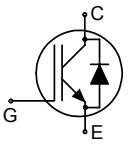
# IHW30N100T

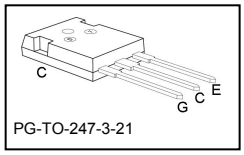
Soft Switching Series

## Low Loss DuoPack : IGBT in TrenchStop®and Fieldstop technology with anti-parallel diode

**Features:**

- 1.1V Forward voltage of antiparallel rectifier diode
- Specified for $T_{Jmax}$ = 175°C
- TrenchStop® and Fieldstop technology for 1000 V applications offers :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
  - easy parallel switching capability due to positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Qualified according to JEDEC[1] for target applications
- Application specific optimisation of inverse diode
- Pb-free lead plating; RoHS compliant




**Applications:**

- Microwave Oven
- Soft Switching Applications

| Type | $V_{CE}$ | $I_C$ | $V_{CE(sat),Tj=25°C}$ | $T_{j,max}$ | Marking | Package |
|---|---|---|---|---|---|---|
| IHW30N100T | 1000V | 30A | 1.55V | 175°C | H30T100 | PG-TO-247-3-21 |

**Maximum Ratings**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage | $V_{CE}$ | 1000 | V |
| DC collector current | $I_C$ | | A |
| $T_C$ = 25°C | | 60 | |
| $T_C$ = 100°C | | 30 | |
| Pulsed collector current, $t_p$ limited by $T_{jmax}$ | $I_{Cpuls}$ | 90 | |
| Turn off safe operating area $V_{CE} \le$ 1200V, $T_j \le$ 150°C | - | 90 | |
| Diode forward current | $I_F$ | | |
| $T_C$ = 25°C | | 22 | |
| $T_C$ = 100°C | | 12 | |
| Diode pulsed current, $t_p$ limited by $T_{jmax}$ | $I_{Fpuls}$ | 36 | |
| Gate-emitter voltage | $V_{GE}$ | ±20 | V |
| Transient Gate-emitter voltage ($t_p$ < 5 ms) | | ±25 | |
| Power dissipation, $T_C$ = 25°C | $P_{tot}$ | 412 | W |
| Operating junction temperature | $T_j$ | -40...+175 | °C |
| Storage temperature | $T_{stg}$ | -55...+175 | °C |
| 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 | $R_{thJC}$ | | 0.36 | K/W |
| Diode thermal resistance, junction – case | $R_{thJCD}$ | | 1.1 | |
| 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 | 1000 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE}$ = 15V, $I_C$=30A | | | | |
| | | $T_j$=25°C | 1.3 | 1.55 | 1.7 | |
| | | $T_j$=150°C | - | 1.7 | - | |
| | | $T_j$=175°C | - | 1.8 | - | |
| Diode forward voltage | $V_F$ | $V_{GE}$=0V, $I_F$=10A | | | | |
| | | $T_j$=25°C | - | 1.1 | 1.3 | |
| | | $T_j$=150°C | - | 1.0 | - | |
| | | $T_j$=175°C | - | 1.0 | - | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C$=700µA, $V_{CE}$=$V_{GE}$ | 5.1 | 5.8 | 6.4 | |
| Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$=1000V, $V_{GE}$=0V | | | | µA |
| | | $T_j$=25°C | - | - | 5 | |
| | | $T_j$=175°C | - | - | 2500 | |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=20V | - | - | 600 | nA |
| Transconductance | $g_{fs}$ | $V_{CE}$=20V, $I_C$=30A | - | 28 | - | S |
| **Dynamic Characteristic** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{CE}$=25V, | - | 3573 | - | pF |
| Output capacitance | $C_{oss}$ | $V_{GE}$=0V, | - | 98 | - | |
| Reverse transfer capacitance | $C_{rss}$ | $f$=1MHz | - | 76 | - | |
| Gate charge | $Q_{Gate}$ | $V_{CC}$=800V, $I_C$=30A | - | 217 | - | nC |
| | | $V_{GE}$=15V | | | | |
| Internal emitter inductance 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-on delay time | $t_{d(on)}$ | $T_j$=25°C, | - | 50 | - | ns |
| Rise time | $t_r$ | $V_{CC}$=600V, $I_C$=30A, | - | 25 | - | |
| Turn-off delay time | $t_{d(off)}$ | $V_{GE}$=0/15V, | - | 550 | - | |
| Fall time | $t_f$ | $R_G$=26.9Ω, | - | 48 | 70 | |
| Turn-on energy | $E_{on}$ | Energy losses include | - | - | - | mJ |
| Turn-off energy | $E_{off}$ | “tail” and diode | - | 2.1 | 2.6 | |
| Total switching energy | $E_{ts}$ | reverse recovery. | - | - | - | |

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

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | Typ. | max. | |
| **IGBT Characteristic** | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j$=175°C | - | 50 | - | ns |
| Rise time | $t_r$ | $V_{CC}$=600V, | - | 40 | - | |
| Turn-off delay time | $t_{d(off)}$ | $I_C$=30A, | - | 650 | - | |
| Fall time | $t_f$ | $V_{GE}$=0/15V, | - | 52 | 130 | |
| Turn-on energy | $E_{on}$ | $R_G$= 26.9Ω | - | - | - | mJ |
| Turn-off energy | $E_{off}$ | Energy losses include | - | 2.7 | 4 | |
| Total switching energy | $E_{ts}$ | “tail” and diode reverse recovery. | - | - | - | |

