

Induction Heating Series

Reverse conducting IGBT with monolithic body diode

IHW15N120R3

Data sheet

Industrial Power Control

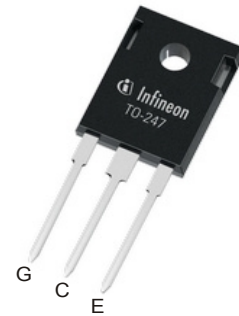
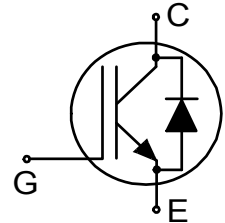
Reverse conducting IGBT with monolithic body diode

Features:

- Powerful monolithic body diode with low forward voltage designed for soft commutation only
- TRENCHSTOP™ technology applications offers:
 - 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
- Qualified according to JESD-022 for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>

Applications:

- Inductive cooking



Key Performance and Package Parameters

| Type | V_{CE} | I_C | $V_{CEsat}, T_{vj}=25^{\circ}C$ | T_{vjmax} | Marking | Package |
|-------------|----------|-------|---------------------------------|-------------|----------|------------|
| IHW15N120R3 | 1200V | 15A | 1.48V | 175°C | H15R1203 | PG-TO247-3 |



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Maximum ratings

| Parameter | Symbol | Value | Unit |
|--|-------------|----------------------|------------------|
| Collector-emitter voltage | V_{CE} | 1200 | V |
| DC collector current, limited by T_{vjmax} $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$ | 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 $V_{CE} \leq 1200\text{V}$, $T_{vj} \leq 175^\circ\text{C}$ | - | 45.0 | A |
| Diode forward current, limited by T_{vjmax} $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$ | 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 ($t_p \leq 10\mu\text{s}$, $D < 0.010$) | V_{GE} | ± 20 ± 25 | V |
| Power dissipation $T_C = 25^\circ\text{C}$ Power dissipation $T_C = 100^\circ\text{C}$ | P_{tot} | 254.0 127.0 | W |
| Operating junction temperature | T_{vj} | -40...+175 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | -55...+175 | $^\circ\text{C}$ |
| Soldering temperature, wave soldering 1.6 mm (0.063 in.) from case for 10s | | 260 | $^\circ\text{C}$ |
| 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 | $R_{th(j-a)}$ | | 40 | 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 | $V_{(BR)CES}$ | $V_{GE} = 0\text{V}, I_C = 0.50\text{mA}$ | 1200 | - | - | V |
| Collector-emitter saturation voltage | V_{CEsat} | $V_{GE} = 15.0\text{V}, I_C = 15.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$ | - - - | 1.48 1.70 1.80 | 1.70 - - | V |
| Diode forward voltage | V_F | $V_{GE} = 0\text{V}, I_F = 15.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$ | - - - | 1.55 1.70 1.80 | 1.75 - - | V |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C = 0.40\text{mA}, V_{CE} = V_{GE}$ | 5.1 | 5.8 | 6.4 | V |
| Zero gate voltage collector current | I_{CES} | $V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$ | - - | - - | 100.0 2500.0 | μA |
| Gate-emitter leakage current | I_{GES} | $V_{CE} = 0\text{V}, V_{GE} = 20\text{V}$ | - | - | 100 | nA |
| Transconductance | g_{fs} | $V_{CE} = 20\text{V}, I_C = 15.0\text{A}$ | - | 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} | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | - | 1165 | - | pF |
| Output capacitance | C_{oes} | | - | 40 | - | |
| Reverse transfer capacitance | C_{res} | | - | 32 | - | |
| Gate charge | Q_G | $V_{CC} = 960\text{V}, I_C = 15.0\text{A},$ $V_{GE} = 15\text{V}$ | - | 165.0 | - | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | L_E | | - | 13.0 | - | nH |

Switching Characteristic, Inductive Load

| Parameter | Symbol | Conditions | Value | | | Unit |
|-----------|--------|------------|-------|------|------|------|
| | | | min. | typ. | max. | |

IGBT Characteristic, at $T_{vj} = 25^{\circ}\text{C}$

| | | | | | | |
|---------------------|--------------|---|---|------|---|----|
| Turn-off delay time | $t_{d(off)}$ | $T_{vj} = 25^{\circ}\text{C},$ $V_{CC} = 600\text{V}, I_C = 15.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $r_G = 14.6\Omega, L\sigma = 180\text{nH},$ $C\sigma = 39\text{pF}$ $L\sigma, C\sigma$ 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

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

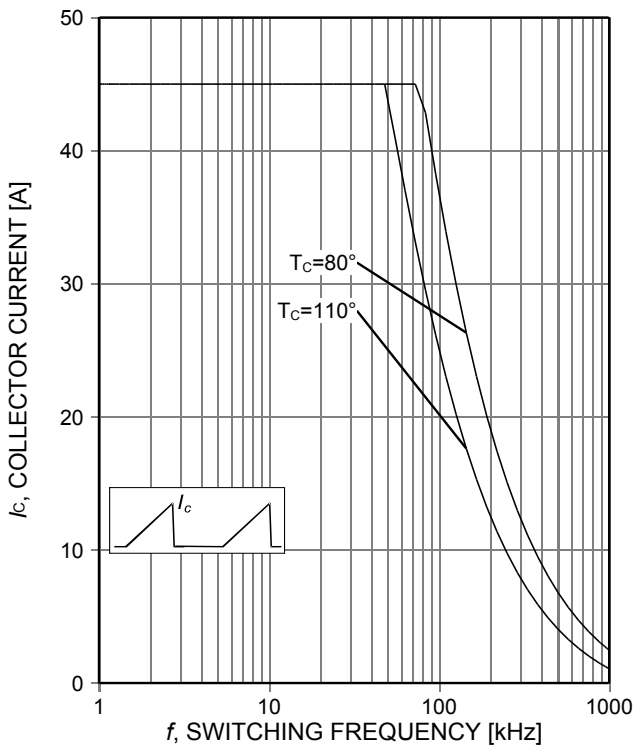


Figure 1. **Collector current as a function of switching frequency**
 ($T_j \leq 175^\circ\text{C}$, $D=0.5$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=14,6\Omega$)

