TGA2595-CP

27.5 – 31 GHz 8 W GaN Power Amplifier

Product Description

Qorvo's TGA2595-CP is a balanced Ka-Band power amplifier fabricated on Qorvo's QGaN15 0.15 um GaN on SiC process. The balanced configuration supports low return loss and improves robustness into non-ideal loads. Operating from 27.5 to 31 GHz, the TGA2595-CP achieves 39 dBm saturated output power with power-added efficiency of > 22 % and power gain of 21 dB.

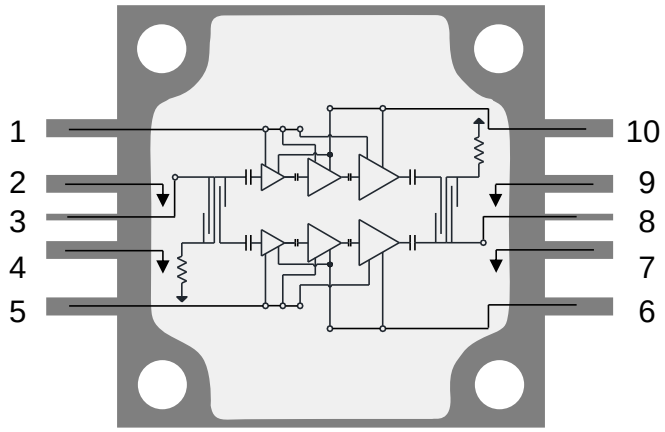
The TGA2595-CP is packaged in a 10-lead 15 x 15 mm bolt-down package with a Cu base for superior thermal management. To simply system integration, the TGA2595-CP is fully matched to 50 ohms with integrated DC blocking capacitors on both I/O ports.

The TGA2595-CP is ideally suited for both commercial and defense satellite communications.

Lead free and RoHS compliant.

Evaluation Boards are available upon request.

Functional Block Diagram



Product Features

- Frequency Range: 27.5 – 31 GHz
- P_{OUT}: 39 dBm (P_{IN} = 18 dBm)
- PAE: > 22 % (P_{IN} = 18 dBm)
- Power Gain: 21 dB (P_{IN} = 18 dBm)
- IM3 @ 30 dBm/Tone = −27 dBc
- IM5 @ 30 dBm/Tone = −46 dBc
- Bias: V_D = +20 V, I_{DQ} = 560 mA, V_G = −2.5 V typical
- Package Dimensions: 15.2 x 15.2 x 5.2 mm
- Package base is pure Cu offering superior thermal management

Applications

- Satellite Communications

Ordering Information

Part No.	ECCN	Description
TGA2595-CP	3A001.b.2.c	27.5 – 31 GHz 8 W GaN Power Amplifier

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	29.5 V
Gate Voltage Range (V_G)	−5 to 0 V
Drain Current (I_D)	2.8 A
Gate Current (I_G)	−6 to 34 (1) mA
Power Dissipation (P_{DISS}), 85 °C	48 W
Input Power, CW, 50 Ω, (P_{IN})	30 dBm
Input Power, CW, VSWR 6:1, V_D = +22 V, 85 °C, (P_{IN})	25 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.

Max rating for IG is at Channel Temperature (TCH) of 200 °C .

Recommended Operating

Parameter	Value / Range
Drain Voltage (V_D): Pulsed	+20 V
Drain Current (I_{DQ})	560 mA
Drain Current Under RF Drive (I_{D_DRIVE})	See plots p. 6
Gate Voltage (V_G)	−2.5 V (Typ.)
Gate Current Under RF Drive (I_{G_DRIVE})	See plots p. 6
Temperature (T_{BASE})	−40 to 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	27.5	–	31	GHz
Small Signal Gain	–	> 25	–	dB
Input Return Loss	–	> 12	–	dB
Output Return Loss	–	> 13	–	dB
Output Power (at P_{IN} = 18 dBm)	–	39	–	dBm
Power Added Efficiency (at P_{IN} = 18 dBm)	–	> 22	–	%
Power Gain (at P_{IN} = 18 dBm)	–	21	–	dB
IM3 @ 30 dBm/Tone	–	−27	–	dBc
IM5 @ 30 dBm/Tone	–	−46	–	dBc
Output Power Temperature Coefficient (25 °C to 85 °C only)	–	−0.01	–	dBm/°C
Recommended Operating Voltage	–	20	22	V

Test conditions unless otherwise noted: 25 °C, V_D = +20 V, I_{DQ} = 560 mA, V_G = −2.5 V typical.

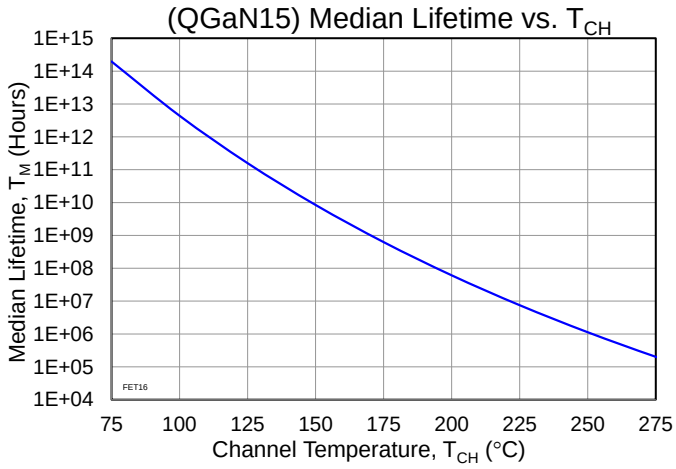
Thermal and Reliability Information

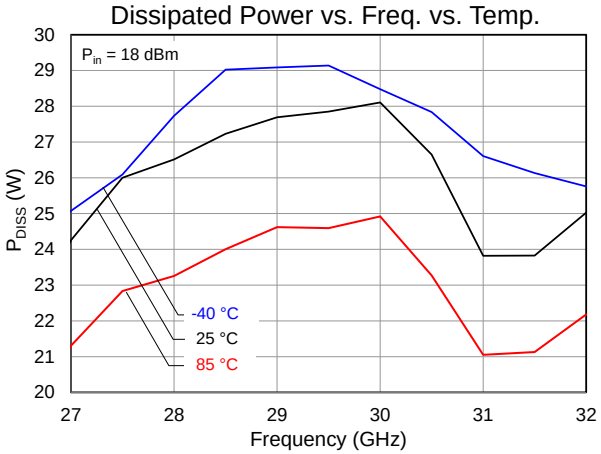
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	CW, V_D = +20 V, I_{DQ} = 560 mA, T_{BASE} = 85 °C P_{DISS} =11.2 W	3.3	°C/W
Channel Temperature (T_{CH}) (Quiescent)		125	°C
Median Lifetime (T_M)		4.0E+13	Hrs
Thermal Resistance (θ_{JC}) (1)	V_D = +20 V, I_{DQ} = 280 mA, T_{BASE} = 85 °C, Freq = 29 GHz, P_{IN} = 18 dBm, P_{OUT} = 37.9 dBm, P_{DISS} = 21.2 W, I_{D_Drive} = 1.37 A	3.61	°C/W
Channel Temperature (T_{CH}) (under RF drive)		170	°C
Median Lifetime (T_M)		5.9E+10	Hrs
Thermal Resistance (θ_{JC}) (1)	V_D = +20 V, I_{DQ} = 560 mA, T_{BASE} = 85 °C, Freq = 29 GHz, P_{IN} = 18 dBm, P_{OUT} = 39.4 dBm, P_{DISS} = 27.6 W, I_{D_Drive} = 1.81 A	3.76	°C/W
Channel Temperature (T_{CH}) (under RF drive)		197	°C
Median Lifetime (T_M)		2.2E+9	Hrs

