| Dissipated Power (P_{DISS}), $T_{BASE} = 85\text{ }^{\circ}\text{C}$, $T_{CH} = 175\text{ }^{\circ}\text{C}$, CW | 3.2 W |
| Input Power (50 Ω , 85 $^{\circ}\text{C}$) | 29 dBm |
| Channel Temperature, T_{CH} | 175 $^{\circ}\text{C}$ |
| Mounting Temperature (30 seconds) | 260 $^{\circ}\text{C}$ |
| Storage Temperature | -55 to 150 $^{\circ}\text{C}$ |

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 |
|--|------------------------------|
| Collector Voltage (V_{CC}) | 6 V |
| Collector Current (quiescent, I_{CQ}) | 400 mA |
| Collector Current (under drive, I_{CD}) | 1 A |
| V_{PD} | 5 V |
| V_{SW} | 5 V |
| TJ Max | 165 $^{\circ}\text{C}$ |
| Operating Temperature Range | -40 to 85 $^{\circ}\text{C}$ |

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

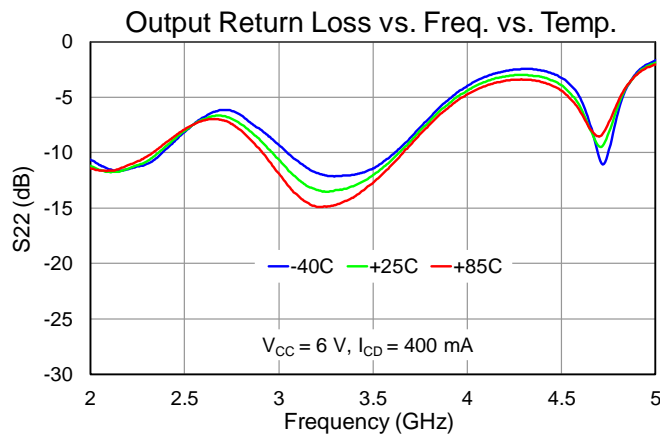
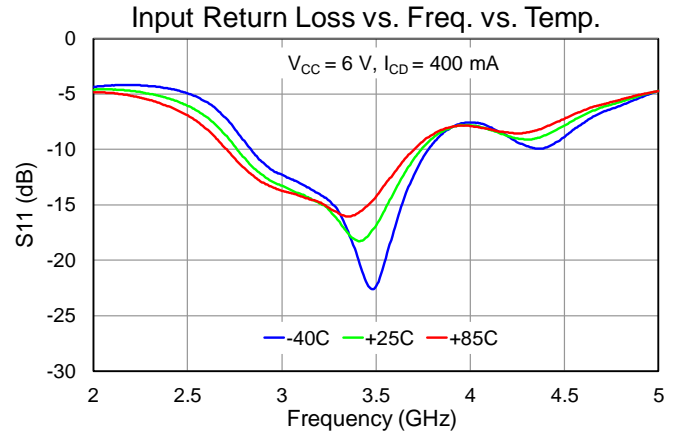
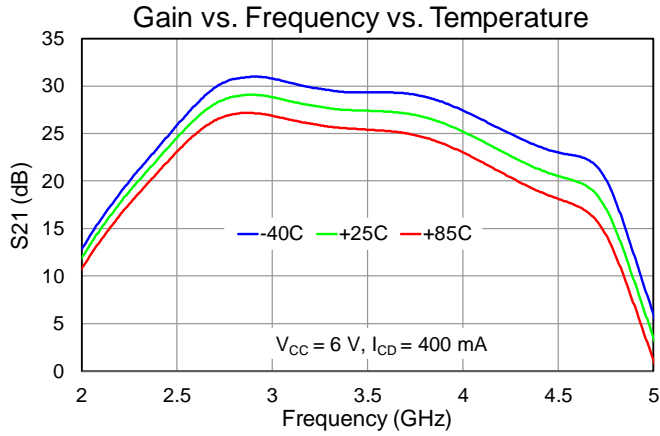
Electrical Specifications

Test conditions, unless otherwise noted: 25 $^{\circ}\text{C}$, $V_{CC} = 6\text{ V}$, $I_{CQ} = 400\text{ mA}$, $V_{PD} = 5\text{ V}$, $V_{SW} = 5\text{ V}$, CW

| Parameter | Min | Typical | Max | Units |
|--|-----|---------|-----|------------------------|
| Operating Frequency Range | 2.7 | 3.3 | 3.8 | GHz |
| Output Power @ 1dB Compression (P1dB) | | 30.8 | | dBm |
| Power Added Efficiency @ 1dB Compression (P1dB) | | 34.6 | | % |
| Small Signal Gain | | 28 | | dB |
| Input Return Loss | | 16 | | dB |
| Output Return Loss | | 15 | | dB |
| OIP3 ($P_{OUT}/\text{tone} \leq 22\text{ dBm}$) | | 42 | | dBm |
| IM3 ($P_{OUT}/\text{tone} \leq 22\text{ dBm}$) | | -37 | | dBc |
| Gain Control Range | | 32 | | dB |
| Switching Speed | | 20 | | nS |
| Attenuator / Switch Control (V_{SW}) Voltage Range | 0 | | 5 | V |
| Small Signal Temperature Coefficient | | 0.031 | | dB/ $^{\circ}\text{C}$ |
| Output Power Temperature Coefficient | | 0.004 | | dB/ $^{\circ}\text{C}$ |

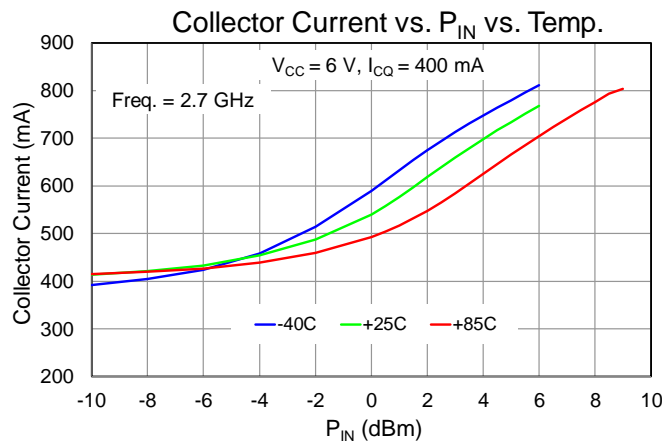
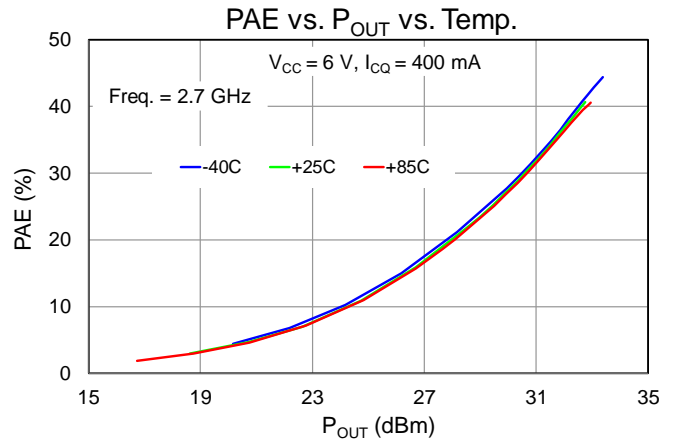
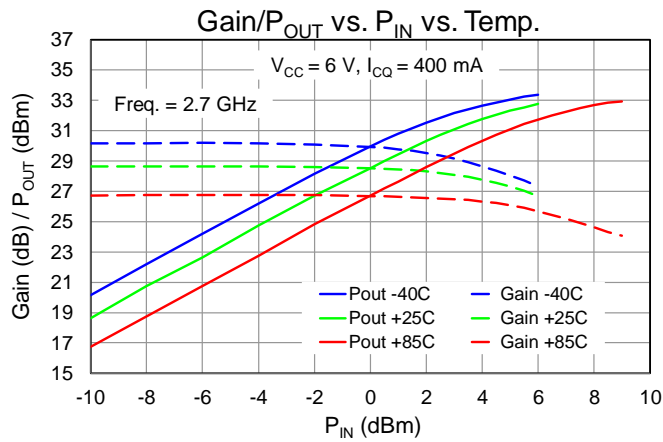
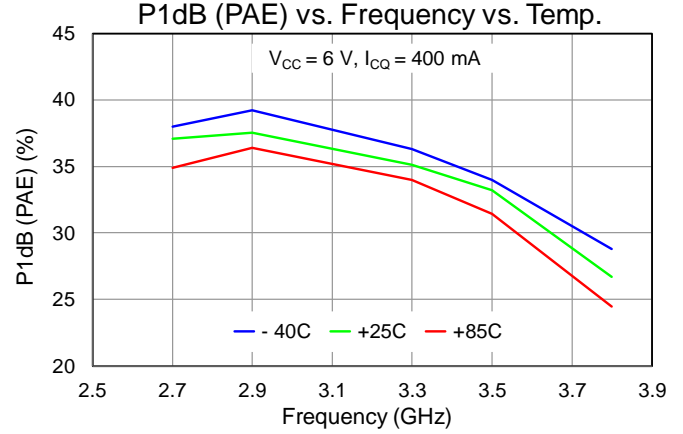
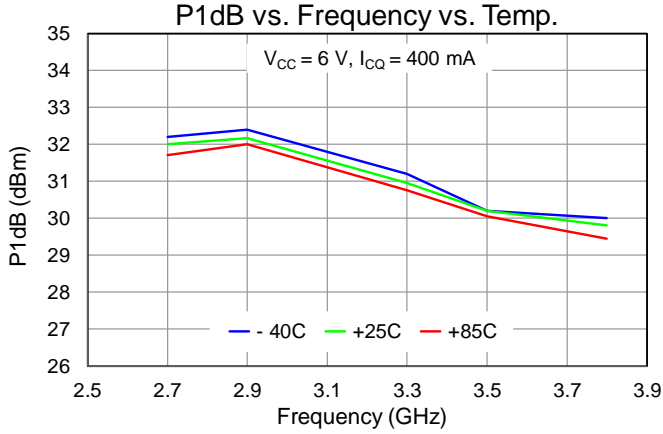
Performance Plots – Small Signal

