QPA2308

5 – 6 GHz 60 Watt GaN Power Amplifier

Product Overview

Qorvo's QPA2308 is a MMIC power amplifier fabricated on Qorvo's production 0.25 um GaN on SiC process (QGaN25). Operating from 5.0 – 6.0 GHz, the QPA2308 produces greater than 60 W of saturated output power and greater than 21 dB of large-signal gain while achieving greater than 47% power-added efficiency.

The QPA2308 is offered in a 10-lead 0.6 x 0.6 in bolt-down package. Assembled with a pure-copper base, coupled with its high efficiency, the QPA2308 minimizes the strain on the system-level cooling requirements, further reducing system operating costs. The QPA2308's performance makes it well suited for both commercial and military applications

Both RF ports are fully matched to 50 ohms with integrated DC blocking capacitors thereby simplifying system integration.

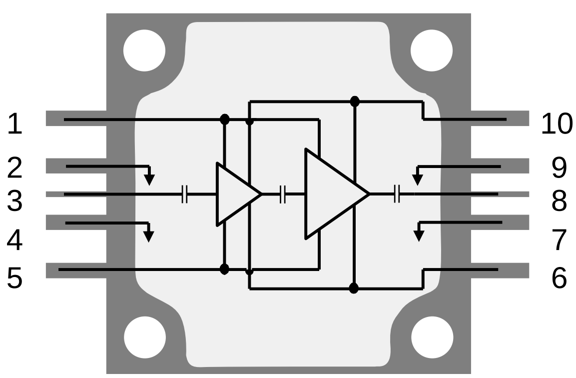
Lead-free and RoHS compliant.

Key Features

- Frequency Range: 5.0 – 6.0 GHz
- P_{SAT} (P_{IN}=26 dBm): 48 dBm
- PAE (P_{IN}=26 dBm): 47 %
- Power Gain (P_{IN}=26 dBm): 22 dB
- Small Signal Gain: > 30 dB
- Bias (pulsed): V_D = 28 V, I_{DQ} = 1200 mA
- Package Dimensions: 0.6 x 0.6 x 0.138 in.
- Package base is pure Cu offering superior thermal management.

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

Functional Block Diagram



Applications

- C-Band Radar
- Satellite Communications

Ordering Information

Part No.	Description
QPA2308	5-6 GHz 60 Watt GaN Power Amplifier
QPA2308S2	Samples (2 pcs.)
QPA2308EVB1	Evaluation Board for QPA2308

Absolute Maximum Ratings

Parameter	Value / Rang
Drain Voltage (V_D)	40 V
Gate Voltage Range (V_G)	−8 V to +1 V
Drain Current (I_D)	7600 mA
Gate Current (I_G)	See plot pg.12
Power Dissipation (P_{DISS}), 50 Ω, Pulsed, 85 °C	169 W
Input Power (P_{IN}), 50 Ω, Pulsed, V_D=28 V, I_{DQ}=1.2 A, 85 °C	32 dBm
Input Power (P_{IN}), 3.5:1 VSWR, Pulsed, V_D=28 V, I_{DQ}=1.2 A, 85 °C	32 dBm
Soldering Temperature (30 seconds, maximum)	320 °C
Storage Temperature	−55 to +125 °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)	28 V
Drain Current (I_{DQ})	1200 mA
Operating Temperature	−40 to +85 °C

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

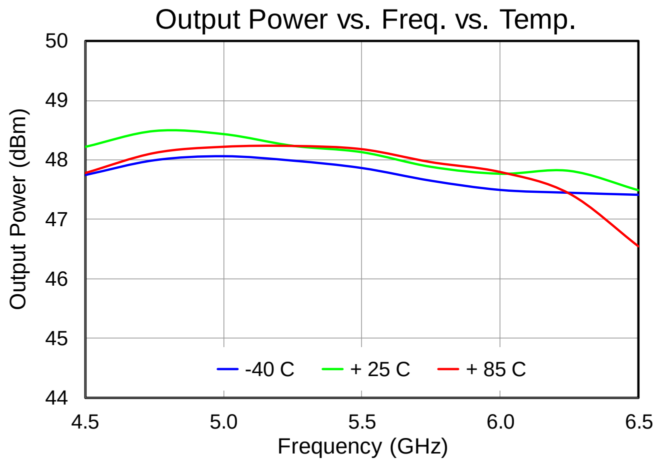
Electrical Specifications

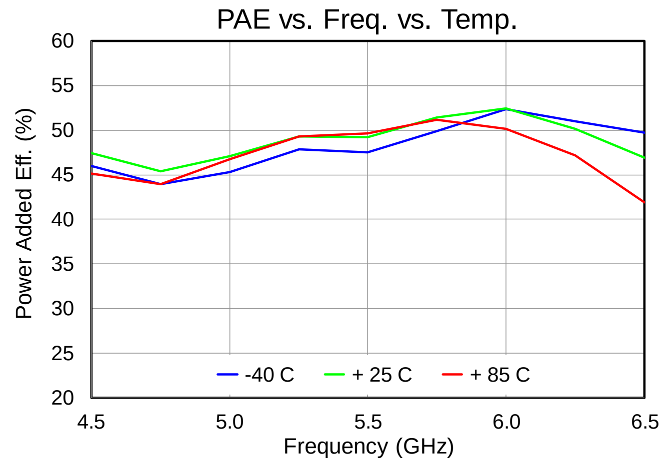
Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency		5		6	GHz
Output Power (P_{IN}=26 dBm)	Freq. = 5.0 GHz	46.5	48.4		dBm
	Freq. = 5.5 GHz	46.5	48.1		
	Freq. = 6.0 GHz	46.5	47.7		
Power Added Efficiency (P_{IN}=26 dBm)	Freq. = 5.0 GHz		47.0		%
	Freq. = 5.5 GHz		49.2		
	Freq. = 6.0 GHz		52.4		
Small Signal Gain	Freq. = 5.0 GHz		31.5		dB
	Freq. = 5.5 GHz		32.4		
	Freq. = 6.0GHz		30.5		
Input Return Loss	Freq. = 5.0 GHz		23		dB
	Freq. = 5.5 GHz		14		
	Freq. = 6.0 GHz		14		
Output Return Loss	Freq. = 5.0 GHz		13		dB
	Freq. = 5.5 GHz		13		
	Freq. = 6.0 GHz		13		
Second Harmonic (P_{OUT} = 45 dBm)	Freq. = 5.5 GHz		−38		dBc
Third Harmonic (P_{OUT} = 45 dBm)	Freq. = 5.5 GHz		−60		dBc
P_{OUT} Temp. Coefficient. (P_{IN} = 26 dBm)	Temp.: +25 ºC to +85 ºC		−0.0001		dB/ºC
Sm. Sig. Gain Temp. Coefficient	Temp.: -40 ºC to +85 ºC		−0.047		dB/ºC

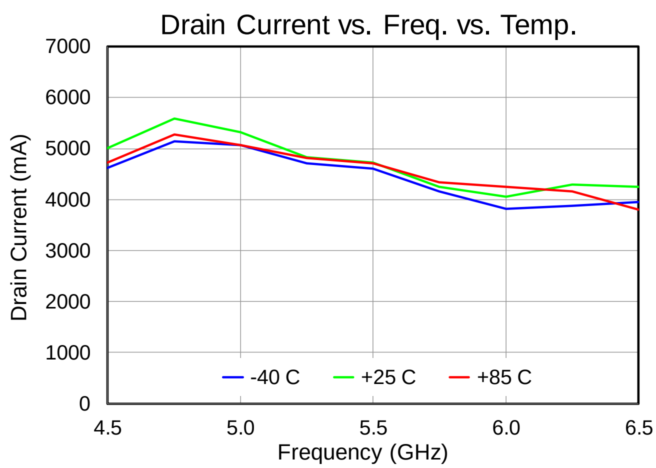
Test conditions, unless otherwise noted: T = 25 ºC, V_D = 28 V, I_{DQ} = 1200 mA, PW = 600 us, Duty Cycle = 20%

