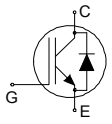
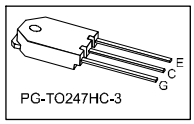
# Reverse conducting IGBT with monolithic body diode




RoHS

Halogen-Free

Features:
- Powerful monolithic body diode with low forward voltage designed for soft commutation only
- TrenchStop® technology offering:
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
  - low $V_{CEsat}$
  - easy parallel switching capability due to positive temperature coefficient in $V_{CEsat}$
- Low EMI
- New TO-247HC package offers increased air & creepage distances compared to TO247 package
- Qualified according to JEDEC J-STD-020 and JESD-022 for target applications
- Pb-free lead plating; RoHS compliant
- Halogen free (according to IEC 61249-2-21)
- Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/

Applications:
- Inductive cooking

| Type | $V_{CE}$ | $I_C$ | $V_{CEsat}$, $T_{vj}$=25°C | $T_{vjmax}$ | Marking | Package |
|---|---|---|---|---|---|---|
| IHY15N120R3 | 1200V | 15A | 1.48V | 175°C | H15R1203 | PG-TO247HC-3 |

**Maximum ratings**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage | $V_{CE}$ | 1200 | V |
| DC collector current, limited by $T_{vjmax}$<br>$T_C$ = 25°C<br>$T_C$ = 100°C | $I_C$ | <br>30.0<br>15.0 | A |
| Pulsed collector current, $t_p$ limited by $T_{vjmax}$ | $I_{Cpuls}$ | 45.0 | A |
| Turn off safe operating area $V_{CE}$ ≤ 1200V, $T_{vj}$ ≤ 175°C | - | 45.0 | A |
| Diode forward current, limited by $T_{vjmax}$<br>$T_C$ = 25°C<br>$T_C$ = 100°C | $I_F$ | <br>30.0<br>15.0 | A |
| Diode pulsed current, $t_p$ limited by $T_{vjmax}$ | $I_{Fpuls}$ | 45.0 | A |
| Gate-emitter voltage<br>Transient Gate-emitter voltage ($t_p$ = 10µs, D < 0.010) | $V_{GE}$ | ±20<br>±25 | V |
| Power dissipation $T_C$ = 25°C<br>Power dissipation $T_C$ = 100°C | $P_{tot}$ | 254.0<br>127.0 | W |
| Operating junction temperature | $T_{vj}$ | -40...+175 | °C |
| Storage temperature | $T_{stg}$ | -55...+175 | °C |
| Soldering temperature,<br>for 10 s (according to JEDEC J-STA-020A) | | 260 | °C |
| Mounting torque, M3 screw<br>Maximum of mounting processes: 3 | $M$ | 0.6 | Nm |

**Thermal Resistance**

| Parameter | Symbol | Conditions | Max. Value | Unit |
|---|---|---|---|---|
| **Characteristic** | | | | |
| IGBT thermal resistance, junction - case | $R_{th(j-c)}$ | | 0.59 | K/W |
| Diode thermal resistance, junction - case | $R_{th(j-c)}$ | | 0.59 | K/W |
| Thermal resistance junction - ambient | $R_{th(j-a)}$ | | 55 | K/W |

**Electrical Characteristic, at $T_{vj}$ = 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, $I_C$ = 0.50mA | 1200 | - | - | V |
| Collector-emitter saturation voltage | $V_{CEsat}$ | $V_{GE}$ = 15.0V, $I_C$ = 15.0A<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 175°C | <br>-<br>-<br>- | <br>1.48<br>1.70<br>1.80 | <br>1.70<br>-<br>- | V |
| Diode forward voltage | $V_F$ | $V_{GE}$ = 0V, $I_F$ = 15.0A<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 175°C | <br>-<br>-<br>- | <br>1.55<br>1.70<br>1.80 | <br>1.75<br>-<br> | V |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C$ = 0.40mA, $V_{CE}$ = $V_{GE}$ | 5.1 | 5.8 | 6.4 | V |
| Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$ = 1200V, $V_{GE}$ = 0V<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 175°C | <br>-<br>- | <br>-<br>- | <br>100.0<br>2500.0 | µA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = 20V | - | - | 100 | nA |
| Transconductance | $g_{fs}$ | $V_{CE}$ = 20V, $I_C$ = 15.0A | - | 13.9 | - | S |
| Integrated gate resistor | $r_G$ | | | none | | Ω |

**Electrical Characteristic, at $T_{vj}$ = 25°C, unless otherwise specified**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic Characteristic** | | | | | | |
| Input capacitance | $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | - | 1165 | - | pF |
| Output capacitance | $C_{oes}$ | | - | 40 | - | |
| Reverse transfer capacitance | $C_{res}$ | | - | 32 | - | |
| Gate charge | $Q_G$ | $V_{CC}$ = 960V, $I_C$ = 15.0A, $V_{GE}$ = 15V | - | 165.0 | - | nC |

**Switching Characteristic, Inductive Load, at $T_{vj}$ = 25°C**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **IGBT Characteristic** | | | | | | |
| Turn-off delay time | $t_{d(off)}$ | $T_{vj}$ = 25°C, $V_{CC}$ = 600V, $I_C$ = 15.0A, $V_{GE}$ = 0.0/15.0V, $r_G$ = 14.6Ω, $L_\sigma$ = 180nH, $C_\sigma$ = 39pF $L_\sigma$, $C_\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery. | - | 300 | - | ns |
| Fall time | $t_f$ | | - | 46 | - | ns |
| Turn-off energy | $E_{off}$ | | - | 0.70 | - | mJ |

**Switching Characteristic, Inductive Load, at $T_{vj}$ = 175°C**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **IGBT Characteristic** | | | | | | |
| Turn-off delay time | $t_{d(off)}$ | $T_{vj}$ = 175°C, $V_{CC}$ = 600V, $I_C$ = 15.0A, $V_{GE}$ = 0.0/15.0V, $r_G$ = 14.6Ω, $L_\sigma$ = 180nH, $C_\sigma$ = 39pF $L_\sigma$, $C_\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery. | - | 370 | - | ns |
| Fall time | $t_f$ | | - | 90 | - | ns |
| Turn-off energy | $E_{off}$ | | - | 1.25 | - | mJ |

