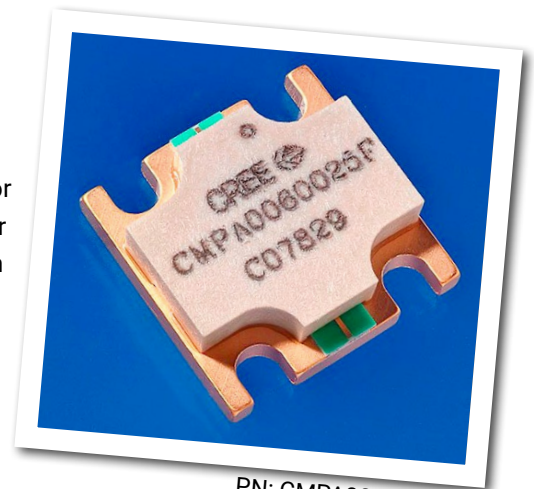


CMPA0060025F

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

Cree'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	%

Note¹: $V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$

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

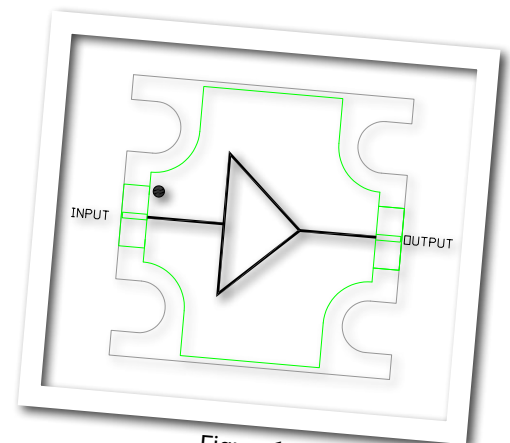


Figure 1.



Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units
Drain-source Voltage	V_{DSS}	84	VDC
Gate-source Voltage	V_{GS}	-10, +2	VDC
Storage Temperature	T_{STG}	-65, +150	°C
Operating Junction Temperature	T_J	225	°C
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

Note:

¹ Refer to the Application Note on soldering at www.cree.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, $\Delta I_D = 20$ mA
Gate Quiescent Voltage	$V_{(GS)Q}$	-	-2.7	-	VDC	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm
Saturated Drain Current	I_{DC}	-	12	-	A	$V_{DS} = 12$ V, $V_{GS} = 2.0$ V
RF Characteristics¹						
Power Output at P_{OUT} @ 4.5 GHz	P_{OUT1}	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	P_{OUT2}	41.0	43.3	-	dBm	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm
Power Output at P_{OUT} @ 6.0 GHz	P_{OUT3}	41.0	42.9	-	dBm	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm
Drain Efficiency at P_{OUT} @ 4.5 GHz	η_1	18.0	24.1	-	%	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm
Drain Efficiency at P_{OUT} @ 5.0 GHz	η_2	18.0	28.0	-	%	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm
Drain Efficiency at P_{OUT} @ 6.0 GHz	η_3	18.0	27.2	-	%	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm
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			S11			S22			Conditions
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	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	18.0	19.8	22.0	-	-6.8	-3.5	-	-8.9	-4.5	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA
0.5 GHz - 1.0 GHz	15.5	18.6	22.0	-	-15.3	-6.5	-	-6.7	-4.5	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA
1.0 GHz - 2.0 GHz	15.5	18.6	22.0	-	-15.3	-12.5	-	-6.7	-4.5	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA
2.0 GHz - 3.0 GHz	13.0	18.6	20.0	-	-15.3	-12.5	-	-6.0	-2.5	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA
3.0 GHz - 6.0 GHz	13.0	16.3	20.0	-	-14.2	-6.5	-	-5.3	-2.5	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA

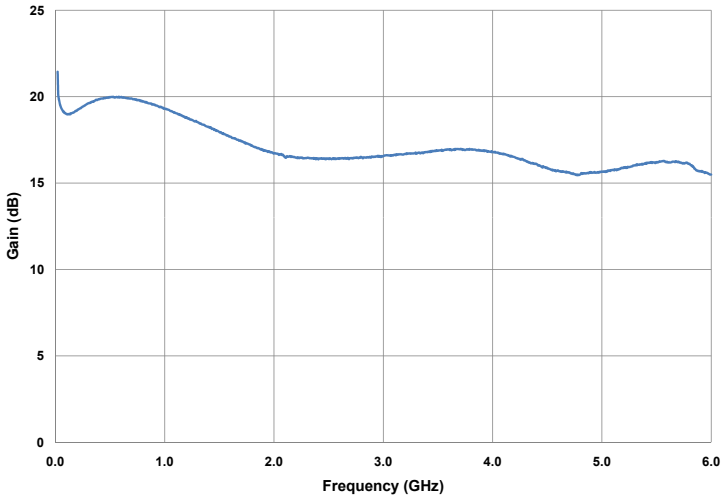
Notes:

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

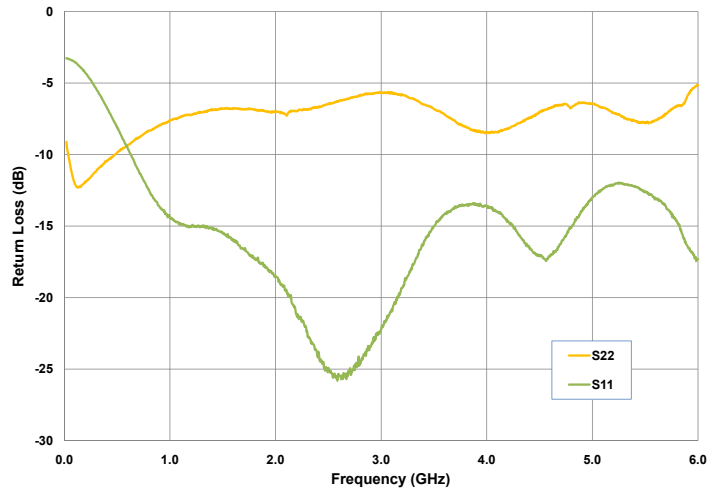
² The device will draw approximately 55-70 mA at pinch off due to the internal circuit structure.

Typical Performance

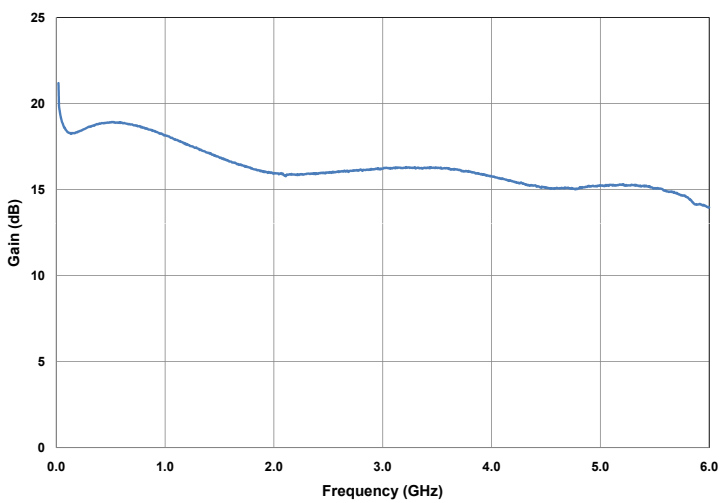
**Small Signal Gain
vs Frequency at 50 V**



