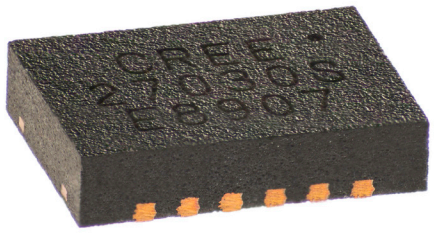
CGH27030S

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˚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 W	-39.5	-42.1	-39.1	dBc
Drain Efficiency @ P_{AVE} = 5 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˚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 W	-32.0	-36.4	-33.6	dBc
Drain Efficiency @ P_{AVE} = 5 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[1]	I_{DMAX}	3.0	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Case Operating Temperature[3]	T_C	-40, +150	˚C	
Thermal Resistance, Junction to Case[4,5]	$R_{\theta JC}$	3.65	˚C/W	85˚C

Notes:
[1] Current limit for long term, reliable operation
[2] Refer to the Application Note on soldering at wolfspeed.com/RF/Document-Library
[3] 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
[4] Simulated for the CGH27030S at P_{DISS} = 21.6 W
[5] 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
DC Characteristics[1]						
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
RF Characteristics[3] (T_C = 25˚C, F_0 = 2.65 GHz unless otherwise noted)						
Gain	G	–	19.1	–	dB	V_{DD} = 28 V, I_{DQ} = 0.20 A, P_{IN} = 10 dBm
Output Power[3]	P_{OUT}	–	44.9	–	dBm	V_{DD} = 28 V, I_{DQ} = 0.20 A, P_{IN} = 30 dBm
Drain Efficiency[3]	η	–	72	–	%	V_{DD} = 28 V, I_{DQ} = 0.20 A, P_{IN} = 30 dBm
Output Mismatch Stress	VSWR	–	10:1	–	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 0.20 A, P_{IN} = 30 dBm
Dynamic Characteristics						
Input Capacitance[4]	C_{GS}	–	8.6	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance[4]	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:
[1] Measured on wafer prior to packaging
[2] Measured in Cree's production test fixture. This fixture is designed for high volume test at 2.65 GHz
[3] Un-modulated Pulsed Signal, 100 µs, 10% duty cycle
[4] Includes package and internal matching components

