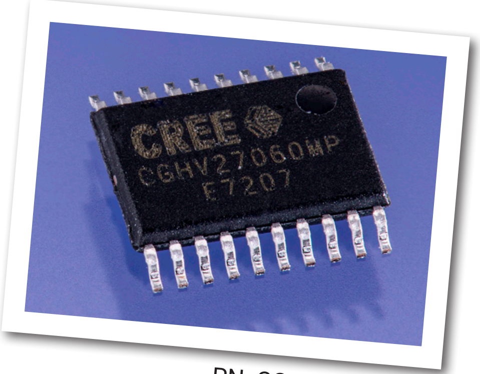
CGHV27060MP

60 W, DC - 2700 MHz, 50 V, GaN HEMT for LTE and Pulse Radar Applications

Cree's CGHV27060MP is a 60W gallium nitride (GaN) high electron mobility transistor (HEMT) housed in a small plastic SMT package 4.4mm x 6.5mm. The transistor is a broadband device with no internal input or output match which allows for the agility to apply to a wide range of frequencies from UHF thru 2.7GHz. The CGHV27060MP makes for an excellent transistor for pulsed applications at UHF, L Band or low S Band (<2.7GHz). Additionally, the transistor is well suited for LTE micro basestation amplifiers in the power class of 10 to 15W average power in high efficiency topologies such as Class A/B, F or Doherty amplifiers.



PN: CGHV27060MP

Typical Performance Over 2.5 - 2.7 GHz (T_c = 25˚C) of Demonstration Amplifier

Parameter	2.5 GHz	2.6 GHz	2.7 GHz	Units
Gain @ 41.5 dBm Avg P_{OUT}	18.4	18.2	17.6	dB
ACLR @ 41.5 dBm Avg P_{OUT}	-33.2	-34.5	-35.8	dBc
Drain Efficiency @ 41.5 dBm Avg P_{OUT}	33	33	32	%

Note:
Measured in the CGHV27060MP-TB amplifier circuit, under WCDMA 3GPP test model 1, 64 DPCH, 45% clipping, PAR = 7.5 dB @ 0.01% Probability on CCDF, V_{DD} = 50 V, I_{DS} = 125 mA.

Typical Performance Over 2.5 - 2.7 GHz (T_c = 25˚C) of Demonstration Amplifier

Parameter	2.5 GHz	2.6 GHz	2.7 GHz	Units
Gain	16.7	16.4	16.2	dB
Output Power	94	87	83	W
Drain Efficiency	69	69	64	%

Note:
Measured in the CGHV27060MP-TB amplifier circuit, under pulse width 100 μs, 10% duty cycle, P_{IN} = 33 dBm.

Features - WCDMA

- 2.5 - 2.7 GHz Reference Design Amplifier
- 18 dB Gain at 14 W P_{AVE}
- -35 dBc ACLR at 14 W P_{AVE}
- 33% Efficiency at 14 W P_{AVE}
- High Degree of DPD Correction Can be Applied

Features - Pulsed

- 16.5 dB Gain at Pulsed P_{SAT}
- 70% Efficiency at Pulsed P_{SAT}
- 85 W at Pulsed P_{SAT}

Rev 2.0 – April 2019

Absolute Maximum Ratings (not simultaneous) at 25˚C Case Temperature

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	150	Volts	25˚C
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts	25˚C
Storage Temperature	T_{STG}	-65, +150	˚C	
Operating Junction Temperature	T_J	225	˚C	
Maximum Forward Gate Current	I_{GMAX}	10.4	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	6.3	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	2.6	˚C/W	85˚C, P_{DISS} = 52 W
Thermal Resistance Pulsed 10%, 100 µs, Junction to Case	$R_{\theta JC}$	1.95	˚C/W	85˚C, P_{DISS} = 62W, 100 µs/10%
Case Operating Temperature[4]	T_C	-40, +90	˚C	CW

Note:
[1] Current limit for long term, reliable operation.
[2] Refer to the Application Note on soldering at http://www.cree.com/rf/document-library
[3] Measured for the CGHV27060MP
[4] See also, the Power Dissipation De-rating Curve on Page 7.

