MAMG-002735-085L0L

S-Band 85 W 2-Stage Fully Matched Hybrid GaN Amplifier
Surface Mount Laminate Package

Rev. V2

Features

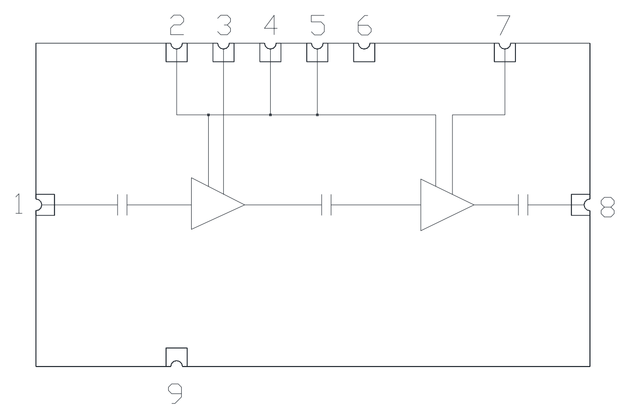
- Compact Size (14 x 24 mm^2)
- GaN on SiC D-Mode Transistor Technology
- Fully Matched, Decoupled DC and RF
- Typical Bias: 50 V, Class AB
- Intended for Pulsed RADAR Applications
- Output Power > 85 W, with 23 dB Gain and 50% Power Added Efficiency
- Up to 1 ms Pulse Width and 15% Duty Cycle
- MTTF = 600 years (T_J < 200°C)
- Thermally Enhanced Laminate LGA Package
- RoHS* Compliant. Lead Free Reflow Compatible
- MSL-3

Description

The MAMG-002735-085L0L is a fully-matched, 2-stage hybrid GaN amplifier in a “True SMT” laminate package. Under pulsed conditions, it can deliver output power greater than 85 W, with 23 dB typical associated gain and 50% typical power added efficiency.

Flexible design allows for gate and/or drain pulsing. Additional features include a gate voltage sense port for use in temperature compensation or pulse droop compensation. The amplifier’s compact size, combined with excellent RF performance make this product an ideal solution for pulsed RADAR applications.

Functional Schematic



Ordering Information[1]

Part Number	Package
MAMG-002735-085L0L	Bulk Packaging
MAMG-002735-085LTL	100 Piece Reel
MAMG-S12735-085L0L	Evaluation Board[2]

1. Reference Application Note M513 for reel size information.
2. Includes one module surface mounted onto board.

Pin Configuration

Pin No.	Function
1	RF IN
2	VG [3]
3	VD1
4	NC [4]
5	VG Sense [5]
6	Ground
7	VD2
8	RF OUT
9	NC [4]

3. One common gate voltage for both stages in the module.
4. Do not connect.
5. Do not connect to ground if not used.

* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

Electrical Specifications [6]: T_A = 25°C

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
RF Specifications						
P_{OUT}	Peak Output Power [7]	Freq. = 2.7 - 3.5 GHz, P_{IN} = 0.3 W V_{DD} = 50 V, I_{DQ} = 200 mA, Pulse Width = 1 ms, Duty = 10% Z_L = 50 Ω	85	95	-	W
G_P	Power Gain		-	25	-	dB
PAE	Power Added Efficiency		45	50	-	%
Droop	Pulse Droop [8]		-	0.2	0.3	dB
2F0	2nd Harmonic		-	-35	-	dBc
3F0	3rd Harmonic		-	-55	-	dBc
VSWR-S	Load Mismatch Stability		-	3:1	-	-
VSWR-T	Load Mismatch Tolerance		-	5:1	-	-

6. Typical RF performance measured in RF evaluation board (see layout on page 4).
7. Peak output power measured at center of pulse.
8. Pulse droop measured between 10% and 90% of pulse.

