Features
- Optimized for a Multitude of Applications
- CW and Pulsed Operation: 50 W Output Power
- Internally Pre-matched
- 260°C Reflow Compatible
- 50 V Operation
- 100% RF Tested
- RoHS* Compliant

TO-272S-2

Description
The MAGX-100027-050C0P is a high power GaN on Silicon HEMT D-mode amplifier optimized for DC - 2700 MHz frequency operation. The device supports both CW and pulsed operation with peak output power levels to 50 W (47 dBm) in a plastic package.

The MAGX-100027-050C0P is ideally suited for a multitude of applications including military radio communications, digital cellular infrastructure, RF energy, avionics, test instrumentation and RADAR.

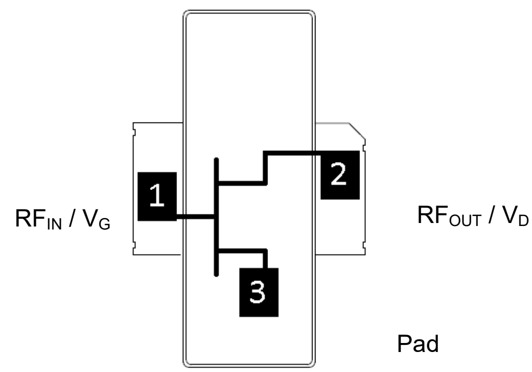
Typical Performance:
- V_{DS} = 50 V, I_{DQ} = 100mA, T_C = 25°C.
  Measured under pulsed load-pull at optimum efficiency load impedance, 2.0 dB Compression, 100μs pulse width,1ms period, 10% duty cycle

Frequency (MHz)	Output Power (dBm)	Gain (dB)	η_D (%)
650	47.6	27.1	79.1
950	45.6	24.5	79.5
1200	47.9	22.4	79.7
1600	48.3	19.8	76.3
2000	48.3	19.1	75.4
2400	47.6	18.5	76.5

Ordering Information

Part Number	Package
MAGX-100027-050C0P	Bulk Quantity
MAGX-100027-050CTP	Tape and Reel
MAGX-1A0027-050C0P	Sample Board

Functional Schematic



Pin Configuration

Pin #	Pin Name	Function
1	RF_{IN} / V_G	RF Input / Gate
2	RF_{OUT} / V_D	RF Output / Drain
3	Pad[1]	Ground / Source

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

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

RF Electrical Characteristics: T_C = 25°C, V_{DS} = 50 V, I_{DQ} = 100 mA
Note: Performance in MACOM Application Fixture (2400 - 2500 MHz), 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Small Signal Gain	CW, 2500 MHz	G_{SS}	-	18.8	-	dB
Power Gain	CW, 2500 MHz, 2 dB Gain Compression	G_{SAT}	-	16.8	-	dB
Saturated Drain Efficiency	CW, 2500 MHz, 2 dB Gain Compression	η_{SAT}	-	72	-	%
Saturated Output Power	CW, 2500 MHz, 2 dB Gain Compression	P_{SAT}	-	48.4	-	dBm
Gain Variation (-25°C to +85°C)	Pulsed[2], 2500 MHz	ΔG	-	0.02	-	dB/°C
Power Variation (-25°C to +85°C)	Pulsed[2], 2500 MHz	ΔP2dB	-	0.004	-	dB/°C
Gain	CW, 2500 MHz, P_{IN} = 32 dBm	G_P	-	16.8	-	dB
Drain Efficiency	CW, 2500 MHz, P_{IN} = 32 dBm	η	-	72	-	%
Ruggedness: Output Mismatch	All phase angles	Ψ	VSWR = 10:1, No Device Damage			

RF Electrical Specifications: T_A = 25°C, V_{DS} = 50 V, I_{DQ} = 100 mA
Note: Performance in MACOM Production Test Fixture, 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Power Gain	CW, 2500 MHz, 2 dB Gain Compression	G_{SAT}	14	15.3	-	dB
Saturated Drain Efficiency	CW, 2500 MHz, 2 dB Gain Compression	η_{SAT}	60	67.5	-	%
Saturated Output Power	CW, 2500 MHz, 2 dB Gain Compression	P_{SAT}	48	49.4	-	dBm
Gain	CW, 2500 MHz, P_{IN} = 33 dBm	G_P	15	16	-	dB
Drain Efficiency	CW, 2500 MHz, P_{IN} = 33 dBm	η	58	65	-	%

