



# 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.

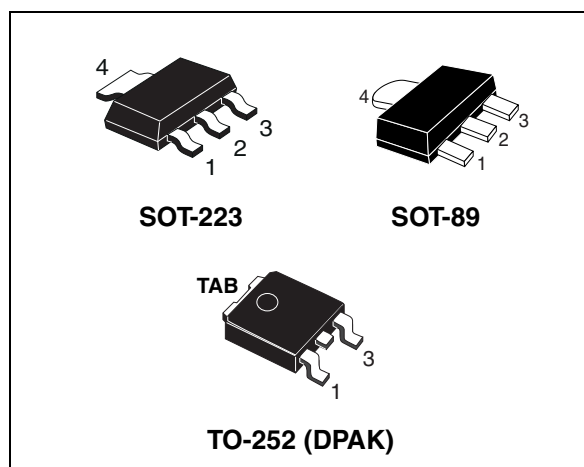


Figure 1. Internal schematic diagram

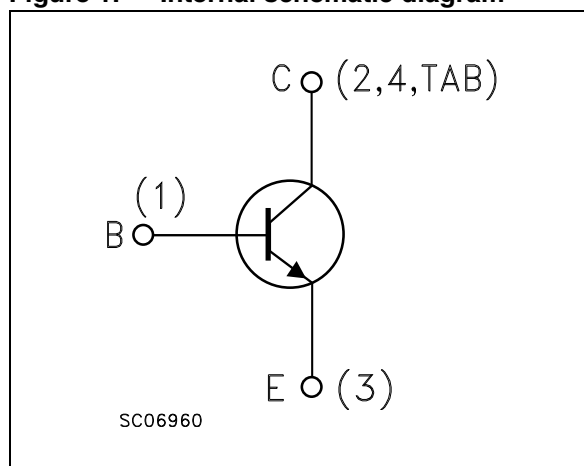


Table 1. Device summary

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 ( $I_E = 0$ )	$V_{CB} = 80\text{ V}$			100	nA
$I_{EBO}$	Emitter cut-off current ( $I_C = 0$ )	$V_{EB} = 6\text{ V}$			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 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 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	
$t_d$ $t_r$ $t_s$ $t_f$	Resistive load	$I_C = 3\text{ A}$ $V_{CC} = 10\text{ V}$ $I_{B(on)} = - I_{B(off)} = 300\text{ mA}$ $V_{BE(off)} = - 5\text{ V}$				
	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)

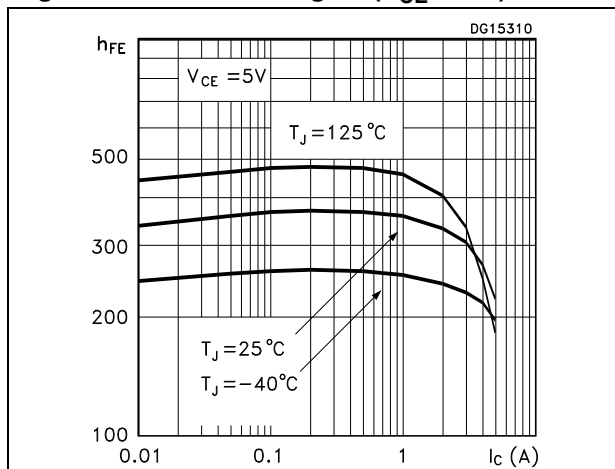
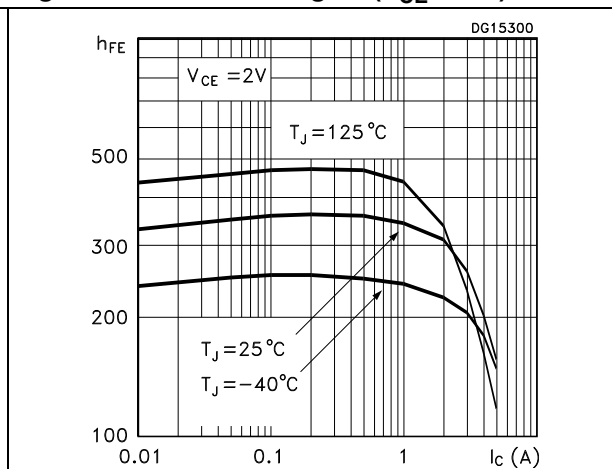
Figure 2. DC current gain ( $V_{CE} = 5\text{ V}$ )Figure 3. DC current gain ( $V_{CE} = 2\text{ V}$ )

