# AP5P04MI

## -40V P-Channel Enhancement Mode MOSFET

### Description

The AP5P04MI 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

$V_{DS}$ = -40V $I_D$ =-5.0A

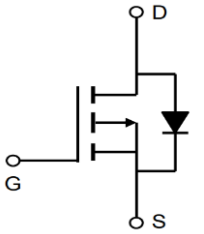
$R_{DS(ON)}$ < 72mΩ @ $V_{GS}$=-10V **（Type：65mΩ）**

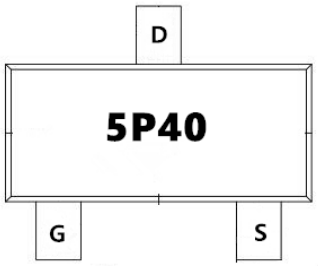
### Application

Battery protection

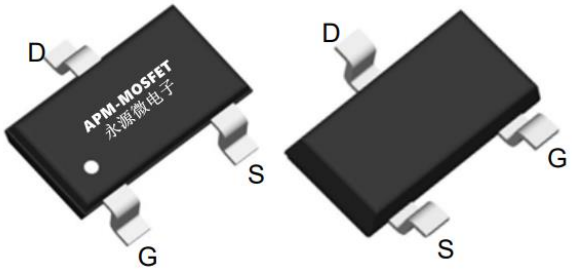
Load switch

Uninterruptible power supply




Top View Bottom View




### Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|---|---|---|---|
| AP5P04MI | SOT23-3L | 5P40 | 3000 |

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

| Symbol | Parameter | Steady State | Units |
|---|---|---|---|
| VDS | Drain-Source Voltage | -40 | V |
| VGS | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_A$=25℃ | Continuous Drain Current, $V_{GS}$ @ -4.5V[1] | -5.0 | A |
| $I_D$@$T_A$=70℃ | Continuous Drain Current, $V_{GS}$ @ -4.5V[1] | -3.0 | A |
| IDM | Pulsed Drain Current[2] | -16.1 | A |
| $P_D$@$T_A$=25℃ | Total Power Dissipation[3] | 1.32 | W |
| $P_D$@$T_A$=70℃ | Total Power Dissipation[3] | 0.84 | W |
| TSTG | 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 |
| $R_{\theta}JC$ | Thermal Resistance Junction-Case[1] | 80 | ℃/W |

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

| Symbol | Parameter | Conditions | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|---|
| BVDSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -40 | -46 | --- | V |
| △BVDSS/△TJ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=-1mA | --- | -0.018 | --- | V/℃ |
| RDS(ON) | Static Drain-Source On-Resistance[2] | $V_{GS}$=-4.5V , $I_D$=-3A | --- | 65 | 72 | mΩ |
| | | $V_{GS}$=-2.5V , $I_D$=-2A | --- | 89 | 100 | |
| VGS(th) | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -1.0 | -1.5 | -2.5 | V |
| △$V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | 2.5 | --- | mV/℃ |
| IDSS | Drain-Source Leakage Current | $V_{DS}$=-24V , $V_{GS}$=0V ,$T_J$=25℃ | --- | --- | -1 | uA |
| | | $V_{DS}$=-24V , $V_{GS}$=0V ,$T_J$=55℃ | --- | --- | -5 | |
| IGSS | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=-5V , $I_D$=-3A | --- | 5.8 | --- | S |
| $Q_g$ | Total Gate Charge (-4.5V) | $V_{DS}$=-32V , $V_{GS}$=-4.5V , $I_D$=-3A | --- | 6.4 | --- | nC |
| Qgs | Gate-Source Charge | | --- | 2.1 | --- | |
| Qgd | Gate-Drain Charge | | --- | 2.5 | --- | |
| Td(on) | Turn-On Delay Time | $V_{DD}$=-20V , $V_{GS}$=-4.5V , $R_G$=3.3Ω, $I_D$=-3A | --- | 4.2 | --- | ns |
| $T_r$ | Rise Time | | --- | 23 | --- | |
| Td(off) | Turn-Off Delay Time | | --- | 26.8 | --- | |
| $T_f$ | Fall Time | | --- | 20.6 | --- | |
| Ciss | Input Capacitance | $V_{DS}$=-15V , $V_{GS}$=0V , f=1MHz | --- | 620 | --- | pF |
| Coss | Output Capacitance | | --- | 65 | --- | |
| Crss | Reverse Transfer Capacitance | | --- | 53 | --- | |
| IS | Continuous Source Current[1,4] | $V_G$=$V_D$=0V , Force Current | --- | --- | -5.2 | A |
| ISM | Pulsed Source Current[2,4] | | --- | --- | -16.1 | A |
| VSD | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=-1A , $T_J$=25℃ | --- | --- | -1 | V |

