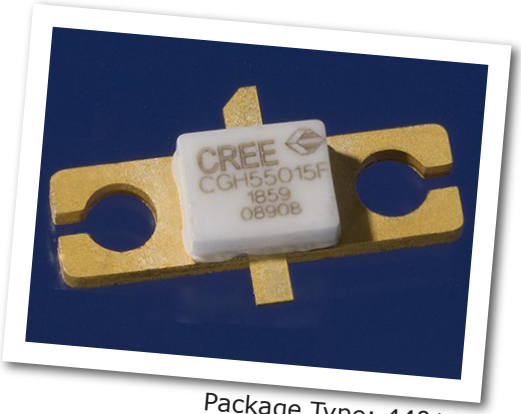
PRELIMINARY

CGH55015

15 W, 5500-5800 MHz, GaN HEMT for WiMAX



Package Type: 440166
PN: CGH55015F

Cree's CGH55015 is a gallium nitride (GaN) high electron mobility transistor designed specifically for 802.16-2004 WiMAX Fixed Access applications. GaN HEMTs offer high efficiency, high gain and wide bandwidth capabilities, which makes the CGH55015 ideal for 5.5-5.8 GHz WiMAX and BWA amplifier applications. The transistor is available in a screw-down, flange package. Based on appropriate external match adjustment, the CGH55015F is suitable for 4.9 - 5.5 GHz applications as well.

Typical Performance 5.5-5.8GHz (T_c = 25°C)

Parameter	5.50 GHz	5.65 GHz	5.80 GHz	Units
Small Signal Gain	10.7	11.0	10.7	dB
EVM at 18 dBm	1.9	1.8	2.0	%
EVM at 33 dBm	1.5	1.5	1.7	%
Drain Efficiency at 33 dBm	25	25	25	%
Input Return Loss	11.5	14.5	10.5	dB

Note:
Measured in the CGH55015F-TB amplifier circuit, under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, 5 ms Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.

Features

RoHS COMPLIANT

- 5.5 - 5.8 GHz Operation
- >10.5 dB Small Signal Gain
- >2.5 W P_{OUT} at 2.0 % EVM
- 26 % Efficiency at 2.5 W P_{OUT}
- Designed for WiMAX Fixed Access 802.16-2004 OFDM Applications
- Designed for Multi-carrier DOCSIS Applications

Rev 1.1 – June 2008

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

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	84	Volts
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts
Storage Temperature	T_{STG}	-55, +150	˚C
Operating Junction Temperature	T_J	175	˚C
Soldering Temperature	T_S	245	˚C
Thermal Resistance, Junction to Case [1]	$R_{\theta JC}$	5.0	˚C/W
Screw Torque	T	60	in-oz

Note:
[1] Measured for the CGH55015F at P_{DISS} = 7W.

Electrical Characteristics (T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	-3.6	-2.5	-1.8	VDC	V_{DS} = 10 V, I_D = 3.6 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	VDC	V_{DS} = 28 V, I_D = 75 mA
Saturated Drain Current	I_{DS}	2.4	2.7	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	84	100	–	VDC	V_{GS} = -8 V, I_D = 3.6 mA
Case Operating Temperature	T_C	-10	–	+105	˚C	P_{DISS} = 7W
RF Characteristics[2,3] (T_C = 25˚C, F_0 = 5.65 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	10.0	11.0	-	dB	V_{DD} = 28 V, I_{DQ} = 75 mA
Drain Efficiency[1]	η	21	25	–	%	V_{DD} = 28 V, I_{DQ} = 75 mA, P_{AVE} = 2.0 W
Back-Off Error Vector Magnitude	EVM_1	–	2.5	-	%	V_{DD} = 28 V, I_{DQ} = 75 mA, P_{AVE} = 18 dBm
Error Vector Magnitude	EVM_2	–	2.0	-	%	V_{DD} = 28 V, I_{DQ} = 75 mA, P_{AVE} = 2.0 W
Output Mismatch Stress	VSWR	-	10 : 1	-	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 75 mA, P_{AVE} = 2.0 W
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	5.00	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	1.32	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.43	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz

Notes:
[1] Drain Efficiency = P_{OUT} / P_{DC}
[2] Under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, 5 ms Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.
[3] Measured in the CGH55015F-TB test fixture.

