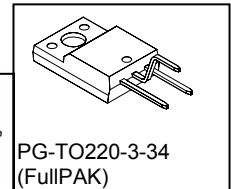
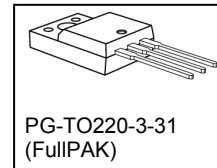
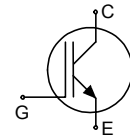


## HighSpeed 2-Technology

- **Designed for:**
  - TV – Horizontal Line Deflection
- **2<sup>nd</sup> generation HighSpeed-Technology for 1200V applications offers:**
  - loss reduction in resonant circuits
  - temperature stable behavior
  - parallel switching capability
  - tight parameter distribution
  - $E_{off}$  optimized for  $I_C = 3A$
  - simple Gate-Control
- 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        | $V_{CE}$ | $I_C$ | $E_{off}$ | $T_{j,max}$ | Marking  | Package        |
|-------------|----------|-------|-----------|-------------|----------|----------------|
| IGA03N120H2 | 1200V    | 3A    | 0.15mJ    | 150°C       | G03H1202 | PG-TO-220-3-31 |
| IGA03N120H2 | 1200V    | 3A    | 0.15mJ    | 150°C       | G03H1202 | PG-TO-220-3-34 |

### Maximum Ratings

| Parameter                                                  | Symbol         | Value      | Unit      |
|------------------------------------------------------------|----------------|------------|-----------|
| Collector-emitter voltage                                  | $V_{CE}$       | 1200       | V         |
| Triangular collector peak current ( $V_{GS} = 15V$ )       | $I_{Cpk}$      | 8.2        | A         |
| $T_C = 100^\circ C, f = 32kHz$                             |                |            |           |
| Pulsed collector current, $t_p$ limited by $T_{jmax}$      | $I_{Cpuls}$    | 9          |           |
| Turn off safe operating area                               | -              | 9          |           |
| $V_{CE} \leq 1200V, T_j \leq 150^\circ C$                  |                |            |           |
| Gate-emitter voltage                                       | $V_{GE}$       | $\pm 20$   | V         |
| Power dissipation                                          | $P_{tot}$      | 29         | W         |
| $T_C = 25^\circ C$                                         |                |            |           |
| Operating junction and storage temperature                 | $T_j, T_{stg}$ | -40...+150 | °C        |
| Soldering temperature, 1.6mm (0.063 in.) from case for 10s | -              | 260        |           |
| Isolation Voltage                                          | $V_{isol}$     | 2500       | $V_{rms}$ |

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

**Thermal Resistance**

| Parameter                                   | Symbol     | Conditions | Max. Value | Unit |
|---------------------------------------------|------------|------------|------------|------|
| <b>Characteristic</b>                       |            |            |            |      |
| IGBT thermal resistance,<br>junction – case | $R_{thJC}$ |            | 4.3        | K/W  |
| Thermal resistance,<br>junction – ambient   | $R_{thJA}$ |            | 64         |      |

**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                               | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=300\mu A$                    | 1200  | -    | -    | V       |
| Collector-emitter saturation voltage                              | $V_{CE(sat)}$ | $V_{GE} = 15V, I_C=3A$                       | -     | 2.2  | 2.8  |         |
|                                                                   |               | $T_j=25^{\circ}C$                            | -     | 2.5  | -    |         |
|                                                                   |               | $T_j=150^{\circ}C$                           | -     | -    | -    |         |
|                                                                   |               | $V_{GE} = 10V, I_C=3A,$<br>$T_j=25^{\circ}C$ | -     | 2.4  | -    |         |
| Gate-emitter threshold voltage                                    | $V_{GE(th)}$  | $I_C=90\mu A, V_{CE}=V_{GE}$                 | 2.1   | 3    | 3.9  |         |
| Zero gate voltage collector current                               | $I_{CES}$     | $V_{CE}=1200V, V_{GE}=0V$                    | -     | -    | -    | $\mu A$ |
|                                                                   |               | $T_j=25^{\circ}C$                            | -     | -    | 20   |         |
|                                                                   |               | $T_j=150^{\circ}C$                           | -     | -    | 80   |         |
| Gate-emitter leakage current                                      | $I_{GES}$     | $V_{CE}=0V, V_{GE}=20V$                      | -     | -    | 100  | nA      |
| Transconductance                                                  | $g_{fs}$      | $V_{CE}=20V, I_C=3A$                         | -     | 2    | -    | S       |
| Dynamic Characteristic                                            |               |                                              |       |      |      |         |
| Input capacitance                                                 | $C_{iss}$     | $V_{CE}=25V$<br>$V_{GE}=0V$<br>$f=1MHz$      | -     | 205  | -    | pF      |
| Output capacitance                                                | $C_{oss}$     |                                              | -     | 24   | -    |         |
| Reverse transfer capacitance                                      | $C_{rss}$     |                                              | -     | 7    | -    |         |
| Gate charge                                                       | $Q_{Gate}$    | $V_{CC}=960V, I_C=3A$<br>$V_{GE}=15V$        | -     | 8.6  | -    | nC      |
| Internal emitter inductance<br>measured 5mm (0.197 in.) from case | $L_E$         |                                              | -     | 7    | -    | nH      |

