

# N-Channel Super Junction Power MOSFET II

## General Description

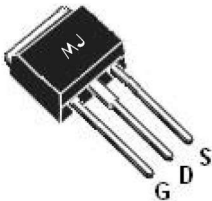
The series of devices use advanced super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

## 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



Schematic diagram



TO-251

## Application

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

$V_{DS}$	800	V
$R_{DS(ON)}$ TYP	1000	m $\Omega$
$I_D$	5	A

## Package Marking And Ordering Information

Device	Device Package	Marking
MJ80R1K2I	TO-251	MJ80R1K2I

Table 1. Absolute Maximum Ratings (Tc=25°C)

Parameter	Symbol	Value	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	800	V
Gate-Source Voltage ( $V_{DS}=0V$ )	$V_{GS}$	$\pm 30$	V
Continuous Drain Current at Tc=25°C	$I_D$ (DC)	5	A
Continuous Drain Current at Tc=100°C	$I_D$ (DC)	3	A
Pulsed drain current <sup>(Note 1)</sup>	$I_{DM}$ (pluse)	15	A
Maximum Power Dissipation (Tc=25°C)	$P_D$	81	W
Derate above 25°C	$P_D$	0.65	W/°C
Single pulse avalanche energy <sup>(Note 2)</sup>	$E_{AS}$	75	mJ
Avalanche current <sup>(Note 1)</sup>	$I_{AR}$	2.5	A
Repetitive Avalanche energy, $t_{AR}$ limited by $T_{jmax}$ <sup>(Note 1)</sup>	$E_{AR}$	0.4	mJ

Parameter	Symbol	Value	Unit
Drain Source voltage slope, $V_{DS} \leq 480$ V	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS} \leq 480$ V, $I_{SD} < I_D$	dv/dt	5	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	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R <sub>thJC</sub>	1.54	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	R <sub>thJA</sub>	62	°C/W

Table 3. Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	800	-	-	V
Zero Gate Voltage Drain Current (Tc=25°C)	I <sub>DSS</sub>	V <sub>DS</sub> =800V,V <sub>GS</sub> =0V	-	-	1	μA
Zero Gate Voltage Drain Current (Tc=125°C)	I <sub>DSS</sub>	V <sub>DS</sub> =800V,V <sub>GS</sub> =0V	-	-	100	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±30V,V <sub>DS</sub> =0V	-	-	±100	nA
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA	2.5	3	3.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V,I <sub>D</sub> =2.5A	-	1000	1200	mΩ
Dynamic Characteristics						
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =20V,I <sub>D</sub> =2.5A	-	5.5	-	S
Input Capacitance	C <sub>ies</sub>	V <sub>DS</sub> =50V,V <sub>GS</sub> =0V F=1.0MHz	-	680	-	PF
Output Capacitance	C <sub>oss</sub>		-	55	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	3.5	-	PF
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =480V,I <sub>D</sub> =5A V <sub>GS</sub> =10V	-	14.5	22	nC
Gate-Source Charge	Q <sub>gs</sub>		-	2.8	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	5.5	-	nC
Intrinsic gate resistance	R <sub>G</sub>	f=1 MHz open drain	-	2	-	Ω
Switching times						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =480V,I <sub>D</sub> =2.5A R <sub>G</sub> =15Ω,V <sub>GS</sub> =10V	-	7	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	5	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	70	85	nS
Turn-Off Fall Time	t <sub>f</sub>		-	9	15	nS
Source- Drain Diode Characteristics						
Source-drain current (Body Diode)	I <sub>SD</sub>	T <sub>C</sub> =25°C	-	-	5	A
Pulsed Source-drain current (Body Diode)	I <sub>SDM</sub>		-	-	15	A
Forward On Voltage	V <sub>SD</sub>	T <sub>J</sub> =25°C,I <sub>SD</sub> =5A,V <sub>GS</sub> =0V	-	0.85	1.2	V
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> =25°C,I <sub>F</sub> =5A di/dt=100A/μs	-	240	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	2.2	-	uC
Peak reverse recovery Current	I <sub>rrm</sub>		-	16	-	A

## Notes

- 1.Repetitive Rating: Pulse width limited by maximum junction temperature
2. $T_J=25^{\circ}\text{C}$ ,  $V_{DD}=50\text{V}$ ,  $V_G=10\text{V}$ ,  $R_G=25\Omega$

