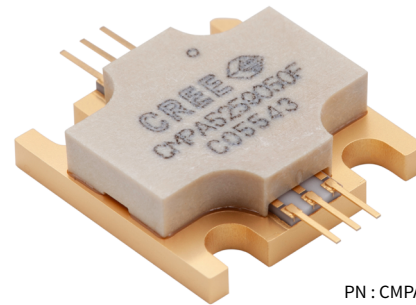


# CMPA5259050F

50 W, 4.9 – 5.9 GHz, 28 V, GaN MMIC for Radar Power Amplifiers

## Description

Wolfspeed's CMPA5259050F is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC). It is designed specifically for high efficiency, high gain, and wide bandwidth capabilities, which makes CMPA5259050F ideal for 4.9 - 5.9 GHz radar amplifier applications. The transistor is supplied in a 0.5 inch square ceramic/metal flange package.



PN : CMPA5259050F  
Package Type : 440219

### Features

- 30 dB Small Signal Gain
- 50% Efficiency at  $P_{SAT}$
- Operation up to 28 V
- High Breakdown Voltage
- 0.5 inch-square package

### Applications

- AESA Radar
- Defense Radar
- Fire Control Radar
- Naval, Marine, Ground Protection Radar
- Weather Radar

## Typical Performance Over 4.9 - 5.9 GHz ( $T_c = 25^\circ\text{C}$ ) of Demonstration Amplifier

Parameter	5.2 GHz	5.5 GHz	5.9 GHz	Units
Small Signal Gain	31.4	30.8	31.0	dB
Output Power	59.6	56.0	55.2	W
Power Added Efficiency	51.5	52	52	%

Note:

100  $\mu\text{sec}$  Pulse Width, 10% Duty Cycle,  $P_{IN} = 26\text{ dBm}$



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

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	$V_{DS}$	84	$V_{DC}$	
Gate-source Voltage	$V_{GS}$	-10, +2	$V_{DC}$	
Storage Temperature	$T_{STG}$	-55, +150	°C	
Operating Junction Temperature	$T_J$	225	°C	
Soldering Temperature	$T_S$	245	°C	
Screw Torque	$\tau$	40	in-oz	
Thermal Resistance, Junction to Case <sup>1</sup>	$R_{\theta JC}$	1.60	°C/W	$P_{DISS} = 61 \text{ W}, T_{CASE} = 85 \text{ °C}, 500 \mu\text{s}, 20\%$
Case Operating Temperature	$T_C$	-40, +105	°C	
Forward Gate Current	$I_{GS}$	16.8	mA	

### Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	2 (125 V < 250 V)	JEDEC JESD22 C101-C


