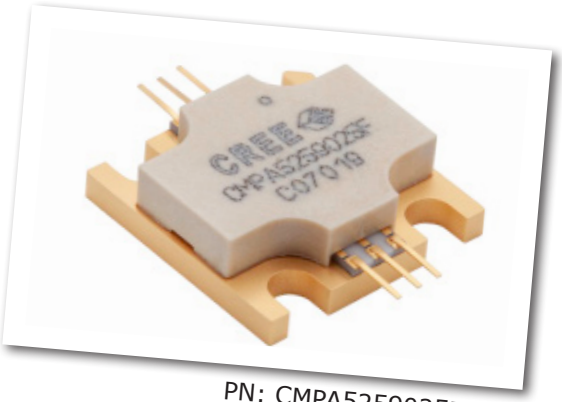
CMPA5259025F

25 W, 5200 - 5900 MHz, 28 V, GaN MMIC for Radar Power Amplifiers

Cree's CMPA5259025F is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) designed specifically for high efficiency, high gain, and wide bandwidth capabilities, which makes CMPA5259025F ideal for 5.2 - 5.9 GHz Radar amplifier applications. The transistor is supplied in a ceramic/metal flange package.



PN: CMPA5259025F
Package Type: 440219

Typical Performance Over 5.2-5.9 GHz (T_C = 25˚C) of Demonstration Amplifier

Parameter	5.2 GHz	5.5 GHz	5.9 GHz	Units
Small Signal Gain	33.6	31.9	32.2	dB
Output Power	38.5	39.6	34.8	W
Efficiency	53.5	51.3	47.2	%
Input Return Loss	-13.5	-15.5	-4.8	dB

Note:
100 µsec Pulse Width, 10% Duty Cycle, P_{IN}= 22 dBm

Features

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

Applications

- Radar

RoHS

Rev 0.1 – September 2018

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

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	V_{DSS}	84	V_{DC}	25˚C
Gate-source Voltage	V_{GS}	-10, +2	V_{DC}	25˚C
Storage Temperature	T_{STG}	-55, +150	˚C	
Operating Junction Temperature	T_J	225	˚C	
Soldering Temperature	T_S	245	˚C	
Screw Torque	τ	60	in-oz	
Forward Gate Current	I^G	8	mA	25˚C
Thermal Resistance, Junction to Case[1]	$R_{\theta JC}$	1.66	˚C/W	100 usec, 10%, 85˚C
Case Operating Temperature	T_C	-40, +105	˚C	

Notes:

[1] Measured for the CMPA5259025F at P_{DISS} = 35 W.

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 to 250 V)	JEDEC JESD22 C101-C

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Electrical Characteristics (T_C = 25°C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.0	-2.5	-	V_{DC}	V_{DS} = 10 V, I_{DS} = 500 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V_{DC}	V_{DS} = 10 V, I_D = 500 mA
Saturated Drain Current	I_{DS}	16.4	18.6	–	A	V_{DS} = 6 V, V_{GS} = 2 V
Drain-Source Breakdown Voltage	V_{BD}	84	100	–	V_{DC}	V_{GS} = -8 V, I_{DS} = 500 mA
Case Operating Temperature	T_C	-10		+105	°C	
RF Characteristics[2]						
Small Signal Gain$_1$	G_{SS}	-	32	–	dB	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.2 GHz, P_{IN}= -20 dBm
Small Signal Gain$_2$	G_{SS}	-	32	–	dB	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.5 GHz, P_{IN}= -20 dBm
Small Signal Gain$_3$	G_{SS}	-	32	–	dB	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.9 GHz, P_{IN}= -20 dBm
Power Output$_1$	P_{OUT}	-	38.5	-	W	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.2 GHz, P_{IN}= 22 dBm
Power Output$_2$	P_{OUT}	-	39.6	-	W	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.5 GHz, P_{IN}= 22 dBm
Power Output$_3$	P_{OUT}	-	34.8	-	W	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.9 GHz, P_{IN}= 22 dBm
Power Added Efficiency$_1$	PAE	-	54	-	%	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.2 GHz, P_{IN}= 22 dBm
Power Added Efficiency$_2$	PAE	-	51	-	%	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.5 GHz, P_{IN}= 22 dBm
Power Added Efficiency$_3$	PAE	-	47	-	%	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.9 GHz, P_{IN}= 22 dBm
Power Gain$_1$	G_P	-	24	-	dB	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.2 GHz, P_{IN}= 22 dBm
Power Gain$_2$	G_P	-	24	-	dB	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.5 GHz, P_{IN}= 22 dBm
Power Gain$_3$	G_P	-	23.4	-	dB	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.9 GHz, P_{IN}= 22 dBm
Input Return Loss	S11	-	-10	-	dB	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.2 - 5.9 GHz, P_{IN}= -20 dBm
Output Return Loss	S22	-	-15	-	dB	V_{DD} = 28 V, I_{DQ} = 500 mA, Freq = 5.2 - 5.9 GHz, P_{IN}= -20 dBm
Output Mismatch Stress	VSWR	–	3:1	-	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 500 mA, P_{IN}= 22 dBm

