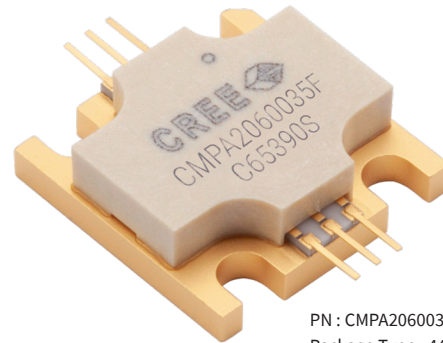


# CMPA2060035F

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

## Description

Wolfspeed'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

## 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

## Typical Performance Over 2.0-6.0 GHz, 32 V ( $T_c = 25^\circ\text{C}$ )

Parameter	2.0 GHz	4.0 GHz	6.0 GHz	Units
Small Signal Gain	24.5	27.1	26.2	dB
Output Power <sup>1</sup>	36.3	53.7	36.3	W
Power Gain <sup>1</sup>	18.6	20.3	18.6	dB
Power Added Efficiency <sup>1</sup>	42.6	46.2	31.7	%

Notes:

<sup>1</sup>  $V_{DD} = 32\text{ V}$ ,  $I_{DQ} = 1.2\text{ A}$ ,  $P_{IN} = 27\text{ dBm}$ . All data tested CW



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

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	$V_{DS}$	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	$R_{\theta JC}$	2.06	°C/W	85 °C, $P_{DISS} = 65$ W, CW
Case Operating Temperature	$T_C$	-40, +150	°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
<b>DC Characteristics<sup>1,2</sup></b>						
Gate Threshold Voltage	$V_{(GS)TH}$	-3.4	-3.0	-2.7	V	$V_{DS} = 10$ V, $I_D = 16.5$ mA
Gate Quiescent Voltage	$V_{(GS)Q}$	-	-2.6	-	$V_{DC}$	$V_{DD} = 28$ V, $I_D = 1.2$ A
Saturated Drain Current <sup>1</sup>	$I_{DS}$	11.9	16.5	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	$V_{BD}$	84	-	-	V	$V_{GS} = -8$ V, $I_D = 16.5$ mA
<b>RF Characteristics<sup>3,4,5</sup></b>						
Small Signal Gain	S21	22.2	27.6	-	dB	$V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, Frequency = 2.0 - 6.0 GHz
Input Return Loss	S11	-	-11	-4	dB	$V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, Frequency = 2.0 - 6.0 GHz
Output Return Loss	S22	-	-11.6	-4	dB	$V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, Frequency = 2.0 - 6.0 GHz
Output Power <sub>1</sub>	$P_{OUT}$	23.7	30.6	-	W	$V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, Freq = 2.0 GHz
Output Power <sub>2</sub>	$P_{OUT}$	34.3	42.7	-	W	$V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, Freq = 4.0 GHz
Output Power <sub>3</sub>	$P_{OUT}$	23.7	29.4	-	W	$V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, Freq = 6.0 GHz
Power Added Efficiency <sub>1</sub>	PAE	34.5	44	-	%	$V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, Freq = 2.0 GHz
Power Added Efficiency <sub>2</sub>	PAE	37	46.2	-	%	$V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, Freq = 4.0 GHz
Power Added Efficiency <sub>3</sub>	PAE	23	31.2	-	%	$V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, Freq = 6.0 GHz
Output Mismatch Stress	VSWR	-	-	5 : 1	$\Psi$	No damage at all phase angles, $V_{DD} = 28$ V, $I_{DQ} = 1.2$ A, $P_{IN} = 27$ dBm

Notes:

