

-30V P-Channel Enhancement Mode MOSFET

Description

The AP3409MI 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

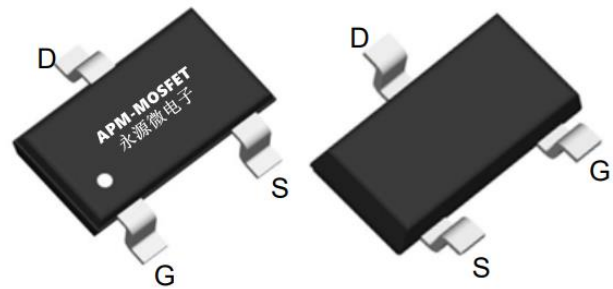
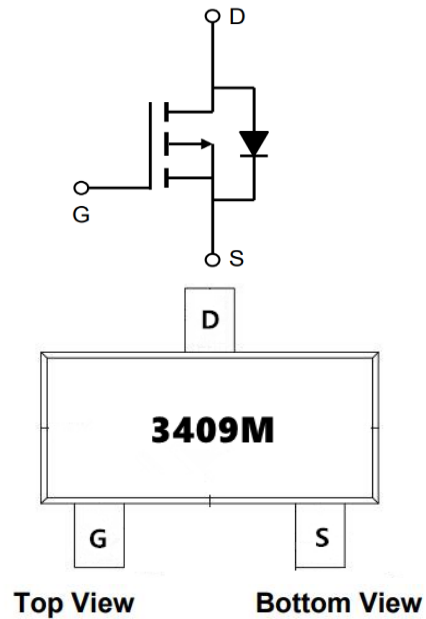
$V_{DS} = -30V$ $I_D = -12A$

$R_{DS(ON)} < 30m\Omega$ @ $V_{GS} = -10V$ (Type: 25m Ω)

Application

Boost driver

Brushless motor



Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|------------|----------|---------|----------|
| AP3409MI | SOT23-3L | 3409M | 3000 |

Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

| Symbol | Parameter | Rating | Units |
|--------------------------|--|------------|--------------|
| V_{DS} | Drain-Source Voltage | -30 | V |
| V_{GS} | Gate-Source Voltage | ± 20 | V |
| $I_D @ T_C = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ -4.5V^1$ | -12 | A |
| $I_D @ T_C = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ -4.5V^1$ | -7.5 | A |
| IDM | Pulsed Drain Current ² | -36 | A |
| $P_D @ T_C = 25^\circ C$ | Total Power Dissipation ³ | 1.8 | W |
| TSTG | Storage Temperature Range | -55 to 150 | $^\circ C$ |
| T_J | Operating Junction Temperature Range | -55 to 150 | $^\circ C$ |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient ¹ | 125 | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case ¹ | 110 | $^\circ C/W$ |



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

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|--------------|--|--|------|------|-----------|------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=-250\mu A$ | -30 | -33 | --- | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance ² | $V_{GS}=-10V, I_D=-7A$ | --- | 25 | 32 | m Ω |
| | | $V_{GS}=-4.5V, I_D=-5A$ | --- | 37 | 54 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}=V_{DS}, I_D=-250\mu A$ | -1.0 | -1.5 | -2.5 | V |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=-24V, V_{GS}=0V, T_J=25^\circ\text{C}$ | --- | --- | -1 | μA |
| | | $V_{DS}=-24V, V_{GS}=0V, T_J=55^\circ\text{C}$ | --- | --- | -5 | |
| I_{GSS} | Gate-Source Leakage Current | $V_{GS}=\pm 20V, V_{DS}=0V$ | --- | --- | ± 100 | nA |
| g_{fs} | Forward Transconductance | $V_{DS}=-5V, I_D=-7A$ | --- | 15 | --- | S |
| R_g | Gate Resistance | $V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$ | | 15 | 30 | Ω |
| Q_g | Total Gate Charge (-4.5V) | $V_{DS}=-20V, V_{GS}=-4.5V, I_D=-7A$ | --- | 9.8 | --- | nC |
| Q_{gs} | Gate-Source Charge | | --- | 2.2 | --- | |
| Q_{gd} | Gate-Drain Charge | | --- | 3.4 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}=-15V, V_{GS}=-10V, R_G=3.3\Omega, I_D=-5A$ | --- | 16.4 | --- | ns |
| T_r | Rise Time | | --- | 20.2 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 55 | --- | |
| T_f | Fall Time | | --- | 10 | --- | |
| C_{iss} | Input Capacitance | $V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$ | --- | 930 | --- | pF |
| C_{oss} | Output Capacitance | | --- | 148 | --- | |
| C_{rss} | Reverse Transfer Capacitance | | --- | 115 | --- | |
| I_S | Continuous Source Current ^{1,5} | $V_G=V_D=0V, \text{Force Current}$ | --- | --- | -8 | A |
| V_{SD} | Diode Forward Voltage ² | $V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$ | --- | --- | -1.2 | V |

