CGHV35400F

400 W, 2.9 - 3.5 GHz, 50-Ohm Input/Output Matched, GaN HEMT for S-Band Radar Systems

Package Types: 440225
PN's: CGHV35400F

Description

The CGHV35400F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain, and wide bandwidth capabilities, which makes the CGHV35400F ideal for 2.9 - 3.5 GHz S-Band radar amplifier applications. The transistor is matched to 50-ohms on the input and 50-ohms on the output. The CGHV35400 is based on the high power density 50 V, 0.4 µm GaN on silicon carbide (SiC) foundry process. The transistor is supplied in a ceramic/metal flange package, type 440225.

Features

- 2.9 - 3.5 GHz operation
- 500 W typical output power
- 11 dB power gain
- 70% typical drain efficiency
- 50 Ohm internally matched
- <0.3 dB pulsed amplitude droop

Typical Performance Over 2.9-3.5 GHz (T_c = 25 °C) of Demonstration Amplifier

Parameter	2.9 GHz	3.2 GHz	3.5 GHz	Units
Output Power	500	535	480	W
Gain	11.0	11.3	10.8	dB
Drain Efficiency	74	69	64	%

Note:
Measured in the CGHV35400F-AMP application circuit, under 500 µs pulse width, 10% duty cycle, P_{IN} = 46 dBm.

Large Signal Models Available for ADS and MWO

RoHS compliant

Rev. 5.3, SEPTEMBER 2023

Absolute Maximum Ratings (Not Simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Pulse Width	PW	500	µs	
Duty Cycle	DC	10	%	
Drain-Source Voltage	V_{DSS}	150	Volts	25 °C
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts	25 °C
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225	°C	
Maximum Forward Gate Current	I_{GMAX}	80	mA	25 °C
Maximum Drain Current[1]	I_{DMAX}	24	A	25 °C
Soldering Temperature[2]	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.22	°C/W	100 µsec, 10%, 85 °C , P_{DISS} = 418 W
Pulsed Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.30	°C/W	500 µsec, 10%, 85 °C , P_{DISS} = 418 W
Case Operating Temperature	T_C	-40, +125	°C	

Notes:
[1] Current limit for long term, reliable operation.
[2] Refer to the Application Note on soldering

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 = 83.6 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V_{DC}	V_{DS} = 50 V, I_D = 0.5 A
Saturated Drain Current[2]	I_{DS}	62.7	75.5	-	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 = 83.6 mA

Notes:
[1] Measured on wafer prior to packaging.
[2] Scaled from PCM data.

Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
RF Characteristics[3] (T_C = 25 °C, F_0 = 2.9 - 3.5 GHz Unless Otherwise Noted)						
Output Power at 2.9 GHz	P_{OUT1}	445	500	-	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Power at 3.2 GHz	P_{OUT2}	475	535	-	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Power at 3.5 GHz	P_{OUT3}	410	480	-	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Gain at 2.9 GHz	G_{P1}	10.5	11	-	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Gain at 3.2 GHz	G_{P2}	10.75	11.3	-	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Gain at 3.5 GHz	G_{P3}	10.1	10.8	-	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 2.9 GHz	D_{E1}	60	70	-	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 3.2 GHz	D_{E2}	60	70	-	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 3.5 GHz	D_{E3}	54	64	-	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Small Signal Gain	S21	10.5	12	-	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = -10 dBm
Input Return Loss	S11	-	-8	-3.0	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = -10 dBm
Output Return Loss	S22	-	-8	-4.0	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = -10 dBm
Amplitude Droop	D	-	-0.3	-	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Stress Match	VSWR	-	5:1	-	Ψ	No Damage at All Phase Angles, V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm Pulsed

Note:
[3] Measured in CGHV35400F-AMP. Pulse width = 500 µS, duty cycle = 10%.

