

### Features

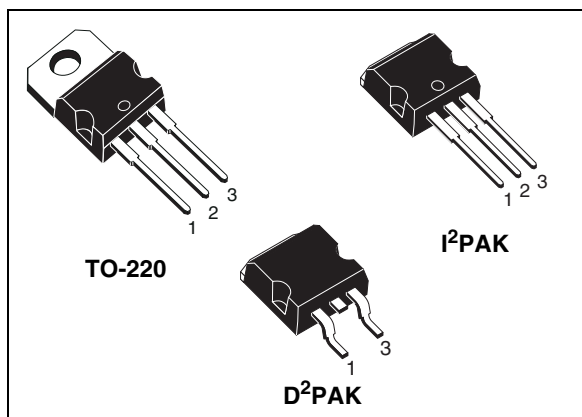
- Low spread of dynamic parameters
- High voltage capability
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

### Applications

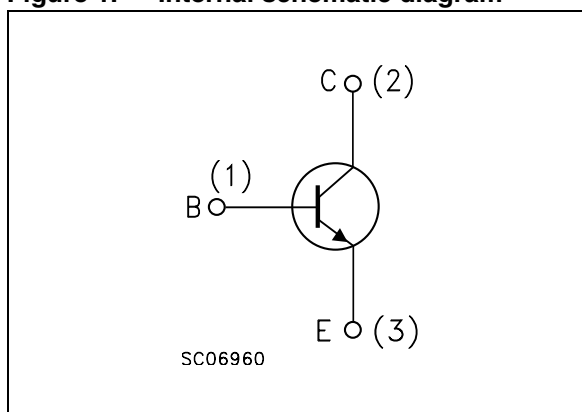
- Electronic ballast for fluorescent lighting (277 V push-pull and 347 V half bridge topologies)

### Description

The devices are manufactured using diffused collector technology to enhance switching speeds and tight  $h_{FE}$  while maintaining the wide RBSOA.



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

| Order code | Marking  | Package | Packaging     |
|------------|----------|---------|---------------|
| BUL7216    | BUL7216  | TO-220  | Tube          |
| BULB7216-1 | BULB7216 | I²PAK   | Tube          |
| BULB7216T4 | BULB7216 | D²PAK   | Tape and reel |

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# 1 Electrical ratings

**Table 2. Absolute maximum rating**

| Symbol    | Parameter                                     | Value      | Unit             |
|-----------|-----------------------------------------------|------------|------------------|
| $V_{CES}$ | Collector-emitter voltage ( $V_{BE} = 0$ )    | 1600       | V                |
| $V_{CEO}$ | Collector-emitter voltage ( $I_B = 0$ )       | 700        | V                |
| $V_{EBO}$ | Emitter-base voltage ( $I_C = 0$ )            | 12         | V                |
| $I_C$     | Collector current                             | 3          | A                |
| $I_{CM}$  | Collector peak current ( $t_P < 5\text{ms}$ ) | 6          | A                |
| $I_B$     | Base current                                  | 1          | A                |
| $I_{BM}$  | Base peak current ( $t_P < 5\text{ms}$ )      | 2          | A                |
| $P_{tot}$ | Total dissipation at $T_C = 25^\circ\text{C}$ | 80         | W                |
| $T_{stg}$ | Storage temperature                           | -65 to 150 | $^\circ\text{C}$ |
| $T_J$     | Max. operating junction temperature           | 150        | $^\circ\text{C}$ |

**Table 3. Thermal data**

| Symbol         | Parameter                          | Value | Unit               |
|----------------|------------------------------------|-------|--------------------|
| $R_{thj-case}$ | Thermal resistance junction - case | 1.56  | $^\circ\text{C/W}$ |

