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.

Lead-free and RoHS compliant.

Key Features

- Frequency Range: 7.9 – 11 GHz
- PSAT: > 50 dBm (PIN = 28 dBm)
- PAE: > 35% (PIN = 28 dBm)
- Large Signal Gain: > 22 dB (PIN = 28 dBm)
- Small Signal Gain: > 26 dB
- Bias: VD = 28 V, IDQ = 1.3 A, VG = -2.6 V Typical
- 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 (VD)	40 V
Gate Voltage Range (VG)	-8 to -0 V
Drain Current (ID)	16 A
Gate Current (IG) at TCH = 200 °C	-52 / 124 mA
Power Dissipation (PDISS), 85°C, Pulsed; PW = 100 us, DC = 10%	316 W
Input Power (PIN), 50 Ω, 85°C , VD = 28 V, Pulsed; PW = 100 us, DC = 10%	33 dBm
Input Power (PIN), 85°C, VSWR 3:1, VD = 28 V, Pulsed; PW = 100 us, DC = 10%	33 dBm
Mounting Temperature (30 seconds)	260 °C
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	Min	Typ	Max	Units
Drain Voltage (V_D)		28		V
Drain Current (I_{DQ}, total)		1.3		A
Gate Voltage (V_G)		-2.6		V
Operating Temperature Range	−40		85	°C

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

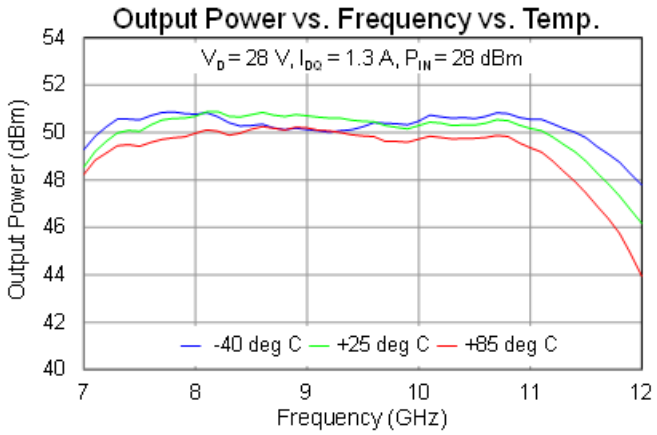
Electrical Specifications

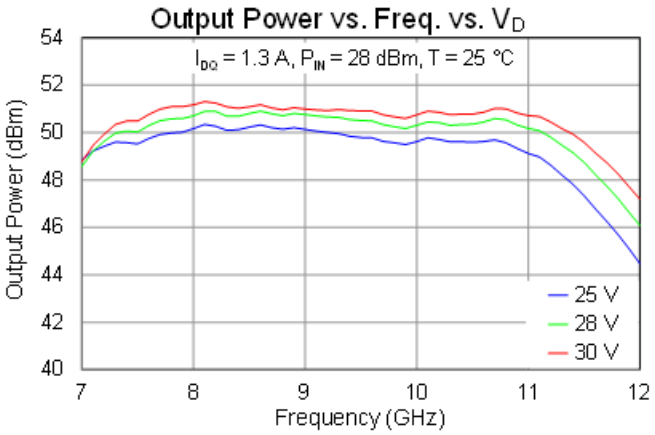
Parameter	Conditions [1]	Min	Typ	Max	Units
Frequency Range		7.9		11.0	GHz
Output Power	P_{IN} = 28 dBm, Pulsed 8 GHz 9 GHz 10 GHz 11 GHz	 50.0 50.0 49.5 49.5	 51.0 51.0 51.0 51.0		dBm
Power Added Efficiency	P_{IN} = 28 dBm, Pulsed 8 GHz 9 GHz 10 GHz 11 GHz	 37 33 35 33	 41 41 41 41		%
Power Gain	P_{IN}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

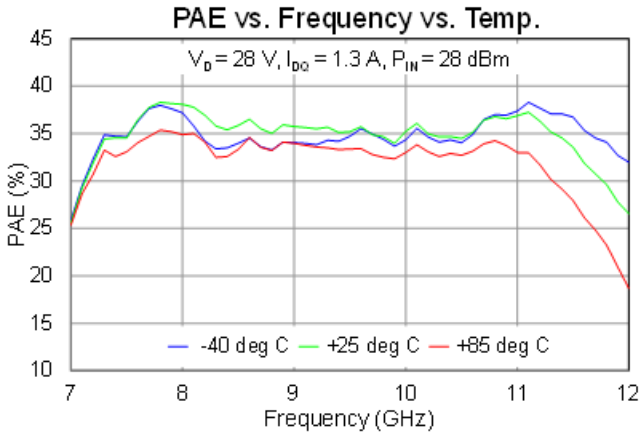
Notes:
1. Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, V_G = -2.6 V typical, PW = 100 us, Duty Cycle = 10%

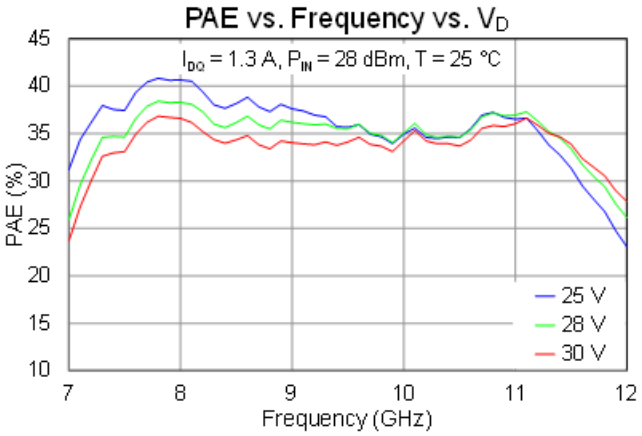
Performance Plots – Large Signal (Pulsed)

