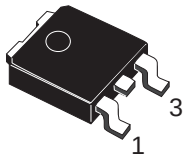
# STGD3NB60SD

## N-CHANNEL 3A - 600V DPAK
## Power MESH™ IGBT

**PRELIMINARY DATA**

| TYPE | $V_{CES}$ | $V_{CE(sat)}$ | $I_C$ |
|---|---|---|---|
| STGD3NB60SD | 600 V | < 1.5 V | 3 A |

- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- VERY LOW ON-VOLTAGE DROP ($V_{cesat}$)
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- INTEGRATED FREEWHEELING DIODE
- SURFACE-MOUNTING DPAK (TO-252) POWER PACKAGE IN TAPE & REEL (SUFFIX "T4")




**DPAK**
**TO-252**
(Suffix "T4")

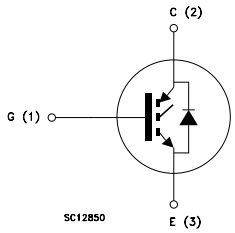
### DESCRIPTION

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 perfomances. The suffix "S" identifies a family optimized to achieve minimum on-voltage drop for low frequency applications (<1kHz).

### APPLICATIONS

- GAS DISCHARGE LAMP
- STATIC RELAYS
- MOTOR CONTROL

### INTERNAL SCHEMATIC DIAGRAM




### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage ($V_{GS}$ = 0) | 600 | V |
| $V_{GE}$ | Gate-Emitter Voltage | ± 20 | V |
| $I_C$ | Collector Current (continuous) at $T_c$ = 25 °C | 6 | A |
| $I_C$ | Collector Current (continuous) at $T_c$ = 100 °C | 3 | A |
| $I_{CM}$(•) | Collector Current (pulsed) | 25 | A |
| $P_{tot}$ | Total Dissipation at $T_c$ = 25 °C | 48 | W |
| | Derating Factor | 0.32 | W/°C |
| $T_{stg}$ | Storage Temperature | -65 to 175 | °C |
| $T_j$ | Max. Operating Junction Temperature | 175 | °C |

(•) Pulse width limited by safe operating area

## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case | Max | 3.125 | $^oC/W$ |
| $R_{thj\text{-}amb}$ | Thermal Resistance Junction-ambient | Max | 100 | $^oC/W$ |
| $R_{thc\text{-}sink}$ | Thermal Resistance Case-sink | Typ | 1.5 | $^oC/W$ |

## ELECTRICAL CHARACTERISTICS ($T_j$ = 25 $^oC$ unless otherwise specified)

OFF

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

**ON (*)**

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{CE}$ = $V_{GE}$ $I_C$ = 250 µA | 2.5 | | 5 | V |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$ = 15 V $I_C$ = 1.5 A<br>$V_{GE}$ = 15 V $I_C$ = 3 A<br>$V_{GE}$ = 15 V $I_C$ = 3 A $T_j$ = 125 $^oC$ | | 1<br>1.2<br>1.1 | <br>1.5<br> | V<br>V<br>V |

**DYNAMIC**

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ | Forward Transconductance | $V_{CE}$ =25 V $I_C$ = 3 A | 1.7 | 2.5 | | 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 | | 255<br>30<br>5.6 | 330<br>40<br>7 | 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 $I_C$ = 3 A $V_{GE}$ = 15 V | | 18<br>5.4<br>5.5 | | nC<br>nC<br>nC |
| $I_{CL}$ | Latching Current | $V_{clamp}$ = 480 V $R_G$=1kΩ<br>$T_j$ = 150 $^oC$ | 12 | | | 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 $I_C$ = 3 A<br>$V_{GE}$= 15 V $R_G$ = 1kΩ | | 125<br>150 | | ns<br>ns |
| $(di/dt)_{on}$ | Turn-on Current Slope | $V_{CC}$ = 480 V $I_C$ = 3 A<br>$R_G$ = 1kΩ $V_{GE}$ = 15 V | | 50 | | A/µs |
| $E_{on}$ | Turn-on Switching Losses | $T_j$ = 125 $^oC$ | | 1100 | | µJ |

