QPA2628D

25 – 31 GHz GaAs Low Noise Amplifier

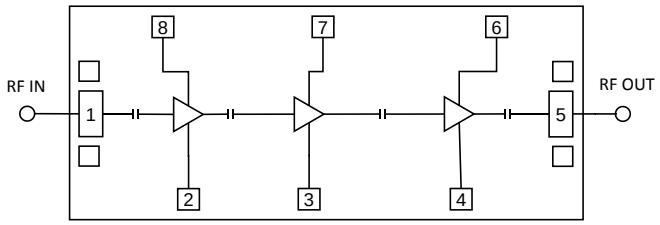
Applications

- Satellite Communications
- Point-to-Point Communications

Product Features

- Frequency Range: 25–31 GHz
- Noise Figure: 1.7 dB (typical)
- Small Signal Gain: 22 dB (typical)
- P1dB: 19 dBm (typical)
- IM3: −53 dBc (Pout=0 dBm/tone) (typical)
- Bias: V_D = 3.5 V, I_{DQ} = 90 mA, V_G = −0.46 V (typical)
- Die Dimensions: 2.40 x 1.00 x 0.10 mm

Functional Block Diagram



General Description

Qorvo's QPA2628D is a high-performance, low noise amplifier fabricated on Qorvo's production 90nm pHEMT (QPHT09) process. Covering 25–31 GHz, the QPA2628D provides 22 dB small signal gain and P1dB of 19 dBm, while supporting a noise figure of 1.7 dB and IM3 levels of −53 dBc (at Pout=0 dBm/tone).

The QPA2628D is in die form, 2.40 x 1.00 x 0.10 mm, with both RF ports matched to 50 ohms and with integrated DC blocking caps on both I/O ports for simple system integration.

The QPA2628D high performance makes it ideal for satellite and point to point communication systems.

Lead-free and RoHS compliant.

Evaluation boards are available upon request.

Pad Configuration

Pad No.	Label
1	RF Input
2	VG1
3	VG2
4	VG3
5	RF Output
6	VD3
7	VD2
8	VD1

Ordering Information

Part	ECCN	Description
QPA2628D	3A001.b.2.d	25 – 31 GHz Low Noise Amplifier

Absolute Maximum Ratings

Parameter	Value
Drain Voltage (V_D)	5.0 V
Drain Current ($I_{D1}/I_{D2}/I_{D3}$)	45/45/160 mA
Gate Voltage Range	0 to −1.5 V
Gate Current ($I_{G1}/I_{G2}/I_{G3}$ at 125 °C)	5.0/5.0/6.6 mA
RF Input Power (50 Ω, 85 °C)	20 dBm
Channel Temperature, T_{CH}	175 °C
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
Drain Voltage	3.5 V
Drain Current (quiescent, I_{DQ})	90 mA
Drain Current (I_D, Low noise / P_{SAT})	90 / 200 mA
Gate Voltage (typical)	−0.46 V
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 = 3.5 V, I_{DQ} = 90 mA. Data de-embedded to MMIC bondwires.

Parameter	Min	Typical	Max	Units
Frequency	25		31	GHz
Small Signal Gain		22		dB
Noise Figure		1.7		dB
1-dB Compression Point		19		dBm
Input Return Loss		8		dB
Output Return Loss		14		dB
3RD Order Intermodulation level (Pout=0 dBm/tone)		−53		dBc
Output TOI (Pout=0 dBm/tone)		27		dBm
Gain Temperature Coefficient		−0.013		dBm/°C

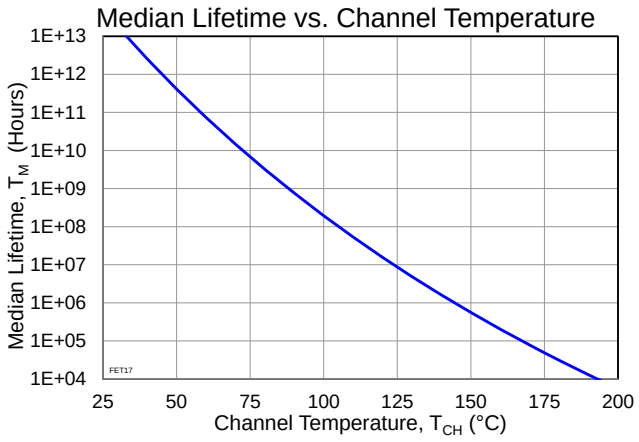
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85°C, V_D = 3.5 V, I_{DQ} = 90 mA Quiescent/Small Signal operation P_{DISS} = 0.315 W	65.1	°C/W
Channel Temperature (T_{CH})		105.5	°C
Median Lifetime (T_M)		1.236E08	Hrs

Notes:
1. Thermal resistance is measured to back of the MMIC carrier plate..

Median Lifetime

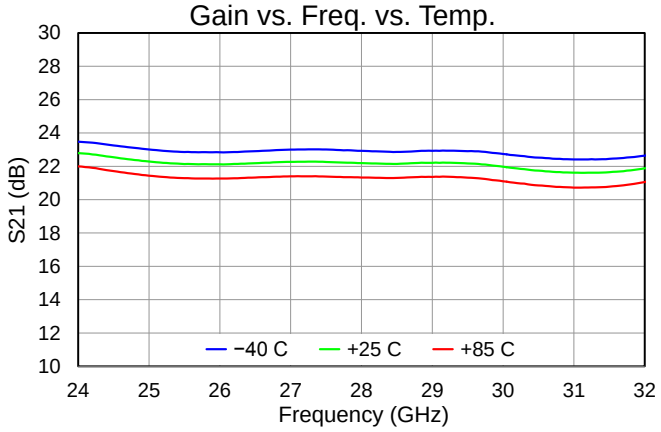
Test Conditions: V_D = 4 V
Failure Criteria = 10% reduction in I_{D_MAX}



