

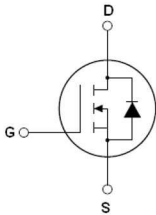
# N-Channel Super Junction Power MOSFET II

## General Description

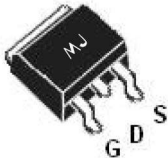
The series of devices use advanced super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

## 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-252

## Application

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

$V_{DS@T_{jmax}}$	710	V
$R_{DS(ON)TYP}$	2.2	$\Omega$
$I_D$	2	A

## Package Marking And Ordering Information

Device	Device Package	Marking
MJ65R2K2K	TO-252	MJ65R2K2K

Table 1. Absolute Maximum Ratings (Tc=25℃)

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V <sub>GS</sub> =0V)	V <sub>DS</sub>	650	V
Gate-Source Voltage (V <sub>DS</sub> =0V)	V <sub>GS</sub>	±30	V
Continuous Drain Current at Tc=25℃	I <sub>D</sub> (DC)	2	A
Continuous Drain Current at Tc=100℃	I <sub>D</sub> (DC)	1.3	A
Pulsed drain current <sup>(Note 1)</sup>	I <sub>DM</sub> (pluse)	6	A
Maximum Power Dissipation (Tc=25℃)	P <sub>D</sub>	23	W
Derate above 25℃	P <sub>D</sub>	0.184	W/℃
Single pulse avalanche energy <sup>(Note 2)</sup>	E <sub>AS</sub>	45	mJ
Avalanche current <sup>(Note 1)</sup>	I <sub>AR</sub>	1	A
Repetitive Avalanche energy , t <sub>AR</sub> limited by T <sub>jmax</sub> <sup>(Note 1)</sup>	E <sub>AR</sub>	0.06	mJ

Parameter	Symbol	Value	Unit
Drain Source voltage slope, V <sub>DS</sub> ≤480 V	dv/dt	50	V/ns
Reverse diode dv/dt, V <sub>DS</sub> ≤480 V, I <sub>SD</sub> <I <sub>D</sub>	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55...+150	℃

\* limited by maximum junction temperature

Table 2. Thermal Characteristic

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

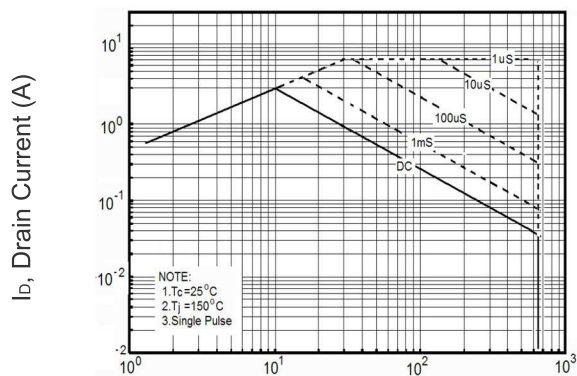
Table 3. Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

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	650	-	-	V
Zero Gate Voltage Drain Current (Tc=25°C)	I <sub>DSS</sub>	V <sub>DS</sub> =650V,V <sub>GS</sub> =0V	-	-	1	μA
Zero Gate Voltage Drain Current (Tc=125°C)	I <sub>DSS</sub>	V <sub>DS</sub> =650V,V <sub>GS</sub> =0V	-	-	10	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> =1A	-	2200	2500	mΩ
Dynamic Characteristics						
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =20V,I <sub>D</sub> =1A	-	2	-	S
Input Capacitance	C <sub>ies</sub>	V <sub>DS</sub> =50V,V <sub>GS</sub> =0V F=1.0MHz	-	190	-	PF
Output Capacitance	C <sub>oss</sub>		-	13	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	1.1	-	PF
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =480V,I <sub>D</sub> =2A V <sub>GS</sub> =10V	-	3.2	10	nC
Gate-Source Charge	Q <sub>gs</sub>		-	0.6	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	1.2	-	nC
Intrinsic gate resistance	R <sub>G</sub>	f=1 MHz open drain	-	9	-	Ω
Switching times						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =380V,I <sub>D</sub> =1A R <sub>G</sub> =50Ω,V <sub>GS</sub> =10V	-	6	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	3	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	65	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	11	-	nS
Source- Drain Diode Characteristics						
Source-drain current (Body Diode)	I <sub>SD</sub>	T <sub>C</sub> =25°C	-	-	2	A
Pulsed Source-drain current (Body Diode)	I <sub>SDM</sub>		-	-	6	A
Forward On Voltage	V <sub>SD</sub>	T <sub>J</sub> =25°C,I <sub>SD</sub> =2A,V <sub>GS</sub> =0V	-	1	1.3	V
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> =25°C,I <sub>F</sub> =2A di/dt=100A/μs	-	140	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	0.65	-	uC
Peak reverse recovery current	I <sub>rrm</sub>		-	9	-	A

