



TGA3042-SM

7 – 10.5 GHz 4.5 W GaN Power Amplifier

Product Description

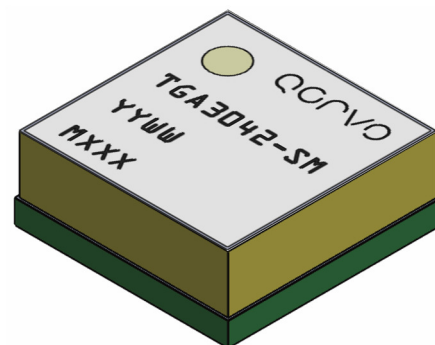
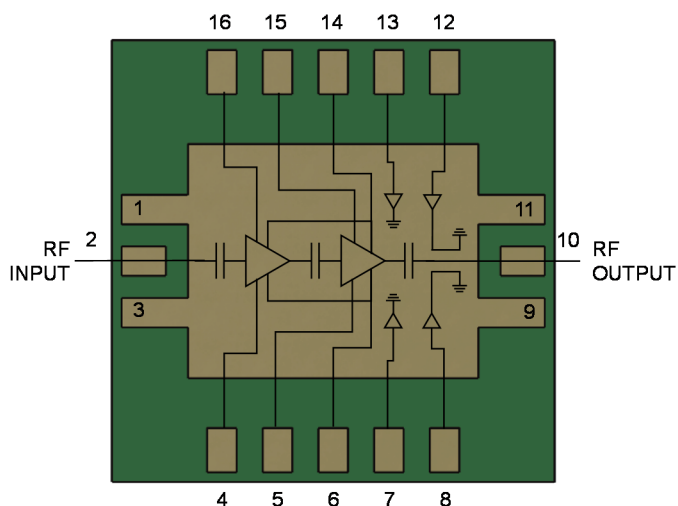
Qorvo's TGA3042-SM is a packaged high power MMIC amplifier fabricated on Qorvo's production 0.15um GaN on SiC process (QGaN15). The TGA3042-SM operates from 7 – 10.5 GHz and typically provides 4.5 W saturated output power with power-added efficiency of 38.5% and large-signal gain of 23.5 dB. This combination of wideband performance provides the flexibility designers are looking for to improve system performance while reducing size and cost.

The TGA3042-SM is matched to 50Ω with integrated DC blocking capacitors on both RF I/O ports simplifying system integration. The wideband performance makes it ideally suited in support of multiple radar and communication bands.

Lead-free and RoHS compliant.

Evaluation boards are available upon request.

Functional Block Diagram



Product Features

- Frequency Range: 7 – 10.5 GHz
- P_{OUT} : 36.5 dBm at $P_{IN} = 13$ dBm
- PAE: 38.5 % at $P_{IN} = 13$ dBm
- Large Signal Gain: 23.5 dB at $P_{IN} = 13$ dBm
- Small Signal Gain: 32 dB
- Bias: $V_D = 20$ V, $I_{DQ} = 200$ mA, $V_G = -2.2$ V Typical
- Package Dimensions: 4.50 x 4.50 x 1.74 mm

Performance is typical across frequency. Please reference electrical specification table and data plots for more details.

Applications

- Radar
- Communications

Ordering Information

Part No.	ECCN	Description
TGA3042-SM	EAR99	7 – 10.5 GHz 4.5 W GaN Power Amplifier



TGA3042-SM

7 – 10.5 GHz 4.5 W GaN Power Amplifier

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	29.5 V
Gate Voltage Range (V_G)	–8 to 0 V
Drain Current (I_D)	720 A
Gate Current (I_G)	See chart pg. 13
Power Dissipation (P_{DISS}), 85 °C	15.4 W
Input Power (P_{IN}), CW, 50 Ω , $V_D=20$ V, $I_{DQ}=200$ mA, 85 °C	23 dBm
Input Power (P_{IN}), CW, VSWR 3:1, $V_D=20$ V, $I_{DQ}=200$ mA 85 °C	23 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.

Electrical Specifications

Parameter		Min	Typ	Max	Units
Operational Frequency Range		7		10.5	GHz
Output Power ($P_{in} = 13$ dBm)	7.0 GHz 9.0 GHz 10.5 GHz		36.3 36.5 35.9		dBm dBm dBm
Power Added Efficiency ($P_{in} = 13$ dBm)	7.0 GHz 9.0 GHz 10.5 GHz		41.1 38.9 37.8		% % %
3 rd Order Intermodulation Level ($P_{OUT}/Tone = 26$ dBm)	7.0 GHz 9.0 GHz 10.5 GHz		–23.2 –24.7 –23.4		dBc dBc dBc
Small Signal Gain	7.0 GHz 9.0 GHz 10.5 GHz		33.3 32.9 30.6		dB dB dB
Input Return Loss	7.0 GHz 9.0 GHz 10.5 GHz		12 15 18		dB dB dB
Output Return Loss	7.0 GHz 9.0 GHz 10.5 GHz		9 13 10		dB dB dB
Output Power Temperature Coefficient (25 – 85 °C)			–0.006		dB/°C
Sm. Signal Gain Temperature Coefficient			–0.059		dB/°C

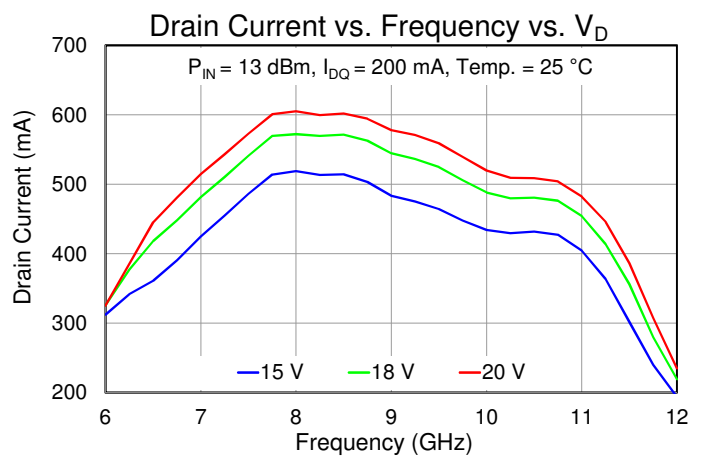
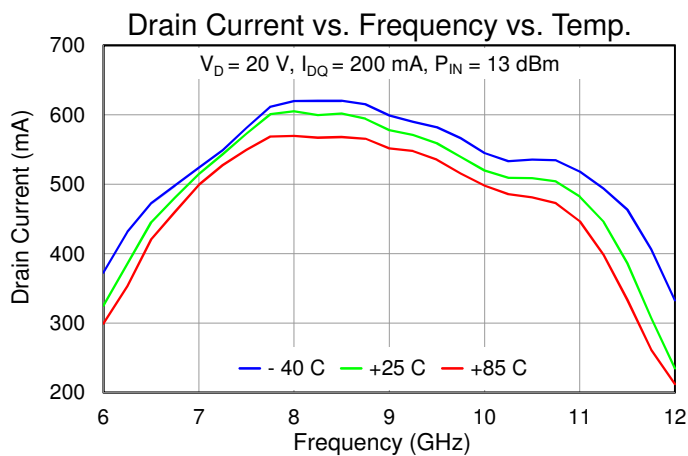
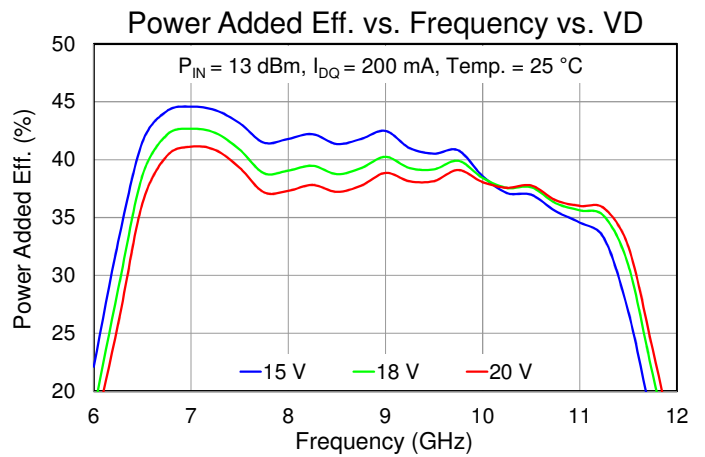
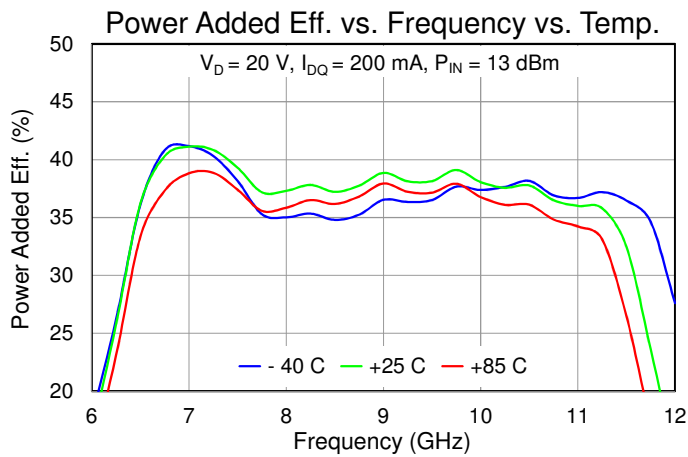
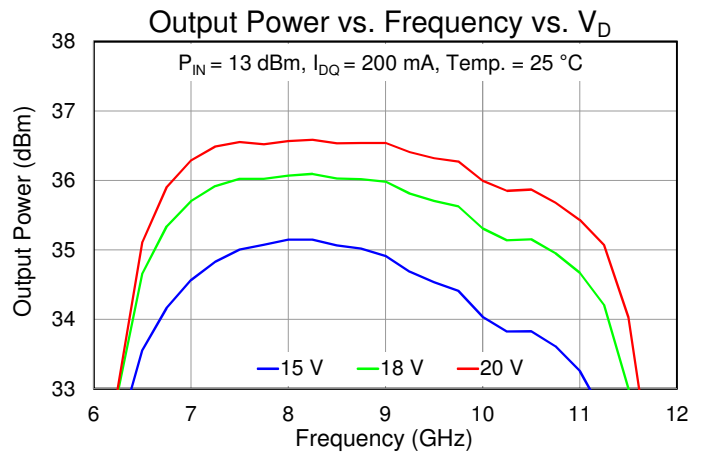
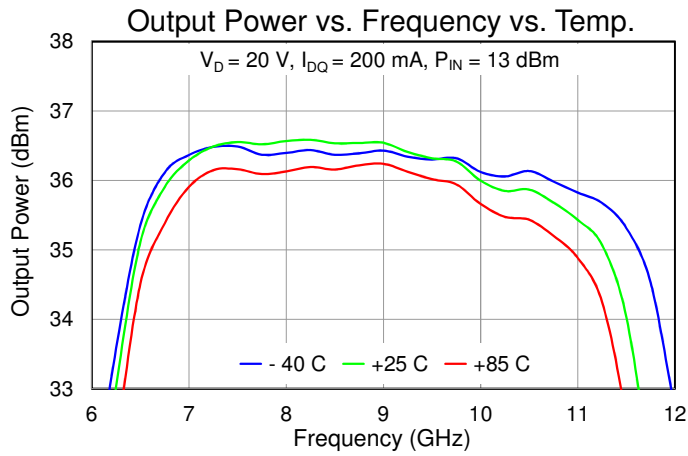
Test conditions unless otherwise noted: 25 °C, $V_D = 20$, $I_{DQ} = 200$ mA, $V_G = -2.2$ V typical.