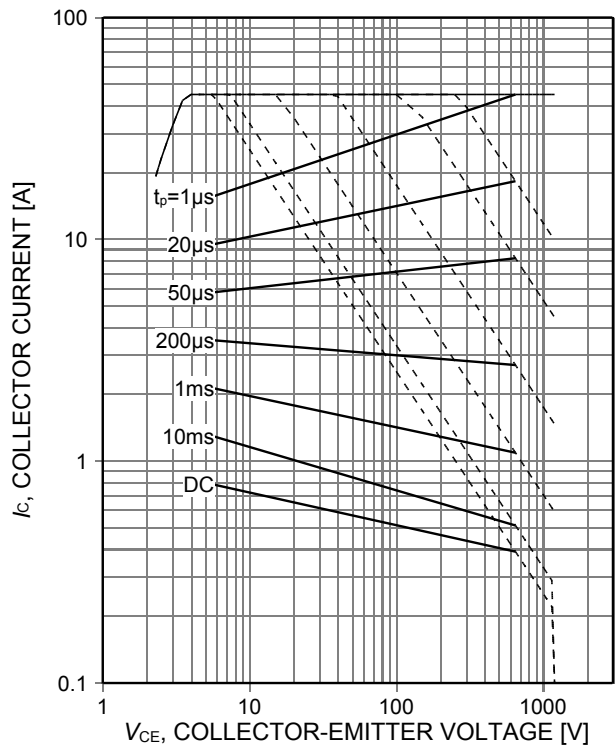


Figure 2. **Forward bias safe operating area**
 ($D=0$, $T_C=25^\circ\text{C}$, $T_j \leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$)

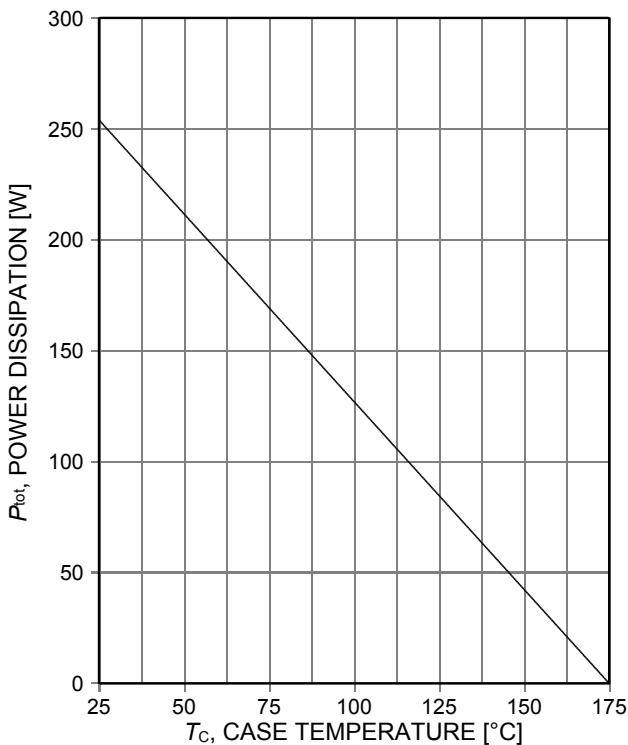


Figure 3. **Power dissipation as a function of case temperature**
 ($T_j \leq 175^\circ\text{C}$)

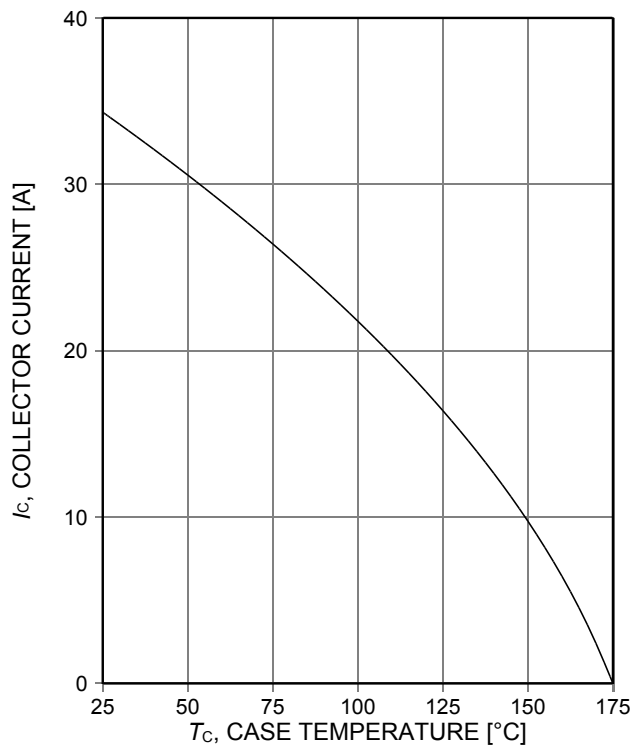


Figure 4. **Collector current as a function of case temperature**
 ($V_{GE} \geq 15\text{V}$, $T_j \leq 175^\circ\text{C}$)

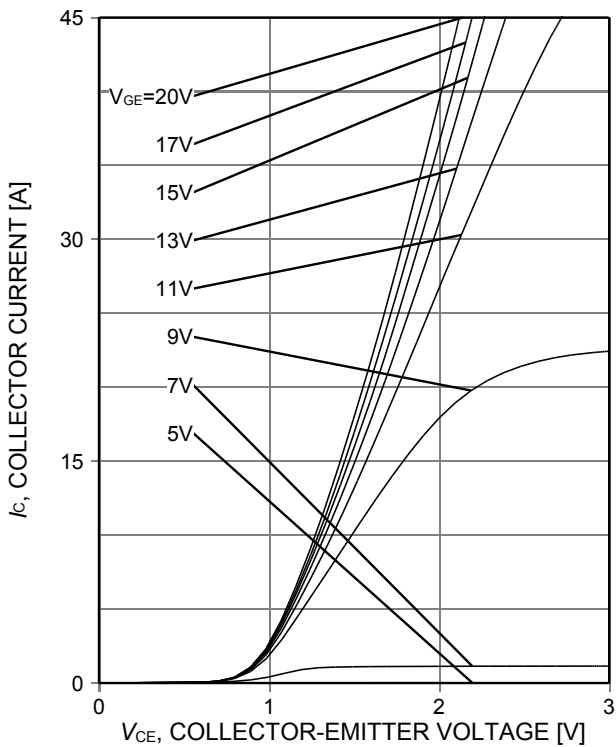


Figure 5. **Typical output characteristic**
($T_j=25^\circ\text{C}$)