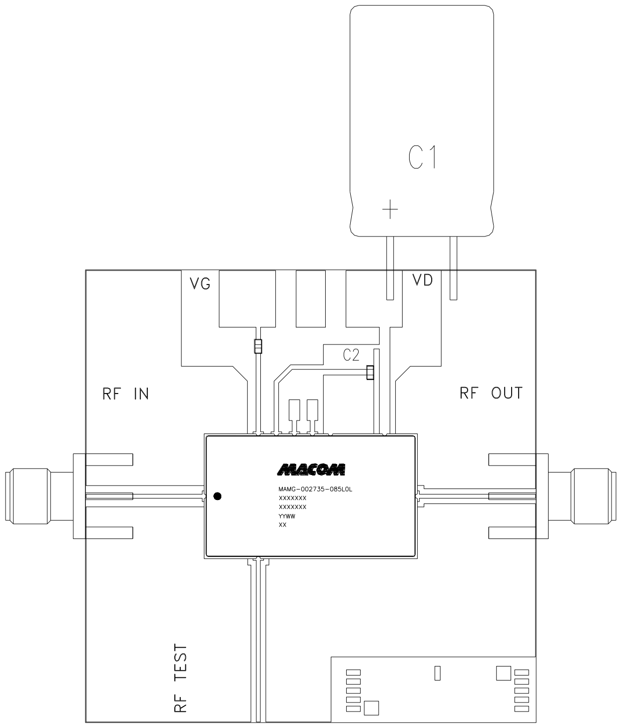
Absolute Maximum Ratings [9,10,11,12,13]

Parameter	Absolute Maximum
Input Power	P_{IN} (nominal) + 3 dB
Drain Supply Voltage (pulsed), V_{DD}	+53 V
Gate Supply Voltage Range, V_{GG}	-9 V to -2.5 V
Supply Current, I_{DD}	4.2 A
Pulsed Power Dissipation at 85ºC	85 W
Junction Temperature [14]	200°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
ESD Maximum - Human Body Model (HBM)	600 V
ESD Maximum - Charged Device Model (CDM)	300 V

9. Exceeding any one or combination of these limits may cause permanent damage to this device.
10. MACOM does not recommend sustained operation near these survivability limits.
11. For saturated performance it is recommended that the sum of (3 * V_{DD} + abs (V_{GG})) $\leq$ 175 V.
12. CW operation is not recommended. Max Duty cycle is 20%
13. Operating at nominal conditions with $T_J \leq$ 200°C will ensure MTTF > 1 x 10^6 hours. Junction temperature directly affects device MTTF and should be kept as low as possible to maximize lifetime.
14. Junction Temperature (T_J) = T_C + Θ_{JC} * ((V * I) - (P_{OUT} - P_{IN})).

Typical Transient Thermal Resistance Θ_{JC} = 1.4 °C/W (1 ms pulses, 10% duty cycle)

Evaluation Board



Parts List

Part	Value	Case Style
C1	100 μF	Radial
C2	10 nF	0603

Evaluation board material is 8-mil thick RO4003C. Electrical and thermal ground is provided using a Cu-filled via-hole array (not pictured). Module base is facilitated by a land grid array defined by solder mask (see landing pattern on page 4). The evaluation board is bolted onto a metal plate (Ni-plated Aluminum). DC blocks are not required.

Bias Sequencing

Turning the device ON

1. Set V_{GS} to pinch-off voltage (V_P), typically –6 V.
2. Set V_{DS} to nominal voltage (50 V).
3. Increase V_{GS} to nominal I_{DS} current.
4. Apply RF power to desired level.

