Features
- *MACOM PURE CARBIDE®* Amplifier Series
- Suitable for Linear and Saturated Applications
- CW and Pulsed Operation: 50 W Output Power
- 50 Ω Input Matched
- 260°C Reflow Compatible
- 50 V Operation
- 100% RF Tested
- RoHS* Compliant

5 x 6 mm DFN

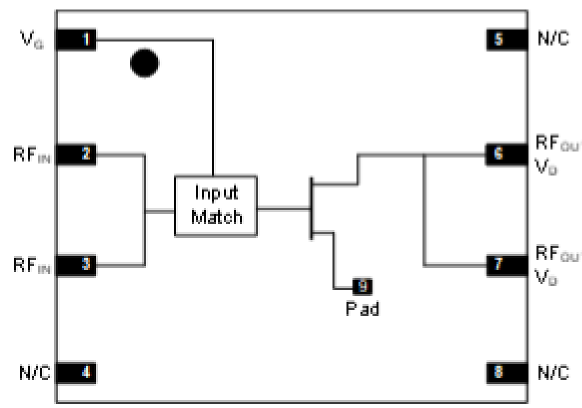
Applications
The MAPC-A1001-BD has a wide range of applications, including military radio communications, RADAR, avionics, digital cellular infrastructure, RF energy, and test instrumentation.

Description
The MAPC-A1001-BD is a GaN on Silicon Carbide HEMT D-mode amplifier suitable for 30 - 1400 MHz frequency operation. The device supports both CW and pulsed operation with minimum output power levels of 50 W (47 dBm) in a 5 x 6 mm plastic package.

Typical Performance:
Measured in Evaluation Test Fixture:
3dB Compression, 100 μs pulse width, 10% duty cycle
VDS = 50 V, IDQ = 130 mA, TC = 25°C

Frequency (GHz)	Output Power (dBm)	Gain (dB)	η_D (%)
0.03	44.6	16.6	73
0.15	45.3	19.3	78
0.55	45.5	19.4	60
0.90	47.4	19.4	66
1.20	46.3	18.3	64
1.40	44.2	16.2	54

Functional Schematic



Pin Configuration

Pin #	Pin Name	Function
1	V_G	Gate
2, 3	RF_{IN}	RF Input
4, 5, 8	N/C	No Connection
6, 7	RF_{OUT}/V_D	RF Output / Drain
9	Pad[1]	Ground / Source

1. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	Package
MAPC-A1001-BD000	Bulk Quantity
MAPC-A1001-BDTR1	Tape and Reel
MAPC-A1001-BDSB1	Sample Board

RF Electrical Characteristics: T_C = 25˚C, V_{DS} = 50 V, I_{DQ} = 130 mA
Note: Performance in MACOM Application Fixture (30 – 1400 MHz), 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Small Signal Gain	Pulsed[2], 900 MHz	G_{SS}	-	21.9	-	dB
Power Gain	Pulsed[2], 900 MHz, 2.5 dB Gain Compression	G_{SAT}	-	19.4	-	dB
Drain Efficiency	Pulsed[2], 900 MHz, 2.5 dB Gain Compression	η_{SAT}	-	66	-	%
Output Power	Pulsed[2], 900 MHz, 2.5 dB Gain Compression	P_{SAT}	-	47.4	-	dBm
Power Gain	Pulsed[2], 900 MHz, P_{IN} = 30 dB	G_P	-	17.9	-	dB
Drain Efficiency	Pulsed[2], 900 MHz, P_{IN} = 30 dB	η_P	-	69	-	%
Output Power	Pulsed[2], 900 MHz, P_{IN} = 30 dB	P_P	-	47.9	-	dBm
Gain Variation	Pulsed[2], 900 MHz, (-40˚C to +85˚C)	ΔG	-	0.005	-	dB/°C
Power Variation	Pulsed[2], 900 MHz, (-40˚C to +85˚C)	ΔPdB	-	0.005	-	dB/°C
Ruggedness: Output Mismatch	All phase angles	Ψ	VSWR = 30:1, No Device Damage			

RF Electrical Characteristics: T_C = 25˚C, V_{DS} = 50 V, I_{DQ} = 130 mA
Note: Performance in MACOM Production Test Fixture, 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Power Gain	Pulsed[2], 1400 MHz, 2.5 dB Gain Compression	G_{SAT}	16	17	-	dB
Saturated Drain Efficiency	Pulsed[2], 1400 MHz, 2.5 dB Gain Compression	η_{SAT}	66	69	-	%
Saturated Output Power	Pulsed[2], 1400 MHz, 2.5 dB Gain Compression	P_{SAT}	47.6	48	-	dBm

2. Pulse Details: 100µs pulse width, 10 ms period, 10% Duty Cycle.

DC Electrical Characteristics T_A = 25˚C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 130 V	I_{DLK}	-	-	6.48	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 0 V	I_{GLK}	-	-	6.48	mA
Gate Threshold Voltage	V_{DS} = 50 V, I_D = 6.48 mA	V_T	-	-2.9	-	V
Gate Quiescent Voltage	V_{DS} = 50 V, I_D = 130 mA	V_{GSQ}	-3.5	-2.5	-2.0	V

Absolute Maximum Ratings[3,4,5,6,7]

Parameter	Absolute Maximum
Drain Source Voltage, V_{DS}	150 V
Gate Source Voltage, V_{GS}	-8 to +2 V
Gate Current, I_G	6.5 mA
Drain Current, I_D	3.84 A
Storage Temperature Range	-65˚C to +150˚C
Case Operating Temperature Range	-40˚C to +85˚C
Channel Operating Temperature Range, T_{CH}	-40˚C to +85˚C
Absolute Maximum Junction Temperature	+275˚C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation above maximum operating conditions.
5. Operating at drain source voltage VDS < 55 V will ensure MTTF > 2.15 x 10^6 hours.
6. Operating at nominal conditions with TCH ≤ 275°C will ensure MTTF > 2.15 x 10^6 hours.
7. MTTF may be estimated by the expression MTTF (hours) = A e [B + C/(T+273)] where T is the channel temperature in degrees Celsius, A = 1.537, B = -24.8111, and C = 21,352.