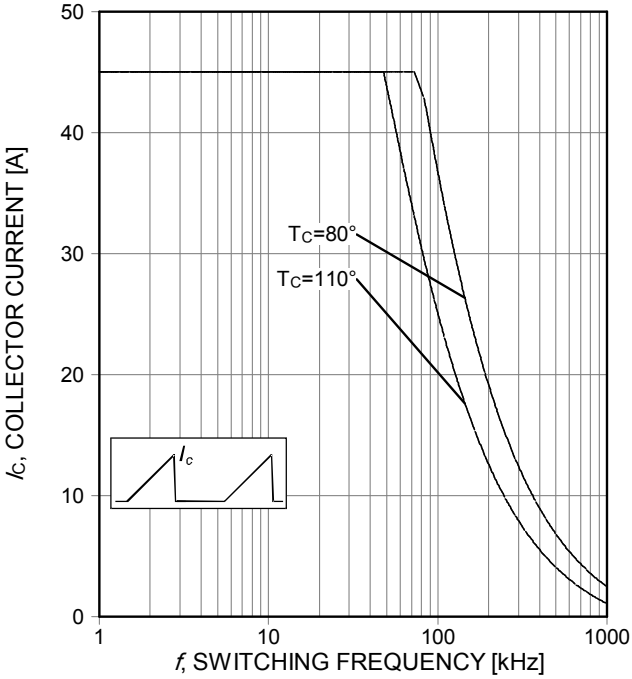



**Figure 1. Collector current as a function of switching frequency**
($T_j$≤175°C, $D$=0.5, $V_{CE}$=600V, $V_{GE}$=15/0V, $R_G$=14,6Ω)

