TGA2625-CP

10 – 11 GHz 20 W GaN Power Amplifier

Product Description

Qorvo's TGA2625-CP is a packaged high-power X-Band amplifier fabricated on Qorvo's QGaN25 0.25 um GaN on SiC process. Operating from 10 to 11 GHz, the TGA2625-CP achieves 42.5 dBm saturated output power, a power-added efficiency of > 40 %, and power gain of 28 dB.

The TGA2625-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 CW and pulsed conditions. Both RF ports are internally DC blocked and matched to 50 ohms allowing for simple system integration.

The TGA2625-CP is ideally suited for both commercial and defense applications.

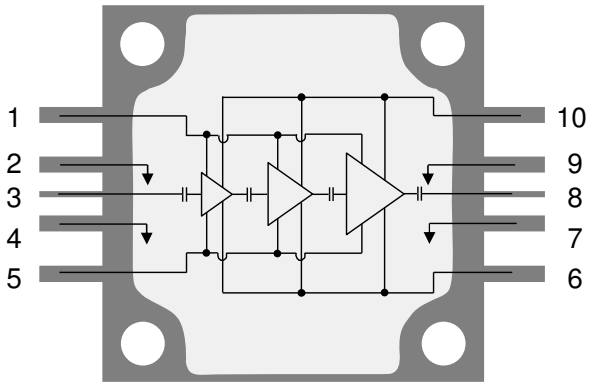
Lead free and RoHS compliant.

Evaluation Boards are available upon request.

Product Features

- Frequency Range: 10 – 11 GHz
- Pout: 42.5 dBm (at P_{IN} = 15 dBm)
- PAE: > 40 %
- Power Gain: 28 dB (at P_{IN} = 15 dBm)
- Bias: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.6 V typical, pulsed (PW = 100 µs, DC = 10 %)
- Package Dimensions: 15.2 x 15.2 x 3.5 mm
- Package base is pure Cu offering superior thermal management

Functional Block Diagram



Applications

- Radar
- Communications

Ordering Information

Part No.	ECCN	Description
TGA2625-CP	3A001.b.2.b	10 – 11 GHz 20 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)	3 A
Gate Current (I_G)	-6 to 14 (1) mA
Power Dissipation (P_{DISS}), 85 ℃	53 W
Input Power, CW, 50 Ω, (P_{IN})	21 dBm
Input Power, CW, VSWR 6:1, V_D = 28 V, 85 ℃, (P_{IN})	21 dBm
Channel Temperature (T_{CH})	275 ℃
Mounting Temperature (30 Seconds)	260 ℃
Storage Temperature	-55 to 150 ℃

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.

(1) Max rating for IG is at Channel Temperature (TCH) of 200 ℃.

Recommended Operating Conditions

Parameter	Value / Range
Drain Voltage (V_D) pulsed: PW = 100 µs, DC = 10 %	28 V
Drain Current (I_{DQ})	365 mA
Drain Current Under RF Drive (I_{D_DRIVE})	See plots p. 6
Gate Voltage (V_G)	–2.6 V (Typ.)
Gate Current Under RF Drive (I_{G_DRIVE})	See plots p. 6
Temperature (T_{BASE})	-40 to 85 ℃

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	10		11	GHz
Small Signal Gain		36		dB
Input Return Loss		13.5		dB
Output Return Loss		10		dB
Output Power (at P_{IN} = 15 dBm)		42.5		dBm
Power Added Efficiency (at P_{IN} = 15 dBm)		40		%
Power Gain (at P_{IN} = 15 dBm)		28		dB
Output Power Temperature Coefficient (25 ℃ to 85 ℃ only) Pulsed / CW		-0.003 / -0.01		dBm/℃
Recommended Operating Voltage	25	28	32	V

Test conditions unless otherwise noted: 25 ℃, V_D = 28 V (PW = 100 µs, DC = 10 %), I_{DQ} = 365 mA, V_G = -2.6 V typical.

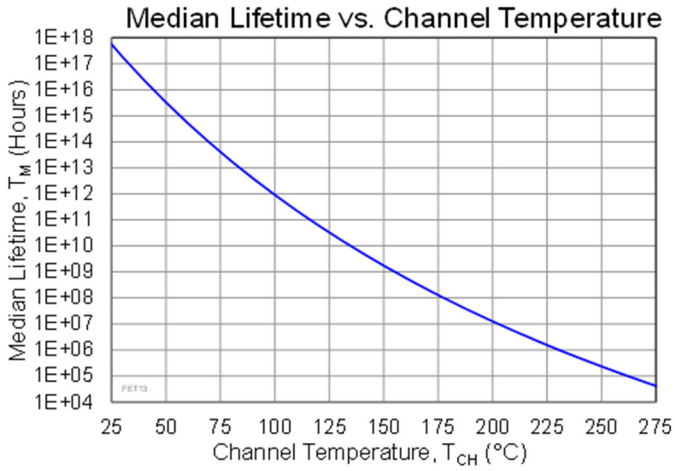
Thermal and Reliability Information

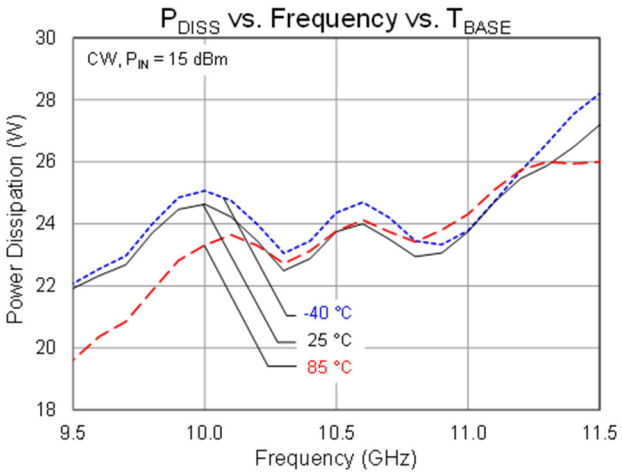
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	CW, V_D = 28 V, I_{DQ} = 365 mA, T_{BASE} = 85 °C, Freq = 10.5 GHz, P_{IN} = 15 dBm, P_{OUT} = 42.4 dBm P_{DISS} =24 W, I_{D_Drive} = 1.46 A	3.3	°C/W
Channel Temperature (T_{CH}) (under RF drive)		165	°C
Median Lifetime (T_M)		3.6 x 10^8	Hrs
Thermal Resistance (θ_{JC}) (1)	V_D = 28 V, I_{DQ} = 365 mA, (Pulsed: PW = 100 µs, DC = 10 %), T_{BASE} = 85 °C, Freq = 10.5 GHz, P_{IN} = 15 dBm, P_{OUT} = 42.8 dBm, P_{DISS} =26 W, I_{D_Drive} = 1.61 A	2.2	°C/W
Channel Temperature (T_{CH}) (under RF drive)		145	°C
Median Lifetime (T_M)		3.1 x 10^9	Hrs

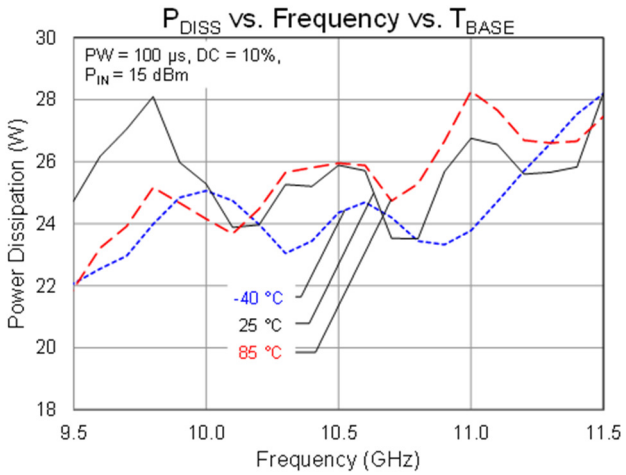
Notes:
1. Thermal resistance measured to back of package.

