TGA2594-HM

27 – 31 GHz GaN Power Amplifier

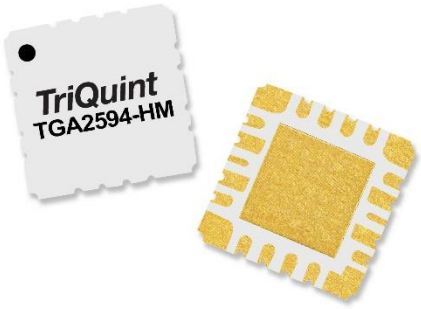
Product Description

Qorvo's TGA2594-HM is a packaged power amplifier fabricated on Qorvo's 0.15 um GaN on SiC process (QGaN15). Operating from 27 to 31 GHz, the TGA2594-HM achieves 36.5 dBm saturated output power with a power-added efficiency of 25 %, and 25 dB small signal gain.

The TGA2594-HM is offered in a hermetically sealed 22-lead 7 x7 mm ceramic QFN designed for surface mount to a printed circuit board. The package has a Cu-Mo base, offering superior thermal management. The TGA2594-HM is ideally suited to support both commercial and military applications.

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

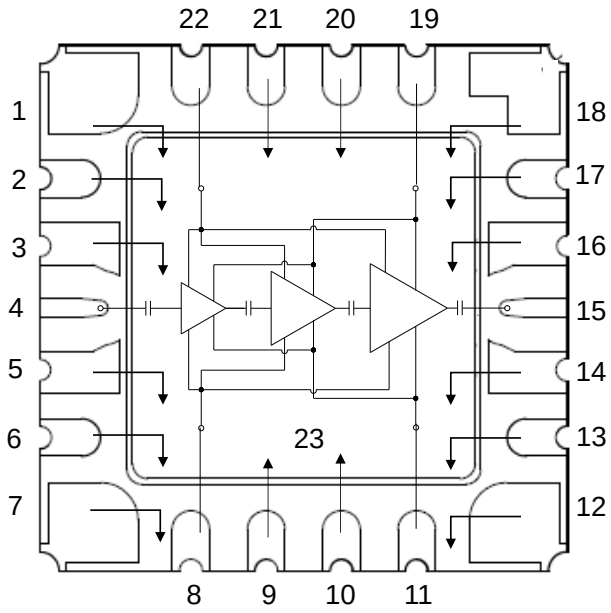
Lead free and RoHS compliant.



Product Features

- Frequency Range: 27 – 31 GHz
- P_{OUT}: 36.5 dBm at P_{IN} = 14 dBm
- PAE: 25 % CW
- Small Signal Gain: 25 dB
- IM3: −35 dBc @ 25 dBm P_{OUT} / Tone
- Bias: V_D = +20 V, I_{DQ} = 140 mA, V_G = −3.0 V Typical
- Package Dimensions: 7 x 7 x 1.3 mm

Functional Block Diagram



Top View

Applications

- Military SATCOM Terminals
- Commercial SATCOM Terminals
- Point-to-Point Digital Radio
- Point-to Multipoint Digital Radio

Ordering Information

Part No.	Description
TGA2594-HM	27 – 31 GHz GaN Power Amplifier

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	+29.5 V
Gate Voltage Range (V_G)	−5 to 0 V
Drain Current (I_D)	1.4 A
Gate Current (I_G)	85 °C: −3 to 17 mA
Power Dissipation (P_{DISS}), 85 °C	15 W
Input Power, CW, 50 Ω, (P_{IN})	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

Parameter	Value / Range
Drain Voltage (V_D)	+20 V
Drain Current (I_{DQ})	140 mA
Drain Current Under RF Drive (I_{D_DRIVE})	See plots p. 7
Gate Voltage (V_G)	−3 V (Typ.)
Gate Current Under RF Drive (I_{G_DRIVE})	See plots p. 7
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

Parameter	Min	Typ	Max	Units
Operational Frequency Range	27	–	31	GHz
Small Signal Gain	–	25	–	dB
Input Return Loss	–	> 5	–	dB
Output Return Loss	–	> 5	–	dB
Output Power @ P_{IN} = 14 dBm	–	36.5	–	dBm
Power Added Efficiency @ P_{IN} = 14 dBm	–	25	–	%
IM3 (P_{OUT}/ Tone = 25 dBm/Tone)	–	−35	–	dBc
IM5 (P_{OUT}/ Tone = 25 dBm/Tone)	–	−43	–	dBc
Small Signal Gain Temperature Coefficient	–	−0.05	–	dB/°C
Output Power Temperature Coefficient	–	−0.04	–	dBm/°C

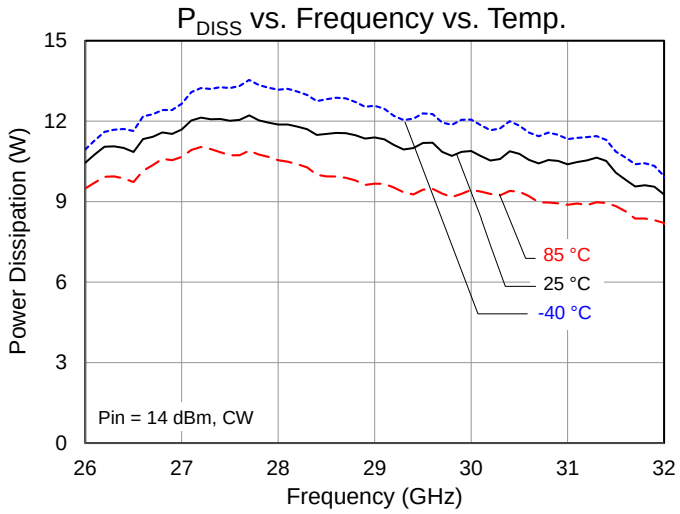
Test conditions unless otherwise noted: 25 °C, V_D = +20 V, I_{DQ} = 140 mA, V_G = −3 V Typ, CW.

Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, V_D=+20 V (CW) Freq=29 GHz, P_{IN}=14 dBm, I_{DQ}=140 mA, I_{D_Drive}=640 mA, P_{OUT}=36 dBm, P_{DISS}=9 W	6.89	°C/W
Channel Temperature (T_{CH}) (Under RF drive)		147	°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

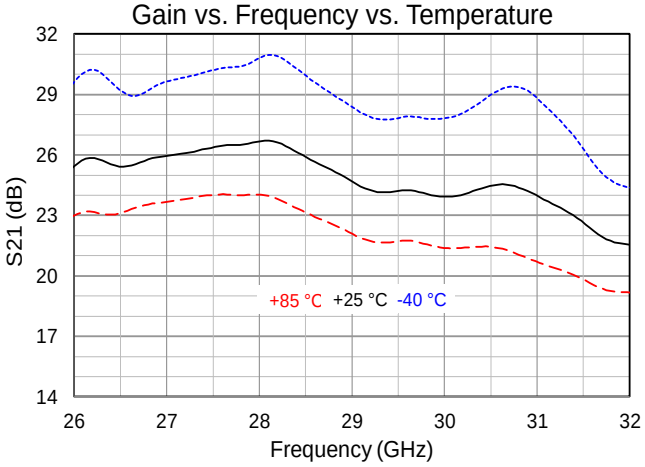
Power Dissipation



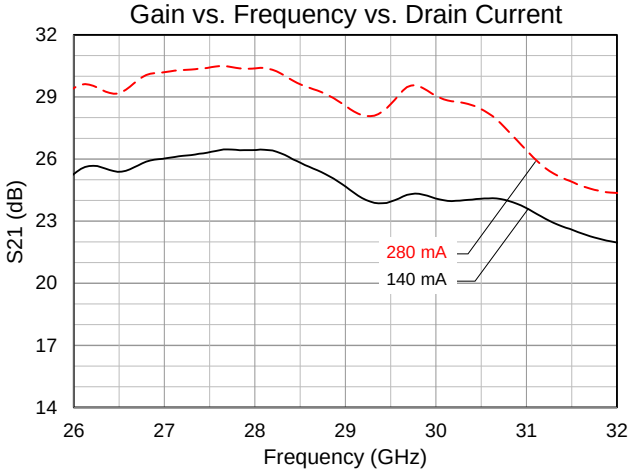
Performance Plots – Small Signal

Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 140 mA, V_G = −3 V Typical, CW.

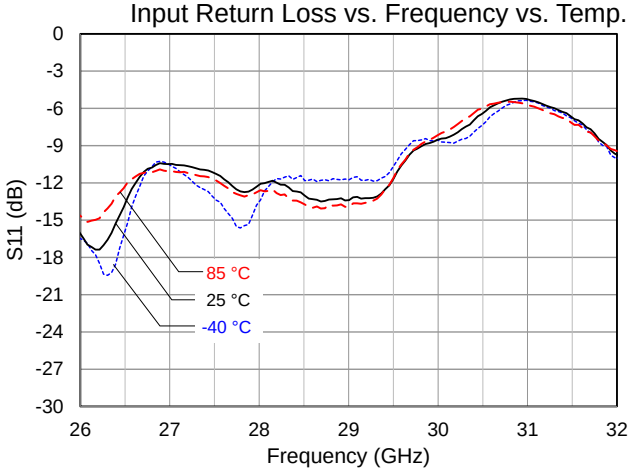
Gain vs. Frequency vs. Temperature



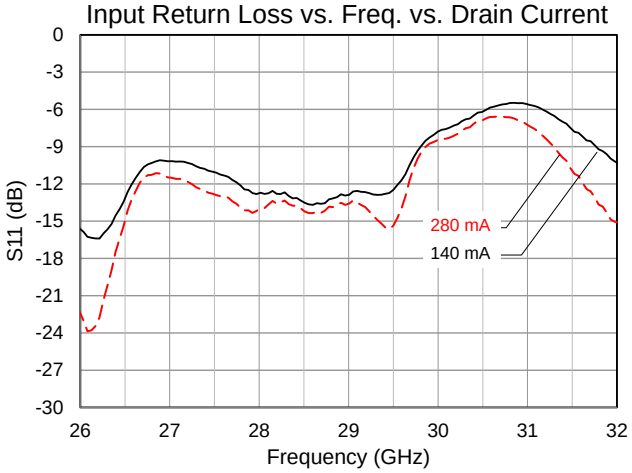
Gain vs. Frequency vs. Drain Current



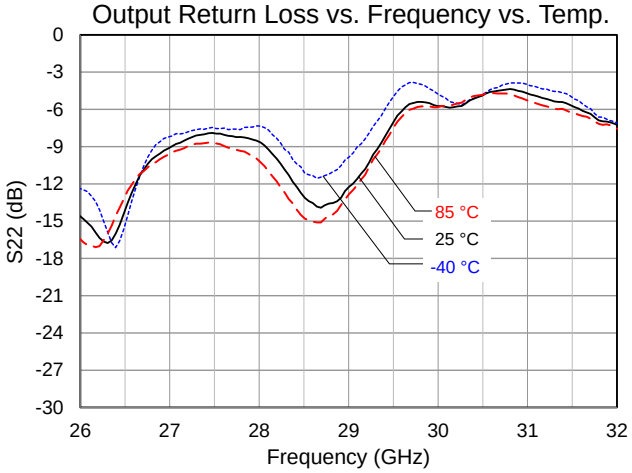
Input Return Loss vs. Frequency vs. Temp.



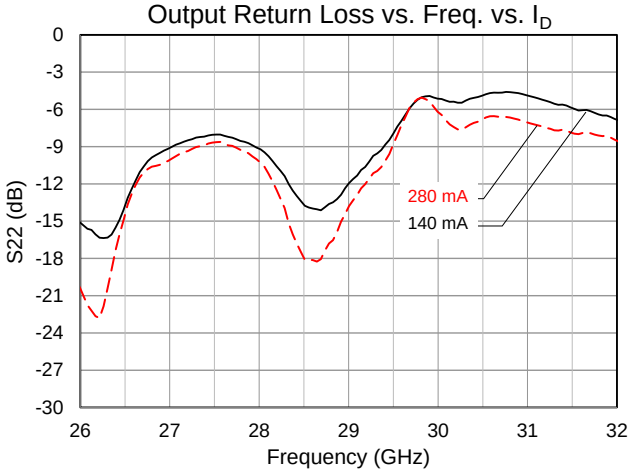
Input Return Loss vs. Freq. vs. Drain Current



Output Return Loss vs. Frequency vs. Temp.



