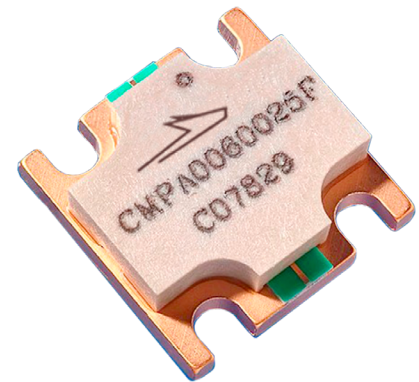


CMPA0060025F

25 W, 20 MHz - 6000 MHz, GaN MMIC Power Amplifier

Description

Wolfspeed's CMPA0060025F is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity and higher thermal conductivity. GaN HEMTs also offer greater power density and wider bandwidths compared to Si and GaAs transistors. This MMIC enables extremely wide bandwidths to be achieved in a small footprint screw-down package.



PN: CMPA0060025F
Package Type: 780019

Typical Performance Over 20 MHz - 6.0 GHz ($T_c = 25^\circ\text{C}$)

Parameter	20 MHz	0.5 GHz	1.0 GHz	2.0 GHz	3.0 GHz	4.0 GHz	5.0 GHz	6.0 GHz	Units
Gain	21.4	20.1	19.3	16.7	16.6	16.8	15.7	15.5	dB
Output Power @ $P_{IN} = 32\text{ dBm}$	26.9	30.2	26.3	23.4	24.5	24.0	20.9	18.6	W
Power Gain @ $P_{IN} = 32\text{ dBm}$	12.3	12.8	12.2	11.7	11.9	11.8	11.3	10.7	dB
Efficiency @ $P_{IN} = 32\text{ dBm}$	63	55	40	31	33	31	28	26	%

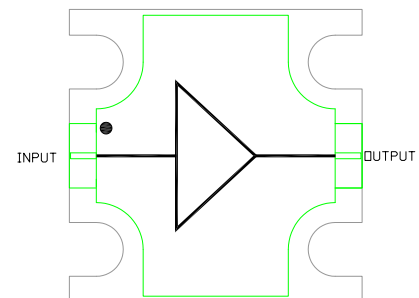
Note: $V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$

Features

- 17 dB Small Signal Gain
- 25 W Typical P_{SAT}
- Operation up to 50 V
- High Breakdown Voltage
- High Temperature Operation
- 0.5" x 0.5" total product size

Applications

- Ultra Broadband Amplifiers
- Test Instrumentation
- EMC Amplifier Drivers



 Large Signal Models Available for ADS and MWO





Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DS}	84	V_{DC}
Gate-Source Voltage	V_{GS}	-10, +2	
Storage Temperature	T_{STG}	-65, +150	°C
Operating Junction Temperature	T_J	225	
Maximum Forward Gate Current	I_{GMAX}	4	mA
Soldering Temperature ¹	T_S	245	°C
Screw Torque	τ	40	in-oz
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.3	°C/W
Case Operating Temperature ^{2,3}	T_C	-40, +150	°C

Notes:

¹ Refer to the Application Note on soldering at wolfspeed.com/rf/document-library

