



# STGP7NB60H

N-CHANNEL 7A - 600V - TO-220

PowerMESH™ IGBT

| TYPE       | V <sub>CES</sub> | V <sub>CE(sat)</sub> | I <sub>C</sub> |
|------------|------------------|----------------------|----------------|
| STGP7NB60H | 600 V            | < 2.8 V              | 7 A            |

- HIGH INPUT IMPEDANCE
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- OFF LOSSES INCLUDE TAIL CURRENT
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- CO-PACKAGED WITH TURBOSWITCHT
- TYPICAL SHORT CIRCUIT WITHSTAND TIME  
5MICROS S-family, 4 micro H family
- ANTIPARALLEL DIODE

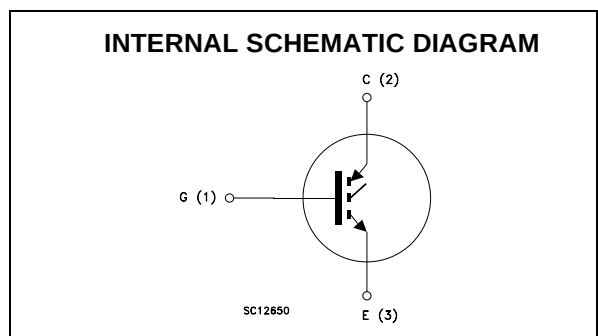
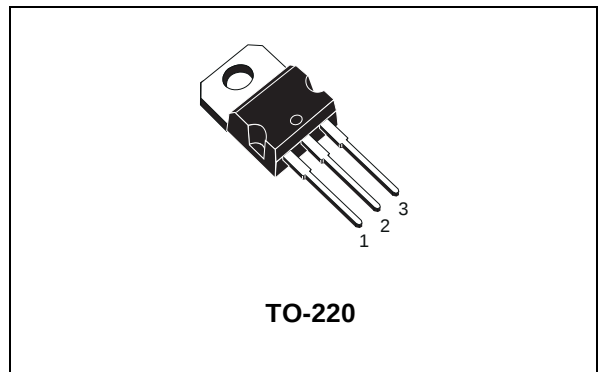
## DESCRIPTION

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 for high frequency applications (up to 50kHz) in order to achieve very high switching performances (reduced t<sub>fall</sub>) maintaining a low voltage drop.

## APPLICATIONS

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



## 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>    | 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  | 14         | A    |
| I <sub>C</sub>      | Collector Current (continuous) at T <sub>C</sub> = 100°C | 7          | A    |
| I <sub>CM</sub> (■) | Collector Current (pulsed)                               | 56         | A    |
| P <sub>TOT</sub>    | Total Dissipation at T <sub>C</sub> = 25°C               | 80         | W    |
|                     | Derating Factor                                          | 0.64       | W/°C |
| T <sub>stg</sub>    | Storage Temperature                                      | -65 to 150 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                      | 150        | °C   |

## STGP7NB60H

### THERMAL DATA

|           |                                         |      |      |
|-----------|-----------------------------------------|------|------|
| Rthj-case | Thermal Resistance Junction-case Max    | 1.56 | °C/W |
| Rthj-amb  | Thermal Resistance Junction-ambient Max | 62.5 | °C/W |
| Rthc-sink | Thermal Resistance Case-sink Typ        | 0.5  | °C/W |

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

#### OFF

| Symbol                | Parameter                                          | Test Conditions                                                                                               | Min. | Typ. | Max.      | Unit     |
|-----------------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------|------|------|-----------|----------|
| V <sub>BR</sub> (CES) | Collectro-Emitter Breakdown Voltage                | I <sub>C</sub> = 250 µA, V <sub>GE</sub> = 0                                                                  | 600  |      |           | V        |
| I <sub>CES</sub>      | Collector cut-off (V <sub>GE</sub> = 0)            | V <sub>CE</sub> = Max Rating, T <sub>C</sub> = 25 °C<br>V <sub>CE</sub> = Max Rating, T <sub>C</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> = ± 20V, V <sub>CE</sub> = 0                                                                  |      |      | ±100      | nA       |

