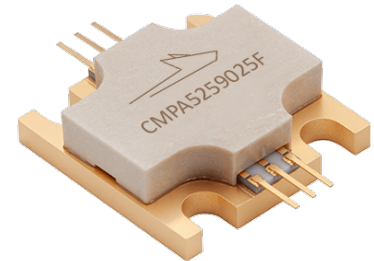


CMPA5259025F

25 W, 5.2 – 5.9 GHz, 28 V, GaN MMIC for Radar Power Amplifiers

Description

Wolfspeed's CMPA5259025F is a gallium-nitride (GaN) high electron mobility transistor (HEMT) based monolithic microwave integrated circuit (MMIC) 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.



Package Types: 440219
PN's: CMPA5259025F

Features

- 30 dB small signal gain
- 50% efficiency at P_{SAT}
- Operation up to 28 V
- High breakdown voltage

Applications

- Radar

Typical Performance Over 5.2 - 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	33.6	31.9	32.2	dB
Output Power ¹	38.5	39.6	34.8	W
Efficiency ¹	53.5	51.3	47.2	%
Input Return Loss	-13.5	-15.5	-4.8	dB

Note:

¹ 100 μsec pulse width, 10% duty cycle, $P_{IN} = 22\text{ dBm}$.





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	40	in-oz	
Forward Gate Current	I_G	9.6	mA	25 °C
Thermal Resistance, Junction to Case ¹	$R_{\theta JC}$	1.66	°C/W	100 μ s, 10%, 85 °C
Case Operating Temperature	T_C	-40, +105	°C	

Note:

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

Electrical Characteristics ($T_C = 25$ °C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics¹						
Gate Threshold Voltage	$V_{GS(TH)}$	-3.6	-2.8	-2.4	V_{DC}	$V_{DS} = 10$ V, $I_D = 16.5$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	$V_{DD} = 28$ V, $I_D = 1.2$ A
Saturated Drain Current	I_{DS}	6.9	9.6	–	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	V_{BD}	84	–	–	V_{DC}	$V_{GS} = -8$ V, $I_D = 16.5$ mA
RF Characteristics²						
Small Signal Gain	S21	24	32	–	dB	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.2 - 5.9 GHz, $P_{IN} = -20$ 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	-4	dB	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.2 - 5.9 GHz, $P_{IN} = -20$ dBm
Output Power	P_{OUT}	25	38.5	–	W	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.2 GHz, $P_{IN} = 22$ dBm
Output Power	P_{OUT}	25	39.6	–	W	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.5 GHz, $P_{IN} = 22$ dBm
Output Power	P_{OUT}	25	34.8	–	W	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.9 GHz, $P_{IN} = 22$ dBm
Power Added Efficiency	PAE	40	54	–	%	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.2 GHz, $P_{IN} = 22$ dBm
Power Added Efficiency	PAE	40	51	–	%	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.5 GHz, $P_{IN} = 22$ dBm
Power Added Efficiency	PAE	35	47	–	%	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.9 GHz, $P_{IN} = 22$ dBm
Power Gain	G_p	–	24	–	dB	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.2 GHz, $P_{IN} = 22$ dBm
Power Gain	G_p	–	24	–	dB	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.5 GHz, $P_{IN} = 22$ dBm
Power Gain	G_p	–	23.4	–	dB	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, Freq = 5.9 GHz, $P_{IN} = 22$ 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 at pulse width = 100 μ s, duty cycle = 10%.

