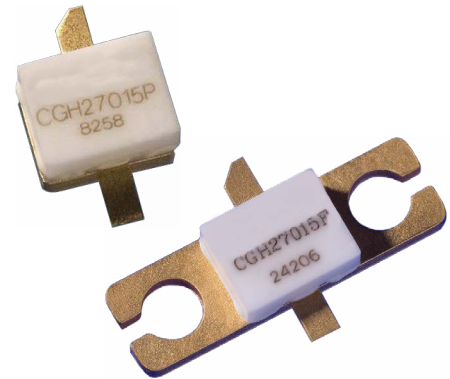


CGH27015

15 W, 28 V, GaN HEMT for Linear
Communications ranging from VHF to 3 GHz

Description

The CGH27015 is a gallium nitride (GaN) high electron mobility transistor designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGH27015 ideal for VHF, Comms, 3G, 4G, LTE, 2.3-2.9 GHz WiMAX and BWA amplifier applications. The unmatched transistor is available in both screw-down, flange and solder-down, pill packages.



Package Types: 440166 and 440196
PNs: CGH27015F and CGH27015P

Typical Performance Over 2.3-2.7 GHz ($T_c = 25^\circ\text{C}$)

Parameter	2.3 GHz	2.4 GHz	2.5 GHz	2.6 GHz	2.7 GHz	Unit
Small Signal Gain	16.9	16.0	15.1	14.6	14.3	dB
EVM at $P_{AVE} = 33\text{ dBm}$	1.69	1.51	1.50	1.66	1.93	%
Drain Efficiency at $P_{AVE} = 33\text{ dBm}$	27.1	27.8	28.4	28.0	28.0	dB

Notes:

¹ Measured in the CGH27015F-AMP amplifier circuit, under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, 5ms Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3, PAR = 9.8 dB @ 0.01 % Probability on CCDF.

Features

- VHF - 3.0 GHz Operation
- 15 W Peak Power Capability
- 14.5 dB Small Signal Gain
- 2 W $P_{AVE} < 2.0\%$ EVM
- 28% Efficiency at 2 W Average Power
- Designed for WiMAX Fixed Access 802.16-2004 OFDM Applications
- Designed for WiMAX Mobile Access 802.16e OFDMA Applications

Large Signal Models Available for ADS and MWO



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

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DS}	120	V	25°C
Gate-to-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}	4.0	mA	25°C
Maximum Drain Current ¹	I_{DMAX}	1.5	A	
Soldering Temperature ²	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case ³	$R_{\theta JC}$	8.0	°C/W	85°C
Case Operating Temperature ³	T_C	-40, +150	°C	

Notes:

¹ Current limit for long term, reliable operation

² Refer to the Application Note on soldering

³ Measured for the CGH27015F at $P_{DISS} = 14\text{ W}$

Electrical Characteristics ($T_C = 25^\circ\text{C}$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics¹						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	$V_{DS} = 10\text{ V}, I_D = 3.6\text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	—	-2.7	—		$V_{DS} = 28\text{ V}, I_{DQ} = 100\text{ mA}$
Saturated Drain Current	I_{DS}	2.9	3.5	—	A	$V_{DS} = 6.0\text{ V}, V_{GS} = 2.0\text{ V}$
Drain-Source Breakdown Voltage	V_{BR}	84	—	—	V_{DC}	$V_{GS} = -8\text{ V}, I_D = 3.6\text{ mA}$
RF Characteristics^{2, 3} ($T_C = 25^\circ\text{C}$, $F_0 = 2.5\text{ GHz}$ unless otherwise noted)						
Small Signal Gain	G_{SS}	13	15	—	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 100\text{ mA}$
Drain Efficiency ⁴	η	20	28	—	%	$V_{DD} = 28\text{ V}, I_{DQ} = 100\text{ mA}, P_{AVE} = 33\text{ dBm}$
Error Vector Magnitude	EVM	—	2.0	—		
Output Mismatch Stress	VSWR	—	—	10 : 1	Ψ	No damage at all phase angles, $V_{DD} = 28\text{ V}, I_{DQ} = 100\text{ mA}, P_{AVE} = 33\text{ dBm OFDM } P_{AVE}$
Dynamic Characteristics						
Input Capacitance	C_{GS}	—	4.5	—	pF	$V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$
Output Capacitance	C_{DS}	—	1.3	—		
Feedback Capacitance	C_{GD}	—	0.2	—		

Notes:

¹ Measured in the CGH27015F-AMP test fixture

² Scaled from PCM data

³ Under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, 5ms Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3

