



## STGE200NB60S

N-channel 150A - 600V - ISOTOP  
Low drop PowerMESH™ IGBT

### General features

| TYPE         | V <sub>CES</sub> | V <sub>CE(sat)</sub><br>(typ.) | I <sub>C</sub> | T <sub>C</sub> |
|--------------|------------------|--------------------------------|----------------|----------------|
| STGE200NB60S | 600V             | 1.2V<br>1.3V                   | 150A<br>200A   | 100°C<br>25°C  |

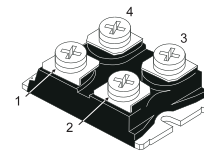
- High input impedance (voltage driven)
- Low on-voltage drop (V<sub>cesat</sub>)
- Off losses include tail current
- Low gate charge
- High current capability

### Description

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "S" identifies a family optimized to achieve very low V<sub>CE(sat)</sub> (@ max frequency of 1KHz).

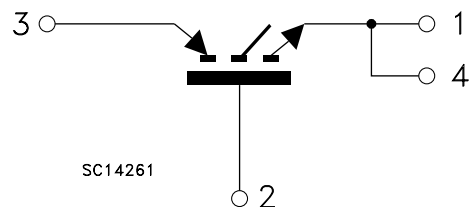
### Applications

- Low frequency motor controls
- Aluminum welding equipment



ISOTOP

### Internal schematic diagram



### Order codes

| Part number  | Marking    | Package | Packaging |
|--------------|------------|---------|-----------|
| STGE200NB60S | GE200NB60S | ISOTOP  | Tube      |

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter   | Value       | Unit                |
|----------------|---|-------------|---------------------|
| $V_{CES}$      | Collector-emitter voltage ( $V_{GS} = 0$ )                  | 600         | V                   |
| $V_{GE}$       | Gate-emitter voltage  | $\pm 20$    | V                   |
| $I_C$          | Collector current (continuous) at $T_C = 25^\circ\text{C}$  | 200         | A                   |
| $I_C$          | Collector current (continuous) at $T_C = 100^\circ\text{C}$ | 150         | A                   |
| $I_{CM}^{(1)}$ | Collector current (pulsed)                                  | 400         | A                   |
| $P_{TOT}$      | Total dissipation at $T_C = 25^\circ\text{C}$               | 600         | W                   |
|                | Derating factor   | 4.8         | W/ $^\circ\text{C}$ |
| $V_{ISO}$      | Insulation withstand voltage (DC)                           | 2500        | V                   |
| $T_{stg}$      | Storage temperature   | – 55 to 150 | $^\circ\text{C}$    |
| $T_j$          | Operating junction temperature                              |             |                     |

1. Pulse width limited by safe operating area

**Table 2. Thermal resistance**

| Symbol         | Parameter                               | Value | Unit   |
|----------------|---|-------|--|
| $R_{thj-case}$ | Thermal resistance junction-case max    | 0.208 | $^\circ\text{C}/\text{W}$<br>$^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient max | 30    | $^\circ\text{C}/\text{W}$                              |

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}\text{C}$  unless otherwise specified)

