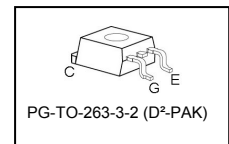
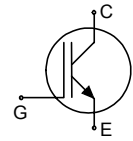


## Fast IGBT in NPT-technology

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



- Qualified according to JEDEC<sup>1</sup> for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt/>

| Type      | $V_{CE}$ | $I_C$ | $E_{off}$ | $T_j$ | Marking  | Package       |
|-----------|----------|-------|-----------|-------|----------|---------------|
| SGB07N120 | 1200V    | 8A    | 0.7mJ     | 150°C | GB07N120 | PG-TO-263-3-2 |

### Maximum Ratings

| Parameter                                                                                           | Symbol            | Value      | Unit             |
|-----------------------------------------------------------------------------------------------------|-------------------|------------|------------------|
| Collector-emitter voltage                                                                           | $V_{CE}$          | 1200       | V                |
| DC collector current                                                                                | $I_C$             | 16.5       | A                |
| $T_C = 25^\circ\text{C}$                                                                            |                   | 7.9        |                  |
| $T_C = 100^\circ\text{C}$                                                                           |                   |            |                  |
| Pulsed collector current, $t_p$ limited by $T_{jmax}$                                               | $I_{Cpuls}$       | 27         |                  |
| Turn off safe operating area                                                                        | -                 | 27         |                  |
| $V_{CE} \leq 1200\text{V}$ , $T_j \leq 150^\circ\text{C}$                                           |                   |            |                  |
| Gate-emitter voltage                                                                                | $V_{GE}$          | $\pm 20$   | V                |
| Avalanche energy, single pulse                                                                      | $E_{AS}$          | 40         | mJ               |
| $I_C = 8\text{A}$ , $V_{CC} = 50\text{V}$ , $R_{GE} = 25\Omega$ , start at $T_j = 25^\circ\text{C}$ |                   |            |                  |
| Short circuit withstand time <sup>2</sup>                                                           | $t_{SC}$          | 10         | $\mu$ 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                                                                                   | $P_{tot}$         | 125        | W                |
| $T_C = 25^\circ\text{C}$                                                                            |                   |            |                  |
| Operating junction and storage temperature                                                          | $T_j$ , $T_{stg}$ | -55...+150 | $^\circ\text{C}$ |
| Soldering temperature (reflow soldering, MSL1)                                                      | $T_s$             | 245        |                  |

<sup>1</sup> J-STD-020 and JESD-022

<sup>2</sup> Allowed number of short circuits: <1000; time between short circuits: >1s.

**Thermal Resistance**

| Parameter                                               | Symbol     | Conditions | Max. Value | Unit |
|---------------------------------------------------------|------------|------------|------------|------|
| <b>Characteristic</b>                                   |            |            |            |      |
| IGBT thermal resistance,<br>junction – case             | $R_{thJC}$ |            | 1          | K/W  |
| Thermal resistance,<br>junction – ambient <sup>1)</sup> | $R_{thJA}$ |            | 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                               | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=500\mu A$                                                                  | 1200     | -          | -          | V       |
| Collector-emitter saturation voltage                              | $V_{CE(sat)}$ | $V_{GE} = 15V, I_C=8A$<br>$T_j=25^{\circ}C$<br>$T_j=150^{\circ}C$                          | 2.5<br>- | 3.1<br>3.7 | 3.6<br>4.3 |         |
| Gate-emitter threshold voltage                                    | $V_{GE(th)}$  | $I_C=350\mu A, V_{CE}=V_{GE}$                                                              | 3        | 4          | 5          |         |
| Zero gate voltage collector current                               | $I_{CES}$     | $V_{CE}=1200V, V_{GE}=0V$<br>$T_j=25^{\circ}C$<br>$T_j=150^{\circ}C$                       | -<br>-   | -<br>-     | 100<br>400 | $\mu A$ |
| Gate-emitter leakage current                                      | $I_{GES}$     | $V_{CE}=0V, V_{GE}=20V$                                                                    | -        | -          | 100        |         |
| Transconductance                                                  | $g_{fs}$      | $V_{CE}=20V, I_C=8A$                                                                       |          | 6          | -          | S       |
| Dynamic Characteristic                                            |               |                                                                                            |          |            |            |         |
| Input capacitance                                                 | $C_{iss}$     | $V_{CE}=25V,$<br>$V_{GE}=0V,$<br>$f=1MHz$                                                  | -        | 720        | 870        | pF      |
| Output capacitance                                                | $C_{oss}$     |                                                                                            | -        | 60         | 75         |         |
| Reverse transfer capacitance                                      | $C_{rss}$     |                                                                                            | -        | 40         | 50         |         |
| Gate charge                                                       | $Q_{Gate}$    | $V_{CC}=960V, I_C=8A$<br>$V_{GE}=15V$                                                      | -        | 70         | 90         | nC      |
| Internal emitter inductance<br>measured 5mm (0.197 in.) from case | $L_E$         |                                                                                            | -        | 7          | -          | nH      |
| Short circuit collector current <sup>2)</sup>                     | $I_{C(SC)}$   | $V_{GE}=15V, t_{SC}\leq 10\mu s$<br>$100V\leq V_{CC}\leq 1200V,$<br>$T_i\leq 150^{\circ}C$ | -        | 75         | -          | A       |

<sup>1)</sup> Device on 50mm\*50mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70μm thick) copper area for collector connection. PCB is vertical without blown air.

<sup>2)</sup> Allowed number of short circuits: <1000; time between short circuits: >1s.