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

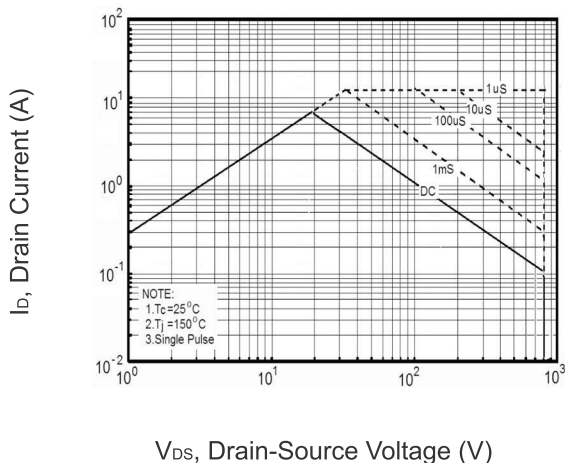


Figure 1 Safe operating area

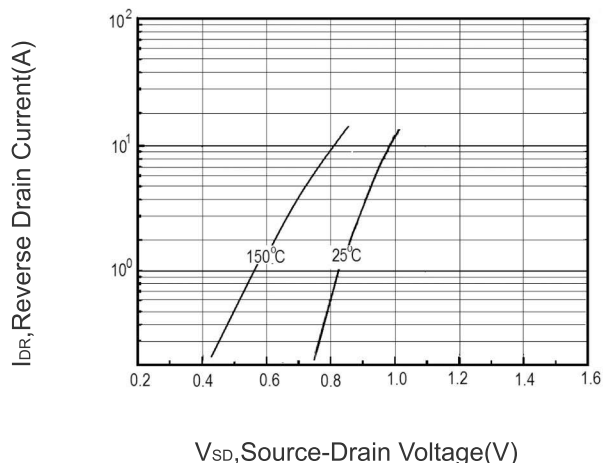


Figure 2 Source-Drain Diode Forward Voltage

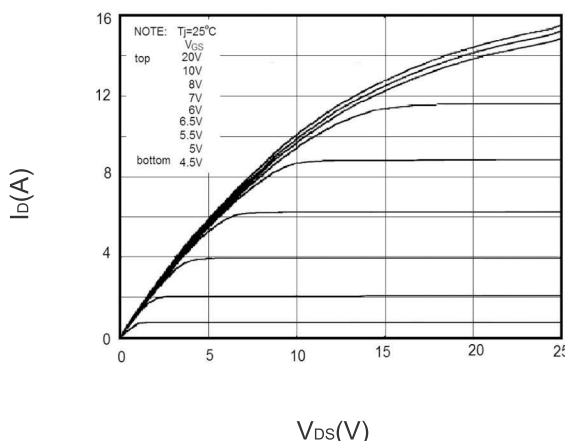


Figure 3 Output characteristics

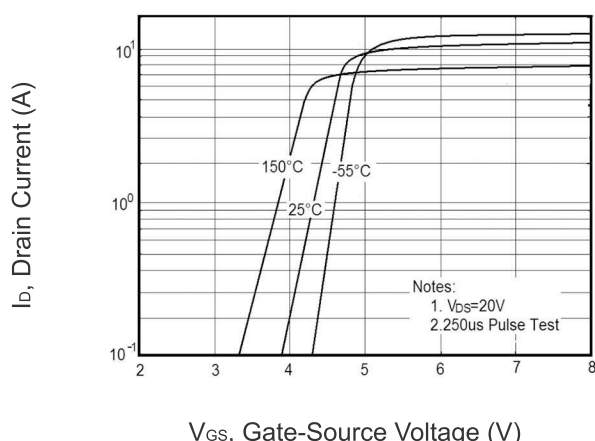


Figure 4 Transfer characteristics

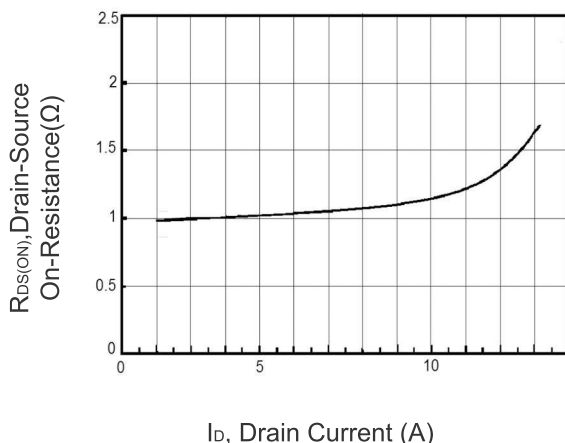


Figure 5 Static drain-source on resistance

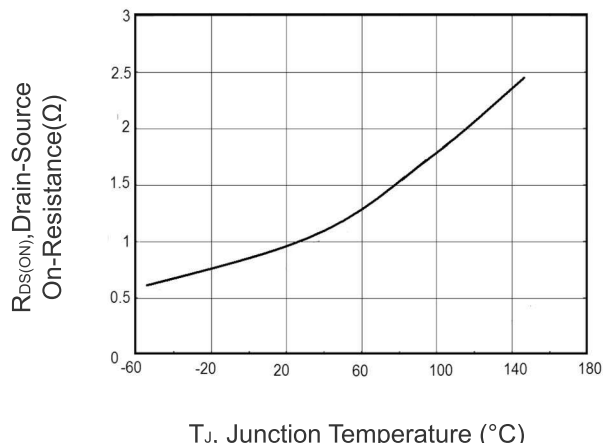


Figure 6  $R_{DS(ON)}$  vs Junction Temperature

