



## BUL128D-B

# HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- STMicroelectronics PREFERRED SALESTYPE
- NPN TRANSISTOR
- HIGH VOLTAGE CAPABILITY
- LOW SPREAD OF DYNAMIC PARAMETERS
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- VERY HIGH SWITCHING SPEED
- INTEGRATED ANTIPARALLEL COLLECTOR-EMITTER DIODE

### APPLICATIONS:

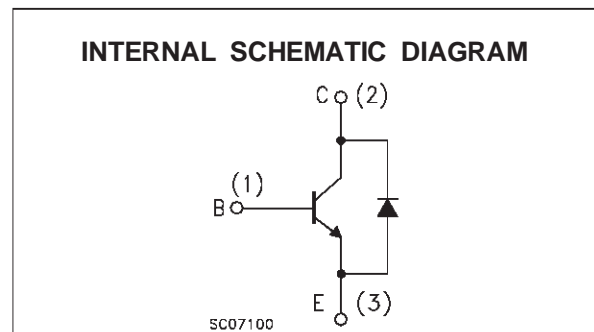
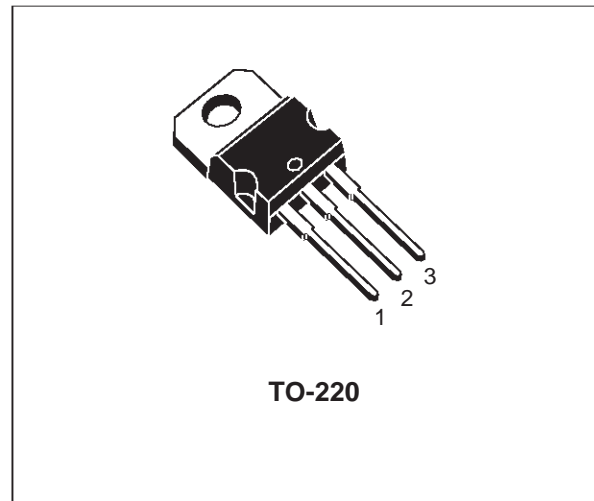
- ELECTRONIC BALLASTS FOR FLUORESCENT LIGHTING
- FLYBACK AND FORWARD SINGLE TRANSISTOR LOW POWER CONVERTERS

### DESCRIPTION

The device is manufactured using high voltage Multi Epitaxial Planar technology for high switching speeds and medium voltage capability.

It uses a Cellular Emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA.

The device is designed for use in lighting applications and low cost switch-mode power supplies.



### ABSOLUTE MAXIMUM RATINGS

| Symbol    | Parameter                                  | Value      | Unit |
|-----------|--|------------|------|
| $V_{CES}$ | Collector-Emitter Voltage ( $V_{BE} = 0$ ) | 700        | V    |
| $V_{CEO}$ | Collector-Emitter Voltage ( $I_B = 0$ )    | 400        | V    |
| $V_{EBO}$ | Emitter-Base Voltage ( $I_C = 0$ )         | 9          | V    |
| $I_C$     | Collector Current                          | 4          | A    |
| $I_{CM}$  | Collector Peak Current ( $t_p < 5$ ms)     | 8          | A    |
| $I_B$     | Base Current                               | 2          | A    |
| $I_{BM}$  | Base Peak Current ( $t_p < 5$ ms)          | 4          | A    |
| $P_{tot}$ | Total Dissipation at $T_c = 25$ °C         | 70         | W    |
| $T_{stg}$ | Storage Temperature                        | -65 to 150 | °C   |
| $T_j$     | Max. Operating Junction Temperature        | 150        | °C   |

