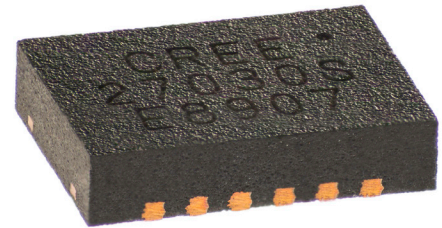


# CGH27030S

30 W, DC - 6.0 GHz, 28 V, GaN HEMT

## Description

Cree's CGH27030S is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGH27030S ideal for LTE, 4G Telecom and BWA amplifier applications. The CGH27030S operates from a 28 volt rail. The transistor is available in a 3mm x 4mm, surface mount, dual-flat-no-lead (DFN) package.



Package Type: 3x4 DFN  
PN: CGH27030S

## Typical Performance 1.8-2.2 GHz ( $T_c = 25^\circ\text{C}$ ), 28 V

Parameter	1.8 GHz	2.0 GHz	2.2 GHz	Units
Small Signal Gain	20.0	20.4	19.5	dB
Adjacent Channel Power @ $P_{AVE} = 5\text{ W}$	-39.5	-42.1	-39.1	dBc
Drain Efficiency @ $P_{AVE} = 5\text{ W}$	31.8	32.8	33.8	%
Input Return Loss	-4.2	-6.4	-7.7	dB

Note: Measured in the CGH27030S-AMP1 amplifier circuit, under 7.5 dB PAR single carrier WCDMA signal test model 1 with 64 DPCH

## Typical Performance 2.3-2.7 GHz ( $T_c = 25^\circ\text{C}$ ), 28 V

Parameter	2.3 GHz	2.5 GHz	2.7 GHz	Units
Small Signal Gain	21.1	20.6	20.0	dB
Adjacent Channel Power @ $P_{AVE} = 5\text{ W}$	-32.0	-36.4	-33.6	dBc
Drain Efficiency @ $P_{AVE} = 5\text{ W}$	37.8	36.2	35.0	%
Input Return Loss	-7.3	-7.9	-7.2	dB

Note: Measured in the CGH27030SF-AMP2 amplifier circuit, under 7.5 dB PAR single carrier WCDMA signal test model 1 with 64 DPCH

### Features for 28 V in CGH27030S-AMP1

- 1.8 - 2.2 GHz Operation
- 30 W Typical Output Power
- 18 dB Gain at 5 W  $P_{AVE}$
- -39 dBc ACLR at 5 W  $P_{AVE}$
- 33% efficiency at 5 W  $P_{AVE}$
- High degree of APD and DPD correction can be applied

### Features for 28 V in CGH27030S-AMP2

- 2.3 - 2.7 GHz Operation
- 30 W Typical Output Power
- 18.5 dB Gain at 5 W  $P_{AVE}$
- -39 dBc ACLR at 5 W  $P_{AVE}$
- 36% efficiency at 5 W  $P_{AVE}$
- High degree of APD and DPD correction can be applied

 Large Signal Models Available for ADS and MWO

**RoHS**  
COMPLIANT

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

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	$V_{DSS}$	120	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	$I_{GMAX}$	7.2	mA	25 °C
Maximum Drain Current <sup>1</sup>	$I_{DMAX}$	3.0	A	25 °C
Soldering Temperature <sup>2</sup>	$T_S$	245	°C	
Case Operating Temperature <sup>3</sup>	$T_C$	-40, +150	°C	
Thermal Resistance, Junction to Case <sup>4,5</sup>	$R_{\theta JC}$	3.65	°C/W	85 °C

### Notes:

<sup>1</sup> Current limit for long term, reliable operation

<sup>2</sup> Refer to the Application Note on soldering at [wolfspeed.com/RF/Document-Library](http://wolfspeed.com/RF/Document-Library)

<sup>3</sup>  $T_C$  = Case temperature for the device. It refers to the temperature at the ground tab underneath the package. The PCB will add additional thermal resistance

<sup>4</sup> Simulated for the CGH27030S at  $P_{DISS} = 21.6$  W

<sup>5</sup> The  $R_{TH}$  for Cree's demonstration amplifier, CGH27030S-AMP1, with 33 x 0.011 via holes designed on a 20 mil thick Rogers 4350 PCB, is 3.51 °C. The total  $R_{TH}$  from the heat sink to the junction is 3.62 °C + 3.51 °C = 7.13 °C/W

## Electrical Characteristics ( $T_C = 25$ °C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics<sup>1</sup></b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	$V_{DC}$	$V_{DS} = 10$ V, $I_D = 7.2$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	$V_{DC}$	$V_{DS} = 28$ V, $I_D = 0.20$ mA
Saturated Drain Current	$I_{DS}$	5.0	7.0	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	84	-	-	$V_{DC}$	$V_{GS} = -8$ V, $I_D = 7.2$ mA
<b>RF Characteristics<sup>3</sup> (<math>T_C = 25</math> °C, <math>F_0 = 2.65</math> GHz unless otherwise noted)</b>						
Gain	G	-	19.1	-	dB	$V_{DD} = 28$ V, $I_{DQ} = 0.20$ A, $P_{IN} = 10$ dBm
Output Power <sup>3</sup>	$P_{OUT}$	-	44.9	-	dBm	$V_{DD} = 28$ V, $I_{DQ} = 0.20$ A, $P_{IN} = 30$ dBm
Drain Efficiency <sup>3</sup>	$\eta$	-	72	-	%	$V_{DD} = 28$ V, $I_{DQ} = 0.20$ A, $P_{IN} = 30$ dBm
Output Mismatch Stress	VSWR	-	10:1	-	$\Psi$	No damage at all phase angles, $V_{DD} = 28$ V, $I_{DQ} = 0.20$ A, $P_{IN} = 30$ dBm
<b>Dynamic Characteristics</b>						
Input Capacitance <sup>4</sup>	$C_{GS}$	-	8.6	-	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Output Capacitance <sup>4</sup>	$C_{DS}$	-	2.0	-	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Feedback Capacitance	$C_{GD}$	-	0.4	-	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz

### Notes:

<sup>1</sup> Measured on wafer prior to packaging

<sup>2</sup> Measured in Cree's production test fixture. This fixture is designed for high volume test at 2.65 GHz

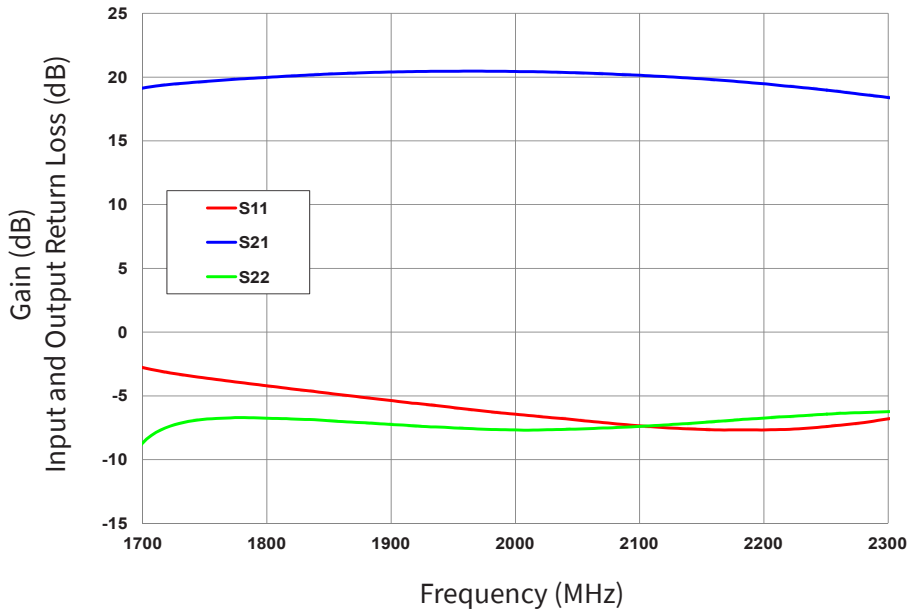
<sup>3</sup> Un-modulated Pulsed Signal, 100  $\mu$ s, 10% duty cycle

