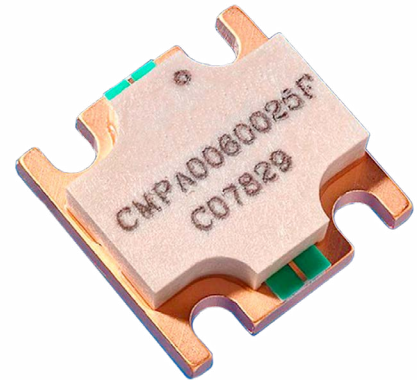


CMPA0060025F

25 W, 20 MHz - 6000 MHz, GaN MMIC Power Amplifier

Description

The CMPA0060025F 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: CMPA0060025F
Package Type: 780019

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 | % |

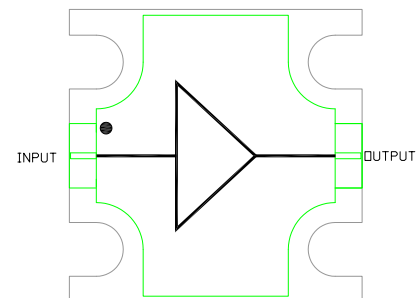
Note: $V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$

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



Large Signal Models Available for ADS and MWO



Absolute Maximum Ratings (not simultaneous) at 25°C

| Parameter | Symbol | Rating | Units |
|---|-----------------|-----------|----------|
| Drain-Source Voltage | V_{DS} | 84 | V_{DC} |
| Gate-Source Voltage | V_{GS} | -10, +2 | |
| Storage Temperature | T_{STG} | -65, +150 | °C |
| Operating Junction Temperature | T_J | 225 | |
| 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 |

Notes:

¹ Refer to the Application Note on soldering² Measured for the CMPA0060025F 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)} | -3.8 | -3.0 | -2.3 | V | V _{DS} = 20 V, ΔI _D = 20 mA | | |
| Gate Quiescent Voltage | V _{GS(Q)} | — | -2.7 | — | V _{DC} | V _{DD} = 50 V, I _{DQ} = 500 mA, P _{IN} = 32 dBm | | |
| Saturated Drain Current | I _{DS} | — | 12 | — | A | V _{DS} = 12 V, V _{GS} = 2.0 V | | |
| RF Characteristics ¹ | | | | | | | | |
| Power Output at P _{OUT} @ 4.5 GHz | P _{OUT} | 41.0 | 42.8 | — | dBm | V _{DD} = 50 V, I _{DQ} = 500 mA, P _{IN} = 32 dBm | | |
| Power Output at P _{OUT} @ 5.0 GHz | | | 43.3 | — | | | | |
| Power Output at P _{OUT} @ 6.0 GHz | | | 42.9 | — | | | | |
| Drain Efficiency at P _{OUT} @ 4.5 GHz | η | 18.0 | 24.1 | — | % | | | |
| Drain Efficiency at P _{OUT} @ 5.0 GHz | | | 28.0 | — | | | | |
| Drain Efficiency at P _{OUT} @ 6.0 GHz | | | 27.2 | — | | | | |
| Output Mismatch Stress | VSWR | — | — | 5:1 | 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 (dB) | | | S11 (dB) | | S22 (dB) | | Conditions |
| | Min. | Typ. | Max. | Typ. | Max. | Typ. | Max. | |
| 0.02 GHz - 0.25 GHz | 18.0 | 19.3 | 23.7 | -4.1 | -2.5 | -8.5 | -4.5 | V _{DD} = 50 V, I _{DQ} = 500 mA |
| 0.25 GHz - 0.5 GHz | | 19.8 | 22.0 | -6.8 | -3.5 | -8.9 | | |
| 0.5 GHz - 1.0 GHz | 15.5 | 18.6 | | -15.3 | -6.5 | -6.7 | | |
| 1.0 GHz - 2.0 GHz | | | 13.0 | | 20.0 | -12.5 | -6.0 | |
| 2.0 GHz - 3.0 GHz | 16.3 | -14.2 | | -6.5 | | | -5.3 | |
| 3.0 GHz - 6.0 GHz | | | | | | | | |

Notes:

¹ P_{OUT} is defined as $P_{IN} = 32$ dBm² The device will draw approximately 55-70 mA at pinch off due to the internal circuit structure.

