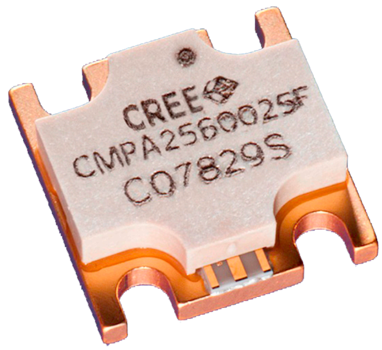
CMPA2560025F

25 W, 2500 - 6000 MHz, GaN MMIC Power Amplifier

Description

Cree's CMPA2560025F 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 contains a two-stage reactively matched amplifier enabling very wide bandwidths to be achieved in a small footprint screw-down package featuring a Copper-Tungsten heat-sink.



PN: CMPA2560025F
Package Type: 780019

Typical Performance Over 2.5 - 6.0 GHz (T_C = 25˚C)

Parameter	2.5 GHz	4.0 GHz	6.0 GHz	Units
Gain	27.5	14.9	23.1	dB
Saturated Output Power, P_{SAT} [1]	35.8	177	25.6	W
Power Gain @ P_{OUT} 43 dBm	23.1	100	16.3	dB
PAE @ P_{OUT} 43 dBm	31.5	11.6	30.7	%

Note:
[1] P_{SAT} is defined as the RF output power where the device starts to draw positive gate current in the range of 7-13 mA

Features

- 24 dB Small Signal Gain
- 25 W Typical P_{SAT}
- Operation up to 28 V
- High Breakdown Voltage
- High Temperature Operation

Applications

- Ultra Broadband Amplifiers
- Fiber Drivers
- Test Instrumentation
- EMC Amplifier Drivers

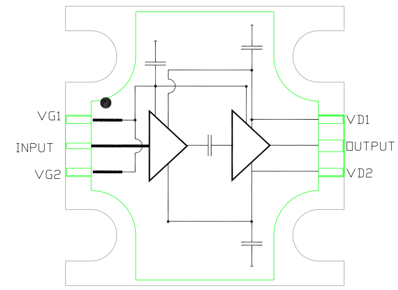


Figure 1.

RoHS COMPLIANT

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
Forward Gate Current	I_G	13	mA
Screw Torque	T	40	in-oz
Thermal Resistance, Junction to Case	$R_{θJC}$	2.5	˚C/W

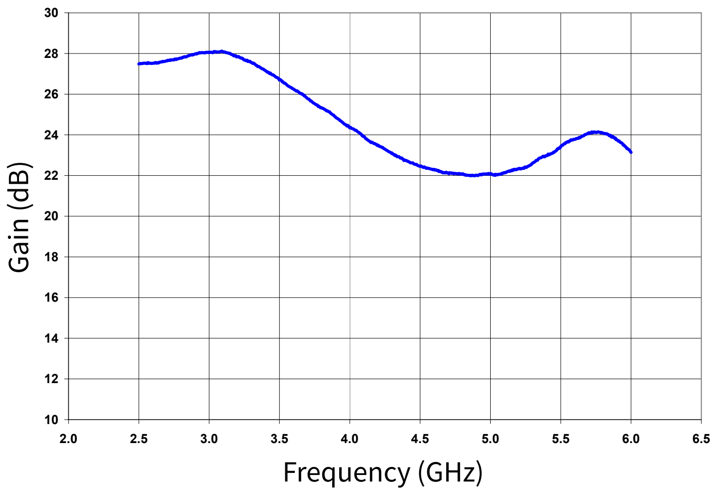
Electrical Characteristics (Frequency = 2.5 GHz to 6.0 GHz unless otherwise stated; T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	$V_{(GS)TH}$	-3.8	-3.0	-2.3	V	V_{DS} = 10 V, I_D = 20 mA
Gate Quiescent Voltage	$V_{(GS)Q}$	–	-2.7	–	VDC	V_{DD} = 28 V, I_D = 1200 mA
Drain-Source Breakdown Voltage	V_{BD}	84	100	–	V	V_{GS} = -8 V, I_D = 20 mA
Saturated Drain Current[1]	I_{DC}	8.0	9.7	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
RF Characteristics[2]						
Small Signal Gain	S21	19.5	24	–	dB	V_{DD} = 28 V, I_D = 1200 mA
Input Return Loss	S11	–	-8	-5	dB	V_{DD} = 28 V, I_D = 1200 mA
Output Return Loss	S22	–	-8	-3	dB	V_{DD} = 28 V, I_D = 1200 mA
Power Output$_1$	P_{OUT}	22.0	30	–	W	V_{DD} = 28 V, I_D = 1200 mA, P_{IN} = 26 dBm, Freq = 4.0 GHz
Power Output$_2$	P_{OUT}	12.5	17	–	W	V_{DD} = 28 V, I_D = 1200 mA, P_{IN} = 26 dBm, Freq = 5.0 GHz
Power Output$_3$	P_{OUT}	15.5	20	–	W	V_{DD} = 28 V, I_D = 1200 mA, P_{IN} = 26 dBm, Freq = 6.0 GHz
Power Added Efficiency$_1$	PAE	34	40	–	%	V_{DD} = 28 V, I_D = 1200 mA, P_{IN} = 26 dBm, Freq = 4.0 GHz
Power Added Efficiency$_2$	PAE	20	26	–	%	V_{DD} = 28 V, I_D = 1200 mA, P_{IN} = 26 dBm, Freq = 5.0 GHz
Power Added Efficiency$_3$	PAE	24	30	–	%	V_{DD} = 28 V, I_D = 1200 mA, P_{IN} = 26 dBm, Freq = 6.0 GHz
Power Gain$_1$	G_P	17.5	18.8	–	dB	V_{DD} = 28 V, I_D = 1200 mA, P_{IN} = 26 dBm, Freq = 4.0 GHz
Power Gain$_2$	G_P	15.0	16.3	–	dB	V_{DD} = 28 V, I_D = 1200 mA, P_{IN} = 26 dBm, Freq = 5.0 GHz
Power Gain$_3$	G_P	16.0	17.0	–	dB	V_{DD} = 28 V, I_D = 1200 mA, P_{IN} = 26 dBm, Freq = 6.0 GHz
Output Mismatch Stress	VSWR	–	–	5 : 1	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 1200 mA, P_{IN} = 26 dBm

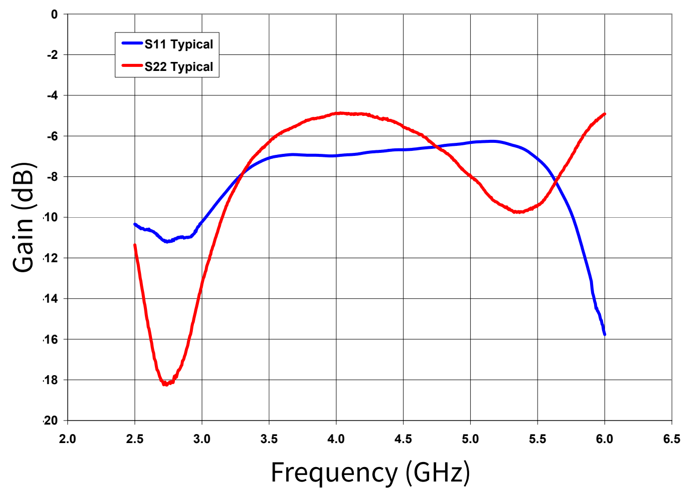
Notes:
[1] Scaled from PCM data
[2] All data CW tested in CMPA2560025F-AMP

Typical Performance

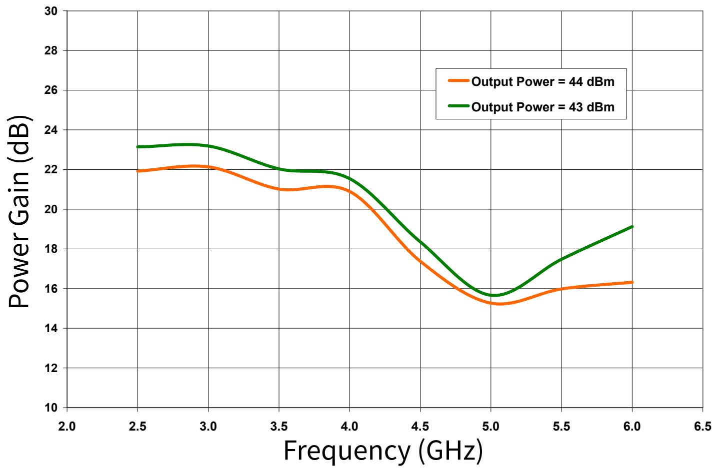
Small Signal Gain vs Frequency



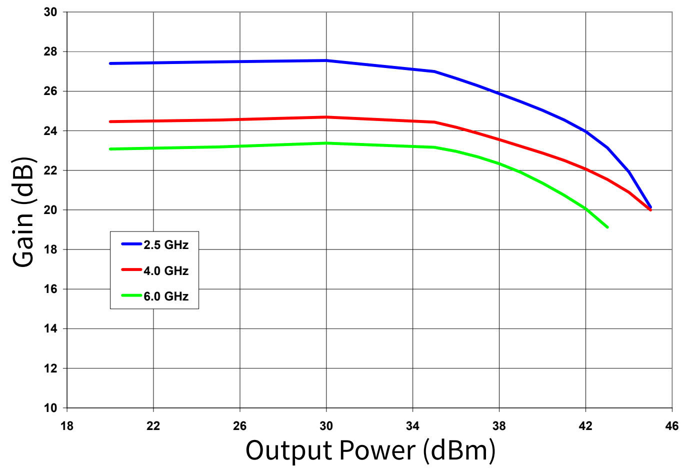
Input & Output Return Losses vs Frequency



Power Gain vs Frequency

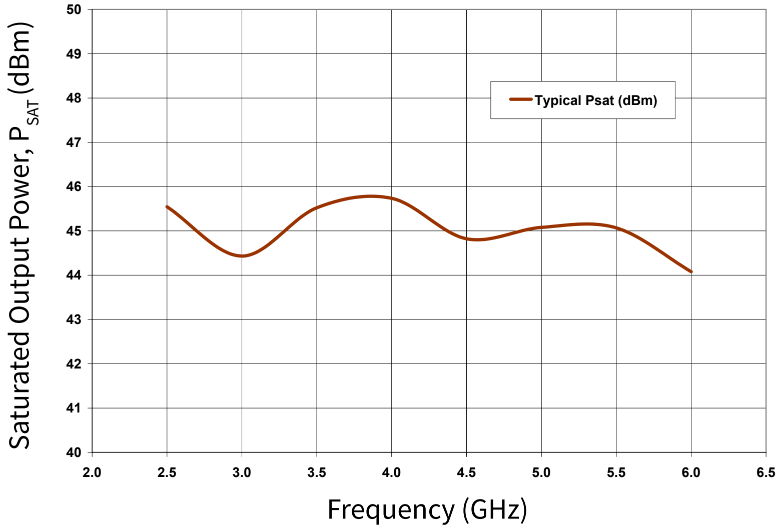


Gain vs Output Power as a Function of Frequency



Typical Performance

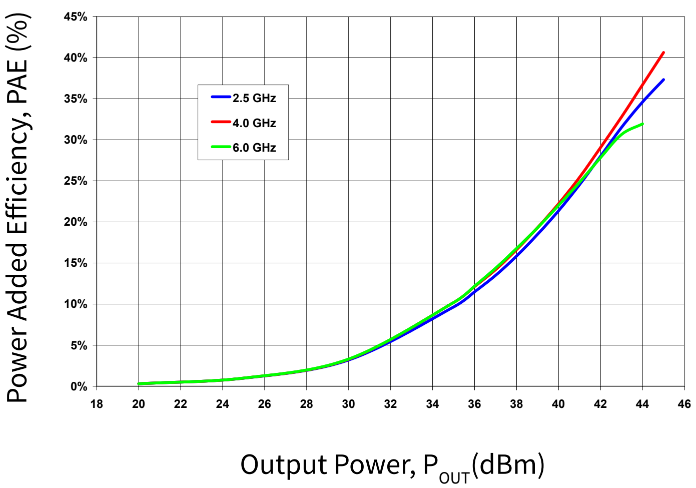
Saturated Output Power Performance (P_{SAT}) vs Frequency



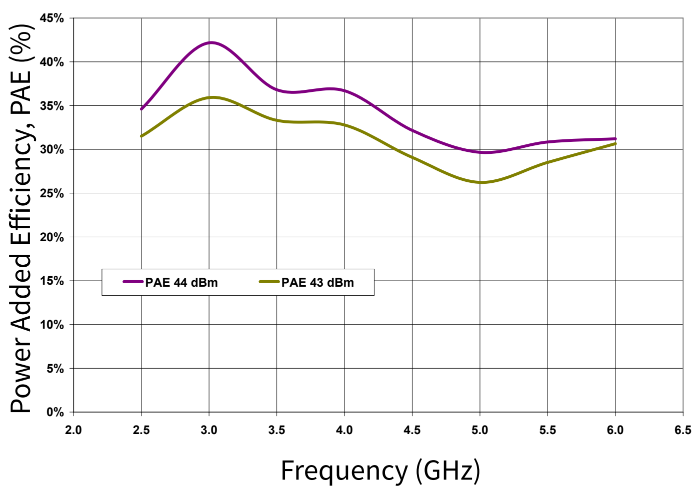
Frequency (GHz)	P_{SAT} (dBm)	P_{SAT} (W)
2.5	45.54	35.8
3.0	44.43	27.7
3.5	45.52	35.7
4.0	45.74	37.5
4.5	44.82	30.4
5.0	45.08	32.2
5.5	45.07	32.1
6.0	44.08	25.6

Note:
P_{SAT} is defined as the RF output power where the device starts to draw positive gate current in the range of 7-13 mA.

Power Added Efficiency vs Output Power as a Function of Frequency

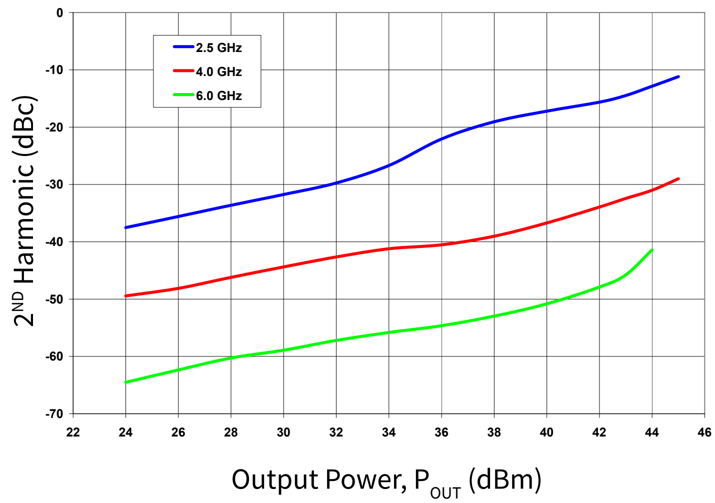


PAE at 43 dBm and 44 dBm Output Power vs Frequency

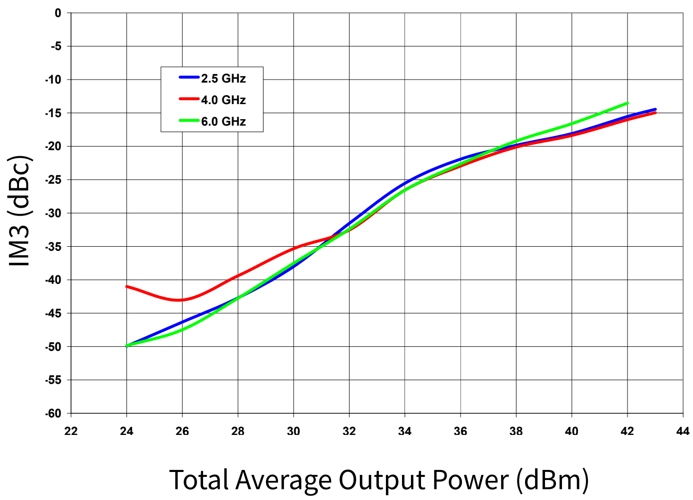


Typical Performance

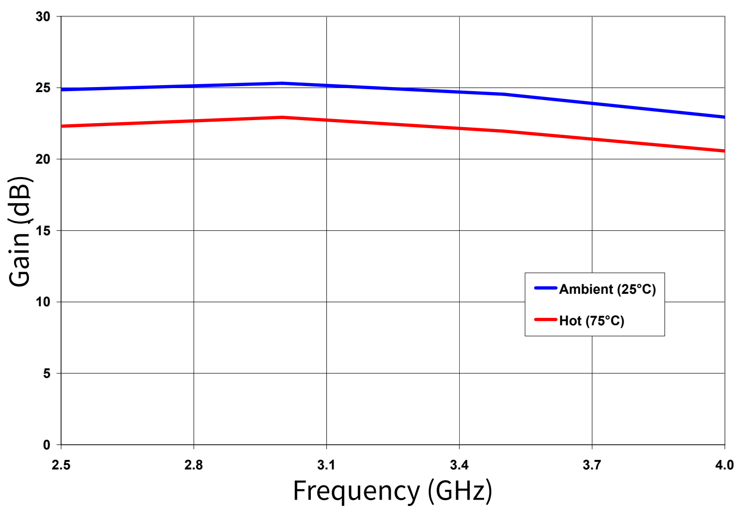
2^ND Harmonic vs Output Power as a Function of Frequency



IM3 vs Total Average Power as a Function of Frequency



Gain at P_{OUT} of 40 dBm at 25°C & 75°C vs Frequency



Note: The temperature coefficient is -0.05 dB/°C

General Device Information

The CMPA2560025F is a two stage GaN HEMT MMIC Power Amplifier, which operates between 2.5- 6.0 GHz. The amplifier typically provides 25 dB of small signal gain and 25 W saturated output power with an associated power added efficiency of better than 30 %. The wideband amplifier's input and output are internally matched to 50 Ohm. The amplifier requires bias from dedicated ports. The RF-input and output both require an external DC-block. DC voltage should not be applied to the RF output pin due to the internal matching elements. The two gate pins, G1 and G2, are internally connected so it is sufficient to apply bias to only one of them. The drain pins, D1 and D2, should both be connected to the drain supply. The component has internal DC-decoupling on the gate and drain pins, 1840pF and 920pF respectively. The test fixture also provides extra decoupling capacitors on all supply lines. Details of these components can be found on the bill of materials.

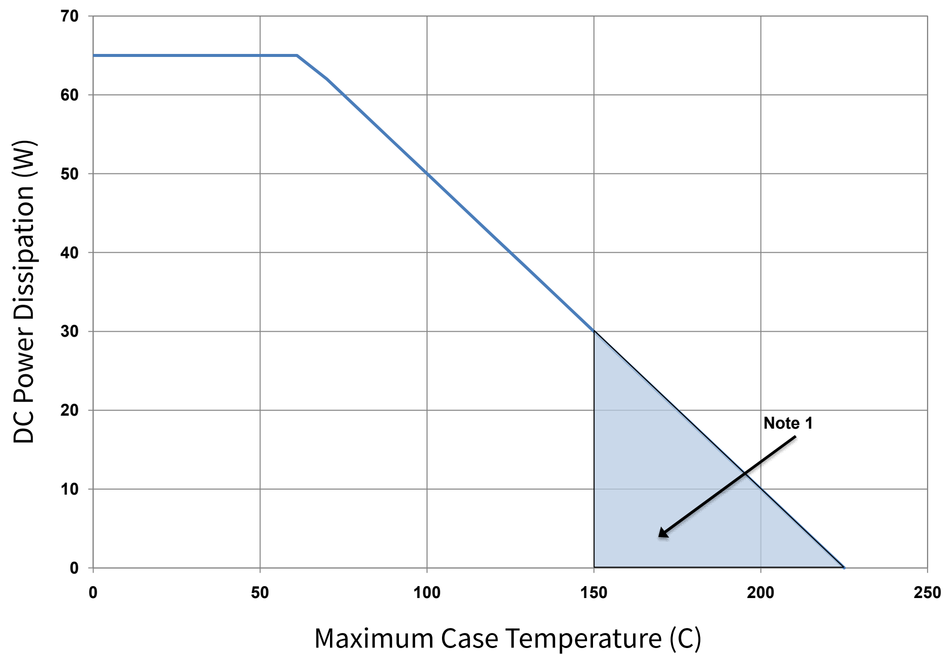
The CMPA2560025F is provided in a lead-less package format. The input and output connections are gold plated to enable gold bond wire attach at the next level assembly.

The measurements in this data sheet were taken on devices wire-bonded to the test fixture with 2 mil gold bond wires. All losses associated with the test fixture are included in the measurements.

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

CMPA2560025F CW Power Dissipation De-rating Curve



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

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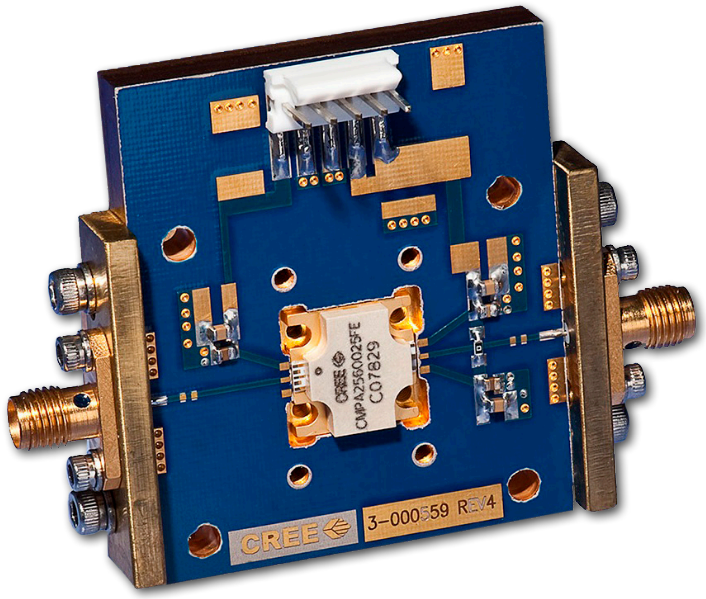
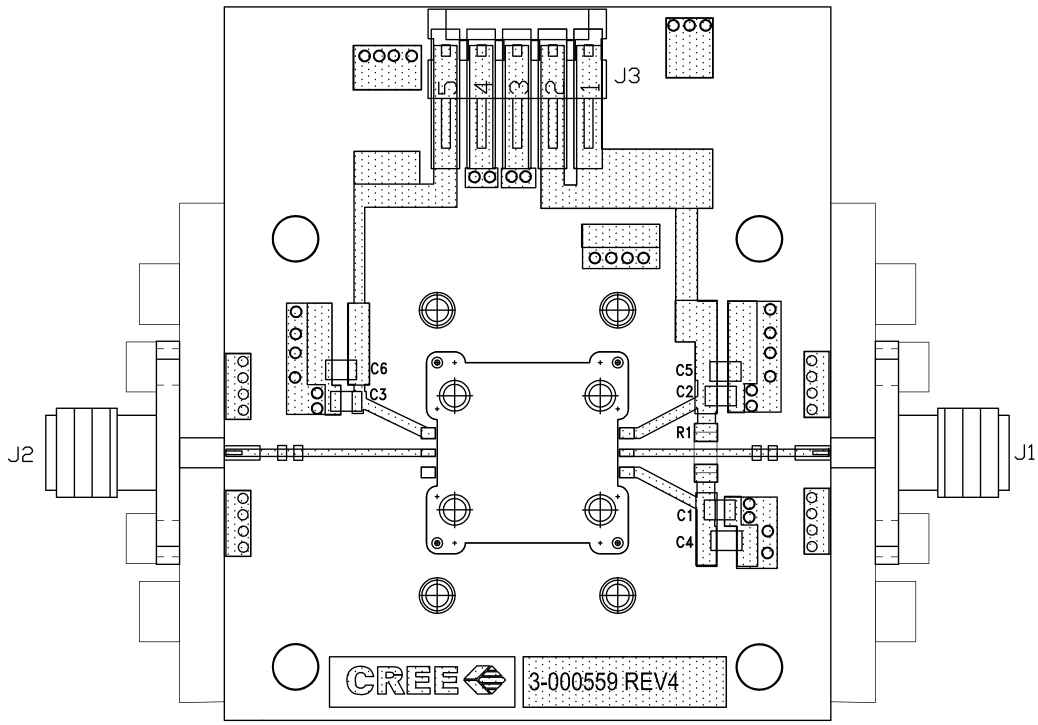
CMPA2560025F-AMP Demonstration Amplifier Circuit



CMPA2560025F-AMP Demonstration Amplifier Circuit Outline

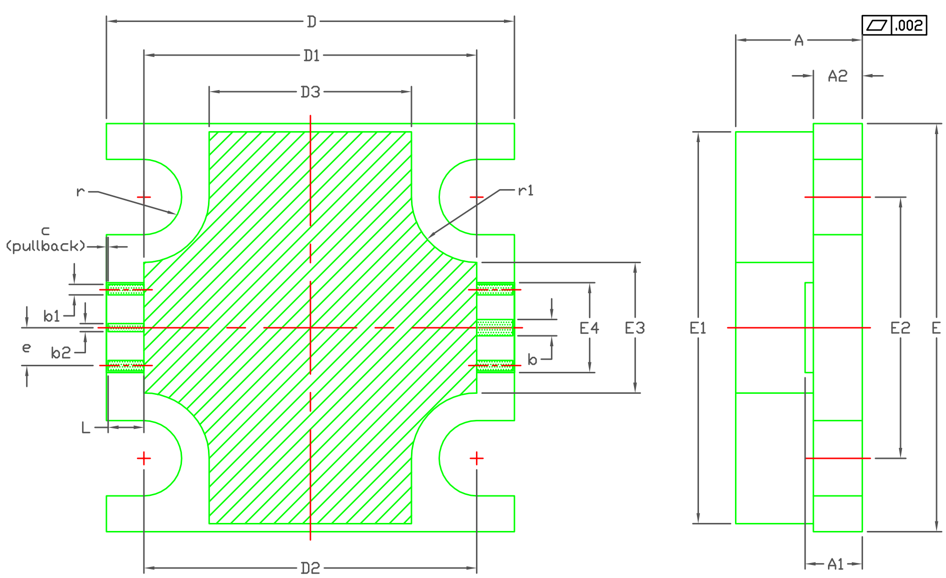


CMPA2560025F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
J1,J2	CONNECTOR, SMA, AMP1052901-1	2
J3	HEADER, RT. PLZ. 1, CEN LK, 5 POS	1
C1,C2,C3	CAP, 2400 pF, BROADBAND BLOCK, C08BL242X-5UN-X0T 2	3
C4,C5,C6	CAP, 0.1 UF, +/- 10 % , 0805	3
R1	RES, 0 OHM, 1206	1
-	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA2560025F	1

Notes:
[1] The CMPA2560025F is connected to the PCB with 2.0 mil Au bond wires
[2] An external DC Block is required on the input and output

Product Dimensions CMPA2560025F (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	0.022		0.56		–
b1	0.013		0.33		x4
b2	0.010		0.25		–
c	0.002		0.05		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	–
e	0.046		1.17		x4
L	0.044		1.12		x6
r	R0.046		R1.17		x4
r1	R0.080		R2.03		x4

Part Number System

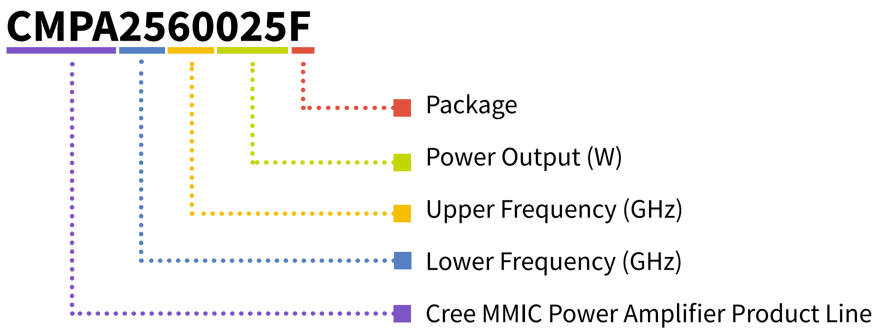


Table 1.

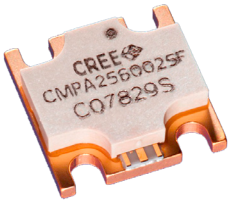
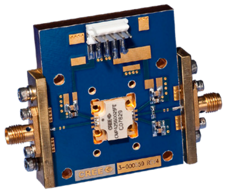
Parameter	Value	Units
Lower Frequency	13.75	GHz
Upper Frequency[1]	14.5	GHz
Power Output	25	W
Package	Flange	-

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

Table 2.

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
CMPA25650025F	GaN HEMT	Each	
CMPA2560025F-AMP	Test board with GaN HEMT installed	Each	

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Notes

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