

# N-Channel Super Junction Power MOSFET II

## General Description

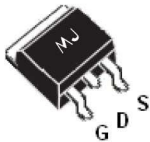
The series of devices use advanced super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

## 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-263

## Application

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

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

## Package Marking And Ordering Information

Device	Device Package	Marking
MJ70R540D	TO-263	MJ70R540D

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

Parameter	Symbol	MJ70R540D	Unit
Drain-Source Voltage (V <sub>GS</sub> =0V)	V <sub>DS</sub>	700	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)	8	A
Continuous Drain Current at Tc=100℃	I <sub>D</sub> (DC)	5.2	A
Pulsed drain current <sup>(Note 1)</sup>	I <sub>DM</sub> (pluse)	24	A
Maximum Power Dissipation (Tc=25℃)	P <sub>D</sub>	80	W
Derate above 25℃	P <sub>D</sub>	0.64	W/℃
Single pulse avalanche energy <sup>(Note 2)</sup>	E <sub>AS</sub>	185	mJ
Avalanche current <sup>(Note 1)</sup>	I <sub>AR</sub>	4	A
Repetitive Avalanche energy, t <sub>AR</sub> limited by T <sub>jmax</sub> <sup>(Note 1)</sup>	E <sub>AR</sub>	0.4	mJ

Parameter	Symbol	MJ70R540D	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	MJ70R540D	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R <sub>thJC</sub>	1.56	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	R <sub>thJA</sub>	62	°C/W

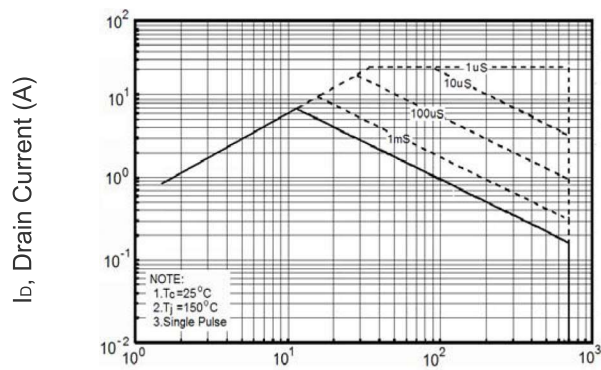
Table 3. Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

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	700	-	-	V
Zero Gate Voltage Drain Current (Tc=25°C)	I <sub>DSS</sub>	V <sub>DS</sub> =700V,V <sub>GS</sub> =0V	-	-	1	μA
Zero Gate Voltage Drain Current (Tc=125°C)	I <sub>DSS</sub>	V <sub>DS</sub> =700V,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> =4A	-	540	600	mΩ
Dynamic Characteristics						
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =20V,I <sub>D</sub> =4A	-	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>		-	58	-	pF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	4	-	pF
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =480V,I <sub>D</sub> =8A 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> =380V,I <sub>D</sub> =4A R <sub>G</sub> =12Ω,V <sub>GS</sub> =10V	-	5.5	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	3.5	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	55	75	nS
Turn-Off Fall Time	t <sub>f</sub>		-	6.5	10	nS
Source- Drain Diode Characteristics						
Source-drain current (Body Diode)	I <sub>SD</sub>	T <sub>C</sub> =25°C	-	-	8	A
Pulsed Source-drain current (Body Diode)	I <sub>SDM</sub>		-	-	23.4	A
Forward On Voltage	V <sub>SD</sub>	T <sub>J</sub> =25°C,I <sub>SD</sub> =8A,V <sub>GS</sub> =0V	-	0.9	1.2	V
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> =25°C,I <sub>F</sub> =8A di/dt=100A/μs	-	220	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	2.2	-	uC
Peak reverse recovery Current	I <sub>rrm</sub>		-	20	-	A