**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     | $t_{d(on)}$  | $T_j=25^{\circ}\text{C}$                                               | -     | 9.2  | -    | ns   |
| Rise time              | $t_r$        | $V_{CC}=800\text{V}, I_C=3\text{A}$                                    | -     | 5.2  | -    |      |
| Turn-off delay time    | $t_{d(off)}$ | $V_{GE}=0\text{V}/15\text{V}$                                          | -     | 281  | -    |      |
| Fall time              | $t_f$        | $R_G=82\Omega$                                                         | -     | 29   | -    |      |
| Turn-on energy         | $E_{on}$     | $L_{\sigma}^{(2)}=180\text{nH}$                                        | -     | 0.14 | -    | mJ   |
| Turn-off energy        | $E_{off}$    | $C_{\sigma}^{(1)}=40\text{pF}$                                         | -     | 0.15 | -    |      |
| Total switching energy | $E_{ts}$     | Energy losses include “tail” and diode <sup>2)</sup> reverse recovery. | -     | 0.29 | -    |      |

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

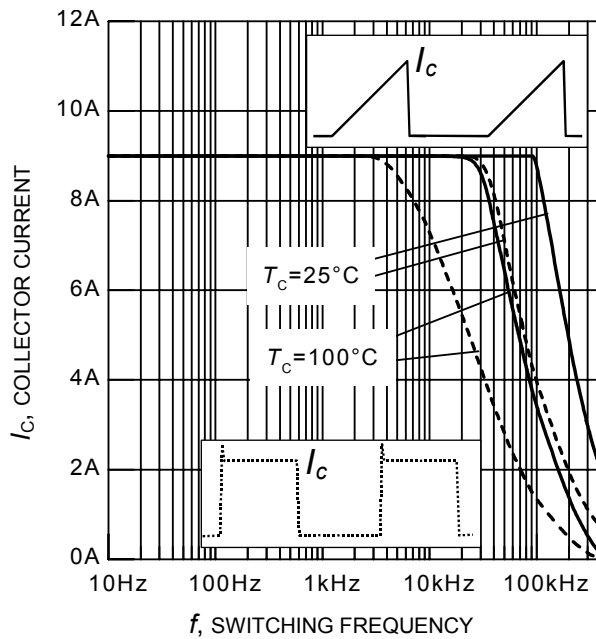
| Parameter              | Symbol       | Conditions                                                             | Value |      |      | Unit |
|------------------------|--------------|------------------------------------------------------------------------|-------|------|------|------|
|                        |              |                                                                        | min.  | Typ. | max. |      |
| IGBT Characteristic    |              |                                                                        |       |      |      |      |
| Turn-on delay time     | $t_{d(on)}$  | $T_j=150^{\circ}\text{C}$                                              | -     | 9.4  | -    | ns   |
| Rise time              | $t_r$        | $V_{CC}=800\text{V}, I_C=3\text{A}$                                    | -     | 6.7  | -    |      |
| Turn-off delay time    | $t_{d(off)}$ | $V_{GE}=0\text{V}/15\text{V}$                                          | -     | 340  | -    |      |
| Fall time              | $t_f$        | $R_G=82\Omega$                                                         | -     | 63   | -    |      |
| Turn-on energy         | $E_{on}$     | $L_{\sigma}^{1)}=180\text{nH}$                                         | -     | 0.22 | -    | mJ   |
| Turn-off energy        | $E_{off}$    | $C_{\sigma}^{1)}=40\text{pF}$                                          | -     | 0.26 | -    |      |
| Total switching energy | $E_{ts}$     | Energy losses include “tail” and diode <sup>3)</sup> reverse recovery. | -     | 0.48 | -    |      |

