## Fast IGBT in NPT-technology

- 40% lower E_{off} compared to previous generation
- Short circuit withstand time – 10 µs
- Designed for:
  - Motor controls
  - Inverter
  - SMPS
- NPT-Technology offers:
  - very tight parameter distribution
  - high ruggedness, temperature stable behaviour
  - parallel switching capability
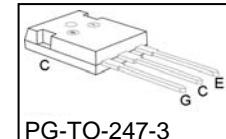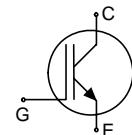
- Qualified according to JEDEC[1] for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/

PG-TO-247-3

Type	V_{CE}	I_C	E_{off}	T_j	Marking	Package
SGW25N120	1200V	25A	2.9mJ	150°C	SGW25N120	PG-TO-247-3

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current	I_C		A
$T_C = 25°C$		46	
$T_C = 100°C$		25	
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	84	
Turn off safe operating area $V_{CE} \leq 1200V$, $T_j \leq 150°C$	-	84	
Gate-emitter voltage	V_{GE}	±20	V
Avalanche energy, single pulse $I_C = 25A$, $V_{CC} = 50V$, $R_{GE} = 25\Omega$, start at $T_j = 25°C$	E_{AS}	130	mJ
Short circuit withstand time[2] $V_{GE} = 15V$, $100V \leq V_{CC} \leq 1200V$, $T_j \leq 150°C$	t_{SC}	10	µs
Power dissipation $T_C = 25°C$	P_{tot}	313	W
Operating junction and storage temperature	T_j , T_{stg}	-55...+150	°C
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}		0.4	K/W
Thermal resistance, junction – ambient	R_{thJA}		40	

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V$, $I_C=1500\mu A$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V$, $I_C=25A$				
		$T_j=25°C$	2.5	3.1	3.6	
		$T_j=150°C$	-	3.7	4.3	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=1000\mu A$, $V_{CE}=V_{GE}$	3	4	5	
Zero gate voltage collector current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$				μA
		$T_j=25°C$	-	-	350	
		$T_j=150°C$	-	-	1400	
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE}=20V$, $I_C=25A$		20	-	S
Dynamic Characteristic						
Input capacitance	C_{iss}	$V_{CE}=25V$,	-	2150	2600	pF
Output capacitance	C_{oss}	$V_{GE}=0V$,	-	160	190	
Reverse transfer capacitance	C_{rss}	$f=1MHz$	-	110	130	
Gate charge	Q_{Gate}	$V_{CC}=960V$, $I_C=25A$ $V_{GE}=15V$	-	225	300	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH
Short circuit collector current[1]	$I_{C(SC)}$	$V_{GE}=15V, t_{SC}\leq10\mu s$ $100V\leq V_{CC}\leq1200V$, $T_j \leq 150°C$	-	240	-	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,	-	45	60	ns
Rise time	t_r	V_{CC}=800V, I_C=25A,	-	40	52	
Turn-off delay time	$t_{d(off)}$	V_{GE}=15V/0V,	-	730	950	
Fall time	t_f	R_G=22Ω,	-	30	39	
Turn-on energy	E_{on}	$L_\sigma{}^{1)}$=180nH, $C_\sigma{}^{1)}$=40pF	-	2.2	2.9	mJ
Turn-off energy	E_{off}	Energy losses include	-	1.5	2.0	
Total switching energy	E_{ts}	"tail" and diode reverse recovery.	-	3.7	4.9	

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	-	50	60	ns
Rise time	t_r	V_{CC}=800V,	-	36	43	
Turn-off delay time	$t_{d(off)}$	I_C=25A,	-	820	990	
Fall time	t_f	V_{GE}=15V/0V,	-	42	50	
Turn-on energy	E_{on}	R_G=22Ω, $L_\sigma{}^{1)}$=180nH,	-	3.8	4.6	mJ
Turn-off energy	E_{off}	$C_\sigma{}^{1)}$=40pF	-	2.9	3.8	
Total switching energy	E_{ts}	Energy losses include "tail" and diode reverse recovery.	-	6.7	8.4	

[1] Leakage inductance L_σ and stray capacity C_σ due to dynamic test circuit in figure E.
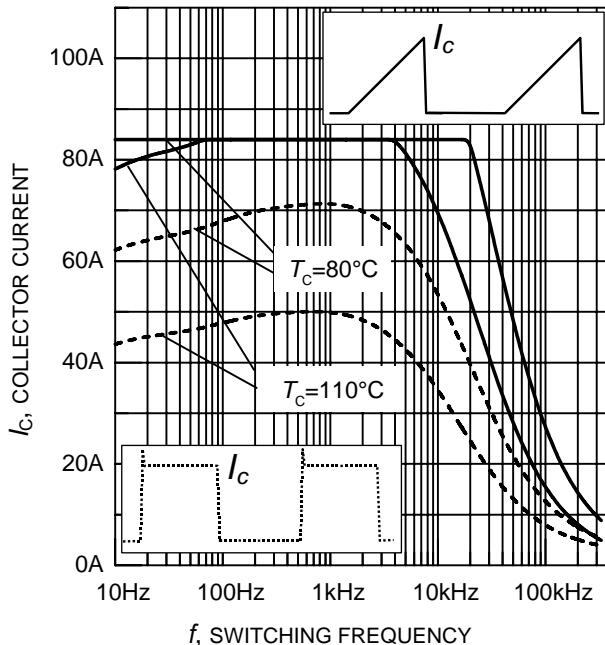
Figure 1. Collector current as a function of switching frequency