Note :

- 1、 The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2、 The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3、 The power dissipation is limited by 150 $^\circ\text{C}$ 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

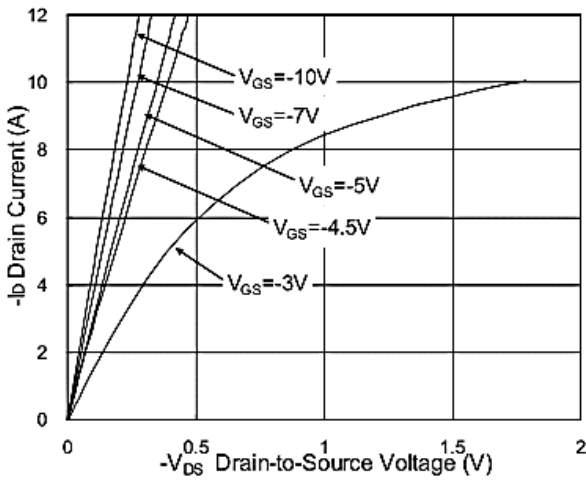


Fig.1 Typical Output Characteristics

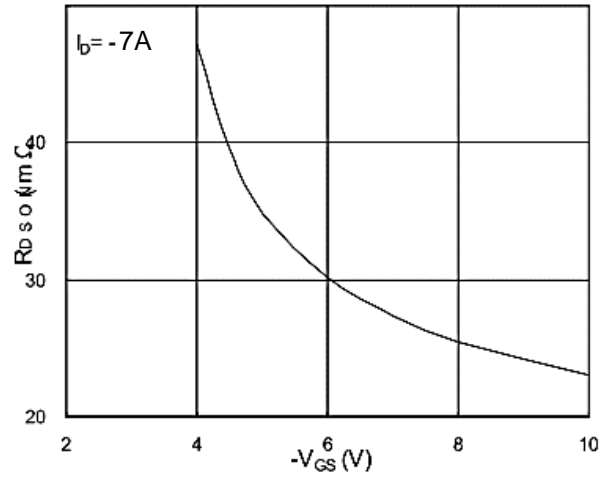


Fig.2 On-Resistance v.s Gate-Source

