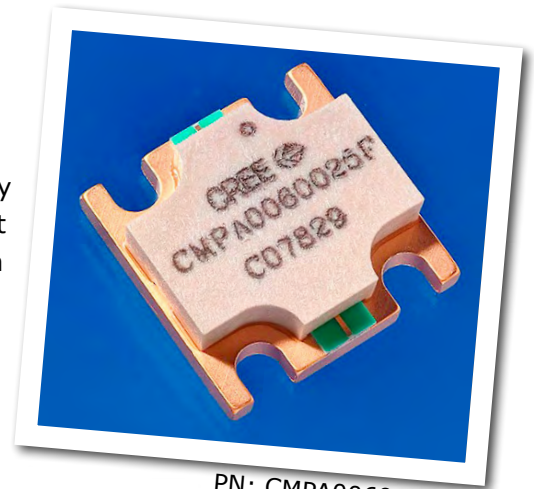


# CPMA0060025F

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

Cree's CPMA0060025F 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: CPMA0060025F  
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<sup>1</sup>:  $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 500\text{ mA}$

### 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

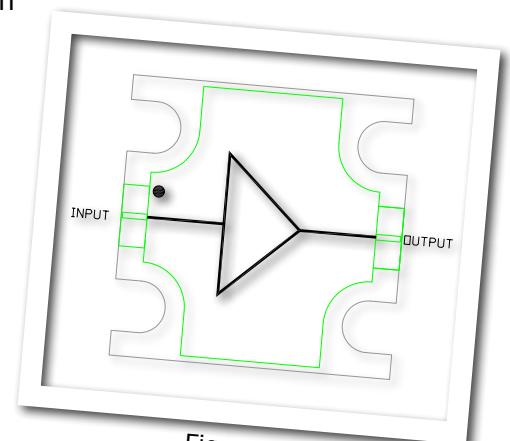


Figure 1.



## 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 <sup>1</sup>	$T_S$	245	°C
Screw Torque	$\tau$	40	in-oz
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.3	°C/W
Case Operating Temperature <sup>2,3</sup>	$T_C$	-40, +150	°C

Note:

<sup>1</sup> Refer to the Application Note on soldering at [www.cree.com/products/wireless\\_appnotes.asp](http://www.cree.com/products/wireless_appnotes.asp)

<sup>2</sup> Measured for the CMPA0060025F at  $P_{IN} = 32$  dBm.

## Electrical Characteristics (Frequency = 20 MHz to 6.0 GHz unless otherwise stated; $T_C = 25$ °C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions				
<b>DC Characteristics</b>										
Gate Threshold Voltage <sup>2</sup>	$V_{(GS)TH}$	-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				
<b>RF Characteristics<sup>1</sup></b>										
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	$\eta_1$	18.0	24.1	-	%	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm				
Drain Efficiency at $P_{OUT}$ @ 5.0 GHz	$\eta_2$	18.0	28.0	-	%	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm				
Drain Efficiency at $P_{OUT}$ @ 6.0 GHz	$\eta_3$	18.0	27.2	-	%	$V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm				
Output Mismatch Stress	VSWR	-	-	5 : 1	$\Psi$	No damage at all phase angles, $V_{DD} = 50$ V, $I_{DQ} = 500$ mA, $P_{IN} = 32$ dBm				
<b>Small Signal RF Characteristics</b>										
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:

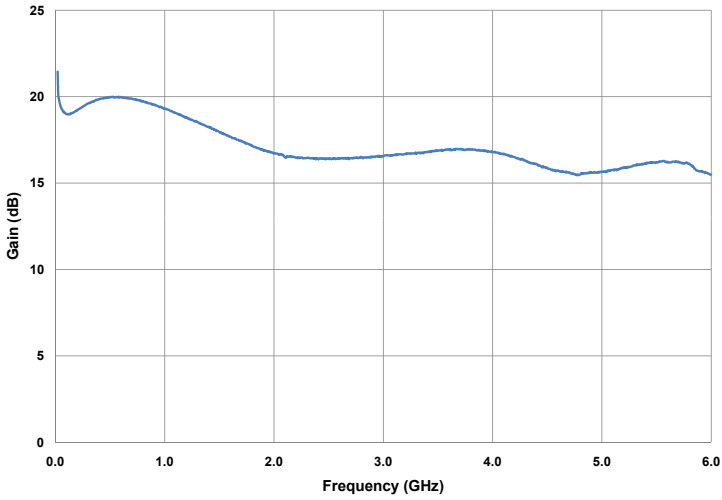
<sup>1</sup>  $P_{OUT}$  is defined as  $P_{IN} = 32$  dBm.

