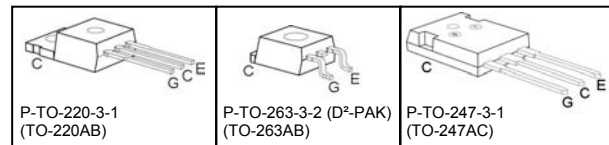
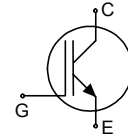


Fast IGBT in NPT-technology

- 40% lower E_{off} compared to previous generation
- Short circuit withstand time – 10 μ s
- Designed for:
 - Motor controls
 - Inverter
 - SMPS
- NPT-Technology offers:
 - very tight parameter distribution
 - high ruggedness, temperature stable behaviour
 - parallel switching capability



- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt/>

| Type | V_{CE} | I_C | E_{off} | T_j | Package | Ordering Code |
|-----------|----------|-------|-----------|-------|-----------------|---------------|
| SGP15N120 | 1200V | 15A | 1.5mJ | 150°C | TO-220AB | Q67040-S4274 |
| SGB15N120 | | | | | TO-263AB(D2PAK) | Q67040-S4275 |
| SGW15N120 | | | | | TO-247AC | Q67040-S4276 |

Maximum Ratings

| Parameter | Symbol | Value | Unit |
|--|----------------|------------|------------------|
| Collector-emitter voltage | V_{CE} | 1200 | V |
| DC collector current | I_C | 30 | A |
| $T_C = 25^\circ\text{C}$ | | 15 | |
| $T_C = 100^\circ\text{C}$ | | | |
| Pulsed collector current, t_p limited by T_{jmax} | I_{Cpuls} | 52 | |
| Turn off safe operating area | - | 52 | |
| $V_{CE} \leq 1200\text{V}, T_j \leq 150^\circ\text{C}$ | | | |
| Gate-emitter voltage | V_{GE} | ± 20 | V |
| Avalanche energy, single pulse | E_{AS} | 85 | mJ |
| $I_C = 15\text{A}, V_{CC} = 50\text{V}, R_{GE} = 25\Omega$, start at $T_j = 25^\circ\text{C}$ | | | |
| Short circuit withstand time ¹⁾ | t_{SC} | 10 | μ s |
| $V_{GE} = 15\text{V}, 100\text{V} \leq V_{CC} \leq 1200\text{V}, T_j \leq 150^\circ\text{C}$ | | | |
| Power dissipation | P_{tot} | 198 | W |
| $T_C = 25^\circ\text{C}$ | | | |
| Operating junction and storage temperature | T_j, T_{stg} | -55...+150 | $^\circ\text{C}$ |
| 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} | | 0.63 | K/W |
| Thermal resistance, junction – ambient | R_{thJA} | TO-220AB TO-247AC | 62 40 | |
| SMD version, device on PCB ¹⁾ | R_{thJA} | TO-263AB(D2PAK) | 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 | $V_{(BR)CES}$ | $V_{GE}=0V$, $I_C=1000\mu A$ | 1200 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE} = 15V$, $I_C=15A$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ | 2.5 - | 3.1 3.7 | 3.6 4.3 | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C=600\mu A$, $V_{CE}=V_{GE}$ | 3 | 4 | 5 | |
| Zero gate voltage collector current | I_{CES} | $V_{CE}=1200V$, $V_{GE}=0V$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ | - - | - - | 200 800 | μA |
| Gate-emitter leakage current | I_{GES} | $V_{CE}=0V$, $V_{GE}=20V$ | - | - | 100 | |
| Transconductance | g_{fs} | $V_{CE}=20V$, $I_C=15A$ | - | 11 | - | S |
| Dynamic Characteristic | | | | | | |
| Input capacitance | C_{iss} | $V_{CE}=25V$, $V_{GE}=0V$, $f=1\text{MHz}$ | - | 1250 | 1500 | pF |
| Output capacitance | C_{oss} | | - | 100 | 120 | |
| Reverse transfer capacitance | C_{riss} | | - | 65 | 80 | |
| Gate charge | Q_{Gate} | $V_{CC}=960V$, $I_C=15A$ $V_{GE}=15V$ | - | 130 | 175 | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | L_E | TO-220AB TO-247AC | - | 7 13 | - | nH |
| Short circuit collector current ²⁾ | $I_{C(SC)}$ | $V_{GE}=15V$, $t_{SC}\leq 5\mu s$ $100V\leq V_{CC}\leq 1200V$, $T_j\leq 150^\circ\text{C}$ | - | 145 | - | |

¹⁾ Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μ m thick) copper area for collector connection. PCB is vertical without blown air.

²⁾ 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 | $t_{d(on)}$ | $T_j=25\text{ }^\circ\text{C}$, $V_{CC}=800\text{V}$, $I_C=15\text{A}$, $V_{GE}=15\text{V}/0\text{V}$, $R_G=33\Omega$, $L_{\sigma}^{(1)}=180\text{nH}$, $C_{\sigma}^{(1)}=40\text{pF}$ Energy losses include "tail" and diode reverse recovery. | - | 18 | 24 | ns |
| Rise time | t_r | | - | 23 | 30 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 580 | 750 | |
| Fall time | t_f | | - | 22 | 29 | |
| Turn-on energy | E_{on} | | - | 1.1 | 1.5 | mJ |
| Turn-off energy | E_{off} | | - | 0.8 | 1.1 | |
| Total switching energy | E_{ts} | | - | 1.9 | 2.6 | |

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 | $t_{d(on)}$ | $T_j=150\text{ }^\circ\text{C}$ $V_{CC}=800\text{V}$, $I_C=15\text{A}$, $V_{GE}=15\text{V}/0\text{V}$, $R_G=33\Omega$, $L_{\sigma}^{(1)}=180\text{nH}$, $C_{\sigma}^{(1)}=40\text{pF}$ Energy losses include "tail" and diode reverse recovery. | - | 38 | 46 | ns |
| Rise time | t_r | | - | 30 | 36 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 652 | 780 | |
| Fall time | t_f | | - | 31 | 37 | |
| Turn-on energy | E_{on} | | - | 1.9 | 2.3 | mJ |
| Turn-off energy | E_{off} | | - | 1.5 | 2.0 | |
| Total switching energy | E_{ts} | | - | 3.4 | 4.3 | |

