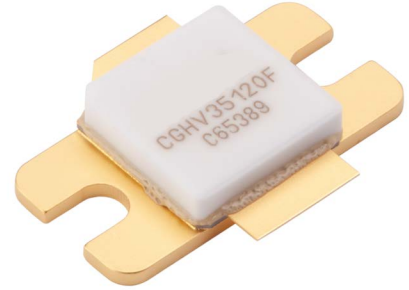


CGHV35120F

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



PN: 440162

Package Type: CGHV35120F

Description

The 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 ($T_c = 85^\circ\text{C}$)

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, $P_{IN} = 38.5 \text{ dBm}$

Features

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



Large Signal Models Available for ADS and MWO



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 μ sec, 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

³ Measured for the CGHV35120F at $P_{DISS} = 80$ W

Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics¹ ($T_C = 25^\circ\text{C}$)						
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 Characteristics³ ($T_C = 25^\circ\text{C}$, $F_0 = 3.1 - 3.5$ 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 μ s, Duty Cycle = 10%

Typical Performance

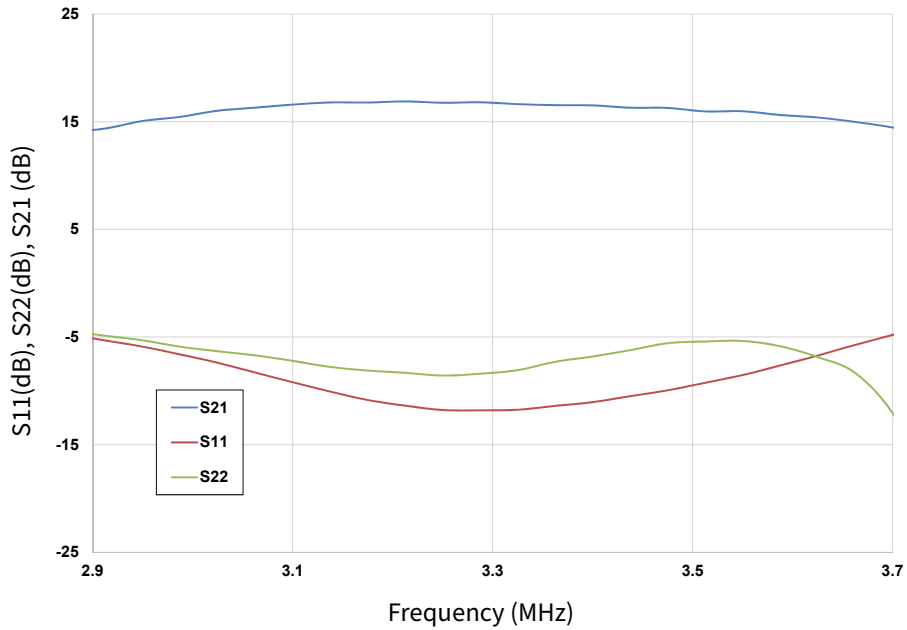


Figure 1. CGHV35120F Typical S Parameters Measured in CGHV35120F-AMP1
 $V_{DD} = 48\text{ V}$, $I_{DQ} = 220\text{ mA}$, $T_{CASE} = 25^{\circ}\text{C}$