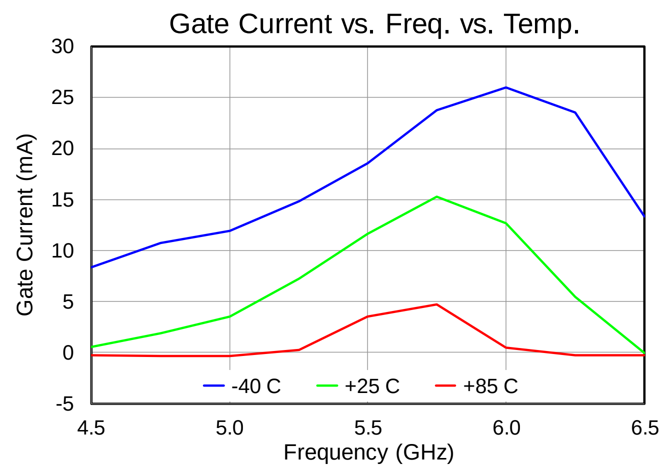
Performance Plots – Large Signal

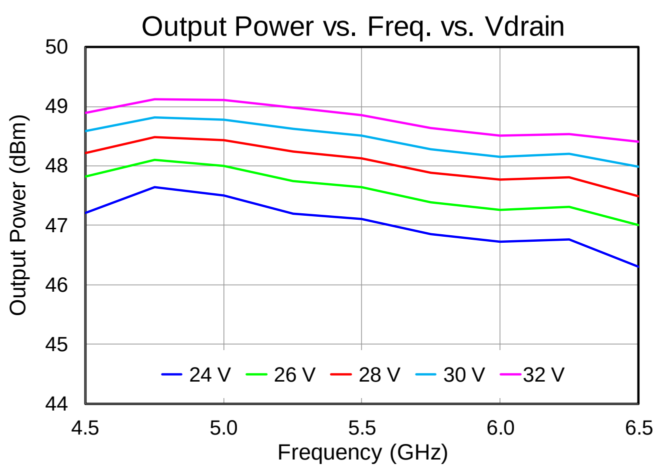
Test conditions, unless otherwise noted: V_D = 28 V, I_{DQ} = 1200 mA, T=+25 °C, P_{IN} = 26 dBm, PW = 600 us, Duty Cycle = 20%

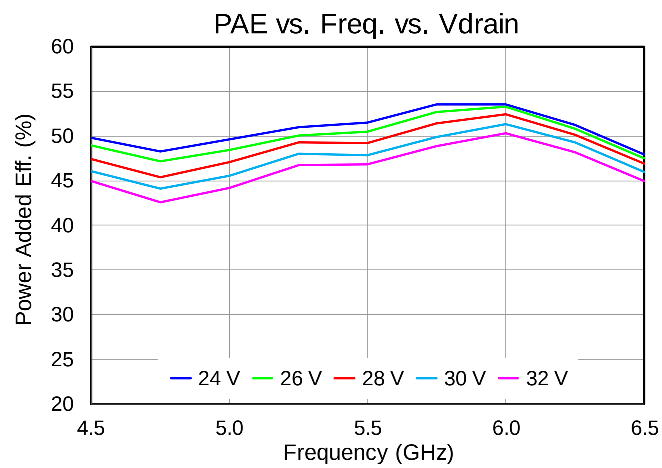












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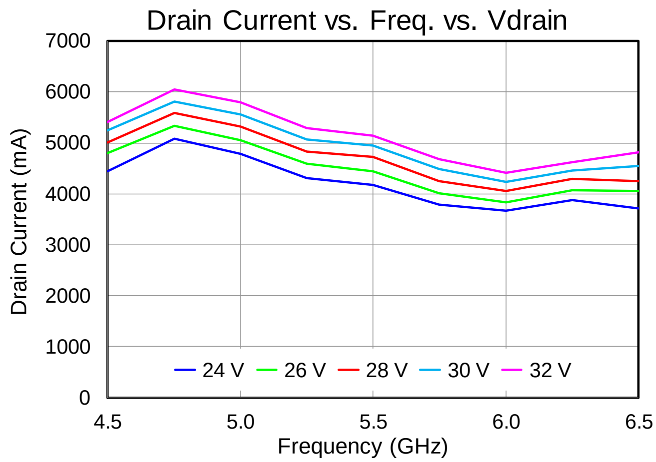
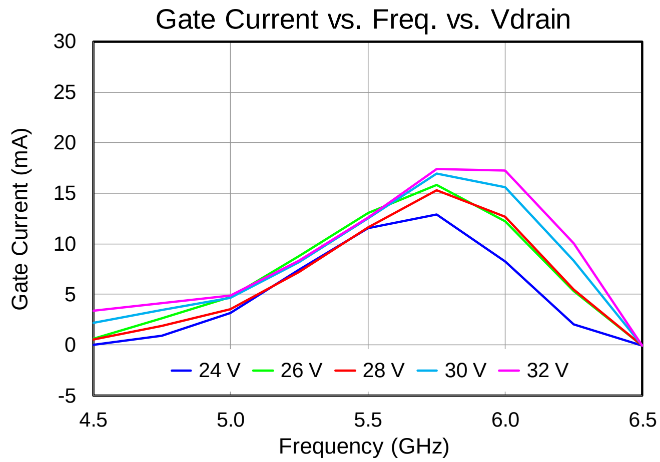
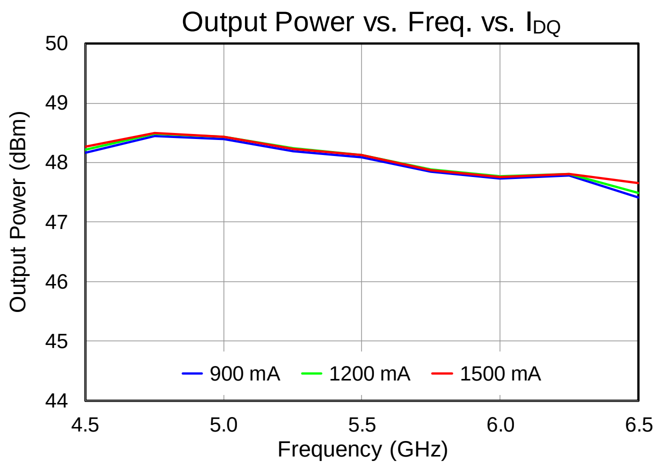
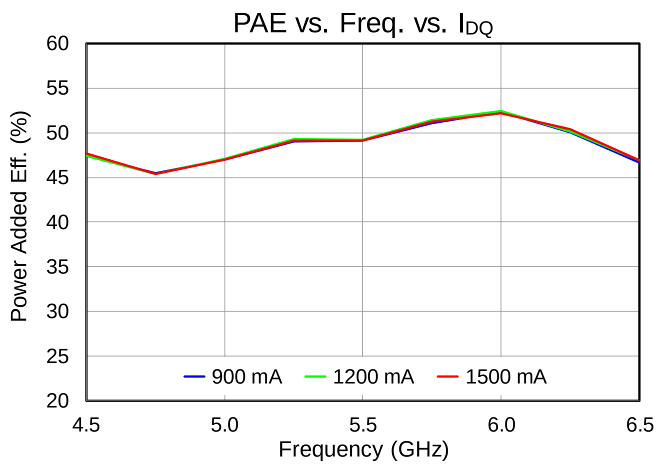
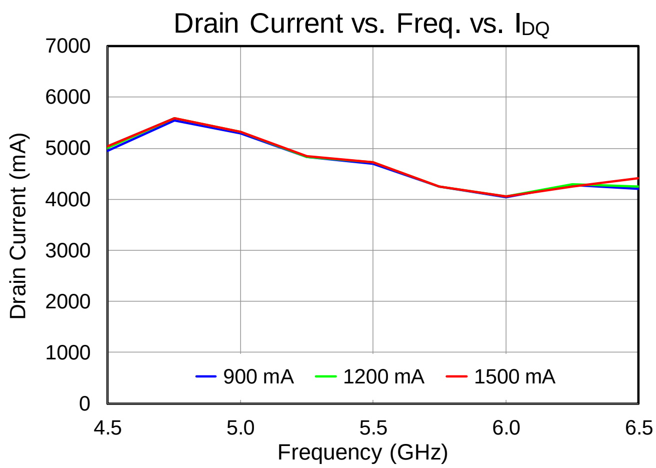
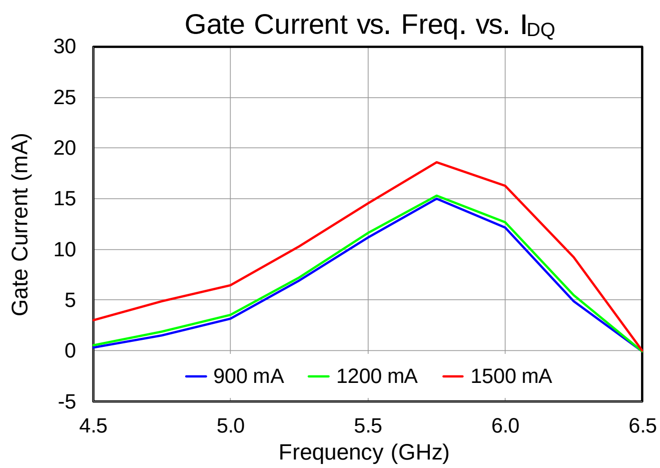






