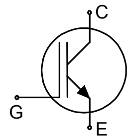
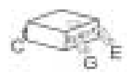
# SGP02N60
# SGD02N60

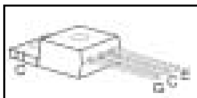
## Fast IGBT in NPT-technology




- 75% lower $E_{off}$ compared to previous generation combined with low conduction losses
- Short circuit withstand time – 10 µs
- Designed for:
  - Motor controls
  - Inverter
- NPT-Technology for 600V applications offers:
  - very tight parameter distribution
  - high ruggedness, temperature stable behaviour
  - parallel switching capability
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC[2] for target applications
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/




PG-TO-252-3-1 (D-PAK) (TO-252AA)




PG-TO-220-3-1 (TO-220AB)

| Type | $V_{CE}$ | $I_C$ | $V_{CE(sat)150°C}$ | $T_j$ | Marking | Package |
|---|---|---|---|---|---|---|
| SGP02N60 | 600V | 2A | 2.2V | 150°C | G10N60 | PG-TO-220-3-1 |
| SGD02N60 | 600V | 2A | 2.2V | 150°C | G10N60 | PG-TO-252-3-11 |

**Maximum Ratings**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage | $V_{CE}$ | 600 | V |
| DC collector current<br>$T_C$ = 25°C<br>$T_C$ = 100°C | $I_C$ | <br>6.0<br>2.9 | A |
| Pulsed collector current, $t_p$ limited by $T_{jmax}$ | $I_{Cpuls}$ | 12 | |
| Turn off safe operating area<br>$V_{CE} \leq$ 600V, $T_j \leq$ 150°C | - | 12 | |
| Gate-emitter voltage | $V_{GE}$ | ±20 | V |
| Avalanche energy, single pulse<br>$I_C$ = 2 A, $V_{CC}$ = 50 V, $R_{GE}$ = 25 Ω,<br>start at $T_j$ = 25°C | $E_{AS}$ | 13 | mJ |
| Short circuit withstand time[1)]<br>$V_{GE}$ = 15V, $V_{CC} \leq$ 600V, $T_j \leq$ 150°C | $t_{SC}$ | 10 | µs |
| Power dissipation<br>$T_C$ = 25°C | $P_{tot}$ | 30 | W |
| Operating junction and storage temperature | $T_j$ , $T_{stg}$ | -55...+150 | °C |
| Soldering temperature,<br>wavesoldering, 1.6mm (0.063 in.) from case for 10s | $T_s$ | 260 | |

[2] J-STD-020 and JESD-022
[1)] 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 | $R_{thJC}$ | | 4.2 | K/W |
| Thermal resistance, junction – ambient | $R_{thJA}$ | PG-TO-220-3-1 | 62 | |
| SMD version, device on PCB[1)] | $R_{thJA}$ | PG-TO-252-3-1 | 50 | |

**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, $I_C$=500µA | 600 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE}$ = 15V, $I_C$=2A<br>$T_j$=25°C<br>$T_j$=150°C | <br>1.7<br>- | <br>1.9<br>2.2 | <br>2.4<br>2.7 | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C$=150µA, $V_{CE}$=$V_{GE}$ | 3 | 4 | 5 | |
| Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$=600V, $V_{GE}$=0V<br>$T_j$=25°C<br>$T_j$=150°C | <br>-<br>- | <br>-<br>- | <br>20<br>250 | µA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=20V | - | - | 100 | nA |
| Transconductance | $g_{fs}$ | $V_{CE}$=20V, $I_C$=2A | - | 1.6 | - | S |
| **Dynamic Characteristic** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{CE}$=25V, | - | 142 | 170 | pF |
| Output capacitance | $C_{oss}$ | $V_{GE}$=0V, | - | 18 | 22 | |
| Reverse transfer capacitance | $C_{rss}$ | $f$=1MHz | - | 10 | 12 | |
| Gate charge | $Q_{Gate}$ | $V_{CC}$=480V, $I_C$=2A<br>$V_{GE}$=15V | - | 14 | 18 | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | $L_E$ | | - | 7 | - | nH |
| Short circuit collector current[2)] | $I_{C(SC)}$ | $V_{GE}$=15V, $t_{SC}$≤10µs<br>$V_{CC}$ ≤ 600V,<br>$T_j$ ≤ 150°C | - | 20 | - | A |

1) Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70µm thick) copper area for collector connection. PCB is vertical without blown air.
2) 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, $V_{CC}$=400V, $I_C$=2A, $V_{GE}$=0/15V, $R_G$=118Ω, $L_\sigma$[1] =180nH, $C_\sigma$[1] =180pF Energy losses include “tail” and diode reverse recovery. | - | 20 | 24 | ns |
| Rise time | $t_r$ | | - | 13 | 16 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 259 | 311 | |
| Fall time | $t_f$ | | - | 52 | 62 | |
| Turn-on energy | $E_{on}$ | | - | 0.036 | 0.041 | mJ |
| Turn-off energy | $E_{off}$ | | - | 0.028 | 0.036 | |
| Total switching energy | $E_{ts}$ | | - | 0.064 | 0.078 | |

**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, $V_{CC}$=400V, $I_C$=2A, $V_{GE}$=0/15V, $R_G$=118Ω, $L_\sigma$[1] =180nH, $C_\sigma$[1] =180pF Energy losses include “tail” and diode reverse recovery. | - | 20 | 24 | ns |
| Rise time | $t_r$ | | - | 14 | 17 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 287 | 344 | |
| Fall time | $t_f$ | | - | 67 | 80 | |
| Turn-on energy | $E_{on}$ | | - | 0.054 | 0.062 | mJ |
| Turn-off energy | $E_{off}$ | | - | 0.043 | 0.056 | |
| Total switching energy | $E_{ts}$ | | - | 0.097 | 0.118 | |

[1] Leakage inductance $L_\sigma$ and Stray capacity $C_\sigma$ due to dynamic test circuit in Figure E.