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

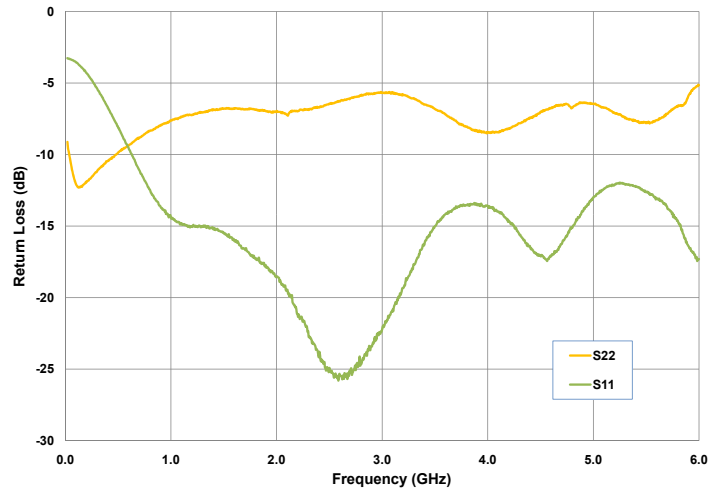


## Typical Performance

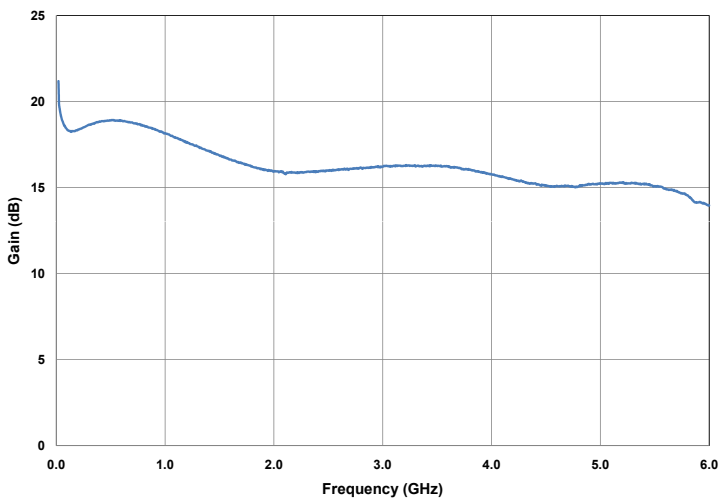
### Small Signal Gain vs Frequency at 50 V



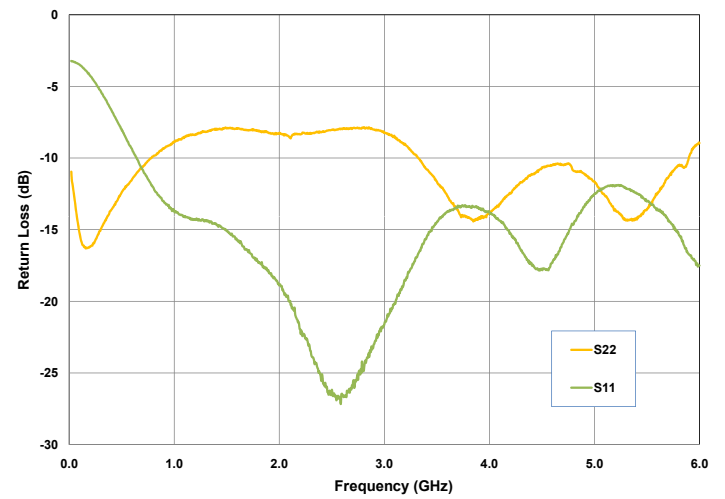
### Input & Output Return Losses vs Frequency at 50 V



