DatasheetArchive.com

## The Data Book Project

DatasheetArchive.com has launched an ambitious effort to digitize thousands of obsolete data books and technical manuals, making them searchable via the DatasheetArchive website.

**Scroll down to see the scanned document.**

Datasheet and Data Book Site: http://www.datasheetarchive.com

Development Site: http://www.datasheets.org.uk

# Transistors

# silicon n-channel field effect transistors

book 1 parts 1 and 2

## INSULATED GATE FET (MOST)

| Type No. | Outline | Drawing reference | Maximum Ratings $V_{DB}$ (V) | $V_{SB}$ (V) | $\pm V_{GBM}$ (V) | $I_{DM}$ max. (mA) | $T_j$ (°C) | $P_{tot}$ at 25°C (mW) | $r_{DS(on)}$ (Ω) | $r_{DS(off)}$ (Ω) | Special Features |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BFR29** | TO–72 | BA5 | 30 | 30 | 10 | 50 | 125 | 200 | – | – | For linear applications in the audio as well as the i.f. and v.h.f. frequency region |
| **BSV81** | TO–72 | BA5 | 30 | 30 | 10 | 50 | 125 | 200 | <50 | $>1 \times 10^{10}$ | For switching and particularly for chopping applications |

## DUAL INSULATED GATE FET ('Tetrode' MOST)

| Type No. | Outline | Drawing reference | $V_{DS}$ Max. (V) | $V_{GS}$ max. (V) | Maximum Ratings $I_D$ max. (mA) | $T_j$ (°C) | $P_{tot}$ at 25°C (mW) | $I_{GSS}$ max. (nA) | $-C_{rss}$ typ. (fF) | G typ. (dB) | N max. (dB) | Measured at f (MHz) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BF327*** | SOT–103 | AO | 20 | – | 50 | 150 | 200 | 10 | 30 | – | 3 | 200 |
| **BFS28** | TO–72 | BA4 | 20 | 8 | 20 | 135 | 200 | 1 | 25 | 18 | 4 | 200 |
| **BFR84*** | TO–72 | BA4 | 20 | – | 50 | 175 | 300 | 10 | 30 | – | 3 | 200 |

*Protected-gate types

## JUNCTION FET

| Type No. | Outline | Drawing reference | Maximum Ratings $V_{DGM}$ (V) | $V_{GSM}$ (V) | $V_{DSM}$ (V) | $I_{GM}$ (mA) | $T_j$ (°C) | $P_{tot}$ at 25°C (mW) | $V_{(P)GS}$ max. (V) | at $I_D$ (nA) | $I_{GSS}$ max. (nA) | $I_{DSS}$ ($V_{GS}$ = 0) min. (mA) | $I_{DSS}$ ($V_{GS}$ = 0) max. (mA) | at $V_{DS}$ (V) | Special Features |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BF245A** | TO–92 | BB3 | 30 | –30 | 30 | 10 | 150 | 300 | 8 | 10 | 5 | 2 | 6.5 | 15 | N = 1.5dB typ at 100MHz |
| **BF245B** | | | | | | | | | | | | 6 | 15 | | $R_G$ = 1kΩ |
| **BF245C** | | | | | | | | | | | | 12 | 25 | | |
| **BF256A** | TO–92 | BB3 | 30 | –30 | 30 | 10 | 150 | 300 | – | – | 5 | 3 | 7 | 15 | Gp= 11dB typ. at |
| **BF256B** | | | | | | | | | | | | 6 | 13 | | 800MHz. $R_S$ = 47Ω |
| **BF256C** | | | | | | | | | | | | 11 | 18 | | |
| **BFW10** | TO–72 | BA3 | 30 | –30 | 30 | 10 | 200 | 300 | 8 | 0.5 | 0.1 | 8 | 20 | 15 | N <2.5dB at 100MHz |
| **BFW11** | TO–72 | BA3 | 30 | –30 | 30 | 10 | 200 | 300 | 6 | 0.5 | 0.1 | 4 | 10 | 15 | Noise Voltage <75nV/√Hz at 10Hz |
| **BFW12** | TO–72 | BA3 | 30 | –30 | 30 | 5 | 200 | 150 | 2.5 | 0.5 | 0.1 | 1 | 5 | 15 | |
| **BFW13** | | | | | | | | | 1.2 | | | 0.2 | 1.5 | | |
| **BFW61** | TO–72 | BA3 | 25 | –25 | 25 | 10 | 200 | 300 | 8 | 1 | 1 | 2 | 20 | 15 | |
| **BSV78** | TO–18 | AT2 | 40 | –40 | 40 | 50 | 175 | 350 | 11 | 1 | 0.25 | 50 | – | 15 | $r_{DS(on)}$ <25Ω |
| **BSV79** | TO–18 | AT2 | 40 | –40 | 40 | 50 | 175 | 350 | 7 | 1 | 0.25 | 20 | – | 15 | $r_{DS(on)}$ <40Ω |
| **BSV80** | TO–18 | AT2 | 40 | –40 | 40 | 50 | 175 | 350 | 5 | 1 | 0.25 | 10 | – | 15 | $r_{DS(on)}$ <60Ω |
| **2N3823** | TO–72 | BA3 | 30 | –30 | 30 | 10 | 200 | 300 | 8 | 0.5 | 0.5 | 4 | 20 | 15 | N <2.5dB at 100MHz |
| **Matched Pairs** | | | | | | | | | | | | | | | |
| †**BFS21** | 2xTO–72 | BA3 | 30 | –30 | 30 | 10 | 200 | 300‡ | 6.0 | 0.5 | 0.5 | 1 | – | 15 | $V_{G1S1} - V_{G2S2}$ <20mV<br>$I_{D1}/I_{D2}$ = 0.95 to 1.05<br>N <75nV/√Hz at 10Hz |
| †**BFS21A** | 2xTO–72 | BA3 | 30 | –30 | 30 | 10 | 200 | 300‡ | 6.0 | 0.5 | 0.5 | 1 | – | 15 | $V_{G1S1} - V_{G2S2}$ <10mV<br>$I_{D1}/I_{D2}$ = 0.95 to 1.05<br>N <75nV/√Hz at 10Hz |

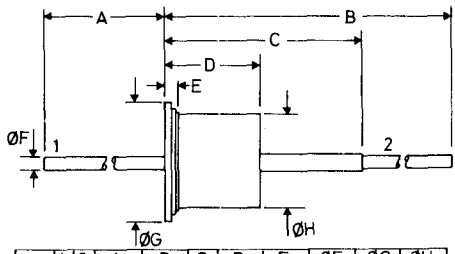
†The devices are supplied in matched pairs, mounted in a heat conducting S-clip. ‡Individual transistors

## Dual Field Effect Transistors

| | | | | | | | | | | $\Delta I_G$ (pA) | $\Delta V_{GS}$ (mV) | $\frac{d\Delta V_{GS}}{dt}$ (μV/°C) | CMRR (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BFQ10** | TO–71 | AZ2 | 30 | –30 | 30 | 10 | 200 | 250 | 3.5 | <10 | <5 | <5 | >100 | Intended for |
| **BFQ11** | | | | | | | | | | | <10 | <5 | >90 | high-performance, |
| **BFQ12** | | | | | | | | | | | <10 | <10 | >90 | low-level differential |
| **BFQ13** | | | | | | | | | | | <10 | <20 | >90 | amplifiers |
| **BFQ14** | | | | | | | | | | | <15 | <20 | >90 | |
| **BFQ15** | | | | | | | | | | | <20 | <40 | >90 | |
| **BFQ16** | | | | | | | | | | | <50 | <50 | >80 | |

