

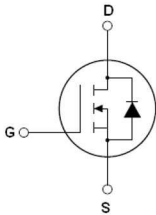
N-Channel Super Junction Power MOSFET II

General Description

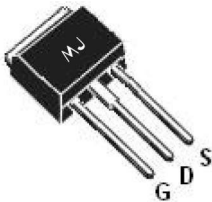
The series of devices use advanced super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

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)

$V_{DS}@T_{jmax}$	650	V
$R_{DS(ON)} TYP$	1.85	Ω
I_D	2	A

Package Marking And Ordering Information

Device	Device Package	Marking
MJ60R2K2I	TO-251	MJ60R2K2I

Table 1. Absolute Maximum Ratings ($T_c=25^{\circ}C$)

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	600	V
Gate-Source Voltage ($V_{DS}=0V$)	V_{GS}	± 30	V
Continuous Drain Current at $T_c=25^{\circ}C$	$I_D (DC)$	2	A
Continuous Drain Current at $T_c=100^{\circ}C$	$I_D (DC)$	1.3	A
Pulsed drain current ^(Note 1)	$I_{DM} (pluse)$	6	A
Maximum Power Dissipation ($T_c=25^{\circ}C$)	P_D	23	W
Derate above $25^{\circ}C$	P_D	0.184	W/ $^{\circ}C$
Single pulse avalanche energy ^(Note 2)	E_{AS}	45	mJ
Avalanche current ^(Note 1)	I_{AR}	1	A
Repetitive Avalanche energy, t_{AR} limited by T_{jmax} ^(Note 1)	E_{AR}	0.06	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	15	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	$-55...+150$	$^{\circ}C$

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R _{thJC}	5.4	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	R _{thJA}	75	°C/W

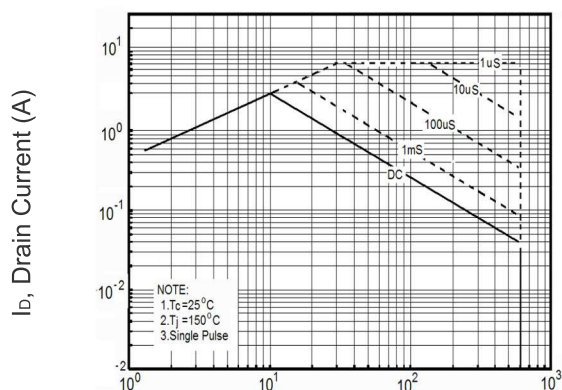
Table 3. Electrical Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250μA	600	-	-	V
Zero Gate Voltage Drain Current (Tc=25°C)	I _{DSS}	V _{DS} =600V,V _{GS} =0V	-	-	1	μA
Zero Gate Voltage Drain Current (Tc=125°C)	I _{DSS}	V _{DS} =600V,V _{GS} =0V	-	-	10	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 =1A	-	1850	2200	mΩ
Dynamic Characteristics						
Forward Transconductance	g _{FS}	V _{DS} =20V,I _D =1A	-	2	-	S
Input Capacitance	C _{ies}	V _{DS} =50V,V _{GS} =0V F=1.0MHz	-	190	-	PF
Output Capacitance	C _{oss}		-	13	-	PF
Reverse Transfer Capacitance	C _{rss}		-	1.1	-	PF
Total Gate Charge	Q _g	V _{DS} =480V,I _D =2A V _{GS} =10V	-	3.2	10	nC
Gate-Source Charge	Q _{gs}		-	0.6	-	nC
Gate-Drain Charge	Q _{gd}		-	1.2	-	nC
Intrinsic gate resistance	R _G	f=1 MHz open drain	-	9	-	Ω
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V,I _D =1A R _G =50Ω,V _{GS} =10V	-	6	-	nS
Turn-on Rise Time	t _r		-	3	-	nS
Turn-Off Delay Time	t _{d(off)}		-	65	-	nS
Turn-Off Fall Time	t _f		-	11	-	nS
Source- Drain Diode Characteristics						
Source-drain current (Body Diode)	I _{SD}	T _C =25°C	-	-	2	A
Pulsed Source-drain current (Body Diode)	I _{SDM}		-	-	6	A
Forward On Voltage	V _{SD}	T _J =25°C,I _{SD} =2A,V _{GS} =0V	-	1	1.3	V
Reverse Recovery Time	t _{rr}	T _J =25°C,I _F =2A di/dt=100A/μs	-	140	-	nS
Reverse Recovery Charge	Q _{rr}		-	0.65	-	uC
Peak reverse recovery current	I _{rrm}		-	9	-	A

