

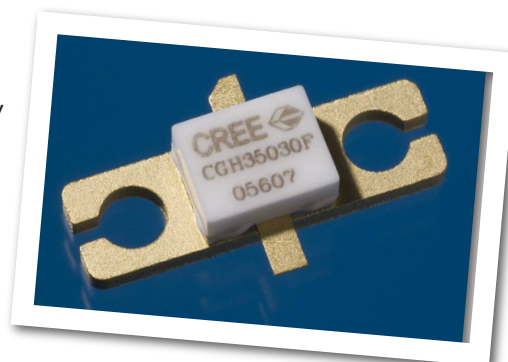
# PRELIMINARY



## CGH35030F

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

Cree's CGH35030F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGH35030F ideal for 3.3-3.9GHz WiMAX and BWA amplifier applications. The transistor is supplied in a ceramic/metal flange package.



Package Type: 440166  
PN: CGH35030F

### Typical Performance Over 3.3-3.7GHz ( $\tau_c = 25^\circ\text{C}$ ) of Demonstration Amplifier

Parameter	3.3 GHz	3.4 GHz	3.5 GHz	3.6 GHz	3.7 GHz	Units
Small Signal Gain	10.9	11.1	10.9	10.7	10.8	dB
EVM @ 36 dBm	1.9	1.9	1.9	2.0	2.0	%
Drain Efficiency @ 36 dBm	20.8	20.8	21.6	22.7	23.9	%
Input Return Loss	11.4	8.2	5.3	4.0	3.7	dB

Note:

Measured in the CGH35030F-TB amplifier circuit, 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.

### Features

- 3.3 - 3.9 GHz Operation
- >11 dB Small Signal Gain
- 2.0 % EVM at 4 W  $P_{OUT}$
- 23 % Efficiency at 4 W  $P_{OUT}$
- $3.7^\circ\text{C/W}$  Typical thermal resistance under 4.0 W  $P_{AVE}$  OFDM
- WiMAX Fixed Access 802.16-2004 OFDM





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

Parameter	Symbol	Rating	Units
Drain-Source Voltage	$V_{DS}$	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 <sup>1</sup>	$R_{\theta JC}$	3.7	°C/W

Note:

<sup>1</sup> Measured for the CGH35030F at 14 W  $P_{DISS}$

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

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics<sup>4</sup></b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.6	-2.5	-	VDC	$V_{DS} = 10\text{ V}, I_D = 7.2\text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.6	-	VDC	$V_{DS} = 28\text{ V}, I_D = 120\text{ mA}$
Saturated Drain Current	$I_{DS}$	4.8	5.4	-	A	$V_{DS} = 6.0\text{ V}, V_{GS} = 2\text{ V}$
Drain-Source Breakdown Voltage	$V_{BR}$	84	100	-	VDC	$V_{GS} = -8\text{ V}, I_D = 7.2\text{ mA}$
Forward Transconductance	$g_m$	1200	1300	-	mS	$V_{DS} = 28\text{ V}, I_D = 2\text{ A}$
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\text{C}, F_0 = 3.6\text{ GHz}</math> unless otherwise noted)</b>						
Small Signal Gain	$G_{SS}$	10.0	10.7	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 120\text{ mA}$
Drain Efficiency <sup>1</sup>	$\eta$	20.0	22.5	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 120\text{ mA}, P_{AVE} = 4\text{ W}$
Back-Off Error Vector Magnitude	$EVM_1$	-	2.3	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 120\text{ mA}, P_{AVE} = 21\text{ dBm}$
Error Vector Magnitude	$EVM_2$	-	2.0	-		$V_{DD} = 28\text{ V}, I_{DQ} = 120\text{ mA}, P_{AVE} = 4\text{ W}$
Output Mismatch Stress	VSWR	-	TBD	-	$\psi$	No damage at all phase angles, $V_{DD} = 28\text{ V}, I_{DQ} = 120\text{ mA}$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{GS}$	-	9.3	-	pF	$V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$
Output Capacitance	$C_{DS}$	-	2.0	-	pF	$V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$
Feedback Capacitance	$C_{GD}$	-	0.9	-	pF	$V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$

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, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.

