# IGW75N60T

TrenchStop Series

Low Loss IGBT in Trench and Fieldstop technology

- Very low $V_{CE(sat)}$ 1.5 V (typ.)
- Maximum Junction Temperature 175 °C
- Short circuit withstand time – 5µs
- Designed for :
  - Frequency Converters
  - Uninterrupted Power Supply
- Trench and Fieldstop technology for 600 V applications offers :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
  - very high switching speed
  - low $V_{CE(sat)}$
- Positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Low Gate Charge
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/

P-TO-247-3-1
(TO-220AC)
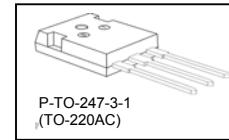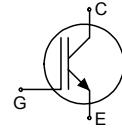
Type	V_{CE}	I_C	$V_{CE(sat), Tj=25°C}$	$T_{j,max}$	Marking Code	Package	Ordering Code
IGW75N60T	600V	75A	1.5V	175°C	G75T60	TO-247	Q67040S4726

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	600	V
DC collector current, limited by T_{jmax}	I_C		A
T_C = 25°C		150	
T_C = 100°C		75	
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	225	
Turn off safe operating area ($V_{CE} \leq$ 600V, $T_j \leq$ 175°C)	-	225	
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time[1] V_{GE} = 15V, $V_{CC} \leq$ 400V, $T_j \leq$ 150°C	t_{SC}	5	µs
Power dissipation T_C = 25°C	P_{tot}	428	W
Operating junction temperature	T_j	-40...+175	°C
Storage temperature	T_{stg}	-55...+175	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

[1] Allowed number of short circuits: <1000; time between short circuits: >1s.

Power Semiconductors

1

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}	TO-247	0.35	K/W
Thermal resistance, junction – ambient	R_{thJA}	TO-247 AC	40	

Electrical Characteristic, at T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	min.	Typ.	max.	Unit
Static Characteristic				Value		
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=0.2mA	600	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=75A				
		T_j=25°C	-	1.5	2.0	
		T_j=175°C	-	1.9	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=1.2mA, V_{CE}=V_{GE}	4.1	4.9	5.7	
Zero gate voltage collector current	I_{CES}	V_{CE}=600V, V_{GE}=0V				µA
		T_j=25°C	-	-	40	
		T_j=175°C	-	-	1000	
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=75A	-	41	-	S
Integrated gate resistor	R_{Gint}			-		Ω

Dynamic Characteristic

Parameter	Symbol	Conditions	min.	Typ.	max.	Unit
Input capacitance	C_{iss}	V_{CE}=25V,	-	4620	-	pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	288	-	
Reverse transfer capacitance	C_{rss}	f=1MHz	-	137	-	
Gate charge	Q_{Gate}	V_{CC}=480V, I_C=75A V_{GE}=15V	-	470	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E	TO-247-3-1	-	7	-	nH
Short circuit collector current[1]	$I_{C(SC)}$	V_{GE}=15V, t_{SC}≤5µs V_{CC} = 400V, T_j ≤ 150°C	-	687.5	-	A

[1] Allowed number of short circuits: <1000; time between short circuits: >1s.

Switching Characteristic, Inductive Load, at T_j=25 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=25°C,	-	33	-	ns
Rise time	t_r	V_{CC}=400V, I_C=75A,	-	36	-	
Turn-off delay time	$t_{d(off)}$	V_{GE}=0/15V,	-	330	-	
Fall time	t_f	R_G=5Ω, $L_\sigma{}^{2)}$=100nH,	-	35	-	
Turn-on energy[1]	E_{on}	$C_\sigma{}^{2)}$=39pF	-	2.0	-	mJ
Turn-off energy	E_{off}	Energy losses include "tail" and diode	-	2.5	-	
Total switching energy	E_{ts}	reverse recovery.	-	4.5	-	

Switching Characteristic, Inductive Load, at T_j=175 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=175°C,	-	32	-	ns
Rise time	t_r	V_{CC}=400V, I_C=75A,	-	37	-	
Turn-off delay time	$t_{d(off)}$	V_{GE}=0/15V,	-	363	-	
Fall time	t_f	R_G= 5Ω $L_\sigma{}^{2)}$=100nH,	-	38	-	
Turn-on energy[1]	E_{on}	$C_\sigma{}^{2)}$=39pF	-	2.9	-	mJ
Turn-off energy	E_{off}	Energy losses include "tail" and diode	-	2.9	-	
Total switching energy	E_{ts}	reverse recovery.	-	5.8	-	