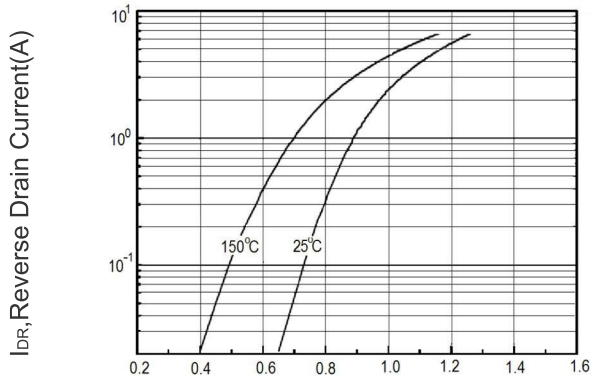
## Notes

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

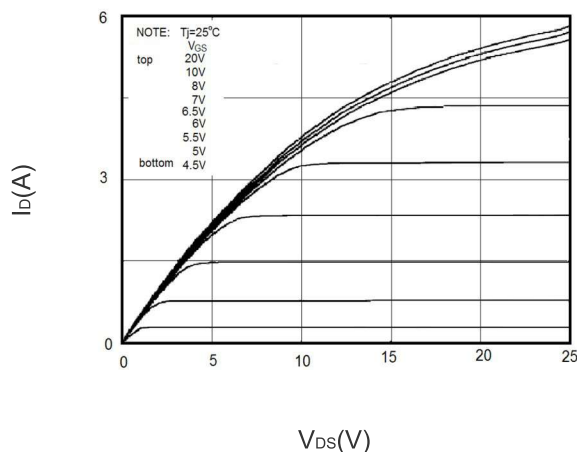
## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)



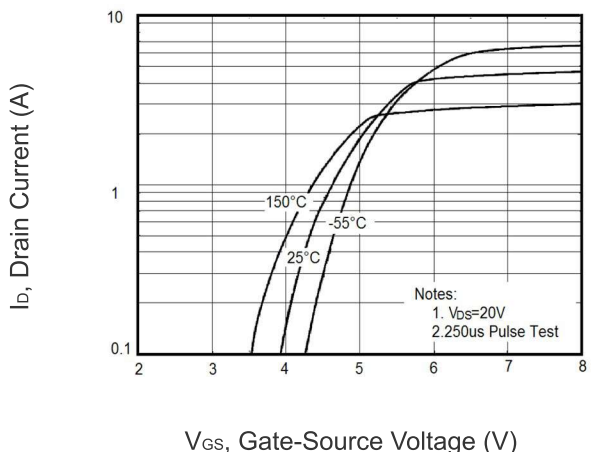
$V_{DS}$ , Drain-Source Voltage (V)  
Figure 1 Safe operating area



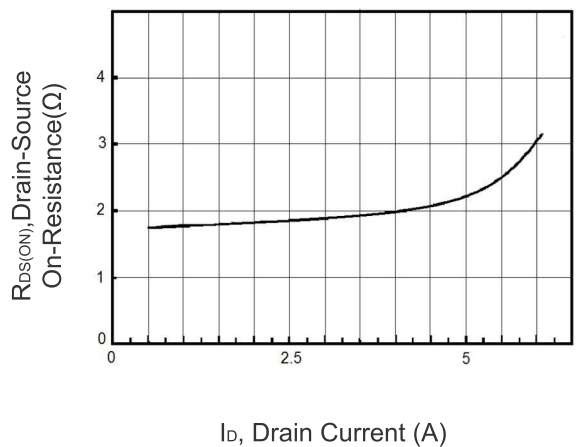
$V_{SD}$ , Source-Drain Voltage (V)  
Figure 2 Source-Drain Diode Forward Voltage



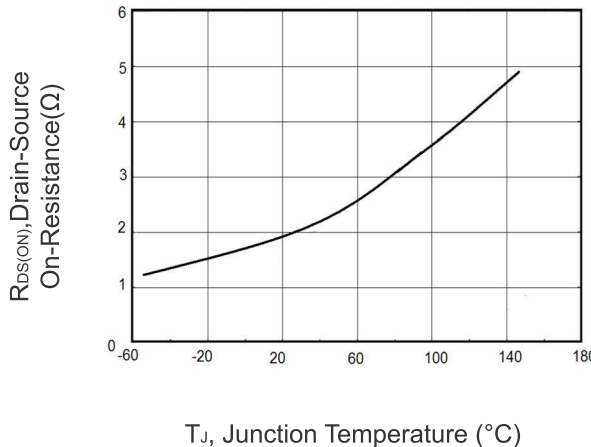
$V_{DS}$ (V)  
Figure 3 Output characteristics



