

## Complementary power Darlingtons

### Features

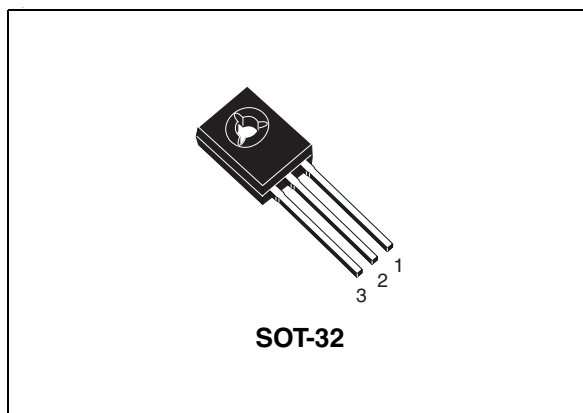
- Good  $h_{FE}$  linearity
- High  $f_T$  frequency
- Monolithic Darlingtons configuration with integrated antiparallel collector-emitter diode

### Applications

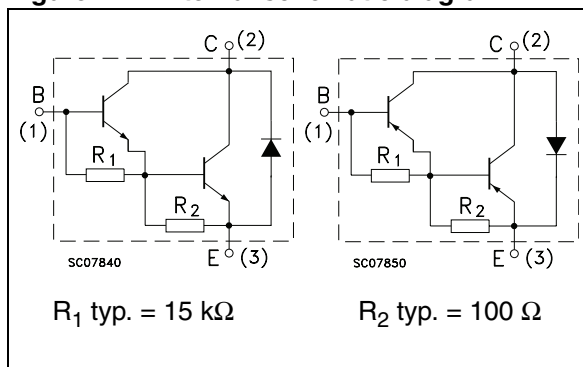
- Linear and switching industrial equipment

### Description

The devices are manufactured in planar technology with “base island” layout and monolithic Darlingtons configuration.



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

Order codes	Marking	Polarity	Package	Packaging
2N6036	2N6036	NPN	SOT-32	Tube
2N6039	2N6039	PNP	SOT-32	Tube

# 1 Absolute maximum ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CBO}$	Collector-base voltage ( $I_E = 0$ )	80	V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )		
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	5	V
$I_C$	Collector current	4	A
$I_{CM}$	Collector peak current	8	A
$I_B$	Base current	0.1	A
$P_{TOT}$	Total dissipation at $T_{case} = 25^\circ\text{C}$	40	W
$T_{STG}$	Storage temperature	-65 to 150	$^\circ\text{C}$
$T_J$	Max. operating junction temperature	150	$^\circ\text{C}$

*Note:* For PNP types voltage and current values are negative.

## 2 Electrical characteristics

( $T_{\text{case}} = 25\text{ °C}$ ; unless otherwise specified)

