GaN HEMT Pulsed Power Transistor
2.7 - 3.1 GHz, 100W Peak, 500us Pulse, 10% Duty Cycle

Production V1
23 Aug 11

## Features

- GaN depletion mode HEMT microwave transistor
- Common source configuration
- Broadband Class AB operation
- Thermally enhanced Cu/Mo/Cu package
- RoHS Compliant
- +50V Typical Operation
- MTTF of 114 years (Channel Temperature < 200°C)


## Application

- Civilian and Military Pulsed Radar

### Product Description

The MAGX-002731-100L00 is a gold metalized matched Gallium Nitride (GaN) on Silicon Carbide RF power transistor optimized for civilian and military radar pulsed applications between 2700 - 3100 MHz. Using state of the art wafer fabrication processes, these high performance transistors provide high gain, efficiency, bandwidth, ruggedness over a wide bandwidth for today's demanding application needs. The MAGX-002731-100L00 is constructed using a thermally enhanced Cu/Mo/Cu flanged ceramic package which provides excellent thermal performance. High breakdown voltages allow for reliable and stable operation in extreme mismatched load conditions unparalleled with older semiconductor technologies.

## Typical RF Performance

| Freq. (MHz) | Pin (W | Pout (W Peak) | Gain (dB) | Id-Pk (A) | Eff (%) |
|---|---|---|---|---|---|
| 2700 | 7 | 109 | 12 | 4.2 | 51 |
| 2900 | 7 | 112 | 12 | 4.4 | 51 |
| 3100 | 7 | 109 | 12 | 4.2 | 52 |

*Typical RF performance measured in M/A-COM RF test fixture. Devices tested in common source Class-AB configuration as follows: Vdd=50V, Idq=500mA (pulsed), F=2.7—3.1 GHz, Pulse=500us, Duty=10%.*

### Ordering Information

| | |
|---|---|
| MAGX-002731-100L00 | 100W GaN Power Transistor |
| MAGX-002731-SB2PPR | Evaluation Fixture |





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## Absolute Maximum Ratings Table (1, 2, 3)

| | |
|---|---|
| Supply Voltage (Vdd) | +65V |
| Supply Voltage (Vgg) | -8 to 0V |
| Supply Current (Id1) | 7100 mA Pk |
| Input Power (Pin) | +34 dBm |
| Absolute Max. Junction/Channel Temp | 200 ºC |
| Pulsed Power Dissipation (Pavg) at 85 ºC | 128W |
| Thermal Resistance, (Tchannel = 200 ºC)<br>$V_{DD}$ = 50V, $I_{DQ}$ = 500mA, Pout = 100W Peak<br>(300us Pulse / 10% Duty) | 0.9 ºC/W |
| Operating Temp | -40 to +95C |
| Storage Temp | -65 to +150C |
| Mounting Temperature | See solder reflow profile |
| ESD Min. - Machine Model (MM) | 50 V |
| ESD Min. - Human Body Model (HBM) | >250 V |
| MSL Level | MSL1 |

(1) Operation of this device above any one of these parameters may cause permanent damage.

(2) Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.

(3) For saturated performance it recommended that the sum of (3*Vdd + abs(Vgg)) <175

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **DC CHARACTERISTICS** | | | | | | |
| Drain-Source Leakage Current | $V_{GS}$ = -8V, $V_{DS}$ = 175V | $I_{DS}$ | - | - | 6 | mA |
| Gate Threshold Voltage | $V_{DS}$ = 5V, $I_D$ = 15.0mA | $V_{GS\ (th)}$ | -5 | -3 | -2 | V |
| Forward Transconductance | $V_{DS}$ = 5V, $I_D$ = 3.5mA | $G_M$ | 2.5 | - | - | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | Not applicable—Input internally matched | $C_{GS}$ | N/A | N/A | N/A | pF |
| Output Capacitance | $V_{DS}$ = 50V, $V_{GS}$ = -8V, F = 1MHz | $C_{DS}$ | - | 30.3 | 35.4 | pF |
| Feedback Capacitance | $V_{DS}$ = 50V, $V_{GS}$ = -8V, F = 1MHz | $C_{GD}$ | - | 2.8 | 5.4 | pF |





