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.

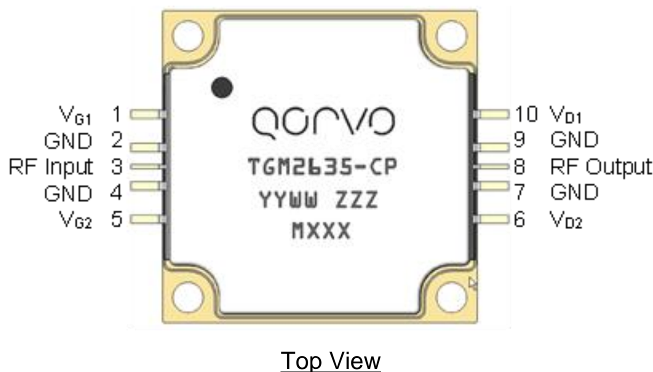
The TGM2635-CP is ideally suited for both commercial and military X-Band radar systems, satellite communications systems, and data links.

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 (P_{IN}), 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.

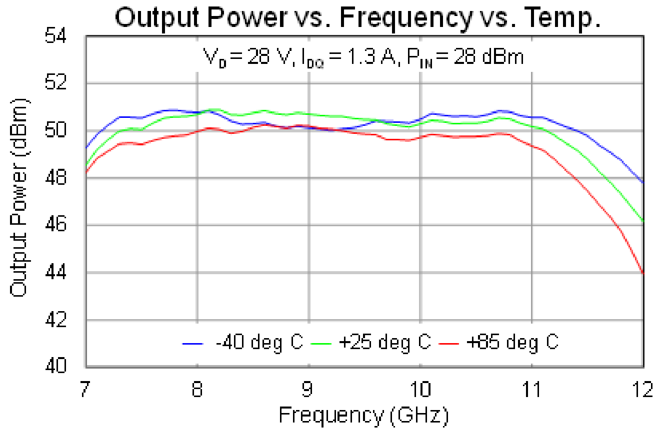
Electrical Specifications

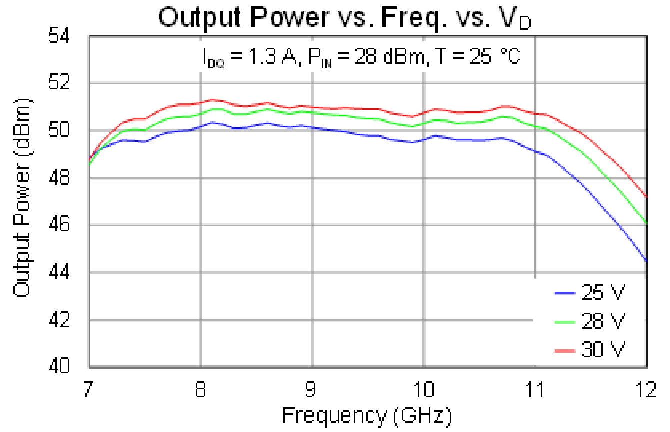
Parameter	Conditions [1]	Min	Typ	Max	Units
Frequency Range		7.9		11.0	GHz
Output Power	P_{IN} = 28 dBm, Pulsed 8 GHz 9 GHz 10 GHz 11 GHz	 50.0 50.0 49.5 49.5	 51.0 51.0 51.0 51.0		dBm
Power Added Efficiency	P_{IN} = 28 dBm, Pulsed 8 GHz 9 GHz 10 GHz 11 GHz	 37 33 35 33	 41 41 41 41		%
Power Gain	P_{IN} = 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

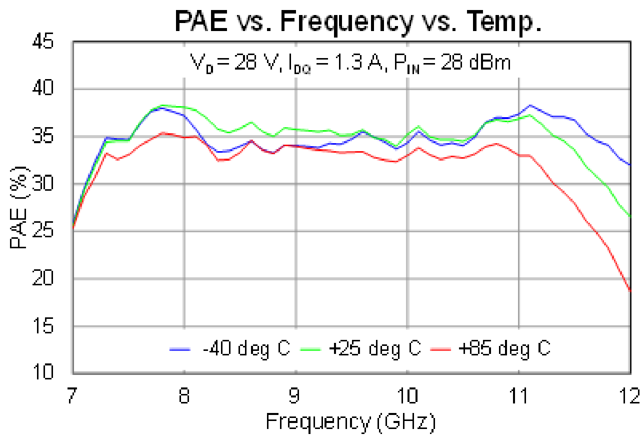
Notes:
1. Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, PW = 100 us, Duty Cycle = 10%

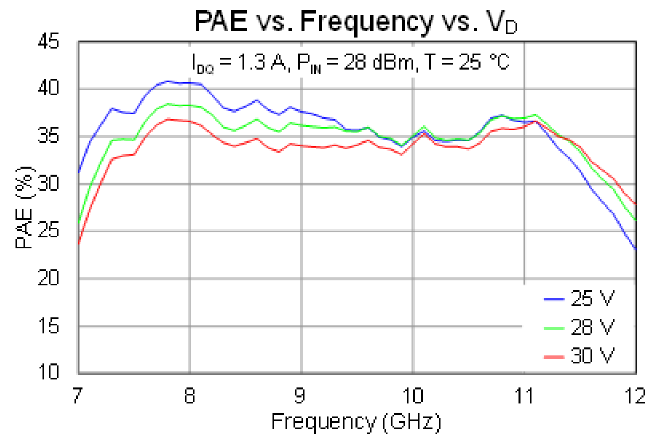
Performance Plots – Large Signal (Pulsed)

