

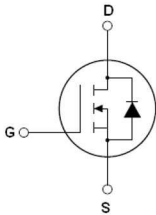
N-Channel Super Junction Power MOSFET II

General Description

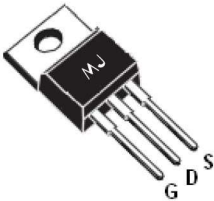
The series of devices use advanced super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

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-220

Application

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

$V_{DS}@T_{jmax}$	650	V
$R_{DS(ON) MAX}$	360	mΩ
I_D	11	A

Package Marking And Ordering Information

Device	Device Package	Marking
MJ60R360	TO-220	MJ60R360

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

Parameter	Symbol	MJ60R360	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 Tc=25°C	I _D (DC)	11	A
Continuous Drain Current at Tc=100°C	I _D (DC)	7	A
Pulsed drain current ^(Note 1)	I _{DM} (pluse)	33	A
Maximum Power Dissipation (Tc=25°C)	P _D	121	W
Derate above 25°C	P _D	0.97	W/°C
Single pulse avalanche energy ^(Note 2)	E _{AS}	280	mJ
Avalanche current ^(Note 1)	I _{AR}	5.5	A
Repetitive Avalanche energy, t _{AR} limited by T _{jmax} ^(Note 1)	E _{AR}	0.5	mJ

Parameter	Symbol	MJ60R360	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	MJ60R360	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	1.03	$^{\circ}C/W$
Thermal Resistance, Junction-to-Ambient (Maximum)	R_{thJA}	62	$^{\circ}C/W$

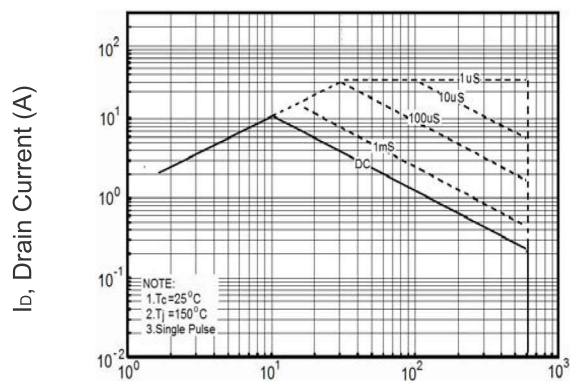
Table 3. Electrical Characteristics (T_A=25°C unless otherwise noted)

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	-	0.05	1	μA
Zero Gate Voltage Drain Current (Tc=125°C)	I _{DSS}	V _{DS} =600V,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 =7A	-	300	360	mΩ
Dynamic Characteristics						
Forward Transconductance	g _{FS}	V _{DS} =20V,I _D =7A	-	8	-	S
Input Capacitance	C _{ies}	V _{DS} =50V,V _{GS} =0V F=1.0MHz	-	1030	-	PF
Output Capacitance	C _{oss}		-	87	-	PF
Reverse Transfer Capacitance	C _{rss}		-	4.5	-	PF
Total Gate Charge	Q _g	V _{DS} =480V,I _D =11A V _{GS} =10V	-	23	40	nC
Gate-Source Charge	Q _{gs}		-	5.7	-	nC
Gate-Drain Charge	Q _{gd}		-	8	-	nC
Intrinsic gate resistance	R _G	f=1 MHz open drain	-	2	-	Ω
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V,I _D =5.5A R _G =6.8Ω,V _{GS} =10V	-	9	-	nS
Turn-on Rise Time	t _r		-	4	-	nS
Turn-Off Delay Time	t _{d(off)}		-	40	65	nS
Turn-Off Fall Time	t _f		-	4.5	8	nS
Source- Drain Diode Characteristics						
Source-drain current (Body Diode)	I _{SD}	T _C =25°C	-	-	11	A
Pulsed Source-drain current (Body Diode)	I _{SDM}		-	-	33	A
Forward On Voltage	V _{SD}	T _J =25°C,I _{SD} =11A,V _{GS} =0V	-	0.9	1.2	V
Reverse Recovery Time	t _{rr}	T _J =25°C,I _F =11A di/dt=100A/μs	-	245	-	nS
Reverse Recovery Charge	Q _{rr}		-	2.4	-	uC
Peak reverse recovery current	I _{rrm}		-	20	-	A

