

# N-Channel Super Junction Power MOSFET III

## General Description

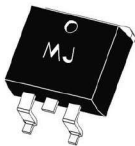
The series of devices use advanced super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

## 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)

$V_{DS}$	800	V
$R_{DS(ON)TYP}$	260	mΩ
$I_D$	17	A

## Package Marking And Ordering Information

Device	Device Package	Marking
MJ80T320D	TO-263	MJ80T320D

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

Parameter	Symbol	MJ80T320D	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	800	V
Gate-Source Voltage ( $V_{DS}=0V$ ) ,AC ( $f>1\text{ Hz}$ )	$V_{GS}$	$\pm 30$	V
Continuous Drain Current at $T_c=25^{\circ}C$	$I_D$ (DC)	17	A
Continuous Drain Current at $T_c=100^{\circ}C$	$I_D$ (DC)	11	A
Pulsed drain current <sup>(Note 1)</sup>	$I_{DM}$ (pluse)	68	A
Maximum Power Dissipation ( $T_c=25^{\circ}C$ )	$P_D$	265	W
Derate above $25^{\circ}C$	$P_D$	2.12	W/ $^{\circ}C$
Single pulse avalanche energy <sup>(Note 2)</sup>	$E_{AS}$	324	mJ
Avalanche current <sup>(Note 1)</sup>	$I_{AR}$	3	A
Repetitive Avalanche energy, $t_{AR}$ limited by $T_{jmax}$ <sup>(Note 1)</sup>	$E_{AR}$	1.8	mJ

Parameter	Symbol	MJ80T320D	Unit
Drain Source voltage slope, $V_{DS} \leq 480\text{ V}$	$dv/dt$	50	V/ns
Reverse diode $dv/dt$ , $V_{DS} \leq 480\text{ V}$ , $I_{SD} < I_D$	$dv/dt$	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	MJ80T320D	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R <sub>thJC</sub>	0.47	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	R <sub>thJA</sub>	62	°C/W

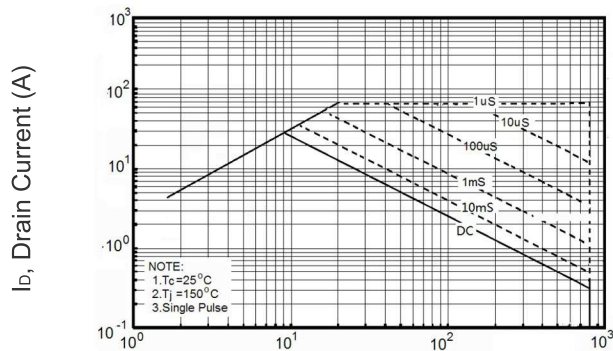
Table 3. Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

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	800	-	-	V
Zero Gate Voltage Drain Current (Tc=25°C)	I <sub>DSS</sub>	V <sub>DS</sub> =800V,V <sub>GS</sub> =0V	-	-	1	μA
Zero Gate Voltage Drain Current (Tc=125°C)	I <sub>DSS</sub>	V <sub>DS</sub> =800V,V <sub>GS</sub> =0V	-	-	100	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V,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	3	3.5	4	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V,I <sub>D</sub> =8.5A	-	260	320	mΩ
Dynamic Characteristics						
Input Capacitance	C <sub>ies</sub>	V <sub>DS</sub> =50V,V <sub>GS</sub> =0V F=1.0MHz	-	2060	-	pF
Output Capacitance	C <sub>OSS</sub>		-	120	-	pF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	0.5	-	pF
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =480V,I <sub>D</sub> =17A V <sub>GS</sub> =10V	-	36	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	12.5	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	11	-	nC
Switching times						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =480V,I <sub>D</sub> =8.5A R <sub>G</sub> =2.3Ω,V <sub>GS</sub> =10V	-	14	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	12	-	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	-	-	17	A
Pulsed Source-drain current (Body Diode)	I <sub>SDM</sub>		-	-	68	A
Forward On Voltage	V <sub>SD</sub>	T <sub>J</sub> =25°C,I <sub>SD</sub> =17A,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> =8.5A di/dt=100A/μs	-	320	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	3.1	-	uC
Peak reverse recovery Current	I <sub>rrm</sub>		-	19	-	A

