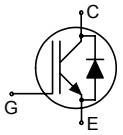
# IHW25N120R2

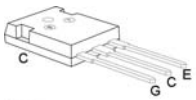
Soft Switching Series

## Reverse Conducting IGBT with monolithic body diode

**Features:**

- Powerful monolithic Body Diode with very low forward voltage
- Body diode clamps negative voltages
- Trench and Fieldstop technology for 1200 V applications offers :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
- NPT technology offers easy parallel switching capability due to positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- 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

**Applications:**

- Inductive Cooking
- Soft Switching Applications

| Type | $V_{CE}$ | $I_C$ | $V_{CE(sat),Tj=25°C}$ | $T_{j,max}$ | Marking | Package |
|---|---|---|---|---|---|---|
| IHW25N120R2 | 1200V | 25A | 1.6V | 175°C | H25R1202 | PG-TO-247-3 |

**Maximum Ratings**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage | $V_{CE}$ | 1200 | V |
| DC collector current<br>$T_C$ = 25°C<br>$T_C$ = 100°C | $I_C$ | <br>50<br>25 | A |
| Pulsed collector current, $t_p$ limited by $T_{jmax}$ | $I_{Cpuls}$ | 75 | |
| Turn off safe operating area ($V_{CE} \le$ 1200V, $T_j \le$ 175°C) | - | 75 | |
| Diode forward current<br>$T_C$ = 25°C<br>$T_C$ = 100°C | $I_F$ | <br>50<br>25 | |
| Diode pulsed current, $t_p$ limited by $T_{jmax}$ | $I_{Fpuls}$ | 75 | |
| Diode surge non repetitive current, $t_p$ limited by $T_{jmax}$<br>$T_C$ = 25°C, $t_p$ = 10ms, sine halfwave<br>$T_C$ = 25°C, $t_p \le$ 2.5µs, sine halfwave<br>$T_C$ = 100°C, $t_p \le$ 2.5µs, sine halfwave | $I_{FSM}$ | <br>50<br>130<br>120 | |
| Gate-emitter voltage<br>Transient Gate-emitter voltage ($t_p$ < 10 µs, D < 0.01) | $V_{GE}$ | ±20<br>±25 | V |
| Power dissipation $T_C$ = 25°C | $P_{tot}$ | 365 | W |
| Operating junction temperature | $T_j$ | -40...+175 | °C |
| Storage temperature | $T_{stg}$ | -55...+175 | |
| Soldering temperature, 1.6mm (0.063 in.) from case for 10s | - | 260 | |

[1] J-STD-020 and JESD-022

**Thermal Resistance**

| Parameter | Symbol | Conditions | Max. Value | Unit |
|---|---|---|---|---|
| **Characteristic** | | | | |
| IGBT thermal resistance, junction – case | $R_{thJC}$ | | 0.41 | K/W |
| Diode thermal resistance, junction – case | $R_{thJCD}$ | | 0.41 | |
| 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, $I_C$=500µA | 1200 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE}$ = 15V, $I_C$=25A | | | | |
| | | $T_j$=25°C | - | 1.6 | 1.8 | |
| | | $T_j$=150°C | - | 1.95 | - | |
| | | $T_j$=175°C | - | 2.0 | - | |
| Diode forward voltage | $V_F$ | $V_{GE}$=0V, $I_F$=25A | | | | |
| | | $T_j$=25°C | - | 1.5 | 1.75 | |
| | | $T_j$=150°C | - | 1.75 | - | |
| | | $T_j$=175°C | - | 1.8 | - | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C$=0.58mA, $V_{CE}$=$V_{GE}$ | 5.1 | 5.8 | 6.4 | |
| Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$=1200V, $V_{GE}$=0V | | | | µA |
| | | $T_j$=25°C | - | - | 4 | |
| | | $T_j$=175°C | - | - | 2500 | |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=20V | - | - | 100 | nA |
| Transconductance | $g_{fs}$ | $V_{CE}$=20V, $I_C$=25A | - | 16.3 | - | S |
| Integrated gate resistor | $R_{Gint}$ | | | none | | Ω |

**Dynamic Characteristic**

| | | | | | | |
|---|---|---|---|---|---|---|
| Input capacitance | $C_{iss}$ | $V_{CE}$=25V, | - | 2342 | - | pF |
| Output capacitance | $C_{oss}$ | $V_{GE}$=0V, | - | 68.7 | - | |
| Reverse transfer capacitance | $C_{rss}$ | $f$=1MHz | - | 55.5 | - | |
| Gate charge | $Q_{Gate}$ | $V_{CC}$=960V, $I_C$=25A<br>$V_{GE}$=15V | - | 60.7 | - | nC |
| Internal emitter inductance<br>measured 5mm (0.197 in.) from case | $L_E$ | | - | 13 | - | nH |

**Switching Characteristic, Inductive Load,** at $T_j$=25 °C

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **IGBT Characteristic** | | | | | | |
| Turn-off delay time | $t_{d(off)}$ | $T_j$=25°C,<br>$V_{CC}$=600V, $I_C$=25A<br>$V_{GE}$=0 /15V,<br>$R_G$=10Ω, | - | 324 | - | ns |
| Fall time | $t_f$ | | - | 55.8 | - | |
| Turn-on energy | $E_{on}$ | | - | - | - | |
| Turn-off energy | $E_{off}$ | | - | 1.59 | - | |
| Total switching energy | $E_{ts}$ | | - | 1.59 | - | mJ |

