

VALVE ELECTRONIC
(SEMICONDUCTOR)
(DEVICE)

CV7099-7106
CV7138-7146

ADMIRALTY SURFACE WEAPONS ESTABLISHMENT

| | | |
|---|--------------------------------------|------------------------------|
| Specification AD/CV7099-7106, CV7138-7146 Issue No. 2 dated 1.4.62. To be read in conjunction with K.1007 Mandatory Sections - 1,2,3,4,5.1,5.2, 5.3, 9,15. Other Sections and Appendices as called up by this Specification | <u>SECURITY</u> | |
| | <u>Specification</u> Unclassified | <u>Valve</u> Unclassified |

—————> Indicates a change

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|--|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|--------|------------------|
| TYPE OF VALVE - Silicon Zener Diode PROTOTYPE - 1S7000A Series | | <u>MARKING</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <u>RATINGS</u> (Not for Inspection Purposes) <u>All limiting values are absolute</u> | | CV number or colour code to denote CV number. Polarity Marking. Factory and date code if practicable. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <u>DIMENSIONS</u> K1007/A1/D9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Max. Dissipation at 25°C amb. (mW) | 400 | A | <u>MOUNTING POSITION</u> Any. Device intended for air cooling. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Max. continuous reverse current at 25°C amb. (mA) | 100 95 90 85 80 70 65 60 55 50 45 40 38 34 32 28 25 | A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Max. continuous forward current at 25°C amb. (mA) | | <u>PACKAGING</u> K1007/14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <u>NOTES</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Operating ambient temperature range -55°C to +150°C | | A. Derating above 25°C amb. See Fig. 1, page 3. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | B. J.S. Catalogue numbers are: <table style="width: 100%; border: none;"> <tr><td>CV7138</td><td>5960-99-037-2388</td></tr> <tr><td>CV7139</td><td>5960-99-037-2389</td></tr> <tr><td>CV7140</td><td>5960-99-037-2390</td></tr> <tr><td>CV7141</td><td>5960-99-037-2391</td></tr> <tr><td>CV7099</td><td>5960-99-037-2199</td></tr> <tr><td>CV7100</td><td>5960-99-037-2200</td></tr> <tr><td>CV7101</td><td>5960-99-037-2201</td></tr> <tr><td>CV7102</td><td>5960-99-037-2202</td></tr> <tr><td>CV7103</td><td>5960-99-037-2203</td></tr> <tr><td>CV7104</td><td>5960-99-037-2204</td></tr> <tr><td>CV7105</td><td>5960-99-037-2205</td></tr> <tr><td>CV7142</td><td>5960-99-037-2392</td></tr> <tr><td>CV7143</td><td>5960-99-037-2393</td></tr> <tr><td>CV7144</td><td>5960-99-037-2394</td></tr> <tr><td>CV7145</td><td>5960-99-037-2395</td></tr> <tr><td>CV7146</td><td>5960-99-037-2396</td></tr> <tr><td>CV7106</td><td>5960-99-037-2206</td></tr> </table> | | CV7138 | 5960-99-037-2388 | CV7139 | 5960-99-037-2389 | CV7140 | 5960-99-037-2390 | CV7141 | 5960-99-037-2391 | CV7099 | 5960-99-037-2199 | CV7100 | 5960-99-037-2200 | CV7101 | 5960-99-037-2201 | CV7102 | 5960-99-037-2202 | CV7103 | 5960-99-037-2203 | CV7104 | 5960-99-037-2204 | CV7105 | 5960-99-037-2205 | CV7142 | 5960-99-037-2392 | CV7143 | 5960-99-037-2393 | CV7144 | 5960-99-037-2394 | CV7145 | 5960-99-037-2395 | CV7146 | 5960-99-037-2396 |
| CV7138 | 5960-99-037-2388 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7139 | 5960-99-037-2389 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7140 | 5960-99-037-2390 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7141 | 5960-99-037-2391 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7099 | 5960-99-037-2199 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7100 | 5960-99-037-2200 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7101 | 5960-99-037-2201 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7102 | 5960-99-037-2202 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7103 | 5960-99-037-2203 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7104 | 5960-99-037-2204 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7105 | 5960-99-037-2205 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7142 | 5960-99-037-2392 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7143 | 5960-99-037-2393 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7144 | 5960-99-037-2394 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7145 | 5960-99-037-2395 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7146 | 5960-99-037-2396 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CV7106 | 5960-99-037-2206 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200 | | A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

TABLE I
CHARACTERISTICS

| | V_z nom. at $I_R = 5 \text{ mA}$ $T_{amb} = 25^\circ\text{C}$ (V) | r_z max. at $I_R = 5 \text{ mA}$ $T_{amb} = 25^\circ\text{C}$ (Ω) | S_z typ. at $I_R = 5 \text{ mA}$ (%/°C) |
|--------|---|--|--|
| CV7138 | 3.3 | 120 | -0.07 |
| CV7139 | 3.6 | 110 | -0.06 |
| CV7140 | 3.9 | 100 | -0.05 |
| CV7141 | 4.3 | 90 | -0.04 |
| CV7099 | 4.7 | 85 | -0.025 |
| CV7100 | 5.1 | 80 | -0.01 |
| CV7101 | 5.6 | 75 | +0.005 |
| CV7102 | 6.2 | 40 | +0.03 |
| CV7103 | 6.8 | 15 | +0.045 |
| CV7104 | 7.5 | 15 | +0.05 |
| CV7105 | 8.2 | 15 | +0.06 |
| CV7142 | 9.1 | 15 | +0.06 |
| CV7143 | 10.0 | 20 | +0.065 |
| CV7144 | 11.0 | 40 | +0.07 |
| CV7145 | 12.0 | 60 | +0.07 |
| CV7146 | 13.0 | 75 | +0.07 |
| CV7106 | 15.0 | 90 | +0.07 |

FIG.1.

