



# TGA2590-CP

## 6 – 12 GHz 30 W GaN Power Amplifier

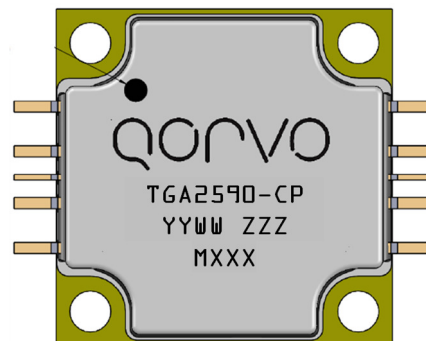
### Product Description

Qorvo's TGA2590-CP is a wideband MMIC power amplifier fabricated on Qorvo's QGaN25 0.25um GaN on SiC process. The TGA2590-CP operates from 6-12GHz and provides 30W of saturated output power with >22dB of large signal gain and >30% power-added efficiency.

The TGA2590-CP is offered in a 10-lead 15 x 15 mm bolt-down package. The package has a pure Cu base, offering superior thermal management.

The TGA2590-CP is fully matched to 50  $\Omega$  with DC blocking caps at both RF ports allowing for simple system integration. The broadband performance supports both electronic warfare and radar opportunities across defense and commercial markets.

Lead-free and RoHS compliant.

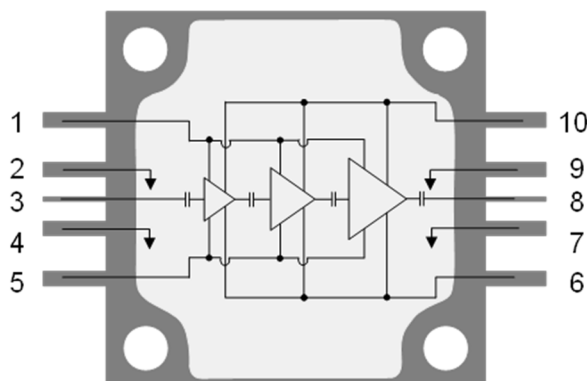


### Product Features

- Frequency Range: 6 – 12 GHz
- $P_{OUT}$ : 45 dBm @  $P_{IN} = 23$  dBm
- PAE: >30% @  $P_{IN} = 23$  dBm
- Small Signal Gain: 35 dB
- Bias:  $V_D = +20$  V (CW),  $I_{DQ} = 2$  A,  $V_G = -2.4$  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
- Commercial and Military Radar

### Ordering Information

Part No.	Description
TGA2590-CP	6 – 12 GHz 30 W GaN Power Amplifier
1098063	TGA2590-CP Evaluation Board



# TGA2590-CP

## 6 – 12 GHz 30 W GaN Power Amplifier

### Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage ( $V_D$ )	40 V
Gate Voltage Range ( $V_G$ )	-8 to 0 V
Drain Current ( $I_D$ )	8 A
Gate Current ( $I_G$ )	See plot page 6
Power Dissipation ( $P_{DISS}$ ), 85°C	135 W
Input Power ( $P_{IN}$ ), 50Ω, 85°C, CW	30 dBm
Input Power ( $P_{IN}$ ), 85°C, VSWR 6:1, $V_D = 20V$ , CW	27 dBm
Mounting Temperature	Refer to Assembly Notes, page 9
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 ( $V_D$ )	+20		+25	V
Drain Current, ( $I_{DQ}$ )		2		A
Gate Voltage Range ( $V_G$ )	-2 to -3			V
Input Power ( $P_{IN}$ )	+17		+25	dBm
$T_{BASE}$ Range	-40		+85	°C

