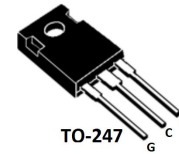


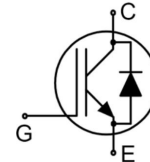
## Features

- Low gate charge
- Trench-Stop Technology
- High speed switching
- Saturation voltage:  $V_{CE(sat),typ} = 1.6V @ I_C=50A$  and  $T_C=25^\circ C$



## Applications

- General purpose inverters
- Induction heating(IH)
- Welding Converters
- UPS



## Absolute Ratings ( $T_C=25^\circ C$ )

Parameter	Symbol	Value	Unit	
Collector-Emitter Voltage	$V_{CES}$	650	V	
Collector Current-continuous	$I_C$	$T=25^\circ C$	120	A
		$T=100^\circ C$	60	A
Diode Forward current, limited by $T_{jmax}$	$I_F$	$T=25^\circ C$	120	A
		$T=100^\circ C$	60	A
Collector Current-pulse(note 1)	$I_{CM}$	240	A	
Continuous Gate-Emitter Voltage	$V_{GE}$	$\pm 20$	V	
Transient Gate-emitter voltage	$V_{GE}$	$\pm 30$	V	
Surge non repetitive forward current	$I_{FSM}$	240	A	
Power Dissipation	$P_D$ $T_C=25^\circ C$	625	W	
Operating Temperature Range	$T_J$	-55~175	$^\circ C$	
Storage Temperature Range	$T_{STG}$	-55~175	$^\circ C$	
Maximum Lead Temperature for Soldering Purposes	$T_L$	300	$^\circ C$	

## Thermal Characteristic

Parameter	Symbol	Tests conditions	Min	Type	Max	Units
Off-Characteristics						
Collector-Emitter Voltage	$BV_{CES}$	$I_C=250\mu A, V_{GE}=0V$	650	-	-	V

Zero Gate Voltage Collector Current	$I_{CES}$	$V_{CE}=650V, V_{GE}=0V,$ $T_C=25^\circ C$	-	0.1	40	$\mu A$
Gate-body leakage current	$I_{GESF}$	$V_{CE}=0V, V_{GE}=\pm 20V$	-	-	200	nA
Gate-body leakage current	$I_{GESR}$	$V_{CE}=0V, V_{GE}=\pm 20V$	-	-	-200	nA
<b>On-Characteristics</b>						
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE}=V_{GE},$ $I_C=250\mu A$	3.0	4.10	5.0	V
Collector-Emitter saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=50A$	1.30	1.60	1.90	V
<b>Dynamic Characteristics</b>						
Input capacitance	$C_{ies}$	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1.0MHz$	-	2650	-	pF
Output capacitance	$C_{oes}$		-	320	-	pF
Reverse transfer capacitance	$C_{res}$		-	63	-	pF
<b>Switching Characteristics</b>						
Turn-On delay time	$t_{d(on)}$	$V_{CC}=400V, I_C=60A,$ $R_G=5\Omega,$ $V_{GE}=0.0/15.0V$ $T_C=25^\circ C$ Inductive Load	-	23	-	ns
Turn-On rise time	$t_r$		-	115	-	ns
Turn-off delay time	$t_{d(off)}$		-	90	-	ns
Turn-off Fall time	$t_f$		-	76	-	ns
Turn-on energy	$E_{on}$		-	2.6	-	mJ
Turn-off energy	$E_{off}$		-	1.3	-	mJ
Total switching Energy	$E_{total}$		-	3.9	-	mJ
Turn-On delay time	$t_{d(on)}$	$V_{CC}=400V, I_C=60A,$ $R_G=5\Omega,$ $V_{GE}=0.0/15.0V$ $T_C=75^\circ C$ Inductive Load	-	26	-	ns
Turn-On rise time	$t_r$		-	125	-	ns
Turn-off delay time	$t_{d(off)}$		-	115	-	ns
Turn-off Fall time	$t_f$		-	120	-	ns
Turn-on energy	$E_{on}$		-	2.7	-	mJ
Turn-off energy	$E_{off}$		-	2.3	-	mJ
Total switching Energy	$E_{total}$		-	5.0	-	mJ
Total Gate Charge	$Q_g$	$V_{CE}=480V, I_C=60A,$ $V_{GE}=15V$	-	132	-	nC
Gate to emitter Charge	$Q_{ge}$		-	33	-	nC
Gate to Collector	$Q_{gc}$		-	55	-	nC

