



UNI-SEMICONDUCTOR CO., LTD

宇力半导体有限公司



## AP2012 Data Sheet

V 1.1

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## Description

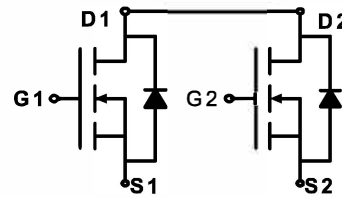
The AP2012 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a load switch or in PWM applications .

## General Features

- $V_{DS} = 20V, I_D = 12A$   
 $R_{DS(ON)} < 11m\Omega @ V_{GS}=4.5V$   
 $R_{DS(ON)} < 13m\Omega @ V_{GS}=2.5V$
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

## Application

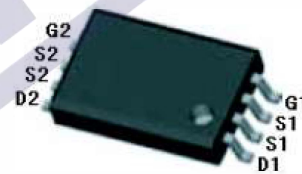
- Uni-directional load switch
- Bi-directional load switch



Schematic diagram



Marking and pin assignment



TSSOP-8 top view

## Absolute Maximum Ratings ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter  | Symbol         | Limit      | Unit             |
|--|----------------|------------|------------------|
| Drain-Source Voltage                             | $V_{DS}$       | 20         | V                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 12$   | V                |
| Drain Current-Continuous                         | $I_D$          | 12         | A                |
| Drain Current-Pulsed <sup>(Note 1)</sup>         | $I_{DM}$       | 45         | A                |
| Maximum Power Dissipation                        | $P_D$          | 2          | W                |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 150 | $^\circ\text{C}$ |

## Thermal Characteristic

|   |                 |      |                    |
|---|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup> | $R_{\theta JA}$ | 62.5 | $^\circ\text{C/W}$ |
|---|-----------------|------|--------------------|

## Electrical Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter                       | Symbol     | Condition                 | Min | Typ | Max | Unit    |
|---------------------------------|------------|---------------------------|-----|-----|-----|---------|
| <b>Off Characteristics</b>      |            |                           |     |     |     |         |
| Drain-Source Breakdown Voltage  | $BV_{DSS}$ | $V_{GS}=0V, I_D=250\mu A$ | 20  |     |     | V       |
| Zero Gate Voltage Drain Current | $I_{DSS}$  | $V_{DS}=20V, V_{GS}=0V$   | -   | -   | 1   | $\mu A$ |

| Parameter                                 | Symbol       | Condition  | Min | Typ  | Max       | Unit       |
|---|--------------|--|-----|------|-----------|------------|
| Gate-Body Leakage Current                 | $I_{GSS}$    | $V_{GS}=\pm 10V, V_{DS}=0V$                                  | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics</b> (Note 3)        |              |  |     |      |           |            |
| Gate Threshold Voltage                    | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                                | 0.5 | 0.7  | 1.0       | V          |
| Drain-Source On-State Resistance          | $R_{DS(on)}$ | $V_{GS}=4.5V, I_D=5A$  |     | 8    | 11        | m $\Omega$ |
|   |              | $V_{GS}=2.5V, I_D=4A$  | -   | 10   | 13        | m $\Omega$ |
| Forward Transconductance                  | $g_{FS}$     | $V_{DS}=5V, I_D=8A$  | -   | 15   | -         | S          |
| <b>Dynamic Characteristics</b> (Note 4)   |              |  |     |      |           |            |
| Input Capacitance                         | $C_{iss}$    | $V_{DS}=10V, V_{GS}=0V,$<br>$F=1.0MHz$                       | -   | 1800 | -         | PF         |
| Output Capacitance                        | $C_{oss}$    |  | -   | 230  | -         | PF         |
| Reverse Transfer Capacitance              | $C_{rss}$    |  | -   | 200  | -         | PF         |
| <b>Switching Characteristics</b> (Note 4) |              |  |     |      |           |            |
| Turn-on Delay Time                        | $t_{d(on)}$  | $V_{DD}=10V, R_L=1.2\Omega$<br>$V_{GS}=10V, R_{GEN}=3\Omega$ | -   | 2.5  |           | nS         |
| Turn-on Rise Time                         | $t_r$        |  | -   | 7.2  |           | nS         |
| Turn-Off Delay Time                       | $t_{d(off)}$ |  | -   | 49   |           | nS         |
| Turn-Off Fall Time                        | $t_f$        |  | -   | 10.8 |           | nS         |
| Total Gate Charge                         | $Q_g$        | $V_{DS}=10V, I_D=8A,$<br>$V_{GS}=4.5V$                       | -   | 17.9 |           | nC         |
| Gate-Source Charge                        | $Q_{gs}$     |  | -   | 1.5  | -         | nC         |
| Gate-Drain Charge                         | $Q_{gd}$     |  | -   | 4.7  | -         | nC         |
| <b>Drain-Source Diode Characteristics</b> |              |  |     |      |           |            |
| Diode Forward Voltage (Note 3)            | $V_{SD}$     | $V_{GS}=0V, I_S=1A$  | -   | -    | 1.2       | V          |
| Diode Forward Current (Note 2)            | $I_S$        |  | -   | -    | 12        | 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