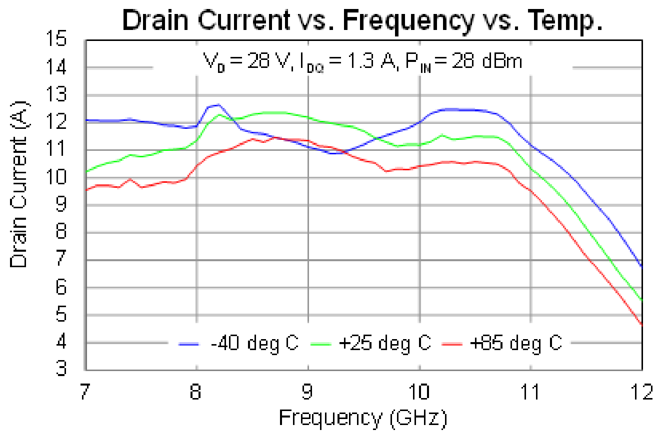
Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, PW = 100 us, Duty Cycle = 10%

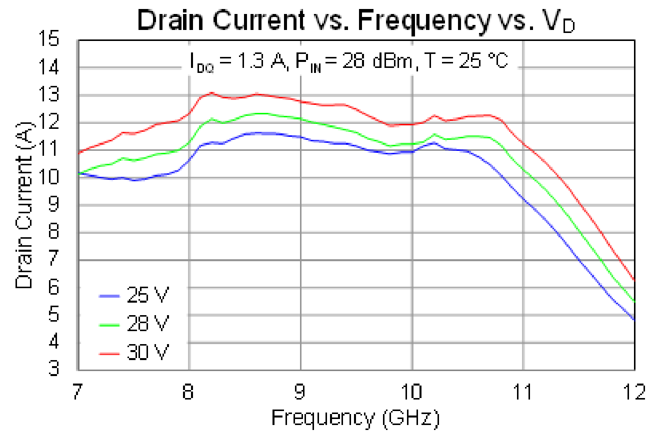












Performance Plots – Large Signal (Pulsed)

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