Median Lifetime

Test Conditions: V_D = +40 V; Failure Criteria = 10 % reduction in ID_MAX during DC Life Testing



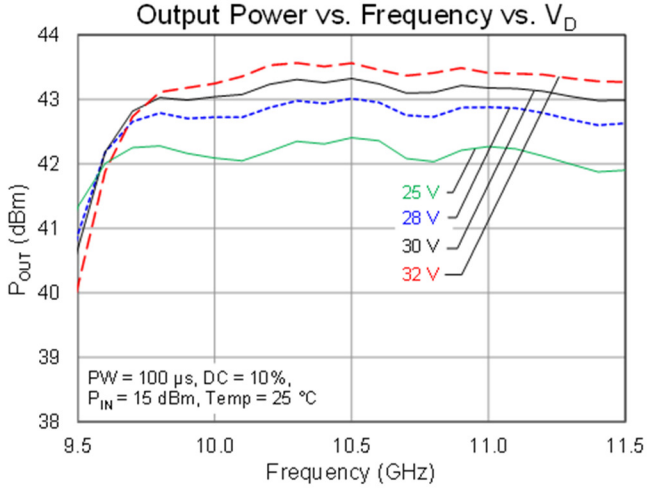




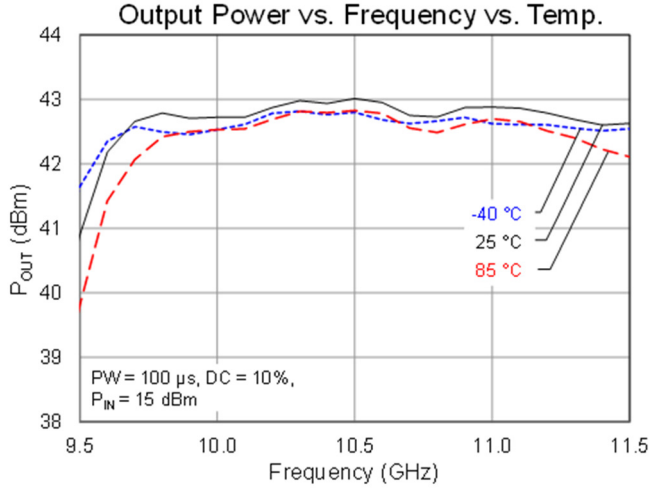
Typical Performance – Large Signal

Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.6 V typical.

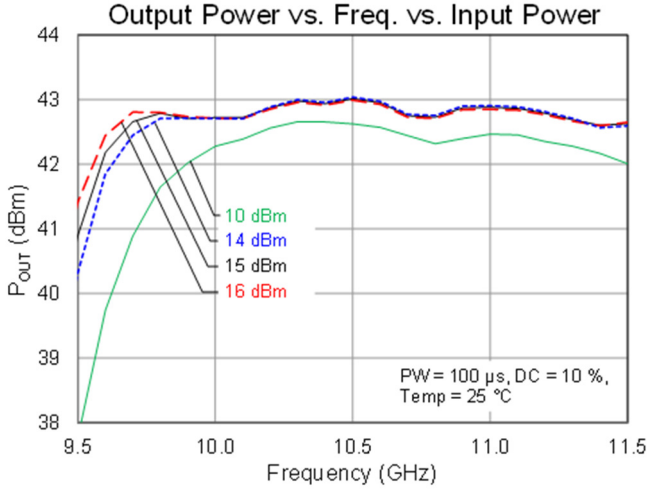
Output Power vs. Frequency vs. V_D



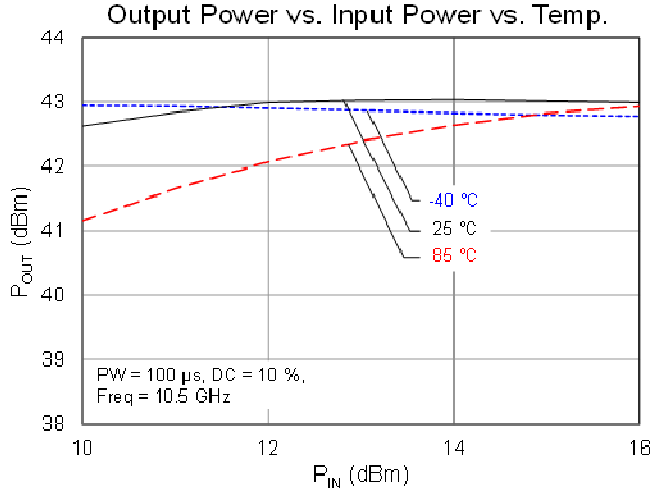
Output Power vs. Frequency vs. Temp.



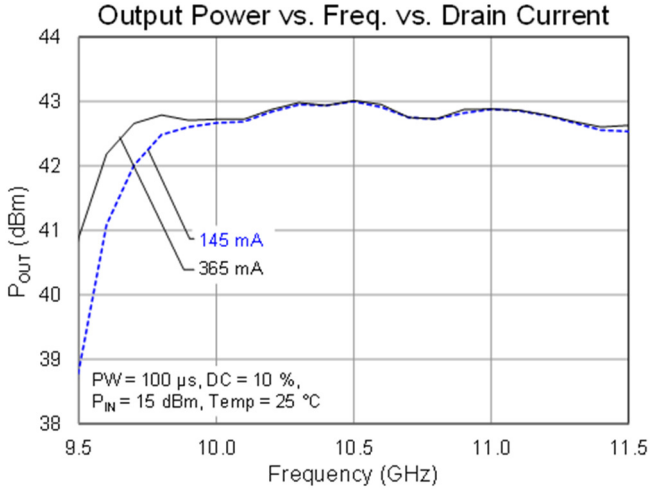
Output Power vs. Freq. vs. Input Power



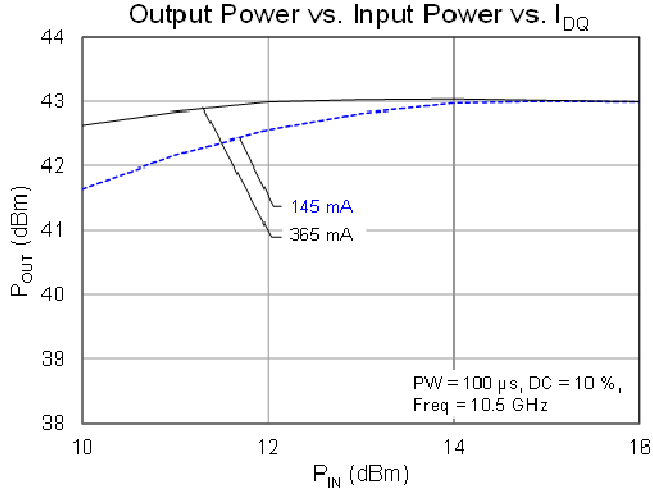
Output Power vs. Input Power vs. Temp.



Output Power vs. Freq. vs. Drain Current



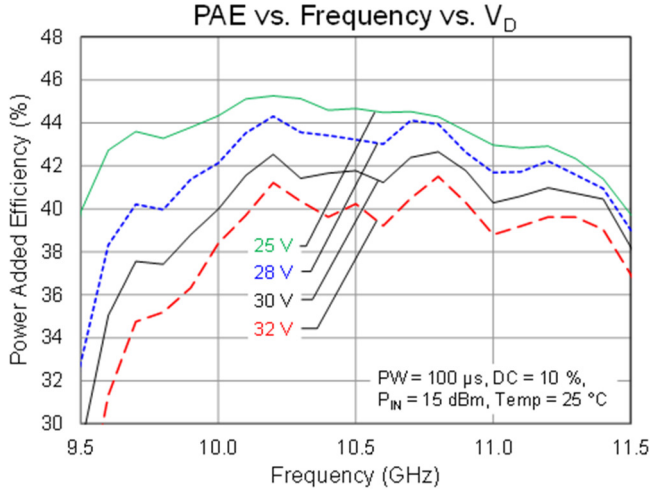
Output Power vs. Input Power vs. I_{DQ}



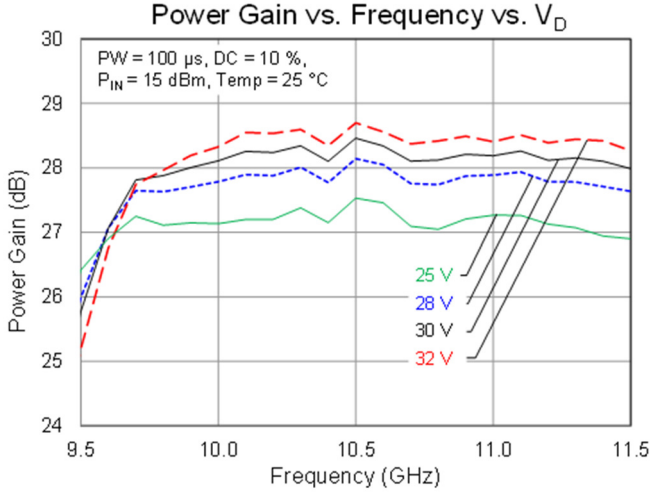
Typical Performance – Large Signal (Pulsed)

Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.6 V typical.

