

Silicon epitaxial-base transistors

BD433/435/437/439/441

DESCRIPTION

NPN transistors in a TO-126 (SOT32) plastic envelope, intended for use in complementary output stages of audio amplifiers up to 15 W. The complementary pairs are BD434, BD436, BD438, BD440 and BD442 respectively.

PINNING - TO-126 (SOT32)

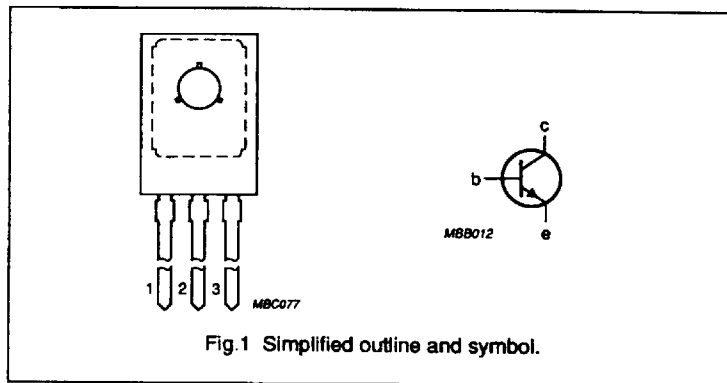
| PIN | DESCRIPTION |
|-----|-------------|
| 1   | emitter     |
| 2   | collector   |
| 3   | base        |

Collector connected to metal part of mounting surface.

QUICK REFERENCE DATA

| SYMBOL    | PARAMETER                 | CONDITIONS                                      | MIN.  | MAX. | UNIT |
|-----------|---------------------------|---|-------|------|------|
| $V_{CES}$ | collector-emitter voltage | $V_{BE} = 0$                                    |       |      |      |
|           | BD433                     |   | -     | 22   | V    |
|           | BD435                     |   | -     | 32   | V    |
|           | BD437                     |   | -     | 45   | V    |
|           | BD439                     |   | -     | 60   | V    |
| $V_{CEO}$ | collector-emitter voltage | open base                                       |       |      |      |
|           | BD433                     |   | -     | 22   | V    |
|           | BD435                     |   | -     | 32   | V    |
|           | BD437                     |   | -     | 45   | V    |
|           | BD439                     |   | -     | 60   | V    |
| $I_C$     | collector current         | average value                                   | -     | 4    | A    |
|           |                           | peak value                                      | -     | 7    | A    |
| $P_{tot}$ | total power dissipation   | $T_{mb} = 25\text{ }^\circ\text{C}$             | -     | 36   | W    |
| $h_{FE}$  | DC current gain           | $I_C = 2\text{ A};$<br>$V_{CE} = 1\text{ V}$    |       |      |      |
|           |                           |   | BD433 | 50   | -    |
|           |                           |   | BD435 | 50   | -    |
|           |                           |   | BD437 | 40   | -    |
|           |                           |   | BD439 | 25   | -    |
| $f_T$     | transition frequency      | $I_C = 250\text{ mA};$<br>$V_{CE} = 1\text{ V}$ | 7     | -    | MHz  |

PIN CONFIGURATION



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## LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

| SYMBOL    | PARAMETER                 | CONDITIONS                          | MIN. | MAX. | UNIT             |
|-----------|---------------------------|-------------------------------------|------|------|------------------|
| $V_{CBO}$ | collector-base voltage    | open emitter                        |      |      |                  |
|           | BD433                     |                                     | -    | 22   | V                |
|           | BD435                     |                                     | -    | 32   | V                |
|           | BD437                     |                                     | -    | 45   | V                |
|           | BD439                     |                                     | -    | 60   | V                |
|           | BD441                     |                                     | -    | 80   | V                |
| $V_{CES}$ | collector-emitter voltage | $V_{BE} = 0$                        |      |      |                  |
|           | BD433                     |                                     | -    | 22   | V                |
|           | BD435                     |                                     | -    | 32   | V                |
|           | BD437                     |                                     | -    | 45   | V                |
|           | BD439                     |                                     | -    | 60   | V                |
|           | BD441                     |                                     | -    | 80   | V                |
| $V_{CEO}$ | collector-emitter voltage | open base                           |      |      |                  |
|           | BD433                     |                                     | -    | 22   | V                |
|           | BD435                     |                                     | -    | 32   | V                |
|           | BD437                     |                                     | -    | 45   | V                |
|           | BD439                     |                                     | -    | 60   | V                |
|           | BD441                     |                                     | -    | 80   | V                |
| $V_{EBO}$ | emitter-base voltage      | open collector                      | -    | 5    | V                |
| $I_C$     | collector current         | average value                       | -    | 4    | A                |
| $I_{CM}$  | collector current         | peak value                          | -    | 7    | A                |
| $I_B$     | base current              | $T_{mb} = 25\text{ }^\circ\text{C}$ | -    | 1    | A                |
| $P_{tot}$ | total power dissipation   | $T_{mb} = 25\text{ }^\circ\text{C}$ | -    | 36   | W                |
| $T_{stg}$ | storage temperature range |                                     | -65  | +150 | $^\circ\text{C}$ |
| $T_j$     | junction temperature      |                                     | -    | +150 | $^\circ\text{C}$ |