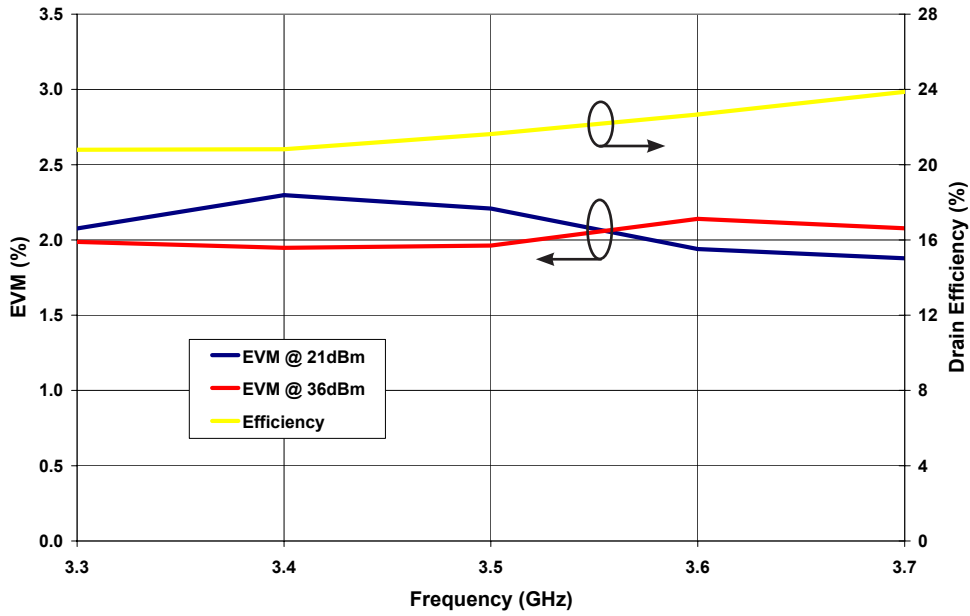
<sup>3</sup> Measured in the CGH35030F test fixture.

<sup>4</sup> Measured on wafer prior to packaging.



