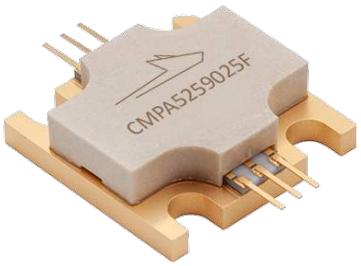
CMPA5259025F

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 °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 dBm.

RoHS compliant

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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 µs, 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 Characteristics[1]						
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 Characteristics[2]						
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 µs, duty cycle = 10%.

Typical Pulsed Performance

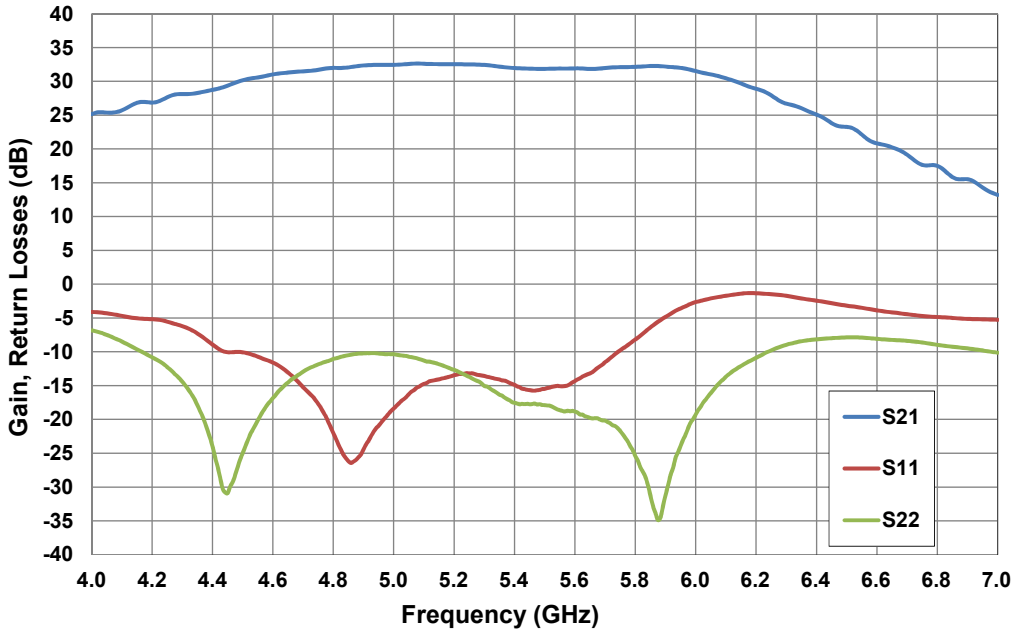


Figure 1. Gain and Return Loss vs Frequency of the CMPA5259025F
Measured in CMPA5259025F-AMP Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 0.5 A, T_C = 25 °C

