

### N-Channel Power MOSFET

#### Description

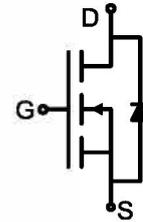
The AP2310S uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a Battery protection or in other switching application.

#### General Features

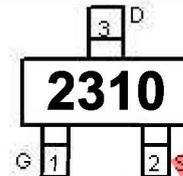
- $V_{DS} = 60V, I_D = 3A$   
 $R_{DS(ON)} < 105m\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)} < 125m\Omega @ V_{GS} = 4.5V$
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

#### Application

- Battery switch
- DC/DC converter



Schematic Diagram



Marking and Pin Assignment



SOT-23 -3L Top View

#### Absolute Maximum Ratings (TA=25°C unless otherwise noted)

| Parameter  | Symbol         | Limit      | Unit |
|--|----------------|------------|------|
| Drain-Source Voltage                             | $V_{DS}$       | 60         | V    |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$   | V    |
| Drain Current-Continuous                         | $I_D$          | 3          | A    |
| Drain Current-Pulsed (Note 1)                    | $I_{DM}$       | 10         | A    |
| Maximum Power Dissipation                        | $P_D$          | 1.7        | W    |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 150 | °C   |

#### Thermal Characteristic

|  |                 |      |      |
|--|-----------------|------|------|
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 73.5 | °C/W |
|--|-----------------|------|------|

#### Electrical Characteristics (TA=25°C unless otherwise noted)

| Parameter                       | Symbol     | Condition                     | Min | Typ | Max | Unit    |
|---------------------------------|------------|-------------------------------|-----|-----|-----|---------|
| <b>Off Characteristics</b>      |            |                               |     |     |     |         |
| Drain-Source Breakdown Voltage  | $BV_{DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$ | 60  | 65  | -   | V       |
| Zero Gate Voltage Drain Current | $I_{DSS}$  | $V_{DS} = 60V, V_{GS} = 0V$   | -   | -   | 1   | $\mu A$ |

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|   |              |   |     |      |           |            |
|---|--------------|---|-----|------|-----------|------------|
| Gate-Body Leakage Current                 | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$                             | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics (Note 3)</b>        |              |   |     |      |           |            |
| Gate Threshold Voltage                    | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                           | 0.8 | 1.1  | 1.4       | V          |
| Drain-Source On-State Resistance          | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=3A$                                    | -   | -    | 105       | m $\Omega$ |
|   |              | $V_{GS}=4.5V, I_D=3A$                                   | -   | -    | 125       | m $\Omega$ |
| Forward Transconductance                  | $g_{FS}$     | $V_{DS}=15V, I_D=2A$                                    | 3   | -    | -         | S          |
| <b>Dynamic Characteristics (Note4)</b>    |              |   |     |      |           |            |
| Input Capacitance                         | $C_{iss}$    | $V_{DS}=30V, V_{GS}=0V,$<br>$F=1.0MHz$                  | -   | 247  | -         | PF         |
| Output Capacitance                        | $C_{oss}$    |   | -   | 34   | -         | PF         |
| Reverse Transfer Capacitance              | $C_{rss}$    |   | -   | 19.5 | -         | PF         |
| <b>Switching Characteristics (Note 4)</b> |              |   |     |      |           |            |
| Turn-on Delay Time                        | $t_{d(on)}$  | $V_{DD}=30V, I_D=1.5A$<br>$V_{GS}=10V, R_{GEN}=1\Omega$ | -   | 6    | -         | nS         |
| Turn-on Rise Time                         | $t_r$        |   | -   | 15   | -         | nS         |
| Turn-Off Delay Time                       | $t_{d(off)}$ |   | -   | 15   | -         | nS         |
| Turn-Off Fall Time                        | $t_f$        |   | -   | 10   | -         | nS         |
| Total Gate Charge                         | $Q_g$        | $V_{DS}=30V, I_D=3A,$<br>$V_{GS}=4.5V$                  | -   | 6    | -         | nC         |
| Gate-Source Charge                        | $Q_{gs}$     |   | -   | 1    | -         | nC         |
| Gate-Drain Charge                         | $Q_{gd}$     |   | -   | 1.3  | -         | nC         |
| <b>Drain-Source Diode Characteristics</b> |              |   |     |      |           |            |
| Diode Forward Voltage (Note 3)            | $V_{SD}$     | $V_{GS}=0V, I_S=3A$                                     | -   | -    | 1.2       | V          |
| Diode Forward Current (Note 2)            | $I_S$        |   | -   | -    | 3         | A          |

### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

Typical Electrical And Thermal Characteristics

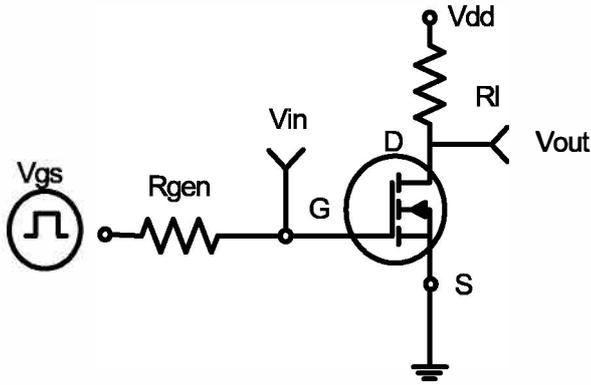


Figure 1: Switching Test Circuit

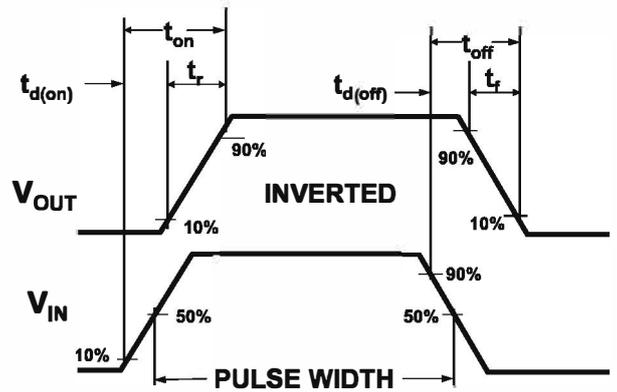


Figure 2: Switching Waveforms