Electrical Characteristics (T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	V_{DS} = 10 V, I_D = 10.4 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DS} = 50 V, I_D = 125 mA
Saturated Drain Current[2]	I_{DS}	8.4	10.4	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	150	–	–	V_{DC}	V_{GS} = -8 V, I_D = 10.4 mA
RF Characteristics[5] (T_C = 25˚C, F_0 = 2.7 GHz unless otherwise noted)						
Saturated Output Power[3,4]	P_{SAT}	–	80	–	W	V_{DD} = 50 V, I_{DQ} = 125 mA
Pulsed Drain Efficiency[3,4]	η	–	70	–	%	V_{DD} = 50 V, I_{DQ} = 125 mA, P_{OUT} = P_{SAT}
Gain[3,4]	G	–	16.5	–	dB	V_{DD} = 50 V, I_{DQ} = 125 mA, P_{OUT} = P_{SAT}
Gain[6]	G	–	18.5	–	dB	V_{DD} = 50 V, I_{DQ} = 125 mA, P_{OUT} = 41.5 dBm
WCDMA Linearity[6]	ACLR	–	-35	–	dBc	V_{DD} = 50 V, I_{DQ} = 125 mA, P_{OUT} = 41.5 dBm
Drain Efficiency[6]	η	–	32	–	%	V_{DD} = 50 V, I_{DQ} = 125 mA, P_{OUT} = 41.5 dBm
Output Mismatch Stress[3]	VSWR	–	–	TBD	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 125 mA, P_{OUT} = 60 W Pulsed
Dynamic Characteristics						
Input Capacitance[7]	C_{GS}	–	15.3	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance[7]	C_{DS}	–	4.7	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.5	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz

Notes:
[1] Measured on wafer prior to packaging.
[2] Scaled from PCM data.
[3] Pulse Width = 100 µs, Duty Cycle = 10%
[4] P_{SAT} is defined as I_{GS} = 1.0 mA peak
[5] Measured in CGHV27060MP-TB.
[6] Single Carrier WCDMA, 3GPP Test Model 1, 64 DPCH, 45% Clipping, PAR = 7.5 dB @ 0.01% Probability on CCDF, V_{DD} = 50 V.
[7] Includes package.

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Typical Performance

Figure 1. - Small Signal Gain and Return Losses of the CGHV27060MP
Measured in Demonstration Amplifier Circuit CGHV27060MP-TB