Recommended Operating Conditions

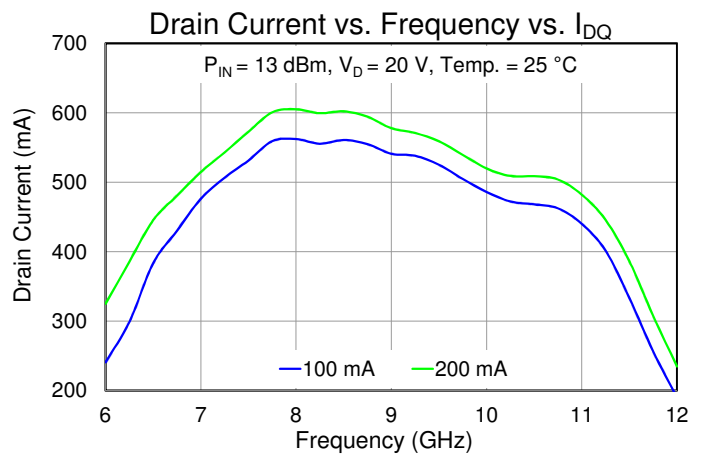
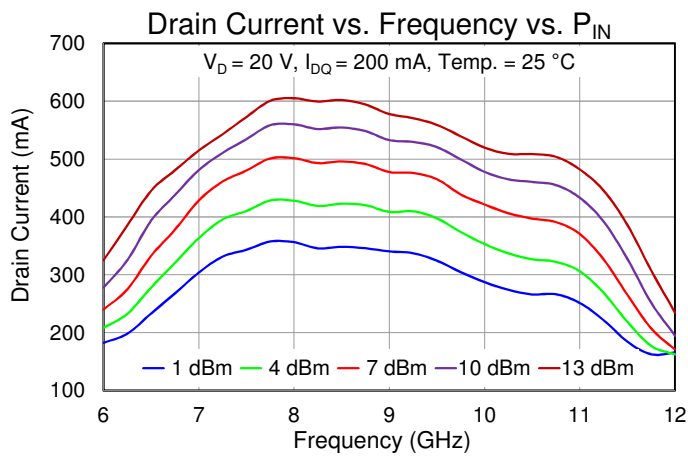
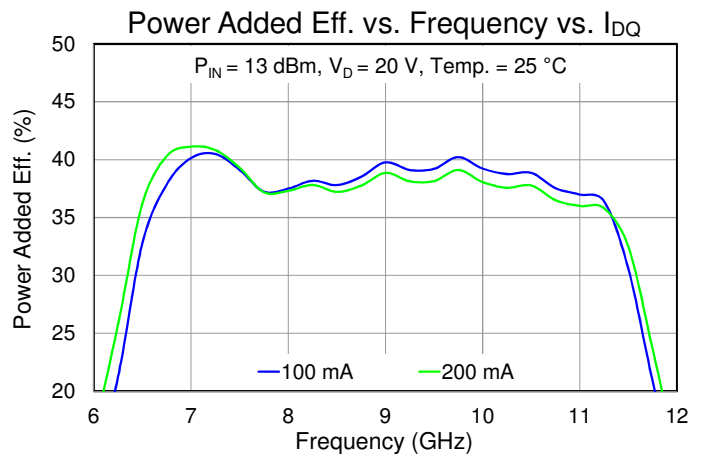
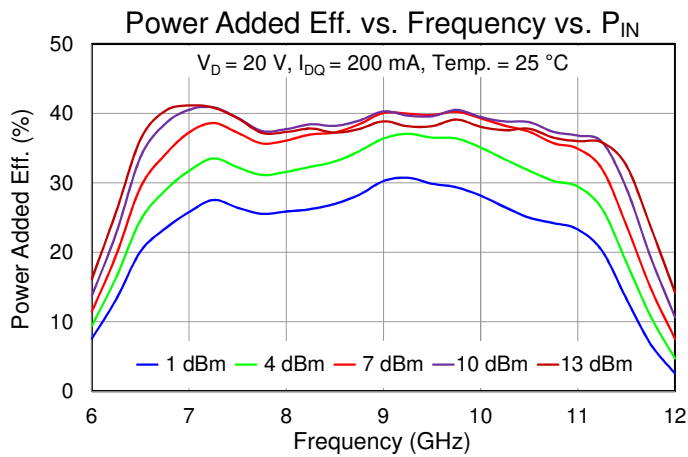
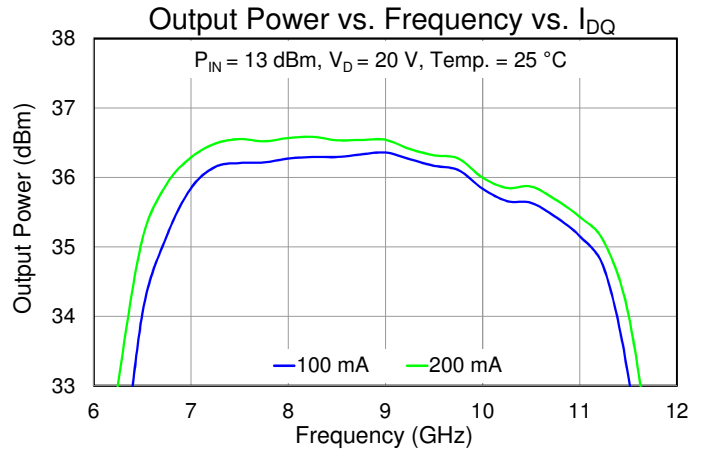
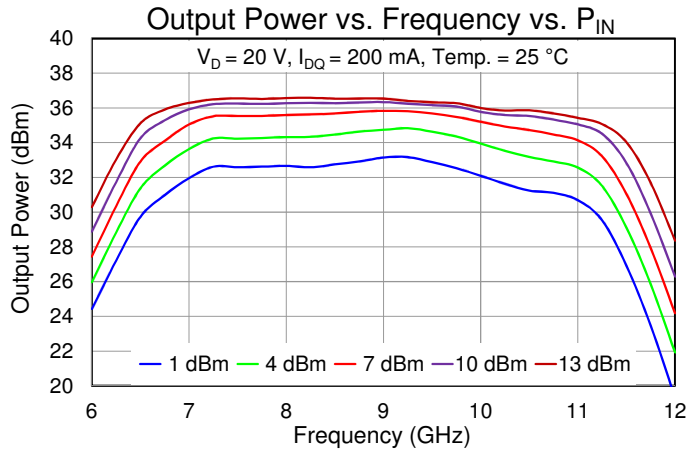
Parameter	Value / Range
Drain Voltage (V_D)	20 V
Drain Current (I_{DQ})	200 mA
Gate Voltage (V_G), Typical	–2.2 V