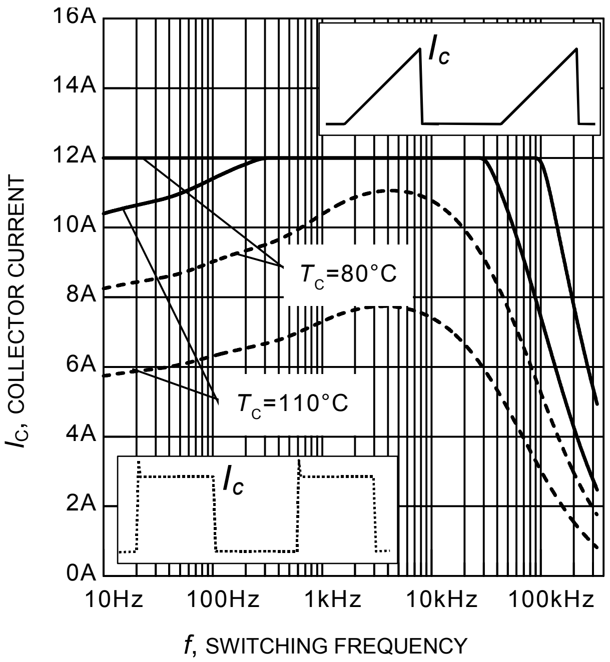



**Figure 1. Collector current as a function of switching frequency**
($T_j \leq 150$°C, $D = 0.5$, $V_{CE} = 400$V, $V_{GE} = 0/+15$V, $R_G = 118\Omega$)

