

# CGHV37400F

400 W, 3.5 - 3.7 GHz, 50-Ohm Input/Output Matched,  
GaN HEMT for S-Band Radar Systems

## Description

Cree's CGHV37400F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV37400F ideal for 3.5 - 3.7 GHz S-Band radar amplifier applications. The transistor is matched to 50-ohms on the input and 50-ohms on the output. The CGHV37400F is based on Cree's high power density 50 V, 0.4  $\mu\text{m}$  GaN on silicon carbide (SiC) foundry process. The transistor is supplied in a ceramic metal flange package, type 440217.



PN: CGHV37400F  
Package Type: 440217

## Typical Performance Over 3.5-3.7 GHz ( $T_c = 25^\circ\text{C}$ ) of Demonstration Amplifier

Parameter	3.5 GHz	3.6 GHz	3.7 GHz	Units
Output Power	555	560	555	W
Gain	11.4	11.5	11.4	dB
Drain Efficiency	55	55	55	%

Note: Measured in the CGHV37400F-AMP application circuit, under 100  $\mu\text{s}$  pulse width, 10% duty cycle,  $P_{in} = 46\text{ dBm}$

## Features

- 3.3 - 3.8 GHz Operation
- 525 W Typical Output Power
- 11.5 dB Power Gain
- 55% Typical Drain Efficiency
- 50 Ohm Internally Matched
- <0.3 dB Pulsed Amplitude Droop

**Absolute Maximum Ratings (not simultaneous)**

Parameter	Symbol	Rating	Units	Conditions
Pulse Width	PW	100	μs	
Duty Cycle	DC	10	%	
Drain-Source Voltage	V <sub>DSS</sub>	150	Volts	25 °C
Gate-to-Source Voltage	V <sub>GS</sub>	-10, +2	Volts	25 °C
Storage Temperature	T <sub>STG</sub>	-65, +150	°C	
Operating Junction Temperature	T <sub>J</sub>	225	°C	
Maximum Forward Gate Current	I <sub>GMAX</sub>	80	mA	25 °C
Maximum Drain Current <sup>1</sup>	I <sub>DMAX</sub>	24	A	25 °C
Soldering Temperature <sup>2</sup>	T <sub>S</sub>	245	°C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case	R <sub>θJC</sub>	0.22	°C/W	100 μsec, 10%, 85 °C, P <sub>DISS</sub> = 418 W
Case Operating Temperature	T <sub>C</sub>	-40, +125	°C	

Notes:

<sup>1</sup> Current limit for long term, reliable operation<sup>2</sup> Refer to the Application Note on soldering at [wolfspeed.com/rf/document-library](http://wolfspeed.com/rf/document-library)**Electrical Characteristics**