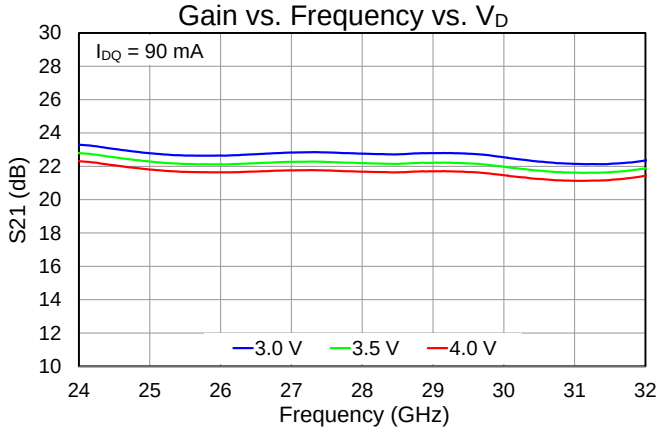
Typical Performance: Small Signal

Test conditions unless otherwise noted: Temp. = 25 °C, V_D = 3.5 V, I_{DQ} = 90 mA. Data de-embedded to MMIC bondwires.

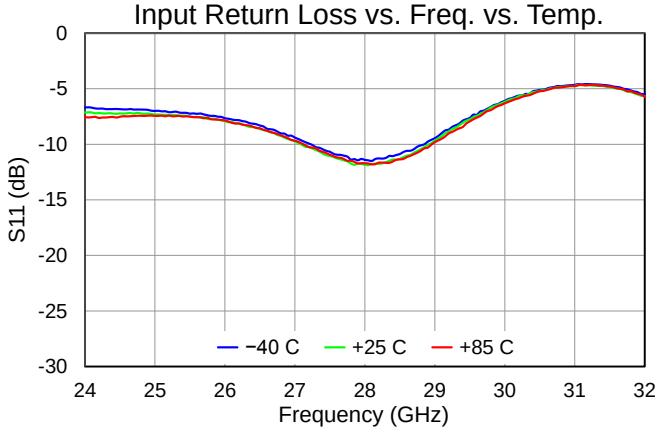
Gain vs. Freq. vs. Temp.



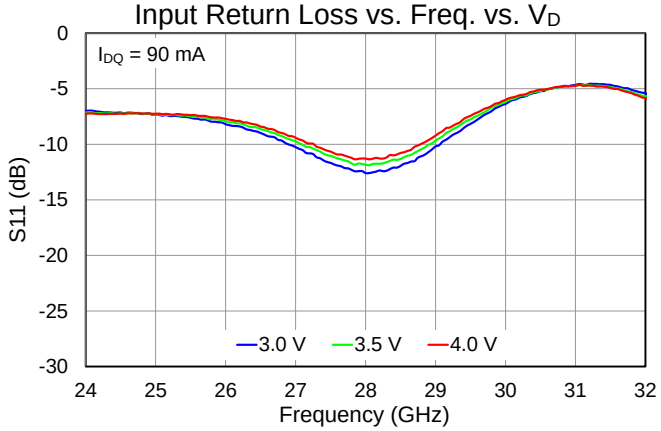
Gain vs. Frequency vs. V_D



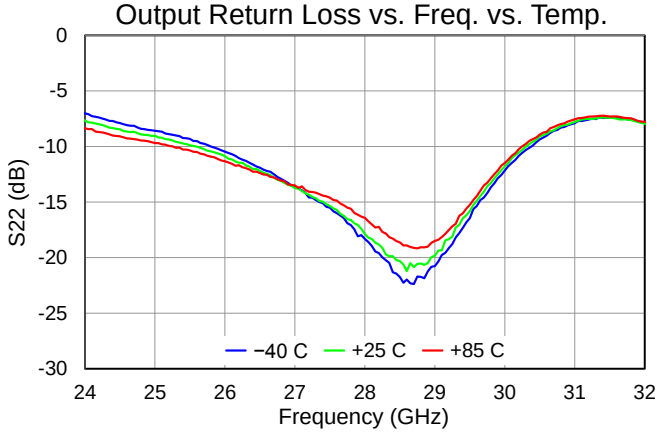
Input Return Loss vs. Freq. vs. Temp.



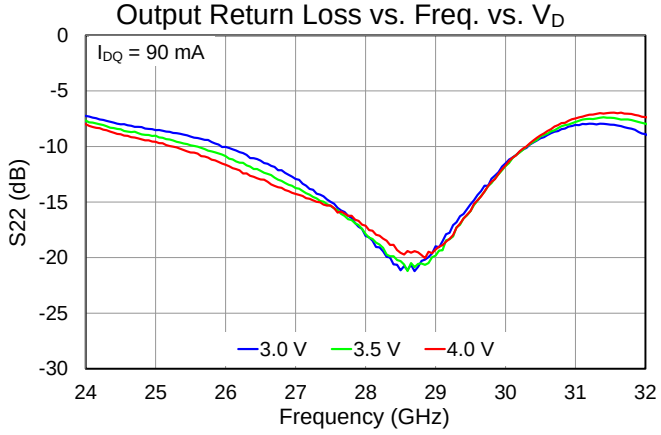
Input Return Loss vs. Freq. vs. V_D



Output Return Loss vs. Freq. vs. Temp.