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1 A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 < 500 V)	JEDEC JESD22 C101-C

Typical Performance

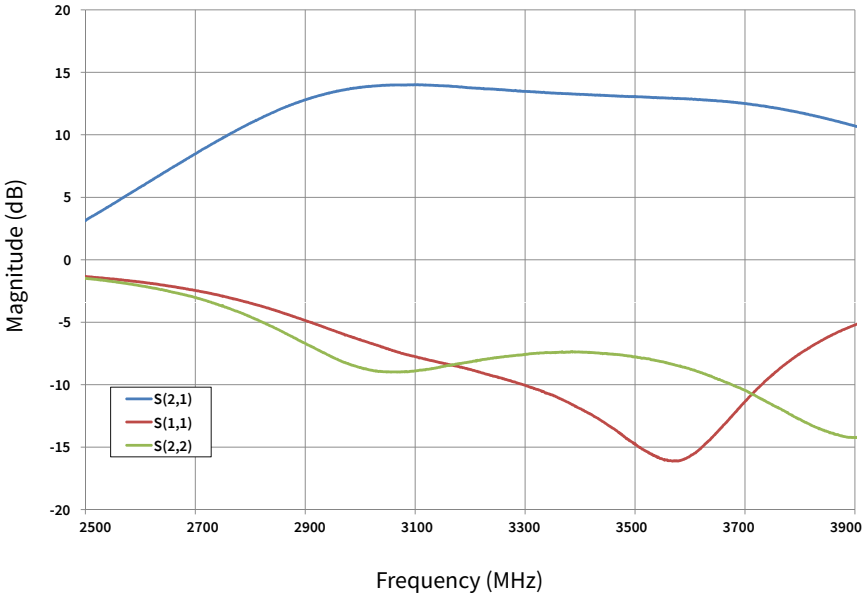


Figure 1. CGHV35400F Typical S Parameters V_{DD} = 50 V, I_{DQ} = 0.5 A

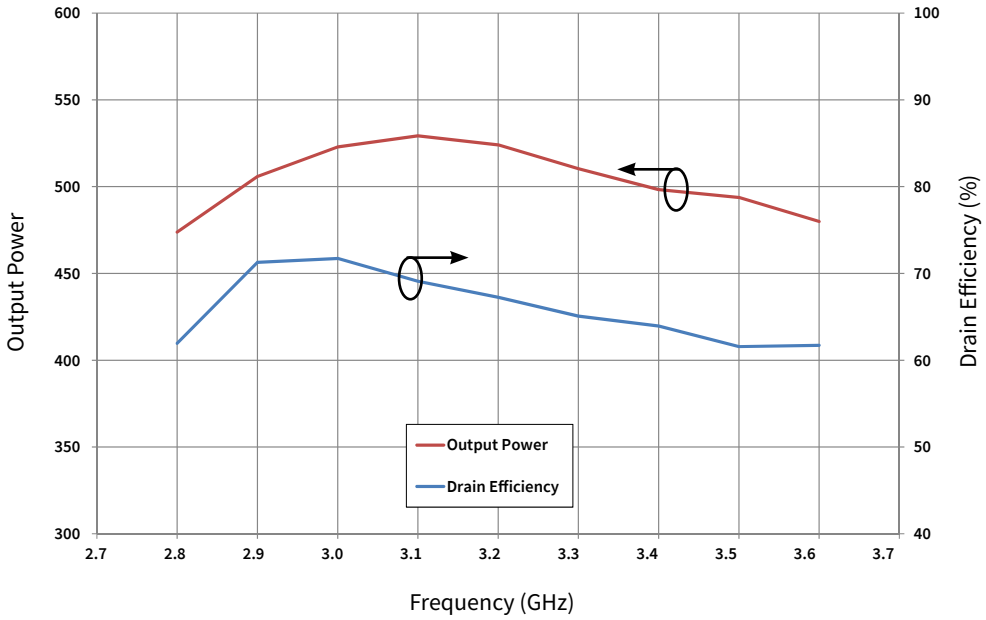


Figure 2. CGHV35400F P_{OUT} and Drain Efficiency vs Frequency at T_{case} = 25 °C
V_{DD} = 50 V, I_{DQ} = 0.5 A, P_{IN} = 46 dBm, Pulse Width = 500 µs, Duty Cycle = 10%