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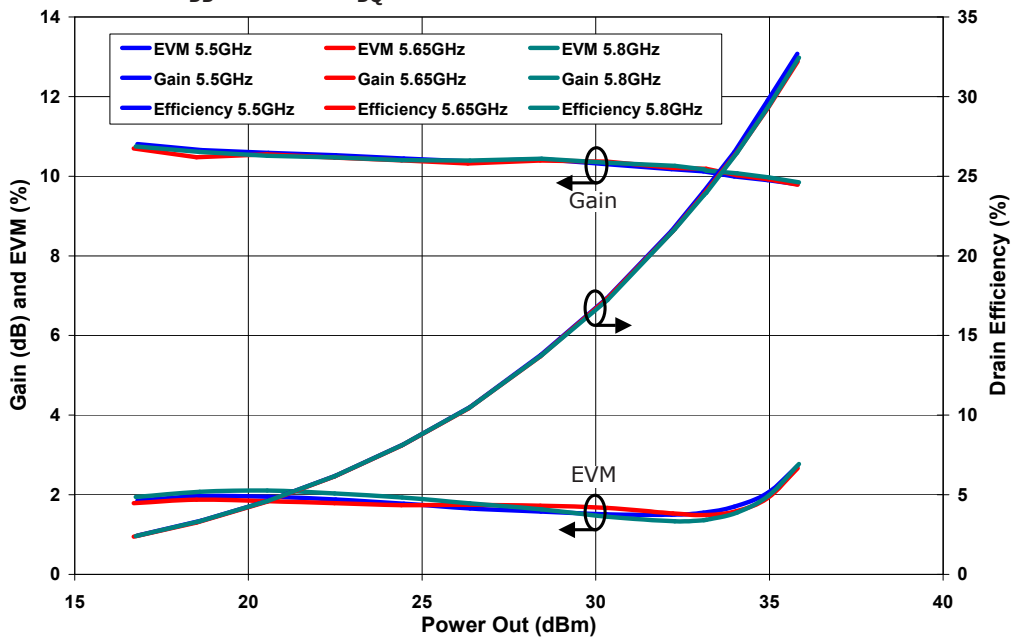
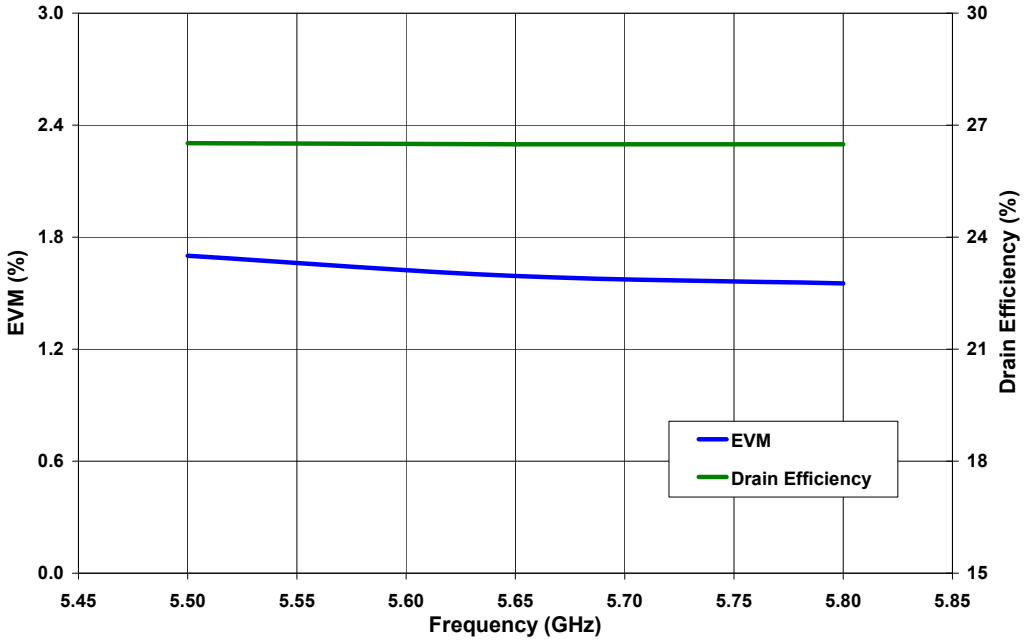
Typical WiMAX Performance