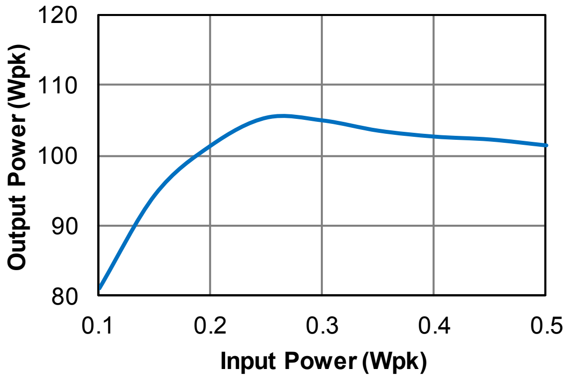
Turning the device OFF

1. Turn off RF power.
2. Decrease V_{GS} to V_P.
3. Decrease V_{DS} to 0 V.
4. Turn off V_{GS}.

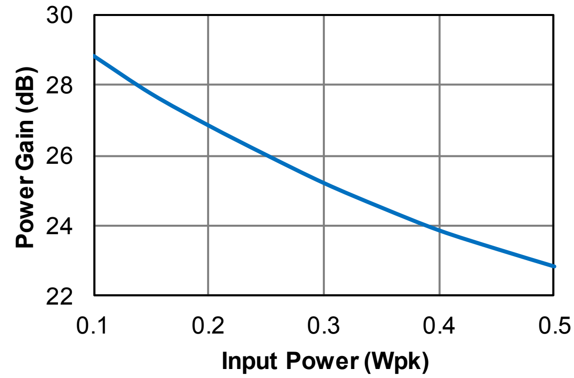
Typical Large Signal Performance Curves

Freq. = 3.1 GHz, Pulse Width = 1 ms, Duty Cycle = 10%, V_{DD}= 50 V, I_{DQ} = 200 mA, T_A = 25°C

