



# STGW30NB60H

## N-CHANNEL 30A - 600V TO-247 PowerMESH™ IGBT

| TYPE        | V <sub>CE(S)</sub> | V <sub>CE(sat)</sub> | I <sub>C</sub> |
|-------------|--------------------|----------------------|----------------|
| STGW30NB60H | 600 V              | < 2.8 V              | 30 A           |

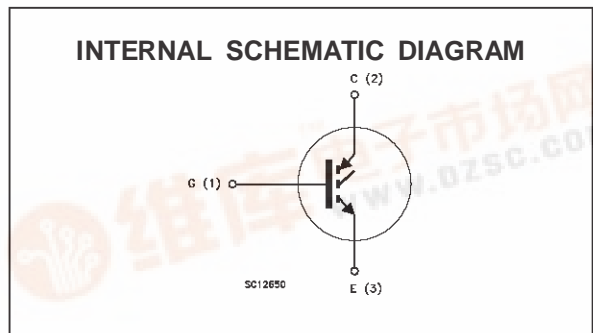
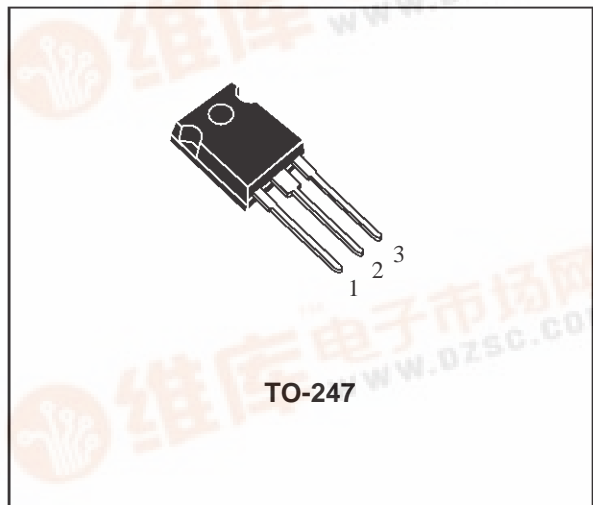
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>CE(SAT)</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- OFF LOSSES INCLUDE TAIL CURRENT

### 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 "H" identifies a family optimized to achieve very low switching times for high frequency applications (<120kHz).

### APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- WELDING EQUIPMENTS
- SMPS AND PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES



### ABSOLUTE MAXIMUM RATINGS

| Symbol             | Parameter   | Value      | Unit |
|--------------------|---|------------|------|
| V <sub>CE(S)</sub> | Collector-Emitter Voltage (V <sub>GS</sub> = 0)           | 600        | V    |
| V <sub>ECR</sub>   | Emitter-Collector Voltage                                 | 20         | V    |
| V <sub>GE</sub>    | Gate-Emitter Voltage                                      | ± 20       | V    |
| I <sub>C</sub>     | Collector Current (continuous) at T <sub>c</sub> = 25 °C  | 60         | A    |
| I <sub>C</sub>     | Collector Current (continuous) at T <sub>c</sub> = 100 °C | 30         | A    |
| I <sub>CM(•)</sub> | Collector Current (pulsed)                                | 240        | A    |
| P <sub>tot</sub>   | Total Dissipation at T <sub>c</sub> = 25 °C               | 190        | W    |
|                    | Derating Factor   | 1.52       | W/°C |
| T <sub>stg</sub>   | Storage Temperature                                       | -65 to 150 | °C   |
| T <sub>j</sub>     | Max. Operating Junction Temperature                       | 150        | °C   |

(•) Pulse width limited by safe operating area

## STGW30NB60H

### THERMAL DATA

|                |                                     |     |      |               |
|----------------|-------------------------------------|-----|------|---------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case    | Max | 0.66 | $^{\circ}C/W$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-ambient | Max | 30   | $^{\circ}C/W$ |
| $R_{thc-h}$    | Thermal Resistance Case-heatsink    | Typ | 0.1  | $^{\circ}C/W$ |