Thermal Characteristics

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance using Finite Element Analysis	V_{DS} = 50 V, T_C = 85˚C, T_{CH} = 225˚C	R_{Θ}(FEA)	TBD	°C/W

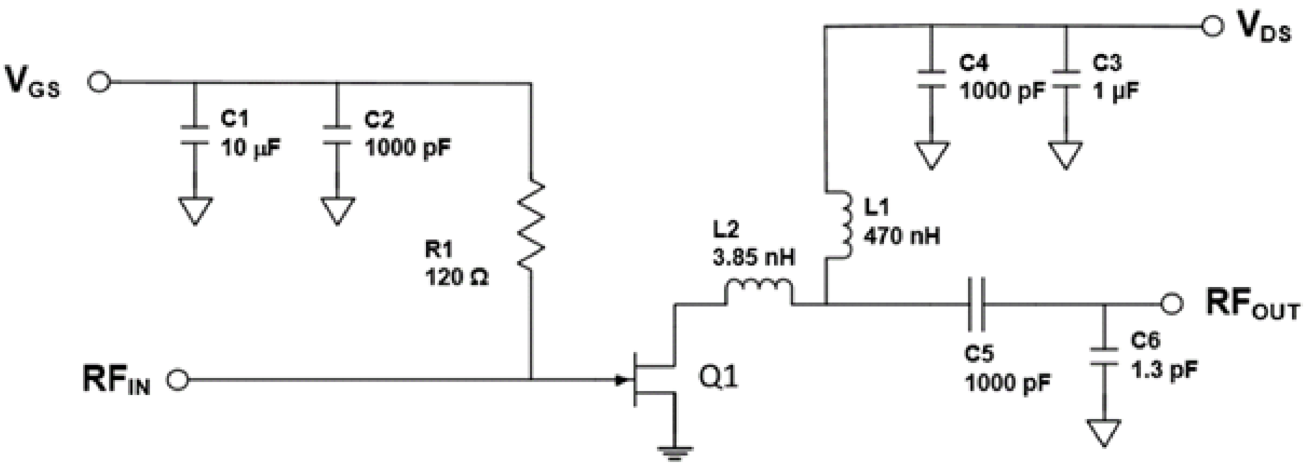
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Nitride Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1B, CDM Class C3 devices.

Application Fixture 30 – 1400 MHz



Description

Parts measured on application board (20-mil thick RO4350). Matching is provided using a combination of lumped elements and transmission lines as shown in the simplified schematic above. Recommended tuning solution component placement, transmission lines, and details are shown on the next page.

Bias Sequencing

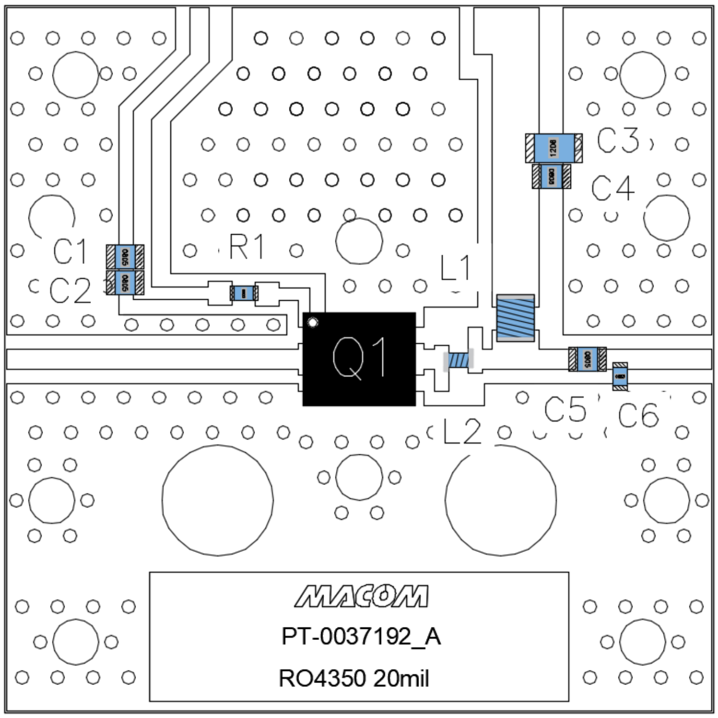
Turning the device ON

1. Set VGS to pinch-off (VP).
2. Turn on VDS to nominal voltage (50 V).
3. Increase VGS until IDS current is reached.
4. Apply RF power to desired level.

Turning the device OFF

1. Turn the RF power off.
2. Decrease VGS down to VP pinch-off.
3. Decrease VDS down to 0 V.
4. Turn off VGS.

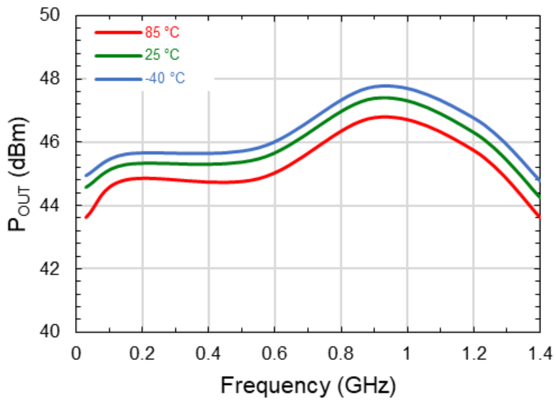
Application Test Fixture and Recommended Tuning Solution 30 - 1400 MHz



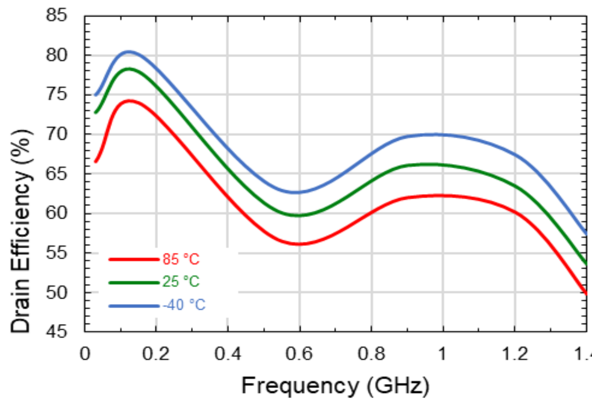
Reference Designator	Value	Tolerance	Manufacturer	Part Number
C1	10 µF	+/- 10 %	Murata	GRM21BC71E106KE11
C2, C4, C5	1000 pF	+/- 5 %	Murata	GRM219R7A102JA01D
C3	1 µF	+/- 10 %	Murata	GRM32CR72A105KA35L
C6	1.3 µF	+/- 0.1 pF	Johanson	251R14S1R3BV4T
R1	120 pF	+/- 25 %	Fair-Rite	2506031217Y0
L1	470 nH	+/- 5 %	CoilCraft	1008CS-471XJRC
L2	3.85 nH	+/- 5 %	CoilCraft	0906-4JLC
Q1	MACOM GaN Power Amplifier			MAPC-A1001
PCB	RO4350LM, 20 mil, 0.5 oz Cu, Au Finish			

Typical Performance Curves as Measured in the 30 – 1400 MHz Application Fixture: 900 MHz, V_{DS} = 50 V, I_{DQ} = 130 mA, 2.5 dB Gain Compression, T_C = 25˚C Unless Otherwise Noted