Typical Performance in CGH27030S-AMP1

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

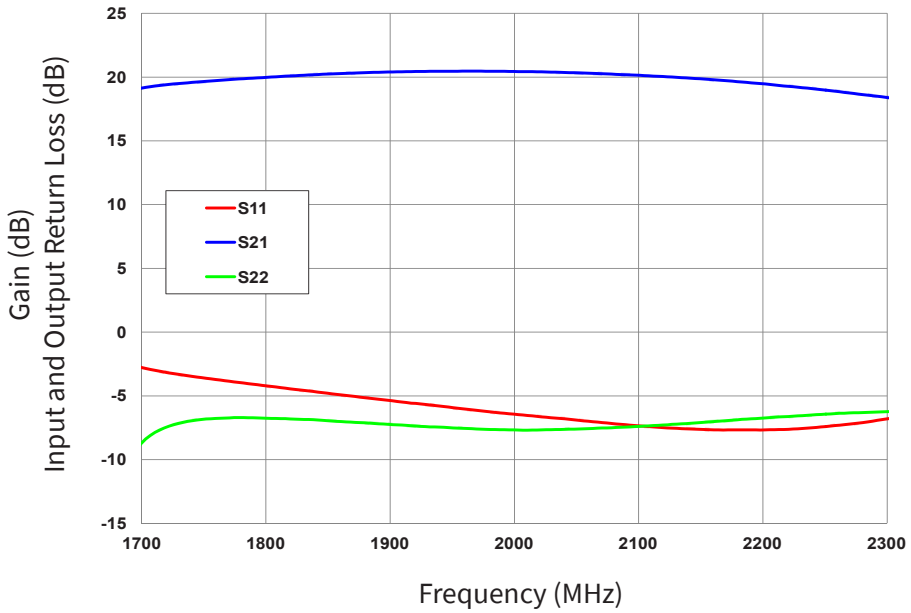
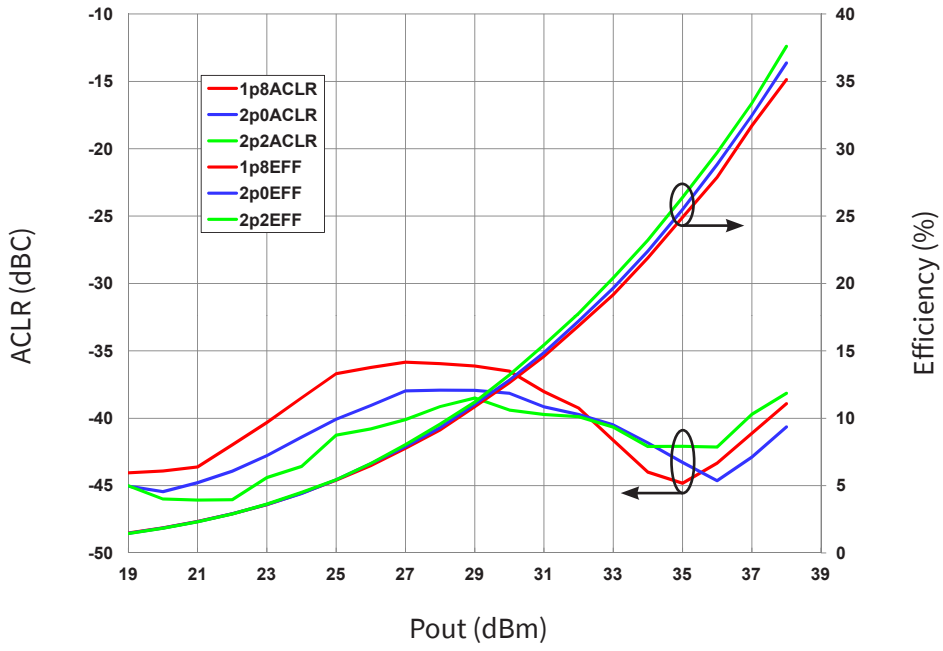
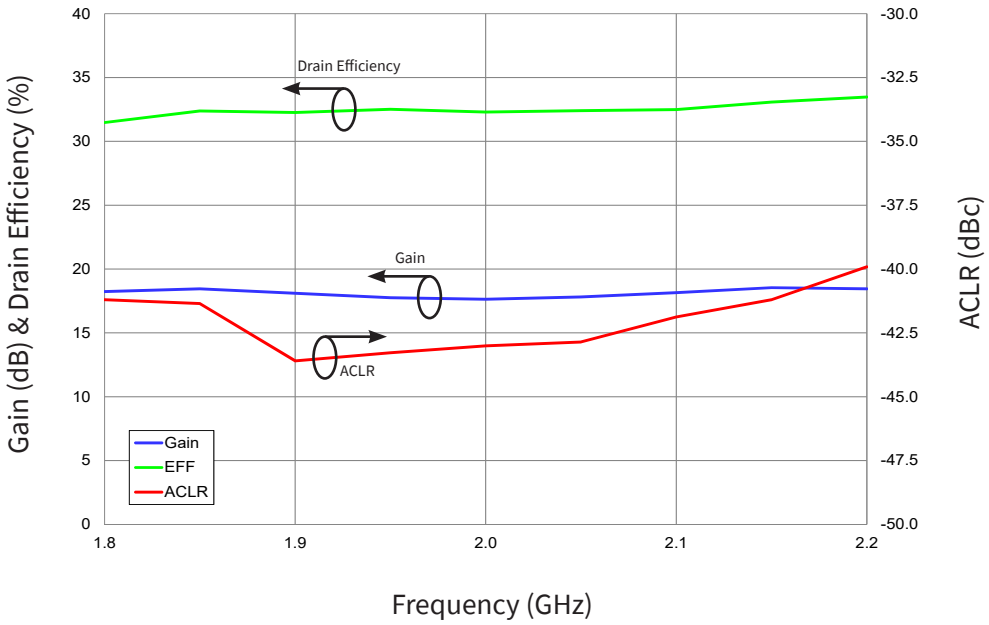


Figure 2. Typical Drain Efficiency and ACLR vs. Output Power
V_{DD} = 28 V, I_{DQ} = 0.20 A, 1c WCDMA, PAR = 7.5 dB