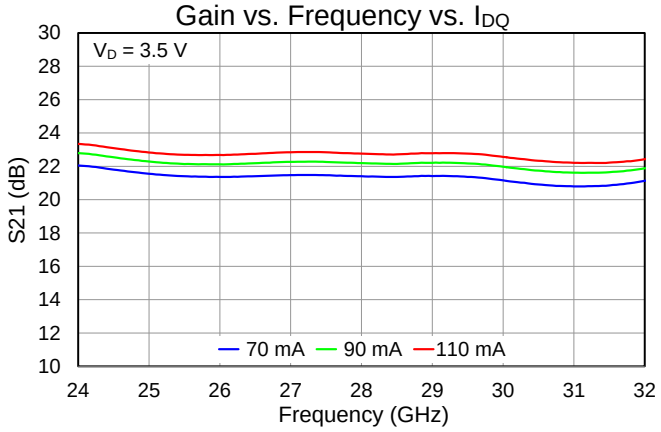
Output Return Loss vs. Freq. vs. V_D



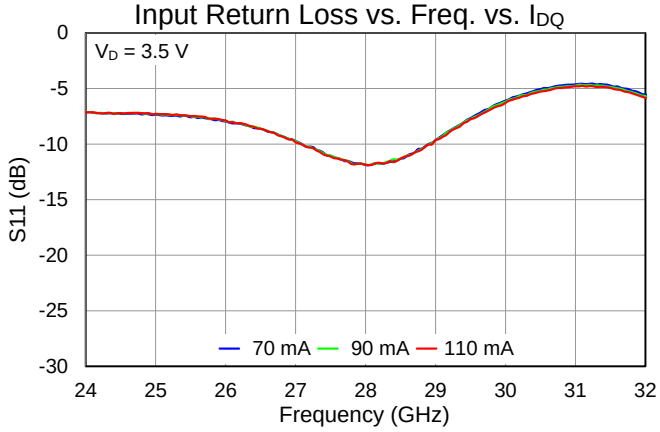
Typical Performance: Small Signal

Test conditions unless otherwise noted: Temp. = 25 °C, V_D = 3.5 V, I_{DQ} = 90 mA. Data de-embedded to MMIC bondwires.

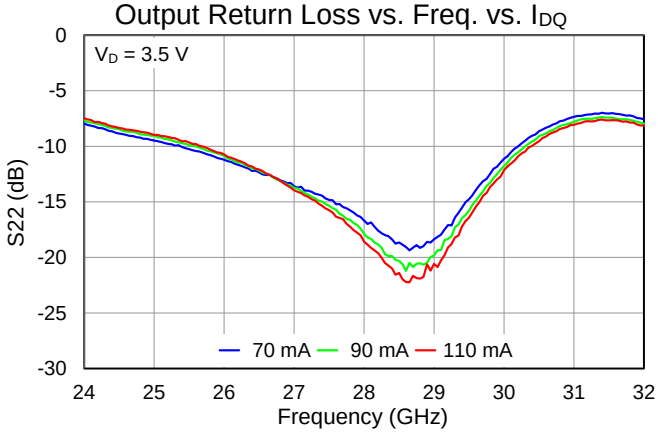
Gain vs. Frequency vs. I_{DQ}



Input Return Loss vs. Freq. vs. I_{DQ}

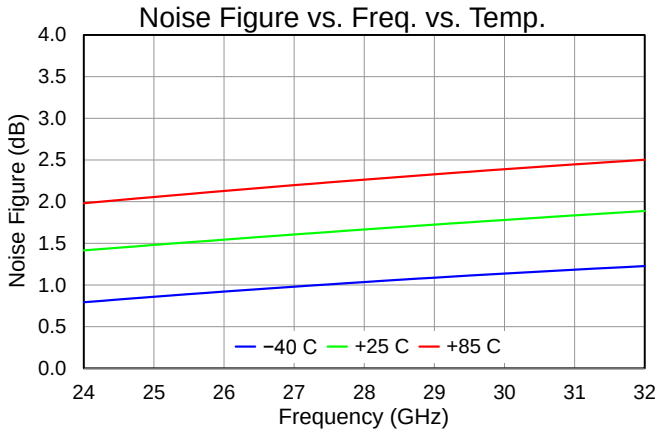


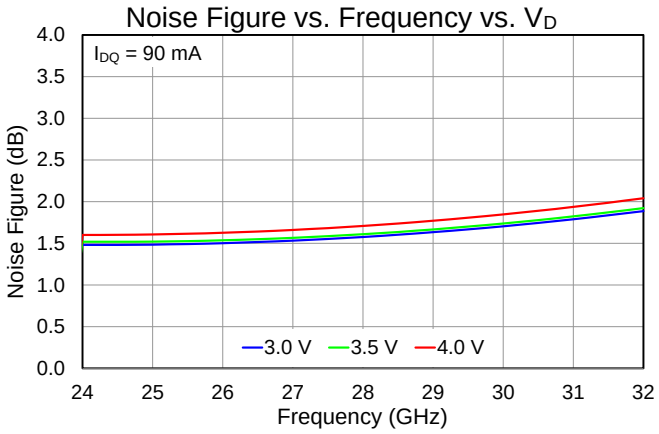
Output Return Loss vs. Freq. vs. I_{DQ}

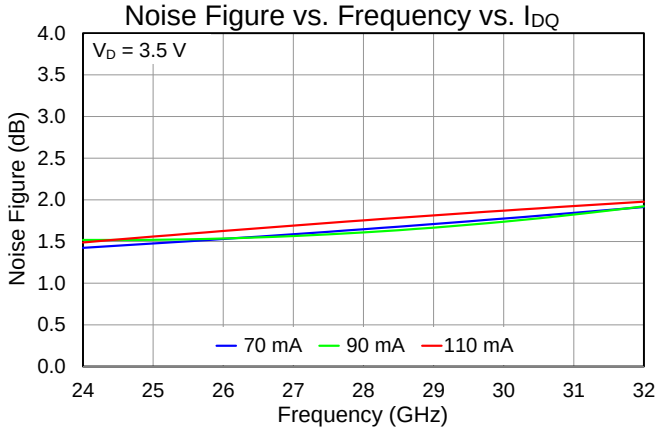


Typical Performance: Noise Figure

Test conditions unless otherwise noted: Temp. = 25 °C, V_D = 3.5 V, I_{DQ} = 90 mA. Data de-embedded to MMIC bondwires.