Notes

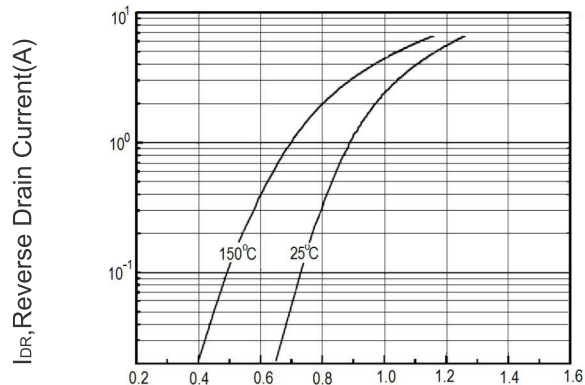
- 1.Repetitive Rating: Pulse width limited by maximum junction temperature
2. $T_J=25^{\circ}\text{C}$, $V_{DD}=50\text{V}$, $V_G=10\text{V}$, $R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)



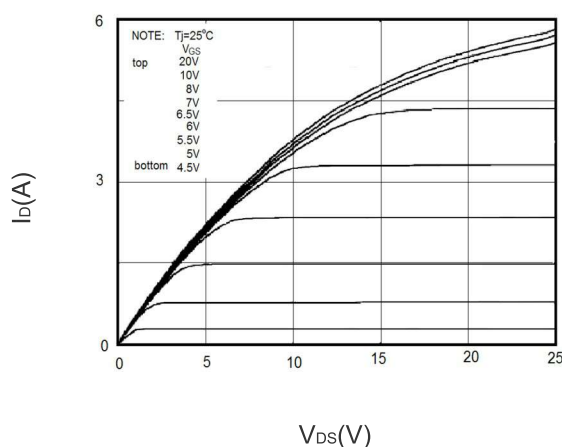
V_{DS} , Drain-Source Voltage (V)

Figure 1 Safe operating area



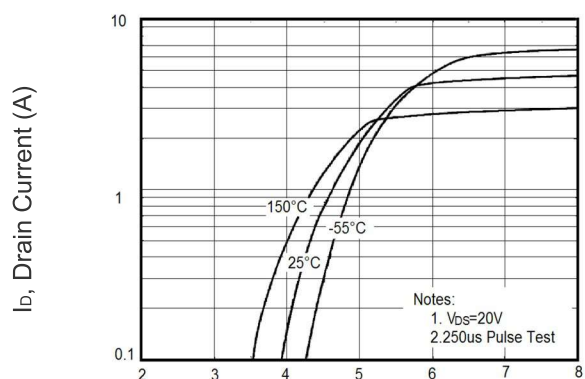
V_{SD} , Source-Drain Voltage (V)

Figure 2 Source-Drain Diode Forward Voltage



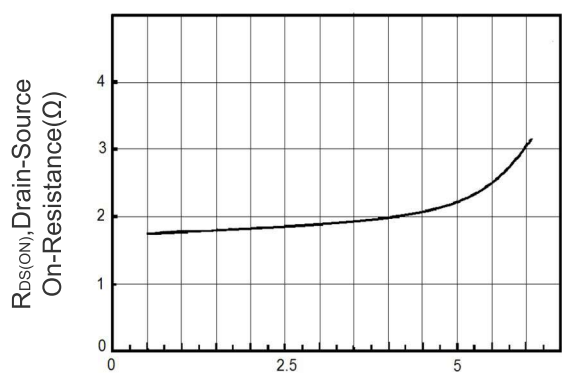
V_{DS} (V)