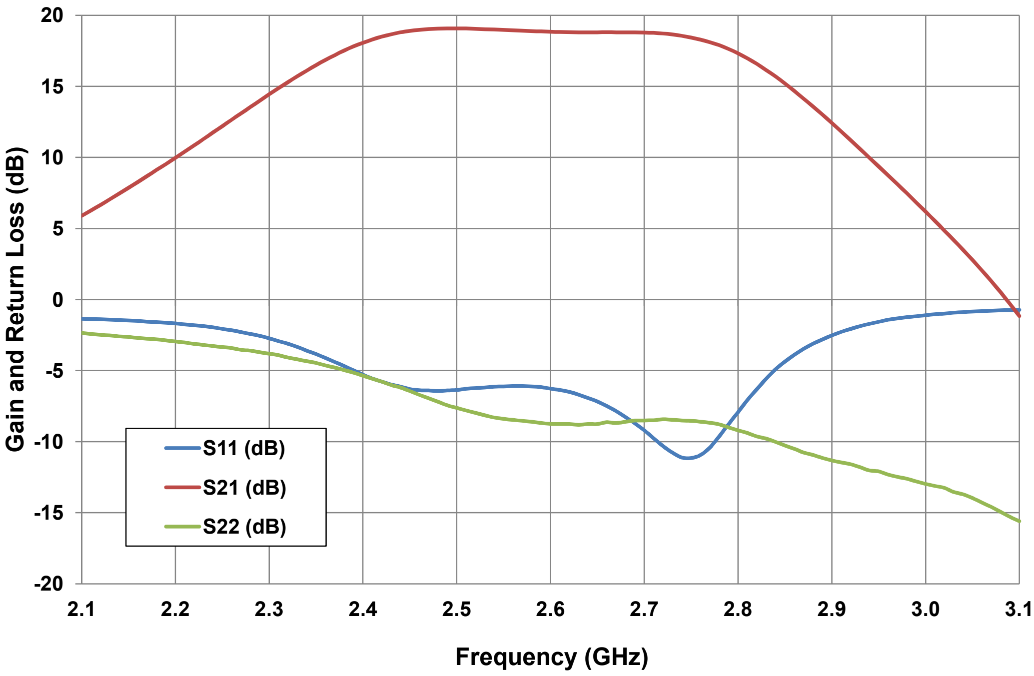
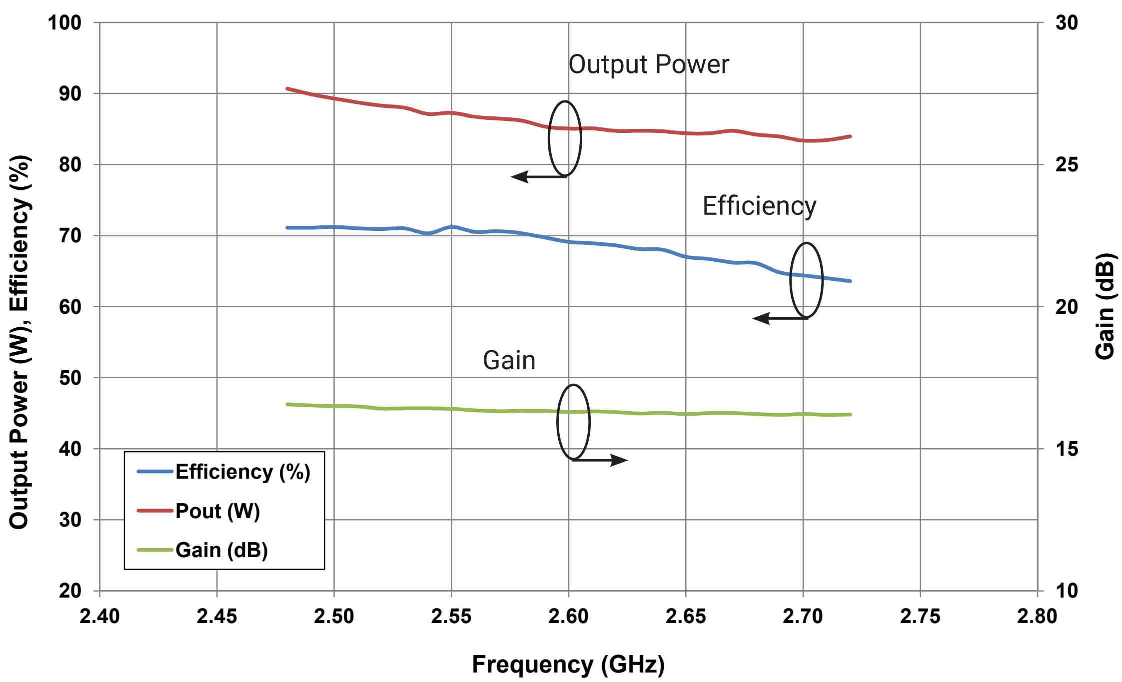


Figure 2. - Gain, Power Added Efficiency & Average Power Output at 10% Duty Cycle
for the CGHV27060MP Measured in Demonstration Amplifier Circuit CGHV27060MP-TB