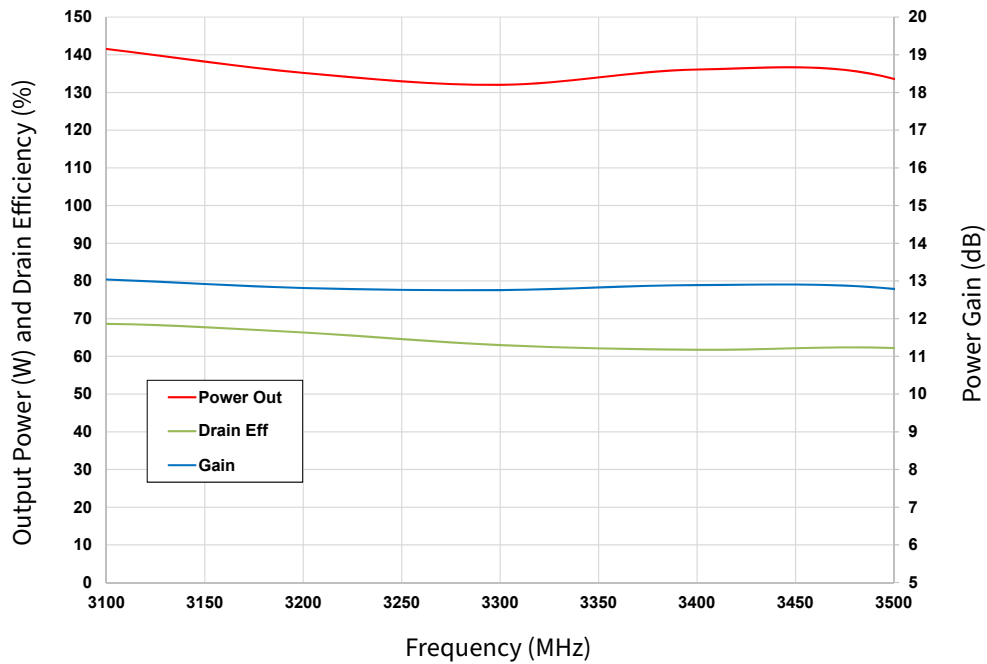


Figure 2. CGHV35120F Typical RF Results Measured in CGHV35120F-AMP1
 $V_{DD} = 48\text{ V}$, $I_{DQ} = 220\text{ mA}$, $T_{PLATE} = 85^{\circ}\text{C}$, Pulse Width = 100 μs , Duty Cycle = 10%

Typical Performance

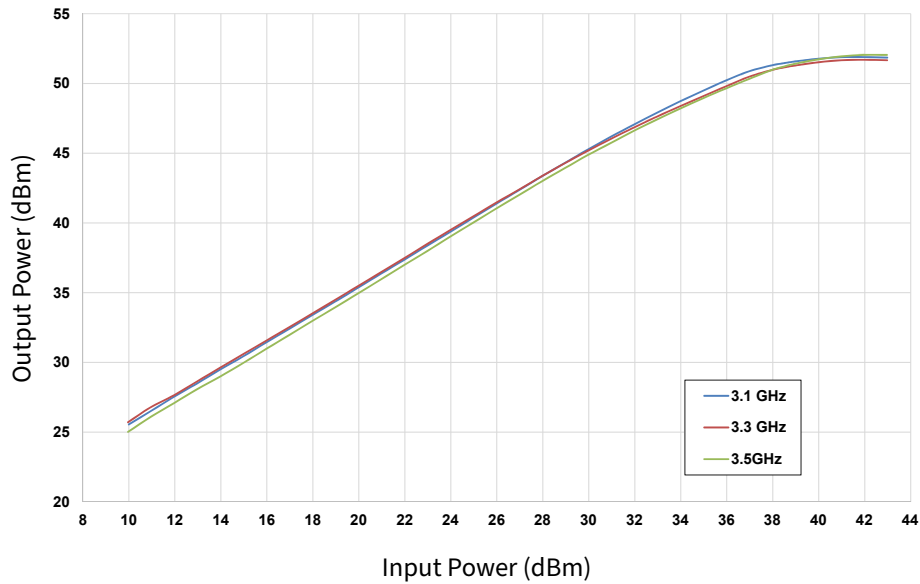


Figure 3. CGHV35120F Output Power vs Input Power Measured in CGHV35120F-AMP1
 $V_{DD} = 48\text{ V}$, $I_{DQ} = 220\text{ mA}$, $T_{PLATE} = 85^{\circ}\text{C}$, Pulse Width = $100\ \mu\text{s}$, Duty Cycle = 10%