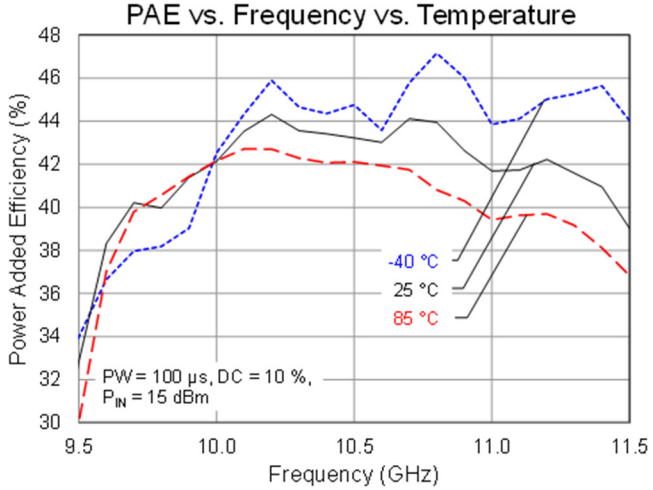
PAE vs. Frequency vs. V_D



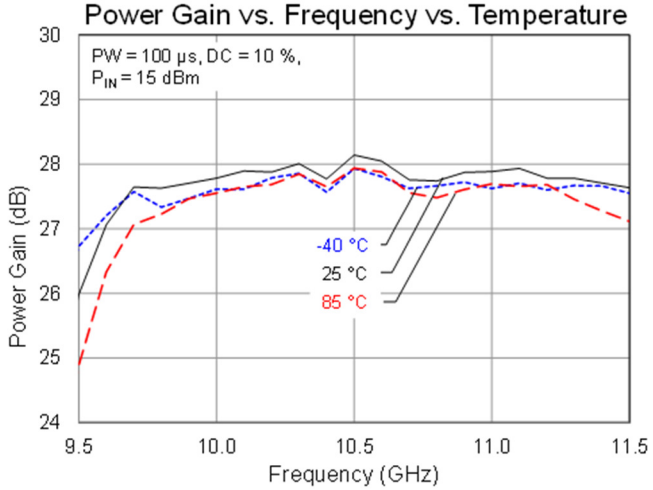
Power Gain vs. Frequency vs. V_D



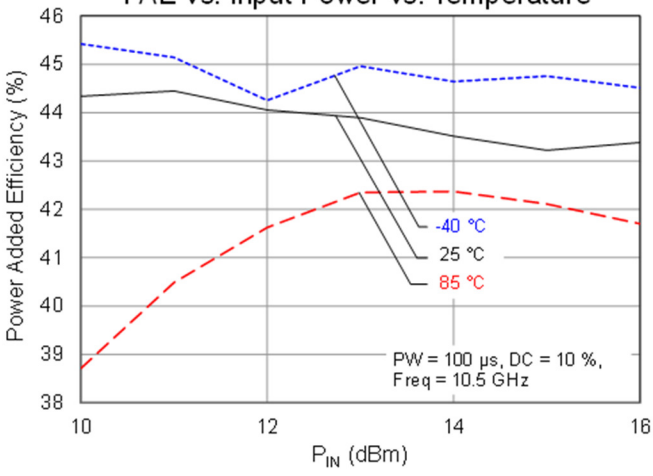
PAE vs. Frequency vs. Temperature



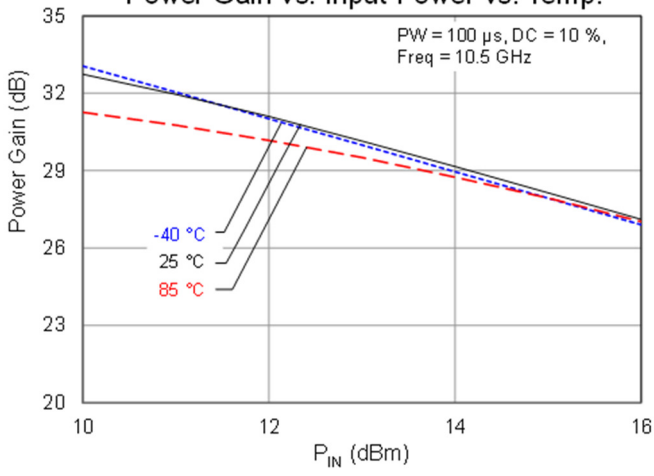
Power Gain vs. Frequency vs. Temperature



PAE vs. Input Power vs. Temperature

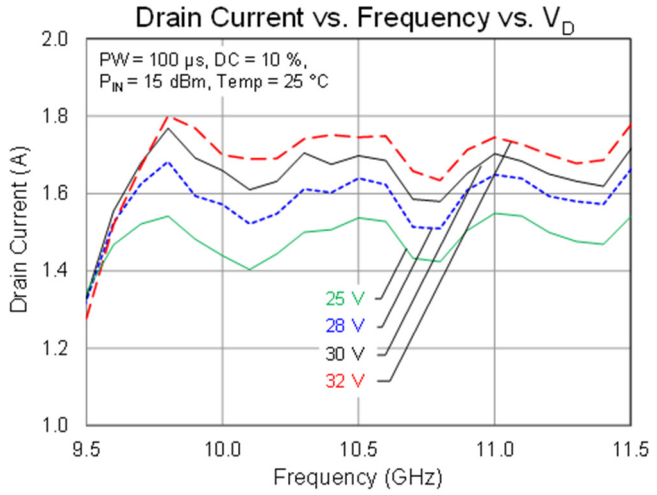


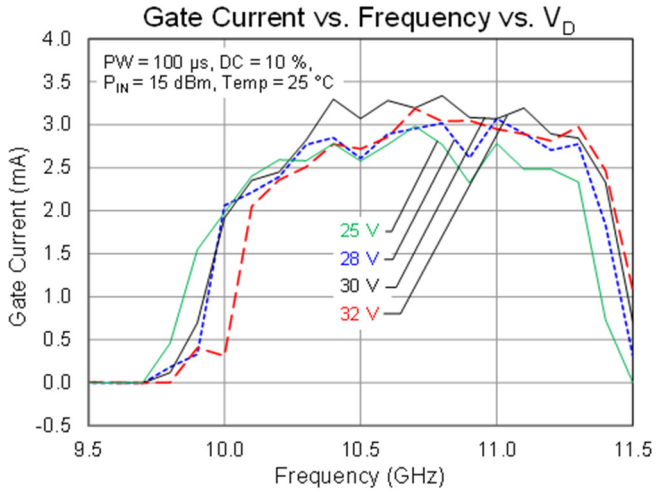
Power Gain vs. Input Power vs. Temp.

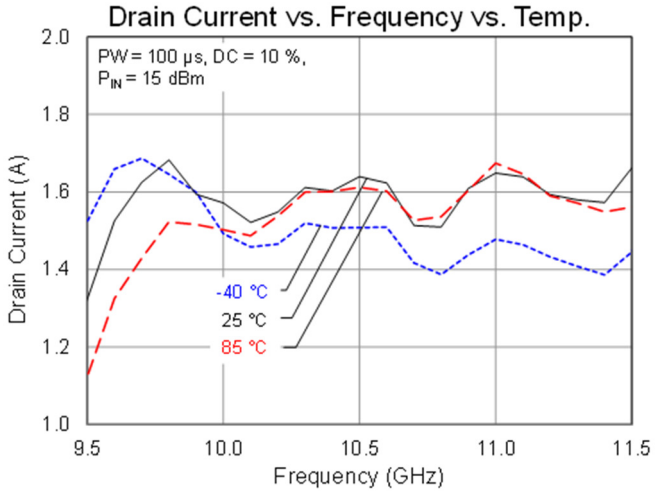


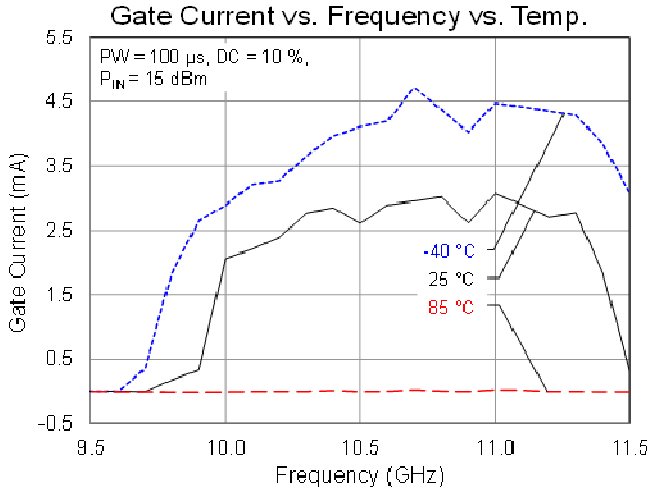
Typical Performance – Large Signal (Pulsed)

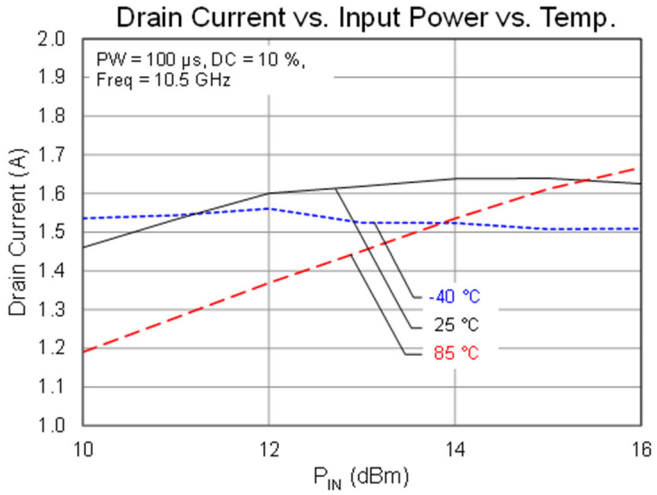
Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.6 V typical.