#### ON (1)

| Symbol                | Parameter                            | Test Conditions                                                                                                    | Min. | Typ.       | Max. | Unit   |
|-----------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------|------|------------|------|--------|
| V <sub>GE</sub> (th)  | Gate Threshold Voltage               | V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250µA                                                         | 3    |            | 5    | V      |
| V <sub>CE</sub> (sat) | Collector-Emitter Saturation Voltage | V <sub>GE</sub> = 15V, I <sub>C</sub> = 7 A<br>V <sub>GE</sub> = 15V, I <sub>C</sub> = 7 A, T <sub>J</sub> = 125°C |      | 2.3<br>1.9 | 2.8  | 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> = 3 A                                | 3.5  | 5                 |      | S              |
| C <sub>ies</sub>                                     | Input Capacitance                                                 | V <sub>CE</sub> = 25V, f = 1 MHz, V <sub>GE</sub> = 0                       |      | 560               |      | pF             |
| C <sub>oes</sub>                                     | Output Capacitance                                                |                                                                             |      | 68                |      | pF             |
| C <sub>res</sub>                                     | Reverse Transfer Capacitance                                      |                                                                             |      | 15                |      | pF             |
| Q <sub>g</sub><br>Q <sub>ge</sub><br>Q <sub>gc</sub> | Total Gate Charge<br>Gate-Emitter Charge<br>Gate-Collector Charge | V <sub>CE</sub> = 480V, I <sub>C</sub> = 7 A,<br>V <sub>GE</sub> = 15V      |      | 42<br>7.9<br>17.6 | 55   | nC<br>nC<br>nC |
| I <sub>CL</sub>                                      | Latching Current                                                  | V <sub>clamp</sub> = 480 V, T <sub>J</sub> = 150°C<br>R <sub>G</sub> = 10 Ω | 28   |                   |      | A              |

### SWITCHING ON

| Symbol                                   | Parameter                                         | Test Conditions                                                                                                      | Min. | Typ.      | Max. | Unit       |
|------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------|-----------|------|------------|
| t <sub>d</sub> (on)<br>t <sub>r</sub>    | Turn-on Delay Time<br>Rise Time                   | V <sub>CC</sub> = 480 V, I <sub>C</sub> = 7 A<br>R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15 V                        |      | 15<br>48  |      | ns<br>ns   |
| (di/dt) <sub>on</sub><br>E <sub>on</sub> | Turn-on Current Slope<br>Turn-on Switching Losses | V <sub>CC</sub> = 480 V, I <sub>C</sub> = 7 A R <sub>G</sub> = 10Ω<br>V <sub>GE</sub> = 15 V, T <sub>J</sub> = 125°C |      | 160<br>70 |      | A/µs<br>µJ |

