

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
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CV7106	5960-99-037-2206																																		

CV7099-7106/2/1
CV7138-7146/2/1

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

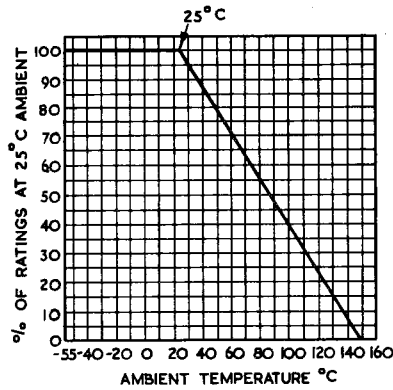


FIG.2.

SURGE RATING AT 25°C

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

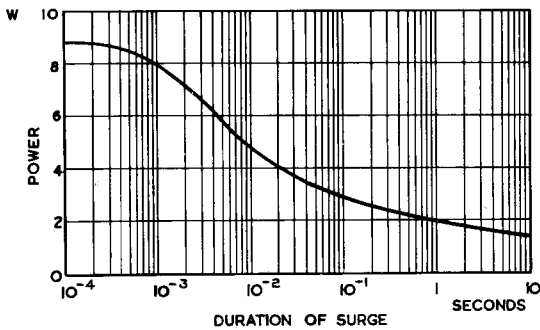
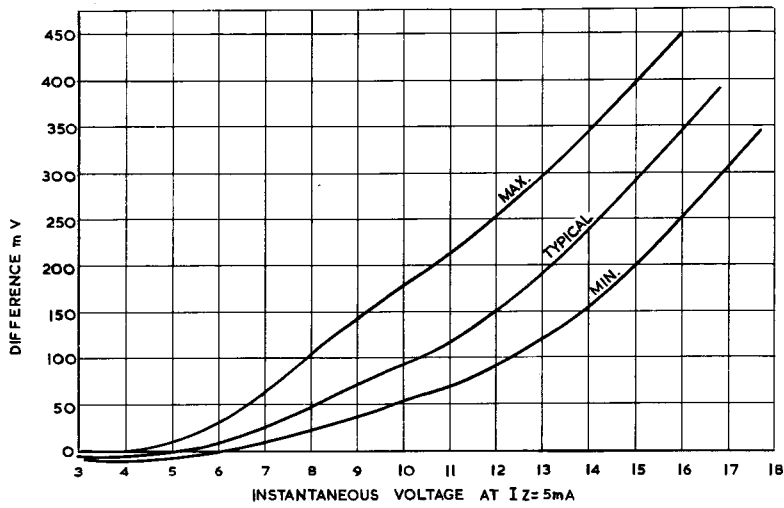


FIG. 3 CORRELATION BETWEEN INSTANTANEOUS
VOLTAGE AND EQUILIBRIUM VOLTAGE



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

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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

