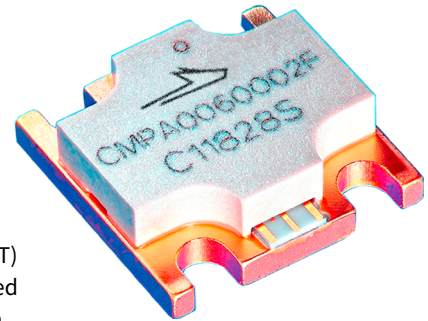


CMPA0060002F

2 W, 20 MHz - 6000 MHz, GaN MMIC Power Amplifier

Description

Wolfspeed's CMPA0060002F 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 employs a distributed (traveling-wave) amplifier design approach, enabling extremely wide bandwidths to be achieved in a small footprint screw-down package featuring a copper-tungsten heat sink.



PN: CMPA0060002F
Package Type: 780019

Typical Performance Over 20 MHz - 6.0 GHz ($T_c = 25^\circ\text{C}$)

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	19.9	18.8	17.8	16.8	16.8	17.5	18.5	16.5	dB
Saturated Output Power, P_{SAT}^1	4.3	4.1	4.5	4.2	3.7	3.9	4.8	3.7	W
Power Gain @ P_{SAT}^1	14.7	13.1	12.6	12.2	12.6	10.9	12.2	9.5	dB
PAE @ P_{SAT}^1	34	28	29	28	24	26	33	20	%

Notes:

¹ P_{SAT} is defined as the RF output power where the device starts to draw positive gate current in the range of 2 - 4 mA.

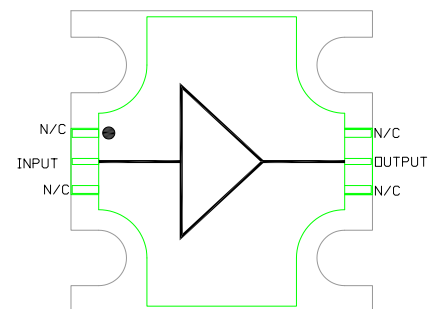
² $V_{DD} = 28\text{ V}$, $I_{DQ} = 100\text{ mA}$

Features

- 17 dB Small Signal Gain
- 3 W Typical P_{SAT}
- Operation up to 28 V
- High Breakdown Voltage
- High Temperature Operation
- 0.5" x 0.5" total product size

Applications

- Ultra Broadband Amplifiers
- Fiber Drivers
- Test Instrumentation
- EMC Amplifier Drivers





Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units
Drain-source Voltage	V_{DS}	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}	4	mA
Soldering Temperature ¹	T_S	245	°C
Screw Torque	τ	40	in-oz
Thermal Resistance, Junction to Case	$R_{\theta JC}$	4.3	°C/W
Case Operating Temperature ^{2,3}	T_C	-40, +150	°C

Notes:

¹ Refer to the Application Note on soldering at wolfspeed.com/rf/document-library

² Measured for the CMPA0060002F at $P_{DISS} = 2$ W.

Electrical Characteristics (Frequency = 20 MHz to 6.0 GHz unless otherwise stated; $T_C = 25^\circ\text{C}$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage ¹	V _{GS(th)}	-3.8	-3.0	-2.7	V	V _{DS} = 20 V, ΔI _D = 2 mA
Gate Quiescent Voltage	V _{GS(Q)}	—	-2.7	—	V _{DC}	V _{DD} = 28 V, I _{DQ} = 100 mA
Saturated Drain Current	I _{DS}	—	1.4	—	A	V _{DS} = 6.0 V, V _{GS} = 2.0 V
RF Characteristics						
Small Signal Gain	S21	13.5	17	21.5	dB	V _{DD} = 28 V, I _{DQ} = 100 mA
Input Return Loss	S11	—	-9	-5		
Output Return Loss	S22	—				
Power Output	P _{OUT}	2	3	—	W	V _{DD} = 28 V, I _{DQ} = 100 mA, f = 4.0 GHz, P _{IN} = 23 dBm
Power Added Efficiency	PAE	—	23	—	%	
Power Gain	G _P	10	—	—	dB	
Output Mismatch Stress	VSWR	—	—	5:1	Ψ	No damage at all phase angles, V _{DD} = 28 V, I _{DQ} = 100 mA, P _{IN} = 23 dBm

Note:

¹ The device will draw approximately 20 - 25 mA at pinch off due to the internal circuit structure.

