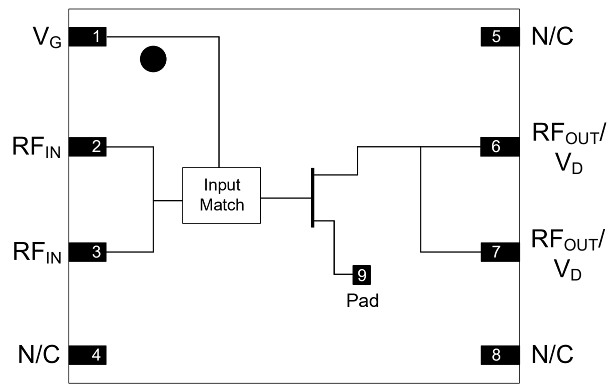
Features
- *MACOM PURE CARBIDE®* Amplifier Series
- Suitable for Linear & Saturated Applications
- CW & Pulsed Operation
- 50 Ω Input Matched
- 260°C Reflow Compatible
- 28 V Operation
- 100% RF Tested
- RoHS* Compliant

5 x 6 mm DFN

Applications
- Defense Communication
- Land Mobile Radio
- Wireless Infrastructure
- Test & Measurement

Description
The MAPC-A1007 is an integrated GaN on SiC power amplifier optimized for 20 - 2500 MHz operation. This amplifier has been designed for saturated and linear operation with output levels to 10 W (40 dBm) assembled in a lead-free 5 x 6 mm 8 -lead PDFN plastic package.

Functional Schematic



Typical Circuit Performance:
V_{DS} = 28 V, I_{DQ} = 100 mA, T_C = 25°C. Measured in sample board circuit under CW operation. Data presented below is at constant P_{OUT} = 40 dBm.

Frequency (MHz)	G_P (dB)	η_D (%)	IRL (dB)
100	11.3	79.4	-11.0
500	10.7	63.1	-10.3
900	10.7	53.4	-8.7
1500	12.7	48.5	-11.6
1900	12.8	50.0	-6.8
2500	14.2	51.3	-13.2

Pin Configuration

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

1. MACOM recommends connecting unused package pins to ground.
2. The pad on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	Package
MAPC-A1007-AD000	Bulk Quantity
MAPC-A1007-ADTR1	1000 piece reel
MAPC-A1106-ADSB1	Sample Board

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

RF Electrical Characteristics: T_C = 25°C, V_{DS} = 28 V, I_{DQ} = 100 mA
Note: Performance in MACOM Evaluation Test Fixture, 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Small Signal Gain	CW, 2500 MHz	G_{SS}	-	17.6	-	dB
Power Gain	CW, 2500 MHz	G_{SAT}	-	10.1	-	dB
Saturated Drain Efficiency	CW, 2500 MHz	η_{SAT}	-	63	-	%
Saturated Output Power	CW, 2500 MHz	P_{SAT}	-	41.7	-	dBm
Gain Variation (-40°C to +85°C)	CW, 2500 MHz, P_{IN} = 30 dBm	ΔG	-	0.01	-	dB/°C
Power Gain	CW, 2500 MHz, P_{IN} = 30 dBm	G_P	-	11.8	-	dB
Drain Efficiency	CW, 2500 MHz, P_{IN} = 30 dBm	η	-	61	-	%
Input Return Loss	CW, 2500 MHz, P_{IN} = 30 dBm	IRL	-	-14	-	dB
Ruggedness: Output Mismatch	All phase angles	Ψ	VSWR = 10:1, No Damage			

RF Electrical Specifications: T_A = 25°C, V_{DS} = 28 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[3], 2500 MHz, P_{IN} = 31 dBm	G_P	10.0	11	-	dB
Drain Efficiency	Pulsed[3], 2500 MHz, P_{IN} = 31 dBm	η_D	40	45	-	%
Input Return Loss	Pulsed[3], 2500 MHz, P_{IN} = 31 dBm	IRL	-	-17	-10	dB

