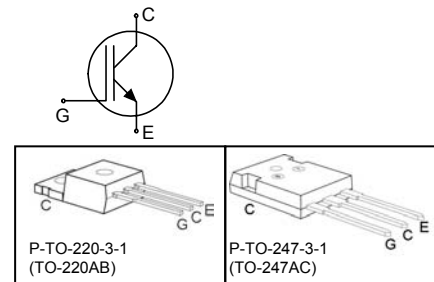


High Speed IGBT in NPT-technology

- 30% lower E_{off} compared to previous generation
- Short circuit withstand time – 10 μ s
- Designed for operation above 30 kHz
- NPT-Technology for 600V applications offers:
 - parallel switching capability
 - moderate E_{off} increase with temperature
 - very tight parameter distribution
- High ruggedness, temperature stable behaviour
- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt/>



| Type | V_{CE} | I_C | E_{off} | T_j | Package | Ordering Code |
|------------|----------|-------|-------------|------------------|----------|---------------|
| SGP30N60HS | 600V | 30 | 480 μ J | 150 $^{\circ}$ C | TO-220AB | Q67040-S4500 |
| SGW30N60HS | 600V | 30 | 480 μ J | 150 $^{\circ}$ C | TO-247AC | Q67040-S4501 |

Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|----------------|----------------------|--------------|
| Collector-emitter voltage | V_{CE} | 600 | V |
| DC collector current | I_C | | A |
| $T_C = 25^{\circ}$ C | | 41 | |
| $T_C = 100^{\circ}$ C | | 30 | |
| Pulsed collector current, t_p limited by T_{jmax} | I_{Cpuls} | 112 | |
| Turn off safe operating area | - | 112 | |
| $V_{CE} \leq 600V, T_j \leq 150^{\circ}$ C | | | |
| Avalanche energy single pulse $I_C = 20A, V_{CC} = 50V, R_{GE} = 25\Omega$ start $T_j = 25^{\circ}$ C | E_{AS} | 165 | mJ |
| Gate-emitter voltage static transient ($t_p < 1\mu$ s, $D < 0.05$) | V_{GE} | ± 20 ± 30 | V |
| Short circuit withstand time ¹⁾ $V_{GE} = 15V, V_{CC} \leq 600V, T_j \leq 150^{\circ}$ C | t_{SC} | 10 | μ s |
| Power dissipation $T_C = 25^{\circ}$ C | P_{tot} | 250 | W |
| Operating junction and storage temperature | T_j, T_{stg} | -55...+150 | $^{\circ}$ C |
| Time limited operating junction temperature for $t < 150h$ | $T_{j(t)}$ | 175 | |
| Soldering temperature, 1.6mm (0.063 in.) from case for 10s | - | 260 | |

¹⁾ 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} | | 0.5 | K/W |
| Thermal resistance, junction – ambient | R_{thJA} | TO-220AB | 62 | |
| | | TO-247AC | 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 | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=500\mu A$ | 600 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE} = 15V, I_C=30A$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ | | 2.8 | 3.15 | |
| | | | | 3.5 | 4.00 | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C=700\mu A, V_{CE}=V_{GE}$ | 3 | 4 | 5 | |
| Zero gate voltage collector current | I_{CES} | $V_{CE}=600V, V_{GE}=0V$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ | | - | 40 | μA |
| | | | | - | 3000 | |
| Gate-emitter leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V$ | - | - | 100 | nA |
| Transconductance | g_{fs} | $V_{CE}=20V, I_C=30A$ | - | 20 | - | S |

Dynamic Characteristic

| | | | | | | |
|--|-------------|---|---|------|--|----|
| Input capacitance | C_{iss} | $V_{CE}=25V,$ $V_{GE}=0V,$ $f=1\text{MHz}$ | - | 1500 | | pF |
| Output capacitance | C_{oss} | | - | 150 | | |
| Reverse transfer capacitance | C_{riss} | | - | 92 | | |
| Gate charge | Q_{Gate} | $V_{CC}=480V, I_C=30A$ $V_{GE}=15V$ | - | 141 | | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | L_E | TO-247AC | - | 13 | | nH |
| Short circuit collector current ¹⁾ | $I_{C(SC)}$ | $V_{GE}=15V, t_{SC}\leq 10\mu s$ $V_{CC}\leq 600V,$ $T_j\leq 150^\circ\text{C}$ | - | 220 | | 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 | $t_{d(on)}$ | $T_j=25^\circ\text{C}$, $V_{CC}=400\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=11\Omega$ $L_{\sigma}^{(1)}=60\text{nH}$, $C_{\sigma}^{(1)}=40\text{pF}$ Energy losses include "tail" and diode reverse recovery. | - | 20 | | ns |
| Rise time | t_r | | - | 21 | | |
| Turn-off delay time | $t_{d(off)}$ | | - | 250 | | |
| Fall time | t_f | | - | 25 | | |
| Turn-on energy | E_{on} | | - | 0.60 | | mJ |
| Turn-off energy | E_{off} | | - | 0.55 | | |
| Total switching energy | E_{ts} | | - | 1.15 | | |

