# N-Channel Super Junction Power MOSFET Ⅱ

## General Description

The series of devices use advanced super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

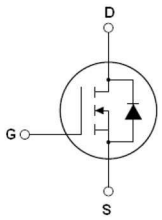
## Features

- ◆ New technology for high voltage device
- ◆ Low on-resistance and low conduction losses
- ◆ Small package
- ◆ Ultra Low Gate Charge cause lower driving requirements
- ◆ 100% Avalanche Tested
- ◆ ROHS compliant

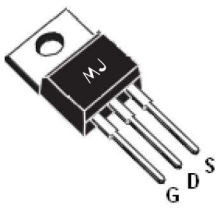
## Application

- ◆ Power factor correction（PFC）
- ◆ Switched mode power supplies(SMPS)
- ◆ Uninterruptible Power Supply（UPS）

| | | |
|---|---|---|
| $V_{DS}$ | 800 | V |
| $R_{DS(ON)\ TYP}$ | 1000 | mΩ |
| $I_D$ | 5 | A |




Schematic diagram




TO-220

## Package Marking And Ordering Information

| Device | Device Package | Marking |
|---|---|---|
| MJ80R1K2 | TO-220 | MJ80R1K2 |

## Table 1. Absolute Maximum Ratings ($T_C$=25℃)

| Parameter | Symbol | MJ80R1K2 | Unit |
|---|---|---|---|
| Drain-Source Voltage ($V_{GS}$=0V) | $V_{DS}$ | 800 | V |
| Gate-Source Voltage ($V_{DS}$=0V) | $V_{GS}$ | ±30 | V |
| Continuous Drain Current at Tc=25°C | $I_{D\ (DC)}$ | 6 | A |
| Continuous Drain Current at Tc=100°C | $I_{D\ (DC)}$ | 3.5 | A |
| Pulsed drain current (Note 1) | $I_{DM\ (pluse)}$ | 18 | A |
| Maximum Power Dissipation (Tc=25℃) | $P_D$ | 81 | W |
| Derate above 25°C | $P_D$ | 0.65 | W/°C |
| Single pulse avalanche energy (Note 2) | $E_{AS}$ | 75 | mJ |
| Avalanche current (Note 1) | $I_{AR}$ | 2.5 | A |
| Repetitive Avalanche energy, $t_{AR}$ limited by $T_{jmax}$ (Note 1) | $E_{AR}$ | 0.4 | mJ |

| Parameter | Symbol | MJ80R1K2 | Unit |
|---|---|---|---|
| Drain Source voltage slope, $V_{DS}$ ≤480 V | dv/dt | 50 | V/ns |
| Reverse diode dv/dt, $V_{DS}$ ≤480 V,$I_{SD}$<$I_D$ | dv/dt | 15 | V/ns |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55...+150 | °C |

* limited by maximum junction temperature

## Table 2. Thermal Characteristic

| Parameter | Symbol | MJ80R1K2 | Unit |
|---|---|---|---|
| Thermal Resistance，Junction-to-Case（Maximum） | $R_{thJC}$ | 1.56 | °C/W |
| Thermal Resistance，Junction-to-Ambient（Maximum） | $R_{thJA}$ | 62 | °C/W |

## Table 3. Electrical Characteristics ($T_A$=25℃ unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **On/off states** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | 800 | - | - | V |
| Zero Gate Voltage Drain Current (Tc=25℃) | $I_{DSS}$ | $V_{DS}$=800V,$V_{GS}$=0V | - | - | 1 | μA |
| Zero Gate Voltage Drain Current (Tc=125℃) | $I_{DSS}$ | $V_{DS}$=800V,$V_{GS}$=0V | - | - | 100 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±30V,$V_{DS}$=0V | - | - | ±100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 2.5 | 3 | 3.5 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V,$I_D$=2.5A | - | 1000 | 1200 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=20V,$I_D$=2.5A | - | 5.5 | - | S |
| Input Capacitance | $C_{ies}$ | $V_{DS}$=50V,$V_{GS}$=0V F=1.0MHz | - | 680 | - | PF |
| Output Capacitance | $C_{oss}$ | | - | 55 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 3.5 | - | PF |
| Total Gate Charge | $Q_g$ | $V_{DS}$=480V,$I_D$=5A $V_{GS}$=10V | - | 14.5 | 22 | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 2.8 | - | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 5.5 | - | nC |
| Intrinsic gate resistance | $R_G$ | f=1 MHz open drain | - | 2 | - | Ω |
| **Switching times** | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=480V,$I_D$=2.5A $R_G$=15Ω,$V_{GS}$=10V | - | 7 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 5 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 70 | 85 | nS |
| Turn-Off Fall Time | $t_f$ | | - | 9 | 15 | nS |
| **Source- Drain Diode Characteristics** | | | | | | |
| Source-drain current (Body Diode) | $I_{SD}$ | $T_C$=25°C | - | - | 5 | A |
| Pulsed Source-drain current (Body Diode) | $I_{SDM}$ | | - | - | 15 | A |
| Forward On Voltage | $V_{SD}$ | $T_j$=25°C,$I_{SD}$=5A,$V_{GS}$=0V | - | 0.85 | 1.2 | V |
| Reverse Recovery Time | $t_{rr}$ | $T_j$=25°C,$I_F$=5A di/dt=100A/μs | - | 240 | - | nS |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 2.2 | - | uC |
| Peak reverse recovery Current | $I_{rrm}$ | | - | 16 | - | A |