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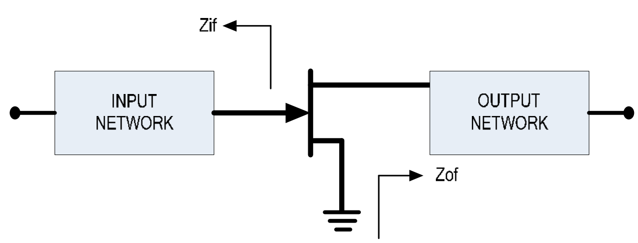
## Electrical Specifications: $T_C$ = 25 ± 5°C (Room Ambient )

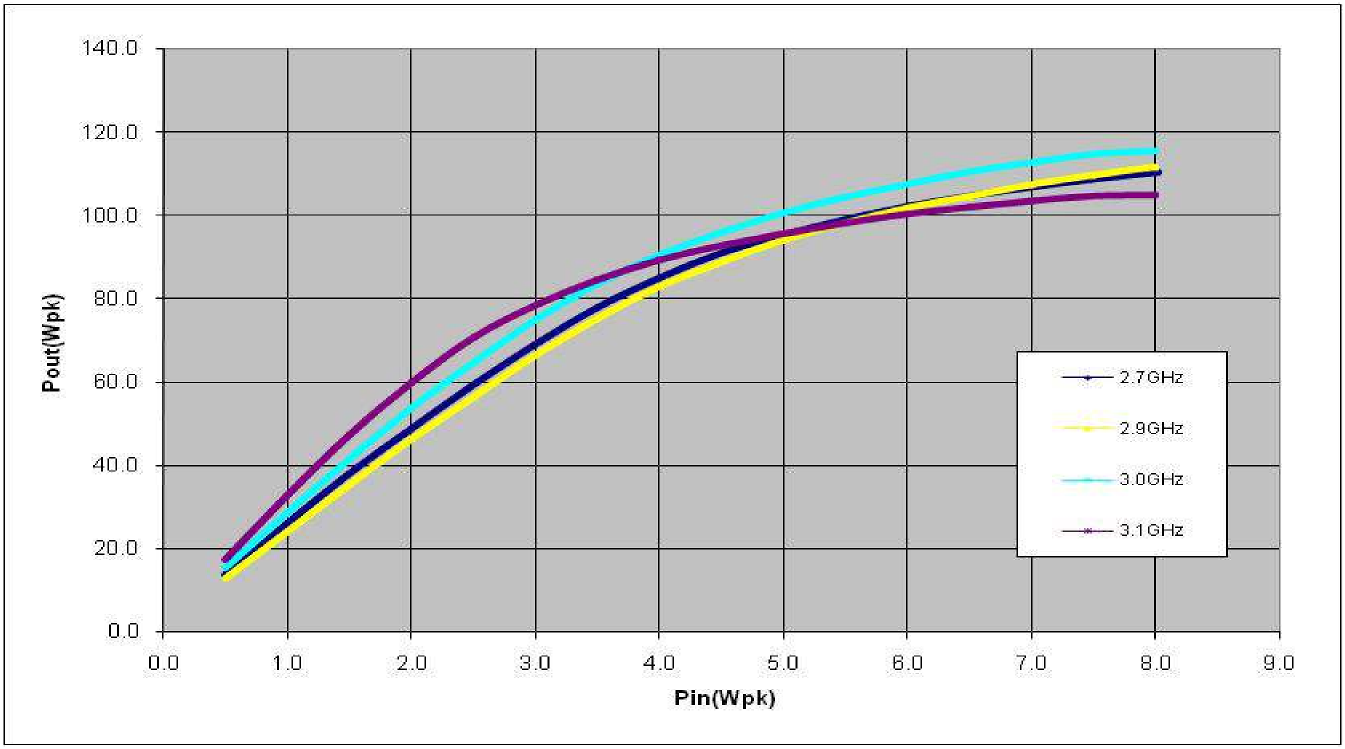
| Parameter | Test Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **RF FUNCTIONAL TESTS** *Vdd=50V, Idq=500mA (pulsed), F=2.7—3.1 GHz, Pulse=500us, Duty=10%* | | | | | | |
| Output Power | Pin = 7W Peak | $P_{OUT}$ | 100<br>10 | 105<br>10.5 | - | W Peak<br>W Ave |
| Power Gain | Pout = 100W Peak, 10W Ave | $G_P$ | 11.6 | 12.6 | - | dB |
| Drain Efficiency | Pin = 7W Peak | $\eta_D$ | 47 | 53 | - | % |
| Load Mismatch Stability | Pin = 7W Peak | VSWR-S | 5:1 | - | - | - |
| Load Mismatch Tolerance | Pin = 7W Peak | VSWR-T | 10:1 | - | - | - |