3. Pulse Details: 100 μs pulse width, 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} = 100 V	I_{DLK}	-	-	3.6	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 0 V	I_{GLK}	-	-	3.6	mA
Gate Threshold Voltage	V_{DS} = 28 V, I_D = 3.6 mA	V_T	-3.0	-2.7	-2.0	V
Gate Quiescent Voltage	V_{DS} = 28 V, I_D = 100 mA	V_{GSQ}	-	-2.6	-	V

Absolute Maximum Ratings[2,3,4,5,6]

Parameter	Absolute Maximum
Drain Source Voltage, V_{DS}	120 V
Gate Source Voltage, V_{GS}	-10 to 2 V
Gate Current, I_G	3.6 mA
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 Channel Temperature	+225°C

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation above maximum operating conditions.
6. Operating at drain source voltage $V_{DS} \leq 28$ V will ensure MTTF > 1 x 10^6 hours.
7. Operating at nominal conditions with $T_{CH} \leq 225$°C will ensure MTTF > 1 x 10^6 hours.
8. 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 = 1.08, B = -32.019, and C = 24369.488.

Thermal Characteristics[7]

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance using Finite Element Analysis	V_{DS} = 28 V T_C = 85°C, T_{CH} = 225°C	R_θ(FEA)	6.7	°C/W
Thermal Resistance using Infrared Measurement of Die Surface Temperature	V_{DS} = 28 V T_C = 85°C, T_{CH} = 225°C	R_θ(IR)	5.4	°C/W

9. Case temperature measured using thermocouple embedded in heat-sink. Contact local applications support team for more details on this measurement.

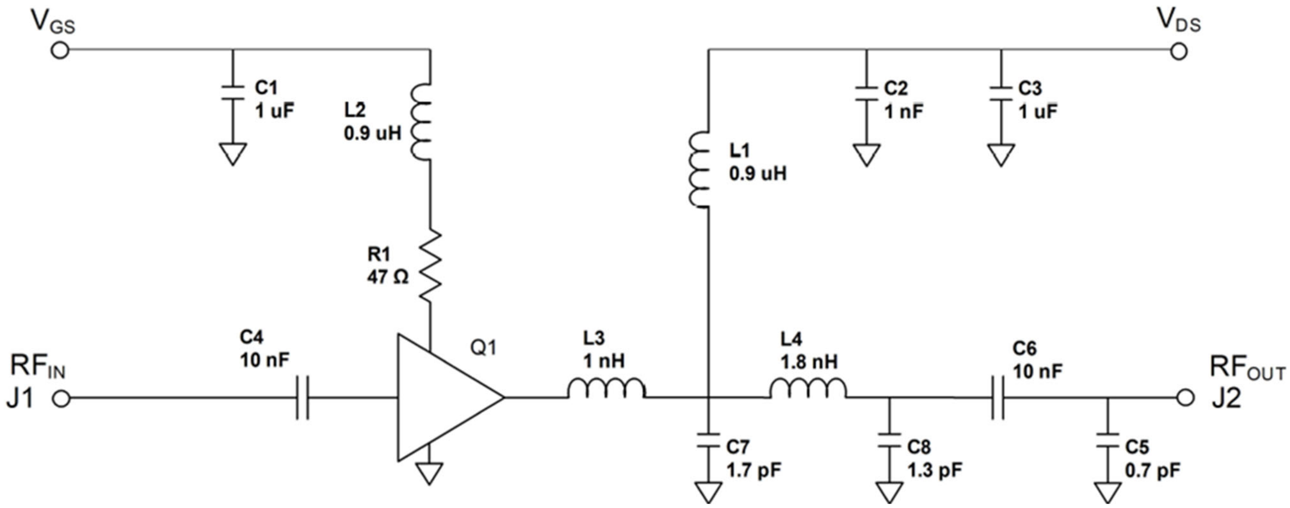
Handling Procedures

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 and CDM Class C3 devices.

Evaluation Test Fixture and Recommended Tuning Solution 20 - 2500 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.