**Switching Characteristic, Inductive Load,** at $T_j$=175 °C

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | Typ. | max. | |
| **IGBT Characteristic** | | | | | | |
| Turn-off delay time | $t_{d(off)}$ | $T_j$=175°C<br>$V_{CC}$=600V, $I_C$=25A,<br>$V_{GE}$= 0 /15V,<br>$R_G$= 10Ω, | - | 373 | - | ns |
| Fall time | $t_f$ | | - | 90.6 | - | |
| Turn-on energy | $E_{on}$ | | - | - | - | |
| Turn-off energy | $E_{off}$ | | - | 2.54 | - | |
| Total switching energy | $E_{ts}$ | | - | 2.54 | - | mJ |

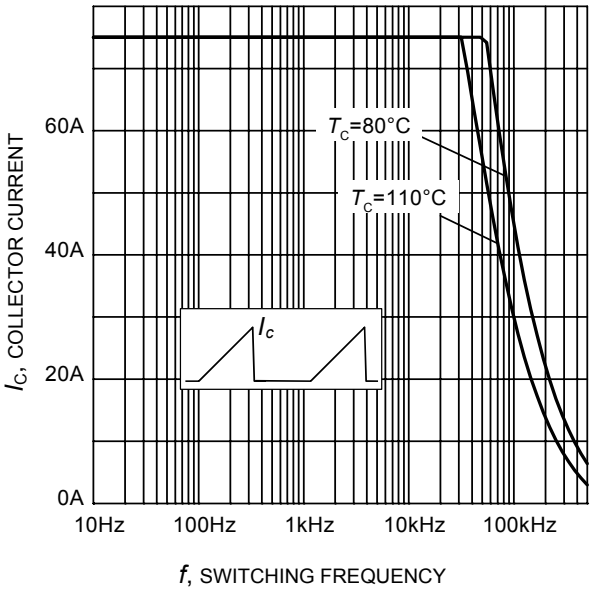



**Figure 1. Collector current as a function of switching frequency for hard switching (turn-off)**
($T_j \leq 175°C$, $D = 0.5$, $V_{CE} = 600V$, $V_{GE} = 0/+15V$, $R_G = 10\Omega$)