2. Pulse details: 100 µs pulse width, 1 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}	-	-	10.8	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 0 V	I_{GLK}	-	-	10.8	mA
Gate Threshold Voltage	V_{DS} = 50 V, I_D = 10.8 mA	V_T	-2.6	-2.0	-1.6	V
Gate Quiescent Voltage	V_{DS} = 50 V, I_D = 250 mA	V_{GSQ}	-2.4	-1.8	-1.4	V
On Resistance	V_{GS} = 2 V, I_D = 80 mA	R_{ON}	-	0.44	-	Ω
Maximum Drain Current	V_{DS} = 7 V pulsed, pulse width 300 µs	$I_{D, MAX}$	-	6.3	-	A

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

Parameter	Absolute Maximum
Drain Source Voltage, V_{DS}	130 V
Gate Source Voltage, V_{GS}	-10 to 3 V
Gate Current, I_G	10 mA
Storage Temperature Range	-65°C to +150°C
Case Operating Temperature Range	-40°C to +120°C
Channel Operating Temperature Range, T_{CH}	-40°C to +225°C
Absolute Maximum Channel Temperature	+250°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 V_{DS} < 55 V will ensure MTTF > 1×10^7 hours.
6. Operating at nominal conditions with $T_{CH} \leq 225°C$ will ensure MTTF > 1×10^7 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* = 3.686, *B* = -35.00, and *C* = 25,416.

Thermal Characteristics[8]

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance using Finite Element Analysis	V_{DS} = 50 V, P_D = 30 W, T_C = 85°C, T_{CH} = 225°C	R_θ(FEA)	3.3	°C/W
Thermal Resistance using Infrared Measurement of Die Surface Temperature	V_{DS} = 50 V, P_D = 30 W, T_C = 85°C, T_{CH} = 225°C	R_θ(IR)	2.76	°C/W

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

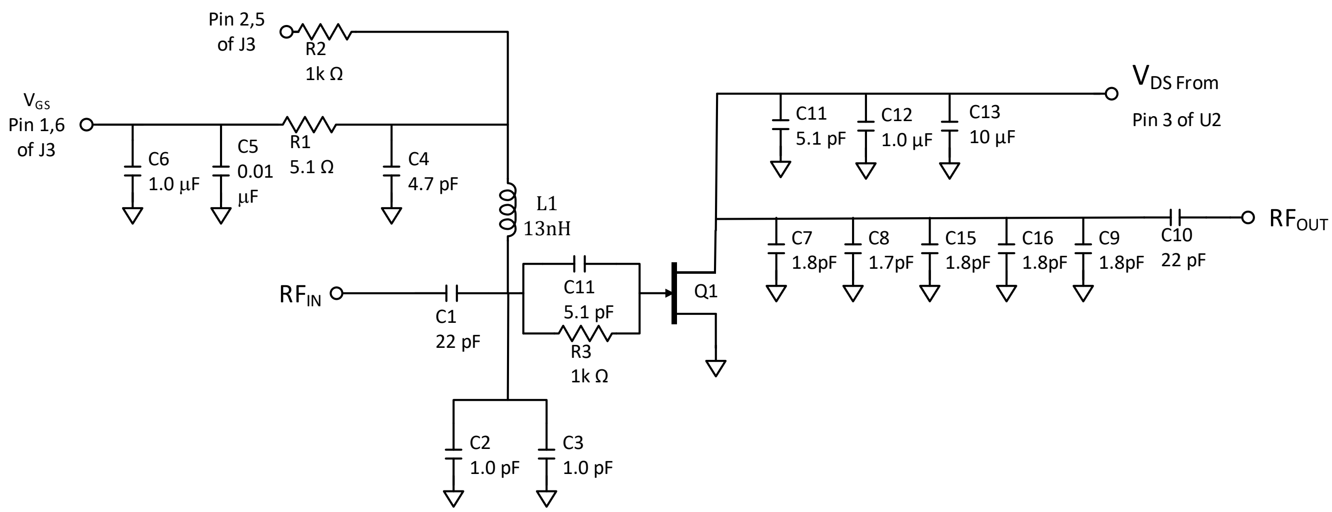
Handling Procedures

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, CDM Class C3 devices.

