RFMD + TriQuint = Qorvo

TGA2590-CP

6 to 12GHz, 30W GaN Power Amplifier

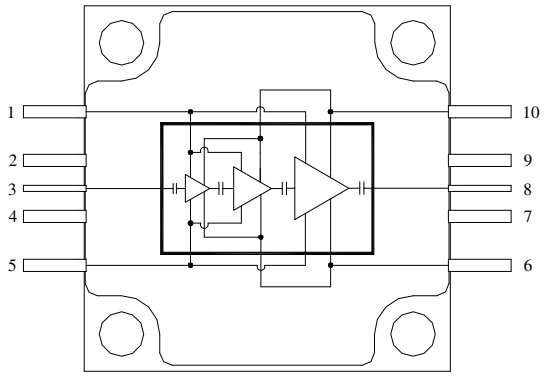
Applications

- Electronic Warfare
- Commercial and Military Radar

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 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_G
2, 4, 7, 9	Gnd
3	RF_{IN}
6, 10	V_D
8	RF_{OUT}

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 Ω, 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.,

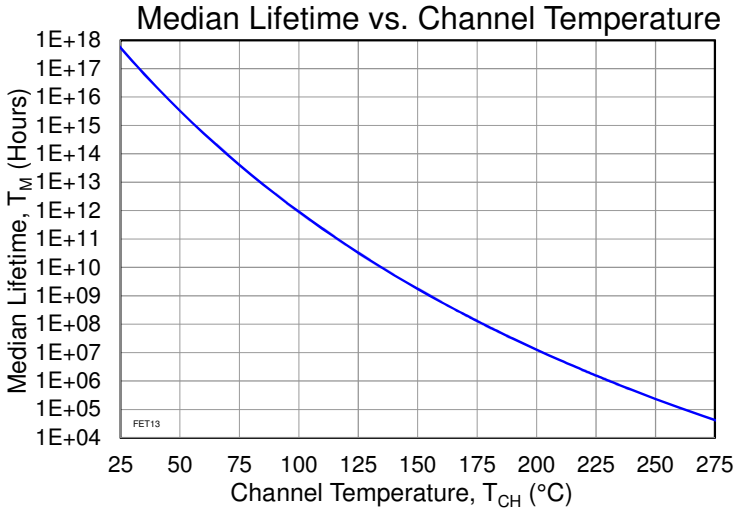
Parameter	Min	Typical	Max	Units
Operational Frequency Range	6		12	GHz
Drain Voltage (V_D)	20		25	V
Load VSWR			2.0:1	
Input Power (P_{IN})	17		25	dBm
Output Power (P_{IN} = 23 dBm)		46		dBm
Power-Added Efficiency (P_{IN} = 23 dBm)		> 30		%
Small Signal Gain		35		dB
Input Return Loss		5		dB
Output Return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