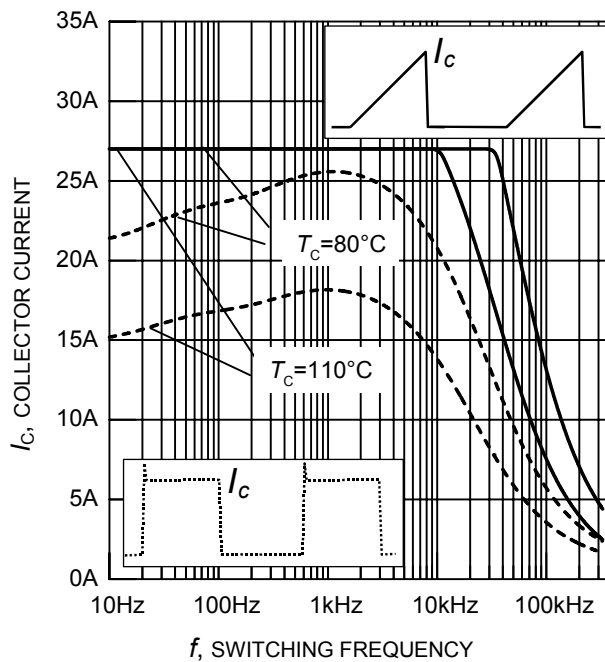
**Switching Characteristic, Inductive Load, at  $T_j=25^\circ\text{C}$** 

| Parameter              | Symbol       | Conditions                                                                                                                                                                                           | Value |      |      | Unit |
|------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------|
|                        |              |                                                                                                                                                                                                      | min.  | typ. | max. |      |
| IGBT Characteristic    |              |                                                                                                                                                                                                      |       |      |      |      |
| Turn-on delay time     | $t_{d(on)}$  | $T_j=25^{\circ}\text{C}$ ,<br>$V_{CC}=800\text{V}$ , $I_C=8\text{A}$ ,<br>$V_{GE}=15\text{V}/0\text{V}$ ,<br>$R_G=47\Omega$ ,<br>$L_{\sigma}^{1)})=180\text{nH}$ ,<br>$C_{\sigma}^{1)})=40\text{pF}$ | -     | 27   | 35   | ns   |
| Rise time              | $t_r$        |                                                                                                                                                                                                      | -     | 29   | 38   |      |
| Turn-off delay time    | $t_{d(off)}$ |                                                                                                                                                                                                      | -     | 440  | 570  |      |
| Fall time              | $t_f$        |                                                                                                                                                                                                      | -     | 21   | 27   |      |
| Turn-on energy         | $E_{on}$     | Energy losses include<br>“tail” and diode<br>reverse recovery.                                                                                                                                       | -     | 0.6  | 0.8  | mJ   |
| Turn-off energy        | $E_{off}$    |                                                                                                                                                                                                      | -     | 0.4  | 0.55 |      |
| Total switching energy | $E_{ts}$     |                                                                                                                                                                                                      | -     | 1.0  | 1.35 |      |

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

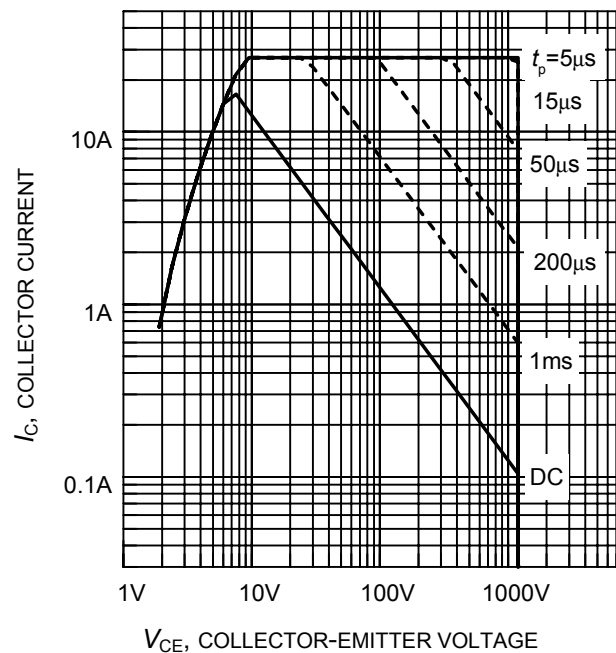
| Parameter              | Symbol       | Conditions                                                                                                                                                                                           | Value |      |      | Unit |
|------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------|
|                        |              |                                                                                                                                                                                                      | min.  | typ. | max. |      |
| IGBT Characteristic    |              |                                                                                                                                                                                                      |       |      |      |      |
| Turn-on delay time     | $t_{d(on)}$  | $T_j=150^{\circ}\text{C}$<br>$V_{CC}=800\text{V}$ ,<br>$I_C=8\text{A}$ ,<br>$V_{GE}=15\text{V}/0\text{V}$ ,<br>$R_G=47\Omega$ ,<br>$L_{\sigma}^{1)}=180\text{nH}$ ,<br>$C_{\sigma}^{1)}=40\text{pF}$ | -     | 30   | 36   | ns   |
| Rise time              | $t_r$        |                                                                                                                                                                                                      | -     | 26   | 31   |      |
| Turn-off delay time    | $t_{d(off)}$ |                                                                                                                                                                                                      | -     | 490  | 590  |      |
| Fall time              | $t_f$        |                                                                                                                                                                                                      | -     | 30   | 36   |      |
| Turn-on energy         | $E_{on}$     | Energy losses include<br>“tail” and diode<br>reverse recovery.                                                                                                                                       | -     | 1.0  | 1.2  | mJ   |
| Turn-off energy        | $E_{off}$    |                                                                                                                                                                                                      | -     | 0.7  | 0.9  |      |
| Total switching energy | $E_{ts}$     |                                                                                                                                                                                                      | -     | 1.7  | 2.1  |      |

<sup>1)</sup> Leakage inductance  $L_\sigma$  and stray capacity  $C_\sigma$  due to dynamic test circuit in figure E.



