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# BD135 - BD136
# BD139 - BD140

## Complementary low voltage transistor

## Features

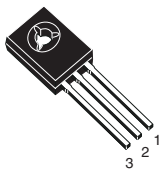
- Products are pre-selected in DC current gain

## Application

- General purpose

## Description

These epitaxial planar transistors are mounted in the SOT-32 plastic package. They are designed for audio amplifiers and drivers utilizing complementary or quasi-complementary circuits. The NPN types are the BD135 and BD139, and the complementary PNP types are the BD136 and BD140.




**SOT-32**

**Figure 1. Internal schematic diagram**

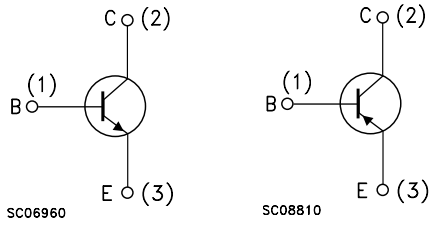



**Table 1. Device summary**

| Order codes | Marking | Package | Packaging |
|---|---|---|---|
| BD135 | BD135 | SOT-32 | Tube |
| BD135-16 | BD135-16 | | |
| BD136 | BD136 | | |
| BD136-16 | BD136-16 | | |
| BD139 | BD139 | | |
| BD139-10 | BD139-10 | | |
| BD139-16 | BD139-16 | | |
| BD140 | BD140 | | |
| BD140-10 | BD140-10 | | |
| BD140-16 | BD140-16 | | |

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | | | | Unit |
|---|---|---|---|---|---|---|
| | | NPN | | PNP | | |
| | | BD135 | BD139 | BD136 | BD140 | |
| $V_{CBO}$ | Collector-base voltage ($I_E$ = 0) | 45 | 80 | -45 | -80 | V |
| $V_{CEO}$ | Collector-emitter voltage ($I_B$ = 0) | 45 | 80 | -45 | -80 | V |
| $V_{EBO}$ | Emitter-base voltage ($I_C$ = 0) | 5 | | -5 | | V |
| $I_C$ | Collector current | 1.5 | | -1.5 | | A |
| $I_{CM}$ | Collector peak current | 3 | | -3 | | A |
| $I_B$ | Base current | 0.5 | | -0.5 | | A |
| $P_{TOT}$ | Total dissipation at $T_c \leq 25$ °C | 12.5 | | | | W |
| $P_{TOT}$ | Total dissipation at $T_{amb} \leq 25$ °C | 1.25 | | | | W |
| $T_{stg}$ | Storage temperature | -65 to 150 | | | | °C |
| $T_j$ | Max. operating junction temperature | 150 | | | | °C |

**Table 3. Thermal data**

| Symbol | Parameter | Max value | Unit |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal resistance junction-case | 10 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal resistance junction-ambient | 100 | °C/W |

# 2 Electrical characteristics

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

**Table 4. On/off states**

| Symbol | Parameter | Polarity | Test conditions | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| $I_{CBO}$ | Collector cut-off current ($I_E$=0) | NPN | $V_{CB}$ = 30 V<br>$V_{CB}$ = 30 V, $T_C$ = 125 °C | | | 0.1<br>10 | µA<br>µA |
| | | PNP | $V_{CB}$ = -30 V<br>$V_{CB}$ = -30 V, $T_C$ = 125 °C | | | -0.1<br>-10 | µA<br>µA |
| $I_{EBO}$ | Emitter cut-off current ($I_C$=0) | NPN | $V_{EB}$ = 5 V | | | 10 | µA |
| | | PNP | $V_{EB}$ = -5 V | | | -10 | µA |
| $V_{CEO(sus)}$ (1) | Collector-emitter sustaining voltage ($I_B$=0) | NPN | $I_C$ = 30 mA<br>BD135<br>BD139 | <br>45<br>80 | | | <br>V<br>V |
| | | PNP | $I_C$ = -30 mA<br>BD136<br>BD140 | <br>-45<br>-80 | | | <br>V<br>V |
| $V_{CE(sat)}$ (1) | Collector-emitter saturation voltage | NPN | $I_C$ = 0.5 A, $I_B$ = 0.05 A | | | 0.5 | V |
| | | PNP | $I_C$ = -0.5 A, $I_B$ = -0.05 A | | | -0.5 | V |
| $V_{BE}$ (1) | Base-emitter voltage | NPN | $I_C$ = 0.5 A, $V_{CE}$ = 2 V | | | 1 | V |
| | | PNP | $I_C$ = -0.5 A, $V_{CE}$ = -2 V | | | -1 | V |
| $h_{FE}$ (1) | DC current gain | NPN | $I_C$ = 5 mA, $V_{CE}$ = 2 V<br>$I_C$ = 150 mA, $V_{CE}$ = 2 V<br>$I_C$ = 0.5 A, $V_{CE}$ = 2 V | 25<br>40<br>25 | | 250 | |
| | | PNP | $I_C$ = -5 mA, $V_{CE}$ = -2 V<br>$I_C$ = -150 mA, $V_{CE}$ = -2 V<br>$I_C$ = -0.5 A, $V_{CE}$ = -2 V | 25<br>40<br>25 | | 250 | |
| $h_{FE}$ (1) | $h_{FE}$ groups | NPN | $I_C$ = 150 mA, $V_{CE}$ = 2 V<br>BD139-10<br>BD135-16/BD139-16 | <br>63<br>100 | | <br>160<br>250 | |
| | | PNP | $I_C$ = -150 mA, $V_{CE}$ = -2 V<br>BD140-10<br>BD136-16/BD140-16 | <br>63<br>100 | | <br>160<br>250 | |