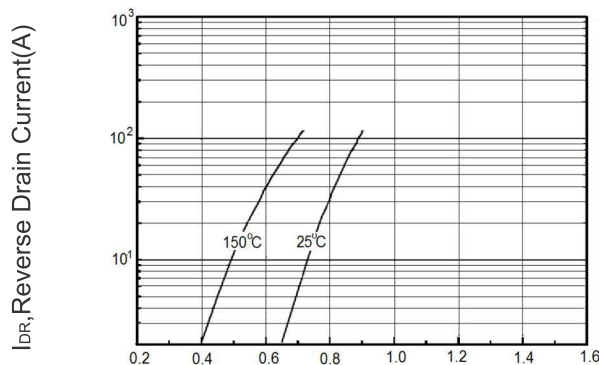
## Notes

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

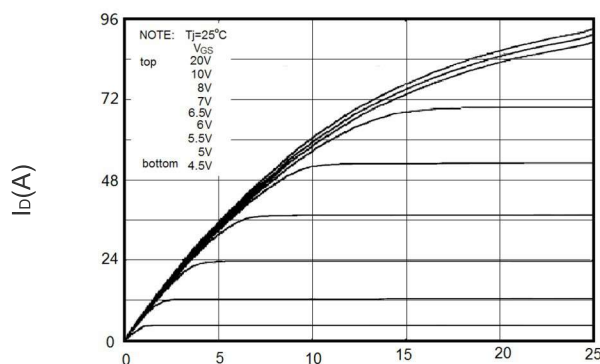
## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)



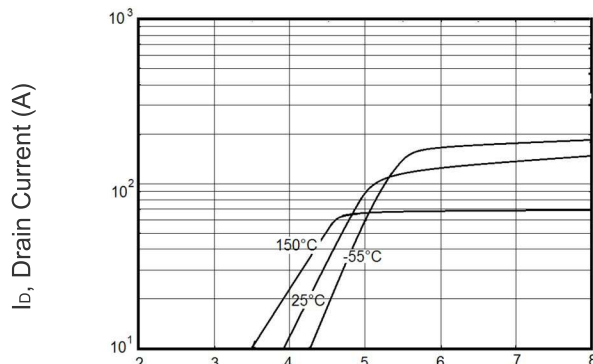
$V_{DS}$ , Drain-Source Voltage (V)  
Figure 1 Safe operating area



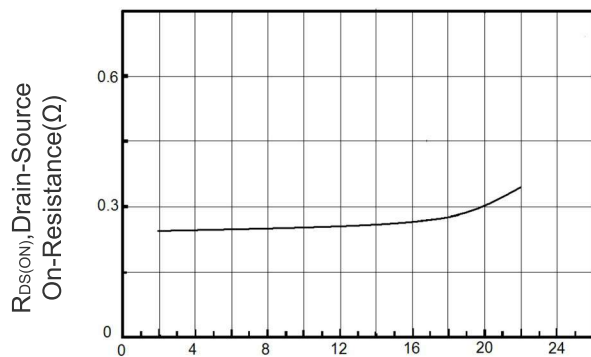
$V_{SD}$ , Source-Drain Voltage(V)  
Figure 2 Source-Drain Diode Forward Voltage



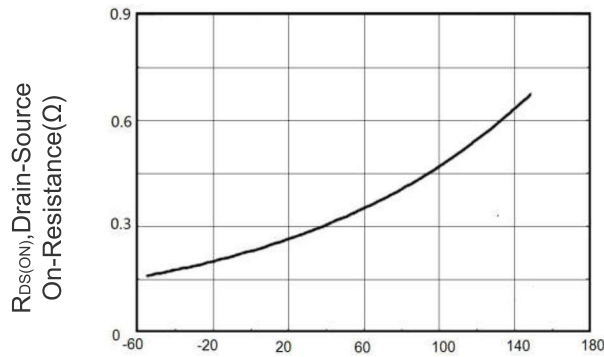
$V_{DS}(V)$   
Figure 3 Output characteristics



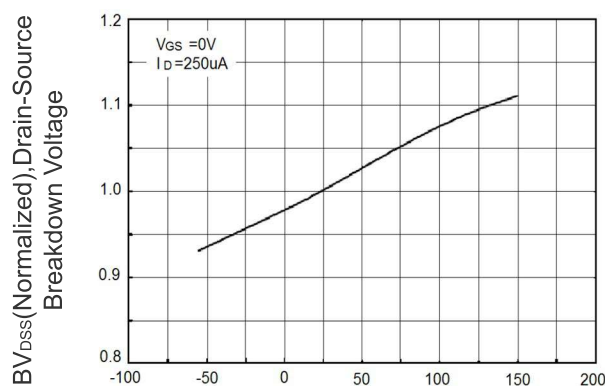
$V_{GS}$ , Gate-Source Voltage (V)  
Figure 4 Transfer characteristics



