

# CGH35015F

15 W, 3300-3900 MHz, 28V, GaN HEMT for WiMAX

Cree's CGH35015F 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 CGH35015F ideal for 3.3-3.9GHz WiMAX and BWA amplifier applications. The transistor is available in a flange package.



Package Type: 440166  
PN: CGH35015F

## Typical Performance 3.4-3.9GHz ( $T_c = 25^\circ\text{C}$ )

Parameter	3.4 GHz	3.5 GHz	3.6 GHz	3.8 GHz	3.9 GHz	Units
Gain @ $P_{OUT} = 2\text{ W}$	11.6	11.8	12.0	11.8	11.2	dB
$P_{OUT}$ @ 2.0 % EVM	33.0	33.0	33.0	33.5	33.5	dBm
Drain Efficiency @ 2.0 % EVM	23.0	23.0	24.0	18.0	17.0	%
Input Return Loss	4.0	4.5	6.0	13.0	9.0	dB

### Note:

Measured in the CGH35015F-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

- 3.3 - 3.9 GHz Operation
- >11 dB Small Signal Gain
- >2.0 W  $P_{OUT}$  at 2.0 % EVM
- 24 % Efficiency at 2.0 W  $P_{OUT}$
- 15 W Typical  $P_{3dB}$
- WiMAX Fixed Access 802.16-2004 OFDM





## 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
Thermal Resistance, Junction to Case <sup>1</sup>	$R_{\theta JC}$	5.0	°C/W

Note:

<sup>1</sup> Measured for the CGH35015F at  $P_{DISS} = 14W$ .

## Electrical Characteristics ( $T_c = 25^\circ C$ )

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.0	-2.5	-1.8	VDC	$V_{DS} = 10 V, I_D = 3.6 mA$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.4	-	VDC	$V_{DS} = 28 V, I_D = 60 mA$
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	
Screw Torque	T	-	-	60	in-oz	Reference 440166 Package Revision 3
<b>RF Characteristics<sup>2,3</sup> (<math>T_c = 25^\circ C, F_0 = 3.5 GHz</math> unless otherwise noted)</b>						
Small Signal Gain	$G_{SS}$	11	12	-	dB	$V_{DD} = 28 V, I_{DQ} = 60 mA$
Drain Efficiency <sup>1</sup>	$\eta$	22	24	-	%	$V_{DD} = 28 V, I_{DQ} = 60 mA, P_{AVE} = 2.0 W$
Back-Off Error Vector Magnitude	$EVM_1$	-	2.5	-	%	$V_{DD} = 28 V, I_{DQ} = 60 mA, P_{AVE} = 18 dBm$
Error Vector Magnitude	$EVM_2$	-	2.0	-	%	$V_{DD} = 28 V, I_{DQ} = 60 mA, P_{AVE} = 2.0 W$
Output Mismatch Stress	VSWR	-	10 : 1	-	$\Psi$	No damage at all phase angles, $V_{DD} = 28 V, I_{DQ} = 60 mA,$ $P_{AVE} = 2.0 W$
<b>Dynamic Characteristics</b>						
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:

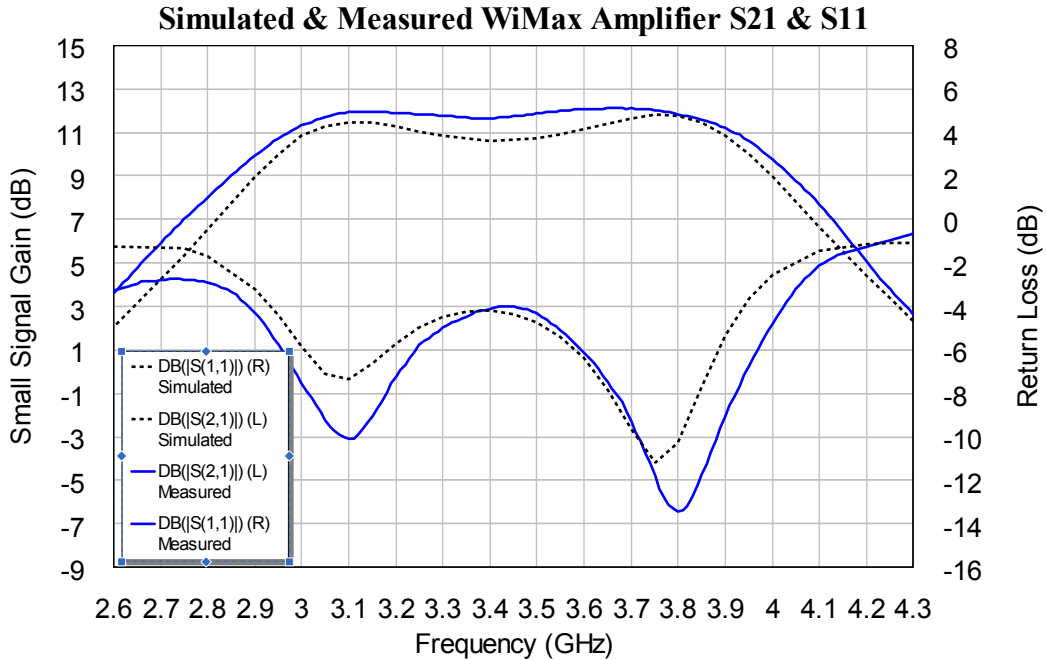
<sup>1</sup> Drain Efficiency =  $P_{OUT} / P_{DC}$

<sup>2</sup> 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.

<sup>3</sup> Measured in the CGH35015F-TB test fixture.

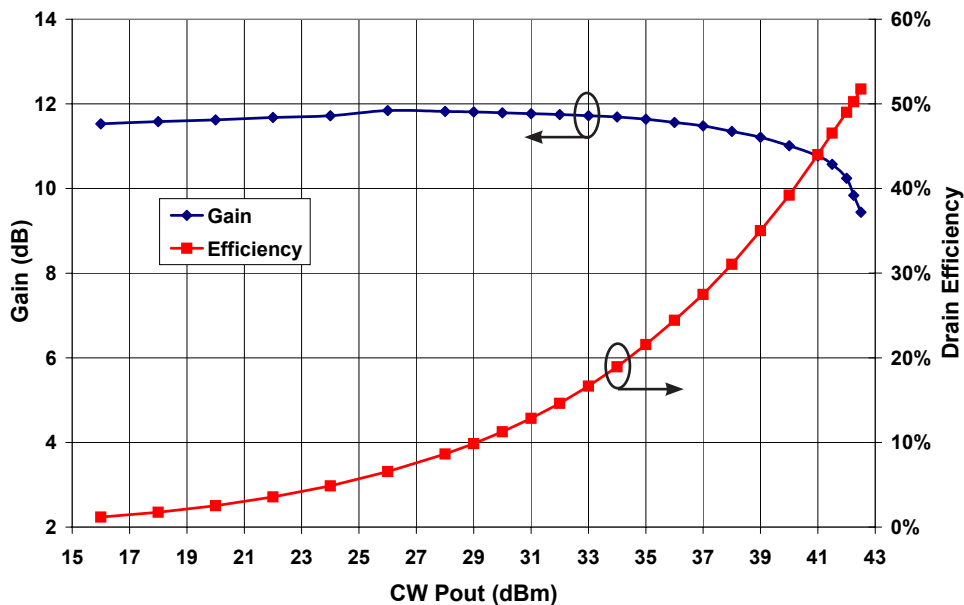
## Typical WiMAX Performance

**Modeled vs Measured Performance of CGH35015F in Broadband Amplifier Circuit**  
 $V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 60\text{ mA}$ , OFDM BW = 3.5 MHz



