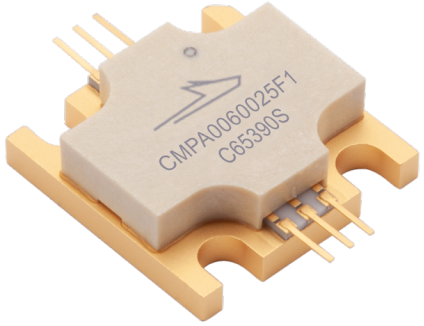
CMPA0060025F1

25 W, 20 MHz - 6.0 GHz, GaN MMIC, Power Amplifier



PN: CMPA0060025F1
Package Type: 440219

Description

Wolfspeed's CMPA0060025F1 is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity and higher thermal conductivity. GaN HEMTs also offer greater power density and wider bandwidths compared to Si and GaAs transistors. This MMIC enables extremely wide bandwidths to be achieved in a small footprint screw-down package

Typical Performance Over 20 MHz - 6.0 GHz (T_C = 25°C)

Parameter	20 MHz	0.5 GHz	1.0 GHz	2.0 GHz	3.0 GHz	4.0 GHz	5.0 GHz	6.0 GHz	Units
Gain	21.4	20.1	19.3	16.7	16.6	16.8	15.7	15.5	dB
Output Power @ P_{IN} = 32 dBm	26.9	30.2	26.3	23.4	24.5	24.0	20.9	18.6	W
Power Gain @ P_{IN} = 32 dBm	12.3	12.8	12.2	11.7	11.9	11.8	11.3	10.7	dB
Efficiency @ P_{IN} = 32 dBm	63	55	40	31	33	31	28	26	%

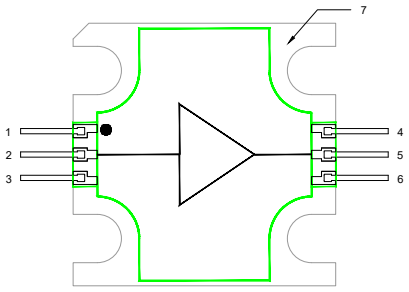
Note: V_{DD} = 50 V, I_{DQ} = 500 mA

Features

- 17 dB Small Signal Gain
- 25 W Typical P_{SAT}
- Operation up to 50 V
- High Breakdown Voltage
- High Temperature Operation
- 0.5" x 0.5" total product size

Applications

- Ultra Broadband Amplifiers
- Test Instrumentation
- EMC Amplifier Drivers



RoHS compliant

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	84	V_{DC}
Gate-Source Voltage	V_{GS}	-10, +2	
Storage Temperature	T_{STG}	-65, +150	°C
Operating Junction Temperature	T_J	225	
Maximum Forward Gate Current	I_{GMAX}	6.3	mA
Soldering Temperature[1]	T_S	245	°C
Screw Torque	τ	40	in-oz
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.3	°C/W
Case Operating Temperature[2]	T_C	-40, +150	°C

Notes:
[1] Refer to the Application Note on soldering at wolfspeed.com/rf/document-library
[2] Measured for the CMPA0060025F1 at P_{IN} = 32 dBm

Electrical Characteristics (Frequency = 20 MHz to 6.0 GHz unless otherwise stated; T_C = 25°C)

Characteristics	Symbol	Typ.	Max.	Units	Conditions
DC Characteristics					
Gate Threshold Voltage[2]	$V_{GS(th)}$	-3.0	—	V	V_{DS} = 20 V, ΔI_D = 20 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-2.7	—	V_{DC}	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 32 dBm
Saturated Drain Current	I_{DS}	12	—	A	V_{DS} = 12 V, V_{GS} = 2.0 V
RF Characteristics[1]					
Power Output at P_{OUT} @ 4.5 GHz	P_{OUT}	42.8	—	dBm	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 32 dBm
Power Output at P_{OUT} @ 5.0 GHz		43.3	—		
Power Output at P_{OUT} @ 6.0 GHz		42.9	—		
Drain Efficiency at P_{OUT} @ 4.5 GHz	η	24.1	—	%	
Drain Efficiency at P_{OUT} @ 5.0 GHz		28.0	—		
Drain Efficiency at P_{OUT} @ 6.0 GHz		27.2	—		
Output Mismatch Stress	VSWR	—	5 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 32 dBm