Notes:

[1] Measured on wafer prior to packaging.

[2] Measured in CMPA5259025F-TB test fixture.

[3] Drain Efficiency = P_{OUT}/P_{DC}

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Typical Pulsed Performance of the CMPA5259025F

Figure 1. - Gain and Input Return Loss vs. Frequency of the CMPA5259025F Measured in CMPA5259025F-AMP Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 0.5 A, T_C = 25°C

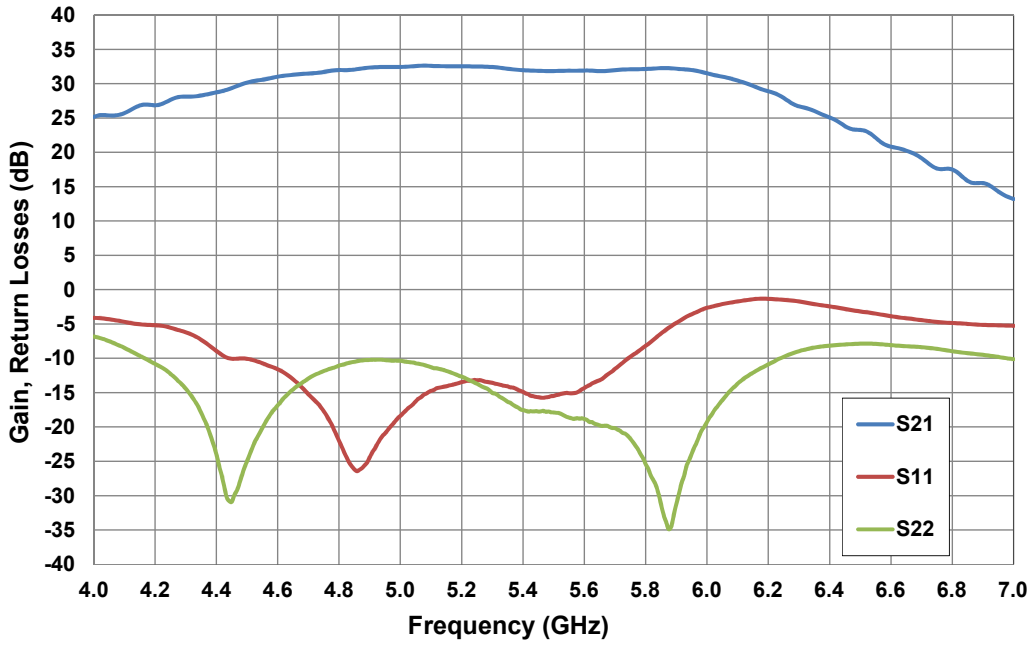
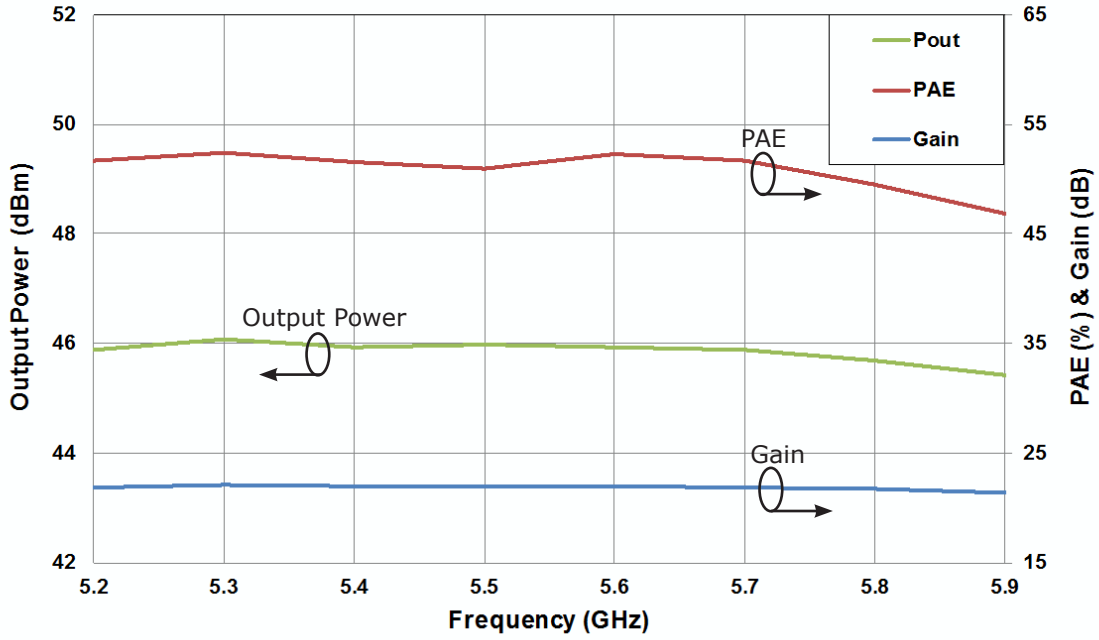


