



# 2STD1360, 2STF1360, 2STN1360

## Low voltage fast-switching NPN power transistors

Datasheet — production data

### Features

- Very low collector-emitter saturation voltage
- High current gain characteristic
- Fast-switching speed

### Applications

- Emergency lighting
- LED
- Voltage regulation
- Relay drive

### Description

This device is an NPN transistor manufactured using new low voltage planar technology with double metal process. The result is a transistor which boasts exceptionally high gain performance coupled with very low saturation voltage.

The complementary PNP types are the 2STD2360T4, the 2STF2360 and the 2STN2360.

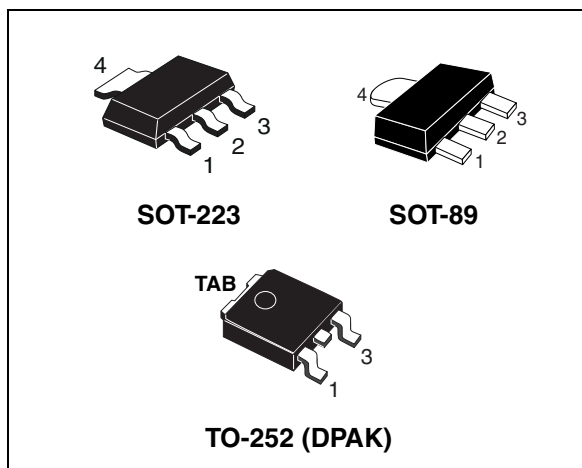


Figure 1. Internal schematic diagram

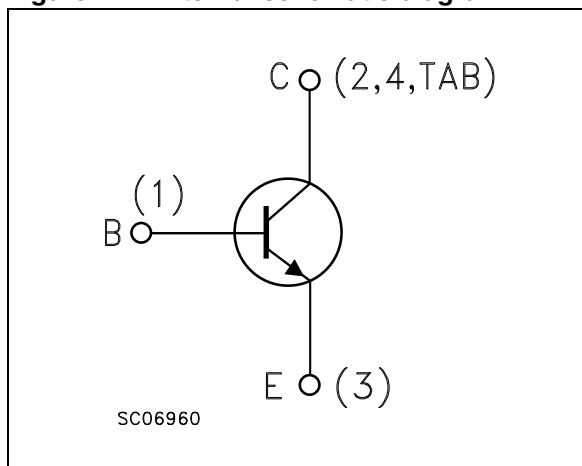


Table 1. Device summary

| Order codes | Marking  | Packages | Packaging     |
|-------------|----------|----------|---------------|
| 2STD1360T4  | 2STD1360 | DPAK     | Tape and reel |
| 2STF1360    | 1360     | SOT-89   | Tape and reel |
| 2STN1360    | N1360    | SOT-223  | Tape and reel |

# 1 Absolute maximum ratings

**Table 2. Absolute maximum ratings**

| Symbol    | Parameter                               | Value      |          |          | Unit |
|-----------|-----------------------------------------|------------|----------|----------|------|
|           |                                         | 2STD1360   | 2STF1360 | 2STN1360 |      |
|           |                                         | DPAK       | SOT-89   | SOT-223  |      |
| $V_{CBO}$ | Collector-base voltage ( $I_E = 0$ )    | 80         |          |          | V    |
| $V_{CEO}$ | Collector-emitter voltage ( $I_B = 0$ ) | 60         |          |          | V    |
| $V_{EBO}$ | Emitter-base voltage ( $I_C = 0$ )      | 6          |          |          | V    |
| $I_C$     | Collector current                       | 3          |          |          | A    |
| $I_{CM}$  | Collector peak current ( $t_P < 5$ ms)  | 5          |          |          | A    |
| $I_B$     | Base current                            | 0.2        |          |          | A    |
| $I_{BM}$  | Base peak current ( $t_P < 5$ ms)       | 0.4        |          |          | A    |
| $P_{TOT}$ | Total dissipation at $T_{amb} = 25$ °C  | 15         | 1.4      | 1.6      | W    |
| $T_{stg}$ | Storage temperature                     | -65 to 150 |          |          | °C   |
| $T_J$     | Max. operating junction temperature     | 150        |          |          | °C   |

**Table 3. Thermal data**

| Symbol           | Parameter                               | DPAK | SOT-89 | SOT-223 | Unit |
|------------------|-----------------------------------------|------|--------|---------|------|
| $R_{thJA}^{(1)}$ | Thermal resistance junction-ambient Max | 8.3  | 89     | 78      | °C/W |

1. Device mounted on a PCB area of 1 cm<sup>2</sup>

## 2 Electrical characteristics

$T_{CASE} = 25^{\circ}\text{C}$ ; unless otherwise specified.