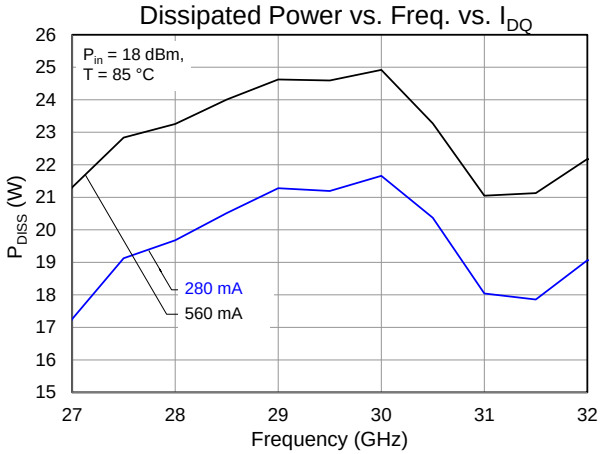
Notes:
1. Thermal resistance measured to back of package.

Median Lifetime

Test Conditions: V_D = +28 V; Failure Criteria = 10 % reduction in ID_MAX during DC Life Testing



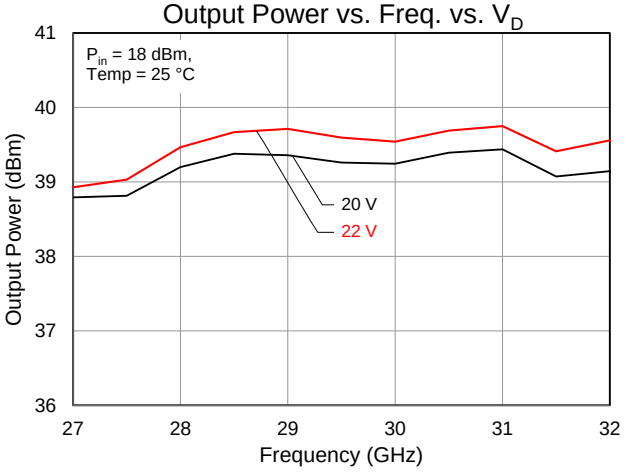




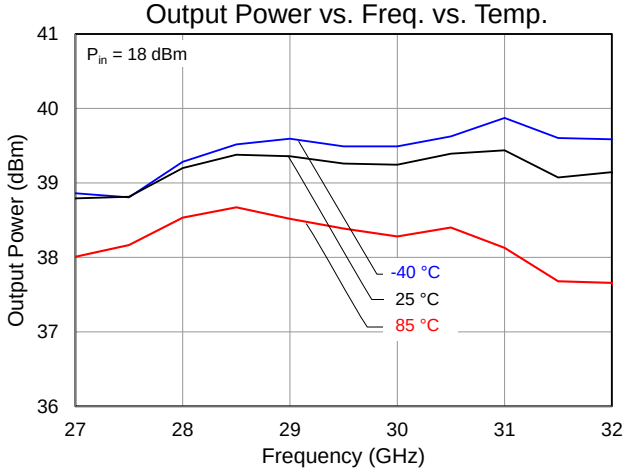
Typical Performance – Large Signal

Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 560 mA, V_G = −2.5 V typical, CW.

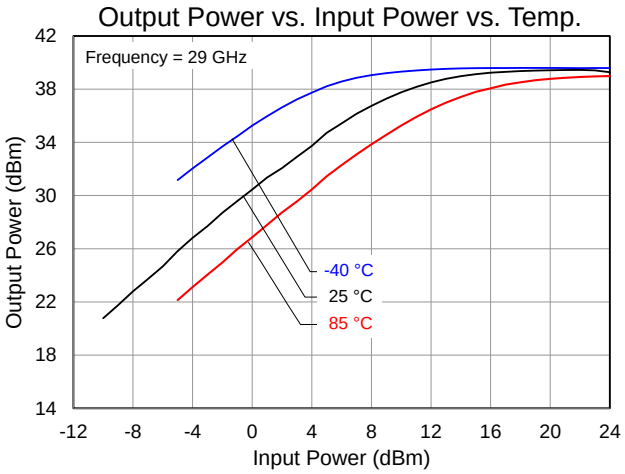
Output Power vs. Freq. vs. V_D



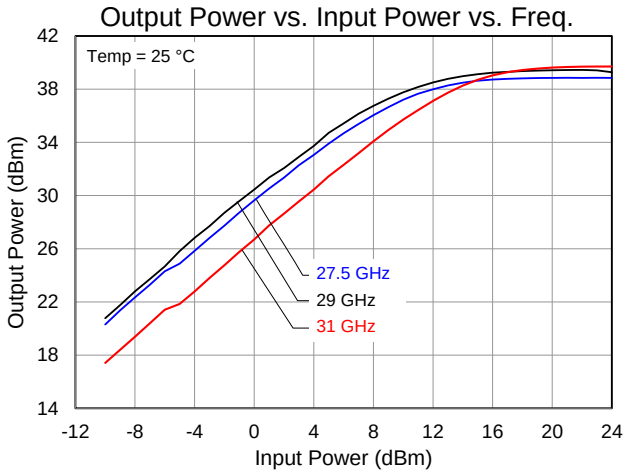
Output Power vs. Freq. vs. Temp.



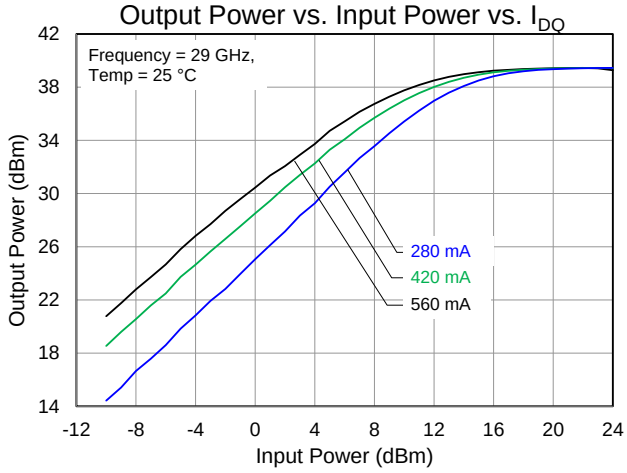
Output Power vs. Input Power vs. Temp.



