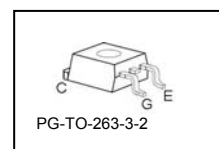
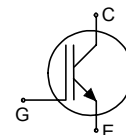


Low Loss IGBT in TrenchStop® technology

- Very low $V_{CE(sat)}$ 1.5 V (typ.)
- Maximum Junction Temperature 175 °C
- Short circuit withstand time – 5µs
- Designed for frequency inverters for washing machines, fans, pumps and vacuum cleaners
- TrenchStop® technology for 600 V applications offers :
 - very tight parameter distribution
 - high ruggedness, temperature stable behavior
 - very high switching speed
- Positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹ for target applications
- 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 |
|-----------|----------|-------|-------------------------------|-------------|--------------|---------------|
| IGB30N60T | 600V | 30A | 1.5V | 175°C | G30T60 | PG-TO-263-3-2 |

Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|--------------|------------|------|
| Collector-emitter voltage | V_{CE} | 600 | V |
| DC collector current, limited by $T_{j,max}$ | I_C | 60 | A |
| $T_C = 25^\circ C$ | | 60 | |
| $T_C = 100^\circ C$ | | 30 | |
| Pulsed collector current, t_p limited by $T_{j,max}$ | $I_{C,puls}$ | 90 | |
| Turn off safe operating area ($V_{CE} \leq 600V, T_j \leq 175^\circ C$) | - | 90 | |
| Gate-emitter voltage | V_{GE} | ± 20 | V |
| Short circuit withstand time ²⁾ | t_{SC} | 5 | µs |
| $V_{GE} = 15V, V_{CC} \leq 400V, T_j \leq 150^\circ C$ | | | |
| Power dissipation $T_C = 25^\circ C$ | P_{tot} | 187 | W |
| Operating junction temperature | T_j | -40...+175 | °C |
| Storage temperature | T_{stg} | -55...+175 | |
| Soldering temperature (reflow soldering, MSL1) | - | 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} | | 0.80 | K/W |
| Thermal resistance, junction – ambient | R_{thJA} | 6 cm ² Cu | 40 | |

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

| Parameter | Symbol | Conditions | Value | | | Unit |
|--------------------------------------|---------------|--|-------|------|------------|---------------|
| | | | min. | typ. | max. | |
| Static Characteristic | | | | | | |
| Collector-emitter breakdown voltage | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=0.2mA$ | 600 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE} = 15V, I_C=30A$ $T_j=25^\circ\text{C}$ $T_j=175^\circ\text{C}$ | - | 1.5 | 2.05 | |
| | | | - | 1.9 | - | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C=0.43mA,$ $V_{CE}=V_{GE}$ | 4.1 | 4.9 | 5.7 | |
| Zero gate voltage collector current | I_{CES} | $V_{CE}=600V,$ $V_{GE}=0V$ $T_j=25^\circ\text{C}$ $T_j=175^\circ\text{C}$ | - | - | 40 1000 | μA |
| Gate-emitter leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V$ | - | - | 100 | nA |
| Transconductance | g_{fs} | $V_{CE}=20V, I_C=30A$ | - | 16.7 | - | S |
| Integrated gate resistor | R_{Gint} | | - | | | Ω |

Dynamic Characteristic

| | | | | | | |
|---|-------------|--|---|------|---|----|
| Input capacitance | C_{iss} | $V_{CE}=25V,$ $V_{GE}=0V,$ $f=1MHz$ | - | 1630 | - | pF |
| Output capacitance | C_{oss} | | - | 108 | - | |
| Reverse transfer capacitance | C_{riss} | | - | 50 | - | |
| Gate charge | Q_{Gate} | $V_{CC}=480V, I_C=30A$ $V_{GE}=15V$ | - | 167 | - | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | L_E | | - | 7 | - | nH |
| Short circuit collector current ¹⁾ | $I_{C(SC)}$ | $V_{GE}=15V, t_{SC}\leq 5\mu s$ $V_{CC} = 400V,$ $T_j = 150^\circ\text{C}$ | - | 275 | - | A |

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

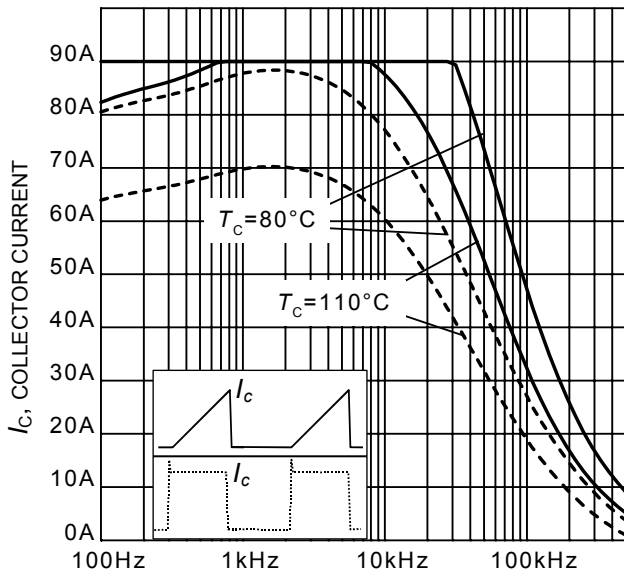
Switching Characteristic, Inductive Load, at $T_j=25^\circ\text{C}$

| Parameter | Symbol | Conditions | Value | | | Unit |
|----------------------------|--------------|---|-------|------|------|------|
| | | | min. | Typ. | max. | |
| IGBT Characteristic | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=25^\circ\text{C}$, $V_{CC}=400\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10.6\ \Omega$, $L_{\sigma}^{1)}=136\text{nH}$, $C_{\sigma}^{1)}=39\text{pF}$ Energy losses include "tail" and diode reverse recovery. | - | 23 | - | ns |
| Rise time | t_r | | - | 21 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 254 | - | |
| Fall time | t_f | | - | 46 | - | |
| Turn-on energy | E_{on} | | - | 0.69 | - | mJ |
| Turn-off energy | E_{off} | | - | 0.77 | - | |
| Total switching energy | E_{ts} | | - | 1.46 | - | |