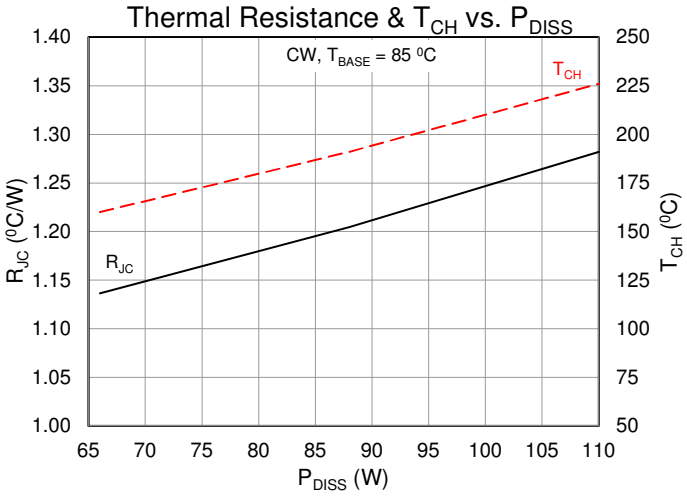
Thermal and Reliability Information

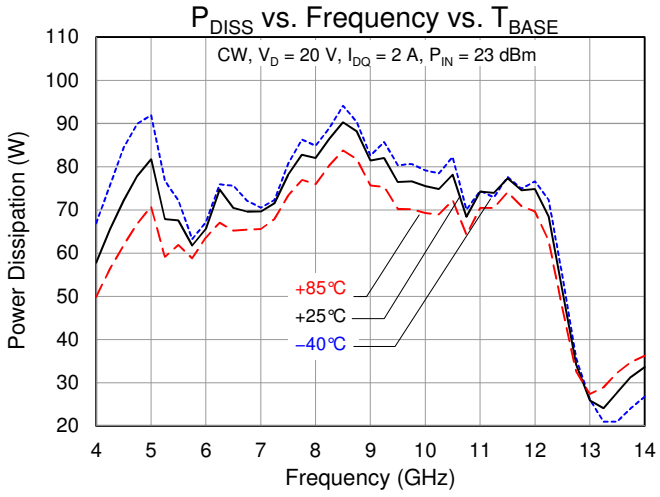
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85°C, V_D = 20 V CW Freq = 9 GHz, P_{IN} = 23 dBm: I_{DQ} = 2 A, I_{D_Drive} = 5.55 A P_{OUT} = 45.5 dBm P_{DISS} = 75.5 W	1.17	°C/W
Channel Temperature (T_{CH}) (Under RF drive)		173	°C
Median Lifetime (T_M)		1.58E+8	Hrs

Notes:
1. Thermal resistance measured to back of package.

Test Conditions: V_D = 40 V; Failure Criteria = 10% reduction in I_{D_MAX}



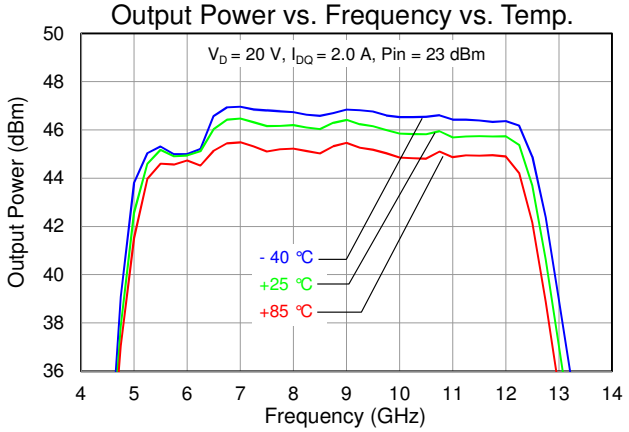




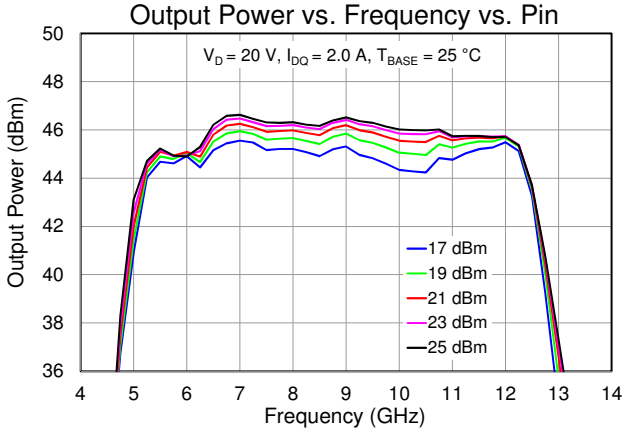
Typical Performance: Large Signal

Condition: CW

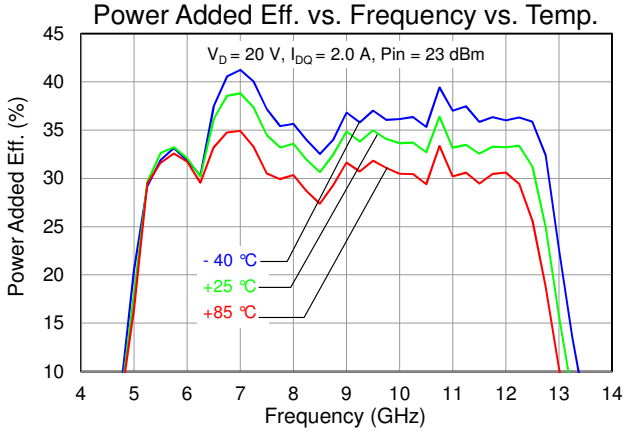
Output Power vs. Frequency vs. Temp.



