

## Applications

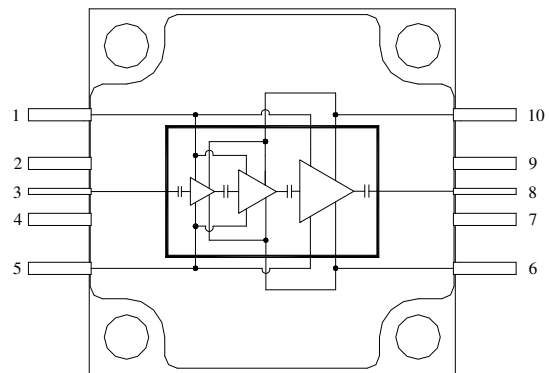
- Electronic Warfare
- Commercial and Military Radar



## Product Features

- Frequency Range: 6 - 12 GHz
- P<sub>OUT</sub>: > 45 dBm (P<sub>IN</sub> = 23 dBm)
- PAE: > 30 % (P<sub>IN</sub> = 23 dBm)
- Small Signal Gain: 35 dB
- Bias: V<sub>D</sub> = 20 V (CW), I<sub>DQ</sub> = 2 A, V<sub>G</sub> = -2.4 V typ.
- Package Dimensions: 15.24 x 15.24 x 3.5 mm

## Functional Block Diagram



## General Description

Qorvo's TGA2590-CP is a wideband MMIC power amplifier fabricated on Qorvo's production 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 Cu-base package that can either be bolted down or eutectically attached for superior thermal management.

The TGA2590-CP is fully matched to 50 Ω 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.

Evaluation boards are available upon request.

## Pin Configuration

Pad No.	Symbol
1, 5	V <sub>G</sub>
2, 4, 7, 9	Gnd
3	RF <sub>IN</sub>
6, 10	V <sub>D</sub>
8	RF <sub>OUT</sub>

## Ordering Information

Part	ECCN	Description
TGA2590-CP	3A001.b.2.b	6-12GHz 30W PA

### Absolute Maximum Ratings

Parameter	Value
Drain Voltage ( $V_D$ )	40 V
Gate Voltage Range ( $V_G$ )	-8 to 0 V
Drain Current ( $I_D$ )	8 A
Gate Current ( $I_G$ )	-20 to 200 mA
Power Dissipation ( $P_{DISS}$ ), 85 °C	135 W
Input Power ( $P_{IN}$ ), CW, 50 $\Omega$ , 85 °C	30 dBm
Input Power ( $P_{IN}$ ), CW, VSWR 6:1, $V_D = 20$ V, 85 °C	27 dBm
Channel Temperature ( $T_{CH}$ )	275 °C
Mounting 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	Value
Drain Voltage ( $V_D$ )	20 - 25 V
Drain Current ( $I_{DQ}$ )	2 A
Drain Current @ Pin = 23 dBm ( $I_{D\_DRIVE}$ )	See plots p. 4
Gate Voltage ( $V_G$ )	-2.4 V (Typ.)
Gate Current @ Pin = 23 dBm ( $I_{G\_DRIVE}$ )	120 mA
Input Power ( $P_{IN}$ )	+17 to +25 dBm

