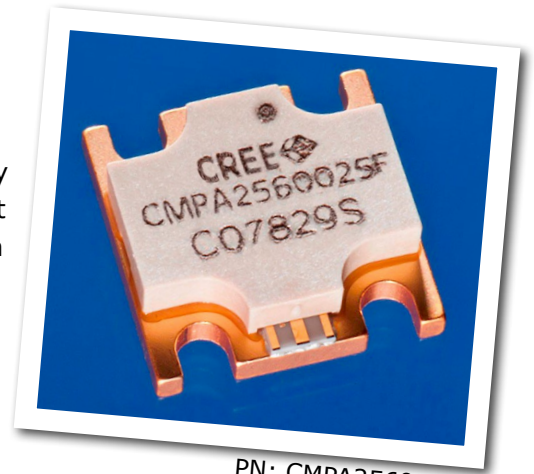


CPMA2560025F

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

Cree's CPMA2560025F 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: CPMA2560025F
Package Type: 780019

Typical Performance Over 2.5-6.0 GHz ($T_c = 25^\circ\text{C}$)

| Parameter | 2.5 GHz | 4.0 GHz | 6.0 GHz | Units |
|--------------------------------------|---------|---------|---------|-------|
| Gain | 27.5 | 24.3 | 23.1 | dB |
| Saturated Output Power, P_{SAT}^1 | 35.8 | 37.5 | 25.6 | W |
| Power Gain @ $P_{OUT} 43\text{ dBm}$ | 23.1 | 20.9 | 16.3 | dB |
| PAE @ $P_{OUT} 43\text{ dBm}$ | 31.5 | 32.8 | 30.7 | % |

Note¹: 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

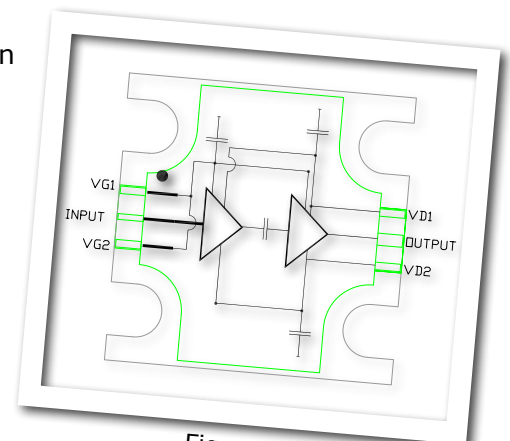


Figure 1.



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 | $R_{\theta JC}$ | 2.5 | °C/W |

Electrical Characteristics (Frequency = 2.5 GHz 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 | $V_{(GS)TH}$ | -3.8 | -3.0 | -2.3 | V | $V_{DS} = 10\text{ V}, I_D = 20\text{ mA}$ |
| Gate Quiescent Voltage | $V_{(GS)Q}$ | - | -2.7 | - | VDC | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}$ |
| Drain-Source Breakdown Voltage | V_{BD} | 84 | 100 | - | V | $V_{GS} = -8\text{ V}, I_D = 20\text{ mA}$ |
| Saturated Drain Current ¹ | I_{DC} | 8.0 | 9.7 | - | A | $V_{DS} = 6.0\text{ V}, V_{GS} = 2.0\text{ V}$ |
| RF Characteristics² | | | | | | |
| Small Signal Gain | S21 | 19.5 | 24 | - | dB | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}$ |
| Input Return Loss | S11 | - | -8 | -5 | dB | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}$ |
| Output Return Loss | S22 | - | -8 | -3 | dB | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}$ |
| Power Output ₁ | P_{OUT} | 22.0 | 30 | - | W | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 4.0\text{ GHz}$ |
| Power Output ₂ | P_{OUT} | 12.5 | 17 | - | W | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 5.0\text{ GHz}$ |
| Power Output ₃ | P_{OUT} | 15.5 | 20 | - | W | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 6.0\text{ GHz}$ |
| Power Added Efficiency ₁ | PAE | 34 | 40 | - | % | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 4.0\text{ GHz}$ |
| Power Added Efficiency ₂ | PAE | 20 | 26 | - | % | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 5.0\text{ GHz}$ |
| Power Added Efficiency ₃ | PAE | 24 | 30 | - | % | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 6.0\text{ GHz}$ |
| Power Gain ₁ | G_p | 17.5 | 18.8 | - | dB | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 4.0\text{ GHz}$ |
| Power Gain ₂ | G_p | 15.0 | 16.3 | - | dB | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 5.0\text{ GHz}$ |
| Power Gain ₃ | G_p | 16.0 | 17.0 | - | dB | $V_{DD} = 28\text{ V}, I_D = 1200\text{ mA}, P_{IN} = 26\text{ dBm}, \text{Freq} = 6.0\text{ GHz}$ |
| Output Mismatch Stress | VSWR | - | - | 5 : 1 | Ψ | No damage at all phase angles, $V_{DD} = 28\text{ V}, I_{DQ} = 1200\text{ mA}, P_{IN} = 26\text{ dBm}$ |