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

| Symbol                                                               | Parameter                                                              | Test conditions                                                                                                                                                                                                                                           | Min.               | Typ. | Max.                      | Unit                                                             |
|----------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------|---------------------------|------------------------------------------------------------------|
| $I_{\text{CES}}$                                                     | Collector cut-off current<br>( $V_{\text{BE}} = 0$ )                   | $V_{\text{CE}} = 1600 \text{ V}$<br>$V_{\text{CE}} = 1600 \text{ V}$ $T_{\text{C}} = 125^{\circ}\text{C}$                                                                                                                                                 |                    |      | 0.1<br>0.5                | mA<br>mA                                                         |
| $I_{\text{CEO}}$                                                     | Collector cut-off current<br>( $I_{\text{B}} = 0$ )                    | $V_{\text{CE}} = 680 \text{ V}$                                                                                                                                                                                                                           |                    |      | 0.1                       | mA                                                               |
| $I_{\text{CBO}}$                                                     | Collector cut-off current<br>( $I_{\text{E}} = 0$ )                    | $V_{\text{CB}} = 1600 \text{ V}$<br>$V_{\text{CB}} = 1600 \text{ V}$ $T_{\text{C}} = 125^{\circ}\text{C}$                                                                                                                                                 |                    |      | 0.1<br>0.5                | mA<br>mA                                                         |
| $I_{\text{EBO}}$                                                     | Emitter cut-off current<br>( $I_{\text{C}} = 0$ )                      | $V_{\text{EB}} = 12 \text{ V}$                                                                                                                                                                                                                            |                    |      | 1                         | mA                                                               |
| $V_{(\text{BR})\text{CEO}}^{(1)}$                                    | Collector-emitter<br>breakdown voltage<br>( $I_{\text{B}} = 0$ )       | $I_{\text{C}} = 1 \text{ mA}$                                                                                                                                                                                                                             | 700                |      |                           | V                                                                |
| $V_{(\text{BR})\text{EBO}}^{(1)}$                                    | Emitter-base breakdown<br>voltage ( $I_{\text{C}} = 0$ )               | $I_{\text{E}} = 1 \text{ mA}$                                                                                                                                                                                                                             | 12                 |      |                           | V                                                                |
| $V_{(\text{BR})\text{CES}}^{(1)}$                                    | Collector-emitter<br>breakdown voltage<br>( $V_{\text{BE}} = 0$ )      | $I_{\text{C}} = 0.1 \text{ mA}$                                                                                                                                                                                                                           | 1600               |      |                           | V                                                                |
| $V_{\text{CE(sat)}}^{(1)}$                                           | Collector-emitter<br>saturation voltage                                | $I_{\text{C}} = 0.25 \text{ A}$ $I_{\text{B}} = 25 \text{ mA}$<br>$I_{\text{C}} = 0.5 \text{ A}$ $I_{\text{B}} = 50 \text{ mA}$<br>$I_{\text{C}} = 0.8 \text{ A}$ $I_{\text{B}} = 80 \text{ mA}$                                                          |                    |      | 1<br>1.5<br>3             | V<br>V<br>V                                                      |
| $V_{\text{BE(sat)}}^{(1)}$                                           | Base-emitter saturation<br>voltage                                     | $I_{\text{C}} = 0.5 \text{ A}$ $I_{\text{B}} = 100 \text{ mA}$<br>$I_{\text{C}} = 1 \text{ A}$ $I_{\text{B}} = 100 \text{ mA}$<br>$I_{\text{C}} = 2 \text{ A}$ $I_{\text{B}} = 400 \text{ mA}$                                                            |                    |      | 1<br>1.1<br>1.2           | V<br>V<br>V                                                      |
| $h_{\text{FE}}^{(1)}$                                                | DC current gain                                                        | $I_{\text{C}} = 0.5 \text{ A}$ $V_{\text{CE}} = 1 \text{ V}$<br>$I_{\text{C}} = 0.5 \text{ A}$ $V_{\text{CE}} = 3 \text{ V}$<br>$I_{\text{C}} = 2 \text{ A}$ $V_{\text{CE}} = 5 \text{ V}$<br>$I_{\text{C}} = 1 \text{ A}$ $V_{\text{CE}} = 10 \text{ V}$ | 7<br>16<br>4<br>19 |      | 18<br>35<br>11            |                                                                  |
| $t_{\text{d}}$<br>$t_{\text{r}}$<br>$t_{\text{s}}$<br>$t_{\text{f}}$ | Resistive load<br>Delay time<br>Rise time<br>Storage time<br>Fall time | $I_{\text{C}} = 0.5 \text{ A}$ $V_{\text{CC}} = 125 \text{ V}$<br>$I_{\text{B1}} = 50 \text{ mA}$ $I_{\text{B2}} = -0.5 \text{ A}$<br>P.W. = 300 $\mu\text{s}$ D.C. = 2%                                                                                  |                    |      | 0.3<br>1.1<br>0.9<br>0.35 | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| $E_{\text{ar}}$                                                      | Repetitive avalanche<br>energy                                         | $L = 2 \text{ mH}$ $C = 1.8 \text{ nF}$<br>$V_{\text{BE(off)}} = -5 \text{ V}$                                                                                                                                                                            | 8                  |      |                           | mJ                                                               |

