## Low Loss IGBT in TrenchStop® and Fieldstop technology

- Short circuit withstand time – 10μs
- Designed for :
    - Frequency Converters
    - Uninterrupted Power Supply
- TrenchStop® and Fieldstop technology for 1200 V applications offers :
    - very tight parameter distribution
    - high ruggedness, temperature stable behavior
- NPT technology offers easy parallel switching capability due to positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Low Gate Charge
- Qualified according to JEDEC[1] for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/

PG-TO-247-3

Type	V_{CE}	I_C	$V_{CE(sat),Tj=25°C}$	$T_{j,max}$	Marking	Package
IGW25T120	1200V	25A	1.7V	150°C	G25T120	PG-TO-247-3

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current	I_C		A
T_C = 25°C		50	
T_C = 100°C		25	
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	75	
Turn off safe operating area $V_{CE} \le 1200V$, $T_j \le 150°C$	-	75	
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time[2] V_{GE} = 15V, $V_{CC} \le 1200V$, $T_j \le 150°C$	t_{SC}	10	μs
Power dissipation T_C = 25°C	P_{tot}	190	W
Operating junction temperature	T_j	-40...+150	°C
Storage temperature	T_{stg}	-55...+150	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

[1] J-STD-020 and JESD-022
[2] Allowed number of short circuits: <1000; time between short circuits: >1s.

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.65	K/W
Thermal resistance, junction – ambient	R_{thJA}		40	

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

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=500µA	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=25A				
		T_j=25°C	-	1.7	2.2	
		T_j=125°C	-	2.0	-	
		T_j=150°C	-	2.2	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=1mA, V_{CE}=V_{GE}	5.0	5.8	6.5	
Zero gate voltage collector current	I_{CES}	V_{CE}=1200V, V_{GE}=0V				mA
		T_j=25°C	-	-	0.25	
		T_j=150°C	-	-	2.5	
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	600	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=25A	-	16	-	S
Integrated gate resistor	R_{Gint}			8		Ω

Dynamic Characteristic

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
Input capacitance	C_{iss}	V_{CE}=25V,	-	1860	-	pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	96	-	
Reverse transfer capacitance	C_{rss}	f=1MHz	-	82	-	
Gate charge	Q_{Gate}	V_{CC}=960V, I_C=25A V_{GE}=15V	-	155	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH
Short circuit collector current[1]	$I_{C(SC)}$	V_{GE}=15V, t_{SC}≤10µs V_{CC} = 600V, T_j = 25°C	-	150	-	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, V_{CC}=600V, I_C=25A V_{GE}=-15/15V, R_G=22Ω, $L_\sigma^{2)}$=180nH, $C_\sigma^{2)}$=39pF Energy losses include "tail" and diode reverse recovery.	-	50	-	ns
Rise time	t_r		-	30	-	
Turn-off delay time	$t_{d(off)}$		-	560	-	
Fall time	t_f		-	70	-	
Turn-on energy	E_{on}		-	2.0	-	mJ
Turn-off energy	E_{off}		-	2.2	-	
Total switching energy	E_{ts}		-	4.2	-	

Switching Characteristic, Inductive Load, at T_j=150 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=150°C V_{CC}=600V, I_C=25A, V_{GE}=-15/15V, R_G= 22Ω, $L_\sigma^{2)}$=180nH, $C_\sigma^{2)}$=39pF Energy losses include "tail" and diode reverse recovery.	-	50	-	ns
Rise time	t_r		-	32	-	
Turn-off delay time	$t_{d(off)}$		-	660	-	
Fall time	t_f		-	130	-	
Turn-on energy	E_{on}		-	3.0	-	mJ
Turn-off energy	E_{off}		-	4.0	-	
Total switching energy	E_{ts}		-	7.0	-	