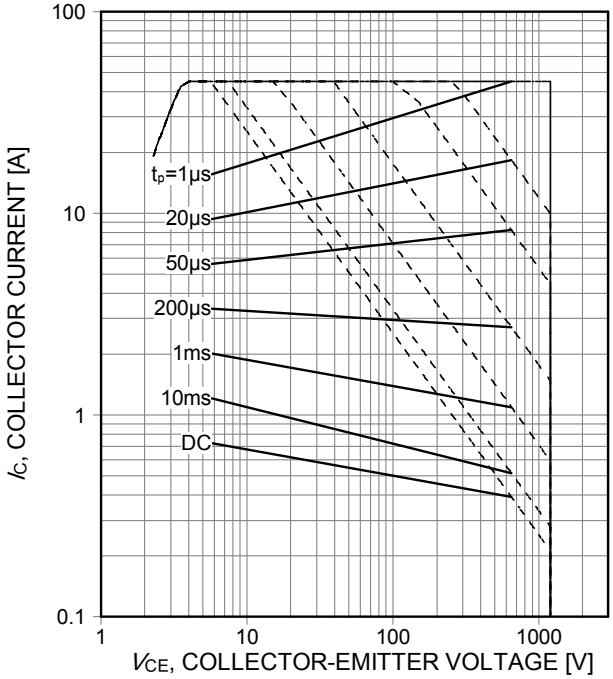



**Figure 2. Forward bias safe operating area**
($D$=0, $T_C$=25°C, $T_j$≤175°C; $V_{GE}$=15V)

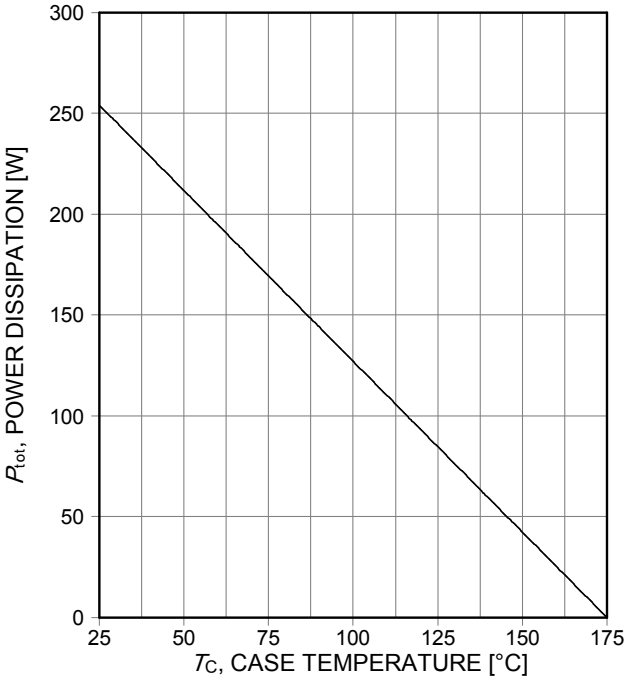



**Figure 3. Power dissipation as a function of case temperature**
($T_j$≤175°C)

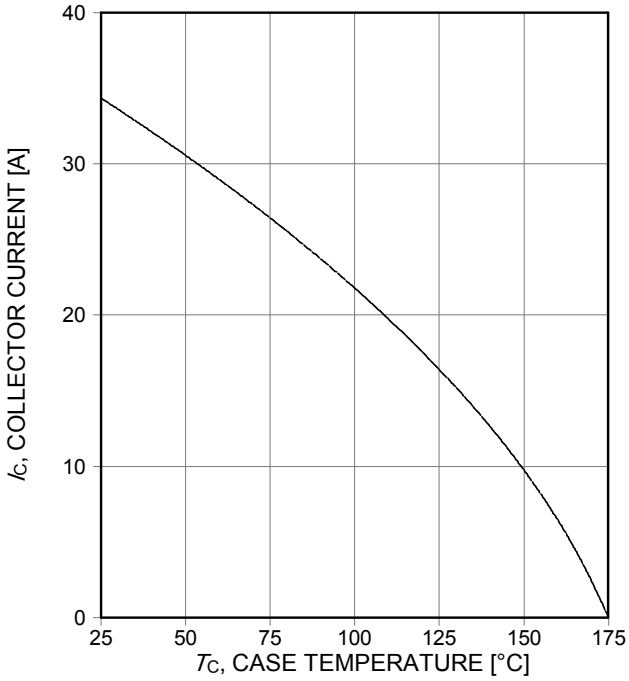



**Figure 4. Collector current as a function of case temperature**
($V_{GE}$≥15V, $T_j$≤175°C)

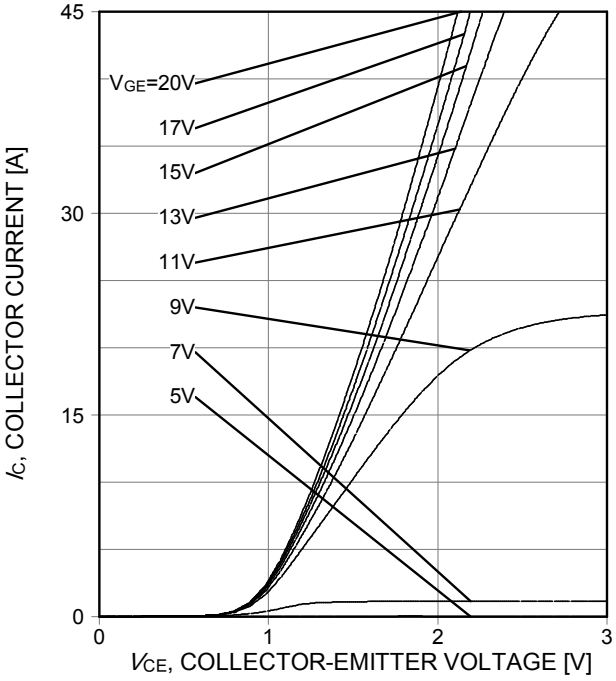



**Figure 5. Typical output characteristic**
($T_j$=25°C)

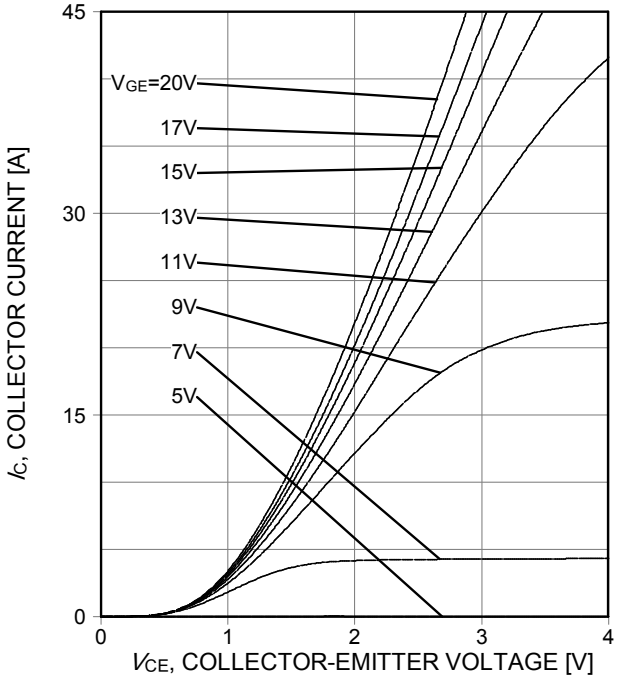



**Figure 6. Typical output characteristic**
($T_j$=175°C)

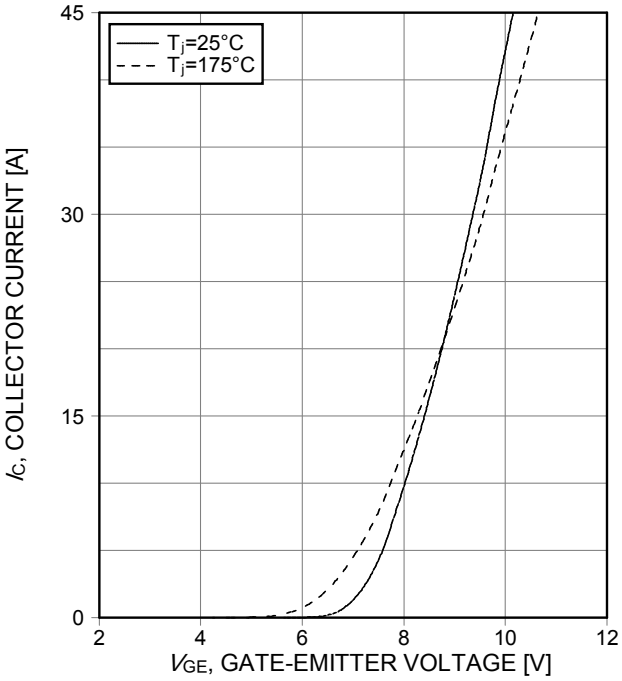



**Figure 7. Typical transfer characteristic**
($V_{CE}$=20V)

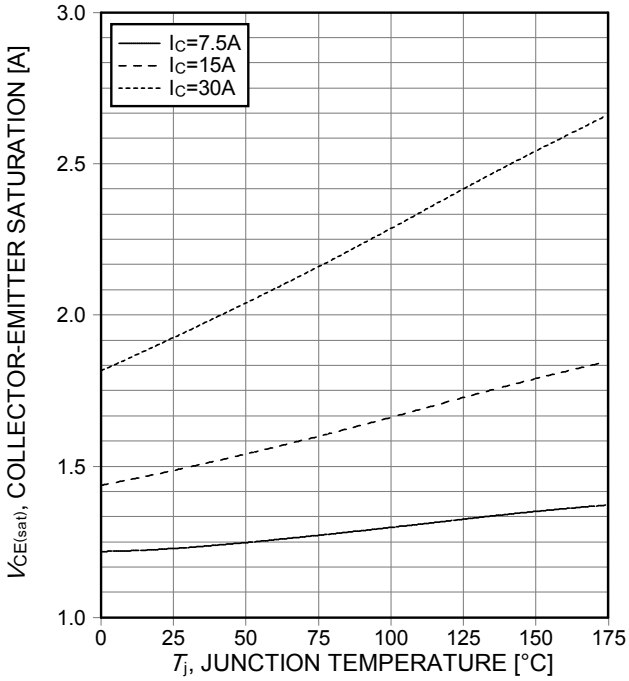



**Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}$=15V)

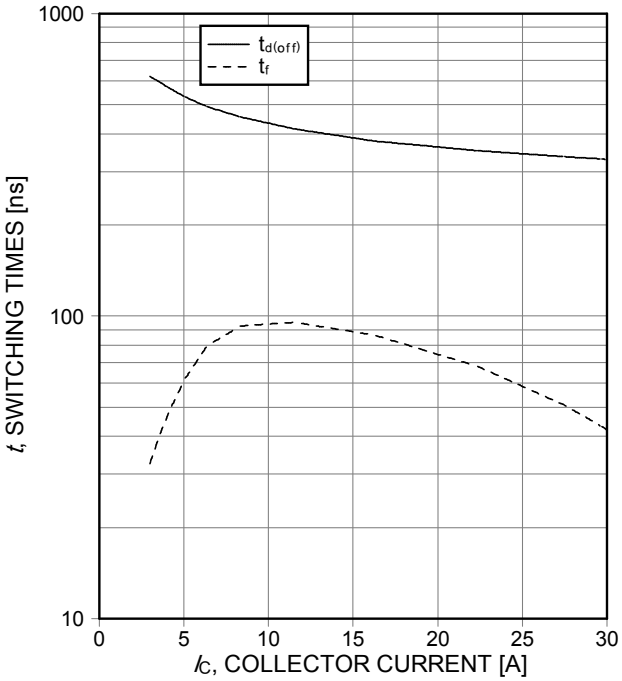



**Figure 9. Typical switching times as a function of collector current**
(ind. load, $T_j$=175°C, $V_{CE}$=600V, $V_{GE}$=15/0V, $R_G$=14,6Ω, test circuit in Fig. E)

