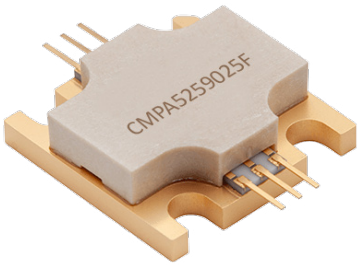
CMPA5259025F

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

Description

The 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

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

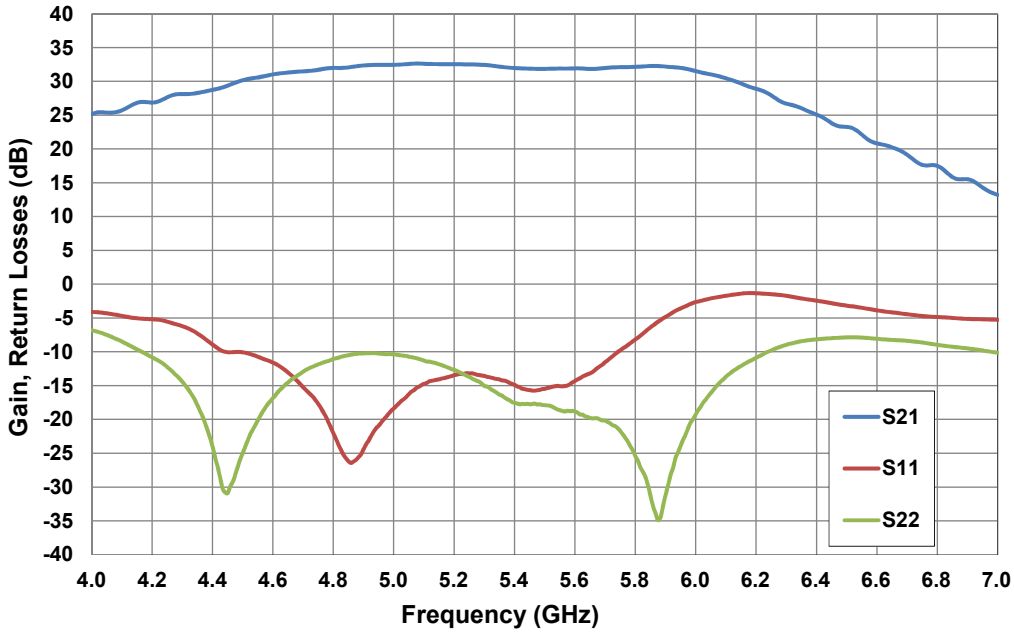


Figure 1. Gain and Return Loss vs Frequency of the CMPA5259025F
Measured in CMPA5259025F-AMP Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 0.5 A, T_C = 25 °C

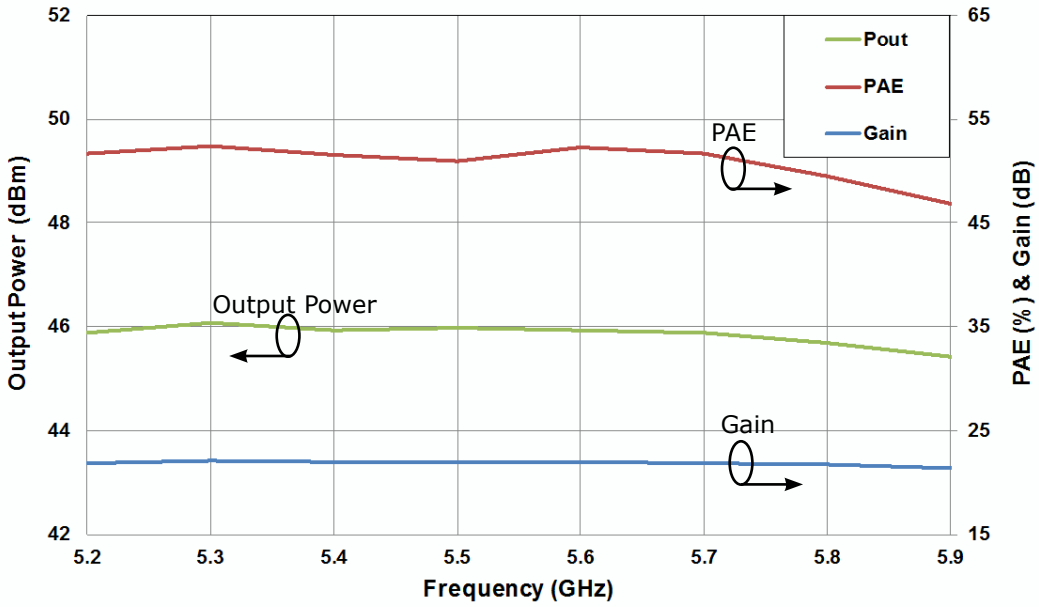


Figure 2. Output Power, Gain, and Power Added Efficiency vs Frequency of the CMPA5259025F
Measured in CMPA525025F-AMP Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 0.5 A, P_{IN} = 24 dBm, Pulse Width = 100 µs, Duty Cycle = 10%, T_C = 25 °C