² Measured for the CMPA0060025F at $P_{IN} = 32$ dBm

Electrical Characteristics (Frequency = 20 MHz to 6.0 GHz unless otherwise stated; $T_C = 25^\circ\text{C}$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions		
DC Characteristics								
Gate Threshold Voltage ²	V _{GS(th)}	-3.8	-3.0	-2.3	V	V _{DS} = 20 V, ΔI _D = 20 mA		
Gate Quiescent Voltage	V _{GS(Q)}	—	-2.7	—	V _{DC}	V _{DD} = 50 V, I _{DQ} = 500 mA, P _{IN} = 32 dBm		
Saturated Drain Current	I _{DS}	—	12	—	A	V _{DS} = 12 V, V _{GS} = 2.0 V		
RF Characteristics ¹								
Power Output at P _{OUT} @ 4.5 GHz	P _{OUT}	41.0	42.8	—	dBm	V _{DD} = 50 V, I _{DQ} = 500 mA, P _{IN} = 32 dBm		
Power Output at P _{OUT} @ 5.0 GHz			43.3	—				
Power Output at P _{OUT} @ 6.0 GHz			42.9	—				
Drain Efficiency at P _{OUT} @ 4.5 GHz	η	18.0	24.1	—	%			
Drain Efficiency at P _{OUT} @ 5.0 GHz			28.0	—				
Drain Efficiency at P _{OUT} @ 6.0 GHz			27.2	—				
Output Mismatch Stress	VSWR	—	—	5:1	Ψ	No damage at all phase angles, V _{DD} = 50 V, I _{DQ} = 500 mA, P _{IN} = 32 dBm		
Small Signal RF Characteristics								
Frequency	S21 (dB)			S11 (dB)		S22 (dB)		Conditions
	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	
0.02 GHz - 0.25 GHz	18.0	19.3	23.7	-4.1	-2.5	-8.5	-4.5	V _{DD} = 50 V, I _{DQ} = 500 mA
0.25 GHz - 0.5 GHz		19.8	22.0	-6.8	-3.5	-8.9		
0.5 GHz - 1.0 GHz	15.5	18.6		-15.3	-6.5	-6.7		
1.0 GHz - 2.0 GHz			13.0		20.0	-12.5	-6.0	
2.0 GHz - 3.0 GHz	-5.3							
3.0 GHz - 6.0 GHz		-14.2		-6.5		-5.3	-2.5	

Notes:

¹ P_{OUT} is defined as $P_{IN} = 32$ dBm

² The device will draw approximately 55-70 mA at pinch off due to the internal circuit structure.