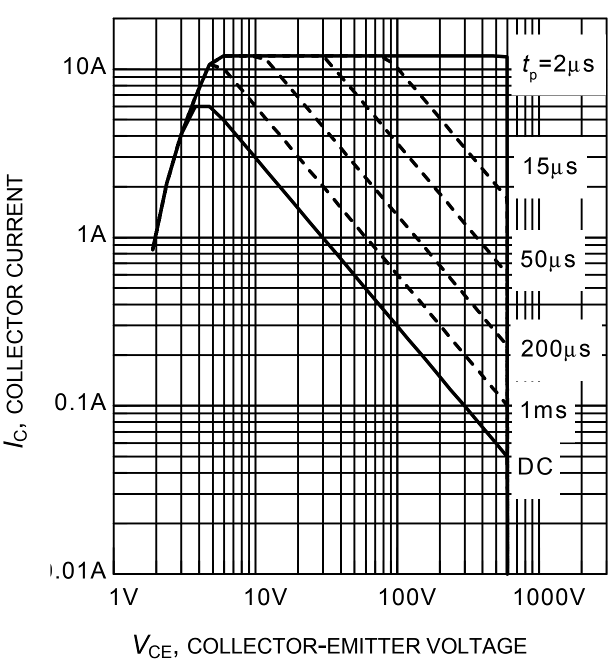



**Figure 2. Safe operating area**
($D = 0$, $T_C = 25$°C, $T_j \leq 150$°C)

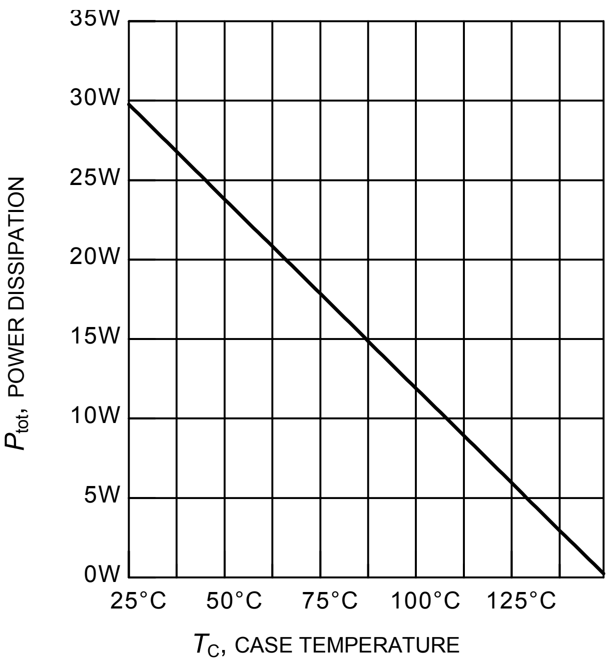



**Figure 3. Power dissipation (IGBT) as a function of case temperature**
($T_j \leq 150$°C)

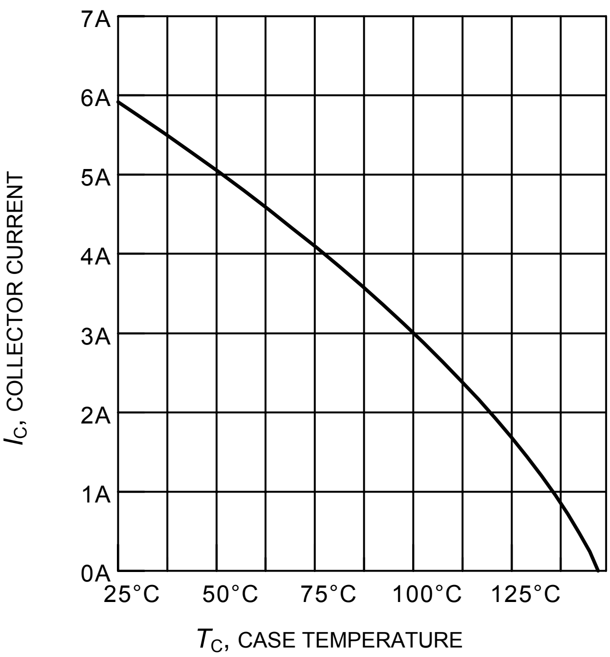



**Figure 4. Collector current as a function of case temperature**
($V_{GE} \leq 15$V, $T_j \leq 150$°C)

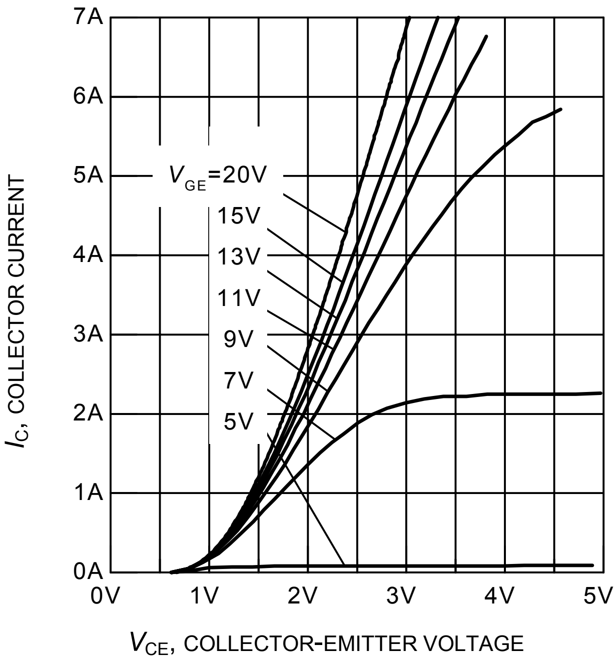



**Figure 5. Typical output characteristics**
($T_j$ = 25°C)

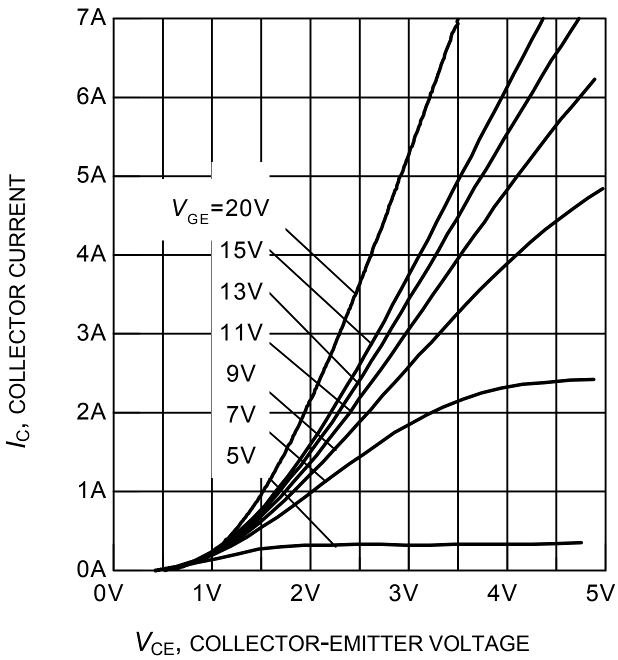



**Figure 6. Typical output characteristics**
($T_j$ = 150°C)

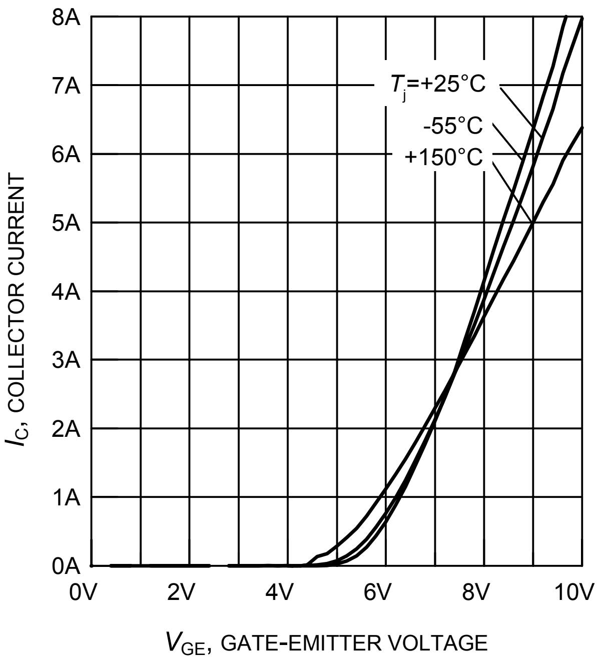



**Figure 7. Typical transfer characteristics**
($V_{CE}$ = 10V)

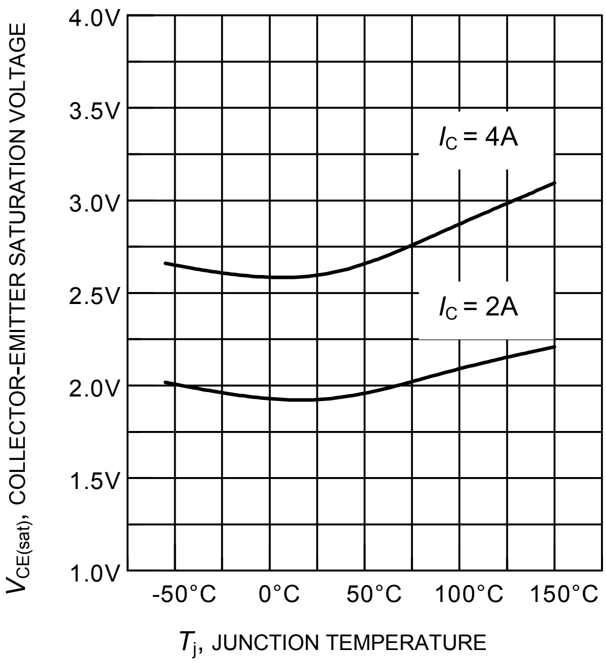



**Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}$ = 15V)

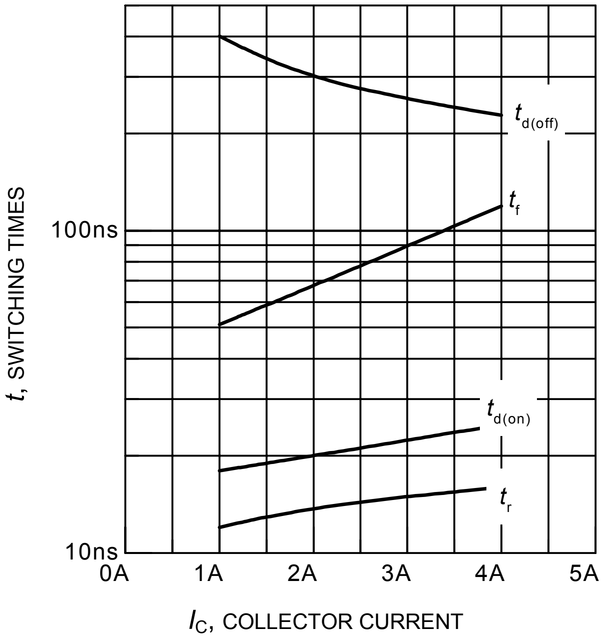



**Figure 9. Typical switching times as a function of collector current**
(inductive load, $T_j$ = 150°C, $V_{CE}$ = 400V, $V_{GE}$ = 0/+15V, $R_G$ = 118Ω, Dynamic test circuit in Figure E)