**ELECTRICAL CHARACTERISTICS** (continued)

SWITCHING OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_c$ | Cross-Over Time | $V_{CC}$ = 480 V $I_C$ = 3 A | | 1.8 | | µs |
| $t_r(v_{off})$ | Off Voltage Rise Time | $R_{GE}$ = 1 kΩ $V_{GE}$ = 15 V | | 1.0 | | µs |
| $t_{d(off)}$ | Delay Time | | | 3.4 | | µs |
| $t_f$ | Fall Time | | | 0.72 | | µs |
| $E_{off}$(**) | Turn-off Switching Loss | | | 1.15 | | mJ |
| $t_c$ | Cross-Over Time | $V_{CC}$ = 480 V $I_C$ = 3 A | | 2.8 | | µs |
| $t_r(v_{off})$ | Off Voltage Rise Time | $R_{GE}$ = 1kΩ $V_{GE}$ = 15 V | | 1.45 | | µs |
| $t_{d(off)}$ | Delay Time | $T_j$ = 125 °C | | 3.6 | | µs |
| $t_f$ | Fall Time | | | 1.2 | | µs |
| $E_{off}$(**) | Turn-off Switching Loss | | | 1.8 | | mJ |

**COLLECTOR-EMITTER DIODE**

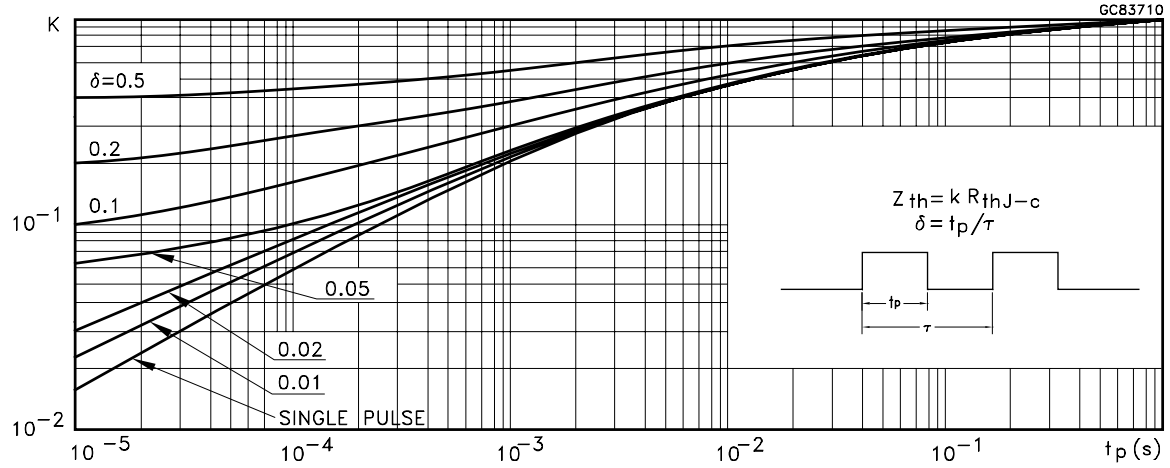
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_f$ | Forward Current | | | | 3 | A |
| $I_{fm}$ | Forward Current pulsed | | | | 25 | A |
| $V_f$ | Forward On-Voltage | $I_f$ = 3 A | | 1.55 | 1.9 | V |
| | | $I_f$ = 1 A | | 1.15 | | V |
| $t_{rr}$ | Reverse Recovery Time | $I_f$ = 3 A $V_R$=200 V | | 1700 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | dI/dt = 100 A/µS $T_j$ = 125 °C | | 4500 | | nC |
| $I_{rrm}$ | Reverse Recovery Current | | | 9.5 | | A |

(•) Pulse width limited by max. junction temperature

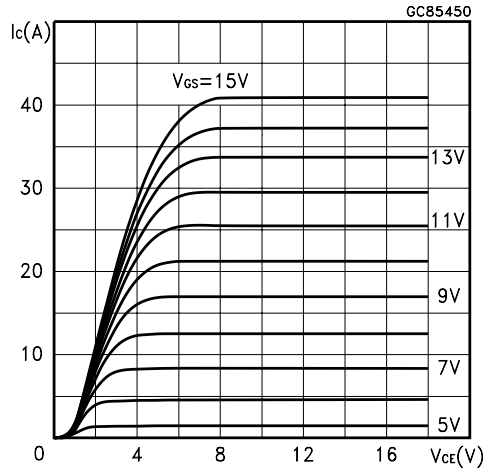
(∗) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(**)Losses Include Also The Tail (Jedec Standardization)

