

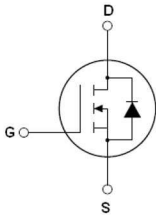
# N-Channel Super Junction Power MOSFET II

## General Description

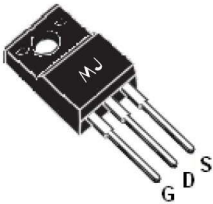
The series of devices use advanced super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

## 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-220F

## Application

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

$V_{DS}$	800	V
$R_{DS(ON) TYP}$	1000	mΩ
$I_D$	5	A

## Package Marking And Ordering Information

Device	Device Package	Marking
MJ80R1K2F	TO-220F	MJ80R1K2F

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

Parameter	Symbol	MJ80R1K2F	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	800	V
Gate-Source Voltage ( $V_{DS}=0V$ )	$V_{GS}$	$\pm 30$	V
Continuous Drain Current at $T_c=25^{\circ}C$	$I_D (DC)$	6*	A
Continuous Drain Current at $T_c=100^{\circ}C$	$I_D (DC)$	3.5*	A
Pulsed drain current <sup>(Note 1)</sup>	$I_{DM} (pluse)$	18*	A
Maximum Power Dissipation ( $T_c=25^{\circ}C$ )	$P_D$	31.8	W
Derate above $25^{\circ}C$	$P_D$	0.254	W/ $^{\circ}C$
Single pulse avalanche energy <sup>(Note 2)</sup>	$E_{AS}$	75	mJ
Avalanche current <sup>(Note 1)</sup>	$I_{AR}$	2.5	A
Repetitive Avalanche energy, $t_{AR}$ limited by $T_{jmax}$ <sup>(Note 1)</sup>	$E_{AR}$	0.4	mJ

Parameter	Symbol	MJ80R1K2F	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	$^{\circ}C$

\* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	MJ80R1K2F	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R <sub>thJC</sub>	3.93	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	R <sub>thJA</sub>	80	°C/W

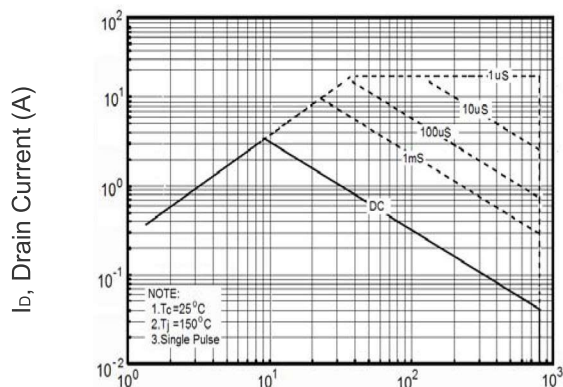
Table 3. Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

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> =±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> =2.5A	-	1000	1200	mΩ
Dynamic Characteristics						
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =20V,I <sub>D</sub> =2.5A	-	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>		-	55	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	3.5	-	PF
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =480V,I <sub>D</sub> =5A 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> =480V,I <sub>D</sub> =2.5A R <sub>G</sub> =15Ω,V <sub>GS</sub> =10V	-	7	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	5	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	70	85	nS
Turn-Off Fall Time	t <sub>f</sub>		-	9	15	nS
Source- Drain Diode Characteristics						
Source-drain current (Body Diode)	I <sub>SD</sub>	T <sub>C</sub> =25°C	-	-	5	A
Pulsed Source-drain current (Body Diode)	I <sub>SDM</sub>		-	-	15	A
Forward On Voltage	V <sub>SD</sub>	T <sub>J</sub> =25°C,I <sub>SD</sub> =5A,V <sub>GS</sub> =0V	-	0.85	1.2	V
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> =25°C,I <sub>F</sub> =5A di/dt=100A/μs	-	240	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	2.2	-	uC
Peak reverse recovery Current	I <sub>rrm</sub>		-	16	-	A