## Test Fixture Impedance

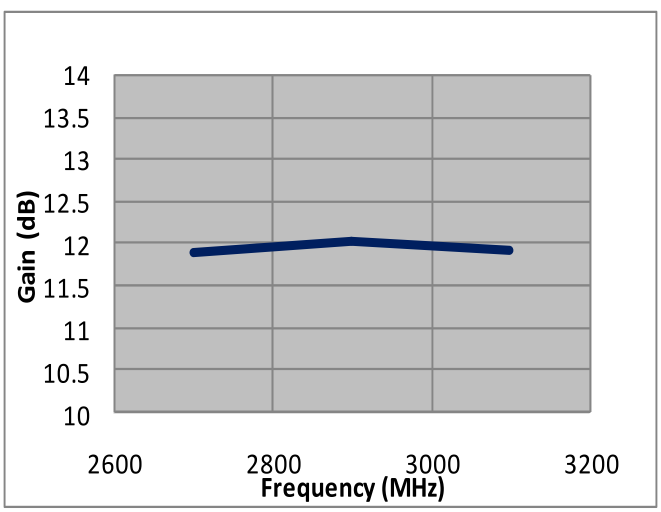
| F (MHz) | $Z_{IF}$ (Ω) | $Z_{OF}$ (Ω) |
|---|---|---|
| 2700 | 3.5 - j7.5 | 3.4 + j0.4 |
| 2900 | 2.7 - j5.3 | 4.7 - j0.8 |
| 3100 | 2.0 - j4.1 | 2.5 - j1.7 |



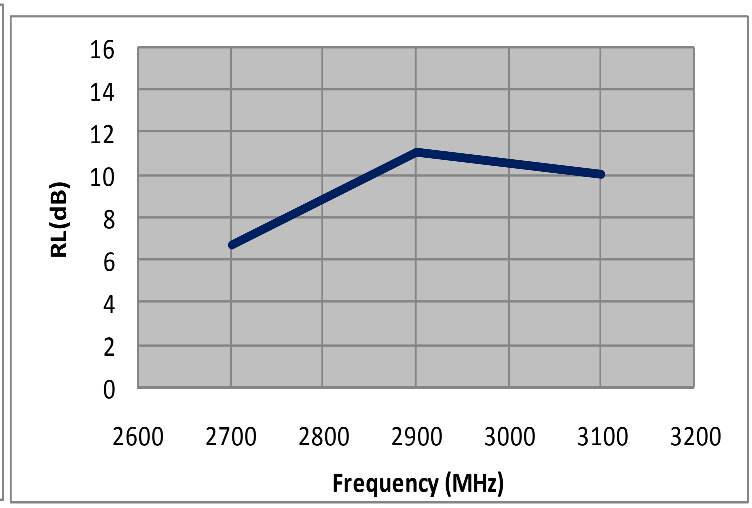
**RF Power Transfer Curve at 50V Drain Bias, Idq=0.5A**
**Output Power vs. Input Power**