Figure 4. Collector emitter saturation voltage

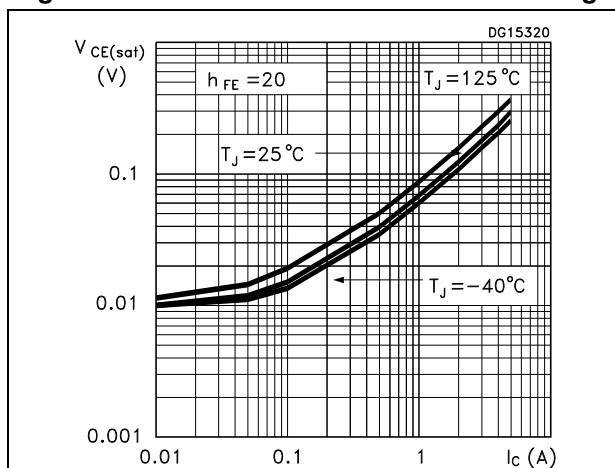


Figure 5. Base emitter saturation voltage

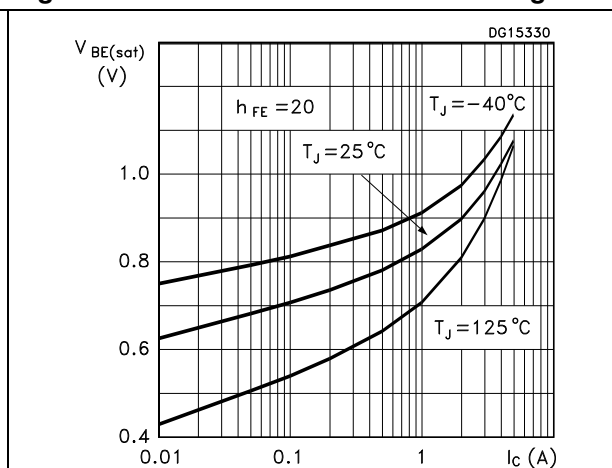


