

### General Description

This IGBT is produced using advanced MagnaChip's Field Stop Trench IGBT Technology, which provides high switching series and excellent quality.

This device is for PFC, UPS & Inverter applications.

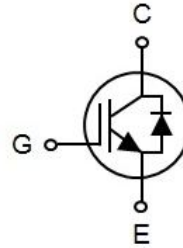
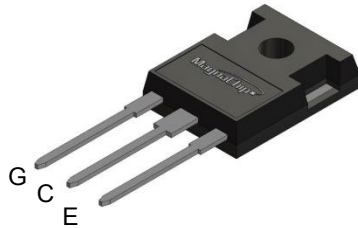
### Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)} = 1.85V @ I_C = 50A$
- $E_{off} = 0.55mJ @ T_C = 25^\circ C$
- High Input Impedance
- $t_{rr} = 80ns$  (typ.) @  $di_F/dt = 1000A/\mu s$
- Maximum junction temperature  $175^\circ C$

### Applications

- PFC
- Welder
- UPS
- IH Cooker
- PV Inverter

TO-247



### Maximum Rating

Parameter	Symbol	Rating	Unit
Collector-emitter voltage	$V_{CE}$	650	V
DC collector current, limited by $T_{vjmax}$	$I_C$	$T_C=25^\circ C$	100
		$T_C=100^\circ C$	50
Pulsed collector current, $t_p$ limited by $T_{vjmax}$	$I_{Cpuls}$	200	A
Turn off safe operating area $V_{CE} \leq 650V, T_{vj} \leq 175^\circ C$	-	200	A
Diode forward current limited by $T_{vjmax}$	$I_F$	$T_C=25^\circ C$	60
		$T_C=100^\circ C$	30
Diode pulsed current, $t_p$ limited by $T_{vjmax}$	$I_{Fpuls}$	200	A
Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
Power dissipation	$P_D$	$T_C=25^\circ C$	375
		$T_C=100^\circ C$	188
Short circuit withstand time $V_{CC} \leq 400V, V_{GE} = 15V, T_{vj} = 150^\circ C$ Allowed number of short circuits < 1000 Time between short circuits $\geq 1.0s$	tsc	5	$\mu s$
Operating Junction temperature range	$T_{vj}$	-40~175	$^\circ C$
Storage temperature range	$T_{stg}$	-55~150	$^\circ C$
Soldering temperature Wave soldering 1.6 mm (0.063 in.) from case for 10s		260	$^\circ C$
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

### Thermal Characteristic

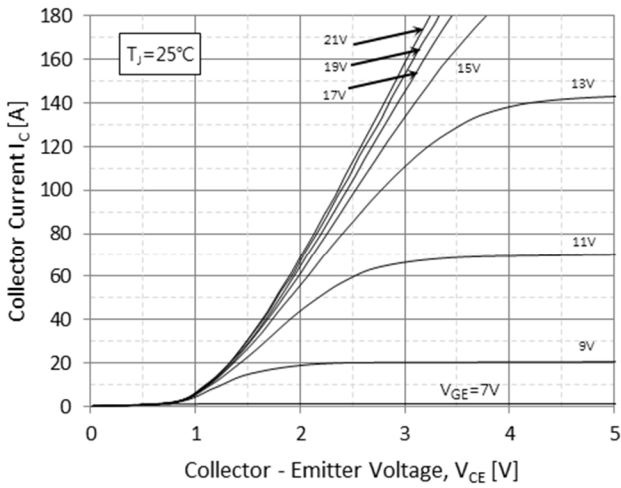
Parameter	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	$^\circ C/W$
Thermal resistance junction-to-case for IGBT	$R_{\theta JC}$	0.4	
Thermal resistance junction-to-case for Diode	$R_{\theta JC}$	1.2	