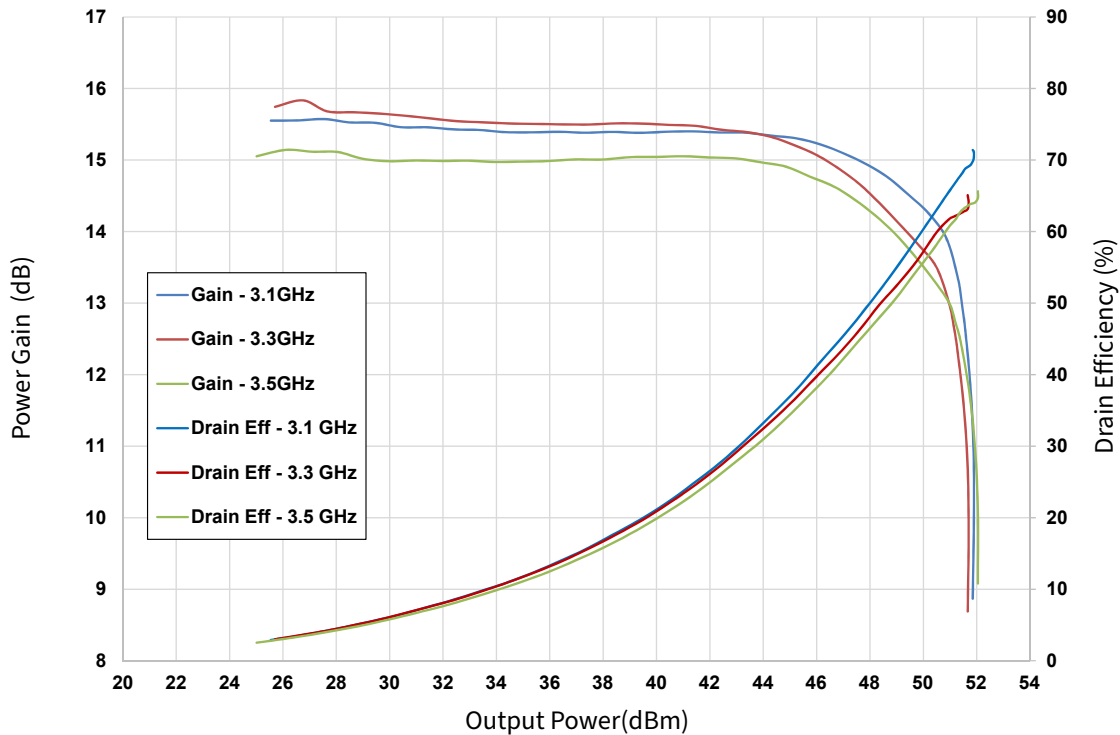


Figure 4. CGHV35120F Gain and Drain Efficiency vs Output Power Measured in CGHV35120F-AMP1
 $V_{DD} = 48\text{ V}$, $I_{DQ} = 220\text{ mA}$, $T_{PLATE} = 85^{\circ}\text{C}$, Pulse Width = $100\ \mu\text{s}$, Duty Cycle = 10%