<sup>1</sup> Measured on-wafer prior to packaging

<sup>2</sup> Scaled from PCM data

<sup>3</sup> Measured in CMPA2060035F-AMP

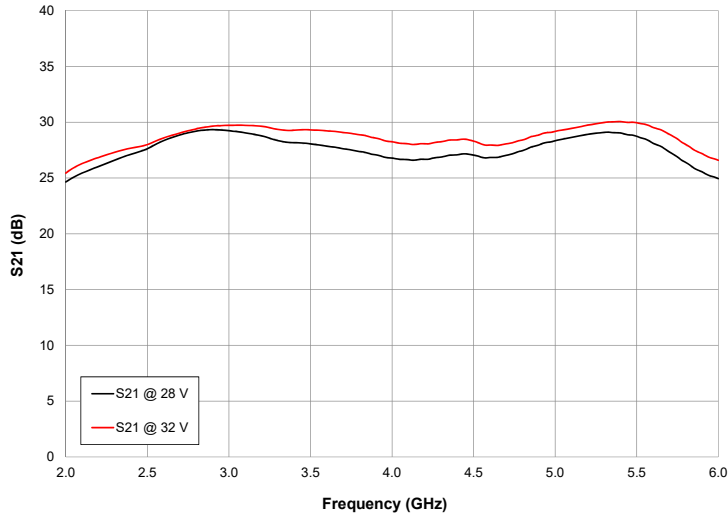
<sup>4</sup> Measured at  $P_{IN} = 27$  dBm