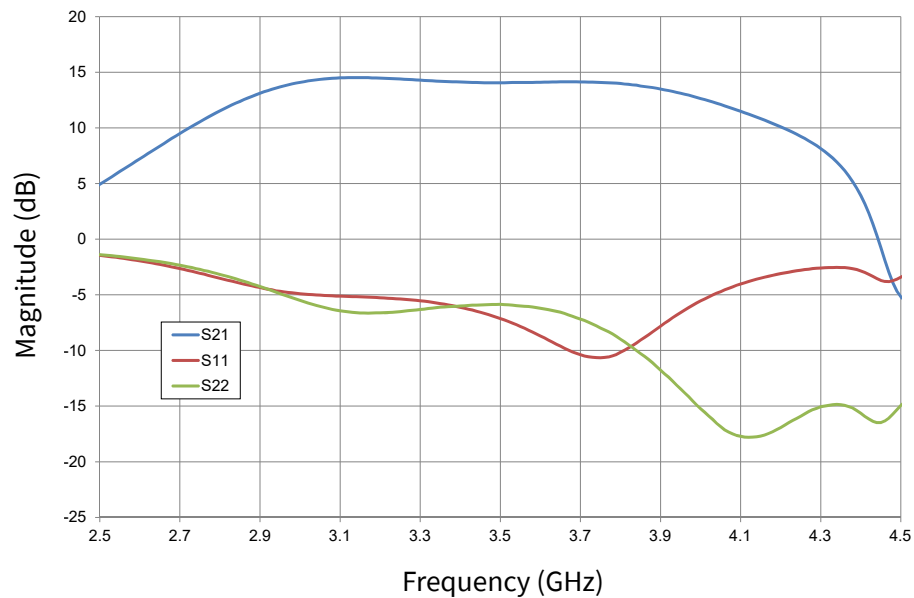
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics<sup>1</sup> (T<sub>C</sub> = 25 °C)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	-3.8	-3.0	-2.3	V <sub>DC</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 83.6 mA
Gate Quiescent Voltage	V <sub>GS(Q)</sub>	-	-2.7	-	V <sub>DC</sub>	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 1 A
Saturated Drain Current <sup>2</sup>	I <sub>DS</sub>	54.3	77.7	-	A	V <sub>DS</sub> = 6.0 V, V <sub>GS</sub> = 2.0 V
Drain-Source Breakdown Voltage	V <sub>BR</sub>	125	-	-	V <sub>DC</sub>	V <sub>GS</sub> = -8 V, I <sub>D</sub> = 83.6 mA
<b>RF Characteristics<sup>3</sup> (T<sub>C</sub> = 25 °C, F<sub>0</sub> = 3.5 - 3.7 GHz unless otherwise noted)</b>						
Output Power at 3.5 GHz	P <sub>OUT1</sub>	400	525	-	W	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1000 mA, P <sub>IN</sub> = 46 dBm
Output Power at 3.7 GHz	P <sub>OUT2</sub>	400	525	-	W	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1000 mA, P <sub>IN</sub> = 46 dBm
Drain Efficiency at 3.5 GHz	DE <sub>1</sub>	50	55	-	%	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1000 mA, P <sub>IN</sub> = 46 dBm
Drain Efficiency at 3.7 GHz	DE <sub>2</sub>	50	55	-	%	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1000 mA, P <sub>IN</sub> = 46 dBm
Small Signal Gain	S21	11.75	14	-	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1000 mA, P <sub>IN</sub> = -10 dBm
Input Return Loss	S11	-	-9	-4	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1000 mA, P <sub>IN</sub> = -10 dBm
Output Return Loss	S22	-	-6	-4	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1000 mA, P <sub>IN</sub> = -10 dBm
Amplitude Droop	D	-	-0.3	-	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1000 mA, P <sub>IN</sub> = 46 dBm
Output Stress Match <sup>4</sup>	VSWR	-	5:1	-	Ψ	No damage at all phase angles, V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1000 mA, P <sub>IN</sub> = 46 dBm Pulsed

Notes:

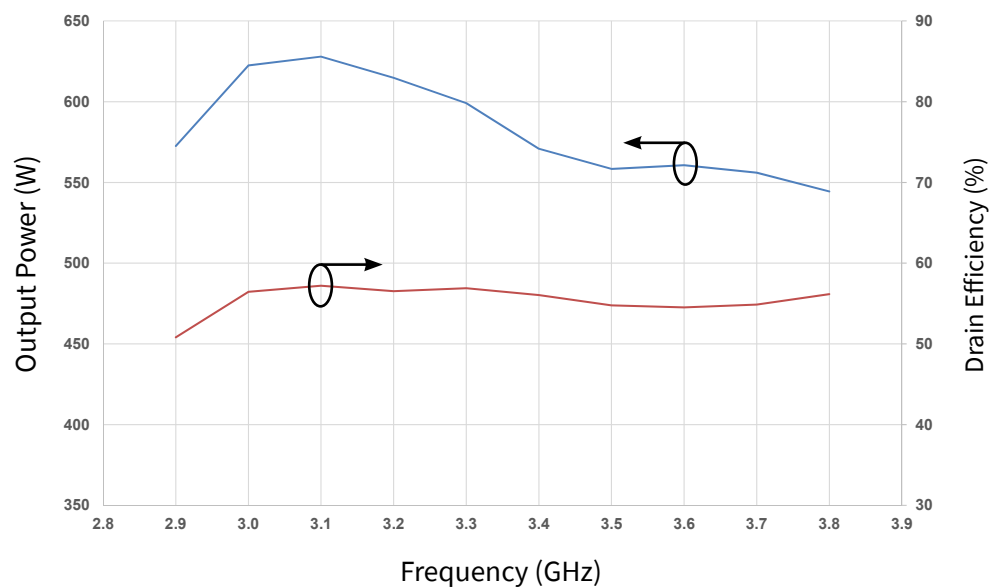
<sup>1</sup> Measured on wafer prior to packaging<sup>2</sup> Scaled from PCM data<sup>3</sup> Measured in CGHV37400F-AMP. Pulse Width = 100 μs, Duty Cycle = 10%<sup>4</sup> The device is not recommended for 5:1 VSWR applications below 3.3 GHz