Switching Characteristic, Inductive Load, at $T_j=175^\circ\text{C}$

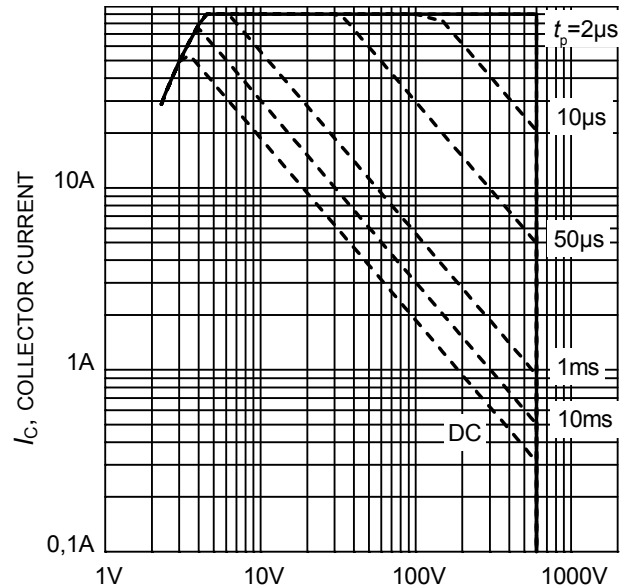
| Parameter | Symbol | Conditions | Value | | | Unit |
|----------------------------|--------------|--|-------|------|------|------|
| | | | min. | Typ. | max. | |
| IGBT Characteristic | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=175^\circ\text{C}$, $V_{CC}=400\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10.6\ \Omega$, $L_{\sigma}^{1)}=136\text{nH}$, $C_{\sigma}^{1)}=39\text{pF}$ Energy losses include "tail" and diode reverse recovery. ²⁾ | - | 24 | - | ns |
| Rise time | t_r | | - | 26 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 292 | - | |
| Fall time | t_f | | - | 90 | - | |
| Turn-on energy | E_{on} | | - | 1.0 | - | mJ |
| Turn-off energy | E_{off} | | - | 1.1 | - | |
| Total switching energy | E_{ts} | | - | 2.1 | - | |

¹⁾ Leakage inductance L_{σ} and Stray capacity C_{σ} due to dynamic test circuit in Figure E.



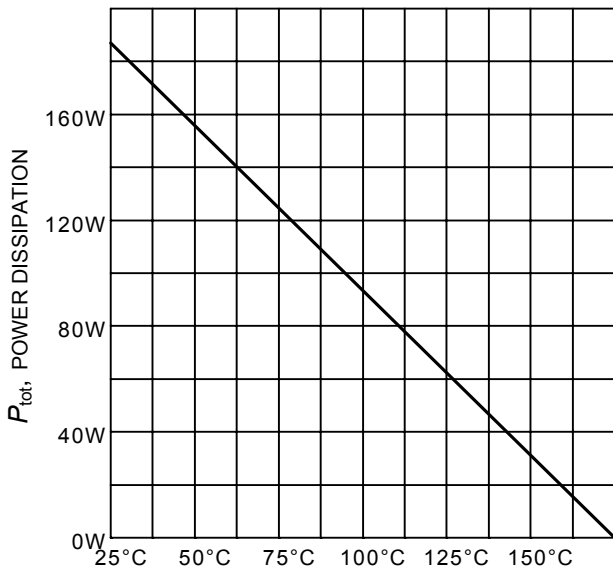
f , SWITCHING FREQUENCY

Figure 1. Collector current as a function of switching frequency
 ($T_j \leq 175^\circ\text{C}$, $D = 0.5$, $V_{CE} = 400\text{V}$,
 $V_{GE} = 0/+15\text{V}$, $R_G = 10\Omega$)