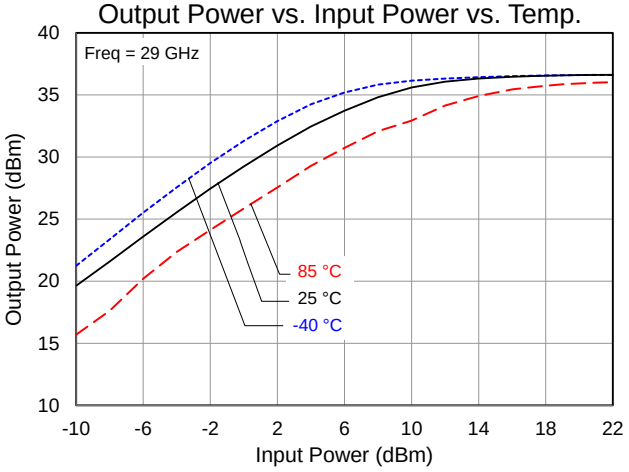
Output Return Loss vs. Freq. vs. I_D



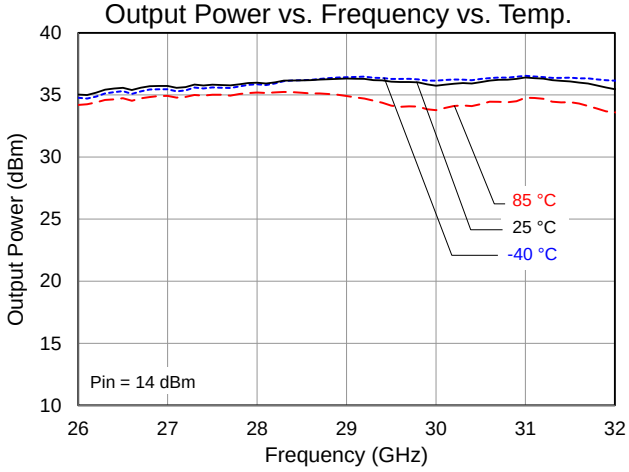
Performance Plots – Large Signal

Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 140 mA, V_G = −3 V Typical, CW.

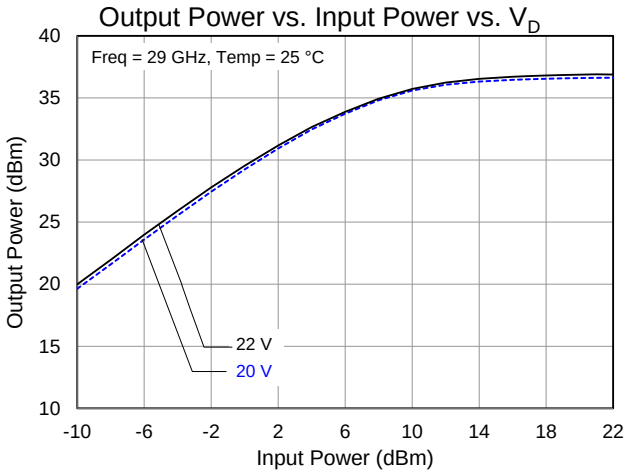
Output Power vs. Input Power vs. Temp.



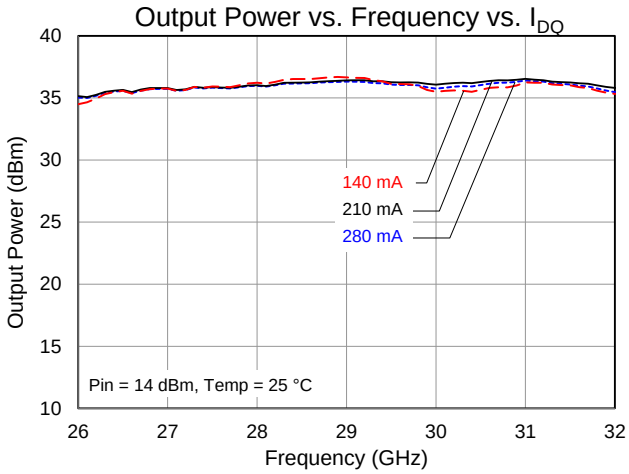
Output Power vs. Frequency vs. Temp.



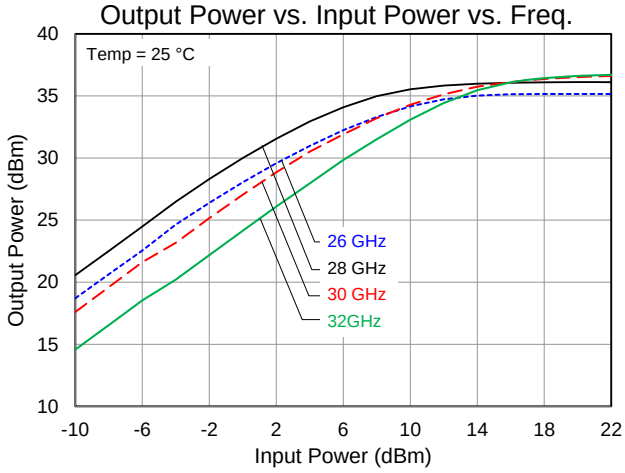
Output Power vs. Input Power vs. V_D



Output Power vs. Frequency vs. I_{DQ}



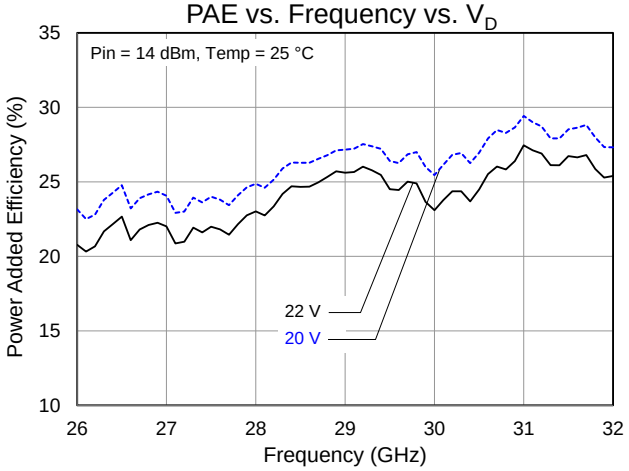
Output Power vs. Input Power vs. Freq.



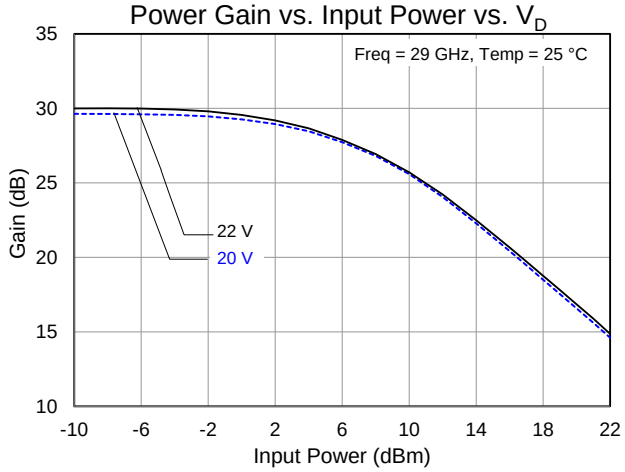
Performance Plots – Large Signal

Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 140 mA, V_G = −3 V Typical, CW.

