TGM2635-CP

X-Band 100 W GaN Power Amplifier

Product Overview

Qorvo's TGM2635–CP is a packaged X-band, high power amplifier fabricated on Qorvo's production 0.25um GaN on SiC process. The TGM2635–CP operates from 7.9 – 11 GHz and provides 100 W of saturated output power with 22.5 dB of large signal gain and greater than 35 % power–added efficiency.

The TGM2635-CP is packaged in a 10-lead 19.05 x 19.05 mm bolt-down package with a pure Cu base for superior thermal management. Both RF ports are internally DC blocked and matched to 50 ohms allowing for simple system integration.

The TGM2635-CP is ideally suited for both commercial and military X-Band radar systems, satellite communications systems, and data links.

RoHS compliant.

Key Features

- Frequency Range: 7.9 – 11 GHz
- P_{SAT}: 50 dBm (P_{IN} = 28 dBm)
- PAE: 35% (P_{IN} = 28 dBm)
- Large Signal Gain: 22 dB (P_{IN} = 28 dBm)
- Small Signal Gain: 26 dB
- Bias: V_D = 28 V, I_{DQ} = 1.3 A
- Package Dimensions: 19.05 x 19.05 x 4.52 mm
- Performance Under Pulsed Operation

Functional Block Diagram

Top View

Applications

- X-band Radar
- Satellite Communications
- Data Links

Ordering Information

Part	Description
TGM2635-CP	X-band 100 W GaN Power Amplifier

Absolute Maximum Ratings

Parameter	Rating
Drain Voltage (V_D)	40 V
Gate Voltage Range (V_G)	−8 to −0 V
Drain Current (I_D)	16 A
Gate Current (I_G)	See plot page 9
Power Dissipation (P_{DISS}), 85°C, Pulsed; PW = 100 us, DC = 10%	316 W
Input Power (P_{IN}), 50 Ω, 85°C , VD = 28 V, Pulsed; PW = 100 us, DC = 10%	33 dBm
Input Power (PI_N), 85°C, VSWR 3:1, VD = 28 V, Pulsed; PW = 100 us, DC = 10%	33 dBm
Mounting Temperature	Refer to Assembly Notes, page 13
Storage Temperature	−55 to 150 °C

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

Recommended Operating Conditions

Parameter	Value/Range
Drain Voltage (V_D)	28 V
Drain Current (I_{DQ}, total)	1.3 A
Drain Current (Under drive, I_{D_TOTAL})	See plots pg. 3-5
Operating Temperature Range	−40 to +85 °C

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

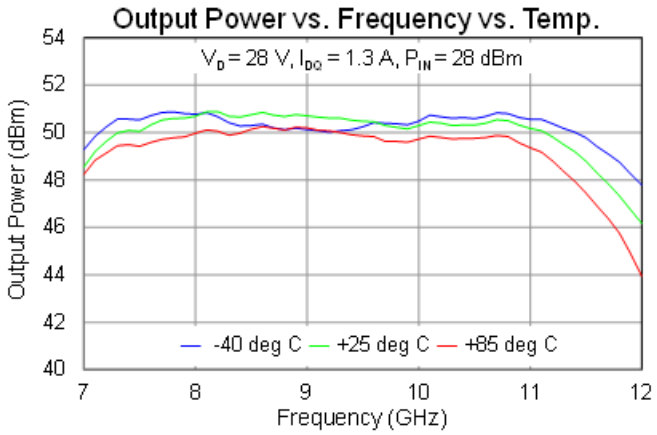
Electrical Specifications

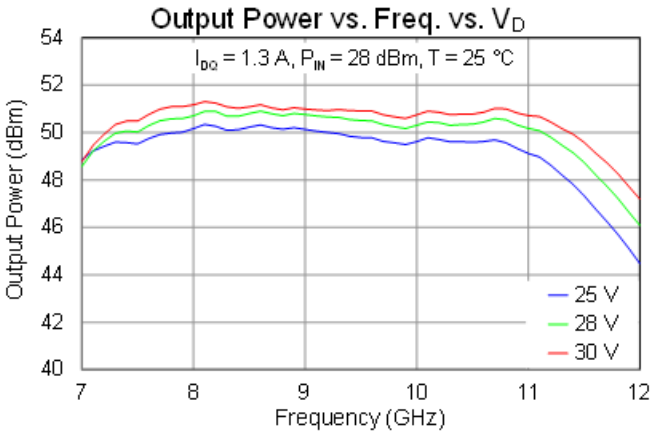
Parameter	Conditions [1]	Min	Typ	Max	Units
Frequency Range		7.9		11.0	GHz
Output Power	P_{IN} = 28 dBm, Pulsed 8 GHz 9 GHz 10 GHz 11 GHz	 50.0 50.0 49.5 49.5	 51.0 51.0 51.0 51.0		dBm
Power Added Efficiency	P_{IN} = 28 dBm, Pulsed 8 GHz 9 GHz 10 GHz 11 GHz	 37 33 35 33	 41 41 41 41		%
Power Gain	P_{IN} = 28 dBm, Pulsed		23		dB
Output Power Temperature Coefficient	Temp: 25 °C to 85 °C, P_{IN} = 28 dBm)		−0.010		dB/°C
Input Return Loss			12		dB
Output Return Loss			12		dB
Small Signal Gain			26		dB
Recommended Operating Voltage		20	28	30	V
Gate Leakage Current	V_D = =10 V, V_G = −3.7 V	−58.1			mA

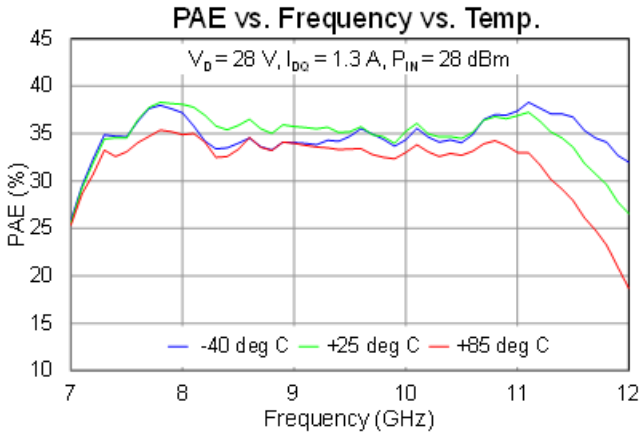
Notes:
1. Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, PW = 100 us, Duty Cycle = 10%

