

600V, 15A, Trench FS II Fast IGBT

General Description:

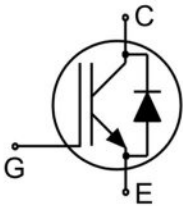
Using MJ's proprietary trench design and advanced FS (Field Stop) second generation technology, the 600V Trench FSII IGBT offers superior conduction and switching performances, and easy parallel operation;

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
MJ15TD60BF	TO-220F	MJ15TD60BF

Absolute Maximum Ratings ($T_c=25^{\circ}\text{C}$ 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	30	A
Collector Current @ $T_c = 100^{\circ}\text{C}$	I_C	15	A
Pulsed Collector Current, t_p limited by T_{jmax}	I_{Cplus}	45	A
turn off safe operating area, $V_{CE}=600\text{V}$, $T_j=150^{\circ}\text{C}$	-	45	A
Diode Continuous Forward Current @ $T_c = 100^{\circ}\text{C}$	I_F	15	A
Diode Maximum Forward Current	I_{FM}	45	A
Power Dissipation @ $T_c = 25^{\circ}\text{C}$	P_D	34	W
Power Dissipation @ $T_c = 100^{\circ}\text{C}$	P_D	17	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^{\circ}\text{C}$
Maximum Temperature for Soldering	T_L	260	$^{\circ}\text{C}$
Short circuit withstand time $V_{GE}=15.0\text{V}$, $V_{CC}\leq 400\text{V}$, Allowed number of short circuits<1000Time between short circuits: $\geq 1.0\text{s}$, $T_j\leq 150^{\circ}\text{C}$	t_{sc}	5	us

Thermal Characteristic

Parameter	Symbol	Value	Units
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	4.41	°C/W
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	3.97	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	78	°C/W

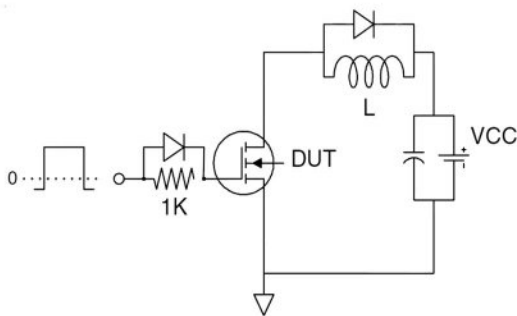
Electrical Characteristics (T_c=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions		Value			Units
				Min	Typ	Max	
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 =15A V _{GE} =15V	T _J =25°C	-	1.7	1.9	V
			T _J =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		-	1635	-	pF
Output Capacitance	C _{Oss}			-	50	-	pF
Reverse Transfer Capacitance	C _{rss}			-	30	-	pF
Total Gate Charge	Q _g	V _{CC} =480V, I _C =15A V _{GE} =15V		-	63	-	nC
Gate to Emitter Charge	Q _{ge}			-	15	-	nC
Gate to Collector Charge	Q _{gc}			-	26	-	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		-	82	-	A
Switching Characteristics							
Turn-on Delay Time	t _{d(ON)}	V _{CC} =400V, I _C =10A V _{GE} =0/15V, R _g =5Ω Inductive Load		-	16	-	ns
Rise Time	t _r			-	12	-	ns
Turn-Off Delay Time	t _{d(OFF)}			-	124	-	ns
Fall Time	t _f			-	12	-	ns
Turn-On Switching Loss	E _{on}			-	0.25	-	mJ
Turn-Off Switching Loss	E _{off}			-	0.12	-	mJ
Total Switching Loss	E _{ts}			-	0.37	-	mJ

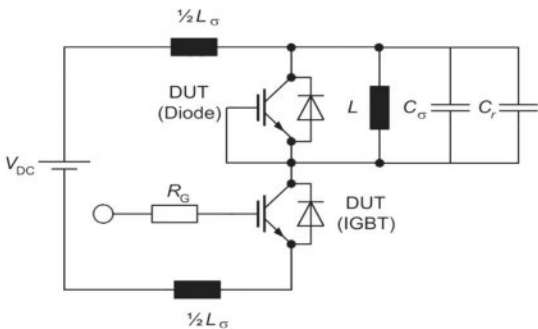
Electrical Characteristics of the Diode (Tc= 25°C unless otherwise specified):

