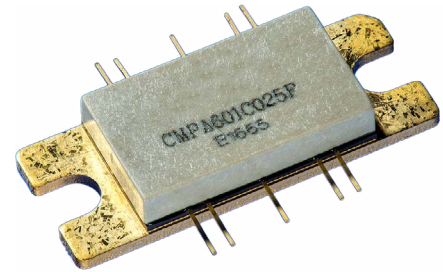


CMPA601C025F

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

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.



PN: CMPA601C025F
Package Type: 440213

Typical Performance Over 6.0 - 12 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_{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



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 | | |
| 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 soldering² See also, the Power Dissipation De-rating Curve on page 5

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

| 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 | S ₂₁ | 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 | S ₁₁ | — | -5 | — | dB | V _{DD} = 28 V, I _{DQ} = 2 A, P _{IN} = -30 dBm |
| Output Return Loss | S ₂₂ | — | | — | | |
| 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 packaging² Scaled from PCM data³ Measured in CMPA601C025F-AMP with 12.4 GHz low pass filter⁴ 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

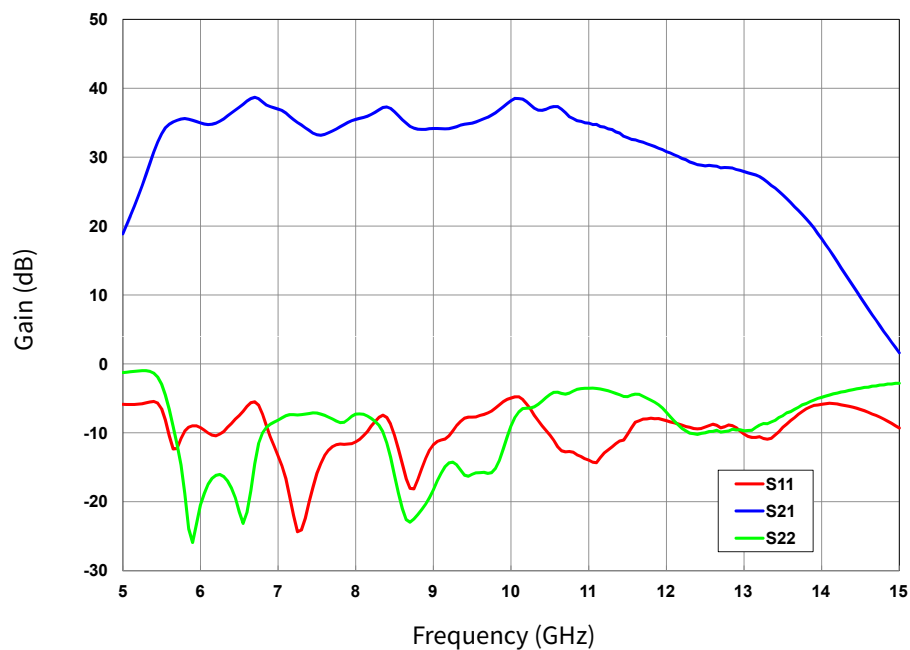


Figure 1. Small Signal S-Parameters vs. Frequency

