TGA2625

10 – 11 GHz 20 W GaN Power Amplifier

Product Description

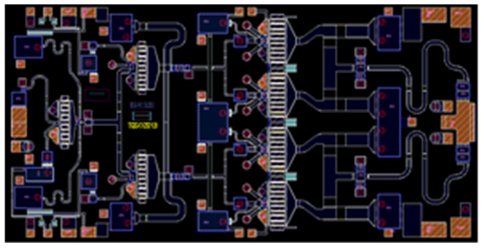
Qorvo's TGA2625 is an x-band, high power MMIC amplifier fabricated on Qorvo's production 0.25 um GaN on SiC process.

The TGA2625 operates from 10 – 11 GHz and provides a superior combination of power, gain and efficiency. Achieving 20 W of saturated output power with 28 dB of large signal gain and greater than 42 % power-added efficiency, the TGA2625 provides the level of performance demanded by today's system architectures.

Depending on the system requirements, the TGA2625 can support cost saving initiatives on existing systems while supporting next generation systems with increased performance.

Lead-free and RoHS compliant.

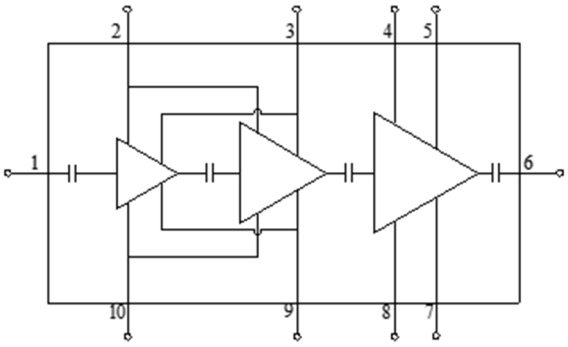
Evaluation boards are available upon request.



Product Features

- Frequency Range: 10 – 11 GHz
- P_{SAT}: 43 dBm @ P_{IN} = 15 dBm
- P1dB: > 40 dBm
- PAE: > 42 % @ P_{IN} = 15 dBm
- Large Signal Gain: 28 dB
- Small Signal Gain: 37 dB
- Return Loss: >11 dB
- Bias: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.5 V Typical
- Pulsed V_D: PW = 100 us and DC = 10 %
- Die Dimensions: 5.00 x 2.62 x 0.10 mm

Functional Block Diagram



Applications

- Radar
- Communications

Ordering Information

Part No.	ECCN	Description
TGA2625	3A001.b.2.c	10 – 11 GHz 20 W GaN Power Amplifier

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	40 V
Gate Voltage Range (V_G)	–8 to 0V
Drain Current (I_{D1-2})	1.65 A
Drain Current (I_{D3})	2.15 A
Gate Current (I_{G1-2})	–2 to 10 mA
Gate Current (I_{G3})	–6 to 14 mA
Power Dissipation (P_{DISS}), 85℃	49 W
Input Power (P_{IN}), CW, 50Ω, VD = 28V, 85℃	25 dBm
Input Power (P_{IN}), CW, VSWR 6:1, VD = 28V, 85℃	19 dBm
Channel Temperature (T_{CH})	275 ℃
Mounting Temperature (30 seconds)	320 ℃
Storage Temperature	–55 to 150 ℃

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)	28 V
Drain Current (I_{DQ})	365 mA (Total)
Gate Voltage (V_G)	-2.5 V (Typ.)

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	10		11	GHz
Small Signal Gain		37		dB
Input Return Loss		12		dB
Output Return Loss		11		dB
Output Power (Pin = 15dBm)		43		dBm
Power Added Efficiency (Pin = 15dBm)		42		%
Power @ 1dB Compression (P1dB)		40		dBm
Small Signal Gain Temperature Coefficient		–0.05		dB/℃
Recommended Operating Voltage:	20	28	32	V

Test conditions unless otherwise noted: 25^0C, V_D = 28V, I_{DQ} = 365mA, V_G = -2.5V Typical, Pulsed V_D: PW = 100us, DC = 10%

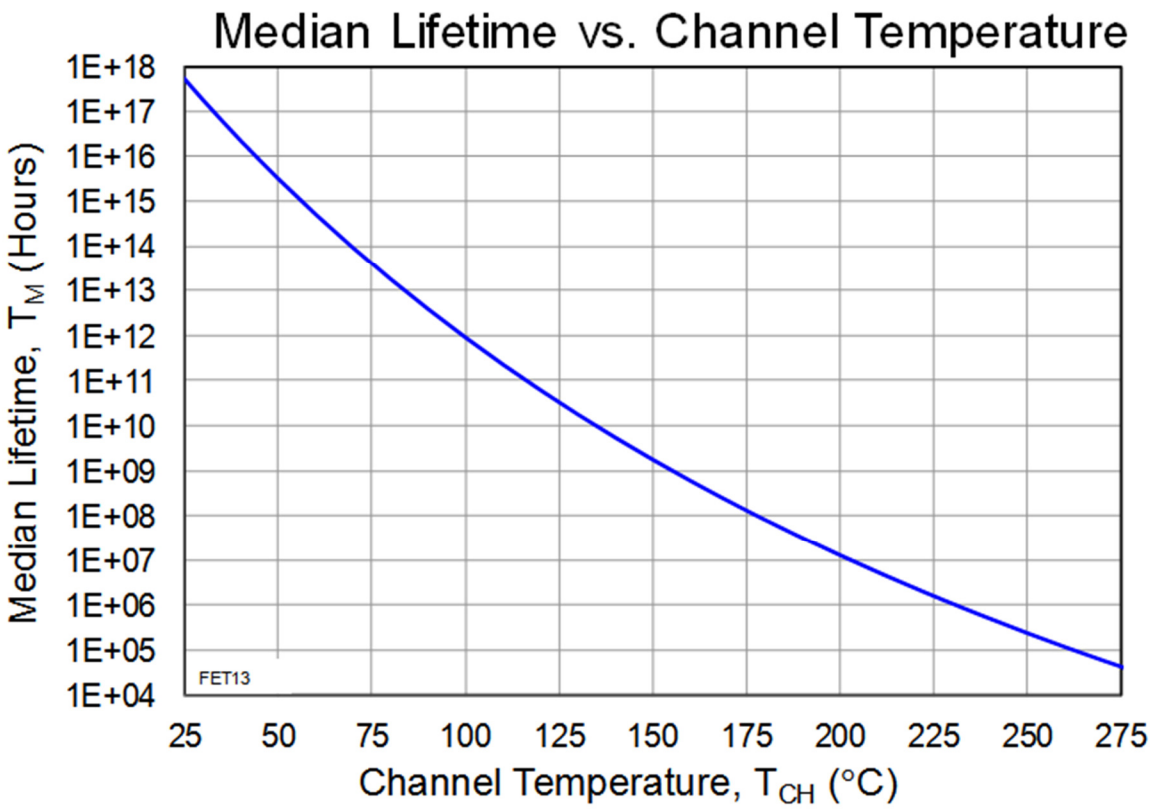
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85 °C, V_D = 28 V, I_{D_Drive} = 1.7 A, P_{IN} = 17 dBm, P_{OUT} = 43 dBm, P_{DISS} = 28 W, PW = 100 us, DC = 10 %	2.67	ºC/W
Channel Temperature (T_{CH}) under RF Drive		160	°C
Median Lifetime (T_M) under RF Drive		5.98 x 10^8	Hrs
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85 °C, V_D = 28 V, I_{D_Drive} = 1.55 A, P_{IN} = 17 dBm, P_{OUT} = 42 dBm, P_{DISS} = 28 W, CW	3.92	ºC/W
Channel Temperature (T_{CH}) under RF Drive		195	°C
Median Lifetime (T_M) under RF Drive		1.98 x 10^7	Hrs