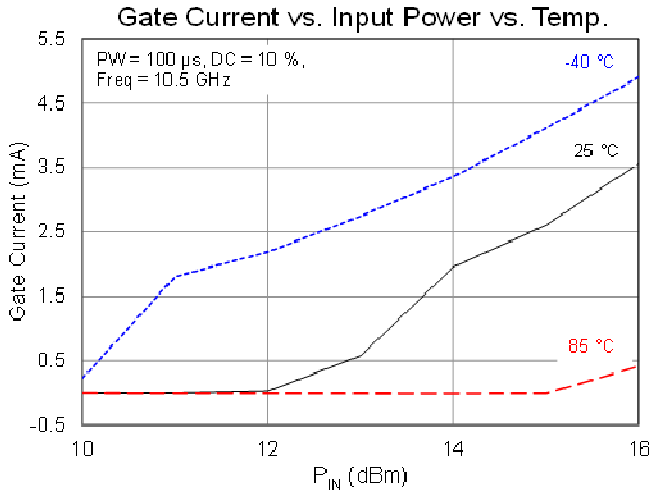








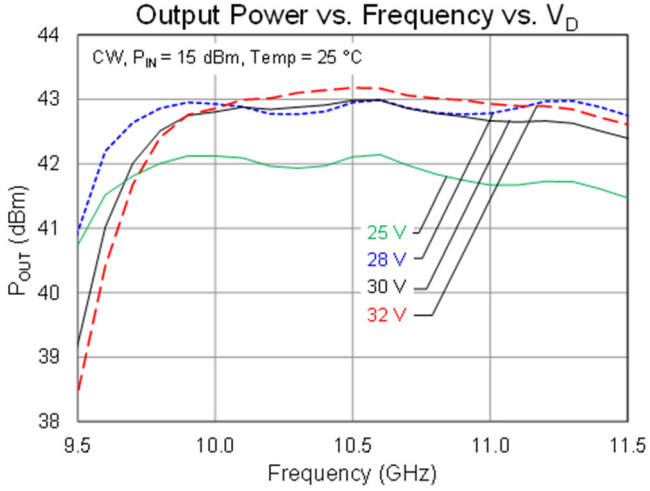




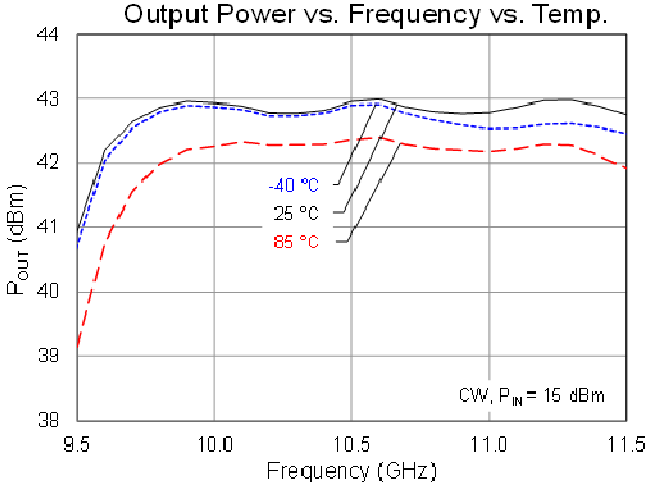
Performance Plots – Large Signal (CW)

Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.6 V typical.

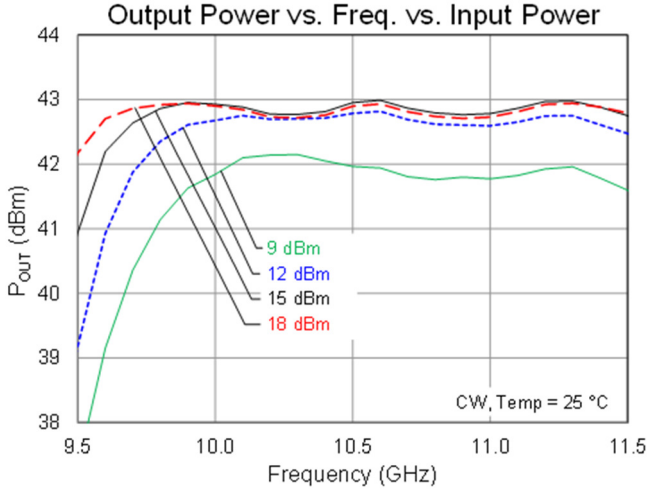
Output Power vs. Frequency vs. V_D



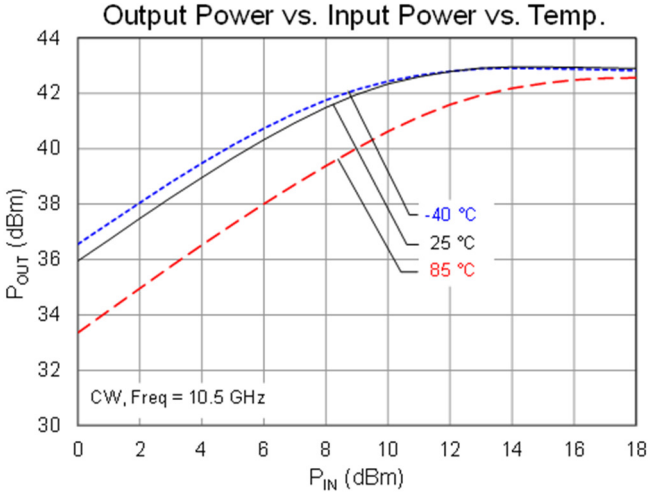
Output Power vs. Frequency vs. Temp.



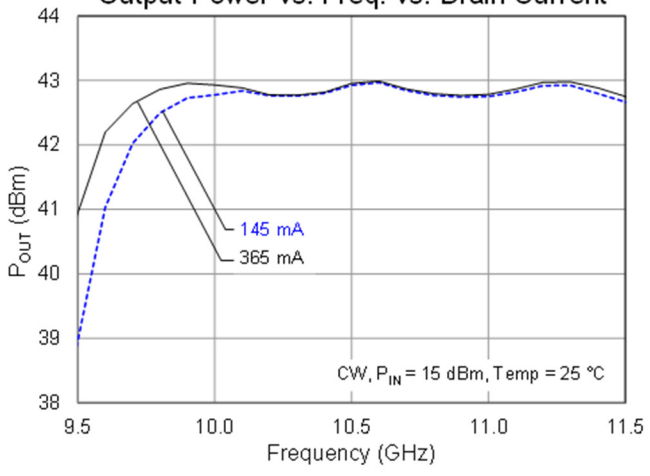
Output Power vs. Freq. vs. Input Power



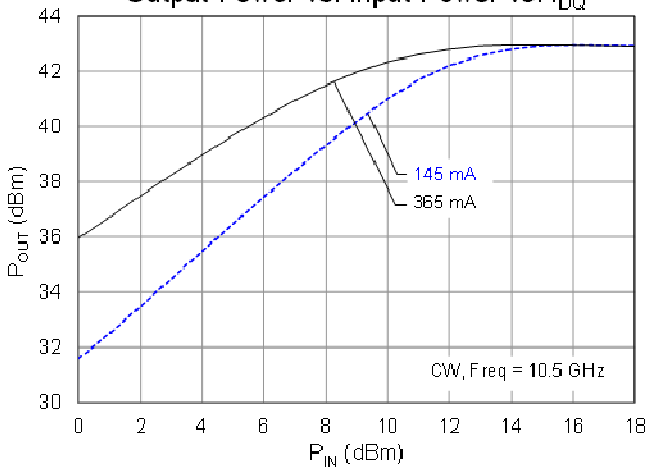
Output Power vs. Input Power vs. Temp.