Typical Pulsed Performance

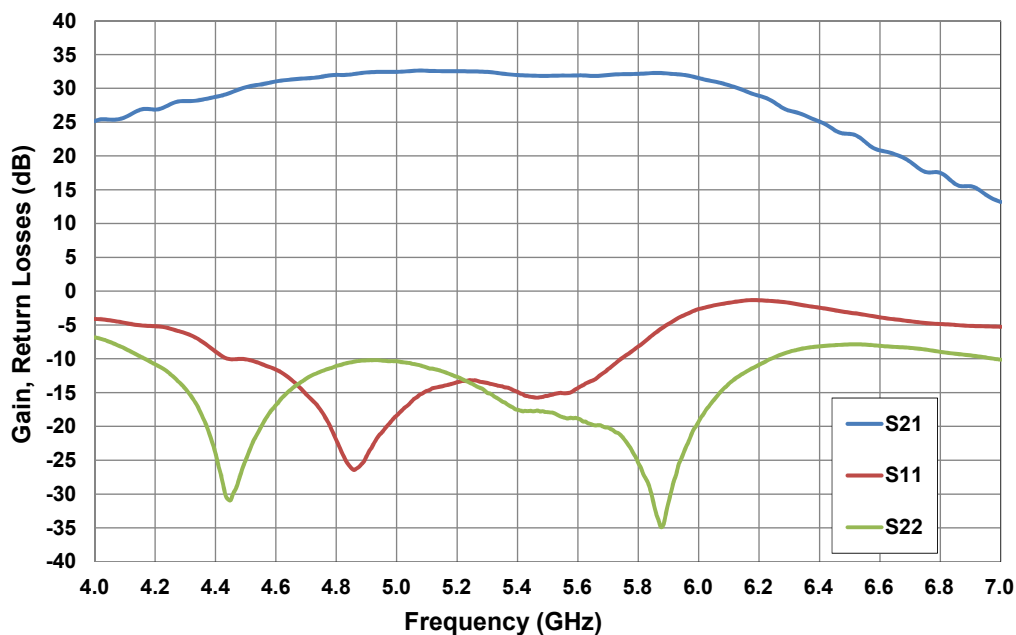


Figure 1. Gain and Return Loss vs Frequency of the CMPA5259025F
 Measured in CMPA5259025F-AMP Amplifier Circuit
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 0.5\text{ A}$, $T_c = 25\text{ }^\circ\text{C}$

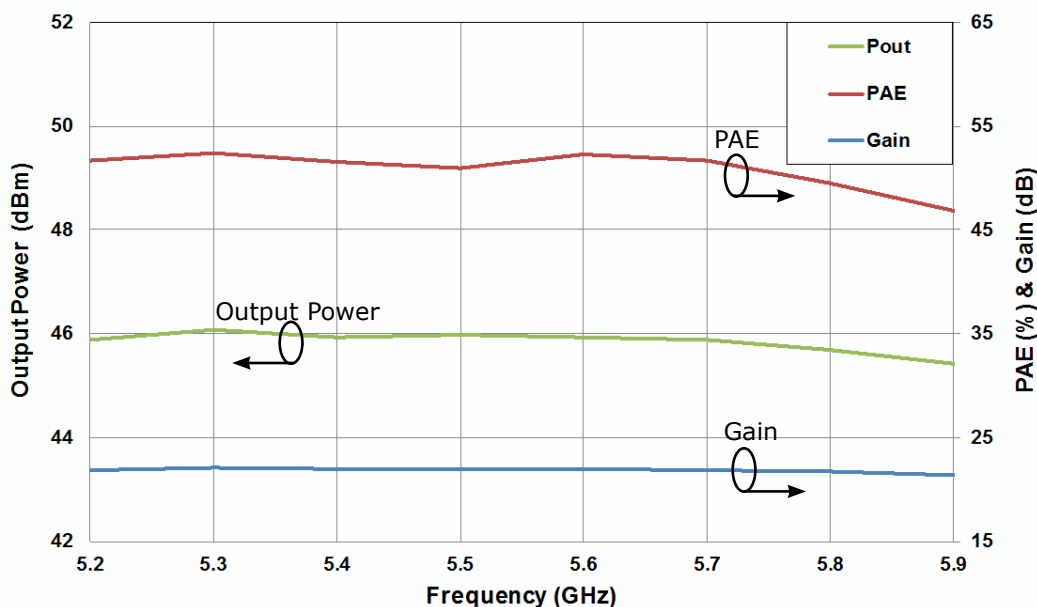


Figure 2. Output Power, Gain, and Power Added Efficiency vs Frequency of the CMPA5259025F
 Measured in CMPA5259025F-AMP Amplifier Circuit
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 0.5\text{ A}$, $P_{IN} = 24\text{ dBm}$, Pulse Width = 100 μs , Duty Cycle = 10%, $T_c = 25\text{ }^\circ\text{C}$

