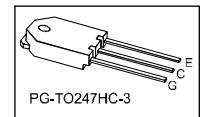
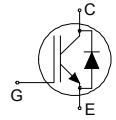


Reverse conducting IGBT with monolithic body diode

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 | $V_{CEsat}, T_{vj}=25^{\circ}C$ | 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} $T_C = 25^{\circ}C$ $T_C = 100^{\circ}C$ | I_C | 30.0 15.0 | A |
| Pulsed collector current, t_p limited by T_{vjmax} | I_{Cpuls} | 45.0 | A |
| Turn off safe operating area $V_{CE} \leq 1200V, T_{vj} \leq 175^{\circ}C$ | - | 45.0 | A |
| Diode forward current, limited by T_{vjmax} $T_C = 25^{\circ}C$ $T_C = 100^{\circ}C$ | I_F | 30.0 15.0 | A |
| Diode pulsed current, t_p limited by T_{vjmax} | I_{Fpuls} | 45.0 | A |
| Gate-emitter voltage Transient Gate-emitter voltage ($t_p = 10\mu s, D < 0.010$) | V_{GE} | ± 20 ± 25 | V |
| Power dissipation $T_C = 25^{\circ}C$ Power dissipation $T_C = 100^{\circ}C$ | P_{tot} | 254.0 127.0 | W |
| Operating junction temperature | T_{vj} | -40...+175 | °C |
| Storage temperature | T_{stg} | -55...+175 | °C |
| Soldering temperature, for 10 s (according to JEDEC J-STA-020A) | | 260 | °C |
| Mounting torque, M3 screw 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 $T_{vj} = 25^{\circ}\text{C}$, 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} | $V_{GE} = 15.0V, I_C = 15.0A$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$ | - - - | 1.48 1.70 1.80 | 1.70 - - | V |
| Diode forward voltage | V_F | $V_{GE} = 0V, I_F = 15.0A$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$ | - - - | 1.55 1.70 1.80 | 1.75 - - | 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} | $V_{CE} = 1200V, V_{GE} = 0V$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$ | - - | - - | 100.0 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 $T_{vj} = 25^{\circ}\text{C}$, 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 $T_{vj} = 25^{\circ}\text{C}$

| Parameter | Symbol | Conditions | Value | | | Unit |
|----------------------------|--------------|--|-------|------|------|------|
| | | | min. | typ. | max. | |
| IGBT Characteristic | | | | | | |
| Turn-off delay time | $t_{d(off)}$ | $T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 600\text{V}$, $I_C = 15.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $r_G = 14.6\Omega$, $L_{\sigma} = 180\text{nH}$, $C_{\sigma} = 39\text{pF}$ L_{σ} , C_{σ} 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 $T_{vj} = 175^{\circ}\text{C}$

| Parameter | Symbol | Conditions | Value | | | Unit |
|----------------------------|--------------|---|-------|------|------|------|
| | | | min. | typ. | max. | |
| IGBT Characteristic | | | | | | |
| Turn-off delay time | $t_{d(off)}$ | $T_{vj} = 175^{\circ}\text{C}$, $V_{CC} = 600\text{V}$, $I_C = 15.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $r_G = 14.6\Omega$, $L_{\sigma} = 180\text{nH}$, $C_{\sigma} = 39\text{pF}$ L_{σ} , C_{σ} 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 |

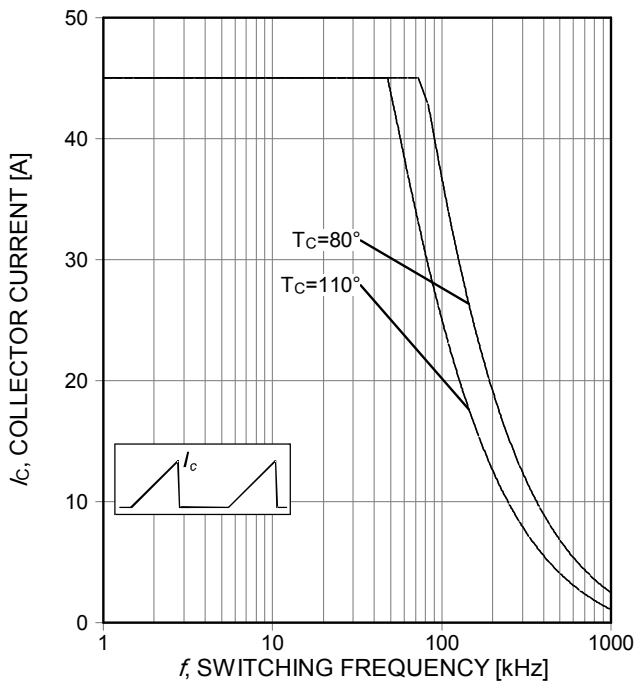


Figure 1. Collector current as a function of switching frequency
 ($T_j \leq 175^\circ\text{C}$, $D=0.5$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $R_G=14,6\Omega$)

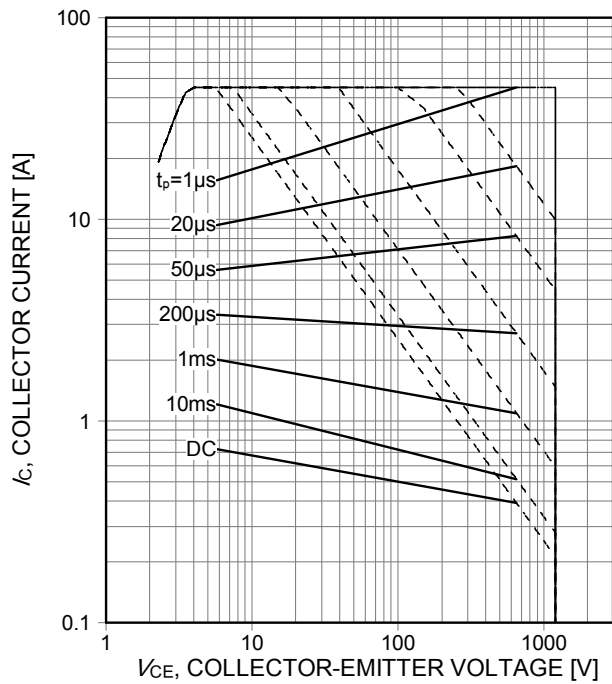


Figure 2. Forward bias safe operating area
 ($D=0$, $T_C=25^\circ\text{C}$, $T_j \leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$)