**Gain vs. Frequency**
**50V Drain Bias, Idq=0.5A**




**Return Loss vs. Frequency**
**50V Drain Bias, Idq=0.5A**





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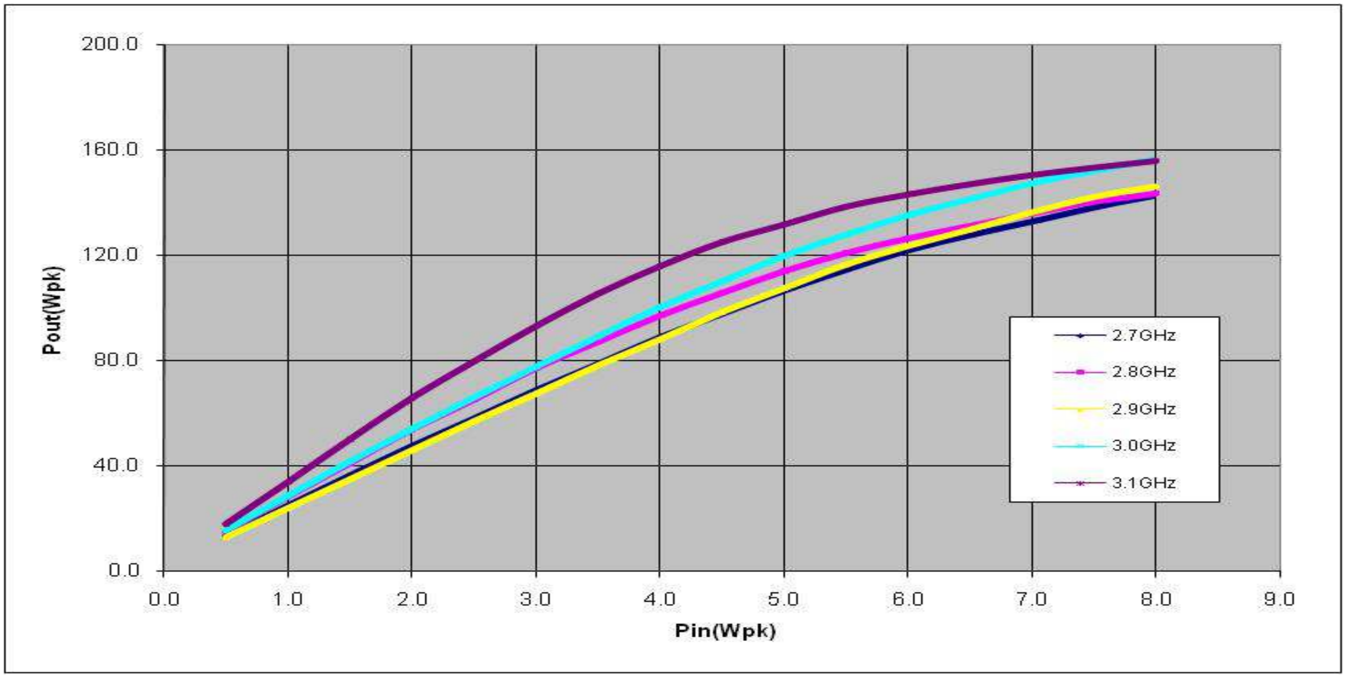
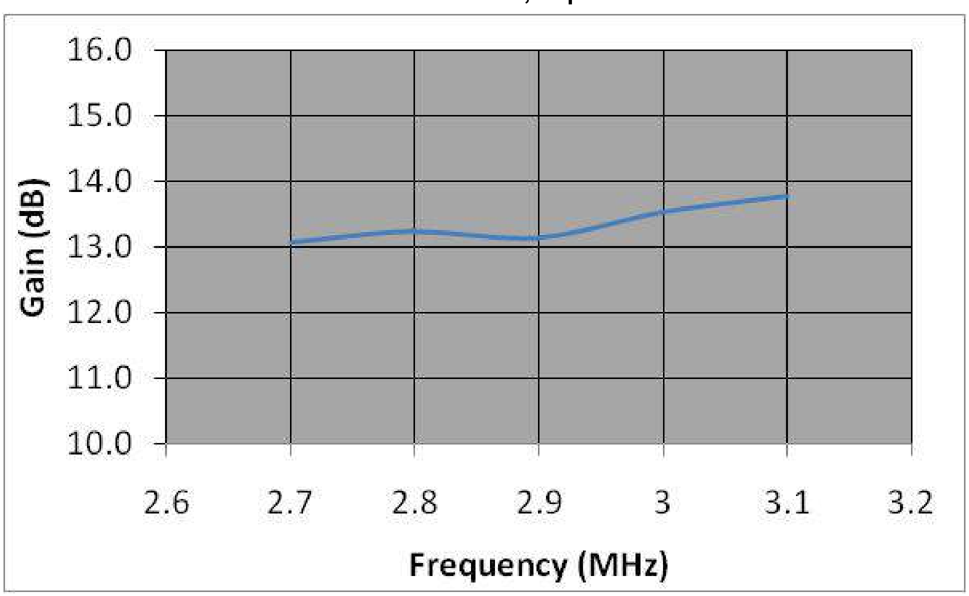
## RF Power Transfer Curve at 65V Drain Bias, Idq=0.5A
## Output Power vs. Input Power