1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle  $\leq 1.5\%$

2.1 Electrical characteristics (curves)

Figure 2. Derating curve

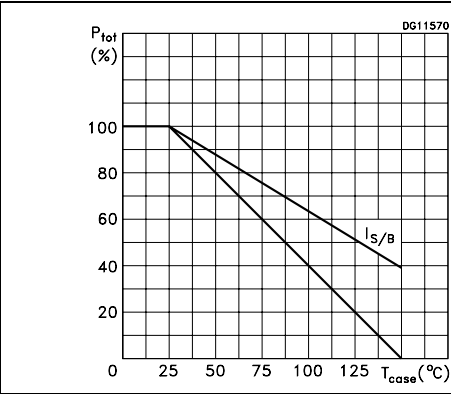


Figure 3. Reverse biased safe operating area

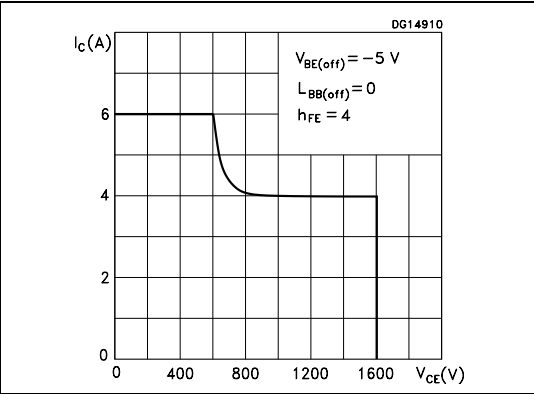


Figure 4. DC current gain

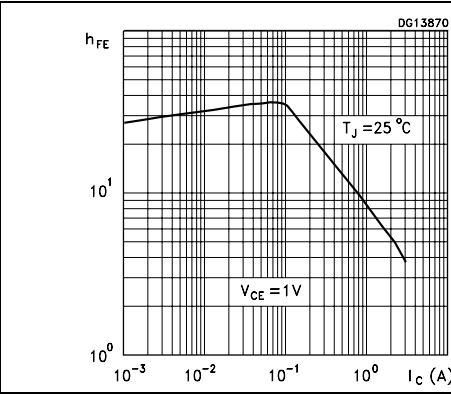


Figure 5. DC current gain

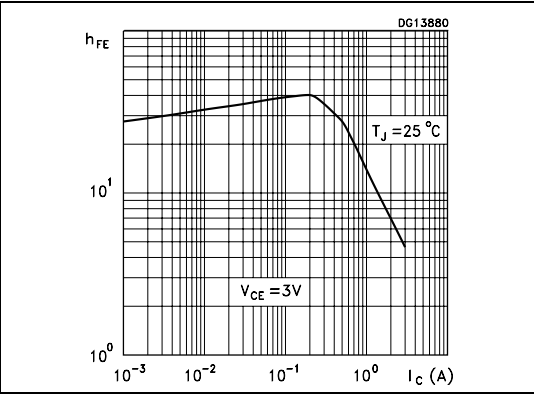


Figure 6. Collector - emitter saturation voltage

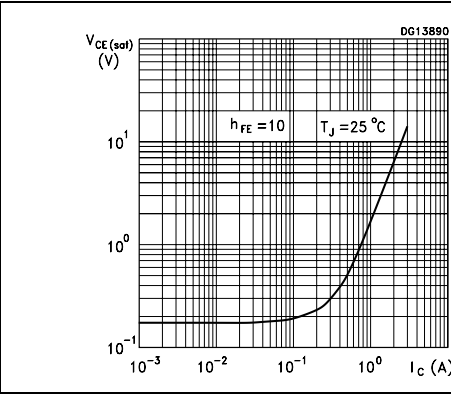


Figure 7. Base - emitter saturation voltage

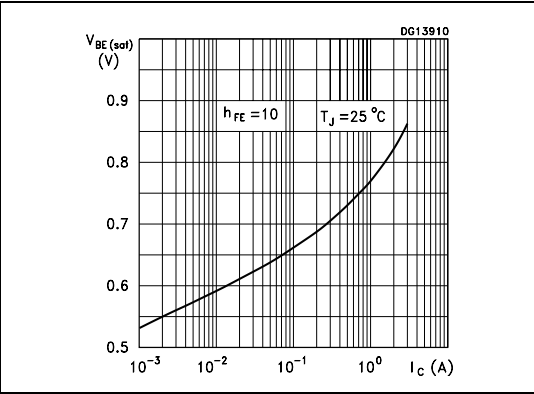
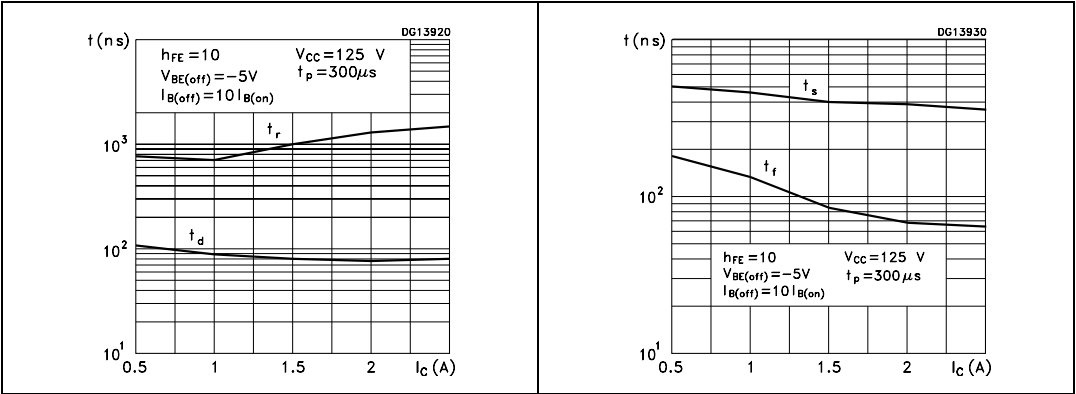


