

HGW50N65IH

650V N-Channel Trench Field Stop IGBT

Features

- Very Low $V_{CE(sat)}$
- Extremely low switching loss
- Excellent stability and uniformity
- Maximum Junction temperature, $T_{J(max)}=175^{\circ}C$

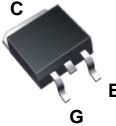
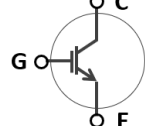
Key Parameters

Parameter	Value	Unit
V_{CES}	650	V
I_C	50	A
$V_{CE(sat)}$	1.35	V
E_{off}	1.24	mJ

Application

- Uninterruptible Power Supplies (UPS)
- Solar / Welding converters
- High frequency Converters

Package & Internal Circuit

TO-263	SYMBOL
	

Absolute Maximum Ratings $T_C=25^{\circ}C$ unless otherwise specified

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GE}	Gate-Emitter Voltage	± 25	V
	Transient Gate-Emitter Voltage, $T_p \leq 10\mu s, D < 0.01$	± 30	V
I_C	Collector Current (@ $T_C = 25^{\circ}C$) (@ $T_C = 100^{\circ}C$)	100	A
		50	A
I_{CM}	Pulsed Collector Current (Note. 1)	200	A
P_D	Power Dissipation (@ $T_C = 25^{\circ}C$) (@ $T_C = 100^{\circ}C$)	272	W
		136	W
T_J	Maximum Operating Junction Temperature	175	$^{\circ}C$
T_{STG}	Storage Temperature Range	-55 to +175	$^{\circ}C$

Thermal Resistance Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	IGBT Thermal Resistance, Junction-to-Case, Max.	0.55	$^{\circ}C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	$^{\circ}C/W$

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

Electrical Characteristics $T_j=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Static Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\ \mu\text{A}$	650	-	-	V
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE} = 650\text{ V}, V_{GE} = 0$ $T_j=25^\circ\text{C}$ $T_j=175^\circ\text{C}$	- -	- 1500	10 -	μA
I_{GES}	Gate Leakage Current	$V_{GE} = \pm 25\text{ V}, V_{CE} = 0\text{ V}$	-	-	± 100	nA
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$V_{CE} = V_{GE}, I_C = 250\ \mu\text{A}$	3.6	4.4	5.2	V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{ V}, I_C = 25\text{ A},$ $T_j=25^\circ\text{C}$ $T_j=175^\circ\text{C}$	- -	1.12 1.11	- -	V
		$V_{GE} = 15\text{ V}, I_C = 50\text{ A},$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ $T_j=175^\circ\text{C}$	- -	1.35 1.45 1.50	1.70 - -	
g_{fs}	Transconductance	$V_{CE} = 10\text{ V}, I_C = 50\text{ A}$	-	80	-	S
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V},$ $f = 1.0\text{ MHz}$	-	6,000	-	pF
C_{oes}	Output Capacitance		-	145	-	pF
C_{res}	Reverse Transfer Capacitance		-	45	-	pF
Q_g	Total Gate Charge	$V_{CE} = 480\text{ V}, I_C = 50\text{ A},$ $V_{GE} = 15\text{ V}$	-	185	-	nC
Q_{ge}	Gate-Emitter Charge		-	40	-	nC
Q_{gc}	Gate-Collector Charge		-	65	-	nC

Electrical Characteristics $T_J=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CE} = 400\text{ V}$, $I_C = 50\text{ A}$, $R_G = 15\ \Omega$, $V_{GE} = 0 / 15\text{ V}$ (Note. 2)	-	70	-	ns
t_r	Turn-On Rise Time		-	32	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	300	-	ns
t_f	Turn-Off Fall Time		-	27	-	ns
E_{off}	Turn-Off Energy Loss		-	1.24	-	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CE} = 400\text{ V}$, $I_C = 50\text{ A}$, $R_G = 15\ \Omega$, $V_{GE} = 0 / 15\text{ V}$ $T_J = 150\ ^\circ\text{C}$ (Note. 2)	-	70	-	ns
t_r	Turn-On Rise Time		-	36	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	330	-	ns
t_f	Turn-Off Fall Time		-	40	-	ns
E_{off}	Turn-Off Energy Loss		-	1.45	-	mJ

Notes : 2. Include tail current and diode reverse recovery.

IGBT Static Characteristics Figure.

