

## Low voltage fast-switching NPN 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 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.

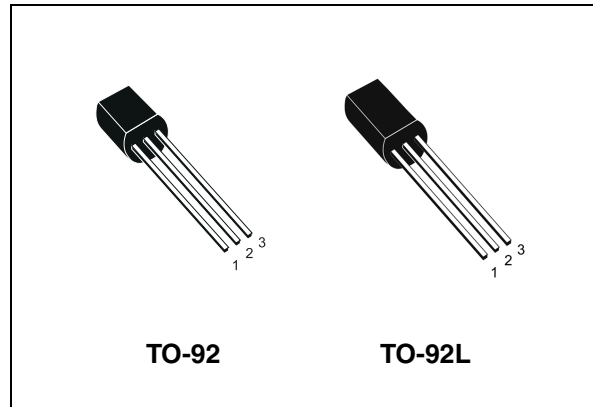


Figure 1. Internal schematic diagram

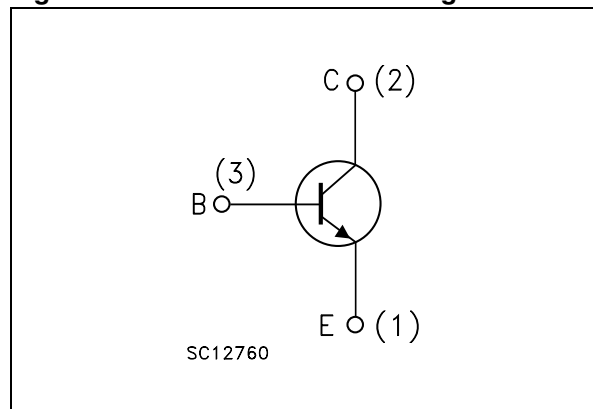


Table 1. Device summary

Order codes	Marking	Packages	Packaging
2STL1360	L1360	TO-92L	Bag
2STX1360	X1360	TO-92	Bag

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		2STX1360	2STL1360	
$V_{CBO}$	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	1	1.2	W
$T_{STG}$	Storage temperature	-65 to 150		°C
$T_J$	Max. operating junction temperature	150		°C

**Table 3. Thermal data**

Symbol	Parameter	Value		Unit
		TO-92	TO-92L	
$R_{thJA}$	Thermal resistance junction-ambient max	125	104	°C/W

## 2 Electrical characteristics

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

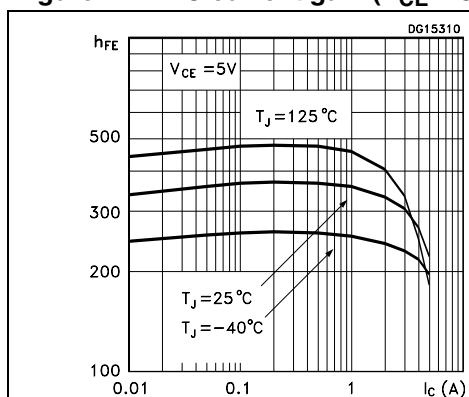
**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CBO}}$	Collector cut-off current ( $I_{\text{E}} = 0$ )	$V_{\text{CB}} = 80\text{ V}$			100	nA
$I_{\text{EBO}}$	Emitter cut-off current ( $I_{\text{C}} = 0$ )	$V_{\text{EB}} = 6\text{ V}$			100	nA
$V_{\text{BE(on)}}$	Base-emitter on voltage	$V_{\text{CE}} = 2\text{ V}$ $I_{\text{C}} = 100\text{ mA}$	630	650	730	mV
$V_{\text{CE(sat)}}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 100\text{ mA}$		130	300	mV
		$I_{\text{C}} = 3\text{ A}$ $I_{\text{B}} = 150\text{ mA}$		180	500	mV
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 100\text{ mA}$		0.9	1.2	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 0.1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$	80			
		$I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$	160		400	
$t_{\text{d}}$ $t_{\text{r}}$ $t_{\text{s}}$ $t_{\text{f}}$	RESISTIVE LOAD					
	Delay time	$V_{\text{CC}} = 10\text{ V}$ $I_{\text{C}} = 3\text{ A}$		17	20	ns
	Rise time	$I_{\text{B(on)}} = - I_{\text{B(off)}} = 300\text{ mA}$		81	100	ns
	Storage time	$V_{\text{BE(off)}} = -5\text{ V}$		620	720	ns
$t_{\text{f}}$	Fall time			54	65	ns
$f_{\text{T}}$	Transition frequency	$I_{\text{C}} = 0.1\text{ A}$ $V_{\text{CE}} = 10\text{ V}$		130		MHz