($T_j \le 150°C$, $D = 0.5$, $V_{CE} = 800V$, $V_{GE} = +15V/0V$, $R_G = 22\Omega$)
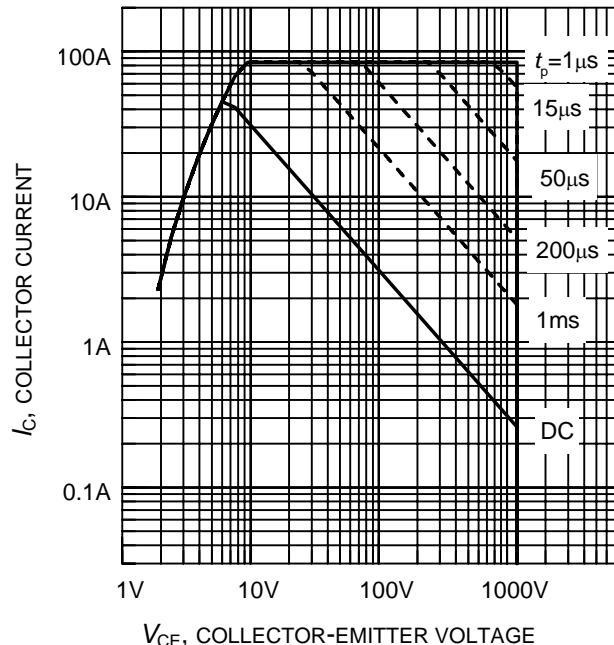
**Figure 2. Safe operating area**

($D = 0$, $T_C = 25°C$, $T_j \le 150°C$)
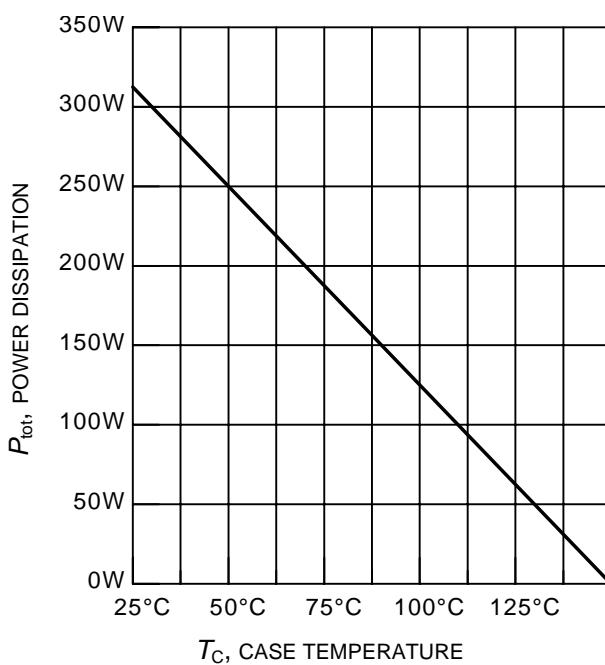
**Figure 3. Power dissipation as a function of case temperature**

($T_j \le 150°C$)
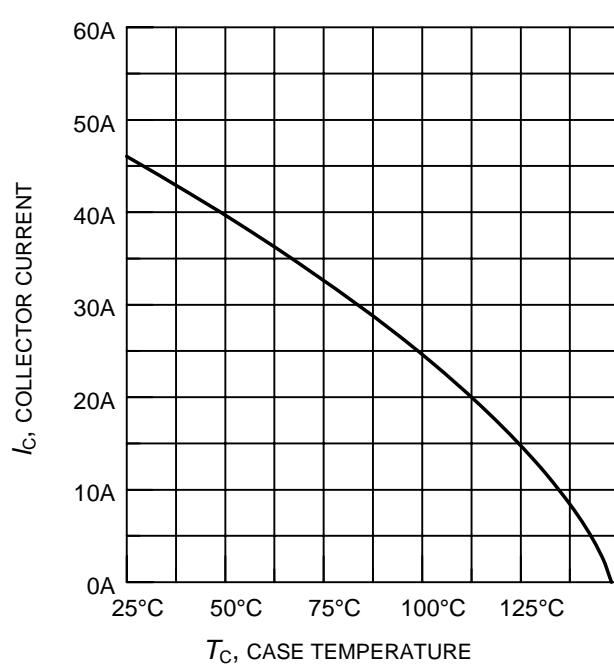
Figure 4. Collector current as a function of case temperature