Typical Performance

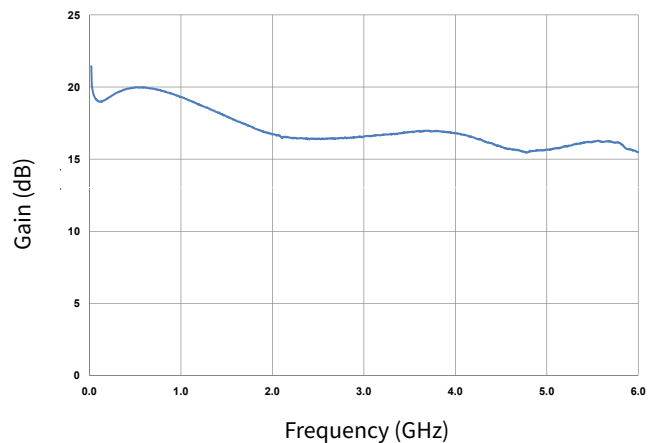


Figure 1. Small Signal Gain vs Frequency at 50 V

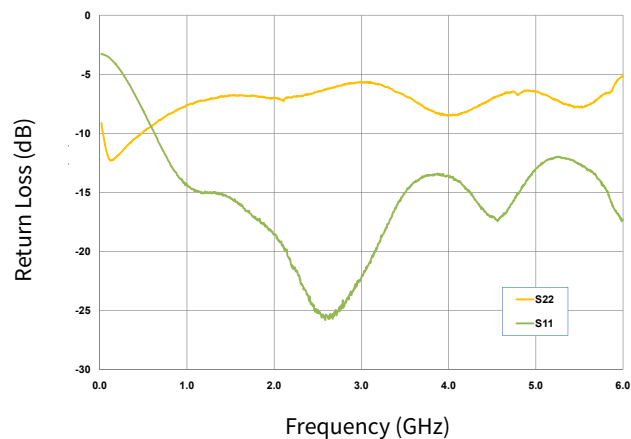


Figure 2. Input & Output Return Losses vs Frequency at 50 V

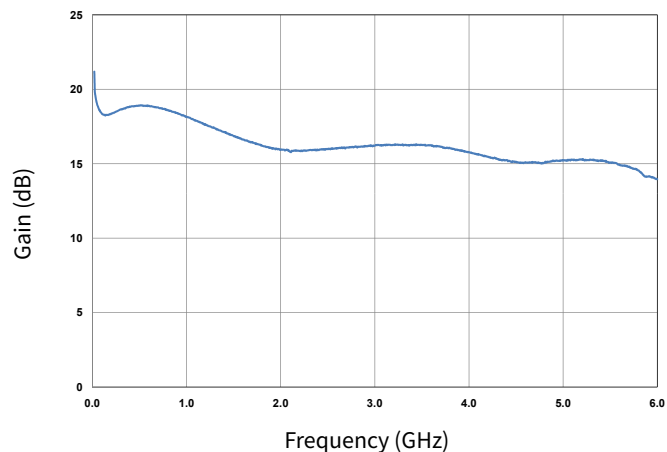


Figure 3. Small Signal Gain vs Frequency at 40 V

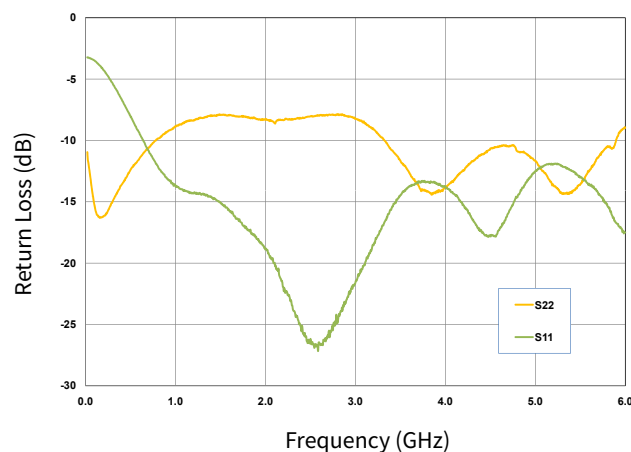


Figure 4. Small Signal Gain vs Frequency at 40 V

Typical Performance

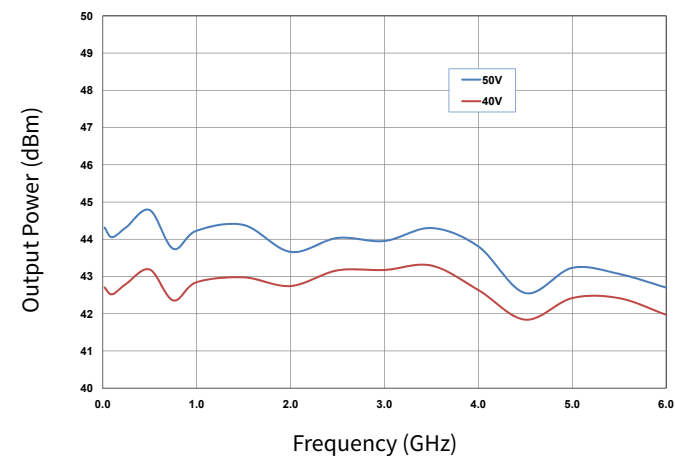


Figure 5. Output Power at $P_{IN} = 32$ dBm vs Frequency as a Function of Drain Voltage

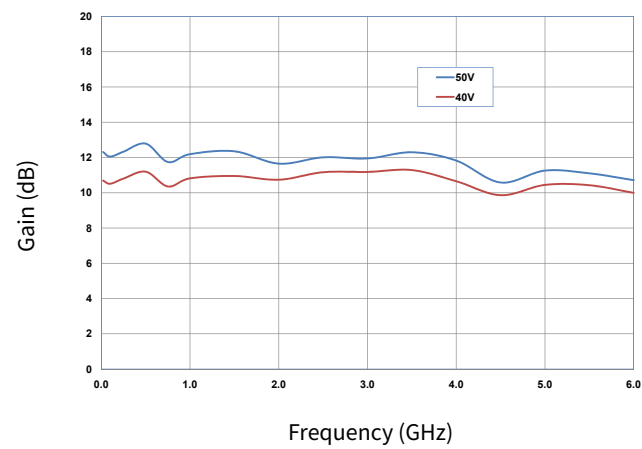


Figure 6. Power Gain at $P_{IN} = 32$ dBm vs Frequency as a Function of Drain Voltage