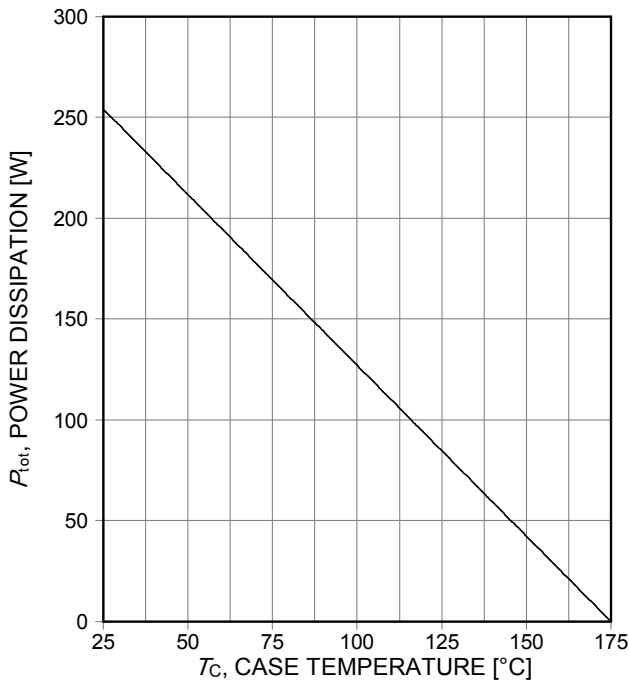


Figure 3. Power dissipation as a function of case temperature
 ($T_j \leq 175^\circ\text{C}$)

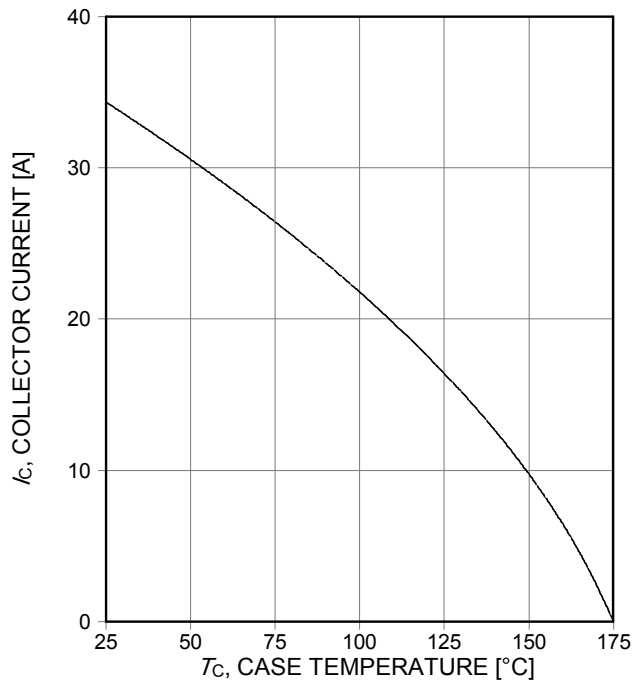


Figure 4. Collector current as a function of case temperature
 ($V_{GE} \geq 15\text{V}$, $T_j \leq 175^\circ\text{C}$)

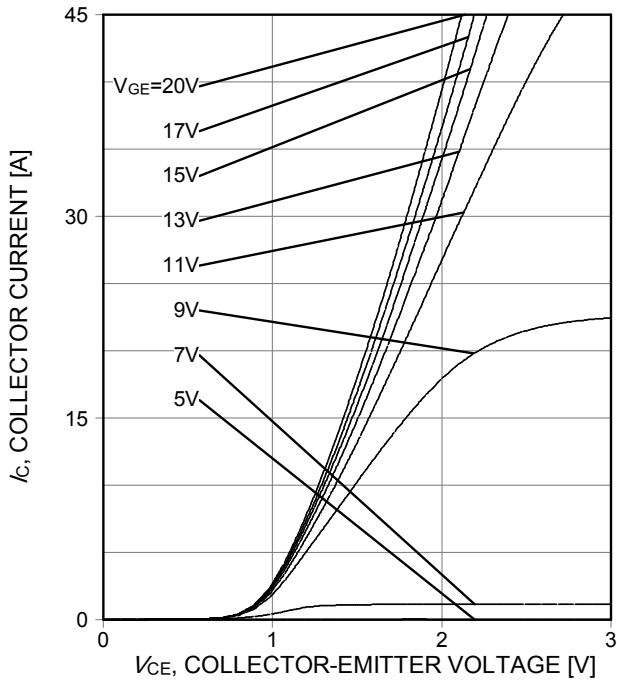


Figure 5. Typical output characteristic ($T_j=25^\circ\text{C}$)