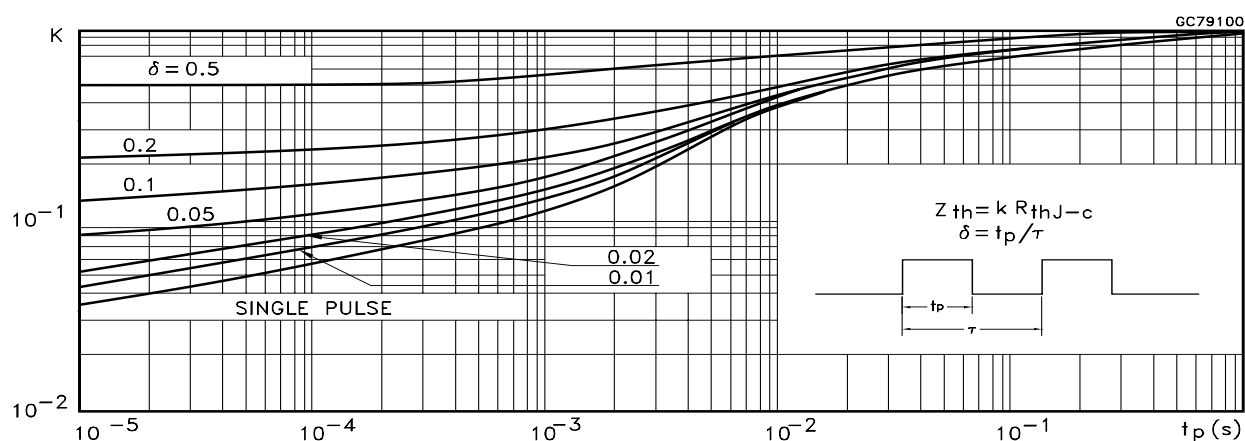
## ELECTRICAL CHARACTERISTICS (CONTINUED)

## SWITCHING OFF

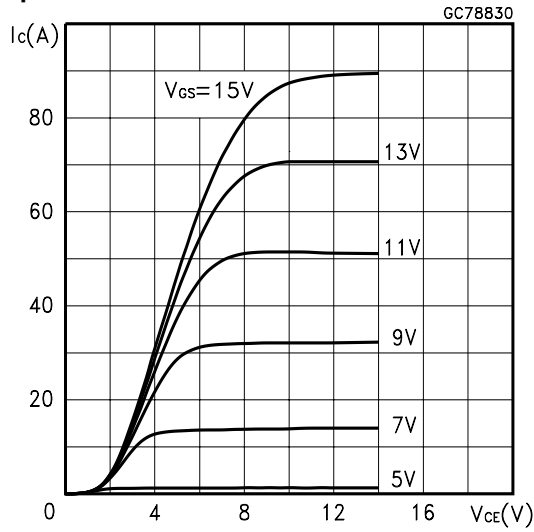
| Symbol         | Parameter               | Test Conditions                                                                                                                         | Min. | Typ. | Max. | Unit          |
|----------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $t_c$          | Cross-over Time         | $V_{CC} = 480\text{ V}$ , $I_C = 7\text{ A}$ ,<br>$R_{GE} = 10\ \Omega$ , $V_{GE} = 15\text{ V}$                                        |      | 85   |      | ns            |
| $t_r(V_{off})$ | Off Voltage Rise Time   |                                                                                                                                         |      | 20   |      | ns            |
| $t_{d(off)}$   | Delay Time              |                                                                                                                                         |      | 75   |      | ns            |
| $t_f$          | Fall Time               |                                                                                                                                         |      | 70   |      | ns            |
| $E_{off(**)}$  | Turn-off Switching Loss |                                                                                                                                         |      | 85   |      | $\mu\text{J}$ |
| $E_{ts}$       | Total Switching Loss    |                                                                                                                                         |      | 130  |      | $\mu\text{J}$ |
| $t_c$          | Cross-over Time         | $V_{CC} = 480\text{ V}$ , $I_C = 3\text{ A}$ ,<br>$R_{GE} = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ ,<br>$T_j = 125\text{ }^\circ\text{C}$ |      | 150  |      | ns            |
| $t_r(V_{off})$ | Off Voltage Rise Time   |                                                                                                                                         |      | 50   |      | ns            |
| $t_{d(off)}$   | Delay Time              |                                                                                                                                         |      | 110  |      | ns            |
| $t_f$          | Fall Time               |                                                                                                                                         |      | 110  |      | ns            |
| $E_{off(**)}$  | Turn-off Switching Loss |                                                                                                                                         |      | 220  |      | $\mu\text{J}$ |
| $E_{ts}$       | Total Switching Loss    |                                                                                                                                         |      | 290  |      | $\mu\text{J}$ |