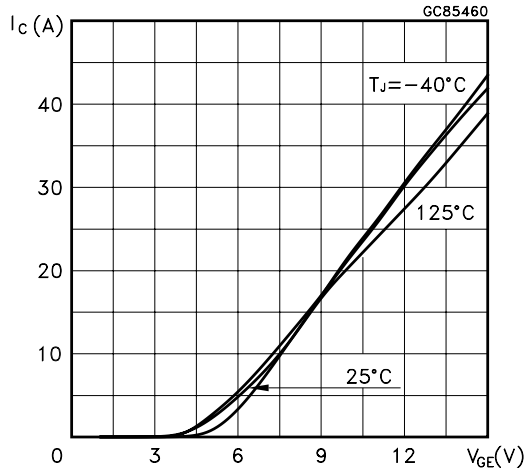
Thermal Impedance



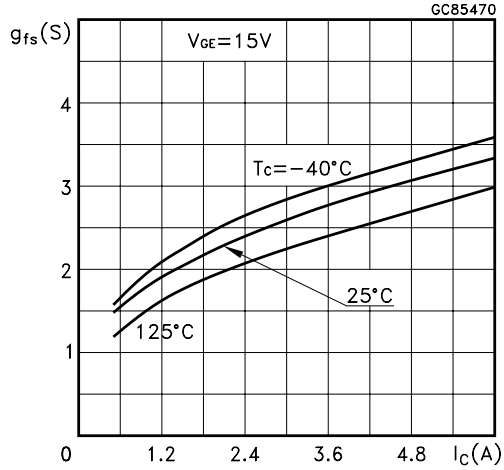
Output Characteristics



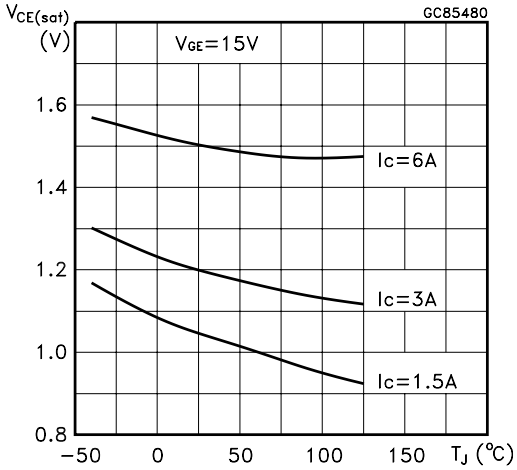

Transfer Characteristics



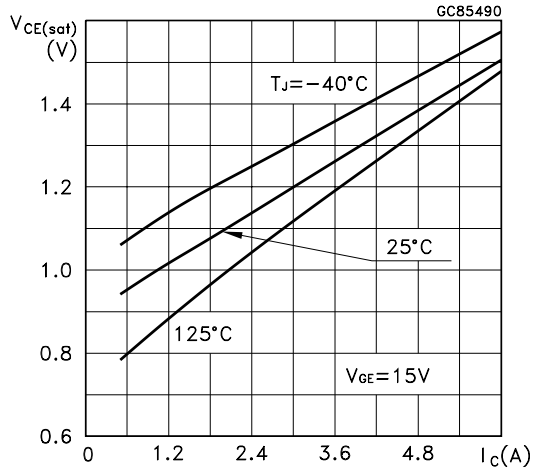

Transconductance



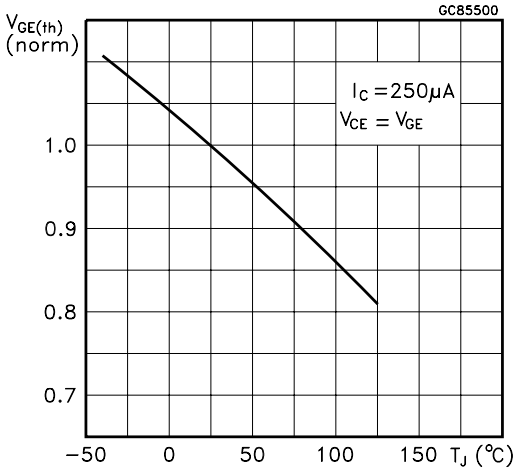

