# AP2301MI-L

## -20V P-Channel Enhancement Mode MOSFET

### Description

The AP2301MI-L uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

### General Features

$V_{DS}$ = -20V $I_D$ =-3.2A

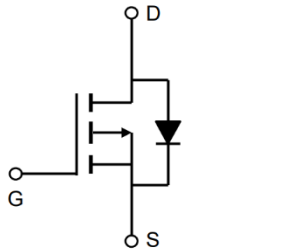
$R_{DS(ON)}$ < 125mΩ @ $V_{GS}$=-4.5V **(Type：95mΩ)**

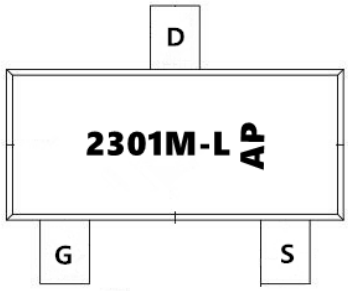
### Application

Battery protection

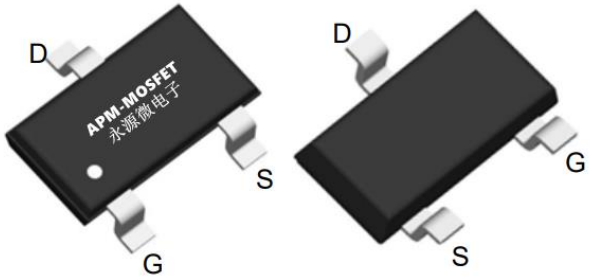
Load switch

Uninterruptible power supply




Top View Bottom View




### Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|---|---|---|---|
| AP2301MI-L | SOT23-3L | 2301MI-L AP | 3000 |

### Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | -20 | V |
| $V_{GS}$ | Gate-Source Voltage | ±12 | V |
| $I_D$@$T_A$=25℃ | Continuous Drain Current, $V_{GS}$ @ -4.5V[1] | -3.2 | A |
| $I_D$@$T_A$=70℃ | Continuous Drain Current, $V_{GS}$ @ -4.5V[1] | -1.8 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | -9.4 | A |
| $P_D$@$T_A$=25℃ | Total Power Dissipation[3] | 1.3 | W |
| $P_D$@$T_A$=70℃ | Total Power Dissipation[3] | 0.8 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ℃ |
| $R_{\theta}JA$ | Thermal Resistance Junction-Ambient [1] | 125 | ℃/W |
| RθJC | Thermal resistance, junction-case | 28 | ℃/W |

## Electrical Characteristics ($T_J$=25℃, unless otherwise noted)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| V(BR)DSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V,$I_D$= -250μA | -20 | - | - | V |
| IDSS | Zero Gate Voltage Drain Current | $V_{DS}$ = -20V, $V_{GS}$ = 0V, | - | - | -1 | μA |
| IGSS | Gate to Body Leakage Current | $V_{DS}$ =0V, $V_{GS}$ = ±12V | - | - | ±100 | nA |
| VGS(th) | Gate Threshold Voltage | $V_{DS}$= $V_{GS}$, $I_D$= -250μA | -0.4 | -0.7 | -1.0 | V |
| RDS(on) | Static Drain-Source on-Resistance | $V_{GS}$ =-4.5V, $I_D$ =-2A | - | 95 | 125 | mΩ |
| | | $V_{GS}$ =-2.5V, $I_D$ =-1A | - | 135 | 190 | |
| Ciss | Input Capacitance | $V_{DS}$ = -10V, $V_{GS}$ = 0V, f = 1.0MHz | - | 185 | - | pF |
| Coss | Output Capacitance | | - | 35 | - | pF |
| Crss | Reverse Transfer Capacitance | | - | 25 | - | pF |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = -10V, $I_D$ = -2A, $V_{GS}$ = -4.5V | - | 2.2 | - | nC |
| Qgs | Gate-Source Charge | | - | 0.5 | - | nC |
| Qgd | Gate-Drain(“Miller”) Charge | | - | 0.5 | - | nC |
| td(on) | Turn-on Delay Time | $V_{DD}$ = -10V, $R_L$=5Ω, $R_{GEN}$=3Ω,$V_{GS}$=-4.5V, | - | 10 | - | ns |
| tr | Turn-on Rise Time | | - | 30 | - | ns |
| td(off) | Turn-off Delay Time | | - | 63 | - | ns |
| $t_f$ | Turn-off Fall Time | | - | 50 | - | ns |
| IS | Maximum Continuous Drain to Source Diode Forward Current | | - | - | -2.8 | A |
| ISM | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | -8 | A |
| VSD | Drain to Source Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = -2A | - | - | -1.2 | V |

Note :
1、The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.
2、The data tested by pulsed , pulse width △ 300us , duty cycle △ 2%
3、The power dissipation is limited by 150℃ junction temperature
4、The data is theoretically the same as $I_D$ and $I_{DM}$ , in real applications , should be limited by total power dissipation.