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Bias Sequencing

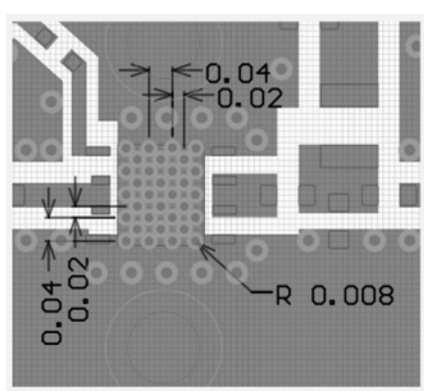
Turning the device ON

1. Set V_{GS} to pinch-off (V_P).
2. Turn on V_{DS} to nominal voltage (28 V).
3. Increase V_{GS} until I_{DS} current is reached.
4. Apply RF power to desired level.

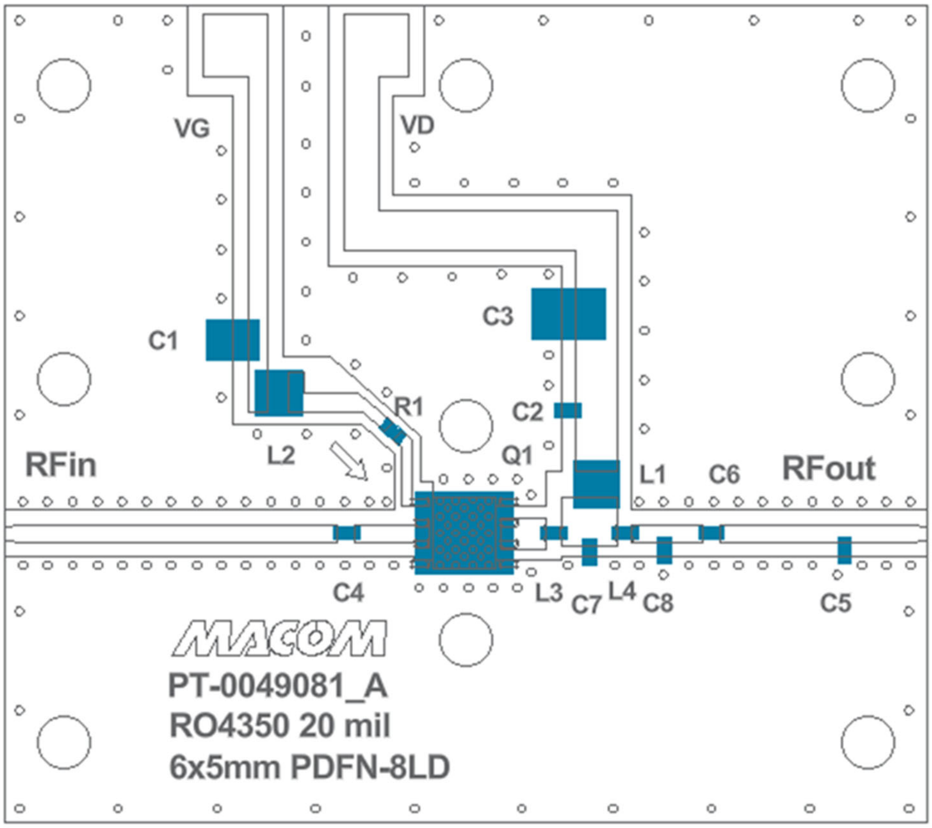
Turning the device OFF

1. Turn the RF power OFF.
2. Decrease V_{GS} down to V_P pinch-off.
3. Decrease V_{DS} down to 0 V.
4. Turn off V_{GS}.

Recommended Via Pattern (All dimensions shown as inches)



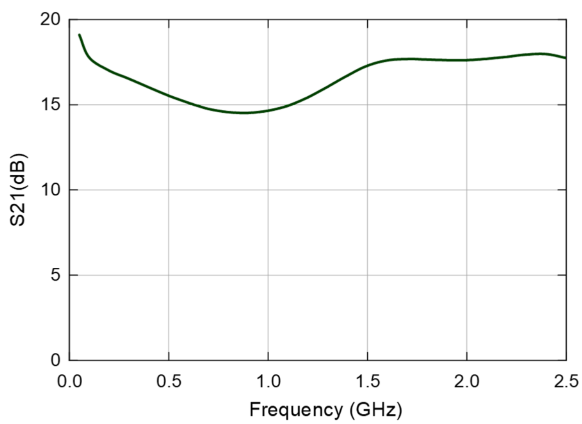
Evaluation Test Fixture and Recommended Tuning Solution 20 - 2500 MHz