Collector-Emitter On Voltage vs Temperature



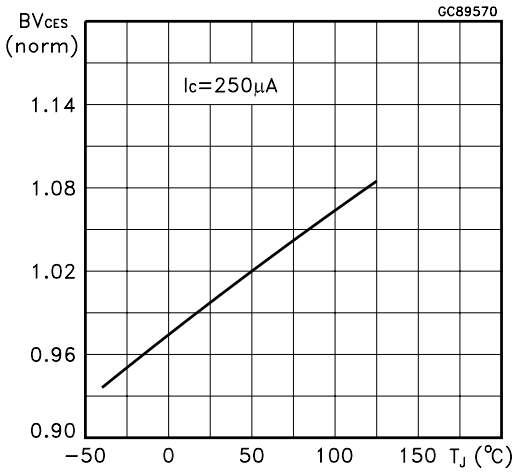

Collector-Emitter On Voltage vs Collector Current



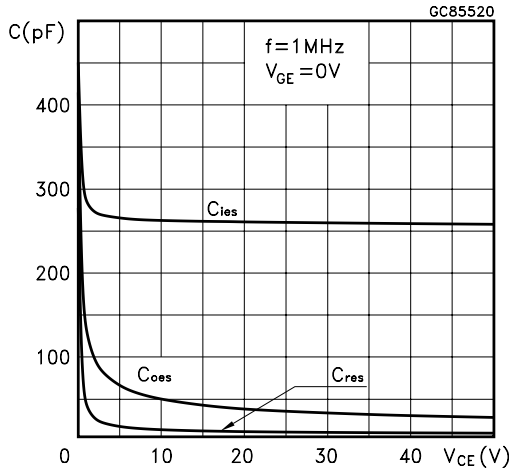

Gate Threshold vs Temperature



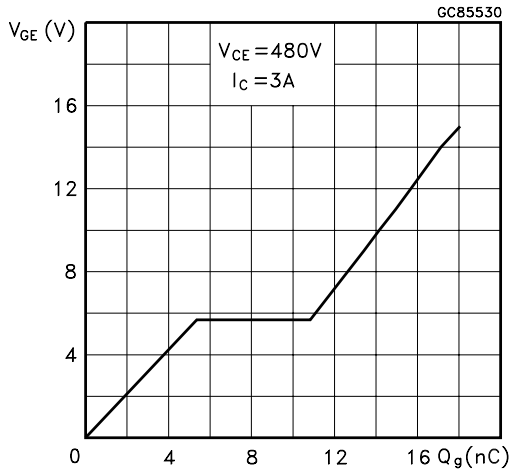
Normalized Breakdown Voltage vs Temperature