Parameter	Symbol	Test Conditions	Rating			Units
			Min	Typ	Max	
Diode Forward Voltage	V _{FM}	I _F =15A	-	1.5	1.7	V
Reverse Recovery Time	T _{rr}	I _F =15A,di/dt=200A/uS	-	170	-	ns
Diode Peak Reverse Recovery Current	I _{RRM}		-	6.5	-	A
Reverse Recovery Charge	Q _{rr}		-	0.7	-	uC
Pulse width ttp≤380μs,δ≤2%						

Test Circuit

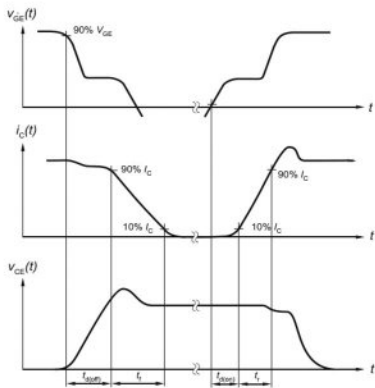


Gate Charge Test Circuit

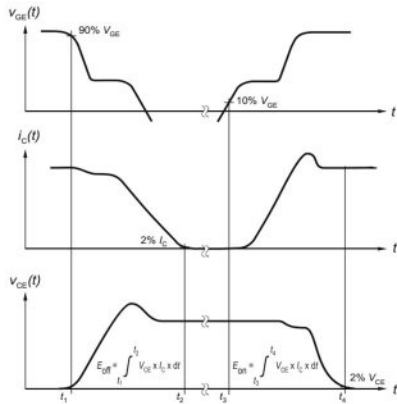


Switch Time Test Circuit

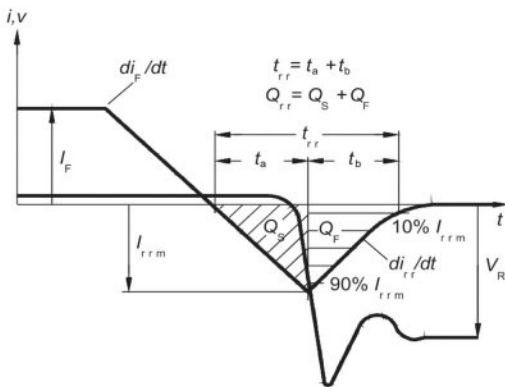
Switching characteristics



definition of switching times

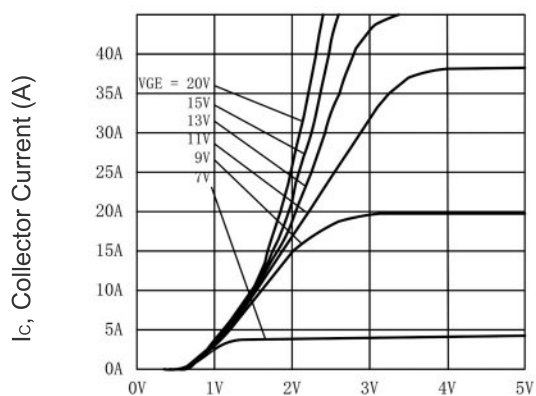


