# BD6xxx

## Complementary power Darlington transistors

## Features

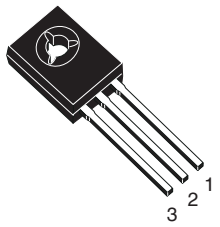
- Good $h_{FE}$ linearity
- High $f_T$ frequency
- Monolithic Darlington configuration with integrated antiparallel collector-emitter diode

## Applications

- Linear and switching industrial equipment

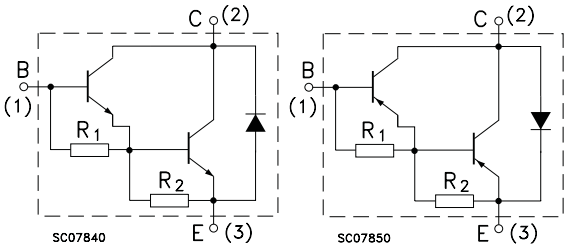
## Description

The devices are manufactured in planar base island technology with monolithic Darlington configuration.




**SOT-32**

**Figure 1. Internal schematic diagram**




R1 typ.= 15 KΩ R2 typ.= 100 Ω

**Table 1. Device summary**

| Order codes | Marking | Package | Packaging |
|---|---|---|---|
| BD677 | BD677 | SOT-32 | Tube |
| BD677A | BD677A | | |
| BD678 | BD678 | | |
| BD678A | BD678A | | |
| BD679 | BD679 | | |
| BD679A | BD679A | | |
| BD680 | BD680 | | |
| BD680A | BD680A | | |
| BD681 | BD681 | | |
| BD682 | BD682 | | |



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# 1 Absolute maximum ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | NPN | BD677<br>BD677A | BD679<br>BD679A | BD681 | |
| | | PNP | BD678<br>BD678A | BD680<br>BD680A | BD682 | |
| $V_{CBO}$ | Collector-base voltage ($I_E$ = 0) | | 60 | 80 | 100 | V |
| $V_{CEO}$ | Collector-emitter voltage ($I_B$ = 0) | | | | | |
| $V_{EBO}$ | Emitte-base voltage ($I_C$ = 0) | | 5 | | | V |
| $I_C$ | Collector current | | 4 | | | A |
| $I_{CM}$ | Collector peak current | | 6 | | | A |
| $I_B$ | Base current | | 0.1 | | | A |
| $P_{TOT}$ | Total dissipation at $T_{case}$ = 25°C | | 40 | | | W |
| $T_{stg}$ | Storage temperature | | -65 to 150 | | | °C |
| $T_J$ | Max. operating junction temperature | | 150 | | | °C |

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



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# 2 Electrical characteristics

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

**Table 3. Electrical characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CEO}$ | Collector cut-off current ($I_B$ = 0) | $V_{CE}$ = half rated $V_{CEO}$ | | | 0.5 | mA |
| $I_{CBO}$ | Collector cut-off current ($I_E$ = 0) | $V_{CE}$ = rated $V_{CBO}$<br>$V_{CE}$ = rated $V_{CBO}$<br>$T_c$ = 100 °C | | | 0.2<br>2 | mA |
| $I_{EBO}$ | Emitter cut-off current ($I_C$ = 0) | $V_{EB}$ = 5 V | | | 2 | mA |
| $V_{CEO(sus)}$(1) | Collector-emitter sustaining voltage ($I_B$ = 0) | for BD677, BD677A, BD678, BD678A<br>$I_C$ = 50 mA | 60 | | | V |
| | | for BD679, BD679A, BD680, BD680A<br>$I_C$ = 50 mA | 80 | | | |
| | | for BD681, BD682<br>$I_C$ = 50 mA | 100 | | | |
| $V_{CE(sat)}$(1) | Collector-emitter saturation voltage | for BD677, BD678, BD679, BD680, BD681, BD682<br>$I_C$ = 1.5 A $I_B$ = 30 mA | | | 2.5 | V |
| | | for BD677A, BD678A, BD679A, BD680A<br>$I_C$ = 2 A $I_B$ = 40 mA | | | 2.8 | |
| $V_{BE}$(1) | Base-emitter voltage | for BD677, BD678, BD679, BD680, BD681, BD682<br>$I_C$ = 1.5 A $V_{CE}$ = 3 V | | | 2.5 | V |
| | | for BD677A, BD678A, BD679A, BD680A<br>$I_C$ = 2 A $V_{CE}$ = 3 V | | | | |



