## N-Channel 40V (D-S) MOSFET

### General Description

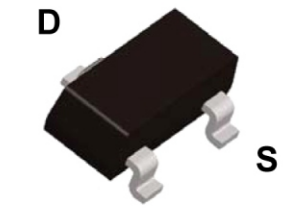
This miniature surface mount MOSFET uses advanced Trench process, low $R_{DS(ON)}$ assures minimal power loss and energy conversion, which makes this device ideal for use in power management circuit.

### Features

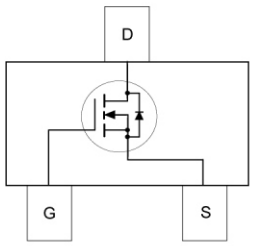
- $V_{DS}$(V)=40V
- $I_D$(A)=5. 0A ($V_{GS}$=10V)
- $R_{DS(ON)}$=31 mΩ @ $V_{GS}$=10V
- $R_{DS(ON)}$=45 mΩ @ $V_{GS}$= 4. 5V
- Low gate charge
- Fast switching speed
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability

### Applications

- Load switch
- DC-DC converters
- Power management



SOT-23




### Absolute Maximum Ratings ($T_A$ = 25℃ Unless Otherwise Noted)

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 40 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | |
| Continuous Drain Current[a] | $T_A$=25℃ | $I_D$ | 5.0 | A |
| | $T_A$=70℃ | | 4.0 | |
| Pulsed Drain Current[b] | | $I_{DM}$ | 20 | |
| Continuous Source Current (Diode Conduction)[a] | | $I_S$ | 3.5 | A |
| Power Dissipation[a] | $T_A$=25℃ | $P_D$ | 1.4 | W |
| | $T_A$=70℃ | | 1.0 | |
| Operating Junction and Storage Temperature Range | | $T_J$,$T_{stg}$ | -55 to 150 | ℃ |

### Thermal Resistance Ratings

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Maximum Junction-to-Ambient[a] | t<= 10 sec | $R_{\theta JA}$ | 90 | ℃/W |
| | Steady-State | | 130 | |

## Ordering Information

| Device | Device Marking | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|
| MI3446 | S40N | 7'' | 8mm | 3000 units |

## Specifications ($T_A$ = 25℃ Unless Otherwise Noted)

| Parameter | Symbol | Test Conditions | Limits | | | Units |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$=0V, $I_D$=250uA | 40 | | | V |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ =$V_{GS}$, $I_D$ = 250 uA | 1. 0 | 2. 3 | 3. 0 | V |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$=0V, $V_{GS}$=±20V | | | ±100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=32V, $V_{GS}$=0V | | | 1 | uA |
| | | $V_{DS}$=32V, $V_{GS}$=0V, $T_J$=55℃ | | | 5 | uA |
| On-State Drain Current [c] | $I_{D(on)}$ | $V_{DS}$=5V, $V_{GS}$=10V | 20 | | | A |
| Drain-Source On-Resistance [c] | $R_{DS(on)}$ | $V_{GS}$=4. 5 V, $I_D$=3. 0A | | 32 | 45 | mΩ |
| | | $V_{GS}$=10 V, $I_D$=5. 0A | | 22 | 31 | mΩ |
| Forward Tranconductance [c] | $g_{fs}$ | $V_{DS}$=20V, $I_D$=5. 0A | | 23 | | S |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=1. 0A, $V_{GS}$=0V | | 0. 77 | 1. 0 | V |
| **Dynamic** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=20V, f=1MHz | | 404 | | pF |
| Output Capacitance | $C_{oss}$ | | | 95 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 37 | | pF |
| Gate Resistance | $R_g$ | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | 2. 7 | | Ω |
| **Switching** | | | | | | |
| Total Gate Charge(10V) | Qg(10V) | $V_{DS}$=20V, $V_{GS}$=10V $I_D$ =5. 0 A | | 12. 8 | | nC |
| Total Gate Charge(4. 5V) | Qg(4.5V) | | | 7 | | nC |
| Gate-Source Charge | Qgs | | | 1. 9 | | nC |
| Gate-Drain Charge | Qgd | | | 3. 5 | | nC |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$=20V, $I_D$=1A, $R_G$=6 ohm, $V_{GEN}$=10V $R_L$=15 ohm | | 4. 3 | | ns |
| Rise Time | $t_r$ | | | 3. 4 | | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 15 | | ns |
| Fall-Time | $t_f$ | | | 2. 8 | | ns |
| Body Diode Reverse Recovery Time | $t_{rr}$ | $I_f$=-5A, di/dt=100A/us | | 21 | | ns |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | $I_f$=-5A, di/dt=100A/us | | 15 | | nC |