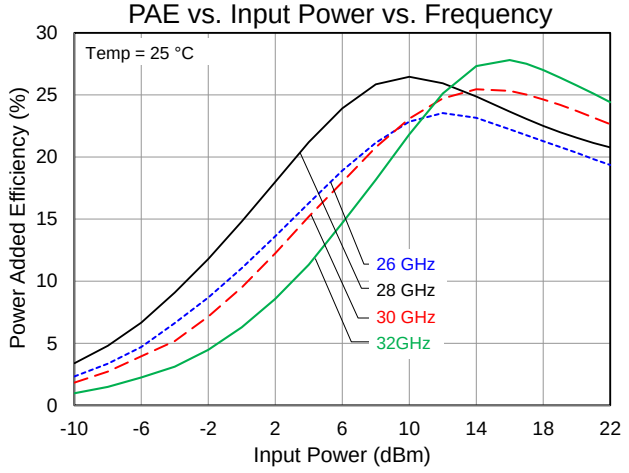
PAE vs. Frequency vs. V_D



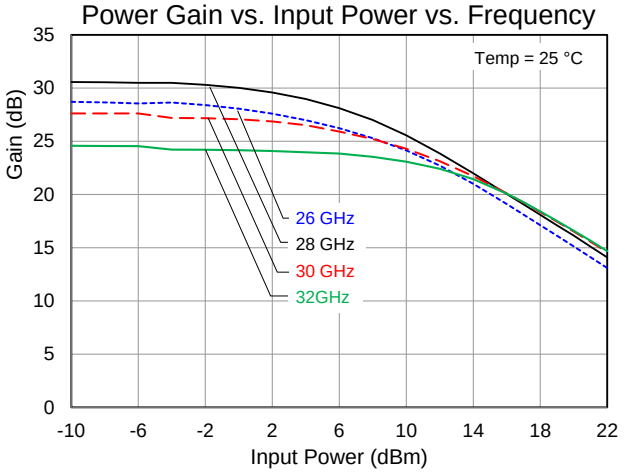
Power Gain vs. Input Power vs. V_D



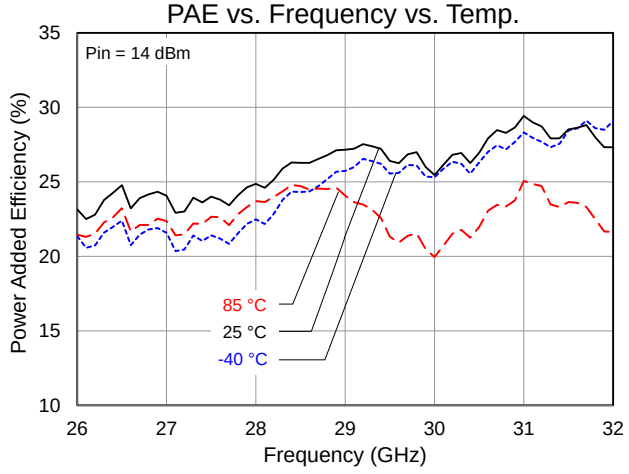
PAE vs. Input Power vs. Frequency



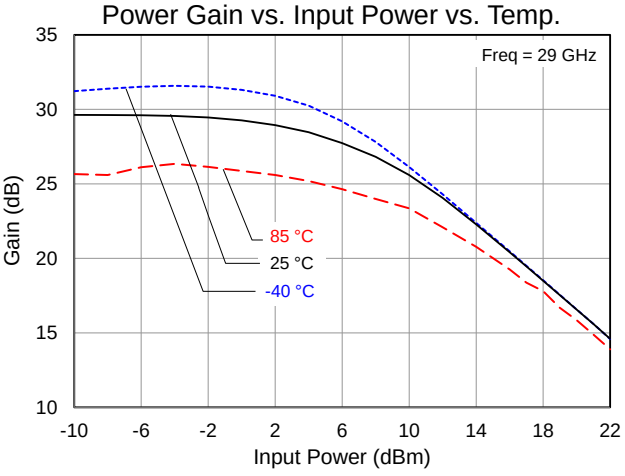
Power Gain vs. Input Power vs. Frequency



PAE vs. Frequency vs. Temp.



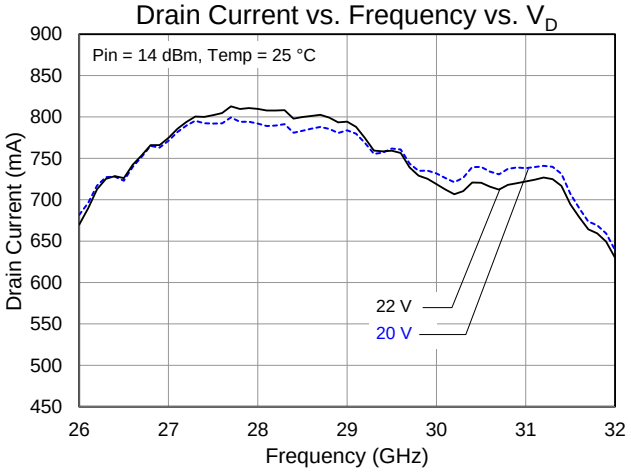
Power Gain vs. Input Power vs. Temp.



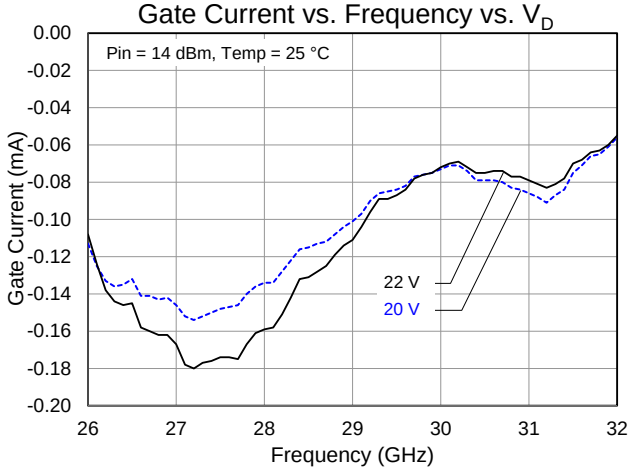
Performance Plots – Large Signal

Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 140 mA, V_G = −3 V Typical, CW.