($V_{GE} \le 15V$, $T_j \le 150°C$)
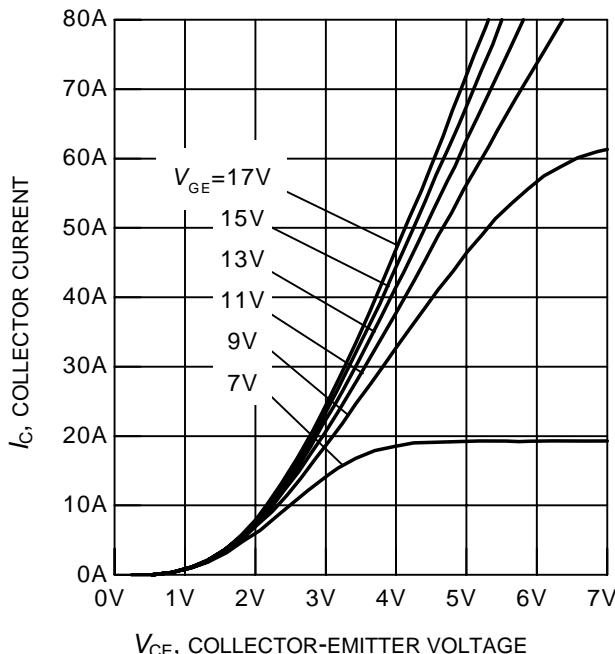
Figure 5. Typical output characteristics
($T_j = 25°C$)
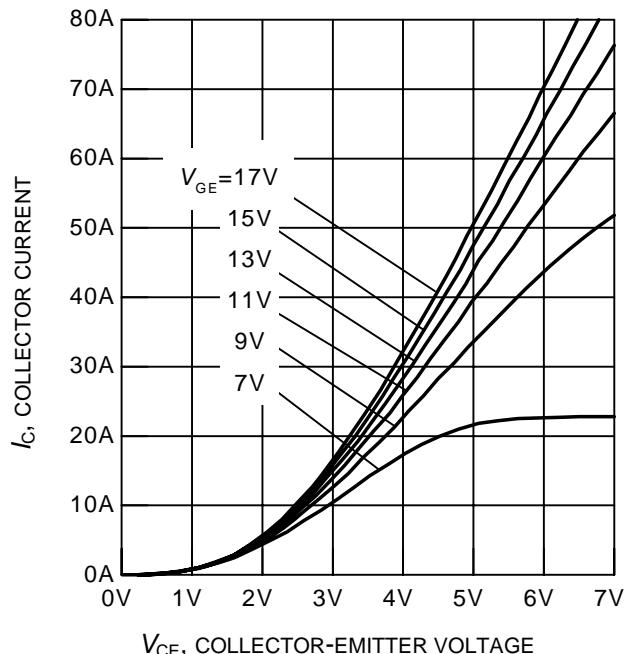
Figure 6. Typical output characteristics
($T_j = 150°C$)
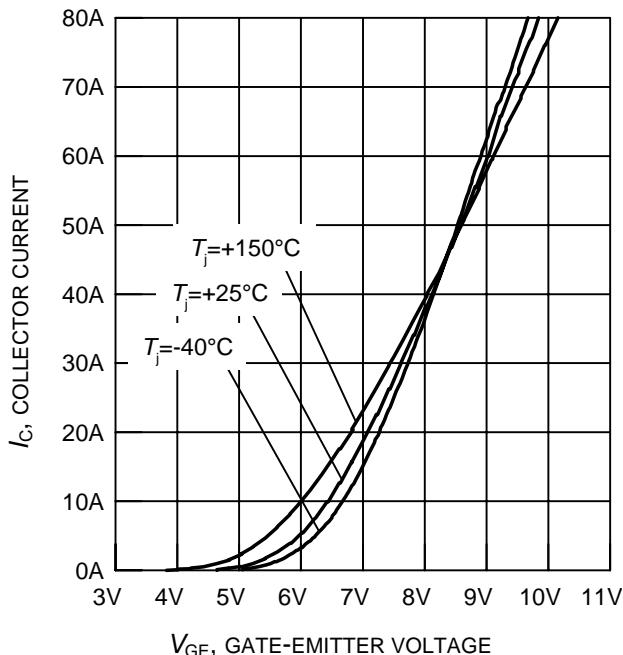
Figure 7. Typical transfer characteristics
($V_{CE} = 20V$)
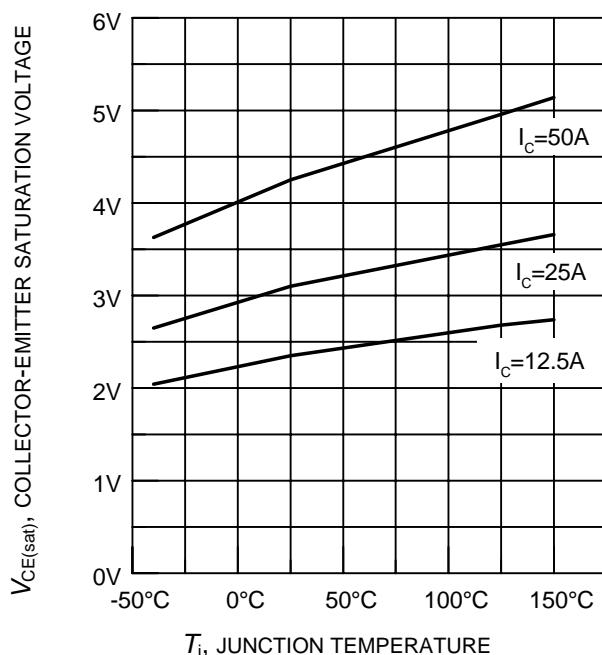
Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15V$)