⁴ Drain Efficiency = P_{OUT}/P_{DC}

Typical Performance Data

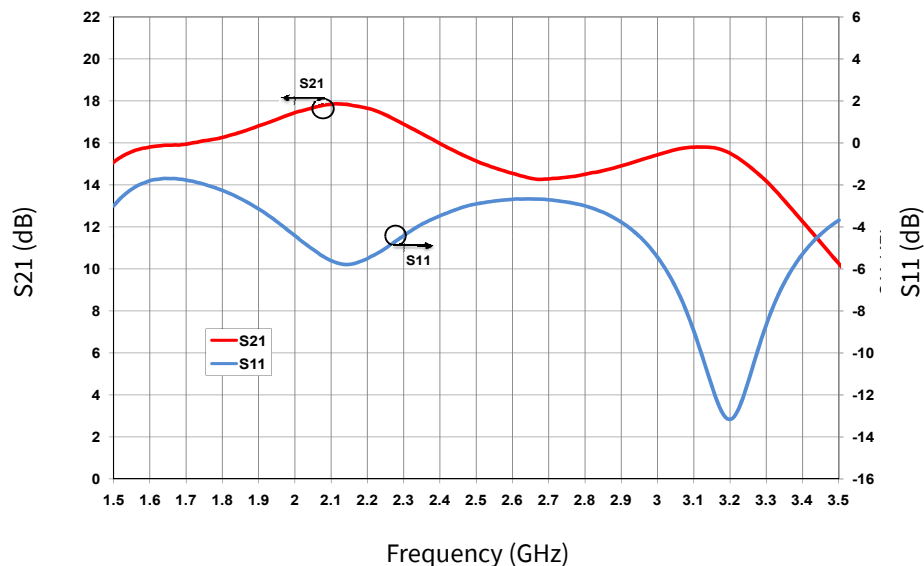


Figure 1. Performance of CGH27015 in Broadband Amplifier Circuit
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 100\text{ mA}$

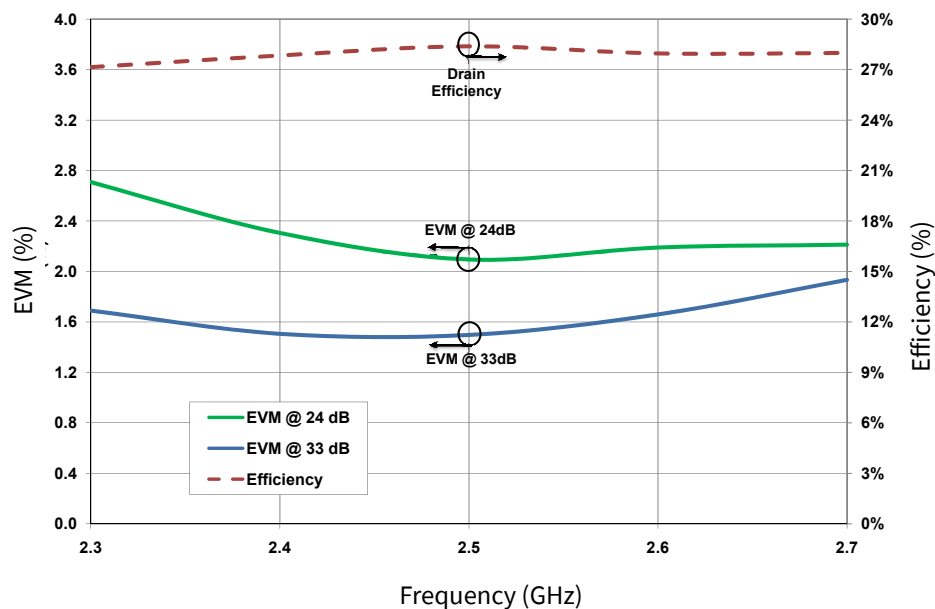


Figure 2. Typical EVM and Efficiency at 24 dBm and 33 dBm vs Frequency of
 CGH27015 in Broadband Amplifier Circuit

Note:

¹ Under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.

