PRELIMINARY

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°C)

Parameter	3.4 GHz	3.5 GHz	3.6 GHz	3.8 GHz	3.9 GHz	Units
Gain @ P_{OUT} = 2 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

RoHS COMPLIANT

- 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

Rev 1.1 - March 2007

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 [1]	$R_{\theta JC}$	5.0	˚C/W

Note:
[1] Measured for the CGH35015F at P_{DISS} = 14W.

Electrical Characteristics (T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
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
RF Characteristics[2,3] (T_C = 25˚C, F_0 = 3.5 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	11	12	-	dB	V_{DD} = 28 V, I_{DQ} = 60 mA
Drain Efficiency[1]	η	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	-	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 60 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 CGH35015F-TB test fixture.

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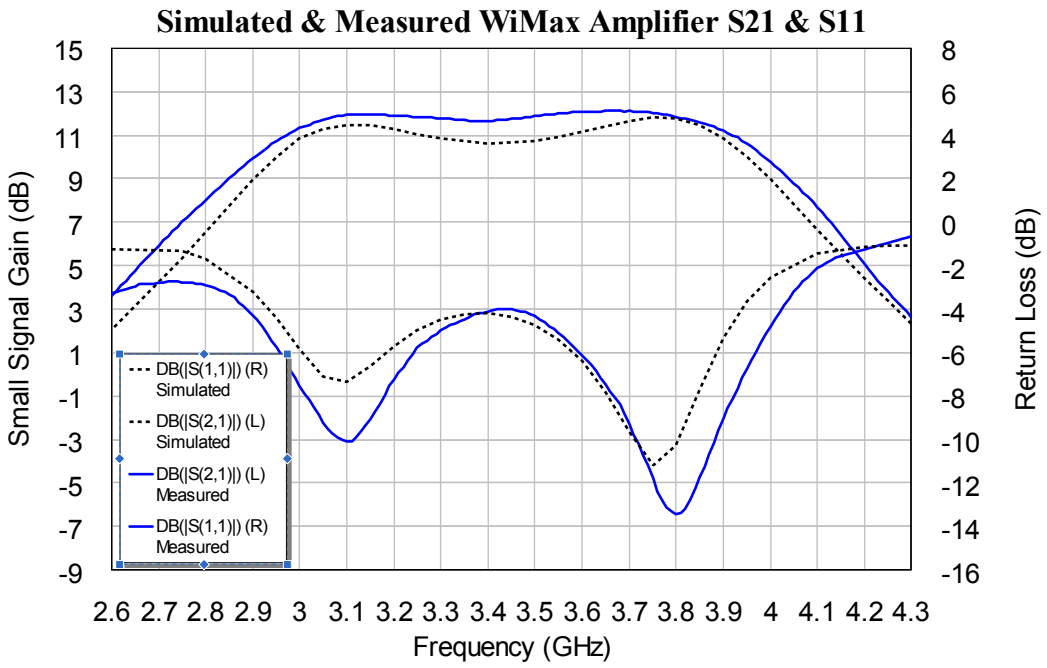
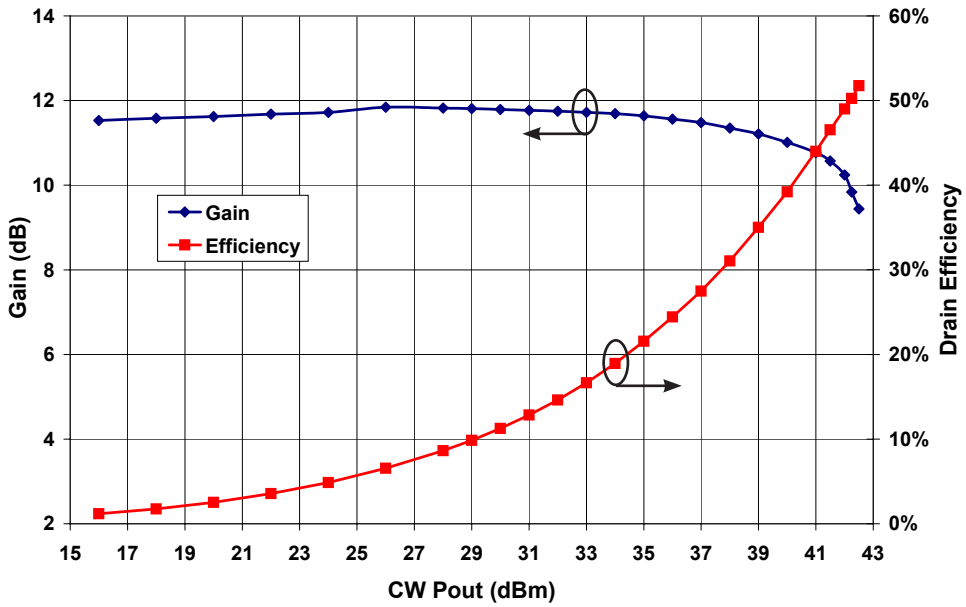
Typical WiMAX Performance

