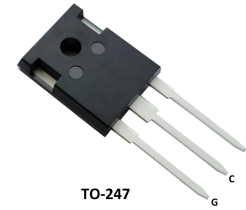


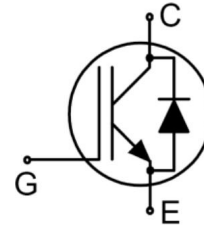
## Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)}=1.95V@I_C=40A$
- $E_{off}=0.35mJ@T_c=25^{\circ}C$
- High Input Impedance
- $T_{rr}=80ns(Typ)@diF/dt=1000A/us$
- Maximum junction temperature  $T_{vjmax}=175^{\circ}C$



## Applications

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



## Absolute Ratings( $T_c=25^{\circ}C$ )

Parameter	Symbol	Value	Unit
Collector-Emmitter Voltage	$V_{ce}$	650	V
Collector Current-continuous	$I_C$ $T=25^{\circ}C$ $T=100^{\circ}C$	80	A
		40	A
Diode forward current	$I_F$ $T=25^{\circ}C$ $T_c=100^{\circ}C$	80	A
		40	A
Collector Current-pulse (note 1)	$I_{CM}$	160	A
Gate-EMMiter Voltage	$V_{GES}$	$\pm 20$	V
Power Dissipation	PD $T_c=25^{\circ}C$ $T_c=100^{\circ}C$	375	W
		188	W
Operating Temperature Range	$T_J$	-40~+175	$^{\circ}C$
Storage Temperature Range	$T_{STG}$	-55~+150	$^{\circ}C$
Short Circuit Withstand Time	$t_{sc}$	5	us
Maximum Lead Temperature for Soldering Purposes	$T_L$	300	$^{\circ}C$

**Electrical Characteristics**

Parameter	Symbol	Tests conditions	Min	Typ	Max	Units
<b>Off-Characteristics</b>						
Collector-Emmitter Voltage	$BV_{CES}$	$I_c=2mA, V_{GE}=0V$	650	-	-	V
Zero Gate Voltage Collector Current	$I_{CES}$	$V_{CE}=650V, V_{GE}=0V, T_c=25^\circ C$	-	-	40	$\mu A$
		$V_{CE}=650V, V_{GE}=0V, T_c=175^\circ C$	-	-	1000	
Gate-body leakage current, forward	$I_{GESF}$	$V_{CE}=0V, V_{GE}=20V$	-	-	100	nA
Gate-body leakage current, reverse	$I_{GESR}$	$V_{CE}=0V, V_{GE}=-20V$	-	-	-100	nA
<b>On-Characteristics</b>						
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}, I_c=0.58mA$	4.0	5.0	6.0	V
Collector-Emmitter saturation Voltage	$V_{CESAT}$	$V_{GE}=15V, I_c=40A, T_c=25^\circ C$	-	1.95	2.4	V
		$V_{GE}=15V, I_c=40A, T_c=175^\circ C$	-	2.3	-	V
<b>Dynamic Characteristics</b>						
Input capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1.0MHZ$	-	2818	-	pF
Output capacitance	$C_{oes}$		-	131	-	pF
Reverse transfer capacitance	$C_{res}$		-	209	-	pF

**Electrical Characteristics**

Parameter	Symbol	Tests conditions	Min	Typ	Max	Units
<b>Switching Characteristics</b>						
Turn-on delay time	$t_d(on)$	$V_{CC}=400V, I_c=40A, R_G=7.9\Omega, V_{GE}=15V, Inductive Load, T_c=25^\circ C$	-	58	-	ns
Turn-On rise time	$t_r$		-	54	-	ns
Turn-Off delay time	$t_d(off)$		-	245	-	ns
Turn-Off Fall time	$t_f$		-	40	-	ns
Turn-on Loss	$E_{on}$		-	1.15	-	mJ
Turn-off Loss	$E_{off}$		-	0.35	-	mJ
Total Loss	$E_{ts}$		-	1.50	-	mJ
Turn-on delay time	$t_d(on)$	$V_{CC}=400V, I_c=40A,$	-	61	-	ns

