



# STGD7NB60S

## N-CHANNEL 7A - 600V DPAK Power MESH™ IGBT

| TYPE       | V <sub>CES</sub> | V <sub>CE(sat)</sub> | I <sub>C</sub> |
|------------|------------------|----------------------|----------------|
| STGD7NB60S | 600 V            | < 1.6 V              | 7 A            |

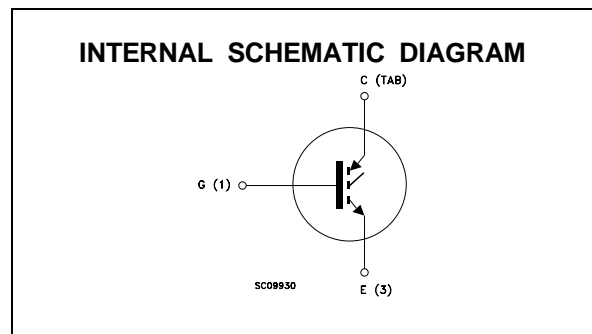
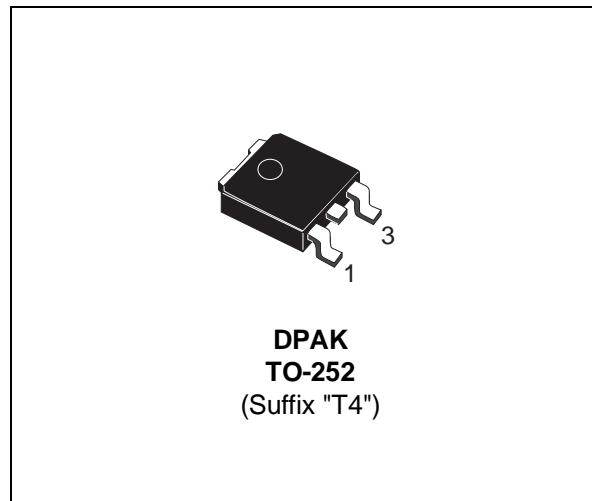
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- VERY LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- SURFACE-MOUNTING DPAK (TO-252) POWER PACKAGE IN TAPE & REEL (SUFFIX "T4")

### 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 minimum on-voltage drop for low frequency applications (<1kHz).

### APPLICATIONS

- LIGHT DIMMER
- STATIC RELAYS
- MOTOR CONTROL



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter   | Value      | Unit |
|---------------------|---|------------|------|
| V <sub>CES</sub>    | Collector-Emitter Voltage (V <sub>GS</sub> = 0)           | 600        | V    |
| V <sub>ECR</sub>    | Reverse Battery Protection                                | 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  | 15         | A    |
| I <sub>C</sub>      | Collector Current (continuous) at T <sub>c</sub> = 100 °C | 7          | A    |
| I <sub>CM</sub> (•) | Collector Current (pulsed)                                | 60         | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C               | 55         | W    |
|                     | Derating Factor   | 0.44       | 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

## STGD7NB60S

### THERMAL DATA

|                       |                                     |     |      |      |
|-----------------------|-------------------------------------|-----|------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case    | Max | 2.27 | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-ambient | Max | 100  | °C/W |
| R <sub>thc-sink</sub> | Thermal Resistance Case-sink        | Typ | 1.5  | °C/W |

### ELECTRICAL CHARACTERISTICS (T<sub>j</sub> = 25 °C unless otherwise specified)

OFF

| Symbol               | Parameter  | Test Conditions   | Min. | Typ. | Max.      | Unit     |
|----------------------|--|---|------|------|-----------|----------|
| V <sub>BR(CES)</sub> | Collector-Emitter Breakdown Voltage                | I <sub>C</sub> = 250 μA V <sub>GE</sub> = 0   | 600  |      |           | V        |
| V <sub>BR(ECR)</sub> | Emitter-Collector Breakdown Voltage                | I <sub>C</sub> = 1 mA V <sub>GE</sub> = 0   | 20   |      |           | V        |
| I <sub>CES</sub>     | Collector cut-off (V <sub>GE</sub> = 0)            | V <sub>CE</sub> = Max Rating T <sub>j</sub> = 25 °C<br>V <sub>CE</sub> = Max Rating T <sub>j</sub> = 125 °C |      |      | 10<br>100 | μA<br>μA |
| I <sub>GES</sub>     | Gate-Emitter Leakage Current (V <sub>CE</sub> = 0) | V <sub>GE</sub> = ± 20 V V <sub>CE</sub> = 0  |      |      | ± 100     | nA       |

