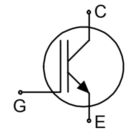
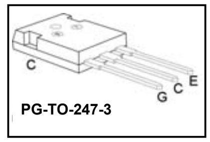
# Low Loss IGBT in TrenchStop® and Fieldstop technology




- Short circuit withstand time – 10µs
- Designed for :
  - Frequency Converters
  - Uninterrupted Power Supply
- TrenchStop® 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
- Low Gate Charge
- 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/




| Type | $V_{CE}$ | $I_C$ | $V_{CE(sat),Tj=25°C}$ | $T_{j,max}$ | Marking | Package |
|---|---|---|---|---|---|---|
| IGW25T120 | 1200V | 25A | 1.7V | 150°C | G25T120 | 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<br>$V_{CE} \leq$ 1200V, $T_j \leq$ 150°C | - | 75 | |
| Gate-emitter voltage | $V_{GE}$ | ±20 | V |
| Short circuit withstand time[2)]<br>$V_{GE}$ = 15V, $V_{CC} \leq$ 1200V, $T_j \leq$ 150°C | $t_{SC}$ | 10 | µs |
| Power dissipation<br>$T_C$ = 25°C | $P_{tot}$ | 190 | W |
| Operating junction temperature | $T_j$ | -40...+150 | °C |
| Storage temperature | $T_{stg}$ | -55...+150 | |
| Soldering temperature, 1.6mm (0.063 in.) from case for 10s | - | 260 | |

[1] J-STD-020 and JESD-022
[2)] Allowed number of short circuits: <1000; time between short circuits: >1s.

**Thermal Resistance**

| Parameter | Symbol | Conditions | Max. Value | Unit |
|---|---|---|---|---|
| **Characteristic** | | | | |
| IGBT thermal resistance, junction – case | $R_{thJC}$ | | 0.65 | K/W |
| 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 | - | 1.7 | 2.2 | |
| | | $T_j$=125°C | - | 2.0 | - | |
| | | $T_j$=150°C | - | 2.2 | - | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C$=1mA, $V_{CE}$=$V_{GE}$ | 5.0 | 5.8 | 6.5 | |
| Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$=1200V, $V_{GE}$=0V | | | | mA |
| | | $T_j$=25°C | - | - | 0.25 | |
| | | $T_j$=150°C | - | - | 2.5 | |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=20V | - | - | 600 | nA |
| Transconductance | $g_{fs}$ | $V_{CE}$=20V, $I_C$=25A | - | 16 | - | S |
| Integrated gate resistor | $R_{Gint}$ | | | 8 | | Ω |

**Dynamic Characteristic**

| Parameter | Symbol | Conditions | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| Input capacitance | $C_{iss}$ | $V_{CE}$=25V, | - | 1860 | - | pF |
| Output capacitance | $C_{oss}$ | $V_{GE}$=0V, | - | 96 | - | |
| Reverse transfer capacitance | $C_{rss}$ | $f$=1MHz | - | 82 | - | |
| Gate charge | $Q_{Gate}$ | $V_{CC}$=960V, $I_C$=25A $V_{GE}$=15V | - | 155 | - | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | $L_E$ | | - | 13 | - | nH |
| Short circuit collector current[1)] | $I_{C(SC)}$ | $V_{GE}$=15V, $t_{SC}$≤10µs $V_{CC}$ = 600V, $T_j$ = 25°C | - | 150 | - | A |

1) Allowed number of short circuits: <1000; time between short circuits: >1s.

**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, $V_{CC}$=600V, $I_C$=25A $V_{GE}$=-15/15V, $R_G$=22Ω, $L_\sigma$[2)]=180nH, $C_\sigma$[2)]=39pF Energy losses include "tail" and diode reverse recovery. | - | 50 | - | ns |
| Rise time | $t_r$ | | - | 30 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 560 | - | |
| Fall time | $t_f$ | | - | 70 | - | |
| Turn-on energy | $E_{on}$ | | - | 2.0 | - | mJ |
| Turn-off energy | $E_{off}$ | | - | 2.2 | - | |
| Total switching energy | $E_{ts}$ | | - | 4.2 | - | |

**Switching Characteristic, Inductive Load,** at $T_j$=150 °C

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **IGBT Characteristic** | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j$=150°C $V_{CC}$=600V, $I_C$=25A, $V_{GE}$=-15/15V, $R_G$= 22Ω, $L_\sigma$[2)]=180nH, $C_\sigma$[2)]=39pF Energy losses include "tail" and diode reverse recovery. | - | 50 | - | ns |
| Rise time | $t_r$ | | - | 32 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 660 | - | |
| Fall time | $t_f$ | | - | 130 | - | |
| Turn-on energy | $E_{on}$ | | - | 3.0 | - | mJ |
| Turn-off energy | $E_{off}$ | | - | 4.0 | - | |
| Total switching energy | $E_{ts}$ | | - | 7.0 | - | |

[2)] Leakage inductance $L_\sigma$ and Stray capacity $C_\sigma$ due to dynamic test circuit in Figure E.

