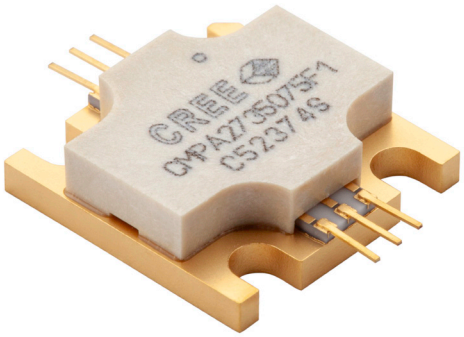
# CMPA2735075F1

## 75 W, 2.7 - 3.5 GHz, GaN MMIC, Power Amplifier




PN: CMPA2735075F1
Package Type: 440219

### Description

Cree's CMPA2735075F1 is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) based monolithic microwave integrated circuit (MMIC). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity and higher thermal conductivity. GaN HEMTs also offer greater power density and wider bandwidths compared to Si and GaAs transistors. This MMIC contains a two-stage reactively matched amplifier design approach enabling very wide bandwidths to be achieved.

### Typical Performance Over 2.7 - 3.5 GHz ($T_C$ = 25˚C)

| Parameter | 2.7 GHz | 2.9 GHz | 3.1 GHz | 3.3 GHz | 3.5 GHz | Units |
|---|---|---|---|---|---|---|
| Small Signal Gain | 29 | 29 | 30 | 29 | 29 | dB |
| Saturated Output Power | 63 | 74 | 86 | 80 | 79 | W |
| PAE @ $P_{SAT}$ | 45 | 54 | 57 | 57 | 57 | % |

Note: $P_{IN}$ = 28 dBm

### Features

- 29 dB Small Signal Gain
- 76 W Typical $P_{SAT}$
- 28 V Operation
- High Breakdown Voltage
- High Temperature Operation
- 0.5" x 0.5" Total Product Size

### Applications

- Civil and Military Pulsed Radar Amplifiers

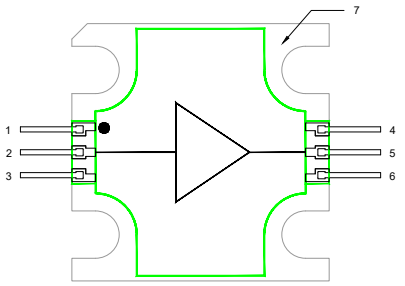



Figure 1.

RoHS COMPLIANT

## Absolute Maximum Ratings (not simultaneous) at 25˚C

| Parameter | Symbol | Rating | Units | Conditions |
|---|---|---|---|---|
| Drain-source Voltage | $V_{DSS}$ | 84 | VDC | 25°C |
| Gate-source Voltage | $V_{GS}$ | -10, +2 | VDC | 25°C |
| Storage Temperature | $T_{STG}$ | -65, +150 | ˚C | |
| Operating Junction Temperature | $T_J$ | 225 | ˚C | |
| Maximum Forward Gate Current | $I_G$ | 28 | mA | 25°C |
| Screw Torque | T | 40 | in-oz | |
| Thermal Resistance, Junction to Case (packaged) [1] | $R_{\theta JC}$ | 0.77 | ˚C/W | 300 µsec, 20%, 85°C |
| Thermal Resistance, Junction to Case (packaged) [2] | $R_{\theta JC}$ | 2.0 | ˚C/W | CW, 85°C |

Notes:
[1] Measured for the CMPA2735075F1 at $P_{DISS}$ = 64 W (pulsed)
[2] Measured for the CMPA2735075F1 at $P_{DISS}$ = 56 W (CW)