## Notes

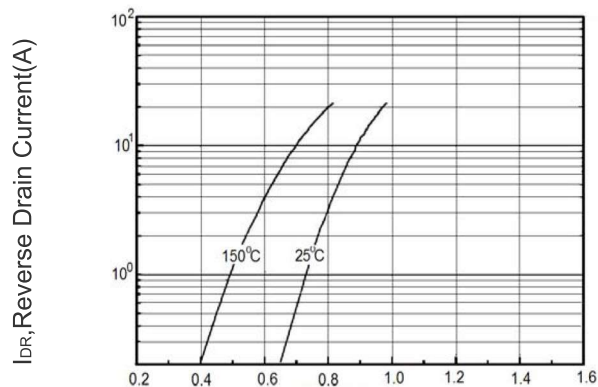
- 1.Repetitive Rating: Pulse width limited by maximum junction temperature
2. $T_J=25^{\circ}\text{C}$ ,  $V_{DD}=50\text{V}$ ,  $V_G=10\text{V}$ ,  $R_G=25\Omega$

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)



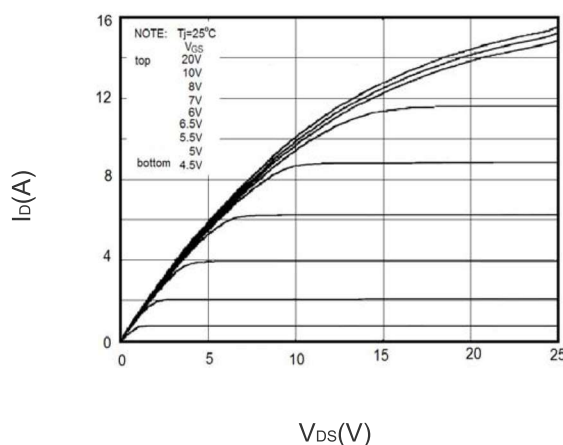
$V_{DS}$ , Drain-Source Voltage (V)

Figure 1 Safe operating area



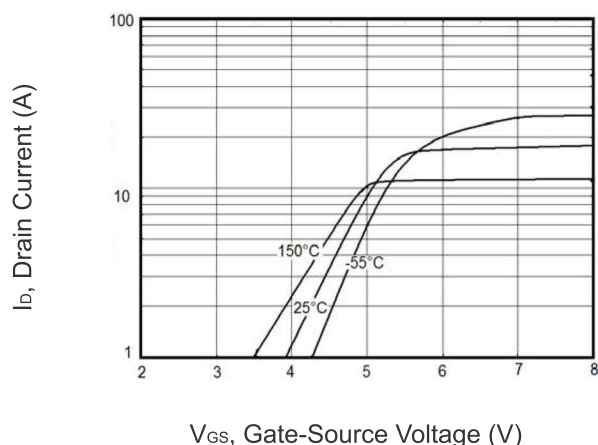
$V_{SD}$ , Source-Drain Voltage (V)

Figure 2 Source-Drain Diode Forward Voltage



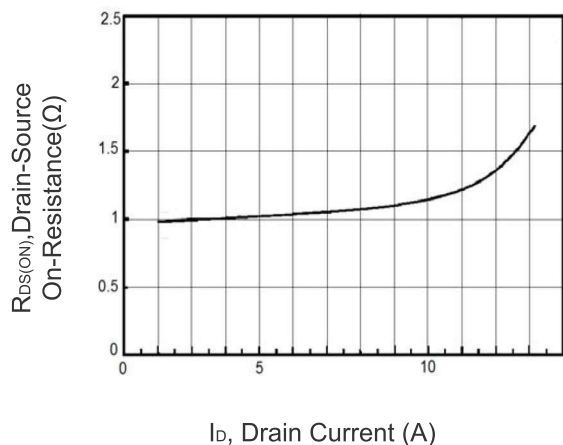
$V_{DS}$  (V)

Figure 3 Output characteristics



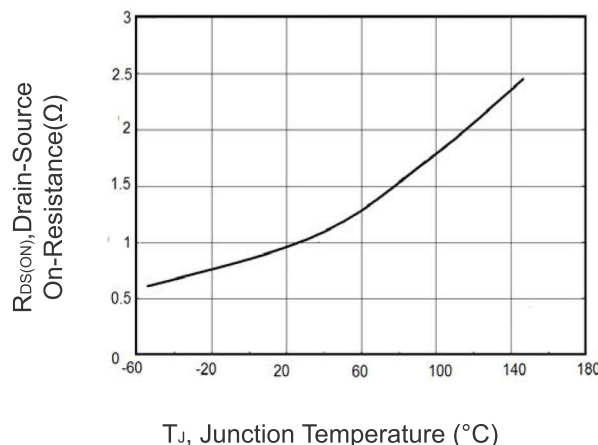
$V_{GS}$ , Gate-Source Voltage (V)