Turn-On rise time	$t_r$	$R_G=7.9\Omega$ , $V_{GE}=15V$ , Inductive Load $T_c=175^\circ C$	-	60	-	ns
Turn-Off delay time	$t_d(off)$		-	260	-	ns
Turn-Off Fall time	$t_f$		-	38	-	ns
Turn-on switching Loss	$E_{on}$		-	1.80	-	mJ
Turn-off switching Loss	$E_{off}$		-	0.38	-	mJ
Total switching Loss	$E_{ts}$		-	2.18	-	mJ
Gate Charge	$Q_g$	$V_{CE}=520V, I_c=40A$ $V_{GE}=15V$	-	219	-	nC
Gate to Emitter Charge	$Q_{ge}$		-	26	-	nC
Gate to Collector Charge	$Q_{gc}$		-	115	-	nC
<b>Anti-Parallel Diode Characteristics and Maximum Ratings</b>						
Drain-Source Diode Forward Voltage	$V_F$	$I_F=40A(T_J=25^\circ C)$	-	1.3	1.9	V
Diode Reverse recovery time	$t_{rr}$	$I_F=40A$ $di_F=dt=1000A/us$ $T_J=25^\circ C$	-	80	-	ns
Diode Reverse recovery charge	$Q_{rr}$		-	1.0	-	$\mu C$
Diode Reverse recovery Current	$I_{rr}$		-	25	-	A

### Thermal Characteristic

Parameter	Symbol	Max	Unit
Thermal Resistance, Junction to Case (IGBT)	$R_{th(j-c)}$	0.4	$^\circ C/W$
Thermal Resistance, Junction to Case (Diode)	$R_{th(j-c)}$	1.2	$^\circ C/W$
Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$	40	$^\circ C/W$

#### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature

### Electrical Characteristics(curves)

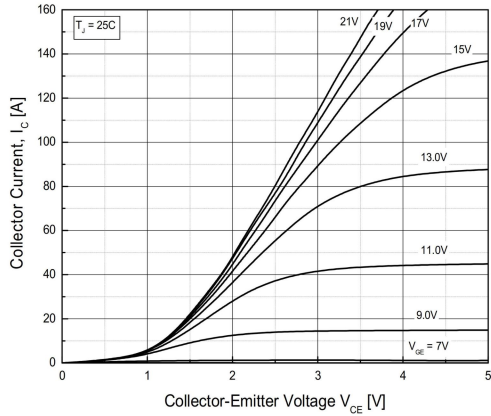


Fig.1 Typical Output Characteristics( $T_J=25^\circ\text{C}$ )

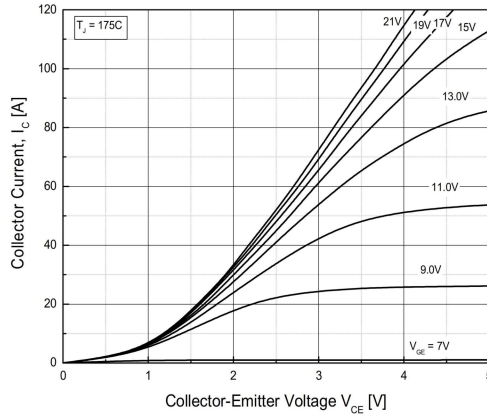


Fig.2 Typical Output Characteristics( $T_J=175^\circ\text{C}$ )