Notes:
1. Thermal resistance measured to back of carrier plate. MMIC mounted on 40 mils CuMo (85/15) carrier using 1.5 mil AuSn.

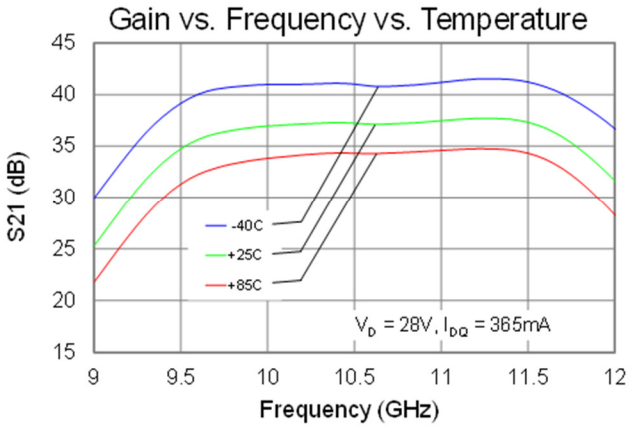
Median Lifetime

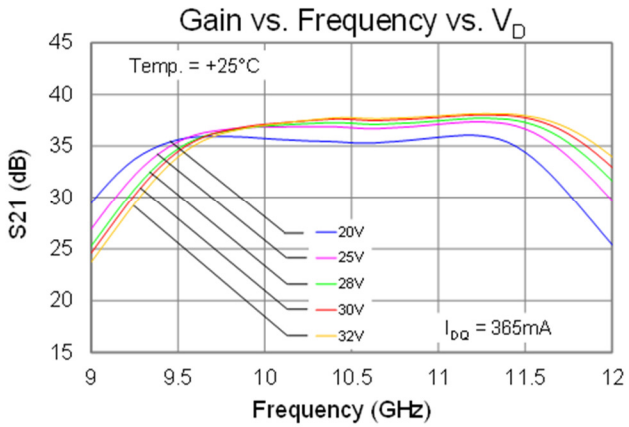
Test Conditions: V_D = +40 V; Failure Criteria = 10 % reduction in I_{D_MAX} during DC Life Testing.

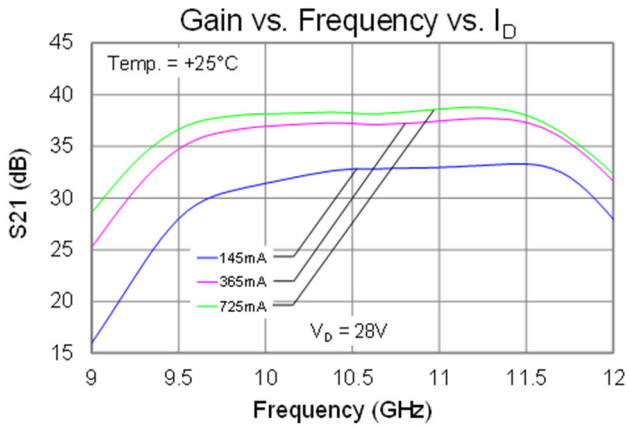


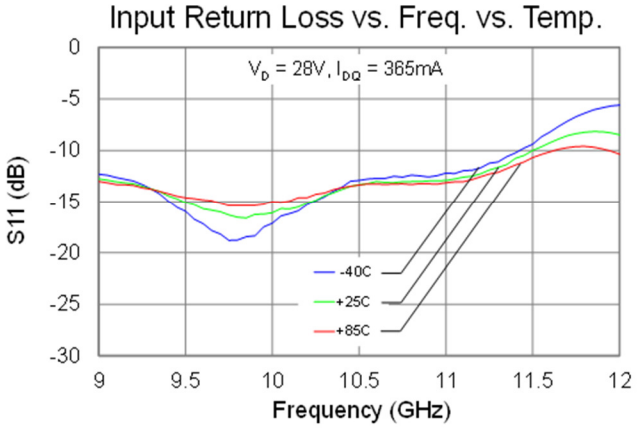
Typical Performance – Small Signal

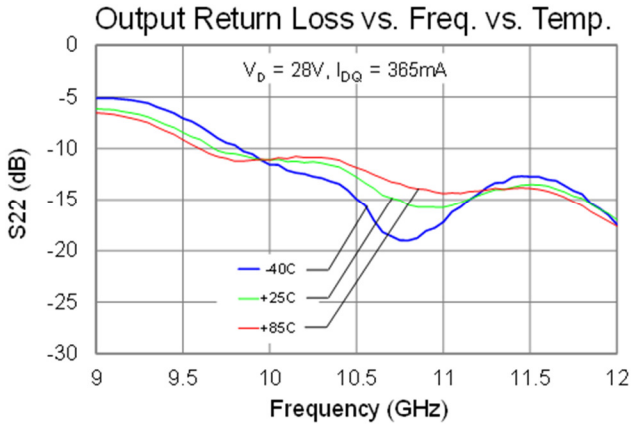
Test conditions unless otherwise noted: 25°C, V_D = 28V, I_{DQ} = 365mA, V_G = -2.5V Typical