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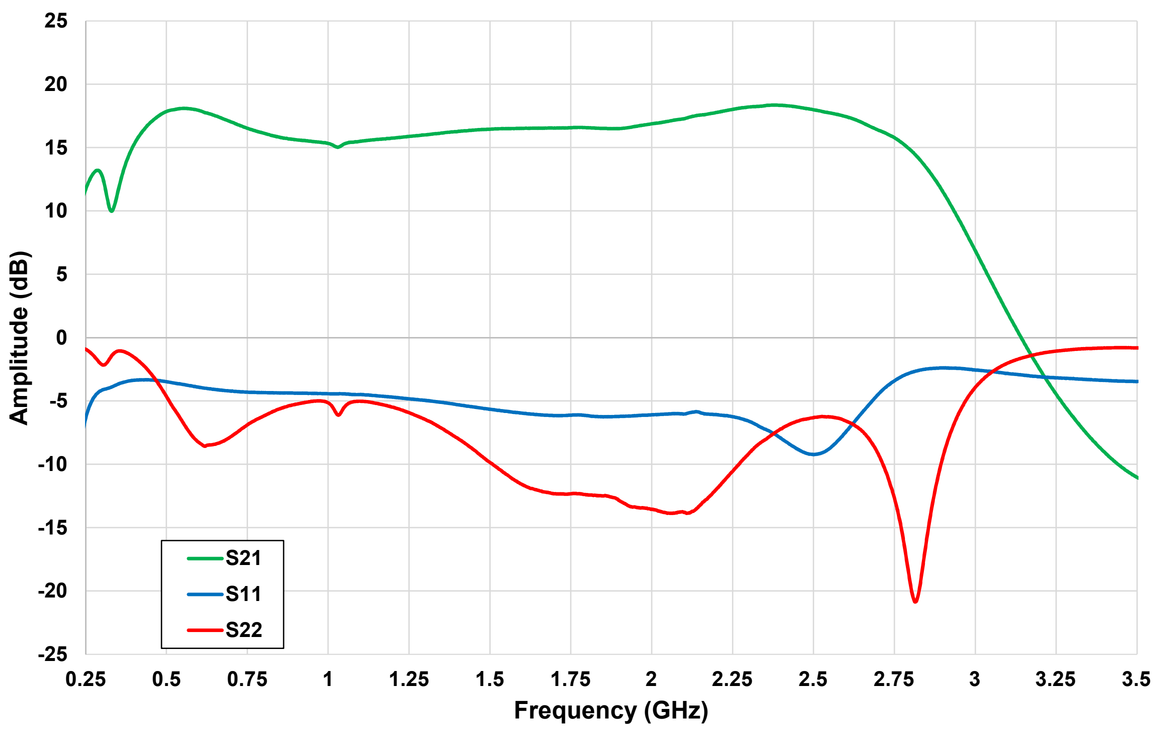
Electrical Characteristics When Tested in CGHV27060MP-AMP3, MILCOM

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
RF Characteristics[1] (T_C = 25˚C, F_0 = 0.8 - 2.7 GHz unless otherwise noted)						
Gain	G	–	16.5	-	dB	V_{DD} = 50 V, I_{DQ} = 120 mA, P_{IN} = 0 dBm
Output Power	P_{OUT}	–	48.5	–	dBm	V_{DD} = 50 V, I_{DQ} = 120 mA, P_{IN} = 37 dBm
Drain Efficiency	η	–	60	-	%	V_{DD} = 50 V, I_{DQ} = 120 mA, P_{IN} = 37 dBm
Output Mismatch Stress	VSWR	–	3 : 1	–	Y	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 120 mA, P_{IN} = 37 dBm

Notes:
Measured in CGHV27060MP-AMP3 Application Circuit

Typical Performance in Application Circuit CGHV27060MP-AMP3, MILCOM

Figure 3. - Small Signal Gain and Return Losses Measured in CGHV27060MP-AMP3
V_{DD} = 50 V, I_{DQ} = 120 mA