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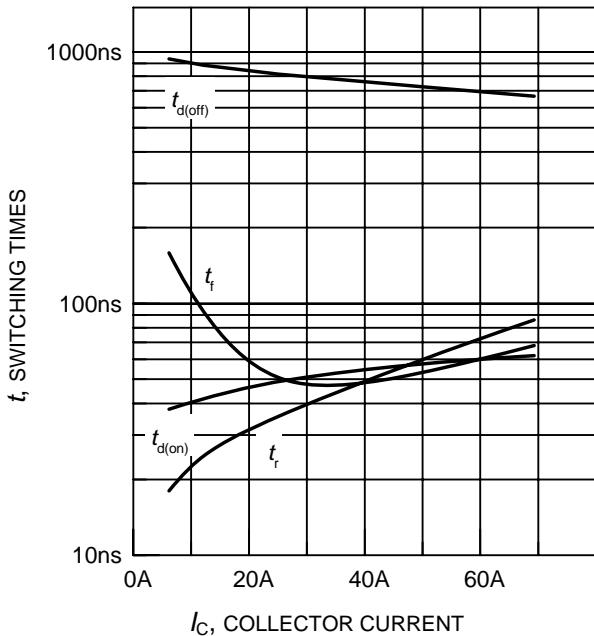
**Figure 9. Typical switching times as a function of collector current**
(inductive load, $T_j = 150°C$,
$V_{CE} = 800V$, $V_{GE} = +15V/0V$, $R_G = 22\Omega$,
dynamic test circuit in Fig.E)
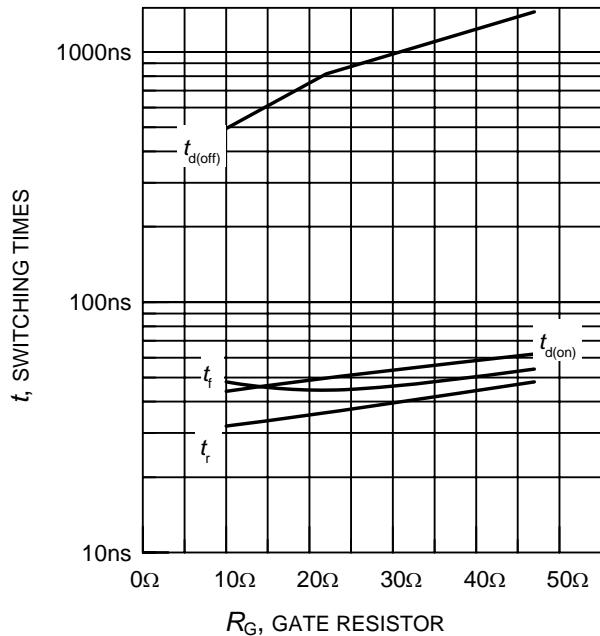
Figure 10. Typical switching times as a function of gate resistor
(inductive load, $T_j = 150°C$,
$V_{CE} = 800V$, $V_{GE} = +15V/0V$, $I_C = 25A$,
dynamic test circuit in Fig.E)
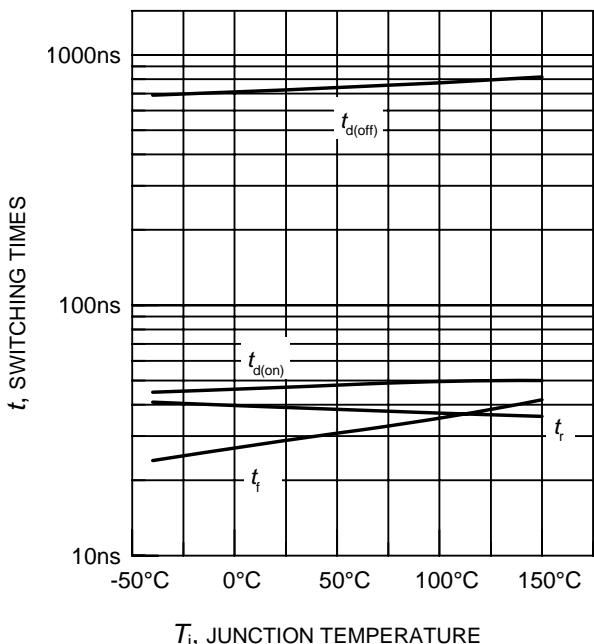
Figure 11. Typical switching times as a function of junction temperature
(inductive load, $V_{CE} = 800V$,
$V_{GE} = +15V/0V$, $I_C = 25A$, $R_G = 22\Omega$,
dynamic test circuit in Fig.E)
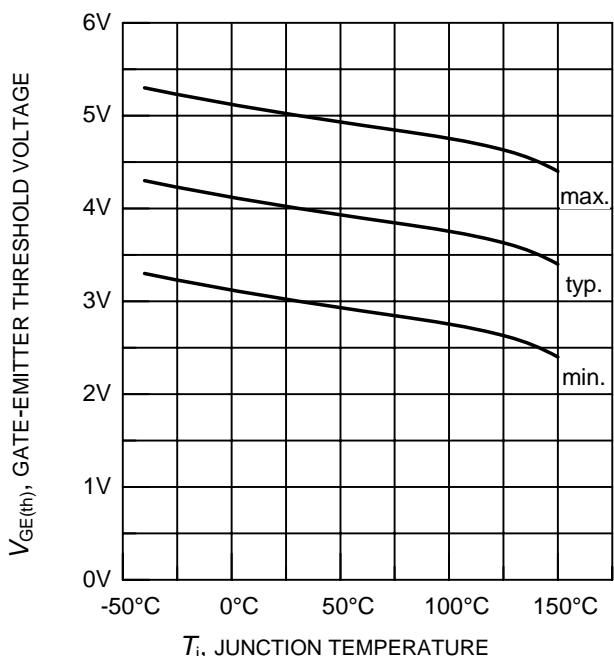
Figure 12. Gate-emitter threshold voltage as a function of junction temperature
($I_C = 0.3mA$)
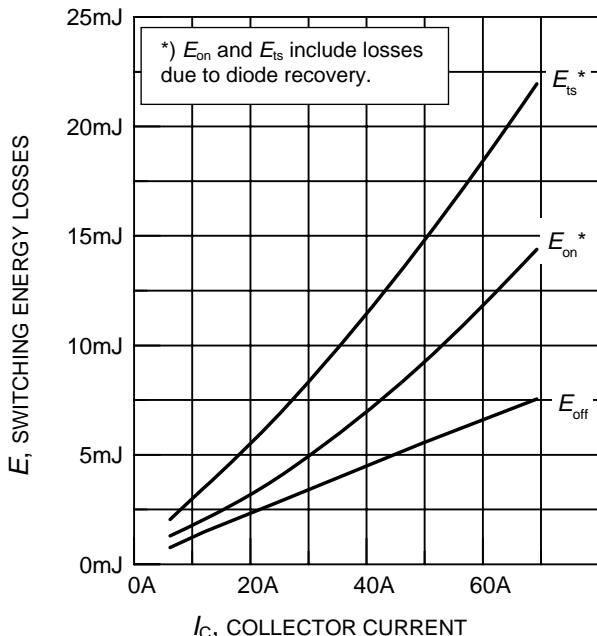
Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_j = 150°C, V_{CE} = 800V, V_{GE} = +15V/0V, R_G = 22Ω, dynamic test circuit in Fig.E)