### ELECTRICAL CHARACTERISTICS ( $T_j = 25^{\circ}C$ unless otherwise specified)

#### OFF

| Symbol        | Parameter                                     | Test Conditions   | Min. | Typ. | Max.      | Unit               |
|---------------|---|---|------|------|-----------|--------------------|
| $V_{BR(CES)}$ | Collector-Emitter Breakdown Voltage           | $I_C = 250 \mu A$ $V_{GE} = 0$  | 600  |      |           | V                  |
| $I_{CES}$     | Collector cut-off ( $V_{GE} = 0$ )            | $V_{CE} = \text{Max Rating}$ $T_j = 25^{\circ}C$<br>$V_{CE} = \text{Max Rating}$ $T_j = 125^{\circ}C$ |      |      | 10<br>100 | $\mu A$<br>$\mu A$ |
| $I_{GES}$     | Gate-Emitter Leakage Current ( $V_{CE} = 0$ ) | $V_{GE} = \pm 20 V$ $V_{CE} = 0$  |      |      | $\pm 100$ | nA                 |

#### ON (\*)

| Symbol        | Parameter                            | Test Conditions   | Min. | Typ.       | Max. | Unit   |
|---------------|--------------------------------------|---|------|------------|------|--------|
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{CE} = V_{GE}$ $I_C = 250 \mu A$   | 3    |            | 5    | V      |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | $V_{GE} = 15 V$ $I_C = 30 A$<br>$V_{GE} = 15 V$ $I_C = 30 A$ $T_j = 125^{\circ}C$ |      | 2.2<br>1.8 | 2.8  | V<br>V |

### DYNAMIC

| Symbol                              | Parameter   | Test Conditions   | Min. | Typ.              | Max. | Unit           |
|-------------------------------------|---|---|------|-------------------|------|----------------|
| $g_{fs}$                            | Forward Transconductance  | $V_{CE} = 25 V$ $I_C = 30 A$                                  |      | 20                |      | S              |
| $C_{ies}$<br>$C_{oes}$<br>$C_{res}$ | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | $V_{CE} = 25 V$ $f = 1 MHz$ $V_{GE} = 0$                      |      | 2300<br>250<br>60 |      | pF<br>pF<br>pF |
| $Q_G$<br>$Q_{GE}$<br>$Q_{GC}$       | Total Gate Charge<br>Gate-Emitter Charge<br>Gate-Collector Charge       | $V_{CE} = 480 V$ $I_C = 30 A$ $V_{GE} = 15 V$                 |      | 150<br>15<br>72   |      | nC<br>nC<br>nC |
| $I_{CL}$                            | Latching Current  | $V_{clamp} = 480 V$ $R_G = 10 \Omega$<br>$T_j = 150^{\circ}C$ | 120  |                   |      | A              |