[2] Leakage inductance L_σ and Stray capacity C_σ due to dynamic test circuit in Figure E.
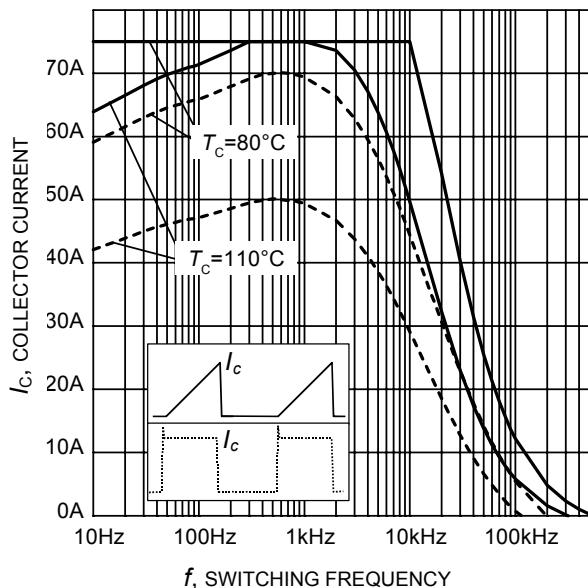
Figure 1. Collector current as a function of switching frequency
$(T_j \leq 150°C, D = 0.5, V_{CE} = 600V, V_{GE} = 0/+15V, R_G = 22\Omega)$
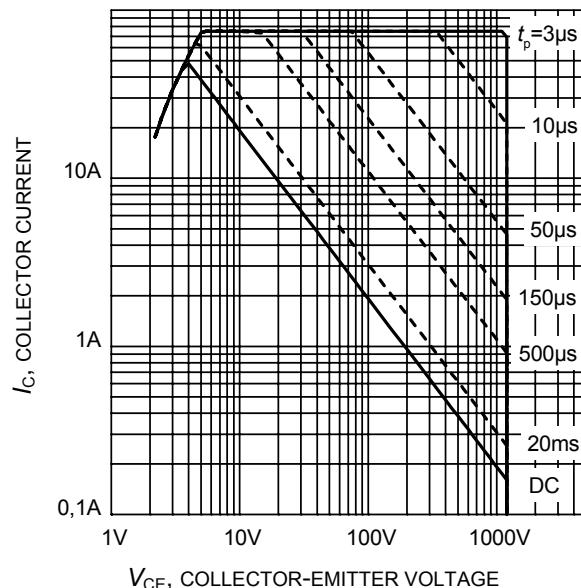
Figure 2. Safe operating area
$(D = 0, T_C = 25°C, T_j \leq 150°C; V_{GE} = 15V)$
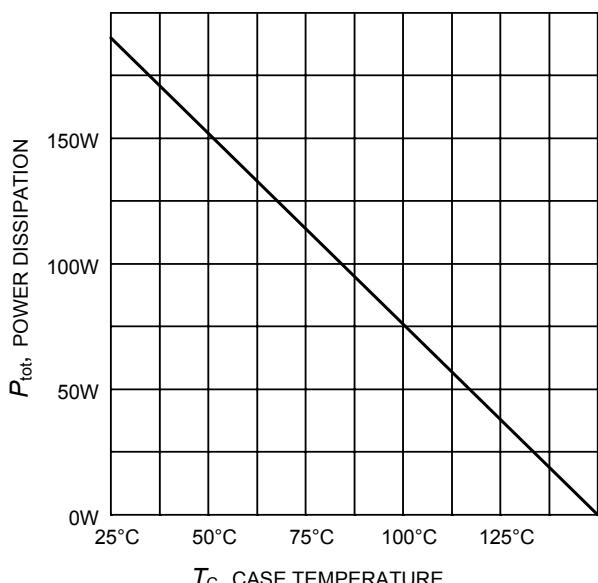
**Figure 3. Power dissipation as a function of case temperature**
$(T_j \leq 150°C)$
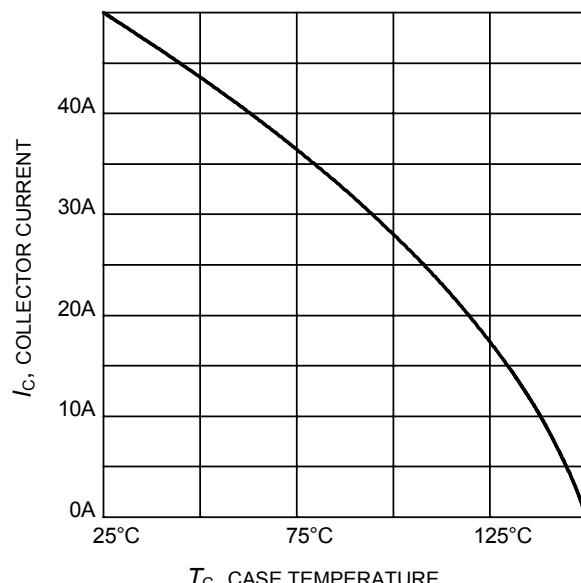
Figure 4. Collector current as a function of case temperature
$(V_{GE} \geq 15V, T_j \leq 150°C)$