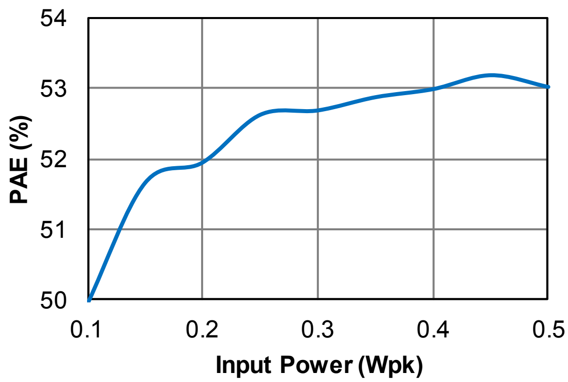
Output Power vs. Input Power



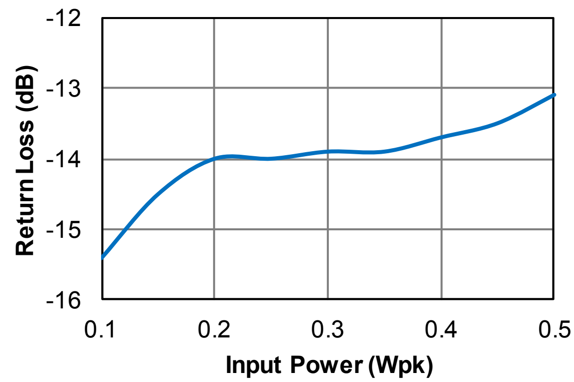
Power Gain vs. Input Power



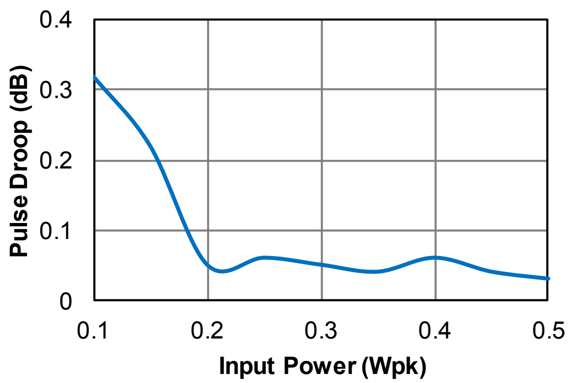
PAE vs. Input Power



Return Loss vs. Input Power



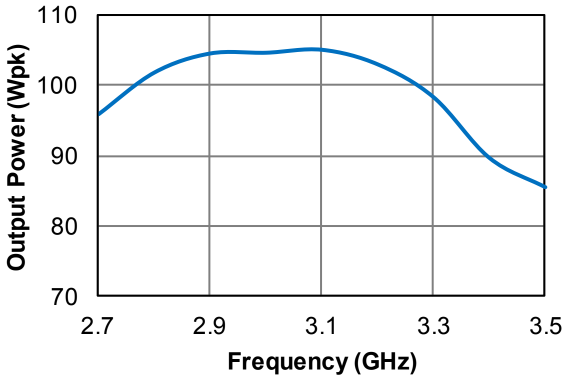
Pulse Droop vs. Input Power



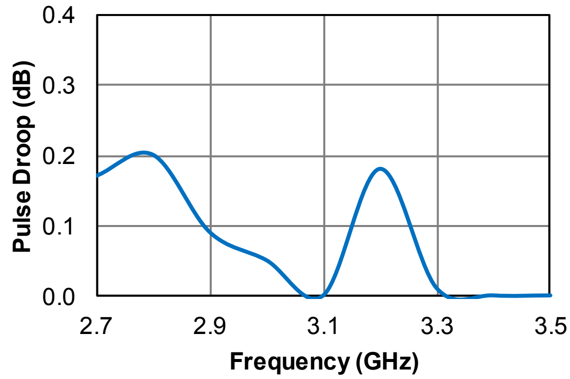
Typical Large-Signal Performance Curves Over Frequency

Pulse Width = 1 ms, Duty Cycle = 10%, V_{DD}= 50 V, I_{DQ} = 200 mA, T_A = 25°C

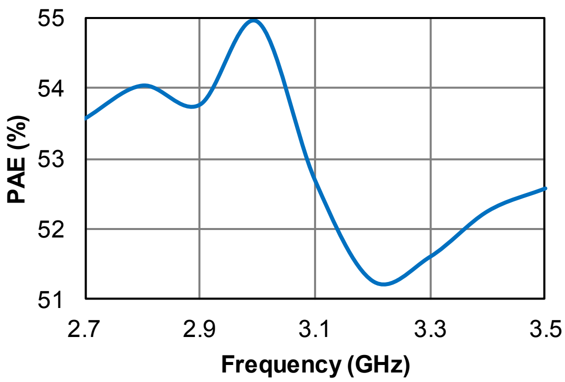
Output Power vs. Frequency



Pulse Droop vs. Frequency



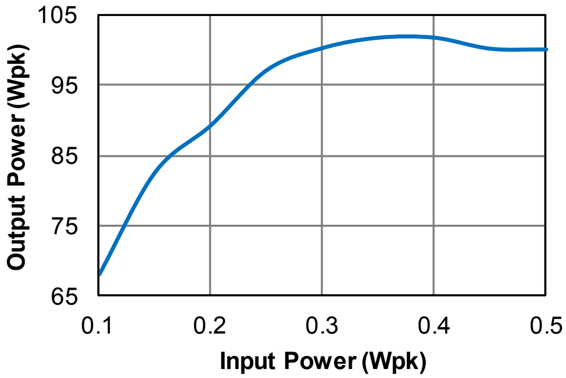
PAE vs. Frequency



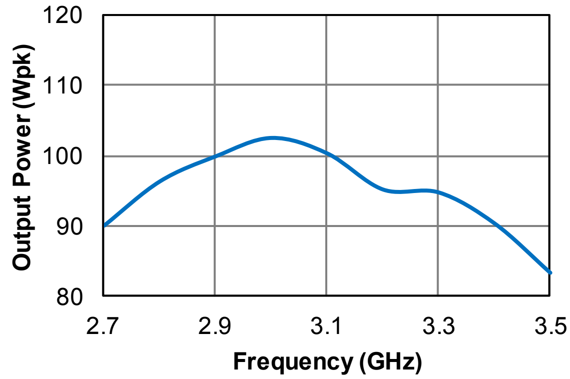
Typical Large-Signal Performance Curves

Pulse Width = 750 µs, 20% Duty Cycle, V_{DD}= 50 V, I_{DQ} = 200 mA, T_A = 25°C

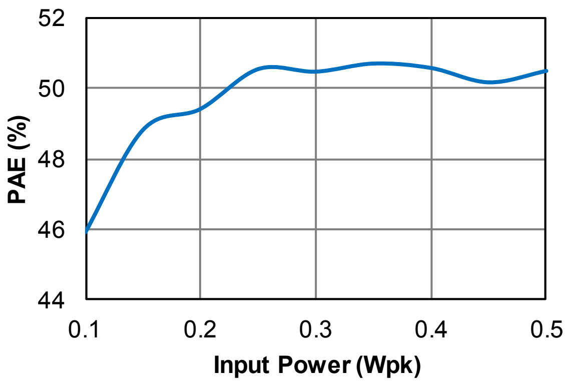
Output Power vs. Input Power (3.1 GHz)