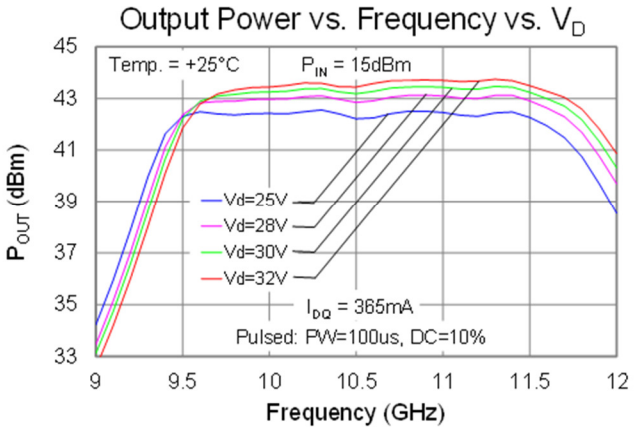


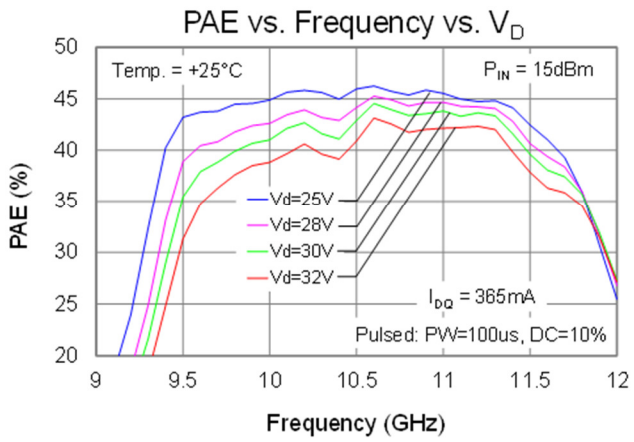


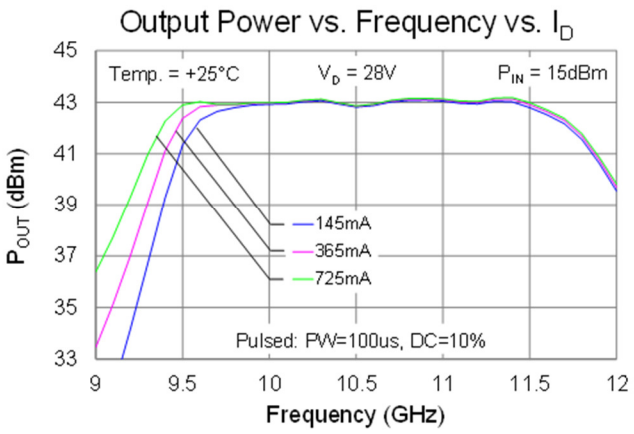


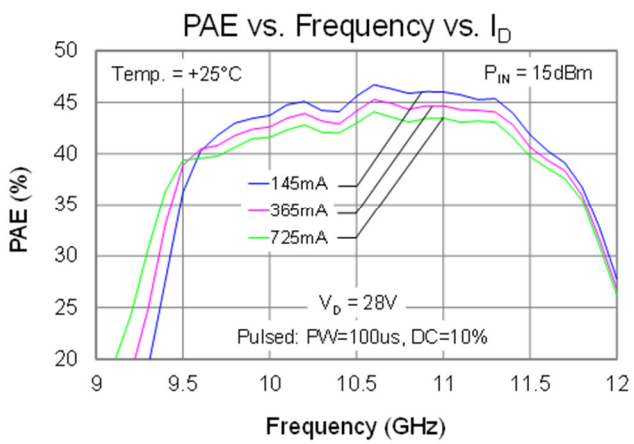
Typical Performance – Large Signal (Pulsed)

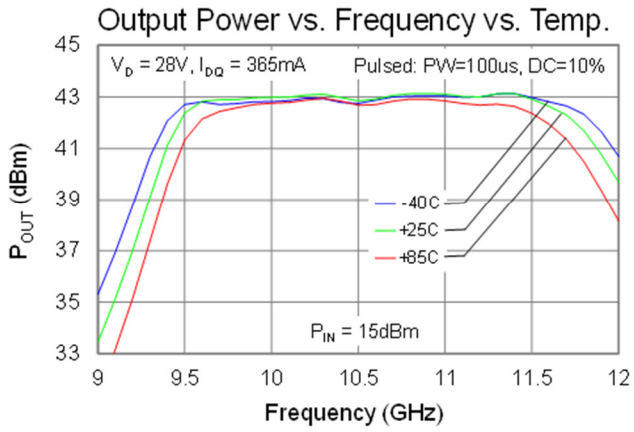
Test conditions unless otherwise noted: 25°C, V_D = 28V, I_{DQ} = 365mA, V_G = -2.5V Typical, Pulsed V_D: PW = 100us, DC = 10%

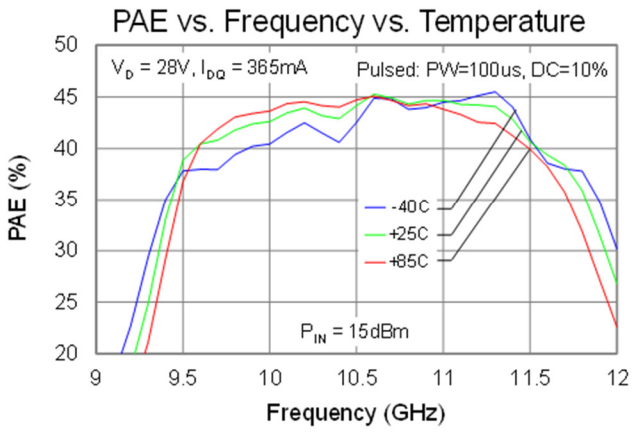












Typical Performance – Large Signal (Pulsed)