DERATING FOR DISSIPATION
REVERSE CURRENT AND
FORWARD CURRENT

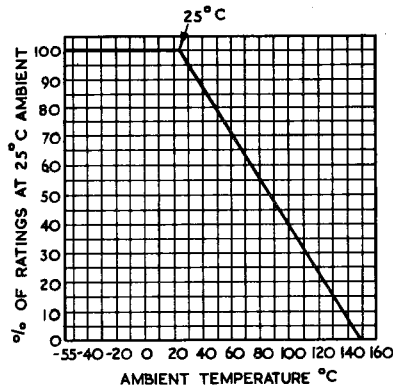


FIG.2.

SURGE RATING AT 25°C

(FOR RATINGS AT OTHER TEMPERATURES SEE PERCENTAGE DERATING CURVE ABOVE)

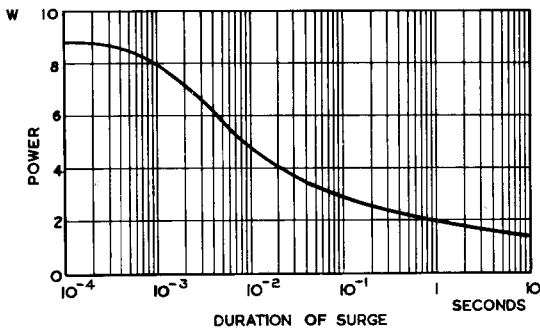
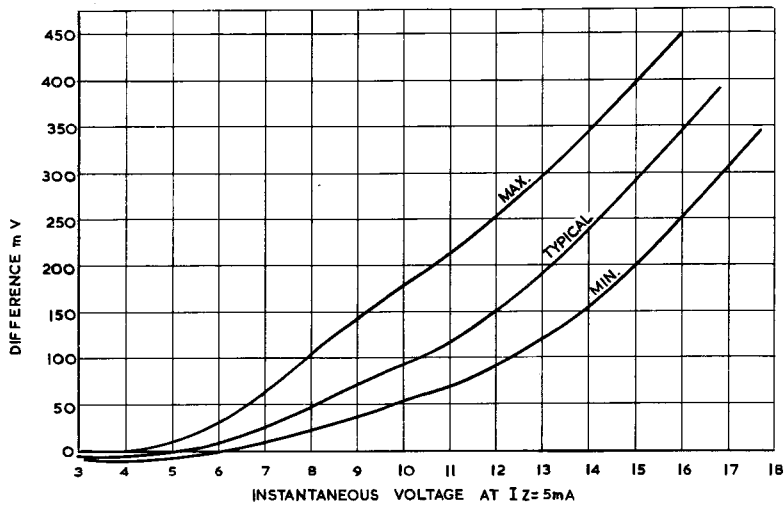


FIG. 3 CORRELATION BETWEEN INSTANTANEOUS
VOLTAGE AND EQUILIBRIUM VOLTAGE



EQUILIBRIUM VOLTAGE = INSTANTANEOUS VOLTAGE + DIFFERENCE

TESTSCV7099-7106
CV7138-7146

| K1007 | TEST | TEST CONDITIONS | AQL % | INSP. LEVEL | SYM- BOL | LIMITS | | UNITS |
|-------|--|--|----------|----------------|-------------|---------------------------|---------------------------|---------------------|
| | | | | | | MIN. | MAX. | |
| | <u>GROUP B</u> | | | | | | | |
| 5.F.2 | Operating Voltage (1) | $I_R = 5 \text{ mA}$ Notes 4 and 5 | 0.65 | II | V_Z | Col. 2 Table II | Col. 3 Table II | V |
| 5.F.2 | Operating Voltage (2) | $I_R = 1 \text{ mA}$ Note 4 | 0.65 | II | V_Z | Col. 4 Table II | Col. 5 Table II | V |
| 5.F.3 | Slope Resistance | $I_R = 5 \text{ mA}$ | 0.65 | II | r_Z | | Col. 6 Table II | Ω |
| | <u>GROUP C</u> | | | | | | | |
| 5.F.5 | Reverse Current | $T_{amb} = +100^\circ\text{C}$ V_R according to Col. 7 Table II | 2.5 | I | I_R | - | Col. 8 Table II | μA |
| | <u>GROUP D</u> | | | | | | | |
| 5.F.4 | Temperature Co-efficient of operating voltage | $I_R = 5 \text{ mA}$ $T_1 = +25^\circ\text{C}$ $T_2 = +60^\circ\text{C}$ | 6.5 | IA | S_Z | Col. 10 Table II | Col. 11 Table II | $\%/^\circ\text{C}$ |
| | <u>GROUP E</u> | | | | | | | |
| 10.2 | Temperature Cycling Note 1. | No voltages Three cycles -55°C to $+100^\circ\text{C}$ | | IC | | | | |
| 10.3 | Climatic Cycling | No voltages | | | | | | |
| | <u>Post temperature and climatic cycling tests</u> | | | | | | | |
| 5.F.2 | Operating Voltage (1) | As in Group B | 6.5 | | V_Z | Col. 2 Table II | Col. 3 Table II | V |