## Electrical Characteristics (Frequency = 2.7 GHz to 3.5 GHz unless otherwise stated; $T_C$ = 25˚C)

| Characteristics | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| **DC Characteristics** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | -3.8 | -3.0 | -2.3 | V | $V_{DS}$ = 10 V, $I_D$ = 28 mA |
| Gate Quiescent Voltage | $V_{GS(Q)}$ | – | -2.7 | – | $V_{DC}$ | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA |
| Saturated Drain Current[1] | $I_{DS}$ | 19.6 | 27.4 | – | A | $V_{DS}$ = 6.0 V, $V_{GS}$ = 2.0 V |
| Drain-Source Breakdown Voltage | $V_{BD}$ | 84 | – | – | V | $V_{GS}$ = -8 V, $I_D$ = 28 mA |
| **RF Characteristics[2,3]** | | | | | | |
| Small Signal Gain | S21 | 26.5 | 28.6 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, Freq = 2.7 - 3.5 GHz |
| Input Return Loss | S11 | – | -14.4 | -10 | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, Freq = 2.7 - 3.5 GHz |
| Output Return Loss | S22 | – | -10.3 | -7 | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, Freq = 2.7 - 3.5 GHz |
| Output Power | $P_{OUT1}$ | 45.7 | 63 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 2.7 GHz |
| Output Power | $P_{OUT2}$ | 60.2 | 74 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 2.9 GHz |
| Output Power | $P_{OUT3}$ | 66.1 | 86 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 3.1 GHz |
| Output Power | $P_{OUT4}$ | 66.1 | 80 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 3.3 GHz |
| Output Power | $P_{OUT5}$ | 66.1 | 79 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 3.5 GHz |
| Power Added Efficiency | $PAE_1$ | – | 45 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 2.7 GHz |
| Power Added Efficiency | $PAE_2$ | 45 | 54 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 2.9 GHz |
| Power Added Efficiency | $PAE_3$ | 49 | 57 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 3.1 GHz |
| Power Added Efficiency | $PAE_4$ | 48 | 57 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 3.3 GHz |
| Power Added Efficiency | $PAE_5$ | 48 | 57 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{IN}$ = 28 dBm, Freq = 3.5 GHz |
| Output Mismatch Stress | VSWR | – | – | 5 : 1 | Ψ | No damage at all phase angles, $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{OUT}$ = 75 W |

Notes:
[1] Scaled from PCM data
[2] All data pulse tested in CMPA2735075F1-AMP
[3] Pulse Width = 300 µS, Duty Cycle = 20%

## Typical Performance of the CMPA2735075F1

**Figure 1. Gain and Return Losses vs Frequency of the CMPA2735075F1 Measured in CMPA2735075F1-AMP Amplifier Circuit**
**$V_{DS}$ = 28 V, $I_{DS}$ = 800 mA**