Figure 8. Resistive load switching time Figure 9. Resistive load switching time



### 3 Test circuit

Figure 10. Energy rating test circuit

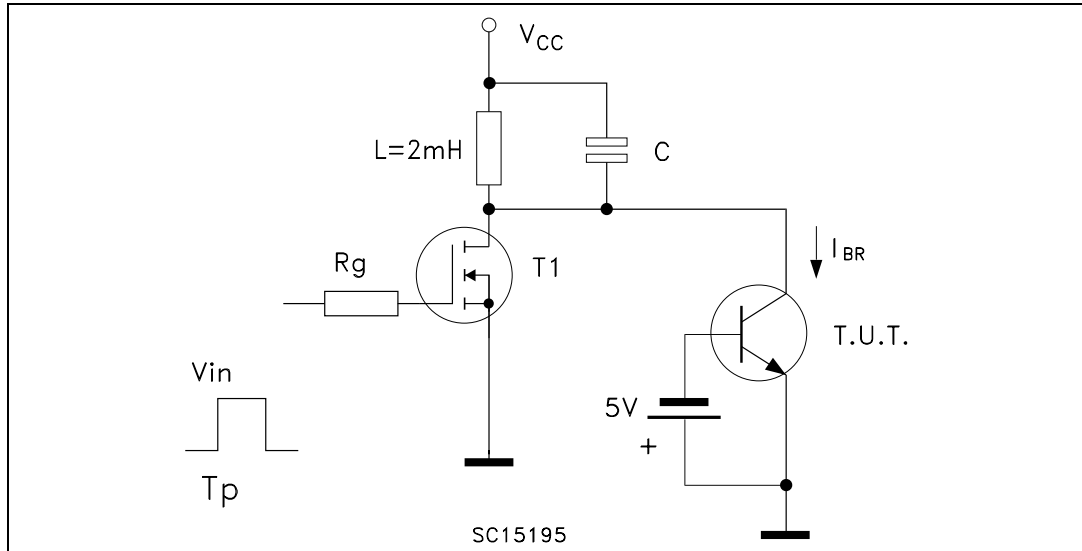