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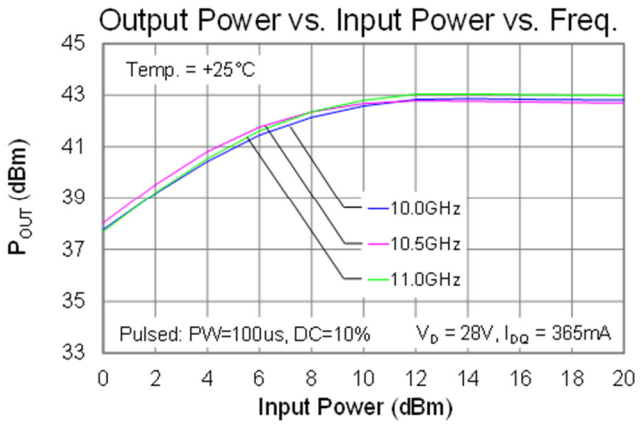
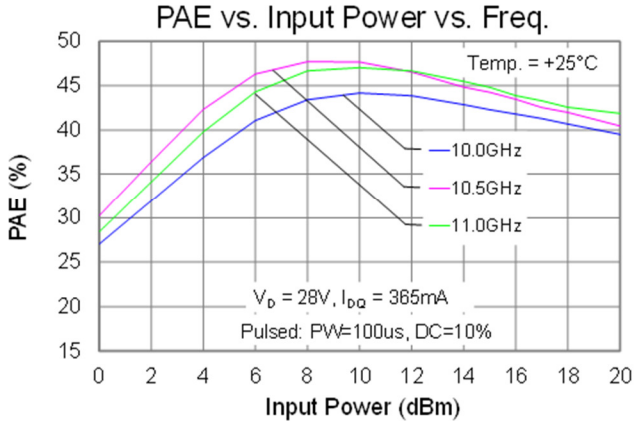
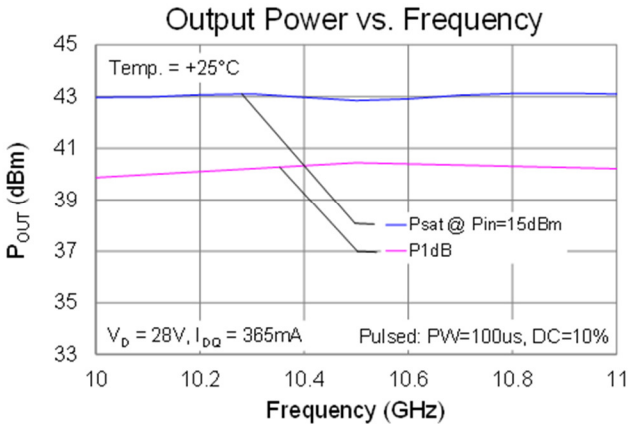
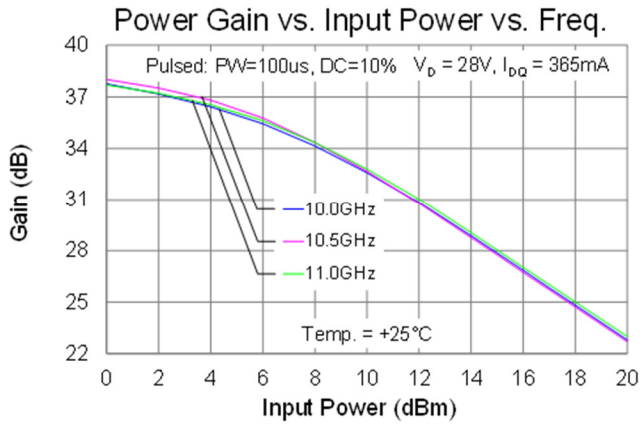
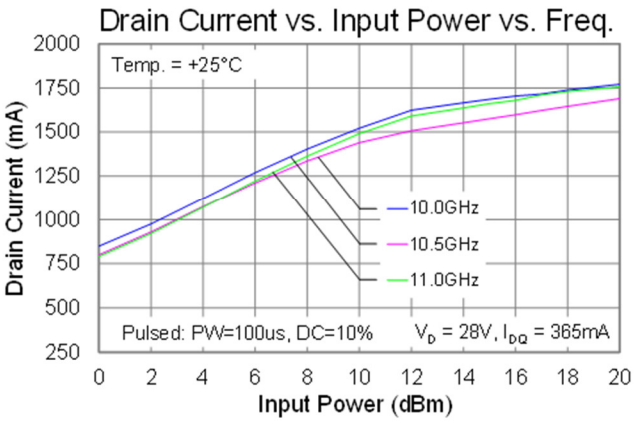
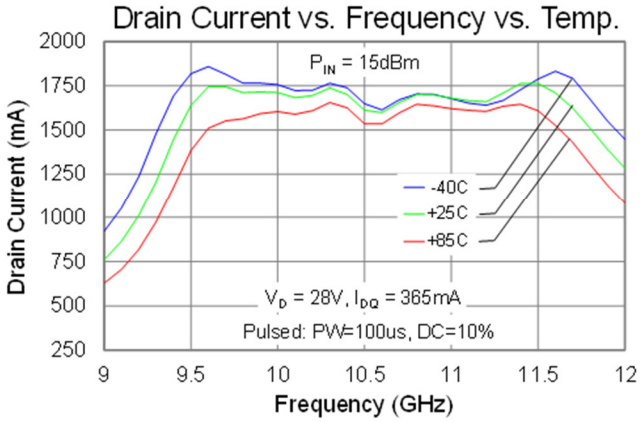






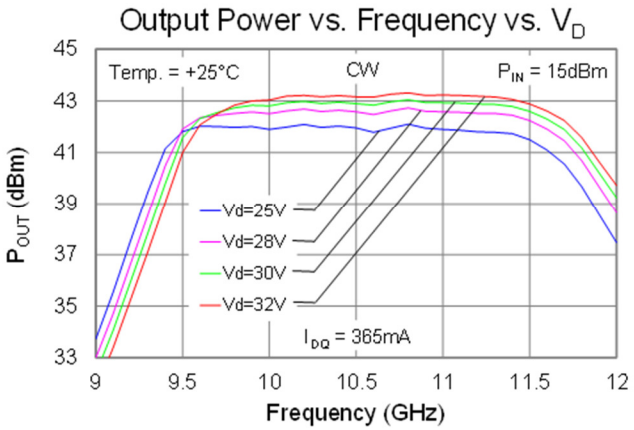


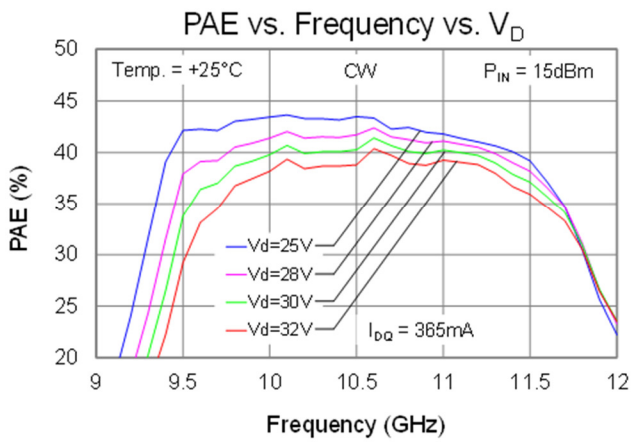


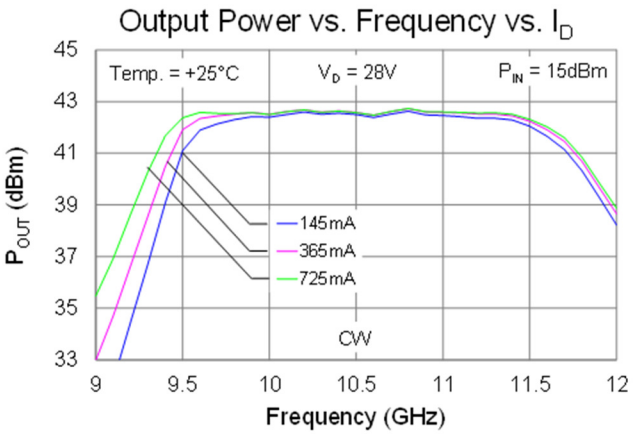


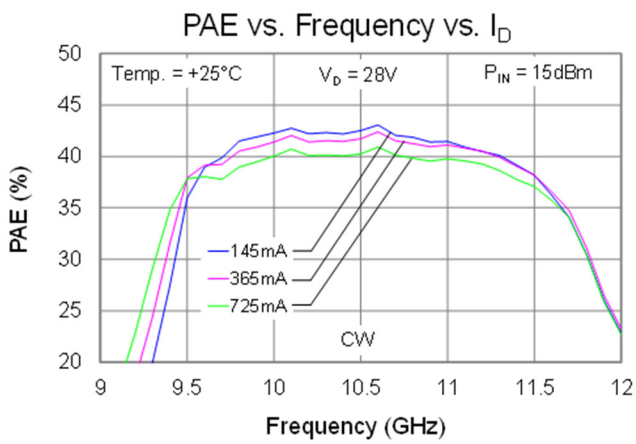
Typical Performance – Large Signal (CW)