Output Power vs. Freq. vs. Drain Current



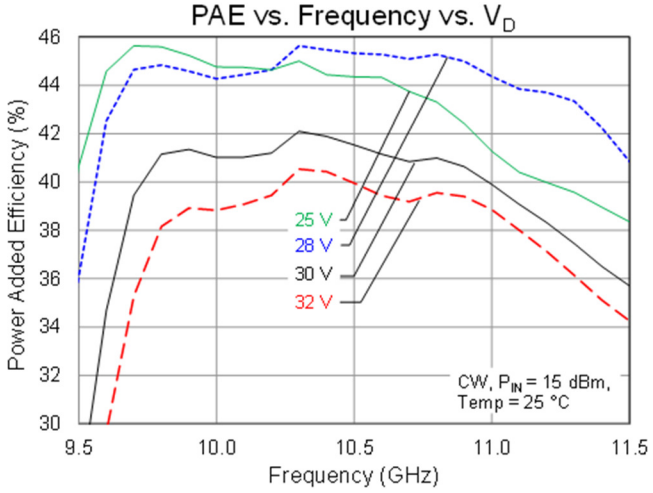
Output Power vs. Input Power vs. I_{DQ}



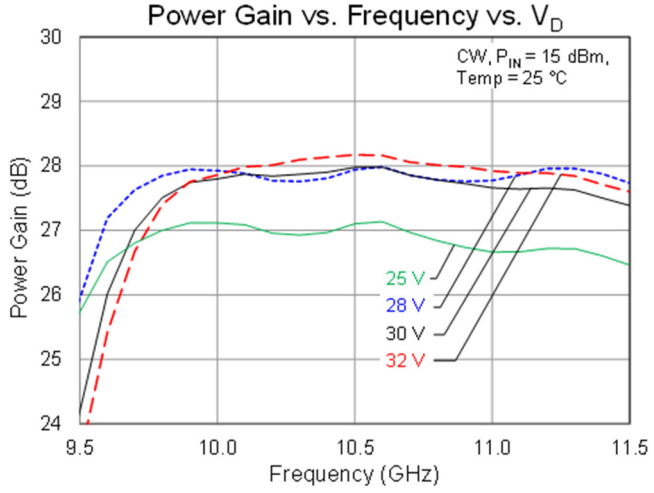
Performance Plots – Large Signal (CW)

Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.6 V typical.

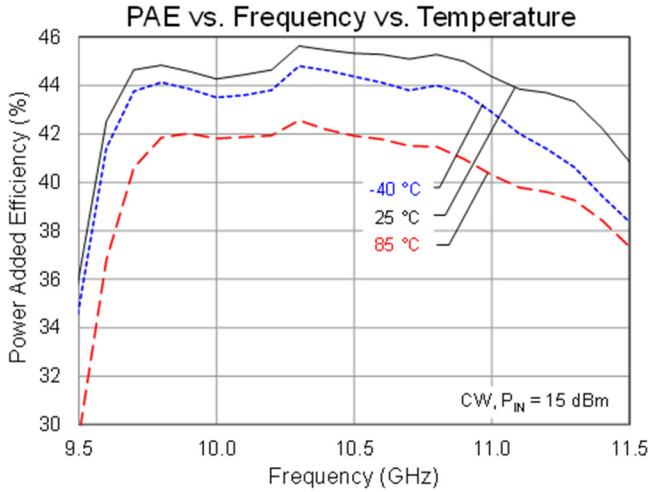
PAE vs. Frequency vs. V_D



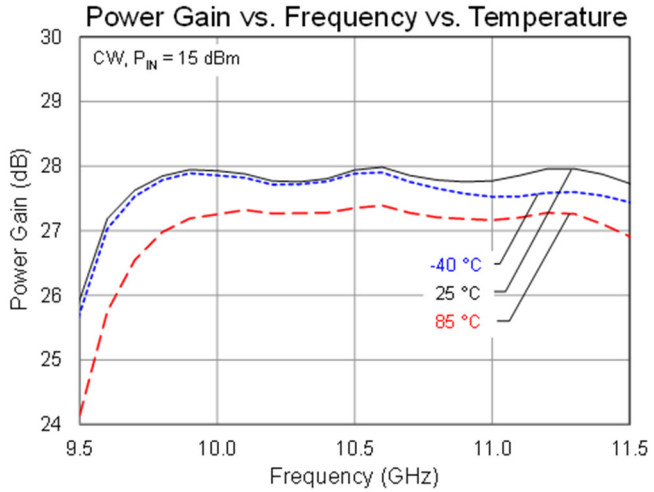
Power Gain vs. Frequency vs. V_D



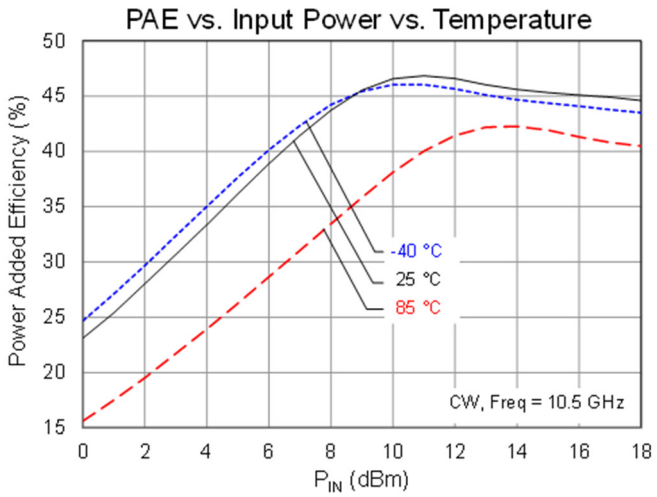
PAE vs. Frequency vs. Temperature



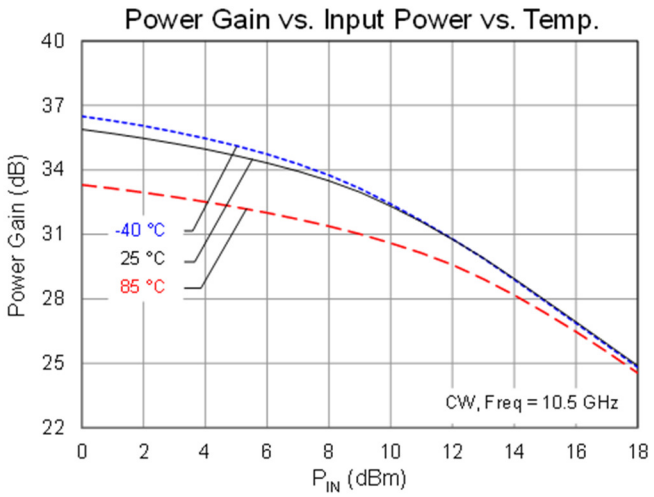
Power Gain vs. Frequency vs. Temperature



PAE vs. Input Power vs. Temperature



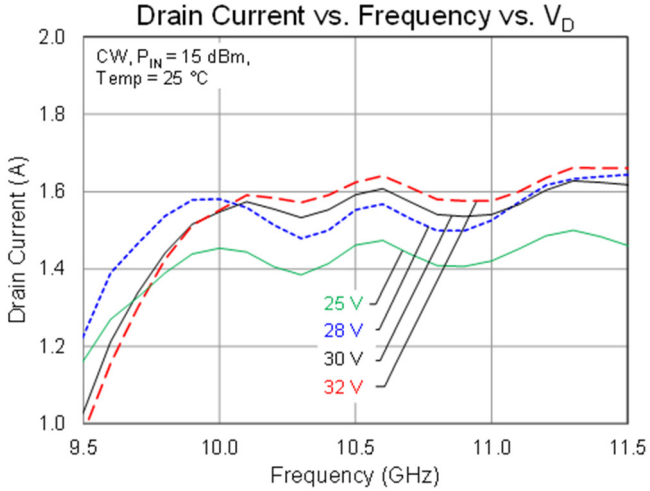
Power Gain vs. Input Power vs. Temp.



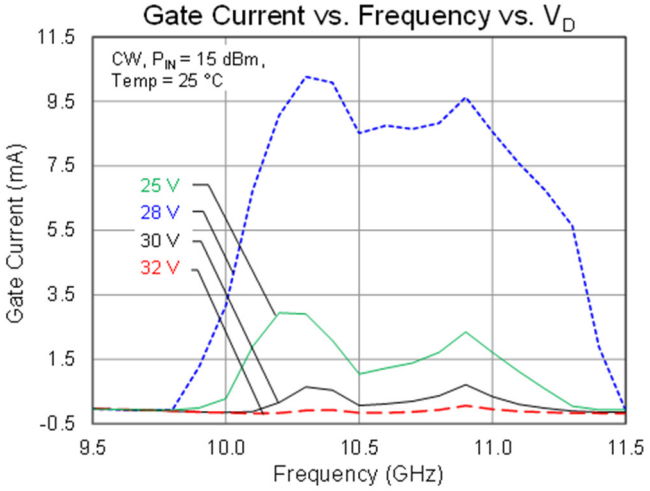
Performance Plots – Large Signal (CW)

Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.6 V typical.

