

## Application Note

### AP22908 Application Information and Demo Board User Guide

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#### **Description**

The AP22908 slew rate controlled load switch is a single P-channel MOSFET power switch designed for high-side load-switching applications. The MOSFET has a typical low  $R_{DS(ON)}$  of 40m $\Omega$  at 3.6V, allowing increased load current handling capacity with a low forward voltage drop. The turn-on slew rate of the device is controlled internally to avoid inrush current.

The AP22908 load switch is designed to operate from 1.08V to 3.6V, making it ideal for 1.2V, 1.8V, 2.5V, 3.3V and 3.6V systems. The typical quiescent supply current is only 0.05 $\mu$ A.

The AP22908 is available in the wafer level chip SOT26 package.

#### **Applications**

- Mobile Device and Smart Phones
- Portable Media Devices
- Wearable Devices
- Advanced Notebook, UMPC and MID
- Portable Medical Devices
- GPS and Navigation Equipment
- Portable Instrumentation

#### **Features**

- Wide Input Voltage Range: 1.08V to 3.6V
- Low On-Resistance:
  - 91m $\Omega$  Typical @1.2V
  - 53m $\Omega$  Typical @1.8V
  - 45m $\Omega$  Typical @2.5V
  - 40m $\Omega$  Typical @3.6V
- High DC Current Capability up to 1.5A
- Quick Discharging by Output Discharge Resistance
- Ultra Low Quiescent Current 0.05 $\mu$ A
- Active-high Control Pin
  - Minimum 0.9V  $V_{IH}$  of ON
- ESD Protection:
  - Human Body Model: 2kV
  - Charged Device Model: 1kV
- Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)

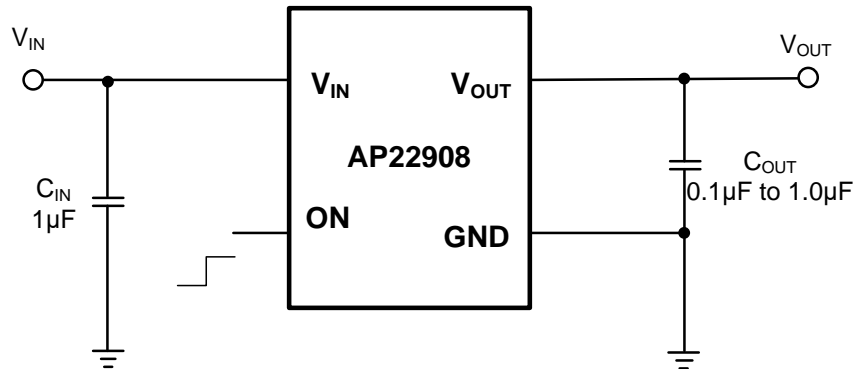
#### Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

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#### Typical Applications Circuit



#### Absolute Maximum Ratings

| Symbol          | Parameter   | Ratings     |     | Unit |
|-----------------|---|-------------|-----|------|
| ESD HBM         | Human Body Model ESD Protection                         | 2           |     | kV   |
| ESD CDM         | Charged Device Model ESD Protection                     | 1           |     | kV   |
| $V_{IN}$        | Input Voltage   | -0.3 to 4   |     | V    |
| $V_{OUT}$       | Output Voltage  | -0.3 to 4   |     | V    |
| $V_{ON}$        | ON Voltage  | -0.3 to 4   |     | V    |
| $I_{LOAD}$      | Maximum Continuous Load Current                         | 1.5         |     | A    |
| $I_{LOAD}$      | Maximum Pulse Load Current, Pulse <300μs, 2% Duty Cycle | 2.5         |     | A    |
| $T_J$           | Maximum Junction Temperature                            | +125        |     | °C   |
| $T_{ST}$        | Storage Temperature Range                               | -65 to +150 |     | °C   |
| $P_D$           | Power Dissipation                                       | SOT26       | 606 | mW   |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 4)        | SOT26       | 165 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Note 5)           | SOT26       | 30  | °C/W |