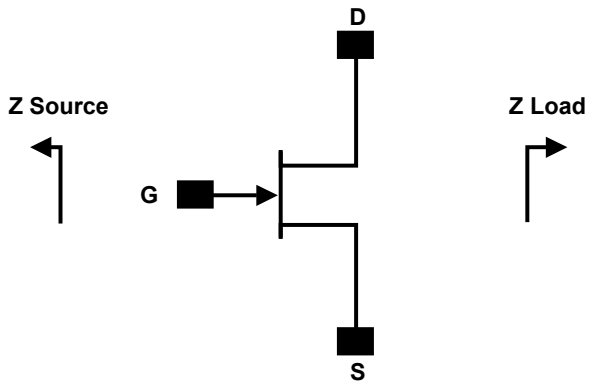


Typical Performance in CGH27030S-AMP1

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



Source and Load Impedances for Application Circuit CGH27030S-AMP1



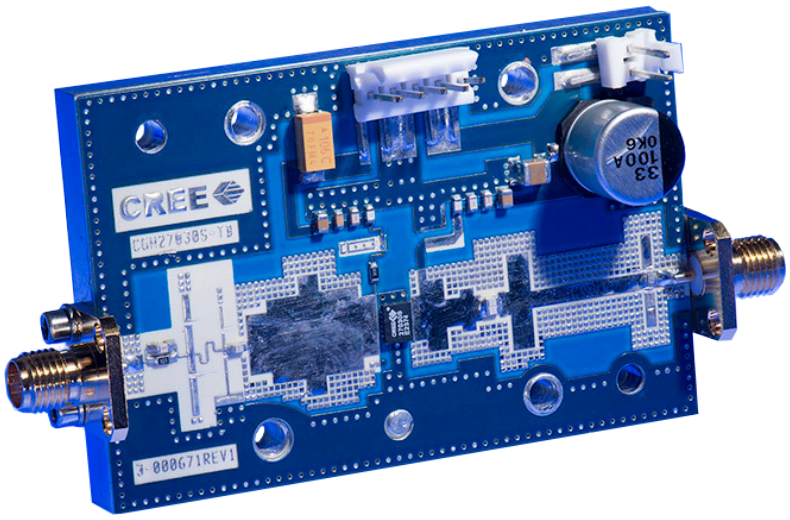
Frequency	Z Source	Z Load
1800	3.5 – j1.6	11 + j0.2
2000	3.6 – j0.6	10.5 – j1.8
2200	3.3 – j0.1	11 + j3.3

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

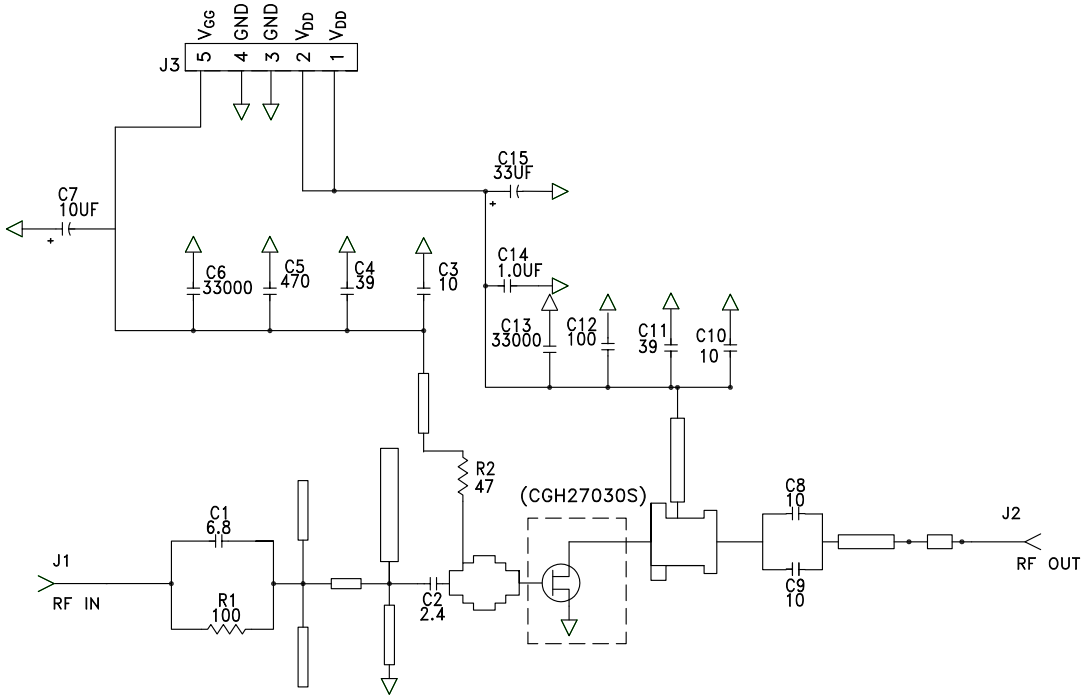
CGH27030S-AMP1 Application Circuit Bill of Materials

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, ±0.25 pF, 0603, ATC	1
C2	CAP, 2.4 pF, ±0.01 pF, 0603, ATC	1
C3, C8, C9, C10	CAP, 10.0 pF, ±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

