CGHV35120F

120 W, 2.9 - 3.8 GHz, 50 V, GaN HEMT for S-Band Radar Systems

PN: 440162
Package Type: CGHV35120F

Description

Wolfspeed's CGHV35120F is a gallium nitride (GaN) high electron mobility transistor (HEMT)designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV35120F ideal for 2.9 - 3.8 GHz S-Band radar amplifier applications. The transistor is supplied in a ceramic/metal flange package.

Typical Performance 3.1 - 3.5 GHz (T_C = 85°C)

Parameter	3.1 GHz	3.2 GHz	3.3 GHz	3.4 GHz	3.5 GHz	Units
Output Power	142	135	132	136	134	W
Gain	13	12.8	12.8	12.9	12.8	dBc
Drain Efficiency	68	66	63	62	62	%

Note: Measured in the CGHV35120F-AMP1 application circuit, under 100 µs pulse width, 10% duty cycle, P_{IN} = 38.5 dBm

Features

- Rated Power = 120 W @ T_{CASE} = 85°C
- Operating Frequency = 2.9 - 3.8 GHz
- Transient 100 µsec - 300 µsec @ 20% Duty Cycle
- 13 dB Power Gain @ T_{CASE} = 85°C
- 62% Typical Drain Efficiency @ T_{CASE} = 85°C
- Input Matched
- <0.3 dB Pulsed Amplitude Droop

Large Signal Models Available for ADS and MWO

RoHS compliant

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	150	V	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	22.5	mA	25°C
Maximum Drain Current[1]	I_{DMAX}	9	A	
Soldering Temperature[2]	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	1.2	°C/W	300 µsec, 20%, 85°C
Case Operating Temperature	T_C	-40, +130	°C	

Notes:
[1] Current limit for long term, reliable operation
[2] Refer to the Application Note on soldering at wolfspeed.com/rf/document-library
[3] Measured for the CGHV35120F at P_{DISS} = 80 W

Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1] (T_C = 25°C)						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	V_{DS} = 10 V, I_D = 21.6 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	—	-2.7	—		V_{DS} = 48 V, I_D = 220 mA
Saturated Drain Current[2]	I_{DS}	16.2	20.1	—	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	125	—	—	V_{DC}	V_{GS} = -8 V, I_D = 21.6 mA
RF Characteristics[3] (T_C = 25°C, F_0 = 3.1 - 3.5 GHz unless otherwise noted)						
Output Power at 3.1 GHz	P_{OUT}	135	142	—	W	V_{DD} = 48 V, I_{DQ} = 220 mA, P_{IN} = 38.5 dBm
Output Power at 3.5 GHz		120	134	—		
Output Return Loss	ORL	—	-8	-6	dB	
Input Return Loss	IRL	—	-8	-6		
Gain at 3.1 GHz	G_P	—	13	—		
Gain at 3.5 GHz		—	12.8	—		
Drain Efficiency at 3.1 GHz	D_E	64	68	—	%	
Drain Efficiency at 3.5 GHz		60	62	—		
Amplitude Droop	D	—	-0.3	—	dB	
Output Mismatch Stress	VSWR	—	—	5 : 1	Ψ	No damage at all phase angles, V_{DD} = 48 V, I_{DQ} = 220 mA, P_{IN} = 38.5 dBm Pulsed
Dynamic Characteristics						
Input Capacitance	C_{GS}	—	65	—	pF	V_{DS} = 48 V, V_{GS} = -8 V, f = 1 MHz
	C_{DS}	—	9.5	—		
	C_{GD}	—	0.7	—		

Notes:
[1] Measured on wafer prior to packaging
[2] Scaled from PCM data
[3] Measured in CGHV35120-AMP. Pulse Width = 100 µs, Duty Cycle = 10%

