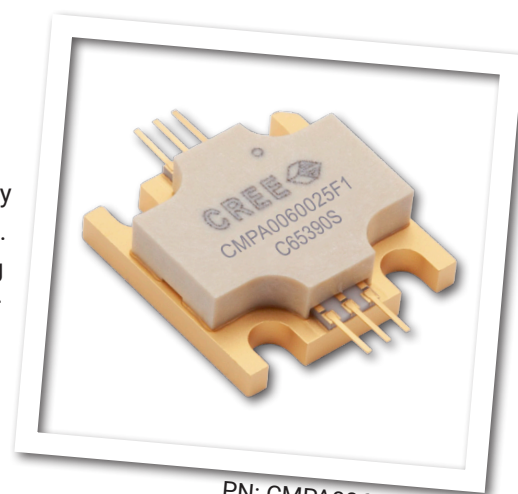


CMPA0060025F1

25 W, DC - 6.0 GHz, GaN MMIC Power Amplifier

Cree's CMPA0060025F1 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: CMPA0060025F1
Package Type: 440219

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

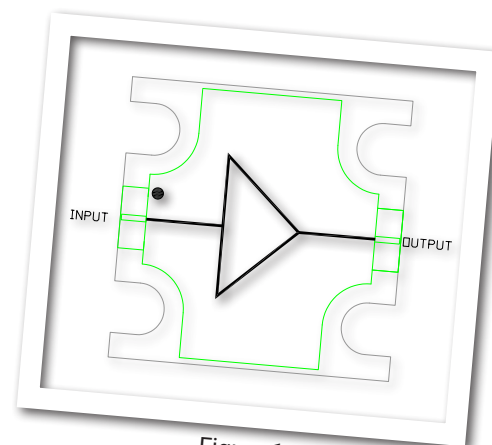


Figure 1.

Parameter	Symbol	Rating	Units
Drain-source Voltage	V_{DS}	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 CMPA0060025F1 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}	–	-3.0	–	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}	–	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}	–	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}	–	42.9	–	dBm	V _{DD} = 50 V, I _{DQ} = 500 mA, P _{IN} = 32 dBm				
Drain Efficiency at P _{OUT} @ 4.5 GHz	η1	–	24.1	–	%	V _{DD} = 50 V, I _{DQ} = 500 mA, P _{IN} = 32 dBm				
Drain Efficiency at P _{OUT} @ 5.0 GHz	η2	–	28.0	–	%	V _{DD} = 50 V, I _{DQ} = 500 mA, P _{IN} = 32 dBm				
Drain Efficiency at P _{OUT} @ 6.0 GHz	η3	–	27.2	–	%	V _{DD} = 50 V, I _{DQ} = 500 mA, P _{IN} = 32 dBm				
Output Mismatch Stress	VSWR	–	–	–	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	–	19.3	–	–	-4.1	–	–	-8.5	–	V _{DD} = 50 V, I _{DQ} = 500 mA
0.25 GHz - 0.5 GHz	–	19.8	–	–	-6.8	–	–	-8.9	–	V _{DD} = 50 V, I _{DQ} = 500 mA
0.5 GHz - 1.0 GHz	–	18.6	–	–	-15.3	–	–	-6.7	–	V _{DD} = 50 V, I _{DQ} = 500 mA
1.0 GHz - 2.0 GHz	–	18.6	–	–	-15.3	–	–	-6.7	–	V _{DD} = 50 V, I _{DQ} = 500 mA
2.0 GHz - 3.0 GHz	–	18.6	–	–	-15.3	–	–	-6.0	–	V _{DD} = 50 V, I _{DQ} = 500 mA
3.0 GHz - 6.0 GHz	–	16.3	–	–	-14.2	–	–	-5.3	–	V _{DD} = 50 V, I _{DQ} = 500 mA

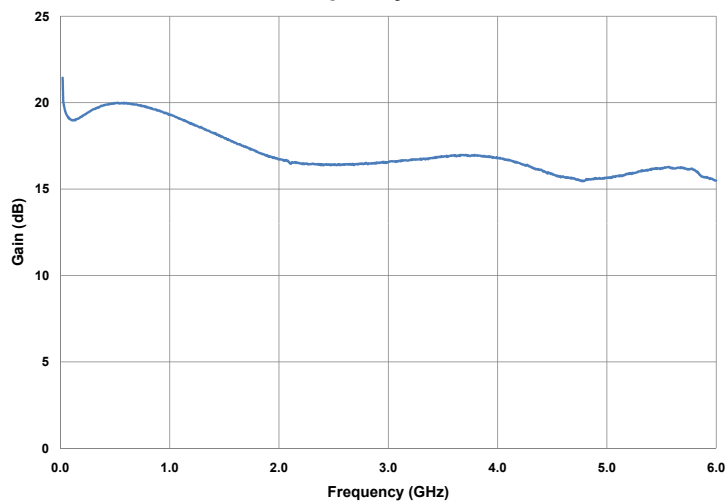
Notes:

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

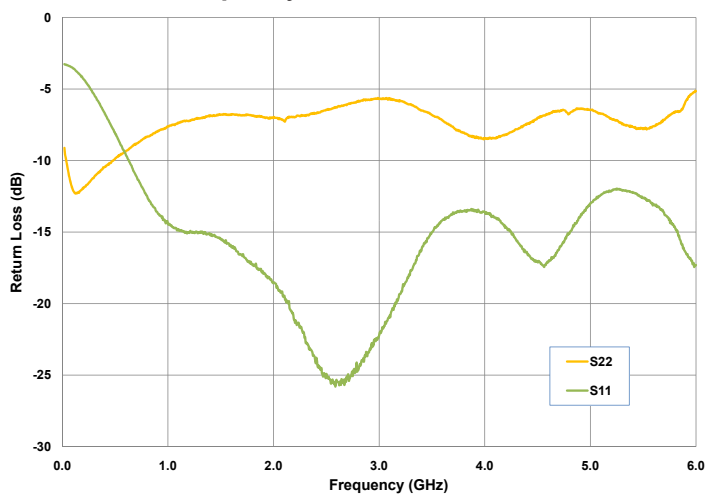
² The device will draw approximately 55-70 mA at pinch off due to the internal circuit structure.

Typical Performance

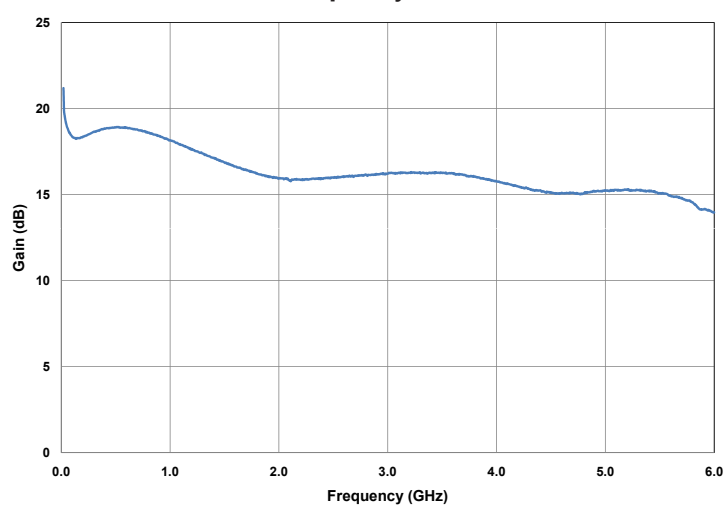
**Small Signal Gain
vs Frequency at 50 V**



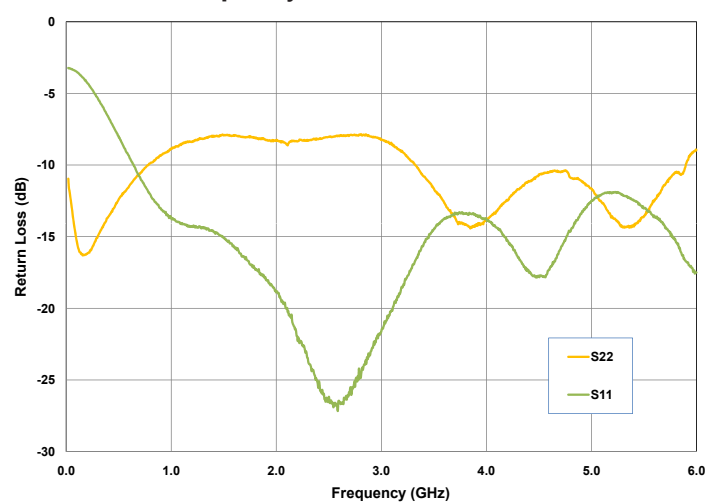
**Input & Output Return Losses
vs Frequency at 50 V**



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

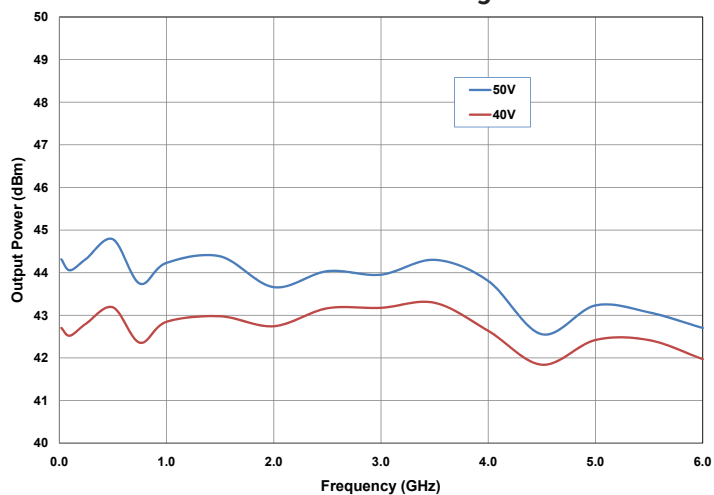


**Input & Output Return Losses
vs Frequency at 40 V**

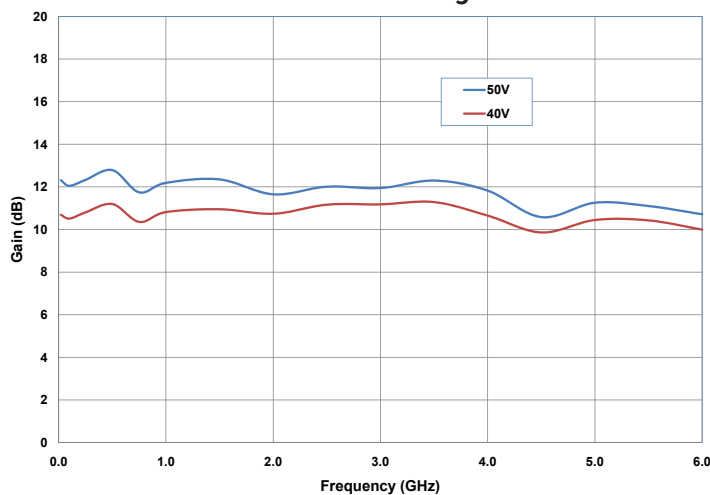


Typical Performance

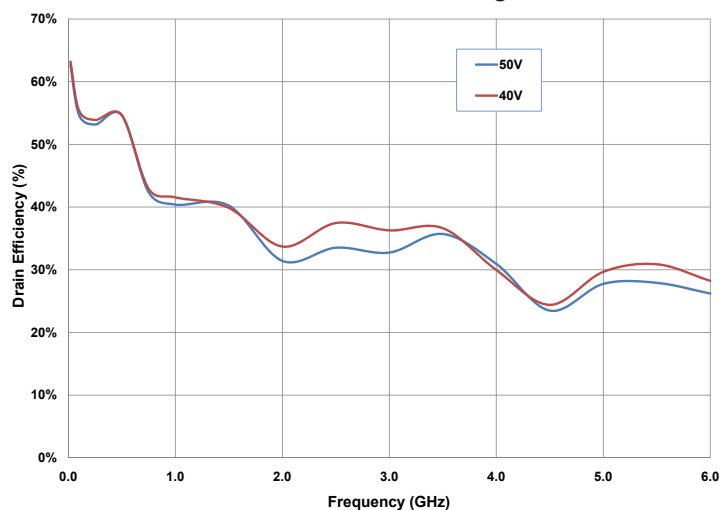
**Output Power at $P_{IN} = 32$ dBm vs Frequency
as a Function of Drain Voltage**



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

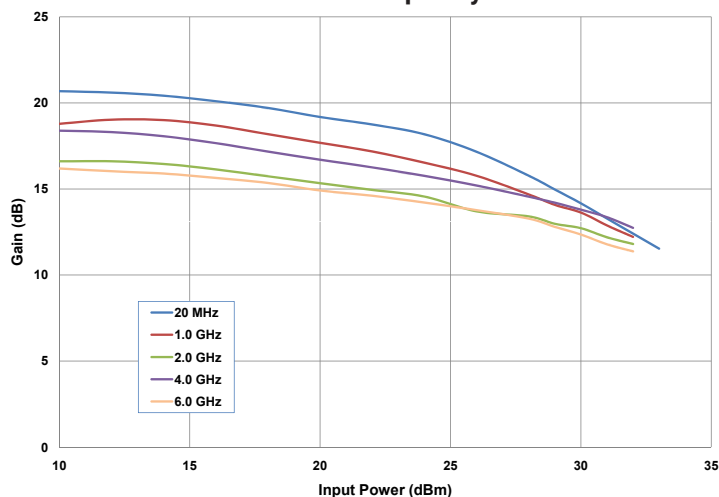


**Drain Efficiency at $P_{IN} = 32$ dBm vs Frequency
as a Function of Drain Voltage**

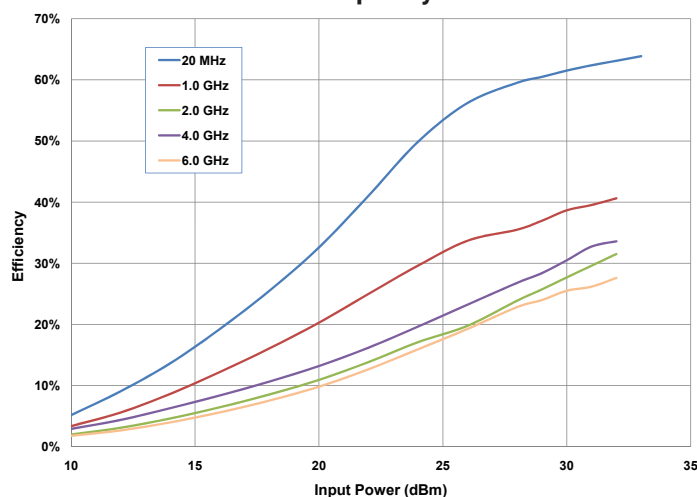


Typical Performance

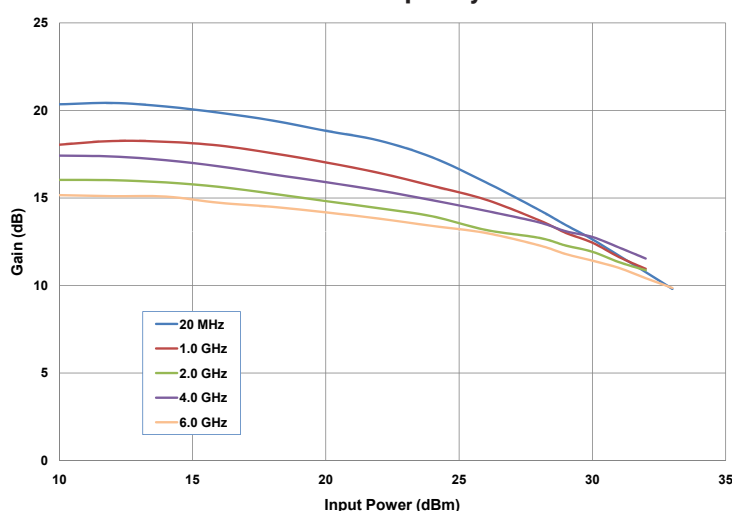
**Gain vs Input Power at 50V
as a Function of Frequency**



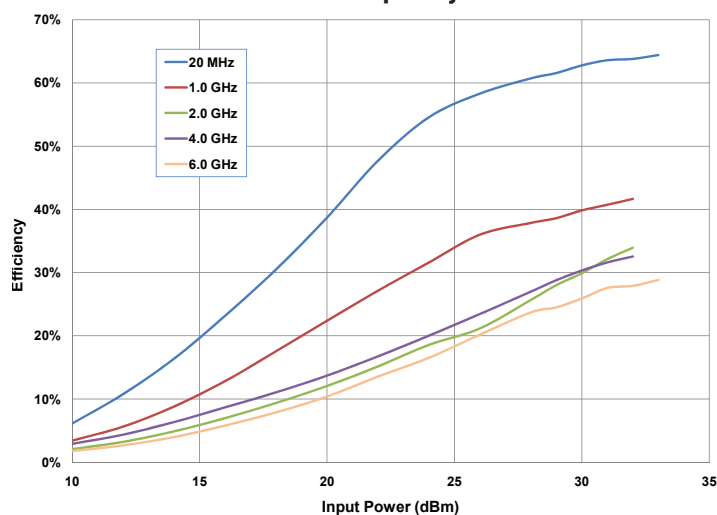
**Efficiency vs Input Power at 50 V
as a Function of Frequency**



**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 CMPA0060025F1 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 CMPA0060025F1 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 CMPA0060025F1-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.

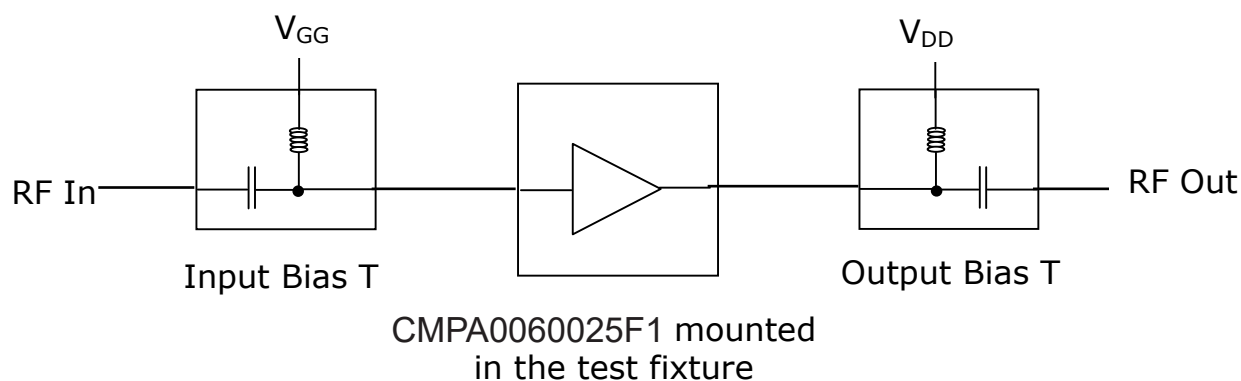
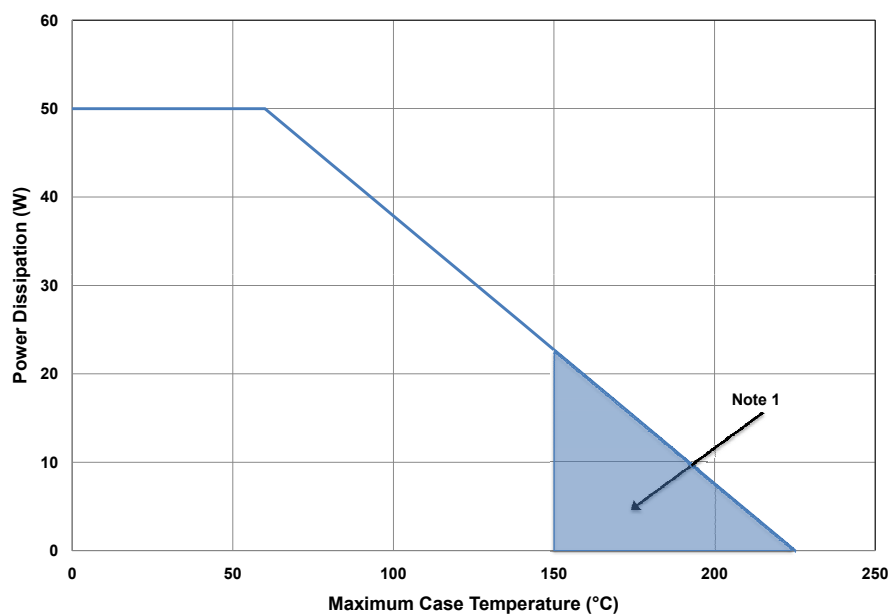


Figure 2. Typical test system setup required for measuring CMPA0060025F1-AMP1

CMPA0060025F1 Power Dissipation De-rating Curve



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

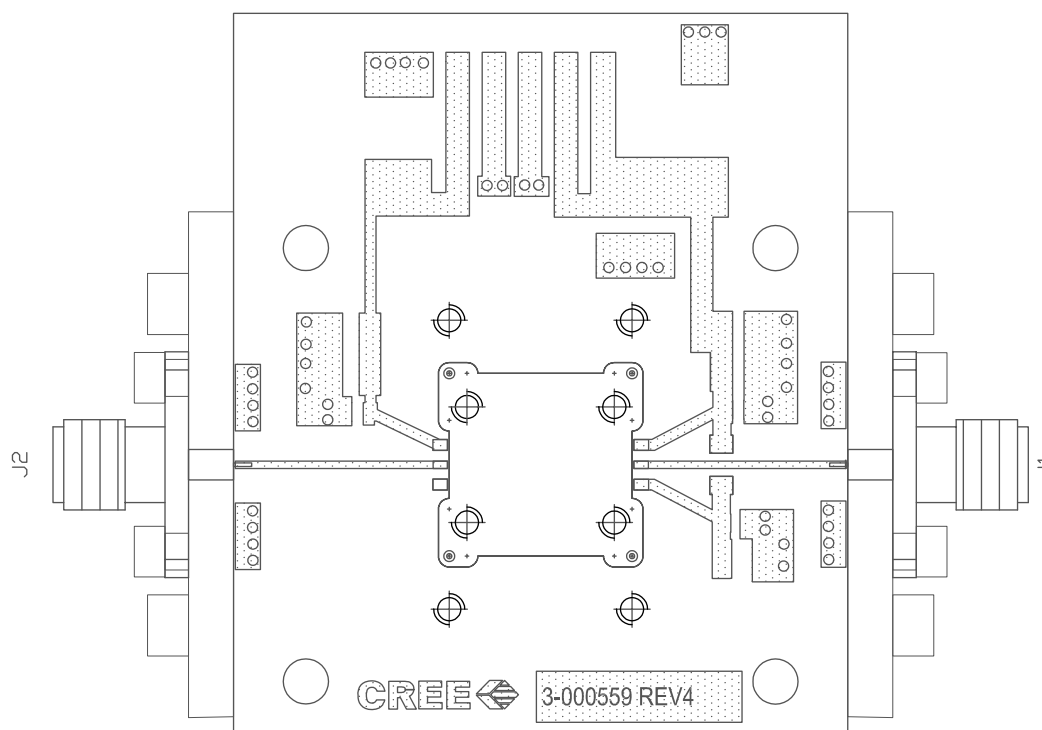
Electrostatic Discharge (ESD) Classifications

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

CMPA0060025F1-AMP Demonstration Amplifier Circuit



CMPA0060025F1-AMP Demonstration Amplifier Circuit Outline



CMPA0060025F1-AMP Demonstration Amplifier Circuit Bill of Materials

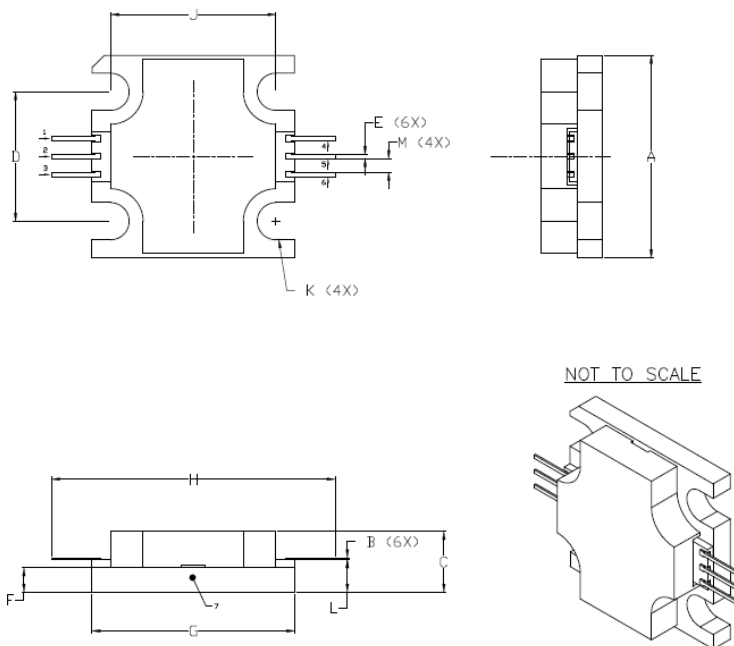
Designator	Description	Qty
J1,J2	CONNECTOR, SMA, AMP11052901-1	2
-	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA0060025F1	1

Notes

¹ The CMPA0060025F1 is connected to the PCB with 2.0 mil Au bond wires.

² An external bias T is required.

Product Dimensions CMPA0060025F1 (Package Type – 440219)

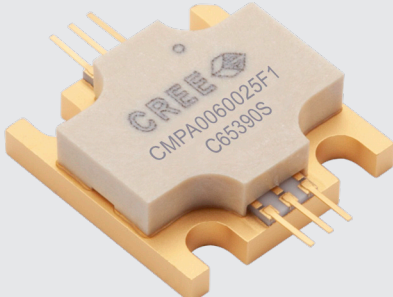


NOTES:

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	
	MIN	MAX	MIN	MAX
A	0.495	0.505	12.57	12.82
B	0.003	0.005	0.076	0.127
C	0.140	0.160	3.56	4.06
D	0.315	0.325	8.00	8.25
E	0.008	0.012	0.204	0.304
F	0.055	0.065	1.40	1.65
G	0.495	0.505	12.57	12.82
H	0.695	0.705	17.65	17.91
J	0.403	0.413	10.24	10.49
K	Ø .092		2.34	
L	0.075	0.085	1.905	2.159
M	0.032	0.040	0.82	1.02

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA0060025F1	GaN MMIC	Each	
CMPA0060025F1-AMP	Test board with GaN MMIC installed	Each	

Disclaimer

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