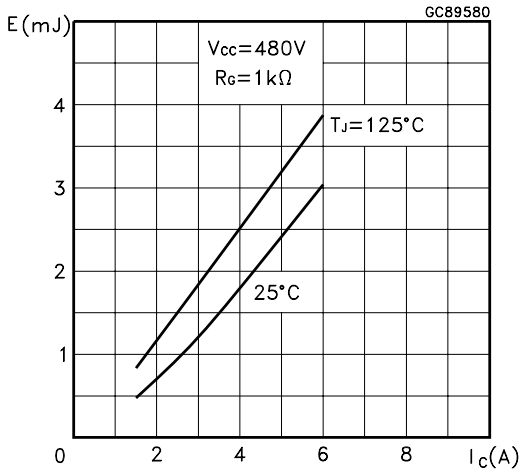

Capacitance Variations



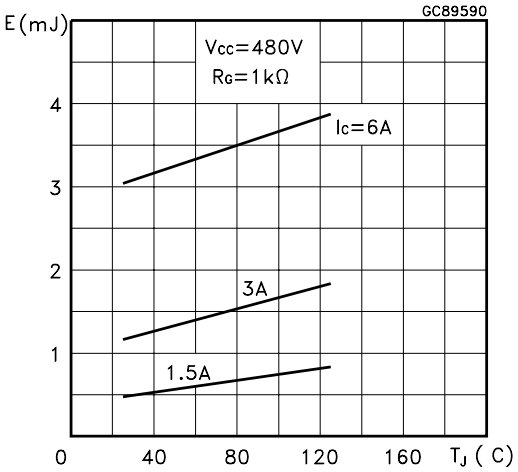

Gate Charge vs Gate-Emitter Voltage



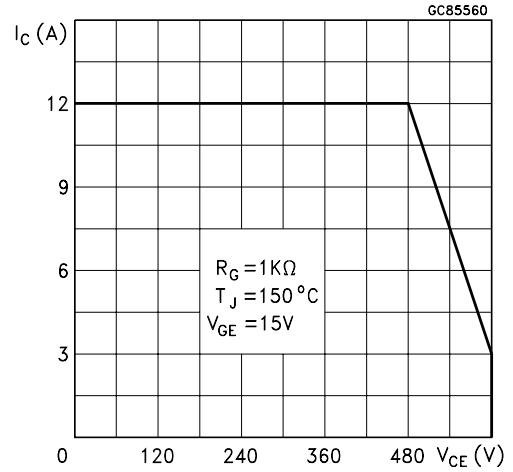

Off Switching Losses vs Ic



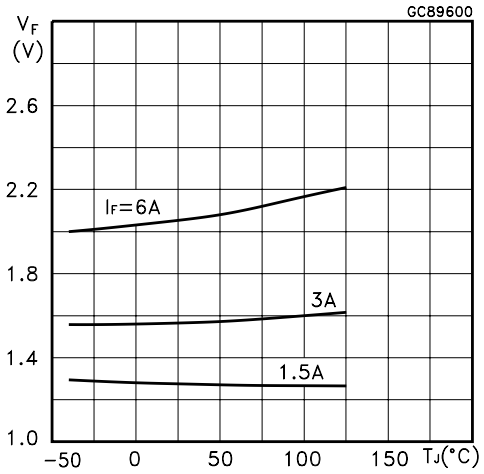

Off Switching Losses vs Tj




Switching Off Safe Operatin Area



Diode Forward vs Tj




Diode Forward Voltage

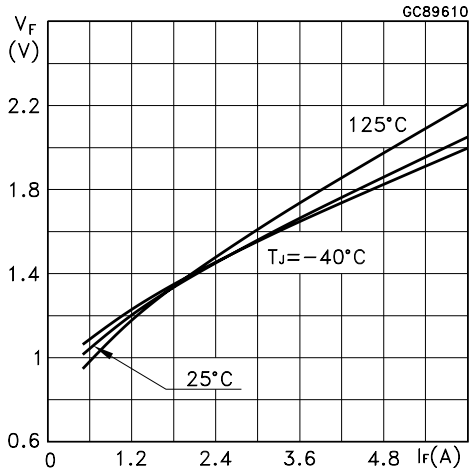
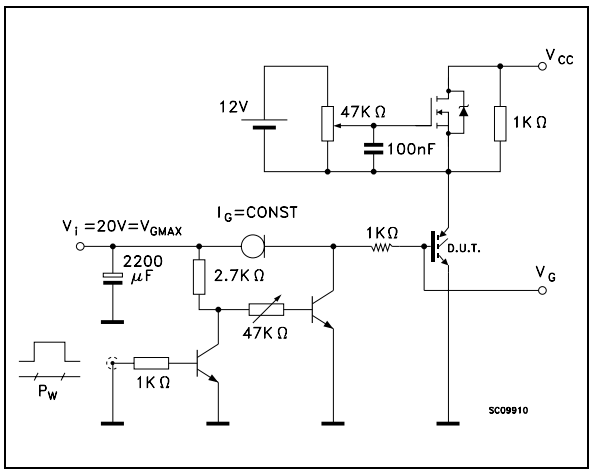