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

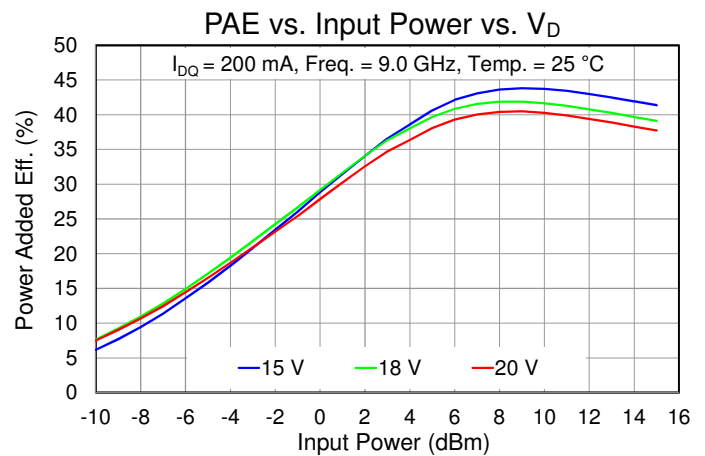
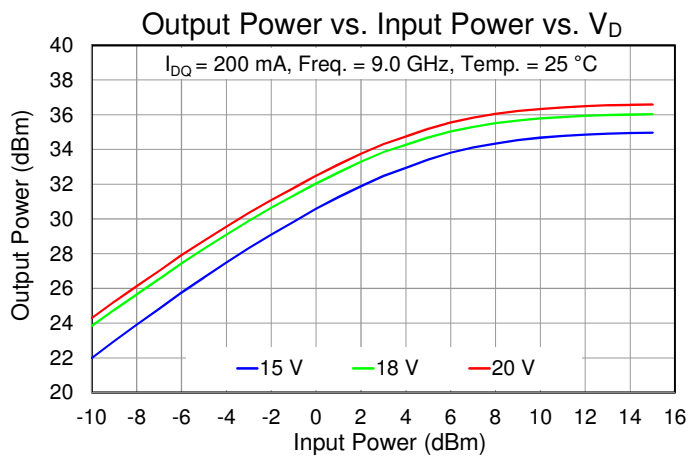
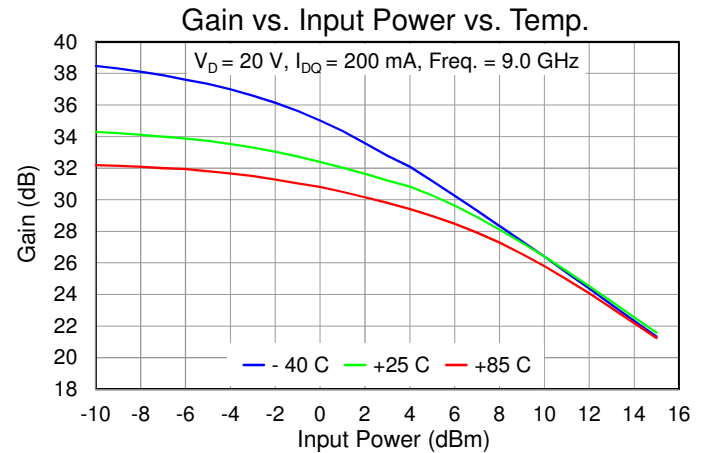
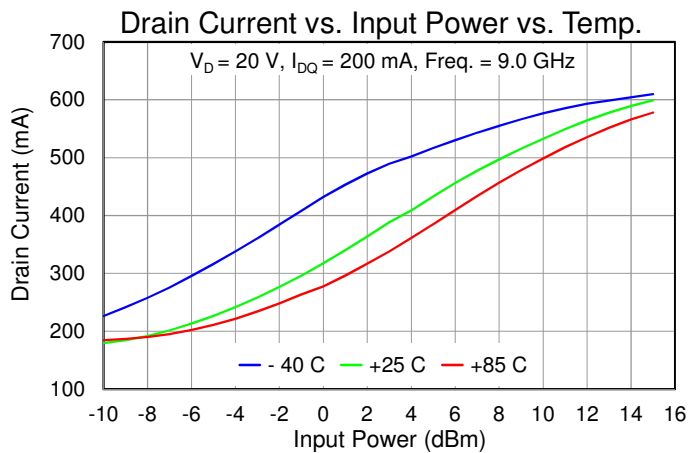
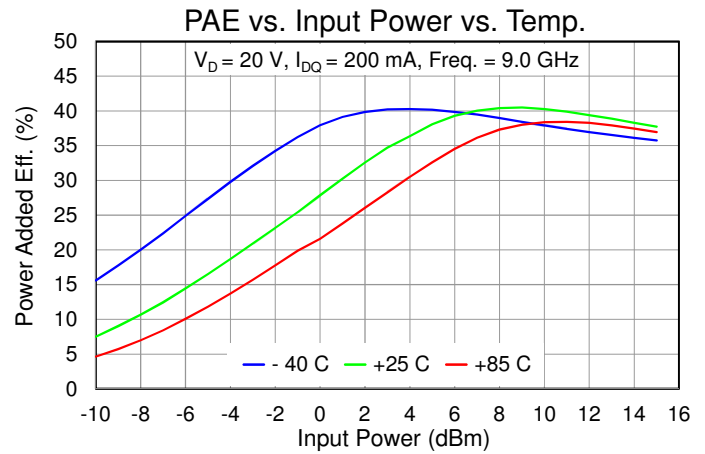
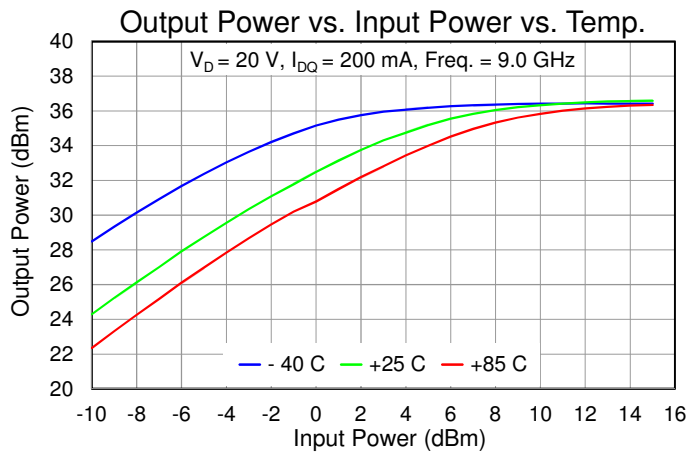
Performance Plots – Large Signal (CW)



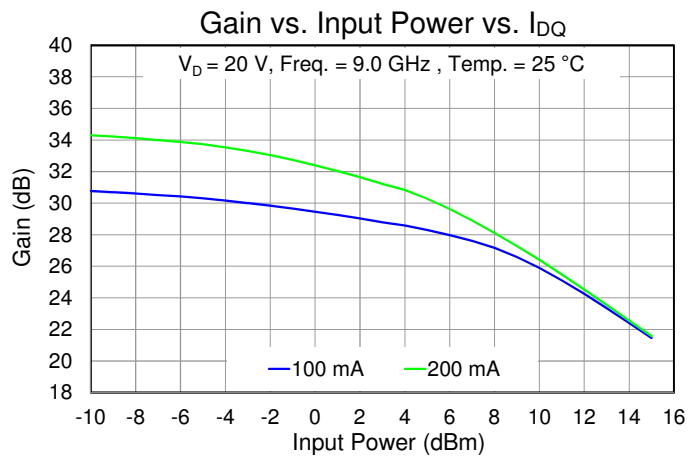
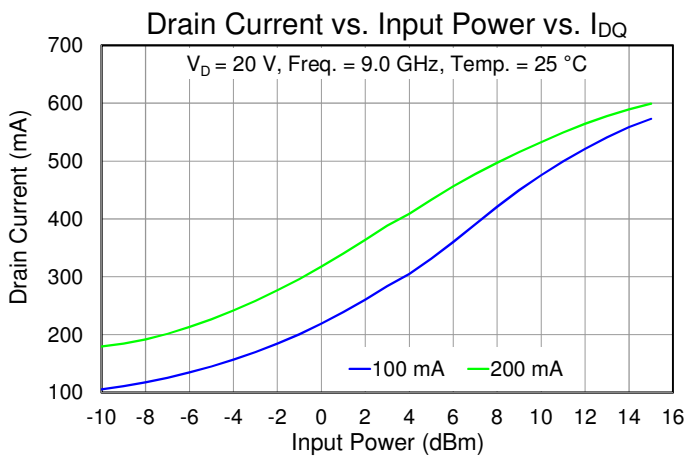
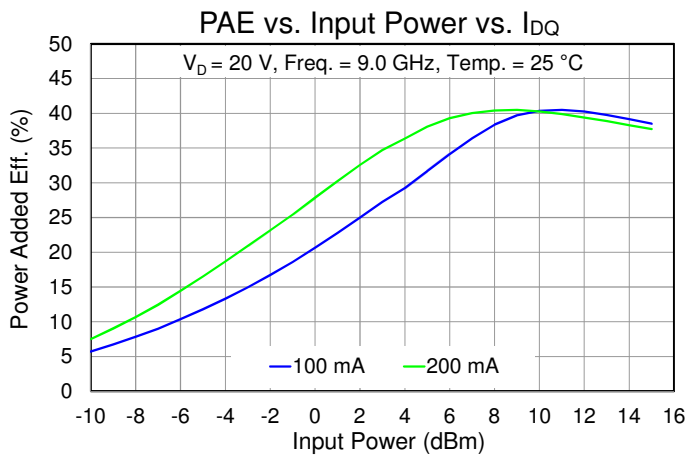
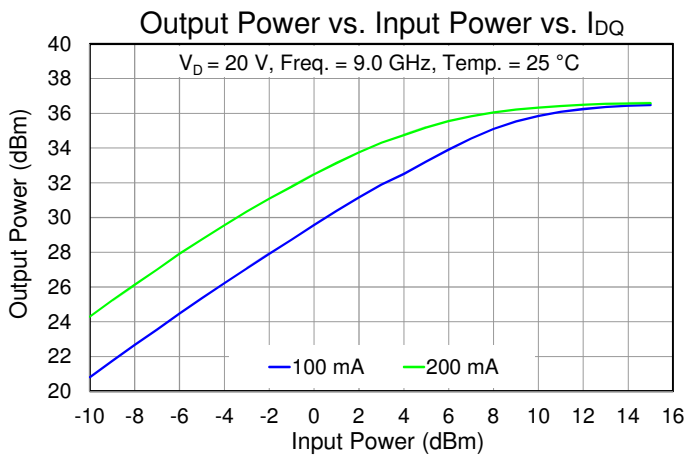
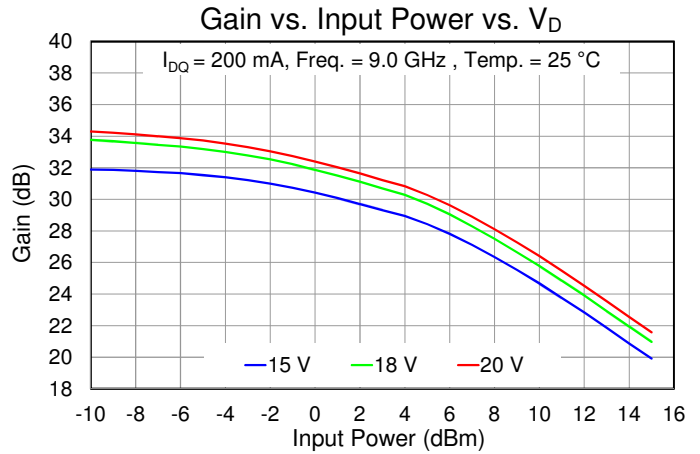
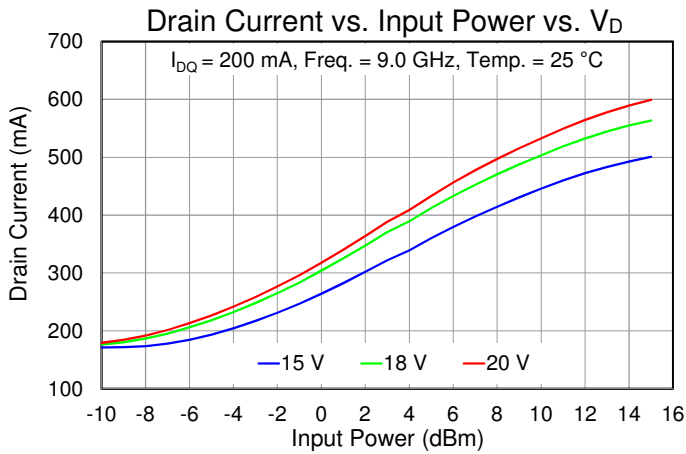
Performance Plots – Large Signal (CW)