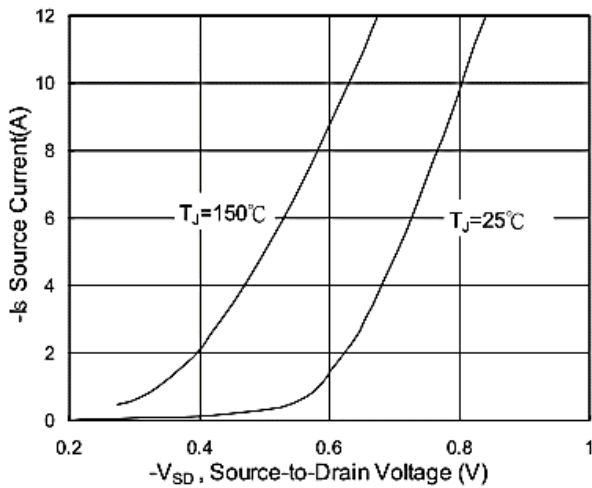


Fig.3 Forward Characteristics Of Reverse

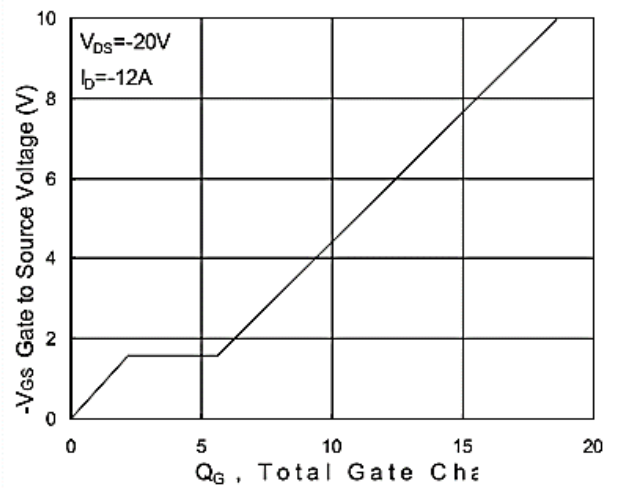


Fig.4 Gate-Charge Characteristics

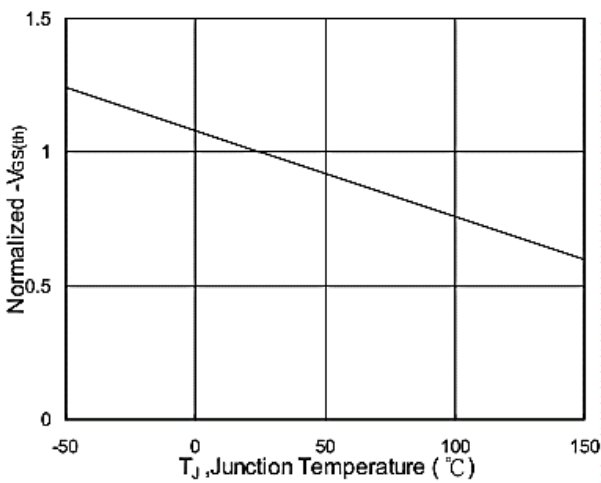


Fig.5 Normalized $V_{GS(th)}$ v.s T_j

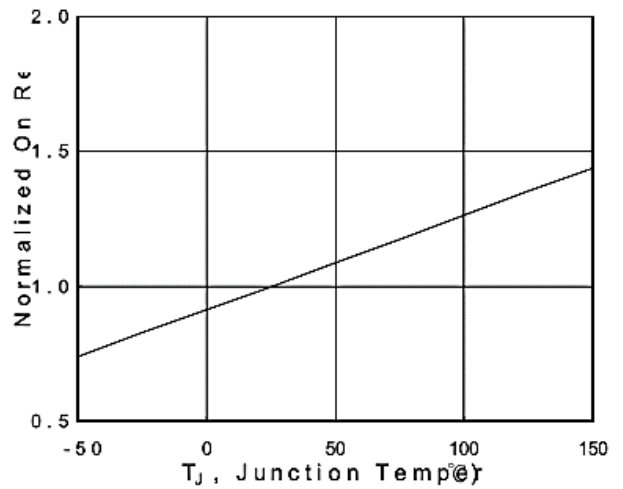


Fig.6 Normalized $R_{DS(on)}$ v.s T_j



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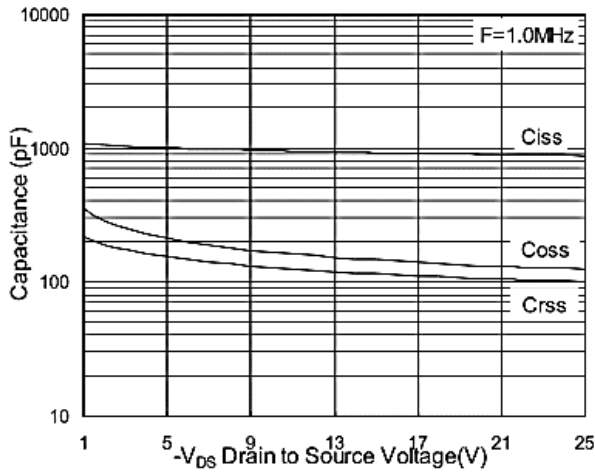