## Typical Characteristics

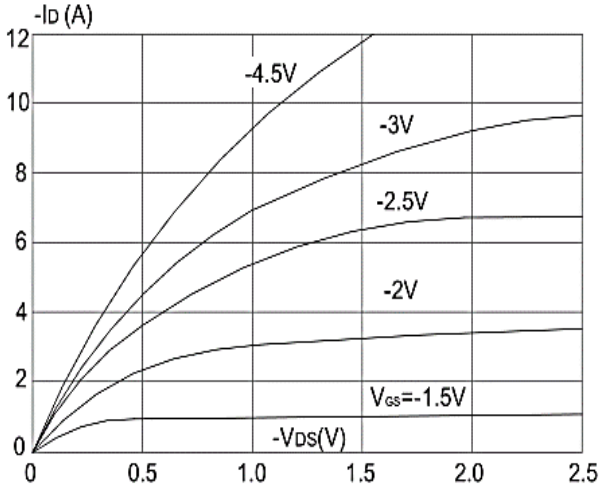



Figure1: Output Characteristics

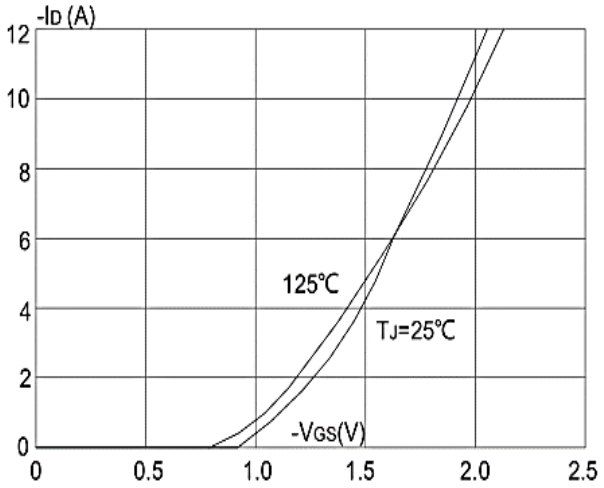



Figure 2: Typical Transfer Characteristics

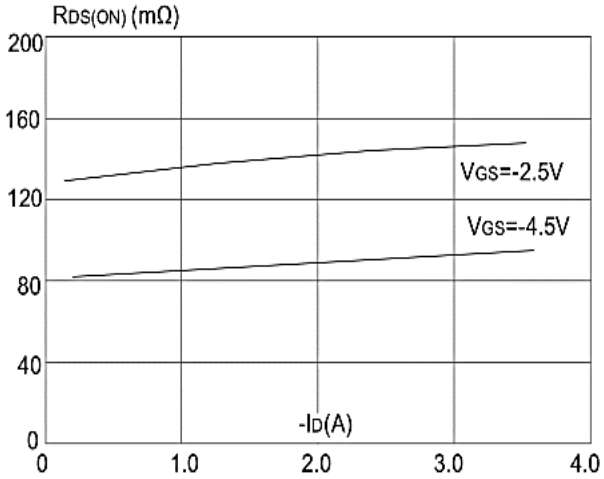



Figure 3:On-resistance vs. Drain Current

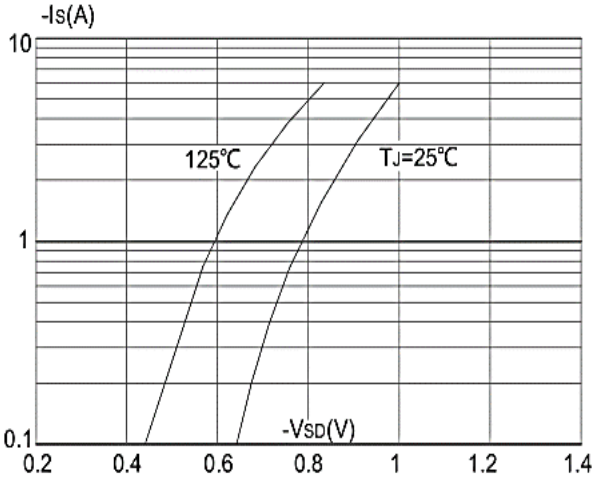



Figure 4: Body Diode Characteristics

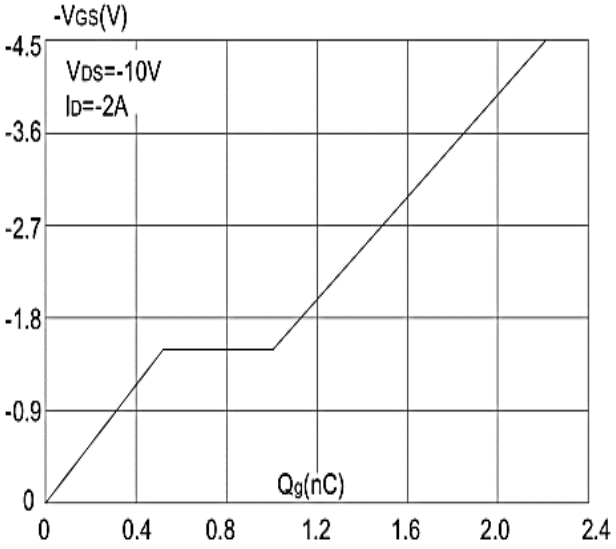



Figure 5: Gate Charge Characteristics

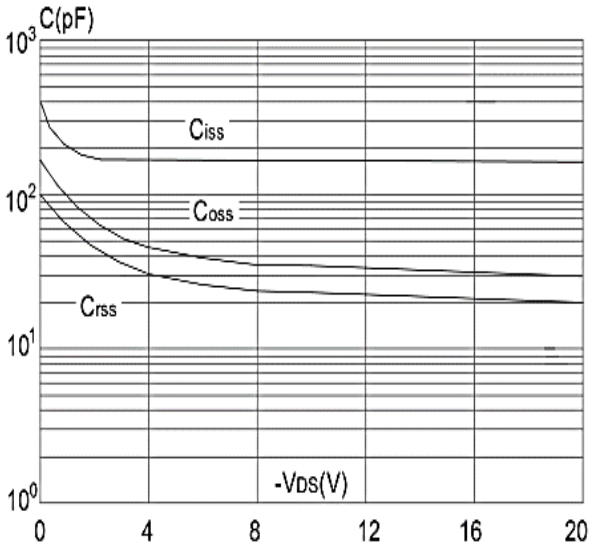



Figure 6: Capacitance Characteristics

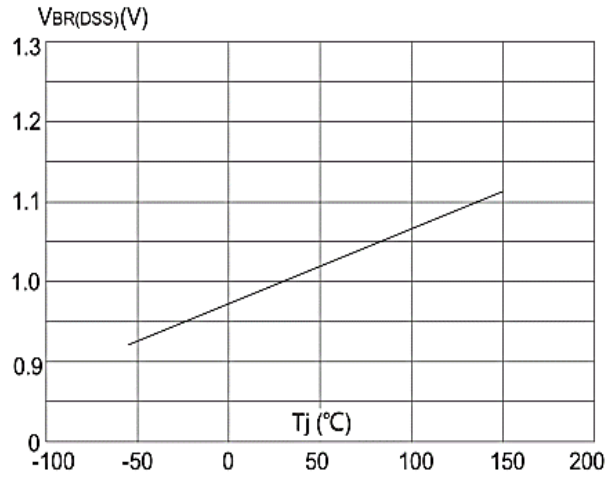