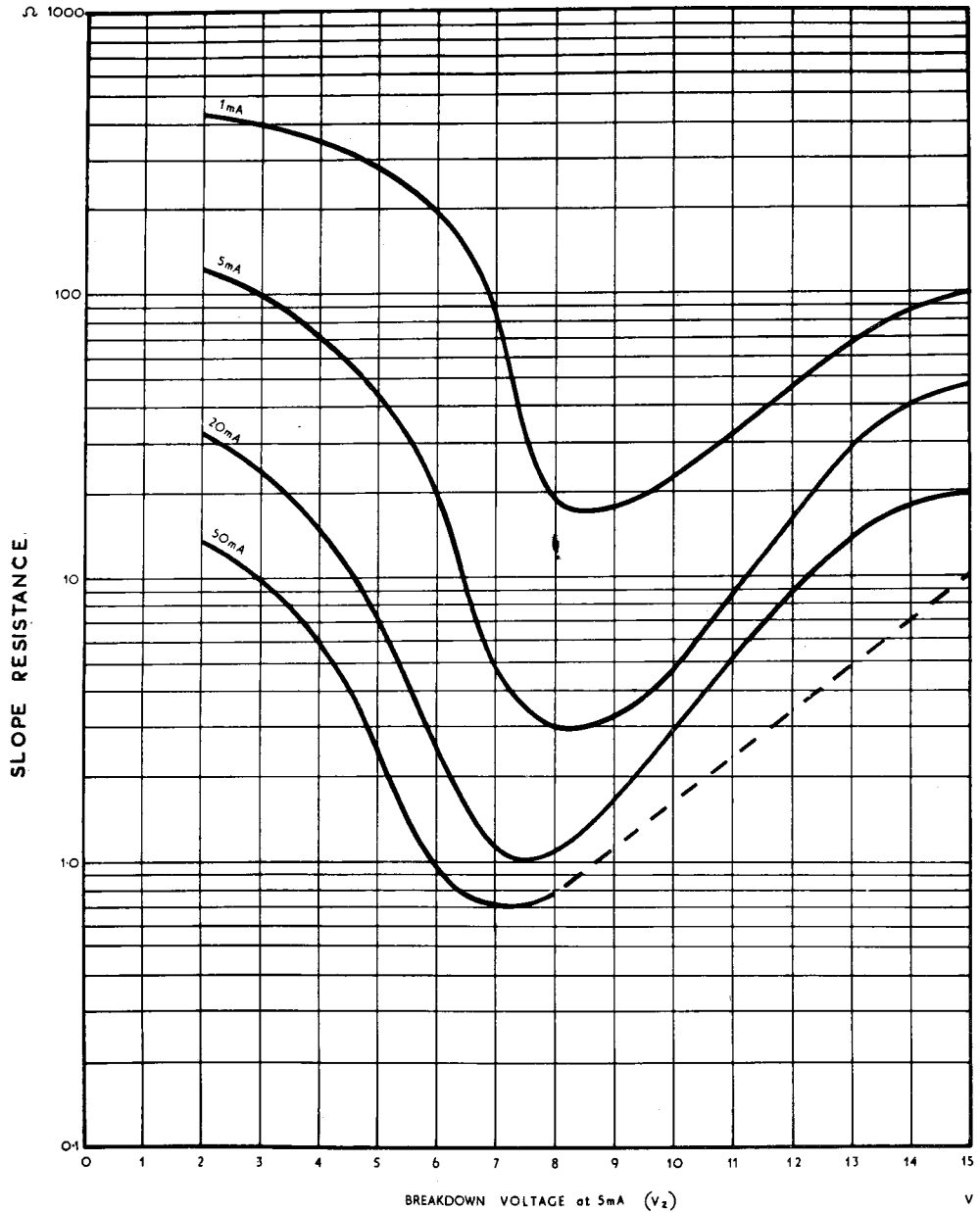
NOTES

- 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

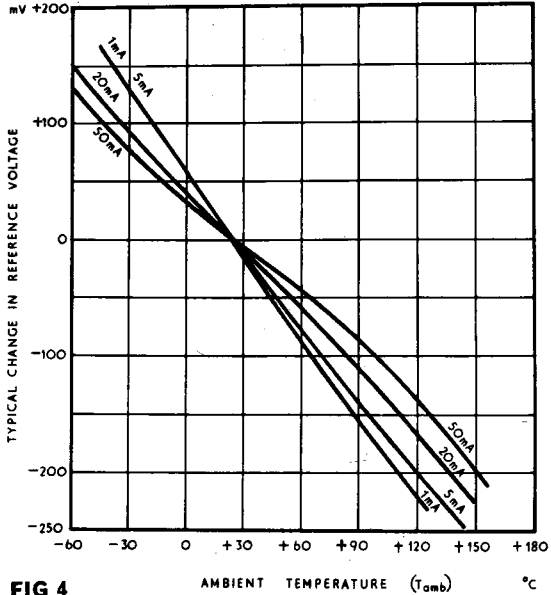


FIG 4

CV7100

