

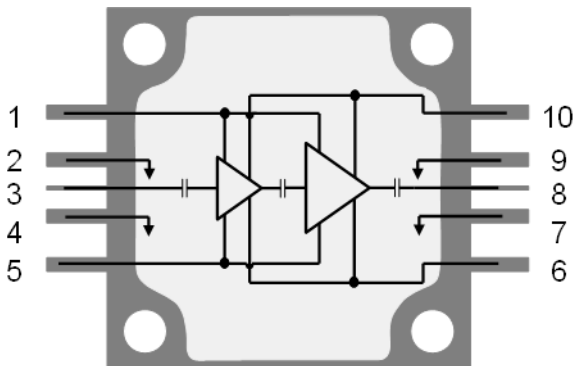
### Product Description

Qorvo's TGA2813-CP is a packaged high-power S-Band amplifier fabricated on Qorvo's QGaN25 0.25  $\mu\text{m}$  GaN on SiC process. Operating from 3.1 to 3.6 GHz, the TGA2813-CP achieves 100 W saturated output power, a power-added efficiency of  $> 50\%$ , and power gain of 23 dB.

The TGA2813-CP is packaged in a 10-lead 15x15 mm bolt-down package with a Cu base for superior thermal management. It can support a range of bias voltages and performs well under both short and long pulse conditions. Both RF ports are internally DC blocked and matched to 50 ohms allowing for simple system integration.



### Functional Block Diagram



### Product Features

- Frequency Range: 3.1–3.6 GHz
- $P_{OUT}$ : 50 dBm @  $P_{IN} = 27$  dBm
- PAE: 51% @  $P_{IN} = 27$  dBm
- Power Gain: 23 dB @  $P_{IN} = 27$  dBm
- Bias:  $V_D = +30$  V,  $I_{DQ} = 300$  mA,  $V_G = -3$  V typical, Pulsed (PW = 15 ms, DC = 30 %)
- 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*

### Applications

- Radar

### Ordering Information

Part No.	Description
TGA2813-CP	3.1 – 3.6 GHz 100 W GaN Power Amplifier
1113462	TGA2813-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 ( $I_D$ )	10.4 A
Gate Current ( $I_G$ )	See plot page 9
Power Dissipation ( $P_{DISS}$ ), 85°C	202 W
Input Power ( $P_{IN}$ ), 50Ω, 85°C, CW	30 dBm
Input Power ( $P_{IN}$ ), 85°C, VSWR 3:1, $V_D = 30V$ , CW	27 dBm
Lead Soldering Temperature (30 Seconds)	260 °C
Storage Temperature	-55 to 150 °C

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 ( $V_D$ ) pulsed: PW = 15 ms, DC = 30 %		+30		V
Drain Current, ( $I_{DQ}$ )		300		mA
Gate Voltage ( $V_G$ )	-3 Typical			V
$T_{BASE}$ Range	-40		+85	°C

