



N-Channel 20V (D-S) MOSFET

General Description

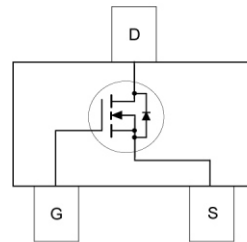
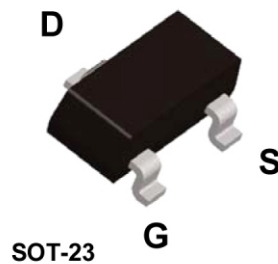
This miniature surface mount MOSFET uses advanced trench process, low $R_{DS(on)}$ assures minimal power loss and energy conversion, which makes this device ideal for use in power management circuit.

Applications

- Load switch
- DC-DC converters
- Power management

Features

- $V_{DS} (V) = 20V$
- $I_D (A) = 6.0A$ ($V_{GS} = 4.5V$)
- $R_{DS(on)} = 24m\Omega @ V_{GS} = 4.5V$
- $R_{DS(on)} = 33m\Omega @ V_{GS} = 2.5V$
- $R_{DS(on)} = 52m\Omega @ V_{GS} = 1.8V$
- Low gate charge
- Fast switching speed



Absolute Maximum Ratings ($T_A = 25^\circ C$ Unless Otherwise Noted)

| Parameter | | Symbol | Maximum | Units |
|---|--------------------|----------------|------------|------------|
| Drain-Source Voltage | | V_{DS} | 20 | V |
| Gate-Source Voltage | | V_{GS} | ± 8 | |
| Continuous Drain Current ^a | $T_A = 25^\circ C$ | I_D | 6.0 | A |
| | $T_A = 70^\circ C$ | | 4.8 | |
| Pulsed Drain Current ^b | | I_{DM} | 24 | |
| Continuous Source Current (Diode Conduction) ^a | | I_S | 1.5 | A |
| Power Dissipation ^a | $T_A = 25^\circ C$ | P_D | 1.4 | W |
| | $T_A = 70^\circ C$ | | 1.0 | |
| Operating Junction and Storage Temperature Range | | T_J, T_{stg} | -55 to 150 | $^\circ C$ |

Thermal Resistance Ratings

| Parameter | | Symbol | Maximum | Units |
|--|-----------------|-----------------|---------|--------------|
| Maximum Junction-to-Ambient ^a | $t \leq 10$ sec | $R_{\theta JA}$ | 90 | $^\circ C/W$ |
| | Steady-State | | 130 | |



Package Outlines and Ordering Information

| Device | Device Marking | Reel Size | Tape Width | Quantity |
|--------|----------------|-----------|------------|------------|
| MI2312 | MPDS | 7" | 8mm | 3000 units |

Specifications (TA = 25°C Unless Otherwise Noted)

| Parameter | Symbol | Test Conditions | Limits | | | Units |
|---|---------------|---|--------|------|-----------|-------|
| | | | Min | Typ | Max | |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$ | 20 | | | V |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 0.60 | 0.85 | 1.20 | V |
| Gate-Body Leakage | I_{GSS} | $V_{DS}=0V, V_{GS}=\pm 8V$ | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=20V, V_{GS}=0V$ | | | 1 | uA |
| | | $V_{DS}=20V, V_{GS}=0V, T_J=55^\circ C$ | | | 10 | |
| On-State Drain Current ^c | $I_{D(on)}$ | $V_{DS}=5V, V_{GS}=4.5V$ | 24 | | | A |
| Drain-Source On-Resistance ^c | $R_{DS(on)}$ | $V_{GS}=4.5V, I_D=6.0A$ | | 23 | 24 | mΩ |
| | | $V_{GS}=2.5V, I_D=2.8A$ | | 30 | 33 | |
| | | $V_{GS}=1.8V, I_D=2.0A$ | | 48 | 52 | |
| Forward Transconductance ^c | g_{fs} | $V_{DS}=5V, I_D=6.0A$ | | 20 | | S |
| Diode Forward Voltage | V_{SD} | $I_S=1.0A, V_{GS}=0V$ | | 0.70 | 1.20 | V |
| Dynamic | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS}=10V, V_{GS}=0V$ $f=1MHz$ | | 880 | | pF |
| Output capacitance | C_{oss} | | | 180 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 85 | | |
| Total Gate Charge | Q_g | $V_{DS}=10V, V_{GS}=4.5V$ $I_D=6.0A$ | | 7.0 | 10 | nC |
| Gate-Source Charge | Q_{gs} | | | 1.20 | | |
| Gate-Drain Charge | Q_{gd} | | | 1.90 | | |
| Switching | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DS}=10V, I_D=1.0A,$ $R_G=6\text{ ohm}, V_{GEN}=4.5V$ | | 9 | 17 | ns |
| Rise Time | t_r | | | 11 | 18 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 18 | 29 | |
| Fall-Time | t_f | | | 5 | 10 | |