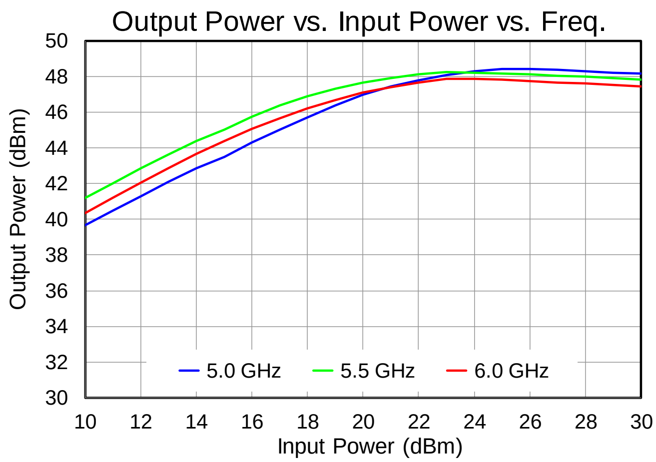


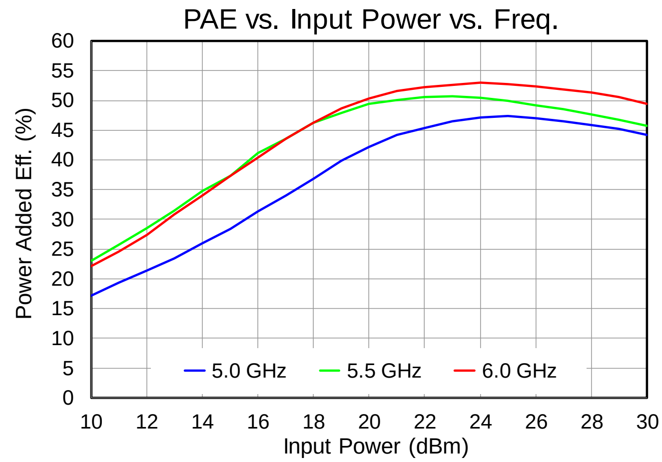


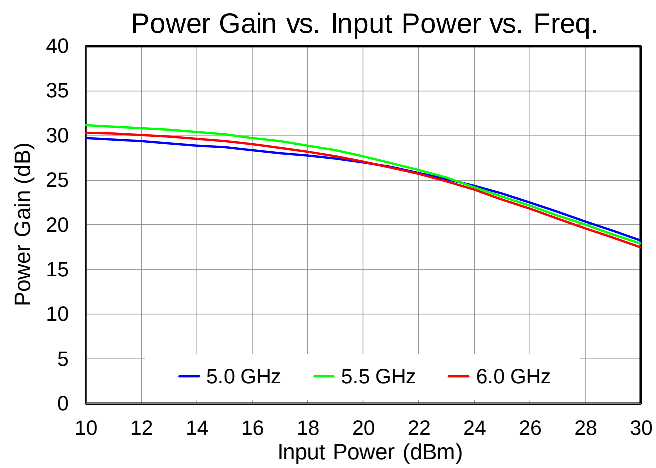


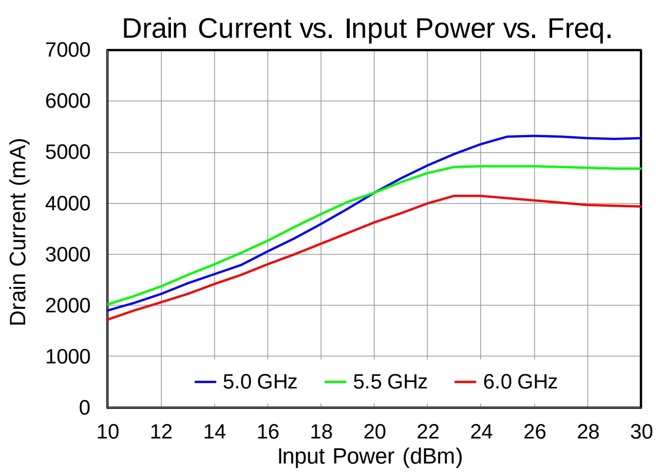
Performance Plots – Large Signal

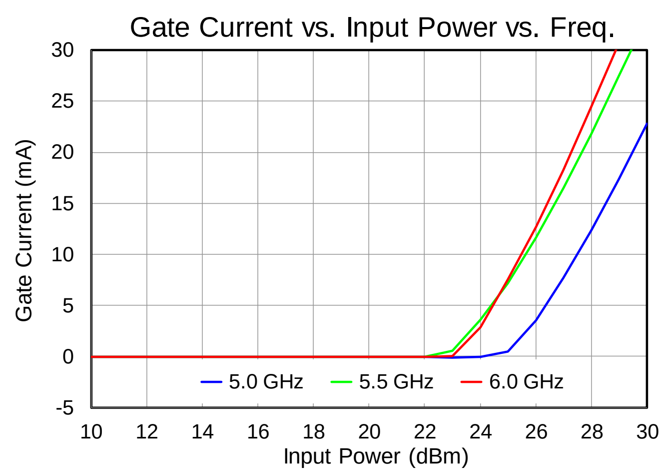
Test conditions, unless otherwise noted: V_D = 28 V, I_{DQ} = 1200 mA, T=+25 °C, PW = 600 us, Duty Cycle = 20%











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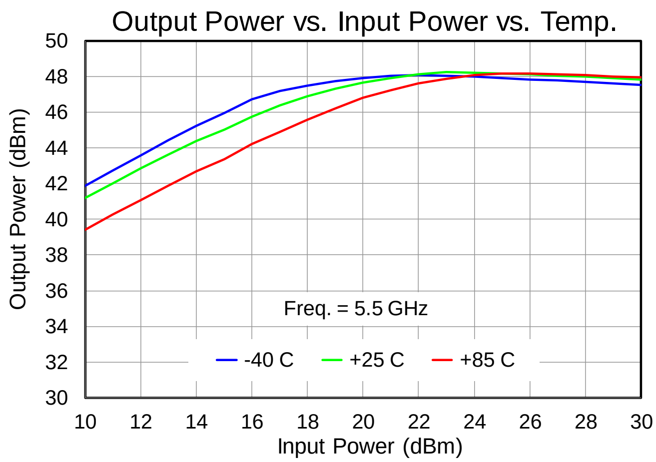