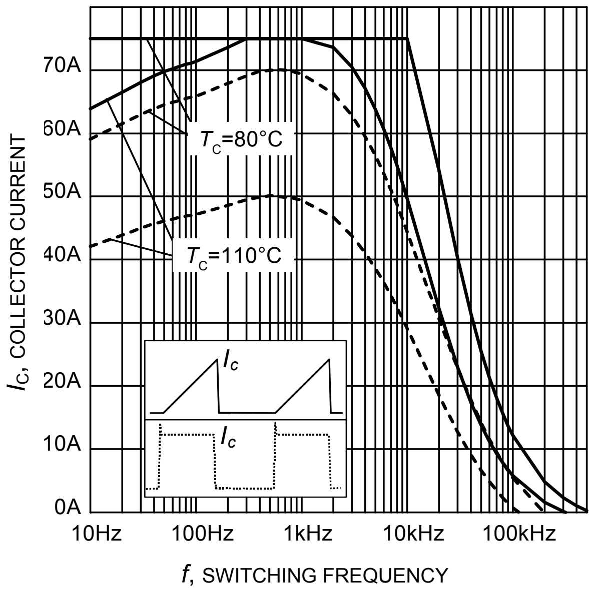



**Figure 1. Collector current as a function of switching frequency**
($T_j \leq 150°C$, $D = 0.5$, $V_{CE} = 600V$, $V_{GE} = 0/+15V$, $R_G = 22\Omega$)