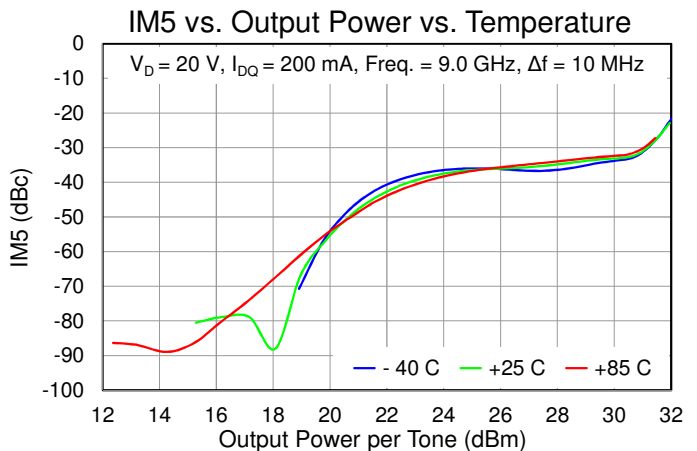
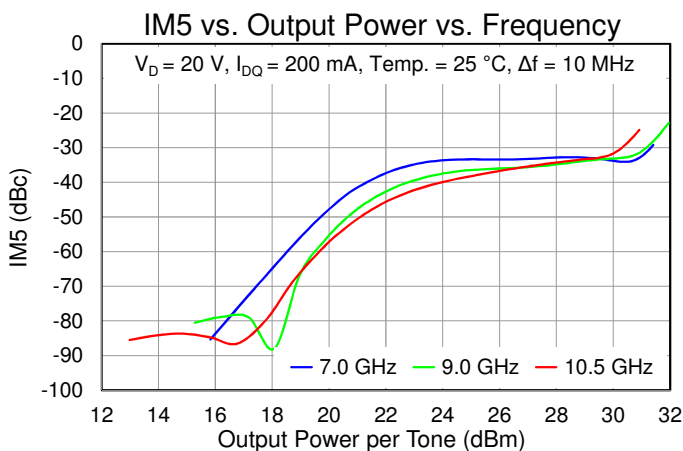
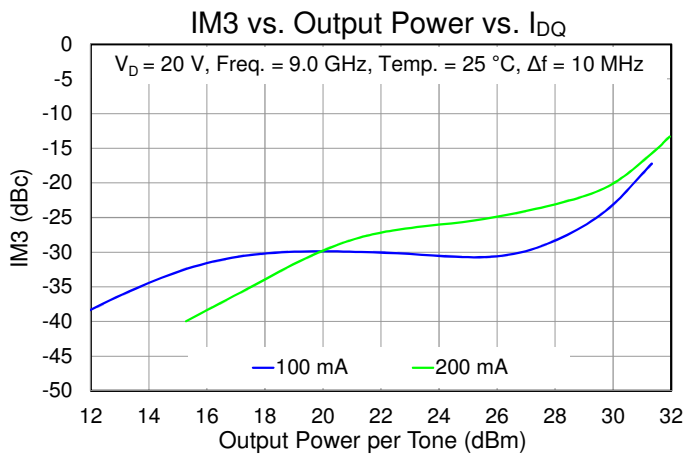
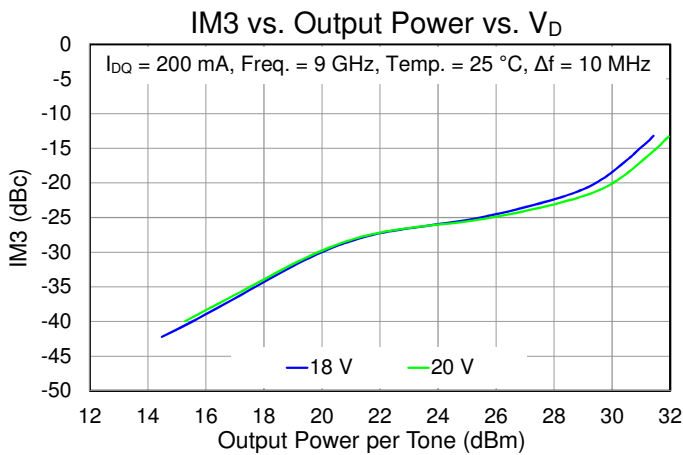
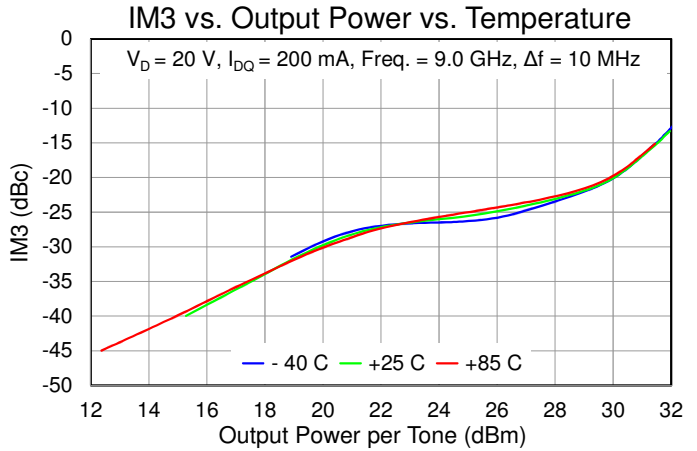
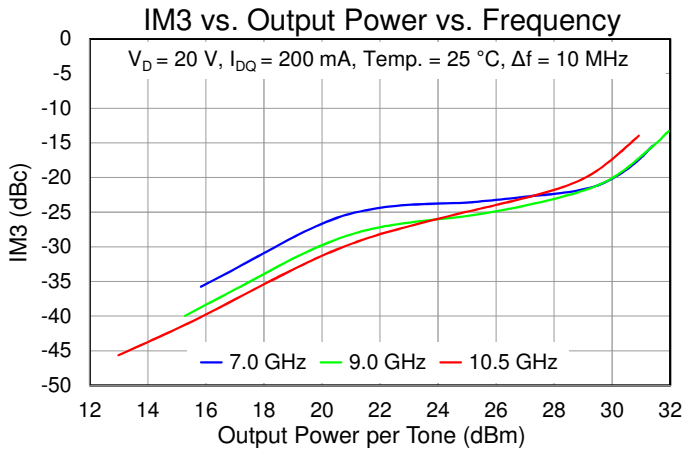
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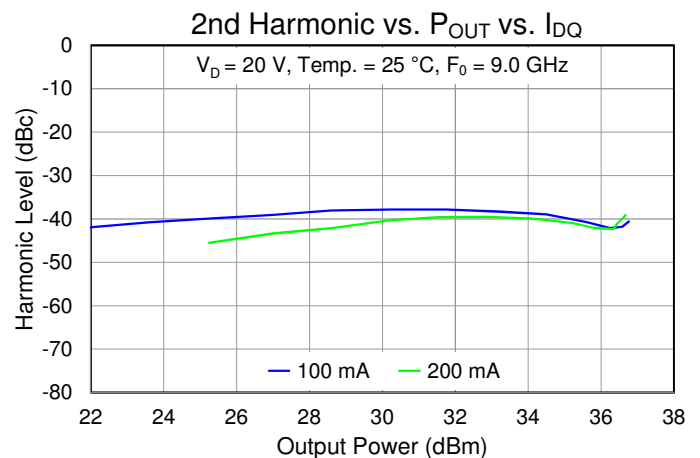
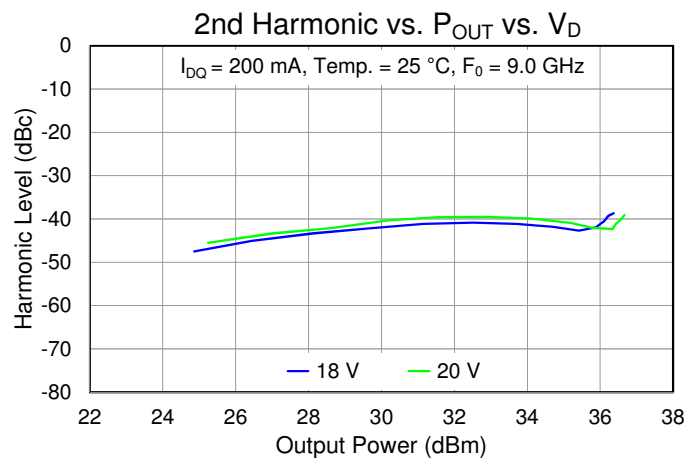