Figure.1 Saturation Voltage characteristics ,Junction Temperature(T_J) 25°C

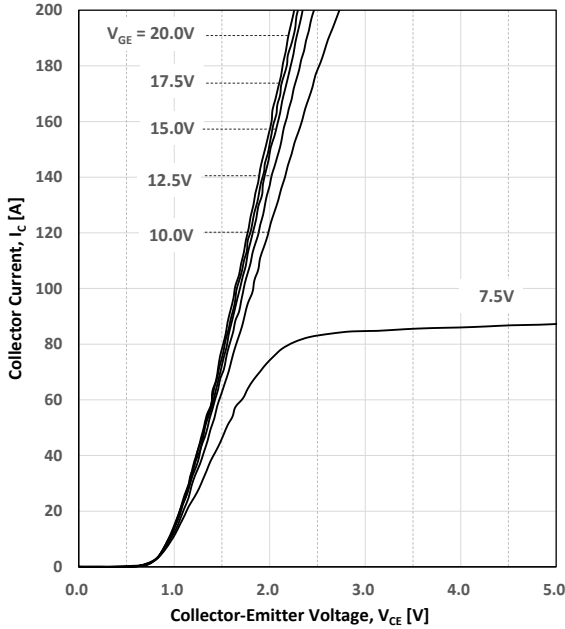


Figure.2 Saturation Voltage characteristics ,Junction Temperature(T_J) 150°C

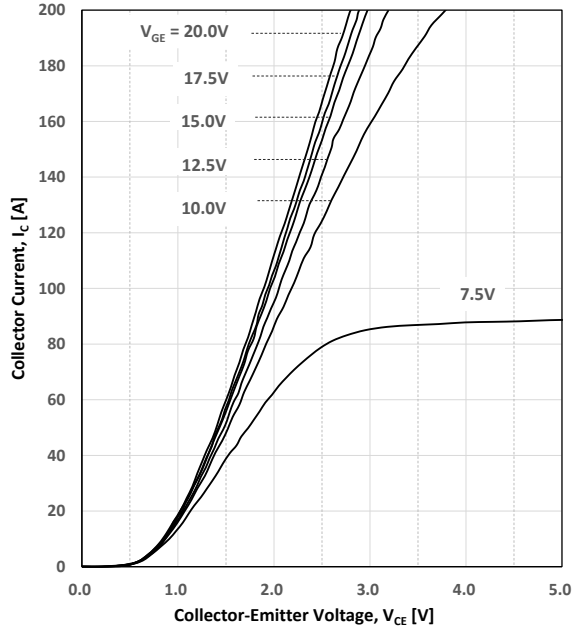


Figure.3 Saturation Voltage characteristics as Junction Temperature, $V_{GE}=15V$