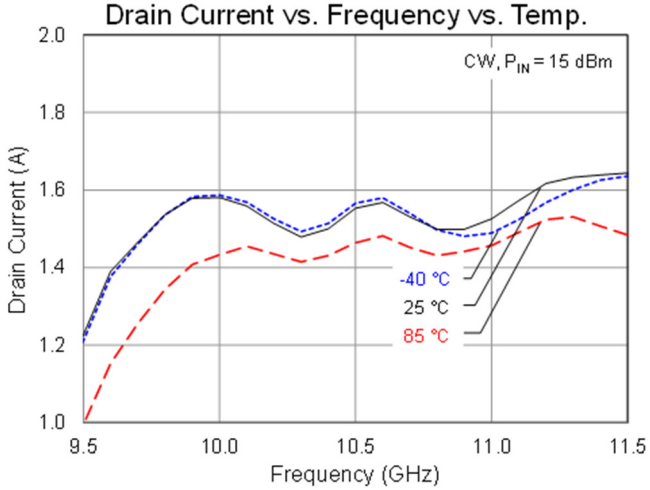
Drain Current vs. Frequency vs. V_D



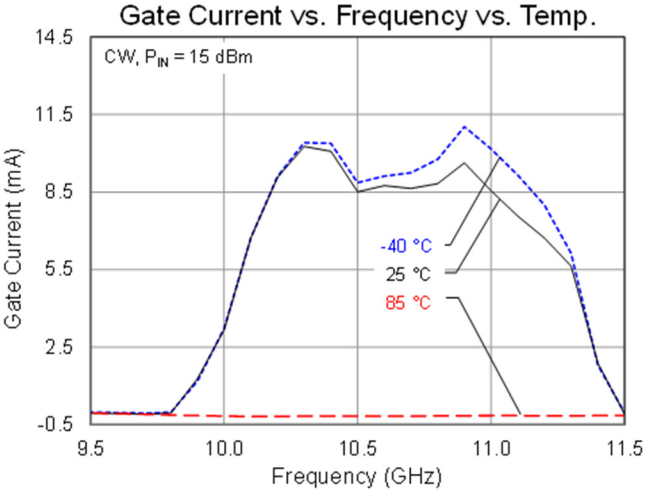
Gate Current vs. Frequency vs. V_D



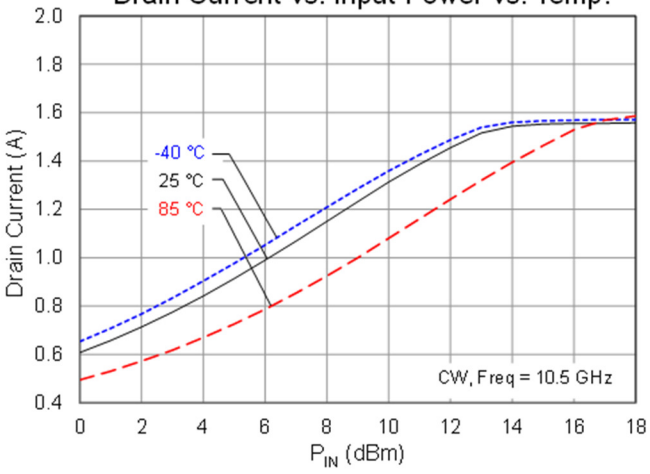
Drain Current vs. Frequency vs. Temp.



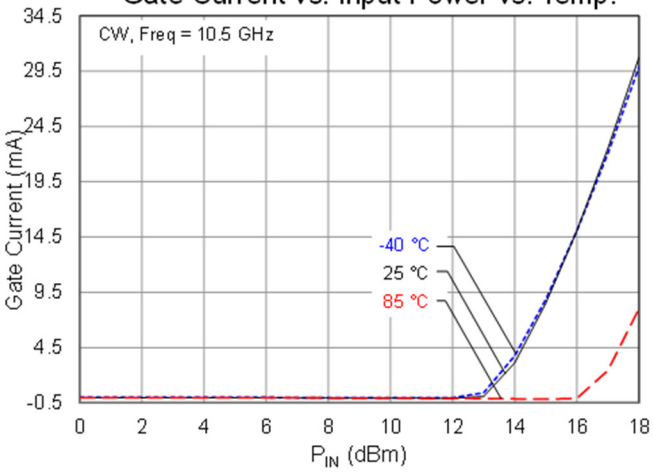
Gate Current vs. Frequency vs. Temp.



Drain Current vs. Input Power vs. Temp.

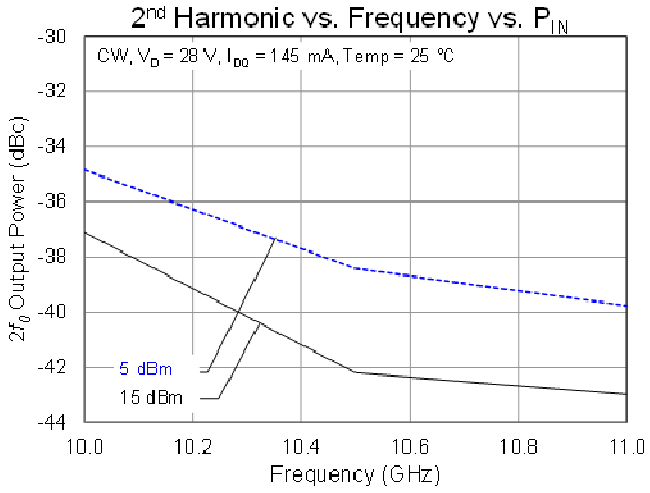


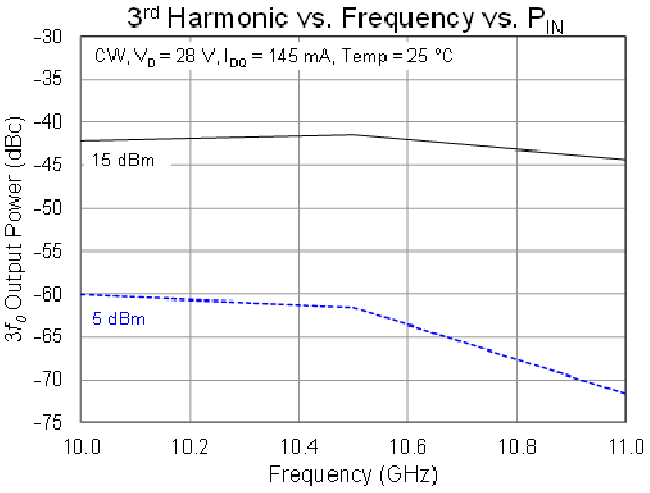
Gate Current vs. Input Power vs. Temp.

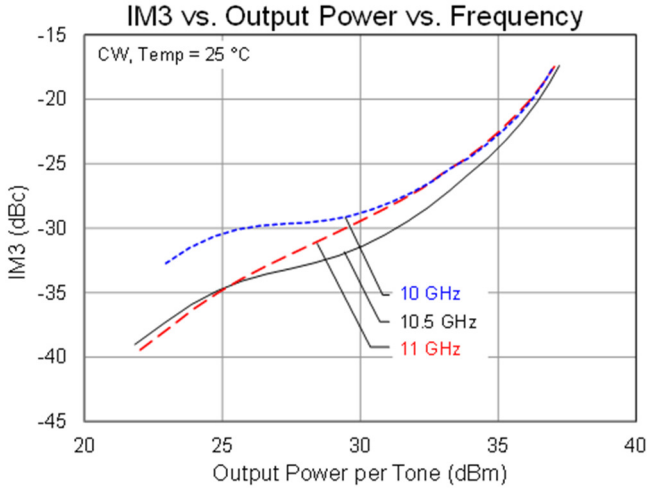


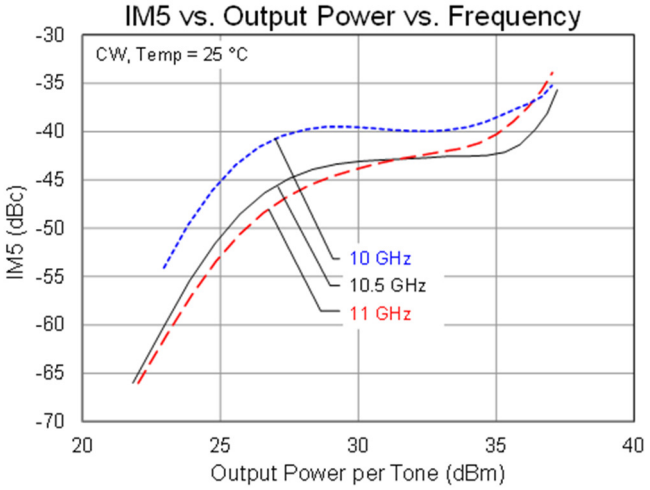
Typical Performance – Linearity

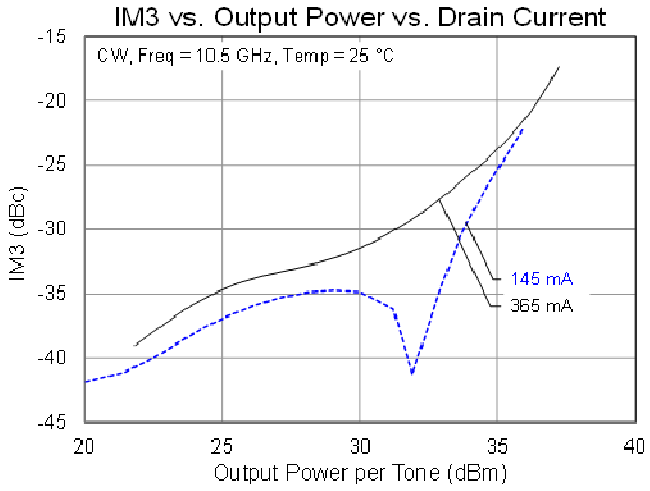
Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.6 V typical.

