



## BUL1203E

# HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- HIGH VOLTAGE CAPABILITY
- LOW SPREAD OF DYNAMIC PARAMETERS
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- VERY HIGH SWITCHING SPEED

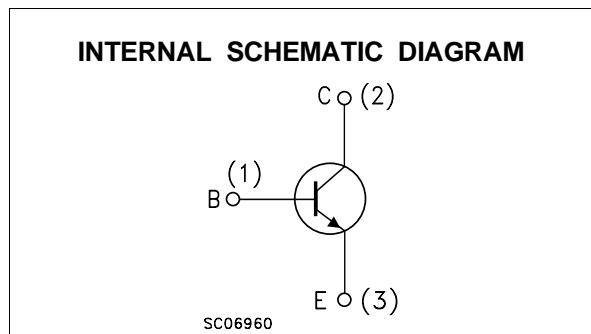
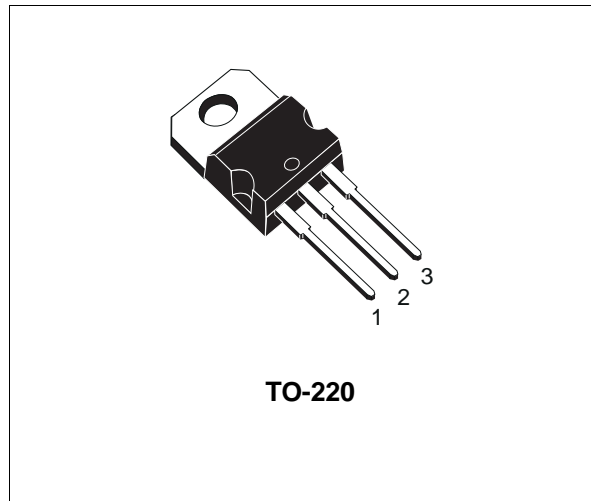
### APPLICATIONS

- ELECTRONIC BALLASTS FOR FLUORESCENT LIGHTING (277 V HALF BRIDGE AND 120 V PUSH-PULL TOPOLOGIES)

### DESCRIPTION

The BUL1203E is a new device manufactured using Diffused Collector technology to enhance switching speeds and tight  $h_{FE}$  range while maintaining a wide RBSOA.

Thanks to his structure it has an intrinsic ruggedness which enables the transistor to withstand a high collector current level during Breakdown condition, without using the transil protection usually necessary in typical converters for lamp ballast.



### ABSOLUTE MAXIMUM RATINGS

| Symbol    | Parameter                                  | Value      | Unit |
|-----------|--|------------|------|
| $V_{CBO}$ | Collector-Base Voltage ( $I_E = 0$ )       | 1200       | V    |
| $V_{CES}$ | Collector-Emitter Voltage ( $V_{BE} = 0$ ) | 1200       | V    |
| $V_{CEO}$ | Collector-Emitter Voltage ( $I_B = 0$ )    | 550        | V    |
| $V_{EBO}$ | Emitter-Base Voltage ( $I_C = 0$ )         | 9          | V    |
| $I_C$     | Collector Current                          | 5          | 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         | 100        | W    |
| $T_{stg}$ | Storage Temperature                        | -65 to 150 | °C   |
| $T_j$     | Max. Operating Junction Temperature        | 150        | °C   |

# BUL1203E

## THERMAL DATA

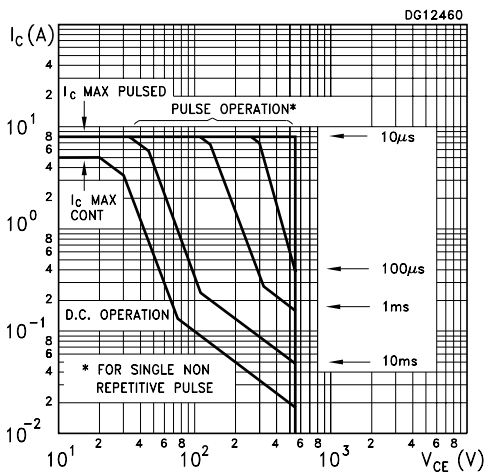
|                       |                                  |     |      |      |
|-----------------------|----------------------------------|-----|------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case | Max | 1.25 | °C/W |
|-----------------------|----------------------------------|-----|------|------|