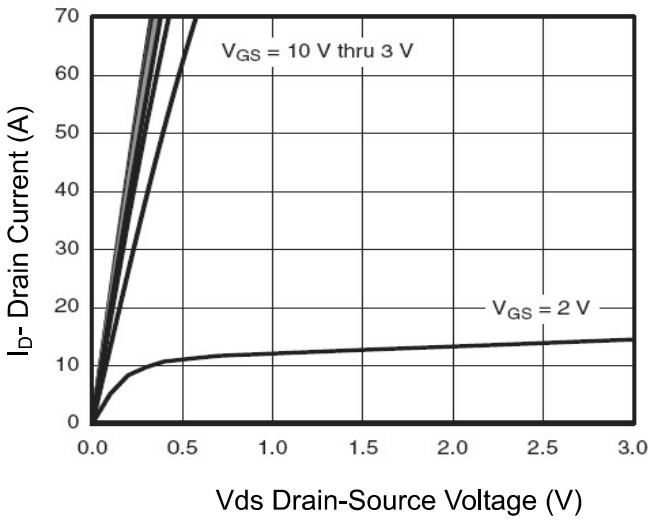


Figure 1 Output Characteristics

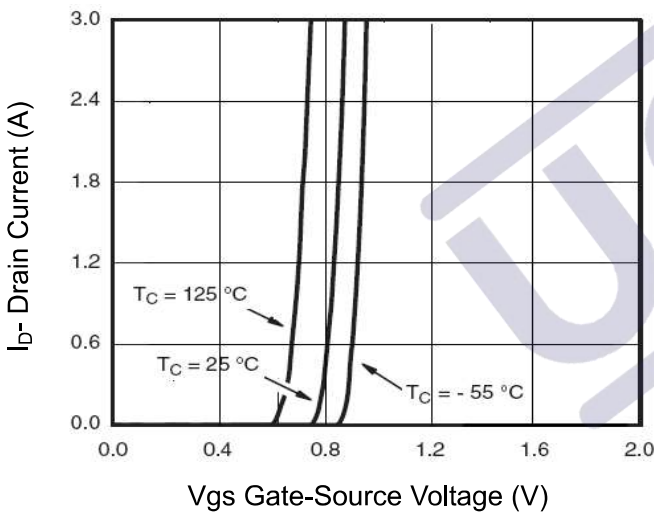


Figure 3 Transfer Characteristics

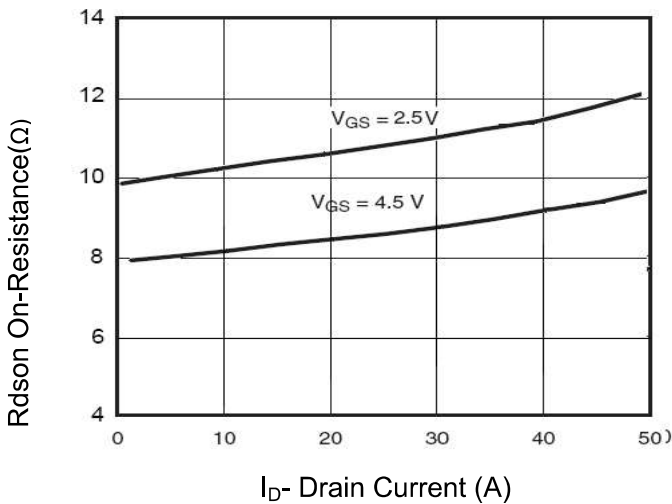


Figure 5 Rdson- Drain Current