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

| Parameter | Symbol | Conditions | Value | | | Unit |
|----------------------------|--------------|--|-------|------|------|------|
| | | | min. | typ. | max. | |
| IGBT Characteristic | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=150^\circ\text{C}$ $V_{CC}=400\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=1.8\Omega$ $L_{\sigma}^{(1)}=60\text{nH}$, $C_{\sigma}^{(1)}=40\text{pF}$ Energy losses include "tail" and diode reverse recovery. | - | 16 | | ns |
| Rise time | t_r | | - | 13 | | |
| Turn-off delay time | $t_{d(off)}$ | | - | 122 | | |
| Fall time | t_f | | - | 29 | | |
| Turn-on energy | E_{on} | | - | 0.78 | | mJ |
| Turn-off energy | E_{off} | | - | 0.48 | | |
| Total switching energy | E_{ts} | | - | 1.26 | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=150^\circ\text{C}$ $V_{CC}=400\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=11\Omega$ $L_{\sigma}^{(1)}=60\text{nH}$, $C_{\sigma}^{(1)}=40\text{pF}$ Energy losses include "tail" and diode reverse recovery. | - | 20 | | ns |
| Rise time | t_r | | - | 19 | | |
| Turn-off delay time | $t_{d(off)}$ | | - | 274 | | |
| Fall time | t_f | | - | 27 | | |
| Turn-on energy | E_{on} | | - | 0.91 | | mJ |
| Turn-off energy | E_{off} | | - | 0.70 | | |
| Total switching energy | E_{ts} | | - | 1.61 | | |

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

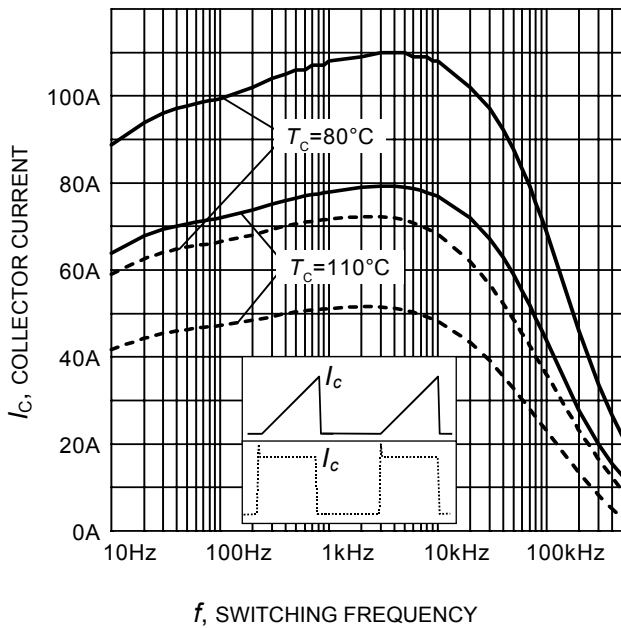


Figure 1. Collector current as a function of switching frequency
 ($T_j \leq 150^\circ\text{C}$, $D = 0.5$, $V_{CE} = 400\text{V}$,
 $V_{GE} = 0/+15\text{V}$, $R_G = 11\Omega$)

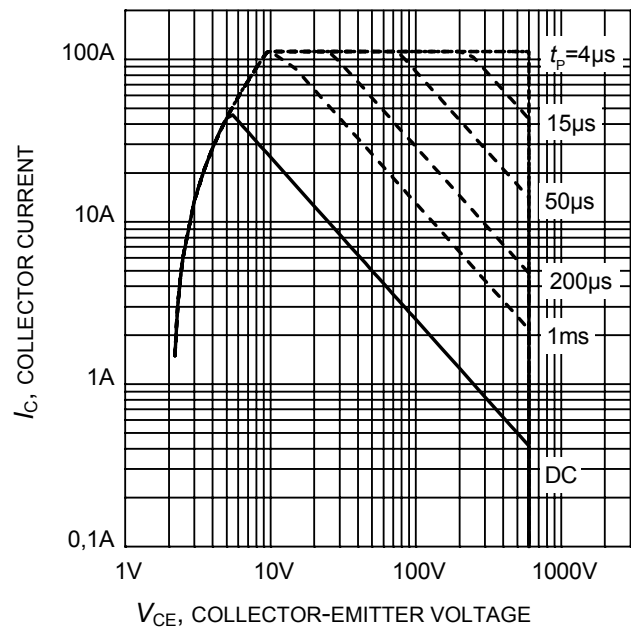


Figure 2. Safe operating area
 ($D = 0$, $T_C = 25^\circ\text{C}$, $T_j \leq 150^\circ\text{C}$;
 $V_{GE} = 15\text{V}$)

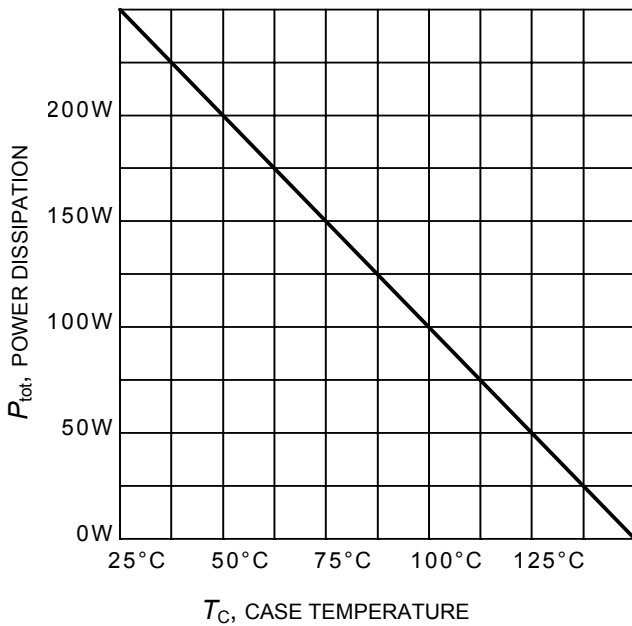


Figure 3. Power dissipation as a function of case temperature
 ($T_j \leq 150^\circ\text{C}$)