Application Fixture 2400 - 2500 MHz



Description

Parts measured on application board (20-mil thick RF35A2). 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

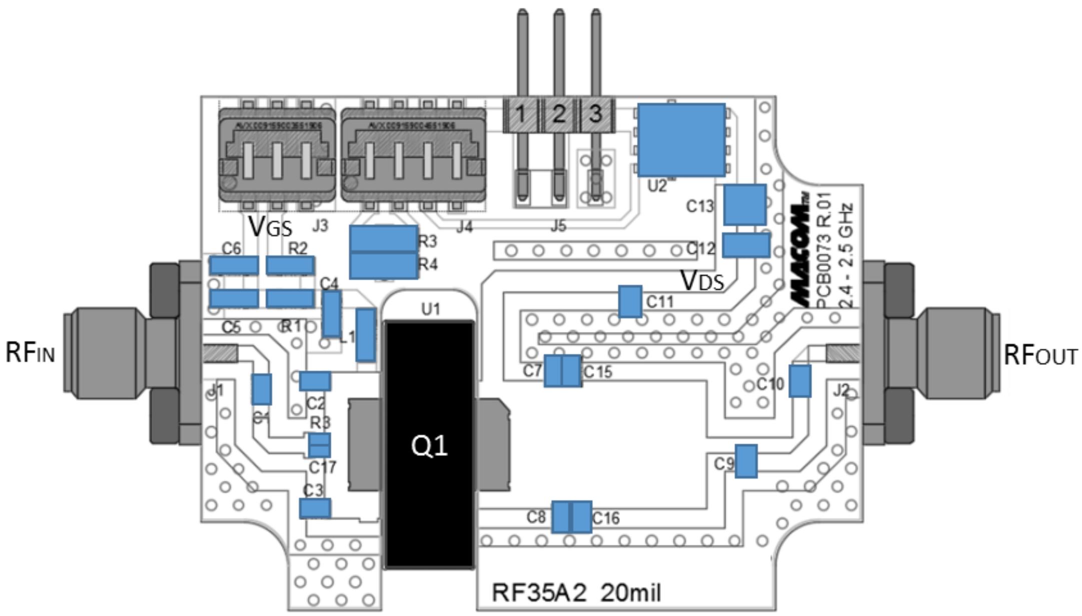
Turning the device ON

1. Set V_{GS} to pinch-off (V_P).
2. Turn on V_{DS} to nominal voltage (50 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}.

