TGA2578-CP

2 – 6 GHz 30 W GaN Power Amplifier

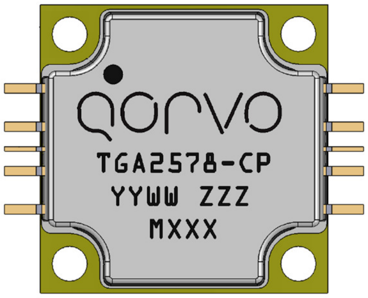
Product Description

Qorvo's TGA2578-CP is a packaged wideband power amplifier fabricated on Qorvo's QGaN25 0.25um GaN on SiC process. Operating from 2 to 6 GHz, the TGA2578-CP achieves 30 W saturated output power with a power-added efficiency of > 30 %, and > 26 dB small signal gain.

The TGA2578-CP is offered in a 10-lead 15.2 x 15.2 mm bolt-down package. The package has a pure Cu base, offering superior thermal management. The TGA2578-CP is ideally suited to support both commercial and defense applications.

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

Lead-free and RoHS compliant.

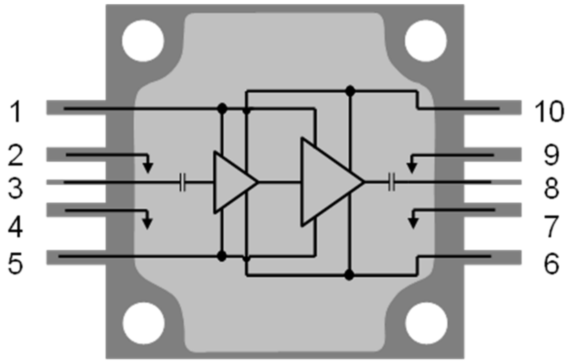


Product Features

- Frequency Range: 2 – 6 GHz
- P_{OUT}: 45 dBm @ P_{IN} = 23 dBm
- PAE: >30% @ P_{IN} = 23 dBm
- Small Signal Gain: > 26 dB
- IM3: -30 dBc @ 30 dBm Pout/Tone
- Bias: V_D = +28 V, I_{DQ} = 400 mA, V_G = –2.8 V typical
- Package Dimensions: 15.2 x 15.2 x 3.5 mm
- Package base is pure Cu offering superior thermal management

Performance is typical across frequency. Please reference electrical specification table and data plots for more details

Functional Block Diagram



Applications

- Electronic Warfare
- Radar
- Communications
- Test Instrumentation
- EMC Amplifier

Ordering Information

Part No.	Description
TGA2578-CP	2 – 6 GHz 30 W GaN Power Amplifier
1096052	TGA2578-CP Evaluation Board

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	40 V
Gate Voltage Range (V_G)	–8 to 0 V
Drain Current (I_D)	5 A
Gate Current (I_G)	See plot page 8
Power Dissipation (P_{DISS}), 85°C	85 W
Input Power (P_{IN}), 50Ω, 85°C, CW	27 dBm
Input Power (P_{IN}), 85°C, VSWR 3:1, V_D = 28V, CW	27 dBm
Input Power (P_{IN}), 85°C, VSWR 10:1, V_D = 28V, CW	25 dBm
Mounting Temperature	Refer to Assembly Notes, page 11
Storage Temperature	–55 to 150 ºC

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 Conditions

Parameter	Min	Typ.	Max	Units
Drain Voltage (V_D)		+28		V
Drain Current, (I_{DQ})		400		mA
Gate Voltage (V_G)		-2.8 Typical		V
T_{BASE} Range	–40		+85	ºC

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

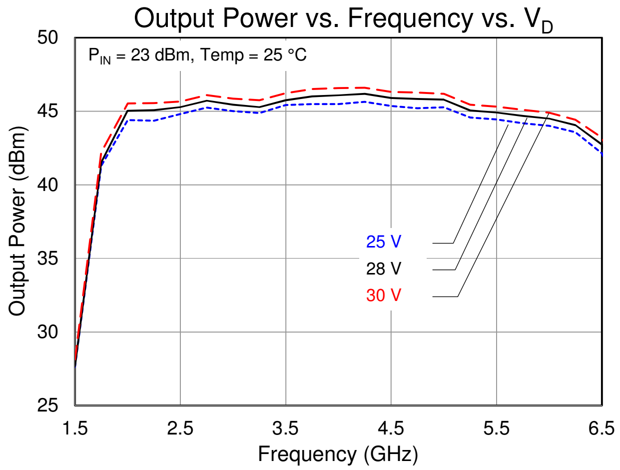
Electrical Specifications

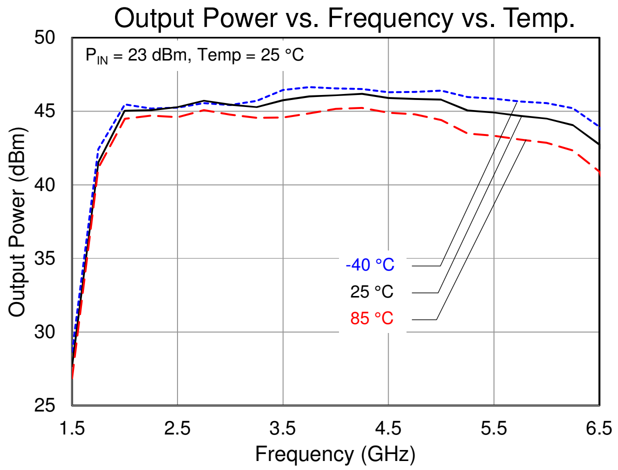
Parameter	Min	Typ	Max	Units
Operational Frequency Range	2		6	GHz
Small Signal Gain		>26		dB
Input Return Loss		>12		dB
Output Return Loss		>5		dB
Output Power (@ P_{IN} = 23 dBm)		45		dBm
Power Added Efficiency (@ P_{IN} = 23 dBm)		>30		%
IM3 (Pout/tone = 30 dBm/Tone)		-30		dBc
IM5 (Pout/tone = 30 dBm/Tone)		-40		dBc
Small Signal Gain Temperature Coefficient		–0.05		dB/°C
Output Power Temperature Coefficient		-0.02		dBm/°C