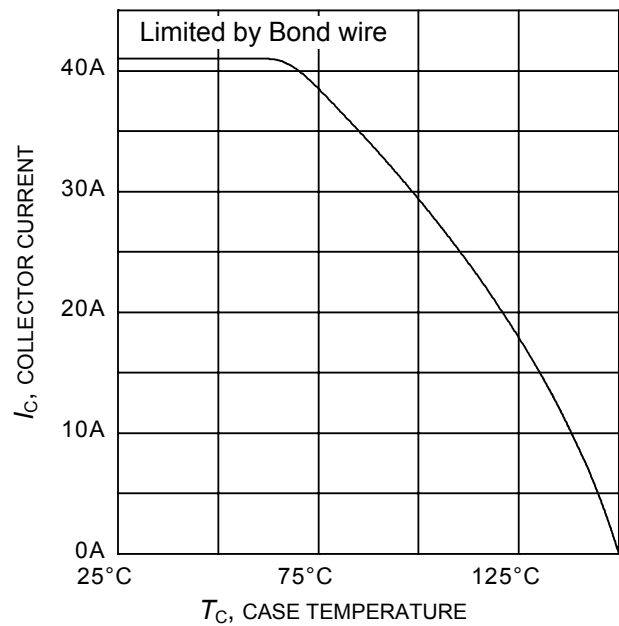


Figure 4. Collector current as a function of case temperature
 ($V_{GE} \leq 15\text{V}$, $T_j \leq 150^\circ\text{C}$)

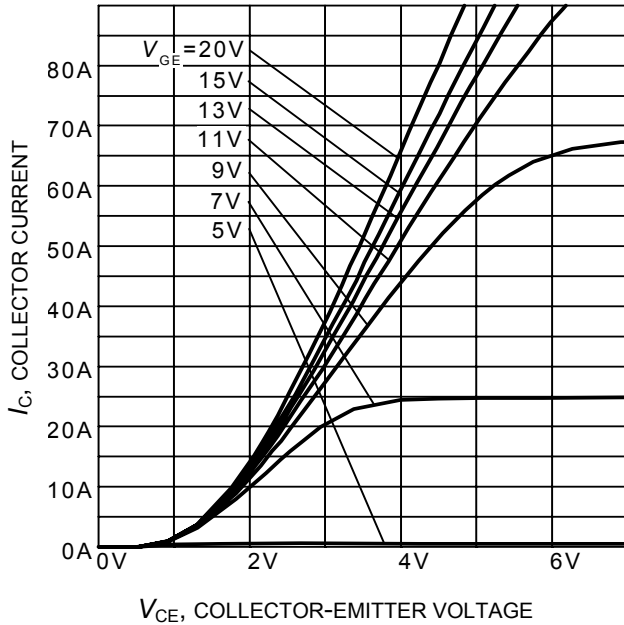


Figure 5. Typical output characteristic
($T_j = 25^\circ\text{C}$)

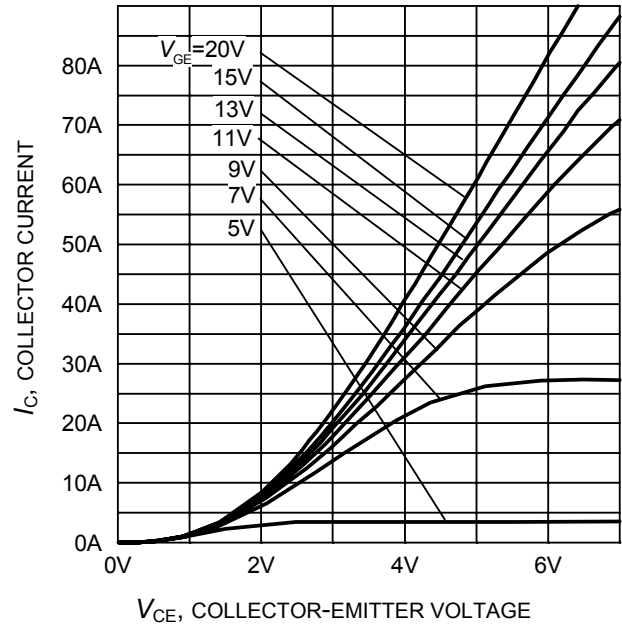


Figure 6. Typical output characteristic
($T_j = 150^\circ\text{C}$)

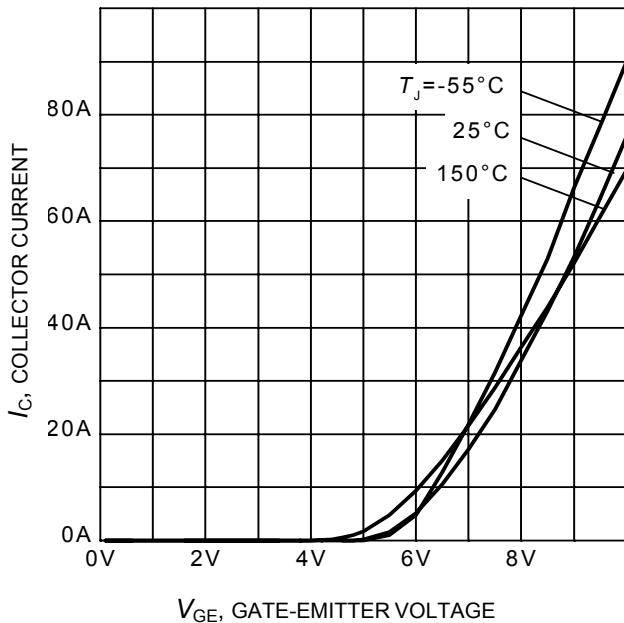


Figure 7. Typical transfer characteristic
($V_{CE} = 10\text{V}$)