**Table 3. Static**

| Symbol        | Parameter                                     | Test conditions  | Min. | Typ.       | Max.      | Unit                |
|---------------|---|--|------|------------|-----------|---------------------|
| $V_{BR(CES)}$ | Collector-emitter breakdown voltage           | $I_C = 250\mu\text{A}$ , $V_{GE} = 0$  | 600  |            |           | V                   |
| $I_{CES}$     | Collector cut-off<br>( $V_{GE} = 0$ )         | $V_{CE} = \text{Max rating}$ , @ $25^{\circ}\text{C}$<br>$V_{CE} = \text{Max rating}$ , @ $125^{\circ}\text{C}$      |      |            | 500<br>5  | $\mu\text{A}$<br>mA |
| $I_{GES}$     | Gate-emitter leakage current ( $V_{CE} = 0$ ) | $V_{GE} = \pm 20\text{V}$ , $V_{CE} = 0$   |      |            | $\pm 100$ | nA                  |
| $V_{GE(th)}$  | Gate threshold voltage                        | $V_{CE} = V_{GE}$ , $I_C = 250\mu\text{A}$   | 3    |            | 5         | V                   |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage          | $V_{GE} = 15\text{V}$ , $I_C = 100\text{A}$<br>$V_{GE} = 15\text{V}$ , $I_C = 150\text{A}$ , @ $100^{\circ}\text{C}$ |      | 1.2<br>1.2 | 1.6       | V<br>V              |
| $g_{fs}$      | Forward transconductance                      | $V_{CE} = 15\text{V}$ , $I_C = 100\text{A}$  |      | 80         |           | S                   |

**Table 4. Dynamic**

| Symbol                              | Parameter   | Test conditions   | Min. | Typ.                    | Max. | Unit           |
|-------------------------------------|---|---|------|-------------------------|------|----------------|
| $C_{ies}$<br>$C_{oes}$<br>$C_{res}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{CE} = 25\text{V}$ , $f = 1\text{MHz}$ , $V_{GE} = 0$                    |      | 1560<br>0<br>1100<br>95 |      | pF<br>pF<br>pF |
| $Q_g$<br>$Q_{ge}$<br>$Q_{gc}$       | Total gate charge<br>Gate-emitter charge<br>Gate-collector charge       | $V_{CE} = 480\text{V}$ , $I_C = 100\text{A}$ ,<br>$V_{GE} = 15\text{V}$     |      | 560<br>70<br>170        |      | nC<br>nC<br>nC |
| $I_{CL}$                            | Latching current  | $V_{clamp} = 480\text{V}$<br>$T_j = 125^{\circ}\text{C}$ , $R_G = 10\Omega$ | 300  |                         |      | A              |

**Table 5. Switching on/off (inductive load)**

| Symbol         | Parameter             | Test conditions                     | Min. | Typ. | Max. | Unit       |
|----------------|-----------------------|-------------------------------------|------|------|------|------------|
| $t_{d(on)}$    | Delay time            | $I_C = 100A$ , $V_{CC} = 480V$      |      | 64   |      | ns         |
| $t_r$          | Current rise time     | $V_{GE} = 15V$ , $R_G = 3\Omega$    |      | 112  |      | ns         |
| $(di/dt)_{on}$ | Turn-on current slope | $T_j = 25^\circ C$ (see Figure 17)  |      | 1840 |      | A/ $\mu s$ |
| $t_{d(on)}$    | Dealy time            | $I_C = 100A$ , $V_{CC} = 480V$      |      | 56   |      | ns         |
| $t_r$          | Current rise time     | $V_{GE} = 15V$ , $R_G = 3\Omega$    |      | 114  |      | ns         |
| $(di/dt)_{on}$ | Turn-on current slope | $T_j = 125^\circ C$ (see Figure 17) |      | 1800 |      | A/ $\mu s$ |
| $t_c$          | Cross-over time       | $I_C = 100A$ , $V_{CC} = 480V$      |      | 2.98 |      | $\mu s$    |
| $t_r(V_{off})$ | Off voltage rise time | $V_{GE} = 15V$ , $R_G = 3\Omega$    |      | 1.7  |      | $\mu s$    |
| $t_{d(off)}$   | Delay time            | $T_j = 25^\circ C$ (see Figure 17)  |      | 2.4  |      | $\mu s$    |
| $t_f$          | Current fall time     |                                     |      | 1.23 |      | $\mu s$    |
| $t_c$          | Cross-over time       | $I_C = 100A$ , $V_{CC} = 480V$      |      | 4.52 |      | $\mu s$    |
| $t_r(V_{off})$ | Off voltage rise time | $V_{GE} = 15V$ , $R_G = 3\Omega$    |      | 2.6  |      | $\mu s$    |
| $t_{d(off)}$   | Delay time            | $T_j = 125^\circ C$ (see Figure 17) |      | 2.8  |      | $\mu s$    |
| $t_f$          | Current fall time     |                                     |      | 1.8  |      | $\mu s$    |

