

# MJ N-Channel Super Trench II Power MOSFET

## Description

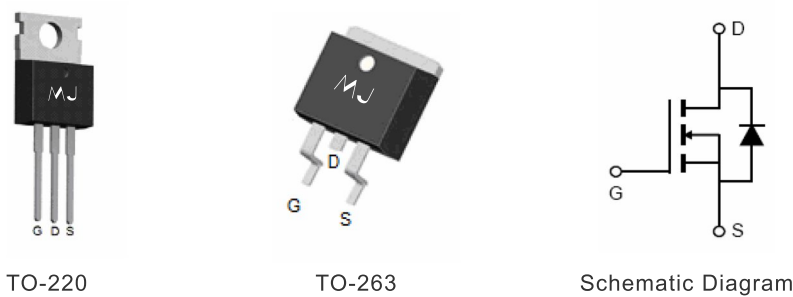
The series of devices uses Super Trench II technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

## General Features

- ◆  $V_{DS}=100V, I_D=240A$   
 $R_{DS(ON)}=2.0m\Omega$ , typical (TO-220)@  $V_{GS}=10V$   
 $R_{DS(ON)}=1.8m\Omega$ , typical (TO-263)@  $V_{GS}=10V$
- ◆ Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- ◆ Very low on-resistance  $R_{DS(on)}$
- ◆ 175 °C operating temperature
- ◆ Pb-free lead plating

## Application

- ◆ DC/DC Converter
- ◆ Ideal for high-frequency switching and synchronous rectification



100% UIS TESTED! 100%  $\Delta V_{ds}$  TESTED!

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
MJXP023N10	MJXP023N10	TO-220	-	-	-
MJXP023N10D	MJXP023N10D	TO-263	-	-	-

## Absolute Maximum Ratings (Tc =25 °Cunless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	100	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	240	A
Drain Current-Continuous(Tc =100°C)	$I_{D(100^{\circ}C)}$	170	A
Pulsed Drain Current (Note 1)	$I_{DM}$	960	A
Maximum Power Dissipation	$P_D$	340	W
Single pulse avalanche energy (Note 4)	$E_{AS}$	2784	mJ
Derating factor		2.27	W/°C
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	°C

## Thermal Characteristic

Thermal Resistance,Junction-to-Case (Note 2)	$R_{\theta JC}$	0.44	°C/W
Thermal Resistance,Junction-to-Ambient (Note 2)	$R_{\theta JA}$	60	°C/W

Electrical Characteristics (T<sub>A</sub> =25℃unless otherwise noted)

Parameter	Symbol	Condition		Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA		100		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =100V,V <sub>GS</sub> =0V		-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> =±20V,V <sub>DS</sub> =0V		-	-	±100	nA
On Characteristics <sup>(Note 2)</sup>							
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA		2.0	3.0	4.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =120A	TO-220	-	2.0	2.3	mΩ
			TO-263	-	1.8	2.1	mΩ
Gate resistance	R <sub>G</sub>			-	2.5	-	S
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V,I <sub>D</sub> =120A			200	-	S
Dynamic Characteristics <sup>(Note 3)</sup>							
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =50V,V <sub>GS</sub> =0V, F=1.0MHz		-	17000	-	PF
Output Capacitance	C <sub>oss</sub>			-	1500	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>			-	77	-	PF
Switching Characteristics <sup>(Note 3)</sup>							
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =50V,I <sub>D</sub> =120A V <sub>GS</sub> =10V,R <sub>G</sub> =1.6Ω		-	37	-	nS
Turn-on Rise Time	t <sub>r</sub>			-	29	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>			-	82	-	nS
Turn-Off Fall Time	t <sub>f</sub>			-	34	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =50V,I <sub>D</sub> =120A, V <sub>GS</sub> =10V		-	252	-	nC
Gate-Source Charge	Q <sub>gs</sub>			-	72	-	nC
Gate-Drain Charge	Q <sub>gd</sub>			-	63	-	nC
Drain-Source Diode Characteristics							
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V,I <sub>S</sub> =120A		-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>			-	-	240	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> =25°C, I <sub>F</sub> =120A di/dt=100A/μs <sup>(Note 2)</sup>		-	105	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>			-	290	-	nC

Notes:

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ② The value of R<sub>θJA</sub> is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25℃. The Power dissipation P<sub>DSM</sub> is based on R<sub>θJA</sub> and the maximum allowed junction temperature of 150℃. The value in any given application depends on.the user's specific board design, and the maximum temperature of 175℃ may be used if the PCB allows it.
- ③ Guaranteed by design, not subject to production
- ④ EAS condition : T<sub>J</sub>=25℃, V<sub>DD</sub>=50V,V<sub>G</sub>=10V,L=0.5mH,R<sub>g</sub>=25Ω

# Typical Electrical and Thermal Characteristics

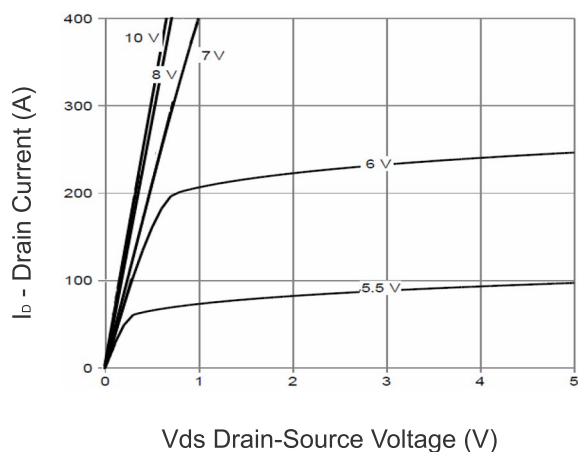


