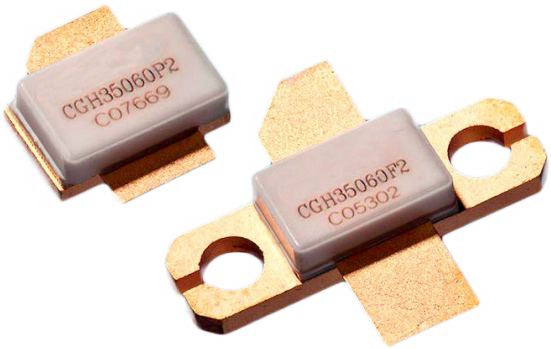
CGH35060F2/P2

60 W, 3.1 - 3.5 GHz, 28 V, GaN HEMT



Package Types: 440193 & 440206
PNs: CGH35060F2 & CGH35060P2

Description

The CGH35060F2/P2 is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGH35060F2/P2 ideal for 3.1 - 3.5 GHz S-band pulsed amplifier applications. The transistor is supplied in a ceramic/metal flange and pill package.

Typical Performance Over 3.1-3.5 GHz (T_C = 25°C) of Demonstration Amplifier

Parameter	3.1 GHz	3.3 GHz	3.5 GHz	Units
Small Signal Gain	12.0	13.2	11.5	dB
P_{OUT} @ P_{IN} = 36.5 dBm	47.0	47.6	46.7	dBm
Gain @ P_{IN} = 36.5 dBm	10.4	11.06	10.1	dB
Drain Efficiency @ P_{IN} = 36.5 dBm	55.0	62.0	62.0	%
Input Return Loss	-7.3	-17.0	-4.3	dB

Note:
Measured in the CGH35060F2-AMP amplifier circuit, under 100µs Pulse Width, 20% Duty Cycle and 28 V.

Features

- 3.1 - 3.5 GHz Operation
- 60 W Peak Power Capability
- 12 dB Small Signal Gain
- 60% Drain Efficiency

Large Signal Models Available for ADS and MWO

RoHS compliant

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

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	120	V	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-55, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	14.4	mA	25°C
Maximum Drain Current[1]	I_{DMAX}	6	A	
Soldering Temperature[2]	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case, Pulsed[3]	$R_{\theta JC}$	1.67	°C/W	85°C, Pulse Width = 300%, Duty Cycle = 10%
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 CGH35060F2 at P_{DISS} = 57.6 W.

Electrical Characteristics (T_C = 25°C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	V_{DS} = 10 V, I_D = 14.4 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–		V_{DS} = 28 V, I_D = 200 mA
Saturated Drain Current	I_{DS}	10.1	14.0	–	A	V_{DS} = 6.0 V, V_{GS} = 2 V
Drain-Source Breakdown Voltage	V_{BR}	84	–	–	V_{DC}	V_{GS} = -8 V, I_D = 14.4 mA
RF Characteristics[2,3] (T_C = 25°C, F_0 = 3.3 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	11.0	13.0	–	dB	V_{DD} = 28 V, I_{DQ} = 200 mA
Drain Efficiency[4]	η	40	62	–	%	V_{DD} = 28 V, I_{DQ} = 200 mA, P_{IN} = 36.5 W
Power Output[4]	P_{OUT}	45.6	47.6	–	dBm	
Output Mismatch Stress	VSWR	–	–	10:1	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 200 mA, P_{OUT} = 60 W Pulse
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	19.0	–	pF	V_{DS} = 28 V, V_{GS} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	5.9	–		
Feedback Capacitance	C_{GD}	–	0.8	–		

Notes:
[1] Measured on wafer prior to packaging.
[2] Measured in the CGH35060F2-AMP test fixture
[3] 100µs Pulse Width at 20% Duty Cycle
[4] Drain Efficiency = P_{OUT} / P_{DC}

