## Features

- Low On-resistance and Low Conduction Loss
- Super Junction technology for High Voltage Application
- Soft Switching with Fast Reverse Recovery Diode
- Ultra Low Gate Charge Cause Lower Driving Requirement
- Epoxy Meets UL 94 V-0 Flammability Rating
- Halogen Free."Green "Device(Note 1)
- Lead Free Finish/RoHS Compliant. "P" Suffix Designates RoHS Compliant. See Ordering Information

# N-CHANNEL Super-Junction Power MOSFET

## Maximum Ratings

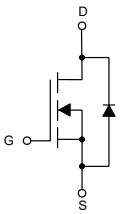
- Operating Junction Temperature Range : -55°C to +150°C
- Storage Temperature Range: -55°C to +150°C
- Thermal Resistance Junction to Ambient,Max(Note 2): 62°C/W
- Thermal Resistance Junction to Case,Max : 0.56°C/W

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 600 | V |
| Gate-Source Volltage | | $V_{GS}$ | ±30 | V |
| Continuous Drain Current | $T_C$=25°C | $I_D$ | 58 | A |
| | $T_C$=100°C | | 36.7 | |
| Pulsed Drain Current(Note 3) | | $I_{DM}$ | 232 | A |
| Total Power Dissipation, $T_C$=25°C | | $P_D$ | 223 | W |
| Single Avalanche Energy(Note 4) | | $E_{AS}$ | 2371 | mJ |

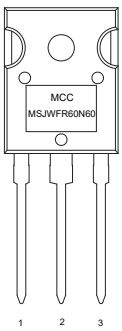
Note:

1. Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. Device in a still air environment with TA=25°C.
3. Repetitive rating; pulse width limited by max. junction temperature.
4. Starting $T_J$=25°C, $V_{DD}$=50V,$I_{AS}$=15.4A.

## Internal Structure and Marking Code

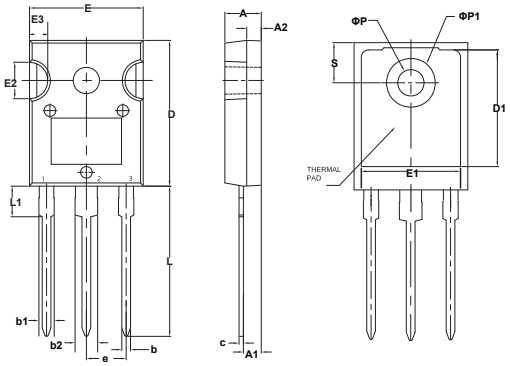



1. Gate
2. Drain
3. Source




Device Code: MSJWFR60N60

## TO-247AB(E)




| DIMENSIONS | | | | | |
|---|---|---|---|---|---|
| DIM | INCHES | | mm | | NOTE |
| | MIN | MAX | MIN | MAX | |
| A | 0.189 | 0.205 | 4.80 | 5.20 | |
| A1 | 0.087 | 0.102 | 2.20 | 2.60 | |
| A2 | 0.059 | 0.098 | 1.50 | 2.50 | |
| b | 0.035 | 0.055 | 0.90 | 1.40 | |
| b1 | 0.063 | 0.094 | 1.60 | 2.40 | |
| b2 | 0.098 | 0.138 | 2.50 | 3.50 | |
| c | 0.014 | 0.035 | 0.35 | 0.90 | |
| D | 0.776 | 0.815 | 19.70 | 20.70 | |
| D1 | 0.512 | - | 13.00 | - | |
| E | 0.598 | 0.630 | 15.20 | 16.00 | |
| E1 | 0.528 | - | 13.40 | - | |
| E2 | 0.177 | 0.217 | 4.50 | 5.50 | |
| E3 | 0.091 | 0.106 | 2.30 | 2.70 | |
| e | 0.215 | | 5.45 | | TYP |
| L | 0.768 | 0.827 | 19.50 | 21.00 | |
| L1 | - | 0.169 | - | 4.30 | |
| P | 0.134 | 0.150 | 3.40 | 3.80 | Φ |
| P1 | - | 0.291 | - | 7.40 | Φ |
| S | 0.217 | | 5.50 | | TYP |