**Table 3. Electrical characteristics**

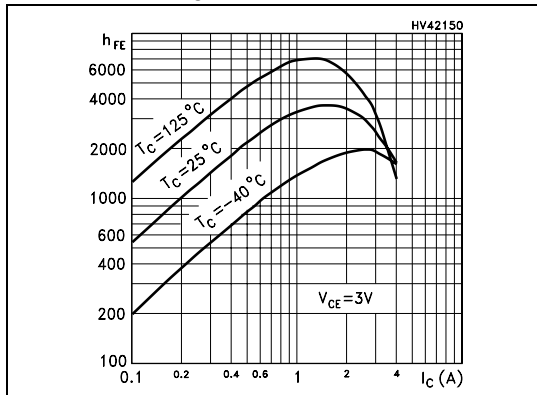
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CEV}}$	Collector cut-off current ( $V_{\text{BE}} = -1.5\text{ V}$ )	$V_{\text{CE}} = 80\text{ V}$ $V_{\text{CE}} = 80\text{ V}, T_{\text{c}} = 125\text{ °C}$		-	0.1 0.5	mA mA
$I_{\text{CBO}}$	Collector cut-off current ( $I_{\text{E}} = 0$ )	$V_{\text{CB}} = 80\text{ V}$		-	0.1	mA
$I_{\text{CEO}}$	Collector cut-off current ( $I_{\text{B}} = 0$ )	$V_{\text{CE}} = 80\text{ V}$		-	0.1	mA
$I_{\text{EBO}}$	Emitter cut-off current ( $I_{\text{C}} = 0$ )	$V_{\text{EB}} = 5\text{ V}$		-	2	mA
$V_{\text{CEO(sus)}}^{(1)}$	Collector-emitter sustaining voltage	$I_{\text{C}} = 100\text{ mA}$	80	-		V
$V_{\text{CE(sat)}}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 8\text{ mA}$ $I_{\text{C}} = 4\text{ A}$ $I_{\text{B}} = 40\text{ mA}$		-	2 3	V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 4\text{ A}$ $I_{\text{B}} = 40\text{ mA}$		-	4	V
$V_{\text{BE(on)}}$	Base-emitter on voltage	$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 3\text{ V}$		-	2.8	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 0.5\text{ A}$ $V_{\text{CE}} = 3\text{ V}$ $I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 3\text{ V}$ $I_{\text{C}} = 4\text{ A}$ $V_{\text{CE}} = 3\text{ V}$	500 750 100	-		
$h_{\text{fe}}$	Small signal current gain	$I_{\text{C}} = 0.75\text{ A}$ $V_{\text{CE}} = 10\text{ V}$ $f = 1\text{ MHz}$	25	-		
$C_{\text{CBO}}$	Collector base capacitance ( $I_{\text{E}} = 0$ )	$V_{\text{CB}} = 10\text{ V}$ $f = 0.1\text{ MHz}$ for 2N6036 for 2N6039		-	100 200	pF pF

1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

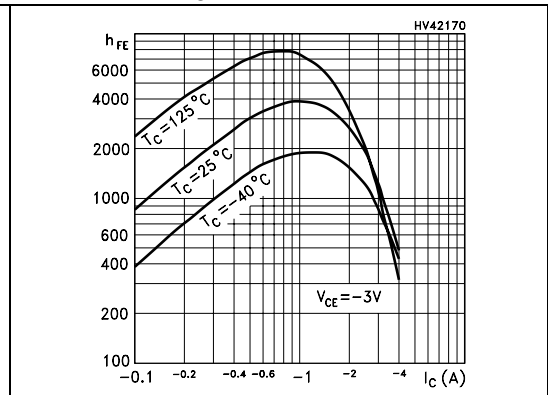
*Note:* For PNP types voltage and current values are negative.

## 2.1 Typical characteristic (curves)

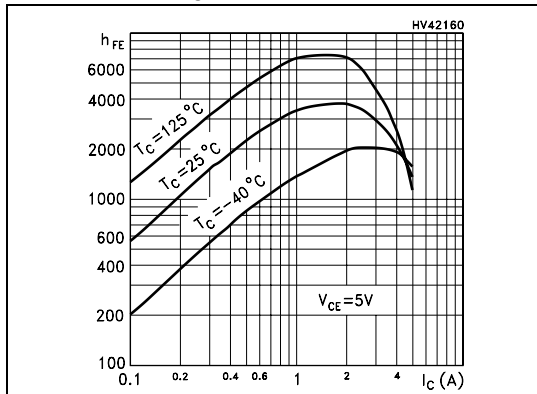
**Figure 2. DC current gain ( $V_{CE} = 3\text{ V NPN}$ )**



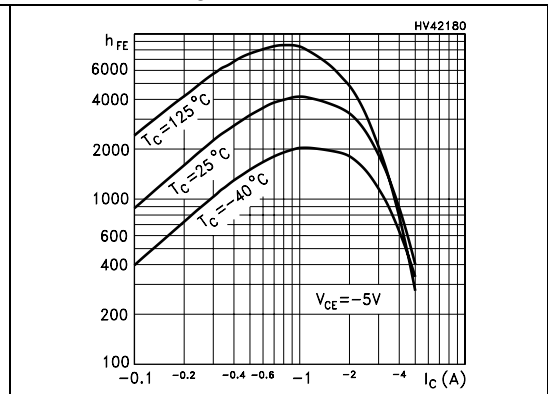
**Figure 3. DC current gain ( $V_{CE} = -3\text{ V PNP}$ )**