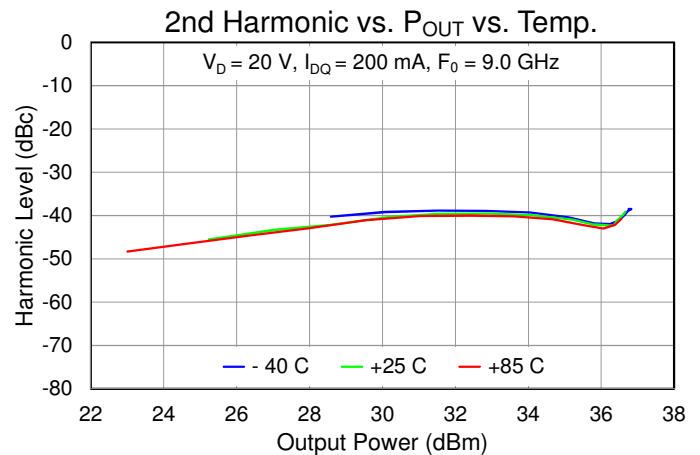
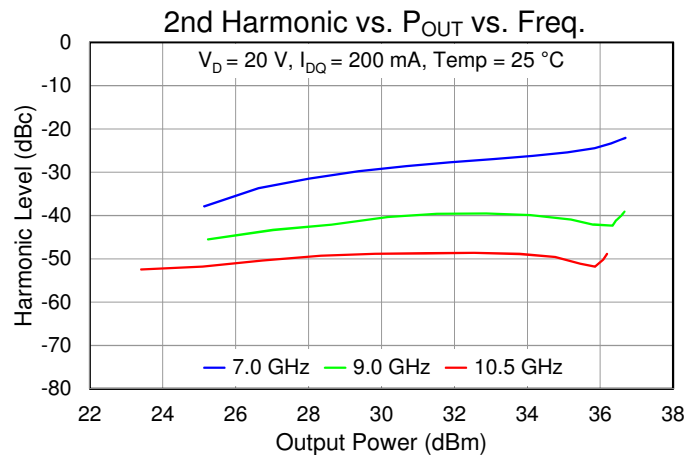
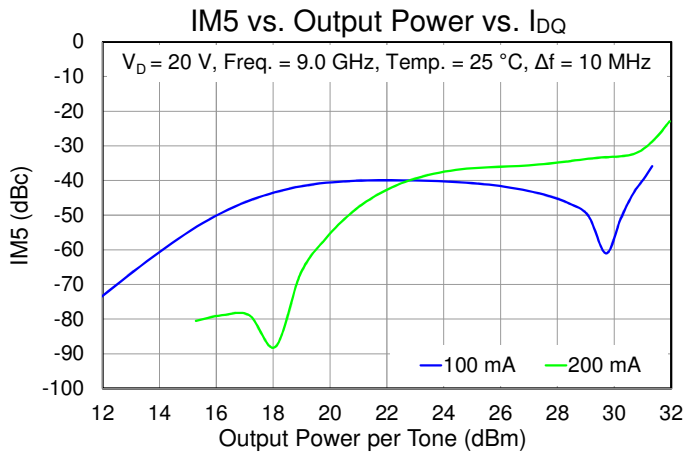
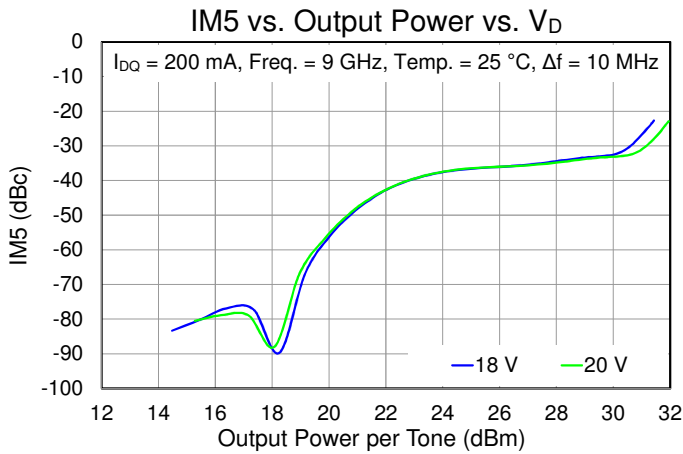
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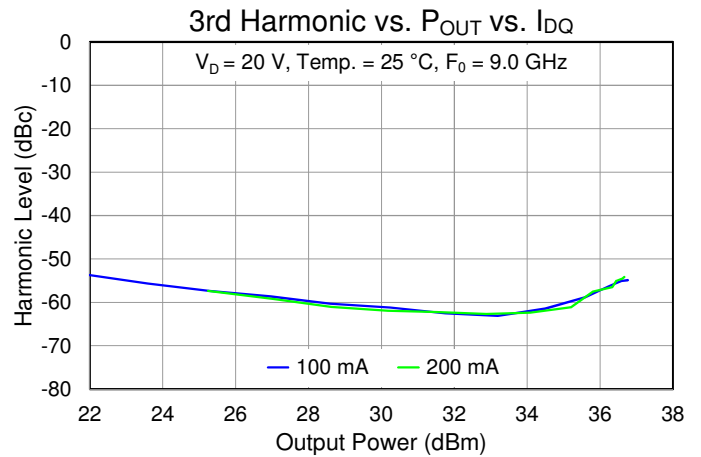
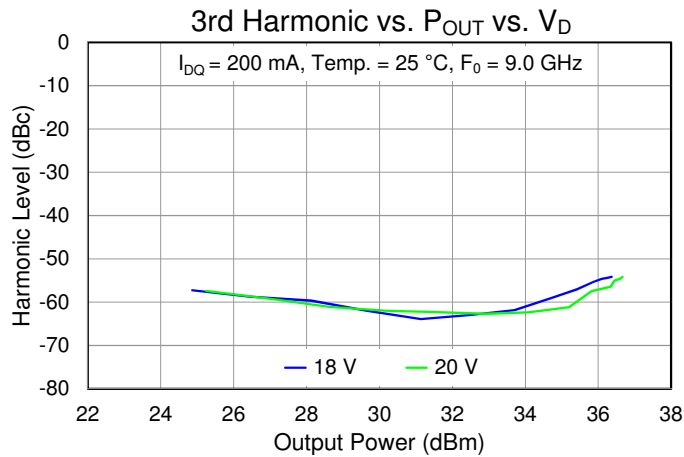
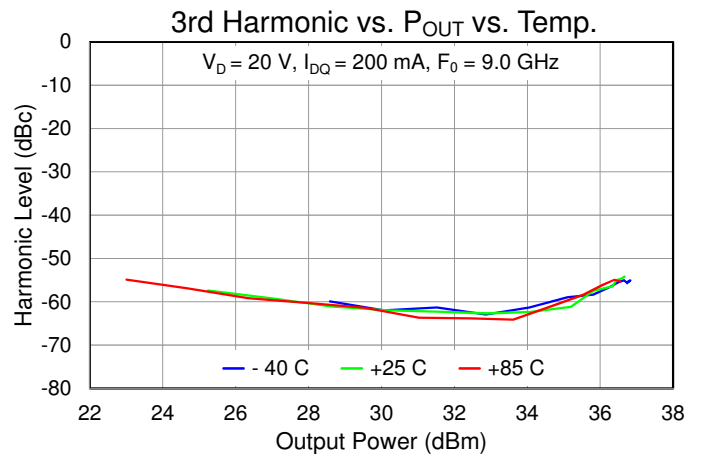
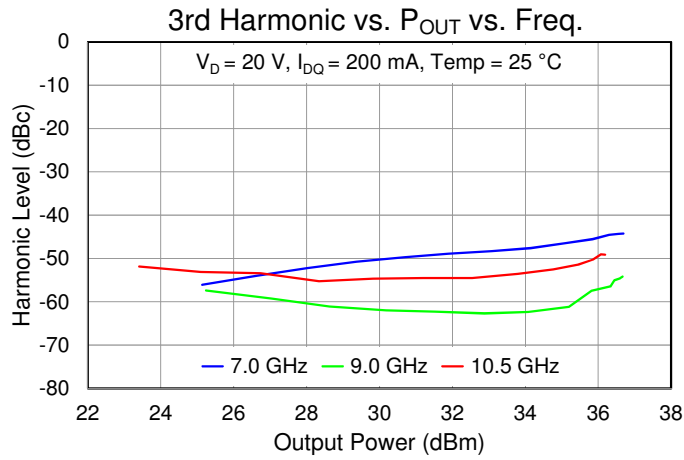
Performance Plots – Linearity