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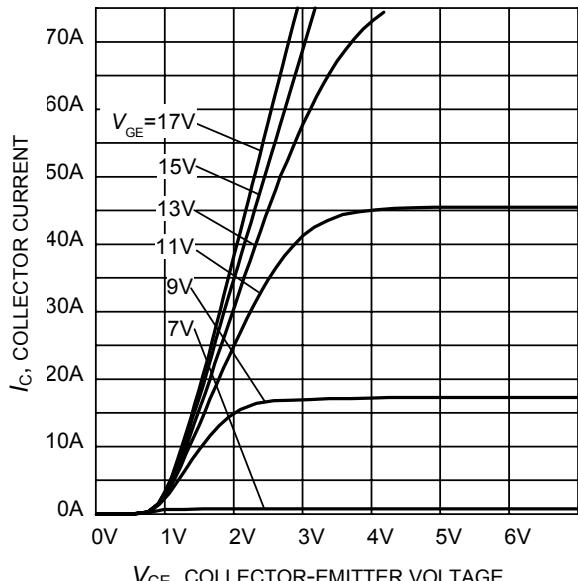
Figure 5. Typical output characteristic (T_j = 25°C)
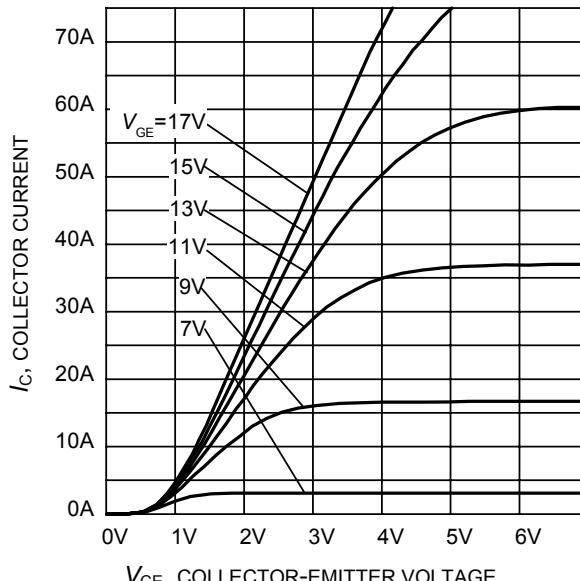
Figure 6. Typical output characteristic (T_j = 150°C)
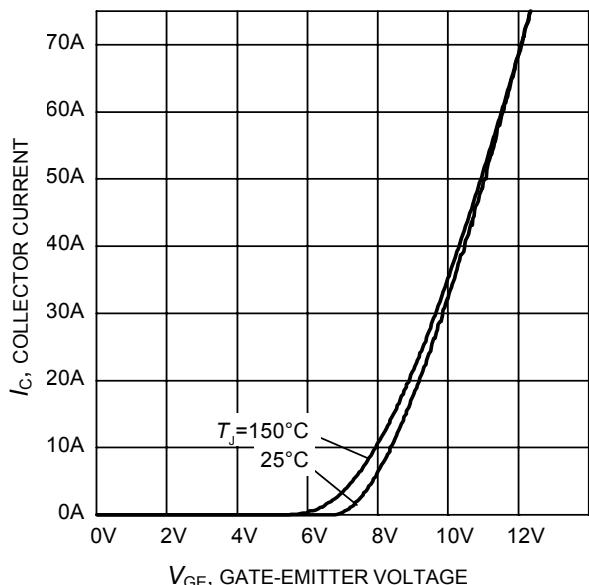
Figure 7. Typical transfer characteristic (V_{CE}=20V)
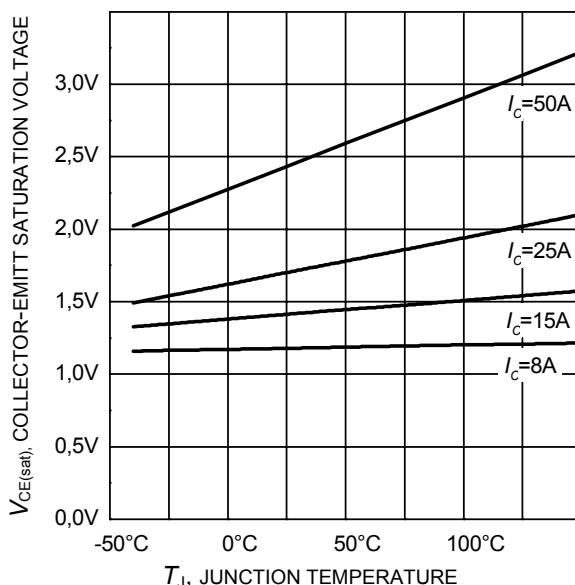
Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature (V_{GE} = 15V)
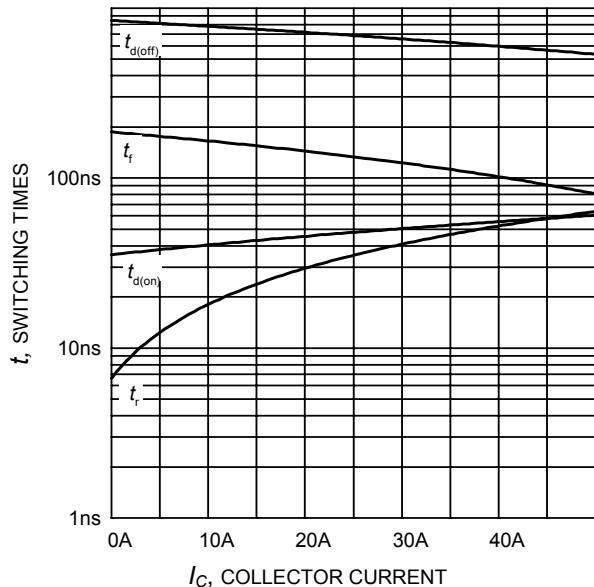
Figure 9. Typical switching times as a
function of collector current
(inductive load, T_J=150°C,
V_{CE}=600V, V_{GE}=0/15V, R_G=22Ω,