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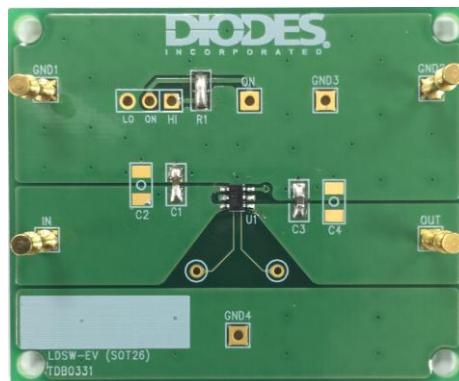
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**Recommended Operating Conditions**

| Symbol    | Parameter                     | Min  | Max  | Unit |
|-----------|-------------------------------|------|------|------|
| $V_{IN}$  | Input Voltage                 | 1.08 | 3.6  | V    |
| $V_{ON}$  | ON Voltage Range              | 0    | 3.6  | V    |
| $V_{OUT}$ | Output Voltage                | 0    | 3.6  | V    |
| $I_{OUT}$ | Output Current                | 0    | 1.5  | A    |
| $V_{IH}$  | ON High-Level Input Voltage   | 0.9  | 3.6  | V    |
| $V_{IL}$  | ON Low-Level Input Voltage    | 0    | 0.38 | V    |
| $T_A$     | Operating Ambient Temperature | -40  | +85  | °C   |

**Evaluation Board**

Top View



**Dimensions: 53.34 mm(L) x 43.82 mm(W)**

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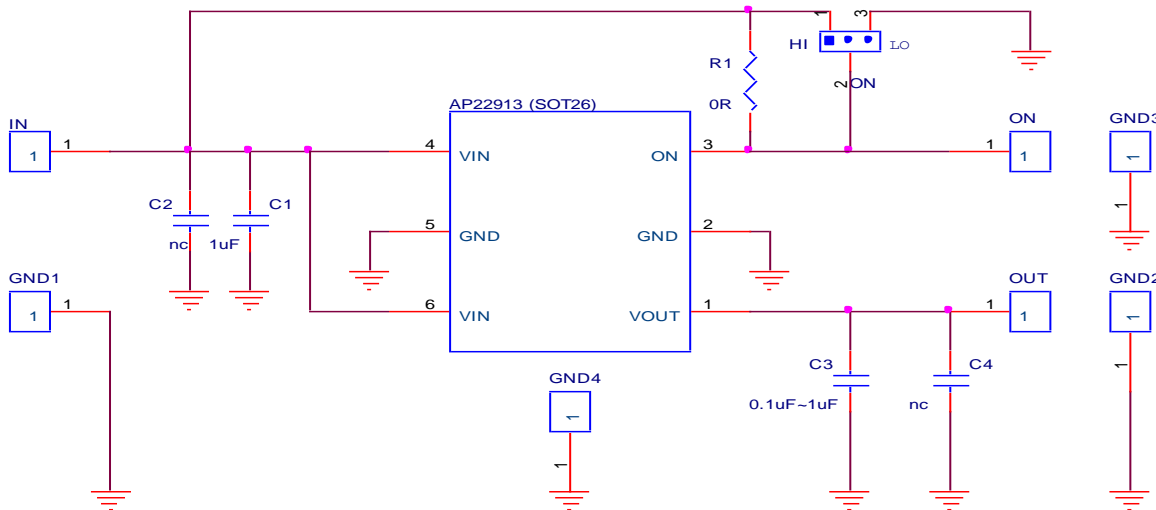
#### Quick Start Guide

AP22908 is a single p-channel MOSFET load switch. It has an input voltage range between 1.08V to 3.6V and is capable of handling up to 1.5A continuous current. The board demonstrates the AP22908's current handling capacity with its controlled turn on, low  $R_{DS(on)}$  and very low quiescent current specification. All inputs and output are brought out to test points for control and monitoring. All passive components are included on the EVM for device operation.