**Note :**

1、The data tested by surface mounted on a 1 inch 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

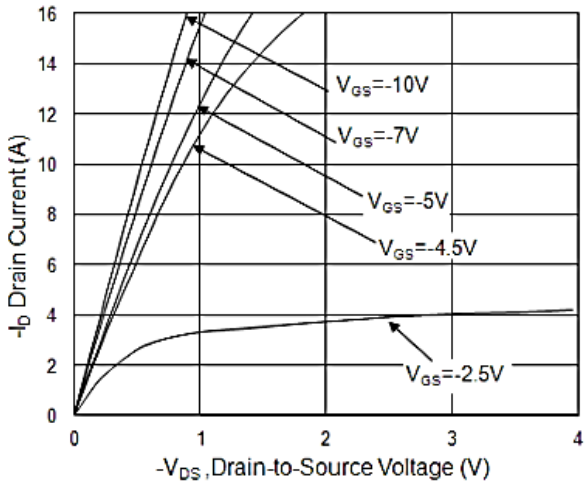


Fig.1 Typical Output Characteristics

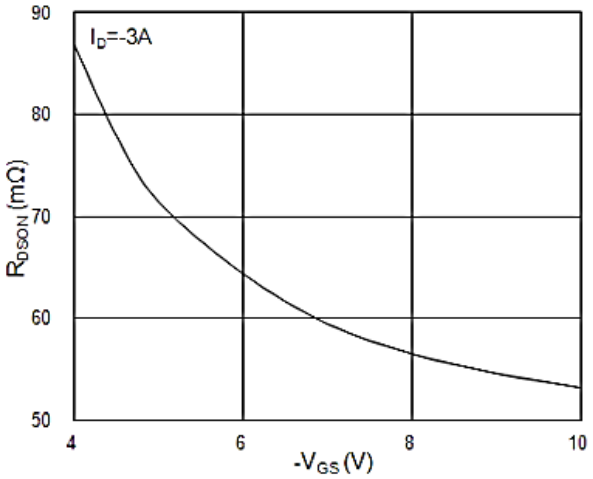


Fig.2 On-Resistance vs. G-S Voltage

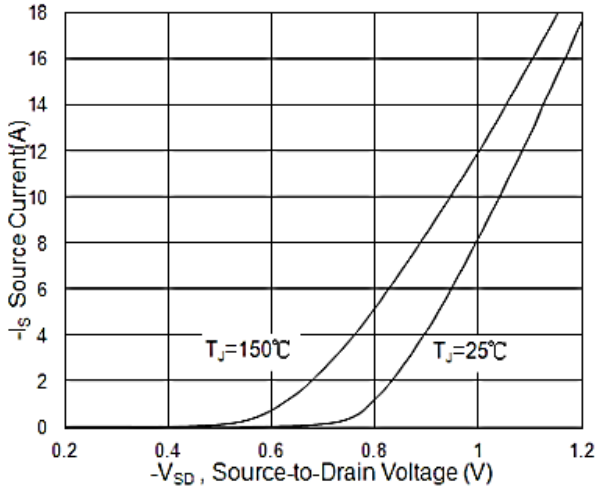


Fig.3 Forward Characteristics Of Reverse