**Table 4. Electrical characteristics**

| Symbol                           | Parameter                                  | Test conditions                                                                                                         | Min. | Typ. | Max. | Unit |
|----------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{CBO}$                        | Collector cut-off current<br>( $I_E = 0$ ) | $V_{CB} = 80\text{ V}$                                                                                                  |      |      | 100  | nA   |
| $I_{EBO}$                        | Emitter cut-off current<br>( $I_C = 0$ )   | $V_{EB} = 6\text{ V}$                                                                                                   |      |      | 100  | nA   |
| $V_{BE(on)}$                     | Base-emitter on voltage                    | $V_{CE} = 2\text{ V}$ $I_C = 100\text{ mA}$                                                                             | 630  | 650  | 730  | mV   |
| $V_{CE(sat)}^{(1)}$              | Collector-emitter<br>saturation voltage    | $I_C = 2\text{ A}$ $I_B = 100\text{ mA}$                                                                                |      | 130  | 300  | mV   |
|                                  |                                            | $I_C = 3\text{ A}$ $I_B = 150\text{ mA}$                                                                                |      | 180  | 500  | mV   |
| $V_{BE(sat)}^{(1)}$              | Base-emitter saturation<br>voltage         | $I_C = 2\text{ A}$ $I_B = 100\text{ mA}$                                                                                |      | 0.9  | 1.2  | V    |
| $h_{FE}^{(1)}$                   | DC current gain                            | $I_C = 100\text{ mA}$ $V_{CE} = 2\text{ V}$                                                                             | 80   |      |      |      |
|                                  |                                            | $I_C = 1\text{ A}$ $V_{CE} = 2\text{ V}$                                                                                | 160  |      | 400  |      |
| $t_d$<br>$t_r$<br>$t_s$<br>$t_f$ | Resistive load                             | $I_C = 3\text{ A}$ $V_{CC} = 10\text{ V}$<br>$I_{B(on)} = - I_{B(off)} = 300\text{ mA}$<br>$V_{BE(off)} = - 5\text{ V}$ |      |      |      |      |
|                                  | Delay time                                 |                                                                                                                         |      | 17   | 20   | ns   |
|                                  | Rise time                                  |                                                                                                                         |      | 81   | 100  | ns   |
|                                  | Storage time                               |                                                                                                                         |      | 620  | 720  | ns   |
|                                  | Fall time                                  |                                                                                                                         |      | 54   | 65   | ns   |
| $f_T$                            | Transition frequency                       | $I_C = 0.1\text{ A}$ $V_{CE} = 10\text{ V}$                                                                             |      | 130  |      | MHz  |

1. Pulse test: pulse duration  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

2.1 Typical characteristics (curves)

Figure 2. DC current gain ( $V_{CE} = 5\text{ V}$ )

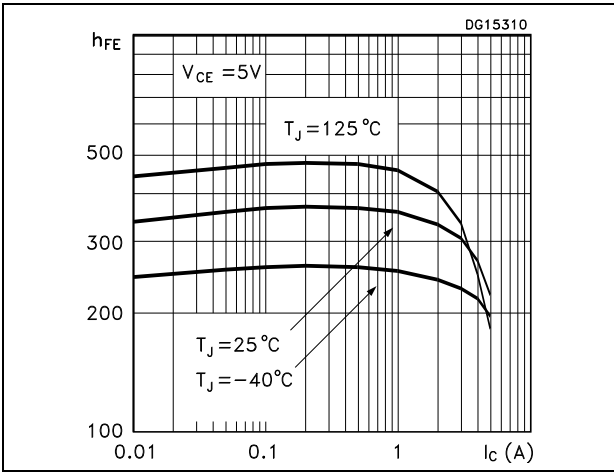


Figure 3. DC current gain ( $V_{CE} = 2\text{ V}$ )