### Small Signal Gain vs Frequency at 40 V



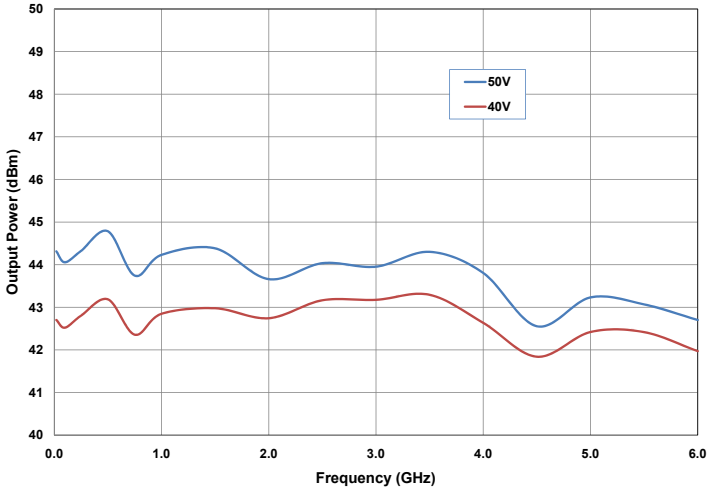
### Input & Output Return Losses vs Frequency at 40 V



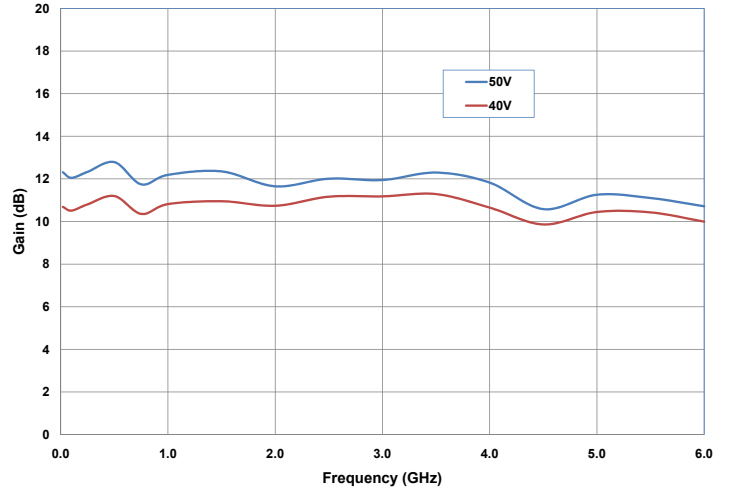


## Typical Performance

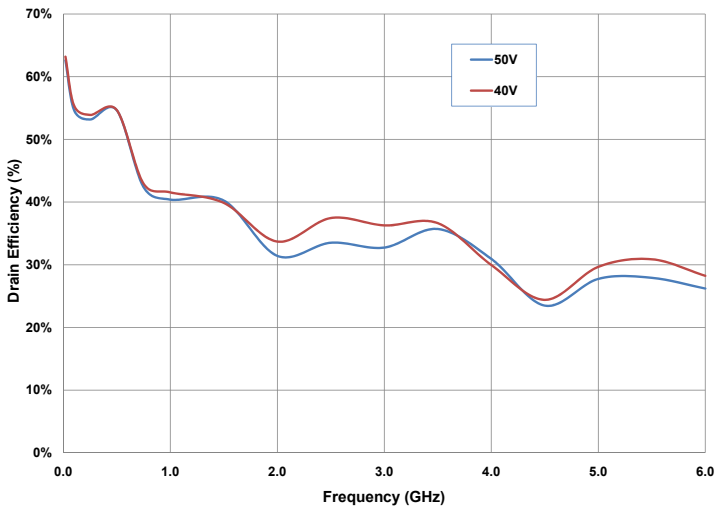
**Output Power at  $P_{IN} = 32$  dBm vs Frequency as a Function of Drain Voltage**