Typical Performance

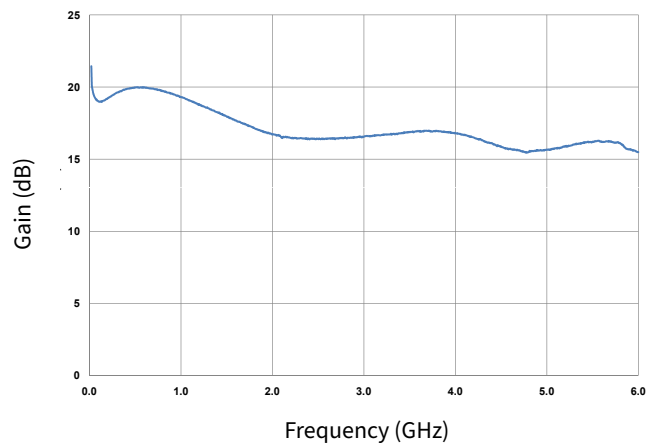


Figure 1. Small Signal Gain vs Frequency at 50 V

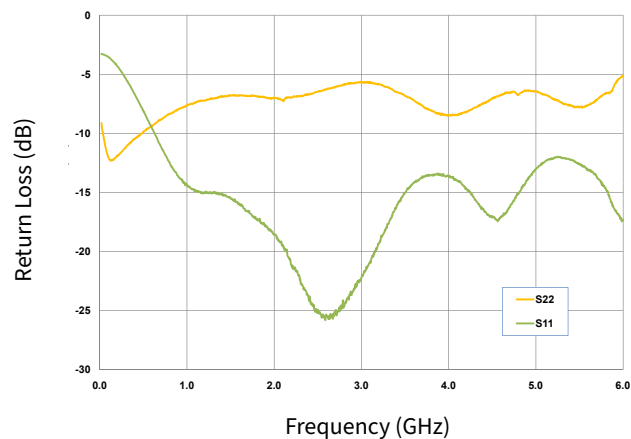


Figure 2. Input & Output Return Losses vs Frequency at 50 V

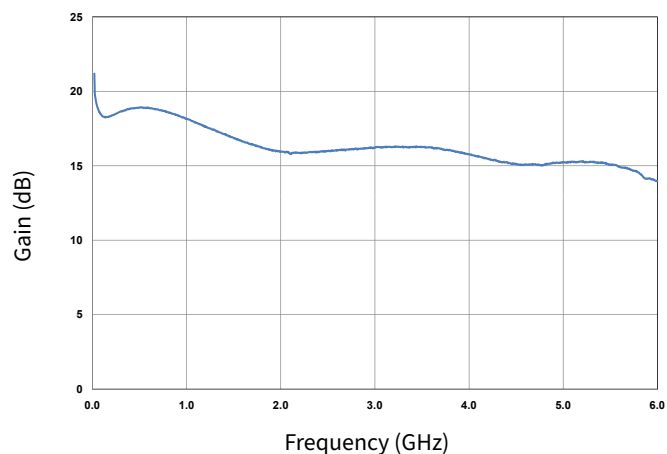


Figure 3. Small Signal Gain vs Frequency at 40 V

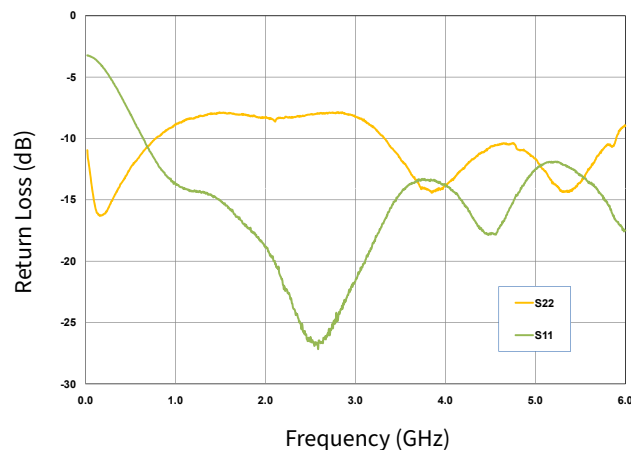


Figure 4. Small Signal Gain vs Frequency at 40 V