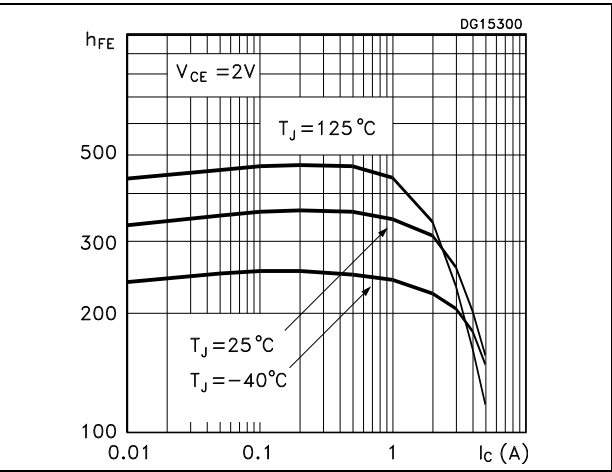


Figure 4. Collector emitter saturation voltage

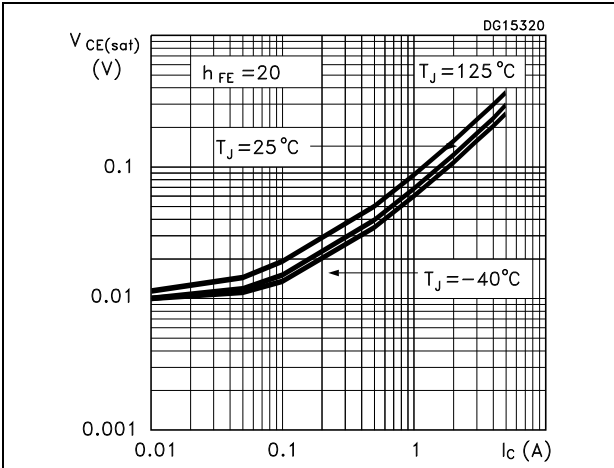


Figure 5. Base emitter saturation voltage

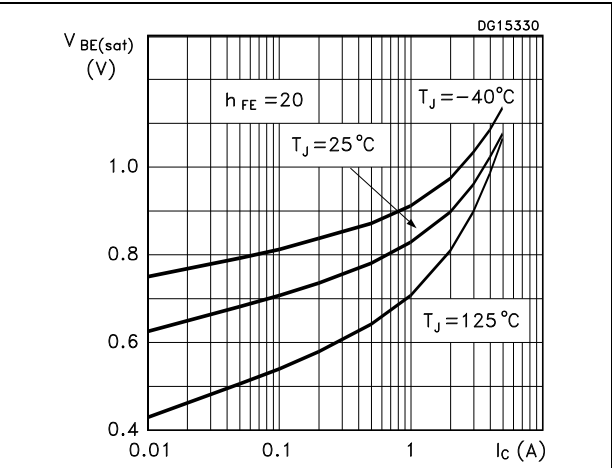


Figure 6. Resistive load switching on

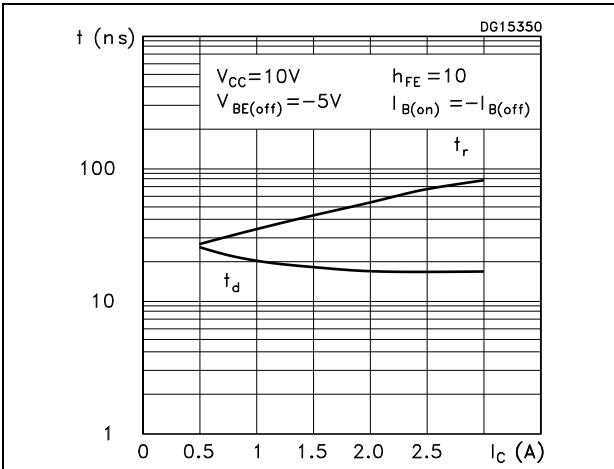
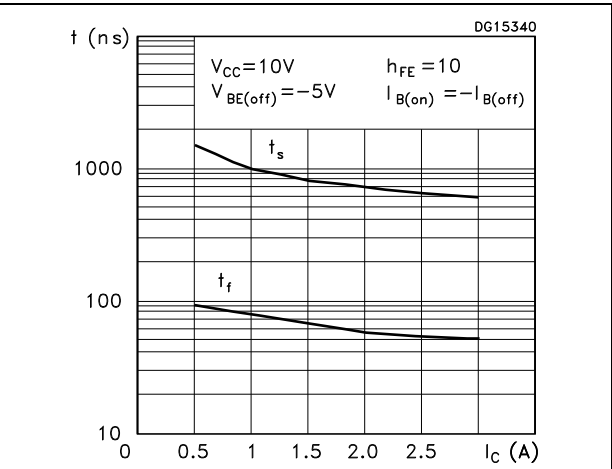
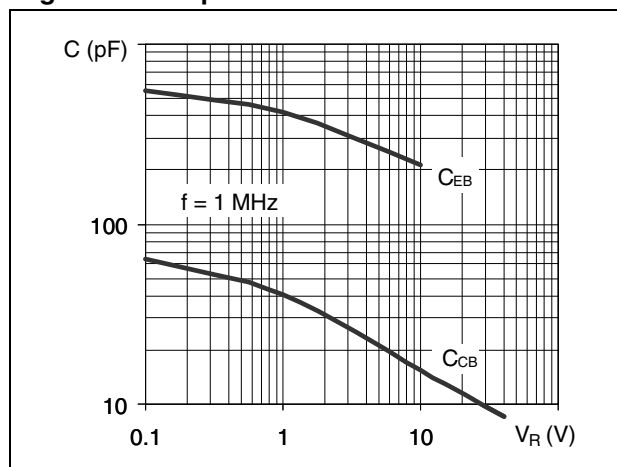
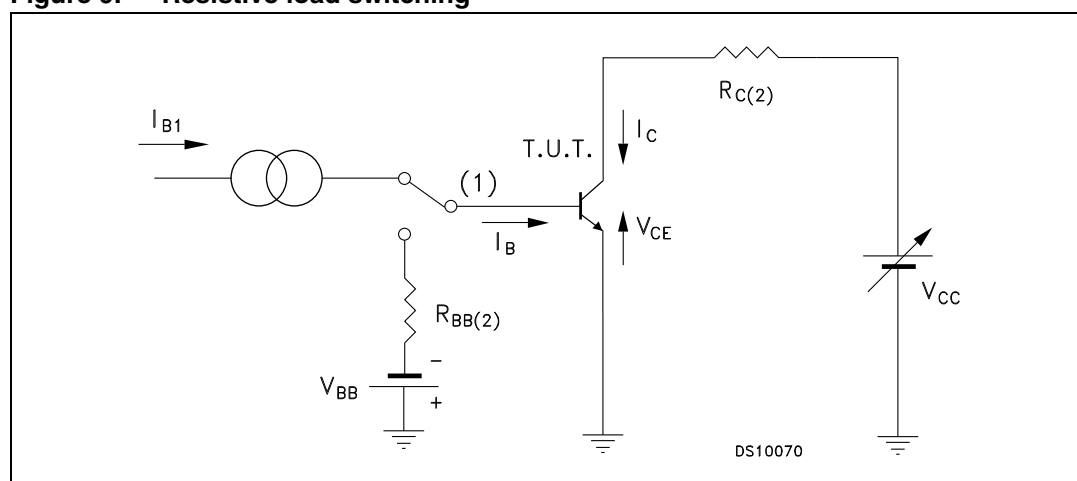