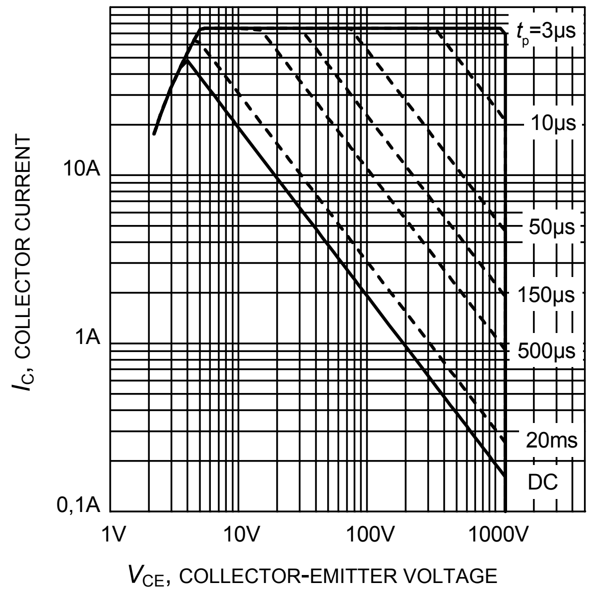



**Figure 2. Safe operating area**
($D = 0$, $T_C = 25°C$, $T_j \leq 150°C$; $V_{GE}$=15V)

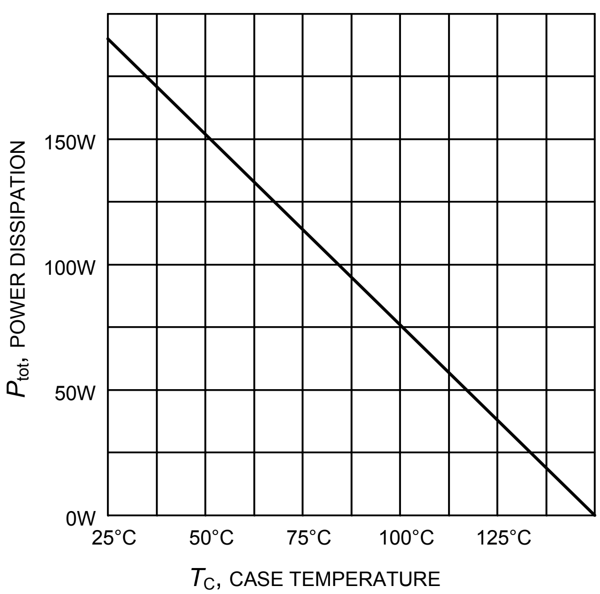



**Figure 3. Power dissipation as a function of case temperature**
($T_j \leq 150°C$)

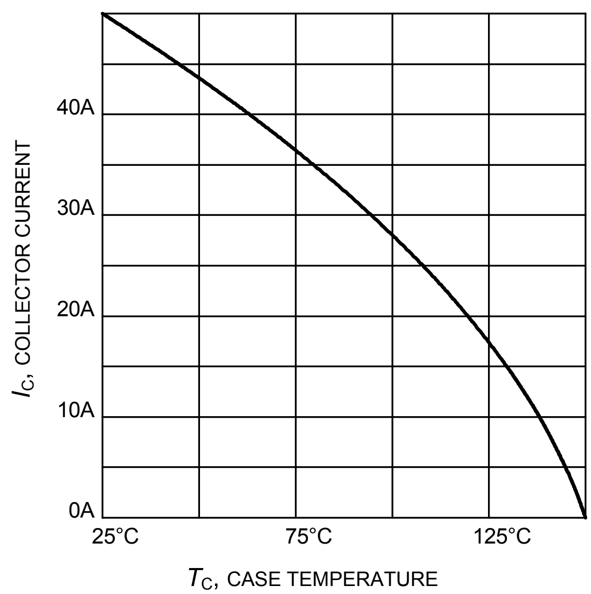



**Figure 4. Collector current as a function of case temperature**
($V_{GE} \geq 15V$, $T_j \leq 150°C$)

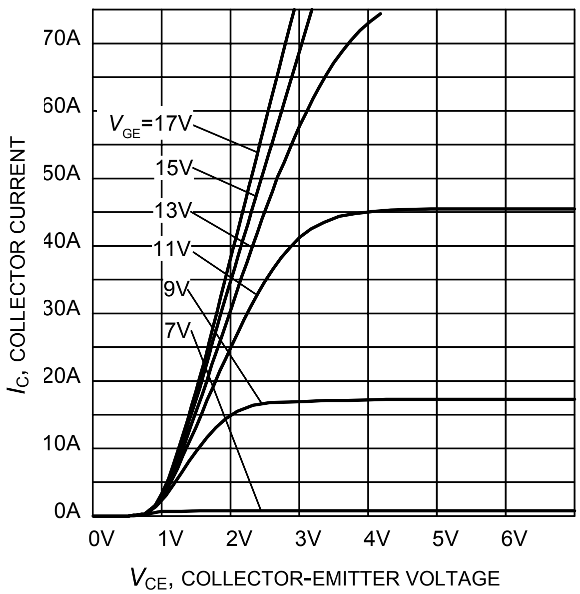



**Figure 5. Typical output characteristic**
($T_j$ = 25°C)

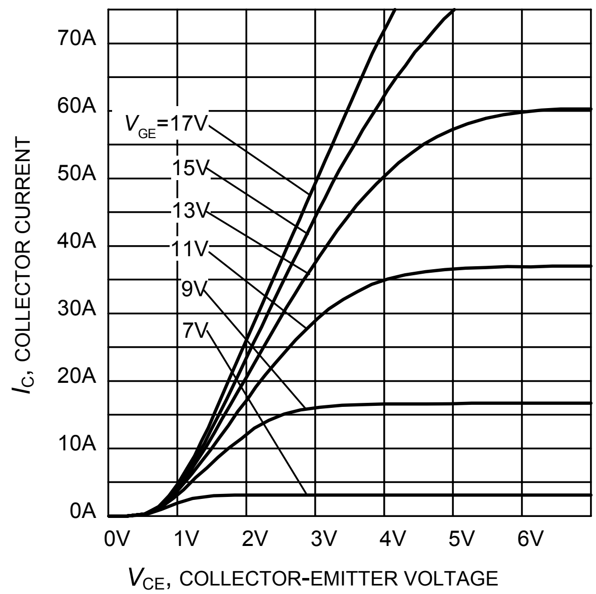



**Figure 6. Typical output characteristic**
($T_j$ = 150°C)

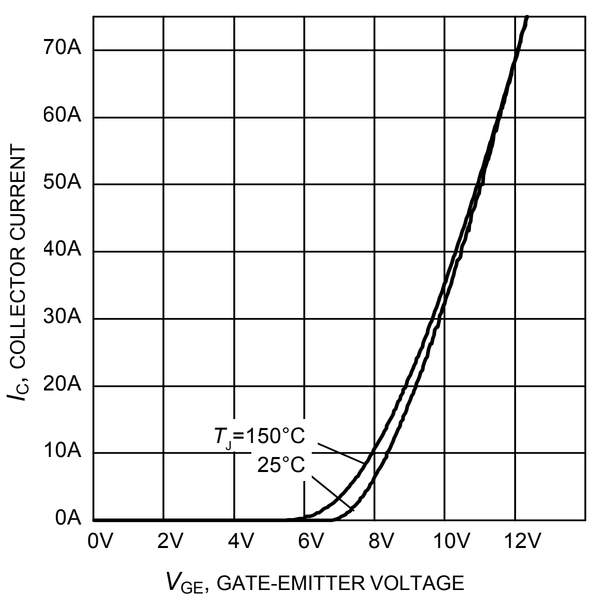



**Figure 7. Typical transfer characteristic**
($V_{CE}$=20V)

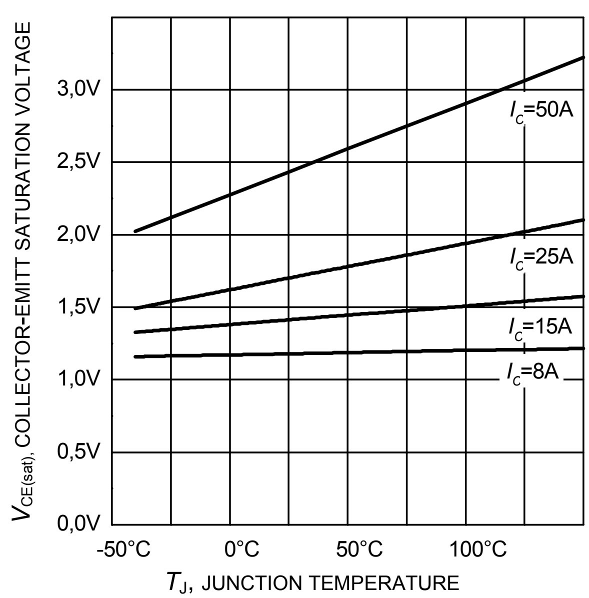



**Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}$ = 15V)

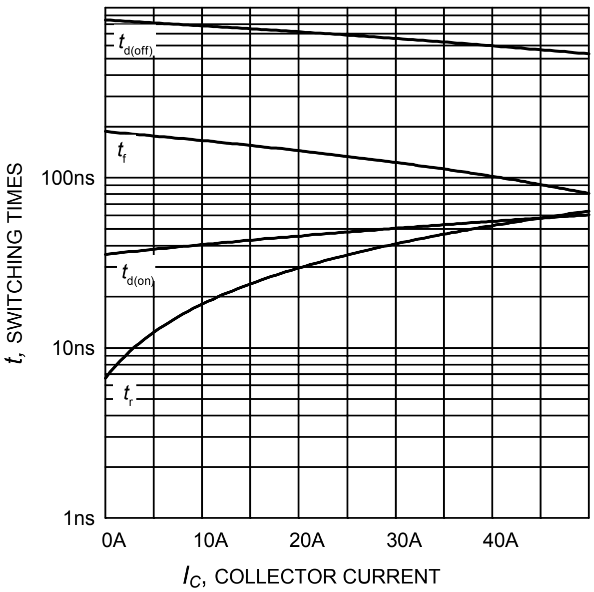



**Figure 9. Typical switching times as a function of collector current**
(inductive load, $T_J$=150°C, $V_{CE}$=600V, $V_{GE}$=0/15V, $R_G$=22Ω, Dynamic test circuit in Figure E)