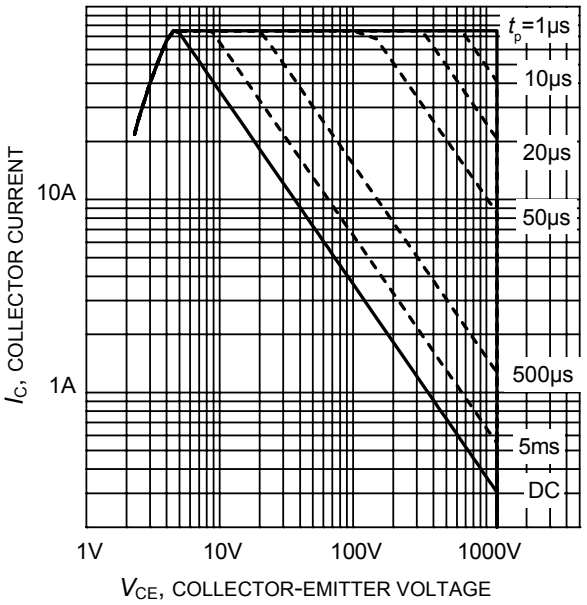



**Figure 2. IGBT Safe operating area**
($D = 0$, $T_C = 25°C$, $T_j \leq 175°C$; $V_{GE}=15V$)

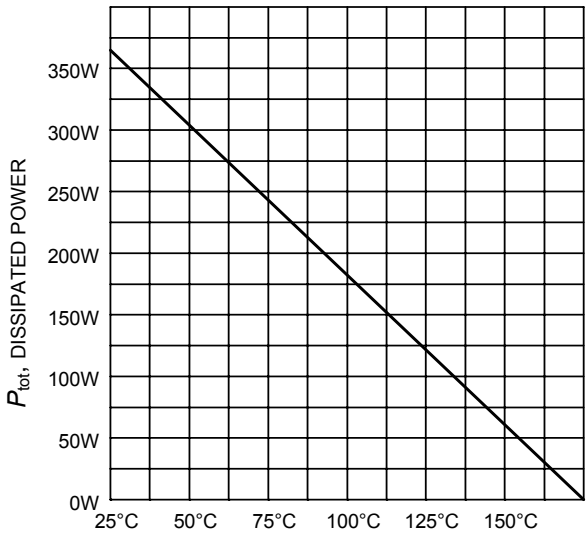



**Figure 3. Power dissipation as a function of case temperature**
($T_j \leq 175°C$)

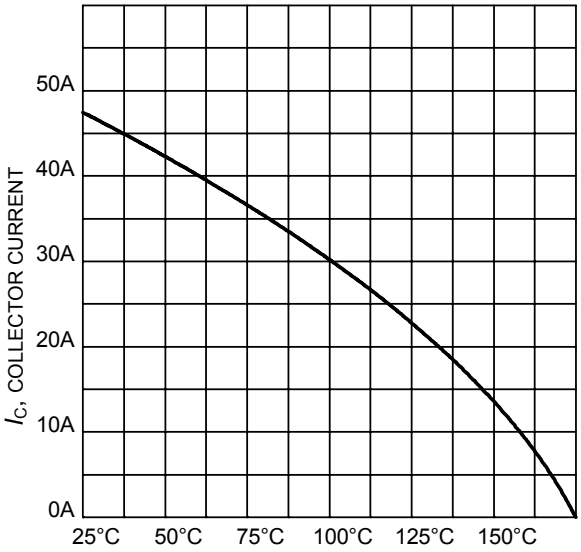



**Figure 4. DC Collector current as a function of case temperature**
($V_{GE} \geq 15V$, $T_j \leq 175°C$)

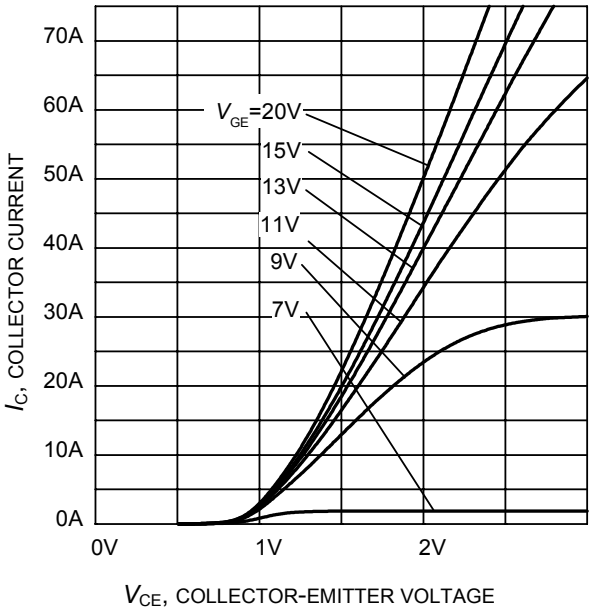



**Figure 5. Typical output characteristic**
($T_j$ = 25°C)

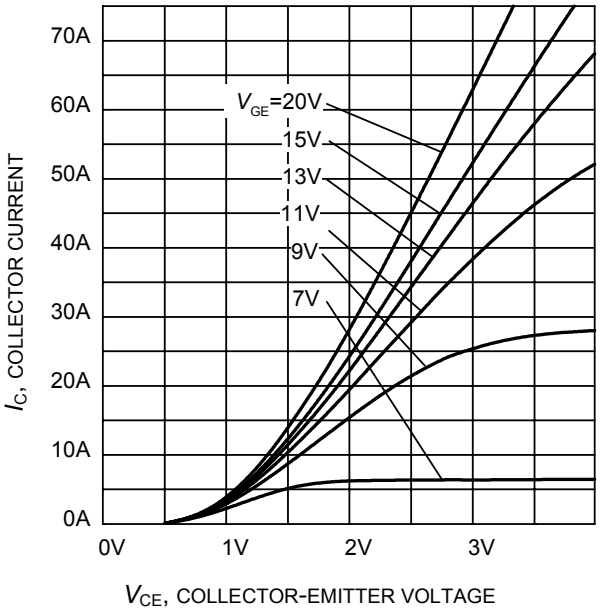



**Figure 6. Typical output characteristic**
($T_j$ = 175°C)

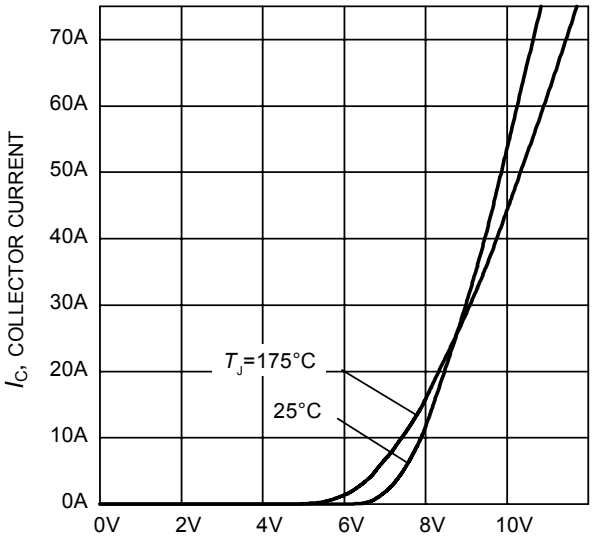



**Figure 7. Typical transfer characteristic**
($V_{CE}$=20V)

