

## High voltage fast-switching NPN power transistor

### Features

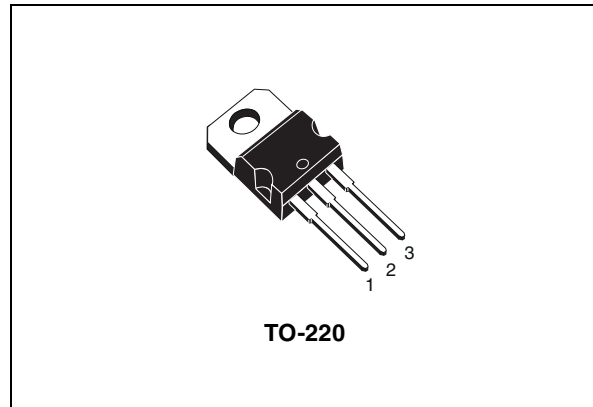
- High voltage capability
- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

### Applications

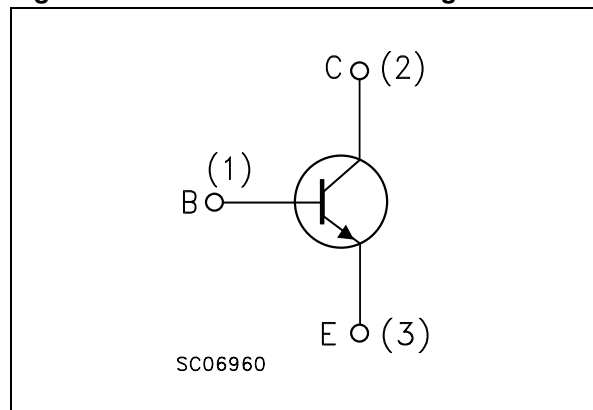
- Electronic ballast for fluorescent lighting
- Electronic transformer for halogen lamps

### Description

The device is manufactured using high voltage Multi Epitaxial Planar technology for high switching speeds. It uses a cellular emitter structure with planar edge termination to enhance switching speeds while maintaining a satisfactory RBSOA.



**Figure 1. Internal schematic diagrams**



**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|------------|---------|---------|-----------|
| TR136      | TR136   | TO-220  | Tube      |

# 1 Electrical ratings

**Table 2. Absolute maximum rating**

| 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                                | 3          | A                |
| $I_{CM}$  | Collector peak current ( $t_P < 5\text{ms}$ )    | 6          | A                |
| $I_B$     | Base current                                     | 1.5        | A                |
| $I_{BM}$  | Base peak current ( $t_P < 5\text{ms}$ )         | 3          | A                |
| $P_{tot}$ | Total dissipation at $T_c \leq 25^\circ\text{C}$ | 60         | W                |
| $T_{stg}$ | Storage temperature                              | -65 to 150 | $^\circ\text{C}$ |
| $T_J$     | Max. operating junction temperature              | 150        | $^\circ\text{C}$ |

## 2 Electrical characteristics

( $T_{\text{case}} = 25^{\circ}\text{C}$  unless otherwise specified)