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

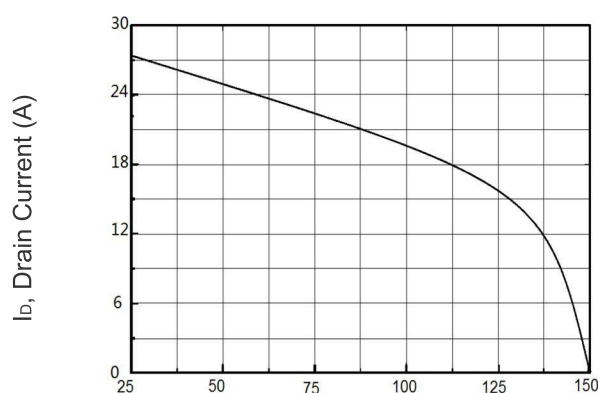


$T_J$ , Junction Temperature ( $^{\circ}\text{C}$ )  
Figure 6  $R_{DS(ON)}$  vs Junction Temperature



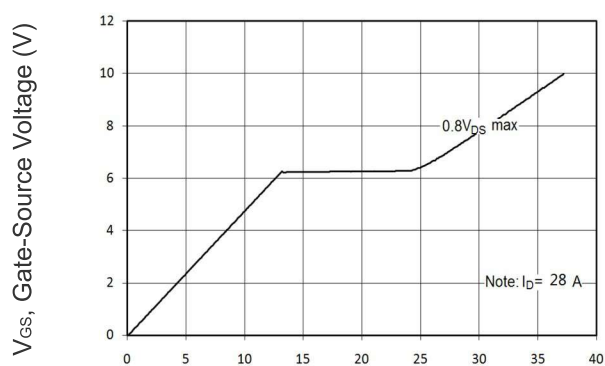
$T_J$ , Junction Temperature ( $^{\circ}\text{C}$ )

Figure 7  $BV_{DSS}$  vs Junction Temperature



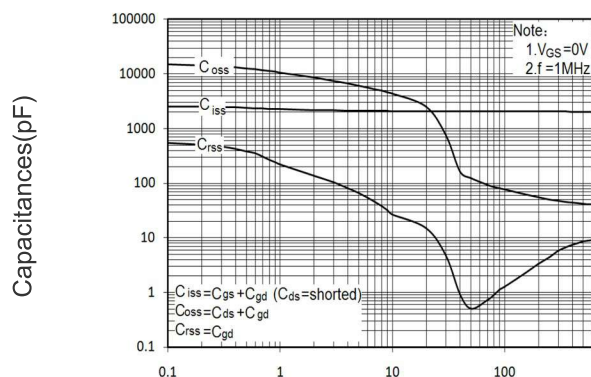
$T_C$ , Case Temperature ( $^{\circ}\text{C}$ )

Figure 8 Maximum  $I_D$  vs Junction Temperature



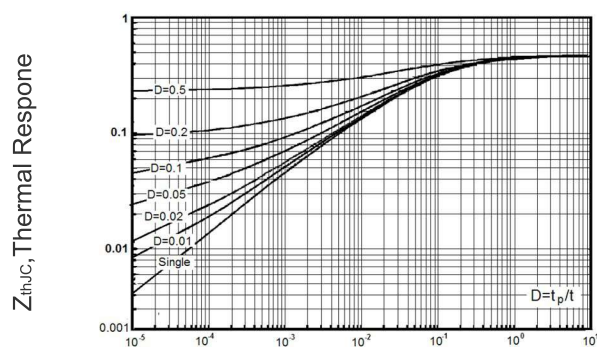
$Q_G$ , Total Gate Charge (nC)

Figure 9 Gate charge waveforms



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

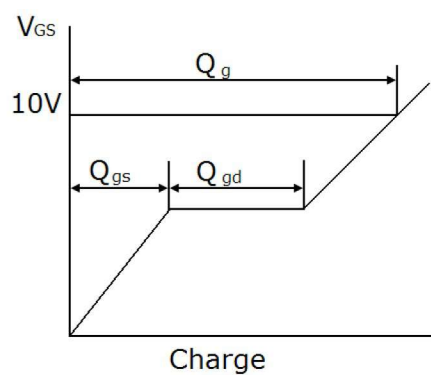
Figure 10 Capacitance



$t_p$ , Square Wave Pulse (S)