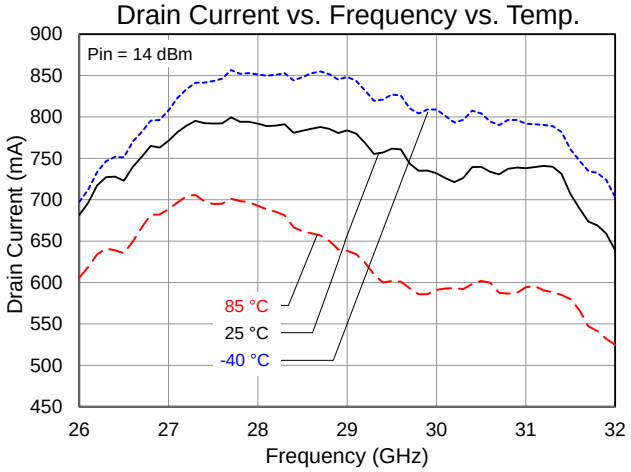
Drain Current vs. Frequency vs. V_D



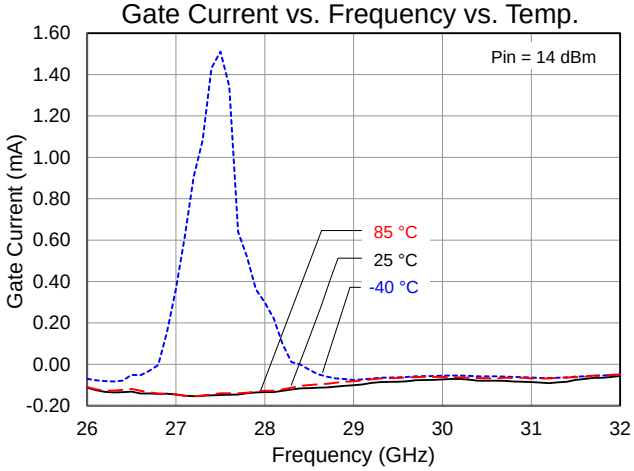
Gate Current vs. Frequency vs. V_D



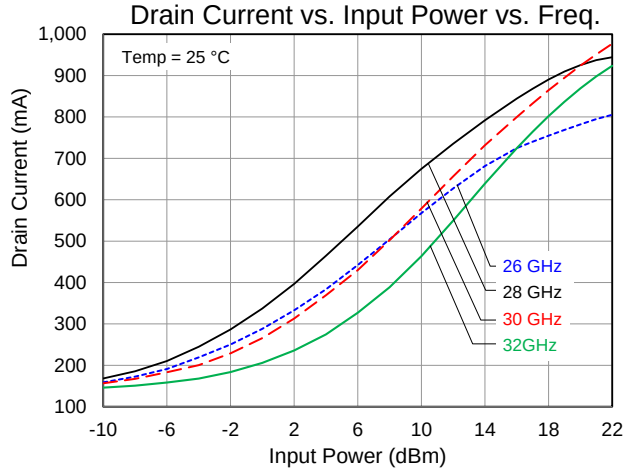
Drain Current vs. Frequency vs. Temp.



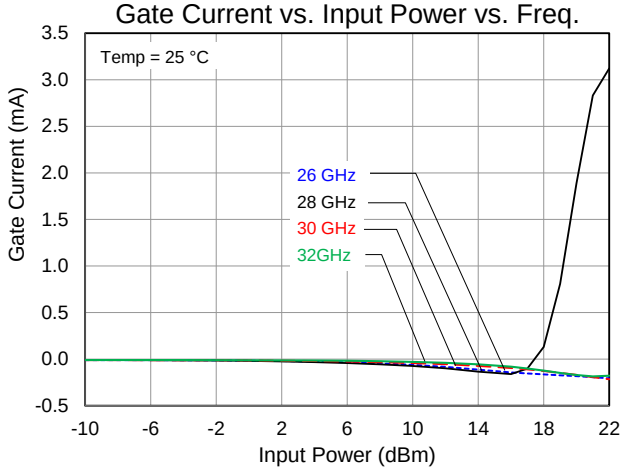
Gate Current vs. Frequency vs. Temp.



Drain Current vs. Input Power vs. Freq.



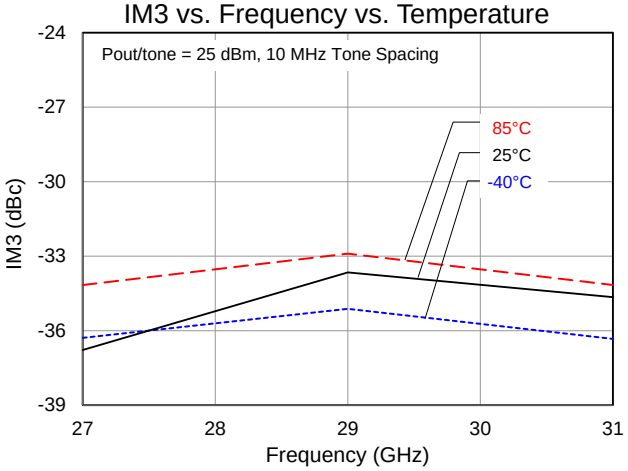
Gate Current vs. Input Power vs. Freq.



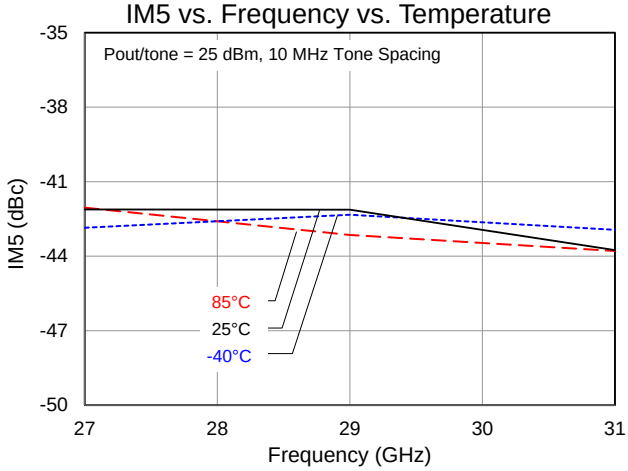
Performance Plots – Large Signal and Linearity

Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 140 mA, V_G = −3 V Typical, CW.

