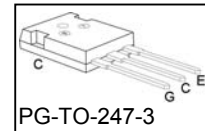
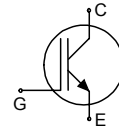


Low Loss IGBT in TrenchStop® and Fieldstop technology

- Best in class TO247
- 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 JEDEC¹ 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 | $V_{CE(sat), T_j=25^\circ C}$ | $T_{j,max}$ | Marking Code | Package |
|-----------|----------|-------|-------------------------------|-------------|--------------|-------------|
| IGW60T120 | 1200V | 60A | 1.7V | 150°C | G60T120 | PG-TO-247-3 |

Maximum Ratings

| Parameter | Symbol | Value | Unit |
|------------------------------------------------------------|--------------|------------|------|
| Collector-emitter voltage | V_{CE} | 1200 | V |
| DC collector current | I_C | | A |
| $T_C = 25^\circ C$ | | 100 | |
| $T_C = 90^\circ C$ | | 60 | |
| Pulsed collector current, t_p limited by $T_{j,max}$ | $I_{C,puls}$ | 150 | |
| Turn off safe operating area | - | 150 | |
| $V_{CE} \leq 1200V, T_j \leq 150^\circ C$ | | | |
| Gate-emitter voltage | V_{GE} | ± 20 | V |
| Short circuit withstand time ²⁾ | t_{SC} | 10 | µs |
| $V_{GE} = 15V, V_{CC} \leq 1200V, T_j \leq 150^\circ C$ | | | |
| Power dissipation | P_{tot} | 375 | W |
| $T_C = 25^\circ C$ | | | |
| 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 JEDEC-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} | | 0.33 | K/W |
| Thermal resistance, junction – ambient | R_{thJA} | | 40 | |

Electrical Characteristic, at $T_j = 25^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Conditions | Value | | | Unit |
|--------------------------------------|---------------|---------------------------------------------------------------------------------------------------------|-------|------|------|----------|
| | | | min. | typ. | max. | |
| Static Characteristic | | | | | | |
| Collector-emitter breakdown voltage | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=3.0mA$ | 1200 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE} = 15V, I_C=60A$ $T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$ $T_j=150^\circ\text{C}$ | - | 1.9 | 2.4 | |
| | | | - | 2.1 | - | |
| | | | - | 2.3 | - | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C=2.0mA, V_{CE}=V_{GE}$ | 5.0 | 5.8 | 6.5 | |
| Zero gate voltage collector current | I_{CES} | $V_{CE}=1200V,$ $V_{GE}=0V$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ | - | - | 0.6 | mA |
| | | | - | - | 6.0 | |
| Gate-emitter leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V$ | - | - | 600 | nA |
| Transconductance | g_{fs} | $V_{CE}=20V, I_C=60A$ | - | 30 | - | S |
| Integrated gate resistor | R_{Gint} | | | 4 | | Ω |

Dynamic Characteristic

| | | | | | | |
|----------------------------------------------------------------|-------------|----------------------------------------------------------------------------------|---|------|---|----|
| Input capacitance | C_{iss} | $V_{CE}=25V,$ $V_{GE}=0V,$ $f=1MHz$ | - | 3700 | - | pF |
| Output capacitance | C_{oss} | | - | 180 | - | |
| Reverse transfer capacitance | C_{riss} | | - | 150 | - | |
| Gate charge | Q_{Gate} | $V_{CC}=960V, I_C=60A$ $V_{GE}=15V$ | - | 280 | - | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | L_E | | - | 13 | - | nH |
| Short circuit collector current ¹⁾ | $I_{C(SC)}$ | $V_{GE}=15V, t_{SC}\leq 10\mu s$ $V_{CC} = 600V,$ $T_j = 25^\circ\text{C}$ | - | 300 | - | A |

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

Switching Characteristic, Inductive Load, at $T_j=25\text{ }^\circ\text{C}$

| Parameter | Symbol | Conditions | Value | | | Unit |
|----------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------|
| | | | min. | typ. | max. | |
| IGBT Characteristic | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=25\text{ }^\circ\text{C}$, $V_{CC}=600\text{V}$, $I_C=60\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, $L_{\sigma}^{2)}=180\text{nH}$, $C_{\sigma}^{2)}=39\text{pF}$ Energy losses include "tail" and diode reverse recovery. | - | 50 | - | ns |
| Rise time | t_r | | - | 44 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 480 | - | |
| Fall time | t_f | | - | 80 | - | |
| Turn-on energy | E_{on} | | - | 4.3 | - | mJ |
| Turn-off energy | E_{off} | | - | 5.2 | - | |
| Total switching energy | E_{ts} | | - | 9.5 | - | |

Switching Characteristic, Inductive Load, at $T_j=150\text{ }^\circ\text{C}$

| Parameter | Symbol | Conditions | Value | | | Unit |
|----------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------|
| | | | min. | typ. | max. | |
| IGBT Characteristic | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=150\text{ }^\circ\text{C}$ $V_{CC}=600\text{V}$, $I_C=60\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, $L_{\sigma}^{2)}=180\text{nH}$, $C_{\sigma}^{2)}=39\text{pF}$ Energy losses include "tail" and diode reverse recovery. | - | 50 | - | ns |
| Rise time | t_r | | - | 45 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 600 | - | |
| Fall time | t_f | | - | 130 | - | |
| Turn-on energy | E_{on} | | - | 6.4 | - | mJ |
| Turn-off energy | E_{off} | | - | 9.4 | - | |
| Total switching energy | E_{ts} | | - | 15.8 | - | |

²⁾ Leakage inductance L_{σ} and Stray capacity C_{σ} due to dynamic test circuit in Figure E.