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

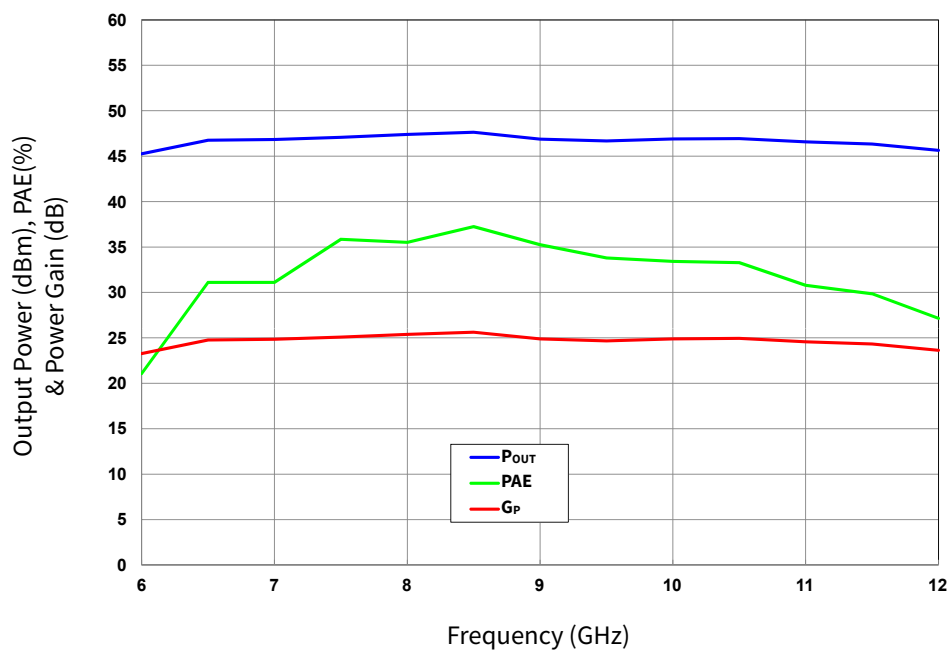


Figure 2. Output Power, Gain and Power Added Efficiency vs. Input Power

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

CMPA601C025F Typical Performance

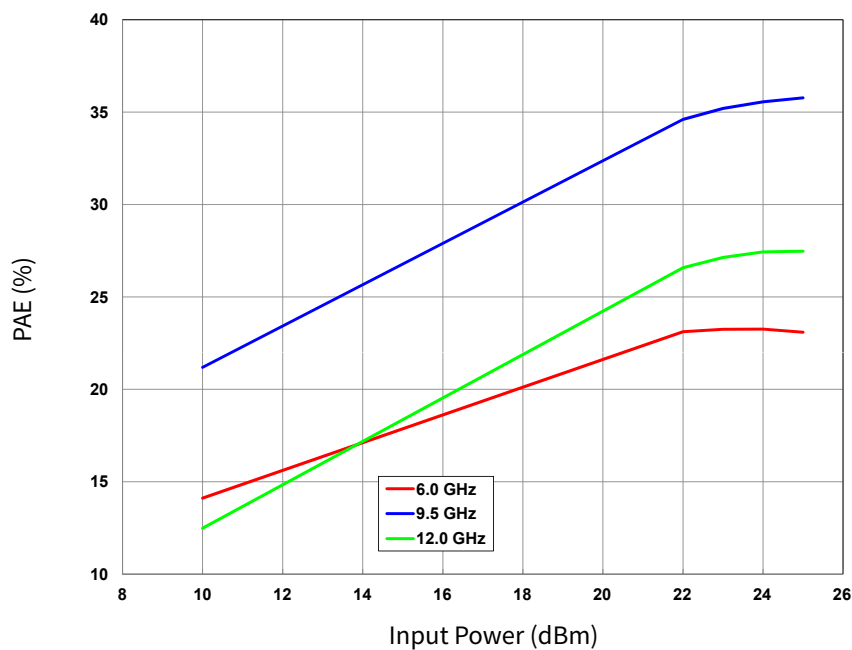


Figure 3. Power Added Efficiency vs. Input Power

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

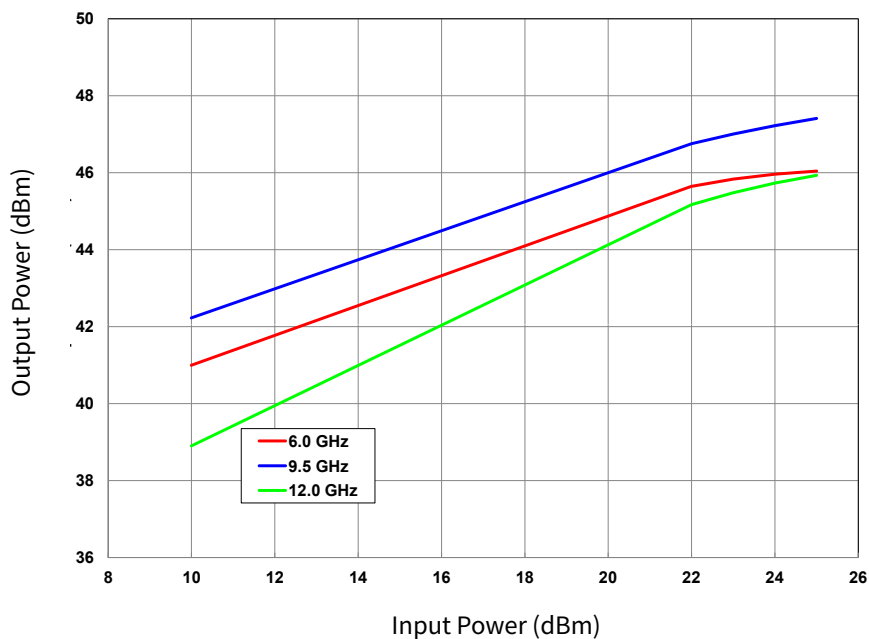


Figure 4. Output Power vs. Input Power

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

CMPA601C025F Typical Performance