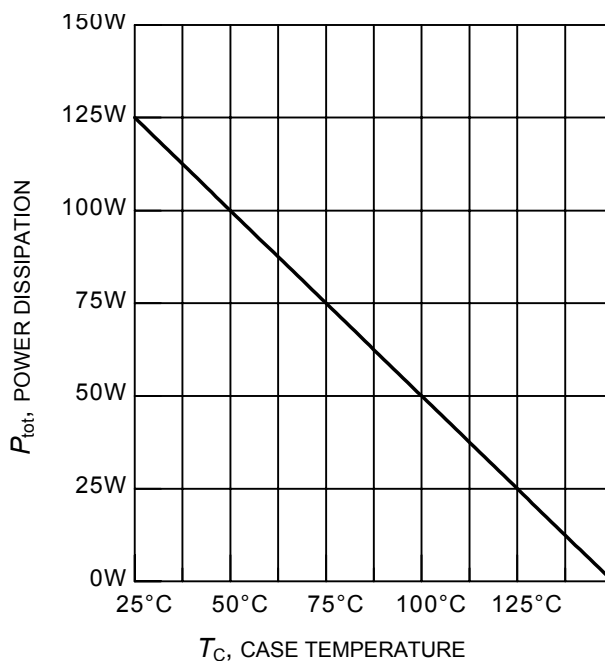
**Figure 1. Collector current as a function of switching frequency**

( $T_j \leq 150^\circ\text{C}$ ,  $D = 0.5$ ,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $R_G = 47\Omega$ )



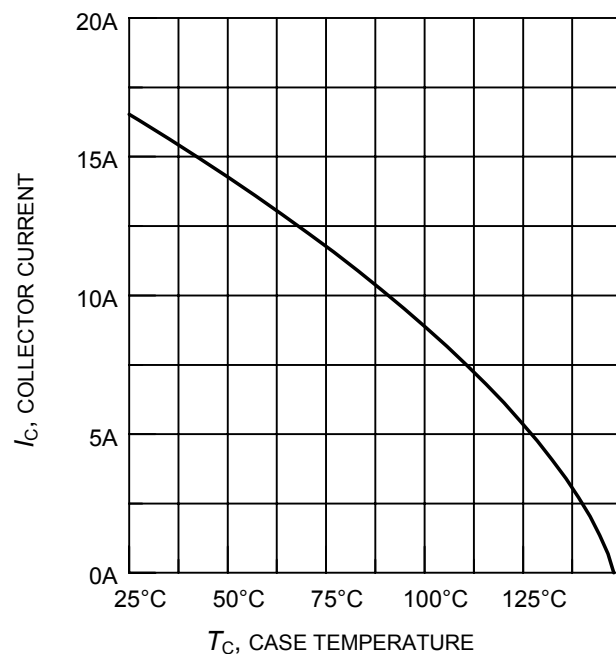
**Figure 2. Safe operating area**

( $D = 0$ ,  $T_C = 25^\circ\text{C}$ ,  $T_j \leq 150^\circ\text{C}$ )



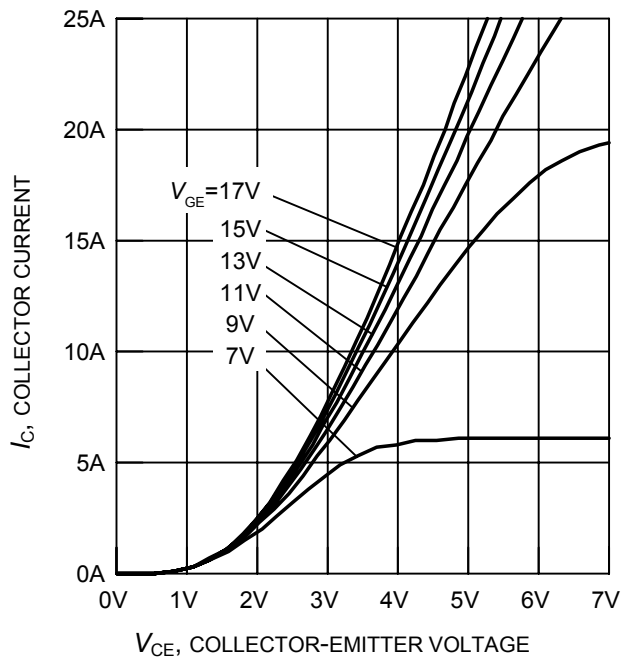
**Figure 3. Power dissipation as a function of case temperature**

( $T_j \leq 150^\circ\text{C}$ )