Typical Performance

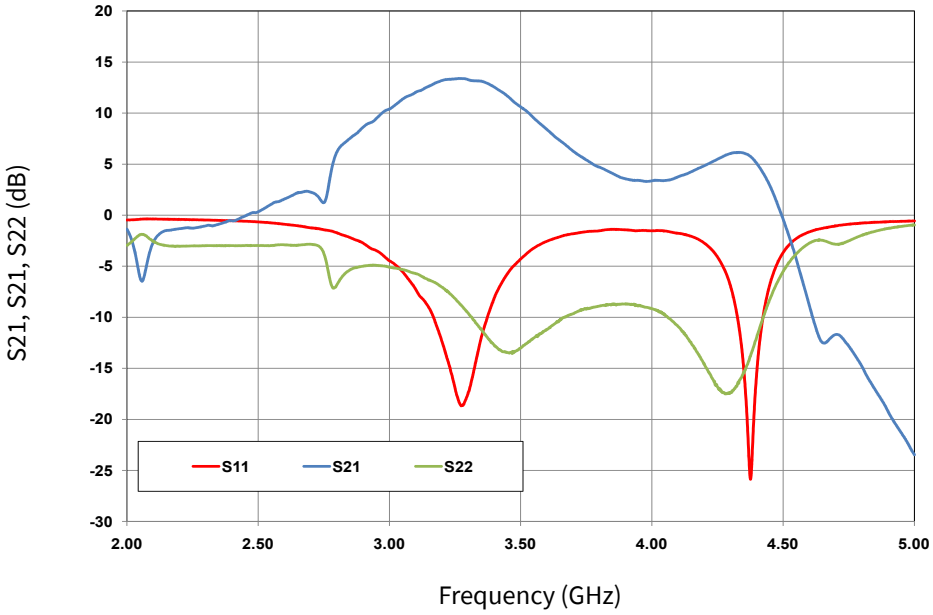


Figure 1. Small Signal Gain and Return Losses vs Frequency of the CGH35060F2 and CGH35060P2
V_{DD} = 28 V, I_{DQ} = 200 mA

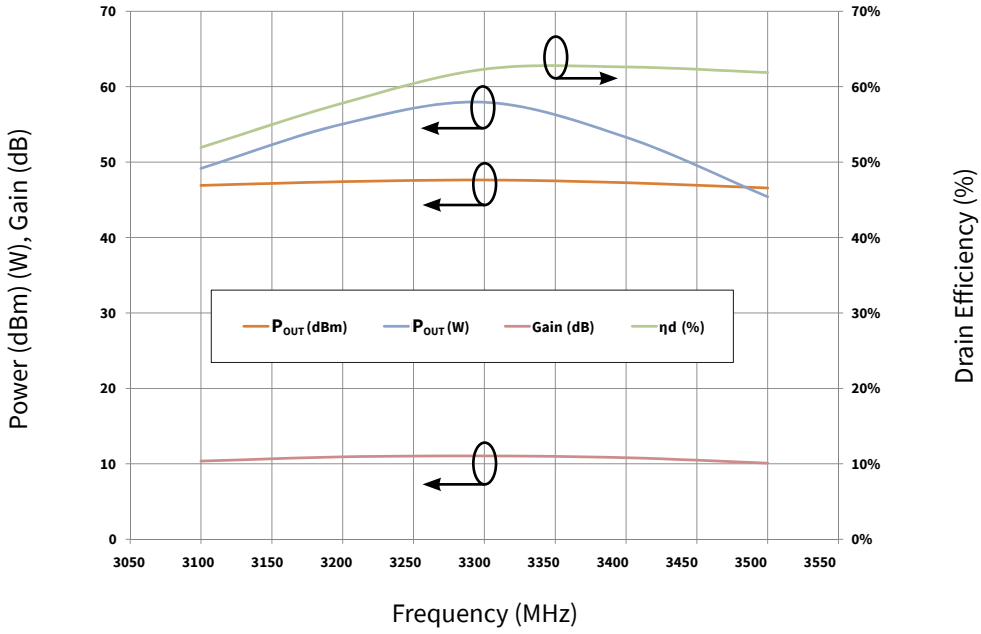
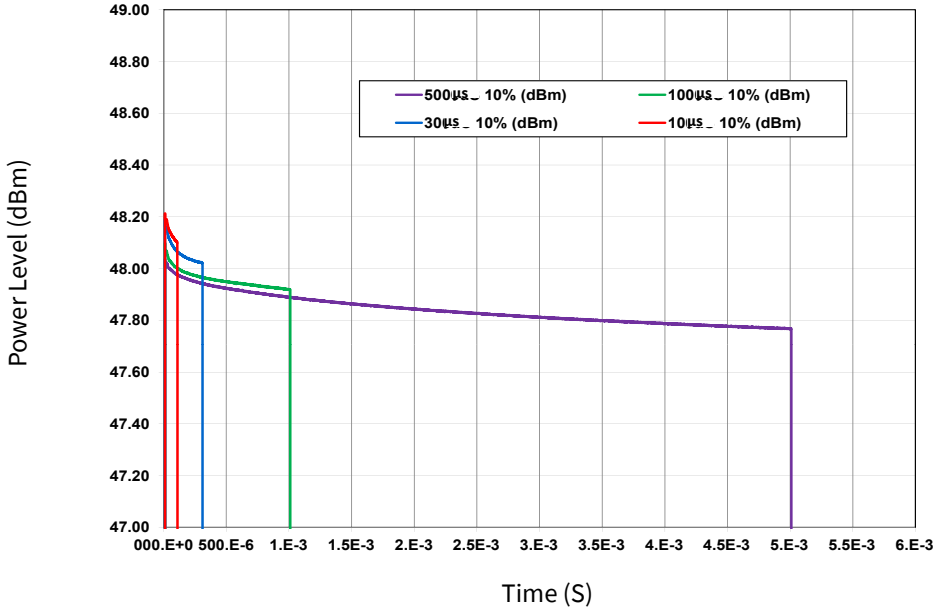