Typical Performance

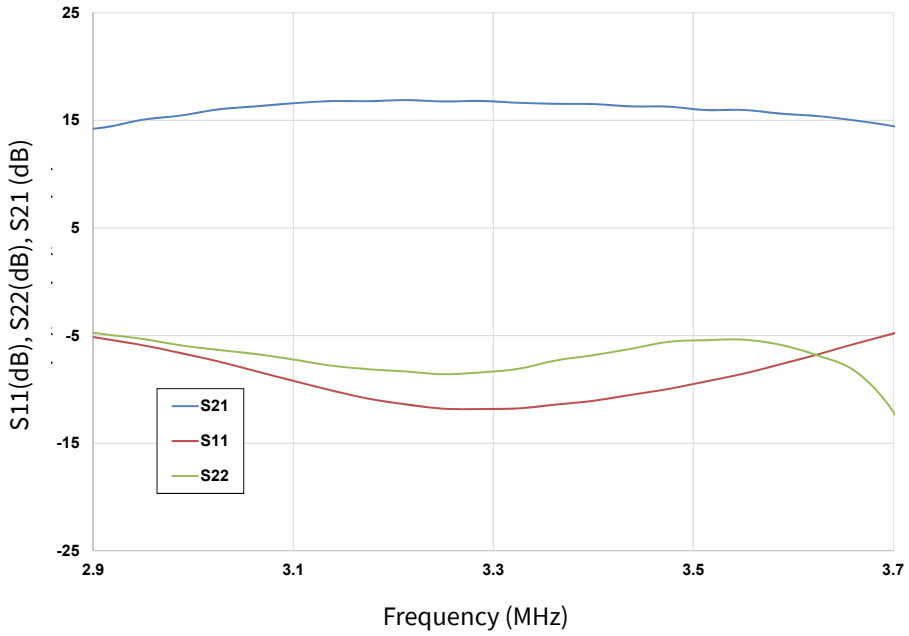


Figure 1. CGHV35120F Typical S Parameters Measured in CGHV35120F-AMP1
V_{DD} = 48 V, I_{DQ} = 220 mA, T_{CASE} = 25°C

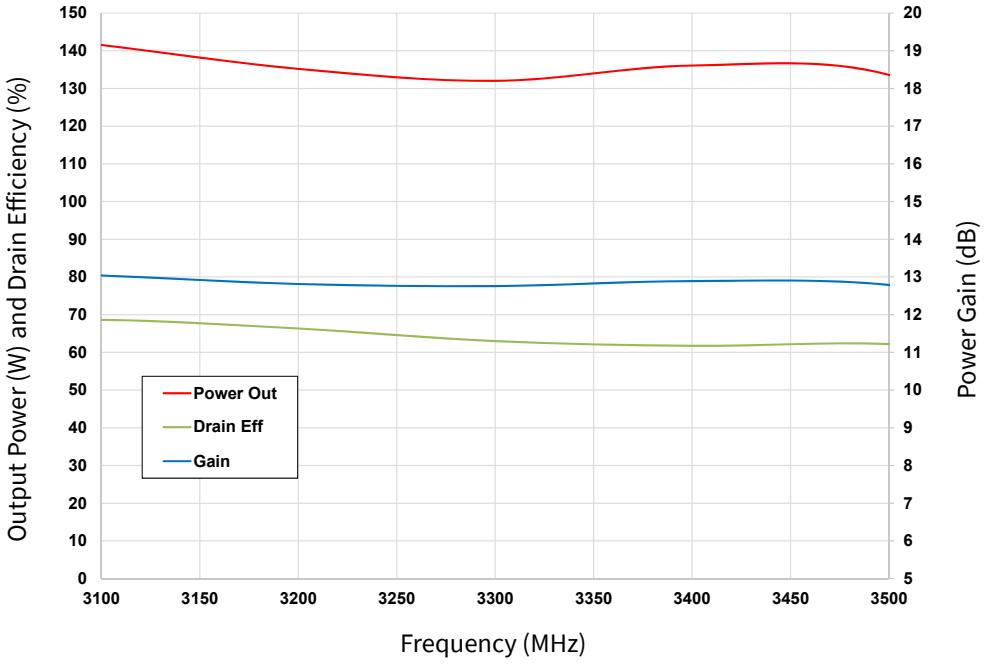


Figure 2. CGHV35120F Typical RF Results Measured in CGHV35120F-AMP1
V_{DD} = 48 V, I_{DQ} = 220 mA, T_{PLATE} = 85°C, Pulse Width = 100 µs, Duty Cycle = 10%