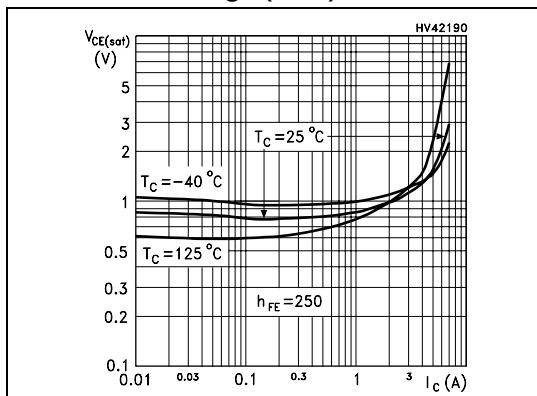
**Figure 4. DC current gain ( $V_{CE} = 5\text{ V NPN}$ )**



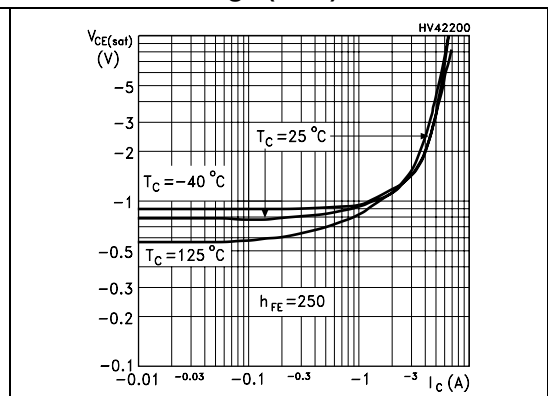
**Figure 5. DC current gain ( $V_{CE} = -5\text{ V PNP}$ )**



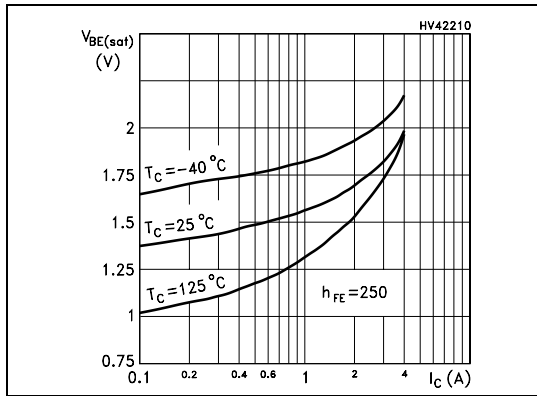
**Figure 6. Collector-emitter saturation voltage (NPN)**



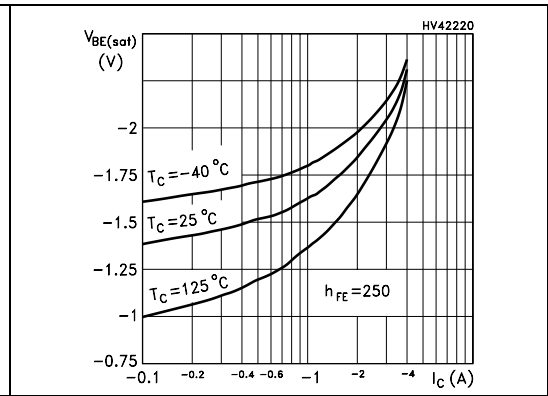
**Figure 7. Collector-emitter saturation voltage (PNP)**