<sup>4</sup> Includes package and internal matching components

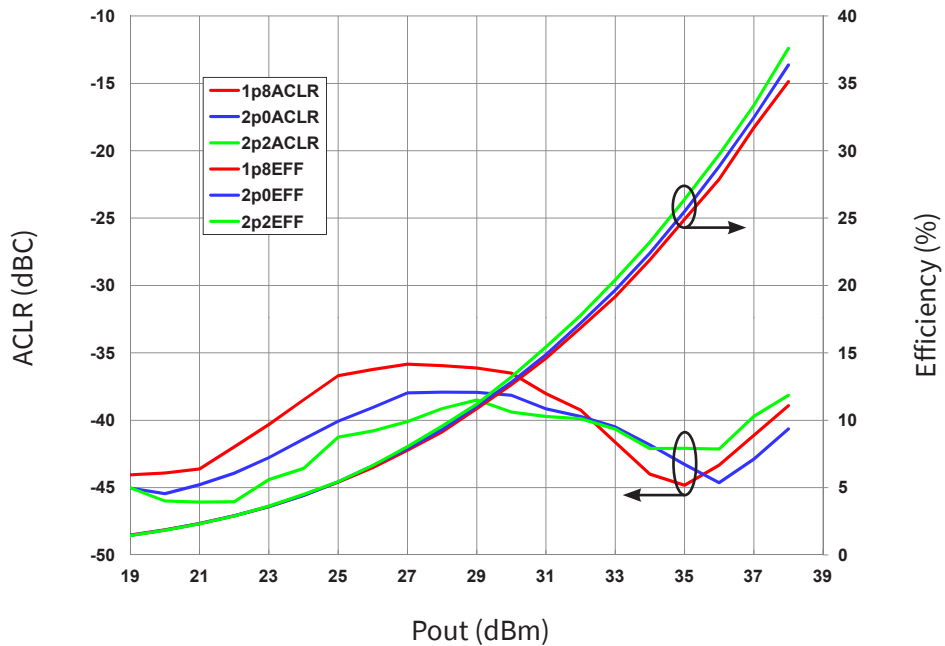


Typical Performance in CGH27030S-AMP1

**Figure 1. Small Signal Gain and Return Losses vs Frequency**  
 $V_{DD} = 28\text{ V}, I_{DQ} = 0.20\text{ A}$

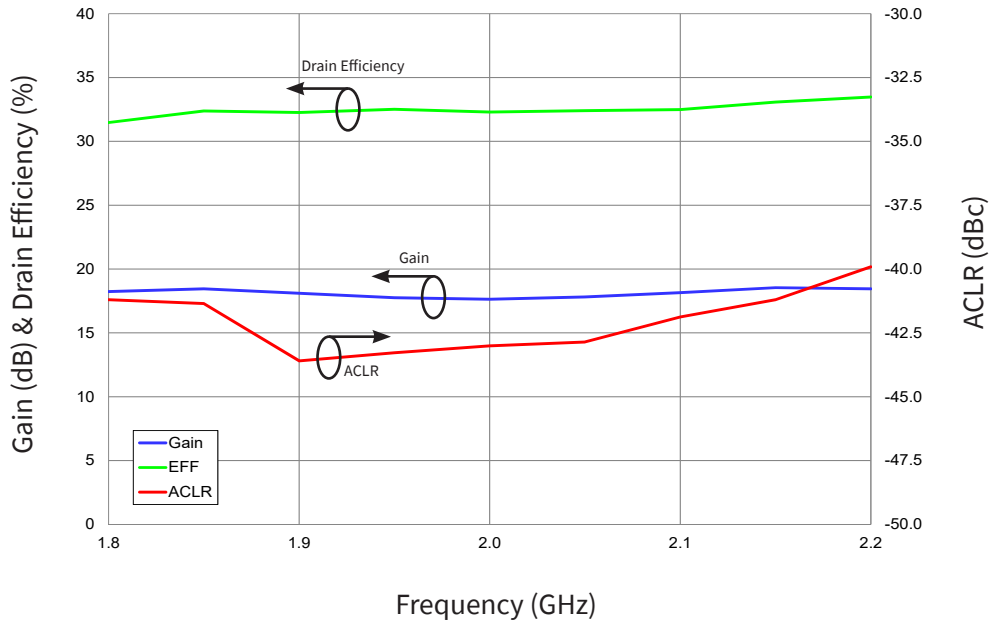


**Figure 2. Typical Drain Efficiency and ACLR vs. Output Power**  
 $V_{DD} = 28\text{ V}, I_{DQ} = 0.20\text{ A}, 1\text{c WCDMA}, \text{PAR} = 7.5\text{ dB}$

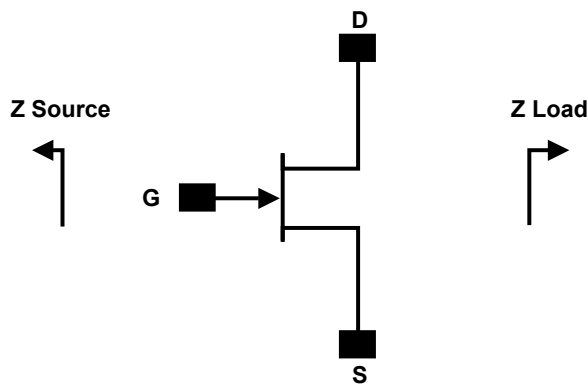


Typical Performance in CGH27030S-AMP1

Figure 3. Typical Gain, Drain Efficiency and ACLR vs Frequency  
 $V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 0.20\text{ A}$ ,  $P_{AVE} = 5\text{ W}$ , 1c WCDMA, PAR = 7.5 dB



Source and Load Impedances for Application Circuit CGH27030S-AMP1



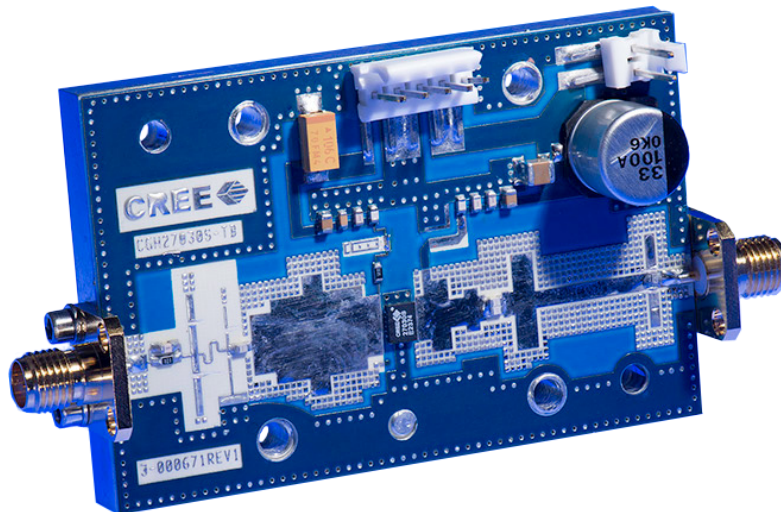
Frequency	Z Source	Z Load
1800	3.5 - j1.6	11 + j0.2
2000	3.6 - j0.6	10.5 - j1.8
2200	3.3 - j0.1	11 + j3.3

Note<sup>1</sup>.  $V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 0.20\text{ A}$  in the DFN package  
 Note<sup>2</sup>. Impedances are extracted from the CGH27030S-AMP1 application circuit and are not source and load pull data derived from the transistor