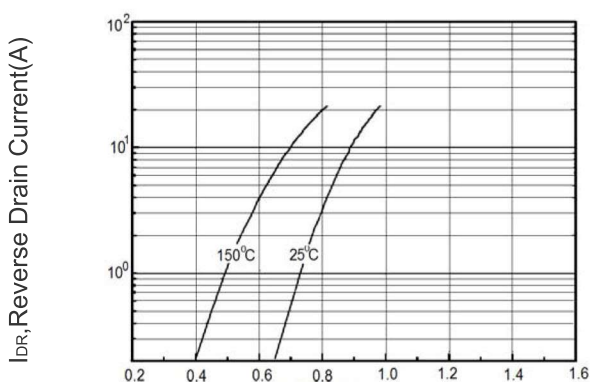
## Notes

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

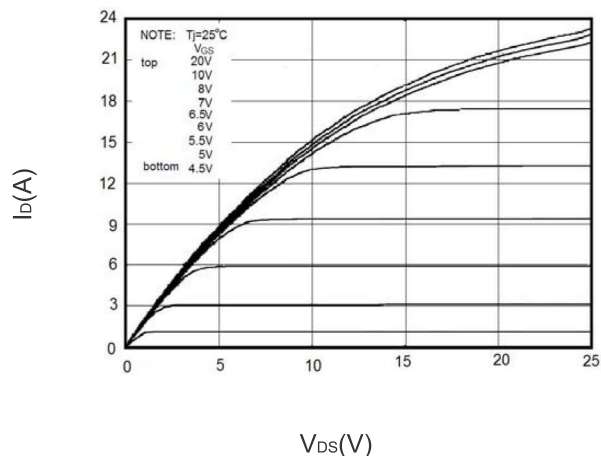
## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)



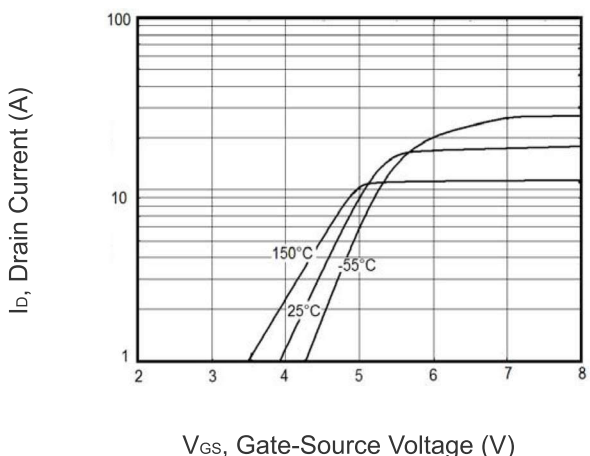
$V_{DS}$ , Drain-Source Voltage (V)  
Figure 1 Safe operating area



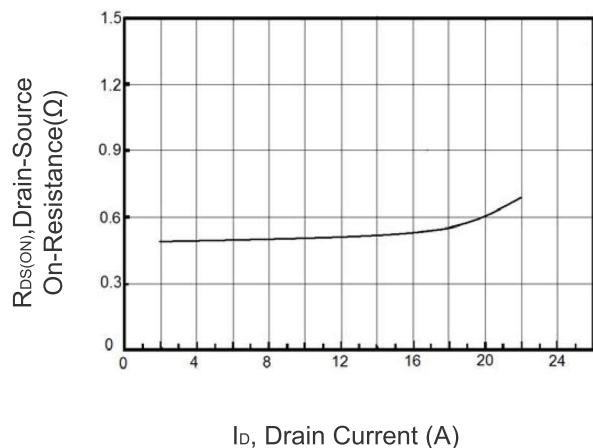
$V_{SD}$ , Source-Drain Voltage(V)  
Figure 2 Source-Drain Diode Forward Voltage



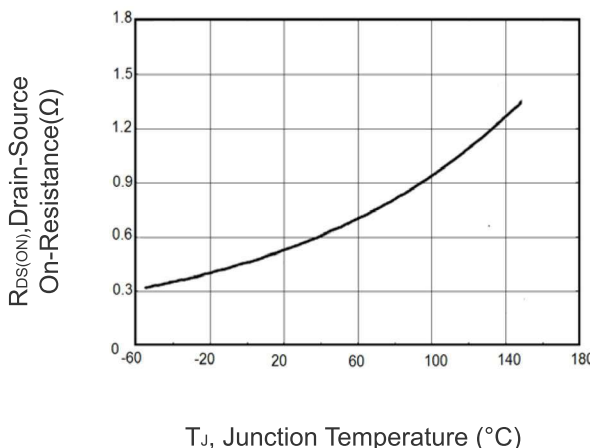
$V_{DS}(V)$   
Figure 3 Output characteristics