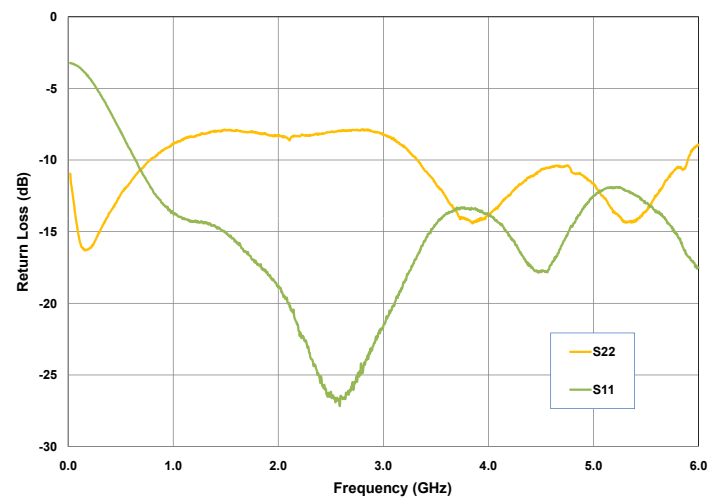
**Input & Output Return Losses
vs Frequency at 50 V**



**Small Signal Gain
vs Frequency at 40 V**

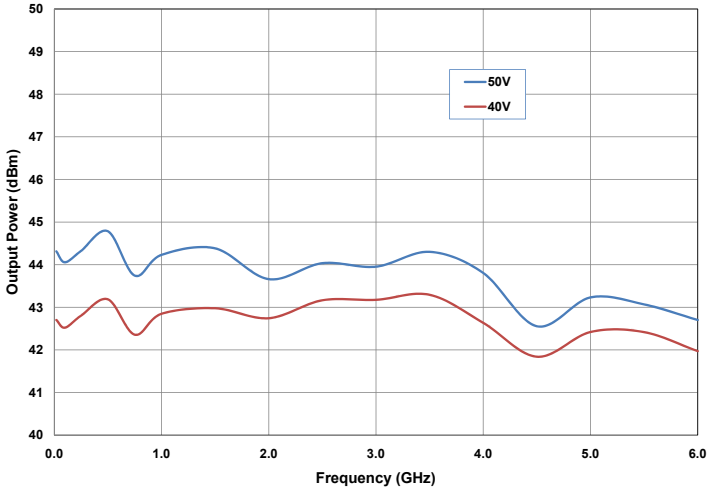


**Input & Output Return Losses
vs Frequency at 40 V**

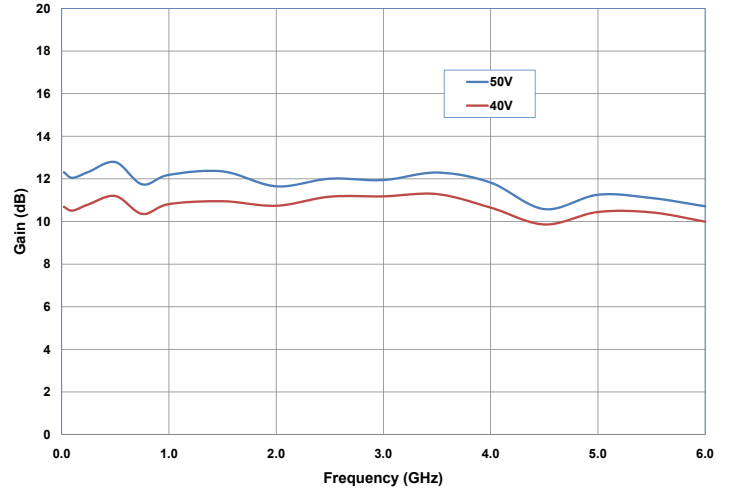


Typical Performance