Application Fixture 2400 - 2500 MHz

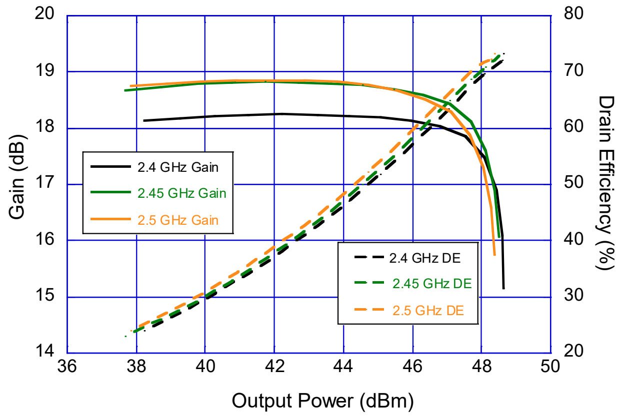


Parts List

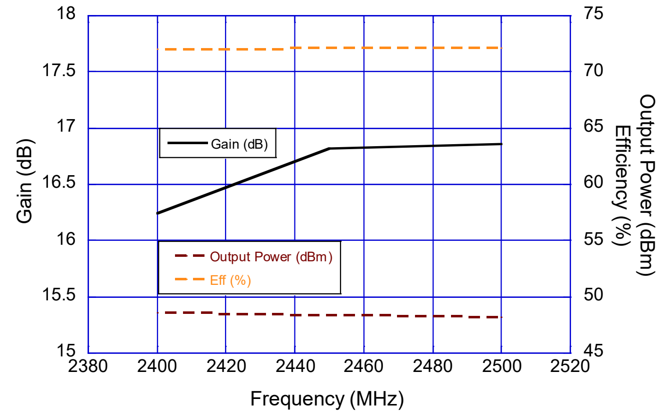
Reference Designator	Value	Tolerance	Manufacturer	Part Number
C1, C10	22 pF	+/-5%	Passive Plus	0805N220JW251T
C2, C3	1.0 pF	+/-0.1 pF	Passive Plus	0805N1R0BW251T
C4	4.7 pF	+/-0.1 pF	Passive Plus	0805N4R7BW251T
C5	0.01 µF	10%	Murata	GRM219R7YA103KA12D
C6	1 µF	10%	Murata	GRM219R7YA105KA12D
C7, C15, C16	1.8 pF	+/-0.1 pF	Passive Plus	0805N1R8BW251T
C8	1.7 pF	+/-0.1 pF	Passive Plus	0805N1R7BW251T
C9	1.8 pF	+/-0.1 pF	Passive Plus	0805N1R8BW251T
C11	5.1 pF	+/-0.1 pF	Passive Plus	0805N5R1BW251T
C12	1 µF	10%	Murata	GRM31CR72A105K
C13	10 µF	20%	Murata	GRM32ER71J106MA12
C17	6.8 pF	+/-0.1 pF	Passive Plus	0603N6R8BW251T
L1	12 nH	5%	Coilcraft	0805HQ-12NXGLB
R1	5.1 Ω	+/-1%	VIKING	CR-05FLF---5R1
R2	1 kΩ	5%	VIKING	CR-05FLF----1K
R3	5.1 Ω	+/-1%	VIKING	CR-03FLF---5R1
U2	80-V	-	MACOM	Si7469DP
Q1	50 W	-	MACOM	MAGX-100027-050C0P
PCB	Taconic RF35A2, 20 mil, 1 oz. Cu, Au Finish			

Typical Performance Curves as Measured in the 2400 - 2500 MHz Application Fixture:
CW, 2.45 GHz, V_{DS} = 50 V, I_{DQ} = 100 mA, T_C = 25°C
Unless Otherwise Noted

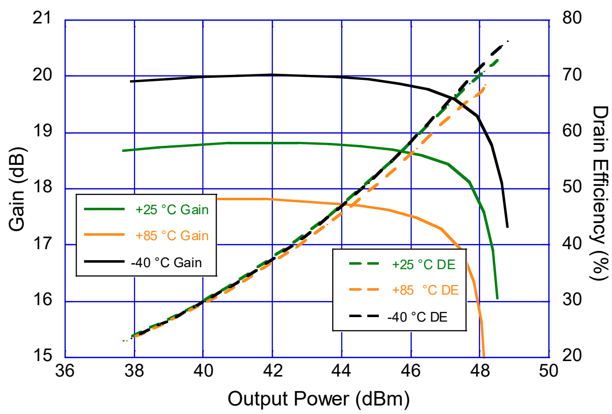
Gain and Drain Efficiency vs. Output Power and Frequency



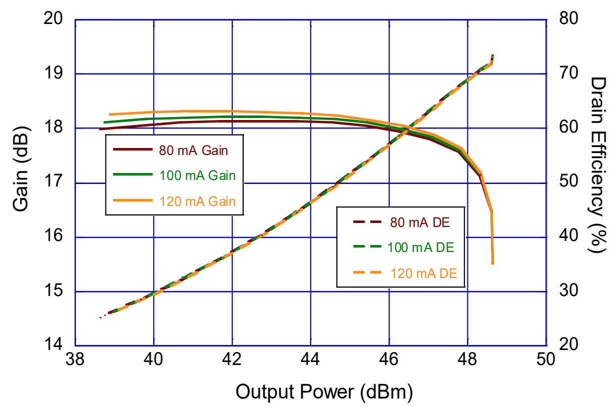
Performance vs. Frequency at Fixed P_{IN} = 32 dBm