**Electrical Characteristics** ( $T_c = 25^\circ\text{C}$ )

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics<sup>1</sup></b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.6	-2.5	-2.4	$V_{DC}$	$V_{DS} = 10\text{ V}, I_{DS} = 16.8\text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	$V_{DC}$	$V_{DS} = 10\text{ V}, I_D = 16.8\text{ mA}$
Saturated Drain Current	$I_{DS}$	12.6	18.6	-	A	$V_{DS} = 6\text{ V}, V_{GS} = 2\text{ V}$
Drain-Source Breakdown Voltage	$V_{BD}$	84	100	-	$V_{DC}$	$V_{GS} = -8\text{ V}, I_{DS} = 16.8\text{ mA}$
<b>RF Characteristics<sup>2,3</sup></b>						
Small Signal Gain	$G_{SS}$	28	31	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 4.9\text{-}5.9\text{ GHz}, P_{IN} = -20\text{ dBm}$
Power Output	$P_{OUT}$	46	59.6	-	W	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 5.2\text{ GHz}, P_{IN} = 24\text{ dBm}$
Power Output	$P_{OUT}$	46	56.0	-	W	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 5.5\text{ GHz}, P_{IN} = 24\text{ dBm}$
Power Output	$P_{OUT}$	46	55.2	-	W	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 5.9\text{ GHz}, P_{IN} = 24\text{ dBm}$
Power Added Efficiency	PAE	40.5	51	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 5.2\text{ GHz}, P_{IN} = 24\text{ dBm}$
Power Added Efficiency	PAE	42	52	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 5.5\text{ GHz}, P_{IN} = 24\text{ dBm}$
Power Added Efficiency	PAE	42	52	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 5.9\text{ GHz}, P_{IN} = 24\text{ dBm}$
Power Gain	$G_p$	-	21.8	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 5.2\text{-}5.9\text{ GHz}, P_{IN} = 26\text{ dBm}$
Input Return Loss	S11	-	-12	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 5.2 - 5.9\text{ GHz}, P_{IN} = -20\text{ dBm}$
Output Return Loss	S22	-	-17	4	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 5.2 - 5.9\text{ GHz}, P_{IN} = -20\text{ dBm}$
Output Mismatch Stress	VSWR	-	3:1	-	$\Psi$	No damage at all phase angles $V_{DD} = 28\text{ V}, I_{DQ} = 1.0\text{ A}, P_{IN} = 26\text{ dBm}$

## Notes:

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

<sup>2</sup> Measured in CMPA5259050F-TB test fixture.

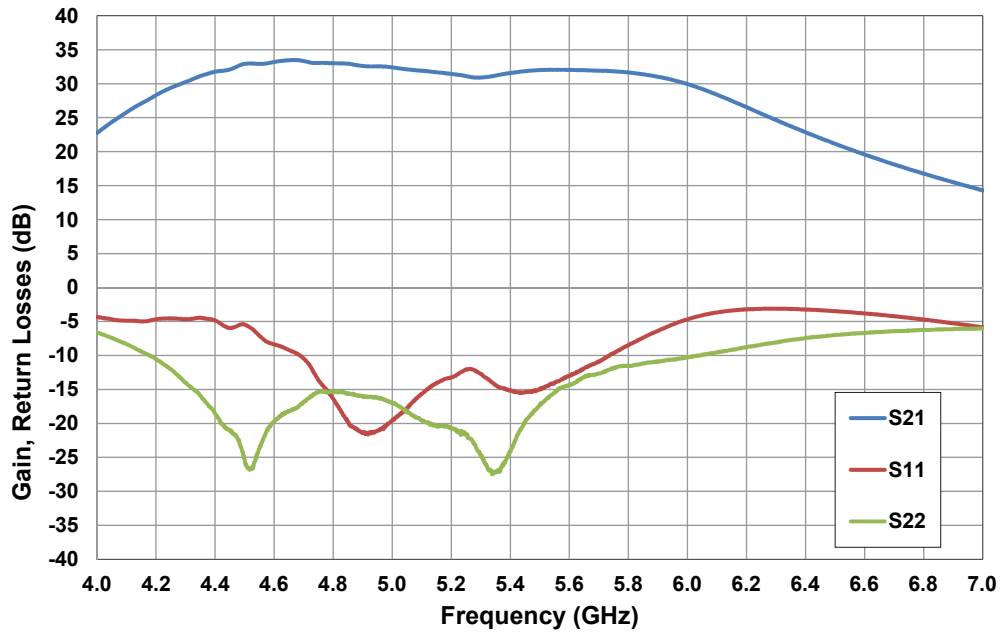
<sup>3</sup> Pulse width = 100  $\mu\text{sec}$ , 10% duty cycle