Figure 2. Output Power, Gain and Drain Efficiency vs Frequency of the CGH35060F2 and CGH35060P2
V_{DD} = 28 V, I_{DQ} = 200 mA, Pulse Width = 100µsec, Duty Cycle = 20%

Typical Pulse Droop Performance



Typical Performance

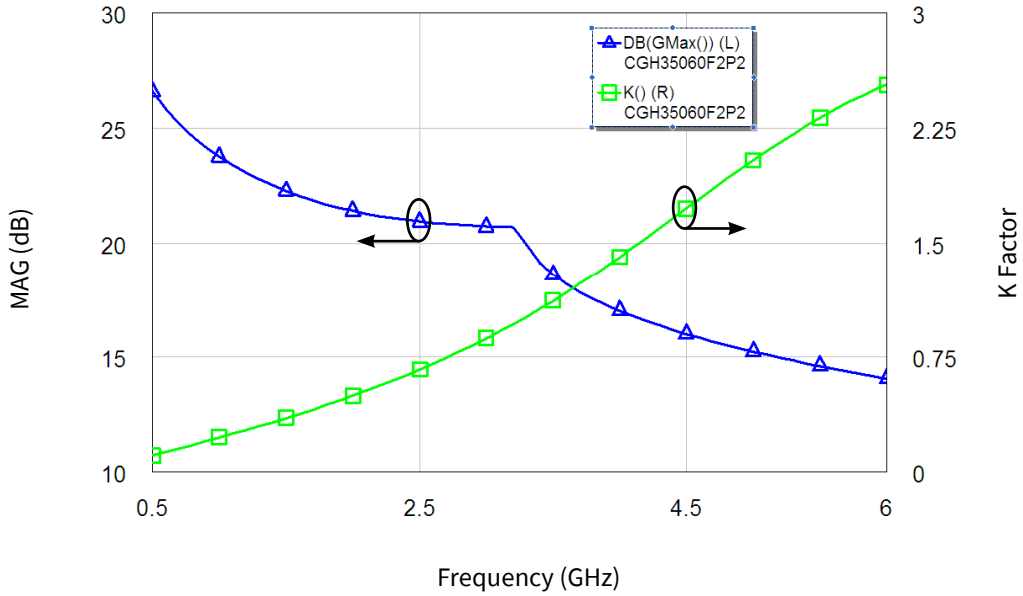
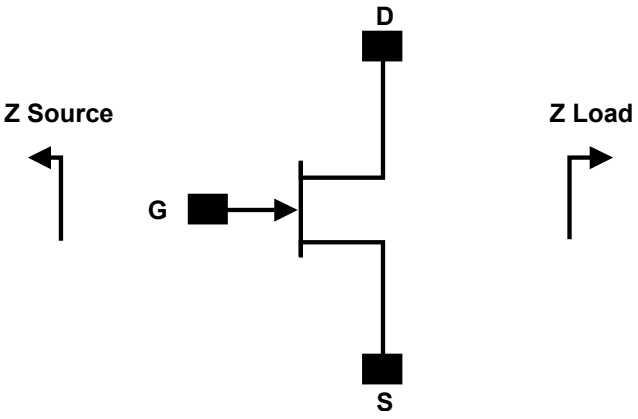