Performance Plots – Linearity, Harmonics

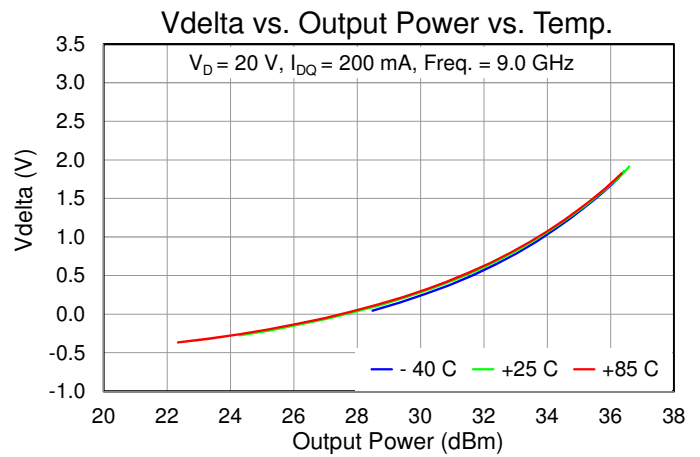
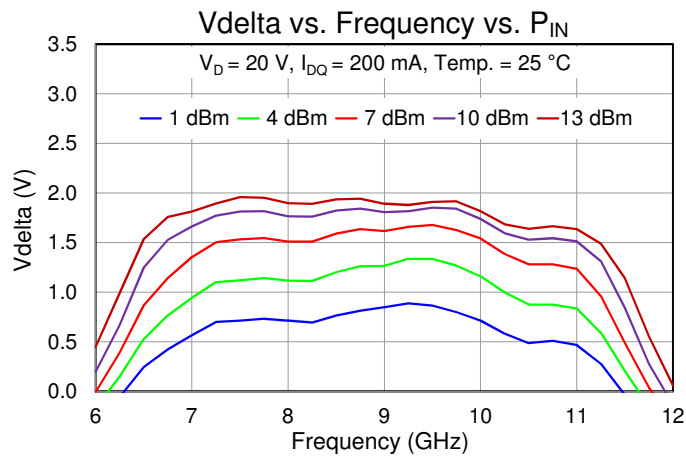
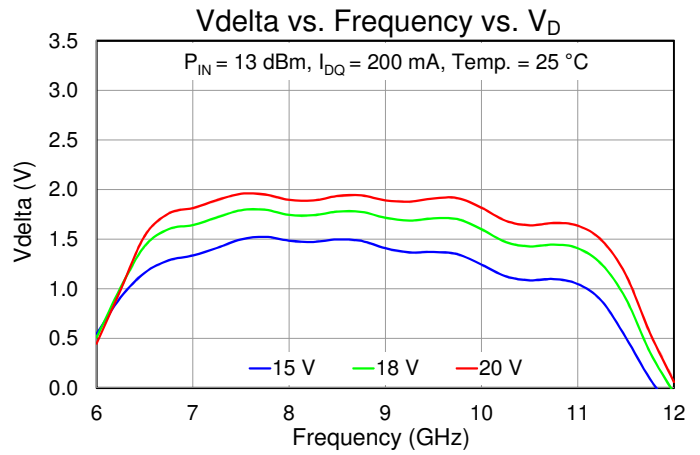
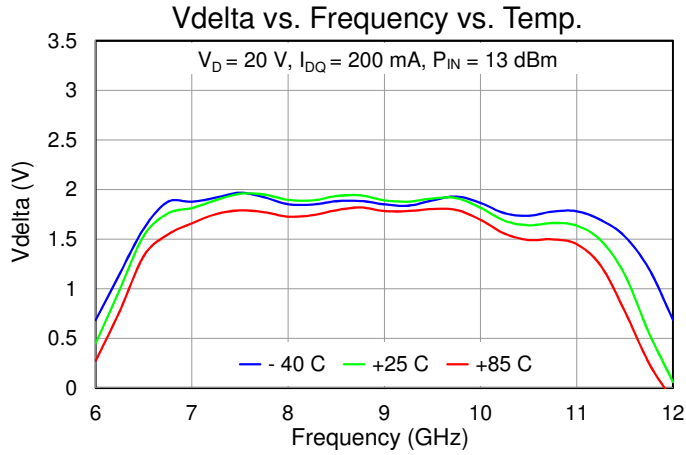


Performance Plots – Harmonics

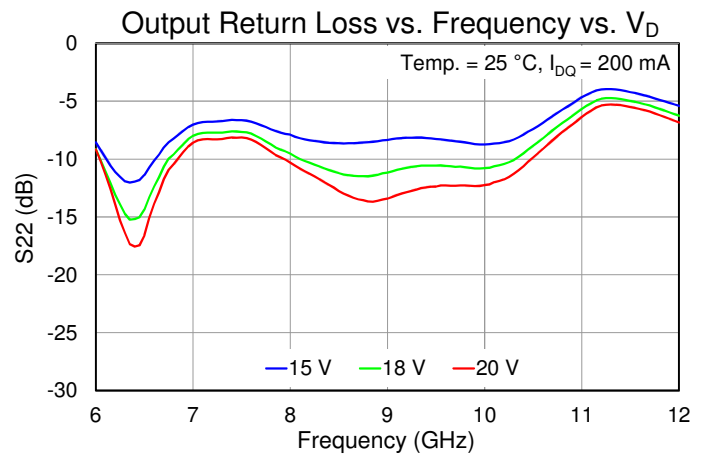
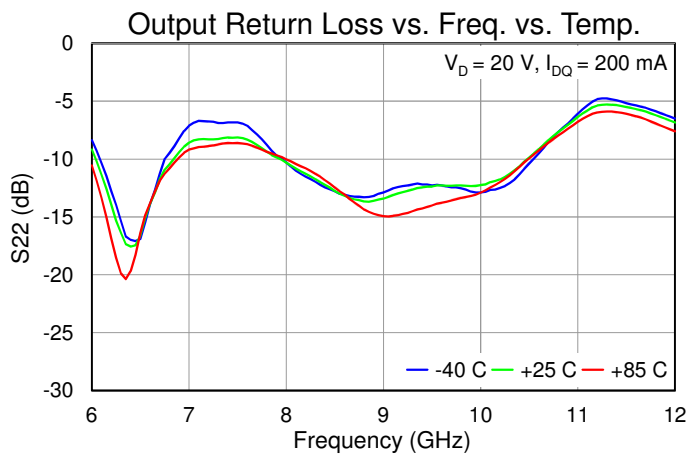
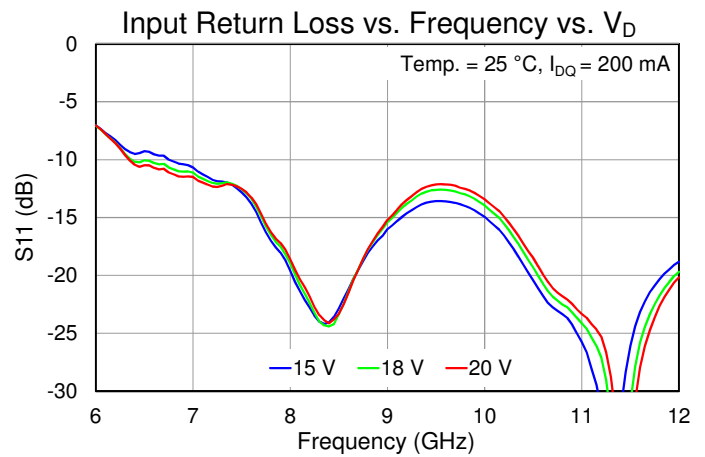
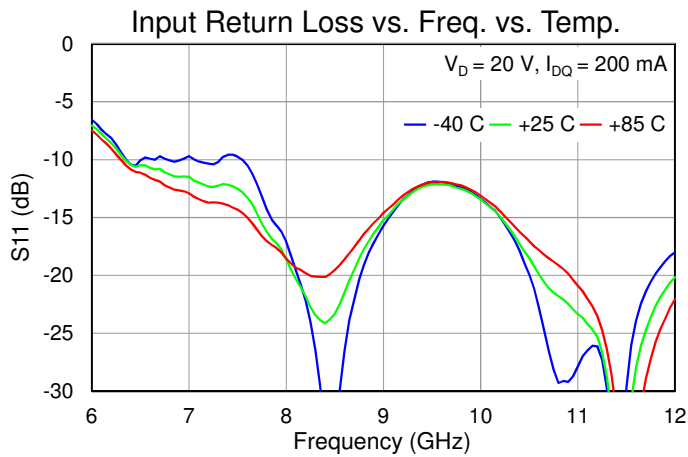
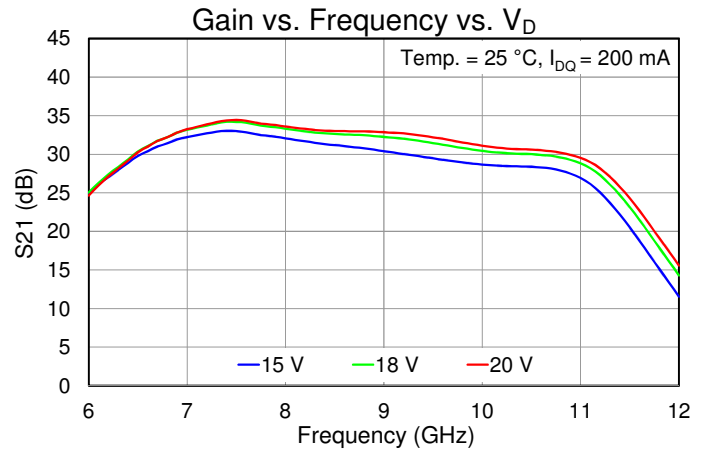
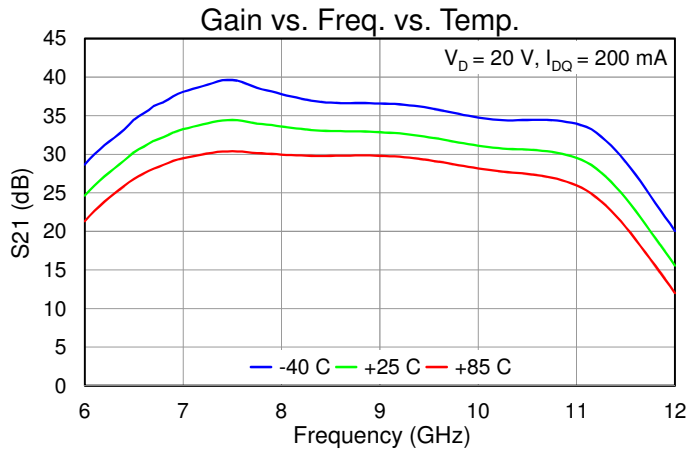