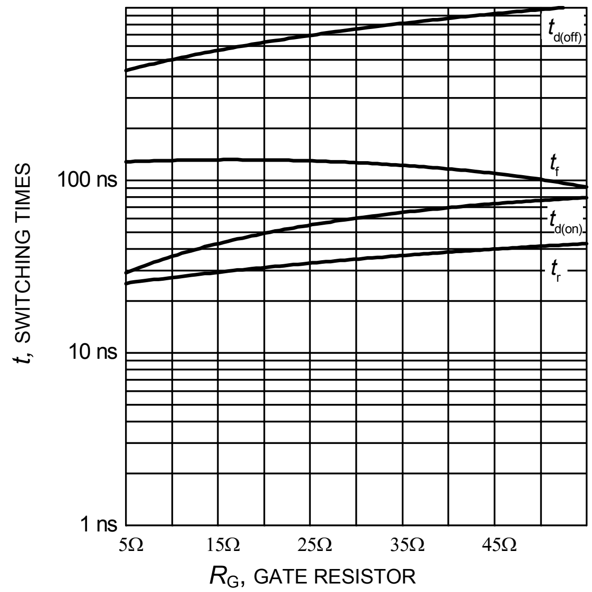



**Figure 10. Typical switching times as a function of gate resistor**
(inductive load, $T_J$=150°C, $V_{CE}$=600V, $V_{GE}$=0/15V, $I_C$=25A, Dynamic test circuit in Figure E)

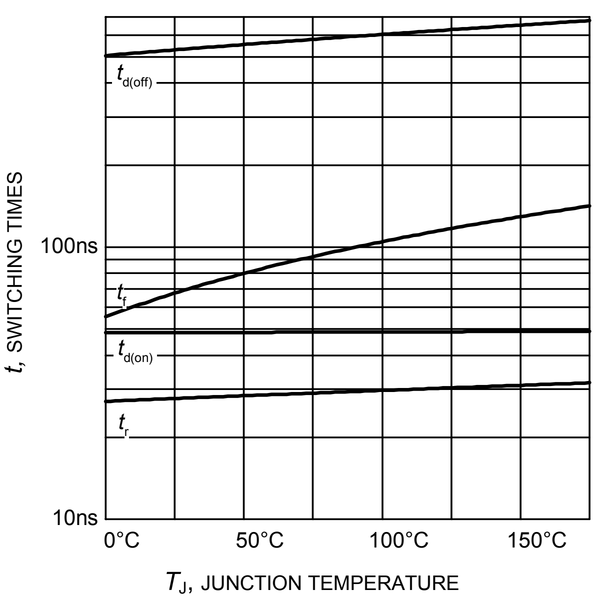



**Figure 11. Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}$=600V, $V_{GE}$=0/15V, $I_C$=25A, $R_G$=22Ω, Dynamic test circuit in Figure E)

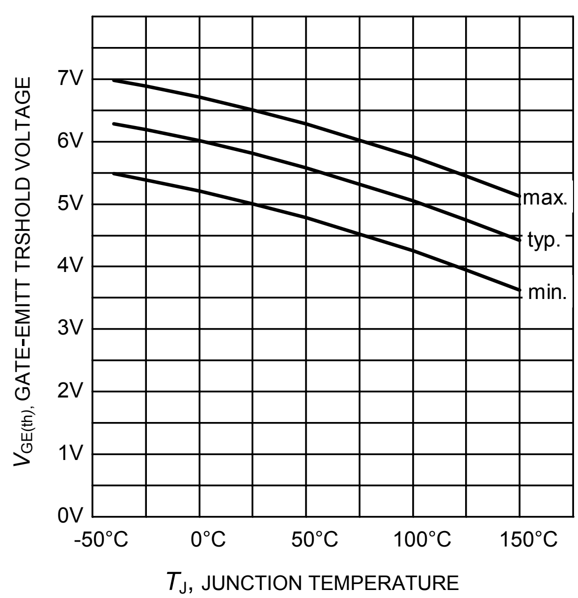



**Figure 12. Gate-emitter threshold voltage as a function of junction temperature**
($I_C$ = 1.0mA)

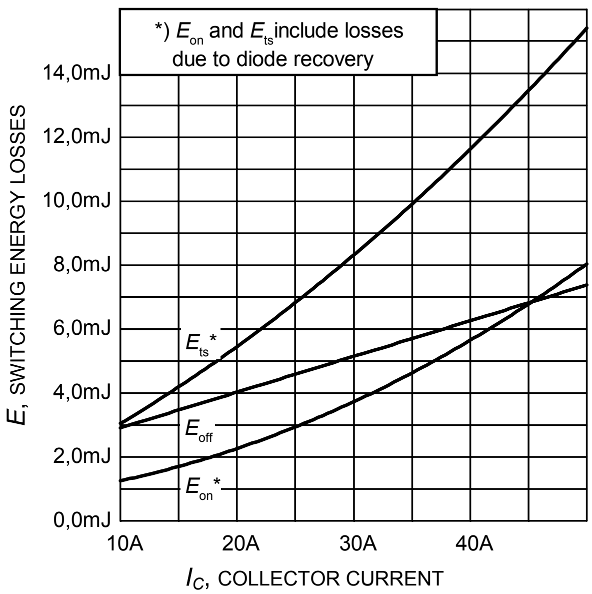



**Figure 13. Typical switching energy losses as a function of collector current**
(inductive load, $T_J$=150°C, $V_{CE}$=600V, $V_{GE}$=0/15V, $R_G$=22Ω, Dynamic test circuit in Figure E)