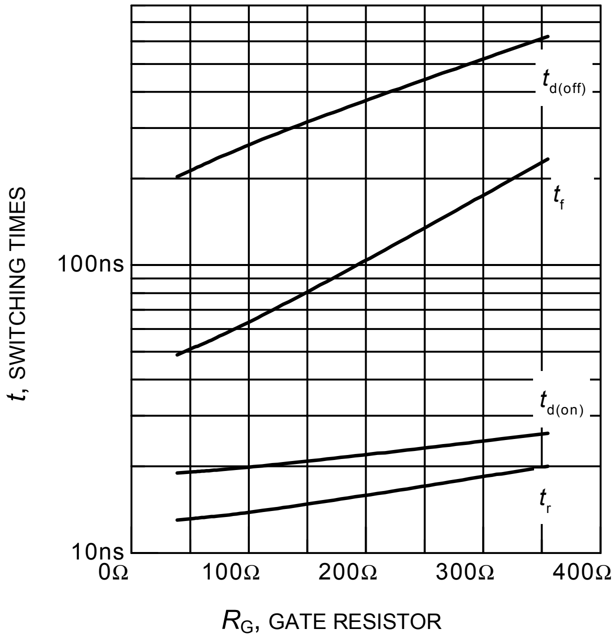



**Figure 10. Typical switching times as a function of gate resistor**
(inductive load, $T_j$ = 150°C, $V_{CE}$ = 400V, $V_{GE}$ = 0/+15V, $I_C$ = 2A, Dynamic test circuit in Figure E)

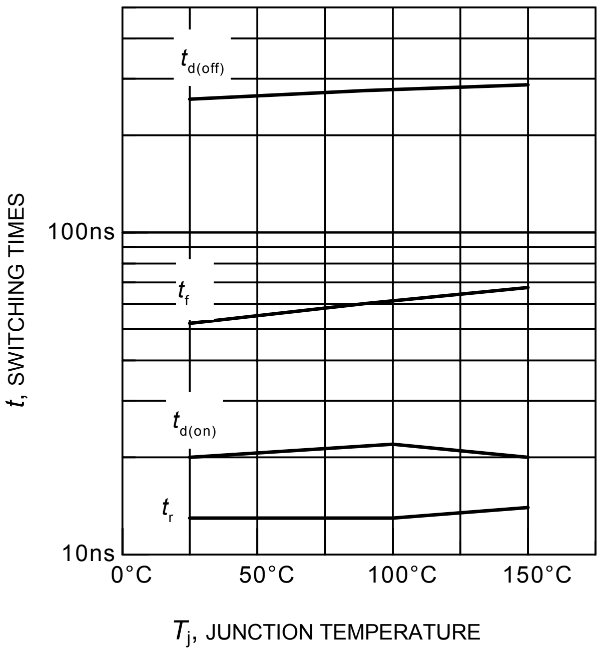



**Figure 11. Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}$ = 400V, $V_{GE}$ = 0/+15V, $I_C$ = 2A, $R_G$ = 118Ω, Dynamic test circuit in Figure E)

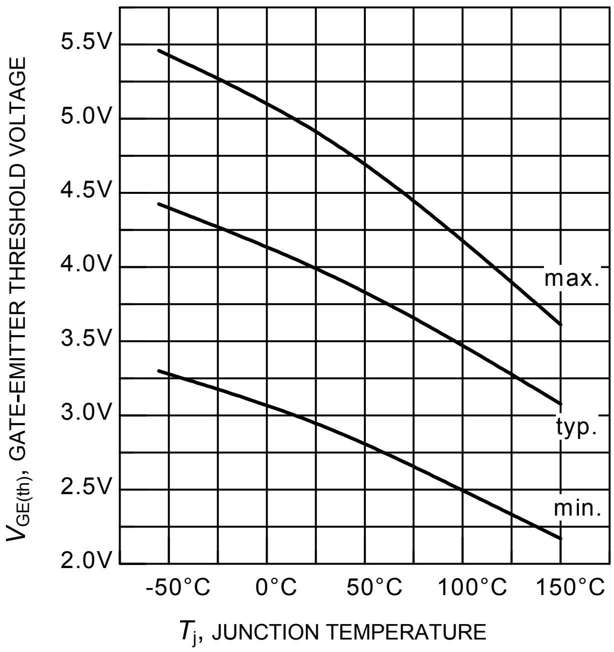



**Figure 12. Gate-emitter threshold voltage as a function of junction temperature**
($I_C$ = 0.15mA)

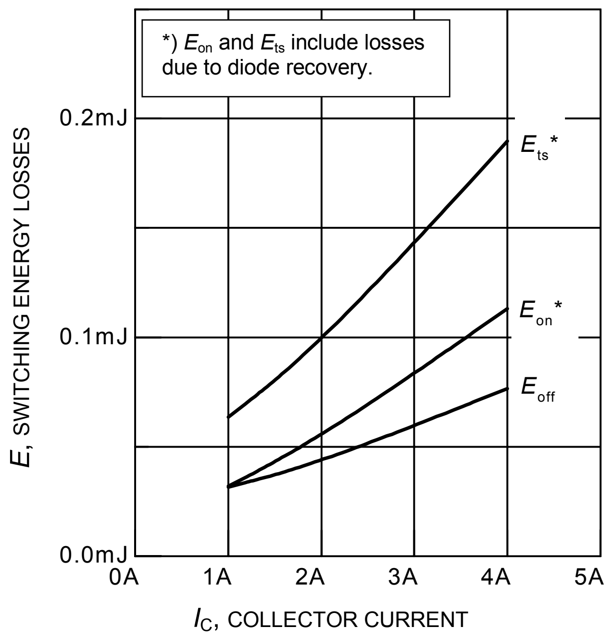



**Figure 13. Typical switching energy losses as a function of collector current**
(inductive load, $T_j$ = 150°C, $V_{CE}$ = 400V, $V_{GE}$ = 0/+15V, $R_G$ = 118Ω, Dynamic test circuit in Figure E)