$V_{GS}$ , 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

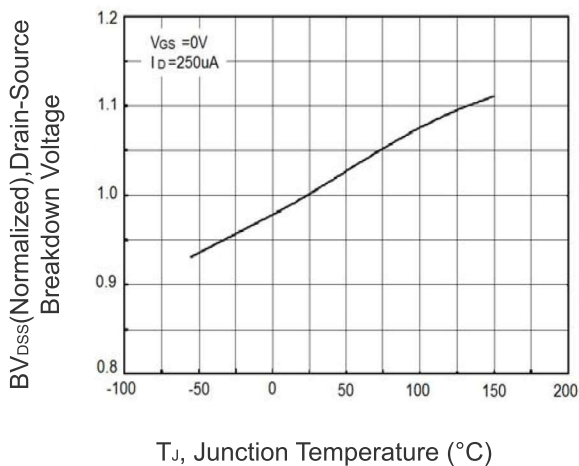
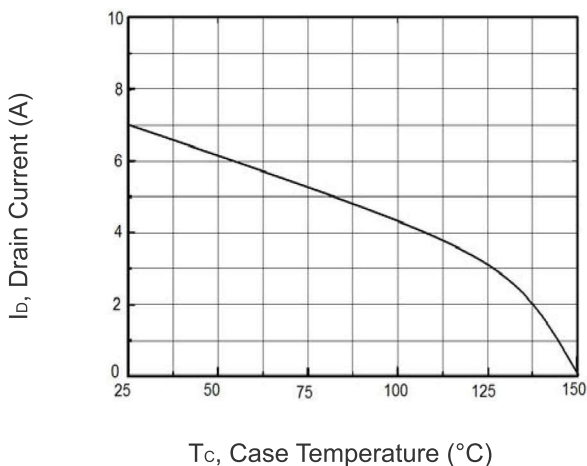
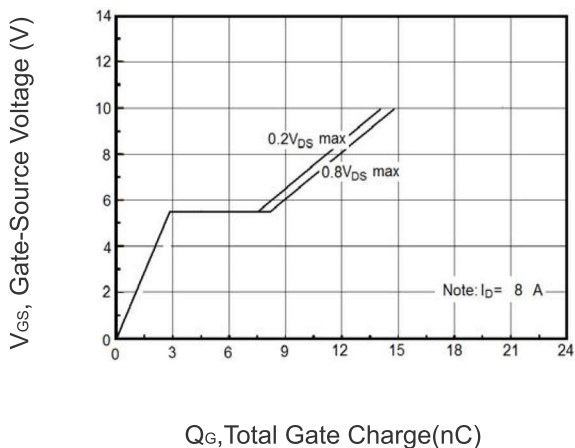