Figure 3. Simulated Maximum Available Gain and K Factor of the CGH35060F2 and CGH35060P2
V_{DD} = 28 V, I_{DQ} = 200 mA

Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
3100	3.6 – j13.5	8.0 – j8.5
3200	3.6 – j12.8	7.1– j7.7
3300	3.5 – j12.1	6.5 – j6.8
3400	3.5 – j11.4	6.0 – j5.9
3500	3.3 – j10.7	5.6 – j5.1

Notes:
[1] V_{DD} = 28V, I_{DQ} = 200mA in the 440193 package
[2] Impedances are extracted from the CGH35060F2-AMP demonstration amplifier and are not source and load pull data derived from the transistor

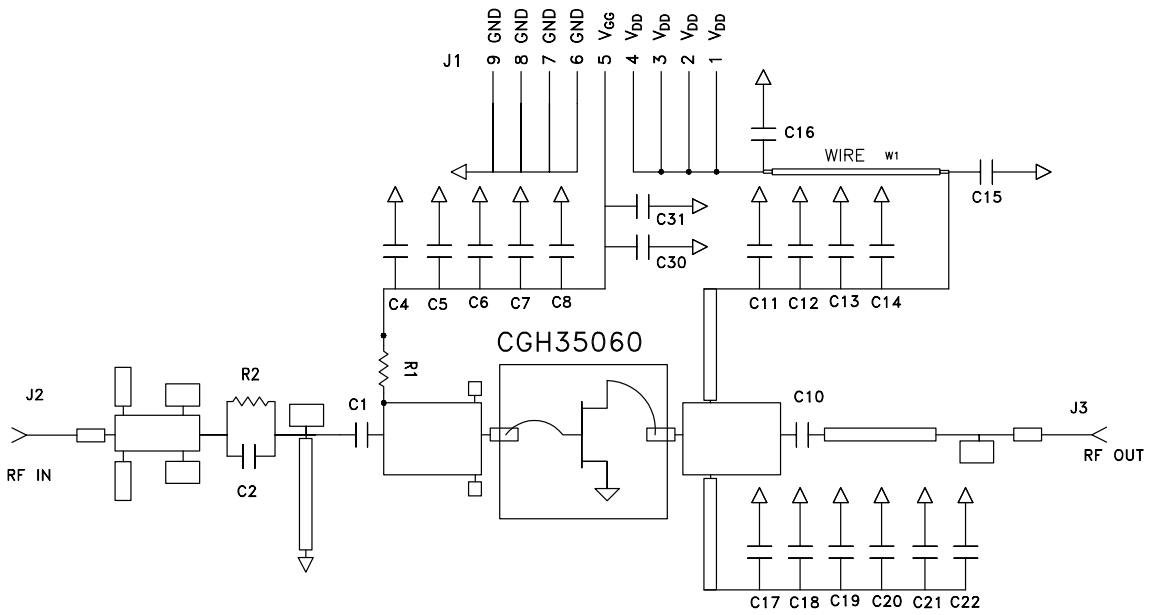
Electrostatic Discharge (ESD) Classifications

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-001 Table 3	JEDEC JESD22 C101-C