## Gain vs. Frequency
**65V Drain Bias, Idq=0.5A**





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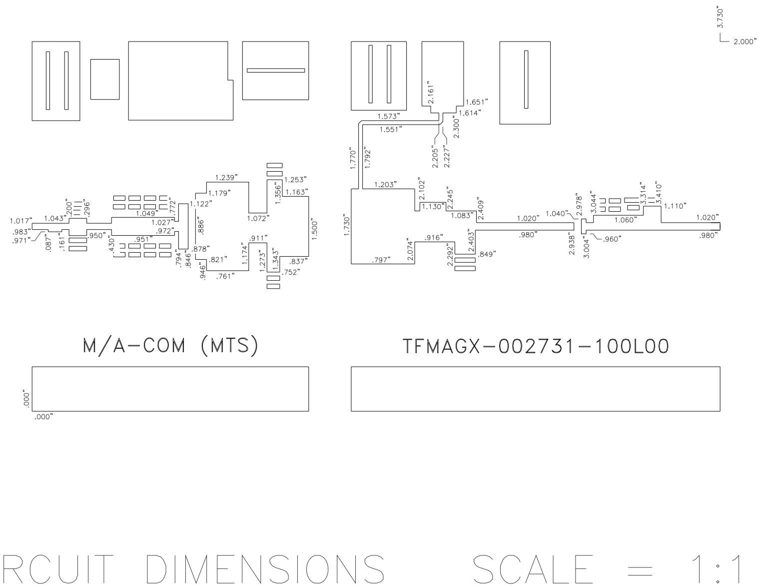
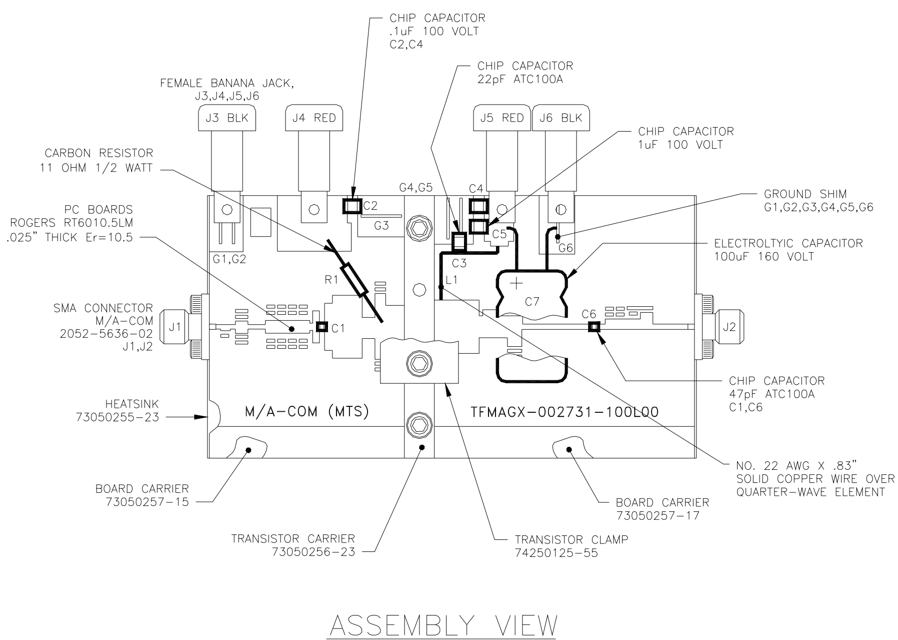
## Test Fixture Circuit Dimensions




Note: A dwg circuit drawing is available upon request

## Test Fixture Assembly



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**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.


