

N-Channel Super Junction Power MOSFET II

General Description

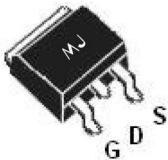
The series of devices use advanced super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

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}	700	V
$R_{DS(ON)TYP.}$	540	m Ω
I_D	8	A

Package Marking And Ordering Information

Device	Device Package	Marking
MJ70R540K	TO-252	MJ70R540K

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	700	V
Gate-Source Voltage ($V_{DS}=0V$)	V_{GS}	± 30	V
Continuous Drain Current at Tc=25°C	I_D (DC)	8	A
Continuous Drain Current at Tc=100°C	I_D (DC)	5.2	A
Pulsed drain current ^(Note 1)	I_{DM} (pluse)	24	A
Maximum Power Dissipation (Tc=25°C)	P_D	80	W
Derate above 25°C	P_D	0.64	W/°C
Single pulse avalanche energy ^(Note 2)	E_{AS}	185	mJ
Avalanche current ^(Note 1)	I_{AR}	4	A
Repetitive Avalanche energy, t_{AR} limited by T_{jmax} ^(Note 1)	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	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	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R _{thJC}	1.56	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	R _{thJA}	62	°C/W

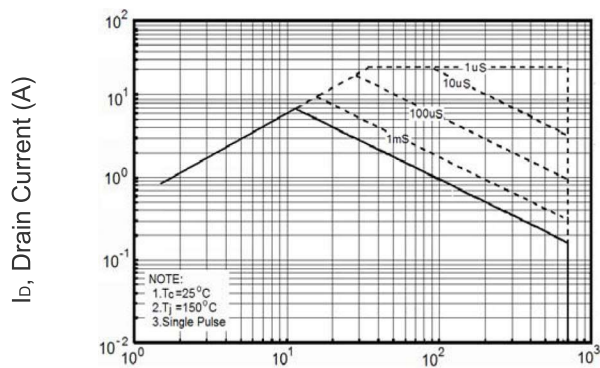
Table 3. Electrical Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250μA	700	-	-	V
Zero Gate Voltage Drain Current (Tc=25°C)	I _{DSS}	V _{DS} =700V,V _{GS} =0V	-	-	1	μA
Zero Gate Voltage Drain Current (Tc=125°C)	I _{DSS}	V _{DS} =700V,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 =4A	-	540	600	mΩ
Dynamic Characteristics						
Forward Transconductance	g _{FS}	V _{DS} =20V,I _D =4A	-	5.5	-	S
Input Capacitance	C _{ies}	V _{DS} =50V,V _{GS} =0V F=1.0MHz	-	680	-	pF
Output Capacitance	C _{oss}		-	58	-	pF
Reverse Transfer Capacitance	C _{rss}		-	4	-	pF
Total Gate Charge	Q _g	V _{DS} =480V,I _D =8A 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} =380V,I _D =4A R _G =12Ω,V _{GS} =10V	-	5.5	-	nS
Turn-on Rise Time	t _r		-	3.5	-	nS
Turn-Off Delay Time	t _{d(off)}		-	55	75	nS
Turn-Off Fall Time	t _f		-	6.5	10	nS
Source- Drain Diode Characteristics						
Source-drain current (Body Diode)	I _{SD}	T _C =25°C	-	-	8	A
Pulsed Source-drain current (Body Diode)	I _{SDM}		-	-	23.4	A
Forward On Voltage	V _{SD}	T _J =25°C,I _{SD} =8A,V _{GS} =0V	-	0.9	1.2	V
Reverse Recovery Time	t _{rr}	T _J =25°C,I _F =8A di/dt=100A/μs	-	220	-	nS
Reverse Recovery Charge	Q _{rr}		-	2.2	-	uC
Peak reverse recovery Current	I _{rrm}		-	20	-	A