Figure 7. Resistive load switching off



**Figure 8. Capacitance**

## 2.2 Test circuits

**Figure 9. Resistive load switching**

1. Fast electronic switch
2. Non-inductive resistor

### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Table 5. DPAK (TO-252) mechanical data

| Dim. | mm   |      |       |
|------|------|------|-------|
|      | Min. | Typ. | Max.  |
| A    | 2.20 |      | 2.40  |
| A1   | 0.90 |      | 1.10  |
| A2   | 0.03 |      | 0.23  |
| b    | 0.64 |      | 0.90  |
| b4   | 5.20 |      | 5.40  |
| c    | 0.45 |      | 0.60  |
| c2   | 0.48 |      | 0.60  |
| D    | 6.00 |      | 6.20  |
| D1   |      | 5.10 |       |
| E    | 6.40 |      | 6.60  |
| E1   |      | 4.70 |       |
| e    |      | 2.28 |       |
| e1   | 4.40 |      | 4.60  |
| H    | 9.35 |      | 10.10 |
| L    | 1    |      |       |
| L1   |      | 2.80 |       |
| L2   |      | 0.80 |       |
| L4   | 0.60 |      | 1     |
| R    |      | 0.20 |       |
| V2   | 0°   |      | 8°    |

Figure 10. DPAK (TO-252) drawing

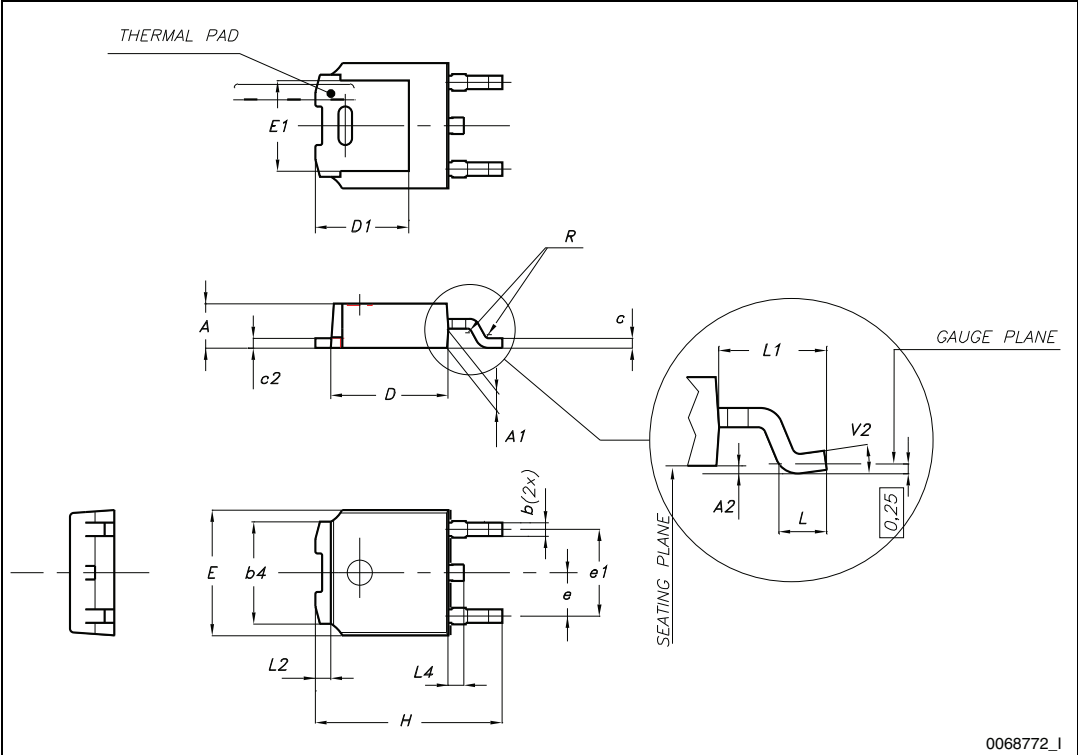
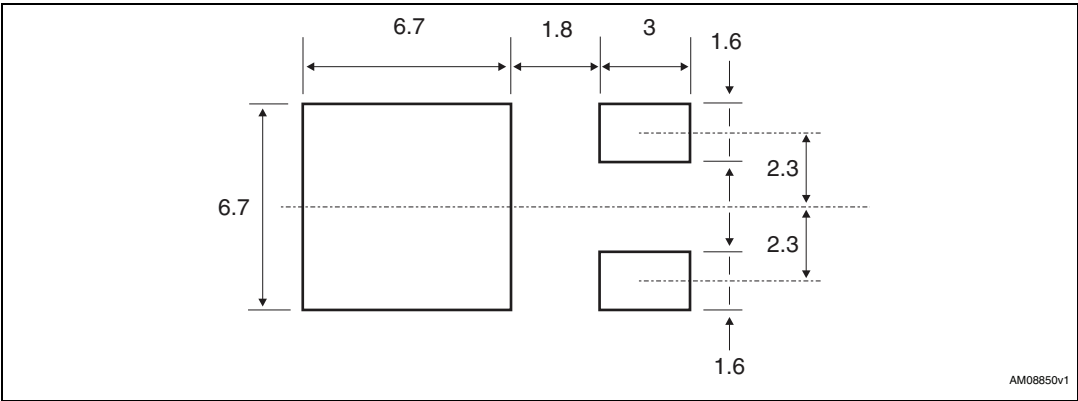