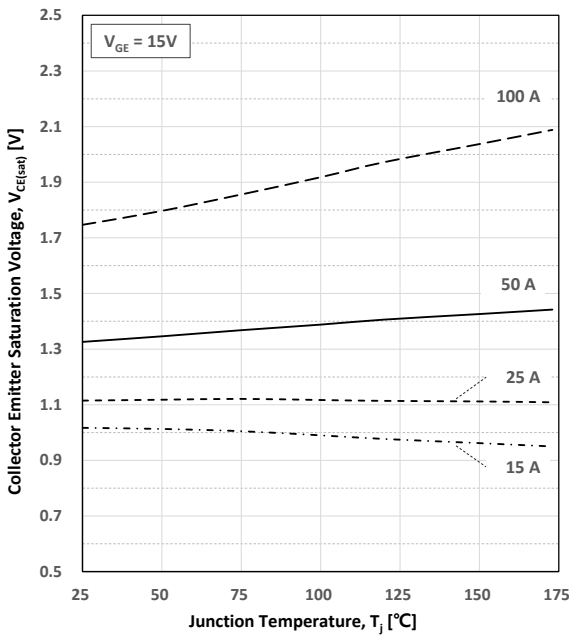


Figure.4 Transconductance characteristics as Junction Temperature

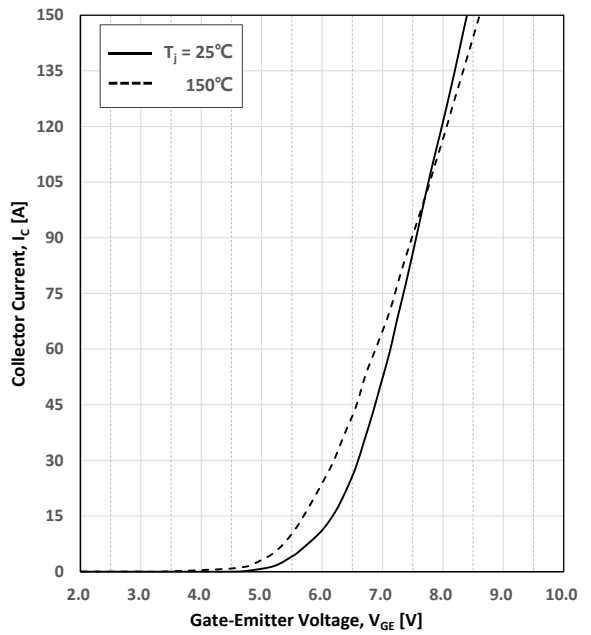


Figure.5 Threshold Voltage characteristics as Junction Temperature

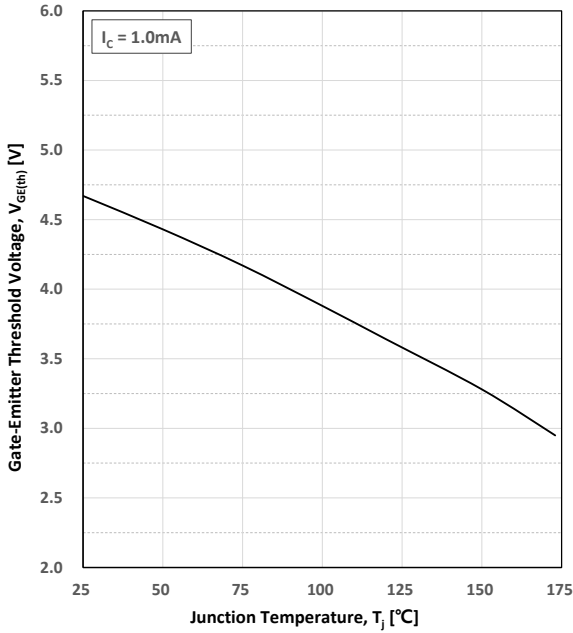
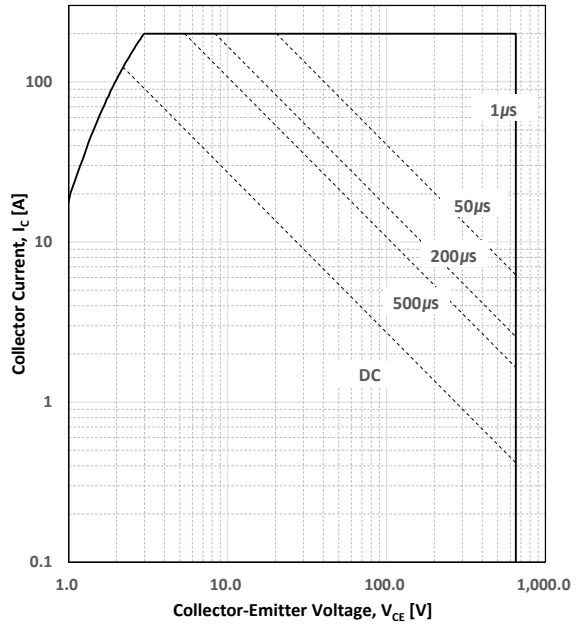


Figure.6 Forward Bias Safe Operating Area ($T_c=25^\circ C, T_j \le 175^\circ C, V_{GE}=15V, t_p=1\mu s, D=0$)



IGBT Dynamic Characteristics Figure.

Figure.7 Capacitance characteristics ($f=1MHz$)

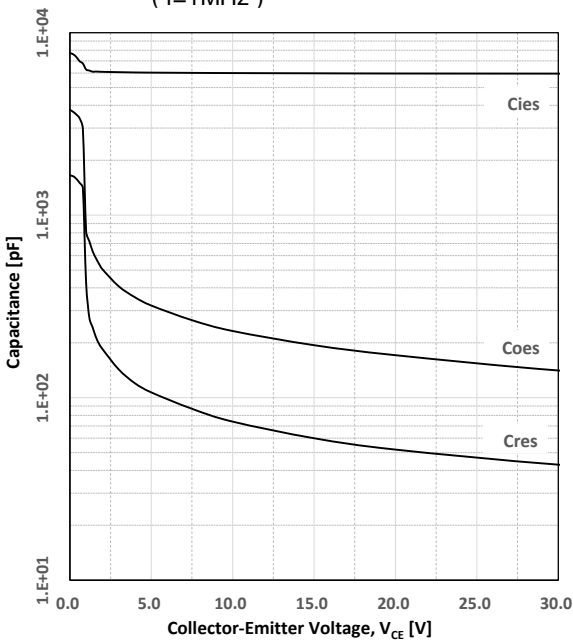
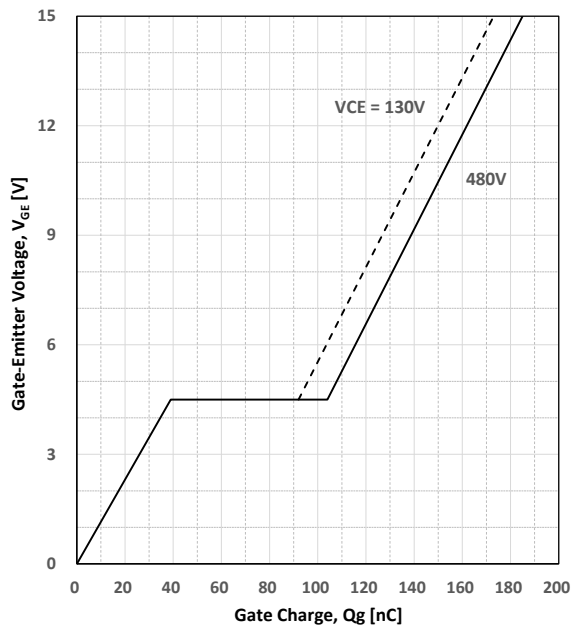


Figure.8 Gate Charge characteristics ($I_c=50A$)



IGBT Switching Characteristics Figure.