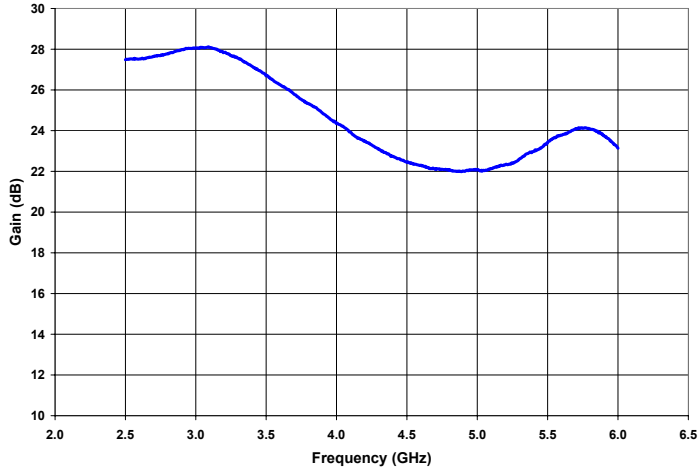
Notes:

¹ Scaled from PCM data.

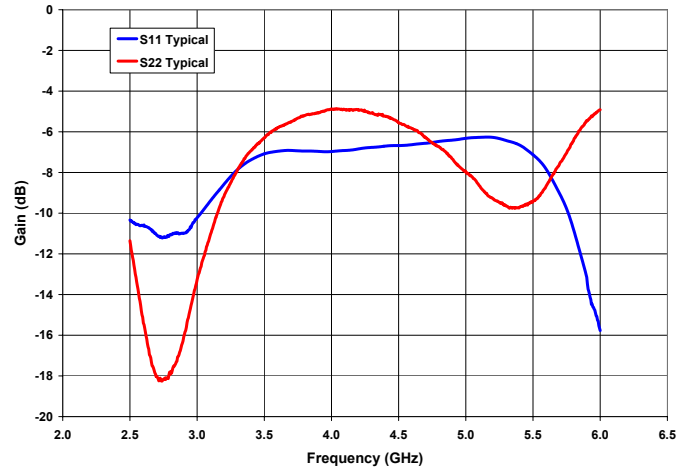
² All data CW tested in CMPA2560025F-TB.