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



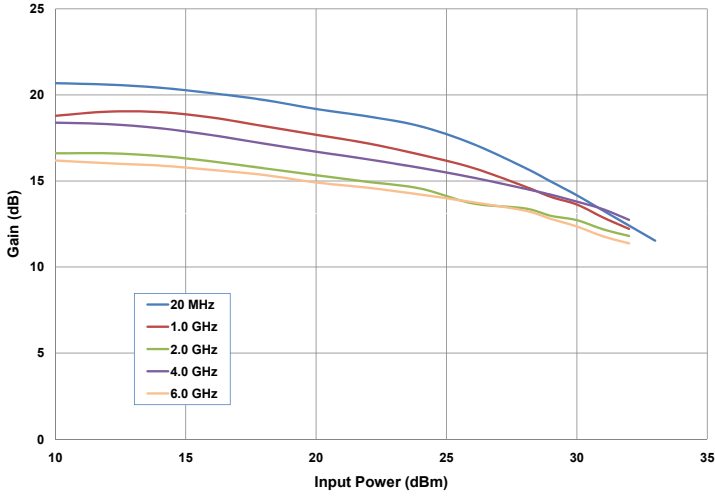
**Drain Efficiency at  $P_{IN} = 32$  dBm vs Frequency as a Function of Drain Voltage**



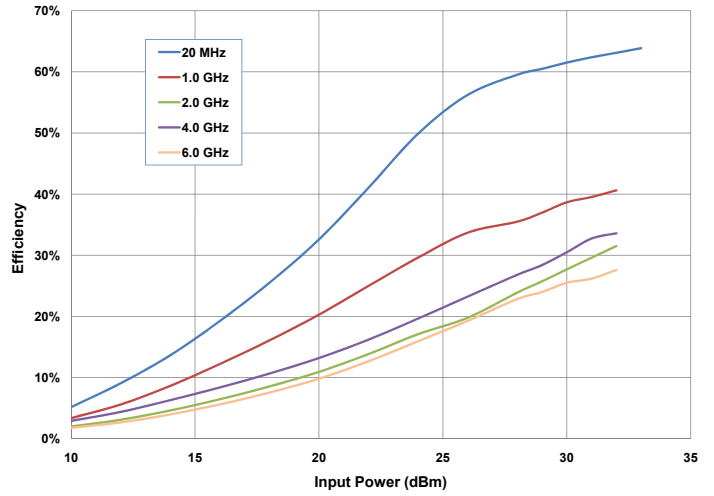


## Typical Performance

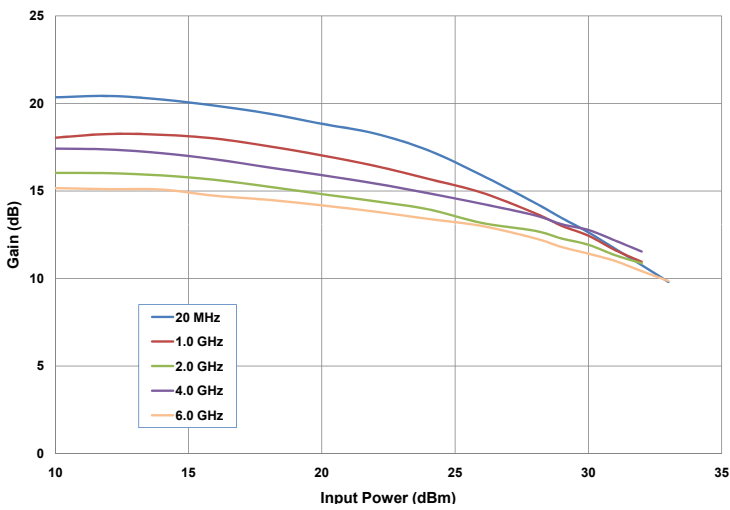
**Gain vs Input Power at 50V  
as a Function of Frequency**