Test conditions unless otherwise noted: Temp. = 25 °C, $V_{CC} = 6\text{ V}$, $I_{CQ} = 400\text{ mA}$, $V_{PD} = 5\text{ V}$, $V_{SW} = 5\text{ V}$, CW



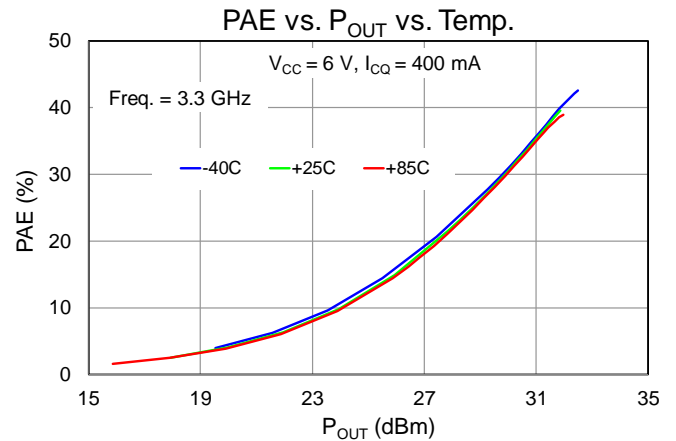
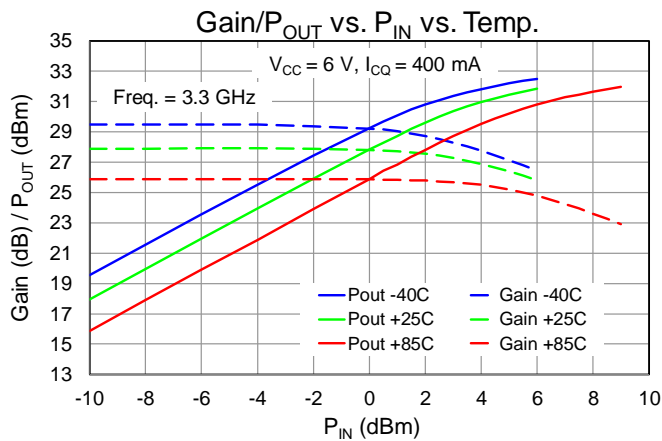
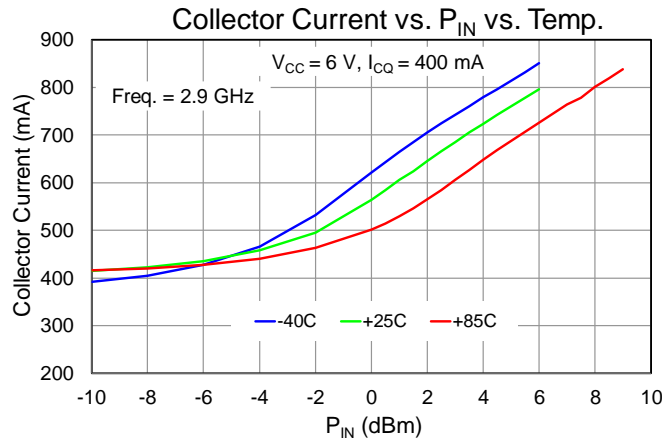
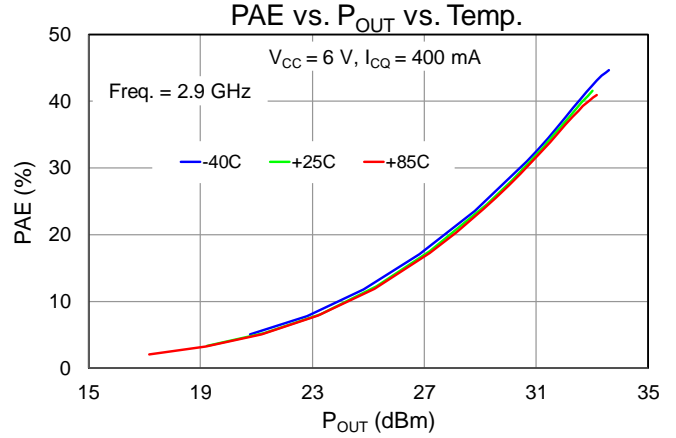
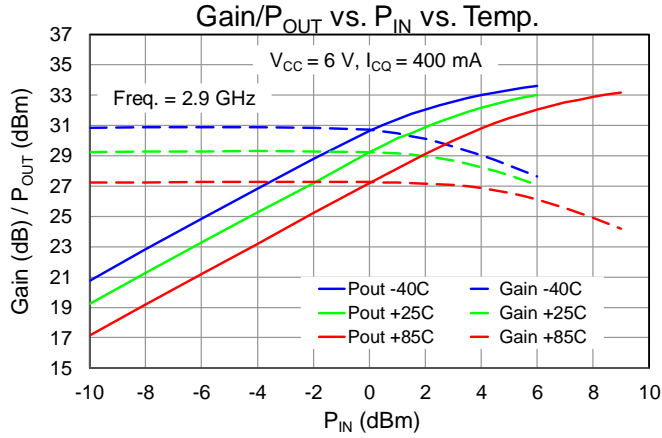
Performance Plots – Large Signal

Test conditions unless otherwise noted: Temp. = 25 °C, $V_{CC} = 6\text{ V}$, $I_{CQ} = 400\text{ mA}$, $V_{PD} = 5\text{ V}$, $V_{SW} = 5\text{ V}$, CW