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

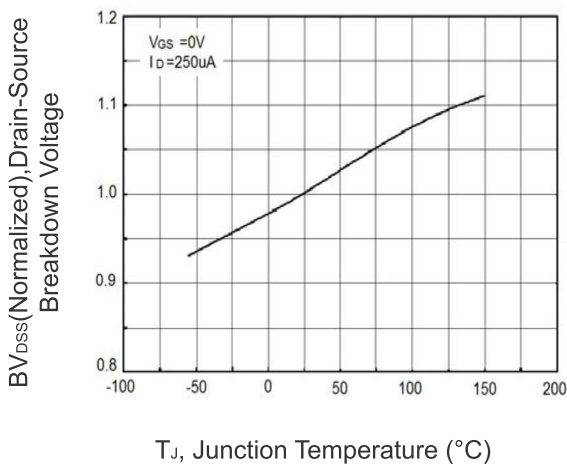


Figure 7  $BV_{DSS}$  vs Junction Temperature

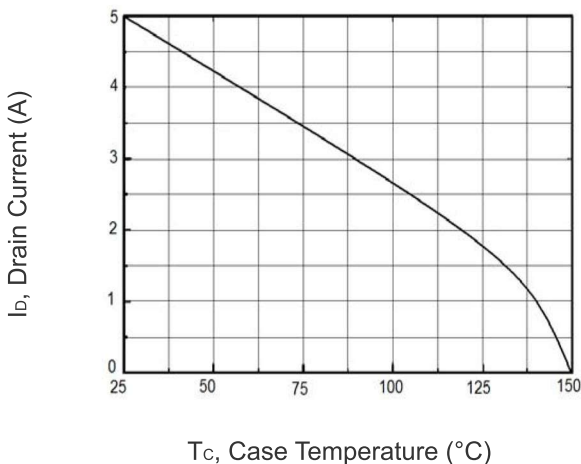


Figure 8 Maximum  $I_D$  vs Junction Temperature

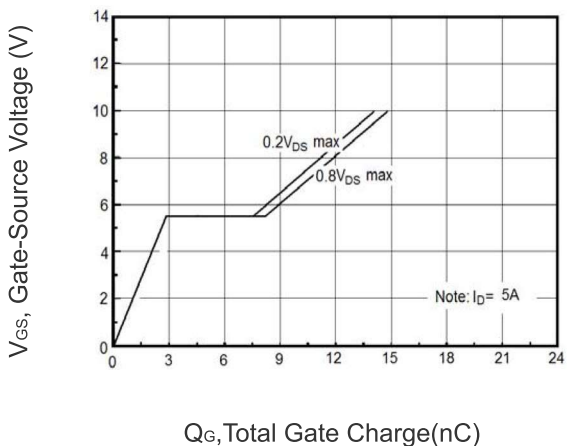


Figure 9 Gate charge waveforms

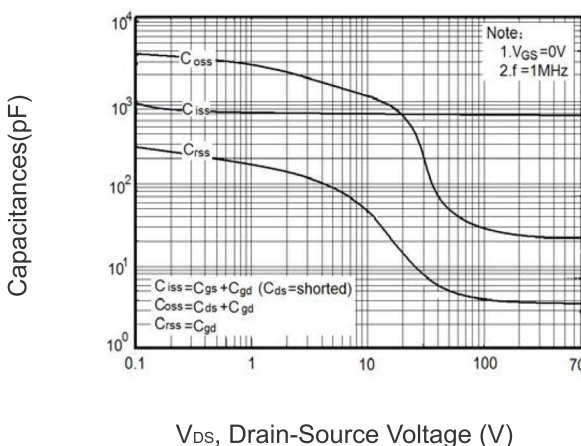