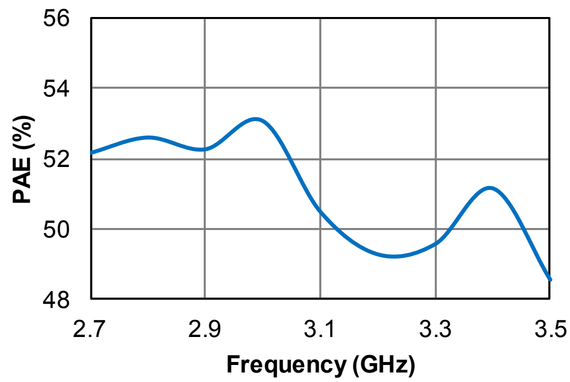
Output Power vs. Frequency



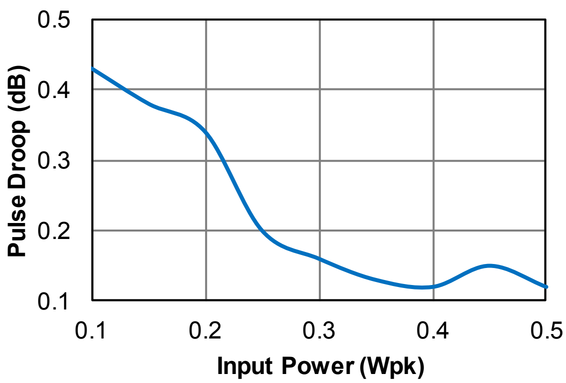
PAE vs. Input Power (3.1 GHz)



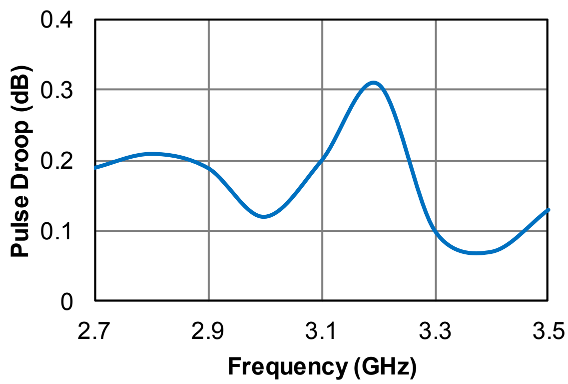
PAE vs. Frequency



Pulse Droop vs. Input Power (3.1 GHz)