Small Signal RF Characteristics

Frequency	Min.	Typ. S21 (dB)	Max.	Min.	Typ. S11 (dB)	Max.	Min.	Typ. S22 (dB)	Conditions
0.02 GHz - 0.25 GHz	18	19.3	23.7	—	-4.1	-2.5	—	-8.5	V_{DD} = 50 V, I_{DQ} = 500 mA
0.25 GHz - 0.5 GHz		19.8	22	—	-6.8	-3.5	—	-8.9	
0.5 GHz - 1.0 GHz	15.5	18.6		—	-15.3	-6.5	—	-6.7	
1.0 GHz - 2.0 GHz				—		-12.5	—		
2.0 GHz - 3.0 GHz	13		20	—			—	-6.0	
3.0 GHz - 6.0 GHz		16.3		—	-14.2	-6.5	—	-12.0	

Notes:
[1] P_{OUT} is defined as P_{IN} = 32 dBm
[2] The device will draw approximately 55-70 mA at pinch off due to the internal circuit structure

Typical Performance

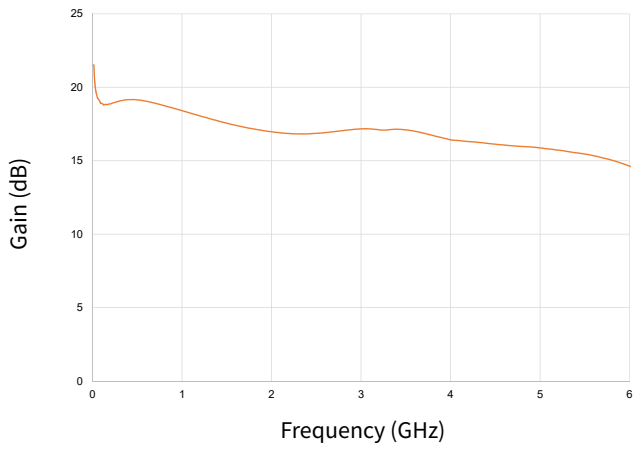


Figure 1. Small Signal Gain vs Frequency
V_{DD} = 50 V, I_{DQ} = 500 mA

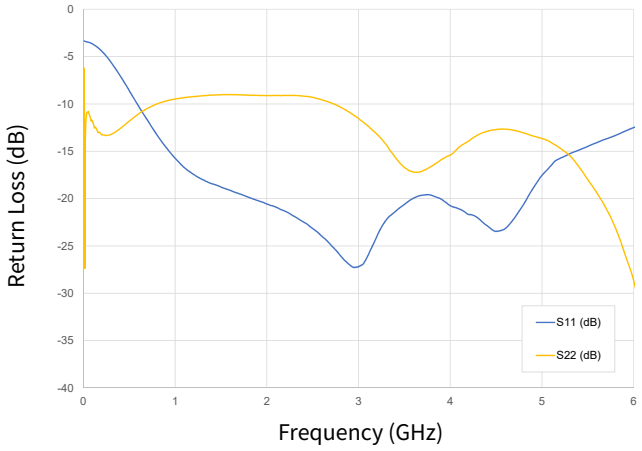


Figure 2. Input & Output Return Losses vs Frequency
V_{DD} = 50 V, I_{DQ} = 500 mA