charge						
<b>Anti-Parallel Diode Characteristics and Maximum Ratings</b>						
Diode Forward Voltage	$V_F$	$V_{GE}=0V, I_F=40A$	-	1.62	2.1	V
Diode Forward Current	$I_F$	$T_C=100^\circ C$	-	-	60	A
Diode Reverse recovery time	$t_{rr}$	$V_{GE}=0V, V_R=300V$ $I_F=40A$ $di/dt=200A/us$	-	54	-	ns
Reverse recovery charge	$Q_{rr}$		-	65	-	nC

### Thermal Characteristic

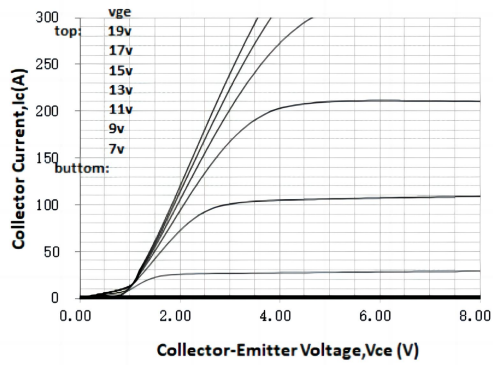
Parameter	Symbol	Max	Unit
IGBT Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.24	$^\circ C/W$
Diode Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.34	$^\circ C/W$
Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$	40	$^\circ C/W$

Note:

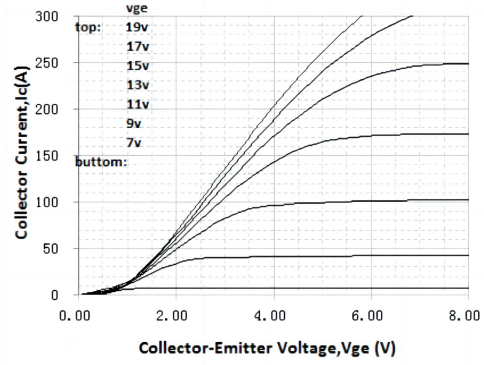
1. Collector current limited by maximum junction temperature

### Electrical Characteristics (curves)

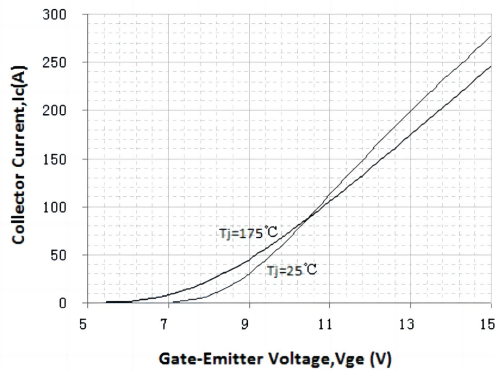
**Output Characteristics (25°C)**



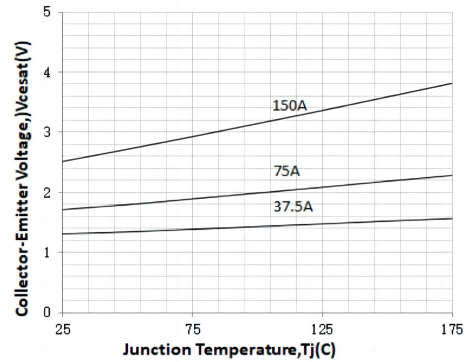
**Output Characteristics (175°C)**



**Transfer Characteristics**

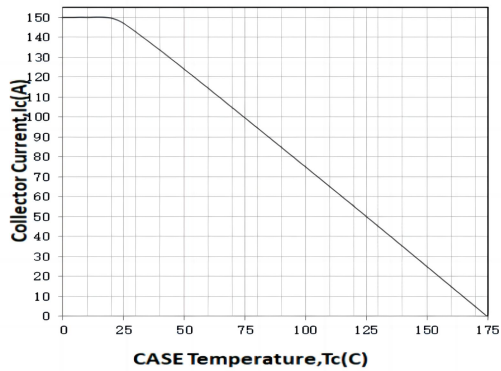


**VCESAT vs. Tj**



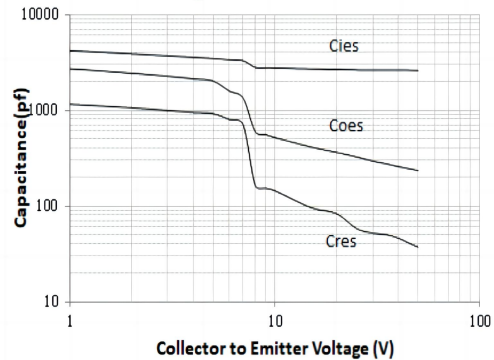
**Collector current vs. case temperature**