### Ordering Information

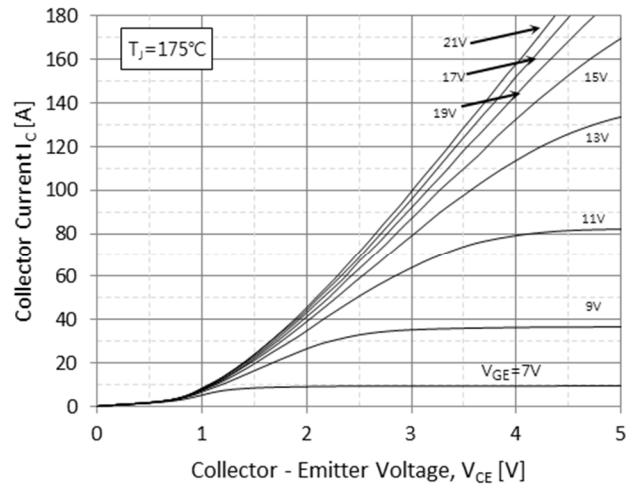
Part Number	Marking	Temp. Range	Package	Packing	RoHS Status
MBQ50T65FESC	50T65FESC	-55~175°C	TO-247	Tube	Halogen Free

### Electrical Characteristic (T<sub>vj</sub> = 25°C unless otherwise specified)

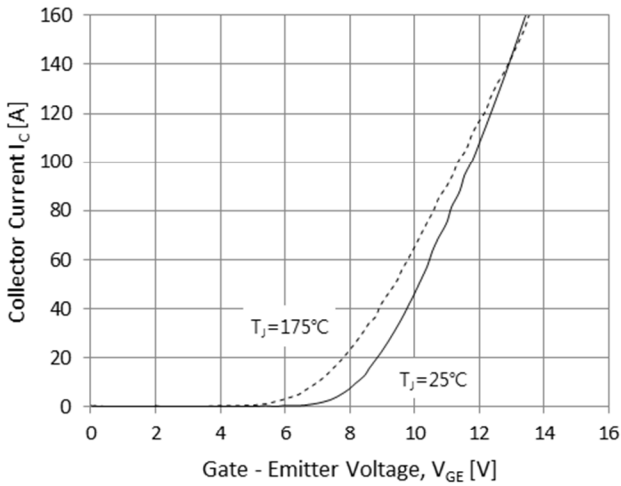
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Static Characteristic</b>						
Collector-emitter breakdown voltage	BV <sub>CES</sub>	I <sub>C</sub> = 2mA, V <sub>GE</sub> = 0V	650	-	-	V
Collector-emitter saturation voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = 50A, V <sub>GE</sub> = 15V	T <sub>vj</sub> = 25°C	1.85	2.4	V
			T <sub>vj</sub> = 175°C	2.2		
Diode forward voltage	V <sub>F</sub>	V <sub>GE</sub> = 0V, I <sub>F</sub> = 30A	T <sub>vj</sub> = 25°C	1.65	2.05	V
			T <sub>vj</sub> = 175°C	1.55		
Gate-emitter threshold voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 0.5mA	3.8	5.0	6.2	V
Zero gate voltage collector current	I <sub>CES</sub>	V <sub>CE</sub> = 650V, V <sub>GE</sub> = 0V, T <sub>vj</sub> = 25°C	-	-	40	μA
Gate-emitter leakage current	I <sub>GES</sub>	V <sub>GE</sub> = 20V, V <sub>CE</sub> = 0V	-	-	±100	nA
<b>Dynamic Characteristic</b>						
Total gate charge	Q <sub>g</sub>	V <sub>CE</sub> = 520V, I <sub>C</sub> = 50A, V <sub>GE</sub> = 15V	-	287		nC
Gate-emitter charge	Q <sub>ge</sub>		-	42		
Gate-collector charge	Q <sub>gc</sub>		-	181		
Input capacitance	C <sub>ies</sub>	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz	-	4453	-	pF
Reverse transfer capacitance	C <sub>res</sub>		-	161	-	
Output capacitance	C <sub>oes</sub>		-	238	-	
Internal emitter inductance measured 5mm (0.197 in.) from case	L <sub>E</sub>		-	13.0	-	nH
Short circuit collector current Max. 1000 short circuits Time between short circuits: ≥ 1.0s	I <sub>C(SC)</sub>	V <sub>GE</sub> = 15V, V <sub>CC</sub> = 400V, t <sub>SC</sub> ≤ 5μs, T <sub>vj</sub> = 150°C	-	140	-	A
<b>Switching Characteristic</b>						
Turn-on delay time	t <sub>d(on)</sub>	V <sub>GE</sub> = 15V, V <sub>CC</sub> = 400V, I <sub>C</sub> = 50A, R <sub>G</sub> = 7.9Ω, Inductive Load, T <sub>vj</sub> = 25°C	-	58	-	ns
Rise time	t <sub>r</sub>		-	60	-	
Turn-off delay time	t <sub>d(off)</sub>		-	328	-	
Fall time	t <sub>f</sub>		-	44	-	mJ
Turn-on switching energy	E <sub>on</sub>		-	0.77	-	
Turn-off switching energy	E <sub>off</sub>		-	0.55	-	
Total switching energy	E <sub>ts</sub>	-	1.32	-		
Turn-on delay time	t <sub>d(on)</sub>	V <sub>GE</sub> = 15V, V <sub>CC</sub> = 400V, I <sub>C</sub> = 50A, R <sub>G</sub> = 7.9Ω, Inductive Load, T <sub>vj</sub> = 175°C	-	51	-	ns
Rise time	t <sub>r</sub>		-	66	-	
Turn-off delay time	t <sub>d(off)</sub>		-	350	-	
Fall time	t <sub>f</sub>		-	49	-	mJ
Turn-on switching energy	E <sub>on</sub>		-	1.05	-	
Turn-off switching energy	E <sub>off</sub>		-	0.55	-	
Total switching energy	E <sub>ts</sub>	-	1.6	-		
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 30A, di <sub>F</sub> /dt = 1000A/μs, T <sub>vj</sub> = 25°C	-	80	-	ns
Reverse recovery current	I <sub>rr</sub>		-	24	-	A
Reverse recovery charge	Q <sub>rr</sub>		-	0.95	-	μC
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 30A, di <sub>F</sub> /dt = 1000A/μs, T <sub>vj</sub> = 175°C	-	116	-	ns
Reverse recovery current	I <sub>rr</sub>		-	34	-	A
Reverse recovery charge	Q <sub>rr</sub>		-	1.97	-	nC