**Typical Performance**

**Figure 1. Typical Small Signal Gain and Return Losses vs Frequency**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 1.0\text{ A}$

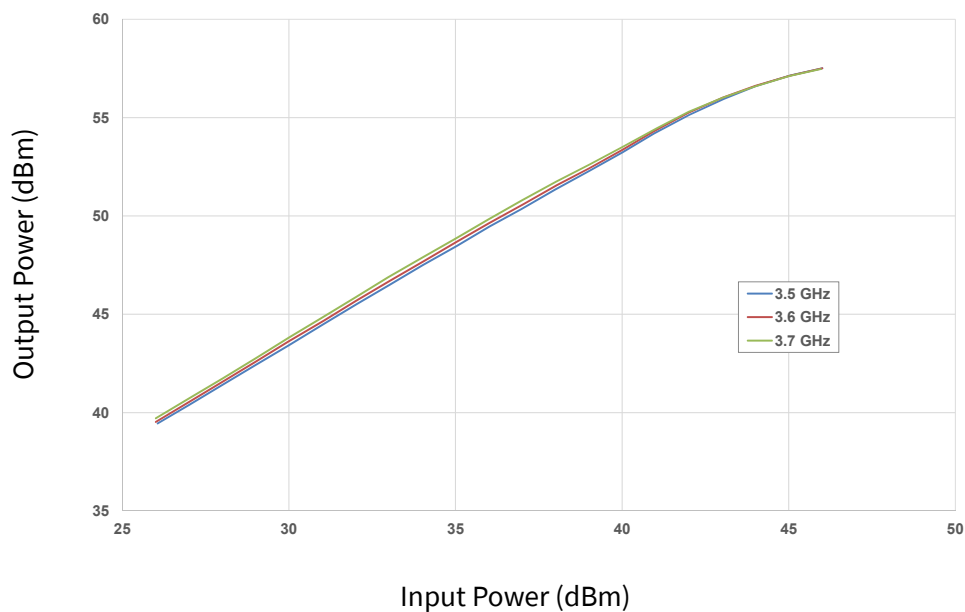


**Figure 2. CGHV37400F Output Power and Drain Efficiency vs Frequency**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 1.0\text{ A}$ ,  $P_{IN} = 46\text{ dBm}$ , Pulse Width =  $100\mu\text{s}$ , Duty Cycle = 10%,  $T_{CASE} = 25^\circ\text{C}$

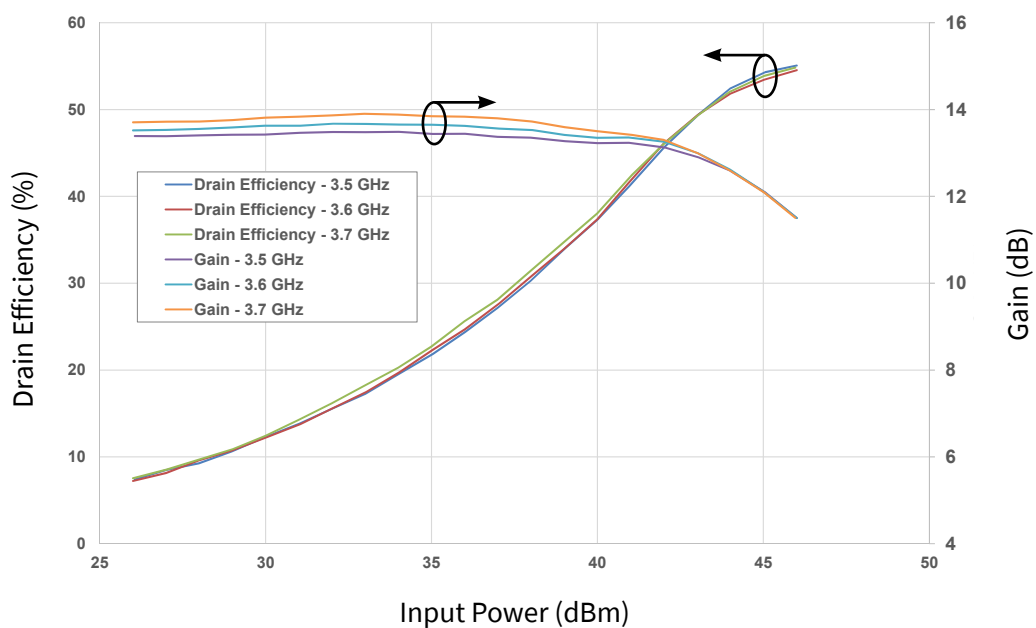


## Typical Performance

**Figure 3. Typical Output Power vs Input Power of the CGHV37400F**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 1.0\text{ A}$ , Pulse Width =  $100\mu\text{s}$ , Duty Cycle = 10%,  $T_{CASE} = 25^\circ\text{C}$