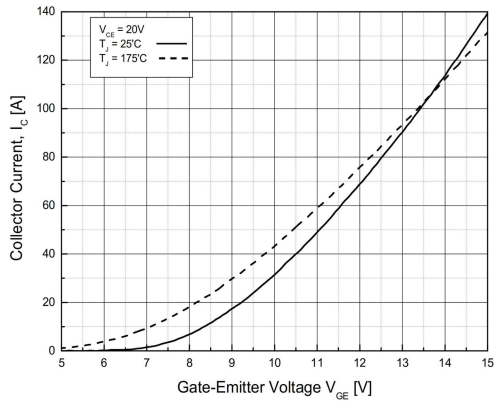


Fig.3 Typical Transfer Characteristics

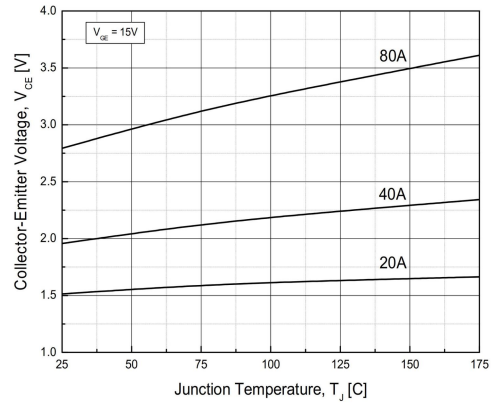


Fig.4 Typical Collector-Emitter Saturation Voltage -Junction Temperature

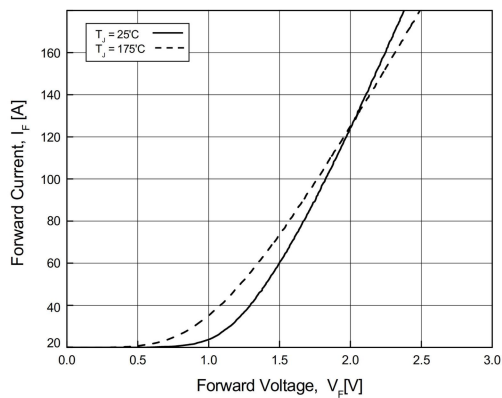


Fig.5 Diode Forward Characteristics

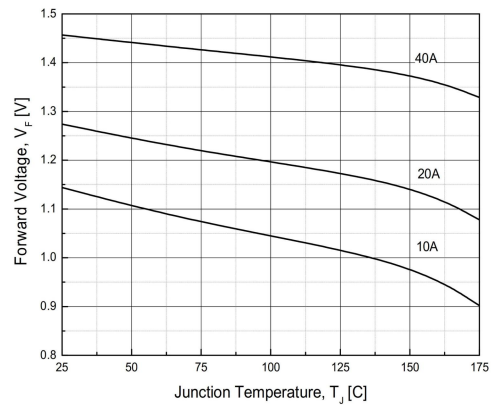
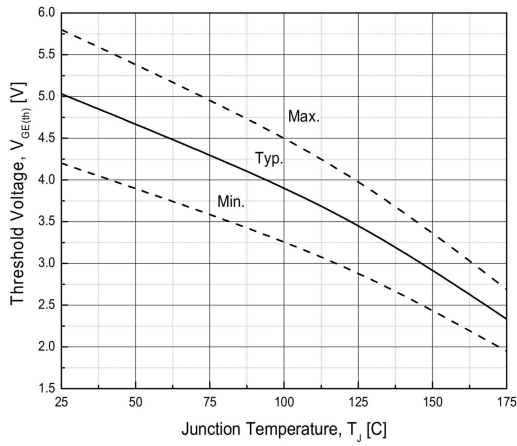
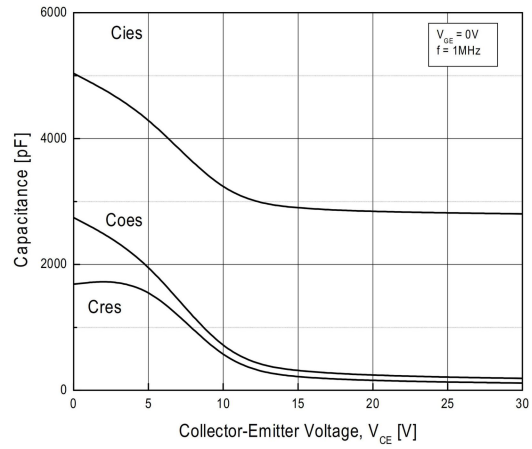