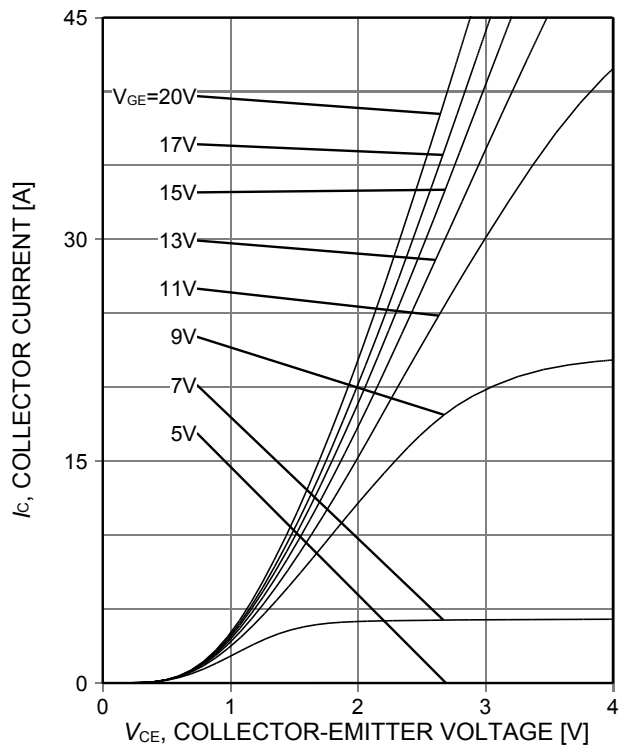


Figure 6. **Typical output characteristic**
($T_j=175^\circ\text{C}$)

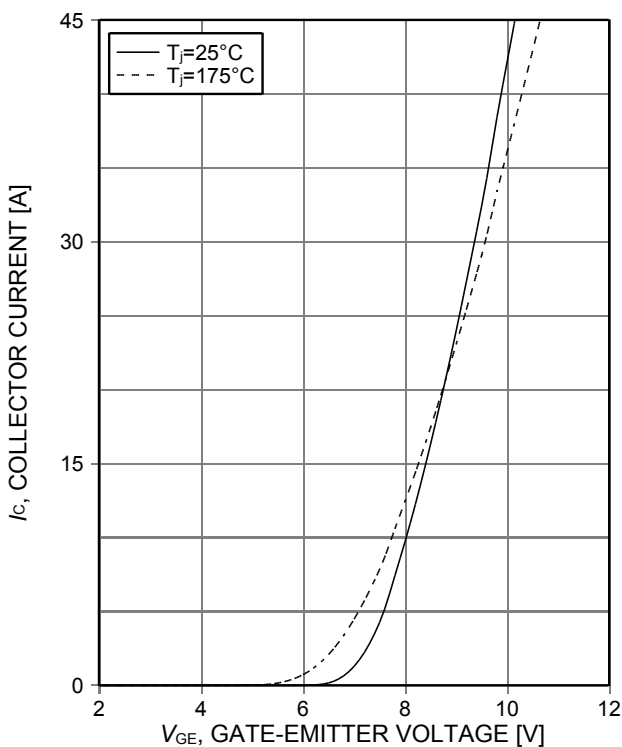


Figure 7. **Typical transfer characteristic**
($V_{CE}=20\text{V}$)

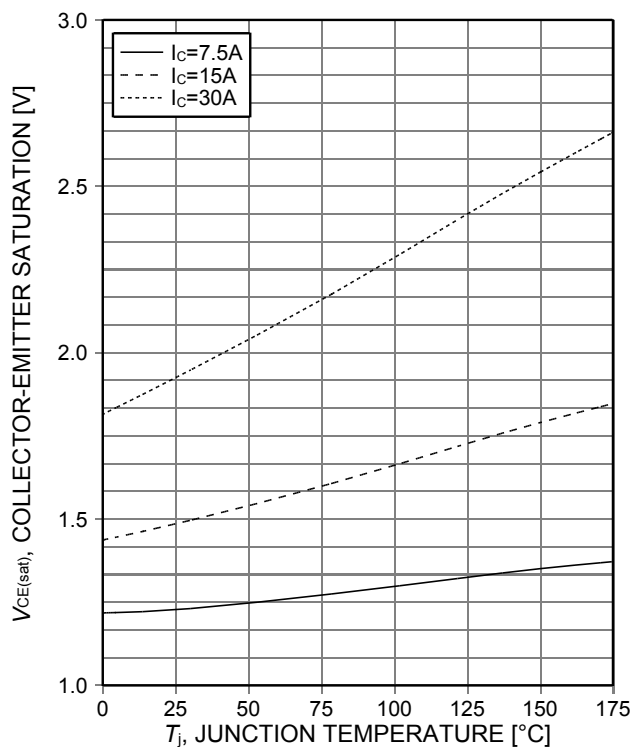


Figure 8. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}=15\text{V}$)

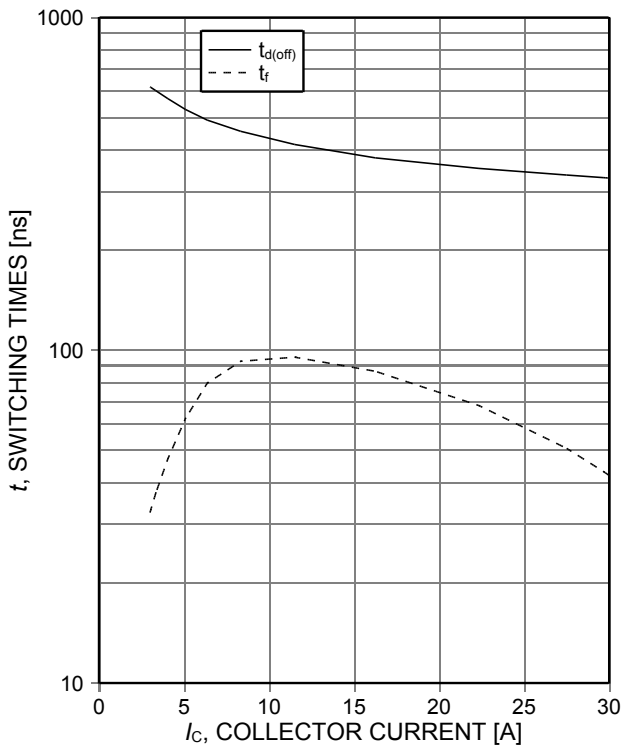


Figure 9. **Typical switching times as a function of collector current**
(ind. load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=14,6\Omega$, test circuit in Fig. E)