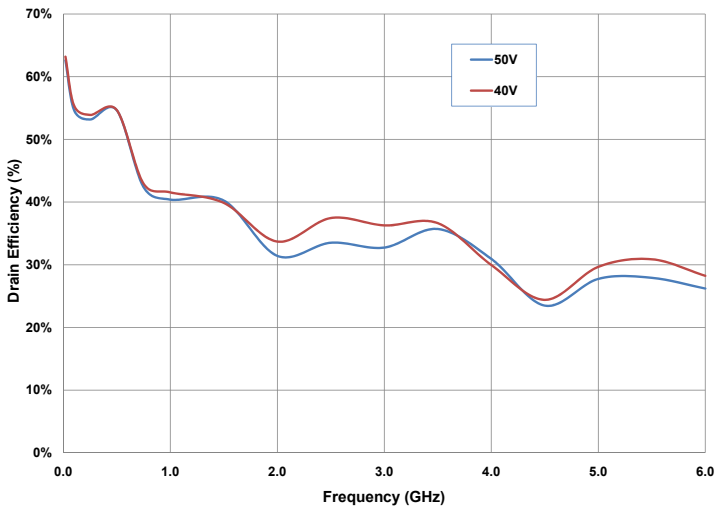
Output Power at $P_{IN} = 32$ dBm vs Frequency as a Function of Drain Voltage



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

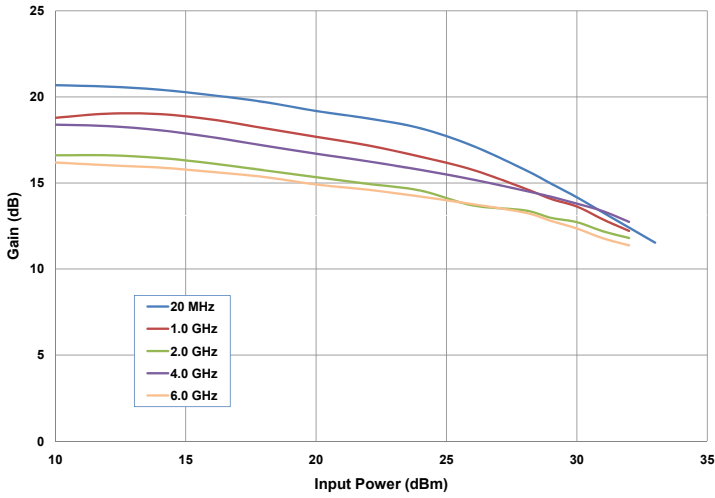


Drain Efficiency at $P_{IN} = 32$ dBm vs Frequency as a Function of Drain Voltage

