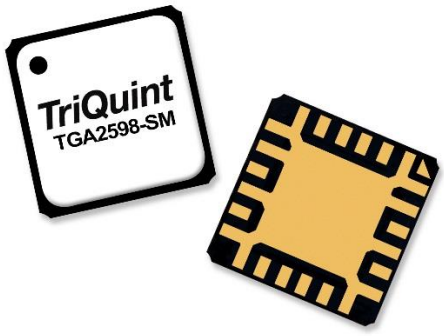
TGA2598-SM

6 to 12 GHz 2W GaN Driver Amplifier

Applications

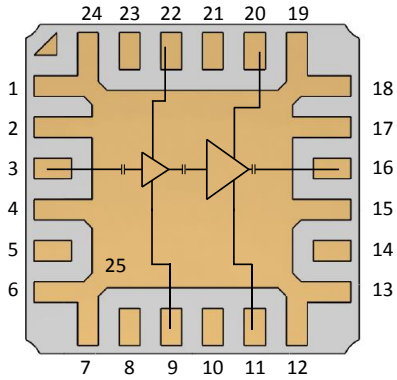
- Commercial and military radar
- Communications
- Electronic Warfare (EW)



Product Features

- Frequency Range: 6 - 12 GHz
- Small Signal Gain: 25 dB (mid-band)
- Pout: 33 dBm (P_{IN} = 19 dBm)
- PAE: > 25 % CW
- IM3: -22 dBc (23 dBm Pout/Tone)
- Input Return Loss: > 10 dB
- Output Return Loss: > 8 dB
- Bias: V_D = 25 V, I_{DQ} = 100 mA, V_G = -2.5 V Typical
- Package Dimensions: 4.0 x 4.0 x 1.5 mm

Functional Block Diagram



General Description

TriQuint's TGA2598-SM is a packaged broadband driver amplifier fabricated on TriQuint's TQGaN25 0.25 um GaN on SiC process. Operating from 6 to 12 GHz, the TGA2598-SM achieves 2 W saturated output power with a power-added efficiency of > 25 %, and 25 dB small signal gain.

The TGA2598-SM is available in a low cost, 4x4 mm air-cavity ceramic QFN. The TGA2598-SM is an ideal choice to drive TriQuint's high performing GaN HPAs allowing the user to run both driver and HPA off the same voltage rail.

Both RF ports have integrated DC blocking capacitors and are fully matched to 50 Ohms.

Lead free and RoHS compliant.

Evaluation Boards are available upon request.

Pin Configuration

Pad No.	Symbol
1, 2, 4, 6, 7, 12, 13, 15, 17-19, 24, 25	GND
3	RF_{IN}
5, 8, 10, 14, 21, 23	NC
9	V_{G1}
11	V_{G2}
16	RF_{OUT}
20	V_{D2}
22	V_{D1}

Ordering Information

Part	ECCN	Description
TGA2598-SM	EAR99	6 - 12 GHz, GaN Driver

Absolute Maximum Ratings

Parameter	Value
Drain Voltage (V_D)	40 V
Gate Voltage Range (V_G)	-8 to 0 V
Drain Current (I_{D1})	128 mA
Drain Current (I_{D2})	260 mA
Gate Current (I_{G1}) at Tch = 200 °C	-0.2 to 1.4mA
Gate Current (I_{G2}) at Tch = 200 °C	-0.6 to 2.8mA
Power Dissipation (P_{DISS}), 85 °C	5.3 W
Input Power (P_{IN}), CW, 50 Ω, V_D=25 V, I_{DQ}=100 mA, 85 °C,	30dBm
Input Power (P_{IN}), CW, VSWR 10:1, V_D=25 V, I_{DQ}=100 mA, 85 °C	30dBm
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)	25 V
Drain Current (I_{DQ})	100 mA
Drain Current Under RF Drive (I_{D_DRIVE})	See plots p. 7
Gate Voltage (V_G)	−2.5 V (Typ.)
Gate Current Under RF Drive (I_{G_DRIVE})	See plots p. 7
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

Test conditions unless otherwise noted: 25 °C, V_D = 25 V, I_{DQ} = 100 mA, V_G = −2.5 V Typical, CW.

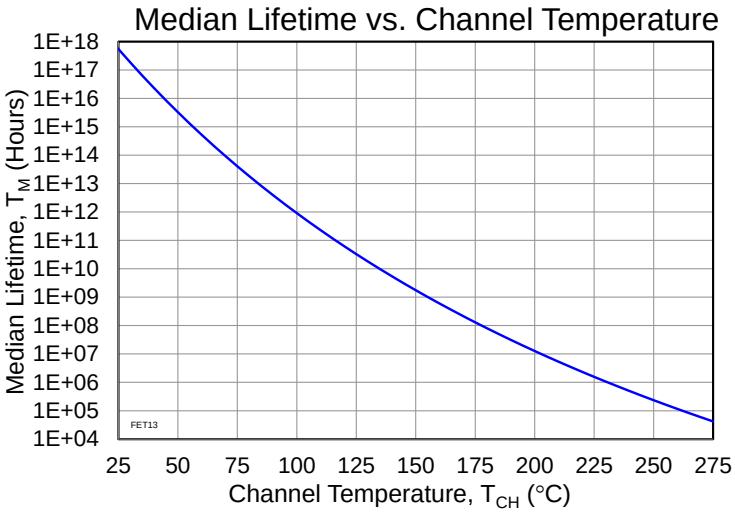
Parameter	Min	Typical	Max	Units
Operational Frequency Range	6		12	GHz
Small Signal Gain		25		dB
Input Return Loss		> 10		dB
Output Return Loss		> 8		dB
Output Power (at Pin = 19 dBm)		33		dBm
Power Added Efficiency (at Pin = 19 dBm)		> 25		%
IM3 (at Pout/tone = 23 dBm/Tone)		-22		dBc
IM5 (at Pout/tone = 23 dBm/Tone)		-37		dBc
Small Signal Gain Temperature Coefficient		-0.05		dB/°C
Output Power Temperature Coefficient		-0.007		dBm/°C