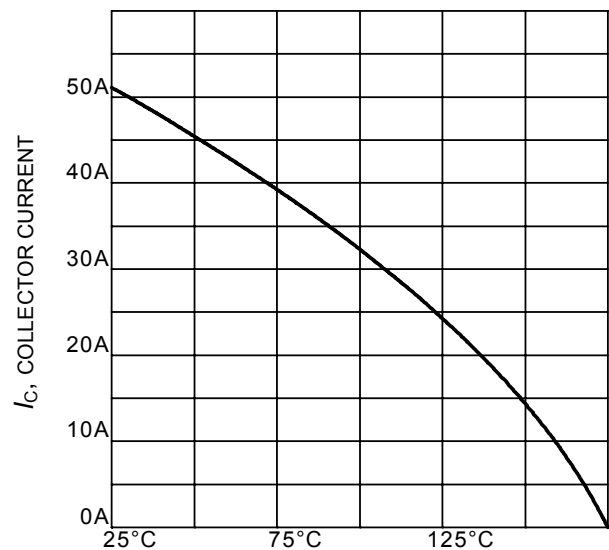
V_{CE} , COLLECTOR-EMITTER VOLTAGE

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



T_C , CASE TEMPERATURE

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



T_C , CASE TEMPERATURE

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

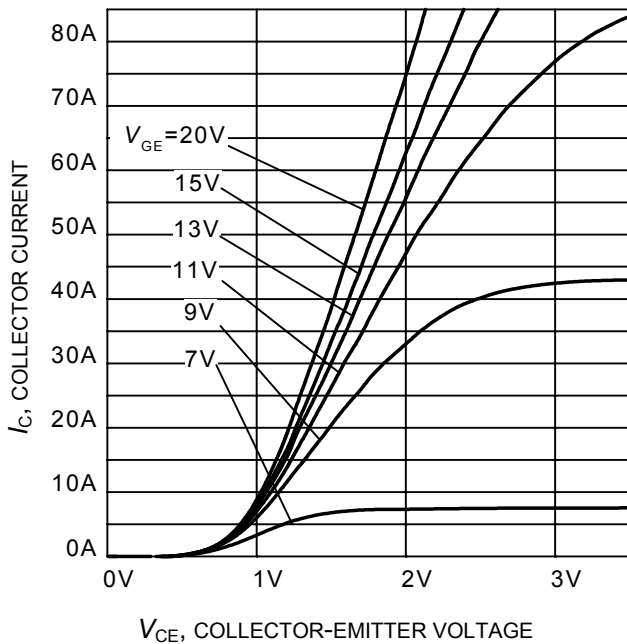


Figure 5. Typical output characteristic
($T_j = 25^\circ\text{C}$)

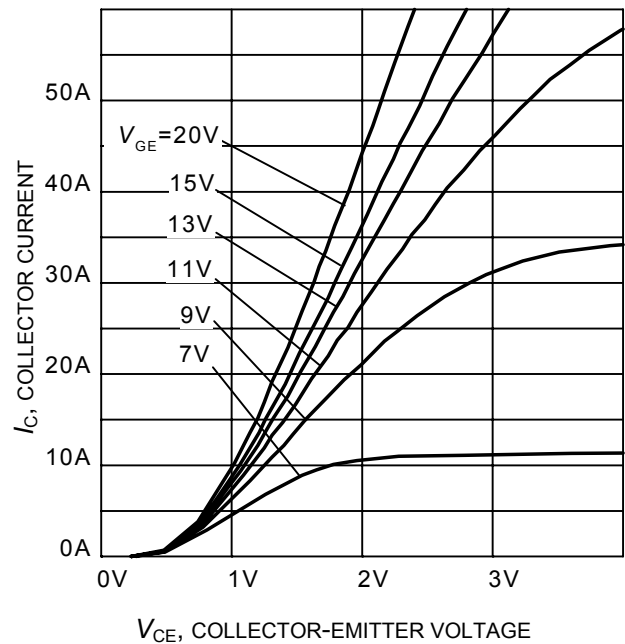


Figure 6. Typical output characteristic
($T_j = 175^\circ\text{C}$)

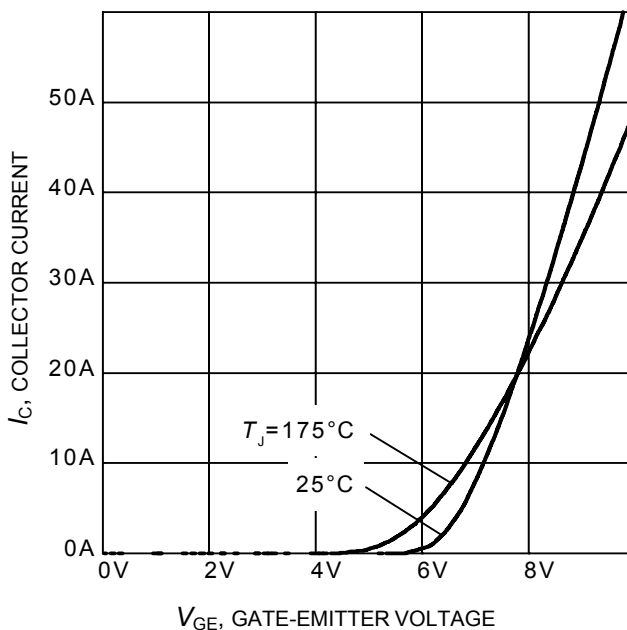


Figure 7. Typical transfer characteristic
($V_{CE} = 20\text{V}$)