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**Table 3. Electrical characteristics (continued)**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $h_{FE}$(1) | DC current gain | for BD677, BD678, BD679, BD680, BD681, BD682<br>$I_C$ = 1.5 A $V_{CE}$ = 3 V | 750 | | | |
| | | for BD677A, BD678A, BD679A, BD680A<br>$I_C$ = 2 A $V_{CE}$ = 3 V | | | | |

1. Pulsed duration = 300 ms, duty cycle ≥1.5%.

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



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## 2.1 Typical characteristic (curves)

**Figure 2. DC current gain (NPN)**

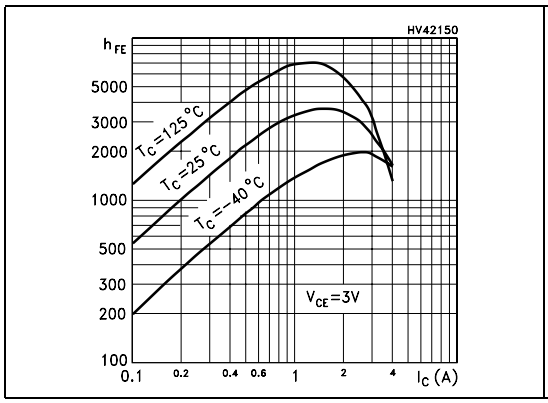



**Figure 3. DC current gain (PNP)**

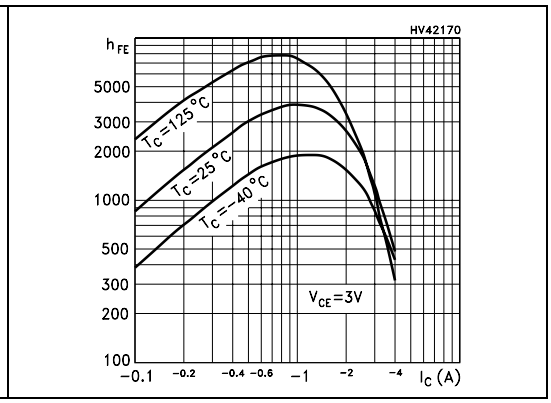



**Figure 4. DC current gain (NPN)**

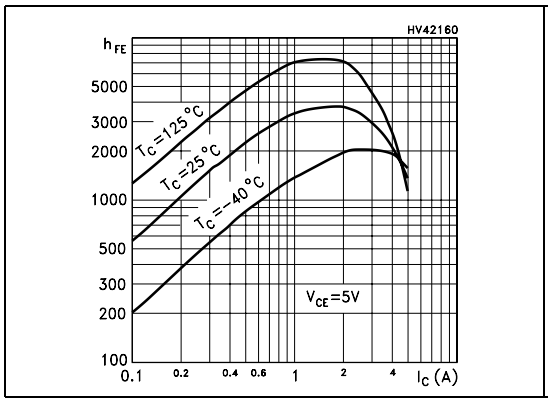



**Figure 5. DC current gain (PNP)**

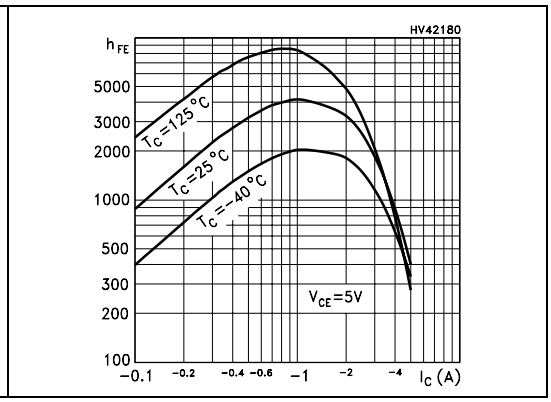



**Figure 6. Collector-emitter saturation voltage (NPN)**

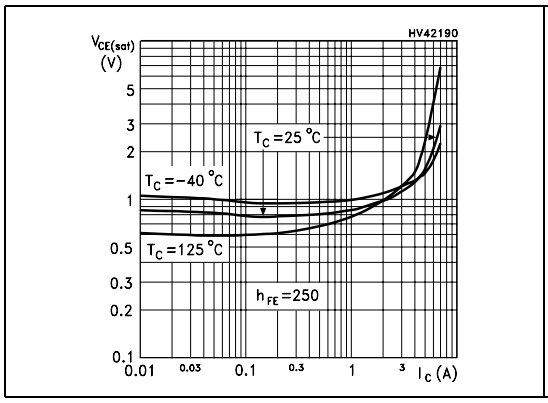
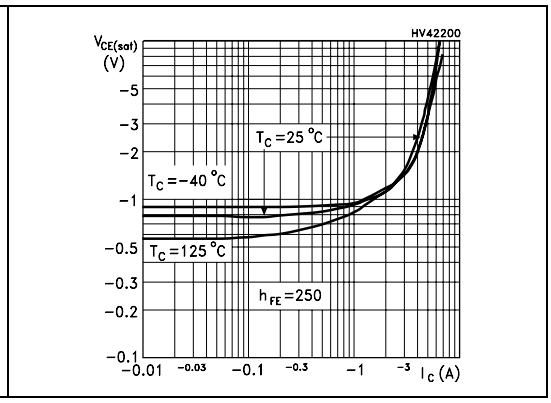