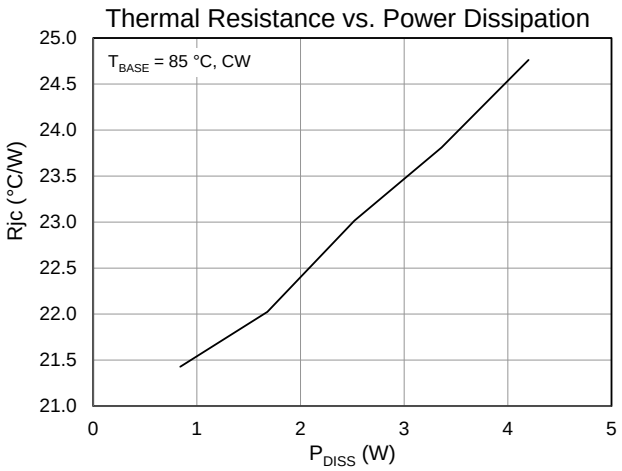
Thermal and Reliability Information

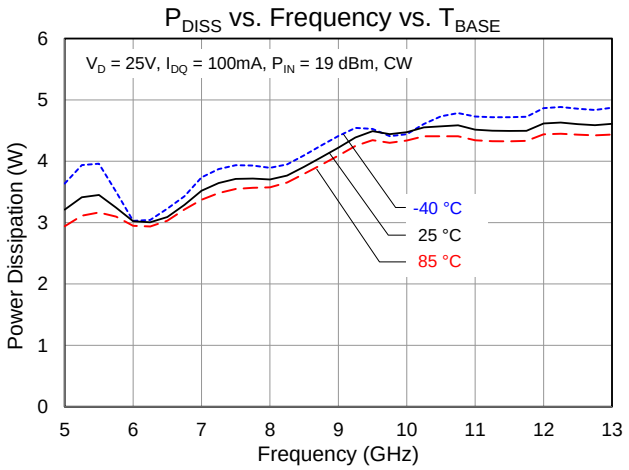
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85°C, V_D = 25 V (CW) At Freq = 9 GHz, P_{IN} = 19 dBm: I_{DQ} = 100 mA, I_{D_Drive} = 243 mA P_{OUT} = 33 dBm, P_{DISS} = 4.1 W	24.8	°C/W
Channel Temperature (T_{CH}) (Under RF drive)		189	°C
Median Lifetime (T_M)		3.4E+7	Hrs

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

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



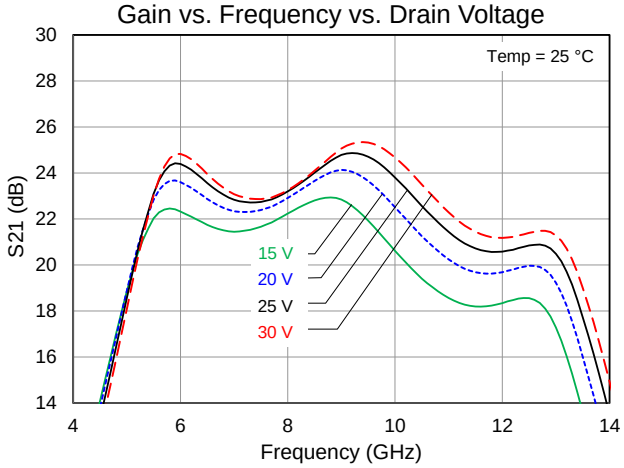




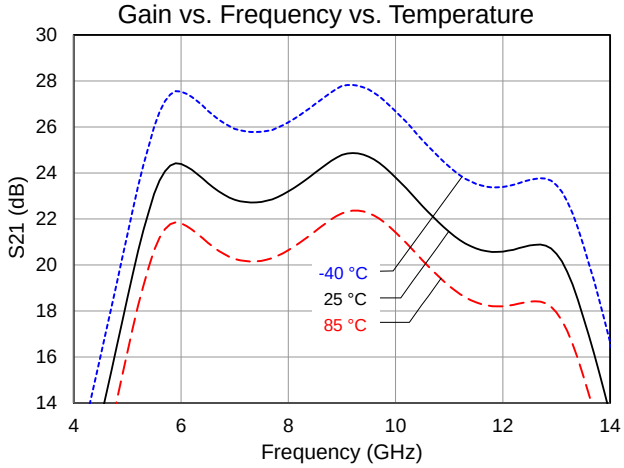
Typical Performance: Small Signal

Conditions unless otherwise specified: V_D = 25 V, I_{DQ} = 100 mA, V_G = -2.5 V Typical, CW.