Figure 6. Resistive load switching on

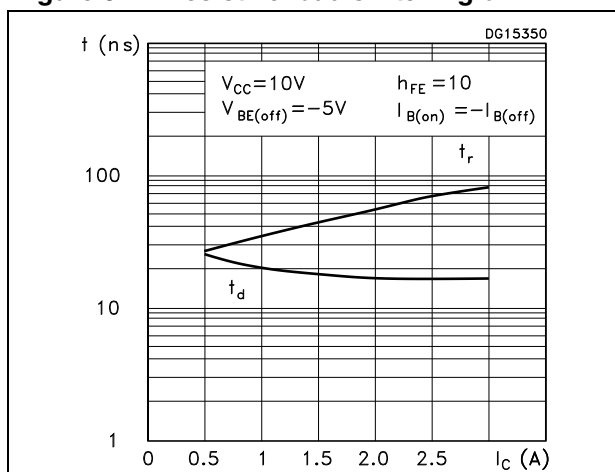
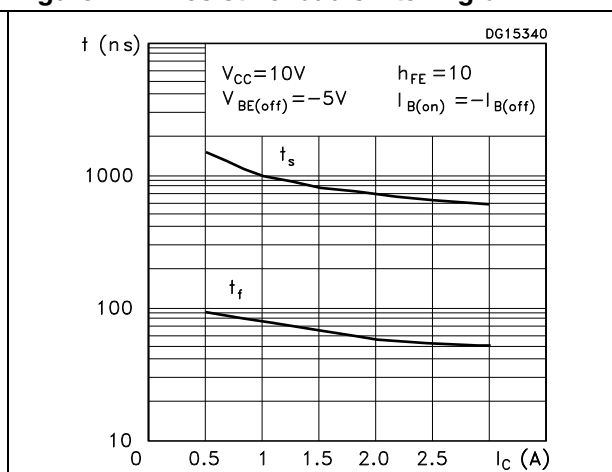
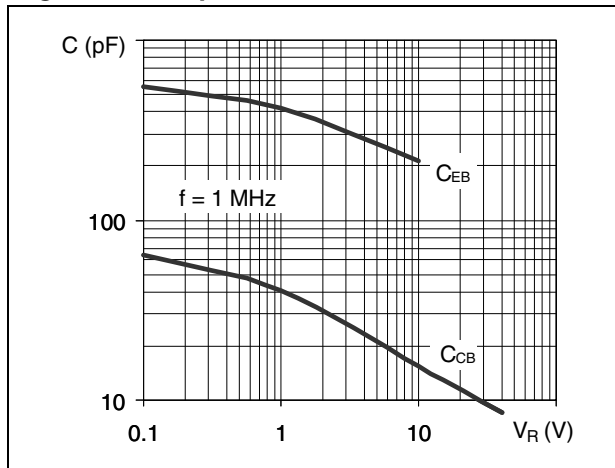
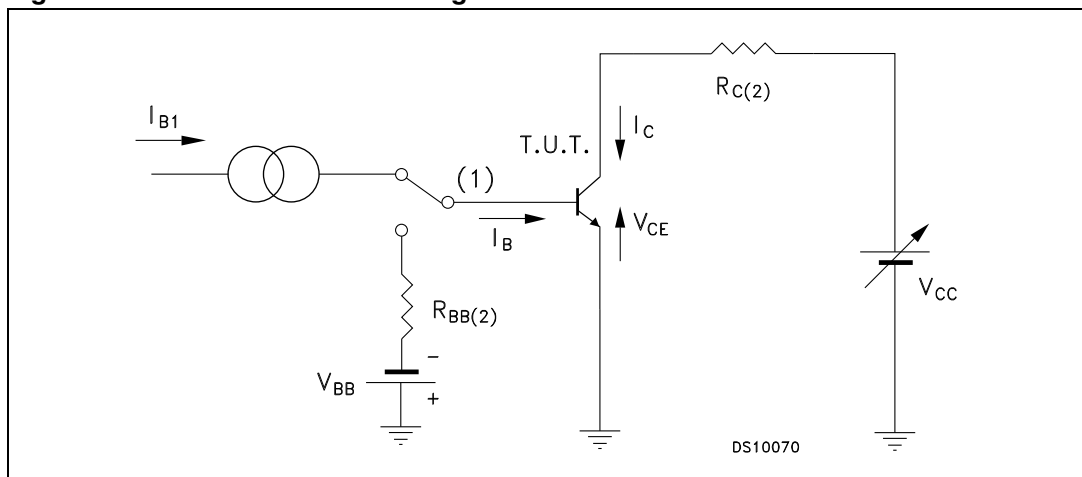