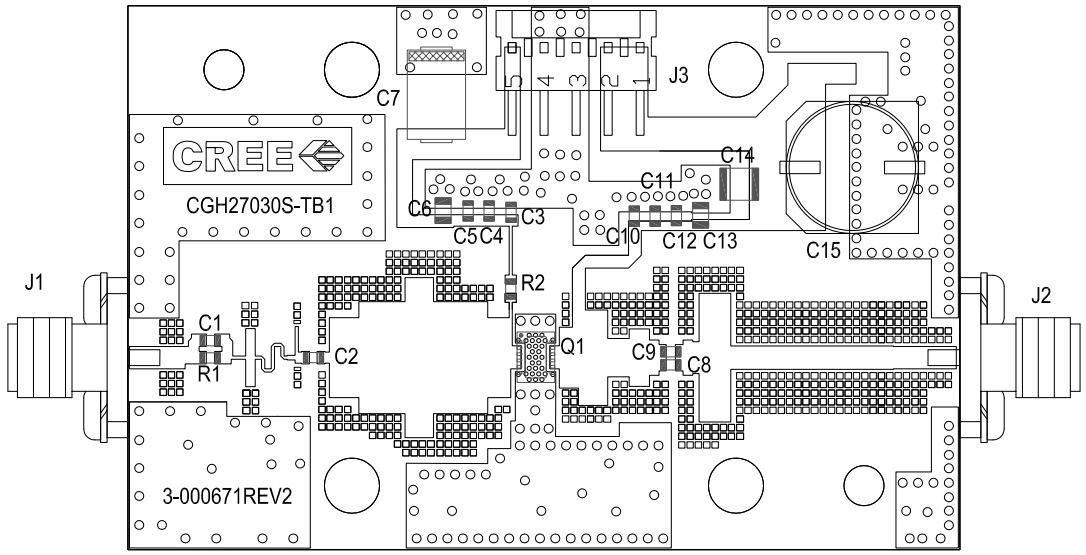
CGH27030S-AMP1 Application Circuit, 28 V, 1.8 - 2.2 GHz