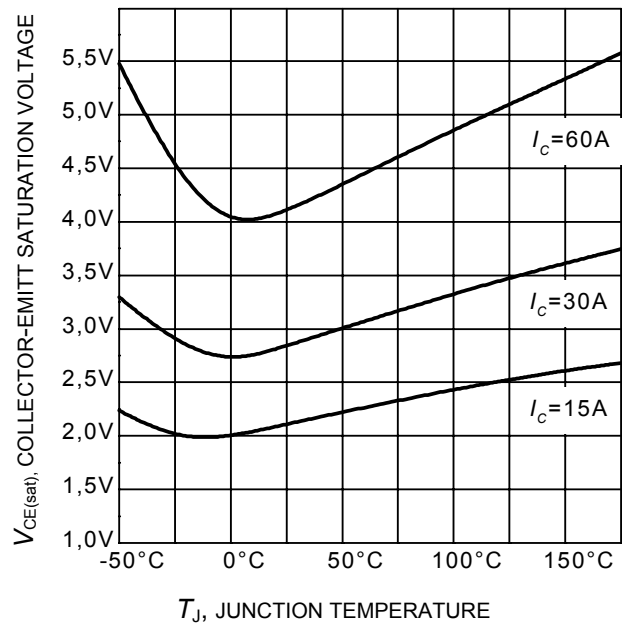


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)

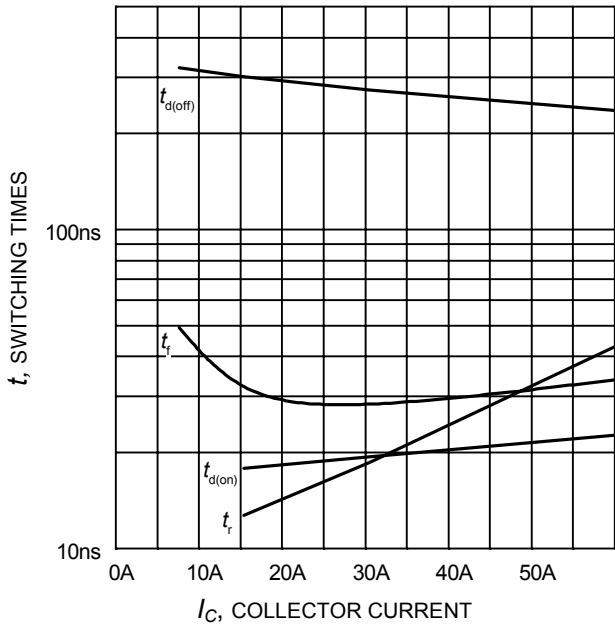


Figure 9. Typical switching times as a function of collector current
(inductive load, $T_J=150^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=11\Omega$, Dynamic test circuit in Figure E)

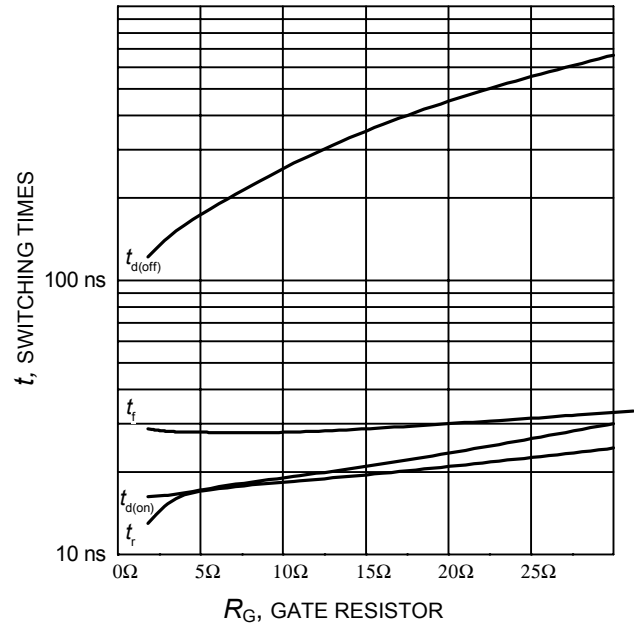


Figure 10. Typical switching times as a function of gate resistor
(inductive load, $T_J=150^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, Dynamic test circuit in Figure E)

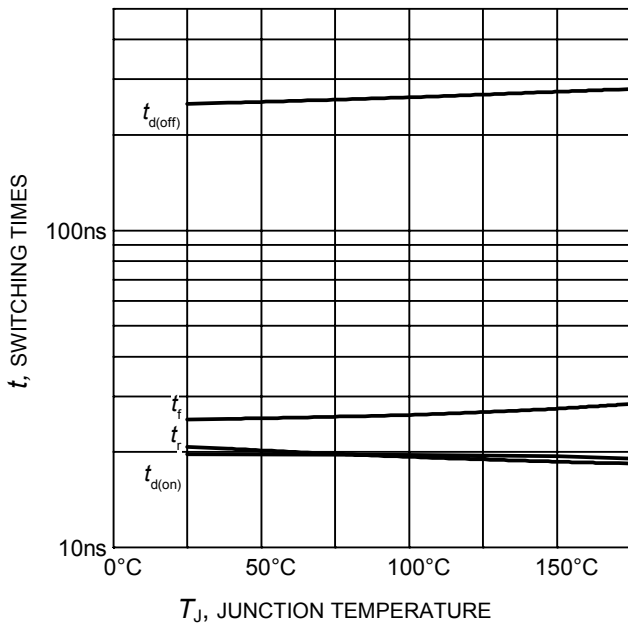


Figure 11. Typical switching times as a function of junction temperature
(inductive load, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_G=11\Omega$, Dynamic test circuit in Figure E)