[1] Includes Reverse Recovery Losses from IKW75N60T due to dynamic test circuit in Figure E.
[2] Leakage inductance L_σ and Stray capacity C_σ due to dynamic test circuit in Figure E.
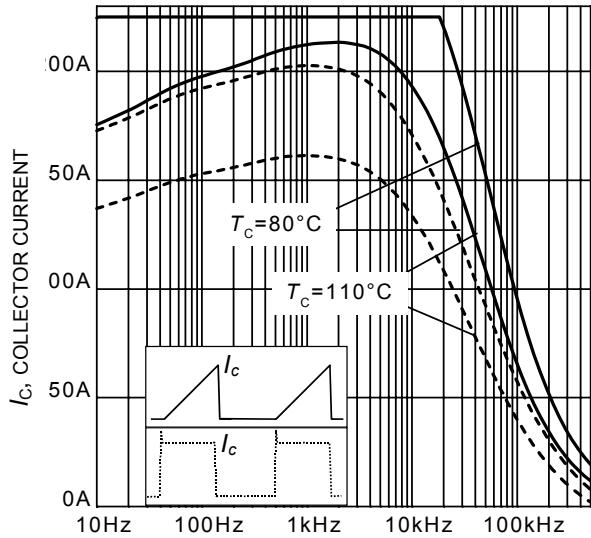
f, SWITCHING FREQUENCY

Figure 1. Collector current as a function of switching frequency
($T_j \leq 175°C$, $D = 0.5$, $V_{CE} = 400V$, $V_{GE} = 0/+15V$, $R_G = 5\Omega$)
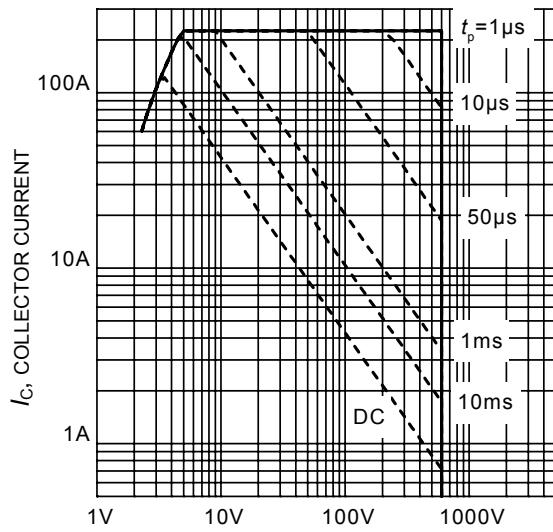
V_{CE}, COLLECTOR-EMITTER VOLTAGE

Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \leq 175°C$; V_{GE}=15V)
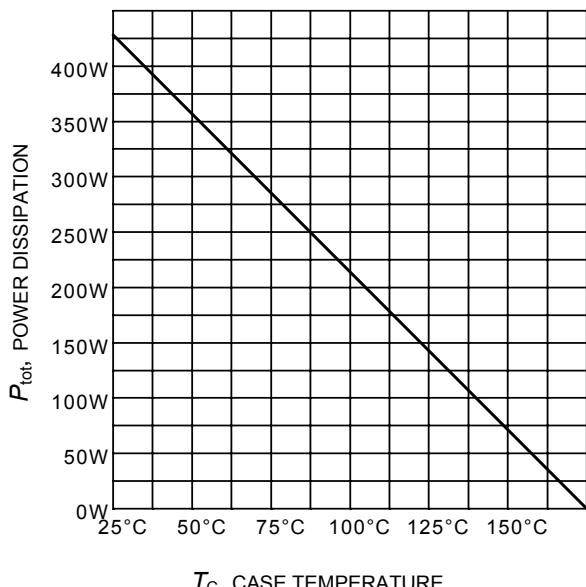
T_C, CASE TEMPERATURE

Figure 3. Power dissipation as a function of case temperature
($T_j \leq 175°C$)
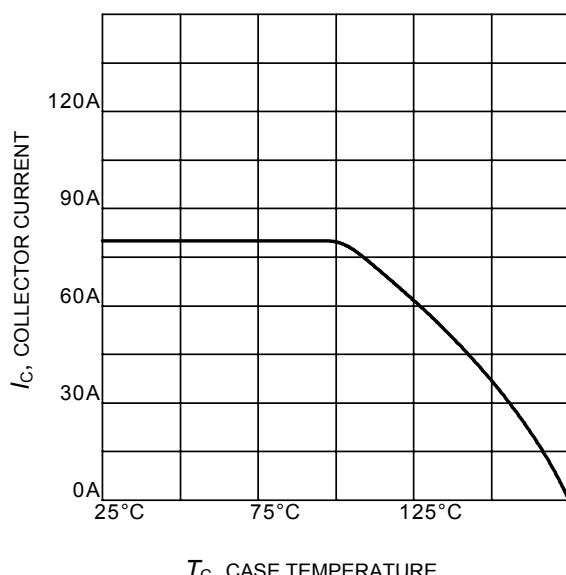
T_C, CASE TEMPERATURE