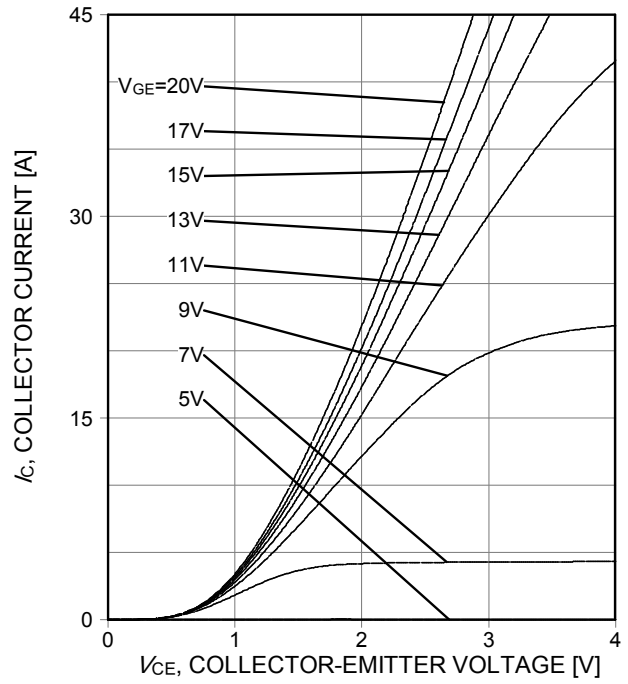


Figure 6. Typical output characteristic ($T_j=175^\circ\text{C}$)

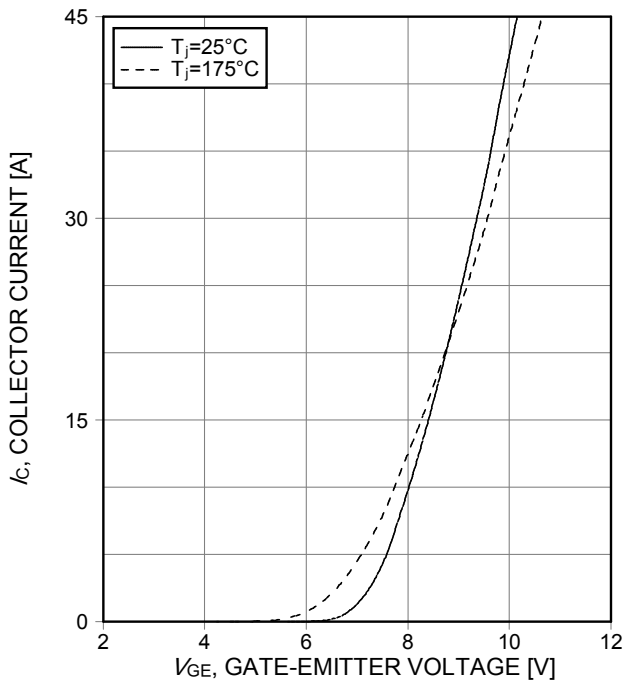


Figure 7. Typical transfer characteristic ($V_{CE}=20\text{V}$)

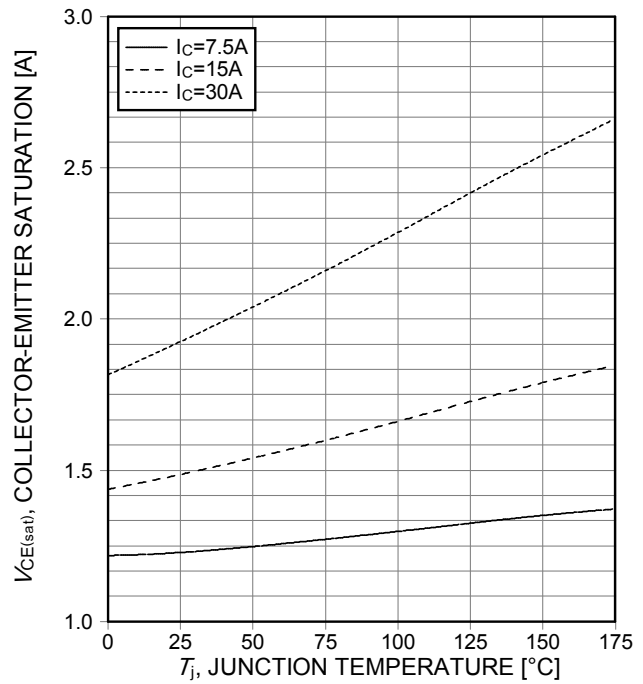


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15\text{V}$)

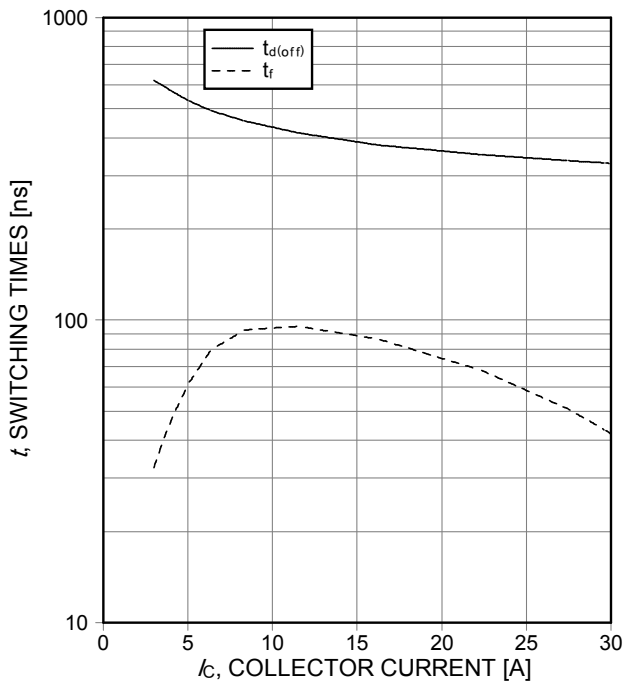


Figure 9. Typical switching times as a function of collector current
 (ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $R_G=14,6\Omega$, test circuit in Fig. E)