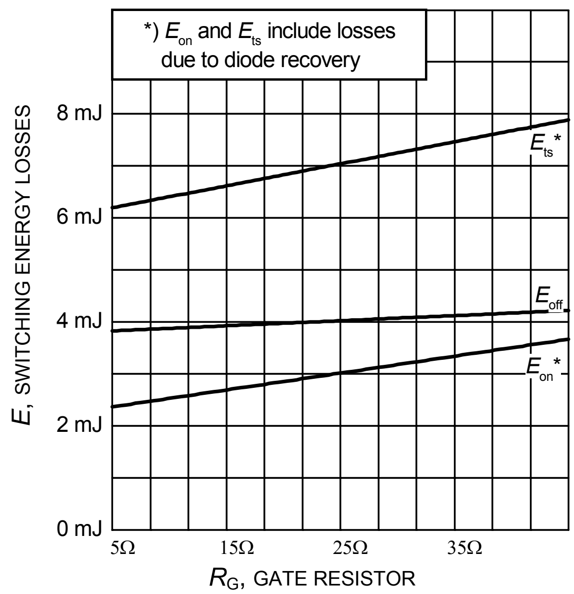



**Figure 14. Typical switching energy losses as a function of gate resistor**
(inductive load, $T_J$=150°C, $V_{CE}$=600V, $V_{GE}$=0/15V, $I_C$=25A, Dynamic test circuit in Figure E)

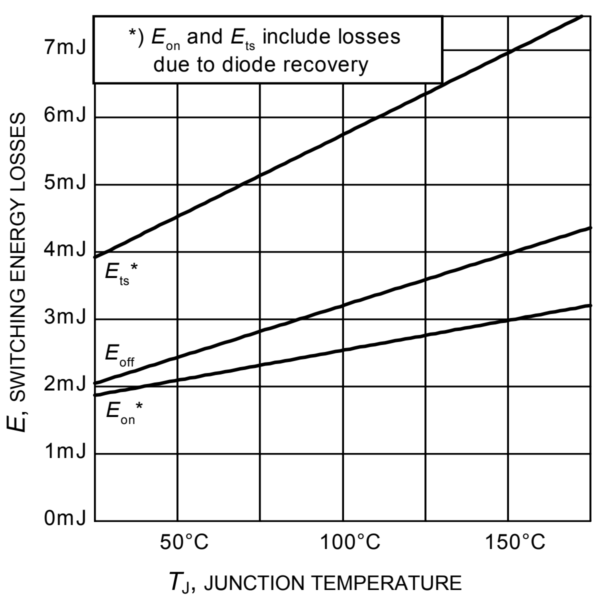



**Figure 15. Typical switching energy losses as a function of junction temperature**
(inductive load, $V_{CE}$=600V, $V_{GE}$=0/15V, $I_C$=25A, $R_G$=22Ω, Dynamic test circuit in Figure E)

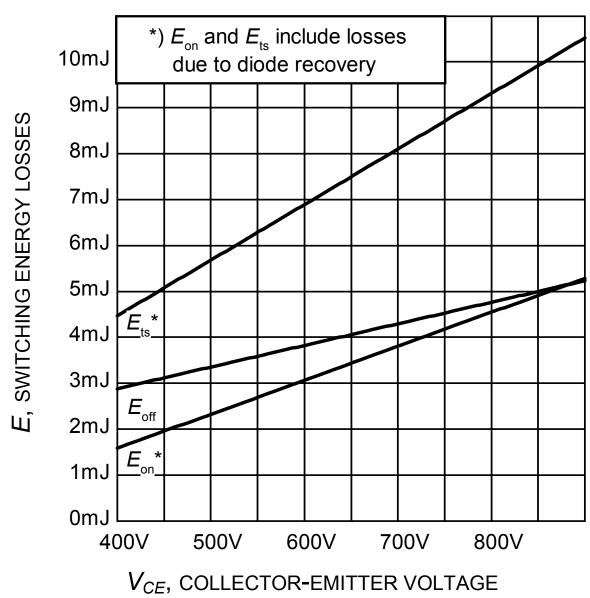



**Figure 16. Typical switching energy losses as a function of collector emitter voltage**
(inductive load, $T_J$=150°C, $V_{GE}$=0/15V, $I_C$=25A, $R_G$=22Ω, Dynamic test circuit in Figure E)