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

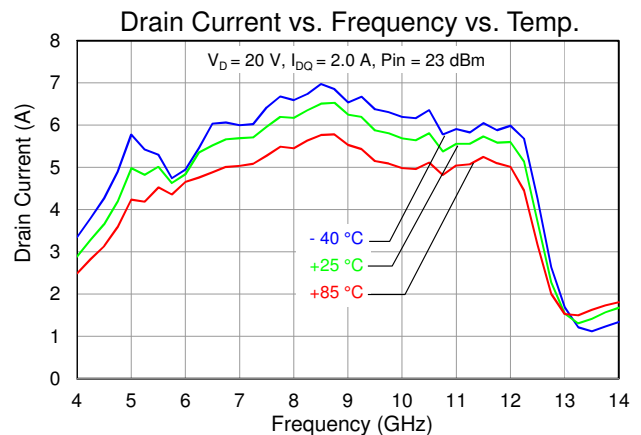
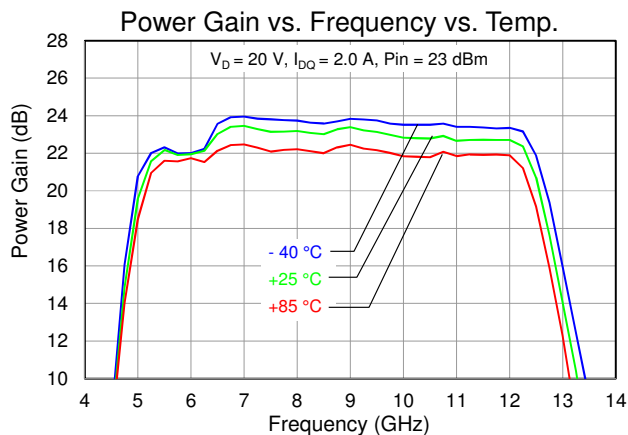
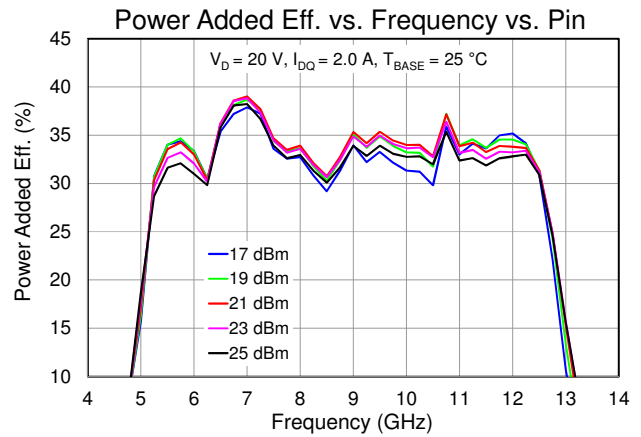
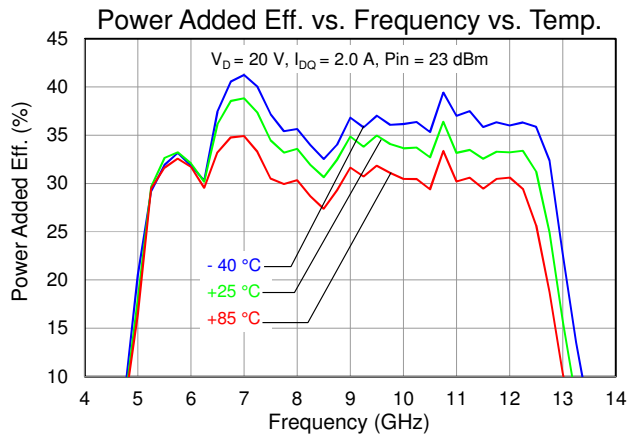
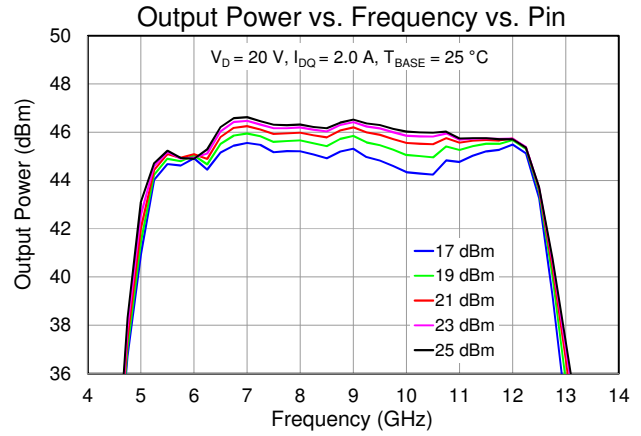
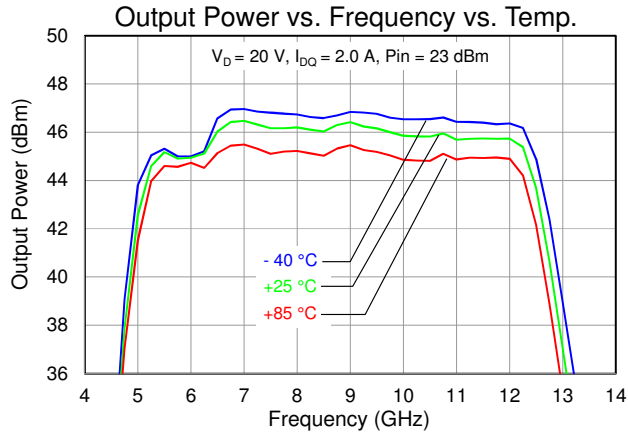
### Electrical Specifications