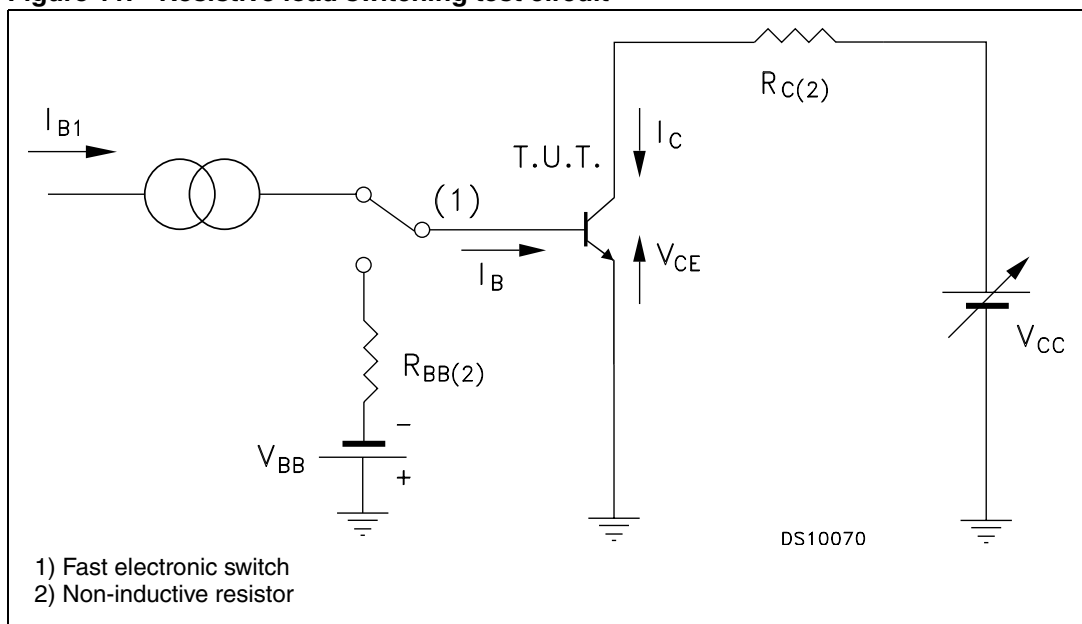


Figure 11. Resistive load switching test circuit

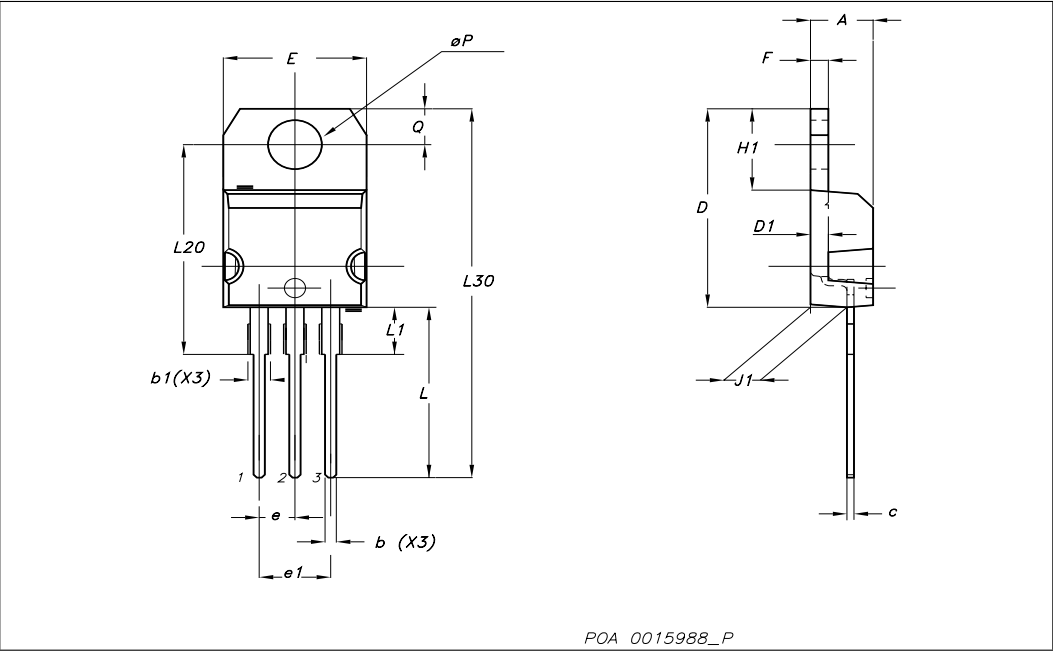


## 4 Package mechanical data

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)