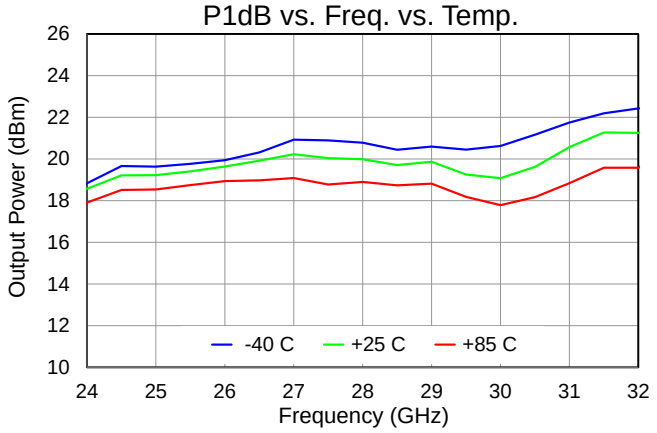




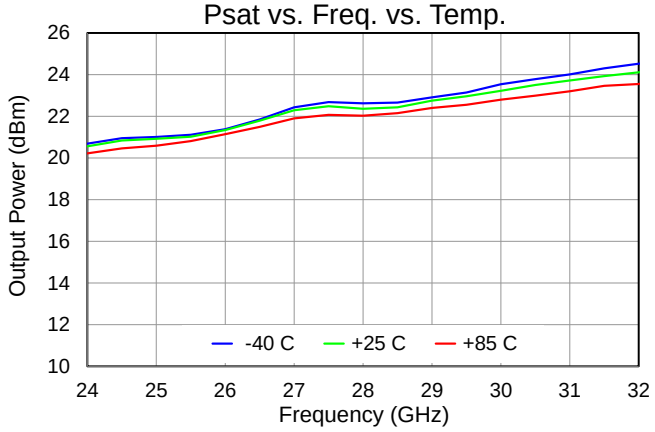
Typical Performance: Large Signal

Test conditions unless otherwise noted: Temp. = 25 °C, V_D = 3.5 V, I_{DQ} = 90 mA. Data de-embedded to MMIC bondwires.

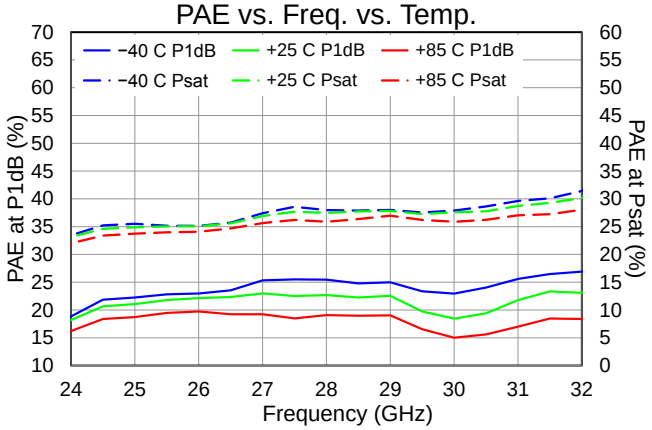
P1dB vs. Freq. vs. Temp.



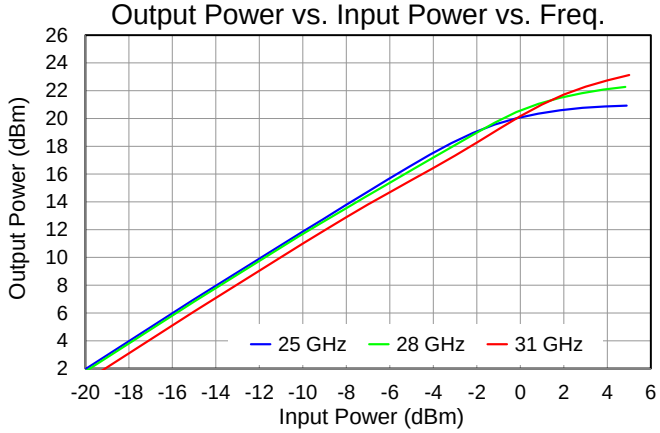
Psat vs. Freq. vs. Temp.



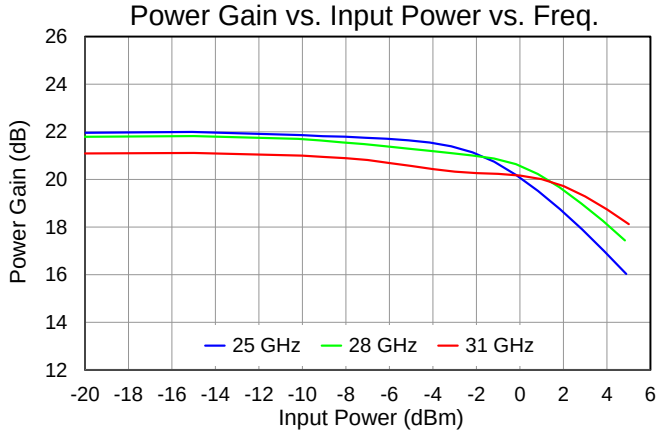
PAE vs. Freq. vs. Temp.



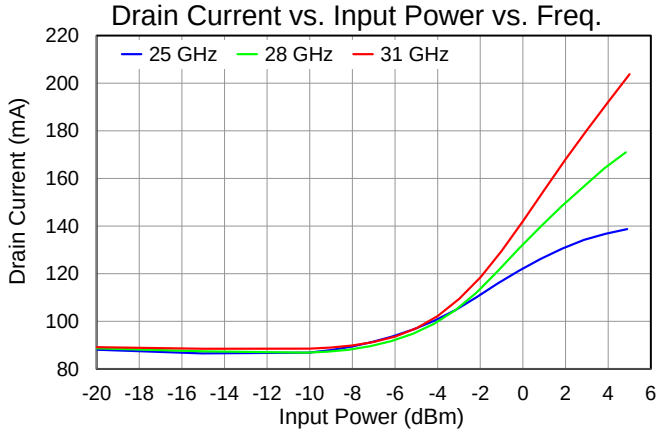
Output Power vs. Input Power vs. Freq.



