TGA2963-CP

6 – 18 GHz 20 W GaN Power Amplifier

Product Description

Qorvo's TGA2963-CP is a broadband high power MMIC amplifier fabricated on Qorvo's production 0.15um GaN on SiC process (QGaN15). The TGA2963-CP operates from 6 – 18 GHz and typically provides 20 W saturated output power with power-added efficiency of 20% and large-signal gain of 18 dB. This combination of wideband performance provides the flexibility designers are looking for to improve system performance while reducing size and cost.

The TGA2963-CP is offered in a 10-lead 15 x 15 mm bolt-down package. Assembled with a pure-copper base, coupled with its high efficiency, the TGA2963-CP minimizes the strain on the system-level cooling requirements, further reducing system operating costs. The broadband performance makes it ideally suited to support test instrumentation and electronic warfare, as well as, supporting multiple radar and communication bands.

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

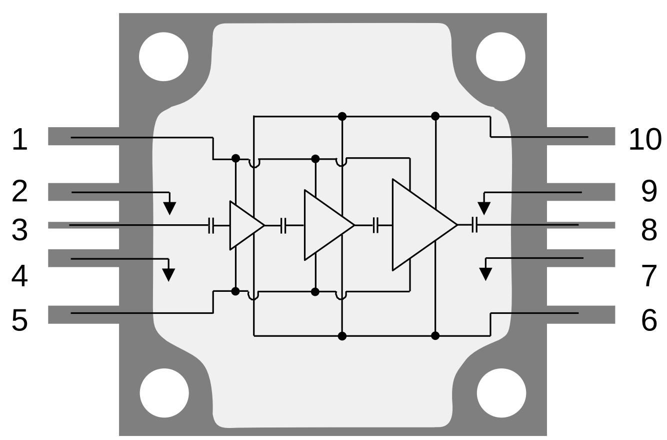
RoHS compliant.

Product Features

- Frequency Range: 6 – 18 GHz
- P_{OUT}: 43 dBm @ P_{IN} = 25 dBm
- PAE: 20 % @ P_{IN} = 25 dBm
- Large Signal Gain: 18 dB @ P_{IN} = 25dBm
- Small Signal Gain: 26 dB
- Bias: V_D = +20 V, I_{DQ} = 2500 mA, V_G = −2.3 V Typical
- Process Technology: QGaN15
- Package Dimensions: 15.2 x 15.2 x 3.5 mm
- 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

- Test Instrumentation
- Electronic Warfare (EW)
- Radar
- Communications

Ordering Information

Part No.	Description
TGA2963-CP	6 – 18 GHz 20 W GaN Power Amplifier

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	+29.5 V
Gate Voltage Range (V_G)	-8 to 0 V
Drain Current	8160 mA
Forward Gate Current (I_G)	See I_{G_MAX} plot
Power Dissipation (P_{DISS}), 85 °C, CW	150 W
Input Power (P_{IN}): CW, 50 Ω, V_D = +20 V, I_{DQ} = 2500 mA, 85 °C	30 dBm
Input Power (P_{IN}): CW, VSWR 3:1, V_D = +20 V, I_{DQ} = 2500 mA, 85 °C	30 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 V
Drain Current (I_{DQ})	2500 mA
Gate Voltage (V_G)	−2.9 to −2.0 V (Typ.)
Temperature (T_{BASE})	−40 to 85 °C

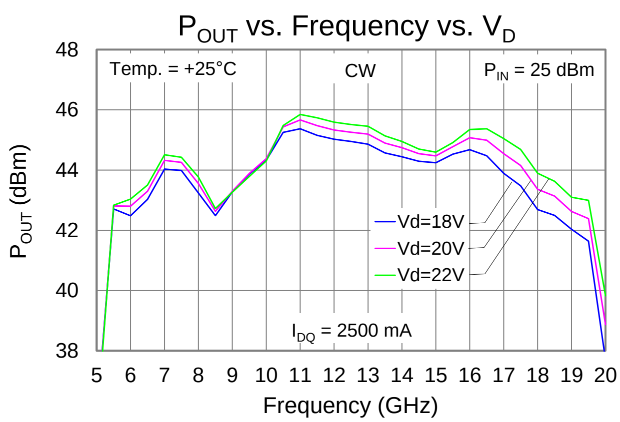
Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

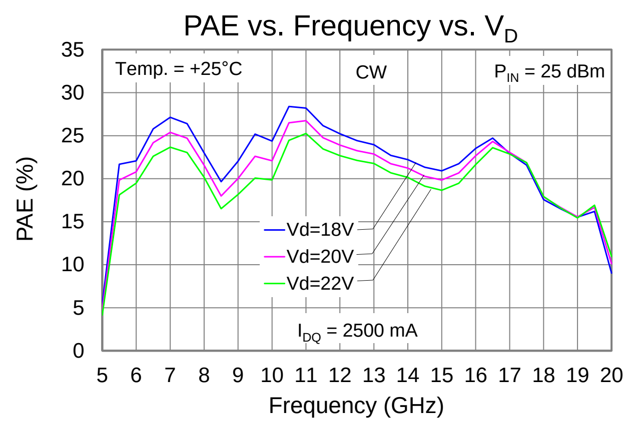
Electrical Specifications

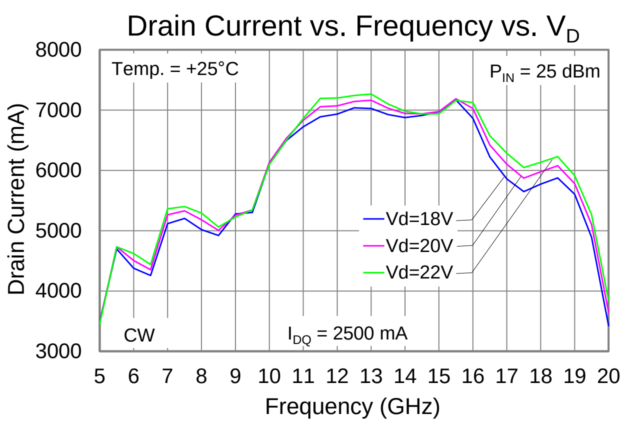
Test conditions unless otherwise noted: 25 °C, V_D = +20 V, I_{DQ} = 2500 mA, CW

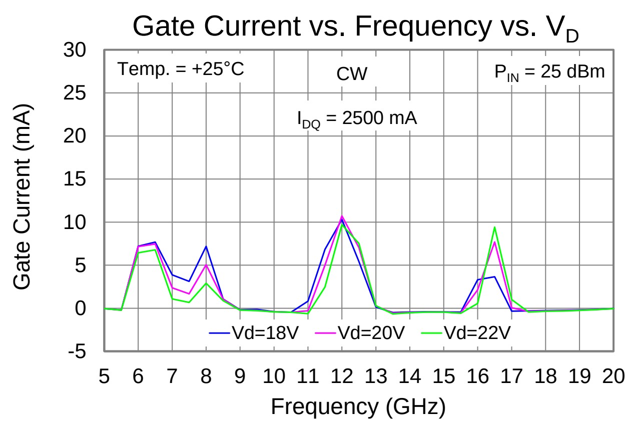
Parameter		Min	Typ	Max	Units
Operational Frequency Range		6	–	18	GHz
Output Power @ P_{IN} = 25 dBm	Frequency = 6 GHz		42.8	–	dBm
	Frequency = 12 GHz		45	–	
	Frequency = 18 GHz		43	–	
Power Added Efficiency @ P_{IN} = 25 dBm	Frequency = 6 GHz		21	–	%
	Frequency = 12 GHz		24	–	
	Frequency = 18 GHz		18	–	
Small Signal Gain	Frequency = 6 GHz		28	–	dB
	Frequency = 12 GHz		34	–	
	Frequency = 18 GHz		24	–	
Input Return Loss	Frequency = 6 GHz		16	–	dB
	Frequency = 12 GHz		12	–	
	Frequency = 18 GHz		9	–	
Output Return Loss	Frequency = 6 GHz		10	–	dB
	Frequency = 12 GHz		7.7	–	
	Frequency = 18 GHz		6.7	–	
Small Signal Gain Temperature Coefficient		–	−0.08	–	dB/°C
Output Power Temperature Coefficient		–	−0.015	–	dBm/°C
Gate Leakage (V_D = 10 V, V_G = −3.7 V)		−21.6			mA