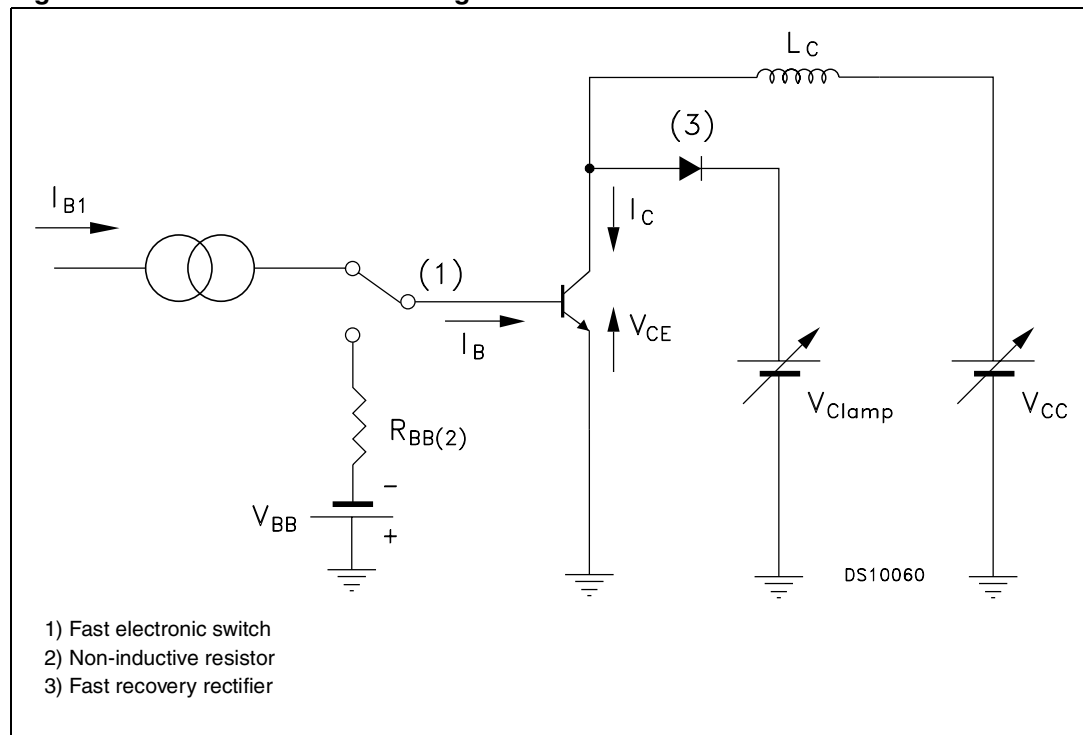
**Table 3. Electrical characteristics**

| Symbol                           | Parameter                                                         | Test conditions                                                                                                                                                                         | Min.     | Typ.        | Max.            | Unit                           |
|----------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------|-----------------|--------------------------------|
| $I_{\text{CEV}}$                 | Collector cut-off current<br>( $V_{\text{BE}} = -1.5\text{V}$ )   | $V_{\text{CE}} = 700\text{ V}$<br>$V_{\text{CE}} = 700\text{ V}$ $T_{\text{C}} = 100^{\circ}\text{C}$                                                                                   |          |             | 1<br>5          | mA<br>mA                       |
| $I_{\text{EBO}}$                 | Emitter cut-off current<br>( $I_{\text{C}} = 0$ )                 | $V_{\text{EB}} = 9\text{ V}$                                                                                                                                                            |          |             | 1               | mA                             |
| $V_{\text{CEO(sus)}}^{(1)}$      | Collector-emitter<br>sustaining voltage<br>( $I_{\text{B}} = 0$ ) | $I_{\text{C}} = 10\text{ mA}$                                                                                                                                                           | 400      |             |                 | V                              |
| $V_{\text{CE(sat)}}^{(1)}$       | Collector-emitter<br>saturation voltage                           | $I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 0.1\text{ A}$<br>$I_{\text{C}} = 0.6\text{ A}$ $I_{\text{B}} = 60\text{ mA}$<br>$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$ |          |             | 0.5<br>0.7<br>1 | V<br>V<br>V                    |
| $V_{\text{BE(sat)}}^{(1)}$       | Base-emitter saturation<br>voltage                                | $I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$<br>$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$                                                                  |          |             | 1.2<br>1.6      | V<br>V                         |
| $h_{\text{FE}}$                  | DC current gain                                                   | $I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$<br>$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 5\text{ V}$                                                                  | 10<br>10 |             | 20              |                                |
| $t_{\text{s}}$<br>$t_{\text{f}}$ | Inductive load<br>Storage time<br>Fall time                       | $I_{\text{C}} = 1\text{ A}$ $R_{\text{BB}} = 0\ \Omega$<br>$V_{\text{Clamp}} = 200\text{ V}$ $L = 50\text{ mH}$<br>(see <a href="#">Figure 2</a> )                                      |          | 0.8<br>0.16 |                 | $\mu\text{s}$<br>$\mu\text{s}$ |