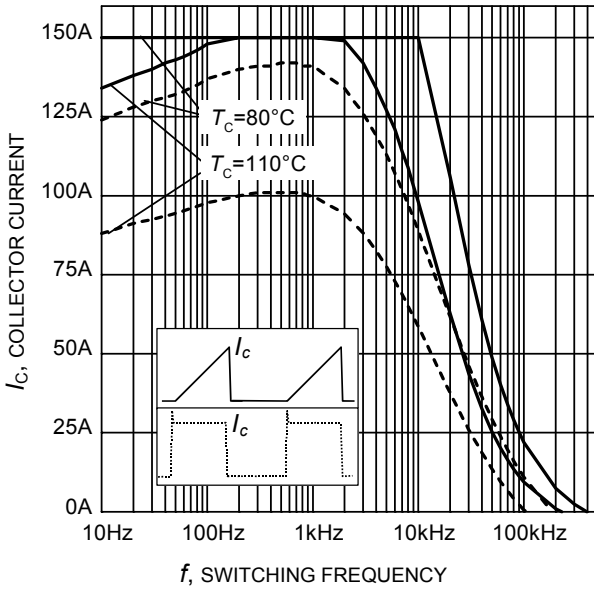


Figure 1. Collector current as a function of switching frequency
 ($T_j \leq 150^\circ\text{C}$, $D = 0.5$, $V_{CE} = 600\text{V}$,
 $V_{GE} = 0/+15\text{V}$, $R_G = 10\Omega$)

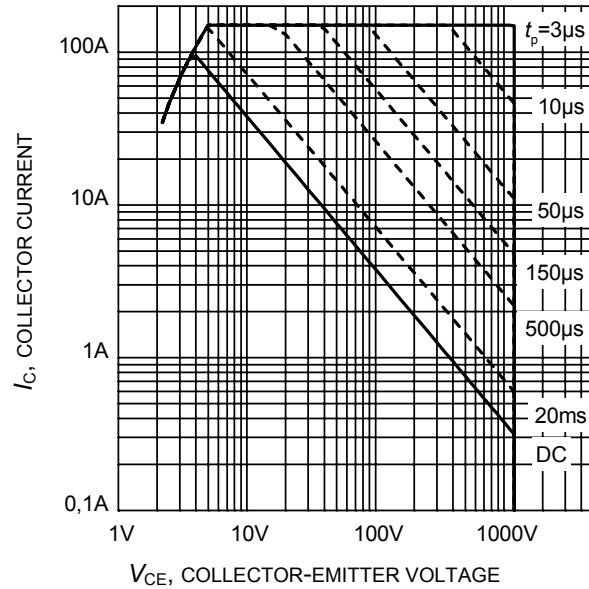


Figure 2. Safe operating area
 ($D = 0$, $T_C = 25^\circ\text{C}$,
 $T_j \leq 150^\circ\text{C}$; $V_{GE} = 15\text{V}$)

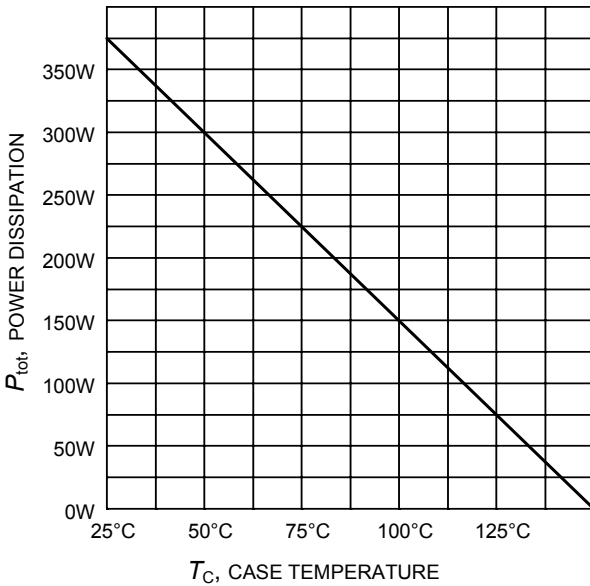


Figure 3. Power dissipation as a function of case temperature
 ($T_j \leq 150^\circ\text{C}$)

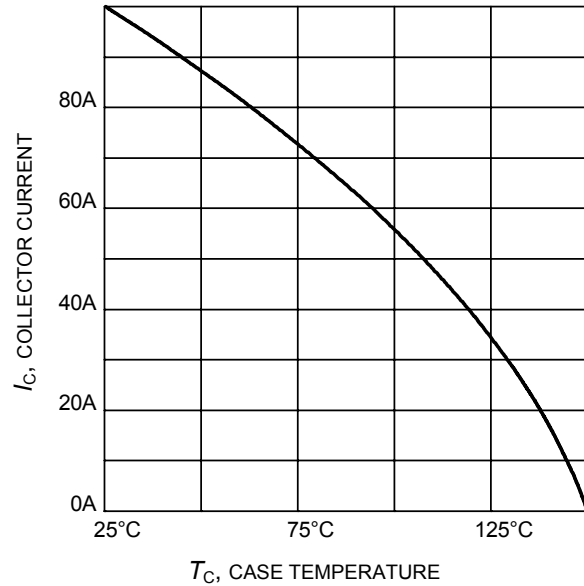


Figure 4. Collector current as a function of case temperature
 ($V_{GE} \geq 15\text{V}$, $T_j \leq 150^\circ\text{C}$)