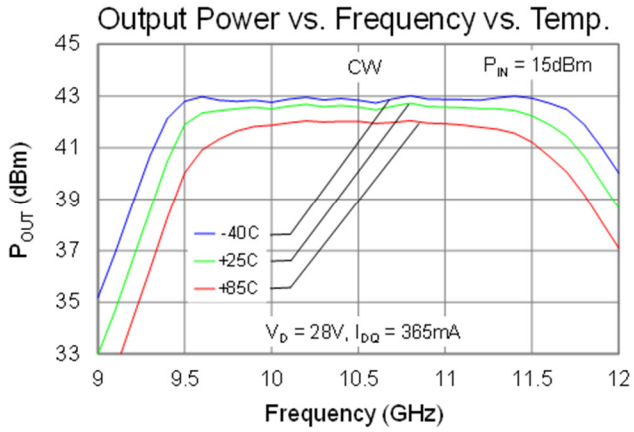
Test conditions unless otherwise noted: 25°C, V_D = 28V, I_{DQ} = 365mA, V_G = -2.5V Typical

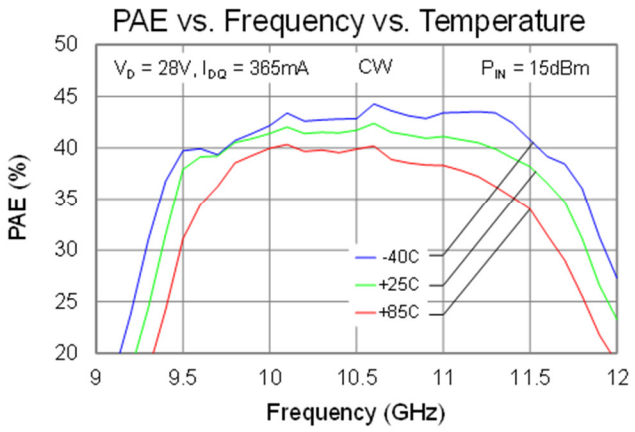






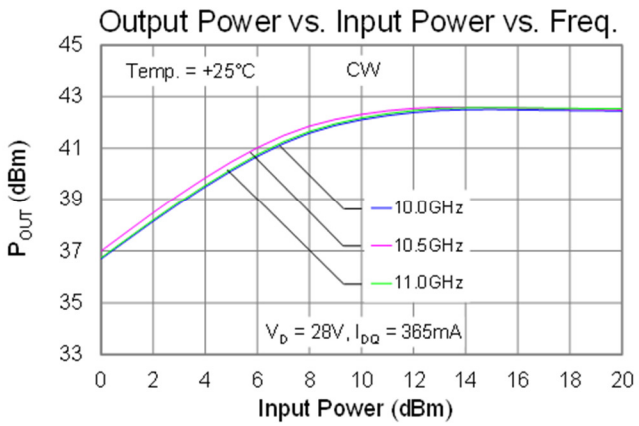


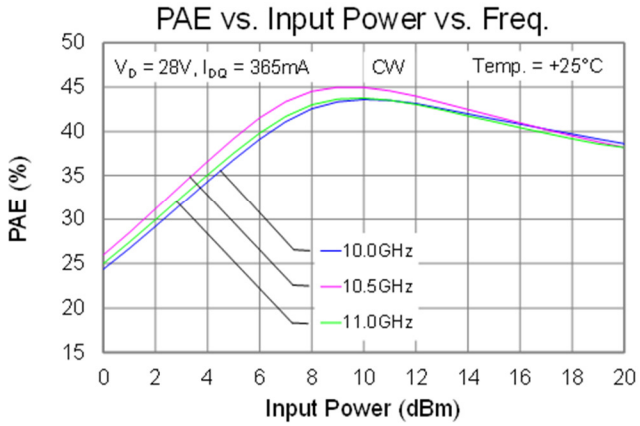


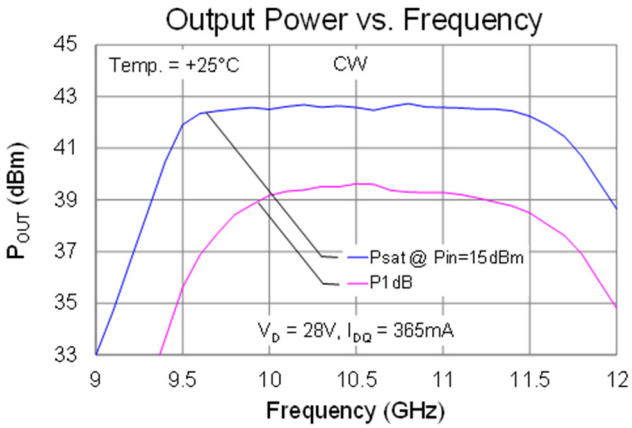


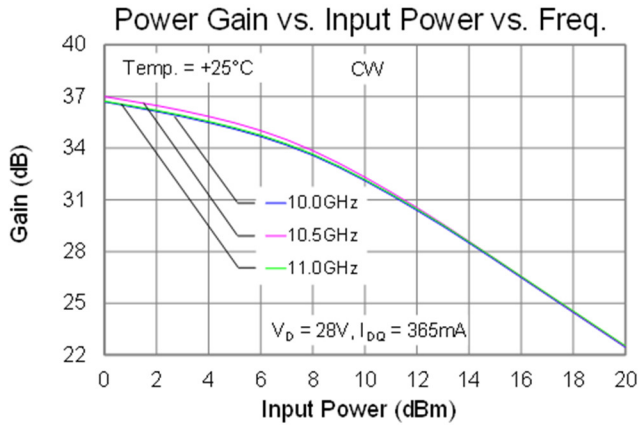
Typical Performance – Large Signal (CW)

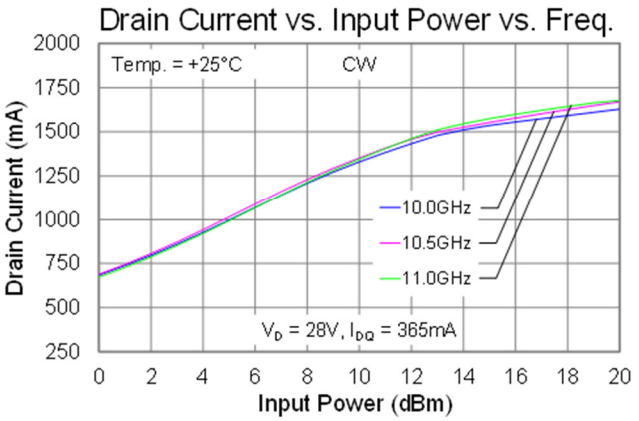
Test conditions unless otherwise noted: 25°C, V_D = 28V, I_{DQ} = 365mA, V_G = -2.5V Typical