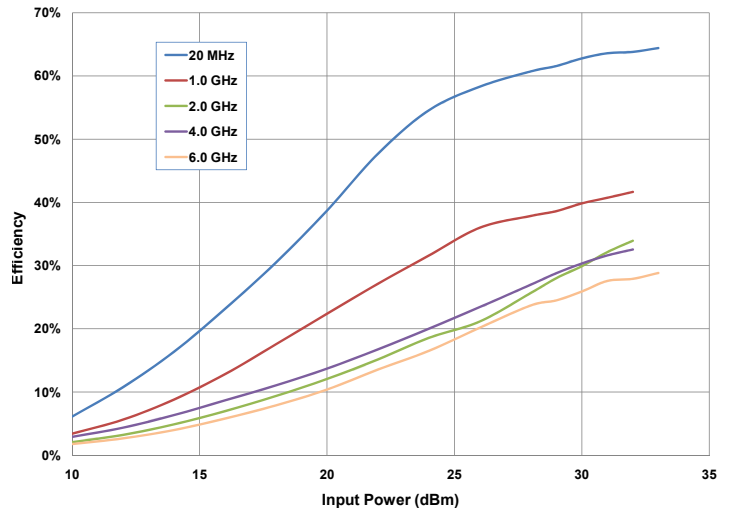
**Efficiency vs Input Power at 50 V  
as a Function of Frequency**



**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-TB and the device were then measured using external Bias-T's, (TECDIA: TBT-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.

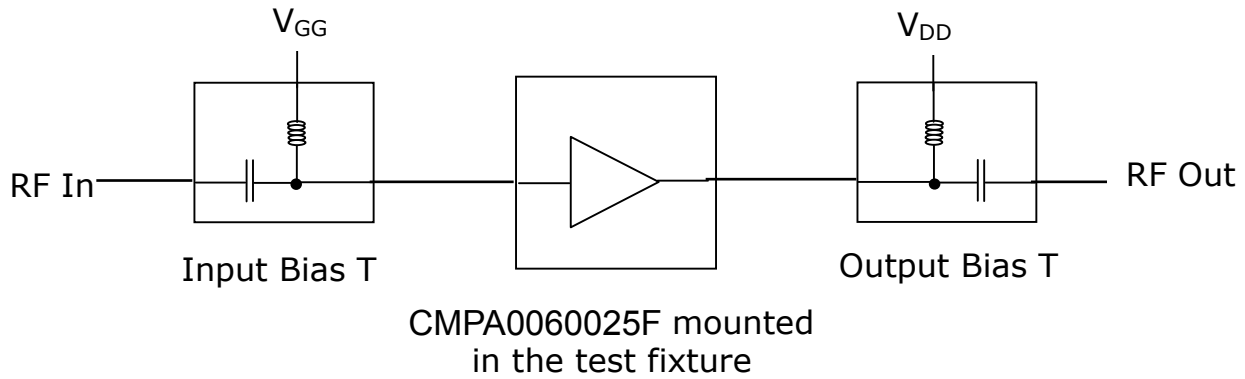
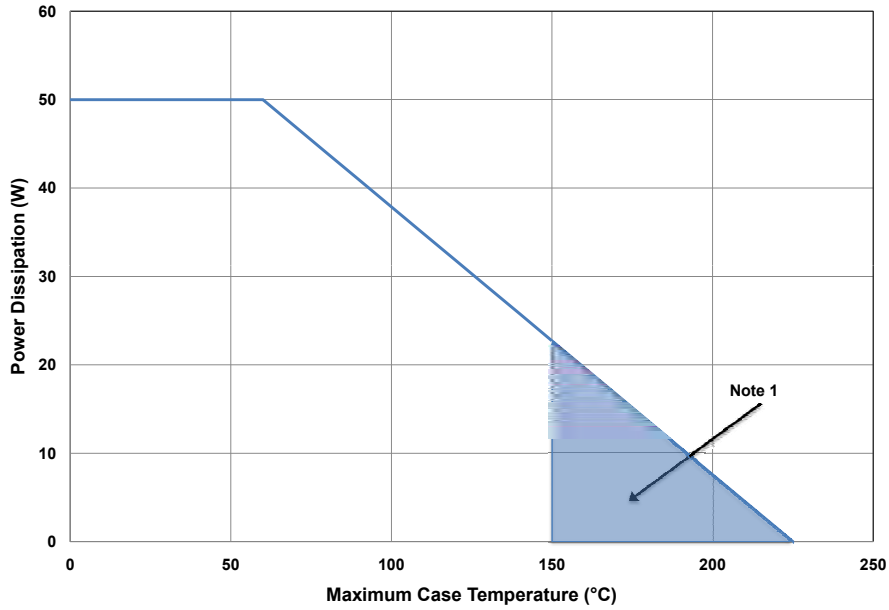


