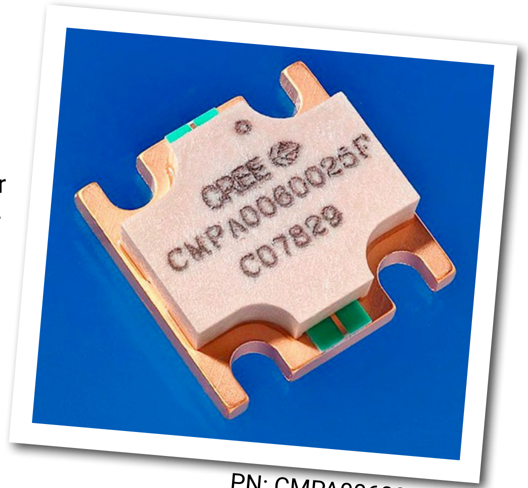
CREE

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˚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 dBm	26.9	30.2	26.3	23.4	24.5	24.0	20.9	18.6	W
Power Gain @ P_{IN} = 32 dBm	12.3	12.8	12.2	11.7	11.9	11.8	11.3	10.7	dB
Efficiency @ P_{IN} = 32 dBm	63	55	40	31	33	31	28	26	%

Note[1]: V_{DD} = 50 V, I_{DQ} = 500 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

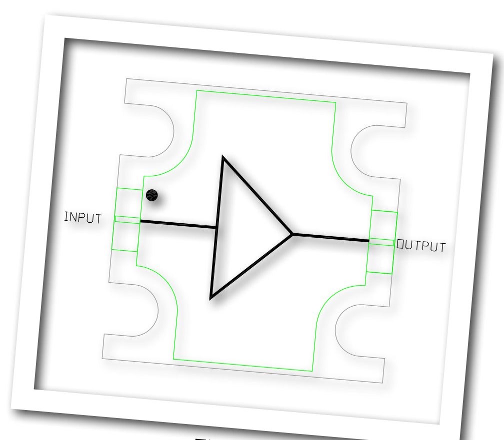


Figure 1.

Rev 4.0 – May 2015

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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	$R_{θJC}$	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˚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	–	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 Characteristics[1]						
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	η1	18.0	24.1	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 32 dBm
Drain Efficiency at P_{OUT} @ 5.0 GHz	η2	18.0	28.0	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 32 dBm
Drain Efficiency at P_{OUT} @ 6.0 GHz	η3	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

	S21			S11			S22			
Frequency	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Conditions
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.

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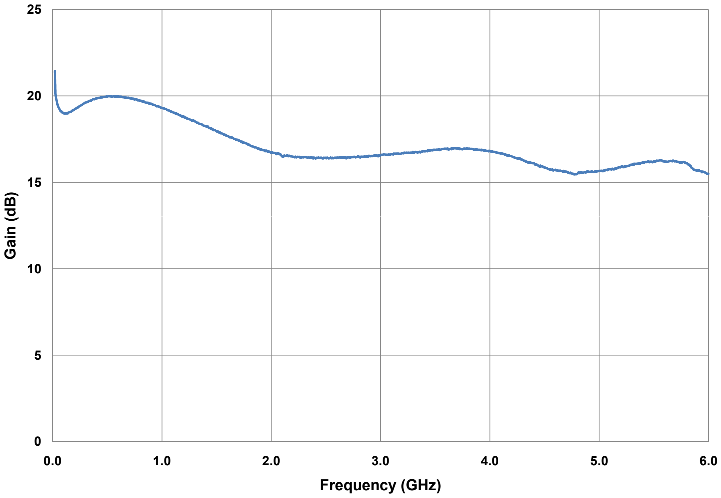
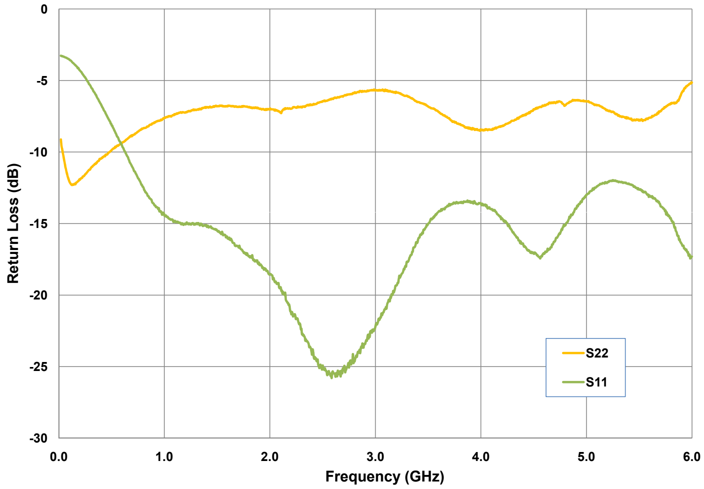
Typical Performance

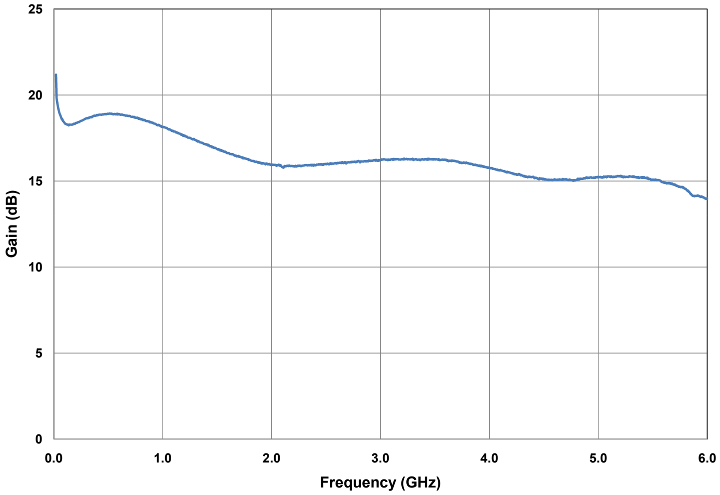
Small Signal Gain vs Frequency at 50 V



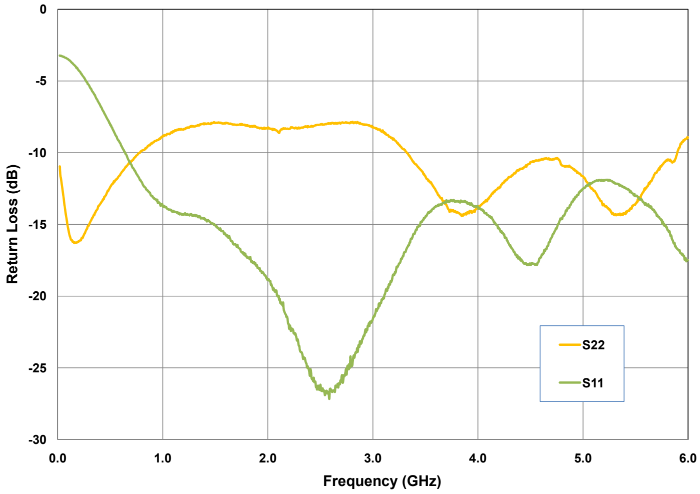
Input & Output Return Losses vs Frequency at 50 V



Small Signal Gain vs Frequency at 40 V



Input & Output Return Losses vs Frequency at 40 V



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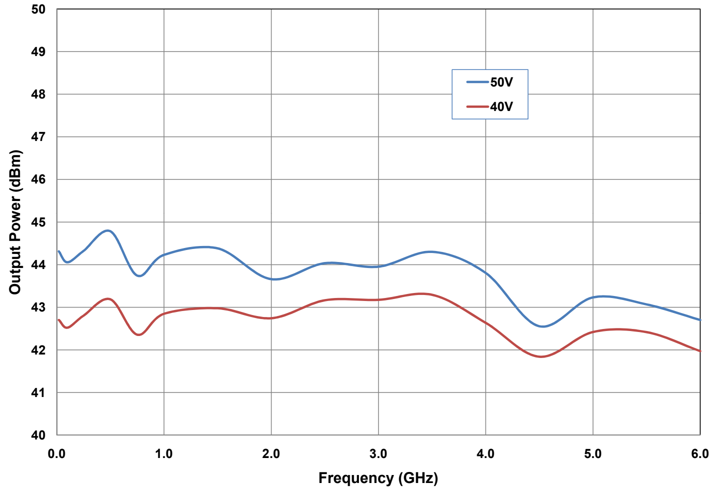
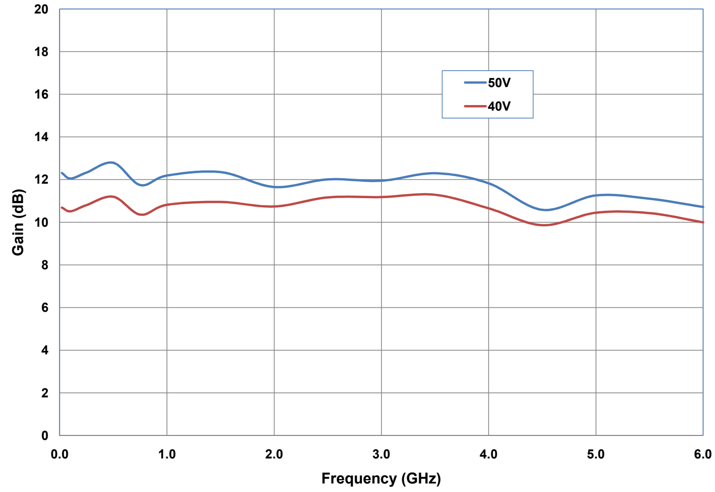
Typical Performance

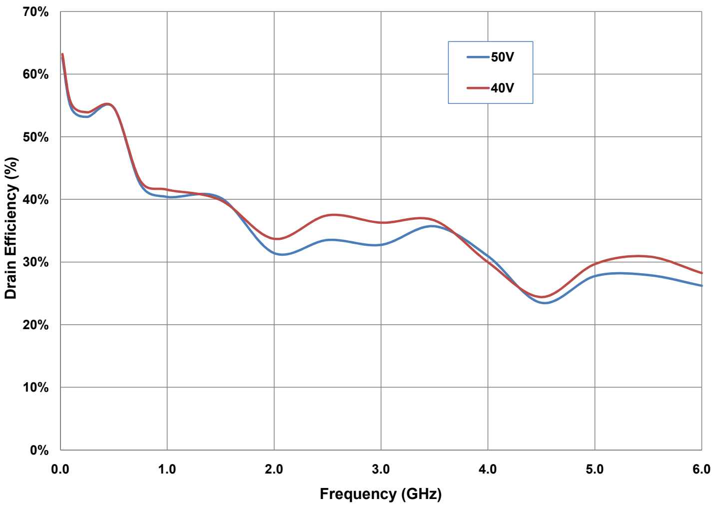
Output Power at P_{IN} = 32 dBm vs Frequency as a Function of Drain Voltage



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



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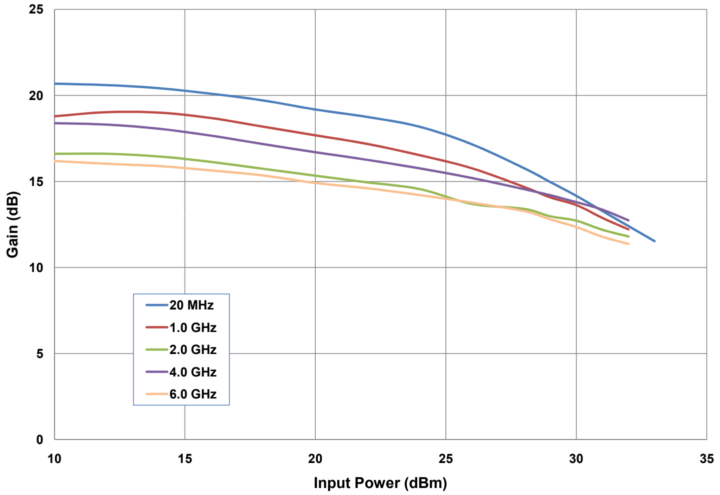
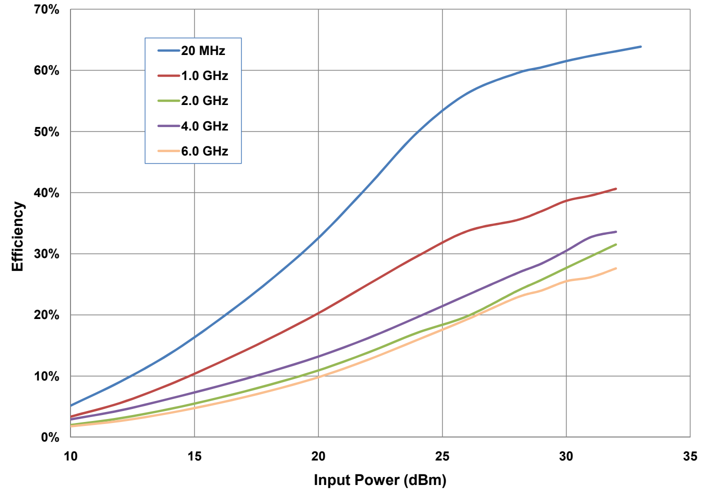
Typical Performance

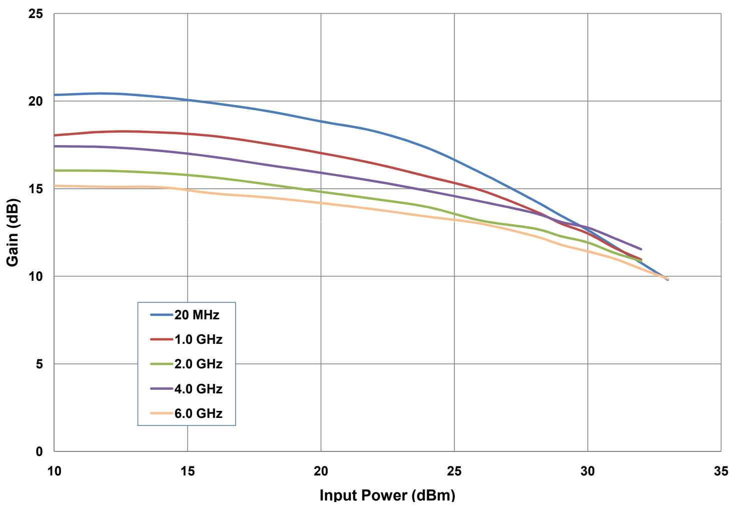
Gain vs Input Power at 50V as a Function of Frequency



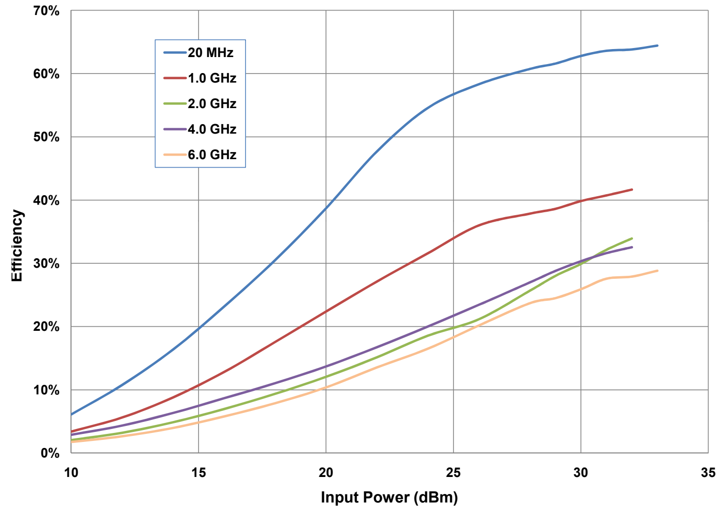
Efficiency vs Input Power at 50 V as a Function of Frequency



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



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



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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.

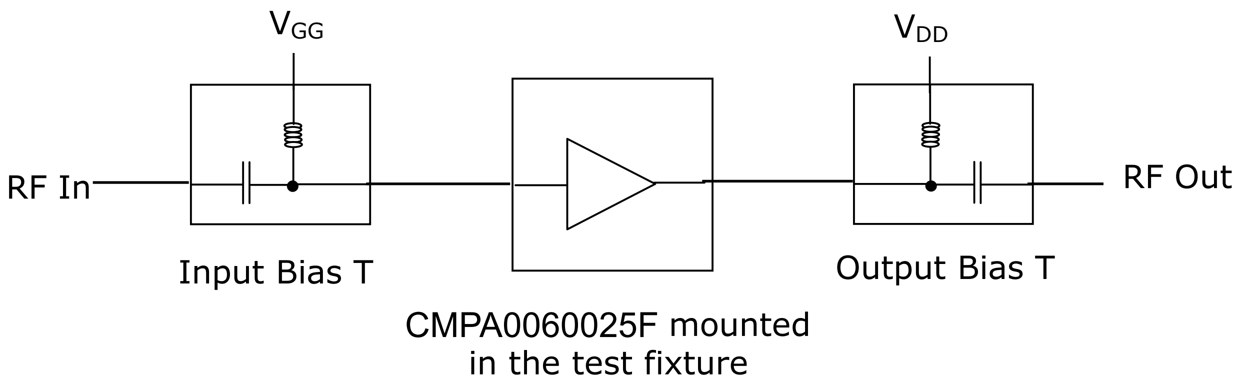

Figure 2. Typical test system setup required for measuring CMPA0060025F-AMP1

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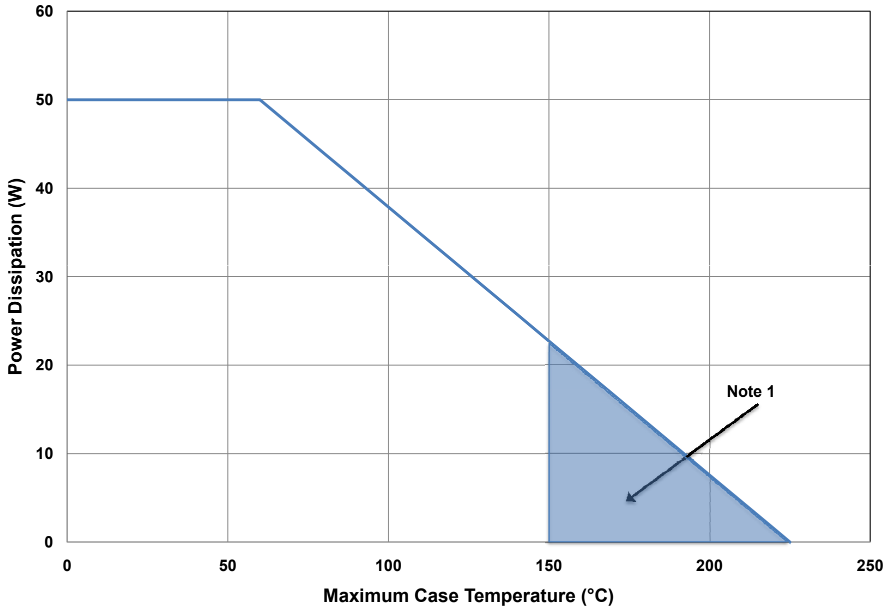
CMPA0060025F Power Dissipation De-rating Curve



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

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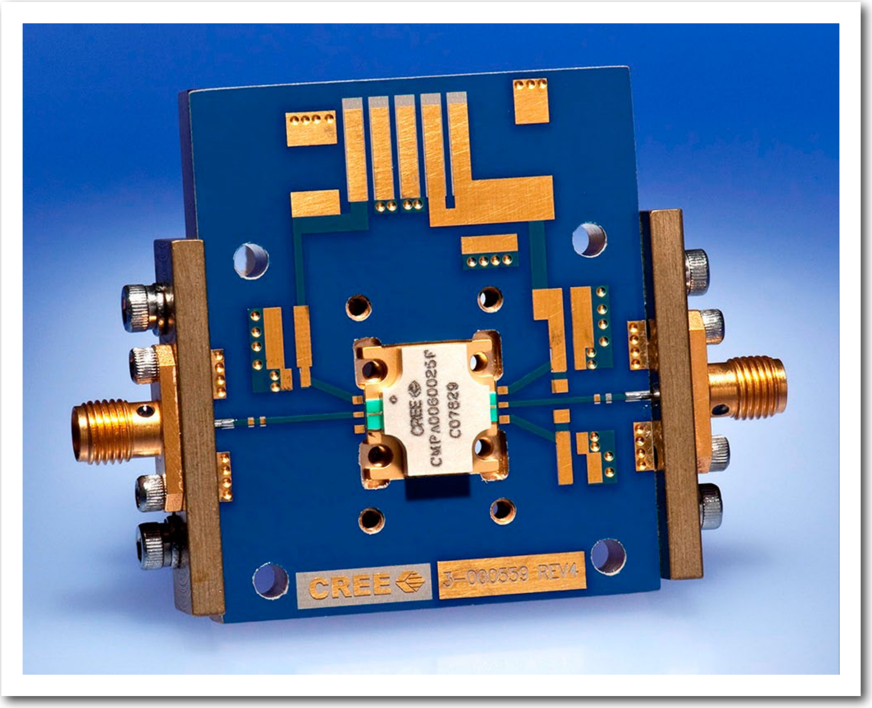
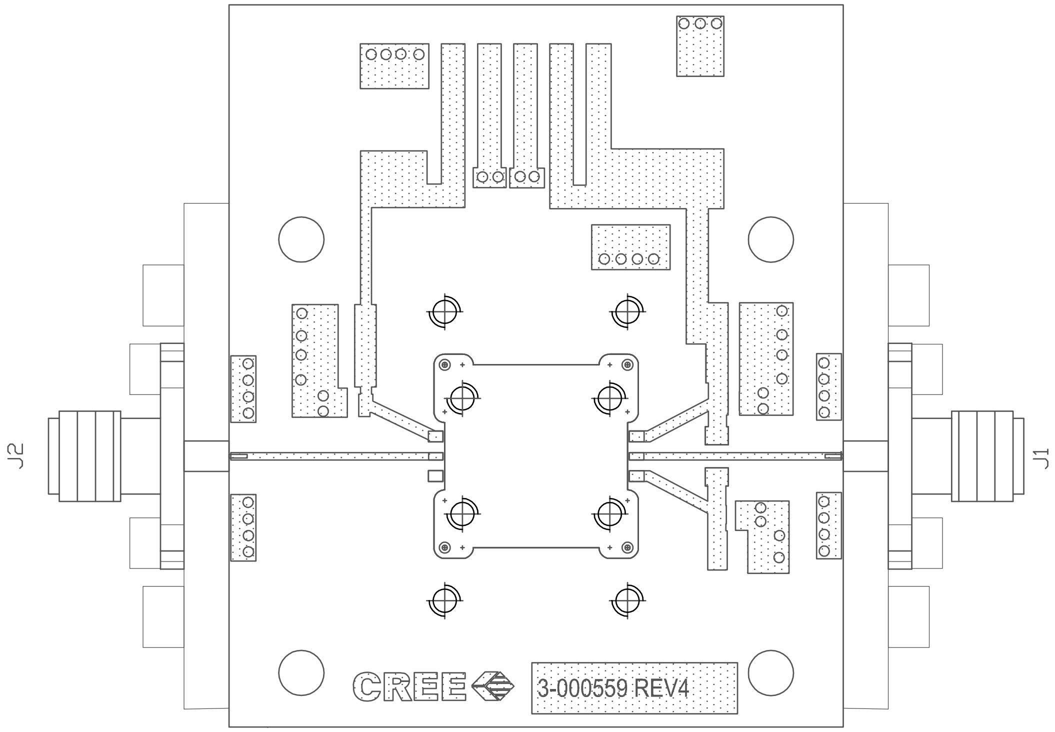
CMPA0060025F-AMP Demonstration Amplifier Circuit



CMPA0060025F-AMP Demonstration Amplifier Circuit Outline



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CMPA0060025F-AMP Demonstration Amplifier Circuit Bill of Materials

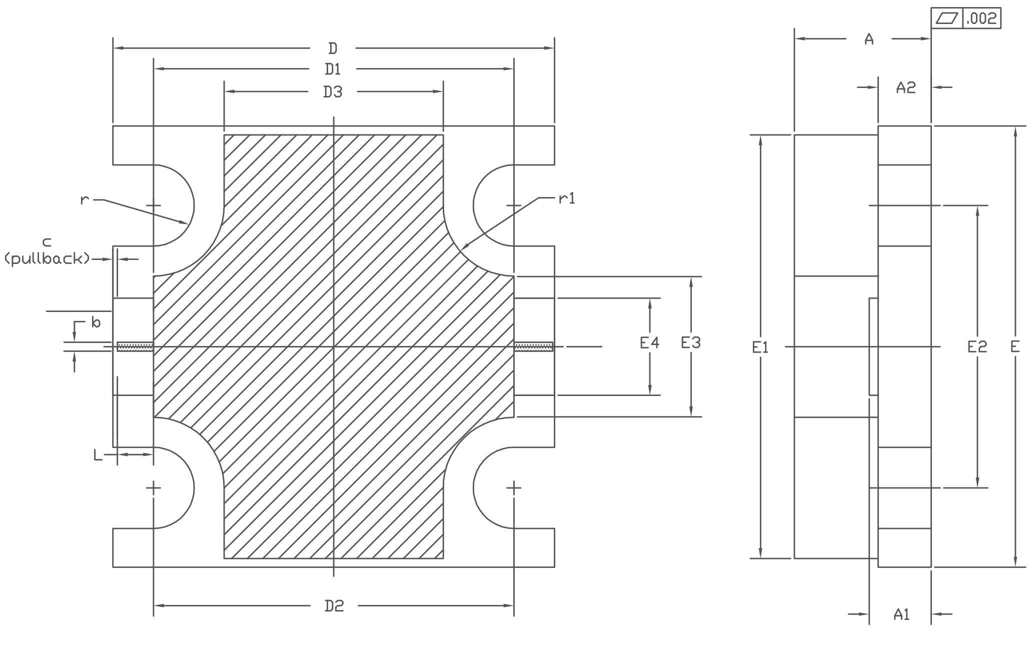
Designator	Description	Qty
J1,J2	CONNECTOR, SMA, AMP11052901-1	2
-	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA0060025F	1

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)



NOTES:

1. DIMENSIONING AND TOLERANICING 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

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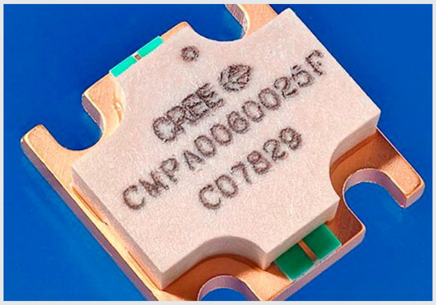
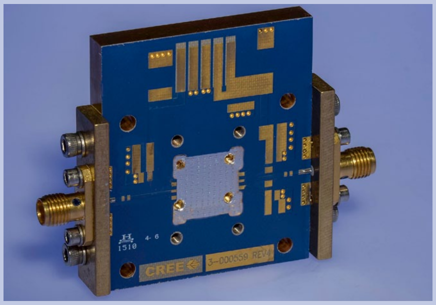
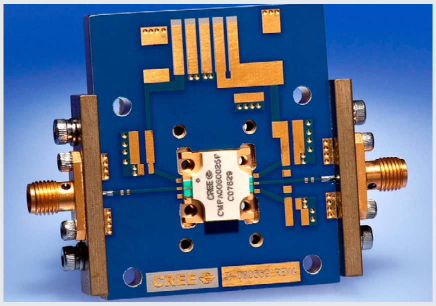
Product Ordering Information

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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