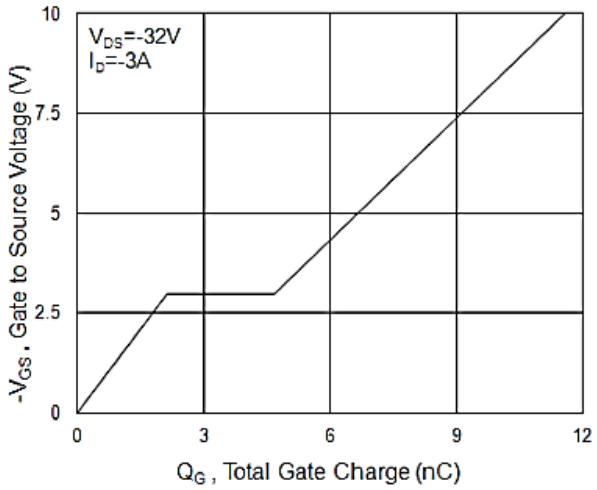


Fig.4 Gate-Charge Characteristics

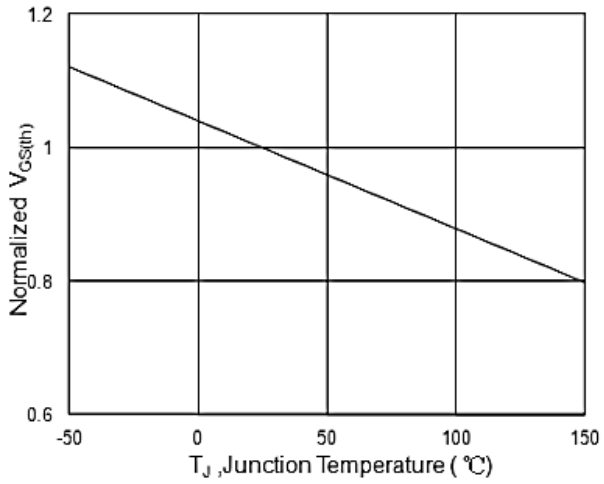


Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$

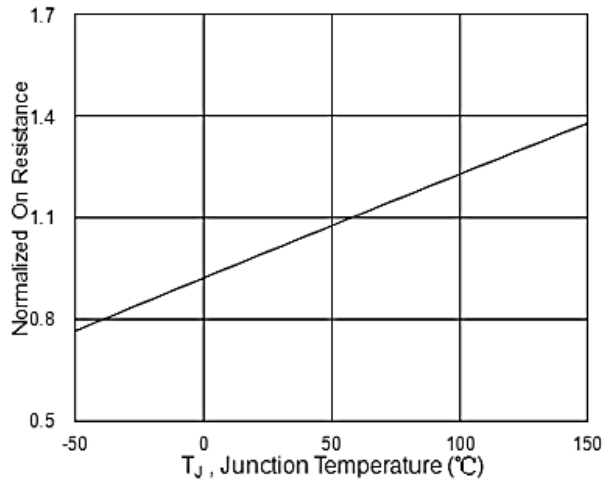


Fig.6 Normalized $R_{DSON}$ vs. $T_J$

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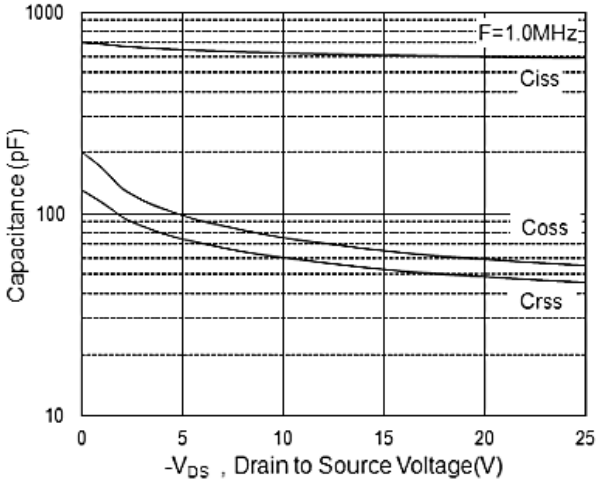