Notes: a. Surface Mounted on 1" x 1" FR4 Board.
 b. Pulse width limited by maximum junction temperature
 c. Pulse test: PW ≤ 300us duty cycle ≤ 2%.



Typical Electrical and Thermal Characteristics

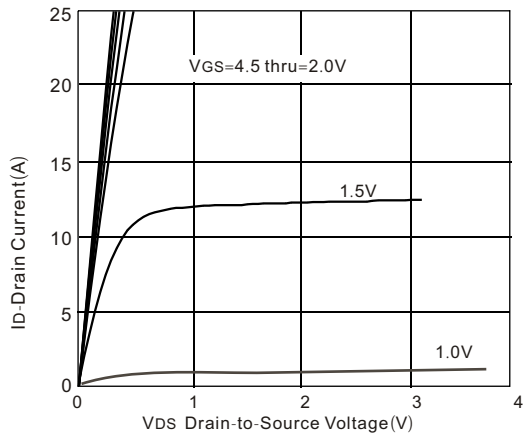


Figure1: Output Characteristics

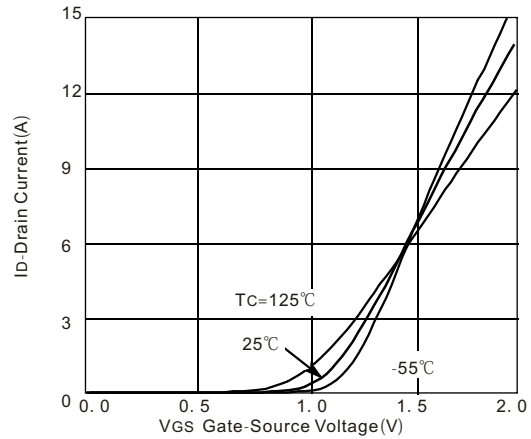


Figure2: Transfer Characteristics

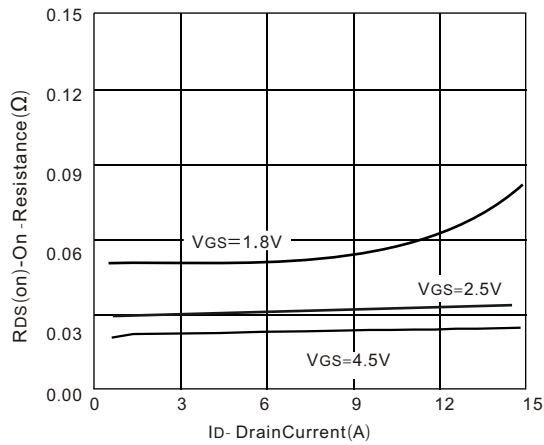


Figure3: On-Resistance vs Drain Current

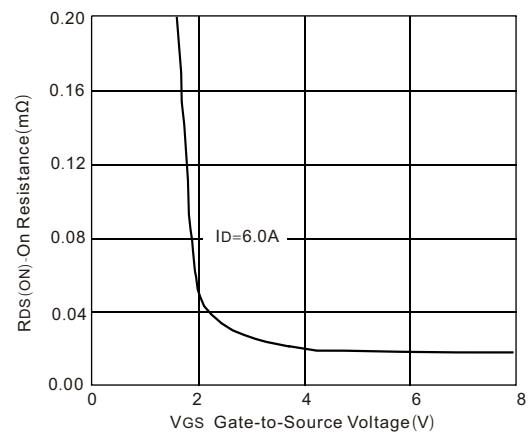


Figure4: On-Resistance vs. Gate-to-Source Voltage

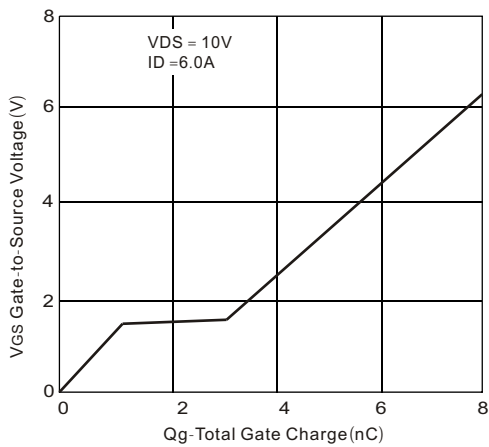


Figure5 :Gate Change

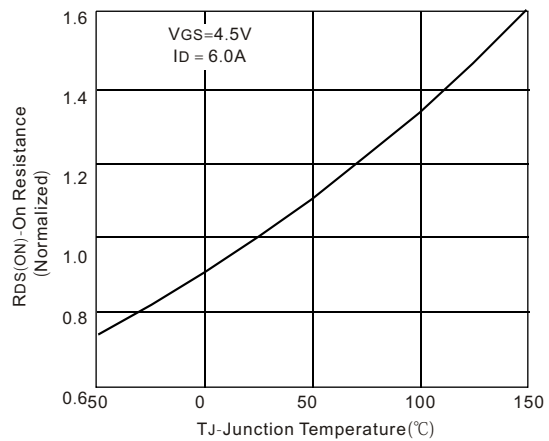