## Notes

1.Repetitive Rating: Pulse width limited by maximum junction temperature

2.$T_j$=25℃,$V_{DD}$=50V,$V_G$=10V, $R_G$=25Ω

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

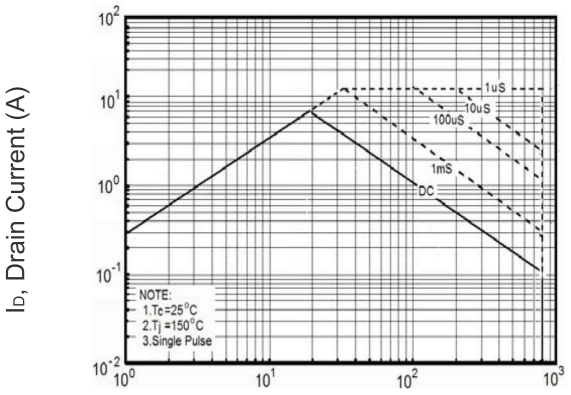



Figure 1 Safe operating area

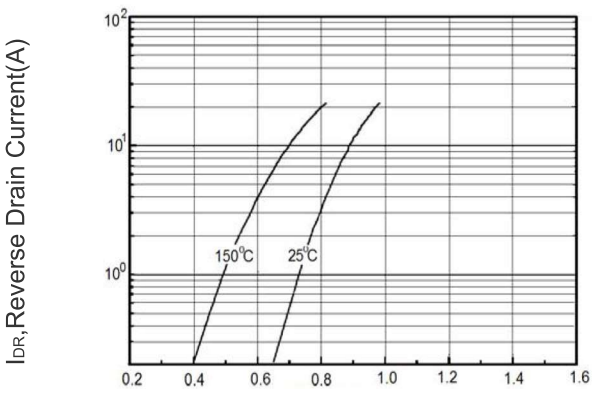



Figure 2 Source-Drain Diode Forward Voltage

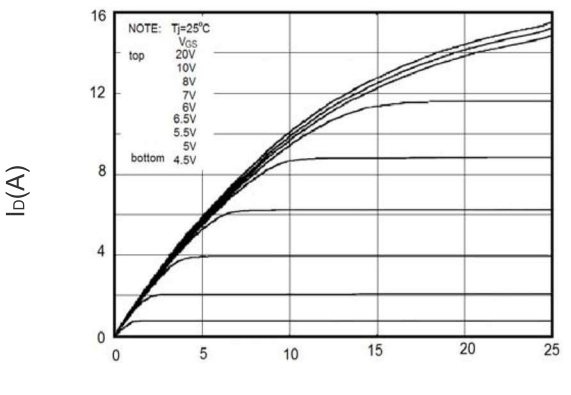