Figure 4. DC Collector current as a function of case temperature
($V_{GE} \geq 15V$, $T_j \leq 175°C$)
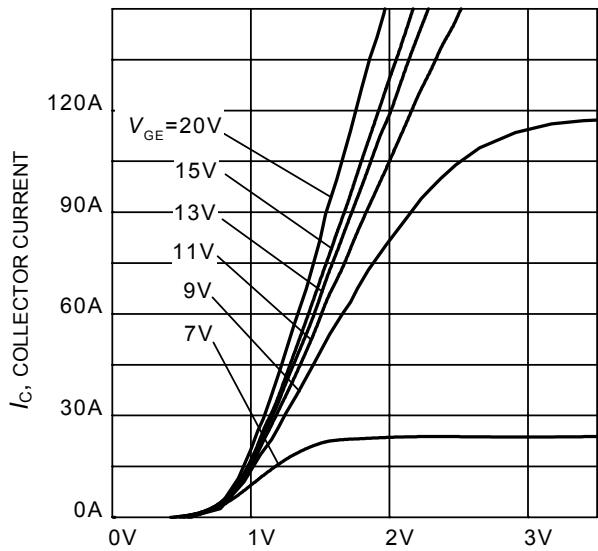
Figure 5. Typical output characteristic
(T_j = 25°C)
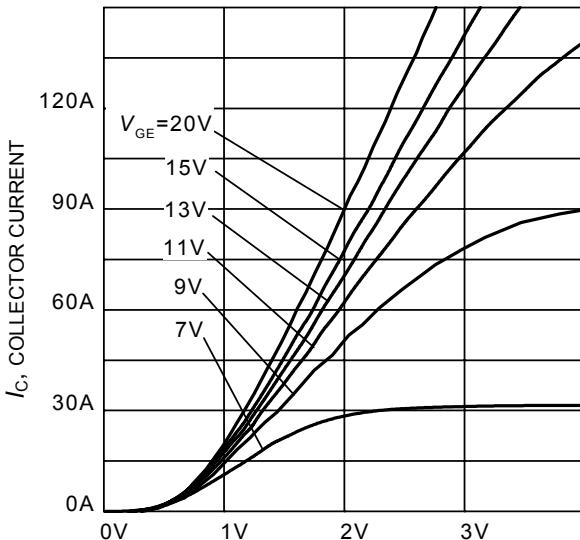
Figure 6. Typical output characteristic
(T_j = 175°C)
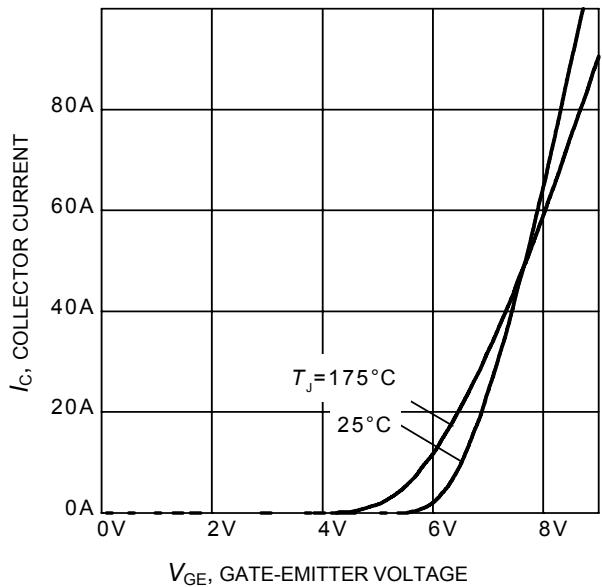
Figure 7. Typical transfer characteristic
(V_{CE}=20V)
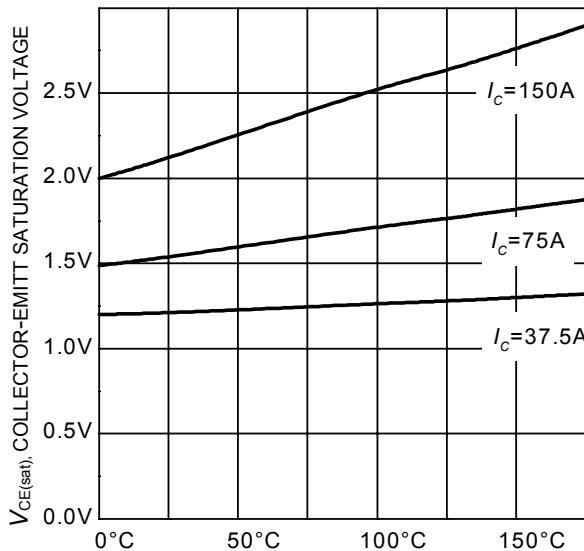
Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)
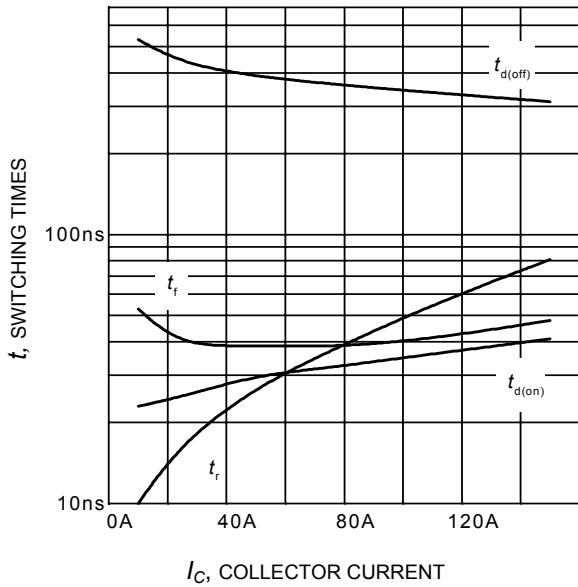
Figure 9. Typical switching times as a function of collector current (inductive load, T_J=175°C, V_{CE} = 400V, V_{GE} = 0/15V, R_G = 5Ω, Dynamic test circuit in Figure E)
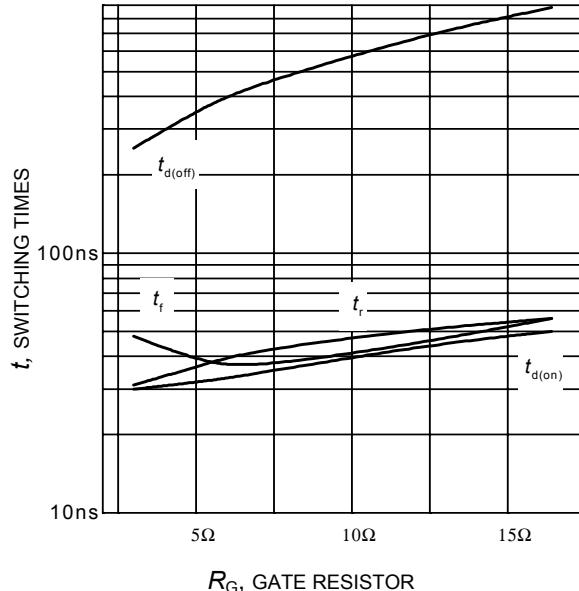
Figure 10. Typical switching times as a function of gate resistor (inductive load, T_J = 175°C, V_{CE}= 400V, V_{GE} = 0/15V, I_C = 75A, Dynamic test circuit in Figure E)
