



P-Channel Enhancement Mode Power MOSFET **MXD60P02**

DESCRIPTION

The MXD60P02 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.

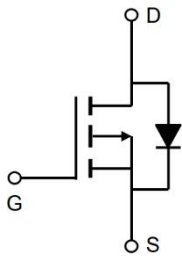
GENERAL FEATURES

- $V_{DS}=-20V$, $I_D=-60A$
 $R_{DS(ON)}(Typ.)=11m\Omega$ @ $V_{GS}=-2.5V$
 $R_{DS(ON)}(Typ.)=8m\Omega$ @ $V_{GS}=-4.5V$

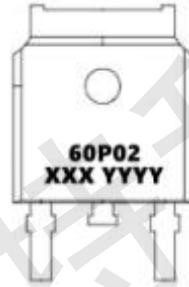
APPLICATION

- Battery protection
- Load switch
- Uninterruptible power supply

PINOUT



Schematic diagram



Marking and pin Assignment



TO-252-3L top view

ORDERING INFORMATION

| Part Number | Storage Temperature | Package | Devices Per Reel |
|-------------|---------------------|-----------|------------------|
| MXD60P02 | -55°C to 150°C | TO-252-3L | 2500 |

ABSOLUTE MAXIMUM RATINGS ($T_C=25^\circ C$ unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|---|-----------------|------------|------|
| Drain-Source Voltage | V_{DS} | -20 | V |
| Gate-Source Voltage | V_{GS} | ± 12 | V |
| Drain Current-Continuous ($V_{GS}=-4.5V$, $T_C=25^\circ C$) ^(Note1) | I_D | -60 | A |
| Drain Current-Continuous ($V_{GS}=-4.5V$, $T_C=70^\circ C$) ^(Note1) | I_D | -48 | A |
| Pulsed Drain Current ^(Note2) | I_{DM} | -200 | A |
| Total Power Dissipation ($T_C=25^\circ C$) ^(Note3) | P_D | 60 | W |
| Total Power Dissipation ($T_C=70^\circ C$) ^(Note3) | P_D | 48 | W |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 150 | °C |
| Thermal Resistance, Junction-to-Ambient ^(Note1) | $R_{\theta JA}$ | 75 | °C/W |
| Thermal Resistance, Junction-to-Ambient ($t \leq 10s$) ^(Note1) | $R_{\theta JA}$ | 40 | °C/W |
| Thermal Resistance, Junction-to-Case ^(Note1) | $R_{\theta JC}$ | 3.6 | °C/W |

Note1. The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.

Note2. The data tested by pulsed , Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.

Note3. The power dissipation is limited by 175°C junction temperature



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ELECTRICAL CHARACTERISTICS($T_J=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|--------------|---|------|-------|-----------|------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=-250\mu A$ | -20 | -22 | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=-20V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 12V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\mu A$ | -0.4 | -0.65 | -1.0 | V |
| Drain-Source On-State Resistance ^(Note2) | $R_{DS(ON)}$ | $V_{GS}=-2.5V, I_D=-5.0A$ | - | 11 | 16 | m Ω |
| | | $V_{GS}=-4.5V, I_D=-10A$ | - | 8 | 12 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=-10V, I_D=-10A$ | 12 | - | - | S |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS}=-15V, V_{GS}=0V, F=1.0MHz$ | - | 1600 | - | pF |
| Output Capacitance | C_{oss} | | - | 350 | - | pF |
| Reverse Transfer Capacitance | C_{rss} | | - | 300 | - | pF |
| Switching Characteristics | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=-10V, I_D=-1A, V_{GS}=-4.5V, R_G=6.0\Omega$ | - | 10 | - | nS |
| Turn-on Rise Time | t_r | | - | 15 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 110 | - | nS |
| Turn-Off Fall Time | t_f | | - | 70 | - | nS |
| Total Gate Charge | Q_g | $V_{DS}=-10V, I_D=-10A, V_{GS}=-4.5V$ | - | 63 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 9.1 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 13 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Continuous Source Current ^(Note1, 3) | I_S | $V_G=V_D=0V$, Force Current | - | - | -50 | A |
| Diode Forward Voltage ^(Note2) | V_{SD} | $V_{GS}=0V, I_S=-15A$ | - | - | -1.2 | V |

Note1. The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.