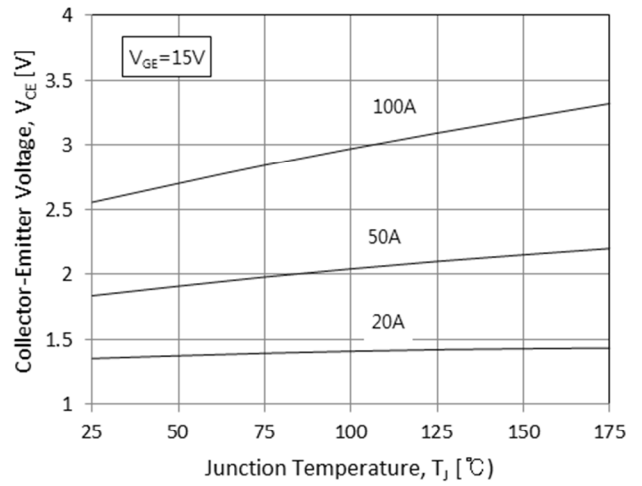
**Fig.1 Typical Output Characteristics ( $T_J = 25^\circ\text{C}$ )**



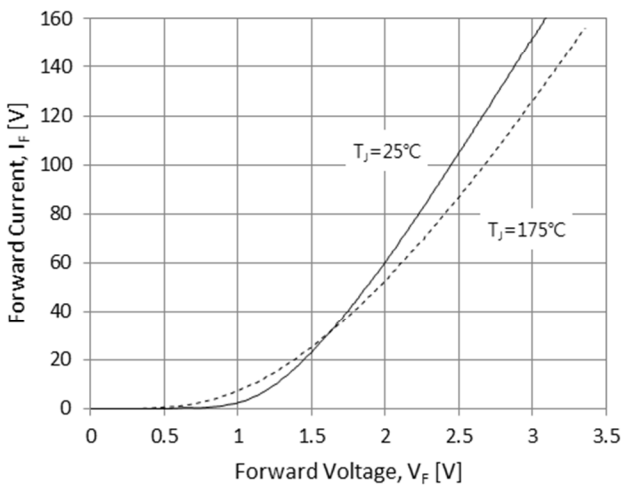
**Fig.2 Typical Output Characteristics ( $T_J = 175^\circ\text{C}$ )**



