

## 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.

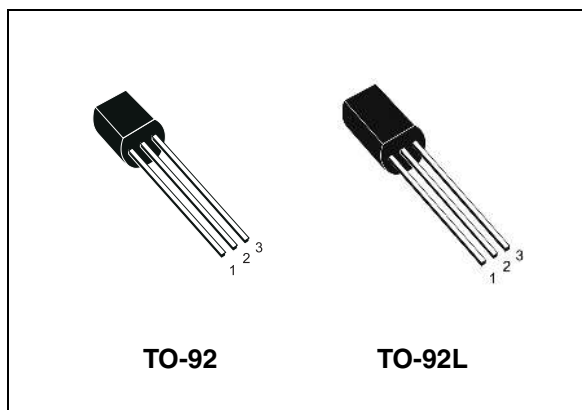


Figure 1. Internal schematic diagram

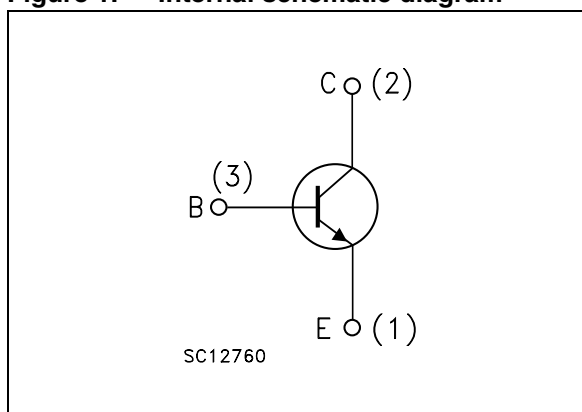


Table 1. Device summary

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

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

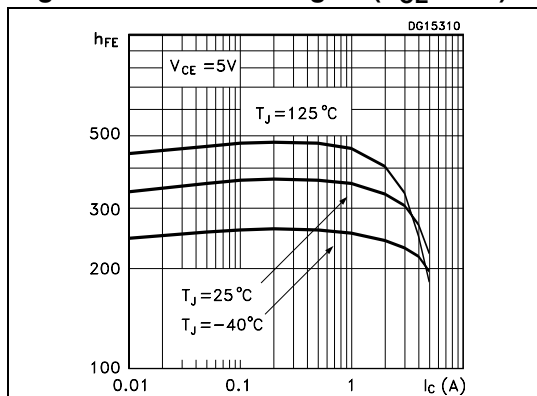
**Table 4. Electrical characteristics**

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	$I_C = 0.1\text{ A}$ $V_{CE} = 2\text{ V}$	80			
		$I_C = 1\text{ A}$ $V_{CE} = 2\text{ V}$	160		400	
$t_d$ $t_r$ $t_s$ $t_f$	RESISTIVE LOAD					
	Delay time	$V_{CC} = 10\text{ V}$ $I_C = 3\text{ A}$		17	20	ns
	Rise time	$I_{B(on)} = - I_{B(off)} = 300\text{ mA}$		81	100	ns
	Storage time	$V_{BE(off)} = - 5\text{ V}$		620	720	ns
$t_f$	Fall time			54	65	ns
$f_T$	Transition frequency	$I_C = 0.1\text{ A}$ $V_{CE} = 10\text{ V}$		130		MHz

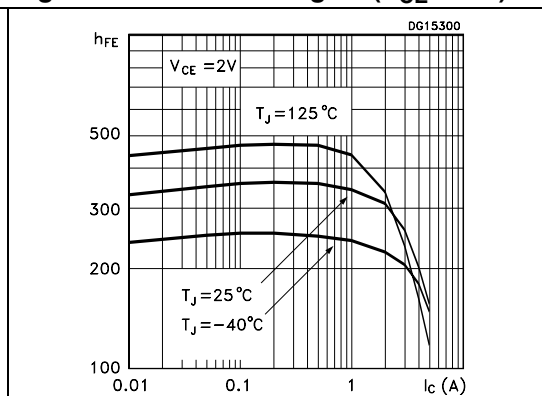
1. Pulse test: pulse duration  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

### 2.1 Electrical characteristics (curves)

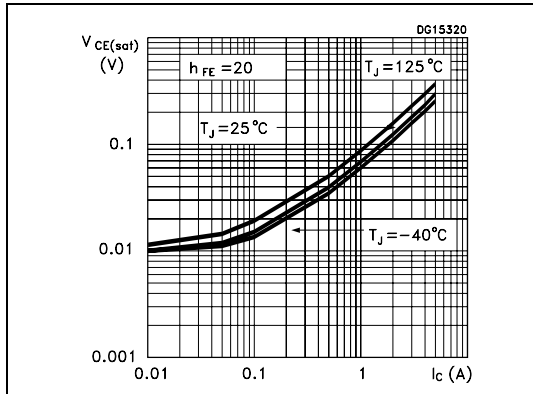
**Figure 2. DC current gain ( $V_{CE} = 5\text{ V}$ )**