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

### Electrical Specifications

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

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

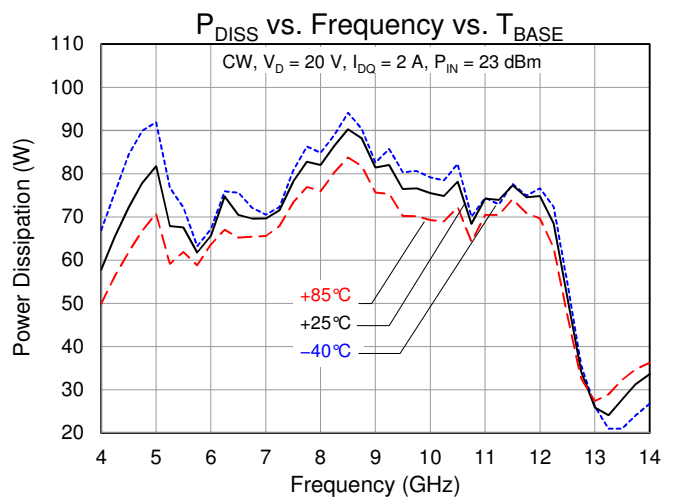
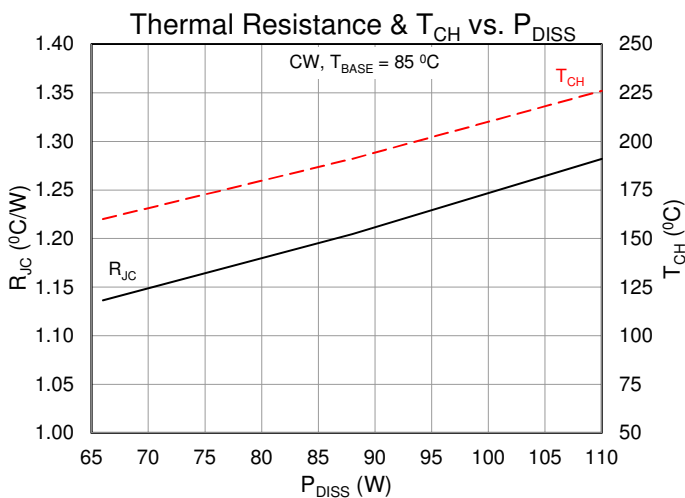
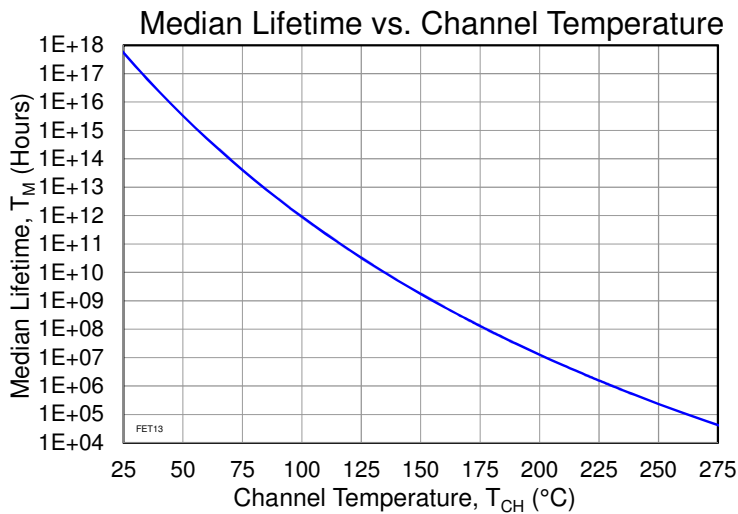
**Thermal and Reliability Information**

Parameter	Test Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	$T_{BASE} = 85^{\circ}C$ , $V_D = 20$ V CW Freq = 9 GHz, $P_{IN} = 23$ dBm: $I_{DQ} = 2$ A, $I_{D\_Drive} = 5.55$ A $P_{OUT} = 45.5$ dBm $P_{DISS} = 75.5$ W	1.17	$^{\circ}C/W$
Channel Temperature ( $T_{CH}$ ) (Under RF drive)		173	$^{\circ}C$
Median Lifetime ( $T_M$ )		1.58E+8	Hrs

Notes:

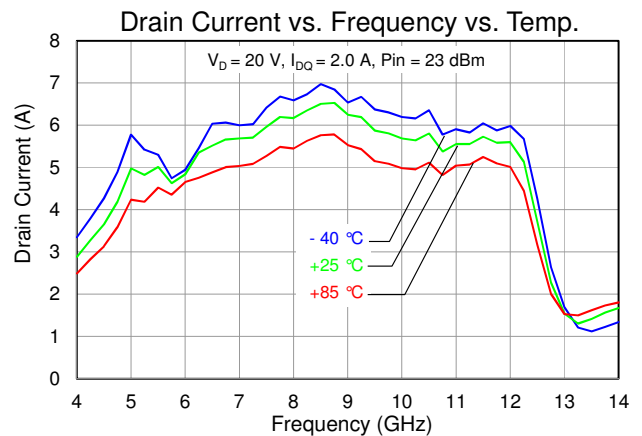
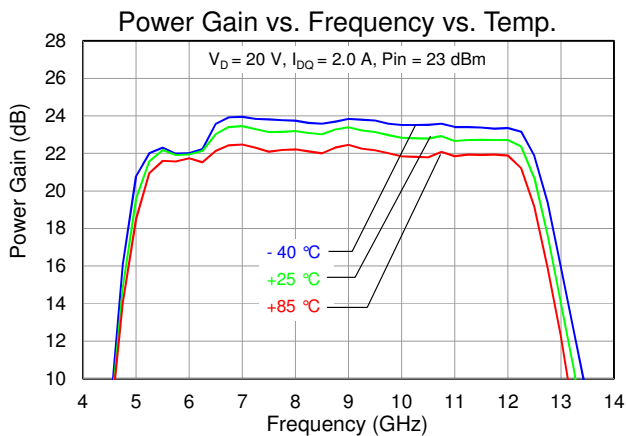
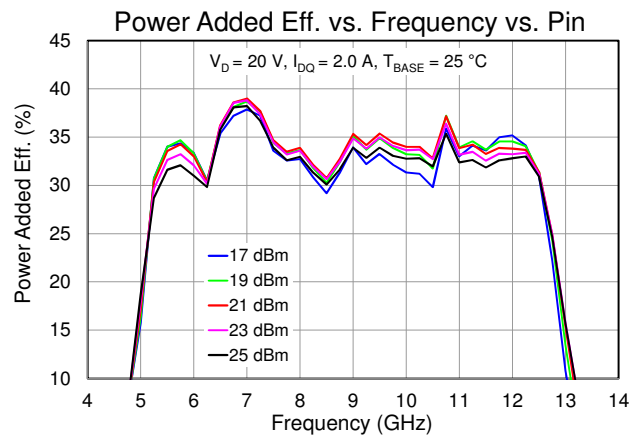
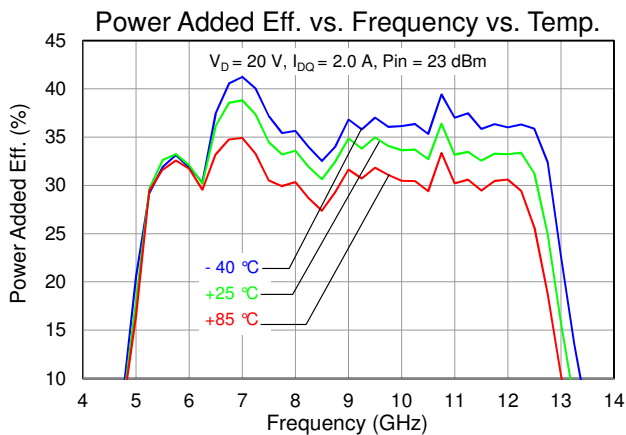
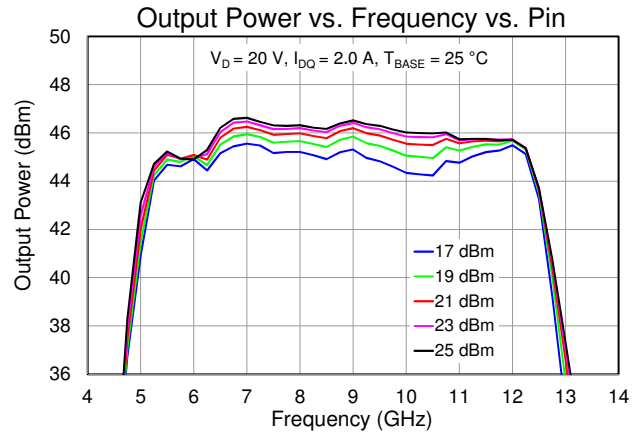
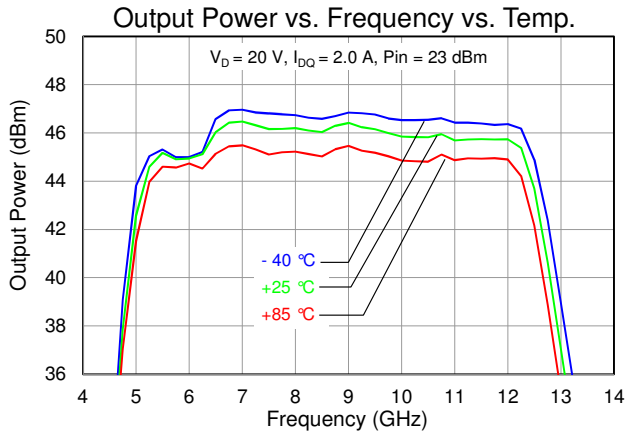
1. Thermal resistance measured to back of package.