Gain, EVM, and Efficiency vs Power Output
V_{DD} = 28 V, I_{DQ} = 75 mA, OFDM BW = 3.5 MHz



EVM and Efficiency of CGH55015 vs. Frequency
in Broadband Amplifier Circuit, CGH55015F-TB
V_{DD} = 28 V, I_{DQ} = 75 mA, P_{OUT} = 2.5 W



Note:
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.

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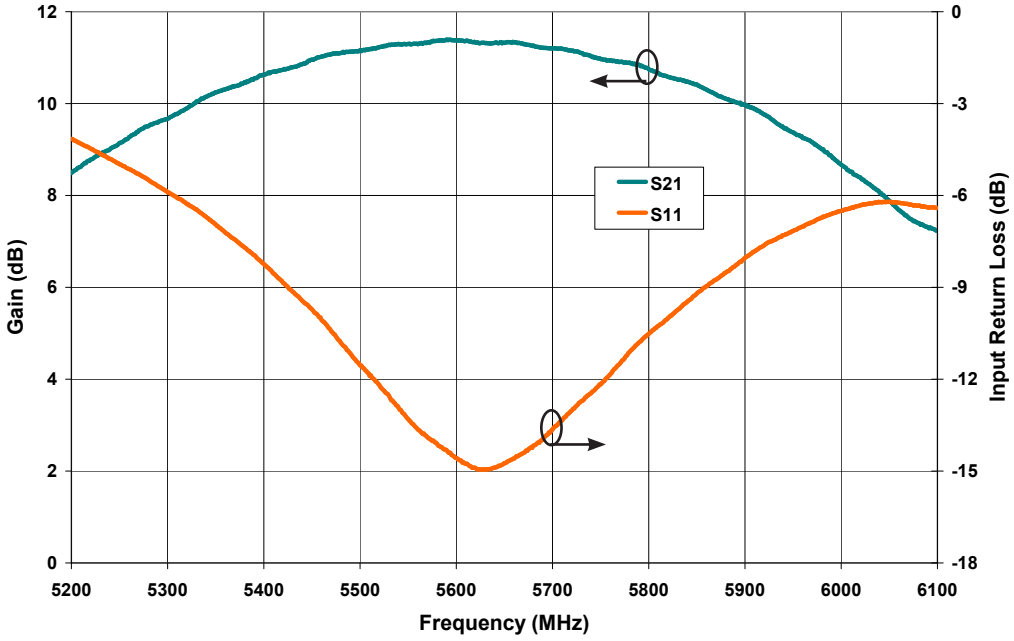
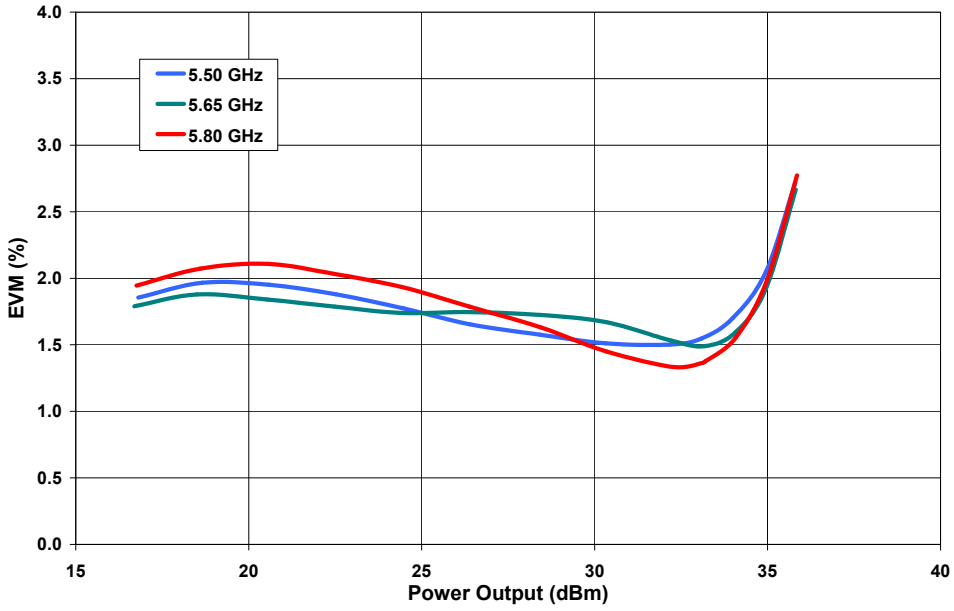
Typical WiMAX Performance