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

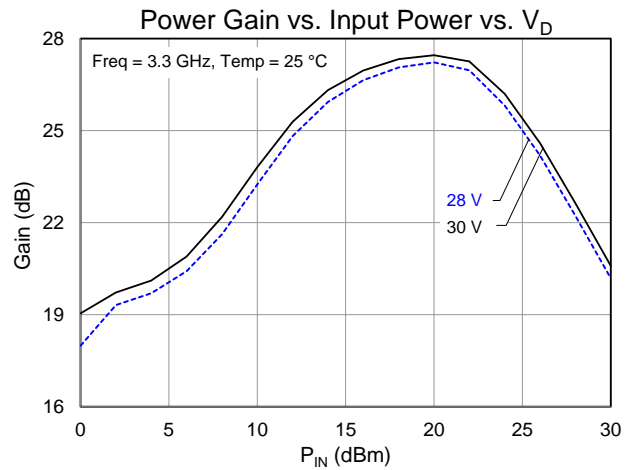
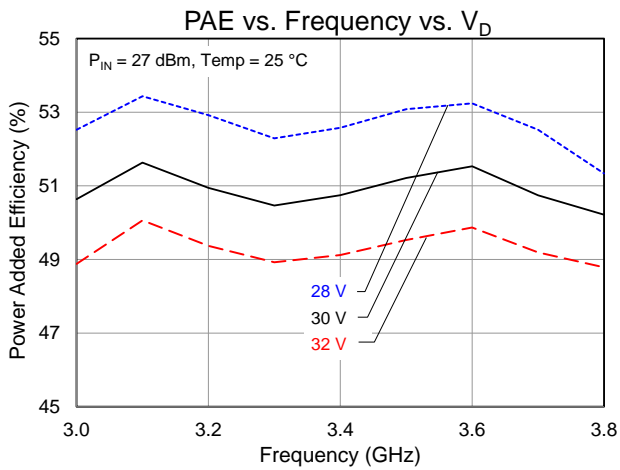
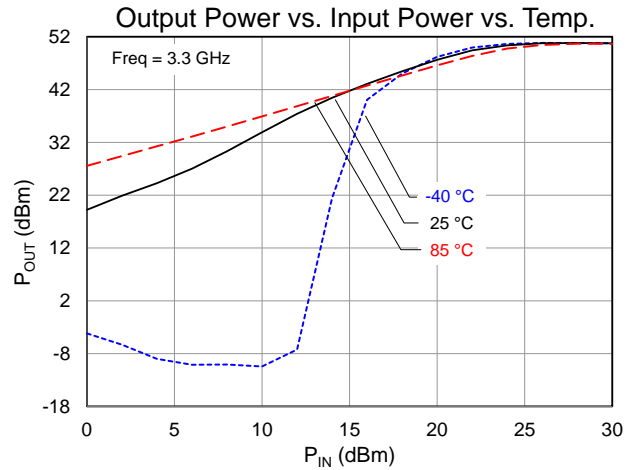
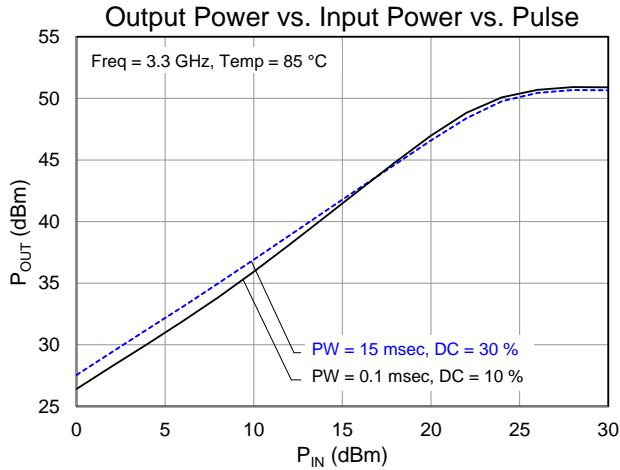
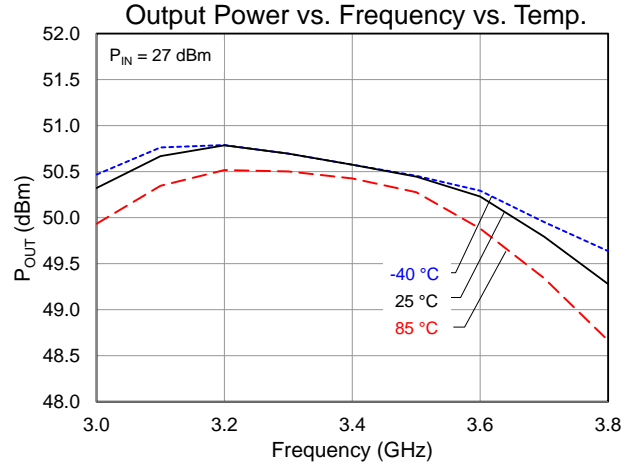
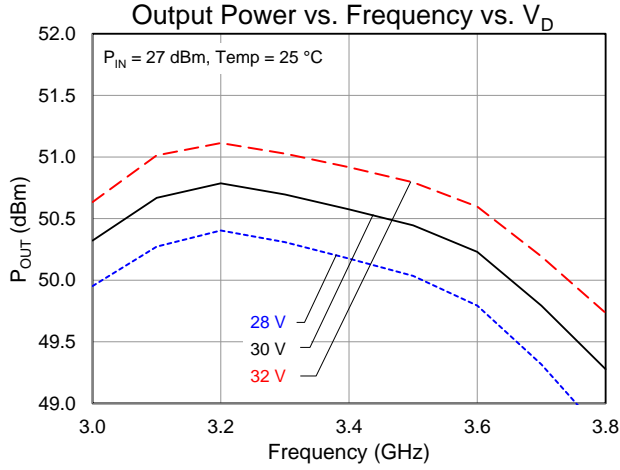
### Electrical Specifications

Parameter	Min	Typ	Max	Units
Operational Frequency Range	3.1		3.6	GHz
Input Return Loss		> 7		dB
Output Return Loss		> 4.5		dB
Output Power (@ $P_{IN} = 27$ dBm)		50		dBm
Power Added Efficiency (@ $P_{IN} = 27$ dBm)		51		%
Power Gain (at $P_{IN} = 27$ dBm)		23		dB
Output Power Temperature Coefficient (Constant $V_G$ )		-0.003		dBm/°C

Test conditions unless otherwise noted: 25 °C,  $V_D = +30$  V (PW = 15 ms, DC = 30 %),  $I_{DQ} = 300$  mA,  $V_G = -3$  V typical.