Parameter	Min	Typ	Max	Units
Operational Frequency Range	6		12	GHz
Small Signal Gain	-	35	-	dB
Input Return Loss	-	5	-	dB
Output Return Loss	-	5	-	dB
Output Power (@ $P_{IN} = 23$ dBm)	-	46	-	dBm
Power Added Efficiency (@ $P_{IN} = 23$ dBm)	-	>30	-	%
Drain Voltage ( $V_D$ )	20	-	25	V
Load VSWR	-	-	2.0:1	
Input Power ( $P_{IN}$ )	17	-	25	dBm
Small Signal Gain Temperature Coefficient		-0.07		dB/°C
Output Power Temperature Coefficient		-0.015		dBm/°C

Test conditions unless otherwise noted: 25 °C,  $V_D = +20$  V,  $I_{DQ} = 2$  A,  $V_G = -2.4$  V typical, CW.

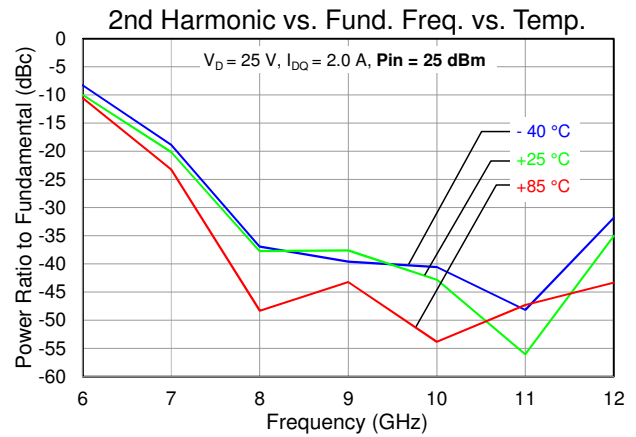
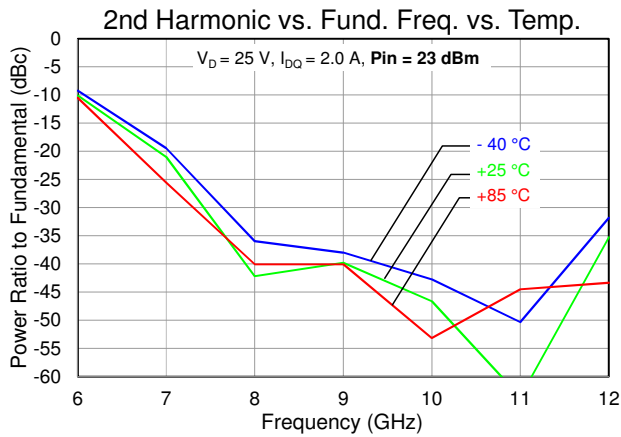
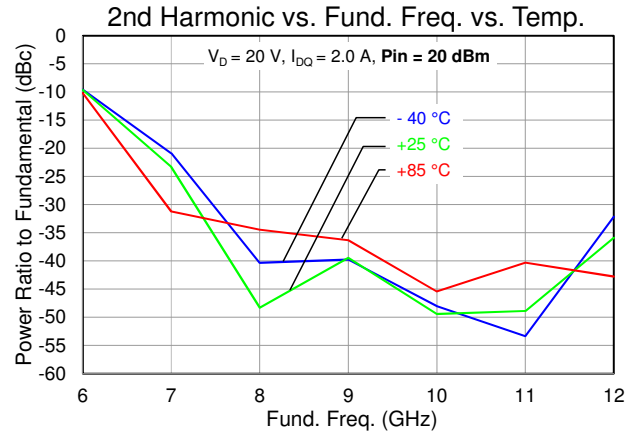
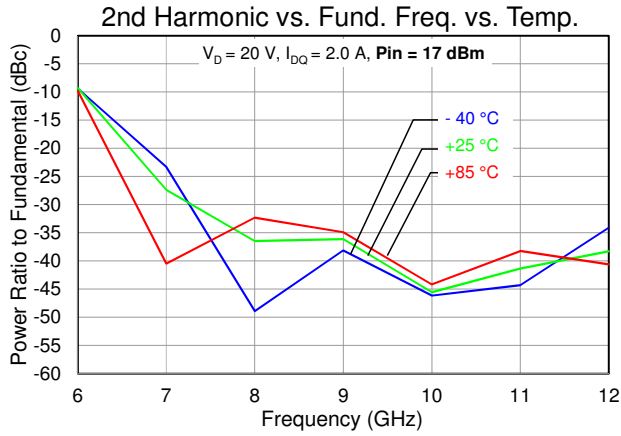
### Typical Performance – Large Signal

Conditions unless otherwise specified:  $V_D = 20\text{ V}$ ,  $I_{DQ} = 2.0\text{ A}$ ,  $V_G = -2.4\text{ V}$  Typical, CW.



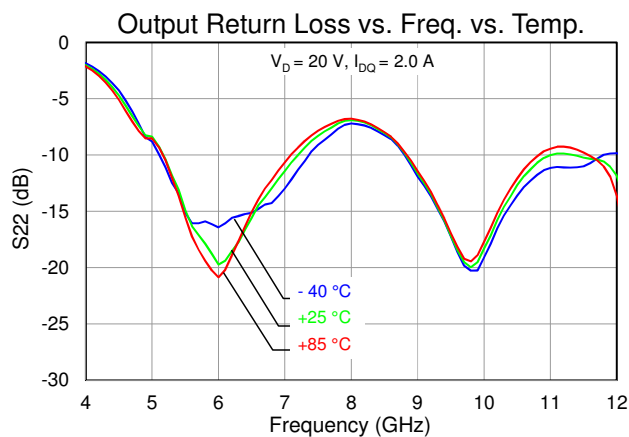
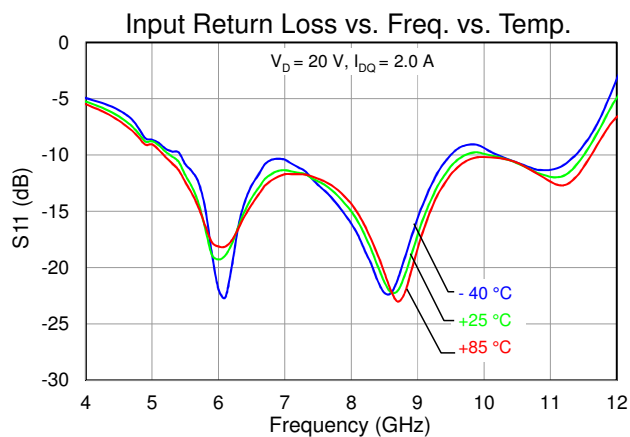
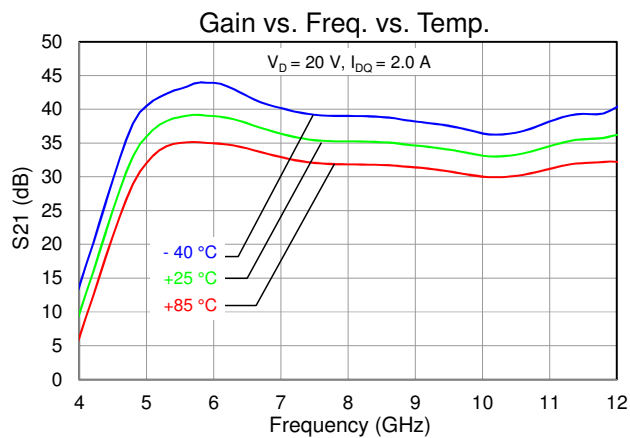
### Typical Performance – Large Signal (Harmonics)