Output Power vs. Input Power vs. Freq.



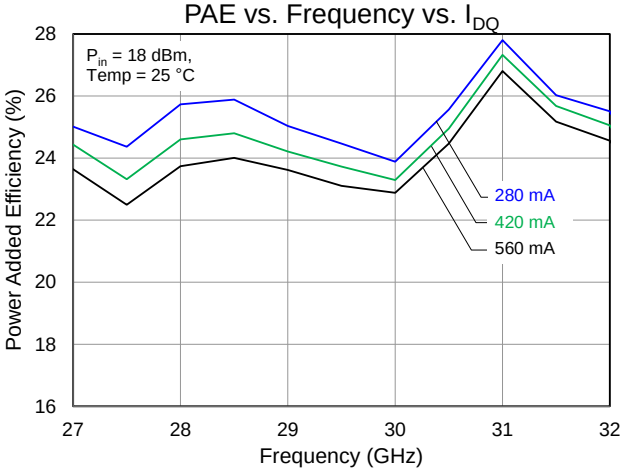
Output Power vs. Input Power vs. I_{DQ}



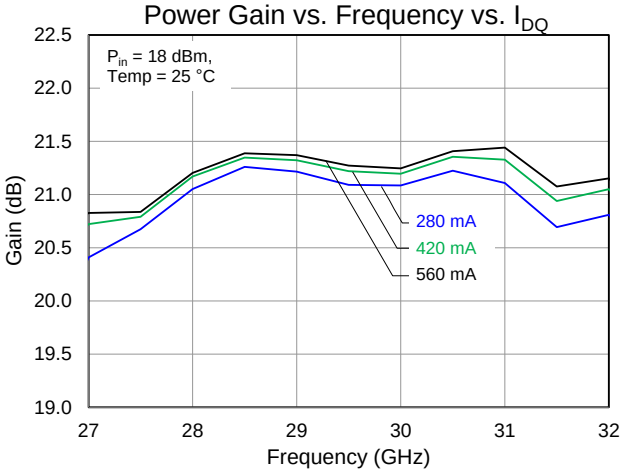
Typical Performance – Large Signal

Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 560 mA, V_G = −2.5 V typical, CW.

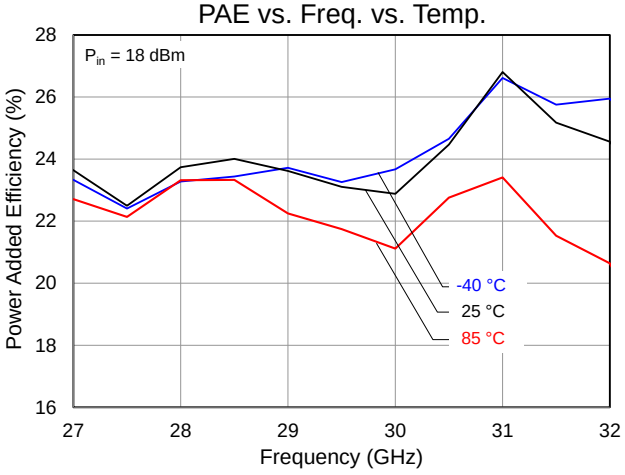
PAE vs. Frequency vs. I_{DQ}



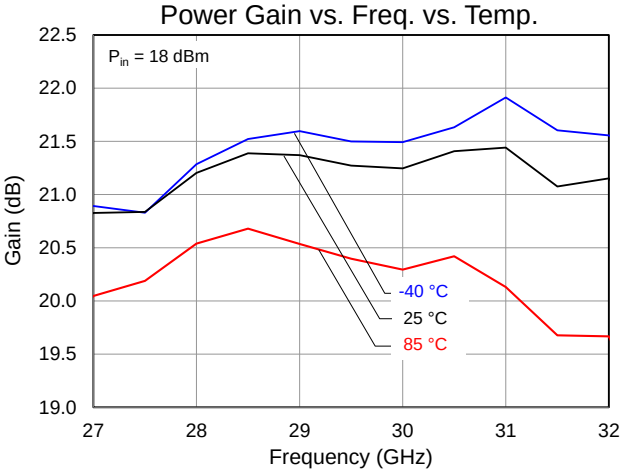
Power Gain vs. Frequency vs. I_{DQ}



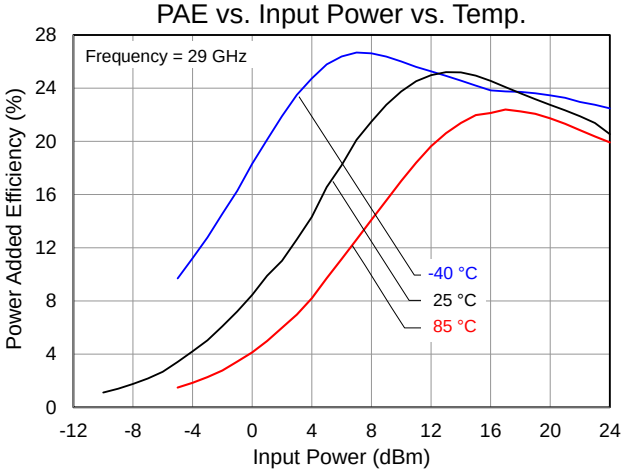
PAE vs. Freq. vs. Temp.



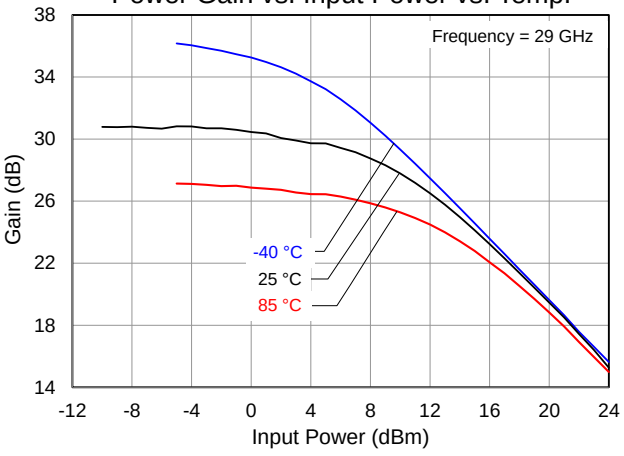
Power Gain vs. Freq. vs. Temp.



PAE vs. Input Power vs. Temp.