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

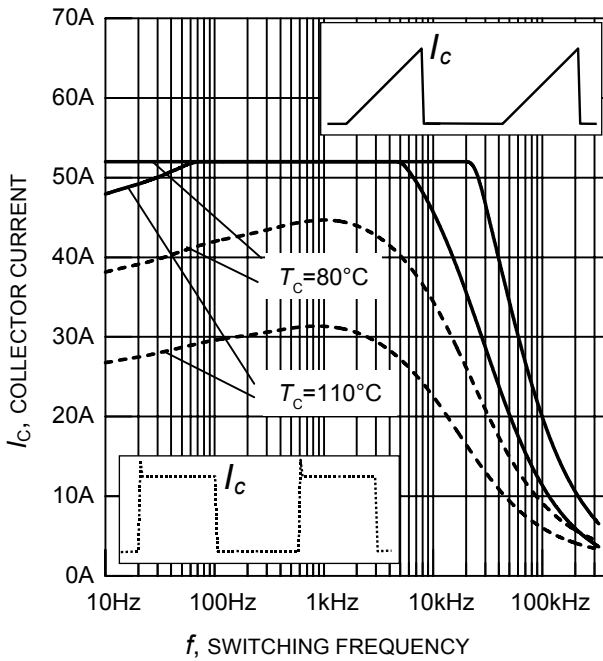


Figure 1. Collector current as a function of switching frequency
 ($T_j \leq 150^\circ\text{C}$, $D = 0.5$, $V_{CE} = 800\text{V}$,
 $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 33\Omega$)

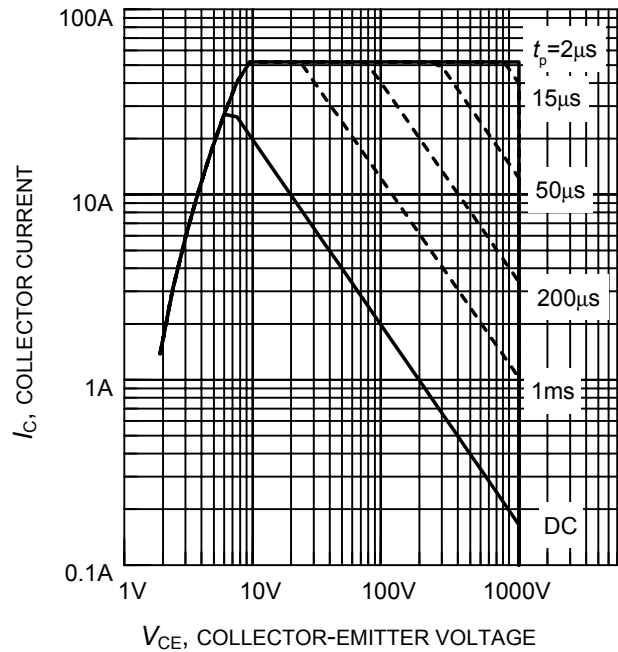


Figure 2. Safe operating area
 ($D = 0$, $T_C = 25^\circ\text{C}$, $T_j \leq 150^\circ\text{C}$)

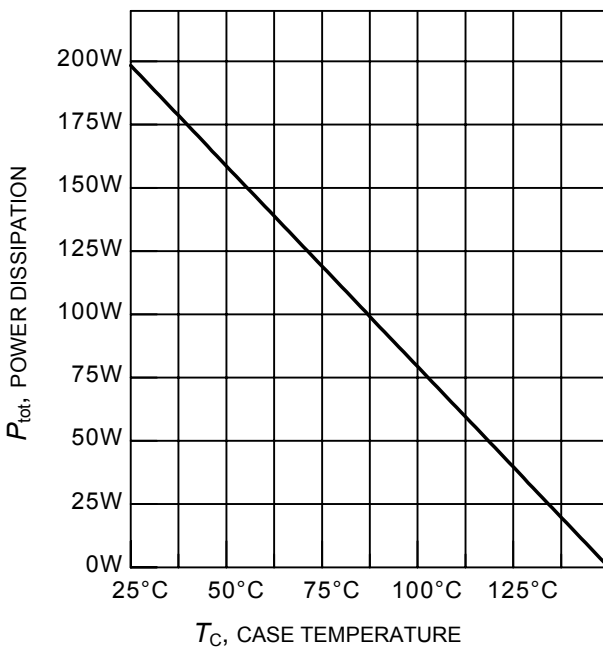


Figure 3. Power dissipation as a function of case temperature
 ($T_j \leq 150^\circ\text{C}$)

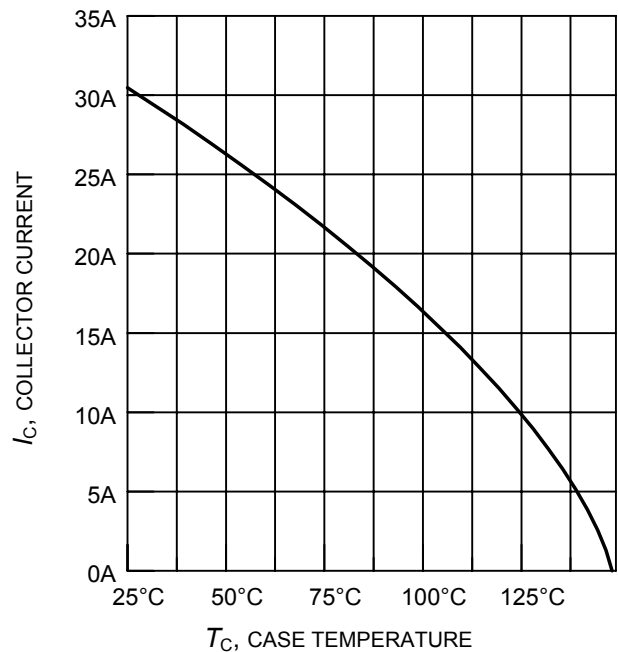


Figure 4. Collector current as a function of case temperature
 ($V_{GE} \leq 15\text{V}$, $T_j \leq 150^\circ\text{C}$)