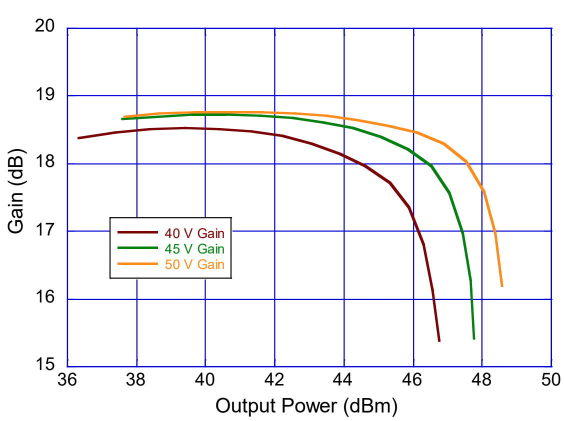
Gain and Drain Efficiency vs Output Power and T_C



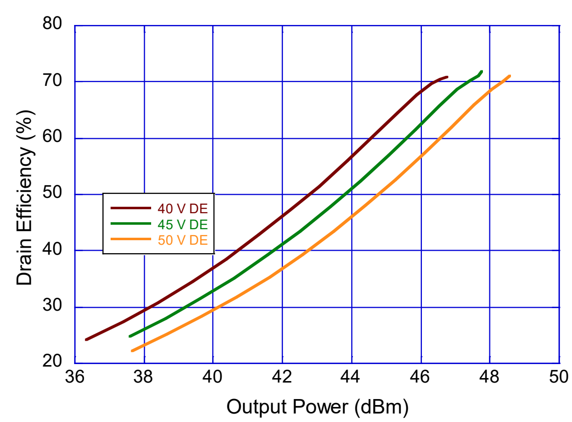
Gain and Drain Efficiency vs. Output Power and I_{DQ}



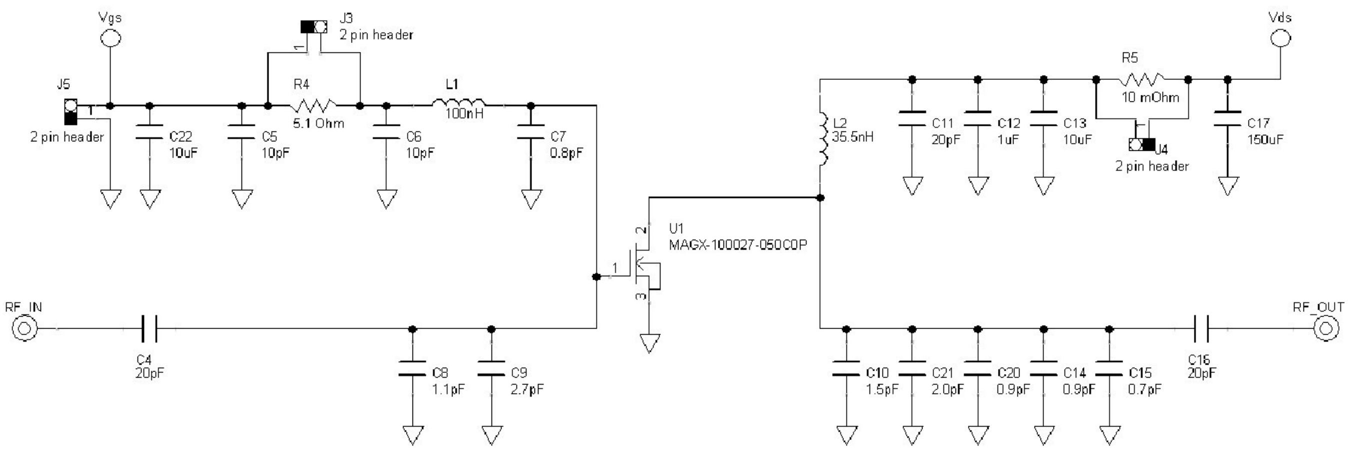
Gain vs. Output Power and V_{DS}



Drain Efficiency vs. Output Power and V_{DS}



MAGX-1A0027-050C0P Sample Board 500 - 2500 MHz



Description

Parts measured on sample board (RO4350, 20-mil thick input, 30-mil thick output). 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