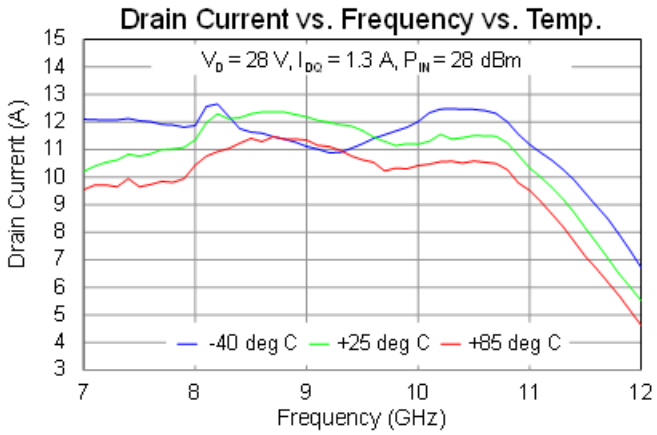
Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 1.3 A, PW = 100 us, Duty Cycle = 10%

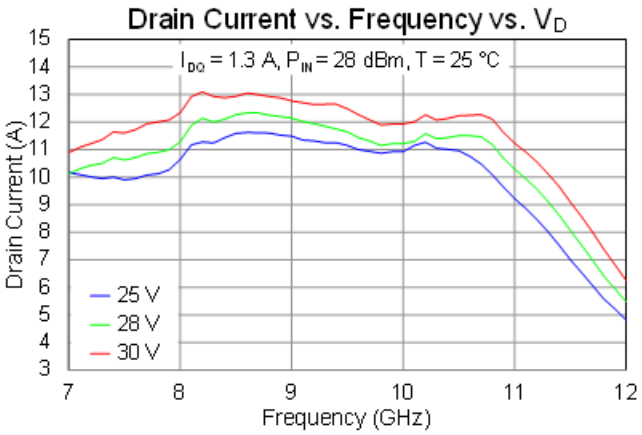












Performance Plots – Large Signal (Pulsed)

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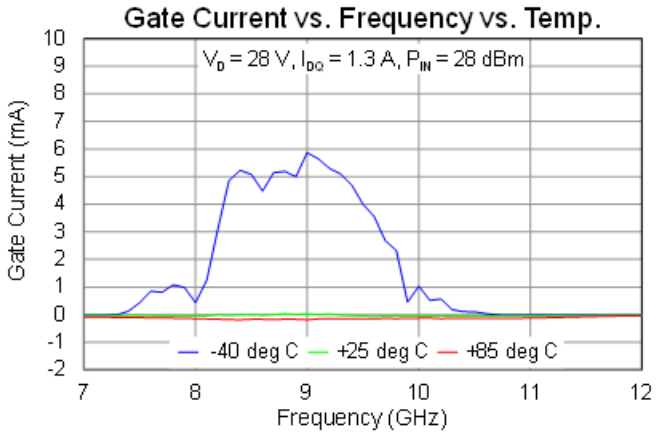
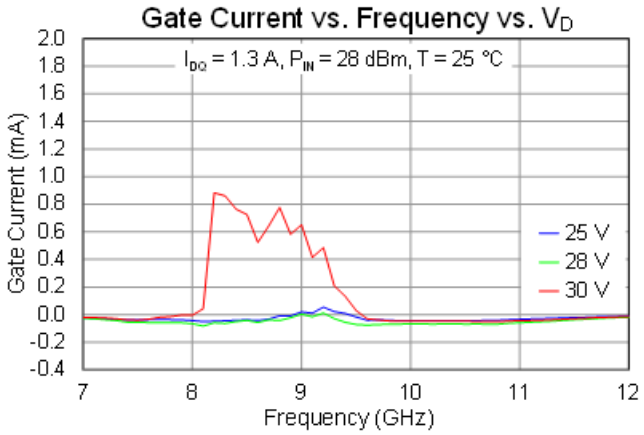
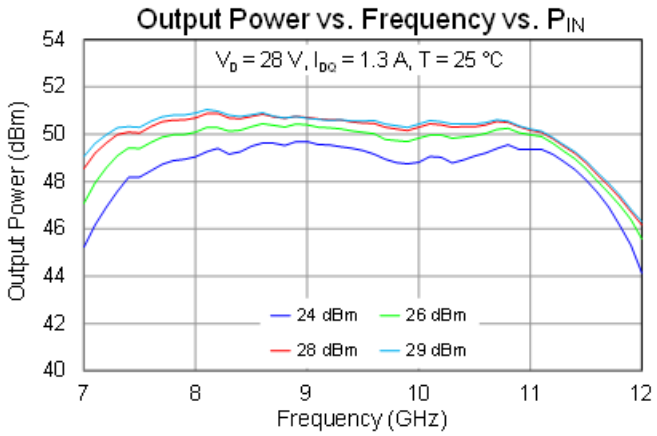
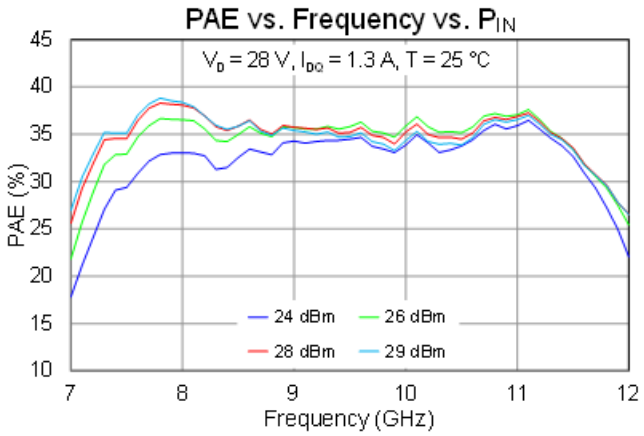
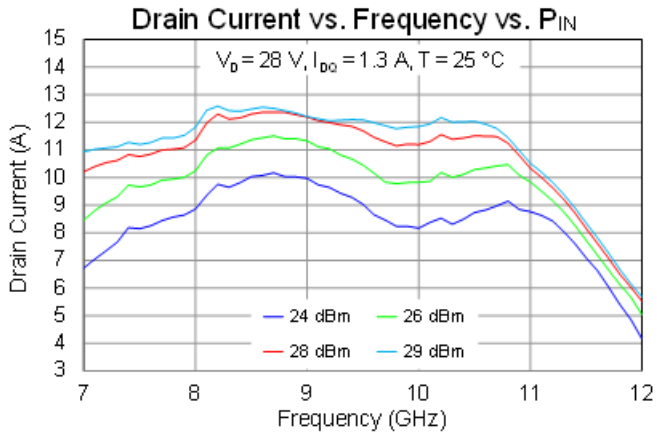
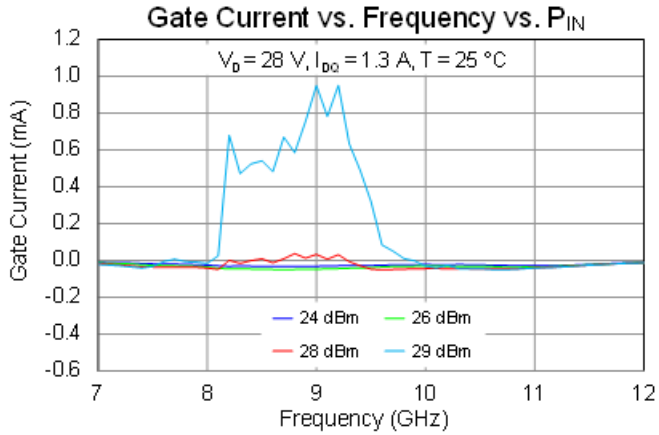