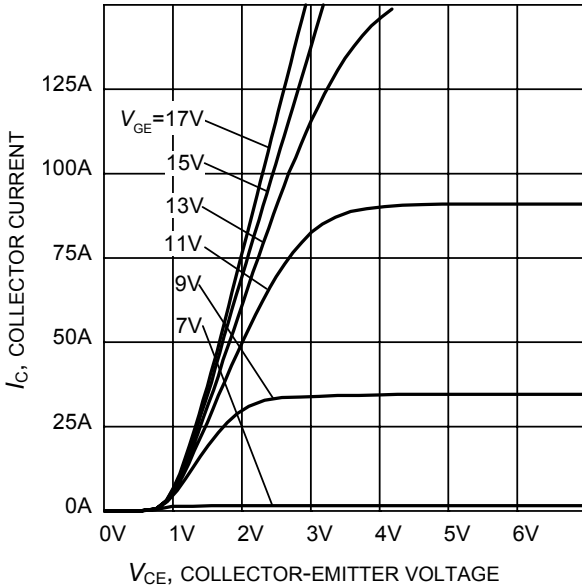


Figure 5. Typical output characteristic
($T_j = 25^\circ\text{C}$)

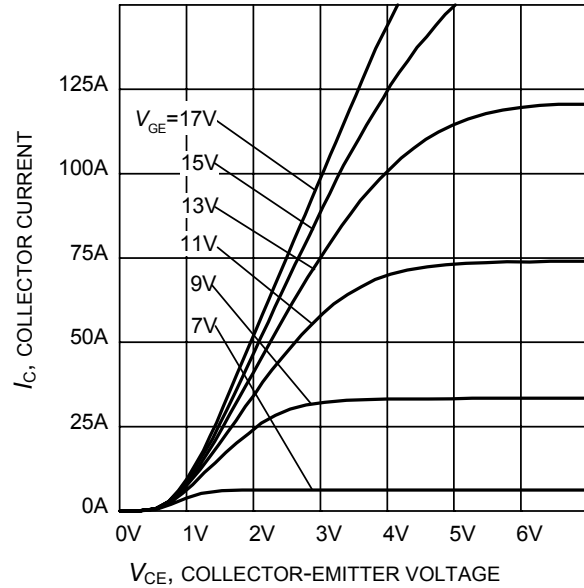


Figure 6. Typical output characteristic
($T_j = 150^\circ\text{C}$)

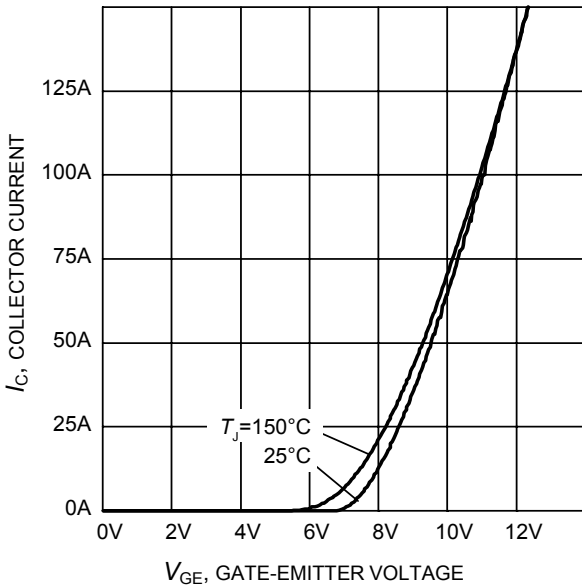


Figure 7. Typical transfer characteristic
($V_{CE} = 20\text{V}$)

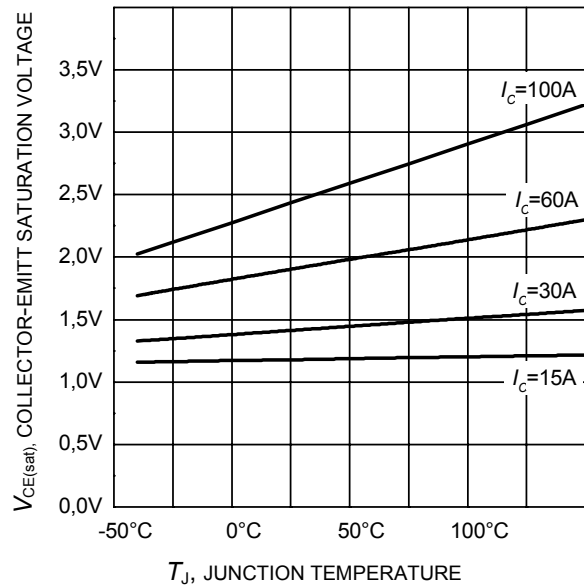


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)