Gain and Input Return Loss vs Frequency of CGH55015F in Broadband Amplifier Circuit



Typical EVM vs Power Output of CGH55015F in Broadband Amplifier Circuit



Note:
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.

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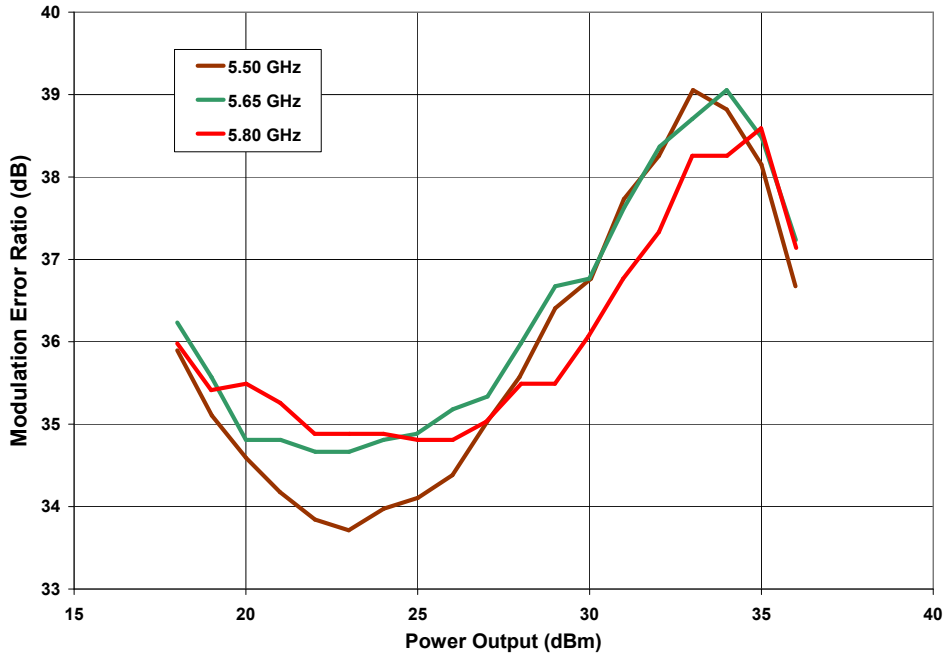
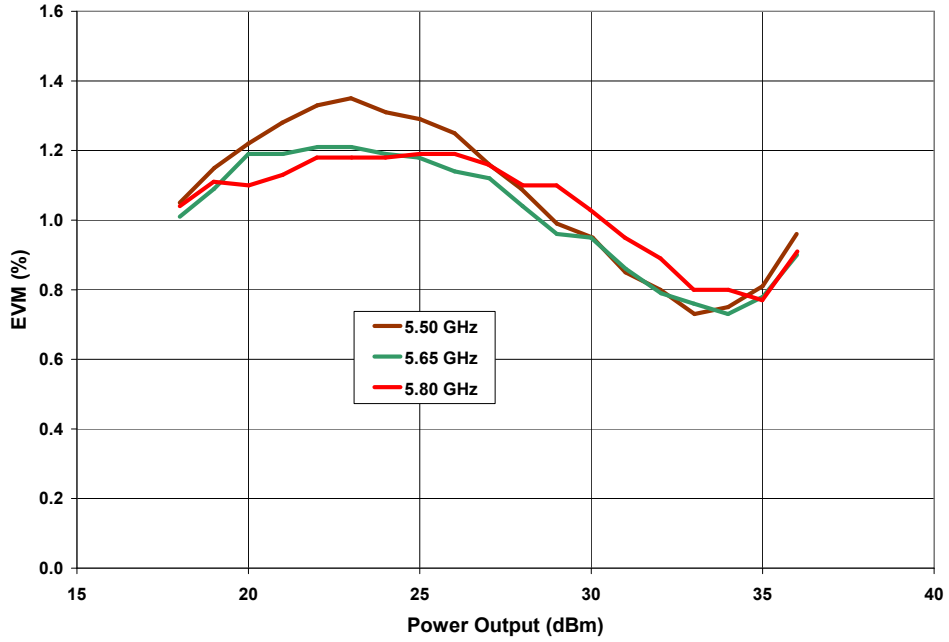
Typical DOCSIS Performance

