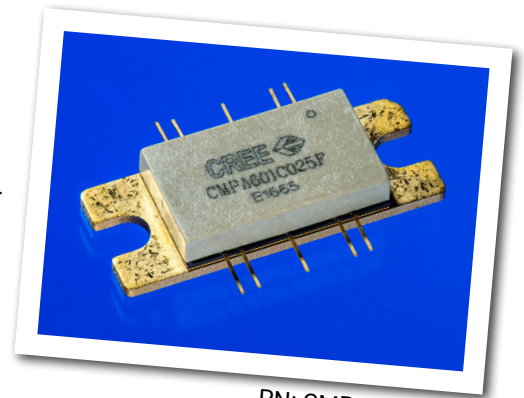


CMPA601C025F

25 W, 6.0 - 12.0 GHz, GaN MMIC, Power Amplifier

The CMPA601C025F is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC) on a silicon carbide (SiC) substrate, using a 0.25 μm gate length fabrication process. The semiconductor offers 25 Watts of power from 6 to 12 GHz of instantaneous bandwidth. The GaN HEMT MMIC is housed in a thermally-enhanced, 10-lead 25 mm x 9.9 mm metal/ceramic flanged package. It offers high gain and superior efficiency in a small footprint package at 50 ohms.



PN: CMPA601C025F
Package Type: 440213

Typical Performance Over 6.0-12.0 GHz ($T_c = 25^\circ\text{C}$)

Parameter	6.0 GHz	7.5 GHz	9.0 GHz	10.5 GHz	12.0 GHz	Units
Small Signal Gain	35	34	34	37	31	dB
$P_{\text{OUT}} @ P_{\text{IN}} = 22 \text{ dBm}$	34	51	49	49.5	36.5	W
Power Gain @ $P_{\text{IN}} = 22 \text{ dBm}$	23	25	25	25	23.5	dB
PAE @ $P_{\text{IN}} = 22 \text{ dBm}$	21	36	35	33	27	%

Note: All data CW.

Features

- 34 dB Small Signal Gain
- 40 W Typical P_{SAT}
- Operation up to 28 V
- High Breakdown Voltage
- High Temperature Operation
- Size 0.172 x 0.239 x 0.004 inches

Applications

- Jamming Amplifiers
- Test Equipment Amplifiers
- Broadband Amplifiers

Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	V_{DS}	84	V_{DC}	25°C
Gate-source Voltage	V_{GS}	-10, +2	V_{DC}	25°C
Storage Temperature	T_{STG}	-40, +150	°C	
Operating Junction Temperature	T_J	225	°C	
Maximum Forward Gate Current	I_{GMAX}	23	mA	25°C
Soldering Temperature ¹	T_{STG}	245	°C	
Screw Torque	T	40	in-oz	
Thermal Resistance, Junction to Case ²	$R_{\theta JC}$	0.85	°C/W	85°C @ $P_{DISS} = 116 W$
Case Operating Temperature ²	T_C	-40, +150	°C	

Note¹ Refer to the Application Note on soldering at <http://www.cree.com/rf/document-library>