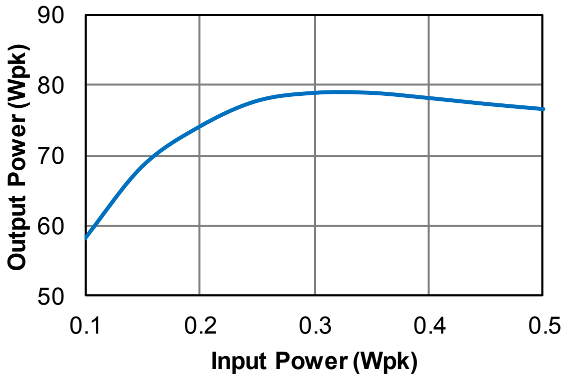
Pulse Droop vs. Frequency



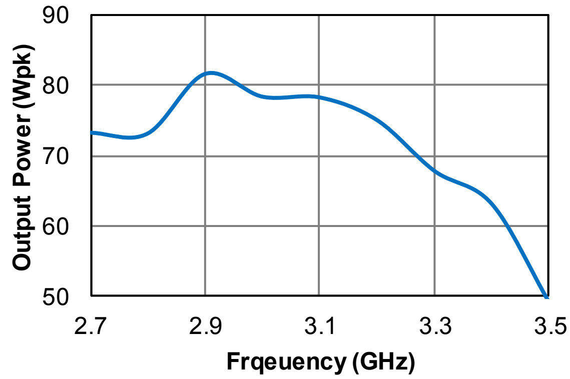
Typical Large-Signal Performance Curves

Pulse Width = 750 μs, 20% Duty Cycle, V_{DD}= 40 V, I_{DQ} = 200 mA, T_A = 25°C

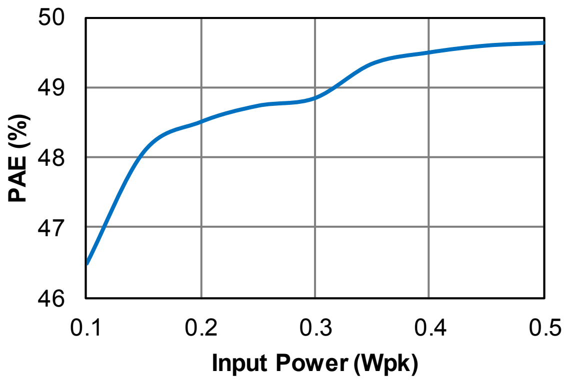
Output Power vs. Input Power (3.1 GHz)



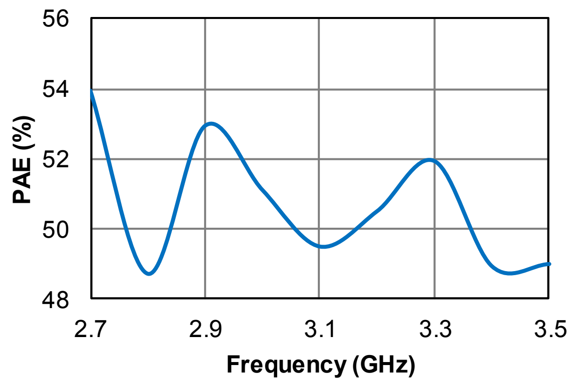
Output Power vs. Frequency



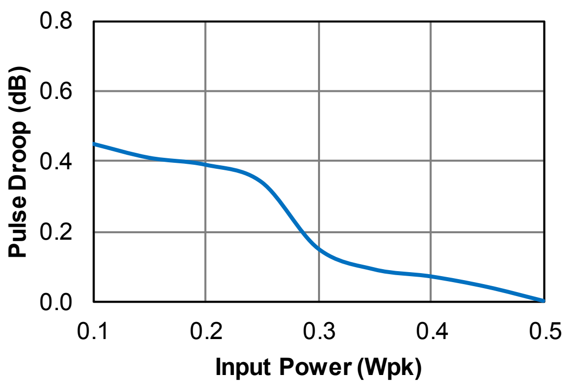
PAE vs. Input Power (3.1 GHz)