Power Gain vs. Input Power vs. Freq.



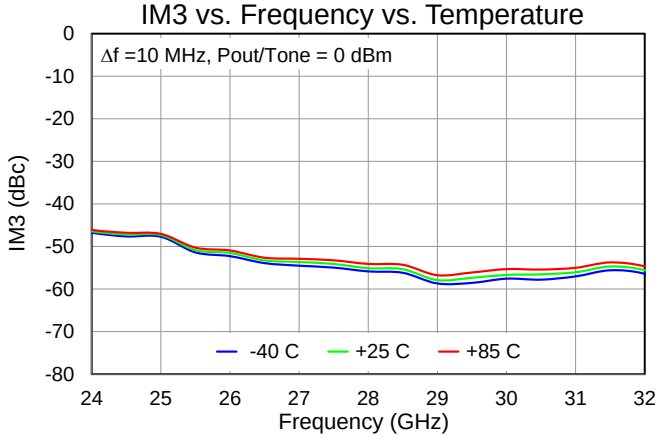
Drain Current vs. Input Power vs. Freq.



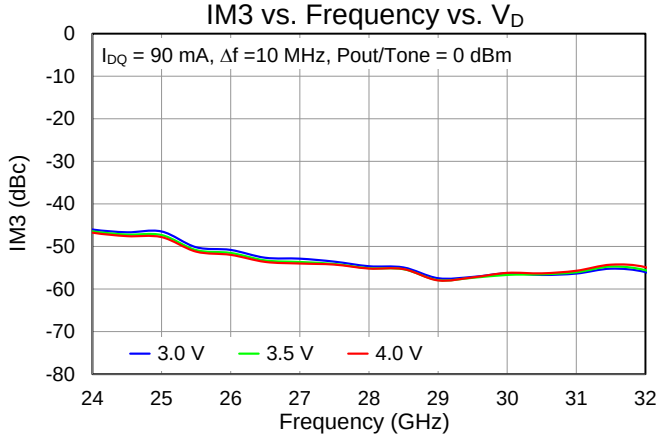
Typical Performance: Linearity

Test conditions unless otherwise noted: Temp. = 25 °C, V_D = 3.5 V, I_{DQ} = 90 mA. Data de-embedded to MMIC bondwires.