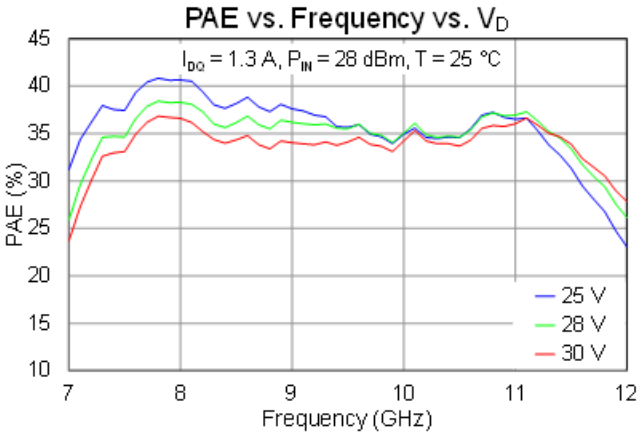
Performance Plots – Large Signal (Pulsed)

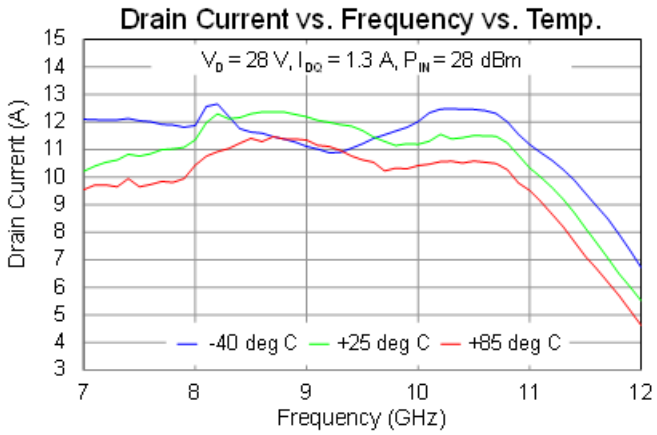
Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, PW = 100 us, Duty Cycle = 10%

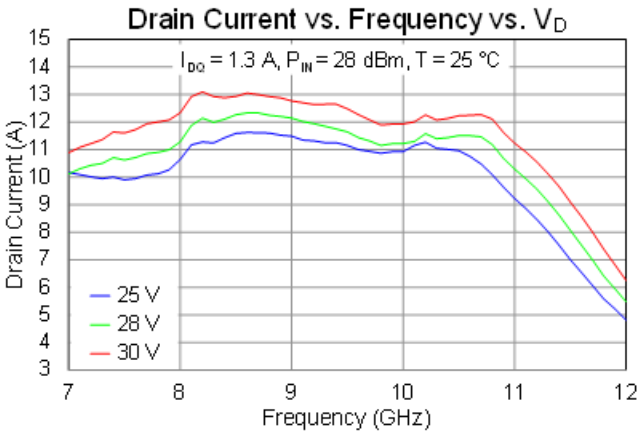






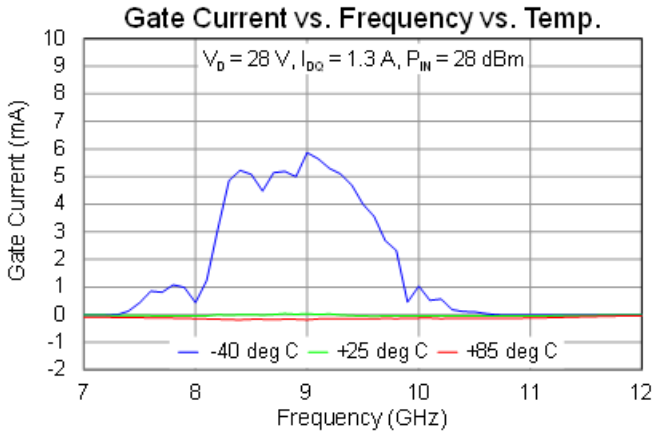


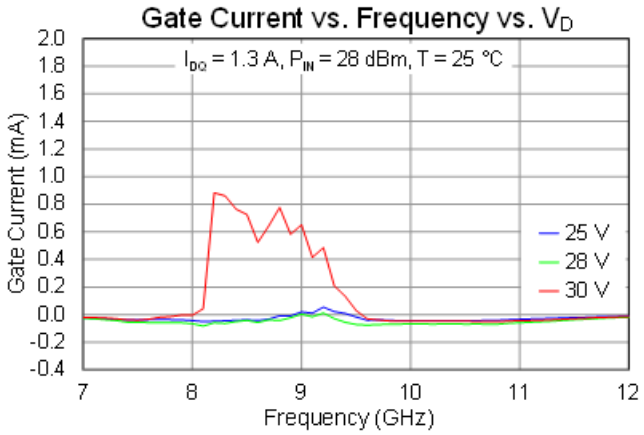


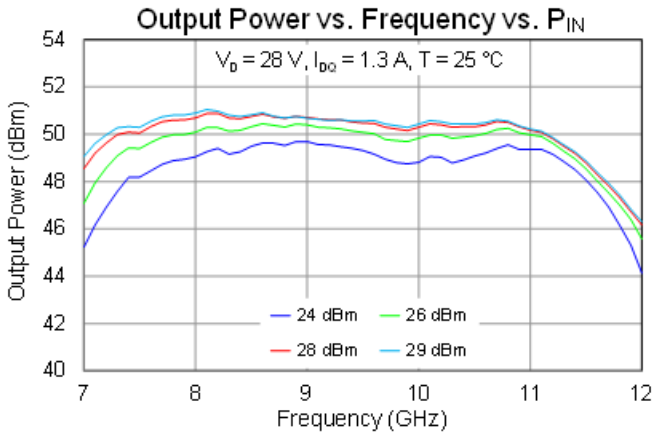


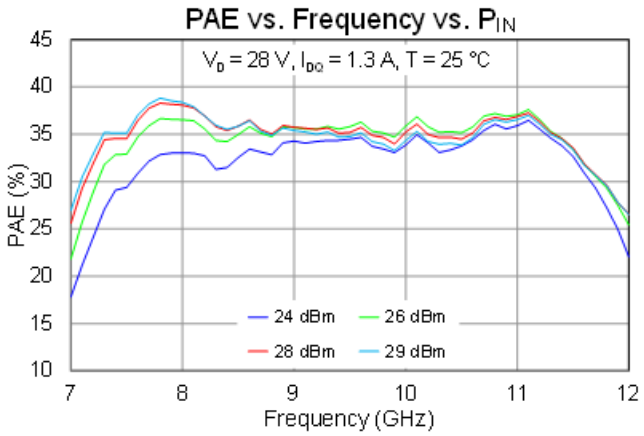
Performance Plots – Large Signal (Pulsed)