## BUL128D-B

### THERMAL DATA

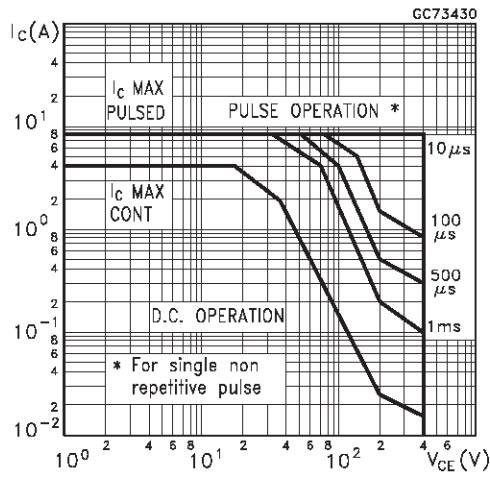
|                       |                                     |     |      |      |
|-----------------------|-------------------------------------|-----|------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-Case    | Max | 1.78 | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-Ambient | Max | 62.5 | °C/W |

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

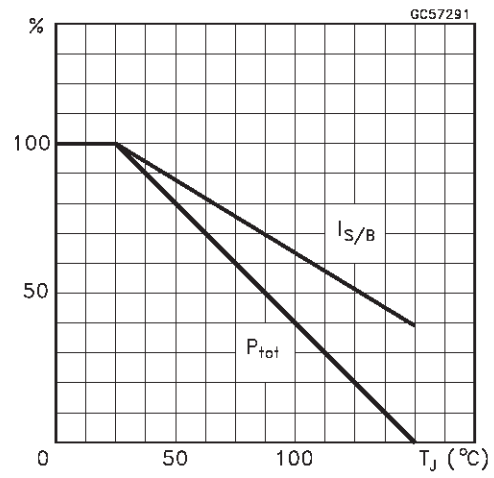
| Symbol                           | Parameter  | Test Conditions  | Min. | Typ. | Max. | Unit |   |
|----------------------------------|--|--|------|------|------|------|---|
| I <sub>CES</sub>                 | Collector Cut-off Current (V <sub>BE</sub> = -1.5 V) | V <sub>CE</sub> = 700 V  |      |      | 100  | μA   |   |
|                                  |  | V <sub>CE</sub> = 700 V      T <sub>j</sub> = 125 °C   |      |      | 500  | μA   |   |
| I <sub>CEO</sub>                 | Collector Cut-off Current (I <sub>B</sub> = 0)       | V <sub>CE</sub> = 400 V  |      |      | 250  | μA   |   |
| V <sub>EBO</sub>                 | Emitter-Base Voltage                                 | I <sub>E</sub> = 10 mA   | 9    |      |      | V    |   |
| V <sub>CEO(sus)</sub>            | Collector-Emitter Sustaining Voltage                 | I <sub>C</sub> = 100 mA      L = 25 mH   | 400  |      |      | V    |   |
| V <sub>CE(sat)*</sub>            | Collector-Emitter Saturation Voltage                 | I <sub>C</sub> = 0.5 A      I <sub>B</sub> = 0.1 A   |      |      | 0.7  | V    |   |
|                                  |  | I <sub>C</sub> = 1 A      I <sub>B</sub> = 0.2 A   |      |      | 1.0  | V    |   |
|                                  |  | I <sub>C</sub> = 2.5 A      I <sub>B</sub> = 0.5 A   |      | 0.5  |      | 1.5  | V |
|                                  |  | I <sub>C</sub> = 4 A      I <sub>B</sub> = 1 A   |      |      |      |      | V |
| V <sub>BE(sat)*</sub>            | Base-Emitter Saturation Voltage                      | I <sub>C</sub> = 0.5 A      I <sub>B</sub> = 0.1 A   |      |      | 1.1  | V    |   |
|                                  |  | I <sub>C</sub> = 1 A      I <sub>B</sub> = 0.2 A   |      |      | 1.2  | V    |   |
|                                  |  | I <sub>C</sub> = 2.5 A      I <sub>B</sub> = 0.5 A   |      |      | 1.3  | V    |   |
| h <sub>FE*</sub>                 | DC Current Gain                                      | I <sub>C</sub> = 10 mA      V <sub>CE</sub> = 5 V  | 10   |      |      |      |   |
|                                  |  | I <sub>C</sub> = 2 A      V <sub>CE</sub> = 5 V  | 8    |      | 40   |      |   |
| V <sub>f</sub>                   | Forward Voltage Drop                                 | I <sub>f</sub> = 2 A   |      |      | 2.5  | V    |   |
| t <sub>s</sub><br>t <sub>f</sub> | INDUCTIVE LOAD<br>Storage Time<br>Fall Time          | V <sub>CC</sub> = 200 V      I <sub>C</sub> = 2 A  |      | 0.6  |      | μs   |   |
|                                  |  | I <sub>B1</sub> = 0.4 A      V <sub>BE(off)</sub> = -5 V<br>R <sub>BB</sub> = 0 Ω      L = 200 μH<br>(see fig.1) |      | 0.1  |      | μs   |   |
| t <sub>s</sub><br>t <sub>f</sub> | RESISTIVE LOAD<br>Storage Time<br>Fall Time          | V <sub>CC</sub> = 250 V      I <sub>C</sub> = 2 A  | 2    | 0.2  | 2.9  | μs   |   |
|                                  |  | I <sub>B1</sub> = 0.4 A      I <sub>B2</sub> = -0.4 A<br>T <sub>p</sub> = 30 μs      (see fig.2)                 |      |      |      | μs   |   |

\* Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %

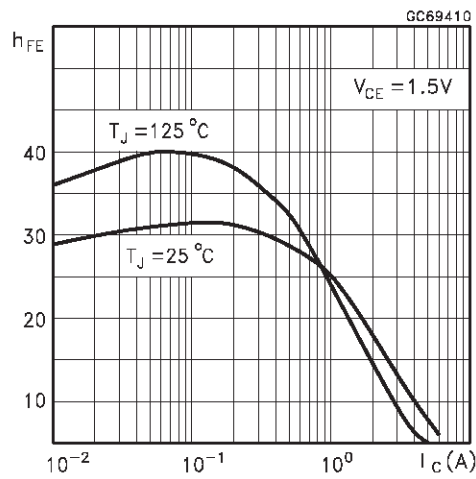
Safe Operating Areas



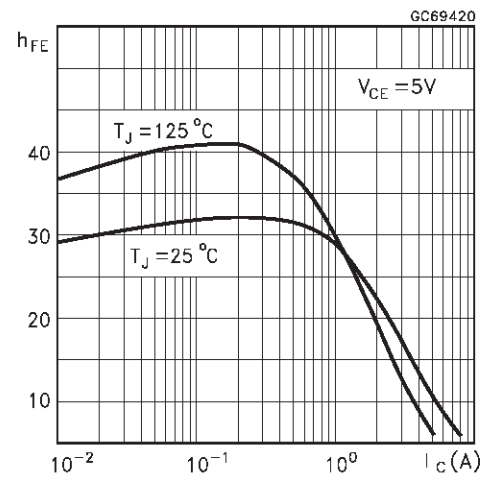
Derating Curve



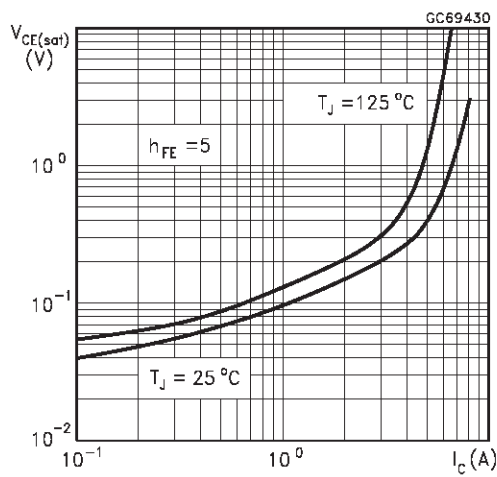
DC Current Gain



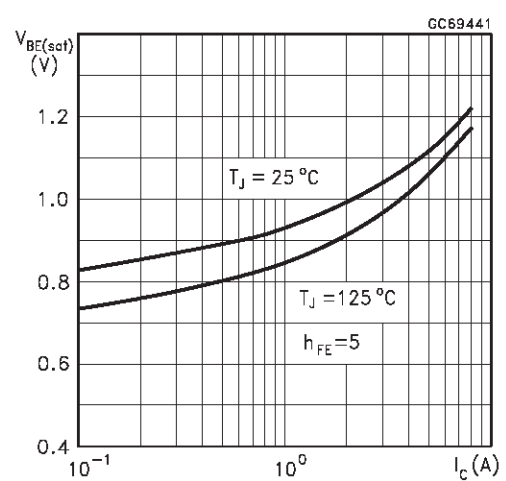
DC Current Gain



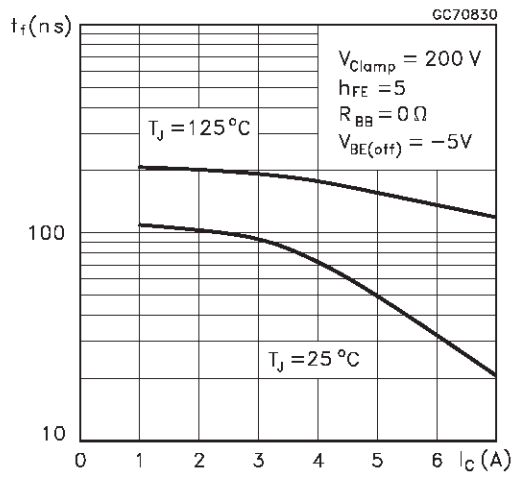
Collector Emitter Saturation Voltage



