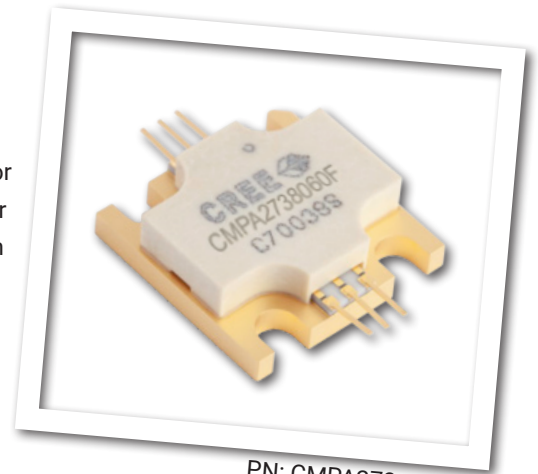


# CMPA2738060F

## 60 W, 2.7 - 3.8 GHz, GaN MMIC, Power Amplifier

Cree's CMPA2738060F 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 contains a two-stage reactively matched amplifier design approach enabling very wide bandwidths to be achieved. This MMIC enables extremely wide bandwidths to be achieved in a small footprint screw-down package.



PN: CMPA2738060F  
Package Type: 440219

### Typical Performance Over 2.7 - 3.8 GHz ( $T_c = 25^\circ\text{C}$ )

Parameter	2.7 GHz	2.9 GHz	3.1 GHz	3.5 GHz	3.8 GHz	Units
Small Signal Gain	34.9	34.6	33.8	35.2	34.2	dB
Output Power <sup>1</sup>	88.0	86.5	88.0	78.0	85.0	W
Power Gain <sup>1</sup>	27.5	27.4	27.5	27.9	28.3	dB
PAE <sup>1</sup>	52	60	54	54.5	52.5	%

Note<sup>1</sup>:  $P_{IN} = 20\text{ dBm}$

### Features

- 34 dB Small Signal Gain
- 85 W Typical  $P_{SAT}$
- Operation up to 50 V
- High Breakdown Voltage
- High Temperature Operation
- 0.5" x 0.5" Total Product Size

### Applications

- Civil and Military Pulsed Radar Amplifiers

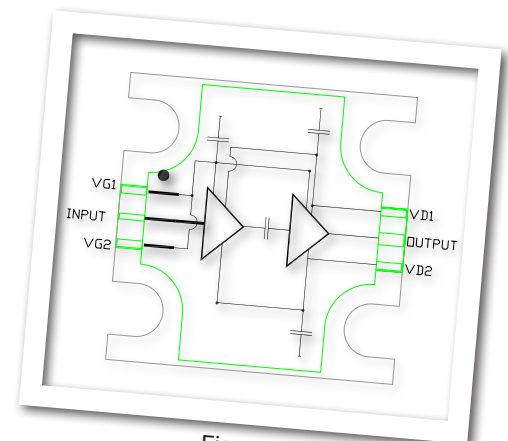


Figure 1.



## Absolute Maximum Ratings (not simultaneous) at 25°C

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	$V_{DSS}$	150	VDC	25°C
Gate-source Voltage	$V_{GS}$	-10, +2	VDC	25°C
Storage Temperature	$T_{STG}$	-65, +150	°C	
Operating Junction Temperature	$T_J$	225	°C	
Maximum Forward Gate Current	$I_G$	12	mA	25°C
Screw Torque	T	40	in-oz	
Thermal Resistance, Junction to Case (packaged) <sup>1</sup>	$R_{\theta JC}$	0.77	°C/W	300 μsec, 20%, 85°C
Thermal Resistance, Junction to Case (packaged) <sup>1</sup>	$R_{\theta JC}$	1.44	°C/W	CW, 85°C

Notes:

<sup>1</sup> Measured for the CMPA2738050F at  $P_{DISS} = 64$  W.