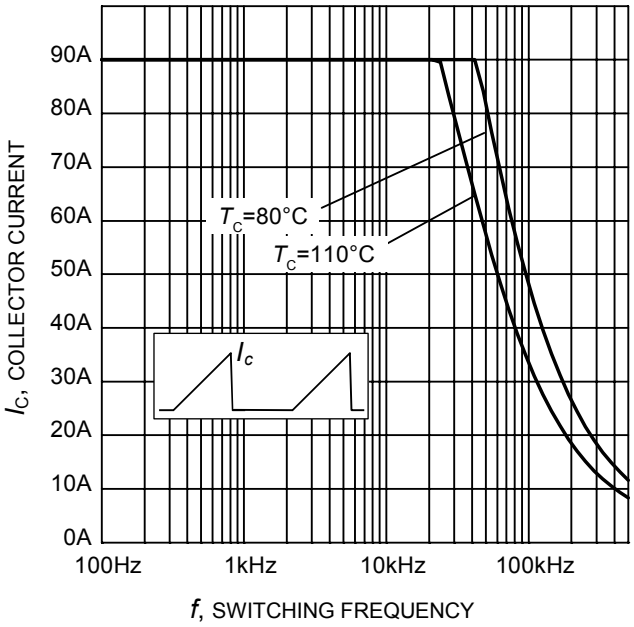



**Figure 1. Collector current as a function of switching frequency for triangular current ($E_{on}$ = 0, hard turn-off)**
($T_j \le 175°C$, $D$ = 0.5, $V_{CE}$ = 400V, $V_{GE}$ = 0/+15V, $R_G$ = 26.9Ω)