Note² See also, the Power Dissipation De-rating Curve on page 4

Electrical Characteristics (Frequency = 6.0 GHz to 12.0 GHz unless otherwise stated; $T_C = 25^\circ C$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics^{1,2}						
Gate Threshold	V_{TH}	-3.8	-2.8	-2.3	V	$V_{DS} = 10 V, I_D = 23 mA$
Saturated Drain Current	I_{DS}	10.6	13.0	-	A	$V_{DS} = 6V, V_{GS} = 2 V$
Drain-Source Breakdown Voltage	V_{BD}	84	100	-	V	$V_{GS} = -8 V, I_{DS} = 23 mA$
RF Characteristics³						
Small Signal Gain	S21	28	31	-	dB	$V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = -30 dBm$
Output Power ^{3,4}	P_{OUT1}	45.5	47.2	-	dBm	$V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = 22 dBm, Freq = 6 GHz$
Output Power ^{3,4}	P_{OUT2}	45.5	47.1	-	dBm	$V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = 22 dBm, Freq = 9.5 GHz$
Output Power ^{3,4}	P_{OUT3}	43.7	45.5	-	dBm	$V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = 22 dBm, Freq = 12 GHz$
Power Added Efficiency ^{3,4}	PAE_1	23	33.2	-	%	$V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = 22 dBm, Freq = 6 GHz$
Power Added Efficiency ^{3,4}	PAE_2	26	32.3	-	%	$V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = 22 dBm, Freq = 9.5 GHz$
Power Added Efficiency ^{3,4}	PAE_3	15.5	26.5	-	%	$V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = 22 dBm, Freq = 12 GHz$
Input Return Loss	S11	-	-5	-	dB	$V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = -30 dBm$
Output Return Loss	S22	-	-5	-	dB	$V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = -30 dBm$
Output Mismatch Stress	VSWR	-	5:1	VSWR	Ψ	No damage at all phase angles, $V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = 22 dBm$

Notes:

¹ Measured on-wafer prior to packaging.

² Scaled from PCM data.

³ Measured in CMPA601C025F-AMP with 12.4 GHz low pass filter.

⁴ Fixture loss de-embedded using the following offsets. The offset is subtracted from the input offset value and added to the output offset value.

- a) 6.0 GHz - 0.13 dB
- b) 9.50 GHz - 0.26 dB
- c) 12.0 GHz - 0.35 dB

CMPA601C025F Typical Performance

Figure 1. - Small Signal S-Parameters vs. Frequency

$V_{DD} = 28\text{ V}$, $I_{DQ} = 2.0\text{ A}$, $P_{IN} = -30\text{ dBm}$

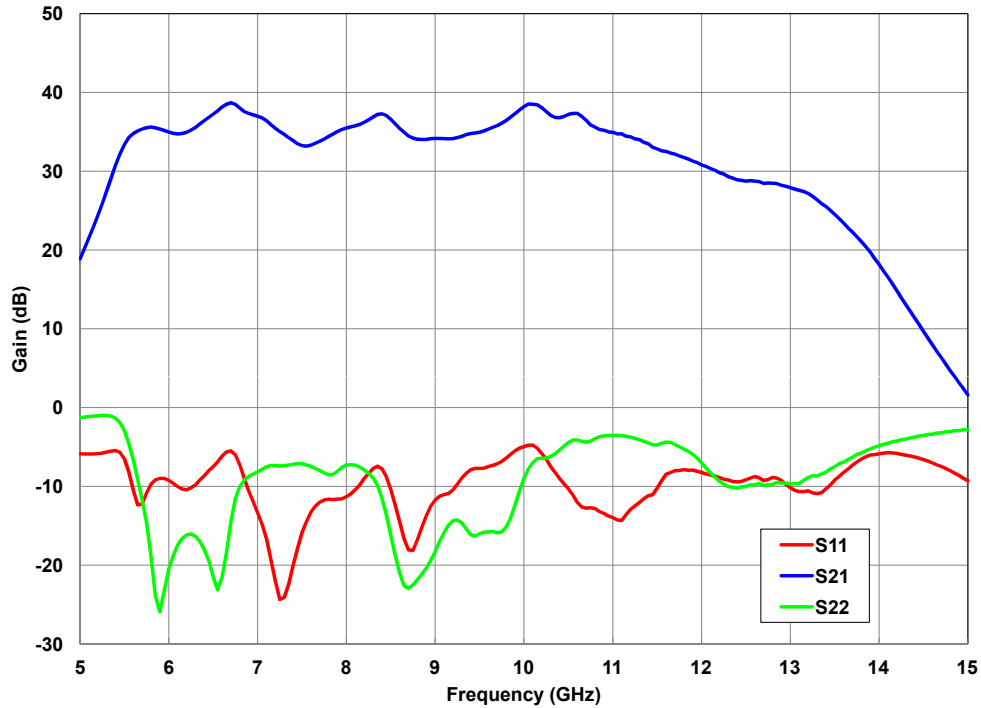
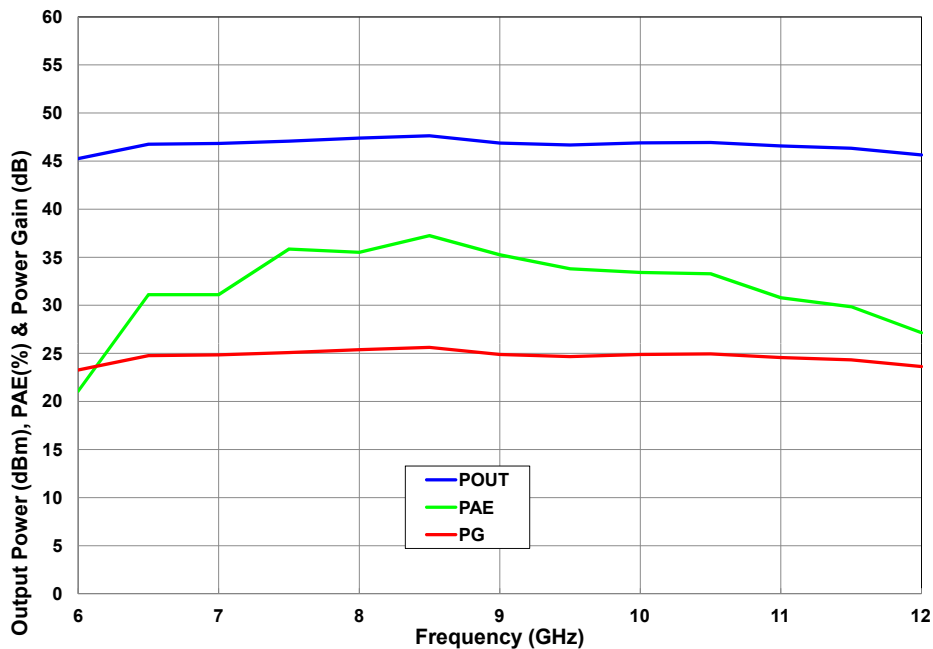


Figure 2. - Output Power, Gain and Power Added Efficiency vs. Input Power

$V_{DD} = 28\text{ V}$, $I_{DQ} = 2.0\text{ A}$, $P_{IN} = 22\text{ dBm}$



CMPA601C025F Typical Performance

Figure 3. - Power Added Efficiency vs. Input Power

$V_{DD} = 28\text{ V}, I_{DQ} = 2.0\text{ A}$

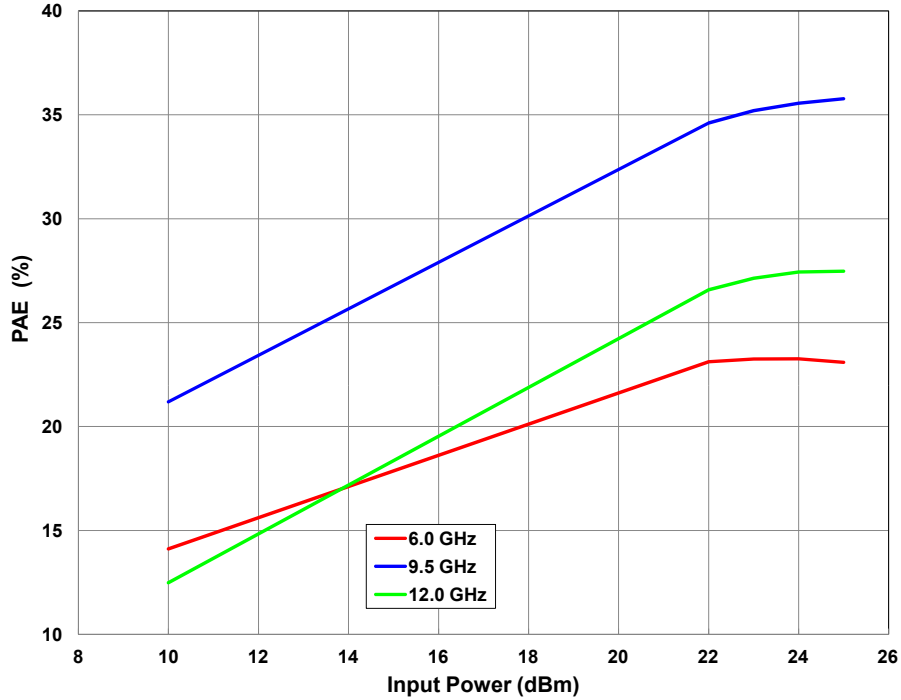
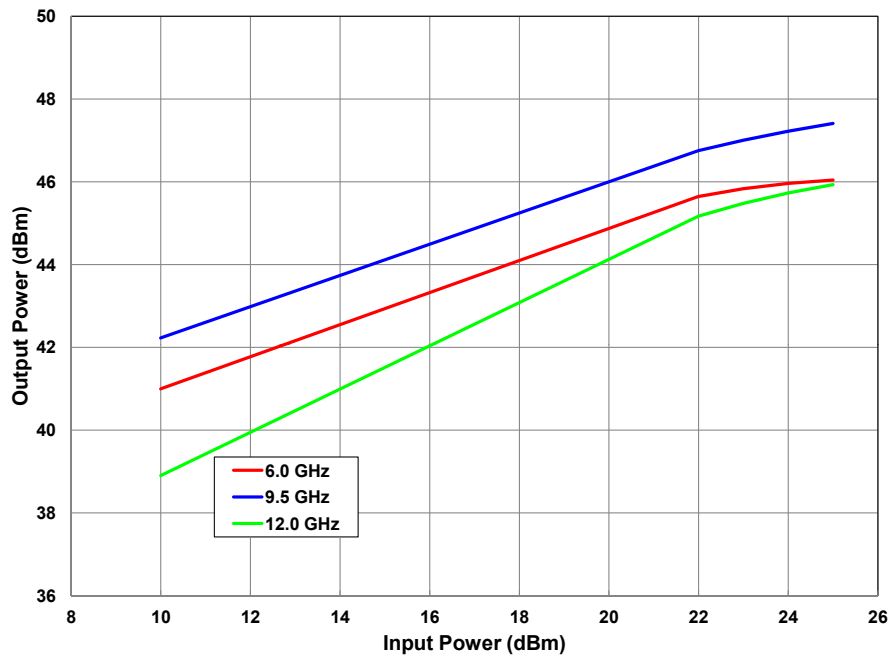


Figure 4. - Output Power vs. Input Power

$V_{DD} = 28\text{ V}, I_{DQ} = 2.0\text{ A}$



CMPA601C025F Typical Performance

Figure 5. - Gain vs Input Power
 $V_{DD} = 28\text{ V}, I_{DQ} = 2.0\text{ A}$

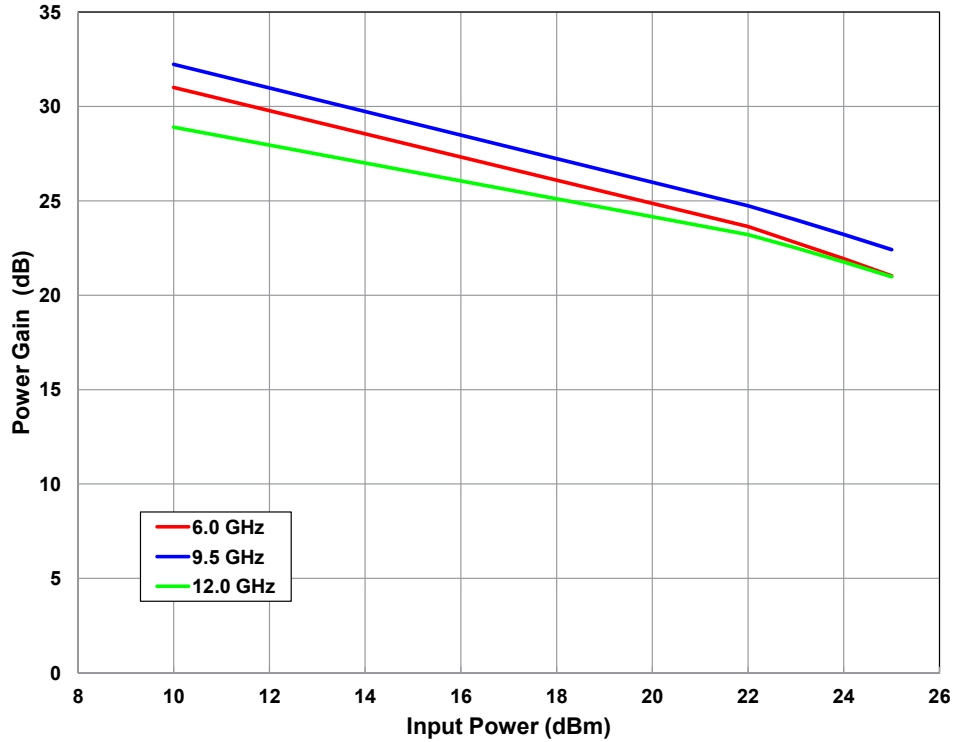
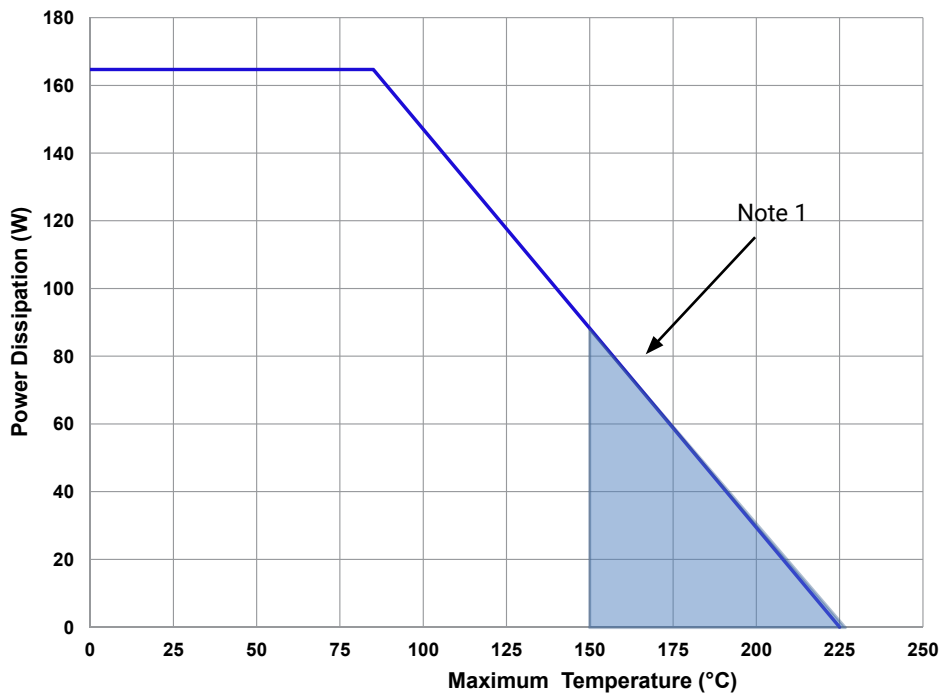


Figure 6. - Power Dissipation Derating Curve



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

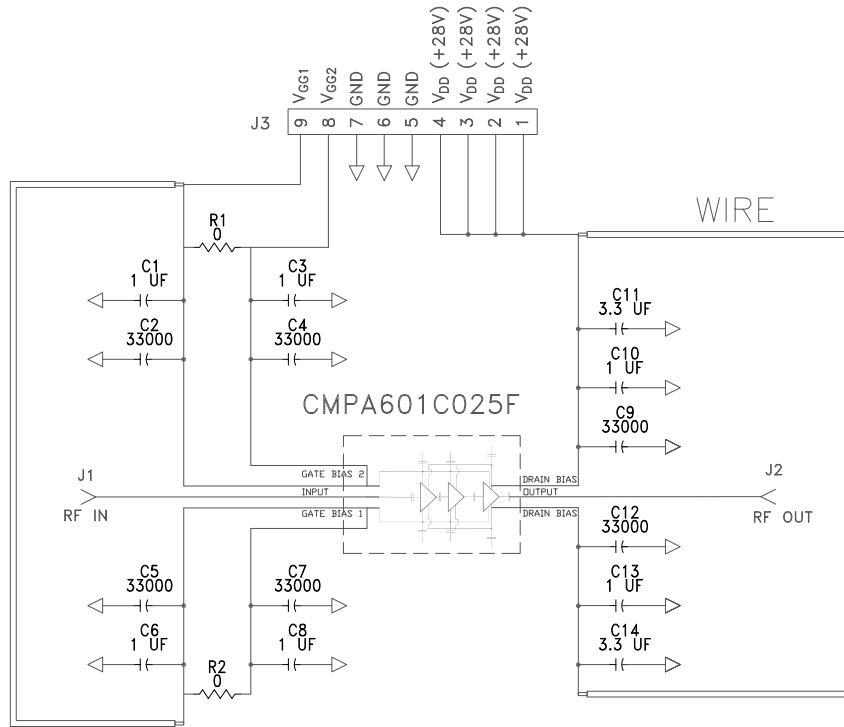
CMPA601C025F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
C2,C4,C5,C7,C9,C12	CAP,33000PF, 0805,100V, X7R	6
C1,C3,C6,C8,C10,C13	CAP, 1.0UF, 100V, 10%, X7R, 1210	6
C11,C14	CAP ELECT 3.3UF 80V FK SMD	2
R1,R2	RES 0.0 OHM 1/16W 0402 SMD	2
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
W1	WIRE, BLACK, 22 AWG ~ 1.50"	1
W2	WIRE, BLACK, 22 AWG ~ 1.75"	1
Q1	CMPA601C025F	1

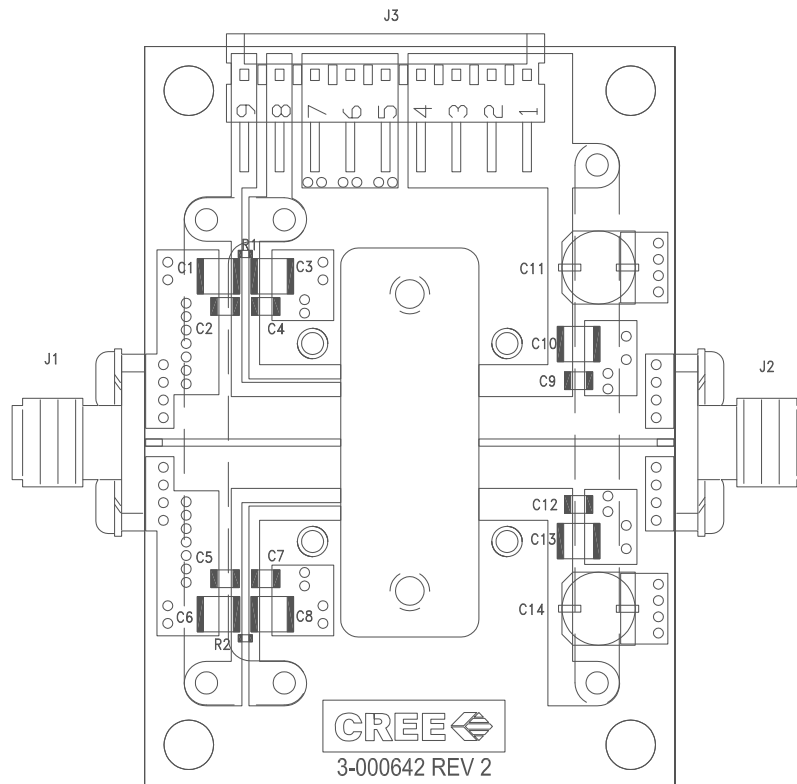
CMPA601C025F-AMP Demonstration Amplifier Circuit



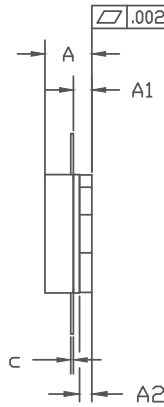
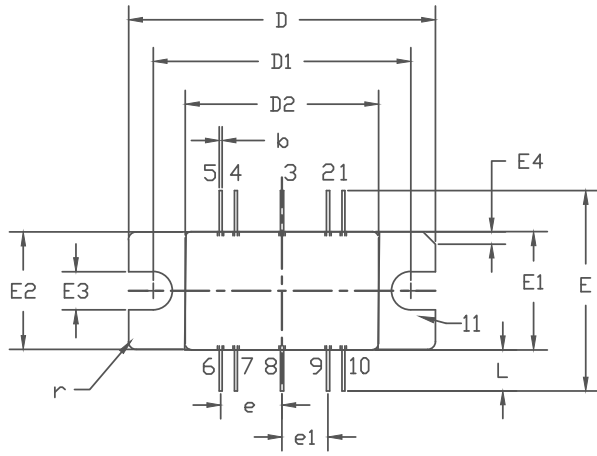
CMP601C025F-AMP Demonstration Amplifier Circuit Schematic



CMPA601C025F-AMP Demonstration Amplifier Circuit Outline



Product Dimensions CMPA601C025F



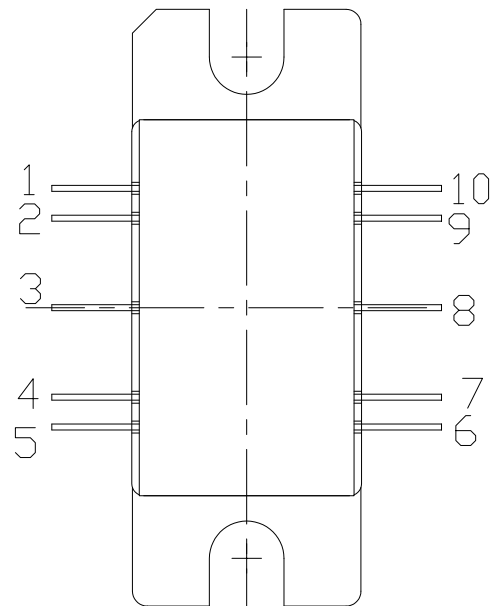
PIN 1: GATE BIAS 6: DRAIN BIAS
 2: GATE BIAS 7: DRAIN BIAS
 3: RF IN 8: RF OUT
 4: GATE BIAS 9: DRAIN BIAS
 5: GATE BIAS 10: DRAIN BIAS
 11: SOURCE

NOTES:

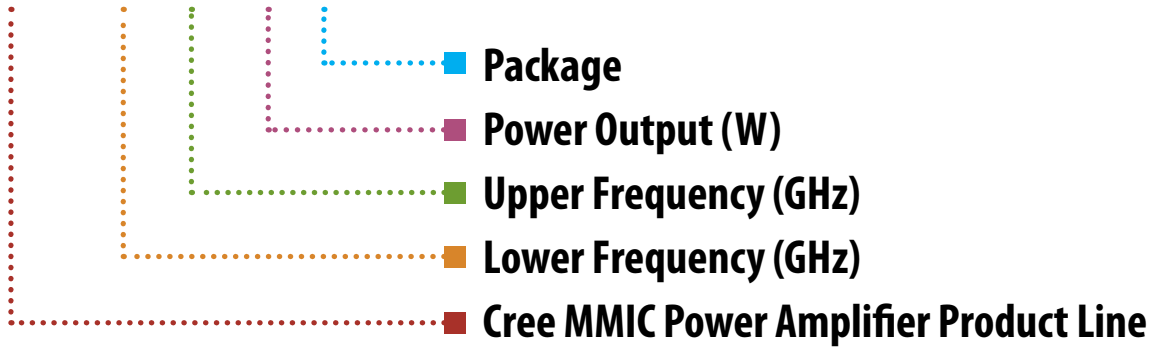
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1994.
- CONTROLLING DIMENSION: INCH.
- ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
- LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.148	0.168	3.76	4.27	
A1	0.055	0.065	1.40	1.65	
A2	0.035	0.045	0.89	1.14	
b	0.01	TYP	0.254	TYP	10x
c	0.007	0.009	0.18	0.23	
D	0.995	1.005	25.27	25.53	
D1	0.835	0.845	21.21	21.46	
D2	0.623	0.637	15.82	16.18	
E	0.653	TYP	16.59	TYP	
E1	0.380	0.390	9.65	9.91	
E2	0.380	0.390	9.65	9.91	
E3	0.120	0.130	3.05	3.30	
E4	0.035	0.045	0.89	1.14	45° CHAMFER
e	0.200	TYP	5.08	TYP	4x
e1	0.150	TYP	3.81	TYP	4x
L	0.115	0.155	2.92	3.94	10x
r	0.025	TYP	.635	TYP	3x

Pin Number	Qty
1	Gate Bias for Stage 1, 2 & 3
2	Gate Bias for Stage 1, 2 & 3
3	RF IN
4	Gate Bias for Stage 1, 2 & 3
5	Gate Bias for Stage 1, 2 & 3
6	Drain Bias
7	Drain Bias
8	RF OUT
9	Drain Bias
10	Drain Bias



CMPA601C025F



Parameter	Value	Units
Lower Frequency	6.0	GHz
Upper Frequency ¹	12.0	GHz
Power Output	25	W
Package	Flanged	-

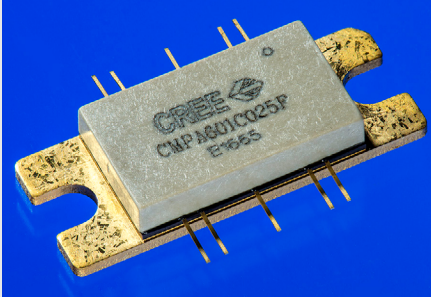
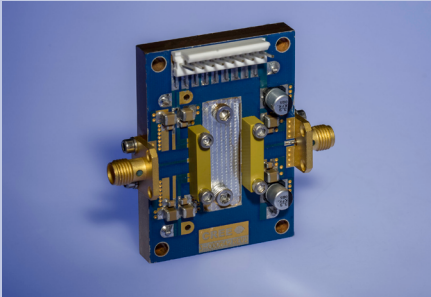
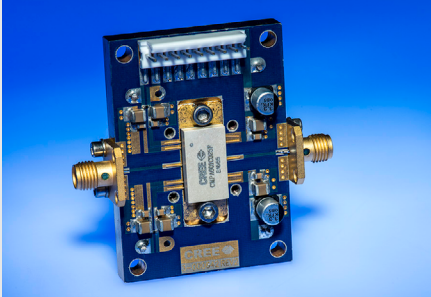
Table 1.

Note¹: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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

Table 2.

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA601C025F	GaN HEMT	Each	
CMPA601C025F-TB	Test board without GaN HEMT	Each	
CMPA601C025F-AMP	Test board with GaN HEMT installed	Each	



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