Typical Performance Data

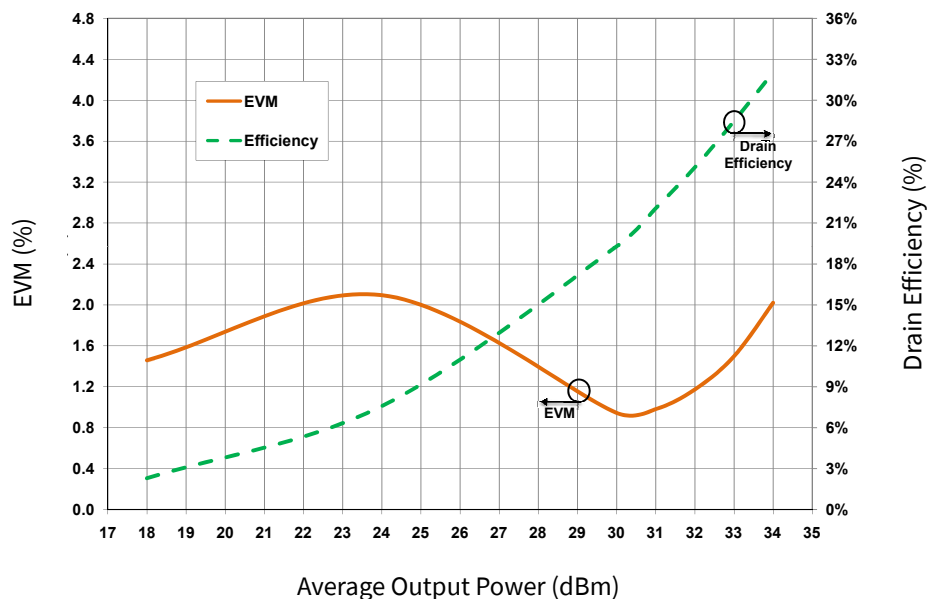


Figure 3. Typical EVM and Efficiency of CGH27015 in Broadband Amplifier Circuit at 2.5 GHz
 $f = 2.5$ GHz, 802.16-2004 OFDM, P/A = 9.8 dB

Note:
¹ Under 802.16-2004 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.

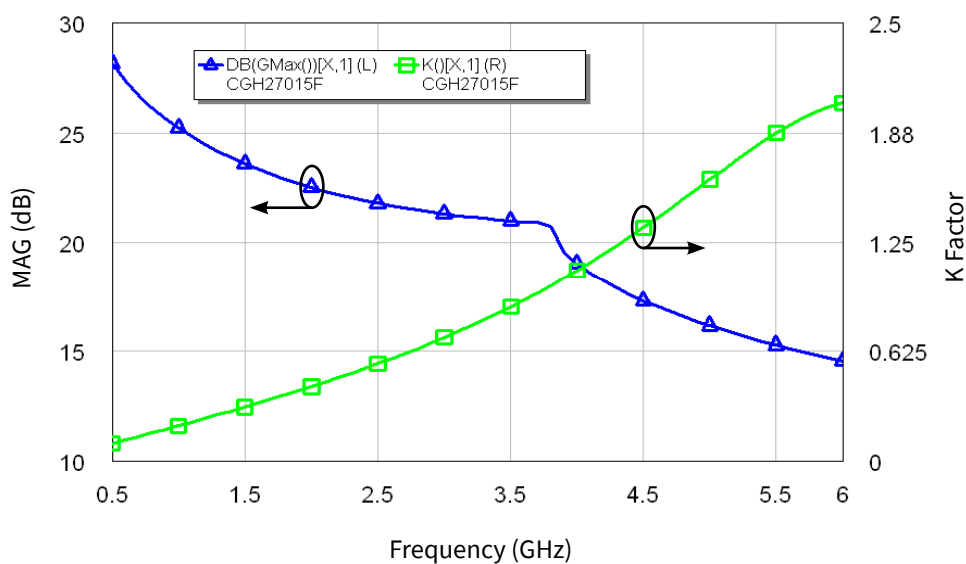


Figure 4. Simulated Maximum Available Gain and K Factor of the CGH27015F
 $V_{DD} = 28$ V, $I_{DQ} = 100$ mA