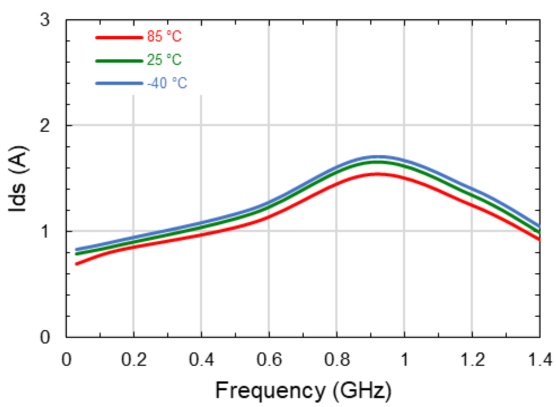
Output Power vs. Temperature and Frequency



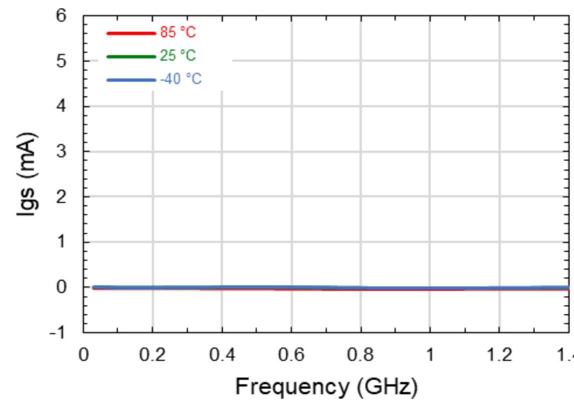
Drain Efficiency vs. Temperature and Frequency



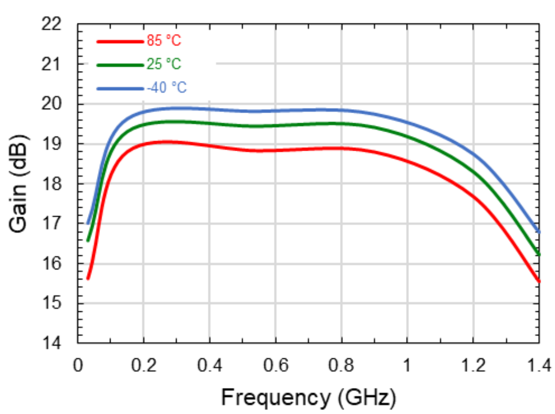
Drain Current vs. Temperature and Frequency



Gate Current vs. Temperature and Frequency

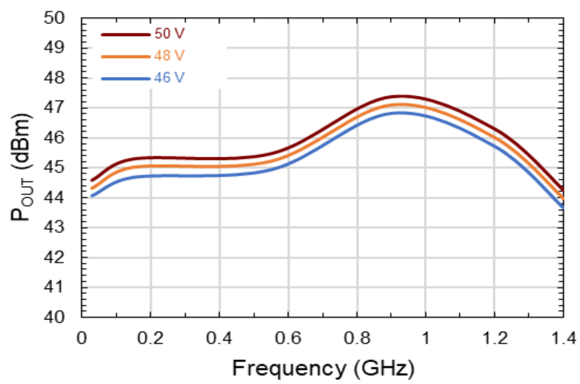


Large Signal Gain vs. Temperature and Frequency

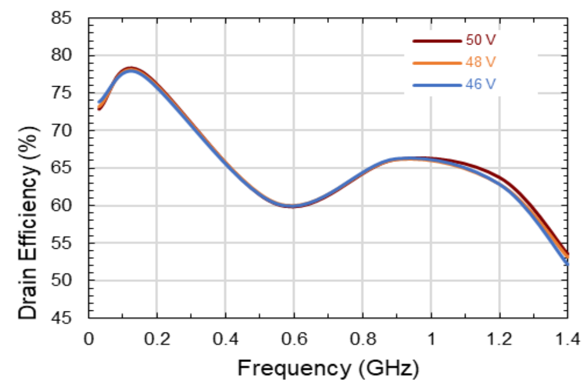


Typical Performance Curves as Measured in the 30 – 1400 MHz Application Fixture: 900 MHz, V_{DS} = 50 V, I_{DQ} = 130 mA, 2.5 dB Gain Compression, T_C = 25˚C Unless Otherwise Noted

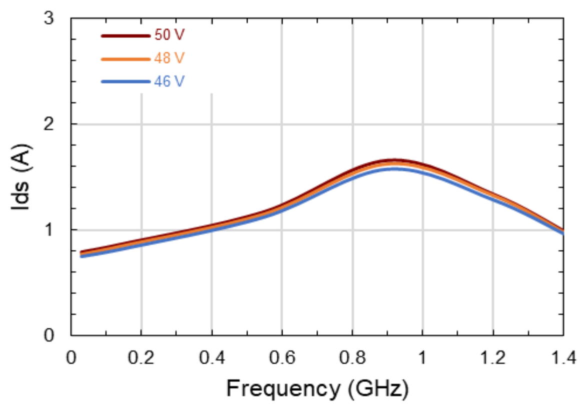
Output Power vs. V_{DS} and Frequency



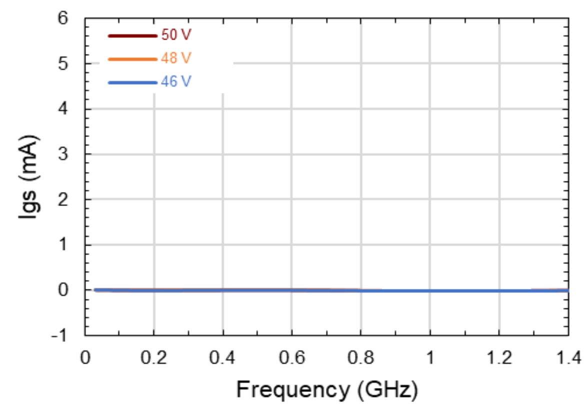
Drain Efficiency vs. V_{DS} and Frequency