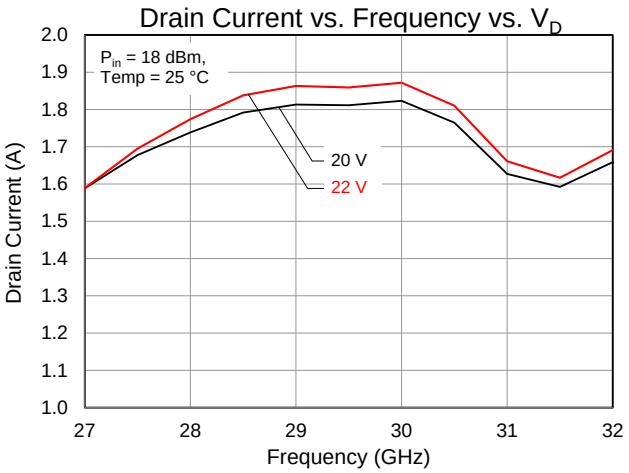


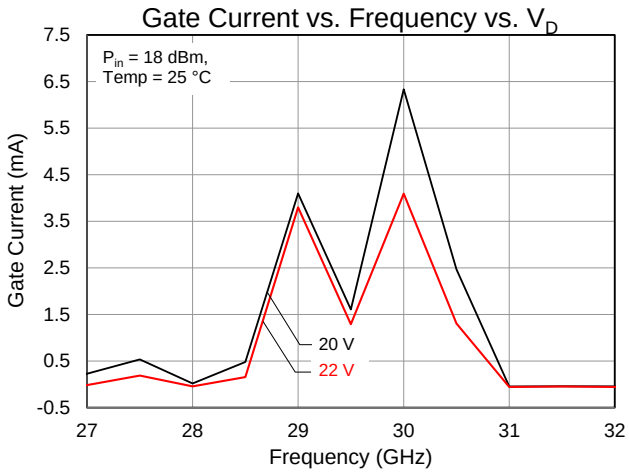
Power Gain vs. Input Power vs. Temp.

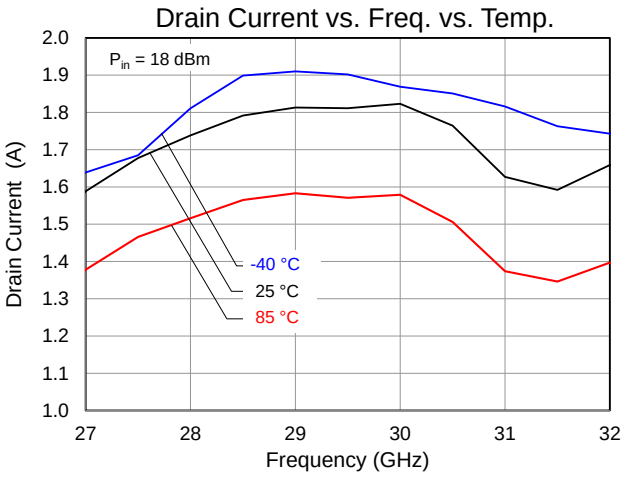


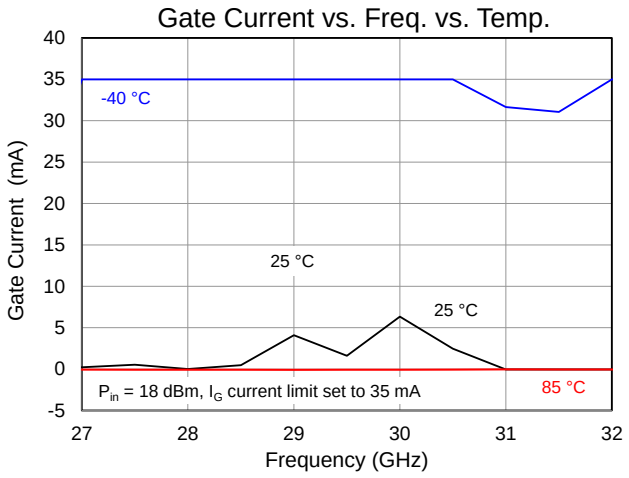
Typical Performance – Large Signal

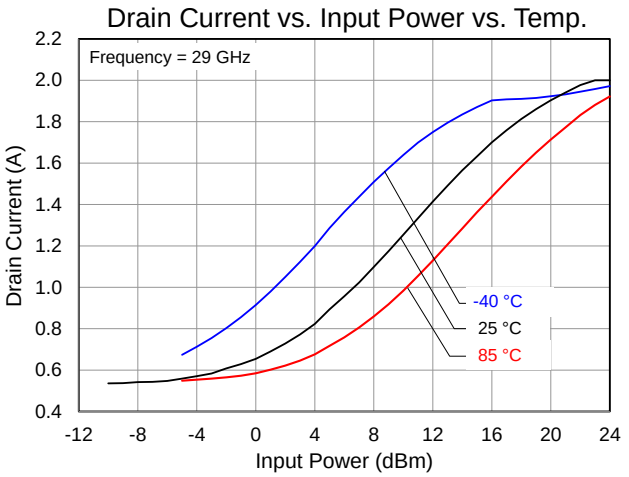
Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 560 mA, V_G = −2.5 V typical, CW.