Typical Performance

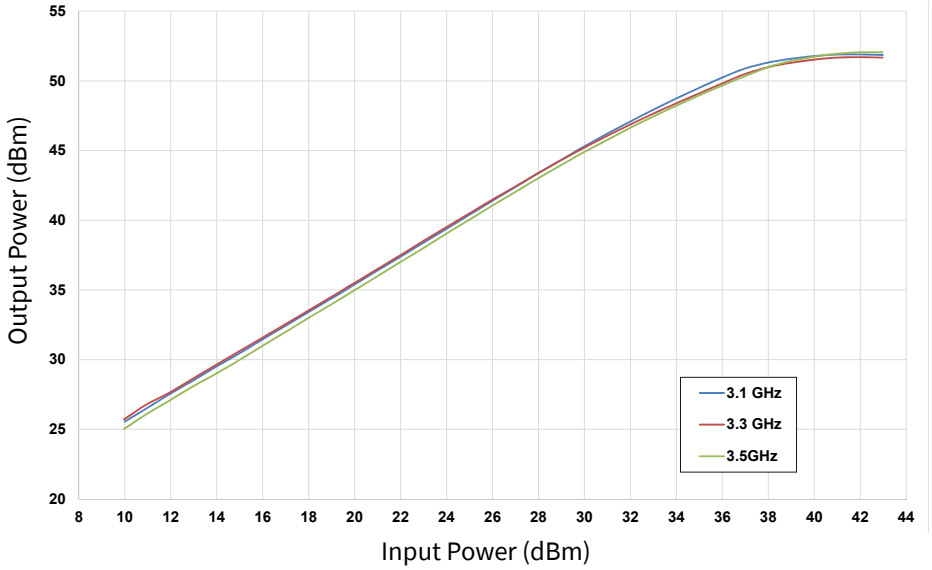


Figure 3. CGHV35120F Output Power vs Input Power Measured in CGHV35120F-AMP1
V_{DD} = 48 V, I_{DQ} = 220 mA, T_{PLATE} = 85°C, Pulse Width = 100 µs, Duty Cycle = 10%