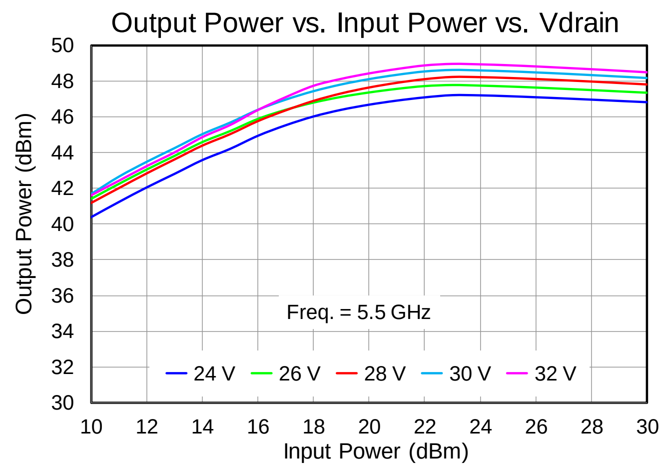

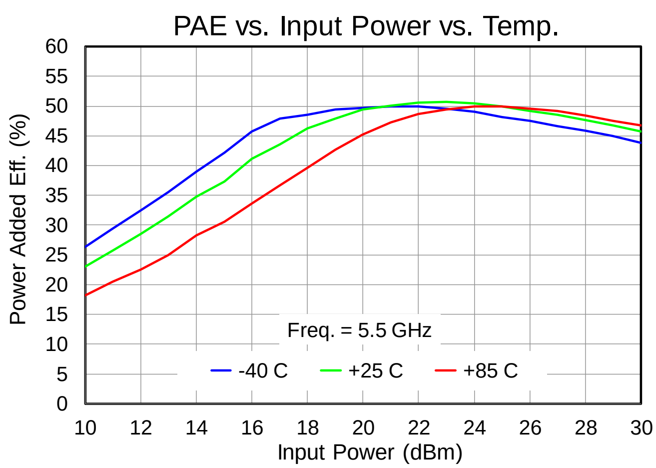

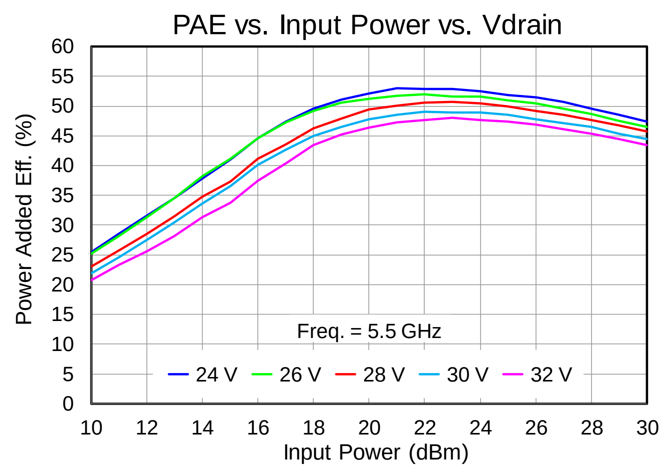

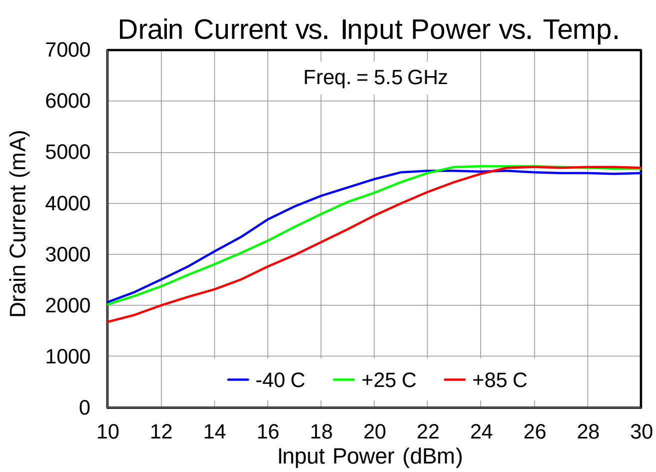

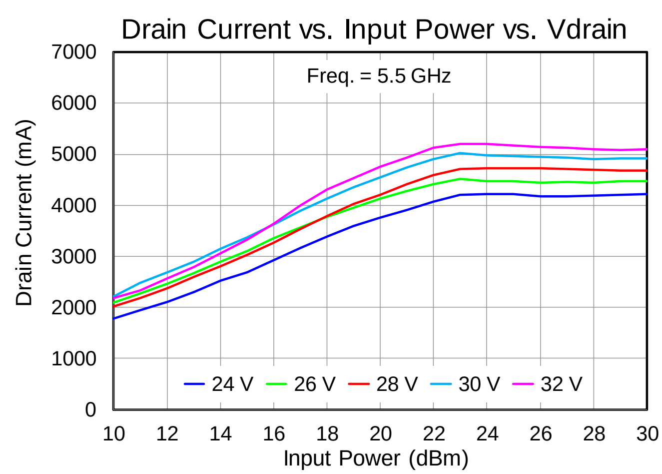

Performance Plots – Large Signal

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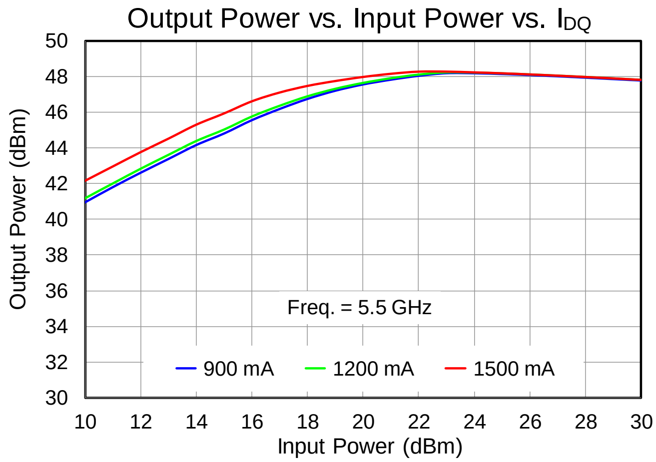
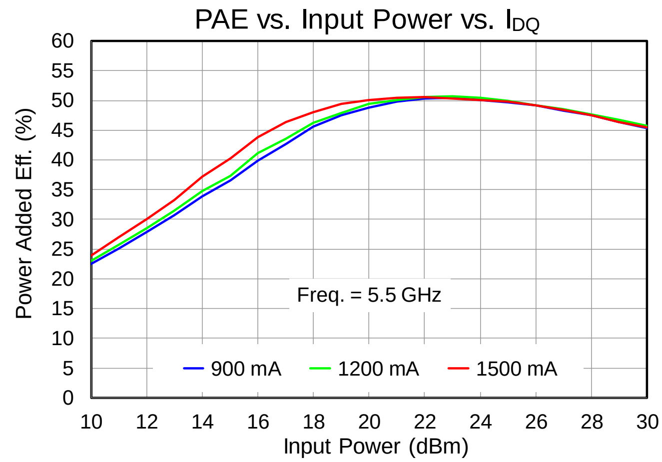
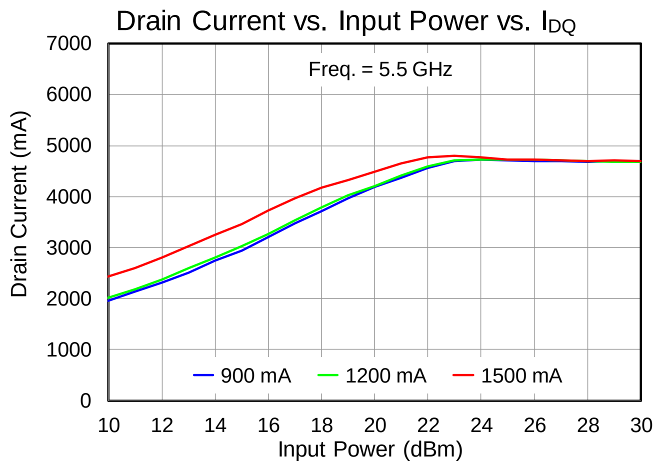
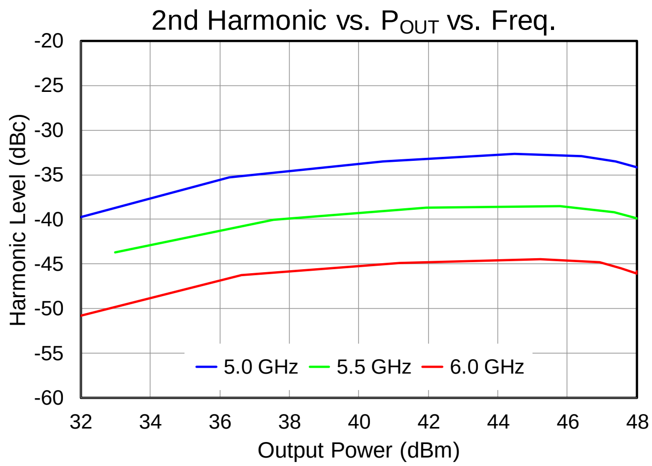