**Figure 4. CGHV37400F Drain Efficiency and Gain vs Input Power**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 1.0\text{ A}$ , Pulse Width =  $100\mu\text{s}$ , Duty Cycle = 10%,  $T_{CASE} = 25^\circ\text{C}$



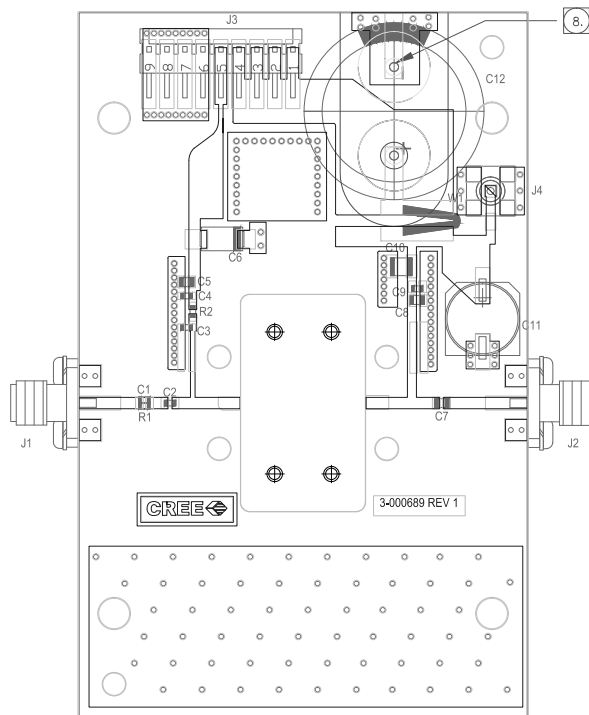
**CGHV37400F-AMP Application Circuit Bill of Materials**

Designator	Description	Qty
R1	RES, 511, OHM, +/- 1%, 1/16W, 0603	1
R2	RES, 5.1, OHM, +/- 1%, 1/16W, 0603	1
C1	CAP, 6.8pF, +/-0.25%, 250V, 0603	1
C2, C7, C8	CAP, 10.0pF, +/-1%, 250V, 0805	3
C3	CAP, 10.0pF, +/-5%, 250V, 0603	1
C4, C9	CAP, 470pF, 5%, 100V, 0603, X	2
C5	CAP, 33000 pF, 0805, 100V, X7R	1
C6	CAP, 10uF 16V TANTALUM	1
C10	CAP, 1.0uF, 100V, 10%, X7R, 1210	1
C11	CAP, 33uF, 20%, G CASE	1
C12	CAP, 3300uF, +/-20%, 100V, ELECTROLYTIC	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FL	2
J3	HEADER, RT>PLZ, 0.1CEN 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	CGHV37400F	1

