

## 2STD2360 2STF2360 - 2STN2360

### Low voltage fast-switching PNP power transistors

#### **Features**

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

### **Applications**

- Emergency lighting
- LED
- Voltage regulation
- Relay drive

#### **Description**

The devices are PNP transistors manufactured using new "PB-HDC" (power bipolar high density current) technology. The resulting transistor shows exceptional high gain performances coupled with very low saturation voltage.

The complementary NPN types are the 2STD1360T4, the 2STF1360 and the 2STN1360.

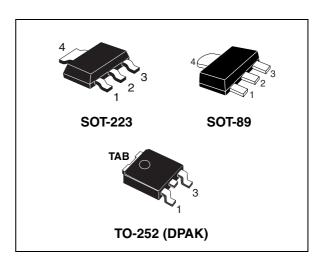


Figure 1. Internal schematic diagram

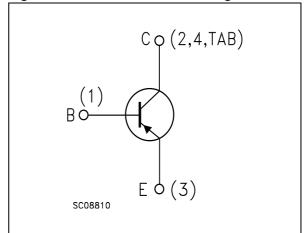


Table 1. Device summary

Order codes	Marking	Packages	Packaging	
2STD2360T4	D2360	DPAK	Tape and reel	
2STF2360	2360	SOT-89	Tape and reel	
2STN2360	N2360	SOT-223	Tape and reel	

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## 1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	2STD2360	2STF2360	2STN2360	Unit
		DPAK	SOT-89	SOT-223	
$V_{CBO}$	Collector-base voltage (I <sub>E</sub> = 0)		-60		V
V <sub>CEO</sub>	Collector-emitter voltage (I <sub>B</sub> = 0)	-60			٧
V <sub>EBO</sub>	Emitter-base voltage $(I_C = 0)$	-6			٧
I <sub>C</sub>	Collector current	-3			Α
I <sub>CM</sub>	Collector peak current (t <sub>P</sub> < 5 ms)	-5			Α
I <sub>B</sub>	Base current	-0.2			Α
I <sub>BM</sub>	Base peak current (t <sub>P</sub> < 5 ms)	-0.4		Α	
P <sub>TOT</sub>	Total dissipation at T <sub>amb</sub> = 25 °C	15 1.4 1.6		W	
T <sub>stg</sub>	Storage temperature	-65 to 150			°C
T <sub>J</sub>	Max. operating junction temperature 150		°C		

Table 3. Thermal data

Symbol	Parameter		DPAK	SOT-89	SOT-223	Unit
R <sub>thJA</sub> <sup>(1)</sup>	Thermal resistance junction-ambient	Max	8.3	89	78	°C/W

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

### 2 Electrical characteristics

 $T_{CASE} = 25$ °C; unless otherwise specified.

Table 4. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I <sub>CBO</sub>	Collector cut-off current (I <sub>E</sub> = 0)	V <sub>CB</sub> = - 60 V			-100	nA
I <sub>EBO</sub>	Emitter cut-off current (I <sub>C</sub> = 0)	V <sub>EB</sub> = - 6 V			-100	nA
V <sub>BE(on)</sub>	Base-emitter on voltage	$V_{CE} = -2 V$ $I_{C} = -100 \text{ mA}$	-630	-650	-730	mV
v (1)	Collector-emitter	$I_C = -2 \text{ A}$ $I_B = -100 \text{ mA}$		-200	-320	mV
V <sub>CE(sat)</sub> <sup>(1)</sup>	saturation voltage	$I_C = -3 \text{ A}$ $I_B = -150 \text{ mA}$		-300	-500	mV
V <sub>BE(sat)</sub> (1)	Base-emitter saturation voltage	$I_C = -2 \text{ A}$ $I_B = -100 \text{ mA}$		-0.9	-1.2	V
h <sub>FF</sub> <sup>(1)</sup>	DC ourrent gain	I <sub>C</sub> = - 100 mA V <sub>CE</sub> = - 2 V	80			
IIFE` '	DC current gain	$I_C = -1 A$ $V_{CE} = -2 V$	160		400	
	Resistive load					
t <sub>d</sub>	Delay time	$I_C = -3 \text{ A}$ $V_{CC} = -10 \text{ V}$		10	15	ns
t <sub>r</sub>	Rise time	$I_{B(on)} = -I_{B(off)} = -300 \text{ mA}$		75	100	ns
t <sub>s</sub>	Storage time	$V_{BE(off)} = 5 V$		250	350	ns
t <sub>f</sub>	Fall time			35	50	ns
f <sub>T</sub>	Transition frequency	I <sub>C</sub> = - 0.1 A V <sub>CE</sub> = - 10 V		130		MHz

<sup>1.</sup> Pulse test: pulse duration  $\leq$  300  $\mu$ s, duty cycle  $\leq$  2 %

### 2.1 Typical characteristics (curves)



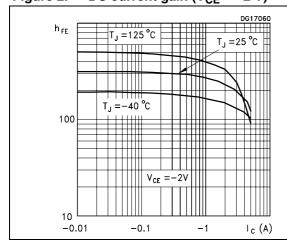


Figure 3. DC current gain  $(V_{CE} = -5 V)$ 

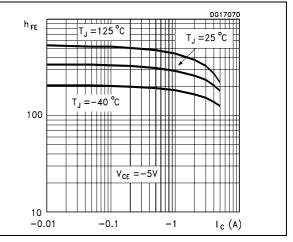


Figure 4. Collector emitter saturation voltage Figure 5. Base emitter saturation voltage