**Table 6. Switching energy (inductive load)**

| Symbol          | Parameter                | Test conditions                                       | Min. | Typ. | Max. | Unit |
|-----------------|--------------------------|---|------|------|------|------|
| $E_{on}^{(1)}$  | Turn-on switching losses | $V_{CC} = 480V$ , $I_C = 100A$                        |      | 11.7 |      | mJ   |
| $E_{off}^{(2)}$ | Turn-off switching loss  | $R_G = 3\Omega$ , $V_{GE} = 15V$ , $T_j = 25^\circ C$ |      | 59   |      | mJ   |
| $E_{ts}$        | Total switching loss     | (see Figure 17)                                       |      | 70.7 |      | mJ   |
| $E_{on}^{(1)}$  | Turn-on switching losses | $V_{CC} = 480V$ , $I_C = 100A$                        |      | 12   |      | mJ   |
| $E_{off}^{(2)}$ | Turn-off switching loss  | $R_G = 3\Omega$ , $V_{GE} = 15V$ ,                    |      | 92   |      | mJ   |
| $E_{ts}$        | Total switching loss     | $T_j = 125^\circ C$ (see Figure 17)                   |      | 104  |      | mJ   |

1.  $E_{on}$  is the turn-on losses when a typical diode is used in the test circuit in Figure 17
2. Turn-off losses include also the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