Figure 2. Typical test system setup required for measuring CMPA0060025F-TB



## CPMA0060025F Power Dissipation De-rating Curve

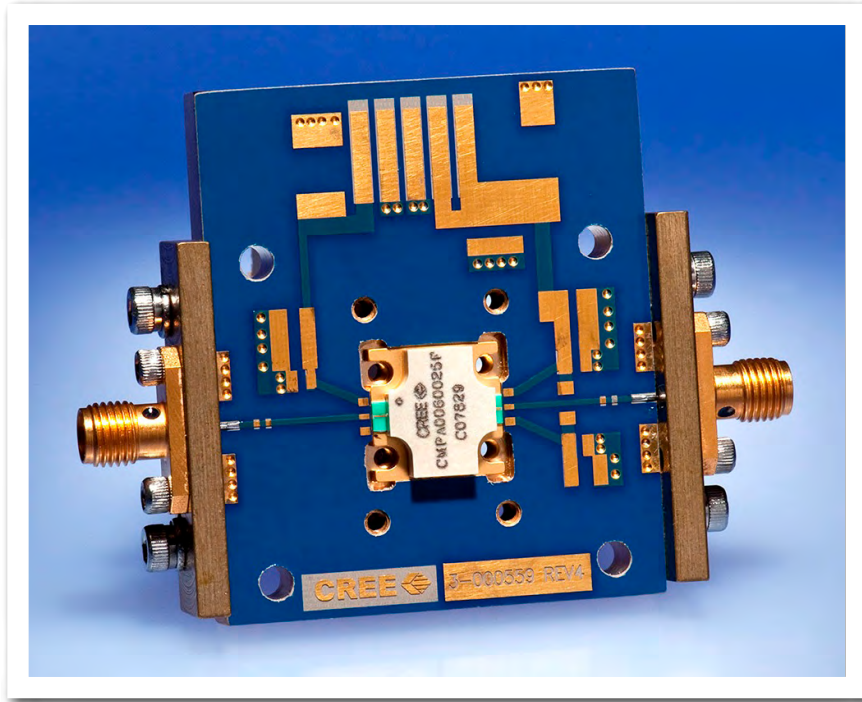


Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).

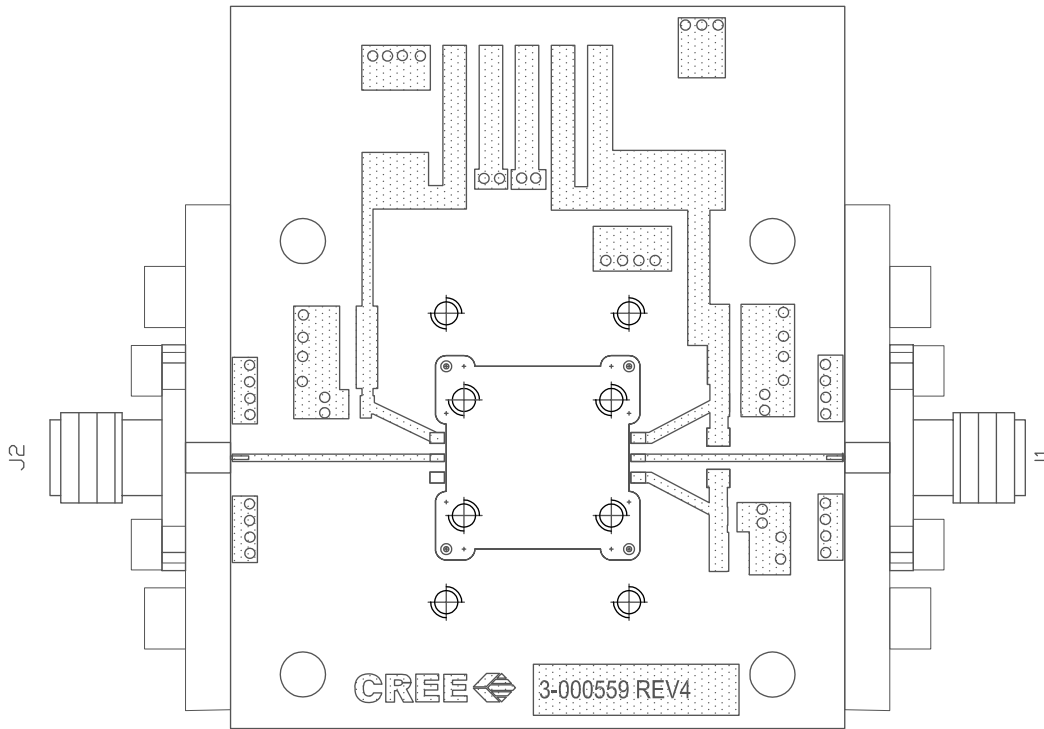
## Electrostatic Discharge (ESD) Classifications

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-TB Demonstration Amplifier Circuit



## CMPA0060025F-TB Demonstration Amplifier Circuit Outline





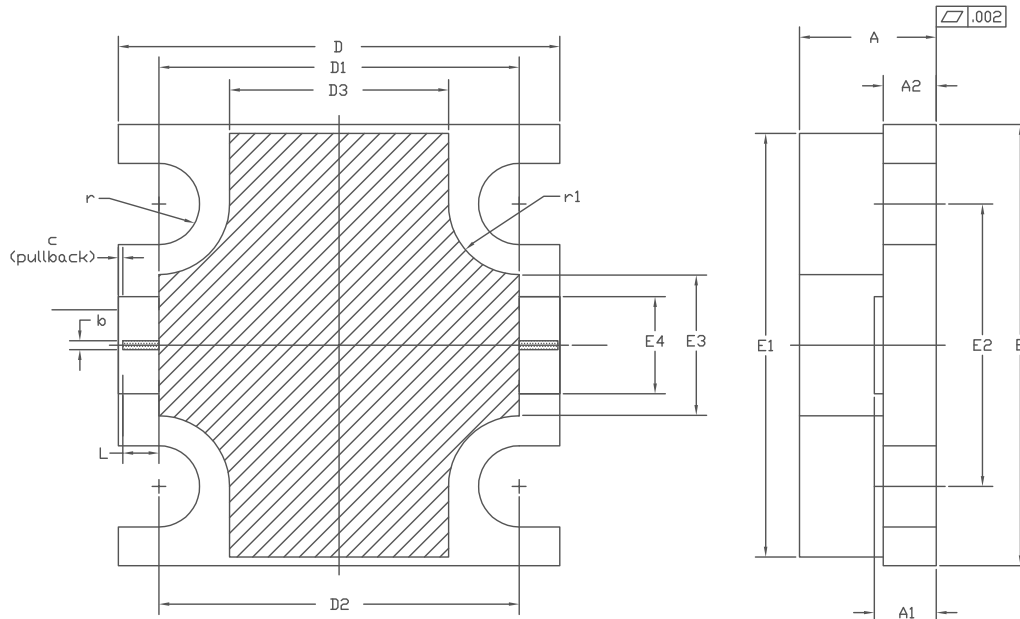
## CMPA0060025F-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
J1,J2	CONNECTOR, SMA, AMP1052901-1	2
-	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA0060025F	1

### Notes

- <sup>1</sup>The CMPA0060025F is connected to the PCB with 2.0 mil Au bond wires.
- <sup>2</sup>An external bias T is required.

## Product Dimensions CMPA0060025F (Package Type – 780019)



### NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
- LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.
- 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



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