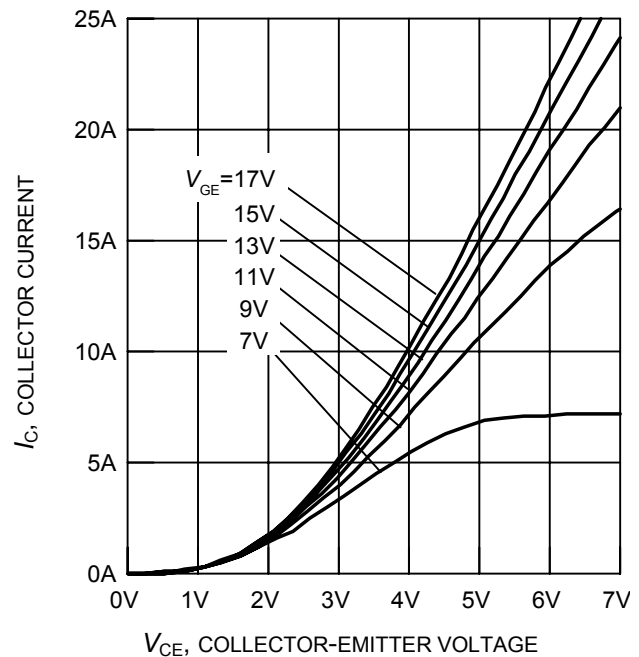


**Figure 4. Collector current as a function of case temperature**

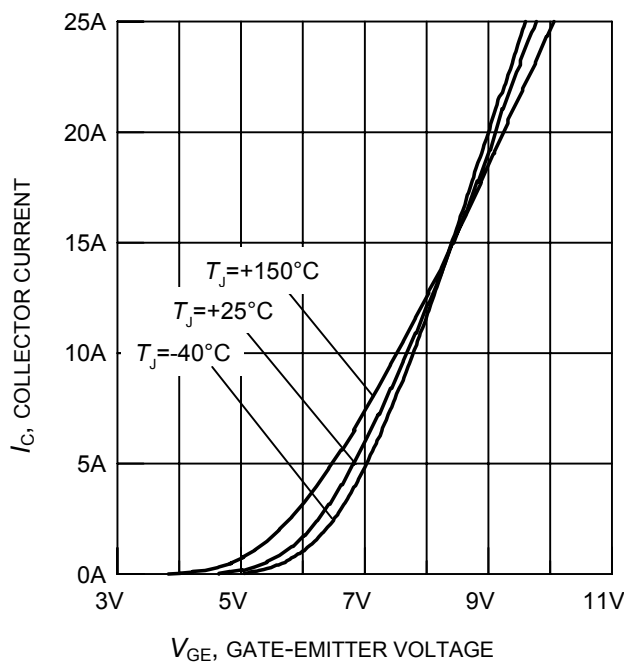
( $V_{GE} \leq 15\text{V}$ ,  $T_j \leq 150^\circ\text{C}$ )



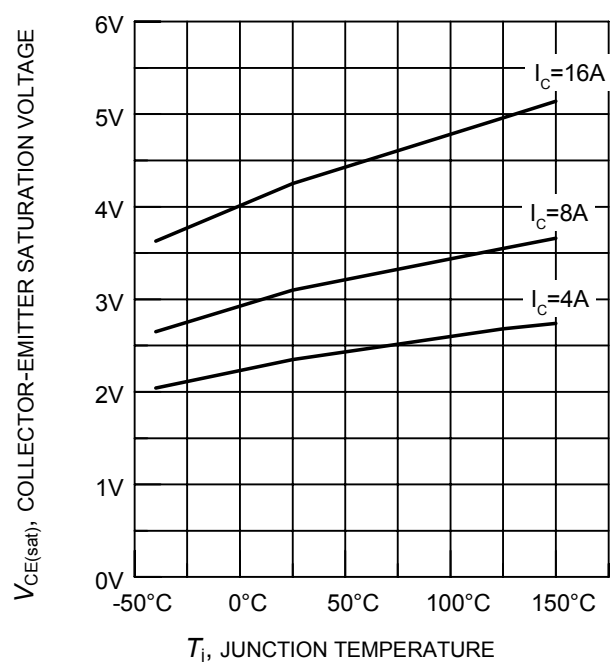
**Figure 5. Typical output characteristics**  
( $T_j = 25^\circ C$ )



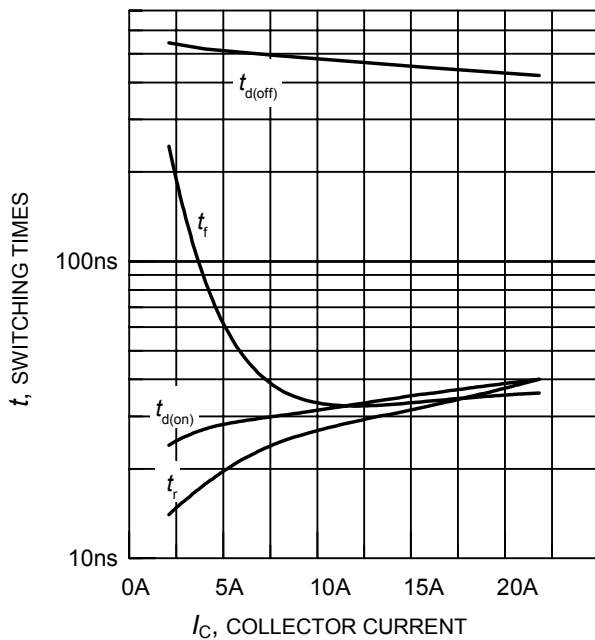
**Figure 6. Typical output characteristics**  
( $T_j = 150^\circ C$ )



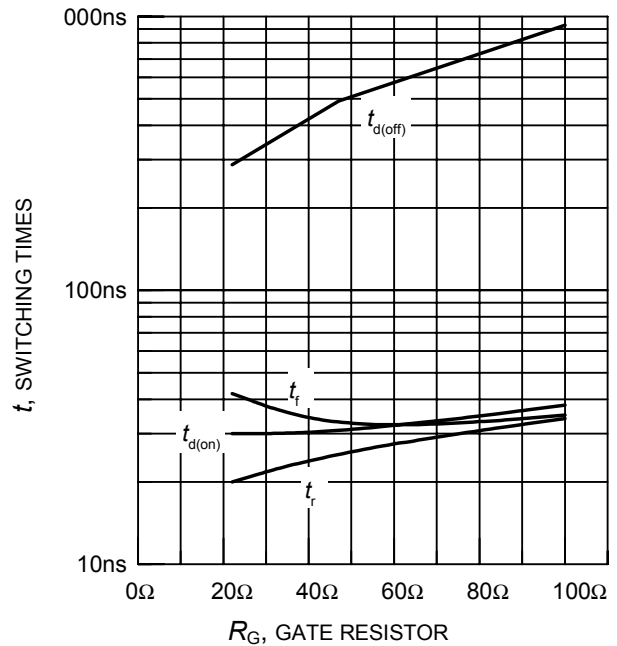
**Figure 7. Typical transfer characteristics**  
( $V_{CE} = 20V$ )



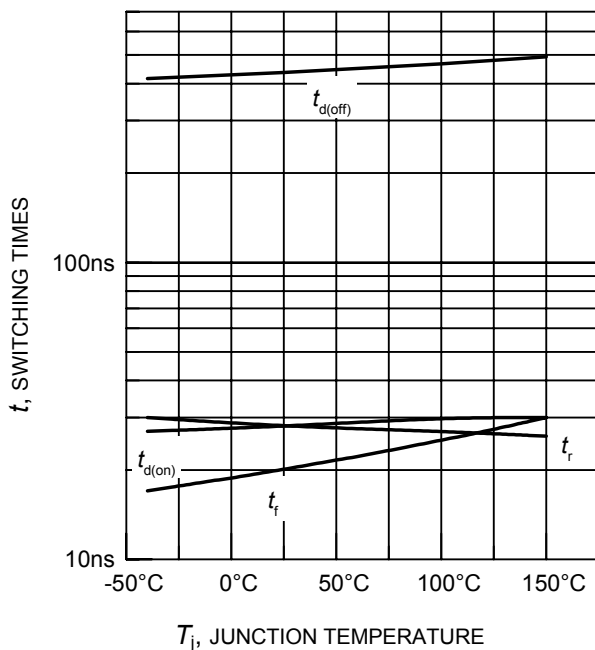
**Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature**  
( $V_{GE} = 15V$ )