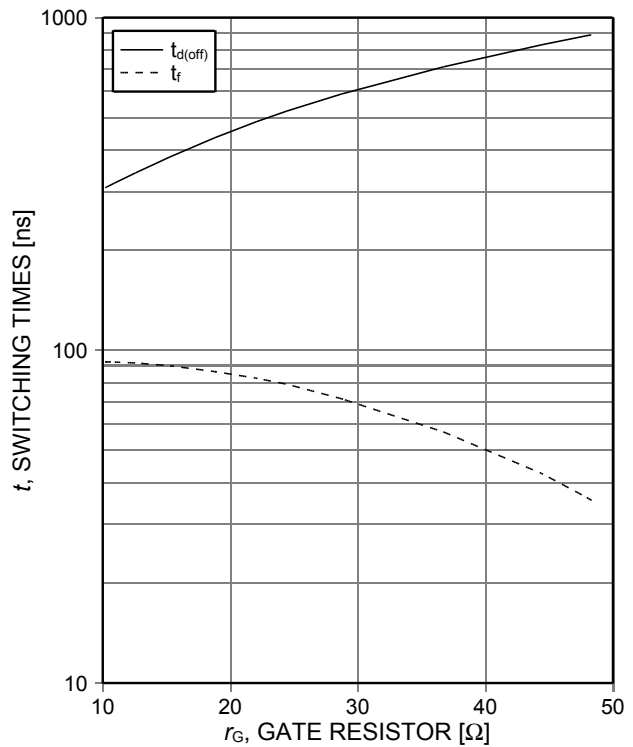


Figure 10. **Typical switching times as a function of gate resistor**
(ind. load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, test circuit in Fig. E)

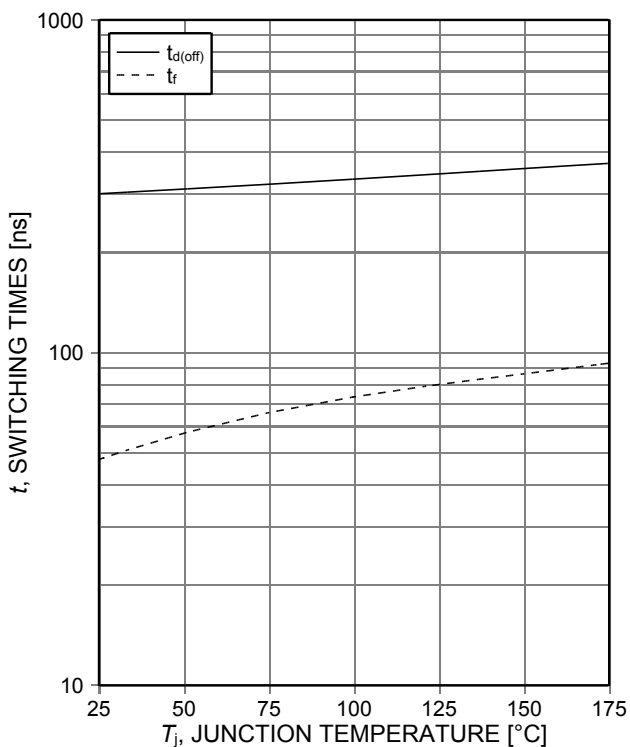


Figure 11. **Typical switching times as a function of junction temperature**
(ind. load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, $r_G=14,6\Omega$, test circuit in Fig. E)

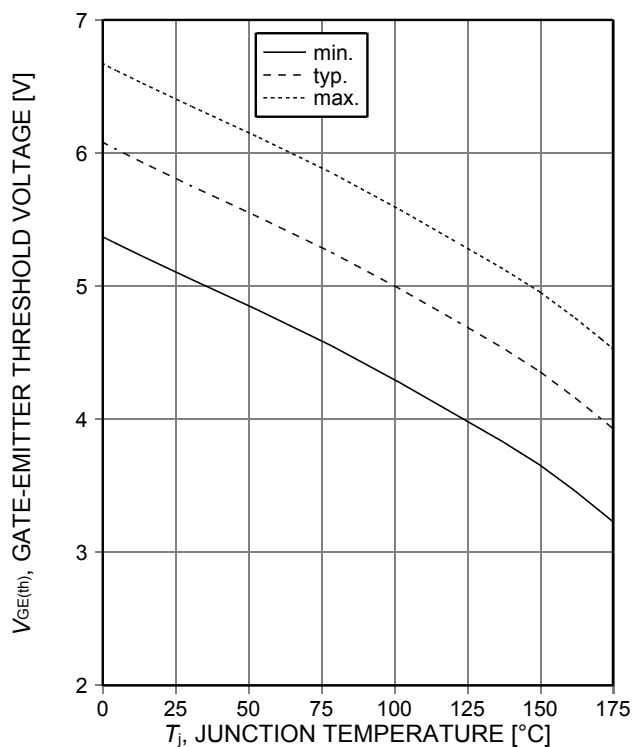


Figure 12. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C=0.4\text{mA}$)

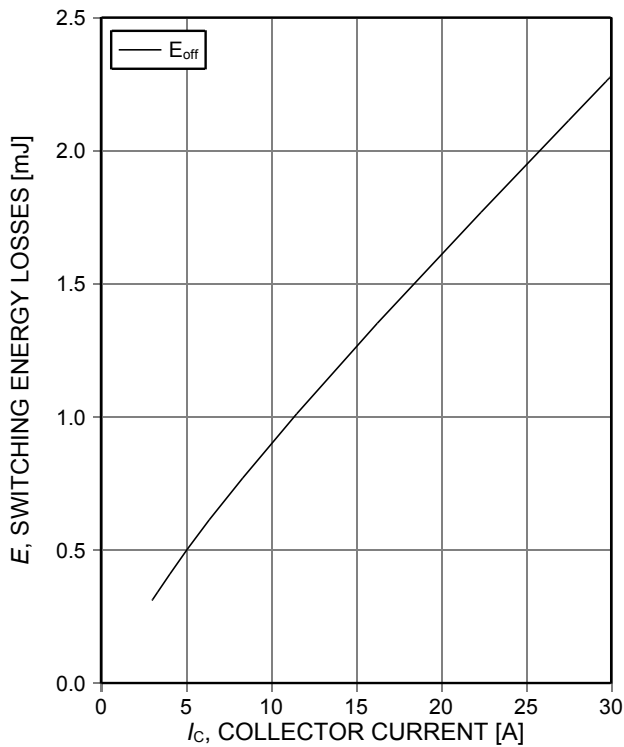


Figure 13. **Typical switching energy losses as a function of collector current**
(ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=14,6\Omega$, test circuit in Fig. E)