## CGH27030S-AMP1 Application Circuit Bill of Materials

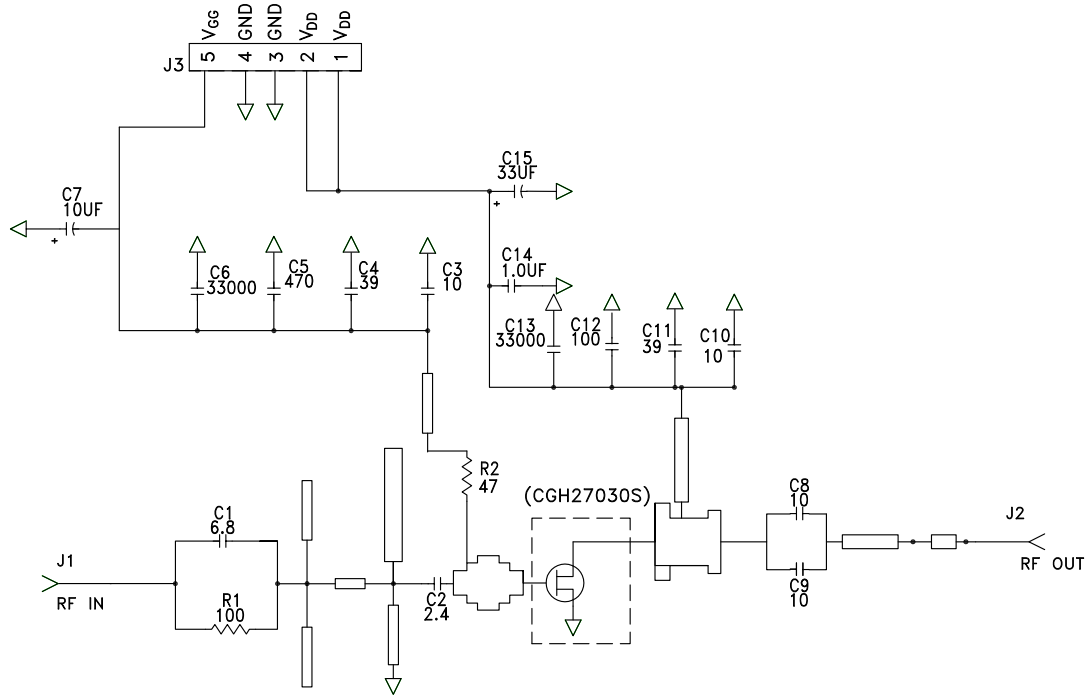
Designator	Description	Qty
R1	RES, 1/16 W, 0603, 1%, 100 OHMS	1
R2	RES, 1/16 W, 0603, 1%, 5.1 OHMS	1
C1	CAP, 6.8 pF, $\pm 0.25$ pF, 0603, ATC	1
C2	CAP, 2.4 pF, $\pm 0.01$ pF, 0603, ATC	1
C3, C8, C9, C10	CAP, 10.0 pF, $\pm 0.5$ pF, 0603, ATC	3
C12	CAP, 100.0 pF, 5%, 0603, ATC	1
C5	CAP, 470 pF, 5%, 100 V, 0603	1
C6, C13	P, 33000 pF, 0805, 10%, 100 V, X7R	2
C14	CAP, 1.0 UF, 100 V, 10%, X7R, 1210	1
C7	CAP, 10 UF, 16 V, TANTALUM	1
C15	CAP, 33 UF, 20%, G CASE	1
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	2
Q1	CGH27030S, QFN	1