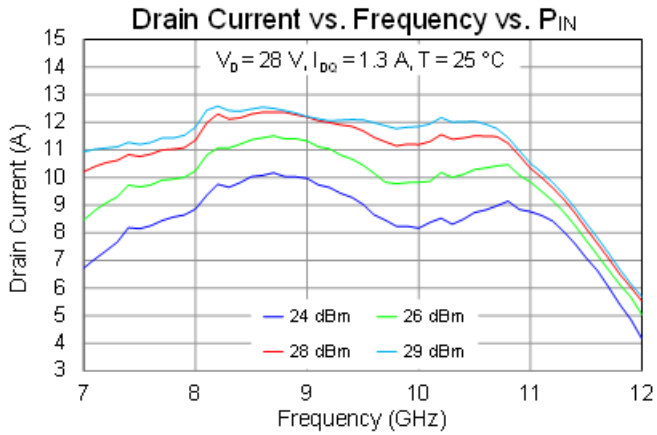
Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, PW = 100 us, Duty Cycle = 10%

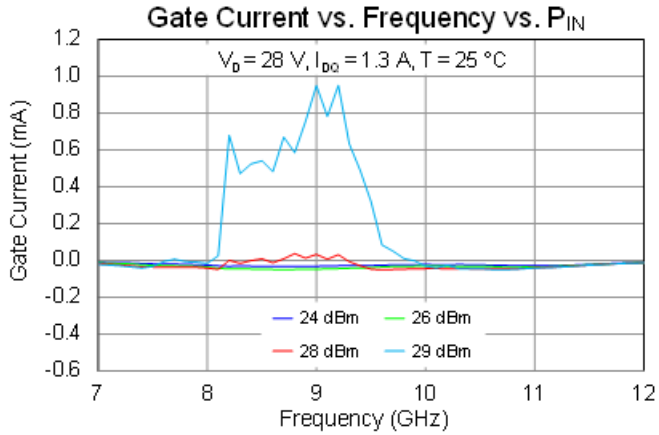






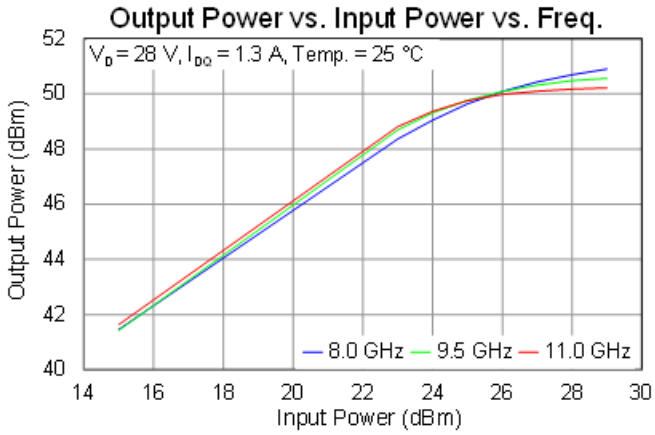


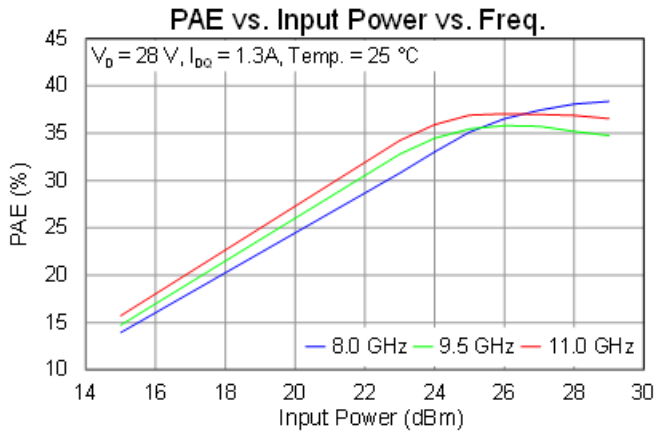


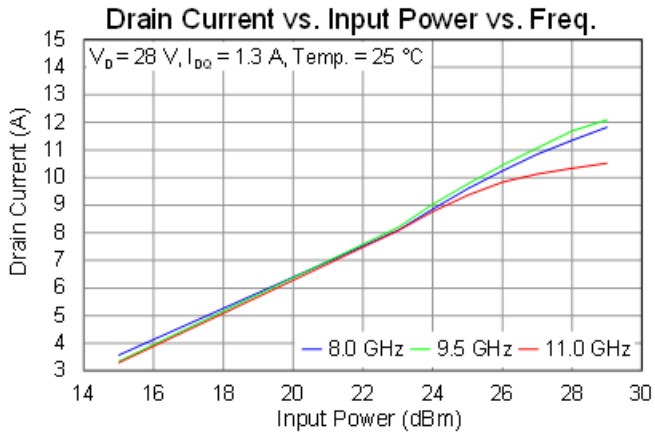


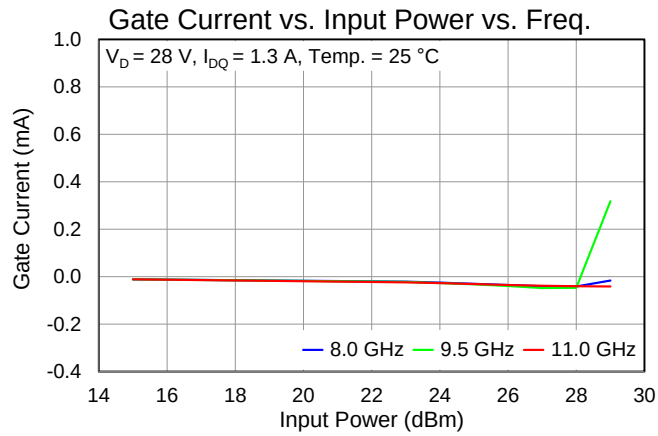
Performance Plots – Large Signal (Pulsed)

Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, PW = 100 us, Duty Cycle = 10%



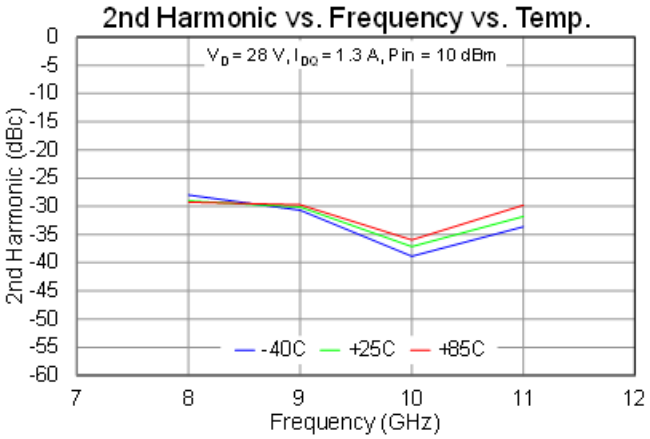


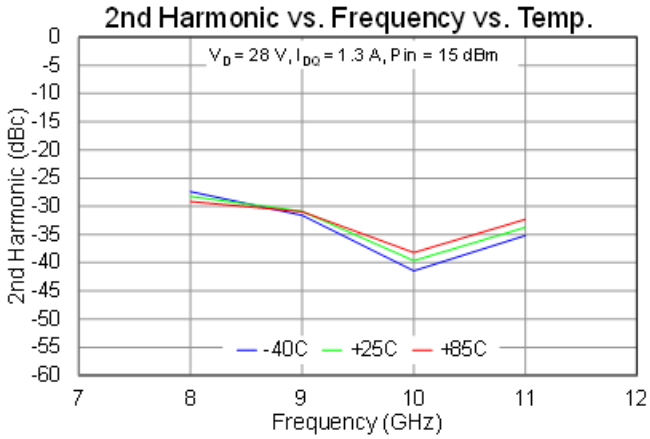


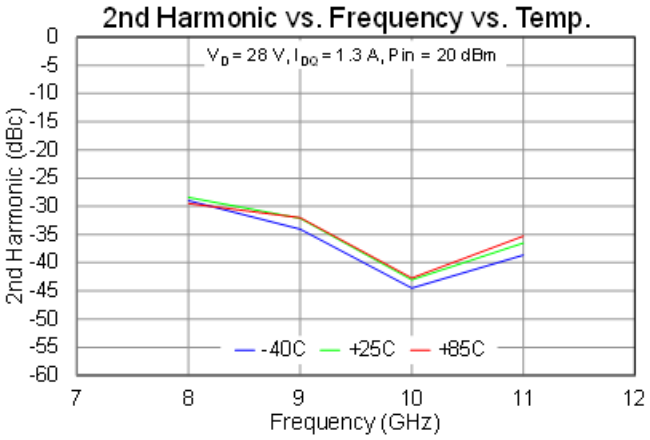


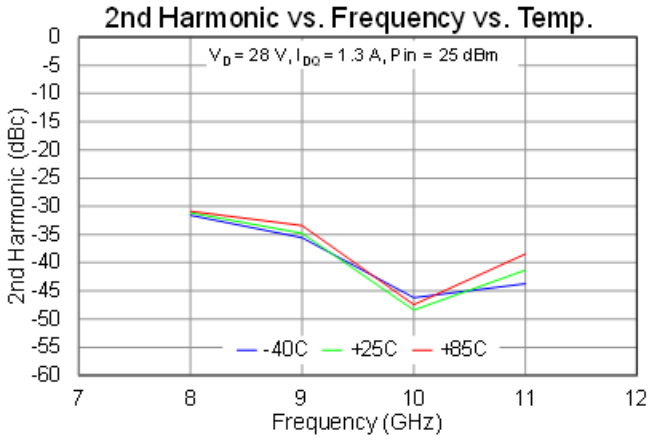
Performance Plots – Large Signal (Pulsed)

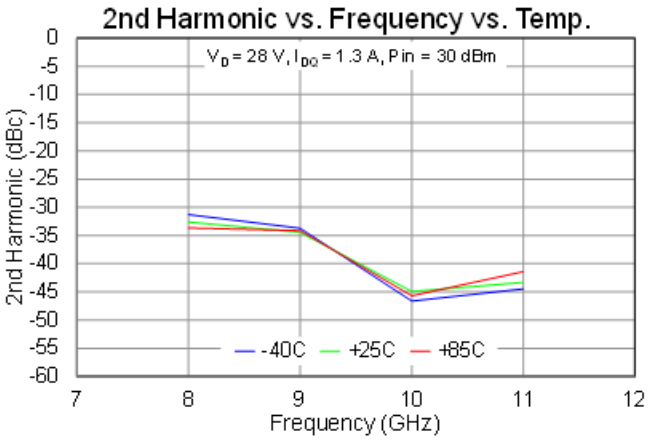
Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, PW = 100 us, Duty Cycle = 10%