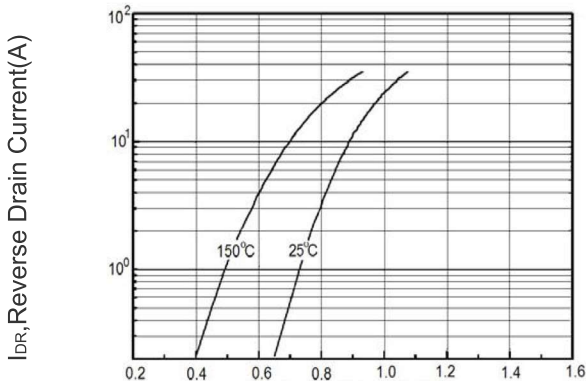
Notes

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

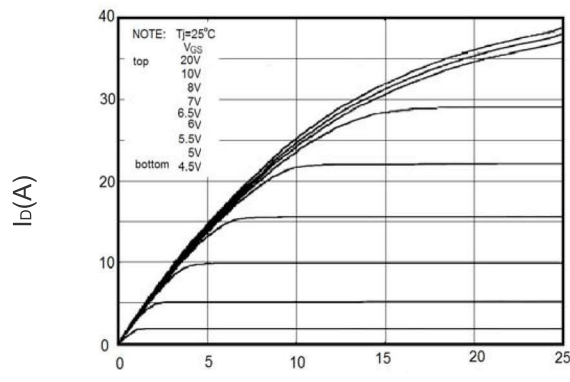
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)



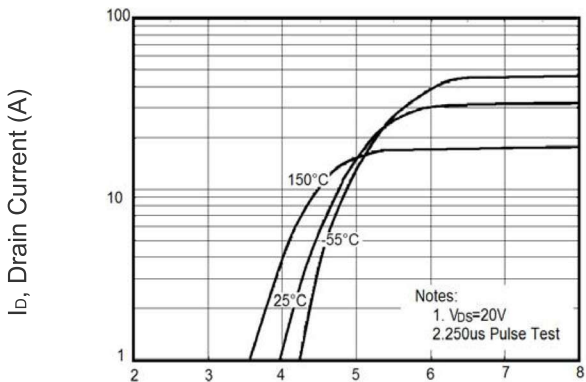
VDs, Drain-Source Voltage (V)
Figure 1 Safe operating area



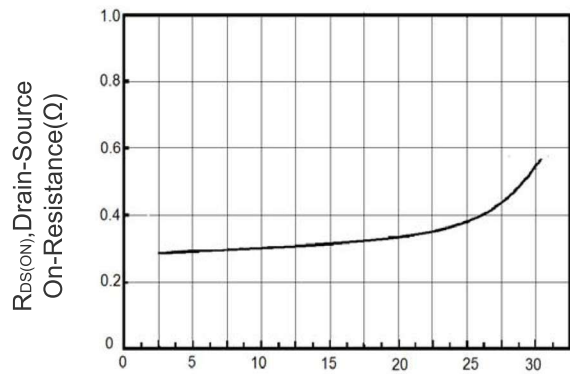
VSD,Source-Drain Voltage(V)
Figure 2 Source-Drain Diode Forward Voltage