Figure6: On-Resistance vs. Junction Temperature



Typical Electrical and Thermal Characteristics

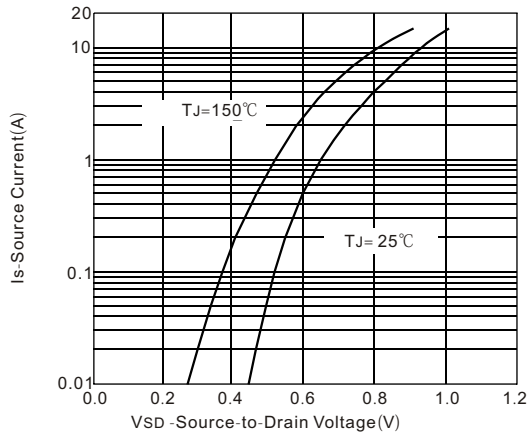


Figure7: Source-Drain Diode Forward Voltage

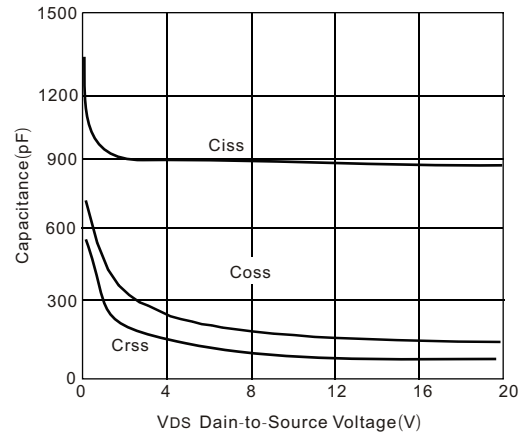


Figure8: Capacitance

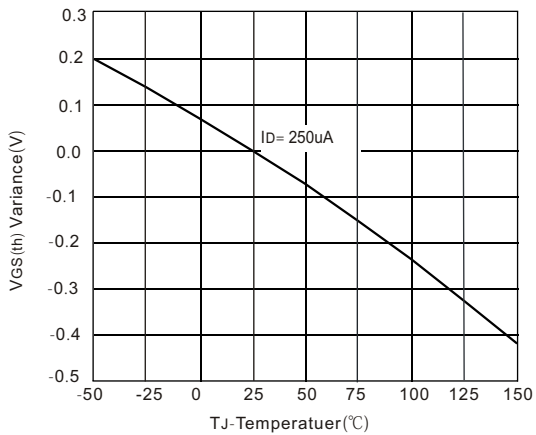


Figure9: Threshold Voltage

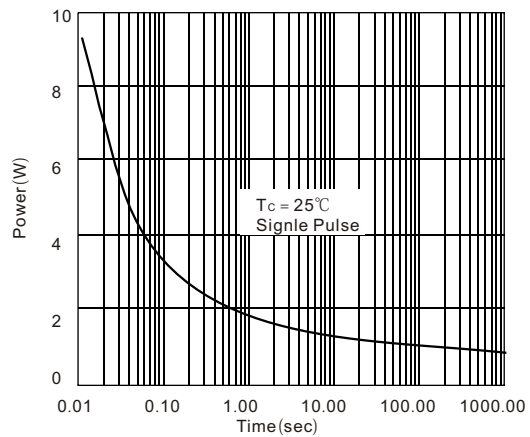


Figure10: Single Pulse Power

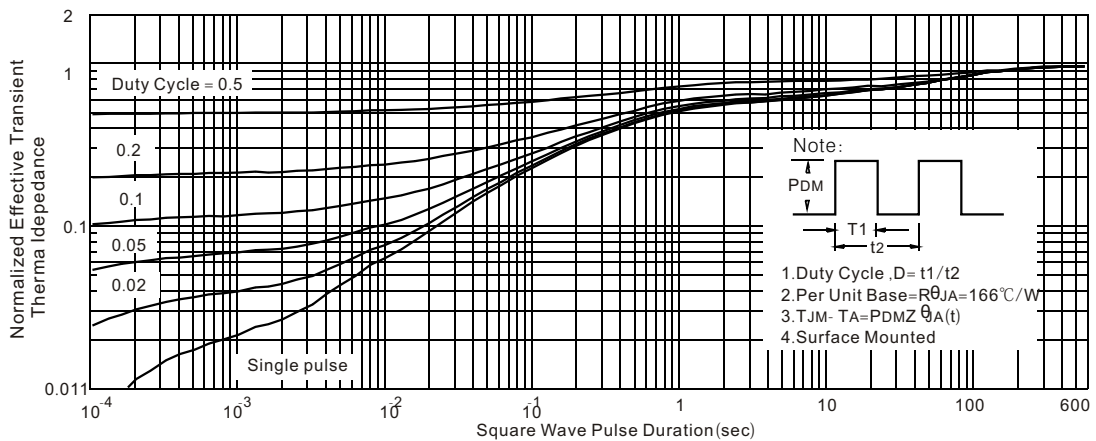


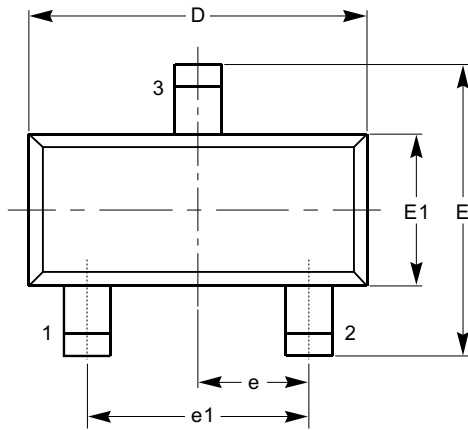
Figure11: Normalized Thermal Transient Impedance, Junction-to-Ambient



Package Outline

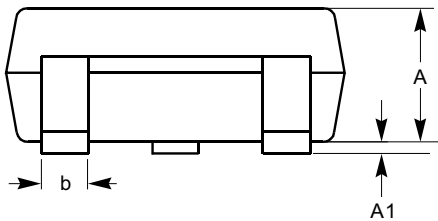
SOT23_3Lead

Unit: mm

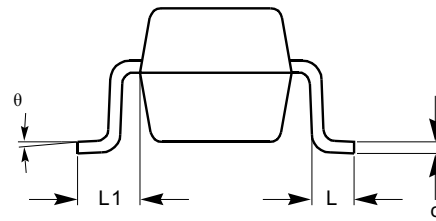


TOP VIEW

| Symbol | Min | Nom | Max |
|----------|----------|------|------|
| A | 0.70 | 1.00 | 1.15 |
| A1 | 0.00 | --- | 0.13 |
| b | 0.30 | 0.40 | 0.50 |
| c | 0.08 | 0.13 | 0.20 |
| D | 2.80 | 2.90 | 3.10 |
| E | 2.60 | 2.80 | 3.00 |
| E1 | 1.40 | 1.60 | 1.80 |
| e | 0.95 BSC | | |
| e1 | 1.90 BSC | | |
| L | 0.40 REF | | |
| L1 | 0.54 REF | | |
| θ | 0° | 5° | 8° |



SIDE VIEW



END VIEW

Notes:

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Package body sizes exclude mold flash and gate burrs.
- (3) Complies with JEDEC TO-236.

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