

### High power NPN epitaxial planar bipolar transistor

#### **Features**

- High breakdown voltage V<sub>CEO</sub> = 140 V
- Typical f<sub>t</sub> = 20 MHz
- Fully characterized at 125 °C

#### **Application**

■ Power supply

### **Description**

The device is a NPN transistor manufactured using new BiT-LA (Bipolar transistor for linear amplifier) technology. The resulting transistor shows good gain linearity behaviour.

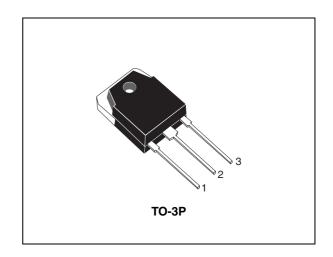


Figure 1. Internal schematic diagram

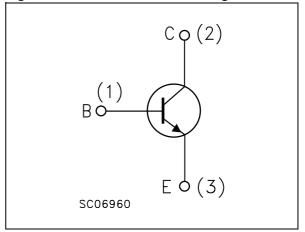


Table 1. Device summary

| Order code | Marking | Package | Packaging |
|------------|---------|---------|-----------|
| 2SD1047    | 2SD1047 | TO-3P   | Tube      |

Electrical ratings 2SD1047

# 1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol           | Parameter                                      | Value      | Unit |
|------------------|--|------------|------|
| V <sub>CBO</sub> | Collector-base voltage (I <sub>E</sub> = 0)    | 200        | ٧    |
| V <sub>CEO</sub> | Collector-emitter voltage (I <sub>B</sub> = 0) | 140        | ٧    |
| V <sub>EBO</sub> | Emitter-base voltage ( $I_C = 0$ )             | 6          | ٧    |
| Ic               | Collector current                              | 12         | Α    |
| I <sub>CM</sub>  | Collector peak current (t <sub>P</sub> < 5 ms) | 20         | Α    |
| P <sub>tot</sub> | Total dissipation at T <sub>c</sub> = 25 °C    | 100        | W    |
| T <sub>stg</sub> | Storage temperature                            | -65 to 150 | °C   |
| T <sub>J</sub>   | Max. operating junction temperature            | 150        | °C   |

Table 3. Thermal data

| Symbol                | Parameter                            | Value | Unit |
|-----------------------|--------------------------------------|-------|------|
| R <sub>thj-case</sub> | Thermal resistance junction-case max | 1.25  | °C/W |

### 2 Electrical characteristics

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

Table 4. Electrical characteristics

| Symbol                              | Parameter  | Test conditions  | Min.     | Тур. | Max.       | Unit   |
|-------------------------------------|--|--|----------|------|------------|--------|
| I <sub>CBO</sub>                    | Collector cut-off current (I <sub>E</sub> = 0)           | V <sub>CB</sub> = 200 V                                  |          |      | 0.1        | μΑ     |
| I <sub>EBO</sub>                    | Emitter cut-off current (I <sub>C</sub> = 0)             | V <sub>EB</sub> = 6 V                                    |          |      | 0.1        | μΑ     |
| V <sub>(BR)CEO</sub> <sup>(1)</sup> | Collector-emitter breakdown voltage (I <sub>B</sub> = 0) | I <sub>C</sub> = 50 mA                                   | 140      |      |            | V      |
| V <sub>(BR)CBO</sub>                | Collector-base breakdown voltage (I <sub>E</sub> = 0)    | I <sub>C</sub> = 100 μA                                  | 200      |      |            | V      |
| V <sub>(BR)EBO</sub> <sup>(1)</sup> | Emitter-base breakdown voltage (I <sub>C</sub> = 0)      | I <sub>E</sub> = 1 mA                                    | 6        |      |            | V      |
| V <sub>CE(sat)</sub> <sup>(1)</sup> | Collector-emitter saturation voltage                     | $I_C = 5 A$ $I_B = 500 mA$<br>$I_C = 7 A$ $I_B = 700 mA$ |          |      | 0.5<br>0.7 | V<br>V |
| V <sub>BE</sub>                     | Base-emitter voltage                                     | V <sub>CE</sub> = 5 V I <sub>C</sub> = 5 A               |          |      | 1.3        | V      |
| h <sub>FE</sub>                     | DC current gain  | $I_C = 1 A$ $V_{CE} = 5 V$<br>$I_C = 5 A$ $V_{CE} = 4 V$ | 60<br>50 |      | 200        |        |
| f <sub>T</sub>                      | Transition frequency                                     | $I_C = 0.5 \text{ A}$ $V_{CE} = 12 \text{ V}$            |          | 20   |            | MHz    |
| C <sub>CBO</sub>                    | Collector-base capacitance (I <sub>E</sub> = 0)          | V <sub>CB</sub> = 10 V f = 1 MHz                         |          | 150  |            | pF     |
|                                     | Resistive Load   |  |          |      |            |        |
| t <sub>on</sub>                     | Turn-on time   | $V_{CC} = 60 \text{ V}$ $I_{C} = 5 \text{ A}$            |          | 0.22 |            | μs     |
| t <sub>stg</sub>                    | Storage time   | $I_{B1} = -I_{B2} = 0.5 A$                               |          | 4.3  |            | μs     |
| t <sub>f</sub>                      | Fall time  |  |          | 0.5  |            | μs     |