1. Pulsed duration = 300 ms, duty cycle  $\leq 1.5\%$

## 2.1 Test circuits

Figure 2. Inductive load switching test circuit

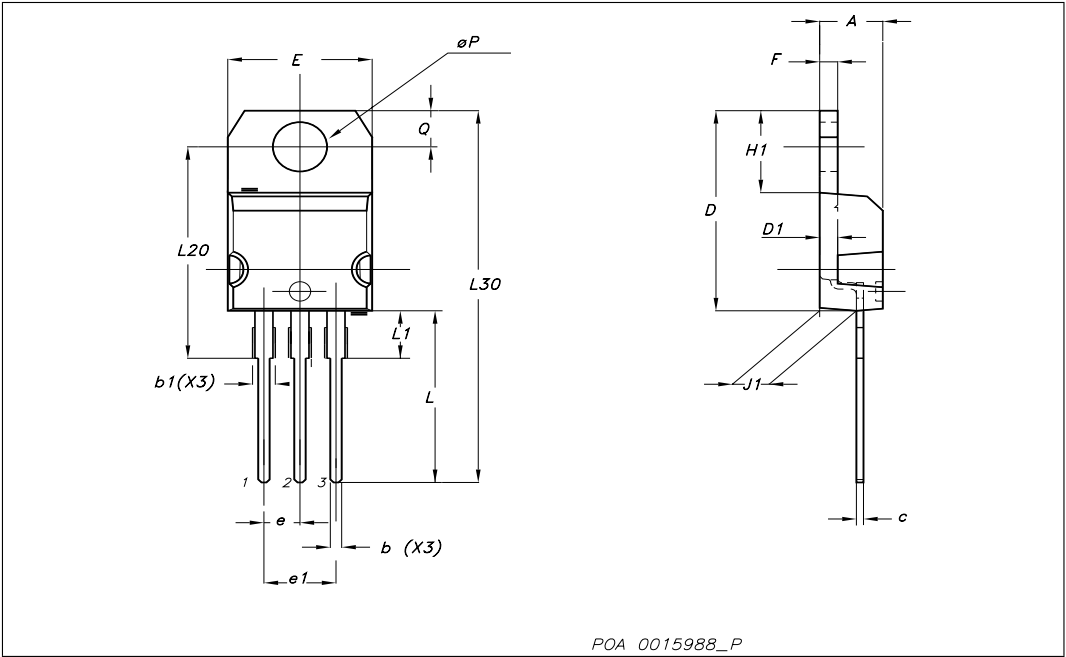


### 3      **Package mechanical data**

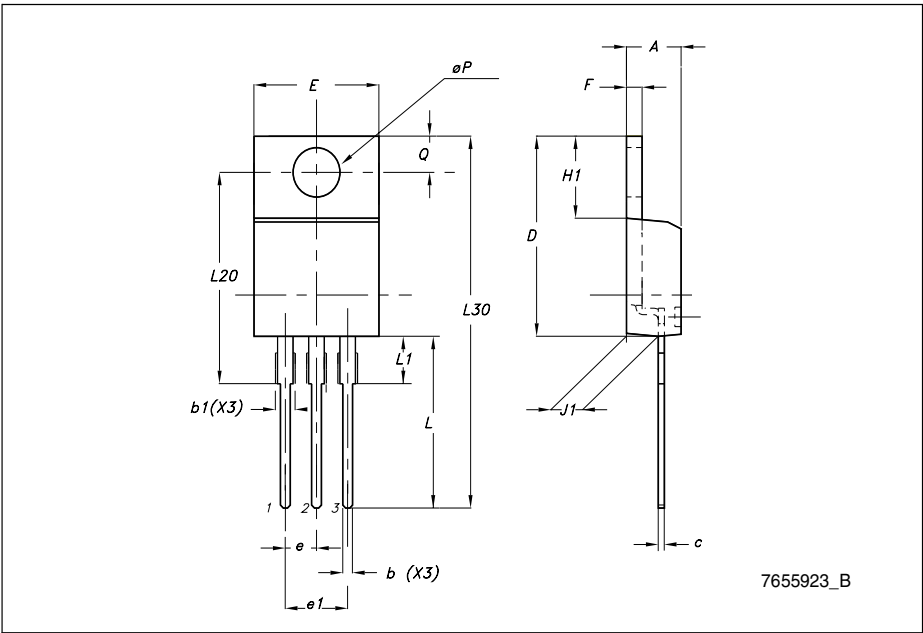
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