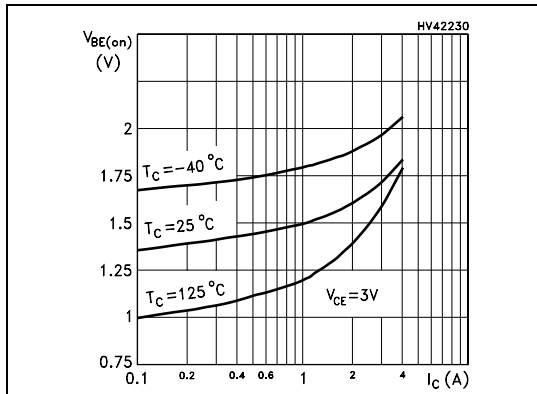
**Figure 8. Base-emitter saturation voltage (NPN)**



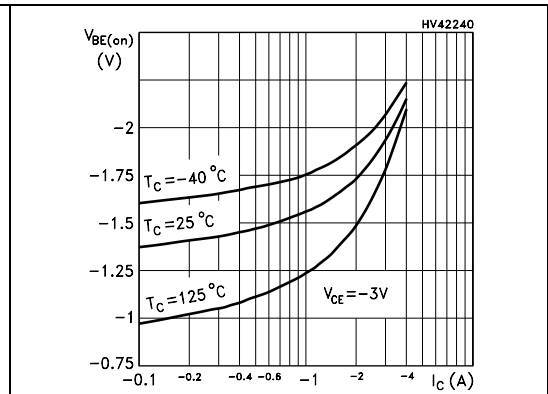
**Figure 9. Base-emitter saturation voltage (PNP)**



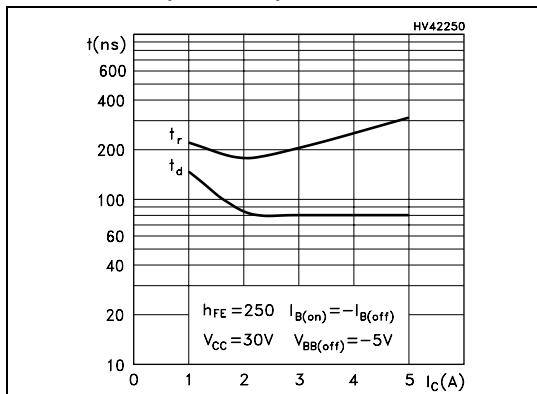
**Figure 10. Base-emitter on voltage (NPN)**



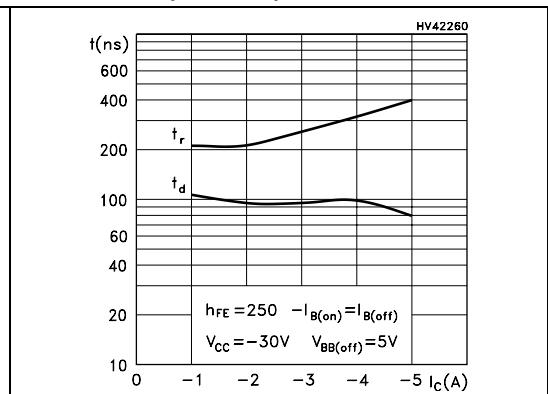
**Figure 11. Base-emitter on voltage (PNP)**



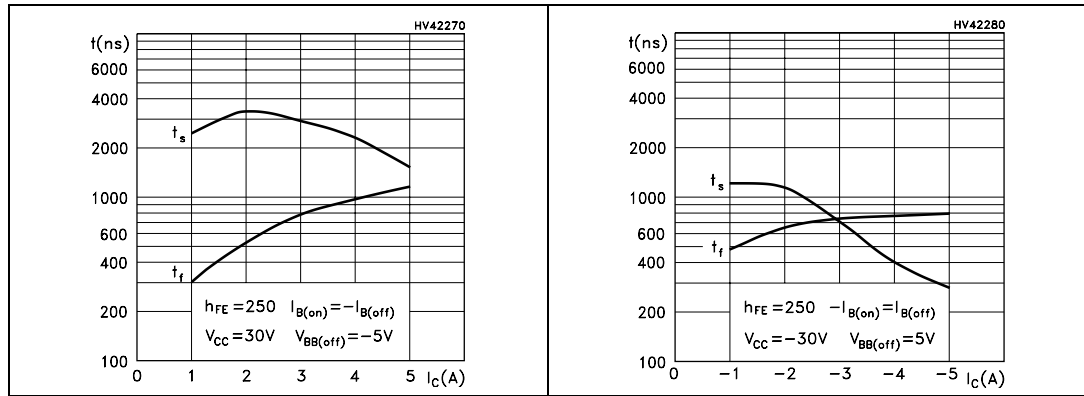
**Figure 12. Resistive load switching time (NPN, on)**