Figure.9 Switching Times as Gate Resistance
($V_{CE}=400V, I_C=50A, V_{GE}=15V, T_J=25^\circ C$)

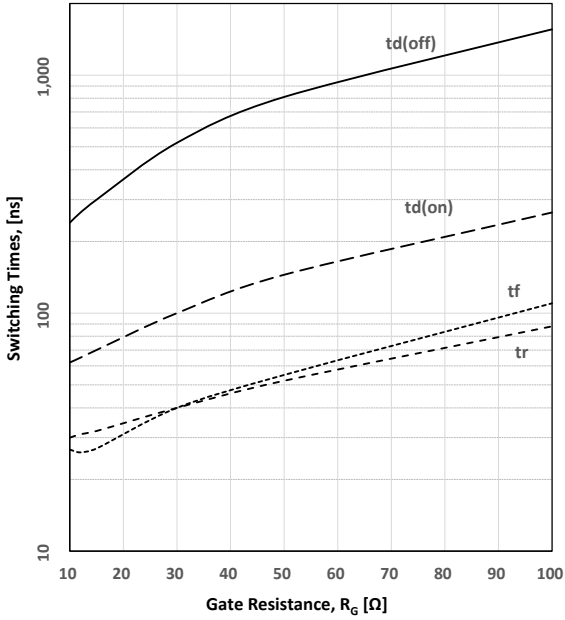


Figure.10 Switching Loss as Gate Resistance
($V_{CE}=400V, I_C=50A, V_{GE}=15V, T_J=25^\circ C$)

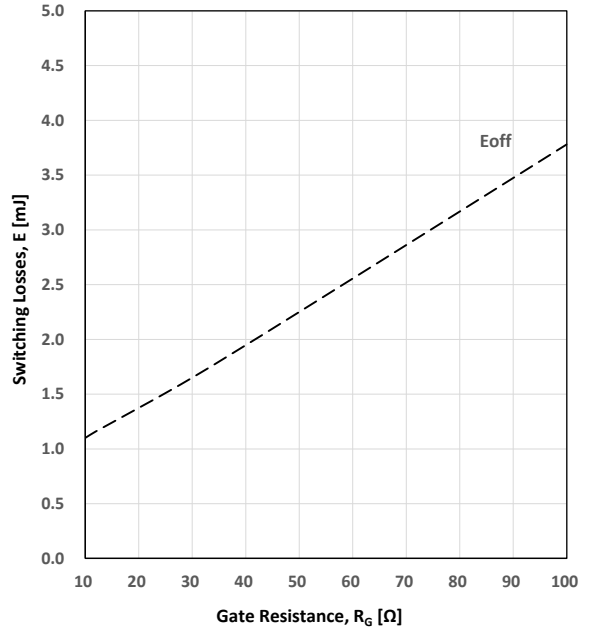


Figure.11 Switching Times as Collector Current
($V_{CE}=400V, V_{GE}=15V, R_g=15\Omega, T_J=25^\circ C$)

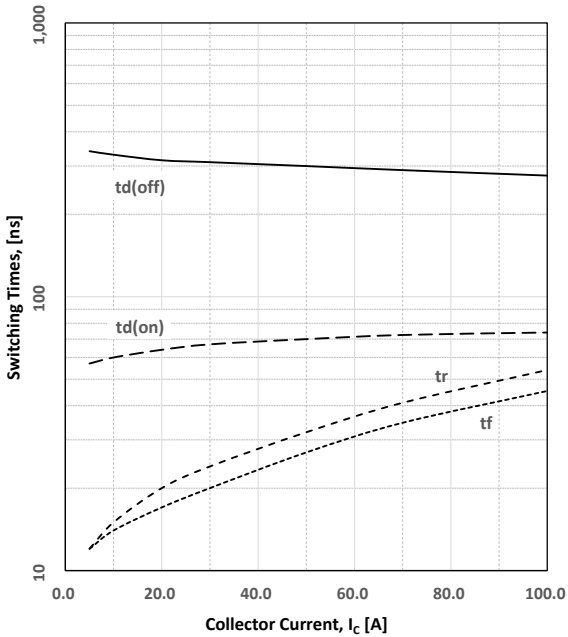


Figure.12 Switching Loss as Collector Current
($V_{CE}=400V, V_{GE}=15V, R_g=15\Omega, T_J=25^\circ C$)

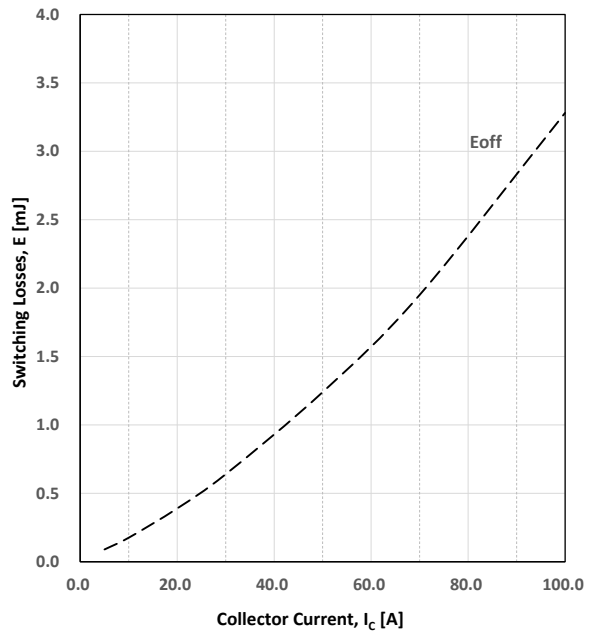


Figure.13 Switching Times as Collector Voltage
 ($I_C=50A$, $V_{GE}=15V$, $R_g=15\Omega$, $T_J=25^\circ C$)