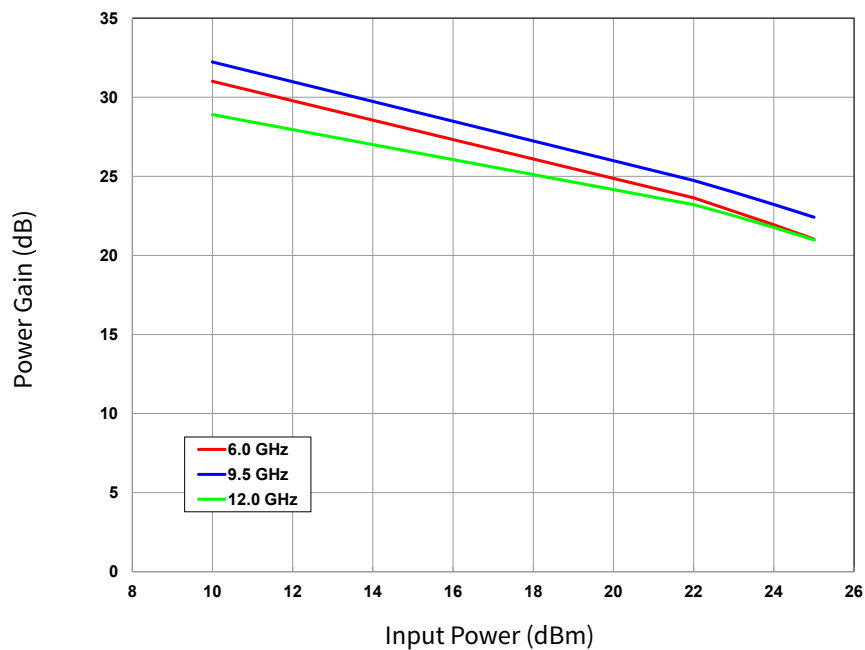


Figure 5. Gain vs Input Power

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

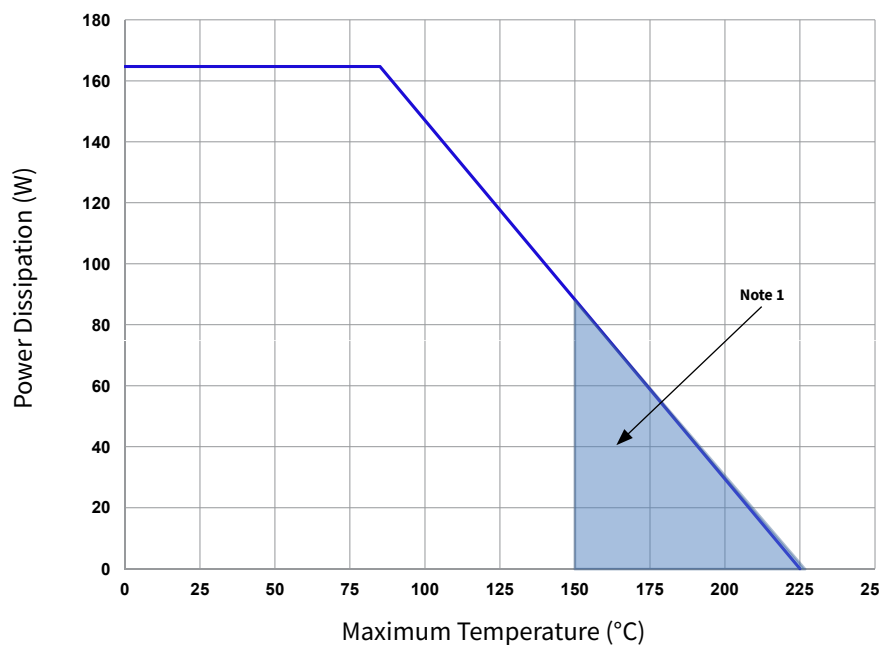


Figure 6. Power Dissipation Derating Curve

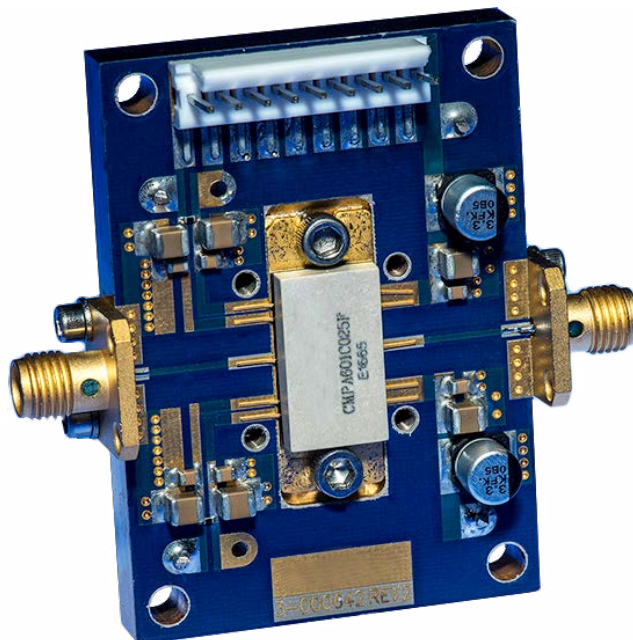
Notes:

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

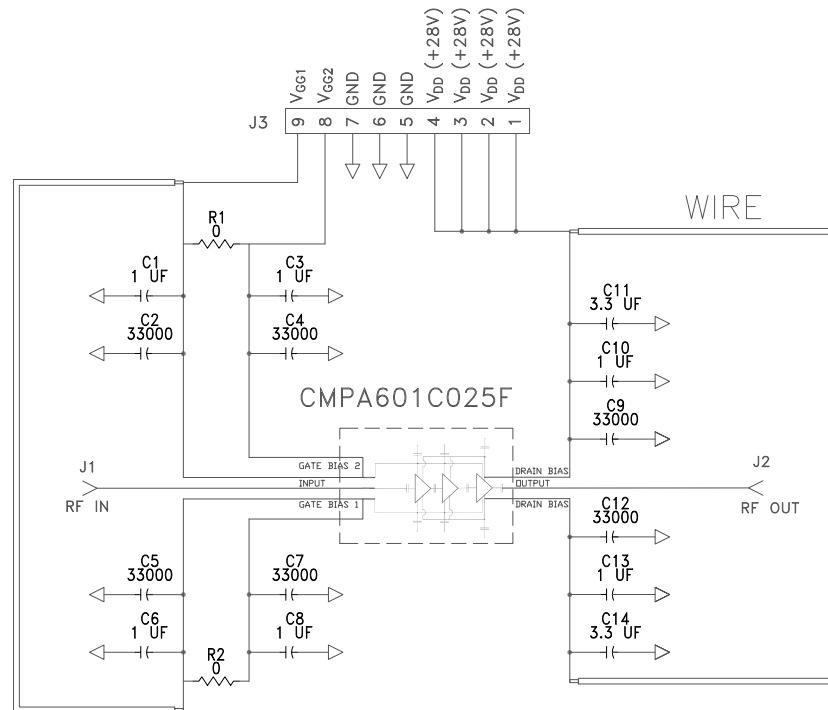
CMPA601C025F-AMP Demonstration Amplifier Circuit Bill of Materials

| 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 |

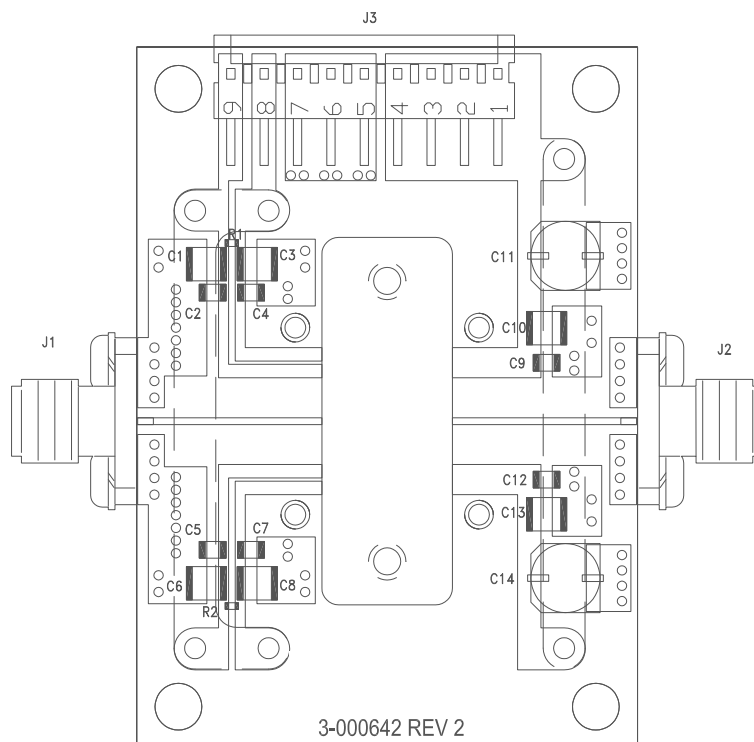
CMPA601C025F-AMP Demonstration Amplifier Circuit