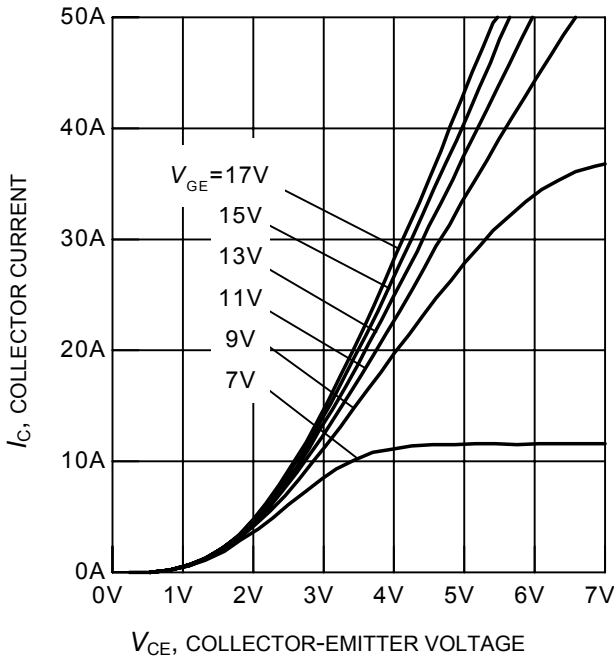


Figure 5. Typical output characteristics
($T_j = 25^\circ\text{C}$)

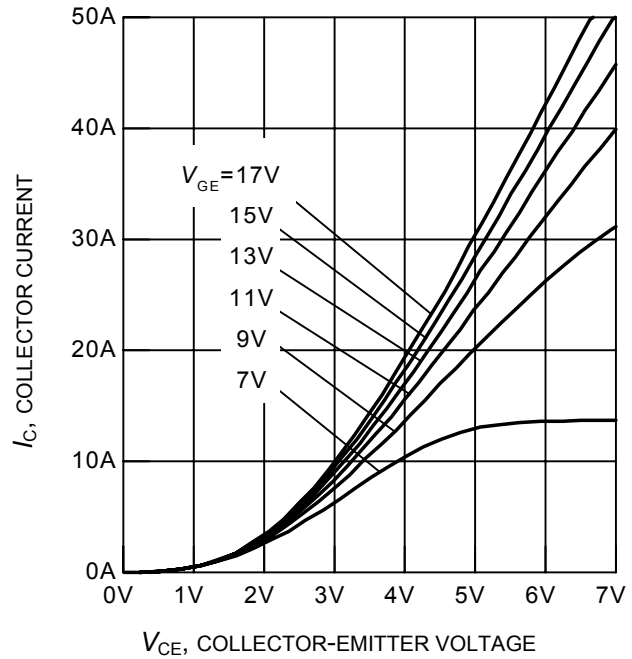


Figure 6. Typical output characteristics
($T_j = 150^\circ\text{C}$)

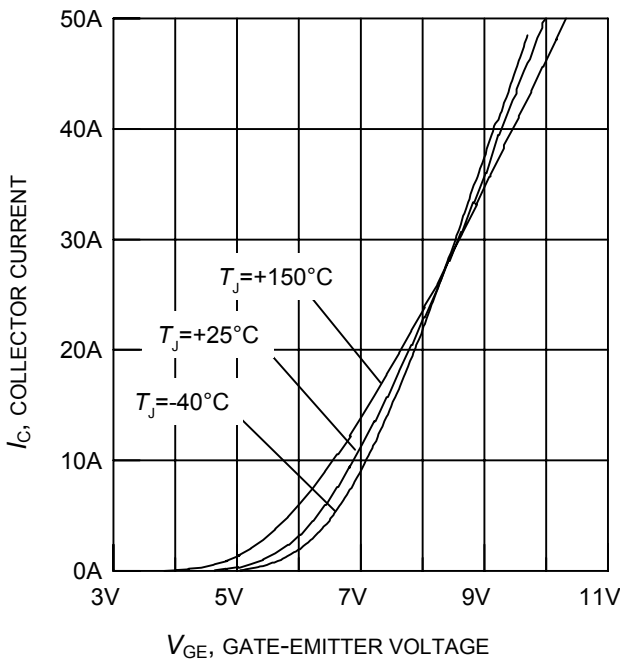


Figure 7. Typical transfer characteristics
($V_{CE} = 20\text{V}$)

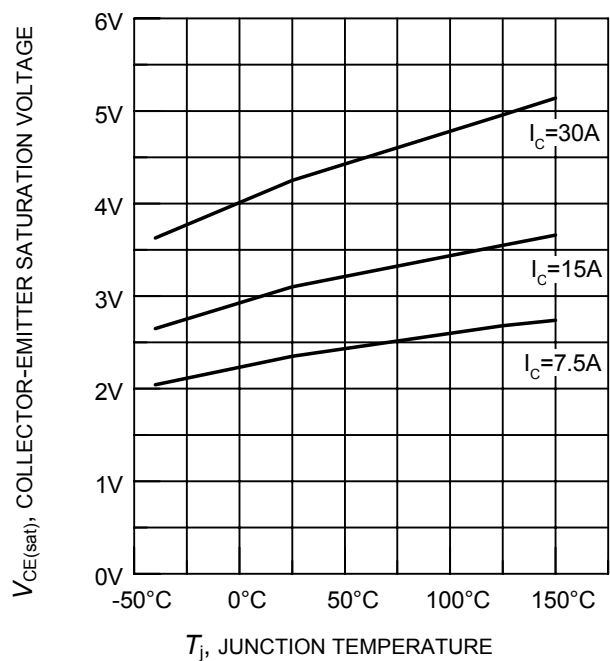


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)