Figure 1 Output Characteristics

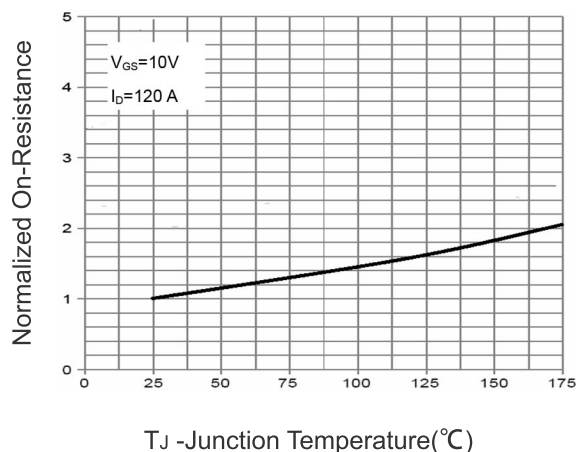


Figure 4 Rdson-Junction Temperature

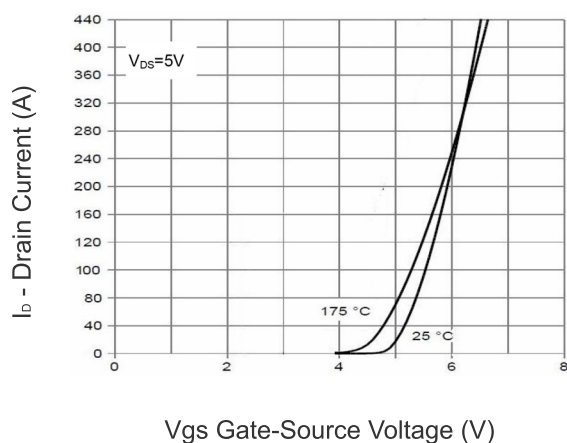


Figure 2 Transfer Characteristics

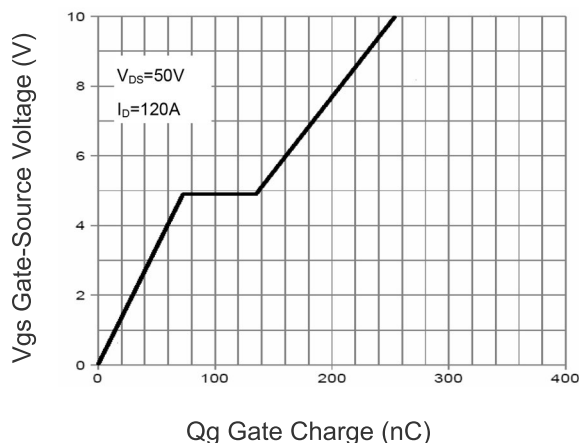


Figure 5 Gate Charge

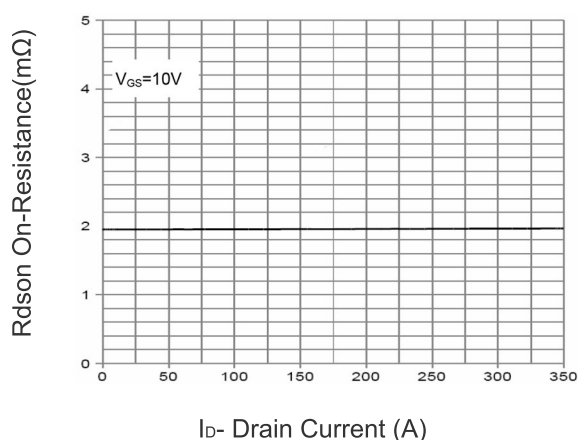


Figure 3 Rdson- Drain Current

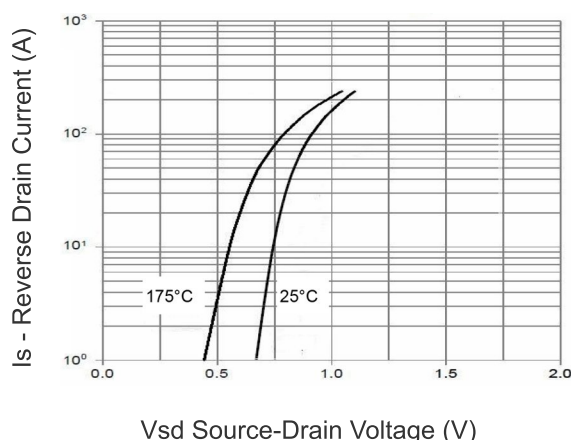
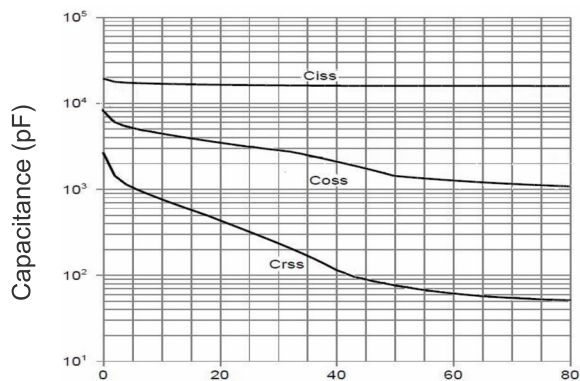
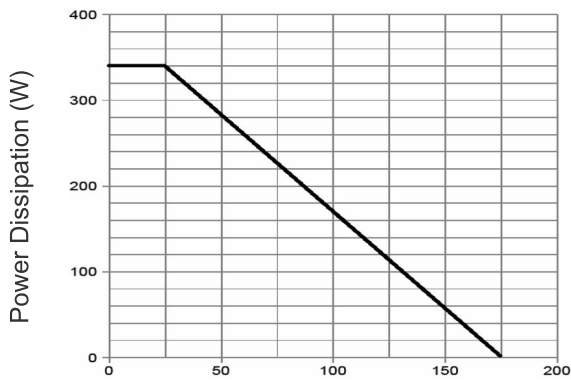


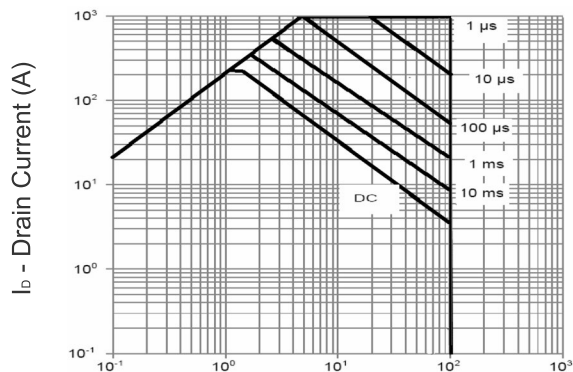
Figure 6 Source- Drain Diode Forward



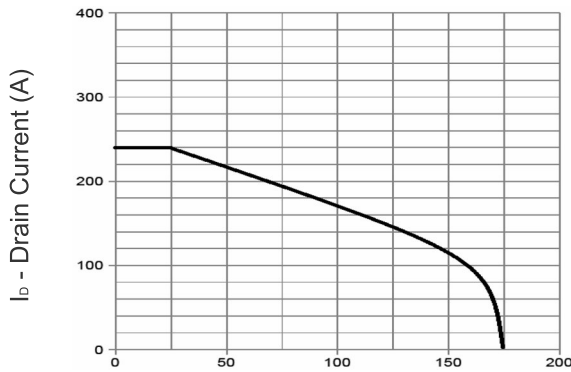
Vds Drain-Source Voltage (V)  
Figure 7 Capacitance vs Vds