CV7099-7106/2/5
CV7138-7146/2/5

| K1007 | TEST | TEST CONDITIONS | AQL % | INSP. LEVEL | SYM BOL | LIMITS | | UNITS |
|-------|--|--|-------|-------------|----------------|-----------------|-----------------|-------|
| | | | | | | MIN. | MAX. | |
| 11.3 | Fatigue <u>Post Fatigue Test</u> | No Voltages | | IC | | | | |
| 5.F.2 | Operating Voltage (1) | As in Group B | 6.5 | | V _Z | Col. 2 Table II | Col. 3 Table II | V |
| 11.4 | Shock <u>Post Shock Test</u> | No voltages Hammer angle = 60° | | QA | | | | |
| 5.F.2 | Operating Voltage (1) | As in Group B | 6.5 | | | Col. 2 Table II | Col. 3 Table II | V |
| 10.1 | Lead Fragility | No voltages Note 2 | 6.5 | IC | | | | |
| 11.5 | Soldering | No voltages | 6.5 | IC | | | | |
| 13 | <u>GROUP F</u> Life | Tamb not greater than 140°C. IR = max. value given by derating curve, Fig. 1, page 3, corresponding to the chosen Tamb. Note 3. | | IA | | | | |
| 13.3 | <u>Life test and point 1000 hours</u> | Combined AQL | 10.0 | | | | | |
| 5.F.2 | Operating Voltage (1) | As in Group B | 6.5 | | V _Z | Col. 2 Table II | Col. 3 Table II | V |
| 5.F.2 | Operating Voltage (2) | As in Group B | 6.5 | | V _Z | Col. 4 Table II | Col. 5 Table II | V |
| 5.F.5 | Reverse Current | As in Group B | 6.5 | | I _R | - | Col. 9 Table II | µA |

| K1007 | TEST | TEST CONDITIONS | AQL % | INSP. LEVEL | SYM- BOL | LIMITS | | UNITS |
|---------|---|--|----------|----------------|----------------|--------------------------|--------------------------|-------|
| | | | | | | MIN. | MAX. | |
| 13.4 | Storage Life (1) | t = 150 hours Tamb. = -55°C | | I | | | | |
| 13.5 | Storage Life (2) | t = 150 hours Tamb. = 100°C | | I | | | | |
| | <u>Post storage life tests</u> | Combined AQL for each storage life test. | 2.5 | | | | | |
| 5.F.2 | Operating Voltage (1) | As in Group B | | | V _Z | Col. 2 Table II | Col. 3 Table II | V |
| 5.F.2 | Operating Voltage (2) | As in Group B | | | V _Z | Col. 4 Table II | Col. 5 Table II | V ← |
| 5.F.5 | Reverse Current | As in Group B | | | I _R | - | Col. 9 Table II | μA ← |
| | <u>GROUP G</u> | | | | | | | |
| 5.3.211 | Retest after 28 days holding period | | | 100% | | | | |
| 8 | Inoperatives | No voltages | 0.5 | | | | | |
| 5.F.2 | Operating Voltage (1) | As in Group B | 0.5 | | V _Z | Col. 2 Table II | Col. 3 Table II | V |