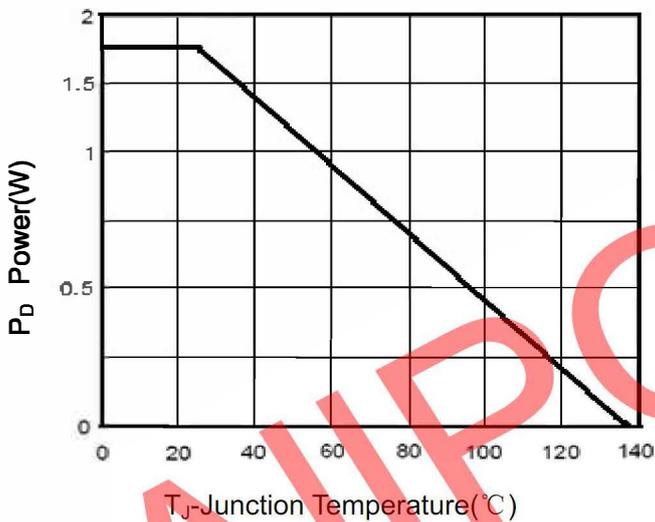


Figure 3 Power Dissipation

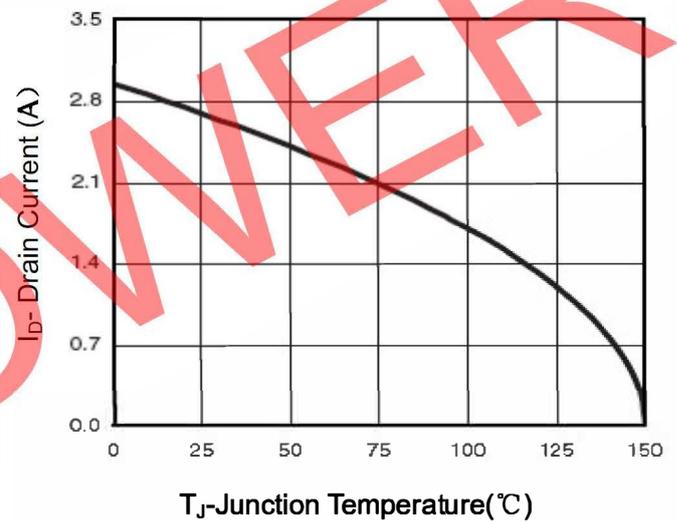


Figure 4 Drain Current

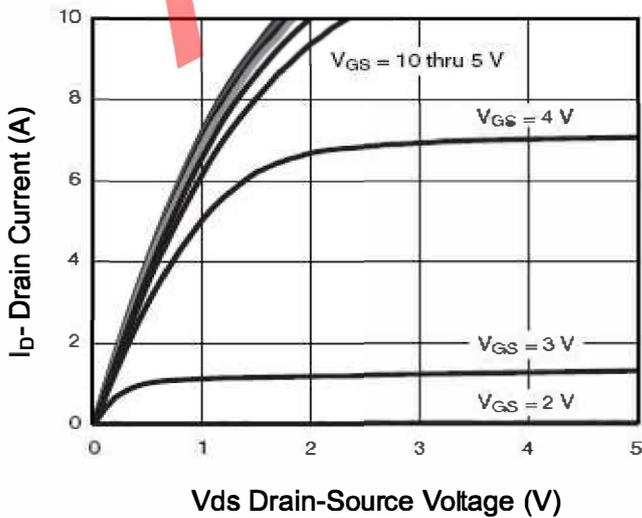


Figure 5 Output Characteristics

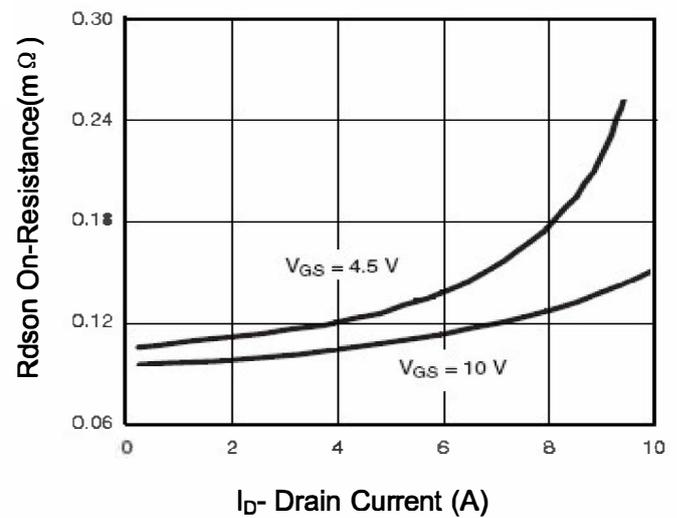
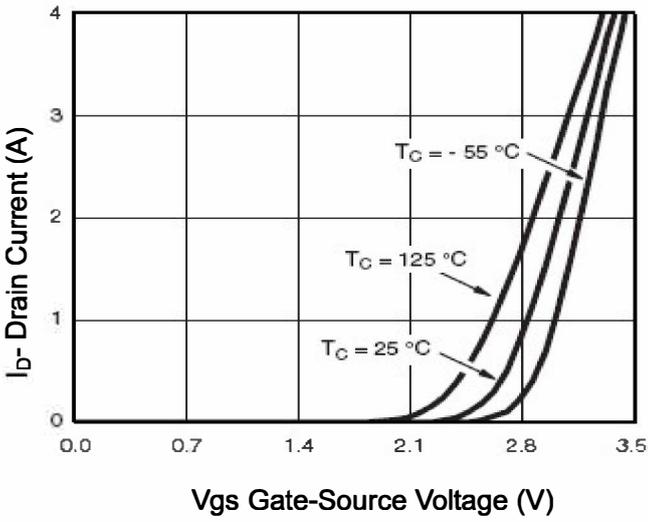