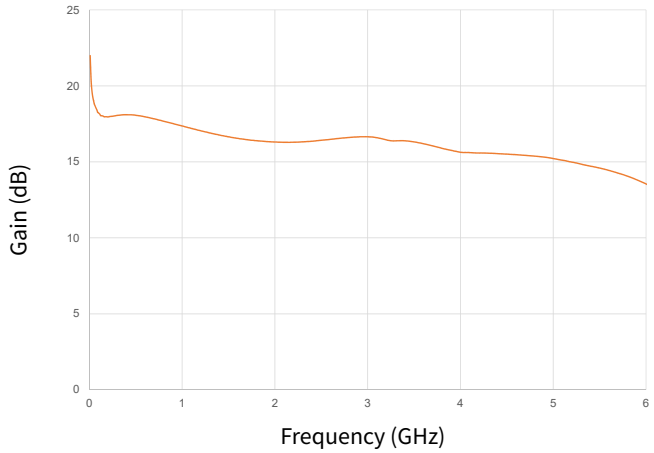


Figure 3. Small Signal Gain vs Frequency
V_{DD} = 40 V, I_{DQ} = 500 mA

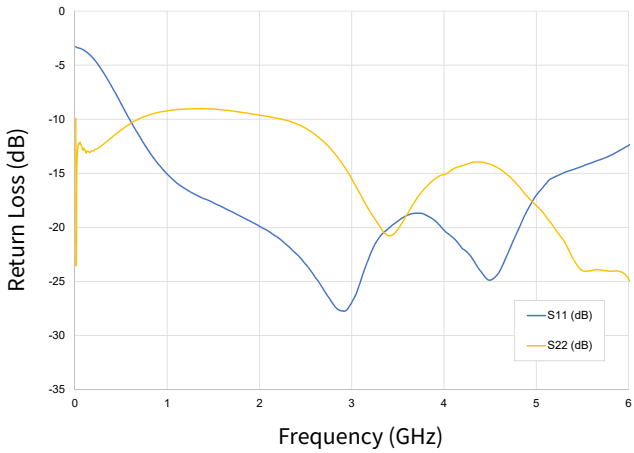


Figure 4. Small Signal Gain vs Frequency
V_{DD} = 40 V, I_{DQ} = 500 mA

Typical Performance

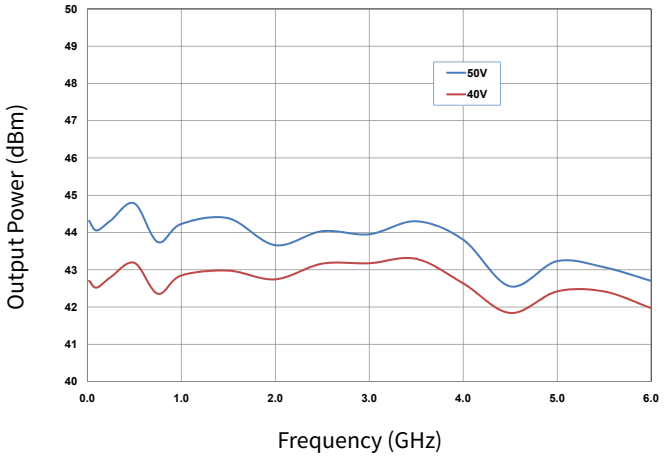


Figure 5. Output Power at P_{IN} = 32 dBm vs Frequency as a Function of Drain Voltage, I_{DQ} = 500 mA

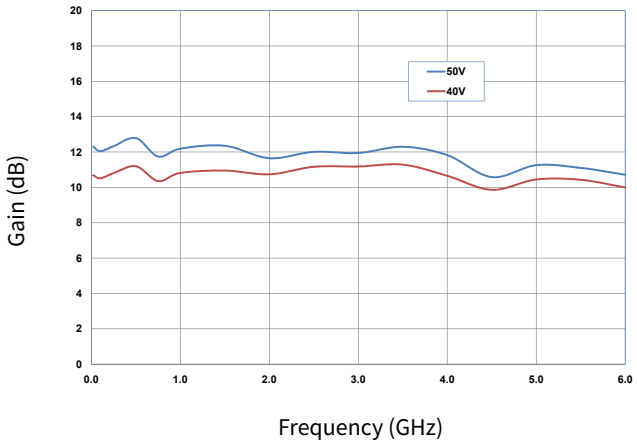


Figure 6. Power Gain at P_{IN} = 32 dBm vs Frequency as a Function of Drain Voltage, I_{DQ} = 500 mA