Typical Performance

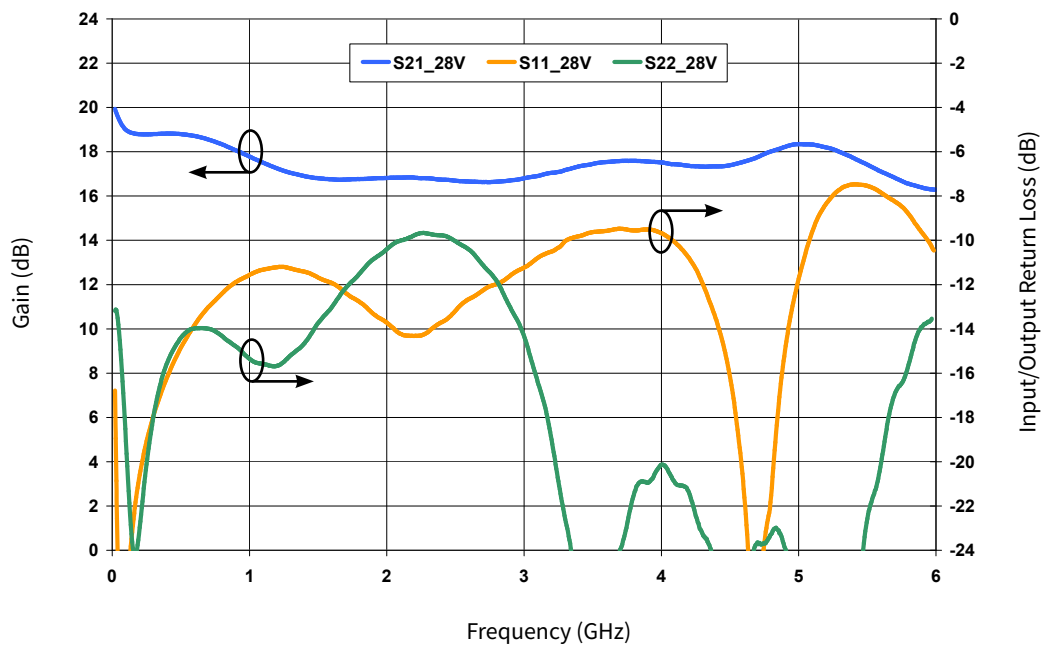


Figure 1. Small Signal Gain and Return Losses vs Frequency at 28 V

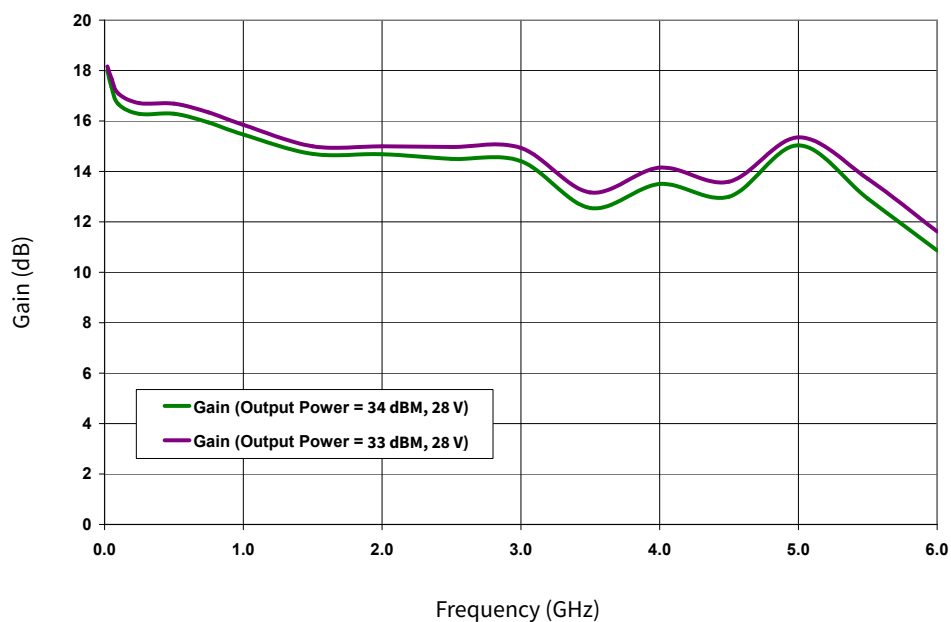


Figure 2. Power Gain vs Frequency at 28 V

Typical Performance

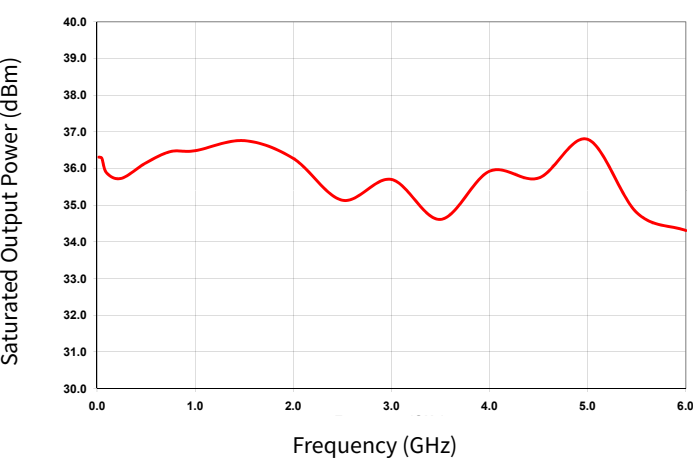


Figure 3. Saturated Output Power Performance (P_{SAT}) vs Frequency

Frequency (GHz)	P_{SAT} at 28V (dBm)	P_{SAT} at 28V (W)
0.02	36.6	4.3
0.5	36.2	4.1
1.0	36.5	4.5
1.5	36.8	4.7
2.0	36.3	4.2
2.5	35.1	3.3
3.0	35.7	3.7
3.5	34.6	2.9
4.0	35.9	3.9
4.5	35.7	3.8
5.0	36.8	4.8
5.5	34.8	3.0
6.0	34.3	2.7

Note: P_{SAT} is defined as the RF output power where the device starts to draw positive gate current in the range of 2 - 4 mA.