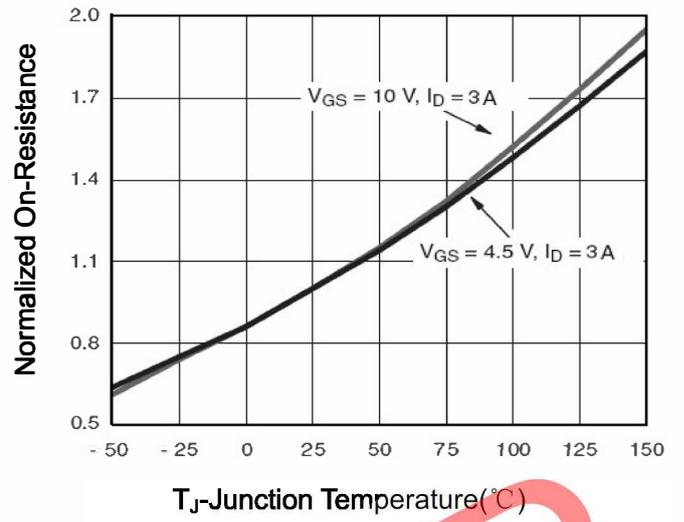
Figure 6 Drain-Source On-Resistance

**AP2310S**

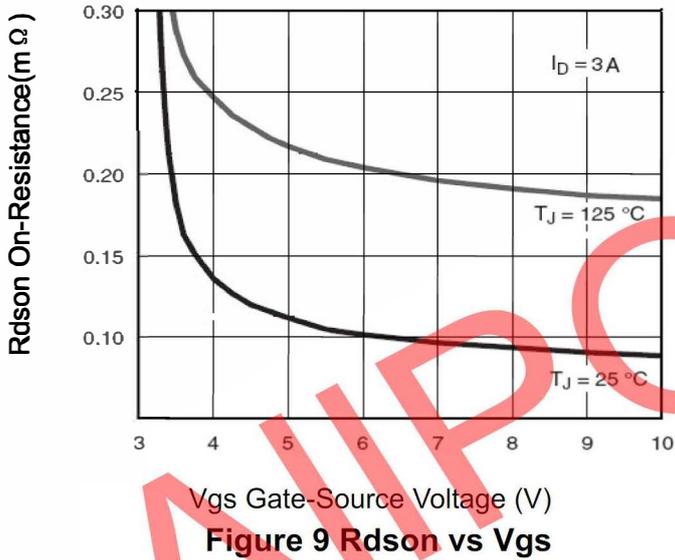
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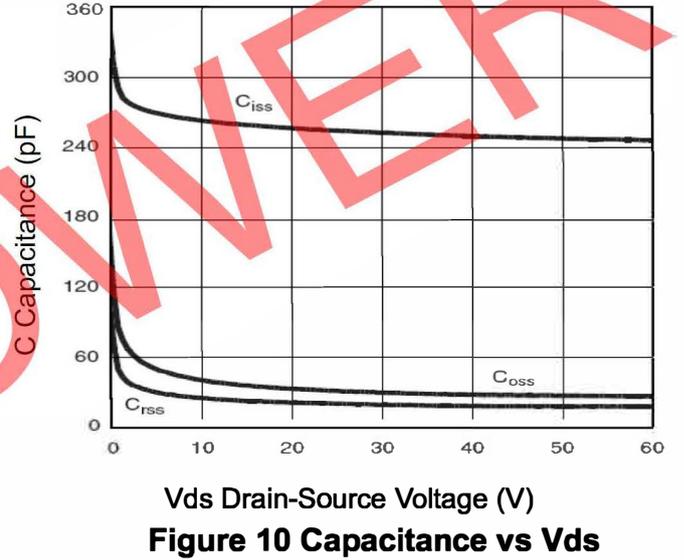
**Figure 7 Transfer Characteristics**