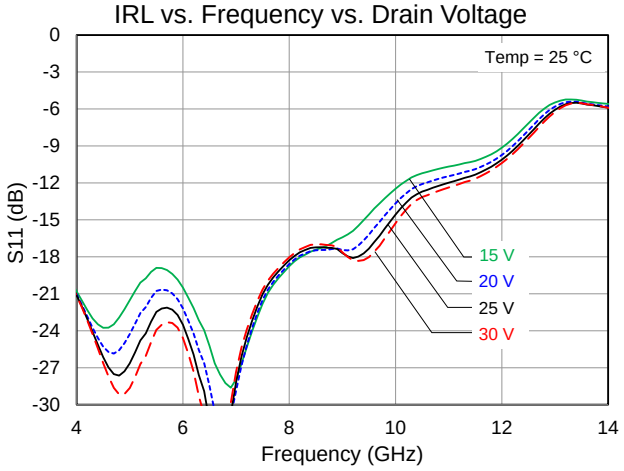
Gain vs. Frequency vs. Drain Voltage



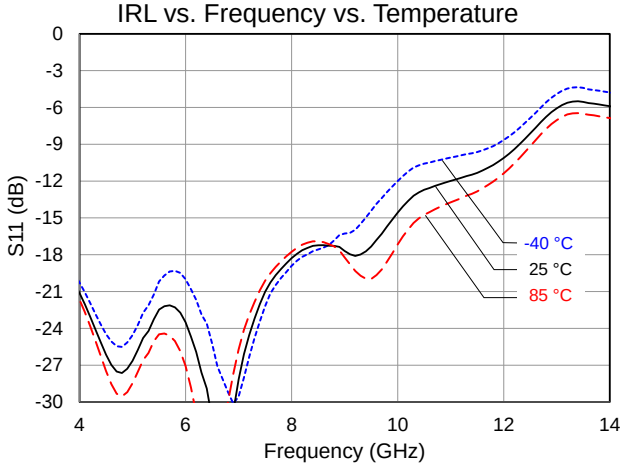
Gain vs. Frequency vs. Temperature



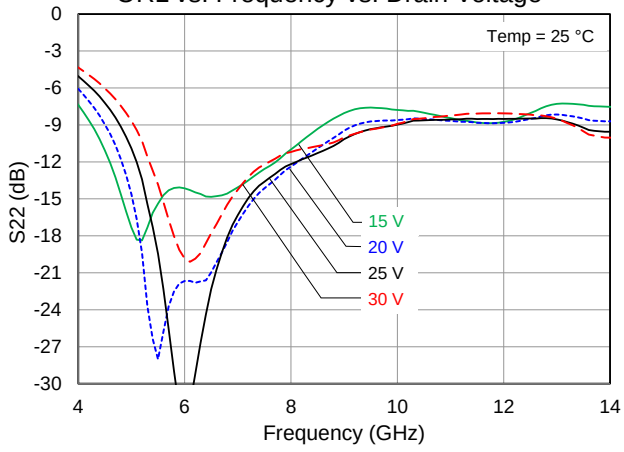
IRL vs. Frequency vs. Drain Voltage



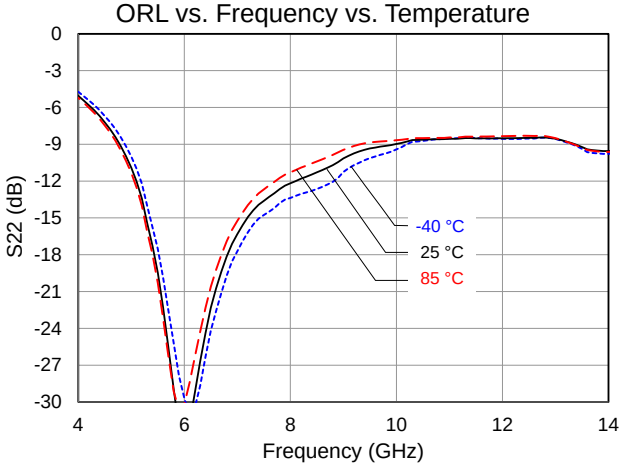
IRL vs. Frequency vs. Temperature



ORL vs. Frequency vs. Drain Voltage



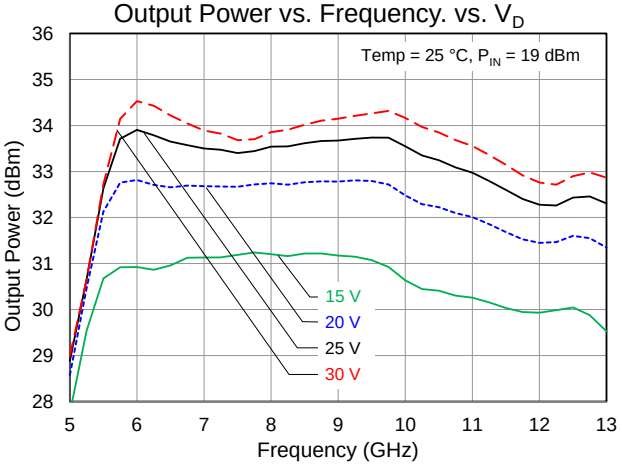
ORL vs. Frequency vs. Temperature



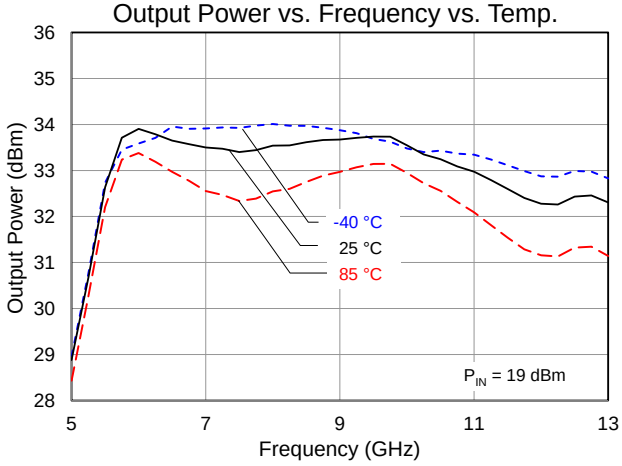
Typical Performance: Large Signal

Conditions unless otherwise specified: V_D = 25 V, I_{DQ} = 100 mA, V_G = -2.5 V Typical, CW.

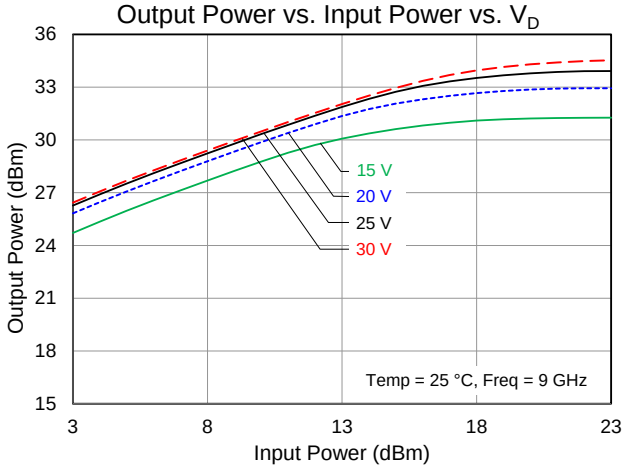
Output Power vs. Frequency. vs. V_D



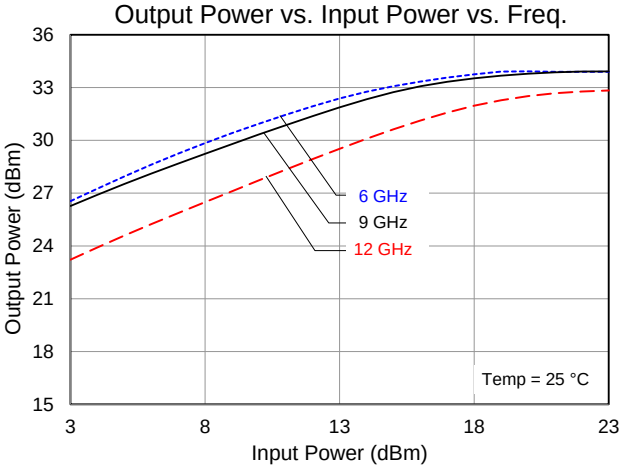
Output Power vs. Frequency vs. Temp.