Figure 7  $BV_{DSS}$  vs Junction Temperature

Figure 8 Maximum  $I_D$  vs Junction Temperature


Figure 9 Gate charge waveforms

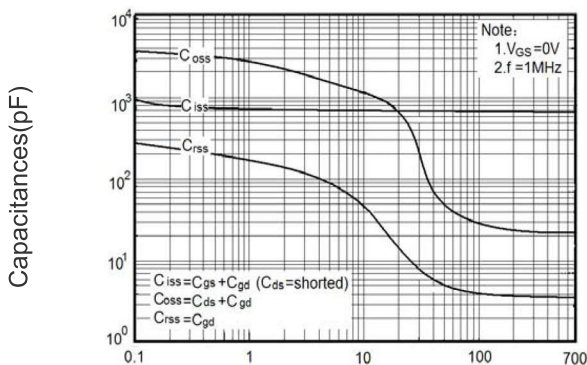


Figure 10 Capacitance

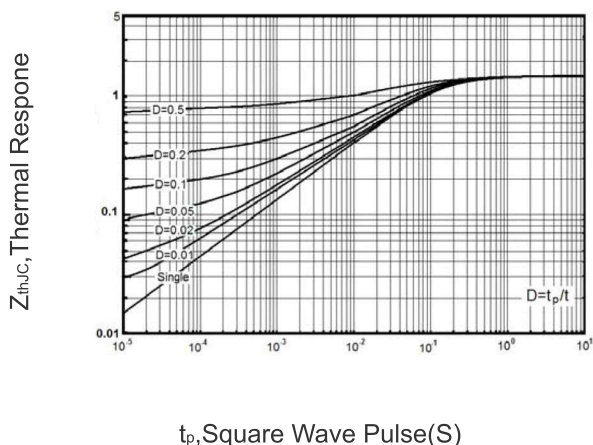
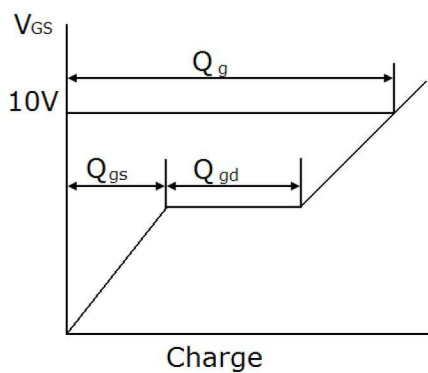
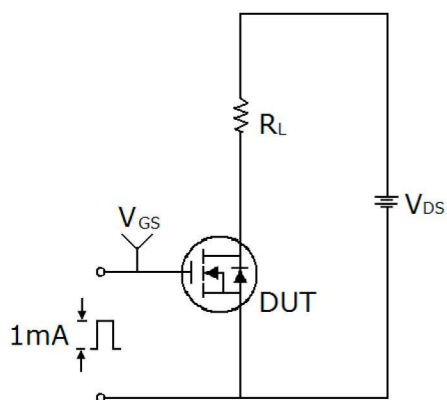
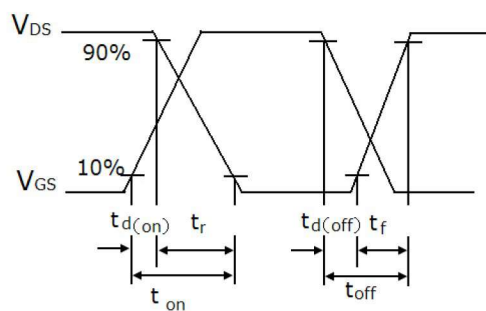


Figure 11 Transient Thermal Impedance

## Test circuit



Gate charge test circuit & Waveform

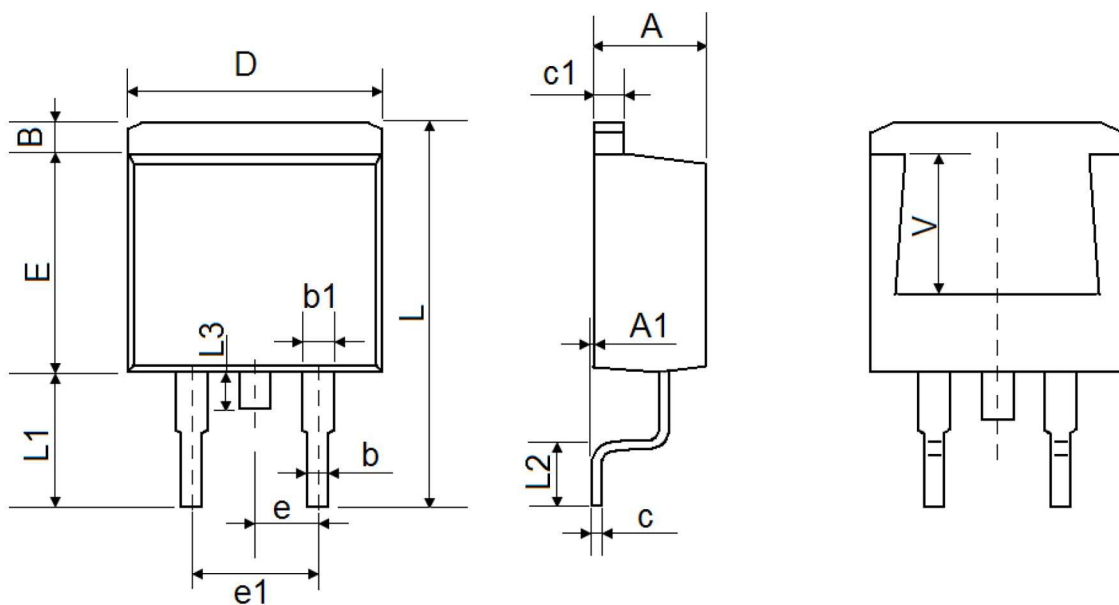


Switch Time Test Circuit



Unclamped Inductive Switching Test Circuit & Waveforms

## TO-263-2L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.170	1.370	0.046	0.054
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
L	15.050	15.450	0.593	0.608
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108
L3	1.300	1.700	0.051	0.067
V	5.600 REF		0.220 REF	

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