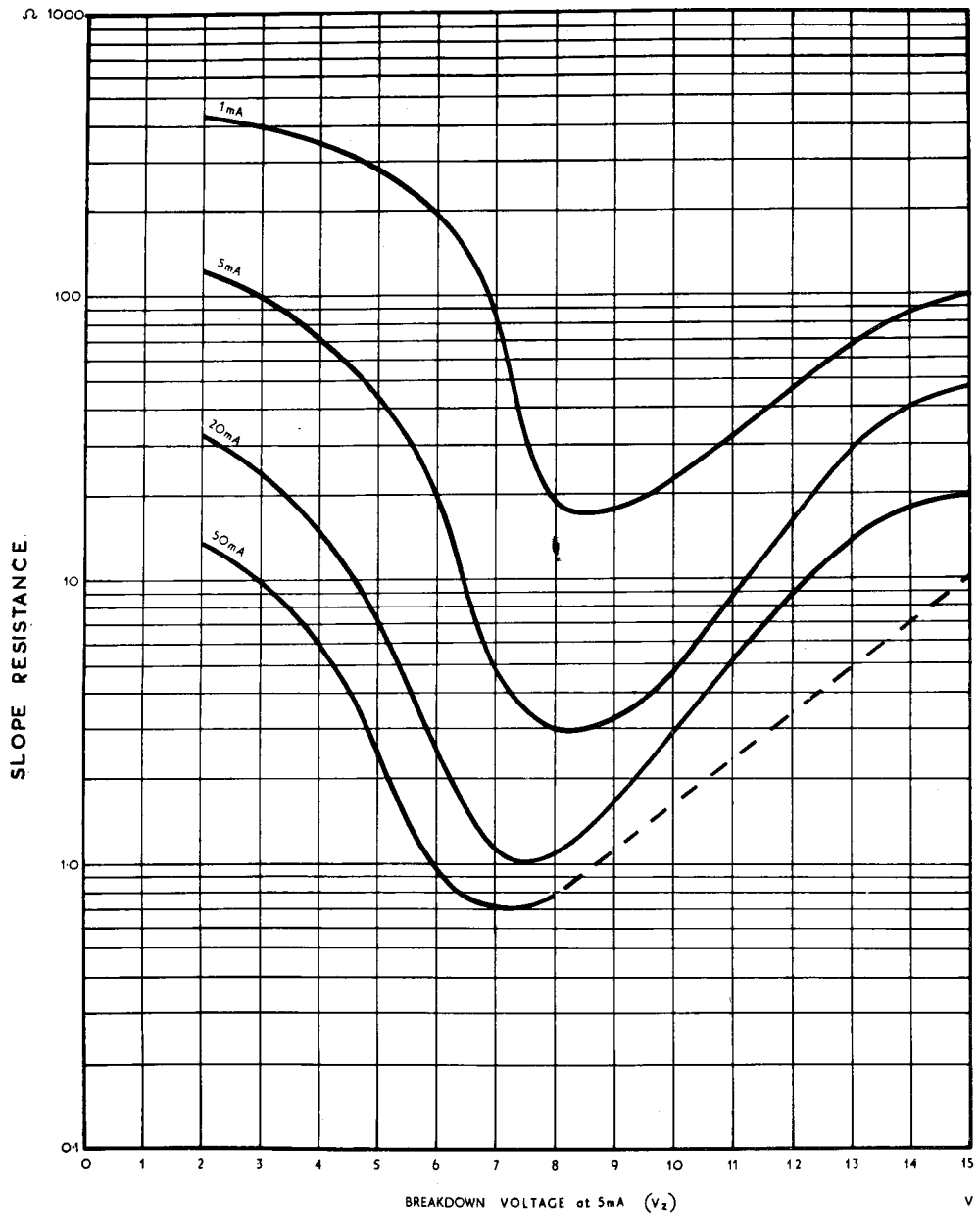
NOTES

- The sample of diodes shall be subjected to conditioning in accordance with K1007/10.1 and shall then be subjected to temperature cycling and climatic cycling in sequence and shall then pass the post temperature and post climatic cycling tests.
- Diodes used for this test must have undergone at least 28 cycles of climatic cycling in accordance with K1007/10.3.1 or K1007/10.3.2, or 6 cycles of climatic cycling in accordance with K1007/10.3.3.
- The diodes shall be mounted by the leads with the mounting clips at least $\frac{3}{8}$ " (9.5 mm) from the body.
- The voltage shall be measured within 5 secs of the application of reverse current.
- For correlation between the instantaneous voltages measured in this test and equilibrium voltages refer to Fig. 3 on page 4.

TABLE II
TEST CONDITIONS AND LIMITS

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|--------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------------|----------------|--------------------------------|----------------------------------|---------|---------|
| | Min. V _Z (1) @ 5 mA | Max. V _Z (1) @ 5 mA | Min. V _Z (2) @ 1 mA | Max. V _Z (2) @ 1 mA | Max. r _Z @ 5 mA | V _R | Max. I _R @ 100°C | Max. I _R Post Life | Min. SZ | Max. SZ |
| | V | V | V | V | Ω | V | mA | mA | %/°C | %/°C |
| CV7138 | 3.1 | 3.5 | 2.1 | 3.0 | 120 | 2.0 | 1.0 | 1.5 | -0.1 | -0.04 |
| CV7139 | 3.4 | 3.8 | 2.4 | 3.3 | 110 | 2.0 | 0.5 | 0.75 | -0.1 | -0.03 |
| CV7140 | 3.7 | 4.1 | 2.8 | 3.7 | 100 | 2.0 | 0.2 | 0.3 | -0.09 | -0.02 |
| CV7141 | 4.0 | 4.5 | 3.3 | 4.2 | 90 | 2.0 | 0.1 | 0.15 | -0.08 | 0 |
| CV7099 | 4.4 | 5.0 | 3.6 | 4.6 | 85 | 3.3 | 0.8 | 1.2 | -0.07 | +0.01 |
| CV7100 | 4.8 | 5.4 | 4.2 | 5.1 | 80 | 3.9 | 0.5 | 0.75 | -0.055 | +0.03 |
| CV7101 | 5.3 | 6.0 | 4.6 | 5.4 | 75 | 4.3 | 0.3 | 0.75 | -0.035 | +0.045 |
| CV7102 | 5.8 | 6.6 | 5.1 | 6.5 | 40 | 4.7 | 0.3 | 0.45 | -0.015 | +0.06 |
| CV7103 | 6.4 | 7.2 | 6.0 | 7.2 | 15 | 5.6 | 0.3 | 0.45 | +0.005 | +0.075 |
| CV7104 | 7.1 | 7.9 | 6.7 | 7.9 | 15 | 6.2 | 0.2 | 0.3 | +0.02 | +0.085 |
| CV7105 | 7.7 | 8.7 | 7.4 | 8.7 | 15 | 6.8 | 0.2 | 0.3 | +0.035 | +0.095 |
| CV7142 | 8.6 | 9.6 | 8.3 | 9.6 | 15 | 7.5 | 0.2 | 0.3 | +0.03 | +0.1 |
| CV7143 | 9.4 | 10.6 | 9.1 | 10.6 | 20 | 8.2 | 0.2 | 0.3 | +0.03 | +0.1 |
| CV7144 | 10.4 | 11.6 | 10.4 | 11.5 | 40 | 9.1 | 0.2 | 0.3 | +0.03 | +0.11 |
| CV7145 | 11.4 | 12.6 | 11.1 | 12.5 | 60 | 10 | 0.2 | 0.3 | +0.04 | +0.11 |
| CV7146 | 12.4 | 14.1 | 12.0 | 14.1 | 75 | 11 | 0.2 | 0.3 | +0.04 | +0.11 |
| CV7106 | 13.9 | 15.6 | 13.6 | 15.4 | 90 | 12 | 0.2 | 0.3 | +0.04 | +0.11 |

TYPICAL SLOPE RESISTANCE



(40478)

