

## Low voltage fast-switching NPN power bipolar transistors

### Features

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

### Applications

- Emergency lighting
- Led
- CCFL drivers (back lighting)
- Voltage regulation
- Relay driver

### Description

The devices are NPN transistors manufactured using new "PB-HCD" (Power Bipolar High Current Density) technology. The resulting transistor shows exceptional high gain performances coupled with very low saturation voltage.

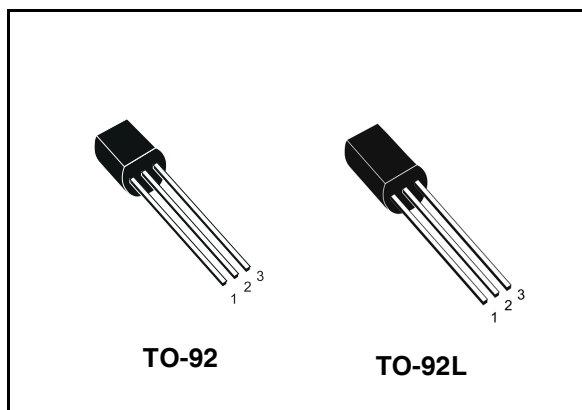


Figure 1. Internal schematic diagram

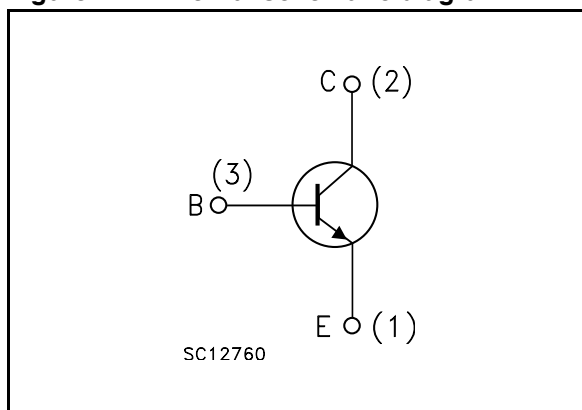


Table 1. Device summary

Order codes	Marking	Package	Packaging
2STX1360	X1360	TO-92	Bulk
2STL1360	L1360	TO-92L	Bulk

# 1 Electrical ratings

**Table 2. Absolute maximum rating**

Symbol	Parameter	Value		Unit
		2STX1360	2STL1360	Unit
$V_{CBO}$	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 ( $t_P < 5\text{ms}$ )	5		A
$P_{tot}$	Total dissipation at $T_{amb} = 25^\circ\text{C}$	1	1.2	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
		TO-92	TO-92L	Unit
$R_{thj-amb}$	Thermal resistance junction-ambient max	125	104.2	$^\circ\text{C/W}$

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CBO}$	Collector cut-off current ( $I_E = 0$ )	$V_{CB} = 80V$			100	nA
$I_{EBO}$	Emitter cut-off current ( $I_C = 0$ )	$V_{EB} = 6V$			100	nA
$V_{BE}$	Base-emitter voltage	$V_{CE} = 2V$ $I_C = 100mA$	630	670	730	mV
$V_{CE(sat)}^{(1)}$	Collector-emitter saturation voltage	$I_C = 2A$ $I_B = 100mA$		150	300	mV
		$I_C = 3A$ $I_B = 150mA$		210	500	mV
$V_{BE(sat)}^{(1)}$	Base-emitter saturation voltage	$I_C = 2A$ $I_B = 100mA$		0.89	1.2	V
$h_{FE}^{(1)}$	DC current gain	$I_C = 0.1A$ $V_{CE} = 2V$	80			
		$I_C = 1A$ $V_{CE} = 2V$	160	280	400	
$t_d$ $t_r$ $t_s$ $t_f$	RESISTIVE LOAD	$V_{CC} = 10V$ $I_C = 3A$ $I_{B1} = -I_{B2} = 300mA$ (see figure 9)				
	Delay time			17	20	ns
	Rise time			81	100	ns
	Storage time			620	720	ns
$t_f$	Fall time		54	65	ns	
$f_T$	Transition frequency	$I_C = 0.1A$ $V_{CE} = 10V$		130		MHz