Typical Performance

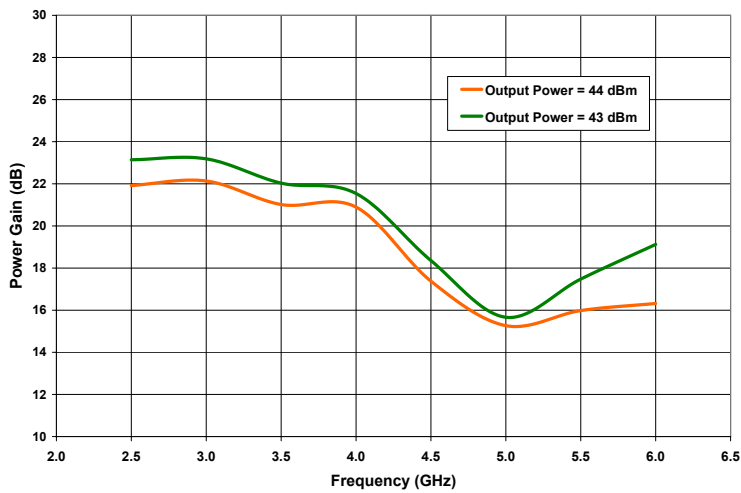
Small Signal Gain vs Frequency



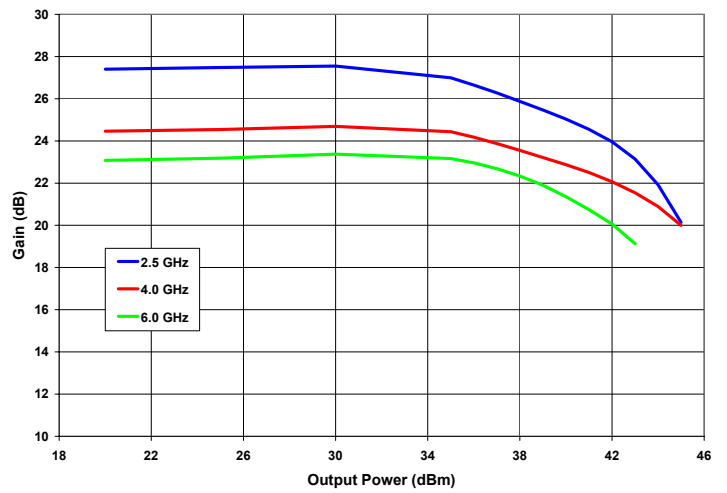
Input & Output Return Losses vs Frequency



Power Gain vs Frequency



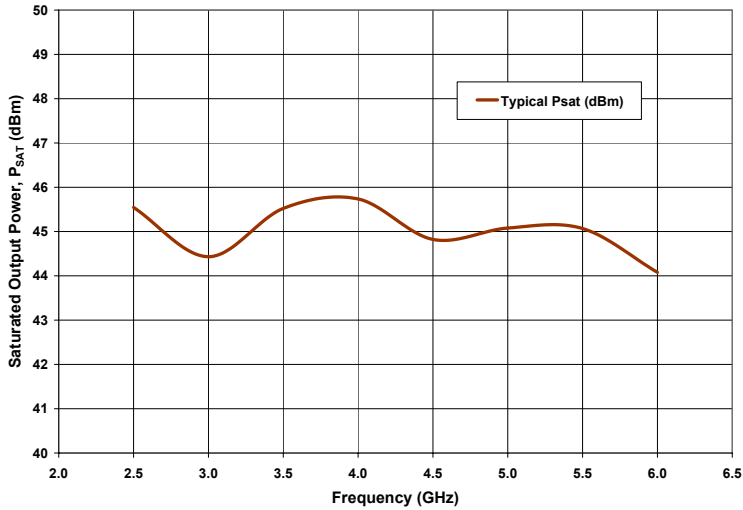
Gain vs Output Power as a Function of Frequency





Typical Performance

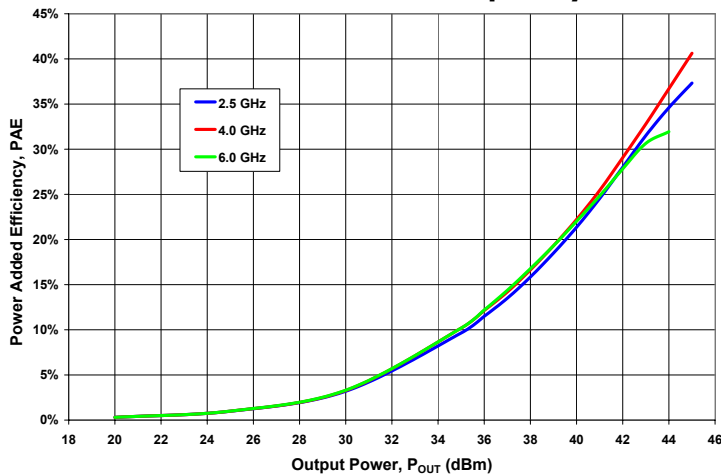
Saturated Output Power Performance (P_{SAT}) vs Frequency