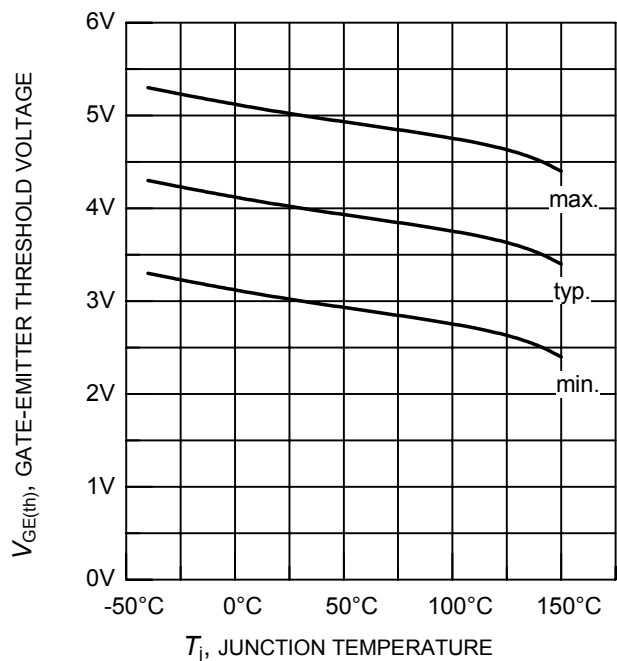
**Figure 9. Typical switching times as a function of collector current**  
(inductive load,  $T_j = 150^\circ\text{C}$ ,  
 $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $R_G = 47\Omega$ ,  
dynamic test circuit in Fig.E )



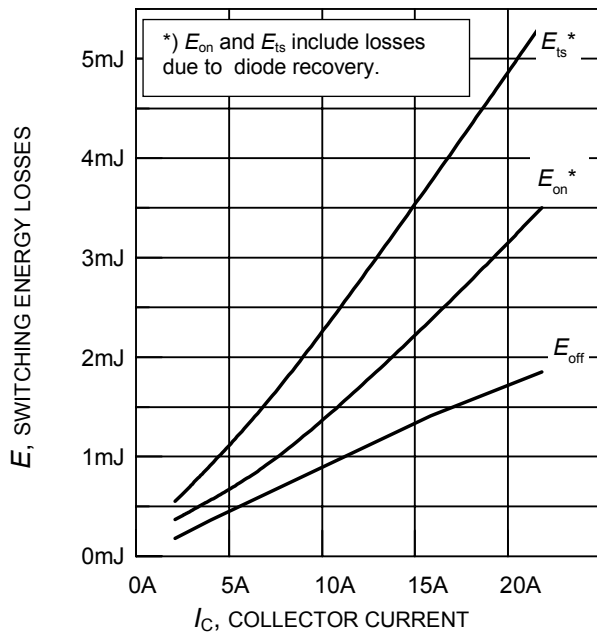
**Figure 10. Typical switching times as a function of gate resistor**  
(inductive load,  $T_j = 150^\circ\text{C}$ ,  
 $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $I_C = 8\text{A}$ ,  
dynamic test circuit in Fig.E )



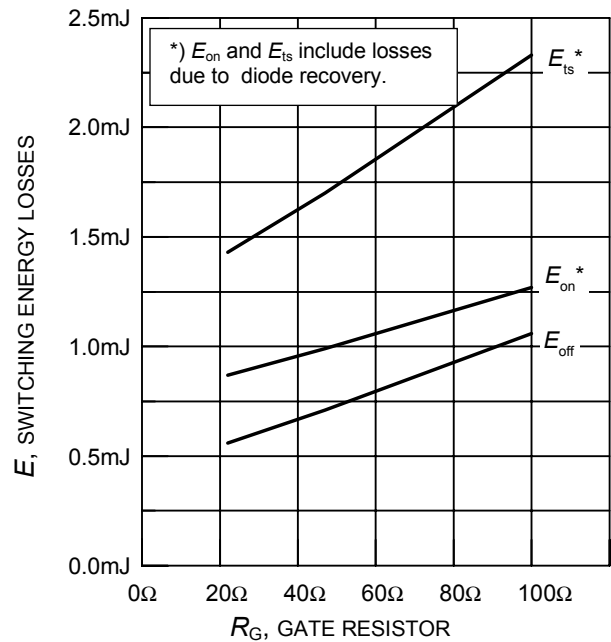
**Figure 11. Typical switching times as a function of junction temperature**  
(inductive load,  $V_{CE} = 800\text{V}$ ,  
 $V_{GE} = +15\text{V}/0\text{V}$ ,  $I_C = 8\text{A}$ ,  $R_G = 47\Omega$ ,  
dynamic test circuit in Fig.E )