Typical Performance

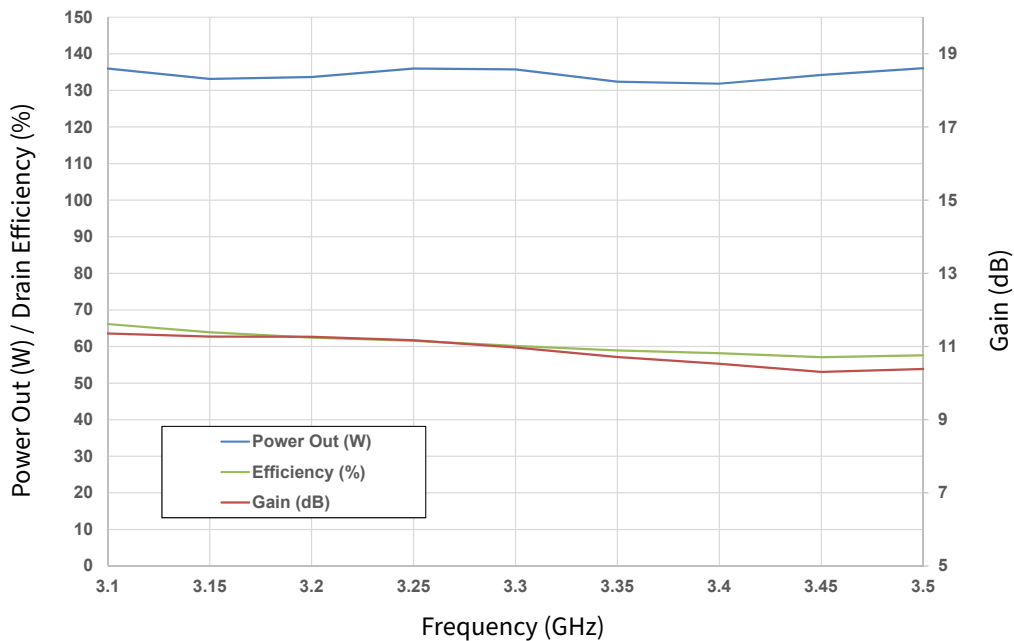


Figure 5. CGHV35120F Power Out/Drain Efficiency vs Frequency Measured in CGHV35120F-AMP1
 $V_{DD} = 48\text{ V}$, P_{SAT} where $IG > 0$, Pulse Width = 1msec, Duty Cycle = 20%

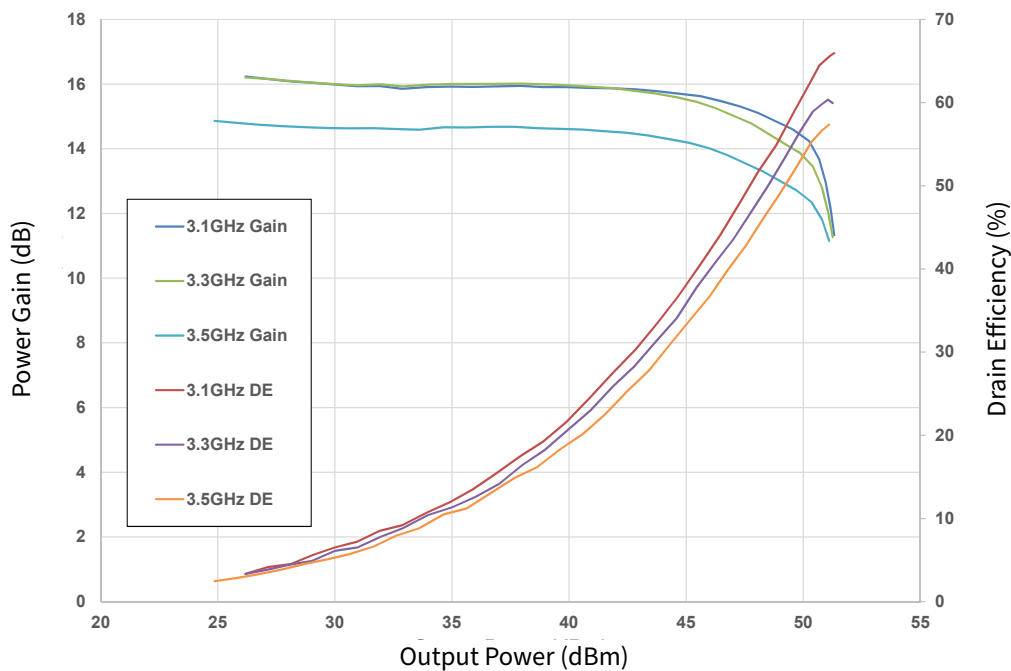


Figure 6. CGHV35120F Gain and Drain Efficiency vs Output Power Measured in CGHV35120F-AMP1
 $V_{DD} = 48\text{ V}$, $I_{DQ} = 220\text{ mA}$, $T_{PLATE} = 25^{\circ}\text{C}$, Pulse Width = 1msec, Duty Cycle = 20%