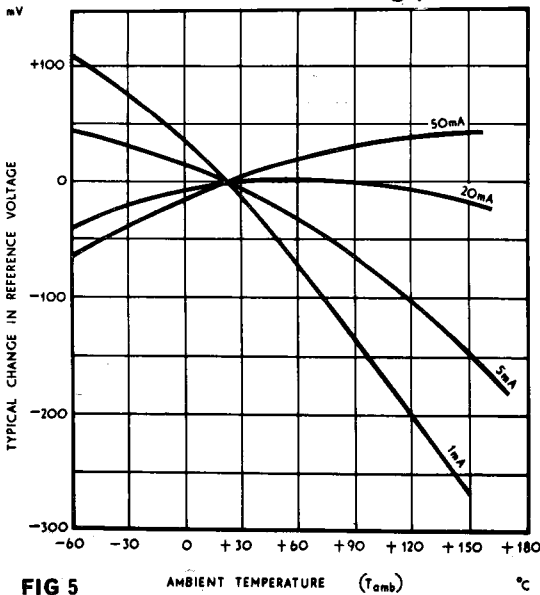


FIG 5

CV7106

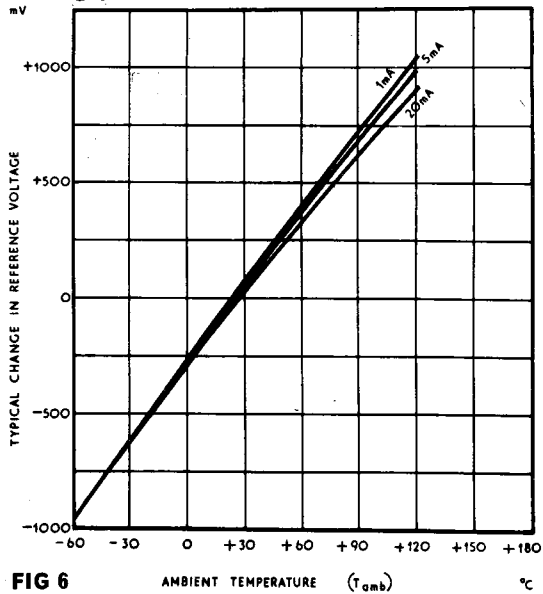


FIG 6

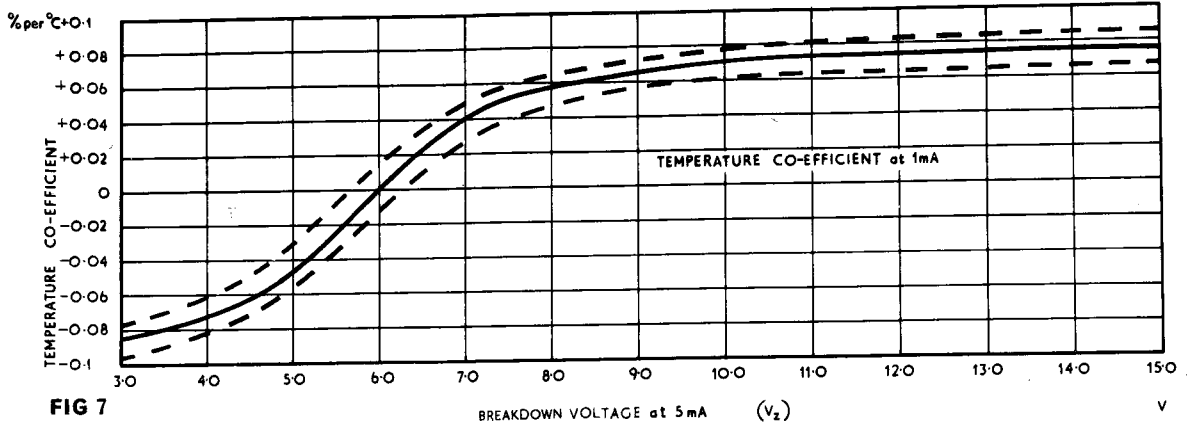


FIG 7