## THERMAL CHARACTERISTICS

| SYMBOL         | PARAMETER                      | CONDITIONS  | NOM. | UNIT |
|----------------|--------------------------------|-------------|------|------|
| $R_{th\ j-mb}$ | from junction to mounting base |             | 3.5  | K/W  |
| $R_{th\ j-a}$  | from junction to ambient       | in free air | 100  | K/W  |

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## CHARACTERISTICS

 $T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified

| SYMBOL              | PARAMETER                            | CONDITIONS  | MIN.  | TYP. | MAX. | UNIT          |
|---------------------|--------------------------------------|---|---|------|------|---------------|
| $I_{CBO}$           | collector cut off current            | $I_E = 0;$<br>$V_{CB} = V_{CBO\text{ max}}$   | -   | -    | 50   | $\mu\text{A}$ |
|                     |                                      | $I_E = 0;$<br>$V_{CB} = 10\text{ V};$<br>$T_j = 150\text{ }^\circ\text{C}$                            | -   | -    | 1    | mA            |
|                     |                                      | $I_E = 0;$<br>$V_{CB} = V_{CBO\text{ max}}$<br>$T_j = 150\text{ }^\circ\text{C}$                      | -   | -    | 1    | mA            |
| $I_{EBO}$           | emitter cut off current              | $I_C = 0;$<br>$V_{EB} = 5\text{ V}$   | -   | -    | 0.2  | mA            |
| $V_{CEK}$           | knee voltage                         | $I_C = 2\text{ A};$<br>$I_B = \text{value for which } I_C = 2.2\text{ A}$<br>at $V_{CE} = 1\text{ V}$ | -   | -    | -    | -             |
|                     | BD433, BD435, BD437                  |   | -   | -    | 0.8  | V             |
| $V_{BE}$            | base-emitter voltage                 | $I_C = 10\text{ mA};$<br>$V_{CE} = 5\text{ V};$<br>note 1   | -   | 580  | -    | mV            |
|                     |                                      | $I_C = 2\text{ A};$<br>$V_{CE} = 1\text{ V};$<br>note 1   | -   | -    | 1.1  | V             |
|                     |                                      | BD433, BD435<br>BD439, BD441  | -   | -    | 1.5  | V             |
|                     |                                      | BD437   | $I_C = 3\text{ A};$<br>$V_{CE} = 1\text{ V};$<br>note 1 | -    | -    | 1.3           |
| $V_{CE\text{ sat}}$ | collector-emitter saturation voltage | $I_C = 2\text{ A};$<br>$I_B = 0.2\text{ A}$   | -   | -    | 0.5  | V             |
|                     |                                      | BD433, BD435<br>BD439, BD441  | -   | -    | 0.8  | V             |
|                     |                                      | BD437   | $I_C = 3\text{ A};$<br>$I_B = 0.3\text{ A}$             | -    | -    | 0.7           |