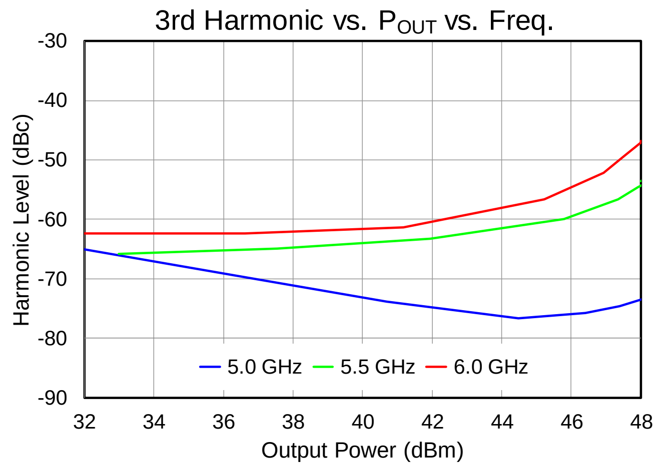


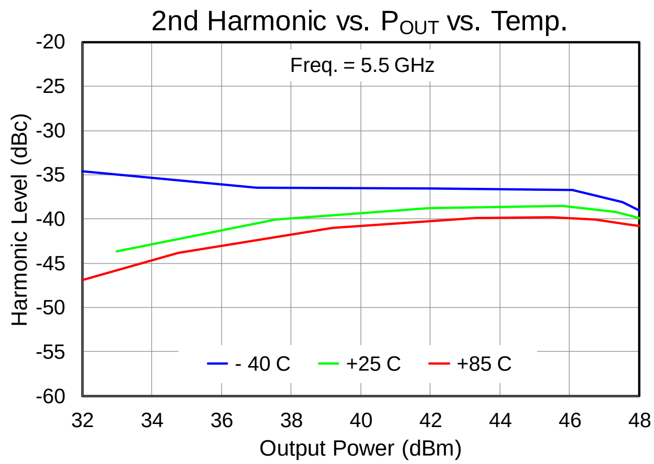


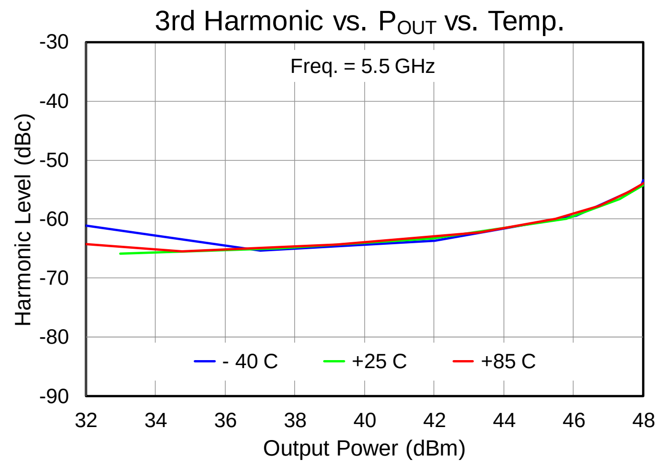
Performance Plots – Harmonics

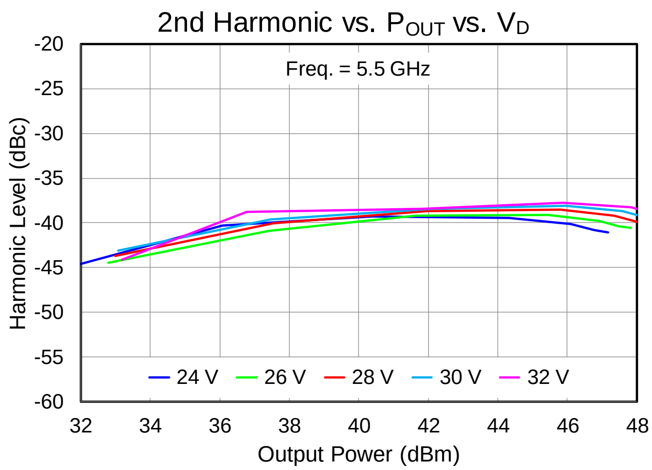
Test conditions, unless otherwise noted: V_D = 28 V, I_{DQ} = 1200 mA, T = +25 °C, PW = 600 us, Duty Cycle = 20%