**Switching Energy ZVT, Inductive Load**

| Parameter           | Symbol           | Conditions                                                                                                                                                                                                                       | Value |      |      | Unit |
|---------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------|
|                     |                  |                                                                                                                                                                                                                                  | min.  | typ. | max. |      |
| IGBT Characteristic |                  |                                                                                                                                                                                                                                  |       |      |      |      |
| Turn-off energy     | $E_{\text{off}}$ | $V_{\text{CC}}=800\text{V}, I_{\text{C}}=3\text{A}$<br>$V_{\text{GE}}=0\text{V}/15\text{V}$<br>$R_{\text{G}}=82\Omega, C_{\text{r}}^{(1)}=4\text{nF}$<br>$T_{\text{j}}=25^{\circ}\text{C}$<br>$T_{\text{j}}=150^{\circ}\text{C}$ |       |      |      | mJ   |
|                     |                  |                                                                                                                                                                                                                                  | -     | 0.05 | -    |      |
|                     |                  |                                                                                                                                                                                                                                  | -     | 0.09 | -    |      |

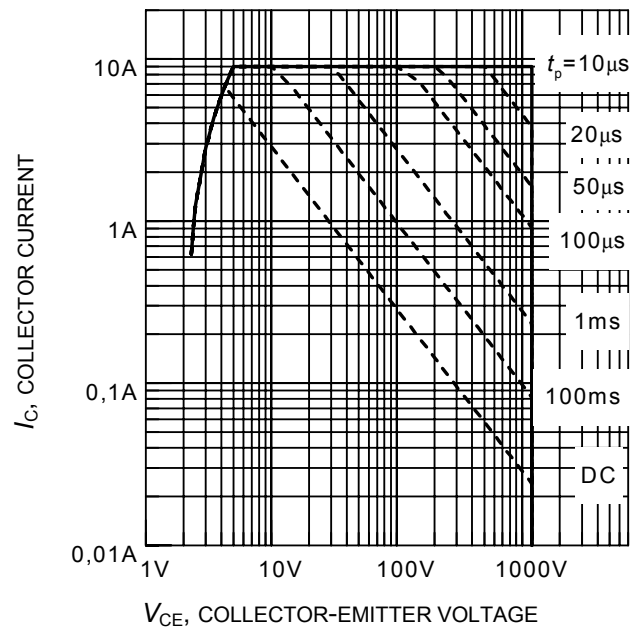
<sup>2)</sup> Leakage inductance  $L_\sigma$  and stray capacity  $C_\sigma$  due to dynamic test circuit in figure E

<sup>3)</sup> Commutation diode from device IKP03N120H2



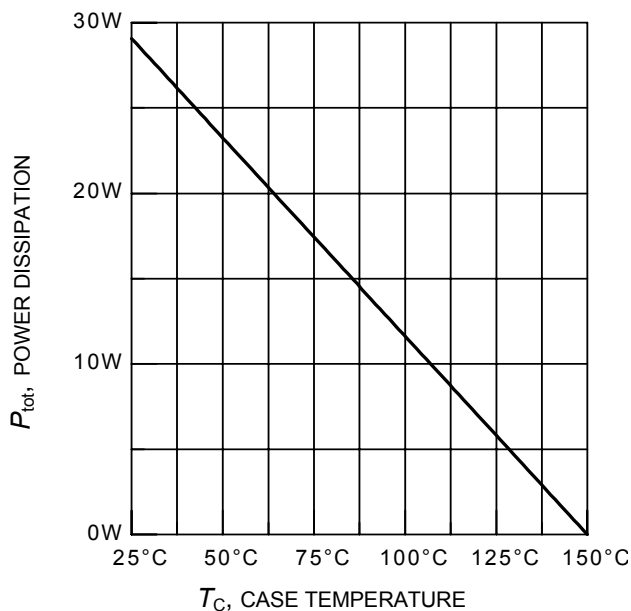
**Figure 1. Collector current as a function of switching frequency**

( $T_j \leq 150^\circ\text{C}$ ,  $D = 0.5$ ,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $R_G = 82\Omega$ )