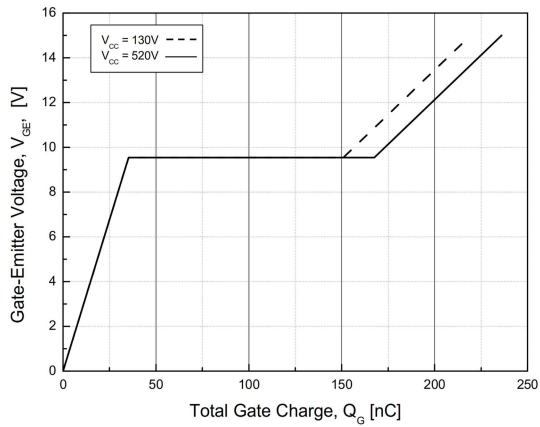
Fig.6 Diode Forward-Junction Temperature



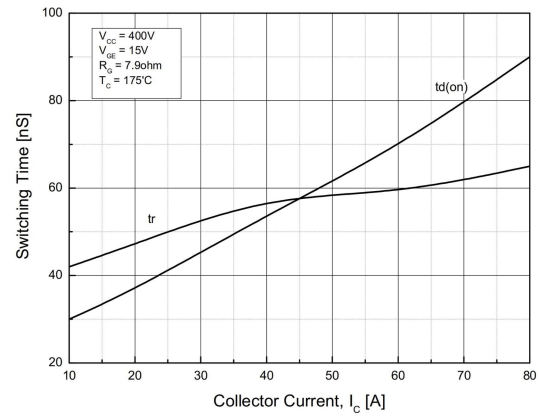
**Fig.7 Threshold Voltage-Junction Temperature**