Typical Pulsed Performance

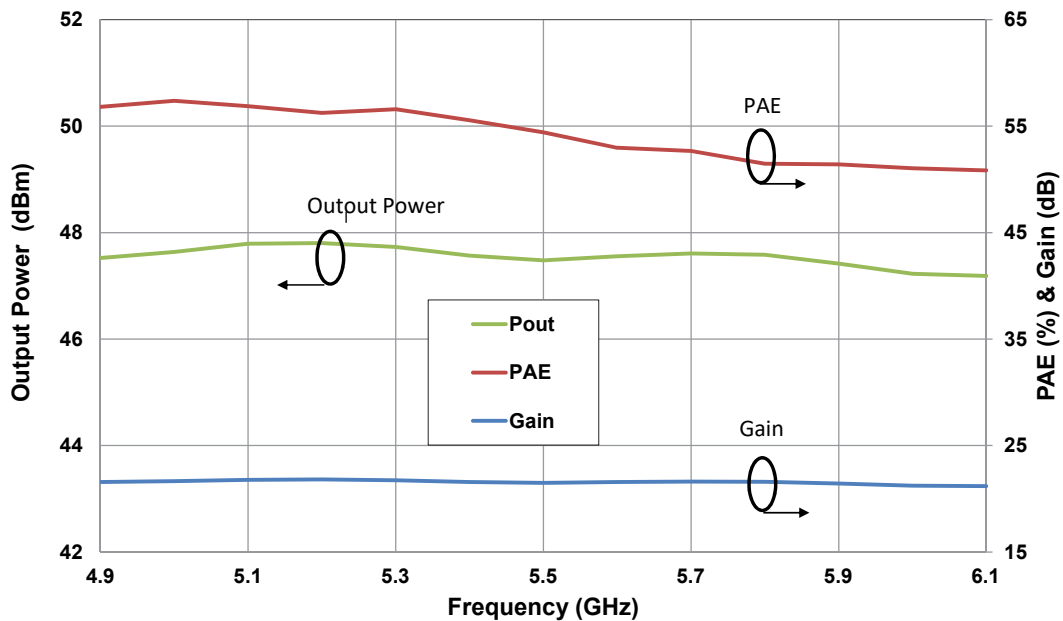
**Figure 1. - Gain and Input Return Loss vs. Frequency of the CMPA5259050F Measured in CMPA5259050F-AMP Amplifier Circuit**

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 1.0\text{ A}$ ,  $T_C = 25^\circ\text{C}$



**Figure 2. - Output Power, Gain, and Power Added Efficiency vs. Frequency of the CMPA5259050F Measured in CMPA5259050F-AMP Amplifier Circuit**

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 1.0\text{ A}$ ,  $P_{IN} = 26\text{ dBm}$ , Pulse Width = 100  $\mu\text{s}$ , Duty Cycle = 10%,  $T_C = 25^\circ\text{C}$