Figure 11. DPAK footprint<sup>(a)</sup>



a. All dimensions are in millimeters



Table 6. DPAK (TO-252) tape and reel mechanical data

| Tape |      |      | Reel      |      |      |
|------|------|------|-----------|------|------|
| Dim. | mm   |      | Dim.      | mm   |      |
|      | Min. | Max. |           | Min. | Max. |
| A0   | 6.8  | 7    | A         |      | 330  |
| B0   | 10.4 | 10.6 | B         | 1.5  |      |
| B1   |      | 12.1 | C         | 12.8 | 13.2 |
| D    | 1.5  | 1.6  | D         | 20.2 |      |
| D1   | 1.5  |      | G         | 16.4 | 18.4 |
| E    | 1.65 | 1.85 | N         | 50   |      |
| F    | 7.4  | 7.6  | T         |      | 22.4 |
| K0   | 2.55 | 2.75 |           |      |      |
| P0   | 3.9  | 4.1  | Base qty. |      | 2500 |
| P1   | 7.9  | 8.1  | Bulk qty. |      | 2500 |
| P2   | 1.9  | 2.1  |           |      |      |
| R    | 40   |      |           |      |      |
| T    | 0.25 | 0.35 |           |      |      |
| W    | 15.7 | 16.3 |           |      |      |

Figure 12. Tape for DPAK (TO-252)