Test Conditions:  $V_D = 40$  V; Failure Criteria = 10% reduction in  $I_{D\_MAX}$



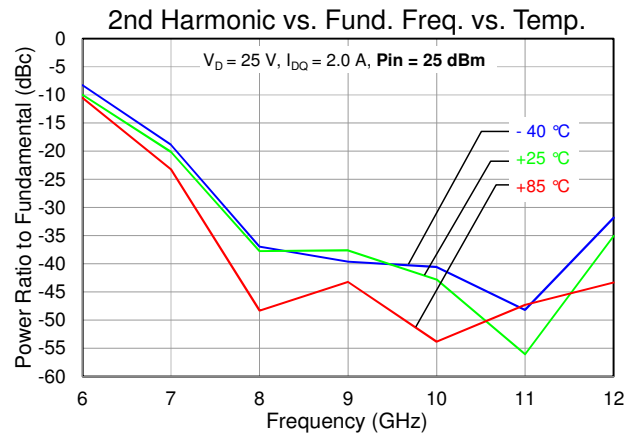
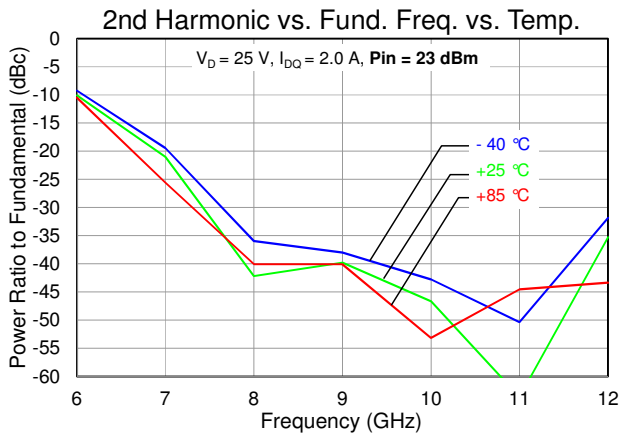
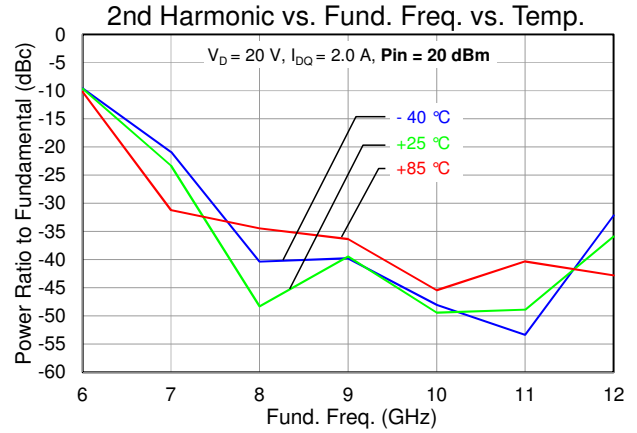
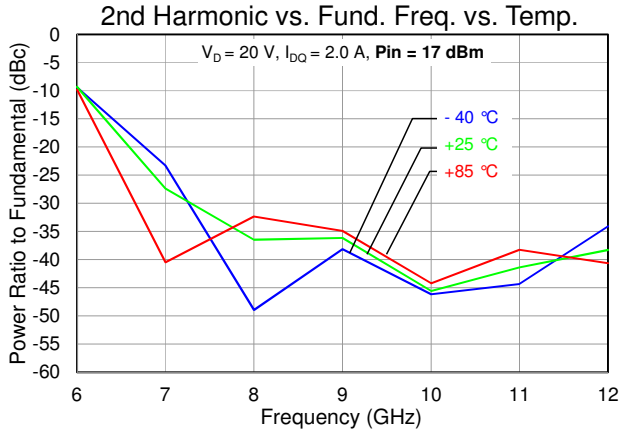
**Typical Performance: Large Signal**