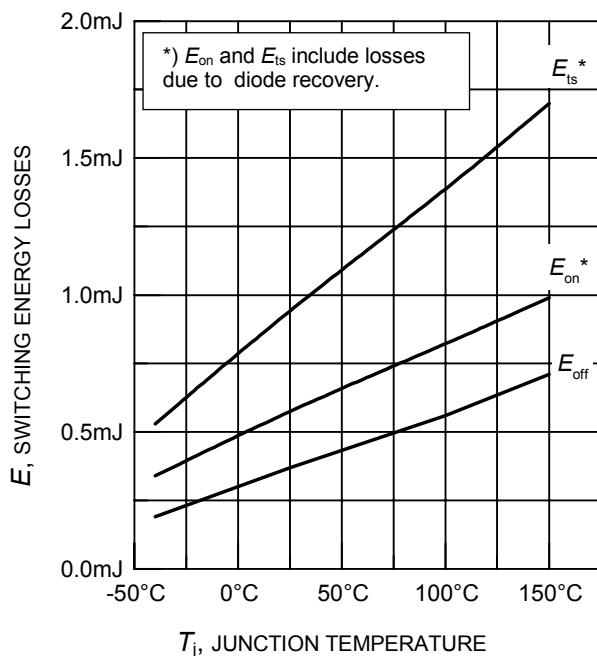
**Figure 12. Gate-emitter threshold voltage as a function of junction temperature**  
( $I_C = 0.3\text{mA}$ )



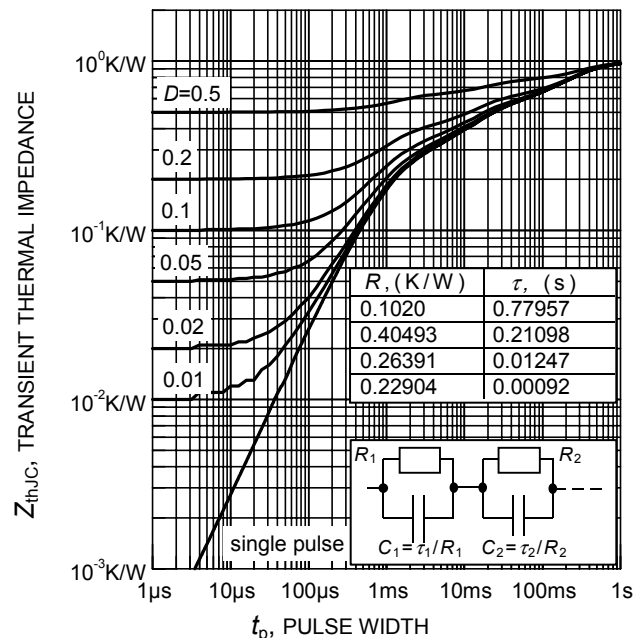
**Figure 13. Typical switching energy losses as a function of collector current**  
(inductive load,  $T_j = 150^\circ\text{C}$ ,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $R_G = 47\Omega$ , dynamic test circuit in Fig.E )



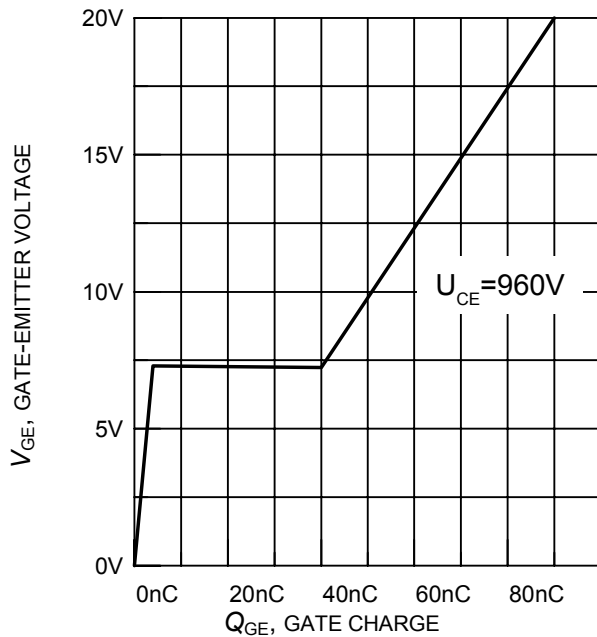
**Figure 14. Typical switching energy losses as a function of gate resistor**  
(inductive load,  $T_j = 150^\circ\text{C}$ ,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $I_C = 8\text{A}$ , dynamic test circuit in Fig.E )



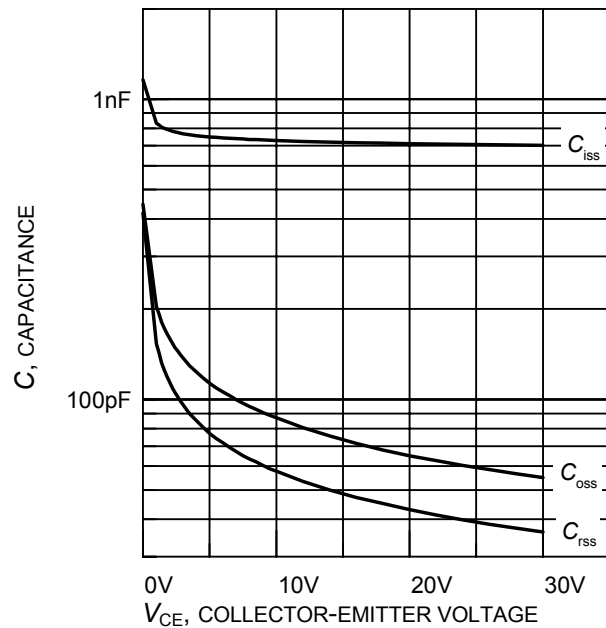
**Figure 15. Typical switching energy losses as a function of junction temperature**  
(inductive load,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $I_C = 8\text{A}$ ,  $R_G = 47\Omega$ , dynamic test circuit in Fig.E )



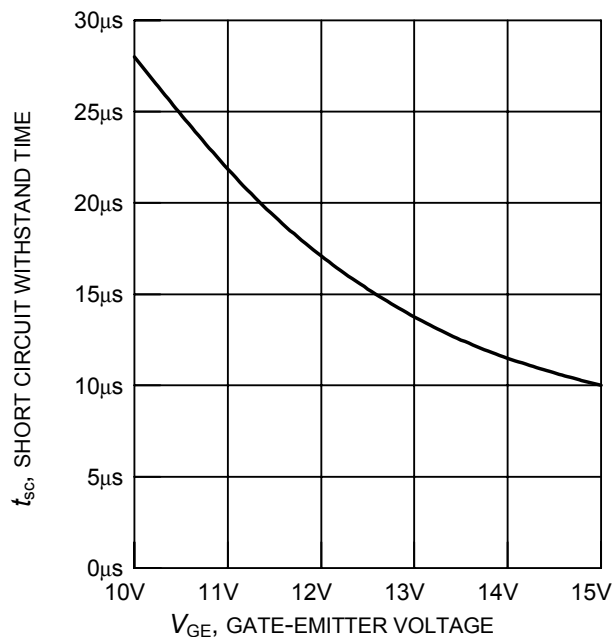
**Figure 16. IGBT transient thermal impedance as a function of pulse width**  
( $D = t_p / T$ )