Typical Performance

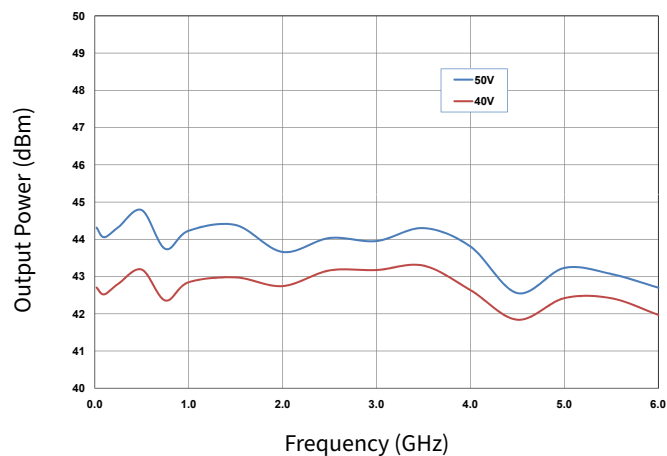


Figure 5. Output Power at $P_{IN} = 32$ dBm vs Frequency as a Function of Drain Voltage

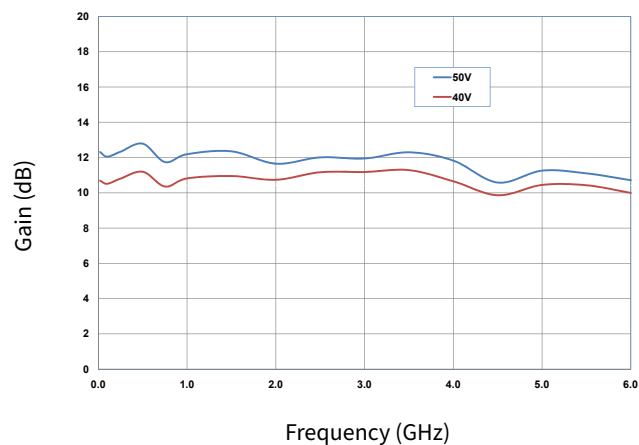


Figure 6. Power Gain at $P_{IN} = 32$ dBm vs Frequency as a Function of Drain Voltage

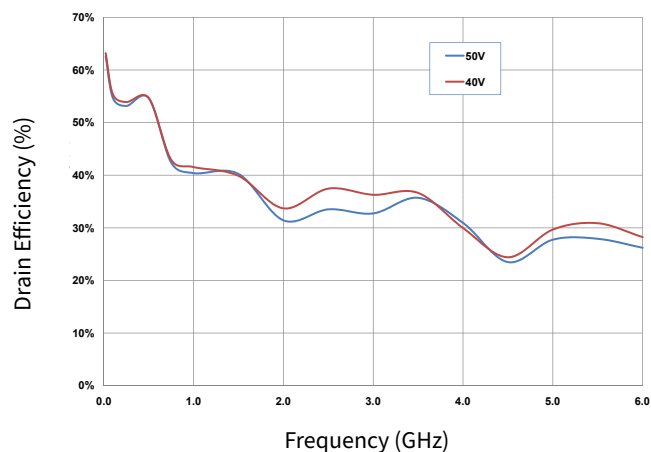


Figure 7. Drain Efficiency at $P_{IN} = 32$ dBm vs Frequency as a Function of Drain Voltage