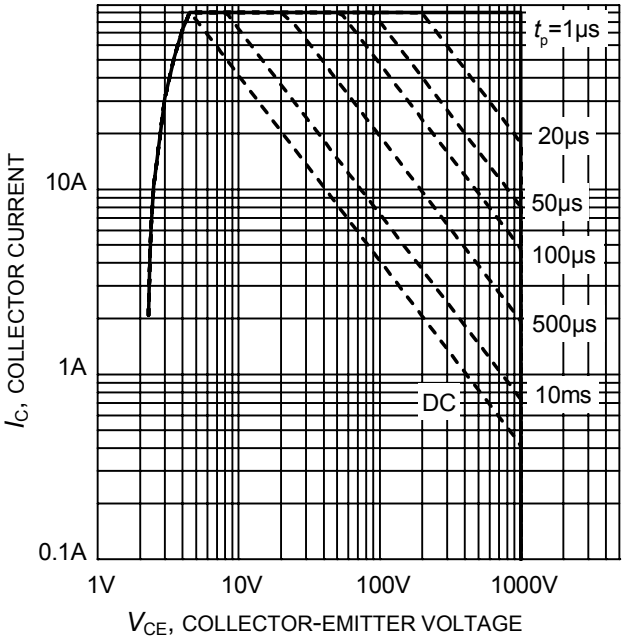



**Figure 2. Safe operating area**
($D$ = 0, $T_C$ = 25°C, $T_j \le 175°C$; $V_{GE}$=15V)

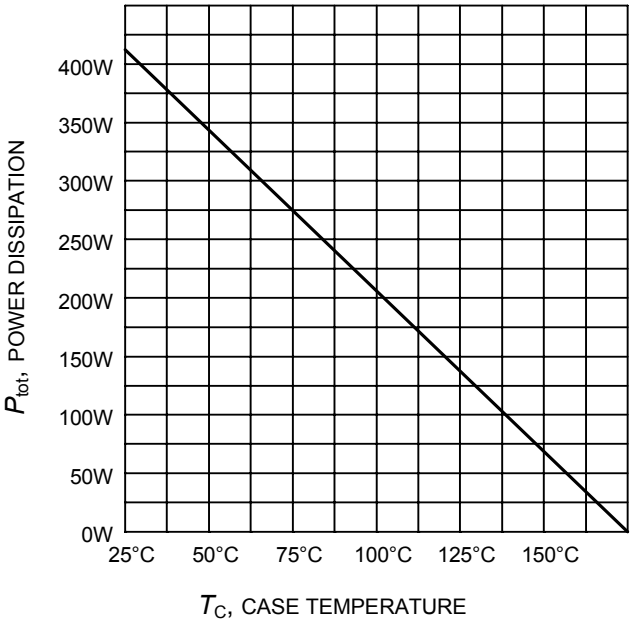



**Figure 3. Power dissipation as a function of case temperature**
($T_j \le 175°C$)

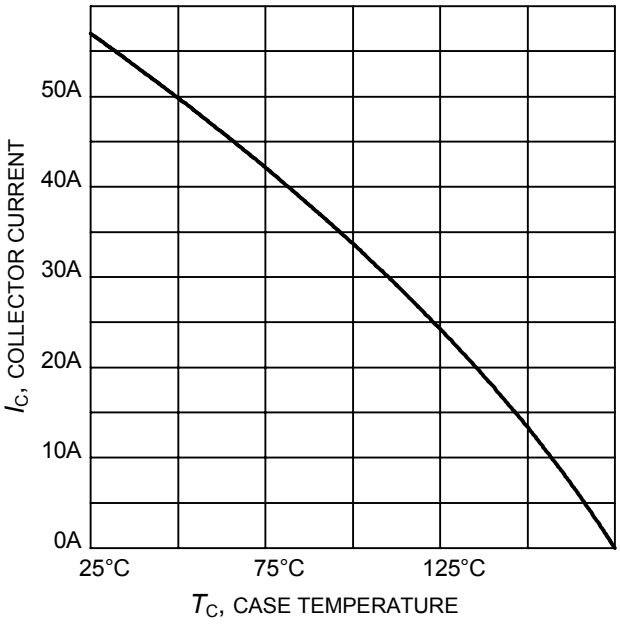



**Figure 4. Collector current as a function of case temperature**
($V_{GE} \ge 15V$, $T_j \le 175°C$)

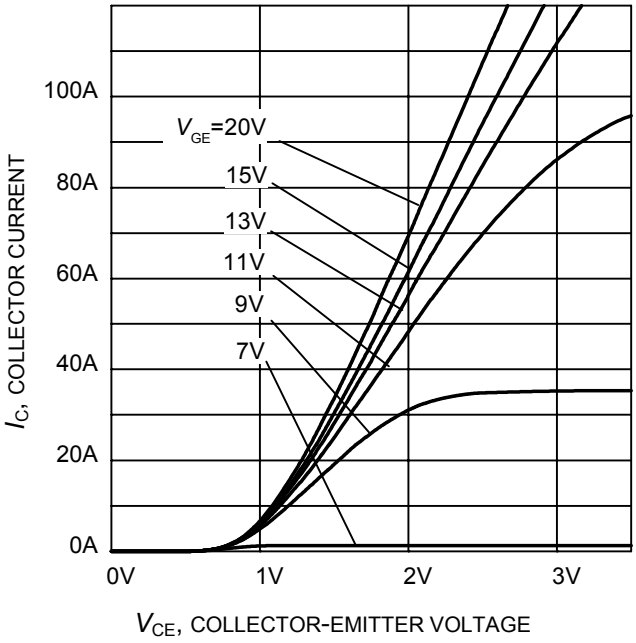



**Figure 5. Typical output characteristic**
($T_j$ = 25°C)

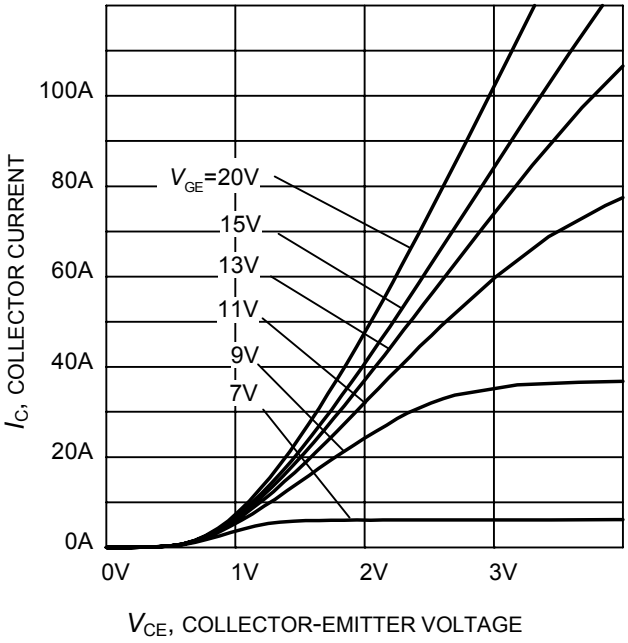



**Figure 6. Typical output characteristic**
($T_j$ = 175°C)

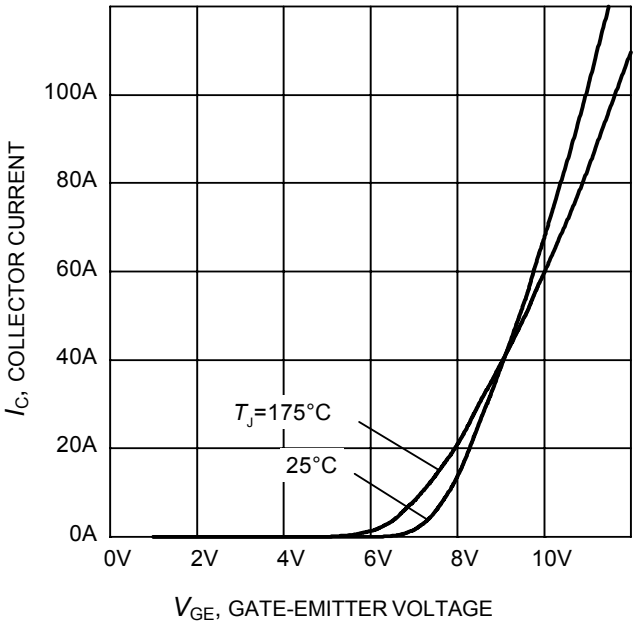



**Figure 7. Typical transfer characteristic**
($V_{CE}$=20V)