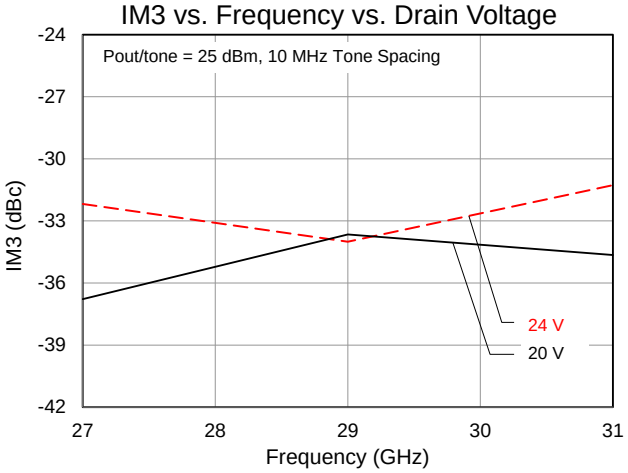
IM3 vs. Frequency vs. Temperature



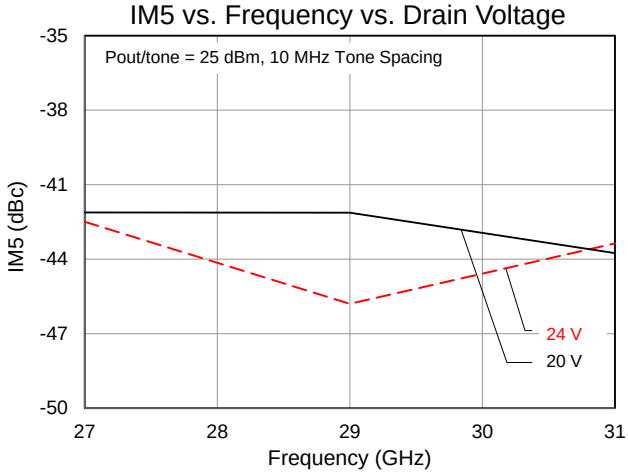
IM5 vs. Frequency vs. Temperature



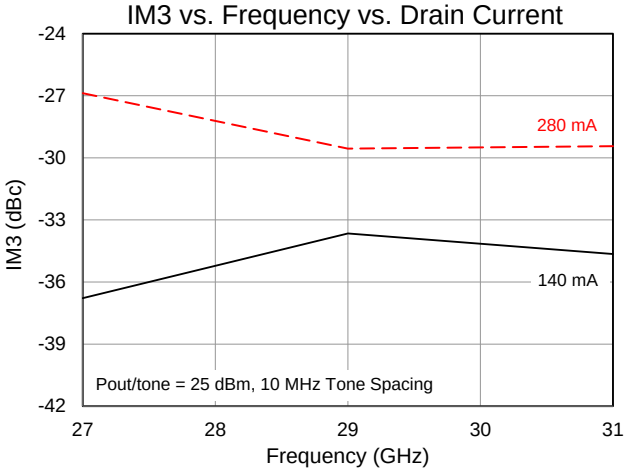
IM3 vs. Frequency vs. Drain Voltage



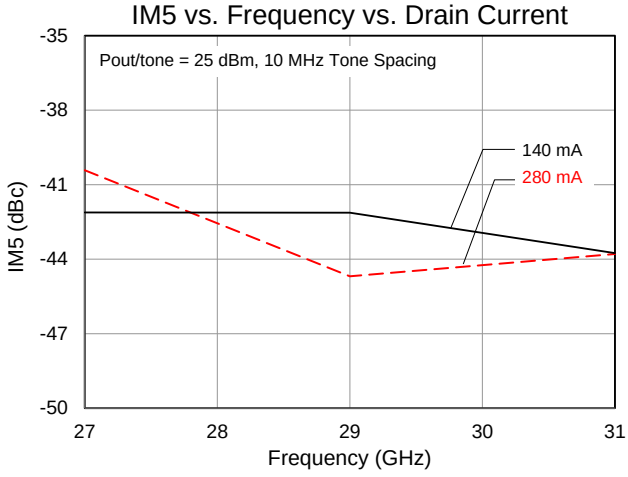
IM5 vs. Frequency vs. Drain Voltage



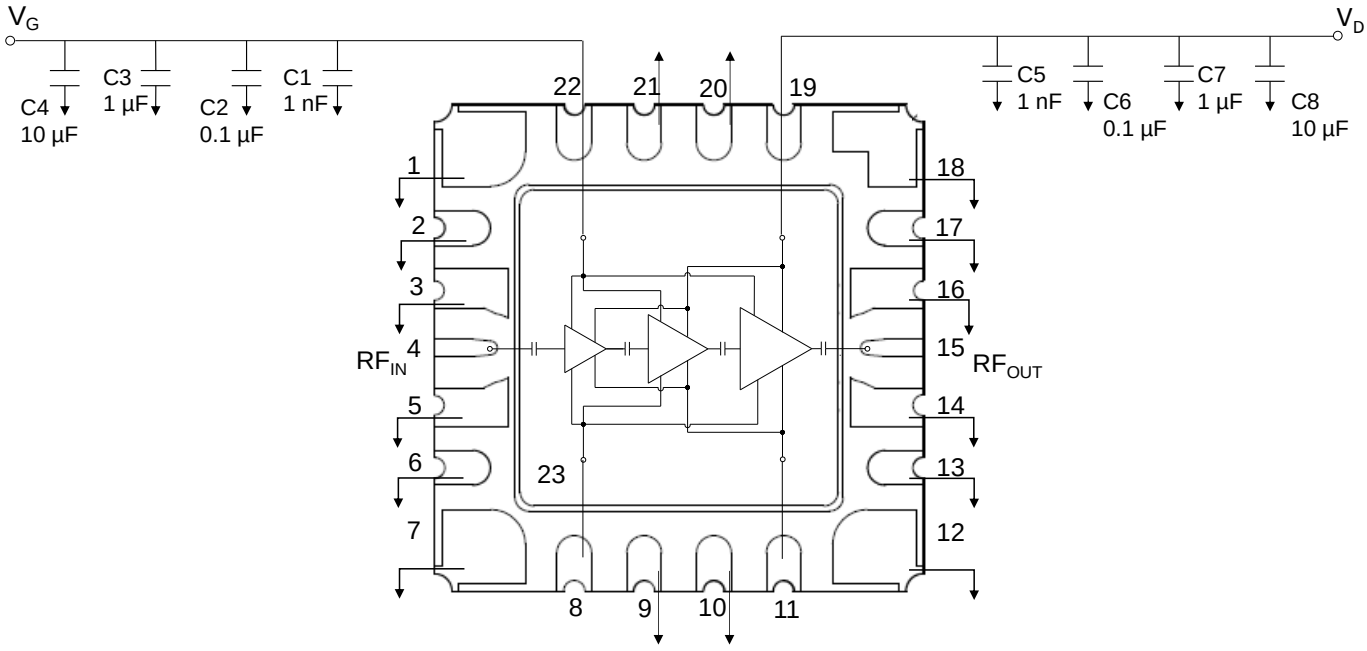
IM3 vs. Frequency vs. Drain Current



IM5 vs. Frequency vs. Drain Current



Applications Information and Pad Layout



Top View

Bias Up Procedure

1. Set I_D limit to 1.2 A, I_G limit to 10 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} = 140 mA (V_G ~ −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