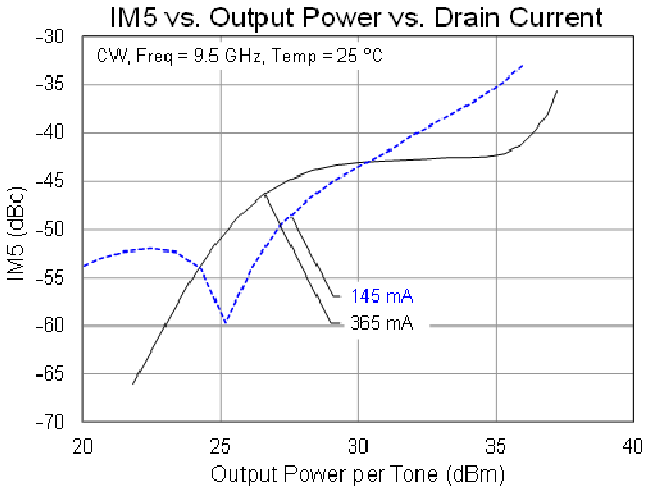








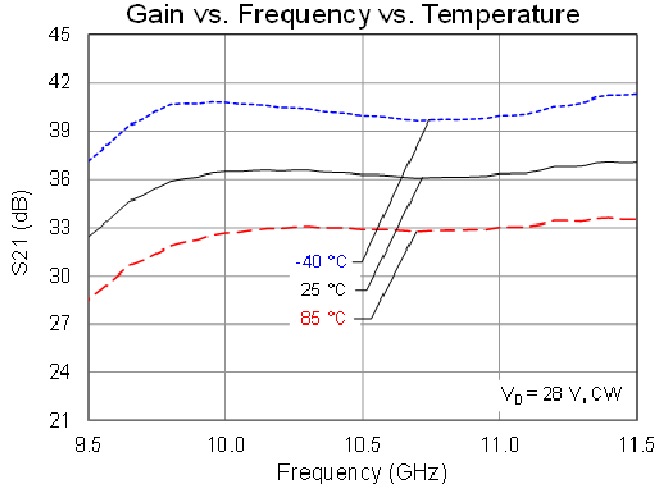




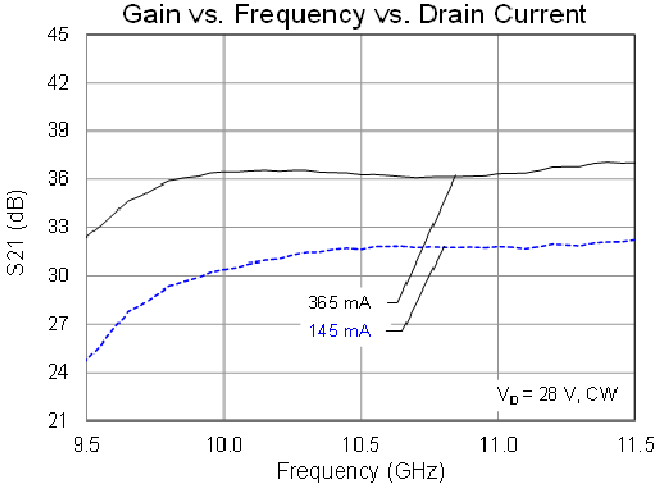
Typical Performance – Small Signal

Conditions unless otherwise specified: V_D = 28 V, I_{DQ} = 365 mA, V_G = -2.6 V typical.

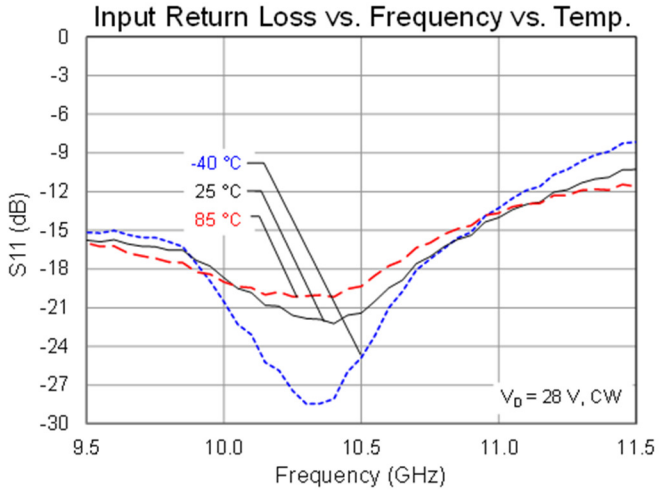
Gain vs. Frequency vs. Temperature



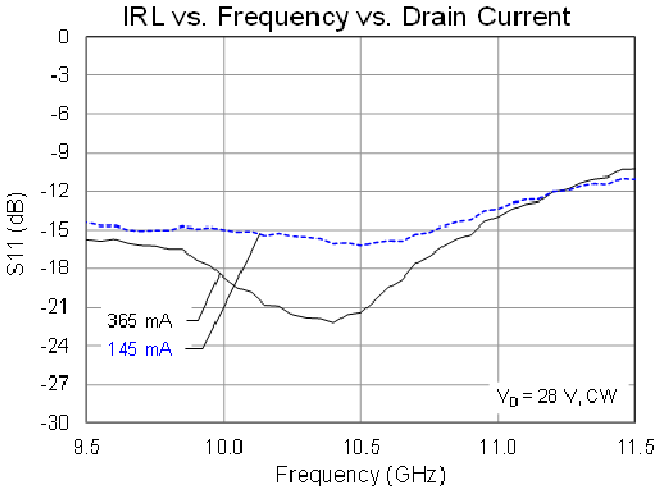
Gain vs. Frequency vs. Drain Current



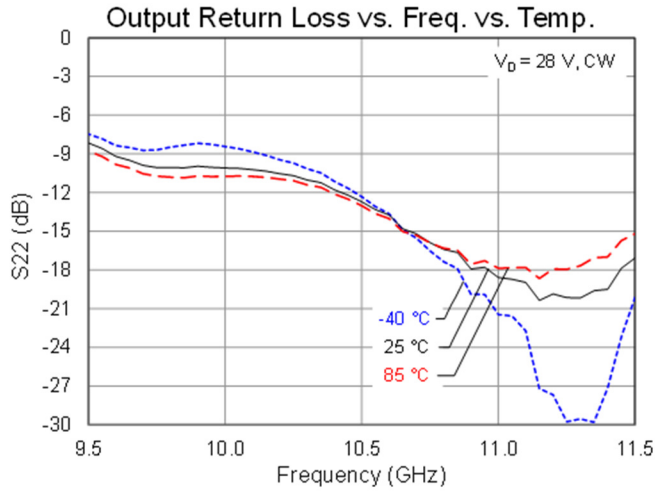
Input Return Loss vs. Frequency vs. Temp.