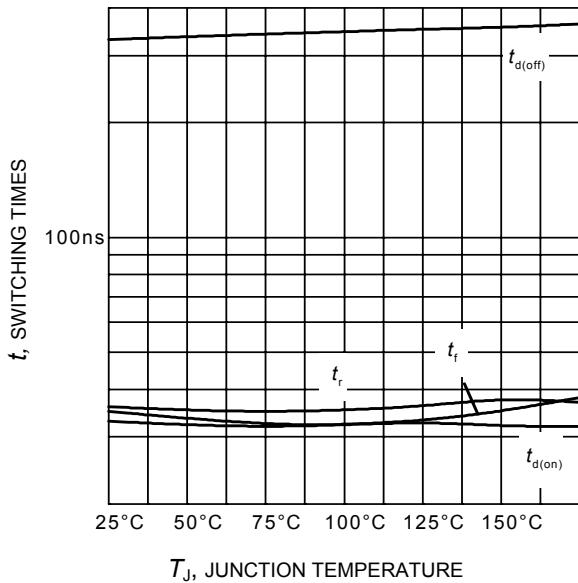
Figure 11. Typical switching times as a function of junction temperature (inductive load, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 75A, R_G=5Ω, Dynamic test circuit in Figure E)
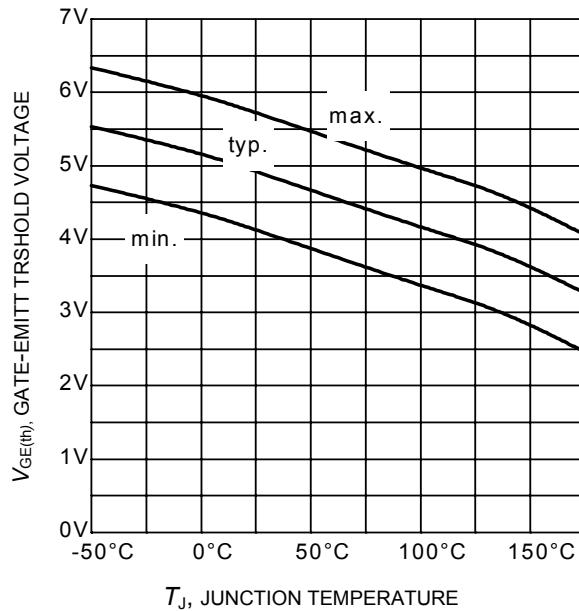
**Figure 12. Gate-emitter threshold voltage as a function of junction temperature** (I_C = 1.2mA)
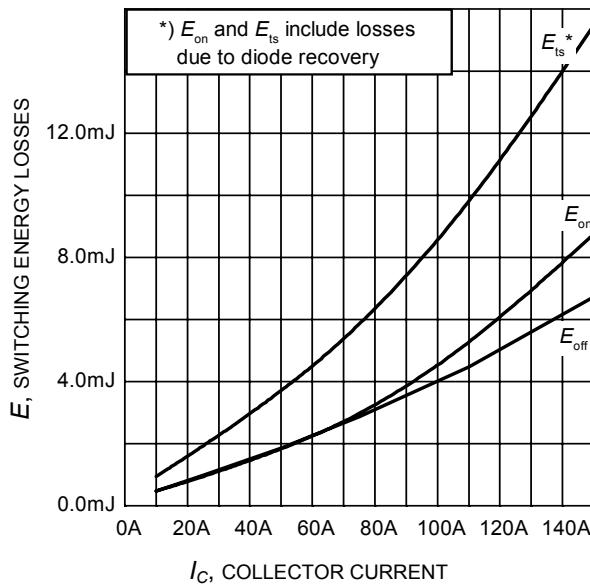
Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_J = 175°C, V_{CE} = 400V, V_{GE} = 0/15V, R_G = 5Ω, Dynamic test circuit in Figure E)
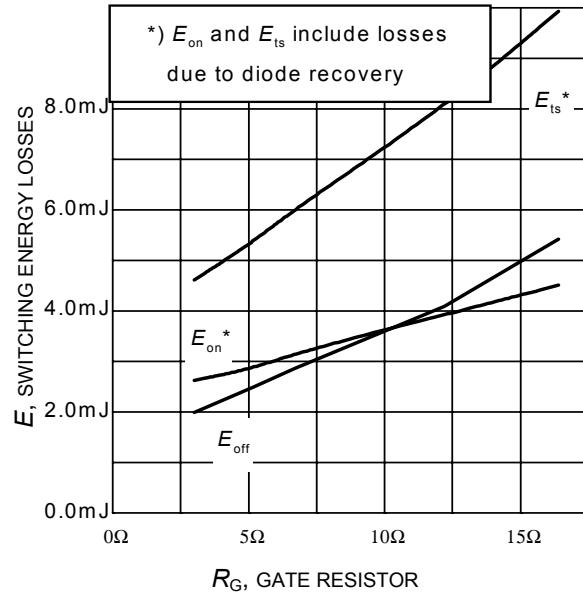
**Figure 14. Typical switching energy losses as a function of gate resistor**
(inductive load, T_J = 175°C, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 75A, Dynamic test circuit in Figure E)
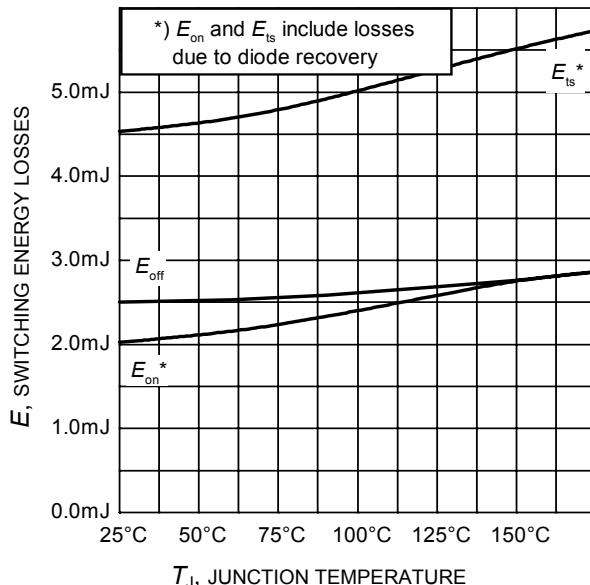
Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 75A, R_G = 5Ω, Dynamic test circuit in Figure E)
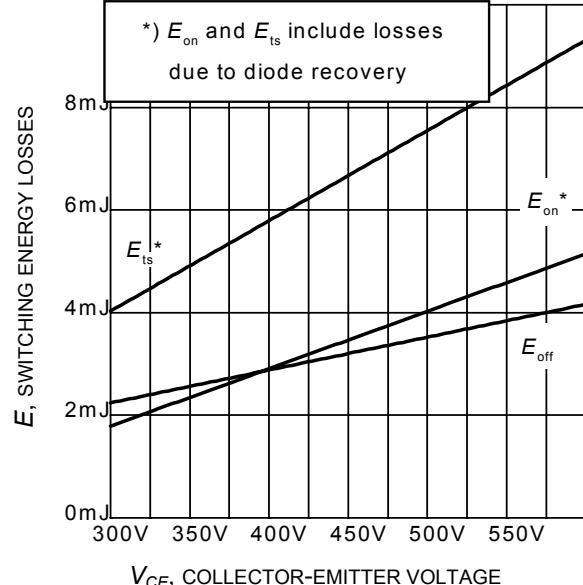
**Figure 16. Typical switching energy losses as a function of collector emitter voltage**
(inductive load, T_J = 175°C, V_{GE} = 0/15V, I_C = 75A, R_G = 5Ω, Dynamic test circuit in Figure E)
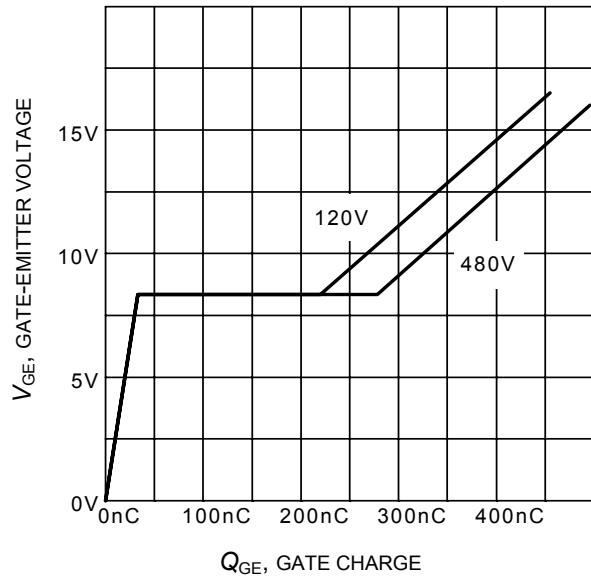
Figure 17. Typical gate charge
(I_C=75 A)
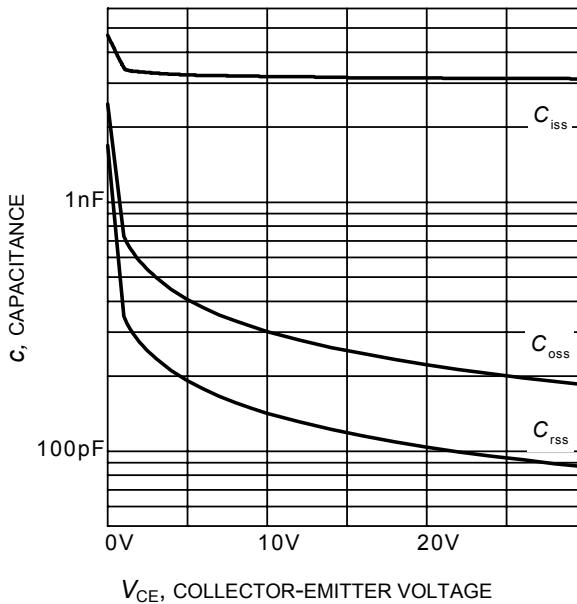
**Figure 18. Typical capacitance as a function
of collector-emitter voltage**
(V_{GE}=0V, f = 1 MHz)
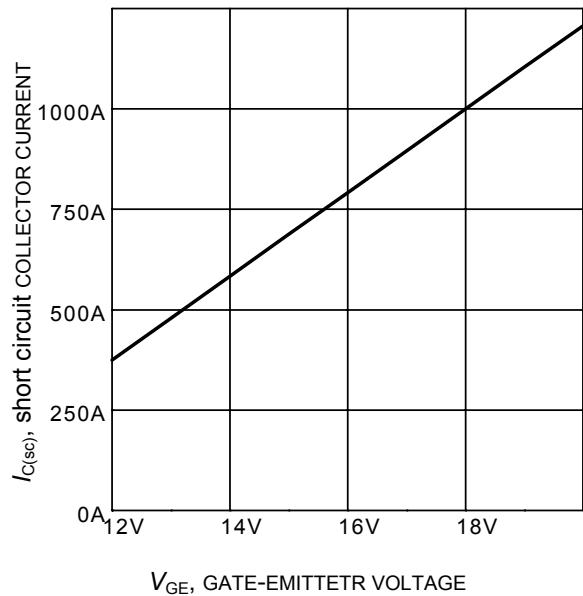
**Figure 19. Typical short circuit collector
current as a function of gate-
emitter voltage**
($V_{CE} \leq 400V$, $T_j \leq 150°C$)
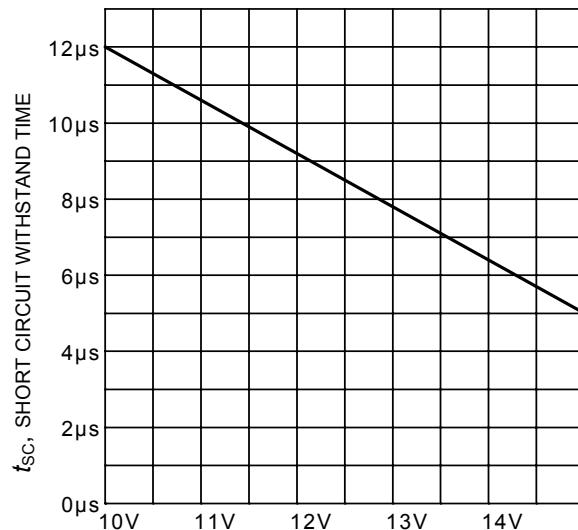
**Figure 20. Short circuit withstand time as a
function of gate-emitter voltage**
(V_{CE}=600V, start at T_J=25°C,
T_{Jmax}<150°C)