$V_{ge} \geq 15V, T_J \leq 175^\circ\text{C}$

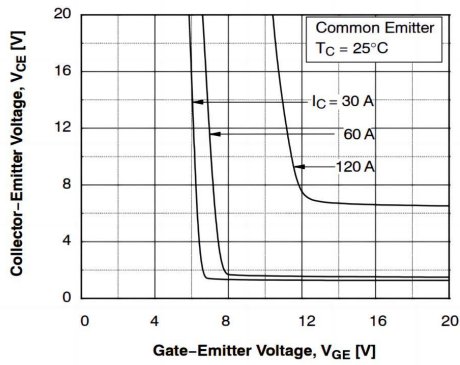


**Capacitance Characteristic**

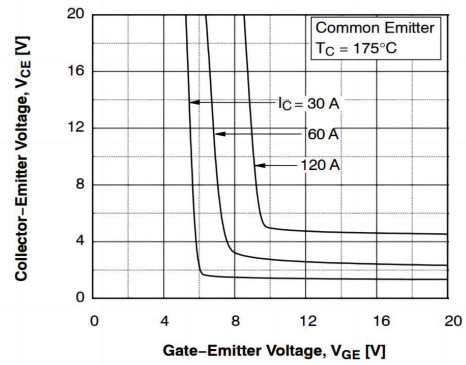
$V_{ge} = 0V, f = 1.0\text{MHz}$



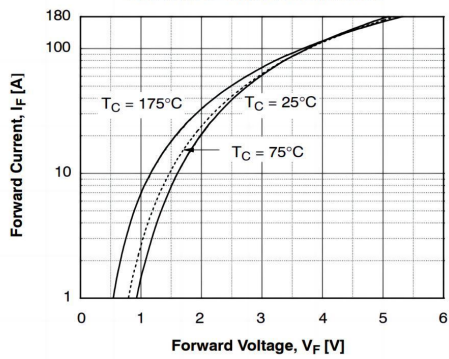
Saturation Voltage vs.  $V_{GE}$  (25°C)



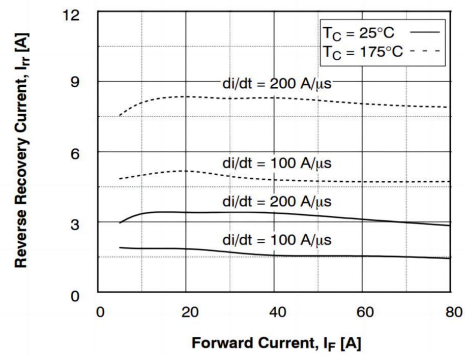
Saturation Voltage vs.  $V_{GE}$  (175°C)