definition of switching losses

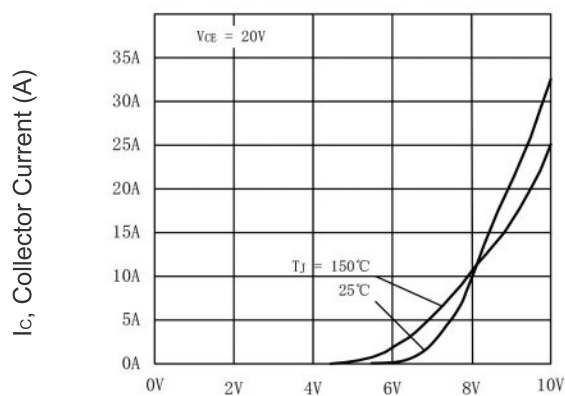


Definition of diode switching characteristics

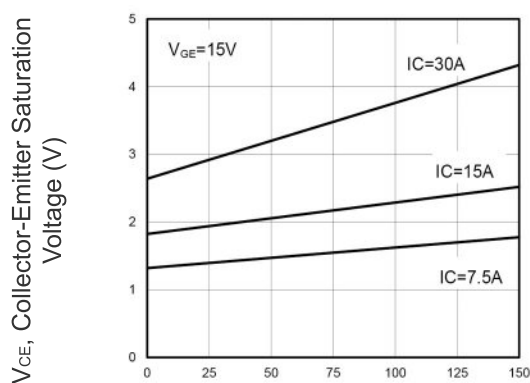
Typical Electrical and Thermal Characteristics



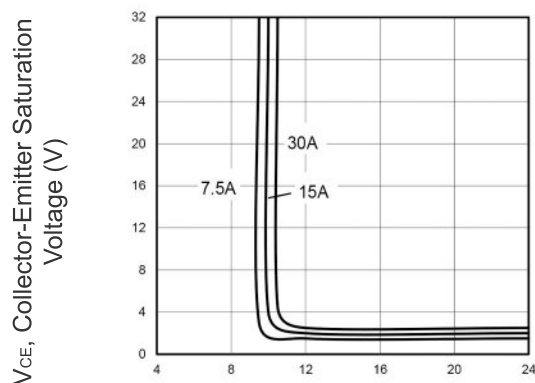
V_{CE} , Collector-Emitter Voltage (V)
Figure 1 Output Characteristics



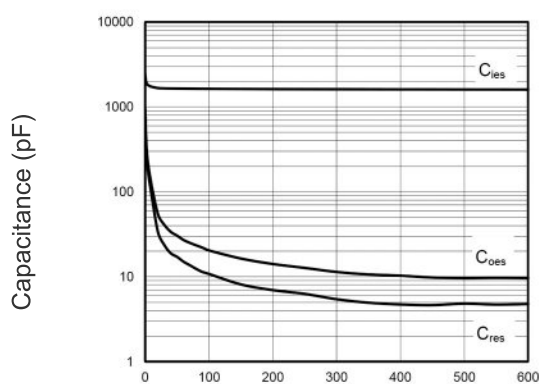
V_{GE} , Gate-Emitter Voltage (V)
Figure 2 Transfer Characteristics



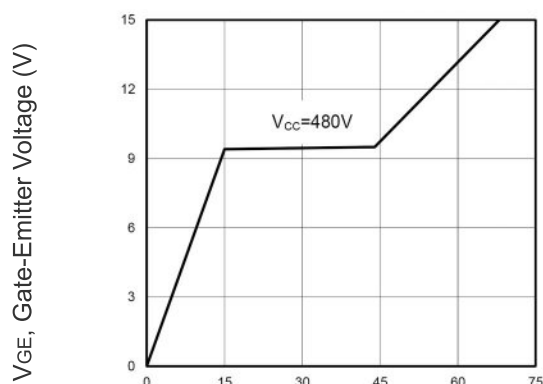
T_J , Junction Temperature ($^{\circ}\text{C}$)
Figure 3 V_{CEsat} vs. Case Temperature