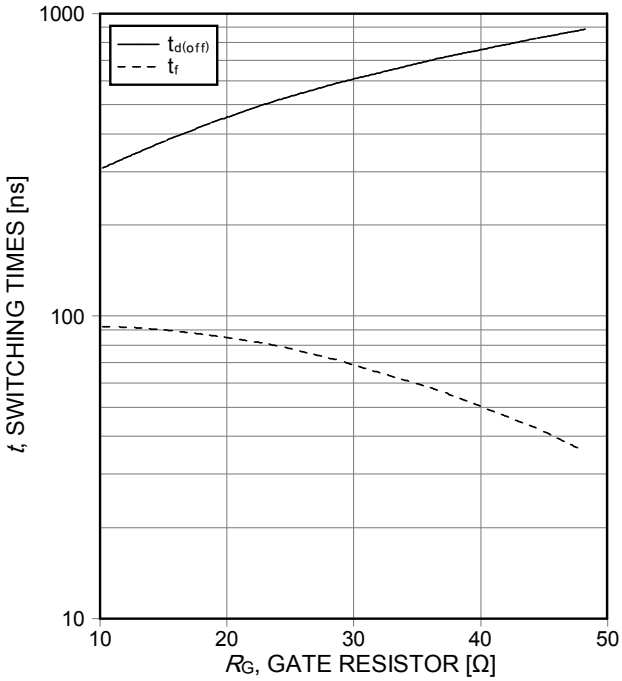



**Figure 10. Typical switching times as a function of gate resistor**
(ind. load, $T_j$=175°C, $V_{CE}$=600V, $V_{GE}$=15/0V, $I_C$=15A, test circuit in Fig. E)

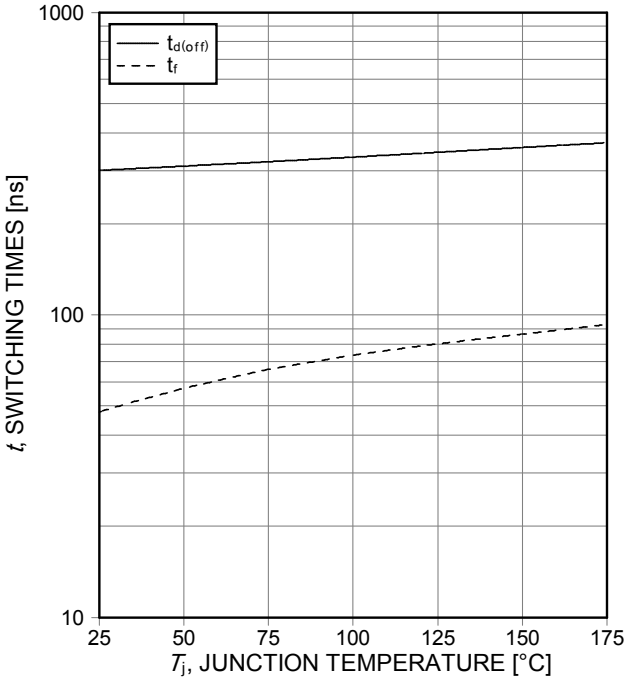



**Figure 11. Typical switching times as a function of junction temperature**
(ind. load, $V_{CE}$=600V, $V_{GE}$=15/0V, $I_C$=15A, $R_G$=14,6Ω, test circuit in Fig. E)

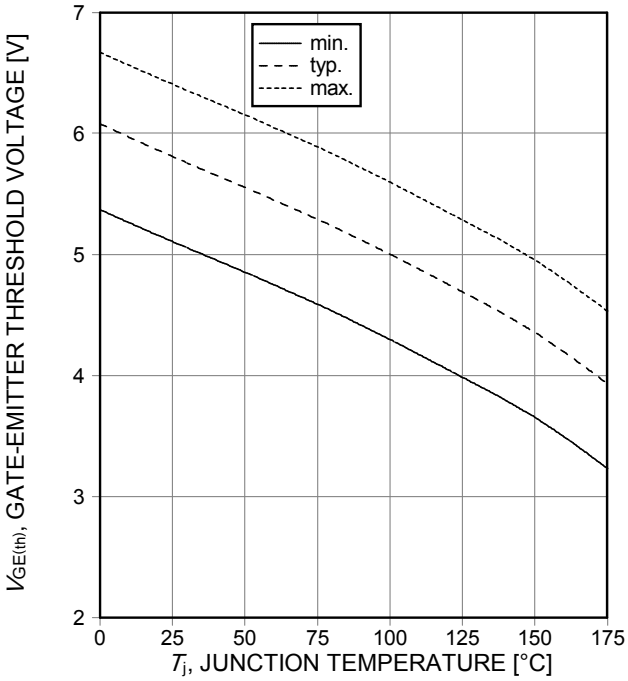



**Figure 12. Gate-emitter threshold voltage as a function of junction temperature**
($I_C$=0.4mA)

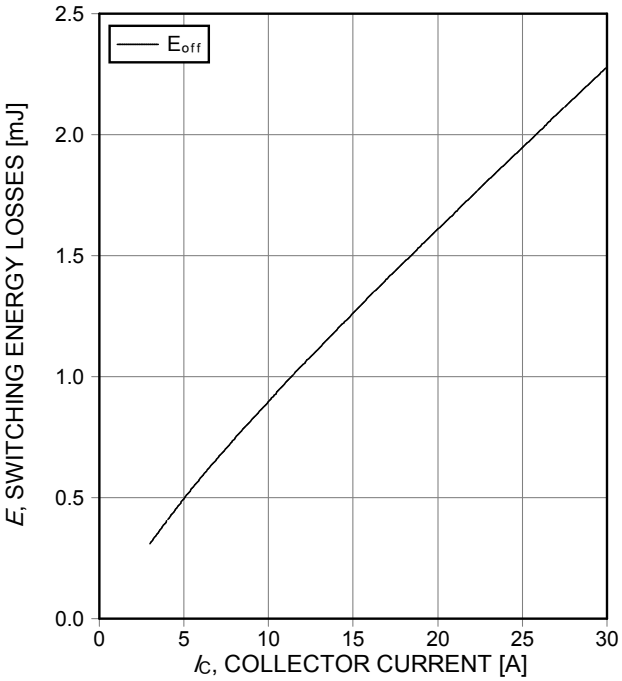



**Figure 13. Typical switching energy losses as a function of collector current**
(ind. load, $T_j$=175°C, $V_{CE}$=600V, $V_{GE}$=15/0V, $R_G$=14,6Ω, test circuit in Fig. E)