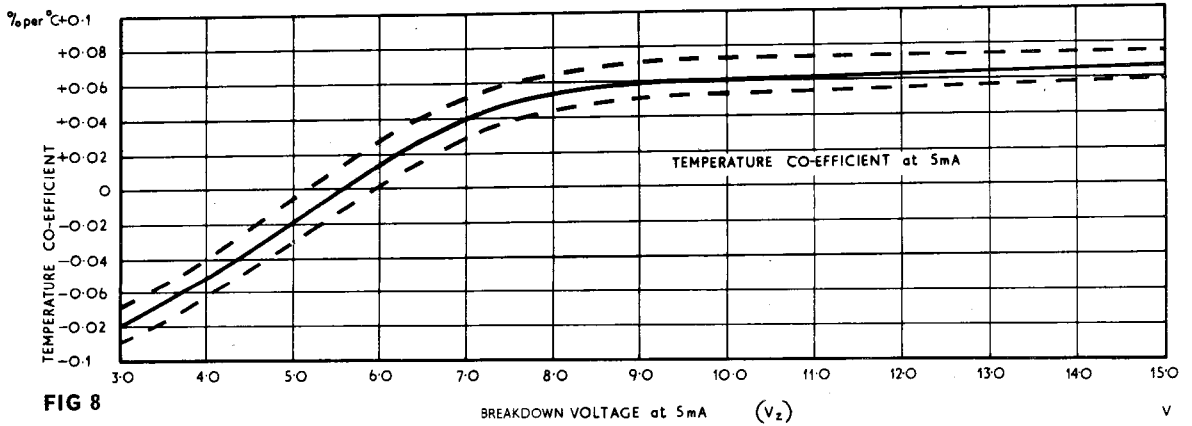


FIG 8

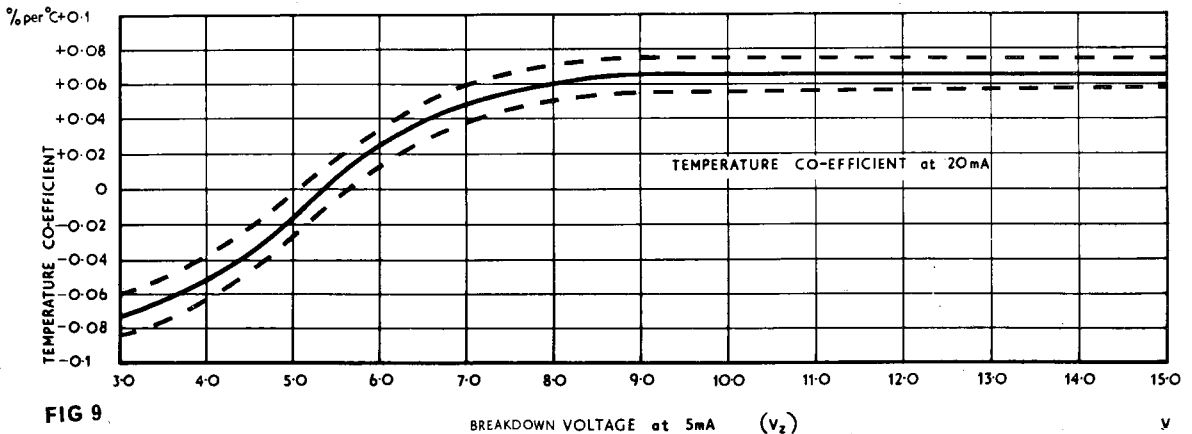


FIG 9

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).