**Figure 13. Resistive load switching time (PNP, on)**



**Figure 14. Resistive load switching time (NPN, off)**      **Figure 15. Resistive load switching time (PNP, off)**

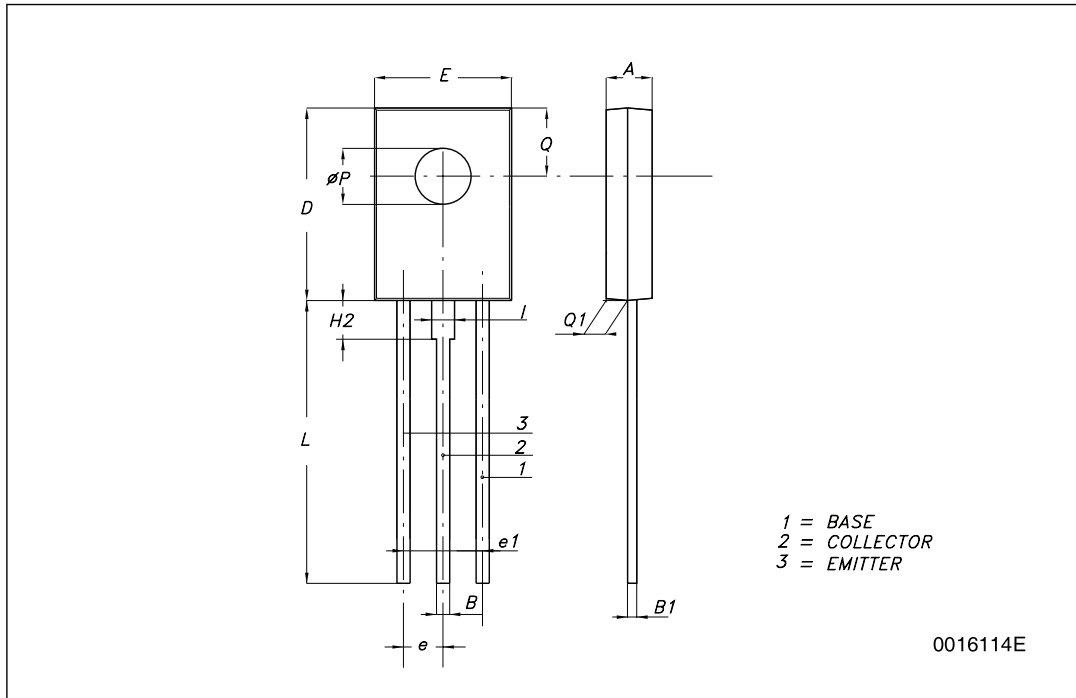


### 3 Package mechanical data

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.

**SOT-32 (TO-126) MECHANICAL DATA**

DIM.	mm.		
	MIN.	TYP	MAX.
A	2.4		2.9
B	0.64		0.88
B1	0.39		0.63
D	10.5		11.05
E	7.4		7.8
e	2.04	2.29	2.54
e1	4.07	4.58	5.08
L	15.3		16
P	2.9		3.2
Q		3.8	
Q1	1		1.52
H2		2.15	
I		1.27	





## 4 Revision history

**Table 4. Document revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
21-Jun-2004	4	Document migration, no content change.
20-May-2009	5	Modified SOT-32 mechanical data.

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