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

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$=0V, $I_D$=1mA | 600 | | | V |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{DS}$=0V, $V_{GS}$=±30V | | | ±100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=600V, $V_{GS}$=0V | | | 10 | μA |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=5mA | 3 | 4 | 5 | V |
| Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}$=10V, $I_D$=37.5A | | 26.5 | 30 | mΩ |
| Gate Resistance | $R_g$ | f=1MHz, open drain | | 1 | | Ω |
| **Diode Characteristics** | | | | | | |
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V, $I_S$=37.5A | | 0.9 | 1.2 | V |
| Reverse Recovery Time | $t_{rr}$ | $V_R$=400V, $I_F$=37.5A<br>$dI_F/dt$=100A/μs | | 165 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | 1450 | | nC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | | 15 | | A |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=100V, $V_{GS}$=0V, f=1MHz | | 8078 | | pF |
| Output Capacitance | $C_{oss}$ | | | 300 | | |
| Output capacitance - energy related | $C_{o(er)}$ | $V_{DS}$=0 to 400V, $V_{GS}$=0V | | 301 | | |
| Output capacitance - time related | $C_{o(tr)}$ | | | 1950 | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$=400V, $V_{GS}$=10V, $I_D$=37.5A | | 197 | | nC |
| Gate-Source Charge | $Q_{gs}$ | | | 49 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 95 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$=400V, $V_{GS}$=10V<br>$R_G$=2.7Ω, $I_D$=37.5A | | 73 | | ns |
| Turn-On Rise Time | $t_r$ | | | 26 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 86 | | |
| Turn-Off Fall Time | $t_f$ | | | 10 | | |