Condition: CW

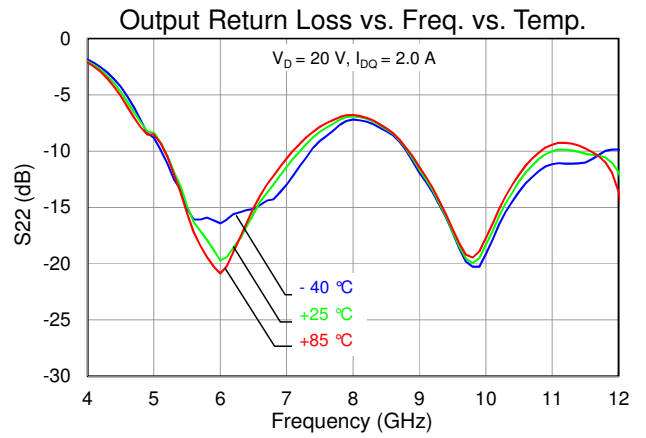
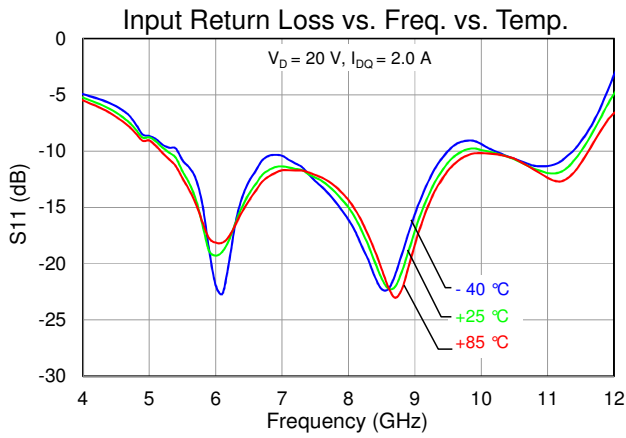
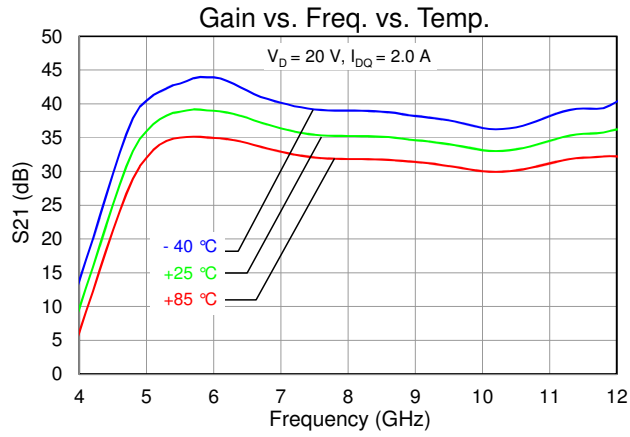