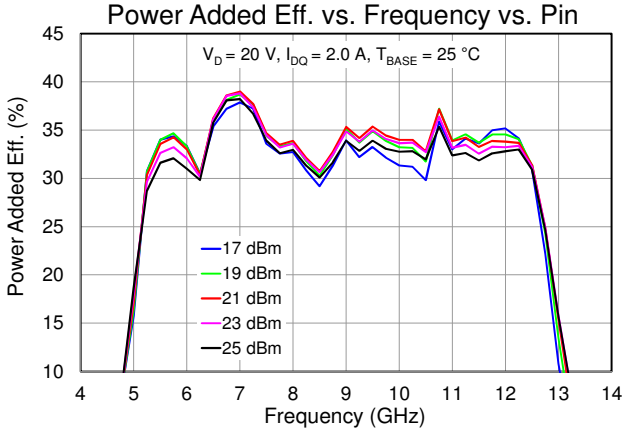
Output Power vs. Frequency vs. Pin



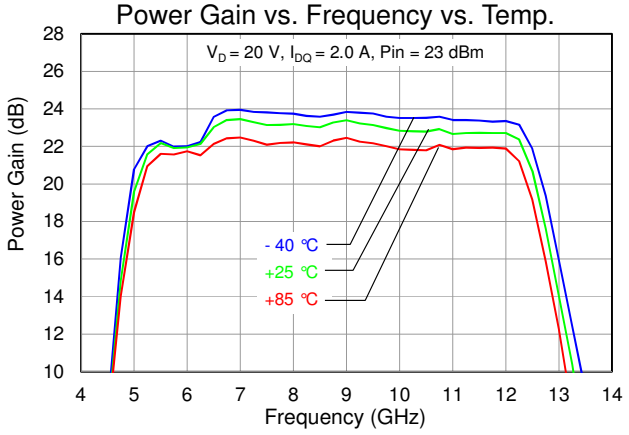
Power Added Eff. vs. Frequency vs. Temp.



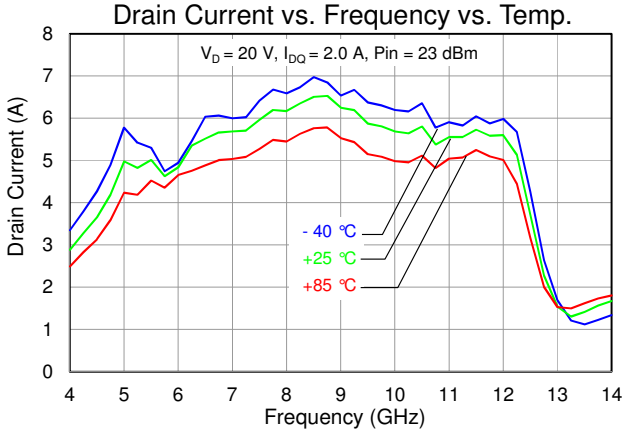
Power Added Eff. vs. Frequency vs. Pin



Power Gain vs. Frequency vs. Temp.

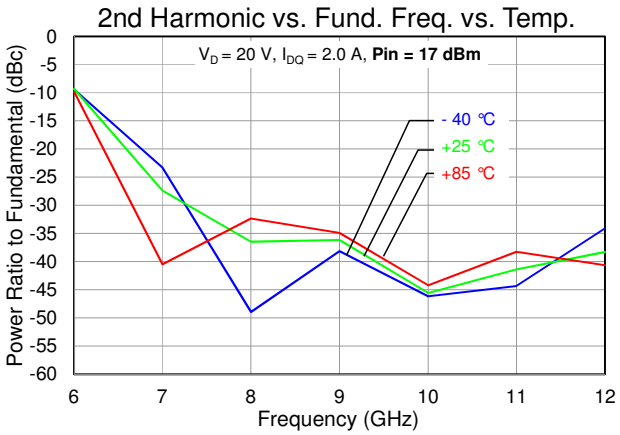


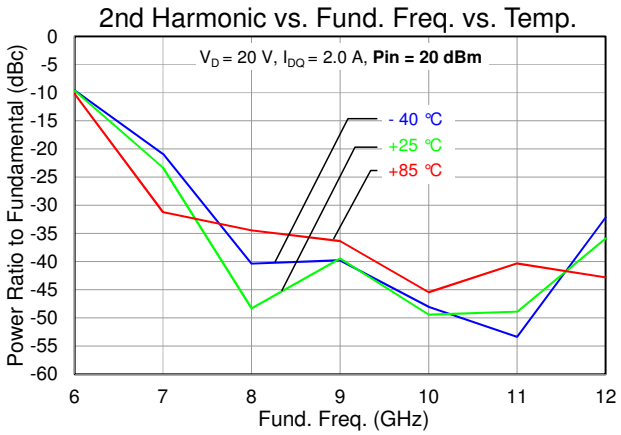
Drain Current vs. Frequency vs. Temp.