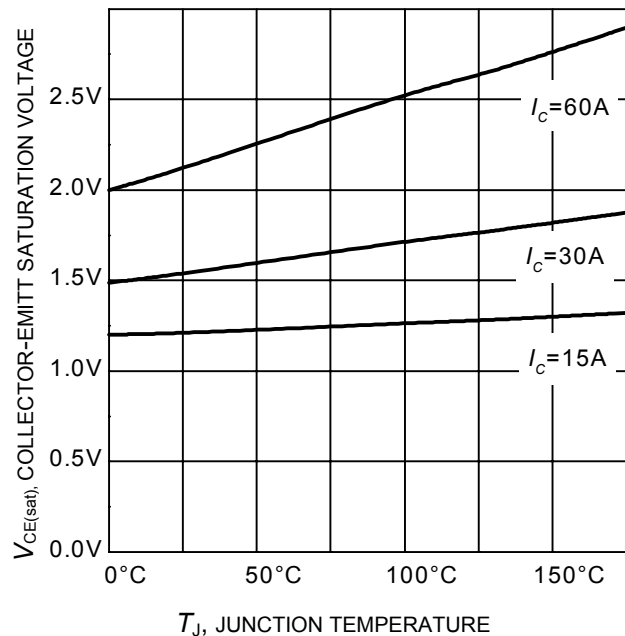
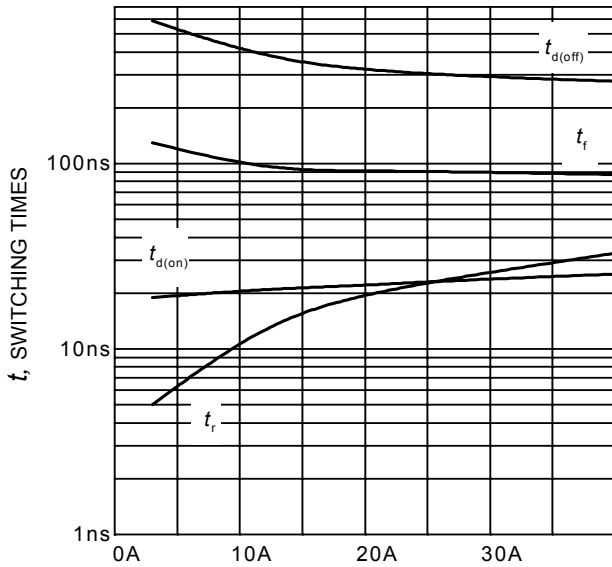
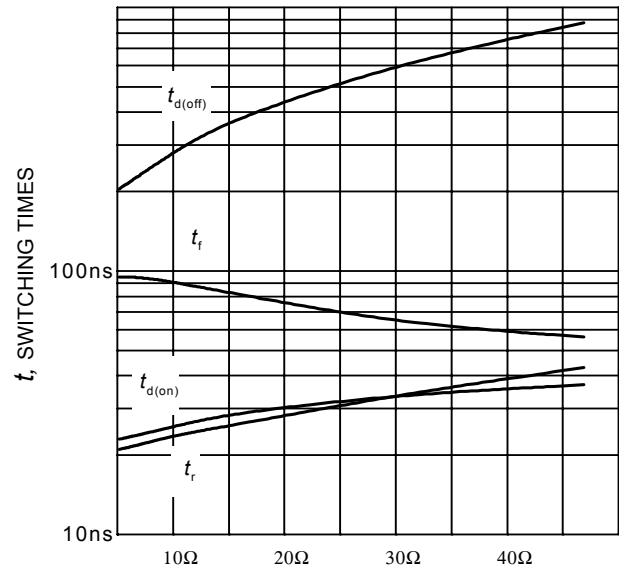


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)



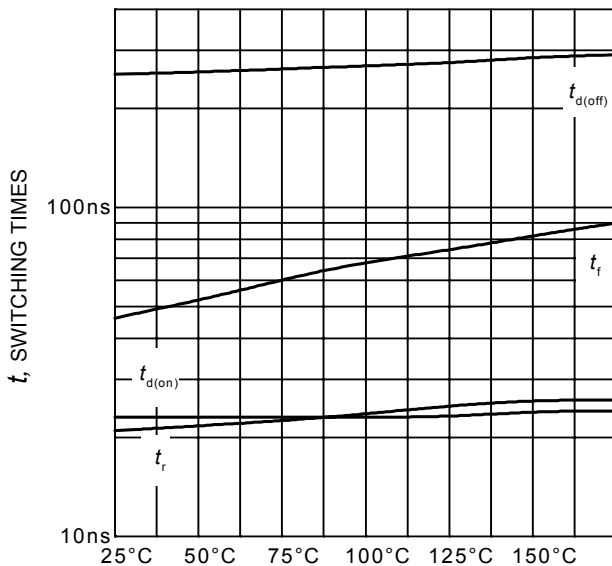
I_C , COLLECTOR CURRENT

Figure 9. Typical switching times as a function of collector current
(inductive load, $T_J=175^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $R_G = 10\Omega$, Dynamic test circuit in Figure E)



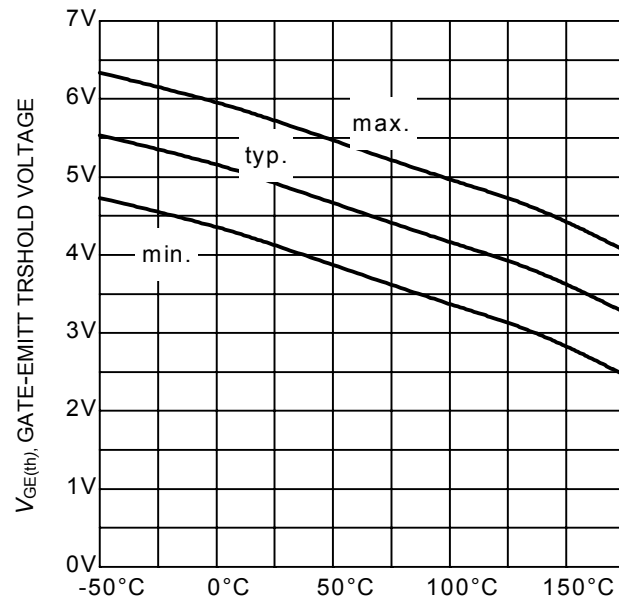
R_G , GATE RESISTOR

Figure 10. Typical switching times as a function of gate resistor
(inductive load, $T_J = 175^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $I_C = 30\text{A}$, Dynamic test circuit in Figure E)



T_J , JUNCTION TEMPERATURE

Figure 11. Typical switching times as a function of junction temperature
(inductive load, $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $I_C = 30\text{A}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)



T_J , JUNCTION TEMPERATURE

Figure 12. Gate-emitter threshold voltage as a function of junction temperature
($I_C = 0.43\text{mA}$)