Dynamic test circuit in Figure E)
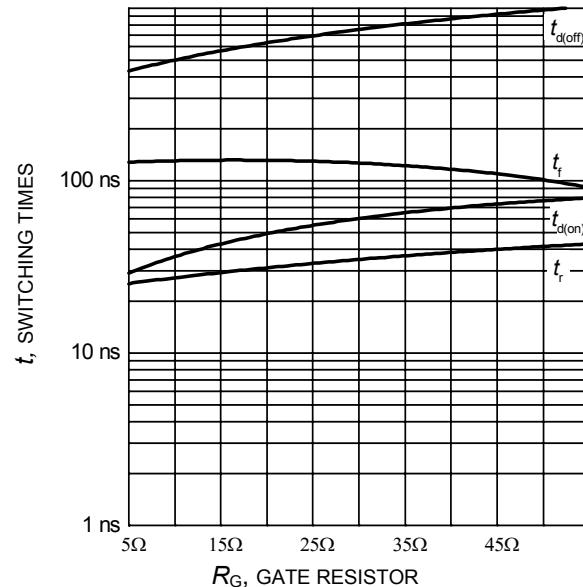
Figure 10. Typical switching times as a
function of gate resistor
(inductive load, T_J=150°C,
V_{CE}=600V, V_{GE}=0/15V, I_C=25A,
Dynamic test circuit in Figure E)
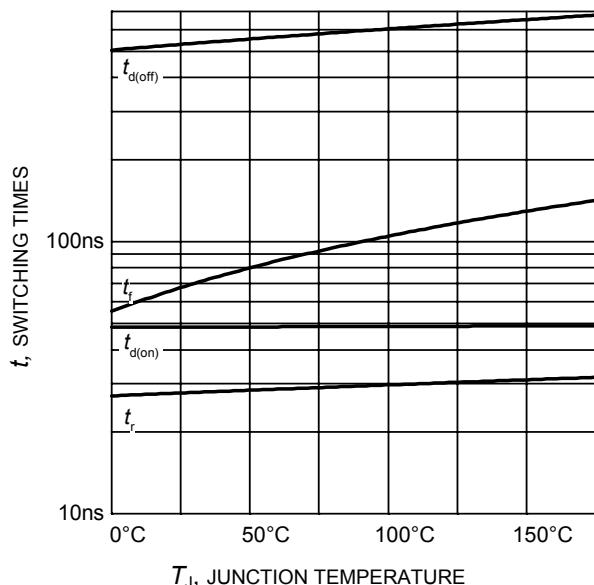
Figure 11. Typical switching times as a
function of junction temperature
(inductive load, V_{CE}=600V,
V_{GE}=0/15V, I_C=25A, R_G=22Ω,
Dynamic test circuit in Figure E)
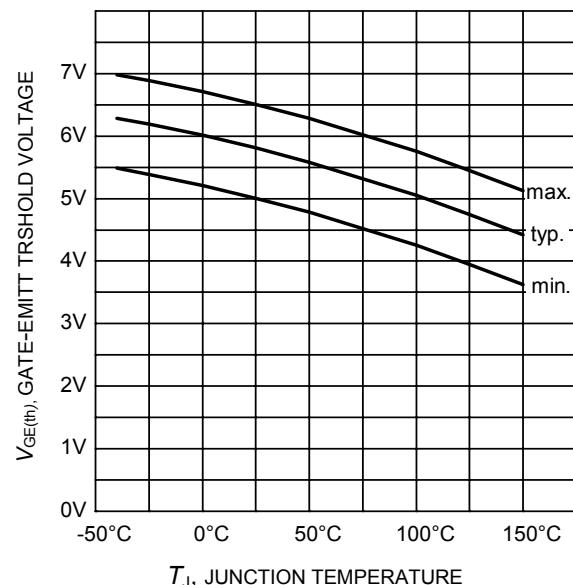
Figure 12. Gate-emitter threshold voltage as
a function of junction temperature
(I_C = 1.0mA)
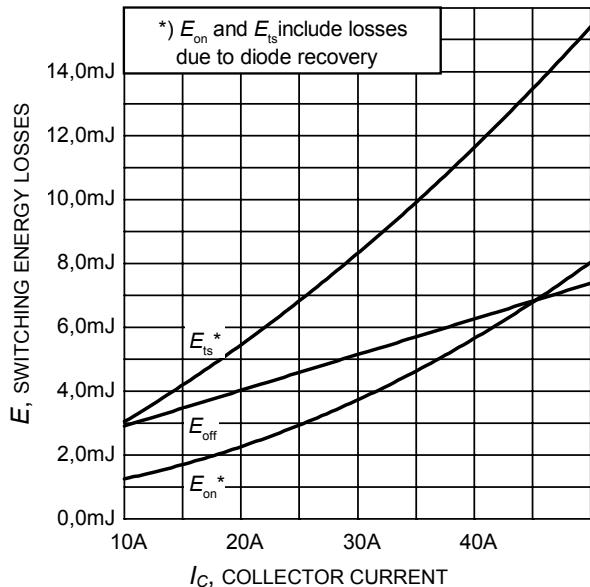
Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_J=150°C, V_{CE}=600V, V_{GE}=0/15V, R_G=22Ω, Dynamic test circuit in Figure E)
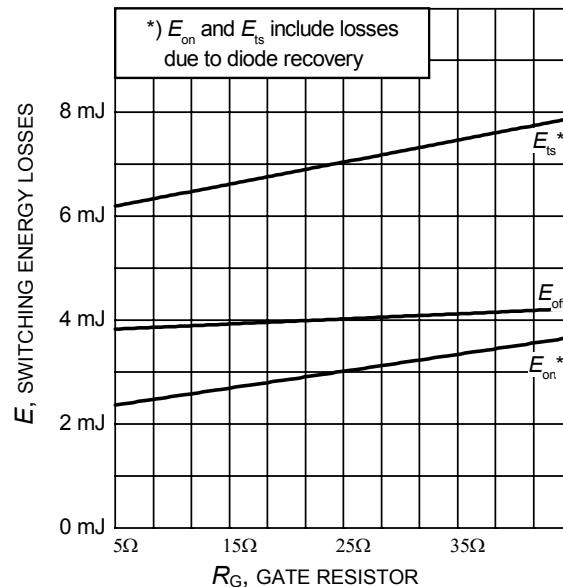
Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_J=150°C, V_{CE}=600V, V_{GE}=0/15V, I_C=25A, Dynamic test circuit in Figure E)
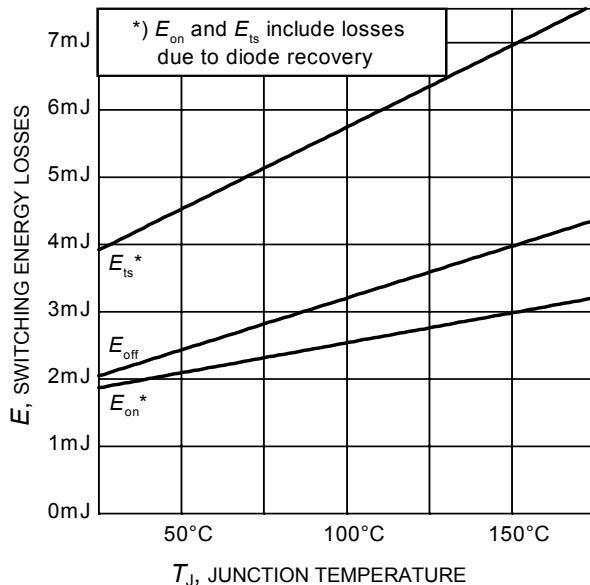
Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=25A, R_G=22Ω, Dynamic test circuit in Figure E)
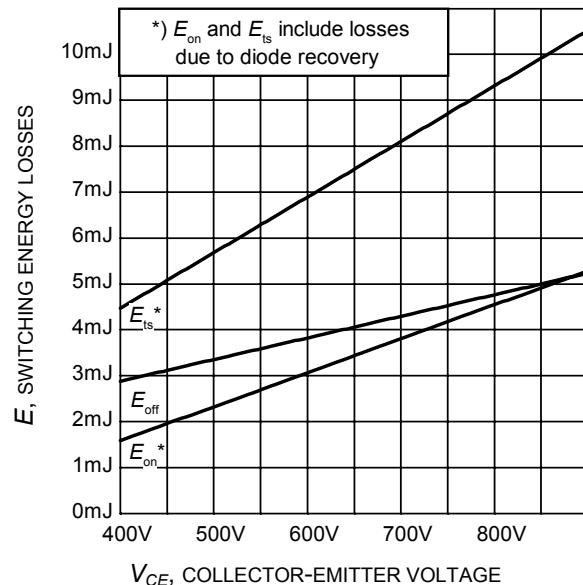
**Figure 16. Typical switching energy losses as a function of collector emitter voltage**
(inductive load, T_J=150°C, V_{GE}=0/15V, I_C=25A, R_G=22Ω, Dynamic test circuit in Figure E)