Note (1) Pulsed duration = 300  $\mu s$ , duty cycle  $\leq 1.5\%$

### 2.1 Electrical characteristics (curves)

**Figure 2. DC current gain**

**Figure 3. DC current gain**

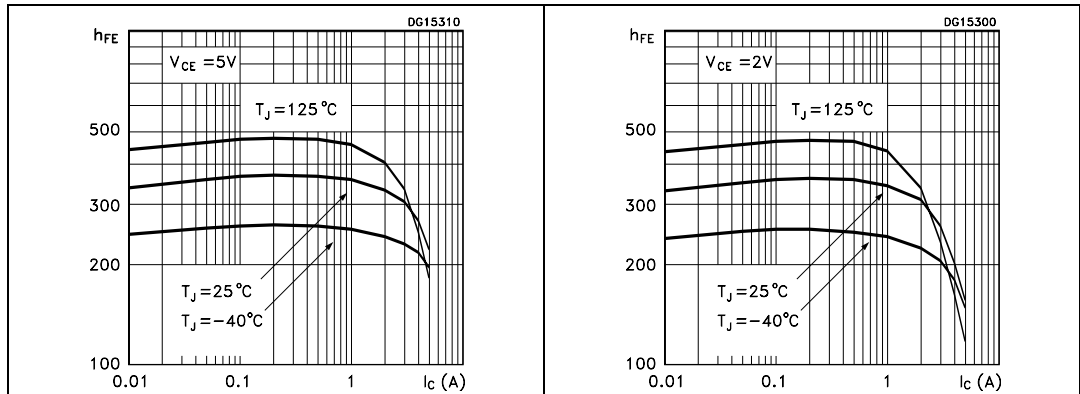


Figure 4. Collector-emitter saturation voltage

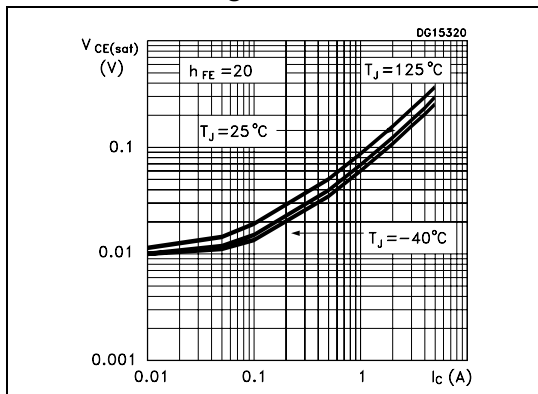