Figure 11 Transient Thermal Impedance

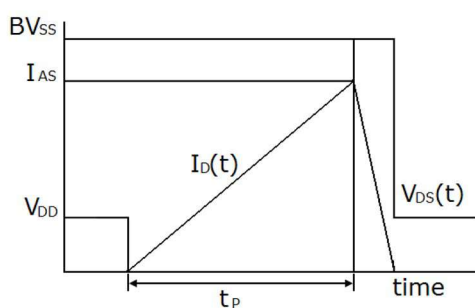
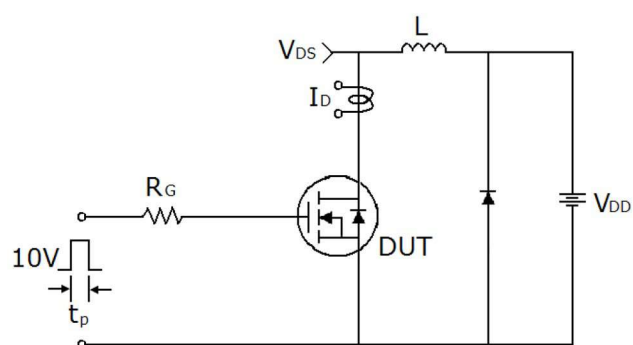
## Test circuit



Gate charge test circuit & Waveform

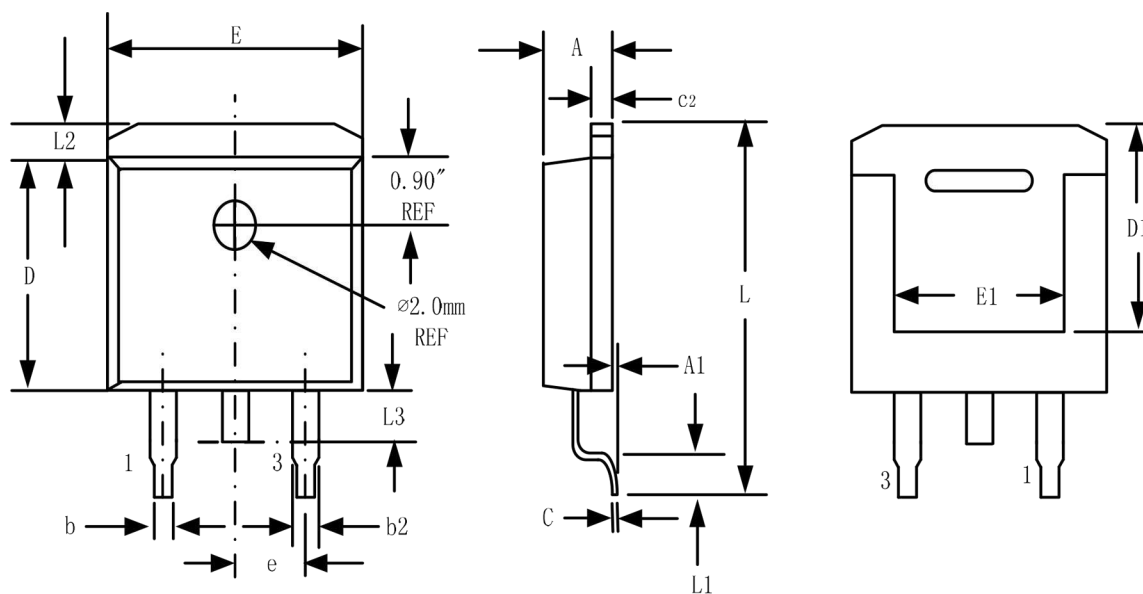


Switch Time Test Circuit



Unclamped Inductive Switching Test Circuit & Waveforms

TO-263-3L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.32	4.57	0.170	0.180
A1	-	0.25		0.010
b	0.71	0.94	0.028	0.037
b2	1.15	1.40	0.045	0.055
c	0.46	0.61	0.018	0.024
c2	1.22	1.40	0.048	0.055
D	8.89	9.40	0.350	0.370
D1	8.01	8.23	0.315	0.324
E	10.04	10.28	0.395	0.405
E1	7.88	8.08	0.310	0.318
e	2.54 BSC		0.100 BSC	
L	14.73	15.75	0.580	0.620
L1	2.29	2.79	0.090	0.110
L2	1.15	1.39	0.045	0.055
L3	1.27	1.77	0.050	0.070

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