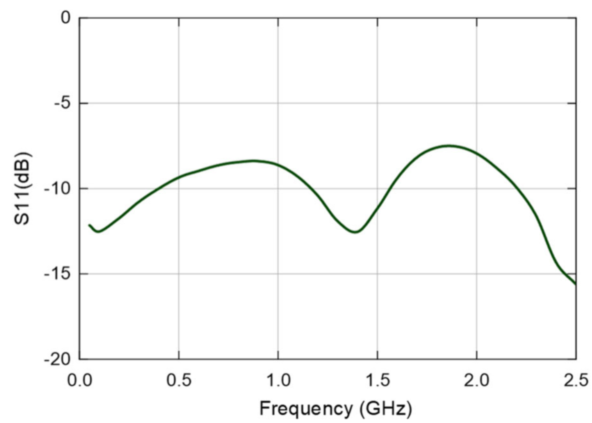
Reference Designator	Value	Tolerance	Manufacturer	Part Number
C1, C3	1 µF	10%	TDK	C4532X7T2E105K250KA
C2	1 nF	10%	Murata	GRM188R72A102KA01D
C4, C6	10 nF	10%	Murata	GCM188R72A103KA37D
C5	0.7 pF	±0.05 pF	PPI	0603N0R7AW251
C7	1.7 pF	±0.1 pF	PPI	0603N1R7BW251
C8	1.3 pF	±0.05 pF	PPI	0603N1R3AW251
R1	47 Ω	1%	Panasonic	ERJ-P03F47R0V
L1, L2	0.9 µH	5%	Coilcraft	1008AF-901XJLC
L3	1 nH	5%	Coilcraft	0603CT-1N0XJLU
L4	1.8 nH	5%	Coilcraft	0603HP-1N8XJLU
Q1	MACOM GaN Power Amplifier			MAPC-A1007
PCB	RO4350, 20 mil, 1 oz Cu, Au Finish			

Typical Performance Curves as Measured in the 20 – 2500 MHz Evaluation Test Fixture: CW, V_{DS} = 28 V, I_{DQ} = 100 mA, T_C = 25°C (Unless Otherwise Noted)