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



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

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



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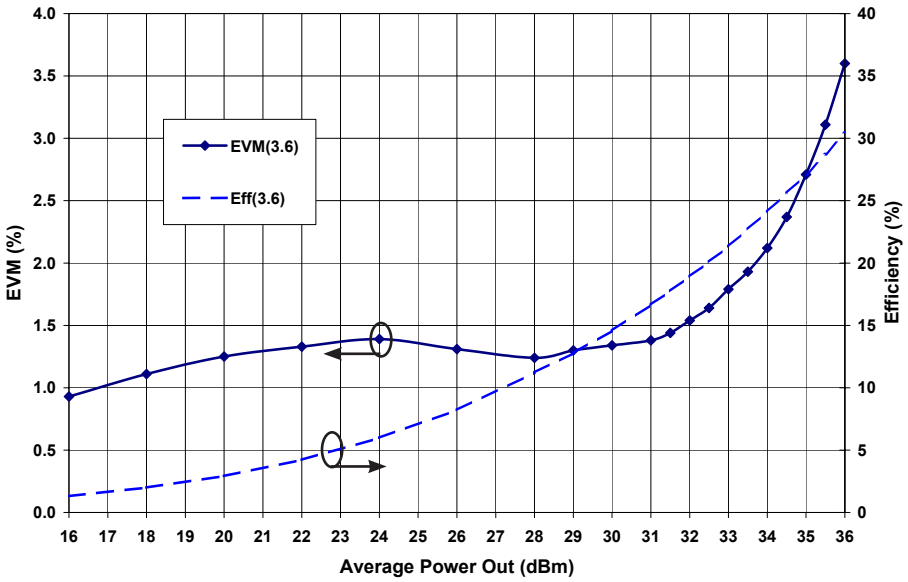
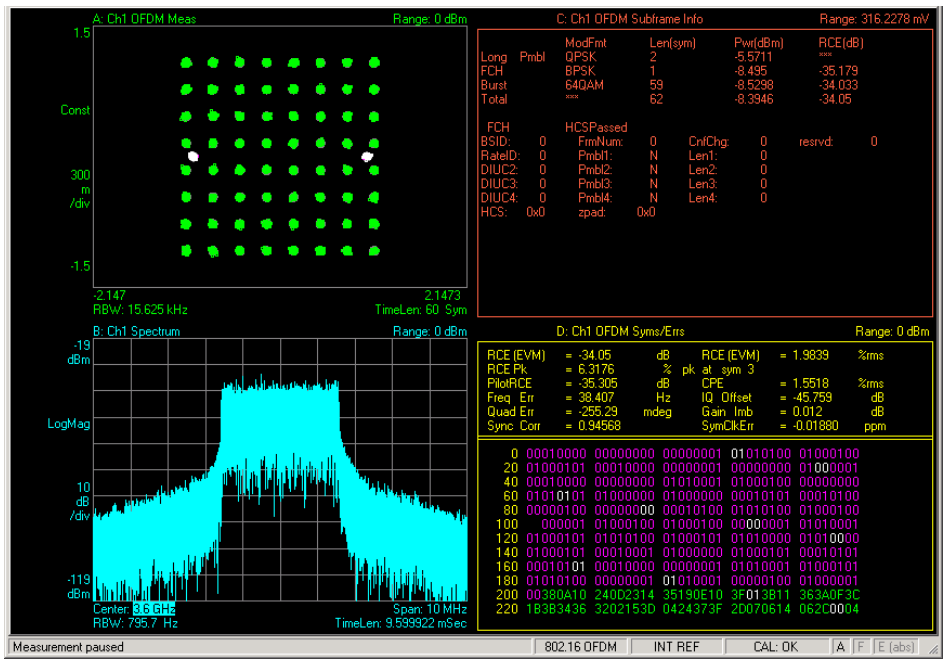
Typical WiMAX Performance