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

### 2.1 Electrical characteristics (curves)

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



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

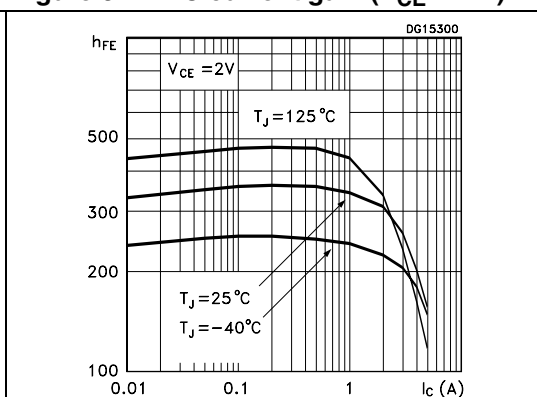


Figure 4. Collector-emitter saturation voltage

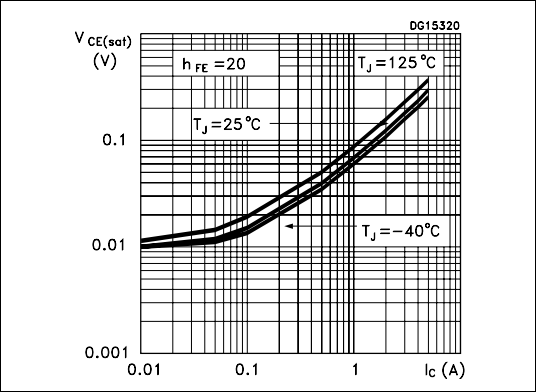


Figure 5. Base-emitter saturation voltage

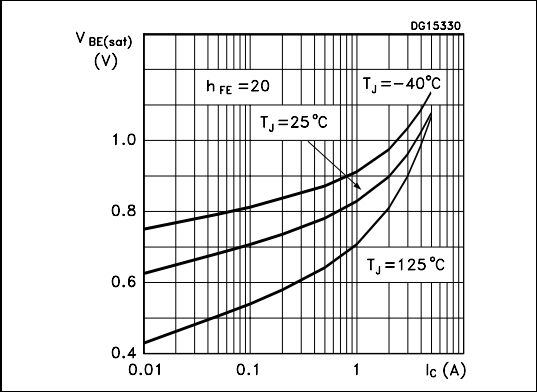


Figure 6. Resistive load switching time

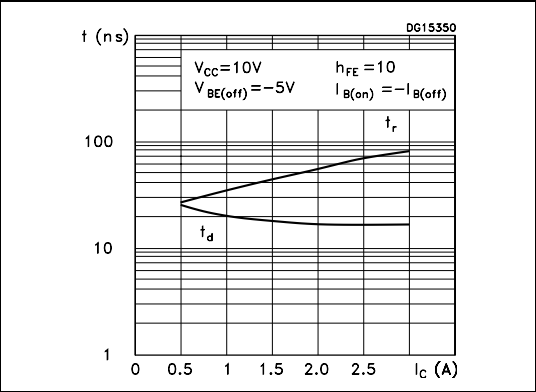


Figure 7. Resistive load switching time

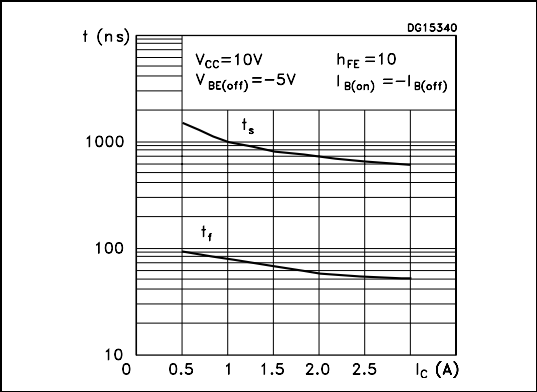
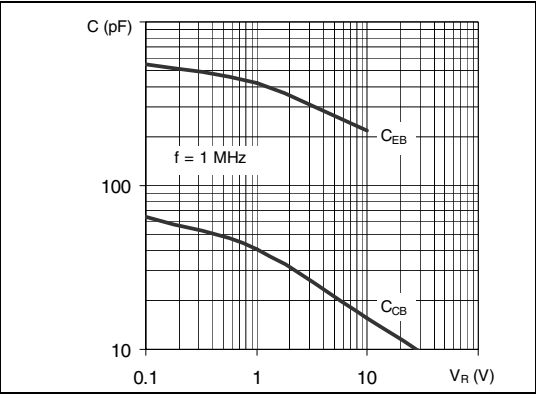
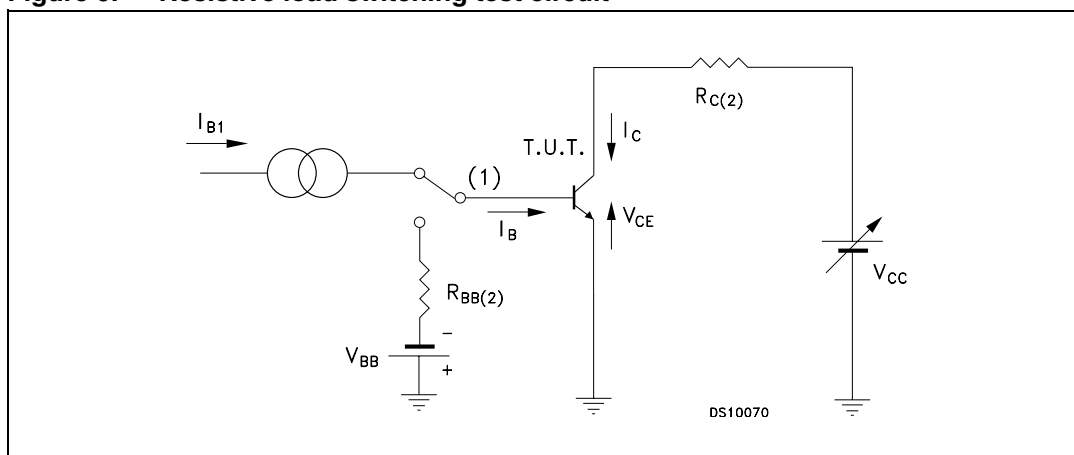