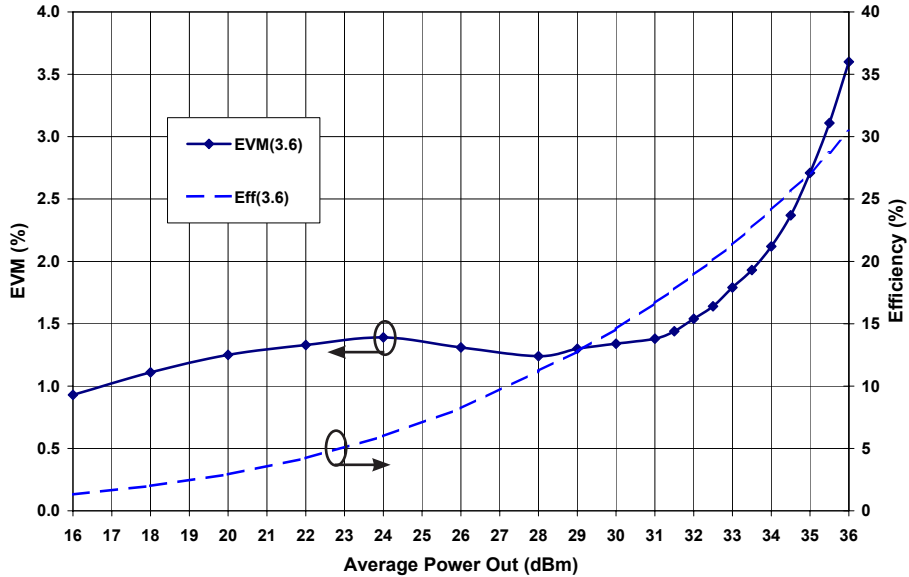
## Single Tone CW Gain and Efficiency of CGH35015F vs. Output Power in Broadband Amplifier Circuit

$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 60\text{ mA}$ , Freq = 3.6 GHz



## Typical WiMAX Performance

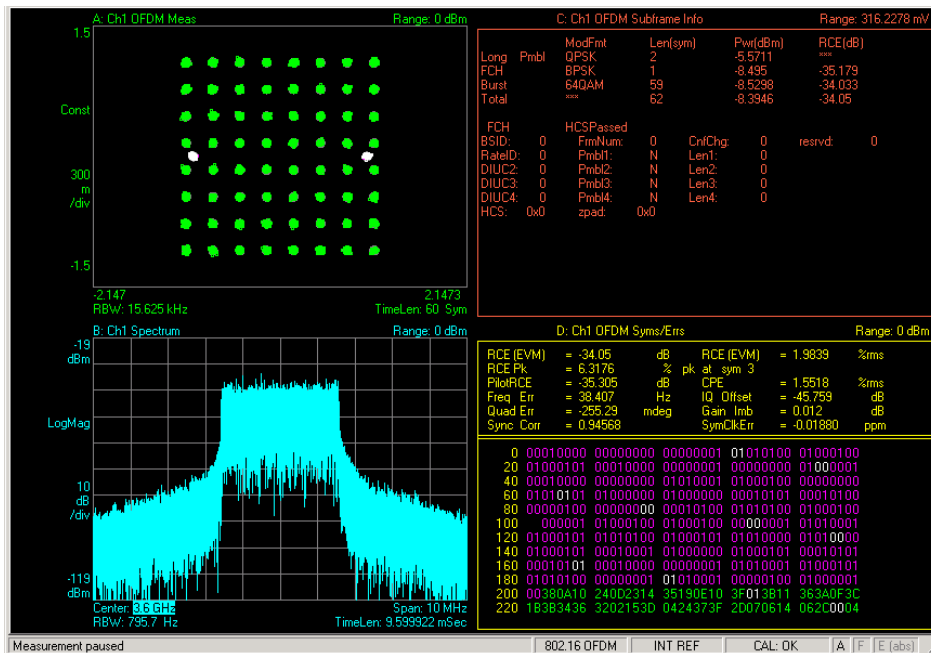
### Typical EVM and Efficiency of CGH35015F in Broadband Amplifier Circuit at 3.6 GHz F=3.6 GHz, 802.16-2004 OFDM, P/A=9.8 dB



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.