## CGH27030S-AMP1 Application Circuit, 28 V, 1.8 - 2.2 GHz

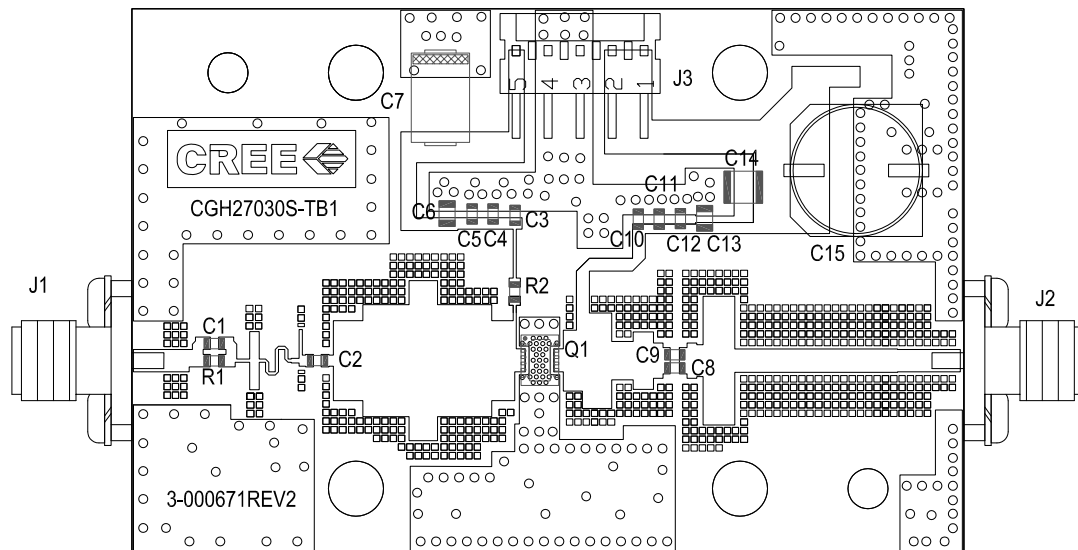




### CGH27030S-AMP1 Application Circuit Schematic, 28 V, 1.8 - 2.2 GHz



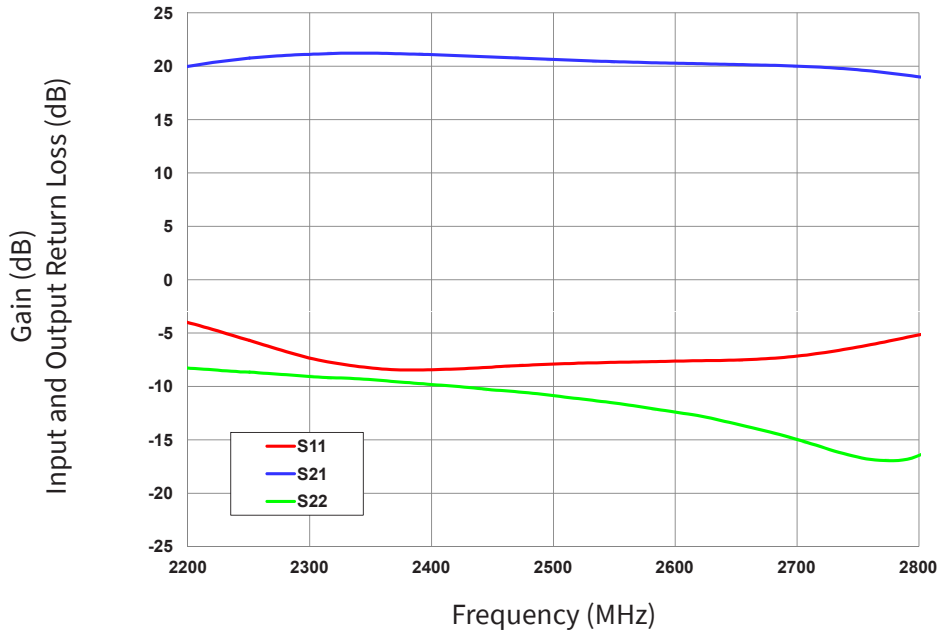
### CGH27030S-AMP1 Application Circuit, 28 V, 1.8 - 2.2 GHz



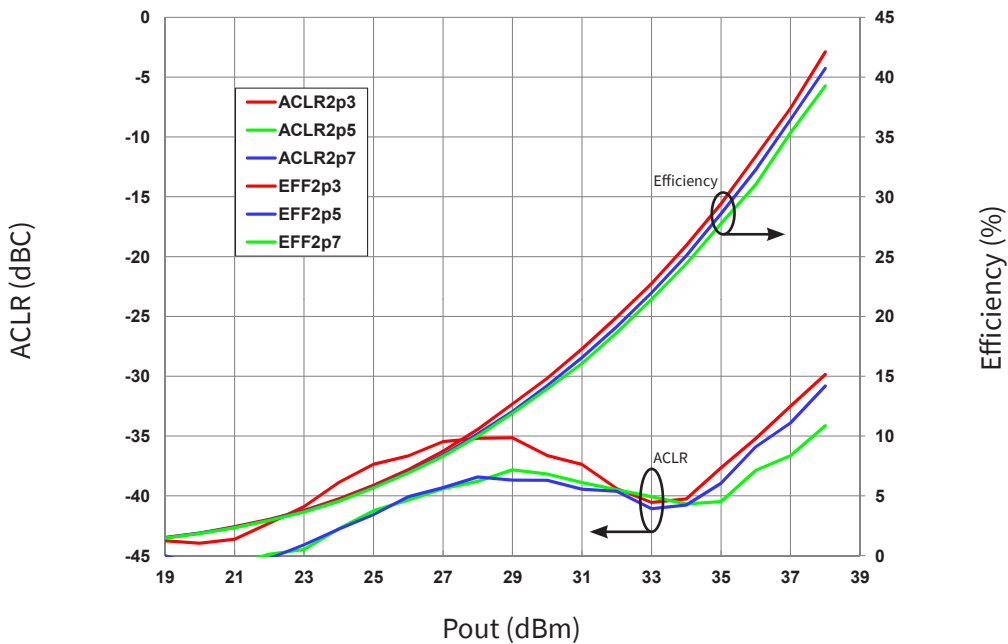


Typical Performance in Application Circuit CGH27030S-AMP2

**Figure 4. Small Signal Gain and Return Losses vs Frequency**  
 $V_{DD} = 28\text{ V}, I_{DQ} = 0.20\text{ A}$



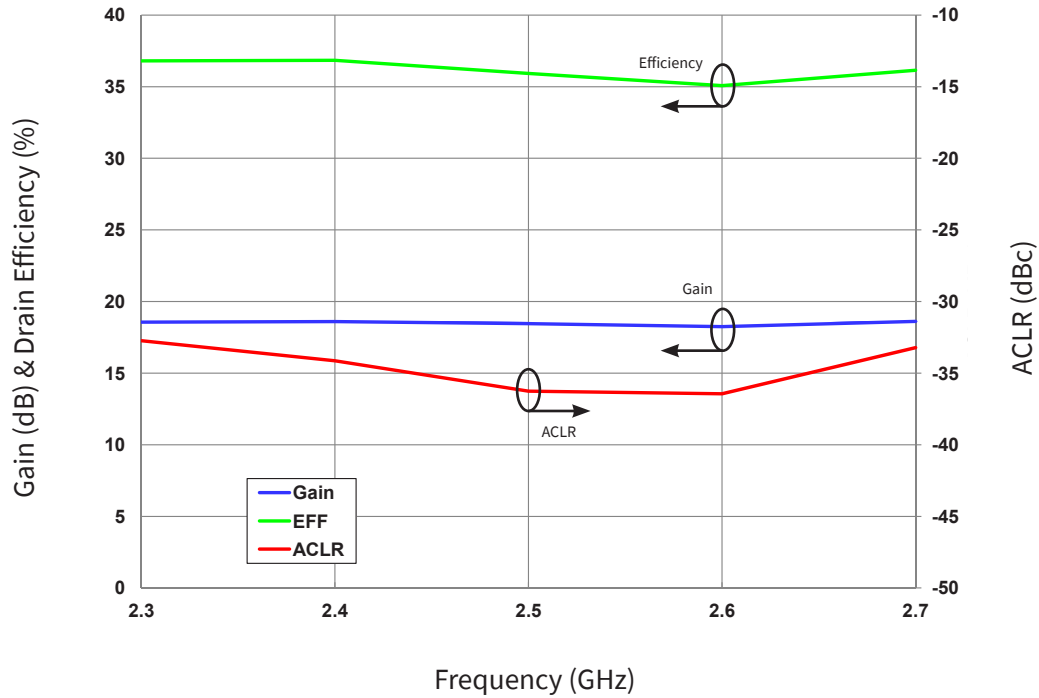
**Figure 5. Typical Drain Efficiency and ACLR vs. Output Power**  
 $V_{DD} = 28\text{ V}, I_{DQ} = 0.20\text{ A}, 1\text{c WCDMA}, \text{PAR} = 7.5\text{ dB}$