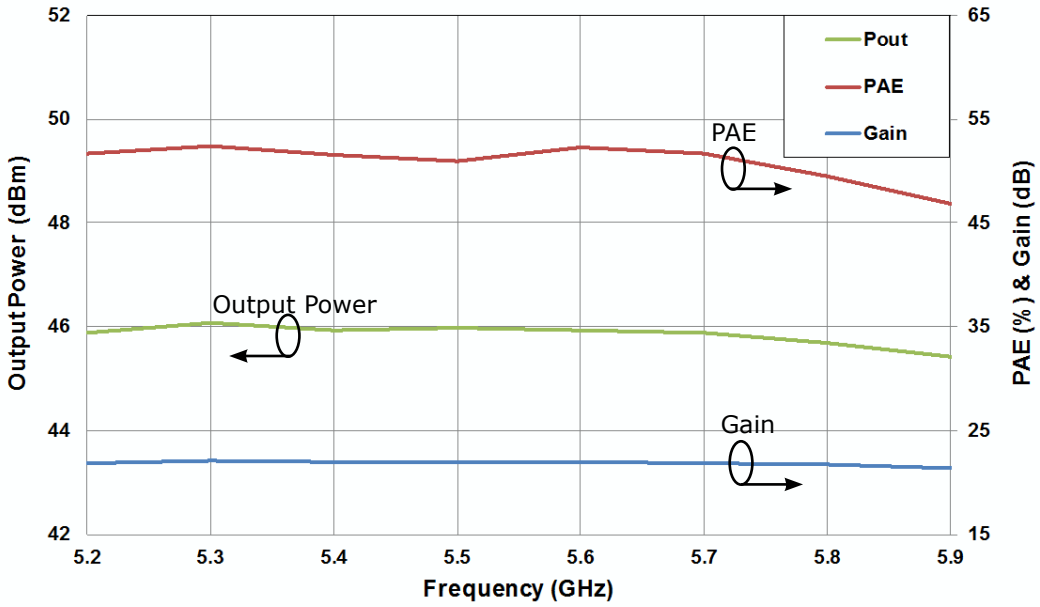


Figure 2. Output Power, Gain, and Power Added Efficiency vs Frequency of the CMPA5259025F
Measured in CMPA525025F-AMP Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 0.5 A, P_{IN} = 24 dBm, Pulse Width = 100 µs, Duty Cycle = 10%, T_C = 25 °C

Typical Pulsed Performance

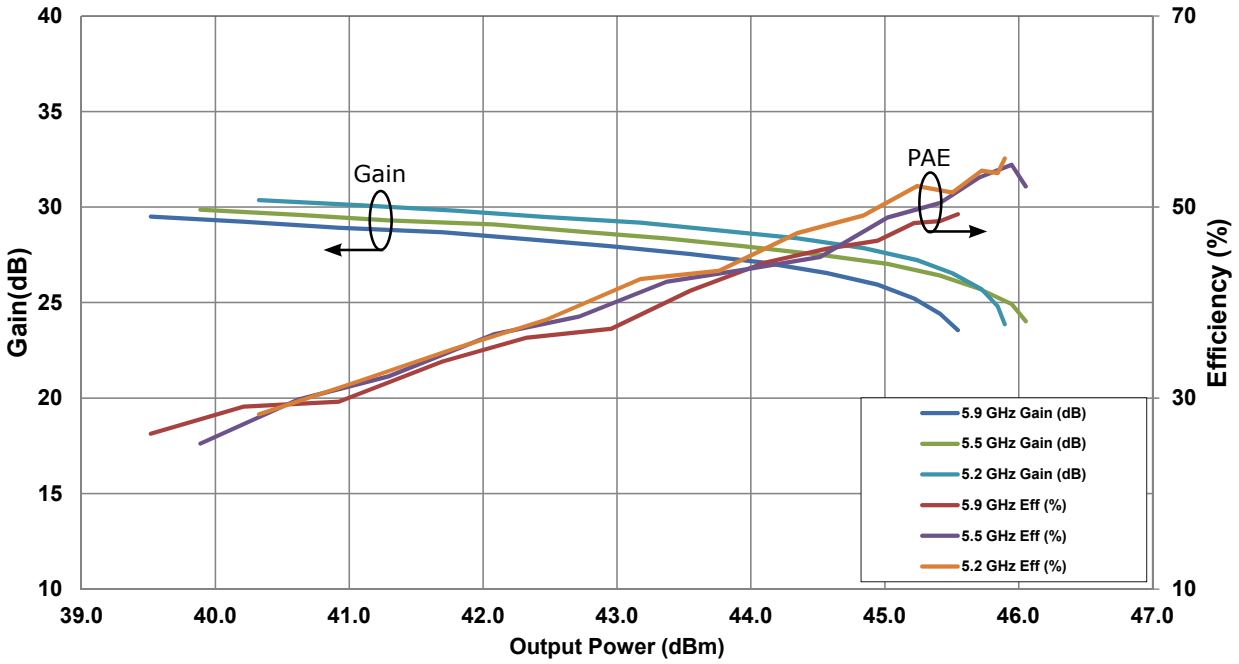
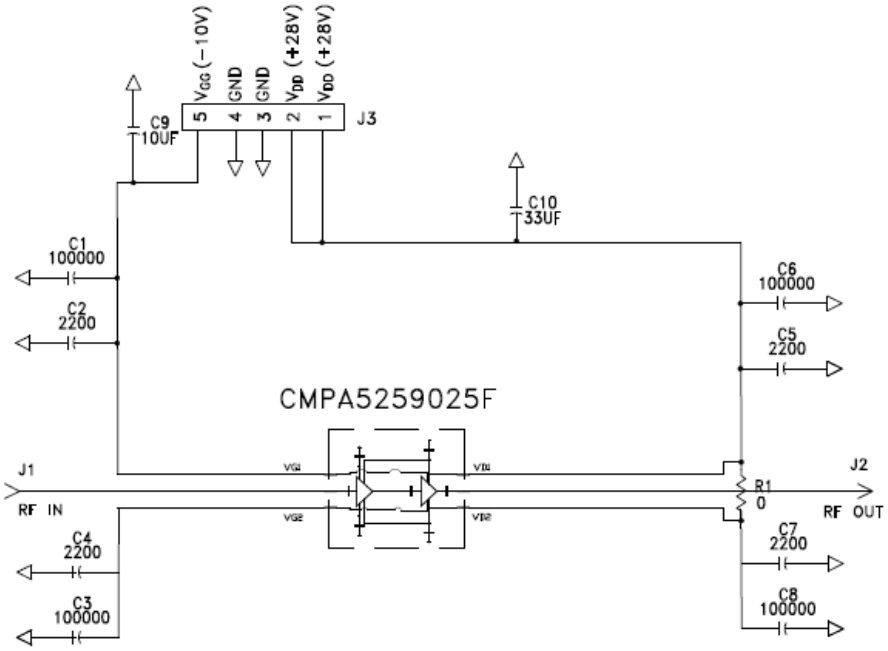
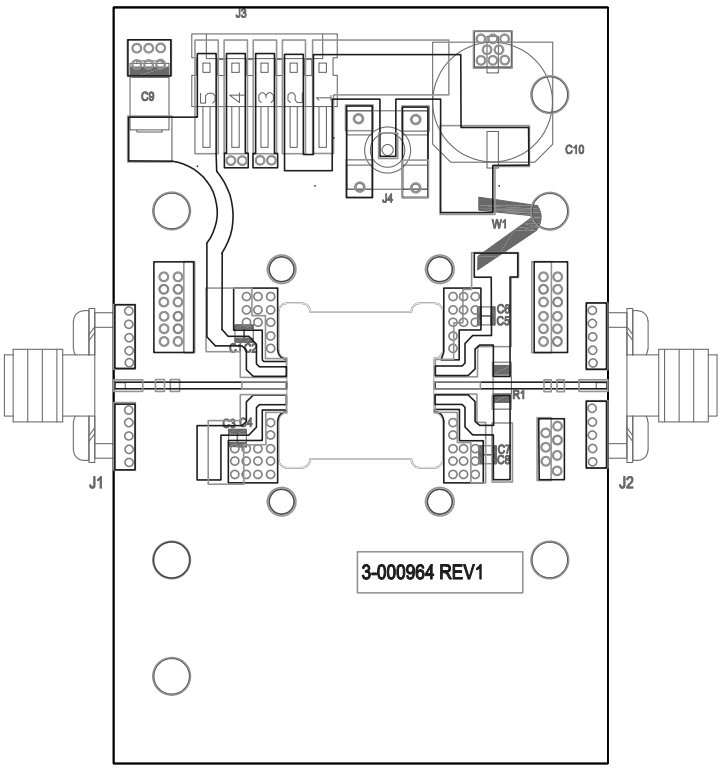