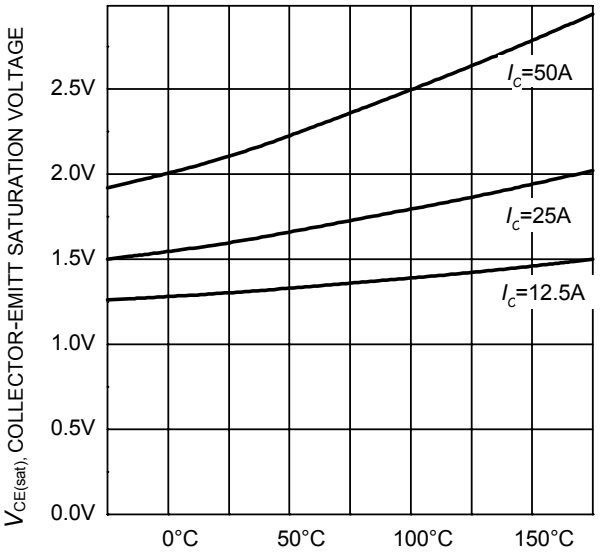



**Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}$ =15V)

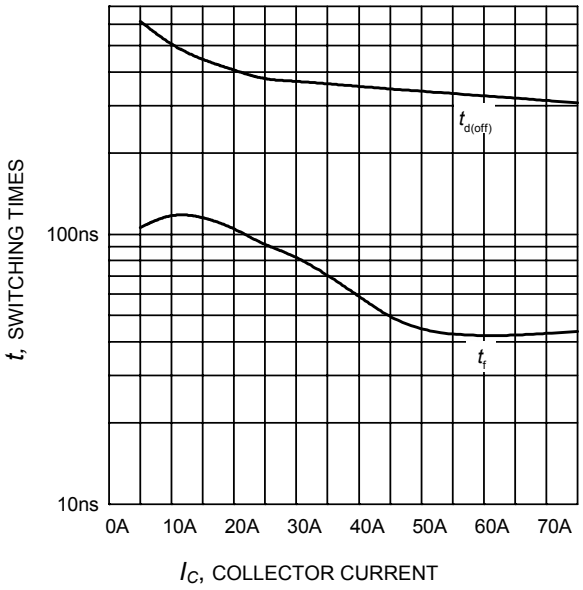



**Figure 9. Typical switching times as a function of collector current**
(inductive load, $T_J$=175°C, $V_{CE}$=600V, $V_{GE}$=0/15V, $R_G$=10Ω, Dynamic test circuit in Figure E)

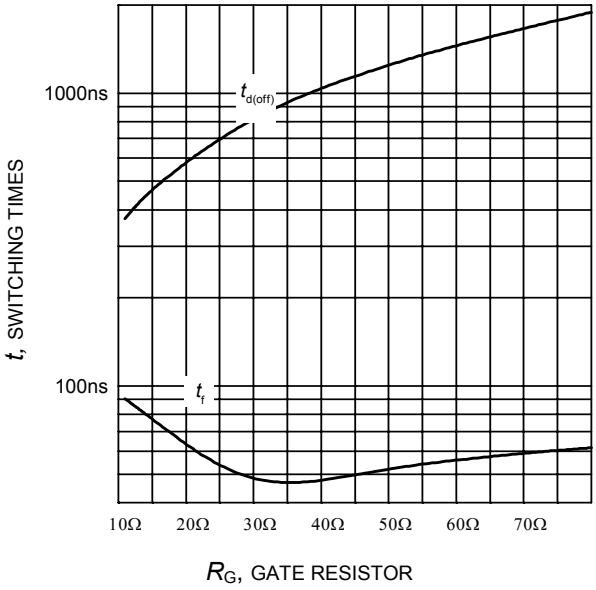



**Figure 10. Typical switching times as a function of gate resistor**
(inductive load, $T_J$=175°C, $V_{CE}$=600V, $V_{GE}$=0/15V, $I_C$=25A, Dynamic test circuit in Figure E)

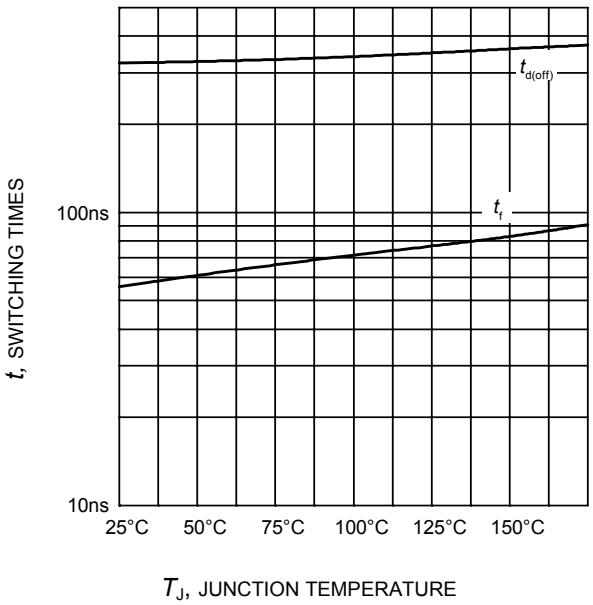



**Figure 11. Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}$=600V, $V_{GE}$=0/15V, $I_C$=25A, $R_G$=10Ω, Dynamic test circuit in Figure E)