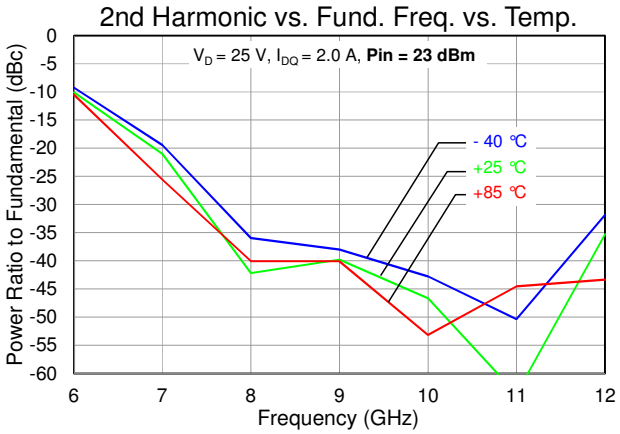


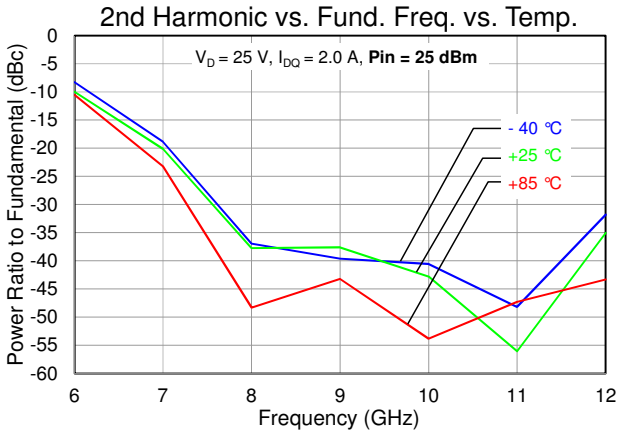
Typical Performance: Small Signal

Condition: CW



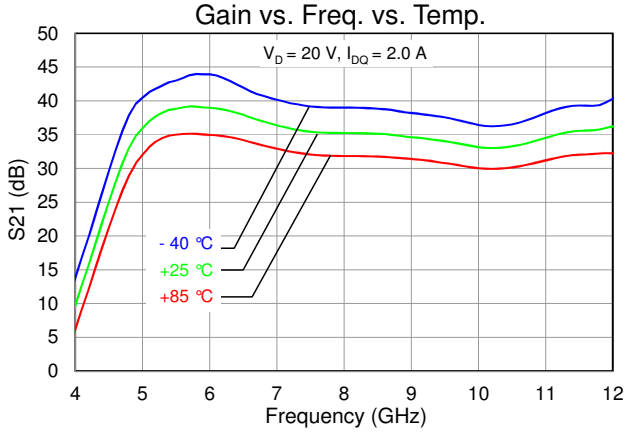




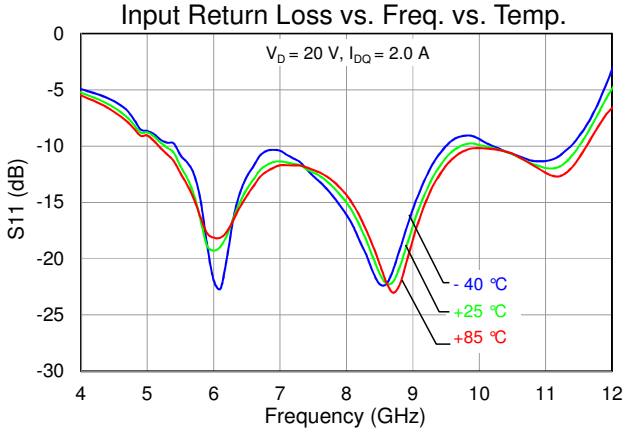