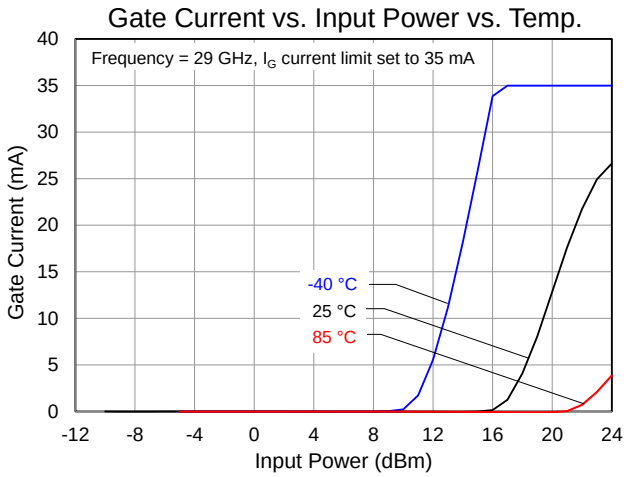






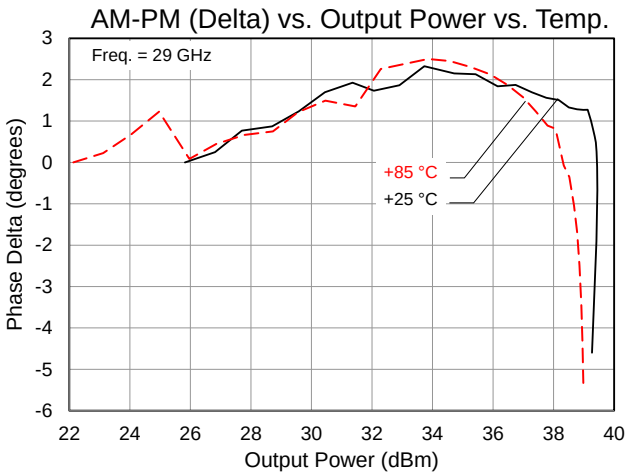


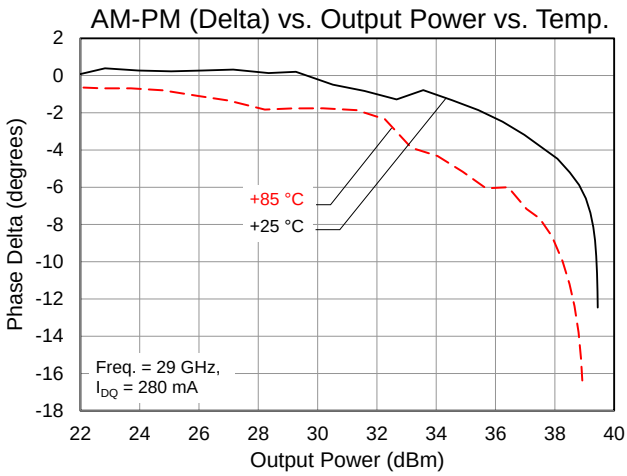


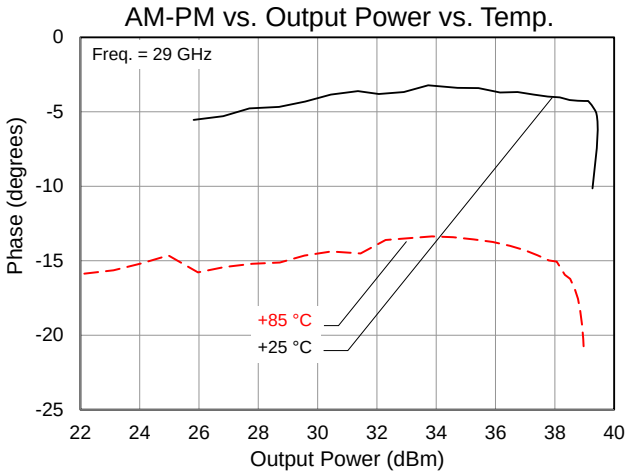


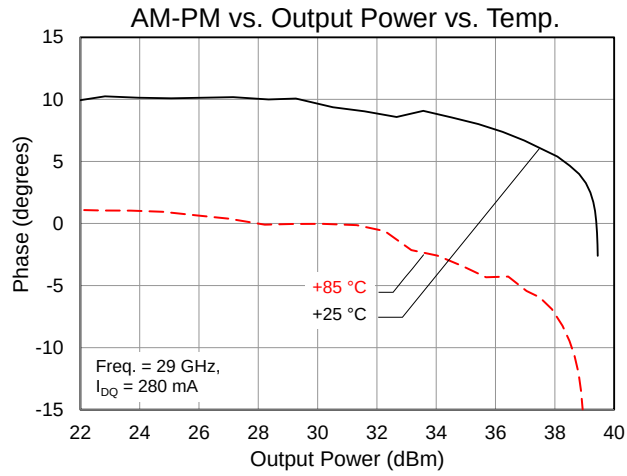
Performance Plots – Large Signal

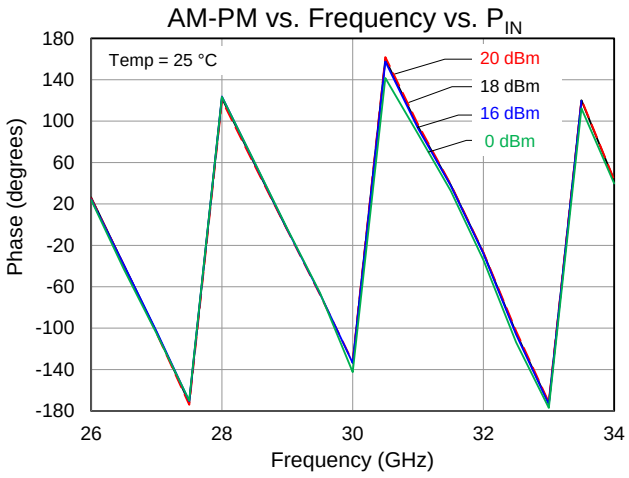
Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 560 mA, V_G = −2.5 V typical, CW.

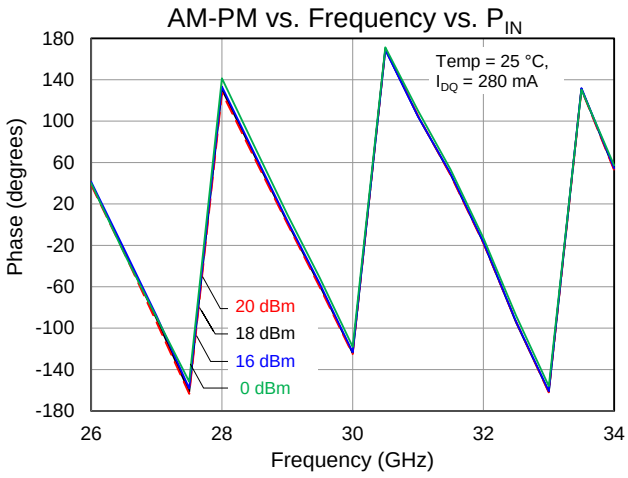








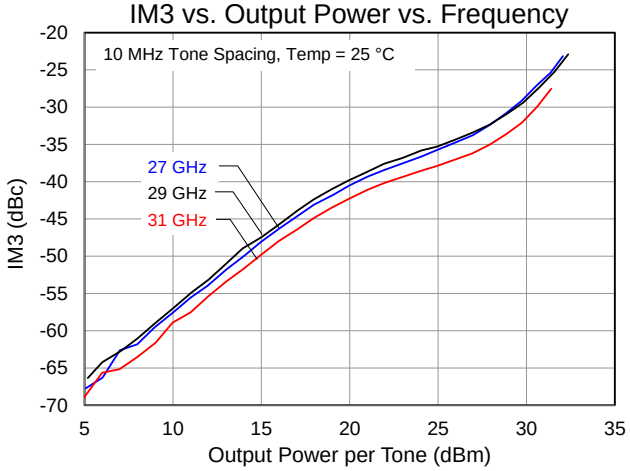




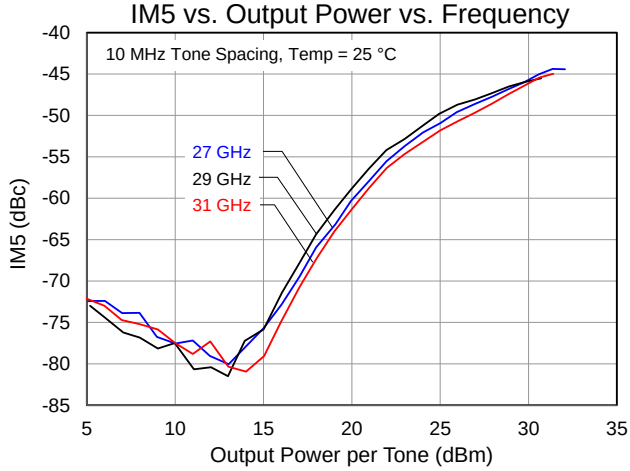
Typical Performance – Linearity

Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 560 mA, V_G = −2.5 V typical, CW.