| R, (K/W)	τ, (s)
0.1968	0.115504
0.0733	0.009340
0.0509	0.000823
0.0290	0.000119

$C_1 = \tau_1 / R_1$ $C_2 = \tau_2 / R_2$
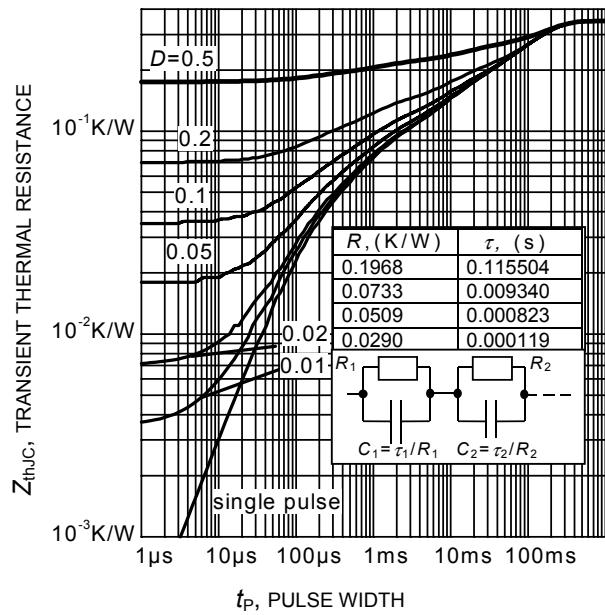
Figure 21. IGBT transient thermal resistance
$(D = t_p / T)$