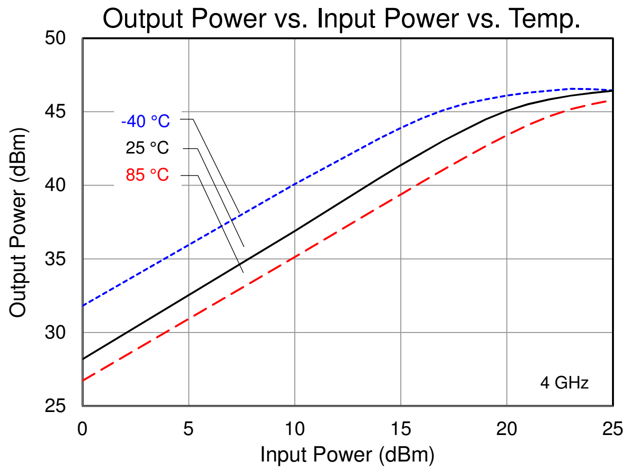
Test conditions unless otherwise noted: 25 ºC, V_D = +28 V, I_{DQ} = 400 mA, V_G = –2.8 V typical, CW.

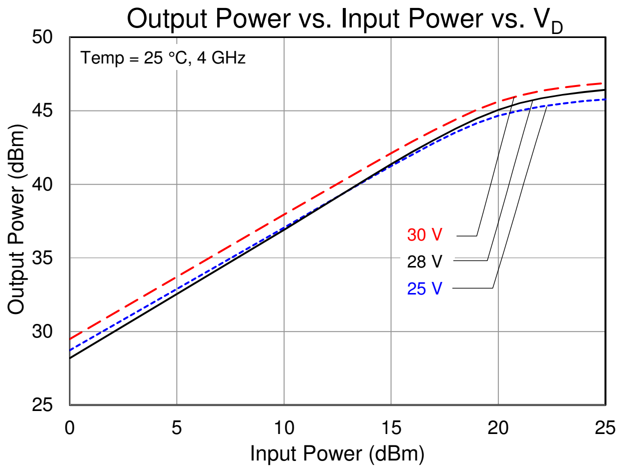
Typical Performance – Large Signal

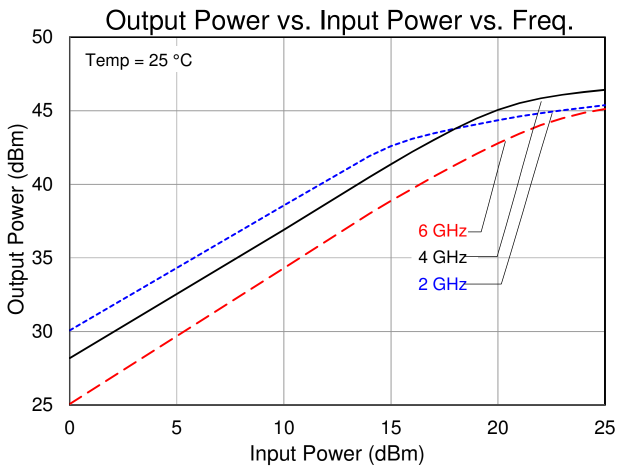
Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 400 mA, V_G = -2.8 V Typical, CW.


Output Power vs. Frequency vs. V_D


Output Power vs. Frequency vs. Temp.


Output Power vs. Input Power vs. Temp.

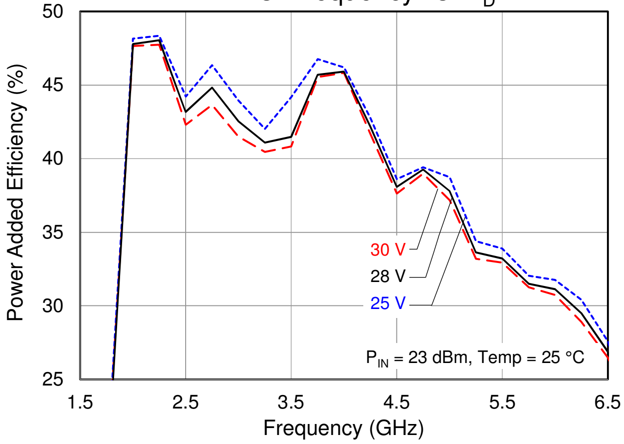

Output Power vs. Input Power vs. V_D


Output Power vs. Input Power vs. Freq.

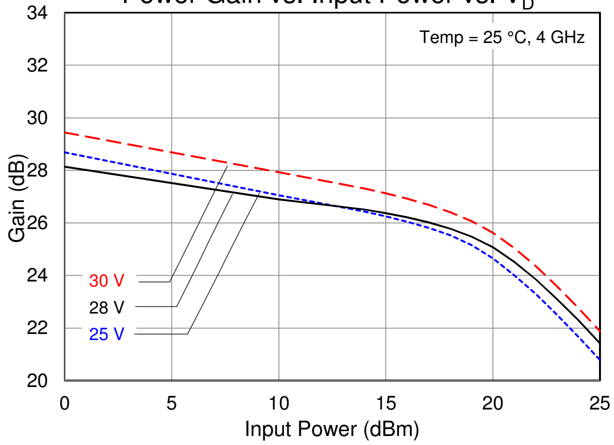
Typical Performance – Large Signal

Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 400 mA, V_G = -2.8 V Typical, CW.