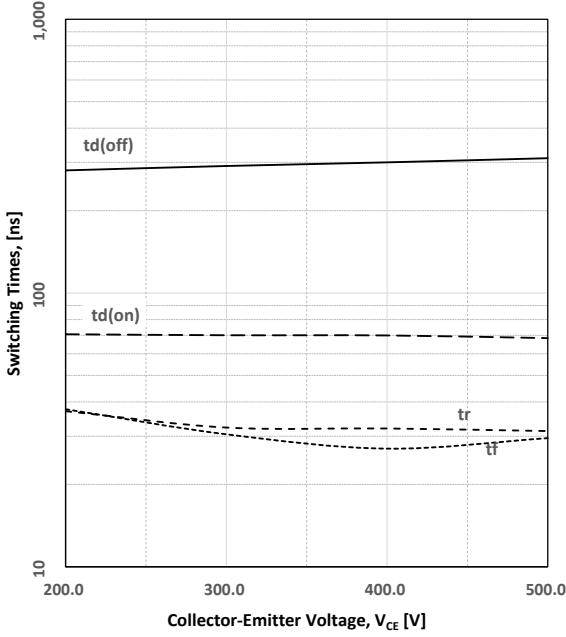


Figure.14 Switching Loss as Collector Voltage
 ($I_C=50A$, $V_{GE}=15V$, $R_g=15\Omega$, $T_J=25^\circ C$)

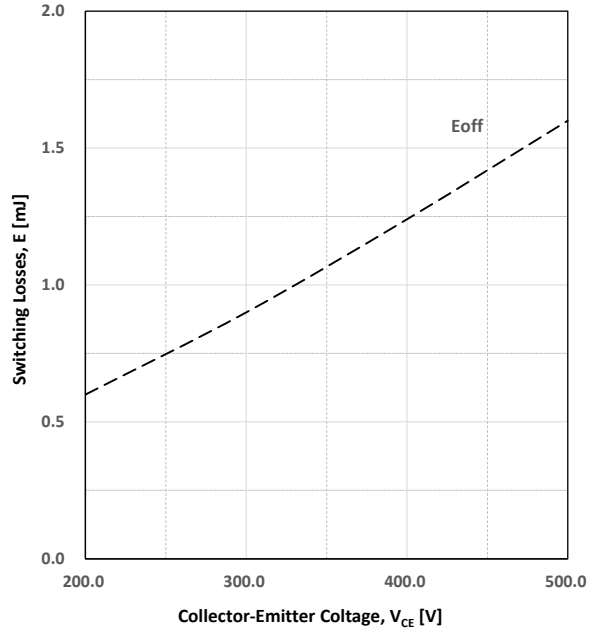


Figure.15 Switching Times as Gate Resistance
 ($V_{CE}=400V$, $I_C=50A$, $V_{GE}=15V$, $T_J=150^\circ C$)

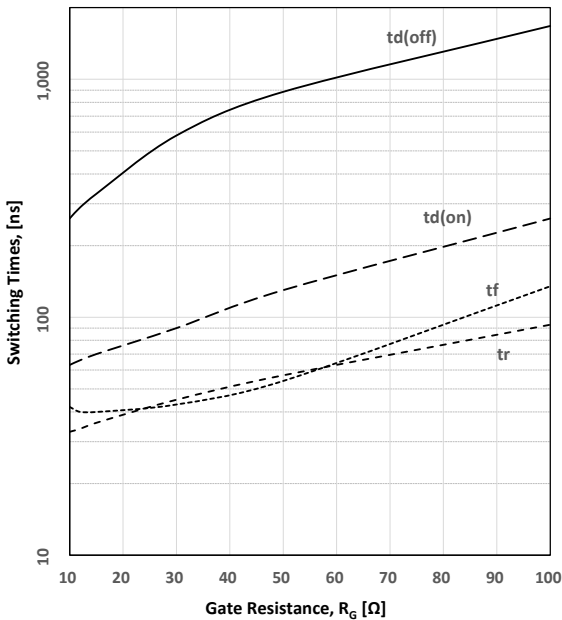


Figure.16 Switching Loss as Gate Resistance
 ($V_{CE}=400V$, $I_C=50A$, $V_{GE}=15V$, $T_J=150^\circ C$)