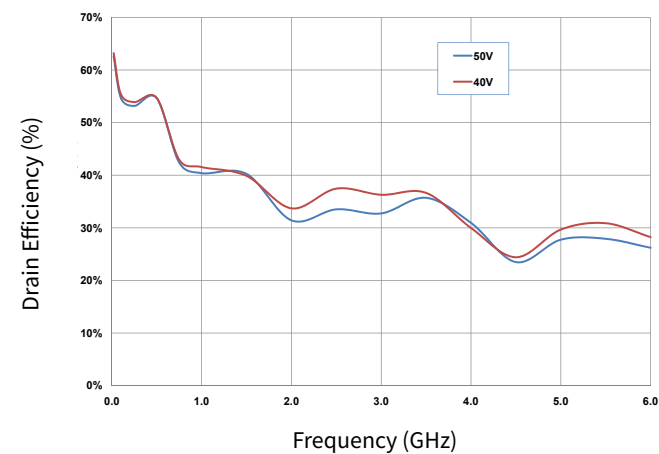


Figure 7. Drain Efficiency at $P_{IN} = 32$ dBm vs Frequency as a Function of Drain Voltage



Typical Performance

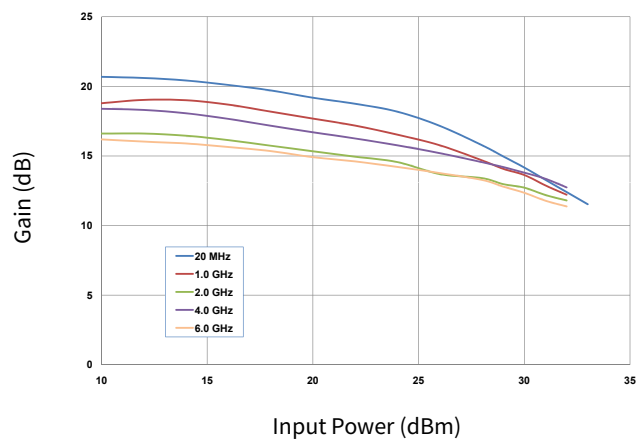


Figure 8. Gain vs Input Power at 50 V as a Function of Frequency

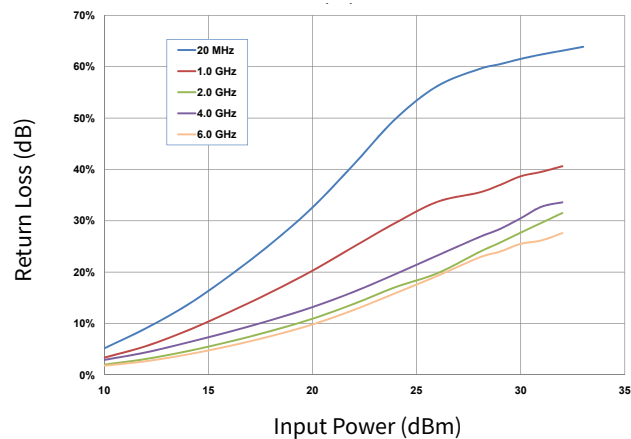


Figure 9. Efficiency vs Input Power at 50 V as a Function of Frequency

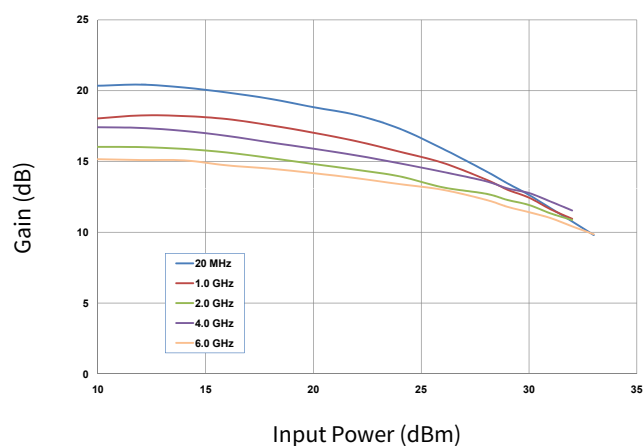


Figure 10. Gain vs Input Power at 40 V as a Function of Frequency

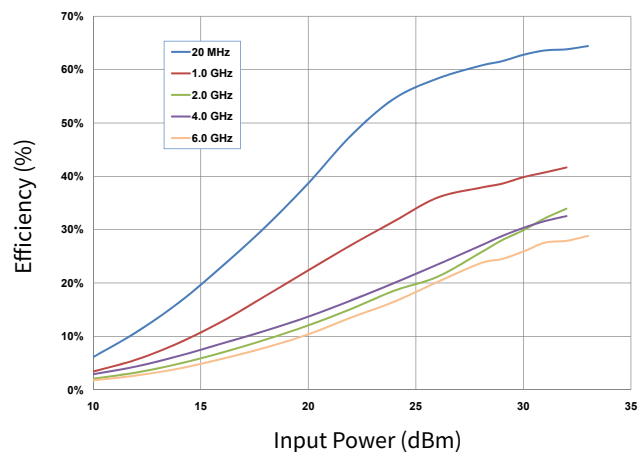


Figure 11. Efficiency vs Input Power at 40 V as a Function of Frequency



General Device Information

The CMPA0060025F is a GaN HEMT MMIC Power Amplifier, which operates between 20 MHz - 6.0 GHz. The amplifier typically provides 17 dB of small signal gain and 25 W saturated output power with an associated power added