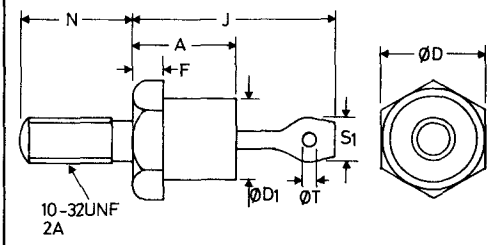
## OUTLINES and DIMENSIONS (millimetres)

### A — B.S.3934 SO-16 — DO-1 DO-2 DO-3




| | 1 | 2 | A min. | B min. | C | D max. | E max. | ØF max. | ØG max. | ØH max. |
|---|---|---|---|---|---|---|---|---|---|---|
| A1 | a | k | 35 | 51 | 17 | 7.7 | 1.6 | 1.1 | 9.6 | 7.1 |
| A2 | k | a | 35 | 49 | 17 | 8.5 | 1.9 | 1.1 | 9.7 | 7.1 |
| A3 | k | a | 35 | 51 | 17 | 7.7 | 1.6 | 1.1 | 9.6 | 7.1 |

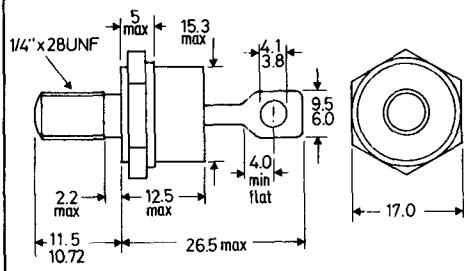
### B — B.S.3934 SO-10 — DO-4




A 10.3 max. J 20.3 max.
ØD 11.1 max. N 11.5 max.
ØD1 9.3 max. S1 4.8 max
F 3.2 ØT 1.6 min

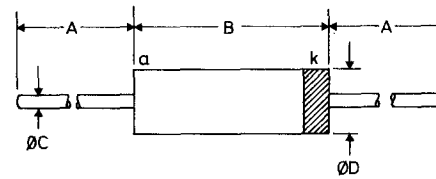
| | Stud | Eyelet |
|---|---|---|
| B1 | k | a |
| B2 | a | k |

### C — B.S.3934 SO-13 — DO-5



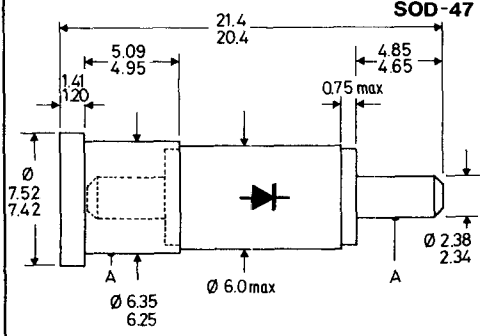

| | Stud | Eyelet |
|---|---|---|
| C1 | k | a |
| C2 | a | k |

### D — DO-7 DO-14 DO-15



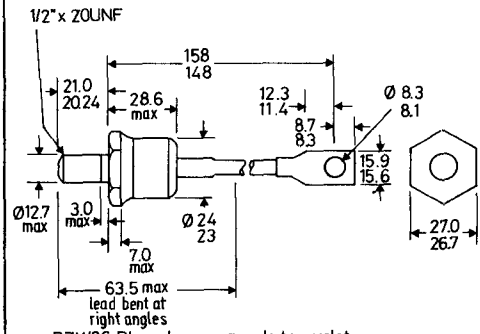

| | | A min. | B max. | ØC nom. | ØD max. |
|---|---|---|---|---|---|
| D1 | DO-7 | 25.4 | 7.6 | 0.52 | 2.5 |
| D2 | DO-14 | 25.4 | 7.6 | 0.5 | 3.3 |
| D3 | DO-15 | 25.4 | 6.4 | 0.8 | 3.2 |

### E — DO-22 SOD-47




A = concentricity tolerance = ± 0.20

### F — DO-30

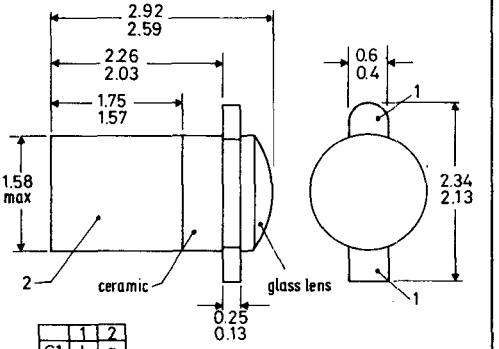



BZW86 Blue sleeve - anode to eyelet
BZW86R Red sleeve - anode to stud

*These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.*

## G

**DO-31**

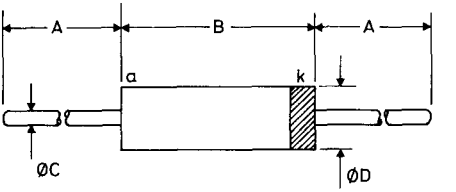



| | 1 | 2 |
|---|---|---|
| G1 | k | a |
| G2 | e | c |

For LED's the overall length = 3.60/2.97

## H

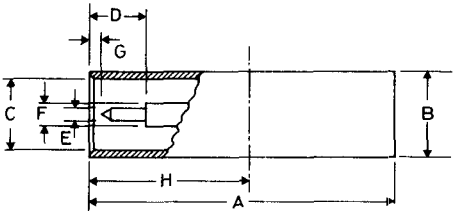
**DO-35**




| A min. | B max. | ØC max. | ØD max. |
|---|---|---|---|
| 25.4 | 4.25 | 0.56 | 1.85 |

## J

**DO-37**
**SOD-49**

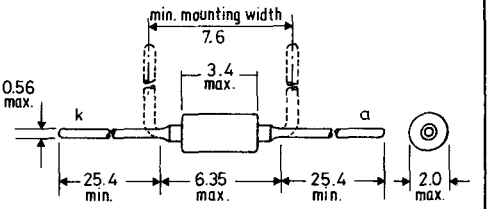



| | | | |
|---|---|---|---|
| A | 19.43/18.67 | ØE | 0.84/0.79 |
| ØB* | 5.59/5.49 | ØF | 1.57/1.52 |
| ØC | 4.80/4.72 | G | 0.71/0.15 |
| D | 3.73 min. | H | 10.32 nom. |

*These tolerances apply only over H

## K

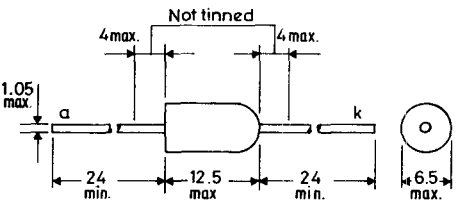
**SOD-17**




Cathode indicated by the broad band of colour code

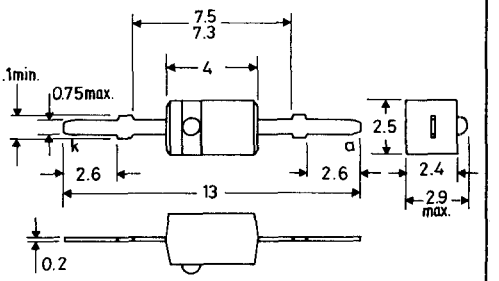
## L

**SOD-18**



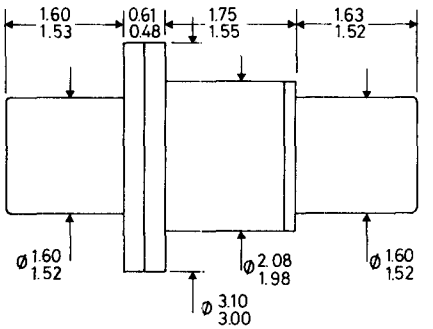

## M

**SOD-23**



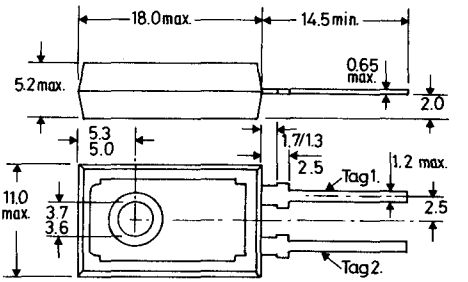
## N

B.S.3934 SO 86 SOD-31




## O

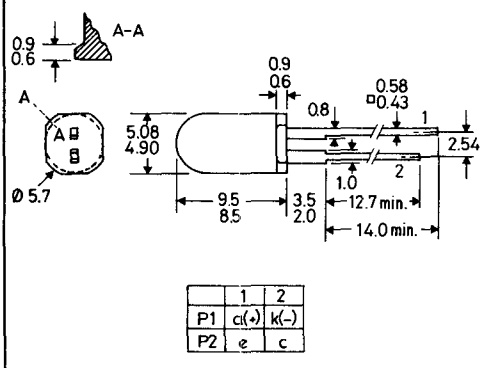
SOD-38




| | polarity normal | reverse |
|---|---|---|
| Tag 1 = base-plate: | cathode | anode |
| Tag 2 : | anode | cathode |