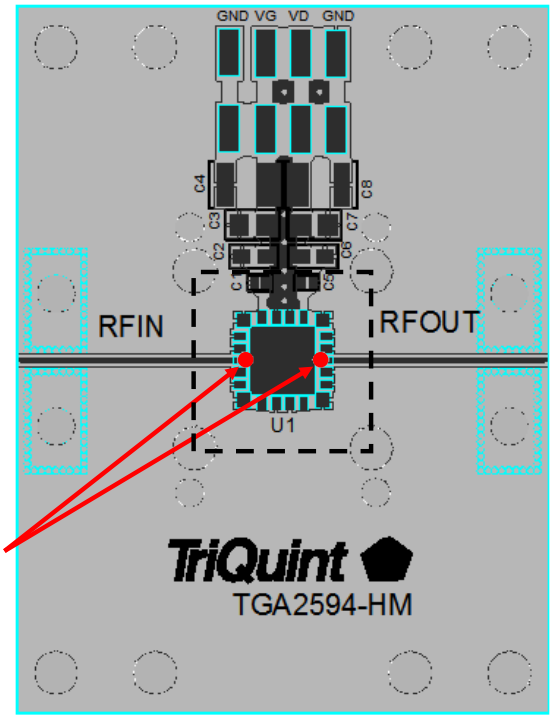
Pad Description

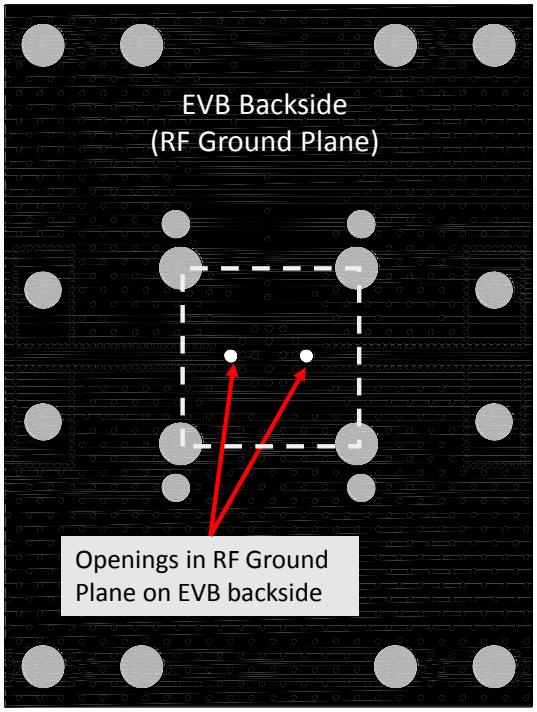
Pad No.	Symbol	Description
1-3, 5-7, 9,10,12-14, 16-18, 20,21,23	GND	Must be grounded on the PCB.
4	RF_{IN}	Output; matched to 50 Ω; DC blocked
8, 11	NC	For use with Q EVB, do not connect (pins are connected internal to package)
15	RF_{OUT}	Input; matched to 50 Ω; DC blocked
19	V_D (1)	Drain voltage; Bias network is required; see recommended Application Information above.
22	V_G (2)	Gate Voltage; Bias network is required; see recommended Application Information above.

Notes:
1. If not using TQ EVB, VD may be applied to either pin 11 or pin 19.
2. If not using TQ EVB, VG may be applied to either pin 8 or pin 22.

Evaluation Board

Location of openings on backside of EVB





Notes:
1. Existence of 1 mm diameter opening on backside of EVB – the openings are required for all EVBs.
2. See Assembly Notes (page 11) for additional detail.

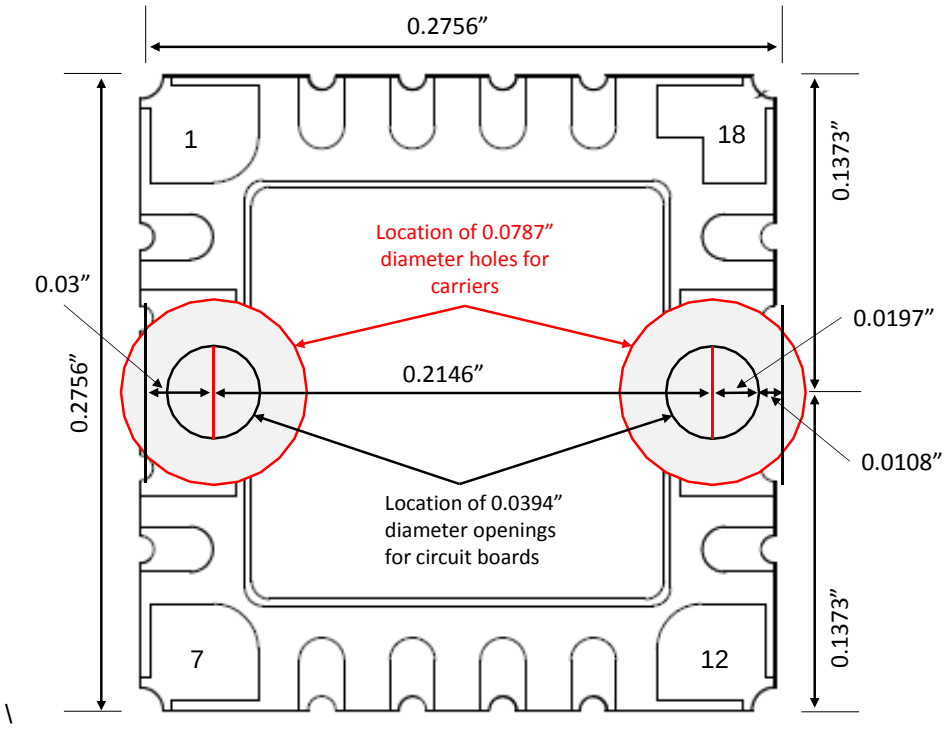
Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C1, C5	1 nF	Cap, 0402, +50 V, 10 %, X7R	Various	–
C2, C6	0.1 µF	Cap, 0603, +50 V, 10 %, X7R	Various	–
C3, C7 (1)	1 µF	Cap, 0805, +50 V, 10 %, X7R	Various	–
C4, C8 (1)	10 µF	Cap, 1206, +50 V, 10 %, X7R	Various	–

Notes:
1. If the designated application is not sensitive to IM3, capacitors C3, C4, C7, and C8 may omitted.