1. Connect a power supply between IN and GND terminals.
2. Connect the positive connection to the IN and the negative connection to the GND.
3. Connect an adjustable current or resistive load to OUT and GND terminals.
4. Connect the positive connection of the load to the OUT and the negative connection to the GND.
5. IN via reserved resistor R1 connect to ON terminal or installed shorting jumper in either the Hi or Lo positions. The default is shorted directly between IN and ON terminals.
6. Turn on the power supply.
7. Increase the load current of OUT and observe that the load current stop increasing after reaching limit level.

#### Evaluation Board Schematic

AP22908W6

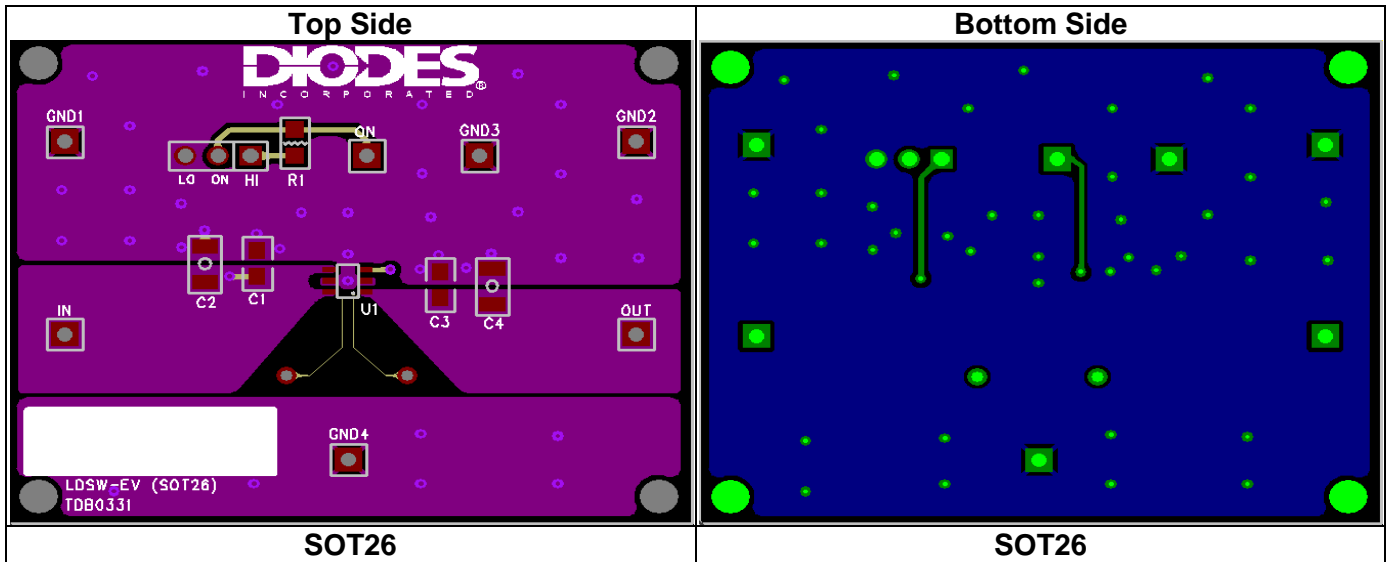


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#### PCB Layout



#### Bill of Materials

| Component Location | Q'ty | Value       | Specification                   | Vendor      | Part No.        | Size  |
|--------------------|------|-------------|---------------------------------|-------------|-----------------|-------|
| U1                 | 1    | AP22908     | 1.5A single channel load switch | Diodes      | AP22908W6-7     | SOT26 |
| C1                 | 1    | 1 $\mu$ F   | X7R 10% 25V Cap MLCC            | Taiyo Yuden | TMK107B7105KA-T | 0603  |
| C3                 | 1    | 0.1 $\mu$ F | X7R 10% 25V Cap MLCC            | Taiyo Yuden | TMK107B7104KAHT | 0603  |
| C2,C4              | 2    | -           | NC                              | -           | -               | -     |
| R1                 | 1    | 0 $\Omega$  | 0603 $\pm$ 1% 1/10W Resistor    | Yageo       | RC0603FR-100RL  | 0603  |
| PCB                | 1    | -           | AP22908 EV Board                | Diodes Inc. | TDB0331         | -     |