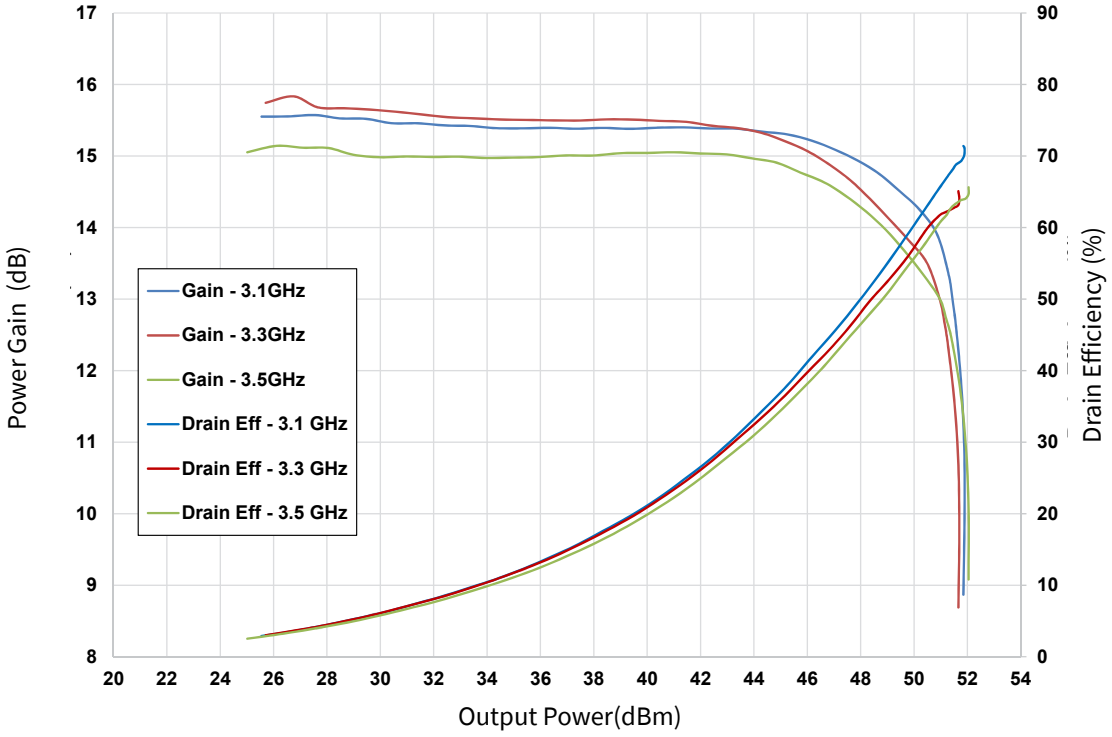


Figure 4. CGHV35120F Gain and Drain Efficiency vs Output Power Measured in CGHV35120F-AMP1
V_{DD} = 48 V, I_{DQ} = 220 mA, T_{PLATE} = 85°C, Pulse Width = 100 µs, Duty Cycle = 10%

Typical Performance

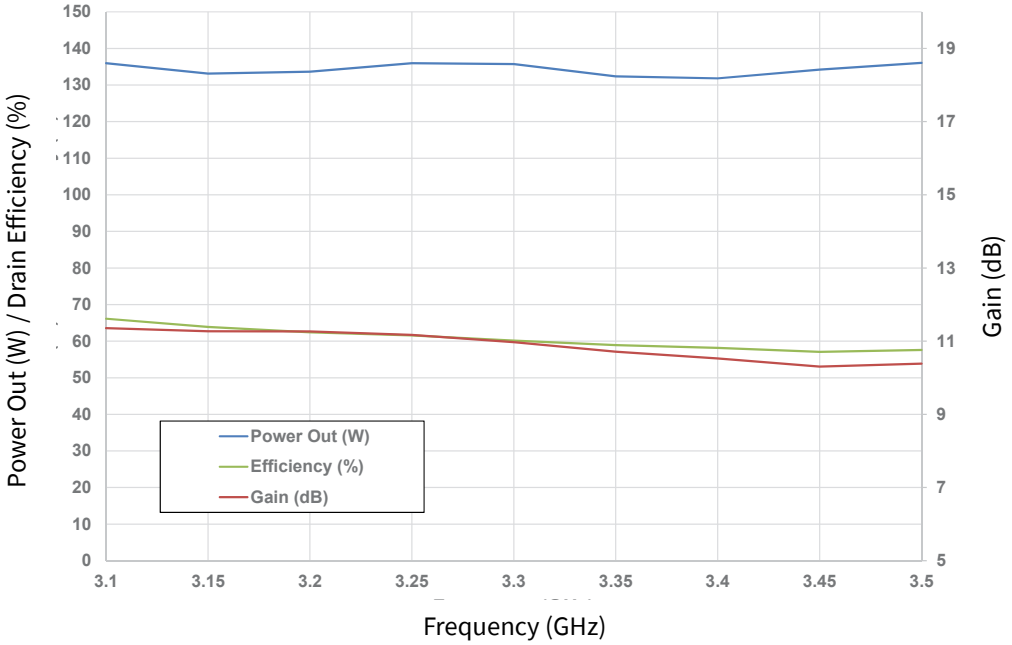


Figure 5. CGHV35120F Power Out/Drain Efficiency vs Frequency Measured in CGHV35120F-AMP1
V_{DD} = 48 V, P_{SAT} where IG > 0, Pulse Width = 1msec, Duty Cycle = 20%