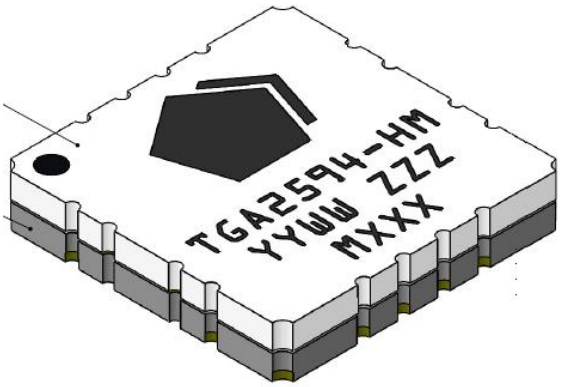
Assembly Notes

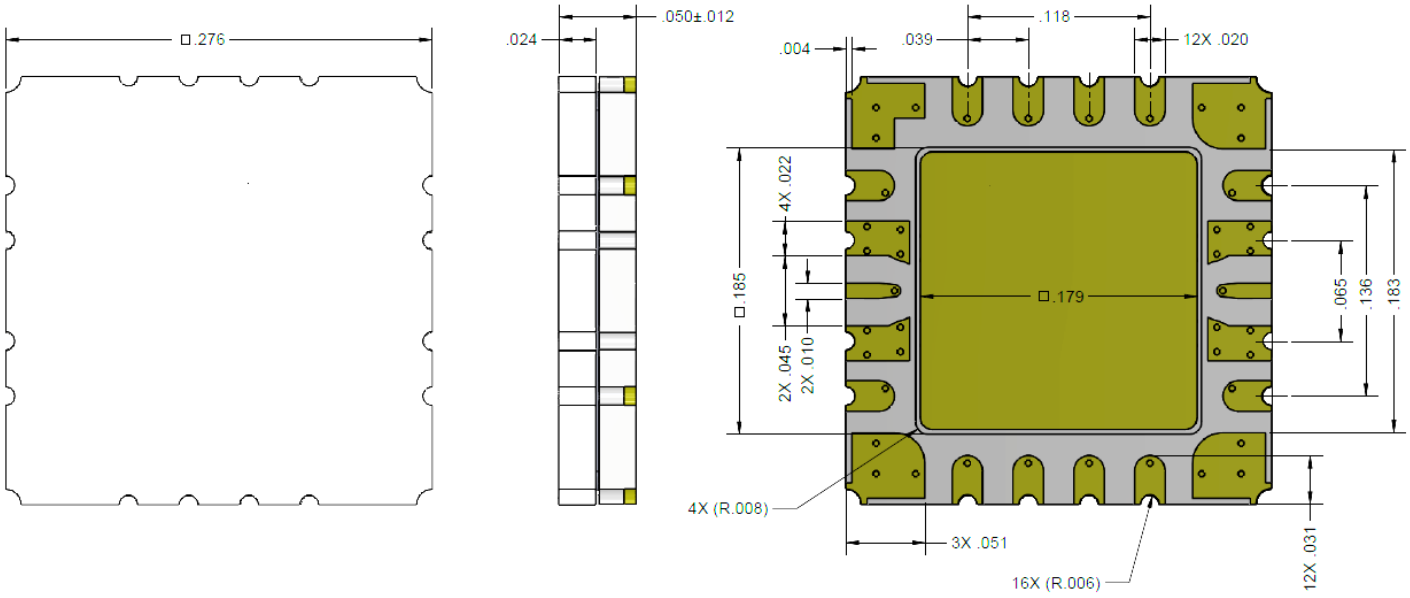
1. Clean the board or module with alcohol. Allow it to dry fully.
2. Apply solder paste to each pin of the TGA2594-HM, and heat achieve reflow, being careful not to exceed the thermal budget.
3. Clean the assembly with alcohol.
4. To attain quoted RF performance, the following is required:
    i. On the printed circuit board, there must be two 1 mm (0.0394”) diameter openings on the backside (RF Ground Plane) of the circuit board.
        - Location of the openings is contained in the Q Evaluation Board layout.
        - The 1 mm diameter openings for the board are shown in the diagram below in reference to the base of the package.
    ii. Use of a carrier plate with 2 mm (0.0787”) diameter holes.
        - The holes should be located with respect to the package pin-out as shown in the diagram below.
        - The holes should be 4 mm deep.
5. To improve thermal performance, the following is recommended:
    i. The use of a 4 mil indium shim between the circuit board and the carrier plate.
    ii. The In shim should have the same hole diameter and positioning as the carrier plate (see diagram below for location with respect to the package backside). The holes should be machined fully through the In shim.



Top View (through package to PCB/carrier)

Mechanical Information





Units: inches
Tolerances: unless specified
x.xx = ± 0.01
x.xxx = ± 0.006
Materials:
Package: Metal/Ceramic
Lid: Ceramic
All metalized features are gold plated
Part is solder sealed
Marking:
2594: 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)	Class 1A, 400 V	JEDEC Standard JESD22 A114
MSL – Convection Reflow	N/A, Hermetic Package	JEDEC standard IPC/JEDEC J-STD-020.

Caution!
ESD-Sensitive Device

Solderability

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

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:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_40_2$) 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

Important Notice

The information contained herein is believed to be reliable; however, Qorvo makes no warranties regarding the information contained herein and assumes no responsibility or liability whatsoever for the use of the information contained herein. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for Qorvo products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information. **THIS INFORMATION DOES NOT CONSTITUTE A WARRANTY WITH RESPECT TO THE PRODUCTS DESCRIBED HEREIN, AND QORVO HEREBY DISCLAIMS ANY AND ALL WARRANTIES WITH RESPECT TO SUCH PRODUCTS WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

Without limiting the generality of the foregoing, Qorvo products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.

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

Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9