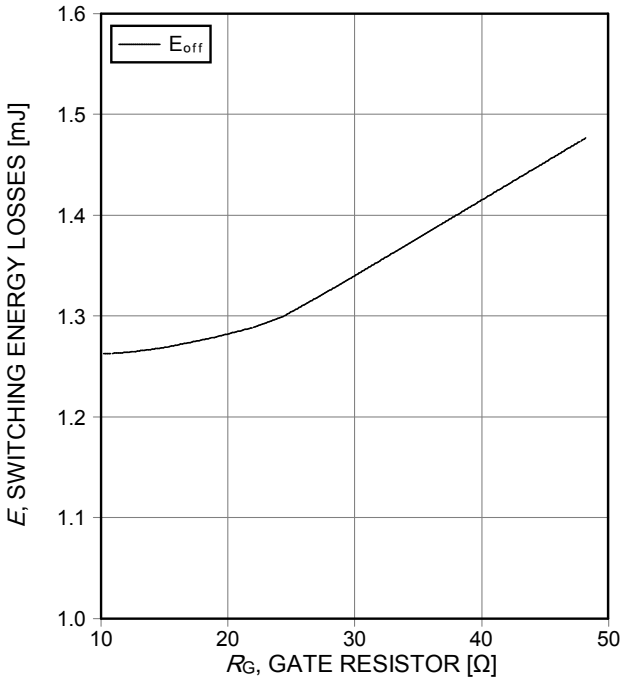



**Figure 14. Typical switching energy losses as a function of gate resistor**
(ind. load, $T_j$=175°C, $V_{CE}$=600V, $V_{GE}$=15/0V, $I_C$=15A, test circuit in Fig. E)

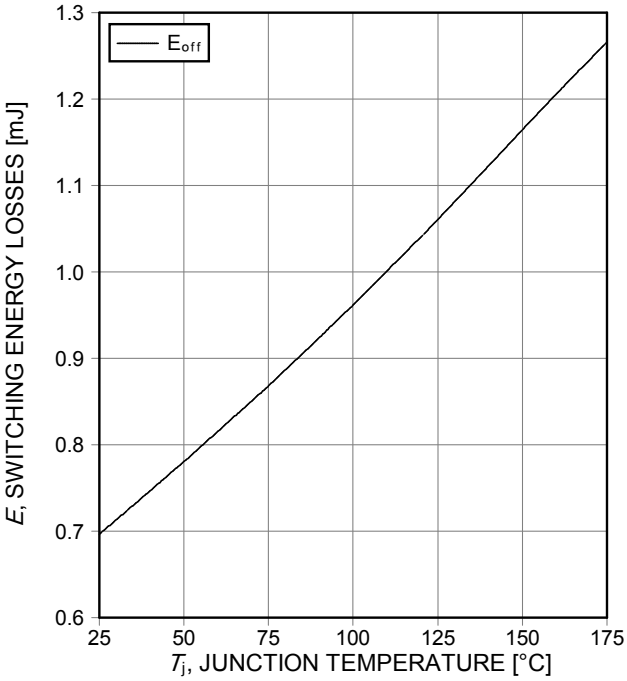



**Figure 15. Typical switching energy losses as a function of junction temperature**
(ind load, $V_{CE}$=600V, $V_{GE}$=15/0V, $I_C$=15A, $R_G$=14,6Ω, test circuit in Fig. E)

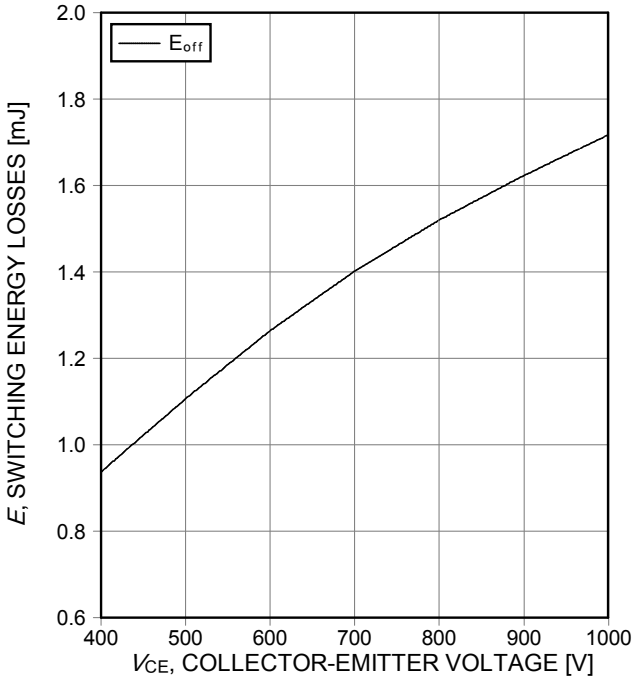



**Figure 16. Typical switching energy losses as a function of collector emitter voltage**
(ind. load, $T_j$=175°C, $V_{GE}$=15/0V, $I_C$=15A, $R_G$=14,6Ω, test circuit in Fig. E)

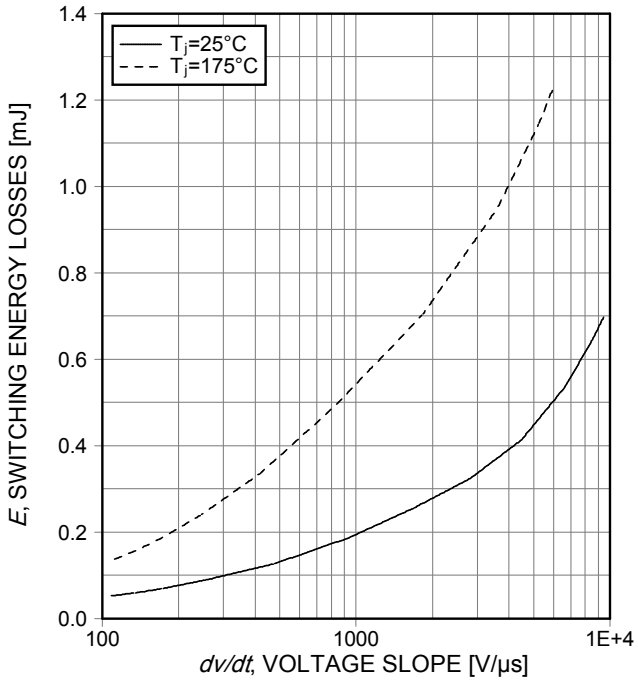



**Figure 17. Typical turn off switching energy loss for soft switching**
(ind load, $V_{CE}$=600V, $V_{GE}$=15/0V, $I_C$=15A, $R_G$=14,6Ω, test circuit in Fig. E)