<sup>5</sup> Tested CW

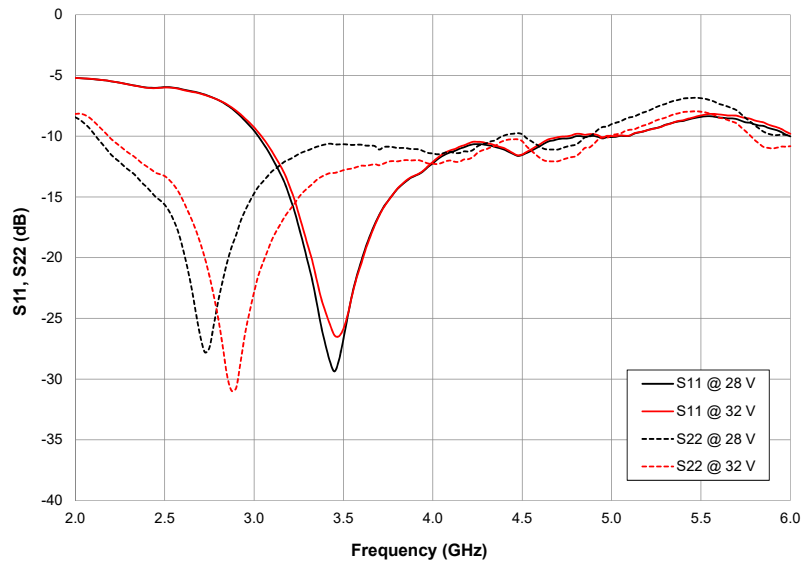


Typical Performance

**Figure 1. CPM2060035F S21 vs. Frequency vs. V<sub>DD</sub>**  
 $I_{DQ} = 1.2 \text{ A}$



**Figure 2. CPM2060035F Return Losses vs. Frequency vs. V<sub>DD</sub>**  
 $I_{DQ} = 1.2 \text{ A}$

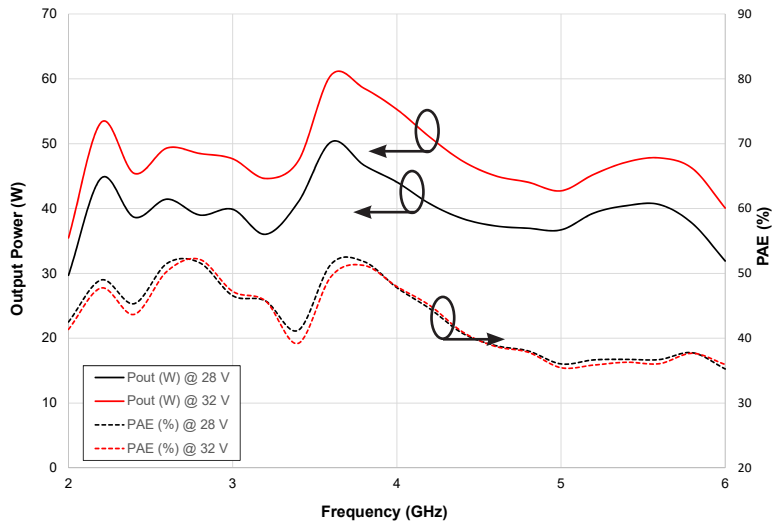




Typical Performance

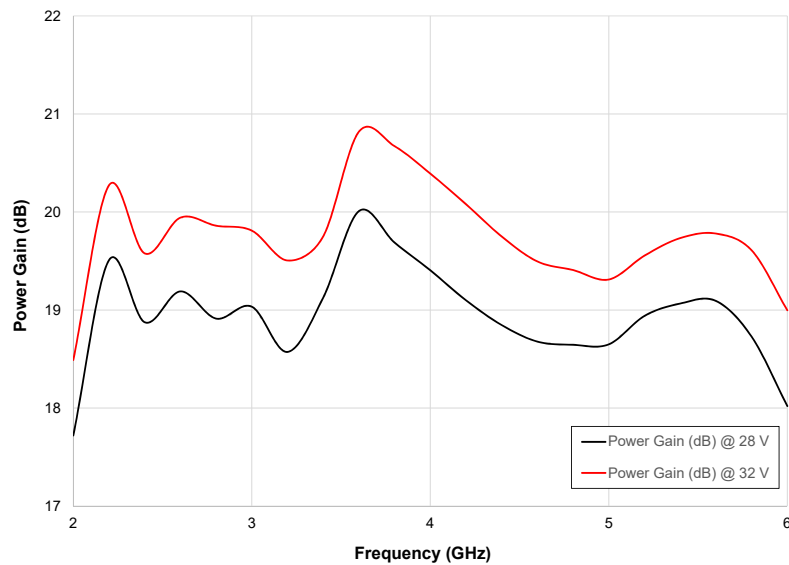
**Figure 3. CMPA2060035F Output Power and Power Added Efficiency vs. Frequency vs. Drain Voltage**

$I_{DQ} = 1.2$  A, Case Temperature = 25 °C, Power Input = 30 dBm



**Figure 4. CMPA2060035F Power Gain vs. Frequency vs. Drain Voltage**

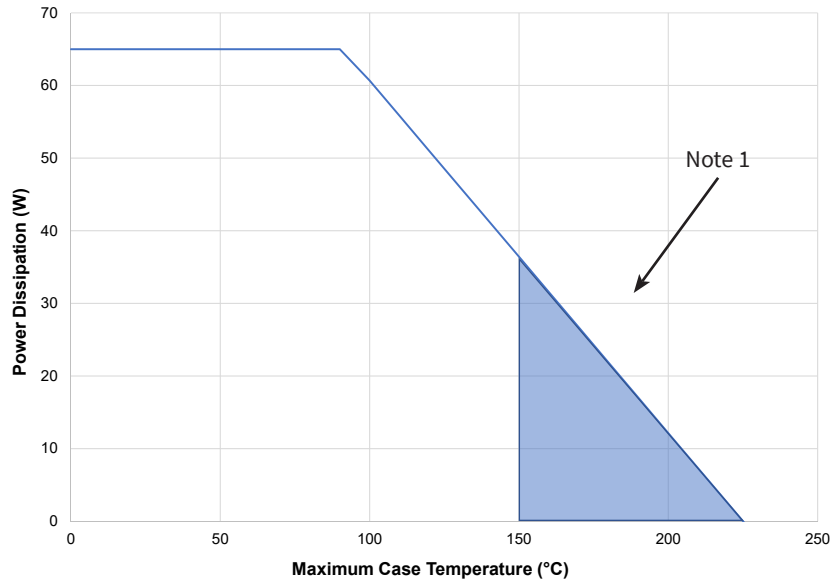
$I_{DQ} = 1.2$  A, Case Temperature = 25 °C, Power Input = 30 dBm