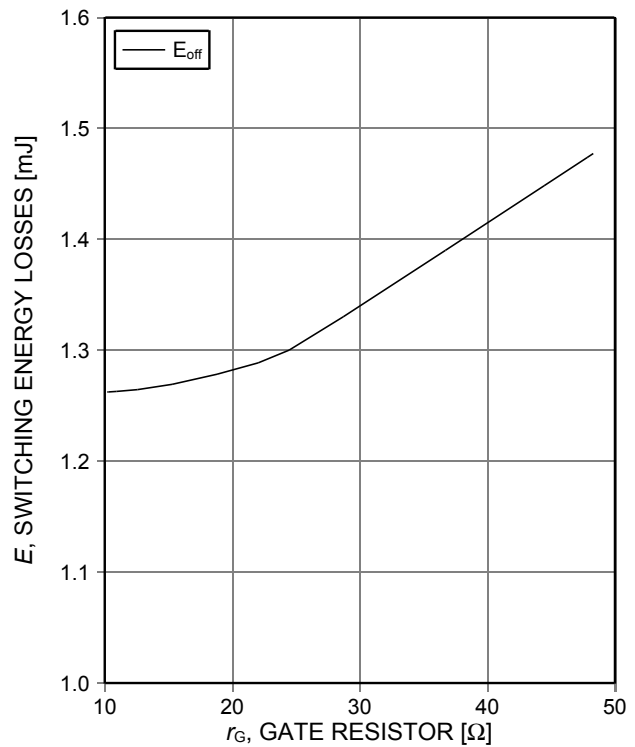


Figure 14. **Typical switching energy losses as a function of gate resistor**
(ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_c=15\text{A}$, test circuit in Fig. E)

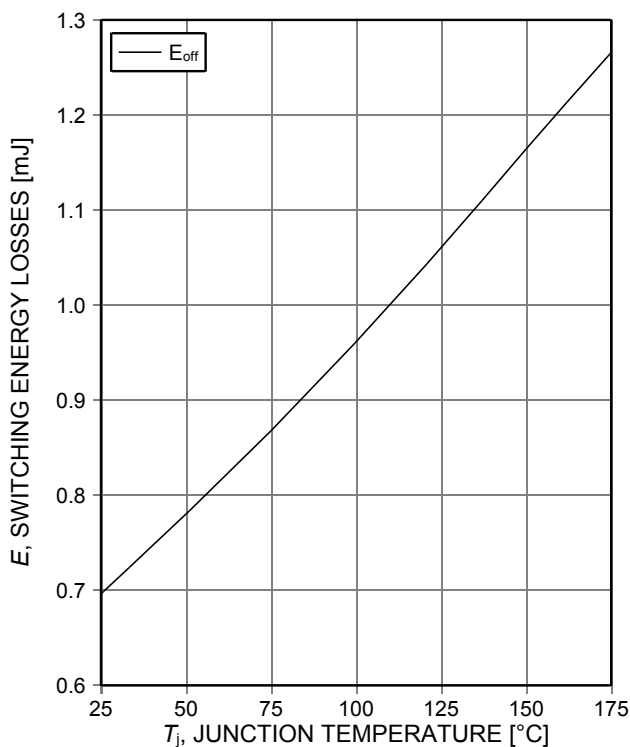


Figure 15. **Typical switching energy losses as a function of junction temperature**
(ind load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_c=15\text{A}$, $r_G=14,6\Omega$, test circuit in Fig. E)

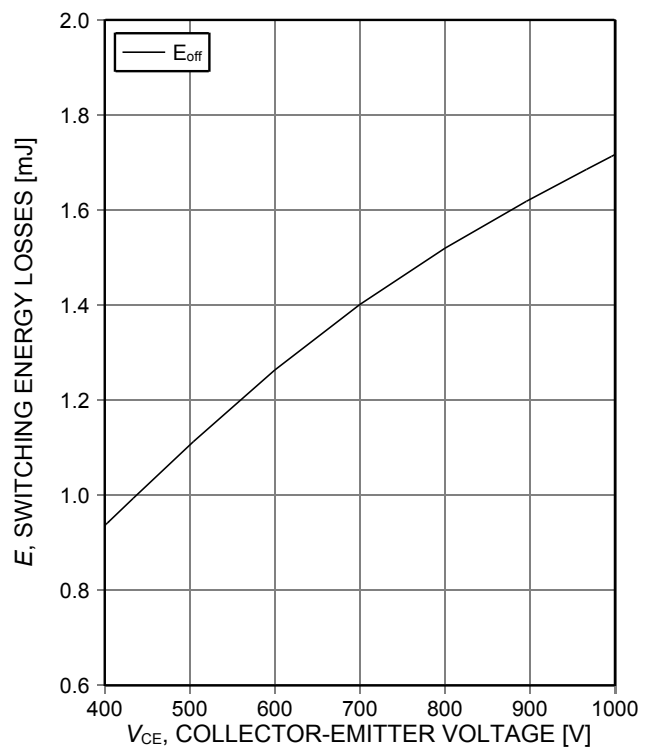


Figure 16. **Typical switching energy losses as a function of collector emitter voltage**
(ind. load, $T_j=175^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_c=15\text{A}$, $r_G=14,6\Omega$, test circuit in Fig. E)

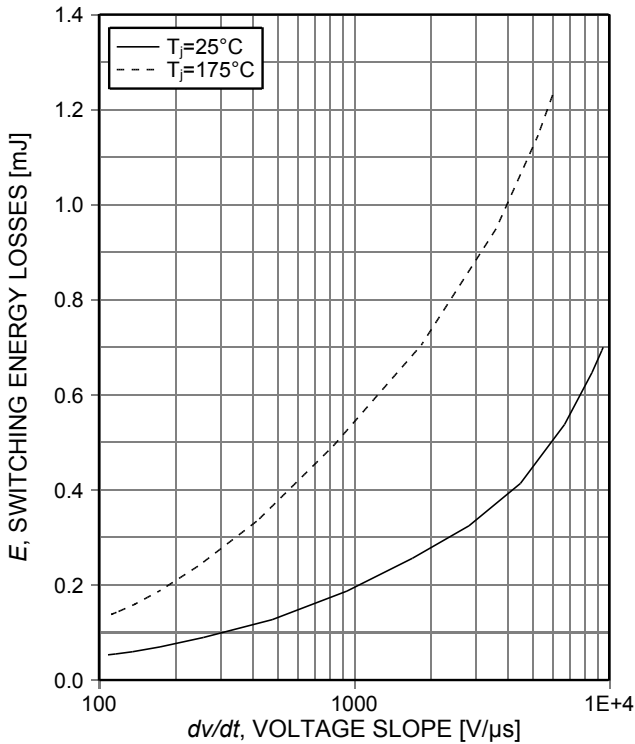


Figure 17. **Typical turn off switching energy loss for soft switching**
(ind load, V_{CE}=600V, V_{GE}=15/0V, I_C=15A, R_G=14,6Ω, test circuit in Fig. E)