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 V, I_{DQ} = 0.20 A

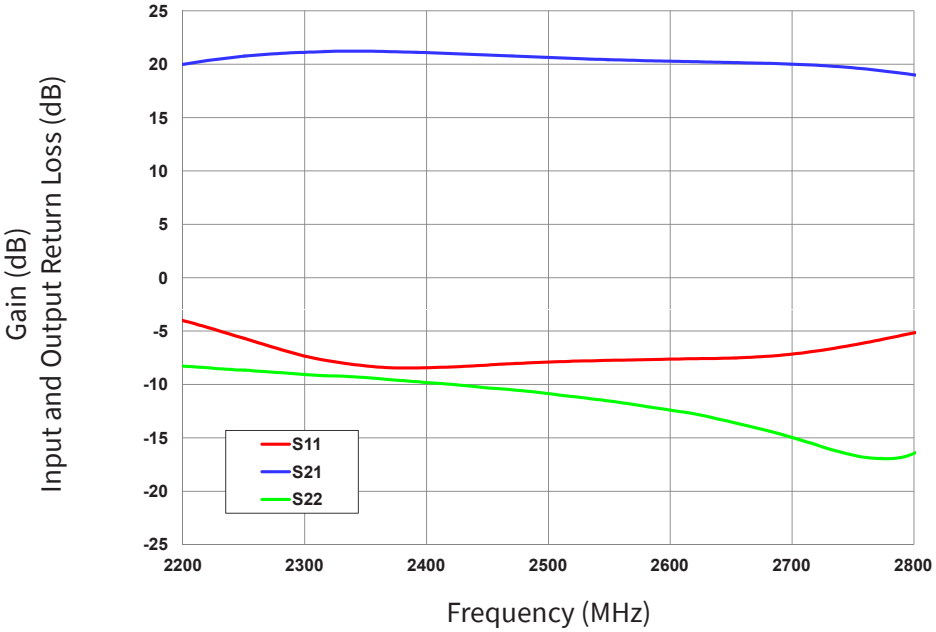
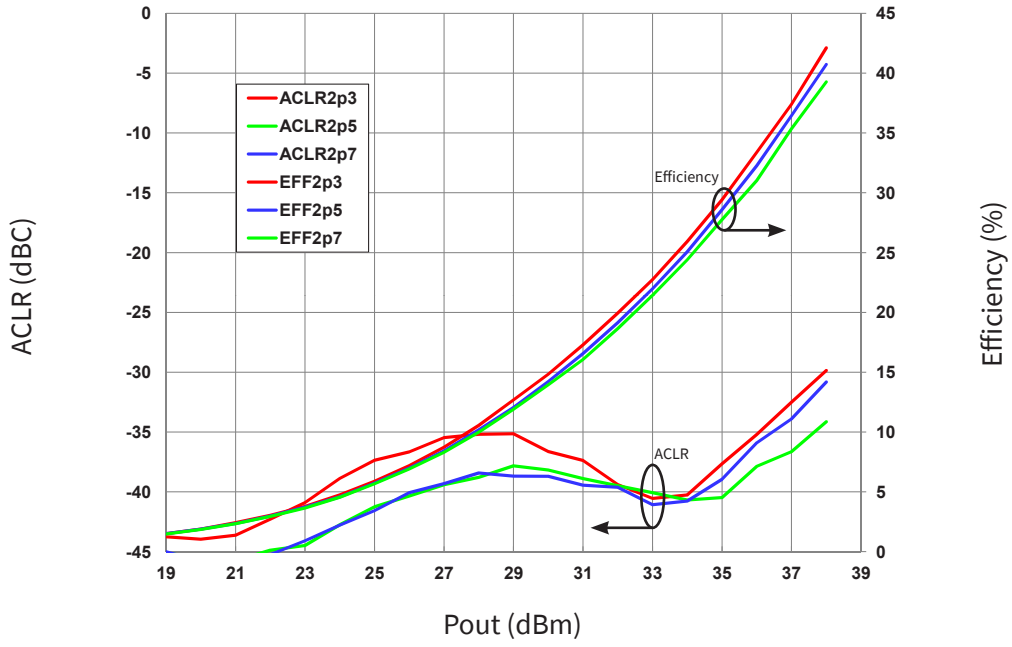
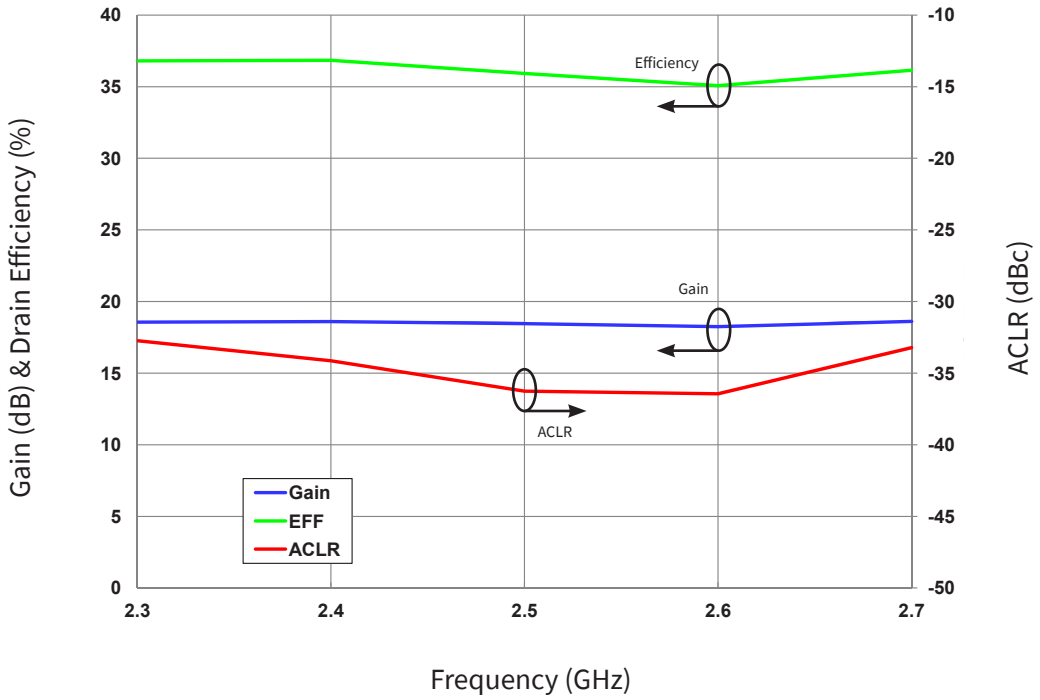


Figure 5. Typical Drain Efficiency and ACLR vs. Output Power
V_{DD} = 28 V, I_{DQ} = 0.20 A, 1c WCDMA, PAR = 7.5 dB



Typical Performance in Application Circuit CGH27030S-AMP2

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



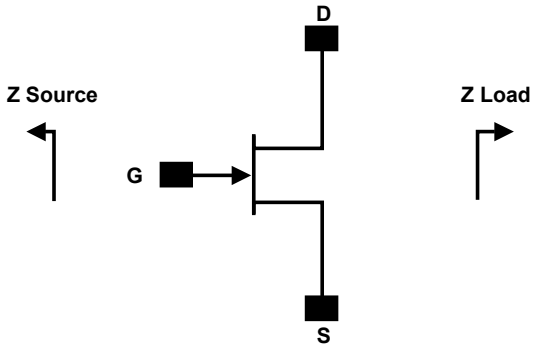
Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1B (≥ 500 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (≥ 200 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