Typical Performance

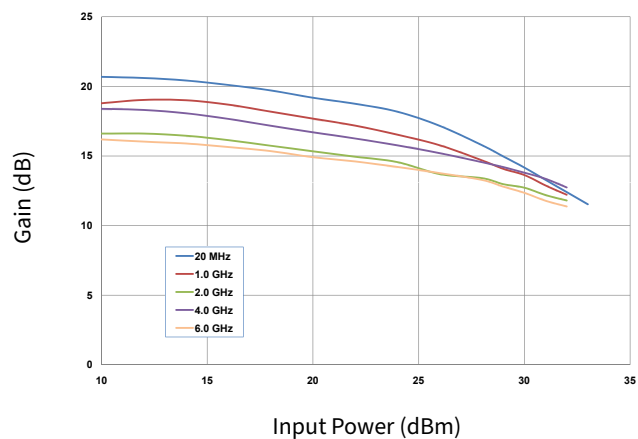


Figure 8. Gain vs Input Power at 50 V
as a Function of Frequency

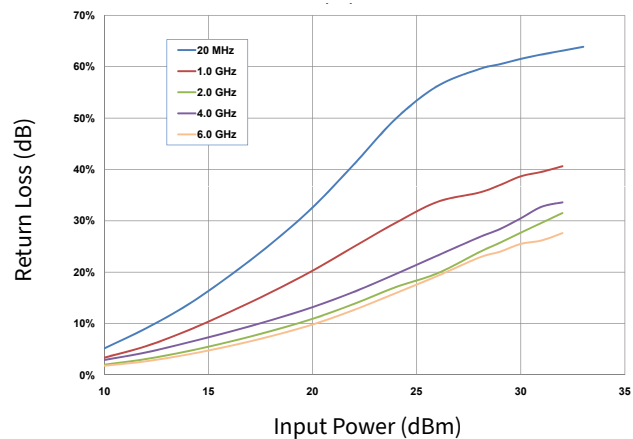


Figure 9. Efficiency vs Input Power at 50 V
as a Function of Frequency

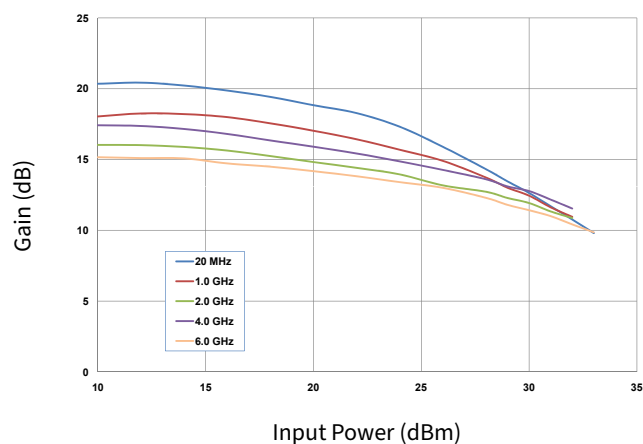


Figure 10. Gain vs Input Power at 40 V
as a Function of Frequency

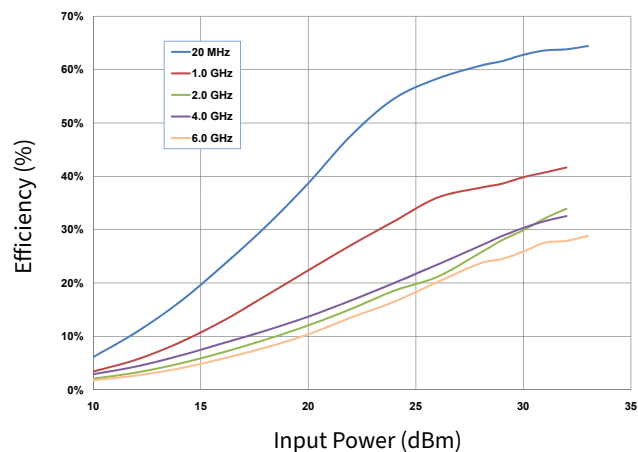


Figure 11. Efficiency vs Input Power at 40 V
as a Function of Frequency

General Device Information

The CMPA0060025F 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 CMPA0060025F 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 CMPA0060025F-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.