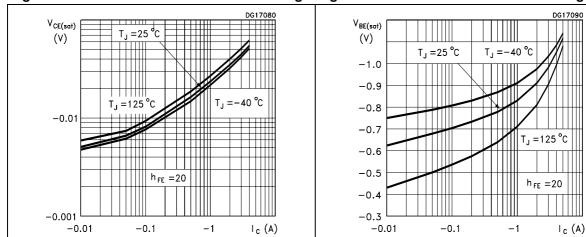
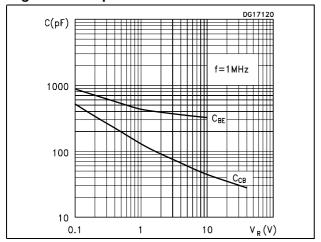


Figure 6. Resistive load switching on

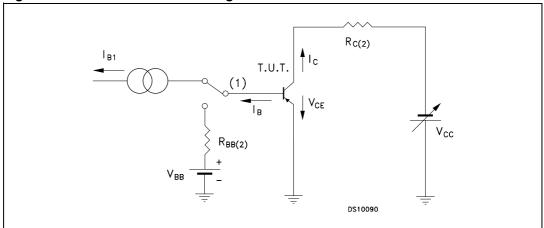
Figure 7. Resistive load switching off DG17100 t (ns) t (ns)  $V_{CC} = -10V$  $V_{CC} = -10V$  $h_{FE} = 10$  $h_{FE} = 10$  $V_{BE(off)} = 5V$  $V_{BE(off)} = 5V$  $-I_{B(on)} = I_{B(off)}$  $-I_{B(on)} = I_{B(off)}$ 100 1000  $t_{r}$ ts  $t_{d}$ t, 10 100 10 -0.5 -1 -1.5 -2.0 -2.5 -0.5 I<sub>C</sub> (A) -1 -1.5 -2 -2.5I<sub>C</sub> (A)

Figure 8. **Capacitances** 



### 2.2 Test circuits

Figure 9. Resistive load switching

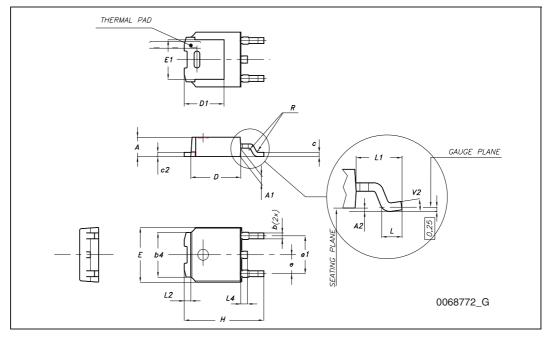


- 1. Fast electronic switch
- 2. Non-inductive resistor

## 3 Package mechanical data

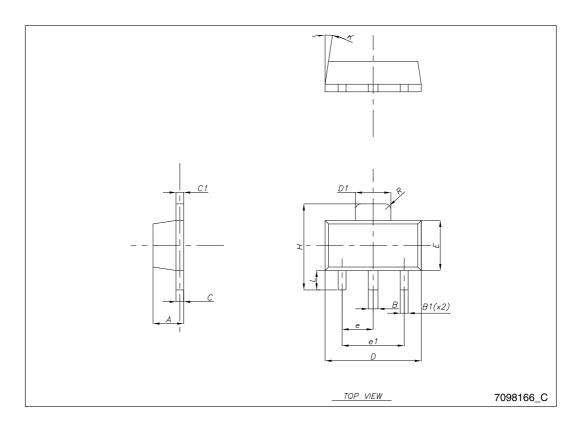
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: <a href="https://www.st.com">www.st.com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

DIM.		mm.	
	min.	typ	max.
А	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
С	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	
е		2.28	
e1	4.40		4.60
Н	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0 °		8 °



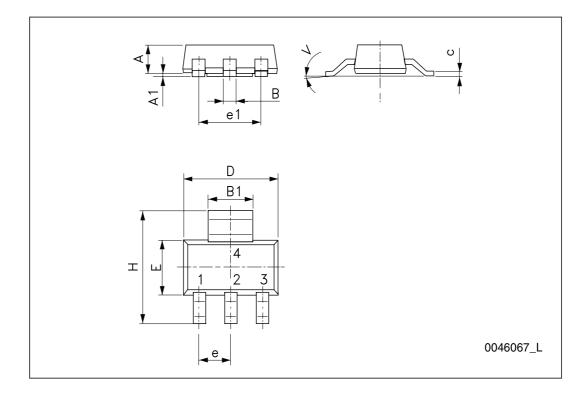
#### SOT-89 mechanical data

Dim.		mm			
	Min.	Тур.	Max.		
А	1.40		1.60		
В	0.44		0.56		
B1	0.36		0.48		
С	0.35		0.44		
C1	0.35		0.44		
D	4.40		4.60		
D1	1.62		1.83		
Е	2.29		2.60		
е	1.42		1.57		
e1	2.92		3.07		
Н	3.94		4.25		
К	1°		8°		
L	0.89		1.20		
R		0.25			



#### SOT-223 mechanical data

DIM.		mm.				
Dilvi.	min.	typ	max.			
А			1.80			
A1	0.02		0.1			
В	0.60	0.70	0.85			
B1	2.90	3.00	3.15			
С	0.24	0.26	0.35			
D	6.30	6.50	6.70			
е		2.30				
e1		4.60				
Е	3.30	3.50	3.70			
Н	6.70	7.00	7.30			
V			10 °			



# 4 Revision history

Table 5. Document revision history

Date	Revision	Changes
13-Sep-2006	1	Initial release
02-Mar-2007	2	New graphics have been added
23-Jan-2009	3	Updated mechanical data
09-Oct-2009	4	Added 2STD2360T4 in TO-252 (DPAK) package
14-Oct-2009	5	Modified Table 1 on page 1.

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