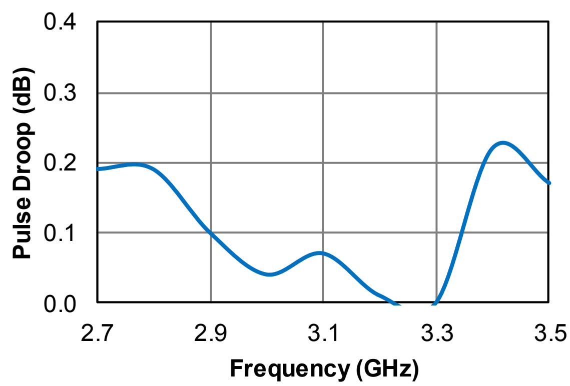
PAE vs. Frequency



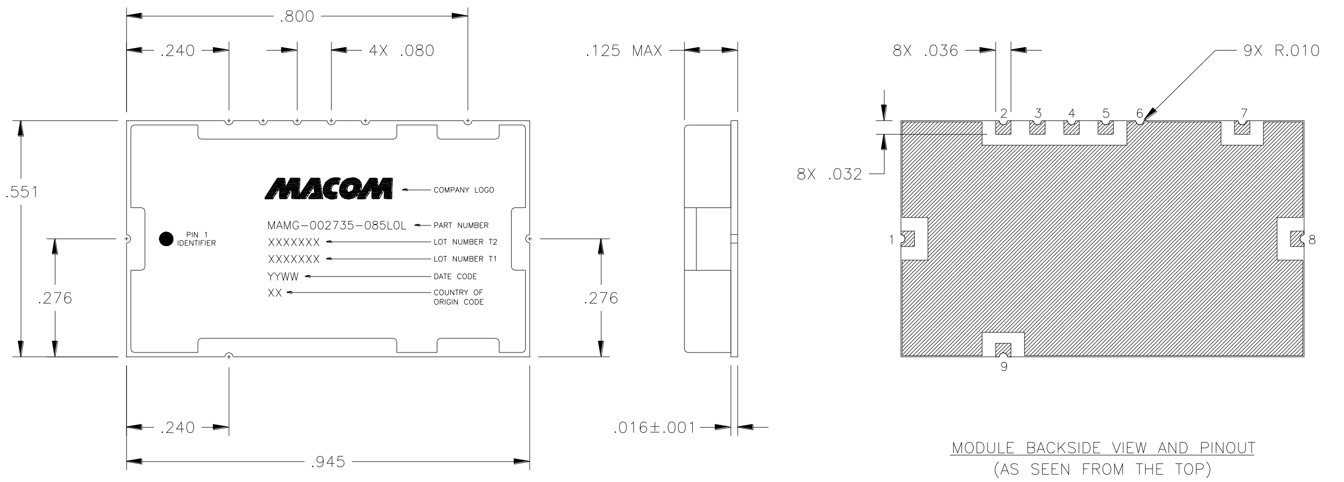
Pulse Droop vs. Input Power (3.1 GHz)



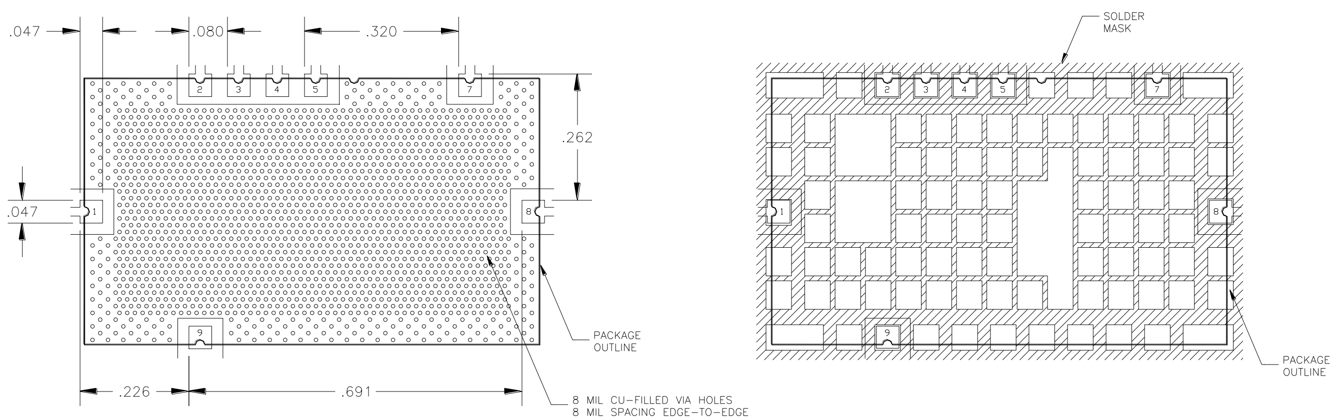
Pulse Droop vs. Frequency



Package Outline [15,16,18]



Recommended Landing Pattern [15,16,17,18]



15. All dimensions are in inches.
16. Reference Application Note S2083 for lead-free solder reflow recommendations. Plating is Ni/Pd/Au.
17. Landing pattern indicates solder mask opening. Cu-filled via-holes under the ground are used for optimal thermal performance. Recommended pattern: 8-mil diameter, 8-mil spacing.
18. Layout drawing available upon request.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Nitride Devices and Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.