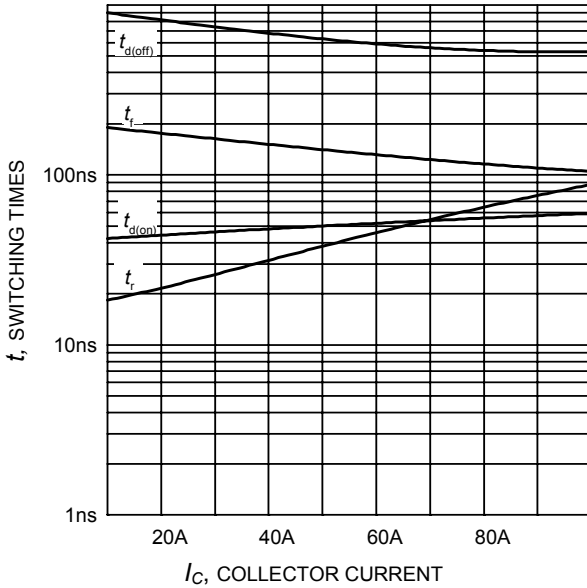


Figure 9. Typical switching times as a function of collector current
 (inductive load, $T_J=150^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

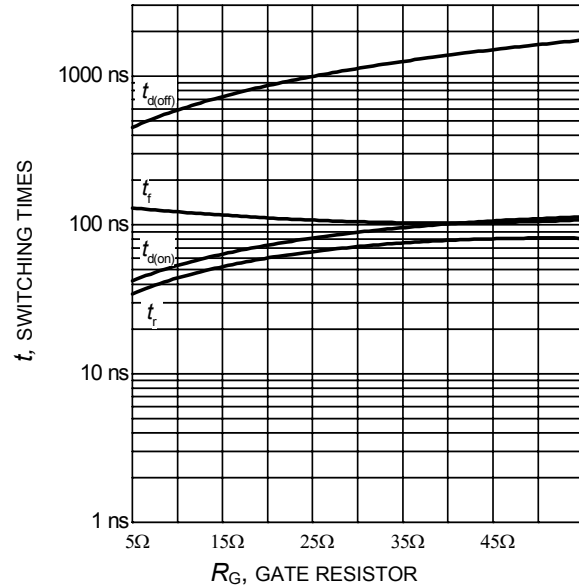


Figure 10. Typical switching times as a function of gate resistor
 (inductive load, $T_J=150^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=60\text{A}$, Dynamic test circuit in Figure E)

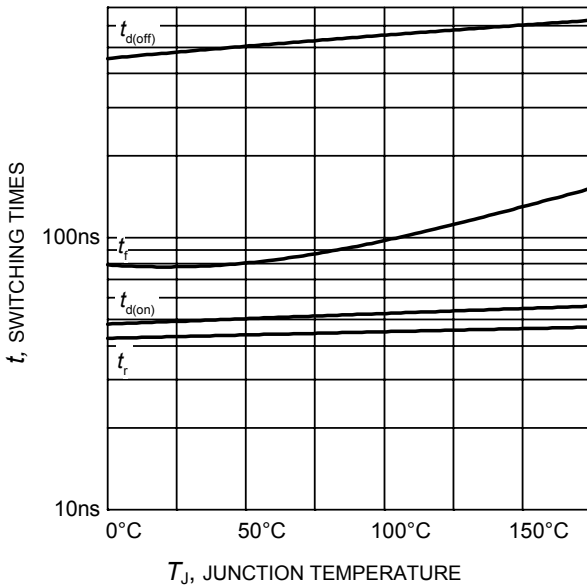


Figure 11. Typical switching times as a function of junction temperature
 (inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=60\text{A}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

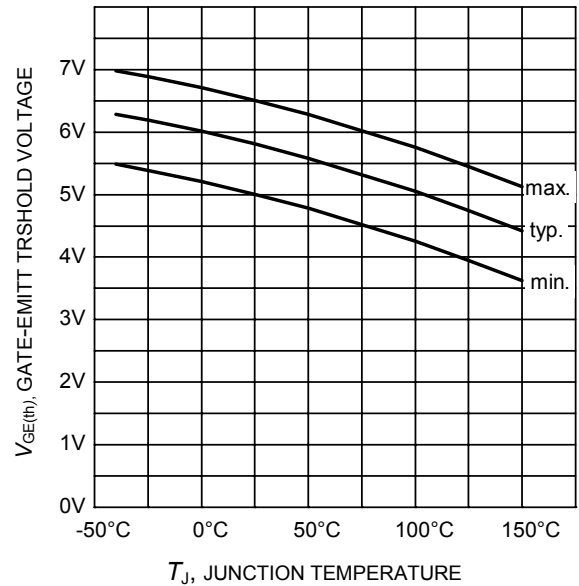


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
 ($I_C = 2.0\text{mA}$)

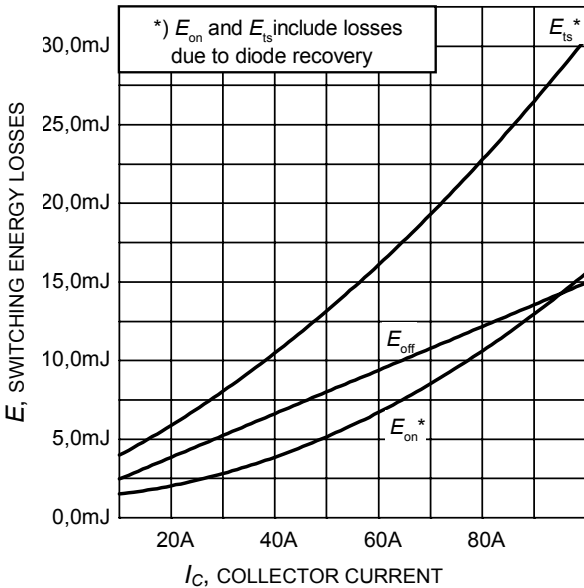


Figure 13. Typical switching energy losses as a function of collector current
 (inductive load, $T_J=150^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