FIG 3

CV7099-7106/d/FEB 62/1
CV7138-7146/d

TEMPERATURE COEFFICIENT

The working voltage of a Zener Diode is a function of both current and junction temperature. The behaviour under conditions of varying temperature is fairly complex. With diodes of a high breakdown voltage (Figure 6) the variation of voltage is nearly linear with temperature and so may be readily represented by a single temperature coefficient of voltage, which is positive and almost independent of current. With diodes of low voltage (Figure 4) the variation is still approximately linear, but the temperature coefficient falls somewhat with current. With diodes of intermediate voltage (Figure 5) the variation is no longer linear and the concept of temperature coefficient of voltage is less useful, being markedly dependent upon both current and temperature. It is then important to state the exact conditions under which the temperature coefficient is measured. In the case of Figures 7, 8 and 9 the values given represent

$$\frac{V_{75^{\circ}\text{C}} - V_{25^{\circ}\text{C}}}{V_{25^{\circ}\text{C}}} \times \frac{100}{50} \%$$

the temperatures of 25°C and 75°C having been chosen to cover the most commonly used temperature range. It should be noted that for diodes with voltages in the region of 5-6 volts, the temperature coefficient for other temperature ranges may be quite different (Figure 5). The curves of temperature coefficient of voltage for operating currents of 1, 5 and 20mA (Figures 7, 8 and 9) are plotted against breakdown voltage at 5mA in each case and give indication both of the mean value and the spread to be expected.