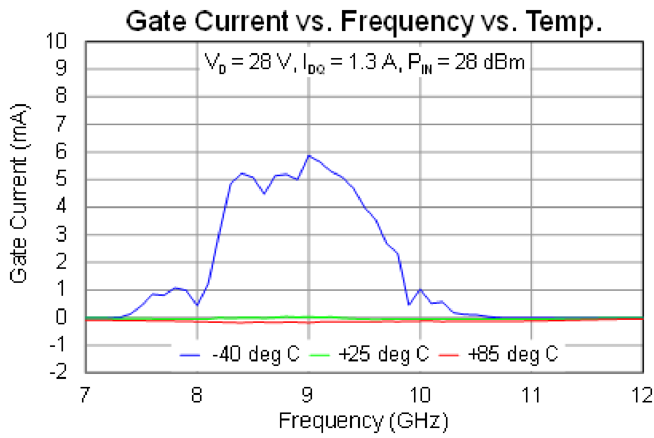
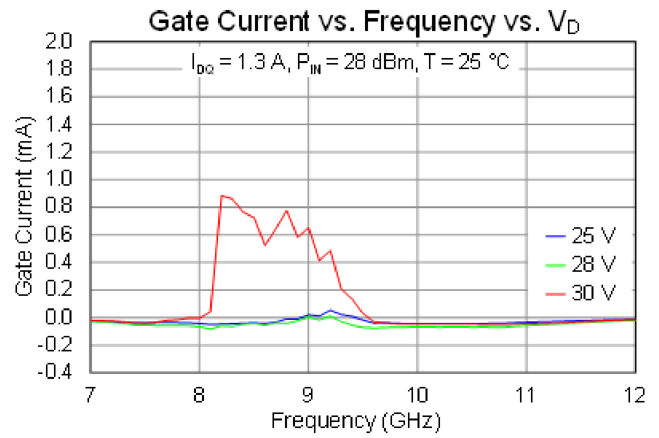
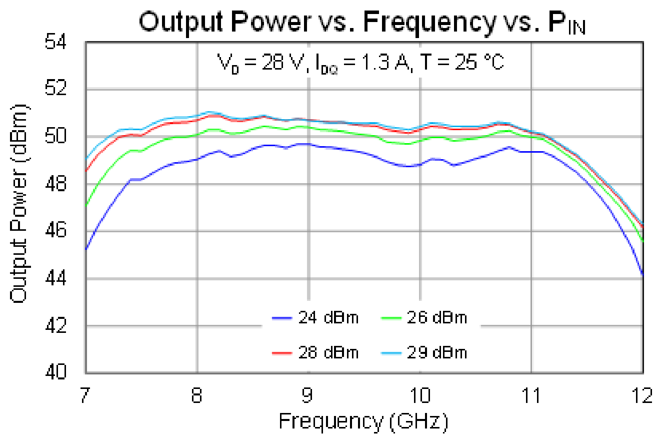
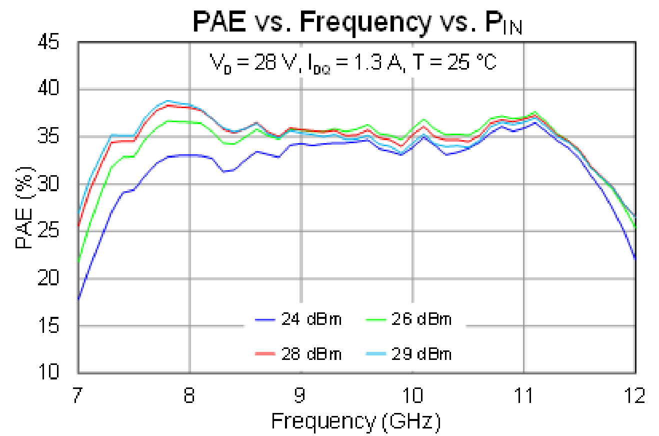
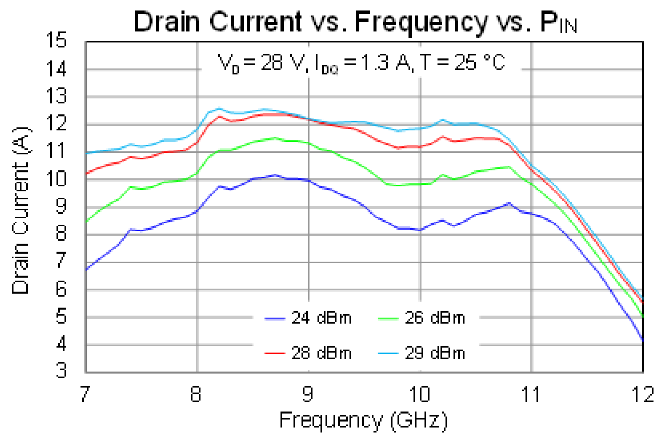
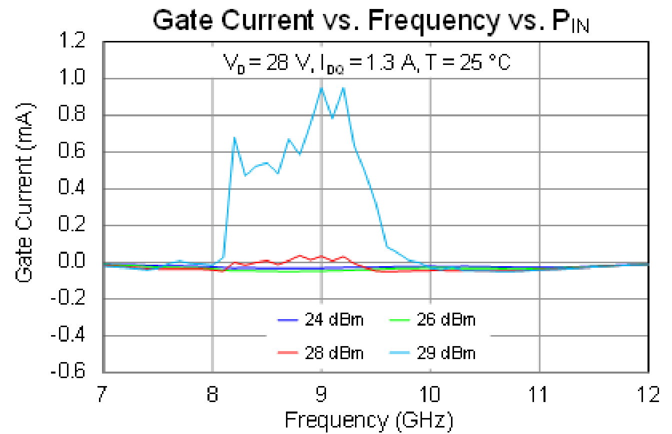