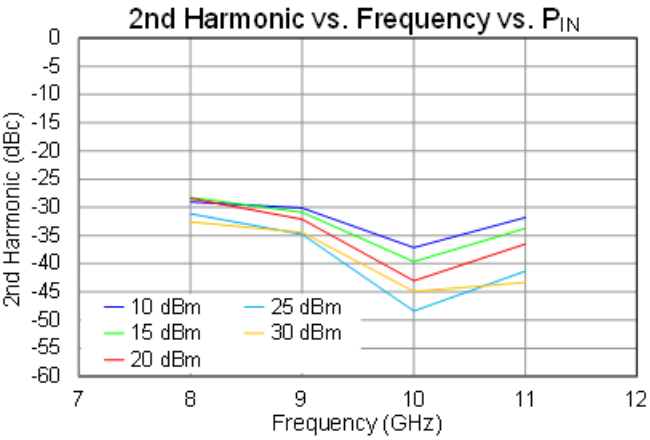






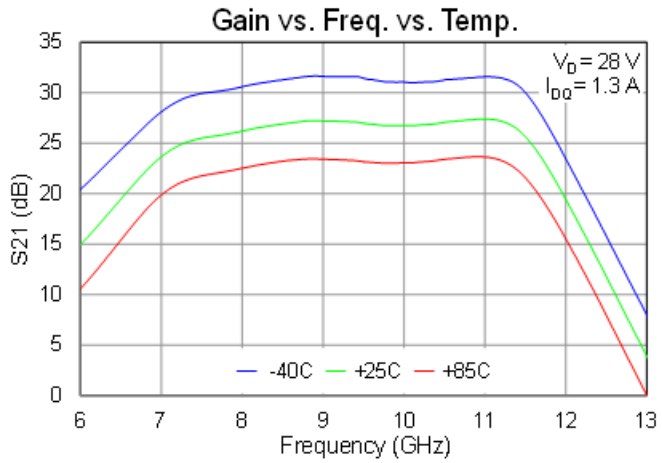


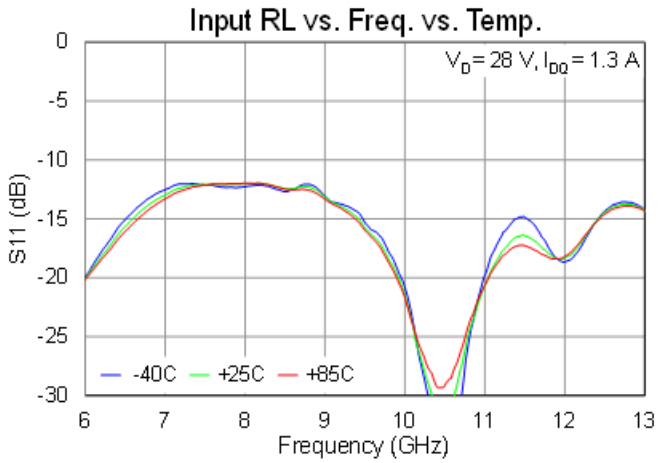


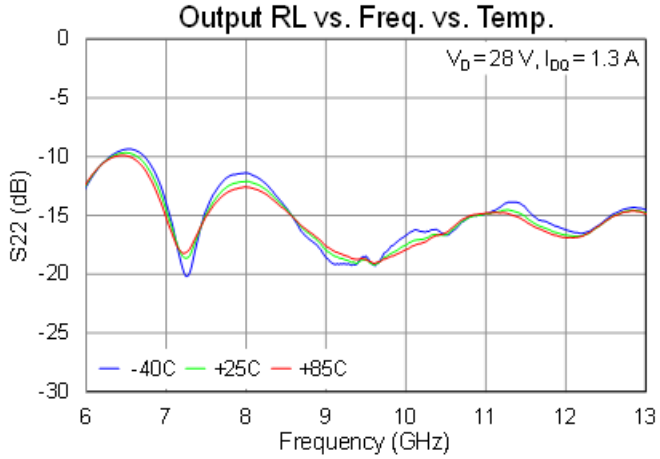


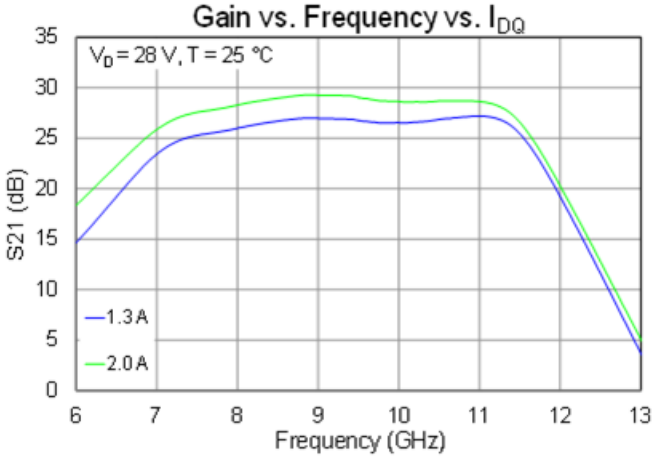
Performance Plots – Small Signal (CW)

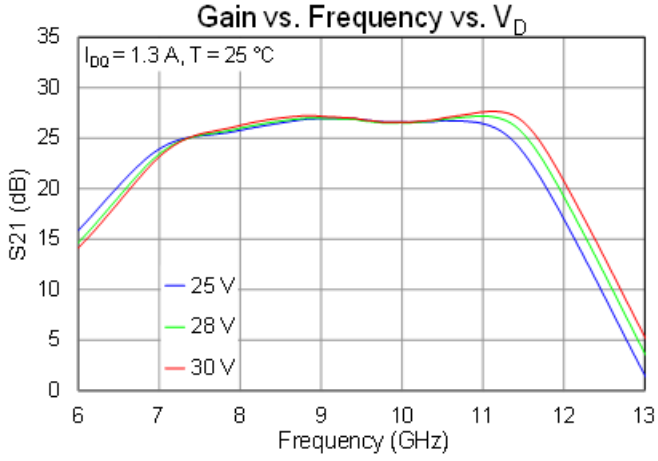
Test conditions unless otherwise noted: 25 °C , V_D = 28 V