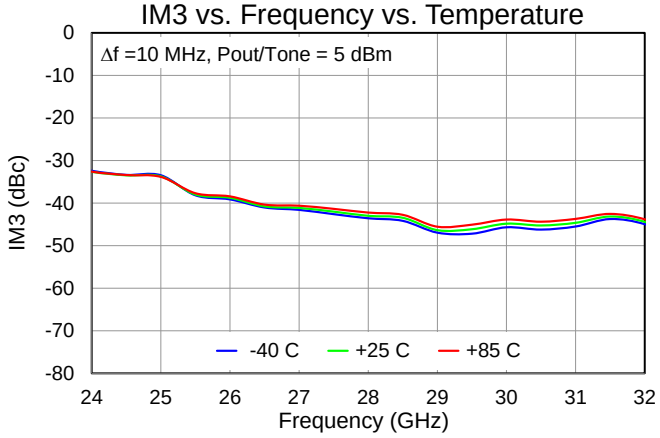
IM3 vs. Frequency vs. Temperature



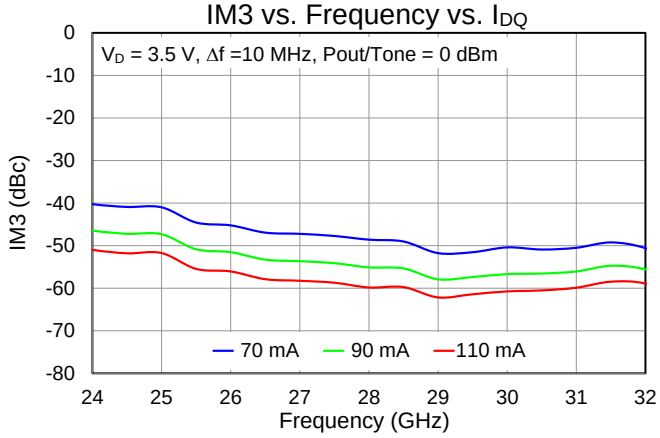
IM3 vs. Frequency vs. V_D



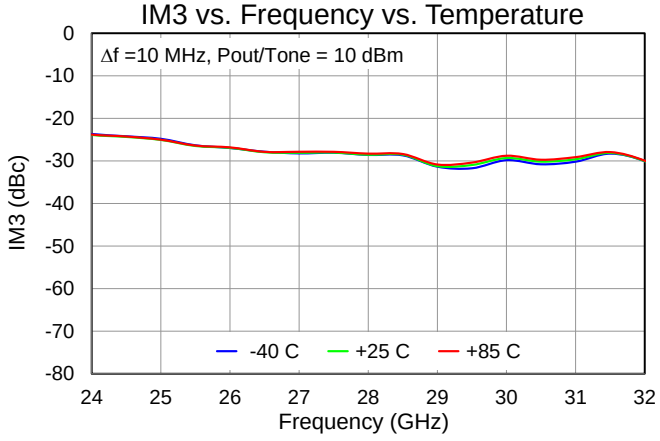
IM3 vs. Frequency vs. Temperature



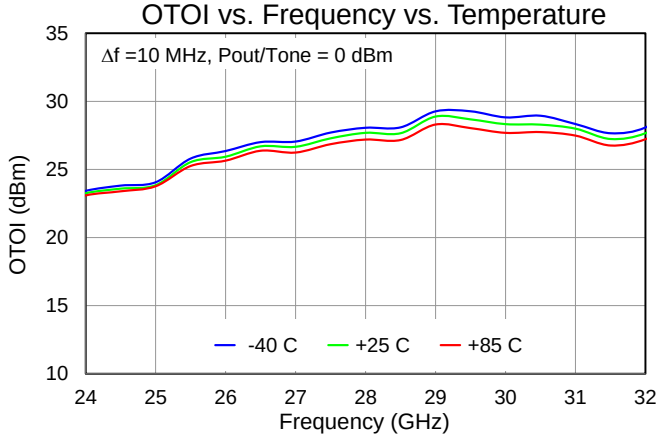
IM3 vs. Frequency vs. I_{DQ}



IM3 vs. Frequency vs. Temperature



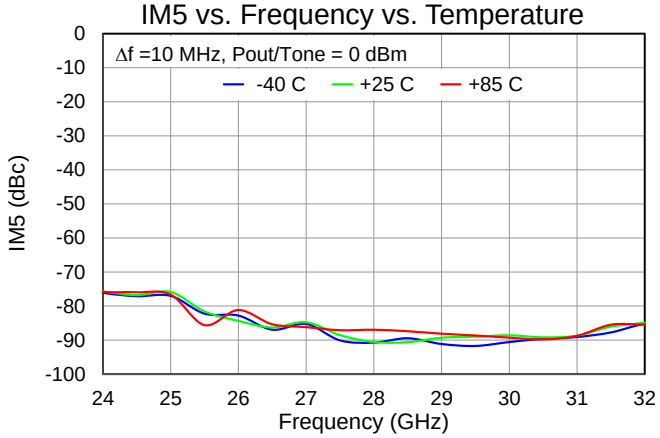
OTOI vs. Frequency vs. Temperature



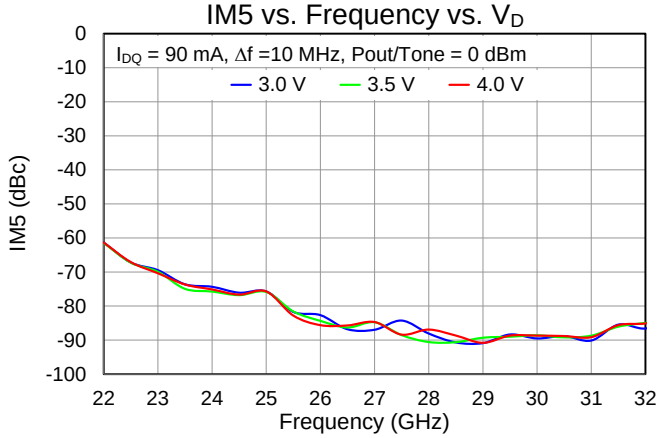
Typical Performance: Linearity

Test conditions unless otherwise noted: Temp. = 25 °C, V_D = 3.5 V, I_{DQ} = 90 mA. Data de-embedded to MMIC bondwires.