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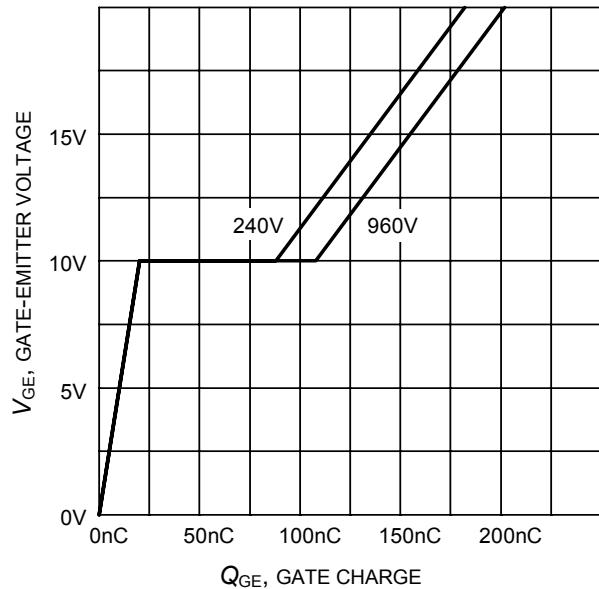
Figure 17. Typical gate charge
(I_C=25 A)
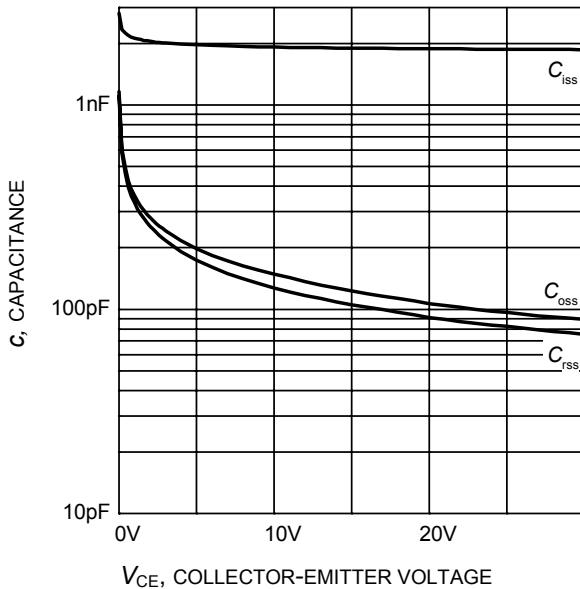
**Figure 18. Typical capacitance as a function
of collector-emitter voltage**
(V_{GE}=0V, f = 1 MHz)
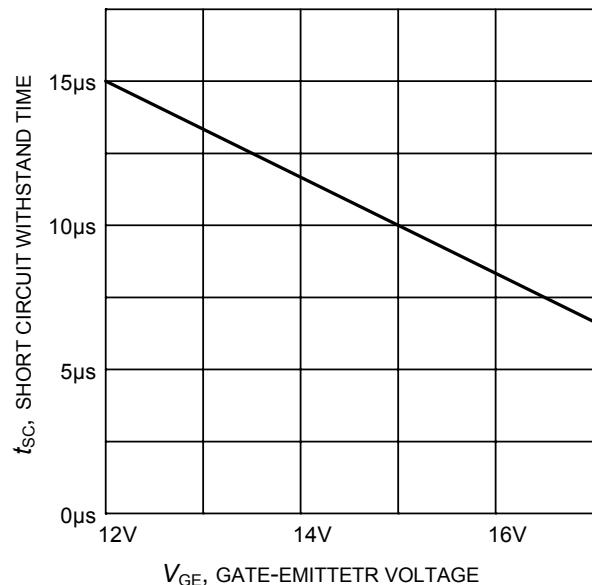
**Figure 19. Short circuit withstand time as a
function of gate-emitter voltage**
(V_{CE}=600V, start at T_J=25°C)
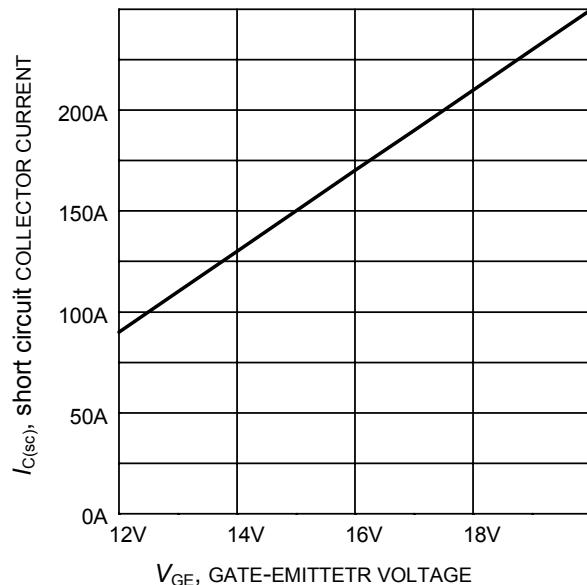
**Figure 20. Typical short circuit collector
current as a function of gate-
emitter voltage**
($V_{CE} \leq$ 600V, $T_j \leq$ 150°C)