**Figure 7: Normalized Breakdown Voltage vs Junction Temperature**

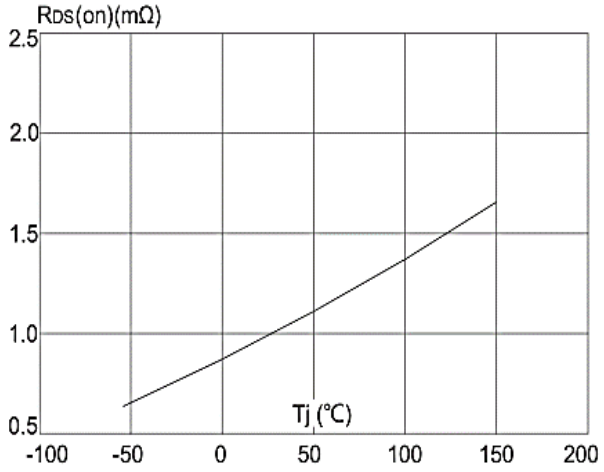



**Figure 8: Normalized on Resistance vs. Junction Temperature**

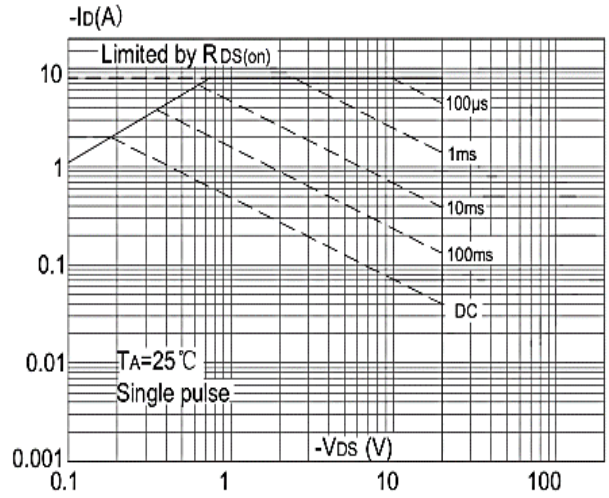



**Figure 9: Maximum Safe Operating Area**

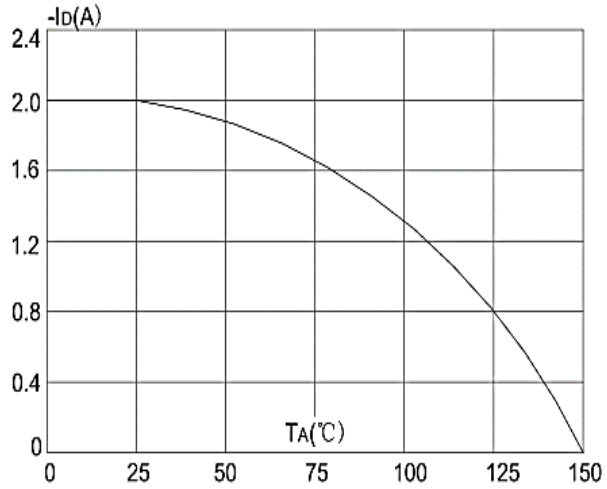



**Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature**

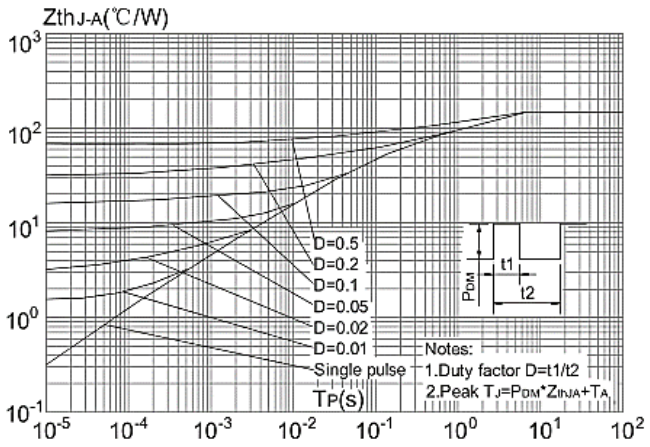
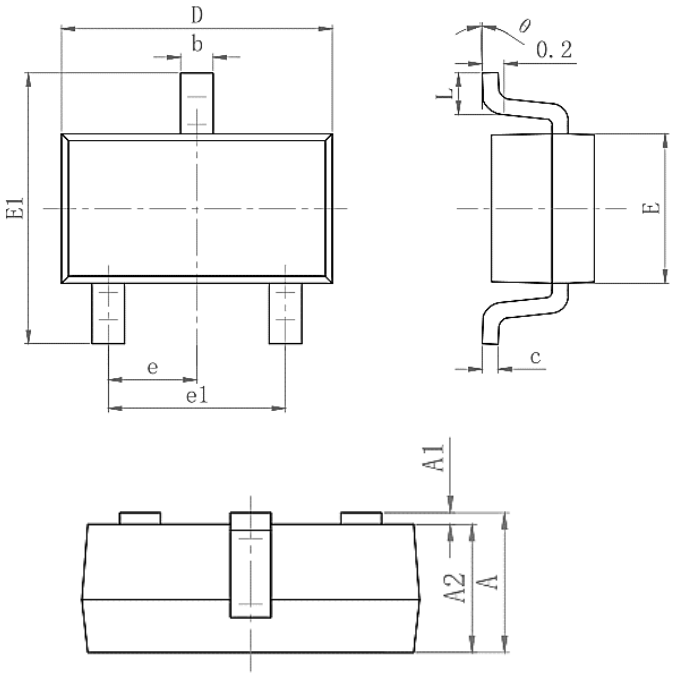



**Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambien**

## Package Mechanical Data-SOT23-3L-Single




| Symbol | Dimensions in Millimeters | |
|---|---|---|
| | mm | |
| | Min | Max |
| A | 1.05 | 1.25 |
| A1 | 0.000 | 0.100 |
| A2 | 1.05 | 1.15 |
| b | 0.25 | 0.45 |
| c | 0.100 | 0.200 |
| D | 2.820 | 3.020 |
| E | 1.500 | 1.700 |
| E1 | 2.650 | 2.950 |
| e | 0.950（BSC） | |
| e1 | 1.800 | 2.000 |
| L | 0.300 | 0.500 |
| θ | 0° | 8° |

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# AP2301MI-L

## -20V P-Channel Enhancement Mode MOSFET

| Edition | Date | Change |
|---|---|---|
| REV1.0 | 2023/4/31 | Initial release |