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

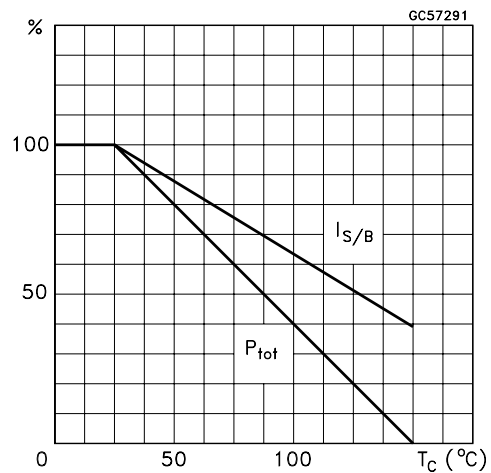
| Symbol  | Parameter   | Test Conditions   | Min.                | Typ.       | Max.              | Unit           |
|---|---|---|---------------------|------------|-------------------|----------------|
| I <sub>CES</sub>                                    | Collector Cut-off Current (V <sub>BE</sub> = 0)             | V <sub>CE</sub> = 1200 V  |                     |            | 100               | μA             |
| I <sub>CEO</sub>                                    | Collector Cut-off Current (I <sub>B</sub> = 0)              | V <sub>CE</sub> = 550 V   |                     |            | 100               | μA             |
| V <sub>CEO(sus)*</sub>                              | Collector-Emitter Sustaining Voltage (I <sub>B</sub> = 0)   | I <sub>C</sub> = 100 mA      L = 25 mH  | 550                 |            |                   | V              |
| V <sub>EBO</sub>                                    | Emitter-Base Voltage (I <sub>C</sub> = 0)                   | I <sub>E</sub> = 10 mA  | 9                   |            |                   | V              |
| V <sub>CE(sat)*</sub>                               | Collector-Emitter Saturation Voltage                        | I <sub>C</sub> = 1 A      I <sub>B</sub> = 0.2 A<br>I <sub>C</sub> = 2 A      I <sub>B</sub> = 0.4 A<br>I <sub>C</sub> = 3 A      I <sub>B</sub> = 1 A  |                     |            | 0.5<br>0.7<br>1.5 | V<br>V<br>V    |
| V <sub>BE(sat)*</sub>                               | Base-Emitter Saturation Voltage                             | I <sub>C</sub> = 2 A      I <sub>B</sub> = 0.4 A<br>I <sub>C</sub> = 3 A      I <sub>B</sub> = 1 A  |                     |            | 1.5<br>1.5        | V<br>V         |
| h <sub>FE*</sub>                                    | DC Current Gain   | I <sub>C</sub> = 1 mA      V <sub>CE</sub> = 5 V<br>I <sub>C</sub> = 10 mA      V <sub>CE</sub> = 5 V<br>I <sub>C</sub> = 0.8 A      V <sub>CE</sub> = 3 V<br>I <sub>C</sub> = 2 A      V <sub>CE</sub> = 5 V | 10<br>10<br>14<br>9 |            | 32<br>28          |                |
| t <sub>on</sub><br>t <sub>s</sub><br>t <sub>f</sub> | RESISTIVE LOAD<br>Turn-on Time<br>Storage Time<br>Fall Time | I <sub>C</sub> = 2 A      I <sub>B1</sub> = 0.4 A<br>I <sub>B2</sub> = -0.8 A      t <sub>p</sub> = 30 μs<br>V <sub>CC</sub> = 150 V      (see figure 2)  |                     | 2.5<br>0.2 | 0.5<br>3.0<br>0.3 | μs<br>μs<br>μs |
| E <sub>ar</sub>                                     | Repetitive Avalanche Energy                                 | L = 2 mH      C = 1.8 nF<br>V <sub>CC</sub> = 50 V      V <sub>BE</sub> = -5 V<br>(see figure 3)  | 6                   |            |                   | mJ             |

