600V, 20A, Trench FS II Fast IGBT

General Description:

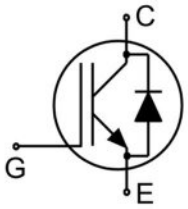
Using MJ's proprietary trench design and advanced FS (Field Stop) second generation technology, the 600V Trench FSII IGBT offers superior conduction and switching performances, and easy parallel operation;

Features

- ◆ Trench FSII Technology offering
- ◆ Very low $V_{CE\ (sat)}$
- ◆ High speed switching
- ◆ Positive temperature coefficient in $V_{CE\ (sat)}$
- ◆ Very tight parameter distribution
- ◆ High ruggedness, temperature stable behavior

Application

- ◆ Air Condition
- ◆ Inverters
- ◆ Motor drives



Schematic diagram

TO-220F

Package Marking and Ordering Information

Device	Device Package	Device Marking
MJ20TD60BF	TO-220F	MJ20TD60BF

Absolute Maximum Ratings (T_C=25°C unless otherwise noted)

Parameter	Symbol	Value	Units
Collector-Emitter Voltage	V_{CES}	600	V
Gate- Emitter Voltage	V_{GES}	±30	V
Collector Current	I_C	40	A
Collector Current @T_C = 100 °C	I_C	20	A
Pulsed Collector Current, t_p limited by T_{jmax}	I_{Cplus}	60	A
turn off safe operating area, V_{CE}=600V, Tj=150°C	-	60	A
Diode Continuous Forward Current @T_C = 100 °C	I_F	20	A
Diode Maximum Forward Current	I_{FM}	60	A
Power Dissipation @ T_C = 25°C	P_D	34.5	W
Power Dissipation @T_C = 100 °C	P_D	17.2	W
Operating Junction and Storage Temperature Range	T_J,T_{stg}	-55 to +175	℃
Maximum Temperature for Soldering	T_L	260	℃
Short circuit withstand time V_{GE}=15.0V, V_{CC}≤400V, Allowed number of short circuits<1000Time between short circuits:≥1.0s,Tj≤150°C	t_{sc}	5	us

Thermal Characteristic

Parameter	Symbol	Value	Units
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	4.34	°C/W
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	3.9	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	78	°C/W

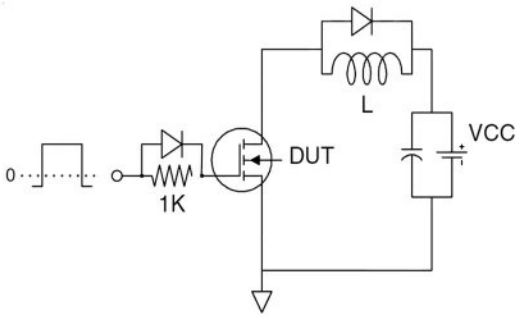
Electrical Characteristics (T_C=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions		Value Min	Value Typ	Value Max	Units
Static Characteristics							
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	V_{GE}=0V,I_{CE}=1mA		600	-	-	V
Collector-Emitter Leakage Current	I_{CES}	V_{GE}=0V,V_{CE}=600V		-	-	4	uA
Gate to Emitter Forward Leakage	$I_{GES(F)}$	V_{GE}=+30V,V_{CE}=0V		-	-	100	nA
Gate to Source Reverse Leakage	$I_{GES(R)}$	V_{GE}=-30V,V_{CE}=0V		-	-	100	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=20A V_{GE}=15V	Tj=25°C	-	1.7	1.9	V
			Tj=100°C	-	1.9	-	V
Gate Threshold Voltage	$V_{GE(th)}$	I_C=1mA, V_{CE}=V_{GE}		4.0	-	6.0	V
Dynamic Characteristics							
Input Capacitance	C_{ies}	V_{CE}=25V,V_{GE}=0V, f=1MHz		-	2580	-	pF
Output Capacitance	C_{oss}			-	48	-	pF
Reverse Transfer Capacitance	C_{rss}			-	26	-	pF
Total Gate Charge	Q_g	V_{CC}=480V, I_C=20A V_{GE}=15V		-	97	-	nC
Gate to Emitter Charge	Q_{ge}			-	17	-	nC
Gate to Collector Charge	Q_{gc}			-	37	-	nC
Short circuit collector current Max.1000 short circuits Time between short circuits: ≥1.0s	$I_{C(SC)}$	V_{GE}=15V,V_{CC}≤400V, t_{SC}≤5us,T_j≤150°C		-	130	-	A
Switching Characteristics							
Turn-on Delay Time	$t_{d(ON)}$	V_{CC}=400V,I_C=10A V_{GE}=0/15V, R_g=25Ω Inductive Load		-	18	-	ns
Rise Time	t_r			-	16	-	ns
Turn-Off Delay Time	$t_{d(OFF)}$			-	164	-	ns
Fall Time	t_f			-	15	-	ns
Turn-On Switching Loss	E_{on}			-	0.43	-	mJ
Turn-Off Switching Loss	E_{off}			-	0.17	-	mJ
Total Switching Loss	E_{ts}			-	0.60	-	mJ