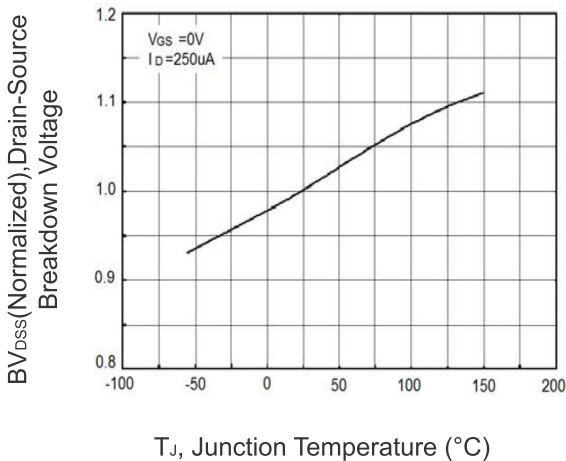


Figure 7  $BV_{DSS}$  vs Junction Temperature

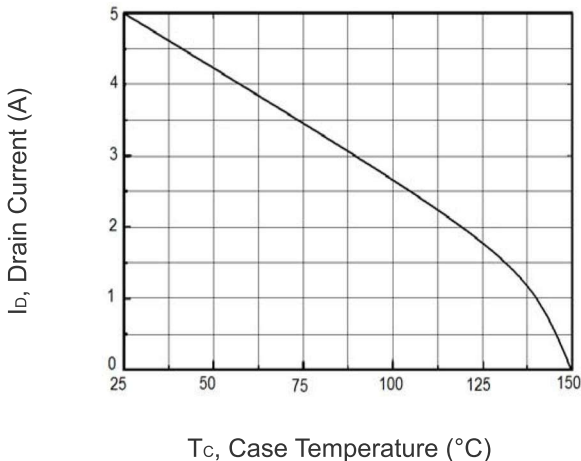


Figure 8 Maximum  $I_D$  vs Junction Temperature

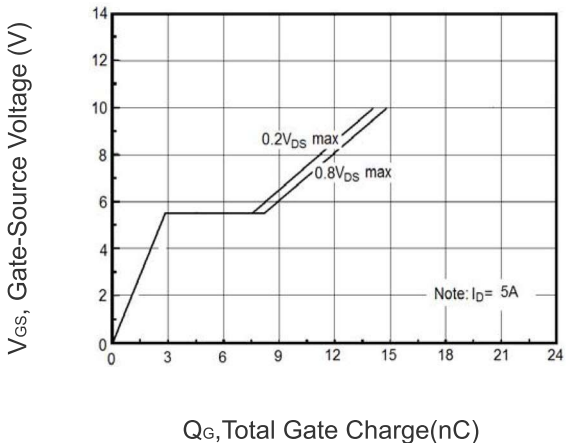


Figure 9 Gate charge waveforms

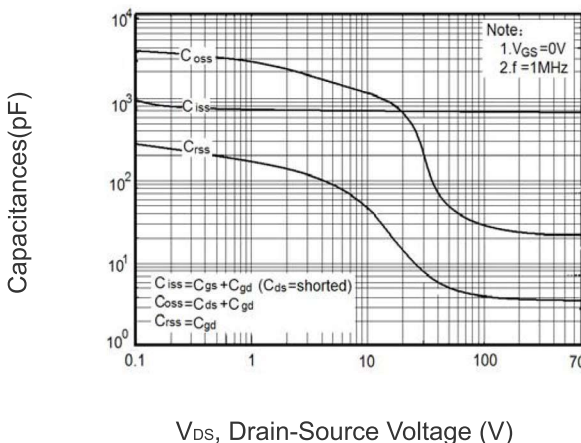


Figure 10 Capacitance

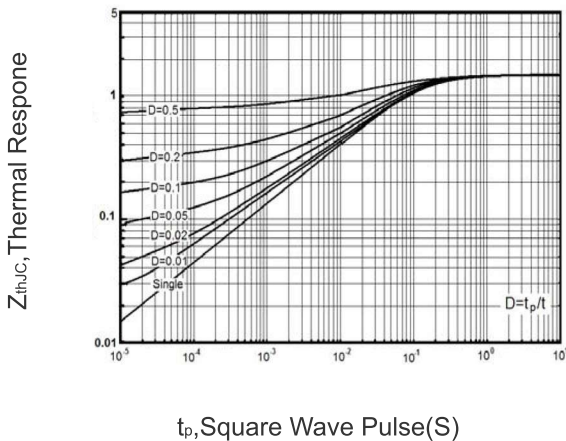
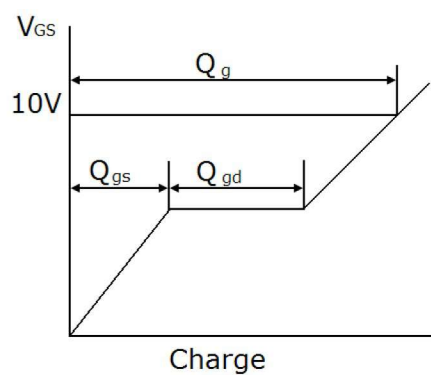


Figure 11 Transient Thermal Impedance

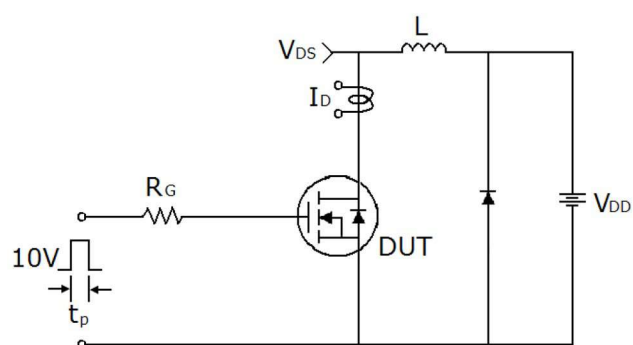
## Test circuit



Gate charge test circuit & Waveform