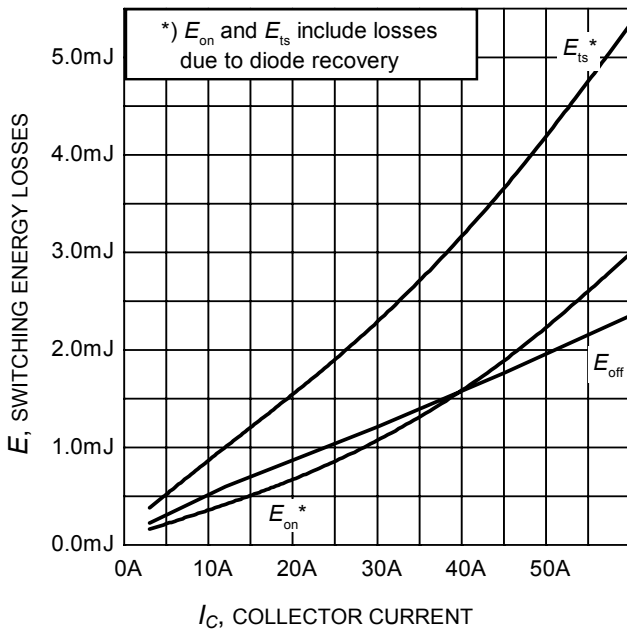


Figure 13. Typical switching energy losses as a function of collector current
 (inductive load, $T_J = 175^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $R_G = 10\Omega$, Dynamic test circuit in Figure E)

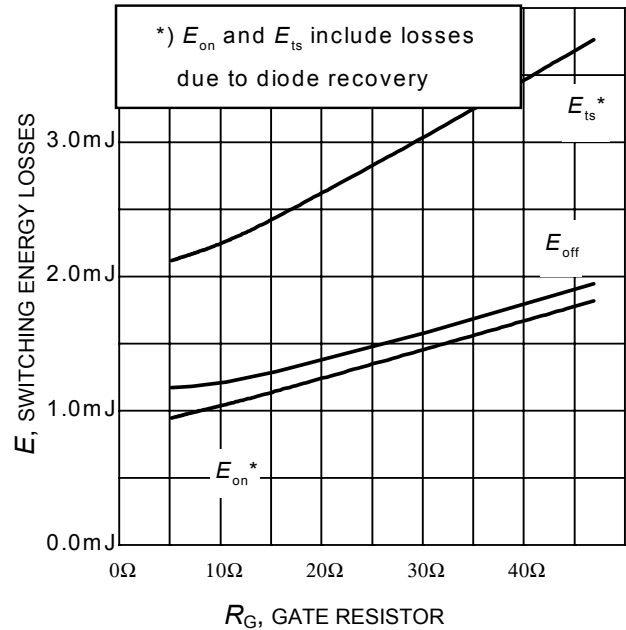


Figure 14. Typical switching energy losses as a function of gate resistor
 (inductive load, $T_J = 175^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $I_C = 30\text{A}$, Dynamic test circuit in Figure E)

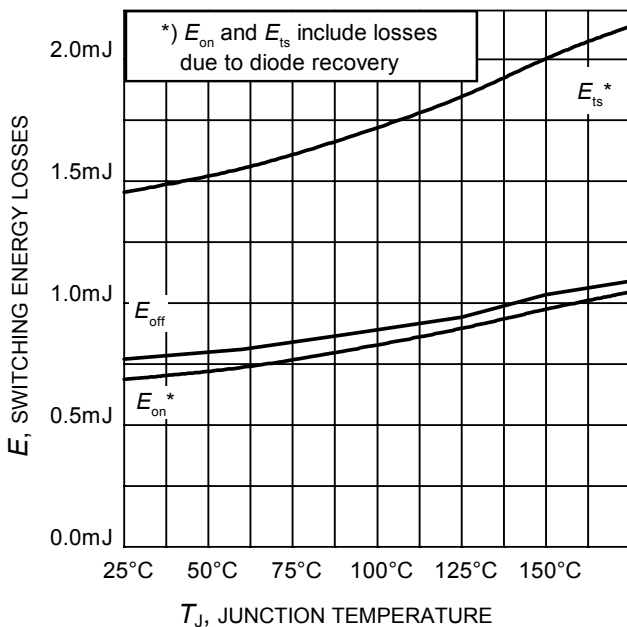


Figure 15. Typical switching energy losses as a function of junction temperature
 (inductive load, $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $I_C = 30\text{A}$, $R_G = 10\Omega$, Dynamic test circuit in Figure E)

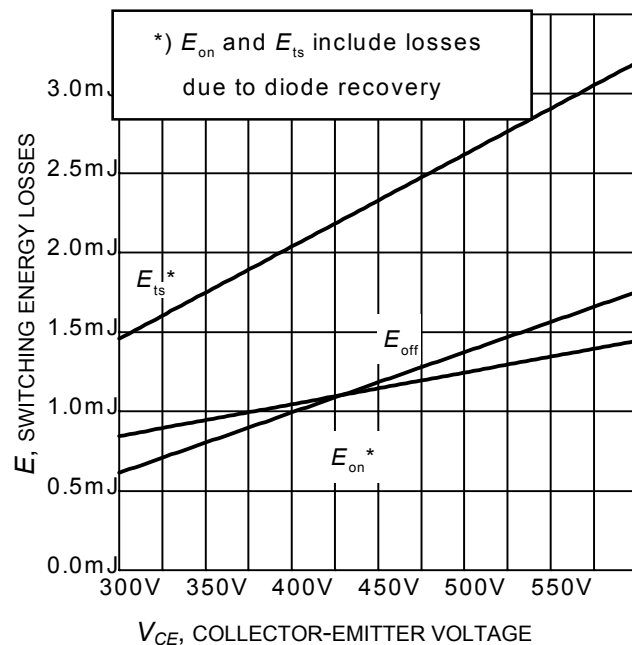


Figure 16. Typical switching energy losses as a function of collector emitter voltage
 (inductive load, $T_J = 175^\circ\text{C}$, $V_{GE} = 0/15\text{V}$, $I_C = 30\text{A}$, $R_G = 10\Omega$, Dynamic test circuit in Figure E)