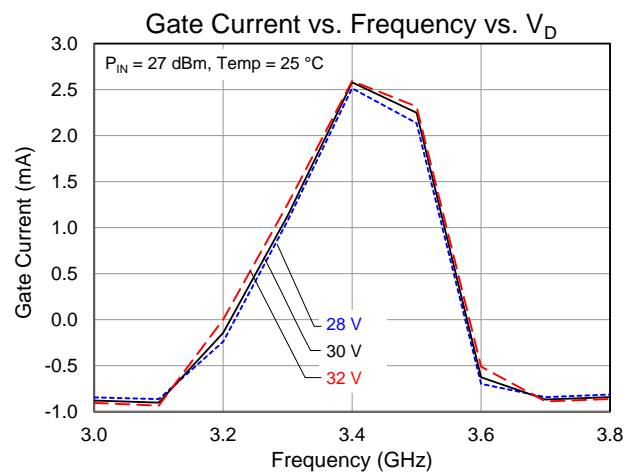
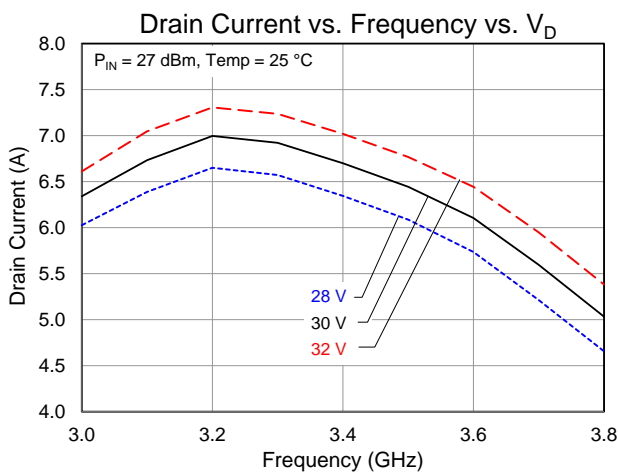
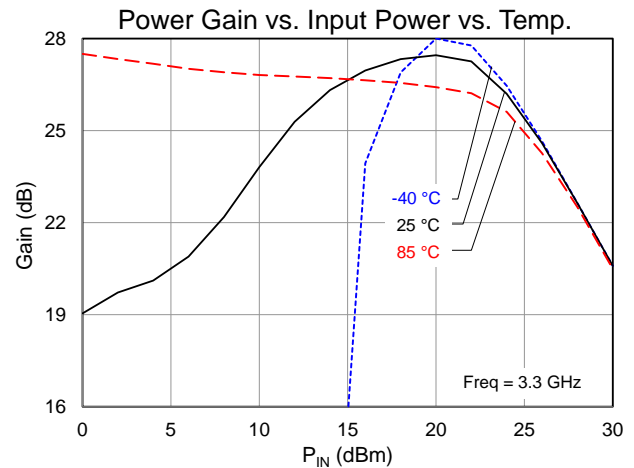
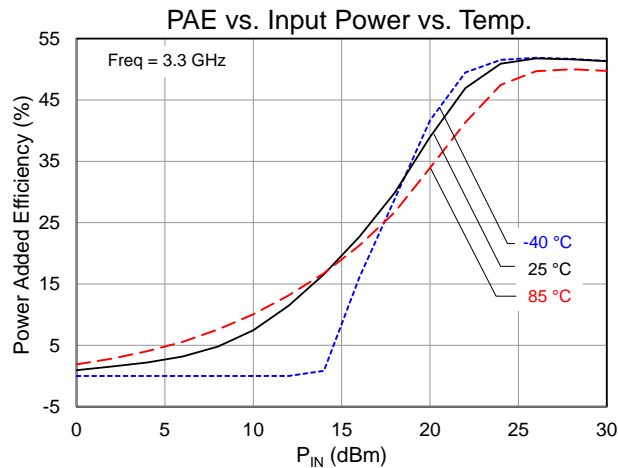
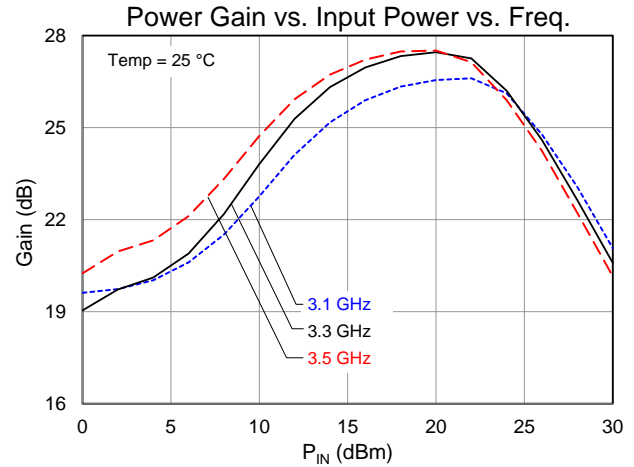
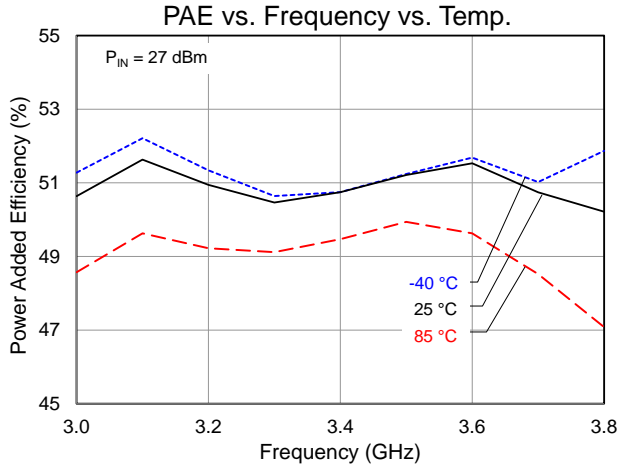
### Typical Performance – Large Signal

Conditions unless otherwise specified:  $V_D = 30\text{ V}$  ( $PW = 15\text{ ms}$ ,  $DC = 30\%$ ),  $I_{DQ} = 300\text{ mA}$ ,  $V_G = -3\text{ V}$  typical.