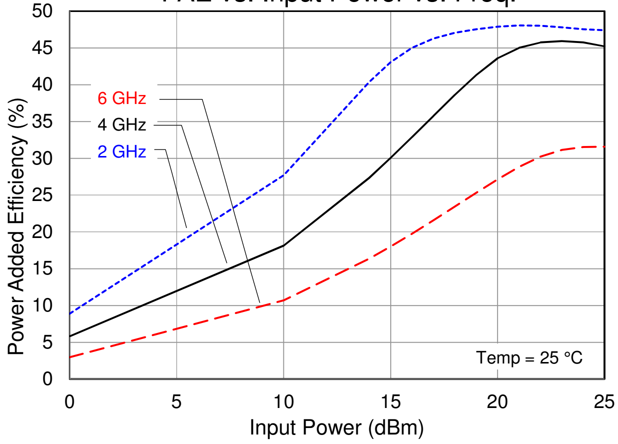
PAE vs. Frequency vs. V_D



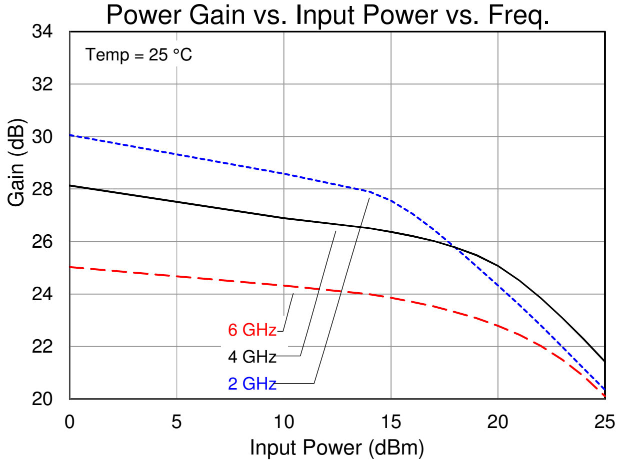
Power Gain vs. Input Power vs. V_D



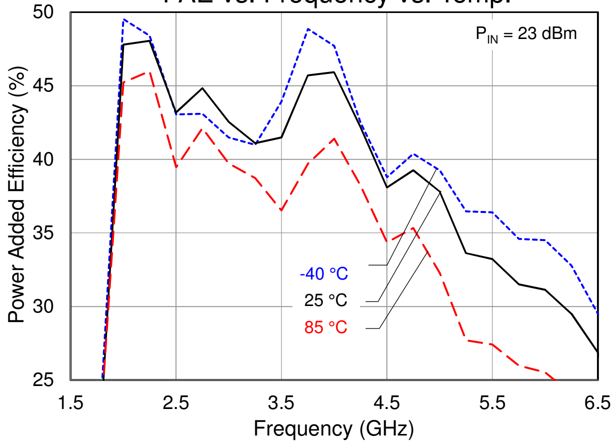
PAE vs. Input Power vs. Freq.



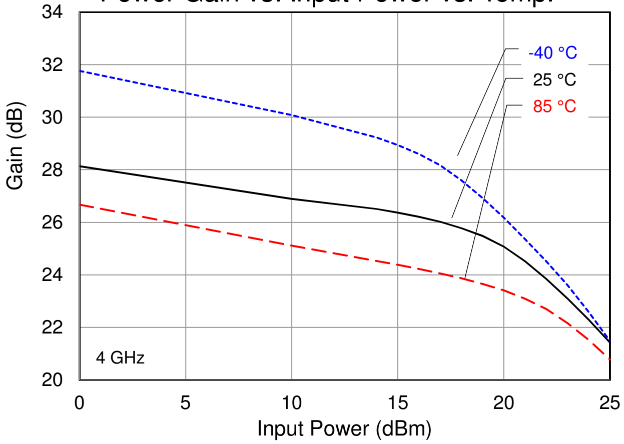
Power Gain vs. Input Power vs. Freq.



PAE vs. Frequency vs. Temp.



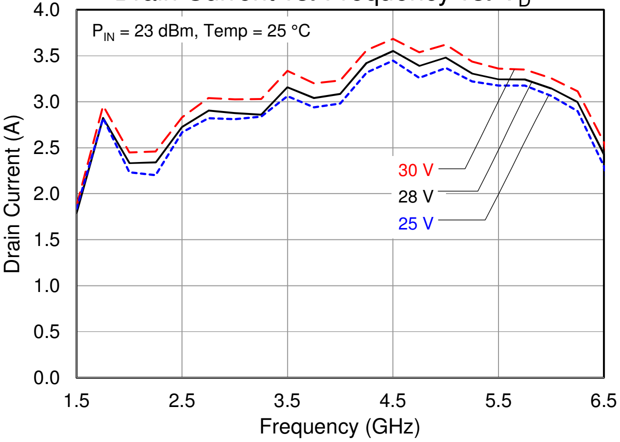
Power Gain vs. Input Power vs. Temp.



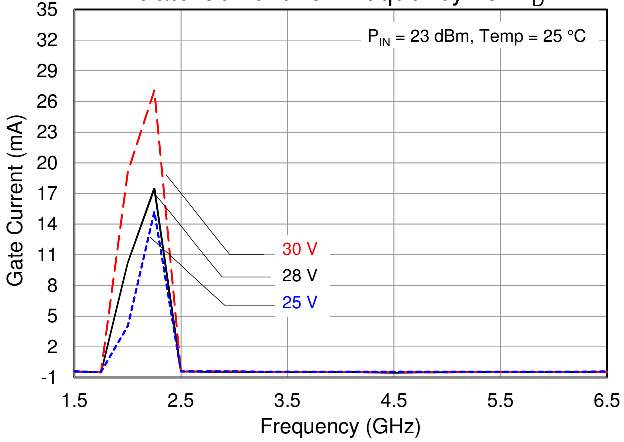
Typical Performance – Large Signal

Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 400 mA, V_G = -2.8 V Typical, CW.