**Figure 14. Typical switching energy losses as a function of gate resistor**
(inductive load, T_j = 150°C, V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 25A, dynamic test circuit in Fig.E)
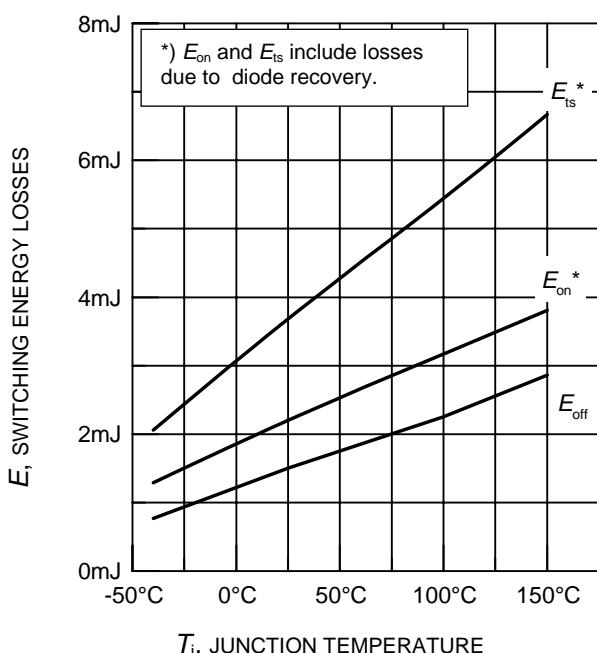
Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 25A, R_G = 22Ω, dynamic test circuit in Fig.E)

| R, (K / W)	τ, (s)
0.07417	0.4990
0.20899	0.08994
0.08065	0.00330
0.03681	0.00038

Figure 16. IGBT transient thermal impedance as a function of pulse width
($D = t_p / T$)
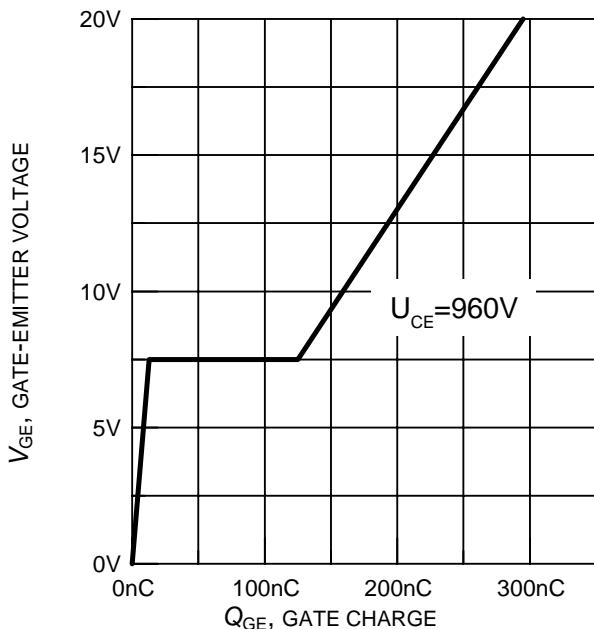
Figure 17. Typical gate charge
(I_C = 25A)