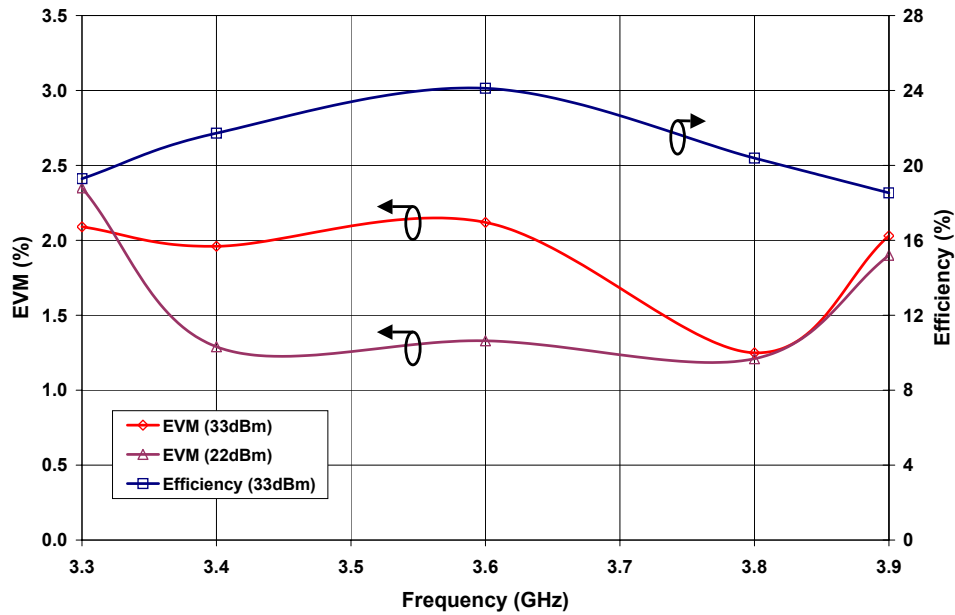
### Typical Constellation Chart, Spectral Mask, and EVM of CGH35015F in Broadband Amplifier Circuit at 3.6 GHz $V_{DD} = 28 V, I_{DQ} = 60 mA, P_{AVE} = 2.0 W$





## Typical WiMAX Performance

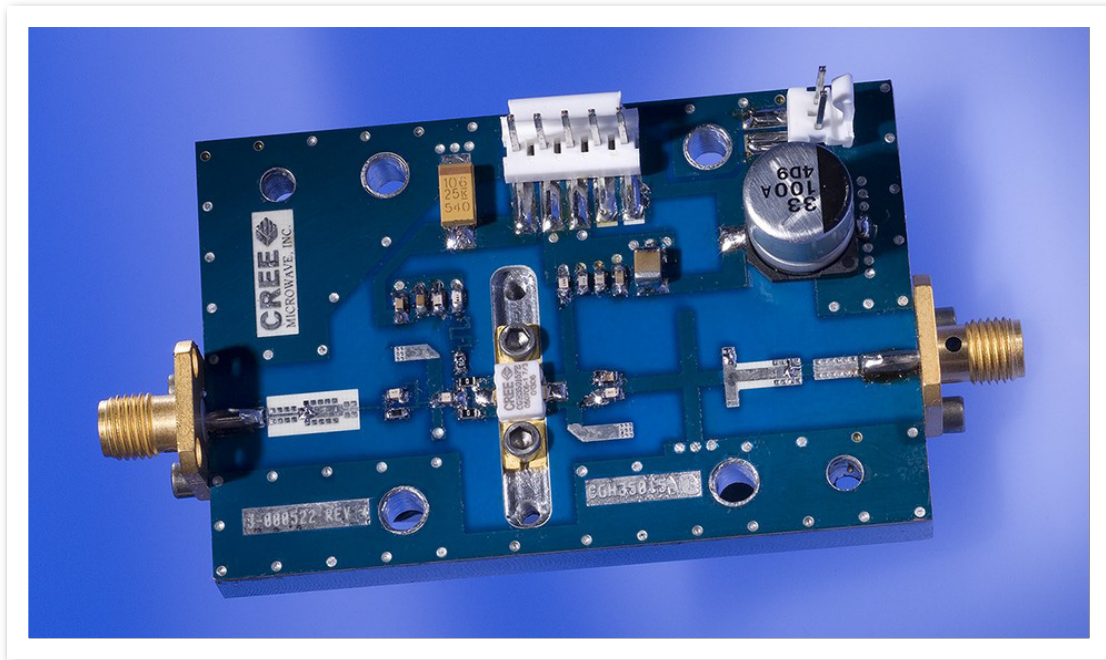
### Typical EVM and Efficiency at 22dBm and 33 dBm vs Frequency of CGH35015F in Broadband Amplifier Circuit