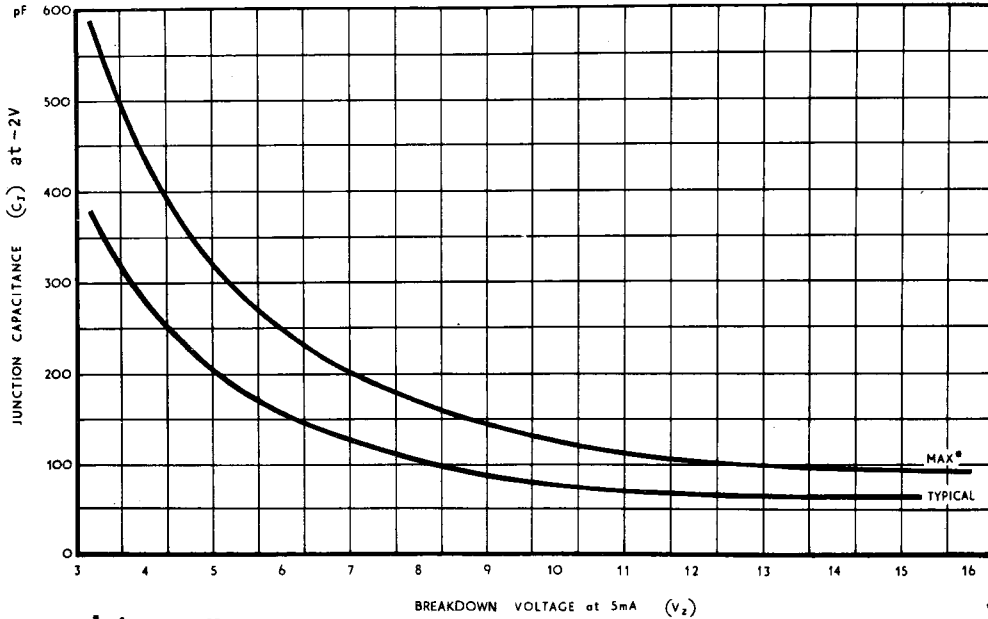


FIG 10 95% CONFIDENCE

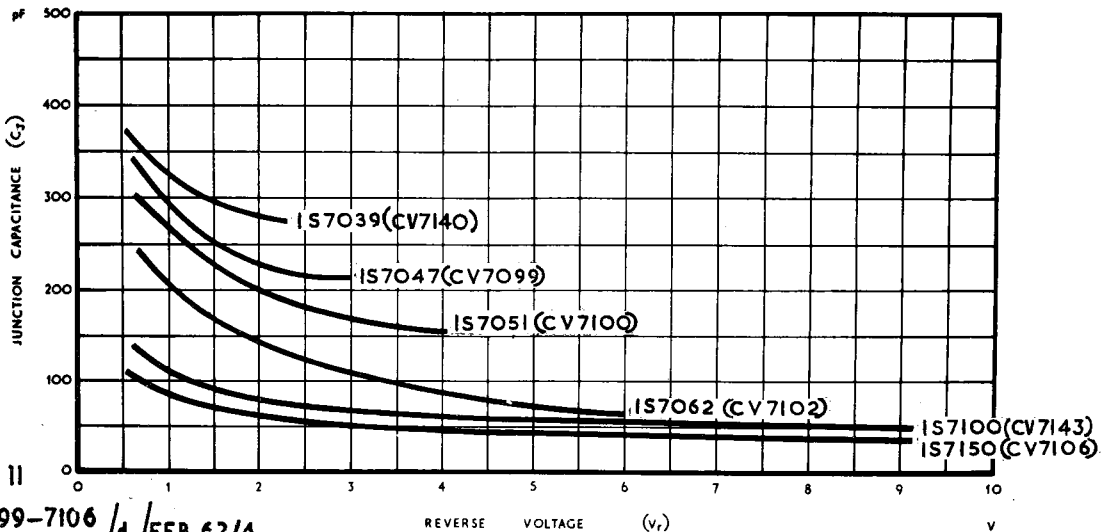


FIG 11

TYPICAL REVERSE CURRENT AT -2V