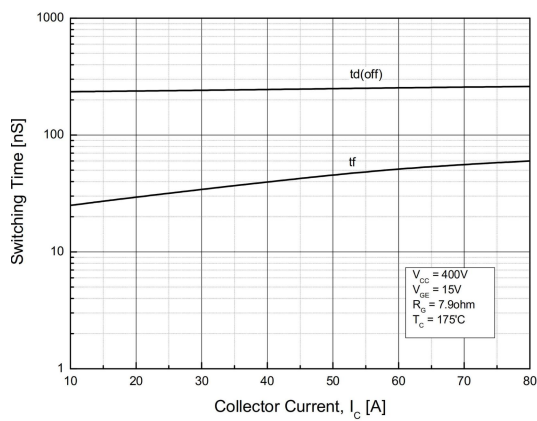
**Fig.8 Typical Capacitance**



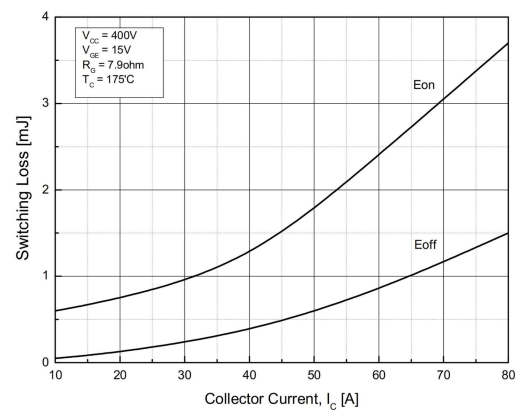
**Fig.9 Typical Gate Charge**



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



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



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

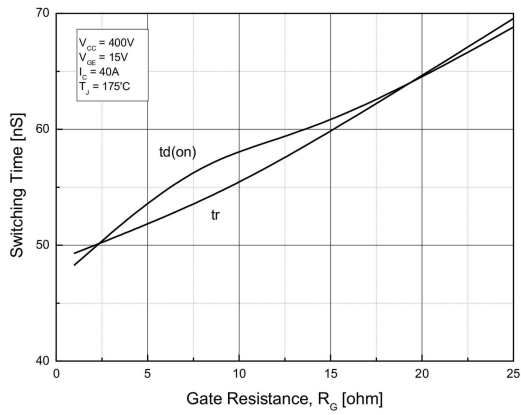


Fig.13 Turn on Characteristics-Gate Resistance

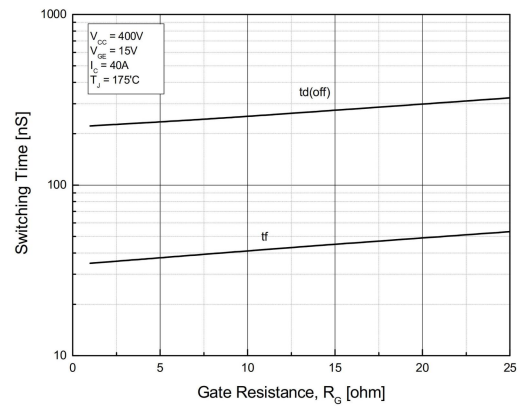


Fig.14 Turn off Characteristics-Gate Resistance

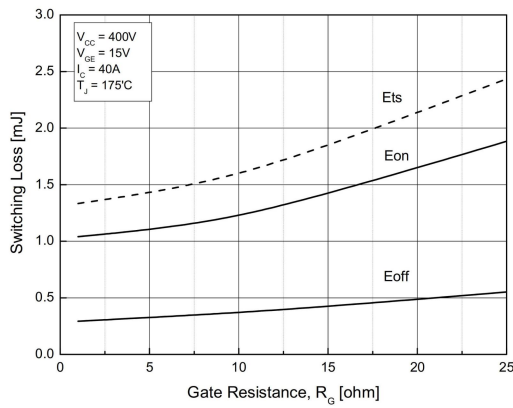


Fig.15 Switching Loss-Gate Resistance