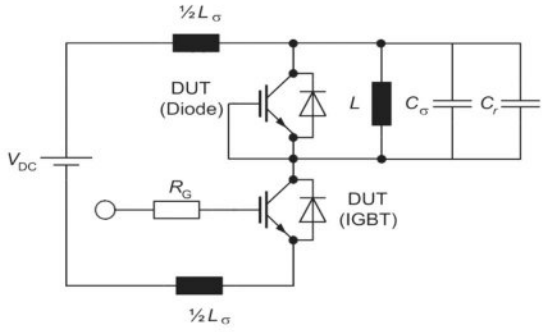
Electrical Characteristics of the Diode (T_C= 25°C unless otherwise specified):

Parameter	Symbol	Test Conditions	Rating			Units
			Min	Typ	Max	
Diode Forward Voltage	V_{FM}	I_F=20A	-	1.45	1.7	V
Reverse Recovery Time	T_{rr}	I_F=20A,di/dt=200A/uS	-	182	-	ns
Diode Peak Reverse Recovery Current	I_{RRM}		-	5.3	-	A
Reverse Recovery Charge	Q_{rr}		-	0.5	-	uC
Pulse width ttp≤380μs,δ≤2%						

Test Circuit

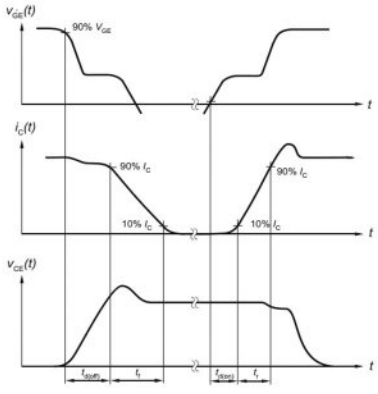


Gate Charge Test Circuit

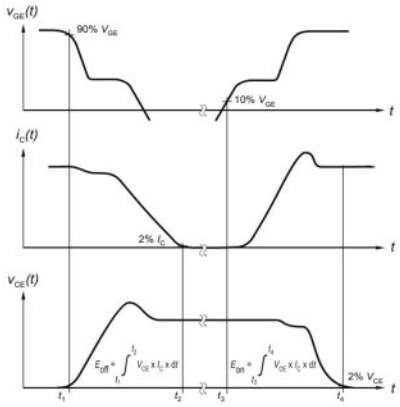


Switch Time Test Circuit

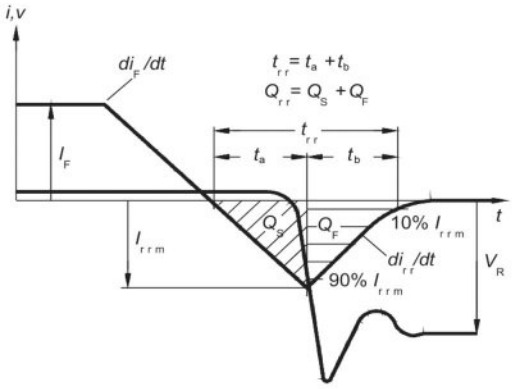
Switching characteristics



definition of switching times