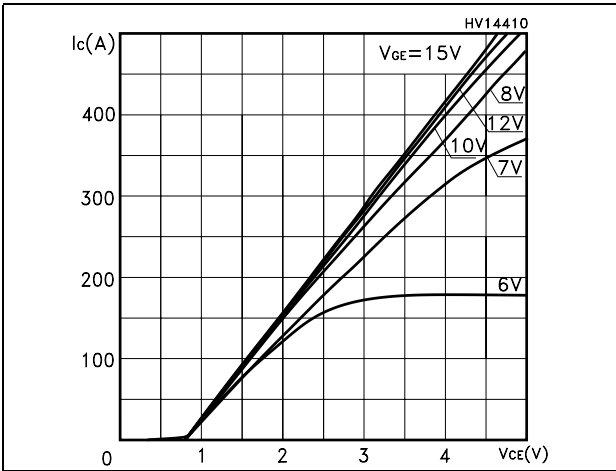


Figure 2. Transfer characteristics

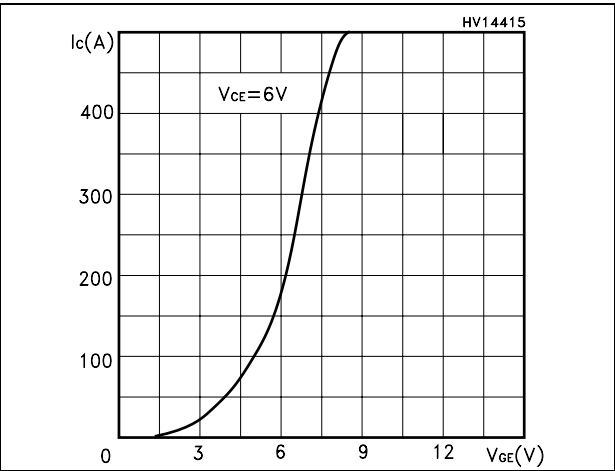


Figure 3. Transconductance

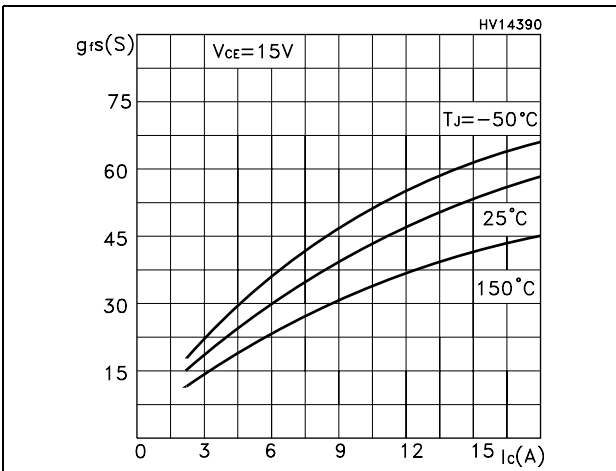


Figure 4. Collector-emitter on voltage vs temperature

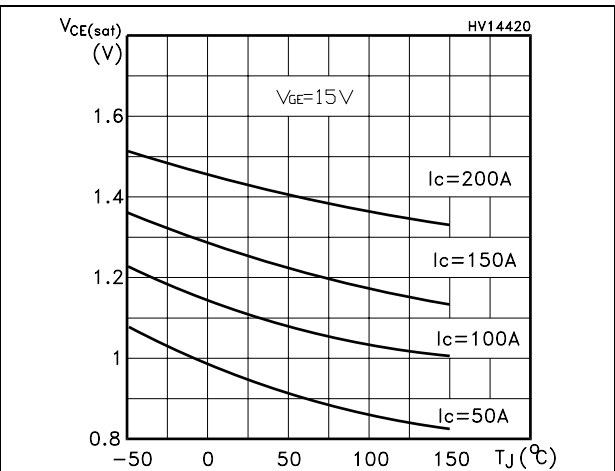


Figure 5. Gate charge vs gate-source voltage

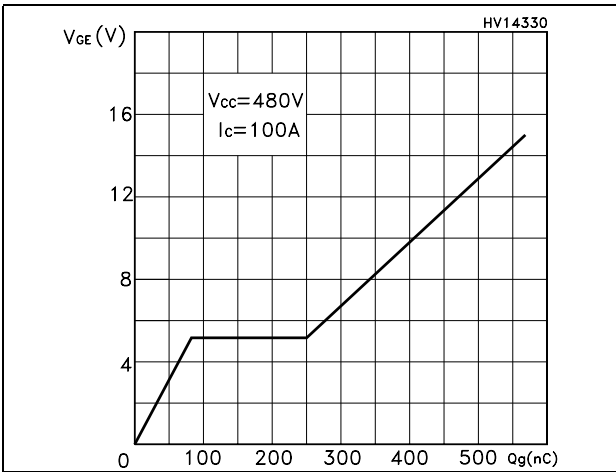