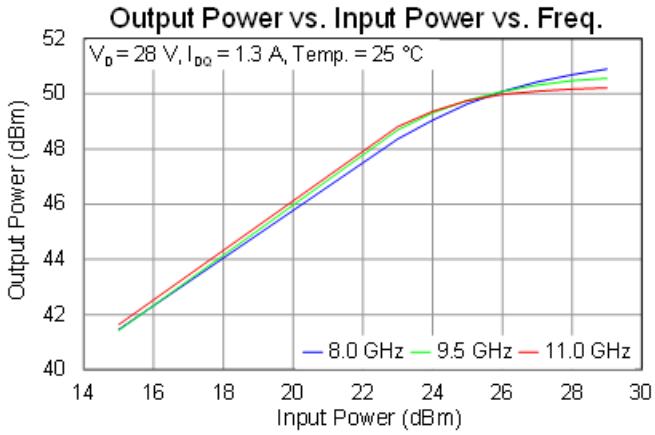


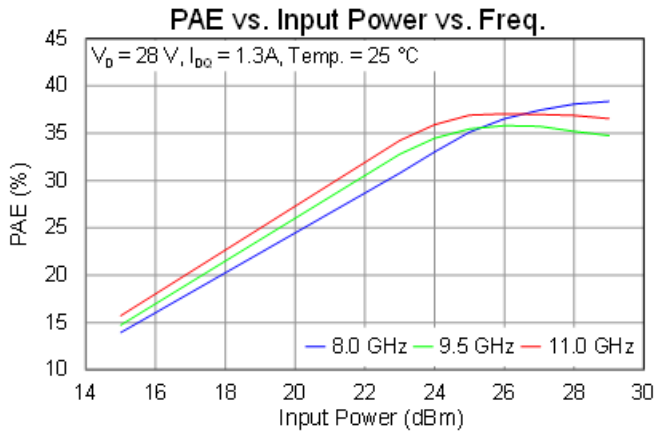


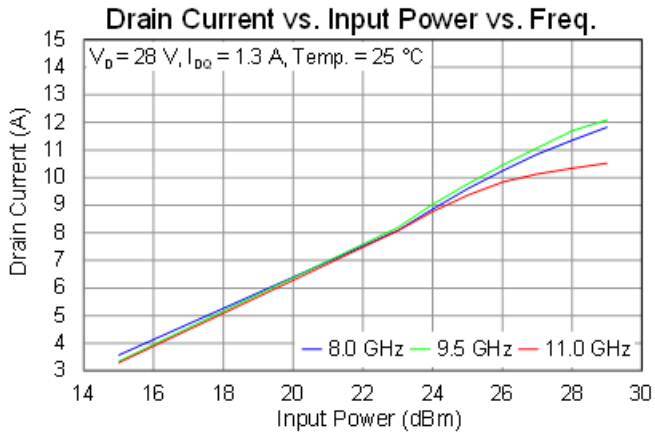


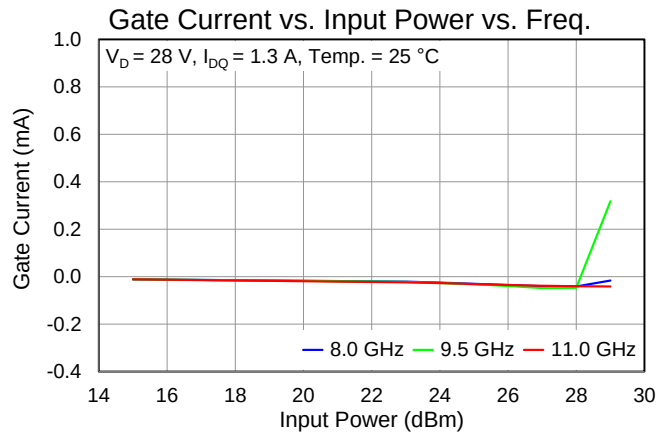
Performance Plots – Large Signal (Pulsed)