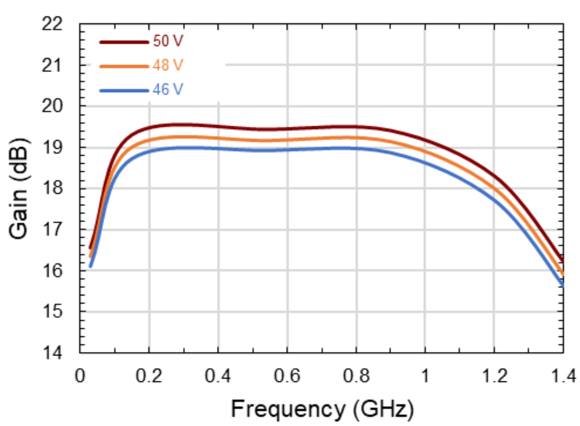
Drain Current vs. V_{DS} and Frequency



Gate Current vs. V_{DS} and Frequency

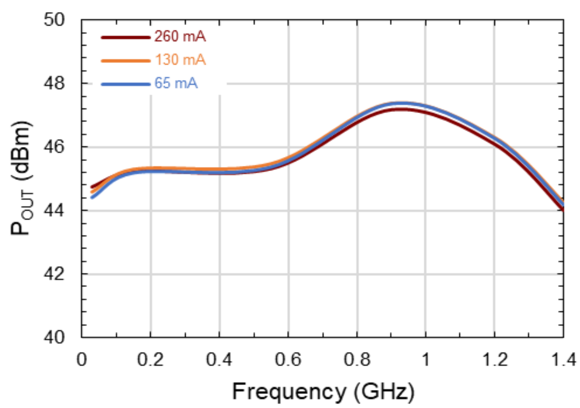


Large Signal Gain vs. V_{DS} and Frequency

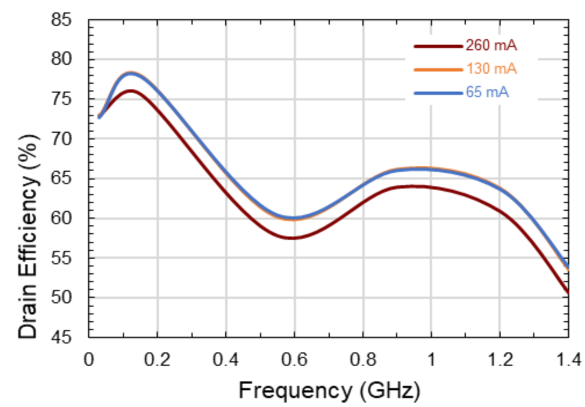


Typical Performance Curves as Measured in the 30 – 1400 MHz Application Fixture: 900 MHz, V_{DS} = 50 V, I_{DQ} = 130 mA, 2.5 dB Gain Compression, T_C = 25˚C Unless Otherwise Noted

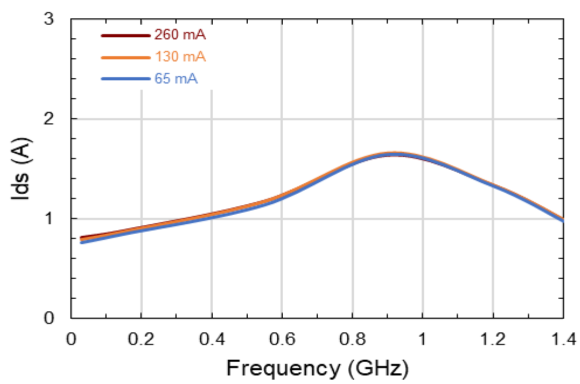
Output Power vs. I_{DQ} and Frequency



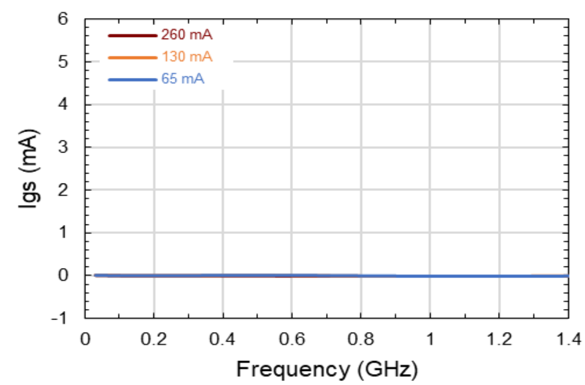
Drain Efficiency vs. I_{DQ} and Frequency



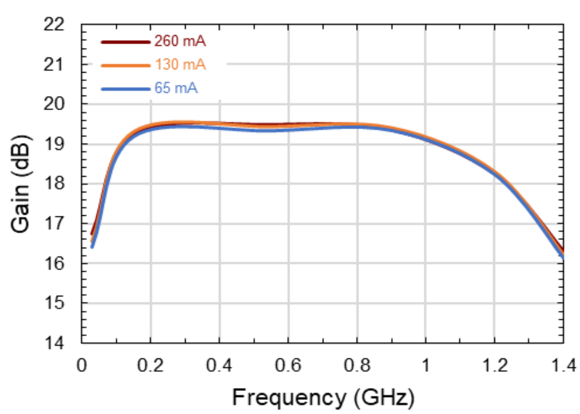
Drain Current vs. I_{DQ} and Frequency



Gate Current vs. I_{DQ} and Frequency

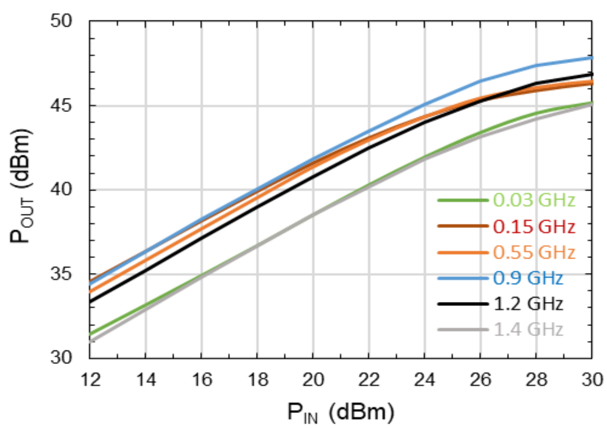


Large Signal Gain vs. I_{DQ} and Frequency

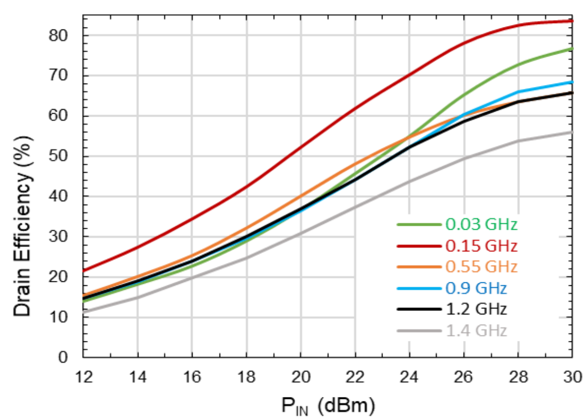


Typical Performance Curves as Measured in the 30 – 1400 MHz Application Fixture: 900 MHz, V_{DS} = 50 V, I_{DQ} = 130 mA, 2.5 dB Gain Compression, T_C = 25°C Unless Otherwise Noted

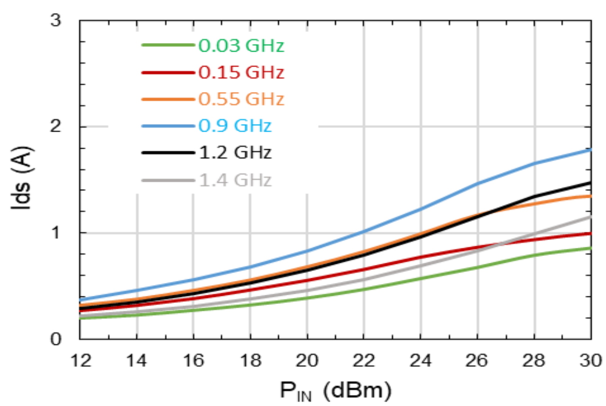
Output Power vs. Frequency and P_{IN}



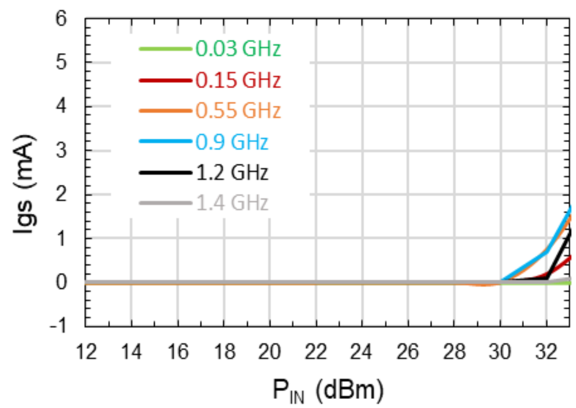
Drain Efficiency vs. Frequency and P_{IN}