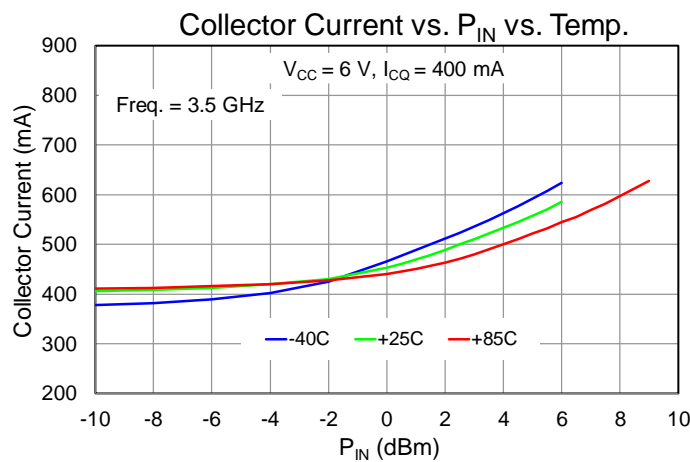
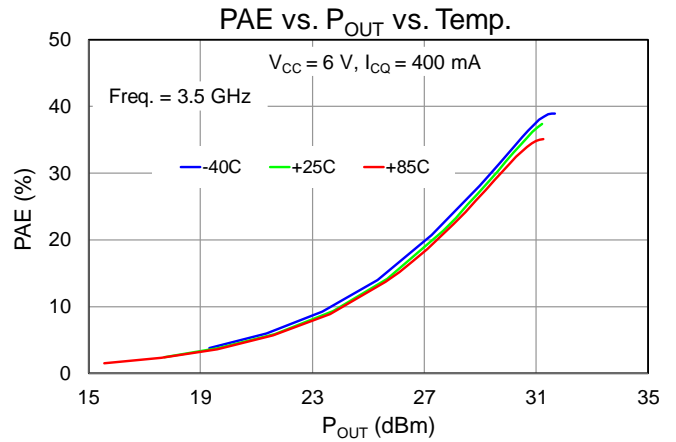
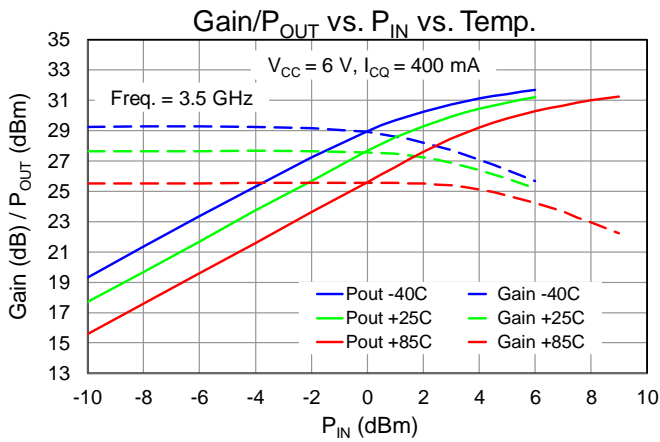
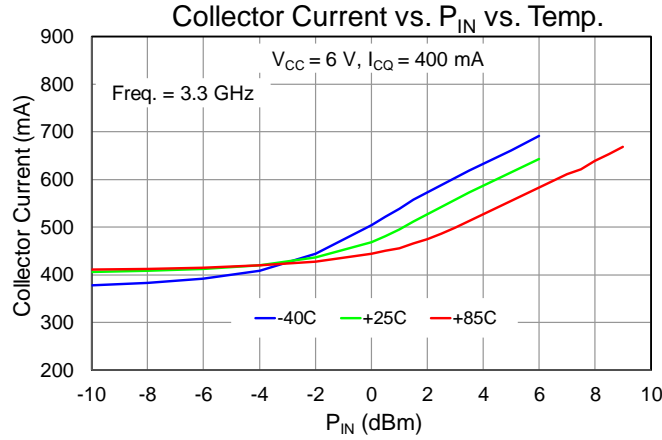
Performance Plots – Large Signal

Test conditions unless otherwise noted: Temp. = 25 °C, $V_{CC} = 6\text{ V}$, $I_{CQ} = 400\text{ mA}$, $V_{PD} = 5\text{ V}$, $V_{SW} = 5\text{ V}$, CW



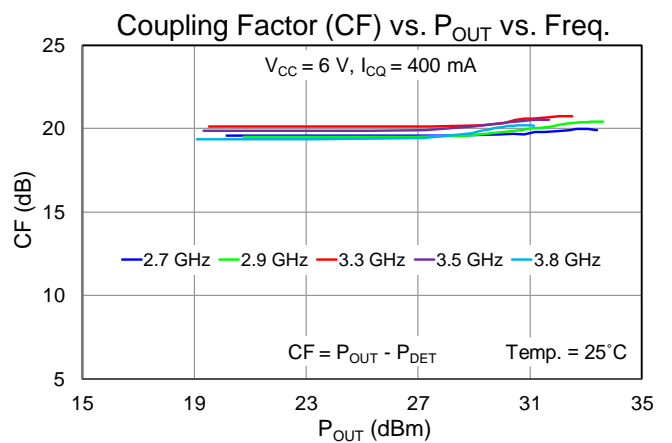
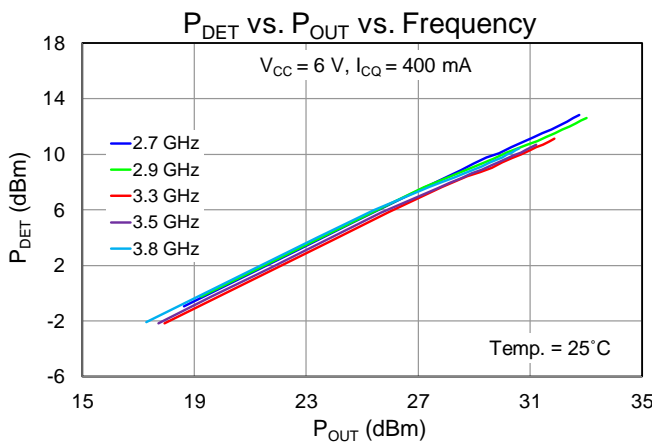
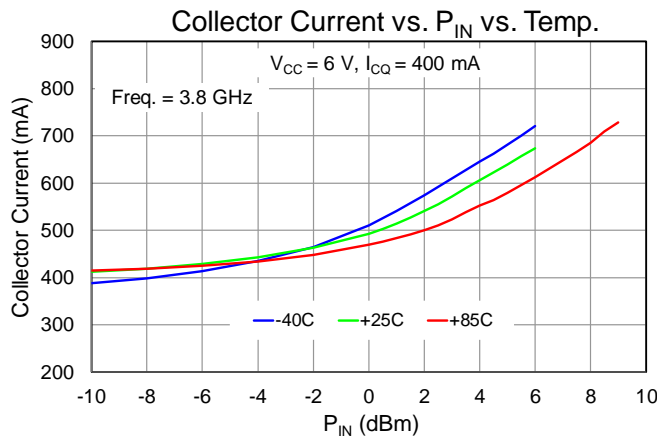
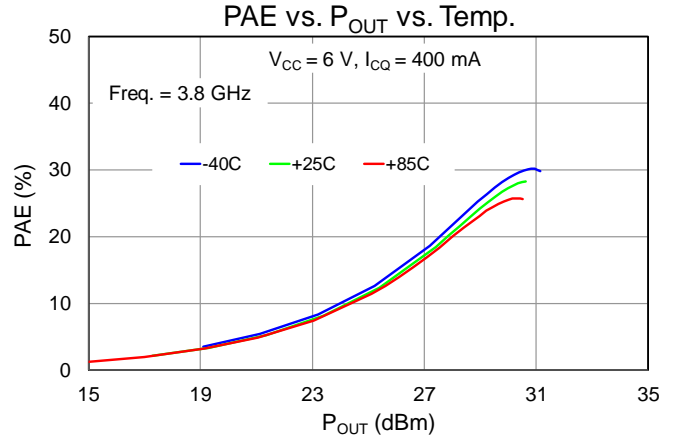
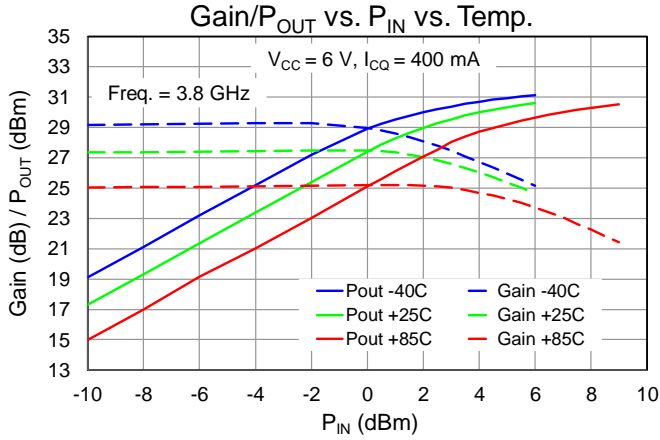
Performance Plots – Large Signal

Test conditions unless otherwise noted: Temp. = 25 °C, $V_{CC} = 6\text{ V}$, $I_{CQ} = 400\text{ mA}$, $V_{PD} = 5\text{ V}$, $V_{SW} = 5\text{ V}$, CW