Figure 3. Gain and Power Added Efficiency vs Frequency of the CMPA529025F
Measured in CMPA525025F-AMP Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 0.5 A, Pulse Width = 100 µs, Duty Cycle = 10%, T_C = 25 °C

CMPA5259025F-AMP Demonstration Amplifier Schematic



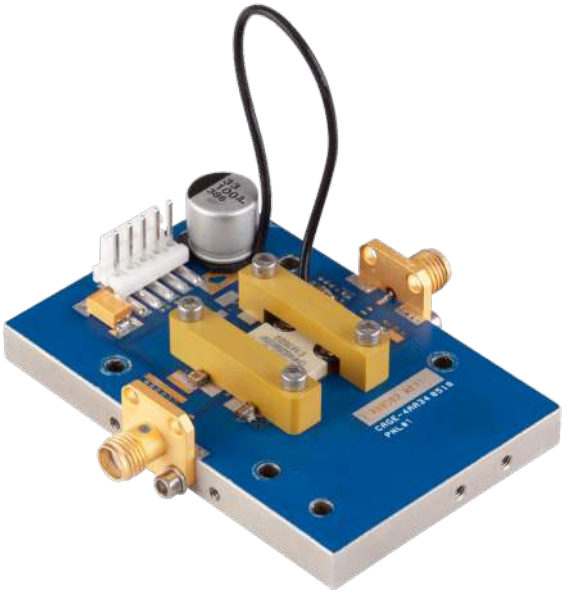
CMPA5259025F-AMP Demonstration Amplifier Circuit Outline