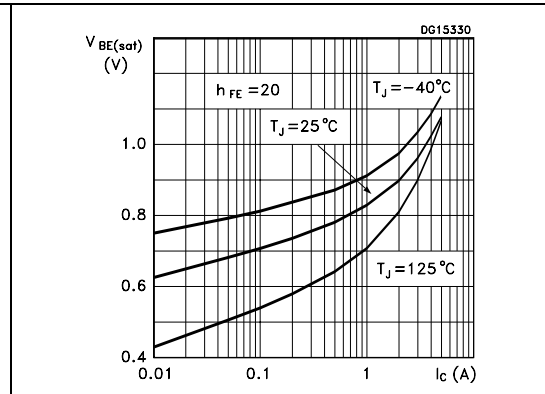
**Figure 3. DC current gain ( $V_{CE} = 2\text{ V}$ )**



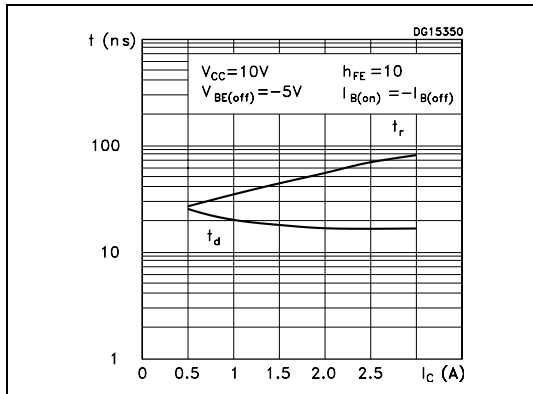
**Figure 4. Collector-emitter saturation voltage**



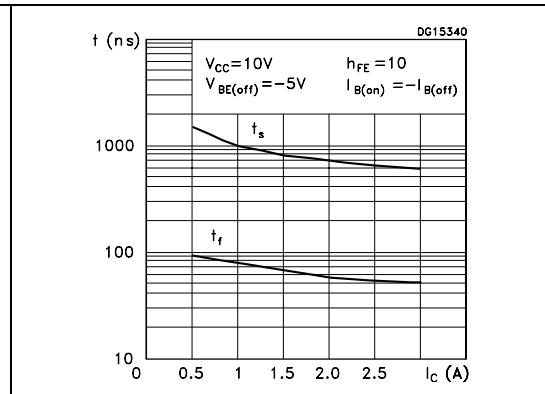
**Figure 5. Base-emitter saturation voltage**



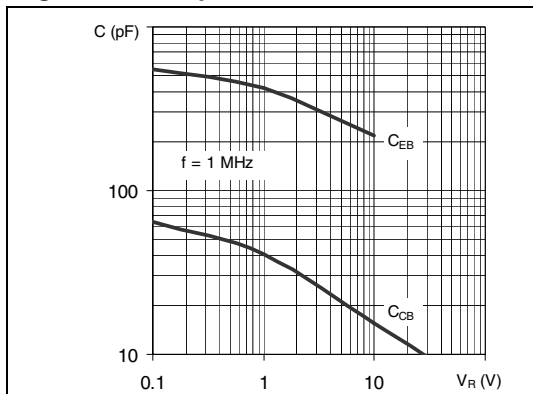
**Figure 6. Resistive load switching time**