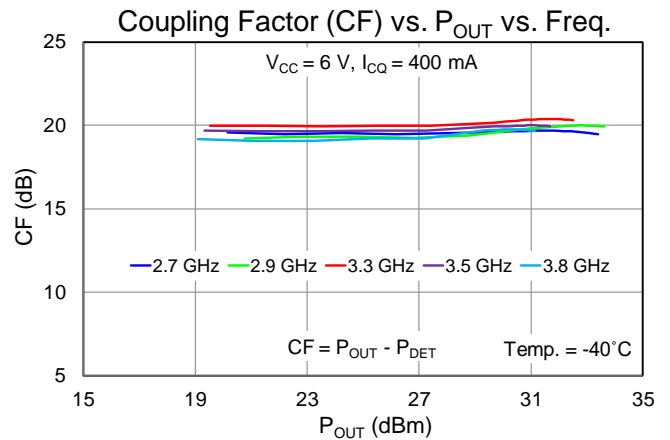
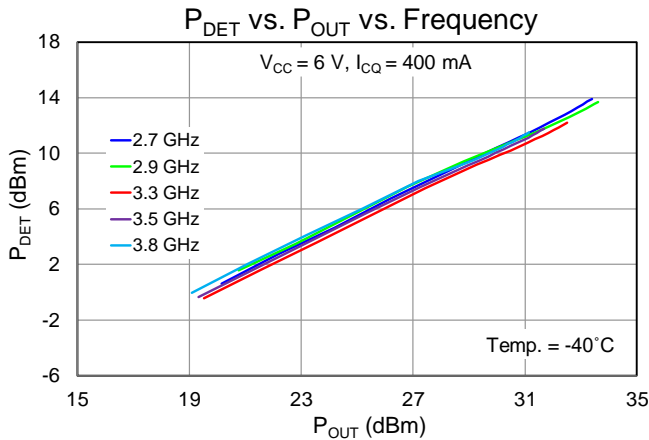
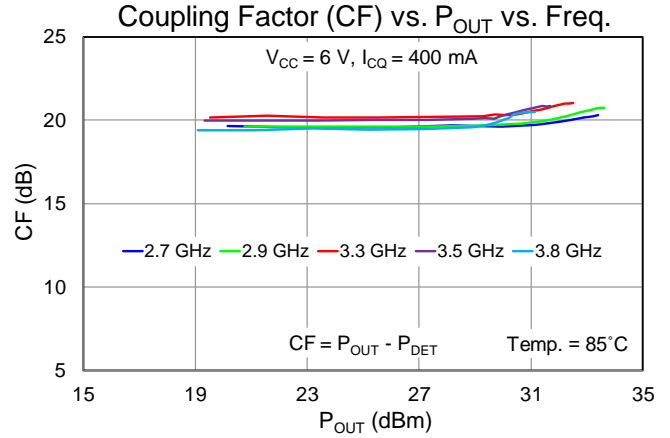
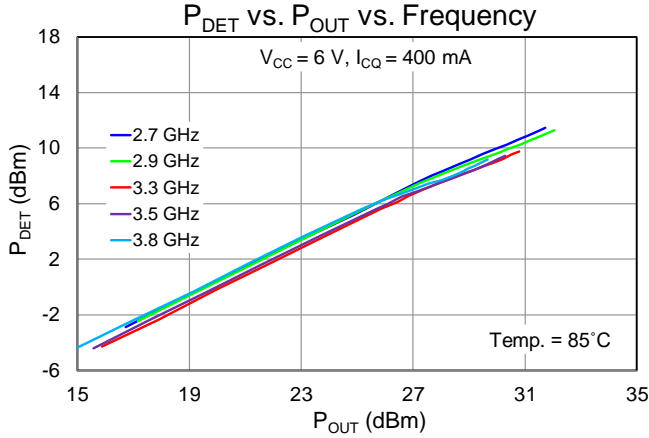
Performance Plots – Large Signal

Test conditions unless otherwise noted: Temp. = 25 °C $V_{CC} = 6\text{ V}$, $I_{CQ} = 400\text{ mA}$, $V_{PD} = 5\text{ V}$, $V_{SW} = 5\text{ V}$, CW



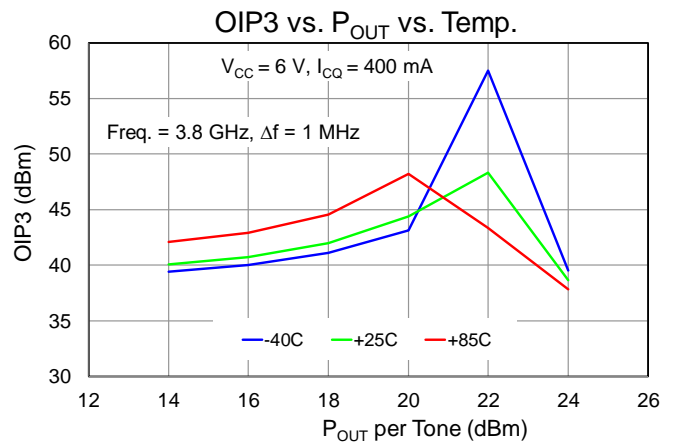
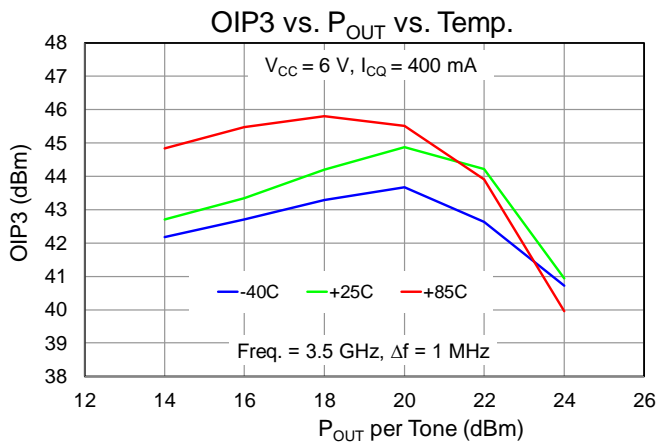
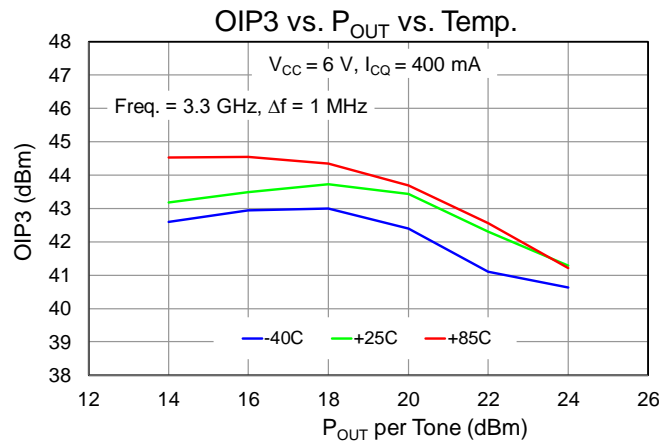
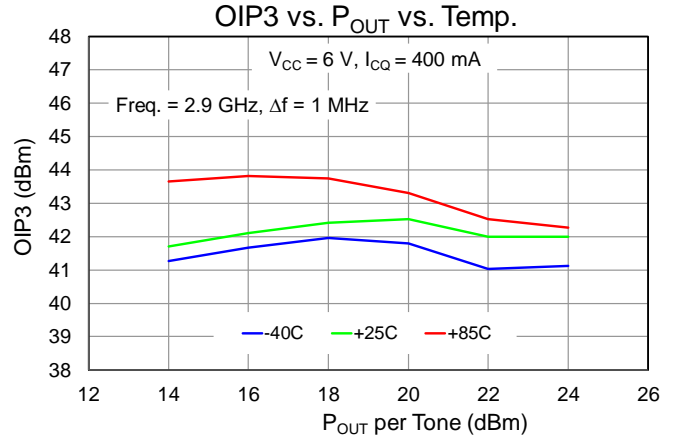
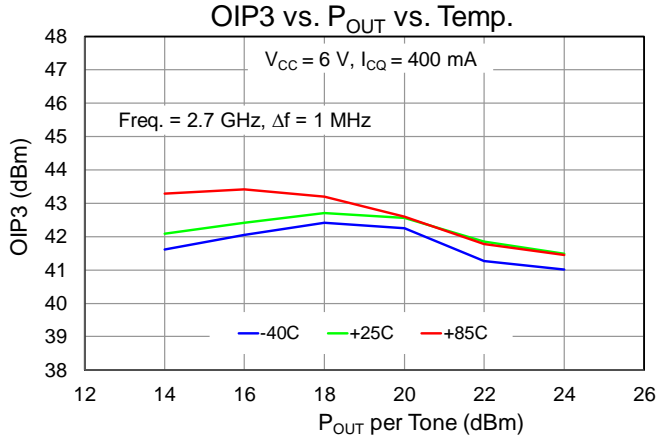
Performance Plots – Large Signal

Test conditions unless otherwise noted: Temp. = 25 °C, V_{CC} = 6 V, I_{CQ} = 400 mA, V_{PD} = 5 V, V_{SW} = 5 V, CW