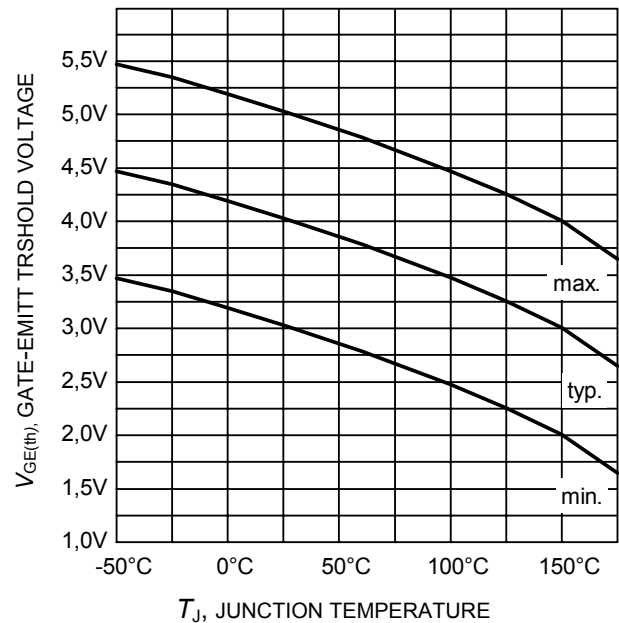


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
($I_C = 0.7\text{mA}$)

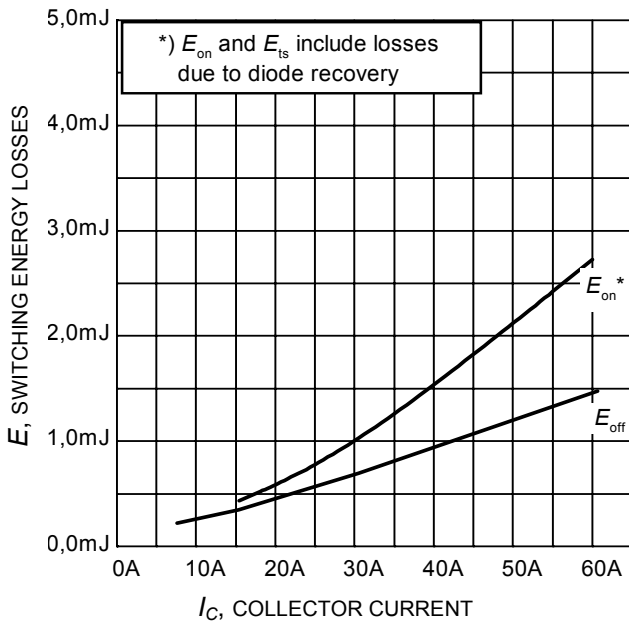


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, $T_J=150^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=11\Omega$, Dynamic test circuit in Figure E)

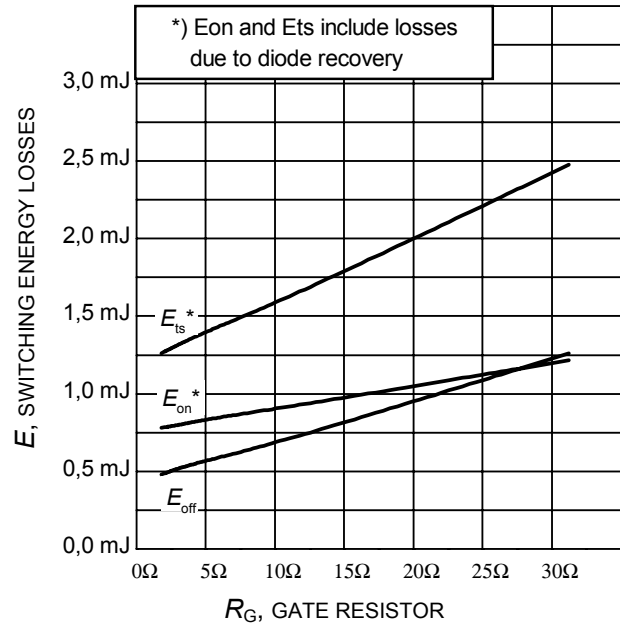


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, $T_J=150^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, Dynamic test circuit in Figure E)

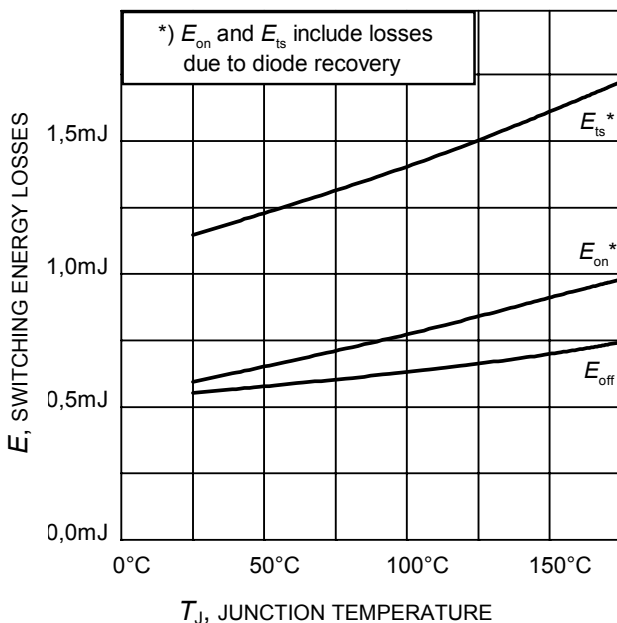


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_G=11\Omega$, Dynamic test circuit in Figure E)

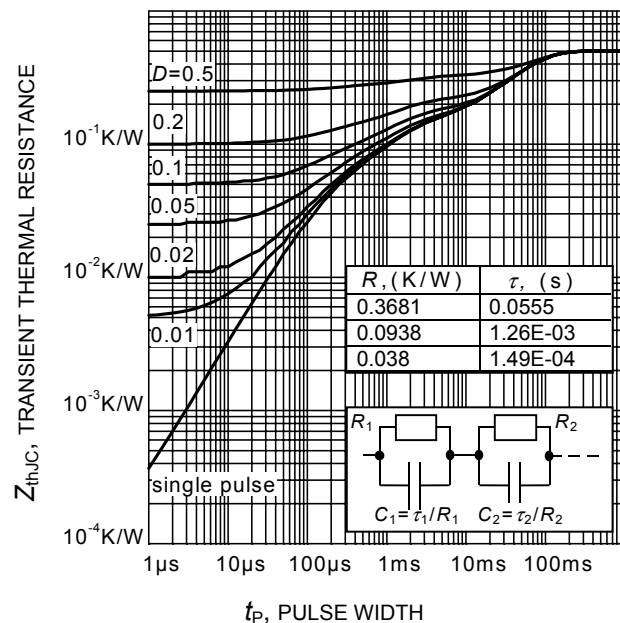


Figure 16. IGBT transient thermal resistance
($D = t_p / T$)