Typical Performance

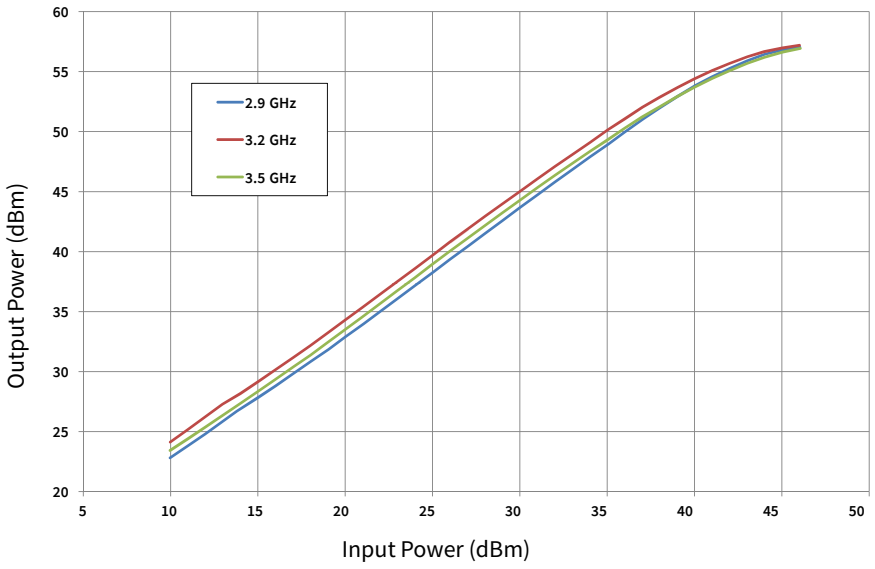


Figure 3. CGHV35400F Output Power vs Input Power
V_{DD} = 50 V, I_{DQ} = 500 mA, Pulse Width = 500 µs, Duty = 10%, T_{case} = 25 °C

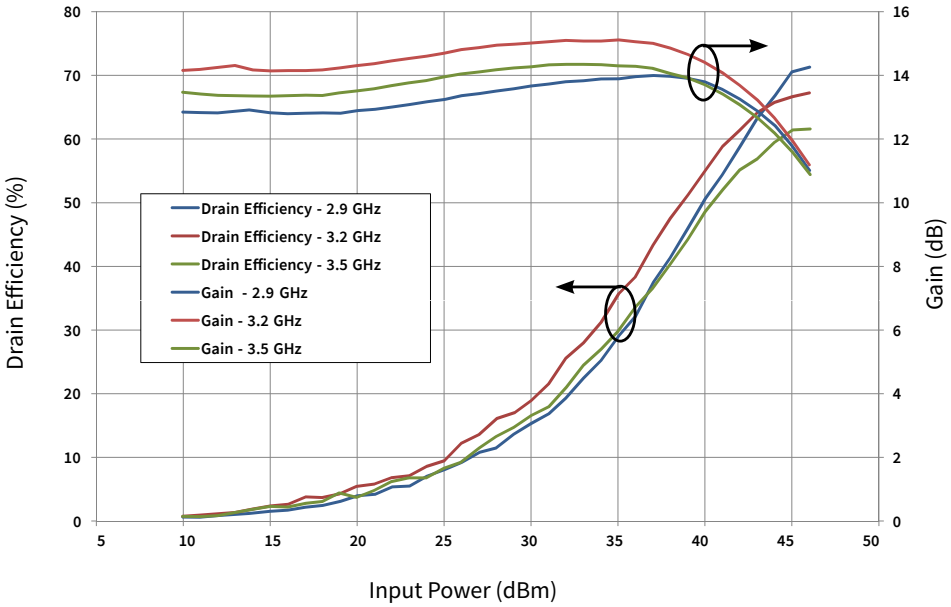
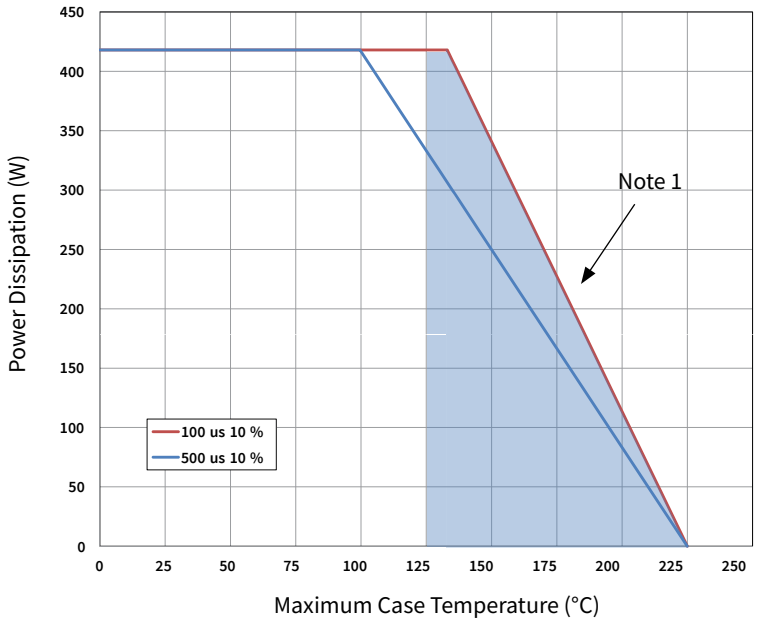