definition of switching losses



Definition of diode switching characteristics

Typical Electrical and Thermal Characteristics

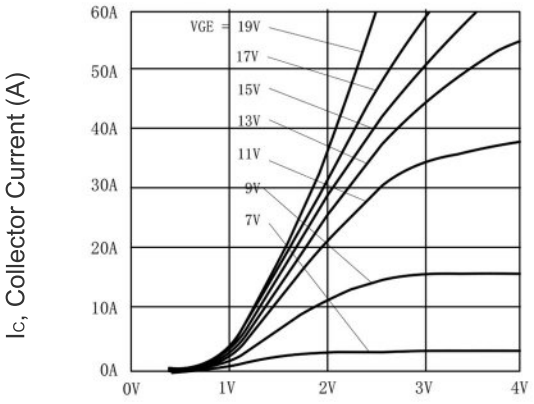


Figure 1 Output Characteristics

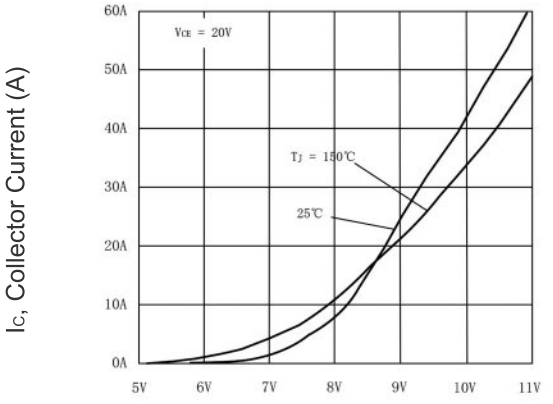


Figure 2 Transfer Characteristics

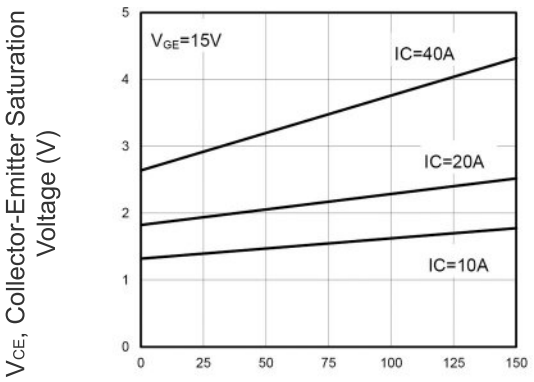


Figure 3 V_{CEsat} vs. Case Temperature

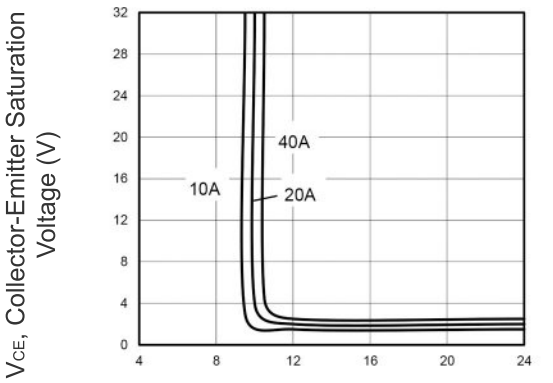


Figure 4 Saturation Voltage vs. V_{GE}

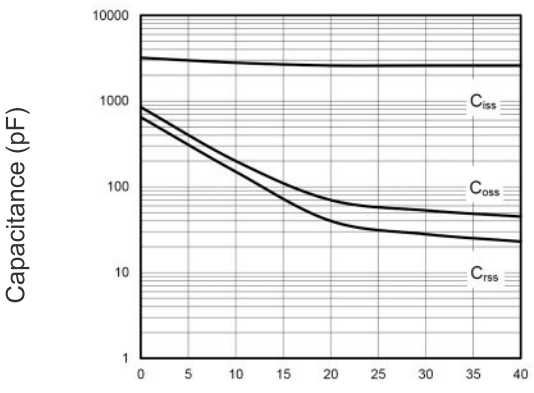


Figure 5 Capacitance Characteristics

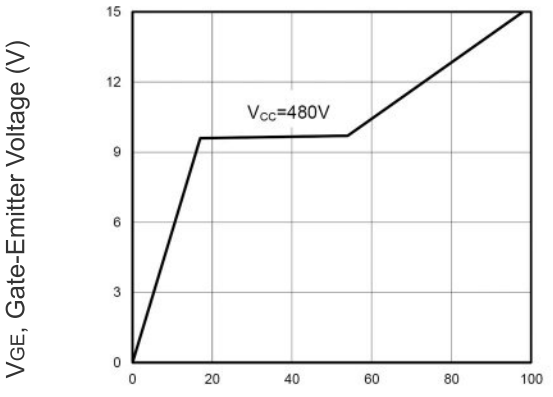


Figure 6 Gate charge waveform

Typical Electrical and Thermal Characteristics (continued)