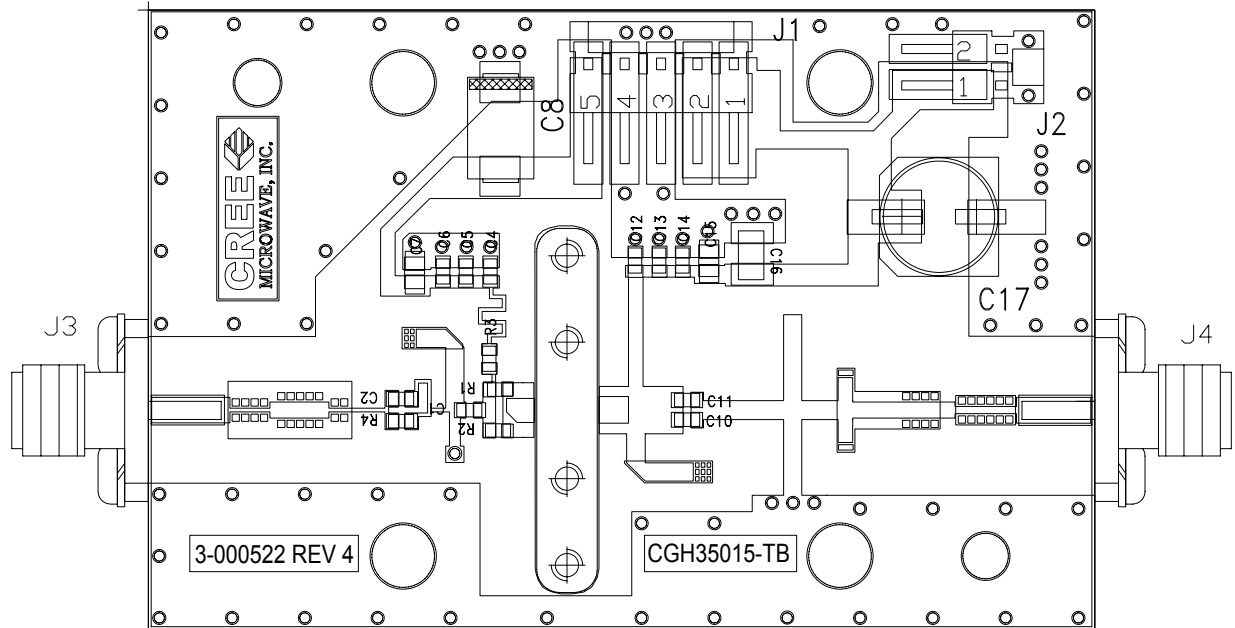
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Under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.

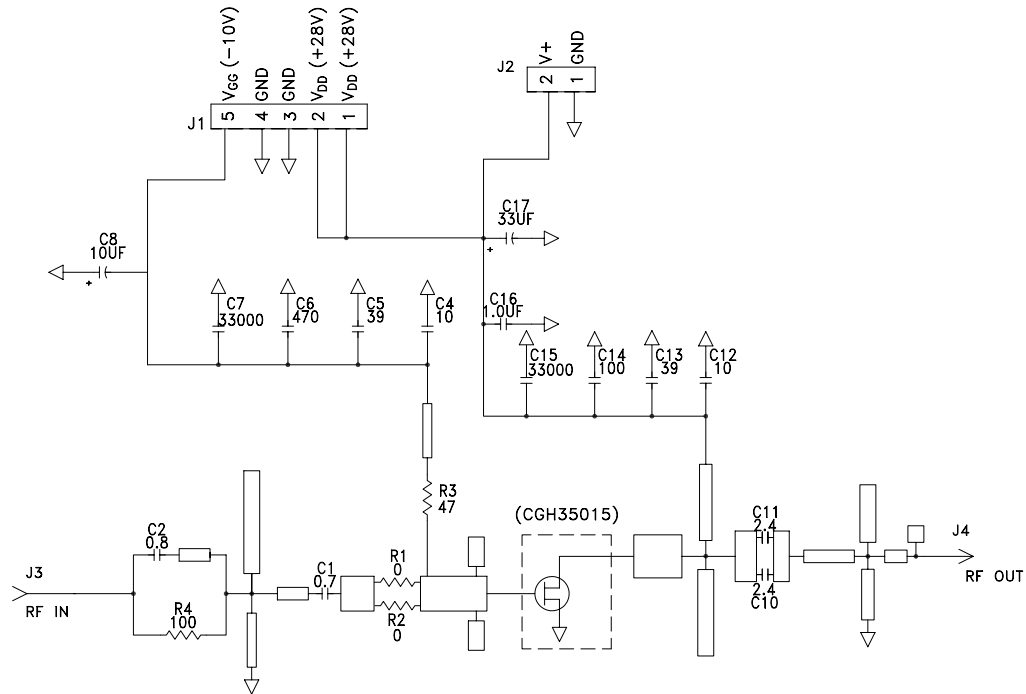
## CGH35015F-TB Demonstration Amplifier Circuit