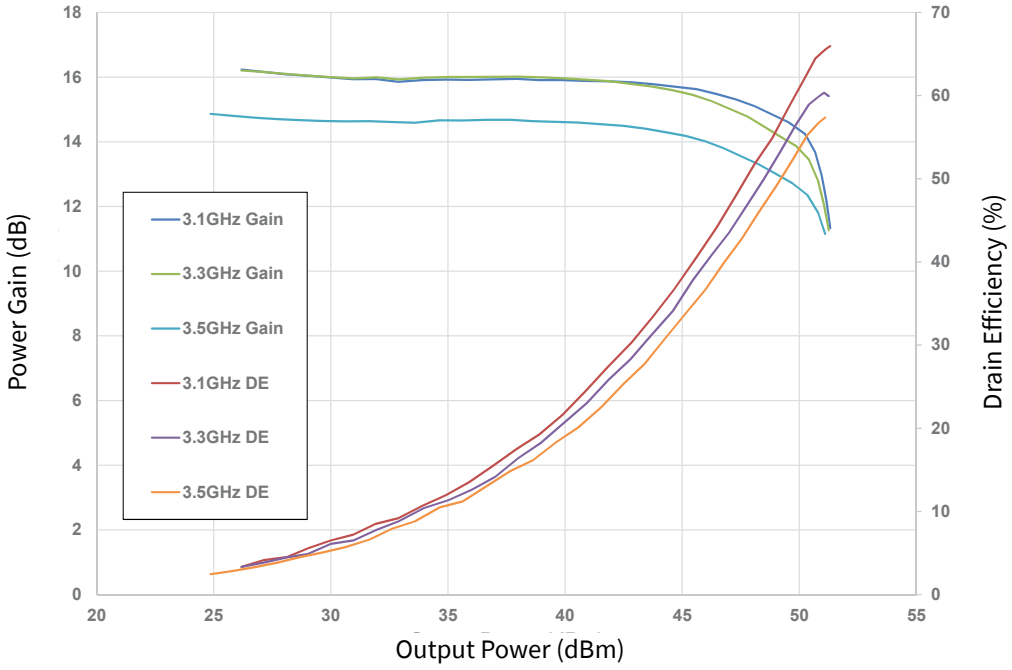


Figure 6. CGHV35120F Gain and Drain Efficiency vs Output Power Measured in CGHV35120F-AMP1
V_{DD} = 48 V, I_{DQ} = 220 mA, T_{PLATE} = 25°C, Pulse Width = 1msec, Duty Cycle = 20%