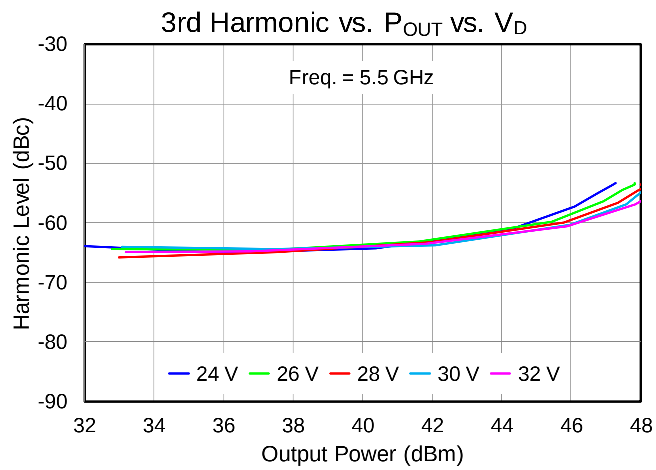






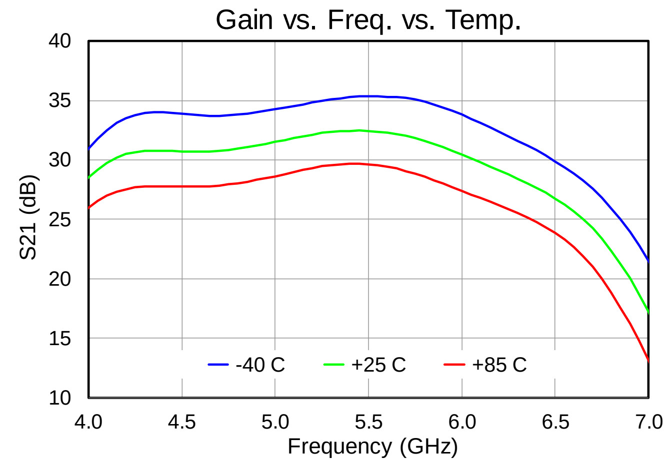


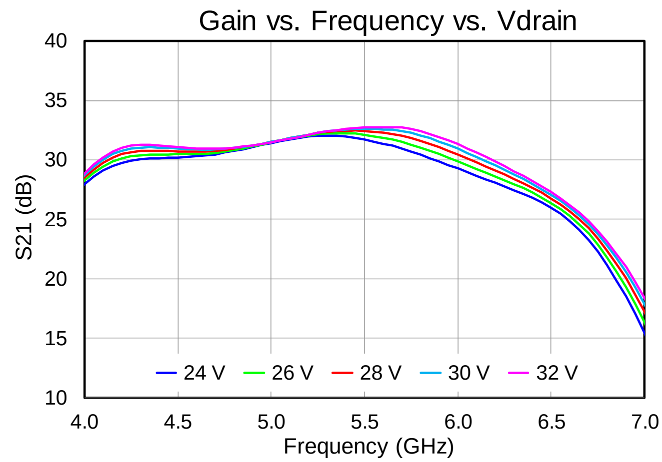


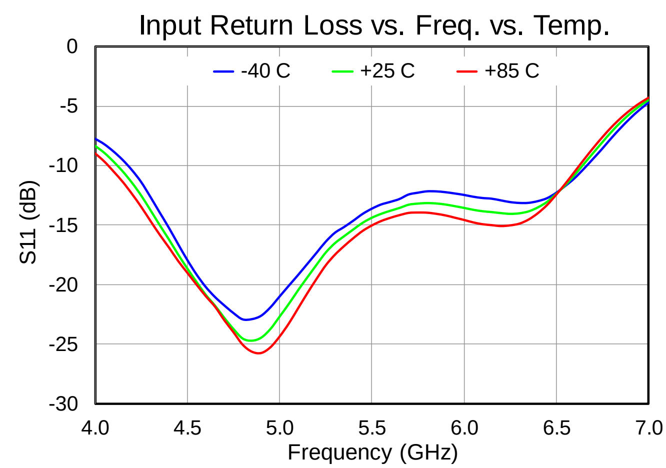


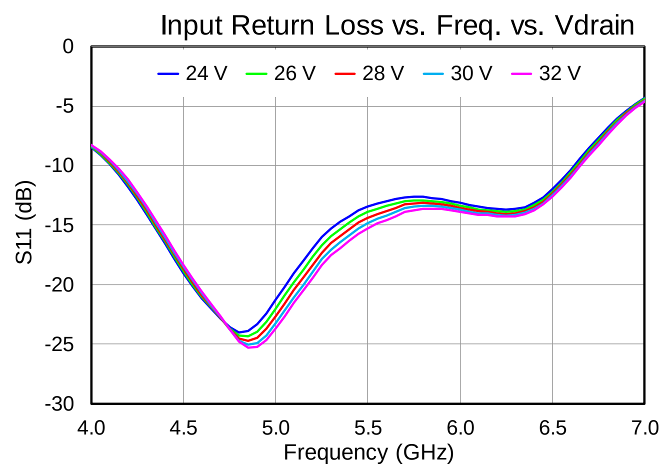
Performance Plots – Small Signal

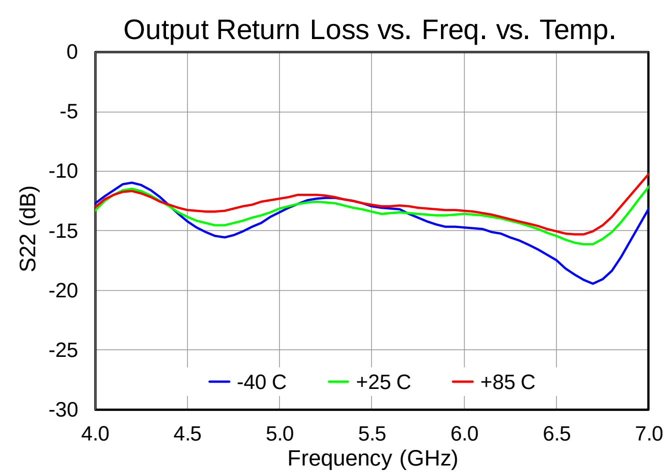
Test conditions, unless otherwise noted: V_D = 28 V, I_{DQ} = 1200 mA, T=+25 °C

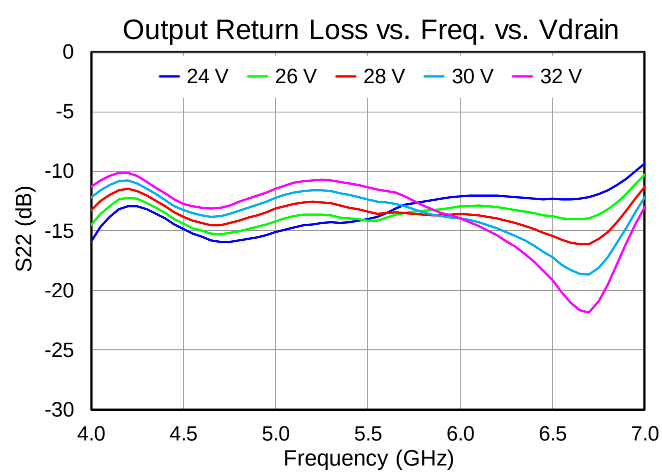












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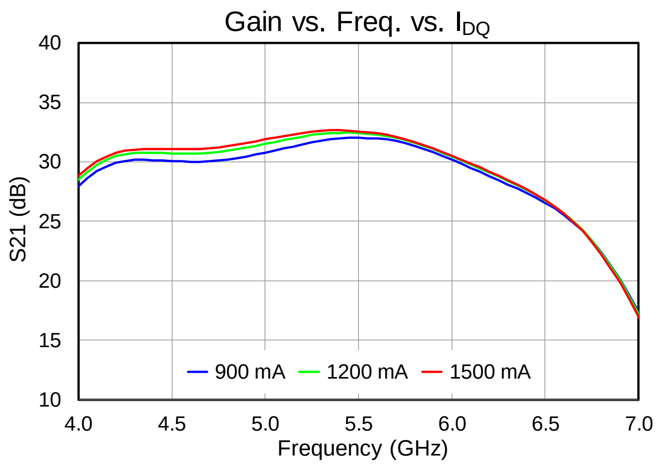
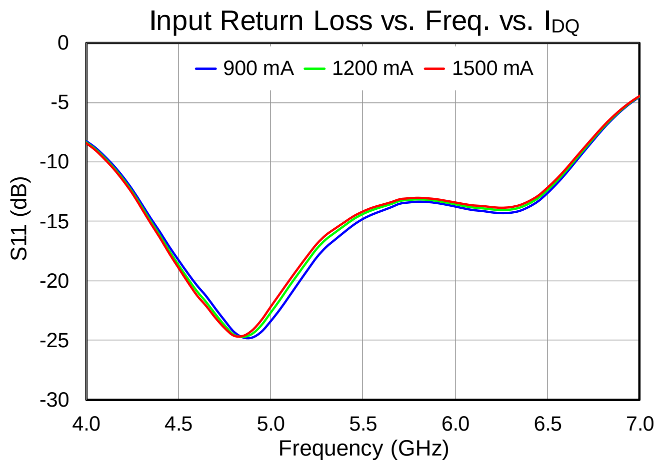
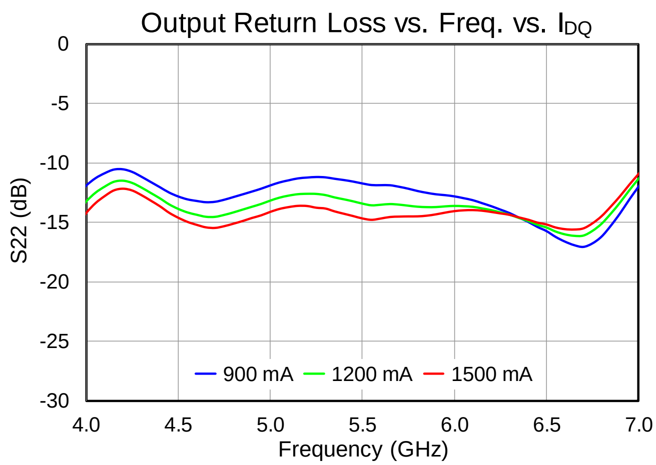