Typical Noise Performance

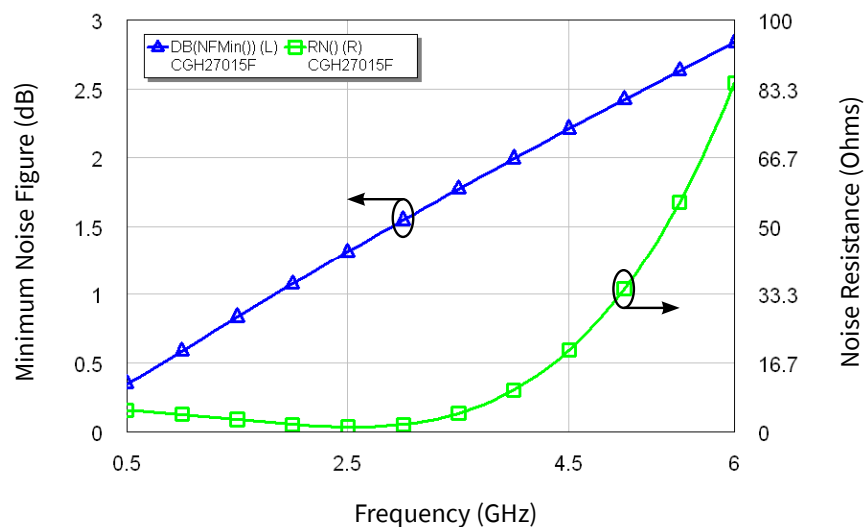
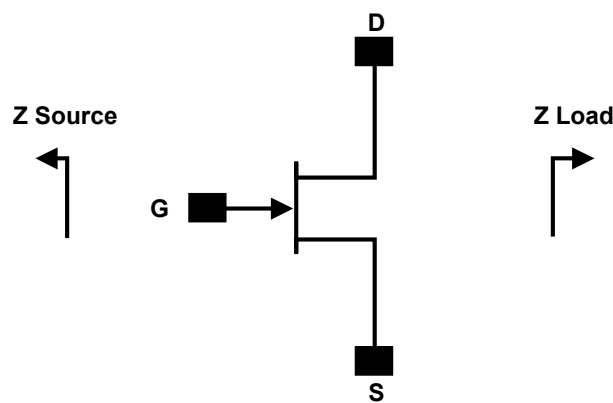


Figure 5. Simulated Minimum Noise Figure and Noise Resistance vs Frequency of the CGH27015
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 100\text{ mA}$

Electrostatic Discharge (ESD) Classifications

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

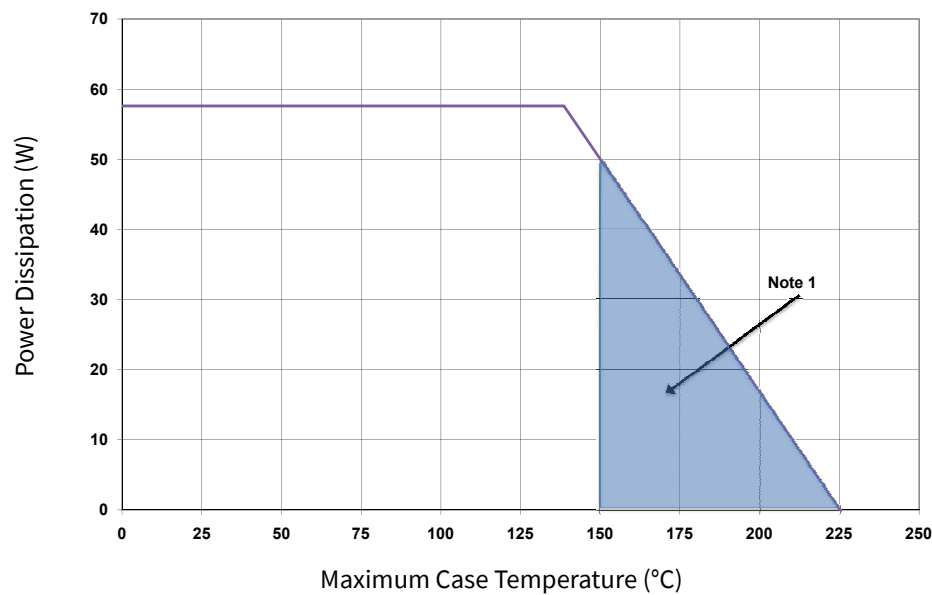
Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
2300	17.8 - j1.5	16.8 - j1.7
2400	20.3 - j4.0	16.9 - j0.8
2500	20.6 - j7.9	17.2 + j0.2
2600	18.2 - j11.3	17.7 + j1.3
2700	14.6 - j12.6	19.1 + j2.4

Notes:
¹ V_{DD} = 28 V, I_{bQ} = 200mA. In the 440166 package
² Impedances are extracted from CGH27015-AMP demonstration circuit and are not source and load pull data derived from the transistor