**Typical Performance: Small Signal**

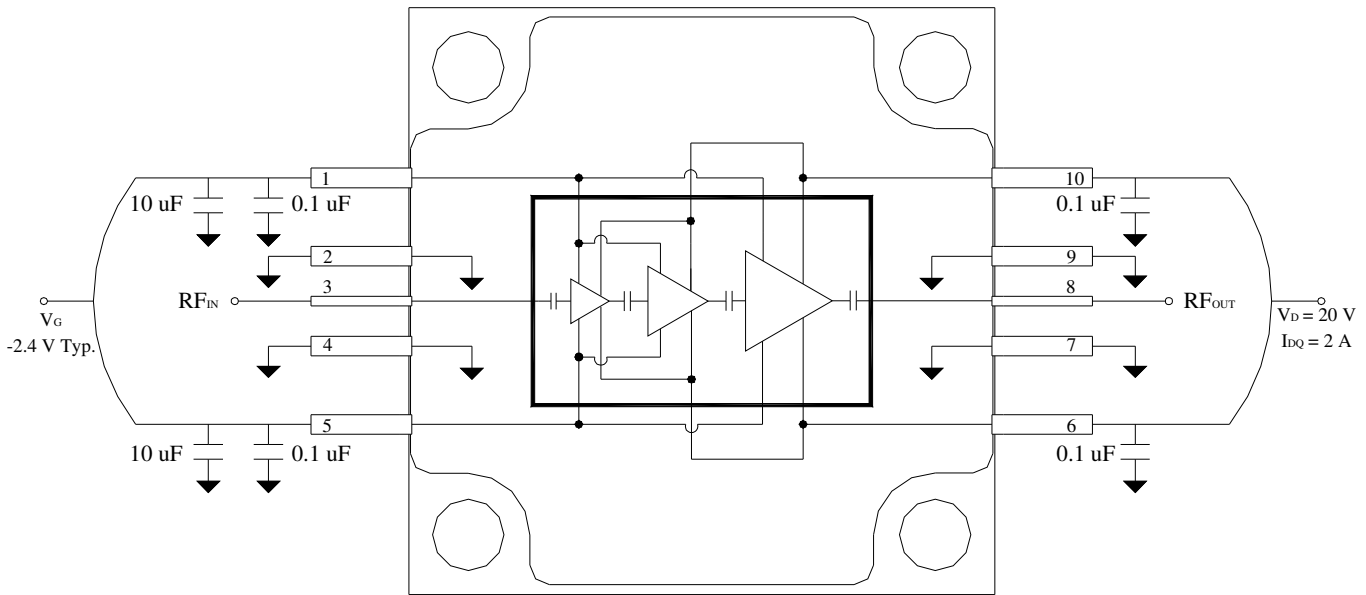
Condition: CW



Condition: CW



**Applications Information**



Note: V<sub>G</sub> and V<sub>D</sub> must be biased from both sides of the EVB.

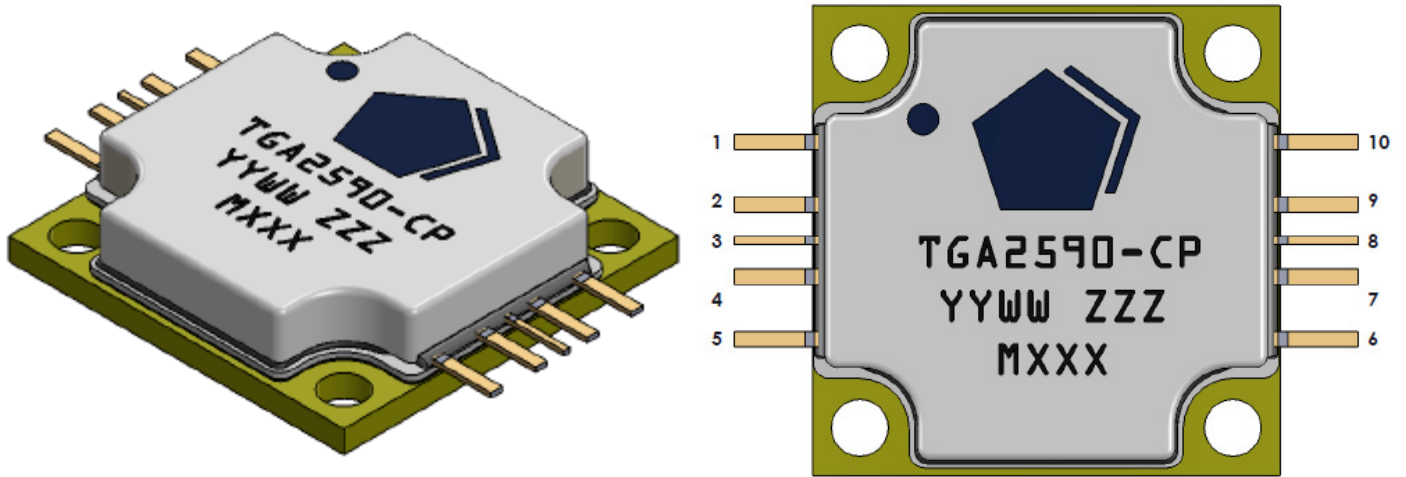
**Bias-up Procedure**

1. Set I<sub>D</sub> limit to 8 A, I<sub>G</sub> limit to 200 mA
2. Apply -5 V to V<sub>G</sub>
3. Apply +20 V to V<sub>D</sub>; ensure I<sub>DQ</sub> is approx. 0 mA
4. Adjust V<sub>G</sub> until I<sub>DQ</sub> = 2 A (V<sub>G</sub> ~ -2.4 V Typ.).
5. Turn on RF supply