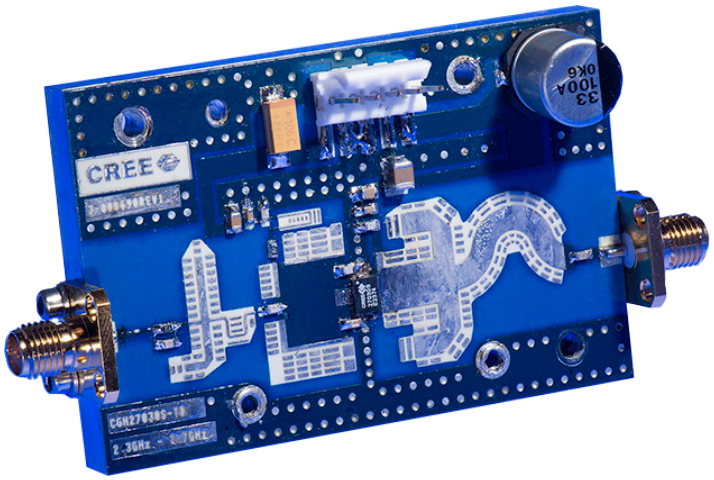
Frequency	Z Source	Z Lead
2300	1.7 – j0.5	7.7 + j7.7
2500	2.2 – j0.2	8.0 + j6.8
2700	1.5 – j0.1	6.6 + j6.3

Note[1]. V_{DD} = 28V, I_{DQ} = 0.20 A in the DFN package
Note[2]. Impedances are extracted from the CGH27030S-AMP2 demonstration amplifier and are not source and load pull data derived from the transistor

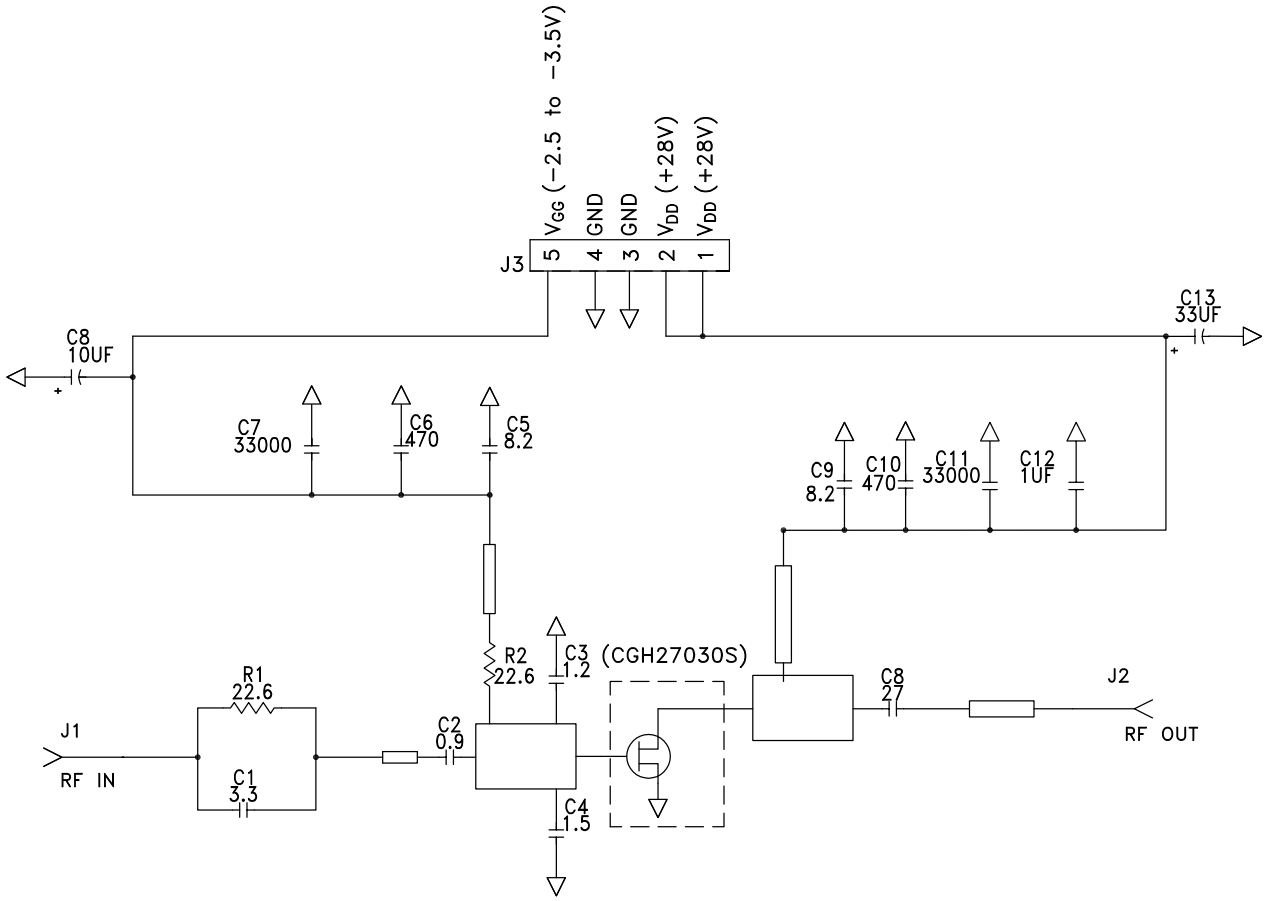
CGH27030S-AMP1 Application Circuit Bill of Materials