T<sub>J</sub> -Junction Temperature(°C)  
Figure 9 Power De-rating



Vds Drain-Source Voltage (V)  
Figure 8 Safe Operation Area



T<sub>J</sub> -Junction Temperature(°C)  
Figure 10 Current De-rating

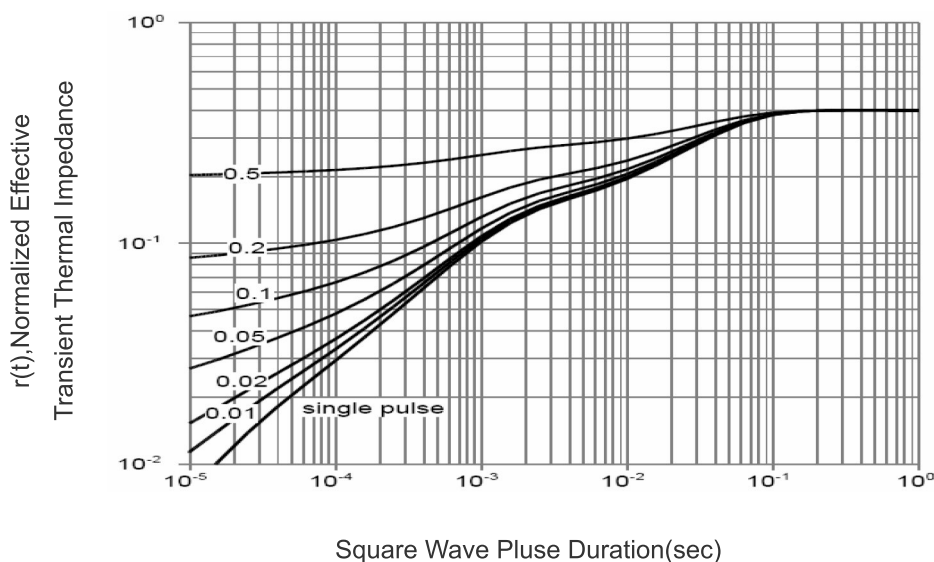
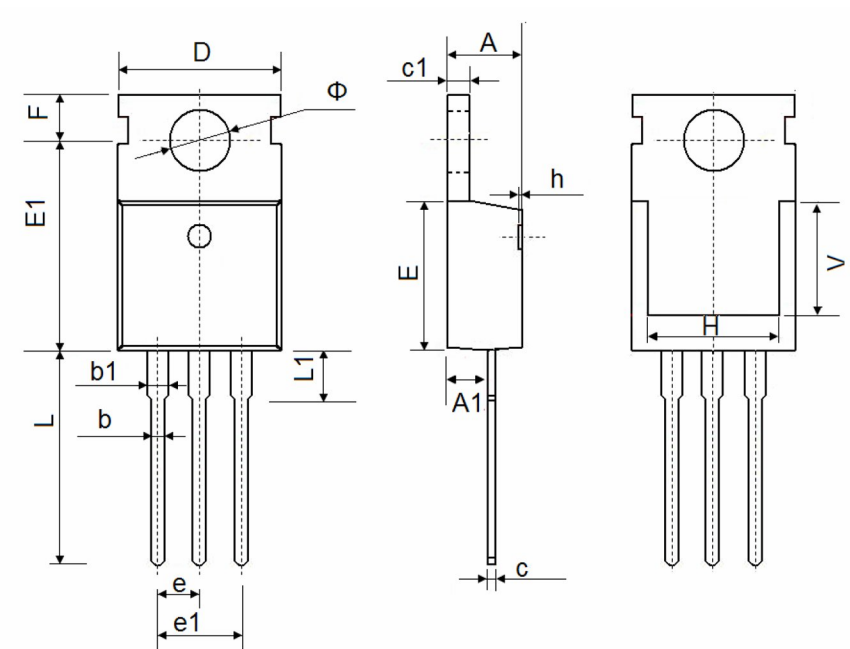