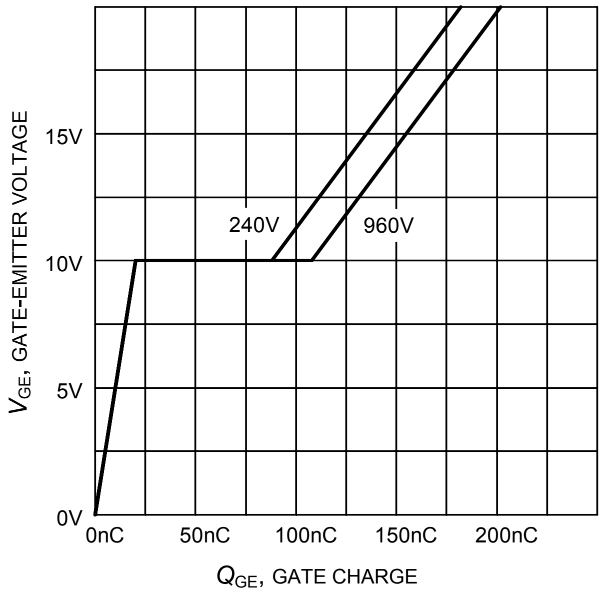



**Figure 17. Typical gate charge**
($I_C$=25 A)

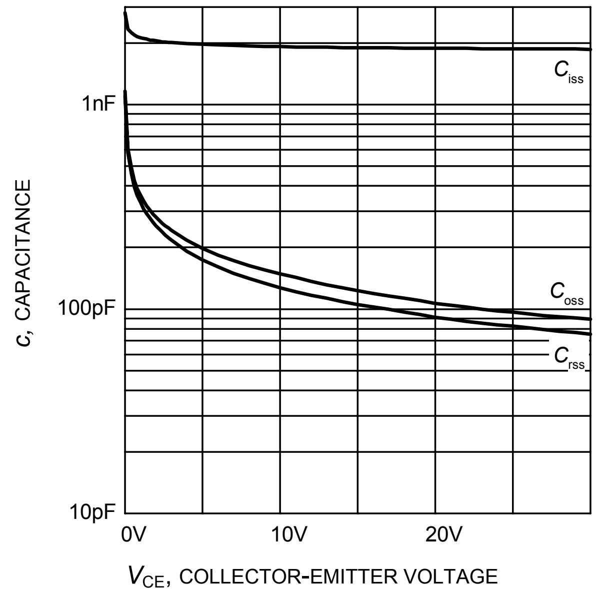



**Figure 18. Typical capacitance as a function of collector-emitter voltage**
($V_{GE}$=0V, $f$ = 1 MHz)

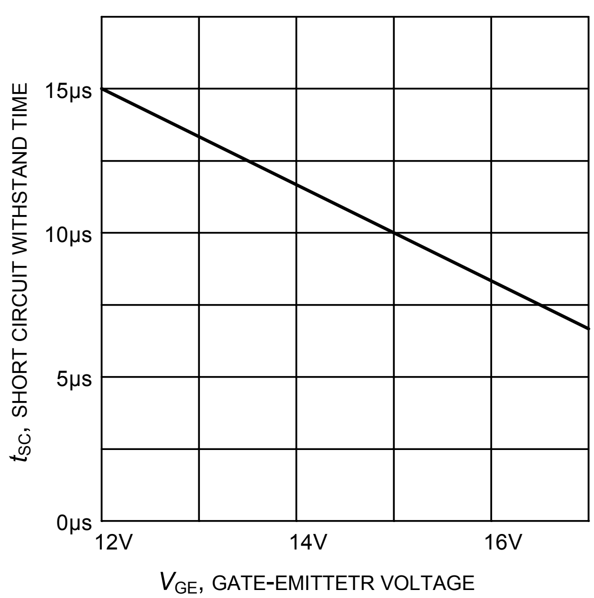



**Figure 19. Short circuit withstand time as a function of gate-emitter voltage**
($V_{CE}$=600V, start at $T_J$=25°C)

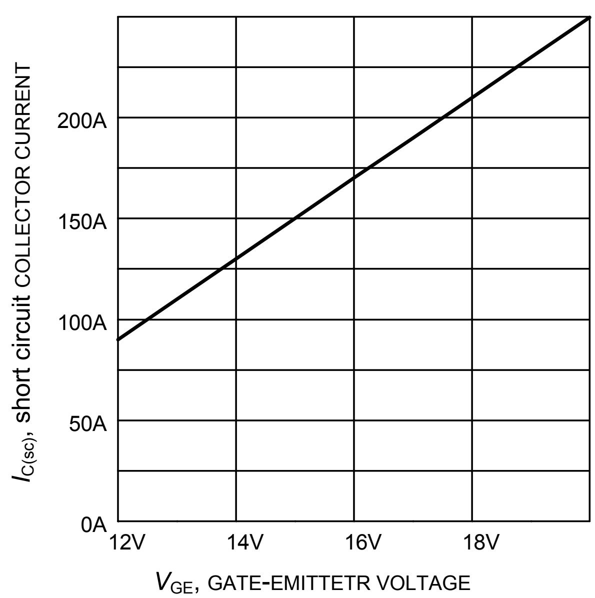



**Figure 20. Typical short circuit collector current as a function of gate-emitter voltage**
($V_{CE} \leq$ 600V, $T_j \leq$ 150°C)