IGW75N60T

TO-247AC
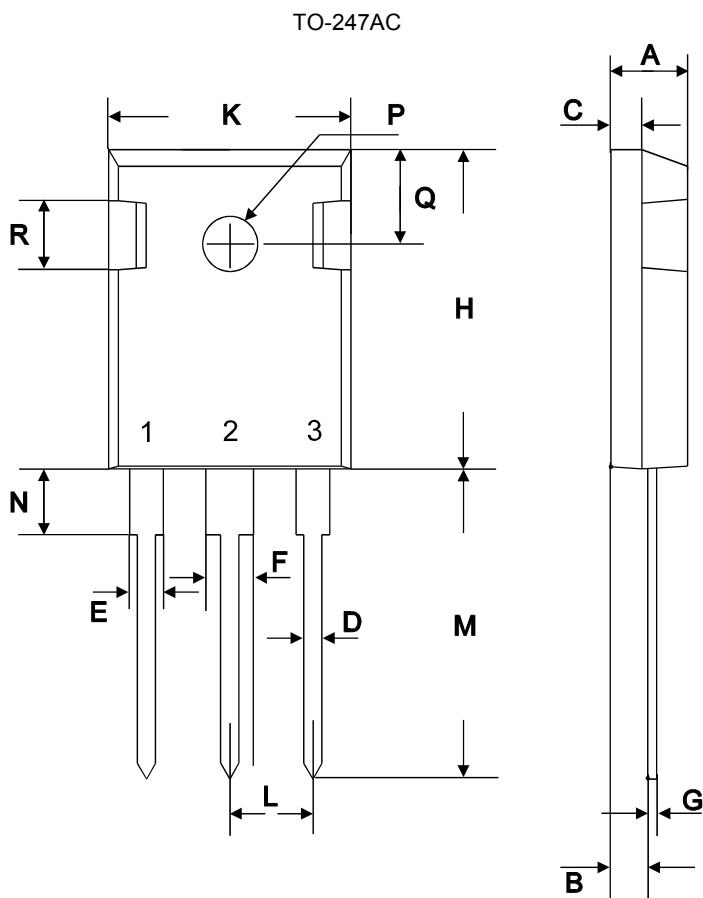
symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	4.78	5.28	0.1882	0.2079
B	2.29	2.51	0.0902	0.0988
C	1.78	2.29	0.0701	0.0902
D	1.09	1.32	0.0429	0.0520
E	1.73	2.06	0.0681	0.0811
F	2.67	3.18	0.1051	0.1252
G	0.76 max		0.0299 max	
H	20.80	21.16	0.8189	0.8331
K	15.65	16.15	0.6161	0.6358
L	5.21	5.72	0.2051	0.2252
M	19.81	20.68	0.7799	0.8142
N	3.560	4.930	0.1402	0.1941
∅P	3.61		0.1421	
Q	6.12	6.22	0.2409	0.2449