CGH27015 Power Dissipation De-rating Curve

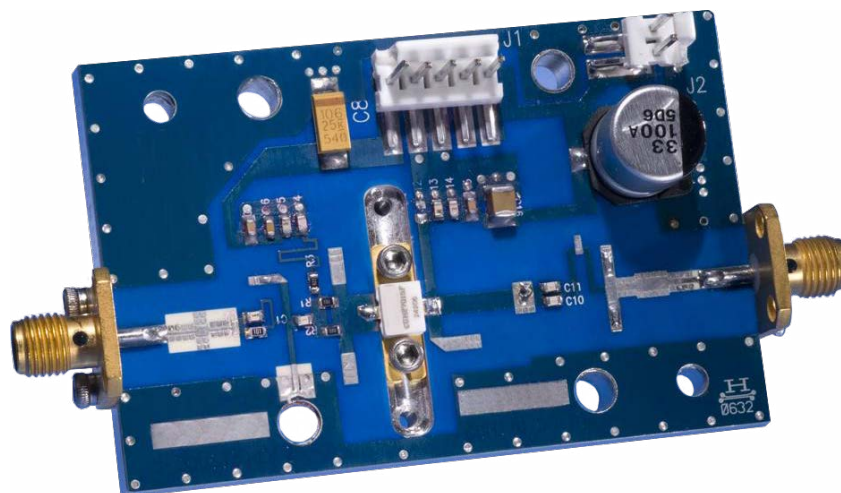


Note:
¹ Area exceeds Maximum Case Operating Temperature (See Page 2)

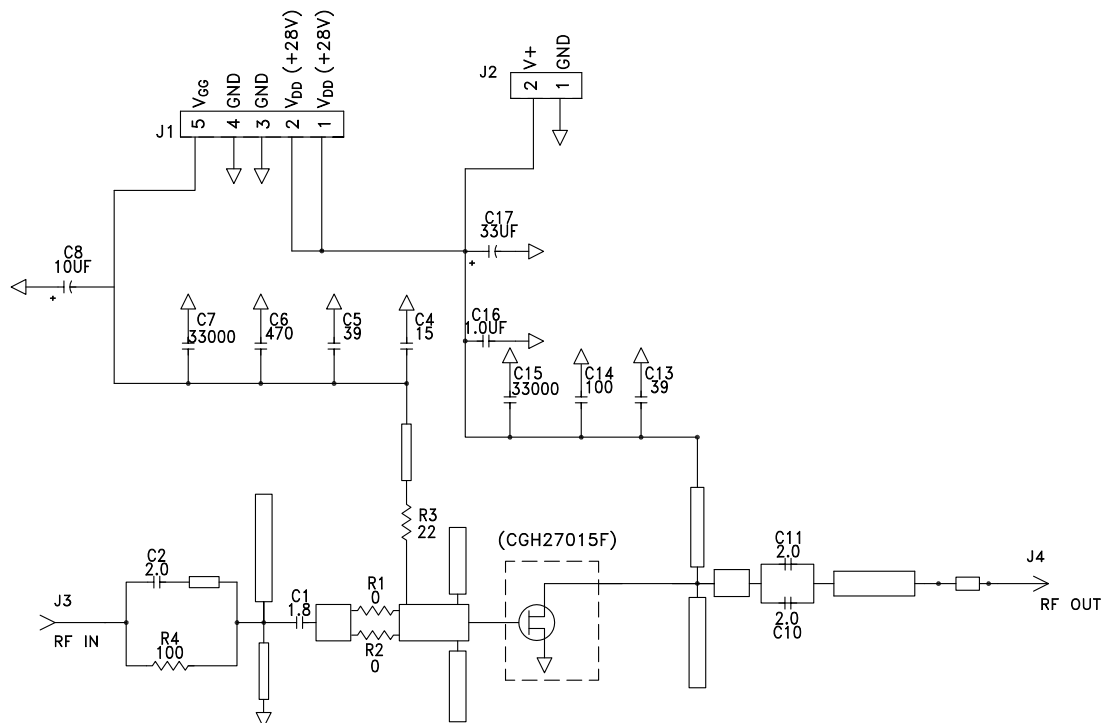
CGH27015-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1, R2	RES, 1/16W, 0603, 1%, 0 OHMS	2
R4	RES, 1/16W, 0603, 1%, 100 OHMS	1
R3	RES, 1/16W, 0603, 1%, 22.6 OHMS	1
C6	CAP, 470pF, 5%, 100V, 0603	1
C17	CAP, 33 μ F, 20%, G CASE	1
C16	CAP, 1.0 μ F, 100V, 10%, X7R, 1210	1
C8	CAP, 10 μ F, 16V TANTALUM	1
C14	CAP, 100.0pF, +/-5%, 0603	1
C4	CAP, 15pF, +/-5%, 0603	1
C1	CAP, 1.8pF, +/-0.1pF, 0603	1
C2, C10, C11	CAP, 2.0pF, +/-0.1pF, 0603	3
C5, C13	CAP, 39pF, +/-5%, 0603	2
C7, C15	CAP, 33000pF, 0805, 100V, X7R	2
J3, J4	CONN SMA STR PANEL JACK RECP	1
J2	HEADER RT>PLZ.1CEN LK 2 POS	1
J1	HEADER RT>PLZ .1CEN LK 5POS	1
—	PCB, RO4350B, Er = 3.48, h = 20 mil	1
—	CGH27015F or CGH27015P	1