Typical Performance

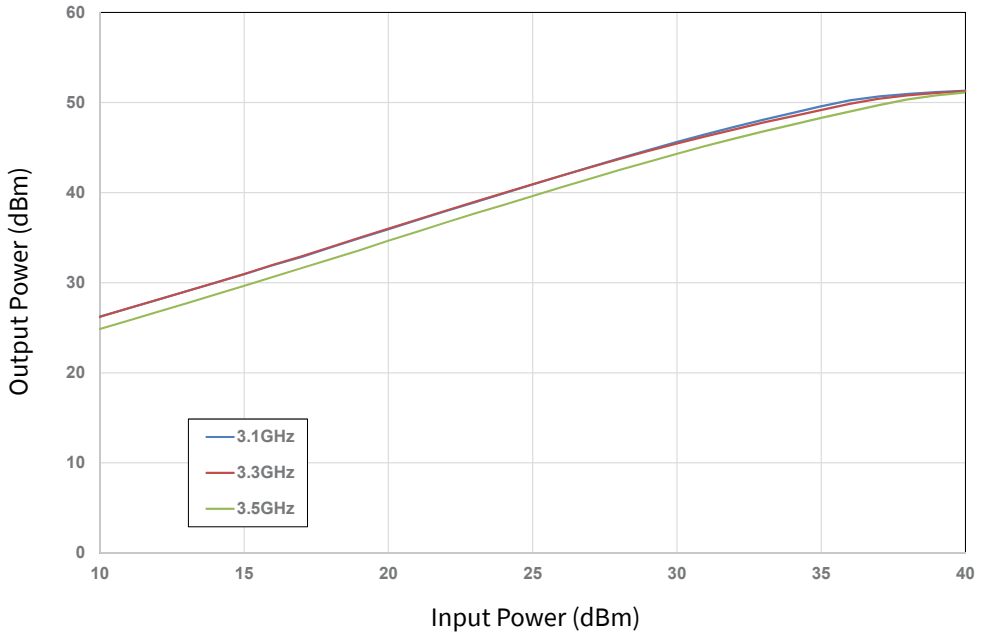
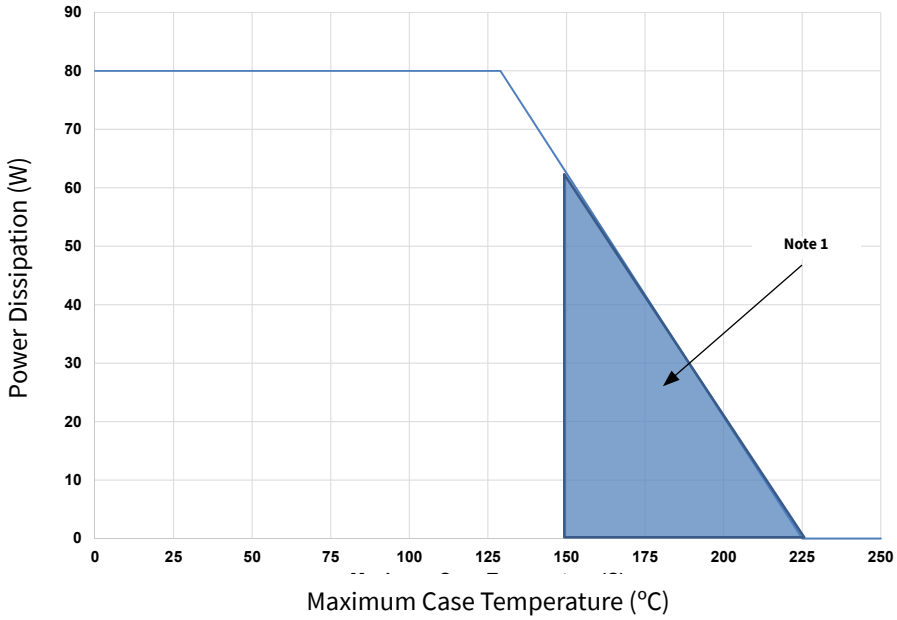


Figure 7. CGHV35120F Output Power vs Input Power Measured in CGHV35120F-AMP1
V_{DD} = 48 V, I_{DQ} = 220 mA, T_{PLATE} = 25°C, Pulse Width = 1msec, Duty Cycle = 20%

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	1A	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	0CB	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

CGHV35120F Power Dissipation De-rating Curve

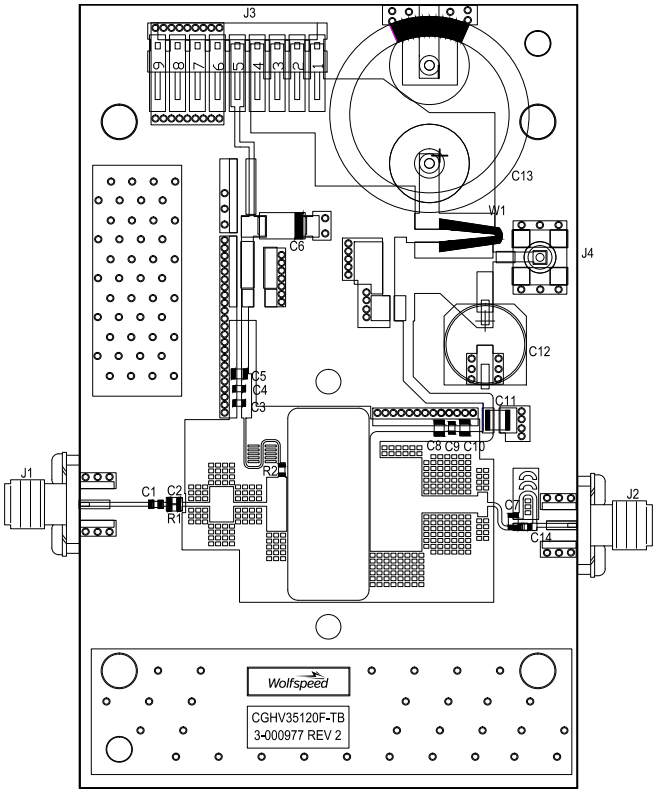


Note: Area exceeds Maximum Case Temperature (See Page 2)