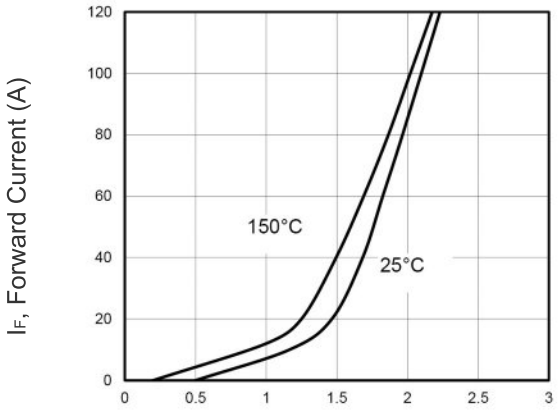


Figure 7 Forward Characteristics

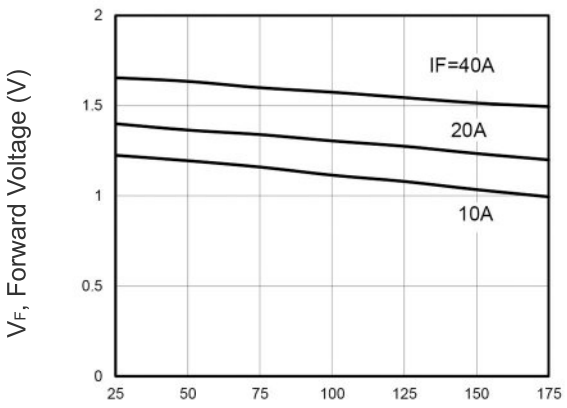


Figure 8 VF vs. Temperature

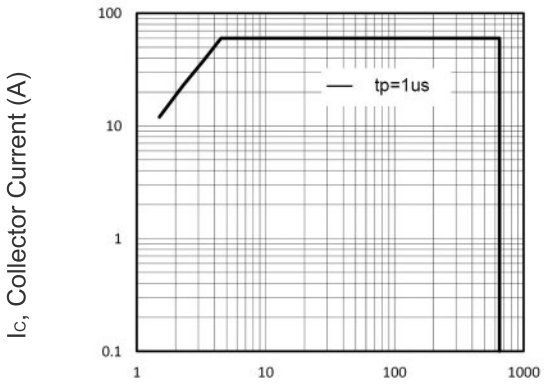


Figure 9 Forward Bias Safe Operating

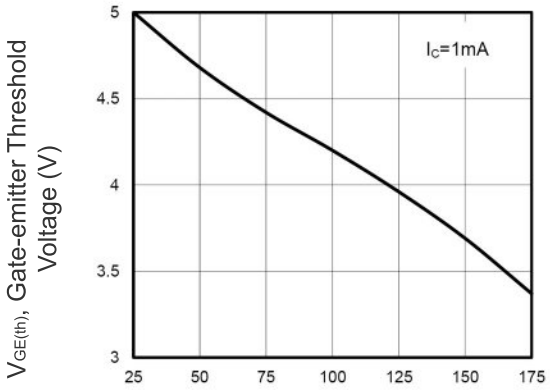


Figure 10 Gate-emitter Threshold Voltage as a Function of Junction Temperature

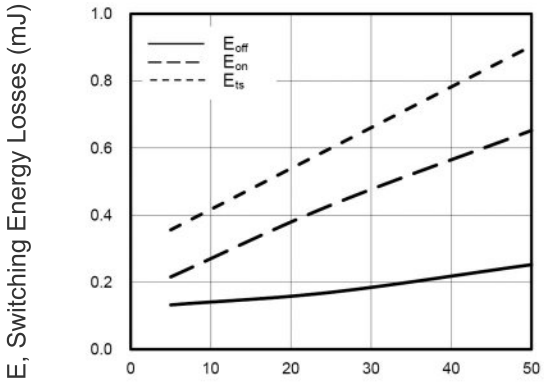


Figure 11 Typical Switching Times as a Function of Gate Resistor

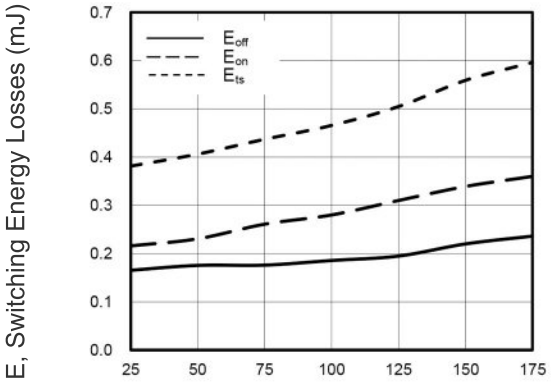


Figure 12 Typical Switching Times as a Function of Junction Temperature