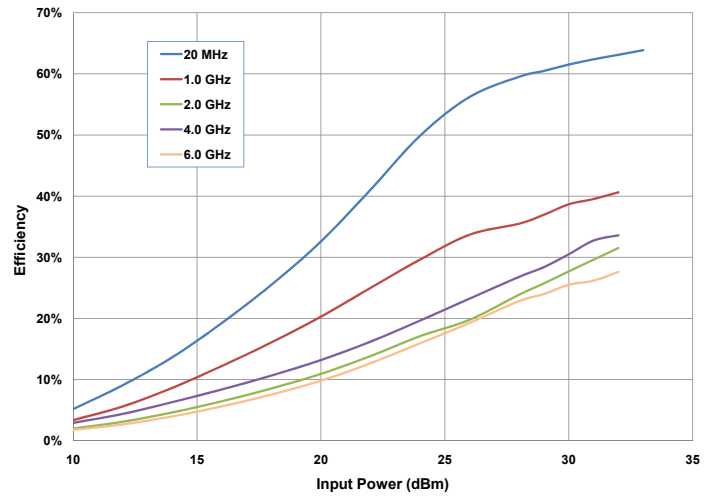


Typical Performance

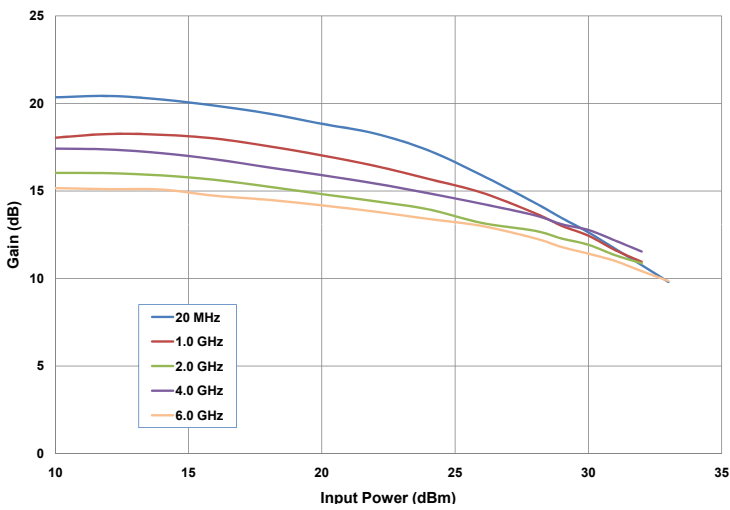
Gain vs Input Power at 50V as a Function of Frequency



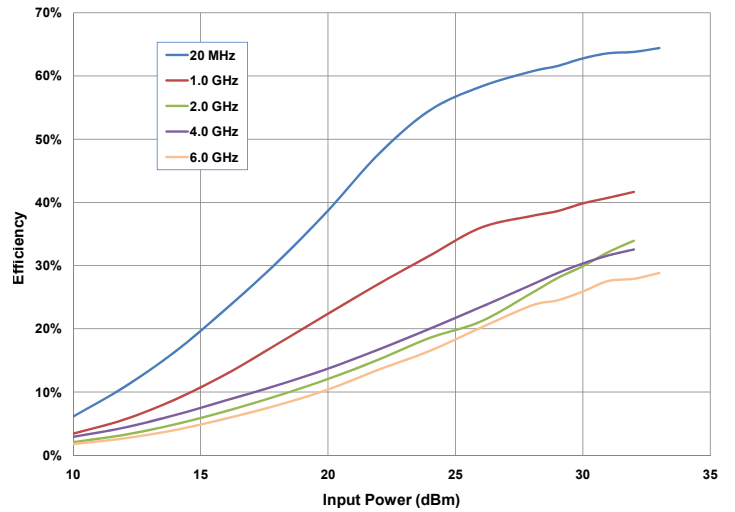
Efficiency vs Input Power at 50 V as a Function of Frequency



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



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.

