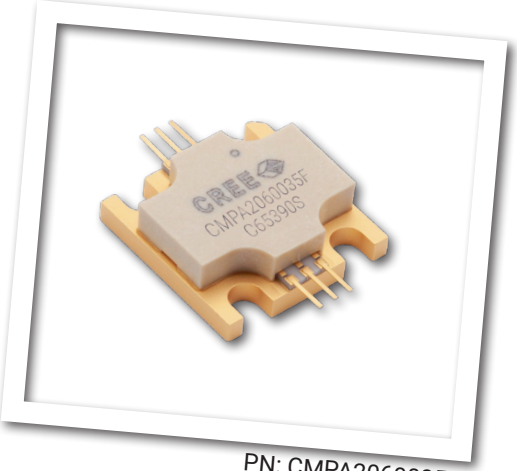
# CMPA2060035F

## 35 W, 2.0 - 6.0 GHz, GaN MMIC Power Amplifier

Cree's CMPA2060035F 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: CMPA2060035F
Package Type: 440219

### Typical Performance Over 2.0-6.0 GHz ($T_C$ = 25°C)

| Parameter | 2.0 GHz | 4.0 GHz | 6.0 GHz | Units |
|---|---|---|---|---|
| Small Signal Gain | 25.6 | 28.5 | 26.8 | dB |
| Output Power[1] | 27.4 | 54 | 37 | W |
| Power Gain[1] | 17.4 | 20.3 | 18.7 | dB |
| Power Added Efficiency[1] | 33 | 47.2 | 34.2 | % |

Note[1]: $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, $P_{IN}$ = 27 dBm. All data tested CW

### Features

- 28 dB Small Signal Gain
- 35 W Typical $P_{SAT}$
- Operation up to 32 V
- High Breakdown Voltage
- High Temperature Operation

### Applications

- Ultra Broadband Amplifiers
- Fiber Drivers
- Test Instrumentation
- EMC Amplifier Drivers

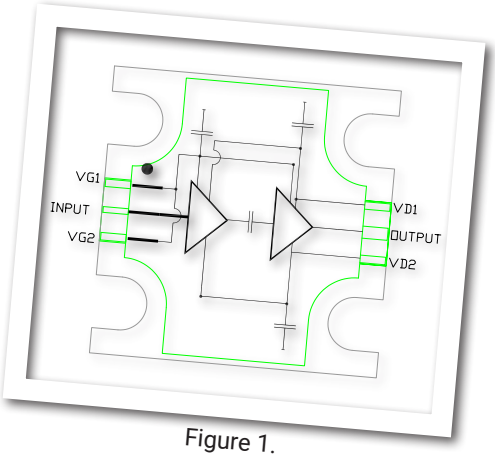



Figure 1.

## Absolute Maximum Ratings (not simultaneous) at 25˚C

| Parameter | Symbol | Rating | Units | Conditions |
|---|---|---|---|---|
| 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 | $I_G$ | 16 | mA | |
| Screw Torque | T | 40 | in-oz | |
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.67 | ˚C/W | 85 ˚C, $P_{DISS}$ = 65 W, CW |
| Case Operating Temperature | $T_C$ | -40, +115 | ˚C | |

## Electrical Characteristics (Frequency = 2.0 GHz to 6.0 GHz unless otherwise stated; $T_C$ = 25˚C)

| Characteristics | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| **DC Characteristics[1,2]** | | | | | | |
| Gate Threshold Voltage | $V_{(GS)TH}$ | -3.6 | -3.1 | -2.4 | V | $V_{DS}$ = 10 V, $I_D$ = 16.8 mA |
| Gate Quiescent Voltage | $V_{(GS)Q}$ | – | -2.7 | – | VDC | $V_{DD}$ = 28 V, $I_D$ = 1.2 A |
| Drain-Source Breakdown Voltage | $V_{BD}$ | 84 | – | – | V | $V_{GS}$ = -8 V, $I_D$ = 16.8 mA |
| Saturated Drain Current[1] | $I_{DC}$ | 12.6 | 15.1 | – | A | $V_{DS}$ = 6.0 V, $V_{GS}$ = 2.0 V |
| **RF Characteristics[3,4,5]** | | | | | | |
| Small Signal Gain | S21 | -- | 28.8 | – | dB | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, $P_{IN}$ = -30 dBm |
| Input Return Loss | S11 | – | -10.7 | -- | dB | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, $P_{IN}$ = -30 dBm |
| Output Return Loss | S22 | – | -12.5 | -- | dB | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, $P_{IN}$ = -30 dBm |
| Output $Power_1$ | $P_{OUT}$ | – | 27.4 | – | W | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, Freq = 2.0 GHz |
| Output $Power_2$ | $P_{OUT}$ | – | 54 | – | W | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, Freq = 4.0 GHz |
| Output $Power_3$ | $P_{OUT}$ | – | 37 | – | W | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, Freq = 6.0 GHz |
| Power Added $Efficiency_1$ | PAE | – | 33.0 | – | % | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, Freq = 2.0 GHz |
| Power Added $Efficiency_2$ | PAE | – | 47.2 | – | % | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, Freq = 4.0 GHz |
| Power Added $Efficiency_3$ | PAE | – | 34.2 | – | % | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, Freq = 6.0 GHz |
| Power $Gain_1$ | $G_P$ | – | 17.4 | – | dB | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, Freq = 2.0 GHz |
| Power $Gain_2$ | $G_P$ | – | 20.3 | – | dB | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, Freq = 4.0 GHz |
| Power $Gain_3$ | $G_P$ | – | 18.7 | – | dB | $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, Freq = 6.0 GHz |
| Output Mismatch Stress | VSWR | – | – | 5 : 1 | Ψ | No damage at all phase angles, $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, $P_{IN}$ = 27 dBm |