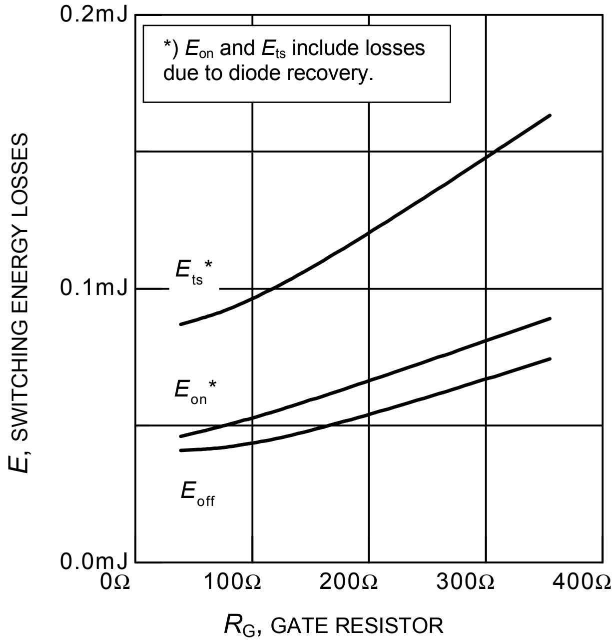



**Figure 14. Typical switching energy losses as a function of gate resistor**
(inductive load, $T_j$ = 150°C, $V_{CE}$ = 400V, $V_{GE}$ = 0/+15V, $I_C$ = 2A, Dynamic test circuit in Figure E)

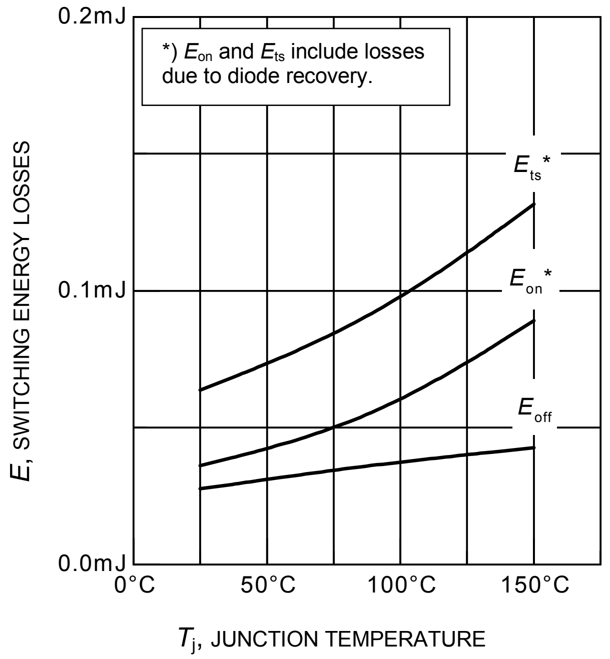



**Figure 15. Typical switching energy losses as a function of junction temperature**
(inductive load, $V_{CE}$ = 400V, $V_{GE}$ = 0/+15V, $I_C$ = 2A, $R_G$ = 118Ω, Dynamic test circuit in Figure E)