Figure 6. Capacitance variations

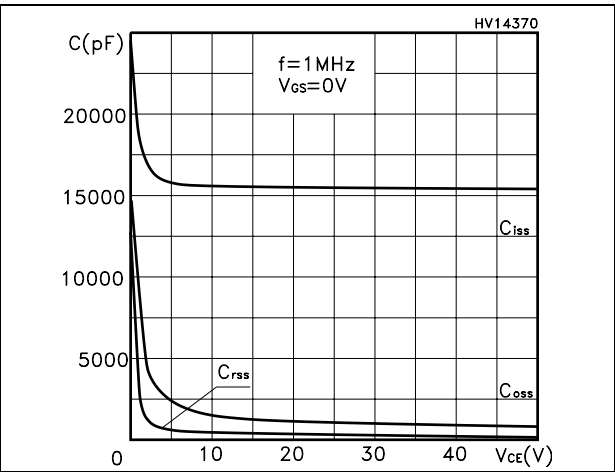


Figure 7. Normalized gate threshold voltage vs temperature

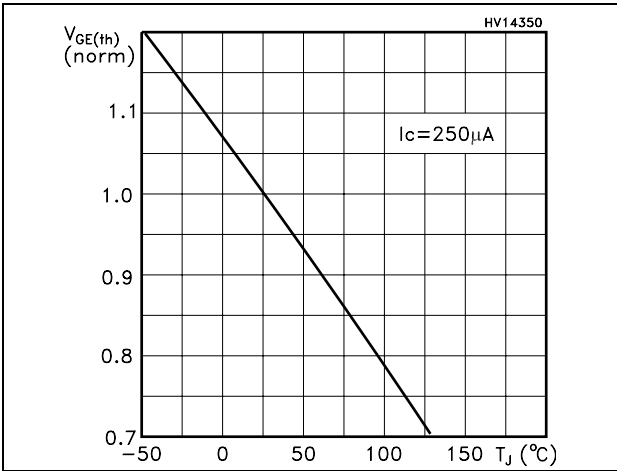


Figure 8. Collector-emitter on voltage vs collector current

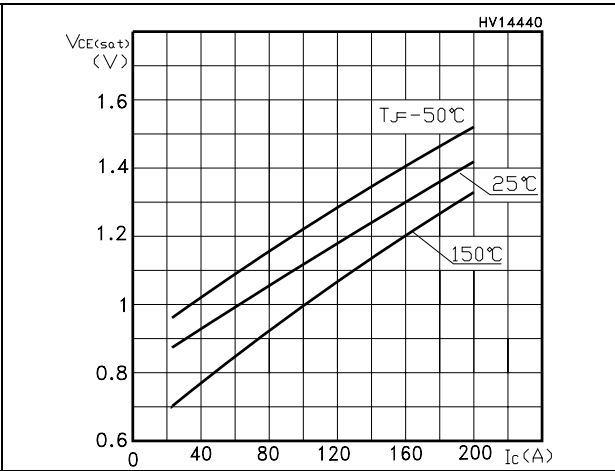


Figure 9. Normalized breakdown voltage vs temperature

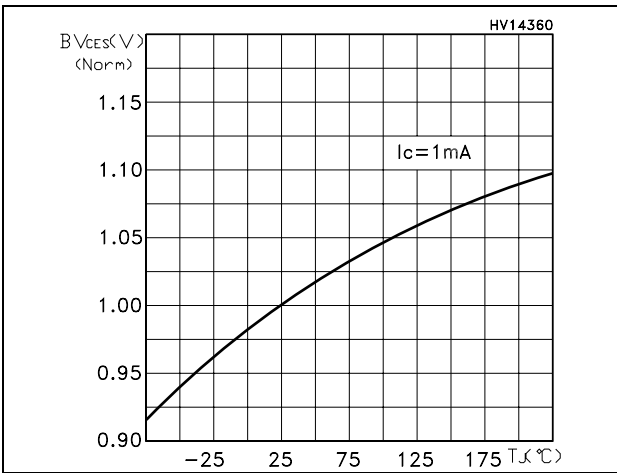