## Typical Characteristics ($T_J$=25℃ unless otherwise specified)

Fig. 1 - Typical Output Characteristics

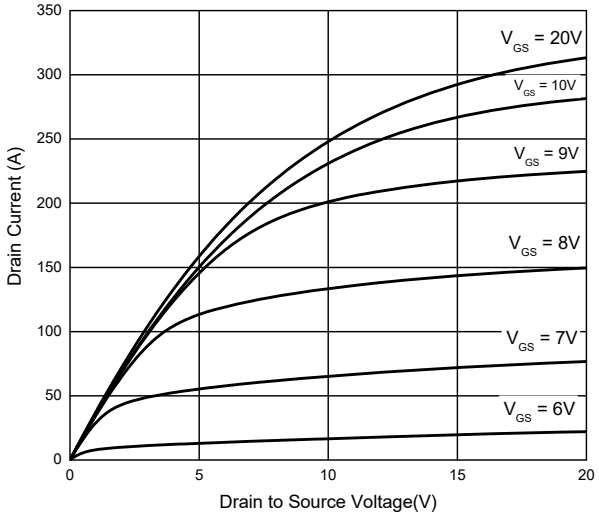



Fig. 2 - Typical Transfer Characteristics

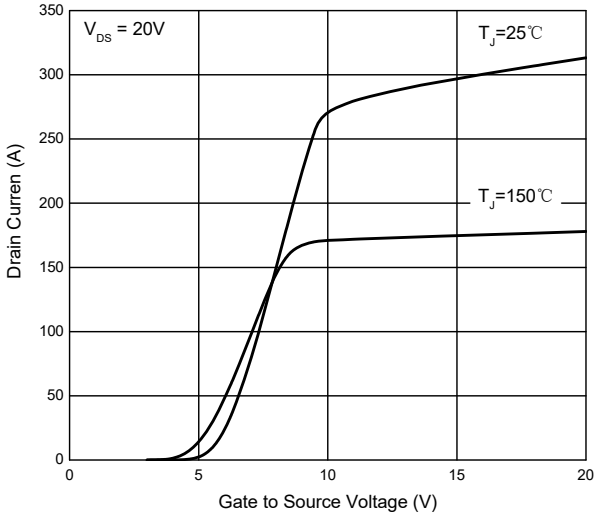



Fig. 3 - On-Resistance vs Gate Bias

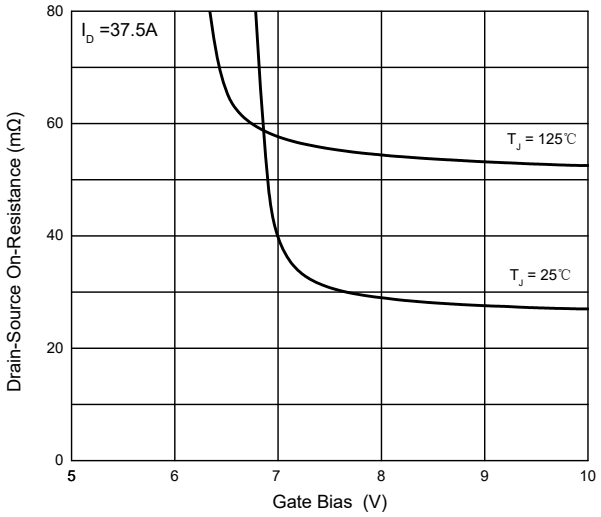



Fig. 4 - On-Resistance vs Drain Current

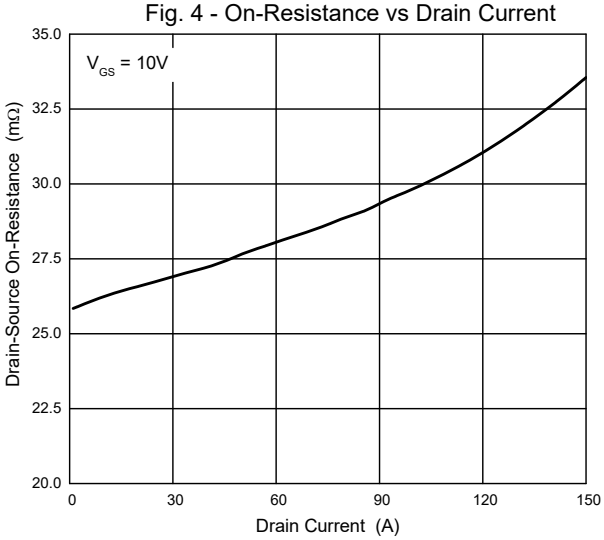



Fig. 5- Capacitance Characteristice

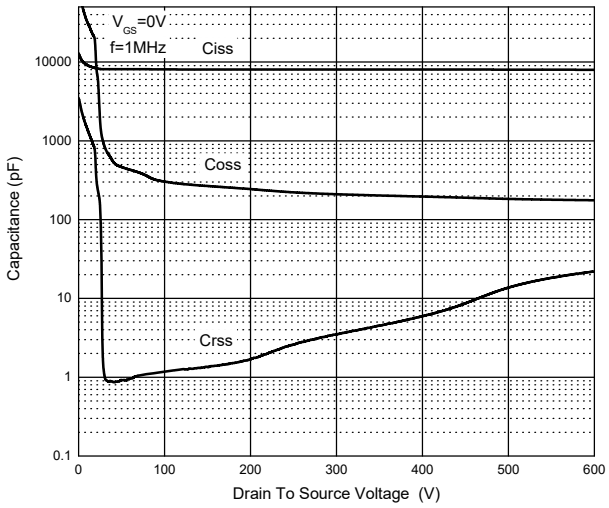
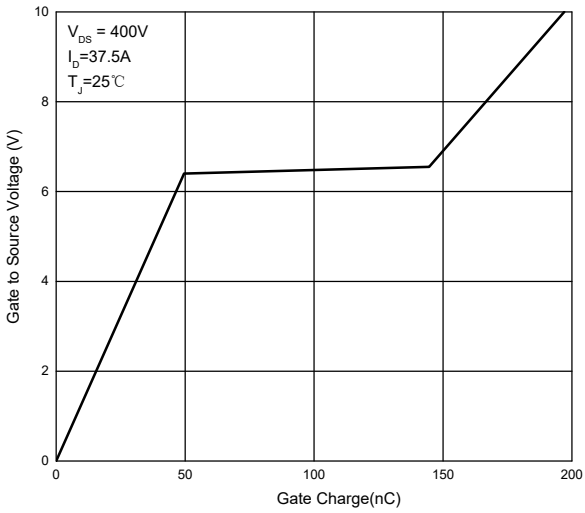



Fig. 6 - Typical Gate Charge



Typical Characteristics ($T_J$=25℃ unless otherwise specified)