Figure 10 Capacitance

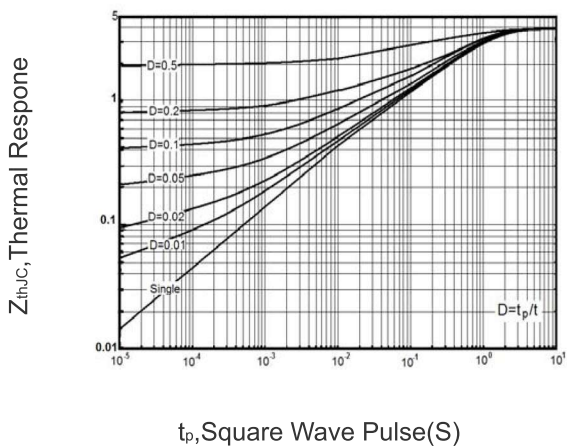
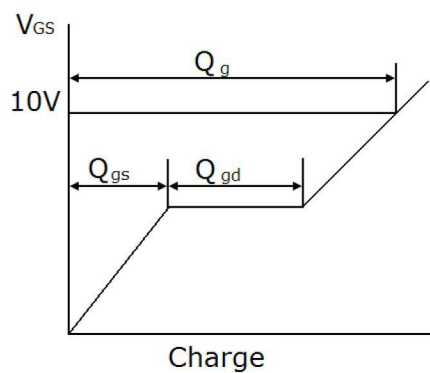
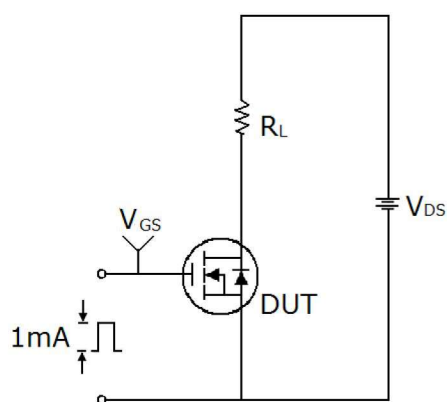
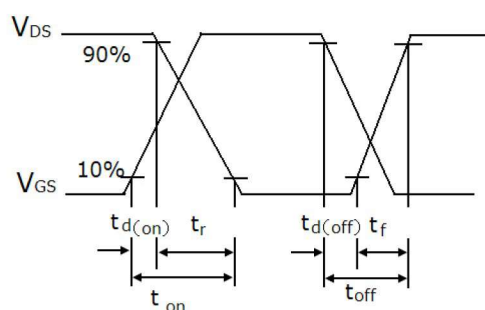
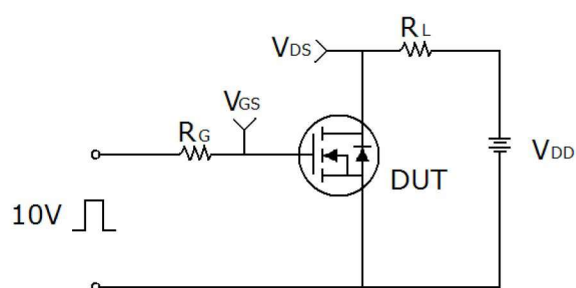


Figure 11 Transient Thermal Impedance

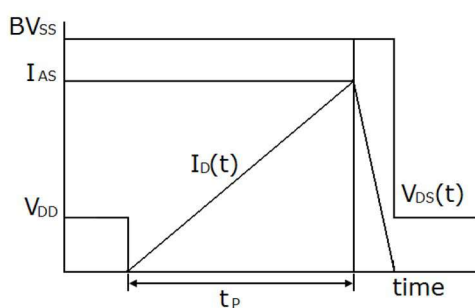
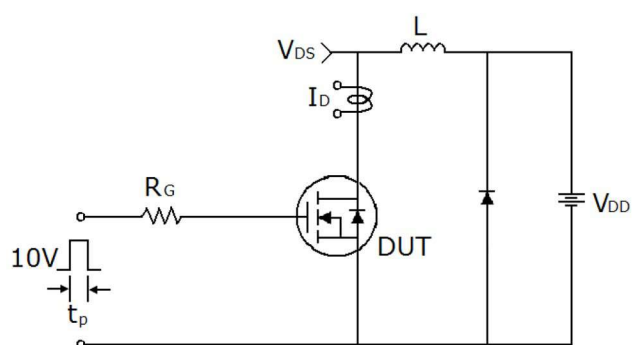
## Test circuit