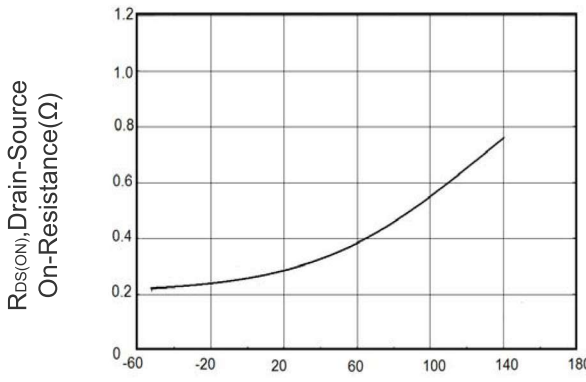
VDS(V)
Figure 3 Output characteristics



VGS, Gate-Source Voltage (V)
Figure 4 Transfer characteristics



Id, Drain Current (A)
Figure 5 Static drain-source on resistance



TJ, Junction Temperature (°C)
Figure 6 RDS(ON) vs Junction Temperature

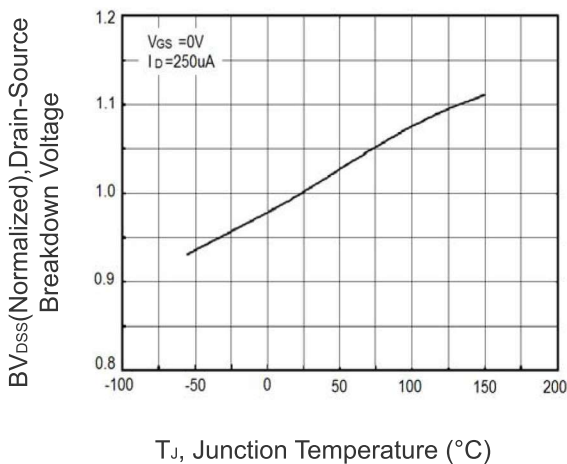


Figure 7 BV_{DSS} vs Junction Temperature

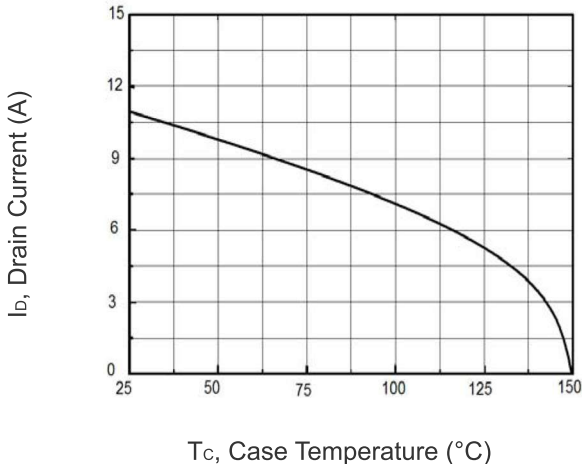


Figure 8 Maximum I_D vs Junction Temperature

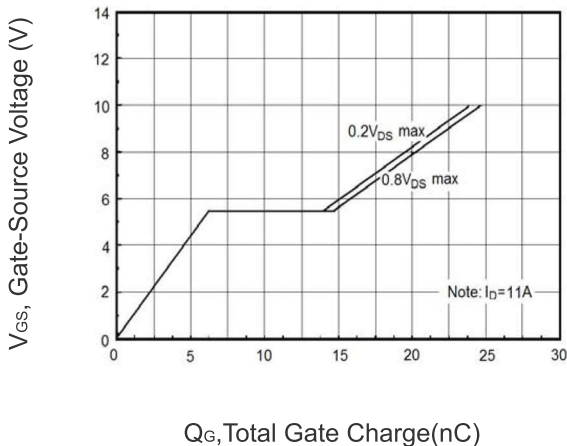