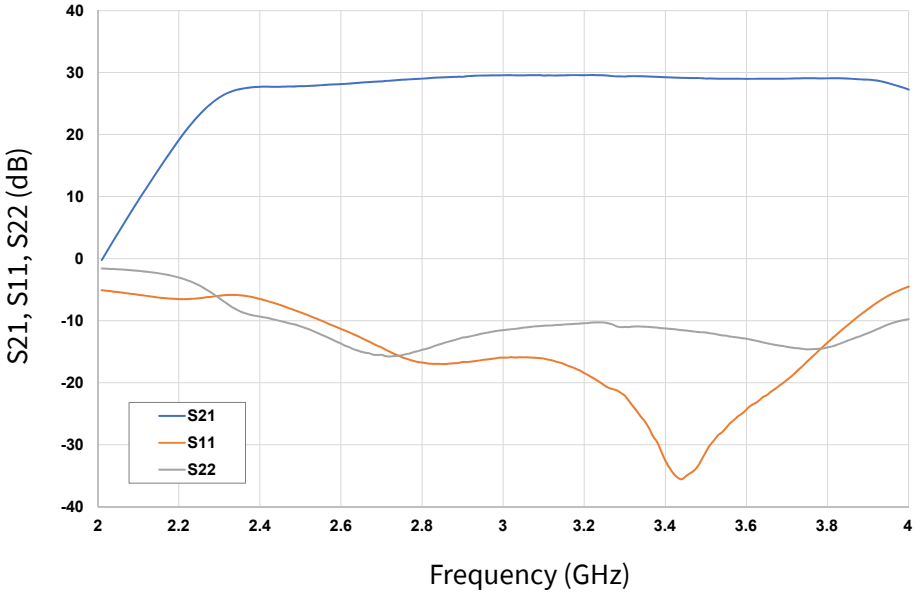
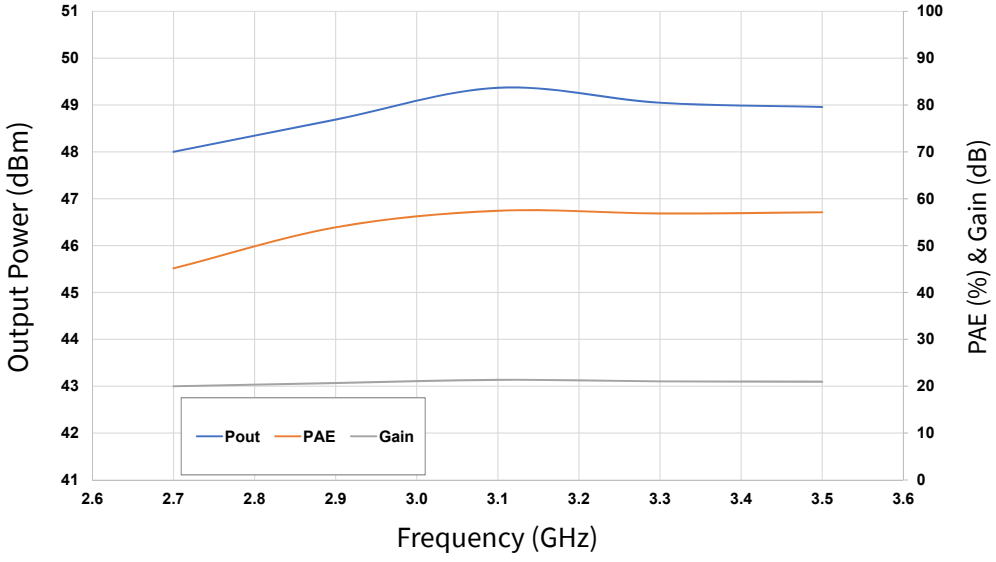
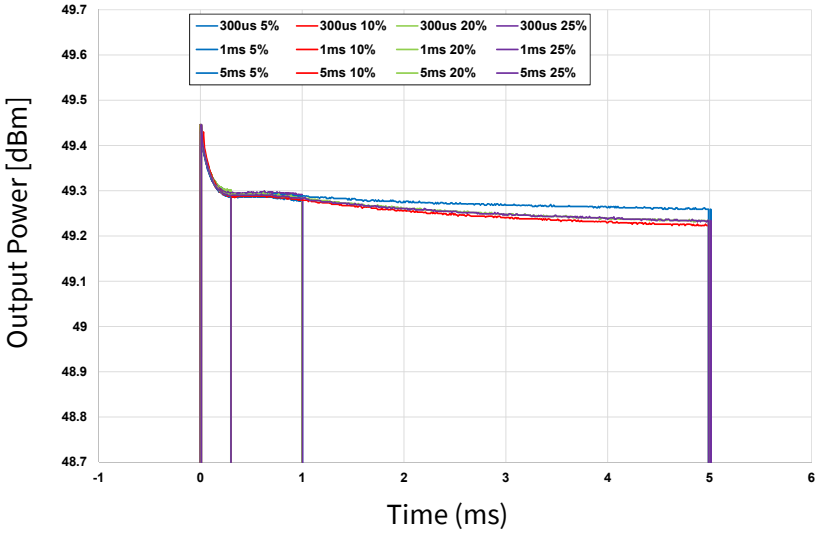



**Figure 2. Output Power, Gain and PAE vs Frequency of the CMPA2735075F1 Measured in CMPA2735075F1-AMP Amplifier Circuit**
**$V_{DS}$ = 28 V, $I_{DS}$ = 800 mA**



## Typical Pulse Droop Performance




| Pulse Width | Duty Cycle (%) | Droop (dB) |
|---|---|---|
| 10 us | 5-25 | 0.10 |
| 50 us | 5-25 | 0.10 |
| 100 us | 5-25 | 0.10 |
| 300 us | 5-25 | 0.20 |
| 1 ms | 5-25 | 0.20 |
| 5 ms | 5-25 | 0.20 |

## Electrostatic Discharge (ESD) Classifications

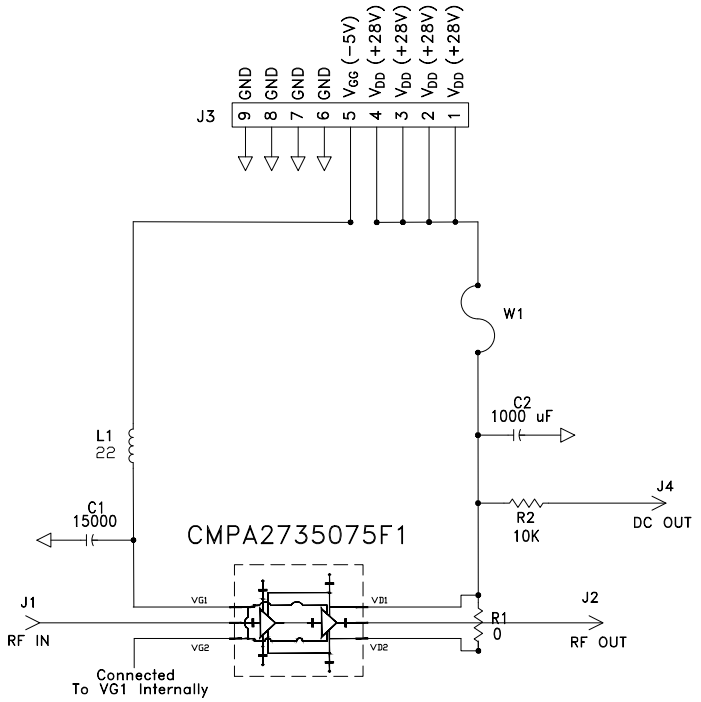
| Parameter | Symbol | Class | Test Methodology |
|---|---|---|---|
| Human Body Model | HBM | 1A (> 250 V) | JEDEC JESD22 A114-D |
| Charge Device Model | CDM | II (200 < 500V) | JEDEC JESD22 C101-C |