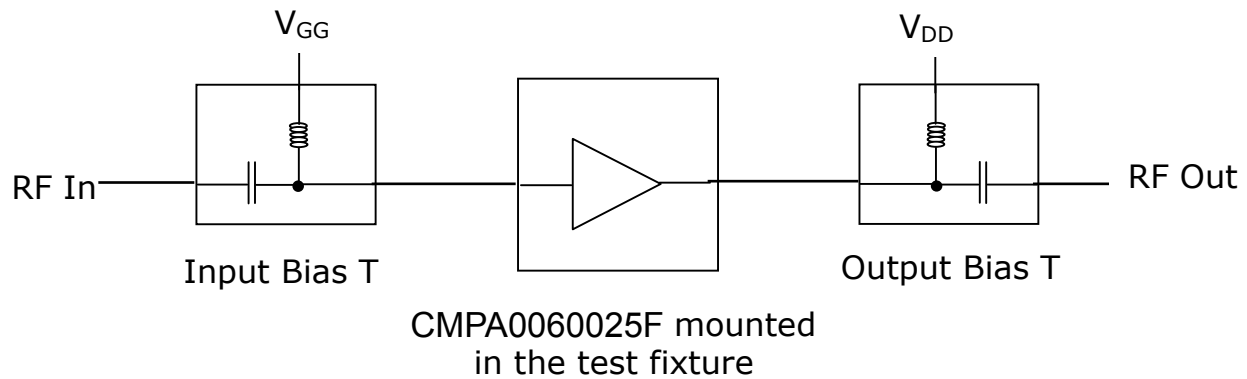
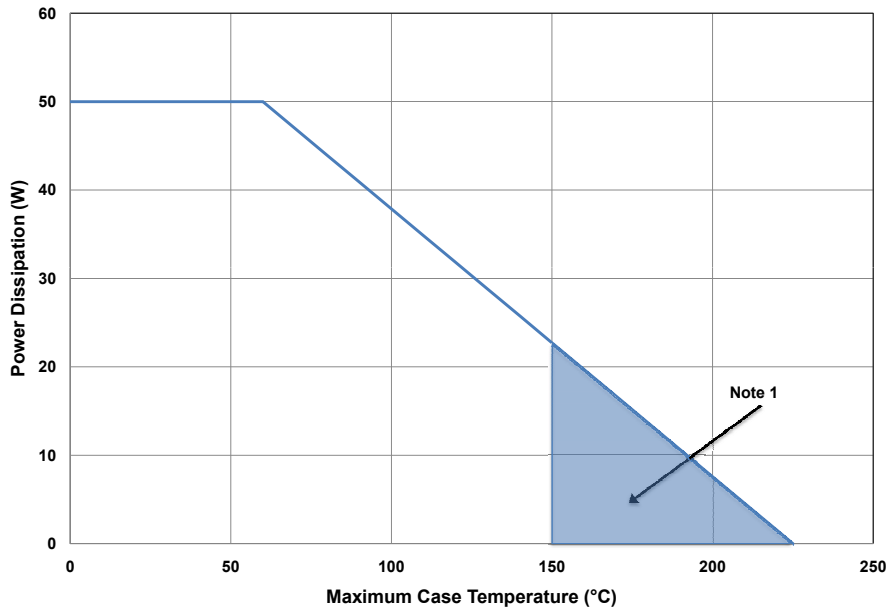


Figure 2. Typical test system setup required for measuring CMPA0060025F-AMP1

CMPA0060025F Power Dissipation De-rating Curve

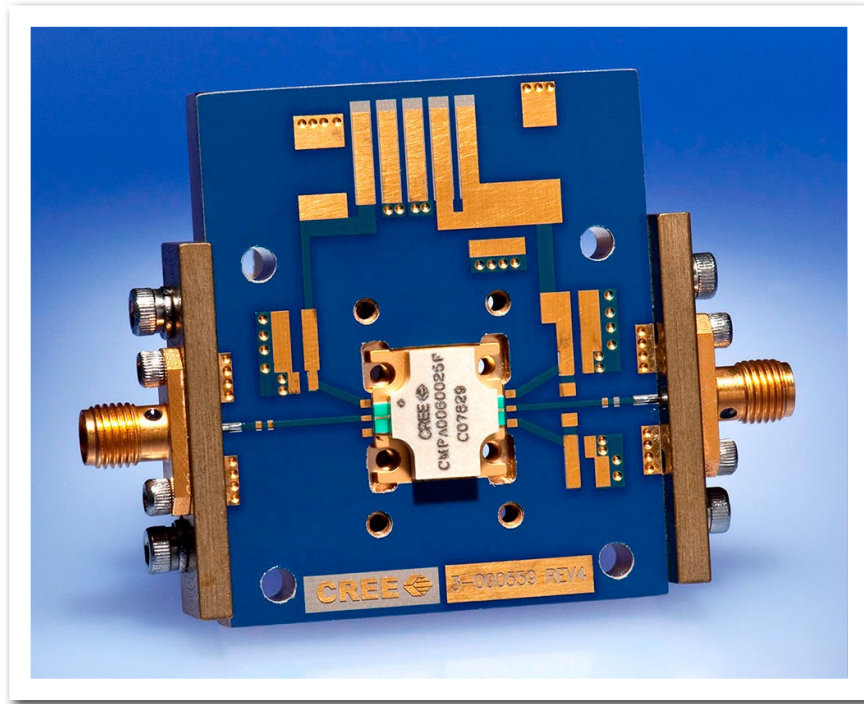


Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).