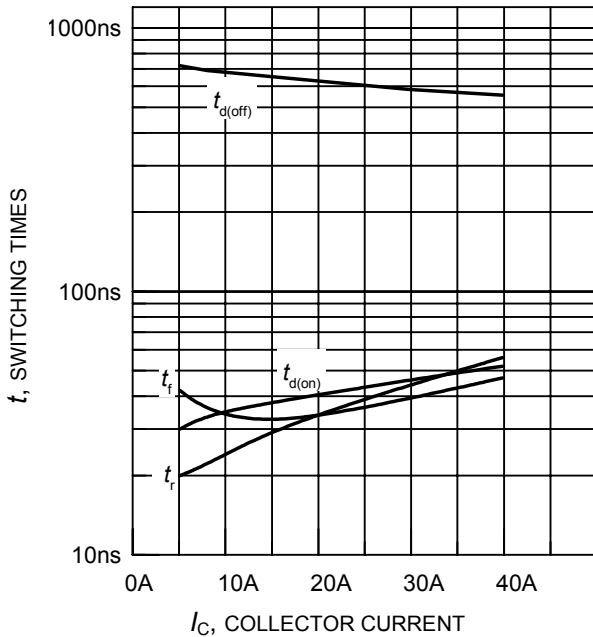


Figure 9. Typical switching times as a function of collector current

(inductive load, $T_j = 150^\circ\text{C}$, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 33\Omega$, dynamic test circuit in Fig.E)

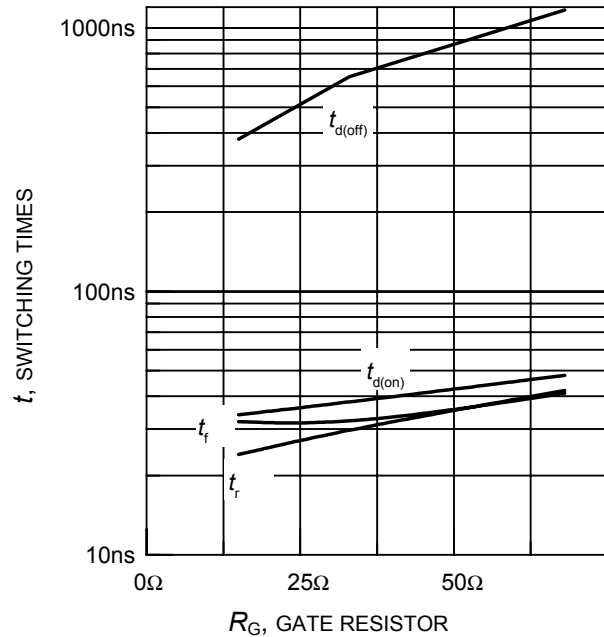


Figure 10. Typical switching times as a function of gate resistor

(inductive load, $T_j = 150^\circ\text{C}$, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 15\text{A}$, dynamic test circuit in Fig.E)

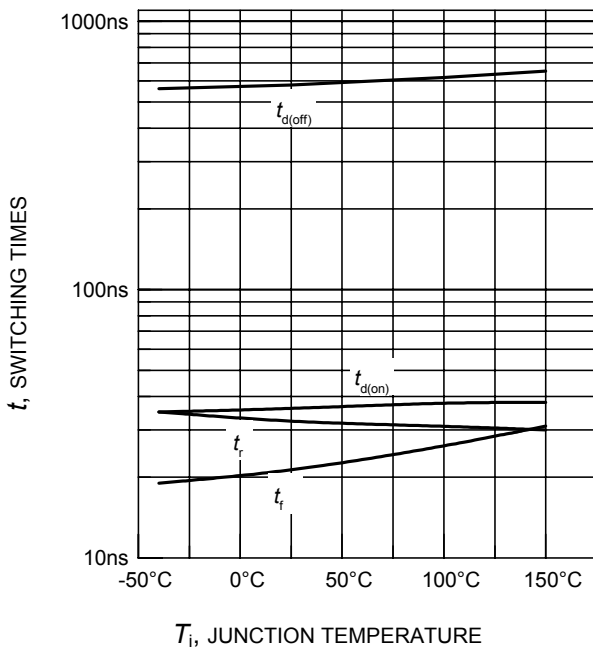


Figure 11. Typical switching times as a function of junction temperature

(inductive load, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 15\text{A}$, $R_G = 33\Omega$, dynamic test circuit in Fig.E)

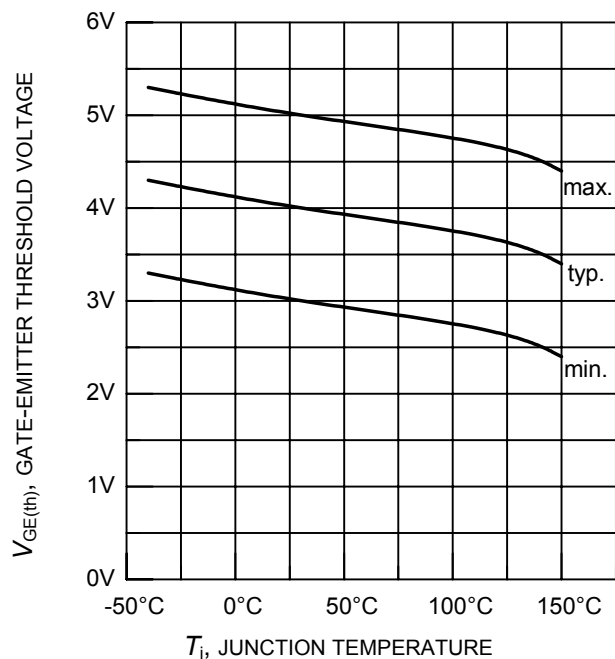


Figure 12. Gate-emitter threshold voltage as a function of junction temperature

($I_C = 0.3\text{mA}$)