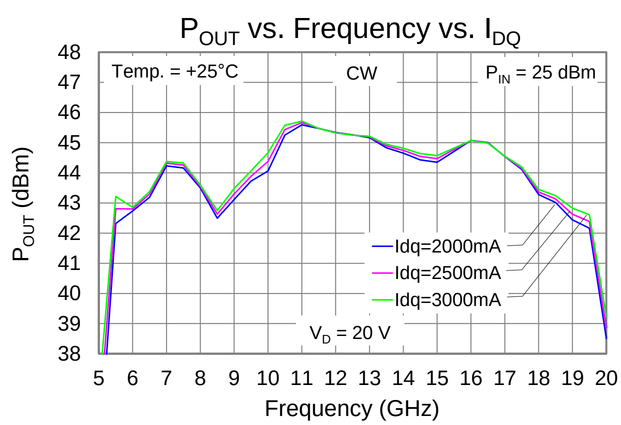
Performance Plots – Large Signal (CW)

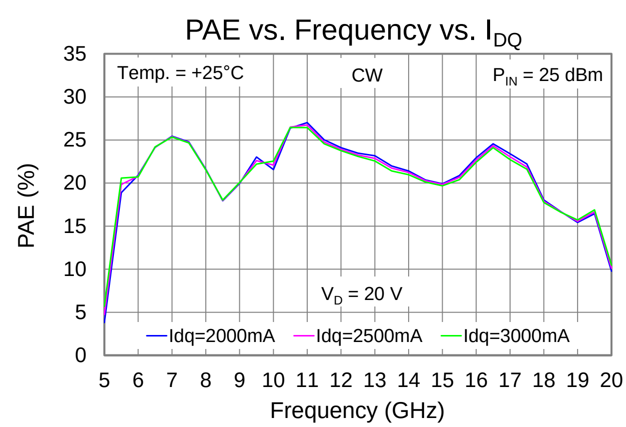




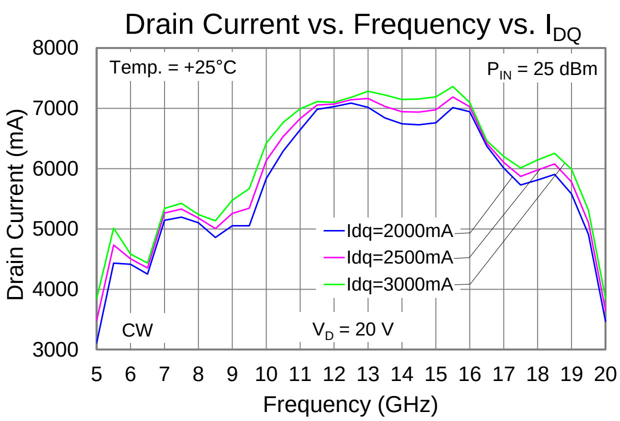


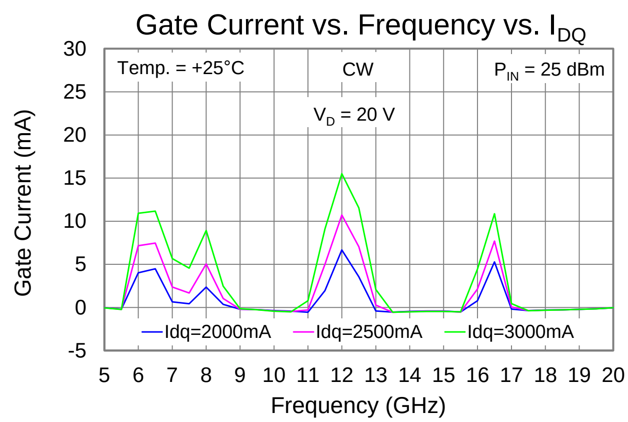


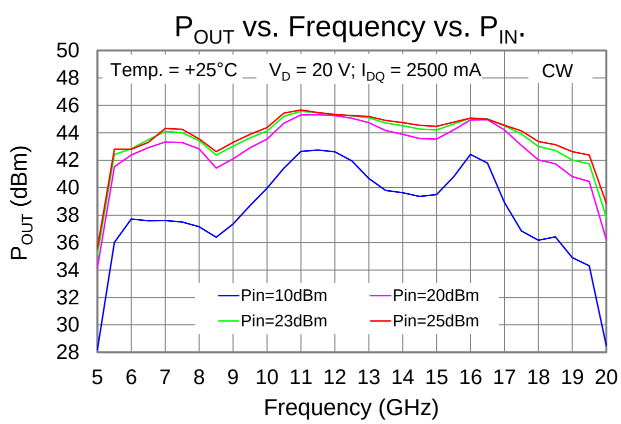


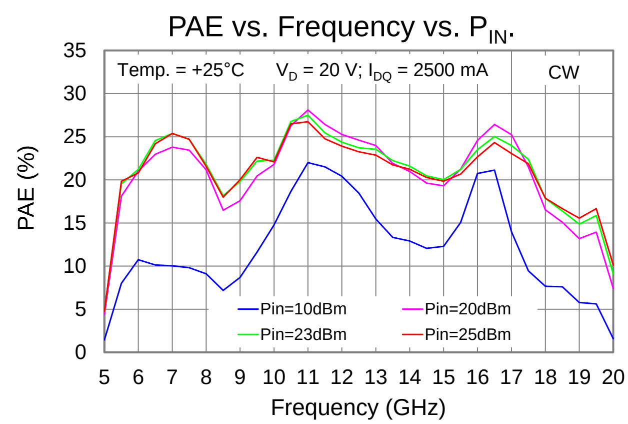


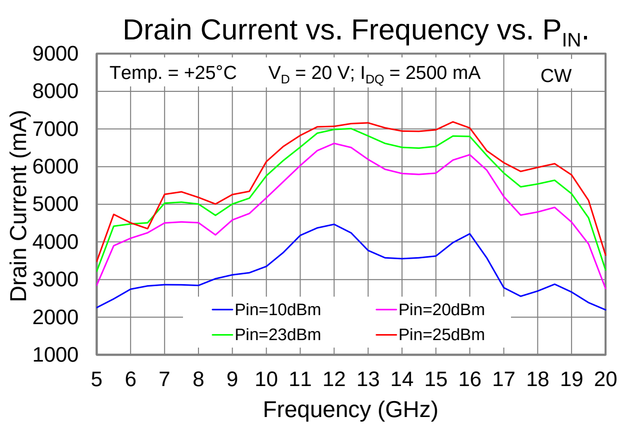
Performance Plots – Large Signal (CW)