Figure 3 Output characteristics



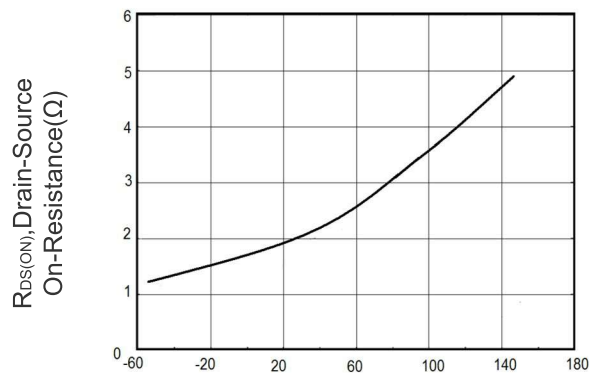
V_{GS} , Gate-Source Voltage (V)

Figure 4 Transfer characteristics



I_D , Drain Current (A)

Figure 5 Static drain-source on resistance



T_J , Junction Temperature ($^{\circ}\text{C}$)

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

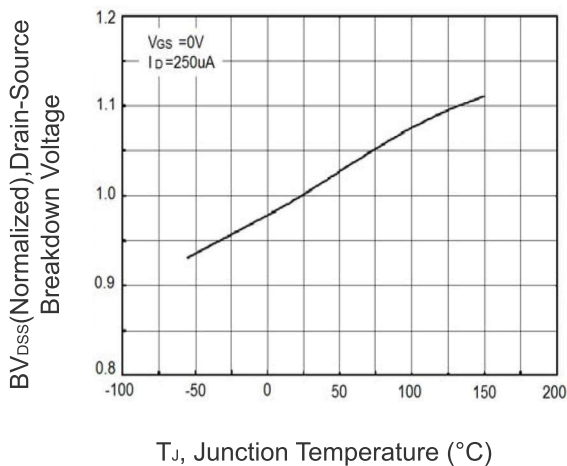


Figure 7 BV_{DSS} vs Junction Temperature

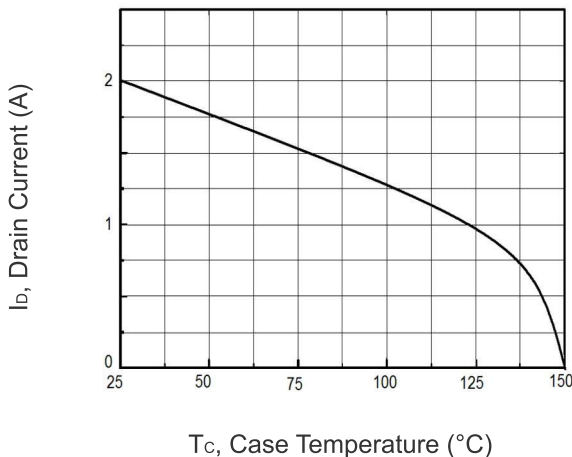


Figure 8 Maximum I_D vs Junction Temperature

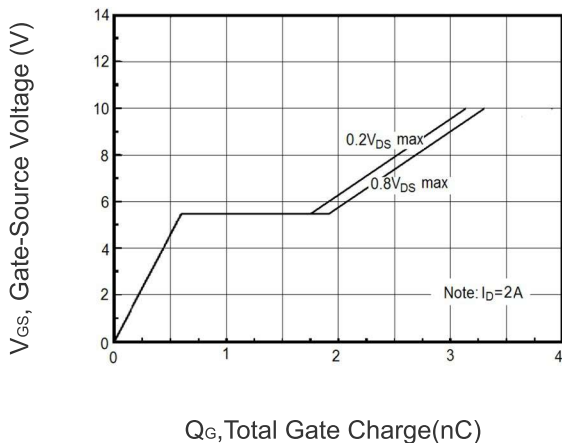