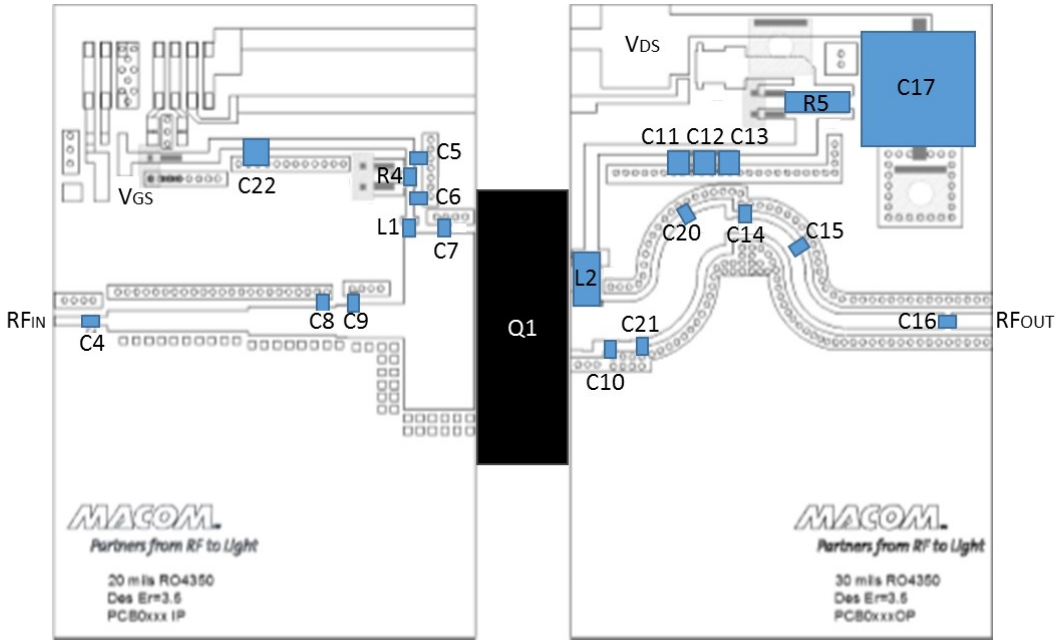
Turning the device ON

1. Set V_{GS} to pinch-off (V_P).
2. Turn on V_{DS} to nominal voltage (50 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}.