Condition: CW

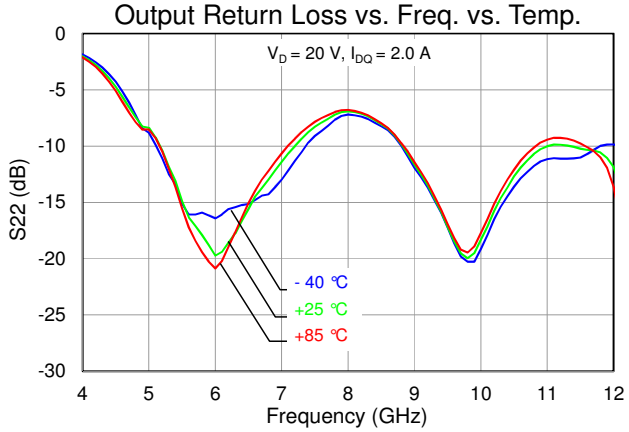
Gain vs. Freq. vs. Temp.



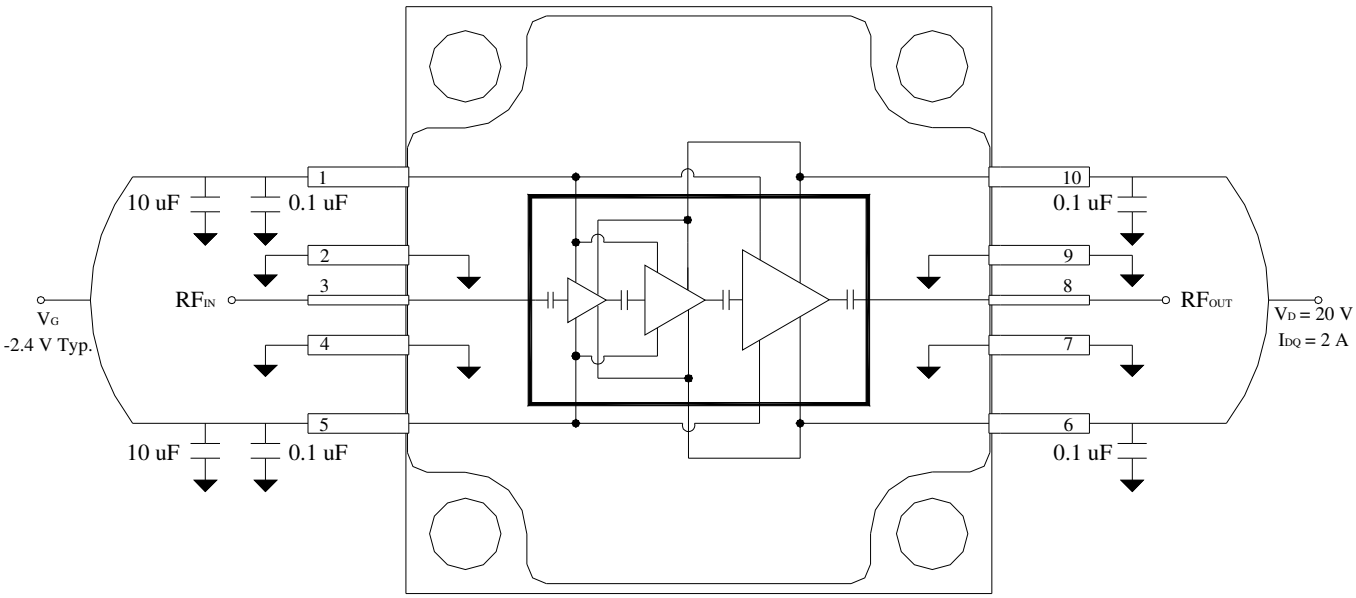
Input Return Loss vs. Freq. vs. Temp.



Output Return Loss vs. Freq. vs. Temp.