Figure 5. Base-emitter saturation voltage

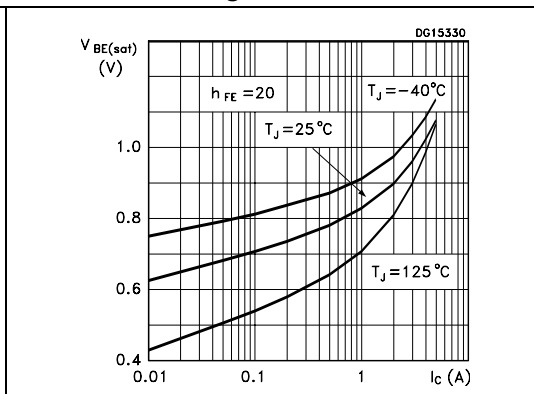


Figure 6. Resistive load switching time

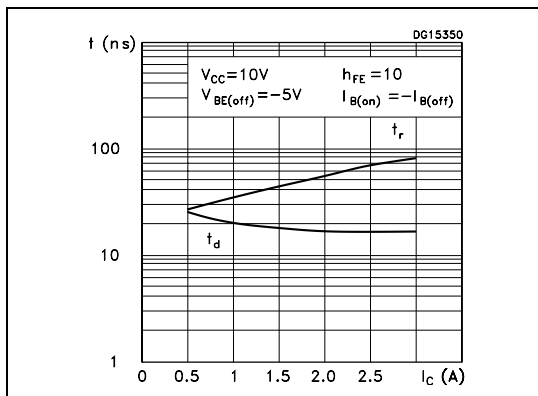


Figure 7. Resistive load switching time

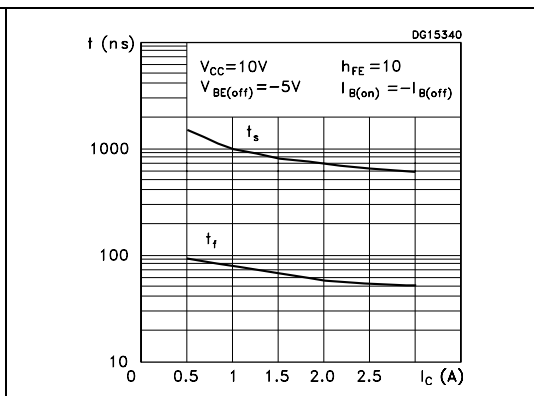
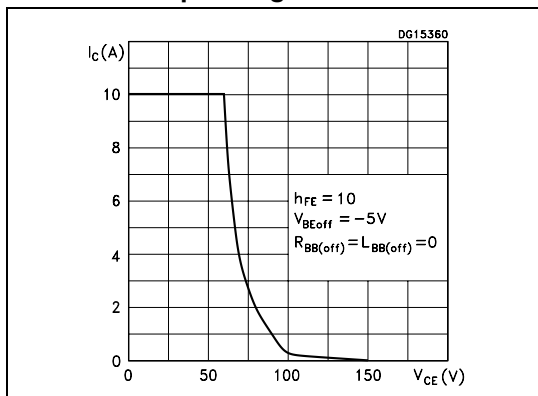
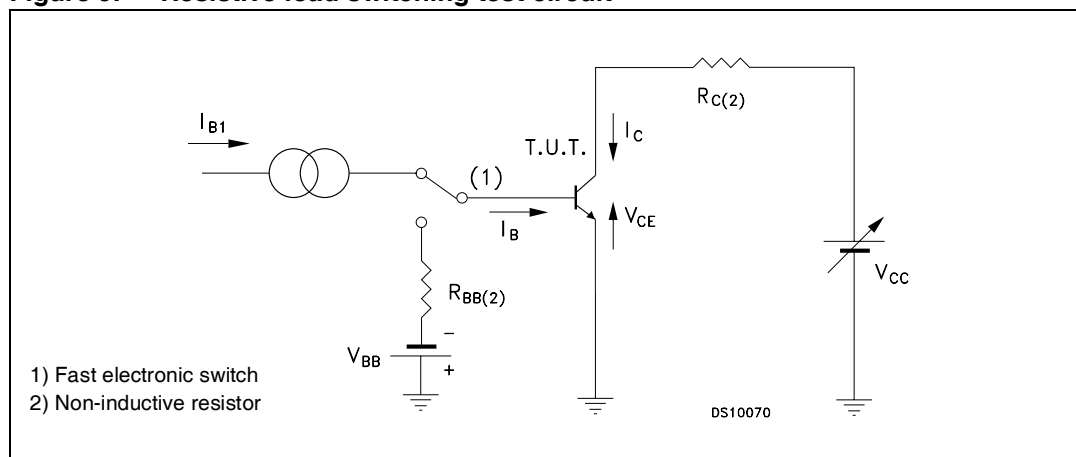


