

**BRITISH STANDARDS INSTITUTION**

2, PARK STREET, LONDON, W1A 2BS

Specification available from:— AS SHOWN IN PD 9002, and  
CECC 00200**SEMELAB MANUFACTURING LTD.,  
10-12 BANK STREET,  
LUTTERWORTH, LEICESTERSHIRE.**

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**BS CECC 50 004-001****ISSUE 1** 22nd February 1977

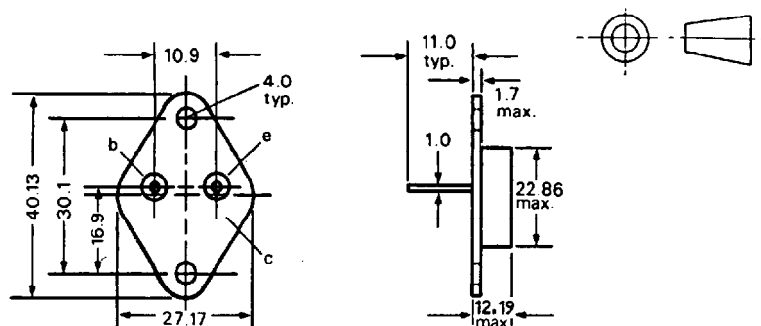
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**ELECTRONIC COMPONENTS OF ASSESSED QUALITY  
DETAIL SPECIFICATION IN ACCORDANCE WITH  
BS CECC 50 000:1977****MANUFACTURER'S TYPE NUMBER**

See PD 9002 and CECC 00200

**BUX10 BUX11 BUX12  
BUX13 BUX14 BUX15****For ordering information  
see clause 5**CASE RATED BIPOLAR SWITCHING  
TRANSISTORSNPN SILICON TRANSISTOR IN  
HERMETICALLY SEALED METAL  
CASEASSESSMENT LEVELS  
F AND L**Outline and dimensions**

Third angle projection



For detail dimensions see IEC 191-2 B18 and C14A

Equivalent To BS3934 SO-127A JEDEC TO-3

**Marking information see clause 3****1. LIMITING VALUES** (Absolute maximum system)

|                                                                    | Min. | Max. | Units       |
|--------------------------------------------------------------------|------|------|-------------|
| $T_{case}$ Case operating temperature range                        | -55  | 150  | $^{\circ}C$ |
| $T_{stg}$ Storage temperature range                                | -65  | 200  | $^{\circ}C$ |
| $P_{tot}$ Maximum total power dissipation $T_{case} = 25^{\circ}C$ | -    | 150  | W           |

**VOLTAGES AND CURRENTS**

| TYPE  | $V_{CBO}$<br>max<br>V | $V_{CEO}$<br>max<br>V | $V_{CEX}$<br>max<br>V<br>$V_{EB} = 1.5$ V | $V_{CER}$<br>max<br>V<br>$R_{BE} = 100 \Omega$ | $V_{EBO}$<br>max<br>V | $I_C$<br>max<br>A | $I_{CM}$<br>max<br>A<br>$t < 10$ ms | $I_B$<br>max<br>A |
|-------|-----------------------|-----------------------|-------------------------------------------|------------------------------------------------|-----------------------|-------------------|-------------------------------------|-------------------|
| BUX10 | 160                   | 125                   | 160                                       | 150                                            | 7                     | 25                | 30                                  | 5                 |
| BUX11 | 250                   | 200                   | 250                                       | 240                                            | 7                     | 20                | 25                                  | 4                 |
| BUX12 | 300                   | 250                   | 300                                       | 300                                            | 7                     | 20                | 25                                  | 4                 |
| BUX13 | 400                   | 325                   | 400                                       | 390                                            | 7                     | 15                | 20                                  | 3                 |
| BUX14 | 450                   | 400                   | 450                                       | 440                                            | 7                     | 10                | 15                                  | 2                 |
| BUX15 | 500                   | 500                   | 500                                       | 500                                            | 7                     | 8                 | 10                                  | 2                 |

(For derating curve see figure 1)

(For safe operating area see figure 2)

Refer to Qualified Products List PD 9002 or CECC 00200 for details of manufacturers approved to this specification