Modulation Error Ratio vs Power Output of CGH55015F in Broadband Amplifier Circuit



Note:
MER is the metric of choice for cable systems and can be related to EVM by the following equation: EVM(%) = 100 x 10 ^ -((MERdB + MTAdB)/20). MTA is the "maximum-to-average constellation power ratio" which varies with the modulation type: MTA = 0 for BPSK and QPSK; 2.55 for 16QAM and 8QAM-DS; 3.68 for 64QAM and 32QAM-DS; 4.23 for 256QAM and 128QAM-DS

EVM vs Power Output of CGH55015F in Broadband Amplifier Circuit



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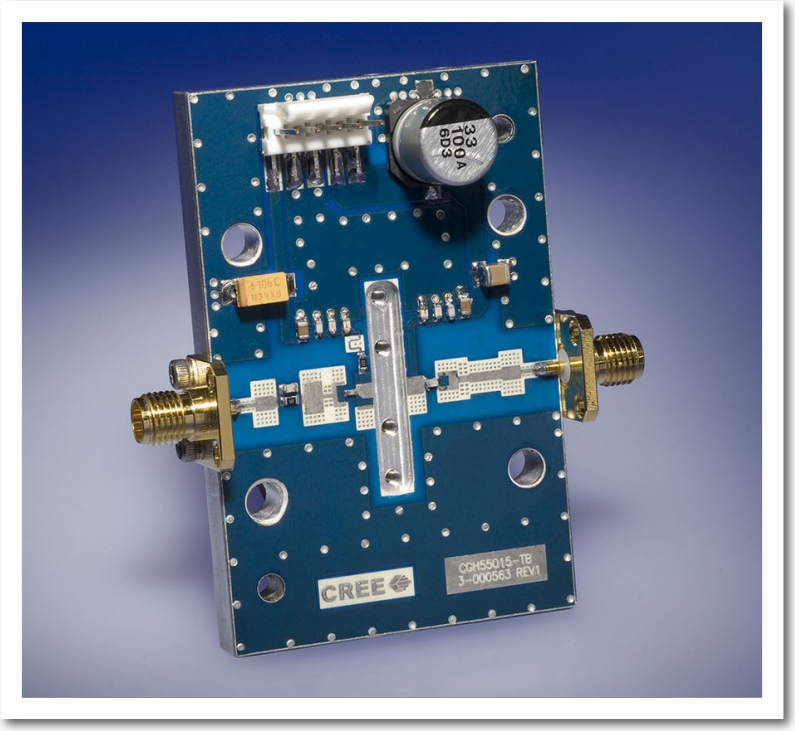
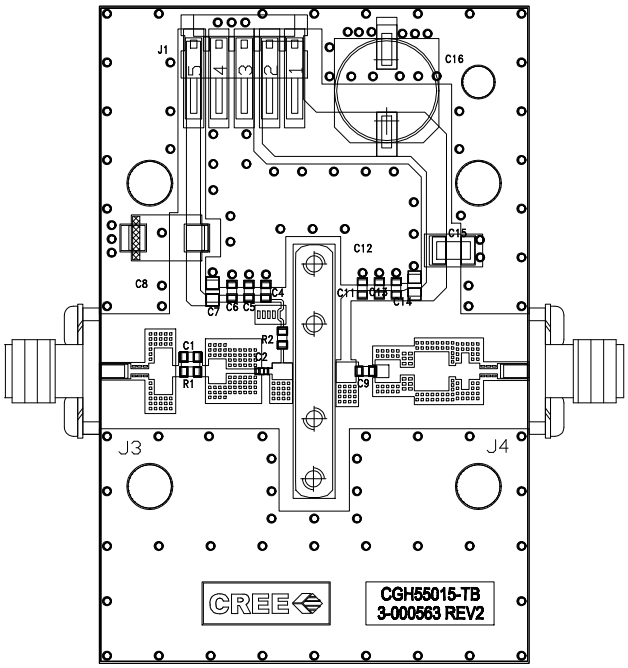
CGH55015F-TB Demonstration Amplifier Circuit