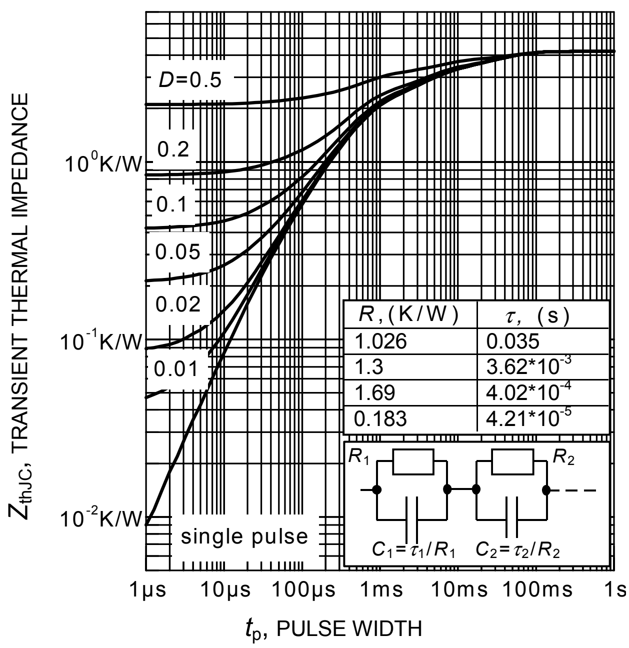



**Figure 16. IGBT transient thermal impedance as a function of pulse width**
($D = t_p / T$)

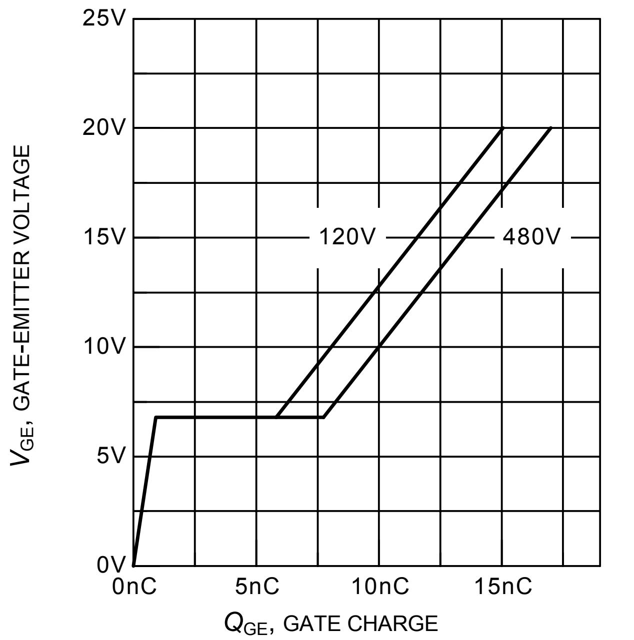



**Figure 17. Typical gate charge**
($I_C$ = 2A)

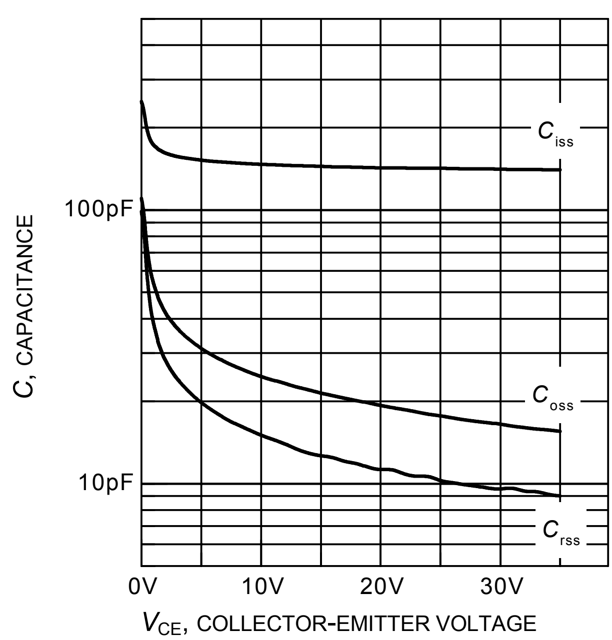



**Figure 18. Typical capacitance as a function of collector-emitter voltage**
($V_{GE}$ = 0V, $f$ = 1MHz)

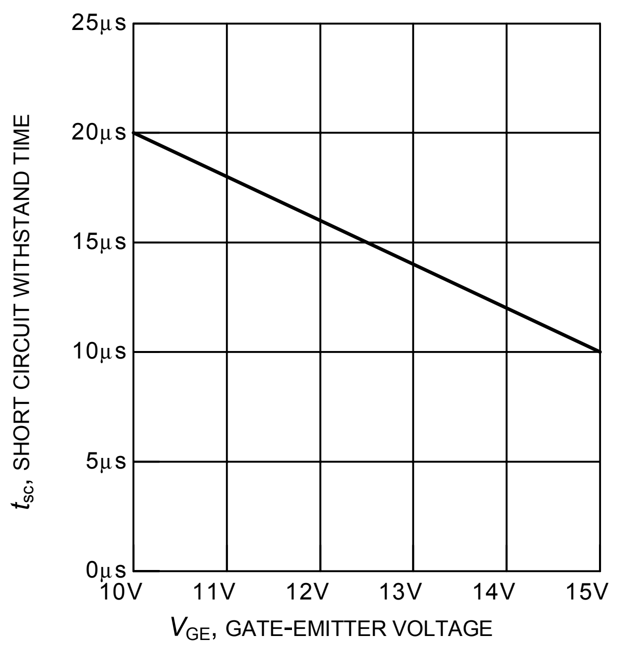



**Figure 19. Short circuit withstand time as a function of gate-emitter voltage**
($V_{CE}$ = 600V, start at $T_j$ = 25°C)

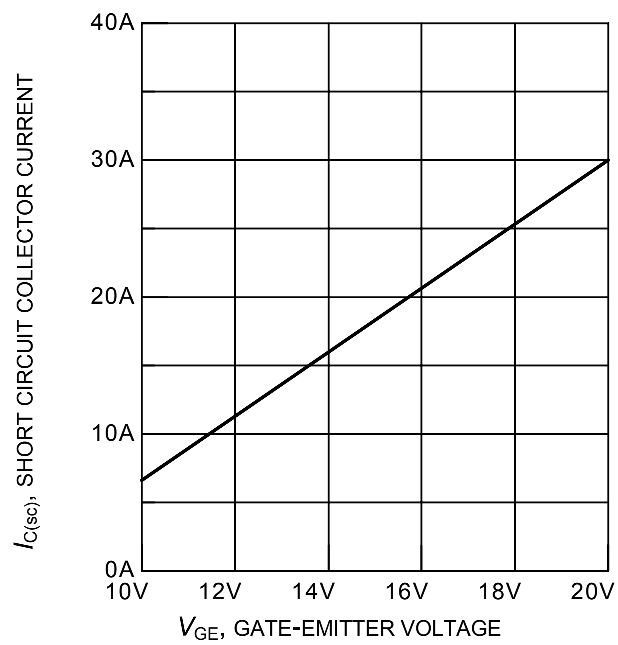
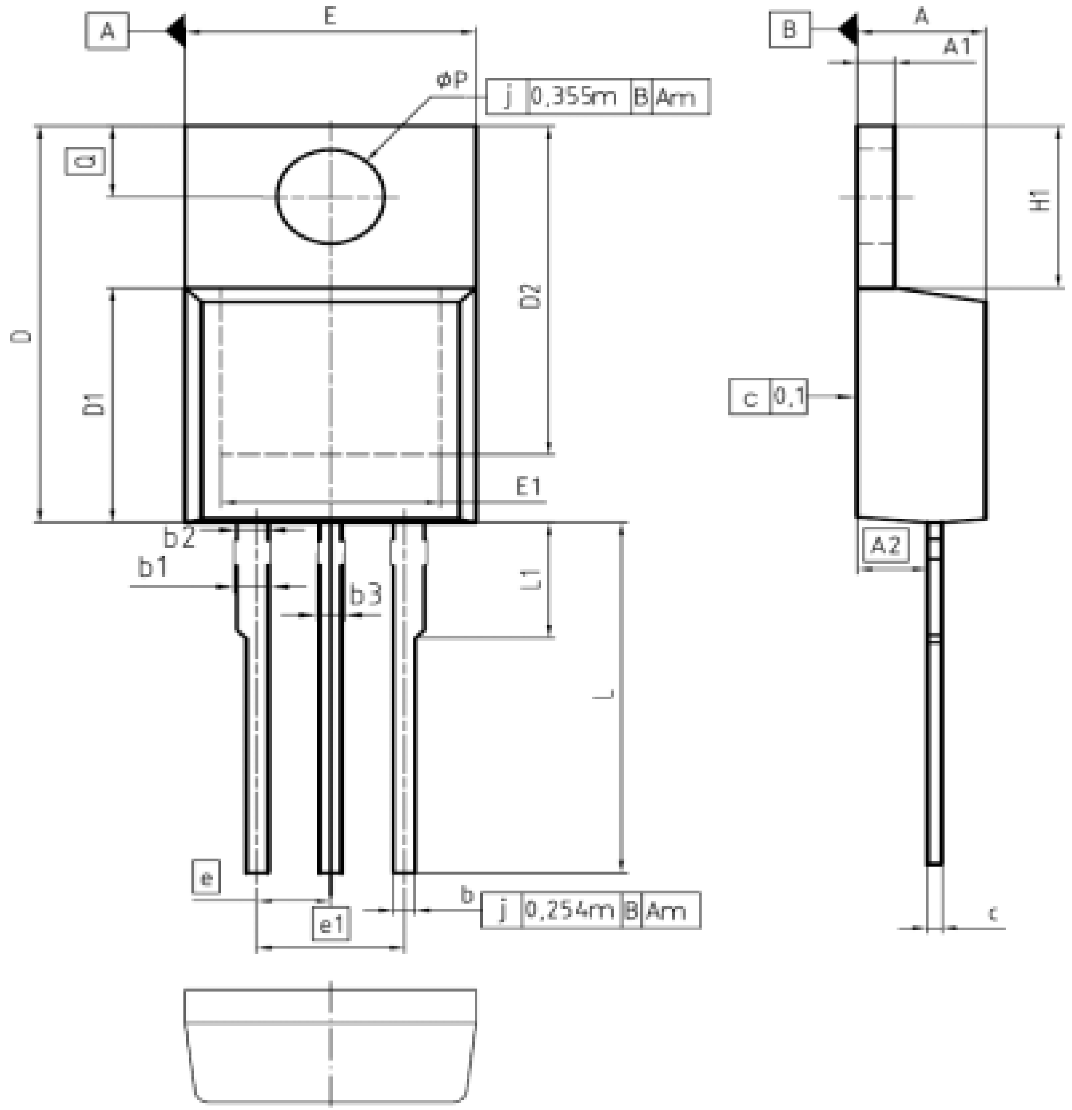