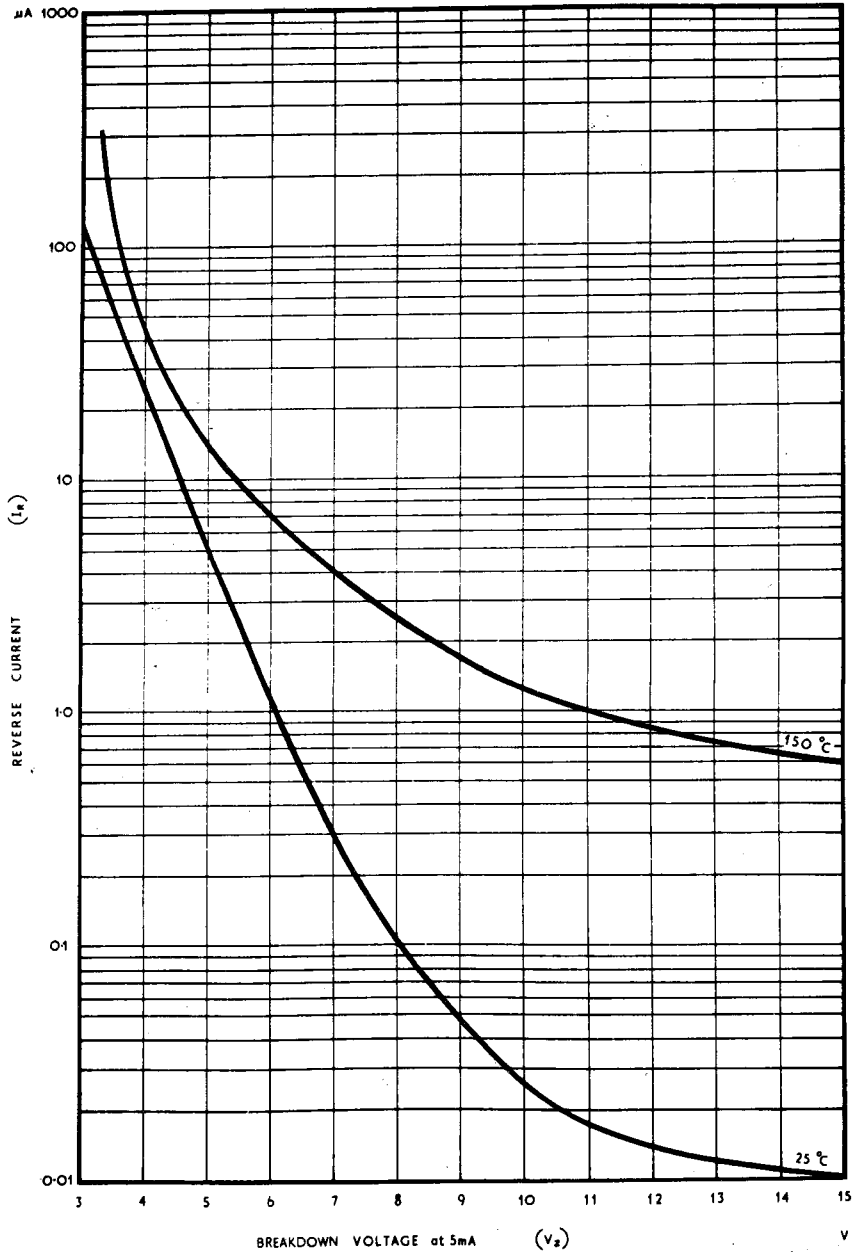


FIG 12

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

FORWARD CHARACTERISTICS

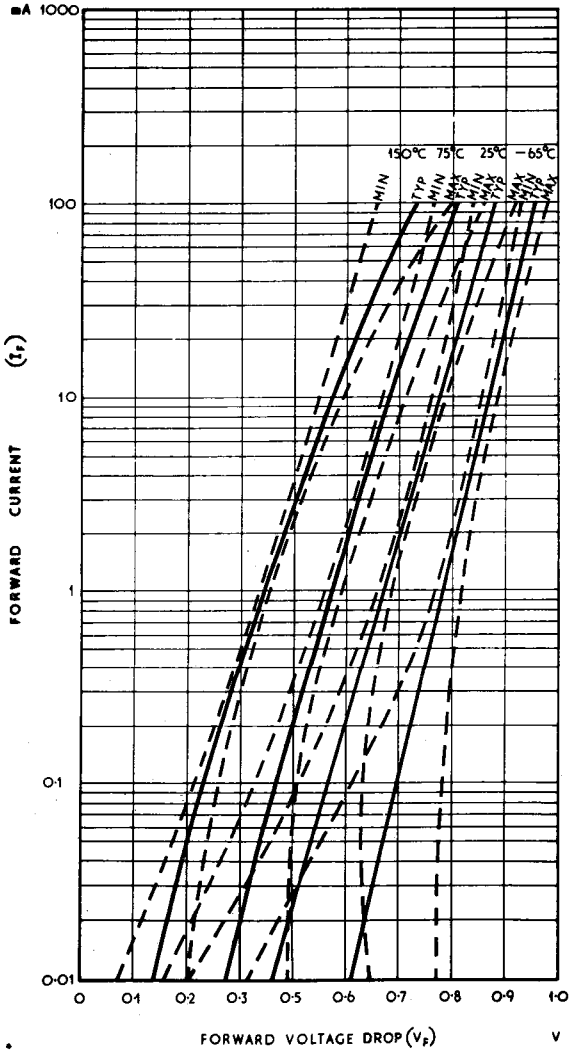


FIG 13