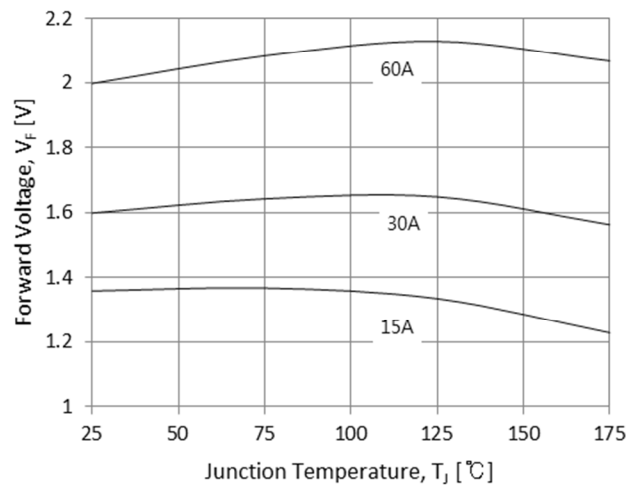
**Fig.3 Typical Transfer Characteristics**



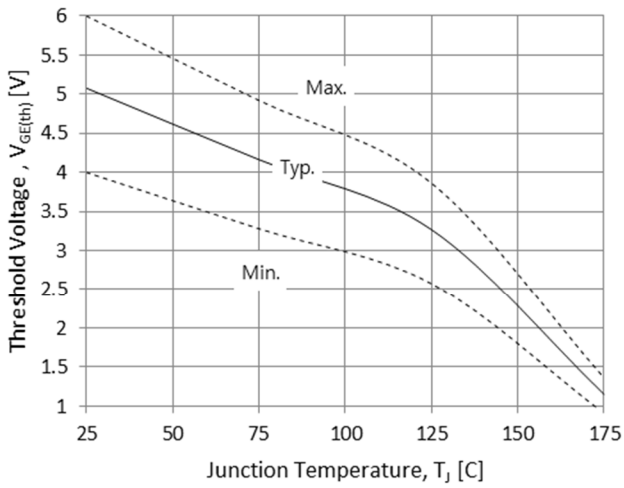
**Fig.4 Typical Collector-Emitter Saturation Voltage - Junction Temperature**



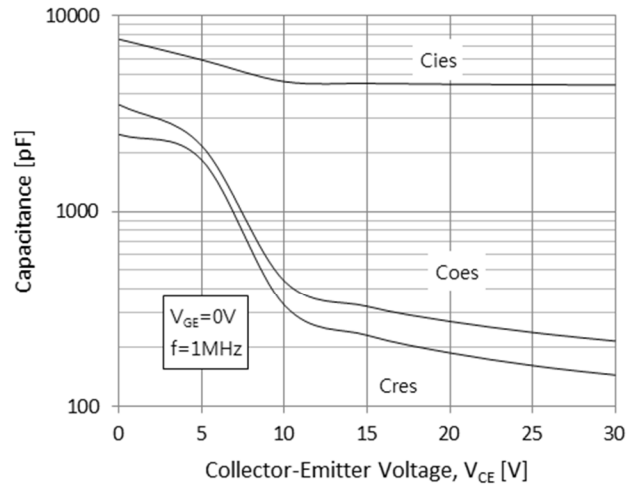
**Fig.5 Diode Forward Characteristics**



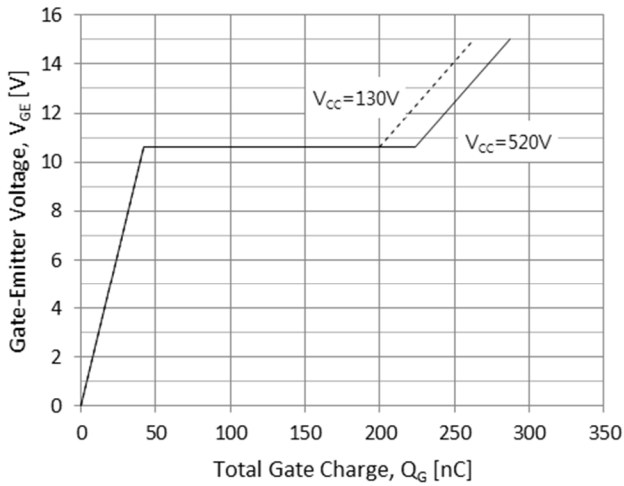
**Fig.6 Diode Forward-Junction Temperature**