Fig.7 Capacitance

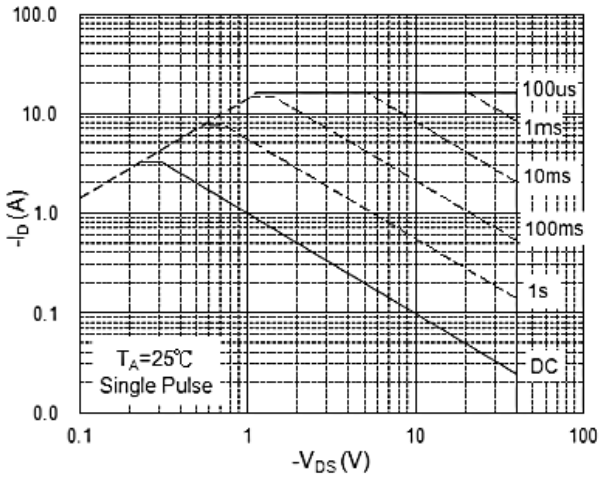


Fig.8 Safe Operating Area

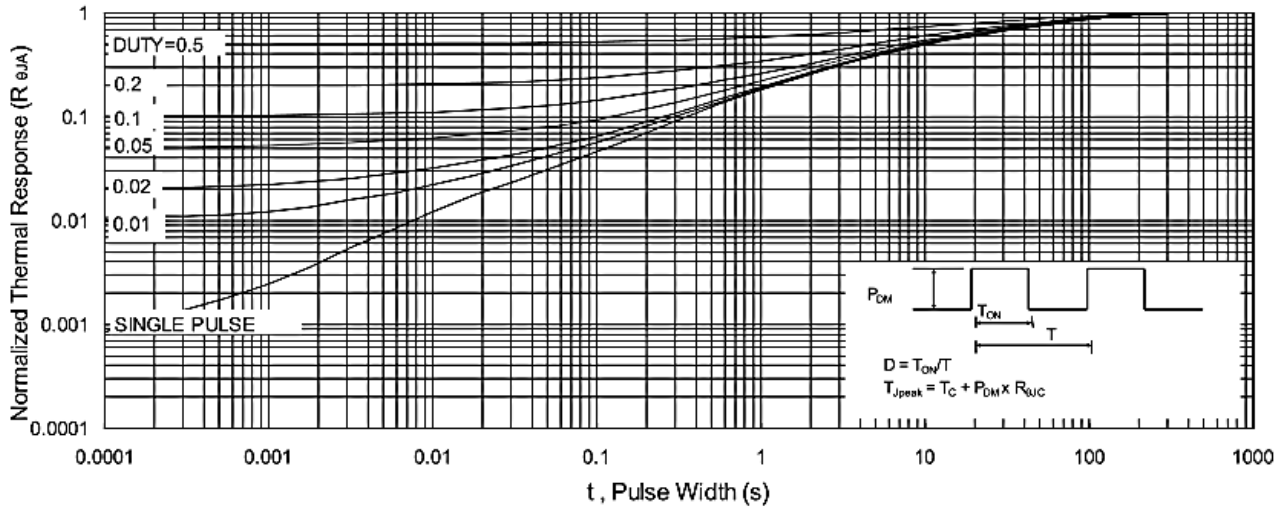


Fig.9 Normalized Maximum Transient Thermal Impedance

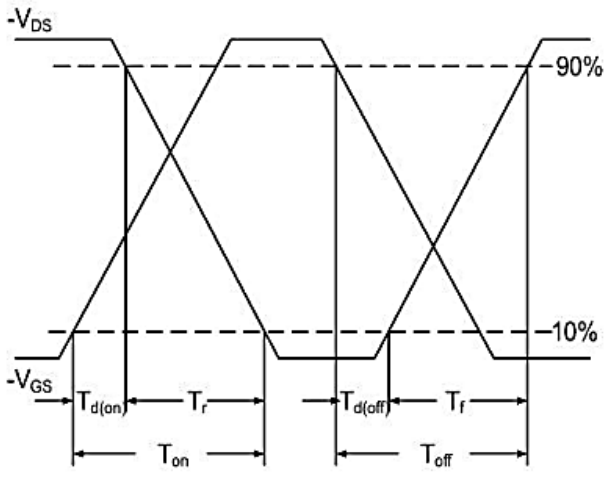


Fig.10 Switching Time Waveform

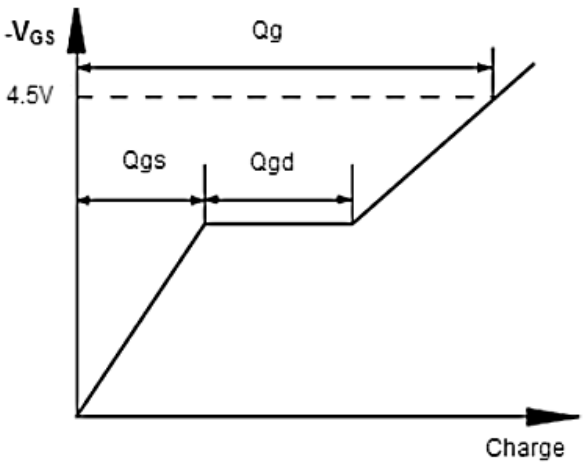


Fig.11 Gate Charge Waveform