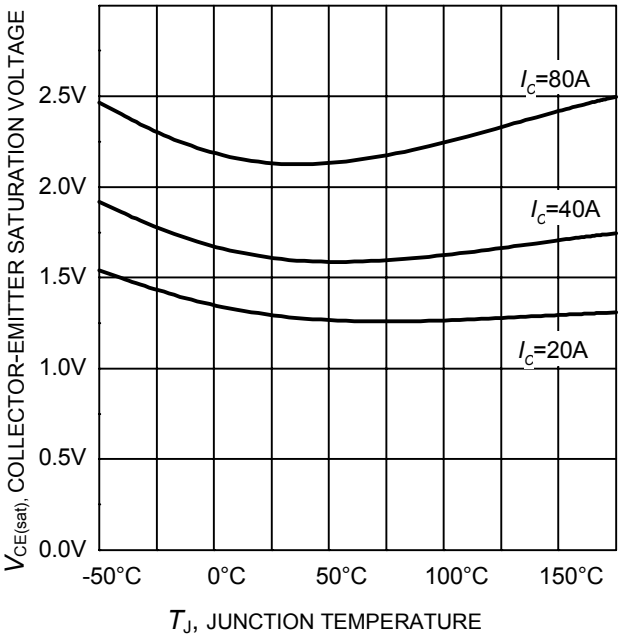



**Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}$ = 15V)

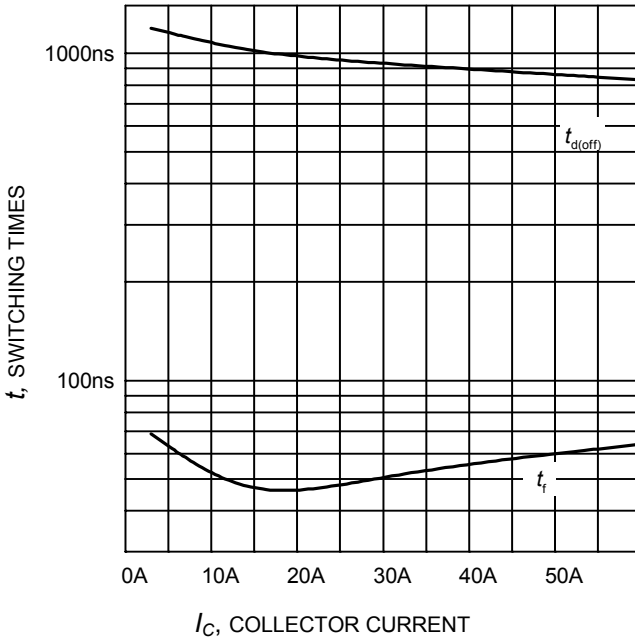



**Figure 9. Typical switching times as a function of collector current**
(inductive load, $T_J$=175°C,
$V_{CE}$ = 600V, $V_{GE}$ = 0/15V, $R_G$=26.9Ω,
Dynamic test circuit in Figure E)

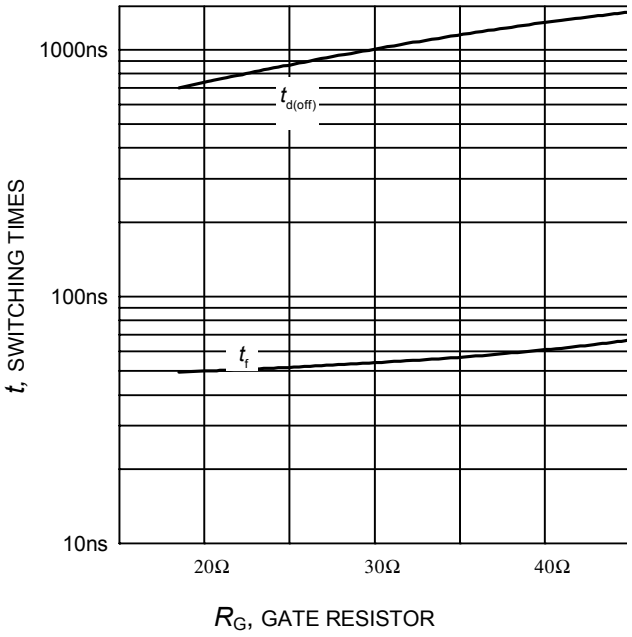



**Figure 10. Typical switching times as a function of gate resistor**
(inductive load, $T_J$ = 175°C,
$V_{CE}$= 600V, $V_{GE}$ = 0/15V, $I_C$ = 30A,
Dynamic test circuit in Figure E)

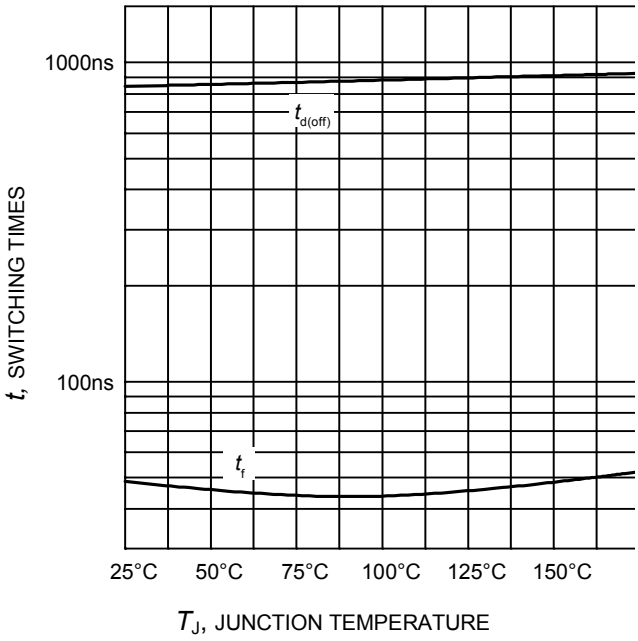



**Figure 11. Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}$ = 600V,
$V_{GE}$ = 0/15V, $I_C$ = 30A, $R_G$=26.9Ω,
Dynamic test circuit in Figure E)