## P

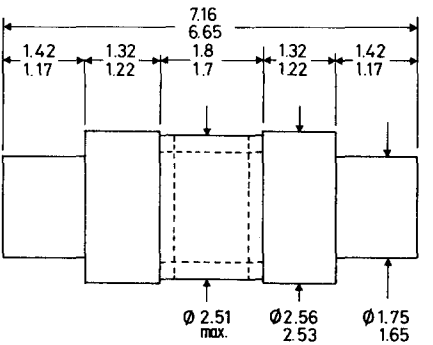
SOD-39




| | 1 | 2 |
|---|---|---|
| P1 | a(+) | k(−) |
| P2 | e | c |

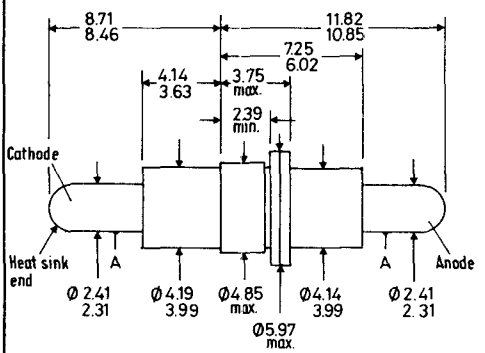
## Q

SOD-42




## R

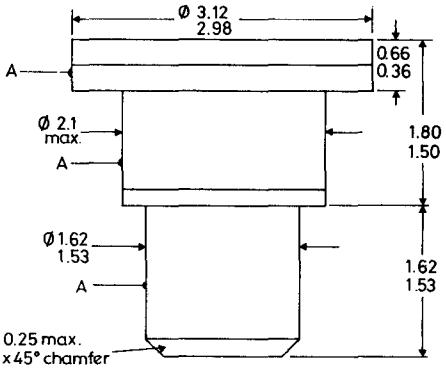
SOD-43




A = concentricity tolerance = ± 0.13

## S

SOD-45

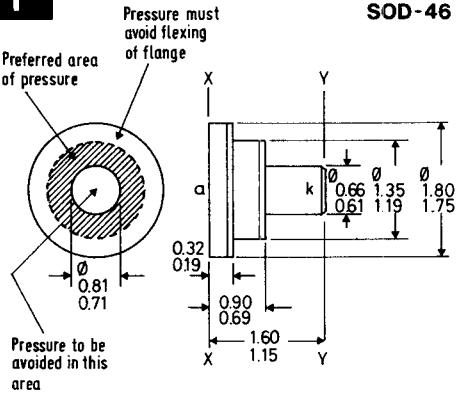



A = concentricity tolerance = ± 0.13

*These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.*

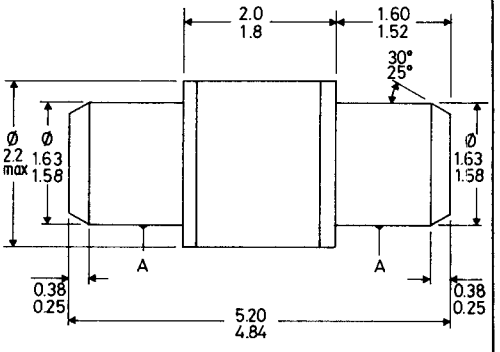
## T

**SOD-46**




## U

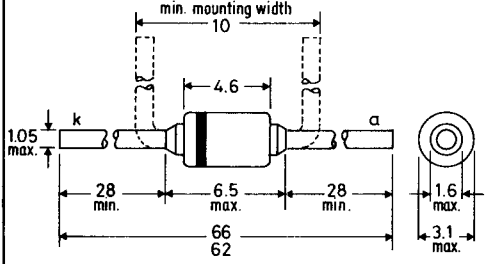
**SOD-50**




A = concentricity tolerance = ± 0.15

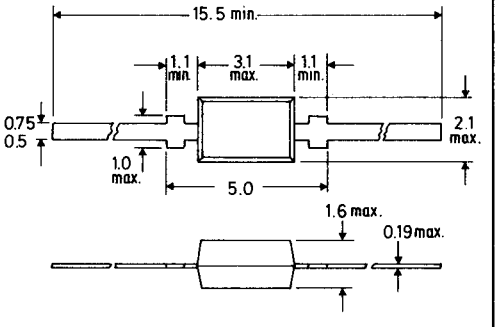
## V

**SOD-51**




## W

**SOD-52**

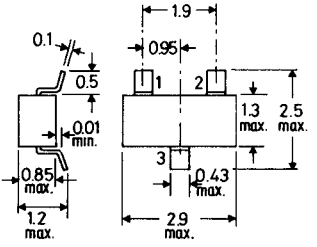



The coloured end indicates the cathode

## X

**SOT-23**

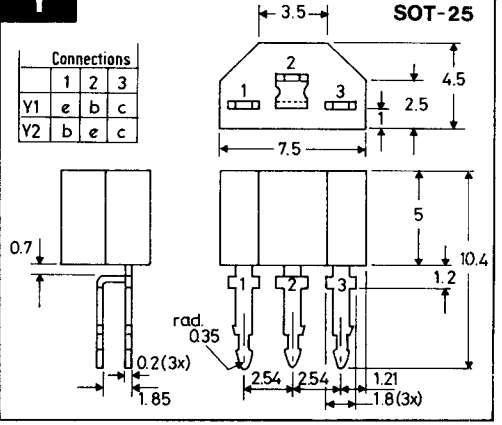
| | 1 | 2 | 3 |
|---|---|---|---|
| X1 | b | e | c |
| X2 | s | d | g |
| X3 | nc | a | k |
| X4 | a1 | a2 | k |
| X5 | k1 | k2 | a |
| X6 | k1 | a2 | common |
| X7 | e | b | c |



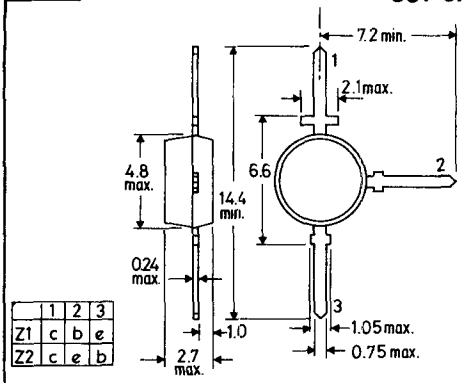

## Y

**SOT-25**

| Connections | 1 | 2 | 3 |
|---|---|---|---|
| Y1 | e | b | c |
| Y2 | b | e | c |