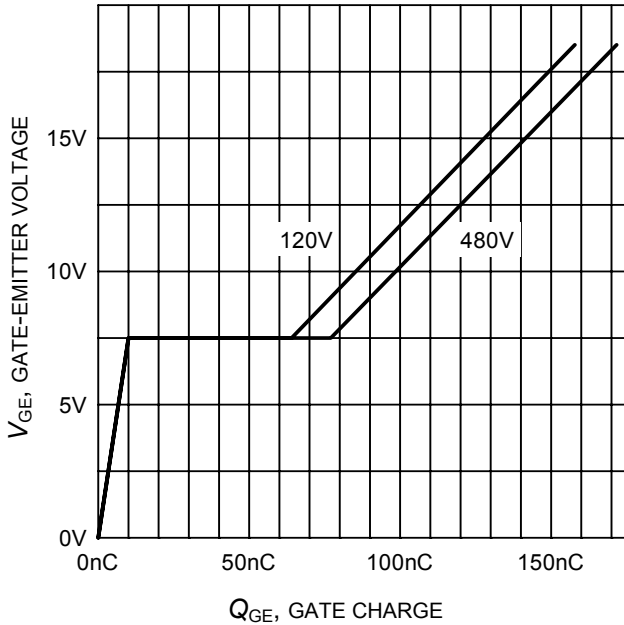


Figure 17. Typical gate charge
($I_C=30\text{ A}$)

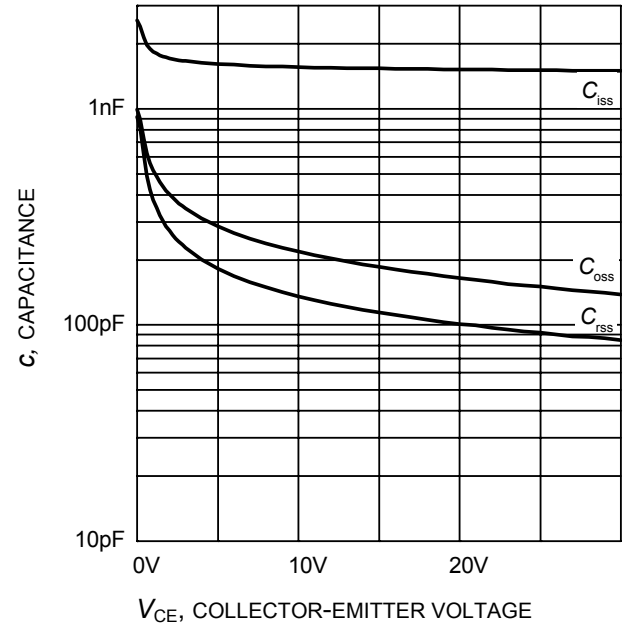


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE}=0\text{V}$, $f = 1\text{ MHz}$)

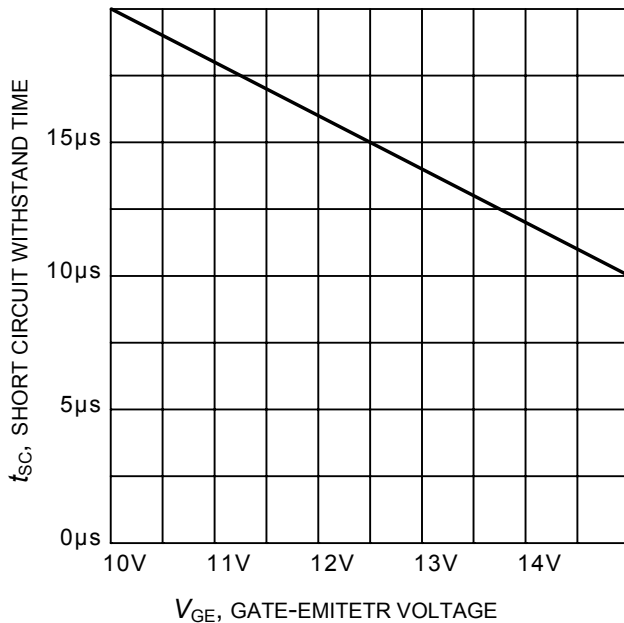


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
($V_{CE}=600\text{V}$, start at $T_J=25^\circ\text{C}$)