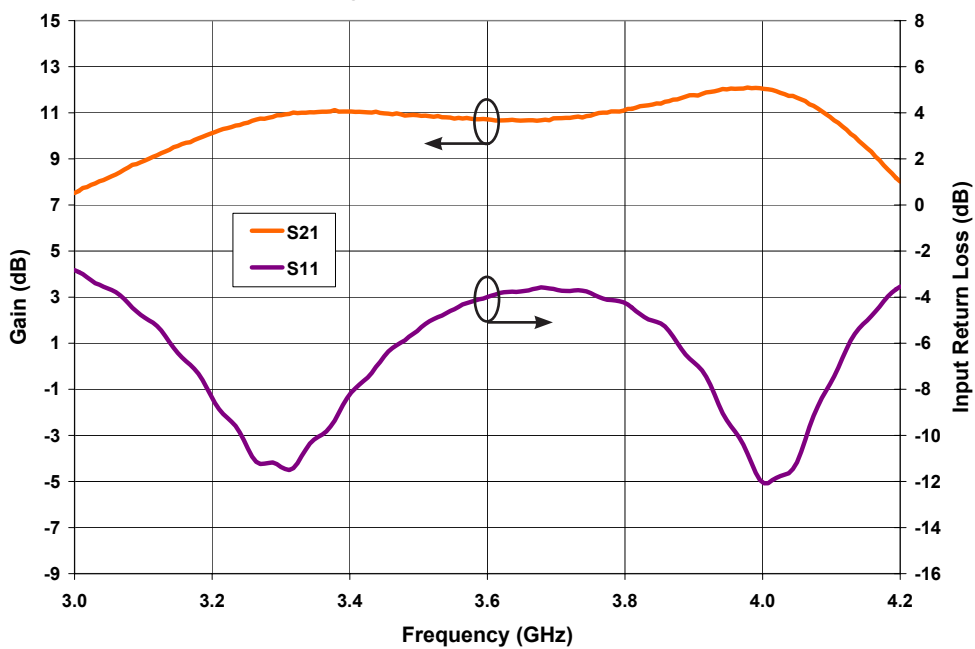
## Typical WiMAX Performance

**Typical EVM and Efficiency at 21 dBm and 36 dBm vs Frequency of CGH35030F in Broadband Amplifier Circuit**



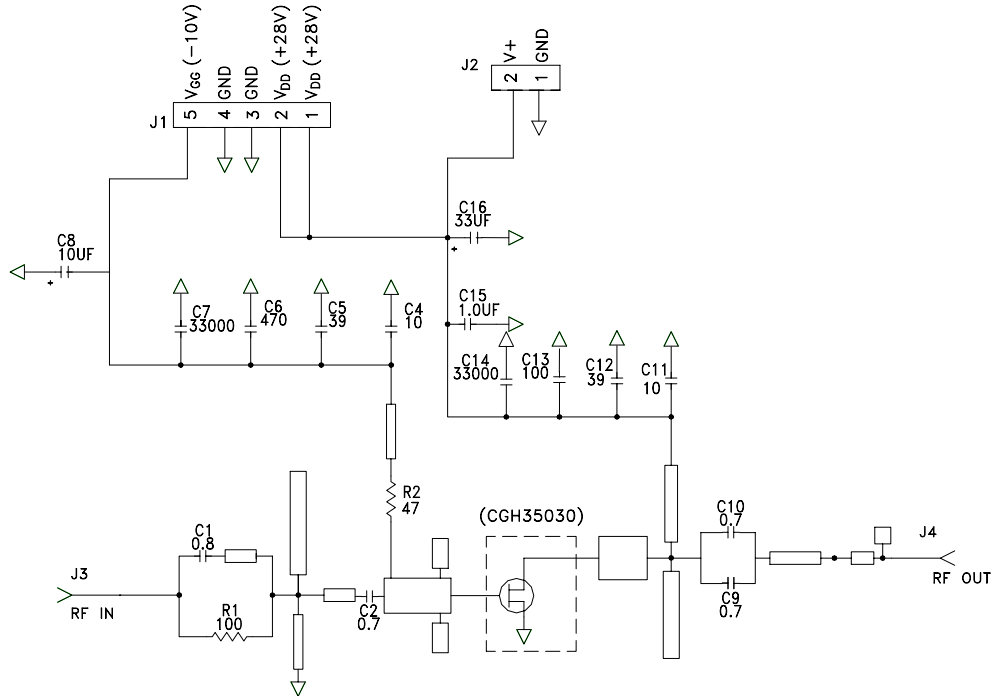
Note:  
Under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3.

**Gain and Return Loss vs Frequency of CGH35030F in Broadband Amplifier Circuit**  
 $V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 120\text{ mA}$ , OFDM BW = 3.5 MHz