Note2. The data tested by pulsed , pulse width $\cong 300\mu s$, duty cycle $\cong 2\%$.

Note3. The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.



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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 1. Power Dissipation

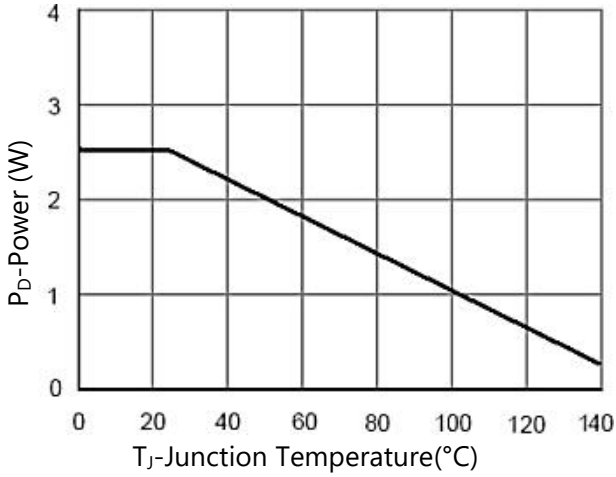


Figure 2. Drain Current

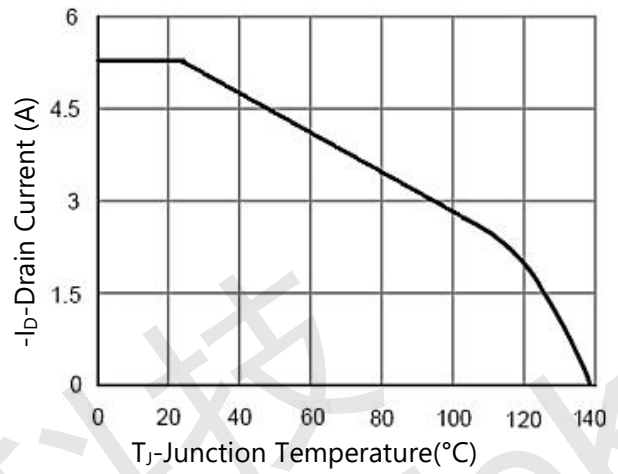


Figure 3. Output Characteristics

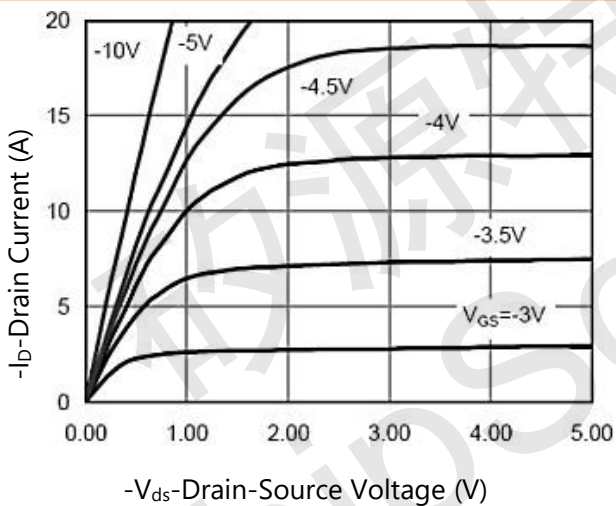


Figure 4. Drain-Source On-Resistance

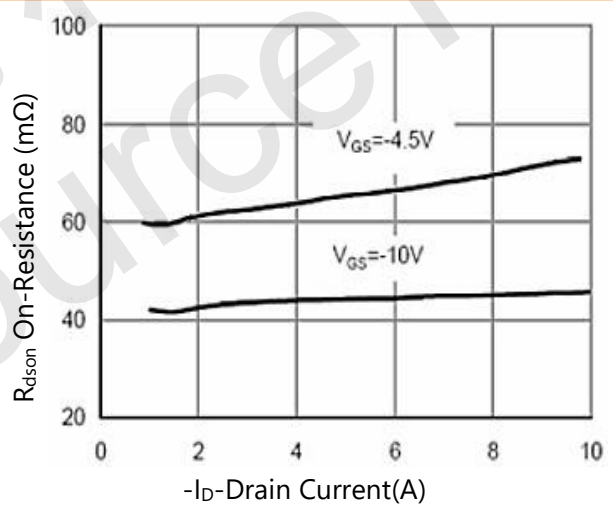


Figure 5. Transfer Characteristics

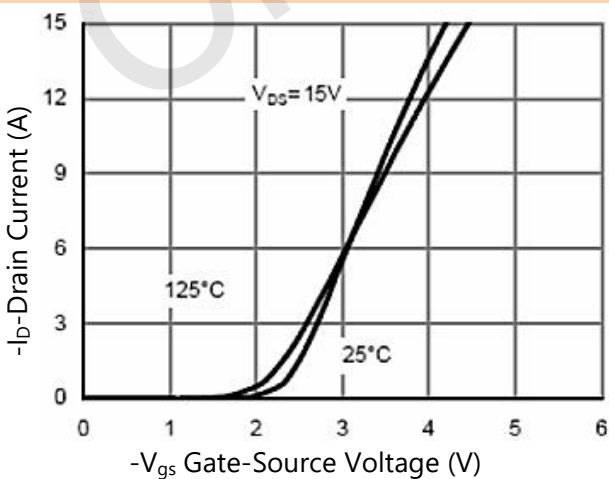
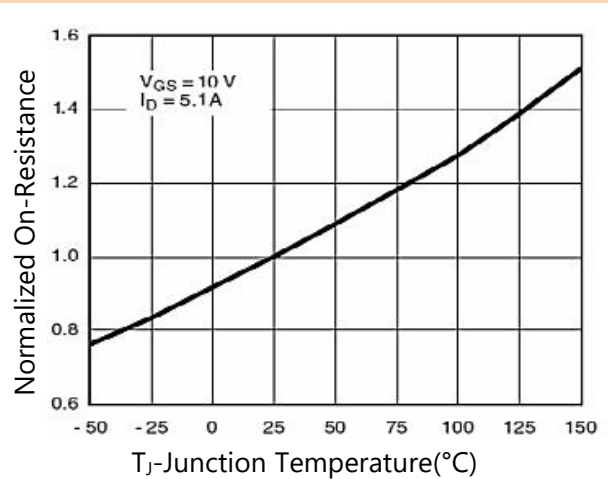