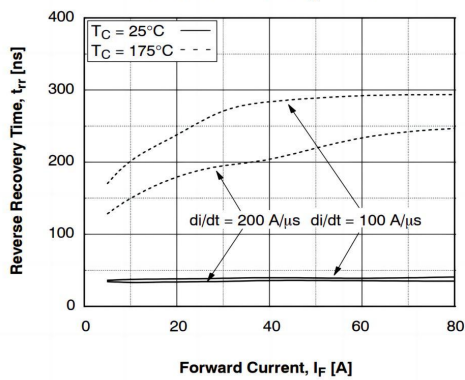
Forward Characteristics



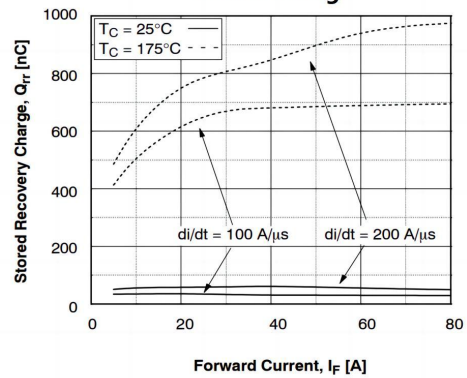
Reverse Recovery Current



Reverse Recovery Time

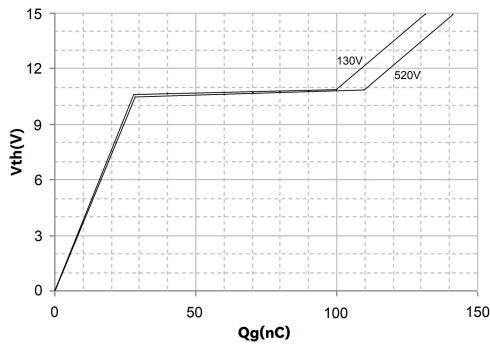


Stored Charge



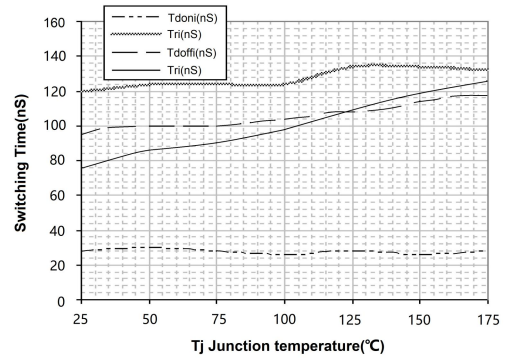
### Gate Charge Characteristics

$V_{ge}=15V, I_c=75A$



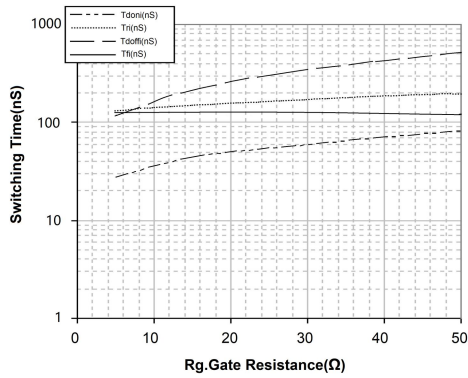
### Switching Time vs. Tj

$V_{ge}=15V, V_{ce}=400V, I_c=75A, R_g=5\Omega$



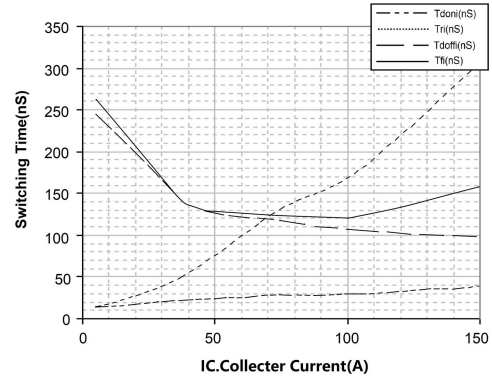
### Switching Time vs. Rg(175°C)

$V_{ge}=15V, V_{ce}=400V, I_c=75A$



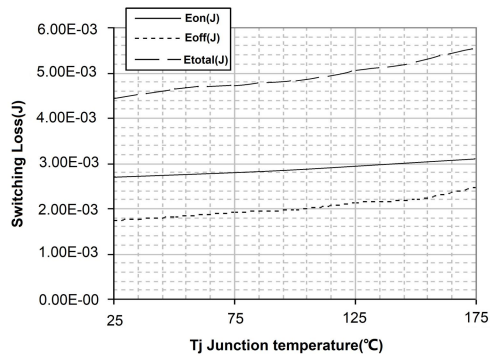
### Switching Time vs. IC(175°C)