ON (\*)

| Symbol               | Parameter                            | Test Conditions   | Min. | Typ.            | Max.       | Unit        |
|----------------------|--------------------------------------|---|------|-----------------|------------|-------------|
| V <sub>GE(th)</sub>  | Gate Threshold Voltage               | V <sub>CE</sub> = V <sub>GE</sub> I <sub>C</sub> = 250 μA   | 2.5  |                 | 5          | V           |
| V <sub>CE(SAT)</sub> | Collector-Emitter Saturation Voltage | V <sub>GE</sub> = 15 V I <sub>C</sub> = 3 A<br>V <sub>GE</sub> = 15 V I <sub>C</sub> = 7 A<br>V <sub>GE</sub> = 15 V I <sub>C</sub> = 7 A T <sub>j</sub> = 125 °C |      | 1<br>1.2<br>1.1 | 1.4<br>1.6 | V<br>V<br>V |

### DYNAMIC

| Symbol   | Parameter   | Test Conditions  | Min. | Typ.            | Max.            | Unit           |
|--|---|--|------|-----------------|-----------------|----------------|
| g <sub>fs</sub>  | Forward Transconductance  | V <sub>CE</sub> = 25 V I <sub>C</sub> = 7 A                                | 4    |                 |                 | S              |
| C <sub>ies</sub><br>C <sub>oes</sub><br>C <sub>res</sub> | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | V <sub>CE</sub> = 25 V f = 1 MHz V <sub>GE</sub> = 0                       |      | 610<br>65<br>12 | 780<br>85<br>15 | pF<br>pF<br>pF |
| Q <sub>G</sub>   | Gate Charge   | V <sub>CE</sub> = 400 V I <sub>C</sub> = 7 A V <sub>GE</sub> = 15 V        |      | 33              |                 | nC             |
| I <sub>CL</sub>  | Latching Current  | V <sub>clamp</sub> = 480 V R <sub>G</sub> = 1kΩ<br>T <sub>j</sub> = 150 °C | 15   |                 |                 | A              |

### SWITCHING ON

| Symbol                               | Parameter                | Test Conditions  | Min. | Typ.        | Max. | Unit     |
|--------------------------------------|--------------------------|--|------|-------------|------|----------|
| t <sub>d(on)</sub><br>t <sub>r</sub> | Delay Time<br>Rise Time  | V <sub>CC</sub> = 480 V I <sub>C</sub> = 7 A<br>V <sub>GE</sub> = 15 V R <sub>G</sub> = 1 KΩ |      | 0.7<br>0.46 |      | μs<br>μs |
| (di/dt) <sub>on</sub>                | Turn-on Current Slope    | V <sub>CC</sub> = 480 V I <sub>C</sub> = 7 A<br>R <sub>G</sub> = 1 KΩ V <sub>GE</sub> = 15 V |      | 8           |      | A/μs     |
| E <sub>on</sub>                      | Turn-on Switching Losses | T <sub>j</sub> = 125 °C  |      | 0.4         |      | mJ       |

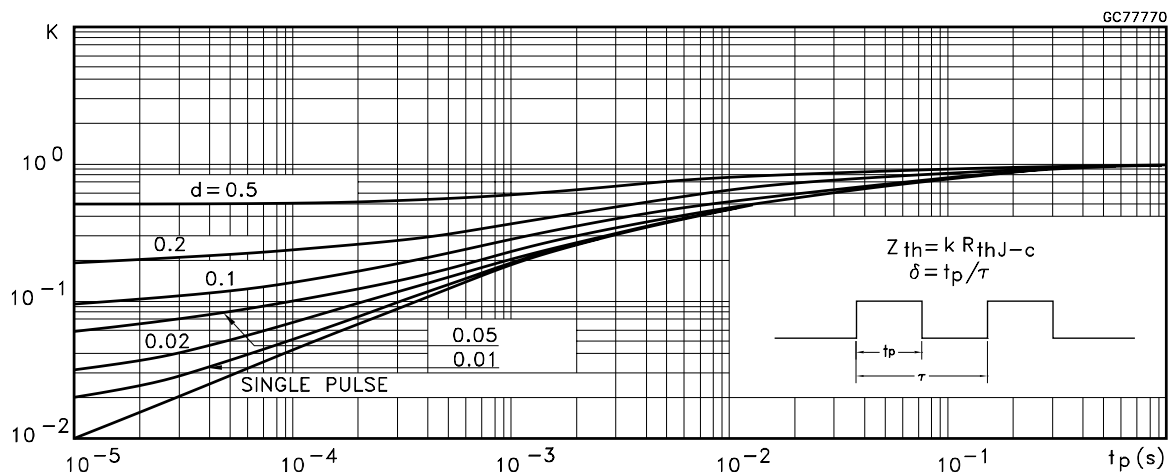
**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING OFF**