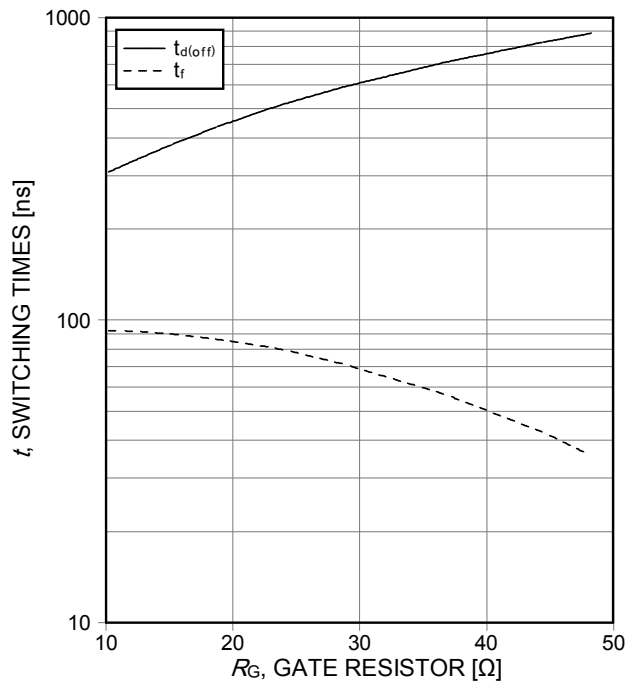


Figure 10. Typical switching times as a function of gate resistor
 (ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, test circuit in Fig. E)

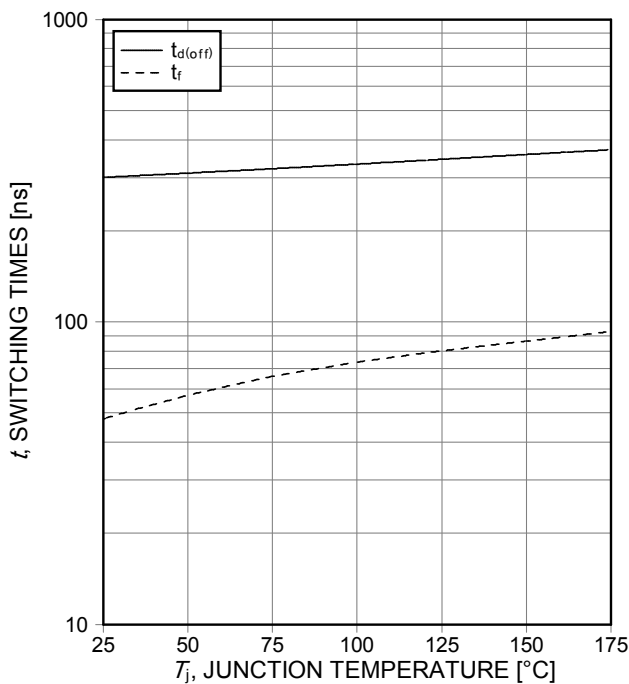


Figure 11. Typical switching times as a function of junction temperature
 (ind. load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, $R_G=14,6\Omega$, test circuit in Fig. E)

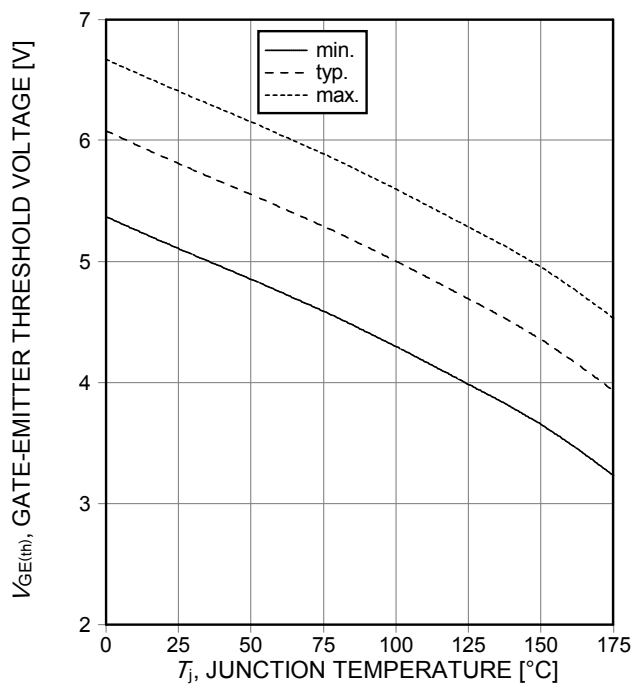


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
 ($I_C=0.4\text{mA}$)

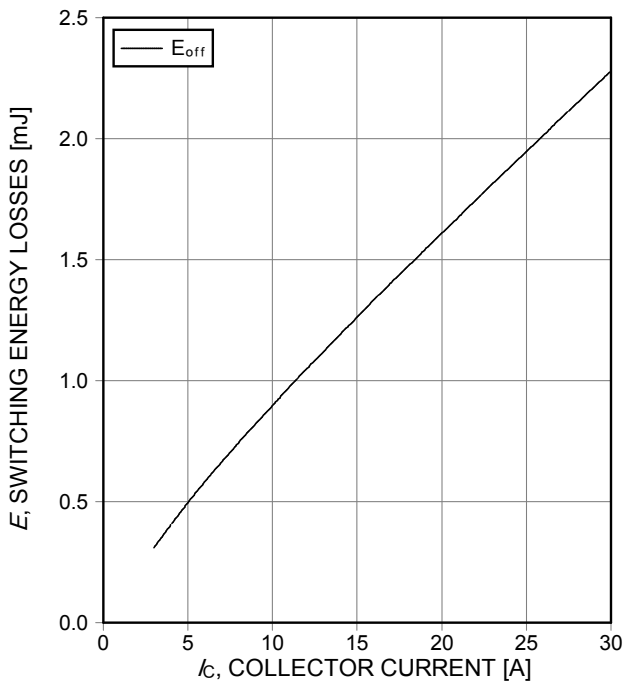


Figure 13. Typical switching energy losses as a function of collector current
 (ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $R_G=14,6\Omega$, test circuit in Fig. E)