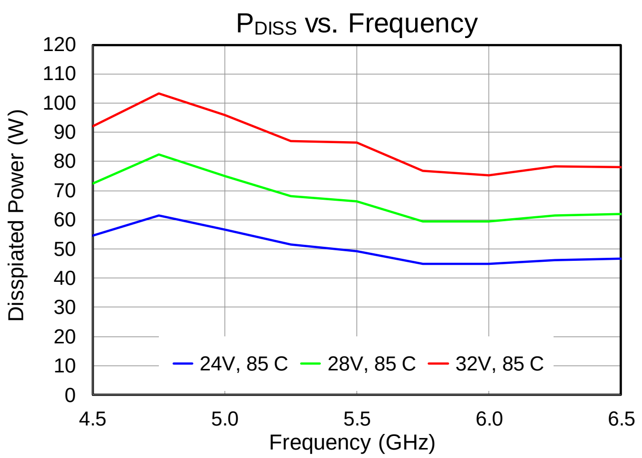


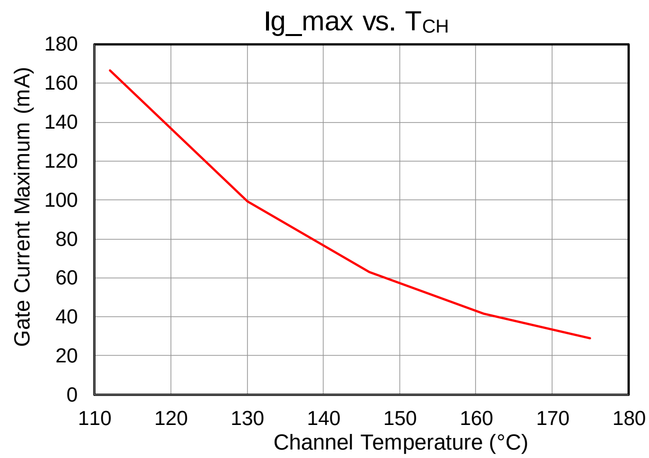
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85 °C, V_D = 28 V, I_{DQ} = 1200 mA, P_{DISS} = 33.6 W, No RF (quiescent DC operation)	0.65	ºC/W
Channel Temperature, T_{CH} (No RF) (2)		107	°C
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85 °C, V_D = 28 V, I_{DQ} = 1200 mA, Freq = 5.0 GHz, I_{D_Drive} = 5.1 A, P_{IN} = 26 dBm, P_{OUT} = 48.2 dBm, P_{DISS} = 75.1 W	0.72	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		139	°C
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85 °C, V_D = 32 V, I_{DQ} = 1200 mA, Freq = 5.0 GHz, I_{D_Drive} = 5.41 A, P_{IN} = 26 dBm, P_{OUT} = 48.8 dBm, P_{DISS} = 95.9 W	0.73	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		155	°C

Notes:
1. Thermal resistance is referenced to the back of package (85 °C)
2. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

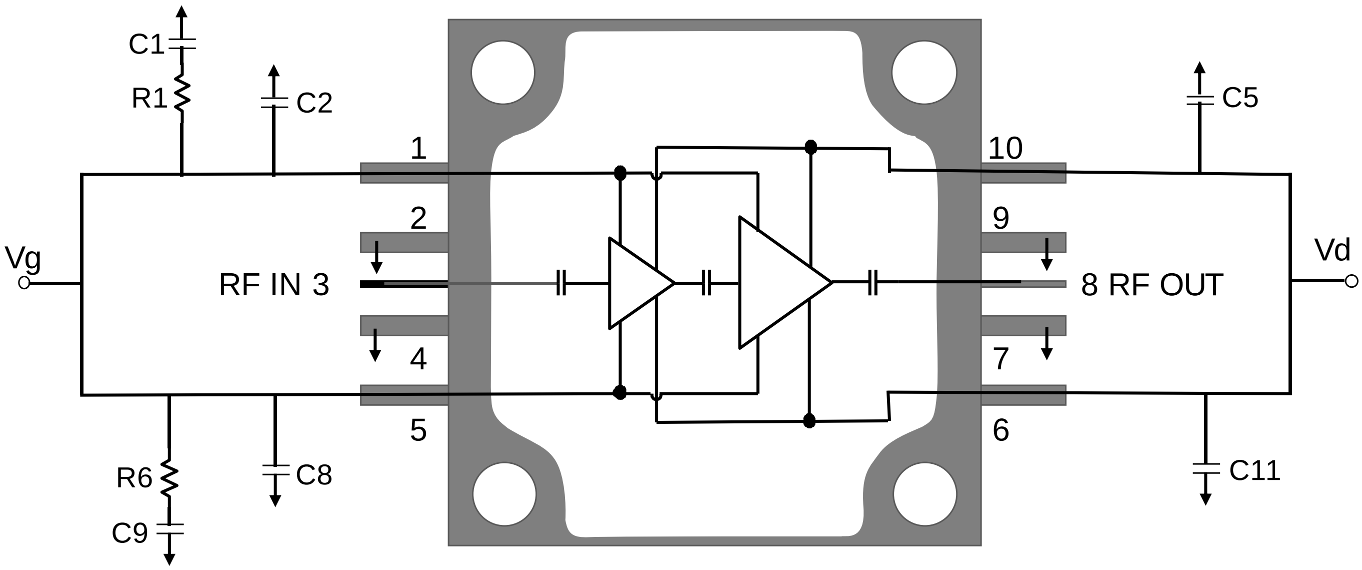
Dissipated Power and Maximum Gate Current





Test conditions, unless otherwise noted: V_D = 28 V, I_{DQ} = 1200 mA, P_{IN}=26 dBm, PW = 600 us, Duty Cycle = 20%

Applications Information



Note: Both top and bottom of Vg and Vd should be biased.