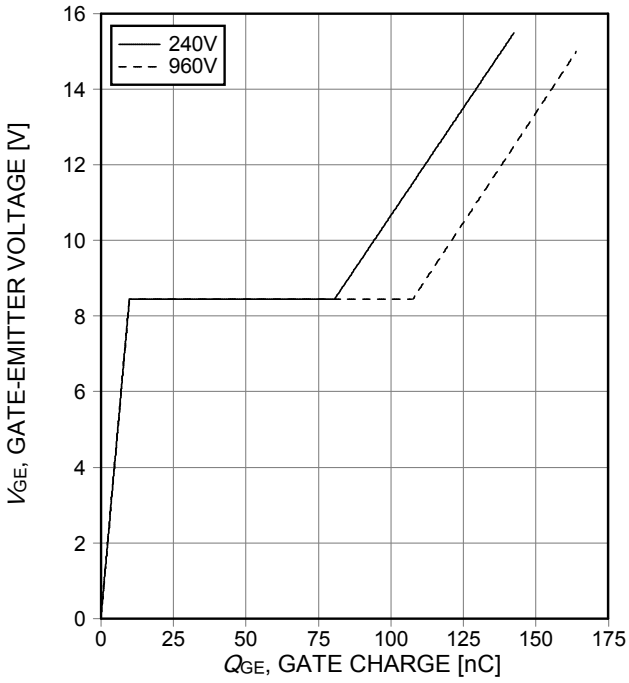



**Figure 18. Typical gate charge**
($I_C$=15A)

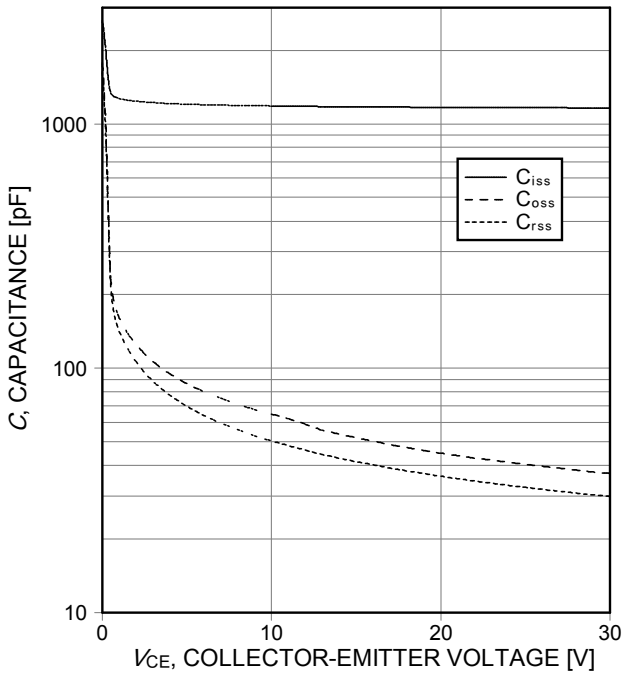



**Figure 19. Typical capacitance as a function of collector-emitter voltage**
($V_{GE}$=0V, f=1MHz)

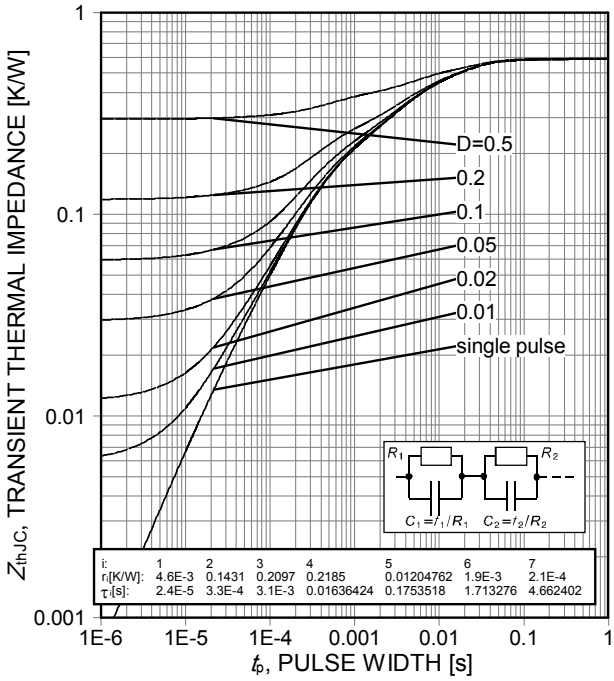



**Figure 20. IGBT transient thermal impedance**
($D=t_p/T$)

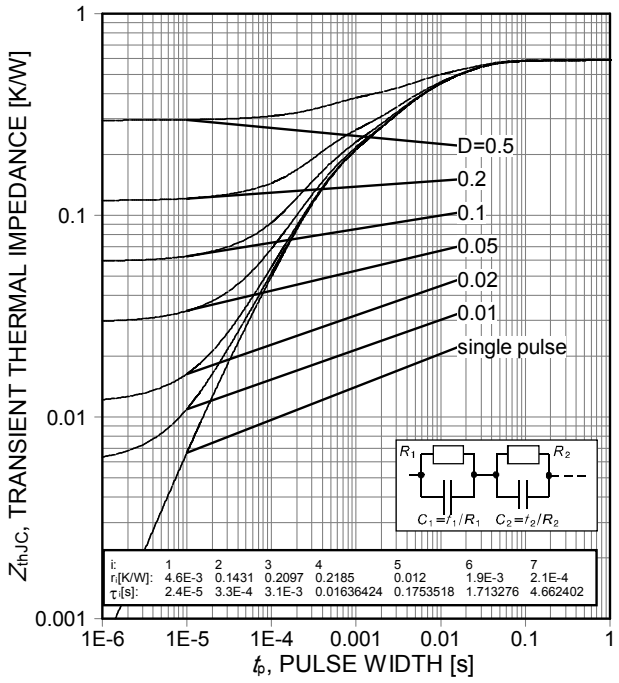



**Figure 21. Diode transient thermal impedance as a function of pulse width**
($D=t_p/T$)

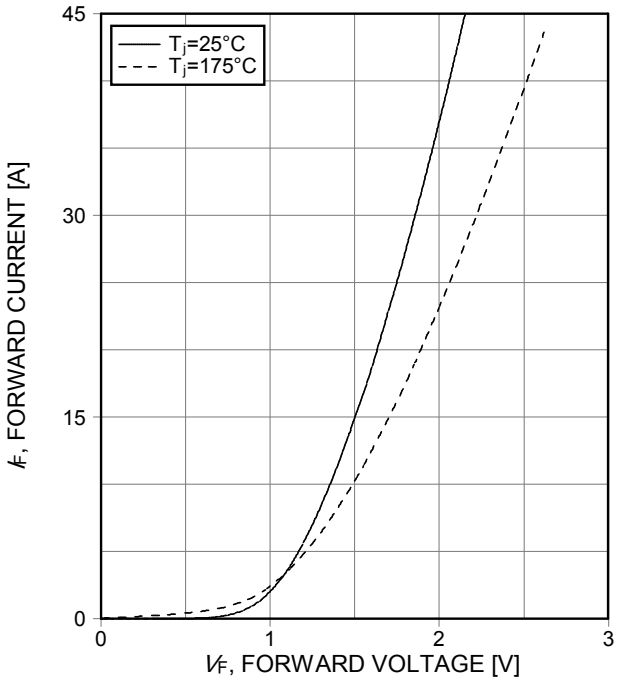



**Figure 22. Typical diode forward current as a function of forward voltage**

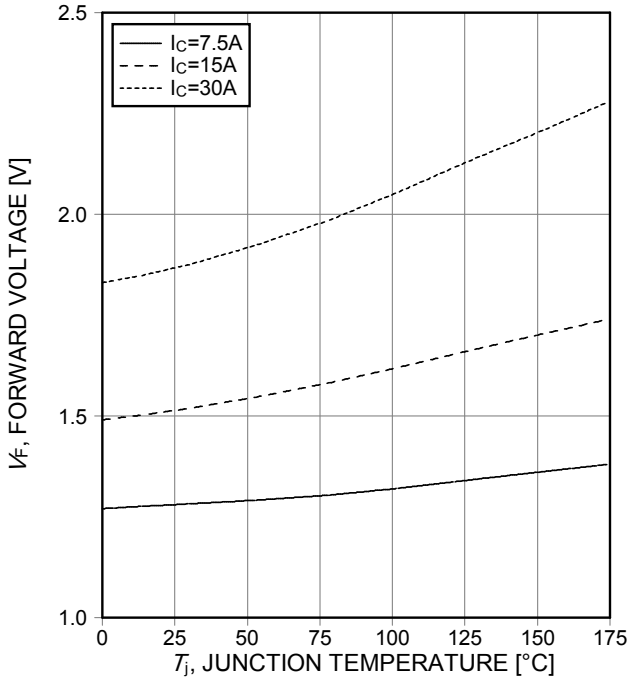
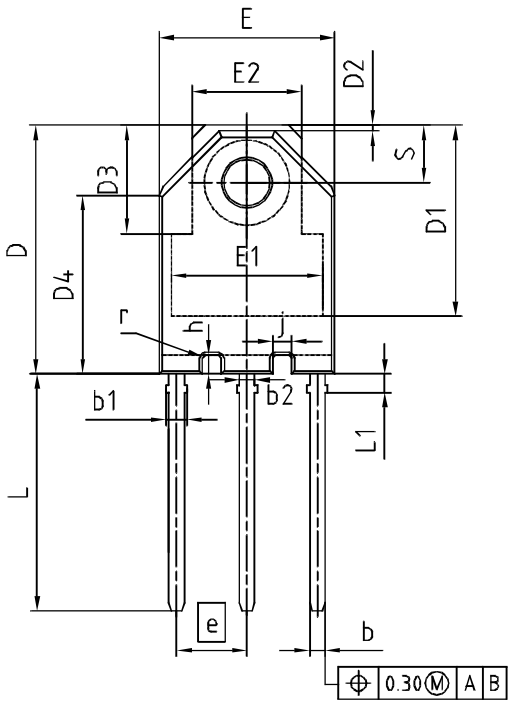
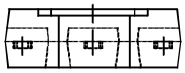
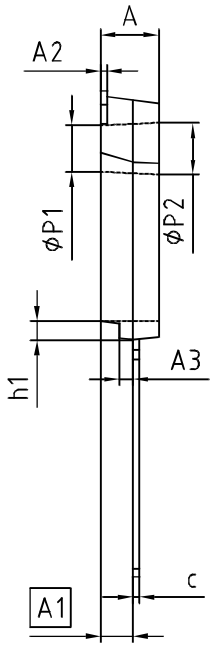



**Figure 23. Typical diode forward voltage as a function of junction temperature**

# PG-TO247HC-3 (PG-TOHC-3)






| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| A1 | 2.40 | 2.60 | 0.094 | 0.102 |