**Figure 20. Typical short circuit collector current as a function of gate-emitter voltage**
($V_{CE} \leq$ 600V, $T_j$ = 150°C)

PG-TO220-3-1




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.30 | 4.57 | 0.169 | 0.180 |
| A1 | 1.17 | 1.40 | 0.046 | 0.055 |
| A2 | 2.15 | 2.72 | 0.085 | 0.107 |
| b | 0.65 | 0.86 | 0.026 | 0.034 |
| b1 | 0.95 | 1.40 | 0.037 | 0.055 |
| b2 | 0.95 | 1.15 | 0.037 | 0.045 |
| b3 | 0.65 | 1.15 | 0.026 | 0.045 |
| c | 0.33 | 0.60 | 0.013 | 0.024 |
| D | 14.81 | 15.95 | 0.583 | 0.628 |
| D1 | 8.51 | 9.45 | 0.335 | 0.372 |
| D2 | 12.19 | 13.10 | 0.480 | 0.516 |
| E | 9.70 | 10.36 | 0.382 | 0.408 |
| E1 | 6.50 | 8.60 | 0.256 | 0.339 |
| e | 2.54 | | 0.100 | |
| e1 | 5.08 | | 0.200 | |
| N | 3 | | 3 | |
| H1 | 5.90 | 6.90 | 0.232 | 0.272 |
| L | 13.00 | 14.00 | 0.512 | 0.551 |
| L1 | - | 4.80 | - | 0.189 |
| øP | 3.60 | 3.89 | 0.142 | 0.153 |
| Q | 2.60 | 3.00 | 0.102 | 0.118 |

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SCALE 0 2.5 5mm

EUROPEAN PROJECTION

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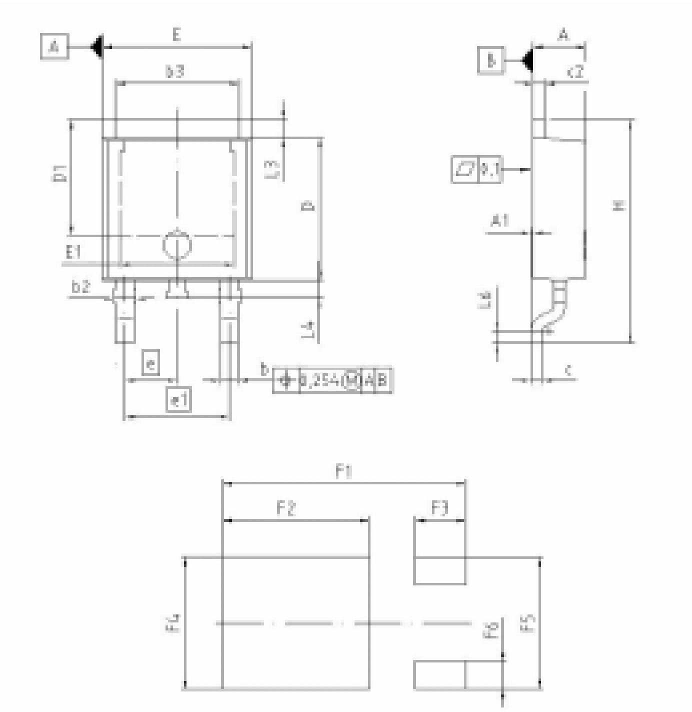
REVISION
05




PG-TO252-3-11

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 2.184 | 2.388 | 0.086 | 0.094 |
| A1 | 0.000 | 0.150 | 0.000 | 0.006 |
| b | 0.635 | 0.889 | 0.025 | 0.035 |
| b2 | 0.650 | 1.150 | 0.025 | 0.045 |
| b3 | 5.004 | 5.500 | 0.197 | 0.217 |
| c | 0.460 | 0.580 | 0.018 | 0.023 |
| c2 | 0.460 | 0.980 | 0.018 | 0.039 |
| D | 5.969 | 6.223 | 0.235 | 0.245 |
| D1 | 5.020 | 5.320 | 0.198 | 0.209 |
| E | 6.400 | 6.731 | 0.252 | 0.265 |
| E1 | 4.900 | 5.100 | 0.193 | 0.201 |
| e | 2.286 | | 0.090 | |
| e1 | 4,572 | | 0.180 | |
| N | 3 | | 3 | |
| H | 9.400 | 10.084 | 0.370 | 0.397 |
| L3 | 0.900 | 1.118 | 0.035 | 0.044 |
| L4 | 0.650 | 1.016 | 0.026 | 0.040 |
| L6 | 0.510 | 0.686 | 0.020 | 0.027 |
| F1 | 10.500 | 10.700 | 0.413 | 0.421 |
| F2 | 6.300 | 6.500 | 0.248 | 0.256 |
| F3 | 2.100 | 2.300 | 0.083 | 0.091 |
| F4 | 5.700 | 5.900 | 0.224 | 0.232 |
| F5 | 5.660 | 5.860 | 0.222 | 0.231 |
| F6 | 1.100 | 1.300 | 0.043 | 0.051 |