Figure 9 Gate charge waveforms

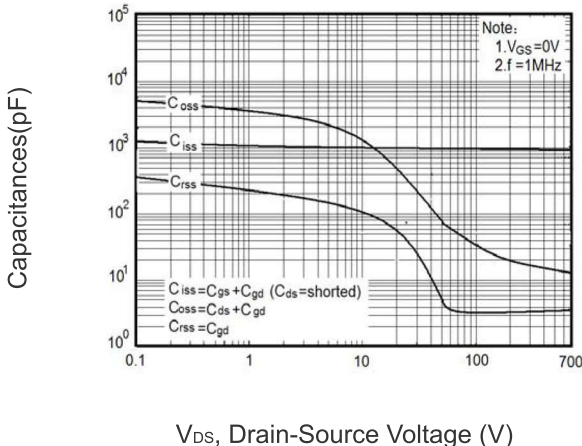


Figure 10 Capacitance

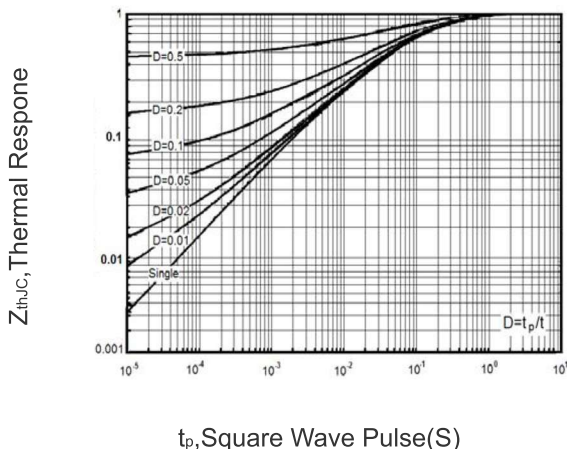
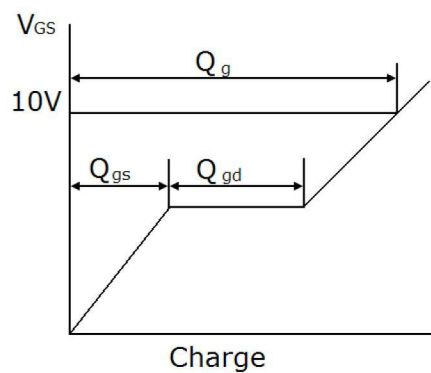


Figure 11 Transient Thermal Impedance

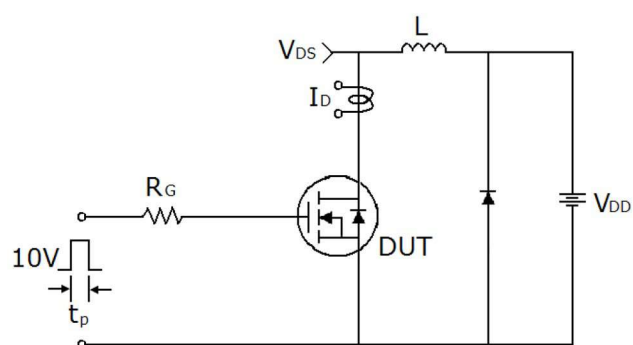
Test circuit



Gate charge test circuit & Waveform

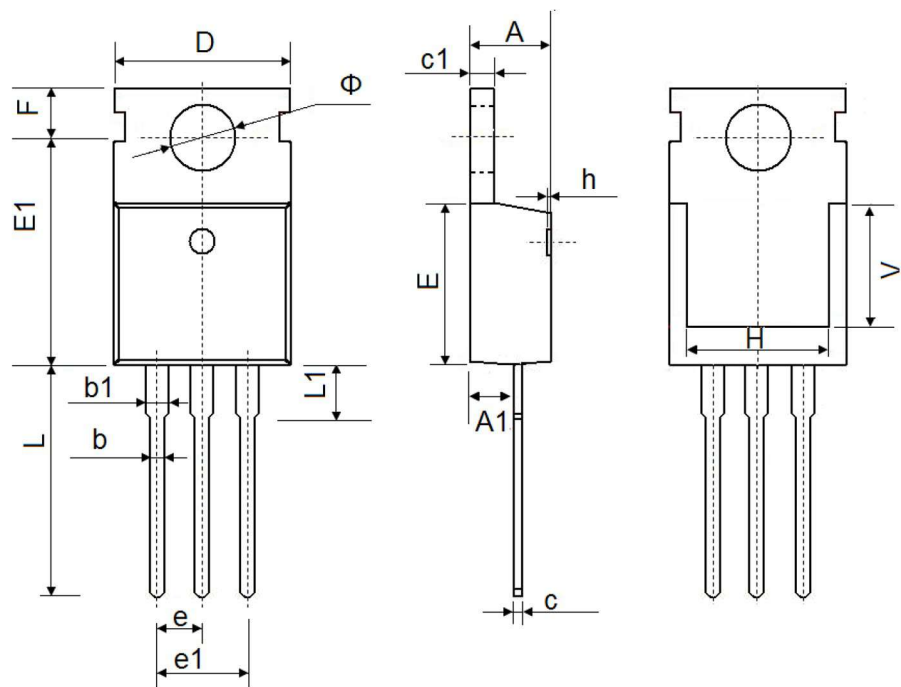


Switch Time Test Circuit



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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