| A2 | 0.40 | 0.60 | 0.016 | 0.024 |
| A3 | 0.95 | 1.15 | 0.037 | 0.045 |
| b | 1.10 | 1.30 | 0.043 | 0.051 |
| b1 | 1.50 | 1.70 | 0.059 | 0.067 |
| b2 | 1.10 | 1.30 | 0.043 | 0.051 |
| c | 0.40 | 0.60 | 0.016 | 0.024 |
| D | 19.05 | 19.45 | 0.750 | 0.766 |
| D1 | 14.69 | 14.89 | 0.578 | 0.586 |
| D2 | 0.35 | 0.55 | 0.014 | 0.022 |
| D3 | 8.30 | 8.50 | 0.327 | 0.335 |
| D4 | 13.51 | 14.11 | 0.532 | 0.556 |
| E | 13.40 | 13.80 | 0.528 | 0.543 |
| E1 | 11.60 | 11.80 | 0.457 | 0.465 |
| E2 | 8.30 | 8.70 | 0.327 | 0.343 |
| e | 5.45 | | 0.215 | |
| N | 3 | | 3 | |
| L | 18.05 | 18.65 | 0.711 | 0.734 |
| L1 | 1.35 | 1.55 | 0.053 | 0.061 |
| øP1 | 3.51 | 3.71 | 0.138 | 0.146 |
| øP2 | 4.00 | 4.10 | 0.157 | 0.161 |
| S | 4.35 | 4.55 | 0.171 | 0.179 |
| j | 1.35 | 1.55 | 0.053 | 0.061 |
| h | 1.35 | 1.55 | 0.053 | 0.061 |
| r | max 0.2 | | max 0.008 | |
| h1 | 1.35 | 1.55 | 0.053 | 0.061 |