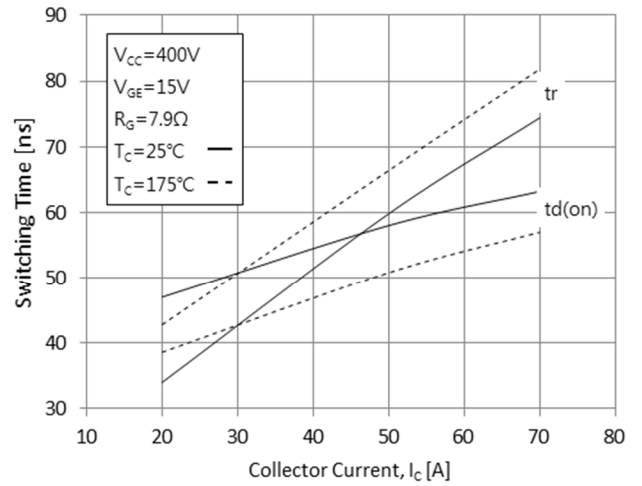
**Fig.7 Threshold Voltage-Junction Temperature**



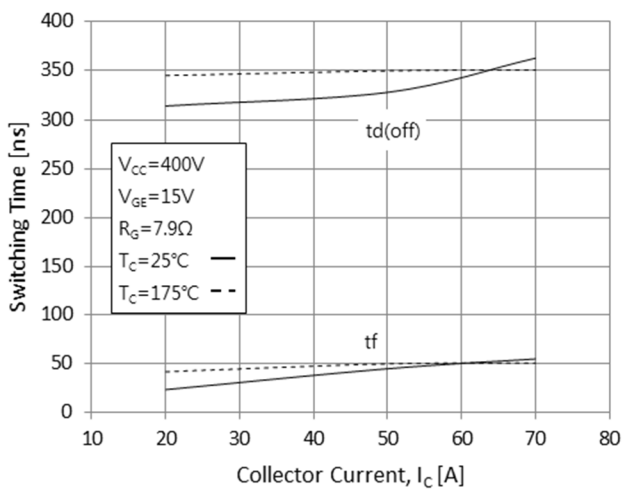
**Fig.8 Typical Capacitance**



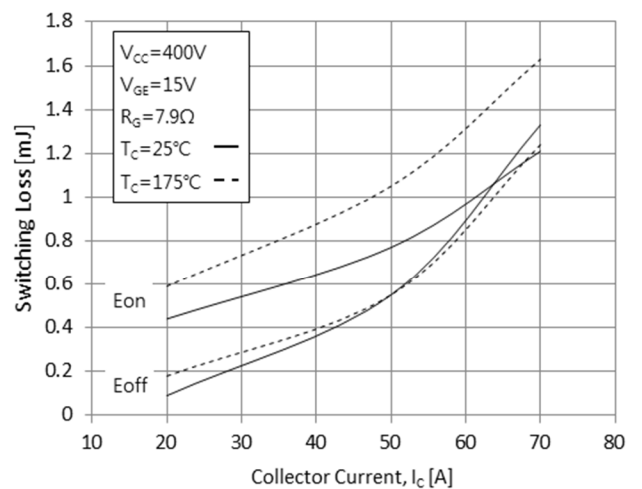
**Fig.9 Typical Gate Charge**



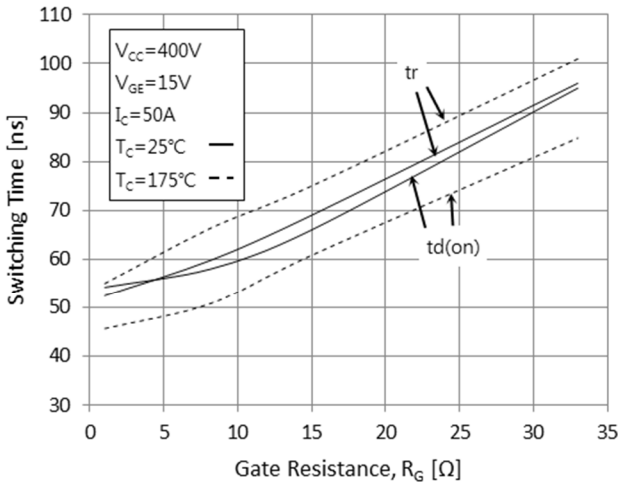
**Fig.10 Typical Turn on-Collector Current**