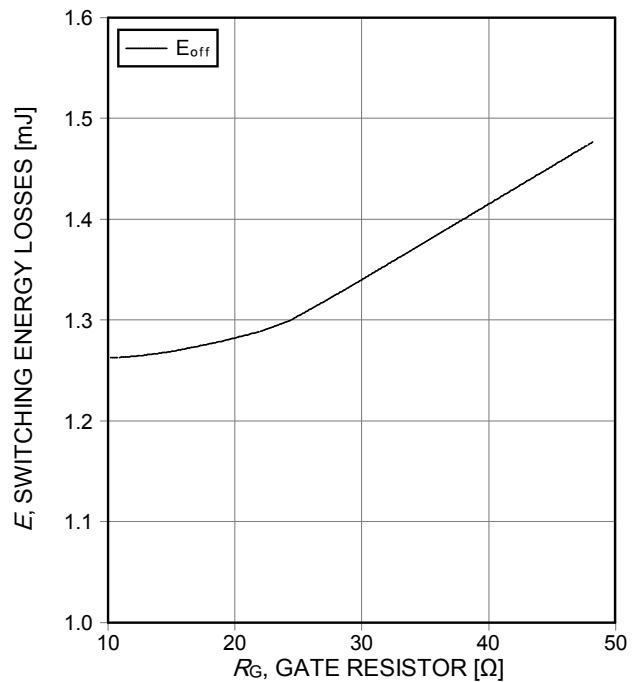


Figure 14. Typical switching energy losses as a function of gate resistor
 (ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_c=15\text{A}$, test circuit in Fig. E)

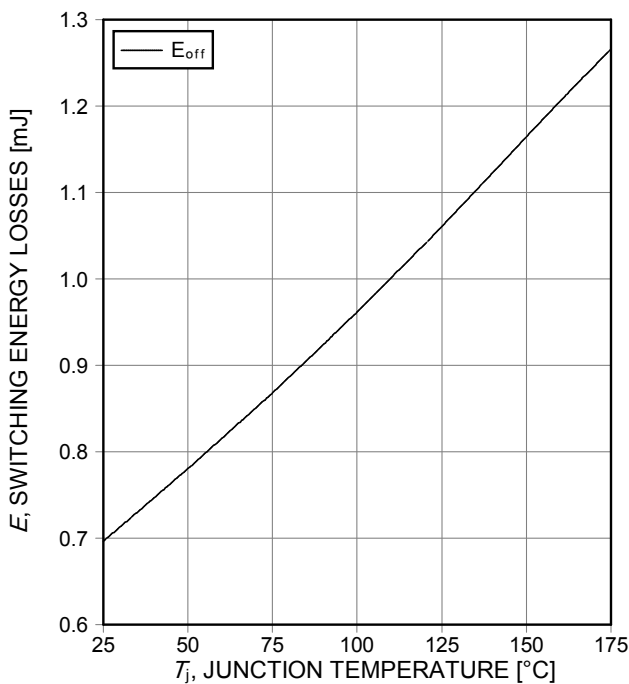


Figure 15. Typical switching energy losses as a function of junction temperature
 (ind. load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_c=15\text{A}$, $R_G=14,6\Omega$, test circuit in Fig. E)

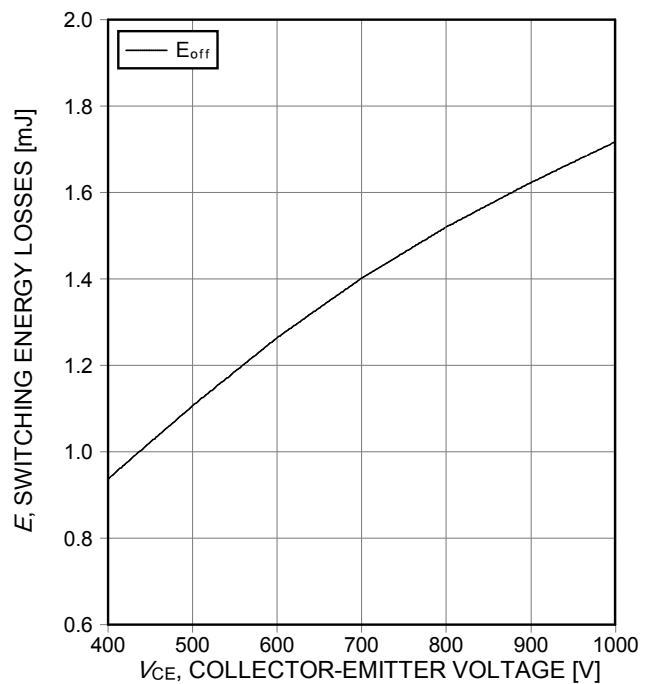


Figure 16. Typical switching energy losses as a function of collector emitter voltage
 (ind. load, $T_j=175^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_c=15\text{A}$, $R_G=14,6\Omega$, test circuit in Fig. E)

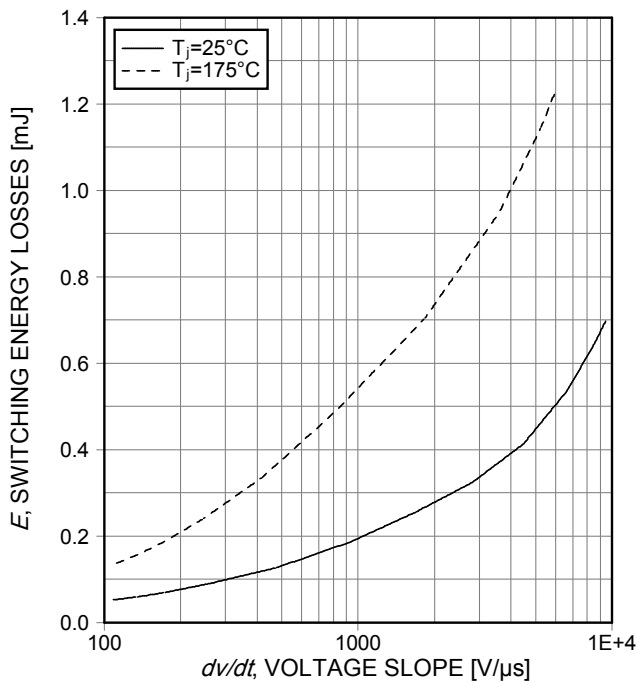


Figure 17. Typical turn off switching energy loss for soft switching
 (ind load, $V_{CE}=600V$, $V_{GE}=15/0V$, $I_C=15A$, $R_G=14,6\Omega$, test circuit in Fig. E)