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)

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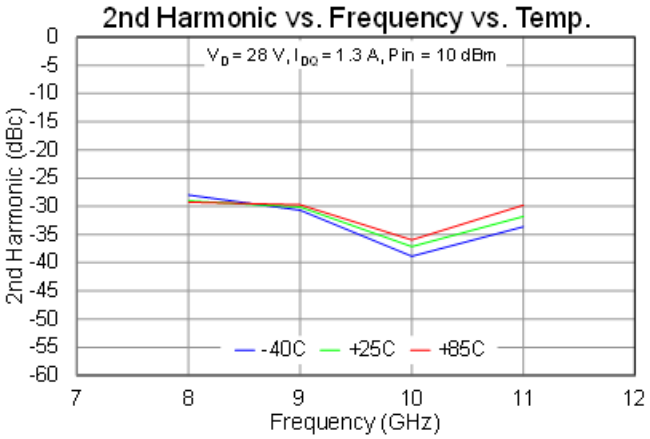
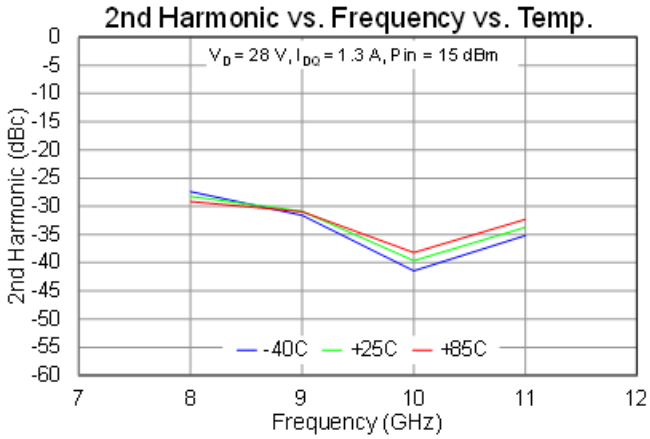
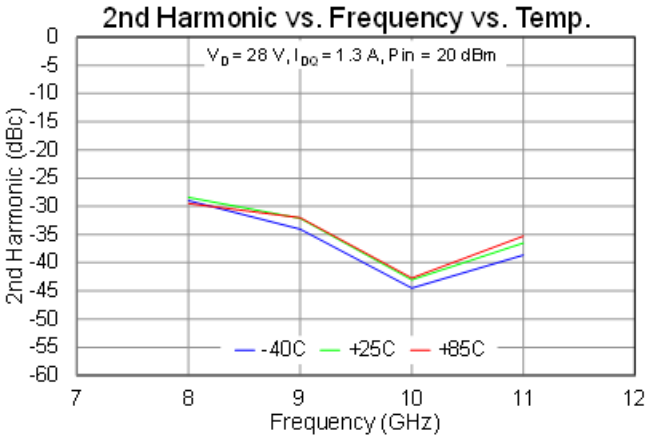
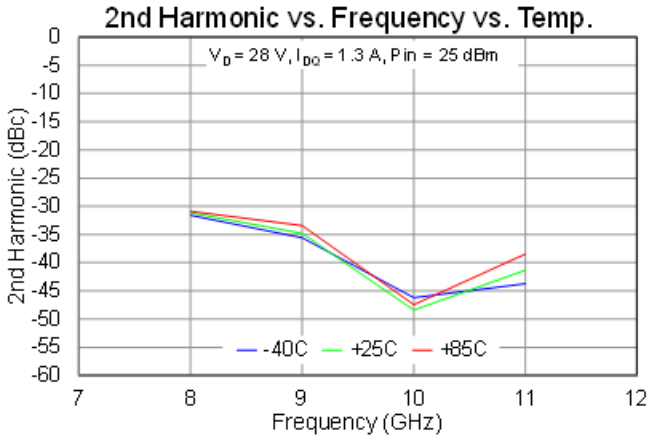
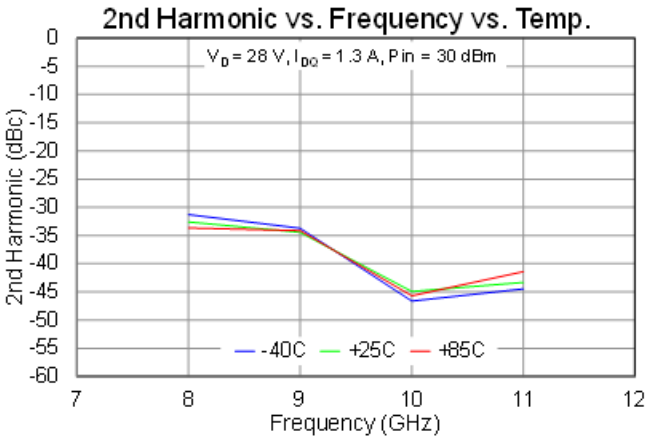
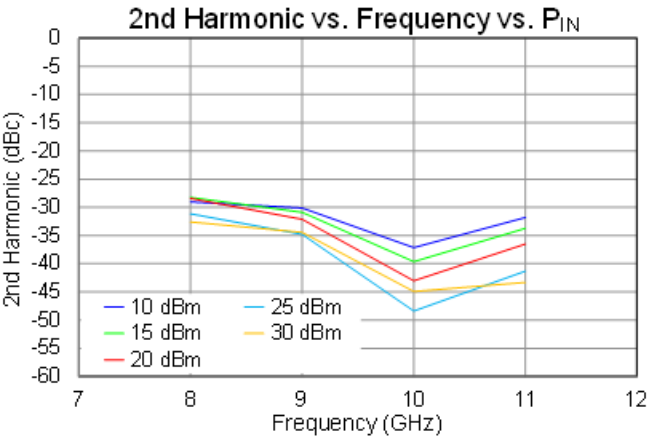