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

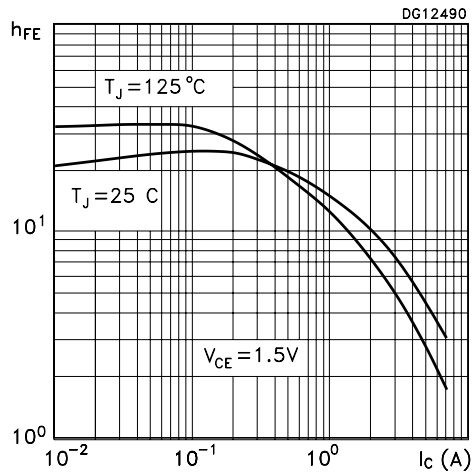
## Safe Operating Area



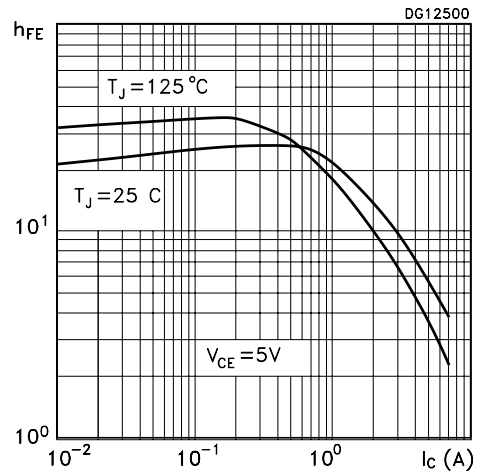
## Derating Curve



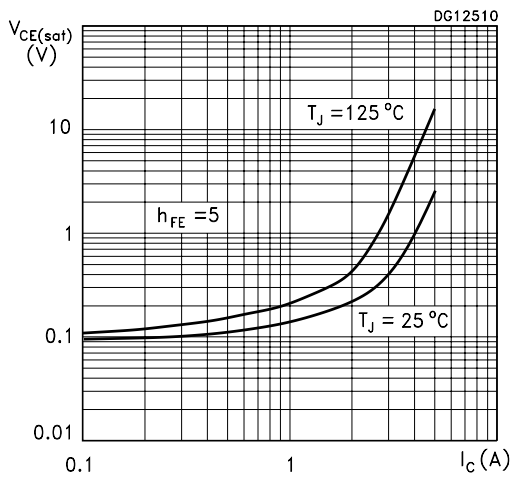
DC Current Gain



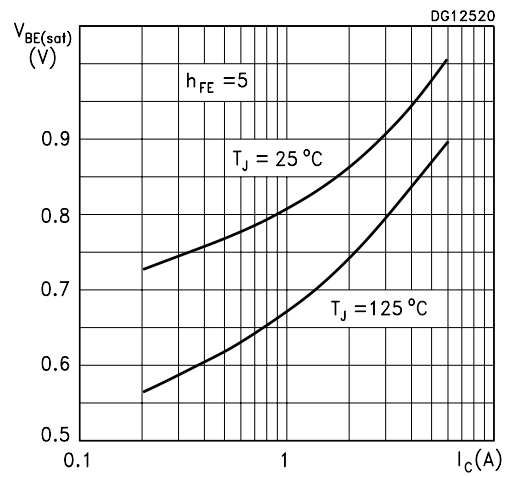
DC Current Gain



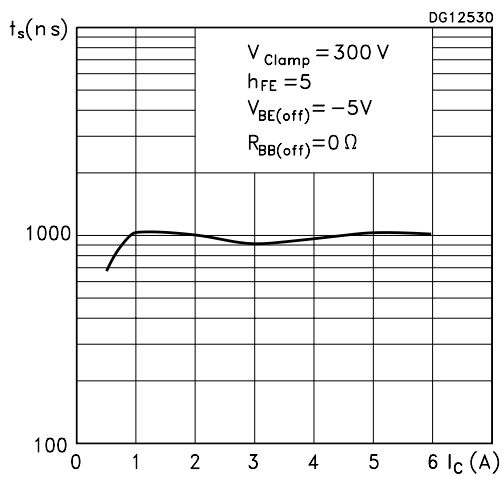
Collector-Emitter Saturation Voltage



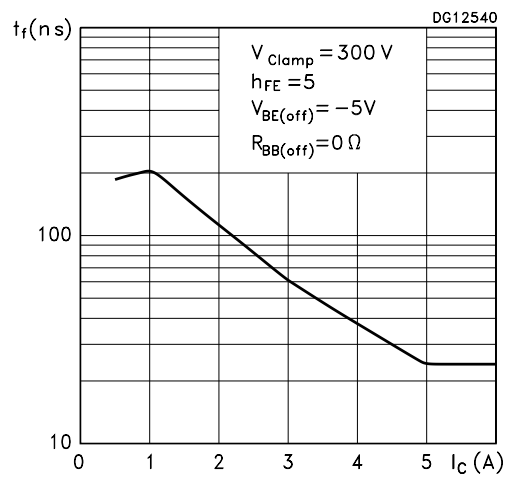