Figure 6. R_{DS(on)} vs Junction Temperature





TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 7. $R_{ds(on)}$ vs V_{gs}

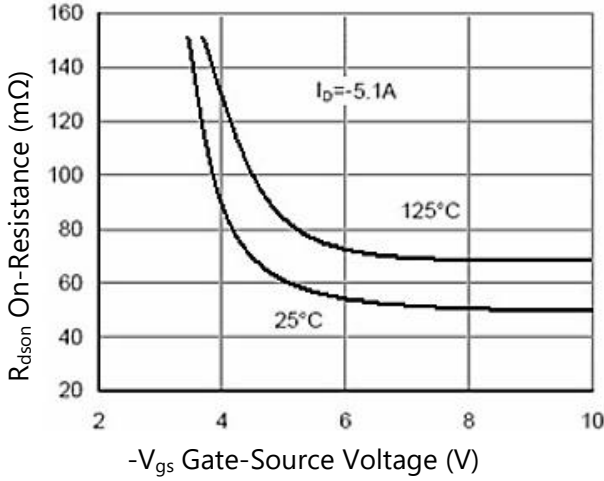


Figure 8. Capacitance vs V_{ds}

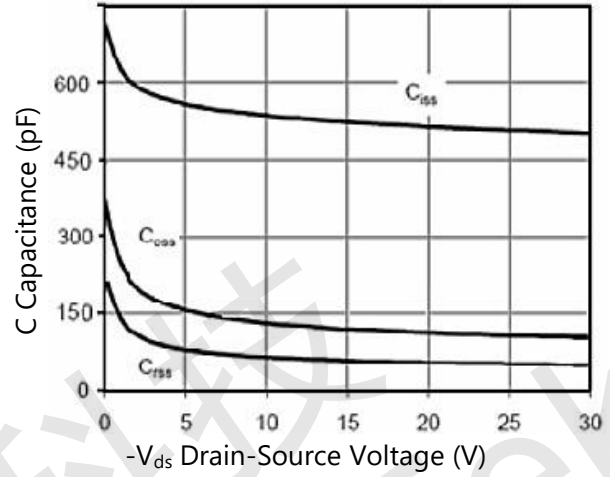


Figure 9. Gate Charge

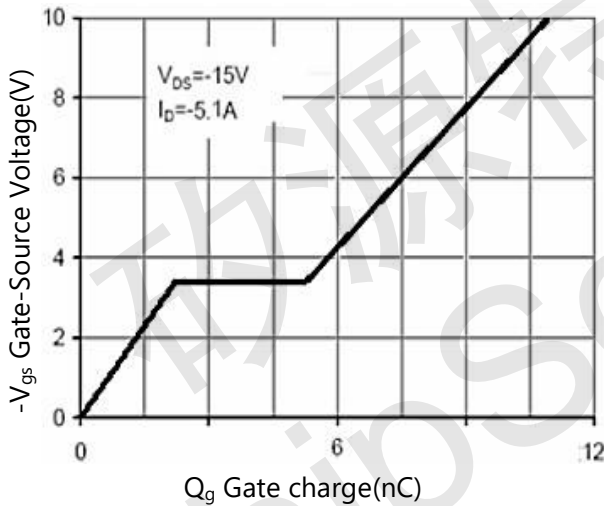


Figure 10. Source-Drain Diode Forward

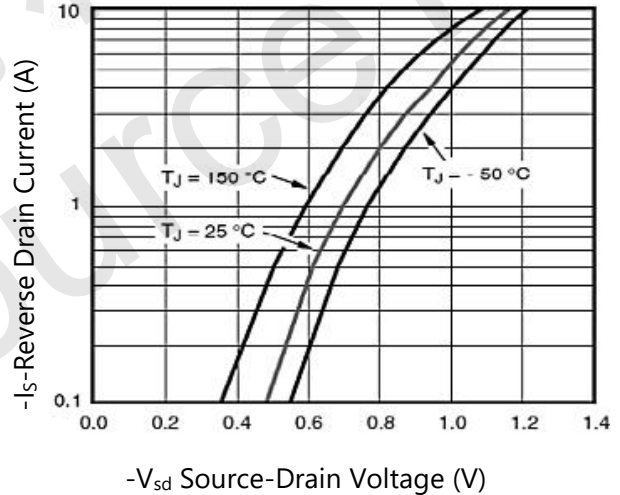
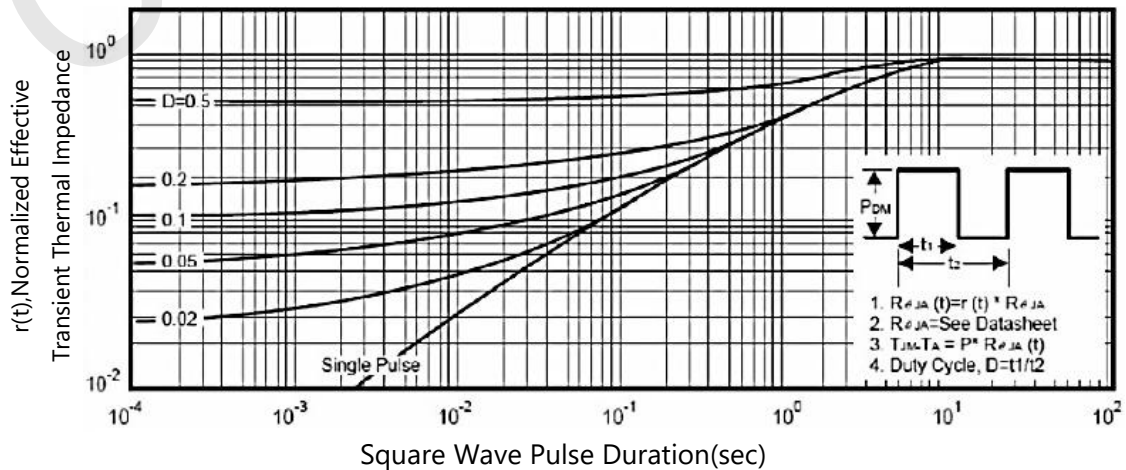