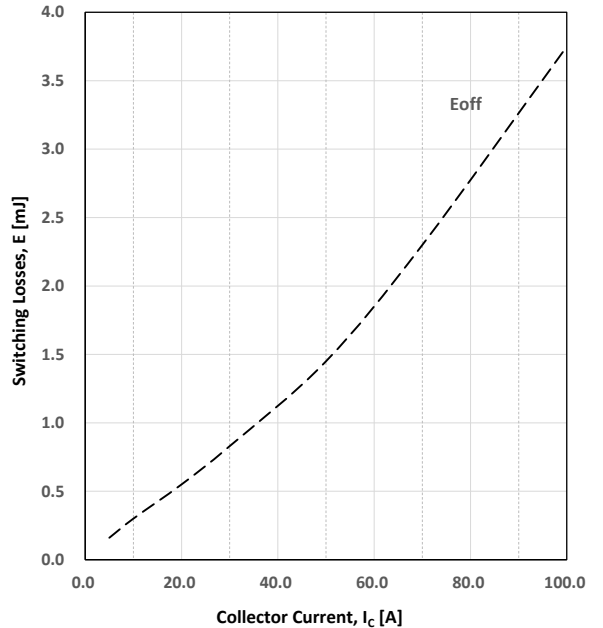


Figure.17 Switching Times as Collector Current
 ($V_{CE}=400V, V_{GE}=15V, R_g=15\Omega, T_J=150^\circ C$)

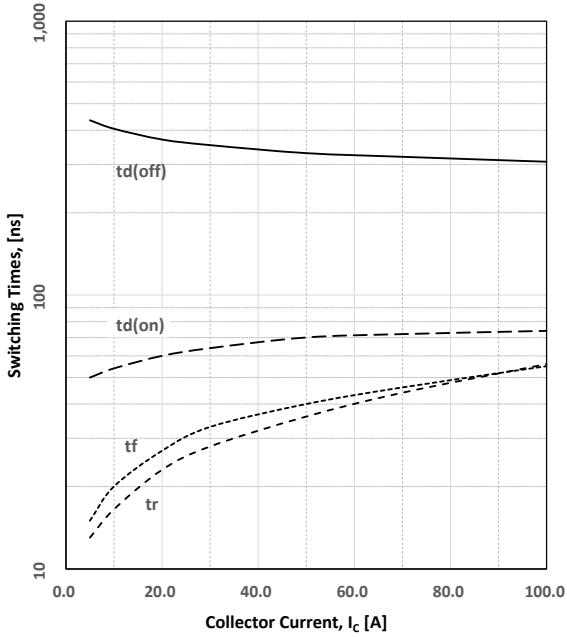


Figure.18 Switching Loss as Collector Current
 ($V_{CE}=400V, V_{GE}=15V, R_g=15\Omega, T_J=150^\circ C$)

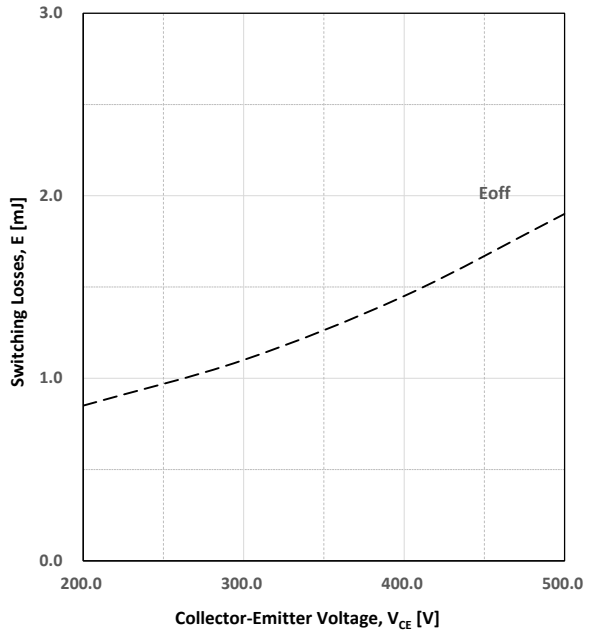


Figure.19 Switching Times as Collector Voltage
 ($I_C=50A, V_{GE}=15V, R_g=15\Omega, T_J=150^\circ C$)

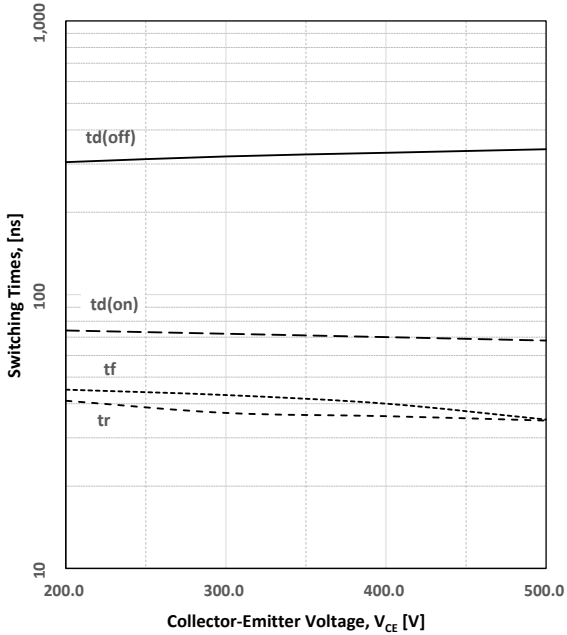


Figure.20 Switching Loss as Collector Voltage
 ($I_C=50A, V_{GE}=15V, R_g=15\Omega, T_J=150^\circ C$)