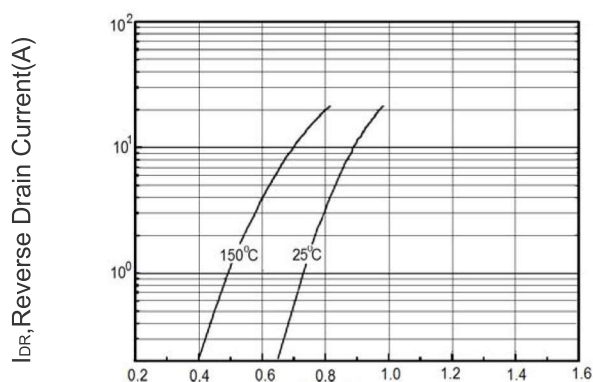
Notes

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

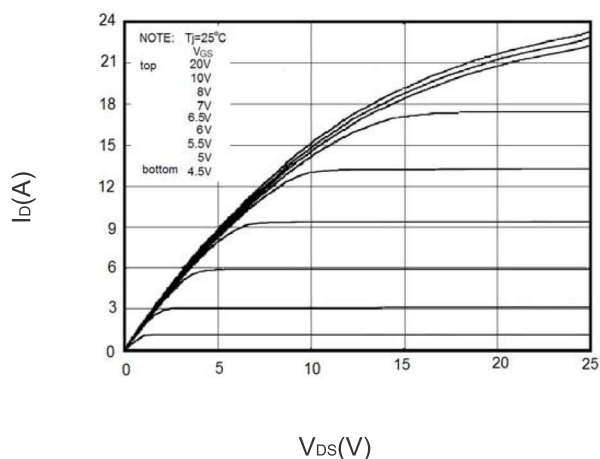
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)



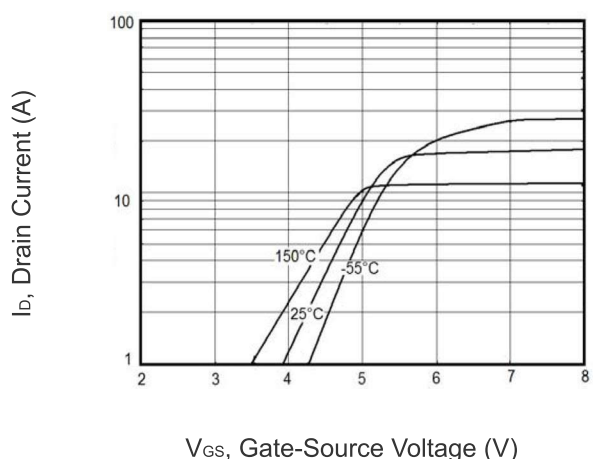
V_{DS} , Drain-Source Voltage (V)
Figure 1 Safe operating area



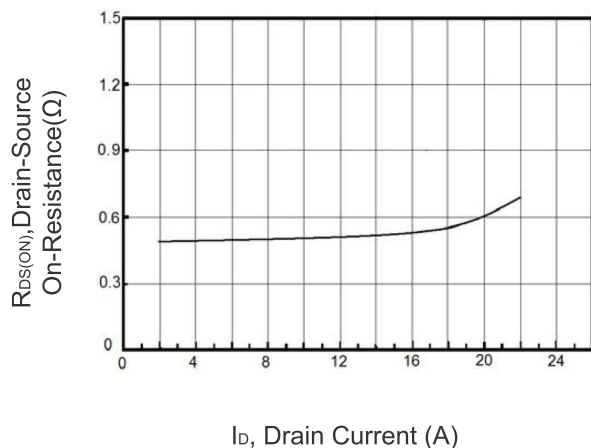
V_{SD} , Source-Drain Voltage (V)
Figure 2 Source-Drain Diode Forward Voltage



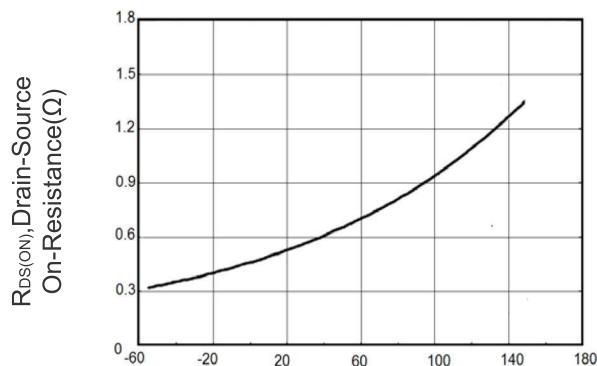
V_{DS} (V)
Figure 3 Output characteristics