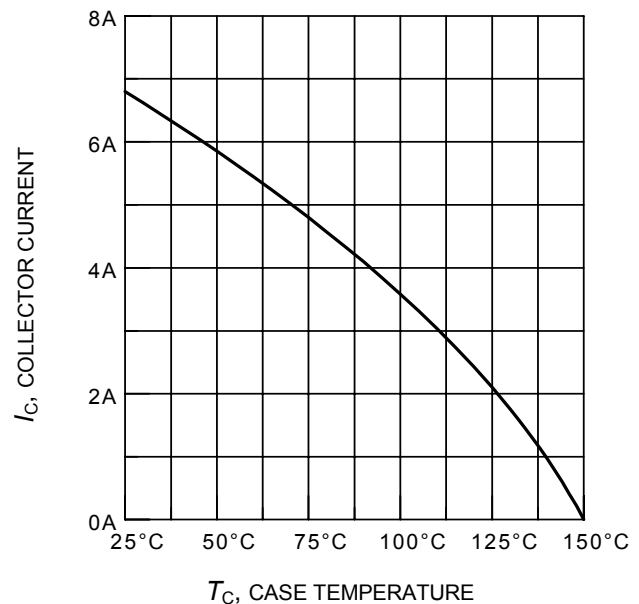
**Figure 2. Safe operating area**

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



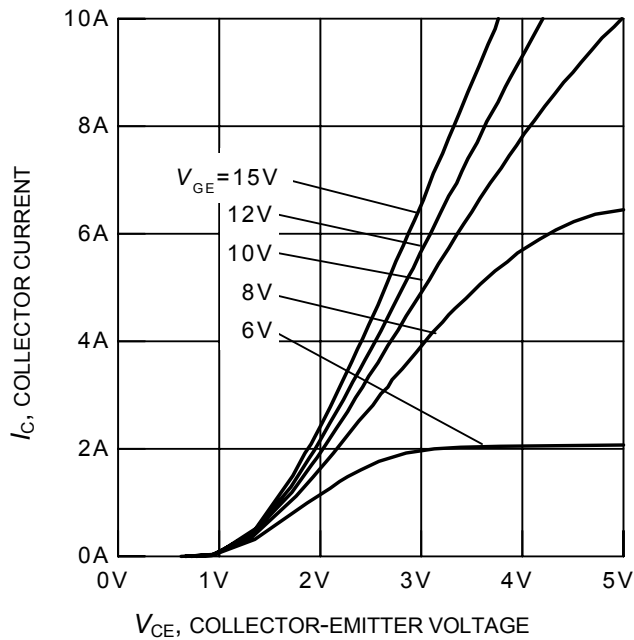
**Figure 3. Power dissipation as a function of case temperature**

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

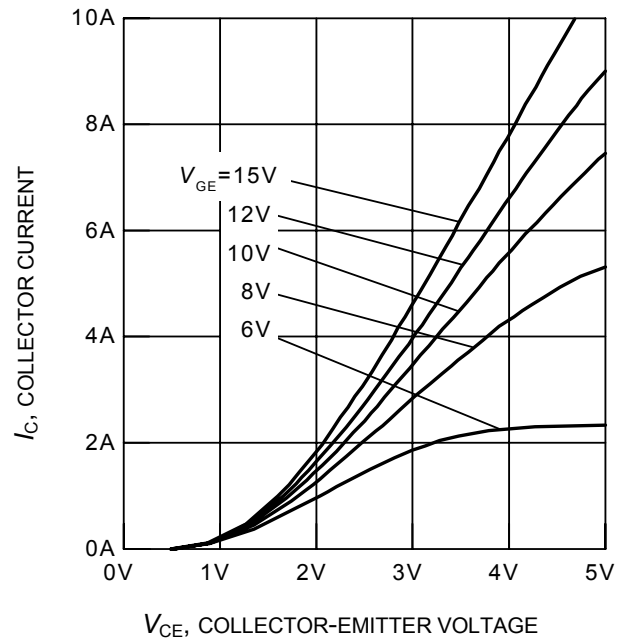


**Figure 4. Collector current as a function of case temperature**

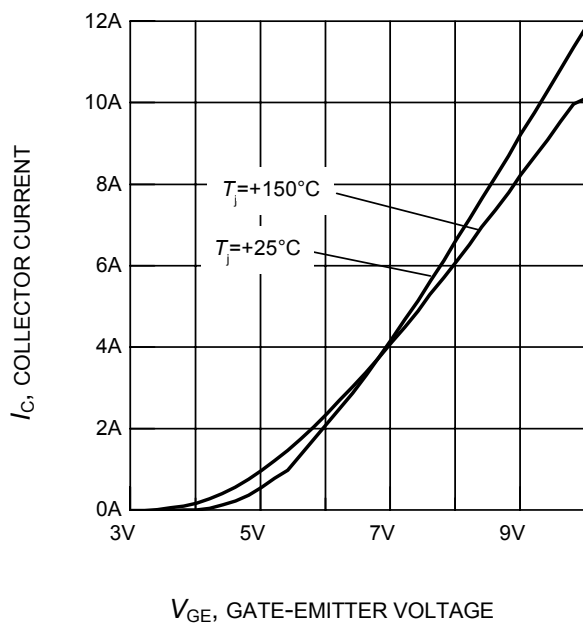
( $V_{GE} \leq 15\text{V}$ ,  $T_j \leq 150^\circ\text{C}$ )