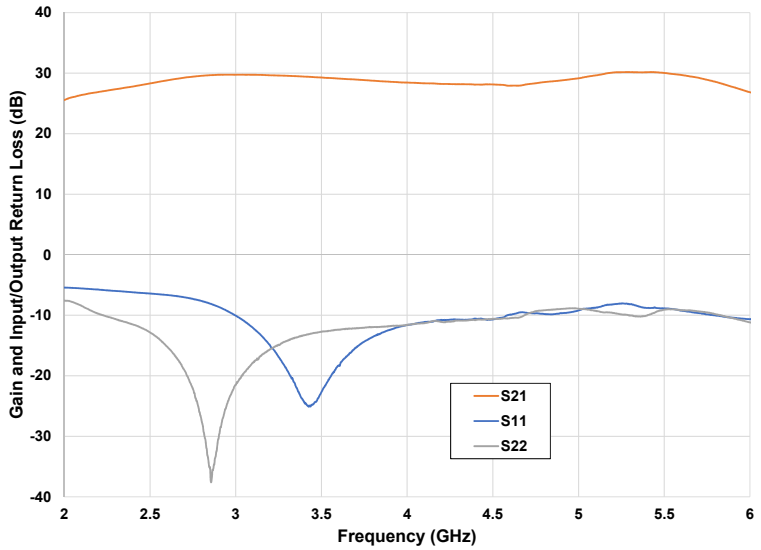
Notes:
[1] Measured on-wafer prior to packaging
[2] Scaled from PCM data
[3] Measured in CMPA2060035F-AMP
[4] Measured at $P_{IN}$ = 27 dBm
[5] Tested CW



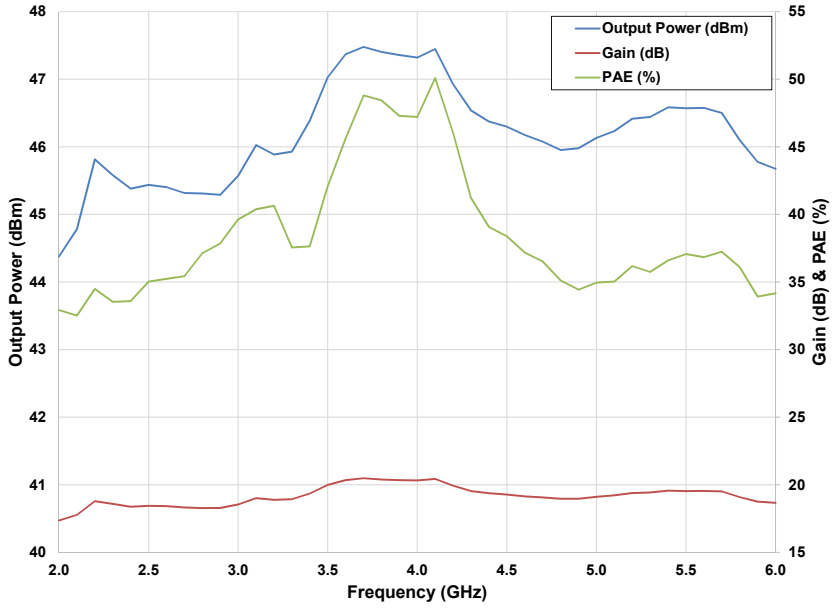
Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