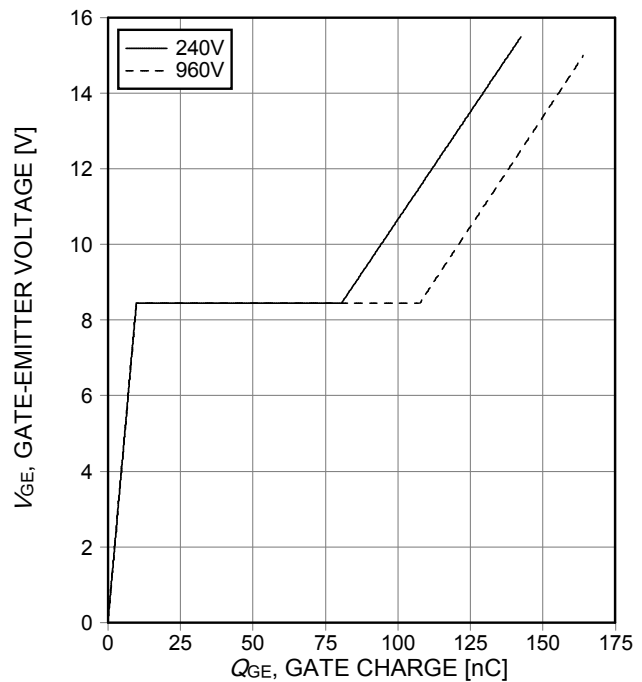


Figure 18. Typical gate charge
 ($I_C=15A$)

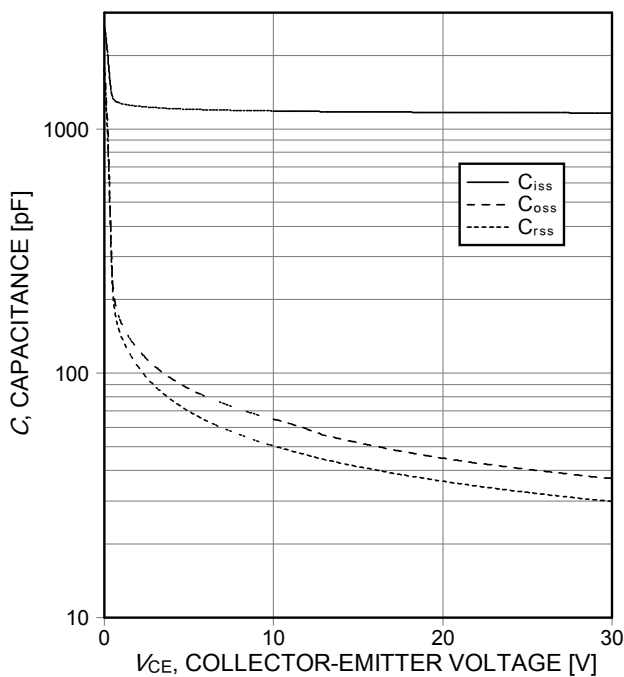


Figure 19. Typical capacitance as a function of collector-emitter voltage
 ($V_{GE}=0V$, $f=1MHz$)

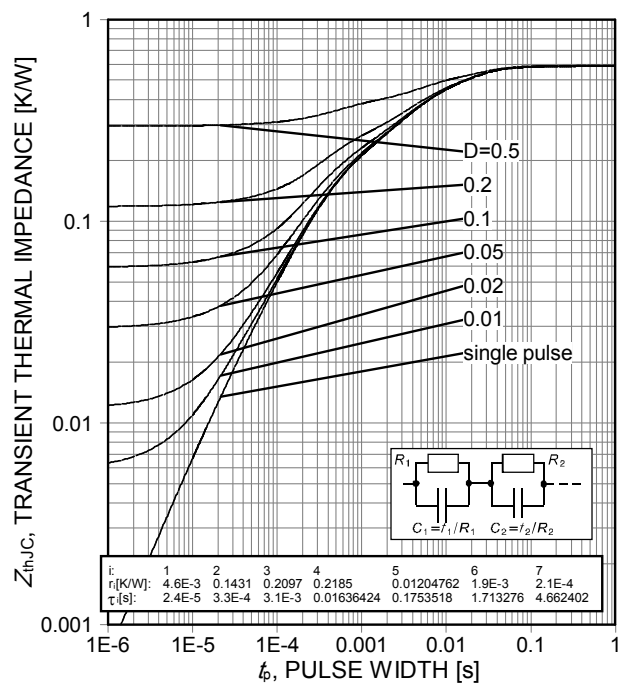


Figure 20. IGBT transient thermal impedance
 ($D=t_p/T$)

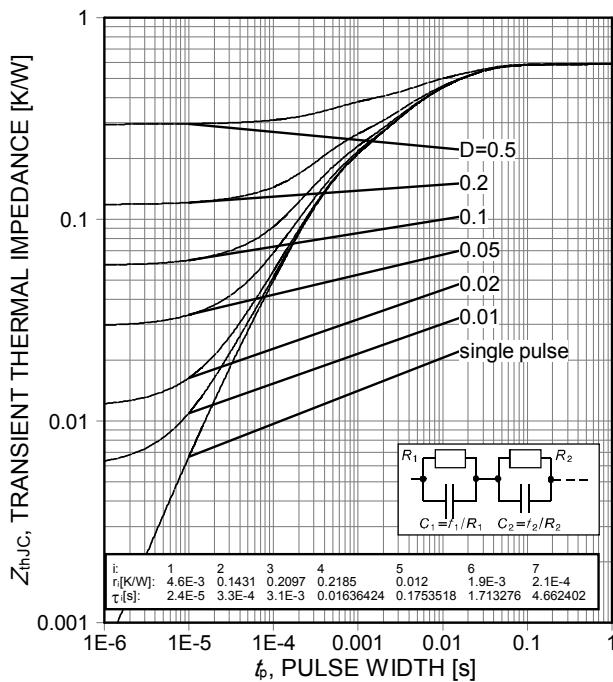


Figure 21. Diode transient thermal impedance as a function of pulse width ($D = t_p/T$)