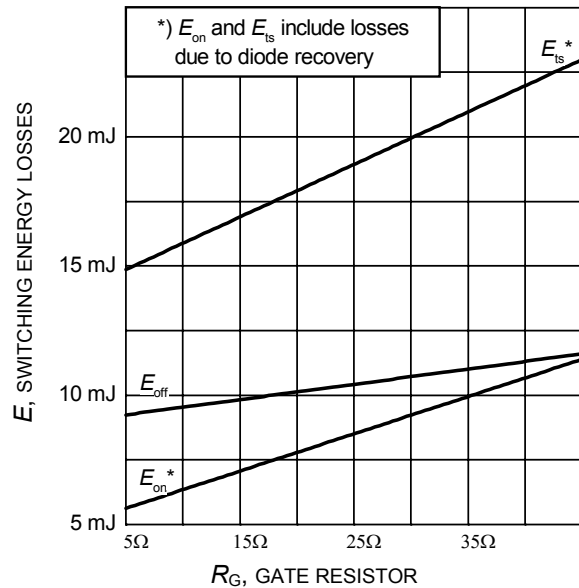


Figure 14. Typical switching energy losses as a function of gate resistor
 (inductive load, $T_J=150^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=60\text{A}$, Dynamic test circuit in Figure E)

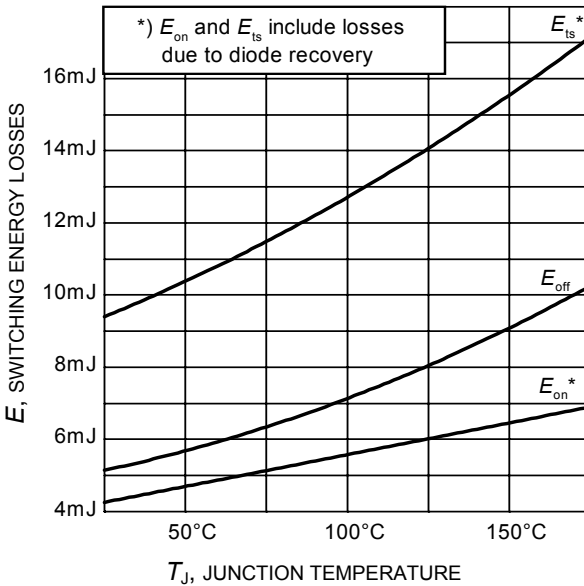


Figure 15. Typical switching energy losses as a function of junction temperature
 (inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=60\text{A}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

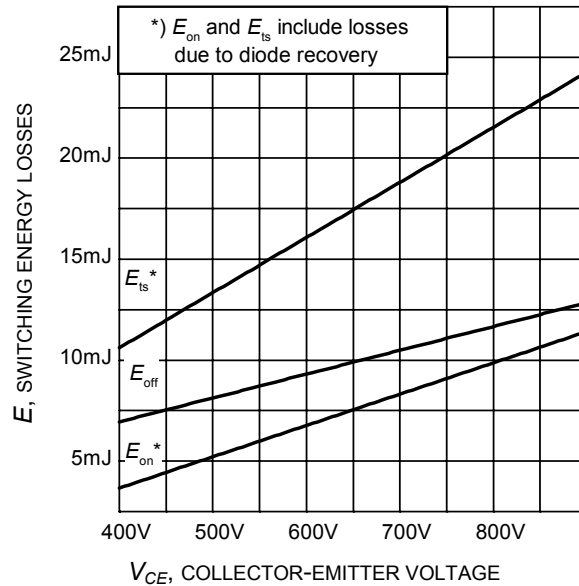


Figure 16. Typical switching energy losses as a function of collector emitter voltage
 (inductive load, $T_J=150^\circ\text{C}$, $V_{GE}=0/15\text{V}$, $I_C=60\text{A}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

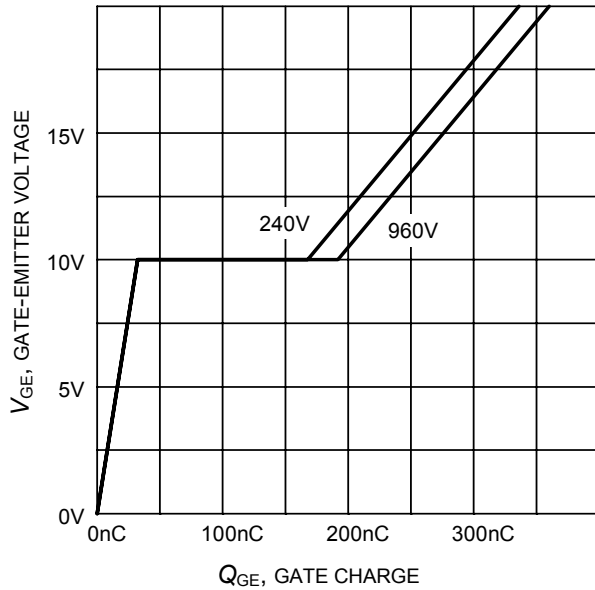


Figure 17. Typical gate charge
($I_C=60\text{ A}$)