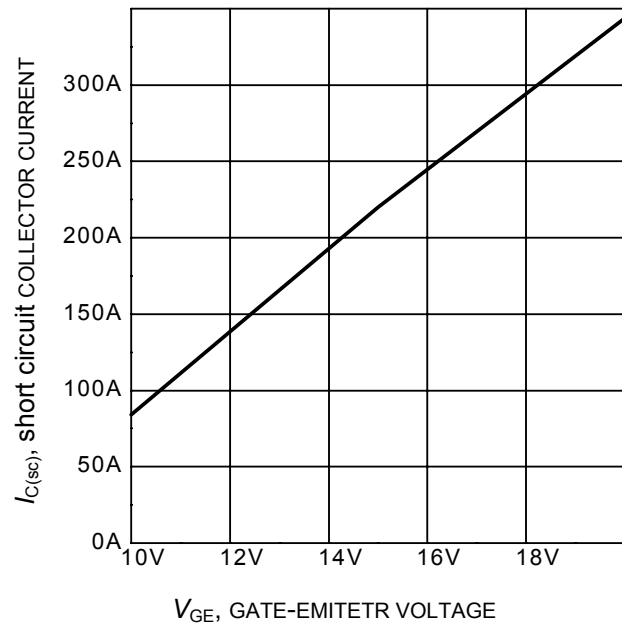
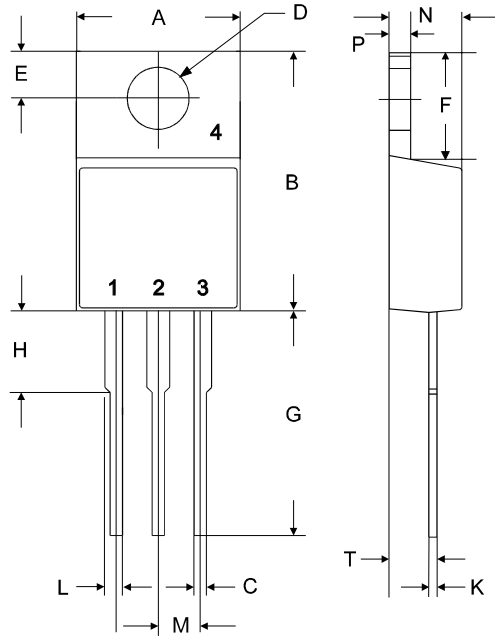


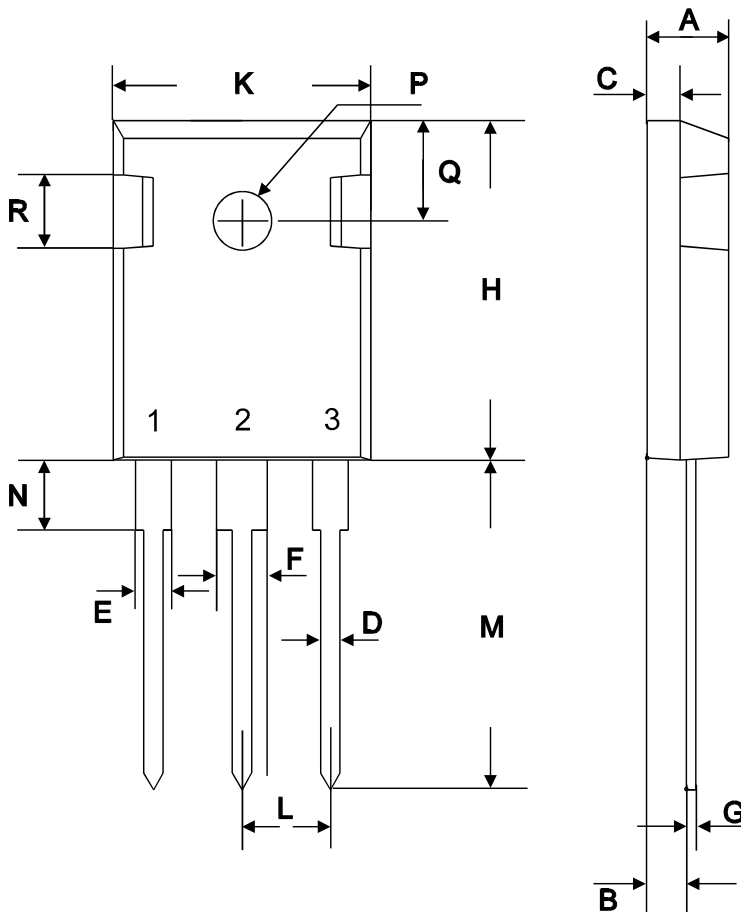
Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq 600\text{V}$, $T_J \leq 150^\circ\text{C}$)

TO-220AB



| symbol | dimensions | | | |
|--------|------------|-------|----------|--------|
| | [mm] | | [inch] | |
| | min | max | min | max |
| A | 9.70 | 10.30 | 0.3819 | 0.4055 |
| B | 14.88 | 15.95 | 0.5858 | 0.6280 |
| C | 0.65 | 0.86 | 0.0256 | 0.0339 |
| D | 3.55 | 3.89 | 0.1398 | 0.1531 |
| E | 2.60 | 3.00 | 0.1024 | 0.1181 |
| F | 6.00 | 6.80 | 0.2362 | 0.2677 |
| G | 13.00 | 14.00 | 0.5118 | 0.5512 |
| H | 4.35 | 4.75 | 0.1713 | 0.1870 |
| K | 0.38 | 0.65 | 0.0150 | 0.0256 |
| L | 0.95 | 1.32 | 0.0374 | 0.0520 |
| M | 2.54 typ. | | 0.1 typ. | |
| N | 4.30 | 4.50 | 0.1693 | 0.1772 |
| P | 1.17 | 1.40 | 0.0461 | 0.0551 |
| T | 2.30 | 2.72 | 0.0906 | 0.1071 |

TO-247AC



| symbol | dimensions | | | |
|--------|------------|-------|------------|--------|
| | [mm] | | [inch] | |
| | min | max | min | max |
| A | 4.78 | 5.28 | 0.1882 | 0.2079 |
| B | 2.29 | 2.51 | 0.0902 | 0.0988 |
| C | 1.78 | 2.29 | 0.0701 | 0.0902 |
| D | 1.09 | 1.32 | 0.0429 | 0.0520 |
| E | 1.73 | 2.06 | 0.0681 | 0.0811 |
| F | 2.67 | 3.18 | 0.1051 | 0.1252 |
| G | 0.76 max | | 0.0299 max | |
| H | 20.80 | 21.16 | 0.8189 | 0.8331 |
| K | 15.65 | 16.15 | 0.6161 | 0.6358 |
| L | 5.21 | 5.72 | 0.2051 | 0.2252 |
| M | 19.81 | 20.68 | 0.7799 | 0.8142 |
| N | 3.560 | 4.930 | 0.1402 | 0.1941 |
| ∅P | 3.61 | | 0.1421 | |
| Q | 6.12 | 6.22 | 0.2409 | 0.2449 |