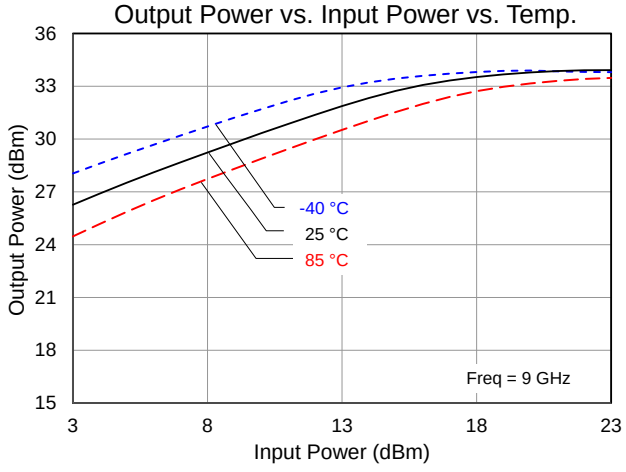
Output Power vs. Input Power vs. V_D



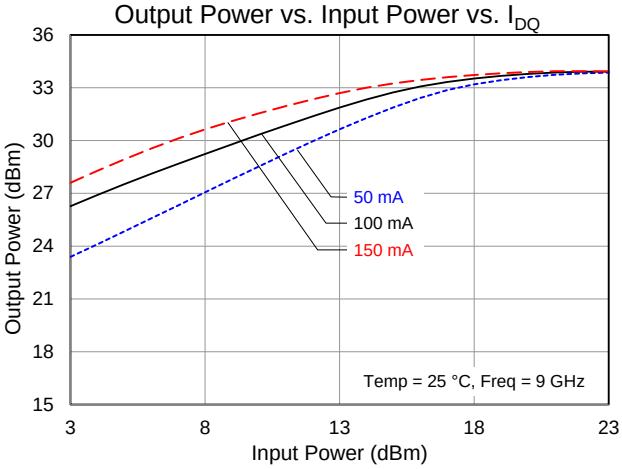
Output Power vs. Input Power vs. Freq.



Output Power vs. Input Power vs. Temp.



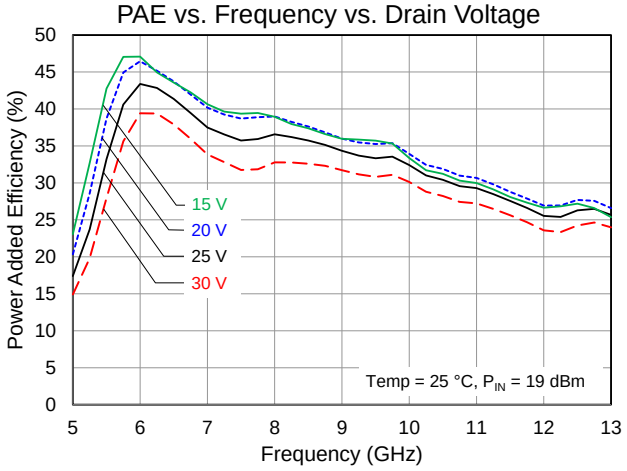
Output Power vs. Input Power vs. I_{DQ}



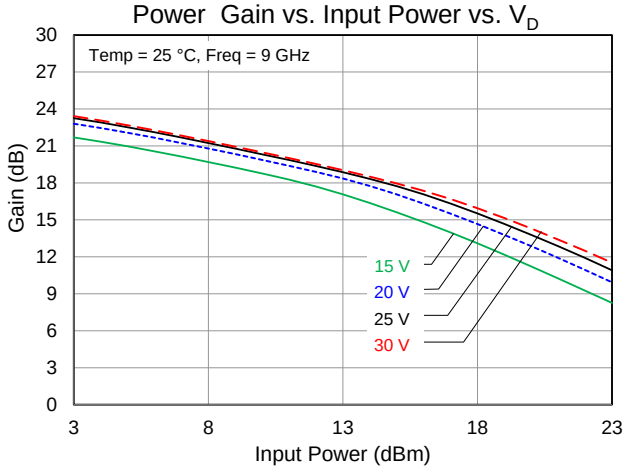
Typical Performance: Large Signal

Conditions unless otherwise specified: V_D = 25 V, I_{DQ} = 100 mA, V_G = -2.5 V Typical, CW.

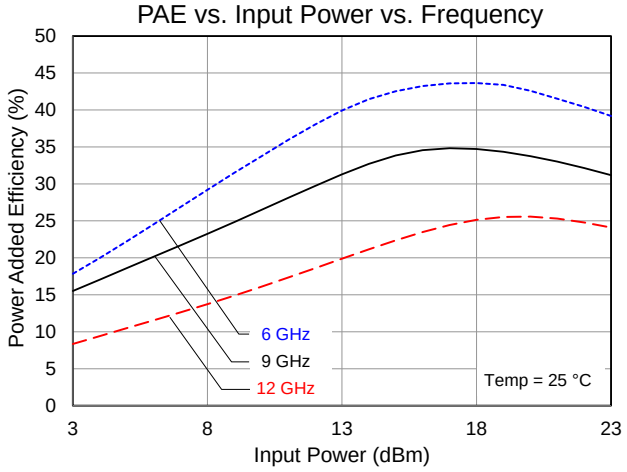
PAE vs. Frequency vs. Drain Voltage



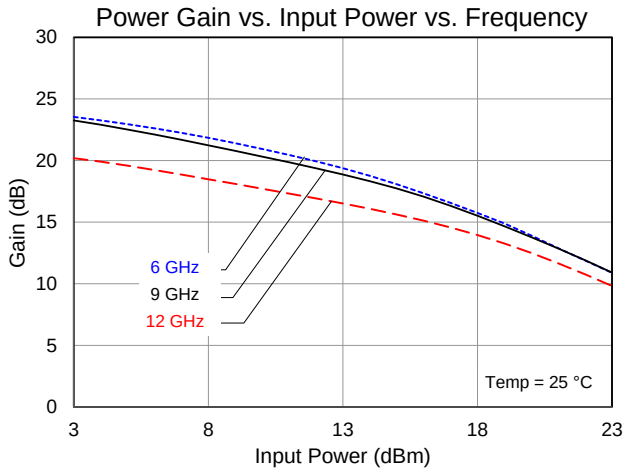
Power Gain vs. Input Power vs. V_D



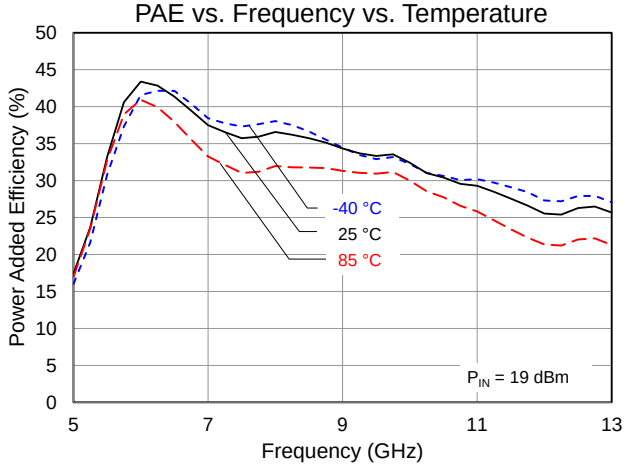
PAE vs. Input Power vs. Frequency



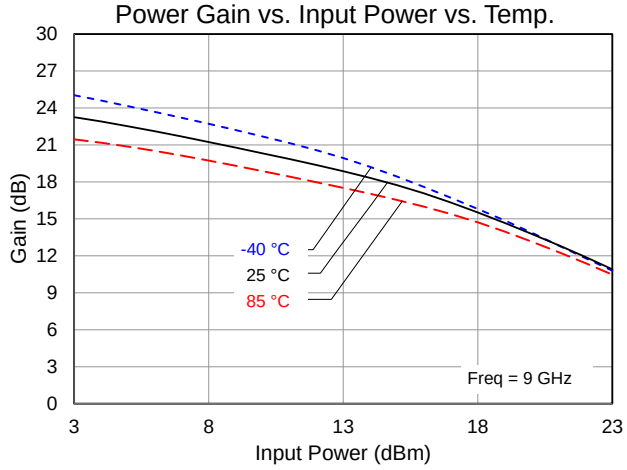
Power Gain vs. Input Power vs. Frequency