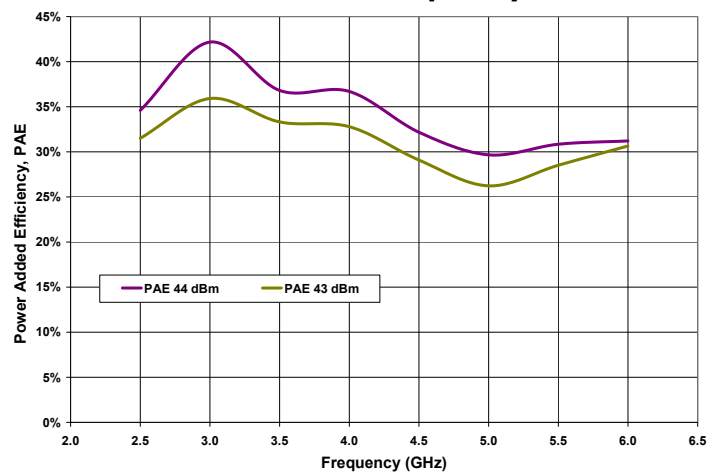
| Frequency (GHz) | P_{SAT} (dBm) | P_{SAT} (W) |
|-----------------|-----------------|---------------|
| 2.5 | 45.54 | 35.8 |
| 3.0 | 44.43 | 27.7 |
| 3.5 | 45.52 | 35.7 |
| 4.0 | 45.74 | 37.5 |
| 4.5 | 44.82 | 30.4 |
| 5.0 | 45.08 | 32.2 |
| 5.5 | 45.07 | 32.1 |
| 6.0 | 44.08 | 25.6 |