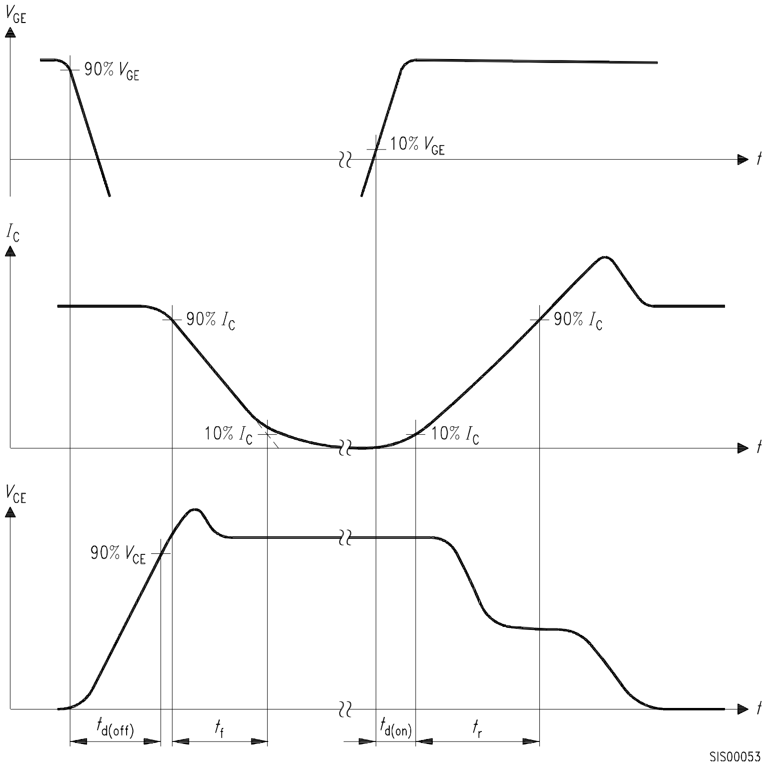



**Figure A. Definition of switching times**

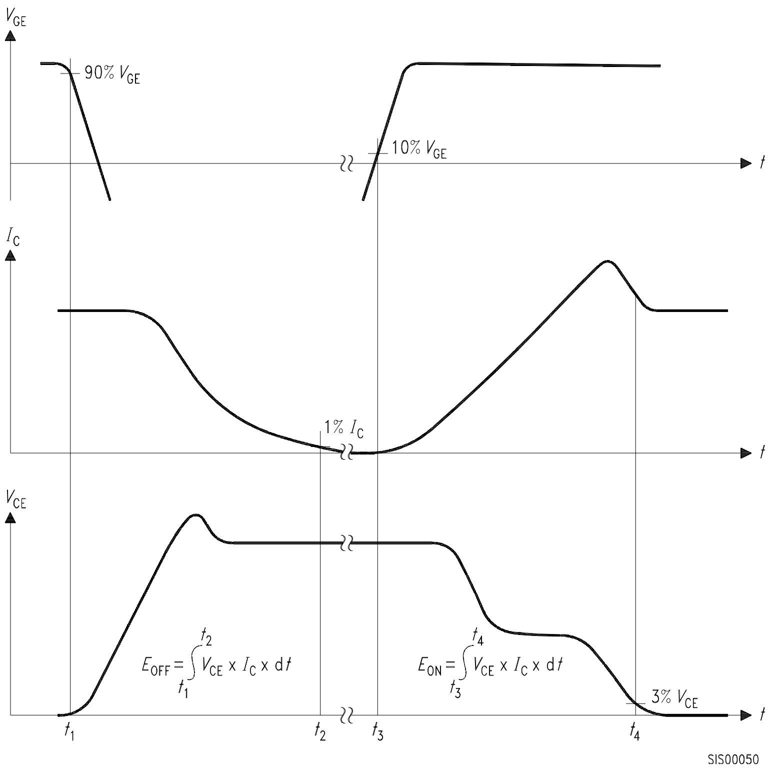



**Figure B. Definition of switching losses**

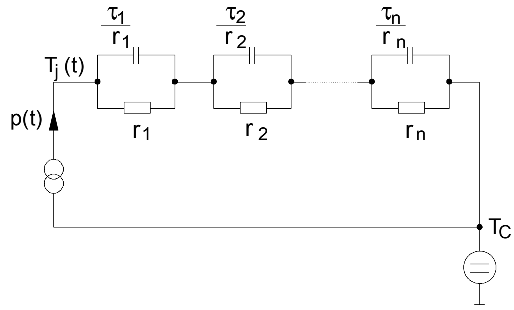



**Figure D. Thermal equivalent circuit**

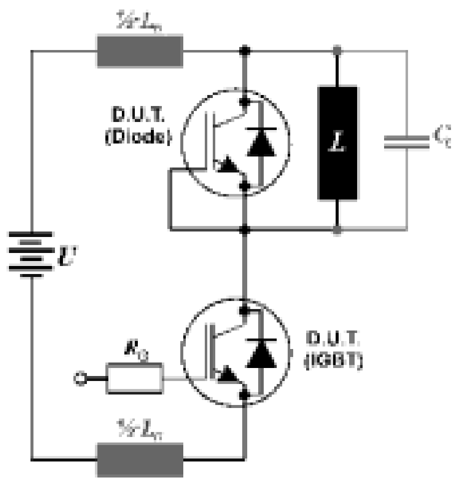



**Figure E. Dynamic test circuit**
Leakage inductance $L_\sigma$ =180nH
and Stray capacity $C_\sigma$ =180pF.

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- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

*В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.*

*Конструкторский отдел помогает осуществить:*

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

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