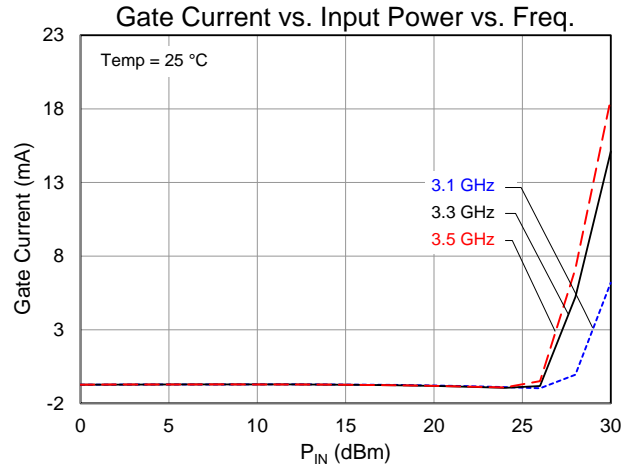
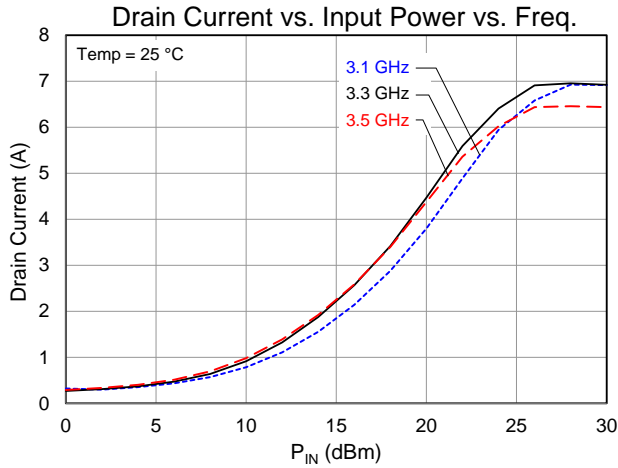
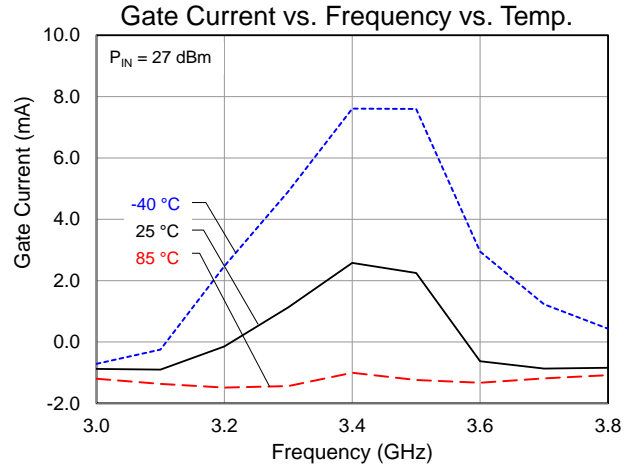
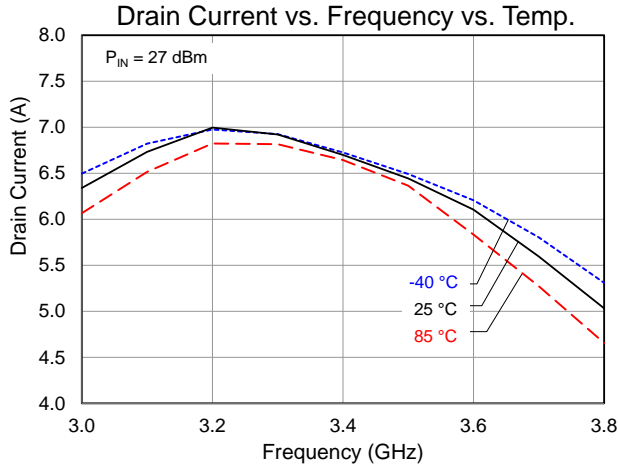
### Typical Performance – Large Signal

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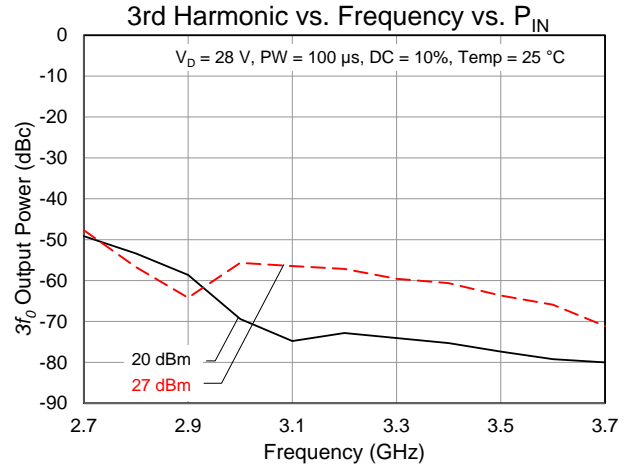
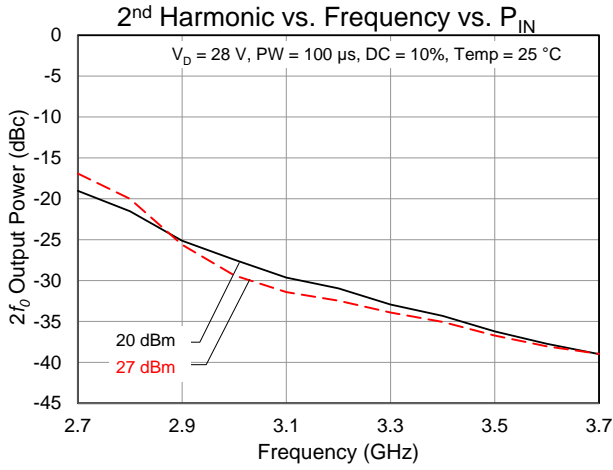
### Typical Performance – Large Signal

Conditions unless otherwise specified:  $V_D = 30\text{ V}$  (PW = 15 ms, DC = 30 %),  $I_{DQ} = 300\text{ mA}$ ,  $V_G = -3\text{ V}$  typical.