CV7138

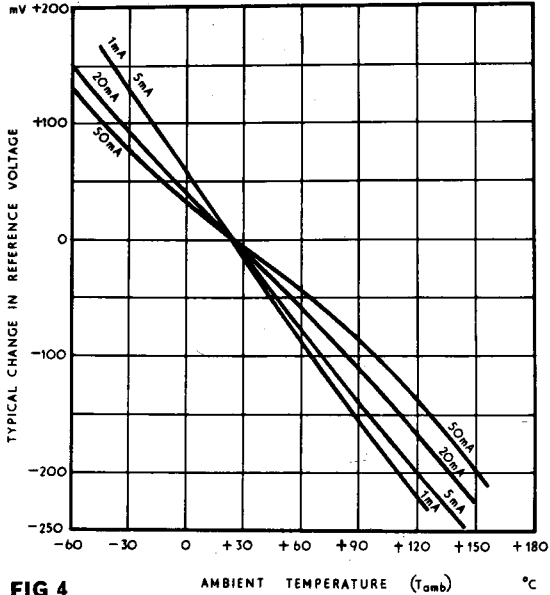


FIG 4

CV7100

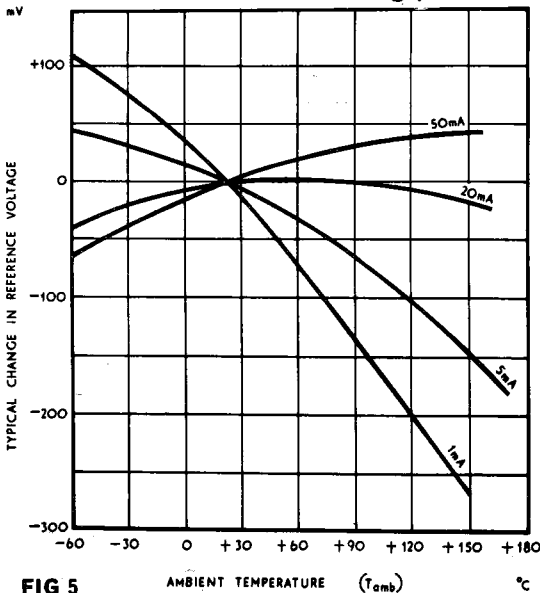


FIG 5

CV7106

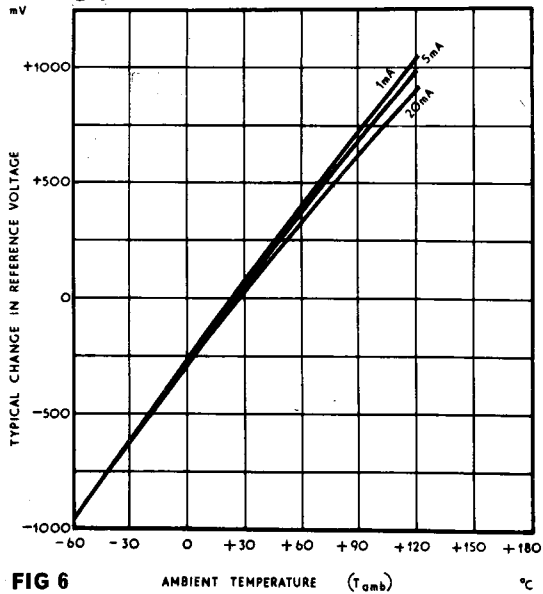


FIG 6

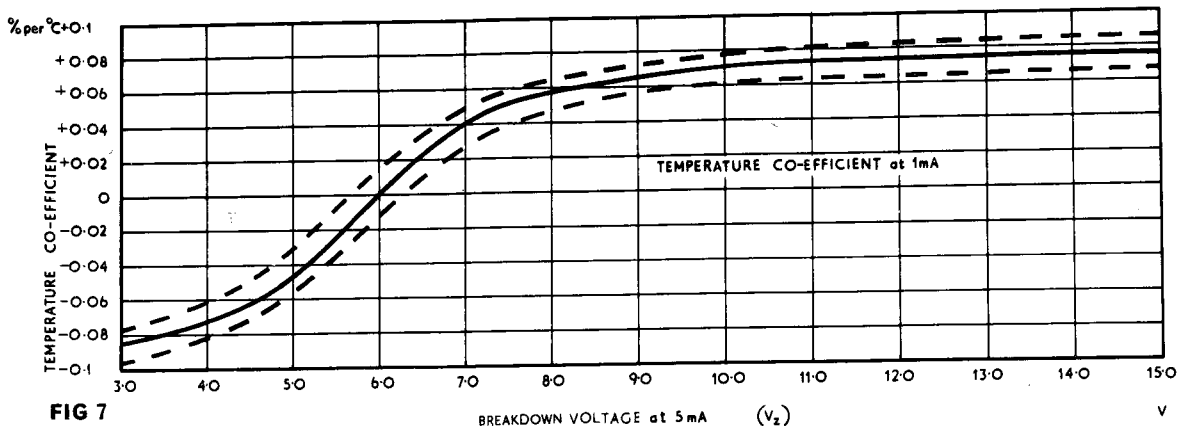


FIG 7

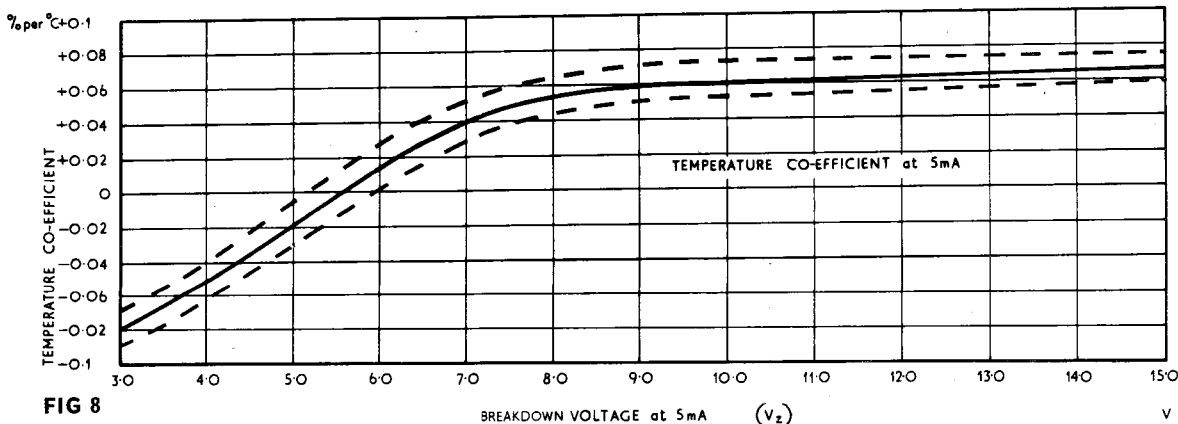


FIG 8

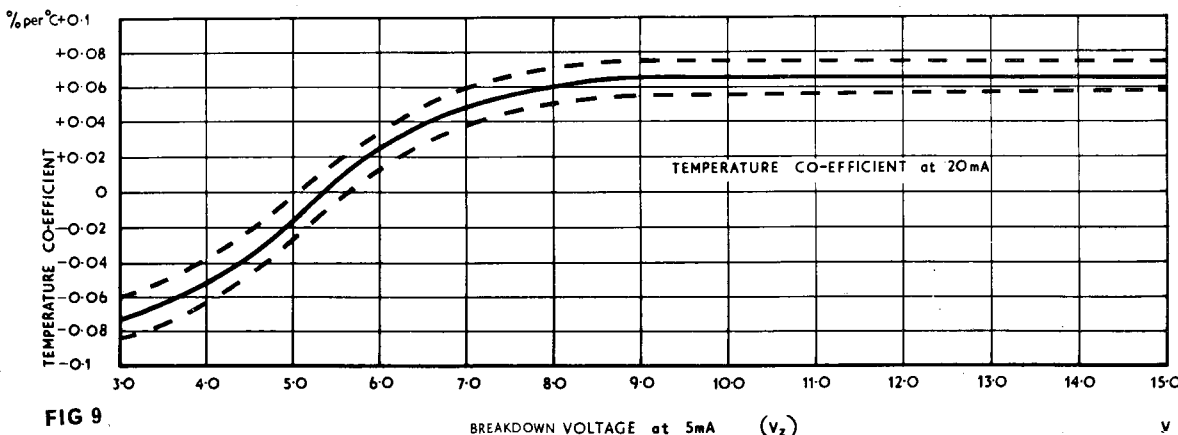


FIG 9

DOTTED LINES INDICATE TYPICAL SPREADS CV7099-7106 /d /FEB 62/3
CV7138-7146

JUNCTION CAPACITY

The effective capacity of these alloy junction devices at voltages below the breakdown voltage is approximately inversely proportional to the square of the applied reverse bias (Figure 11) and therefore they may be used as voltage dependent capacitors in a.f.c. circuits, etc. The capacity of a reference diode at a given voltage is also a function of the breakdown voltage of the device (Figure 10).