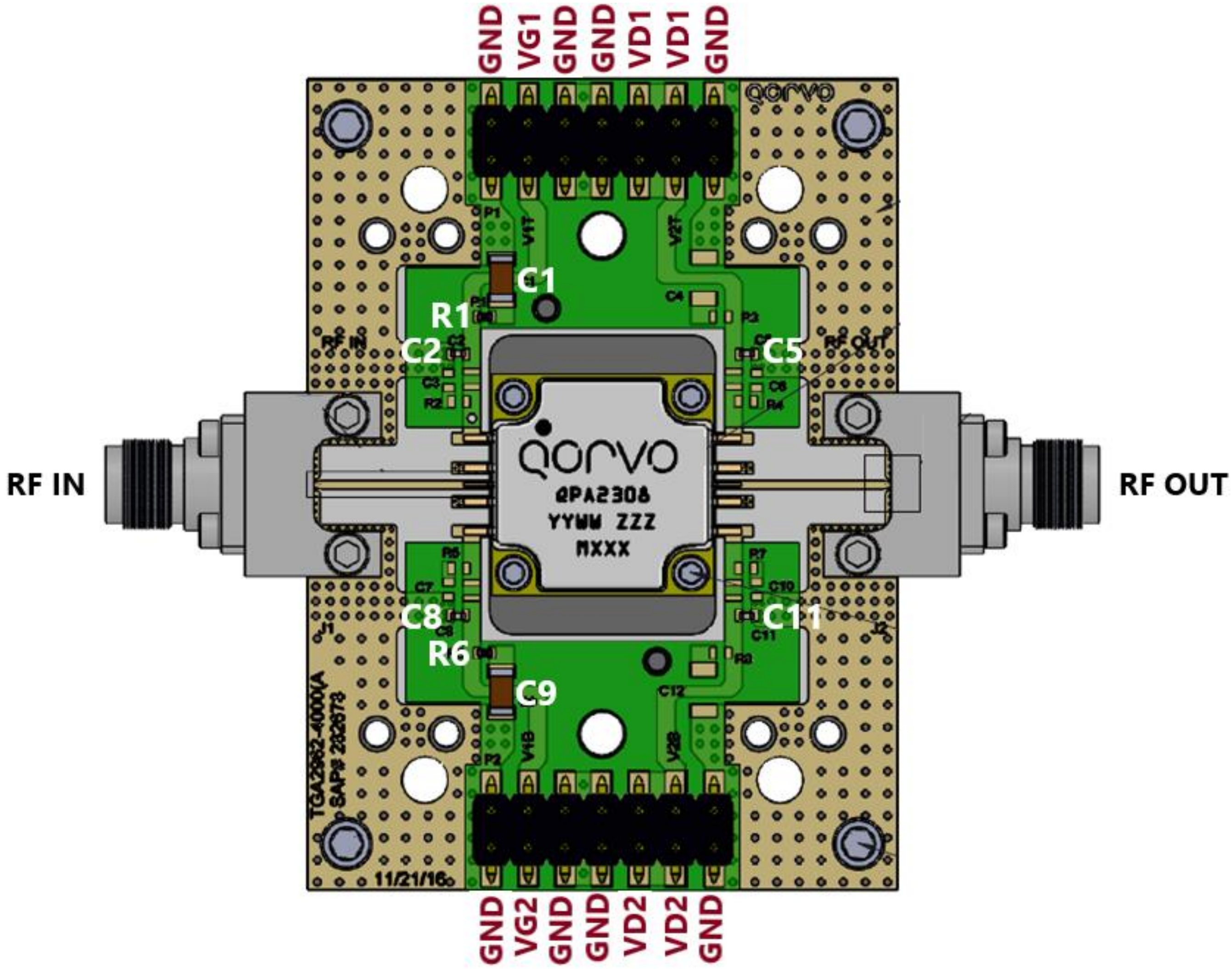
Bias-Up Procedure

1. Set I_D limit to 5500 mA, I_G limit to 30 mA
2. Set V_G to −5.0 V
3. Set V_D +28 V
4. Adjust V_G more positive until $I_{DQ} \approx 1200$ mA
5. Apply RF signal

Bias-Down Procedure

1. Turn off RF signal
2. Reduce V_G to −5.0 V. Ensure I_{DQ} ~ 0 mA
4. Set V_D to 0 V
5. Turn off V_D supply
6. Turn off V_G supply

Evaluation Board (EVB) Layout Assembly



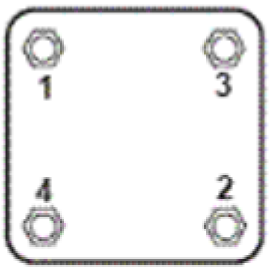
PCB is made from Rogers 6035HTC dielectric, .010 inch thick, 0.5 oz. copper both sides.

Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C1, C9	10 uF	CAP, 10 uF, 20%, 50 V, 20%, X5R, 1206	Various	
C2, C5, C8, C11	0.01 uF	CAP, 0.01 uF, 10%, 50 V, X7R, 0402	Various	
R1, R6	5.1 Ω	RES, 5.1 OHM, 5%, 50 V, 0402	Various	
J1, J2	2.92 mm	CONNECTOR, FEMALE, ENDLAUNCH	Southwest Microwave	1092-01A-5

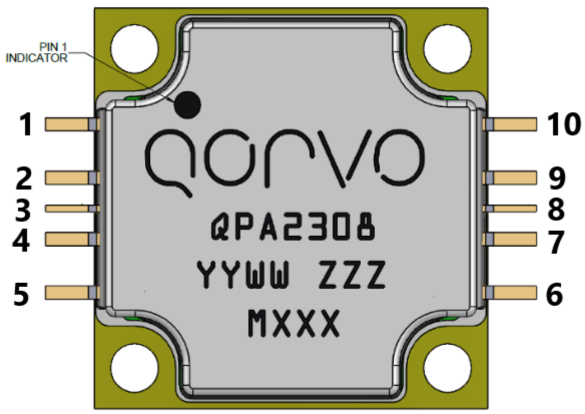
Assembly Notes

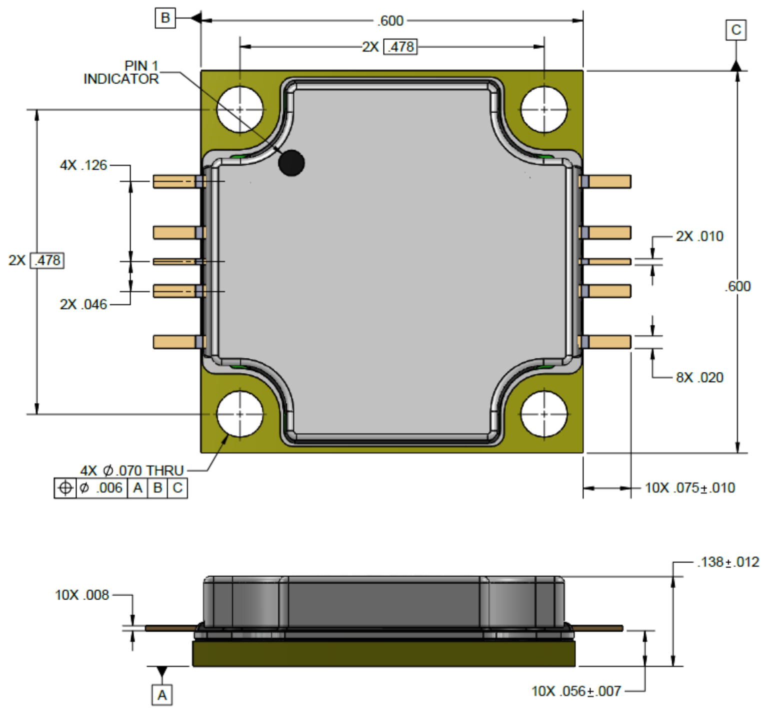
1. Carefully clean the PC board and package leads with alcohol. Allow it to dry fully.
2. To improve the thermal and RF performance, Qorvo recommends attaching a heat sink to the bottom of the PCB and apply thermal compound (Arctic Silver 5 recommended) or 4 mil indium shim between the heat sink and the package.
3. (The following is for *information only*. There are many variables in a second level assembly that Qorvo does not control, so Qorvo does not recommend an absolute torque value.) Use screws to attach the component to the heat sink. A suggested torque value is 16 in-oz. for a 0-80 screw. Start with screws finger tight, then torque to 8 in-oz., then torque to final value. Use the following tightening pattern:



4. Apply no-flux solder to each pin of the QPA2308. The component leads should be manually soldered, and the package cannot be subjected to conventional reflow processes. The use of no-clean solder to avoid washing after soldering is recommended.

Mechanical Information





Units: inches
Tolerances: unless specified; x.xxx = ± 0.005
Materials:
Base: Copper
Lid: LCP (Liquid Crystal Polymer)
Lead: Alloy 194
All metalized features are gold plated
Part is epoxy sealed
Marking:
2308: Part number
YY: Part Assembly year
WW: Part Assembly week
ZZZ: Serial Number
MXXX: Batch ID

Pin Description

Pin No.	Symbol	Description
1,5	VG	Gate Voltage; Bias network is required; must be biased from both sides; refer to page 13.
3	RF IN	RF output. 50 Ohms. DC blocked.
2,4,7,9	GND	Must be grounded on the PCB.
6,10	VD	Drain voltage; Bias network is required; must be biased from both sides; refer to page 13.
8	RF OUT	RF output. 50 Ohms. DC blocked.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1A	ANSI/ESD/JEDEC JS-001

Caution!

ESD-Sensitive Device

Solderability

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

RoHS Compliance

This part is compliant with 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:

- 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:

Web: **www.qorvo.com**

Tel: **1-844-890-8163**

Email: **customer.support@qorvo.com**

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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

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