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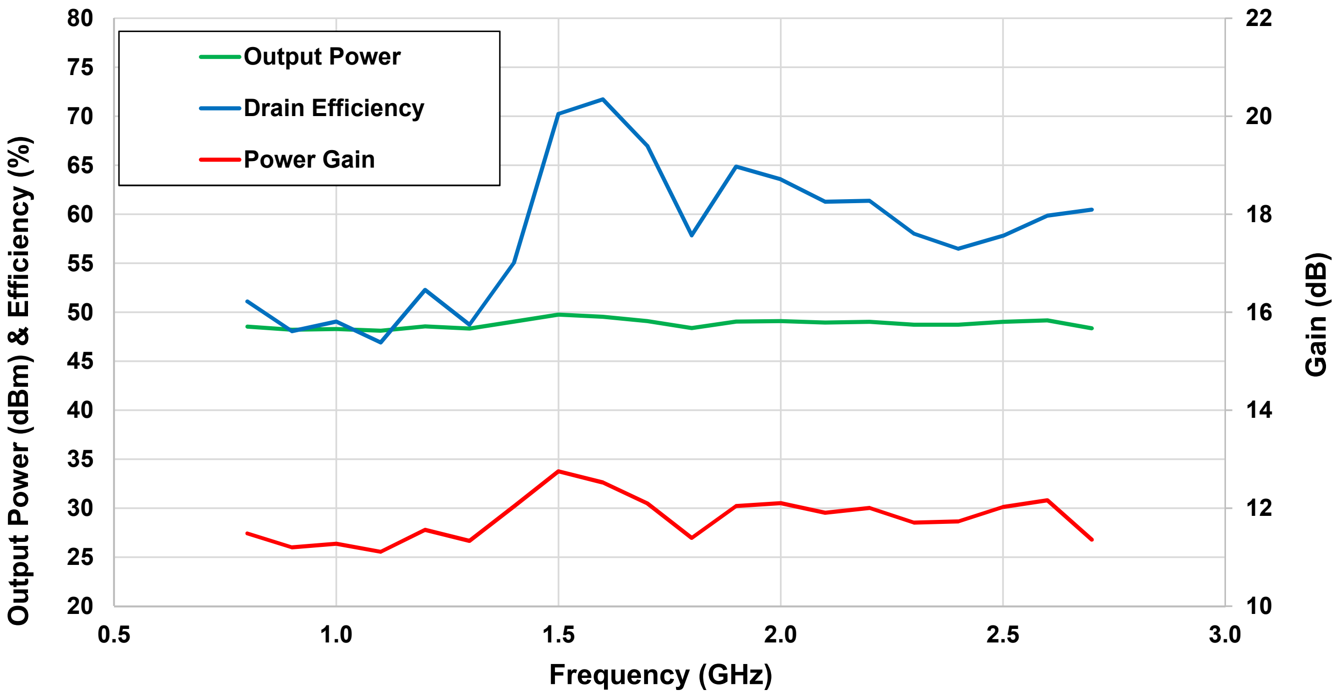
Typical Performance in Application Circuit CGHV27060MP-AMP3, MILCOM

Figure 4. - Power, Drain Efficiency and Gain vs Frequency of CGHV27060MP-AMP3
P_{IN} = 37 dBm, V_{DD} = 50 V, I_{DQ} = 120 mA