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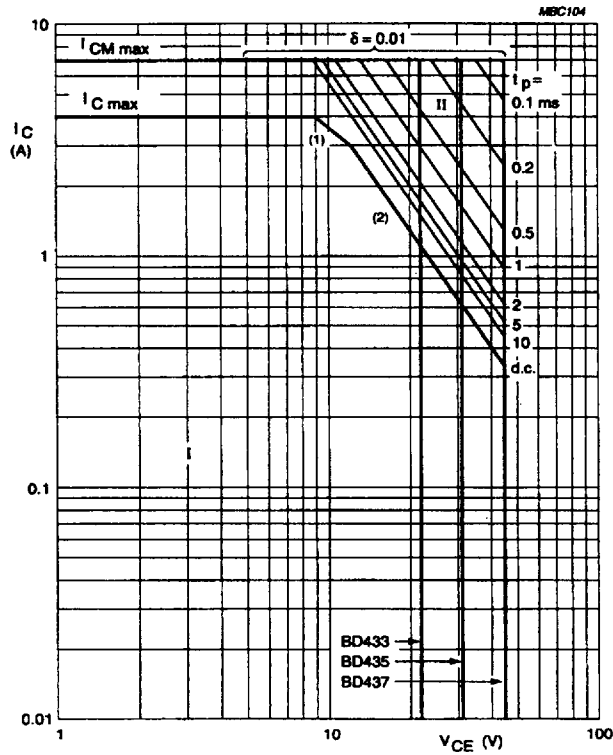
| SYMBOL              | PARAMETER  | CONDITIONS   | MIN.  | TYP. | MAX. | UNIT |  |
|---------------------|--|--|---|------|------|------|--|
| $h_{FE}$            | DC current gain                                  | $I_C = 10 \text{ mA};$<br>$V_{CB} = 5 \text{ V}$                             |   |      |      |      |  |
|                     | BD433  |  | 25  | -    | -    |      |  |
|                     | BD435  |  | 25  | -    | -    |      |  |
|                     | BD437  |  | 25  | -    | -    |      |  |
|                     | BD439  |  | 20  | -    | -    |      |  |
|                     | BD441  |  | 15  | -    | -    |      |  |
|                     |  |  | $I_C = 500 \text{ mA};$<br>$V_{CB} = 1 \text{ V}$ |      |      |      |  |
|                     | BD433  |  | 85  | -    | 475  |      |  |
|                     | BD435  |  | 85  | -    | 475  |      |  |
|                     | BD437  |  | 85  | -    | 375  |      |  |
|                     | BD439  |  | 40  | -    | -    |      |  |
|                     | BD441  |  | 40  | -    | -    |      |  |
|                     |  |  | $I_C = 2 \text{ A};$<br>$V_{CB} = 1 \text{ V}$    |      |      |      |  |
|                     | BD433  |  | 50  | -    | -    |      |  |
|                     | BD435  |  | 50  | -    | -    |      |  |
|                     | BD437  |  | 40  | -    | -    |      |  |
|                     | BD439  |  | 25  | -    | -    |      |  |
|                     | BD441  |  | 15  | -    | -    |      |  |
|                     |  |  | $I_C = 3 \text{ A};$<br>$V_{CB} = 1 \text{ V}$    |      |      |      |  |
| BD437               |  | 30   | -   | -    |      |      |  |
| $f_T$               | transition frequency                             | at $f = 1 \text{ MHz};$<br>$I_C = 250 \text{ mA};$<br>$V_{CE} = 1 \text{ V}$ | 7   | -    | -    | MHz  |  |
| $h_{FE1} / h_{FE2}$ | DC current gain ratio of the complementary pairs | $I_C = 500 \text{ mA};$<br>$V_{CB} = 1 \text{ V}$                            |   |      |      |      |  |
|                     | BD433/BD434                                      |  | -   | -    | 1.4  |      |  |
|                     | BD435/BD436                                      |  | -   | -    | 1.4  |      |  |
|                     | BD437/BD438                                      |  | -   | -    | 1.8  |      |  |
|                     | BD439/BD440                                      |  | -   | -    | 1.4  |      |  |
|                     | BD441/BD442                                      |  | -   | -    | 1.4  |      |  |

Note

- $V_{BE}$  decreases by typ. 2.3 mV/K with increasing temperature.

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**BD433, BD435, BD437**

$T_{mb} = 25\text{ }^\circ\text{C}$

I Region of permissible DC operation.

II Permissible extension for repetitive pulse operation.