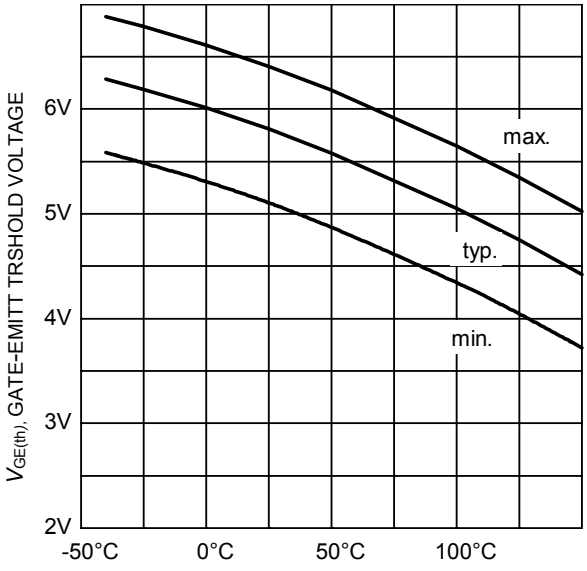



**Figure 12. Gate-emitter threshold voltage as a function of junction temperature**
($I_C$ = 0.6mA)

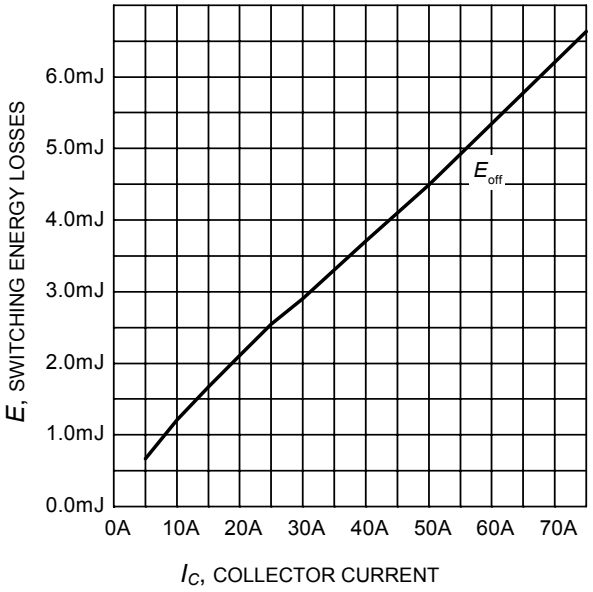



**Figure 13. Typical turn-off energy as a function of collector current**
(inductive load, $T_J$=175°C, $V_{CE}$=600V, $V_{GE}$=0/15V, $R_G$=10Ω, Dynamic test circuit in Figure E)

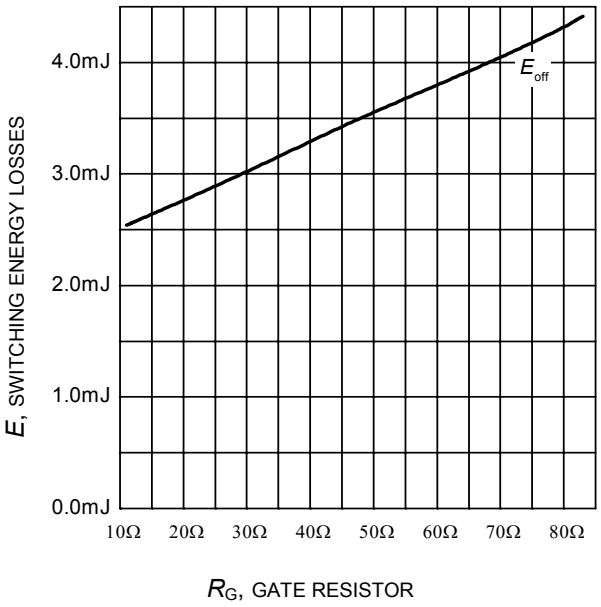



**Figure 14. Typical turn-off energy as a function of gate resistor**
(inductive load, $T_J$=175°C, $V_{CE}$=600V, $V_{GE}$=0/15V, $I_C$=25A, Dynamic test circuit in Figure E)

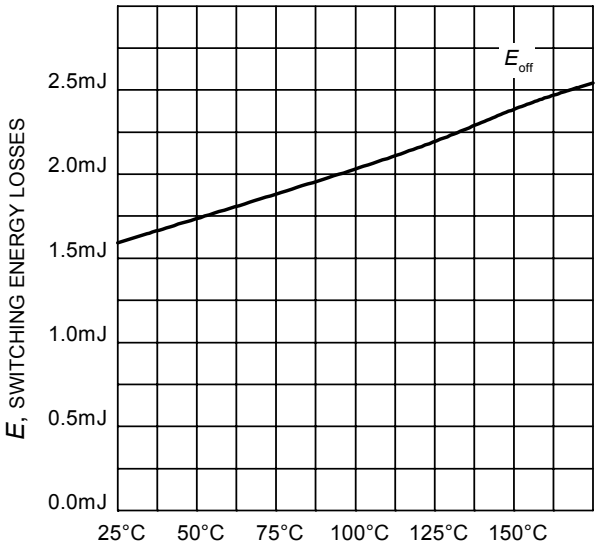



**Figure 15. Typical turn-off energy as a function of junction temperature**
(inductive load, $V_{CE}$=600V, $V_{GE}$=0/15V, $I_C$=25A, $R_G$=10Ω, Dynamic test circuit in Figure E)

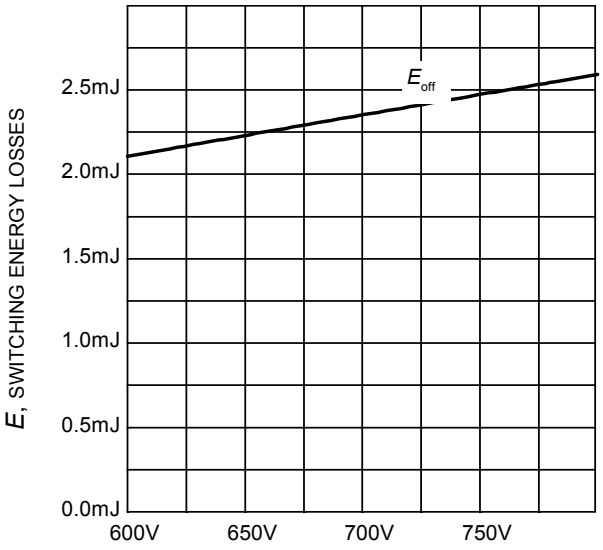



**Figure 16. Typical turn-off energy as a function of collector emitter voltage**
(inductive load, $T_J$=175°C, $V_{GE}$=0/15V, $I_C$=20A, $R_G$=10Ω, Dynamic test circuit in Figure E)