### SWITCHING ON

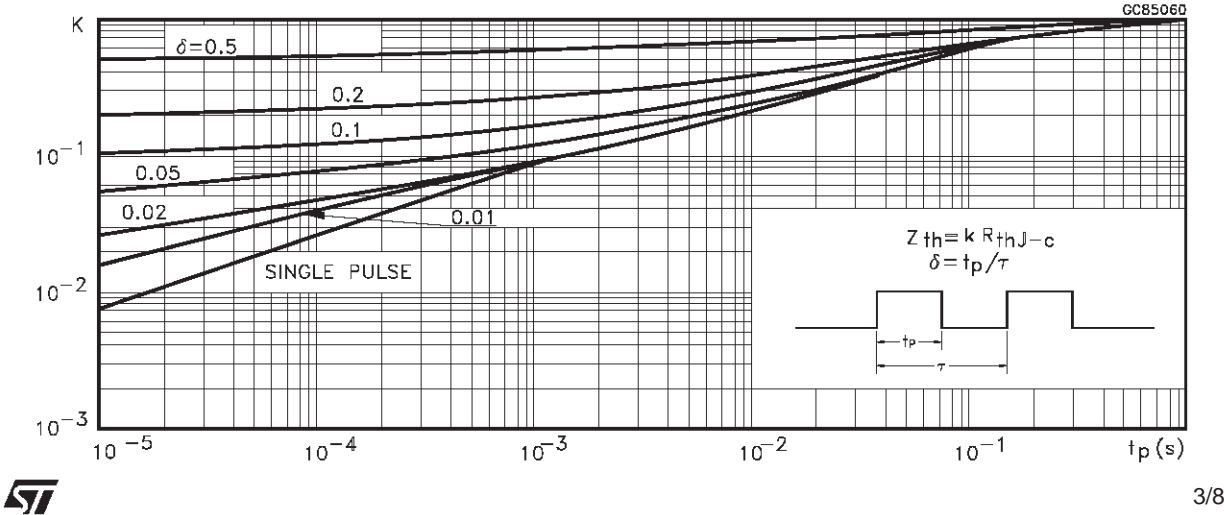
| Symbol               | Parameter                | Test Conditions  | Min. | Typ.     | Max. | Unit       |
|----------------------|--------------------------|--|------|----------|------|------------|
| $t_{d(on)}$<br>$t_r$ | Delay Time<br>Rise Time  | $V_{CC} = 480 V$ $I_C = 30 A$<br>$V_{GE} = 15 V$ $R_G = 10 \Omega$ |      | 15<br>75 |      | ns<br>ns   |
| $(di/dt)_{on}$       | Turn-on Current Slope    | $V_{CC} = 480 V$ $I_C = 30 A$<br>$R_G = 10 \Omega$ $V_{GE} = 15 V$ |      | 760      |      | A/ $\mu s$ |
| $E_{on}$             | Turn-on Switching Losses | $T_j = 125^{\circ}C$   |      | 850      |      | $\mu J$    |

**ELECTRICAL CHARACTERISTICS** (continued)  
**SWITCHING OFF**

| Symbol         | Parameter               | Test Conditions                   | Min. | Typ. | Max. | Unit |
|----------------|-------------------------|-----------------------------------|------|------|------|------|
| $t_c$          | Cross-Over Time         | $V_{CC} = 480\text{ V}$           |      | 150  |      | ns   |
| $t_r(V_{off})$ | Off Voltage Rise Time   | $R_{GE} = 10\ \Omega$             |      | 40   |      | ns   |
| $t_{d(off)}$   | Delay Time              | $I_C = 30\text{ A}$               |      | 210  |      | ns   |
| $t_f$          | Fall Time               | $V_{GE} = 15\text{ V}$            |      | 90   |      | ns   |
| $E_{off(**)}$  | Turn-off Switching Loss |                                   |      | 1.10 |      | mJ   |
| $E_{ts}$       | Total Switching Loss    |                                   |      | 1.8  |      | mJ   |
| $t_c$          | Cross-Over Time         | $V_{CC} = 480\text{ V}$           |      | 250  |      | ns   |
| $t_r(V_{off})$ | Off Voltage Rise Time   | $R_{GE} = 10\ \Omega$             |      | 70   |      | ns   |
| $t_{d(off)}$   | Delay Time              | $I_C = 30\text{ A}$               |      | 250  |      | ns   |
| $t_f$          | Fall Time               | $T_j = 125\text{ }^\circ\text{C}$ |      | 160  |      | ns   |
| $E_{off(**)}$  | Turn-off Switching Loss |                                   |      | 1.6  |      | mJ   |
| $E_{ts}$       | Total Switching Loss    |                                   |      | 2.45 |      | mJ   |