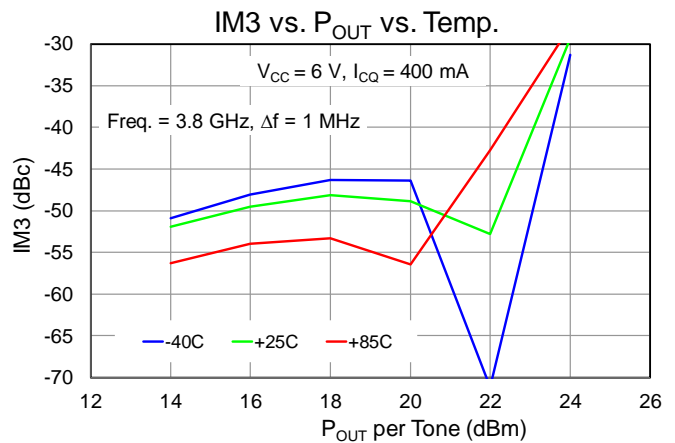
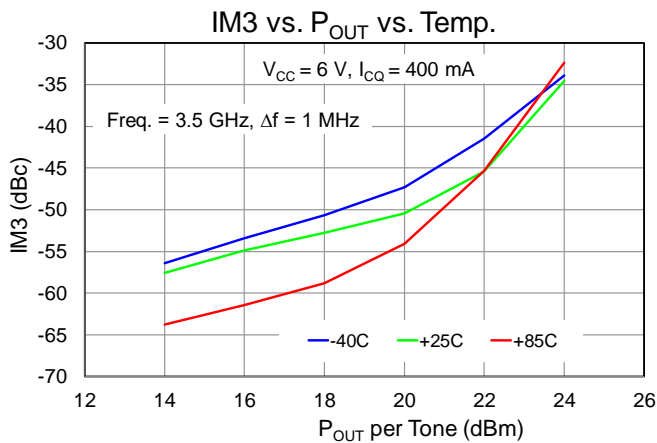
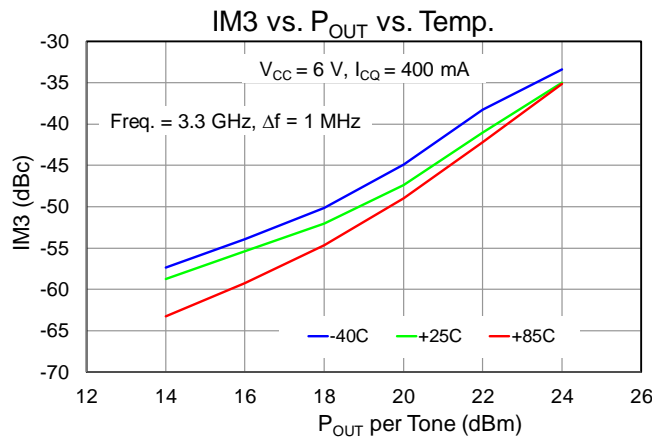
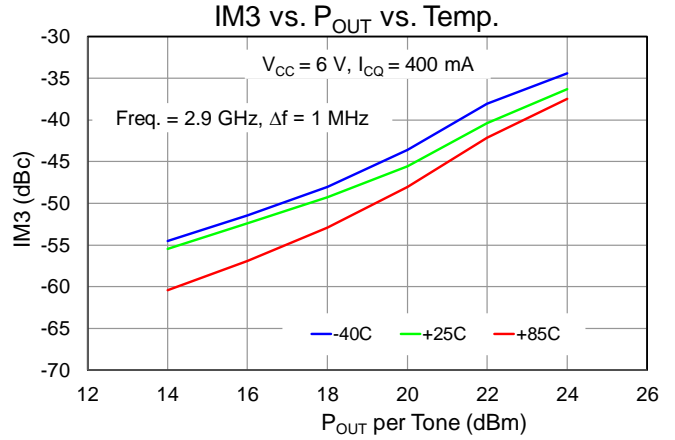
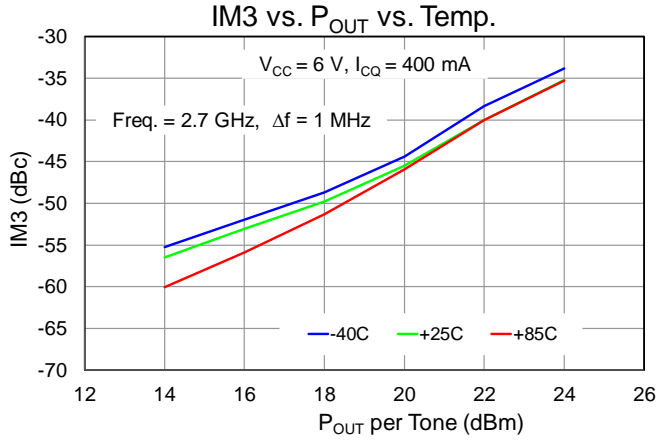
Performance Plots – Linearity

Test conditions unless otherwise noted: Temp. = 25 °C, $V_{CC} = 6\text{ V}$, $I_{CQ} = 400\text{ mA}$, $V_{PD} = 5\text{ V}$, $V_{SW} = 5\text{ V}$, CW



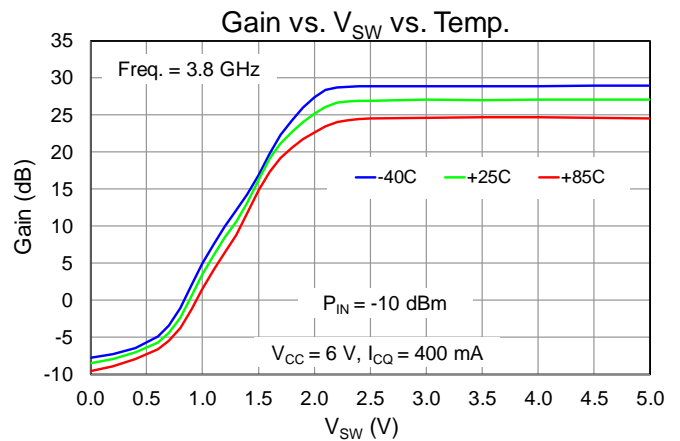
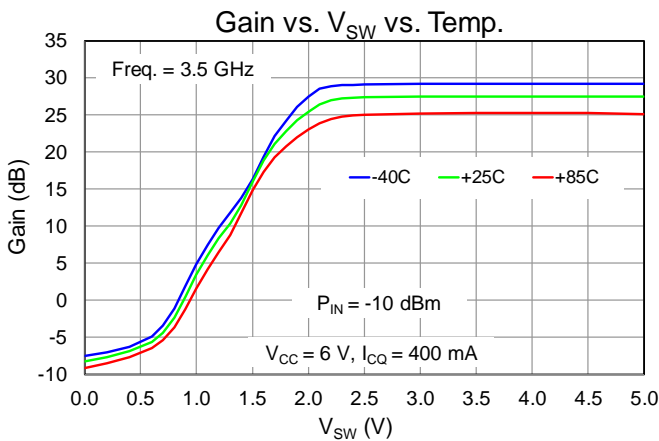
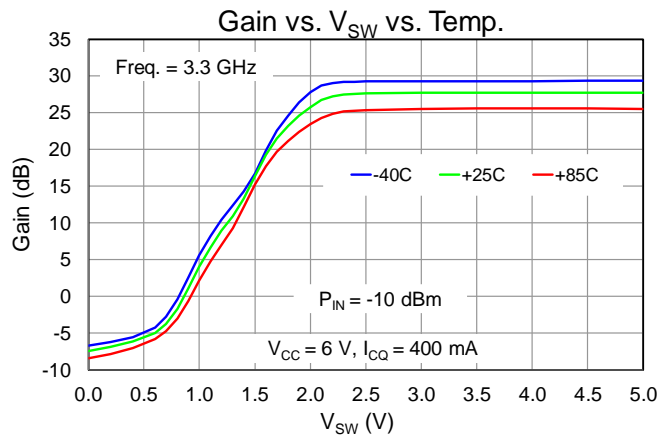
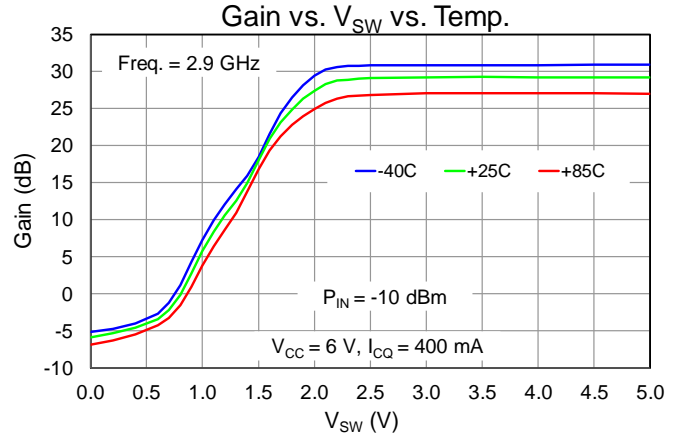
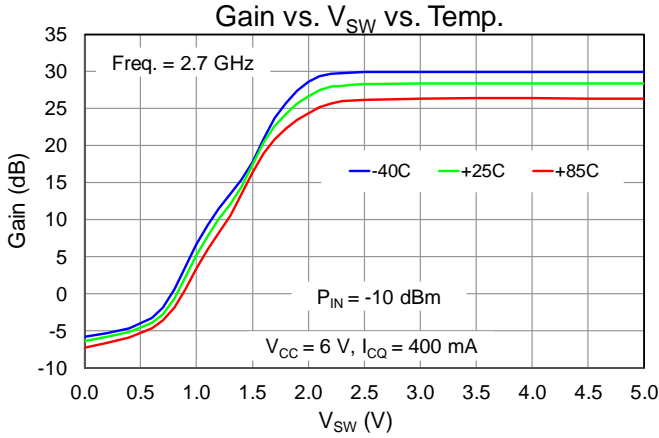
Performance Plots – Linearity