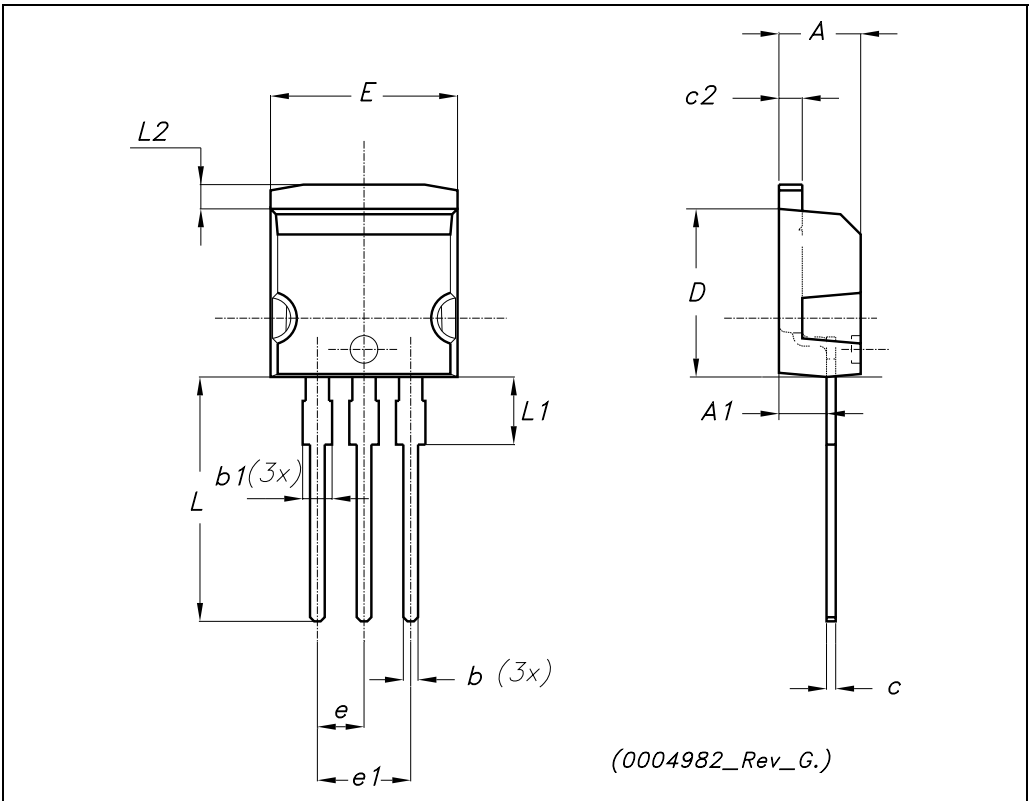
TO-220 mechanical data

| 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 |



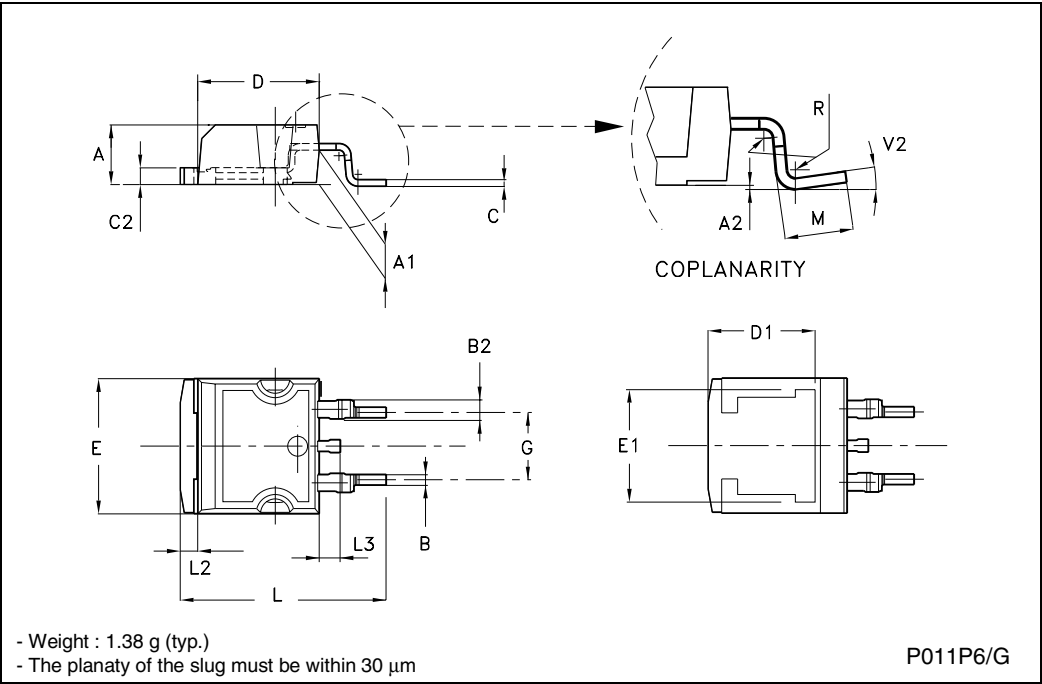
TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA

| DIM. | mm.  |      |       | inch  |      |       |
|------|------|------|-------|-------|------|-------|
|      | MIN. | TYP. | MAX.  | MIN.  | TYP. | MAX.  |
| A    | 4.40 |      | 4.60  | 0.173 |      | 0.181 |
| A1   | 2.40 |      | 2.72  | 0.094 |      | 0.107 |
| 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 |
| c2   | 1.23 |      | 1.32  | 0.048 |      | 0.052 |
| D    | 8.95 |      | 9.35  | 0.352 |      | 0.368 |
| e    | 2.40 |      | 2.70  | 0.094 |      | 0.106 |
| e1   | 4.95 |      | 5.15  | 0.194 |      | 0.202 |
| E    | 10   |      | 10.40 | 0.393 |      | 0.410 |
| L    | 13   |      | 14    | 0.511 |      | 0.551 |
| L1   | 3.50 |      | 3.93  | 0.137 |      | 0.154 |
| L2   | 1.27 |      | 1.40  | 0.050 |      | 0.055 |



TO-263 (D<sup>2</sup>PAK) MECHANICAL DATA

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |      | 4.60  | 0.173 |       | 0.181 |
| A1   | 2.49  |      | 2.69  | 0.098 |       | 0.106 |
| A2   | 0.03  |      | 0.23  | 0.001 |       | 0.009 |
| B    | 0.70  |      | 0.93  | 0.027 |       | 0.036 |