**Documents**

Document Sharing Hub

2. CHARACTERISTICS $T_{case} = 25^{\circ}\text{C}$  unless otherwise stated

| PARAMETER AND TEST CONDITIONS |                                                                  |                                           |                                                       | Min | Max | Units |
|-------------------------------|------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------|-----|-----|-------|
| $h_{21E}$                     | Static value of common-emitter forward current transfer ratio *+ |                                           |                                                       |     |     |       |
|                               | $h_{21E}(1)$                                                     | $V_{CE} = 2\text{ V}$                     | $I_C = 10\text{ A}$ BUX10                             | 20  | 60  | -     |
|                               |                                                                  | $V_{CE} = 2\text{ V}$                     | $I_C = 6\text{ A}$ BUX11                              | 20  | 60  | -     |
|                               |                                                                  | $V_{CE} = 4\text{ V}$                     | $I_C = 5\text{ A}$ BUX12                              | 20  | 60  | -     |
|                               |                                                                  | $V_{CE} = 4\text{ V}$                     | $I_C = 4\text{ A}$ BUX13                              | 15  | 60  | -     |
|                               |                                                                  | $V_{CE} = 4\text{ V}$                     | $I_C = 3\text{ A}$ BUX14                              | 15  | 60  | -     |
|                               |                                                                  | $V_{CE} = 4\text{ V}$                     | $I_C = 2\text{ A}$ BUX15                              | 15  | 60  | -     |
|                               | $h_{21E}(2)$                                                     | $V_{CE} = 4\text{ V}$                     | $I_C = 20\text{ A}$ BUX10                             | 10  | -   | -     |
|                               |                                                                  | $V_{CE} = 4\text{ V}$                     | $I_C = 12\text{ A}$ BUX11                             | 10  | -   | -     |
|                               |                                                                  | $V_{CE} = 4\text{ V}$                     | $I_C = 10\text{ A}$ BUX12                             | 10  | -   | -     |
|                               |                                                                  | $V_{CE} = 4\text{ V}$                     | $I_C = 8\text{ A}$ BUX13                              | 8   | -   | -     |
|                               |                                                                  | $V_{CE} = 4\text{ V}$                     | $I_C = 6\text{ A}$ BUX14                              | 8   | -   | -     |
|                               |                                                                  | $V_{CE} = 4\text{ V}$                     | $I_C = 4\text{ A}$ BUX15                              | 8   | -   | -     |
| $I_{CEX}$                     | Collector-emitter leakage current +                              |                                           |                                                       |     |     |       |
|                               | $I_{CEX}(1)$                                                     | $V_{CE} = \text{rated } V_{CEX}$          | $V_{EB} = 1.5\text{ V}$                               | -   | 1.5 | mA    |
|                               |                                                                  | $V_{CE} = \text{rated } V_{CEX}$          | $V_{EB} = 1.5\text{ V } T_{case}=125^{\circ}\text{C}$ | -   | 6   | mA    |
| $I_{EBO}$                     | Emitter-base cut-off current +                                   |                                           |                                                       |     |     |       |
|                               |                                                                  | $V_{EB} = 5\text{ V}$                     | $I_C = 0$                                             | -   | 1.0 | mA    |
| $I_{CEO}$                     | Collector-emitter cut-off current +                              |                                           |                                                       |     |     |       |
|                               |                                                                  | $V_{CE} = 80\% \text{ of rated } V_{CEO}$ | $I_B = 0$                                             | -   | 1.5 | mA    |
| $V_{BEsat}$                   | Base-emitter saturation voltage *+                               |                                           |                                                       |     |     |       |
|                               |                                                                  | $I_C = 20\text{ A}$                       | $I_B = 2\text{ A}$ BUX10                              | -   | 2.0 | V     |
|                               |                                                                  | $I_C = 12\text{ A}$                       | $I_B = 1.5\text{ A}$ BUX11                            | -   | 1.5 | V     |
|                               |                                                                  | $I_C = 10\text{ A}$                       | $I_B = 1.25\text{ A}$ BUX12                           | -   | 1.5 | V     |
|                               |                                                                  | $I_C = 8\text{ A}$                        | $I_B = 1.6\text{ A}$ BUX13                            | -   | 1.5 | V     |
|                               |                                                                  | $I_C = 6\text{ A}$                        | $I_B = 1.2\text{ A}$ BUX14                            | -   | 1.5 | V     |
|                               |                                                                  | $I_C = 4\text{ A}$                        | $I_B = 0.8\text{ A}$ BUX15                            | -   | 1.5 | V     |
| $V_{CEsat}$                   | Collector-emitter saturation voltage *+                          |                                           |                                                       |     |     |       |
|                               | $V_{CEsat}(1)$                                                   | $I_C = 20\text{ A}$                       | $I_B = 2\text{ A}$ BUX10                              | -   | 1.2 | V     |
|                               |                                                                  | $I_C = 12\text{ A}$                       | $I_B = 1.5\text{ A}$ BUX11                            | -   | 1.5 | V     |
|                               |                                                                  | $I_C = 10\text{ A}$                       | $I_B = 1.25\text{ A}$ BUX12                           | -   | 1.0 | V     |
|                               |                                                                  | $I_C = 8\text{ A}$                        | $I_B = 1.6\text{ A}$ BUX13                            | -   | 1.0 | V     |
|                               |                                                                  | $I_C = 6\text{ A}$                        | $I_B = 1.2\text{ A}$ BUX14                            | -   | 1.0 | V     |
|                               |                                                                  | $I_C = 4\text{ A}$                        | $I_B = 0.8\text{ A}$ BUX15                            | -   | 1.0 | V     |