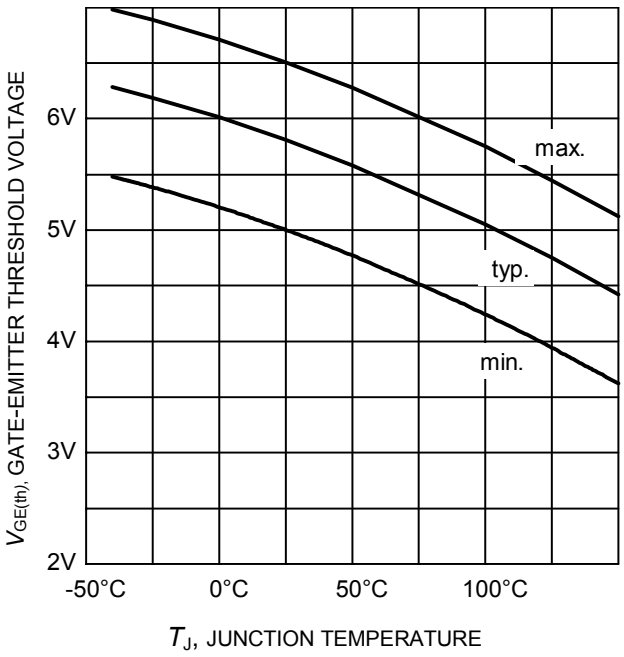



**Figure 12. Gate-emitter threshold voltage as a function of junction temperature**
($I_C$ = 0.7mA)

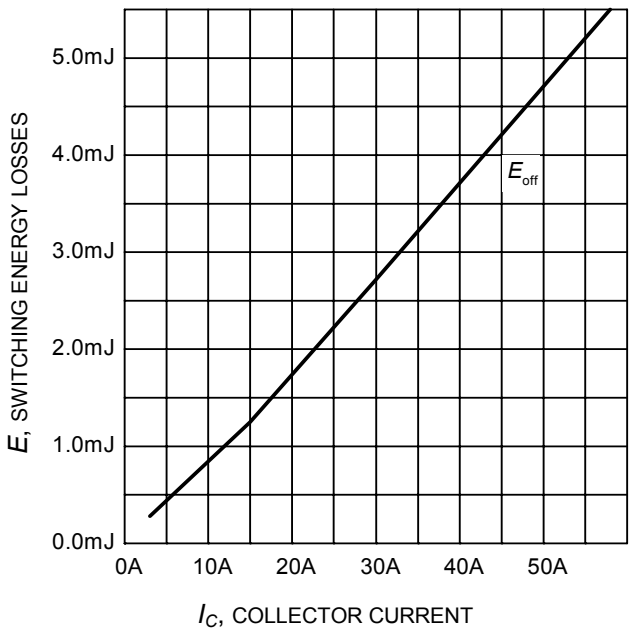



**Figure 13. Typical switching energy losses as a function of collector current**
(inductive load, $T_J$ = 175°C,
$V_{CE}$ = 600V, $V_{GE}$ = 0/15V, $R_G$=26.9Ω,
Dynamic test circuit in Figure E)

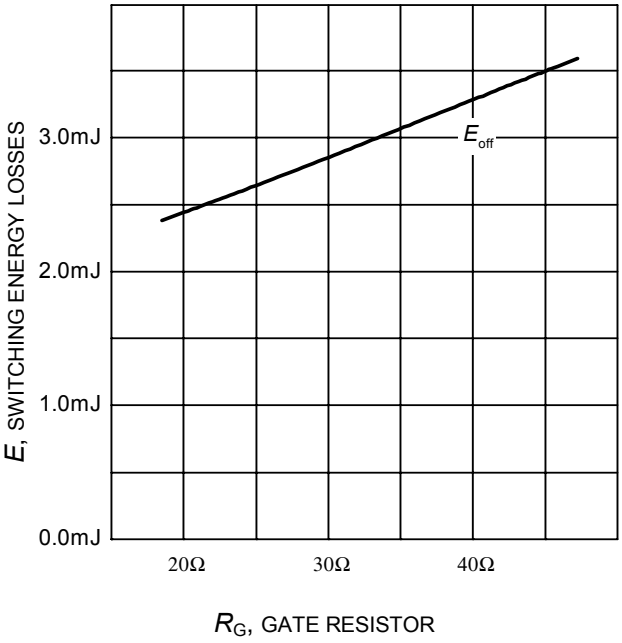



**Figure 14. Typical switching energy losses as a function of gate resistor**
(inductive load, $T_J$ = 175°C,
$V_{CE}$ = 600V, $V_{GE}$ = 0/15V, $I_C$ = 30A,
Dynamic test circuit in Figure E)

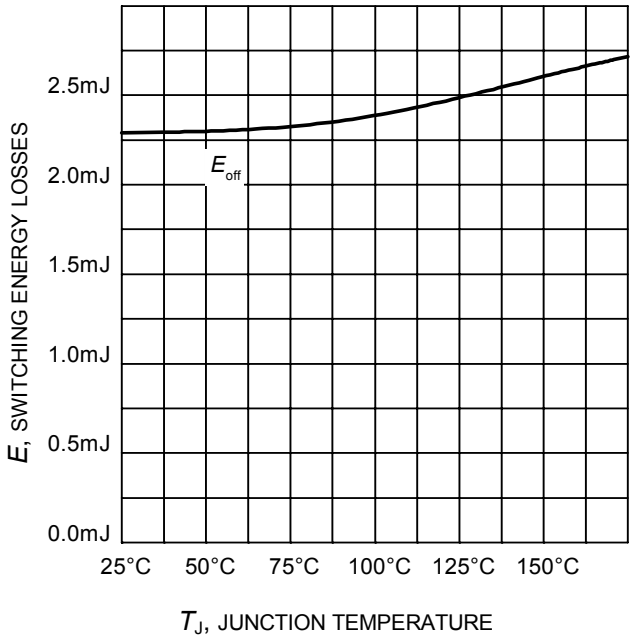



**Figure 15. Typical switching energy losses as a function of junction temperature**
(inductive load, $V_{CE}$ = 600V,
$V_{GE}$ = 0/15V, $I_C$ = 30A, $R_G$ = 26.9Ω,
Dynamic test circuit in Figure E)

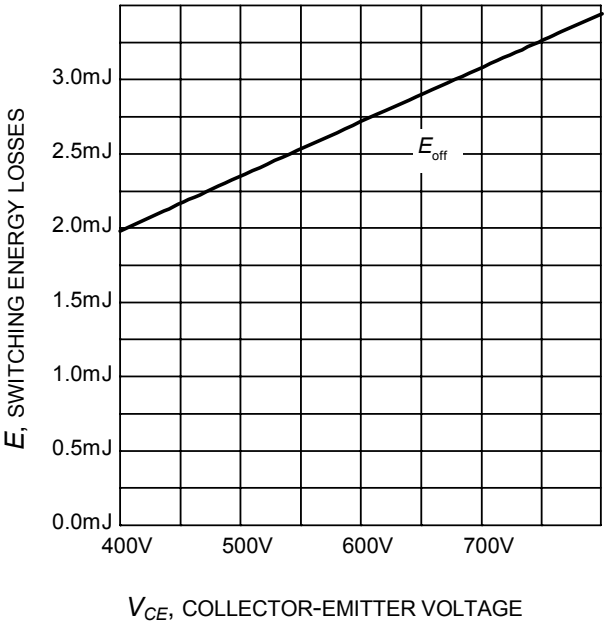



**Figure 16. Typical switching energy losses as a function of collector emitter voltage**
(inductive load, $T_J$ = 175°C,
$V_{GE}$ = 0/15V, $I_C$ = 30A, $R_G$ = 26.9Ω,
Dynamic test circuit in Figure E)