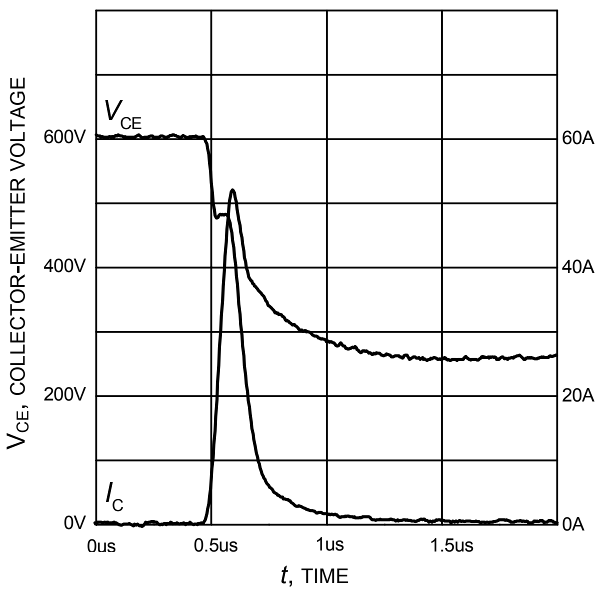



**Figure 21. Typical turn on behavior**
($V_{GE}$=0/15V, $R_G$=22Ω, $T_j$ = 150°C, Dynamic test circuit in Figure E)

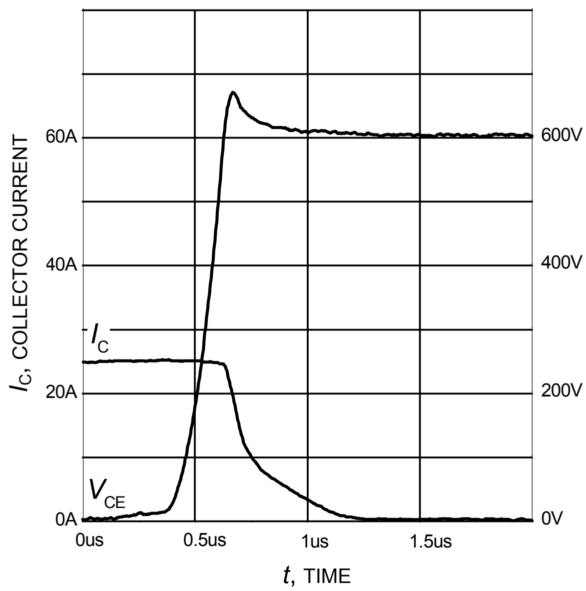



**Figure 22. Typical turn off behavior**
($V_{GE}$=15/0V, $R_G$=22Ω, $T_j$ = 150°C, Dynamic test circuit in Figure E)

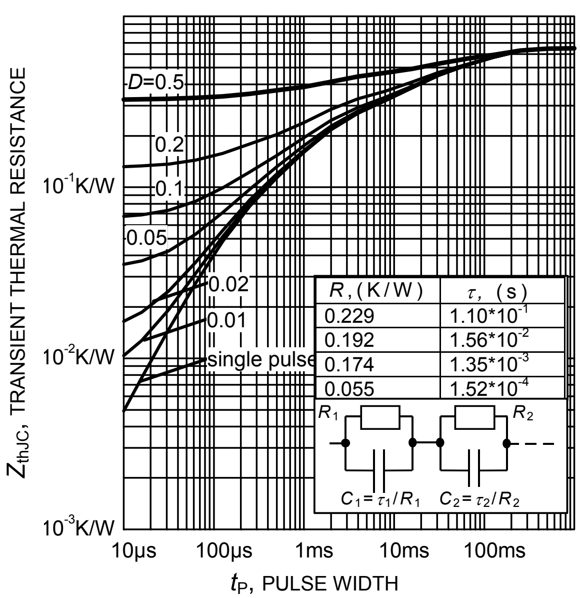



**Figure 23. IGBT transient thermal resistance**
($D = t_p / T$)

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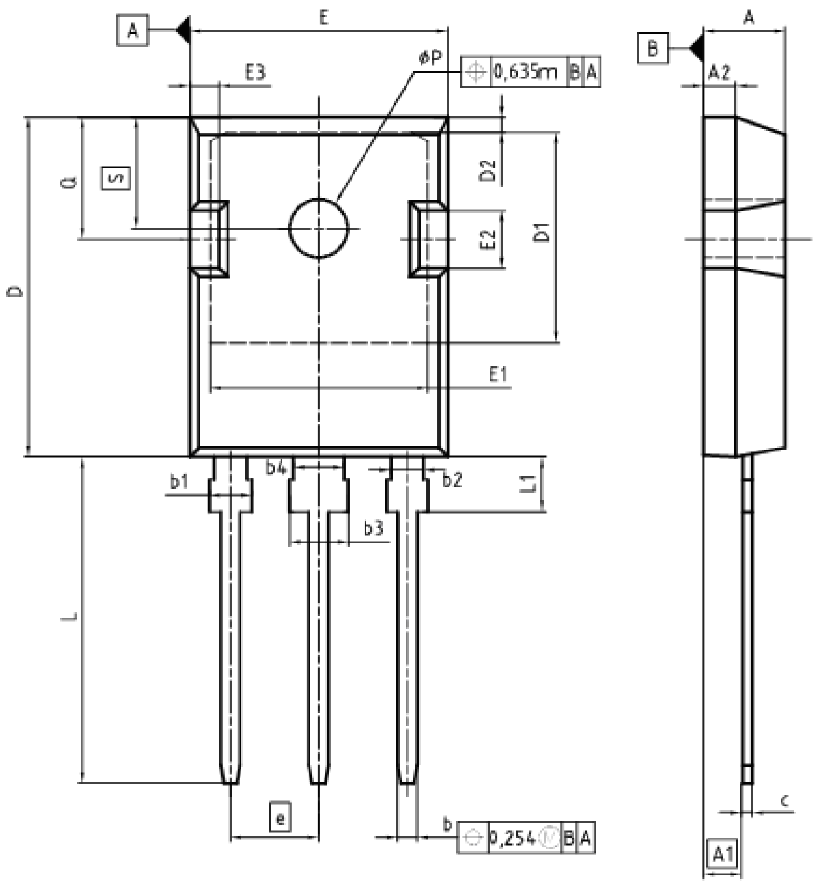
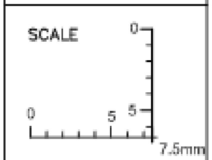