Figure 4. CGHV35400F Drain Efficiency & Gain vs Input Power
V_{DD} = 50 V, I_{DQ} = 500 mA, Pulse Width = 500 µs, Duty Cycle = 10%, T_{case} = 25 °C

CGHV35400F-AMP Application Circuit Bill of Materials

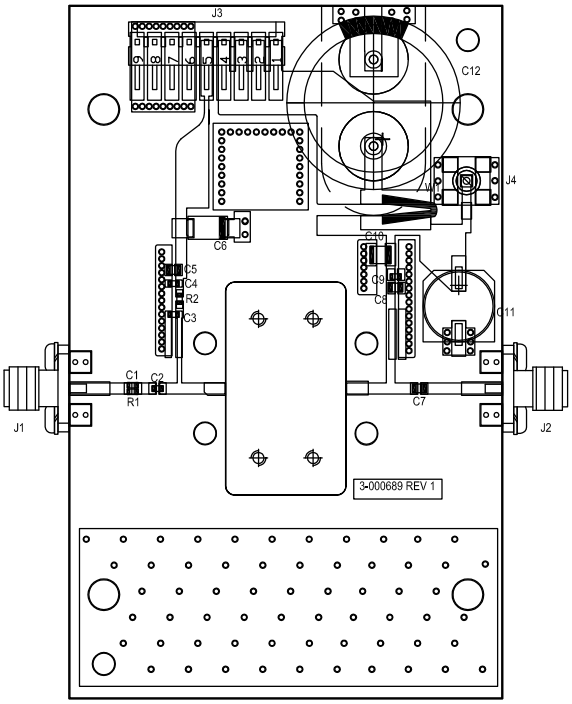
Designator	Description	Qty
R1	RES, 511, OHM, +/- 1%, 1/16 W, 0603	1
R2	RES, 5.1, OHM, +/- 1%, 1/16 W, 0603	1
C1	CAP, 6.8 pF, +/-0.25%, 250 V, 0603	1
C2, C7, C8	CAP, 10.0 pF, +/-1%, 250 V, 0805	3
C3	CAP, 10.0 pF, +/-5%, 250 V, 0603	1
C4, C9	CAP, 470 pF, 5%, 100 V, 0603, X	2
C5	CAP, 33000 pF, 0805, 100 V, X7R	1
C6	CAP, 10 uF 16 V TANTALUM	1
C10	CAP, 1.0 uF, 100 V, 10%, X7R, 1210	1
C11	CAP, 33 uF, 20%, G CASE	1
C12	CAP, 3300 uF, +/-20%, 100 V, ELECTROLYTIC	1
J1, J2	CONN, SMA, PANEL MOUNT JACK, FL	2
J3	HEADER, RT>PLZ, 0.1 CEN LK 9POS	1
J4	CONNECTOR; SMB, Straight, JACK, SMD	1
W1	CABLE, 18 AWG, 4.2	1
-	PCB, RO4350, 2.5 X 4.0 X 0.030	1
Q1	CGHV35400F	1