## CMPA2735075F1-AMP Demonstration Amplifier Circuit Bill of Materials

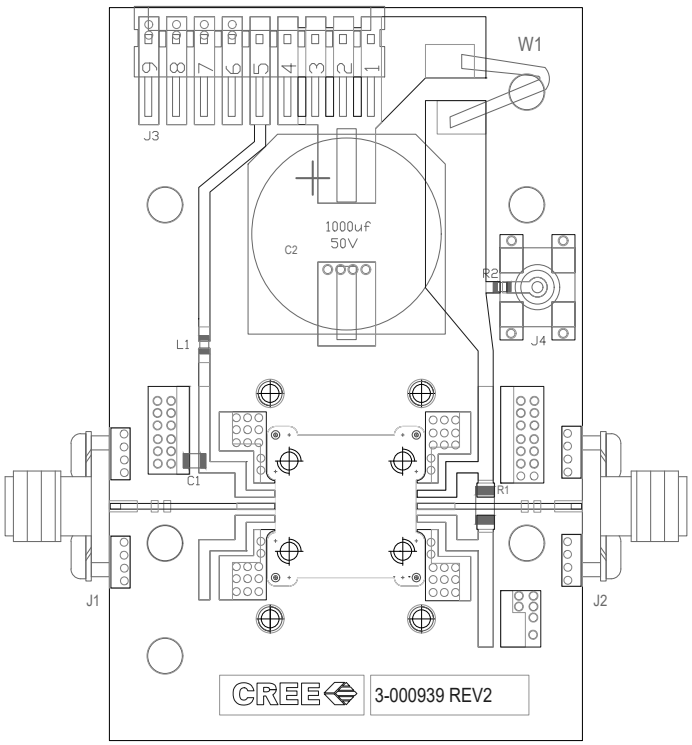
| Designator | Description | Qty |
|---|---|---|
| L1 | FERRITE, 22 OHM, 0805 | 1 |
| R1 | RES,1/8W,1206,5%, 0 OHM | 1 |
| R2 | RES, 1/16W, 0603, 5%, 10K | 1 |
| C1 | CAP, 15000PF,100V,0805,X7R | 1 |
| C2 | CAP, 1000uF, 20%, 50V, ELECT, MVY, SMD | 1 |
| W1 | CABLE, 18 AWG, 4.2 | 1 |
| J4 | CONNECTOR; SMB, Straight JACK, SMD | 1 |
| J1,J2 | CONN,N,FEM,W/.500 SMA FLNG | 2 |
| J3 | DC CONN, HEADER RT>PLZ .1CEN LK 9POS | 1 |
| Q1 | CMPA2735075F1 | 1 |
| | 2-56 SOC HD SCREW 1/4 SS (For Device) | 4 |
| | WIRE ASSEMBLY, 9-PIN, TEST FIXTURE | 1 |
| | LEAD CLAMP, DELRIN | 2 |
| | 2-56 SOC HD SCREW 1/2 SS (For Clamps) | 4 |
| | INDIUM TIM, AL CLAD, .47”x .30” x .003” | 1 |
| | TEST FIXTURE INSTRUCTIONS | 1 |

## CMPA2735075F1-AMP Demonstration Amplifier Circuit

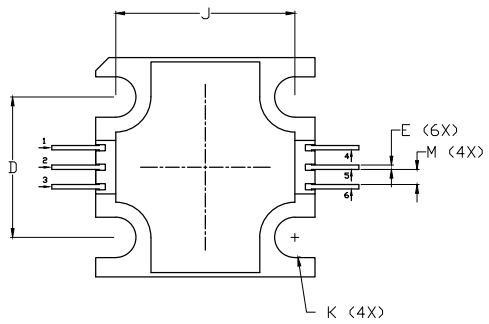
## CMPA2735075F1-AMP Demonstration Amplifier Circuit Schematic