Figure 3 Output characteristics

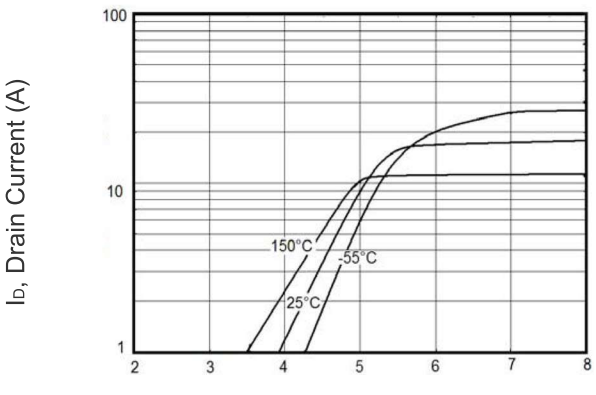



Figure 4 Transfer characteristics

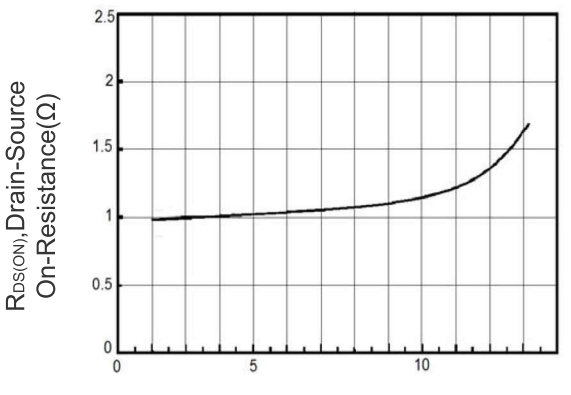



Figure 5 Static drain-source on resistance

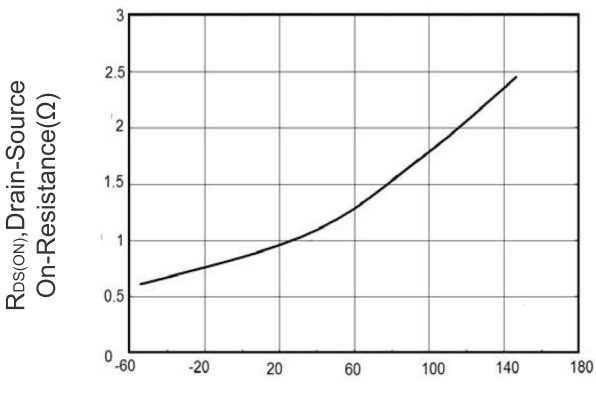



Figure 6 $R_{DS(ON)}$ vs Junction Temperature

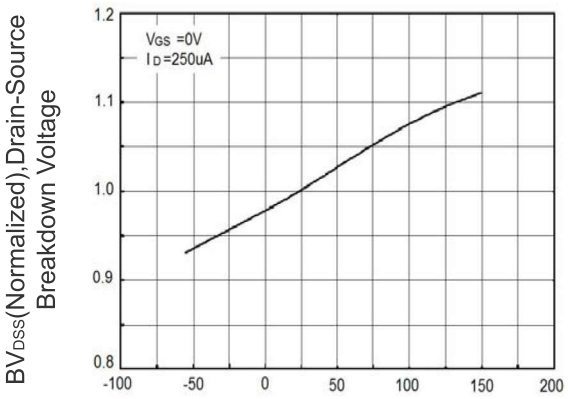



Figure 7 $BV_{DSS}$ vs Junction Temperature