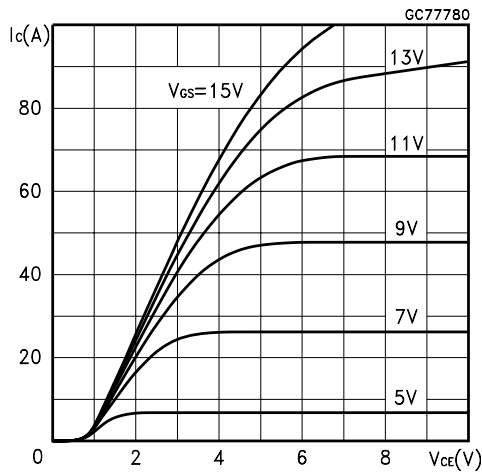
| Symbol         | Parameter               | Test Conditions   | Min. | Typ. | Max. | Unit          |
|----------------|-------------------------|---|------|------|------|---------------|
| $t_c$          | Cross-Over Time         | $V_{CC} = 480\text{ V}$   |      | 2.2  |      | $\mu\text{s}$ |
| $t_r(V_{off})$ | Off Voltage Rise Time   | $R_{GE} = 100\ \Omega$  |      | 1.2  |      | $\mu\text{s}$ |
| $t_f$          | Fall Time               | $I_C = 7\text{ A}$<br>$V_{GE} = 15\text{ V}$                                      |      | 1.2  |      | $\mu\text{s}$ |
| $E_{off(**)}$  | Turn-off Switching Loss |   |      | 3.5  |      | mJ            |
| $t_c$          | Cross-Over Time         | $V_{CC} = 480\text{ V}$   |      | 3.8  |      | $\mu\text{s}$ |
| $t_r(V_{off})$ | Off Voltage Rise Time   | $R_{GE} = 100\ \Omega$  |      | 1.2  |      | $\mu\text{s}$ |
| $t_f$          | Fall Time               | $I_C = 7\text{ A}$<br>$V_{GE} = 15\text{ V}$<br>$T_j = 125\text{ }^\circ\text{C}$ |      | 1.9  |      | $\mu\text{s}$ |
| $E_{off(**)}$  | Turn-off Switching Loss |   |      | 5.3  |      | mJ            |

- (●) Pulse width limited by safe operating area
- (\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %
- (\*\*) Losses Include Also The Tail (Jedec Standardization)