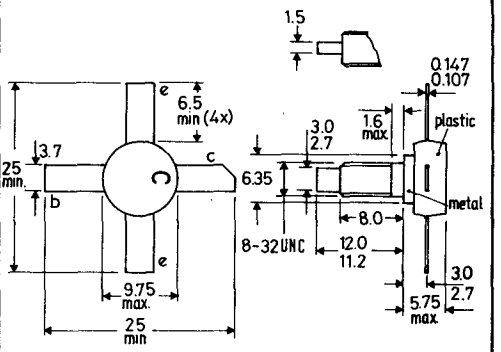


## Z — SOT-37

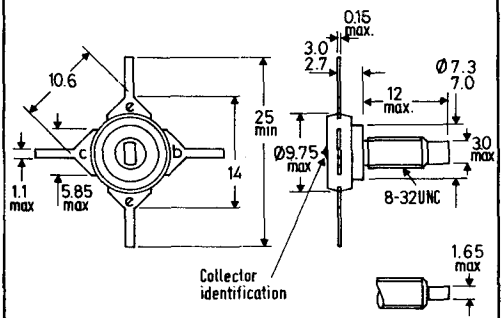



| | 1 | 2 | 3 |
|---|---|---|---|
| Z1 | c | b | e |
| Z2 | c | e | b |

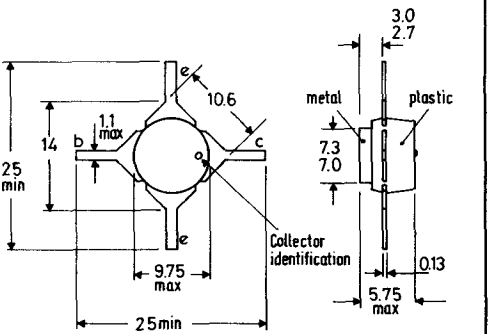
## AC — SOT-48/2



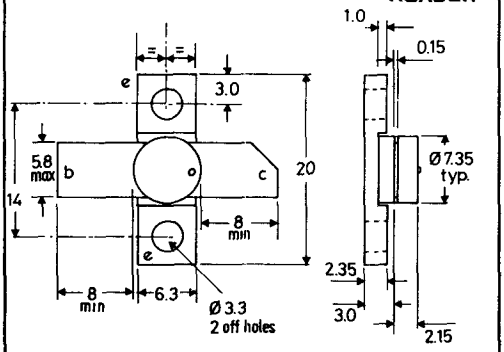

## AD — SOT-48/3



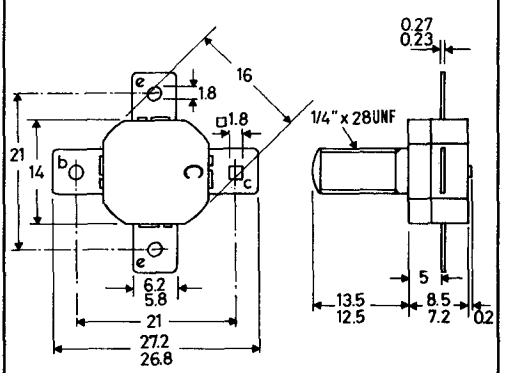

## AE — SOT-48/4




## AF — SOT-48 HEADER



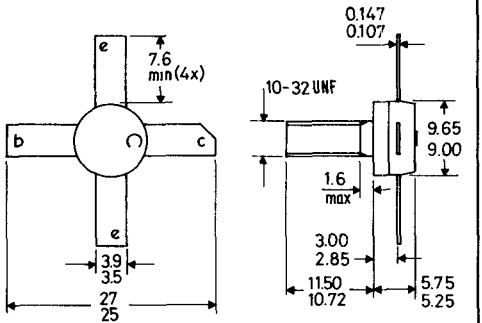

## AG — SOT-55




*These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.*

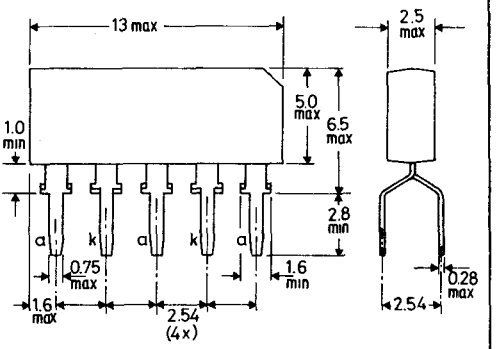
## AH

**SOT-56**



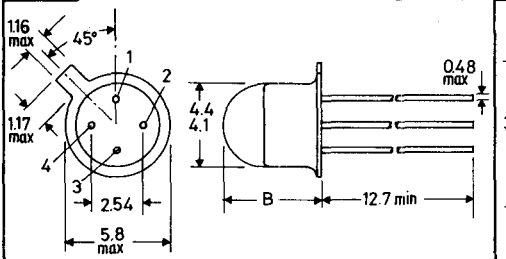

## AJ

**SOT-60**




## AK

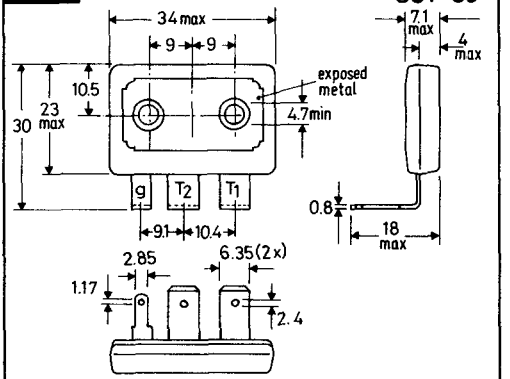
**SOT-70**




| | 1 | 2 | 3 | 4 | B max |
|---|---|---|---|---|---|
| AK1 | a | – | k | – | 5.08 |
| AK2 | e | b | c | – | 4.5 |
| AK3 | Vp | IP | GND | OP | 5.08 |