MAGX-1A0027-050C0P Sample Board 500 - 2500 MHz

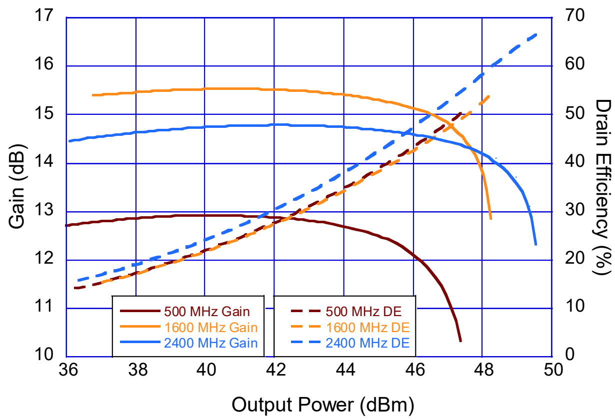


Parts List

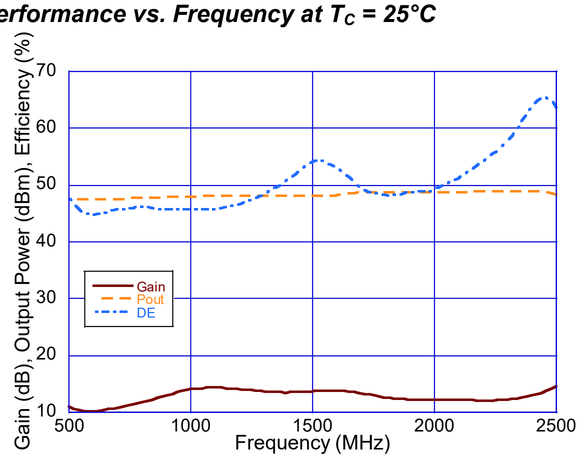
Reference Designator	Value	Tolerance	Manufacturer	Part Number
C4, C16	20 pF	+/-0.1pF	Passive Plus	0805N200JW251T
C5, C6	10 pF	+5%	Passive Plus	0805N100JW251T
C7	0.8 pF	+/-0.1pF	Passive Plus	0805N0R8BW251T
C8	1.1 pF	+/-0.1pF	Passive Plus	0805N1R1BW251T
C9	2.7 pF	+/-0.1pF	Passive Plus	0805N2R7BW251T
C10	1.5 pF	+/-0.1pF	Passive Plus	0805N1R5BW251T
C11	20 pF	5%	Passive Plus	1111N200JW251T
C12	1 µF	10%	Murata	GRM32ER72A105K
C13, C22	10 µF	10%	Murata	GRM32DF51H106ZA01L
C14, C20	0.9 pF	+/-0.1pF	Passive Plus	0805N0R9BW251T
C15	0.7 pF	+/-0.1pF	Passive Plus	0805N0R7BW251T
C17	150 µF	20%	Panasonic	EEV-FK1K151Q
C21	2 pF	+/-0.1pF	Passive Plus	0805N2R0BW251T
L1	100 nH	5%	Coilcraft	0805CS-101
L2	35.5 nH	5%	Coilcraft	B09T
R4	5.1 Ω	+/-1%	VIKING	CR-05FL7---5R1
R5	10 mΩ	+/-1%	VIKING	CS75FTFR010
Q1	MACOM GaN Power Amplifier			MAGX-100027-050C0P
PCB	RO4350, 20mil, 1oz Cu, Au Finish (input) RO4350, 30mil, 1oz Cu Au Finish (output)			

Typical Performance Curves as Measured in the 500 - 2500 MHz Application Fixture: Pulsed[2], 2.4 GHz, V_{DS} = 50 V, I_{DQ} = 100 mA, T_C = 25°C Unless Otherwise Noted

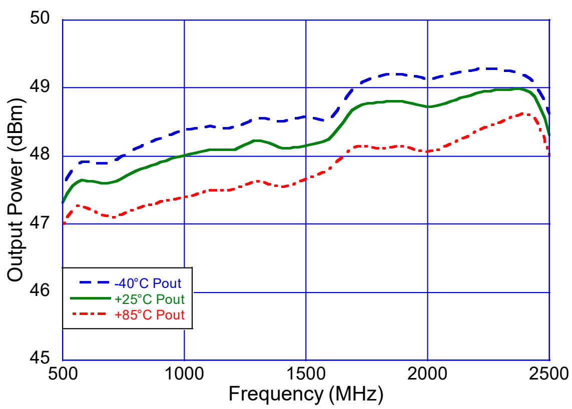
Gain and Drain Efficiency vs. Output Power and Frequency