CGHV35400F Power Dissipation De-Rating Curve

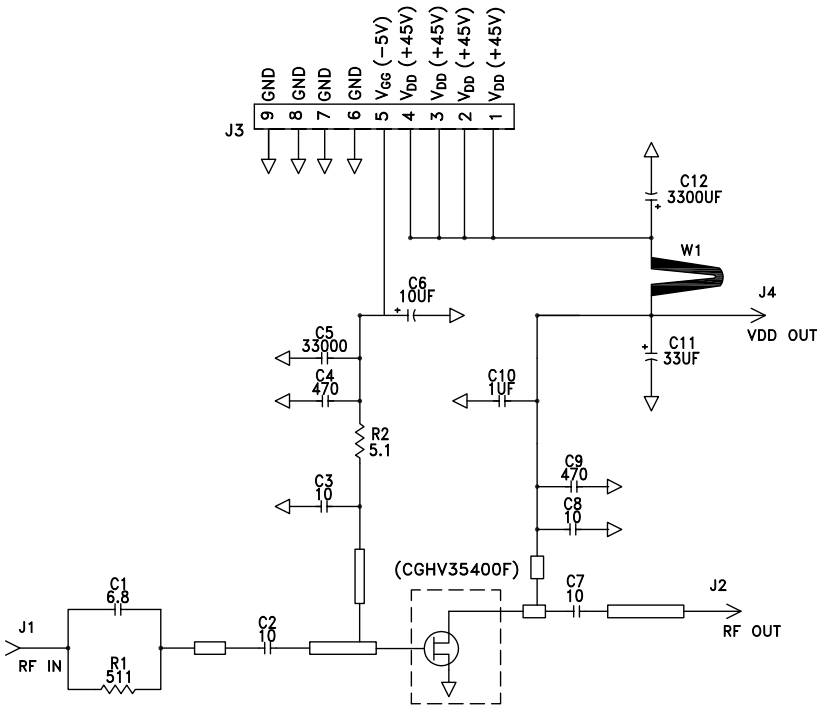


Notes 1: Area exceeds maximum case operating temperature (see page 2).

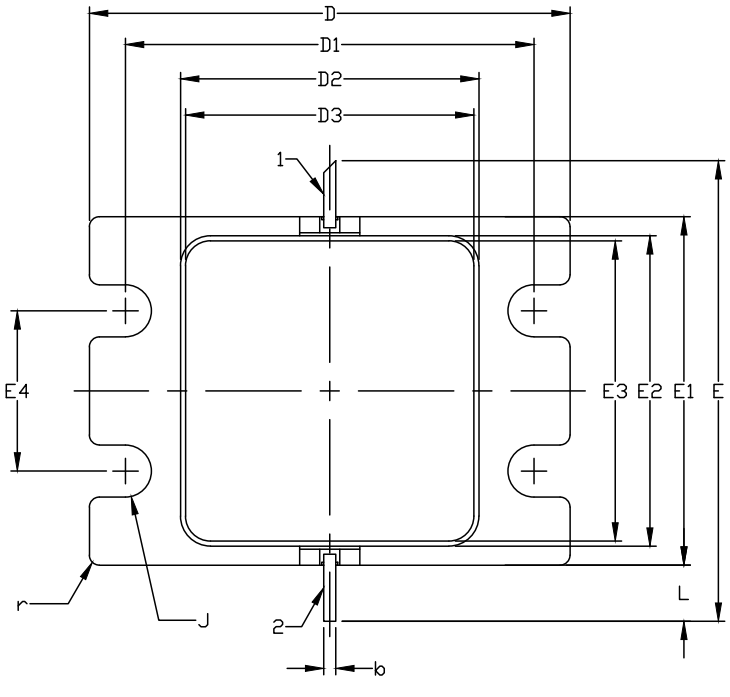
CGHV35400F-AMP Application Circuit Outline