$V_{GS}$ , 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

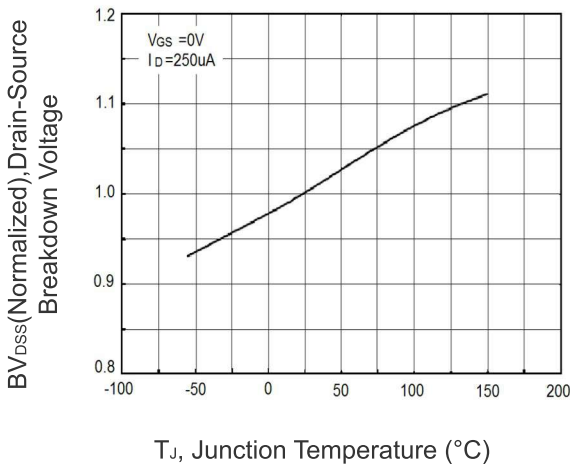


Figure 7  $BV_{DSS}$  vs Junction Temperature

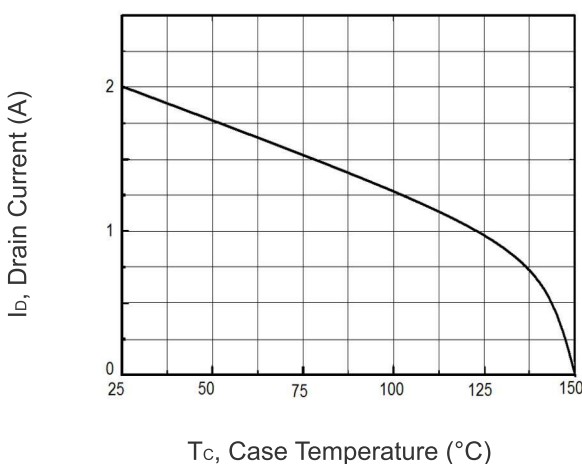


Figure 8 Maximum  $I_D$  vs Junction Temperature

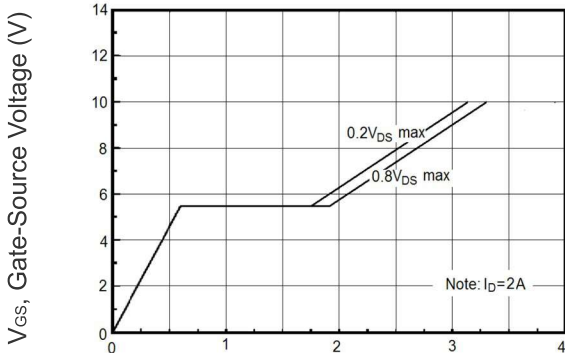


Figure 9 Gate charge waveforms

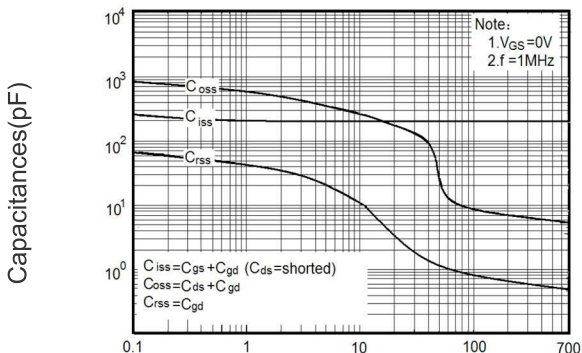


Figure 10 Capacitance

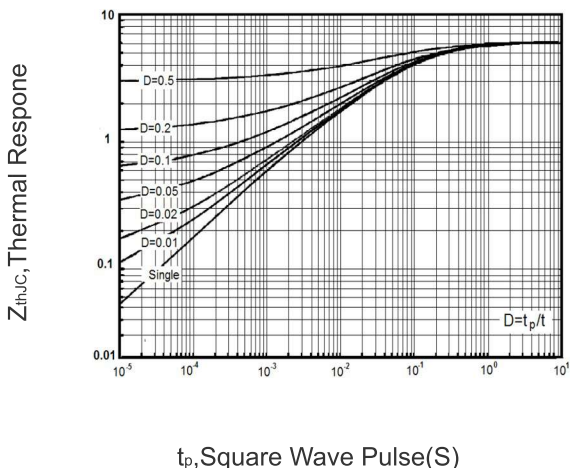
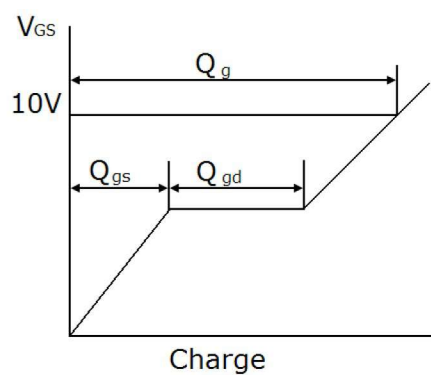
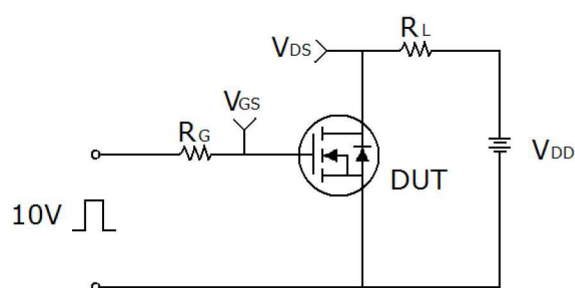