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

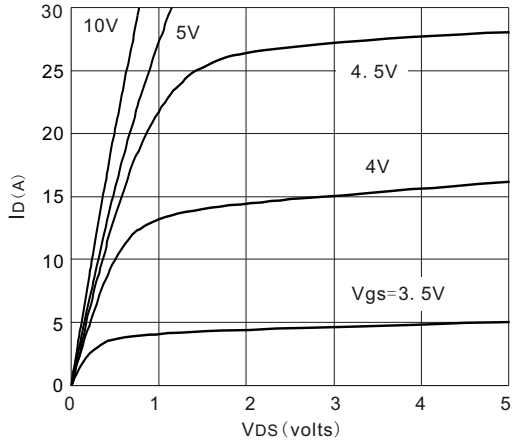



Figure1: On-Region Characteristics

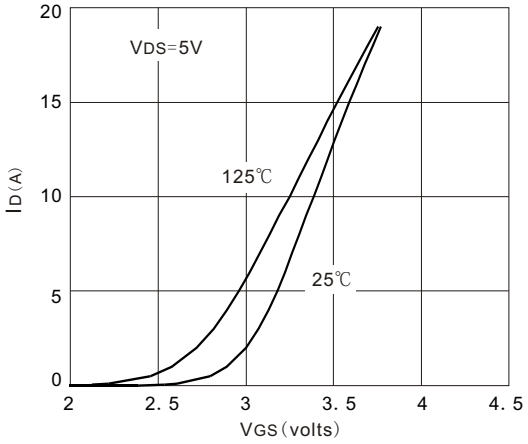



Figure2: Transfer Characteristics

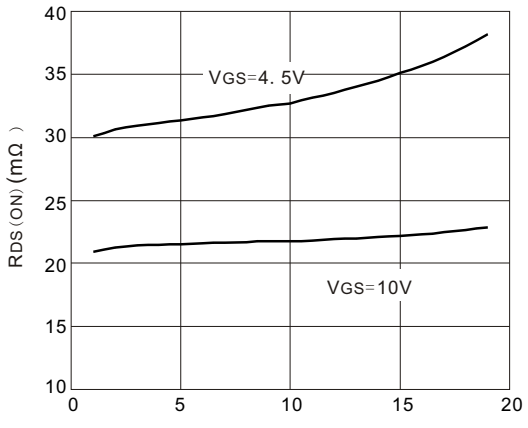



Figure 3: On-Resistance VS. Drain Current and Gate Voltage

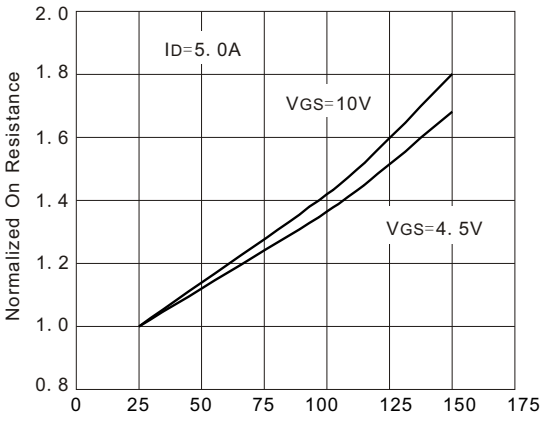



Figure4: On-Resistance vs. Junction Temperature

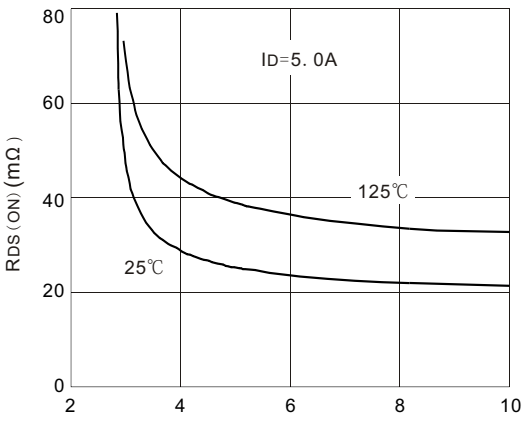