Typical Pulsed Performance

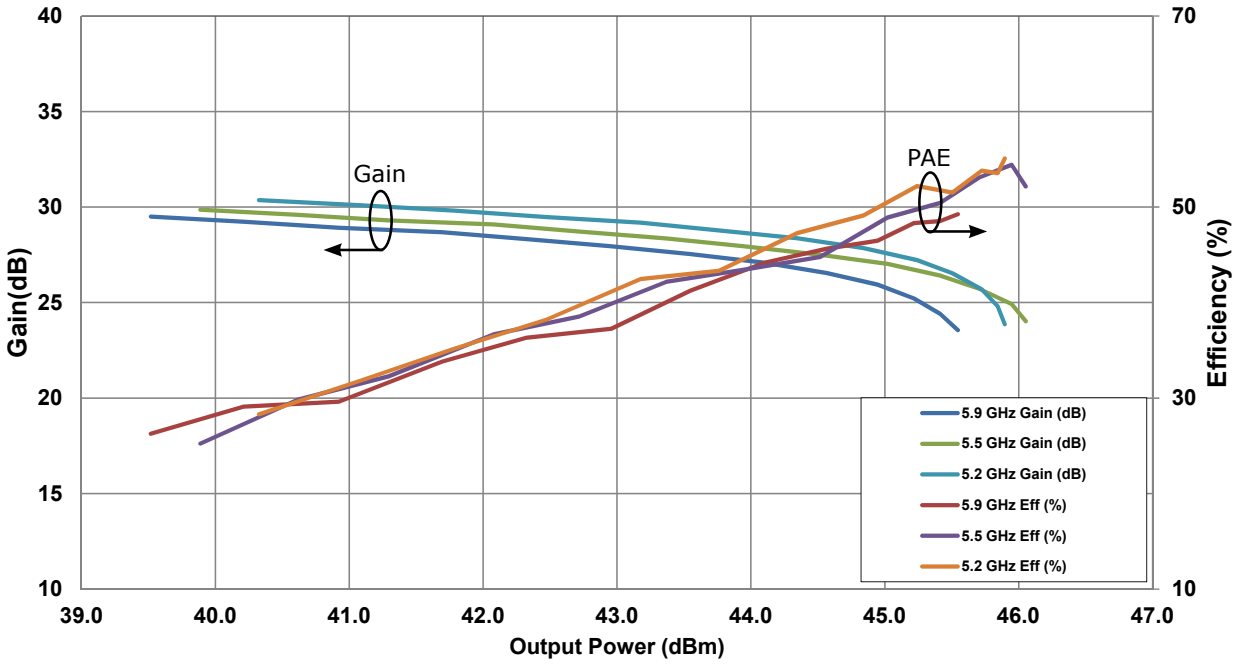
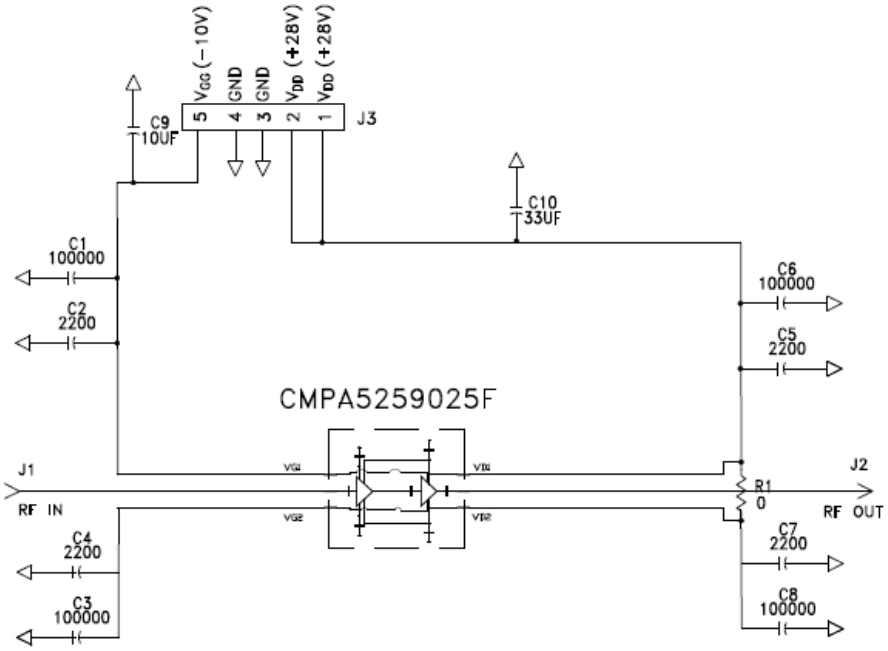
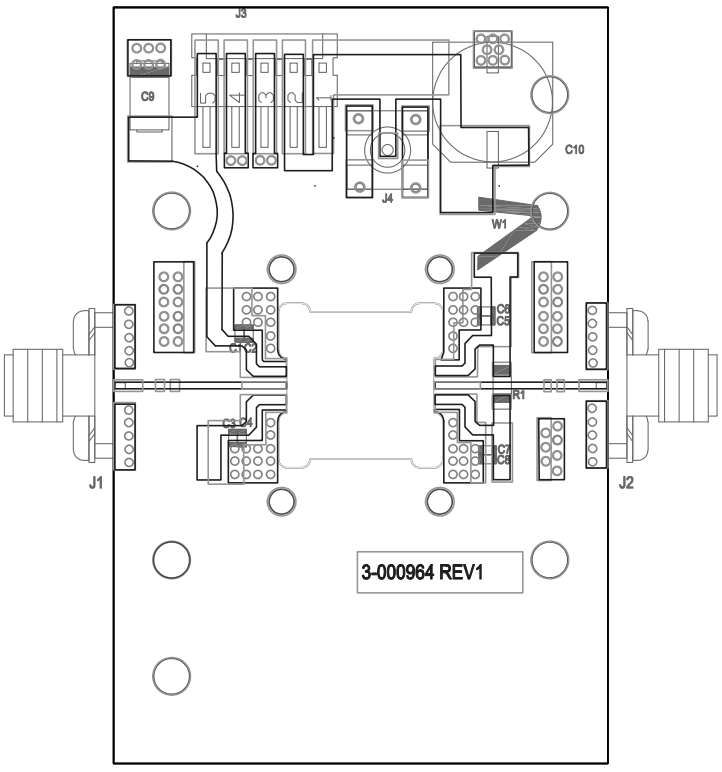