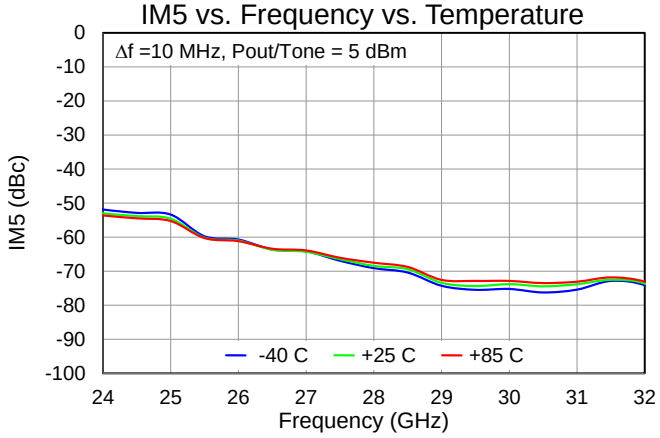
IM5 vs. Frequency vs. Temperature



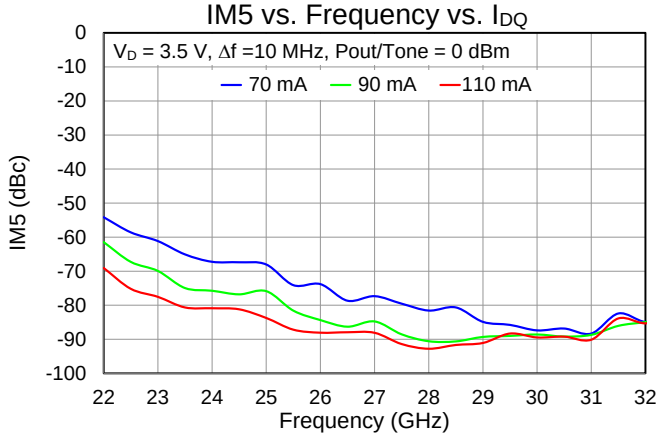
IM5 vs. Frequency vs. V_D



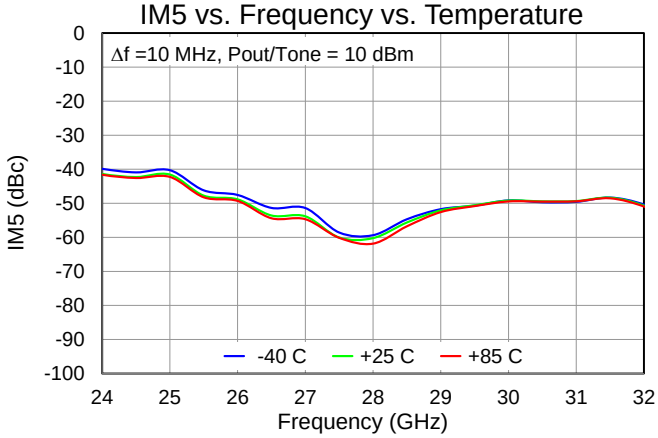
IM5 vs. Frequency vs. Temperature



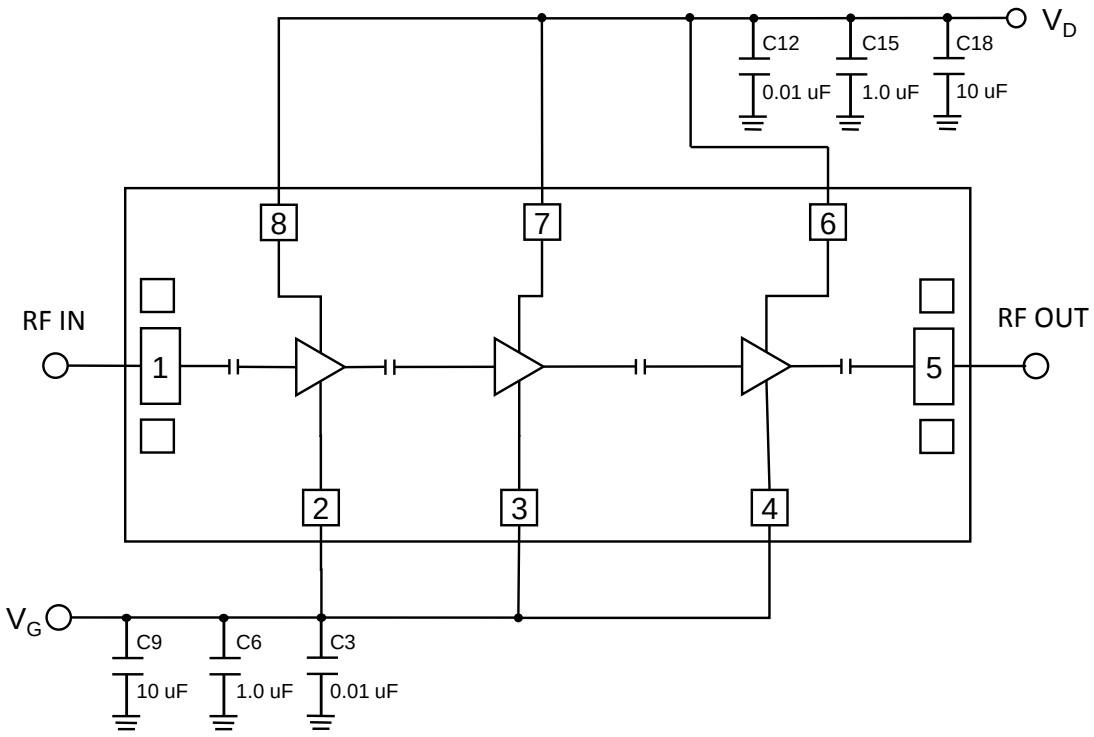
IM5 vs. Frequency vs. I_{DQ}



IM5 vs. Frequency vs. Temperature



Application Circuit



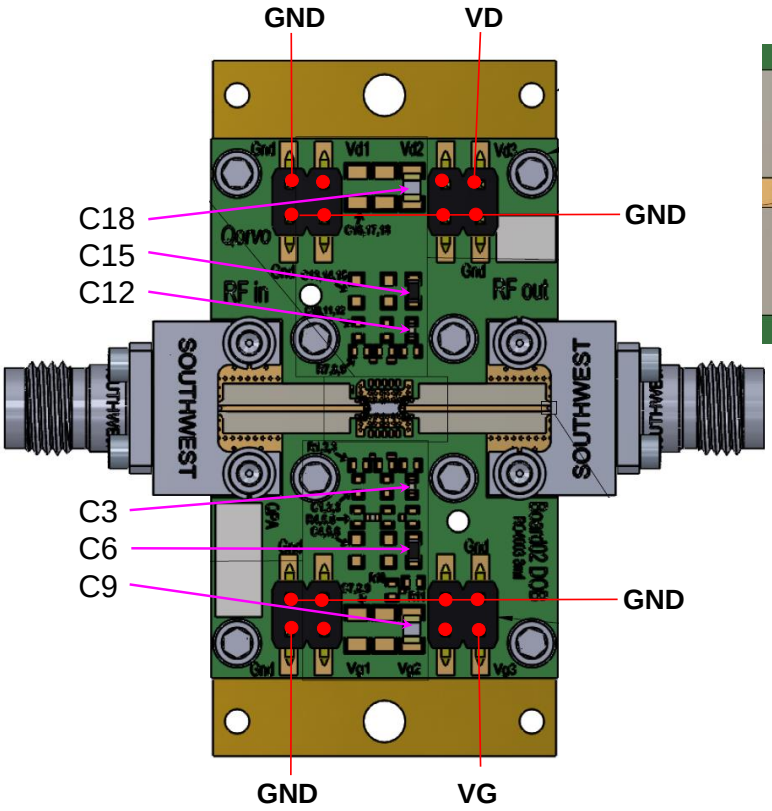
Bias-up Procedure

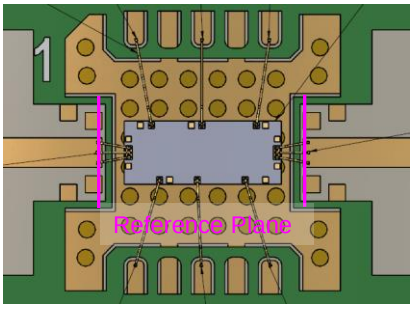
1. Set I_D limit to 220 mA, I_G limit to 10 mA
2. Set V_G to −1.5 V
3. Set V_D +3.5 V
4. Adjust V_G more positive until I_{DQ} = 90mA (V_G ~ −0.46 V Typical)
5. Apply RF signal

Bias-down Procedure

1. Turn off RF signal
2. Reduce V_G to −1.5 V. Ensure I_{DQ} ~ 0mA
3. Set V_D to 0V
4. Turn off V_D supply
5. Turn off V_G supply