Figure 7. Resistive load switching off



**Figure 8. Capacitance**

## 2.2 Test circuits

**Figure 9. Resistive load switching**

1. Fast electronic switch
2. Non-inductive resistor

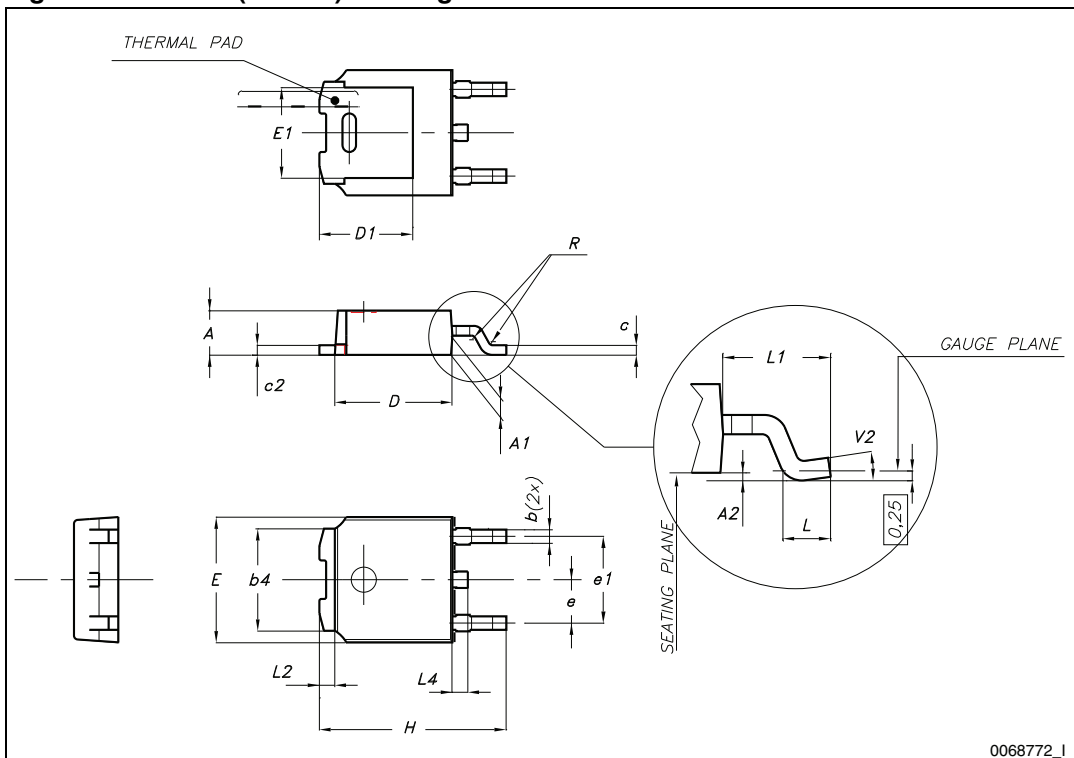
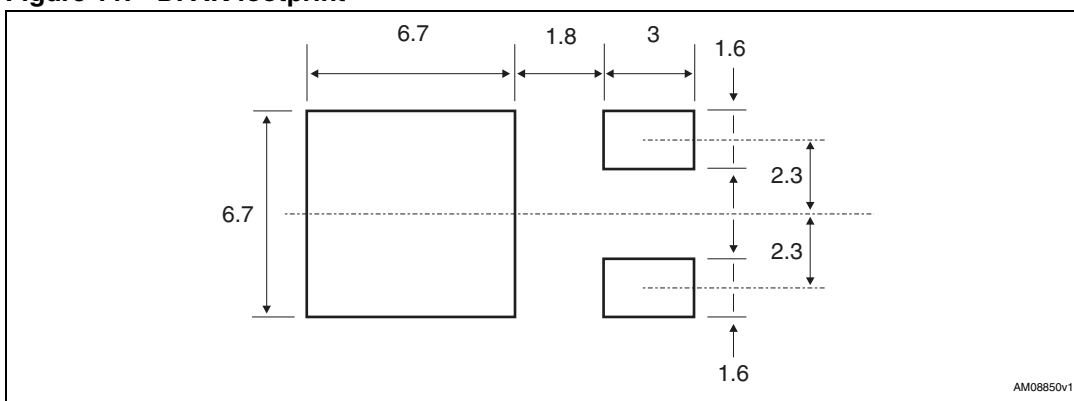
### 3 Package mechanical data

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			

Technical drawing of a tape with components, showing dimensions and assembly details.