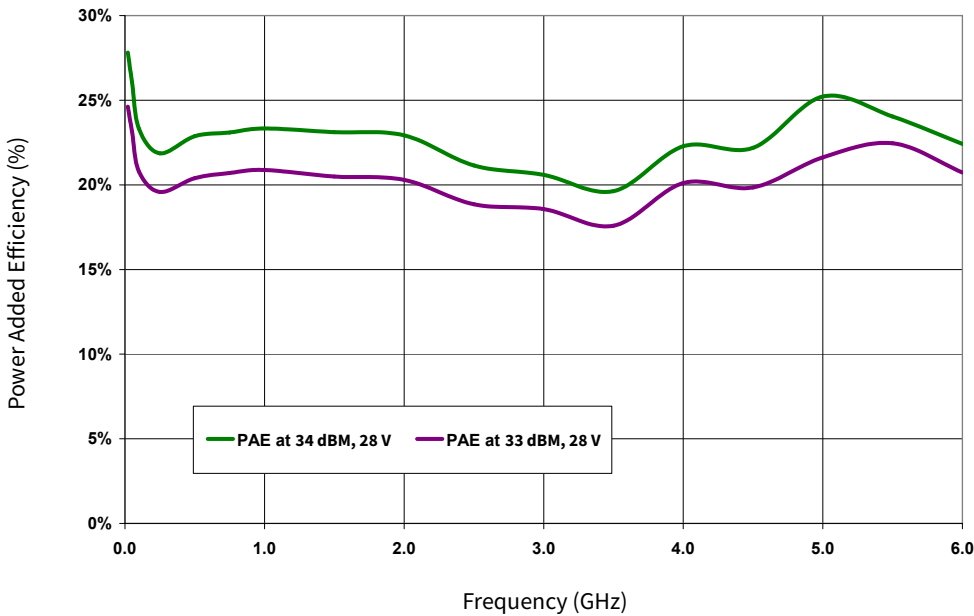


Figure 4. PAE at 33 & 34 dBm Output Power vs Frequency at 28 V

General Device Information

The CMPA0060002F is a GaN HEMT MMIC Distributed Driver Amplifier, which operates between 20 MHz - 6.0 GHz. The amplifier typically provides 17 dB of small signal gain and 2 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 CMPA0060002F is provided in a flange package format. The input and output connections are gold plated to enable gold bond wire attach at the next level assembly.

The measurements in this data sheet were taken on devices wire-bonded to the test fixture with 2 mil gold bond wires. The CMPA0060002F-AMP and the device were then measured using external Bias-T’s, (Aeroflex: 8800, SMF3-12; TECDIA: AMPT-06M20 or similar), as shown in Figure 5. 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.

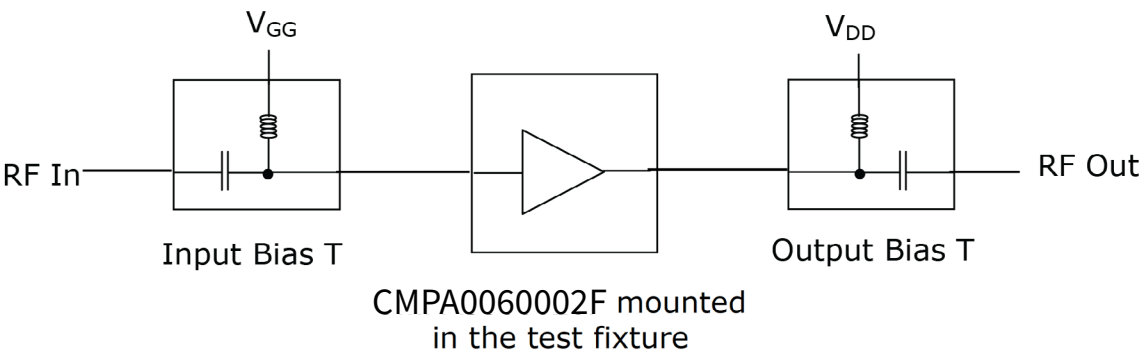


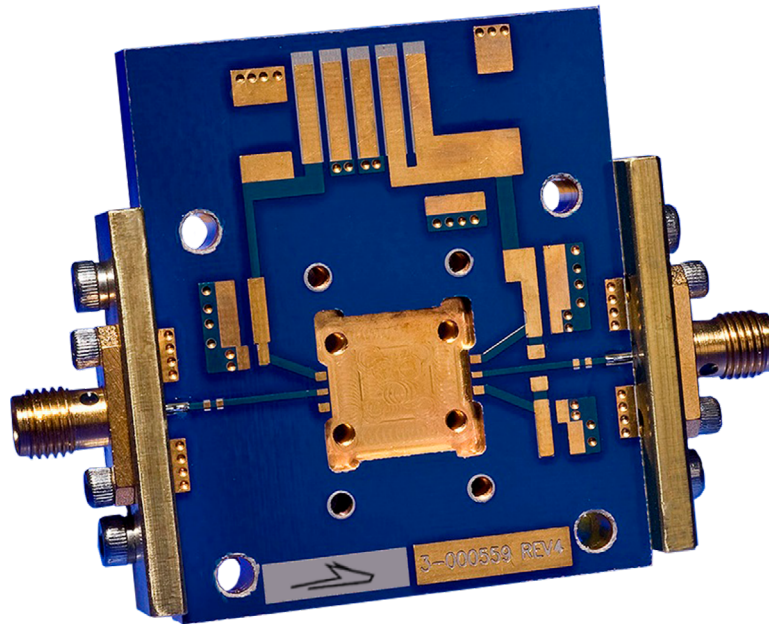
Figure 5. Typical test system setup required for measuring CMPA0060002F-AMP