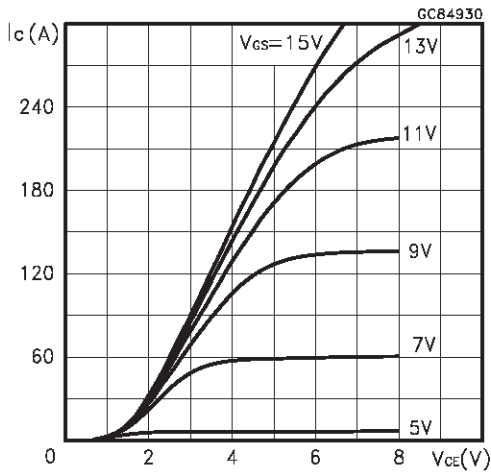
(•) Pulse width limited by max. junction temperature  
 (\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %  
 (\*\*) Losses Include Also The Tail (Jedec Standardization)

Thermal Impedance

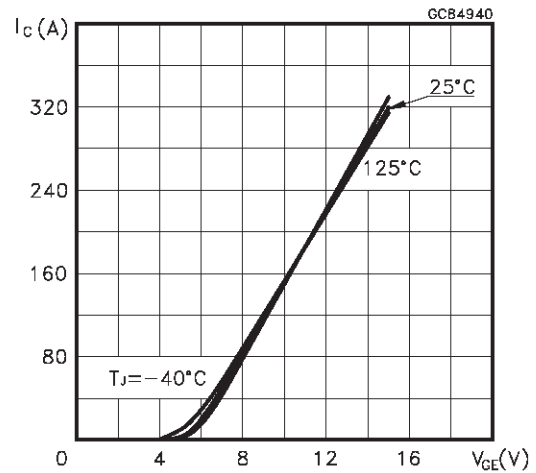


# STGW30NB60H

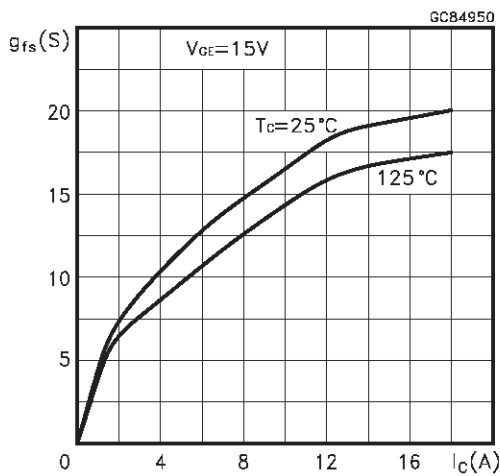
Output Characteristics



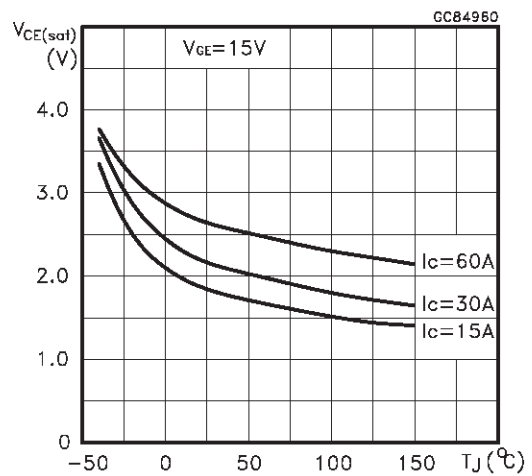
Transfer Characteristics



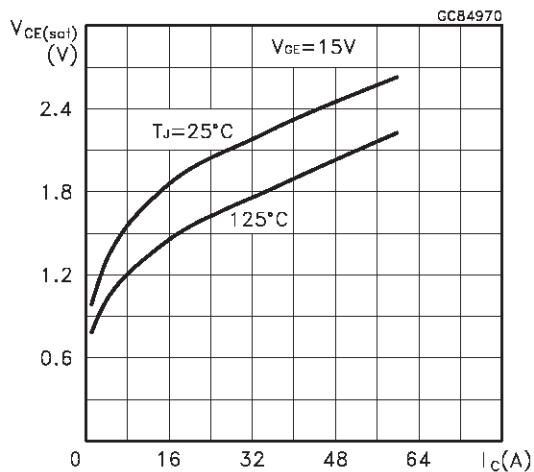
Transconductance



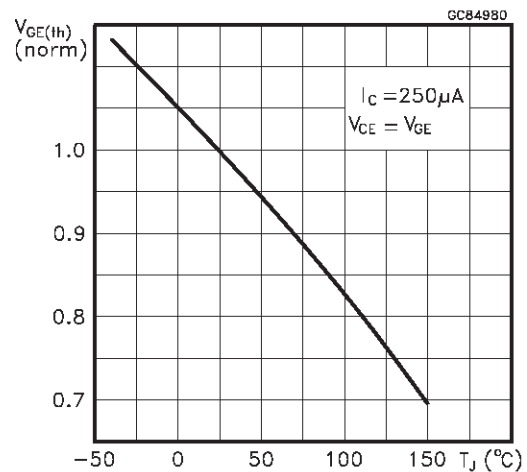
Collector-Emitter On Voltage vs Temperature



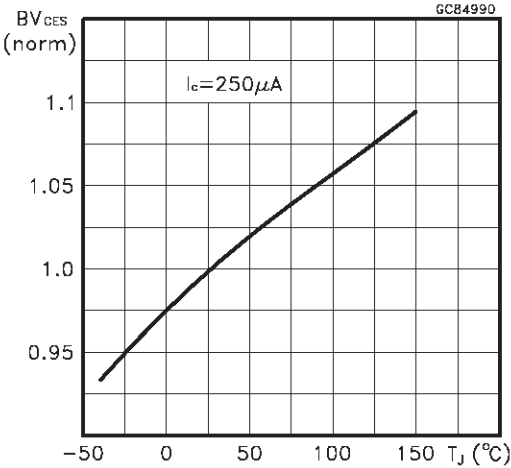
Collector-Emitter On Voltage vs Collector Current



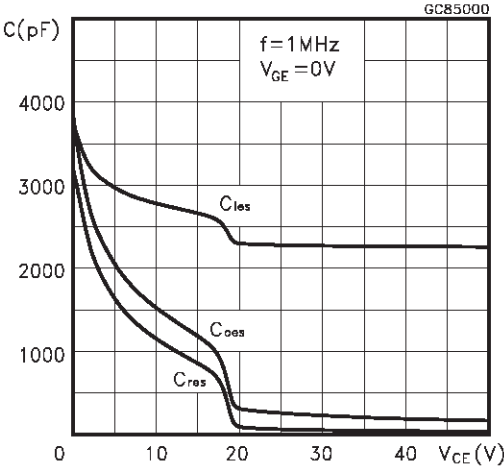
Gate Threshold vs Temperature



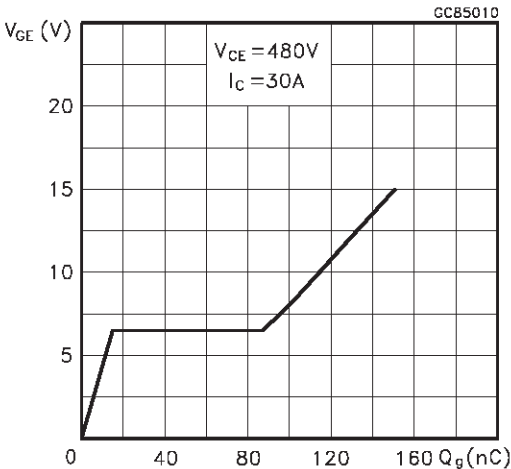
Normalized Breakdown Voltage vs Temperature