TO-220 mechanical data

| Dim | mm    |       |       | inch  |       |       |
|-----|-------|-------|-------|-------|-------|-------|
|     | Min   | Typ   | Max   | Min   | Typ   | Max   |
| A   | 4.40  |       | 4.60  | 0.173 |       | 0.181 |
| b   | 0.61  |       | 0.88  | 0.024 |       | 0.034 |
| b1  | 1.14  |       | 1.70  | 0.044 |       | 0.066 |
| c   | 0.49  |       | 0.70  | 0.019 |       | 0.027 |
| D   | 15.25 |       | 15.75 | 0.6   |       | 0.62  |
| D1  |       | 1.27  |       |       | 0.050 |       |
| E   | 10    |       | 10.40 | 0.393 |       | 0.409 |
| e   | 2.40  |       | 2.70  | 0.094 |       | 0.106 |
| e1  | 4.95  |       | 5.15  | 0.194 |       | 0.202 |
| F   | 1.23  |       | 1.32  | 0.048 |       | 0.051 |
| H1  | 6.20  |       | 6.60  | 0.244 |       | 0.256 |
| J1  | 2.40  |       | 2.72  | 0.094 |       | 0.107 |
| L   | 13    |       | 14    | 0.511 |       | 0.551 |
| L1  | 3.50  |       | 3.93  | 0.137 |       | 0.154 |
| L20 |       | 16.40 |       |       | 0.645 |       |
| L30 |       | 28.90 |       |       | 1.137 |       |
| ØP  | 3.75  |       | 3.85  | 0.147 |       | 0.151 |
| Q   | 2.65  |       | 2.95  | 0.104 |       | 0.116 |



| TO-220 type E mechanical data |       |      |       |
|-------------------------------|-------|------|-------|
| DIM.                          | mm.   |      |       |
|                               | MIN.  | TYP  | MAX.  |
| A                             | 4.47  |      | 4.67  |
| b                             | 0.70  |      | 0.91  |
| b1                            | 1.17  |      | 1.37  |
| c                             | 0.31  |      | 0.53  |
| D                             | 14.60 |      | 15.70 |
| E                             | 9.96  |      | 10.36 |
| e                             |       | 2.54 |       |
| e1                            | 4.98  | 5.08 | 5.18  |
| F                             | 1.17  |      | 1.37  |
| H1                            | 6.10  |      | 6.80  |
| J1                            | 2.52  |      | 2.82  |
| L                             | 12.70 |      | 13.80 |
| L1                            | 3.20  |      | 3.96  |
| L20                           | 15.21 |      | 16.77 |
| øP                            | 3.73  |      | 3.94  |
| Q                             | 2.59  |      | 2.89  |



## 4 Revision history

**Table 4. Document revision history**

| Date        | Revision | Changes                                 |
|-------------|----------|-----------------------------------------|
| 08-Oct-2007 | 1        | Initial release                         |
| 08-Feb-2008 | 2        | Updated TO-220, type E, mechanical data |

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