Figure 5: On-Resistance vs. Gate-Source Voltage

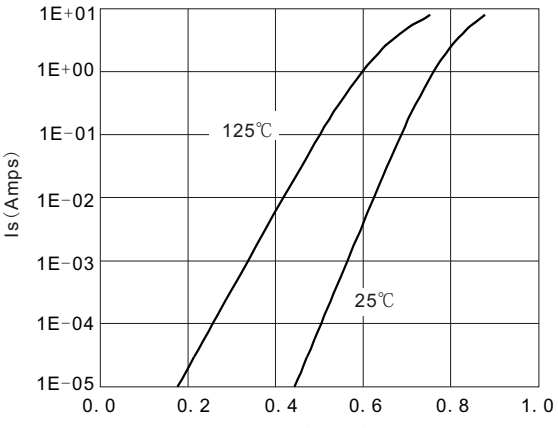



Figure 6: Body diode characteristics

## Typical Electrical and Thermal Characteristics

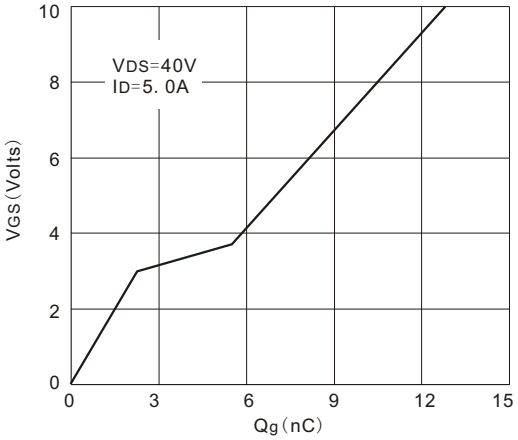



Figure 7: Gate-Charge Characteristics

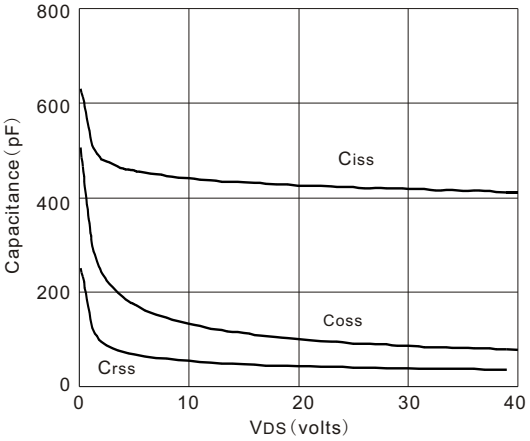



Figure 8: capacitance Characteristics

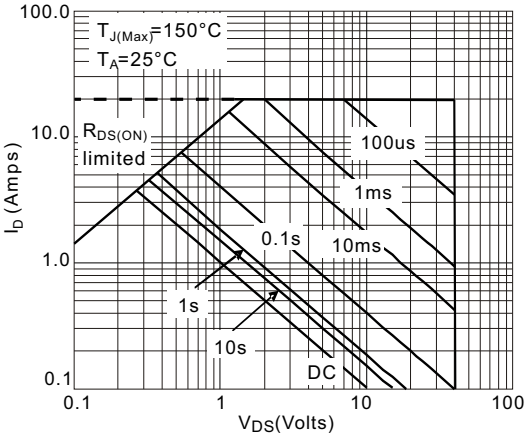



Figure 9: Maximum Forward Biased Safe Operating Area (Note d)