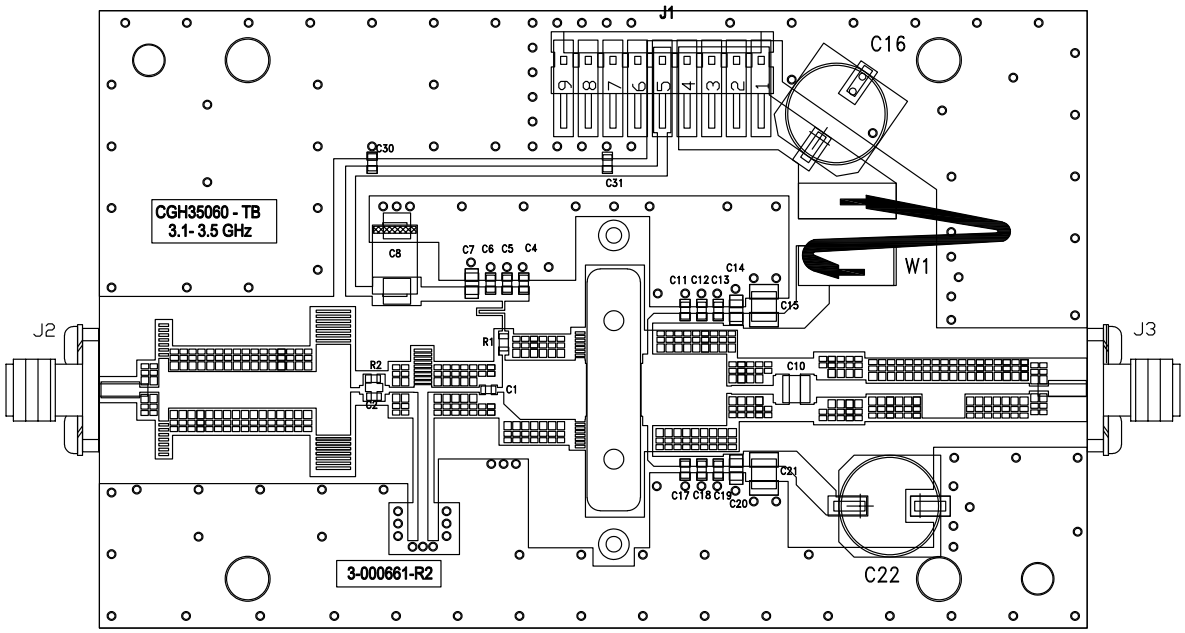
CGH35060F2-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 1/16 W, 0603, 1%, 5.1 OHMS	1
R2	RES, 1/16 W, 0603, 1%, 100 OHMS	1
C6, C13, C19	CAP, 470pF, +/-5%, 100 V, 0603	3
C16, C22	CAP, 33µF 100 V ELECT FK SMD	2
C15, C21	CAP, CER 1.0µF, 100 V, 10%, X7R 1210	2
C8	CAP, 10µF 16V SMT TANTALUM	1
C10	CAP, 20.0pF, +/-5%, 0603, ATC 100B	1
C1	CAP, 5.1pF, +/-5%, 0603, ATC 600S	1
C2	CAP, 3.0pF, +/-0.1pF, 0603, ATC 600S	1
C5, C12, C18, C30, C31	CAP, 4.7pF, 5%pF, 0603, ATC	5
C4, C11, C17	CAP, 7.5pF, 0.1pF, 0603, ATC	3
C7, C14, C20	CAP CER 33000pF, 0805, 100V, X7R	3
	PCB	1
	BASEPLATE	1
J2, J3	CONN, SMA, PANEL MOUNT JACK	2
J1	HEADER RT>PLZ .1CEN LK 9POS	1
	2-56 SOC HD SCREW 1/4 SS	4
	#2 SPLIT LOCKWASHER SS	4
W1	WIRE, BLACK, 22 AWG ~ 2.0”	1
Q1	CGH35060F2	1