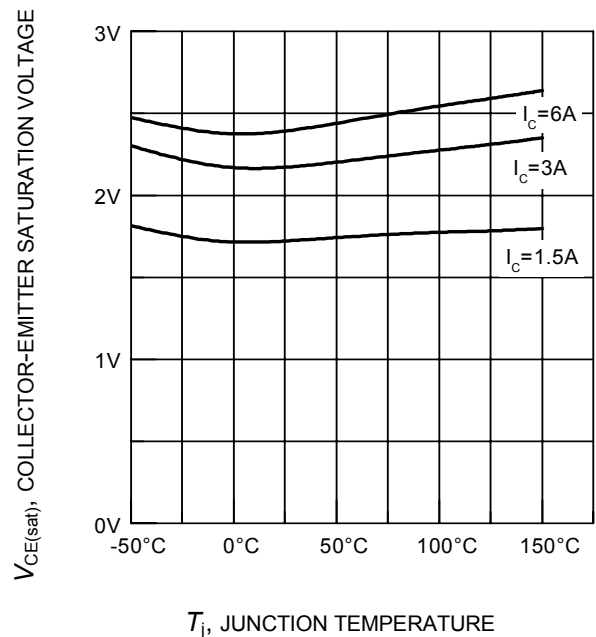
**Figure 5. Typical output characteristics**  
( $T_j = 25^\circ\text{C}$ )



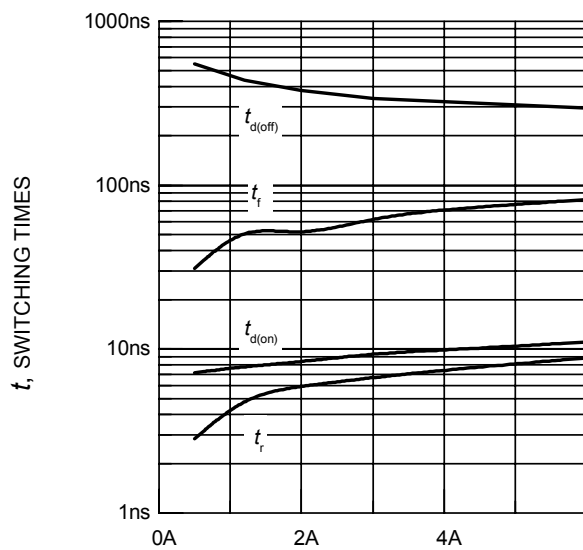
**Figure 6. Typical output characteristics**  
( $T_j = 150^\circ\text{C}$ )



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

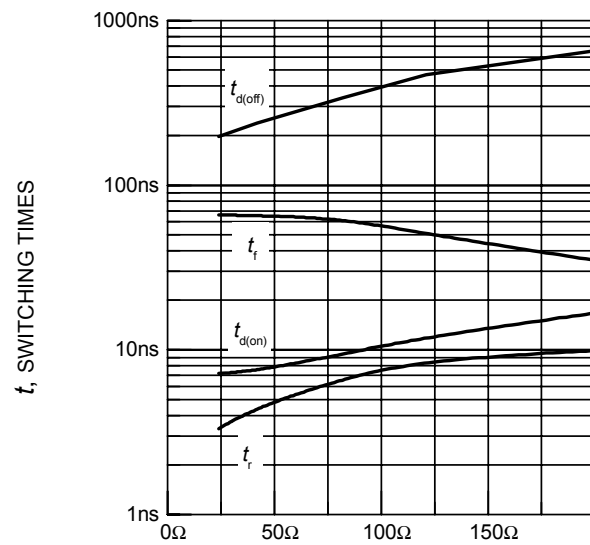


**Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature**  
( $V_{GE} = 15V$ )


 $I_C$ , COLLECTOR CURRENT

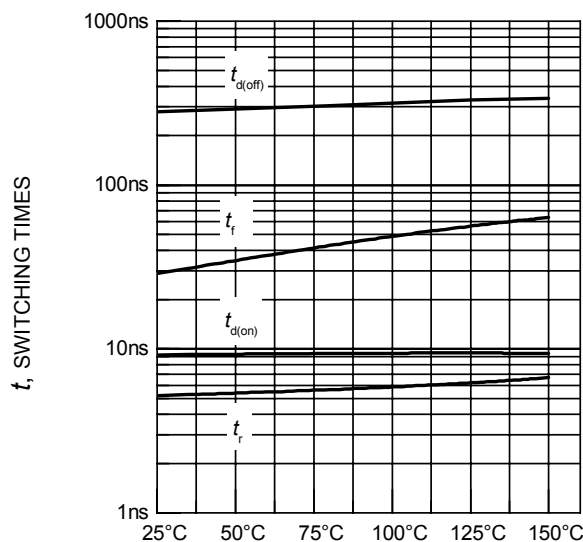
**Figure 9. Typical switching times as a function of collector current**