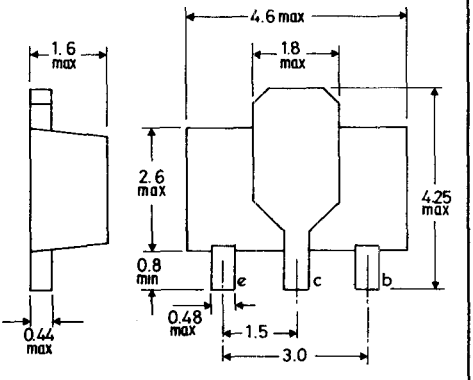
## AL

**SOT-80**



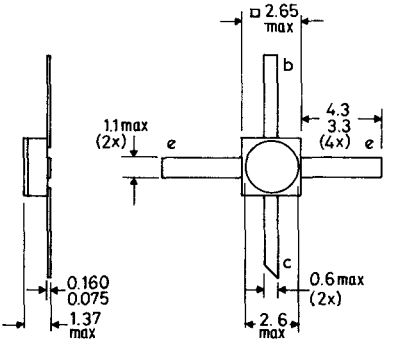

## AM

**SOT-89**



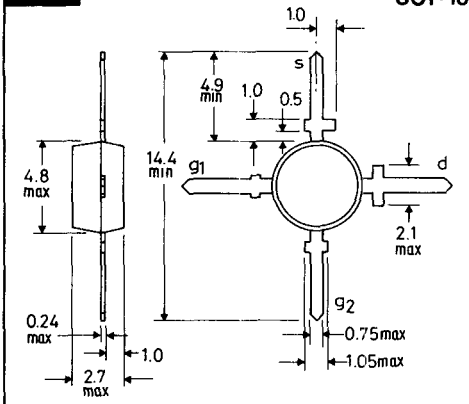

## AN

**SOT-100**



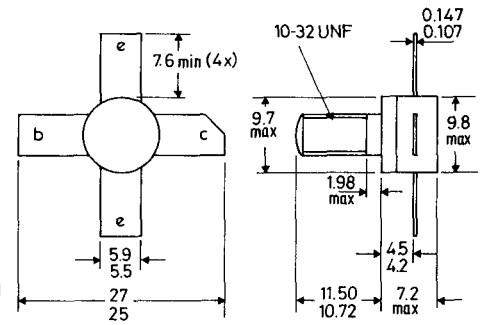
## AO

**SOT-103**



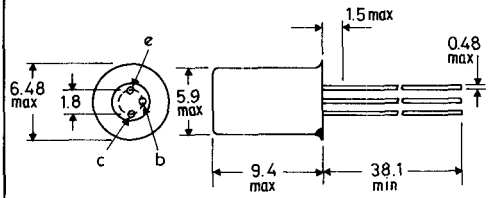

## AP

**SOT-105**



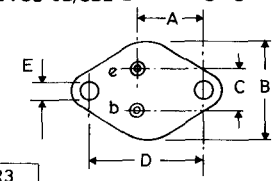

## AQ

**B.S.3934 SO-21/SB3-10** **TO-1**

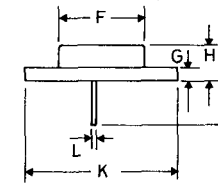



## AR

**B.S.3934 SO-5B/SB2-2** **TO-3**

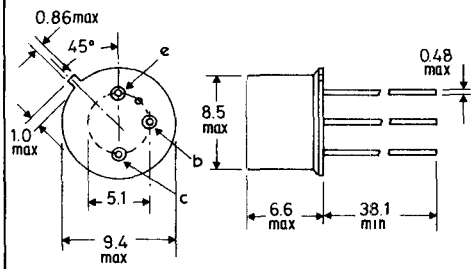



| | AR1 | AR2 | AR3 |
|---|---|---|---|
| A | | 16.9 | |
| B | | 26.6max | |
| C | | 10.9 | |
| D | | 30.1 | |
| E | | 4.2max | |
| F | | 20.3max | |
| G | 3.15 | 1.6 | 1.6 |
| H | 9.5max | 9.5max | 8.63max |
| J | | 12.0 | |
| K | | 39.5max | |
| L | | 1.0 | |




## AS

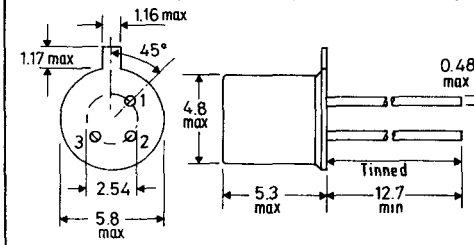
**B.S.3934 SO-3/SB3-3B** **TO-5**




AS1: collector connected to case
AS2: base connected to case

## AT

**B.S.3934 SO-12A/SB3-6A** **TO-18**

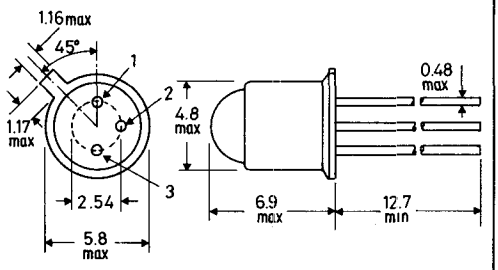



| | 1 | 2 | 3 |
|---|---|---|---|
| AT1 | e | b | c+env. |
| AT2 | s | d | g+env. |
| AT3 | d | g | s+env. |
| AT4 | k | – | a |
| AT5 | a | – | k |
| AT6 | k | – | a |

*These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.*

## AU

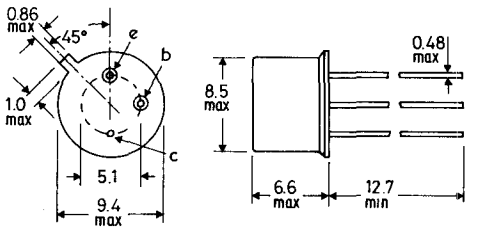
**TO-18**
**(with lens)**




| | 1 | 2 | 3 |
|---|---|---|---|
| AU1 | a | a | k |
| AU2 | e | b | c+case |
| AU3 | k | – | a |

## AV

**B.S.3934 SO-3/SB3-3A** **TO-39**

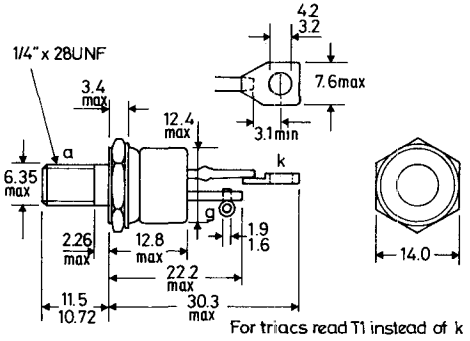



AV1: b+case
AV2: case isolated
AV3: c+case
AV4: e.cathode
b.gate
c.anode+case

AV5: e.b. cell connections
c. metal case
AV6: red spot indicates
+ve connection

## AW

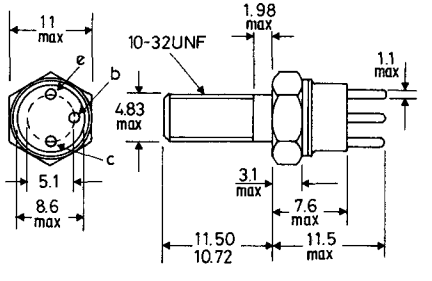
**B.S.3932 SO-36** **TO-48**




For triacs read T1 instead of k
T2 instead of a

## AX

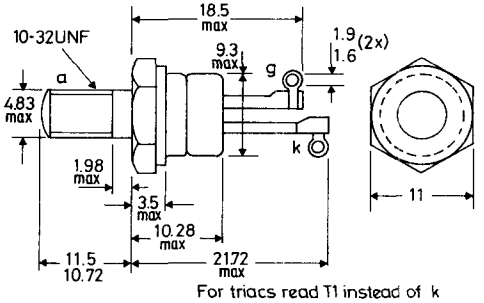
**TO-60**




Emitter connected to envelope

## AY

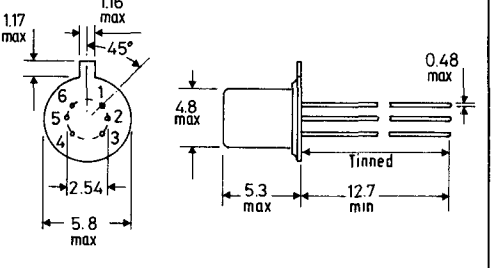
**B.S.3934 SO-35A** **TO-64**




For triacs read T1 instead of k
T2 instead of a

## AZ

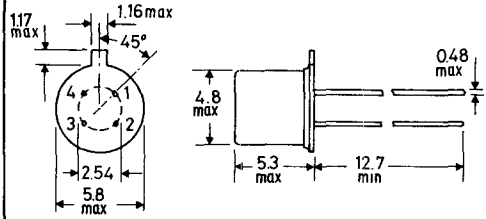
**TO-71**




| Pin | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| AZ1 | e1 | e2 | c2 | b2 | b1 | c1 |
| AZ2 | s1 | d1 | g1 | s2 | d2 | g2 |

## BA

B.S.3934 SO-12A/SB4-3 TO-72

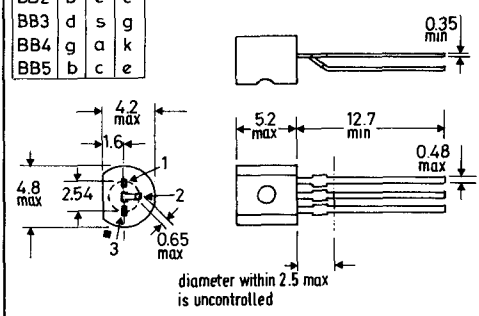



| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| BA1 | b | e | c | s+envelope |
| BA2 | e | b | c | s+envelope |
| BA3 | s | d | g | screen +envelope |
| BA4 | d | g2 | g1 | s+b+ envelope |
| BA5 | d | s | g | b+ envelope |
| BA6 | k | gk | ga | a |