$V_{ce}=400V, V_{ge}=15V, R_g=5\Omega$



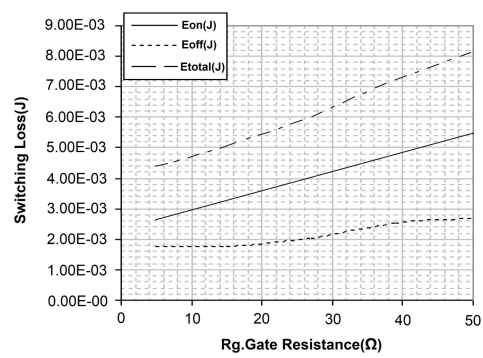
### Switching Loss vs. Tj

$V_{ge}=15V, V_{ce}=400V, I_c=75A, R_g=5\Omega$



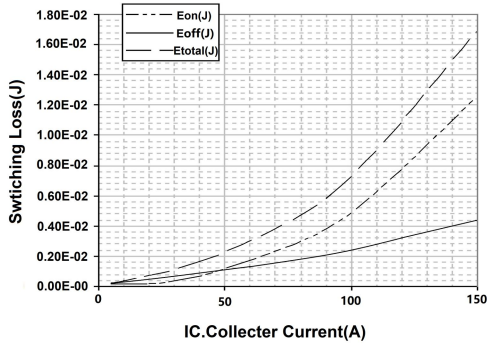
### Switching Loss vs. Rg(175°C)

$V_{ge}=15V, V_{ce}=400V, I_c=75A$



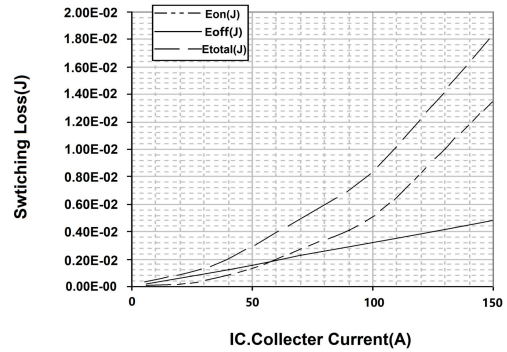
### Switching Loss vs. IC(25°C)

Vce=400V, Vge=15V, Rg=5Ω



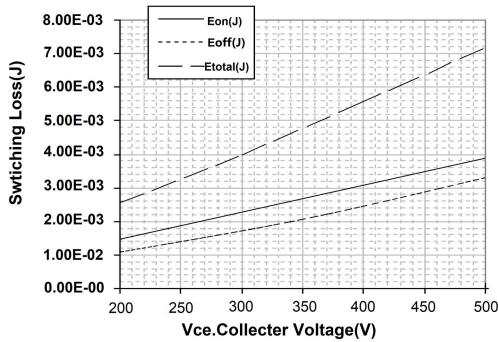
### Switching Loss vs. IC(175°C)

Vce=400V, Vge=15V, Rg=5Ω

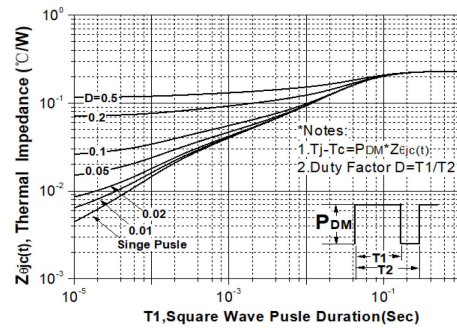


### Switching Loss vs. VCE(175°C)

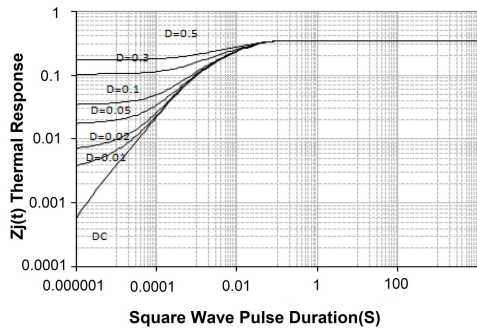
Vge=15V, Ic=75A, Rg=5Ω



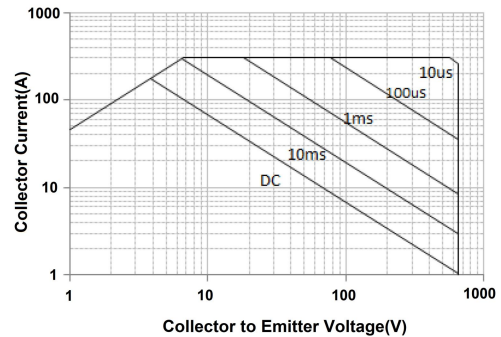
### Transient Thermal Impedance for IGBT



### Transient Thermal Impedance for FRD



### Safe Operating Area For TO-247



Package Mechanical DATA