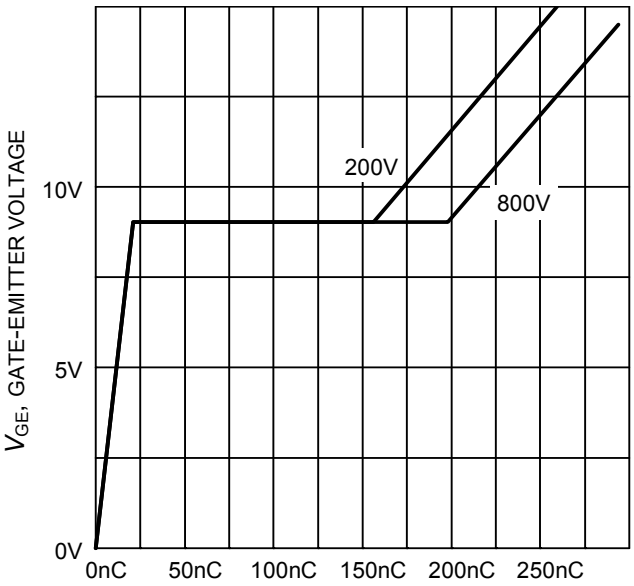



**Figure 17. Typical gate charge**
($I_C$=30 A)

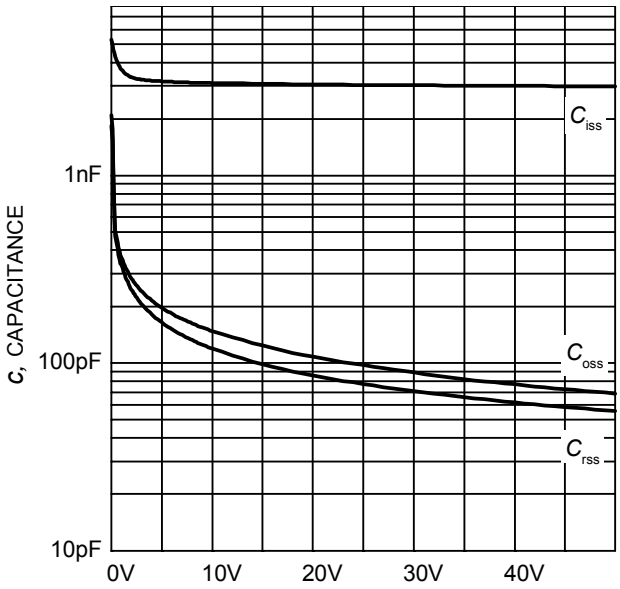



**Figure 18. Typical capacitance as a function of collector-emitter voltage**
($V_{GE}$=0V, $f$ = 1 MHz)

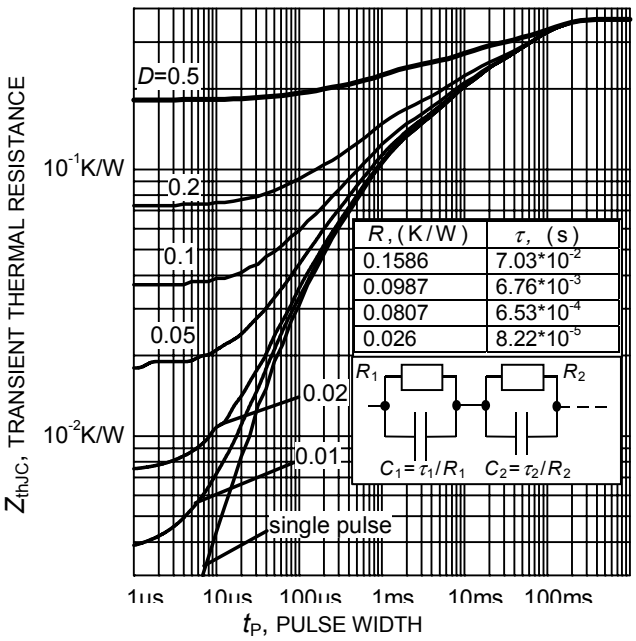



**Figure 19. IGBT transient thermal resistance**
($D = t_p / T$)

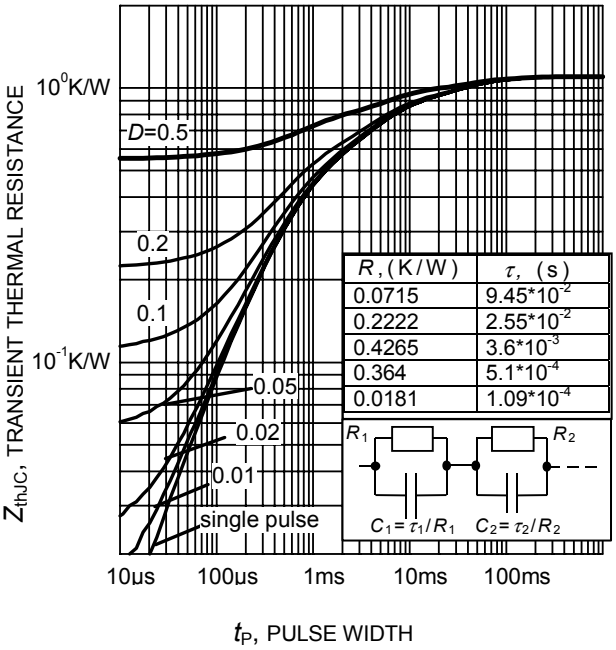



**Figure 20. Diode transient thermal impedance as a function of pulse width**
($D=t_P/T$)

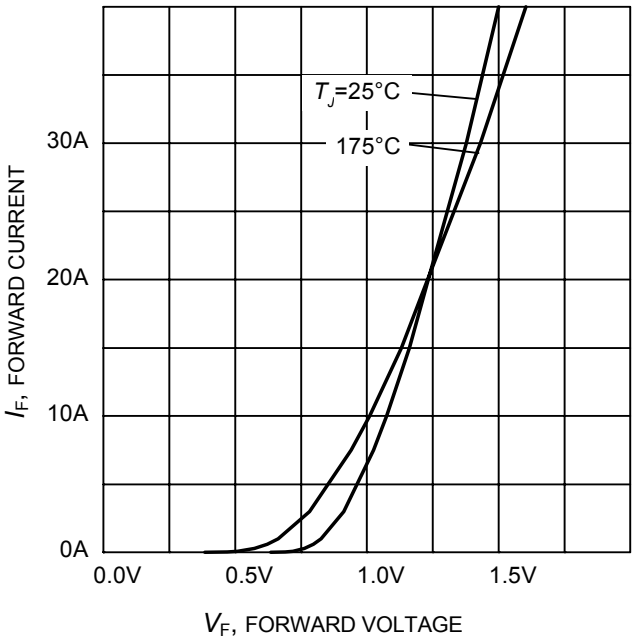



**Figure 21. Typical diode forward current as a function of forward voltage**

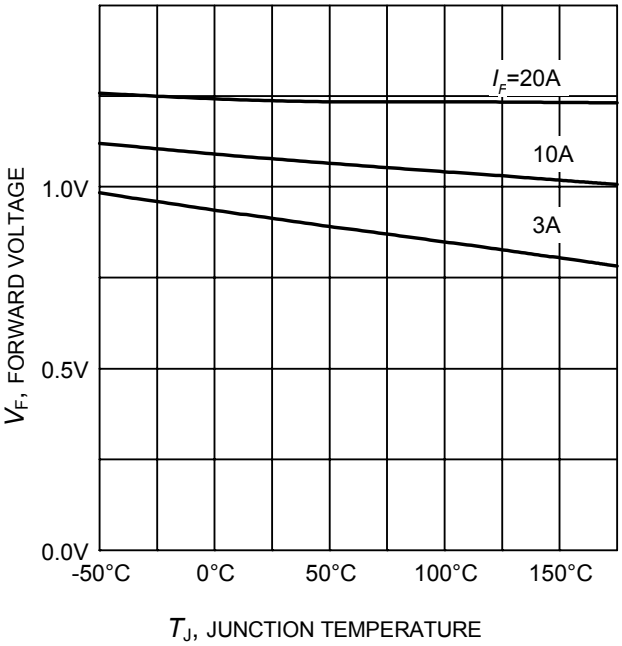
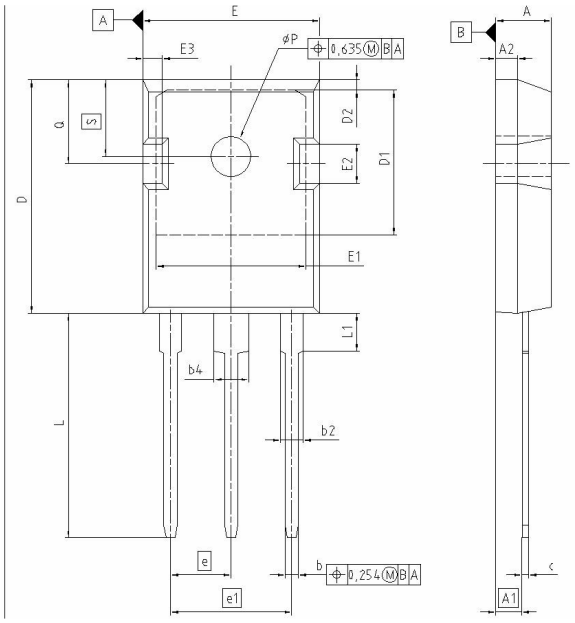



**Figure 22. Typical diode forward voltage as a function of junction temperature**

PG-TO247-3-21




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| **A** | 4.903 | 5.157 | 0.193 | 0.203 |