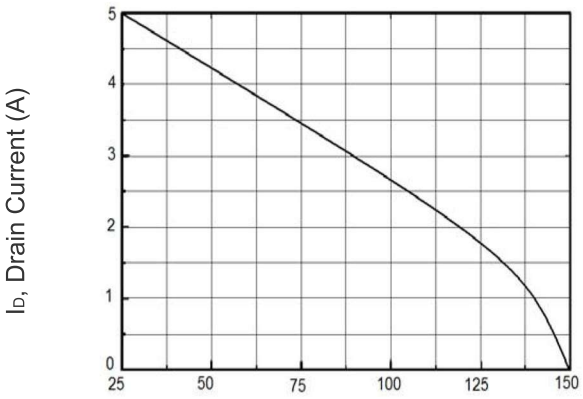



Figure 8 Maximum $I_D$ vs Junction Temperature

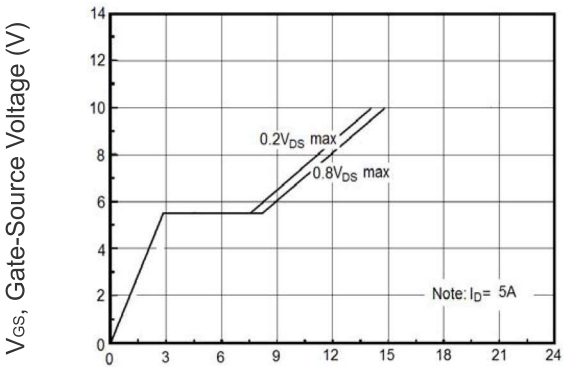



Figure 9 Gate charge waveforms

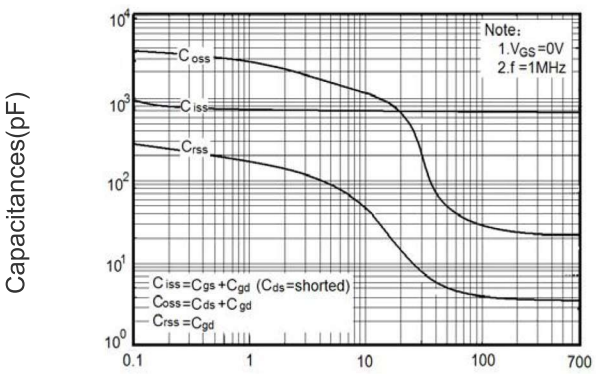



Figure 10 Capacitance

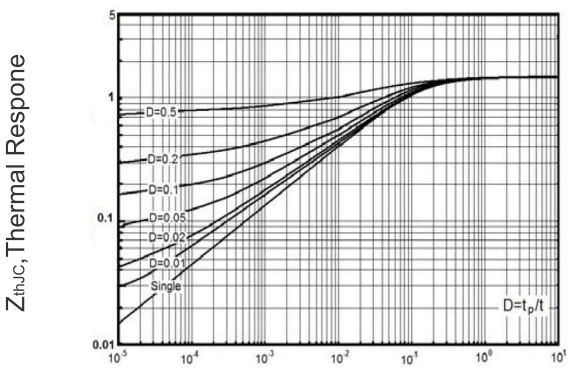
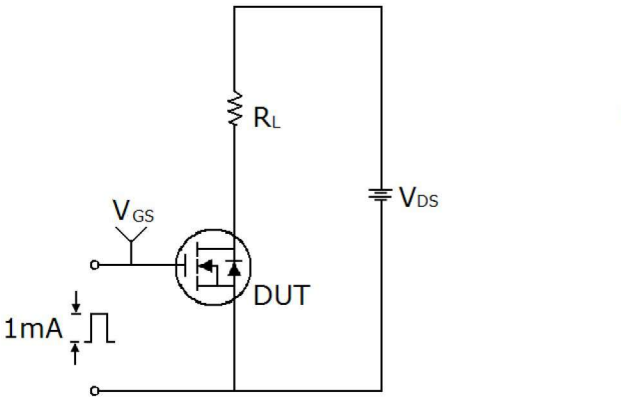
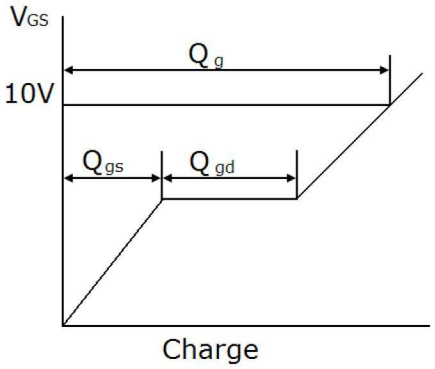