CGH35060F2-AMP Demonstration Amplifier Circuit Schematic



CGH35060F2-AMP Demonstration Amplifier Circuit Outline

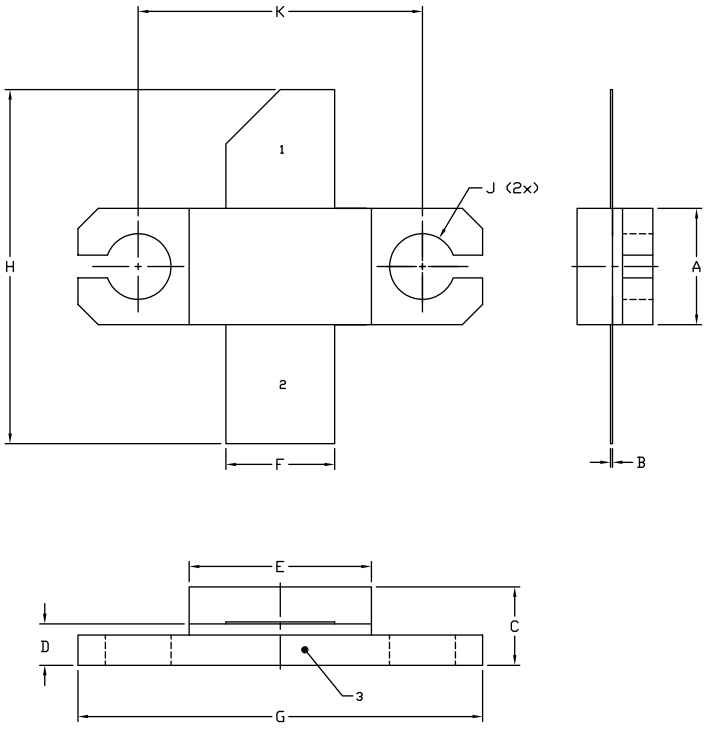


Typical Package S-Parameters for CGH35060F2/P2, (Small Signal, V_{DS} = 28 V, I_{DQ} = 200 mA, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.927	-170.09	7.16	79.27	0.016	-6.59	0.596	-168.07
600 MHz	0.928	-172.55	5.95	75.10	0.016	-9.91	0.605	-168.34
700 MHz	0.929	-174.46	5.08	71.25	0.015	-12.90	0.615	-168.44
800 MHz	0.930	-176.04	4.42	67.64	0.015	-15.66	0.626	-168.49
900 MHz	0.931	-177.39	3.91	64.20	0.015	-18.24	0.637	-168.54
1.0 GHz	0.932	-178.59	3.50	60.90	0.015	-20.65	0.648	-168.63
1.1 GHz	0.933	-179.70	3.16	57.72	0.015	-22.94	0.659	-168.78
1.2 GHz	0.935	179.27	2.88	54.66	0.014	-25.10	0.670	-168.99
1.3 GHz	0.936	178.29	2.65	51.70	0.014	-27.14	0.681	-169.25
1.4 GHz	0.937	177.34	2.45	48.83	0.014	-29.08	0.692	-169.58
1.5 GHz	0.938	176.41	2.28	46.04	0.013	-30.91	0.702	-169.96
1.6 GHz	0.939	175.49	2.13	43.33	0.013	-32.65	0.712	-170.40
1.7 GHz	0.940	174.57	2.00	40.70	0.013	-34.29	0.721	-170.87
1.8 GHz	0.941	173.65	1.88	38.13	0.013	-35.85	0.730	-171.39
1.9 GHz	0.942	172.73	1.78	35.62	0.012	-37.32	0.738	-171.94
2.0 GHz	0.943	171.79	1.69	33.16	0.012	-38.70	0.746	-172.53
2.1 GHz	0.943	170.83	1.62	30.76	0.012	-40.01	0.753	-173.14
2.2 GHz	0.944	169.85	1.55	28.40	0.012	-41.25	0.760	-173.78
2.3 GHz	0.944	168.85	1.49	26.07	0.012	-42.41	0.766	-174.44
2.4 GHz	0.944	167.82	1.44	23.78	0.011	-43.51	0.772	-175.12
2.5 GHz	0.945	166.75	1.39	21.52	0.011	-44.55	0.777	-175.82
2.6 GHz	0.944	165.64	1.35	19.27	0.011	-45.52	0.781	-176.54
2.7 GHz	0.944	164.49	1.32	17.03	0.011	-46.44	0.785	-177.27
2.8 GHz	0.944	163.29	1.29	14.80	0.011	-47.31	0.789	-178.03
2.9 GHz	0.943	162.03	1.26	12.57	0.011	-48.13	0.792	-178.80
3.0 GHz	0.943	160.71	1.24	10.34	0.010	-48.92	0.795	-179.59
3.2 GHz	0.941	157.85	1.22	5.80	0.010	-50.38	0.798	178.78
3.4 GHz	0.938	154.62	1.21	1.13	0.010	-51.75	0.800	177.06
3.6 GHz	0.934	150.94	1.21	-3.76	0.010	-53.09	0.800	175.23
3.8 GHz	0.928	146.65	1.24	-8.97	0.010	-54.51	0.798	173.28
4.0 GHz	0.921	141.58	1.28	-14.63	0.011	-56.12	0.794	171.18
4.2 GHz	0.911	135.46	1.35	-20.90	0.011	-58.11	0.787	168.89
4.4 GHz	0.897	127.93	1.45	-28.01	0.012	-60.71	0.777	166.35
4.6 GHz	0.880	118.44	1.57	-36.26	0.012	-64.27	0.764	163.51
4.8 GHz	0.857	106.23	1.73	-46.04	0.014	-69.22	0.746	160.26
5.0 GHz	0.828	90.20	1.93	-57.83	0.015	-76.13	0.723	156.46
5.2 GHz	0.796	69.08	2.15	-72.17	0.017	-85.57	0.692	151.91
5.4 GHz	0.770	42.01	2.35	-89.39	0.018	-97.96	0.649	146.29
5.6 GHz	0.766	10.14	2.48	-109.22	0.019	-113.08	0.590	139.24
5.8 GHz	0.793	-22.34	2.47	-130.55	0.020	-129.85	0.509	130.26
6.0 GHz	0.839	-50.86	2.33	-152.01	0.019	-146.93	0.401	118.41