**Typical Performance**

**CPA2060035F CW Power Dissipation De-rating Curve**



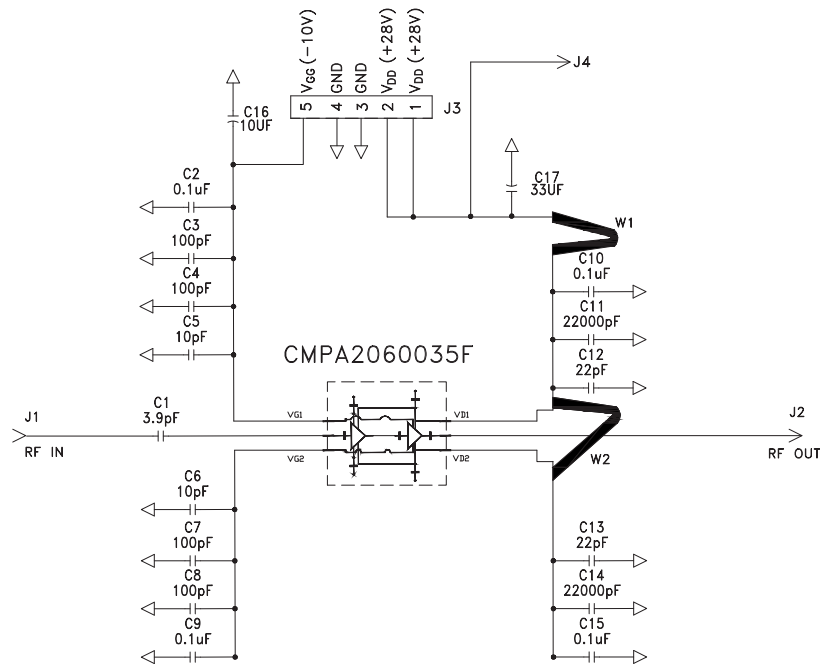
Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).

**Electrostatic Discharge (ESD) Classifications**

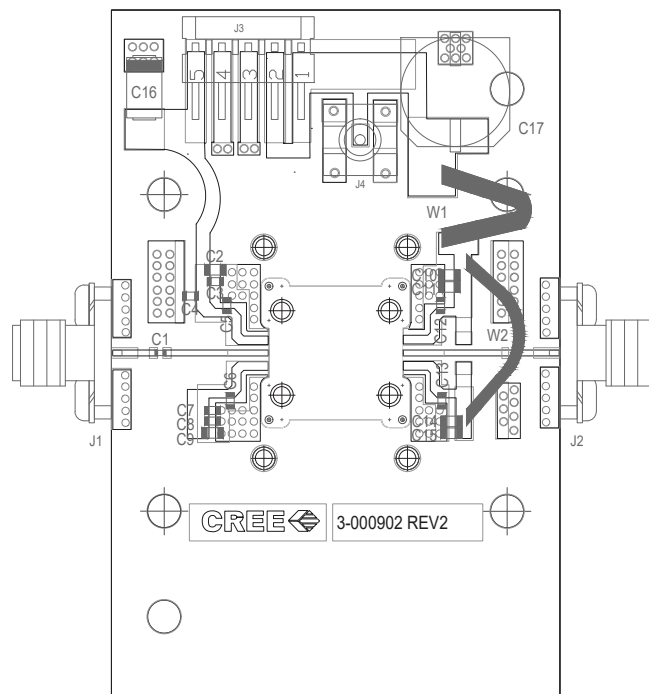
Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 < 500 V)	JEDEC JESD22 C101-C



### CMPA2060035F-AMP Demonstration Amplifier Circuit Schematic



### CMPA2060035F-AMP Demonstration Amplifier Circuit Outline





## CMPA2060035F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
	PCB	1
Q1	CMPA2060035F, 2.0-6.0GHz, GaN MMIC	1
C1	CAP, 3.9pF, +/-0.1pF, 0402, ATC	1
C2, C9, C10, C15	CAP CER 0.1UF 100V 10% X7R 0805	4
C3, C4, C7, C8	CAP, 100.0pF, +/-5%, 0603, ATC	4
C5, C6	CAP, 10.0pF, +/-5%, 0603, ATC	2
C11, C14	CAP CER 2200PF 100V 10% X7R 0805	2
C12, C13	CAP, 22pF, +/-5%, 0603, ATC	2
C16	CAP 10UF 16V TANTALUM, 2312	1
C17	CAP, 33 UF, 20%, G CASE	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J3	HEADER RT>PLZ .1CEN LK 5POS	1
J4	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1
W1, W2	WIRE, BLACK, 22 AWG	2
	WIRE ASSEMBLY, 5-PIN, MMIC HPA FIXTURES	1
	CLAMP, DELRIN	2
	2-56 SOC HD SCREW 3/16 SS	4
	2-56 SOC HD SCREW 1/2 SS	4
	PREFORM, INDIUM, 2 X 2 X 0.003" THK, WITH 0.0002" THK AL CLAD ON ONE SIDE	1
	TEST FIXTURE INSTRUCTIONS	1