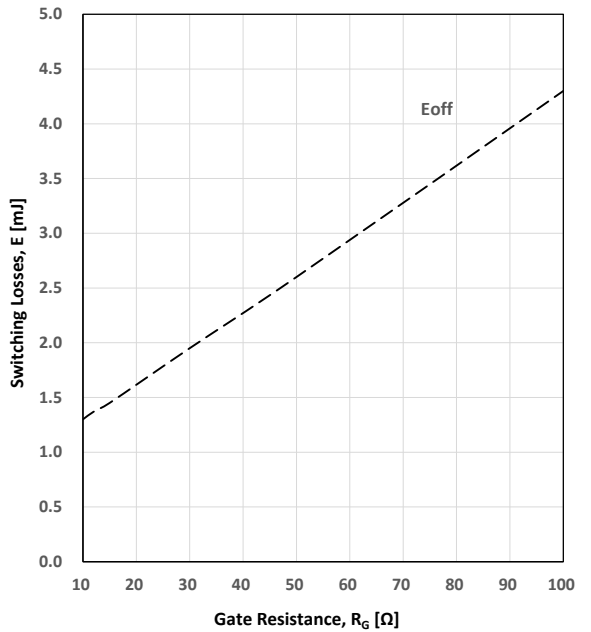


Figure.21 Switching Times as Junction Temp.
 ($V_{CE}=400V, I_C=50A, V_{GE}=15V, R_g=15\Omega$)

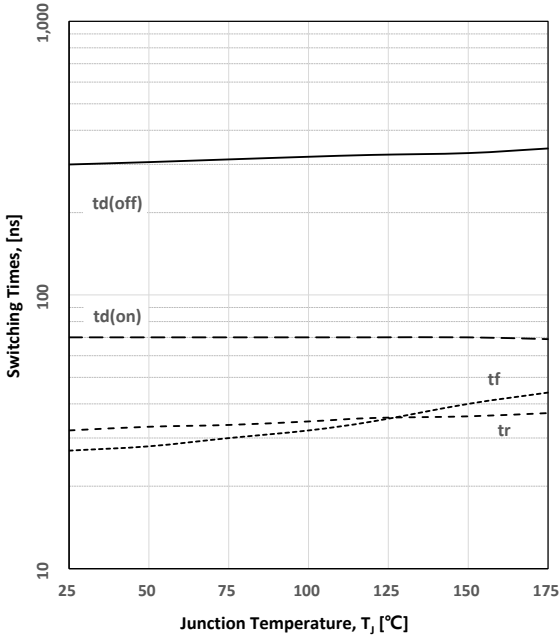
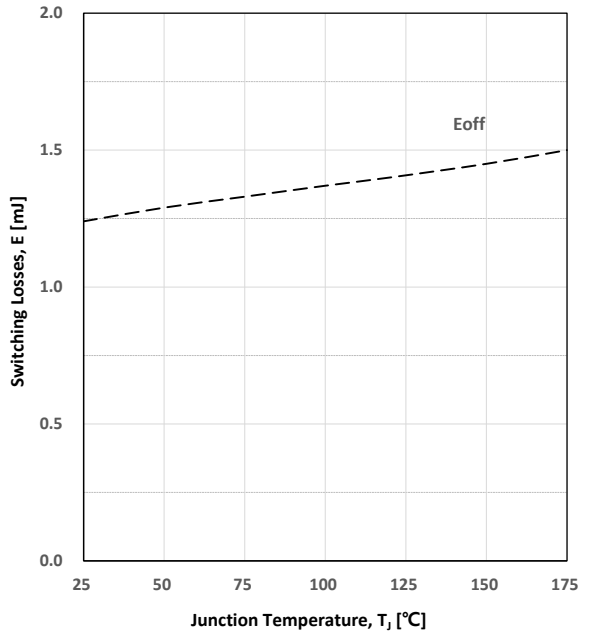
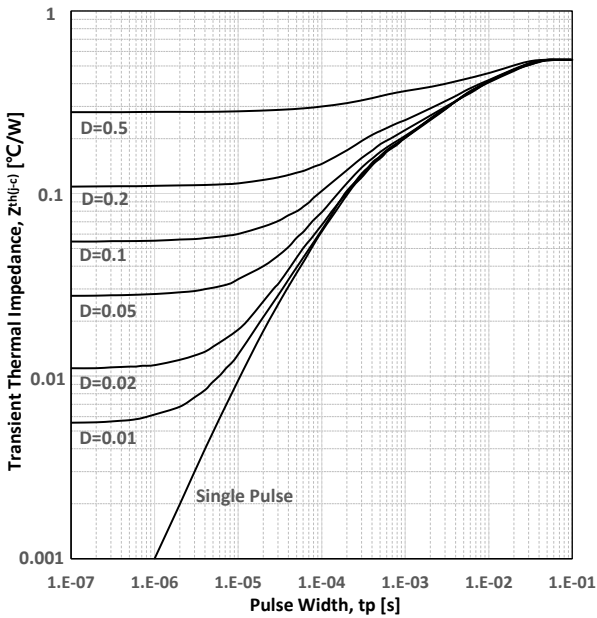