Typical Performance

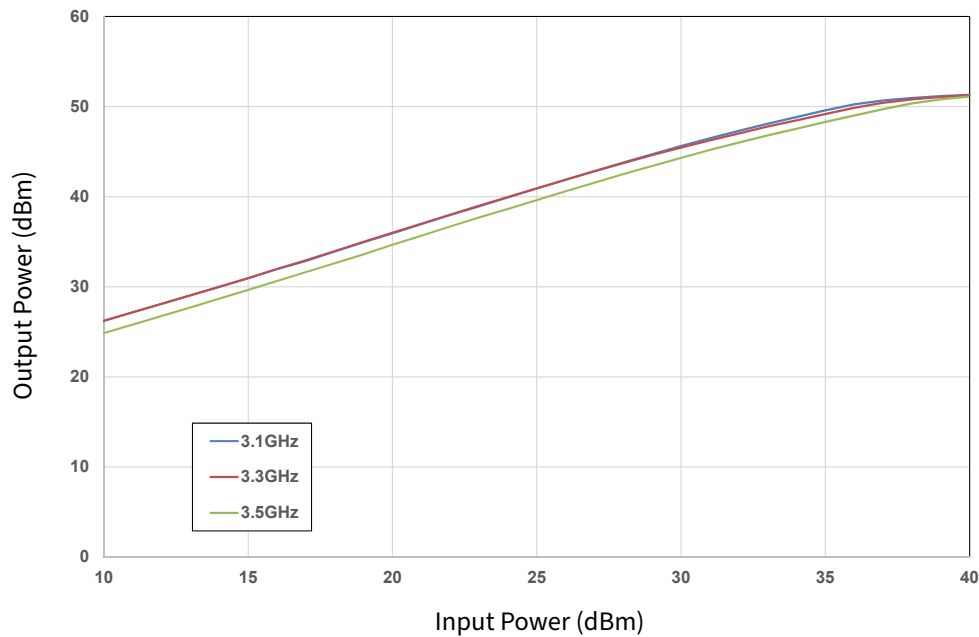
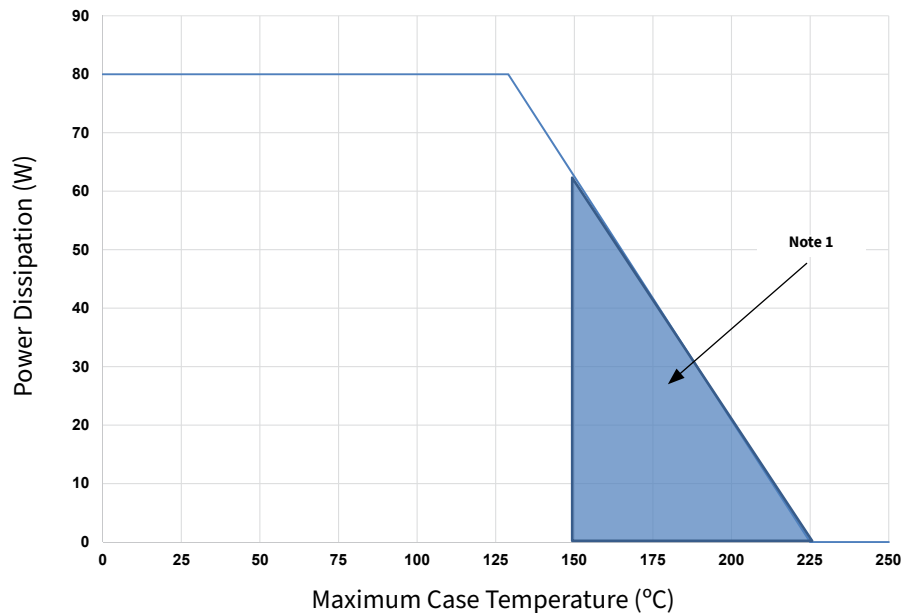