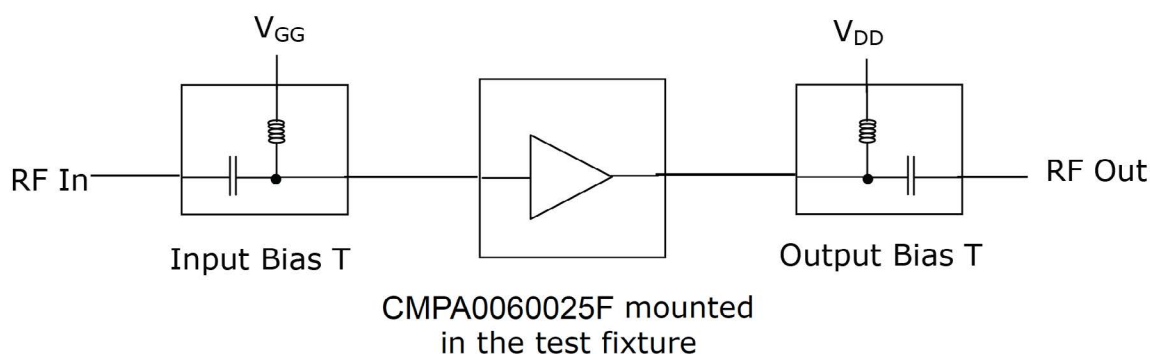
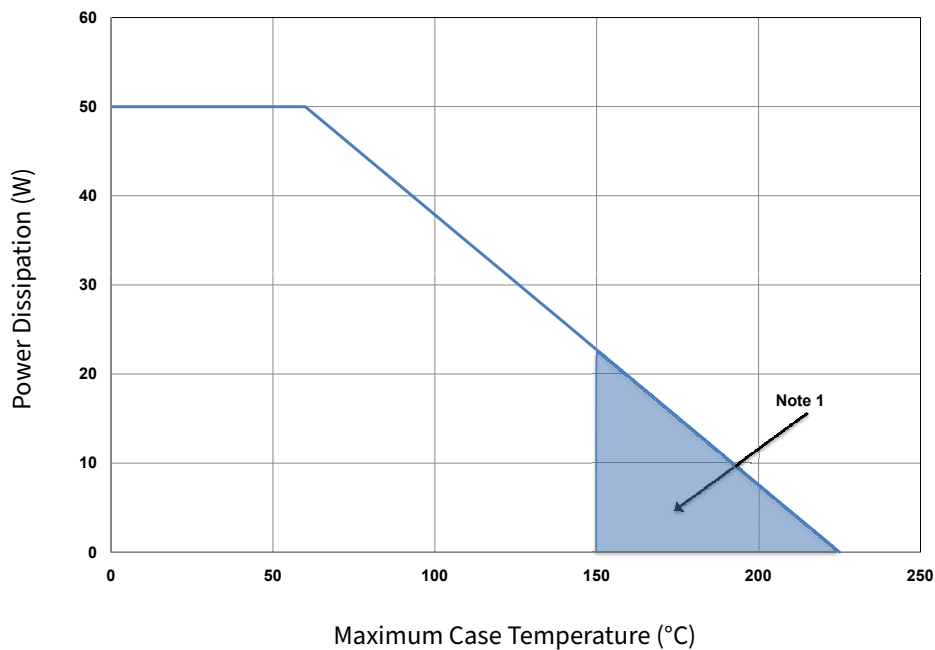