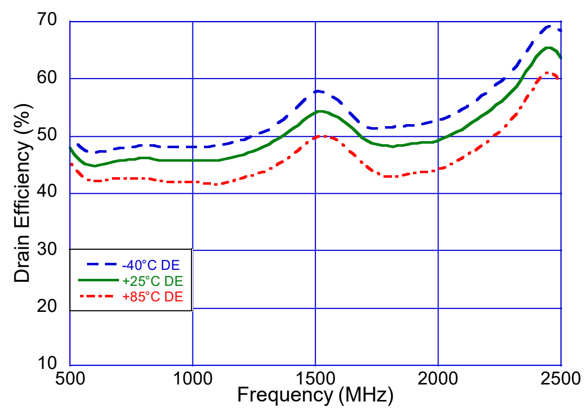
Performance vs. Frequency at T_C = 25°C



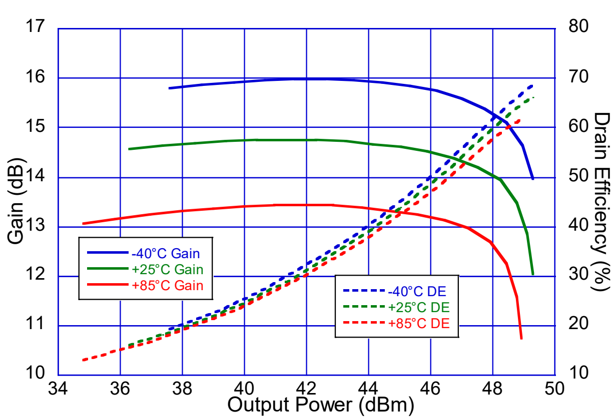
Output Power vs. Frequency and T_C



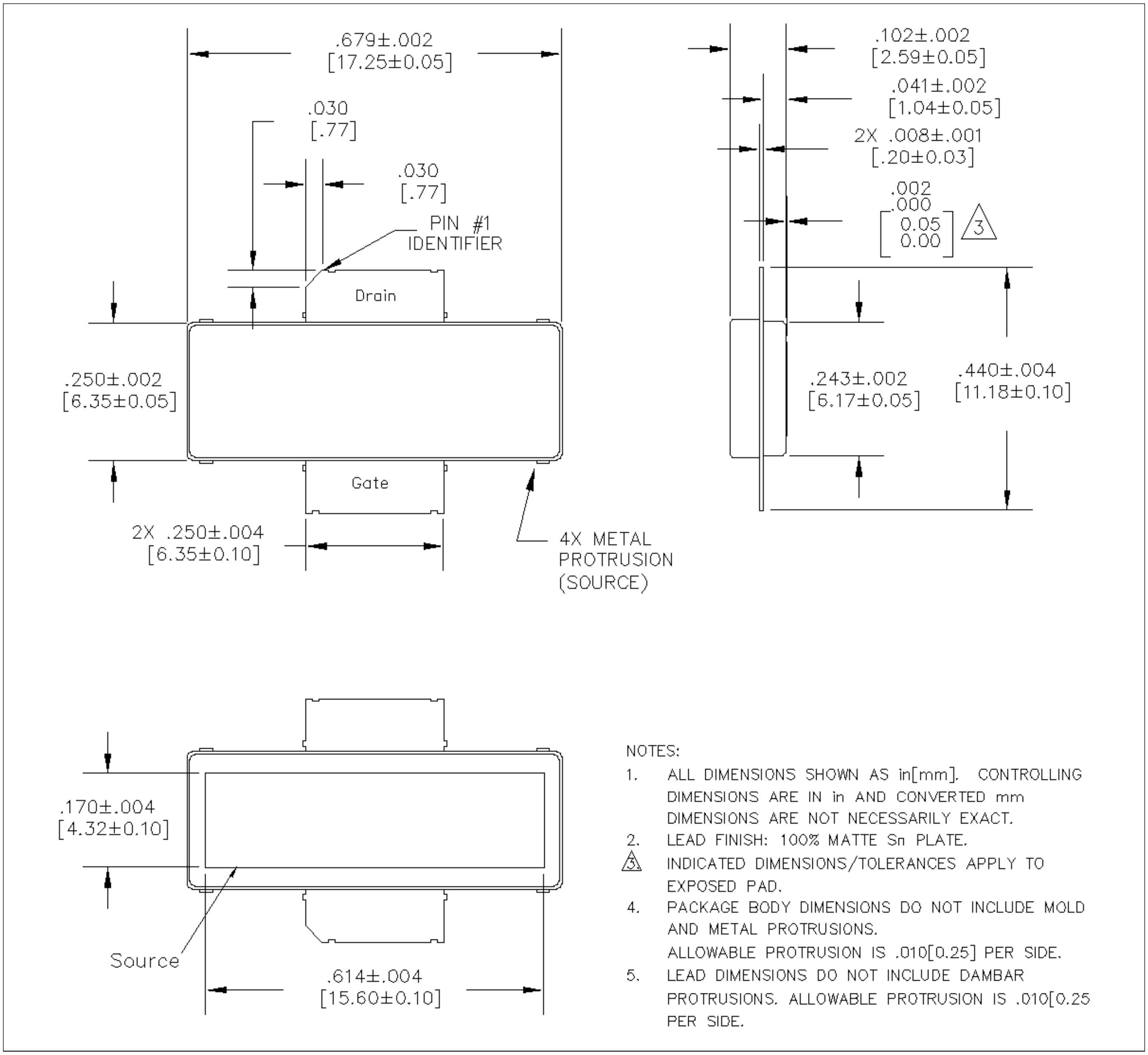
Drain Efficiency vs. Frequency and T_C



Gain and Drain Efficiency vs. Output Power and T_C



Lead-Free TO-272S-2 Package Dimensions†



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