U_{CE}=960V

V_{GE}, GATE-EMITTER VOLTAGE

Q_{GE}, GATE CHARGE
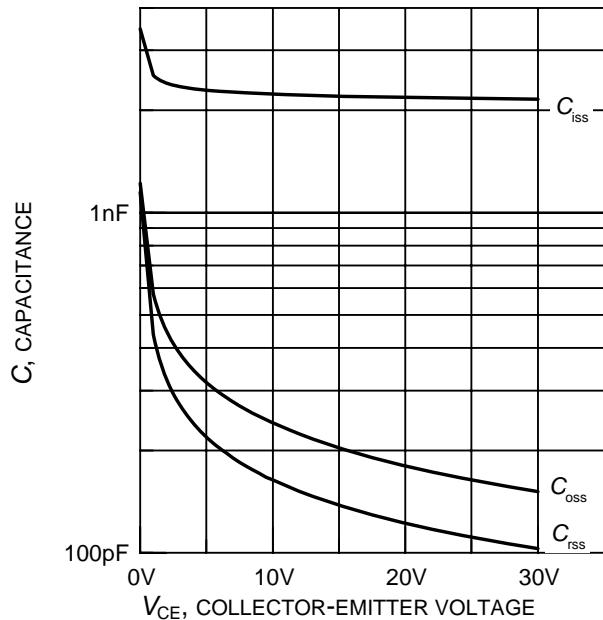
Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE} = 0V, f = 1MHz)

C, CAPACITANCE

C_{iss}

C_{oss}

C_{rss}

V_{CE}, COLLECTOR-EMITTER VOLTAGE
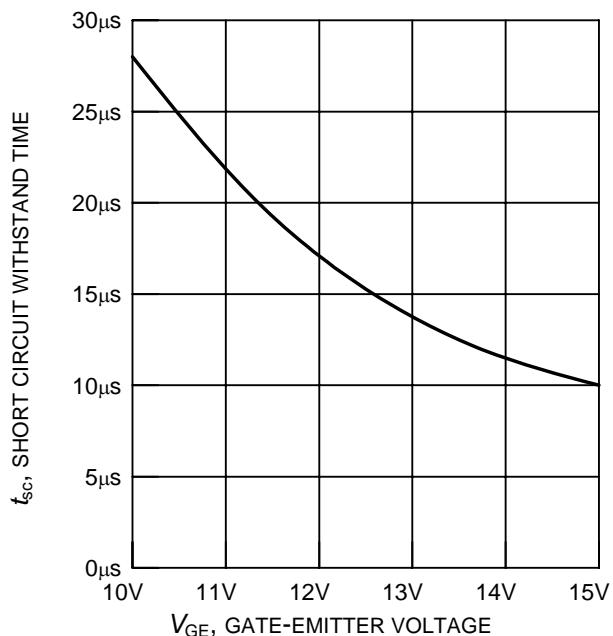
**Figure 19. Short circuit withstand time as a function of gate-emitter voltage**
(V_{CE} = 1200V, start at T_j = 25°C)

t_{sc}, SHORT CIRCUIT WITHSTAND TIME

V_{GE}, GATE-EMITTER VOLTAGE
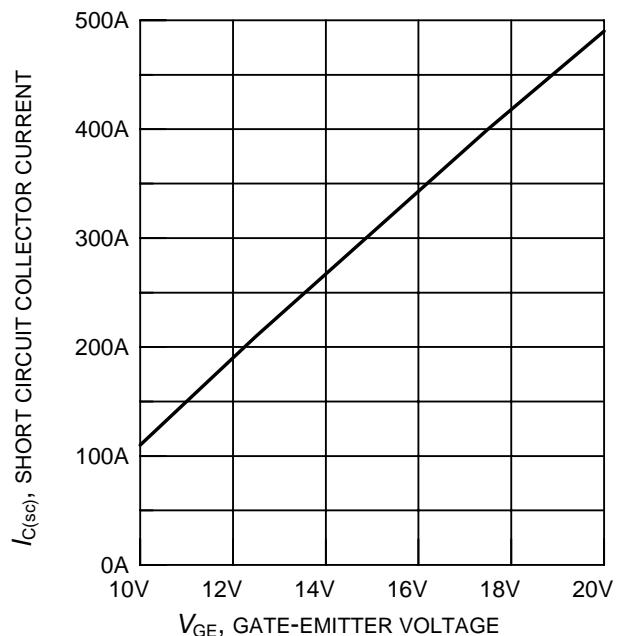
**Figure 20. Typical short circuit collector current as a function of gate-emitter voltage**
(100V≤ V_{CE} ≤1200V, T_C = 25°C, T_j ≤ 150°C)