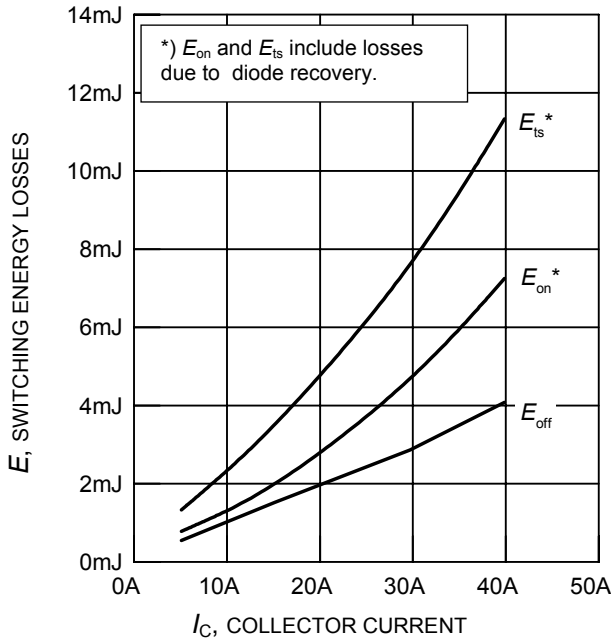


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, $T_j = 150^\circ\text{C}$, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 33\Omega$, dynamic test circuit in Fig.E)

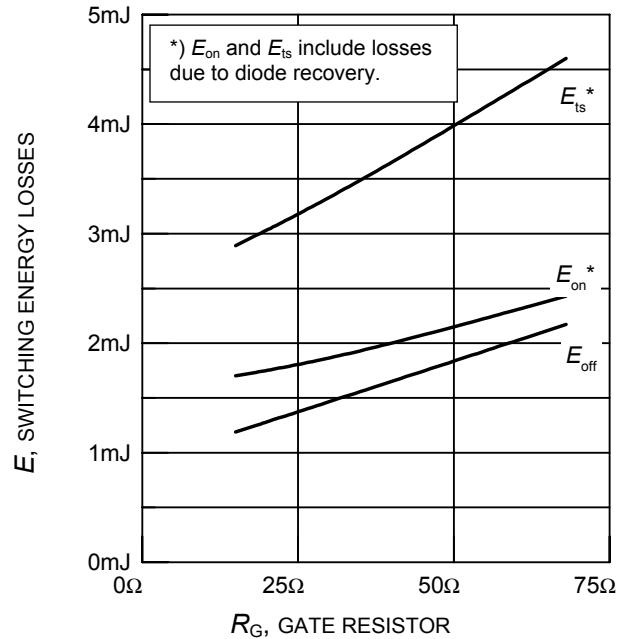


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, $T_j = 150^\circ\text{C}$, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 15\text{A}$, dynamic test circuit in Fig.E)

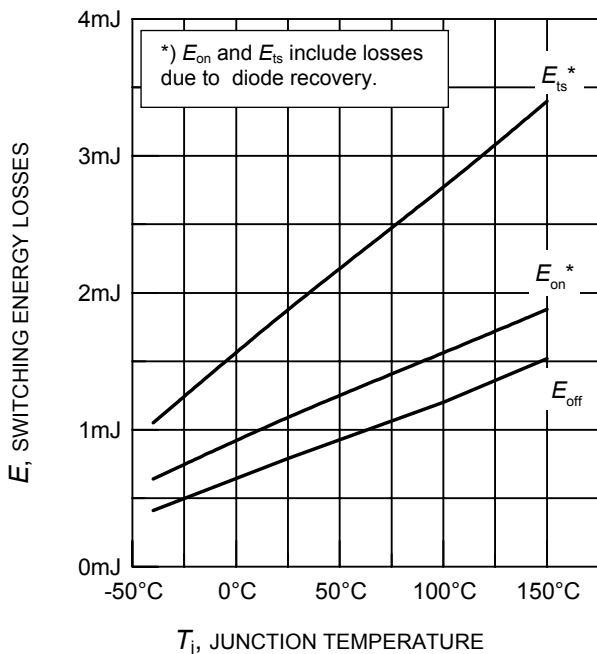


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 15\text{A}$, $R_G = 33\Omega$, dynamic test circuit in Fig.E)

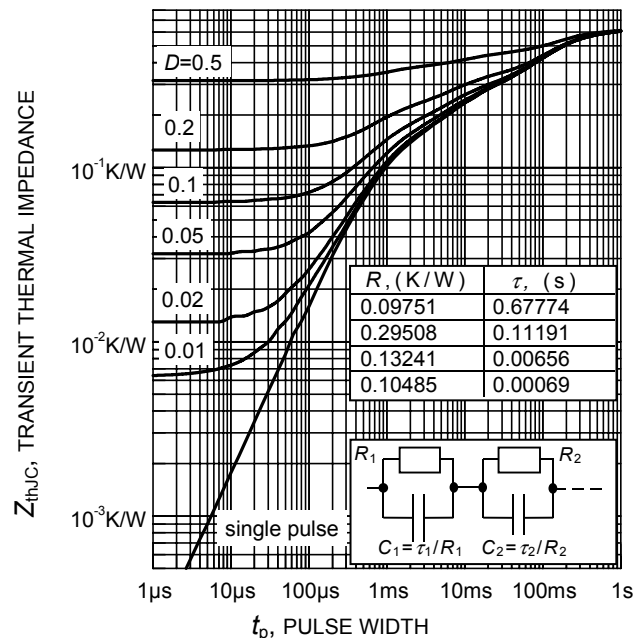


Figure 16. IGBT transient thermal impedance as a function of pulse width
($D = t_p / T$)