Base-Emitter Saturation Voltage



Inductive Load Storage Time



Inductive Load Fall Time



Reverse Biased Safe Operating Area

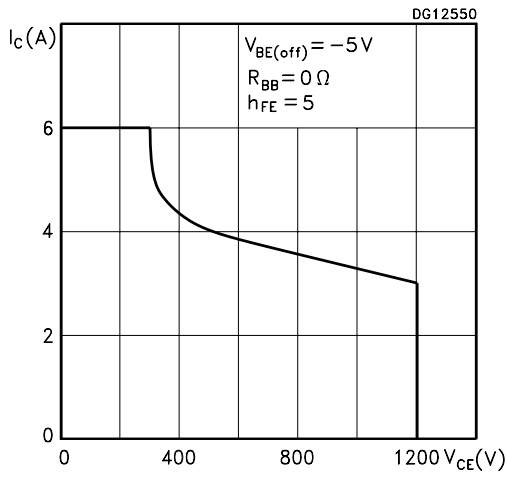


Figure 1: Inductive Load Switching Test Circuit

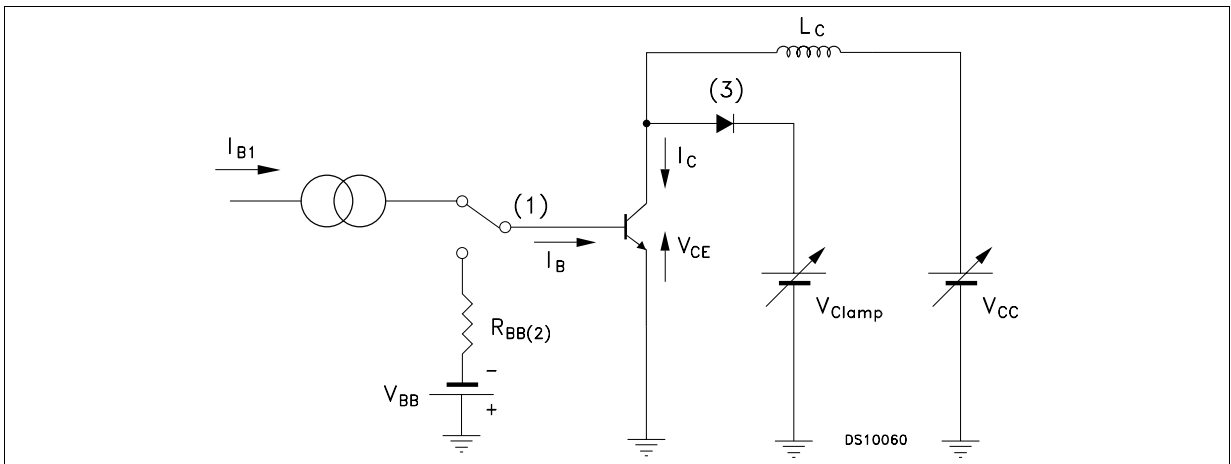


Figure 2: Resistive Load Switching Test Circuit

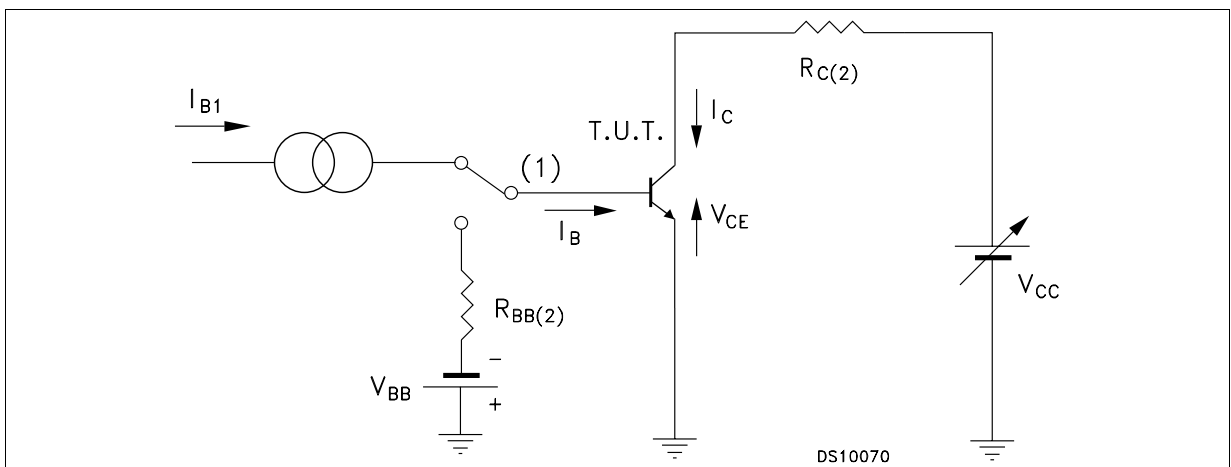
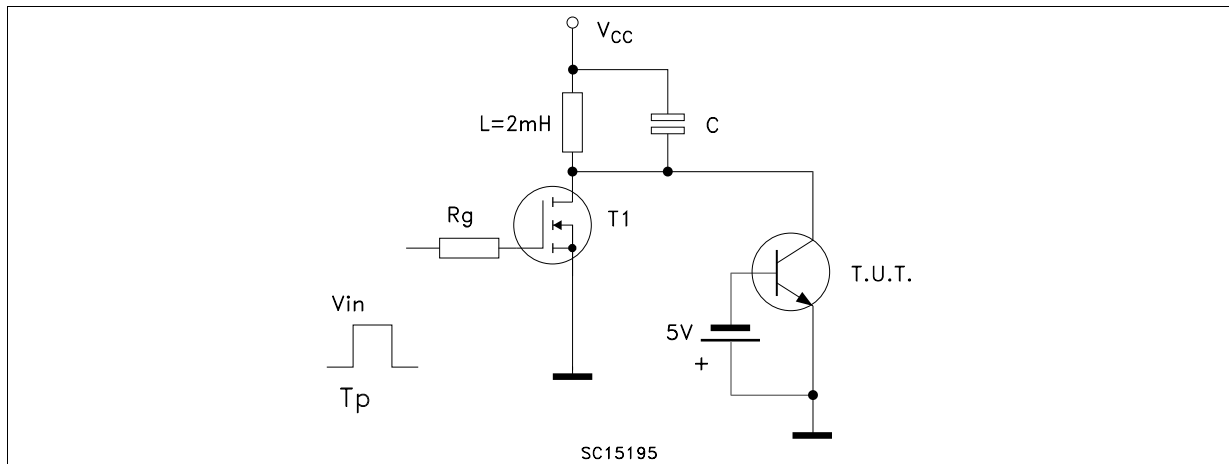
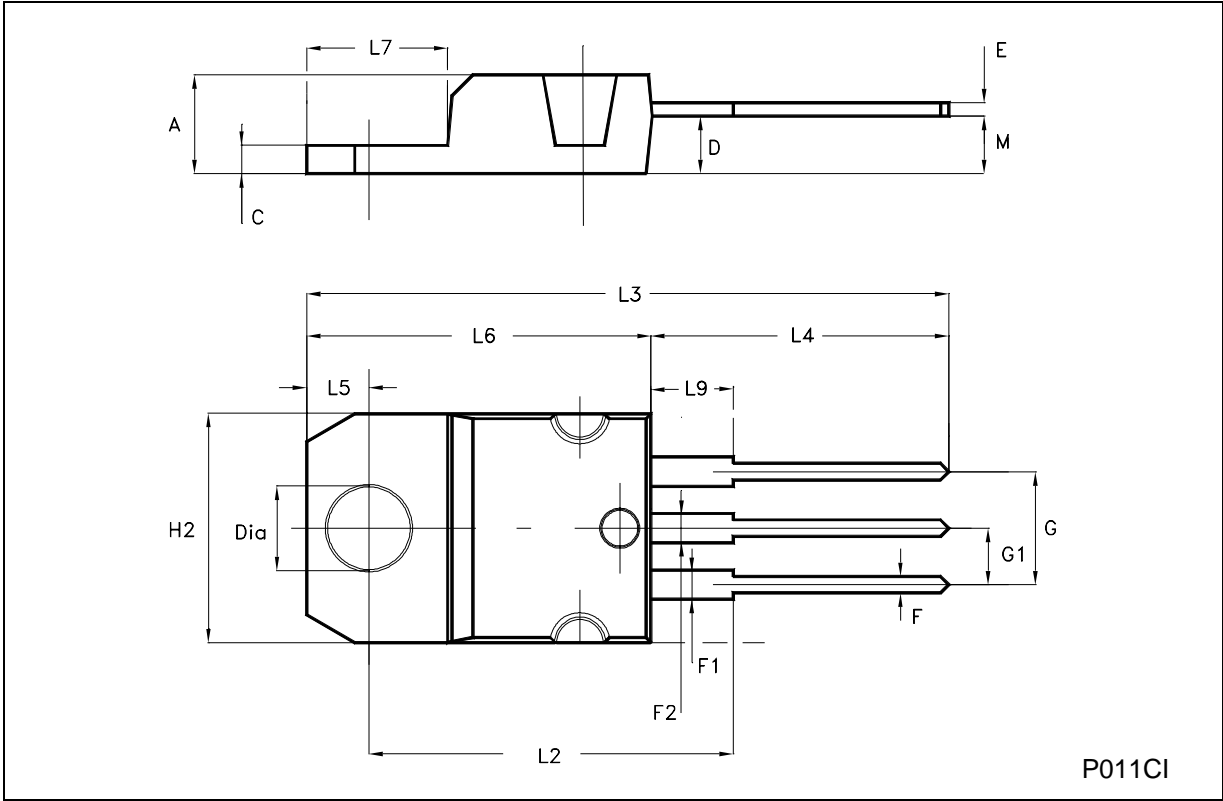


Figure 3: Energy Rating Test Circuit



**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 |       | 0.052 |
| D    | 2.40  |       | 2.72  | 0.094 |       | 0.107 |
| 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 |       | 0.202 |
| G1   | 2.40  |       | 2.70  | 0.094 |       | 0.106 |
| H2   | 10.00 |       | 10.40 | 0.394 |       | 0.409 |
| L2   |       | 16.40 |       |       | 0.645 |       |
| L4   | 13.00 |       | 14.00 | 0.511 |       | 0.551 |
| L5   | 2.65  |       | 2.95  | 0.104 |       | 0.116 |
| L6   | 15.25 |       | 15.75 | 0.600 |       | 0.620 |
| L7   | 6.20  |       | 6.60  | 0.244 |       | 0.260 |
| L9   | 3.50  |       | 3.93  | 0.137 |       | 0.154 |
| M    |       | 2.60  |       |       | 0.102 |       |
| DIA. | 3.75  |       | 3.85  | 0.147 |       | 0.151 |



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