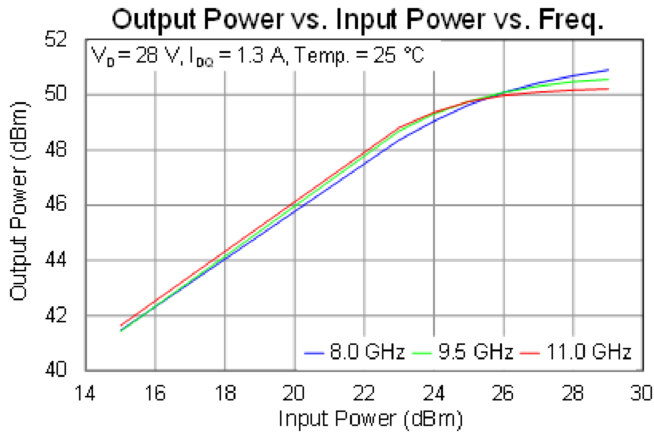


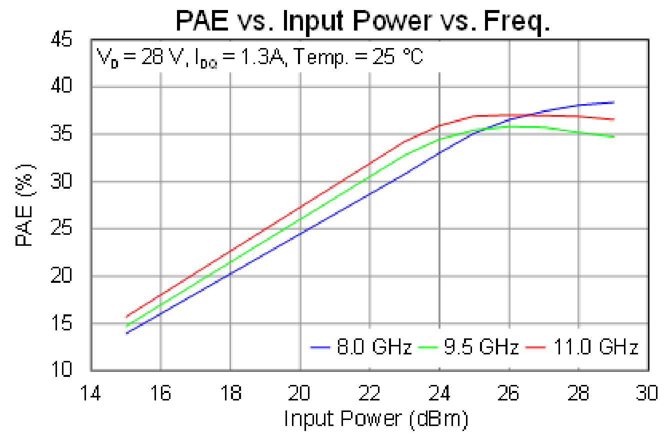


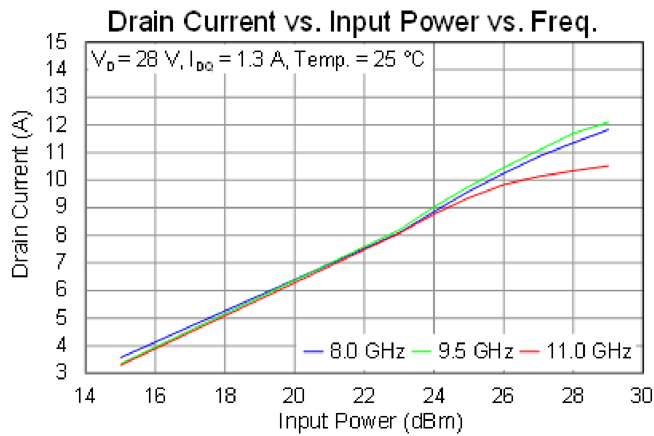


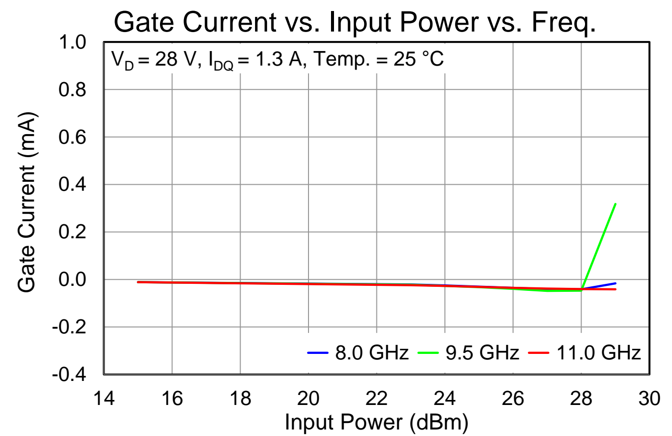
Performance Plots – Large Signal (Pulsed)

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



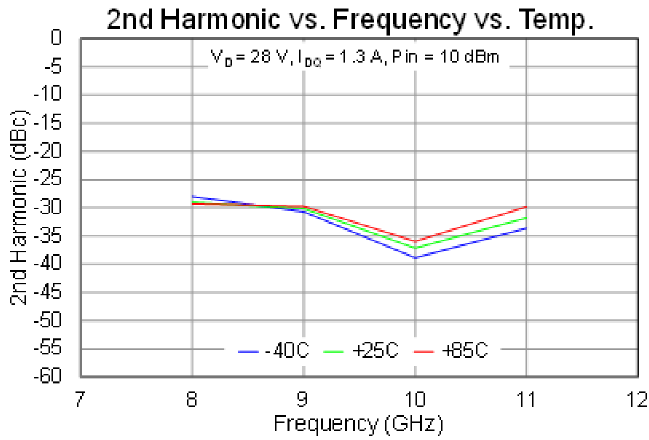


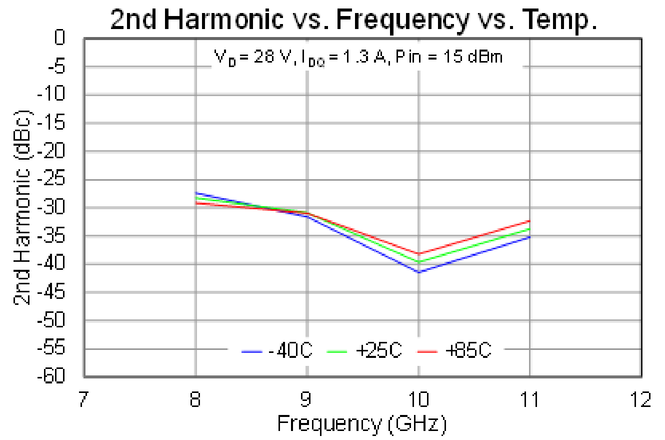


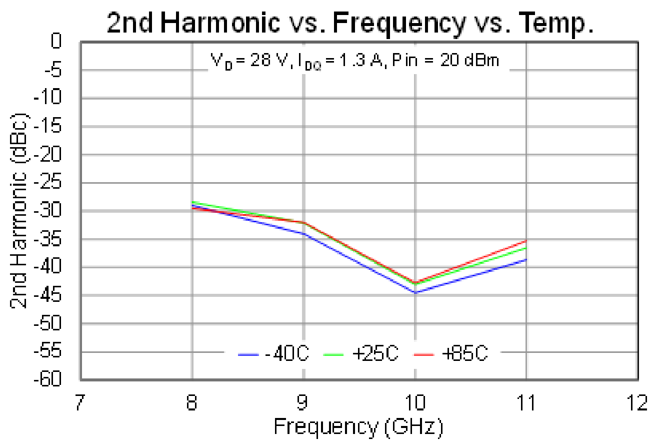


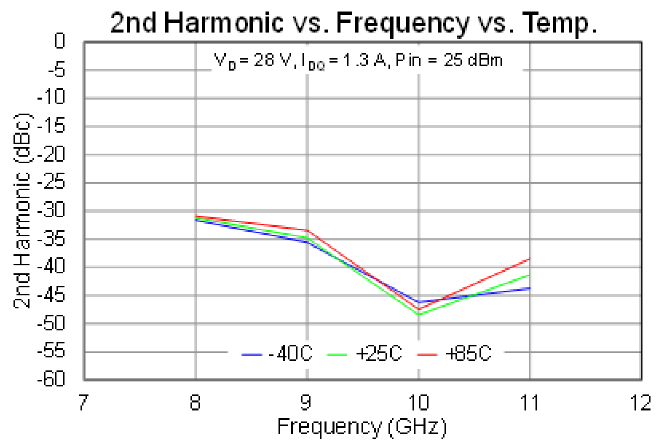
Performance Plots – Large Signal (Pulsed)