**Figure 7. Resistive load switching time**

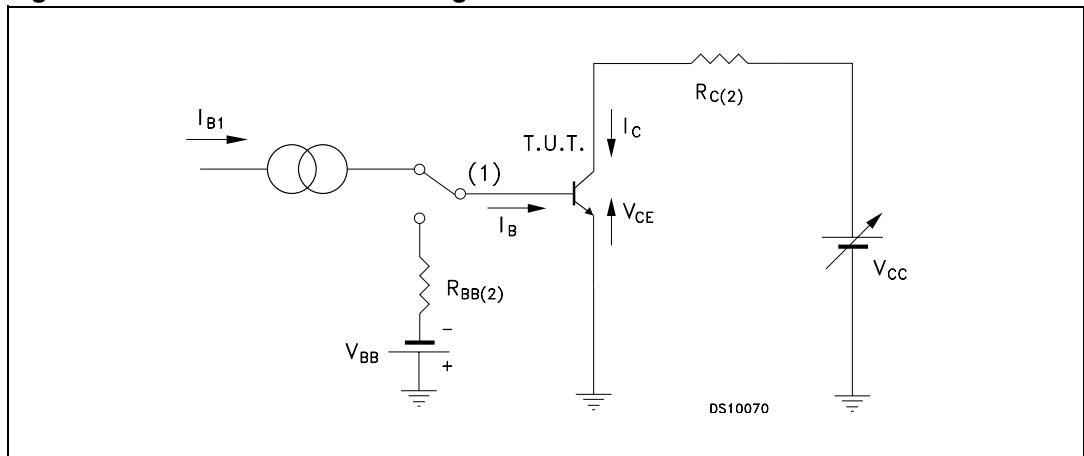


**Figure 8. Capacitance**



## 2.2 Test circuit

Figure 9. Resistive load switching test circuit



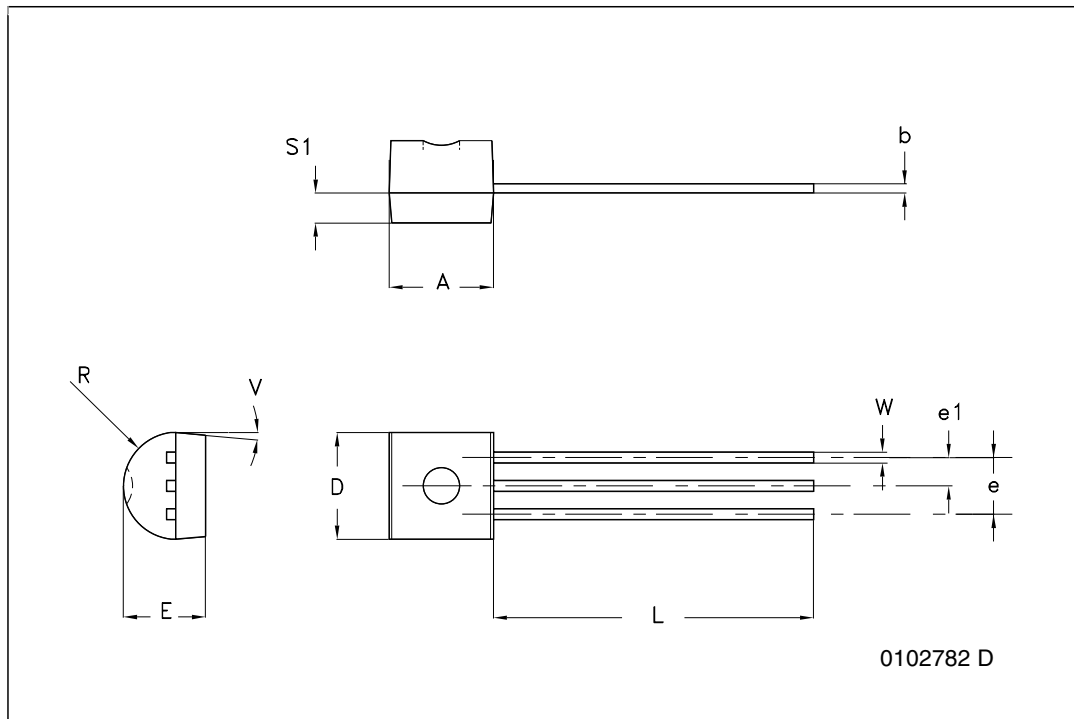
1. Fast electronic switch
2. Non-inductive resistor

### 3 Package mechanical data

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.

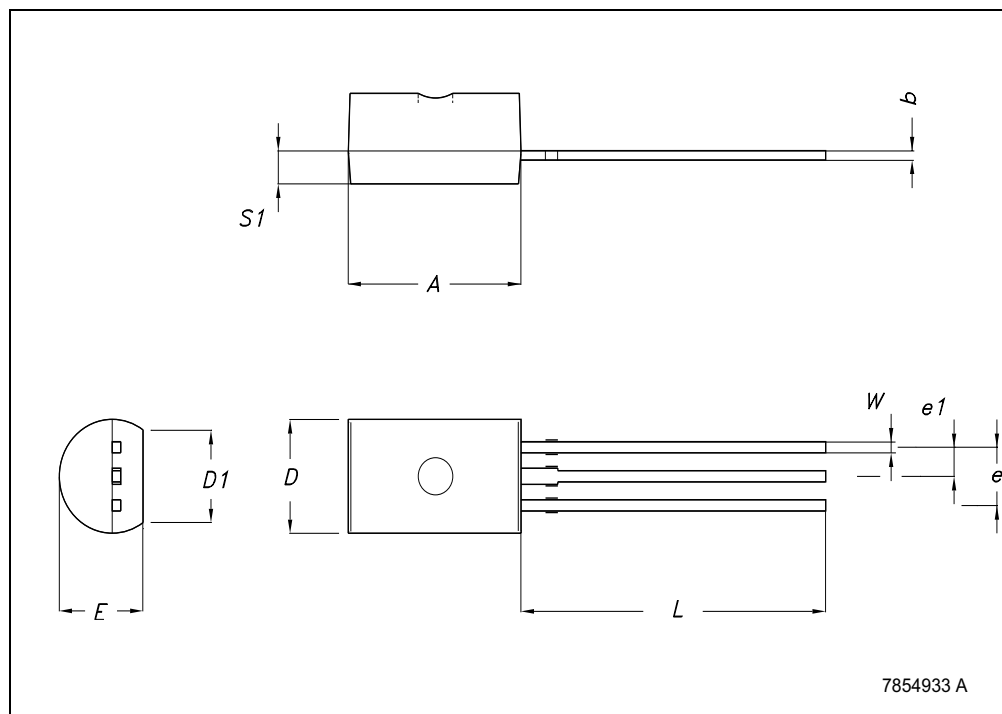
**TO-92 bulk shipment mechanical data**

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. 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

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2009 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)