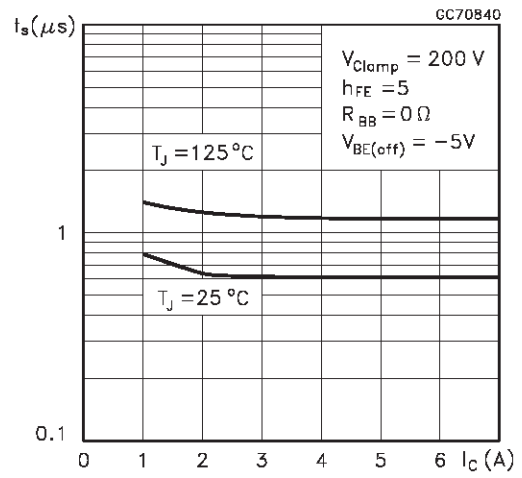
Base Emitter Saturation Voltage



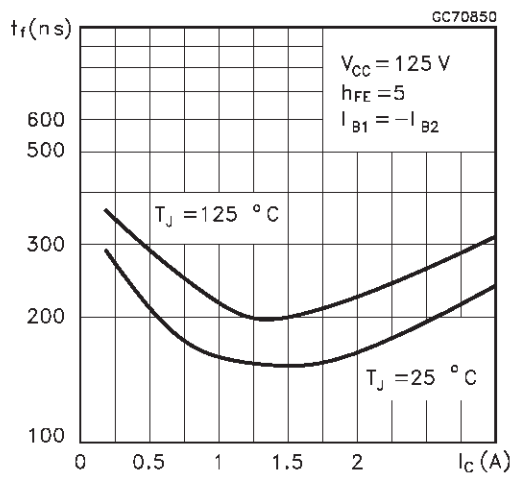
Inductive Fall Time



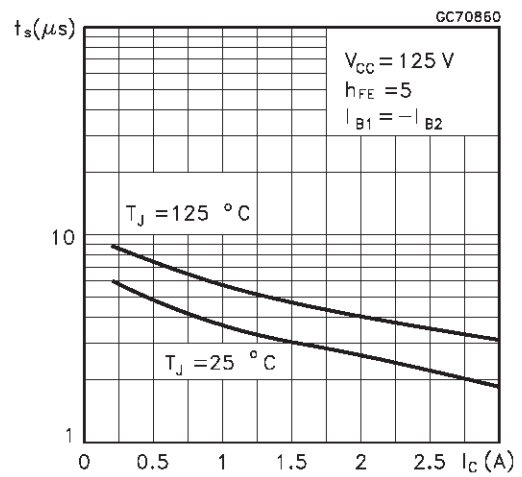
Inductive Storage Time



Resistive Load Fall Time



Resistive Load Storage Time



Reverse Biased SOA

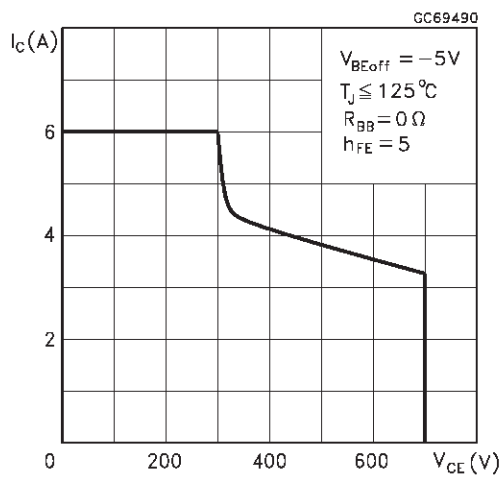


Figure 1: Inductive Load Switching Test Circuits.