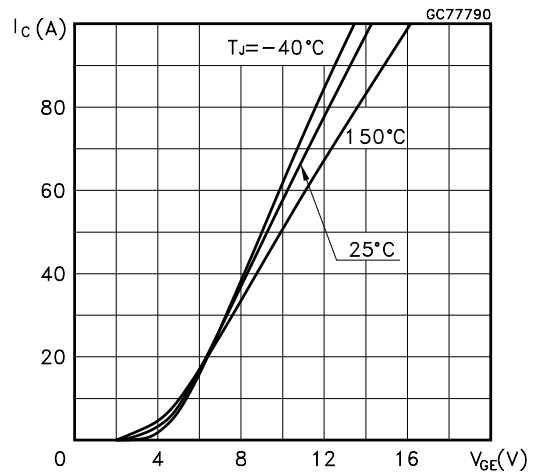
**Thermal Impedance**



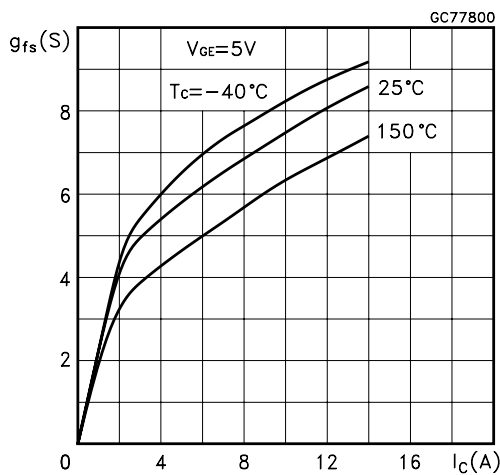
Output Characteristics



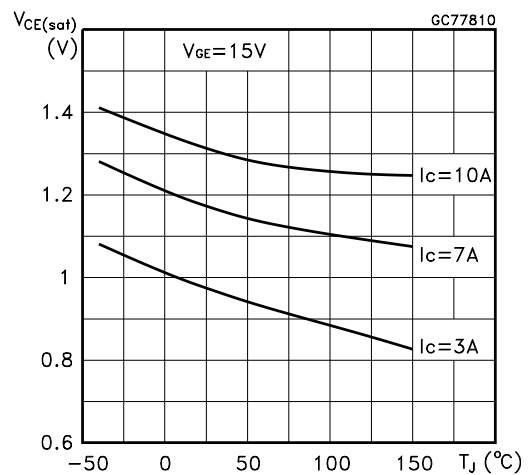
Transfer Characteristics



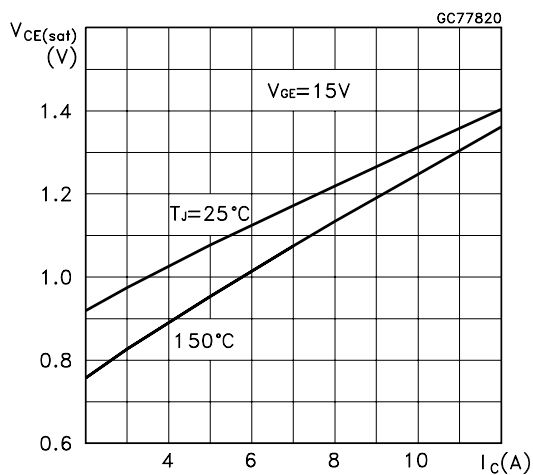
Transconductance



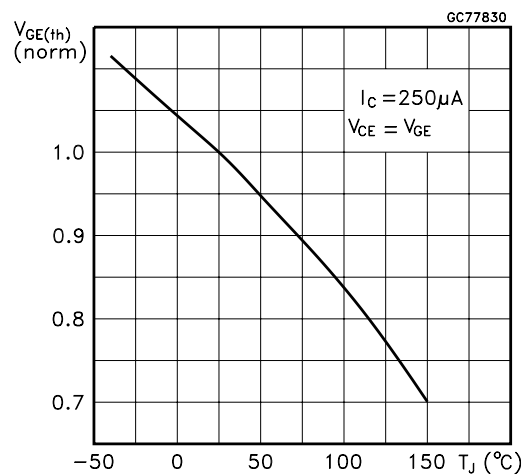
Collector-Emitter On Voltage vs Temperature



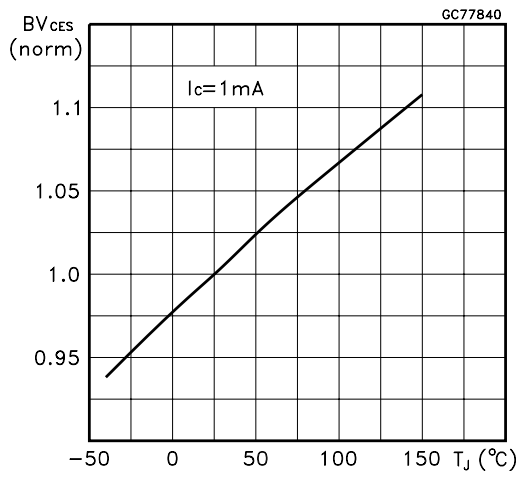
Collector-Emitter On Voltage vs Collector Current