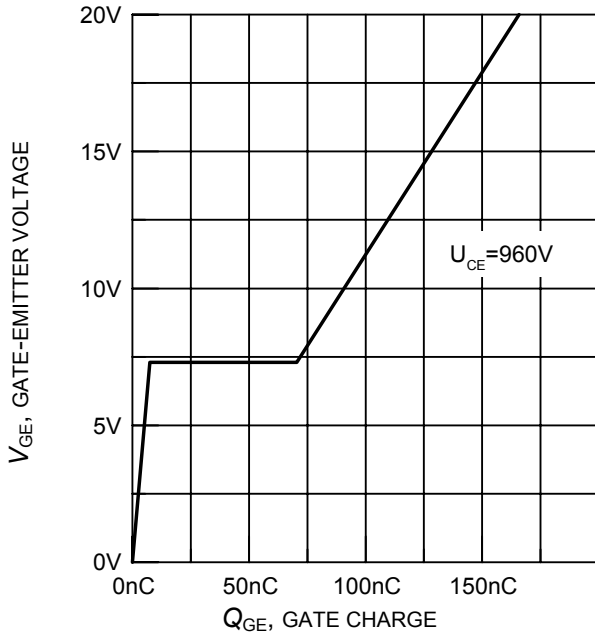


Figure 17. Typical gate charge
($I_C = 15A$)

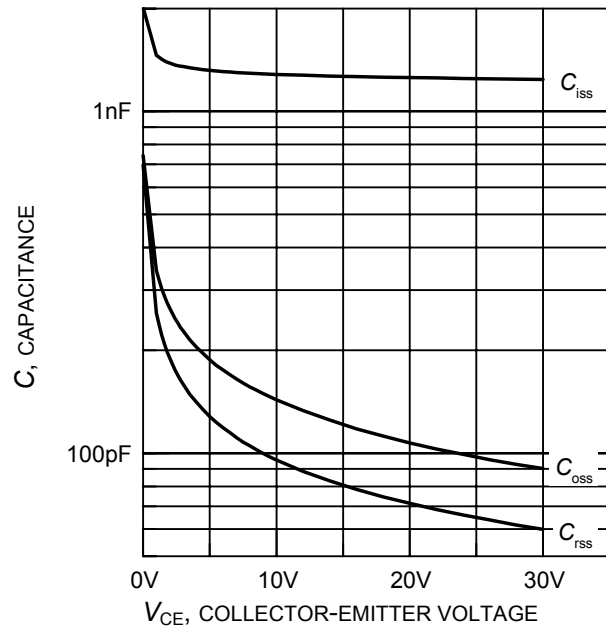


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE} = 0V, f = 1MHz$)

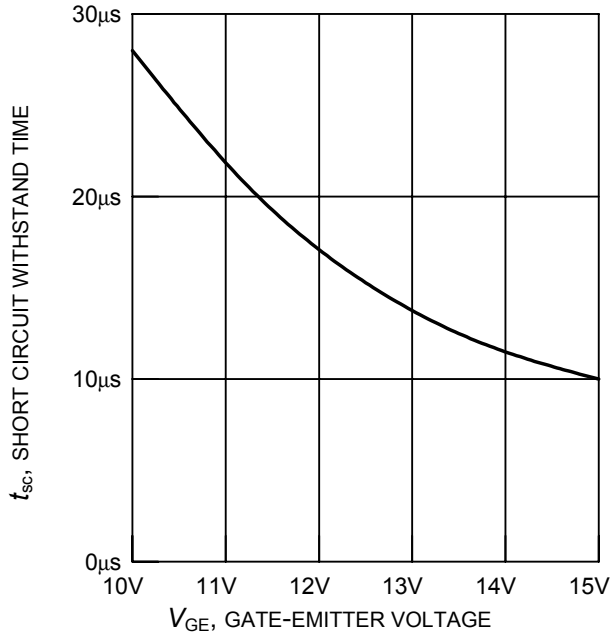


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
($V_{CE} = 1200V, \text{start at } T_j = 25^\circ C$)

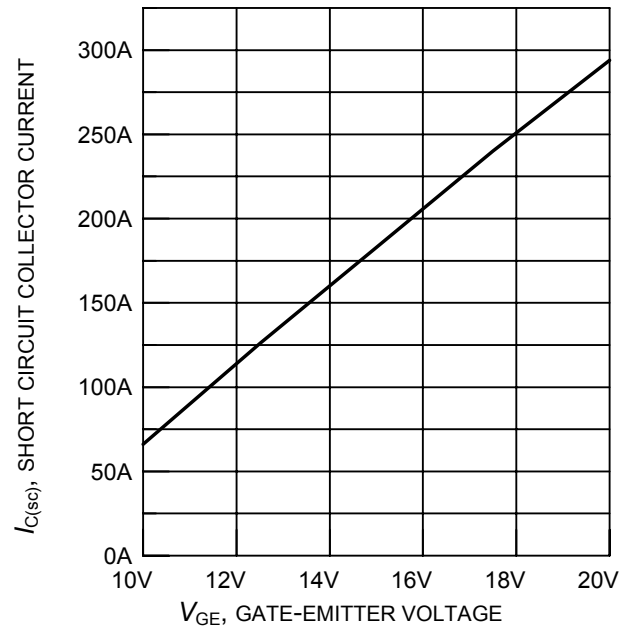
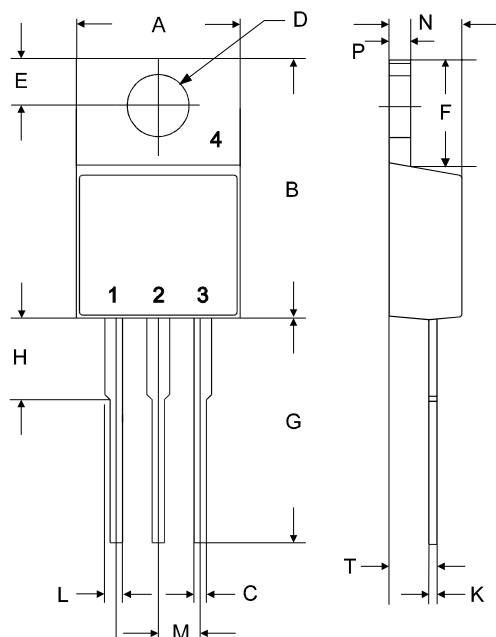