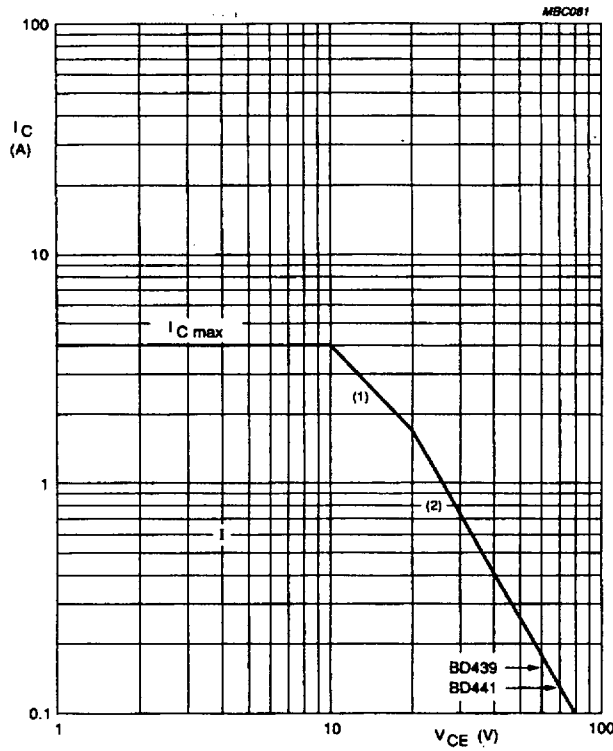
(1)  $P_{tot \max}$  and  $P_{peak \max}$  lines.

(2) Second breakdown limits.

Fig.2 Safe operating area.

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**BD439, BD441**

$T_{mb} = 25\text{ }^{\circ}\text{C}$

I Region of permissible DC operation.

(1)  $P_{tot\ max}$  and  $P_{peak\ max}$  lines.

(2) Second breakdown limits.

Fig.3 Safe operating area.

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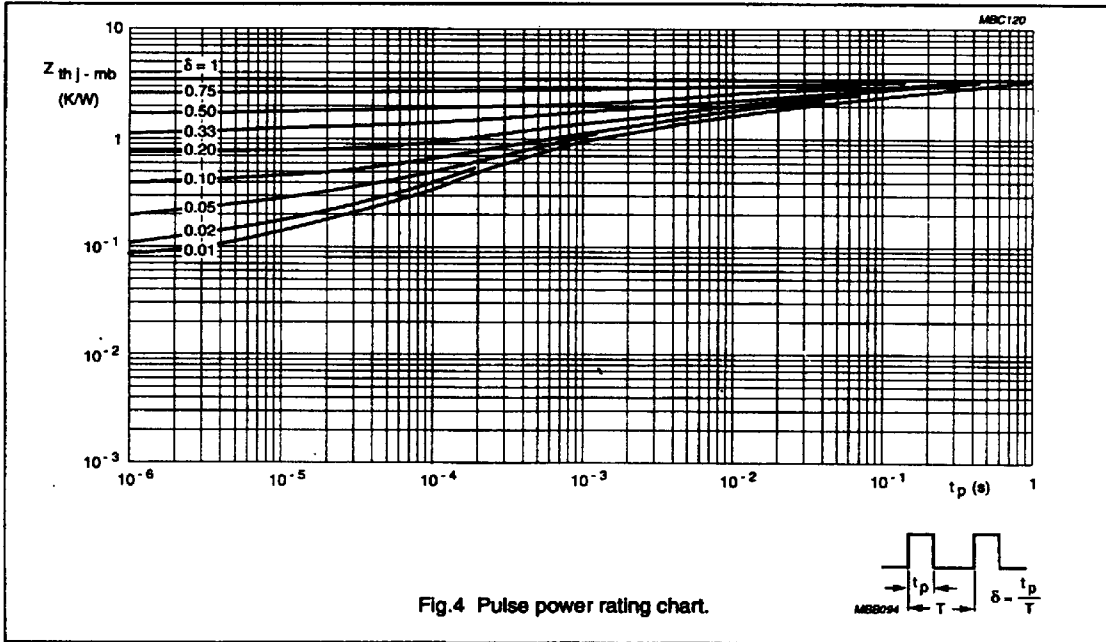


Fig.4 Pulse power rating chart.