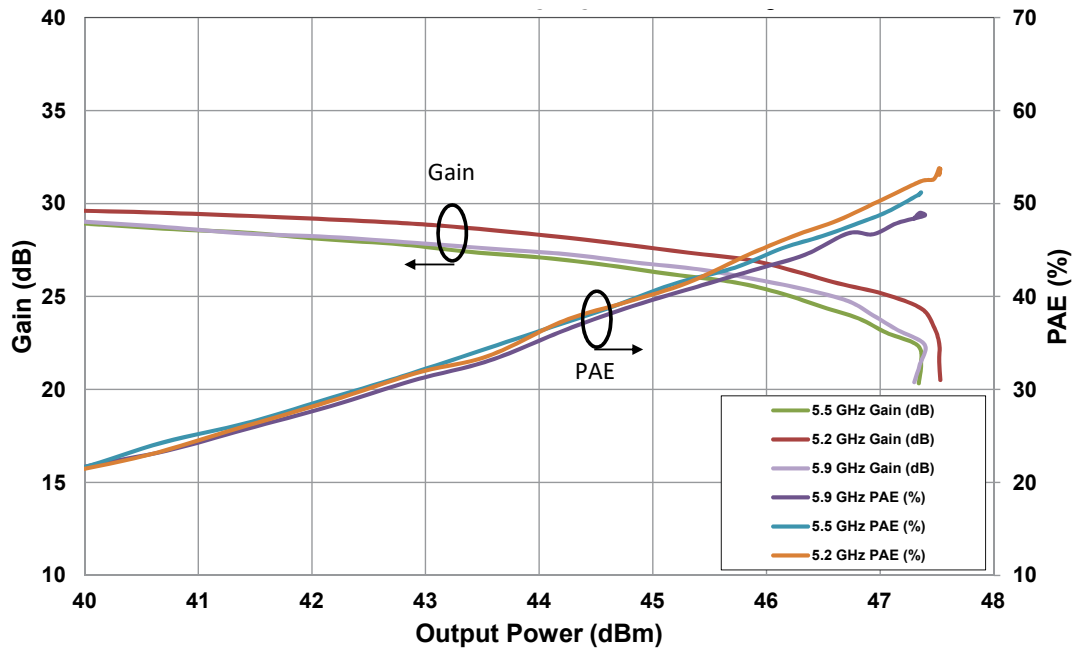




Typical Pulsed Performance

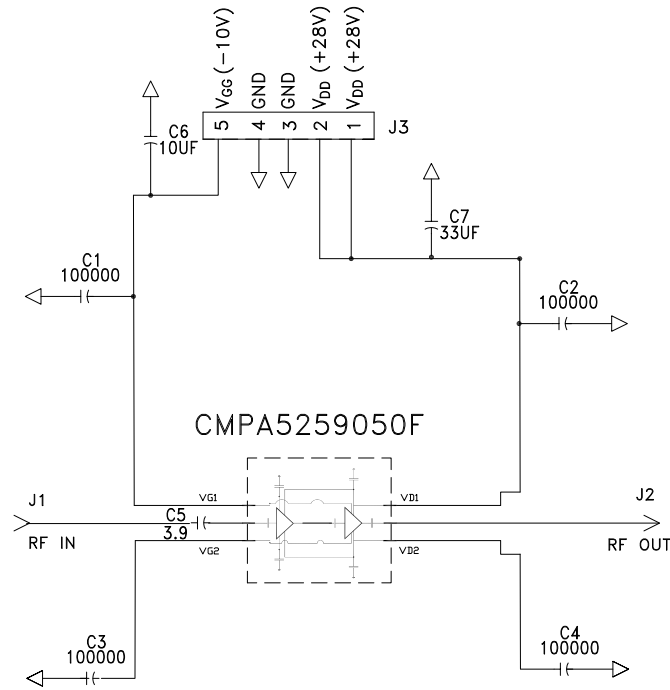
**Figure 3. - Gain and Power Added Efficiency vs. Output Power of the CMPA529050F Measured in CMPA525050F-AMP Amplifier Circuit**

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 1.0\text{ A}$ , Pulse Width = 100  $\mu\text{s}$ , Duty Cycle = 10%,  $T_c = 25^\circ\text{C}$