Conditions unless otherwise specified:  $V_D = 20$  V,  $I_{DQ} = 2$  A,  $V_G = -2.4$  V Typical, CW.



### Performance Plots – Small Signal (CW)

Conditions unless otherwise specified:  $V_D = 20$  V,  $I_{DQ} = 2$  A,  $V_G = -2.4$  V Typical, CW.



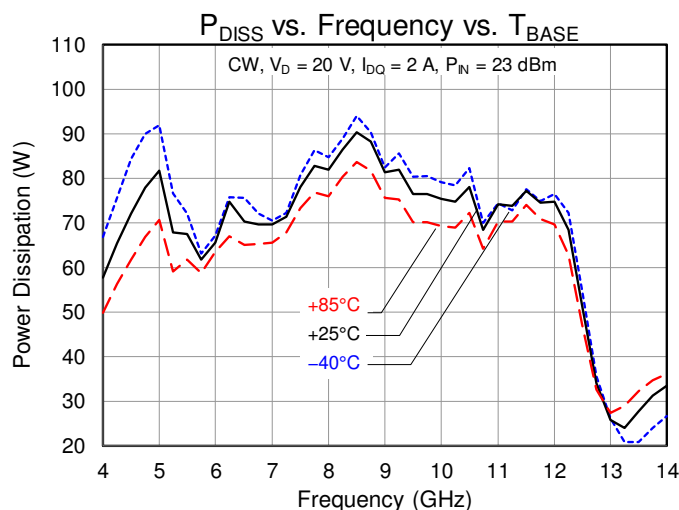
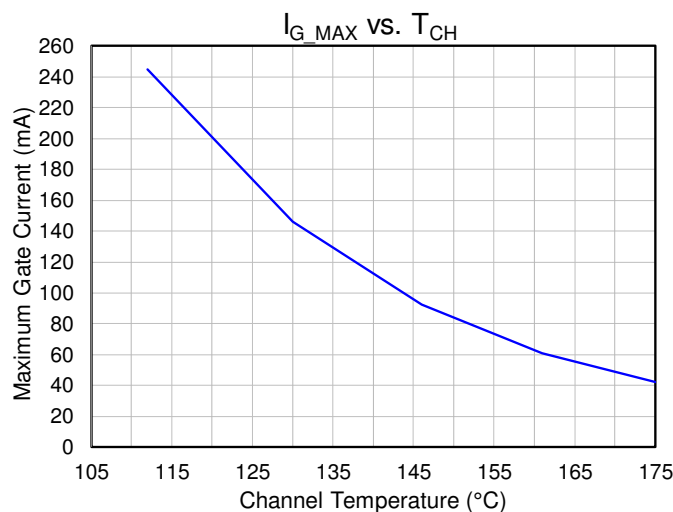
### Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$V_D = 20\text{ V}$ , $I_{DQ} = 2\text{ A}$ , Freq. = 8.5 GHz	0.81	$^{\circ}\text{C/W}$
Channel Temperature, $T_{CH}$ (Under RF) <sup>(2)</sup>	$T_{base} = 85\text{ }^{\circ}\text{C}$ , $V_D = 20\text{ V}$ , $I_{D\_Drive} = 5.8\text{ A}$ , $P_{IN} = 23\text{ dBm}$ , $P_{OUT} = 45\text{ dBm}$ , $P_{DISS} = 83.8\text{ W}$	153	$^{\circ}\text{C}$