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

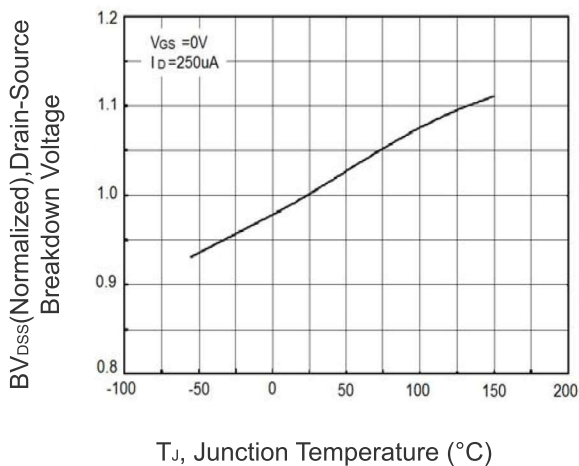


Figure 7 BV_{DSS} vs Junction Temperature

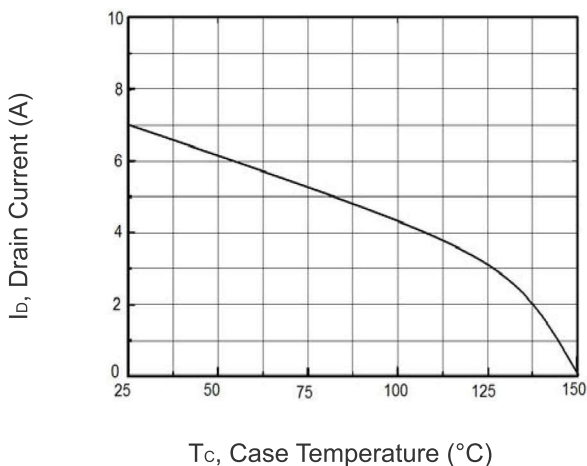


Figure 8 Maximum I_D vs Junction Temperature

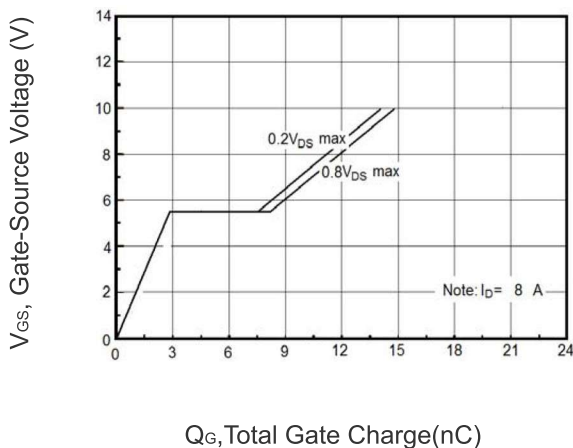


Figure 9 Gate charge waveforms

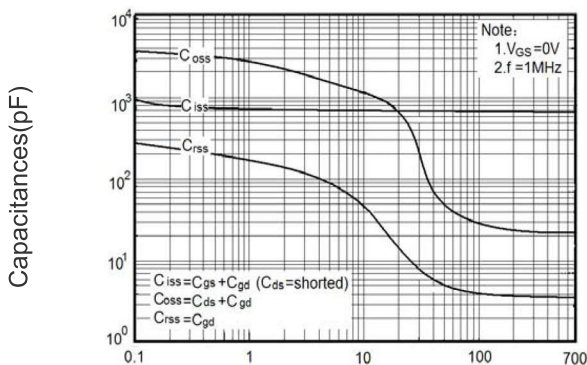


Figure 10 Capacitance

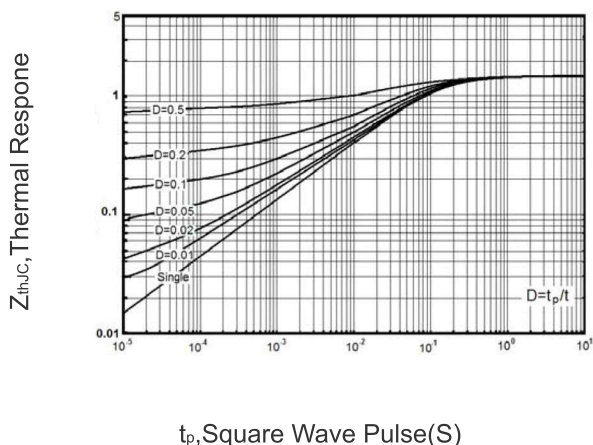