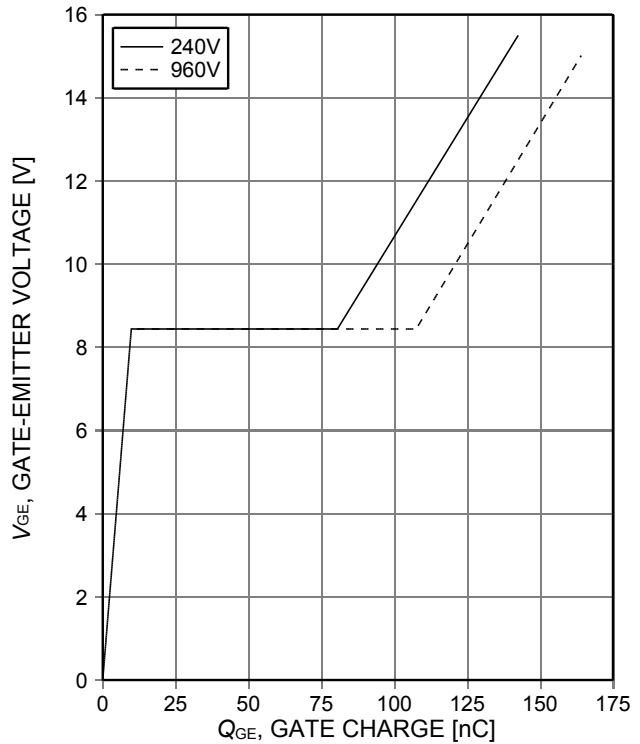


Figure 18. **Typical gate charge**
(I_C=15A)

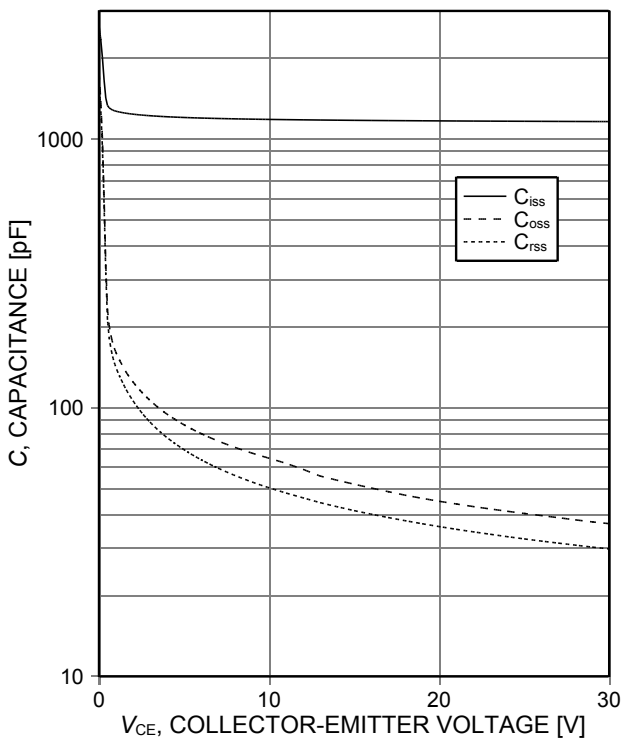


Figure 19. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

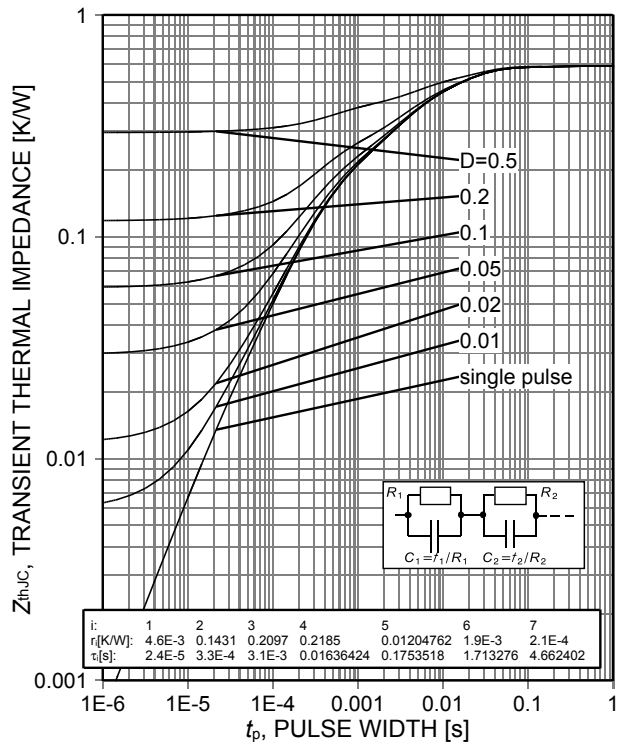


Figure 20. **IGBT transient thermal impedance**
(D=t_p/T)

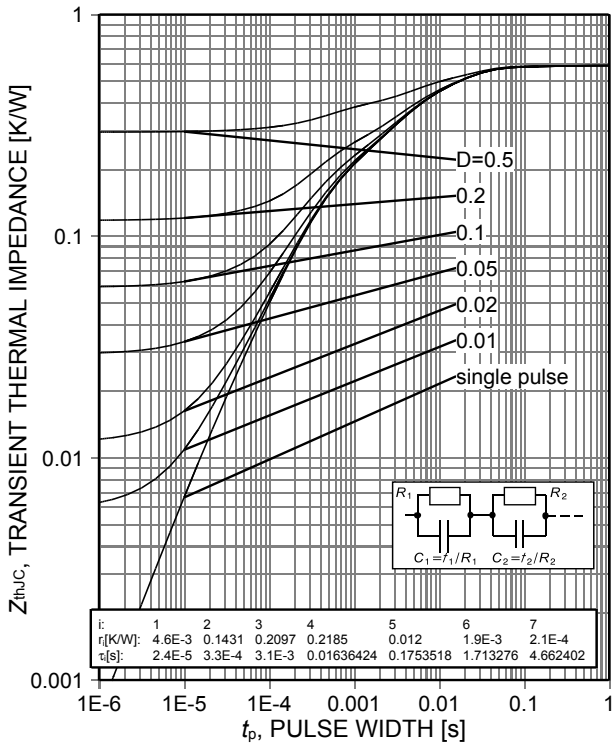


Figure 21. Diode transient thermal impedance as a function of pulse width ($D=t_p/T$)