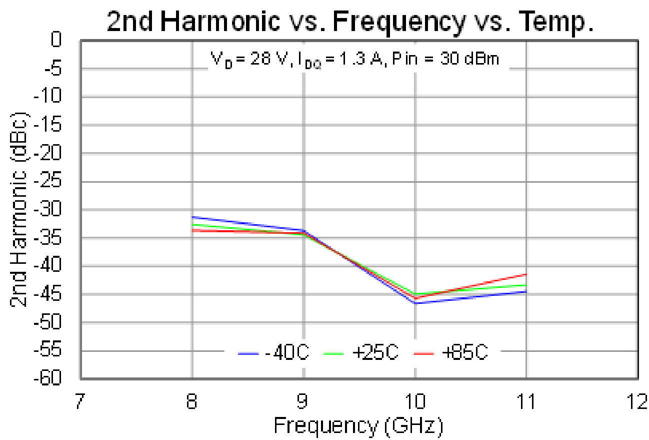
Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, PW = 100 us, Duty Cycle = 10%

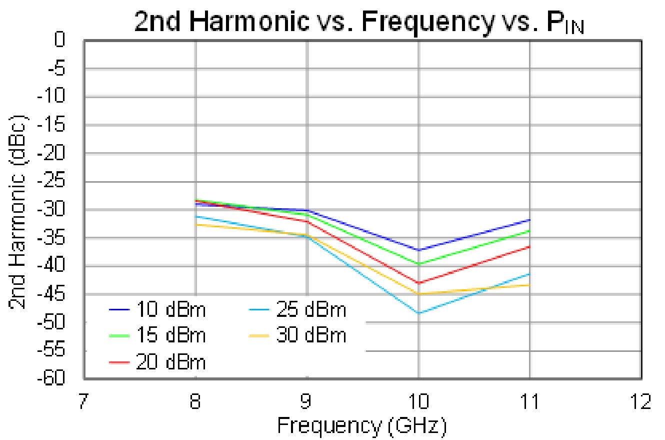






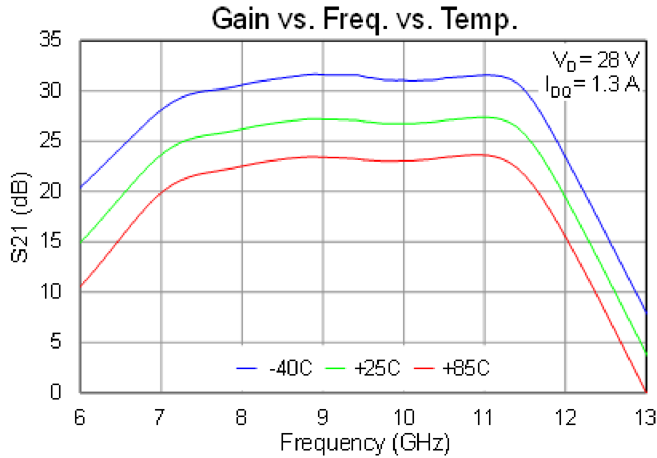


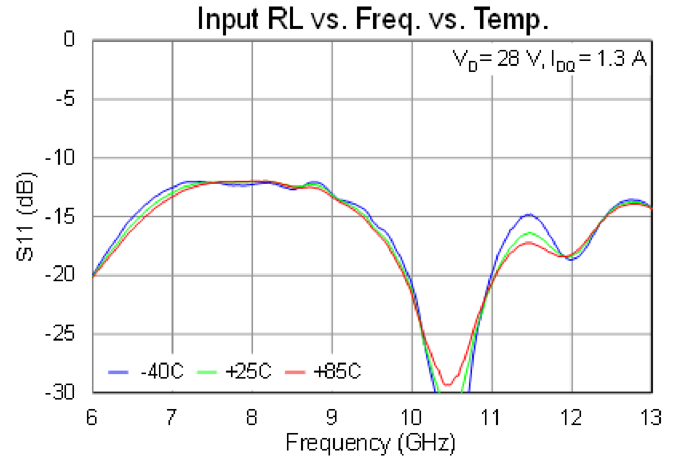


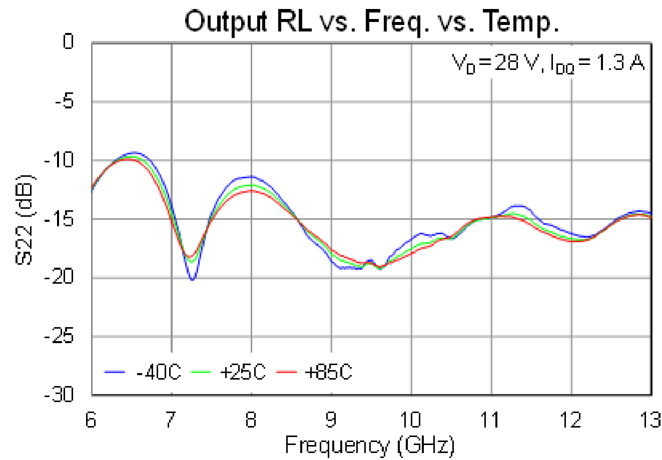


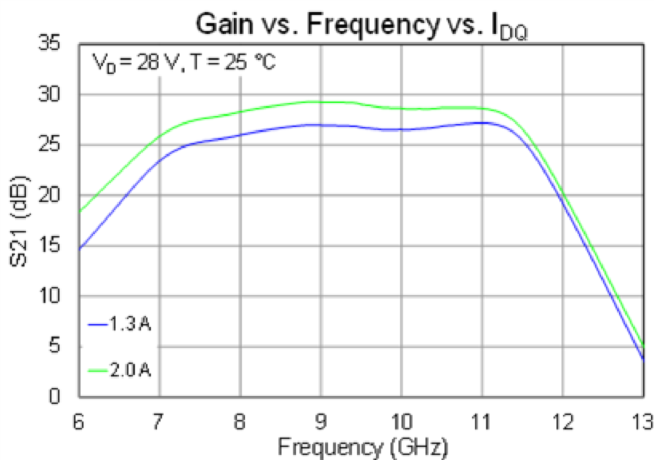
Performance Plots – Small Signal (CW)