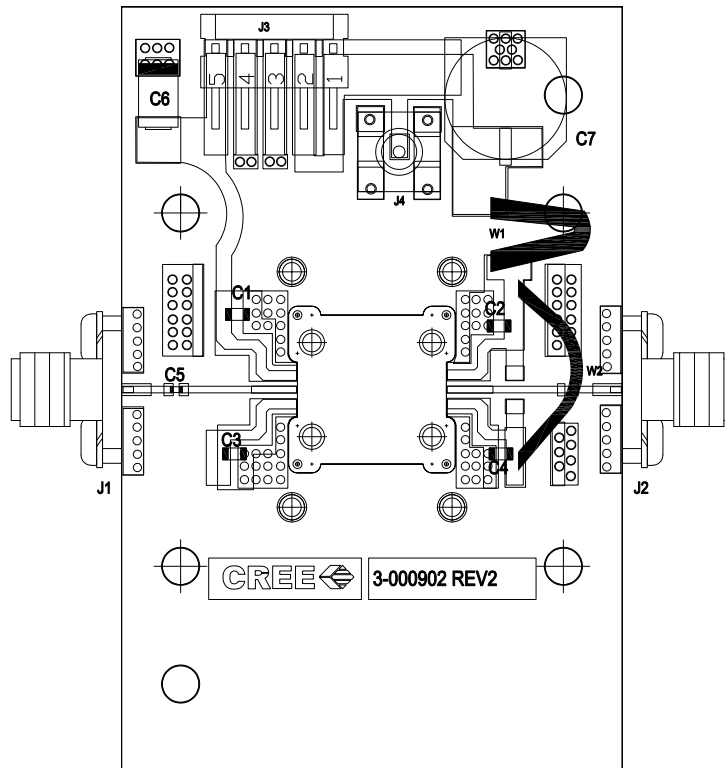




**CMPA5259050F-TB Demonstration Amplifier Schematic**



**CMPA5259050F-TB Demonstration Amplifier Circuit Outline**

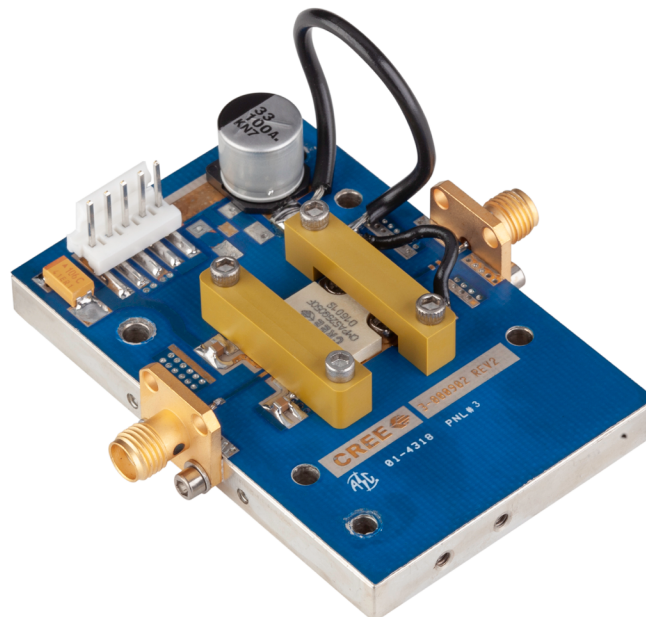




## CMPA5259050F-TB Demonstration Amplifier Circuit Bill of Materials

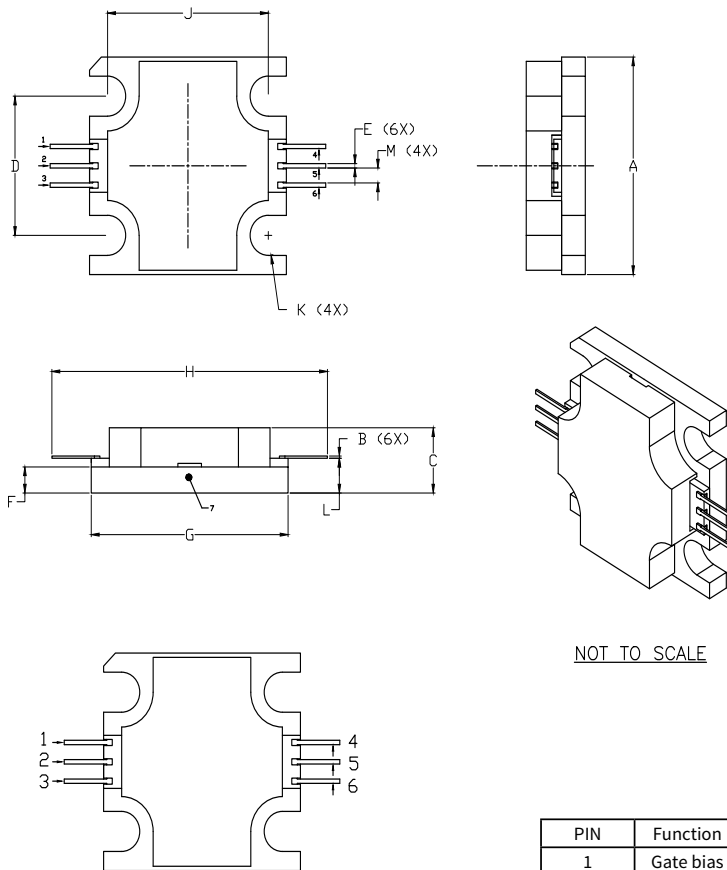
Designator	Description	Qty
C5	CAP, 3.9pF, +/-0.1pF, 0402, ATC	1
C7	CAP, 33 UF, 20%, G CASE	1
C1, C2, C3, C4	CAP CER 0.1UF 100V 10% X7R 0805	4
C6	CAP 10UF 16V TANTALUM, 2312	1
	PCB, RF35, 10 MIL THK	1
J1, J2	CONN, SMA, PANEL MOUNT JACK, FL	2
J3	HEADER RT>PLZ .1CEN LK 5POS	1
W1, W2	WIRE, BLACK, 22 AWG	2
J4	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1