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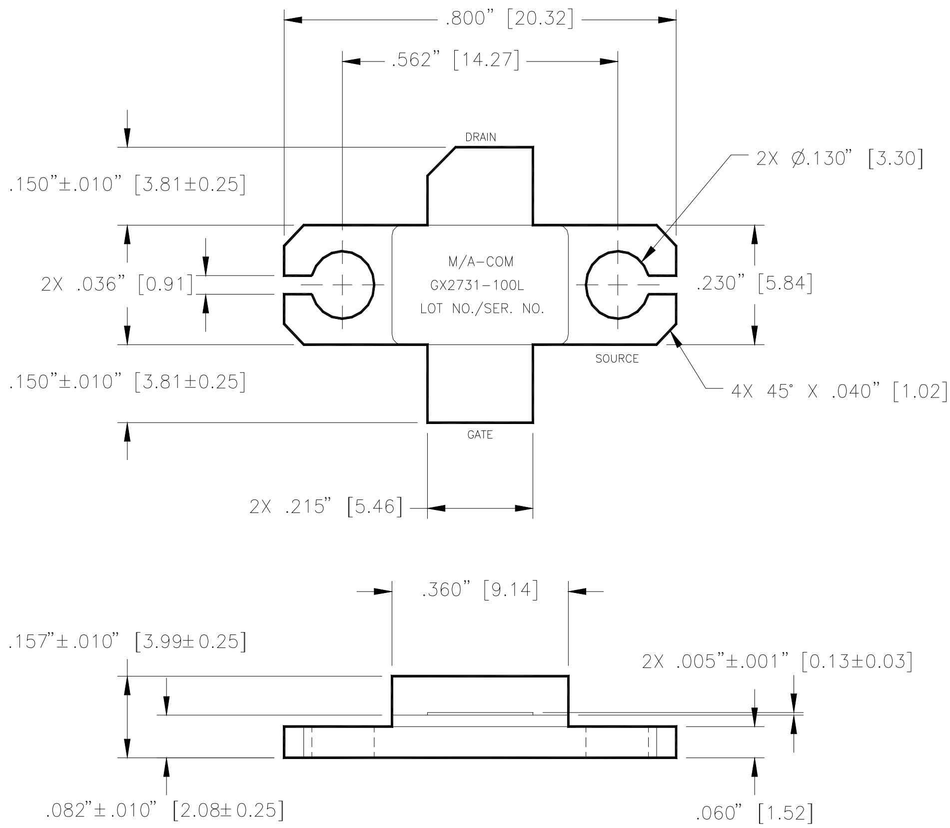
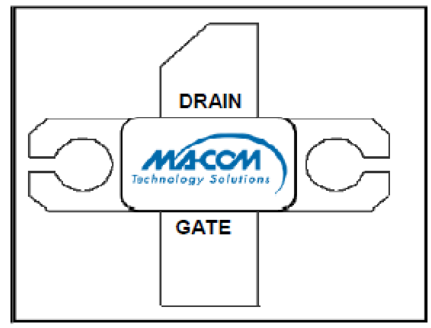
## Outline Drawings




Unless otherwise noted, tolerances are inches ±.005" [millimeters ±0.13mm]




## CORRECT DEVICE SEQUENCING

### TURNING THE DEVICE ON

1. Set $V_{GS}$ to the pinch-off ($V_P$), typically -5V
2. Turn on $V_{DS}$ to nominal voltage (50V)
3. Increase $V_{GS}$ until the $I_{DS}$ current is reached
4. Apply RF power to desired level

### TURNING THE DEVICE OFF

1. Turn the RF power off
2. Decrease $V_{GS}$ down to $V_P$
3. Decrease $V_{DS}$ down to 0V
4. Turn off $V_{GS}$





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