**Figure 7. Collector-emitter saturation voltage (PNP)**






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

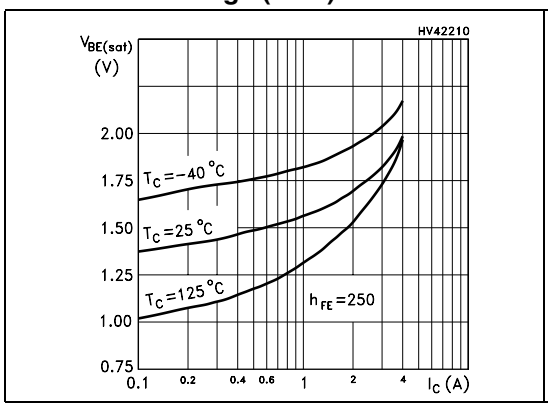



**Figure 9. Base-emitter saturation voltage (PNP)**

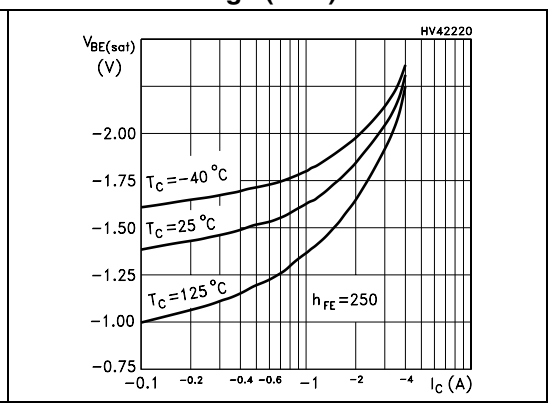



**Figure 10. Base-emitter voltage (NPN)**

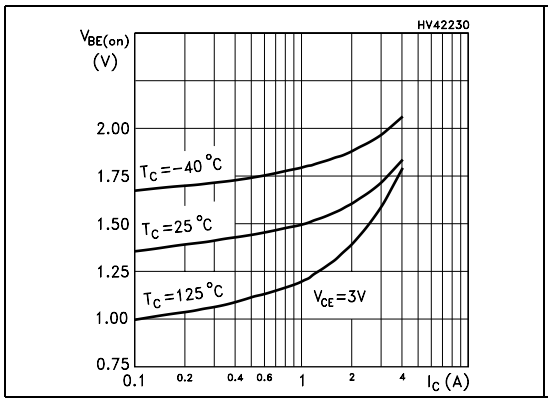



**Figure 11. Base-emitter voltage (PNP)**

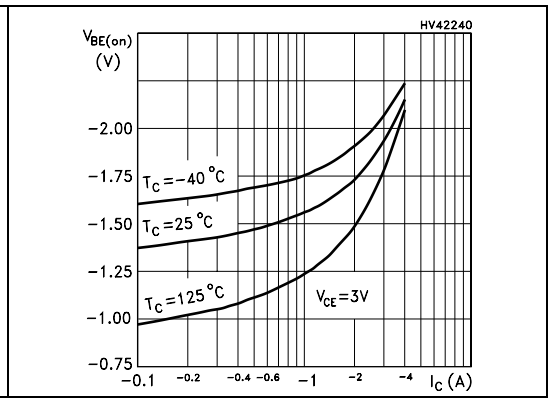



**Figure 12. Resistive load switching time (NPN, on)**

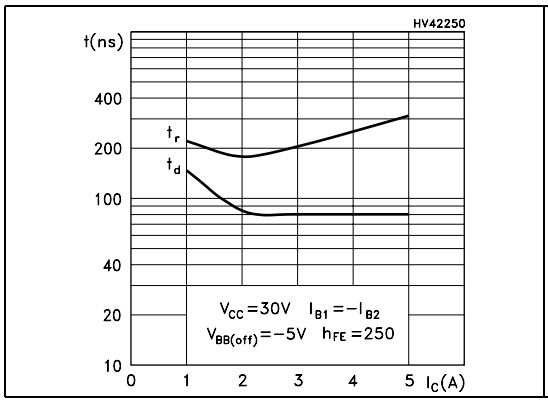
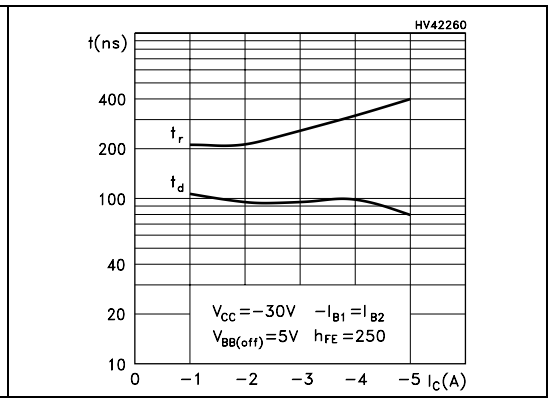