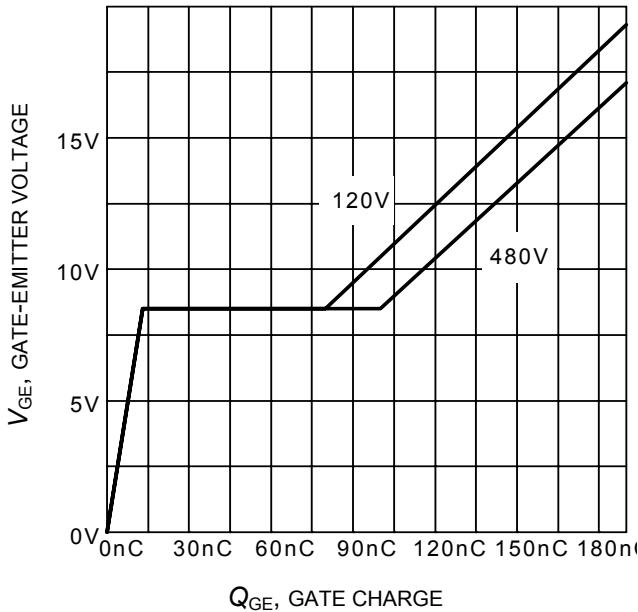


Figure 17. Typical gate charge
($I_C=30\text{ A}$)

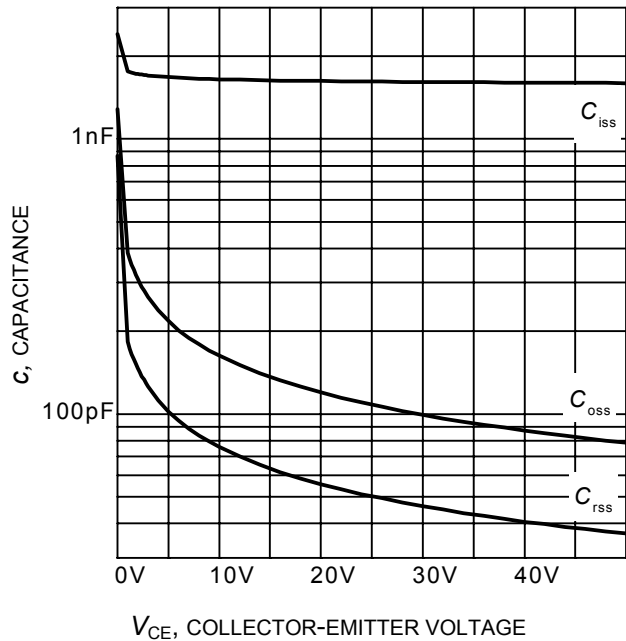


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE}=0\text{V}$, $f = 1\text{ MHz}$)

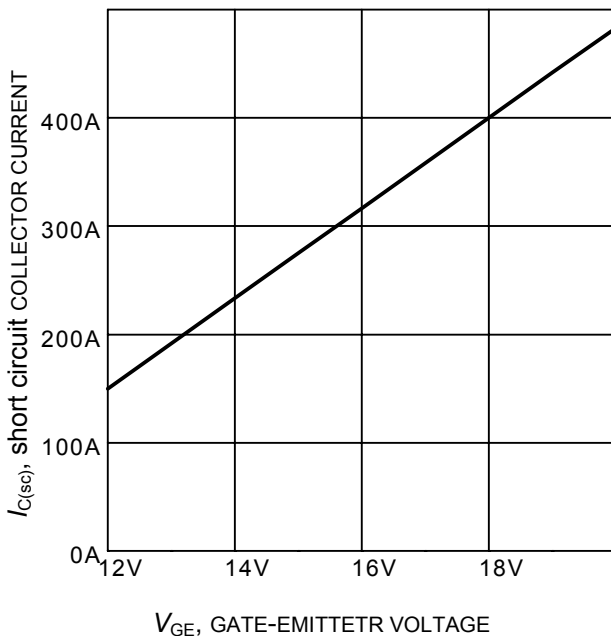


Figure 19. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq 400\text{V}$, $T_J \leq 150^\circ\text{C}$)

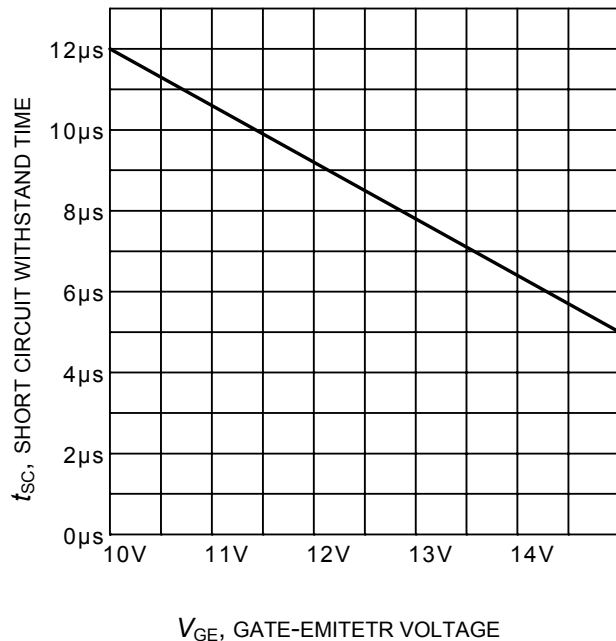


Figure 20. Short circuit withstand time as a function of gate-emitter voltage
($V_{CE}=600\text{V}$, start at $T_J=25^\circ\text{C}$, $T_{Jmax}<150^\circ\text{C}$)