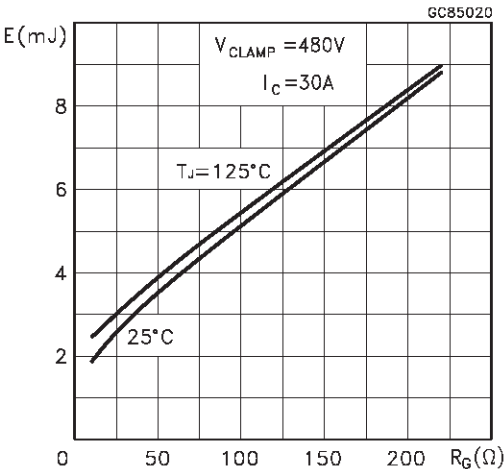
Capacitance Variations



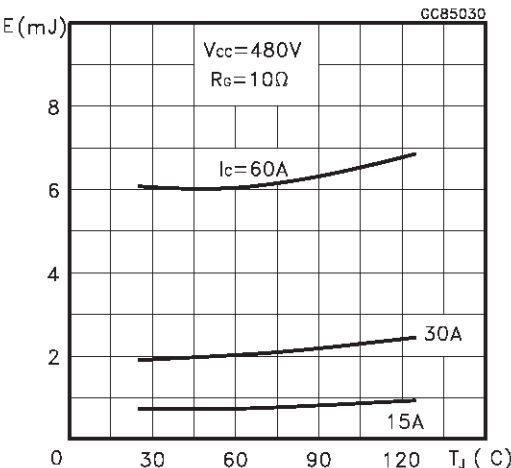
Gate Charge vs Gate-Emitter Voltage



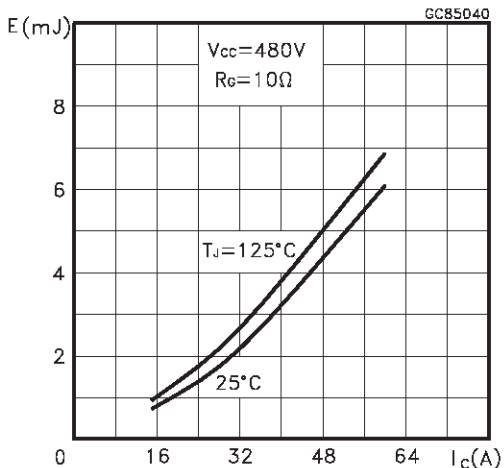
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