Figure 8. Reverse biased safe operating area



## 2.2 Test circuit

Figure 9. Resistive load switching test circuit

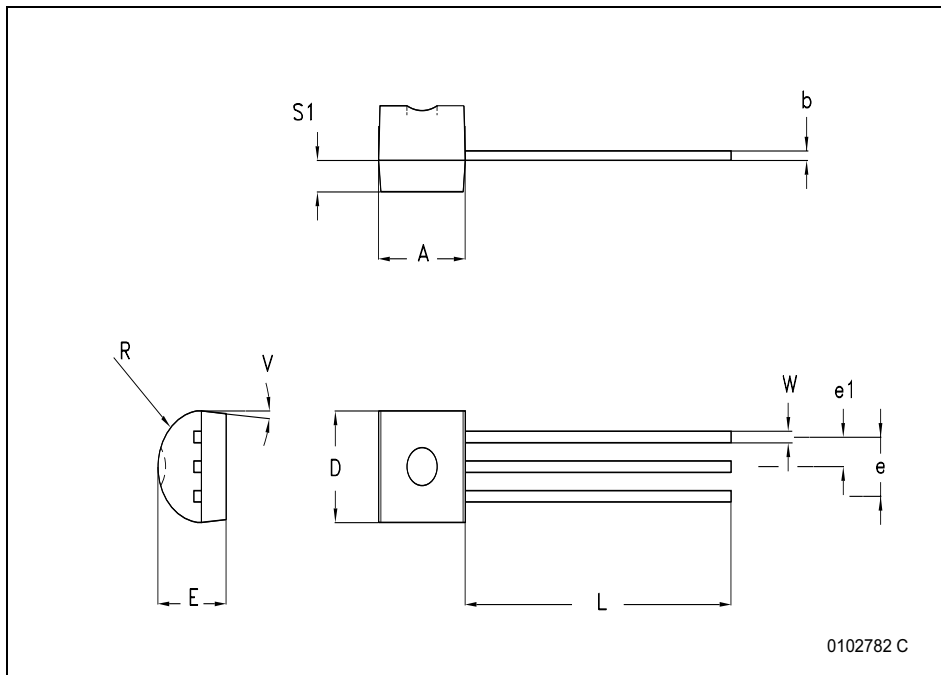


### 3 Package mechanical data

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)

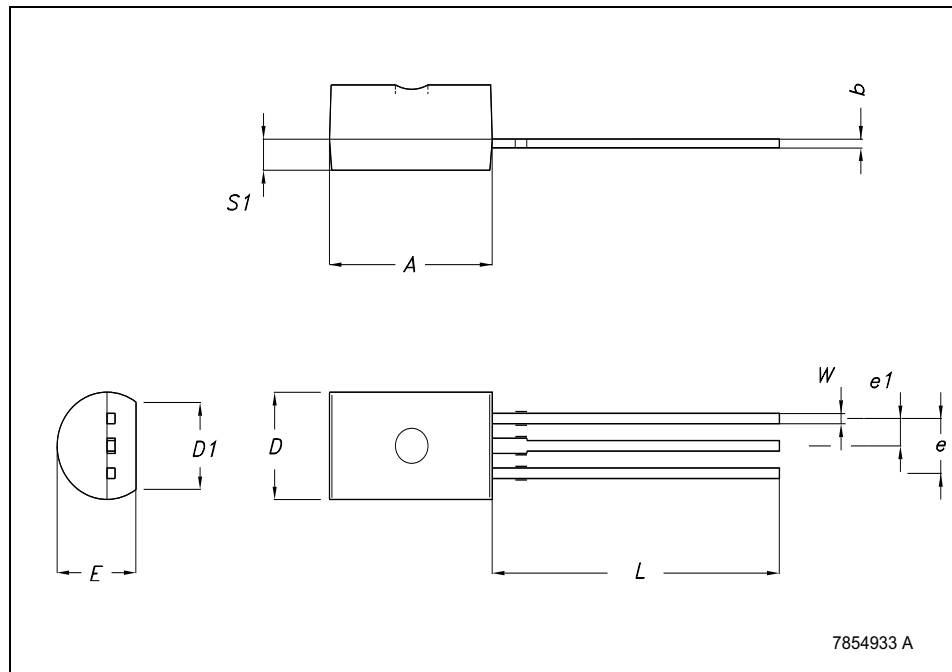
**TO-92 BULK SHIPMENT MECHANICAL DATA**

DIM.	mm.		
	MIN.	TYP	MAX.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	



**TO-92L MECHANICAL DATA**

DIM.	mm.		
	MIN.	TYP	MAX.
A	7.80		8.20
b	0.35		0.45
D	4.70		5.10
D1		4	
E	3.70		4.10
e	2.44		2.64
e1		1.27	
L	13.30		14.30
S1	1.28		1.58
W	0.35		0.55





## 4 Revision history

**Table 5. Revision history**

Date	Revision	Changes
20-Oct-2006	1	Initial release
16-Jul-2007	2	Figure 2, 3,4,5,6,7 and figure 8 added.

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