Figure 9 Gate charge waveforms

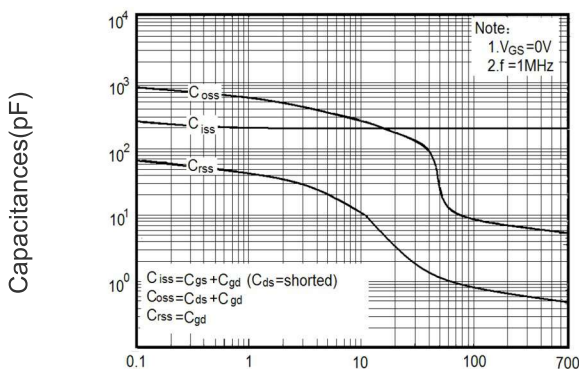


Figure 10 Capacitance

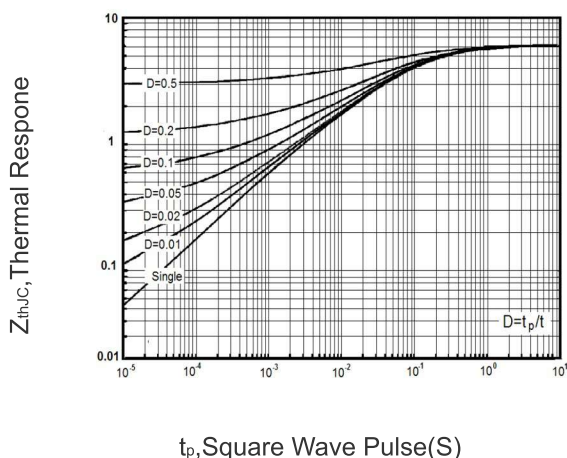
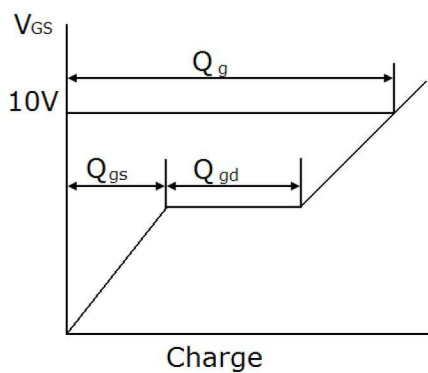
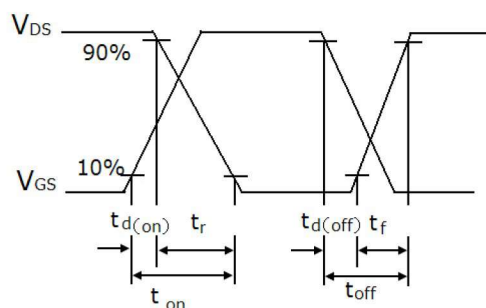
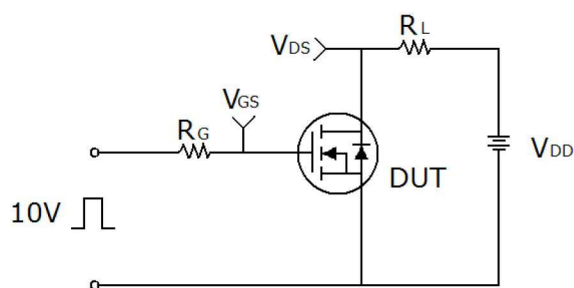


Figure 11 Transient Thermal Impedance

Test circuit



Gate charge test circuit & Waveform

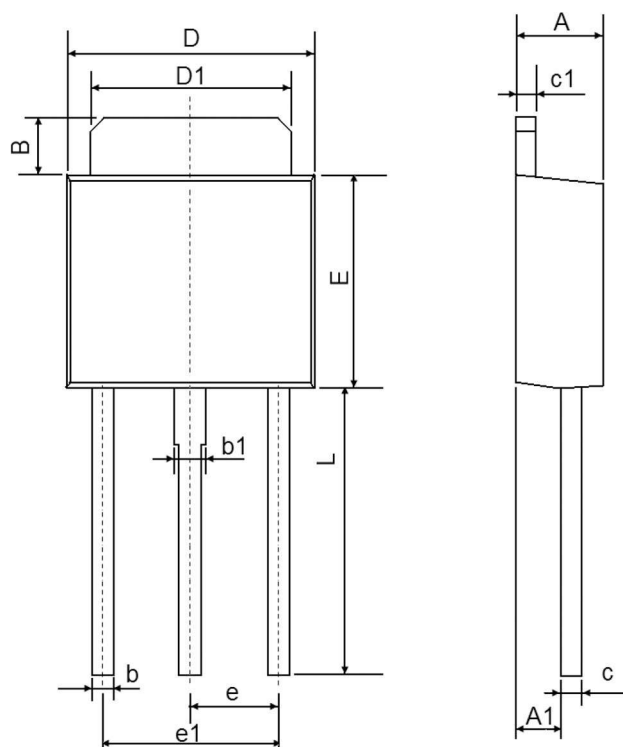


Switch Time Test Circuit



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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