V_{GE} , Gate-Emitter Voltage (V)
Figure 4 Saturation Voltage vs. V_{GE}

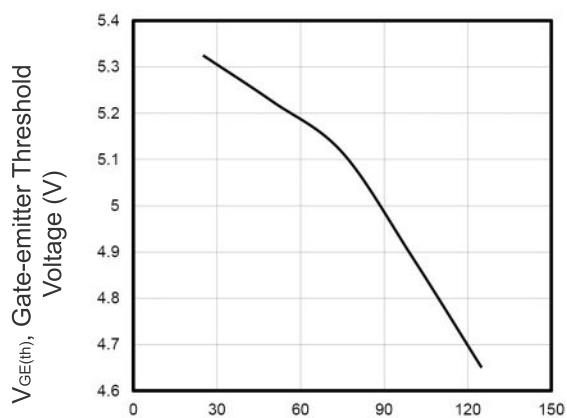


V_{CE} , Collector-Emitter Voltage (V)
Figure 5 Capacitance Characteristics



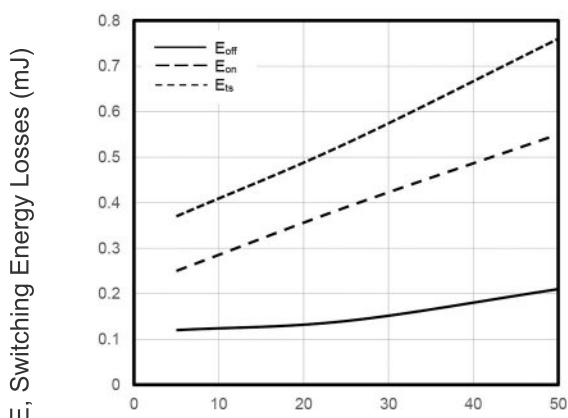
Q_G , Total Gate Charge (nC)
Figure 6 Gate charge waveform

Typical Electrical and Thermal Characteristics



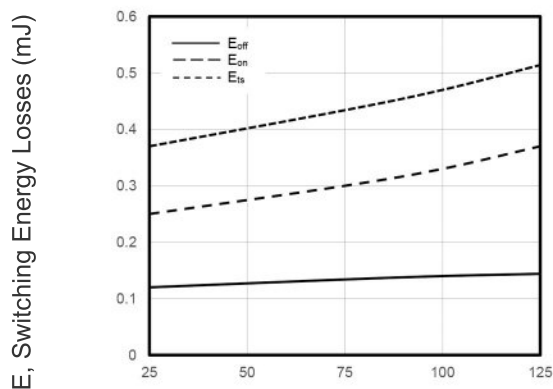
T_J, Junction Temperature (°C)

Figure 7 Gate-emitter Threshold Voltage as a Function of Junction Temperature



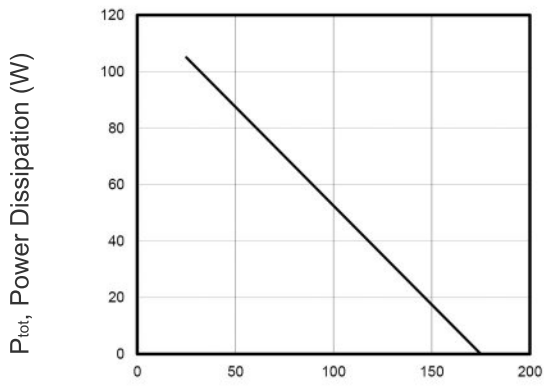
R_G, Gate Resistor (Ω)

Figure 8 Typical Switching Times as a Function of Gate Resistor



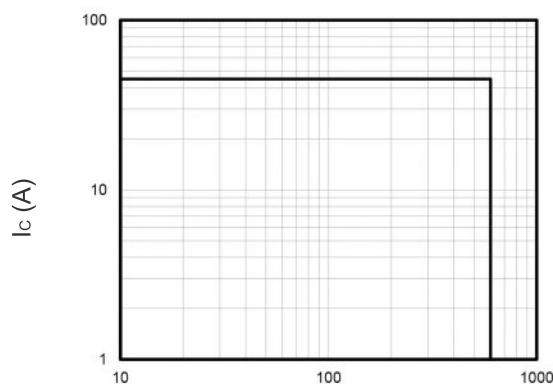
T_J, Junction Temperature (°C)

Figure 9 Typical Switching Times as a Function of Junction Temperature



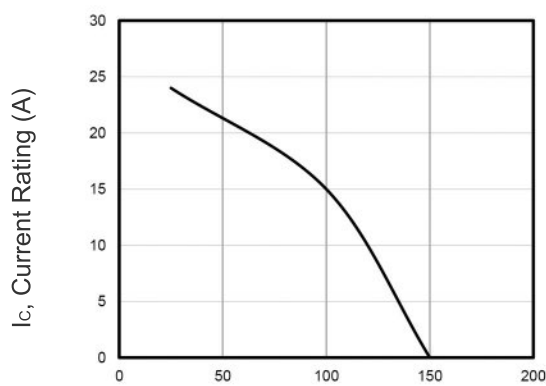
T_C, Case Temperature (°C)