Fig.7 Capacitance

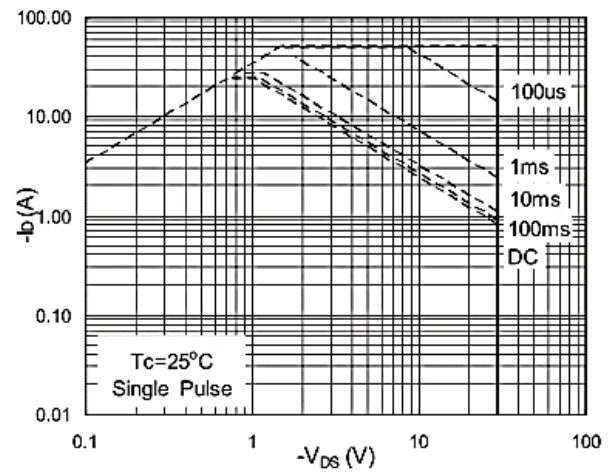


Fig.8 Safe Operating Area

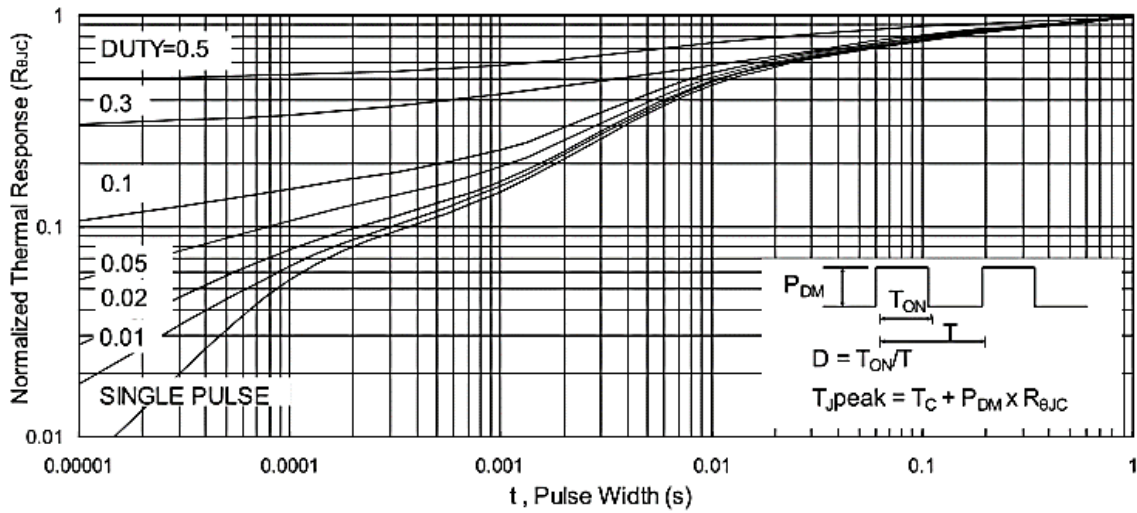


Fig.9 Normalized Maximum Transient Thermal Impedance

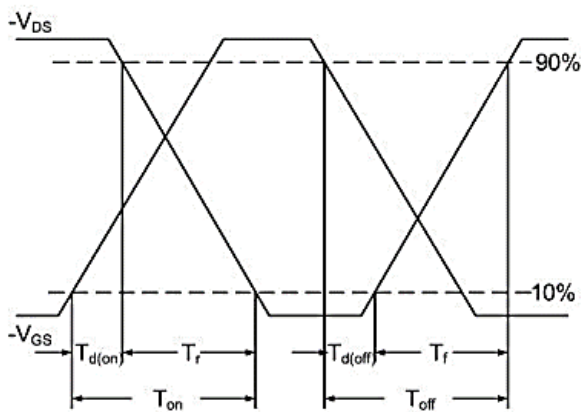


Fig.10 Switching Time Waveform

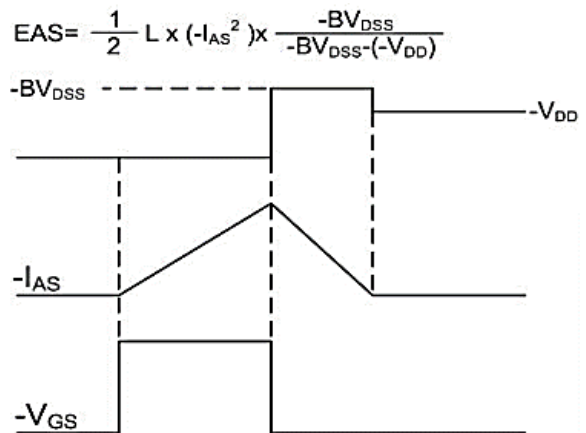
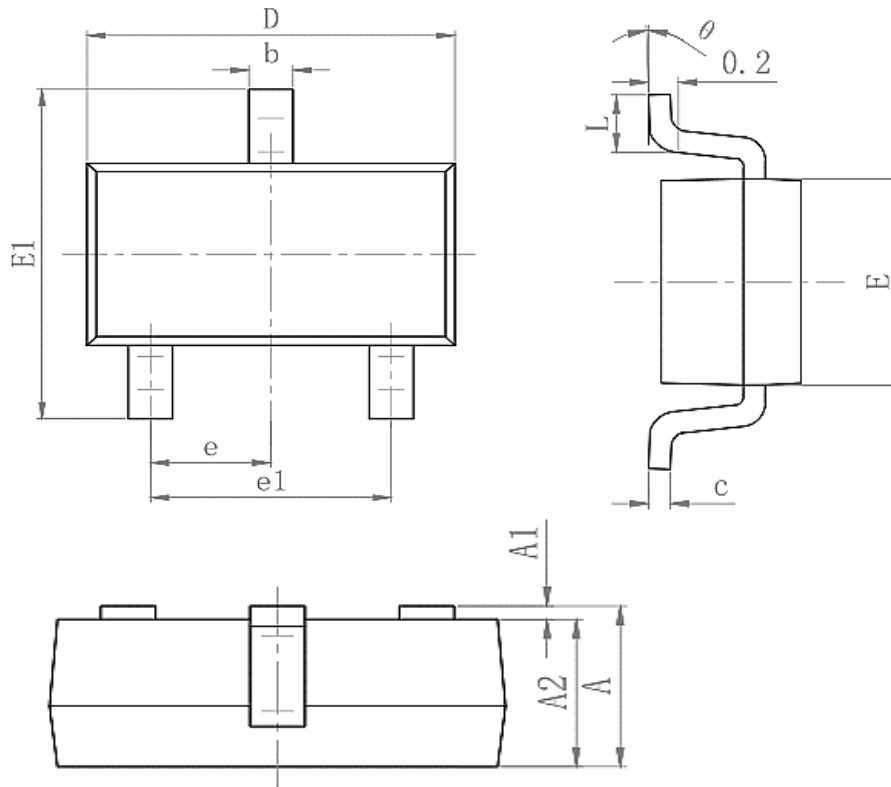


Fig.11 Unclamped Inductive Waveform

Package Mechanical Data-SOT23-3-XC-Single



| Symbol | Dimensions In Millimeters | |
|--------|---------------------------|-------|
| | Min. | Max. |
| A | 1.050 | 1.250 |
| A1 | 0.000 | 0.100 |
| A2 | 1.050 | 1.150 |
| b | 0.25 | 0.45 |
| c | 0.100 | 0.200 |
| D | 2.820 | 3.020 |
| E | 1.5 | 1.7 |
| E1 | 2.650 | 2.950 |
| e | 0.950(BSC) | |
| e1 | 1.800 | 2.000 |
| L | 0.300 | 0.500 |
| θ | 0° | 8° |

-30V P-Channel Enhancement Mode MOSFET**Attention**

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