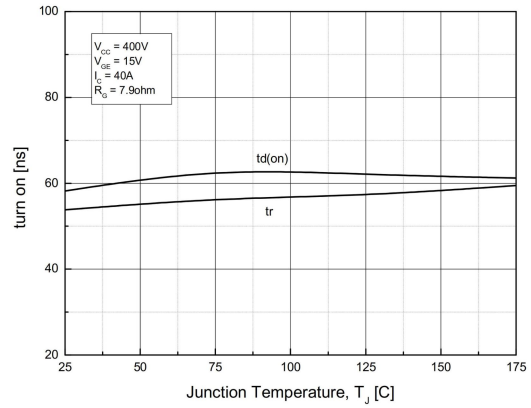


Fig.16 Turn on Characteristics -Junction Temperature

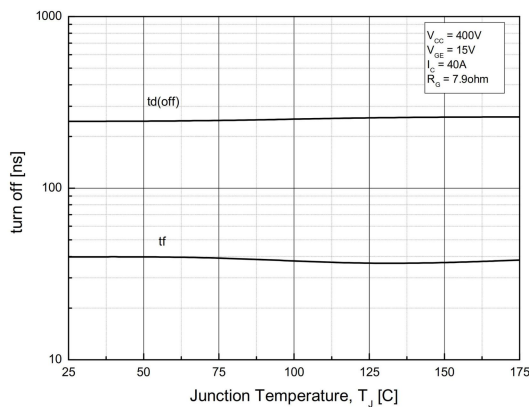


Fig.17 Turn off Characteristics -Junction Temperature

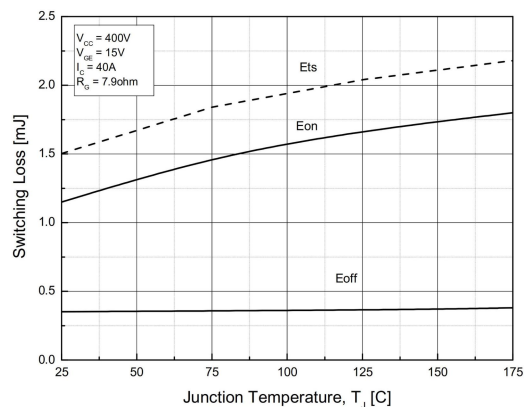
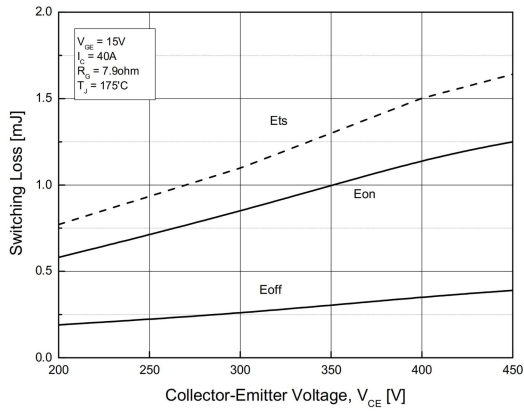
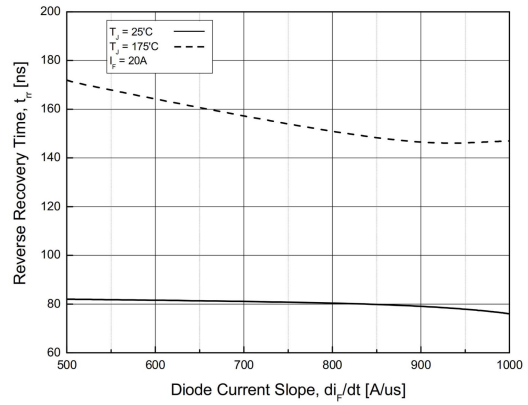


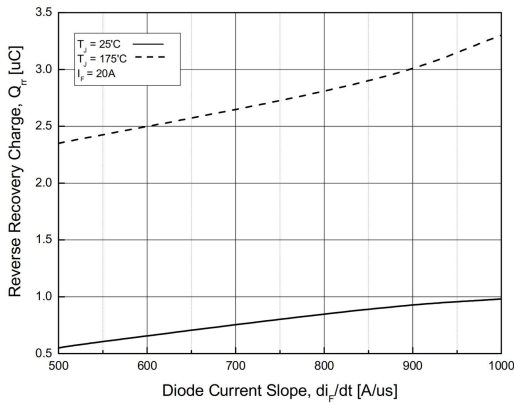
Fig.18 Switching Loss-Junction Temperature



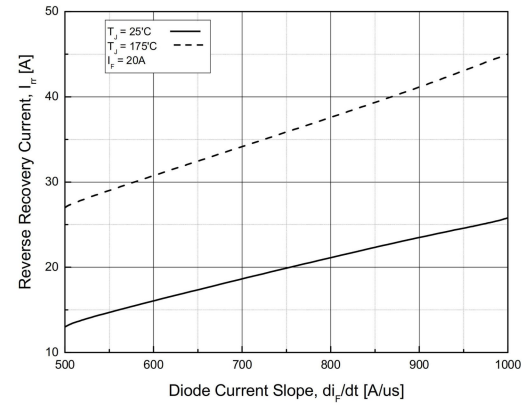
**Fig.19 Switching Loss-Collector Emitter Voltage**



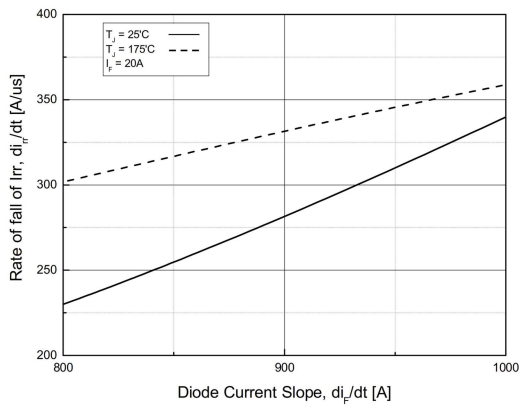
**Fig.20 Reverse Recovery Time -Diode current slope**