## Typical Performance

### CMPA2060035F S-Parameters
### $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A




### CMPA2060035F Output Power, Gain and PAE vs. Frequency
### $V_{DD}$ = 32 V, $I_{DQ}$ = 1.2 A, $P_{IN}$ = 27 dBm, CW



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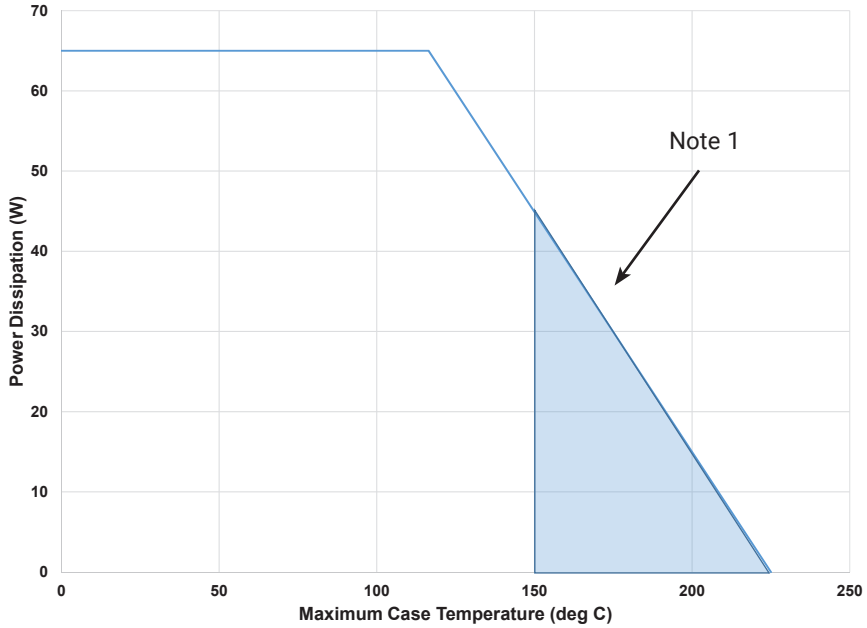
## CMPA2060035F CW Power Dissipation De-rating Curve




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

## 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 |



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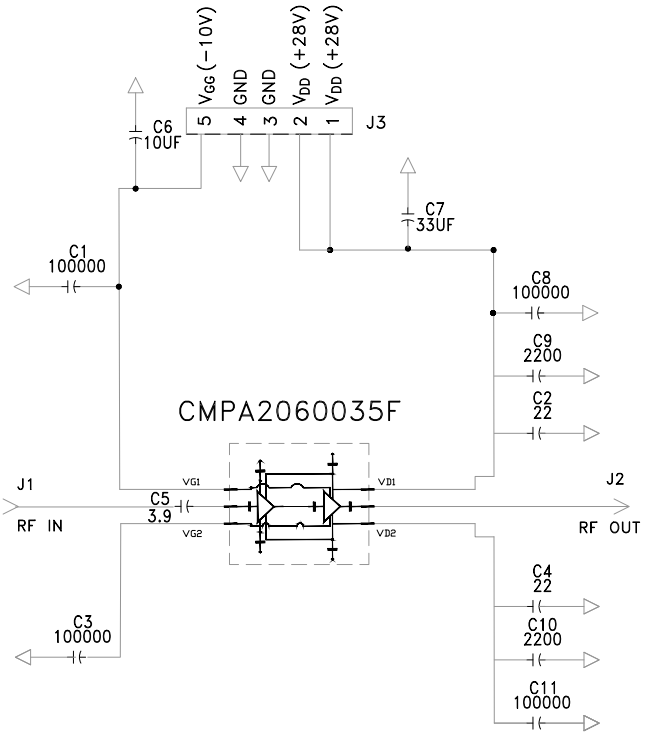
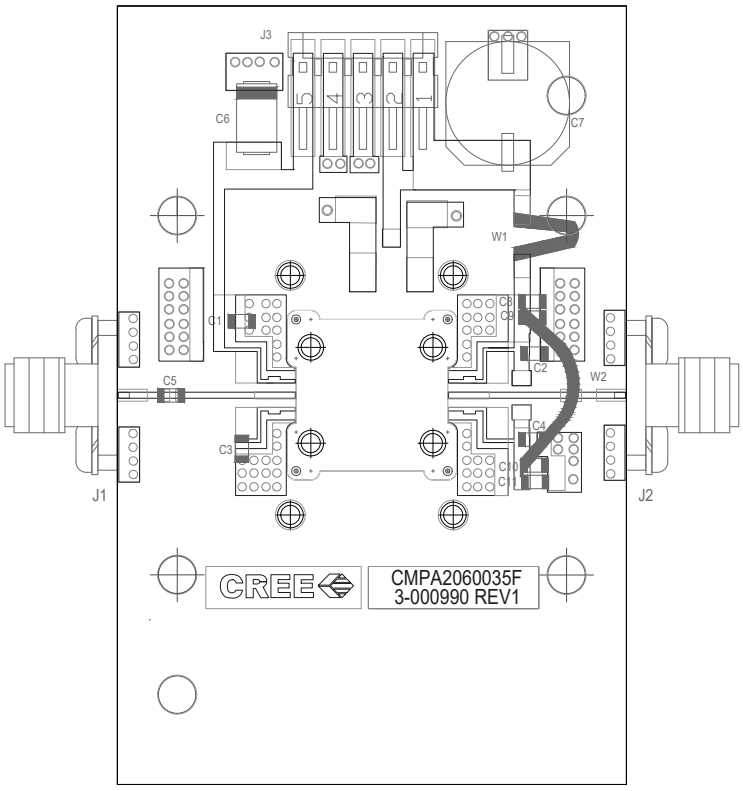
## CMPA2060035F-AMP Demonstration Amplifier Circuit Schematic