Figure 11. Normalized Maximum Transient Thermal Impedance

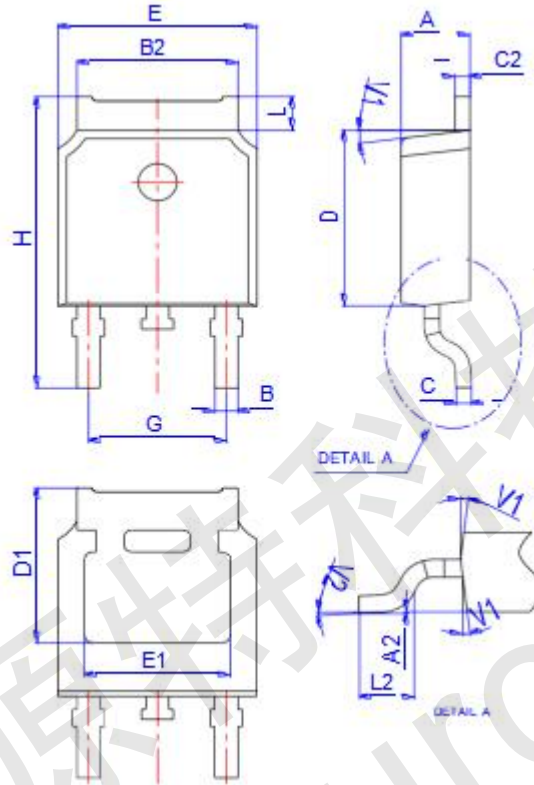




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 **PACKAGE INFORMATION**

TO-252-3L



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 2.10 | 2.50 | 0.083 | 0.098 |
| A2 | 0 | 0.10 | 0 | 0.004 |
| B | 0.66 | 0.86 | 0.026 | 0.034 |
| B2 | 5.18 | 5.48 | 0.202 | 0.216 |
| C | 0.40 | 0.60 | 0.016 | 0.024 |
| C2 | 0.44 | 0.58 | 0.017 | 0.023 |
| D | 5.90 | 6.30 | 0.232 | 0.248 |
| D1 | 5.30REF | | 0.209REF | |
| E | 6.40 | 6.80 | 0.252 | 0.268 |
| E1 | 4.63 | - | 0.182 | - |
| G | 4.47 | 4.67 | 0.176 | 0.184 |
| H | 9.50 | 10.70 | 0.374 | 0.421 |
| L | 1.09 | 1.21 | 0.043 | 0.048 |
| L2 | 1.35 | 1.65 | 0.053 | 0.065 |
| V1 | 7°TYP | | 7°TYP | |
| V2 | 0° | 6° | 0° | 6° |