CGH55015-TB Demonstration Amplifier Circuit Outline



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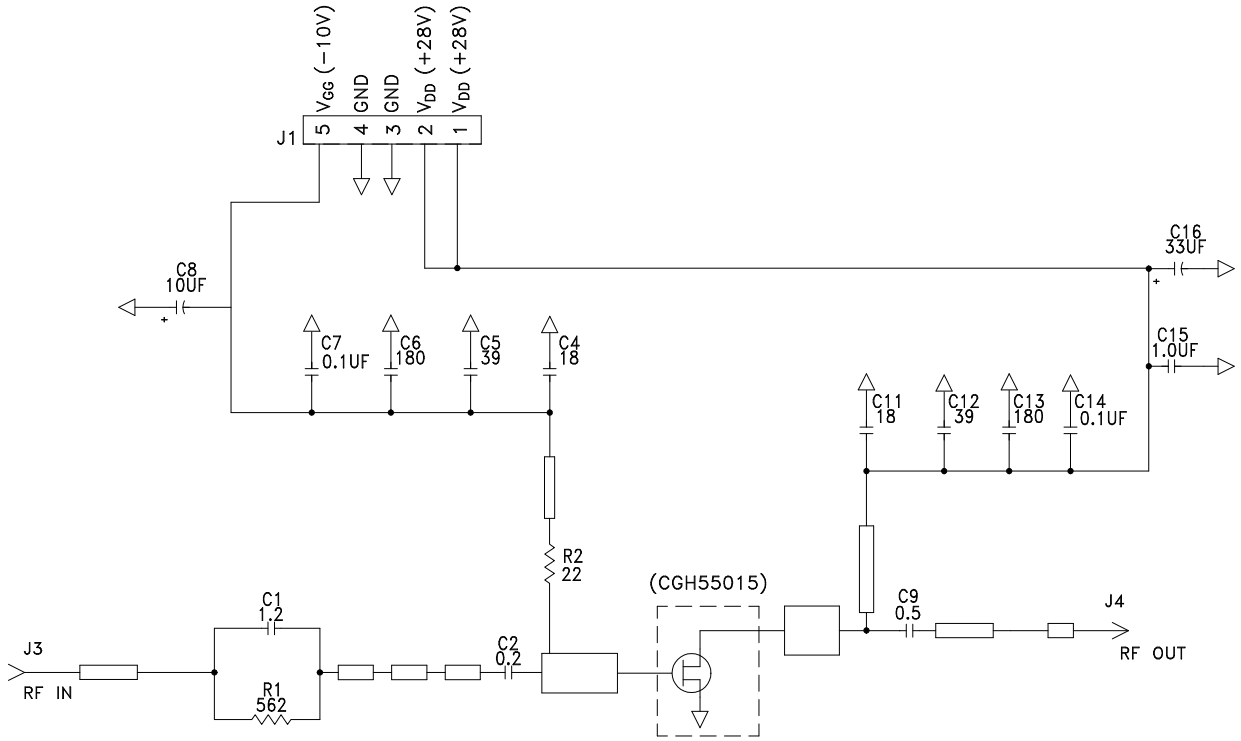
CGH55015-TB Demonstration Amplifier Circuit Schematic