## Electrical Characteristics (Frequency = 2.7 GHz to 3.8 GHz unless otherwise stated; $T_C = 25^\circ\text{C}$ )

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	-3.8	-3.0	-2.3	V	$V_{DS} = 10$ V, $I_D = 15.2$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V <sub>DC</sub>	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA
Saturated Drain Current <sup>1</sup>	$I_{DS}$	9.9	14.1	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	$V_{BD}$	100	-	-	V	$V_{GS} = -8$ V, $I_D = 15.2$ mA
<b>RF Characteristics<sup>2,3</sup></b>						
Small Signal Gain <sub>1</sub>	S21	-	34.9	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 2.7 GHz
Small Signal Gain <sub>2</sub>	S21	-	33.8	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 3.1 GHz
Small Signal Gain <sub>3</sub>	S21	-	34.2	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 3.8 GHz
Output Power <sub>1</sub>	$P_{OUT}$	-	88.0	-	W	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, $P_{IN} = 20$ dBm, Freq = 2.7 GHz
Output Power <sub>2</sub>	$P_{OUT}$	-	88.0	-	W	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, $P_{IN} = 20$ dBm, Freq = 3.1 GHz
Output Power <sub>3</sub>	$P_{OUT}$	-	85.0	-	W	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, $P_{IN} = 20$ dBm, Freq = 3.8 GHz
Power Added Efficiency <sub>1</sub>	PAE	-	52	-	%	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 2.7 GHz
Power Added Efficiency <sub>2</sub>	PAE	-	54	-	%	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 3.1 GHz
Power Added Efficiency <sub>3</sub>	PAE	-	52.5	-	%	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 3.8 GHz
Input Return Loss <sub>1</sub>	S11	-	-11.3	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 2.7 GHz
Input Return Loss <sub>2</sub>	S11	-	-25.0	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 3.1 GHz
Input Return Loss <sub>3</sub>	S11	-	-11.5	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 3.8 GHz
Output Return Loss <sub>1</sub>	S22	-	-8.5	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 2.7 GHz
Output Return Loss <sub>2</sub>	S22	-	-11.0	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 3.1 GHz
Output Return Loss <sub>3</sub>	S22	-	-8.0	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 280$ mA, Freq = 3.8 GHz
Output Mismatch Stress	VSWR	-	-	5 : 1	Ψ	No damage at all phase angles, $V_{DD} = 50$ V, $I_{DQ} = 280$ mA, $P_{OUT} = 60$ W

Notes:

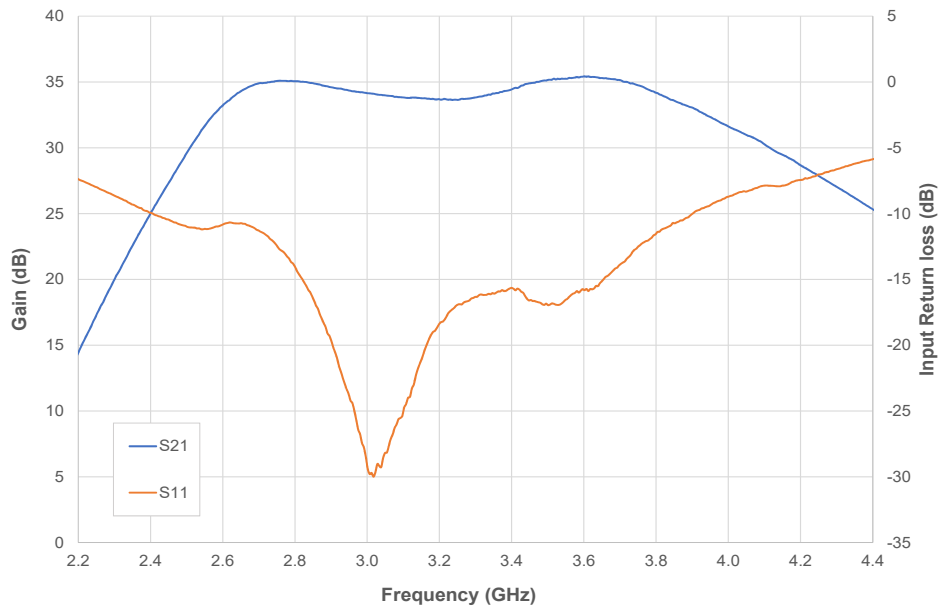
<sup>1</sup> Scaled from PCM data.