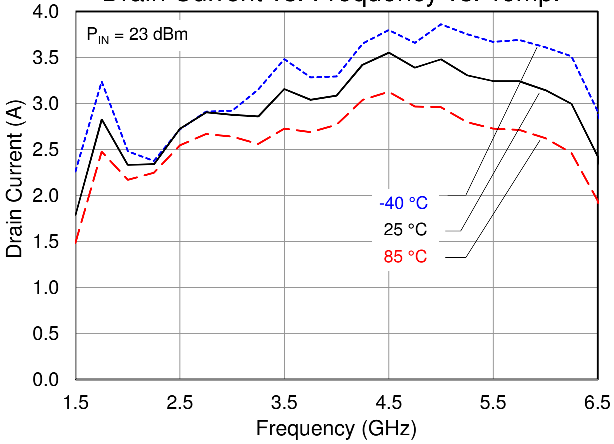
Drain Current vs. Frequency vs. V_D



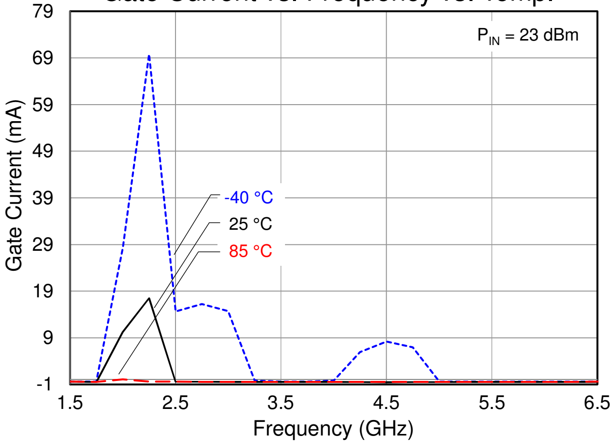
Gate Current vs. Frequency vs. V_D



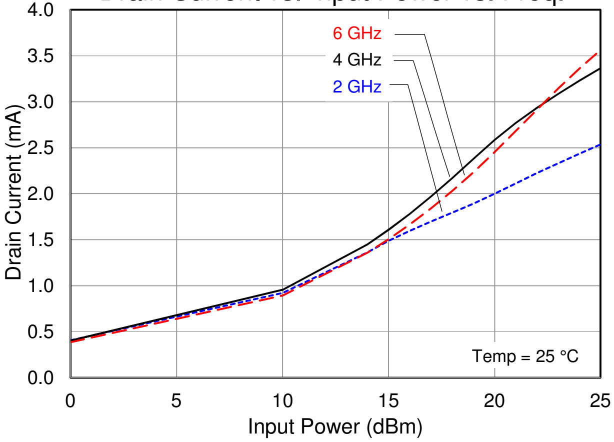
Drain Current vs. Frequency vs. Temp.



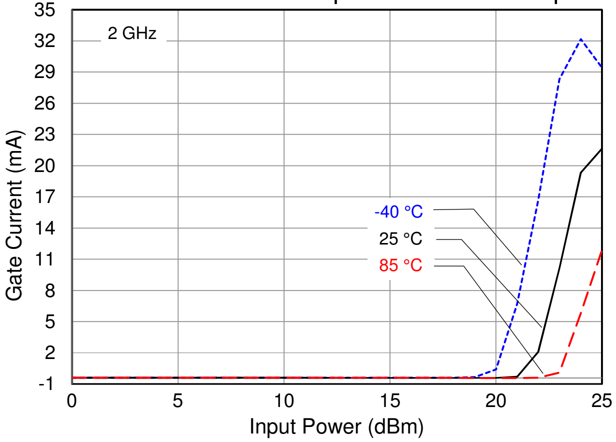
Gate Current vs. Frequency vs. Temp.



Drain Current vs. Input Power vs. Freq.

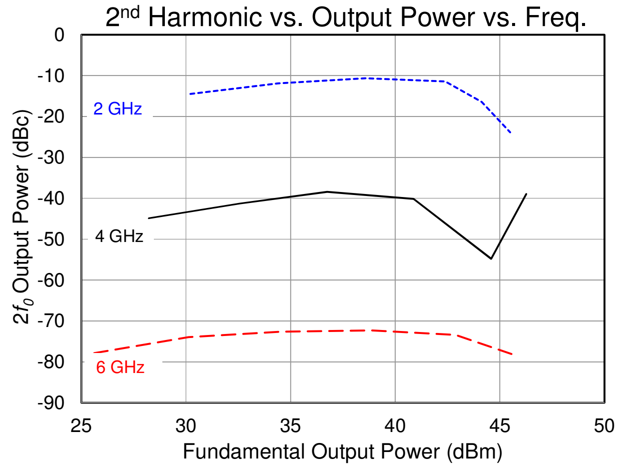


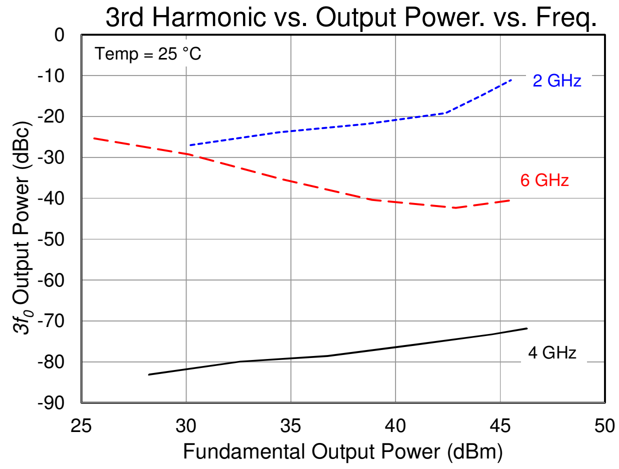
Gate Current vs. Input Power vs. Temp.