Applications Information



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

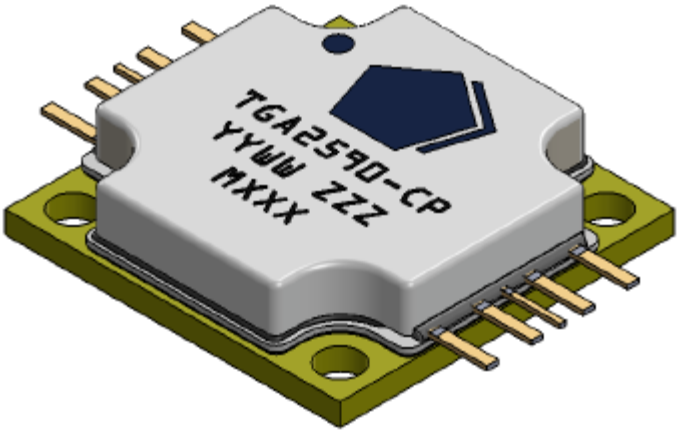
Bias-up Procedure

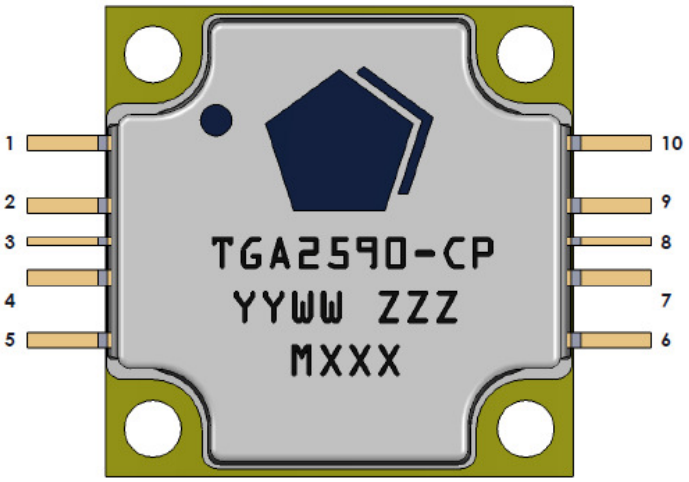
1. Set I_D limit to 8 A, I_G limit to 200 mA
2. Apply –5 V to V_G
3. Apply +20 V to V_D; ensure I_{DQ} is approx. 0 mA
4. Adjust V_G until I_{DQ} = 2 A (V_G ~ –2.4 V Typ.).
5. Turn on RF supply

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 Layout

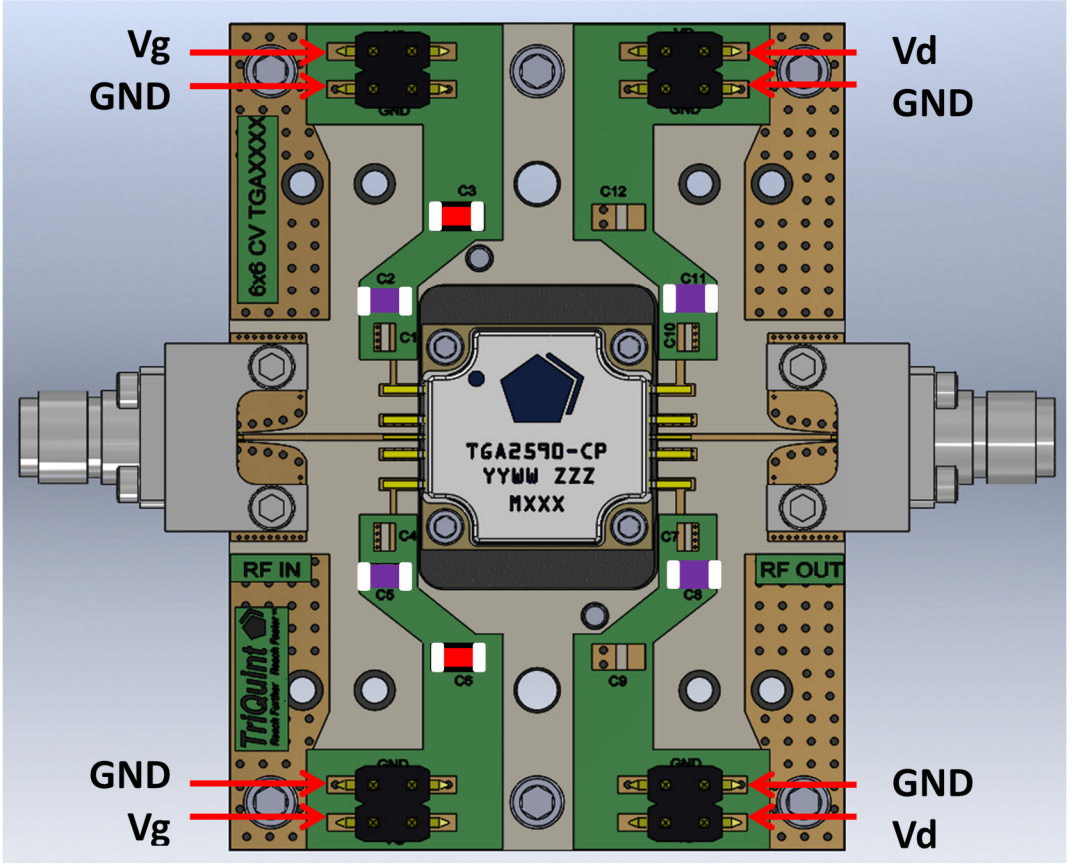




Pin Description

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.