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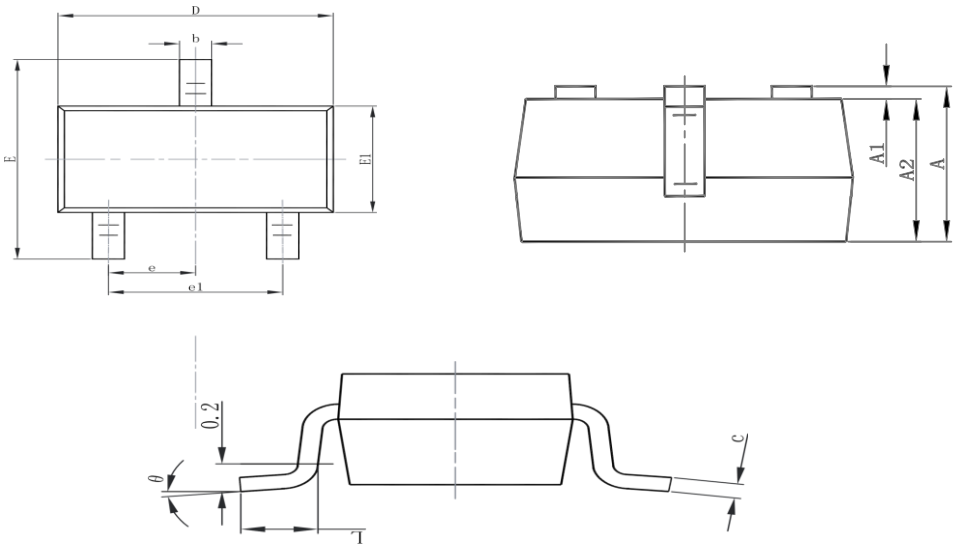
## Package Mechanical Data:SOT23-3L




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E1 | 1.500 | 1.700 | 0.059 | 0.067 |
| E | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950(BSC) | | 0.037(BSC) | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

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