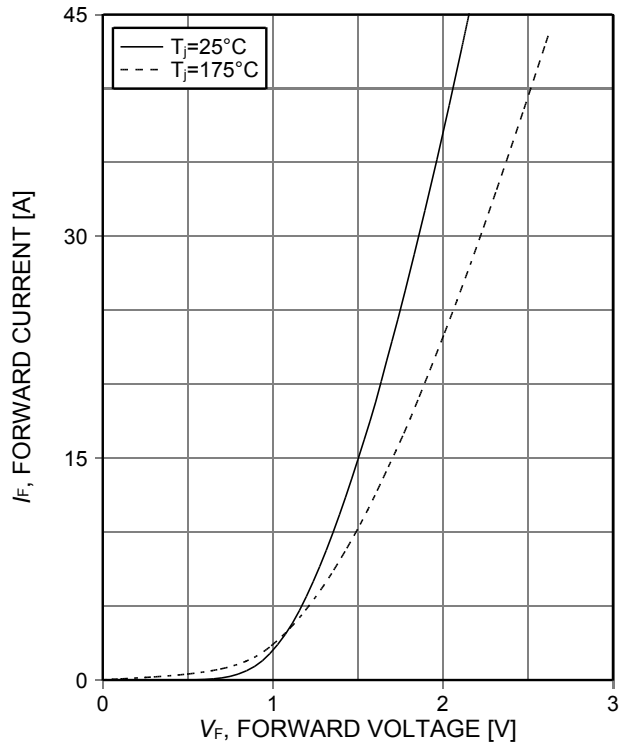


Figure 22. Typical diode forward current as a function of forward voltage

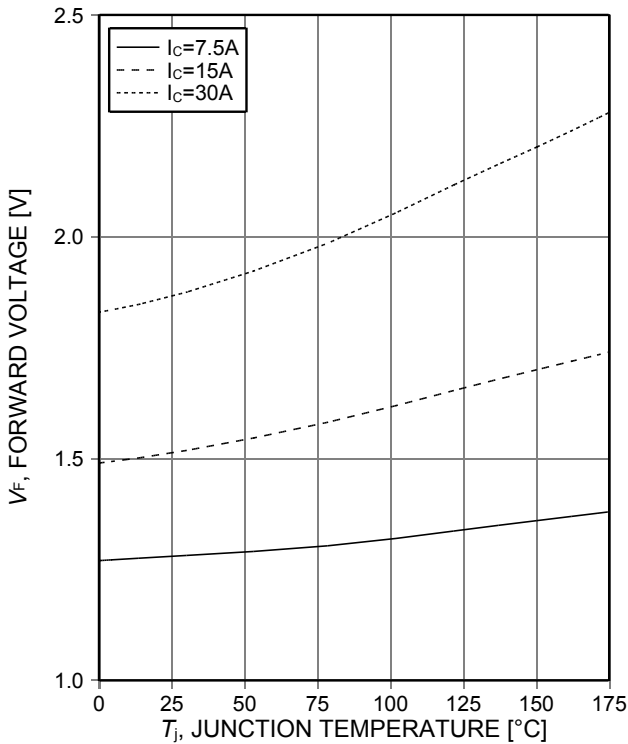
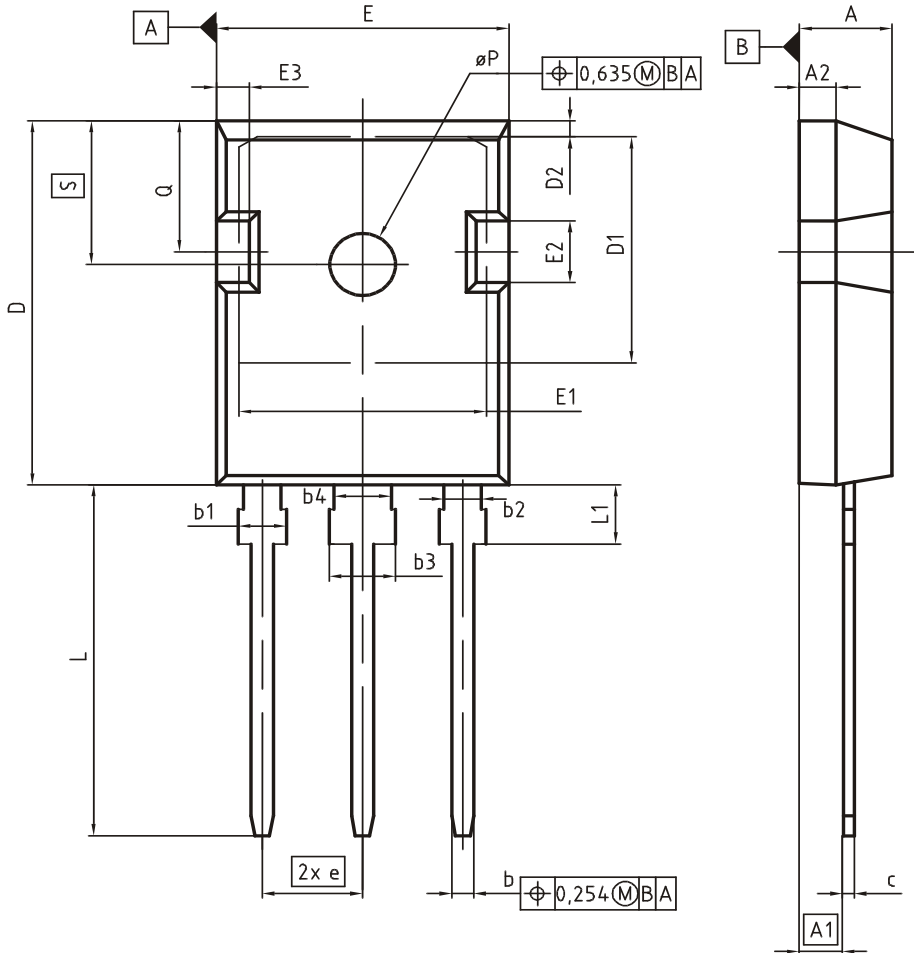