PAE vs. Frequency vs. Temperature



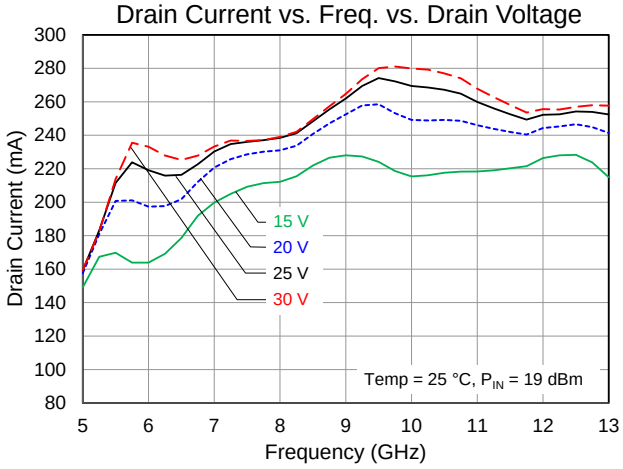
Power Gain vs. Input Power vs. Temp.



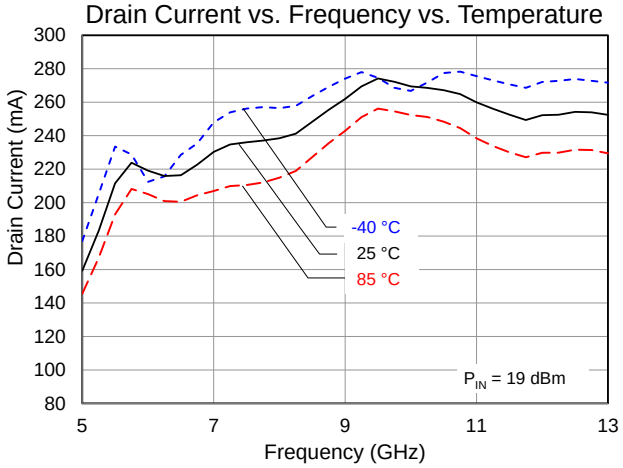
Typical Performance: Large Signal

Conditions unless otherwise specified: V_D = 25 V, I_{DQ} = 100 mA, V_G = -2.5 V Typical, CW.

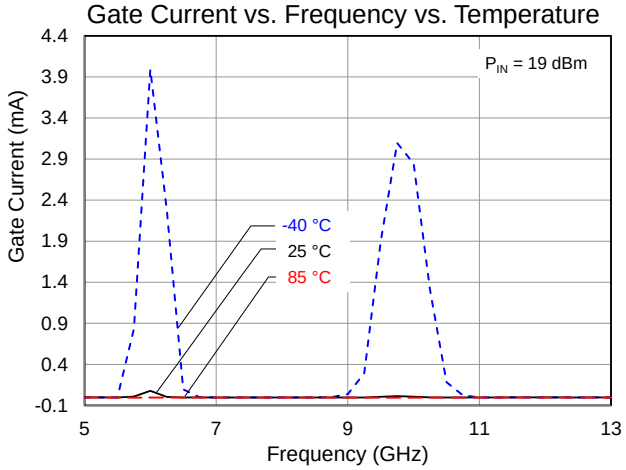
Drain Current vs. Freq. vs. Drain Voltage



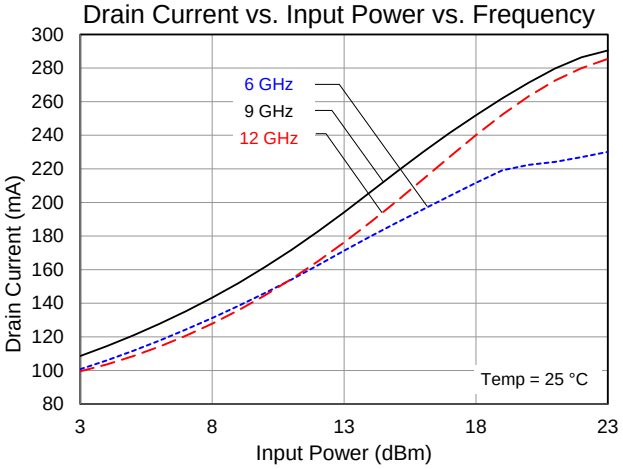
Drain Current vs. Frequency vs. Temperature



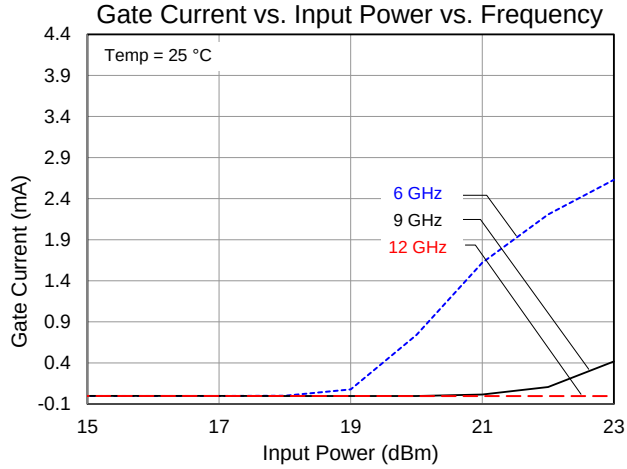
Gate Current vs. Frequency vs. Temperature



Drain Current vs. Input Power vs. Frequency



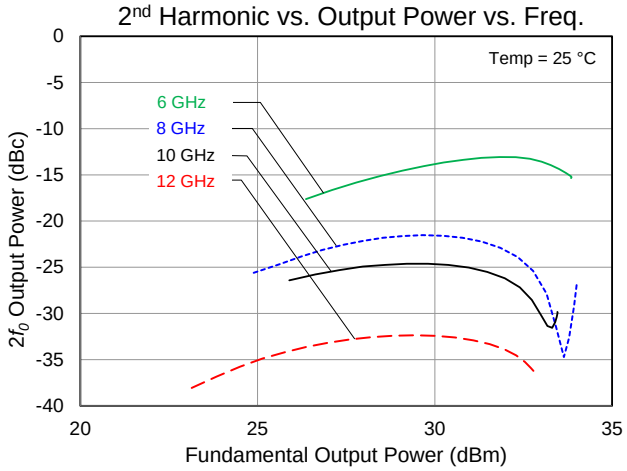
Gate Current vs. Input Power vs. Frequency