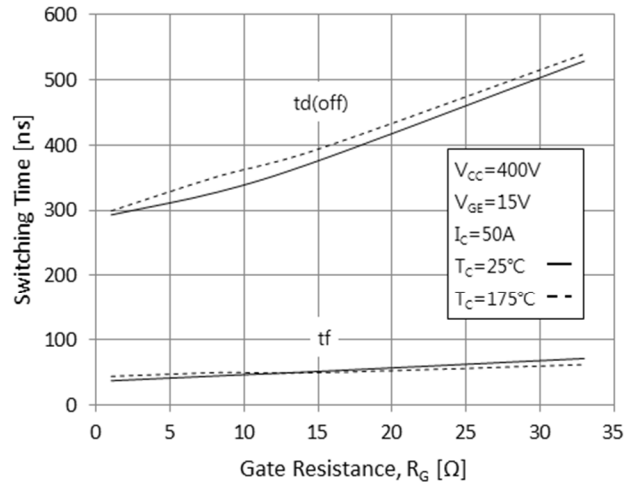
**Fig.11 Typical Turn off-Collector Current**



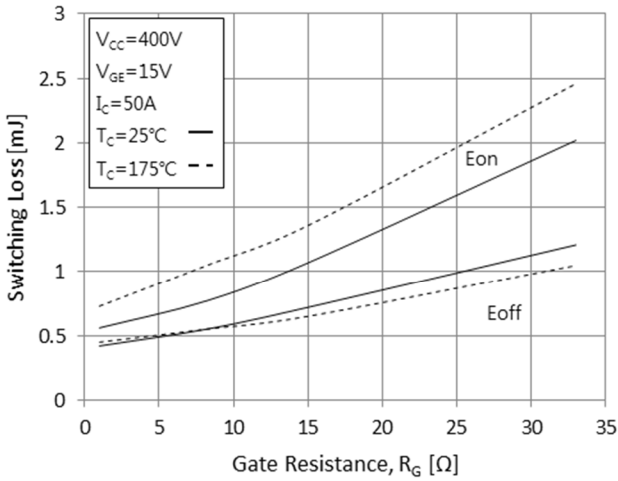
**Fig.12 Switching Loss-Collector Current**



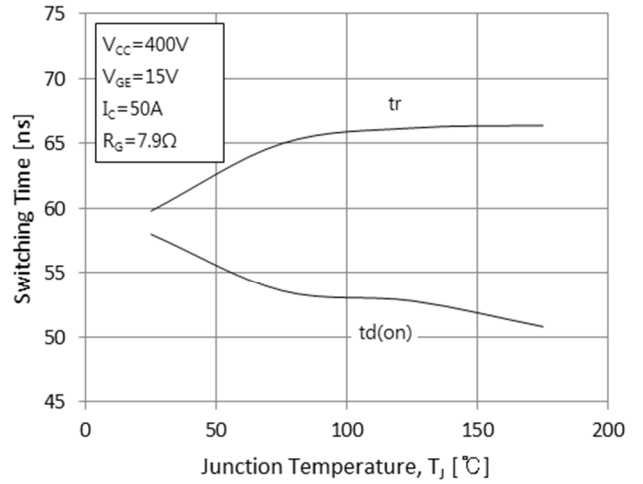
**Fig.13 Turn on Characteristics-Gate Resistance**



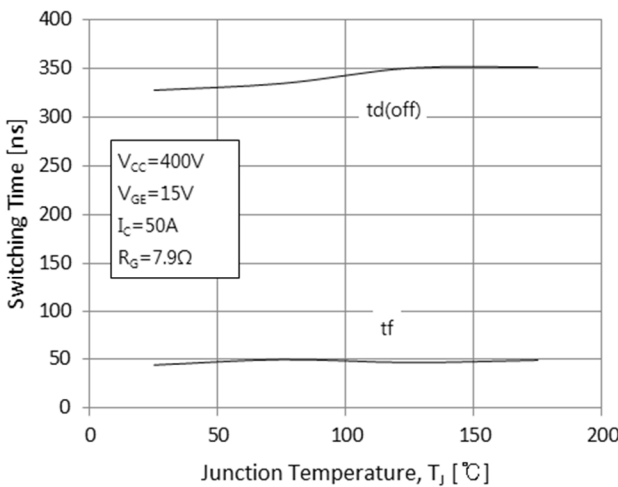
**Fig.14 Turn off Characteristics-Gate Resistance**