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



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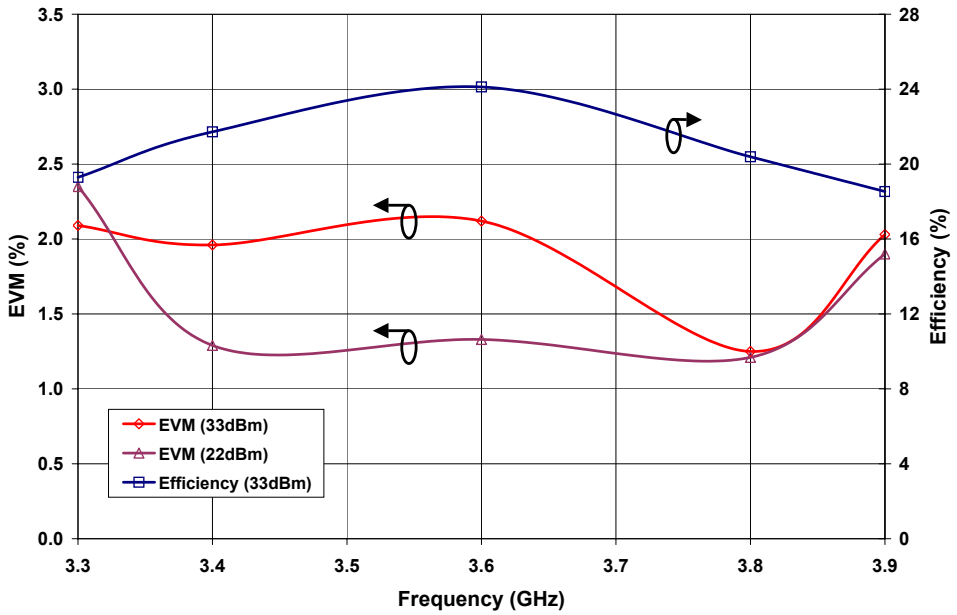
Typical WiMAX Performance