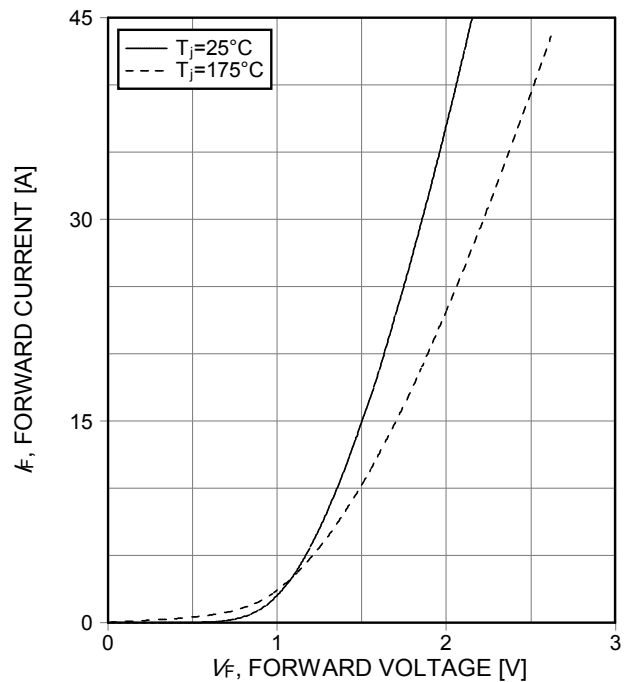


Figure 22. Typical diode forward current as a function of forward voltage

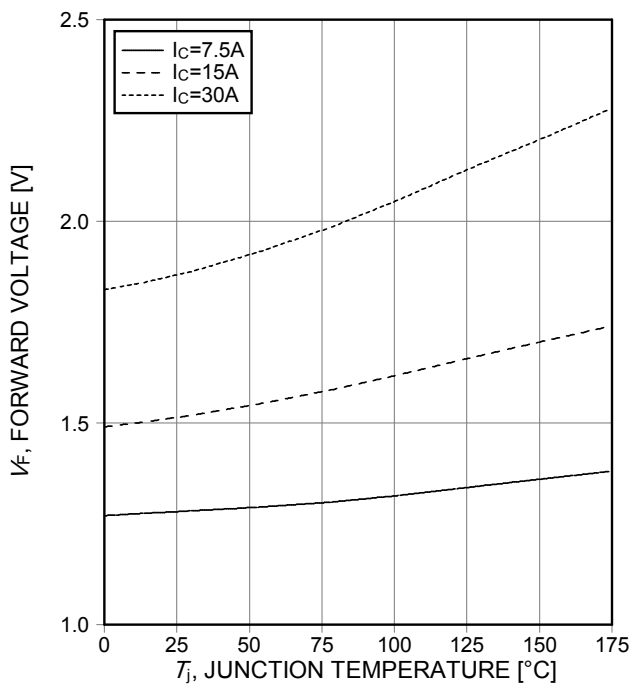
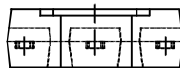
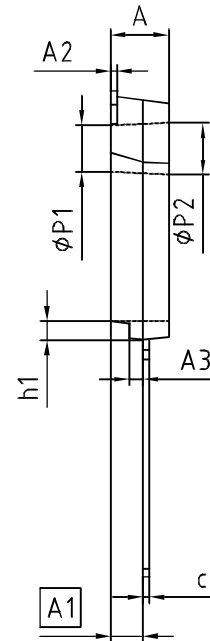
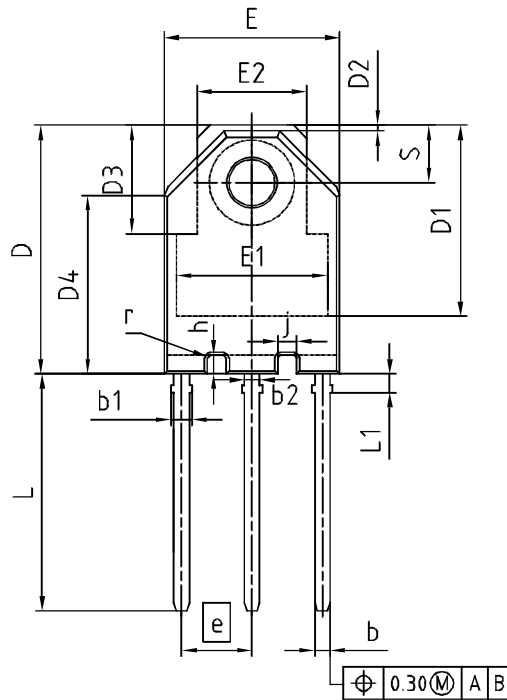


Figure 23. Typical diode forward voltage as a function of junction temperature

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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EUROPEAN PROJECTION