Figure 10. Switching losses vs temperature

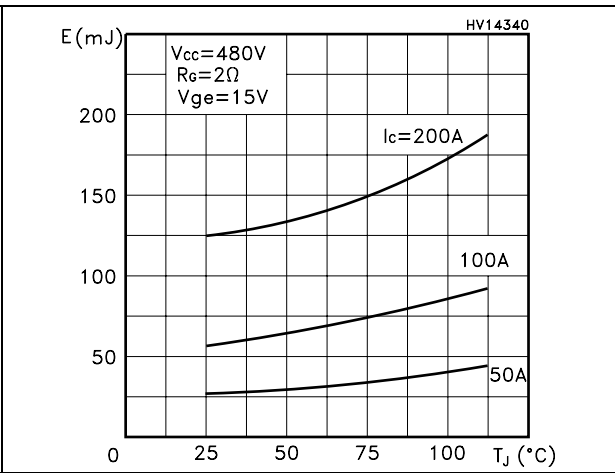


Figure 11. Switching losses vs gate resistance

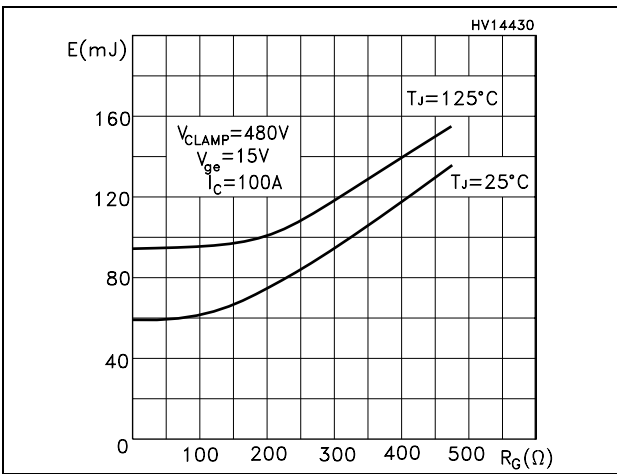


Figure 12. Switching losses vs collector current

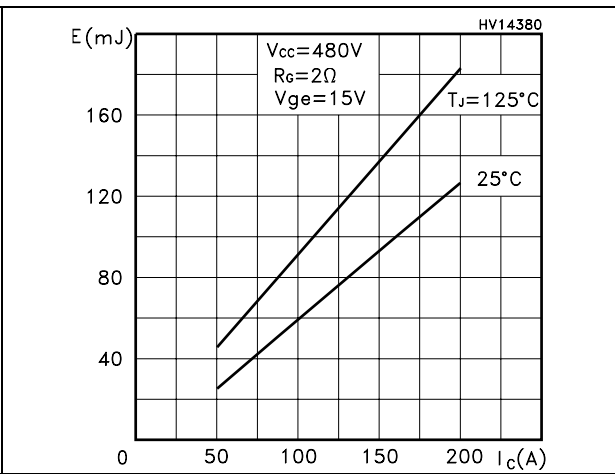


Figure 13. Thermal impedance

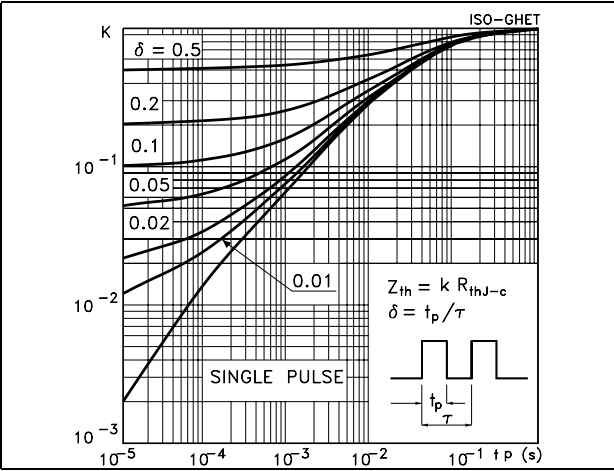
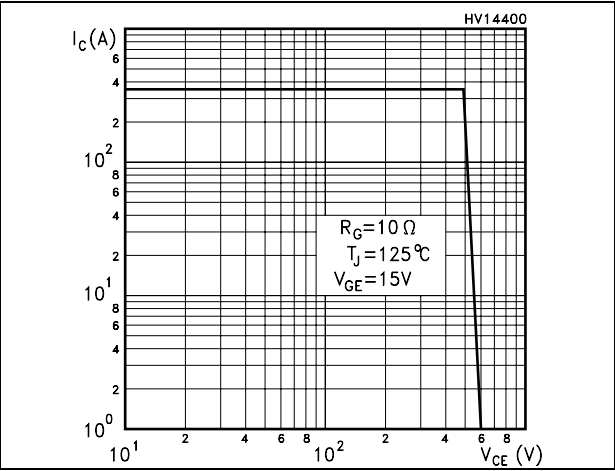