Figure 2. - Output Power, Gain, and Power Added Efficiency vs. Frequency of the CMPA5259025F Measured in CMPA525025F-AMP Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 0.5 A, P_{IN} = 24 dBm, Pulse Width = 100 µs, Duty Cycle = 10%, T_C = 25°C



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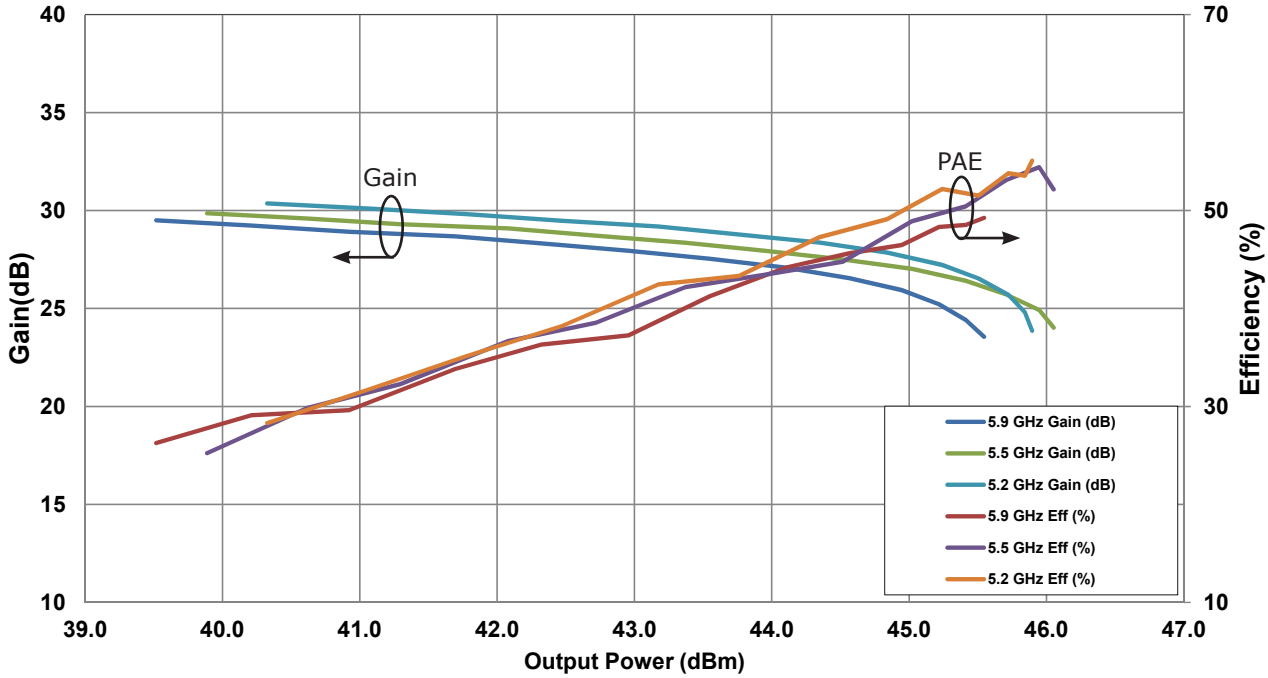
Typical Pulsed Performance of the CMPA5259025F