Typical Pulsed Performance

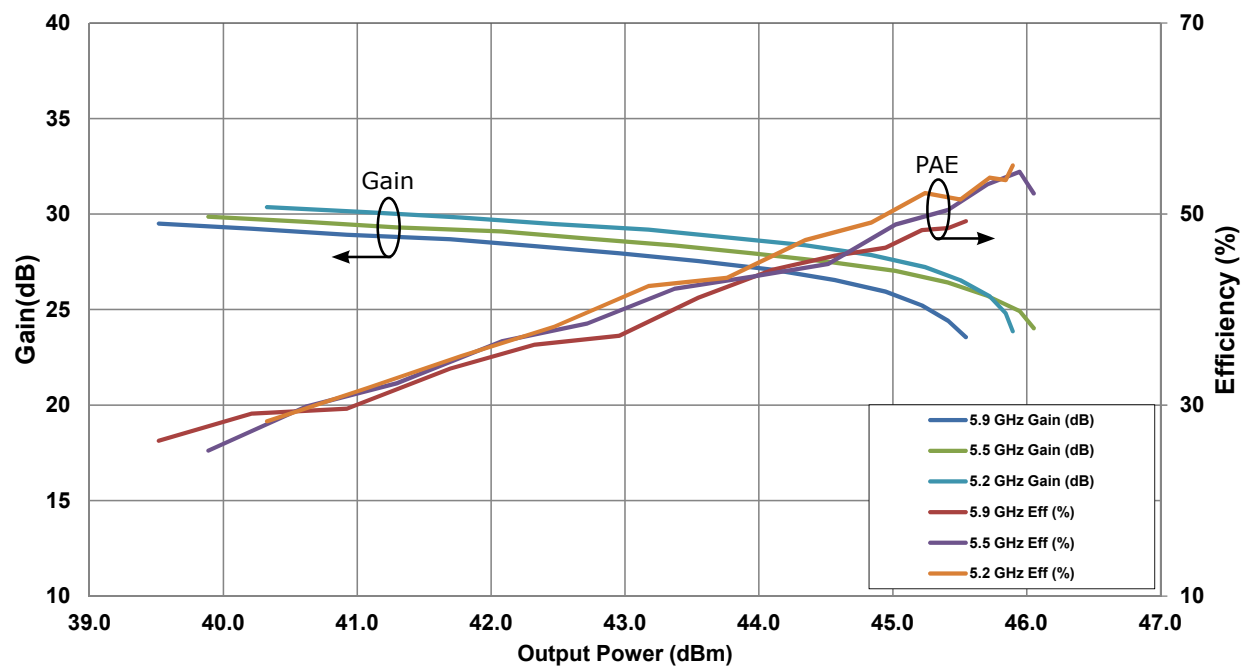
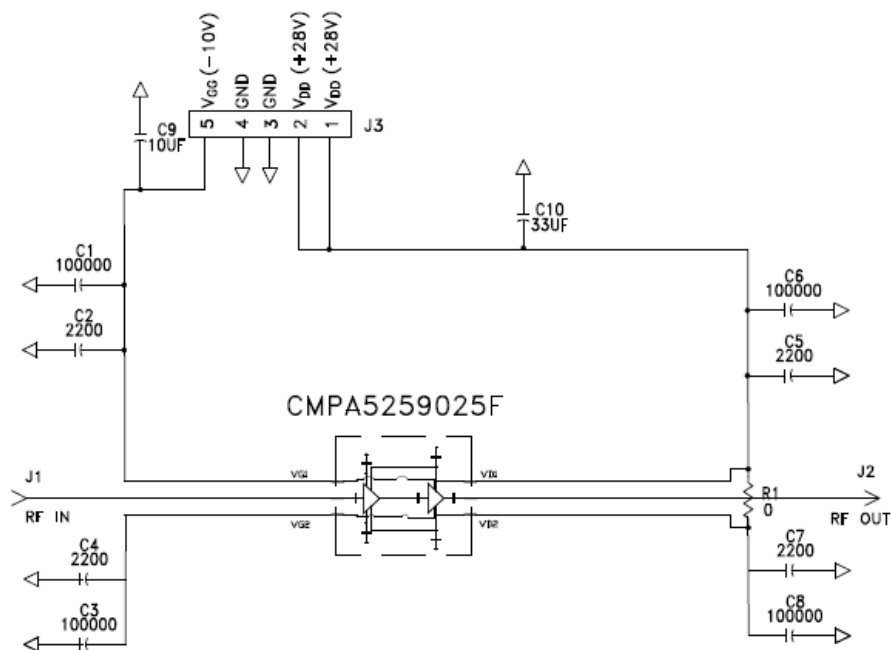
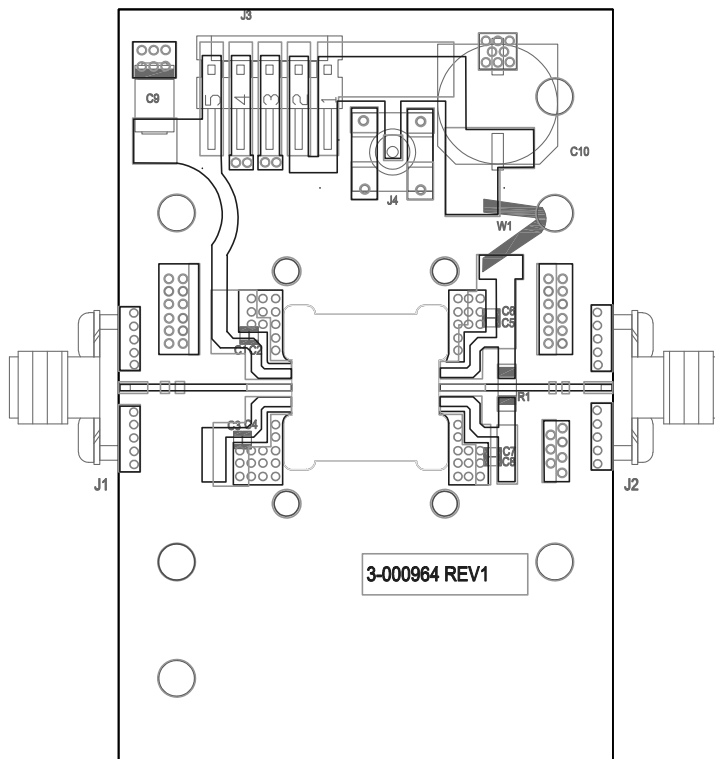