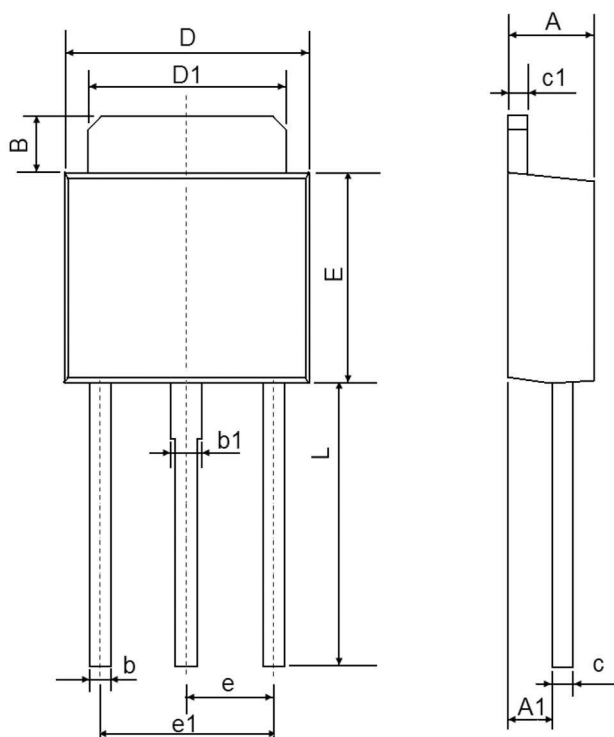


Switch Time Test Circuit



Unclamped Inductive Switching Test Circuit & Waveforms

## TO-251 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	1.050	1.350	0.042	0.054
B	1.350	1.650	0.053	0.065
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.430	0.580	0.017	0.023
c1	0.430	0.580	0.017	0.023
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	5.700	0.213	0.224
e	2.300 TYP.		0.091 TYP.	
e1	4.500	4.700	0.177	0.185
L	7.500	7.900	0.295	0.311

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