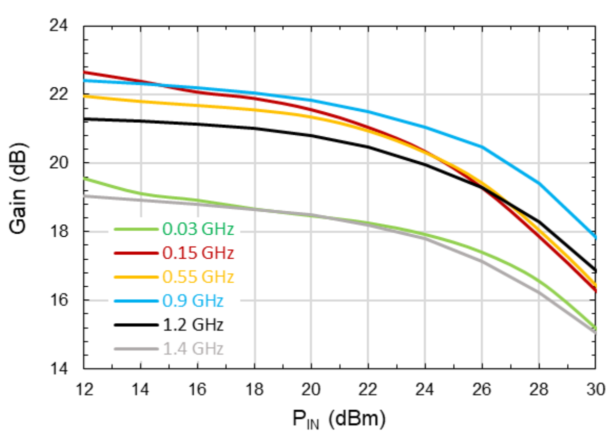
Drain Current vs. Frequency and P_{IN}



Gate Current vs. Frequency and P_{IN}

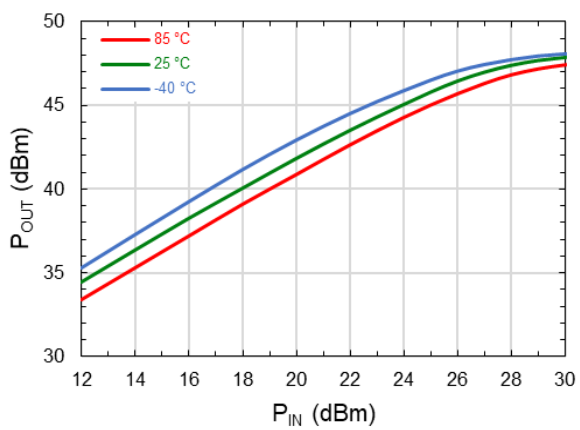


Large Signal Gain vs. Frequency and P_{IN}

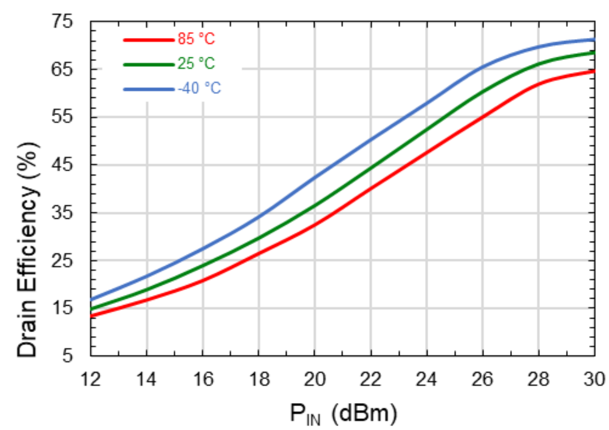


Typical Performance Curves as Measured in the 30 – 1400 MHz Application Fixture: 900 MHz, V_{DS} = 50 V, I_{DQ} = 130 mA, 2.5 dB Gain Compression, T_C = 25°C Unless Otherwise Noted

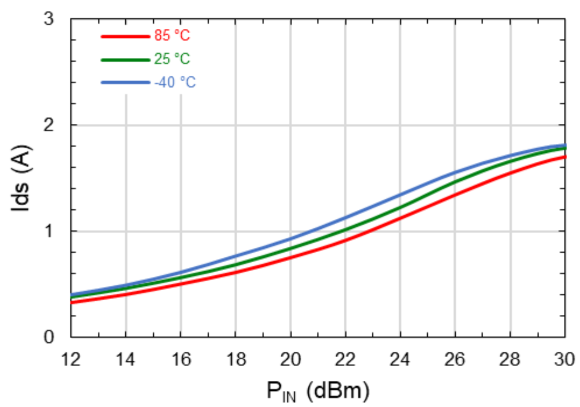
Output Power vs. Temperature and P_{IN}



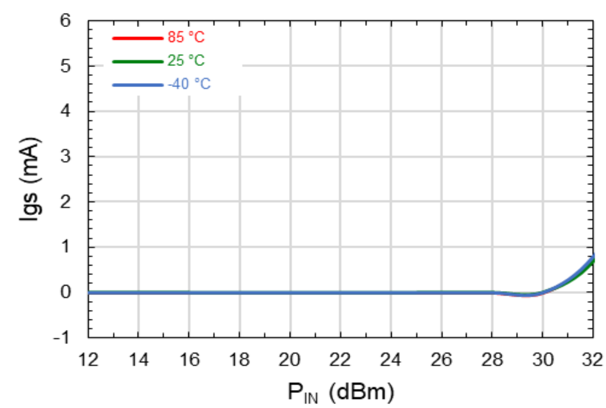
Drain Efficiency vs. Temperature and P_{IN}



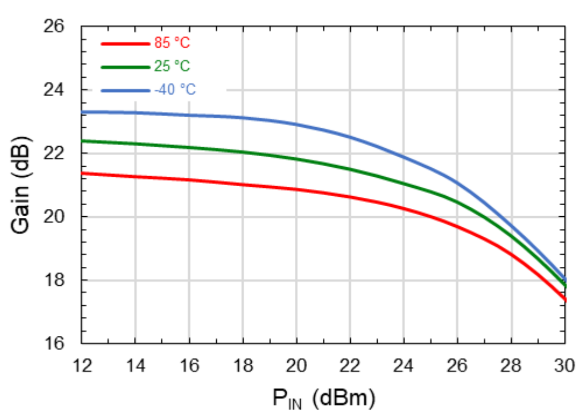
Drain Current vs. Temperature and P_{IN}