Figure 14. Turn-off SOA





### 3 Test circuit

Figure 15. Test circuit for inductive load switching

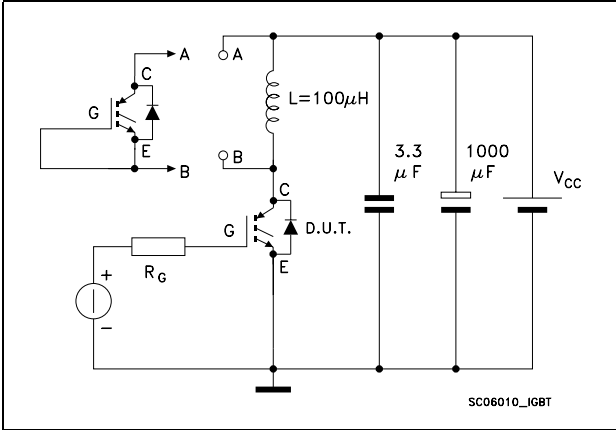


Figure 16. Gate charge test circuit

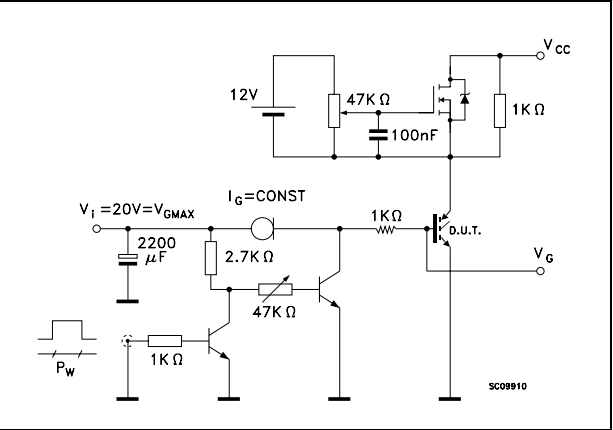


Figure 17. Switching waveform

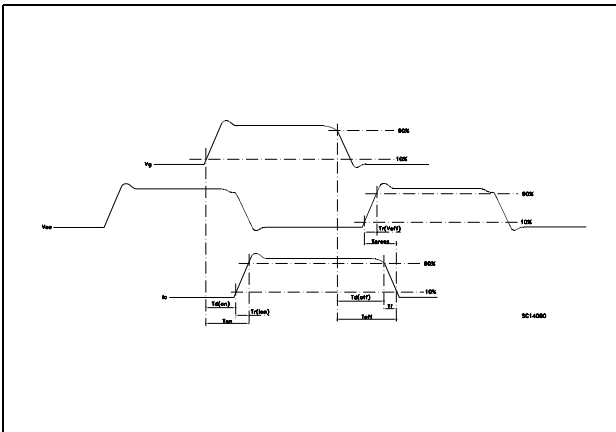
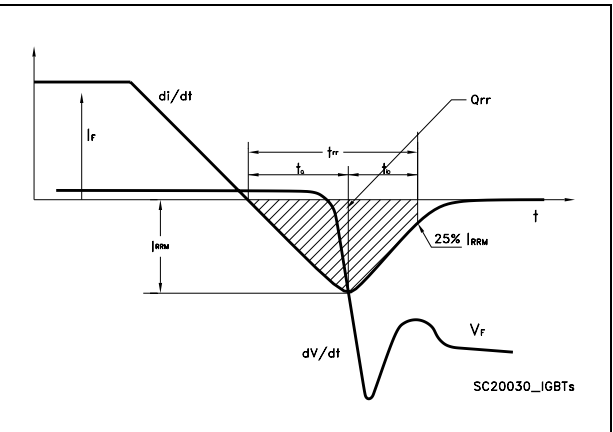