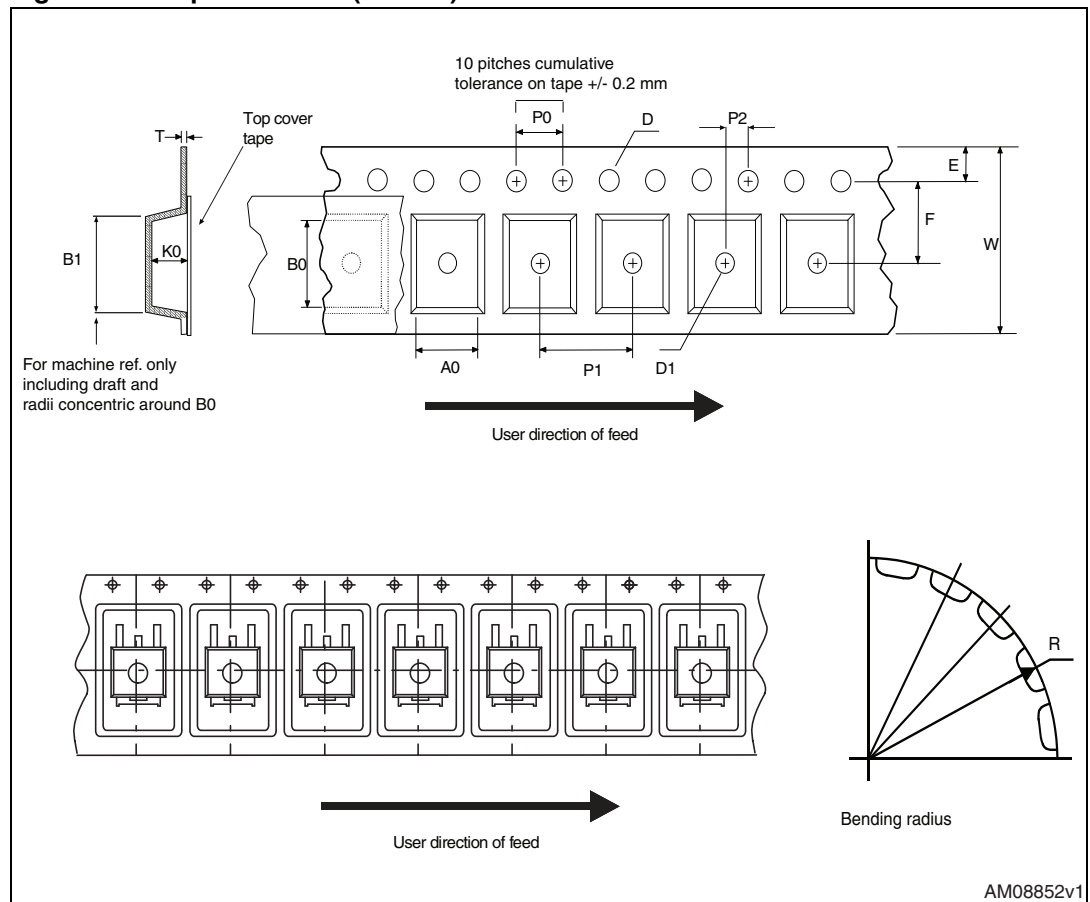


Figure 13. Reel for DPAK (TO-252)

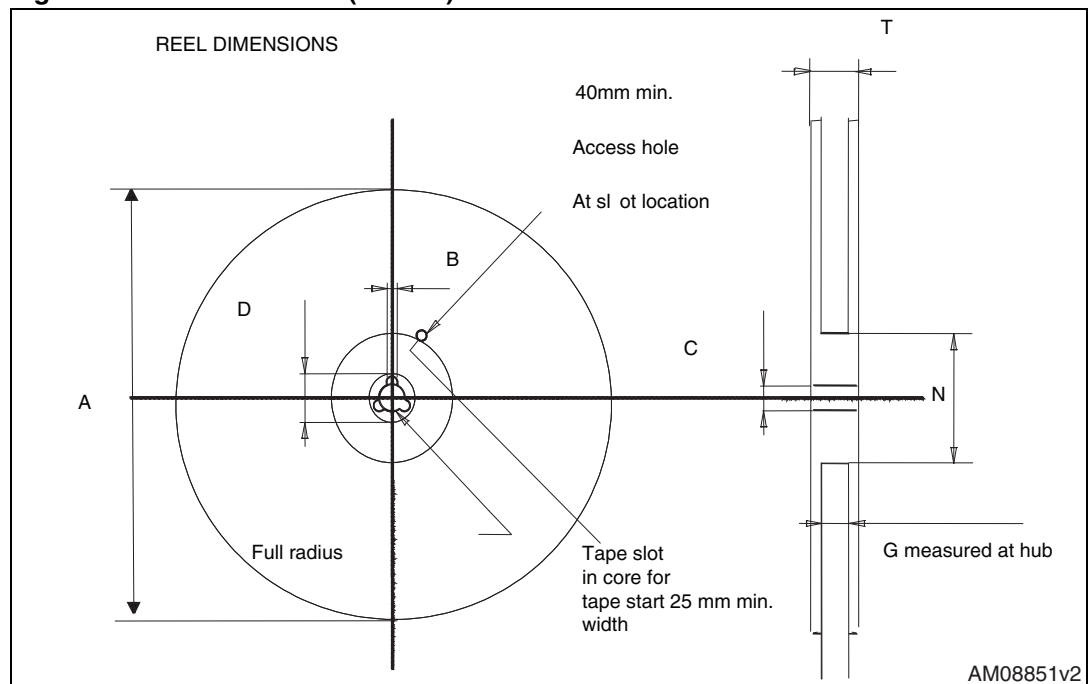


Table 7. SOT-89 mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 1.40 |      | 1.60 |
| B    | 0.44 |      | 0.56 |
| B1   | 0.36 |      | 0.48 |
| C    | 0.35 |      | 0.44 |
| C1   | 0.35 |      | 0.44 |
| D    | 4.40 |      | 4.60 |
| D1   | 1.62 |      | 1.83 |
| D3   |      | 0.90 |      |
| E    | 2.29 |      | 2.60 |
| e    | 1.42 |      | 1.57 |
| e1   | 2.92 |      | 3.07 |
| H    | 3.94 |      | 4.25 |
| H1   | 2.70 |      | 3.10 |
| K    | 1°   |      | 8°   |
| L    | 0.89 |      | 1.20 |
| R    |      | 0.25 |      |
| β    |      | 90°  |      |