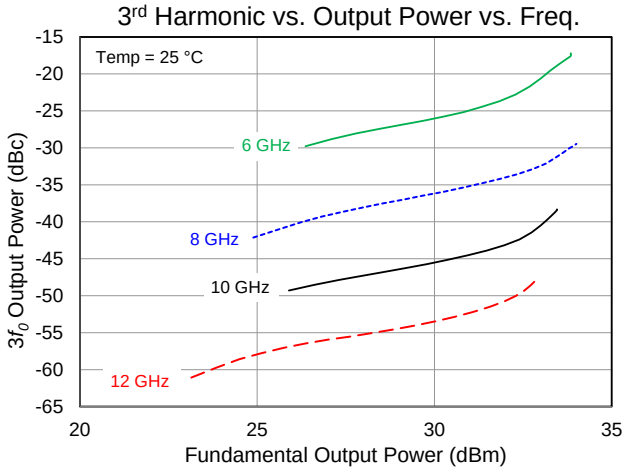
Typical Performance: Large Signal

Conditions unless otherwise specified: V_D = 25 V, I_{DQ} = 100 mA, V_G = -2.5 V Typical, CW.

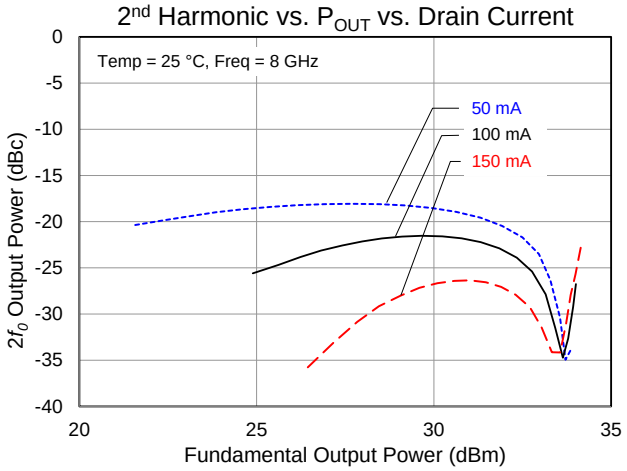
2nd Harmonic vs. Output Power vs. Freq.



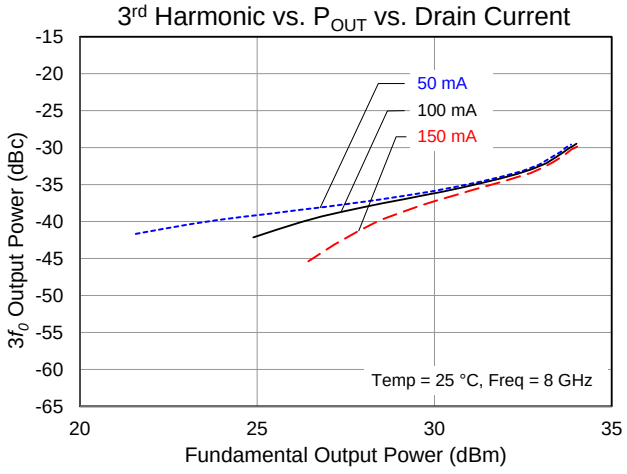
3rd Harmonic vs. Output Power vs. Freq.



2nd Harmonic vs. P_{OUT} vs. Drain Current



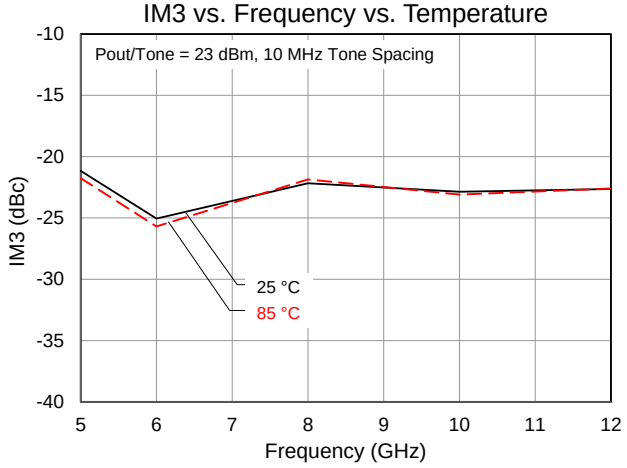
3rd Harmonic vs. P_{OUT} vs. Drain Current



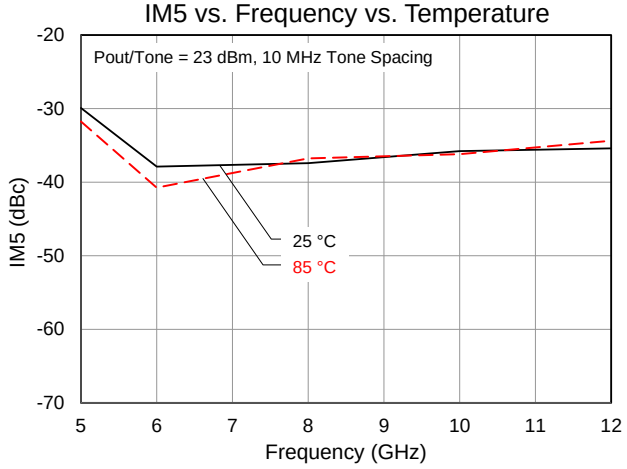
Typical Performance: Linearity

Conditions unless otherwise specified: V_D = 25 V, I_{DQ} = 100 mA, V_G = -2.5 V Typical, CW.