Figure 7. CGHV35120F Output Power vs Input Power Measured in CGHV35120F-AMP1
 $V_{DD} = 48\text{ V}$, $I_{DQ} = 220\text{ mA}$, $T_{PLATE} = 25^{\circ}\text{C}$, Pulse Width = 1msec, Duty Cycle = 20%

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

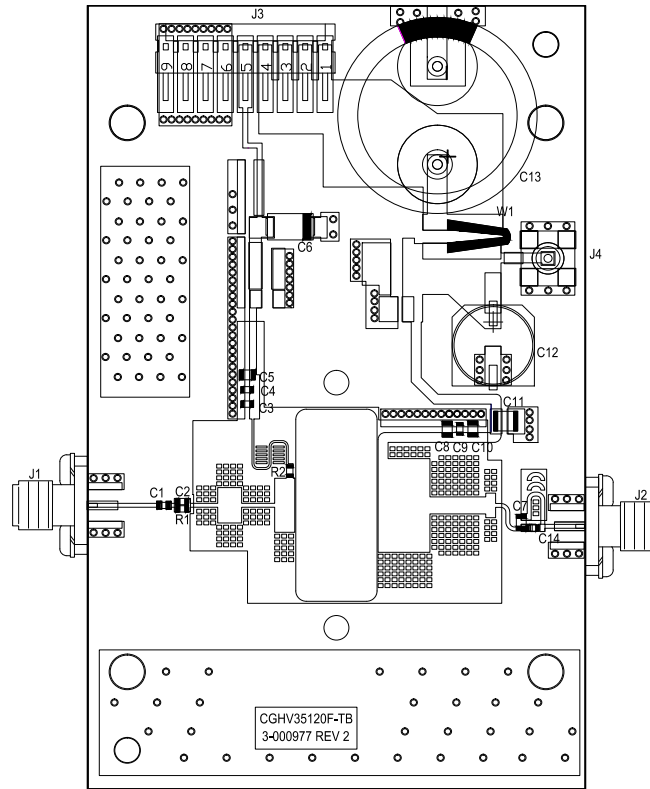


Note: Area exceeds Maximum Case Temperature (See Page 2)