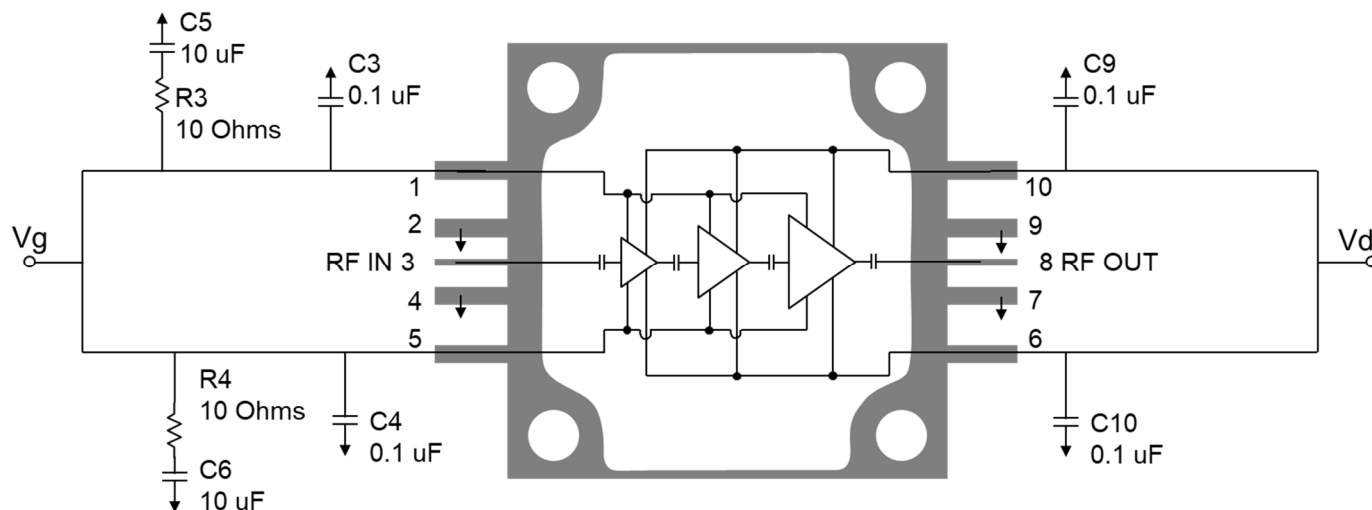
Notes:

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 8 A,  $I_G$  limit to 200 mA
2. Apply  $-5$  V to  $V_G$
3. Apply 20 V to  $V_D$ ; ensure  $I_{DQ}$  is approx. 0 mA
4. Adjust  $V_G$  until  $I_{DQ} = 2$  A ( $V_G \sim -2.4$  V Typ.).
5. Turn on RF supply