**Figure 13. Resistive load switching time (PNP, on)**






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

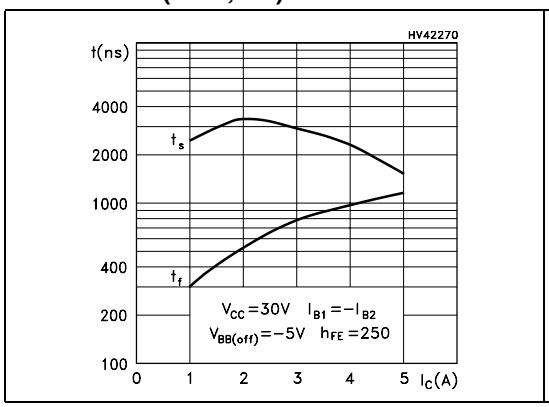
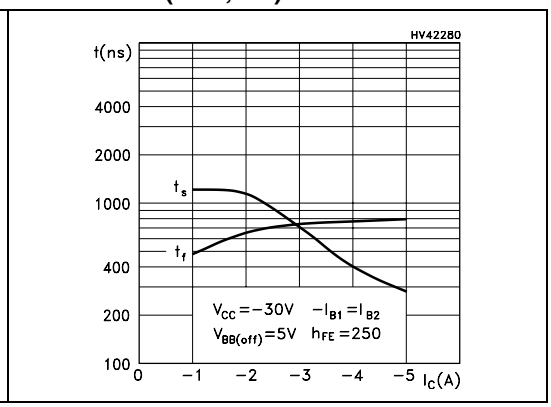
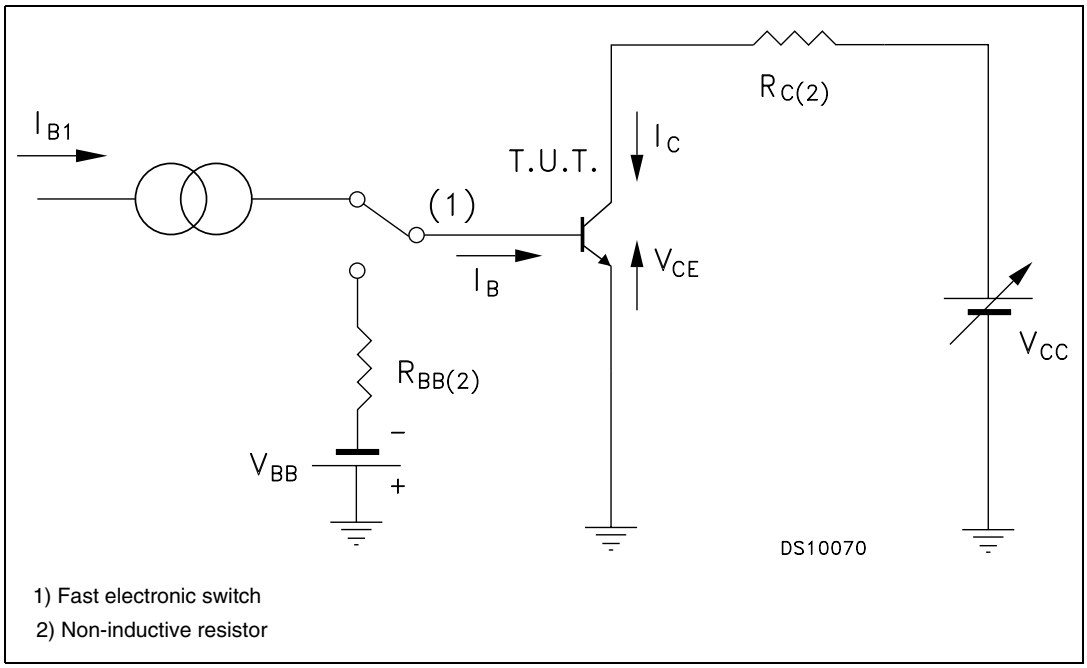



**Figure 15. Resistive load switching time (PNP, off)**




## 2.2 Test circuit

**Figure 16. Resistive load switching test circuit**




1) Fast electronic switch
2) Non-inductive resistor

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



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# 3 Package mechanical data

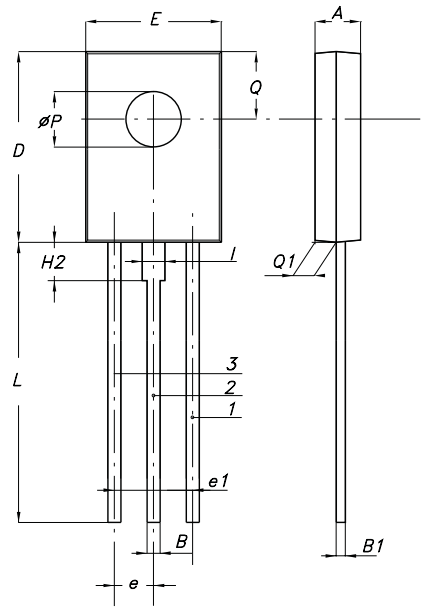
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings 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



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## 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 | |




1 = BASE
2 = COLLECTOR
3 = EMITTER

0016114E



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# 4 Revision history

**Table 4. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 21-Jun-2004 | 4 | |
| 14-Jan-2008 | 5 | 1. Technology change from epybase to planar.<br>2. Updated *Section 2.1: Typical characteristic (curves) on page 6*<br>3. Content reworked to improve readability. |



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