CGH55015-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
C1	CAP, 1.2pF, +/-0.1 pF, 0603, ATC 600S	1
C2	CAP, 0.2pF, +/-0.05 pF, 0402, ATC 600L	1
C9	CAP, 0.5pF,+/-0.05pF, 0603, ATC 600S	1
C4,C11	CAP, 18pF, +/-5%, 0603, ATC 600S	2
C5,C12	CAP, 39pF +/-5%, 0603, ATC 600S	2
C6,C13	CAP, CER, 180pF, 50V, +/-5%, C0G, 0603	2
C7,C14	CAP, CER, 0.1UF, 50V, +/-10%, X7R, 0805	2
C8	CAP, 10UF, 16V, SMT, TANTALUM	1
C15	CAP, 1.0UF ±10%, 100V, 1210, X7R	1
C16	CAP, 33UF, 100V, ELECT, FK, SMD	1
R1	RES, 1/16W, 0603, 1%, 562 OHMS	1
R2	RES, 1/16W, 0603, 1%, 22 OHMS	1
J1	HEADER RT> PLZ .1 CEN LK 5 POS	1
J3,J4	CONN, SMA, FLANGE	2
Q1	CGH55015F	1

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Typical Package S-Parameters
(Small Signal, V_{DS} = 28 V, I_{DQ} = 75 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
2.0 GHz	0.89	173.90	3.88	55.61	0.04	-22.83	0.40	-151.87
2.1 GHz	0.89	172.22	3.69	53.31	0.04	-24.49	0.40	-152.99
2.2 GHz	0.89	170.58	3.53	51.05	0.04	-26.12	0.41	-154.08
2.3 GHz	0.89	168.98	3.37	48.82	0.04	-27.71	0.42	-155.17
2.4 GHz	0.89	167.41	3.23	46.61	0.04	-29.27	0.42	-156.26
2.5 GHz	0.89	165.86	3.10	44.42	0.04	-30.80	0.43	-157.35
2.6 GHz	0.89	164.33	2.98	42.25	0.04	-32.30	0.44	-158.44
2.7 GHz	0.89	162.82	2.87	40.10	0.04	-33.77	0.44	-159.53
2.8 GHz	0.89	161.32	2.77	37.96	0.04	-35.21	0.45	-160.64
2.9 GHz	0.89	159.82	2.68	35.84	0.04	-36.63	0.45	-161.75
3.0 GHz	0.89	158.33	2.59	33.72	0.03	-38.03	0.46	-162.87
3.1 GHz	0.89	156.84	2.51	31.62	0.03	-39.40	0.47	-164.00
3.2 GHz	0.89	155.36	2.43	29.53	0.03	-40.75	0.47	-165.15
3.3 GHz	0.89	153.87	2.36	27.44	0.03	-42.08	0.48	-166.31
3.4 GHz	0.89	152.37	2.29	25.36	0.03	-43.38	0.48	-167.48
3.5 GHz	0.89	150.87	2.23	23.29	0.03	-44.66	0.49	-168.66
3.6 GHz	0.89	149.36	2.17	21.22	0.03	-45.91	0.49	-169.86
3.7 GHz	0.89	147.84	2.11	19.15	0.03	-47.15	0.50	-171.08
3.8 GHz	0.89	146.30	2.06	17.09	0.03	-48.36	0.50	-172.30
3.9 GHz	0.89	144.76	2.01	15.03	0.03	-49.55	0.51	-173.54
4.0 GHz	0.89	143.20	1.96	12.97	0.03	-50.72	0.51	-174.80
4.1 GHz	0.89	141.62	1.92	10.90	0.03	-51.86	0.52	-176.07
4.2 GHz	0.89	140.02	1.88	8.84	0.03	-52.97	0.52	-177.36
4.3 GHz	0.89	138.41	1.84	6.77	0.03	-54.07	0.53	-178.66
4.4 GHz	0.89	136.78	1.80	4.70	0.03	-55.13	0.53	-179.98
4.5 GHz	0.89	135.12	1.76	2.62	0.03	-56.18	0.53	178.68
4.6 GHz	0.89	133.44	1.73	0.54	0.03	-57.19	0.54	177.32
4.7 GHz	0.89	131.74	1.70	-1.55	0.03	-58.18	0.54	175.95
4.8 GHz	0.89	130.01	1.67	-3.65	0.03	-59.13	0.54	174.56
4.9 GHz	0.89	128.26	1.64	-5.75	0.03	-60.06	0.55	173.14
5.0 GHz	0.89	126.47	1.61	-7.87	0.03	-60.96	0.55	171.71
5.1 GHz	0.89	124.66	1.58	-9.99	0.03	-61.82	0.55	170.25
5.2 GHz	0.89	122.82	1.56	-12.13	0.03	-62.65	0.55	168.78
5.3 GHz	0.89	120.95	1.54	-14.29	0.03	-63.45	0.56	167.28
5.4 GHz	0.89	119.05	1.51	-16.45	0.03	-64.20	0.56	165.76
5.5 GHz	0.89	117.11	1.49	-18.63	0.03	-64.92	0.56	164.21
5.6 GHz	0.89	115.14	1.47	-20.83	0.03	-65.61	0.56	162.63
5.7 GHz	0.89	113.13	1.45	-23.05	0.03	-66.24	0.56	161.03
5.8 GHz	0.89	111.09	1.43	-25.28	0.02	-66.84	0.57	159.40
5.9 GHz	0.89	109.01	1.41	-27.53	0.02	-67.39	0.57	157.74
6.0 GHz	0.89	106.90	1.40	-29.81	0.02	-67.90	0.57	156.05