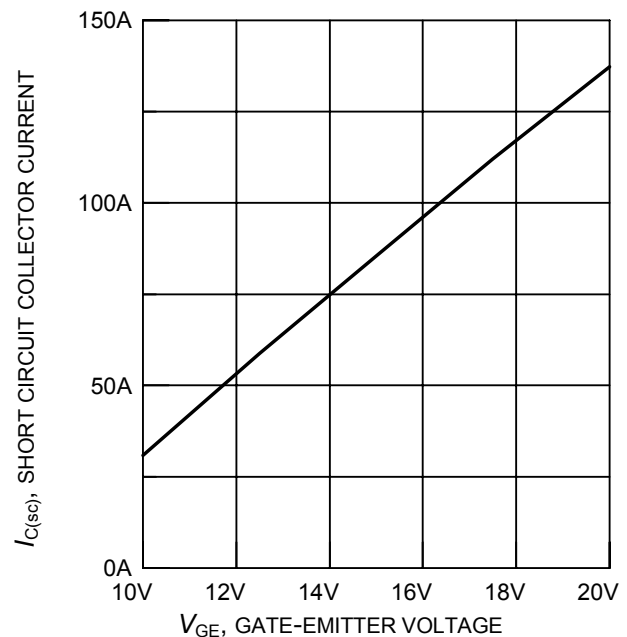
**Figure 17. Typical gate charge**  
( $I_C = 8A$ )



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



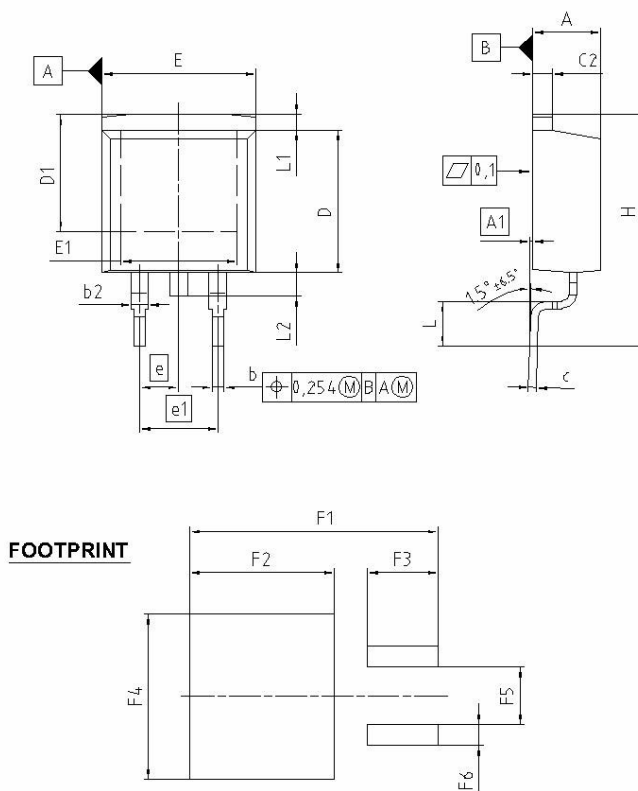
**Figure 19. Short circuit withstand time as a function of gate-emitter voltage**  
( $V_{CE} = 1200V$ , start at  $T_j = 25^\circ C$ )



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



PG-TO263-3-2

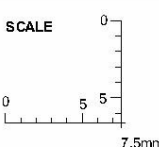


FOOTPRINT

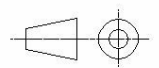
| DIM | MILLIMETERS |        | INCHES |       |
|-----|-------------|--------|--------|-------|
|     | MIN         | MAX    | MIN    | MAX   |
| A   | 4.300       | 4.572  | 0.169  | 0.180 |
| A1  | 0.000       | 0.254  | 0.000  | 0.010 |
| b   | 0.850       | 0.850  | 0.026  | 0.033 |
| b2  | 0.950       | 1.321  | 0.037  | 0.052 |
| c   | 0.330       | 0.850  | 0.013  | 0.026 |
| c2  | 0.170       | 1.400  | 0.046  | 0.055 |
| D   | 8.509       | 9.450  | 0.335  | 0.372 |
| D1  | 7.100       | -      | 0.280  | -     |
| E   | 9.800       | 10.312 | 0.386  | 0.406 |
| E1  | 6.500       | -      | 0.256  | -     |
| e   | 2.540       |        | 0.100  |       |
| e1  | 5.090       |        | 0.200  |       |
| N   | 2           |        | 2      |       |
| H   | 14.605      | 15.875 | 0.575  | 0.625 |
| L   | 2.200       | 3.000  | 0.087  | 0.118 |
| L1  | -           | 1.800  | -      | 0.063 |
| L2  | 1.000       | 1.778  | 0.039  | 0.070 |
| F1  | 16.050      | 16.250 | 0.632  | 0.640 |
| F2  | 9.300       | 9.500  | 0.366  | 0.374 |
| F3  | 4.500       | 4.700  | 0.177  | 0.185 |
| F4  | 10.700      | 10.900 | 0.421  | 0.429 |
| F5  | 3.630       | 3.830  | 0.143  | 0.151 |
| F6  | 1.100       | 1.300  | 0.043  | 0.051 |