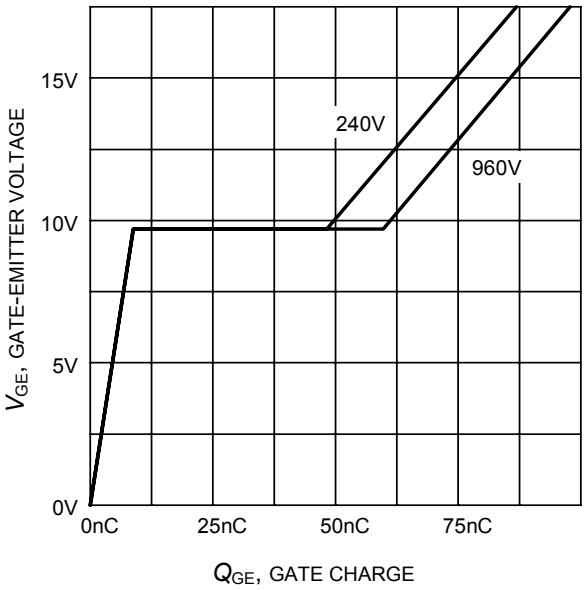



**Figure 17. Typical gate charge**
($I_C$=25 A)

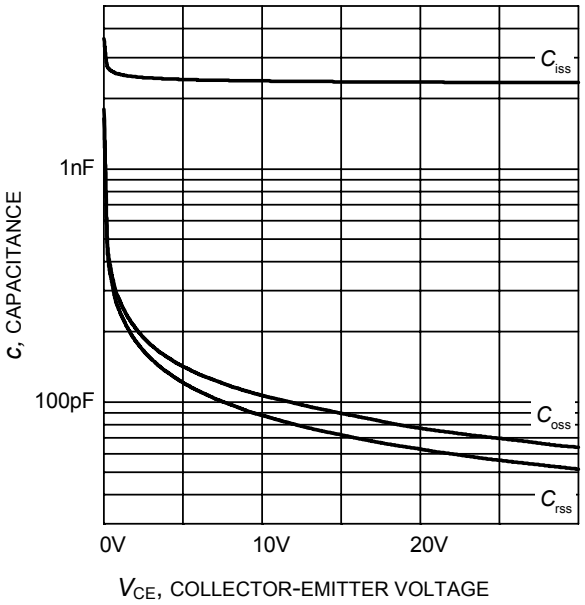



**Figure 18. Typical capacitance as a function of collector-emitter voltage**
($V_{GE}$=0V, $f$ = 1 MHz)

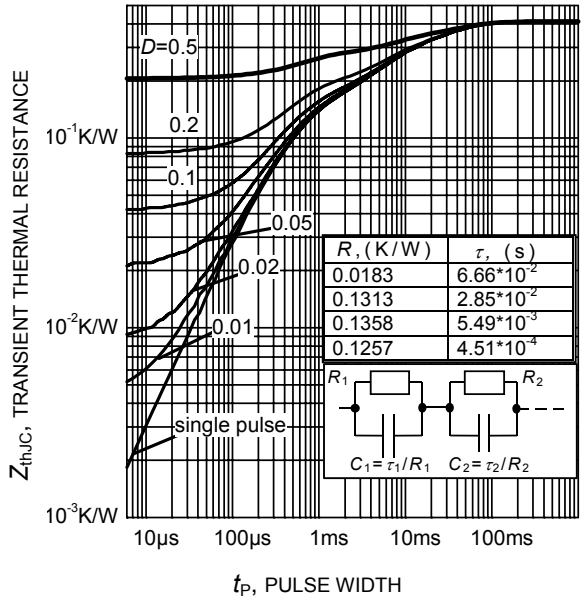



**Figure 19. IGBT transient thermal resistance**
($D = t_p / T$)

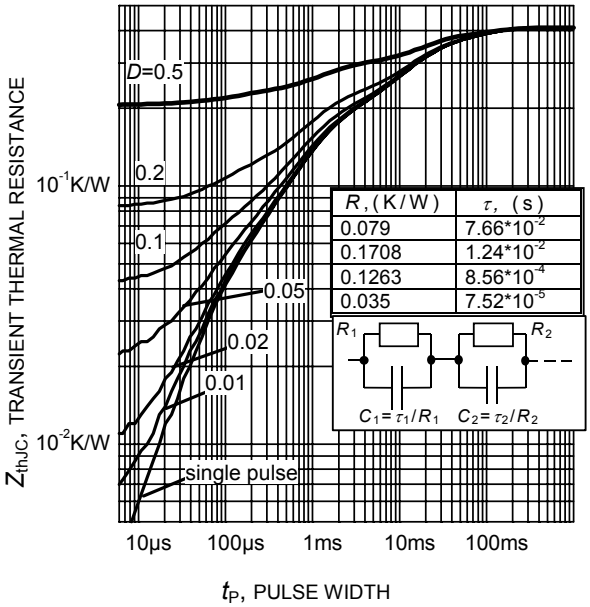



**Figure 20. Diode transient thermal impedance as a function of pulse width**
($D$=$t_P$/$T$)

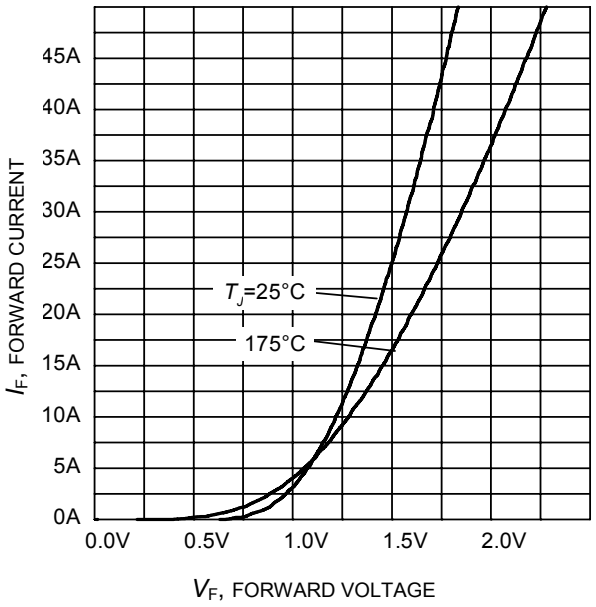



**Figure 21. Typical diode forward current as a function of forward voltage**

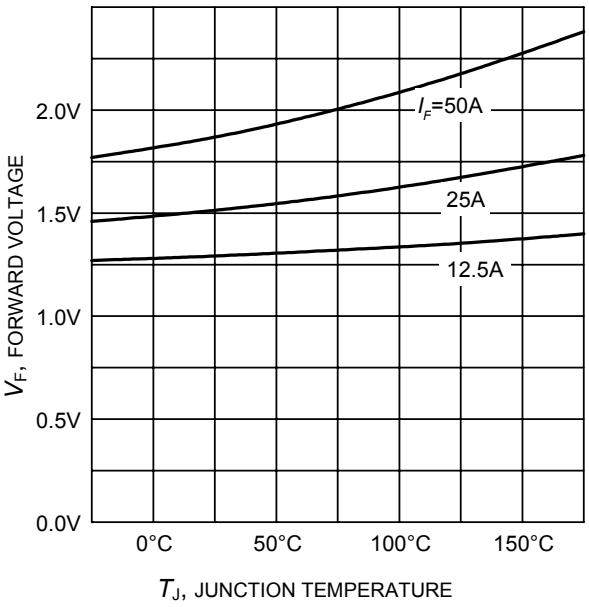



