S-Band 350 W Radar Pulsed Power GaN Pallet 2700 - 2900 MHz

Features

- Output Power > 350 W, with 11.5 dB Gain and 50% Drain Efficiency
- 2.0 x 0.9 Inches (50.8 x 23 mm²) Size
- Weight: 19 Grams
- Nickel Plated Aluminum Carrier
- +50 V Operation
- Input and Output Matched to 50 Ω
- RO4003C Substrate ϵ_R = 3.38 Circuit Board
- True Standard SMT Assembly
- Single Gate and Drain Bias
- Dual GaN on SiC High Power Transistors
- Enhanced Harmonic Rejection
- MTTF = 600 years (T_J < 200°C)
- RoHS* Compliant. Lead Free Reflow Compatible

Description

The MAPG-002729-350L00 is a common-source, Class AB, S-band GaN pallet power amplifier. The pallet is comprised of a matched pair of discrete GaN on SiC high power transistors which are combined to produce a guaranteed 350 W peak pulsed power and 35 W average power.

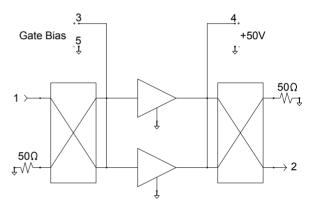
The GaN pallet has excellent harmonic rejection and robust operation under a wide range of environmental conditions. The pallet is constructed by combining a laminate board (RO4003C) with an aluminum carrier to allow for true standard SMT assembly.

The compact size of the integrated pallet, combined with excellent RF performance makes this product an ideal solution for pulsed radar and medical applications where small size, light weight and high power performance (SWaP) are required.

MAPG-002729-350L00



Functional Schematic^{1, 2}



Pin Configuration³

Pin No.	Function	
1	RF Input	
2	RF Output	
3	Gate Bias Voltage ¹ (V _{GG})	
4	Drain Bias Voltage ² (V _{DD})	
5	GND	

Ordering Information

Part Number	Package
MAPG-002729-350L00	Bulk Packaging
MAPG-S22729-350L00	Sample Board

1. One common gate voltage for both transistors.

- 2. One common drain voltage for both transistors.
- 3. The exposed pad centered on the package bottom must be connected to RF and DC ground.

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* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

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Electrical Specifications⁴: 2700 - 2900 MHz, $T_A = 25^{\circ}C$, $Z_L = 50 \Omega$

Parameter	Test Conditions	Symbol	Min.	Тур.	Max.	Units
RF Functional Tests: V _{DD} = 50 V, I _{DQ} = 500 mA, 300 μs Pulse, 10% Duty Cycle						
Output Power	P _{IN} = 32 Wpk	P _{OUT}	350	400	-	Wpk
Gain	P _{IN} = 32 Wpk	G _P	10.4	11.5	-	dB
Drain Efficiency	P _{IN} = 32 Wpk	η _D	45	50	-	%
Droop	P _{IN} = 32 Wpk	Droop	-	0.2	0.5	dB
Input Return Loss	P _{IN} = 32 Wpk	IRL	-	-20	-10	dB
2 ND Harmonic	P _{IN} = 32 Wpk	2F _o	-	- 50	-	dBc
3 RD Harmonic	P _{IN} = 32 Wpk	3F _o	-	- 30	-	dBc
Load Mismatch Stability	P _{IN} = 32 Wpk	VSWR-S	-	5:1	-	-
Load Mismatch Tolerance	P _{IN} = 32 Wpk	VSWR-T	-	10:1	-	-