Test conditions unless otherwise noted: Temp. = 25 °C, V_{CC} = 6 V, I_{CQ} = 400 mA, V_{PD} = 5 V, V_{SW} = 5 V, CW



Performance Plots – Attenuation

Test conditions unless otherwise noted: Temp. = 25 °C, V_{CC} = 6 V, I_{CQ} = 400 mA, V_{PD} = 5 V, V_{SW} = 5 V, CW



Thermal and Reliability Information

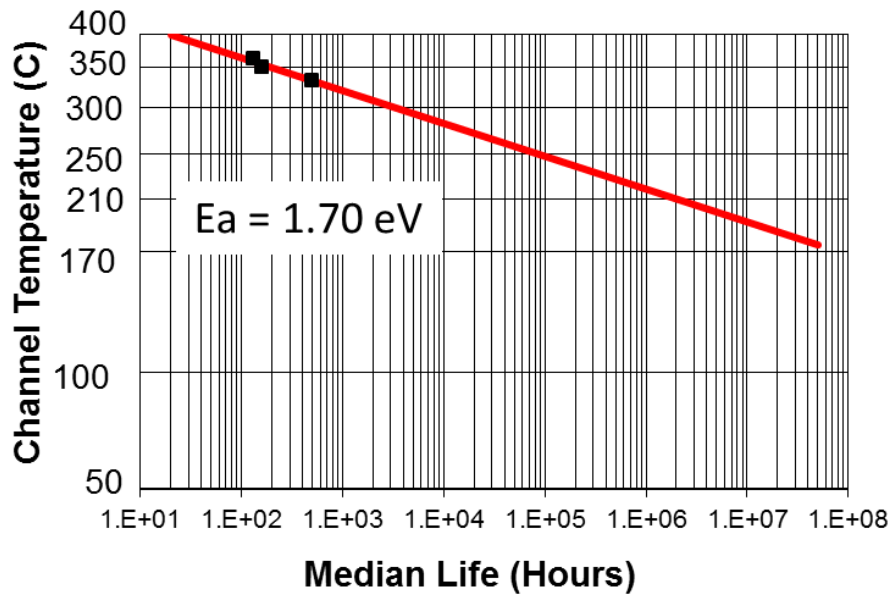
| Parameter | Test Conditions | Value | Units |
|---|---|-------|---------------|
| Thermal Resistance (θ_{JC}) ⁽¹⁾ | $T_{base} = 85^{\circ}C, T_{case} = 94^{\circ}C$ | 29.1 | $^{\circ}C/W$ |
| Channel Temperature (T_{CH}) (Quiescent) | $V_{CC} = 6 V, I_{CQ} = 395 mA,$ | 165 | $^{\circ}C$ |
| Median Lifetime (T_M) | $V_{PD} = 5V I_{PD} = 13 mA P_{DISS} = 2.44 W$ | >8E+7 | Hrs |
| Thermal Resistance (θ_{JC}) ⁽¹⁾ | $T_{base} = 85^{\circ}C, T_{case} = 97^{\circ}C Freq = 3.8 GHz,$ | 26.1 | $^{\circ}C/W$ |
| Channel Temperature (T_{CH}) (Under RF drive) | $V_{CC} = 6 V, I_{CC} = 589 mA,$ | 163 | $^{\circ}C$ |
| Median Lifetime (T_M) | $V_{PD} = 5V I_{PD} = 13 mA$ $P_{IN} = 4 dBm, P_{OUT} = 30.3 dBm, P_{DISS} = 2.53 W$ | >8E+7 | Hrs |

Notes:

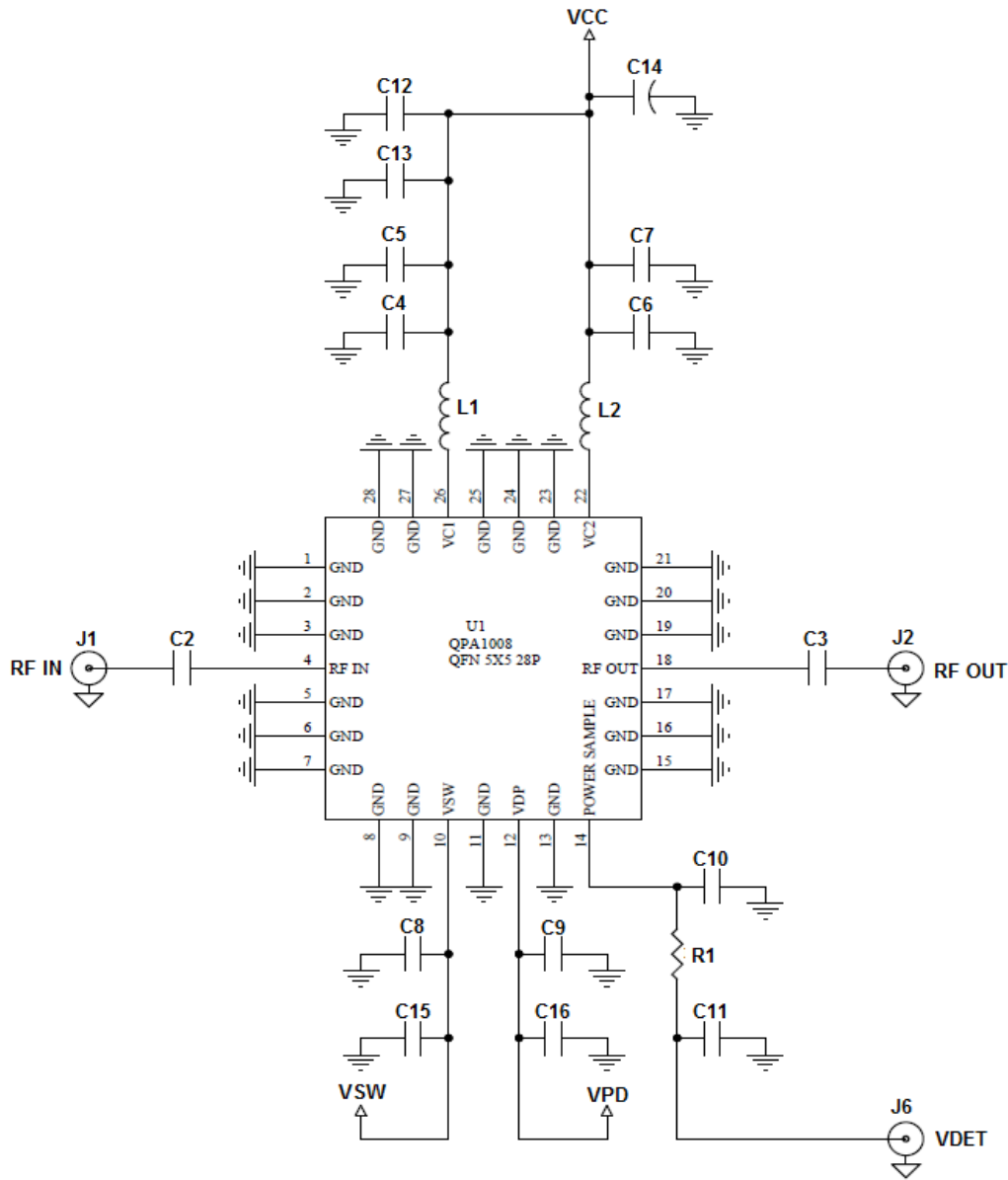
1. Thermal resistance measured to back of EVB.