## BB

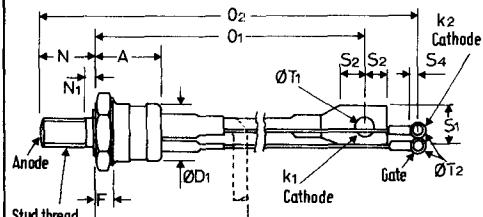
TO-92 variant

| Pin | 1 | 2 | 3 |
|---|---|---|---|
| BB1 | e | b | c |
| BB2 | b | e | c |
| BB3 | d | s | g |
| BB4 | g | a | k |
| BB5 | b | c | e |




## BC

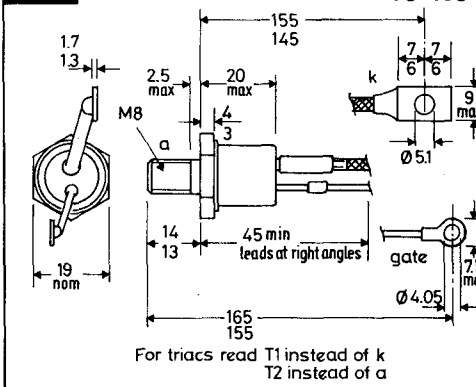
B.S.3934 SO-30C TO-94




| | | | | | |
|---|---|---|---|---|---|
| A | 28.5max | O1 | 158 max | S4 | 3.8 min |
| ØD1 | 24.1 max | O2 | 190 max | ØT1 | 8.3 max |
| F | 8.9 max | Q | 63.5max | ØT2 | 4.2 max |
| N | 21.0max | S1 | 16.5max | | |
| N1 | 3.0max | S2 | 9.6min | | |

## BD

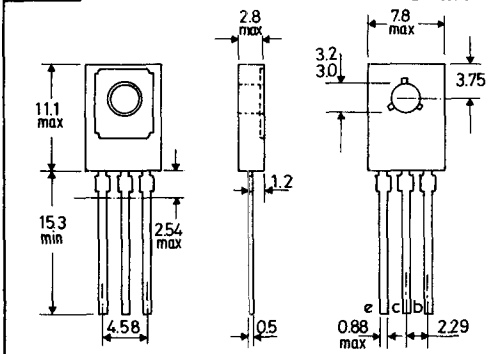
TO-103




For triacs read T1 instead of k
T2 instead of a

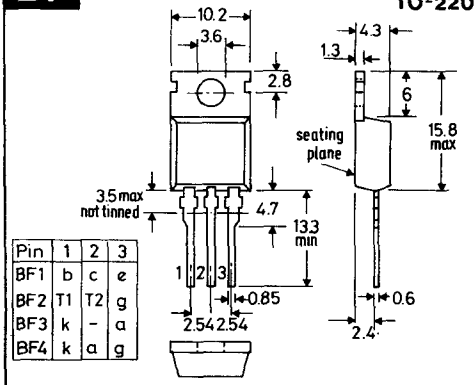
## BE

TO-126




## BF

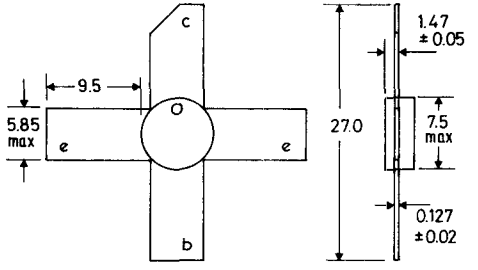
TO-220



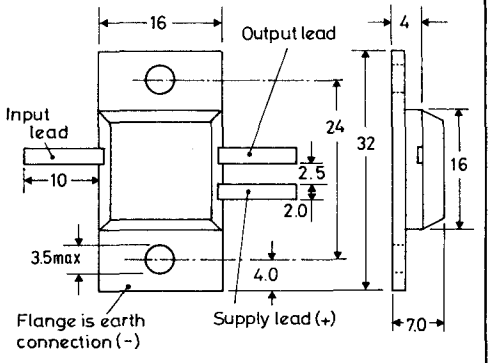

| Pin | 1 | 2 | 3 |
|---|---|---|---|
| BF1 | b | c | e |
| BF2 | T1 | T2 | g |
| BF3 | k | - | a |
| BF4 | k | a | g |

*These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.*

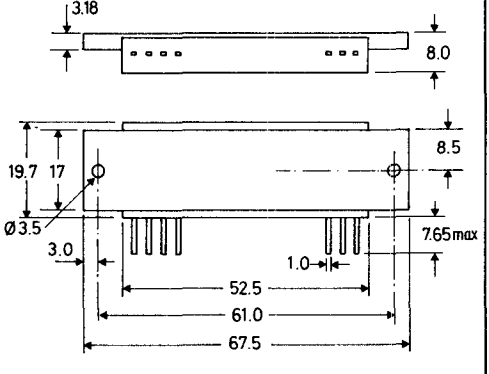
## BG



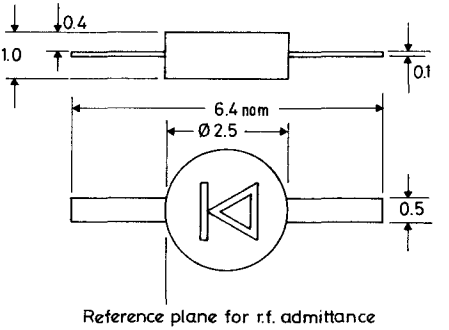

## BH



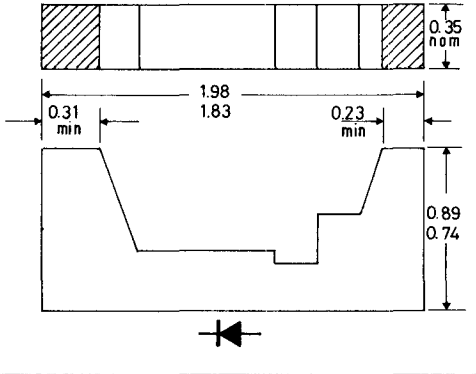

## BJ



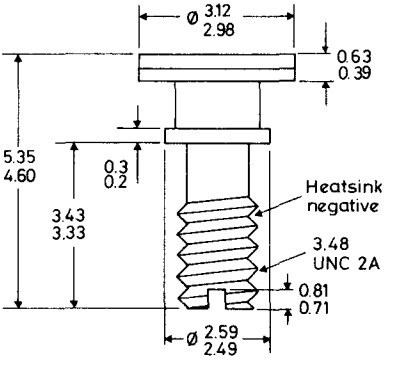

## BK




## BL

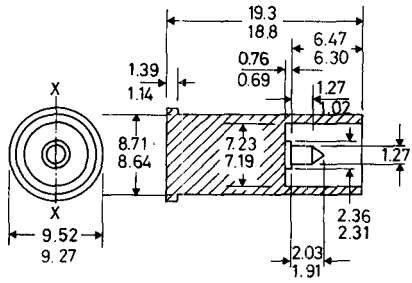



## BM



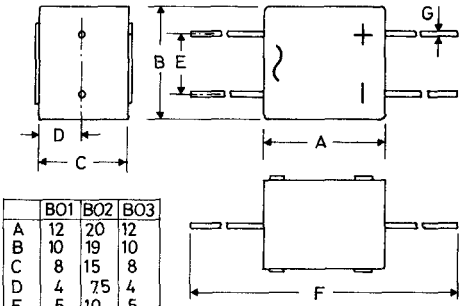
## BN

B.S.3934 SO-26



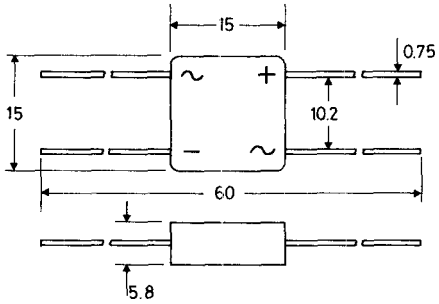

(All dimensions max.)