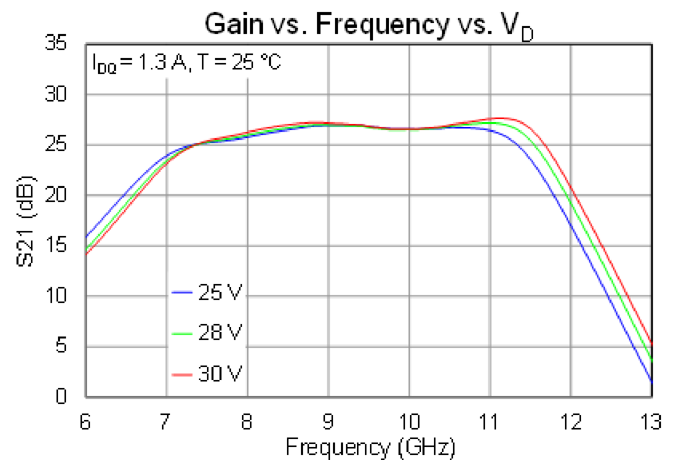
Test conditions unless otherwise noted: 25 °C , V_D = 28 V





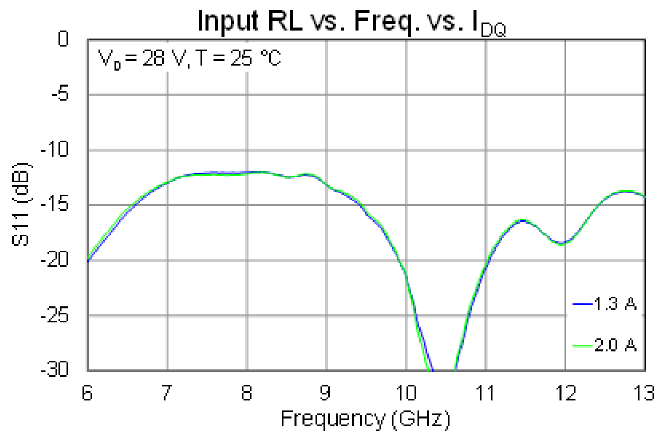


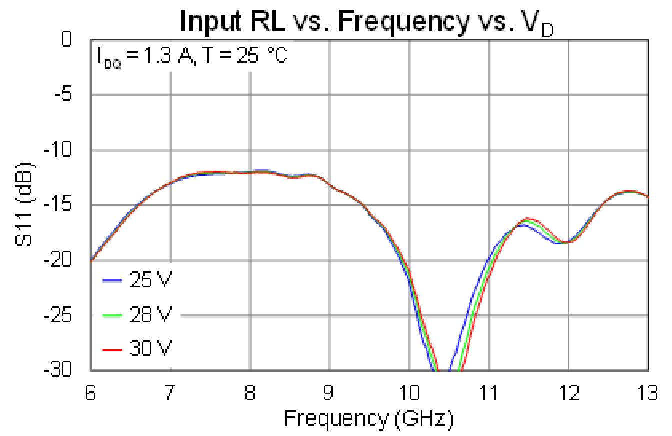


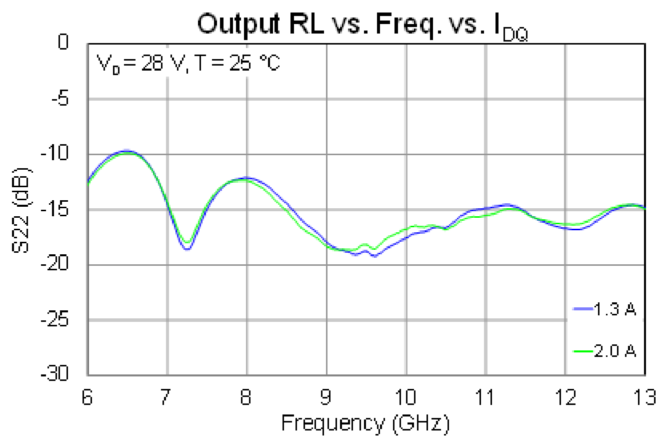


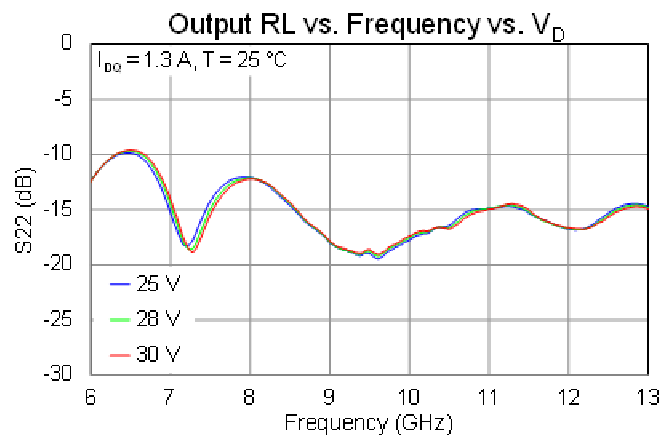
Performance Plots – Small Signal (CW)