efficiency of better than 20%. The wideband amplifier's input and output are internally matched to 50 Ohm. The amplifier requires bias from appropriate Bias-T's, through the RF input and output ports.

The CMPA0060025F is provided in a flange package format. The input and output connections are gold plated to enable gold bond wire attach at the next level assembly.

The measurements in this data sheet were taken on devices wire-bonded to the test fixture with 2 mil gold bond wires. The CMPA0060025F-AMP1 and the device were then measured using external Bias-T's, (TECDIA: AMP1T-H06M20 or similar), as shown in Figure 2. The Bias-T's were included in the calibration of the test system. All other losses associated with the test fixture are included in the measurements.

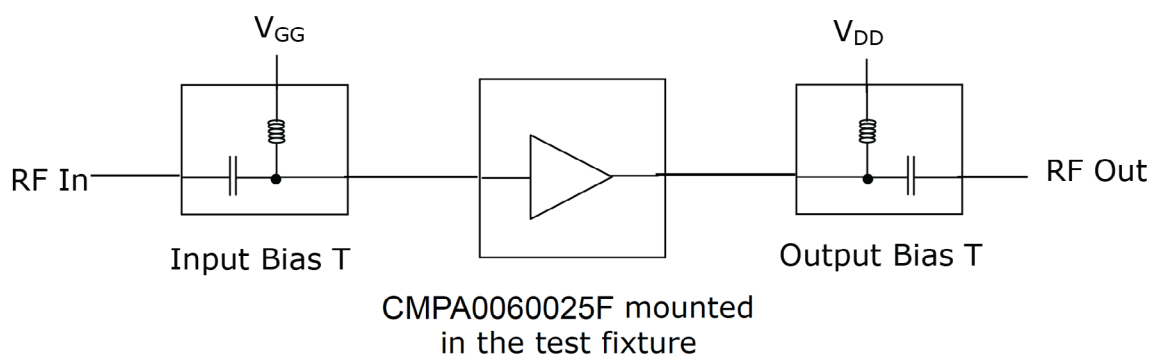
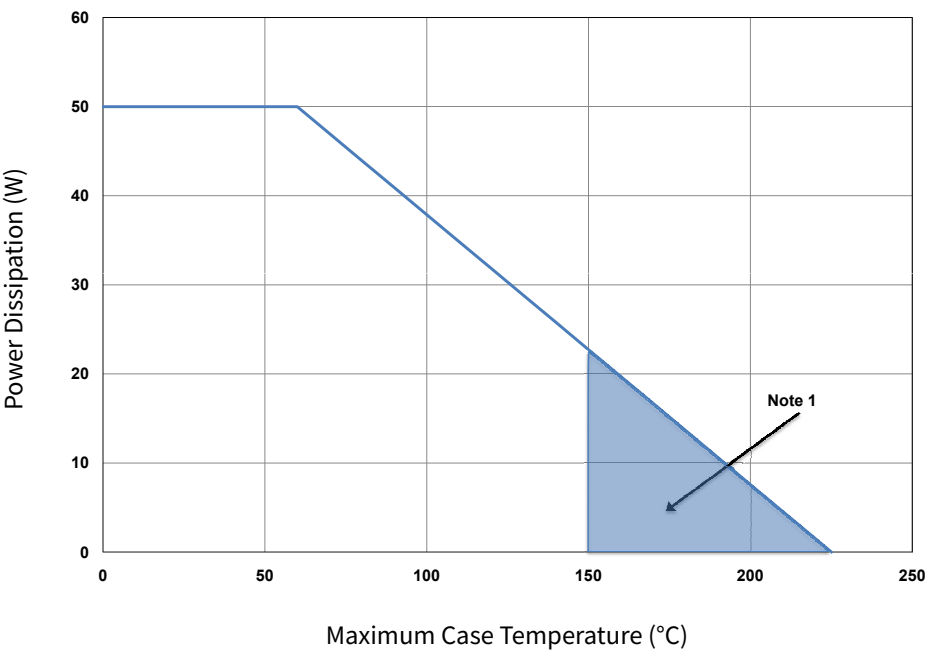