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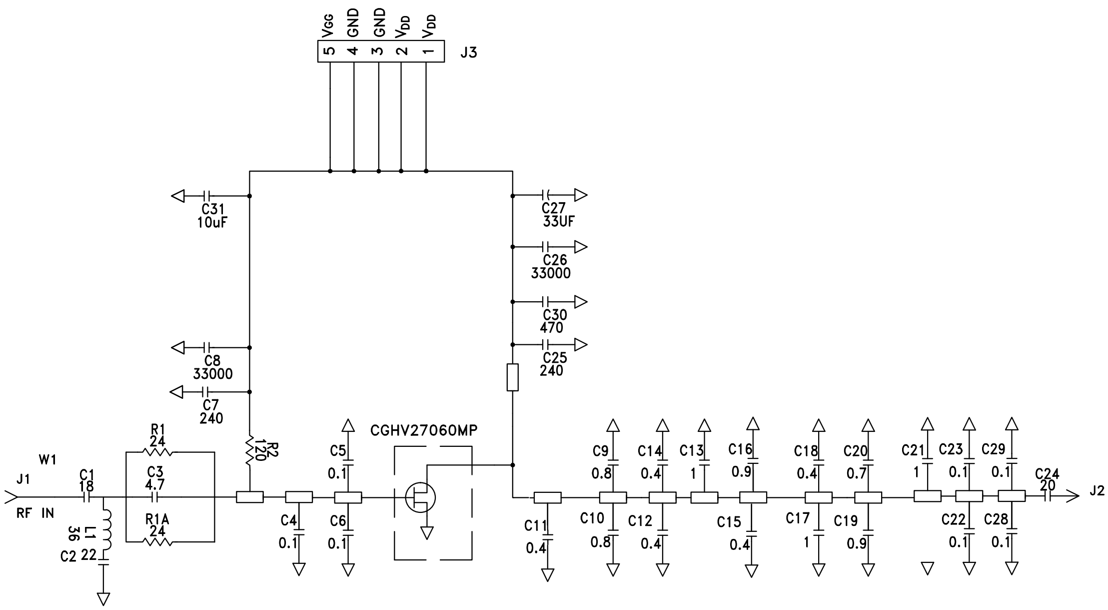
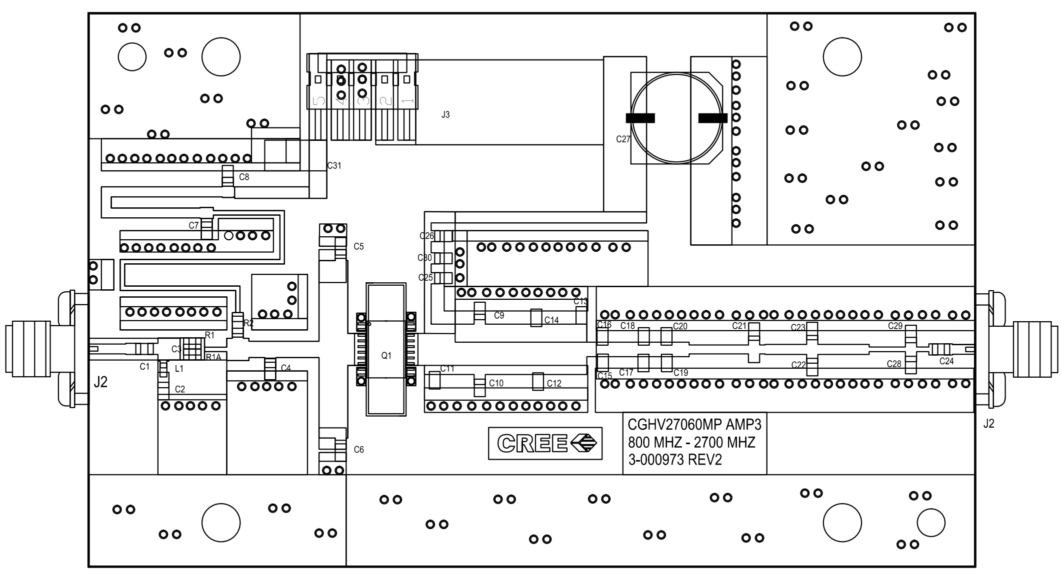
CGHV27060MP-AMP3 Demonstration Amplifier Circuit Schematic