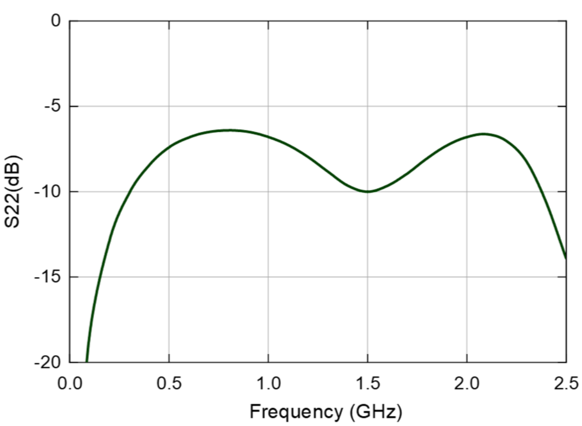
Small Signal Gain



Input Return Loss

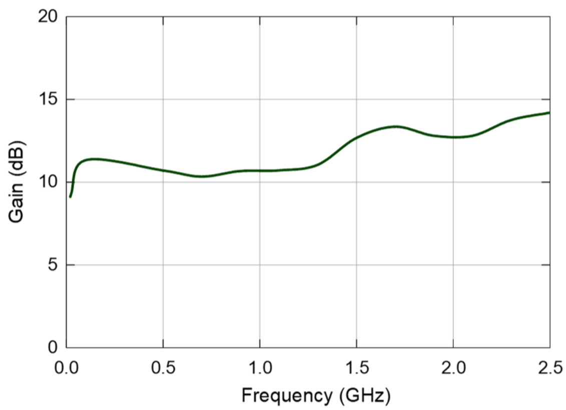


Output Return Loss

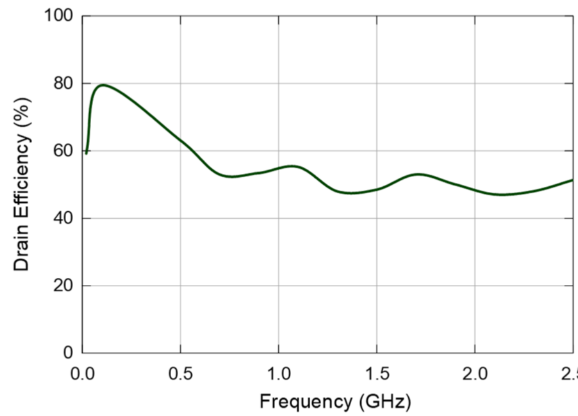


Typical Performance Curves as Measured in the 20 – 2500 MHz Evaluation Test Fixture: CW, V_{DS} = 28 V, I_{DQ} = 100 mA, T_C = 25°C (Unless Otherwise Noted)

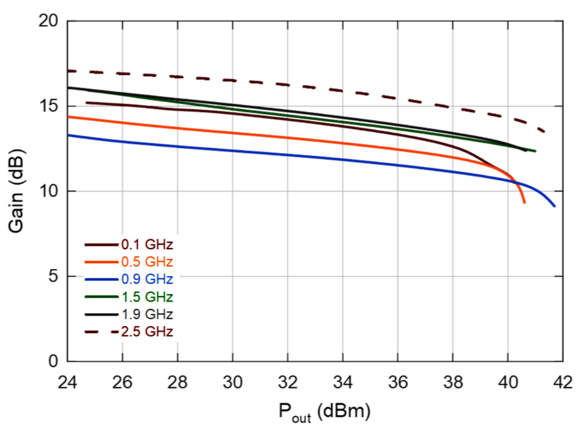
Gain vs. Frequency @ P_{OUT} = 40 dBm



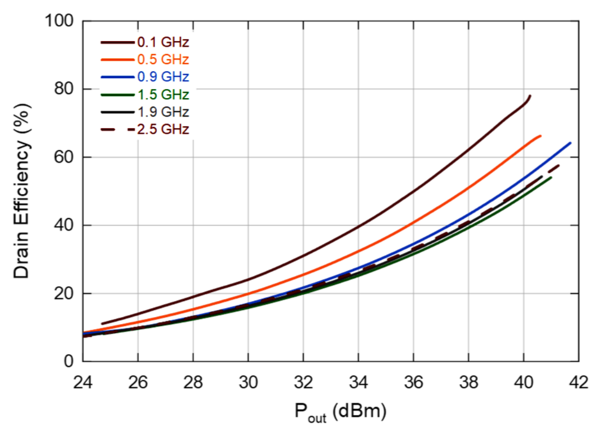
Drain Efficiency vs. Frequency @ P_{OUT} = 40 dBm