Fig. 7 - Gate-Threshold Voltage vs Junction Temperature

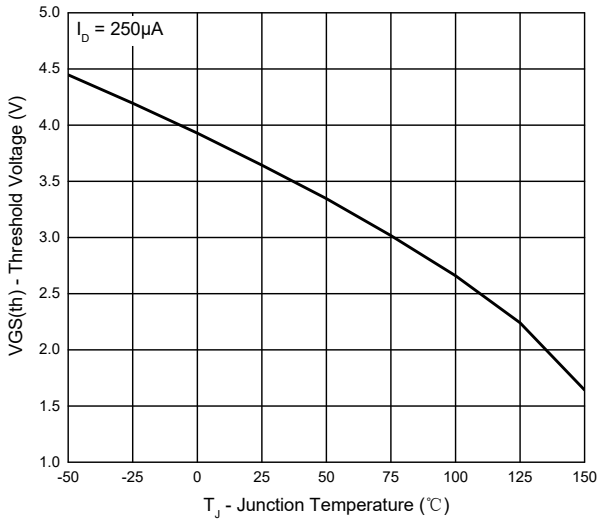



Fig. 8 - Normalized On-Resistance

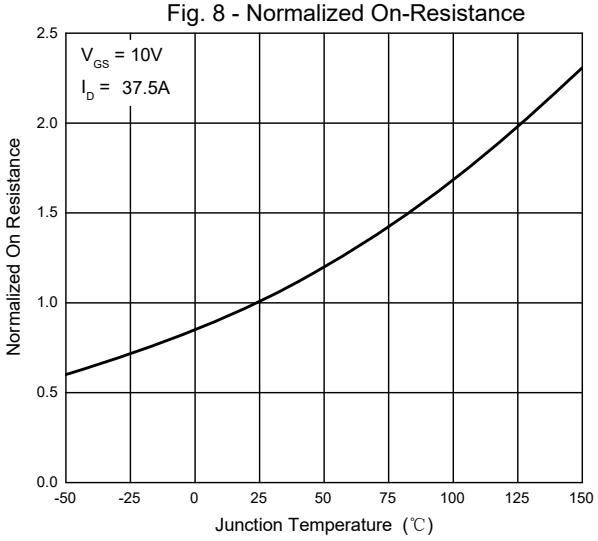



Fig. 9 - Forward Characteristics

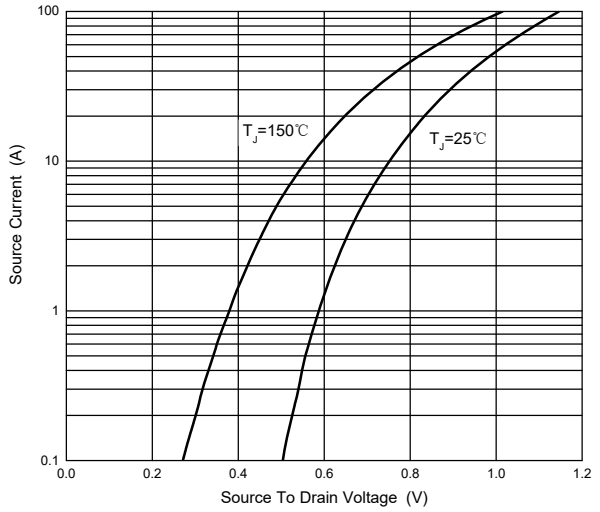



Fig. 10- Drain Current

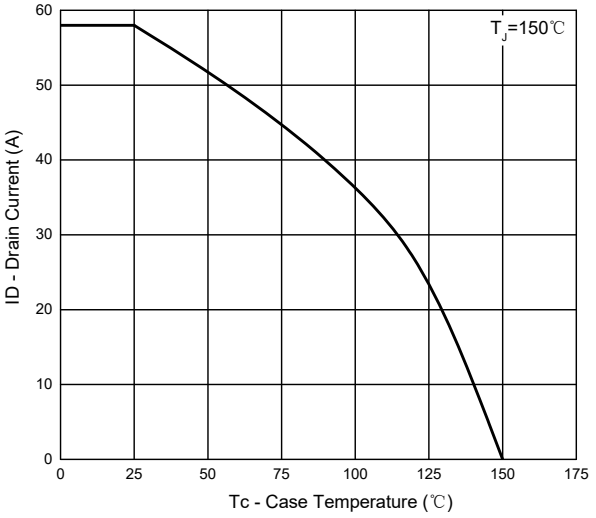



Fig. 11 - Power Dissipation

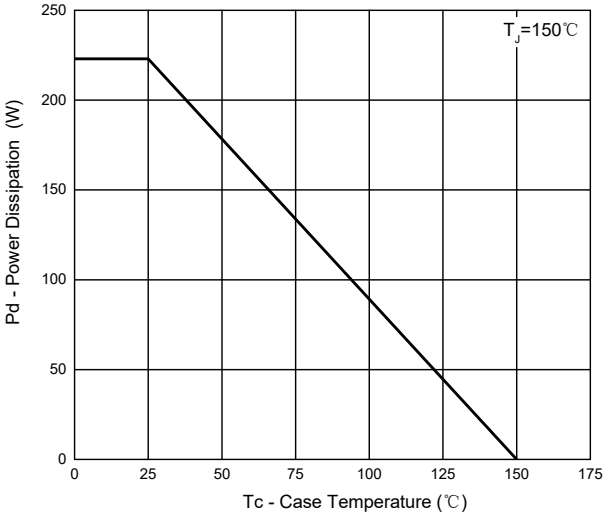