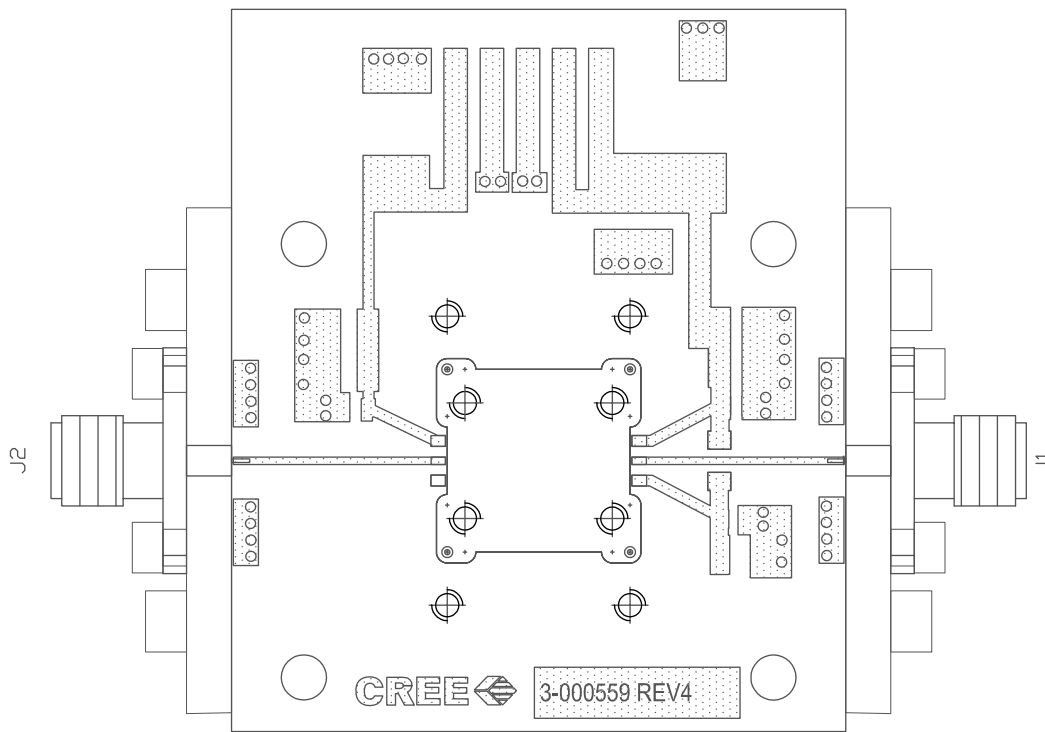
Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 < 500 V)	JEDEC JESD22 C101-C