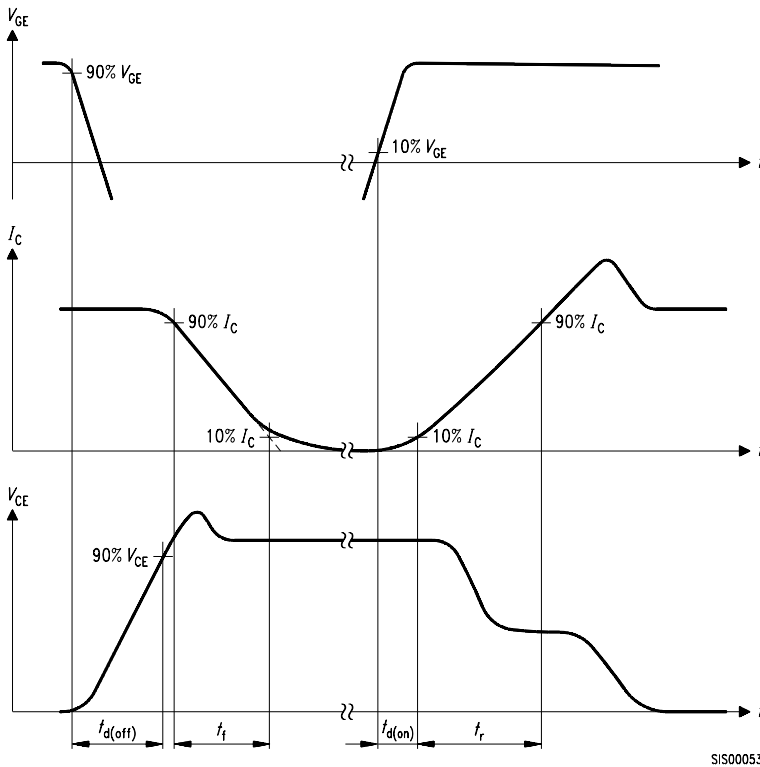


Figure A. Definition of switching times

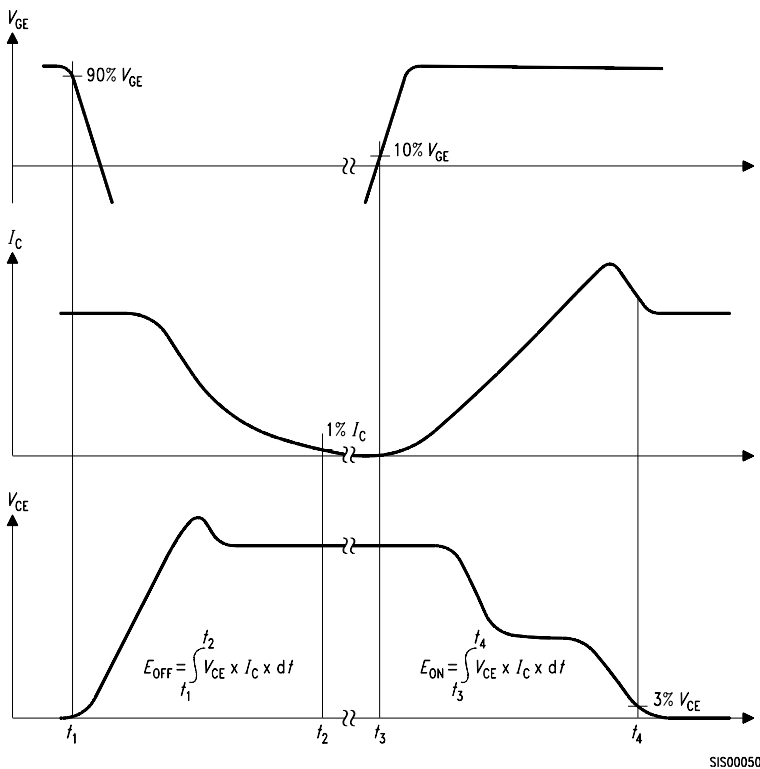


Figure B. Definition of switching losses

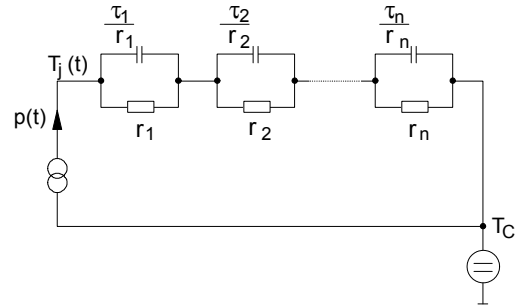


Figure D. Thermal equivalent circuit

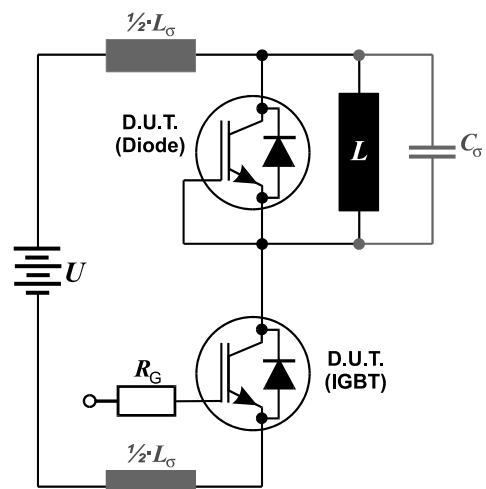


Figure E. Dynamic test circuit
Leakage inductance $L_\sigma = 60\text{nH}$
and Stray capacity $C_\sigma = 40\text{pF}$.

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