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

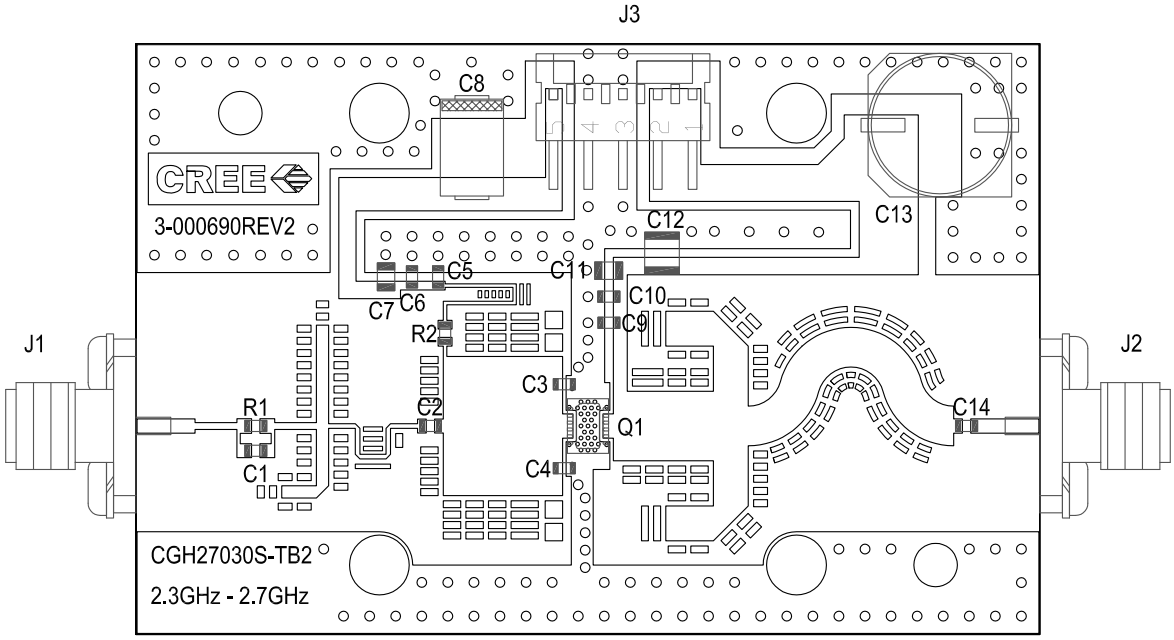
CGH27030S-AMP2 Application Circuit, 28 V, 2.3 - 2.7 GHz



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

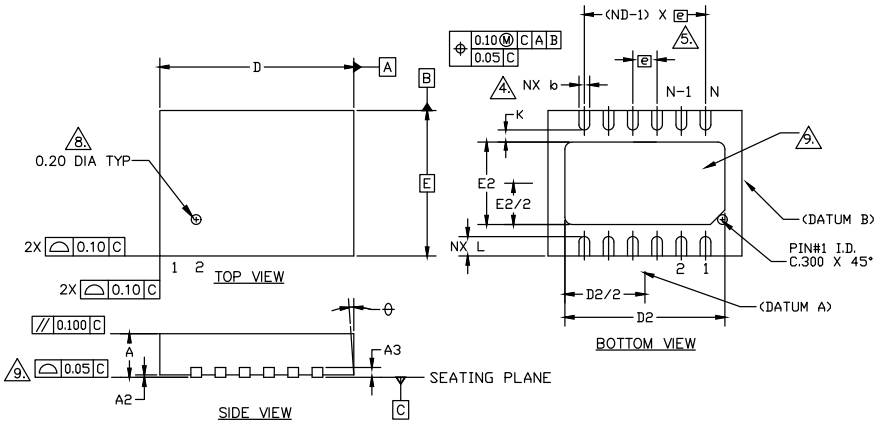


CGH27030S-AMP2 Application Circuit, 28 V, 2.3 - 2.7 GHz



Product Dimensions CGH27030S (Package 3 x 4 DFN)