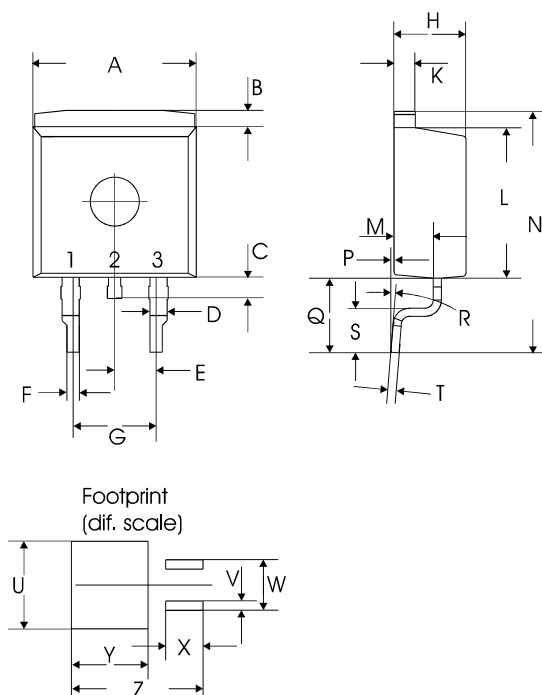
Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($100V \leq V_{CE} \leq 1200V, T_C = 25^\circ C, T_j \leq 150^\circ C$)

TO-220AB

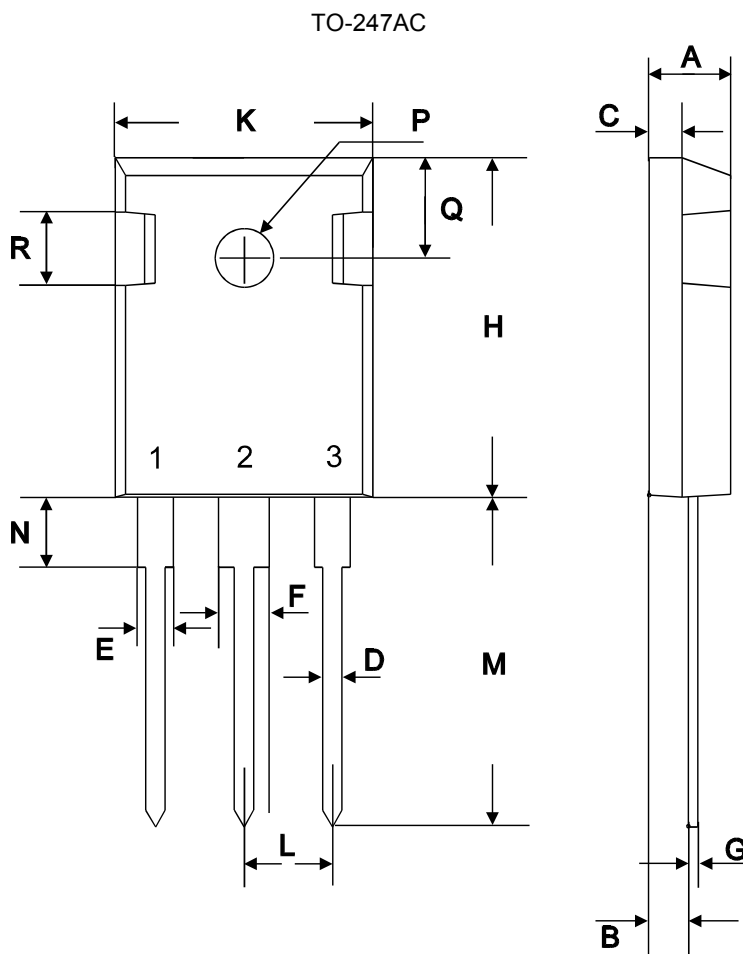


| symbol | dimensions | | | |
|--------|------------|-------|----------|--------|
| | [mm] | | [inch] | |
| | min | max | min | max |
| A | 9.70 | 10.30 | 0.3819 | 0.4055 |
| B | 14.88 | 15.95 | 0.5858 | 0.6280 |
| C | 0.65 | 0.86 | 0.0256 | 0.0339 |
| D | 3.55 | 3.89 | 0.1398 | 0.1531 |
| E | 2.60 | 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-263AB (D²Pak)



| symbol | dimensions | | | |
|--------|------------|-------|-------------|--------|
| | [mm] | | [inch] | |
| | min | max | min | max |
| A | 9.80 | 10.20 | 0.3858 | 0.4016 |
| B | 0.70 | 1.30 | 0.0276 | 0.0512 |
| C | 1.00 | 1.60 | 0.0394 | 0.0630 |
| D | 1.03 | 1.07 | 0.0406 | 0.0421 |
| E | 2.54 typ. | | 0.1 typ. | |
| F | 0.65 | 0.85 | 0.0256 | 0.0335 |
| G | 5.08 typ. | | 0.2 typ. | |
| H | 4.30 | 4.50 | 0.1693 | 0.1772 |
| K | 1.17 | 1.37 | 0.0461 | 0.0539 |
| L | 9.05 | 9.45 | 0.3563 | 0.3720 |
| M | 2.30 | 2.50 | 0.0906 | 0.0984 |
| N | 15 typ. | | 0.5906 typ. | |
| P | 0.00 | 0.20 | 0.0000 | 0.0079 |
| Q | 4.20 | 5.20 | 0.1654 | 0.2047 |
| R | 8° max | | 8° max | |
| S | 2.40 | 3.00 | 0.0945 | 0.1181 |
| T | 0.40 | 0.60 | 0.0157 | 0.0236 |
| U | 10.80 | | 0.4252 | |
| V | 1.15 | | 0.0453 | |
| W | 6.23 | | 0.2453 | |
| X | 4.60 | | 0.1811 | |
| Y | 9.40 | | 0.3701 | |
| Z | 16.15 | | 0.6358 | |