Typical Performance in Application Circuit CGH27030S-AMP2

Figure 6. Typical Gain, Drain Efficiency and ACLR vs Frequency  
 $V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 0.20\text{ A}$ ,  $P_{AVE} = 5\text{ W}$ , 1c WCDMA, PAR = 7.5 dB



Electrostatic Discharge (ESD) Classifications

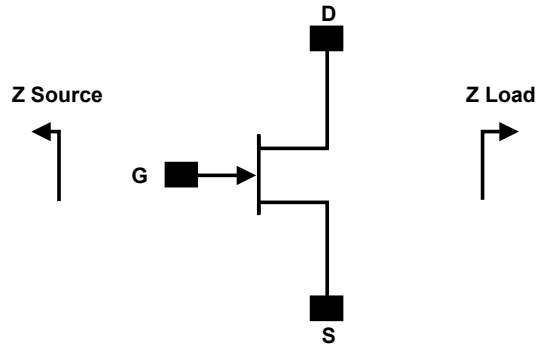
Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1B ( $\geq 500\text{ V}$ )	JEDEC JESD22 A114-D
Charge Device Model	CDM	II ( $\geq 200\text{ V}$ )	JEDEC JESD22 C101-C

Moisture Sensitivity Level (MSL) Classification

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



## Source and Load Impedances for Application Circuit CGH27030S-AMP2



Frequency	Z Source	Z Lead
2300	1.7 – j0.5	7.7 + j7.7
2500	2.2 – j0.2	8.0 + j6.8
2700	1.5 – j0.1	6.6 + j6.3

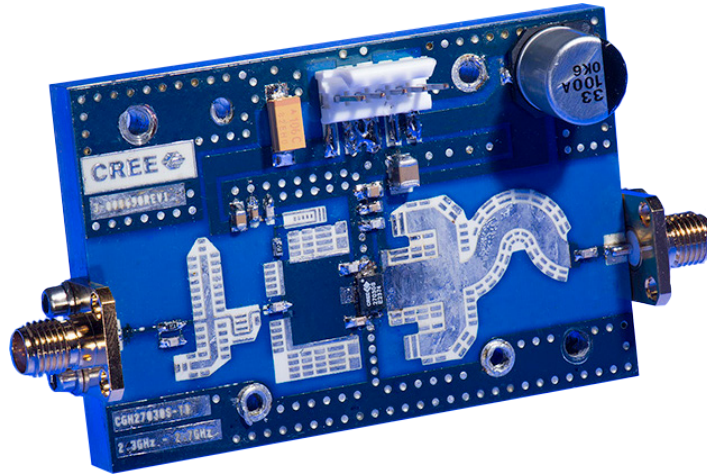
Note<sup>1</sup>.  $V_{DD} = 28V$ ,  $I_{DQ} = 0.20 A$  in the DFN package

Note<sup>2</sup>. Impedances are extracted from the CGH27030S-AMP2 demonstration amplifier and are not source and load pull data derived from the transistor

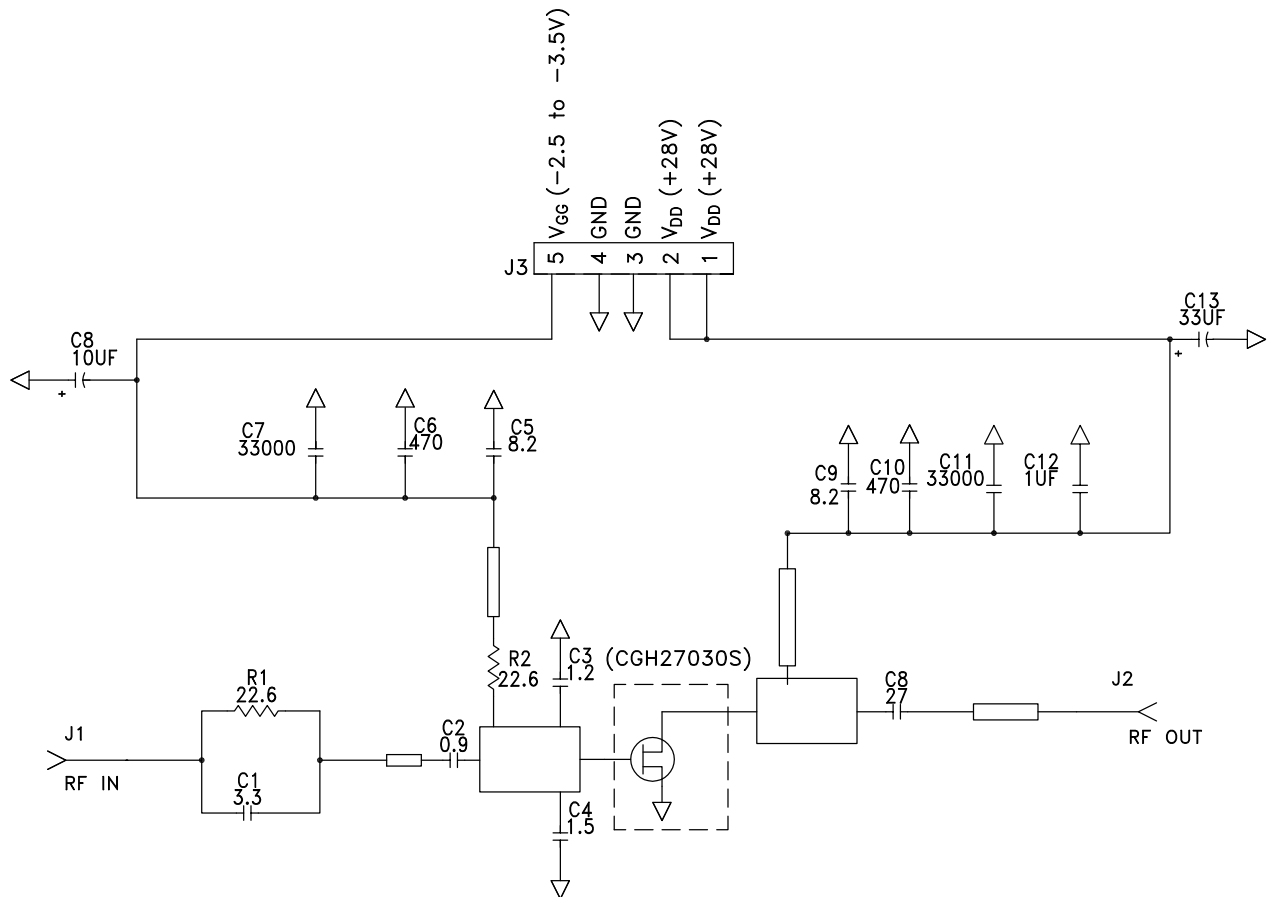
## CGH27030S-AMP1 Application Circuit Bill of Materials