Figure 2. Typical test system setup required for measuring CMPA0060025F1-AMP1

CMPA0060025F Power Dissipation De-rating Curve

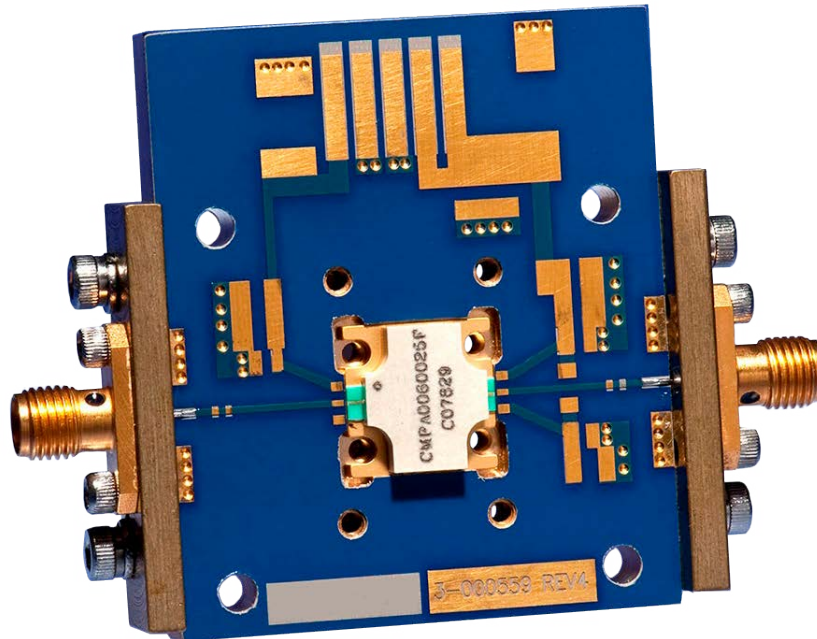
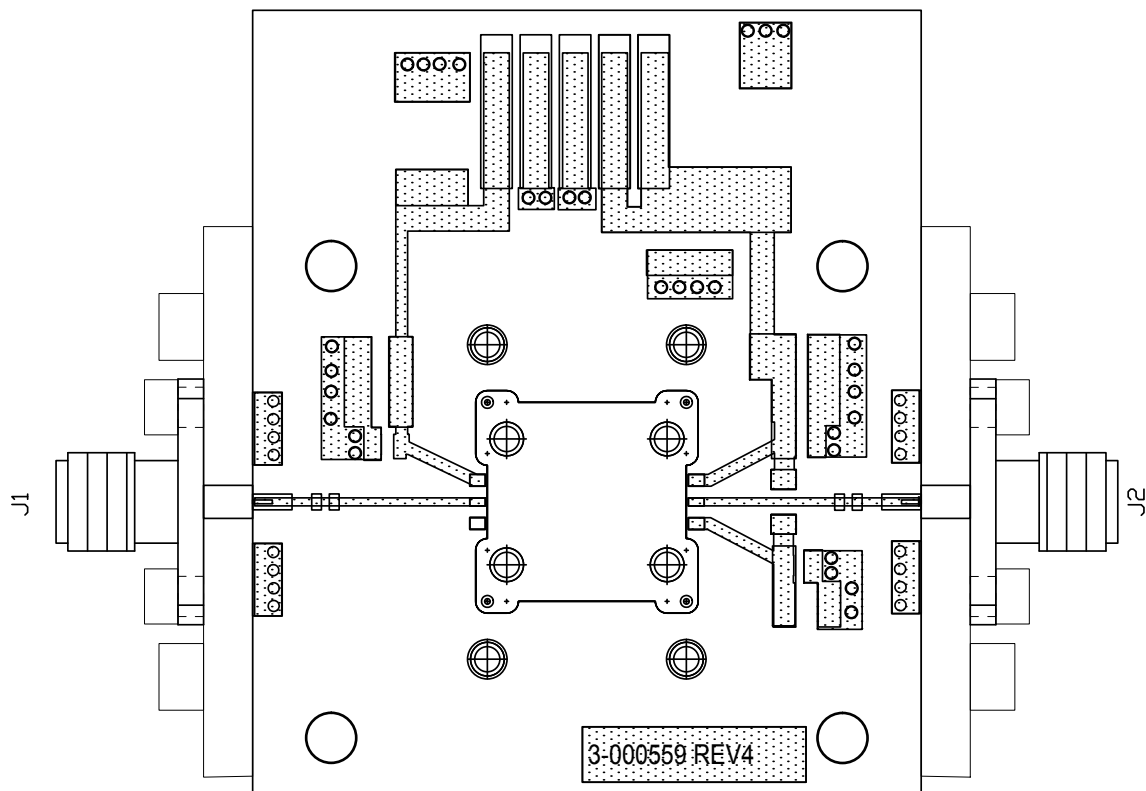


Note:

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

Electrostatic Discharge (ESD) Classifications

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

CMPA0060025F-AMP Demonstration Amplifier Circuit**CMPA0060025F-AMP Demonstration Amplifier Circuit Outline**