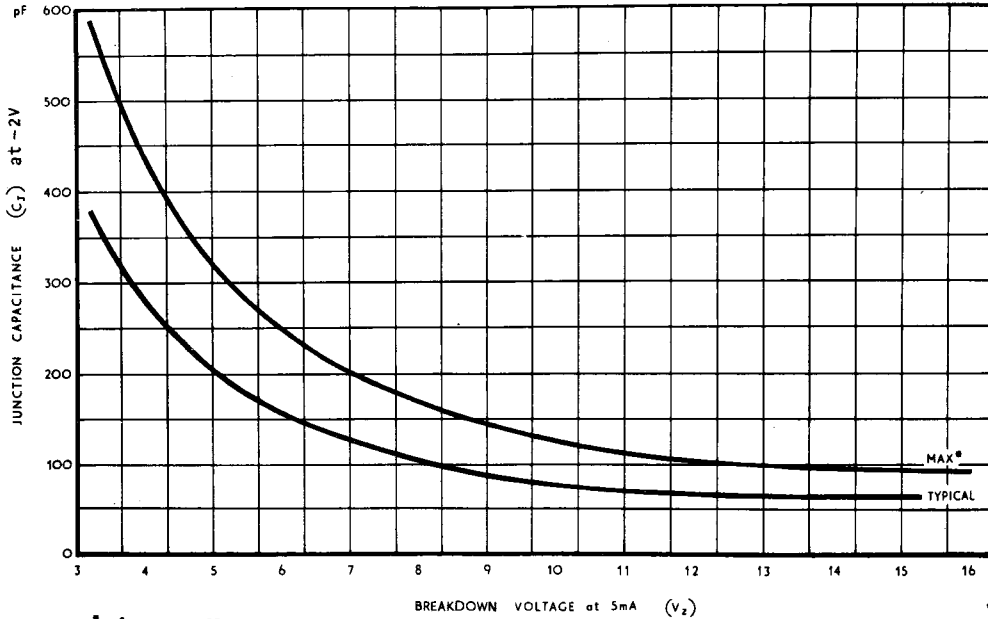


FIG 10 95% CONFIDENCE

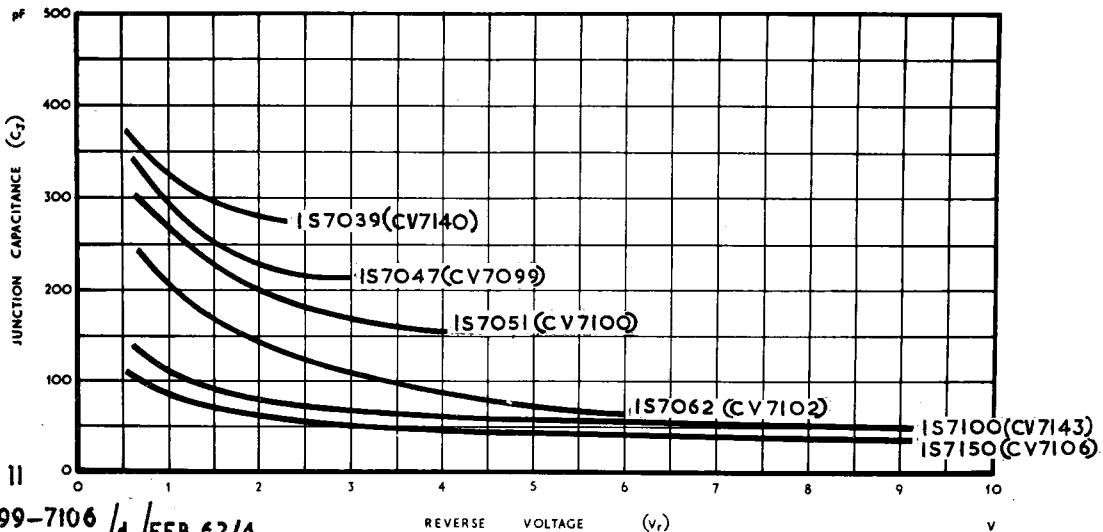


FIG 11

TYPICAL REVERSE CURRENT AT -2V

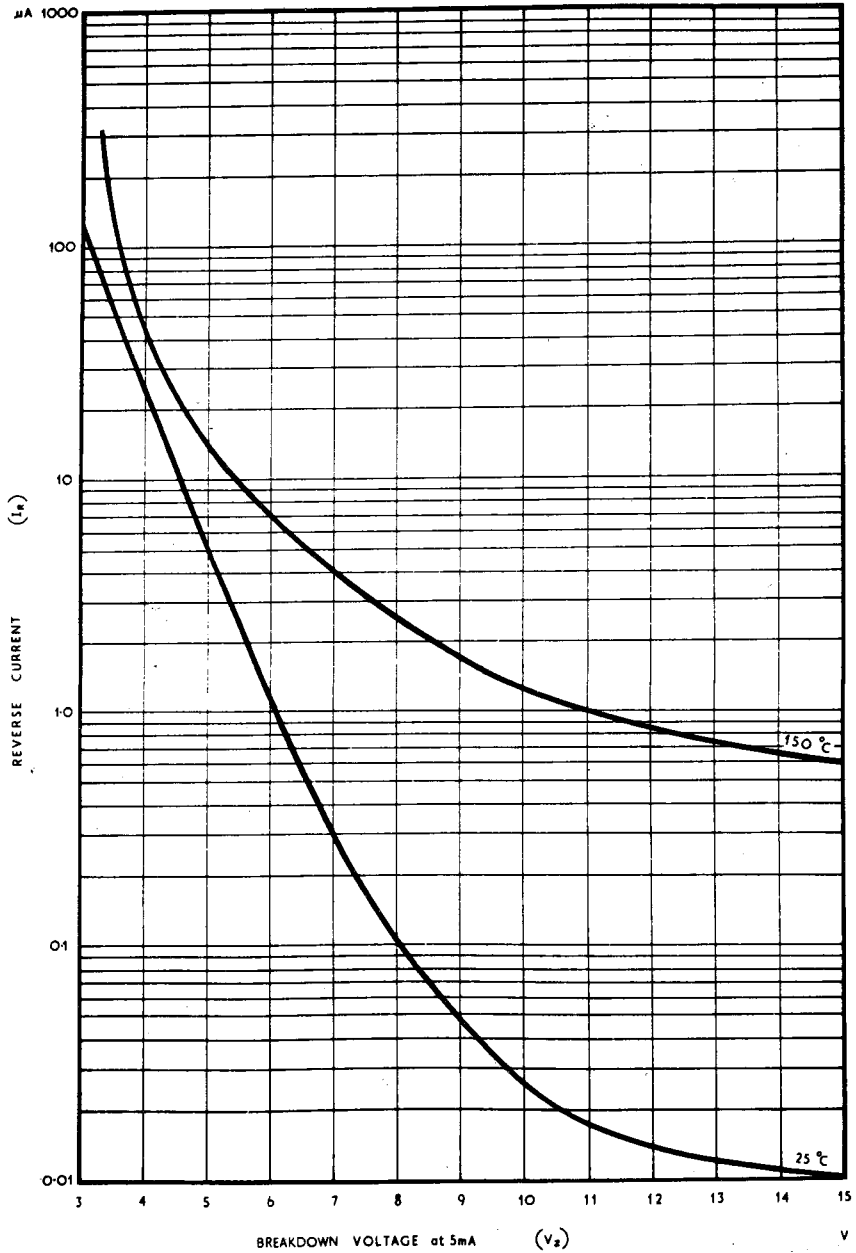


FIG 12

CV7099-7106/d / FEB 62/5
CV7138-7146/d