Median Lifetime

Test Conditions: $V_{CC} = +5 V, J_c = 19.5 kA/cm^2$ Failure Criteria = 20 % change in Beta for HBT Technology



Applications Circuit



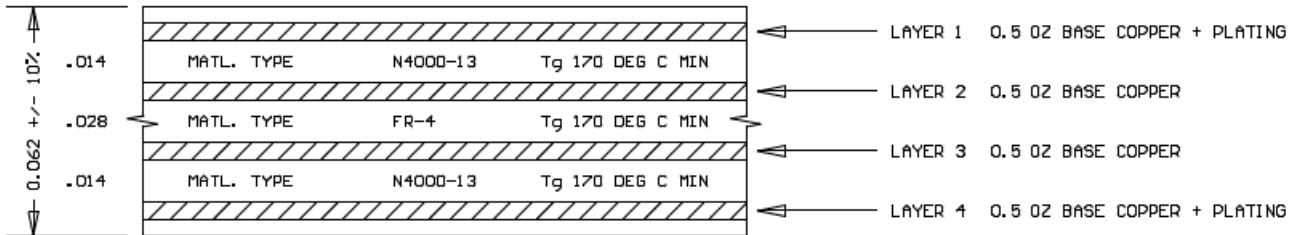
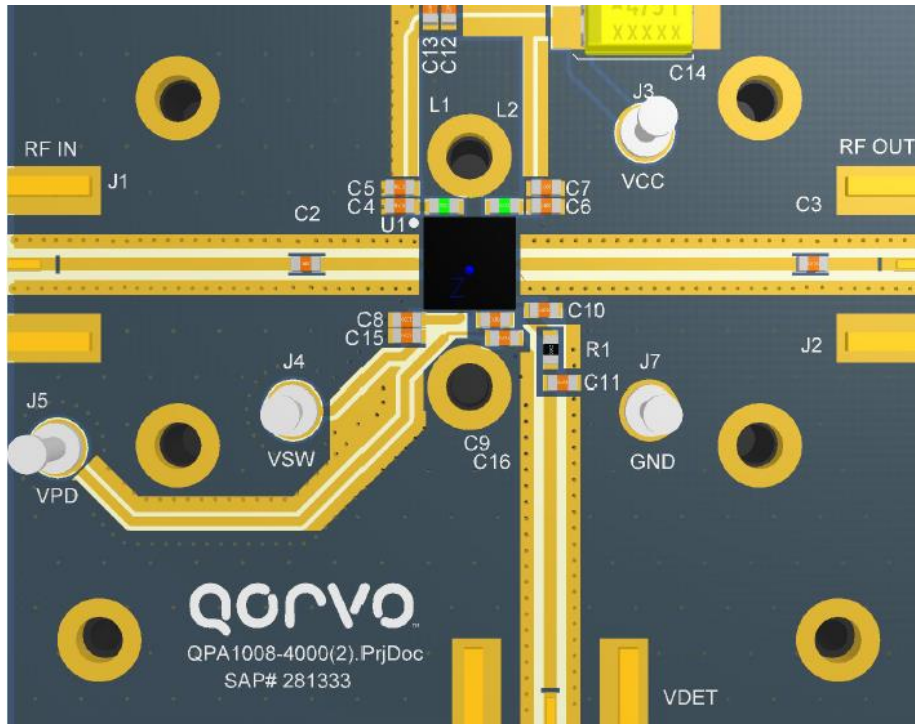
Bias Up Procedure

1. Set Current limits: I_{CC} to 1A, I_{PD} to 20 mA & I_{SW} to 5 mA
2. Set V_{CC} to 6 V; $I_{CQ} \approx 0\text{mA}$
3. Set V_{PD} to 5 V (Switched bias input)
 - $I_{PD} \approx 12\text{ mA}$; $I_{CQ} \approx 400\text{mA}$
4. Apply V_{SW} :
 - $V_{SW} = 0\text{ V}$ (Maximum Attenuation)
 - $V_{SW} = 5\text{ V}$ (Minimum Attenuation)
5. Apply RF signal

Bias Down Procedure

1. RF off signal
2. Turn Off V_{SW}
3. Turn Off V_{PD}
4. Turn Off V_{CC}

Evaluation Board



Qorvo PCB Material and Stack-Up

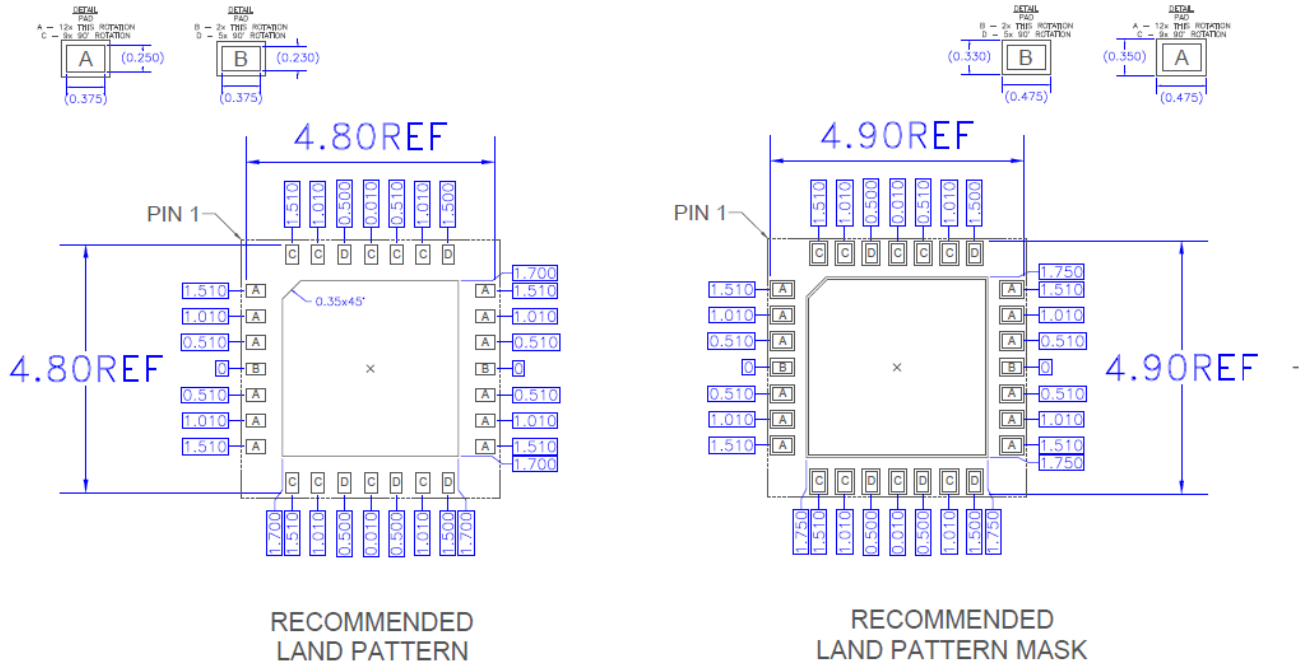
Notes:

If operating near P_{SAT} , 20 dB (>3W) attenuation pad is recommended at the output of the device to protect test equipment.