CMPA0060025F-AMP Demonstration Amplifier Circuit Bill of Materials

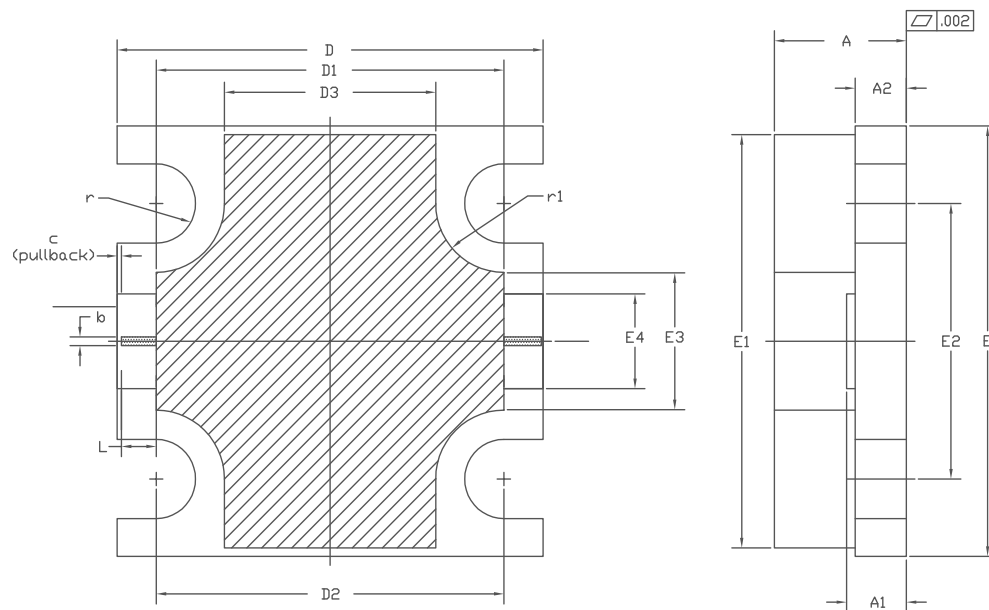
| Designator | Description | Qty |
|------------|--------------------------------|-----|
| J1,J2 | CONNECTOR, SMA, AMP11052901-1 | 2 |
| - | PCB, TACONIC, RF-35-0100-CH/CH | 1 |
| Q1 | CMPA0060025F | 1 |

Notes

¹ The CMPA0060025F is connected to the PCB with 2.0 mil Au bond wires.

² An external Bias-T is required.

Product Dimensions CMPA0060025F (Package Type — 780019)



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 | | 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 | 0.009 | | 0.24 | | x2 |
| c | 0.005 | | 0.13 | | 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 | — |
| L | 0.041 | | 1.04 | | x2 |
| r | R0.046 | | R1.17 | | x4 |
| r1 | R0.080 | | R2.03 | | x4 |

Part Number System

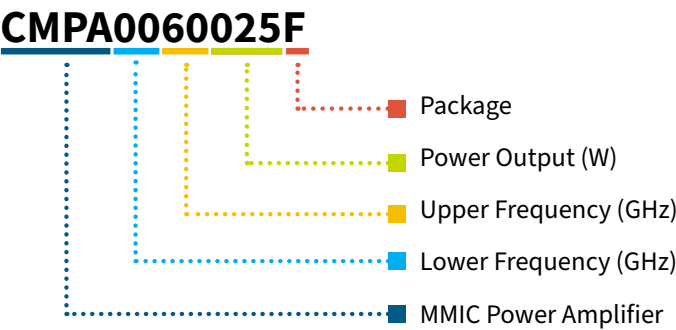


Table 1.

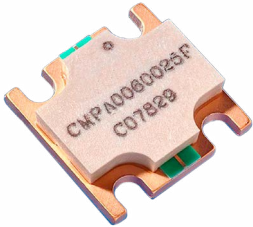
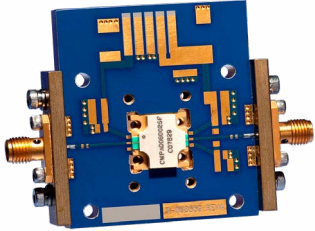
| Parameter | Value | Units |
|-----------------|--------|-------|
| Lower Frequency | 20 | MHz |
| Upper Frequency | 6000 | |
| Power Output | 25 | W |
| Package | Flange | — |

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 |
|------------------|------------------------------------|-----------------|---|
| CMPA0060025F | GaN MMIC | Each |  |
| CMPA0060025F-AMP | Test board with GaN MMIC installed | Each |  |

Notes & Disclaimer

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

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.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[MACOM:](#)

[CMPA0060025F-TB](#) [CMPA0060025F](#) [CMPA0527005F-AMP1](#) [CMPA0060025F-AMP](#)