Performance Plots – Detector Voltage

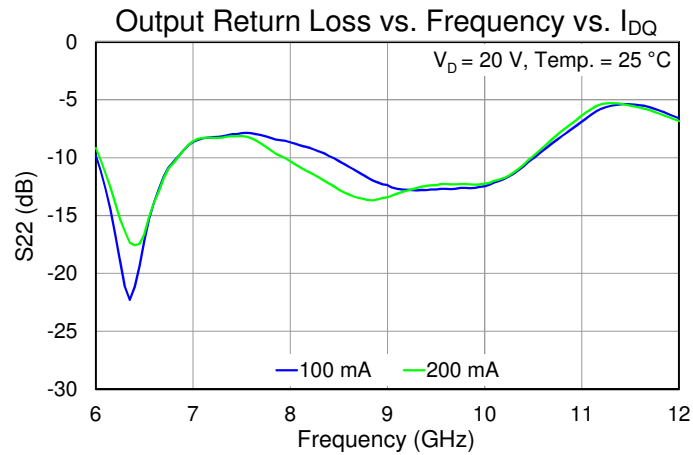
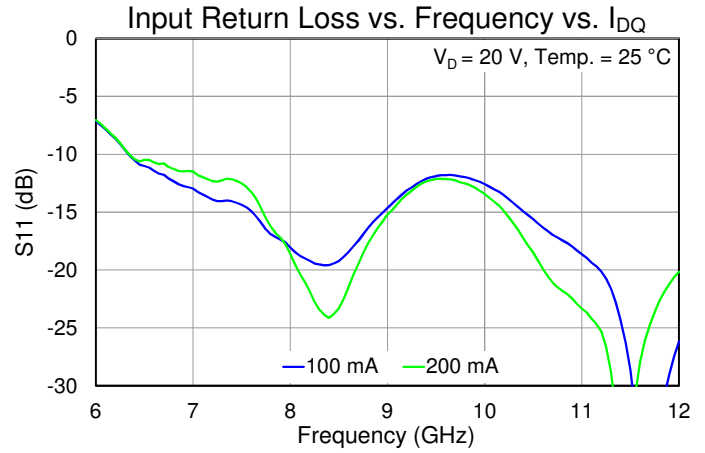
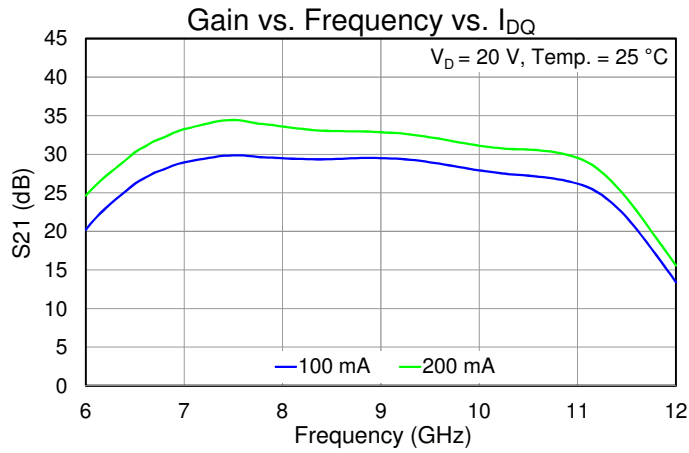
Note: $V_{\Delta} = V_{REF} - V_{DET}$



Performance Plots – Small Signal



Performance Plots – Small Signal



Thermal and Reliability Information

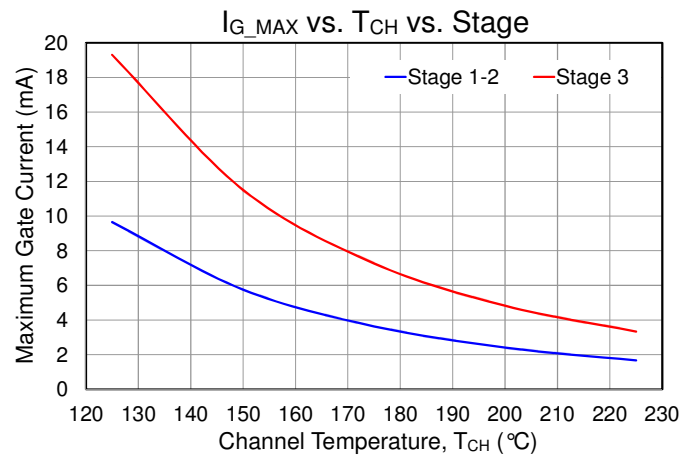
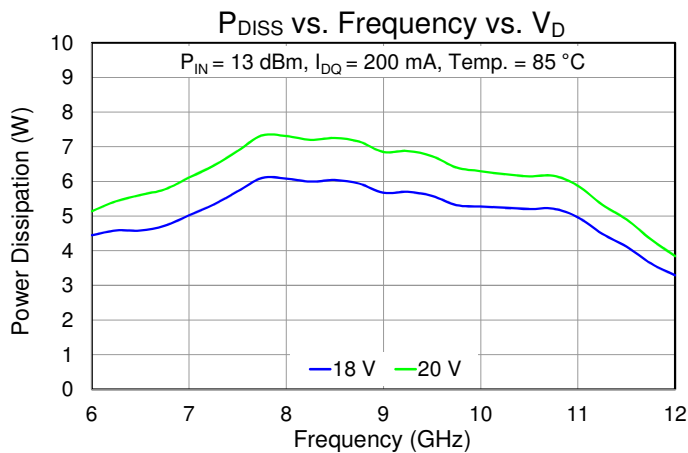
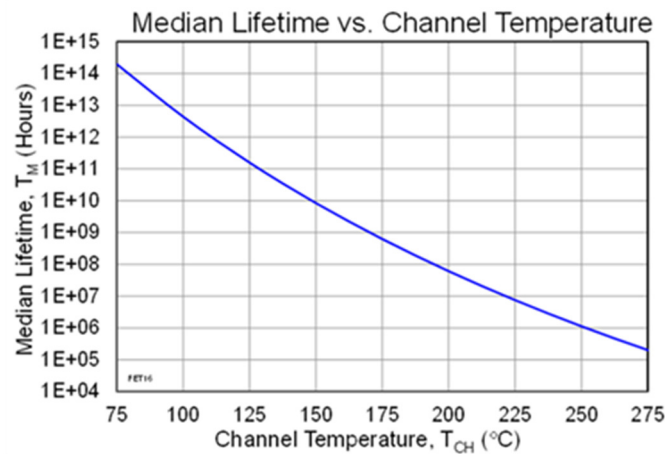
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) ⁽¹⁾	$T_{BASE} = 85^{\circ}\text{C}$, $V_D = +20\text{ V}$, $I_{DQ} = 200\text{ mA}$, $P_{DISS} = 4.0\text{ W}$	9.00	$^{\circ}\text{C/W}$
Channel Temperature (T_{CH}) (Quiescent, No RF)		121	$^{\circ}\text{C}$
Median Lifetime (T_M)		8.36E11	Hrs
Thermal Resistance (θ_{JC}) ⁽¹⁾	$T_{BASE} = 85^{\circ}\text{C}$, $V_D = +20\text{ V}$, $I_{DQ} = 200\text{ mA}$, Freq = 7.75 GHz, $P_{IN} = 13\text{ dBm}$, $I_{D_Drive} = 569\text{ mA}$, $P_{OUT} = 36.1\text{ dBm}$, $P_{DISS} = 7.33\text{ W}$	9.55	$^{\circ}\text{C/W}$
Channel Temperature (T_{CH}) (Under RF drive)		155	$^{\circ}\text{C}$
Median Lifetime (T_M)		6.89E09	Hrs

Notes:

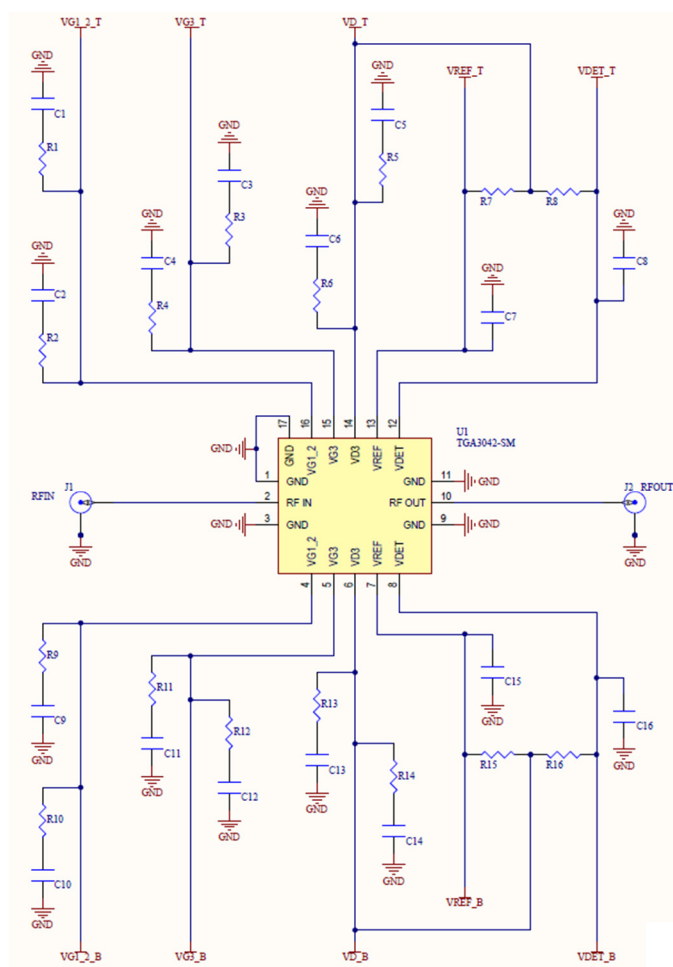
1. Thermal resistance measured to the back of the package, with a fixed base temperature of 85°C .