**Figure 22. Typical diode forward voltage as a function of junction temperature**

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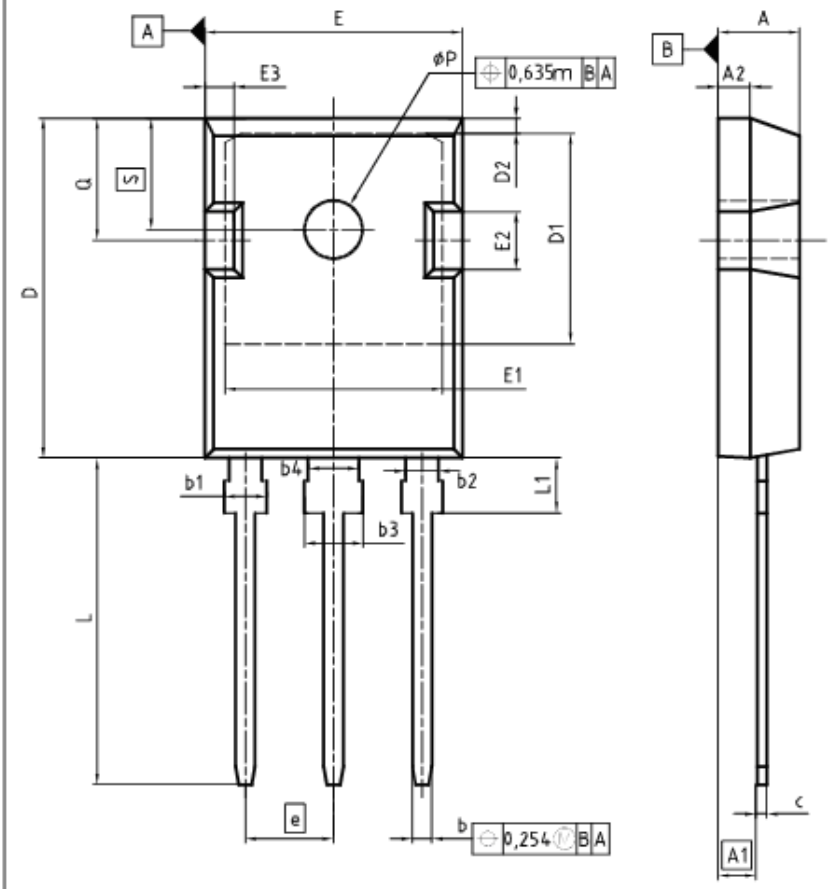


| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.83 | 5.21 | 0.190 | 0.205 |
| A1 | 2.27 | 2.54 | 0.089 | 0.100 |
| A2 | 1.85 | 2.16 | 0.073 | 0.085 |
| b | 1.07 | 1.33 | 0.042 | 0.052 |
| b1 | 1.90 | 2.41 | 0.075 | 0.095 |
| b2 | 1.90 | 2.16 | 0.075 | 0.085 |
| 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 | | 0.214 | |
| N | 3 | | 3 | |
| L | 19.80 | 20.32 | 0.780 | 0.800 |
| L1 | 4.10 | 4.47 | 0.161 | 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 |