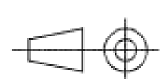

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.83 | 5.21 | 0.190 | 0.205 |
| A1 | 2.27 | 2.54 | 0.089 | 0.100 |
| A2 | 1.85 | 2.16 | 0.073 | 0.085 |
| b | 1.07 | 1.33 | 0.042 | 0.052 |
| b1 | 1.90 | 2.41 | 0.075 | 0.095 |
| b2 | 1.90 | 2.16 | 0.075 | 0.085 |
| 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




EUROPEAN PROJECTION



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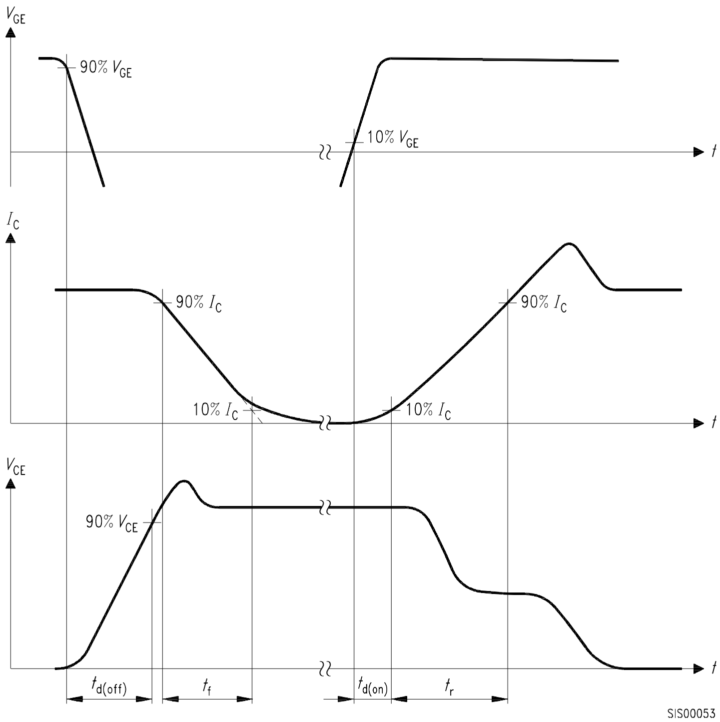


**Figure A. Definition of switching times**

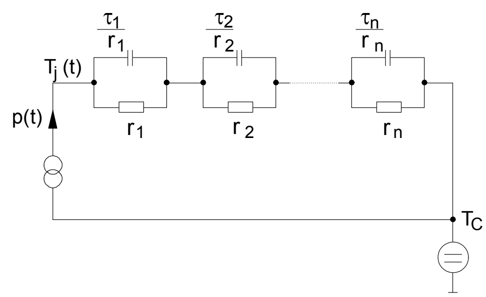


**Figure D. Thermal equivalent circuit**

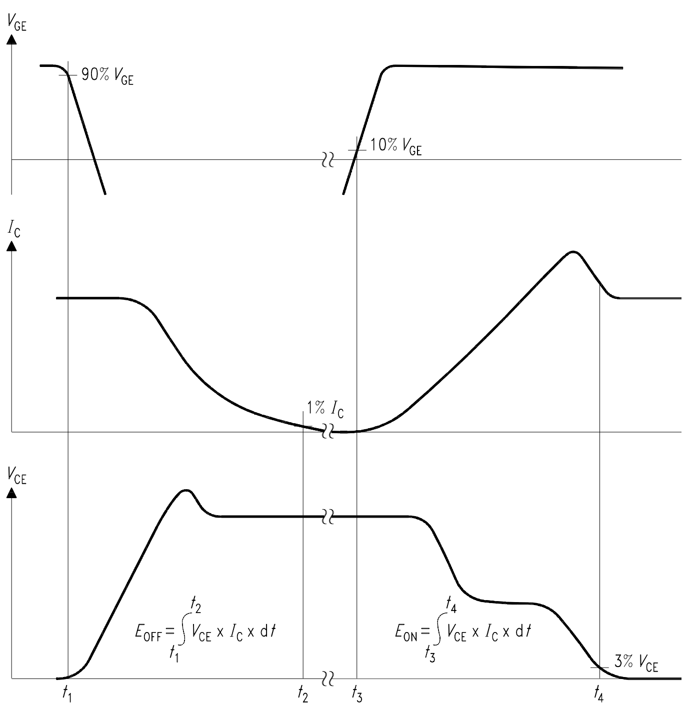


**Figure B. Definition of switching losses**

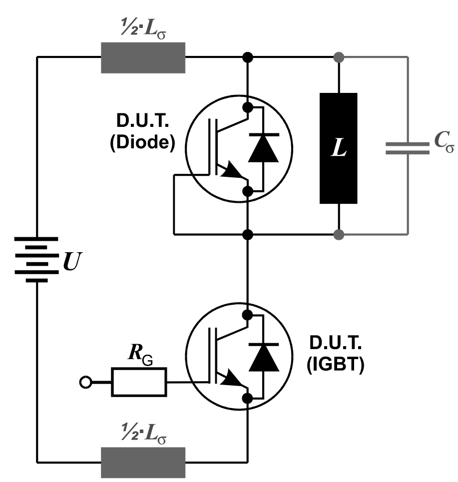


**Figure E. Dynamic test circuit**
Leakage inductance $L_\sigma$ =180nH
and Stray capacity $C_\sigma$ =39pF.

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