Bill of Materials

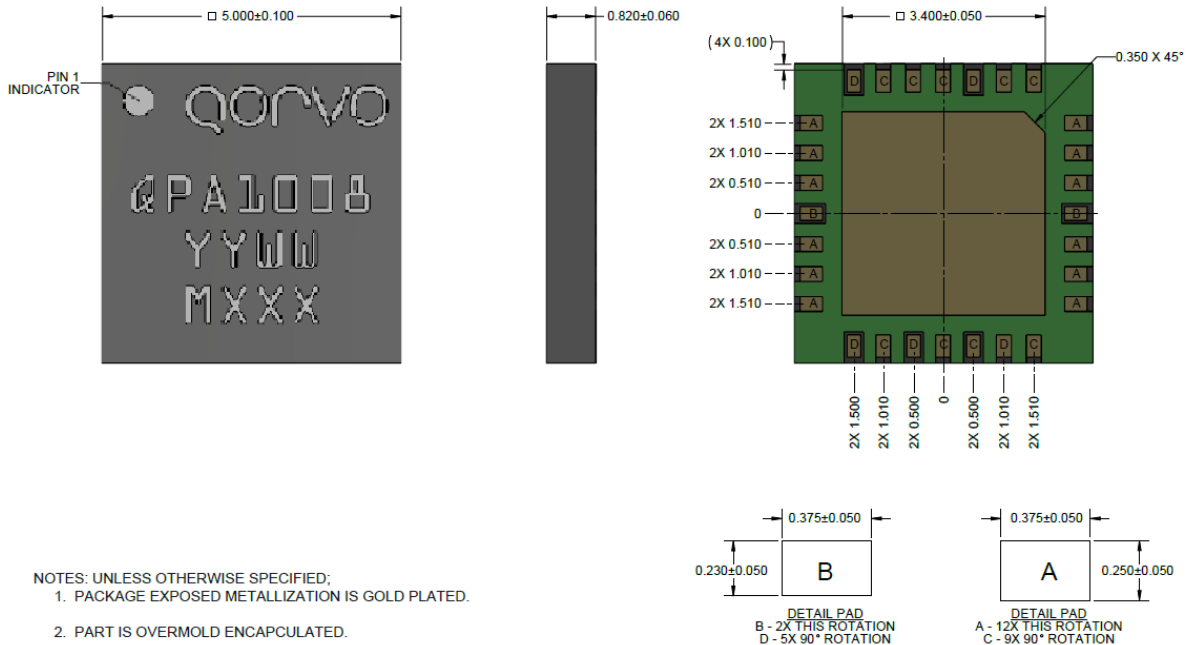
| Ref. Des. | Value | Description | Manufacturer | Part Number |
|-------------------------|---------|--------------------------------|--------------|-------------|
| U1 | | QPA1008 | Various | |
| C2, C3, L1, R1 | 0 Ω | RES, 0603, 1/16 W, Chip | Various | |
| C4, C6, C9 | 100 pF | CAP, 0603, 5%, 50 V | Various | |
| C5, C7, C8 | 1000 pF | CAP, 0603, 5%, 50 V | Various | |
| C10, C11, C12, C15, C16 | N/A | Not used on this EVB | | |
| C13 | 0.1 uF | CAP, 0603, 10%, 50 V, X7R | Various | |
| C14 | 10 uF | CAP, 6032, 20%, 50 V, Tantalum | Various | |
| L2 | 10 nH | IND, 0603 5%, 4800 MHz | Various | |

PCB Mounting Pattern



Recommended PCB land-pad pattern metallization (Top View)

Mechanical Information



Units: millimeters

Tolerances: unless specified

x.xx = ± 0.25

x.xxx = ± 0.100

Materials:

Base: Laminate

All metalized features are gold plated

Marking:

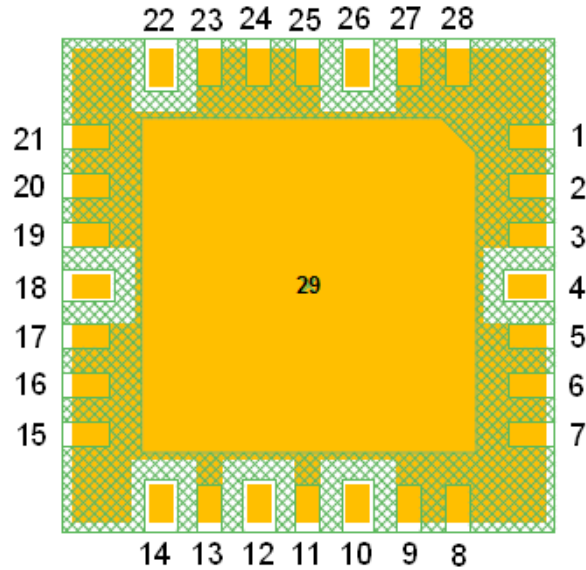
QPA1008: Part number

YY: Part Assembly year

WW: Part Assembly week

MXXX: Batch ID

Pad Description



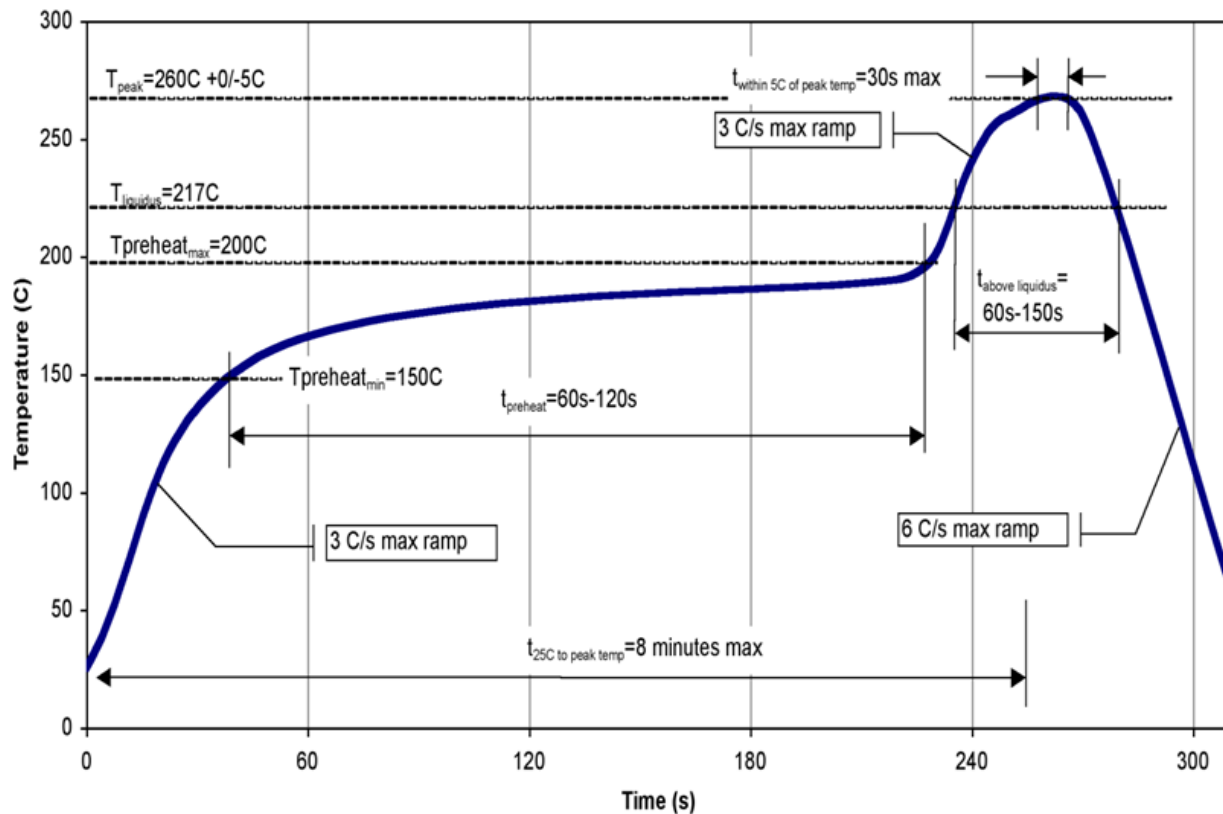
Bottom view of package base

| Pin Number | Label | Description |
|--|------------------|---|
| 1-3, 5-9, 11, 13, 15-17, 19-21, 23-25, 27-28 | No Connect | No internal connection. Pads on PCB should be grounded to improve isolation |
| 4 | RF Input | RF input, matched to 50 Ω, DC blocked |
| 10 | V _{sw} | Attenuator Switch Control |
| 12 | V _{pd} | Bias Switch Control |
| 14 | Power Sample | Power Detector, coupled output power (resistive coupler; approximately 20 dB below output power) |
| 18 | RF Output | RF output, matched to 50 Ω, DC blocked |
| 22 | V _{cc2} | Second stage supply voltage. Bias network required |
| 26 | V _{cc1} | First stage supply voltage. Bias network required |
| 29 | GND | Ground paddle: must be grounded using plated through/copper filled via holes on PCB to improve isolation and for heat sinking |

Solderability

1. Compatible with the latest version of J-STD-020, Lead-free solder, 260° C.
2. Contact plating: Ni-Pd-Au

Recommended Soldering Temperature Profile



Handling Precautions

| Parameter | Rating | Standard |
|----------------------------------|----------|-----------------------|
| ESD – Human Body Model (HBM) | Class 1C | ANSI/ESD/JEDEC JS-001 |
| ESD – Charge Device Model (CDM) | Class C3 | ANSI/ESD/JEDEC JS-002 |
| MSL – Moisture Sensitivity Level | 3 | IPC/JEDEC J-STD-020 |



Caution!
ESD-Sensitive Device

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:

- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS Free

Contact Information

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

Tel: 1-844-890-8163

Web: www.qorvo.com

Email: customer.support@qorvo.com

Important Notice

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