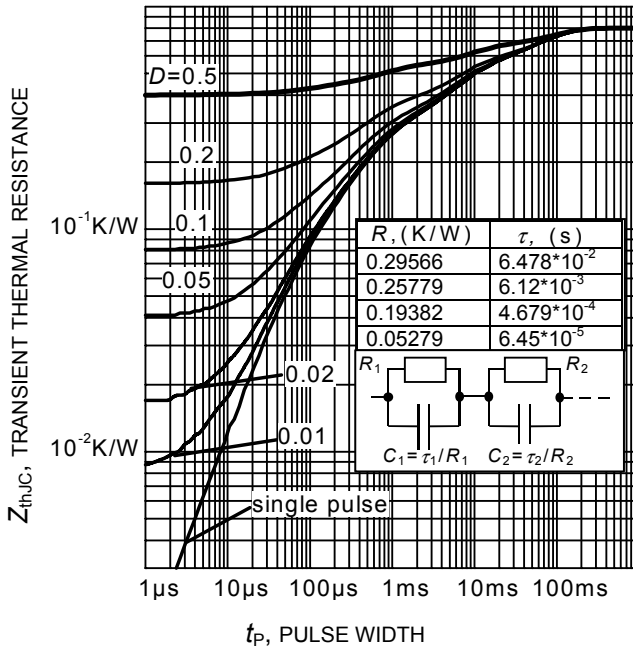
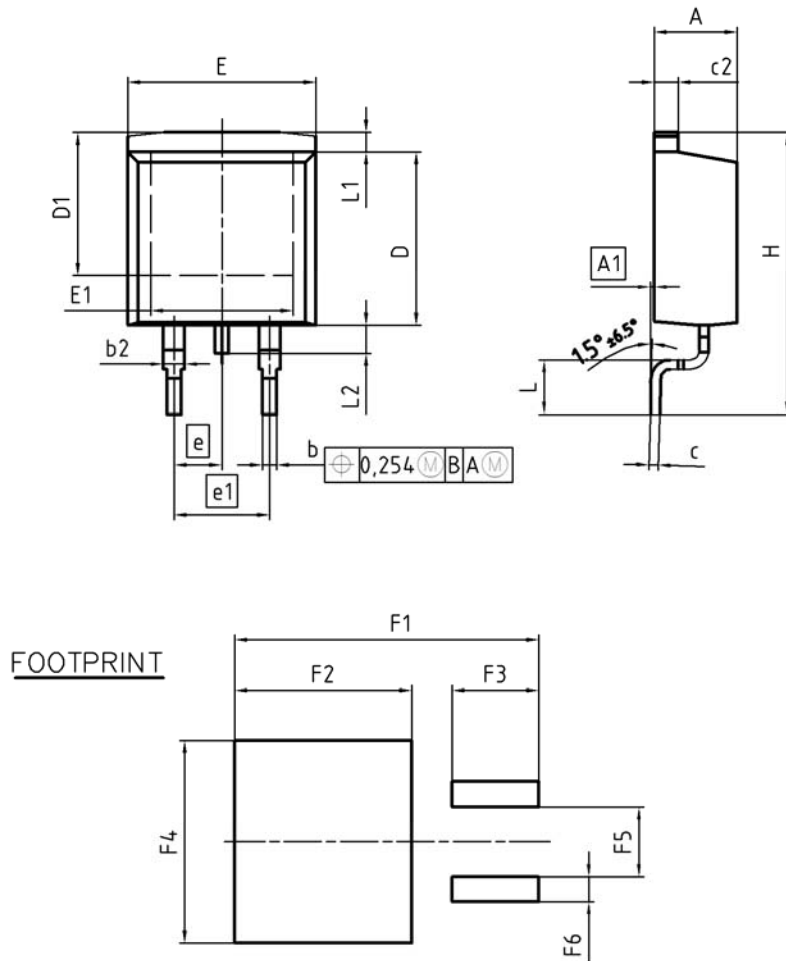


Figure 21. IGBT transient thermal resistance
 $(D = t_p / T)$

PG-TO-263-3-2



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.30 | 4.57 | 0.169 | 0.180 |
| A1 | 0.00 | 0.25 | 0.000 | 0.010 |
| b | 0.65 | 0.85 | 0.026 | 0.033 |
| b2 | 0.95 | 1.15 | 0.037 | 0.045 |
| c | 0.33 | 0.65 | 0.013 | 0.026 |
| c2 | 1.17 | 1.40 | 0.046 | 0.055 |
| D | 8.51 | 9.45 | 0.335 | 0.372 |
| D1 | 7.10 | 7.90 | 0.280 | 0.311 |
| E | 9.80 | 10.31 | 0.386 | 0.406 |
| E1 | 6.50 | 8.60 | 0.256 | 0.339 |
| e | 2.54 | | 0.100 | |
| e1 | 5.08 | | 0.200 | |
| N | 2 | | 2 | |
| H | 14.61 | 15.88 | 0.575 | 0.625 |
| L | 2.29 | 3.00 | 0.090 | 0.118 |
| L1 | 0.70 | 1.60 | 0.028 | 0.063 |
| L2 | 1.00 | 1.78 | 0.039 | 0.070 |
| F1 | 16.05 | 16.25 | 0.632 | 0.640 |
| F2 | 9.30 | 9.50 | 0.366 | 0.374 |
| F3 | 4.50 | 4.70 | 0.177 | 0.185 |
| F4 | 10.70 | 10.90 | 0.421 | 0.429 |
| F5 | 3.65 | 3.85 | 0.144 | 0.152 |
| F6 | 1.25 | 1.45 | 0.049 | 0.057 |