Median Lifetime

Test Conditions: $V_D = +28\text{ V}$; Failure Criteria = 10% reduction in I_{D_MAX} during DC Life Testing



Application Information



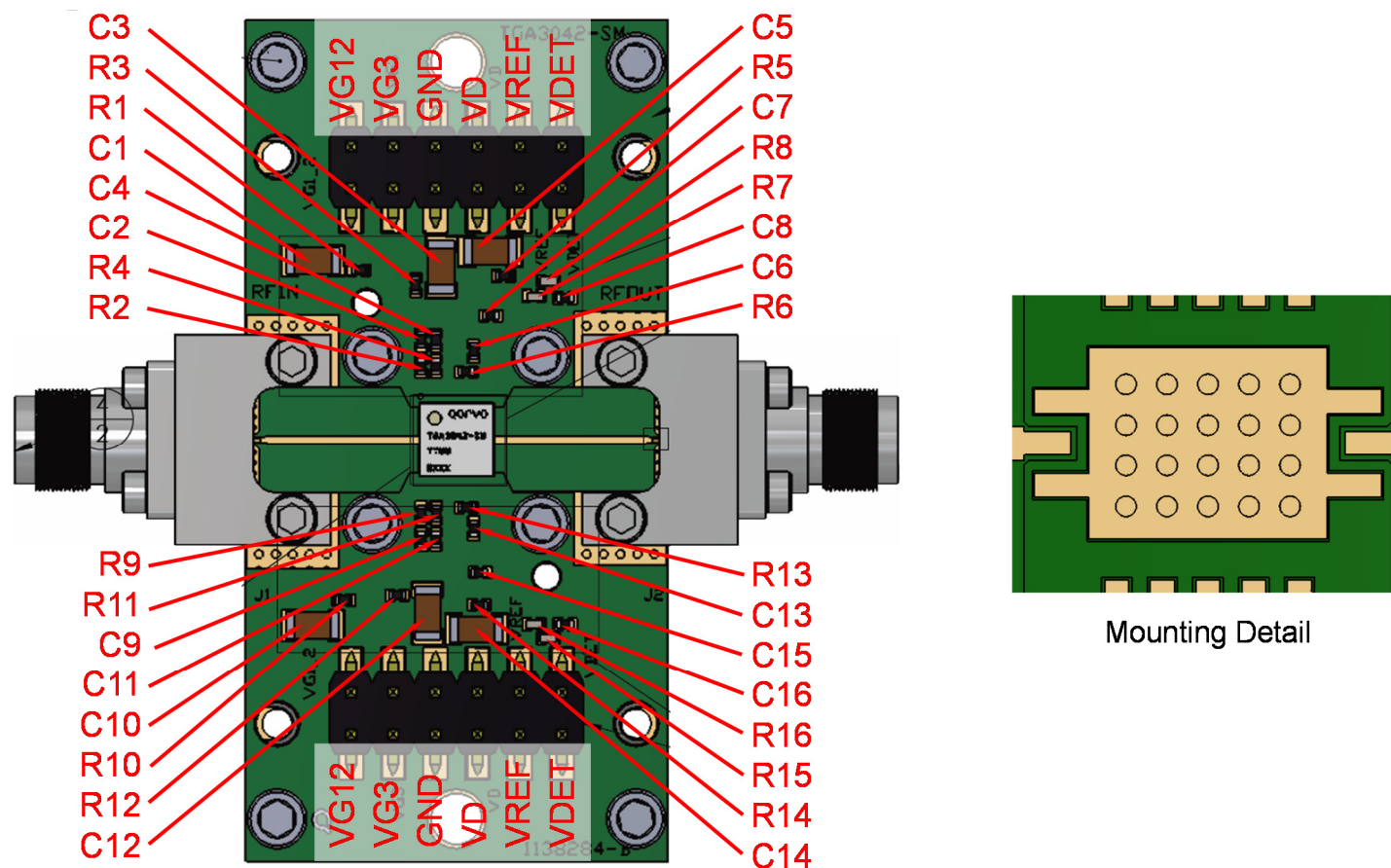
Bias Up Procedure

1. Set I_D limit to 1000 mA, I_G limit to 20 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 $I_{DQ} = 200$ mA ($V_G \sim -2.2$ 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

Evaluation Board (EVB) Layout



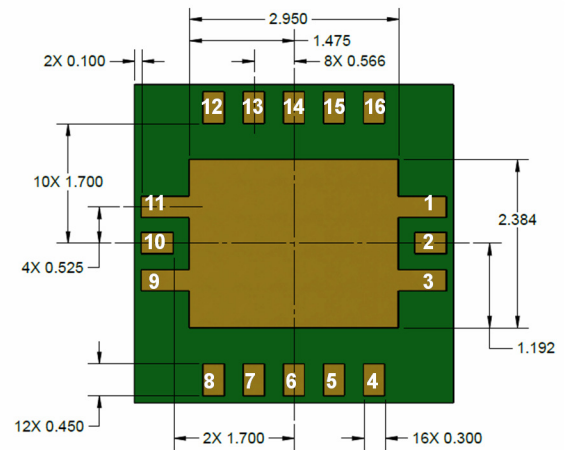
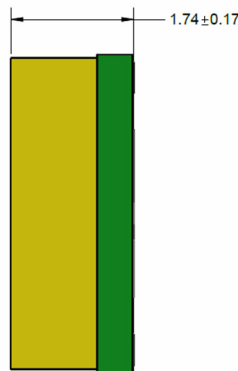
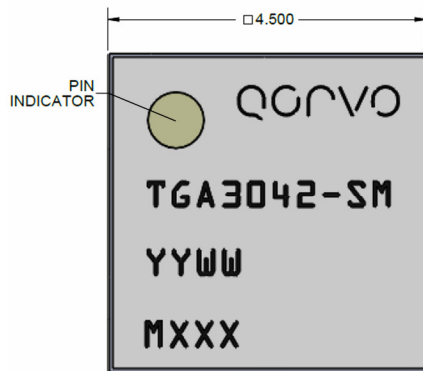
NOTES:

1. RF Layer is 8 mil thick Rogers Corp. RO4003C, $\epsilon_r = 3.38$. Both metal layers are 0.5 oz. copper.
2. TGA3042-SM can be biased from either the top side or the bottom side. Bypassing components are required for the side(s) being biased. Bypass components are required for the side not biased if using the EVB PCB layout in other applications. Do not include metal traces for applications using the EVB PCB layout if biasing and bypassing from one side only

Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C1, C3, C5, C10, C12, C14	1.0 uF	CAP CER 50V 5% X7R 1206	Various	
C2, C4, C6–C9, C11, C13, C15, C16	1000 pF	CAP, 0402, 1000pF, 10%, 100V, X7R	Various	
R7, R8, R15, R16	25.5 k Ω	RES, 1/16W, 1%, 0402	Various	
R1 – R6, R9 – R14	5.1 Ω	RES, 5%, 0402, 1/10W	Various	
J1, J2	N/A	2.92 mm RF Edge Launch Connector	Southwest Microwave	1092-01A-5

Mechanical Information



Units: millimeters

Tolerances: unless specified

x.xx = ± 0.25

x.xxx = ± 0.100

Materials:

Base: Laminate

Lid: FR4

All metalized features are gold plated

Part is epoxy sealed

Marking:

TGA3042-SM: Part number

YY: Part Assembly year

WW: Part Assembly week

MXXX: Batch ID

Pin Description

Pad No.	Symbol	Description
1, 3, 9, 11, Center	GND	Ground. Must be grounded on the PCB. Conductive filled vias recommended for least inductance and improved thermal performance (see Mounting Detail)
2	RF _{IN}	RF Input; matched to 50 Ω; DC blocked
4, 16	V _{G1-2}	Stage 1-2 Gate Voltage. Can be biased from either side. Bias network is required; see recommended Application Information and EVB Layout above.
5, 15	V _{G3}	Stage 3 Gate Voltage. Can be biased from either side. Bias network is required; see recommended Application Information and EVB Layout above.
6, 14	V _D	Drain voltage; Drain can be biased from either side. Bias network is required; see recommended Application Information and EVB Layout above.
7, 13	V _{REF}	Reference voltage
8, 12	V _{DET}	Detector voltage
10	RF _{OUT}	RF Output; matched to 50 Ω; DC blocked

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	TBD	ESDA / JEDEC JS-001-2014
ESD – Charged Device Model (CDM)	TBD	ESDA / JEDEC JS-002-2014
MSL – Convection Reflow 260 °C	TBD	JEDEC standard IPC/JEDEC J-STD-020



Caution!
ESD-Sensitive Device

Solderability

Compatible with the latest version of J-STD-020, Lead-free solder, 260 °C

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
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free



Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about Qorvo:

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