CMPA0060025F-AMP Demonstration Amplifier Circuit



CMPA0060025F-AMP Demonstration Amplifier Circuit Outline



CMPA0060025F-AMP Demonstration Amplifier Circuit Bill of Materials

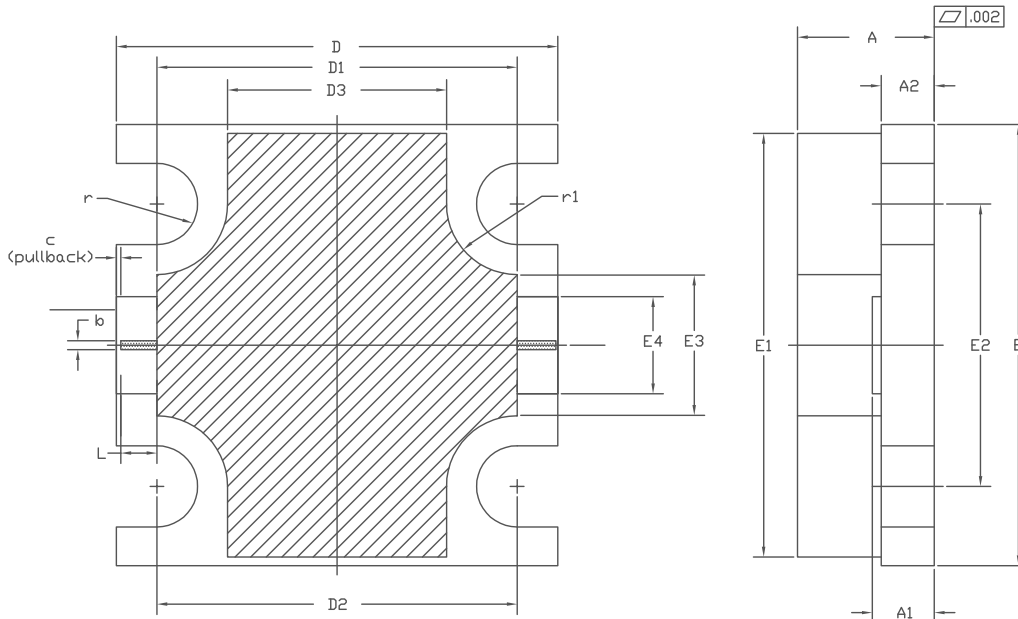
Designator	Description	Qty
J1,J2	CONNECTOR, SMA, AMP11052901-1	2
-	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA0060025F	1

Notes

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

²An external bias T is required.

Product Dimensions CMPA0060025F (Package Type – 780019)

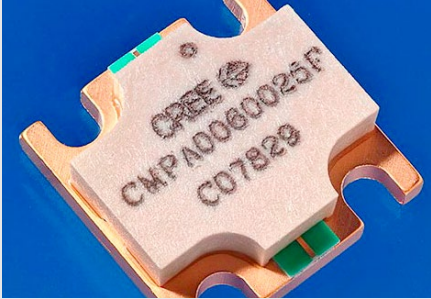
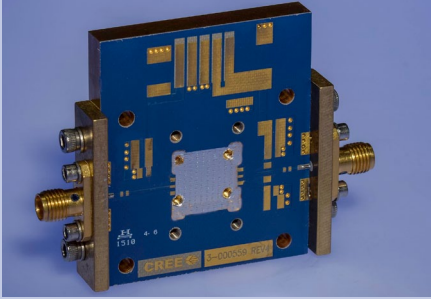
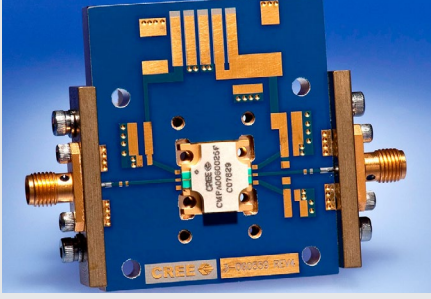


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.
5. ALL PLATED SURFACES ARE NI/AU

DIM	INCHES		MILLIMETERS		NOTE
	MIN	MAX	MIN	MAX	
A	0.148	0.162	3.76	4.12	—
A1	0.066	0.076	1.67	1.93	—
A2	0.056	0.064	1.42	1.63	—
b	0.009		0.24		x2
c	0.005		0.13		x2
D	0.495	0.505	12.57	12.83	—
D1	0.403	0.413	10.23	10.49	—
D2	0.408		10.36		—
D3	0.243	0.253	6.17	6.43	—
E	0.495	0.505	12.57	12.83	—
E1	0.475	0.485	12.06	12.32	—
E2	0.320		8.13		—
E3	0.155	0.165	3.93	4.19	—
E4	0.105	0.115	2.66	2.92	—
L	0.041		1.04		x2
r	R0.046		R1.17		x4
r1	R0.080		R2.03		x4

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA0060025F	GaN MMIC	Each	
CMPA0060025F-TB	Test board without GaN MMIC	Each	
CMPA0060025F-AMP	Test board with GaN MMIC installed	Each	



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For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/RF

Sarah Miller
Marketing
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing & Sales
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639