# STGW30NB60H

## Switching Off Safe Operating Area

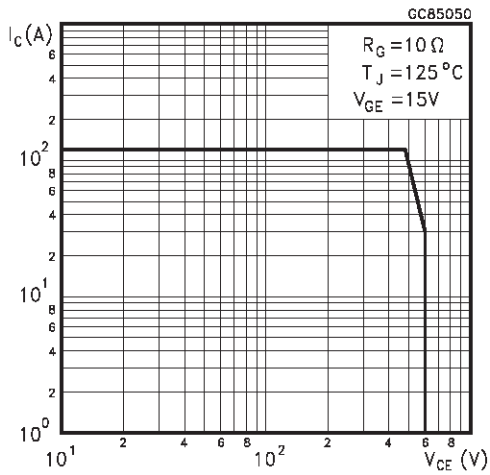


Fig. 1: Gate Charge test Circuit

Fig. 2: Test Circuit For Inductive Load Switching

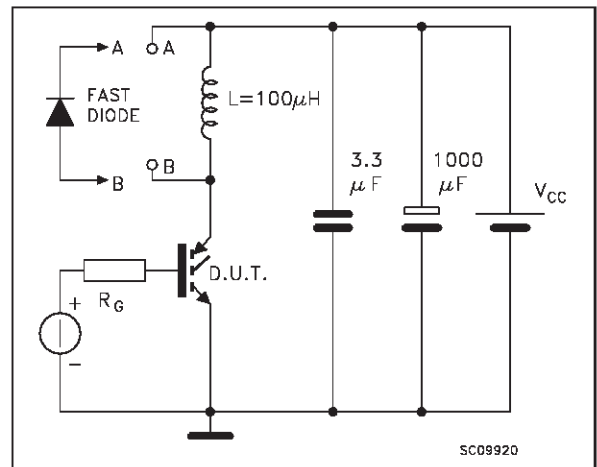
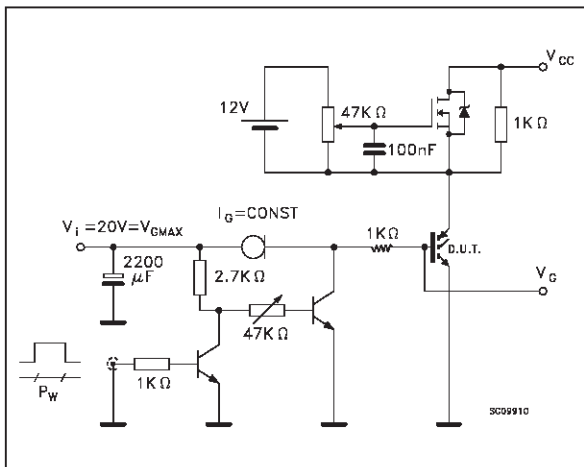
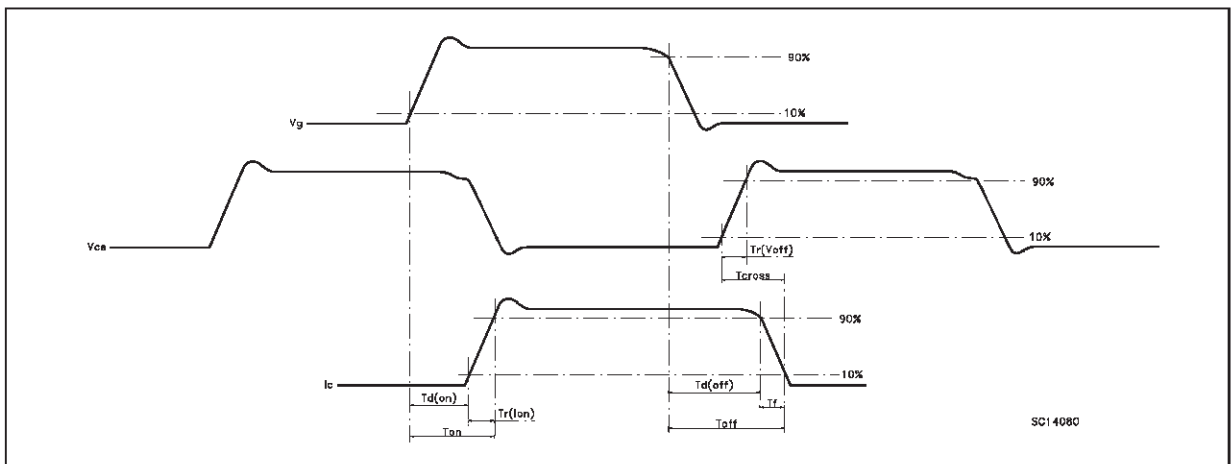
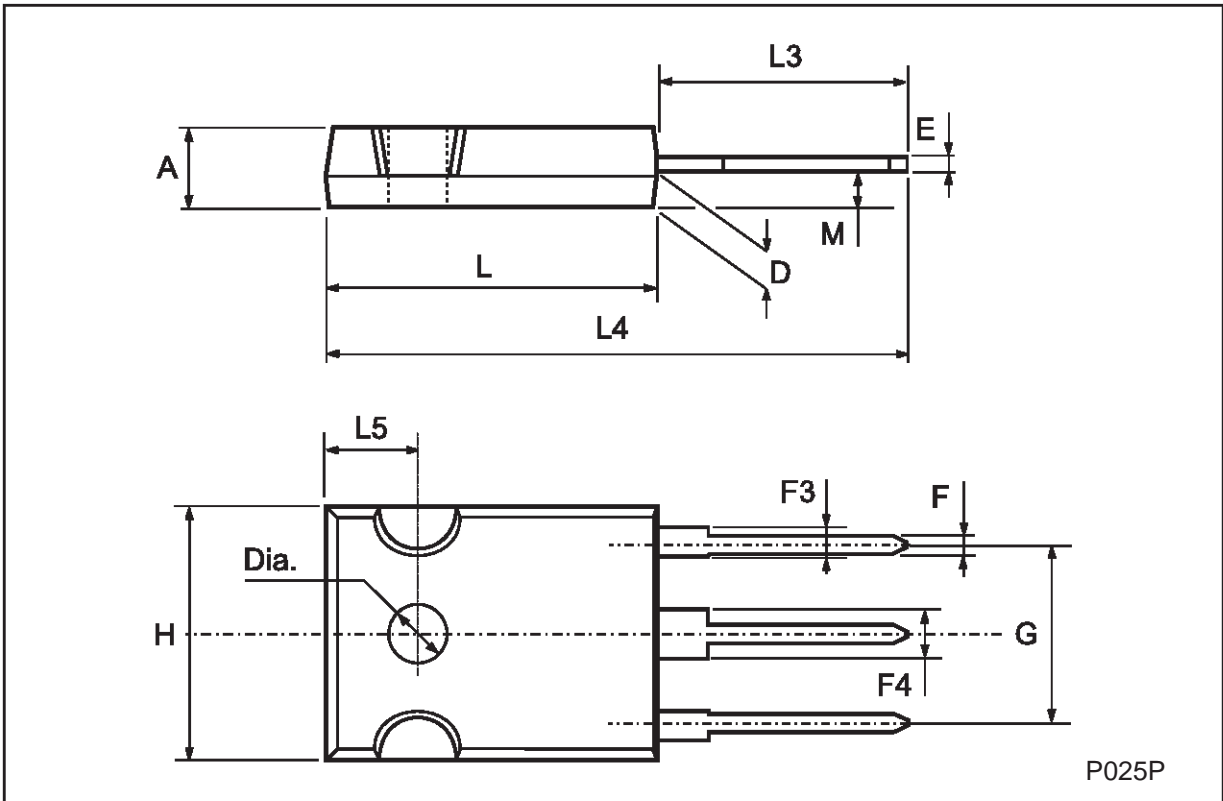