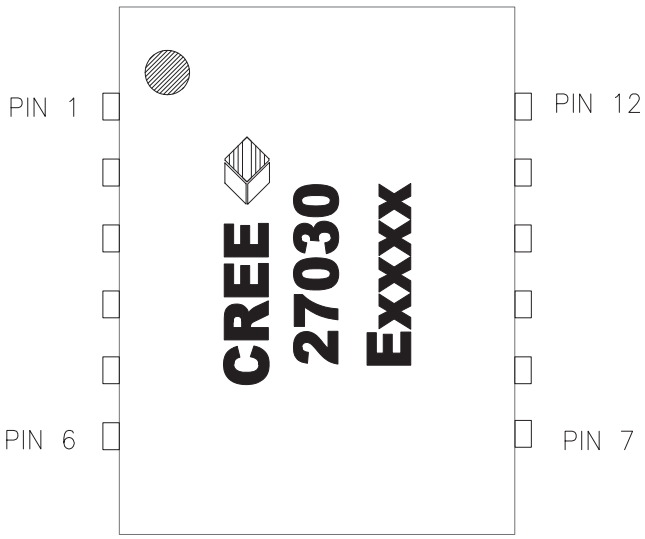
SYMBOL	COMMON DIMENSIONS			NOTE
	MIN.	NOM.	MAX.	
A	0.80	0.85	0.90	
A1	0.00	0.02	0.05	
A3		0.203 REF.		
θ	0	——	12	2
D		4.00 BSC		
E		3.00 BSC		
e		0.50 BSC		
N		12		3
ND		6		5
L	0.35	0.40	0.45	
b	0.18	0.25	0.30	4
D2	3.20	3.30	3.40	
E2	1.60	1.7	1.80	
K	0.20	——	——	



NOTES :

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5M – 1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS, θ IS IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN .15 AND .30mm FROM TERMINAL TIP.
5. ND REFERS TO THE NUMBER OF TERMINALS ON D SIDE
6. MAXIMUM PACKAGE WARPAGE IS .05 mm.
7. MAXIMUM ALLOWABLE BURRS IS .076 mm IN ALL DIRECTIONS.
8. PIN #1 ID ON TOP WILL BE LASER MARKED.
9. UNILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
10. THIS DRAWING CONFORMS TO JEDEC REGISTERED OUTLINE MO-229.
11. ALL PLATED SURFACES TIN 0.010 mm +/– 0.005 mm

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

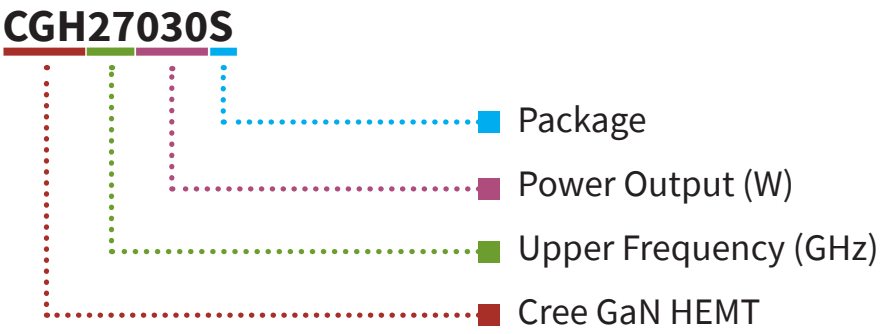


Table 1

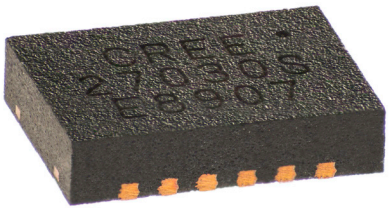
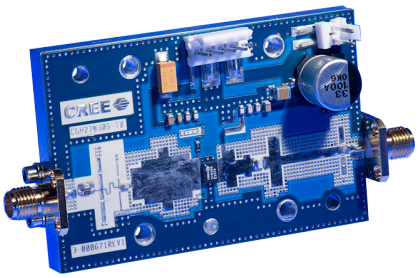
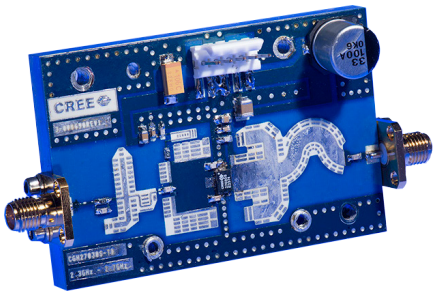
Parameter	Value	Units
Upper Frequency[1]	2.7	GHz
Power Output	30	W
Package	Surface Mount	-

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
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:

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www.wolfspeed.com/RF

Sales Contact
RFSales@cree.com

Notes

Disclaimer

Specifications are subject to change without notice. “Typical” parameters are the average values expected by Cree in large quantities and are provided for information purposes only. Cree products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death. No responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from use of the information contained herein. No license is granted by implication or otherwise under any patent or patent rights of Cree.