## BO

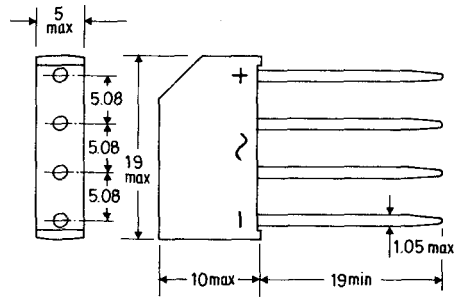



| | BO1 | BO2 | BO3 |
|---|---|---|---|
| A | 12 | 20 | 12 |
| B | 10 | 19 | 10 |
| C | 8 | 15 | 8 |
| D | 4 | 7.5 | 4 |
| E | 5 | 10 | 5 |
| F | 58 | 60 | 48 |
| G | 0.75 | 1.0 | 1.1 |

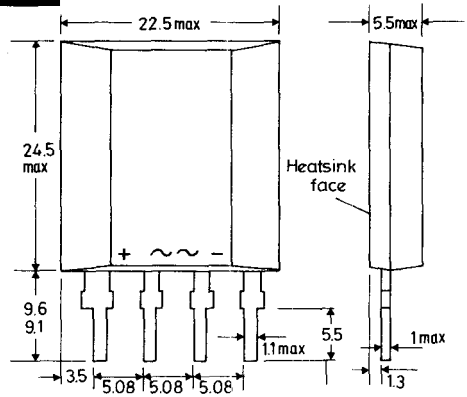
## BP




## BQ

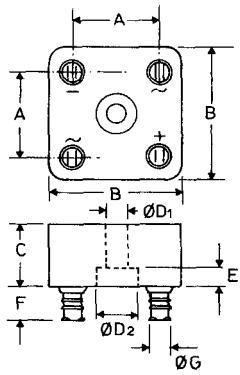



## BR




## BS

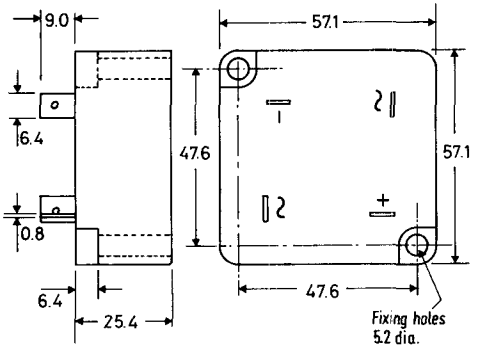
B.S.3934 SO-67



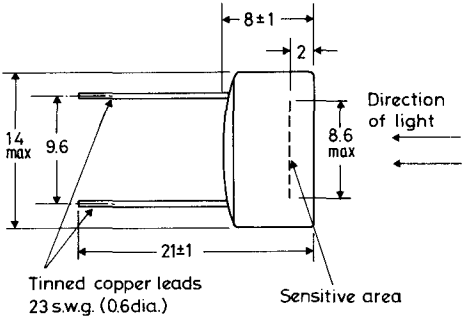

| | BS1 | BS2 |
|---|---|---|
| | typ. | max |
| A | 23 | 21 |
| B | 35 | 34.6 |
| C | 17 | 15.2 |
| ØD1 | 5 | 5.05 |
| ØD2 | 11 | 11 |
| E | 5 | 3.7 |
| F | 9 | 9 |
| ØG | 4.8 | 4.8 |