Typical Electrical and Thermal Characteristics（continued）

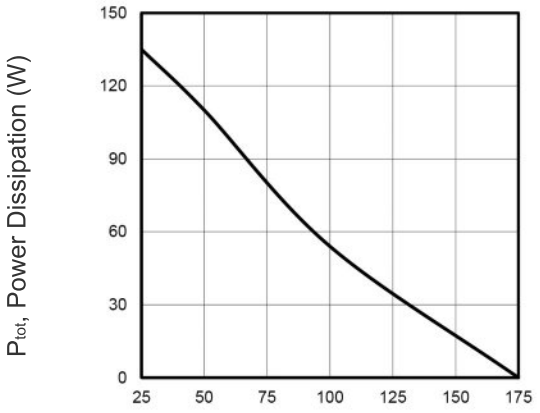


Figure 13 Power Dissipation as a Function of Case Temperature

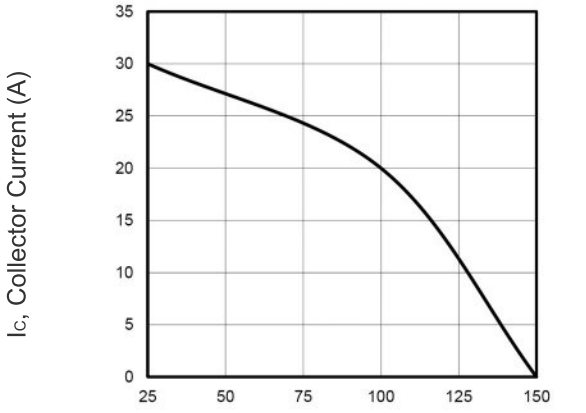


Figure 14 Current Derating

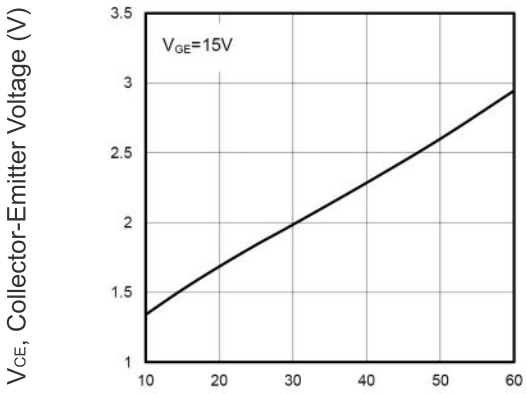
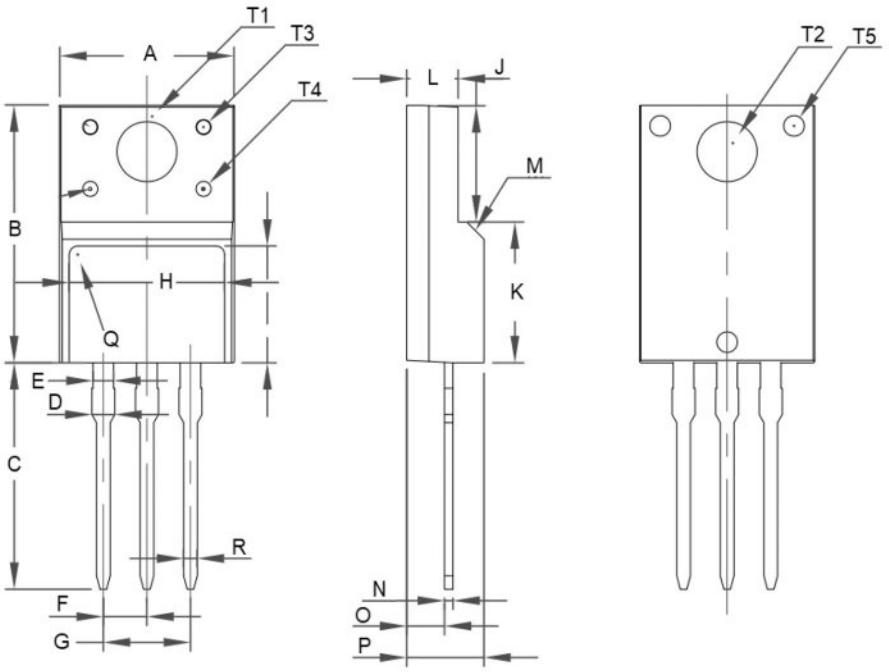


Figure 15 Typical Collector-emitter Saturation Voltage as a function of Collector Current

TO-220F Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	9.96	10.36	0.39	0.41
B	15.67	16.07	0.62	0.63
C	13.14	13.54	0.52	0.53
D	1.20	1.40	0.05	0.06
E	1.20 BSC		0.05 BSC	
F	2.54 BSC		0.10 BSC	
G	5.08 BSC		0.20 BSC	
H	7.60	8.00	0.30	0.31
I	7.10	7.50	0.28	0.30
J	6.48	6.88	0.26	0.27
K	8.99	9.39	0.35	0.37
L	2.34	2.74	0.09	0.11
M	45°		1.77 BSC	
N	0.49	0.52	0.02	0.02
O	2.15	2.55	0.08	0.10
P	4.50	4.90	0.18	0.19
Q	0.50		0.02 BSC	
R	0.77	0.83	0.03	0.03
S	4°	5°	0.16	0.20
T1	3.45 BSC		0.14 BSC	
T2	3.18 BSC		0.13 BSC	
T3	1.50 BSC		0.06 BSC	
T4	1.20 BSC		0.05 BSC	
T5	1.50 BSC		0.06 BSC	

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 erformance, 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.

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.