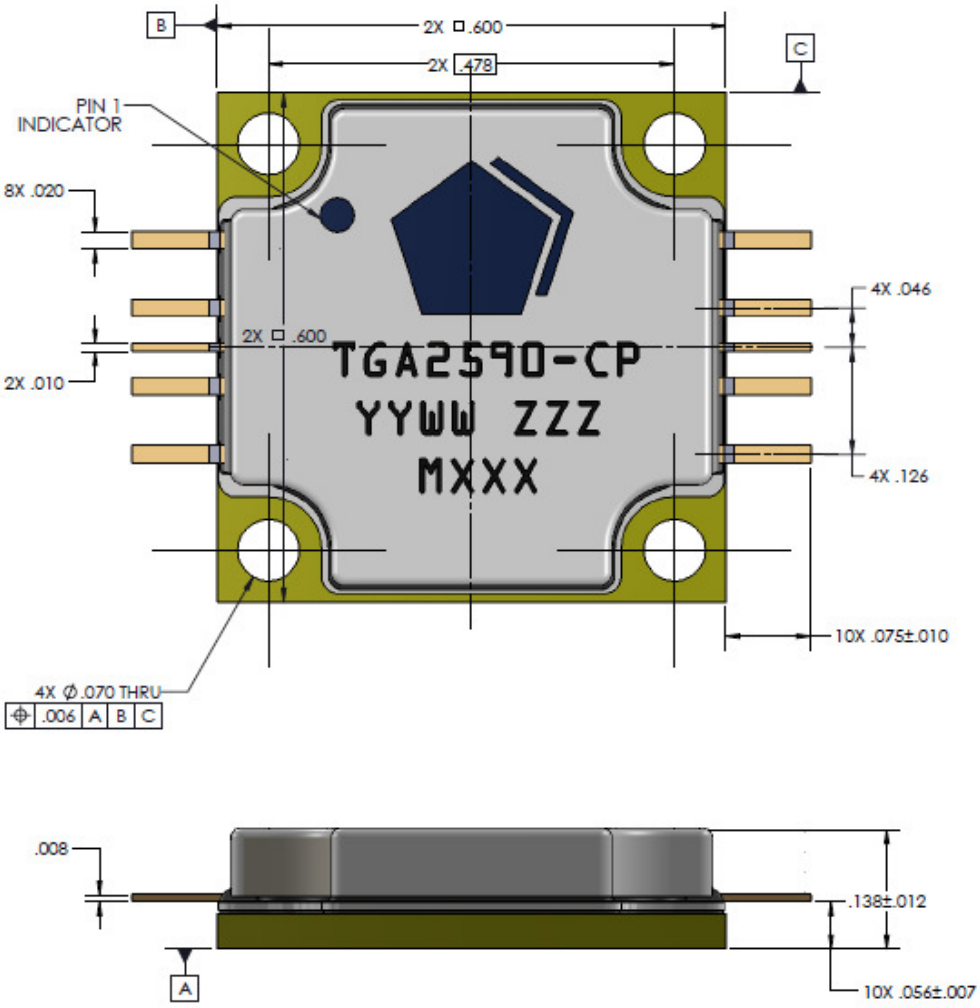
Bill of Material

Reference Des.	Value	Description	Manuf.	Part Number
C2, C5, C8, C11	0.1 µF	Cap, 0603, 50 V, 10%, X7R	Various	
C3, C4	10 µF	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

ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: Class 1B (≤650V)
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class C3 (≤1000V)
Test: Charged Device Model (CDM)
Standard: JEDEC Standard JESD22-C101

MSL Rating

Level MSL 3 at 260°C convection reflow
The part is rated Moisture Sensitivity Level 3 at 260°C per JEDEC standard IPC/JEDEC J-STD-020.

ECCN

US Department of Commerce: 3A001.b.2.b

Solderability

Compatible with the latest version of J-STD-020, Lead-free solder, 210°C

RoHS Compliance

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

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

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