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Z8B00151733

SCALE 0 2.5 0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
11-03-2009

REVISION
01

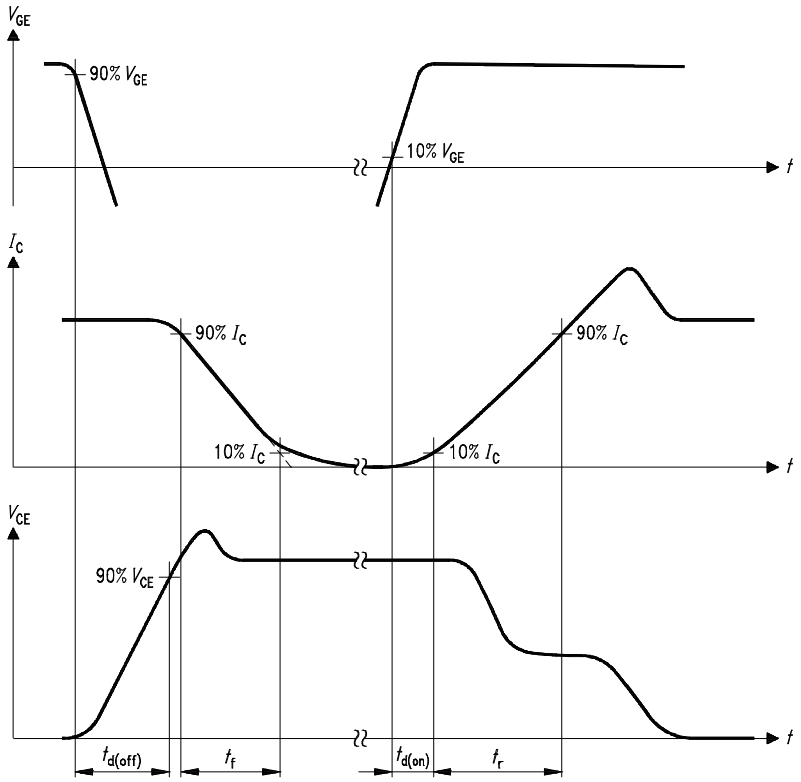


**Figure A. Definition of switching times**

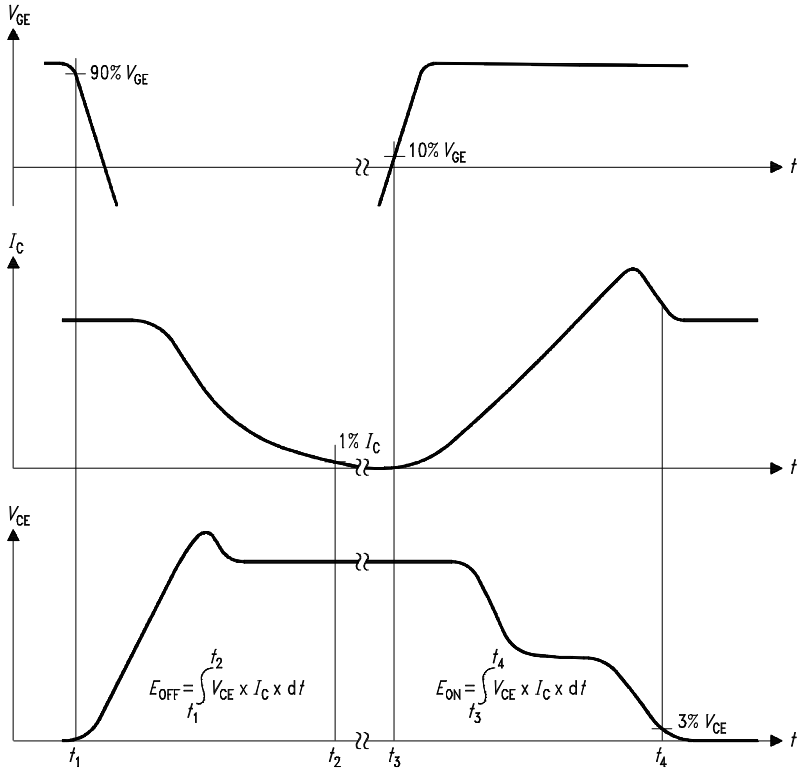


**Figure B. Definition of switching losses**

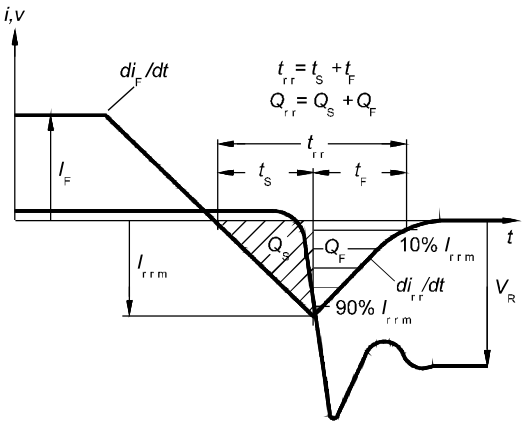


**Figure C. Definition of diodes switching characteristics**

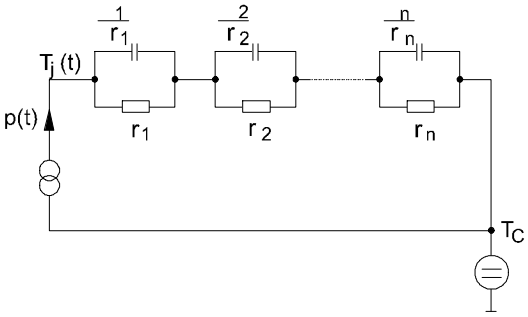


**Figure D. Thermal equivalent circuit**

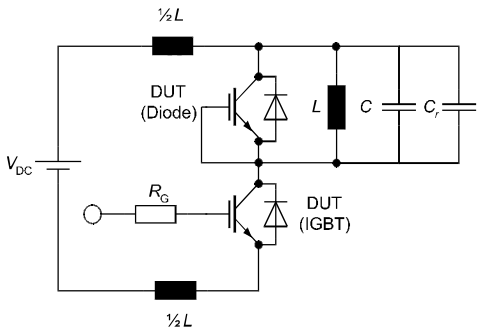


**Figure E. Dynamic test circuit**
Leakage inductance L= 180nH,
Stray capacitor $C_\sigma$ = 40pF,
Relief capacitor $C_r$ = 1nF
(only for ZVT switching)

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