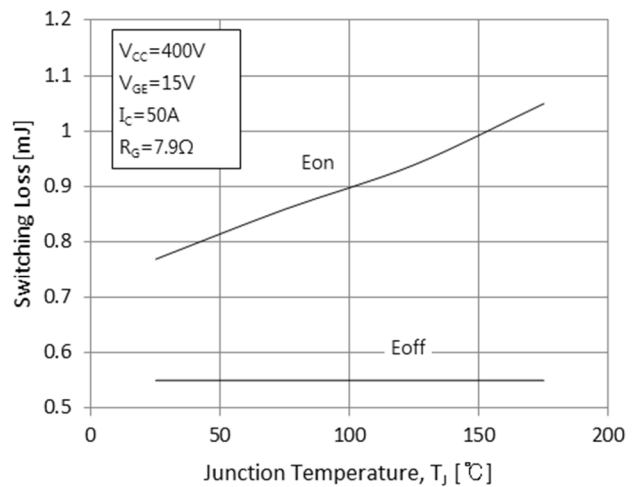
**Fig.15 Switching Loss-Gate Resistance**



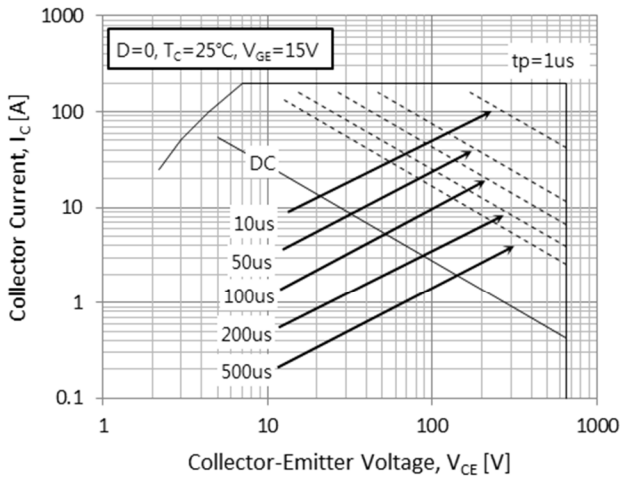
**Fig.16 Turn on Characteristics-Junction Temperature**



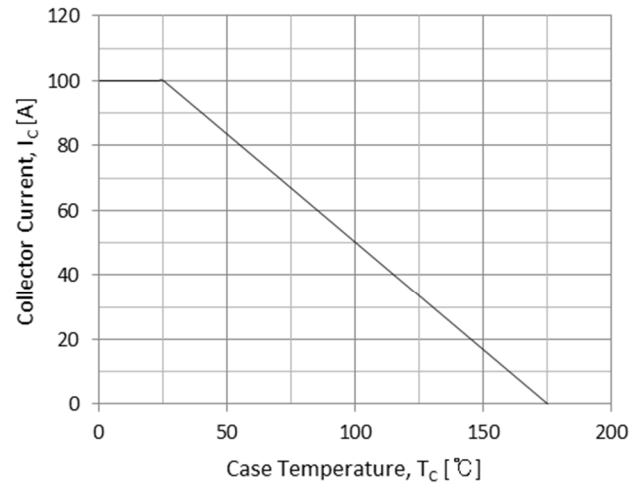
**Fig.17 Turn off Characteristics-Junction Temperature**



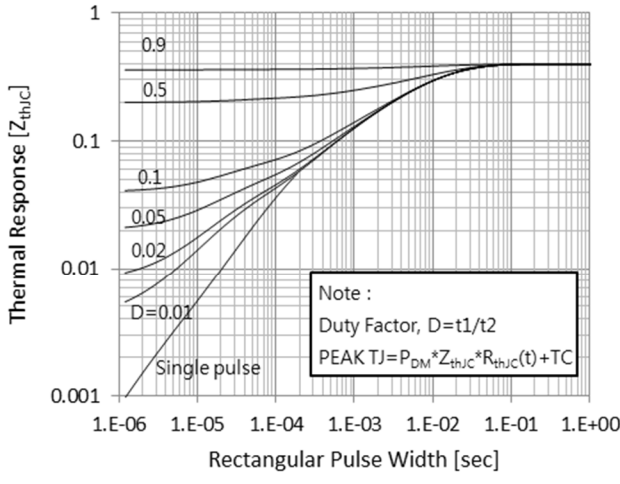
**Fig.18 Switching Loss-Junction Temperature**