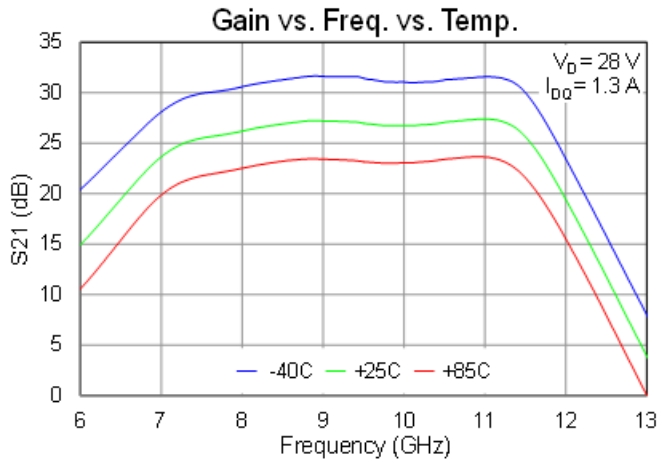


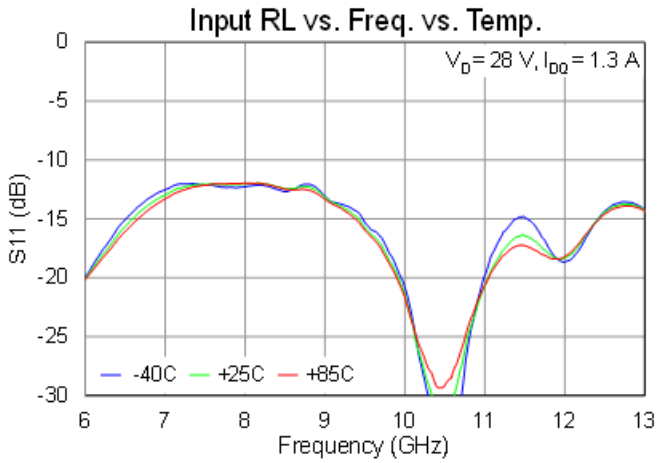


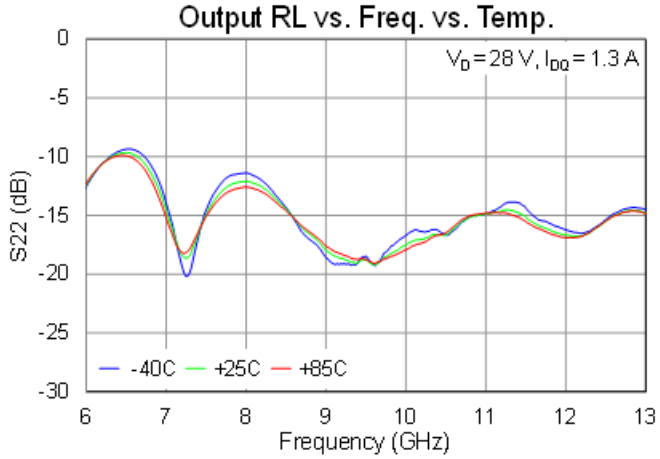


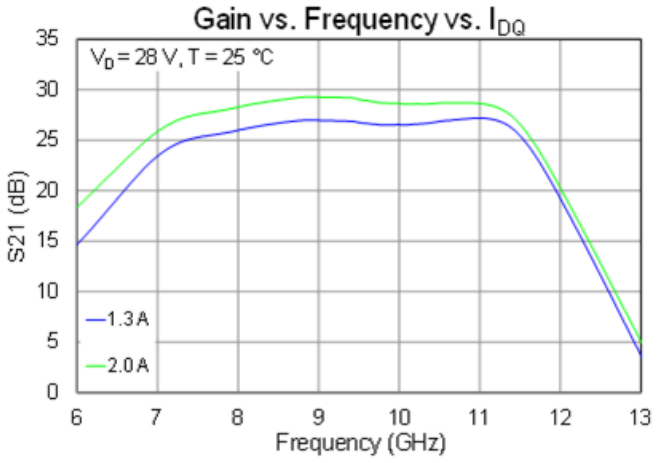
Performance Plots – Small Signal (CW)

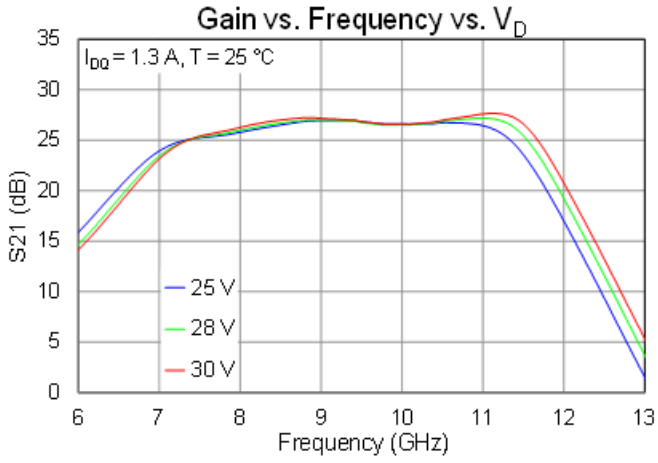
Test conditions unless otherwise noted: 25 °C , V_D = 28 V