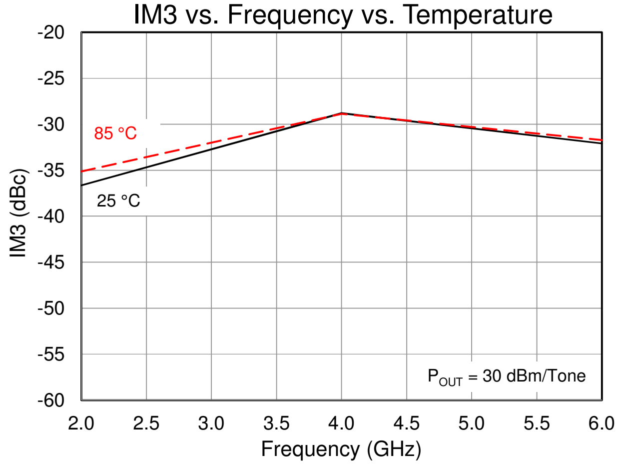


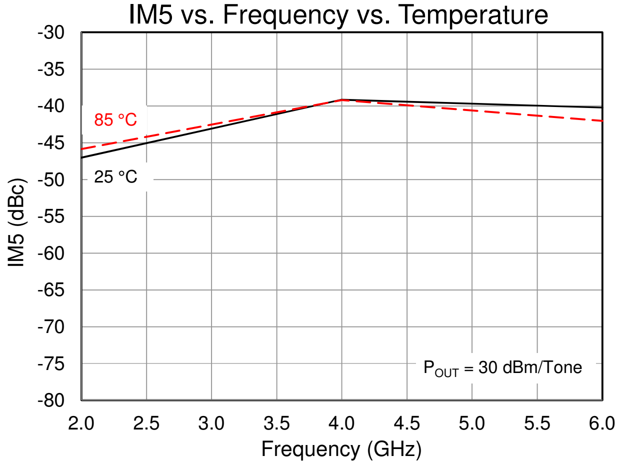
Typical Performance – Linearity

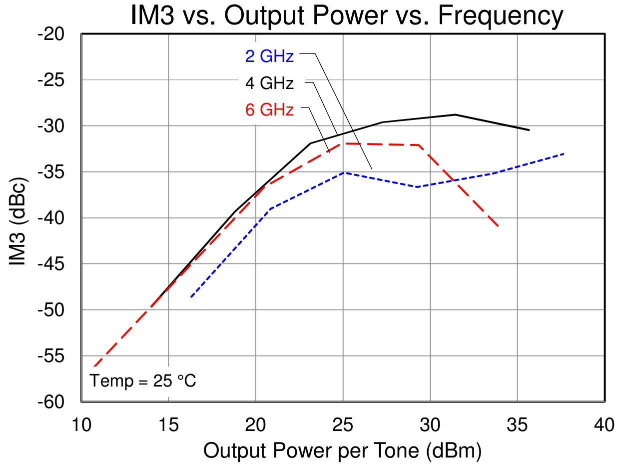
Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 400 mA, V_G = -2.8 V Typical, CW.

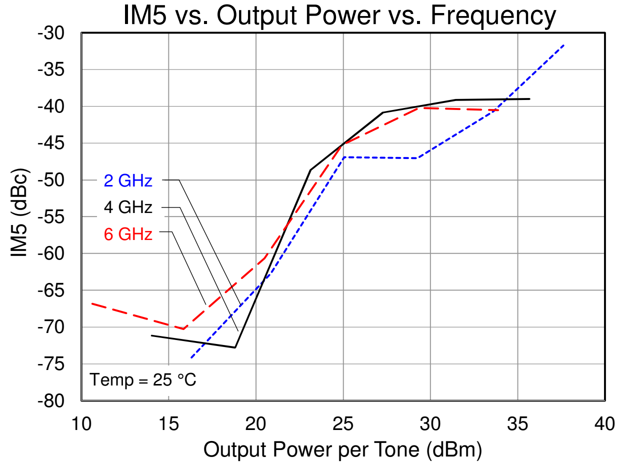








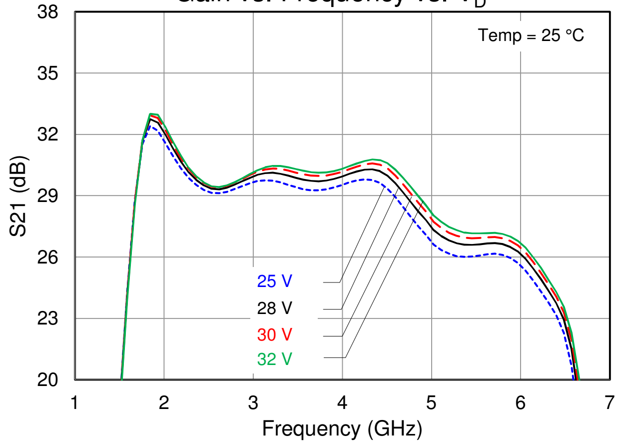




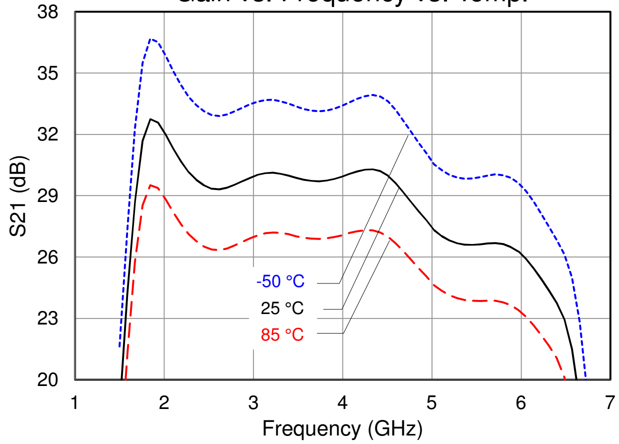
Performance Plots – Small Signal (CW)

Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 400 mA, V_G = -2.8 V Typical, CW.