Figure 3. - Gain and Power Added Efficiency vs. Frequency of the CMPA529025F Measured in CMPA525025F-AMP Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 0.5 A, Pulse Width = 100 µs, Duty Cycle = 10%, T_C = 25°C



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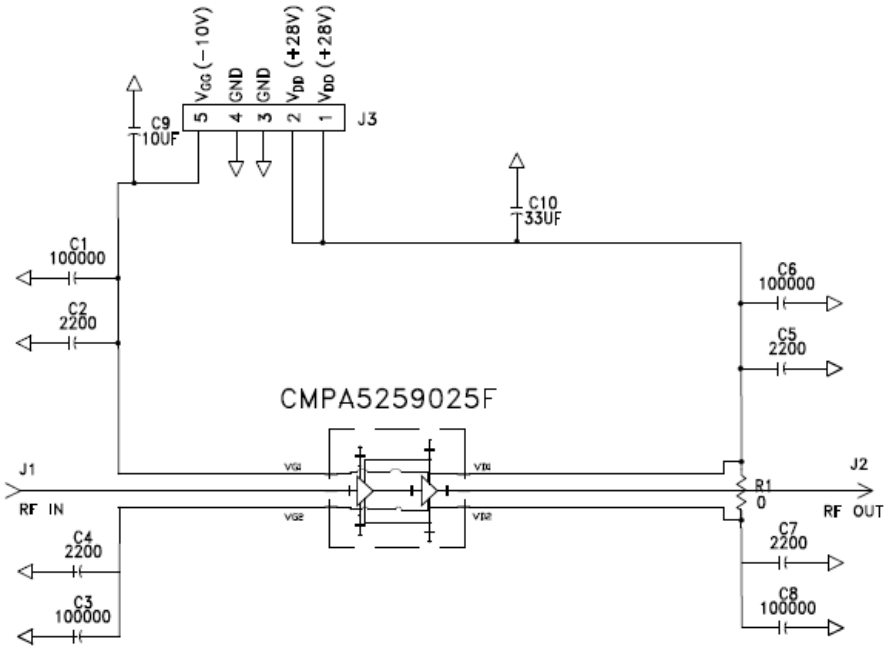
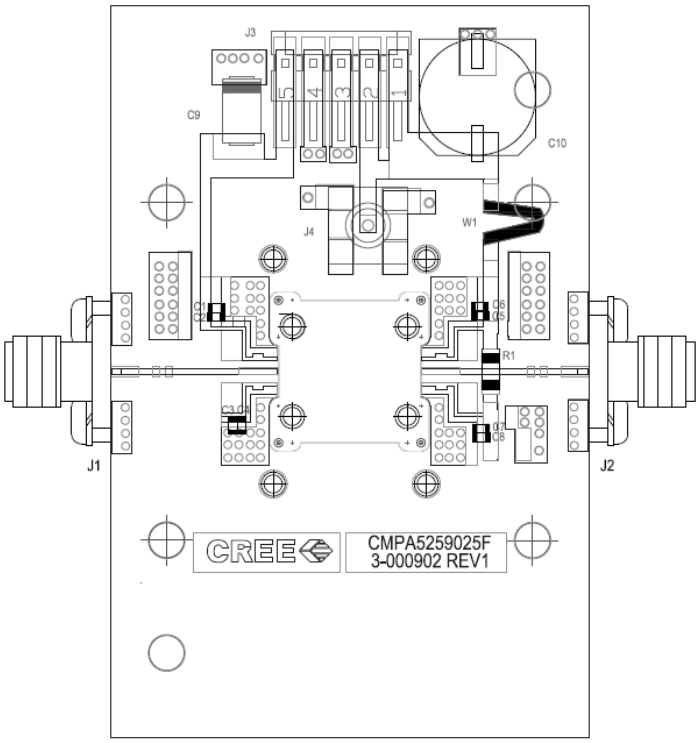
CMPA5259025F-TB Demonstration Amplifier Schematic