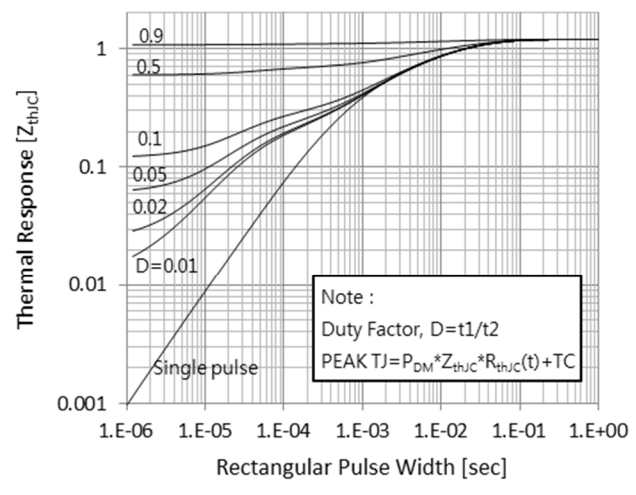
**Fig.19 Forward Bias Safe Operating Area**



**Fig.20 Case Temperature-Collector Current**



**Fig.21 IGBT Transient Thermal Impedance**

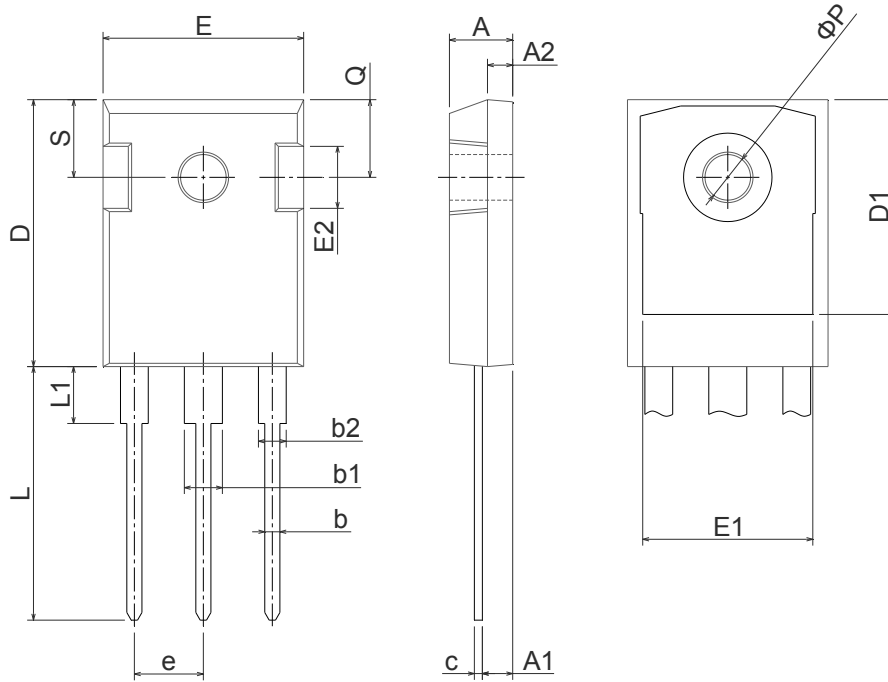


**Fig.22 FRD Transient Thermal Impedance**

**Physical Dimension**

**TO-247**

Dimensions are in millimeters, unless otherwise specified



Dimension	Min(mm)	Max(mm)
A	4.70	5.31
A1	2.20	2.60
A2	1.50	2.49
b	0.99	1.40
b1	2.59	3.43
b2	1.65	2.39
c	0.38	0.89
D	20.30	21.46
D1	13.08	-
E	15.45	16.26
E1	13.06	14.02
E2	4.32	5.49
e	5.45BSC	
L	19.81	20.57
L1	-	4.50
ΦP	3.50	3.70
Q	5.38	6.20
S	6.15BSC	

**DISCLAIMER:**

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