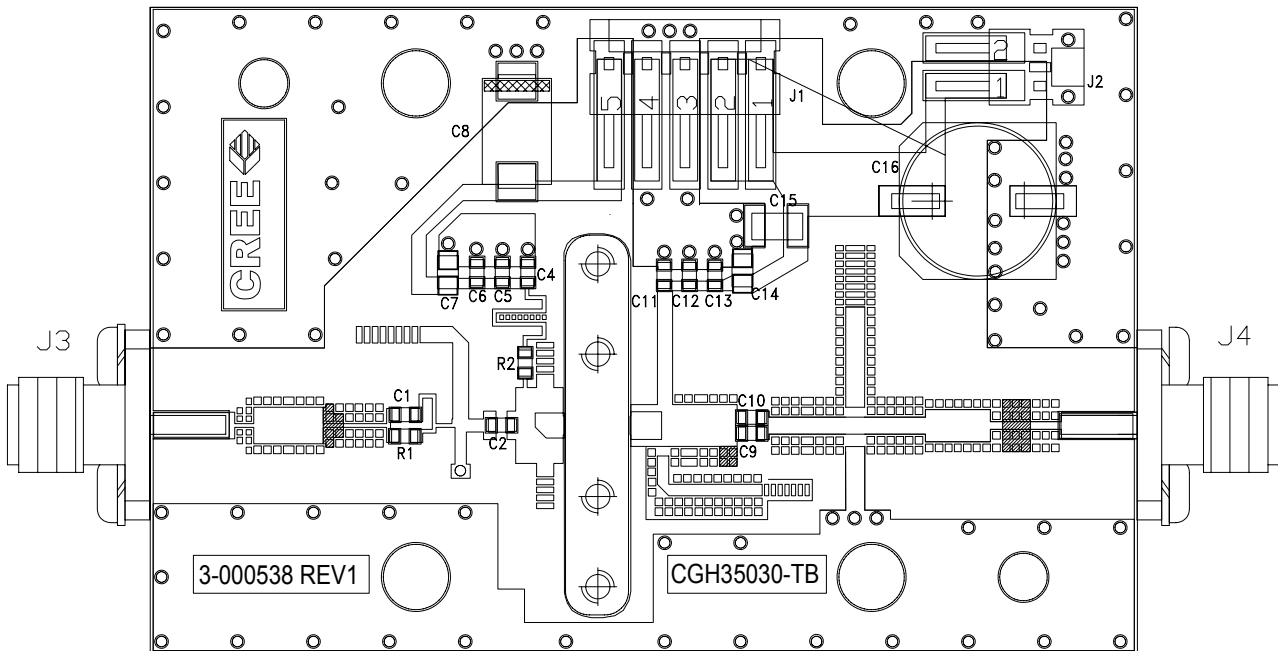




## CGH35030F-TB Demonstration Amplifier Circuit Schematic



## CGH35030F-TB Demonstration Amplifier Circuit Outline

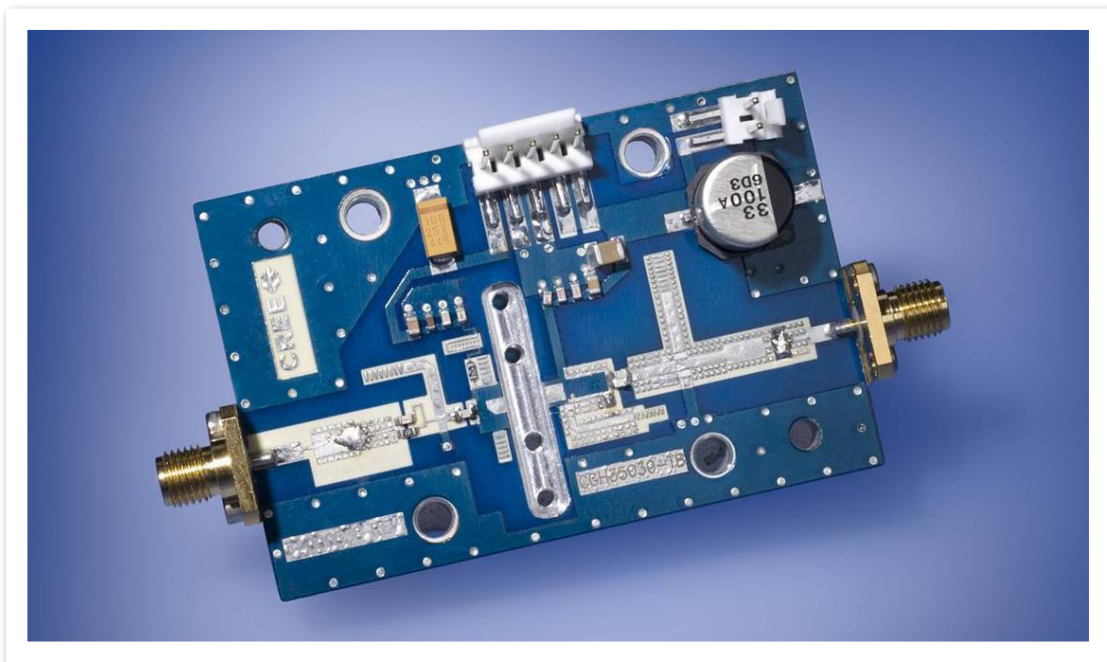




## CGH35030F-TB Demonstration Amplifier Circuit Bill of Materials

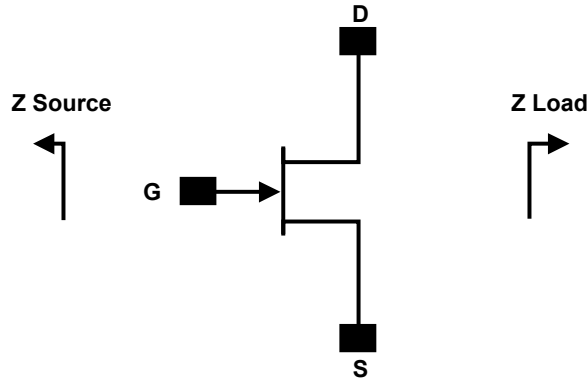
Designator	Description	Qty
R1	RES,1/16W,0603,1%,100 OHMS	1
R2	RES,1/16W,0603,1%,47 OHMS	1
C6	CAP, 470PF, 10%,100V, 0603	1
C17	CAP, 33 UF, 20%, G CASE	1
C16	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C8	CAP 10UF 16V TANTALUM	1
C13	CAP, 100.0pF, +/-5%, 0603	1
C1	CAP, 0.8pF, +/-0.05pF, 0603	1
C2,C9,C10	CAP, 0.7pF, +/-0.05pF, 0603	3
C4,C11	CAP, 10.0pF,+/-5%, 0603	2
C5,C12	CAP, 39pF, +/-5%, 0603	2
C7,C14	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