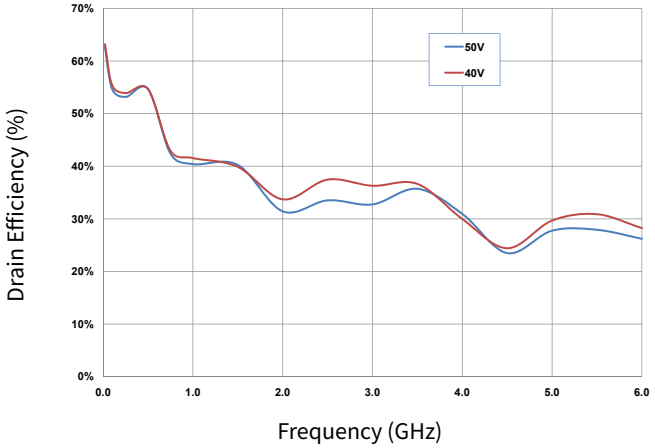


Figure 7. Drain Efficiency at P_{IN} = 32 dBm vs Frequency as a Function of Drain Voltage, I_{DQ} = 500 mA

Typical Performance

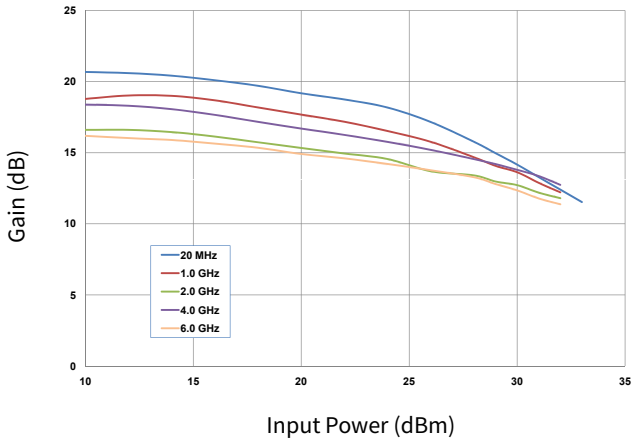


Figure 8. Gain vs Input Power at 50 V as a Function of Frequency, I_{DQ} = 500 mA

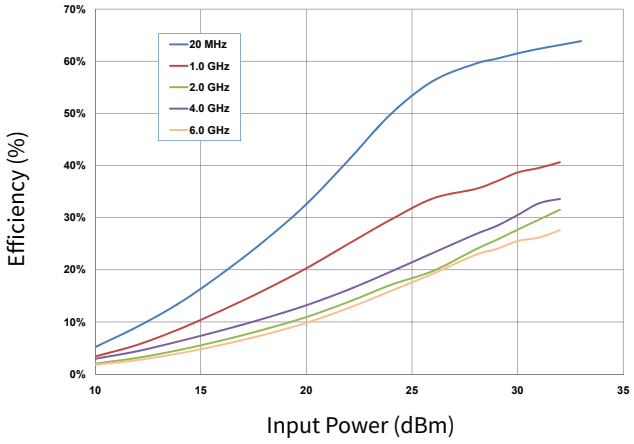


Figure 9. Efficiency vs Input Power at 50 V as a Function of Frequency, I_{DQ} = 500 mA