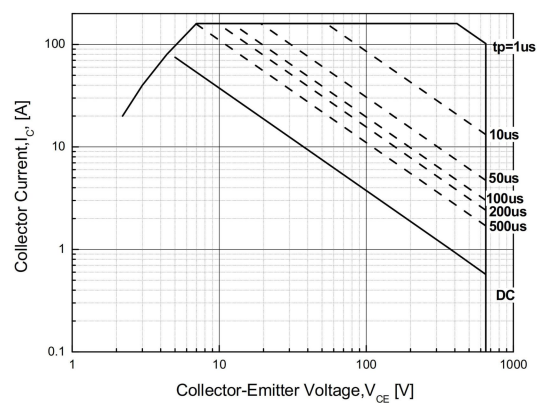
**Fig.21 Reverse Recovery Charge -Diode Current Slope**



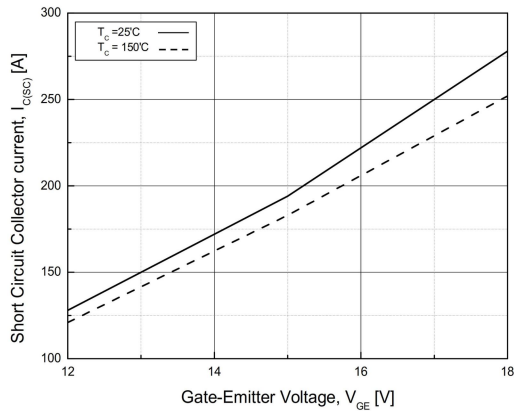
**Fig.22 Reverse Recovery Current -Diode current slope**



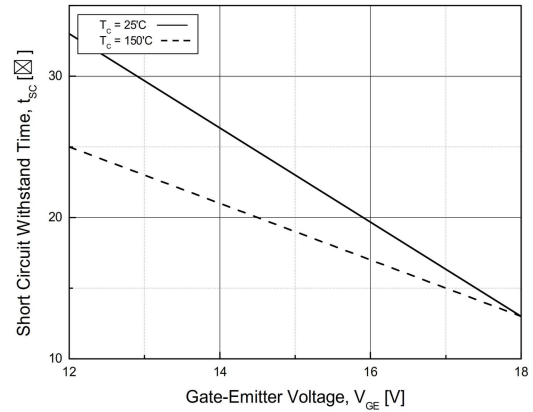
**Fig.23 Rate of fall of reverse recovery current -Diode Current Slope**



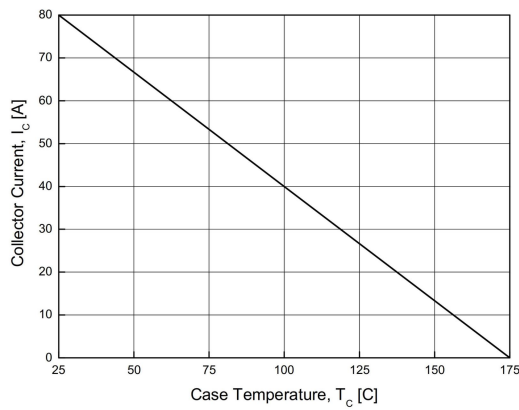
**Fig.24 Forward Bias Safe Operating Area**



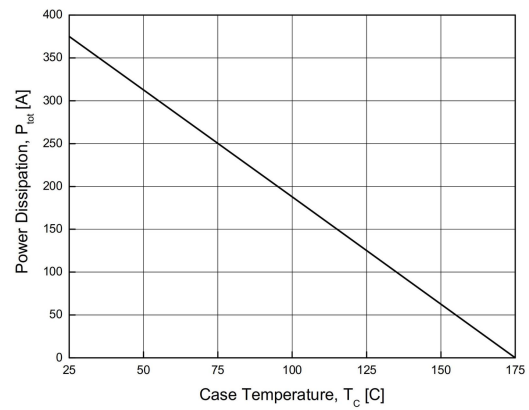
**Fig.25 Typical Short Circuit Collector Current**