Figure 11 Transient Thermal Impedance

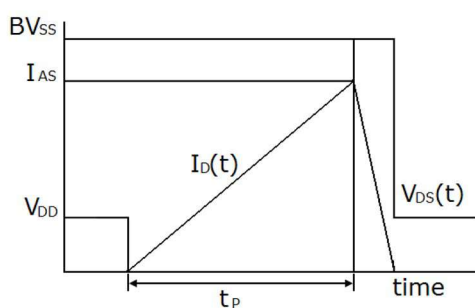
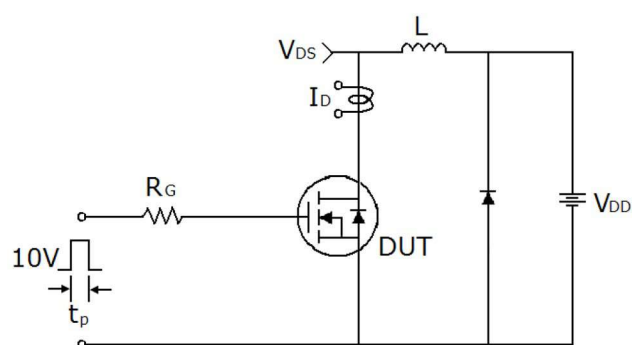
## Test circuit



Gate charge test circuit & Waveform

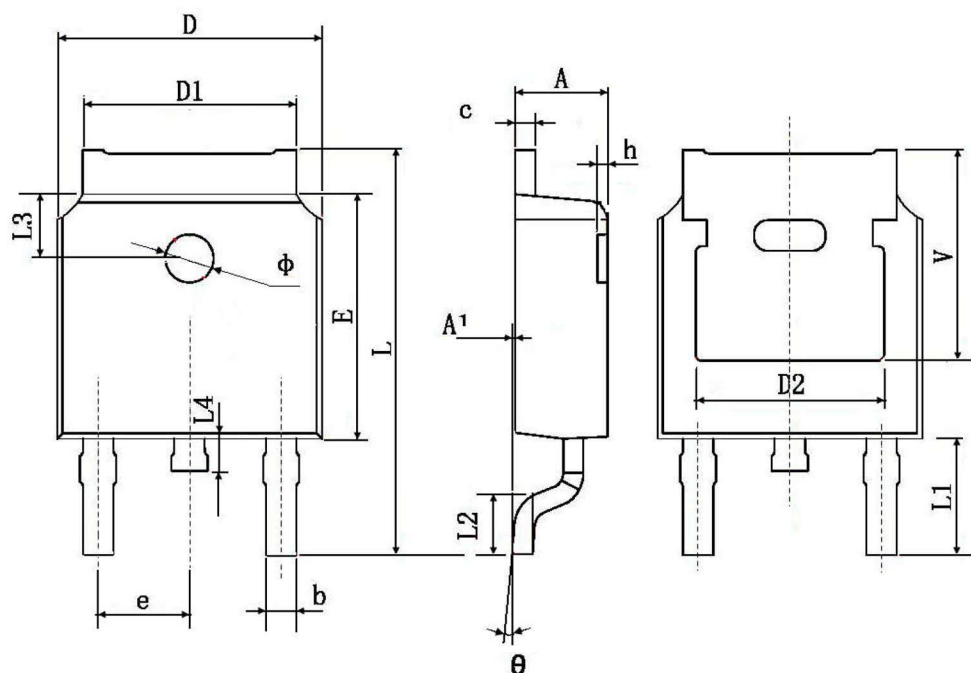


Switch Time Test Circuit



Unclamped Inductive Switching Test Circuit & Waveforms

## TO-252 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	

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