Fig. 3 Switching Waveforms



**TO-247 MECHANICAL DATA**

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 4.7  |      | 5.3  | 0.185 |       | 0.209 |
| D    | 2.2  |      | 2.6  | 0.087 |       | 0.102 |
| E    | 0.4  |      | 0.8  | 0.016 |       | 0.031 |
| F    | 1    |      | 1.4  | 0.039 |       | 0.055 |
| F3   | 2    |      | 2.4  | 0.079 |       | 0.094 |
| F4   | 3    |      | 3.4  | 0.118 |       | 0.134 |
| G    |      | 10.9 |      |       | 0.429 |       |
| H    | 15.3 |      | 15.9 | 0.602 |       | 0.626 |
| L    | 19.7 |      | 20.3 | 0.776 |       | 0.779 |
| L3   | 14.2 |      | 14.8 | 0.559 |       | 0.582 |
| L4   |      | 34.6 |      |       | 1.362 |       |
| L5   |      | 5.5  |      |       | 0.217 |       |
| M    | 2    |      | 3    | 0.079 |       | 0.118 |



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specification mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a trademark of STMicroelectronics

© 1999 STMicroelectronics – Printed in Italy – All Rights Reserved  
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - China - Finland - France - Germany - Hong Kong - India - Italy - Japan - Malaysia - Malta - Morocco -  
Singapore - Spain - Sweden - Switzerland - United Kingdom - U.S.A.