Gain vs. Output Power

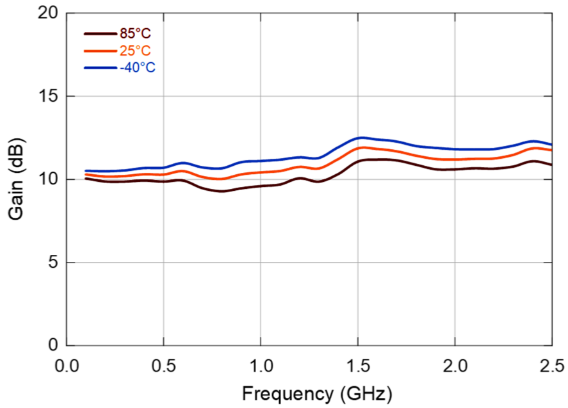


Drain Efficiency vs. Output Power

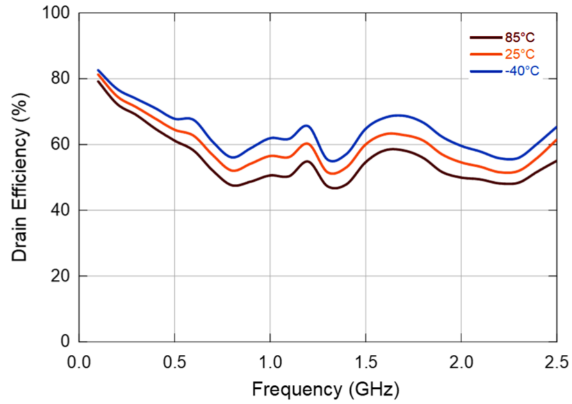


Typical Performance Curves as Measured in the 20 – 2500 MHz Evaluation Test Fixture: CW, V_{DS} = 28 V, P_{IN} = 30 dBm, I_{DQ} = 100 mA, T_C = 25°C (Unless Otherwise Noted)

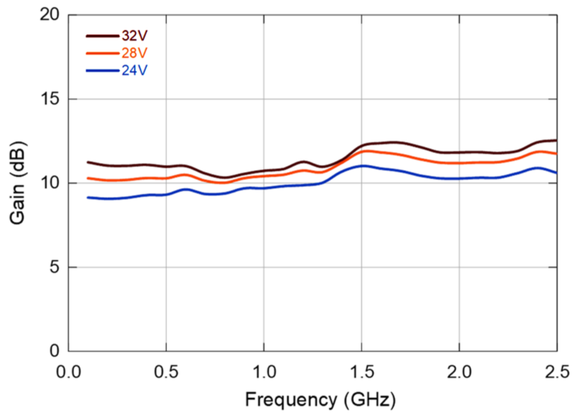
Gain vs. Frequency over Temperature



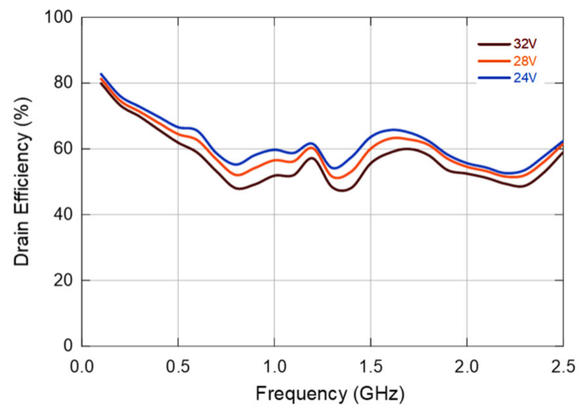
Drain Efficiency vs. Frequency over Temperature



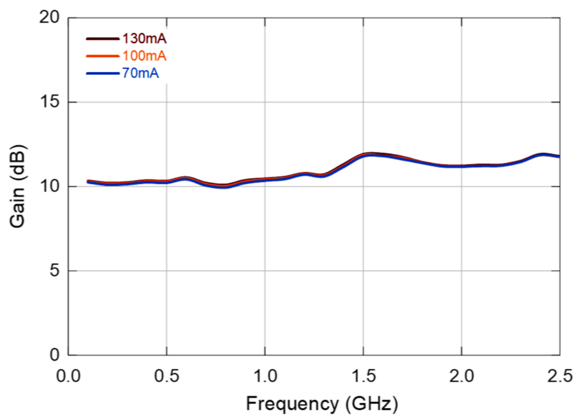
Gain vs. Frequency over Voltage



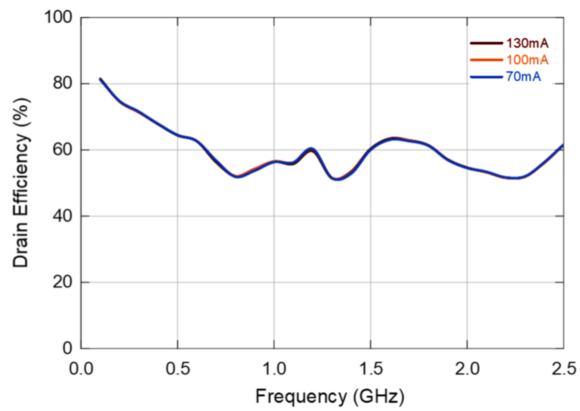
Drain Efficiency vs. Frequency over Voltage