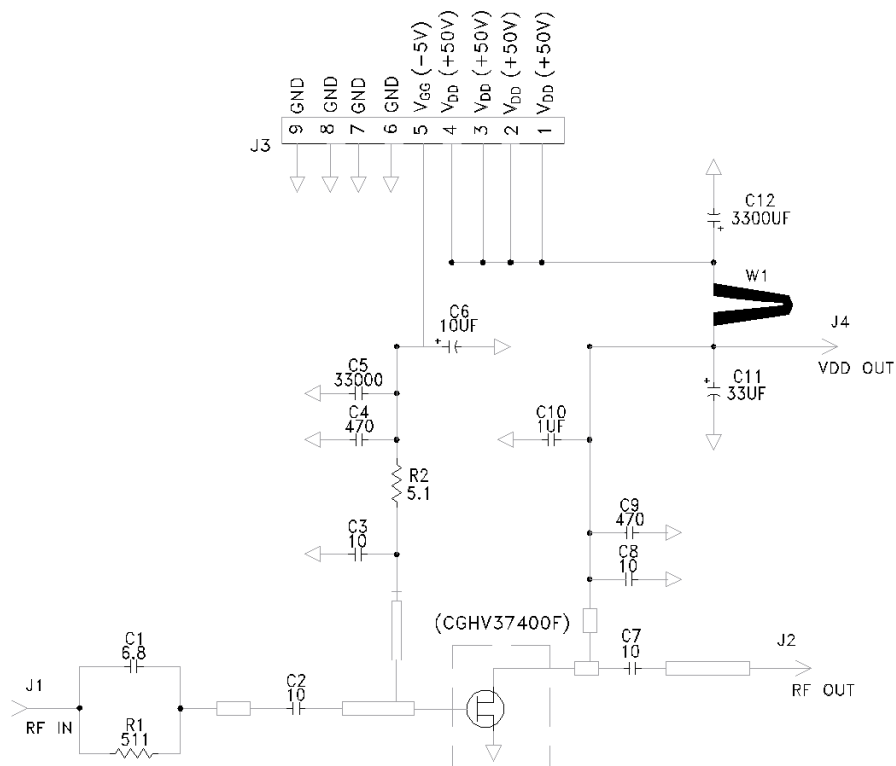
**Electrostatic Discharge (ESD) Classifications**

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

## CGHV37400F-AMP Application Circuit Outline



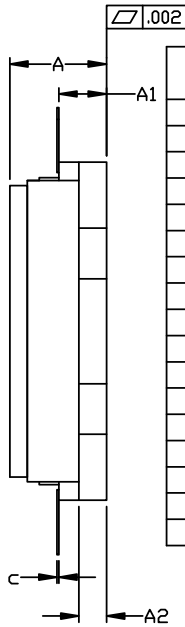
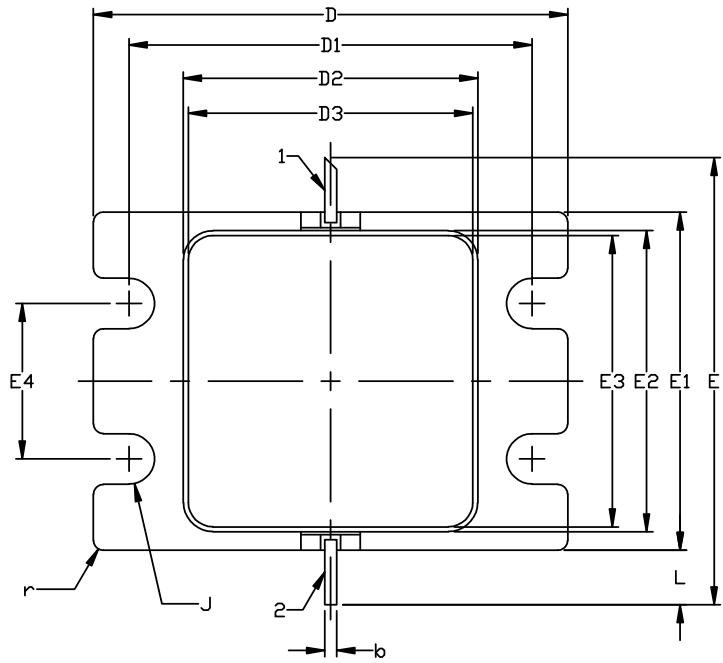
## CGHV37400F-AMP Application Circuit Schematic





Product Dimensions CGHV37400F (Package Type — 440217)

- NOTES: (UNLESS OTHERWISE SPECIFIED)
- 1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
  - 2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
  - 3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
  - 4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.188	0.198	4.78	5.03	
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	0.002	0.006	0.05	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	0.563	0.571	14.30	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	0.586	0.594	14.88	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

**CGHV37400F****Table 1.**

Parameter	Value	Units
Upper Frequency <sup>1</sup>	3.7	GHz
Power Output	400	W
Package	Flange	-


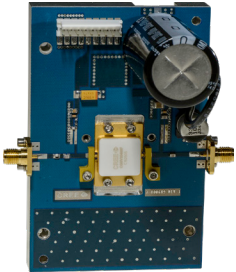
**Note<sup>1</sup>:** Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value

**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
CGHV37400F	GaN HEMT	Each	
CGHV37400F-AMP	Test board with GaN HEMT installed	Each	

For more information, please contact:

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## Notes

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