4. Typical RF performance measured in RF evaluation board (see test fixture assembly on page 3).

Absolute Maximum Ratings 5,6,7,8

Parameter	Absolute Maximum
Peak Input Power (P _{IN})	+36 W
Drain Supply Voltage (V _{DD})	+55 V
Gate Supply Voltage (V _{GG})	-9 V to -2.0 V
Supply Current (I _{DD})	10 A
Peak Power Dissipation (300 µs Pulse, 10% duty cycle)	460 W
Peak Power Dissipation (150 µs Pulse, 15% duty cycle)	550 W
Operating Junction Temperature ⁹	250 °C
Operating Temperature Range	-40 °C to +85 °C
Storage Temperature Range	-65 °C to +150 °C
ESD Min Human Body Model (HBM)	550 V

5. Exceeding any one or combination of these limits may cause permanent damage to this device.

6. MACOM does not recommend sustained operation near these survivability limits.

7. For saturated performance it is recommended that the sum of $(3 * V_{DD} + abs (V_{GG})) \le 175 \text{ V}$.

8. CW operation is not recommended.

Operating junction temperature is measured with infrared (IR) microscope. Junction temperature directly affects a device's MTTF and should be kept as low as possible to maximize lifetime.

MTTF = 5.3 x 10⁶ hours (T_J < 200 °C)

• MTTF = 6.8×10^4 hours (T_J < $250 \degree$ C)

Thermal Characteristics

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance	T_{C} = 85 °C, V_{DD} = 50 V, I_{DQ} = 500 mA Pulse Width = 300 µs, Duty Cycle = 10%	Θ_{JC}	0.2	°C/W

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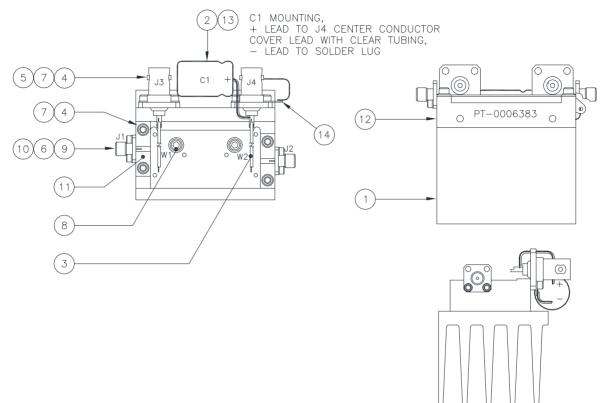
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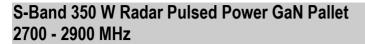
Test Fixture Assembly



Parts List

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Item	Part	Description	
1	-	Aluminum Heatsink	
2	C1	100 µF, 160 V, Electrolytic Capacitor, Panasonic	
3	W1, W2	NO. 24 AWG X 3" Insulated Red Jumper Wire	
4	-	NO. 4 Lock Washer	
5	J3, J4	BNC Connector, Pomona Electronics	
6	-	NO. 2-56 X 1/4" LG SOC HD SCR	
7	-	NO. 4-40 X 1/4" LG SOC HD SCR	
8	-	NO. 6-32 X 1/2" LG SOC HD SCR	
9	-	NO. 2 Lock Washer	
10	J1, J2	SMA Connector, Tyco Electronics	
11	-	РСВ	
12	-	Aluminum Carrier	
13	-	Clear Tubing	
14	-	Solder Lug	

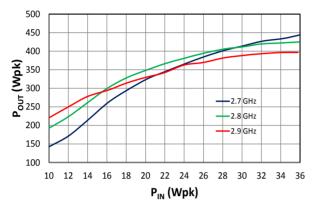
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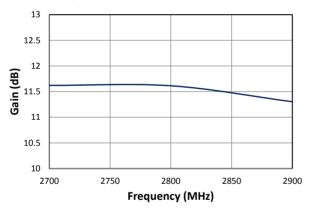
Typical Large-Signal Performance Curves

2700 - 2900 MHz, 300 μs Pulse, 10% Duty Cycle, V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 32 Wpk, T_A = 25°C