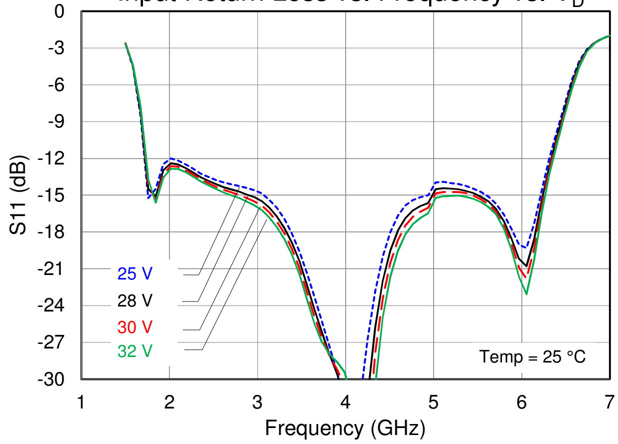
Gain vs. Frequency vs. V_D



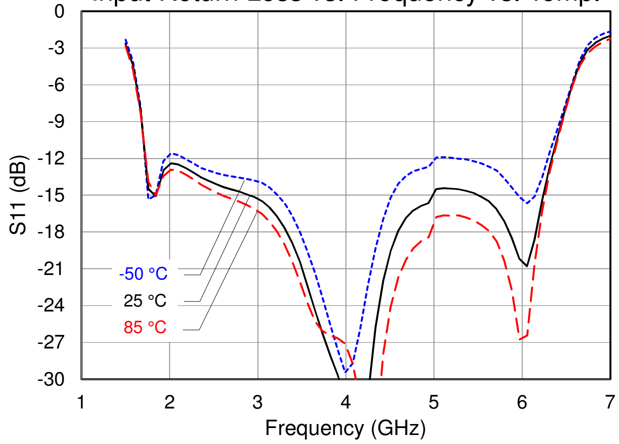
Gain vs. Frequency vs. Temp.



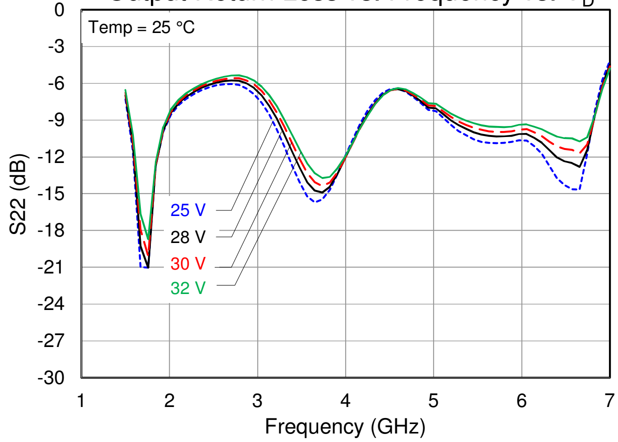
Input Return Loss vs. Frequency vs. V_D



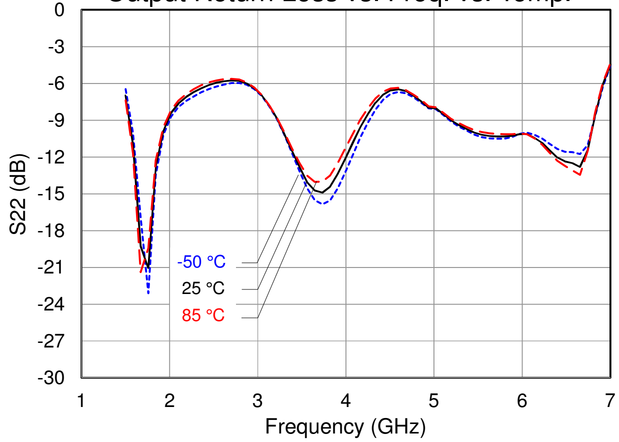
Input Return Loss vs. Frequency vs. Temp.



Output Return Loss vs. Frequency vs. V_D



Output Return Loss vs. Freq. vs. Temp.



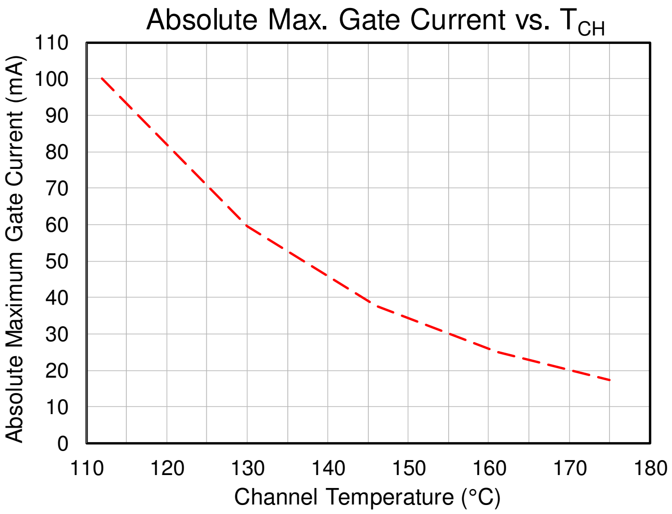
Thermal and Reliability Information

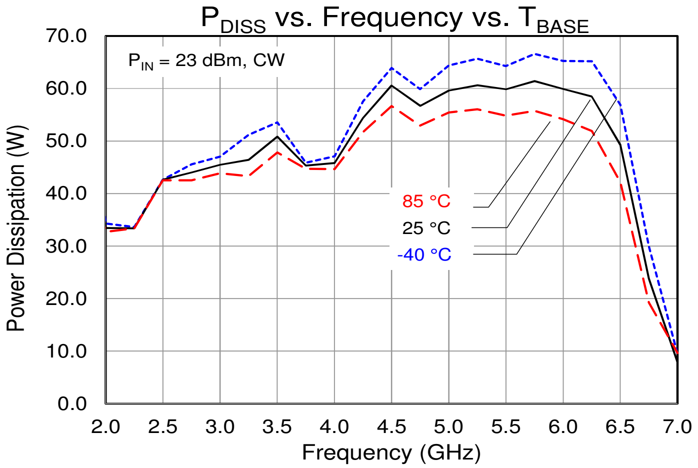
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	V_D = 28 V, I_{DQ} = 400 mA, Freq. = 5 GHz T_{base} = 85 °C, V_D = 28 V, I_{D_Drive} = 3 A, P_{IN} = 23 dBm, P_{OUT} = 44dBm, P_{DISS} = 55 W	1.29	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		156	ºC

Notes:

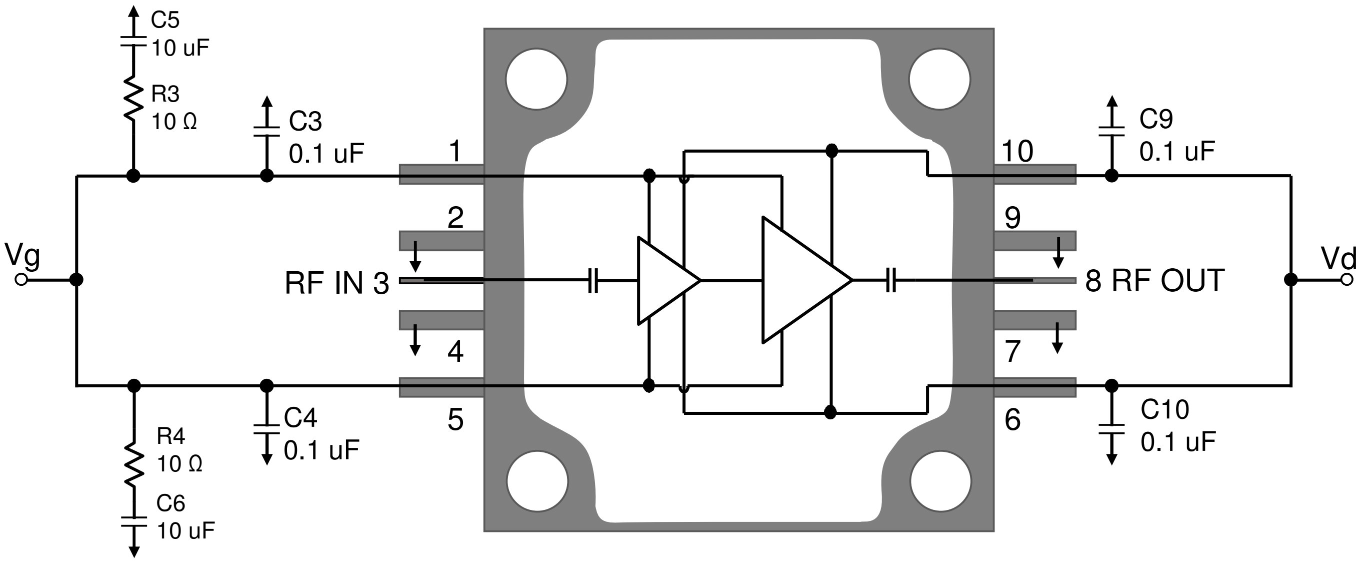
1. Thermal resistance is referenced to the back of package (85 ºC)
2. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

Dissipated Power and Maximum Gate Current





Applications Information and Pin Layout



Notes:

1. V_G must be biased from both sides (Pins 1 and 5)
2. V_D must be biased from both sides (Pins 6 and 10)

Bias Up Procedure

1. Set I_D limit to 5 A, I_G limit to 25 mA
2. Apply –5 V to V_G
3. Apply 28 V to V_D; ensure I_{DQ} is approx. 0 mA
4. Adjust V_G until I_{DQ} = 400 mA (V_G ~ –2.8 V Typ.).
5. Turn on RF supply

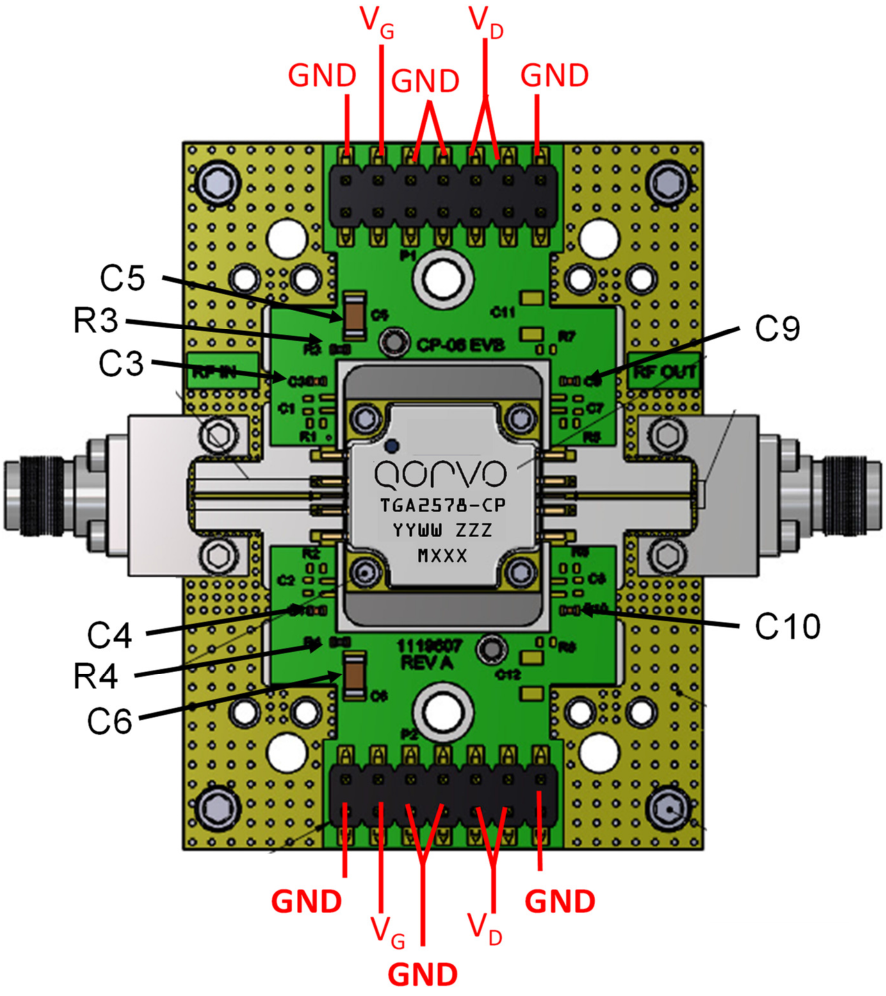
Bias Down Procedure

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

Pin Description

Pad No.	Symbol	Description
1,5	V_G	Gate Voltage; Bias network is required; must be biased from both sides; see recommended Application Information above.
2,4,7,9	GND	Must be grounded on the PCB.
3	RF_{IN}	Input; matched to 50 Ω; DC blocked
6,10	V_D	Drain voltage; Bias network is required; must be biased from both sides; see recommended Application Information above.
8	RF_{OUT}	Output; matched to 50 Ω; DC blocked.