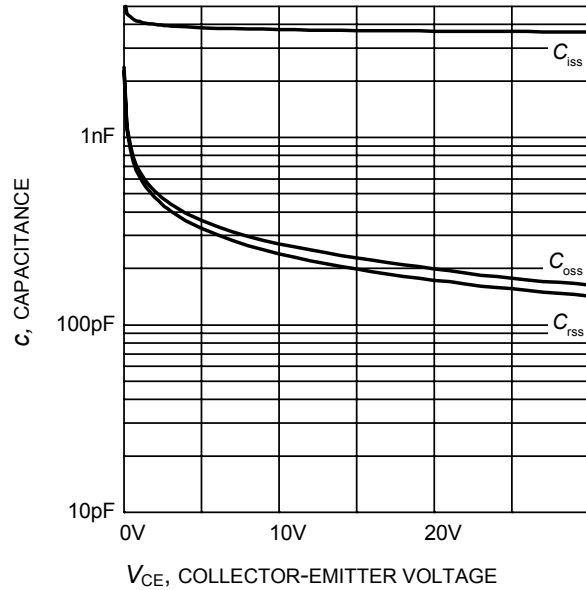


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE}=0\text{V}$, $f = 1\text{ MHz}$)

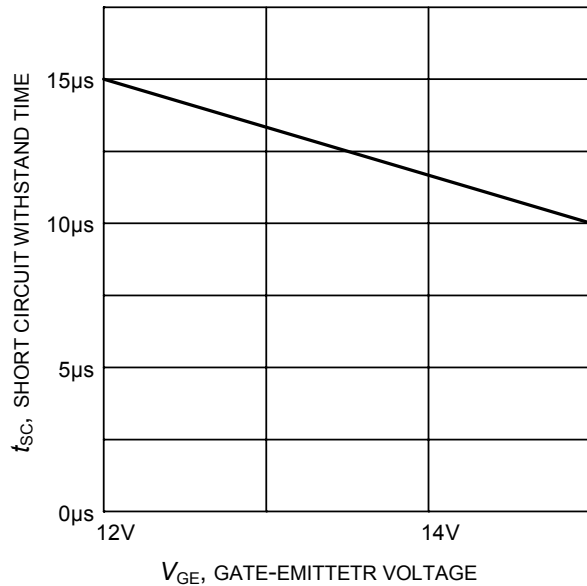


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
($V_{CE}=600\text{V}$, start at $T_J=25^\circ\text{C}$)

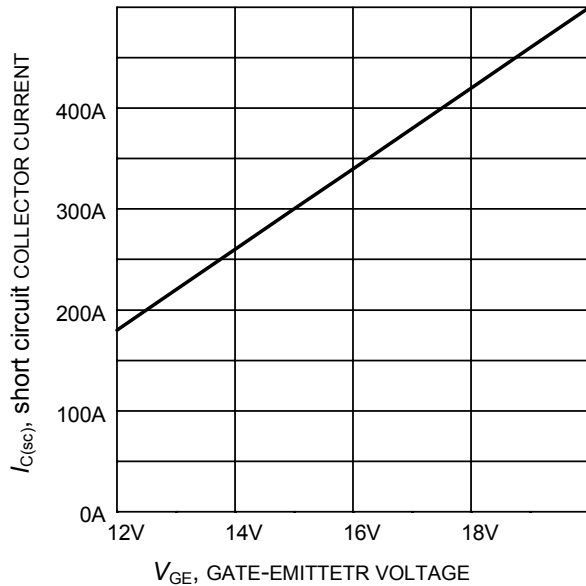


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq 600\text{V}$, $T_J \leq 150^\circ\text{C}$)

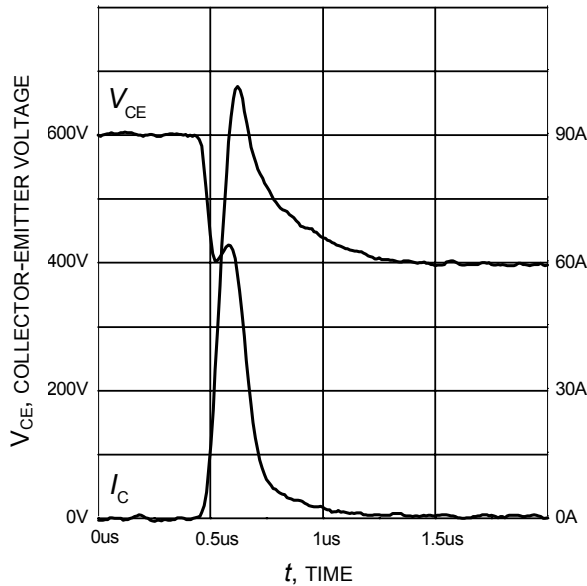


Figure 21. Typical turn on behavior
 ($V_{GE}=0/15V$, $R_G=10\Omega$, $T_j = 150^\circ C$,
 Dynamic test circuit in Figure E)