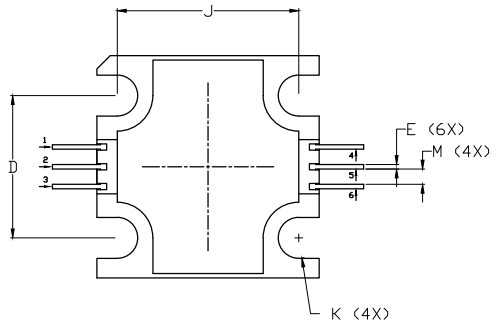
CMPA5259025F-TB Demonstration Amplifier Circuit Bill of Materials

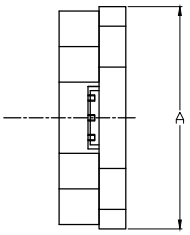
Designator	Description	Qty
R1	RES 0 OHM, SMT, 1206, 125 mW	1
C1, C3, C6, C8	CAP, 100000 pF, (0.1 UF) +/- 10%, 100 V, 0805	4
C2, C4, C5, C7	CAP, 0805, 2200 pF, 100 V, 0805	4
C9	CAP, 10 UF, 16 V, Tantalum	1
C10	CAP, 33 UF, 20%, G Case	1
J3	Header RT> PLZ .1 CEN LK 5POS	1
J1, J2	CONN, SMA, Female, 2-Hole, 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”	

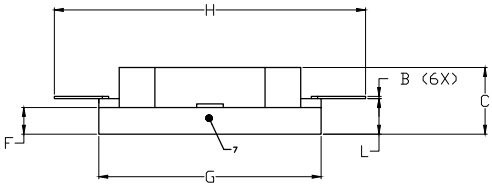
CMPA5259025F-AMP Demonstration Amplifier Circuit

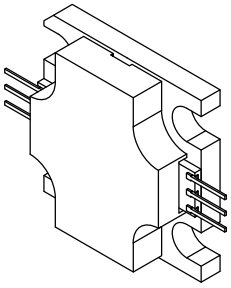


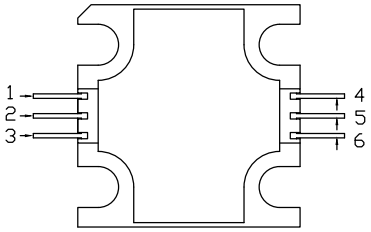
Product Dimensions CMPA5259025F (Package Type — 440219)











NOT TO SCALE

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

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	
	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

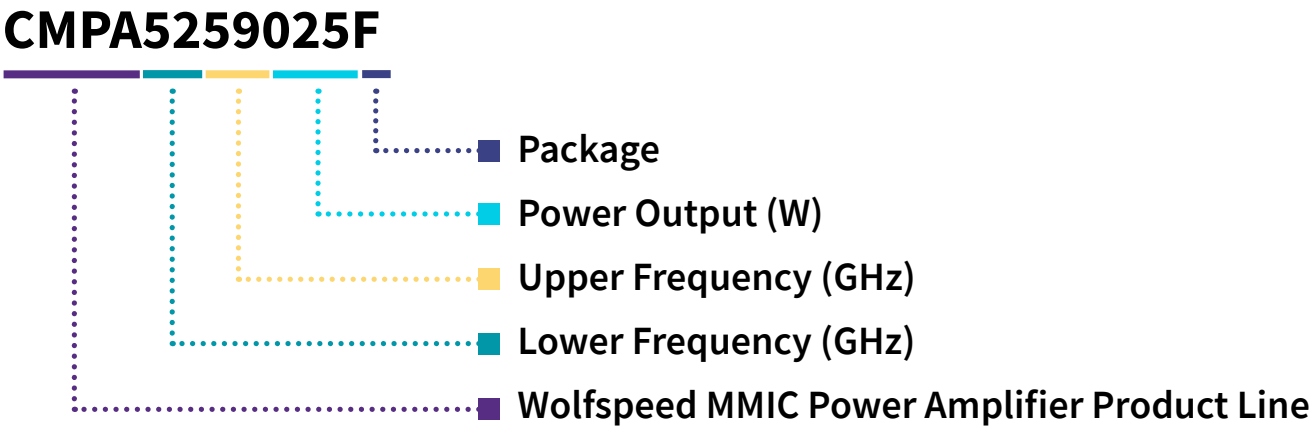


Table 1.

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

Note:
[1] Alpha 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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Notes & Disclaimer

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