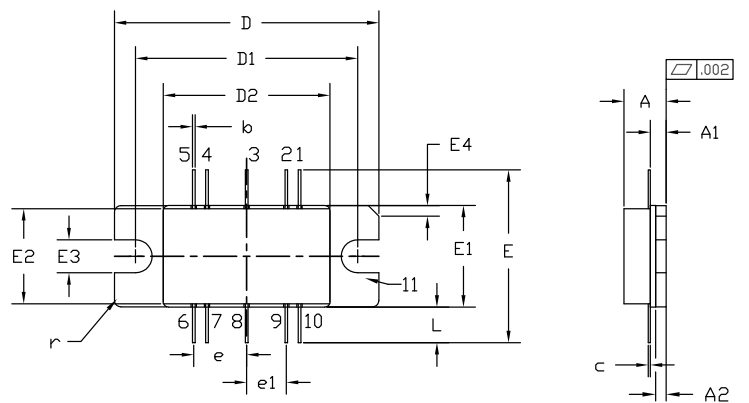
CMP601C025F-AMP Demonstration Amplifier Circuit Schematic



CMPA601C025F-AMP Demonstration Amplifier Circuit Outline



Product Dimensions CPM601C025F

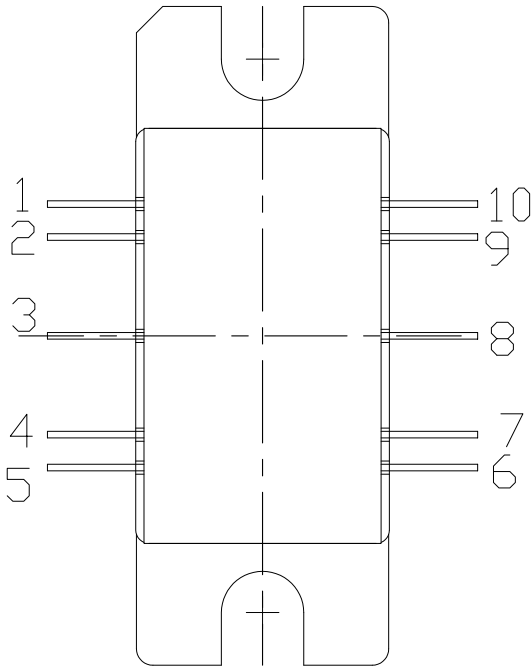


PIN 1: GATE BIAS 6: DRAIN BIAS
2: GATE BIAS 7: DRAIN BIAS
3: RF IN 8: RF OUT
4: GATE BIAS 9: DRAIN BIAS
5: GATE BIAS 10: DRAIN BIAS
11: SOURCE

- 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.

| DIM | INCHES | | MILLIMETERS | | NOTES |
|-----|--------|-------|-------------|-------|-------------|
| | 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

CMPA601C025F

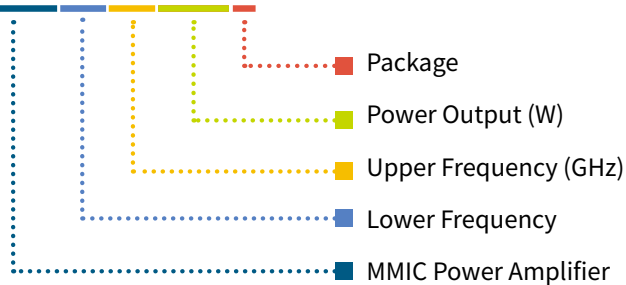


Table 1.

| 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.

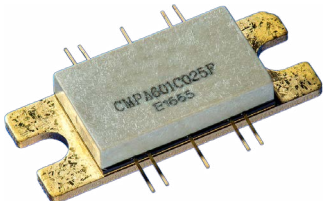
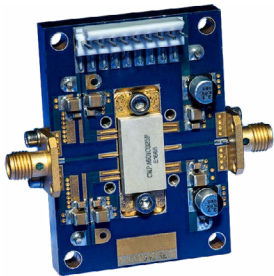
Table 2.

| 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 |  |

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