TYPICAL CHANGE IN FORWARD VOLTAGE

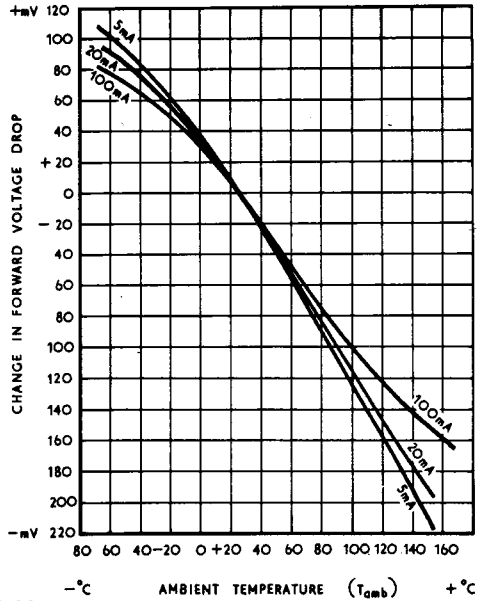


FIG 14

TYPICAL FORWARD SLOPE IMPEDANCE

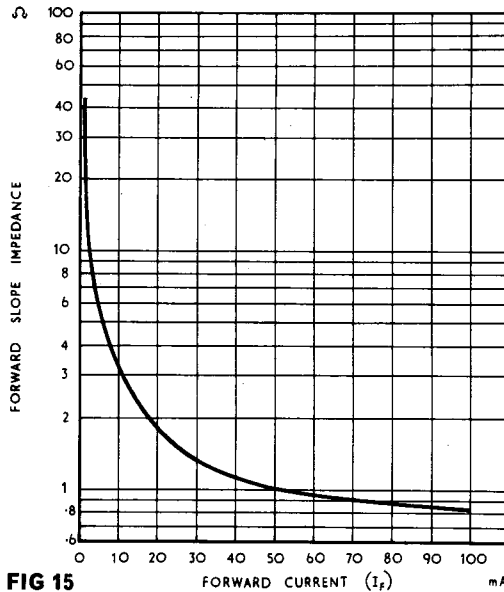


FIG 15