(inductive load,  $T_j = 150^\circ\text{C}$ ,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $R_G = 82\Omega$ , dynamic test circuit in Fig.E)


 $R_G$ , GATE RESISTOR

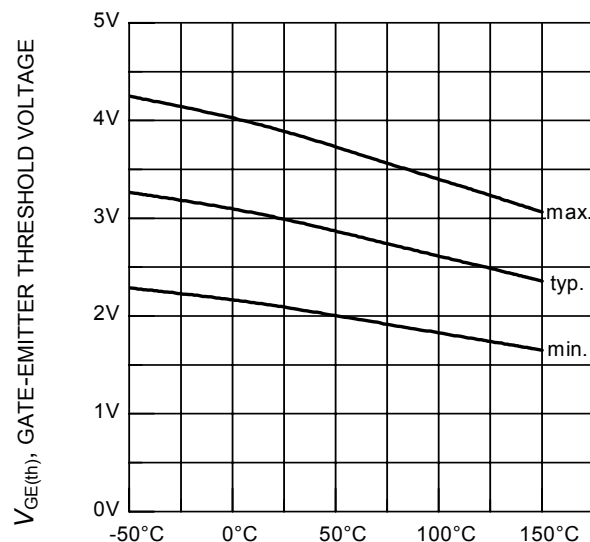
**Figure 10. Typical switching times as a function of gate resistor**

(inductive load,  $T_j = 150^\circ\text{C}$ ,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $I_C = 3\text{A}$ , dynamic test circuit in Fig.E)


 $T_j$ , JUNCTION TEMPERATURE

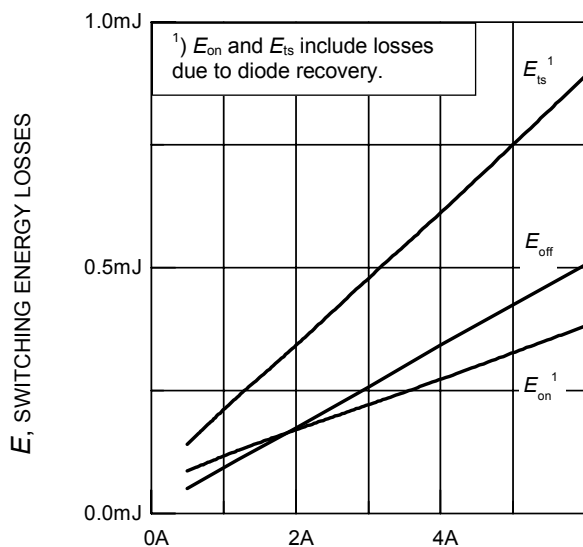
**Figure 11. Typical switching times as a function of junction temperature**

(inductive load,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $I_C = 3\text{A}$ ,  $R_G = 82\Omega$ , dynamic test circuit in Fig.E)


 $T_j$ , JUNCTION TEMPERATURE

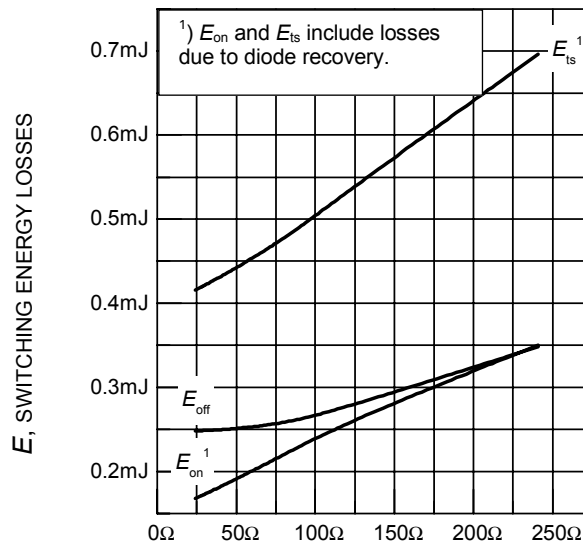
**Figure 12. Gate-emitter threshold voltage as a function of junction temperature**

( $I_C = 0.09\text{mA}$ )