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
 2. Pulse width limited by max. junction temperature.  
 (\*\*\*) Losses include Also the Tail (Jedec Standardization)

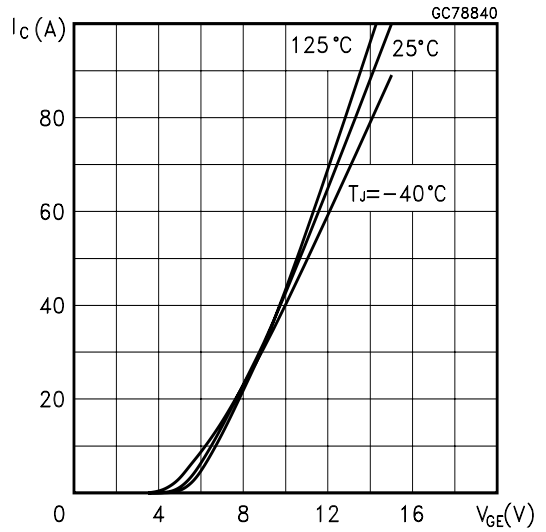
## Thermal Impedance



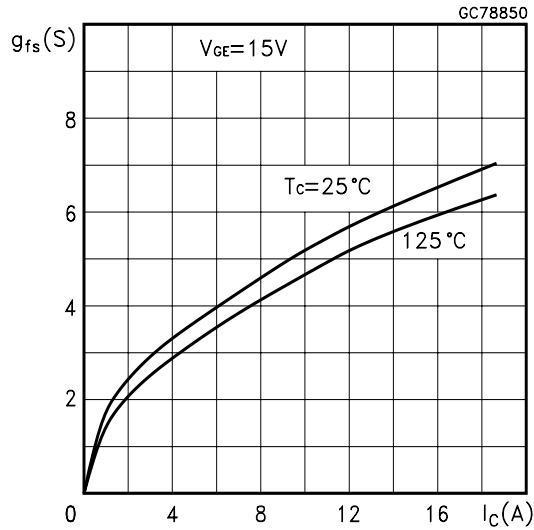
Output Characteristics



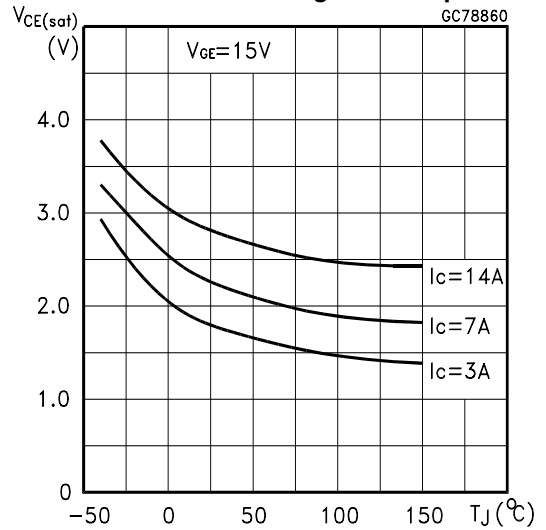
Transfer Characteristics