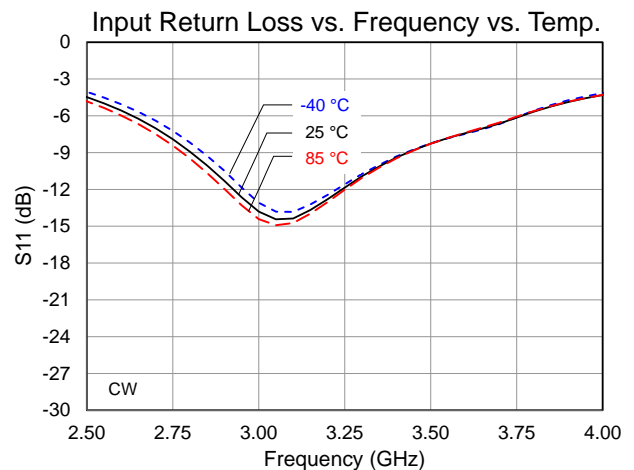
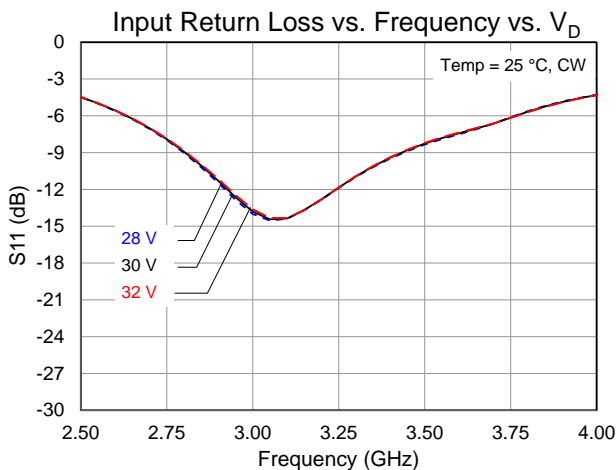
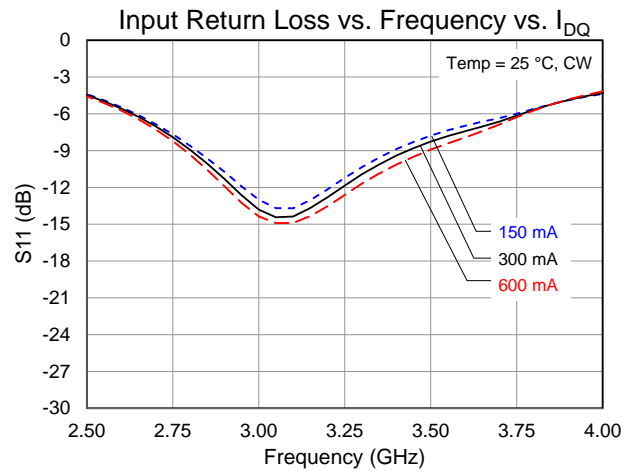
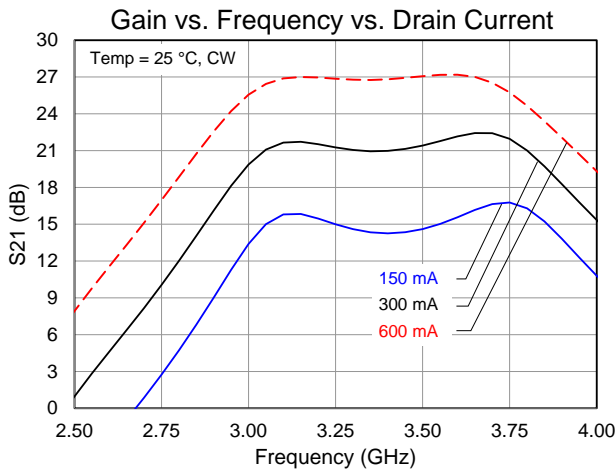
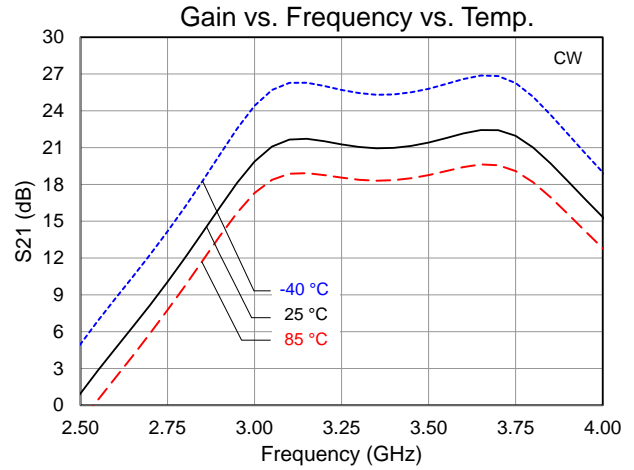
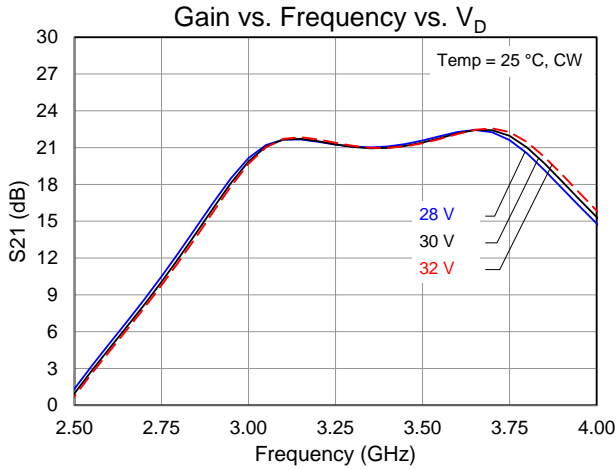
### Typical Performance – Harmonics

Conditions unless otherwise specified:  $V_D = 28\text{ V}$  (PW = 100  $\mu\text{s}$ , DC = 10%),  $I_{DQ} = 300\text{ mA}$ ,  $V_G = -3\text{ V}$  typical.