 $I_C$ , COLLECTOR CURRENT

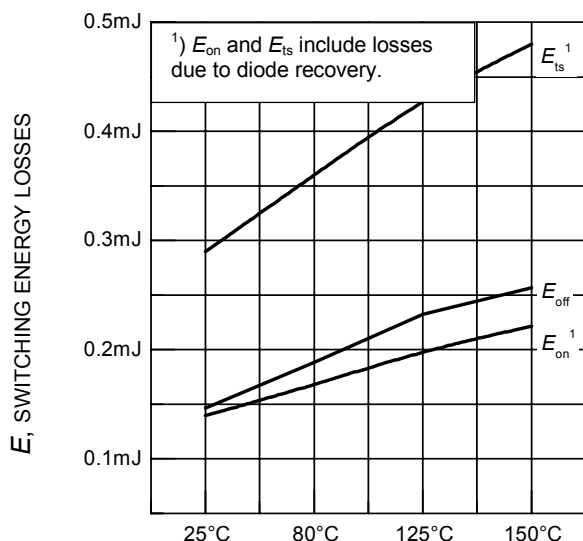
**Figure 13. Typical switching energy losses as a function of collector current**

(inductive load,  $T_j = 150^\circ\text{C}$ ,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $R_G = 82\Omega$ , dynamic test circuit in Fig.E )


 $R_G$ , GATE RESISTOR

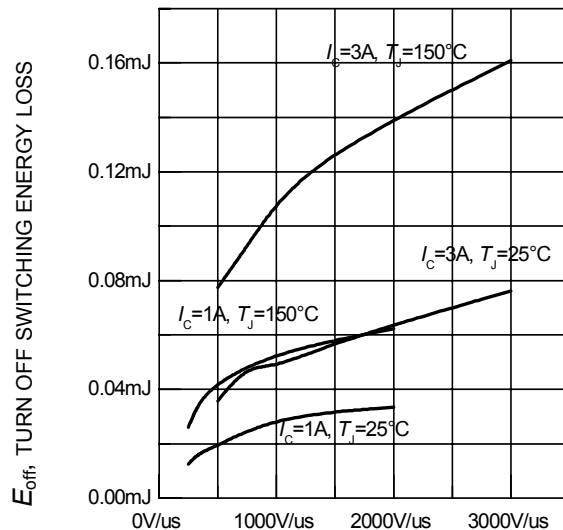
**Figure 14. Typical switching energy losses as a function of gate resistor**

(inductive load,  $T_j = 150^\circ\text{C}$ ,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $I_C = 3\text{A}$ , dynamic test circuit in Fig.E )


 $T_j$ , JUNCTION TEMPERATURE

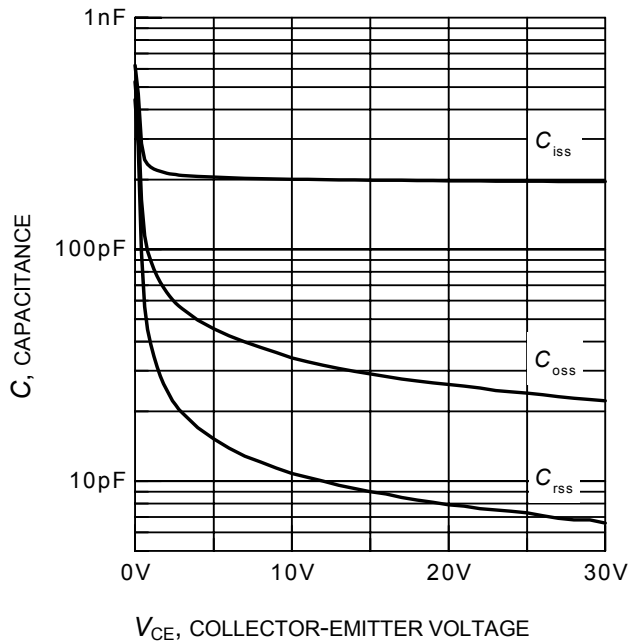
**Figure 15. Typical switching energy losses as a function of junction temperature**

(inductive load,  $V_{CE} = 800\text{V}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $I_C = 3\text{A}$ ,  $R_G = 82\Omega$ , dynamic test circuit in Fig.E )