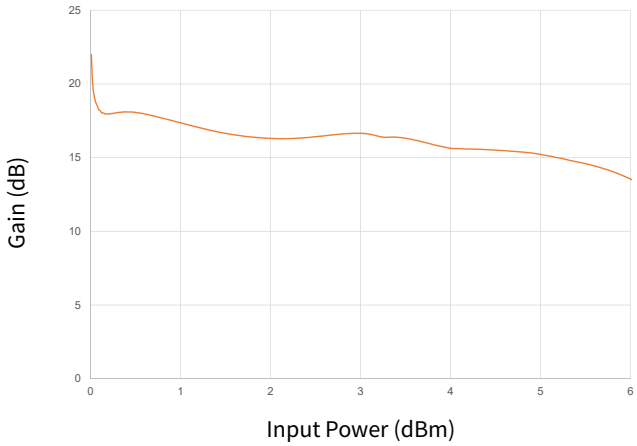


Figure 10. Gain vs Input Power at 40 V as a Function of Frequency, I_{DQ} = 500 mA

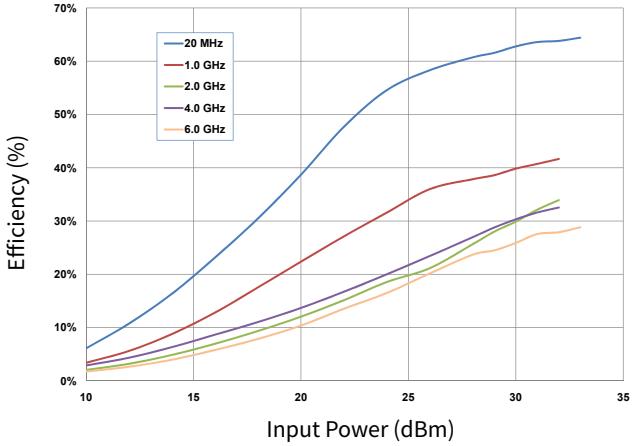


Figure 11. Efficiency vs Input Power at 40 V as a Function of Frequency, I_{DQ} = 500 mA

General Device Information

The CMPA0060025F1 is a GaN HEMT MMIC Power Amplifier, which operates between 20 MHz - 6.0 GHz. The amplifier typically provides 17 dB of small signal gain and 25 W saturated output power with an associated power added efficiency of better than 20%. The wideband amplifier's input and output are internally matched to 50 Ohm. The amplifier requires bias from appropriate Bias-T's, through the RF input and output ports.

The CMPA0060025F1-AMP1 and the device were then measured using external Bias-T's, (TECDIA: AMP1T-H06M20 or similar), as shown in Figure 2. The Bias-T's were included in the calibration of the test system. All other losses associated with the test fixture are included in the measurements.