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







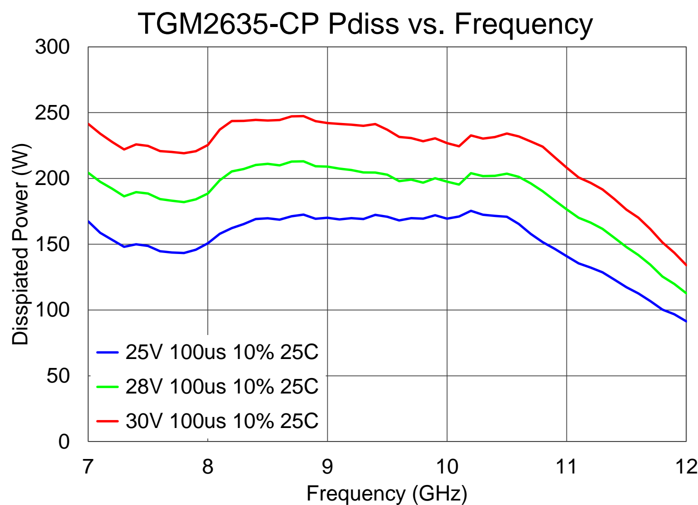


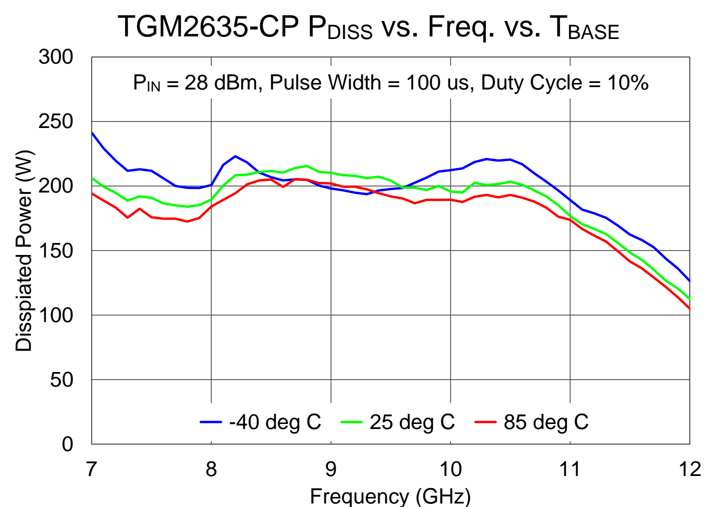
Thermal and Reliability Information

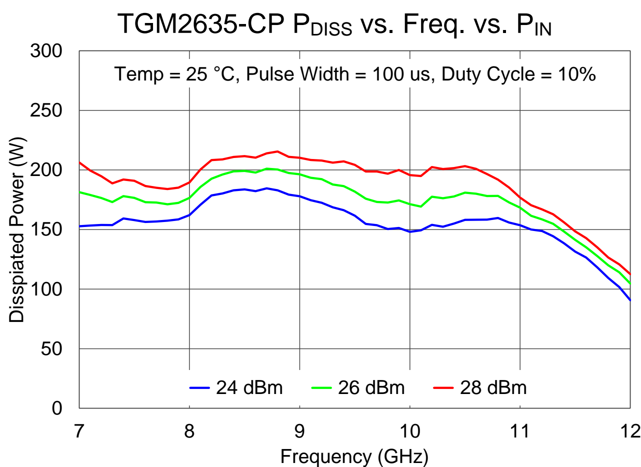
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) [1]	T_{Base} = 85 °C, V_D = 28 V, I_{DQ} = 1.3 A, P_{DISS} = 36.4 W	0.302	ºC/W
Channel Temperature, T_{CH} (No RF drive) [2]		96.0	°C
Thermal Resistance (θ_{JC}) [1]	T_{Base} = 85 °C, V_D = 28 V, I_{DQ} = 1.3 A, Freq = 8.7 GHz, I_{D_Drive} = 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

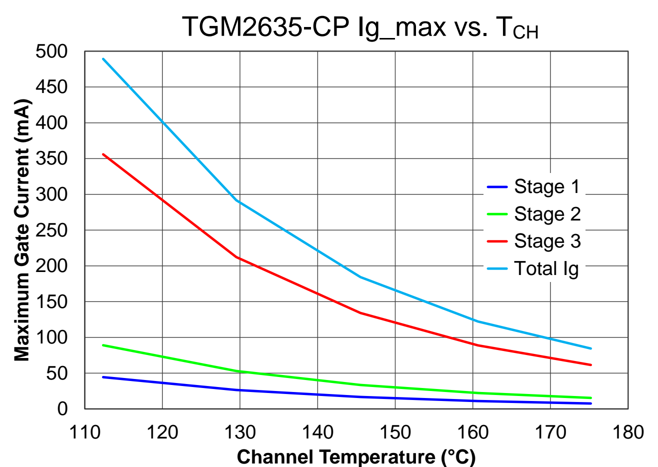
Notes:
1. Thermal resistance measured at back of package.
2. IR Scan equivalent channel temperature. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