Performance Plots – Small Signal (CW)

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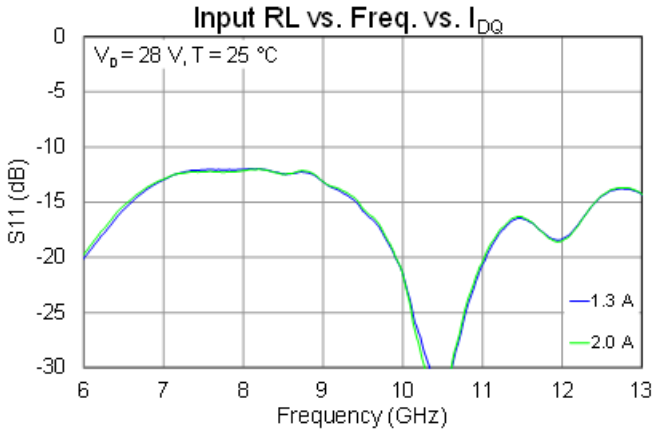
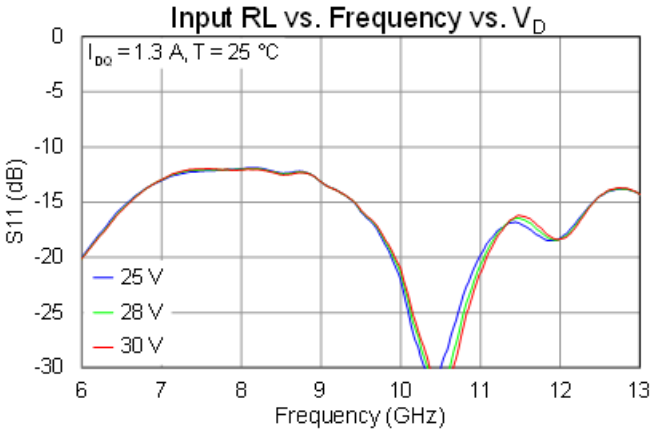
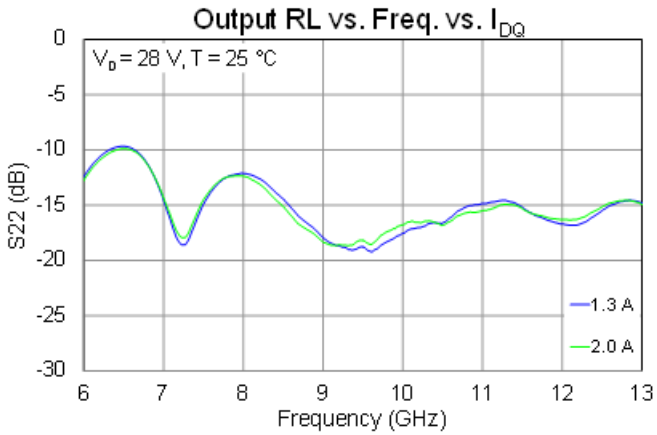
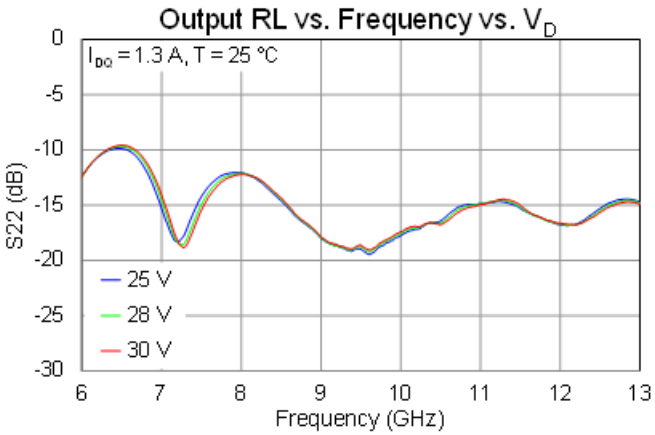