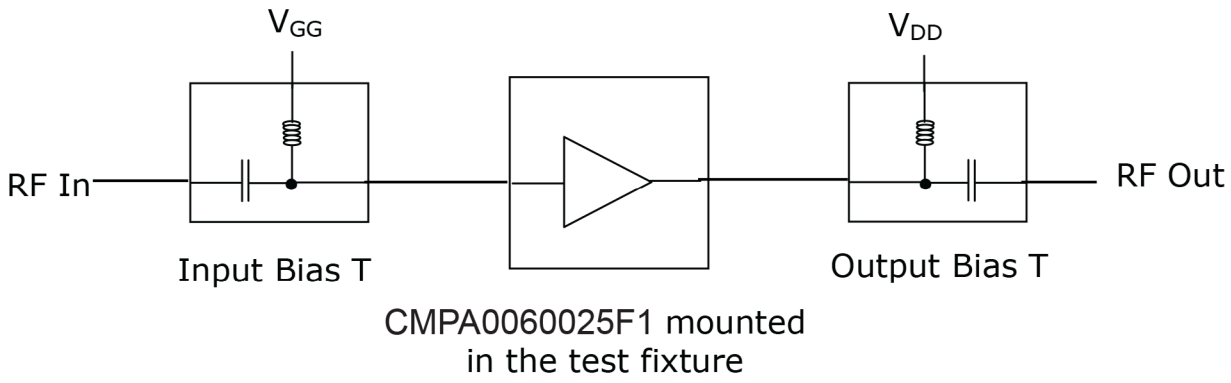
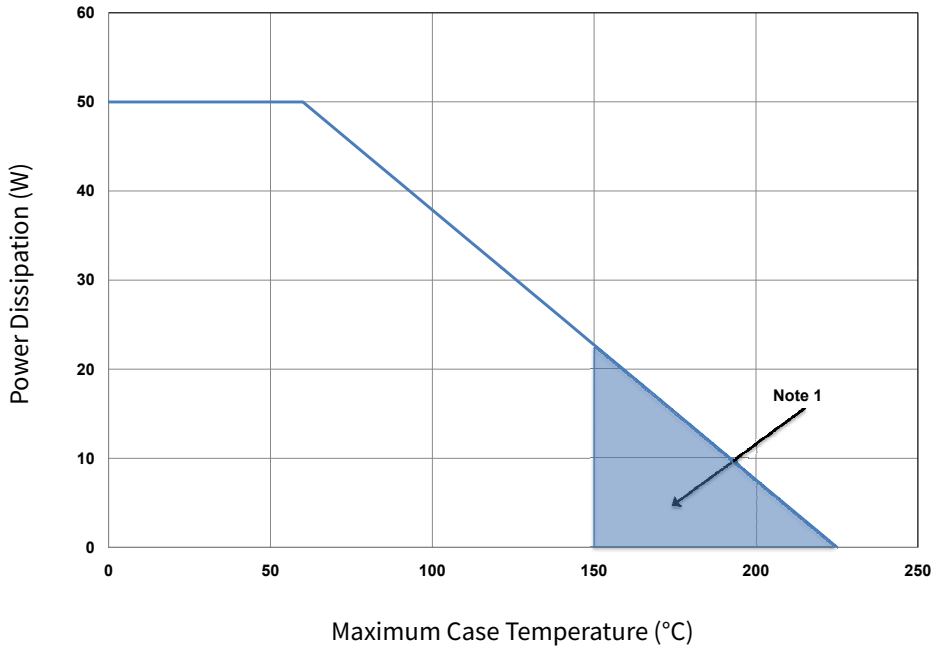


Figure 2. Typical test system setup required for measuring CMPA0060025F1-AMP1

CMPA0060025F1 Power Dissipation De-rating Curve

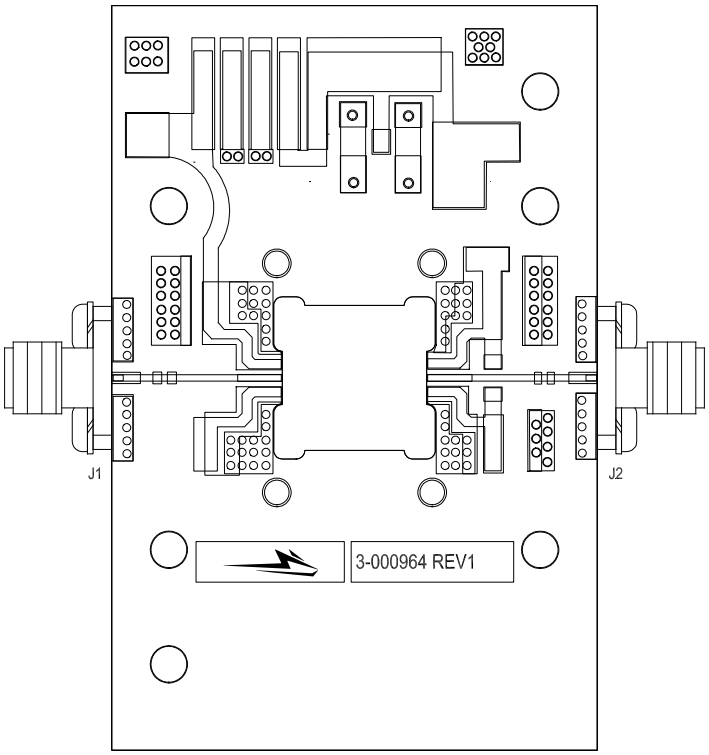


Note: Area exceeds Maximum Case Temperature (See Page 2)