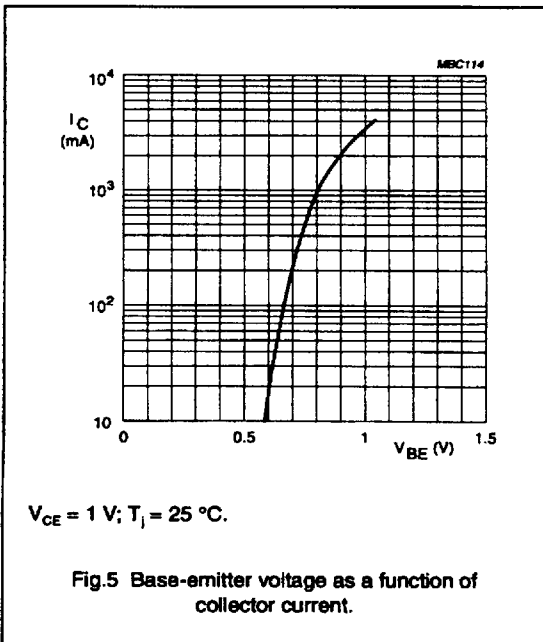


Fig.5 Base-emitter voltage as a function of collector current.

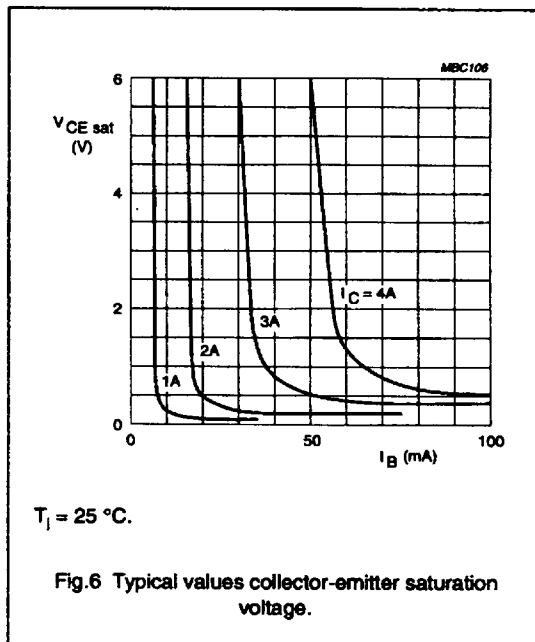
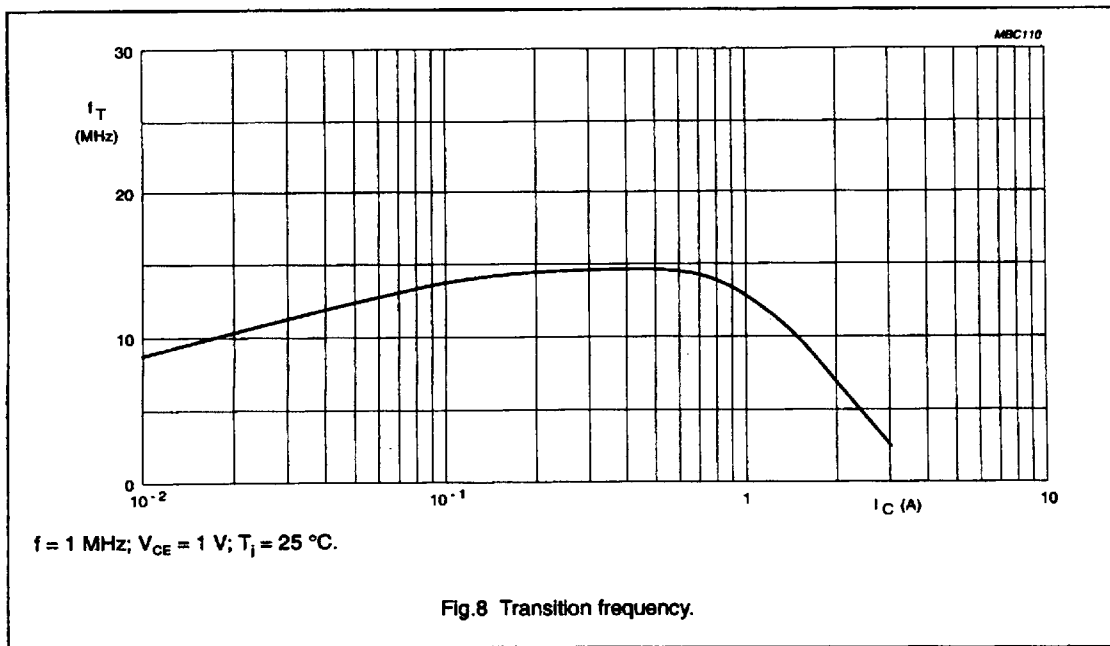
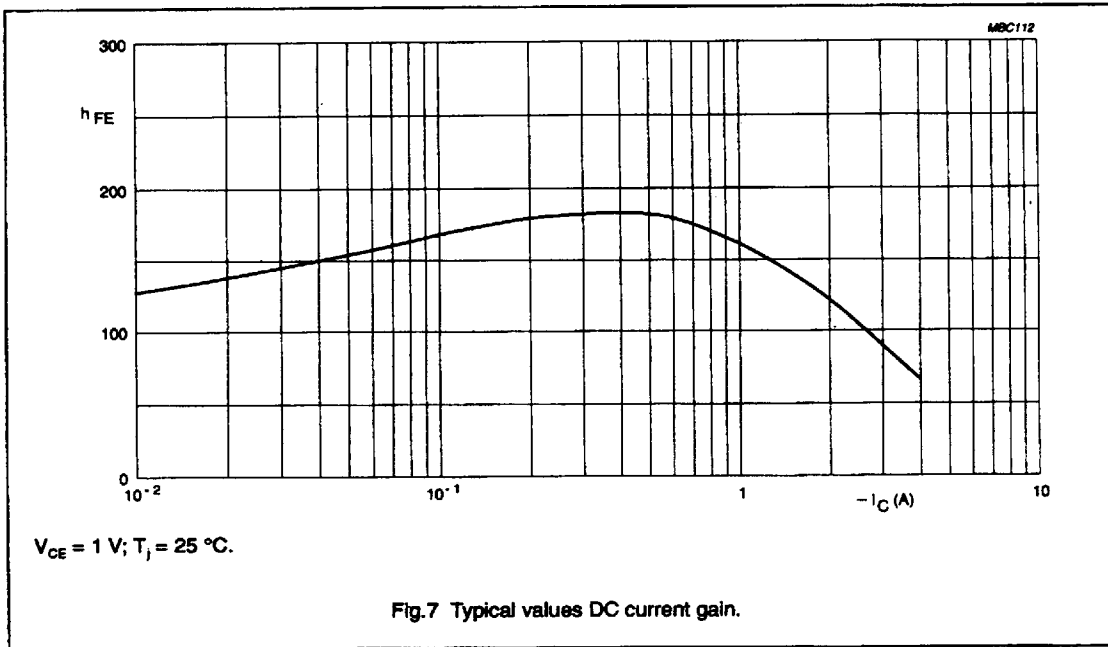