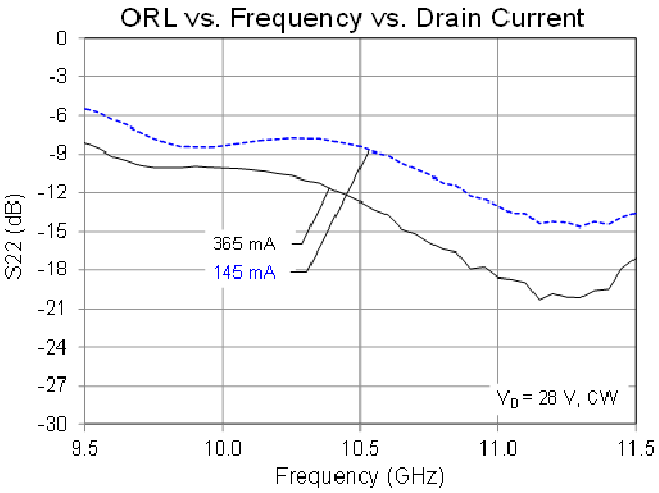
IRL vs. Frequency vs. Drain Current



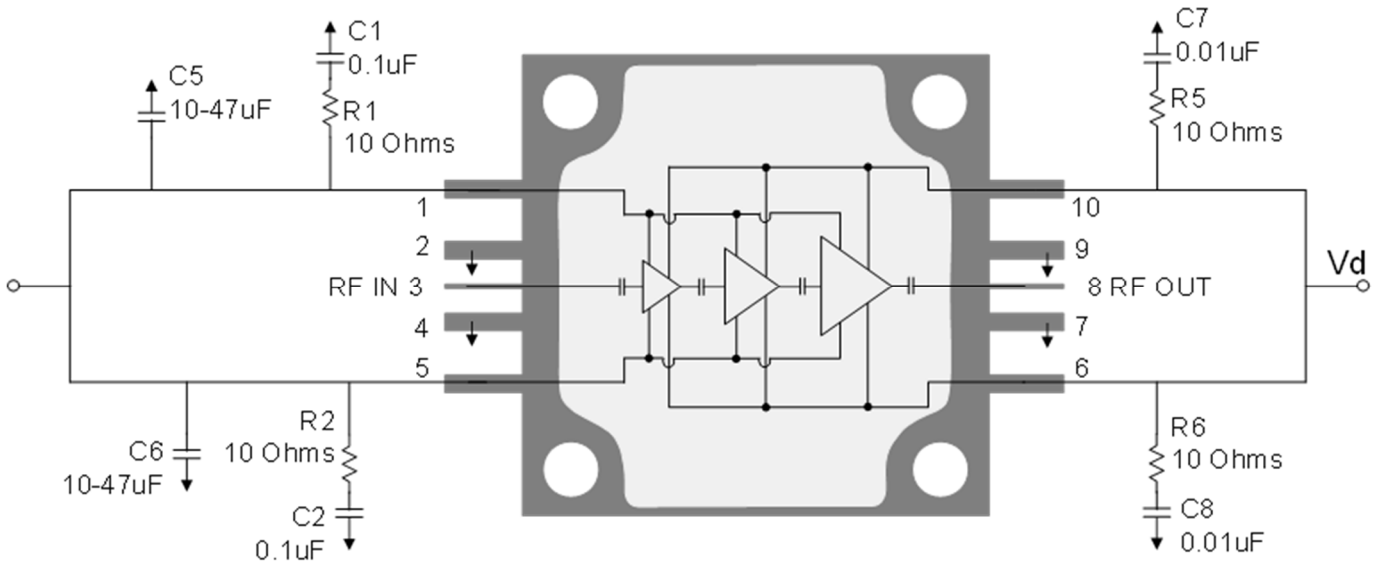
Output Return Loss vs. Freq. vs. Temp.



ORL vs. Frequency vs. Drain Current



Applications Information and Pin Layout



Bias Up Procedure

1. Set I_D limit to 3 A, I_G limit to 14 mA
2. Apply –5 V to V_G
3. Apply +28 V to V_D; ensure I_{DQ} is approx. 0 mA
4. Adjust V_G until I_{DQ} = 365 mA (V_G ~ –2.6 V Typ.).
5. Turn on RF supply

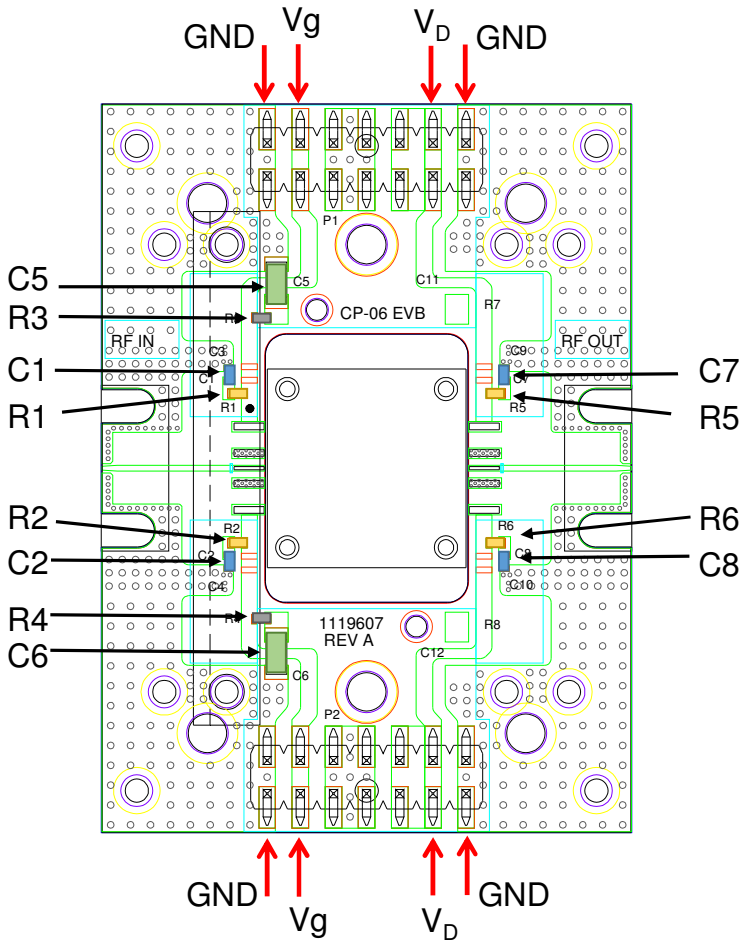
Bias Down Procedure

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}	Output; 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}	Input; matched to 50 Ω; DC blocked

Evaluation Board (EVB)



NOTES:
(1) Both Top and Bottom Vd and Vg must be biased.

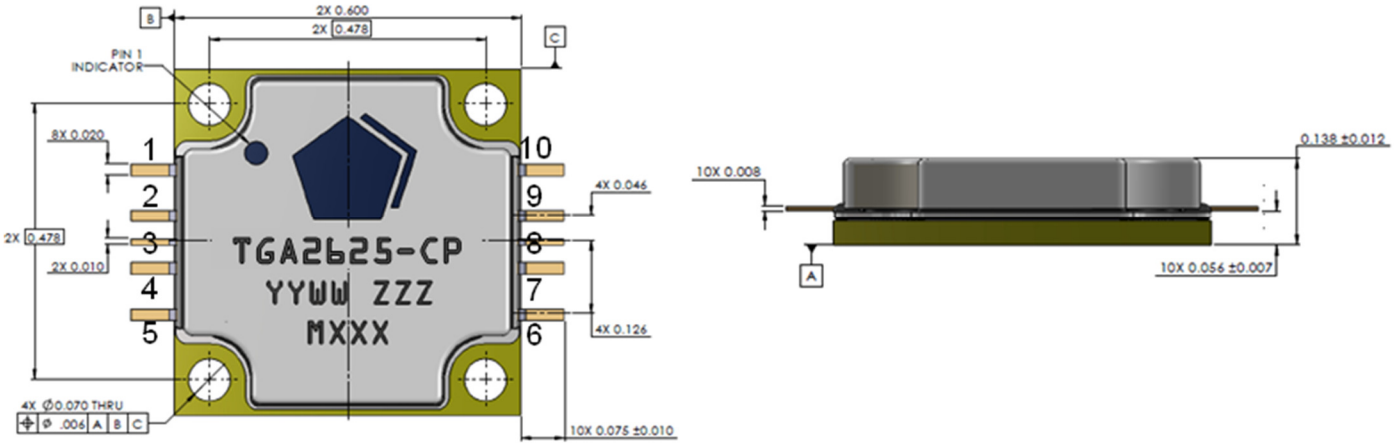
Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C1, C2	0.1 uF	Cap, 0402, 50 V, 10%, X7R	Various	
C5, C6	10-47 uF	Cap, 1206, 50 V, 20%, X5R (10v is OK)	Various	
C7, C8	0.01 uF	Cap, 0402, 50V, 10%, X7R	Various	
R1, R2, R5, R6	10 Ohms	Res, 0402, 50V, 5%	Various	
R3, R4	0 Ohms	Res, 0402, jumper required for the above EVB design	Various	

Assembly Notes

1. Clean the board or module with alcohol. Allow it to dry fully.
2. Screws are recommended for mounting the TGA2625-CP to the T-Carrier.
3. To improve the thermal and RF performance, we recommend the following:
   a. Apply thermal compound (Arctic Silver) 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 other thermal interface material between the heat sink and the T-Carrier.
4. Apply solder to each pin of the TGA2625-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:
2625: Part number
YY: Part Assembly year
WW: Part Assembly week
ZZZ: Serial Number
MXXX: Batch ID