Electrostatic Discharge (ESD) Classifications

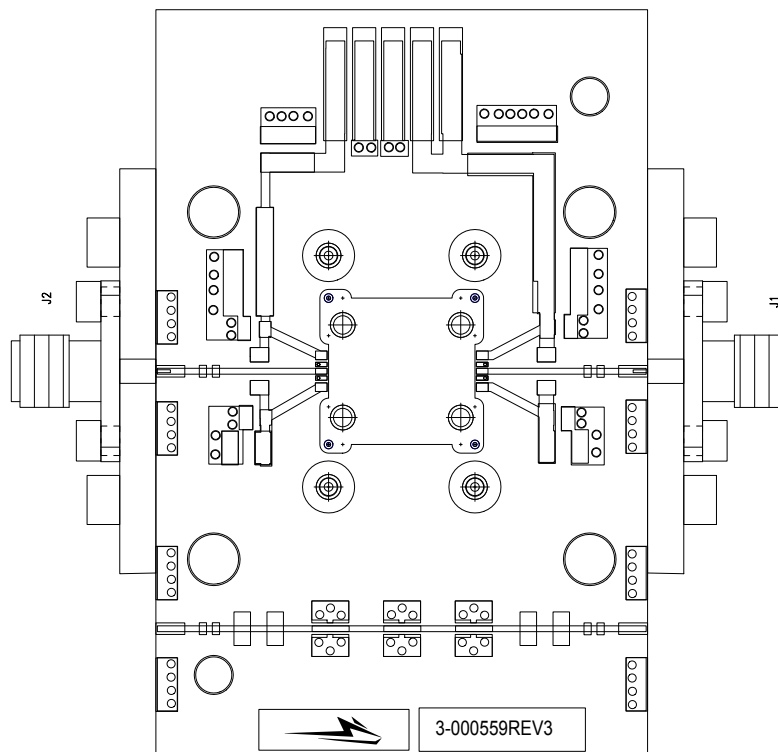
Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	2	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	C2a	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C



CMPA0060002F-TB Demonstration Amplifier Circuit



CMPA0060002F-TB Demonstration Amplifier Circuit Outline



CMPA0060002F-AMP Demonstration Amplifier Circuit Bill of Materials

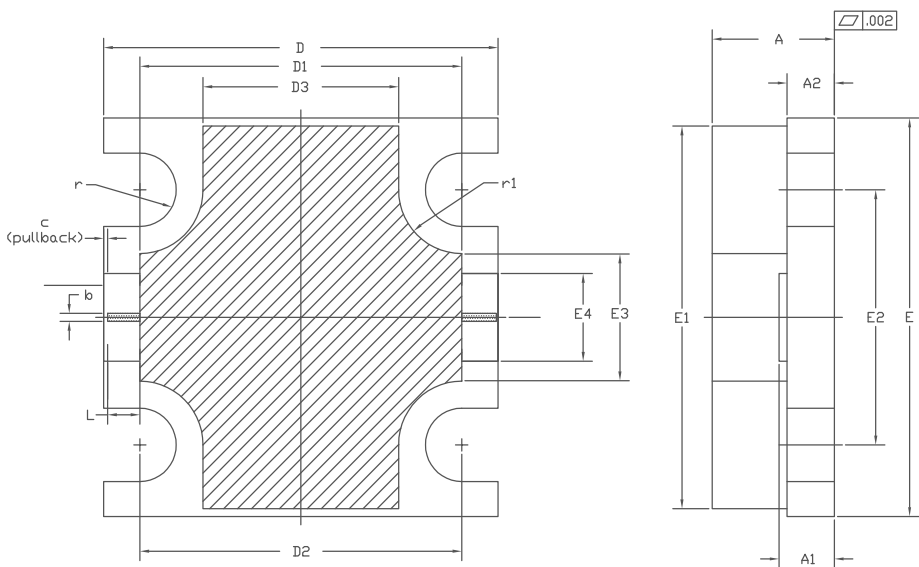
Designator	Description	Qty
J1,J2	CONNECTOR, SMA, AMP11052901-1	2
-	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA0060002F	1