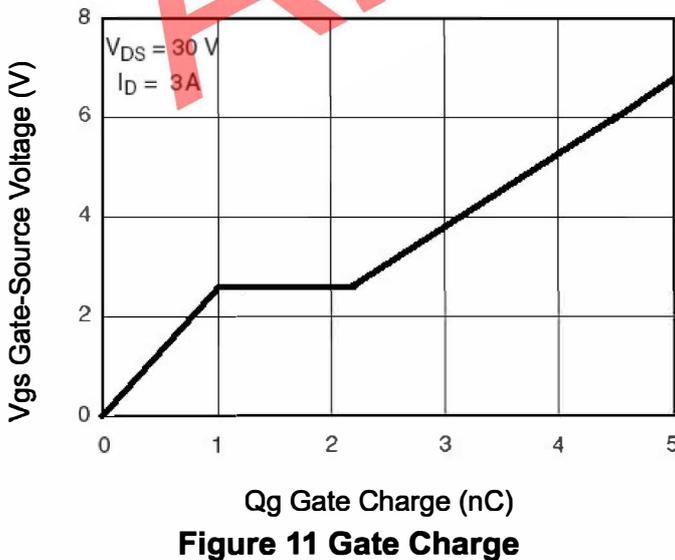
**Figure 8 Drain-Source On-Resistance**



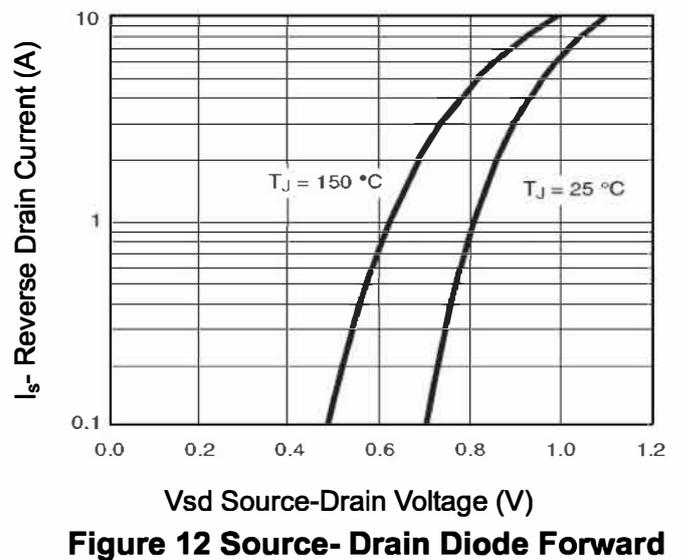
**Figure 9  $R_{DS(on)}$  vs  $V_{GS}$**



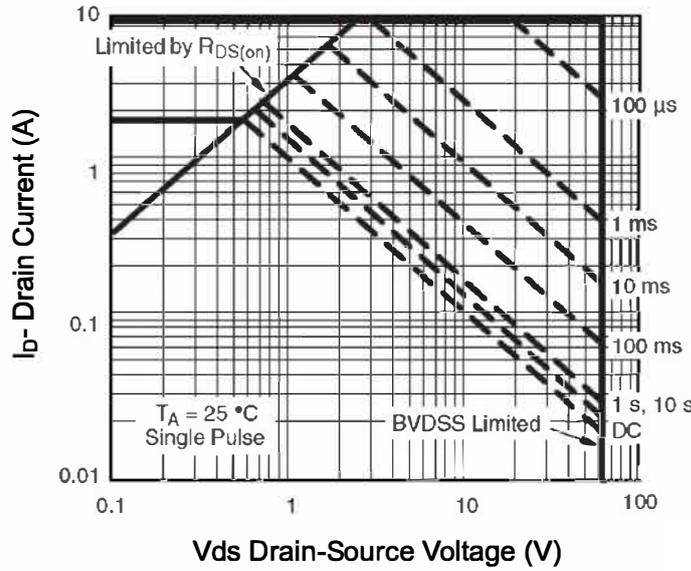
**Figure 10 Capacitance vs  $V_{DS}$**



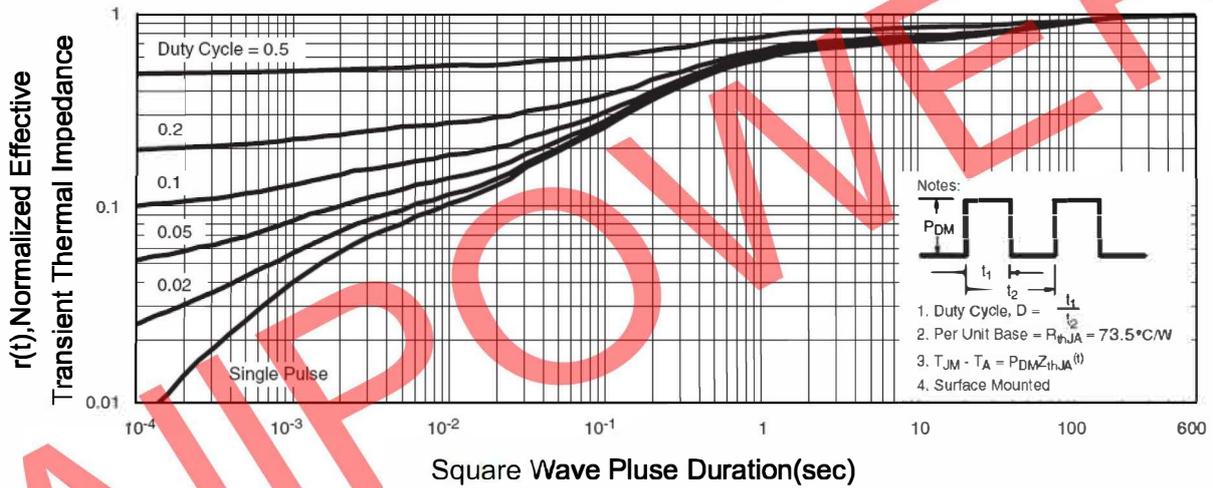
**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**



**Figure 13 Safe Operation Area**



**Figure 14 Normalized Maximum Transient Thermal Impedance**