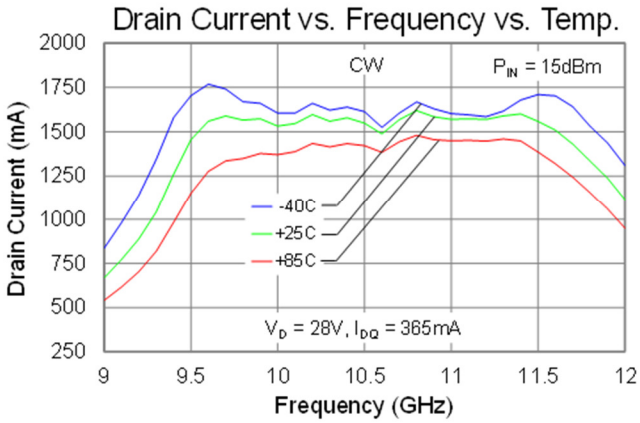






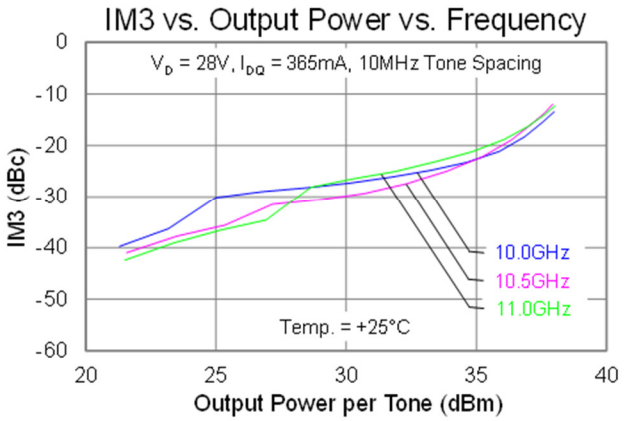


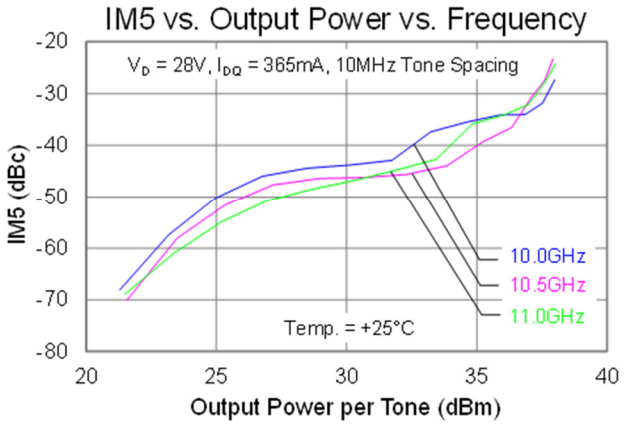


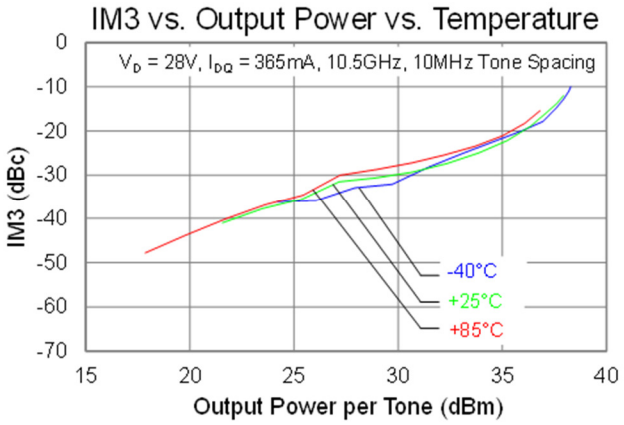


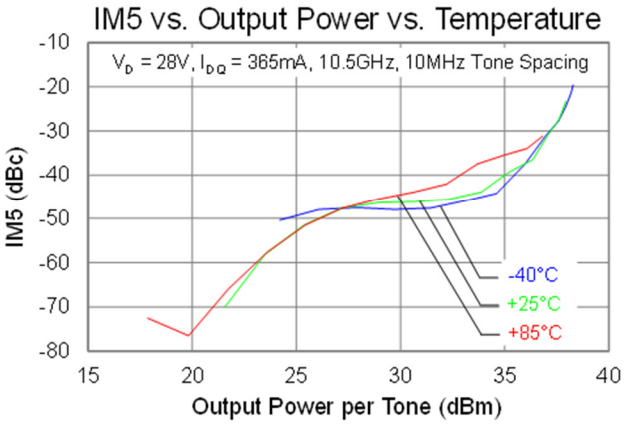
Typical Performance – Linearity

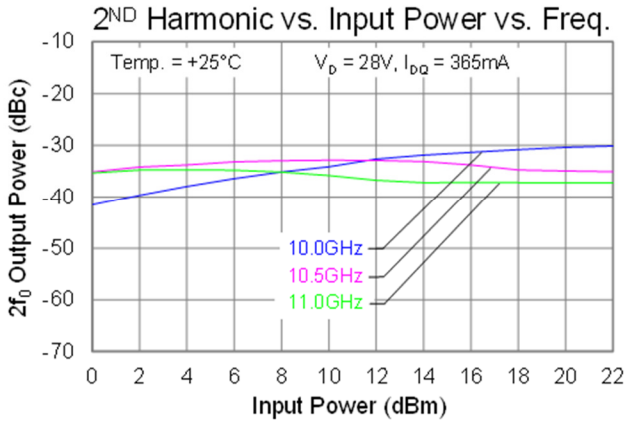
Test conditions unless otherwise noted: 25°C, V_D = 28V, I_{DQ} = 365mA, V_G = -2.5V Typical