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#### Vendors of peripheral components

##### Suggested Capacitors :

| Vendor      | Application | Value       | Capacitance                 | Type | Series             |
|-------------|-------------|-------------|-----------------------------|------|--------------------|
| Taiyo Yuden | Cin<br>Cout | 1 $\mu$ F   | 25V/X7R,10%                 | SMD  | TMK107B7105KA-T    |
|             |             |             |                             | SMD  | TMK212B7105KG-T    |
|             | Cout        | 0.1 $\mu$ F | 25V/X7R,10%<br>50V/X7R, 10% | SMD  | TMK107B7104KAHT    |
|             |             |             |                             | SMD  | UMK212B7104KG-T    |
| Murata      | Cin<br>Cout | 1 $\mu$ F   | 25V/X7R,10%                 | SMD  | GCM188R71E105KA64D |
|             |             |             |                             | SMD  | GRM21BR71E105KA99  |
|             | Cout        | 0.1 $\mu$ F | 25V/X7R, 10%                | SMD  | GRM188R71E104KA01  |
|             |             |             |                             | SMD  | GRM21BR71E104KA01  |

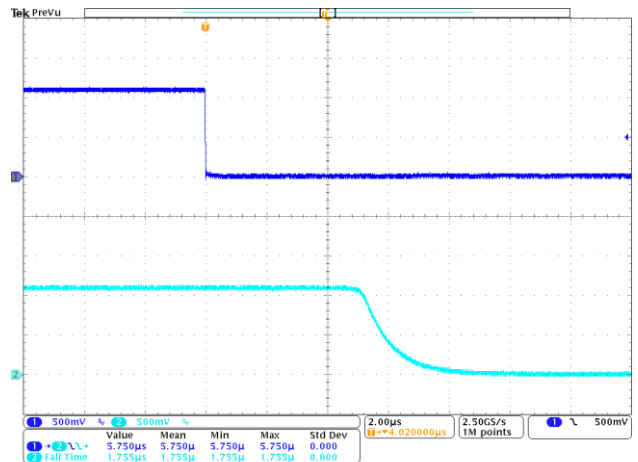
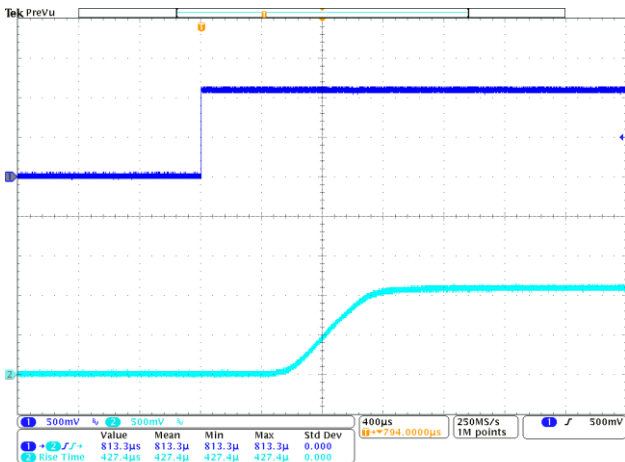
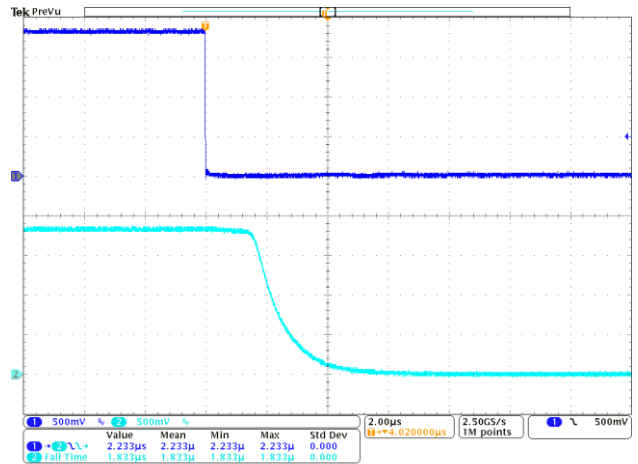
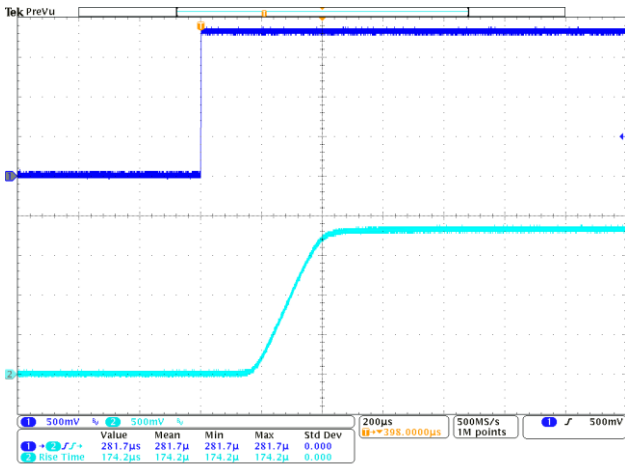
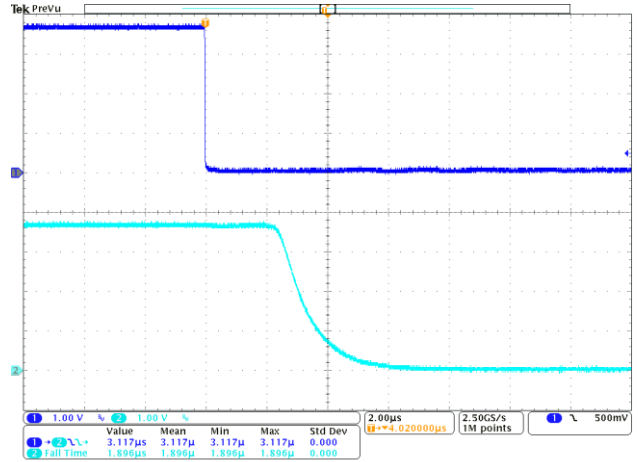
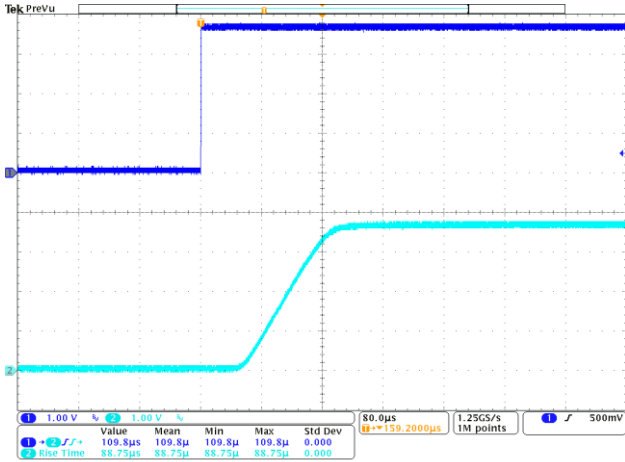
##### Suggested Resistor :

| Vendor | Type | Series   |
|--------|------|----------|
| Yageo  | SMD  | RC0603FR |

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**VOUT Turn On/Off Response Example** (CH1:  $V_{ON}$ , CH2:  $V_{OUT}$ )



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