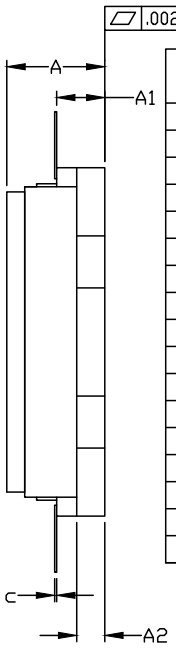


CGHV35400F-AMP Application Circuit Schematic



Product Dimensions CGHV35400F (Package Type — 440225)





1. GATE
2. DRAIN

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.185	0.201	4.70	5.11	
A1	0.088	0.100	2.24	2.54	2x
A2	0.049	0.061	1.24	1.55	
b	0.022	0.026	0.56	0.66	2x
c	0.003	0.006	0.08	0.15	
D	0.935	0.955	23.75	24.26	
D1	0.797	0.809	20.24	20.55	2x
D2	0.581	0.593	14.76	15.06	
D3	0.565	0.571	14.35	14.50	
E	0.906		23.01		REF
E1	0.679	0.691	17.25	17.55	
E2	0.604	0.616	15.34	15.65	
E3	0.588	0.594	14.93	15.09	
E4	0.309	0.321	7.85	8.15	2x
J	ø0.097	ø0.107	ø2.46	ø2.72	4x
L	0.090	0.130	2.29	3.30	2x
r	0.02 TYP		0.51 TYP		12x

Part Number System

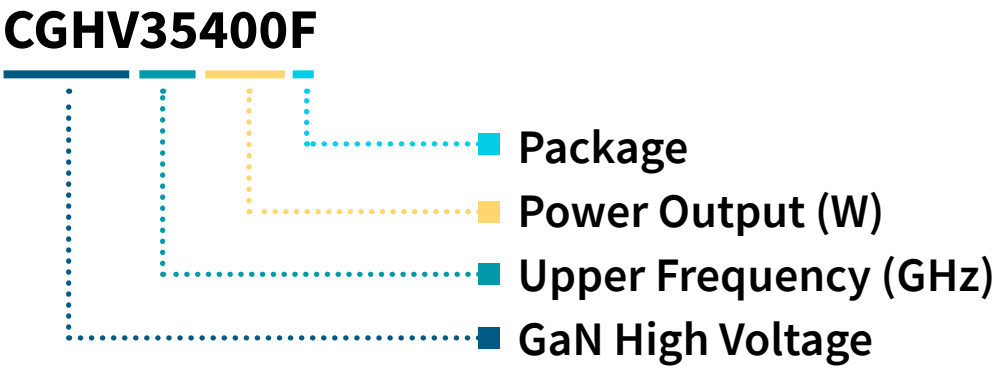


Table 1.

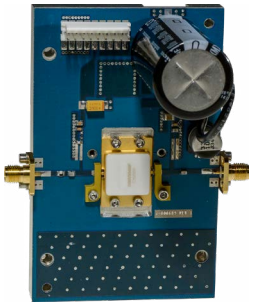
Parameter	Value	Units
Upper Frequency[1]	3.5	GHz
Power Output	400	W
Package	Flange	-

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:	1 A = 10.0 GHz 2 H = 27.0 GHz

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV35400F	GaN HEMT	Each	
CGHV35400F-AMP	Test Board with GaN HEMT Installed	Each	

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