Figure 2. Typical test system setup required for measuring CMPA0060025F1-AMP1

CMPA0060025F Power Dissipation De-rating Curve



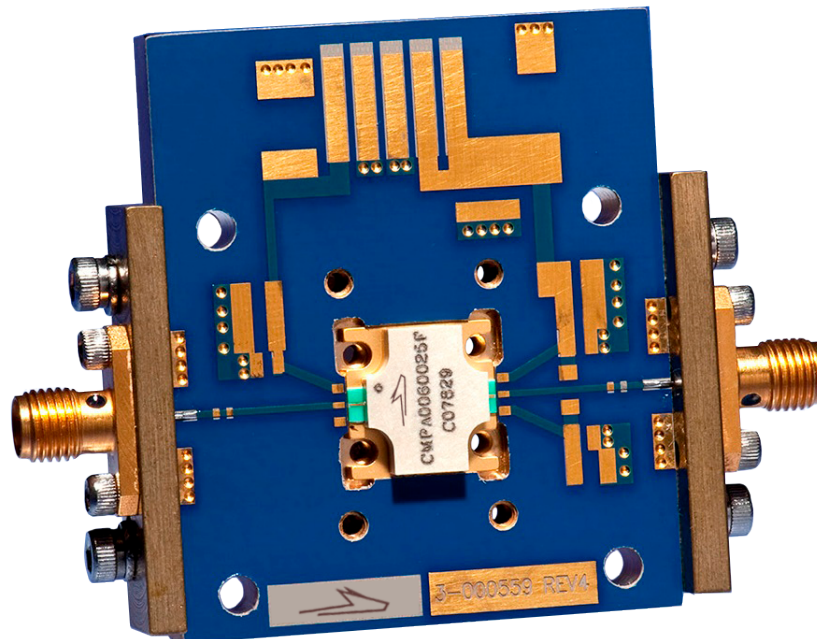
Note:
¹ Area exceeds Maximum Case Operating Temperature (See Page 2).