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

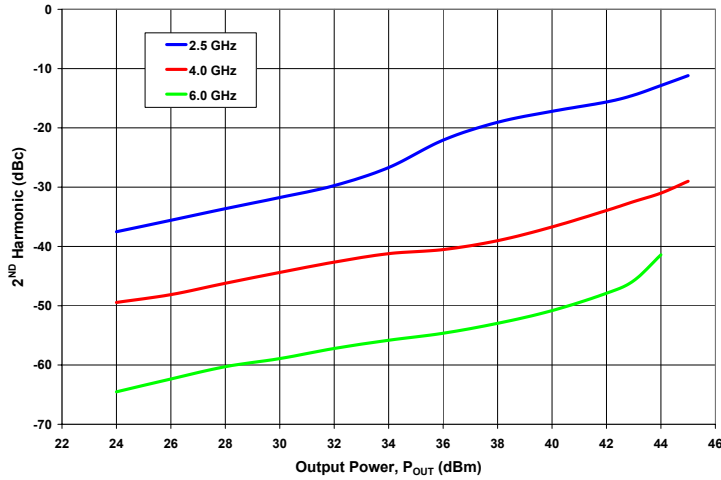


PAE at 43 dBm and 44 dBm Output Power vs Frequency

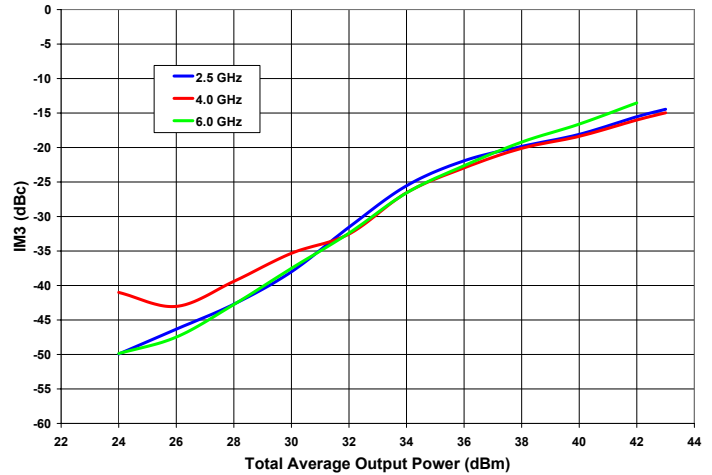


Typical Performance

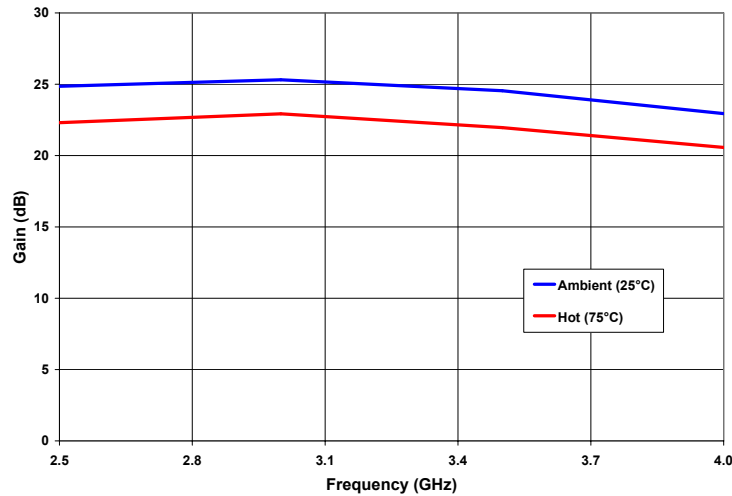
2ND Harmonic vs Output Power as a Function of Frequency



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.

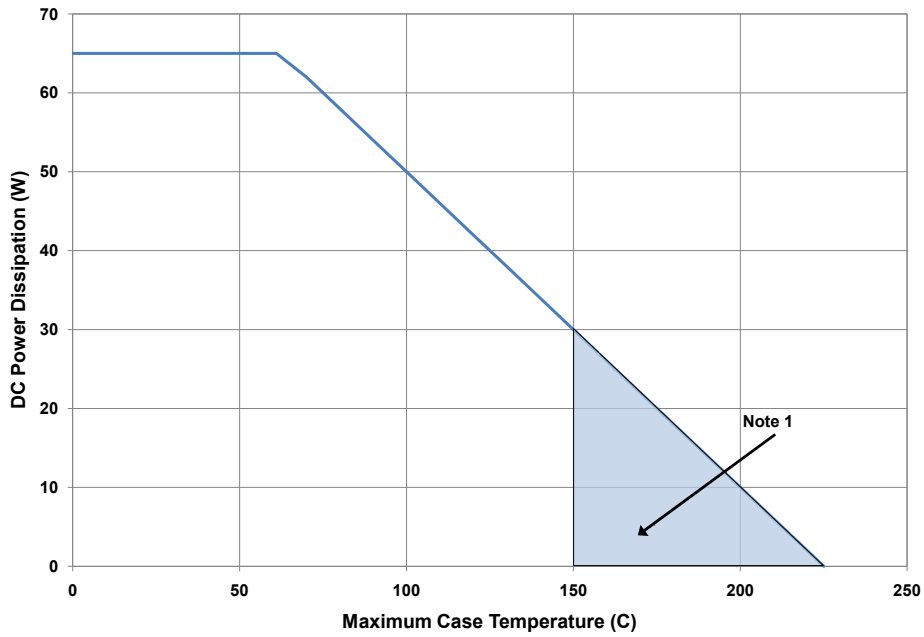
The measurements in this data sheet were taken on devices wire-bonded to the test fixture with 2 mil gold bond wires. All losses associated with the test fixture are included in the measurements.