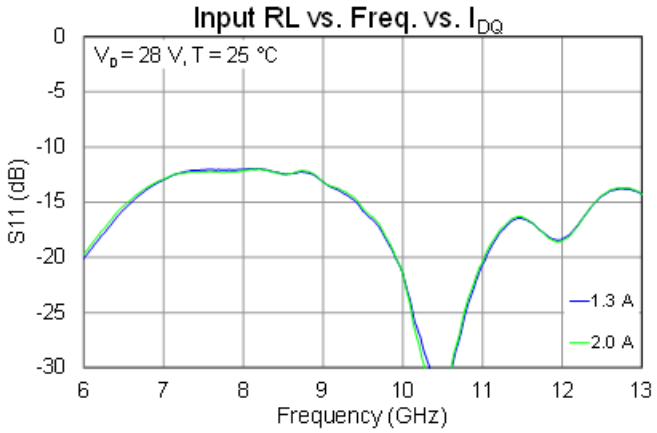


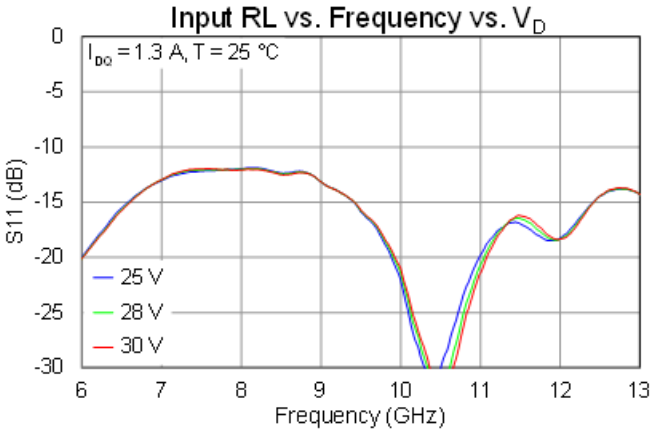


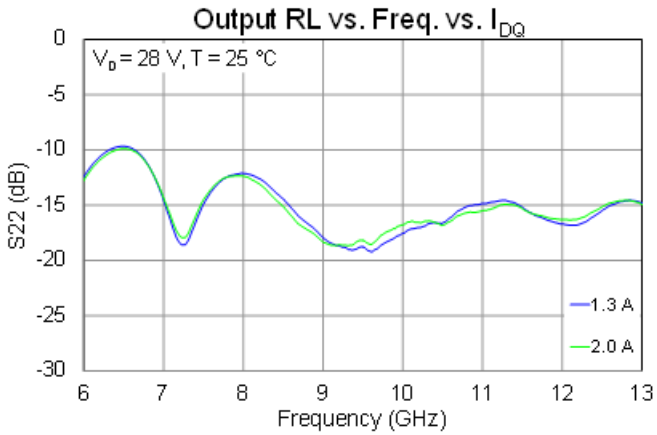


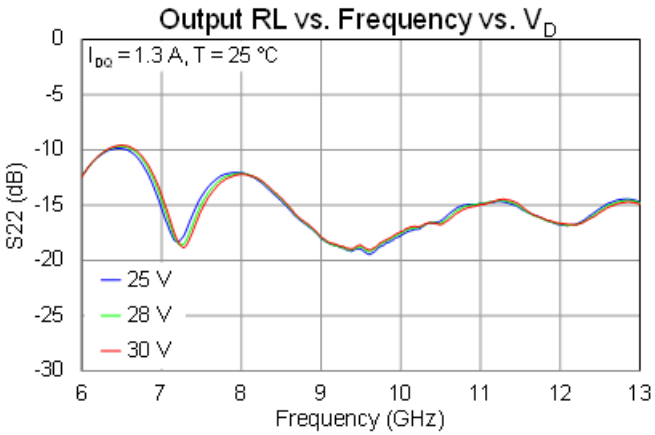
Performance Plots – Small Signal (CW)

Test conditions unless otherwise noted: 25 °C , V_D = 28 V







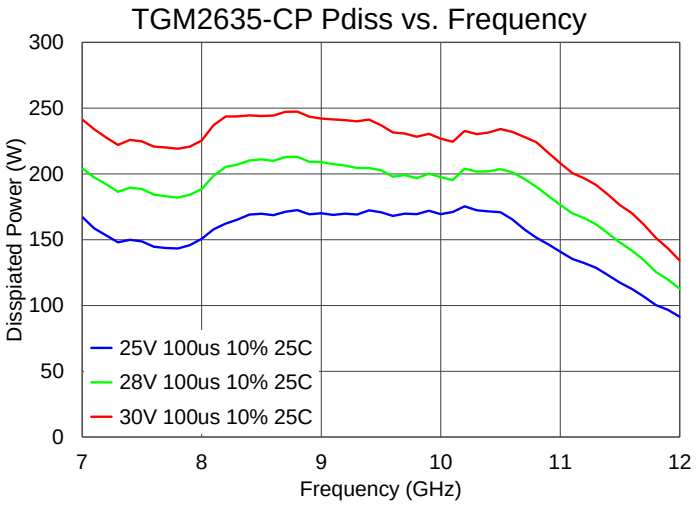


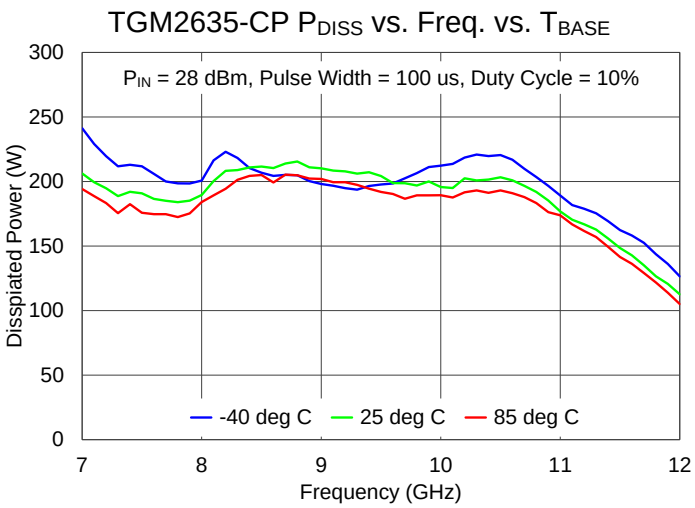
Thermal and Reliability Information

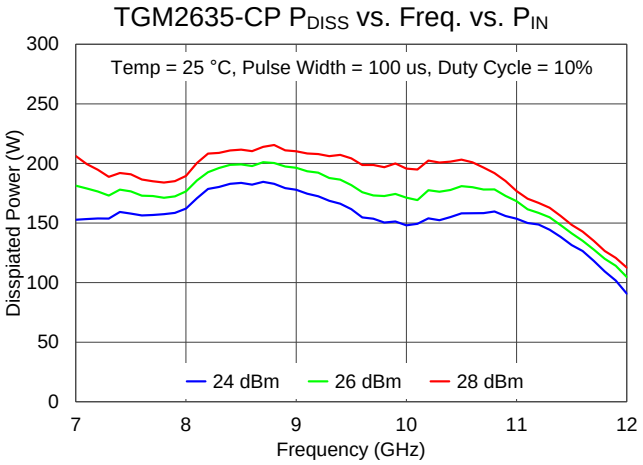
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{Base} = 85 °C, V_D = 28 V, I_{DQ} = 1.3 A, P_{DISS} = 36.4 W	0.302	ºC/W
Channel Temperature, T_{CH} (No RF drive) (2)		96.0	°C
Thermal Resistance (θ_{JC}) (1)	T_{Base} = 85 °C, V_D = 28 V, I_{DQ} = 1.3 A, Freq = 8.7 GHz, I_{D_Drive} = 11.47 A, P_{IN} = 28 dBm, P_{OUT} = 50.2 dBm, P_{DISS} = 205.4 W, PW = 100 us, DC = 10%	0.226	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		131.5	°C