Designator	Description	Qty
R1, R2	RES, 22.6, OHM, +/-1%, 1/16W, 0603	2
C1	CAP, 3.3 pF, ±0.1 pF, 0603, ATC	1
C2	CAP, 0.9 pF, ±0.1 pF, 0603, ATC	1
C3	CAP, 1.2 pF, ±0.1 pF, 0603, ATC	1
C4	CAP, 1.5 pF, ±0.1 pF, 0603, ATC	1
C5, C9	CAP, 8.2 pF, ±0.25 pF, 0603, ATC	2
C6, C10	CAP, 470 pF, 5%, 100 V, 0603, X	2
C7, C11	CAP, 33000 pF, 0805, 100 V, X7R	2
C12	CAP, 1.0 uF, 100 V, 10%, X7R, 1210	1
C8	CAP, 10 uF 16 V TANTALUM	1
C14	CAP, 27 pF, ±5%, 0603, ATC	1
C13	CAP, 33 uF, 20%, G CASE	1
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	1
Q1	CGH27030S, QFN	2

**CGH27030S-AMP2 Application Circuit, 28 V, 2.3 - 2.7 GHz**

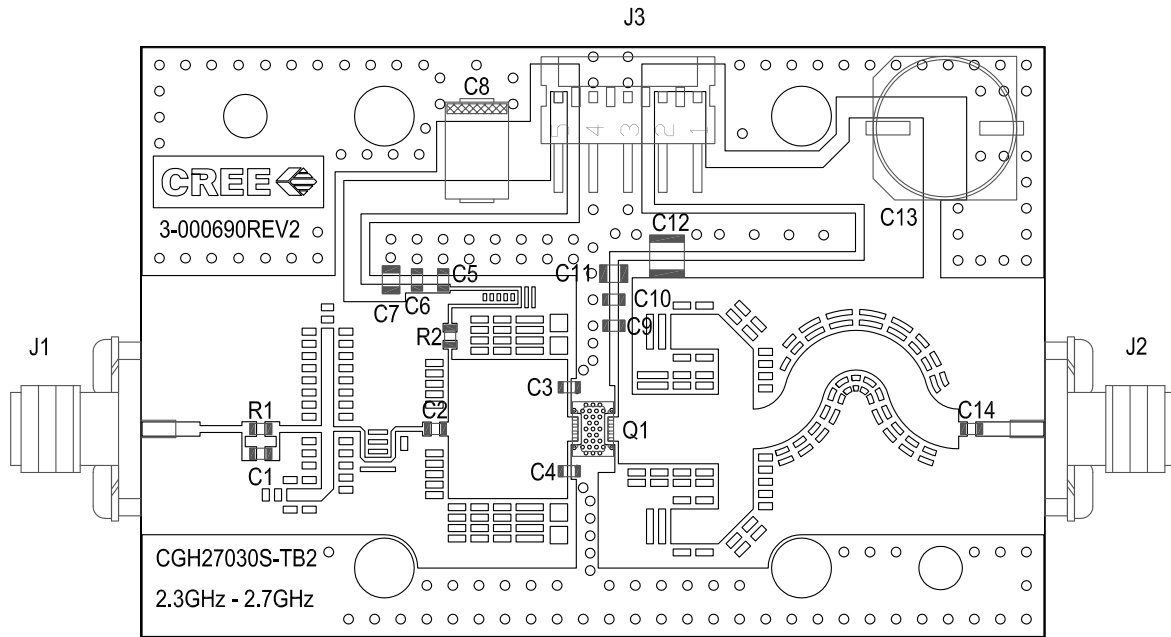


**CGH27030S-AMP2 Application Circuit Schematic, 28 V, 2.3 - 2.7 GHz**



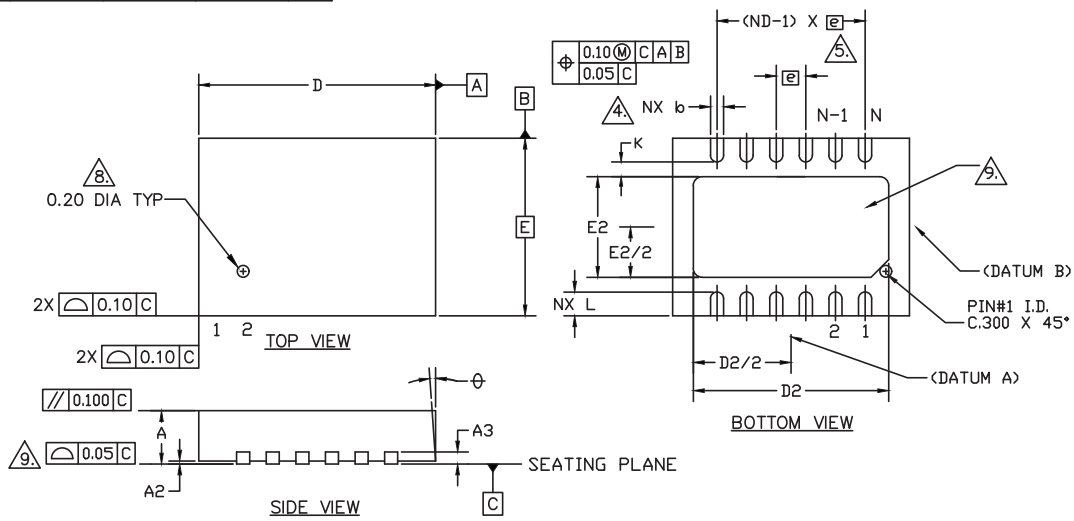


**CGH27030S-AMP2 Application Circuit, 28 V, 2.3 - 2.7 GHz**

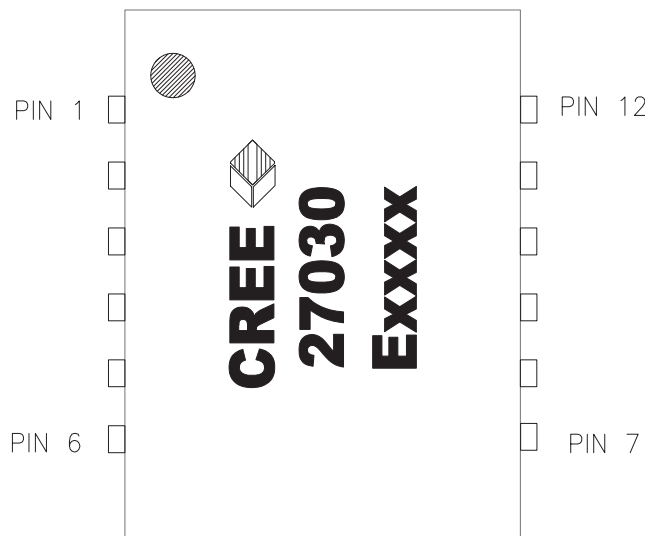


**Product Dimensions CGH27030S (Package 3 x 4 DFN)**

SYMBOL	COMMON DIMENSIONS			NOTE
	MIN.	NOM.	MAX.	
A	0.80	0.90	1.0	
A1	0.00	0.02	0.05	
A3	0.203 REF.			
⌀	0	—	12	2