Figure 3. Gain and Power Added Efficiency vs Frequency of the CMPA5259025F
 Measured in CMPA525025F-AMP Amplifier Circuit
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 0.5\text{ A}$, Pulse Width = 100 μs , Duty Cycle = 10%, $T_C = 25\text{ }^{\circ}\text{C}$

CMPA5259025F-AMP Demonstration Amplifier Schematic



CMPA5259025F-AMP Demonstration Amplifier Circuit Outline

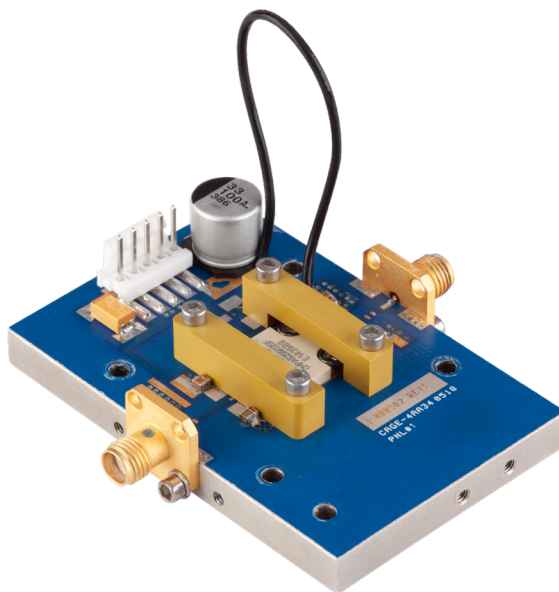




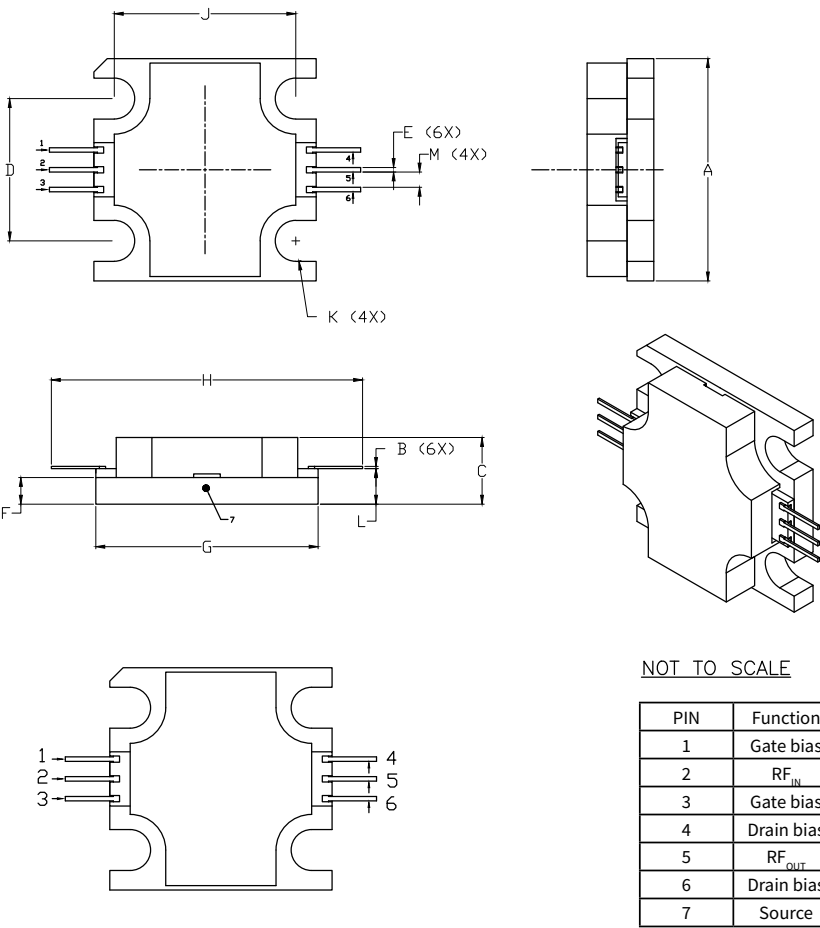
CMPA5259025F-TB Demonstration Amplifier Circuit Bill of Materials

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-AMP Demonstration Amplifier Circuit