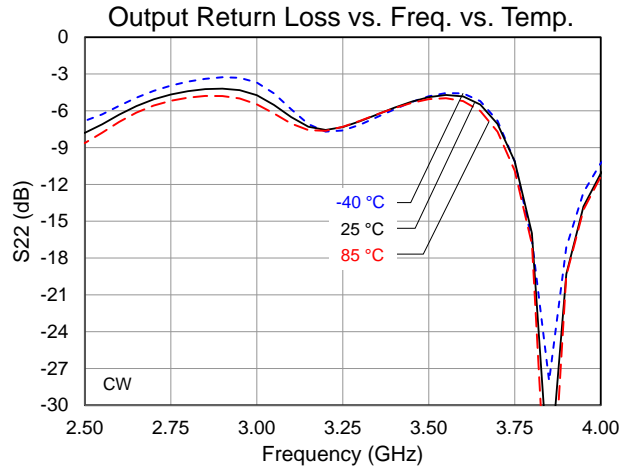
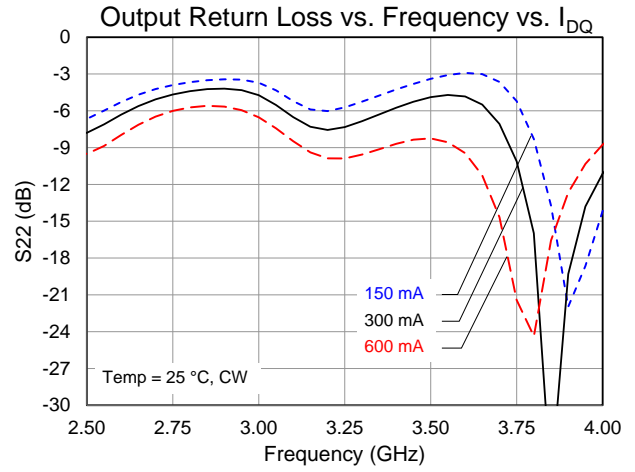
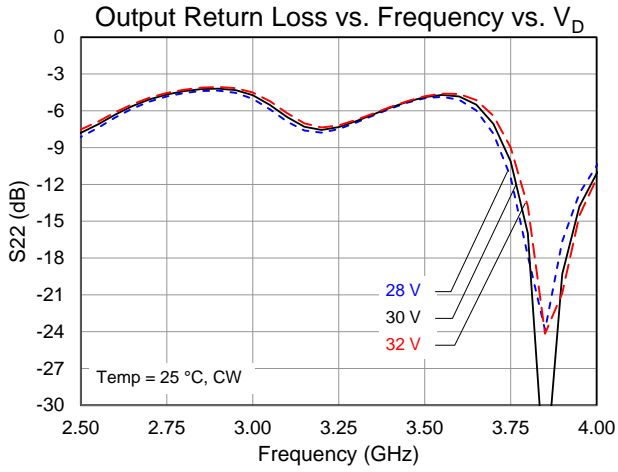
### Performance Plots – Small Signal (CW)

Conditions unless otherwise specified:  $V_D = 30\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ ,  $V_G = -3\text{ V}$  typical. CW



### Performance Plots – Small Signal (CW)

Conditions unless otherwise specified:  $V_D = 30\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ ,  $V_G = -3\text{ V}$  typical. CW





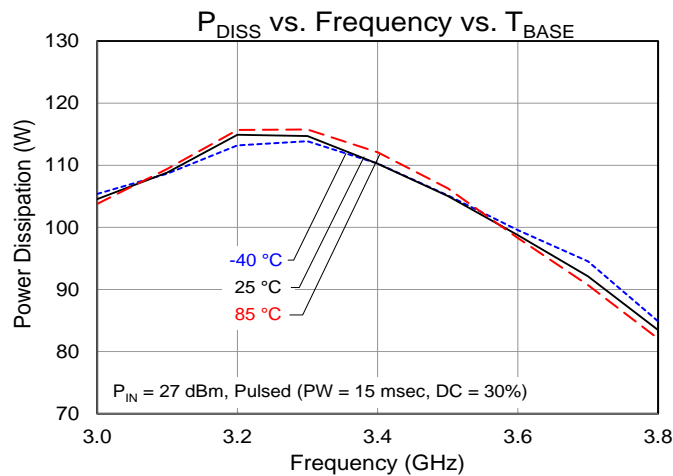
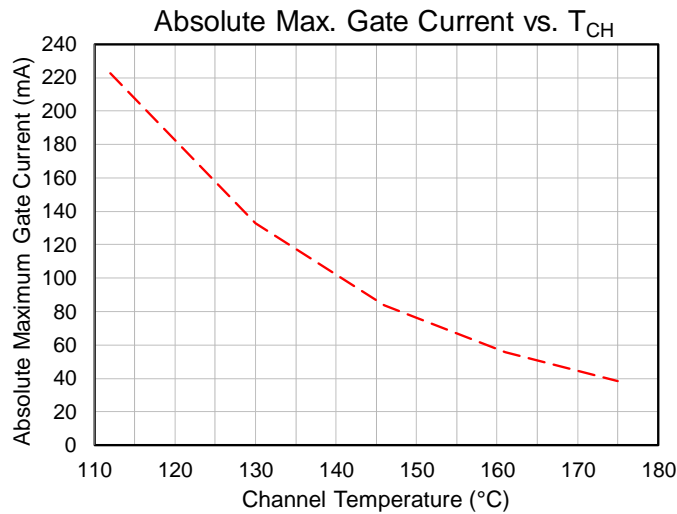
### Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$V_D = 30\text{ V}$ , $I_{DQ} = 300\text{ mA}$ , $PW = 15\text{ ms}$ , $DC = 30\%$	0.526	$^{\circ}\text{C/W}$
Channel Temperature, $T_{CH}$ (Under RF) <sup>(2)</sup>	$T_{base} = 85\text{ }^{\circ}\text{C}$ , $\text{Freq.} = 3.3\text{ GHz}$ , $I_{D\_Drive} = 7.6\text{ A}$ $P_{IN} = 27\text{ dBm}$ , $P_{OUT} = 50.5\text{ dBm}$ , $P_{DISS} = 116\text{ W}$	146	$^{\circ}\text{C}$