Figure 8. Capacitance



## 2.2 Test circuit

Figure 9. Resistive load switching test circuit



1. Fast electronic switch
2. Non-inductive resistor

### 3 Package mechanical data

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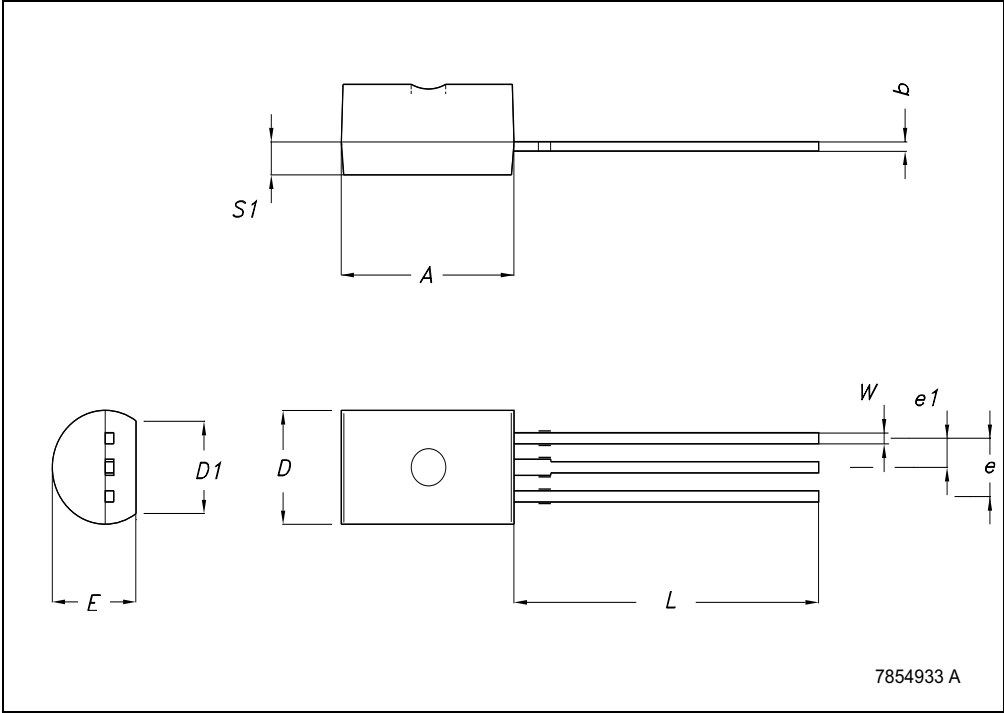
TO-92 bulk shipment mechanical data			
DIM.	mm.		
	MIN.	TYP	MAX.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	

The diagram illustrates the mechanical specifications of a TO-92 package through three views: a top view, a side view, and a front view. The top view shows the width dimension A and the lead length dimension S1. The side view shows the lead thickness dimension b. The front view shows the package body diameter D, the lead length L, the lead thickness W, the lead spacing e1, and the lead thickness e. The package body is shown with a semi-circular top edge of radius R and a total height E. The lead angle V is indicated as 5°.

0102782 D

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. Document revision history**

Date	Revision	Changes
20-Oct-2006	1	Initial release
16-Jul-2007	2	Added figures 2, 3, 4, 5, 6, 7 and 8
29-Oct-2009	3	Updated <a href="#">Figure 8 on page 4</a> and TO-92 package mechanical data

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