CGHV27060MP-AMP3 Demonstration Amplifier Circuit Outline



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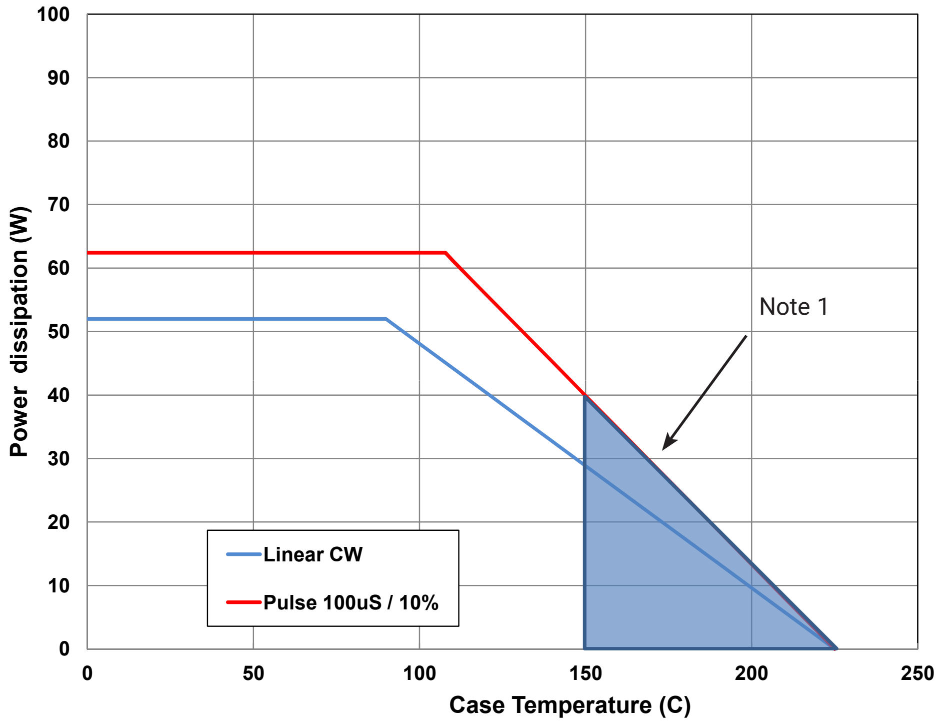
CGHV27060MP Power Dissipation De-rating Curve



Note 1. Area exceeds Maximum Case Temperature (See Page 2).

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 to 250 V)	JEDEC JESD22 C101-C

Moisture Sensitivity Level (MSL) Classification

Parameter	Symbol	Level	Test Methodology
Moisture Sensitivity Level	MSL	3 (168 hours)	IPC/JEDEC J-STD-20

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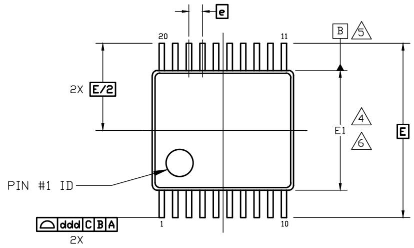
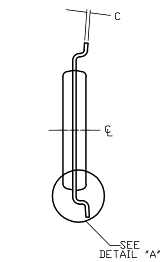
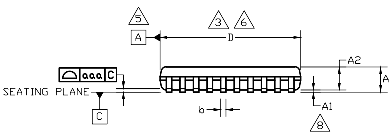
Product Dimensions CGHV27060MP (4.4 mm TSSOP 20-Lead Package)

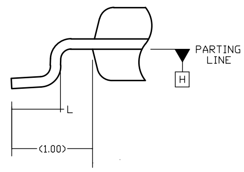




NOTES:

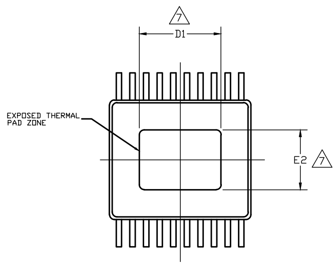
1. ALL DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DIMENSIONING & TOLERANCES PER ASME. Y14.5M-1994.
3. DIMENSION 'D' DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.
4. DIMENSION 'E1' DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 PER SIDE
5. DATUMS A AND B TO BE DETERMINED AT DATUM PLANE H.
6. DIMENSIONS 'D' AND 'E1' TO BE DETERMINED AT DATUM PLANE H.
7. "D1" AND "E2" DIMENSIONS DO NOT INCLUDE MOLD FLASH.
8. A1 IS DEFINED AS THE VERTICAL CLEARANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.