Electrostatic Discharge (ESD) Classifications

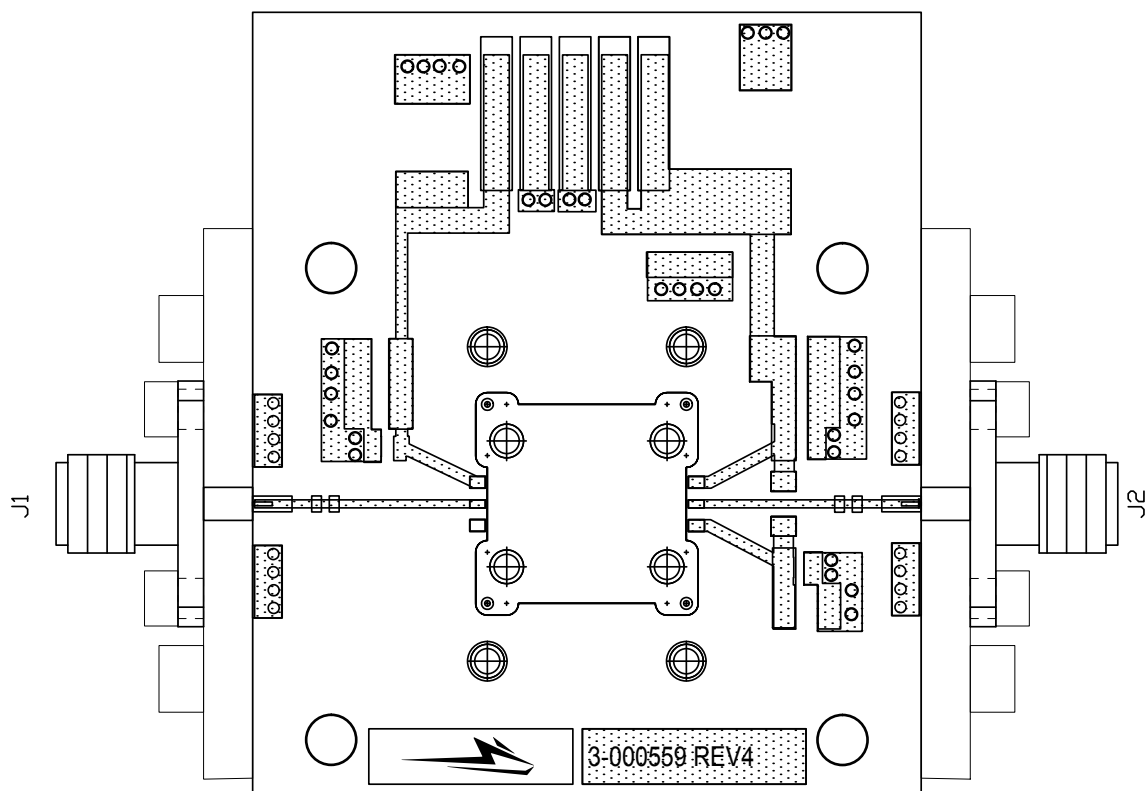
Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	TBD	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	TBD	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C