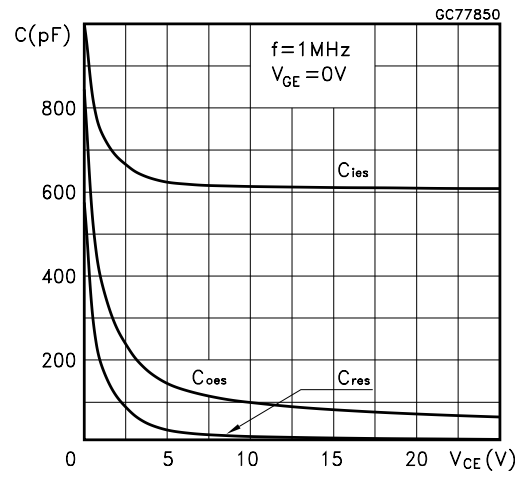
Gate Threshold vs Temperature



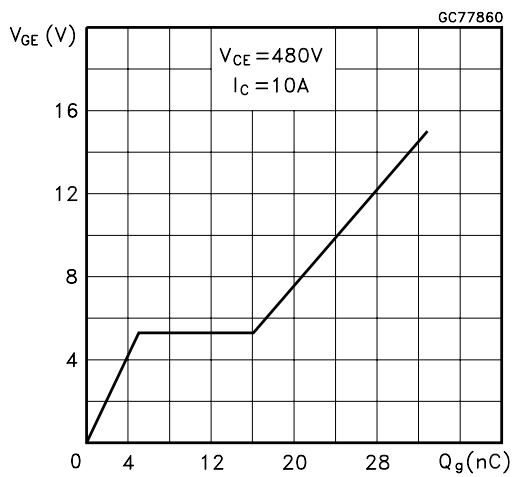
Normalized Breakdown Voltage vs Temperature