\* Measured under pulse conditions: pulse length = 300  $\mu\text{s}$ , duty cycle = 2.0%

+ Parameters which are verified in Groups A and C

## 2. CHARACTERISTICS (contd.)

 $T_{case} = 25^{\circ}C$  unless otherwise stated

| PARAMETER AND TEST CONDITIONS |                                          |                                   |                  |              | Min  | Max | Units         |
|-------------------------------|------------------------------------------|-----------------------------------|------------------|--------------|------|-----|---------------|
| $V_{CEsat(2)}$                | $I_C = 10\text{ A}$                      | $I_B = 1\text{ A}$                | BUX10            |              | -    | 0.6 | V             |
|                               | $I_C = 6\text{ A}$                       | $I_B = 0.6\text{ A}$              | BUX11            |              | -    | 0.6 | V             |
|                               | $I_C = 5\text{ A}$                       | $I_B = 0.5\text{ A}$              | BUX12            |              | -    | 1.0 | V             |
|                               | $I_C = 4\text{ A}$                       | $I_B = 0.8\text{ A}$              | BUX13            |              | -    | 0.8 | V             |
|                               | $I_C = 3\text{ A}$                       | $I_B = 0.6\text{ A}$              | BUX14            |              | -    | 0.6 | V             |
|                               | $I_C = 2\text{ A}$                       | $I_B = 0.4\text{ A}$              | BUX15            |              | -    | 0.6 | V             |
| $V_{CEOsus}$                  | Collector-emitter sustaining voltage *+  |                                   |                  |              |      |     |               |
|                               | $I_C = 200\text{mA}$                     | $I_B = 0$                         | BUX10            |              | 125  | -   | V             |
|                               | $L = 25\text{ mH}$                       |                                   | BUX11            |              | 200  | -   | V             |
|                               |                                          |                                   | BUX12            |              | 250  | -   | V             |
|                               |                                          |                                   | BUX13            |              | 325  | -   | V             |
|                               |                                          |                                   | BUX14            |              | 400  | -   | V             |
|                               |                                          |                                   | BUX15            |              | 500  | -   | V             |
| $V_{(BR)EBD}$                 | Emitter base breakdown voltage           |                                   |                  |              |      |     |               |
|                               | $I_E = 50\text{ mA}$                     | $I_C = 0$                         |                  |              | 7    | -   | V             |
| $I_{S/B}$                     | Secondary breakdown collector current *+ |                                   |                  |              |      |     |               |
|                               | $I_{S/B(1)}$                             | $V_{CE} = 30\text{ V}$            | $t = 1\text{ s}$ | All types    | 5    | -   | A             |
|                               | $I_{S/B(2)}$                             | $V_{CE} = 48\text{ V}$            | $t = 1\text{ s}$ | BUX10        | 1    | -   | A             |
|                               |                                          | $V_{CE} = 140\text{V}$            |                  | Other types  | 0.15 | -   | A             |
| $t_{on}$                      | Turn-on time +                           |                                   |                  | See figure 3 |      |     |               |
|                               | $I_C = 20\text{ A}$                      | $I_{B1} = 2.0\text{ A}$           | BUX10            |              | -    | 1.5 | $\mu\text{s}$ |
|                               | $I_C = 12\text{ A}$                      | $I_{B1} = 1.5\text{ A}$           | BUX11            |              | -    | 1.0 | $\mu\text{s}$ |
|                               | $I_C = 10\text{ A}$                      | $I_{B1} = 1.25\text{A}$           | BUX12            |              | -    | 1.0 | $\mu\text{s}$ |
|                               | $I_C = 8\text{ A}$                       | $I_{B1} = 1.6\text{ A}$           | BUX13            |              | -    | 1.2 | $\mu\text{s}$ |
|                               | $I_C = 6\text{ A}$                       | $I_{B1} = 1.2\text{ A}$           | BUX14            |              | -    | 1.4 | $\mu\text{s}$ |
|                               | $I_C = 4\text{ A}$                       | $I_{B1} = 0.8\text{ A}$           | BUX15            |              | -    | 1.6 | $\mu\text{s}$ |
| $t_s$                         | Storage time +                           |                                   |                  | See figure 3 |      |     |               |
|                               | $I_C = 20\text{ A}$                      | $I_{B1} = -I_{B2} = 2.0\text{ A}$ | BUX10            |              | -    | 1.2 | $\mu\text{s}$ |
|                               | $I_C = 12\text{ A}$                      | $I_{B1} = -I_{B2} = 1.5\text{ A}$ | BUX11            |              | -    | 1.8 | $\mu\text{s}$ |
|                               | $I_C = 10\text{ A}$                      | $I_{B1} = -I_{B2} = 1.25\text{A}$ | BUX12            |              | -    | 2.0 | $\mu\text{s}$ |
|                               | $I_C = 8\text{ A}$                       | $I_{B1} = -I_{B2} = 1.6\text{ A}$ | BUX13            |              | -    | 2.5 | $\mu\text{s}$ |
|                               | $I_C = 6\text{ A}$                       | $I_{B1} = -I_{B2} = 1.2\text{ A}$ | BUX14            |              | -    | 3.0 | $\mu\text{s}$ |
|                               | $I_C = 4\text{ A}$                       | $I_{B1} = -I_{B2} = 0.8\text{ A}$ | BUX15            |              | -    | 5.0 | $\mu\text{s}$ |