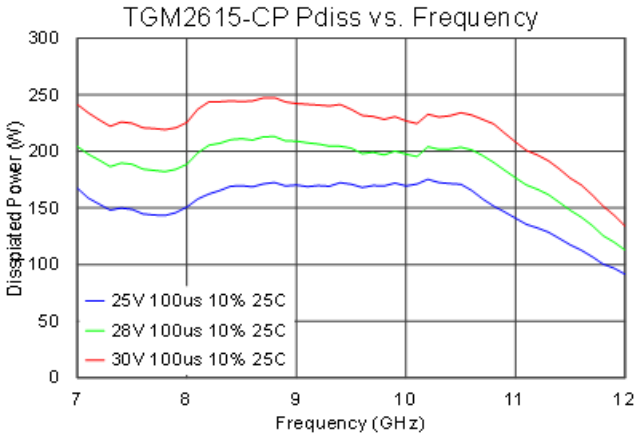


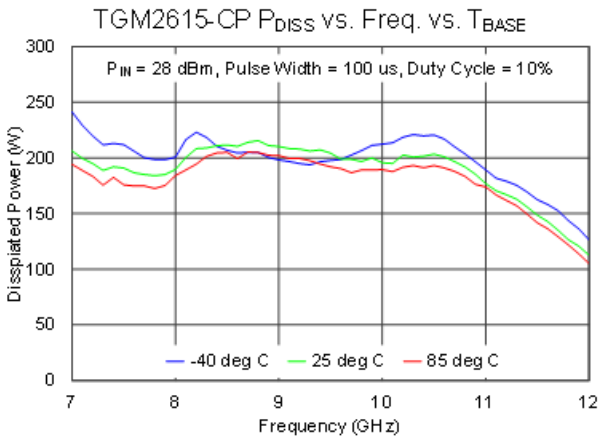
Thermal and Reliability Information

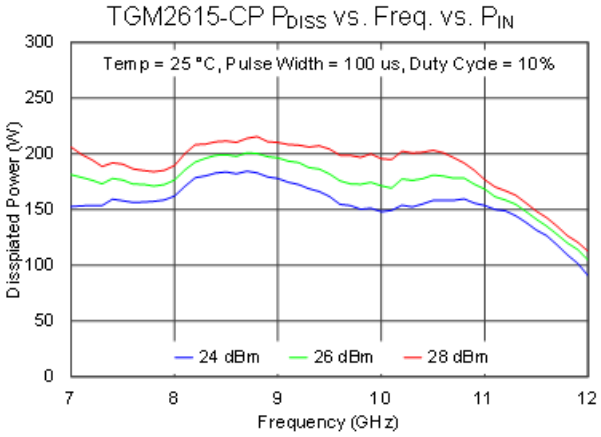
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{Base} = 85 °C V_D = 28 V, I_{DQ} = 1.3 A P_{DISS} = 36.4 W	0.30	ºC/W
Channel Temperature, T_{CH} (No RF drive)		96	°C
Thermal Resistance (θ_{JC}) (1)	T_{Base} = 85 °C, V_D = 28 V, I_{DQ} = 1.3 A, Freq = 9.0 GHz, I_{D_Drive} = 11 A, P_{IN} = 28 dBm, P_{OUT} = 50.0 dBm, P_{DISS} = 173 W, PW = 100 us, DC = 10%	0.33	ºC/W
Channel Temperature, T_{CH} (Under RF)		142	°C
Thermal Resistance (θ_{JC}) (1)	T_{Base} = 85 °C, V_D = 28 V, I_{DQ} = 1.3 A, Freq = 9.0 GHz, I_{D_Drive} = 12 A, P_{IN} = 31 dBm, P_{OUT} = 50.5 dBm, P_{DISS} = 195 W, PW = 100 us, DC = 10%	0.34	ºC/W
Channel Temperature, T_{CH} (Under RF)		150	°C

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

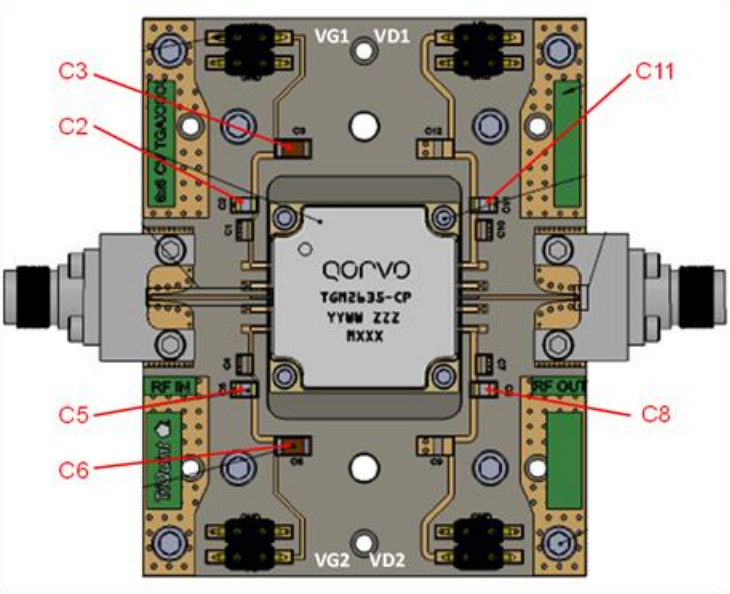
Power Dissipation

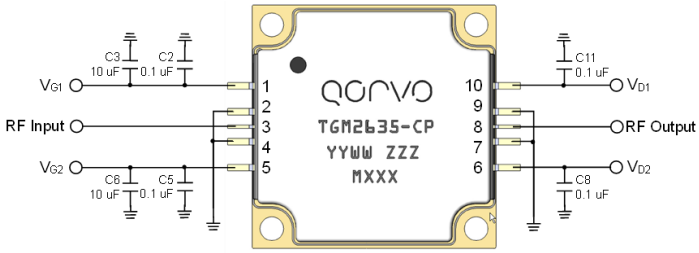






Evaluation Board (EVB) and Application Circuit





Notes:
1. See Evaluation Board PCB Information for material and stack up.
2. Part requires biasing from both sides of the EVB.

Bill of Material

Ref. Des.	Value	Description	Manuf.	Part Number
n/a	n/a	Printed Circuit Board	Qorvo	
U1	n/a	X-Band 100 W GaN Power Amplifier	Qorvo	TGM2635-CP
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

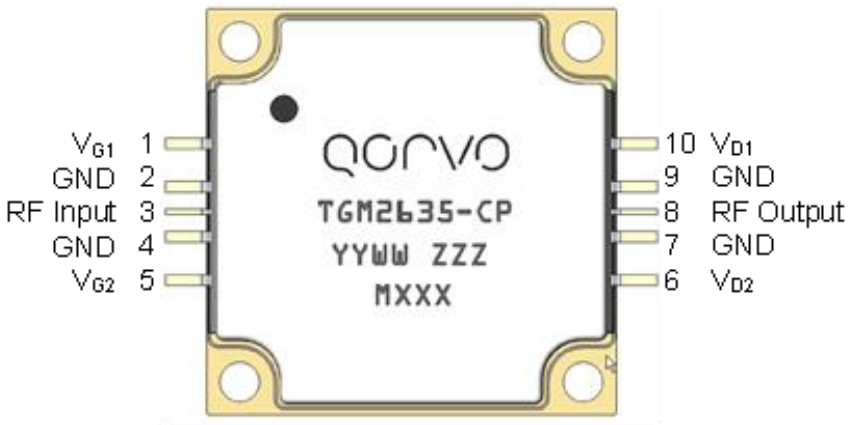
EVB Bias-Up Procedure

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 (V_G ~ −2.6 V Typical)
5. Apply RF signal