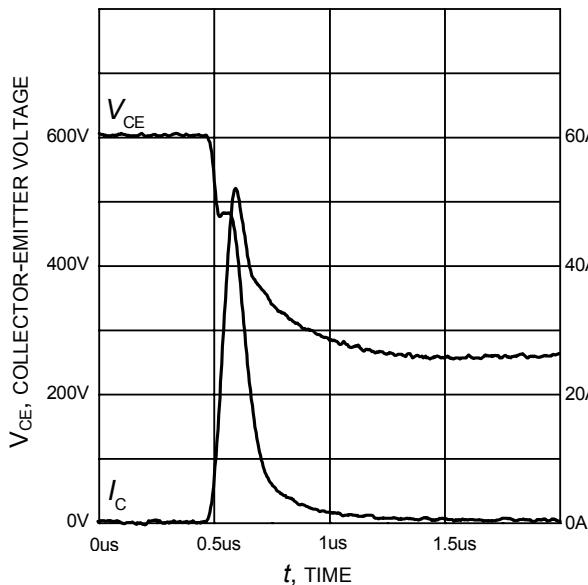
Figure 21. Typical turn on behavior
(V_{GE}=0/15V, R_G=22Ω, T_j = 150°C,
Dynamic test circuit in Figure E)
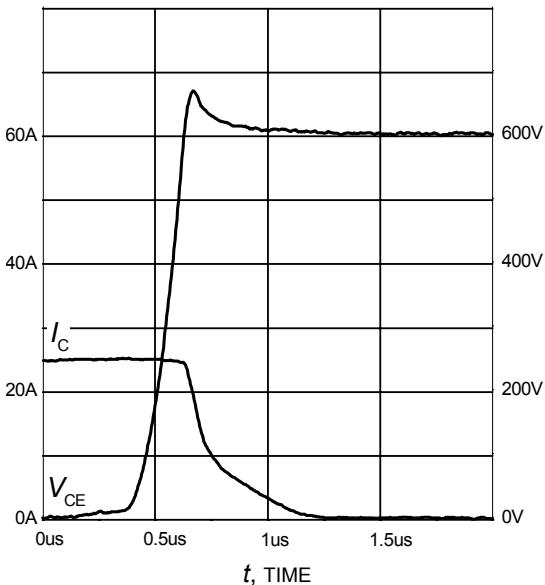
Figure 22. Typical turn off behavior
(V_{GE}=15/0V, R_G=22Ω, T_j = 150°C,
Dynamic test circuit in Figure E)
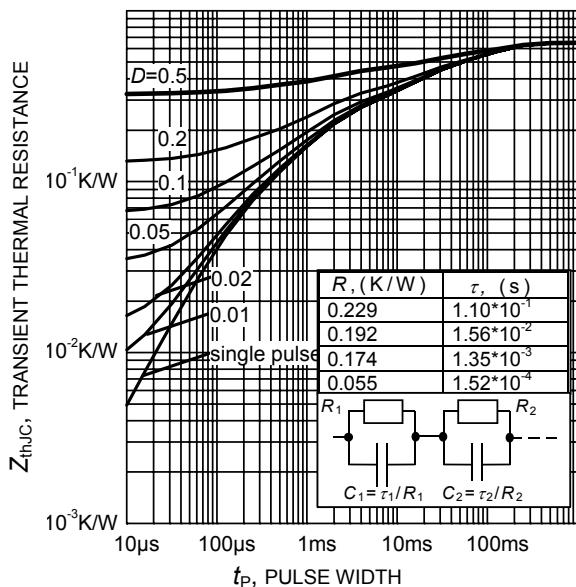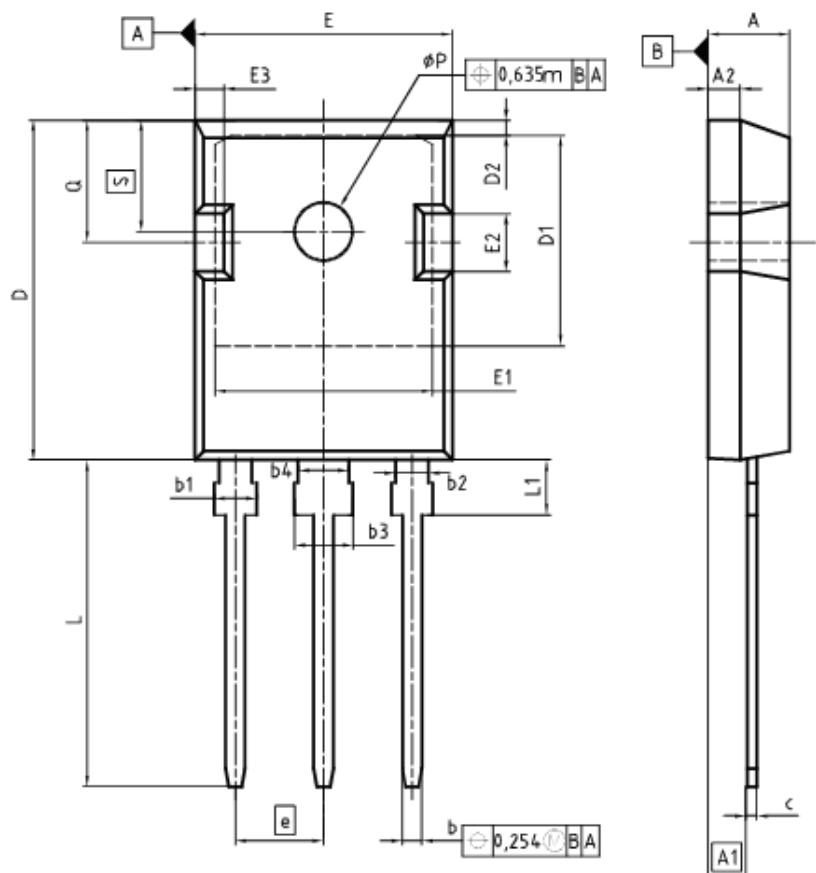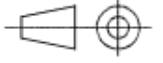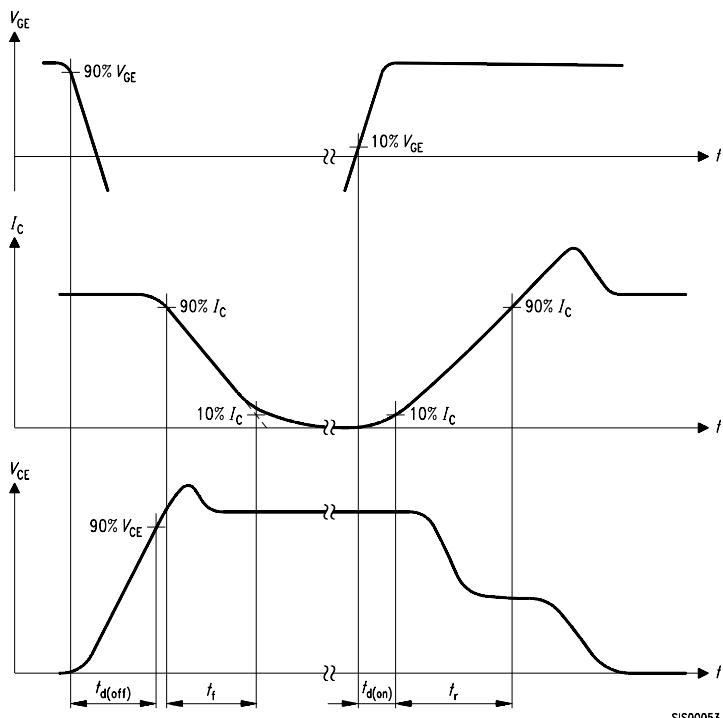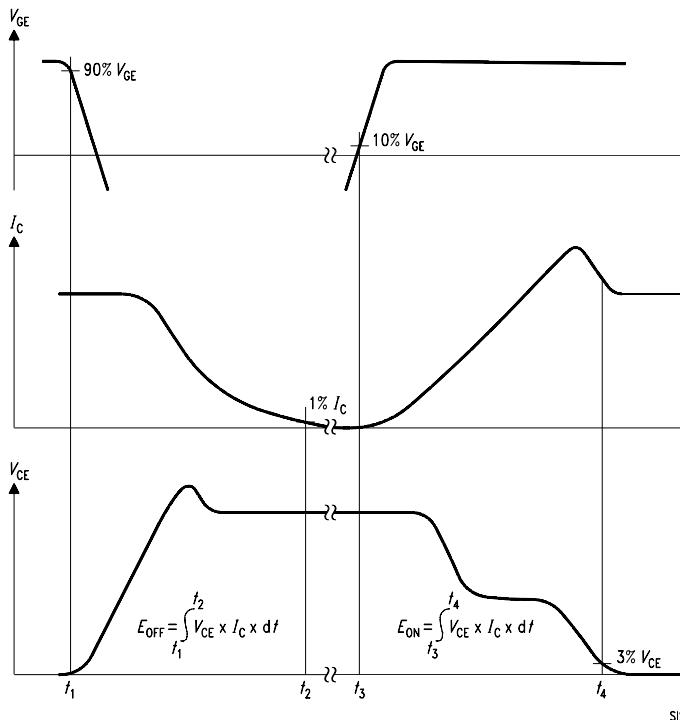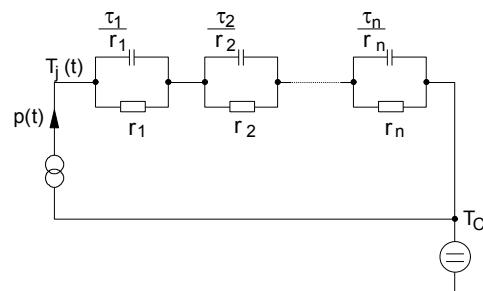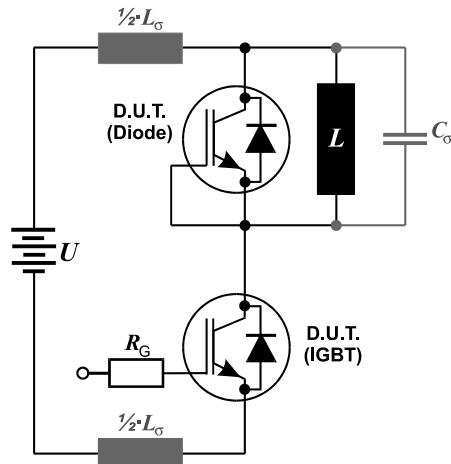
**Figure 23. IGBT transient thermal resistance**
($D = t_p / T$)

R, (K/W)	τ, (s)
0.229	$1.10*10^{-1}$
0.192	$1.56*10^{-2}$
0.174	$1.35*10^{-3}$
0.055	$1.52*10^{-4}$

TO247-3

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44		0.214	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

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SCALE 7.5mm

EUROPEAN PROJECTION

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**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 D. Thermal equivalent circuit

Figure E. Dynamic test circuit
Leakage inductance L_σ =180nH
and Stray capacity C_σ =39pF.