**Bias-down Procedure**

1. Turn off RF supply
2. Reduce V<sub>G</sub> to -5 V; ensure I<sub>DQ</sub> is approx. 0 mA
3. Set V<sub>D</sub> to 0 V
4. Turn off V<sub>D</sub> supply
5. Turn off V<sub>G</sub> supply

**Pin Layout**

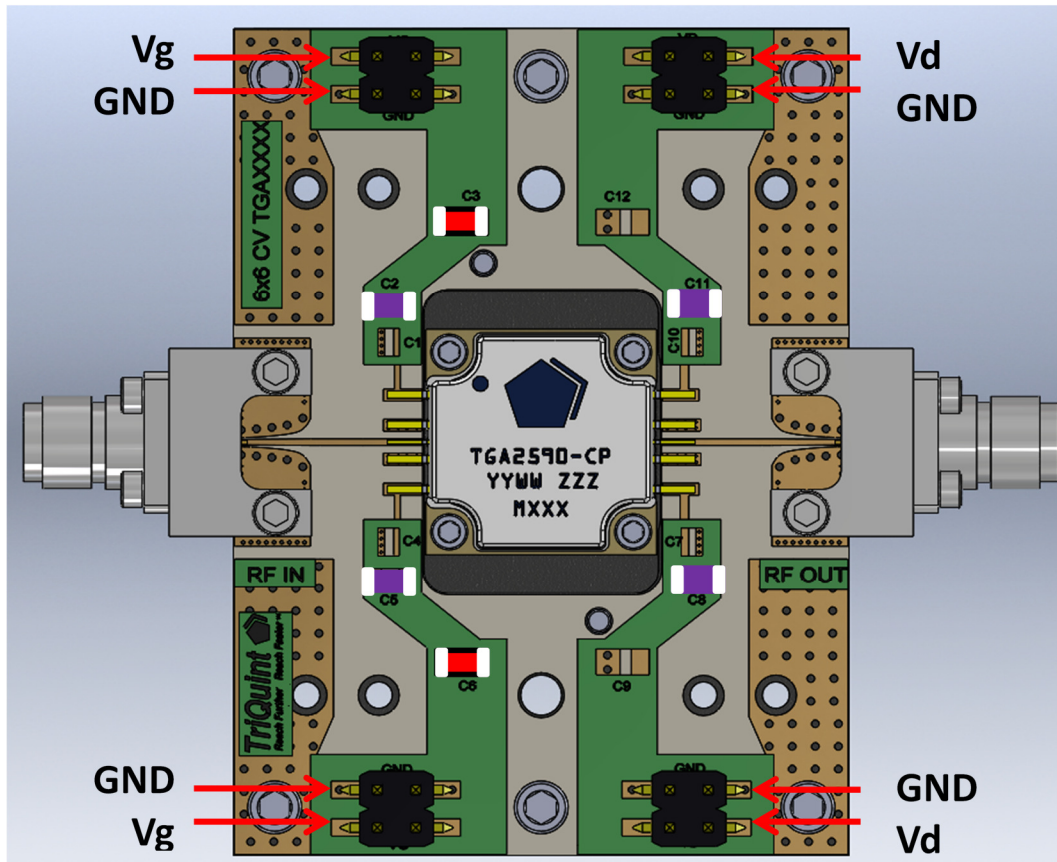


**Pin Description**

Pin No.	Symbol	Description
1, 5	Gate	Gate; bias network is required; see recommended Application Information on page 8
2, 4, 7, 9	Gnd	Ground; connected to ground paddle; must be grounded on PCB
3	RF In	Input; matched to 50 Ω; DC blocked
6, 10	Drain	Drain; bias network is required; see recommended Application Information on page 8
8	RF Out	Input; matched to 50 Ω; DC blocked



**Evaluation Board**



Note: VG and VD must be biased from both sides of the EVB.