Figure 10 Power Dissipation as a Function of Case Temperature



V_{CE} (V)

Figure 11 Reverse Bias SOA



T_C, Case Temperature (°C)

Figure 12 Current De-rating

Typical Electrical and Thermal Characteristics (continued)

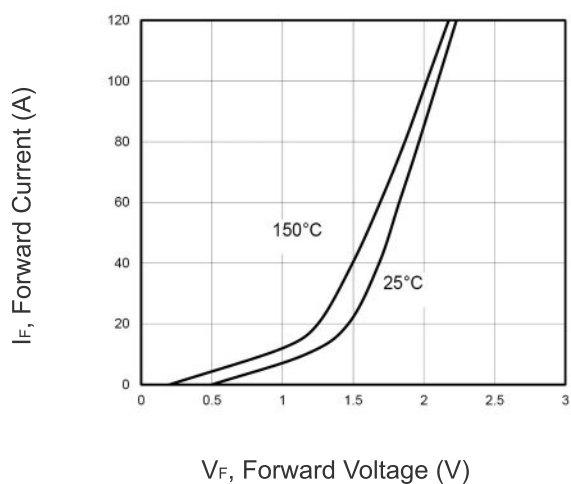


Figure 13 Forward Characteristics

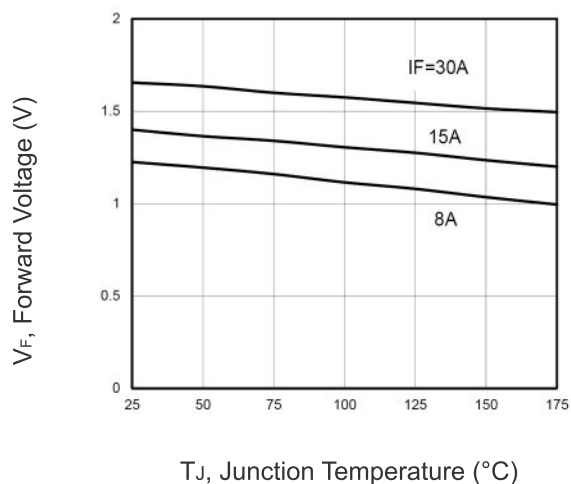
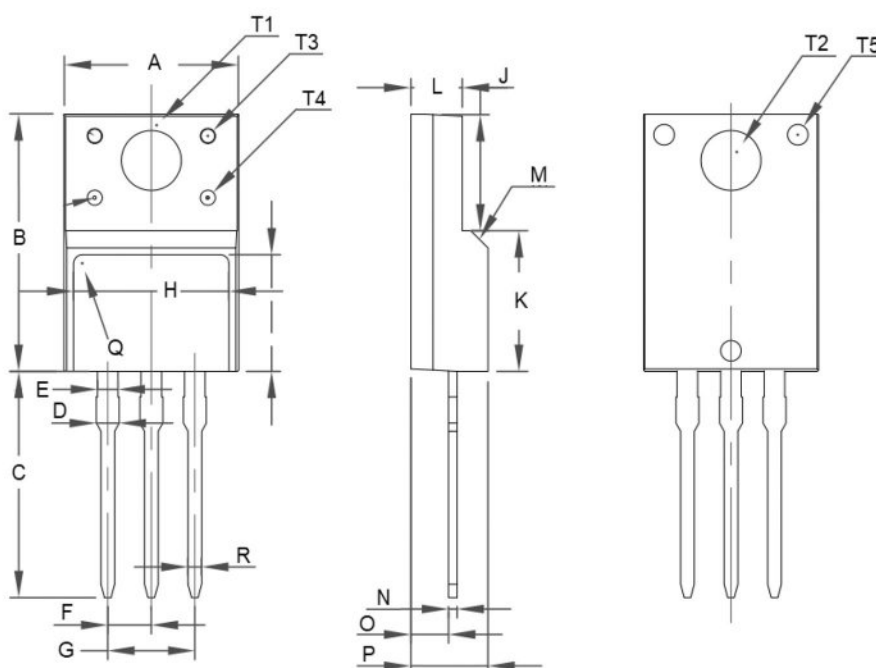


Figure 14 V_F vs. temperature

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	

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