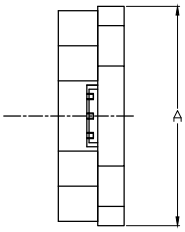


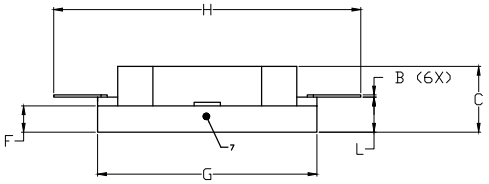

## CMPA2735075F1-AMP Demonstration Amplifier Circuit Outline

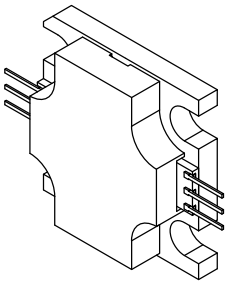


## Product Dimensions CMPA2735075F1 (Package Type — 440219)

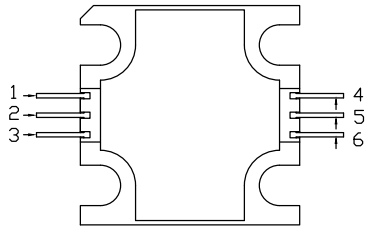


NOT TO SCALE




| PIN | Function |
|---|---|
| 1 | NC |
| 2 | Gate |
| 3 | NC |
| 4 | NC |
| 5 | Drain |
| 6 | NC |
| 7 | Source |

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

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.495 | 0.505 | 12.57 | 12.82 |
| B | 0.003 | 0.005 | 0.076 | 0.127 |
| C | 0.140 | 0.160 | 3.56 | 4.06 |
| D | 0.315 | 0.325 | 8.00 | 8.25 |
| E | 0.008 | 0.012 | 0.204 | 0.304 |
| F | 0.055 | 0.065 | 1.40 | 1.65 |
| G | 0.495 | 0.505 | 12.57 | 12.82 |
| H | 0.695 | 0.705 | 17.65 | 17.91 |
| J | 0.403 | 0.413 | 10.24 | 10.49 |
| K | ø .092 | | 2.34 | |
| L | 0.075 | 0.085 | 1.905 | 2.159 |
| M | 0.032 | 0.040 | 0.82 | 1.02 |

## Part Number System

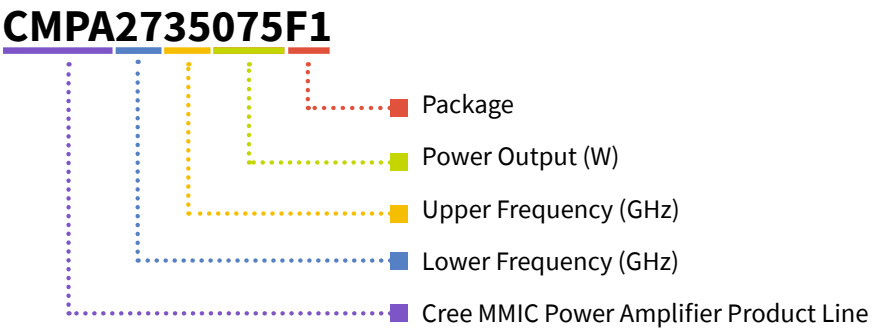



**Table 1.**

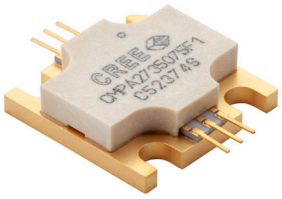
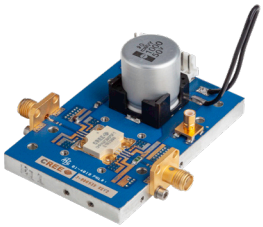
| Parameter | Value | Units |
|---|---|---|
| Lower Frequency | 2.7 | GHz |
| Upper Frequency | 3.5 | GHz |
| Power Output | 75 | W |
| Package | Flange | - |

**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<br>2H = 27.0 GHz |

## Product Ordering Information

| Order Number | Description | Unit of Measure | Image |
|---|---|---|---|
| CMPA2735075F1 | GaN HEMT | Each |  |
| CMPA2735075F1-AMP | Test board with GaN MMIC installed | Each |  |

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## Notes

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