CMPA5259025F-TB Demonstration Amplifier Circuit Outline



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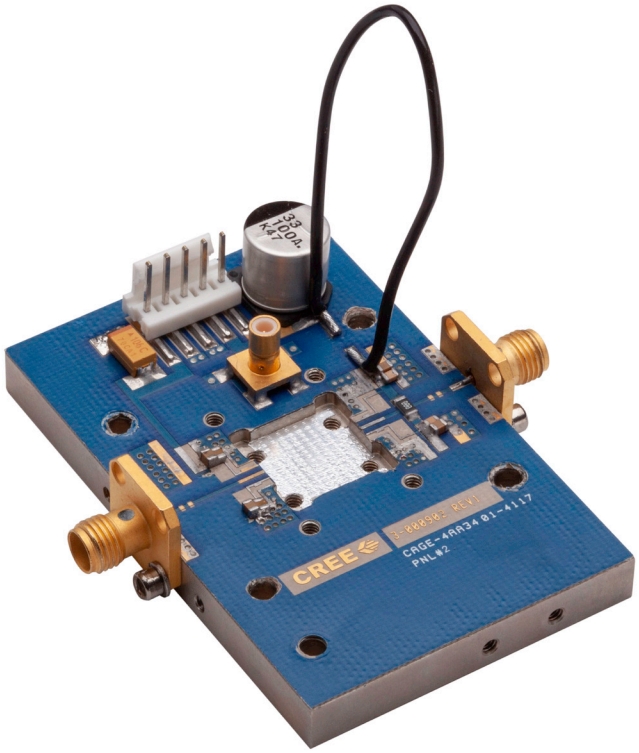
CMPA5259025F-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES 0 OHM, SMT, 1206, 125 mW	1
C1, C3, C6, C8	CAP, 100000 pF, (0.1 UF) +/- 10%, 100 V, 0805	4
C2, C4, C5, C7	CAP, 0805, 2200 pF, 100 V, 0805	4
C9	CAP, 10 UF, 16 V, Tantalum	1
C10	CAP, 33 UF, 20%, G Case	1
J3	Header RT> PLZ .1 CEN LK 5POS	1
J1, J2	CONN, SMA, Female, 2-Hole, Flange	2
J4	CONN, SMB, Straight Jack Receptacle, SMT, 50 OHM, Au Plated	1
	Baseplate, AL, 2.60 X 1.7 X 0.25	1
	#4 Split Lockwasher SS	4
	2-56 SoC HD Screw 3/16 SS	4
	#2 Split Lockwasher SS	4
	4-40 SOC HD Screw 3/8" SS	4
	PCB, Taconics, RF 35, CMPA5259025F 0.010" THK	1
W1	Wire, Black, 22 AWG ~ 3"	