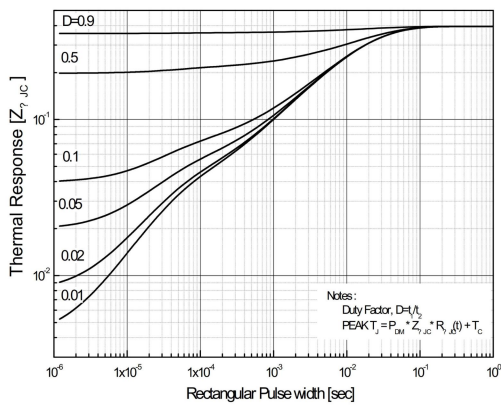
**Fig.26 Typical Short Circuit Withstand Time**



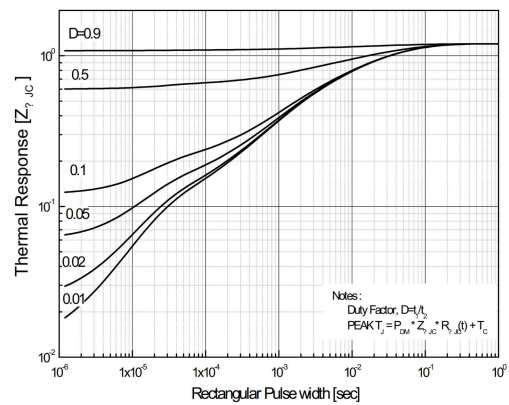
**Fig.27 Case Temperature-Collector Current**



**Fig.28 Power Dissipation-Case Temperature**



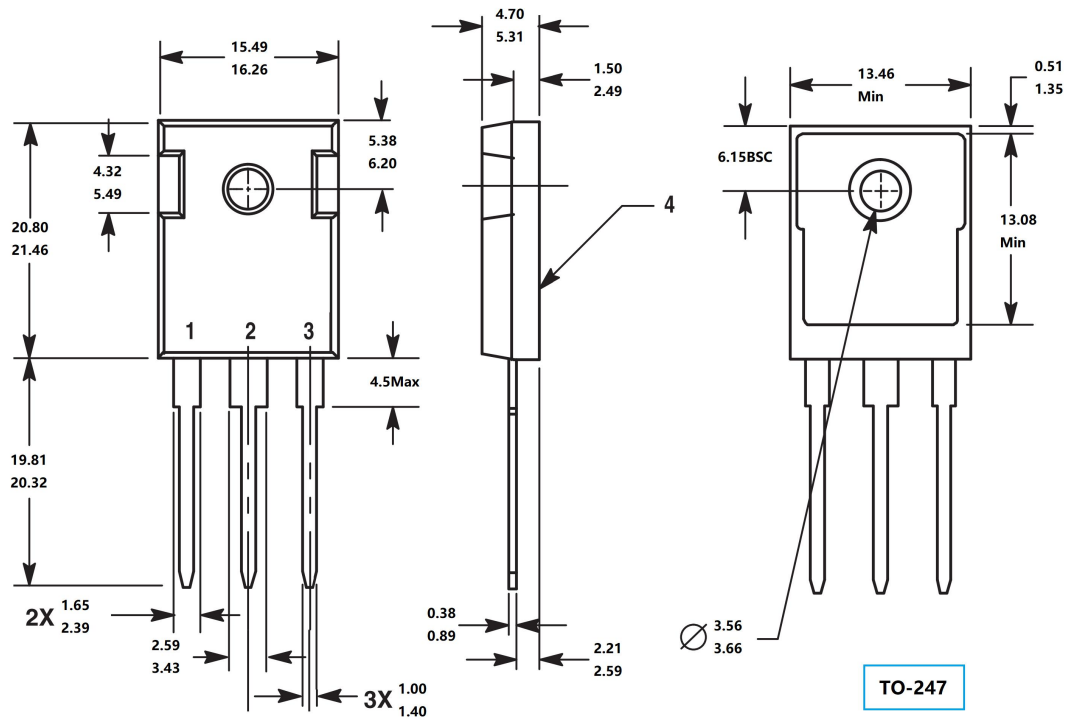
**Fig.29 IGBT Transient Thermal Impedance**



**Fig.30 FRD Transient Thermal Impedance**



### Package Mechanical DATA



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