Figure 3. Gain and Power Added Efficiency vs Frequency of the CMPA529025F
Measured in CMPA525025F-AMP Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 0.5 A, Pulse Width = 100 µs, Duty Cycle = 10%, T_C = 25 °C

CMPA5259025F-AMP Demonstration Amplifier Schematic



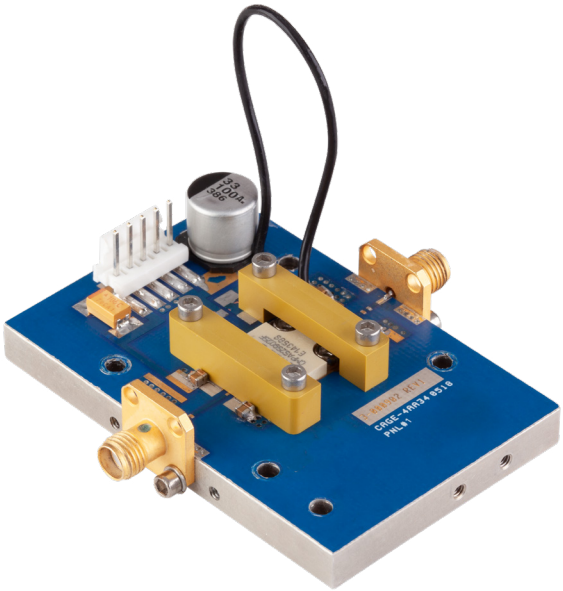
CMPA5259025F-AMP Demonstration Amplifier Circuit Outline