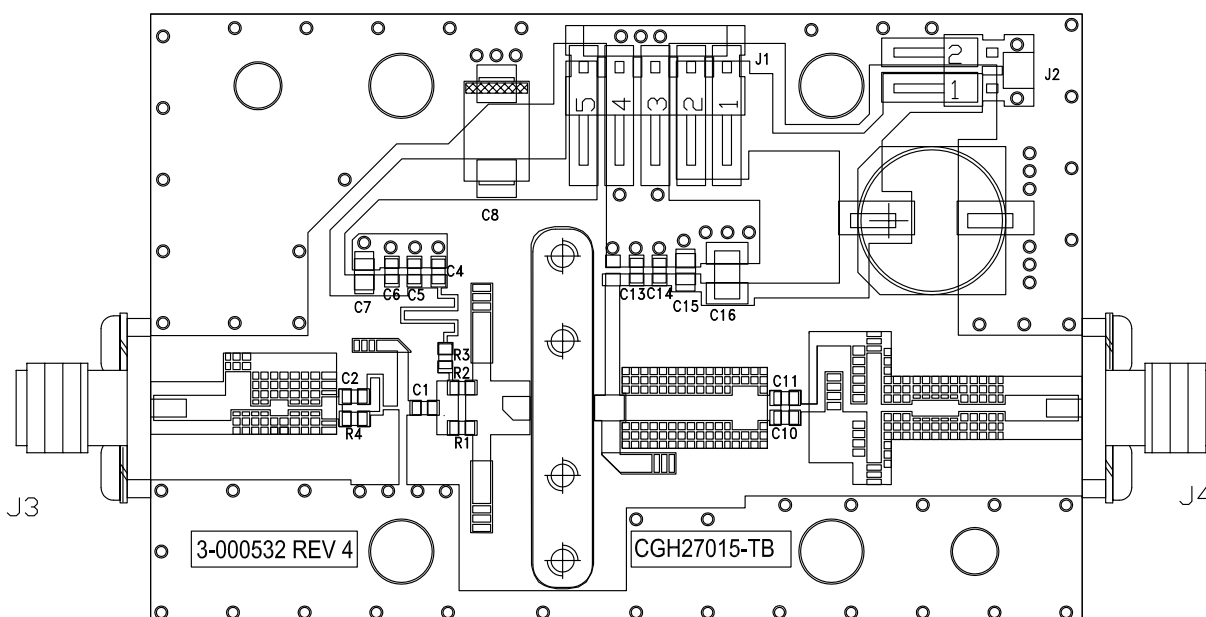
CGH27015-AMP Demonstration Amplifier Circuit