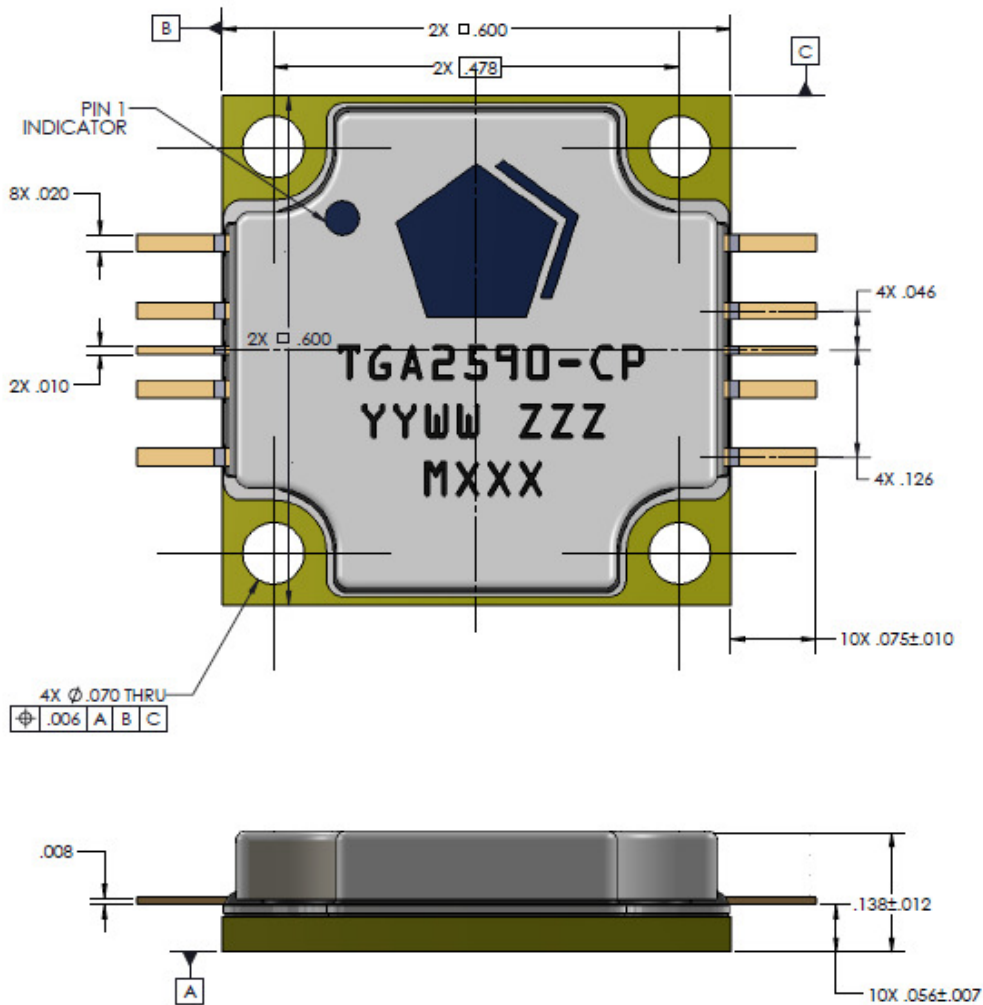
**Bill of Material**

Reference Des.	Value	Description	Manuf.	Part Number
C2, C5, C8, C11	0.1 $\mu$ F	Cap, 0603, 50 V, 10%, X7R	Various	
C3, C4	10 $\mu$ F	Cap, 1206, 50 V, 20%, X5R	Various	

**Assembly Notes**

1. Clean the board or module with alcohol; allow it to dry fully
2. Attach PCB to carrier using film epoxy (i.e Ablefilm 5028E)
3. Nylock screws are recommended for mounting the TGA2590-CP to the carrier.
4. To improve the thermal and RF performance, we recommend the following:
  - a. Apply thermal compound or 4 mils indium shim between the package and the carrier
  - b. Attach a heat sink to the bottom of the board and apply thermal compound or 4 mils indium shim between the heat sink and the board
5. Apply solder to each pin of the TGA2590-CP to PCB
6. Clean the assembly with alcohol

**Product Compliance Information**



Units: inches

Tolerances: unless specified

x.xx = ± 0.01

x.xxx = ± 0.005

Materials:

Lid: Liquid Crystal Polymer (LCP)

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