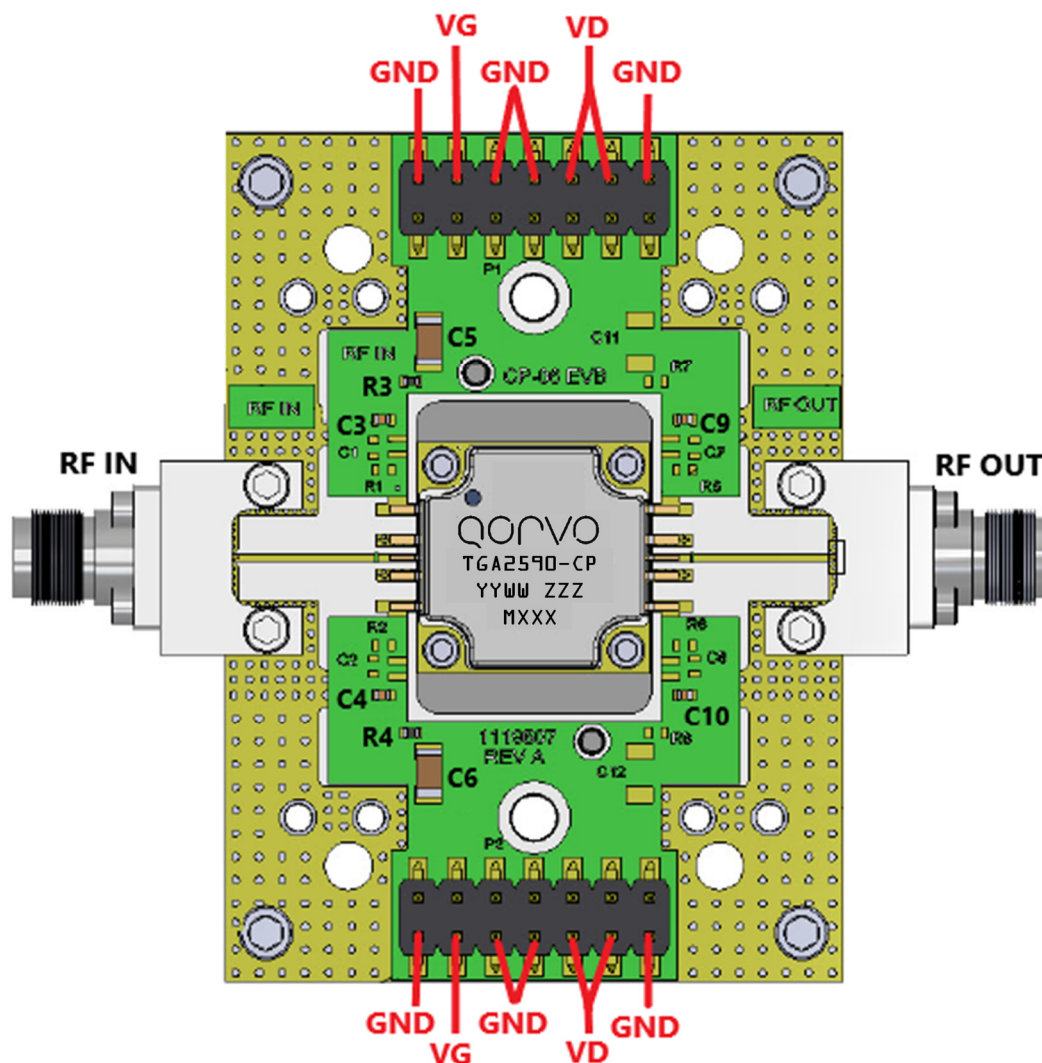
## Bias Down Procedure

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 $\Omega$ ; 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.