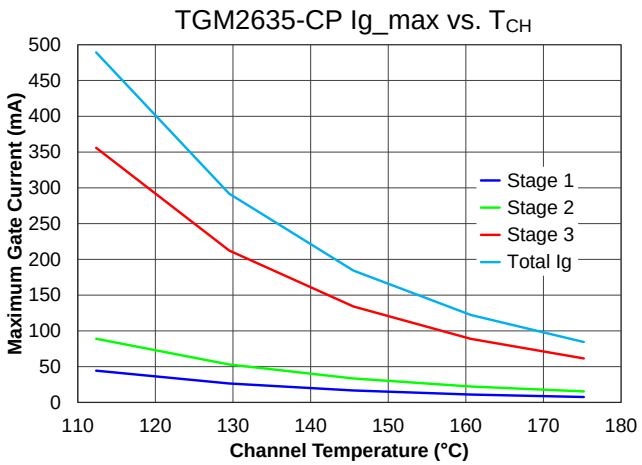
Notes:
1. Thermal resistance measured at back of package.
2. IR Scan equivalent channel temperature. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

Power Dissipation and Maximum Gate Current

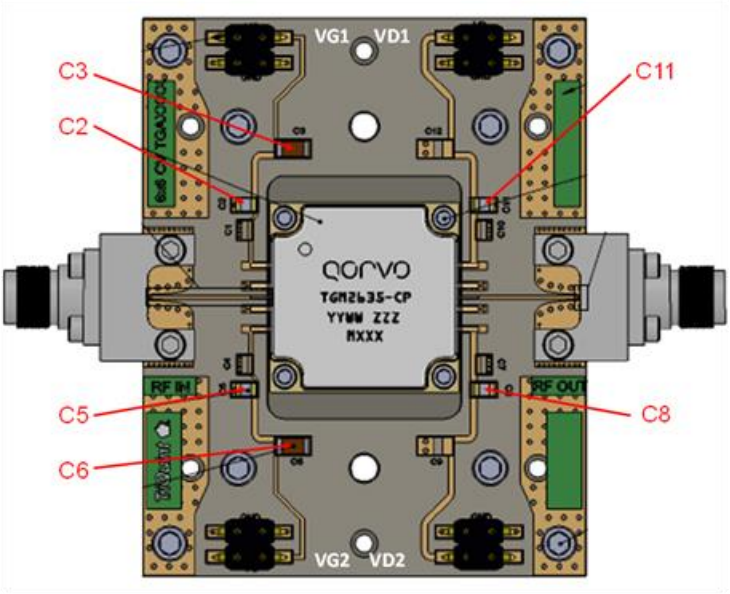


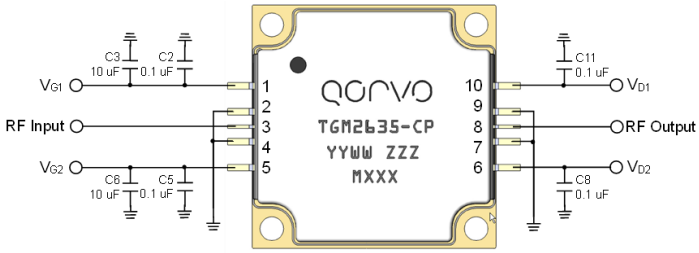






Evaluation Board (EVB) and Application Circuit





Notes:
1. See Evaluation Board PCB Information for material and stack up.
2. Part requires V_D and V_G biasing from both sides of the EVB.
3. EVB is not suitable for long pulse/high duty cycle or CW operation.

Bill of Material

Ref. Des.	Value	Description	Manuf.	Part Number
C3, C6	10 uF, ±20 %, 50 V (1206), X5R	Surface Mount Cap	Various	
C2, C5, C8, C11	0.1 uF, ±10 %, 50 V (0805), X7R	Surface Mount Cap	Various	
J1, J2	2.92 mm	2.92 mm End Launch Connector	Southwest Microwave	1092-02A-5

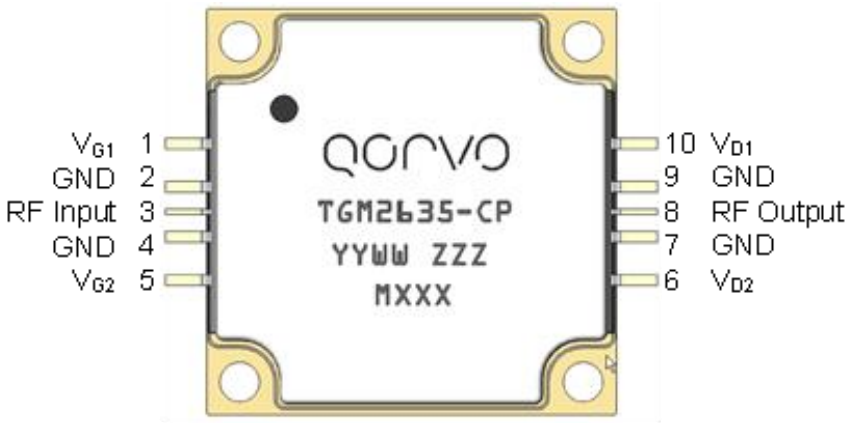
Bias-Up Procedure

1. Set I_D limit to 16 A, I_G limit to 124 mA
2. Set V_G to −5.0 V
3. Set V_D +28 V
4. Adjust V_G more positive until I_{DQ} = 1.3 A
5. Apply RF signal