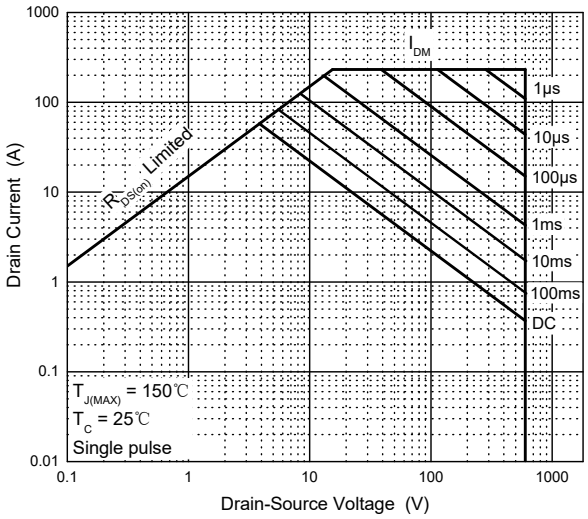
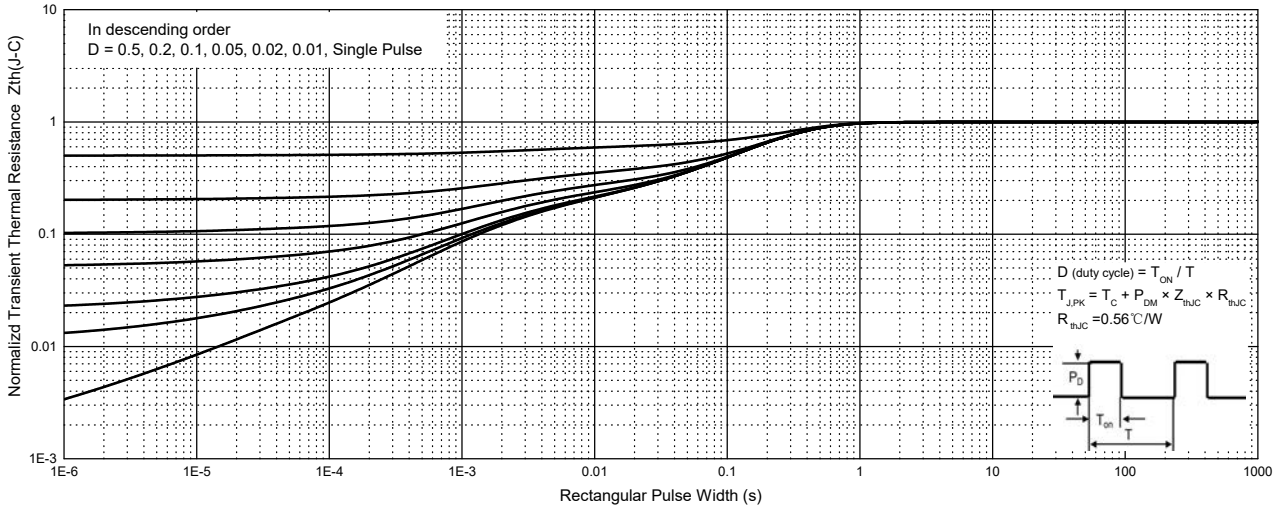



Fig. 12 - Safe Operating Area



Typical Characteristics ($T_J$=25℃ unless otherwise specified)

Fig.13 - Normalized Transient Thermal Impedance, Junction-Case



## Ordering Information

| Device | Packing |
|---|---|
| MSJWFR60N60-BP | Tube:30pcs/Tube, 360pcs/Box,1.8K/Ctn; |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