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	2	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	C3	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

CMPA0060025F1-AMP Demonstration Amplifier Circuit Outline

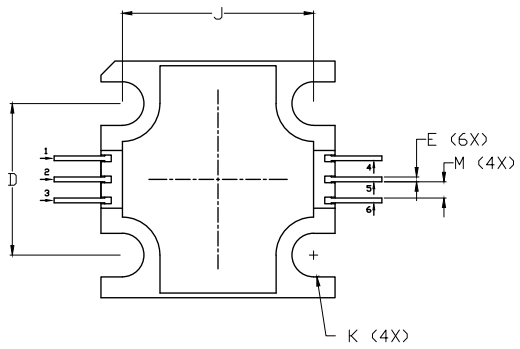


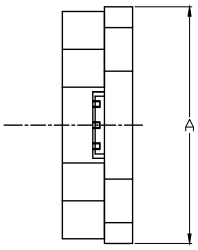
CMPA0060025F1-AMP Demonstration Amplifier Circuit Bill of Materials

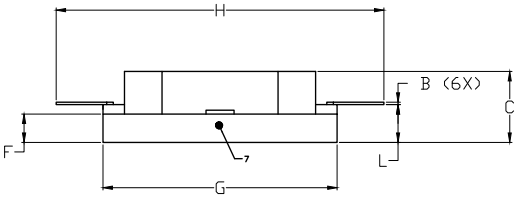
Designator	Description	Qty
J1,J2	CONNECTOR, SMA, AMP11052901-1	2
–	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA0060025F1	1

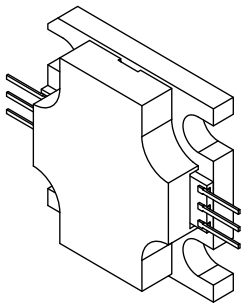
Note: An external Bias-T is required

Product Dimensions CMPA0060025F1 (Package Type — 440219)

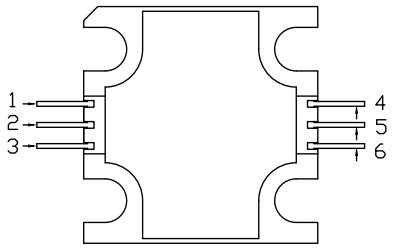








NOT TO SCALE



PIN	Function
1	NC
2	Gate
3	NC
4	NC
5	Drain
6	NC
7	Source

NOTES:

1. DIMENSIONING AND TOLERANICING PER ANSI Y14.5M, 1982.

2. CONTROLLING DIMENSION: INCH.

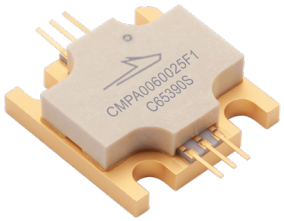
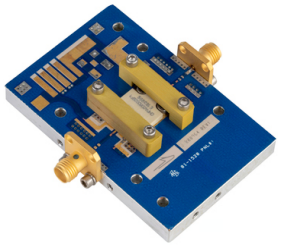
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.

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

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA0060025F1	GaN HEMT	Each	
CMPA0060025F1-AMP	Test board with GaN MMIC installed	Each	

For more information, please contact:

4600 Silicon Drive
Durham, NC 27703 USA
Tel: +1.919.313.5300
www.wolfspeed.com/RF

Sales Contact
RFSales@wolfspeed.com

RF Product Marketing Contact
RFMarketing@wolfspeed.com

Notes & Disclaimer

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