EVB 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



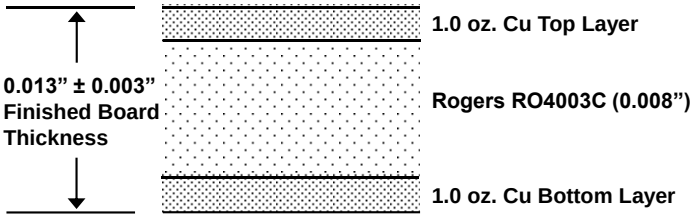
Top View

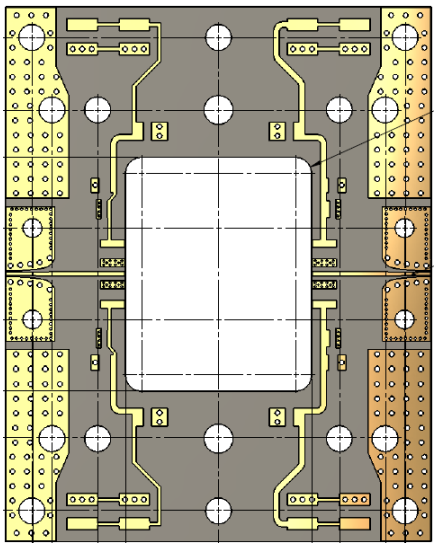
Pad No.	Label	Description
1	V_{G1}	Gate voltage stage 1. Bias network is required; see Application Circuit as an example
2, 4, 7, 9	GND	RF Ground
3	RF Input	RF Input; matched to 50Ω; DC Blocked
5	V_{G2}	Gate voltage stage 2. Bias network is required; see Application Circuit as an example
6	V_{D2}	Drain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

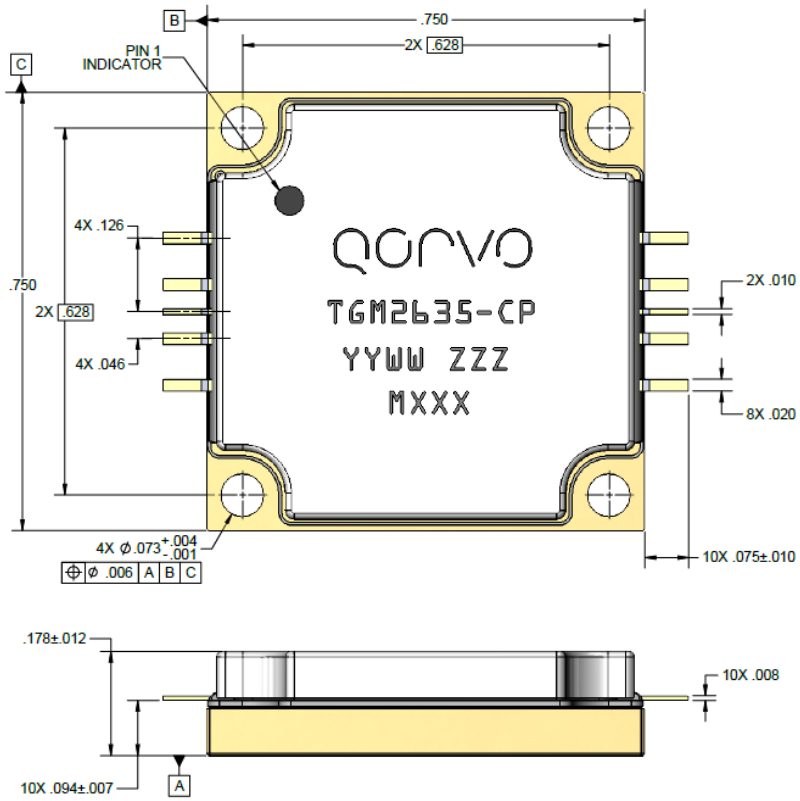
EVB PC Board Layout

PCB Material Stack-up





Package Marking and Dimensions



NOTES:
1. MATERIALS:
   PACKAGE BASE: COPPER
   FINISH: GOLD
   LEADS: ALLOY 194
   FINISH: GOLD
   LID: LCP (LIQUID CRYSTAL POLYMER)
2. PART IS EPOXY SEALED.

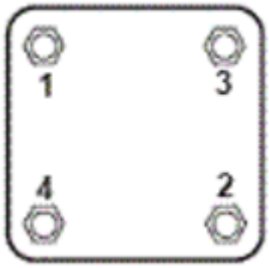
LASER MARK NOTES:
- MARK PER SPE-000429.
- YY IS THE LAST TWO DIGITS OF THE CALENDAR YEAR.
- WW IS THE WEEK NUMBER OF ASSEMBLY LOT START.
- ZZZ IS SERIAL NUMBER.
- MXXX IS THE BATCH ID.

TOLERANCES .XX = ± .01 .XXX = ± .005 .XXXX = ± .0010 ANGLES = 0.5°

Notes:
1. Contact plating: Ni – Au

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 TGM2635-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.

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. 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 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:

- 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:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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