## CMPA2060035F-AMP Demonstration Amplifier Circuit Outline



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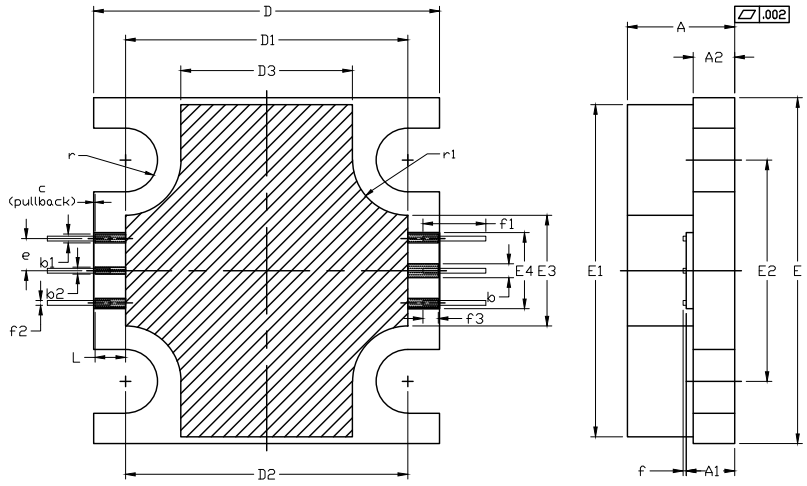
## CMPA2060035F-AMP Demonstration Amplifier Circuit Bill of Materials

| Designator | Description | Qty |
|---|---|---|
| | PCB | 1 |
| C5 | CAP, 3.9 PF, 250V, 0805, ATC600F | 1 |
| C1, C3, C8, C11 | CAP, 100,000 PF, 50V, 0805, 10% | 4 |
| C6 | CAP, 10 UF, 20%, G CASE | 1 |
| C7 | CAP, 33 UF, 20%, G CASE | 2 |
| C9, C10 | CAP, 2200 PF, 100V, 0805, 10% | 2 |
| C2, C4 | CAP, 22 PF, 50V, 10% | 2 |
| J1,J2 | CONN, SMA, FLANGE, 4-HOLE | 2 |
| J3 | DC CONN, HEADER RT>PLZ .1CEN LK 5POS | 1 |
| | 2-56 SOC HD SCREW 1/4 SS | 4 |
| | #2 FLATWASHER | 4 |
| Q1 | CMPA2060035F | 1 |

## Product Dimensions CMPA2060035F (Package Type — 440219)




NOTES:

1. DIMENSIONING AND TOLERANICING 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 | 0.022 | | 0.56 | | – |
| b1 | 0.013 | | 0.33 | | x4 |
| b2 | 0.010 | | 0.25 | | – |
| c | 0.002 | | 0.05 | | 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 | – |
| e | 0.046 | | 1.17 | | x4 |
| f | 0.005 | | 0.127 | | x6 |
| f1 | 0.100 | – | 2.54 | – | x6 |
| f2 | 0.010 | | .254 | | x6 |
| f3 | 0.022 | | .559 | | x6 |
| L | 0.044 | | 1.12 | | x6 |
| r | R0.046 | | R1.17 | | x4 |
| r1 | R0.080 | | R2.03 | | x4 |



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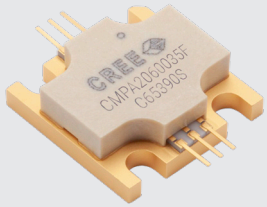
## Product Ordering Information

| Order Number | Description | Unit of Measure | Image |
|---|---|---|---|
| CMPA2060035F | GaN MMIC | Each |  |
| CMPA2060035F-AMP | Test board with GaN MMIC installed | Each | |



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Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/RF



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Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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