Bias-Down Procedure

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

Pad Configuration and Description



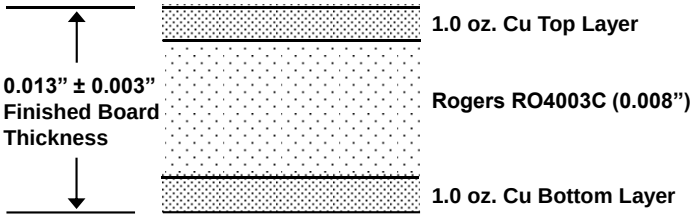
Top View

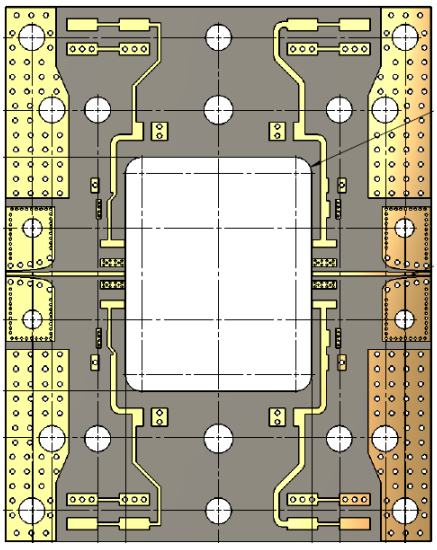
Pad No.	Label	Description
1	V_{G1}	Gate voltage stage 1. Bias network is required; see Application Circuit as an example
2, 4, 7, 9	GND	RF Ground
3	RF Input	RF Input; matched to 50Ω; DC Blocked
5	V_{G2}	Gate voltage stage 2. Bias network is required; see Application Circuit as an example
6	V_{D2}	Drain voltage stage 2. Bias network is required; see Application Circuit as an example.
8	RF Output	RF Output; matched to 50Ω; DC Blocked, DC Shorted
10	V_{D1}	Drain voltage stage 1. Bias network is required; see Application Circuit as an example

Evaluation Board PCB Information

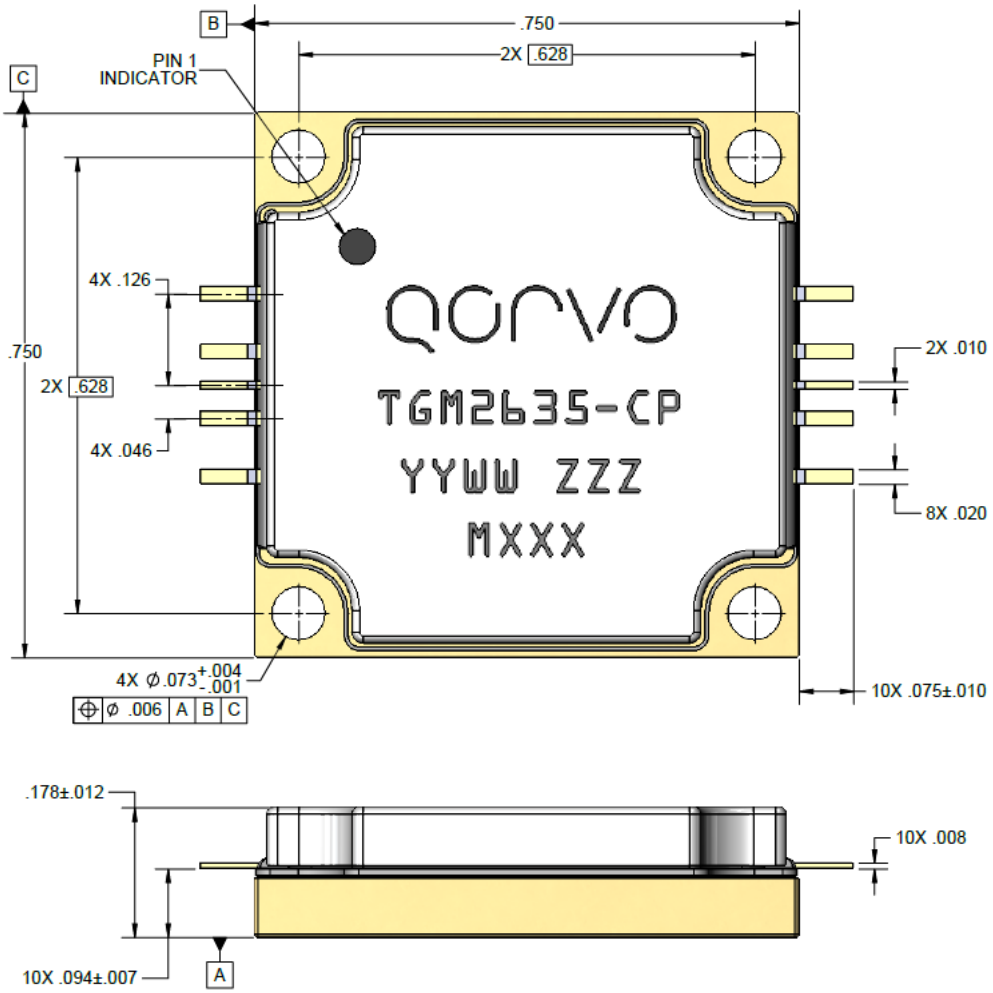
EVB PC Board Layout

PCB Material Stack-up





Package Marking and Dimensions

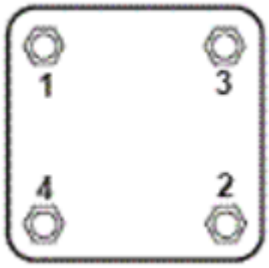


NOTES:

1. MATERIALS
   - PACKAGE BASE: COPPER
   - LEADS: ALLOY 194
   - LID: PLASTIC
   - FINISH: GOLD
2. PART IS EPOXY SEALED
3. UNITS: INCHES
4. TOLERANCES (UNLESS NOTED):
   - .XX = ± .01
   - .XXX = ± .005
5. MARKINGS
   - PART NUMBER: TGM2635-CP
   - WORK YEAR: YY
   - WORK WEEK: WW
   - SERIAL NUMBER: ZZZ
   - BATCH ID: MXXX

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. The component leads should be manually soldered. Apply a low residue solder alloy meeting J-STD-001 (ROL0, ROL1 or equivalent) with a liquidus temperature below 220 °C to each pin of the TGM2635-CP. The use of low residue/no-clean flux (ROL0, ROL1) is recommended. Adding flux during hand soldering of the component leads with localized spot cleaning is acceptable. Soldering irons meeting the requirements of J-STD-001, Appendix A are acceptable. The packaged part should not be subjected to conventional SMT automated solder reflow processes.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 0B	ANSI / ESDA / JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	ANSI / ESDA / JEDEC JS-002
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. The use of no-clean solder to avoid washing after soldering is recommended.

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:

- 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.