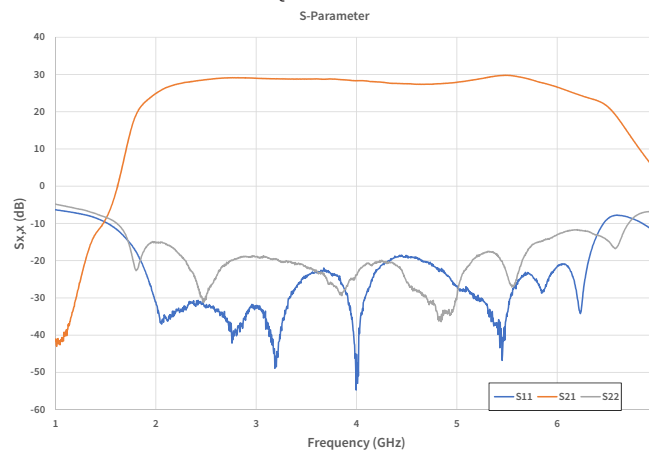
### Electrical Characteristics When Tested in CMPA2060035F-AMP2

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>RF Characteristics (TC = 25 °C, F0 = 2 - 6 GHz unless otherwise noted)</b>						
Gain	G	-	27.5	-	dB	VDD = 32 V, IDQ = 1.2A, PIN = -20 dBm
Output Power	Pout	-	48.5	-	dBm	VDD = 32 V, IDQ = 1.2A, PIN = 30 dBm
Drain Efficiency	$\eta$	-	40	-	%	VDD = 32 V, IDQ = 1.2A, PIN = 35 dBm
Output Mismatch Stress	VSWR		5:1			No damage at all phase angles, VDS = 32 V, IDQ = 1.2A, Pin=30dBm

### Typical Performance of CMPA2060035F-AMP2

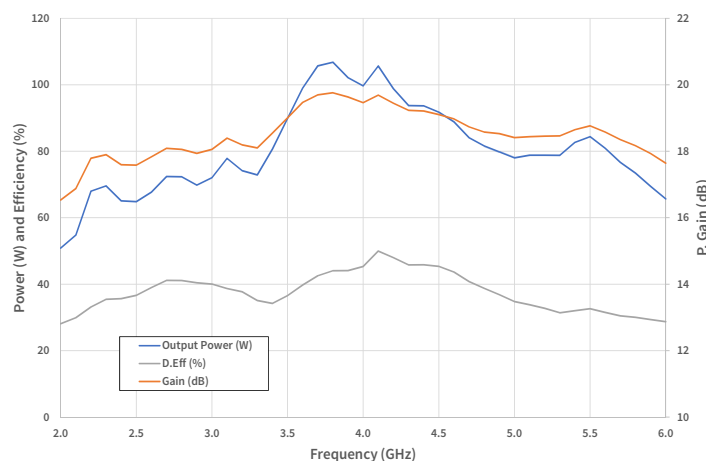
**Figure 5. CMPA2060035F-AMP2 S-Parameters**

$V_D = 32\text{ V}, I_{DQ} = 1.2\text{ A} \times 2, \text{TCASE} = 25\text{ }^\circ\text{C}$



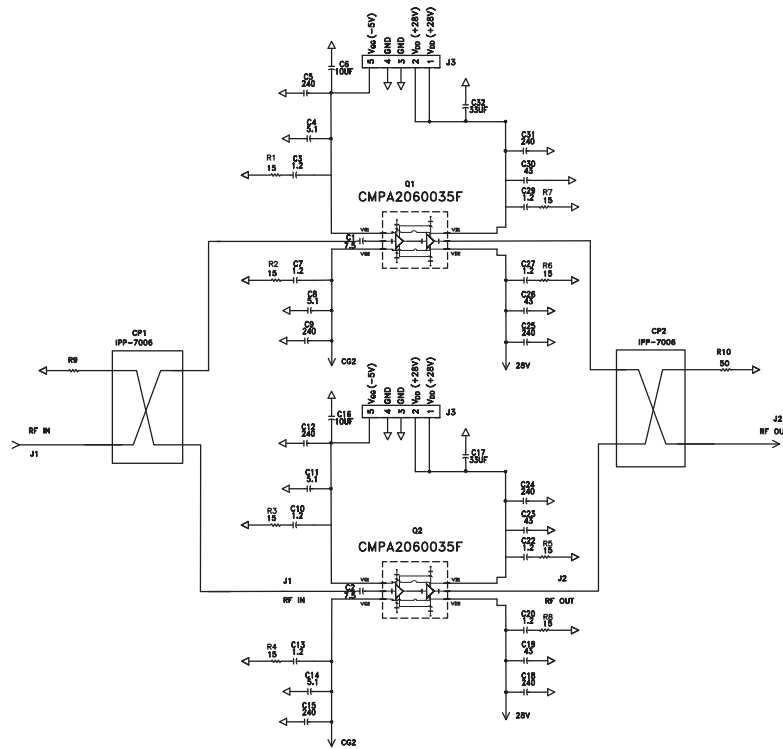
**Figure 6. CMPA2060035F-AMP2 Power Gain and Efficiency vs. Frequency**