**Fig. 1**: Gate Charge test Circuit

**Fig. 2**: Test Circuit For Inductive Load Switching



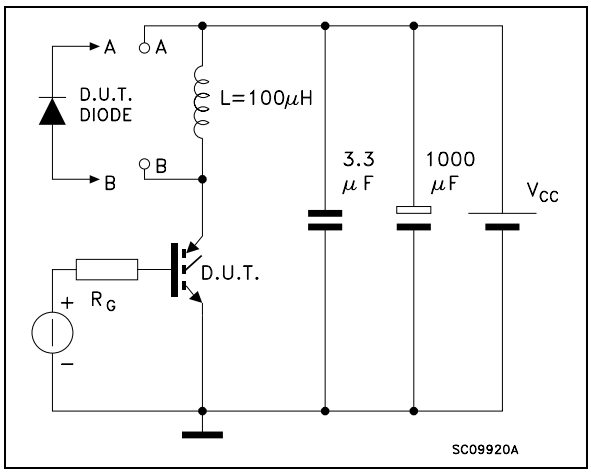
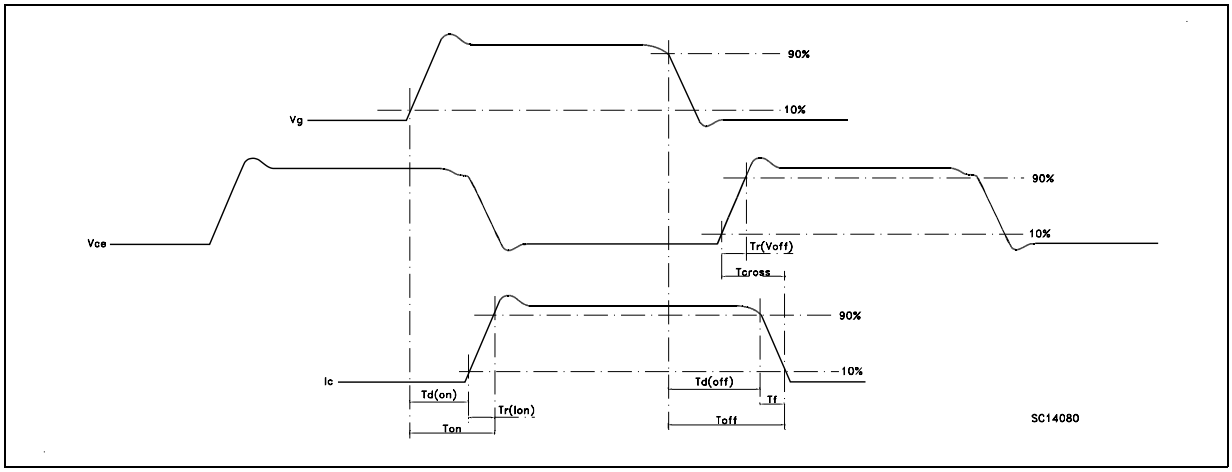
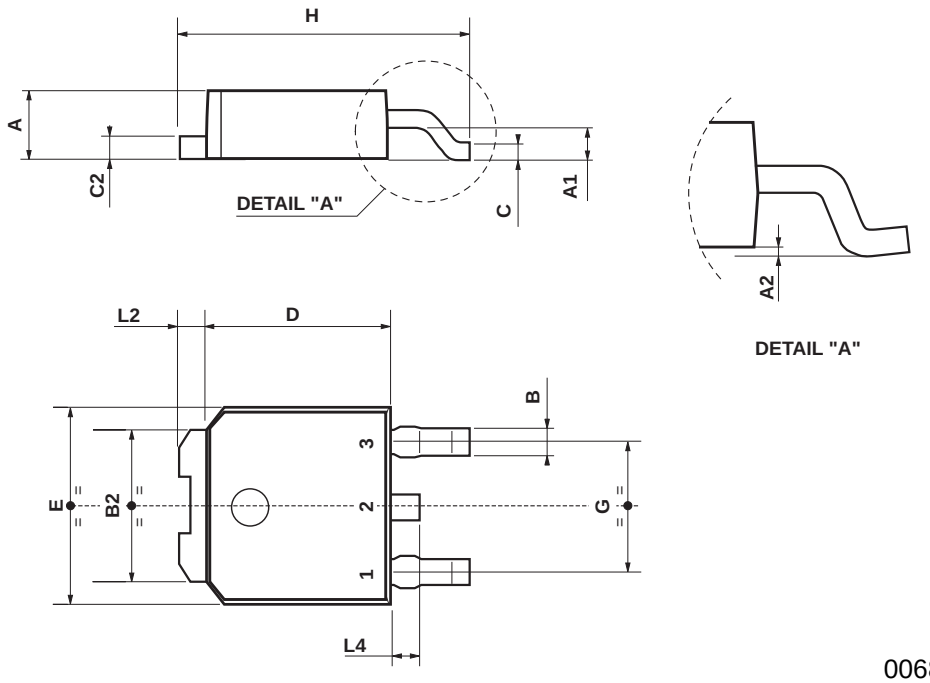




**Fig. 3**: Switching Waveforms



## 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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