$I_{C(sc)}$, SHORT CIRCUIT COLLECTOR CURRENT

V_{GE}, GATE-EMITTER VOLTAGE

PG-TO247-3
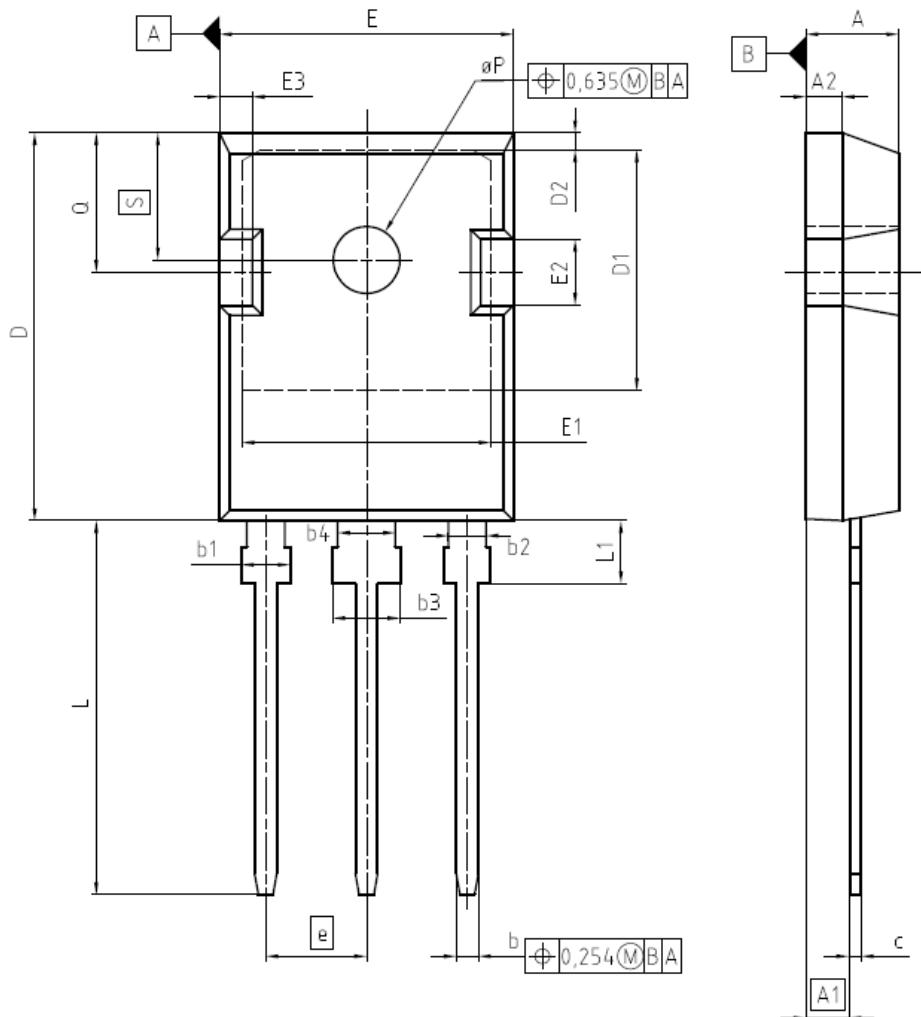
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4,90	5,16	0,193	0,203
A1	2.27	2.53	0.089	0.099
A2	1.85	2.11	0.073	0.083
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20,82	21.10	0.820	0.831
D1	16.25	17.65	0.640	0.695
D2	1.05	1.35	0.041	0.053
E	15.70	16.03	0.618	0.631
E1	13.10	14.15	0.516	0.557
E2	3,68	5,10	0,145	0,201
E3	1.68	2.60	0.066	0.102
e	5.44		0.214	
N	3		3	
L	19.80	20.31	0.780	0.799
L1	4.17	4.47	0.164	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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Z8B00003327