D	4.00 BSC			
E	3.00 BSC			
Ⓜ	0.50 BSC			
N	12			3
ND	6			⚠
L	0.35	0.40	0.45	
b	0.18	0.25	0.30	⚠
D2	3.20	3.30	3.40	
E2	1.60	1.7	1.80	
K	0.20	—	—	



Pin	Input/Output
1	GND
2	RF IN
3	RF IN
4	RF IN
5	RF IN
6	GND
7	GND
8	RF OUT
9	RF OUT
10	RF OUT
11	RF OUT
12	GND



Note: Leadframe finish for 3x4 DFN package is Nickel/Palladium/Gold. Gold is the outer layer.

**Part Number System**

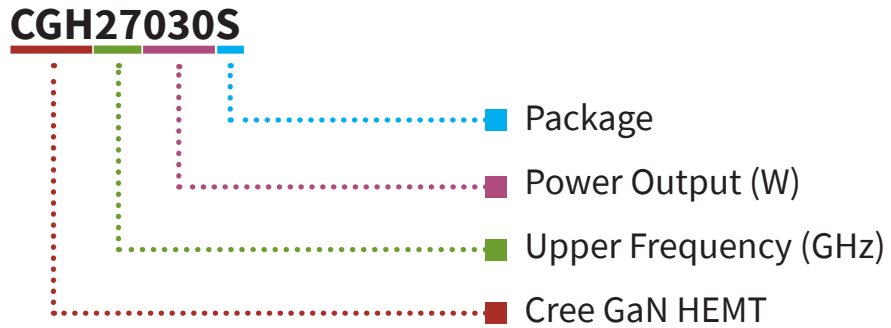


Table 1

Parameter	Value	Units
Upper Frequency <sup>1</sup>	2.7	GHz
Power Output	30	W
Package	Surface Mount	-

Note<sup>1</sup>: 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
CGH27030S	GaN HEMT	Each	
CGH27030S-AMP1	Test board without GaN HEMT	Each	
CGH27030S-AMP2	Test board with GaN HEMT installed	Each	



For more information, please contact:

4600 Silicon Drive  
Durham, North Carolina, USA 27703  
[www.wolfspeed.com/RF](http://www.wolfspeed.com/RF)

Sales Contact  
RFSales@cree.com

## Notes

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### Disclaimer

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