CGH27015-AMP Demonstration Amplifier Circuit Schematic



CGH27015-AMP Demonstration Amplifier Circuit Outline

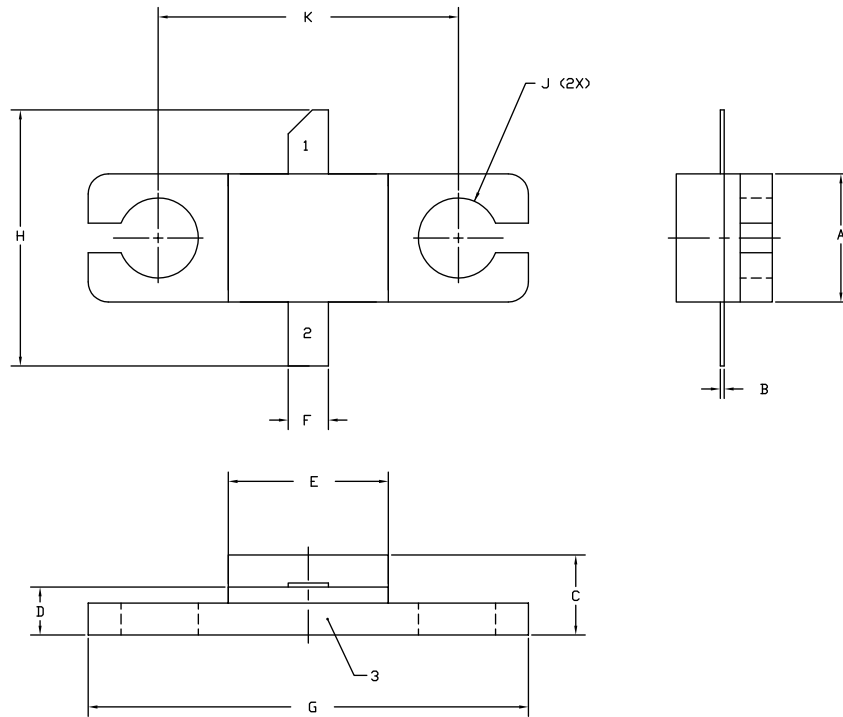


Typical Package S-Parameters for CGH27015
(Small Signal, $V_{DS} = 28\text{ V}$, $I_{DQ} = 100\text{ mA}$, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.909	-124.41	17.41	107.81	0.026	21.06	0.335	-93.73
600 MHz	0.902	-134.04	15.04	101.48	0.027	15.39	0.322	-101.61
700 MHz	0.898	-141.62	13.18	96.16	0.028	10.74	0.315	-107.78
800 MHz	0.894	-147.78	11.71	91.54	0.028	6.79	0.312	-112.73
900 MHz	0.892	-152.91	10.51	87.43	0.028	3.35	0.312	-116.77
1.0 GHz	0.890	-157.30	9.53	83.68	0.028	0.28	0.314	-120.15
1.1 GHz	0.889	-161.12	8.71	80.20	0.028	-2.51	0.318	-123.04
1.2 GHz	0.889	-164.51	8.01	76.95	0.028	-5.07	0.322	-125.57
1.3 GHz	0.888	-167.56	7.41	73.86	0.028	-7.45	0.328	-127.82
1.4 GHz	0.888	-170.34	6.89	70.91	0.028	-9.69	0.335	-129.87
1.5 GHz	0.888	-172.91	6.44	68.07	0.028	-11.81	0.342	-131.77
1.6 GHz	0.888	-175.30	6.04	65.32	0.028	-13.82	0.349	-133.56
1.7 GHz	0.888	-177.55	5.69	62.65	0.027	-15.74	0.357	-135.25
1.8 GHz	0.888	-179.68	5.37	60.05	0.027	-17.58	0.364	-136.89
1.9 GHz	0.888	-178.29	5.09	57.50	0.027	-19.34	0.373	-138.48
2.0 GHz	0.888	-176.34	4.83	55.01	0.027	-21.04	0.381	-140.03
2.1 GHz	0.889	-174.45	4.60	52.56	0.026	-22.69	0.389	-141.55
2.2 GHz	0.889	-172.63	4.39	50.14	0.026	-24.27	0.397	-143.06
2.3 GHz	0.889	-170.84	4.20	47.76	0.026	-25.80	0.405	-144.56
2.4 GHz	0.889	-169.10	4.02	45.41	0.025	-27.28	0.413	-146.04
2.5 GHz	0.890	-167.39	3.86	43.09	0.025	-28.70	0.421	-147.52
2.6 GHz	0.890	-165.71	3.71	40.79	0.025	-30.08	0.429	-149.00
2.7 GHz	0.891	-164.04	3.57	38.51	0.024	-31.41	0.437	-150.48
2.8 GHz	0.891	-162.39	3.44	36.26	0.024	-32.69	0.445	-151.95
2.9 GHz	0.891	-160.76	3.32	34.01	0.024	-33.92	0.452	-153.43
3.0 GHz	0.892	-159.13	3.21	31.79	0.023	-35.10	0.459	-154.92
3.2 GHz	0.892	-155.89	3.00	27.38	0.023	-37.31	0.473	-157.90
3.4 GHz	0.893	-152.65	2.83	23.00	0.022	-39.32	0.486	-160.90
3.6 GHz	0.893	-149.39	2.67	18.66	0.021	-41.09	0.499	-163.93
3.8 GHz	0.894	-146.09	2.54	14.34	0.020	-42.63	0.510	-166.99
4.0 GHz	0.894	-142.74	2.41	10.02	0.020	-43.90	0.521	-170.10
4.2 GHz	0.895	-139.33	2.31	5.70	0.019	-44.88	0.530	-173.24
4.4 GHz	0.895	-135.84	2.21	1.37	0.018	-45.53	0.539	-176.45
4.6 GHz	0.895	-132.26	2.12	-2.98	0.018	-45.84	0.547	-179.71
4.8 GHz	0.895	-128.59	2.04	-7.36	0.017	-45.78	0.554	-176.97
5.0 GHz	0.895	-124.80	1.97	-11.79	0.016	-45.32	0.561	-173.56
5.2 GHz	0.895	-120.90	1.91	-16.27	0.016	-44.47	0.566	-170.07
5.4 GHz	0.895	-116.87	1.85	-20.81	0.016	-43.25	0.571	-166.48
5.6 GHz	0.895	-112.70	1.80	-25.41	0.015	-41.72	0.575	-162.78
5.8 GHz	0.895	-108.38	1.75	-30.10	0.015	-39.97	0.579	-158.96
6.0 GHz	0.895	-103.92	1.70	-34.88	0.016	-38.13	0.581	-155.00