Typical EVM and Efficiency at 22dBm and 33 dBm vs Frequency of CGH35015F 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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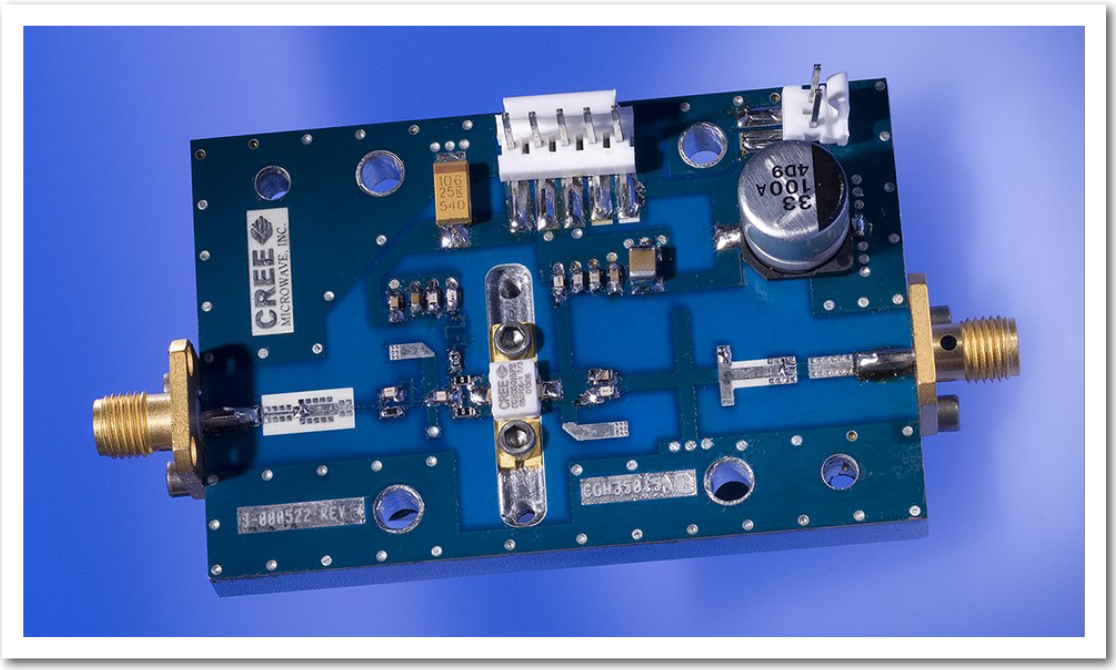
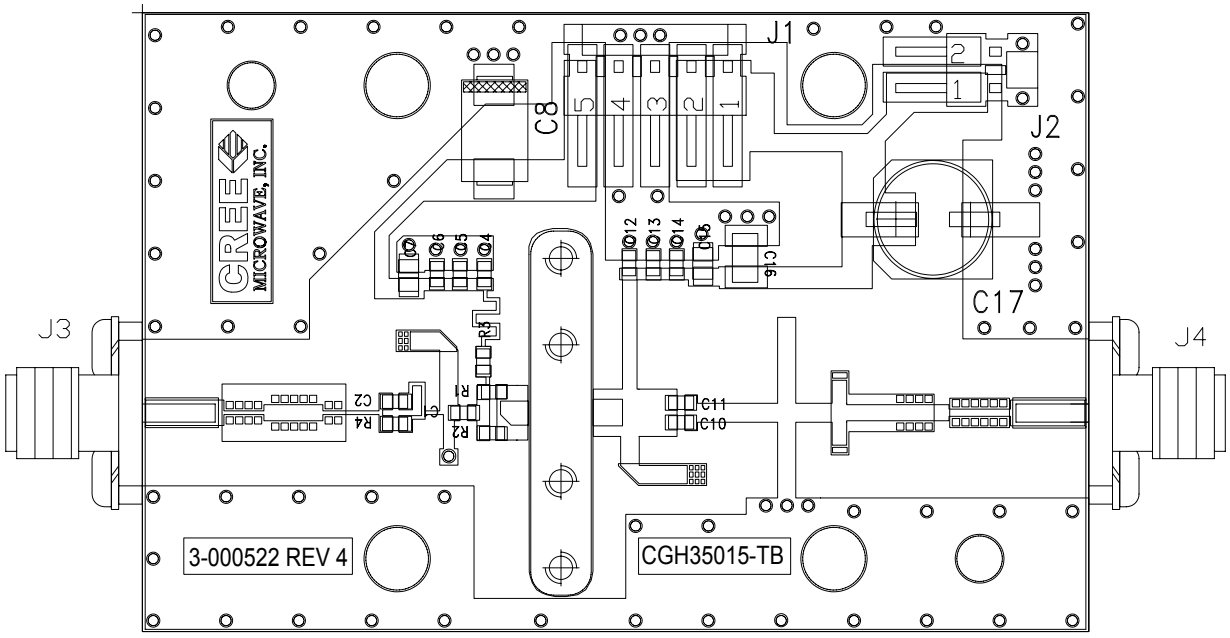
CGH35015F-TB Demonstration Amplifier Circuit