| 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 |

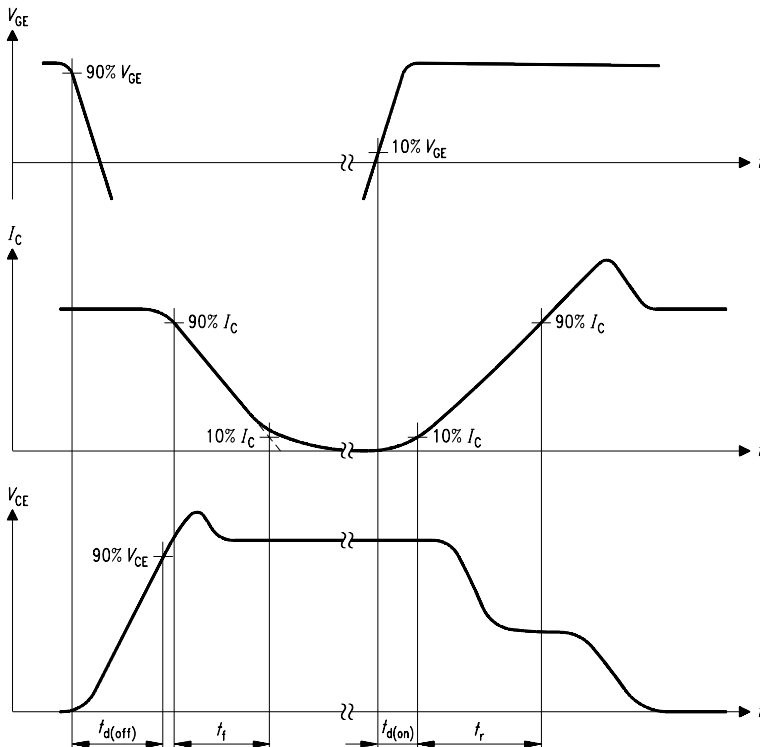


Figure A. Definition of switching times

SIS00053

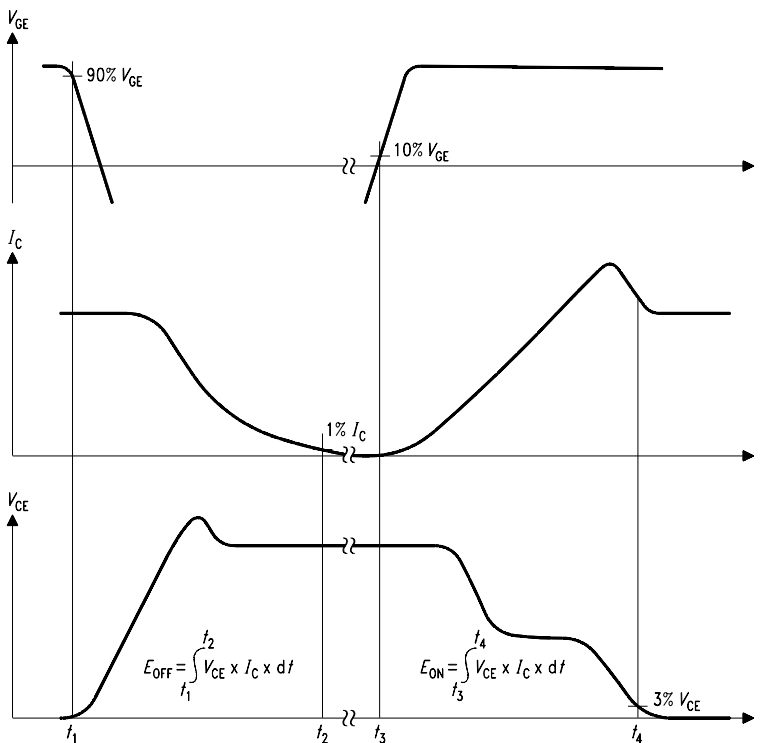


Figure B. Definition of switching losses

SIS00050

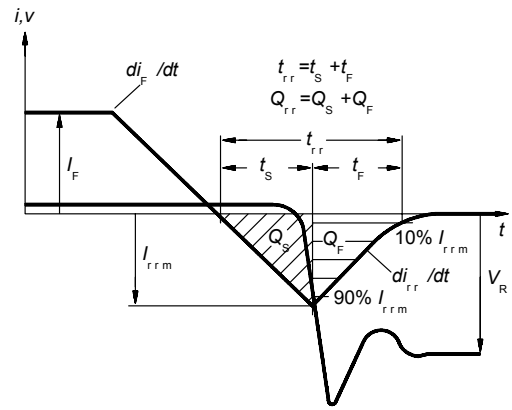


Figure C. Definition of diodes switching characteristics

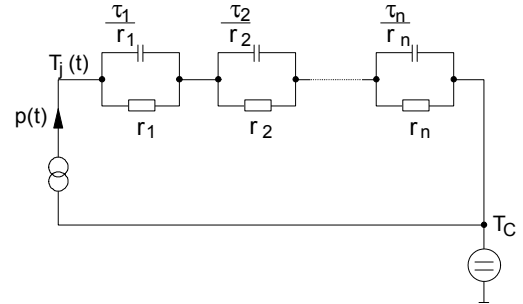


Figure D. Thermal equivalent circuit

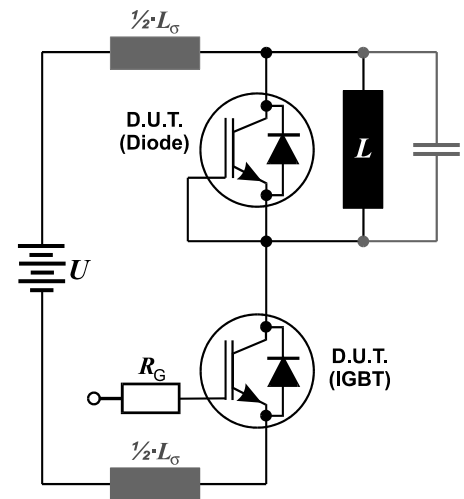


Figure E. Dynamic test circuit
Leakage inductance $L_\sigma=180\text{nH}$,
and stray capacity $C_\sigma =40\text{pF}$.

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