Product Dimensions CMPA5259025F (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

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

Part Number System

CMPA5259025F

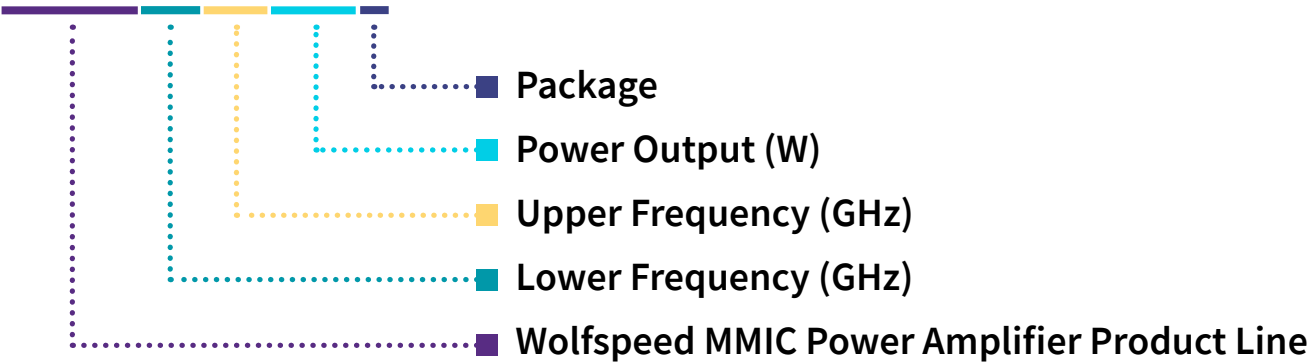


Table 1.

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

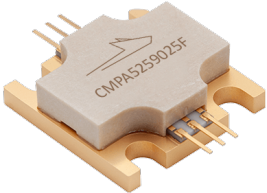
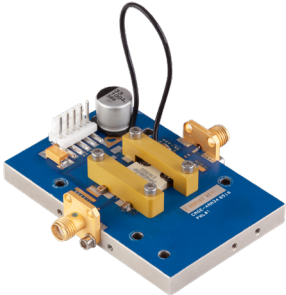
Note:
¹Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Table 2.

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:	1 A = 10.0 GHz 2 H = 27.0 GHz



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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