<sup>2</sup> All data pulse tested in CMPA2738060F-AMP

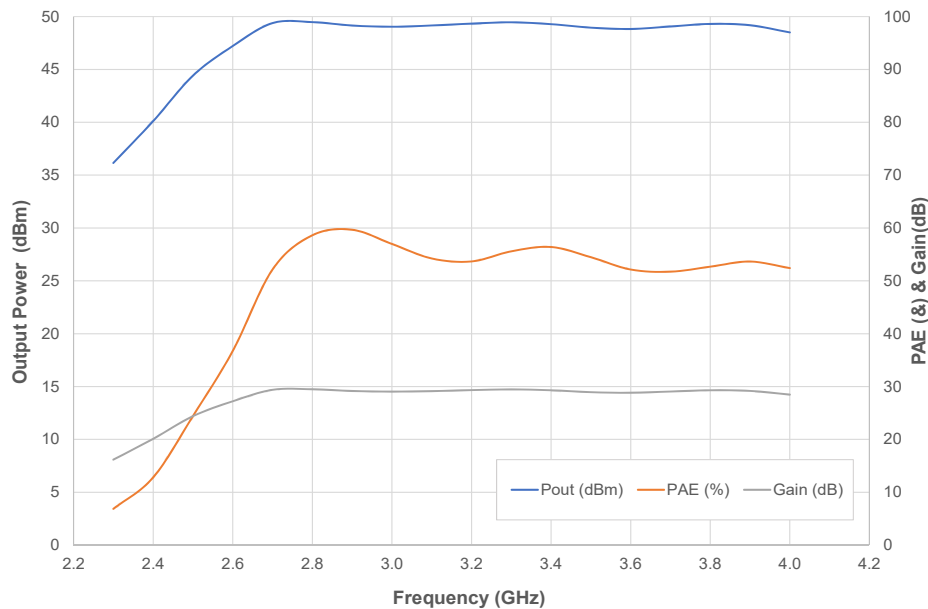
<sup>3</sup> Pulse Width = 300 μs, Duty Cycle = 20%.

## Typical Performance of the CMPA2738060F

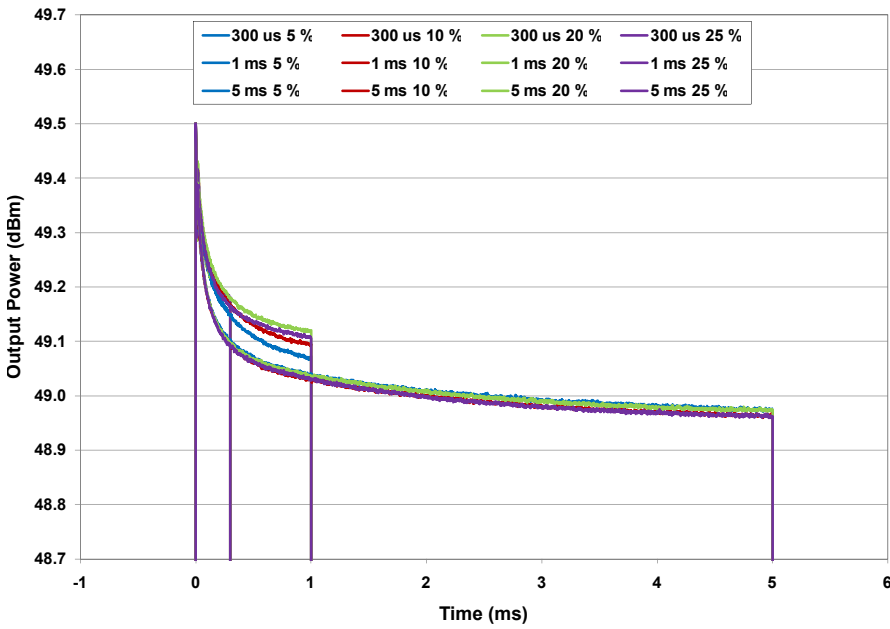
**Gain and Input Return Loss vs Frequency of the CMPA2738060F**  
**Measured in CMPA2738060F-AMP Amplifier Circuit.**  
 $V_{DS} = 50\text{ V}$ ,  $I_{DS} = 280\text{ mA}$



**Output Power, Gain and PAE vs Frequency of the CMPA2738060F**  
**Measured in CMPA2738060F-AMP Amplifier Circuit.**  
 $V_{DS} = 50\text{ V}$ ,  $I_{DS} = 280\text{ mA}$ , Pulse Width =  $300\ \mu\text{s}$ , Duty Cycle = 20%



## Typical Pulse Droop Performance



Pulse Width	Duty Cycle (%)	Droop (dB)
10 us	5-25	0.30
50 us	5-25	0.30
100 us	5-25	0.30
300 us	5-25	0.35
1 ms	5-25	0.40
5 ms	5-25	0.55

## Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 < 500 V)	JEDEC JESD22 C101-C