\* Measured under pulse conditions: pulse length = 300  $\mu\text{s}$ , duty cycle = 2.0%

+ Parameters which are verified in Groups A and C

2. CHARACTERISTICS (contd.) $T_{\text{case}} = 25^{\circ}\text{C}$  unless otherwise stated

| PARAMETER AND TEST CONDITIONS |                                                                                          |                      |                                           | Min | Max  | Units                |
|-------------------------------|------------------------------------------------------------------------------------------|----------------------|-------------------------------------------|-----|------|----------------------|
| $t_f$                         | Fall-time +                                                                              | See figure 3         |                                           |     |      |                      |
|                               |                                                                                          | $I_C = 20 \text{ A}$ | $I_{B1} = -I_{B2} = 2.0 \text{ A}$ BUX10  | -   | 0.3  | $\mu\text{s}$        |
|                               |                                                                                          | $I_C = 12 \text{ A}$ | $I_{B1} = -I_{B2} = 1.5 \text{ A}$ BUX11  | -   | 0.4  | $\mu\text{s}$        |
|                               |                                                                                          | $I_C = 10 \text{ A}$ | $I_{B1} = -I_{B2} = 1.25 \text{ A}$ BUX12 | -   | 0.5  | $\mu\text{s}$        |
|                               |                                                                                          | $I_C = 8 \text{ A}$  | $I_{B1} = -I_{B2} = 1.6 \text{ A}$ BUX13  | -   | 1.0  | $\mu\text{s}$        |
|                               |                                                                                          | $I_C = 6 \text{ A}$  | $I_{B1} = -I_{B2} = 1.2 \text{ A}$ BUX14  | -   | 1.2  | $\mu\text{s}$        |
|                               |                                                                                          | $I_C = 4 \text{ A}$  | $I_{B1} = -I_{B2} = 0.8 \text{ A}$ BUX15  | -   | 1.4  | $\mu\text{s}$        |
| $f_T$                         | Transition frequency<br>$V_{CE} = 15 \text{ V}$ $I_C = 1 \text{ A}$ $f = 10 \text{ MHz}$ |                      |                                           | 8   | -    | MHz                  |
| $R_{th_{j-case}}$             | Thermal resistance junction to case                                                      |                      |                                           | -   | 1.17 | $^{\circ}\text{C/W}$ |

\* Measured under pulse conditions: pulse length = 3000  $\mu\text{s}$ , duty cycle = 1.0%

+ Parameters which are verified in groups A and C

3. MARKING

3.1 Each device shall bear the following marking:

- (a) Terminal identification
- (b) Type number
- (c) Date code
- (d) Manufacturer's trade mark or factory identification code

3.2 Each package containing one or more of these transistors shall bear the above markings b, c and d and in addition, this detail specification number BS CECC 50 004 - 001, Issue 1, dated 22nd February 1977

4. RELATED DOCUMENTS

|                                    |                                                                                          |
|------------------------------------|------------------------------------------------------------------------------------------|
| BS 2011/IEC 68                     | Methods for the environmental testing of electronic components and electronic equipment. |
| BS 3934/IEC 191                    | Dimensions of semiconductor devices.                                                     |
| BS E9000/<br>CECC 00 100 to 00 113 | General requirements for electronic components of assessed quality.                      |
| BS E9007/CECC 00 007               | Sampling plans and procedures for inspection by attributes.                              |
| BS/CECC 50 000                     | Harmonised generic specification for discrete semiconductor devices.                     |
| IEC 147-2                          | General principles of measuring methods.                                                 |
| PD 9002/CECC 00 200                | Component selection guide.                                                               |

5. ORDERING INFORMATION

Orders for these transistors should contain the following minimum information:

- (a) The device type and this detail specification number.
- (b) The quantity required.
- (c) If required, screening sequence from Appendix VI of CECC 50000.
- (d) Level of quality assessment as defined in Appendix IIA of CECC 50000.