Power Dissipation and Maximum Gate Current

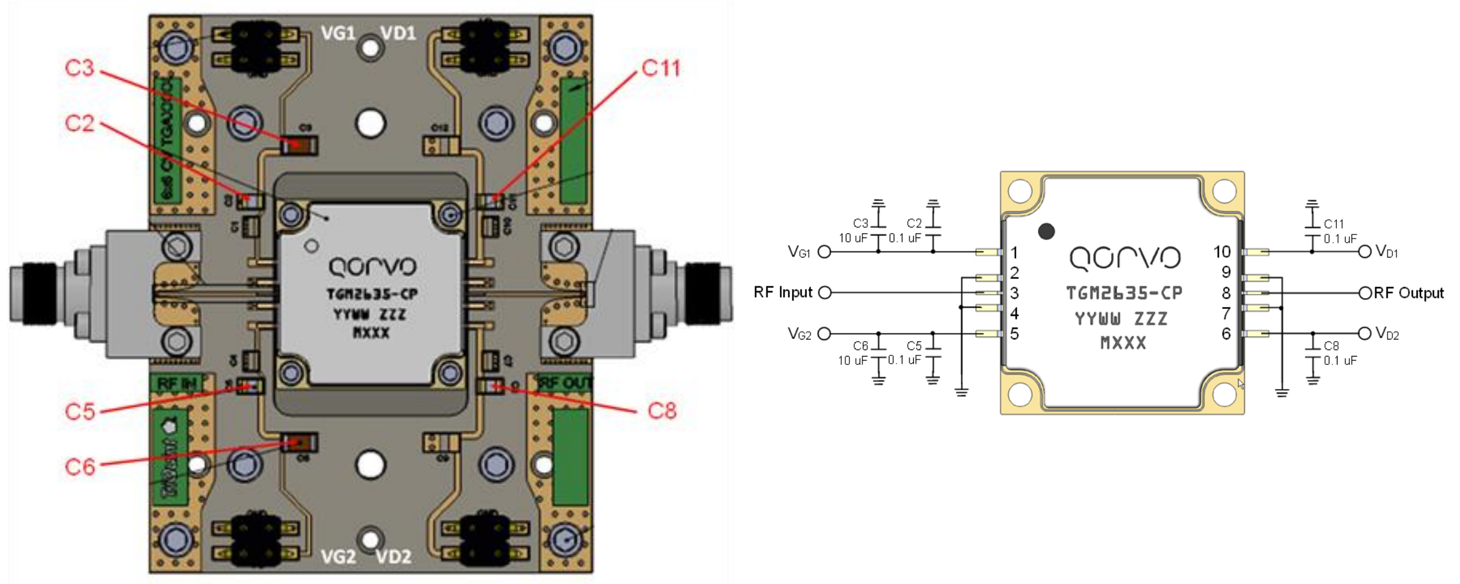








Evaluation Board (EVB) and Application Circuit



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

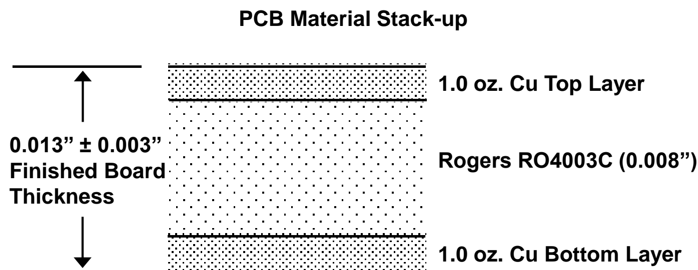
Pad Configuration and Description

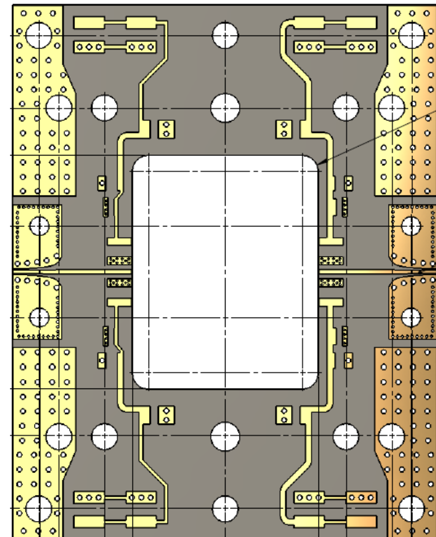
Top View

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





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, base plate, 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 package and apply either a thermal compound (Arctic Silver 5 recommended) or a .004 inch (maximum thickness) Indium shim between the heat sink and the package. Refer to the applications note Application of Arctic Silver 5 Thermal Compound and Indium Shims for Qorvo CP-style Packaged Components for more information.

3. 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. The package lead temperature should not exceed 260 deg C. Each solder connection should be completed within 2 to 5 seconds. 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.

4. The leads should be soldered in a staggered or star pattern from side to side, and never solder two adjacent leads. This allows the heat to dissipate on each lead, and not cause the adjacent leads to become de-soldered and damaged or displaced.

5. The packaged part should not be subjected to conventional SMT automated solder reflow processes.

6. (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 final 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: