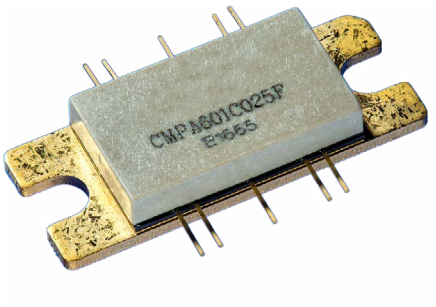
CMPA601C025F

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



PN: CMPA601C025F
Package Type: 440213

Description

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 0.25µm 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.

Typical Performance Over 6.0 - 12 GHz (T_C = 25°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_{OUT} @ P_{IN} = 22 dBm	34	51	49	45.9	36.5	W
Power Gain @ P_{IN} = 22 dBm	23	25	25	25	23.5	dB
PAE @ P_{IN} = 22 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

RoHS compliant

Absolute Maximum Ratings (not simultaneous) at 25°C

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

Notes:
[1] Refer to the Application Note on soldering
[2] See also, the Power Dissipation De-rating Curve on page 5

Electrical Characteristics (Frequency = 6.0 GHz to 12.0 GHz unless otherwise stated; T_C = 25°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} = 6 V, I_{GS} = 2 V
Drain-Source Breakdown Voltage	V_{BD}	84	100	—	V	V_{GS} = -8 V, I_{DS} = 23 mA
RF Characteristics[3]						
Small Signal Gain at 6.0 - 10.5 GHz	S21	28	31	—	dB	V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = -30 dBm
Small Signal Gain at 10.5 - 12 GHz		25	28	—		
Output Power at 6 GHz[3,4]	P_{OUT1}	45.5	47.2	—	dBm	V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = 22 dBm
Output Power at 9.5 GHz[3,4]	P_{OUT2}	45.5	47.1	—		
Output Power at 12 GHz[3,4]	P_{OUT3}	43.0	44.8	—		
Power Added Efficiency at 6 GHz[3,4]	PAE_1	23	33.2	—	%	
Power Added Efficiency at 9.5 GHz[3,4]	PAE_2	26	32.3	—		
Power Added Efficiency at 12 GHz[3,4]	PAE_3	15.5	26.5	—		
Input Return Loss	S11	—	-5	—	dB	V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = -30 dBm
Output Return Loss	S22	—		—		
Output Mismatch Stress	VSWR	—	—	5:1	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

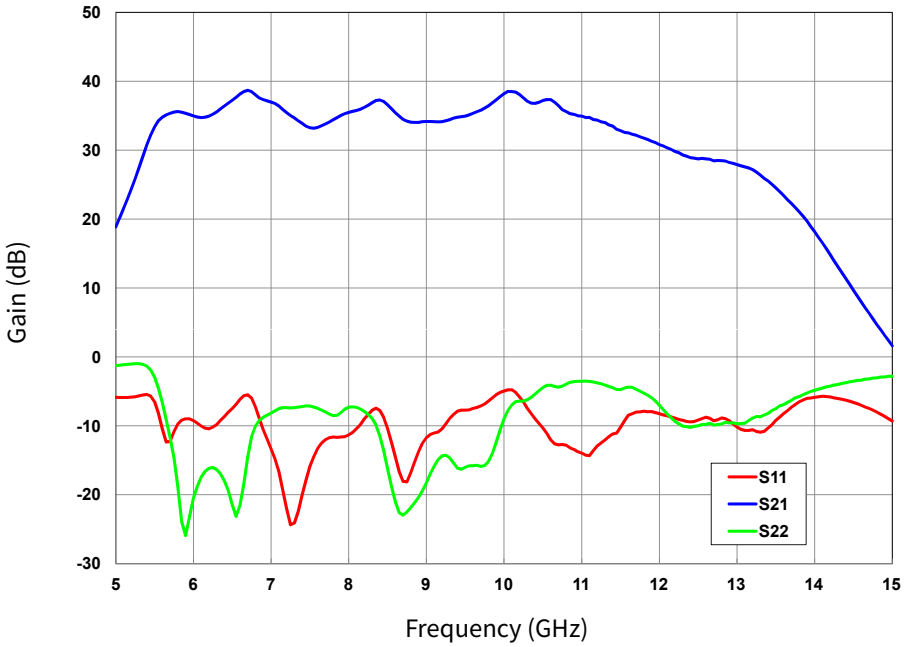


Figure 1. Small Signal S-Parameters vs. Frequency
V_{DD} = 28 V, I_{DQ} = 2.0 A, P_{IN} = -30 dBm

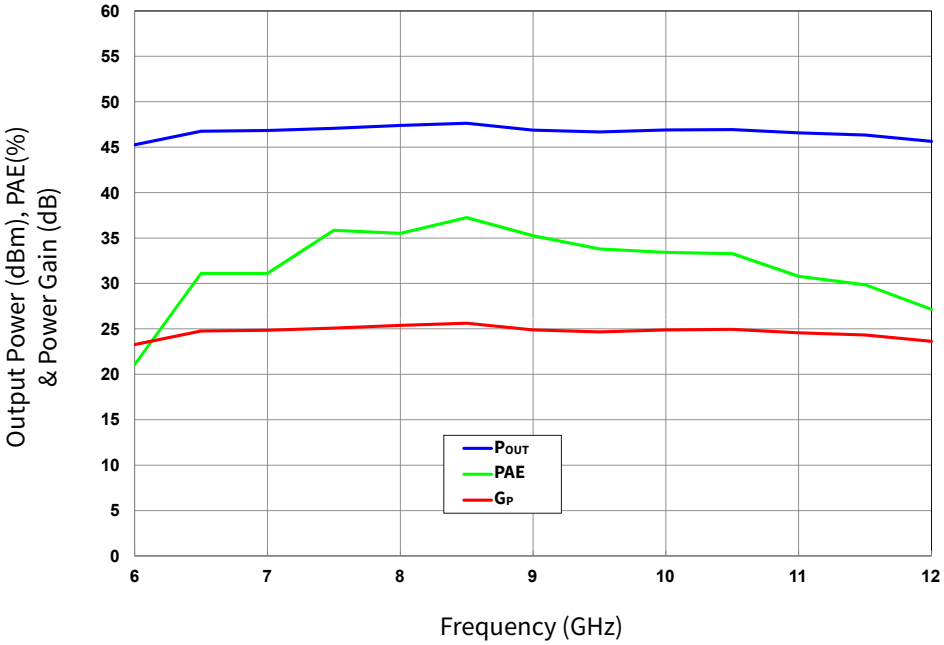


Figure 2. Output Power, Gain and Power Added Efficiency vs. Input Power
V_{DD} = 28 V, I_{DQ} = 2.0 A, P_{IN} = 22 dBm

CMPA601C025F Typical Performance

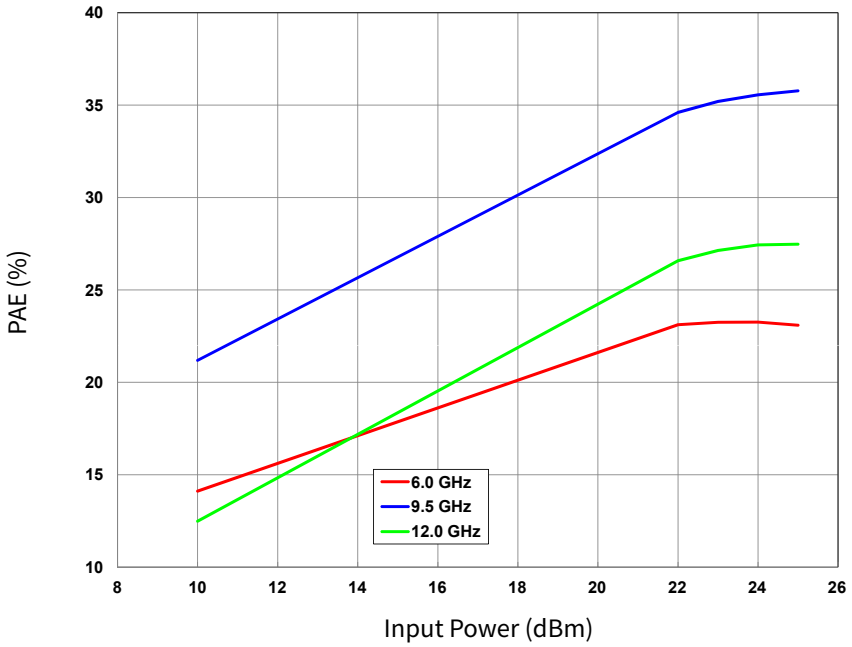


Figure 3. Power Added Efficiency vs. Input Power
V_{DD} = 28 V, I_{DQ} = 2.0 A

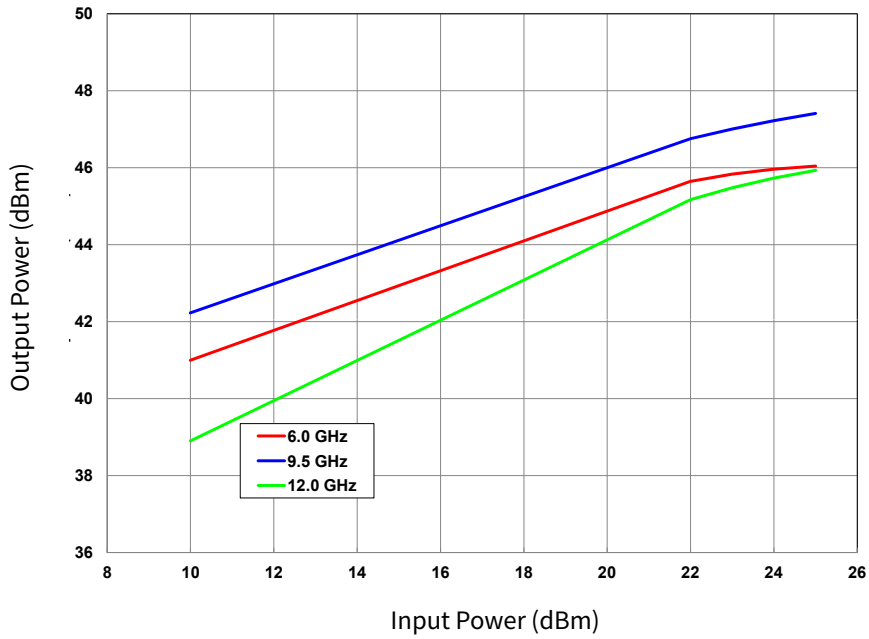


Figure 4. Output Power vs. Input Power
V_{DD} = 28 V, I_{DQ} = 2.0 A

CMPA601C025F Typical Performance

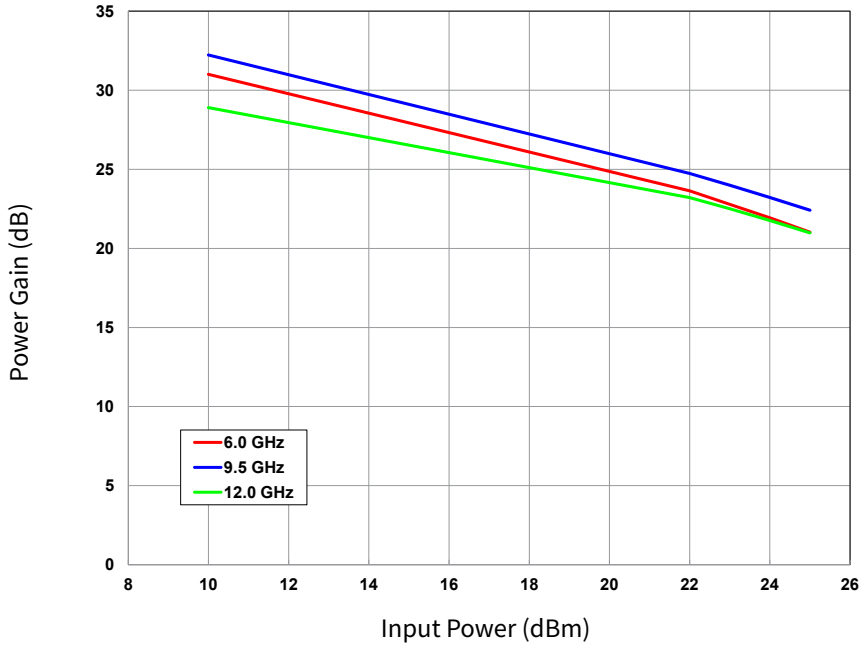


Figure 5. Gain vs Input Power
V_{DD} = 28 V, I_{DQ} = 2.0 A

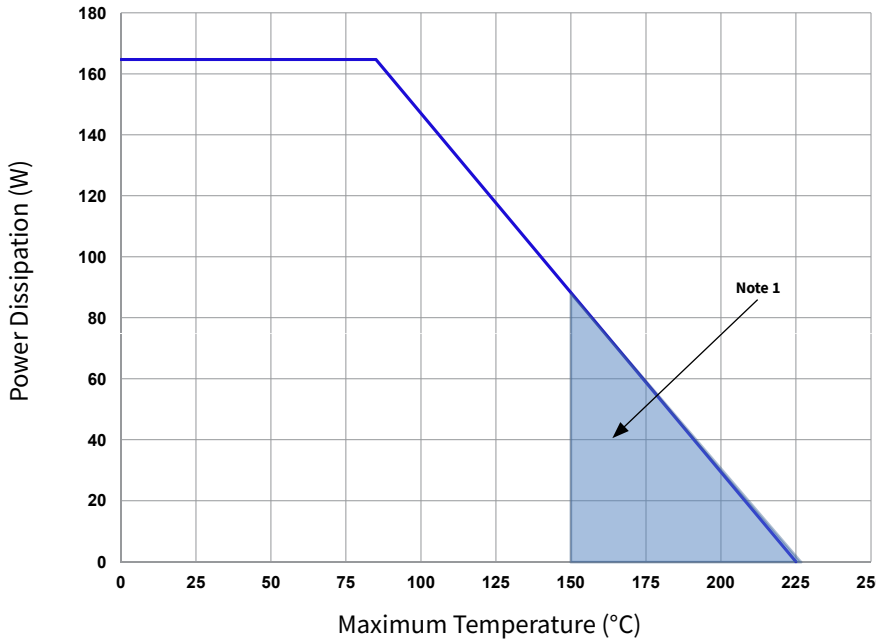


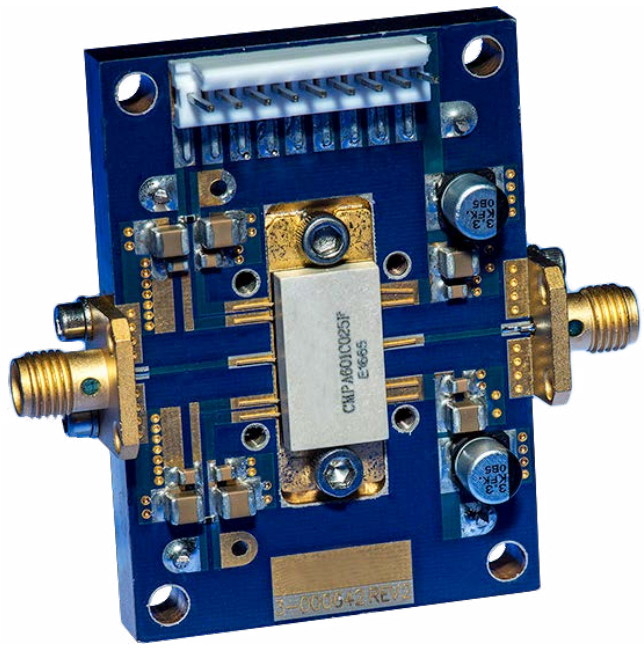
Figure 6. Power Dissipation Derating Curve

Notes:
[1] Area exceeds Maximum Case Operating Temperature (See Page 2)

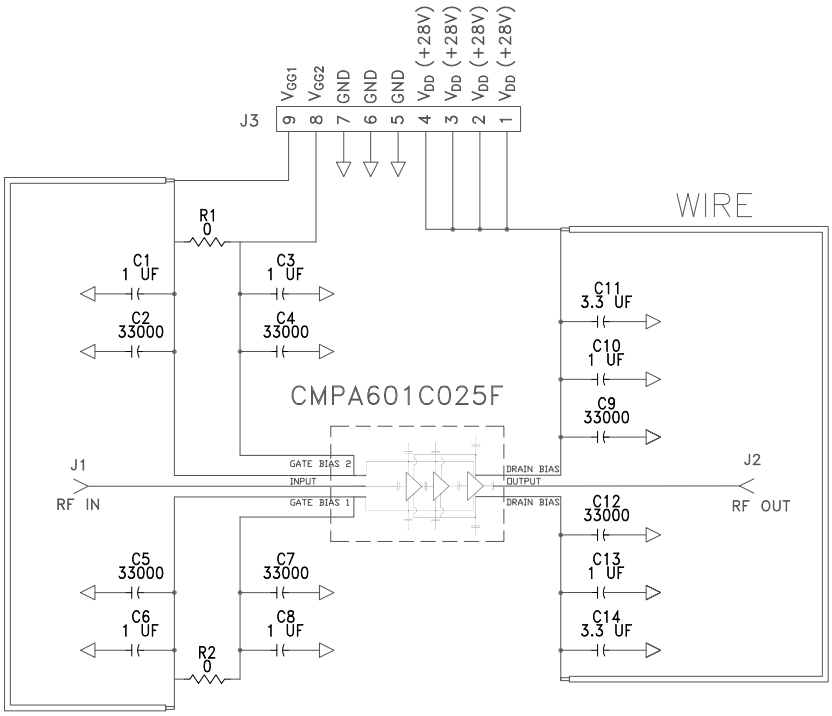
CMPA601C025F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
C2, C4, C5, C7, C9, C12	CAP, 33000pF, 0805, 100V, X7R	6
C1, C3, C6, C8, C10, C13	CAP, 1.0µF, 100V, 10%, X7R, 1210	6
C11 ,C14	CAP ELECT 3.3µF 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

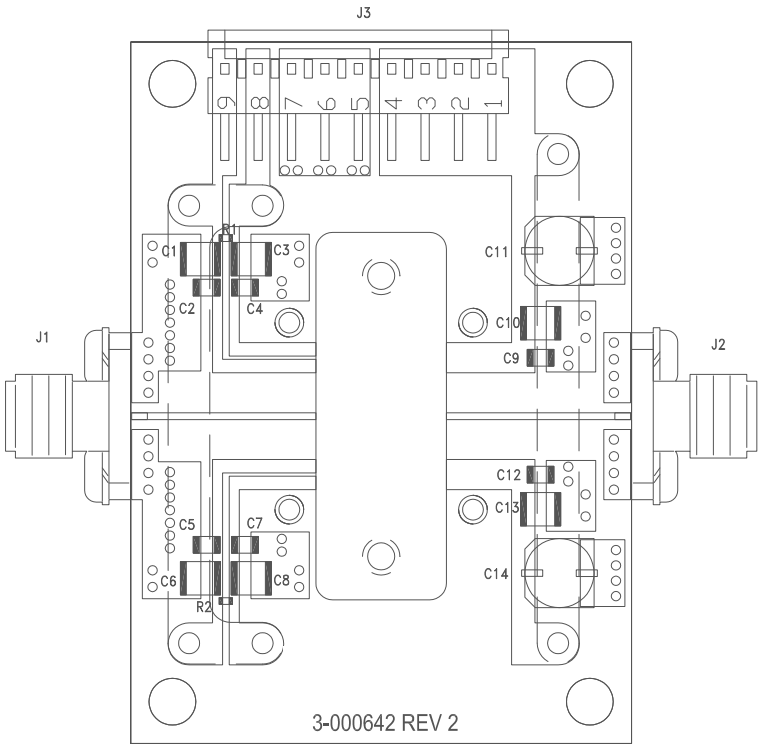
CMPA601C025F-AMP Demonstration Amplifier Circuit



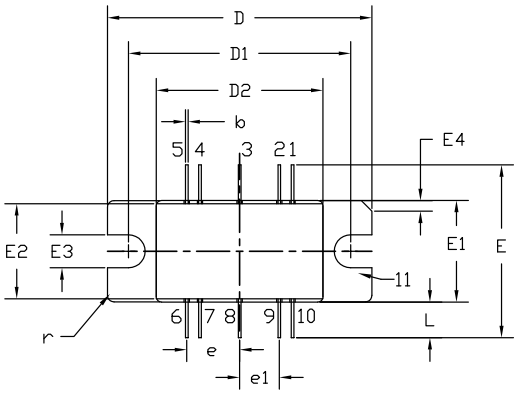
CMP601C025F-AMP Demonstration Amplifier Circuit Schematic

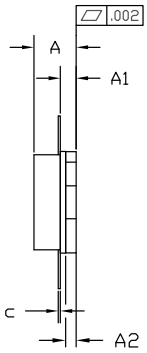


CMPA601C025F-AMP Demonstration Amplifier Circuit Outline



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:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M – 1994.

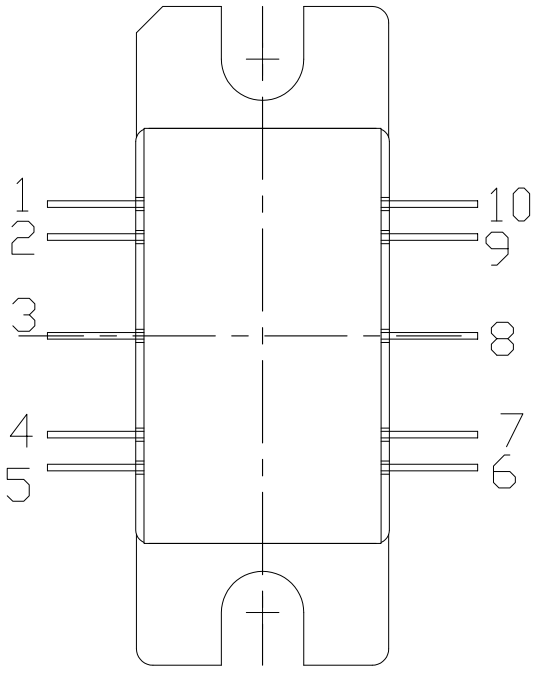
2. CONTROLLING DIMENSION: INCH.

3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.

4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

	INCHES		MILLIMETERS		NOTES
DIM	MIN	MAX	MIN	MAX	
A	0.155	0.175	3.94	4.45	
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	0.355	0.365	9.02	9.27	
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



Part Number System

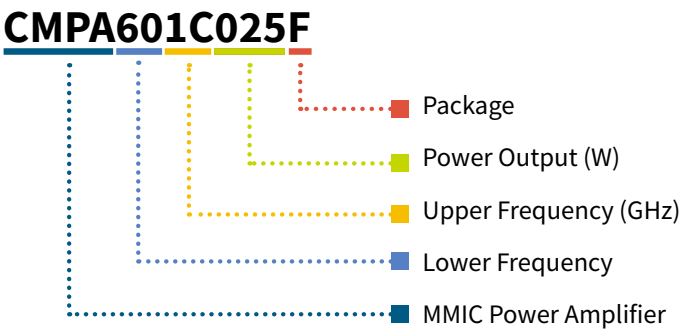


Table 1.

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

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

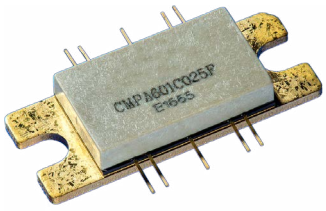
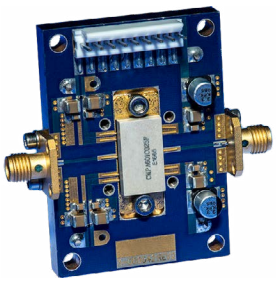
Table 2.

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

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	1A	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	C3	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA601C025F	GaN HEMT	Each	
CMPA601C025F-AMP	Test board with GaN HEMT installed	Each	

Notes & Disclaimer

These materials are provided in connection with MACOM’s products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.