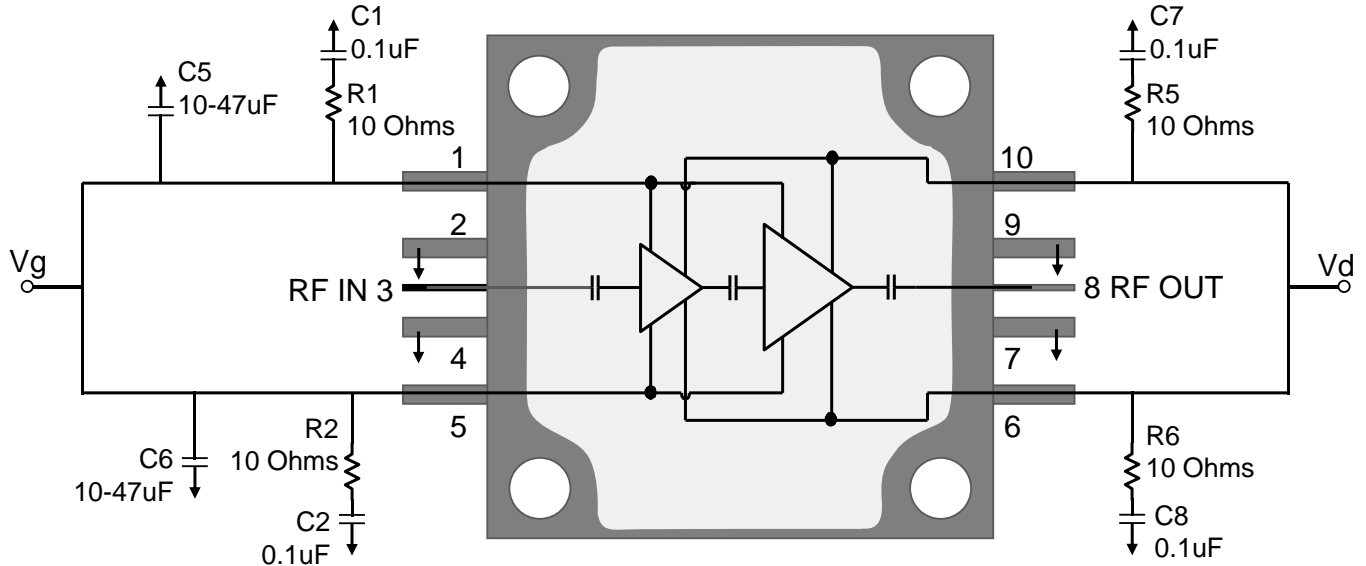
Notes:

1. Thermal resistance is referenced to the back of package ( $85\text{ }^{\circ}\text{C}$ )
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 10 A,  $I_G$  limit to 40 mA
2. Apply  $-5V$  to  $V_G$
3. Apply 30V to  $V_D$ ; ensure  $I_{DQ}$  is approx. 0 mA
4. Adjust  $V_G$  until  $I_{DQ} = 300$  mA ( $V_G \sim -3V$  Typ.).
5. Turn on RF supply