Evaluation Board and Mounting Detail





Mounting pad detail

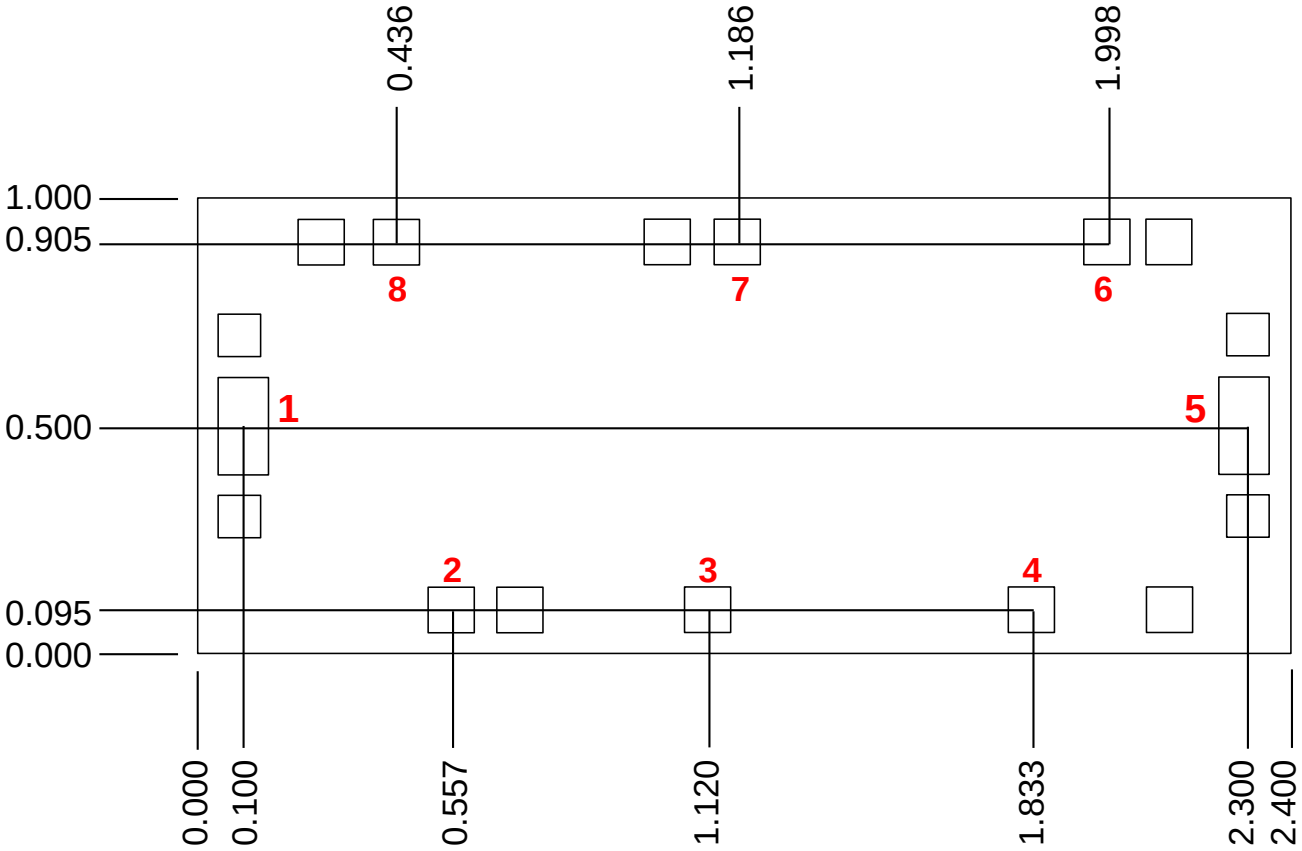
RF Layer is 0.008" thick Rogers Corp. RO4003C (ε_r = 3.35). Metal layers are 0.5 oz. copper. The microstrip line at the connector interface is optimized for the Southwest Microwave end launch connector 1492-04A-5.

All data de-embedded to the MMIC bondwires (shown).

Note: Multiple vias should be employed under die to minimize inductance and thermal resistance.

Ref. Des.	Component	Value	Manuf.	Part Number
C3, C12	Surface Mount Cap.	CAP 0.01UF +/-10% 50V 0402 X7R ROHS	Various	
C6, C15	Surface Mount Cap.	CAP 1.0UF +/-10% 16V 0603 X7R ROHS	Various	
C9, C18	Surface Mount Cap.	CAP CER 10UF 10V X7R 10% 0805 TDK ROHS	Various	

Mechanical Drawing & Bond Pad Description



Dimensions are in millimeters.

Pin Number	Label	Description
1	RF Input	Matched to 50 ohms, DC blocked
2	VG1	Gate Voltage; bias network is required (V_G can be tied together at PCB)
3	VG2	Gate Voltage; bias network is required (V_G can be tied together at PCB)
4	VG3	Gate Voltage; bias network is required (V_G can be tied together at PCB)
5	RF Output	Matched to 50 ohms, DC blocked
6	VD3	Drain Voltage; bias network is required (V_D can be tied together at PCB)
7	VD2	Drain Voltage; bias network is required (V_D can be tied together at PCB)
8	VD1	Drain Voltage; bias network is required (V_D can be tied together at PCB)

Assembly Notes

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment (i.e., conductive epoxy) can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300°C to 3-4 minutes, maximum.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonics are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.

Product Compliance Information

ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: TBD
Value: TBD
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

ECCN

US Department of Commerce: 3A001.b.2.d

Solderability

Use only AuSn (80/20) solder and limit exposure to temperatures above 300 °C to 3-4 minutes, maximum.

Conductive epoxy die attach is recommended for PCBs.

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

Contact Information

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

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Email: info-sales@triquint.com **Fax:** +1.972.994.8504

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

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