$V_D = 32\text{ V}, I_{DQ} = 1.2\text{ A} \times 2, P_{IN} = 30.5\text{ dBm}, \text{TCASE} = 25\text{ }^\circ\text{C}$

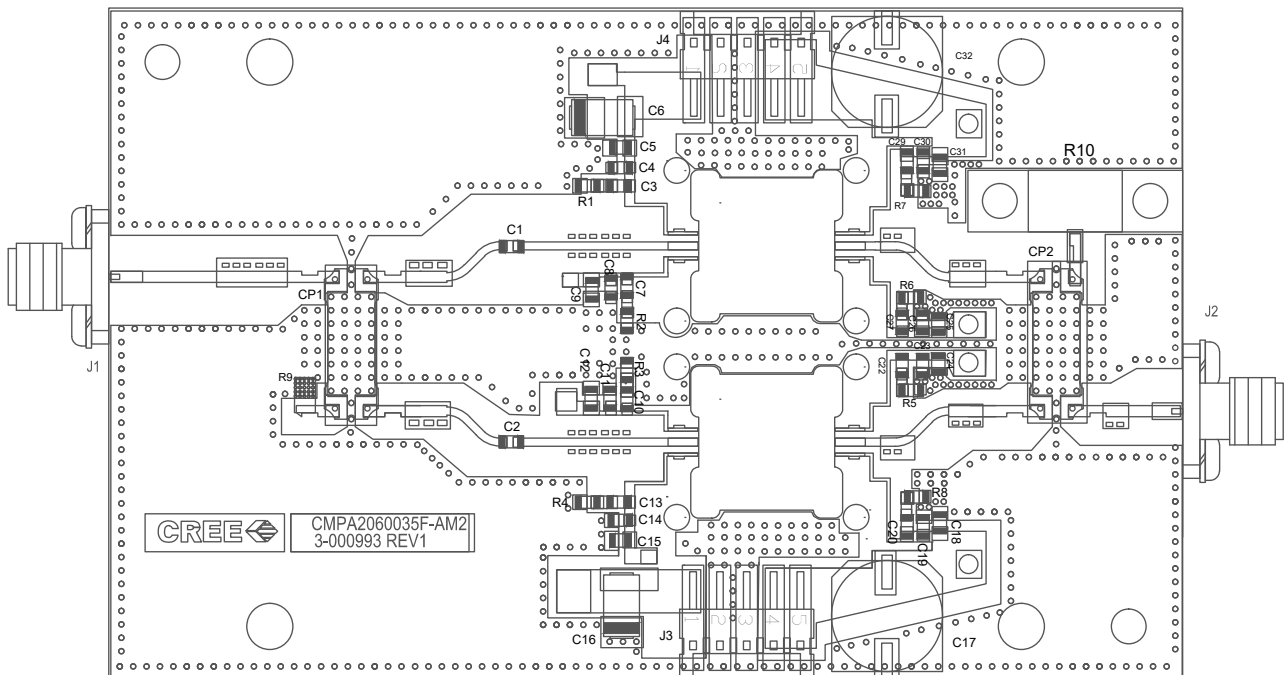




### CMPA2060035F-AMP2 Demonstration Amplifier Circuit Schematic



### CMPA2060035F-AMP2 Demonstration Amplifier Circuit Outline



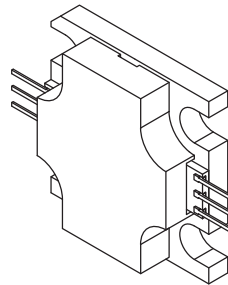
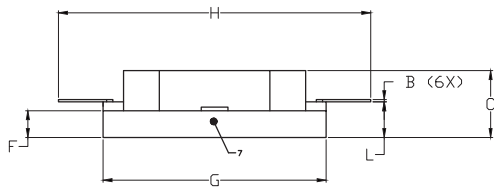
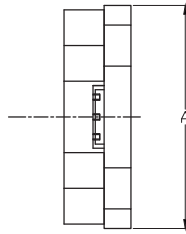
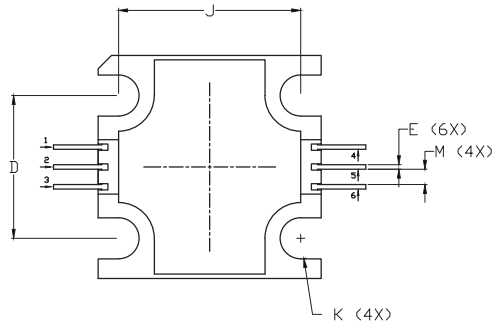


### CMPA2060035F-AMP2 Demonstration Amplifier Circuit Bill of Materials

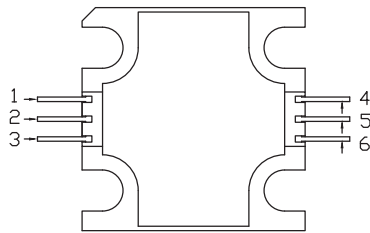
Designator	Description	Qty
C4, C8, C11, C14	CAP, 5.1pF, +/-0.1pF, 250V, 0603, ATC600S	4
C1, C2	CAP, 7.5pF, +/-0.1pF, 250V, 0603, ATC600S	2
C3, C7, C10, 13, C20, C22, C27, C29	CAP, 1.2PF, 0603, ATC600S	8
C5, C9, C31, C25, C12, C15, C24, C18	CAP, 240pF, +/-0.5pF, 250V, 0805, ATC600F	8
C19, C23, C26, C30	CAP, 43pF, 250V, 0805, ATC600F	4
C6, C16	CAP, 10uF, 50V, TANTLUM	2
C17, C32	CAP, 33 UF, 20%, 100V, ELEC	2
R10	TERMINATOR, 50 OHM, ATC FT20800N0050J2	1
R1, R2, R3, R4, R5, R6, R7, R8	RES, 15 OHM, 0805, 1%	1
R9	TERMINATOR, 50 OHM, ANAREN C8A50Z4B	1