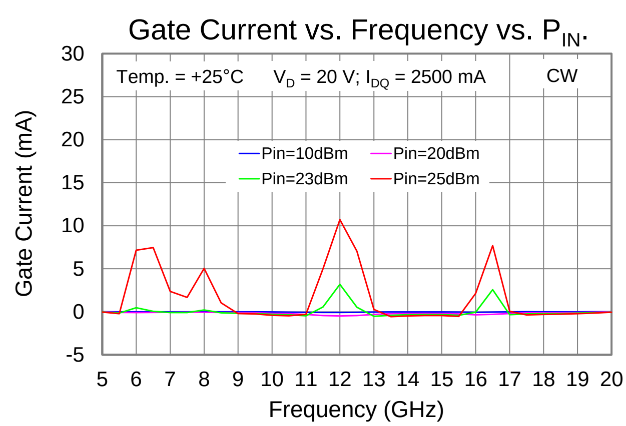




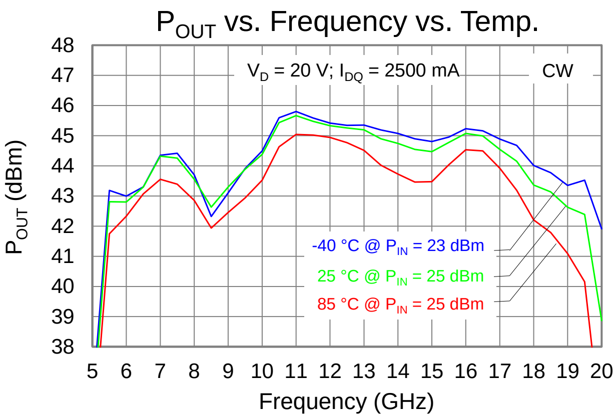


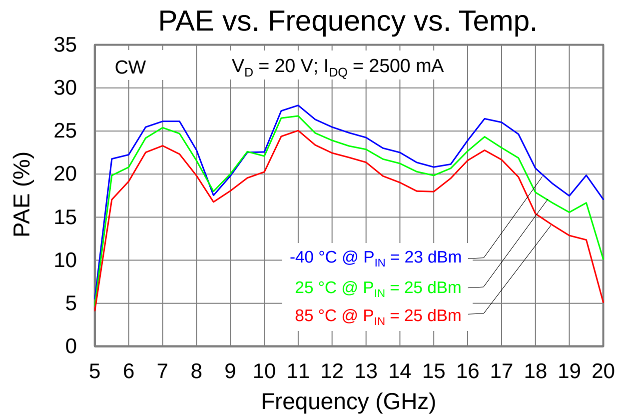


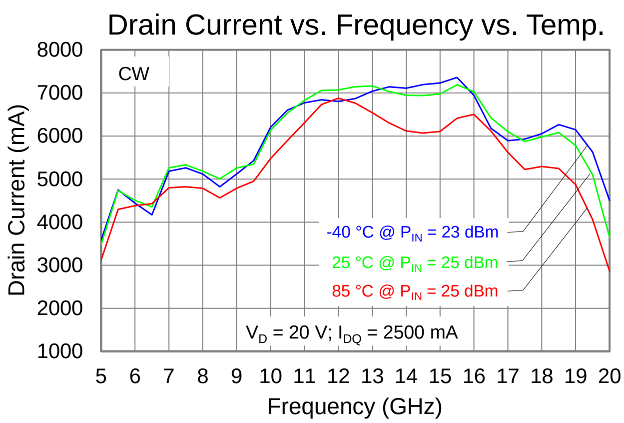


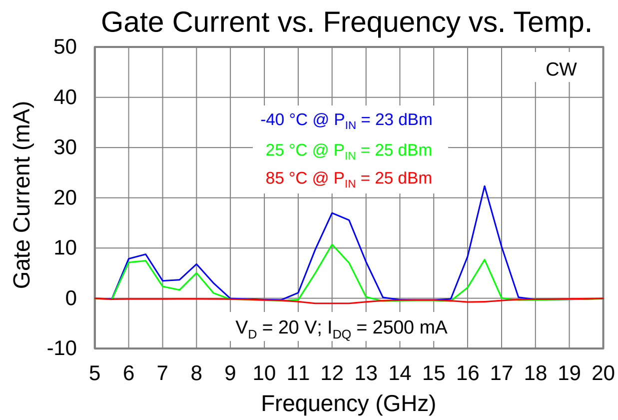


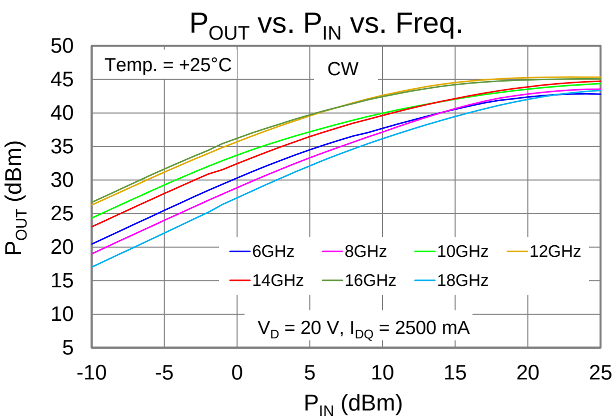
Performance Plots – Large Signal (CW)