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 |

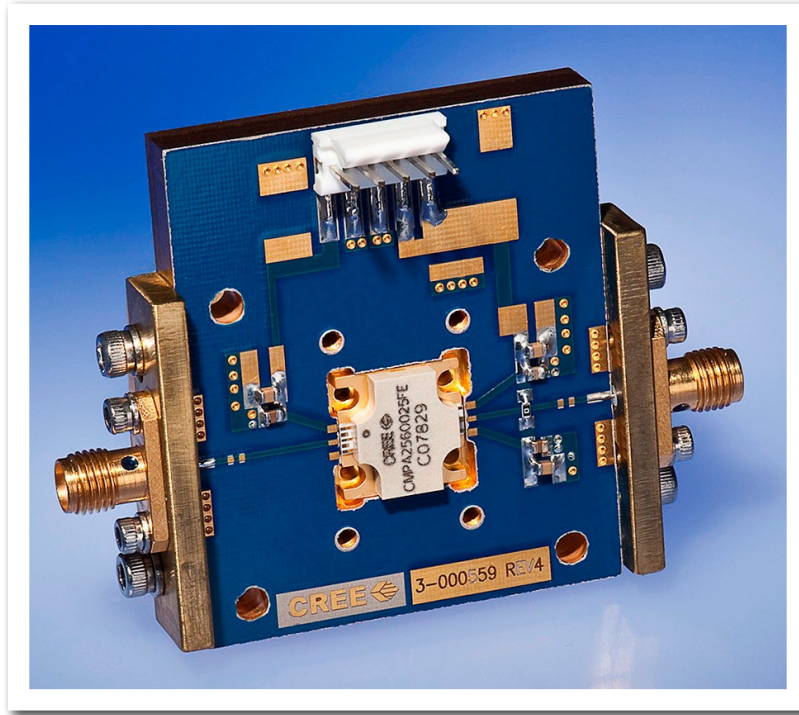


CPA2560025F CW Power Dissipation De-rating Curve

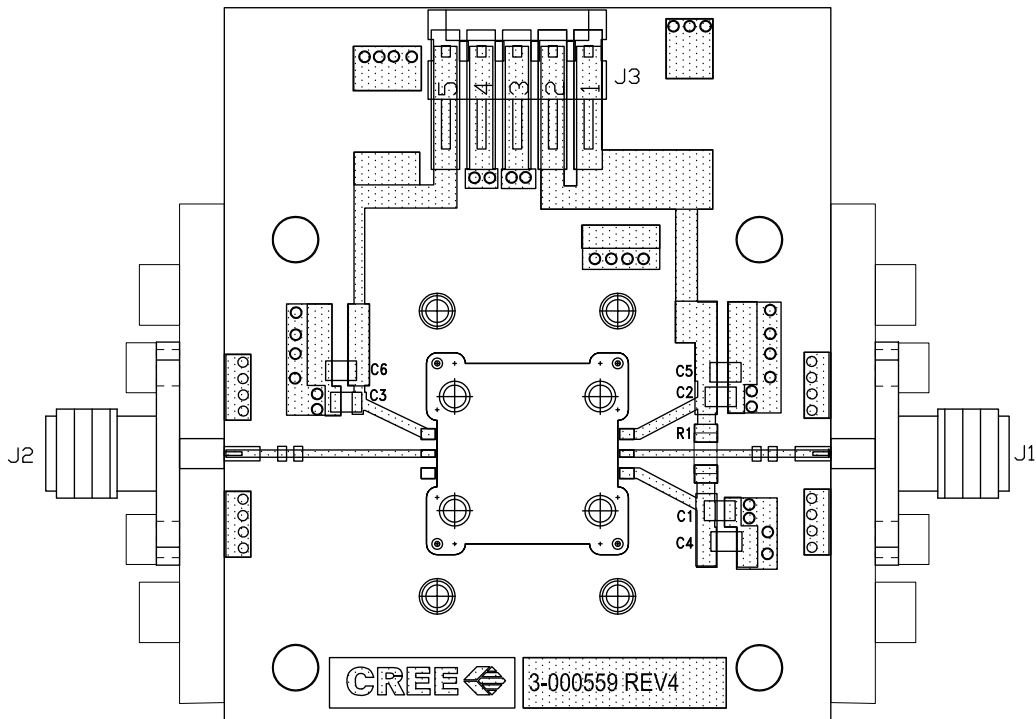


Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).

CMPA2560025F-TB Demonstration Amplifier Circuit



CMPA2560025F-TB Demonstration Amplifier Circuit Outline





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