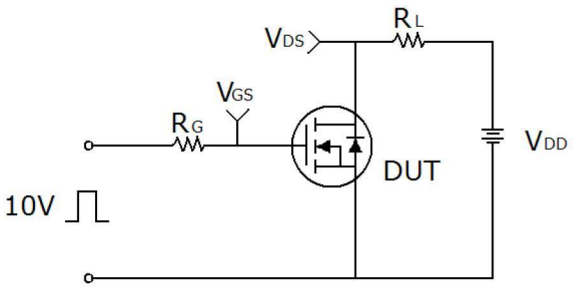

Figure 11 Transient Thermal Impedance

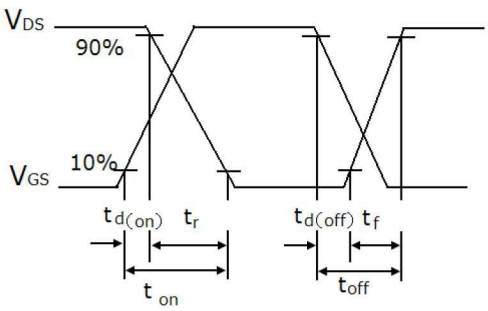
Test circuit



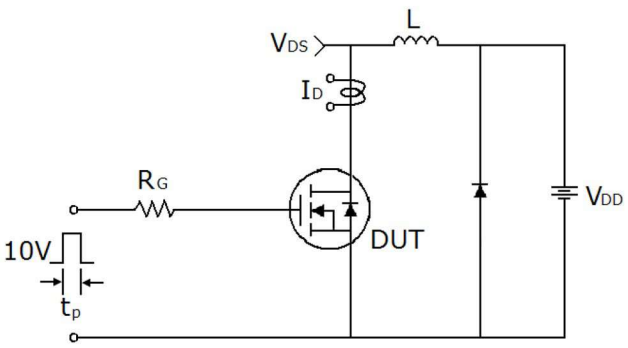



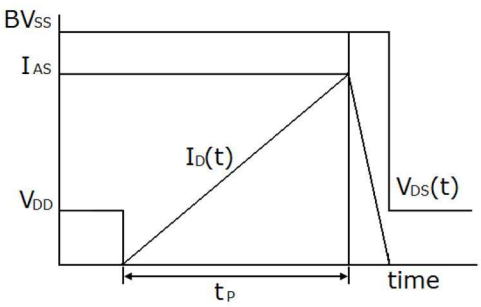

Gate charge test circuit & Waveform



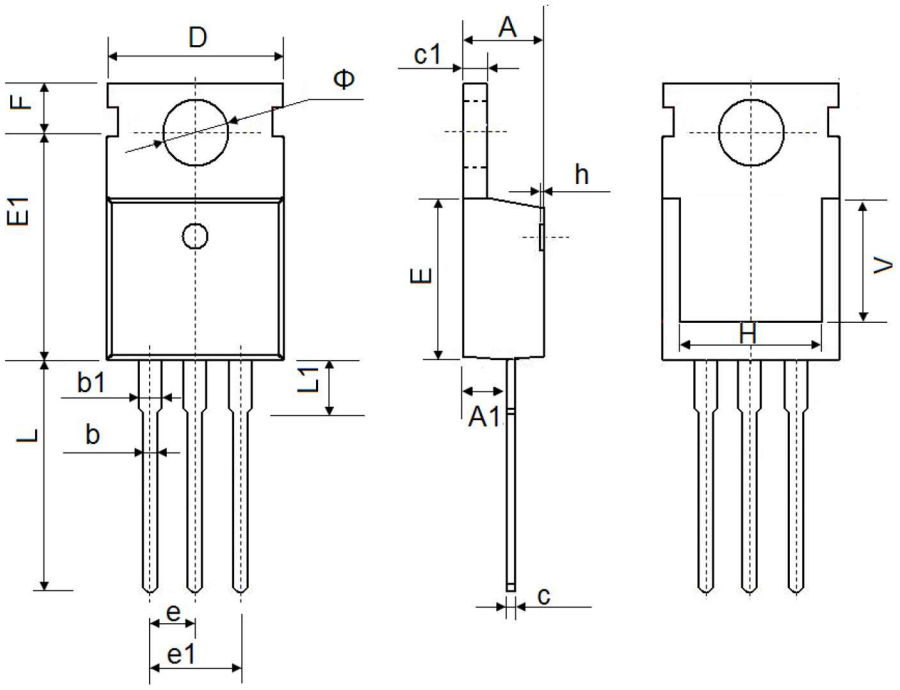

Switch Time Test Circuit




Unclamped Inductive Switching Test Circuit & Waveforms

## TO-220-3L-C Package Information




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 4.400 | 4.600 | 0.173 | 0.181 |
| A1 | 2.250 | 2.550 | 0.089 | 0.100 |
| b | 0.710 | 0.910 | 0.028 | 0.036 |
| b1 | 1.170 | 1.370 | 0.046 | 0.054 |
| c | 0.330 | 0.650 | 0.013 | 0.026 |
| c1 | 1.200 | 1.400 | 0.047 | 0.055 |
| D | 9.910 | 10.250 | 0.390 | 0.404 |
| E | 8.9500 | 9.750 | 0.352 | 0.384 |
| E1 | 12.650 | 12.950 | 0.498 | 0.510 |
| e | 2.540 TYP. | | 0.100 TYP. | |
| e1 | 4.980 | 5.180 | 0.196 | 0.204 |
| F | 2.650 | 2.950 | 0.104 | 0.116 |
| H | 7.900 | 8.100 | 0.311 | 0.319 |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| L | 12.900 | 13.400 | 0.508 | 0.528 |
| L1 | 2.850 | 3.250 | 0.112 | 0.128 |
| V | 7.500 REF. | | 0.295 REF. | |
| Φ | 3.400 | 3.800 | 0.134 | 0.150 |

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