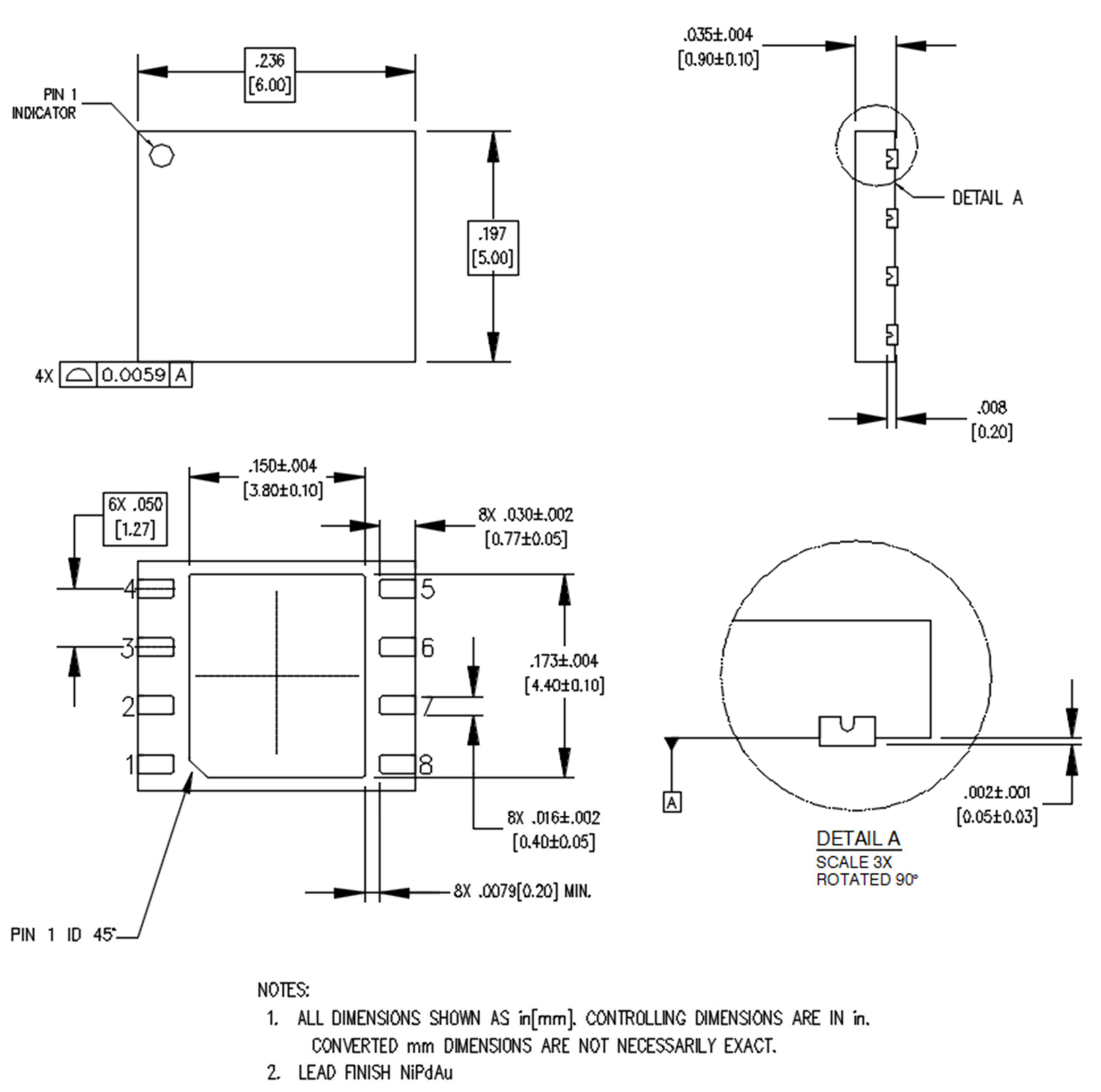
Gain vs. Frequency over Current



Drain Efficiency vs. Frequency over Current



Package Dimensions



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is NiPdAu.