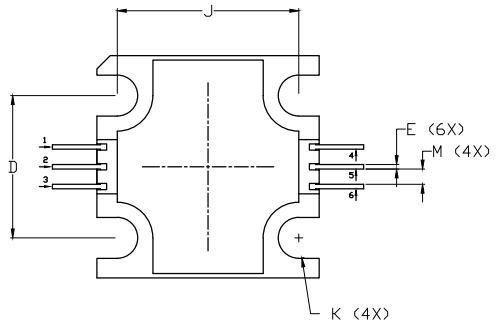
CMPA5259025F-TB Demonstration Amplifier Circuit Bill of Materials

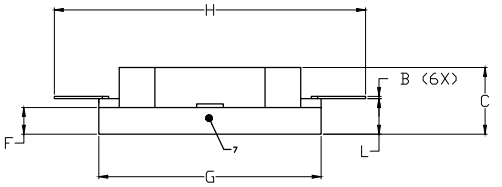
Designator	Description	Qty
R1	RES 0 OHM, SMT, 1206, 125 mW	1
C1, C3, C6, C8	CAP, 100000 pF, (0.1 UF) +/- 10%, 100 V, 0805	4
C2, C4, C5, C7	CAP, 0805, 2200 pF, 100 V, 0805	4
C9	CAP, 10 UF, 16 V, Tantalum	1
C10	CAP, 33 UF, 20%, G Case	1
J3	Header RT> PLZ .1 CEN LK 5POS	1
J1, J2	CONN, SMA, Female, 2-Hole,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

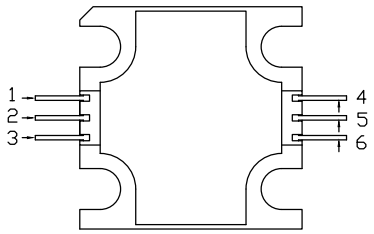
CMPA5259025F-AMP Demonstration Amplifier Circuit

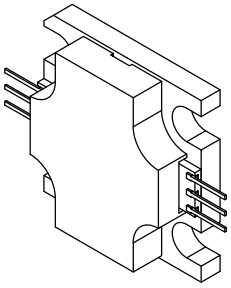


Product Dimensions CMPA5259025F (Package Type — 440219)









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

	INCHES		MILLIMETERS	
DIM	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

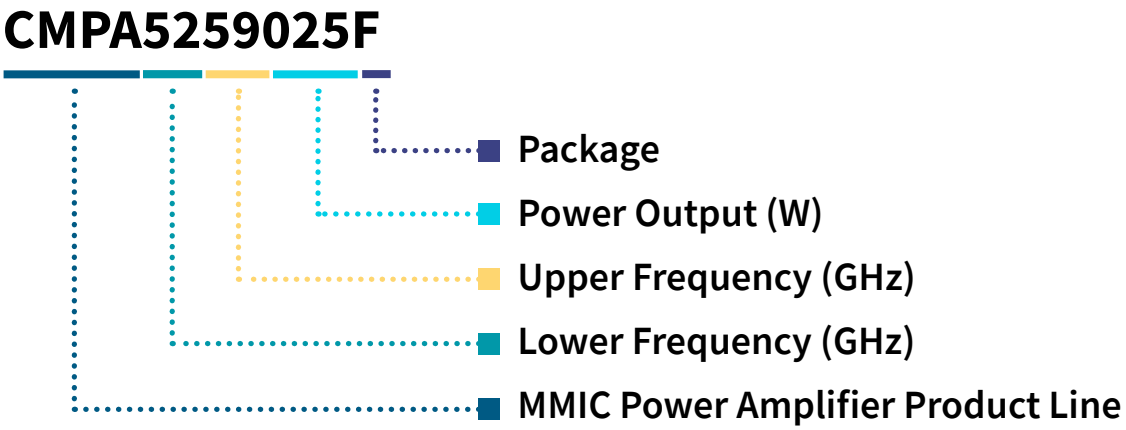


Table 1.

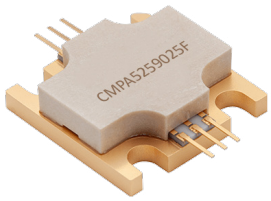
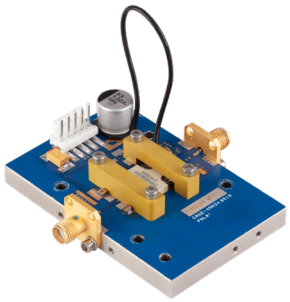
Parameter	Value	Units
Lower Frequency	5.2	GHz
Upper Frequency[1]	5.9	GHz
Power Output	25	W
Package	Flange	–

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	

Notes & Disclaimer

These materials are provided in connection with MACOM’s products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.