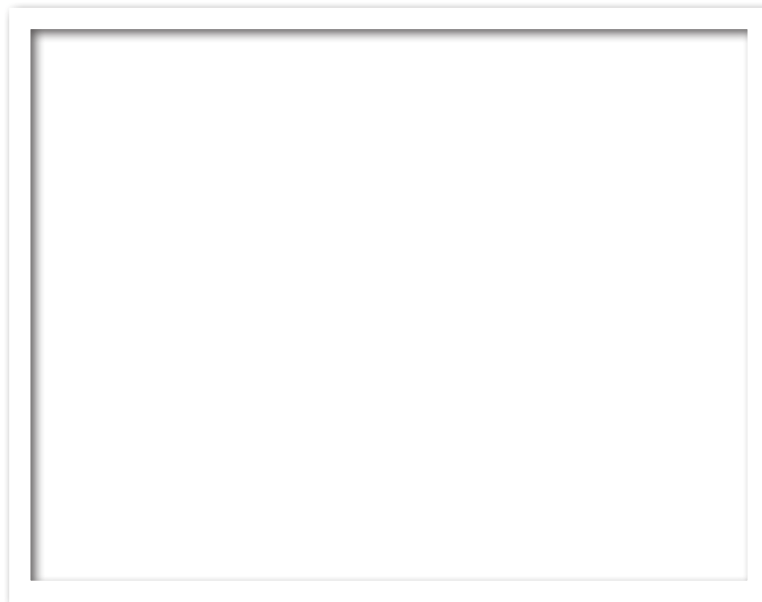
## CMPA2738060F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
C1	CAP, 15000pF, 100V, 0805, X7R	1
C2	CAP, 330uF, 20%, 100V, ELECT, MVY, SMD	1
R1	RES, 1/8W, 1206, +/-5%, 0 OHMS	1
R2	RES, 1/16W, 0603, +/-5%, 10K OHMS	1
L1	FERRITE, 22 OHM, 0805, BLM21PG220SN1	1
J1,J2	CONNECTOR, N-TYPE, FEMALE, W/0.500 SMA FLNG	2
J3	CONNECTOR, HEADER, RT>PLZ .1CEN LK 9POS	1
J4	CONNECTOR, SMB, STRAIGHT JACK, SMD	1
-	PCB, TACONIC, RF-35-0100-CH/CH	1
Q1	CMPA2735075F	1

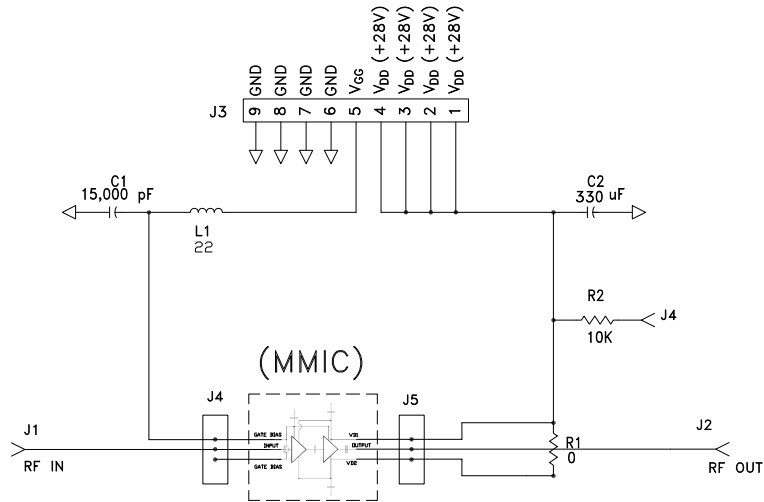
### Notes

<sup>1</sup>The CMPA2738060F is connected to the PCB with 2.0 mil Au bond wires.

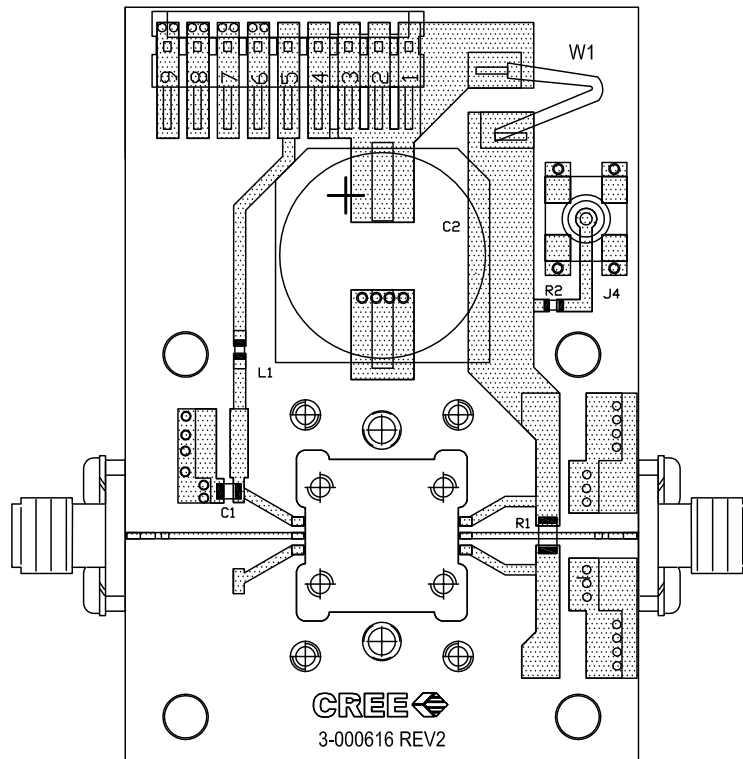
## CMPA2738060F-AMP Demonstration Amplifier Circuit