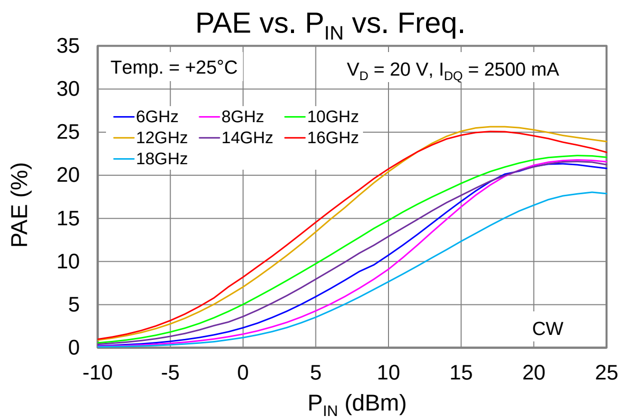




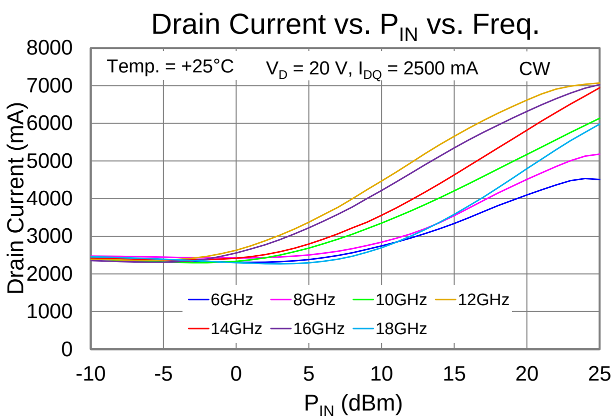


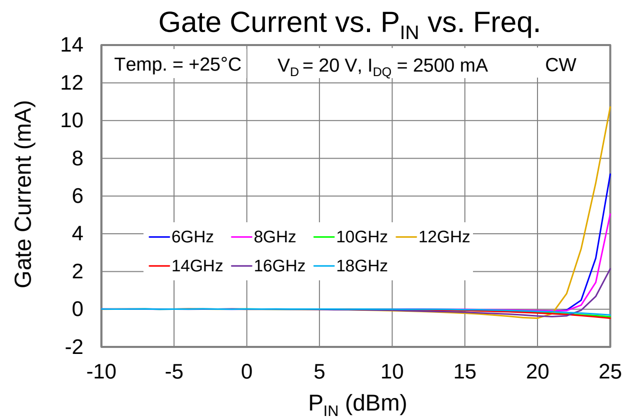


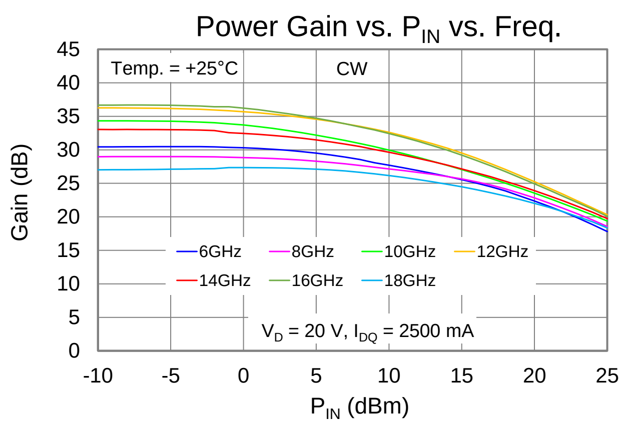


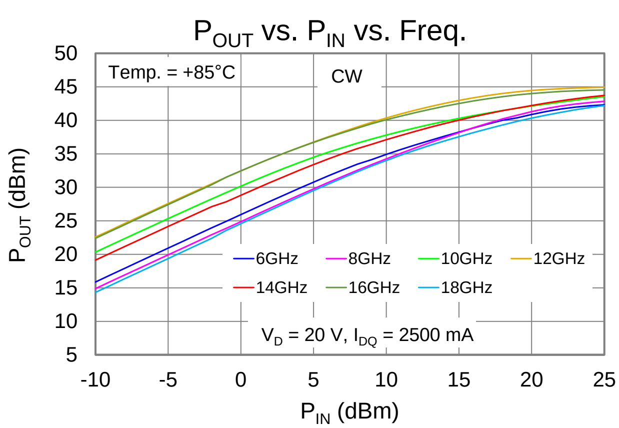


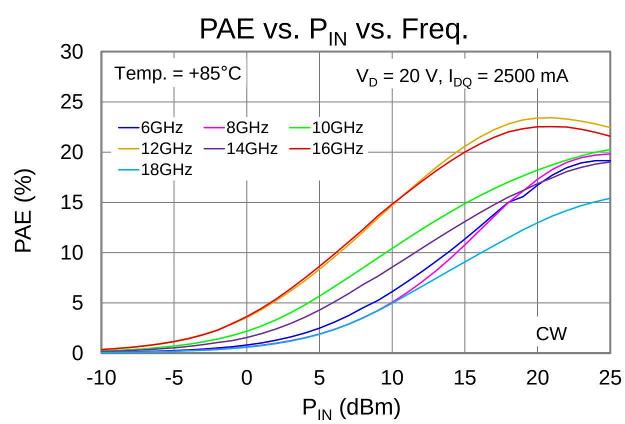
Performance Plots – Large Signal (CW)



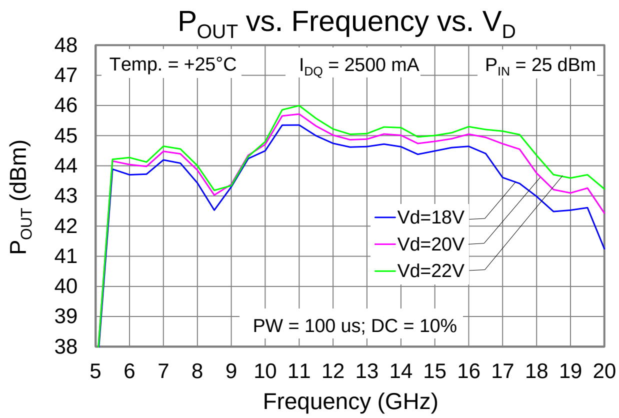


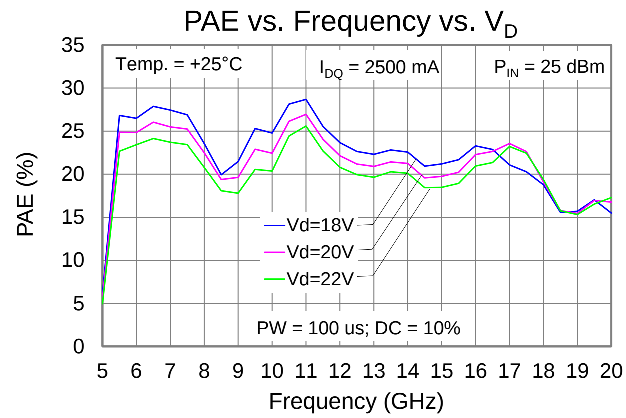


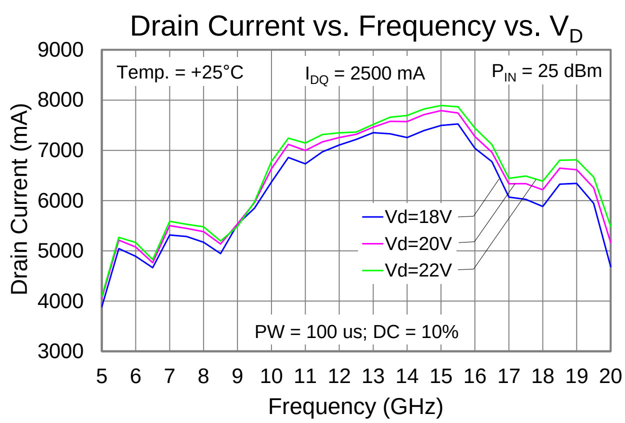


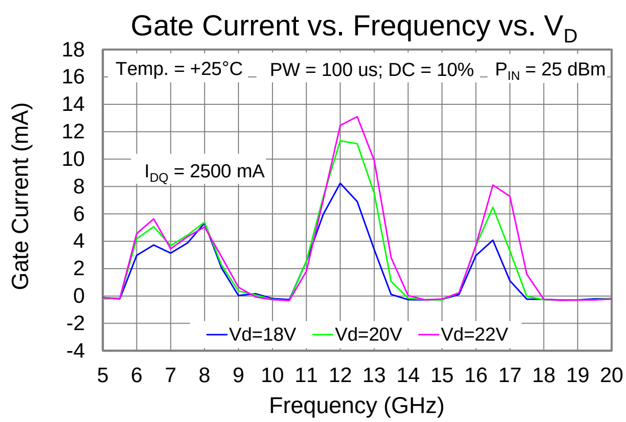


Performance Plots – Large Signal (Pulsed)