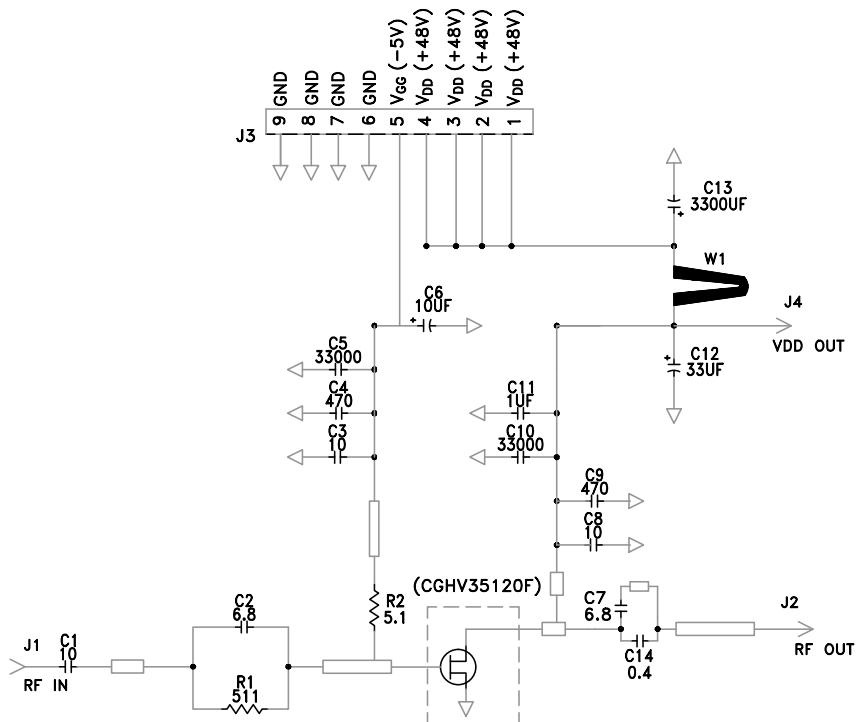
CGHV35120F Bill of Materials

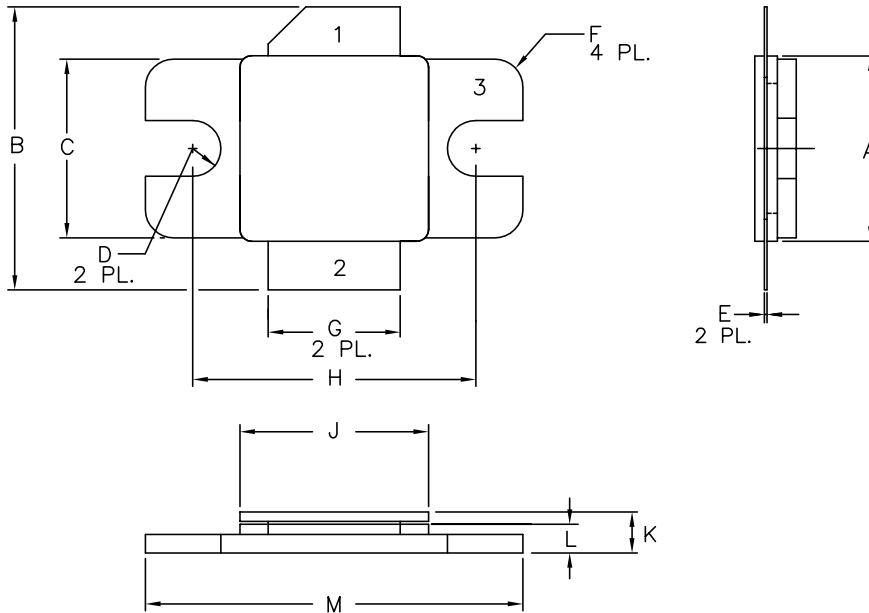
Designator	Description	Qty
R1	RES, 511 ohms, +/- 1%, 1/16W, 0603	1
R2	RES, 5.1, ohm, +/- 1%, 1/16W, 0603	1
C8	CAP, 10pF, +/- 1%, 250V, 0805, ATC	2
C2	CAP, 6.8pF, +/- 0.25 pF, 250V, 0603, ATC	1
C1, C3	CAP, 10.0pF, +/-5%, 250V, 0603, ATC	2
C4, C9	CAP, 470pF, 5%, 100V, 0603, X7R	2
C5, C10	CAP, 33000pF, 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.

DIM	INCHES		MILLIMETERS	
	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

CGHV35120F

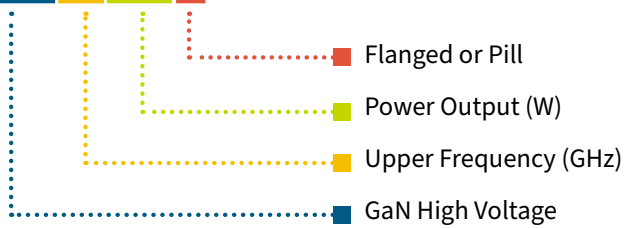


Table 1.

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

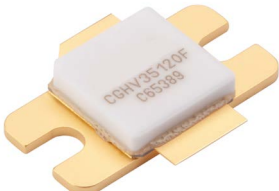

Note:

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	

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