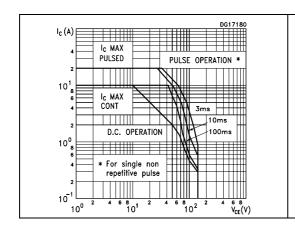
<sup>1.</sup> Pulse duration = 300  $\mu$ s, duty cycle  $\leq$  1.5 %

Electrical characteristics 2SD1047

#### 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

Figure 3. Output characteristics



I<sub>C</sub>(A)

10

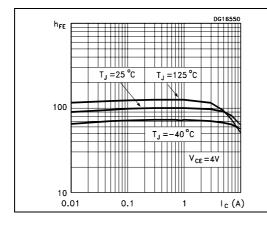
140mA

120mA
100mA
80mA
40mA
40mA

1<sub>B</sub>=20mA
0
0
2
4
6
8
V<sub>CE</sub>(V)

Figure 4. DC current gain

Figure 5. Collector-emitter saturation voltage



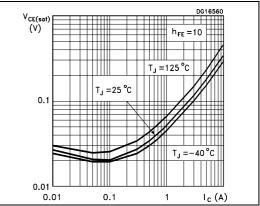
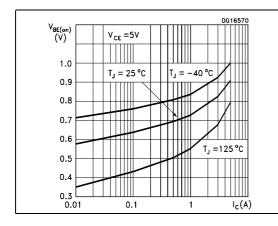
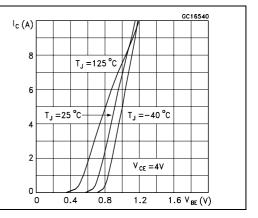


Figure 6. Base-emitter voltage

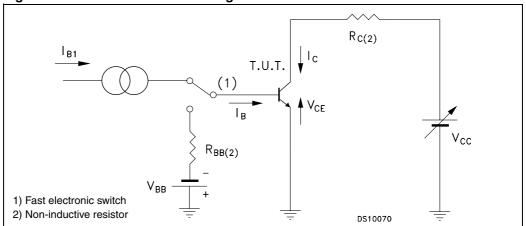
Figure 7. Base-emitter voltage





### 2.2 Test circuit

Figure 8. Resistive load switching test circuit

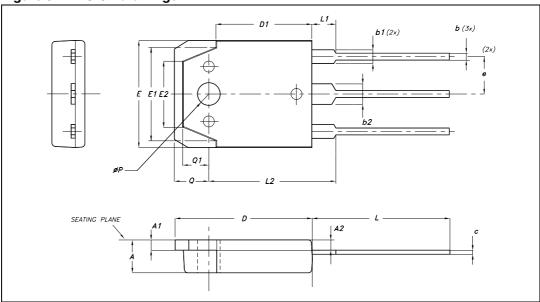


Electrical characteristics 2SD1047

Table 5. TO-3P mechanical data

| Dim  |       | mm    |       |
|------|-------|-------|-------|
| Dim. | Min.  | Тур.  | Max.  |
| Α    | 4.6   |       | 5     |
| A1   | 1.45  | 1.50  | 1.65  |
| A2   | 1.20  | 1.40  | 1.60  |
| b    | 0.80  | 1     | 1.20  |
| b1   | 1.80  |       | 2.20  |
| b2   | 2.80  |       | 3.20  |
| С    | 0.55  | 0.60  | 0.75  |
| D    | 19.70 | 19.90 | 20.10 |
| D1   |       | 13.90 |       |
| Е    | 15.40 |       | 15.80 |
| E1   |       | 13.60 |       |
| E2   |       | 9.60  |       |
| е    | 5.15  | 5.45  | 5.75  |
| L    | 19.50 | 20    | 20.50 |
| L1   |       | 3.50  |       |
| L2   | 18.20 | 18.40 | 18.60 |
| Р    | 3.10  |       | 3.30  |
| Q    |       | 5     |       |
| Q1   |       | 3.80  |       |

Figure 9. TO-3P drawings



## 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

8/10 Doc ID 018729 Rev 1

2SD1047 Revision history

# 4 Revision history

Table 6. Document revision history

| Date        | Revision | Changes          |
|-------------|----------|------------------|
| 12-Apr-2011 | 1        | Initial release. |

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