| **A1** | 2.273 | 2.527 | 0.092 | 0.096 |
| **A2** | 1.853 | 2.107 | 0.075 | 0.081 |
| **b** | 1.073 | 1.327 | 0.047 | 0.052 |
| **b2** | 1.903 | 2.386 | 0.075 | 0.094 |
| **b4** | 2.870 | 3.454 | 0.113 | 0.136 |
| **c** | 0.549 | 0.752 | 0.024 | 0.030 |
| **D** | 20.823 | 21.077 | 0.820 | 0.830 |
| **D1** | 17.323 | 17.831 | 0.682 | 0.702 |
| **D2** | 1.063 | 1.317 | 0.042 | 0.052 |
| **E** | 15.773 | 16.027 | 0.621 | 0.631 |
| **E1** | 13.893 | 14.147 | 0.547 | 0.557 |
| **E2** | 3.683 | 3.937 | 0.145 | 0.155 |
| **E3** | 1.683 | 1.937 | 0.066 | 0.076 |
| **e** | 5.450 | | 0.215 | |
| **e1** | 10.900 | | 0.430 | |
| **N** | 3 | | 3 | |
| **L** | 20.053 | 20.307 | 0.789 | 0.799 |
| **L1** | 4.168 | 4.472 | 0.164 | 0.176 |
| **øP** | 3.559 | 3.661 | 0.140 | 0.144 |
| **Q** | 5.493 | 5.747 | 0.216 | 0.226 |
| **S** | 6.043 | 6.297 | 0.238 | 0.248 |