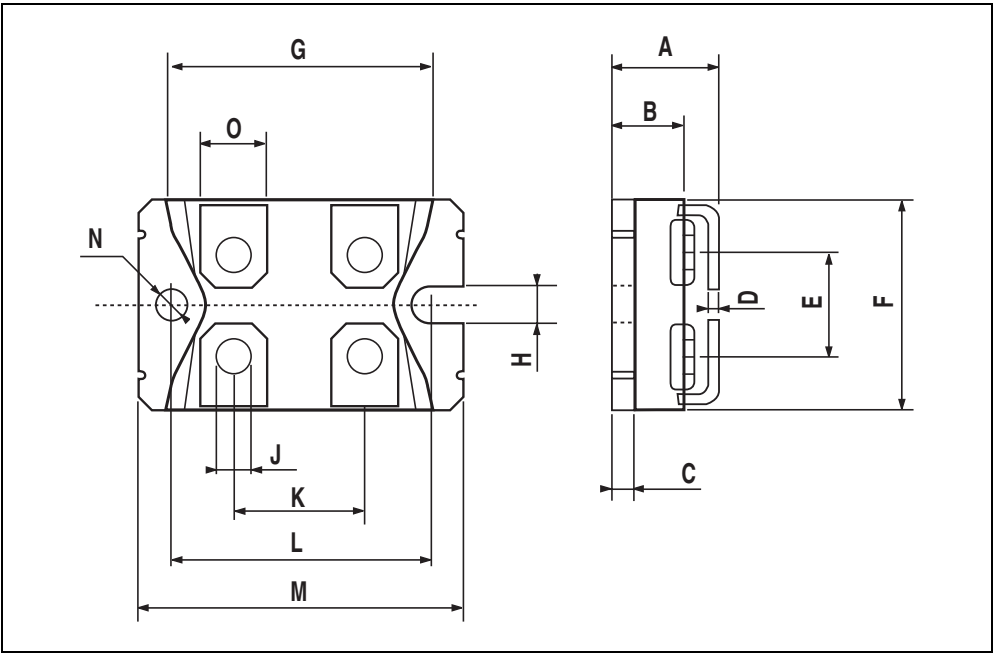
Figure 18. Diode recovery time waveform



## 4      **Package mechanical data**

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

| ISOTOP MECHANICAL DATA |       |      |      |       |      |       |
|------------------------|-------|------|------|-------|------|-------|
| DIM.                   | mm    |      |      | inch  |      |       |
|                        | MIN.  | TYP. | MAX. | MIN.  | TYP. | MAX.  |
| A                      | 11.8  |      | 12.2 | 0.466 |      | 0.480 |
| B                      | 8.9   |      | 9.1  | 0.350 |      | 0.358 |
| C                      | 1.95  |      | 2.05 | 0.076 |      | 0.080 |
| D                      | 0.75  |      | 0.85 | 0.029 |      | 0.033 |
| E                      | 12.6  |      | 12.8 | 0.496 |      | 0.503 |
| F                      | 25.15 |      | 25.5 | 0.990 |      | 1.003 |
| G                      | 31.5  |      | 31.7 | 1.240 |      | 1.248 |
| H                      | 4     |      |      | 0.157 |      |       |
| J                      | 4.1   |      | 4.3  | 0.161 |      | 0.169 |
| K                      | 14.9  |      | 15.1 | 0.586 |      | 0.594 |
| L                      | 30.1  |      | 30.3 | 1.185 |      | 1.193 |
| M                      | 37.8  |      | 38.2 | 1.488 |      | 1.503 |
| N                      | 4     |      |      | 0.157 |      |       |
| O                      | 7.8   |      | 8.2  | 0.307 |      | 0.322 |



## 5 Revision history

**Table 7. Revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 28-Feb-2005 | 6        | Complete version   |
| 26-Jul-2006 | 7        | New template   |
| 03-Nov-2006 | 8        | New value inserted on <a href="#">Table 1.: Absolute maximum ratings</a> |

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