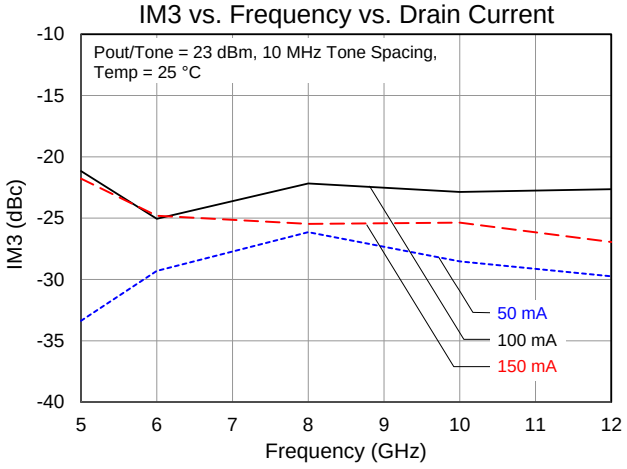
IM3 vs. Frequency vs. Temperature



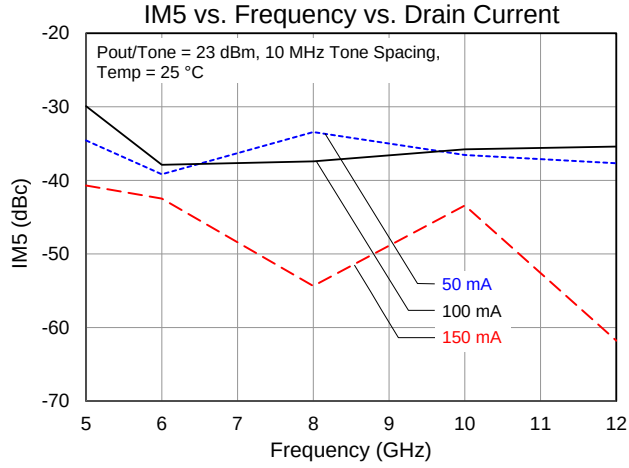
IM5 vs. Frequency vs. Temperature



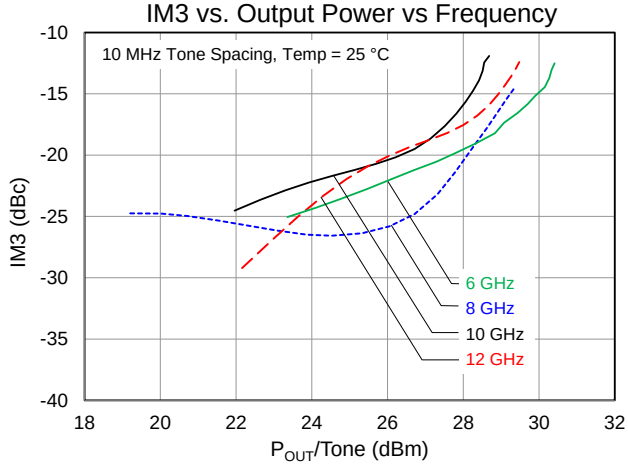
IM3 vs. Frequency vs. Drain Current



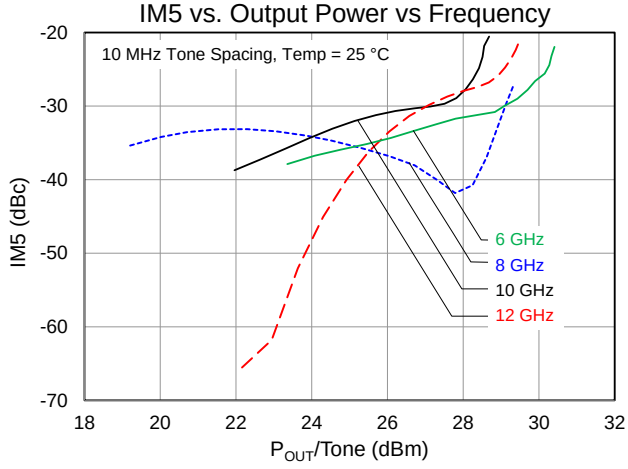
IM5 vs. Frequency vs. Drain Current



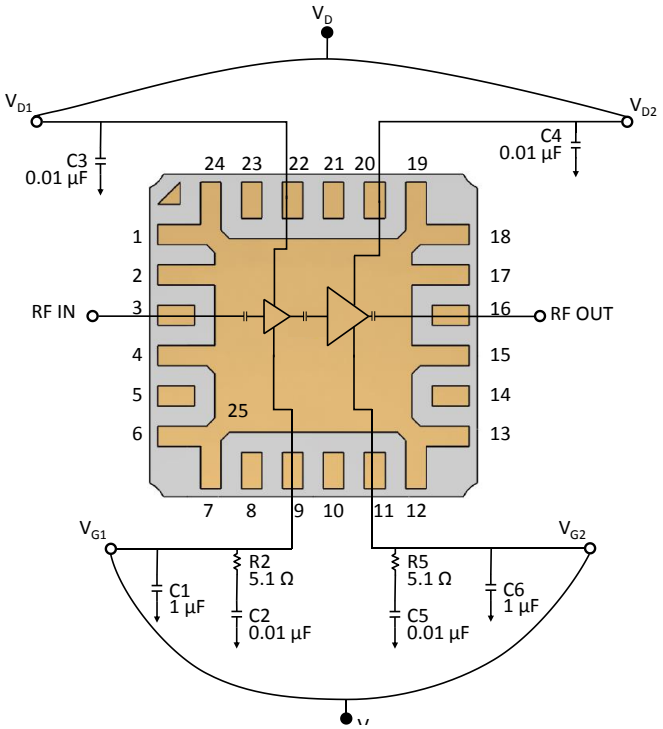
IM3 vs. Output Power vs Frequency



IM5 vs. Output Power vs Frequency



Applications Information and Pin Layout



Bias-up Procedure

1. Set I_D limit to 320 mA, I_G limit to 4 mA
2. Apply −5 V to V_G
3. Apply +25 V to V_D; ensure I_{DQ} is approx. 0 mA
4. Adjust V_G until I_{DQ} = 100 mA (V_G ~ −2.5 V Typ.).
5. Turn on RF supply