| B2   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| C    | 0.45  |      | 0.60  | 0.017 |       | 0.023 |
| C2   | 1.23  |      | 1.36  | 0.048 |       | 0.053 |
| D    | 8.95  |      | 9.35  | 0.352 |       | 0.368 |
| D1   |       | 8.00 |       |       | 0.315 |       |
| E    | 10.00 |      | 10.40 | 0.393 |       | 0.409 |
| E1   |       | 8.50 |       |       | 0.334 |       |
| G    | 4.88  |      | 5.28  | 0.192 |       | 0.208 |
| L    | 15.00 |      | 15.85 | 0.590 |       | 0.624 |
| L2   | 1.27  |      | 1.4   | 0.050 |       | 0.055 |
| L3   | 1.40  |      | 1.75  | 0.055 |       | 0.068 |
| M    | 2.40  |      | 3.2   | 0.094 |       | 0.126 |
| R    |       | 0.40 |       |       | 0.016 |       |
| V2   | 0°    |      | 8°    | 0°    |       | 8°    |



## 5 Revision history

**Table 5. Document revision history**

| Date        | Revision | Changes                                                  |
|-------------|----------|----------------------------------------------------------|
| 17-Jan-2006 | 1        | First release.                                           |
| 28-Nov-2007 | 2        | Added packages D <sup>2</sup> PAK and I <sup>2</sup> PAK |

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