Gate Current vs. Temperature and P_{IN}

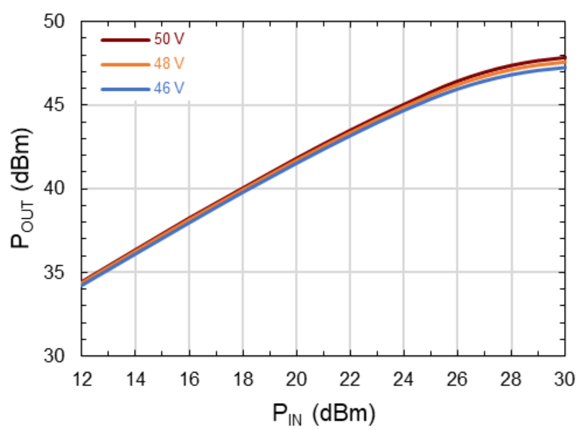


Large Signal Gain vs. Temperature and P_{IN}

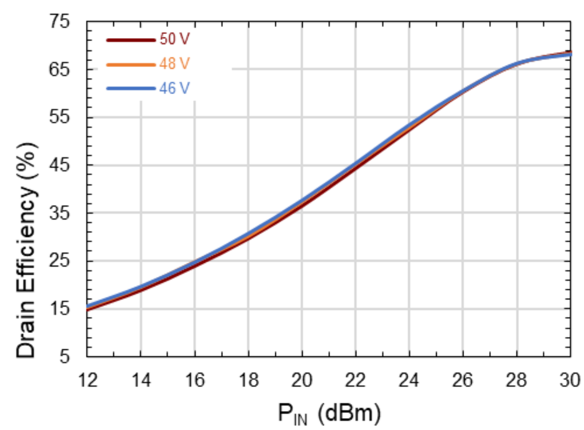


Typical Performance Curves as Measured in the 30 – 1400 MHz Application Fixture: 900 MHz, V_{DS} = 50 V, I_{DQ} = 130 mA, 2.5 dB Gain Compression, T_C = 25˚C Unless Otherwise Noted

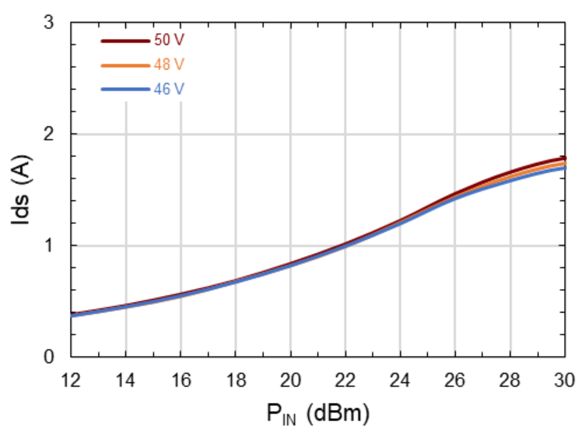
Output Power vs. V_{DS} and P_{IN}



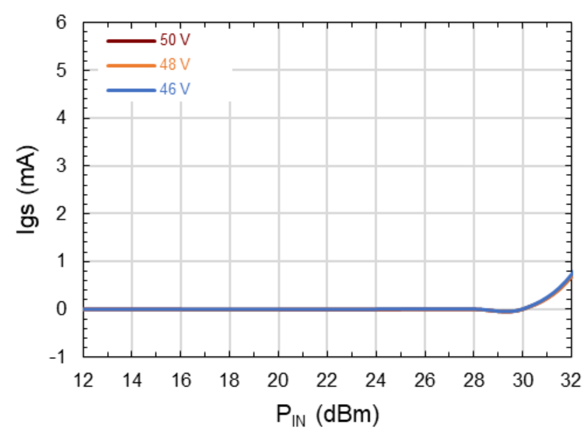
Drain Efficiency vs. V_{DS} and P_{IN}



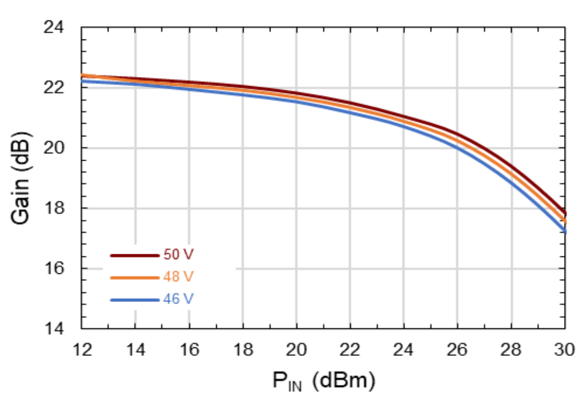
Drain Current vs. V_{DS} and P_{IN}



Gate Current vs. V_{DS} and P_{IN}

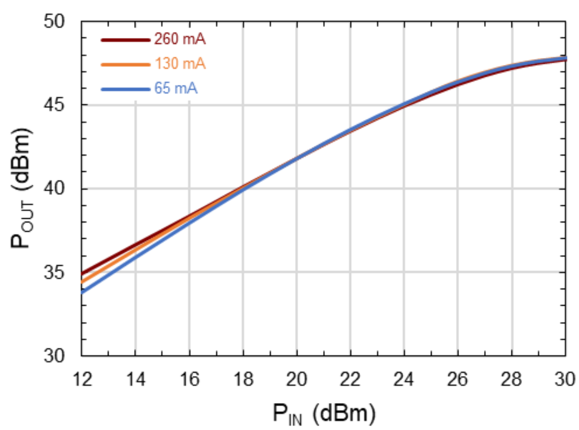


Large Signal Gain vs. V_{DS} and P_{IN}

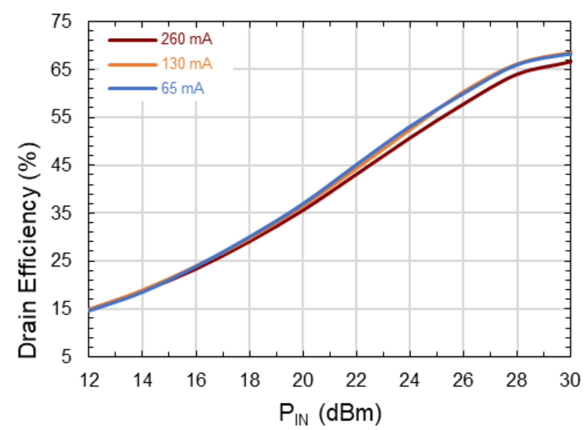


Typical Performance Curves as Measured in the 30 – 1400 MHz Application Fixture: 900 MHz, V_{DS} = 50 V, I_{DQ} = 130 mA, 2.5 dB Gain Compression, T_C = 25˚C Unless Otherwise Noted