Figure 14. SOT-89 drawings

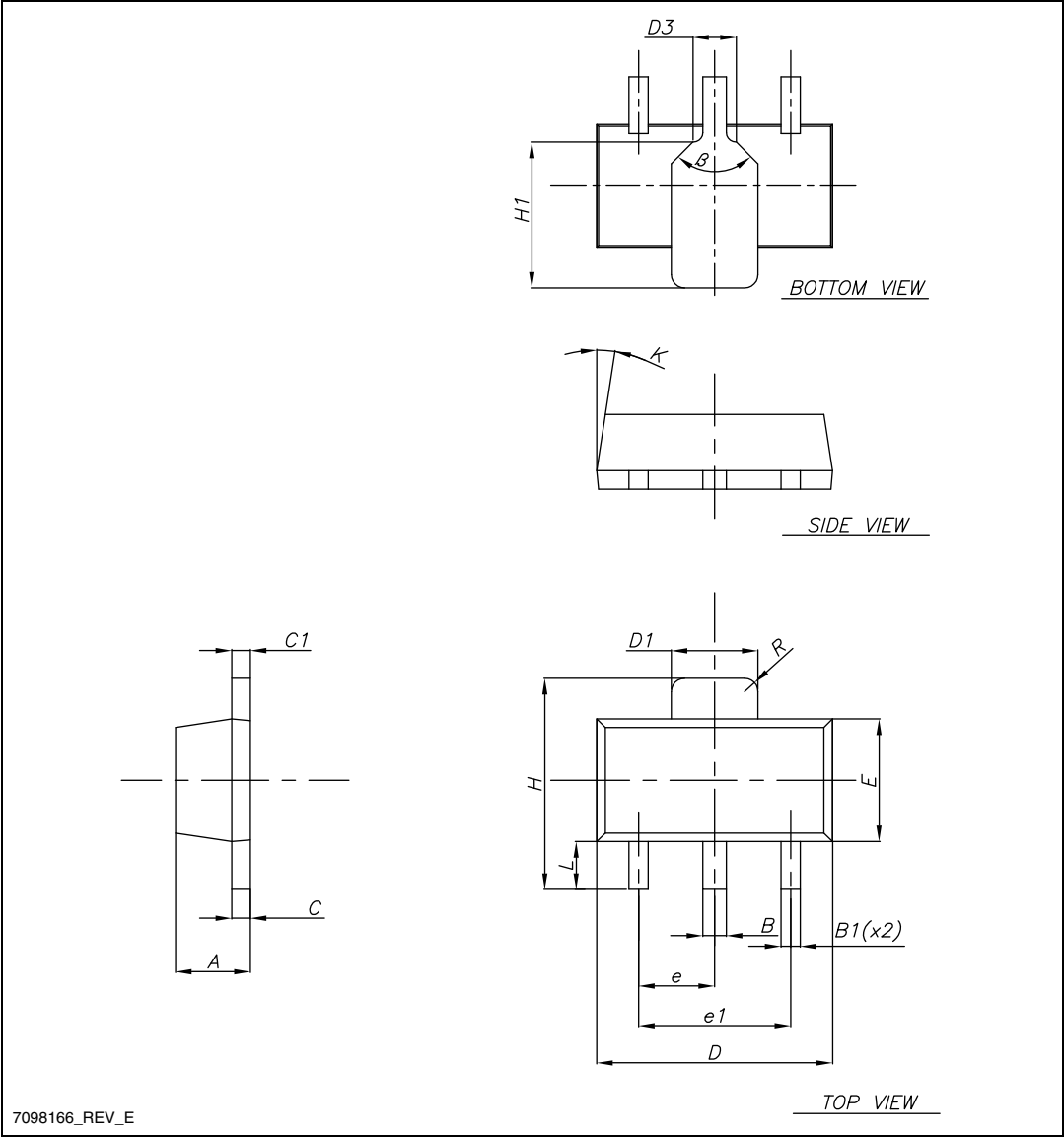


Figure 15. SOT-89 recommended footprint

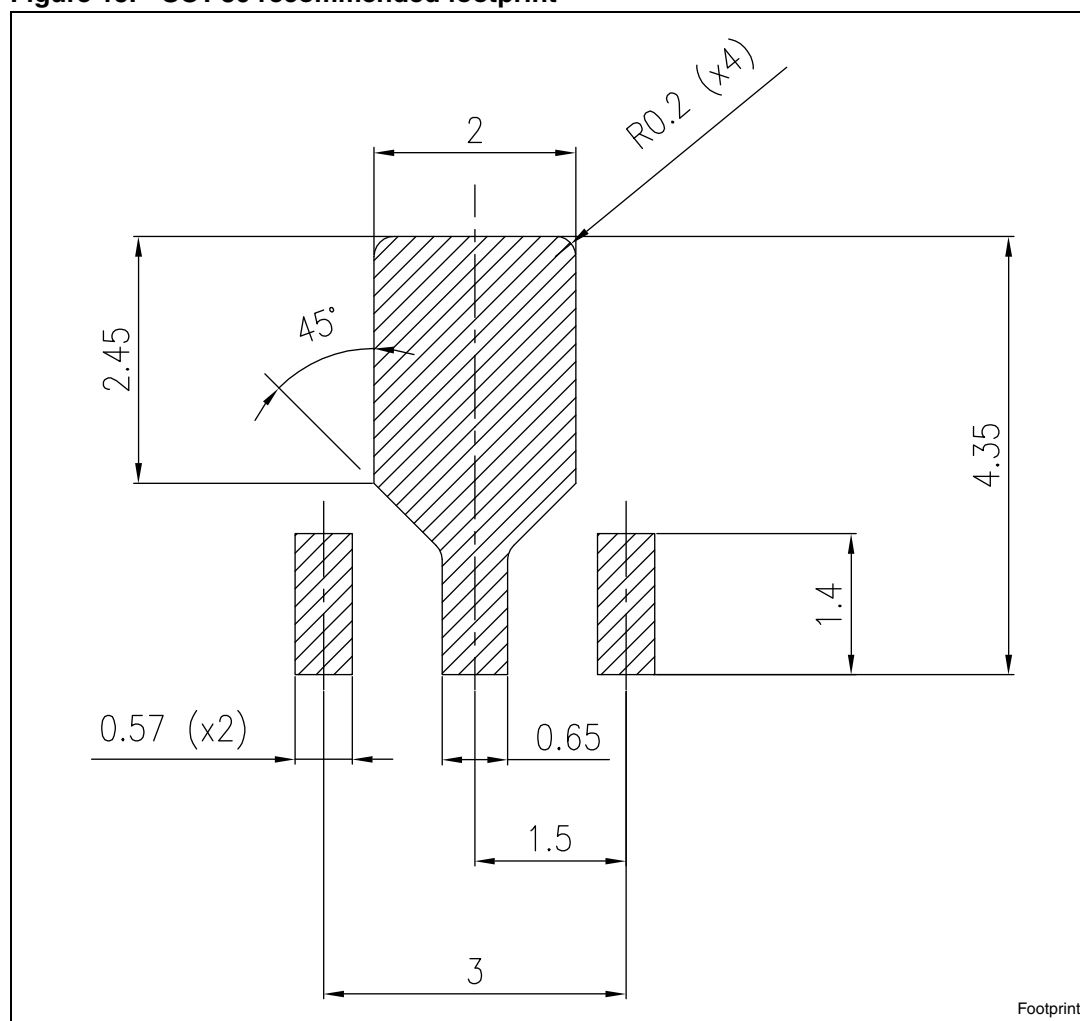
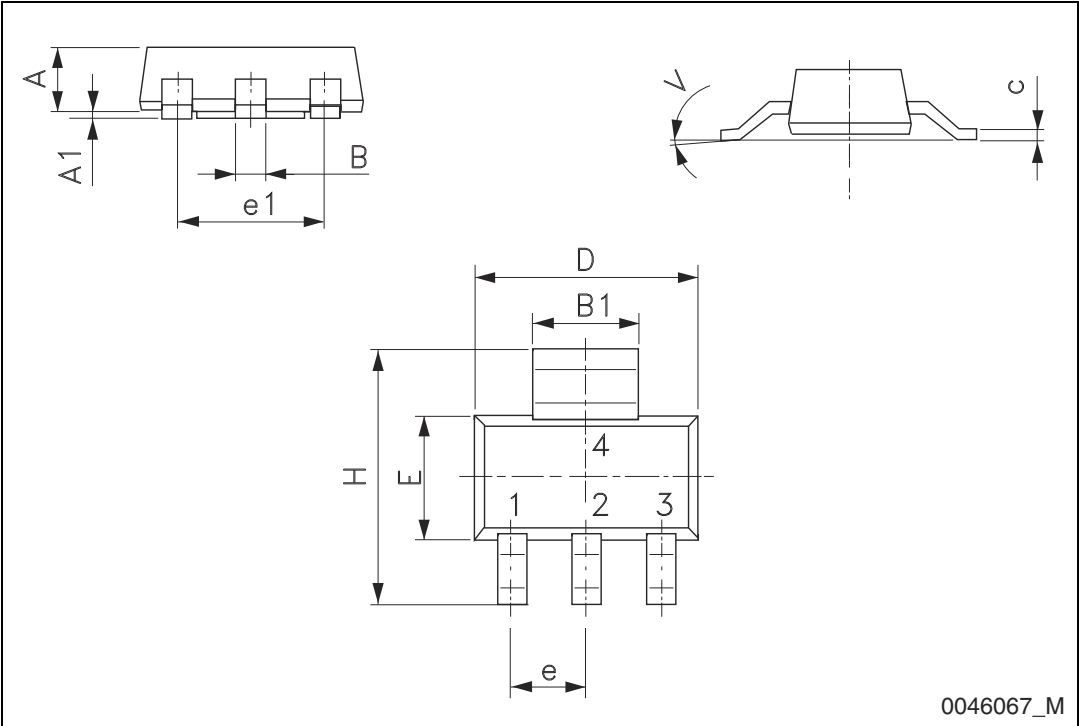


Table 8. SOT-223 mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      |      | 1.80 |
| A1   | 0.02 |      | 0.1  |
| B    | 0.60 | 0.70 | 0.85 |
| B1   | 2.90 | 3.00 | 3.15 |
| c    | 0.24 | 0.26 | 0.35 |
| D    | 6.30 | 6.50 | 6.70 |
| e    |      | 2.30 |      |
| e1   |      | 4.60 |      |
| E    | 3.30 | 3.50 | 3.70 |
| H    | 6.70 | 7.00 | 7.30 |
| V    |      |      | 10°  |

Figure 16. SOT-223 mechanical data drawing



## 4 Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes                                               |
|-------------|----------|-------------------------------------------------------|
| 21-Nov-2005 | 1        | Initial release                                       |
| 09-Oct-2009 | 2        | Added 2STD1360T4 in TO-252 (DPAK) package             |
| 13-Aug-2012 | 3        | Modified: marking for DPAK in <a href="#">Table 1</a> |

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