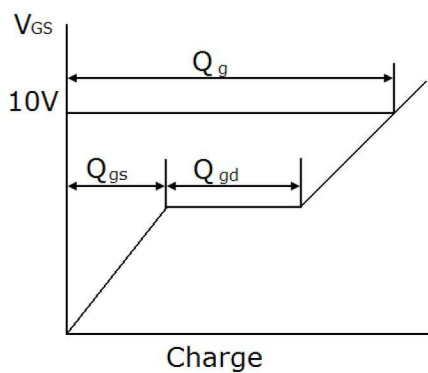
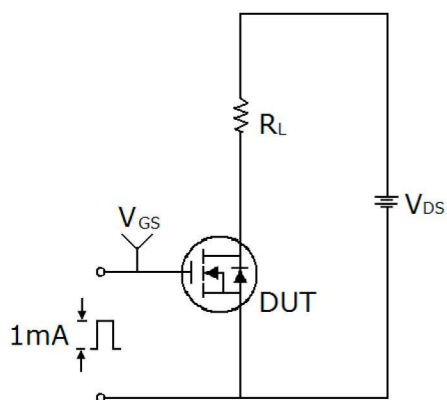
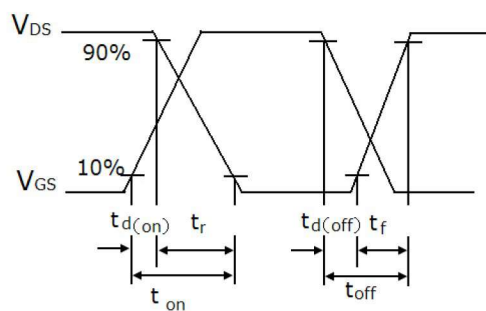


Figure 11 Transient Thermal Impedance

Test circuit



Gate charge test circuit & Waveform

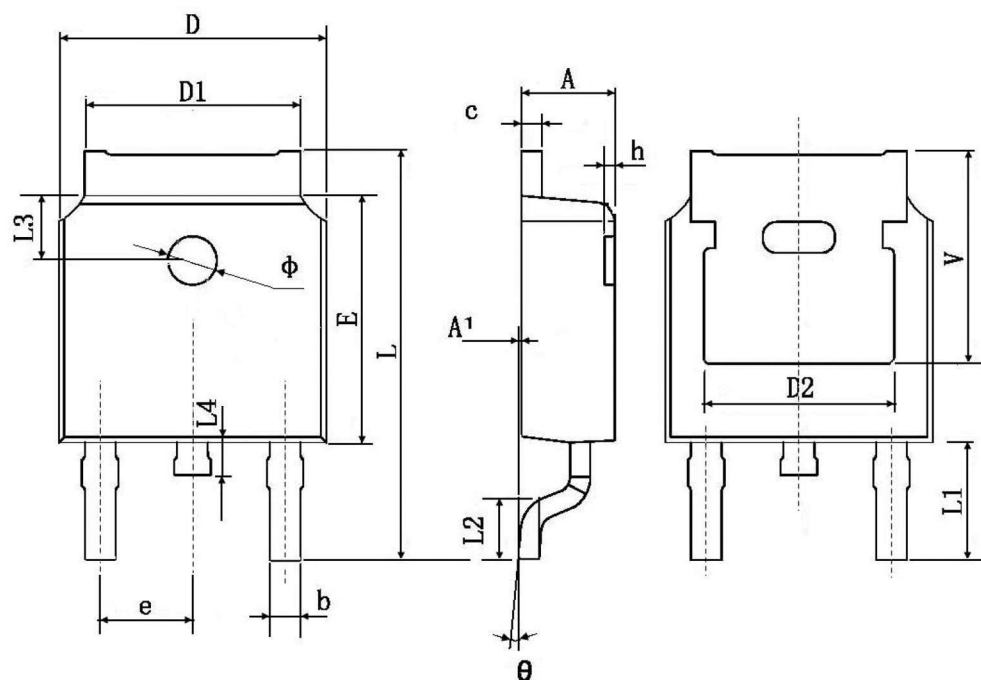


Switch Time Test Circuit



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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