Figure.22 Switching Loss as Junction Temp.
 ($V_{CE}=400V, I_C=50A, V_{GE}=15V, R_g=15\Omega$)

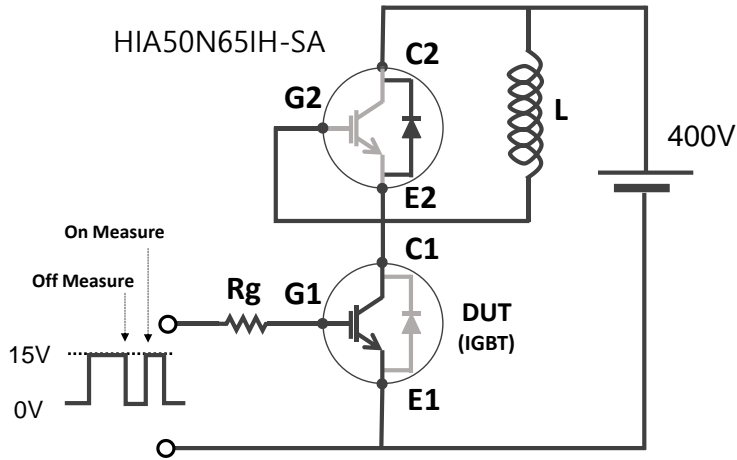


Transient Thermal Impedance Figure.

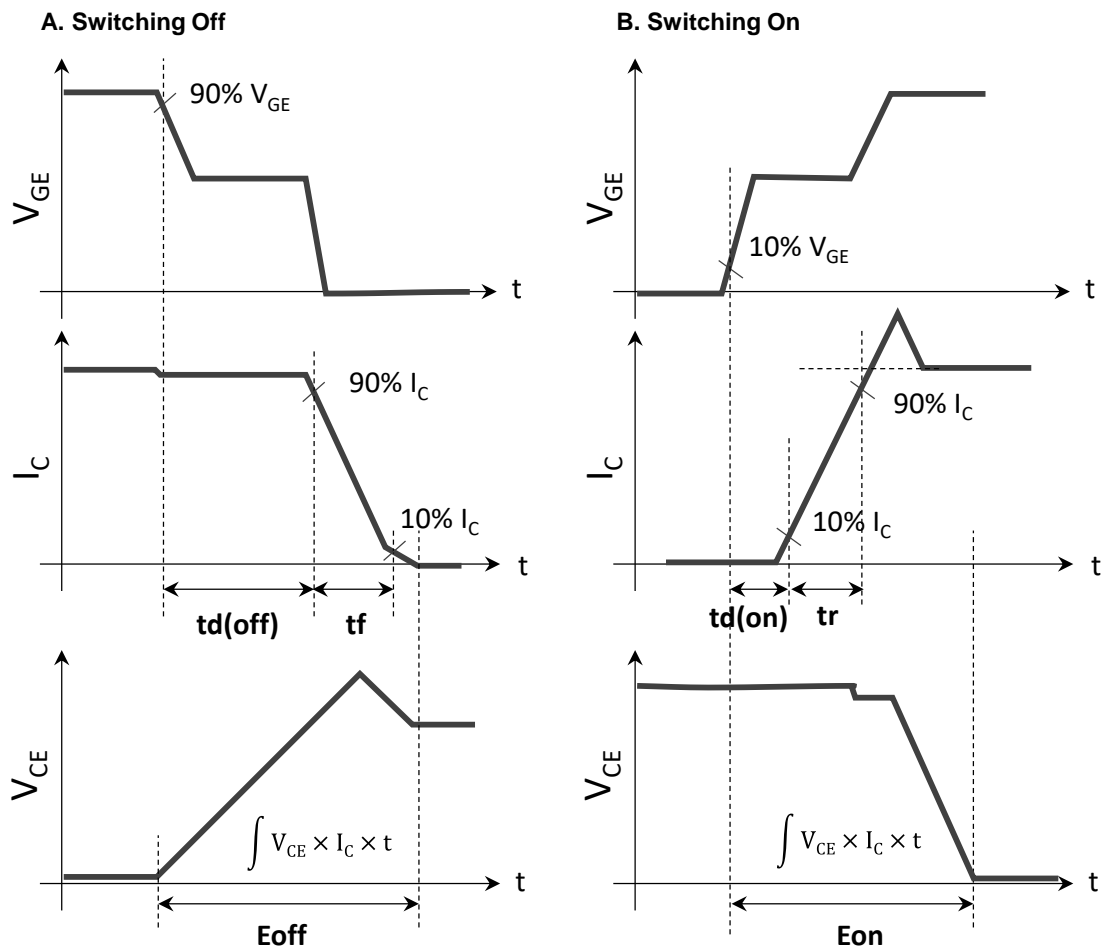
Figure.23 IGBT Transient Thermal Impedance



Ref. 1) Switching Test Circuit



Ref. 2) Definition of switching time and loss



Package Dimension : TO-247