Evaluation Board (EVB) Assembly Drawing



PCB NOTES:

1. PCB is made from Rogers 4003C dielectric, 0.008 inch thick, 0.5 oz. copper both sides.
2. Both Top and Bottom V_D and V_G must be biased.

Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C3, C4, C9, C10	0.1 µF	Cap, 0402, 50 V, 10%, X7R	Various	–
C5, C6	10 uF	Cap, 1206, 50 V, 20%, X5R	Various	–
R3, R4	10 Ω	Res, 0402, 5%	Various	–

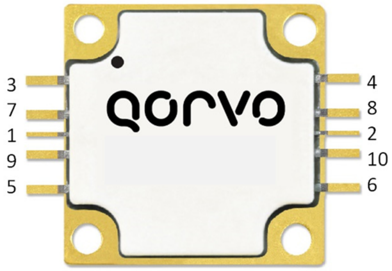
Assembly Notes

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.

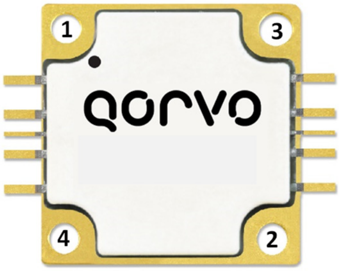
3. The component leads should be manually soldered. Apply a low residue solder alloy meeting J-STD-001 (ROL0, ROL1 or equivalent) with a liquidus temperature below 220 °C to each pin of the TGA/QPA/QPMxxxx. The use of low residue/no-clean flux (ROL0, ROL1) is recommended. The package lead temperature 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.

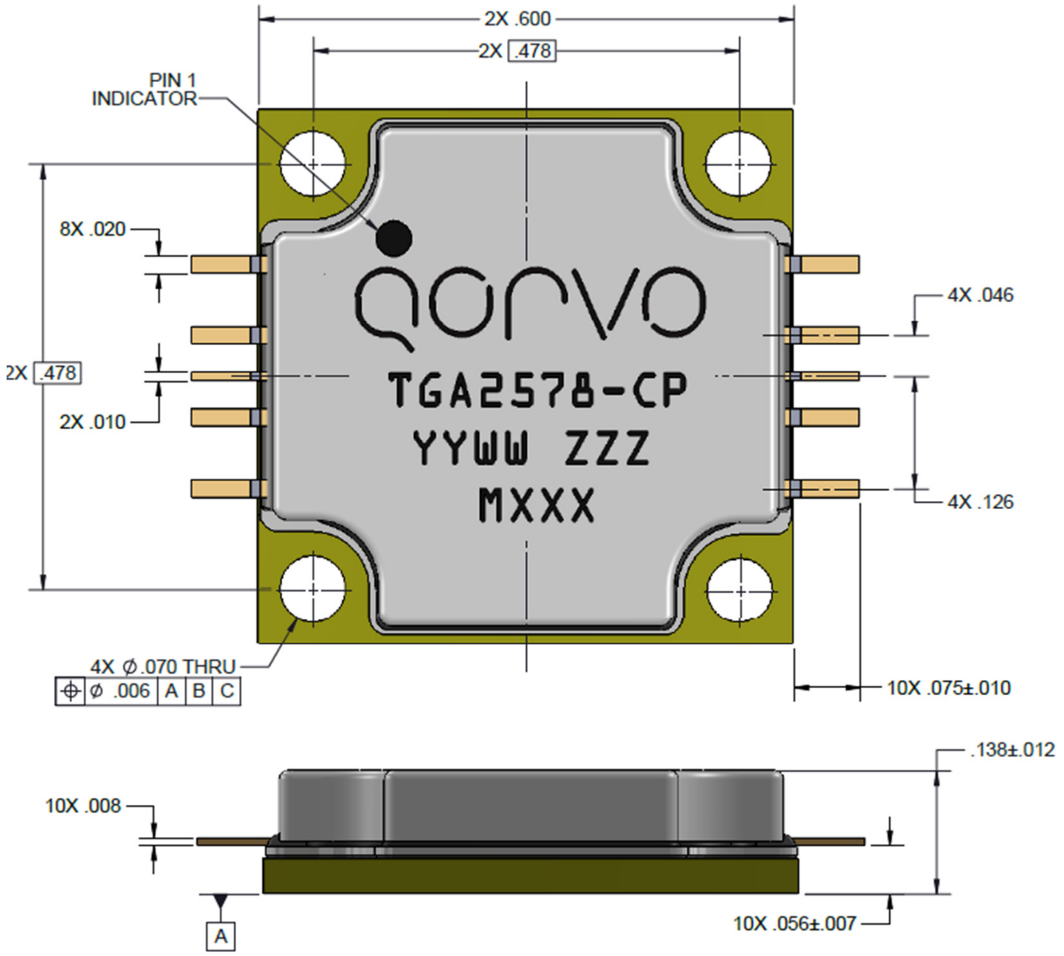


5. The packaged part should not be subjected to conventional SMT automated solder reflow processes.

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:



Mechanical Information



Units: inches
Tolerances: (unless specified)
x.xx = ± 0.01
x.xxx = ± 0.005
Materials:
Base: Copper
Leads: Alloy 194
Lid: Plastic
All metalized features are gold plated
Part is epoxy sealed
Marking:
TGA2578-CP: Part number
YY: Part Assembly year
WW: Part Assembly week
ZZZ: Serial Number (unique for all parts within one assembly lot)
MXXX: Batch ID

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1B	JEDEC Standard JESD22 A114
ESD – Charge Device Model (CDM)	Class C1	JEDEC Standard JESD22-C101F
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 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:

Web: www.qorvo.com

Tel: **1-844-890-8163**

Email: customer.support@qorvo.com

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