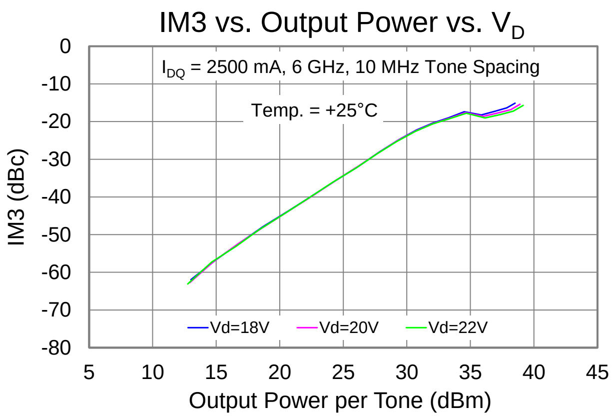


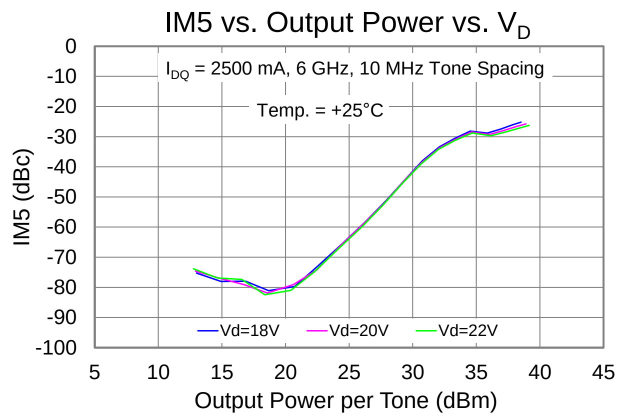


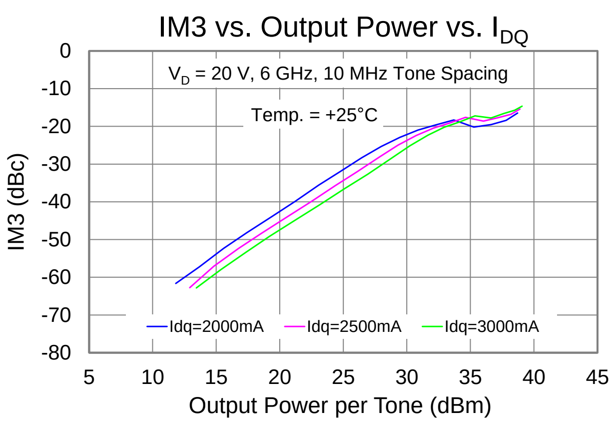


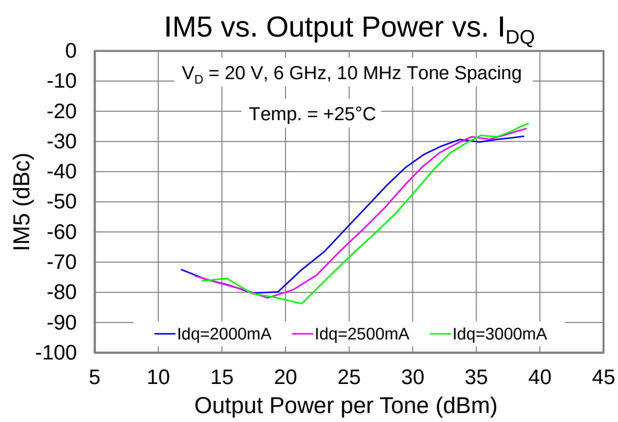


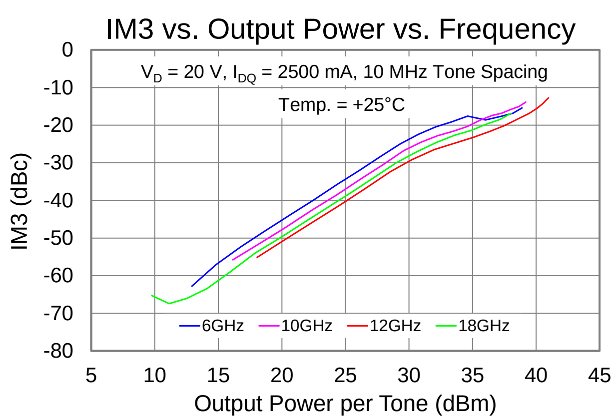
Performance Plots – Linearity

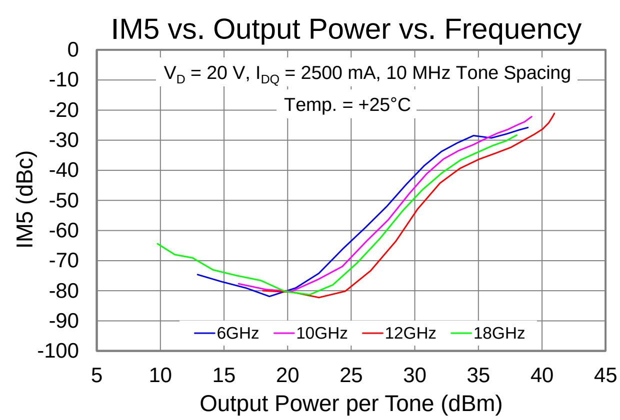




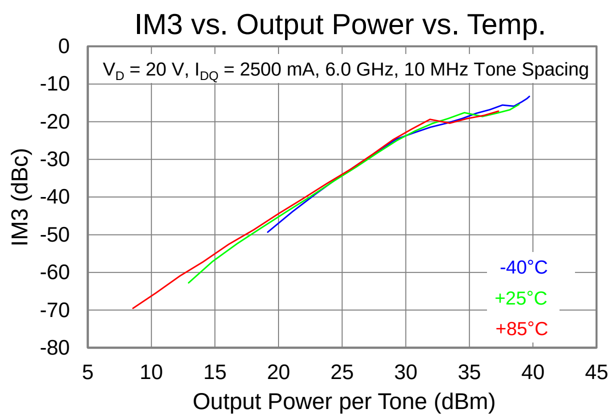


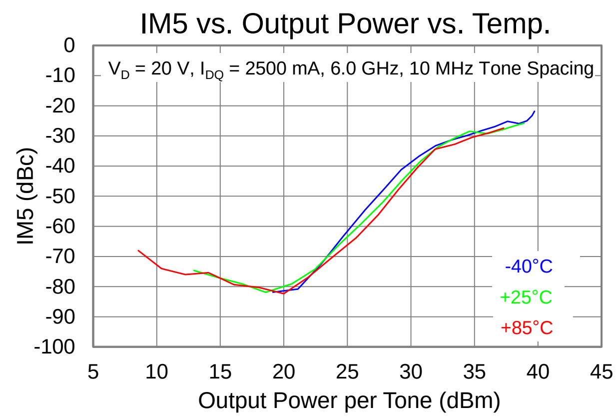


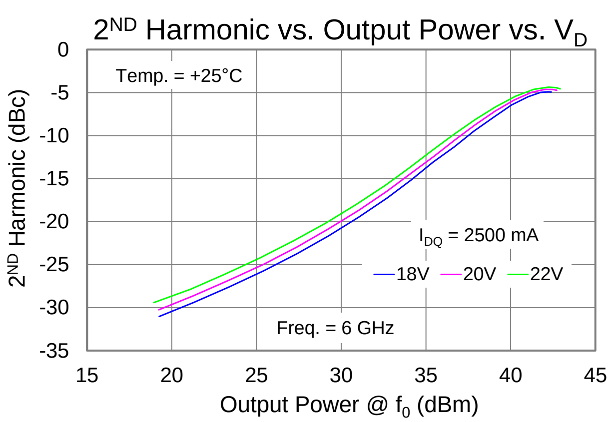


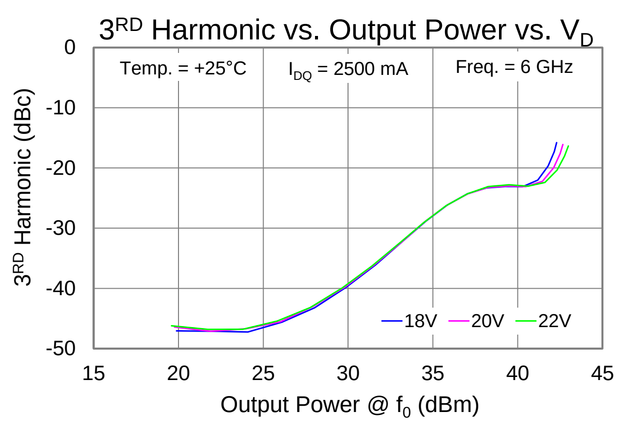


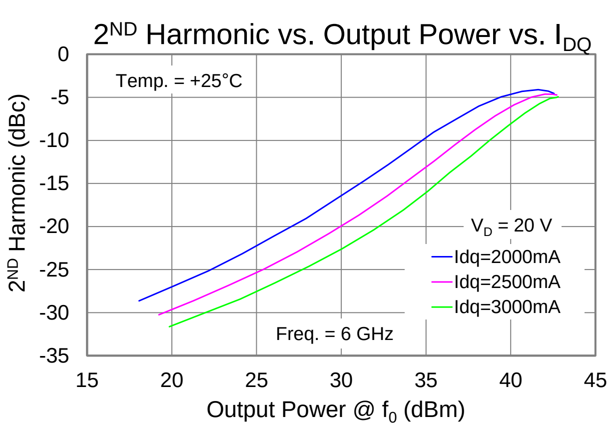
Performance Plots – Linearity

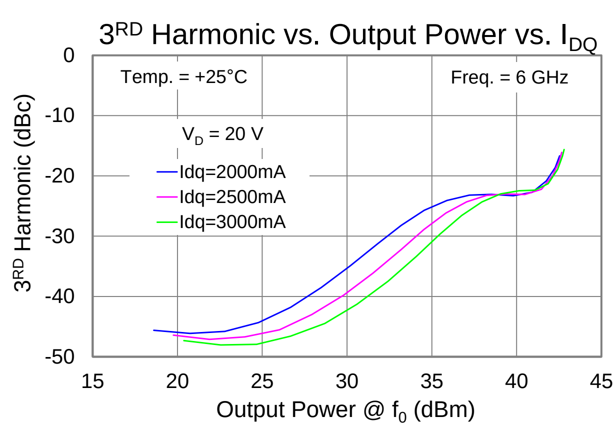




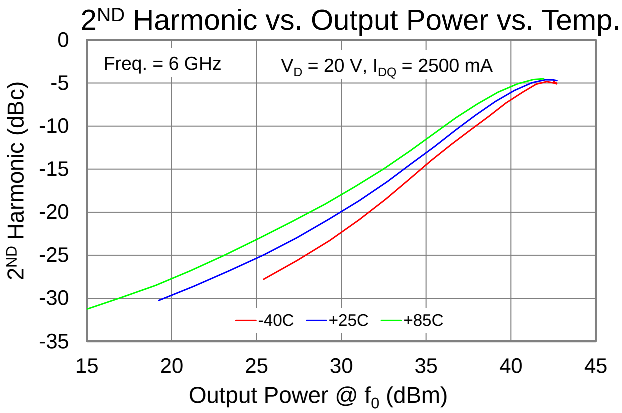