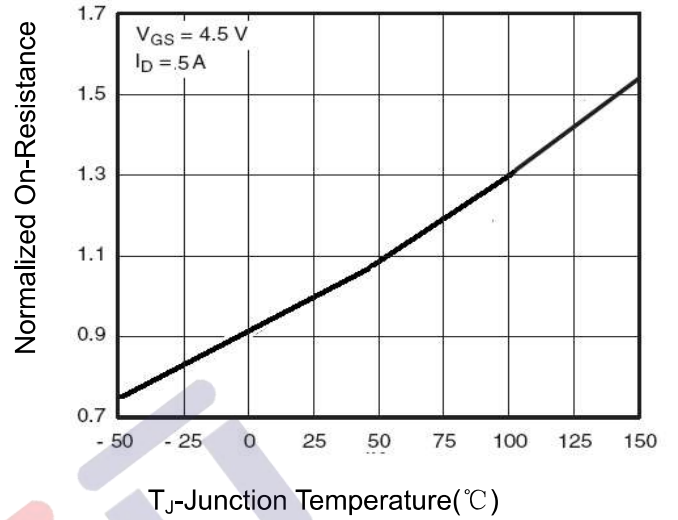


Figure 2 Rdson-Junction Temperature

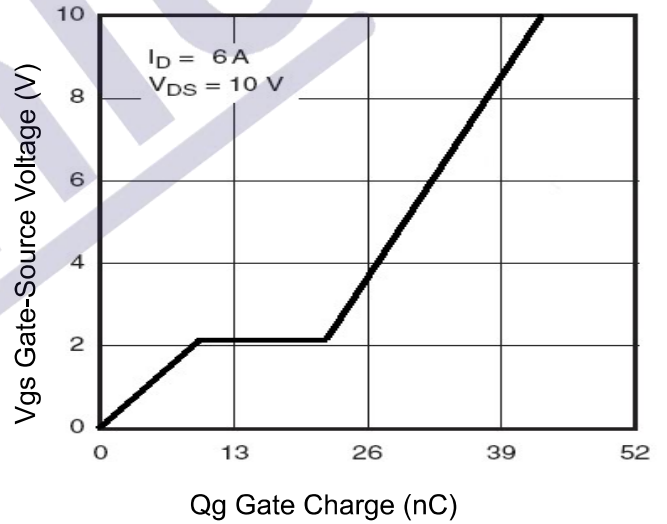


Figure 4 Gate Charge

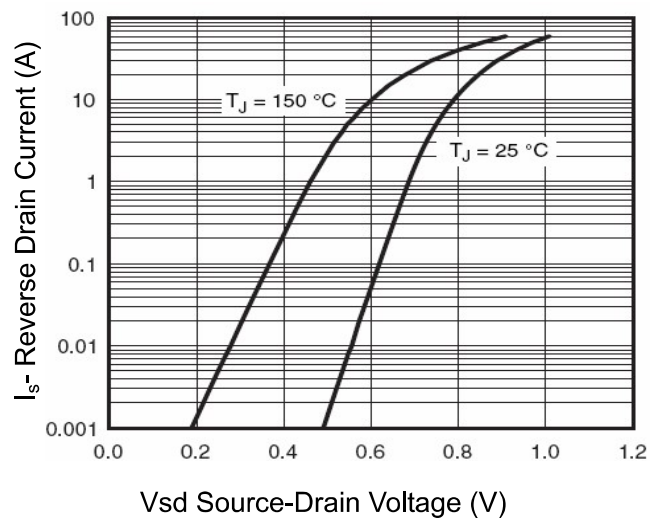
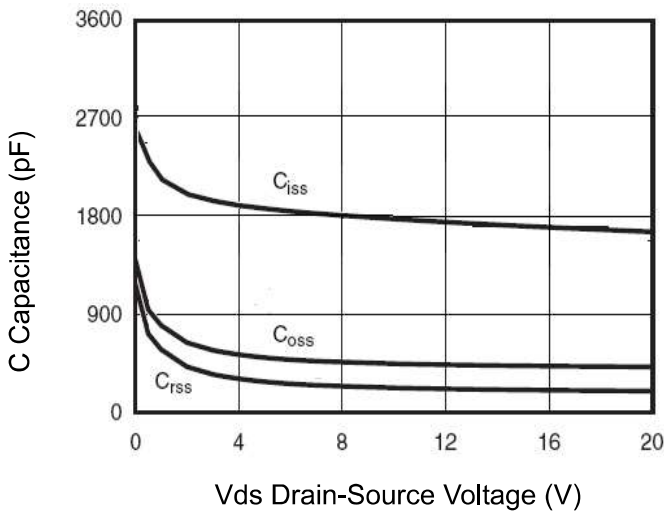
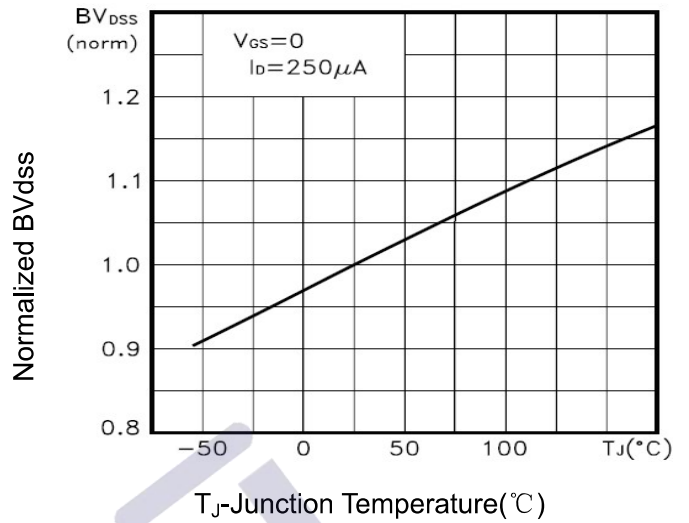