**Top View Dimensions:**

- 10 pitches cumulative tolerance on tape  $\pm 0.2$  mm**
- P0**: Pitch between component centers.
- D**: Component diameter.
- P2**: Pitch between component centers (labeled).
- E**: Distance from top edge to component center line.
- F**: Distance from component center line to bottom edge.
- W**: Total tape width.
- A0**: Distance from left edge to first component center.
- P1**: Pitch between component centers (labeled).
- D1**: Component diameter (labeled).
- B0**: Distance from top edge to component center line (labeled).

**Side View Dimensions:**

- T**: Tape thickness.
- K0**: Component height.
- B1**: Distance from top edge to component center line (labeled).

**Assembly Note:** For machine ref. only including draft and radii concentric around B0

**User direction of feed** (indicated by an arrow pointing right)

**Bottom View:** Shows the component layout from below, with dimensions **A0**, **P1**, and **D1** labeled.

**User direction of feed** (indicated by an arrow pointing right)

**Bending radius:** A diagram showing the tape being bent around a radius **R**.

**AM08852v1**

REEL DIMENSIONS

40mm min.

Access hole

At slot location

A

B

C

D

E

F

G measured at hub

H

I

J

K

L

M

N

O

P

Q

R

S

T

Full radius

Tape slot in core for tape start 25 mm min. width

AM08851v2

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

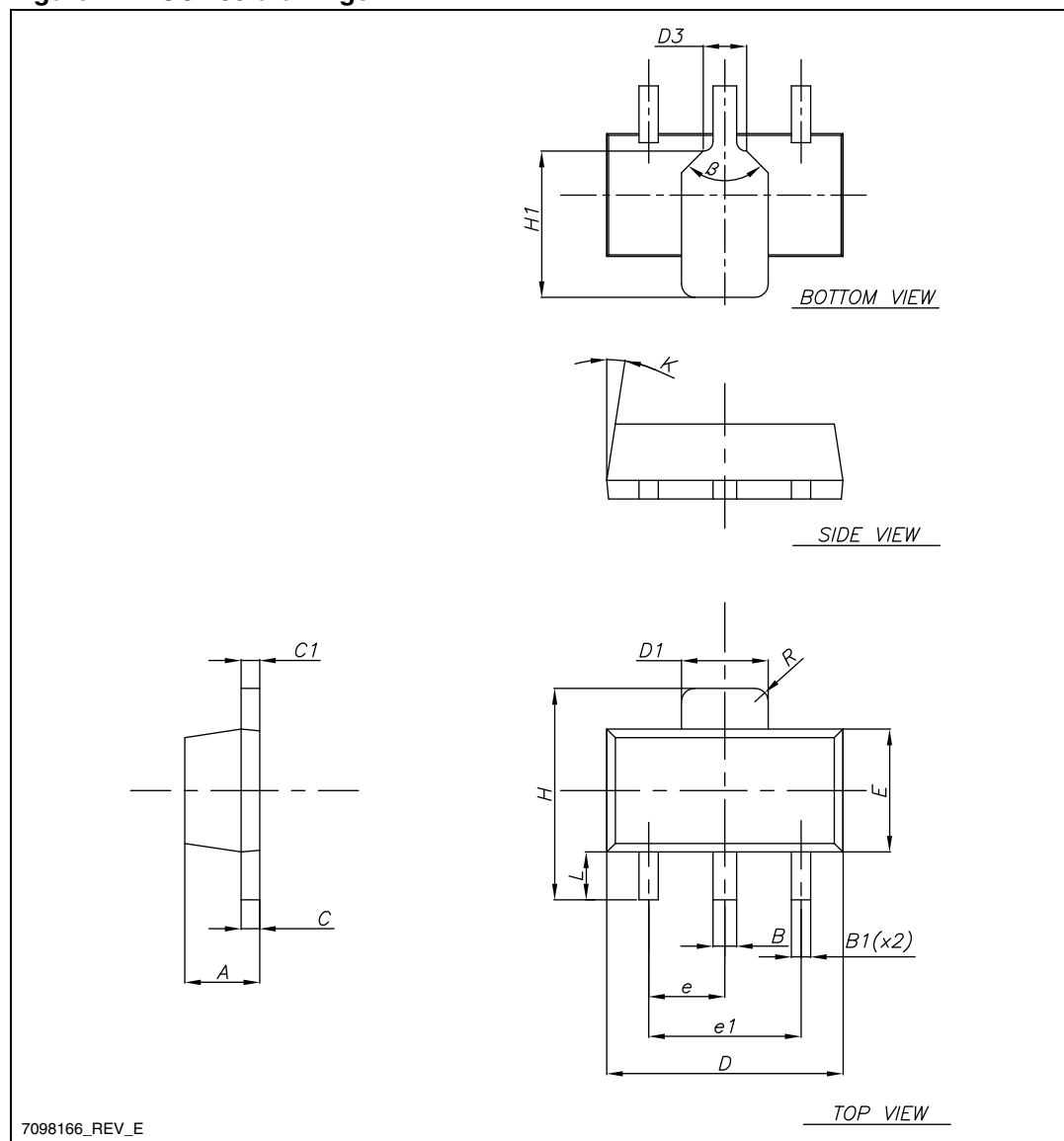


Figure 15. SOT-89 recommended footprint

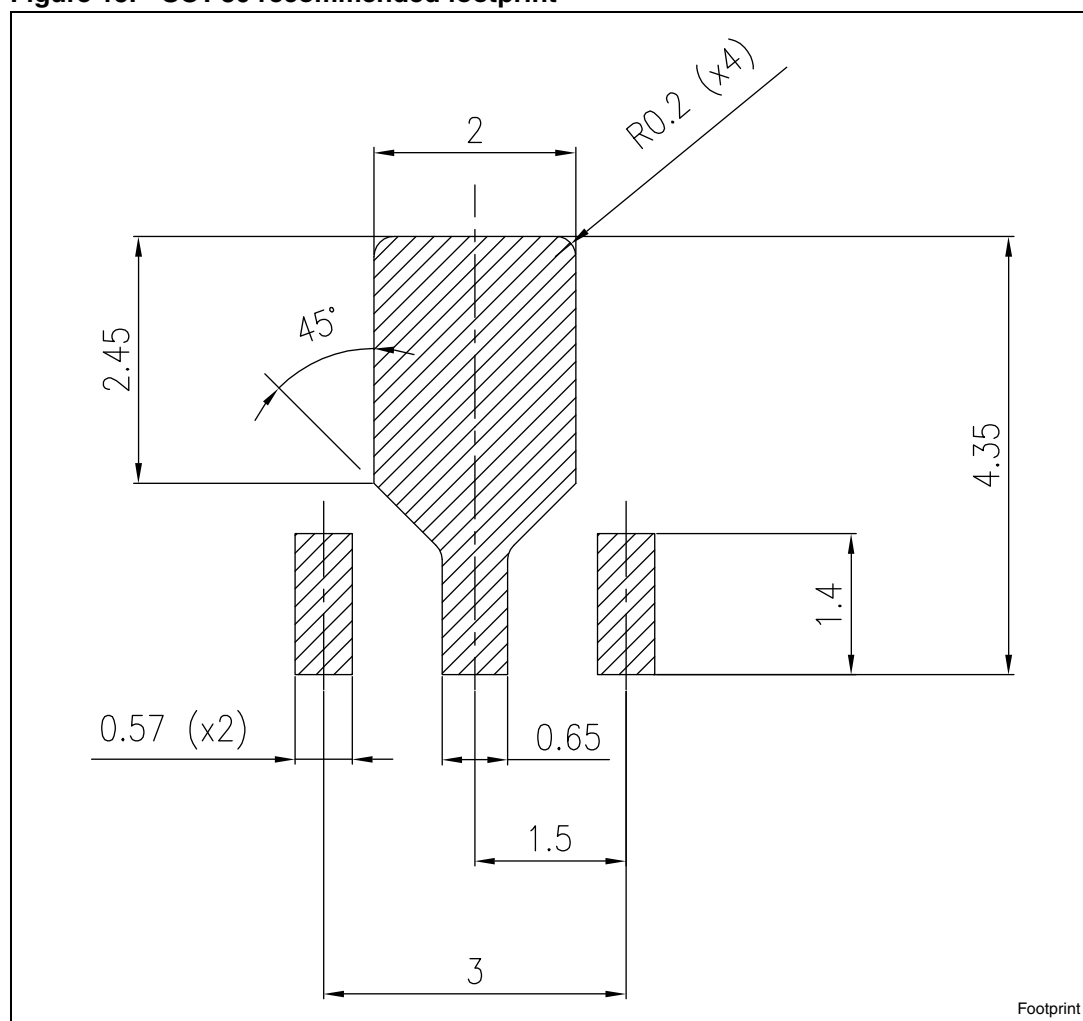
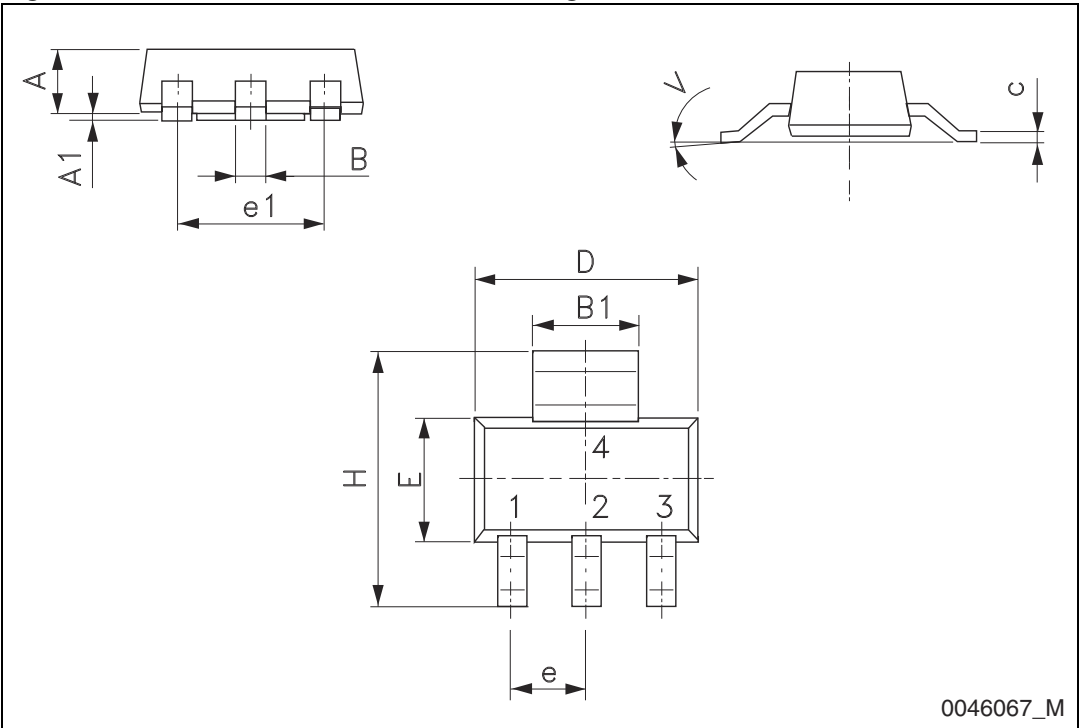


Table 8. SOT-223 mechanical data

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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