To download the s-parameters in s2p format, go to the CGH35060F2/P2 Product Page.

Product Dimensions CGH35060F2 (Package Type — 440193)



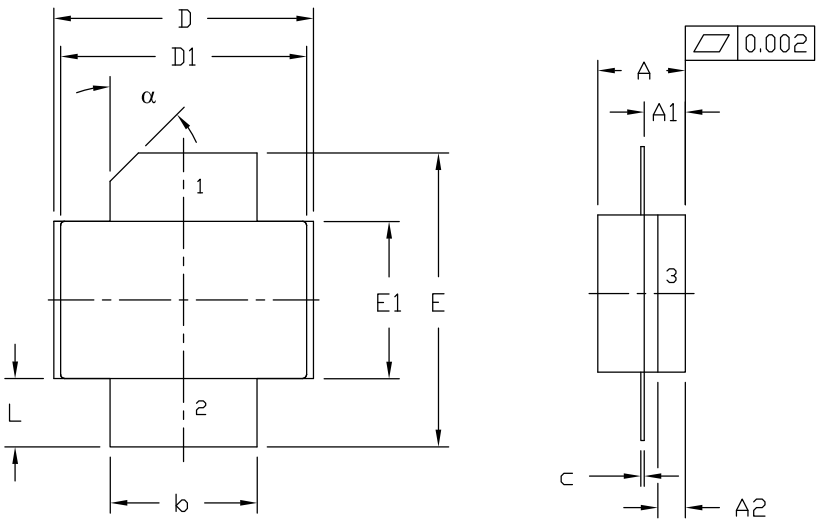
NOTES:

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	0.225	0.235	5.72	5.97
B	0.004	0.006	0.10	0.15
C	0.145	0.165	3.68	4.19
D	0.077	0.087	1.96	2.21
E	0.355	0.365	9.02	9.27
F	0.210	0.220	5.33	5.59
G	0.795	0.805	20.19	20.45
H	0.670	0.730	17.02	18.54
J	ø .130		3.30	
k	0.562		14.28	

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

Product Dimensions CGH35060P2 (Package Type — 440206)



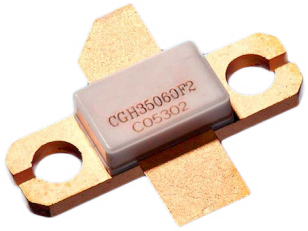
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M – 1994.
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 PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.125	0.145	3.18	3.68	
A1	0.057	0.067	1.45	1.70	
A2	0.035	0.045	0.89	1.14	
b	0.210	0.220	5.33	5.59	2x
c	0.004	0.006	0.10	0.15	2x
D	0.375	0.385	9.53	9.78	
D1	0.355	0.365	9.02	9.27	
E	0.400	0.460	10.16	11.68	
E1	0.225	0.235	5.72	5.97	
L	0.085	0.115	2.16	2.92	2x
α	45° REF		45° REF		

PIN 1. GATE
2. DRAIN
3. SOURCE

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGH35060F2	GaN HEMT (Flanged)	Each	
CGH35060P2	GaN HEMT (Pill)	Each	
CGH35060F2-AMP	Test board with GaN HEMT installed	Each	

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