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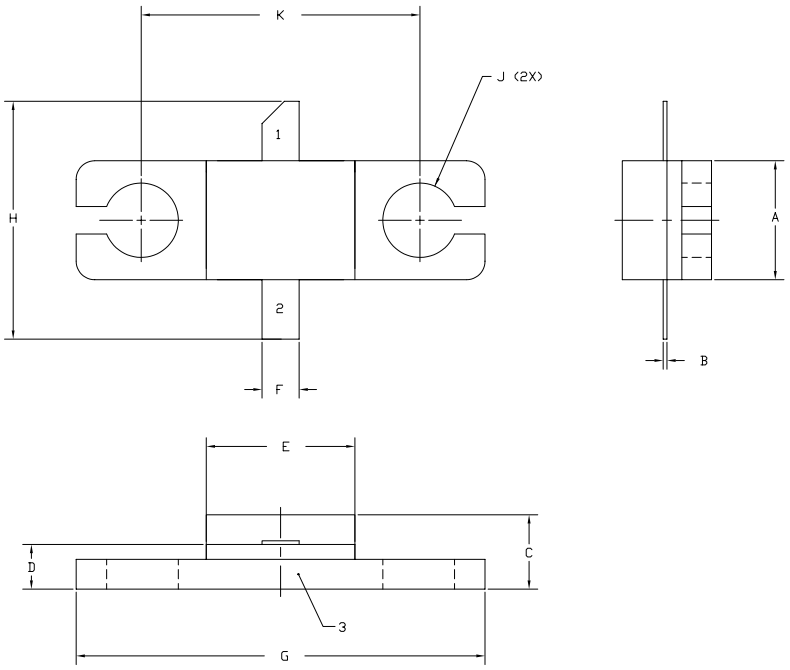
Product Dimensions CGH55015F (Package Type — 440166)



NOTES:

1. DIMENSIONING AND TOLERANICING 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

	INCHES		MILLIMETERS	
DIM	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	7.87	8.38
J	ø .100		2.54	
K	0.375		9.53	

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

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