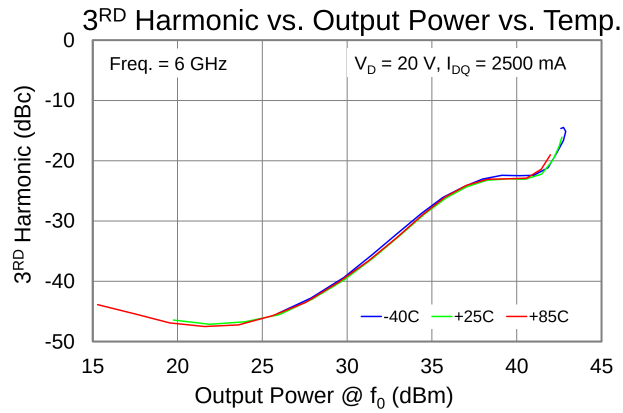


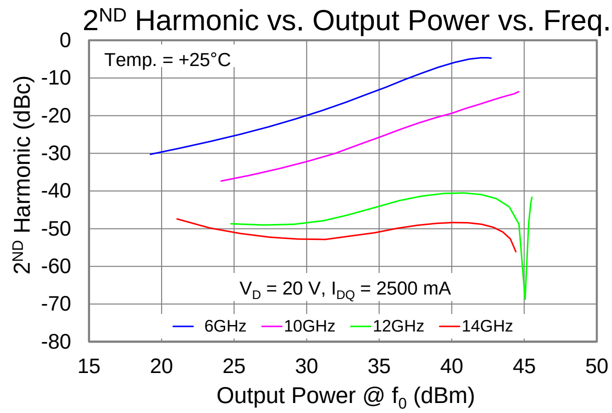




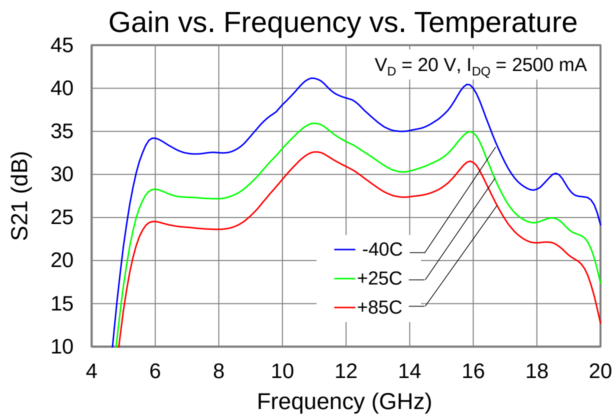
Performance Plots – Linearity

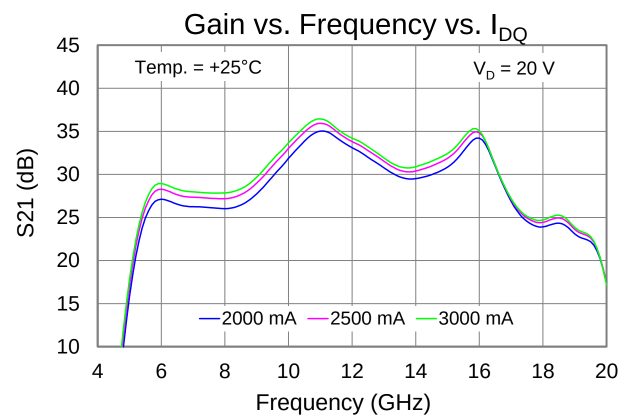


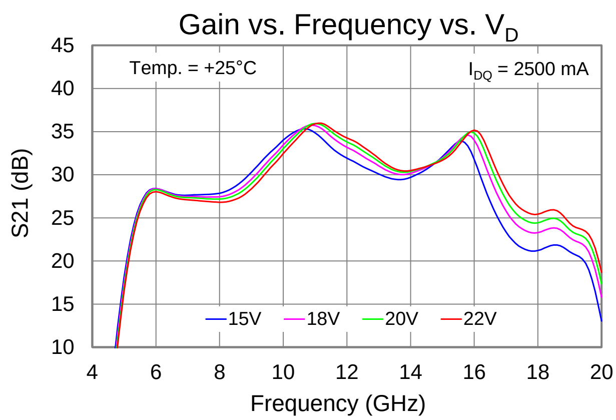


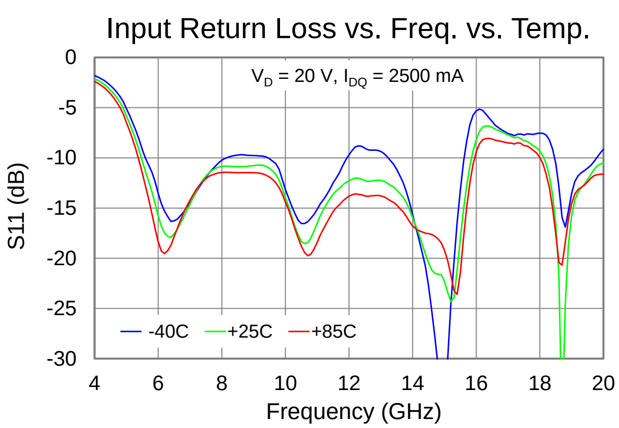


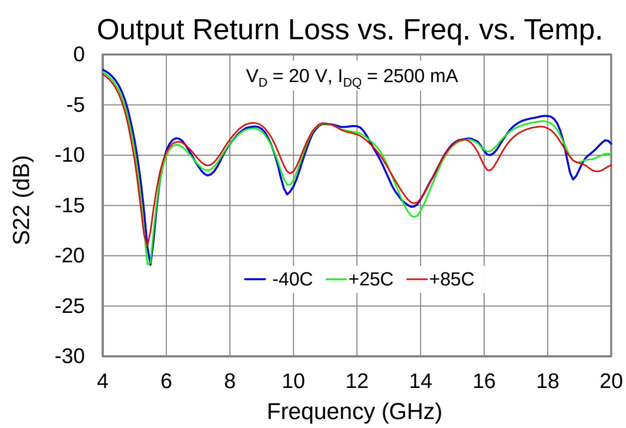
Performance Plots – Small Signal









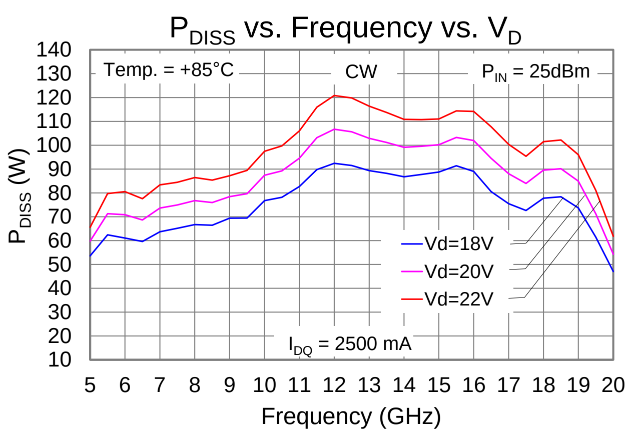


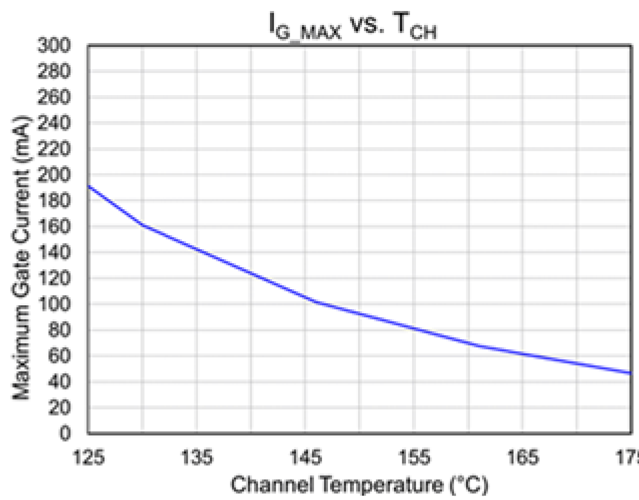
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85°C, V_D = +20 V (CW), I_{DQ} = 2500 mA, P_{DISS} = 50 W (No RF drive)	0.76	°C/W
Channel Temperature (T_{CH}) (Quiescent)		123	°C