CMPA5259025F-TB Demonstration Amplifier Circuit



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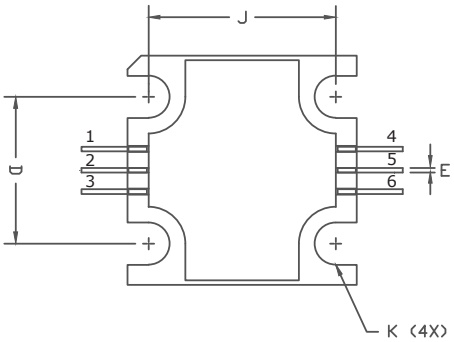
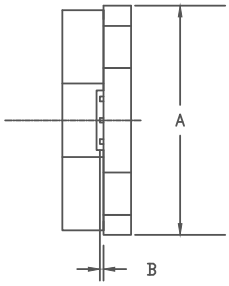
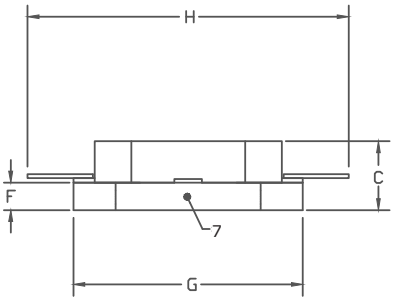
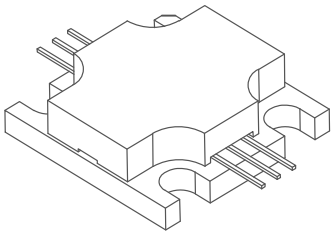
Product Dimensions CMPA5259025F (Package Type — 440219)









NOT TO SCALE

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

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.495	0.505	12.57	12.82
B	0.007	0.009	0.178	0.229
C	0.140	0.160	3.56	4.06
D	0.315	0.325	8.00	8.25
E	0.009	0.011	0.229	0.279
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	

PIN	
1	Gate bias
2	RF_{IN}
3	Gate bias
4	Drain bias
5	RF_{OUT}
6	Drain bias
7	Source

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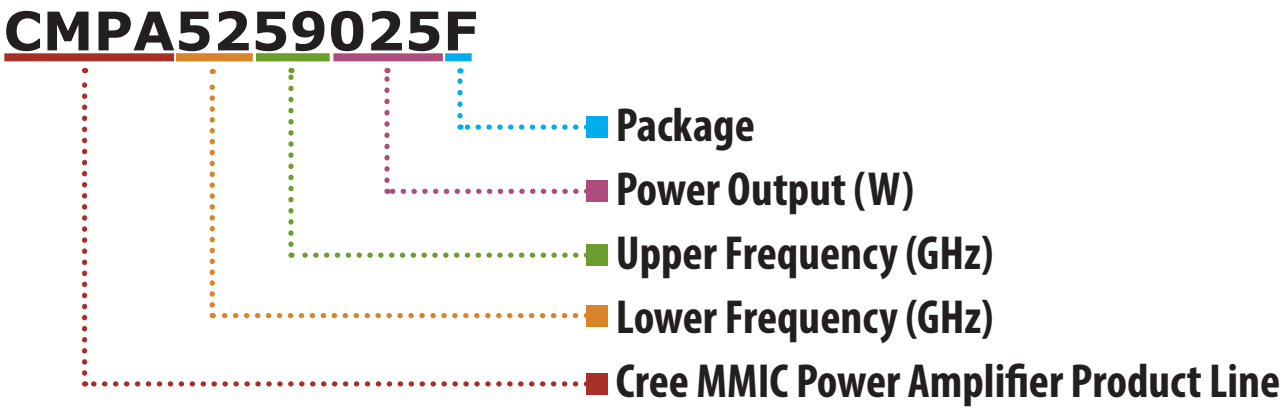
Part Number System



Parameter	Value	Units
Lower Frequency	5.2	GHz
Upper Frequency[1]	5.9	GHz
Power Output	25	W
Package	Flange	-

Table 1.

Note[1]: 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.

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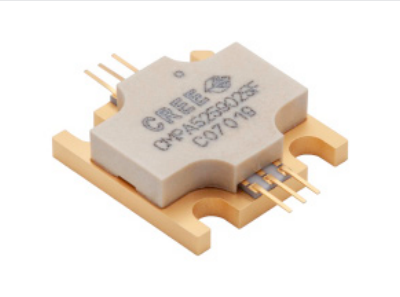
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA5259025F	GaN MMIC	Each	
CMPA5259025F-AMP	Test board with GaN MMIC installed	Each	

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