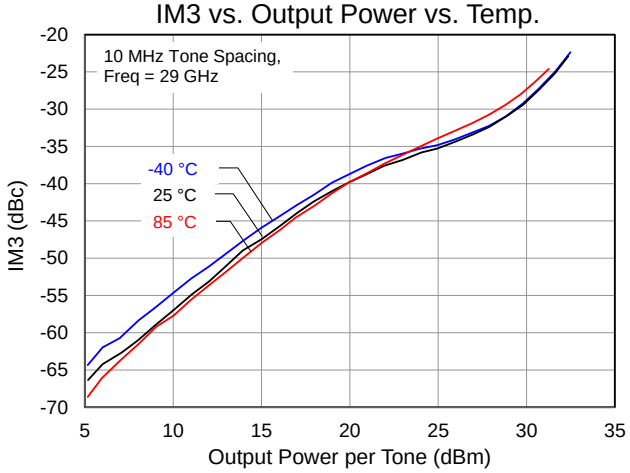
IM3 vs. Output Power vs. Frequency



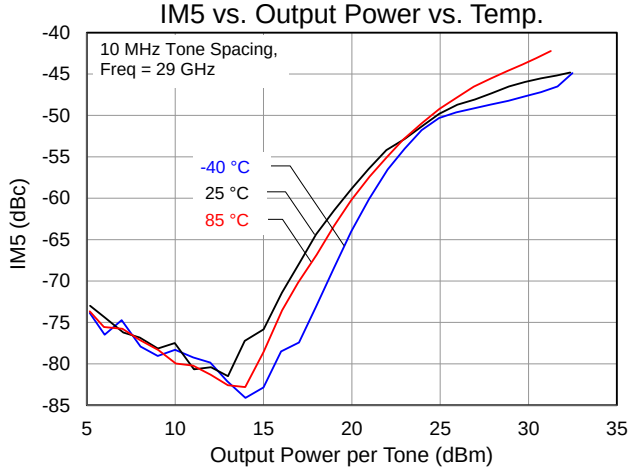
IM5 vs. Output Power vs. Frequency



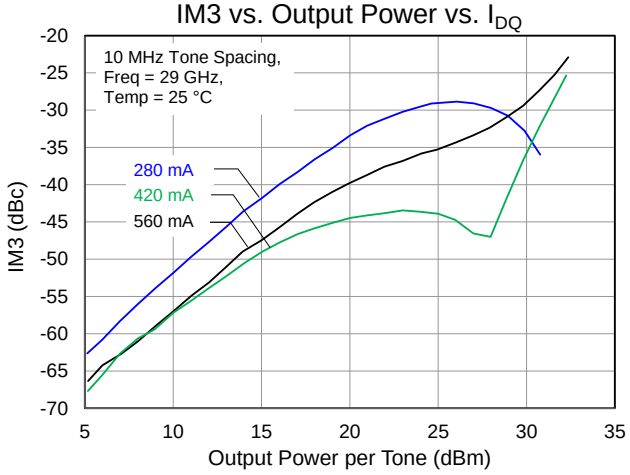
IM3 vs. Output Power vs. Temp.



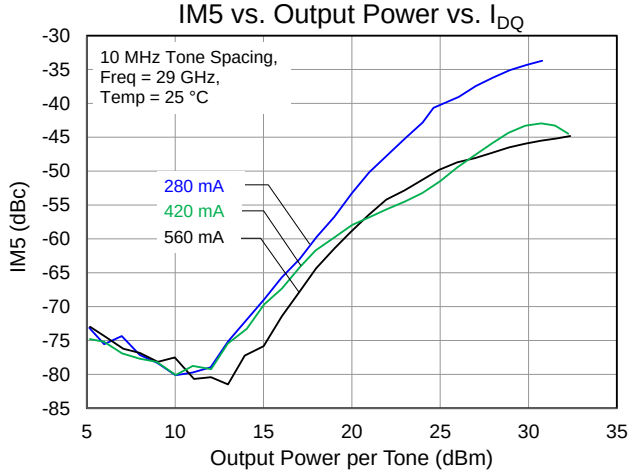
IM5 vs. Output Power vs. Temp.



IM3 vs. Output Power vs. I_{DQ}



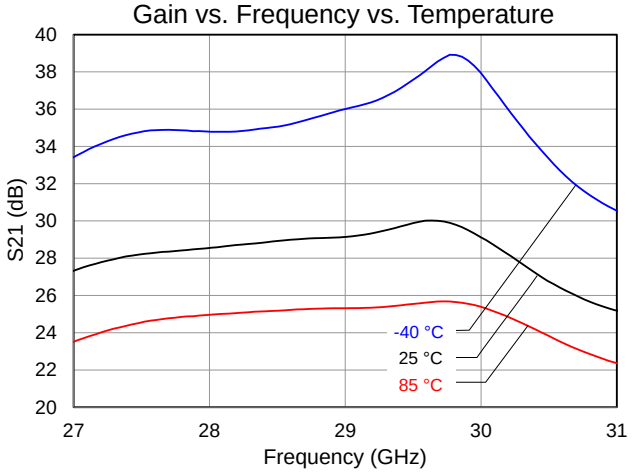
IM5 vs. Output Power vs. I_{DQ}



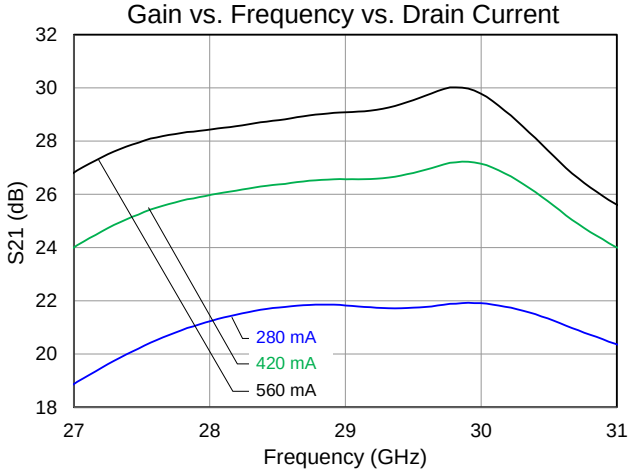
Typical Performance – Small Signal

Conditions unless otherwise specified: V_D = +20 V, I_{DQ} = 560 mA, V_G = −2.5 V typical, CW.