SCALE

7.5mm

EUROPEAN PROJECTION

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REVISION
03

Figure A. Definition of switching times

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

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

Figure B. Definition of switching losses

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

**Figure C. Definition of diodes switching characteristics**
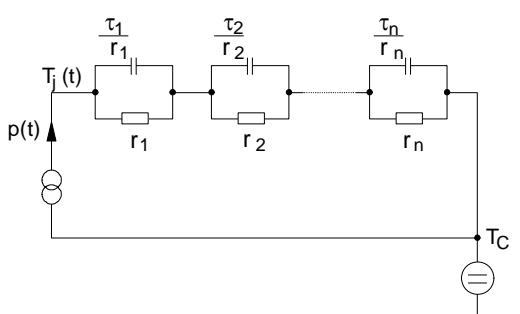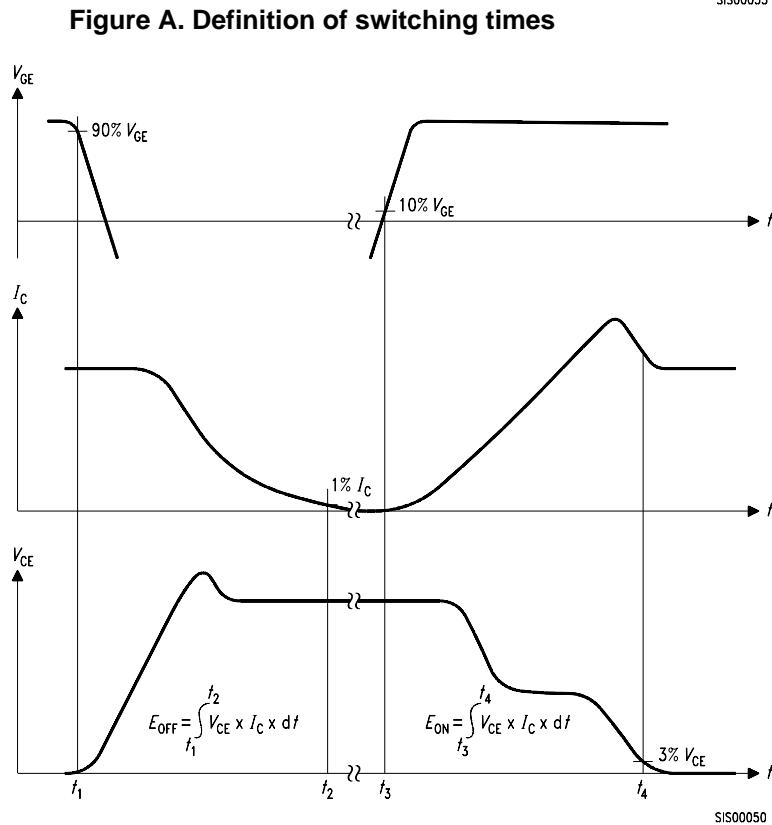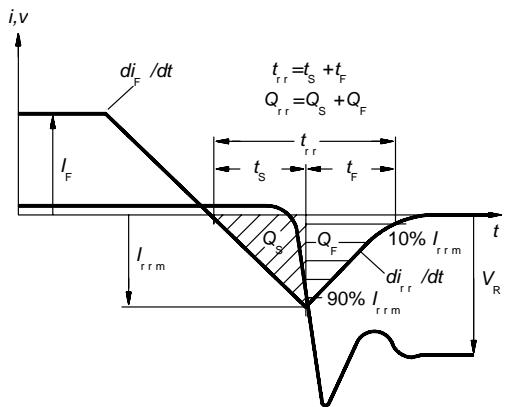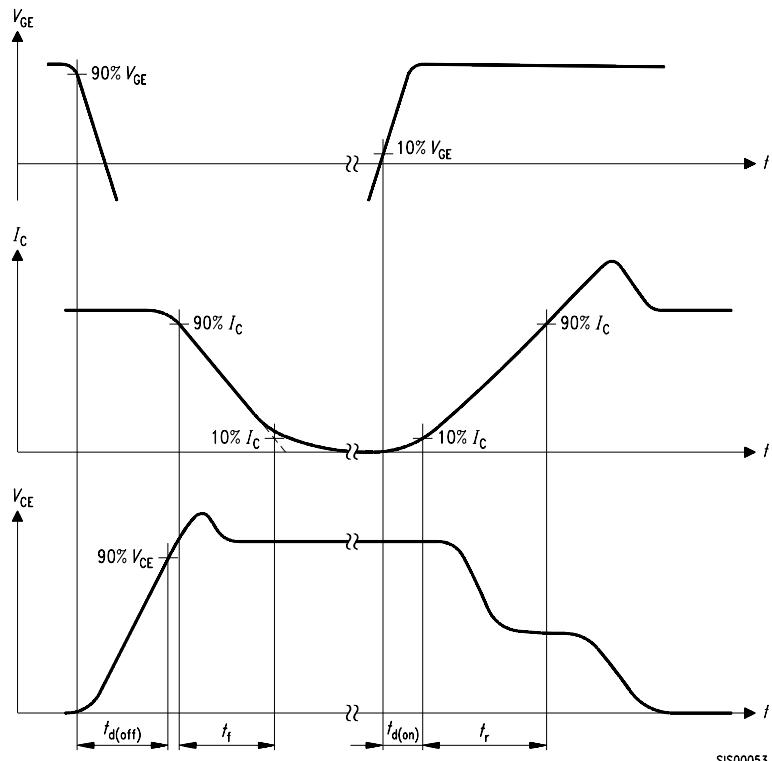
Figure D. Thermal equivalent circuit
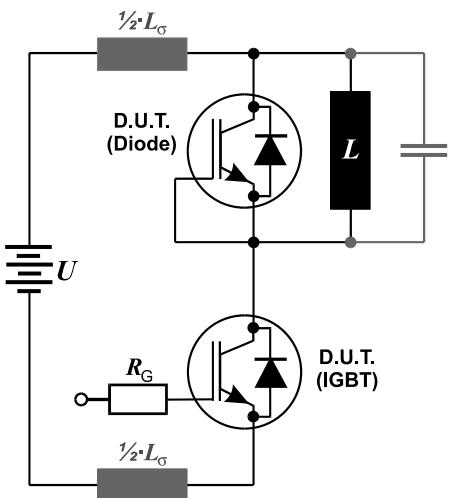
Figure E. Dynamic test circuit
Leakage inductance $L_\sigma = 180nH$, and stray capacity $C_\sigma = 40pF$.

Attention please!

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