Q1	CGH35030F	1

## CGH35030F-TB Demonstration Amplifier Circuit





## Source and Load Impedances

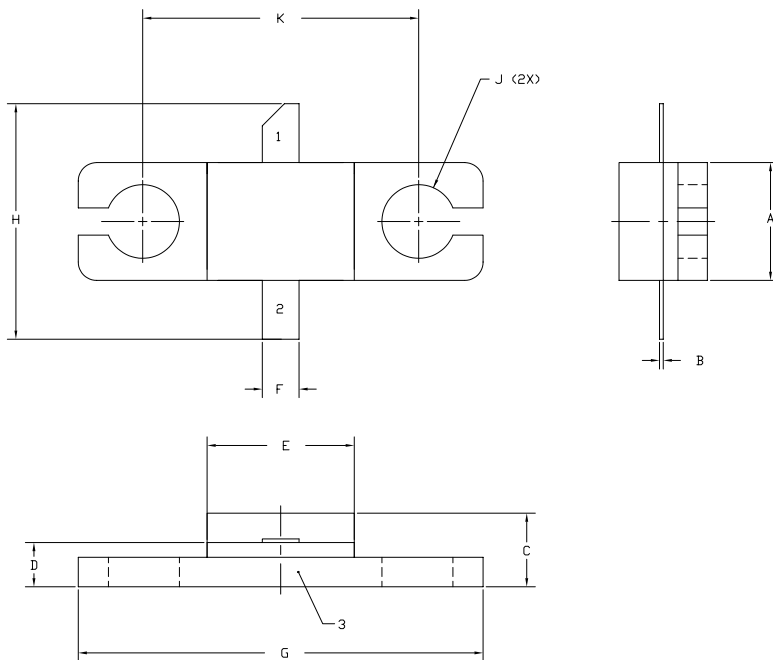


Frequency (MHz)	Z Source	Z Load
3300	5.3 - j8.9	13.3 - j10.0
3400	6.7 - j8.6	12.1 - j8.9
3500	7.7 - j9.3	11.0 - j7.8
3600	7.5 - j10.5	10.2 - j6.6
3700	6.3 - j11.0	9.5 - j5.5

Note<sup>1</sup>:  $V_{DD} = 28V$ ,  $I_{DQ} = 120mA$ . In the 440166 package.

Note<sup>2</sup>: Impedances are extracted from the CGH35030-TB demonstration circuit and are not source and load pull data off the transistors itself.

## Product Dimensions CGH35030F (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



**Typical Package S-Parameters**  
**(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 120\text{ mA}$ , magnitude / angle)**