**REFERENCE**  
JEDEC TO263

**SCALE**

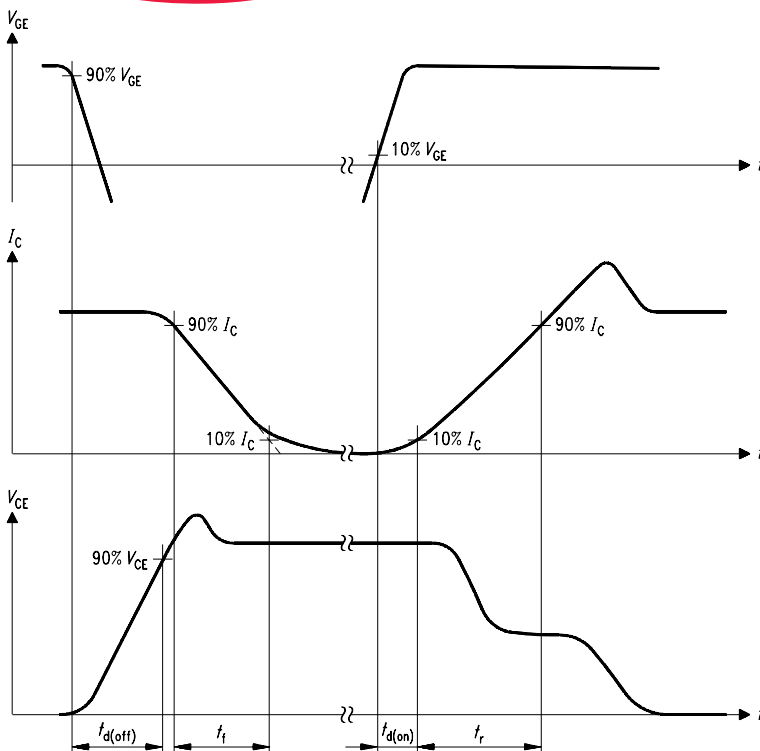


**EUROPEAN PROJECTION**

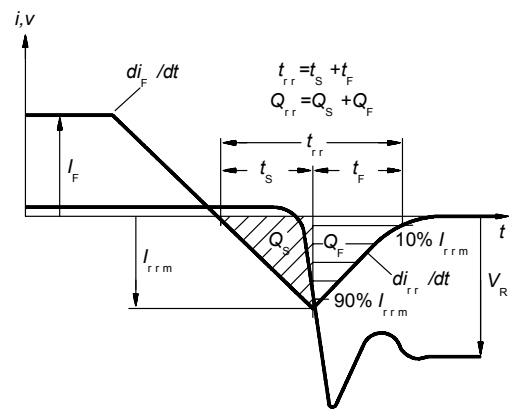


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12-02-2006

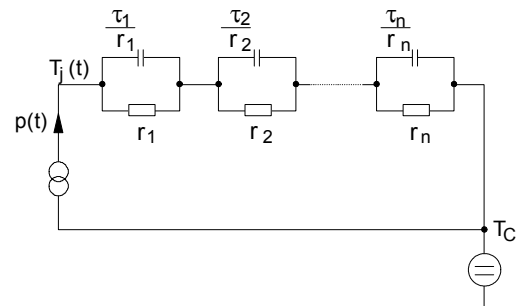
**FILE**  
TO263\_2



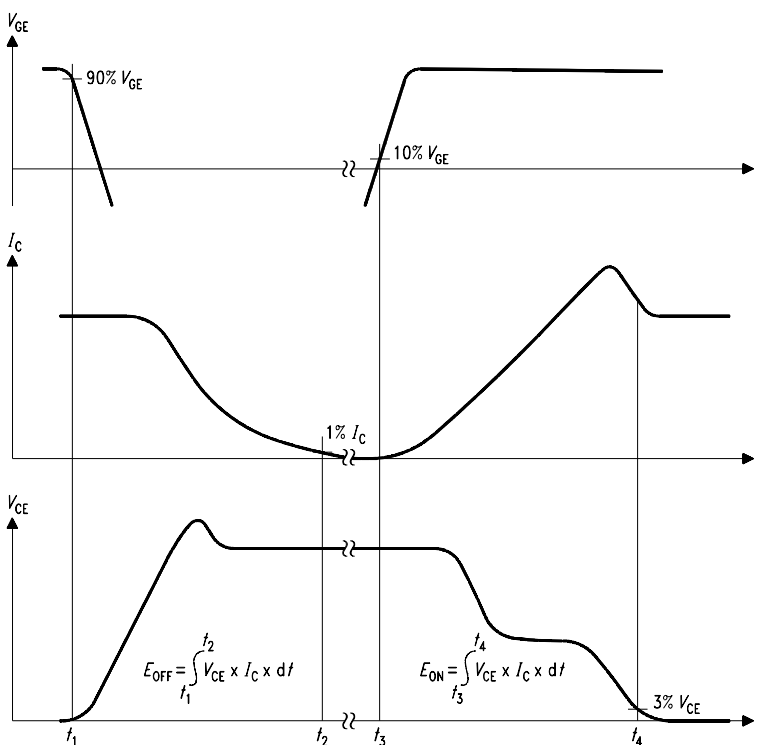
**Figure A. Definition of switching times**



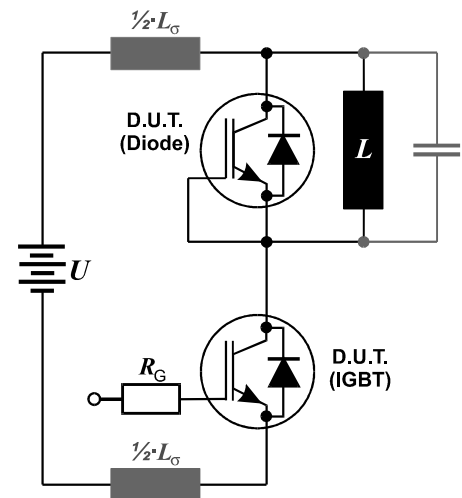
**Figure C. Definition of diodes switching characteristics**



**Figure D. Thermal equivalent circuit**



**Figure B. Definition of switching losses**



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

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