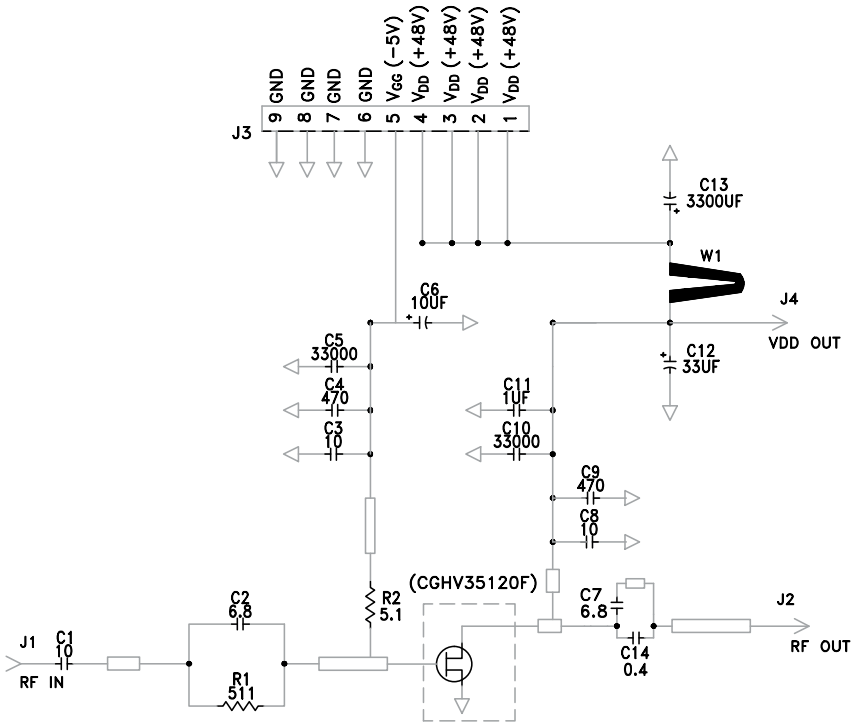
CGHV35120F Bill of Materials

Designator	Description	Qty
R1	RES, 511 ohms, +/- 1%, 1/16W, 0603	1
R2	RES, 5.1, ohm, +/- 1%, 1/16W, 0603	1
C8	CAP, 10pF, +/- 1%, 250V, 0805, ATC	2
C2	CAP, 6.8pF, +/- 0.25 pF, 250V, 0603, ATC	1
C1, C3	CAP, 10.0pF, +/-5%, 250V, 0603, ATC	2
C4, C9	CAP, 470pF, 5%, 100V, 0603, X7R	2
C5, C10	CAP, 33000pF, 0805,100V, X7R	2
C6	CAP, 10µF, 16V, TANTALUM	1
C7	CAP, 6.8pF, +/- 1%, 250V, 0805, ATC	1
C11	CAP, 1.0µF, 100V, 10%, X7R, 1210	1
C12	CAP, 33 µF, 20%, G CASE	1
C13	CAP, 3300 µF, +/-20%, 100V, ELECTROLYTIC	1
C14	CAP, 0.4pF, +/-0.1pF, 0603, ATC	1
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
J4	CONNECTOR; SMB, Straight, JACK, SMD	1
W1	CABLE, 18 AWG, 4.2	1
	PCB, RO4350, 10 MIL THK, CGHV35120F	1
Q1	CGHV35120F	1