Figure A. Definition of switching times

Figure B. Definition of switching losses

$$E_{OFF} = \int_{t_1}^{t_2} V_{CE} \times I_C \times dt$$

$$E_{ON} = \int_{t_3}^{t_4} V_{CE} \times I_C \times dt$$

Figure C. Definition of diodes switching characteristics

$$t_{rr} = t_S + t_F$$
$$Q_{rr} = Q_S + Q_F$$

**Figure D. Thermal equivalent circuit**

Figure E. Dynamic test circuit
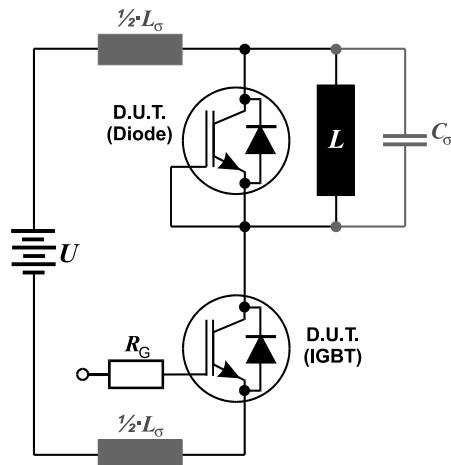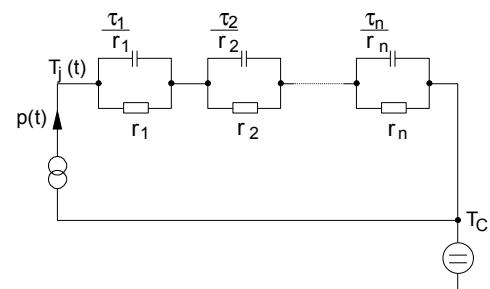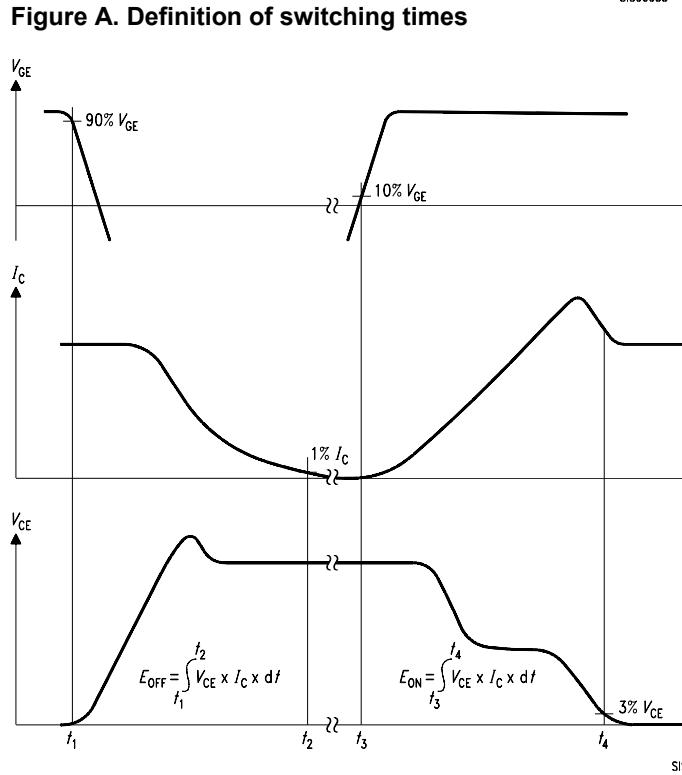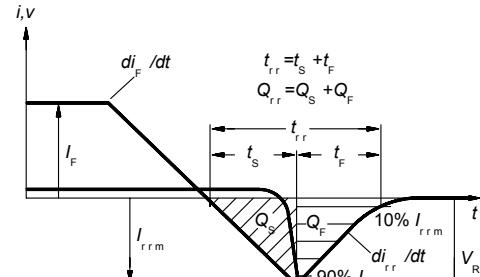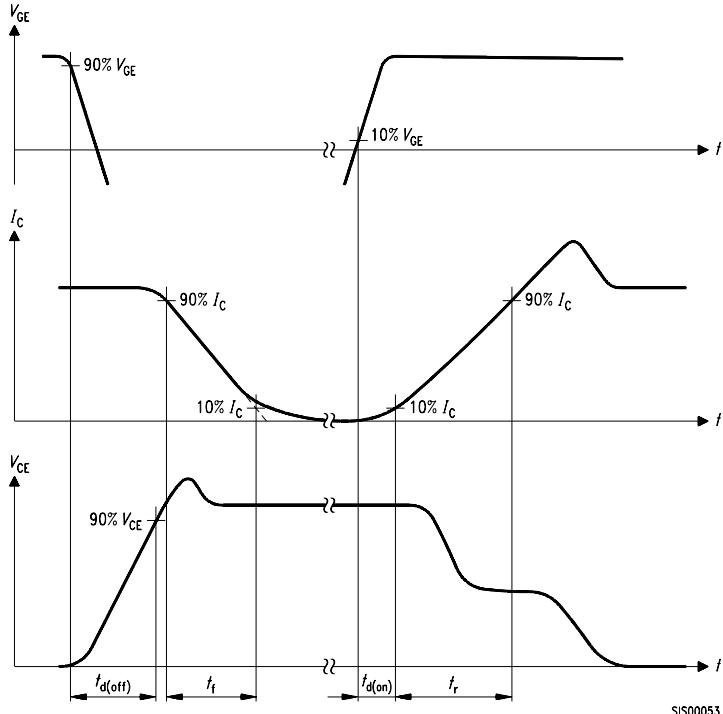
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