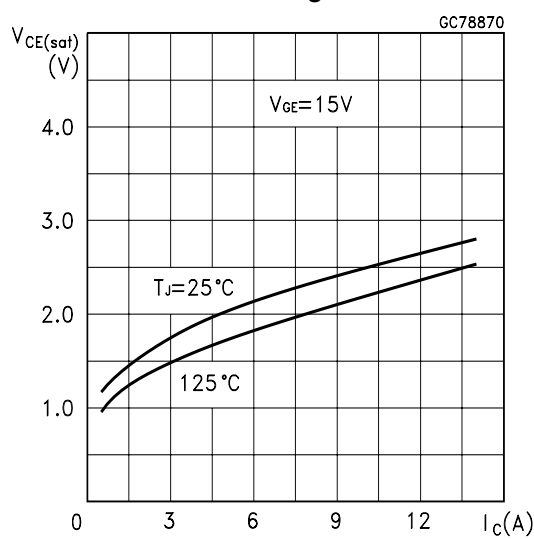
Transconductance



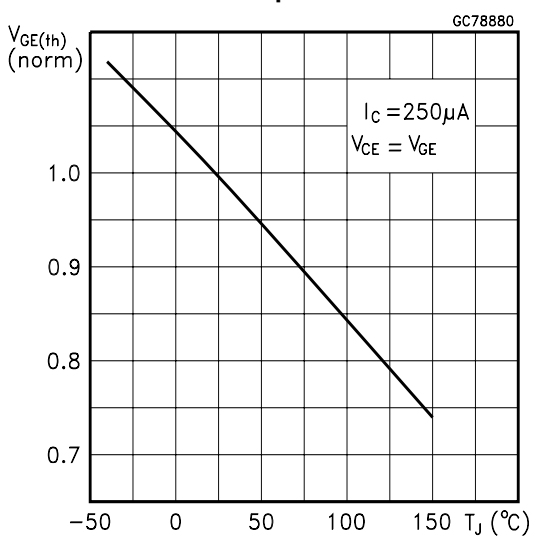
Collector-Emitter On Voltage vs Temperature



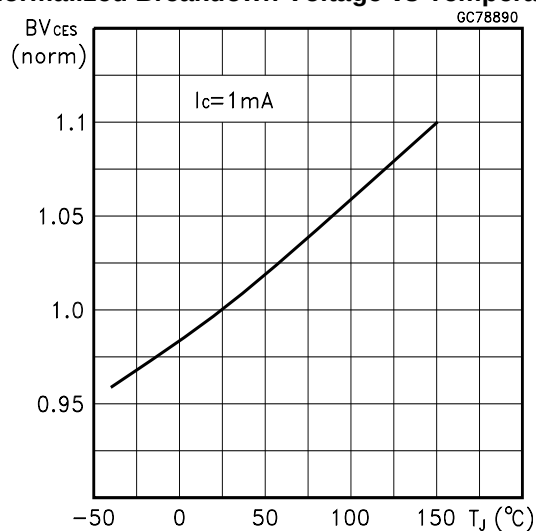
Collector-Emitter On Voltage vs Collector Current



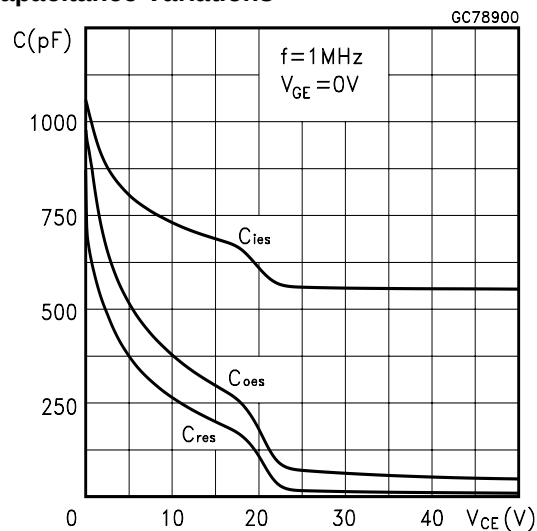
Gate Threshold vs Temperature



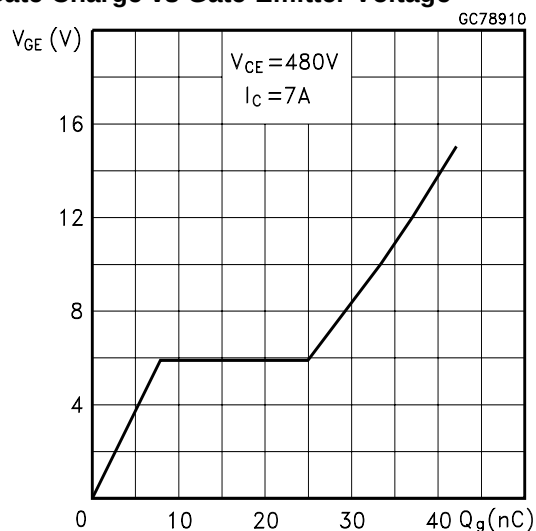
Normalized Breakdown Voltage vs Temperature