CGH35015F-TB Demonstration Amplifier Circuit Outline



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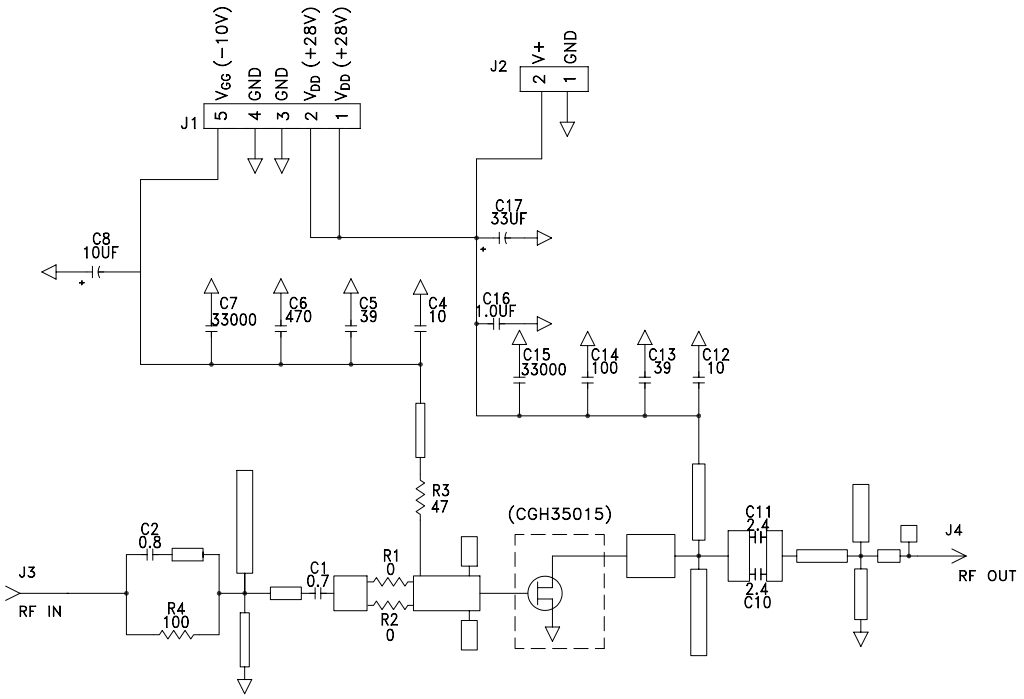
CGH35015F-TB Demonstration Amplifier Circuit Schematic



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

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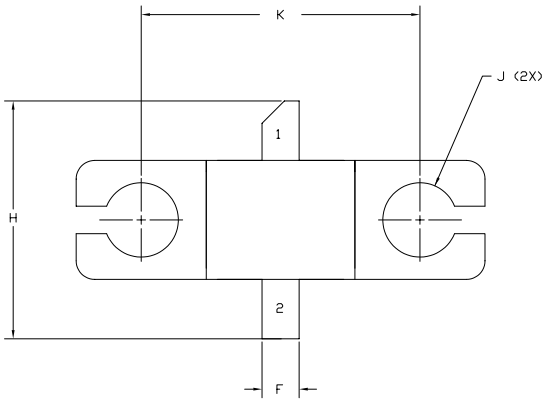
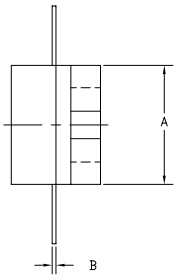
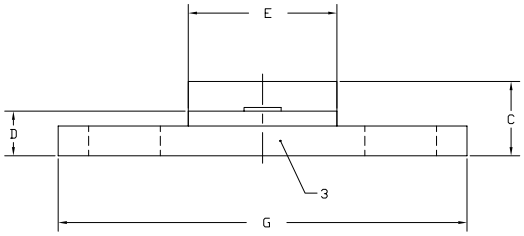
Product Dimensions CGH35015F (Package Type — 440166)







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

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	ø .100		2.54	
K	0.375		9.53	

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

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For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, NC 27703
www.cree.com/wireless

Ryan Baker
Marketing
Cree, Wireless Devices
919.287.7816

Tom Dekker
Sales Director
Cree, Wireless Devices
919.313.5639