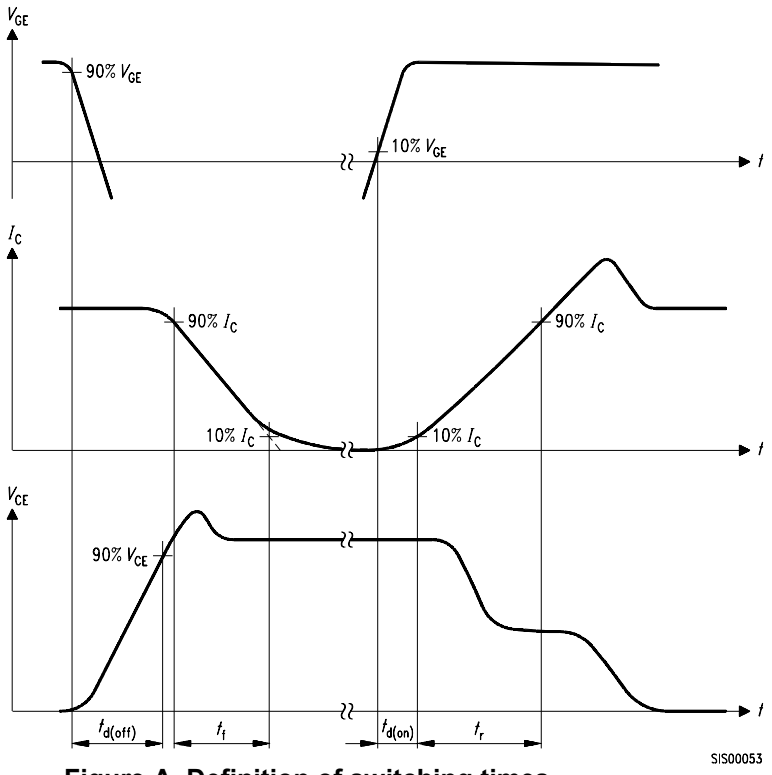



**Figure A. Definition of switching times**

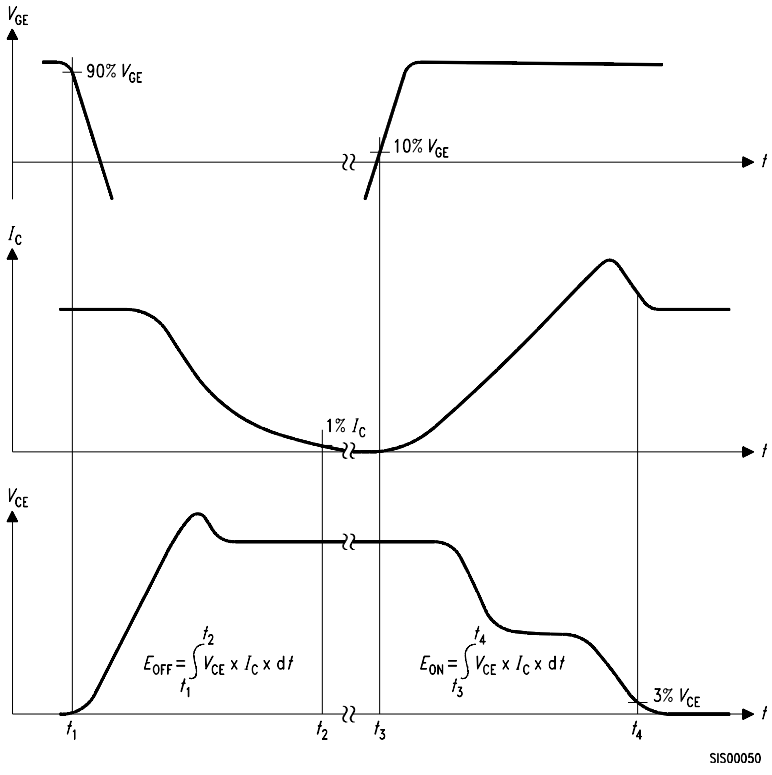



**Figure B. Definition of switching losses**

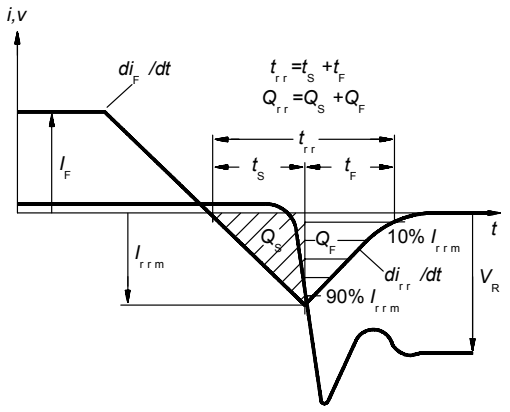



**Figure C. Definition of diodes switching characteristics**

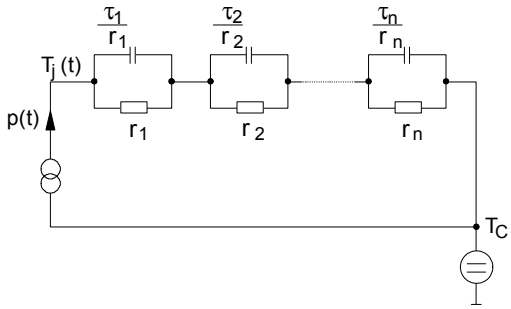



**Figure D. Thermal equivalent circuit**

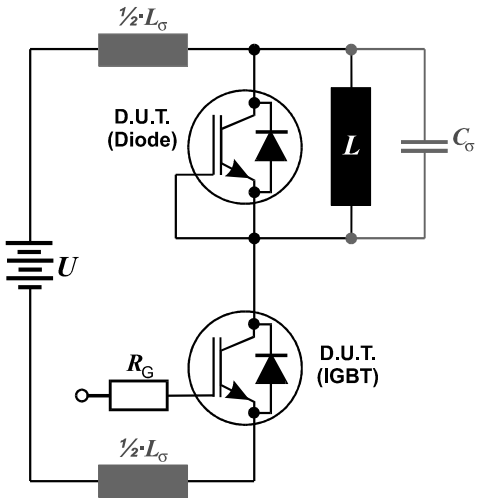



**Figure E. Dynamic test circuit**

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