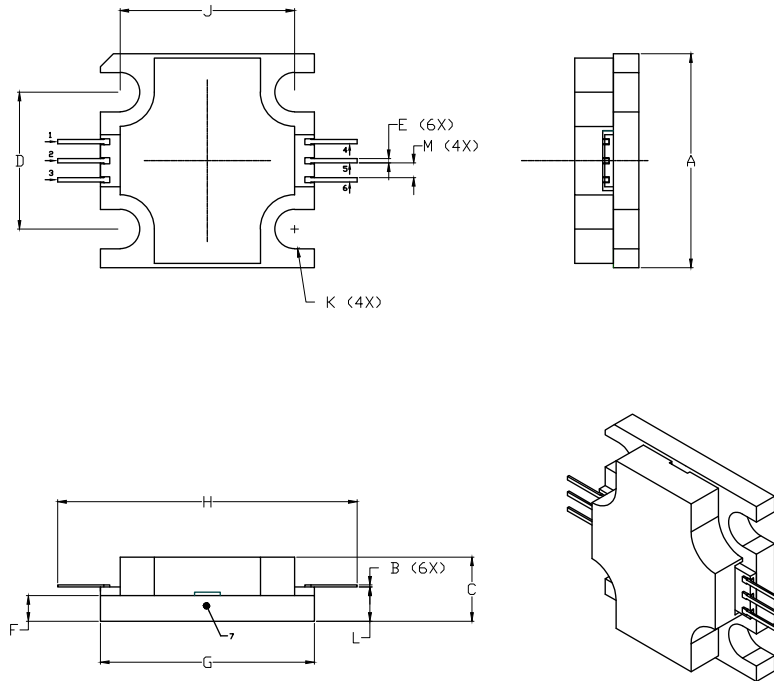
## CMPA2738060F-AMP Demonstration Amplifier Circuit Schematic



## CMPA2738060F-AMP Demonstration Amplifier Circuit Outline



## Product Dimensions CMPA2738060F (Package Type — 440219)



NOT TO SCALE

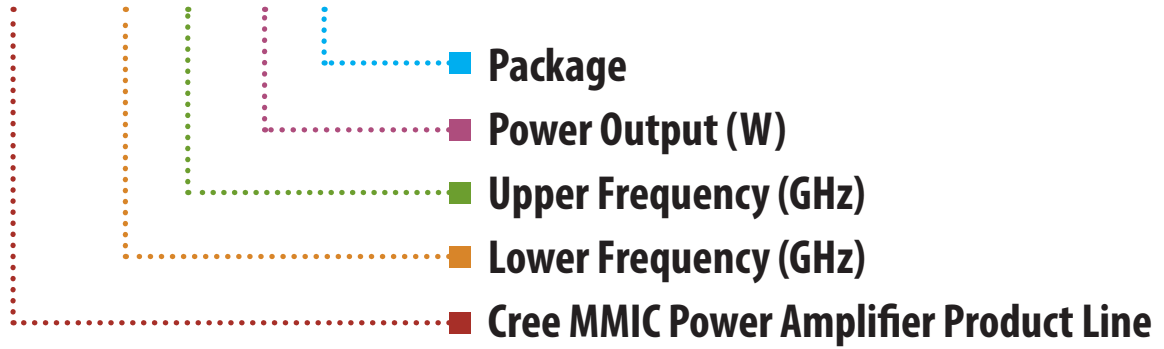
NOTES:

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

PIN	
1	Gate bias
2	RF <sub>IN</sub>
3	Gate bias
4	Drain bias
5	RF <sub>OUT</sub>
6	Drain bias
7	Source

# CMPA2738060F



Parameter	Value	Units
Lower Frequency	2.7	GHz
Upper Frequency	3.8	GHz
Power Output	60	W
Package	Flange	-

Table 1.

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

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

Table 2.



## Product Ordering Information

Order Number	Description	Unit of Measure	Image
CMPA2738060F	GaN HEMT	Each	
CMPA2738060F-AMP	Test board with GaN MMIC installed	Each	



## Disclaimer

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