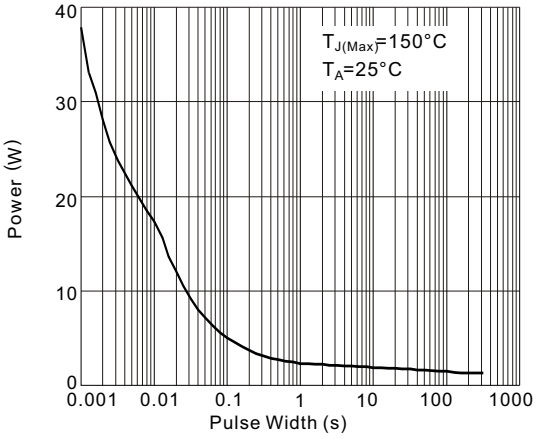



Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note d)

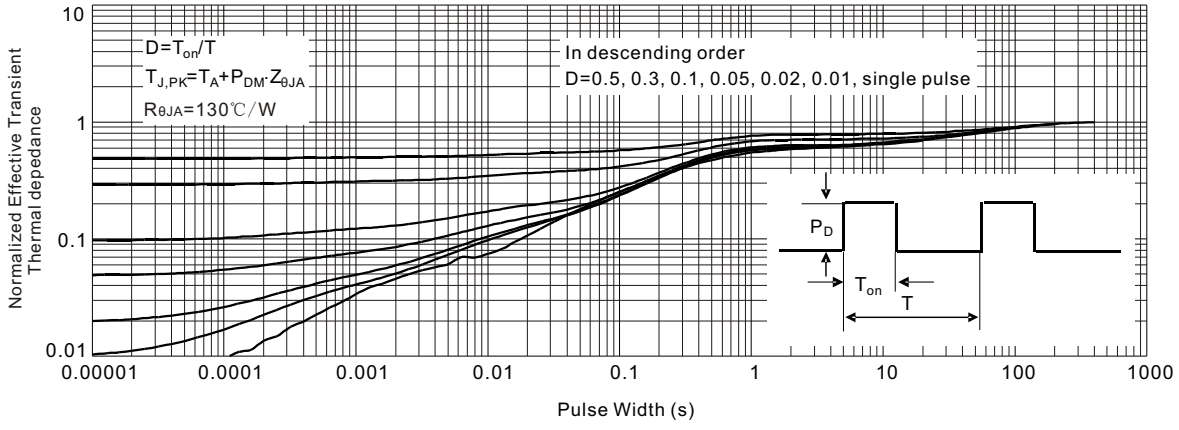
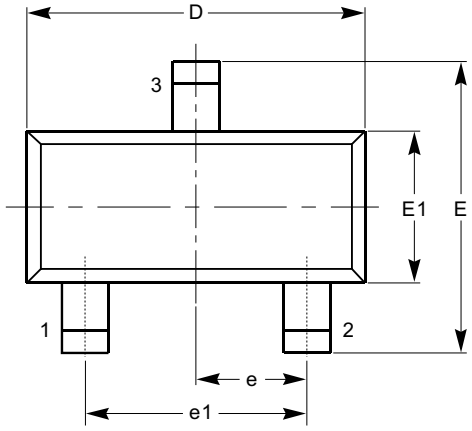



Figure 11: Normalized Maximum Transient Thermal Impedance

Note d: These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with TA=25°C. The SOA curve provides a single pulse rating.

## Package Outline

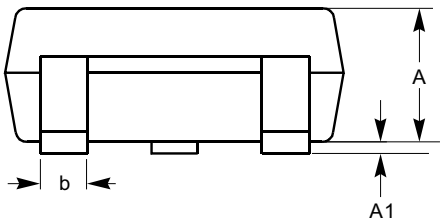
### SOT23_3Lead



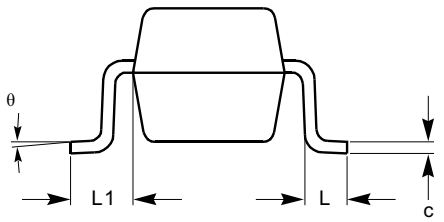

TOP VIEW

Unit: mm

| 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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