Notes

¹ The CMPA0060002F is connected to the PCB with 2.0 mil Au bond wires.

² An external Bias-T is required.

Product Dimensions CMPA0060002F (Package Type – 780019)



- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 - CONTROLLING DIMENSION: INCH.
 - ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
 - LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.
 - ALL PLATED SURFACES ARE Ni/AU

DIM	INCHES		MILLIMETERS		NOTE
	MIN	MAX	MIN	MAX	
A	0.148	0.162	3.76	4.12	—
A1	0.066	0.076	1.67	1.93	—
A2	0.056	0.064	1.42	1.63	—
b	0.009		0.24		x2
c	0.005		0.13		x2
D	0.495	0.505	12.57	12.83	—
D1	0.403	0.413	10.23	10.49	—
D2	0.408		10.36		—
D3	0.243	0.253	6.17	6.43	—
E	0.495	0.505	12.57	12.83	—
E1	0.475	0.485	12.06	12.32	—
E2	0.320		8.13		—
E3	0.155	0.165	3.93	4.19	—
E4	0.105	0.115	2.66	2.92	—
L	0.041		1.04		x2
r	R0.046		R1.17		x4
r1	R0.080		R2.03		x4

Part Number System

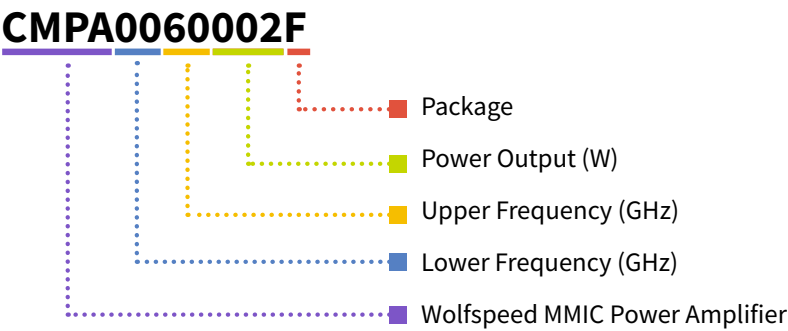


Table 1.

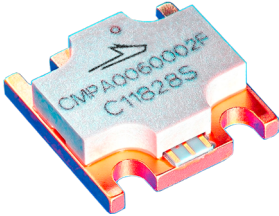
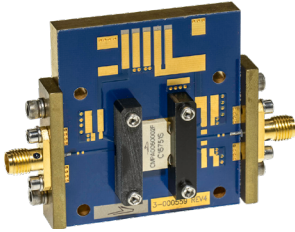
Parameter	Value	Units
Lower Frequency	20	MHz
Upper Frequency	6000	
Power Output	2	W
Package	Flange	—

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	1A = 10.0 GHz 2H = 27.0 GHz

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA0060002F	GaN MMIC	Each	
CMPA0060002F-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.wolfsspeed.com/RF

Sales Contact
RFSales@wolfsspeed.com

RF Product Marketing Contact
RFMarketing@wolfsspeed.com

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