1. Pulsed: pulse duration = 300 µs, duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

**Figure 2. Safe operating area**

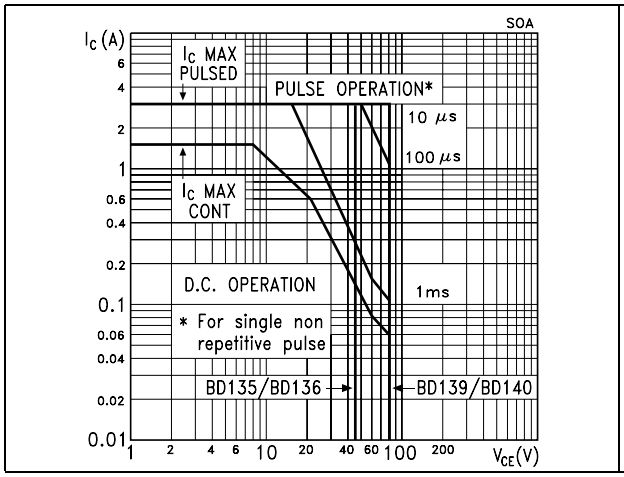
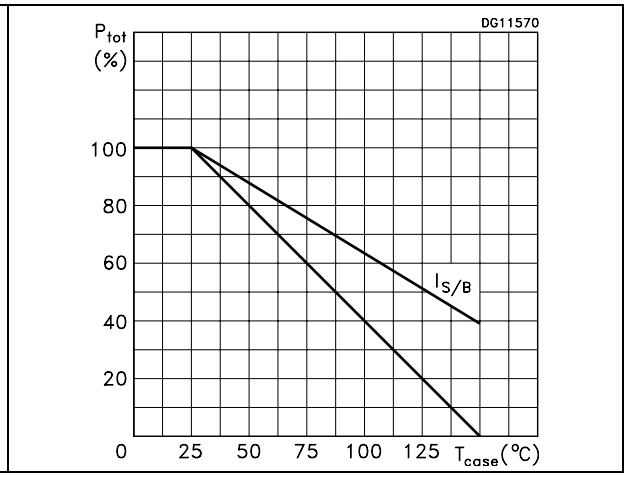



**Figure 3. Derating**

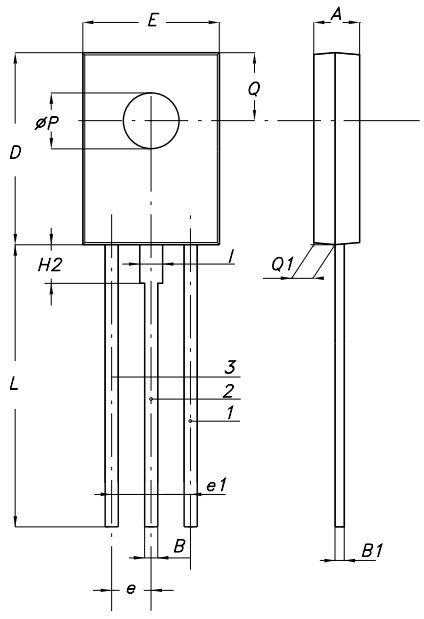


# 3 Package mechanical data

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*

## 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

# 4 Revision history

Table 5. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 16-Sep-2001 | 4 | |
| 22-May-2008 | 5 | Mechanical data has been updated. |

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