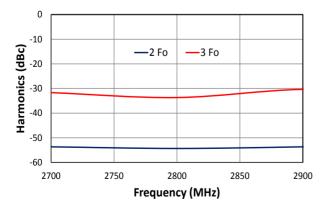
Output Power vs. Input Power



Gain vs. Frequency

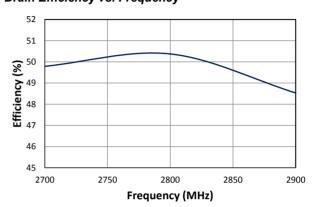




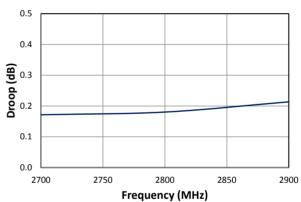




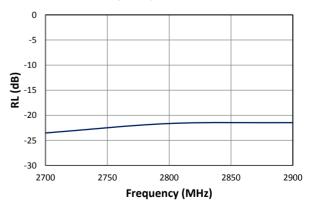
Drain Efficiency vs. Frequency



Droop vs. Frequency



Return Loss vs. Frequency



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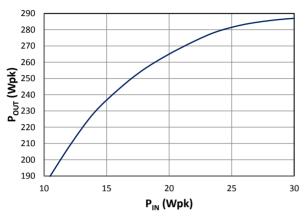
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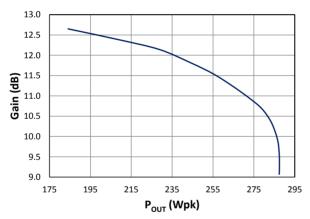
Typical Large-Signal Performance Curves

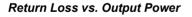
2856 MHz, 1 ms Pulse, 3.3% Duty Cycle, V_{DD} = 40 V, I_{DQ} = 500 mA, T_A = 25°C

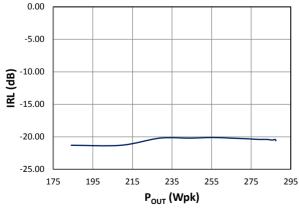
Output Power vs. Input Power



Gain vs. Output Power









P_{our} (Wpk)

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Drain Efficiency vs. Output Power

Droop vs. Output Power

0.50

0.40

(**g**) 0.30 0.20

0.10

0.00

175

195

215

235

P_{OUT} (Wpk)

255

275

295

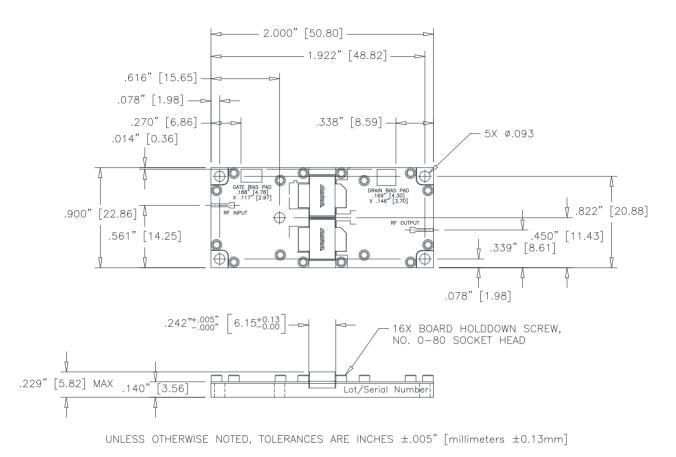


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Pallet Outline: 2.0 x 0.9 Inches (50.8 x 23 mm²). Lead Free.



Bias Sequencing

Turning the device ON

- Set V_G to the pinch-off value (V_P), typically -6 V.
- 2. Turn on V_D to nominal voltage (50 V).
- 3. Increase V_G to desired quiescent current.
- 4. Apply RF power to desired level.

Turning the device OFF

- 1. Turn the RF power off.
- 2. Decrease V_G down to $V_{P_{-}}$
- $3. \quad Turn \ off \ V_D.$
- $4. \quad Turn \ off \ V_G.$

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.

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