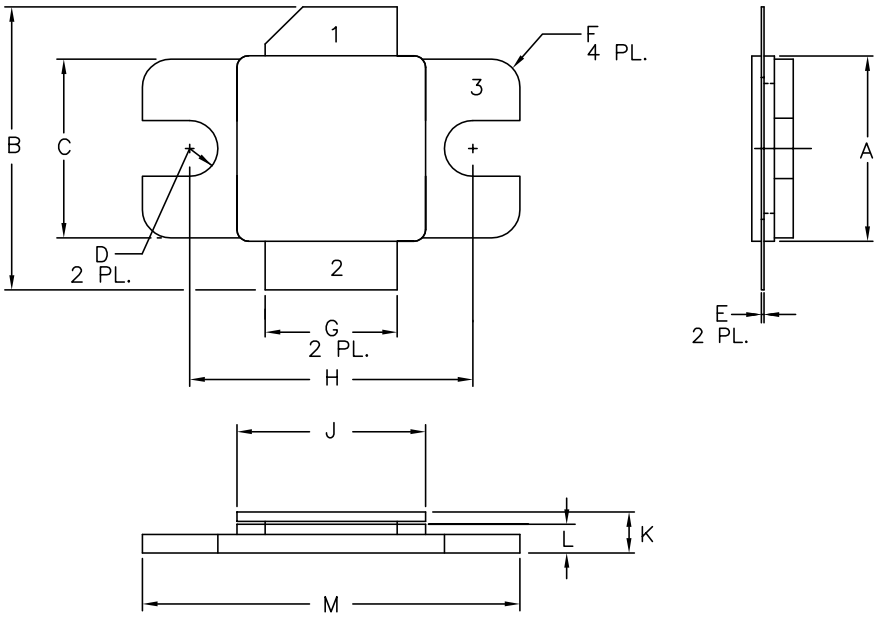
CGHV35120F-AMP1 Application Circuit Outline



CGHV35120F-AMP1 Application Circuit Schematic



Product Dimensions CGHV35120F (Package Type — 440162)



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.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	.395	.405	10.03	10.29
B	.580	.620	14.73	15.75
C	.380	.390	9.65	9.91
D	.055	.065	1.40	1.65
E	.004	.006	0.10	0.15
F	.055	.065	1.40	1.65
G	.275	.285	6.99	7.24
H	.595	.605	15.11	15.37
J	.395	.405	10.03	10.29
K	.129	.149	3.28	3.78
L	.053	.067	1.35	1.70
M	.795	.805	20.19	20.45

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

Part Number System

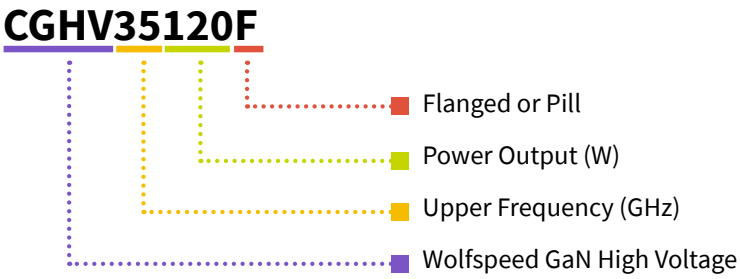


Table 1.

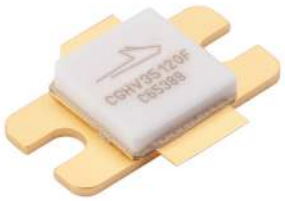
Parameter	Value	Units
Upper Frequency[1]	3.8	GHz
Power Output	120	W
Package	Flange	—

Note:
[1] Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Table 2.

Character Code	Code Value
A	0
B	1
C	2
D	3
E	4
F	5
G	6
H	7
J	8
K	9
Examples:	1A = 10.0 GHz 2H = 27.0 GHz

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV35120F	GaN HEMT	Each	
CGHV35120F-AMP1	3.1 - 3.5 GHz test board with GaN HEMT installed	Each	

For more information, please contact:

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