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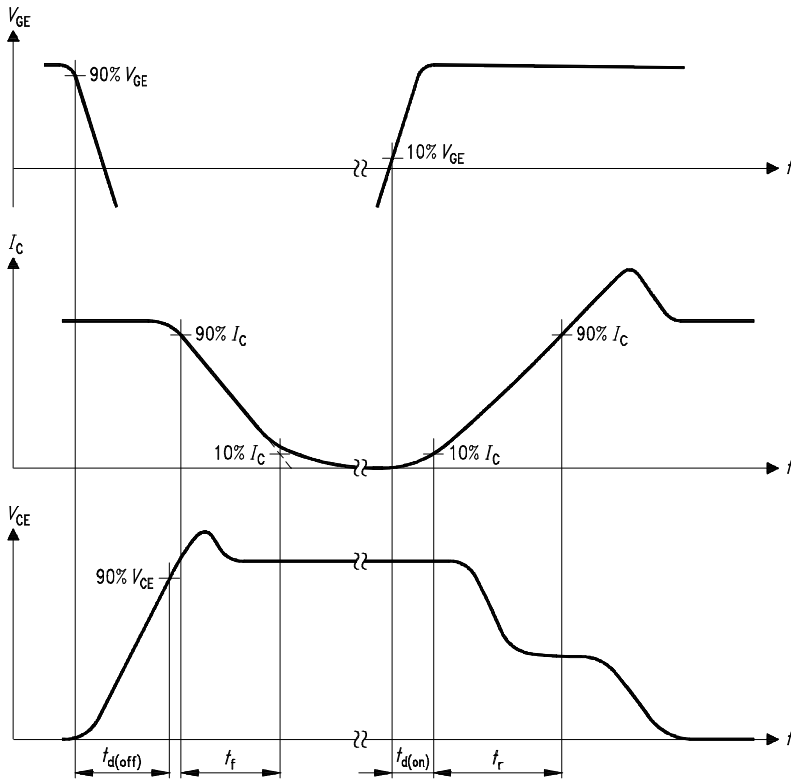


Figure A. Definition of switching times

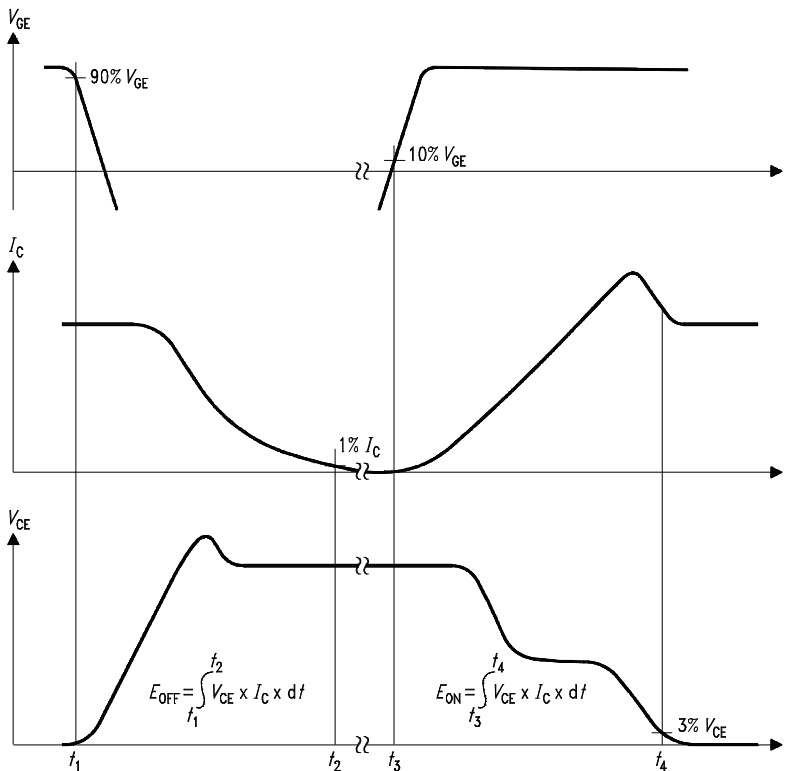


Figure B. Definition of switching losses

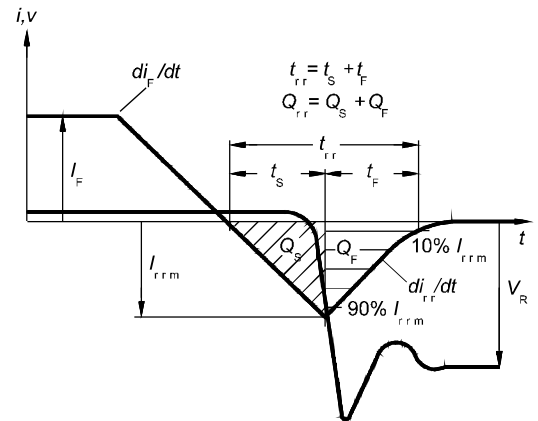


Figure C. Definition of diodes switching characteristics

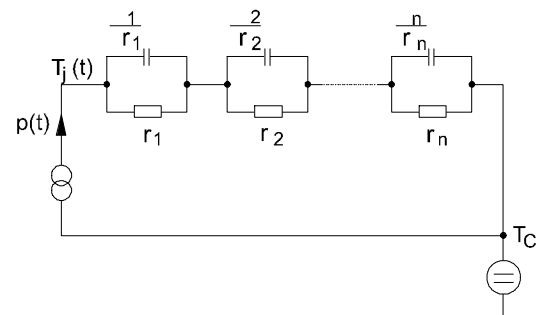


Figure D. Thermal equivalent circuit

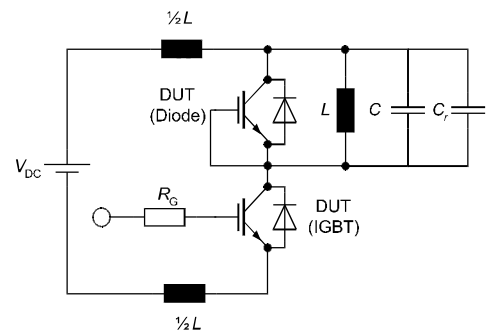


Figure E. Dynamic test circuit
 Leakage inductance $L = 180\text{nH}$,
 Stray capacitor $C_s = 40\text{pF}$,
 Relief capacitor $C_r = 1\text{nF}$
 (only for ZVT switching)

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