DOCUMENT NO.
Z8B00003327

SCALE 0 5 5 7.5mm

EUROPEAN PROJECTION

ISSUE DATE
01-10-2009

REVISION
04

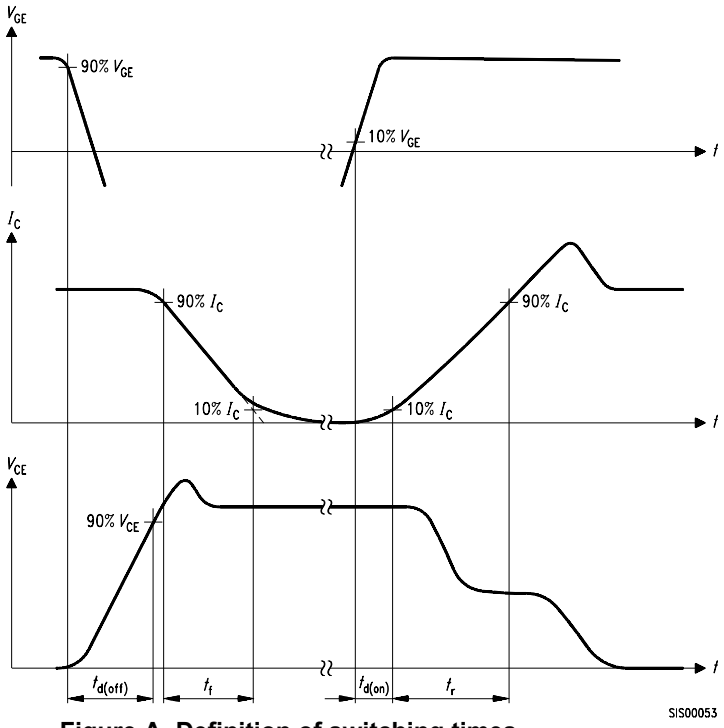


**Figure A. Definition of switching times**

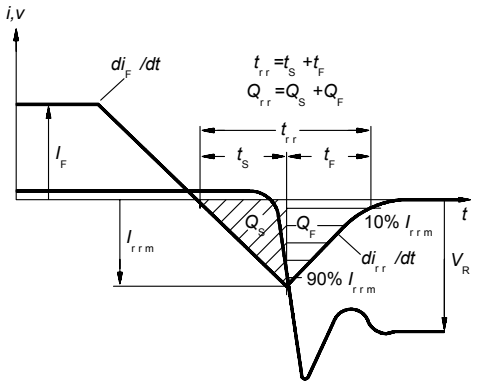


**Figure C. Definition of diodes switching characteristics**

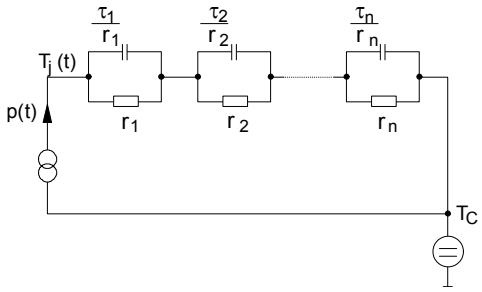


**Figure D. Thermal equivalent circuit**

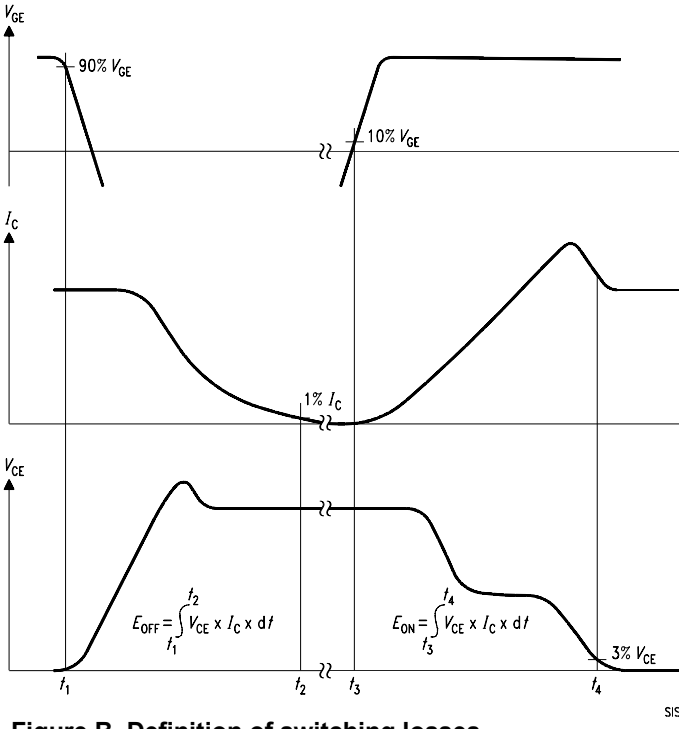


**Figure B. Definition of switching losses**

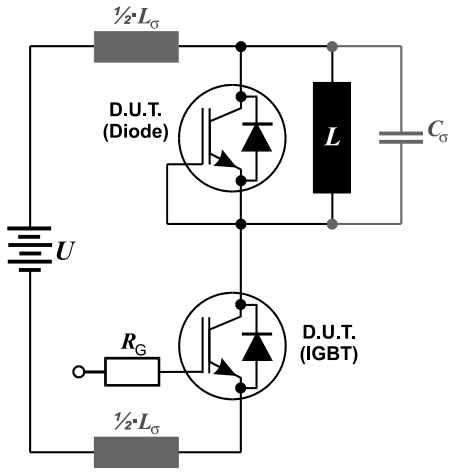


**Figure E. Dynamic test circuit**

**Edition 2006-01**

**Published by**
**Infineon Technologies AG**
**81726 München, Germany**



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