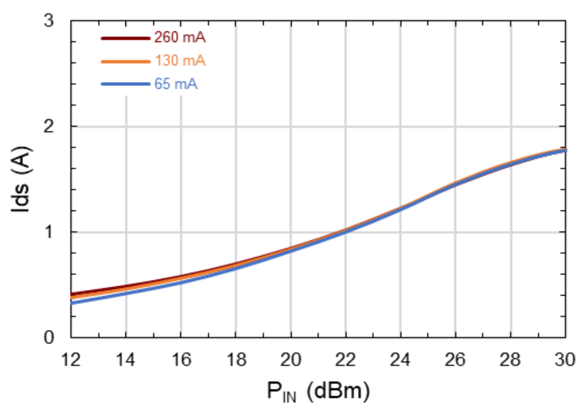
Output Power vs. I_{DQ} and P_{IN}



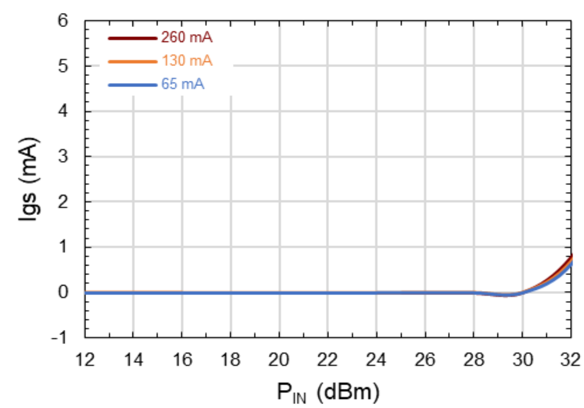
Drain Efficiency vs. I_{DQ} and P_{IN}



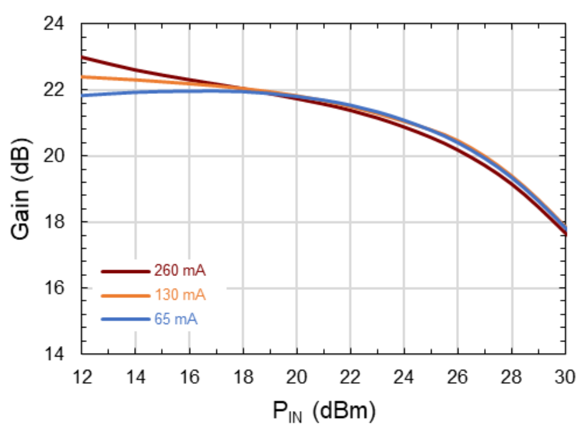
Drain Current vs. I_{DQ} and P_{IN}



Gate Current vs. I_{DQ} and P_{IN}

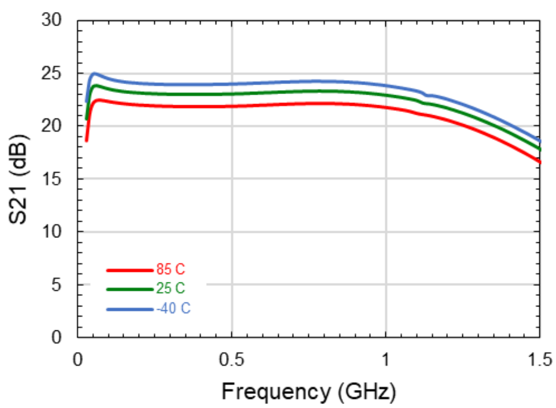


Large Signal Gain vs. I_{DQ} and P_{IN}

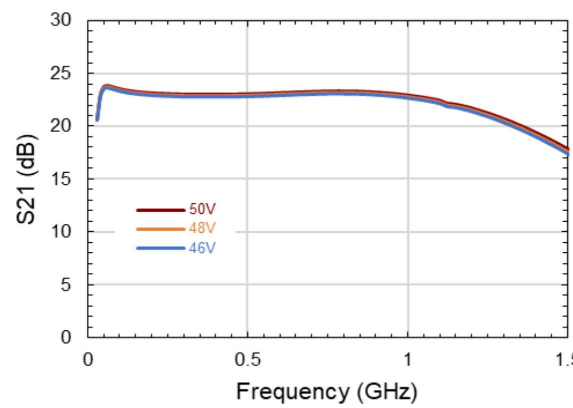


Typical Performance Curves as Measured in the 30 – 1400 MHz Application Fixture: 900 MHz, V_{DS} = 50 V, I_{DQ} = 130 mA, 2.5 dB Gain Compression, T_C = 25˚C Unless Otherwise Noted