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, V_D = +20 V (CW), Freq = 12 GHz, P_{IN} = 25 dBm, I_{DQ} = 2500 mA, I_{D_Drive} = 6.9 A, P_{OUT} = 45 dBm, P_{DISS} = 107 W	0.85	°C/W
Channel Temperature (T_{CH}) (Under RF drive)		176	°C
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, V_D = +22 V (CW), Freq = 12 GHz, P_{IN} = 25 dBm, I_{DQ} = 2500 mA, I_{D_Drive} = 7 A, P_{OUT} = 45 dBm, P_{DISS} = 120 W	0.87	°C/W
Channel Temperature (T_{CH}) (Under RF drive)		189	°C

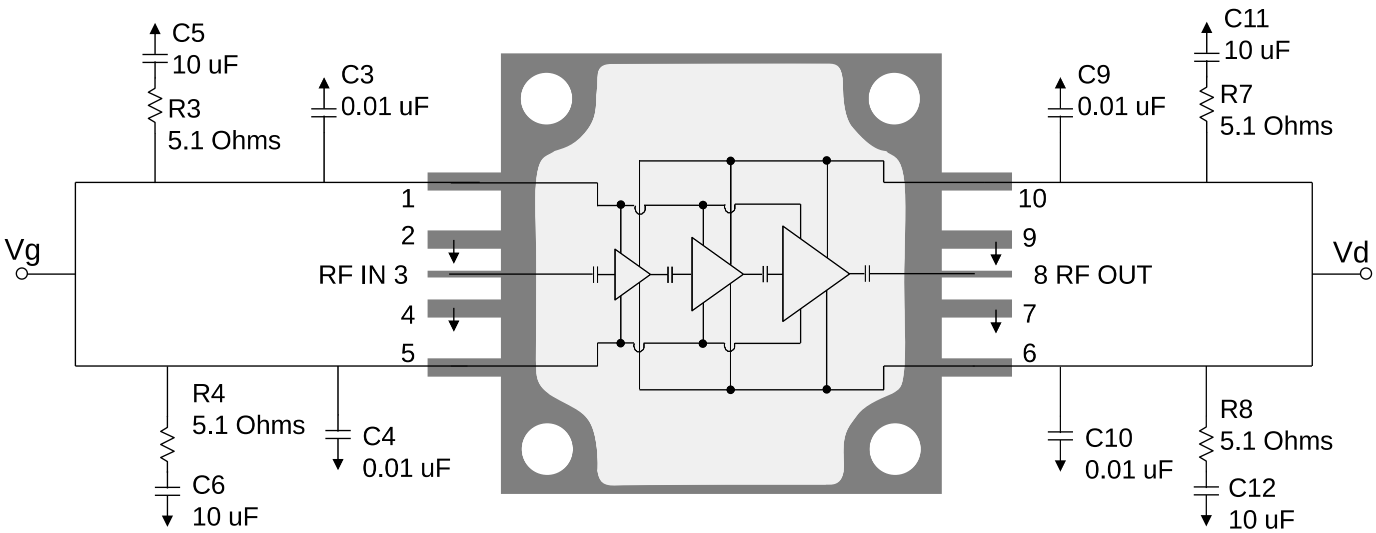
Notes:
1. Thermal resistance measured to back of package.
2. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