DETAIL 'A'

(VIEW ROTATED 90° C.W.)



SYMBOL	COMMON DIMENSIONS MIN.	NOM.	MAX.	NOTE
A	—		1.10	
A_1	0.05	—	0.15	8
A_2	0.85	0.90	0.95	
aaa		0.076		
b	0.19	–	0.30	
c	0.09	–	0.20	
D	6.40	6.50	6.60	3,6
E1	4.30	4.40	4.50	4,6
e		0.65 BSC		
E		6.40 BSC		
L	0.50	0.60	0.70	
D1	4.10	4.20	4.30	7
E2	2.90	3.00	3.10	7
ddd		0.20		

PINOUT TABLE

PIN	FUNCTION
1	GND
2	GND
3	RF INPUT
4	RF INPUT
5	RF INPUT
6	RF INPUT
7	RF INPUT
8	RF INPUT
9	GND
10	GND
11	GND
12	GND
13	RF OUTPUT
14	RF OUTPUT
15	RF OUTPUT
16	RF OUTPUT
17	RF OUTPUT
18	RF OUTPUT
19	GND
20	GND

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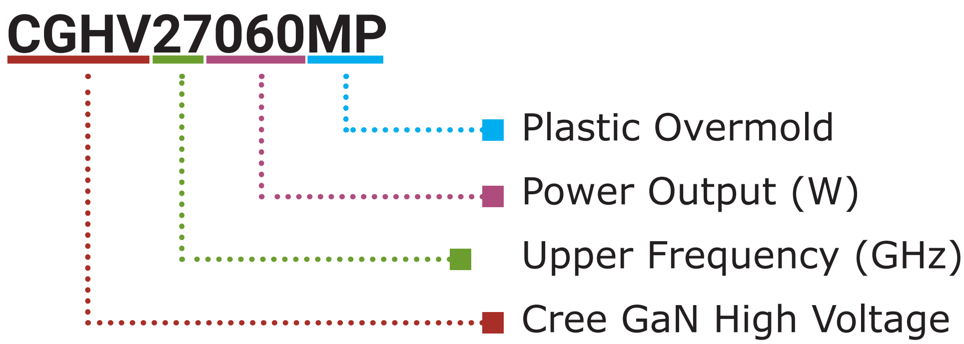
Part Number System



Parameter	Value	Units
Upper Frequency[1]	2.7	GHz
Power Output	60	W
Package	MP	-

Table 1.

Note[1]: 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.

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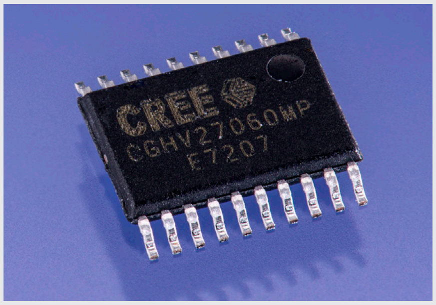
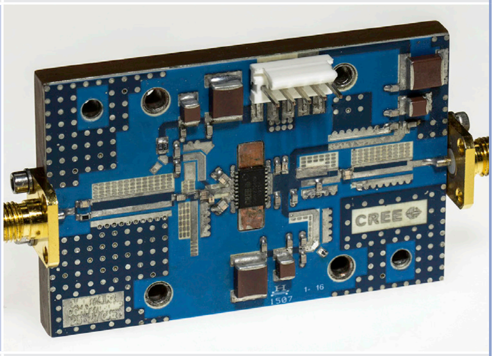
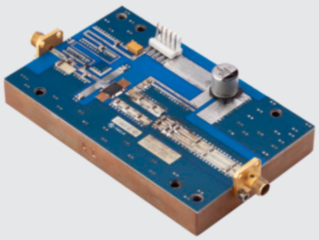
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV27060MP	GaN HEMT	Each	
CGHV27060MP-AMP1	Test board with GaN HEMT installed		
CGHV27060MP-AMP3	Test board with GaN HEMT installed	Each	

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