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
200 MHz	0.9207	-135.03	16.412	108.79	0.02981	20.50	0.6269	-156.01
300 MHz	0.9136	-150.21	11.402	100.13	0.03104	12.71	0.6531	-164.20
400 MHz	0.9108	-158.59	8.683	94.76	0.03149	8.20	0.6633	-168.67
500 MHz	0.9095	-164.02	6.998	90.82	0.03169	5.12	0.6685	-171.56
600 MHz	0.9087	-167.91	5.855	87.61	0.03177	2.77	0.6716	-173.62
700 MHz	0.9083	-170.90	5.032	84.84	0.03180	0.86	0.6737	-175.22
800 MHz	0.9080	-173.33	4.410	82.33	0.03180	-0.77	0.6754	-176.52
900 MHz	0.9079	-175.38	3.925	80.01	0.03177	-2.22	0.6769	-177.62
1.0 GHz	0.9078	-177.16	3.536	77.82	0.03172	-3.53	0.6782	-178.58
1.1 GHz	0.9077	-178.76	3.218	75.72	0.03167	-4.75	0.6794	-179.45
1.2 GHz	0.9077	179.80	2.952	73.69	0.03160	-5.88	0.6807	179.76
1.3 GHz	0.9077	178.46	2.727	71.72	0.03152	-6.96	0.6819	179.01
1.4 GHz	0.9077	177.20	2.533	69.80	0.03143	-7.98	0.6832	178.31
1.5 GHz	0.9078	176.01	2.366	67.91	0.03134	-8.96	0.6845	177.64
1.6 GHz	0.9078	174.88	2.220	66.05	0.03124	-9.90	0.6858	176.99
1.7 GHz	0.9079	173.79	2.091	64.22	0.03114	-10.80	0.6871	176.35
1.8 GHz	0.9079	172.73	1.976	62.41	0.03102	-11.68	0.6885	175.73
1.9 GHz	0.9080	171.70	1.874	60.62	0.03091	-12.52	0.6899	175.11
2.0 GHz	0.9080	170.70	1.781	58.84	0.03079	-13.34	0.6914	174.50
2.1 GHz	0.9081	169.71	1.698	57.09	0.03066	-14.14	0.6928	173.89
2.2 GHz	0.9082	168.74	1.623	55.34	0.03053	-14.91	0.6943	173.28
2.3 GHz	0.9082	167.78	1.554	53.60	0.03040	-15.65	0.6958	172.67
2.4 GHz	0.9083	166.83	1.491	51.88	0.03027	-16.38	0.6974	172.06
2.5 GHz	0.9083	165.89	1.433	50.17	0.03013	-17.07	0.6989	171.45
2.6 GHz	0.9084	164.95	1.380	48.46	0.02999	-17.75	0.7005	170.83
2.7 GHz	0.9084	164.01	1.330	46.76	0.02985	-18.40	0.7020	170.20
2.8 GHz	0.9084	163.08	1.285	45.07	0.02971	-19.03	0.7036	169.57
2.9 GHz	0.9084	162.14	1.243	43.39	0.02956	-19.64	0.7052	168.92
3.0 GHz	0.9085	161.21	1.203	41.72	0.02942	-20.22	0.7067	168.27
3.1 GHz	0.9085	160.27	1.167	40.04	0.02928	-20.78	0.7083	167.61
3.2 GHz	0.9085	159.33	1.133	38.38	0.02914	-21.32	0.7099	166.94
3.3 GHz	0.9084	158.38	1.101	36.72	0.02900	-21.83	0.7114	166.26
3.4 GHz	0.9084	157.43	1.071	35.63	0.02886	-22.31	0.7129	165.58
3.5 GHz	0.9084	156.48	1.043	33.41	0.02872	-22.77	0.7144	164.87
3.6 GHz	0.9083	155.51	1.016	31.76	0.02859	-23.21	0.7159	164.16
3.7 GHz	0.9082	154.54	0.991	30.12	0.02846	-23.62	0.7173	163.44
3.8 GHz	0.9082	153.56	0.968	28.47	0.02834	-24.01	0.7188	162.70
3.9 GHz	0.9081	152.58	0.946	26.83	0.02822	-24.37	0.7202	161.95
4.0 GHz	0.9079	151.58	0.926	25.19	0.02811	-24.70	0.7215	161.19



## Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. "Typical" parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications and actual performance can vary over time. All operating parameters should be validated by customer's technical experts for each application. Cree products are not designed, intended or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death or in applications for planning, construction, maintenance or direct operation of a nuclear facility.

For more information, please contact:

Cree, Inc.  
4600 Silicon Drive  
Durham, NC 27703  
[www.cree.com/wireless](http://www.cree.com/wireless)

Ryan Baker  
Marketing  
Cree, Wireless Devices  
919.287.7816

Tom Dekker  
Sales Director  
Cree, Wireless Devices  
919.313.5639