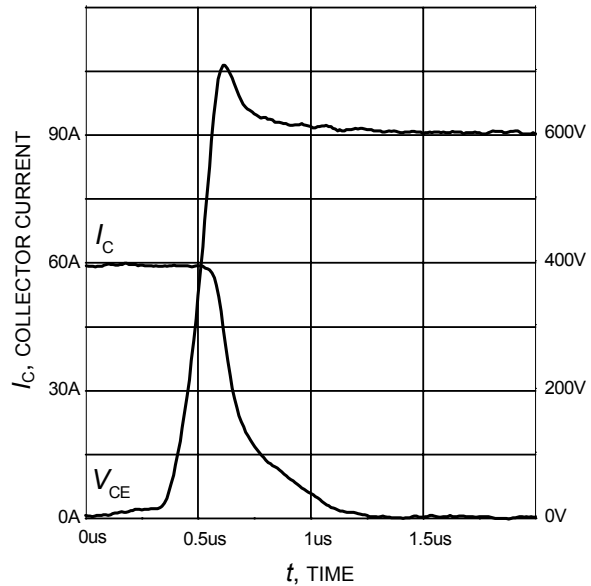


Figure 22. Typical turn off behavior
 ($V_{GE}=15/0V$, $R_G=10\Omega$, $T_j = 150^\circ C$,
 Dynamic test circuit in Figure E)

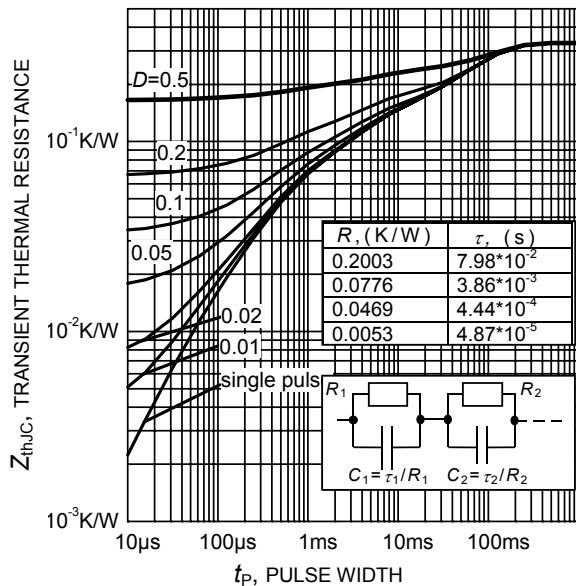
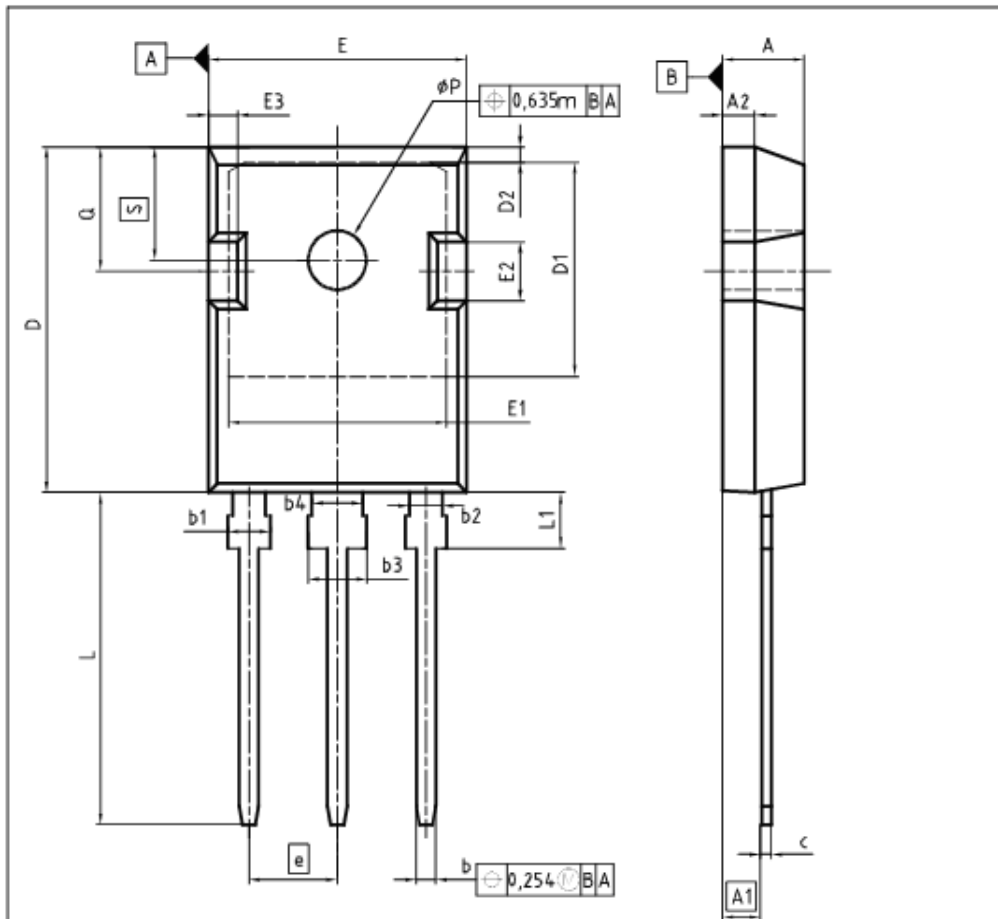