CP1, CP2	HYBRID COUPLER, IPP-7006	2
J1, J2	CONN, SMA, PANEL MOUNT JACK, FL	2
J3, J4	HEADER ST, .1CEN LK 5POS, PBC05SABN	2
	BASEPLATE,	1
	PCB, RO4350B, 2.5"x4"x0.020",	1
	#2, WASHER, SPLIT LK, SS	4
	2-56 SOC HD SCREW 3/16 SS	4



**Product Dimensions CPM2060035F (Package Type – 440219)**



NOT TO SCALE



PIN	Function
1	NC
2	Gate
3	NC
4	NC
5	Drain
6	NC
7	Source

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	
	MIN	MAX	MIN	MAX
A	0.495	0.505	12.57	12.82
B	0.003	0.005	0.076	0.127
C	0.140	0.160	3.56	4.06
D	0.315	0.325	8.00	8.25
E	0.008	0.012	0.204	0.304
F	0.055	0.065	1.40	1.65
G	0.495	0.505	12.57	12.82
H	0.695	0.705	17.65	17.91
J	0.403	0.413	10.24	10.49
K	∅ .092		2.34	
L	0.075	0.085	1.905	2.159
M	0.032	0.040	0.82	1.02



**Product Ordering Information**

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



For more information, please contact:

4600 Silicon Drive  
Durham, North Carolina, USA 27703  
[www.wolfspeed.com/rf](http://www.wolfspeed.com/rf)

Sales Contact  
[rfsales@cree.com](mailto:rfsales@cree.com)

## Notes & Disclaimer

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