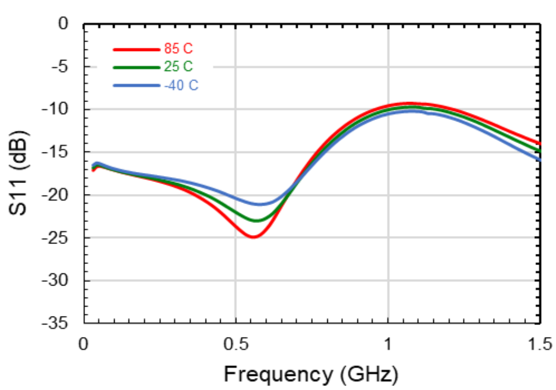
S21 vs. Frequency and Temperature



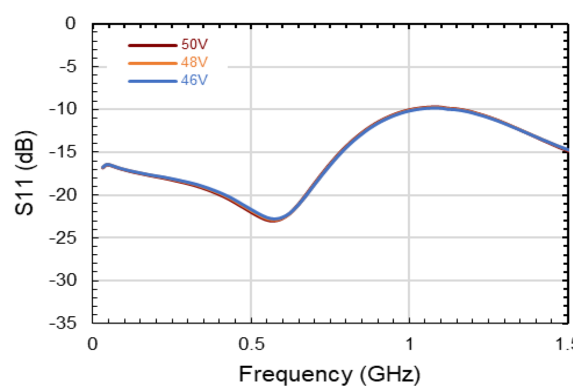
S21 vs. Frequency and V_{DS}



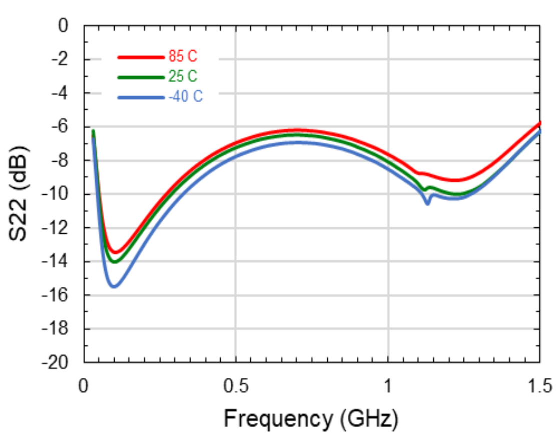
S11 vs. Frequency and Temperature



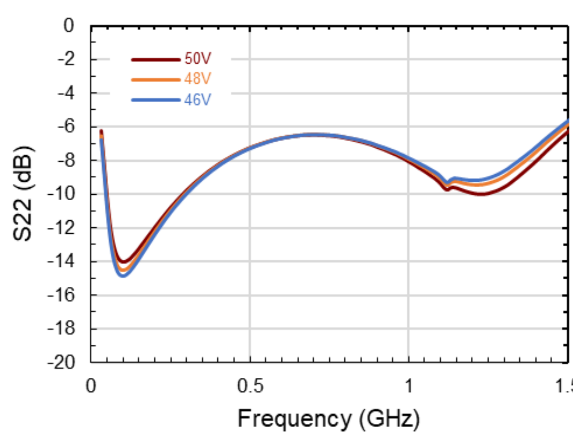
S11 vs. Frequency and V_{DS}



S22 vs. Frequency and Temperature

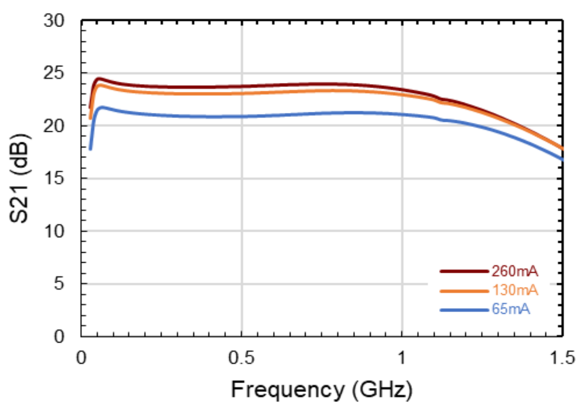


S22 vs. Frequency and V_{DS}

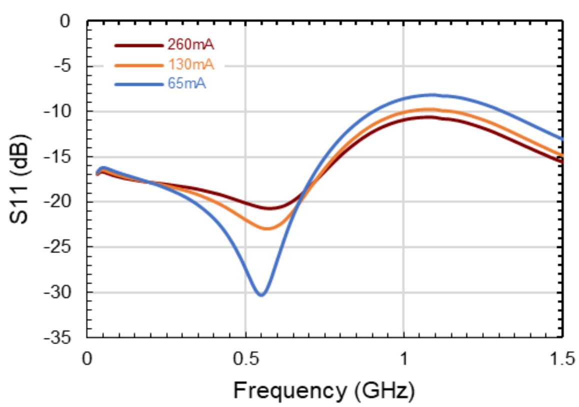


Typical Performance Curves as Measured in the 30 – 1400 MHz Application Fixture: 900 MHz, V_{DS} = 50 V, I_{DQ} = 130 mA, 2.5 dB Gain Compression, T_C = 25°C Unless Otherwise Noted

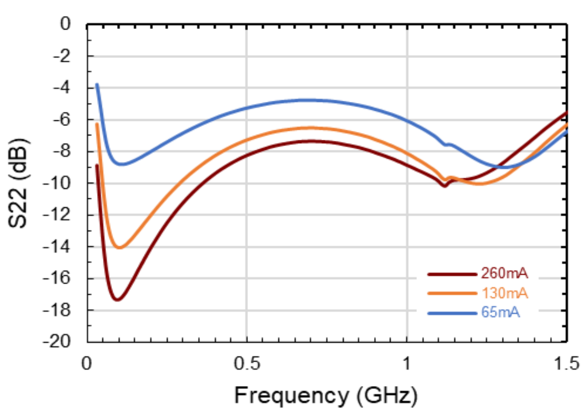
S21 vs. Frequency and I_{DQ}



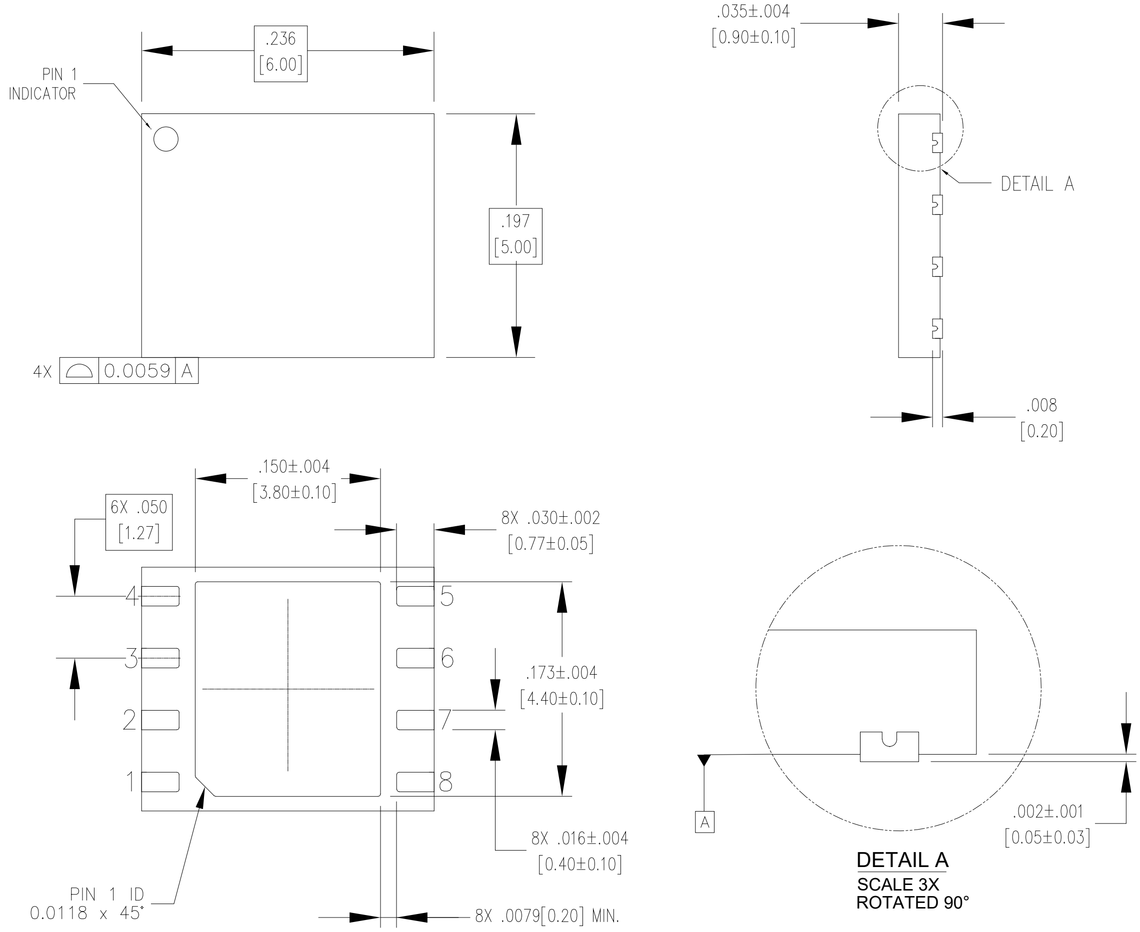
S11 vs. Frequency and I_{DQ}



S22 vs. Frequency and I_{DQ}



Lead-Free 5 x 6 mm Package Dimensions†



NOTES:
1. ALL DIMENSIONS SHOWN AS in[mm]. CONTROLLING DIMENSIONS ARE IN in. CONVERTED mm DIMENSIONS ARE NOT NECESSARILY EXACT.
2. EXPOSED LEADS: NiPdAu.

† Reference Application Note AN0004125 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is Matte Sn.