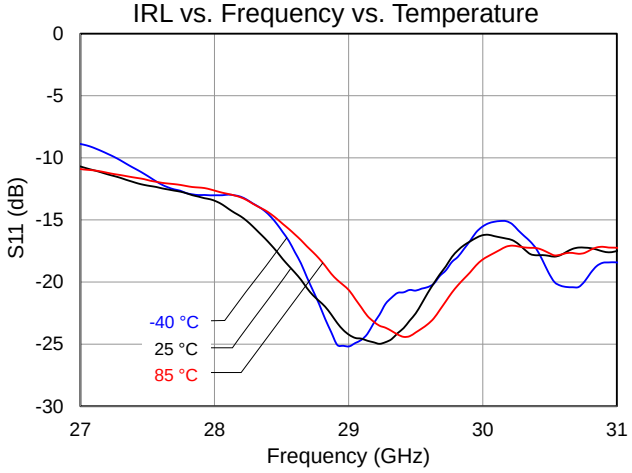
Gain vs. Frequency vs. Temperature



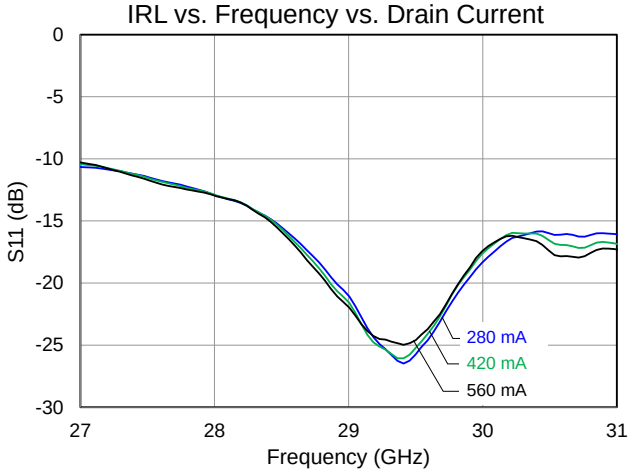
Gain vs. Frequency vs. Drain Current



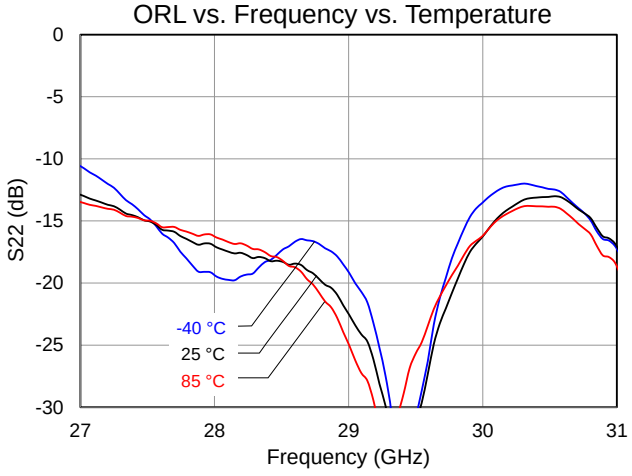
IRL vs. Frequency vs. Temperature



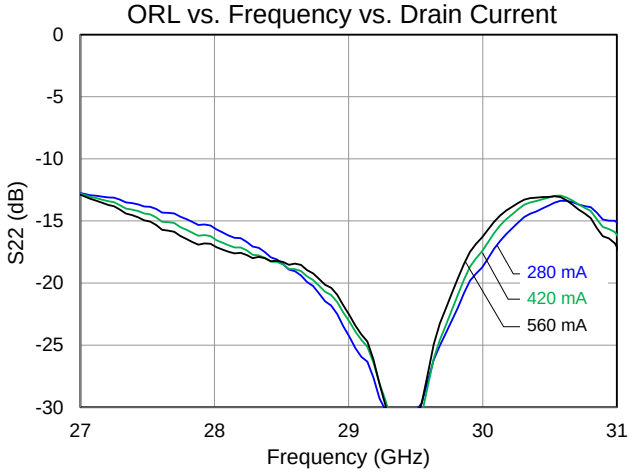
IRL vs. Frequency vs. Drain Current



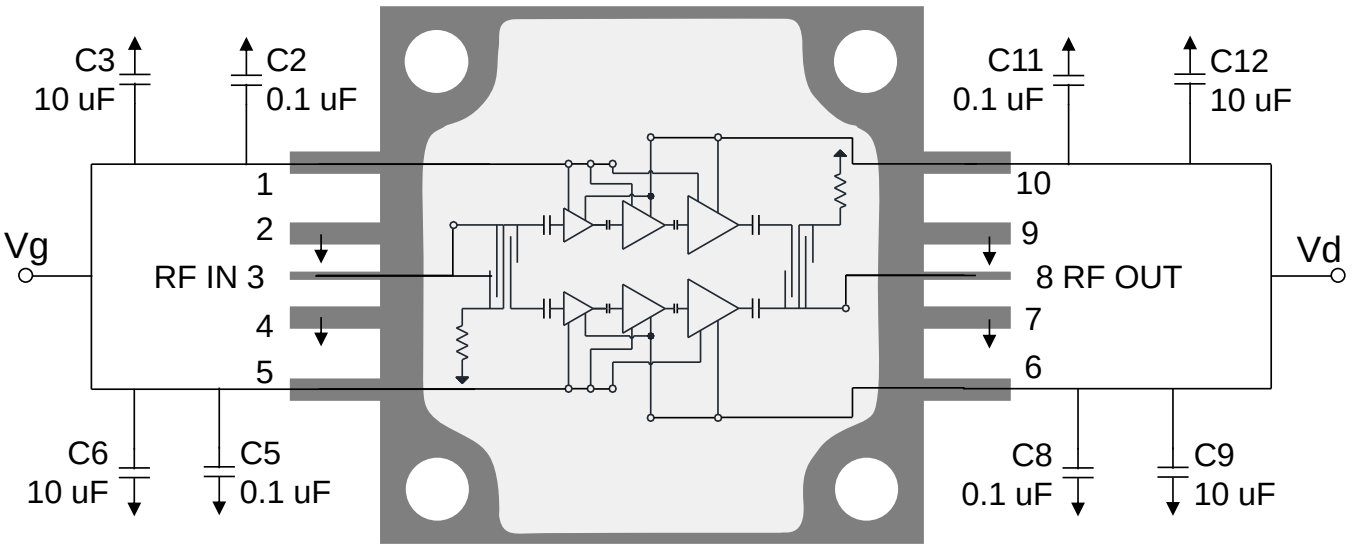
ORL vs. Frequency vs. Temperature



ORL vs. Frequency vs. Drain Current



Applications Information and Pin Layout



Bias Up Procedure

1. Set I_D limit to 2 A, I_G limit to 35 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} = 560 mA (V_G ~ −2.5 V Typ.).
5. Turn on RF supply