Figure 23. Typical diode forward voltage as a function of junction temperature

PG-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 (BSC) | | 0.214 (BSC) | |
| N | 3 | | 3 | |
| L | 19.80 | 20.32 | 0.780 | 0.800 |
| L1 | 4.10 | 4.47 | 0.161 | 0.176 |
| ϕP | 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 |

DOCUMENT NO.
Z8B00003327

SCALE

EUROPEAN PROJECTION

ISSUE DATE
09-07-2010

REVISION
05

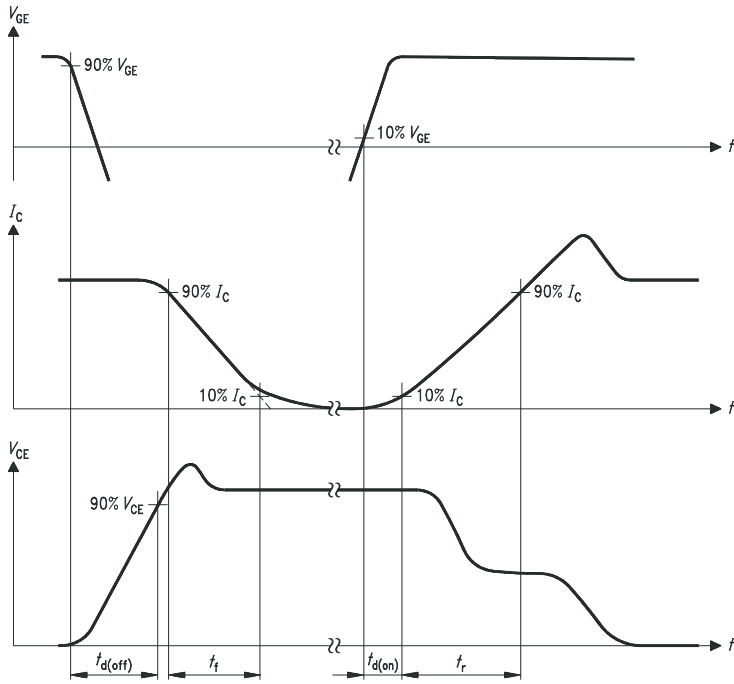


Figure A. Definition of switching times

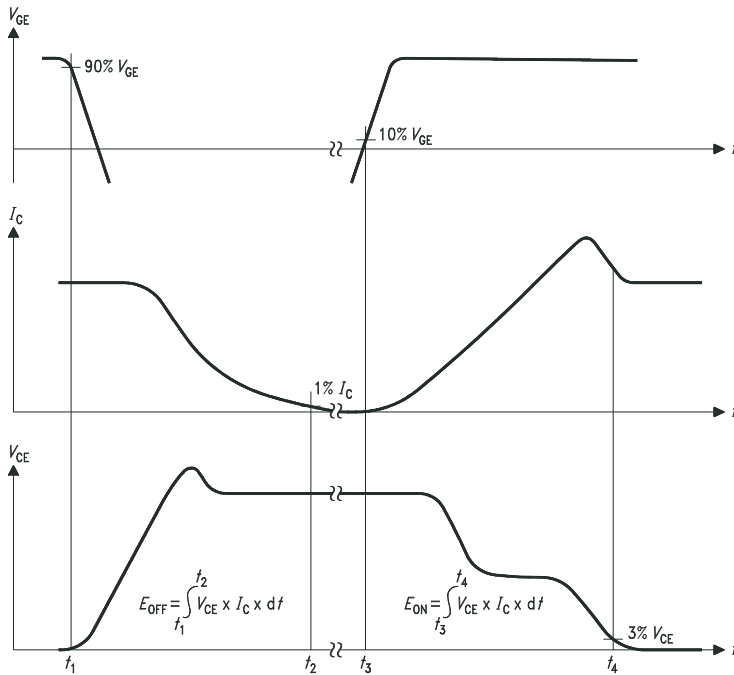


Figure B. Definition of switching losses

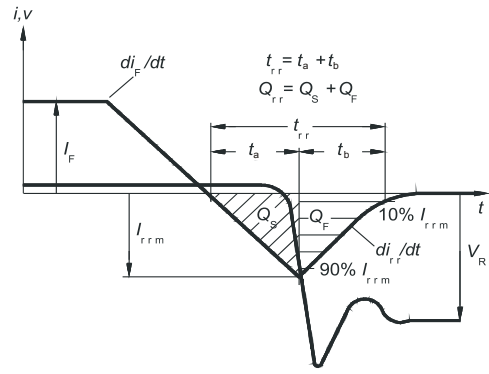


Figure C. Definition of diodes switching characteristics

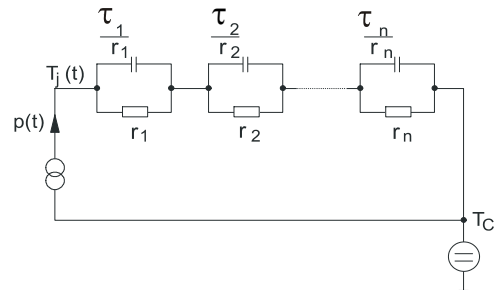


Figure D. Thermal equivalent circuit

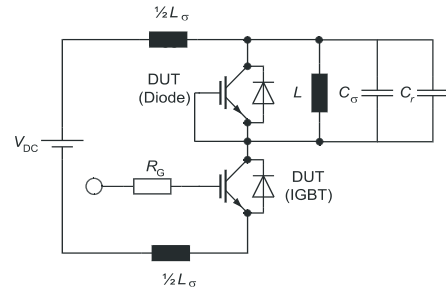


Figure E. Dynamic test circuit
Parasitic inductance L_{σ} ,
Parasitic capacitor C_{σ} ,
Relief capacitor C_r
(only for ZVT switching)

Revision History

IHW15N120R3

Revision: 2013-02-12, Rev. 2.3

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 1.1 | 2009-04-01 | - |
| 2.1 | 2009-05-27 | - |
| 2.2 | 2011-04-05 | Pack. draw. rev. 05, marking update |
| 2.3 | 2013-02-12 | Layout change |

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