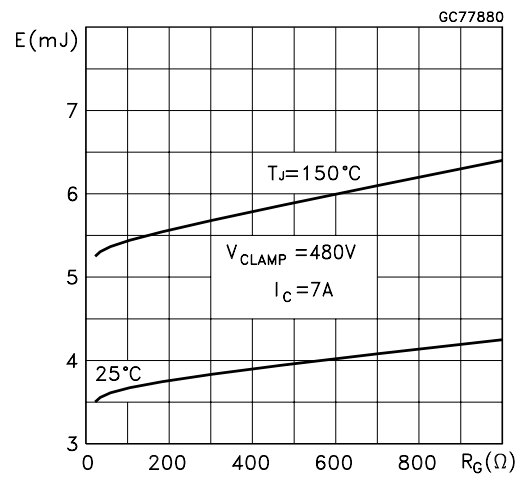
Capacitance Variations



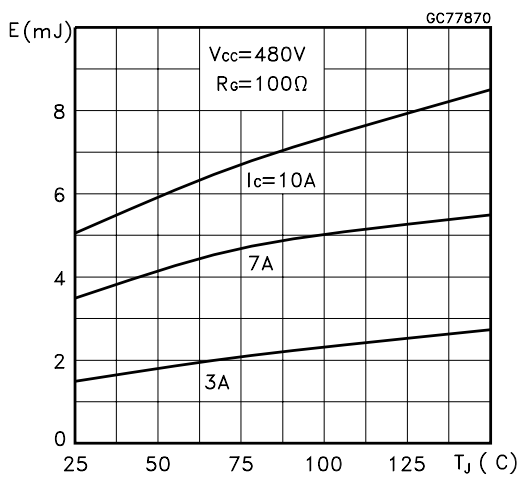
Gate Charge vs Gate-Emitter Voltage



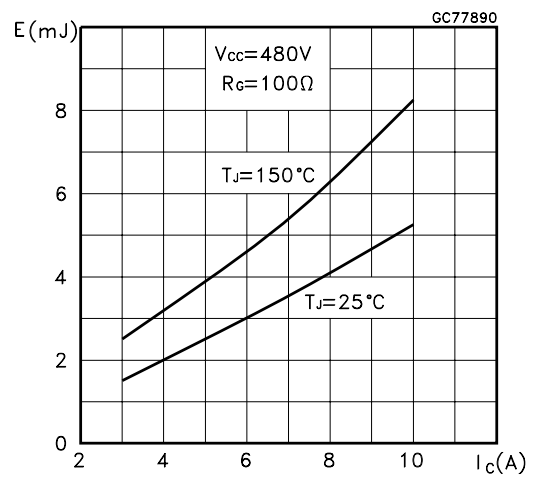
Off Losses vs Gate Resistance



Off Losses vs Temperature



Off Losses vs Collector Current



Switching Off Safe Operatin Area

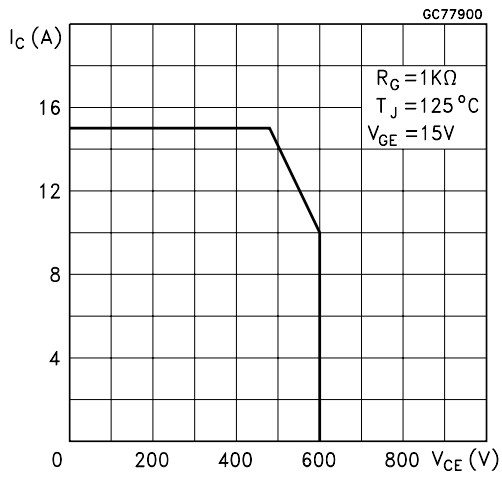


Fig. 1: Gate Charge test Circuit

Fig. 2: Test Circuit For Inductive Load Switching

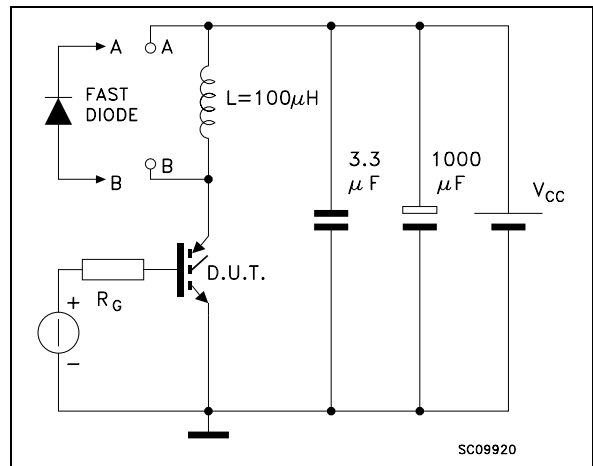
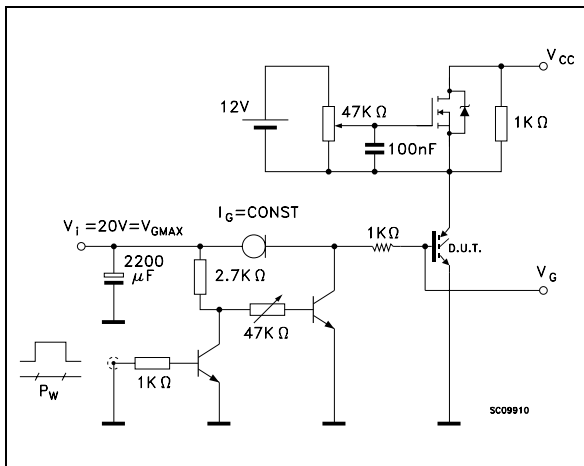
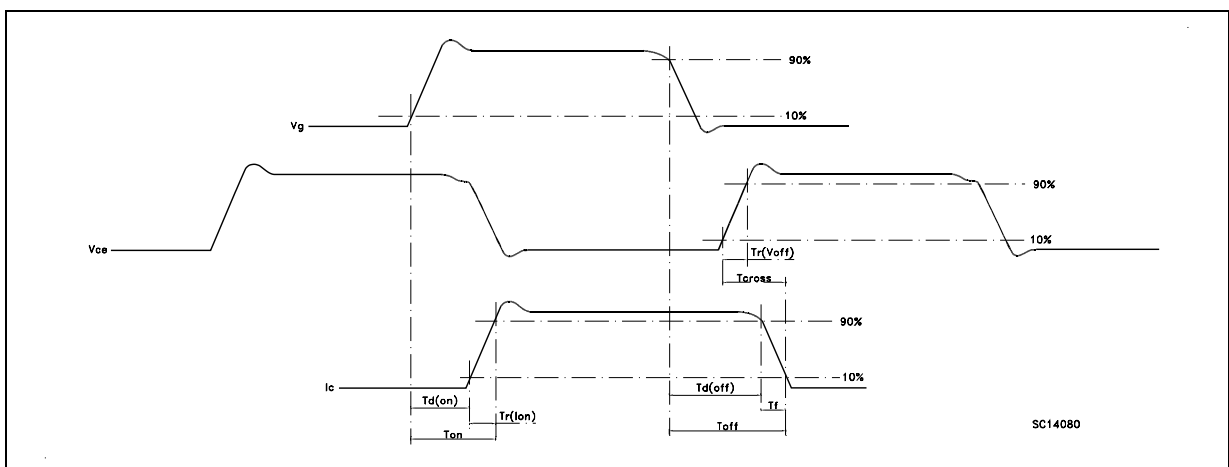
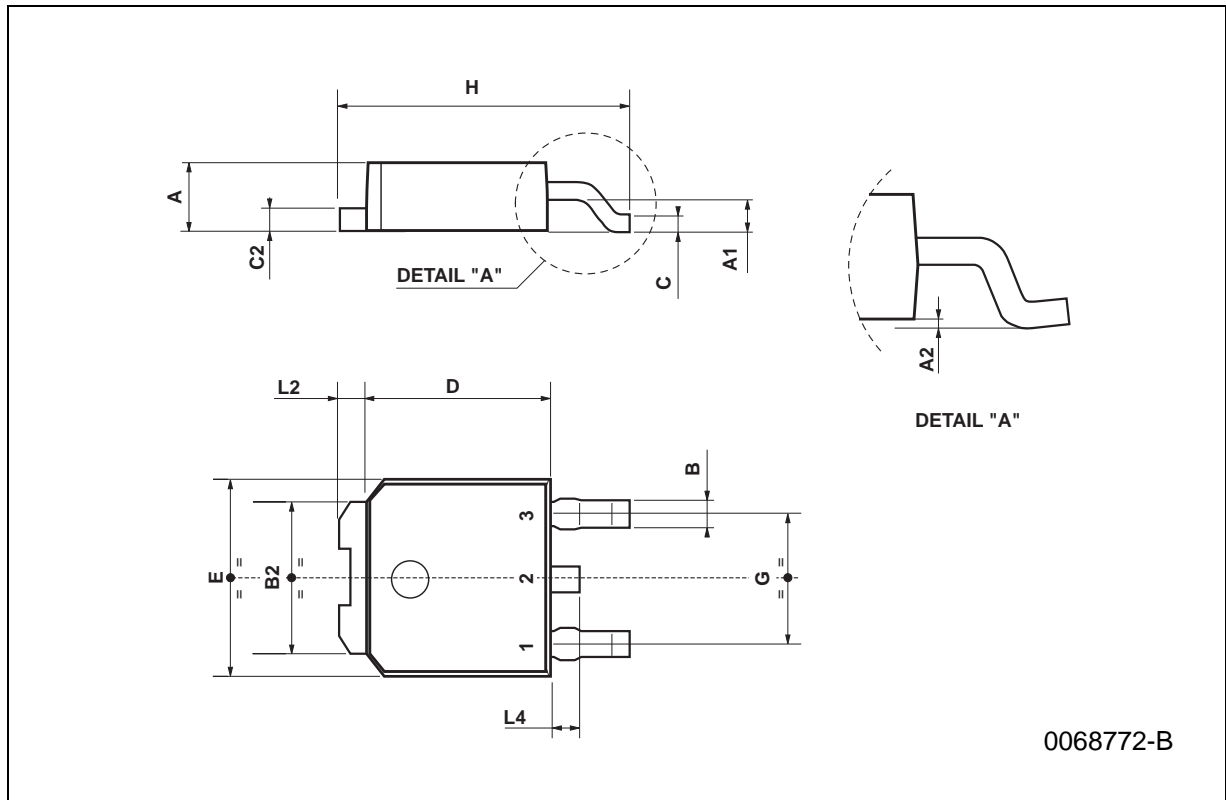


Fig. 3: Switching Waveforms



**TO-252 (DPAK) MECHANICAL DATA**

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 2.2  |      | 2.4  | 0.086 |       | 0.094 |
| A1   | 0.9  |      | 1.1  | 0.035 |       | 0.043 |
| A2   | 0.03 |      | 0.23 | 0.001 |       | 0.009 |
| B    | 0.64 |      | 0.9  | 0.025 |       | 0.035 |
| B2   | 5.2  |      | 5.4  | 0.204 |       | 0.212 |
| C    | 0.45 |      | 0.6  | 0.017 |       | 0.023 |
| C2   | 0.48 |      | 0.6  | 0.019 |       | 0.023 |
| D    | 6    |      | 6.2  | 0.236 |       | 0.244 |
| E    | 6.4  |      | 6.6  | 0.252 |       | 0.260 |
| G    | 4.4  |      | 4.6  | 0.173 |       | 0.181 |
| H    | 9.35 |      | 10.1 | 0.368 |       | 0.397 |
| L2   |      | 0.8  |      |       | 0.031 |       |
| L4   | 0.6  |      | 1    | 0.023 |       | 0.039 |



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