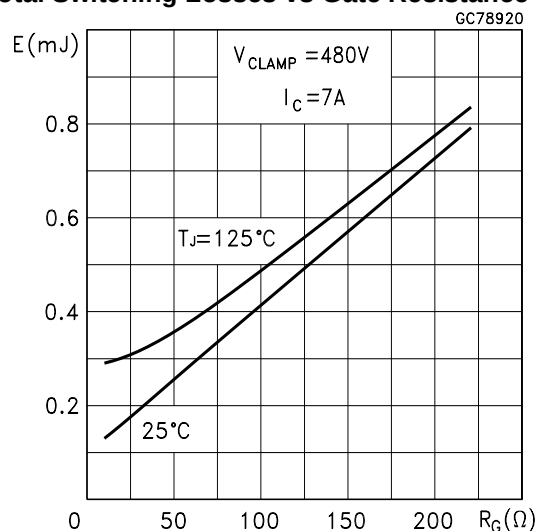
Capacitance Variations



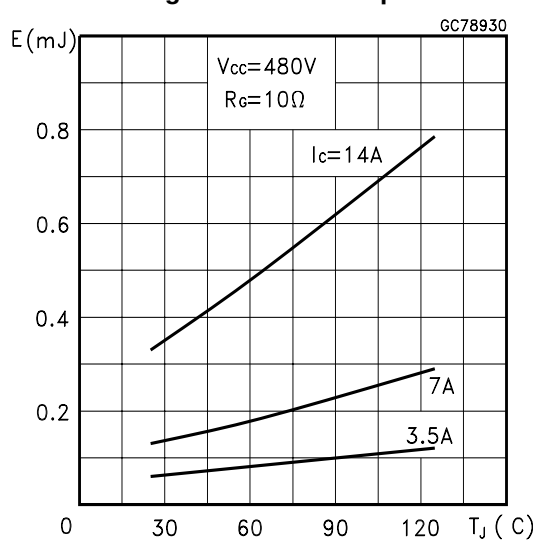
Gate Charge vs Gate-Emitter Voltage



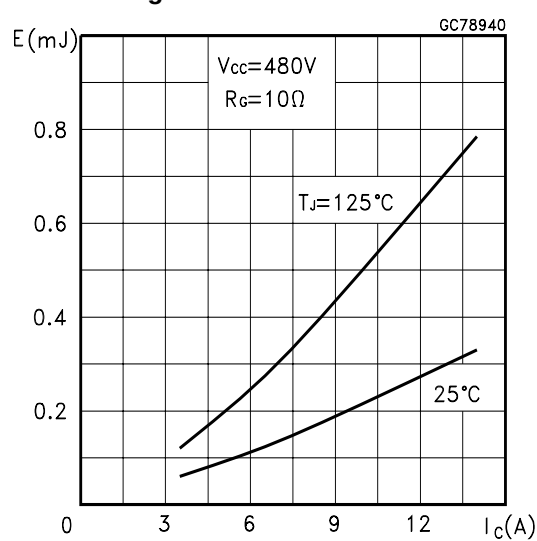
Total Switching Losses vs Gate Resistance