To download the s-parameters in s2p format, go to the CGH27015 Product page.

Product Dimensions CGH27015F (Package Type — 440166)



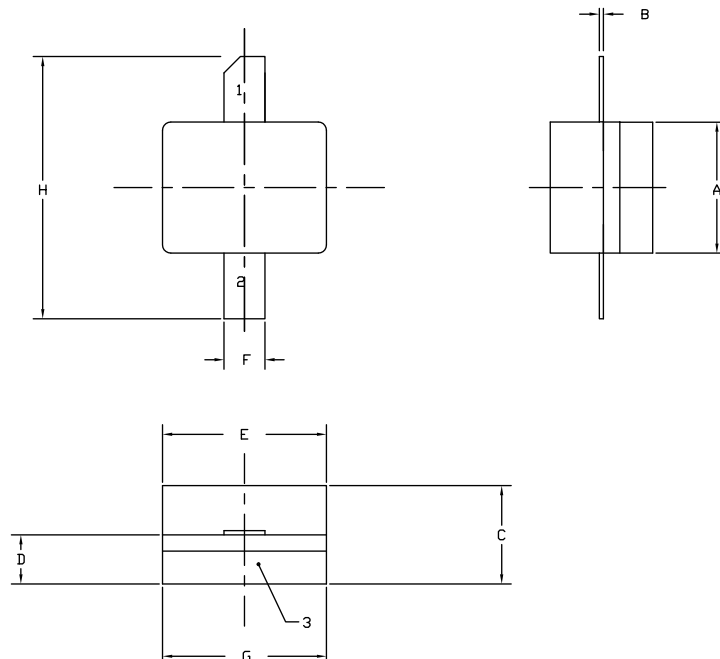
NOTES:

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	0.155	0.165	3.94	4.19
B	0.004	0.006	0.10	0.15
C	0.115	0.135	2.92	3.43
D	0.057	0.067	1.45	1.70
E	0.195	0.205	4.95	5.21
F	0.045	0.055	1.14	1.40
G	0.545	0.555	13.84	14.09
H	0.280	0.360	7.11	9.14
J	Ø .100		2.54	
K	0.375		9.53	

PIN 1. GATE
PIN 2. DRAIN
PIN 3. SOURCE

Product Dimensions CGH27015P (Package Type — 440196)



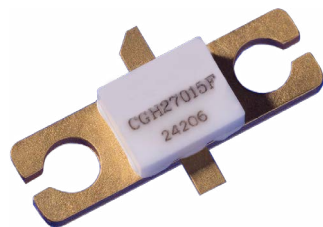
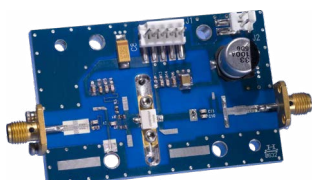
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DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.155	0.165	3.94	4.19
B	0.003	0.006	0.10	0.15
C	0.115	0.135	2.92	3.17
D	0.057	0.067	1.45	1.70
E	0.195	0.205	4.95	5.21
F	0.045	0.055	1.14	1.40
G	0.195	0.205	4.95	5.21
H	0.280	0.360	7.11	9.14

PIN 1. GATE
PIN 2. DRAIN
PIN 3. SOURCE

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGH27015F	GaN HEMT	Each	
CGH27015P	GaN HEMT	Each	
CGH27015F-AMP	Test board with GaN HEMT installed	Each	

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