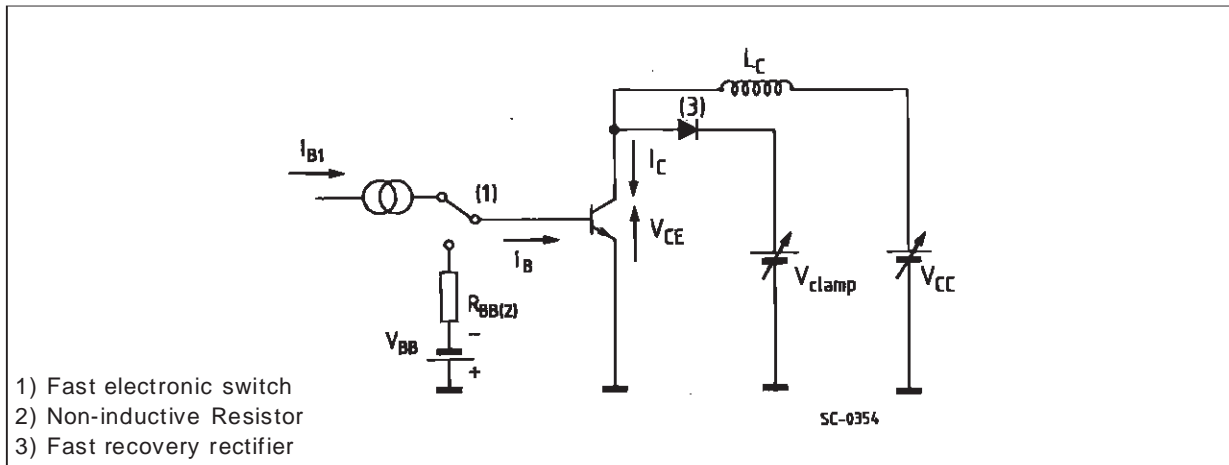
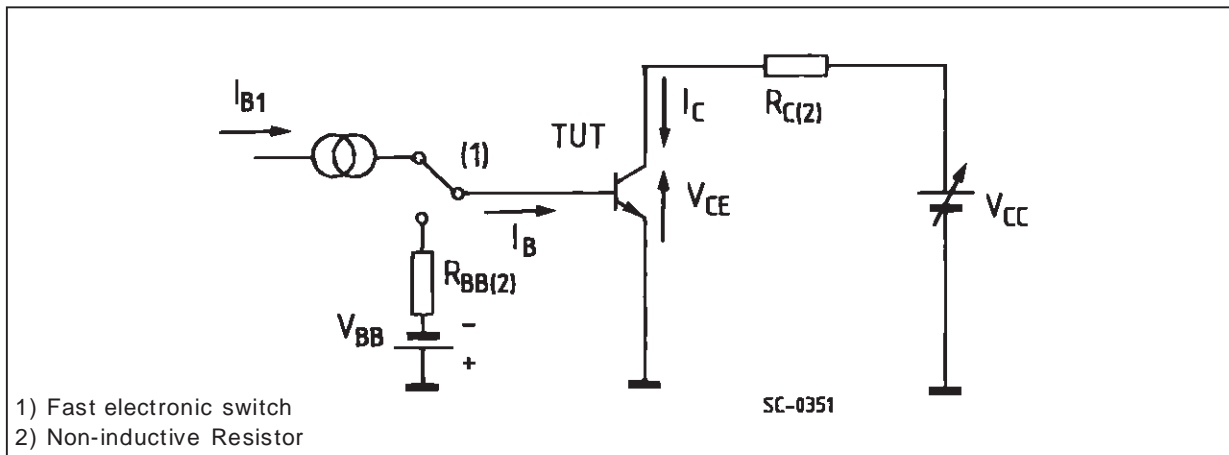
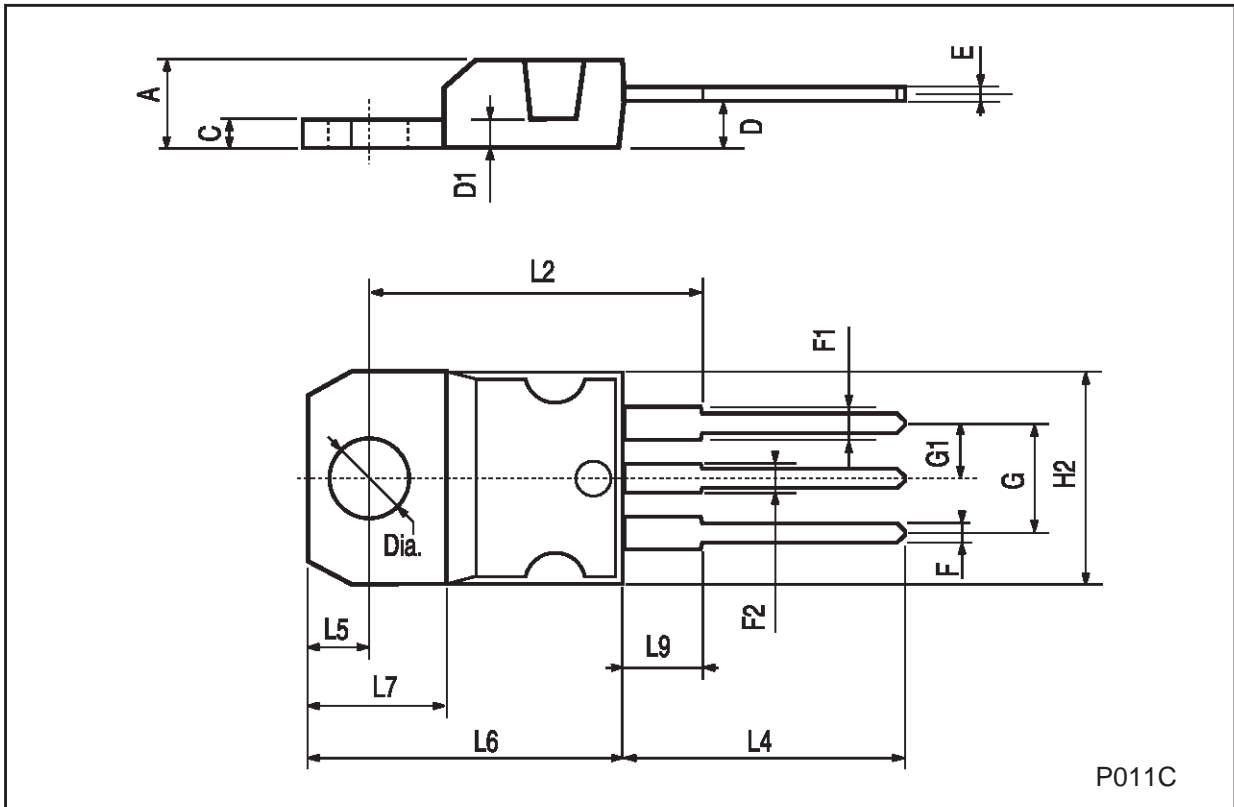


Figure 2: Resistive Load Switching Test Circuits.



**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 |



P011C

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 registered trademark of STMicroelectronics

© 1998 STMicroelectronics – Printed in Italy – All Rights Reserved

STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - France - Germany - Italy - Japan - Korea - Malaysia - Malta - Mexico - Morocco - The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.

<http://www.st.com>