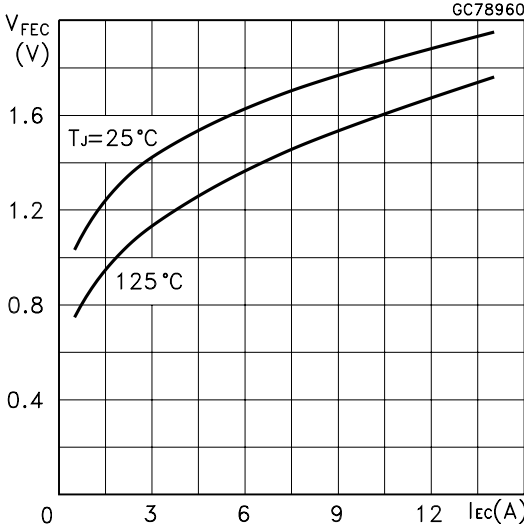
Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



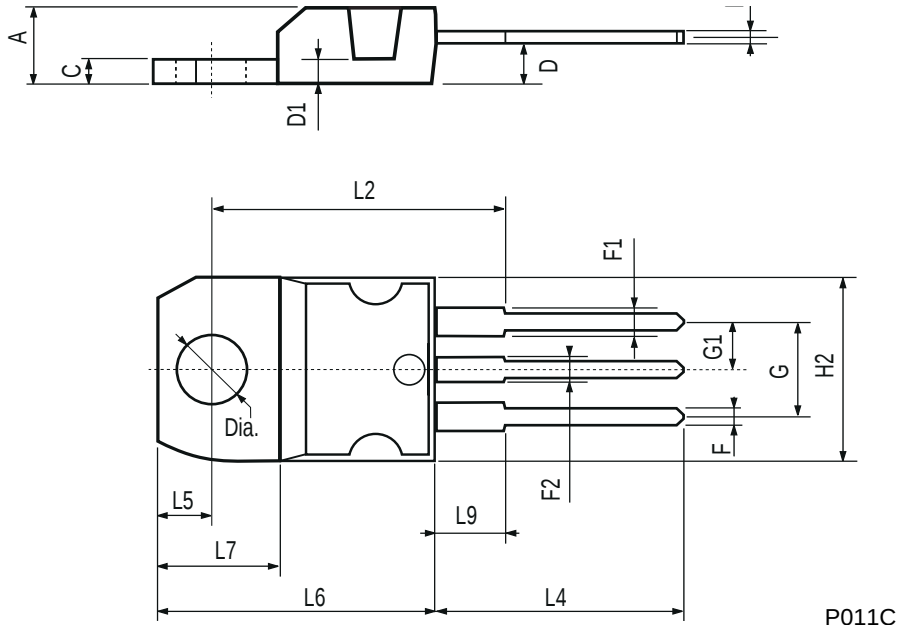
Switching Off Safe Operating Area





TO-220 MECHANICAL DATA

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |      | 4.60  | 0.173 |       | 0.181 |
| C    | 1.23  |      | 1.32  | 0.048 |       | 0.051 |
| D    | 2.40  |      | 2.72  | 0.094 |       | 0.107 |
| D1   |       | 1.27 |       |       | 0.050 |       |
| E    | 0.49  |      | 0.70  | 0.019 |       | 0.027 |
| F    | 0.61  |      | 0.88  | 0.024 |       | 0.034 |
| F1   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| F2   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| G    | 4.95  |      | 5.15  | 0.194 |       | 0.203 |
| G1   | 2.4   |      | 2.7   | 0.094 |       | 0.106 |
| H2   | 10.0  |      | 10.40 | 0.393 |       | 0.409 |
| L2   |       | 16.4 |       |       | 0.645 |       |
| L4   | 13.0  |      | 14.0  | 0.511 |       | 0.551 |
| L5   | 2.65  |      | 2.95  | 0.104 |       | 0.116 |
| L6   | 15.25 |      | 15.75 | 0.600 |       | 0.620 |
| L7   | 6.2   |      | 6.6   | 0.244 |       | 0.260 |
| L9   | 3.5   |      | 3.93  | 0.137 |       | 0.154 |
| DIA. | 3.75  |      | 3.85  | 0.147 |       | 0.151 |



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