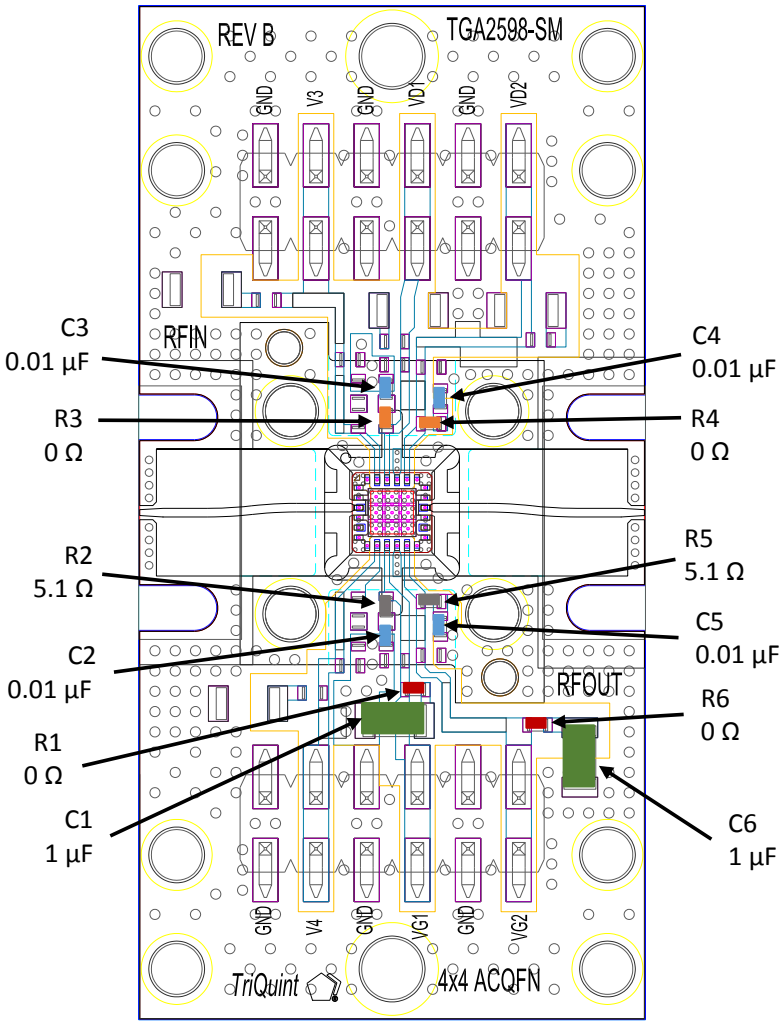
Bias-down Procedure

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

Pin No.	Symbol	Description
1, 2, 4, 6, 7, 12, 13, 15, 17-19, 24, 25	GND	Must be grounded on the PCB.
3	RF_{IN}	Input; matched to 50 Ω; DC blocked
5, 8, 10, 14, 21, 23	NC	Not Connected
9	V_{G1}	Gate Voltage; Bias network required; see recommended Application Information above.
11	V_{G2}	Gate Voltage; Bias network is required; see recommended Application Information above.
16	RF_{OUT}	Output; matched to 50 Ω; DC blocked
20	V_{D2}	Drain voltage; Bias network is required; see recommended Application Information above.
22	V_{D1}	Drain voltage; Bias network is required; see recommended Application Information above.

Evaluation Board

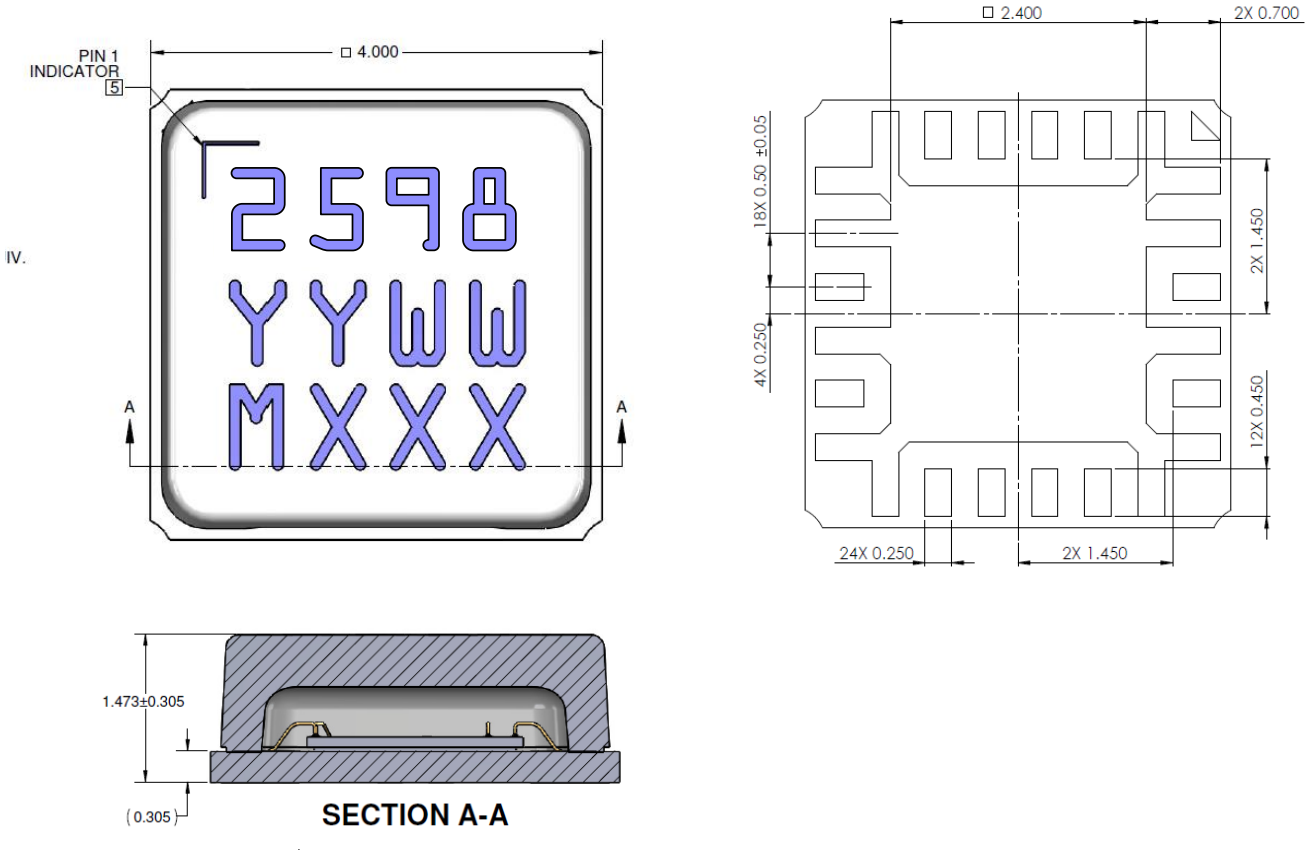


NOTE: Both V_{D1} and V_{D2}, and V_{G1} and V_{G2} must be biased.

Bill of Material

Reference Des.	Value	Description	Manuf.	Part Number
C1, C6	1 µF	Cap, 1206, X5R	Various	
C2, C3, C4, C5	0.01 µF	Cap, 0402, X7R	Various	
R1, R3, R4, R6	0 Ohms	Resistor, 0402	Various	
R2, R5	5.1 Ohms	Resistor, 0402	Various	

Mechanical Information



Units: millimeter
Tolerances: unless specified
x.xx = ± 0.01
x.xxx = ± 0.005
Materials:
Base: Ceramic
Lid: Plastic
All metalized features are Au plated
Part is epoxy sealed
Marking:
2598: Part number
YY: Part Assembly year
WW: Part Assembly week
ZZZ: Serial Number
MXXX: Batch ID

Recommended Soldering Temperature Profile