*These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.*

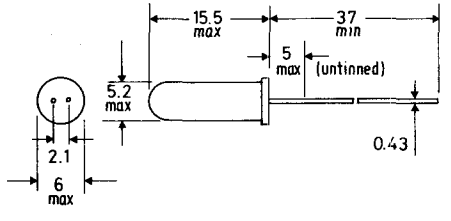
## BT



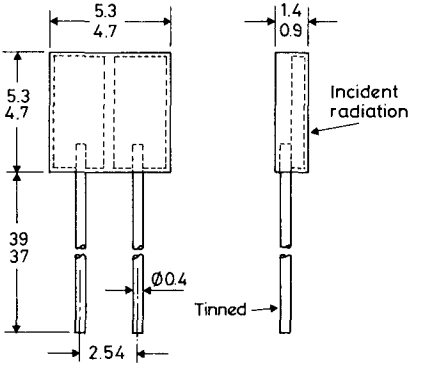

## BU



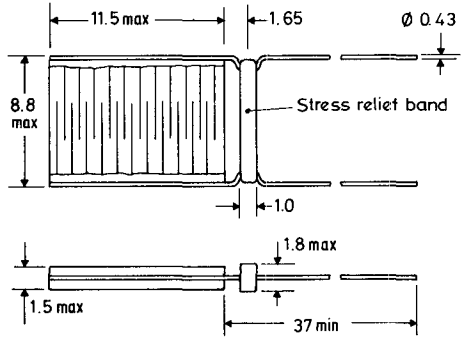

## BV



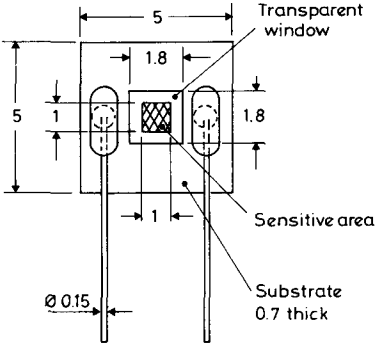

## BW

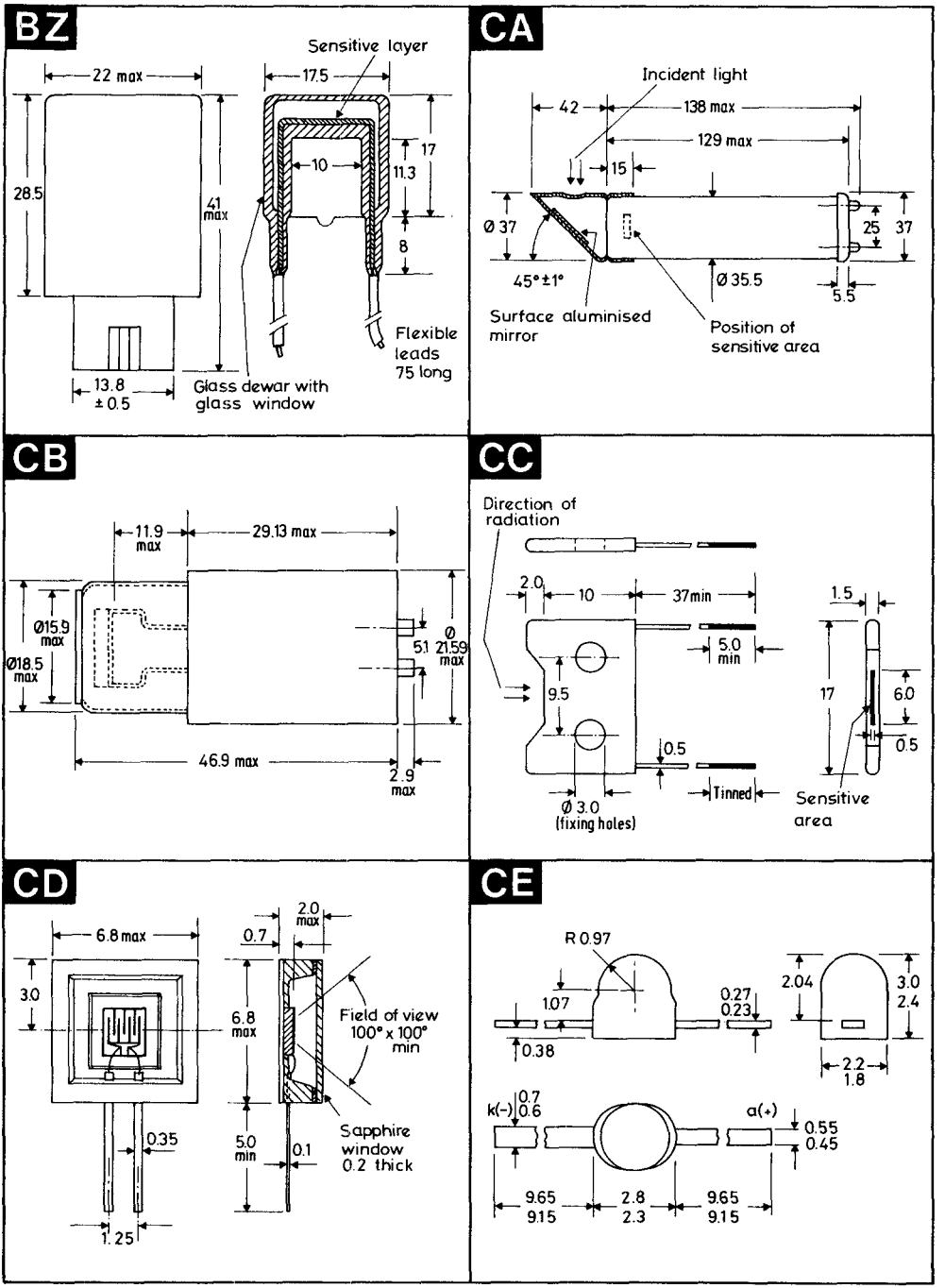



## BX



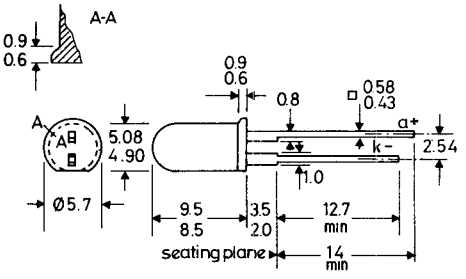

## BY



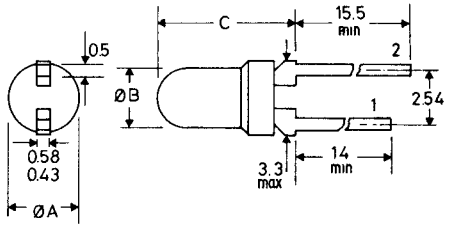



*These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.*

## CF

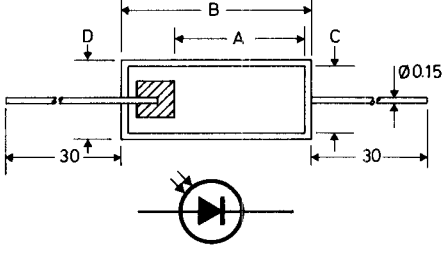



## CG



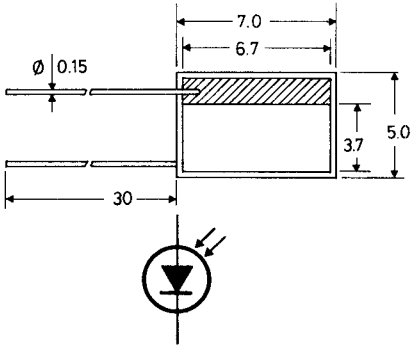

| | 1 | 2 | ØA | ØB | C |
|---|---|---|---|---|---|
| CG1 | k(-) | a(+) | 3.0-3.17 | 2.4-2.6 | 5.8-6.3 |
| CG2 | a(+) | k(-) | 3.0-3.17 | 2.4-2.6 | 5.8-6.3 |
| CG3 | k(-) | a(+) | 3.3 max | 2.65-3.17 | 4.8-6.3 |

## CH

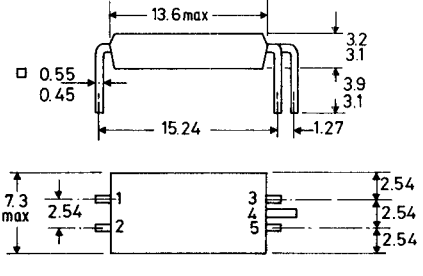



| | CH1 | CH2 |
|---|---|---|
| A | 2.2 | 3.5 |
| B | 3.35 | 4.55 |
| C | 0.95 | 1.85 |
| D | 1.25 | 2.15 |

## CJ

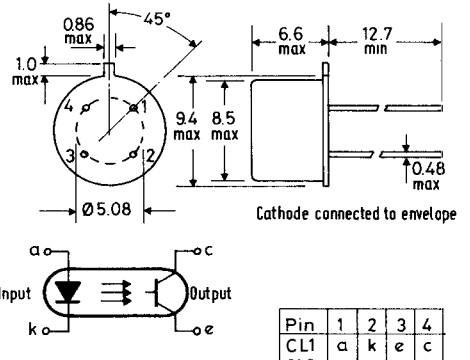



## CK



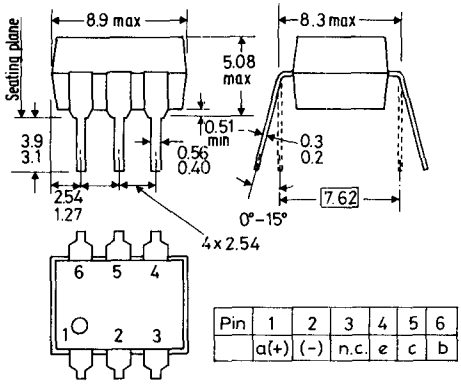

| Pin | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| CK1 | a | k | b | c | e |
| CK2 | k | a | e | omitted | c |

## CL



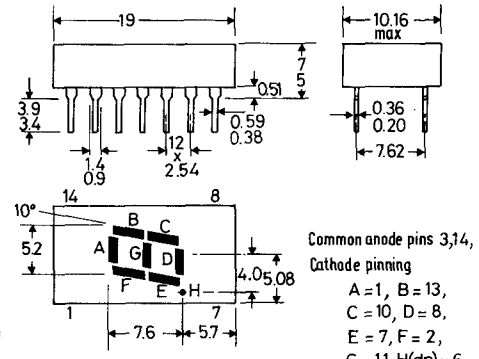

| Pin | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CL1 | a | k | e | c |
| CL2 | e | c | a | k |

## CM



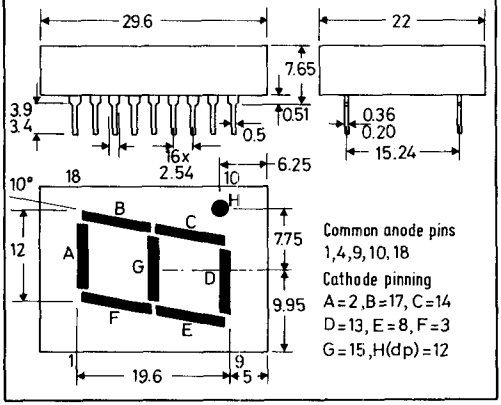

| Pin | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | a(+) | (-) | n.c. | e | c | b |

## CN




Common anode pins 3,14,
Cathode pinning
A = 1, B = 13,
C = 10, D = 8,
E = 7, F = 2,
G = 11, H(dp) = 6

## CO




Common anode pins
1,4,9,10,18
Cathode pinning
A = 2, B = 17, C = 14
D = 13, E = 8, F = 3
G = 15, H(dp) = 12

*These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.*