## CGH35015F-TB Demonstration Amplifier Circuit Outline



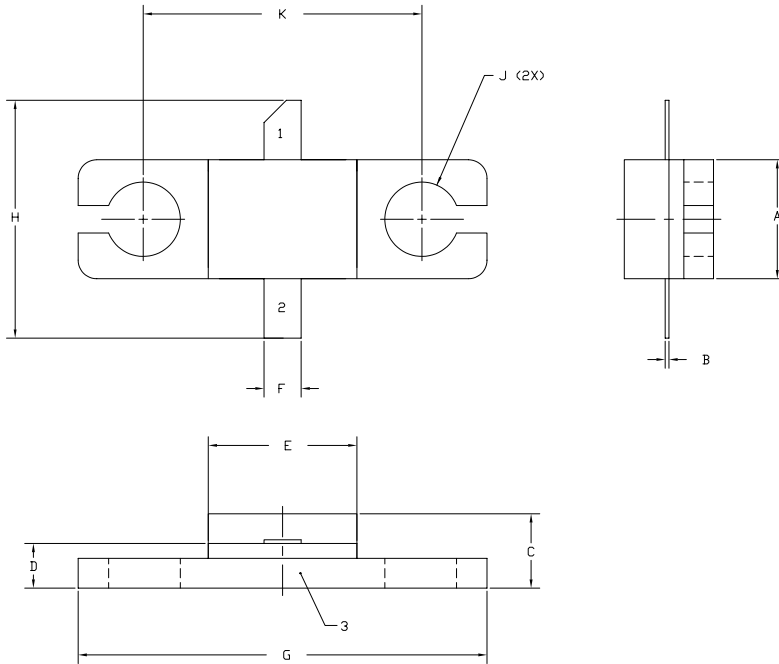
## CGH35015F-TB Demonstration Amplifier Circuit Schematic



## CGH35015F-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
C1	CAP, 0.7pF, +/-0.1 pF, 0603, ATC 600S	1
C2	CAP, 0.8pF, +/-0.1 pF, 0603, ATC 600S	1
C10,C11	CAP, 2.4pF,+/-0.1pF, 0603, ATC 600S	2
C4	CAP, 10.0pF, +/-5%, 0603, ATC 600S	1
C5,C13	CAP, 39 PF±5%, 0603, ATC 600S	2
C14	CAP, 100 PF±5%, 0603, ATC 600S	1
C6	CAP, 470 PF ±10%,100 V, 0603	1
C7,C15	CAP, 33000PF, 100V, 0805, X7R	2
C8	CAP, 10UF, 16V, SMT, TANTALUM (240096)	1
C16	CAP, 1.0UF ±10%, 100V, 1210, X7R	1
C17	CAP, 33UF, 100V, ELECT, FK, SMD	1
R1,R2	RES, 1/16W, 0603, 0 Ohms, 1%	2
R3	RES, 1/16W, 0603, 47 Ohms ≤5%	1
R4	RES, 1/16W, 0603, 100 Ohms ≤5%	1
J1	5-PIN, MOLEX, MALE, CONNECTOR	1
J2	2-PIN, MOLEX, MALE, CONNECTOR	1
J3,J4	SMA, FEMALE, CONNECTOR	2
Q1	CGH35015	1

# Product Dimensions CGH35015F (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	7.87	8.38
J	∅ .100		2.54	
K	0.375		9.53	

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





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