CMPA0060025F-AMP Demonstration Amplifier Circuit



CMPA0060025F-AMP Demonstration Amplifier Circuit Outline



CMPA0060025F-AMP Demonstration Amplifier Circuit Bill of Materials

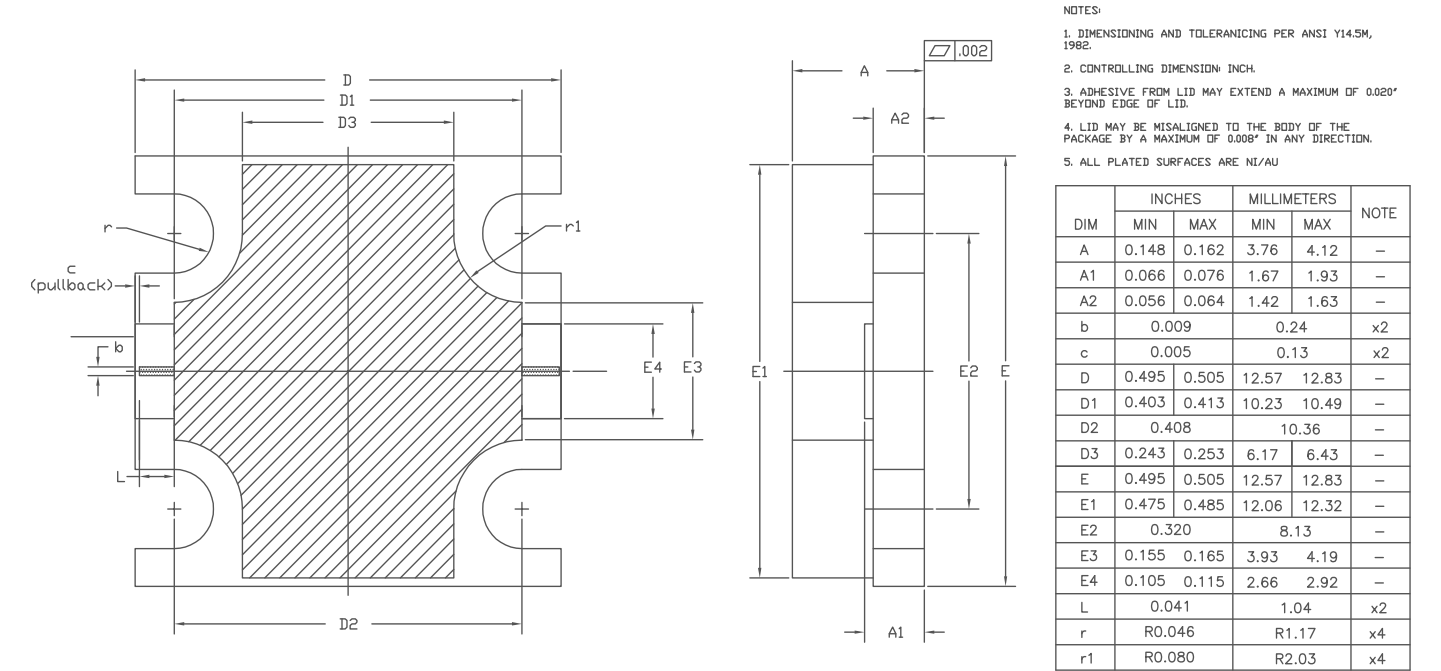
Designator	Description	Qty
J1,J2	CONNECTOR, SMA, AMP11052901-1	2
-	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA0060025F	1

Notes

¹ The CMPA0060025F is connected to the PCB with 2.0 mil Au bond wires.

² An external Bias-T is required.

Product Dimensions CMPA0060025F (Package Type — 780019)



The chart displays the performance of various power amplifiers across five metrics. The metrics are represented by colored lines: Package (red), Power Output (W) (yellow), Upper Frequency (GHz) (orange), Lower Frequency (GHz) (blue), and Wolfspeed MMIC Power Amplifier (purple). The chart shows that the Wolfspeed MMIC Power Amplifier has the highest performance across all metrics, followed by the Lower Frequency (GHz) amplifier, the Upper Frequency (GHz) amplifier, the Power Output (W) amplifier, and the Package amplifier.

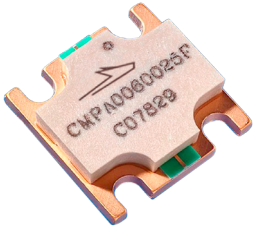
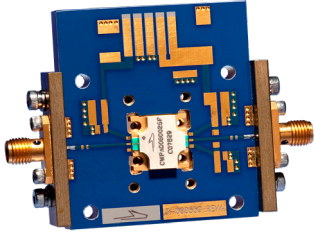
Amplifier Type	Package	Power Output (W)	Upper Frequency (GHz)	Lower Frequency (GHz)	Wolfspeed MMIC Power Amplifier
Package	High	Low	Low	Low	Low
Power Output (W)	Low	High	Low	Low	Low
Upper Frequency (GHz)	Low	Low	High	Low	Low
Lower Frequency (GHz)	Low	Low	Low	High	Low
Wolfspeed MMIC Power Amplifier	Low	Low	Low	Low	High

Parameter	Value	Units
Lower Frequency	20	MHz
Upper Frequency	6000	
Power Output	25	W
Package	Flange	—

¹ Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Character Code	Code Value
A	0
B	1
C	2
D	3
E	4
F	5
G	6
H	7
J	8
K	9
Examples	1A = 10.0 GHz 2H = 27.0 GHz

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA0060025F	GaN MMIC	Each	
CMPA0060025F-AMP	Test board with GaN MMIC installed	Each	

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