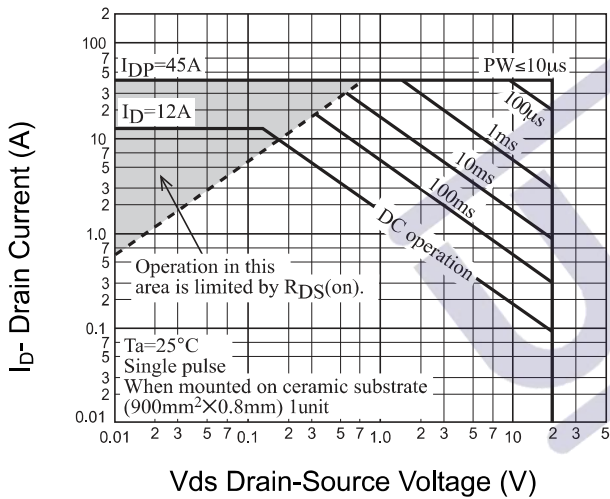
Figure 6 Source- Drain Diode Forward



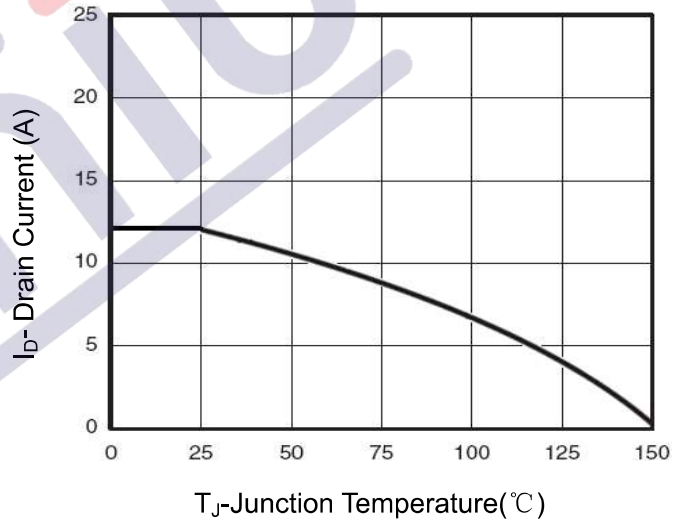
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



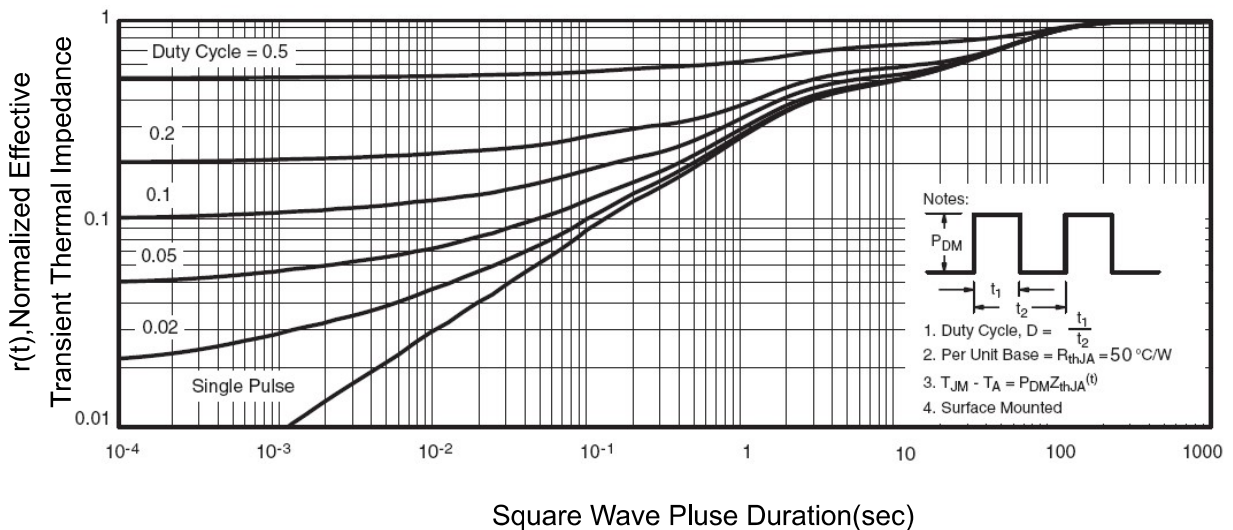
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 8 BV<sub>DSS</sub> vs Junction Temperature**



Vds Drain-Source Voltage (V)  
**Figure 9 Safe Operation Area**



T<sub>J</sub>-Junction Temperature(°C)  
**Figure 10 Current vs Junction Temperature**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## 1.版本记录

| DATE       | REV. | DESCRIPTION       |
|------------|------|-------------------|
| 2018/04/19 | 1.0  | First Release     |
| 2021/06/12 | 1.1  | Layout adjustment |
|            |      |                   |

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## 3.联系我们

浙江宇力微新能源科技有限公司

总部地址：绍兴市越城区斗门街道袍渚路25号中节能科创园45幢4/5楼

电话：0575-85087896（研发部）

传真：0575-88125157

E-mail: htw@uni-semic.com

无锡地址：无锡市新吴区纺城大道299号深港都会广场9-1401

电话：0510-85297939

E-mail: zh@uni-semic.com

深圳地址：深圳市宝安区航城街道三围社区南昌路上合工业园B2栋501

电话：0755-84510976

E-mail: htw@uni-semic.com