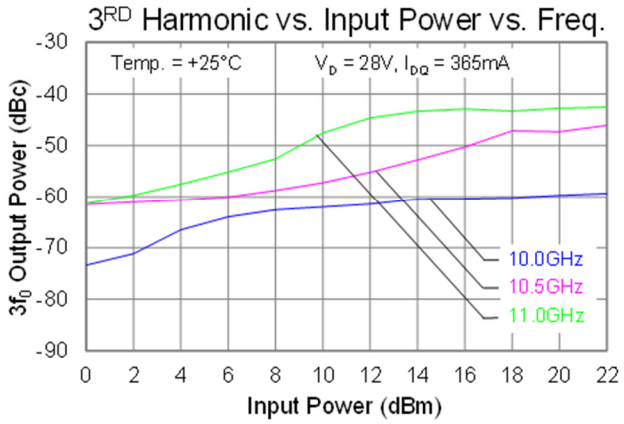




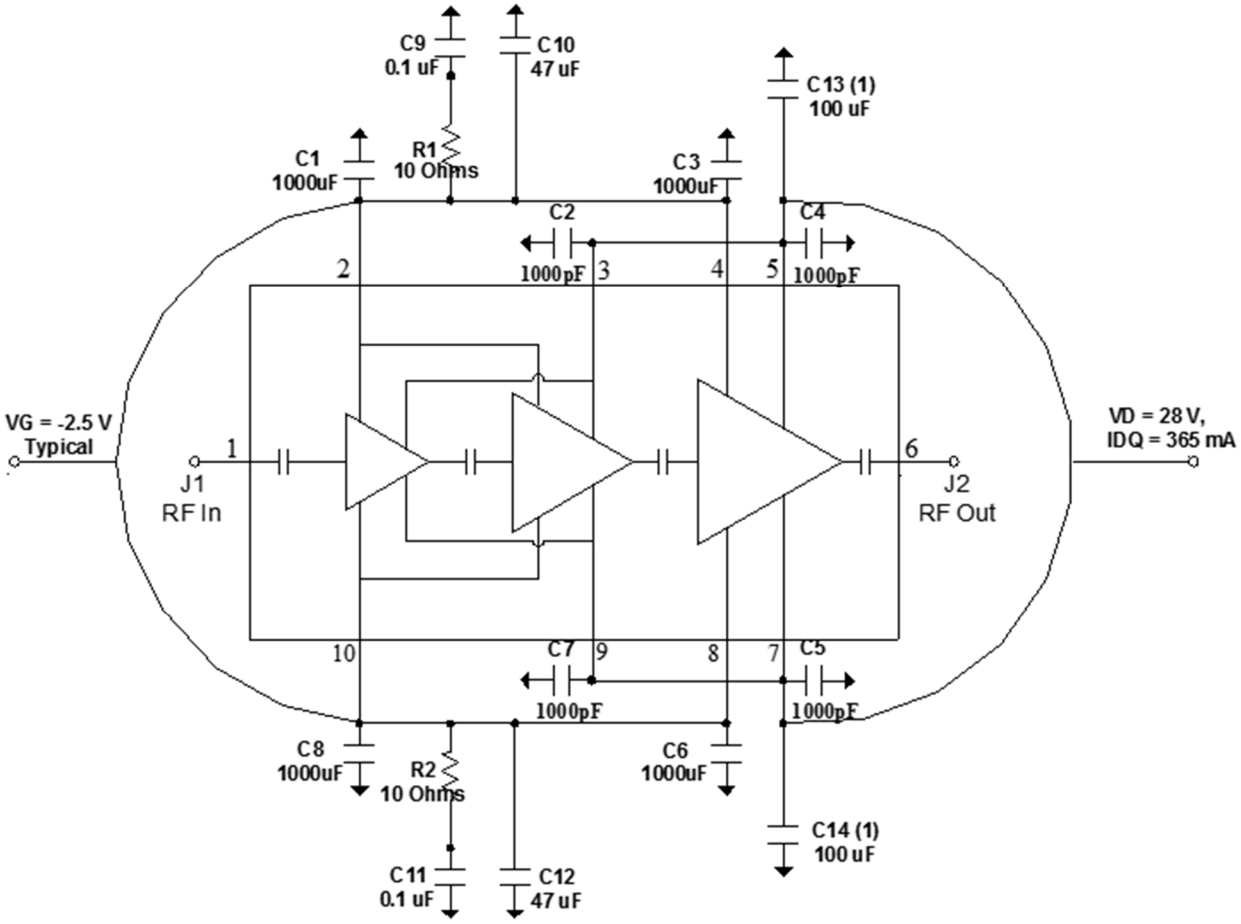








Application Circuit



Notes:

1. Remove caps for pulse operation. These caps are part of the cable harness for CW operation.

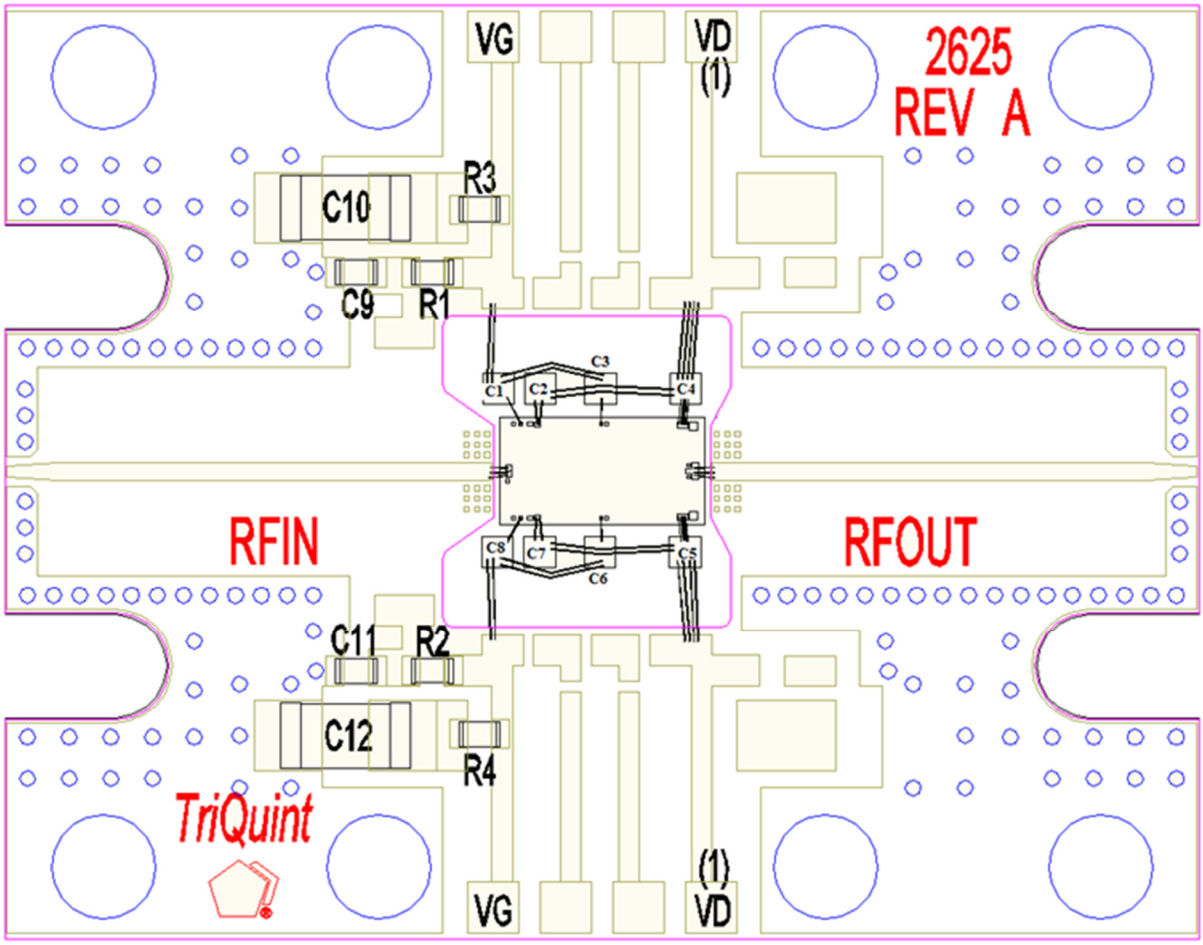
Bias Up Procedure

1. Set I_D limit to 1.9 A, I_G limit to 12 mA
2. Set V_G to –5.0 V
3. Set VD +28 V
4. Adjust V_G more positive until I_{DQ} = 365mA (V_G ~ –2.5 V Typical)
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
3. Set V_D to 0 V
4. Turn off V_D supply
5. Turn off V_G supply

Evaluation Board (EVB) Layout Assembly



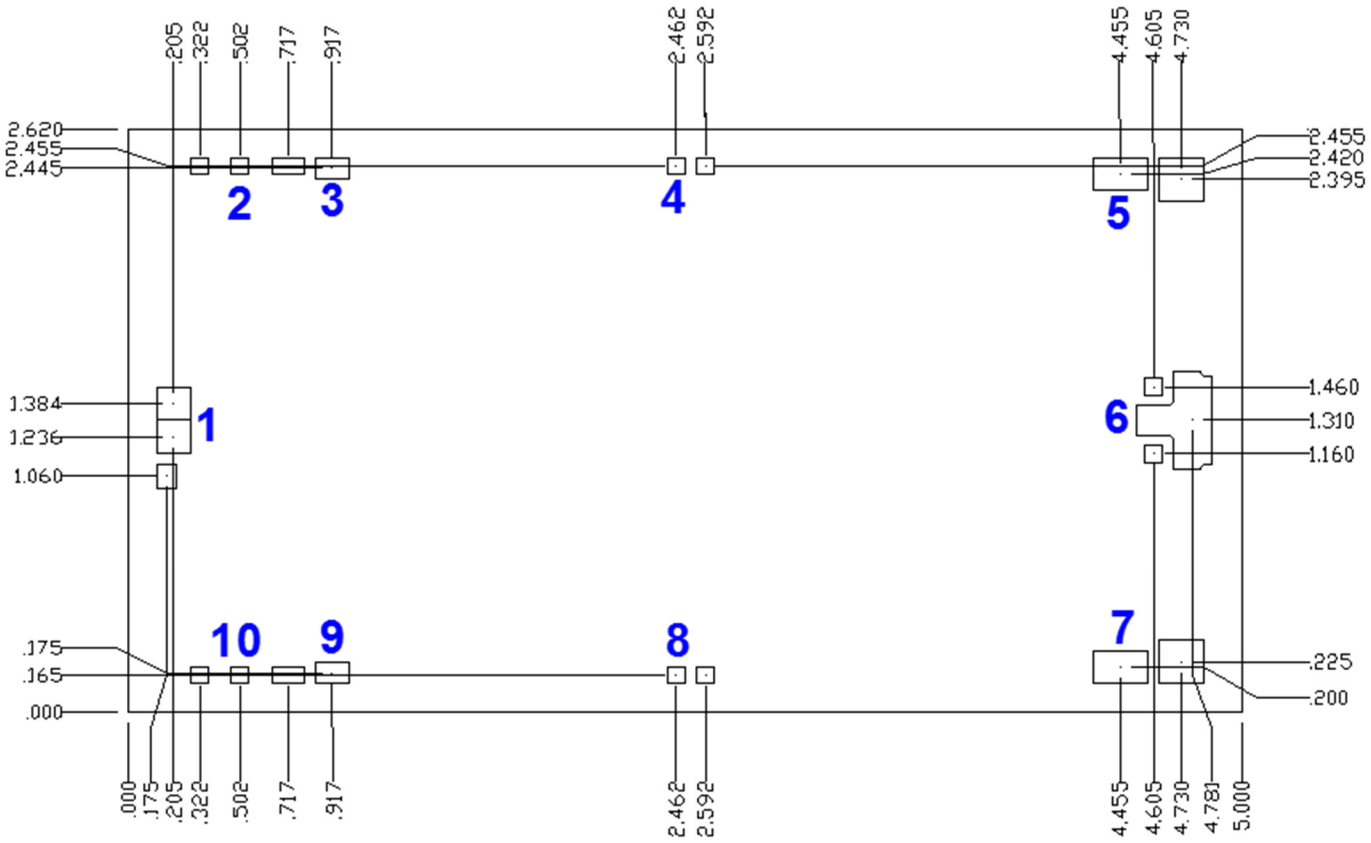
Notes:

1. 100 uF/100 V charge storage cap is needed on the drain. For pulsed operation, this cap must be on the supply-side of the pulse modulator.

Bill of Materials

Reference Des.	Value	Description	Manufacturer	Part Number
C1 – C8	1000pF	SLC, 50V	Various	
C9, C11	0.1uF	Cap, 0402, 50V, 10%, X7R	Various	
C10, C12	47uF	Cap, 1206, 50V, 10%, X7R	Various	
R1 – R2	10Ω	Res, 0402	Various	
R3 – R4	0Ω	Res, 0402	Various	

Mechanical Drawing and Bond Pad Description



Unit: millimeters
Thickness: 0.10
Die x, y size tolerance: ± 0.050
Chip edge to bond pad dimensions are shown to center of pad
Ground is backside of die

Bond Pad Description

Pad No.	Symbol	Pad Size	Description
1	RF In	0.150 x 0.300	RF Input; matched to 50Ω; DC Blocked
2, 8	V_{G1-2}	0.080 x 0.080	Gate voltage 1, bias network is required; see Application Circuit on page 10 as an example.
4,10	V_{G3}	0.080 x 0.080	Gate voltage 3, bias network is required; see Application Circuit on page 10 as an example.
3, 9	V_{D1-2}	0.150 x 0.100	Drain voltage 1, bias network is required; see Application Circuit on page 10 as an example.
5, 7	V_{D3}	0.250 x 0.150	Drain voltage 3, bias network is required; see Application Circuit on page 10 as an example.
6	RF Out	0.180 x 0.350	RF Output; matched to 50Ω; DC Blocked

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. 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.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	TBD	JEDEC Standard JESD22 A114

Caution!
ESD-Sensitive Device

Solderability

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

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 ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Contact Information

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

Web: www.qorvo.com **Tel:** +1.972.994.8465
Email: info-sales@qorvo.com **Fax:** +1.972.994.8504

For technical questions and application information:

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