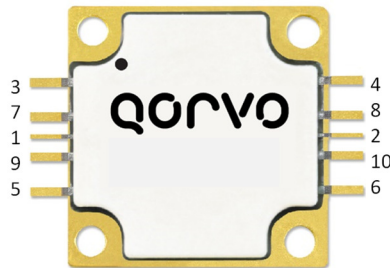
## Bill of Materials

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

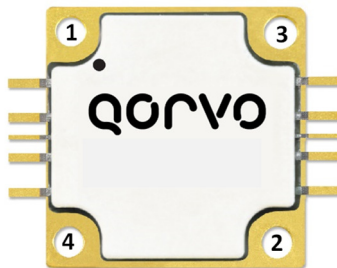


### Assembly Notes

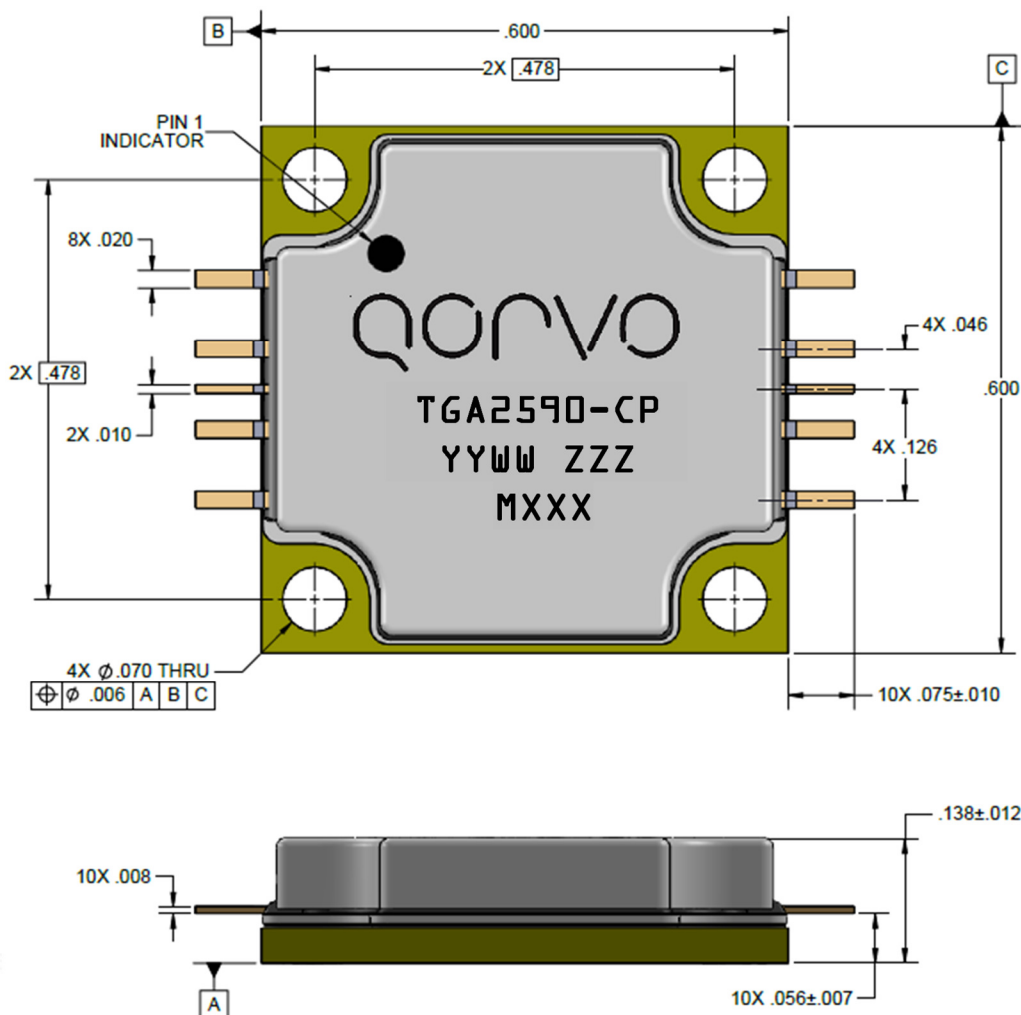
1. Carefully clean the PC board, base plate, and package leads with alcohol. Allow it to dry fully.
2. To improve the thermal and RF performance, Qorvo recommends attaching a heat sink to the bottom of the package and apply either a thermal compound (Arctic Silver 5 recommended) or a .004 inch (maximum 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:

Lid: Plastic

Leads: Alloy 194

Base: Copper

Finish: All metalized features are gold plated; part is epoxy sealed

Marking:

TGA2590-CP: Part number

YY: Part assembly year

WW: Part assembly week

ZZZ: Serial number

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-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<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:

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Tel: 1-844-890-8163

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

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