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EUROPEAN PROJECTION

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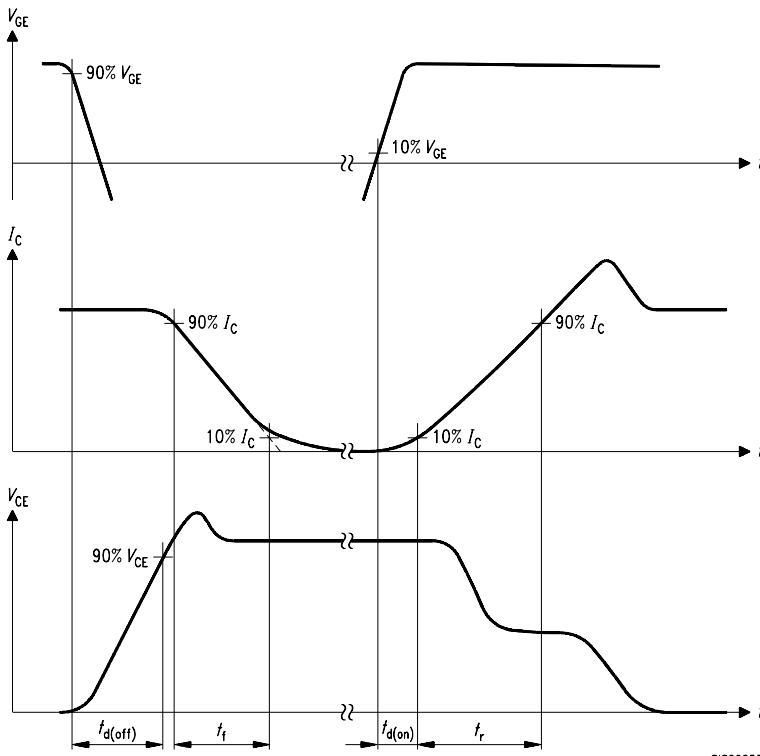


Figure A. Definition of switching times

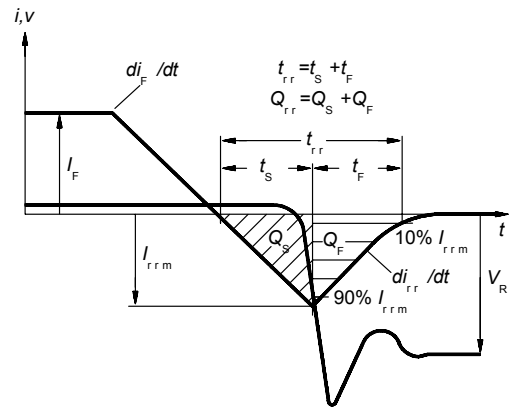


Figure C. Definition of diodes switching characteristics

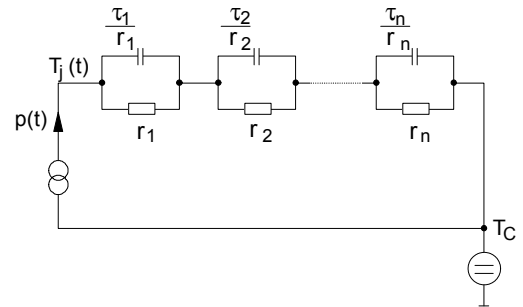


Figure D. Thermal equivalent circuit

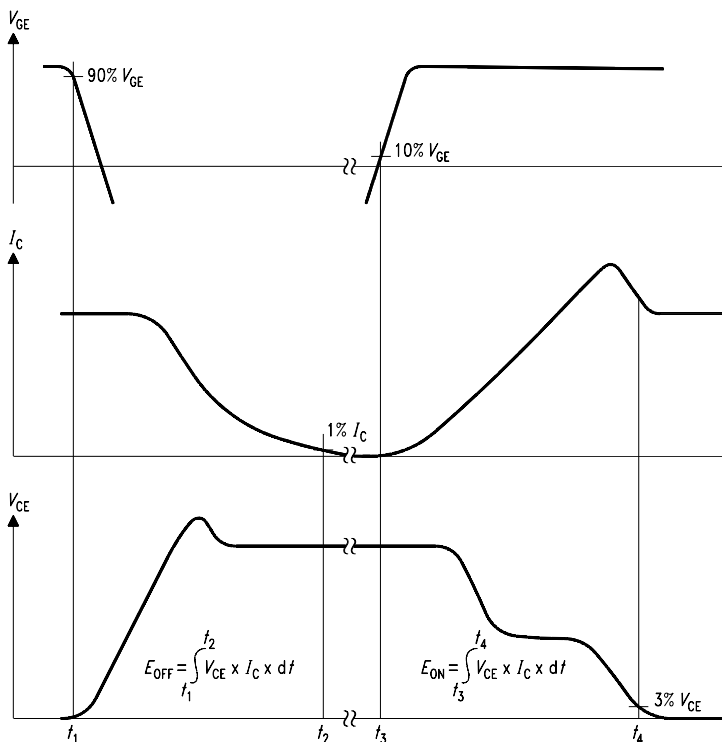


Figure B. Definition of switching losses

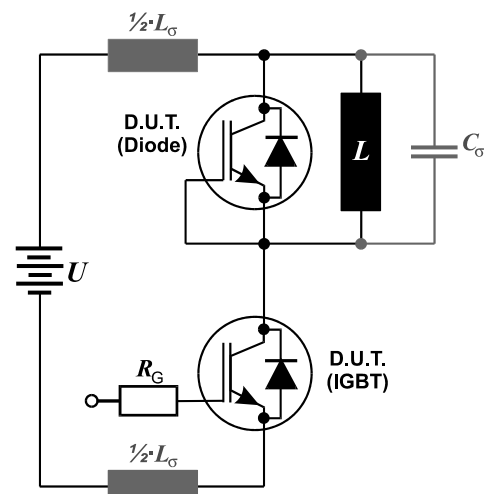


Figure E. Dynamic test circuit

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