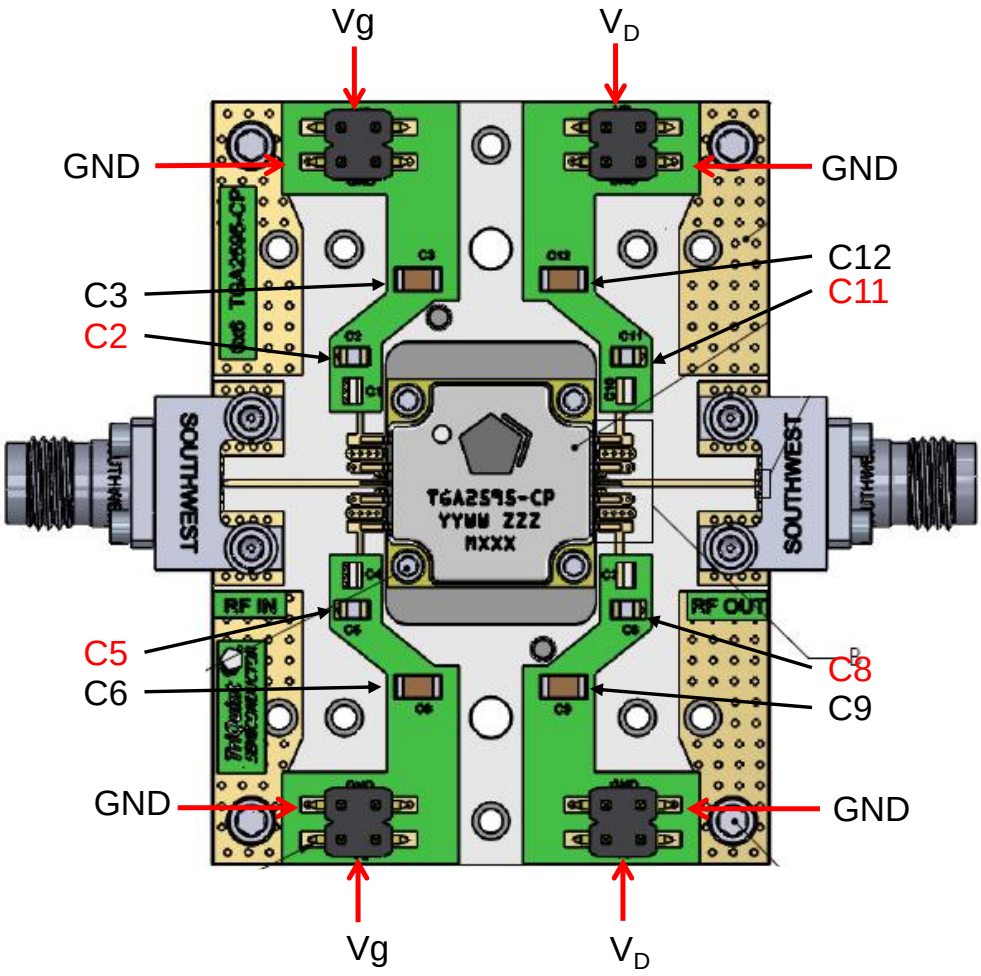
Bias Down Procedure

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.
3	RF_{IN}	Input; matched to 50 Ω; DC blocked
2,4,7,9	GND	Must be grounded on the PCB.
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

Assembly Drawing



PCB NOTES:
(1) Both Top and Bottom Vd and Vg must be biased.
(2) This PCB is non-standard, and requires PCB trace modification for 30 GHz performance optimization. See Gerber files for detailed information.

Bill of Materials

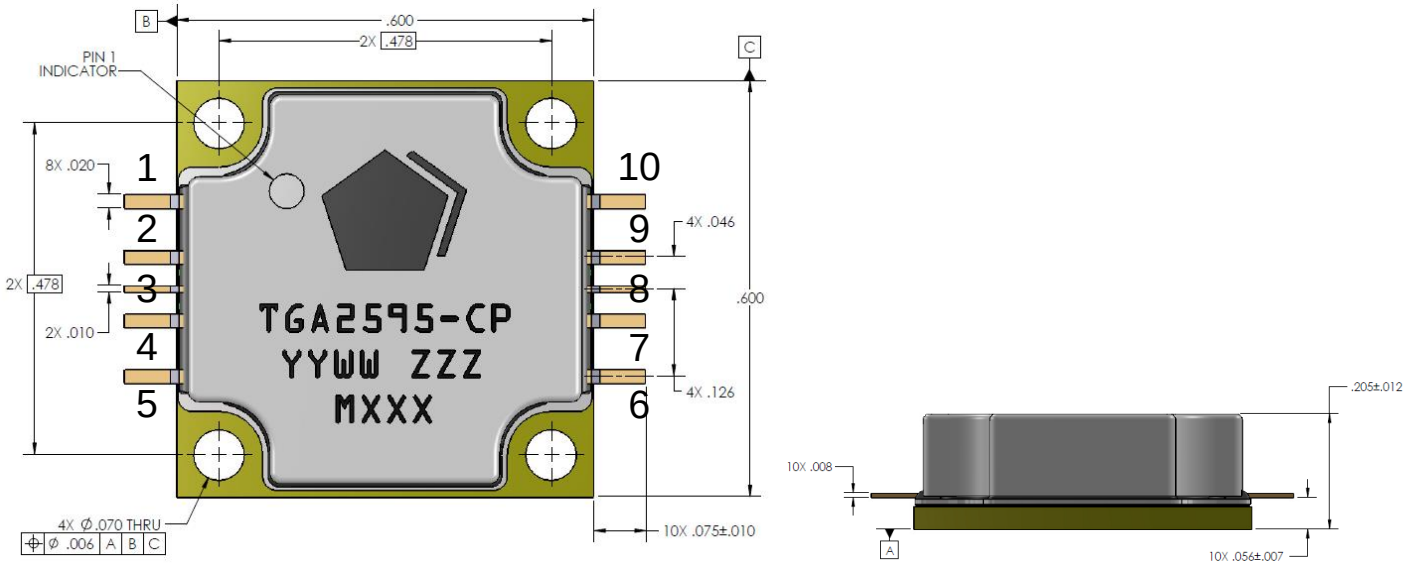
Reference Des.	Value	Description	Manuf.	Part Number
C2, C5, C8, C11	0.1 µF	Cap, 0603, +50 V, 10 %, X7R	Various	–
C3, C6, C9, C12 (1)	10 µF	Cap, 1206, +50 V, 20 %, X5R	Various	–

Notes:
1. Capacitors in drain path should be removed for pulsed operation.

Assembly Notes

1. Clean the board or module with alcohol. Allow it to dry fully.
2. Screws are recommended for mounting the TGA2595-CP to the T-Carrier.
3. 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 T-Carrier.
   b. Attach a heat sink to the bottom of the T-Carrier and apply thermal compound or 4 mils indium shim between the heat sink and the T-Carrier.
4. Apply solder to each pin of the TGA2595-CP.
5. Clean the assembly with alcohol.

Mechanical Information



Units: inches
Tolerances: unless specified
x.xx = ± 0.01
x.xxx = ± 0.005
Materials:
Base: Copper
Lid: Plastic
All metalized features are gold plated
Part is epoxy sealed
Marking:
2595: Part number
YY: Part Assembly year
WW: Part Assembly week
ZZZ: Serial Number
MXXX: Batch ID