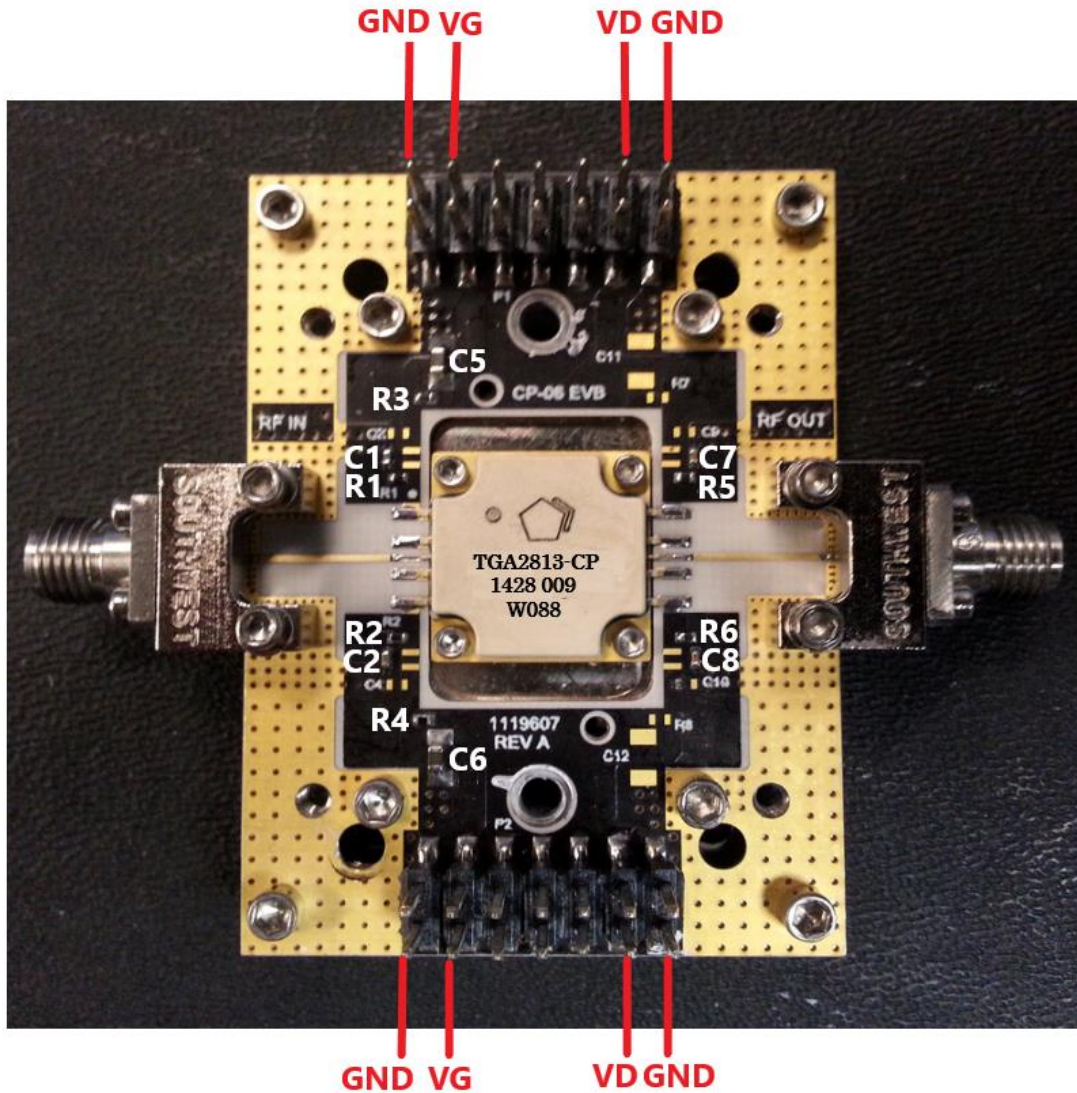
### Bias Down Procedure

1. Turn off RF supply
2. Reduce  $V_G$  to  $-5V$ ; 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 $\Omega$ ; 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 $\Omega$ ; 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.

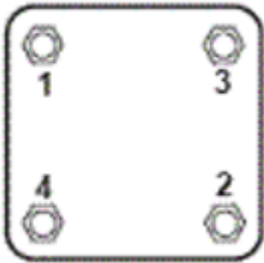
### Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C1, C2, C7, C8	0.1 $\mu$ F	Cap, 0402, 50 V, 10%, X7R	Various	–
C5, C6	10 - 47 $\mu$ F	Cap, 1206, 50 V, 20%, X5R (10V is OK)	Various	–
R1, R2, R5, R6	10 $\Omega$	Res, 0402, 50 V, 5%	Various	–
R3, R4	0 $\Omega$	Res, 0402, Jumper required for the above EVB design	Various	–

### Assembly Notes

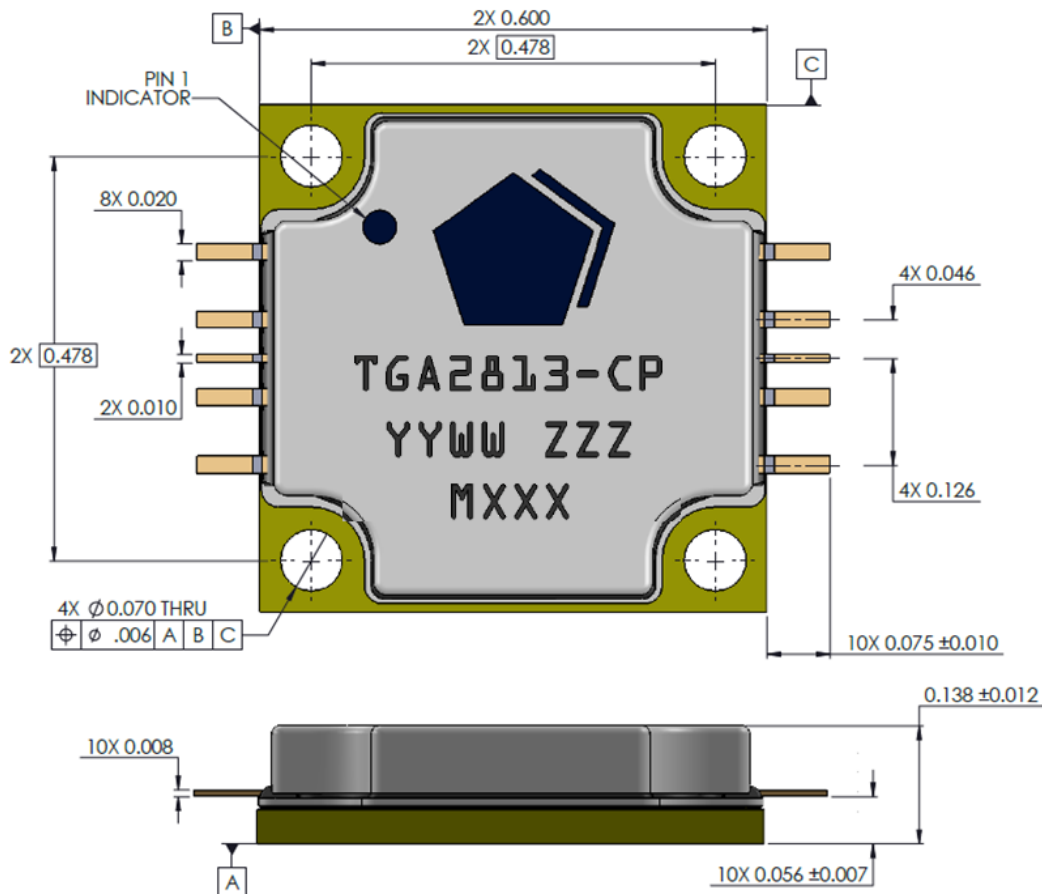
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1. Carefully clean the PC board and package leads with alcohol. Allow it to dry fully.
2. To improve the thermal and RF performance, Qorvo recommends attaching a heat sink to the bottom of the PCB and apply thermal compound (Arctic Silver 5 recommended) 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 TGA2813-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.

## Mechanical Information



Units: inches

Tolerances: (unless specified)

x.xx = ± 0.01

x.xxx = ± 0.005

Materials:

Base: Copper

Leads: Alloy 194

Lid: LCP (liquid crystal polymer)

All metalized features are gold plated

Part is epoxy sealed

Marking:

TGA2813-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 C3	JEDEC Standard JESD22-C101
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 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:

- Product uses RoHS Exemption 7c-I to meet RoHS compliance requirements
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free

## Contact Information

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

**Web:** [www.qorvo.com](http://www.qorvo.com)

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

**Email:** [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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