Gate charge test circuit & Waveform

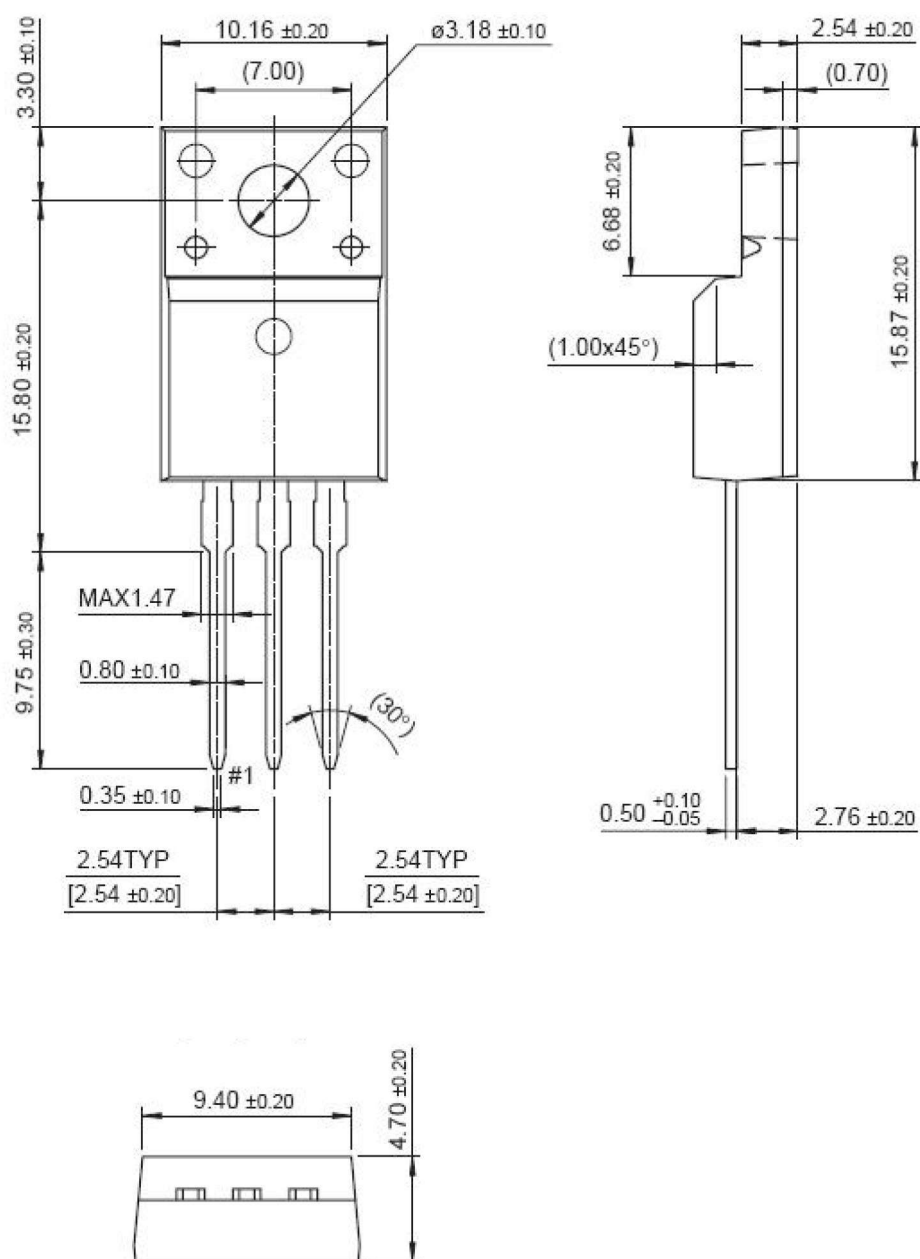


Switch Time Test Circuit



Unclamped Inductive Switching Test Circuit & Waveforms

# TO-220F Package Information



Dimensions in Millimeters

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