Figure 23. IGBT transient thermal resistance
 ($D = t_p / T$)

T0247-3



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.83 | 5.21 | 0.180 | 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 | 17.85 | 0.640 | 0.695 |
| D2 | 0.85 | 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 |
| 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 |

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SCALE

EUROPEAN PROJECTION

ISSUE DATE
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REVISION
04

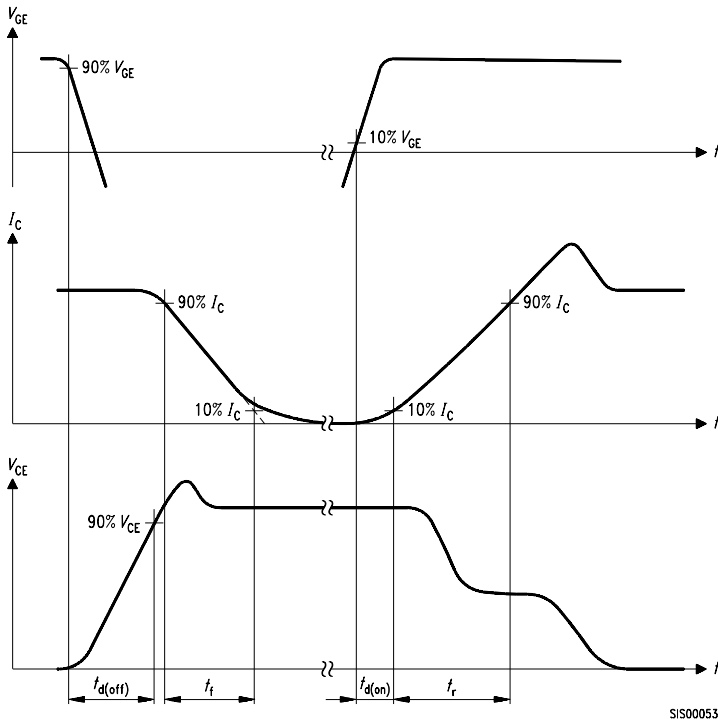


Figure A. Definition of switching times

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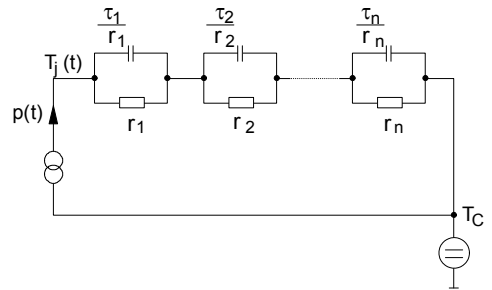


Figure D. Thermal equivalent circuit

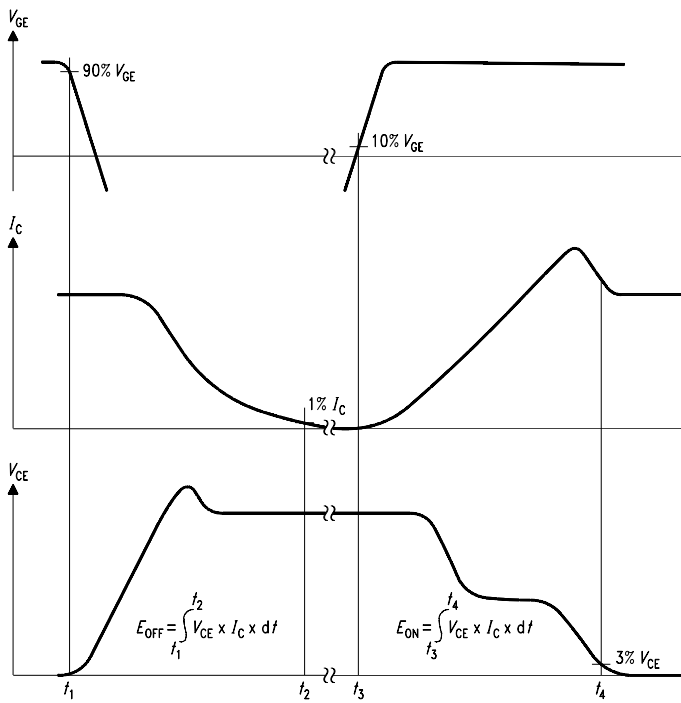


Figure B. Definition of switching losses

SIE

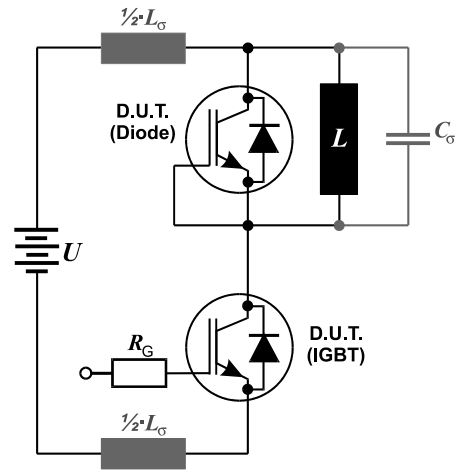


Figure E. Dynamic test circuit
Leakage inductance $L_{\sigma} = 180\text{nH}$
and Stray capacity $C_{\sigma} = 39\text{pF}$.

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