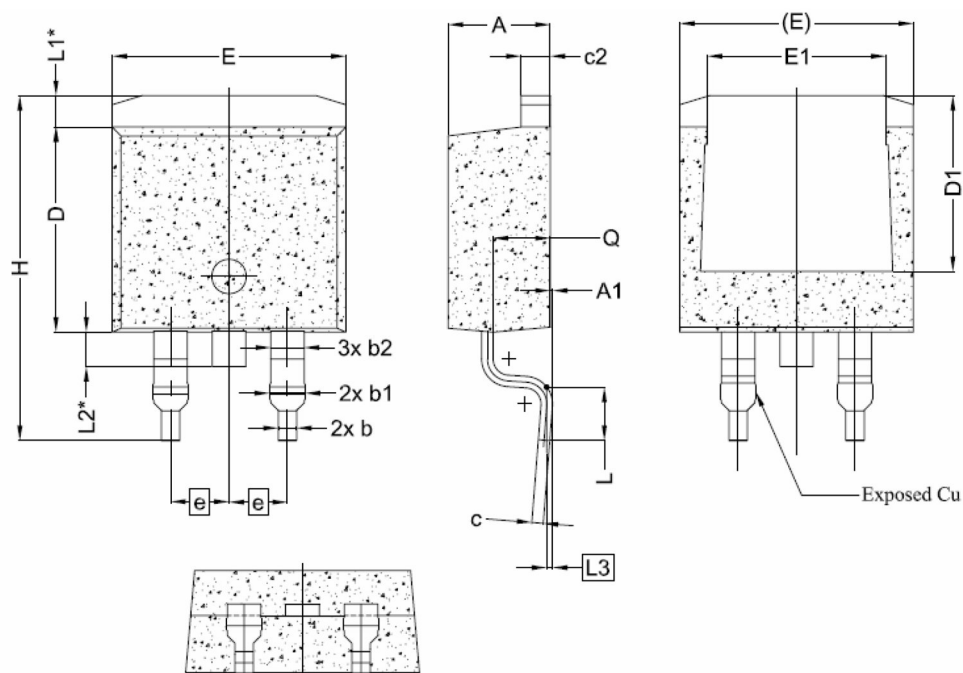
Figure 11 Normalized Maximum Transient Thermal Impedance

# TO-220-3L Package Information

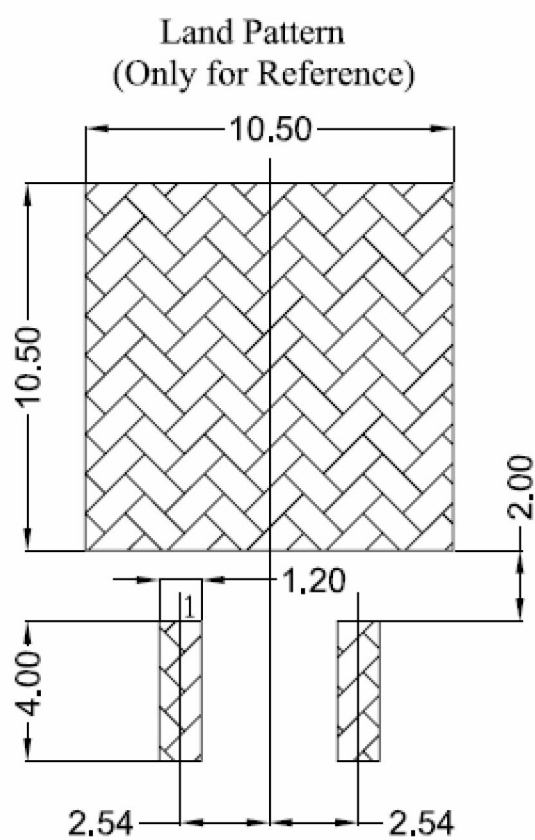


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	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	6.900 REF.		0.276 REF.	
Φ	3.400	3.800	0.134	0.150

# TO-263-2L Package Information



Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	4.24	4.44	4.64
A1	0.00	0.10	0.25
b	0.70	0.80	0.90
b1	1.20	1.55	1.75
b2	1.20	1.45	1.70
c	0.40	0.50	0.60
c2	1.15	1.27	1.40
D	8.82	8.92	9.02
D1	6.86	7.65	-
E	9.96	10.16	10.36
E1	6.89	7.77	7.89
e	2.54BSC		
H	14.61	15.00	15.88
L	1.78	2.32	2.79
L1	1.36 REF.		
L2	1.50 REF.		
L3	0.25 BSC		
Q	2.30	2.48	2.70



## Attention:

Any and all MJ power products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your MJ power representative nearest you before using any MJ power products described or contained herein in such applications.

MJ power assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all MJ power products described or contained herein.

Specifications of any and all MJ power products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

MJ power Semiconductor CO.,LTD. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.

In the event that any or all MJ power products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of MJ power Semiconductor CO.,LTD.

Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. MJ power believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the MJ power product that you intend to use.

This catalog provides information as of Sep.2010. Specifications and information herein are subject to change without notice.