Power Dissipation and Maximum Gate Current





Applications Information and Pad Layout



Bias Up Procedure

1. Set I_D limit to 8 A, I_G limit to 50 mA
2. Apply −5 V to V_G
3. Apply +20 V to V_D; ensure I_{DQ} is approx. 0 mA
4. Adjust V_G until I_{DQ} = 2500 mA (V_G ~ −2.3 V Typ.).
5. Turn on RF supply

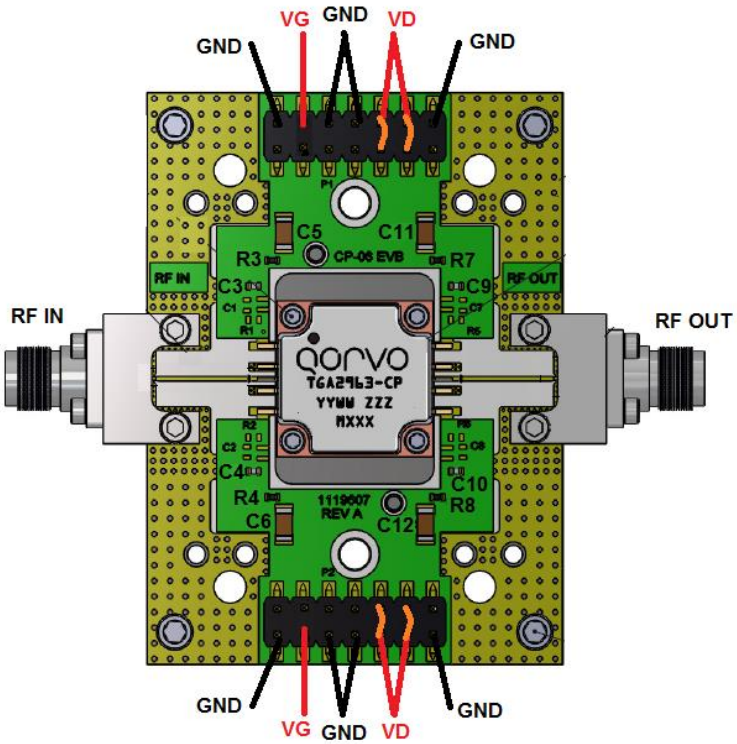
Bias Down Procedure

1. Turn off RF supply
2. Reduce V_G to −5 V; ensure I_{DQ} is approx. 0 mA
3. Set V_D to 0 V
4. Turn off V_D supply
5. Turn off V_G supply

Pin Description

Pad No.	Symbol	Description
1,5	V_G	Gate voltage. Bias network is required; must be biased from both sides; see recommended Application Information above.
3	RF_{IN}	Input; matched to 50 Ω; DC blocked
2,4,7,9	GND	Must be grounded on the PCB.
6,10	V_D	Drain voltage. Bias network is required; must be biased from both sides; see recommended Application Information above.
8	RF_{OUT}	Output; matched to 50 Ω; DC blocked

Evaluation Board



Notes:

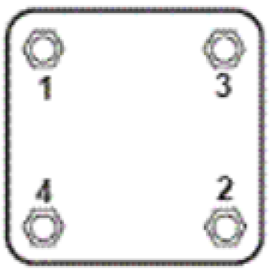
1. Both Top and Bottom V_D and V_G must be biased.
2. Remove R7, R8, C11 & C12 for pulsed operation.

Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C3, C4, C9, C10	0.01 µF	CAP, 0.01uF, 10%, 50V, X7R, 0402	Various	–
C5, C6, C11, C12	10 µF	CAP, 10uF, 20%, 50V, 20%, X5R, 1206	Various	–
R3, R4, R7, R8	5.1 Ohm	RES, 5.1 OHM, 5%, 50V, 0402	Various	–
J1, J2	2.92 mm	RF Connector, F, 2.92 mm	Southwest Microwave	1092-01A-5

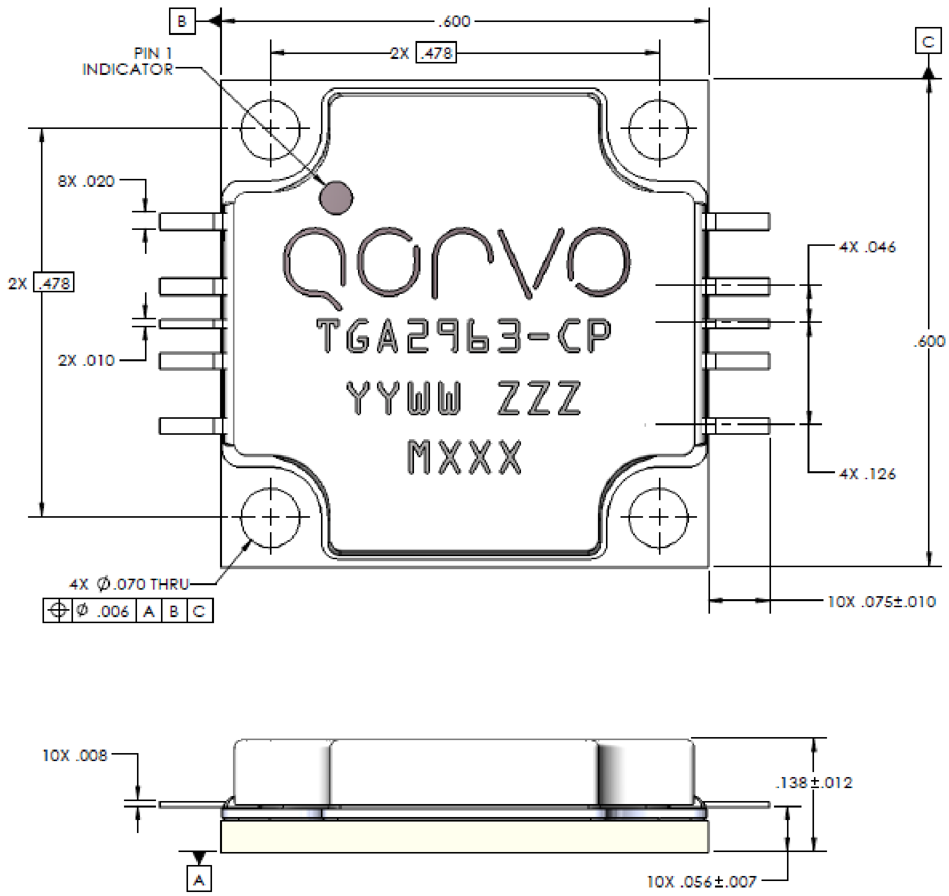
Assembly Notes

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 TGA2963-CP. 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.xx = ± 0.01

x.xxx = ± 0.005

Materials:

Base: Copper

Lid: Plastic

All metalized features are gold plated

Part is epoxy sealed

Marking:

2963: Part number

YY: Part Assembly year

WW: Part Assembly week

ZZZ: Serial Number

MXXX: Batch ID

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	TBD	ESDA / JEDEC JS-001-2012
MSL – Moisture Sensitivity Level	N/A	

Caution!
ESD-Sensitive Device

Solderability

The component leads should be manually soldered, and the package cannot be subjected to conventional reflow processes. Soldering of the component leads is compatible with the latest version of J-STD-020, lead-free solder, 260 °C. The use of no-clean solder to avoid washing after soldering is recommended.

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:

- Product uses RoHS Exemption 7c-1 to meet RoHS Compliance requirements
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_{4}0_{2}$) 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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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

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(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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