Fig.6 Typical values collector-emitter saturation voltage.

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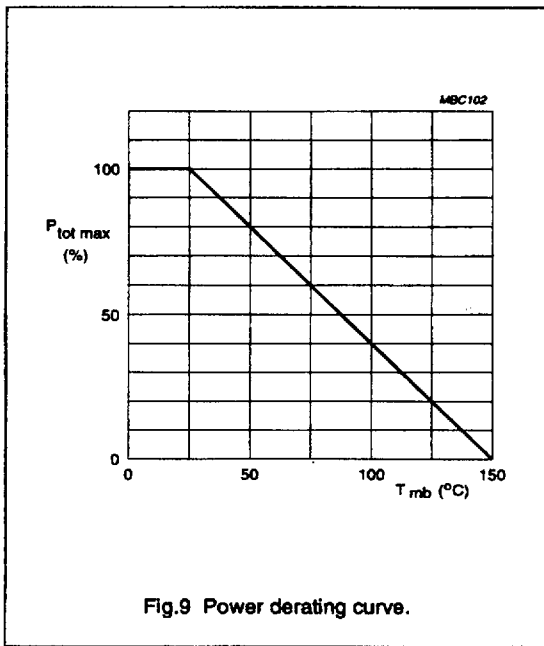
BD433/435/437/439/441





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BD433/435/437/439/441

PACKAGE OUTLINE