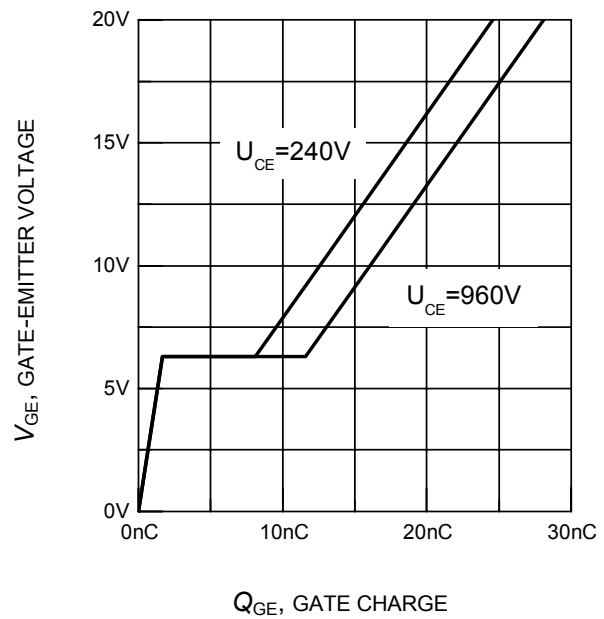

 $dv/dt$ , VOLTAGE SLOPE

**Figure 16. Typical turn off switching energy loss for soft switching**

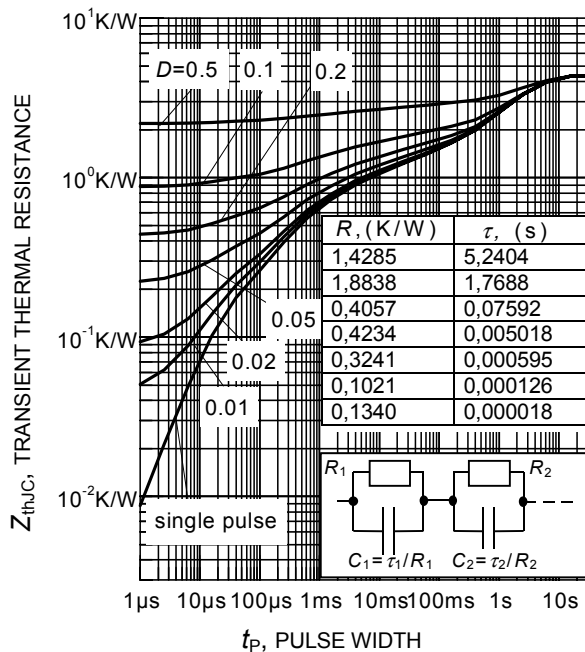
(dynamic test circuit in Fig. E )



**Figure 19. Typical capacitance as a function of collector-emitter voltage**  
( $V_{GE} = 0V$ ,  $f = 1MHz$ )



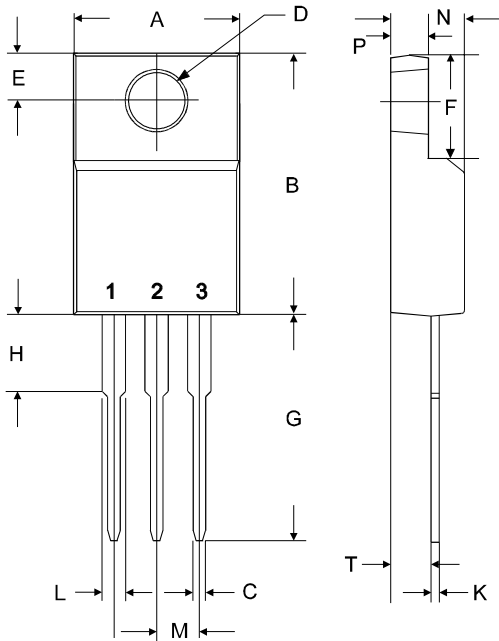
**Figure 18. Typical gate charge**  
( $I_C = 3A$ )



**Figure 17. IGBT transient thermal impedance as a function of pulse width**  
( $D = t_p / T$ )



## PG-TO-220-3-31 (FullPAK)



| symbol | dimensions |       |             |        |
|--------|------------|-------|-------------|--------|
|        | [mm]       |       | [inch]      |        |
|        | min        | max   | min         | max    |
| A      | 10.37      | 10.63 | 0.4084      | 0.4184 |
| B      | 15.86      | 16.12 | 0.6245      | 0.6345 |
| C      | 0.65       | 0.78  | 0.0256      | 0.0306 |
| D      | 2.95 typ.  |       | 0.1160 typ. |        |
| E      | 3.15       | 3.25  | 0.124       | 0.128  |
| F      | 6.05       | 6.56  | 0.2384      | 0.2584 |
| G      | 13.47      | 13.73 | 0.5304      | 0.5404 |
| H      | 3.18       | 3.43  | 0.125       | 0.135  |
| K      | 0.45       | 0.63  | 0.0177      | 0.0247 |
| L      | 1.23       | 1.36  | 0.0484      | 0.0534 |
| M      | 2.54 typ.  |       | 0.100 typ.  |        |
| N      | 4.57       | 4.83  | 0.1800      | 0.1900 |
| P      | 2.57       | 2.83  | 0.1013      | 0.1113 |
| T      | 2.51       | 2.62  | 0.0990      | 0.1030 |

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