## CMPA5259050F-AMP Demonstration Amplifier Circuit





**Product Dimensions CMPA5259050F (Package Type – 440219)**



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	Ø .092		2.34	
L	0.075	0.085	1.905	2.159
M	0.032	0.040	0.82	1.02

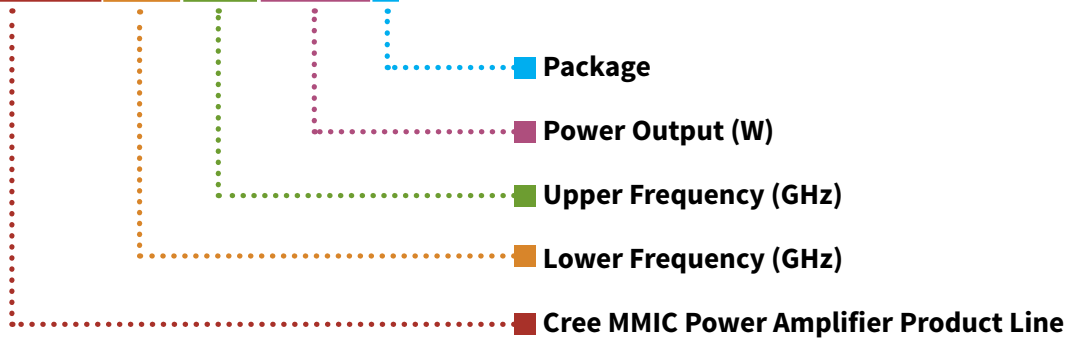
PIN	Function
1	Gate bias
2	RF <sub>IN</sub>
3	Gate bias
4	Drain bias
5	RF <sub>OUT</sub>
6	Drain bias
7	Source





Part Number System

# CMPA5259050F



Parameter	Value	Units
Lower Frequency	4.9	GHz
Upper Frequency <sup>1</sup>	5.9	GHz
Power Output	50	W
Package	Flange	-

**Table 1.**

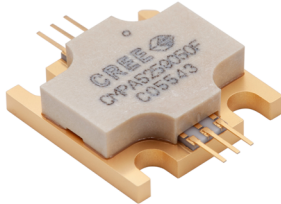
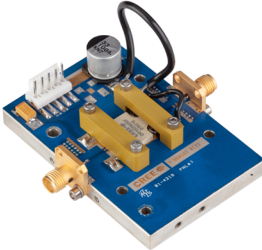
**Note<sup>1</sup>:** Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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

**Table 2.**



**Product Ordering Information**

Order Number	Description	Unit of Measure	Image
CMPA5259050F	GaN MMIC	Each	
CMPA5259050F-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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