FORWARD CHARACTERISTICS

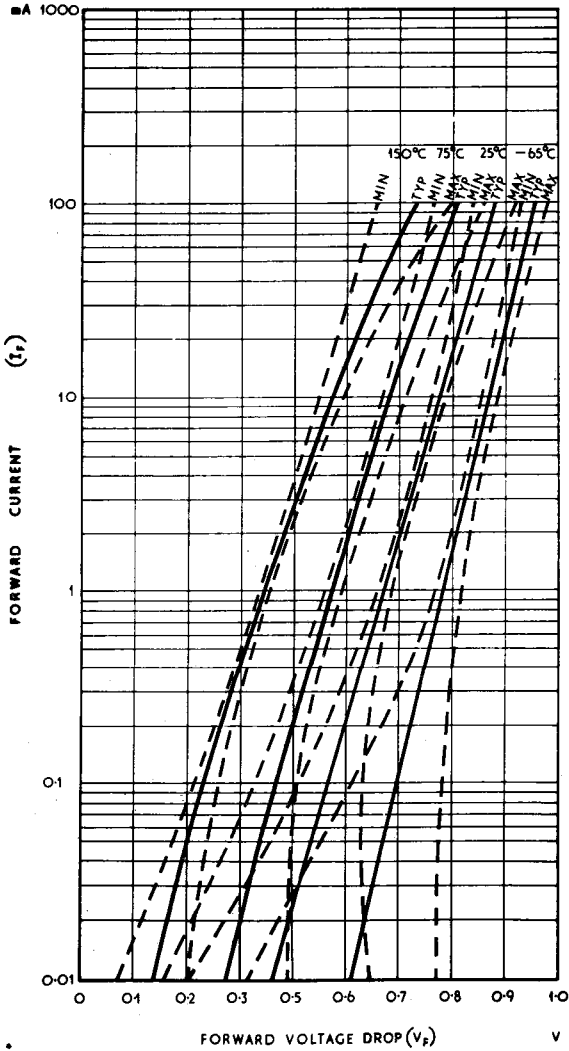


FIG 13

TYPICAL CHANGE IN FORWARD VOLTAGE

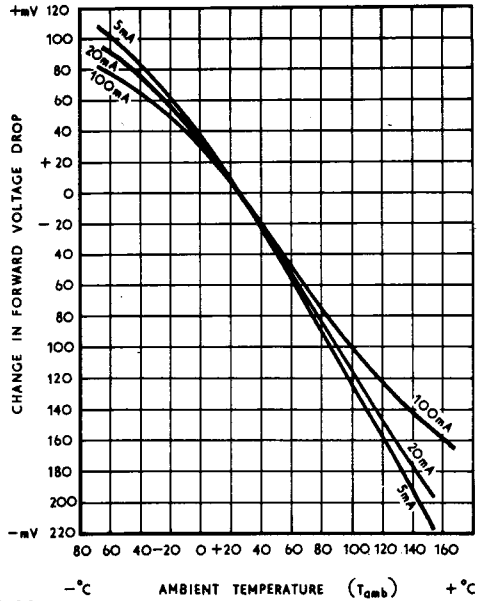


FIG 14

TYPICAL FORWARD SLOPE IMPEDANCE

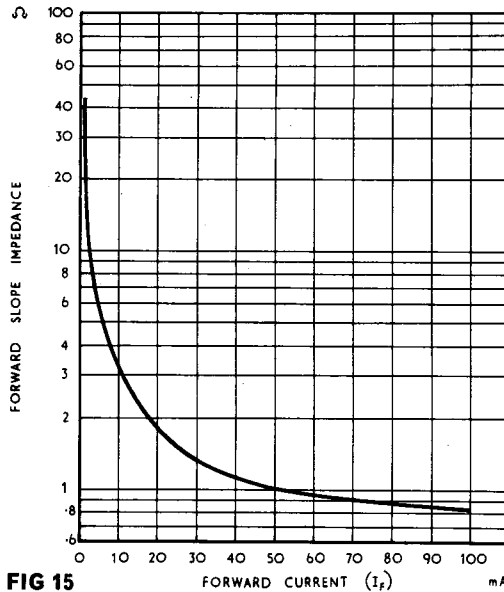


FIG 15