

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	
Note Max. Dissipation at 25°C amb. (mW) 400 A Max. continuous reverse current at 25°C amb. (mA) A CV7138 100 CV7139 95 CV7140 90 CV7141 85 CV7099 80 CV7100 70 CV7101 65 CV7102 60 CV7103 55 CV7104 50 CV7105 45 CV7142 40 CV7143 38 CV7144 34 CV7145 32 CV7146 28 CV7106 25 Max. continuous forward current at 25°C amb. (mA) 200 A Operating ambient temperature range -55°C to +150°C		<u>MOUNTING POSITION</u> Any. Device intended for air cooling.	
		<u>PACKAGING</u> K1007/14	
		<u>NOTES</u>	
		A. Derating above 25°C amb. See Fig. 1, page 3. B. J.S. Catalogue numbers are: 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	

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 $I_R = 5 \text{ mA}$ $T_{amb} = 25^\circ\text{C}$ ( $\Omega$ )	$S_Z$ 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

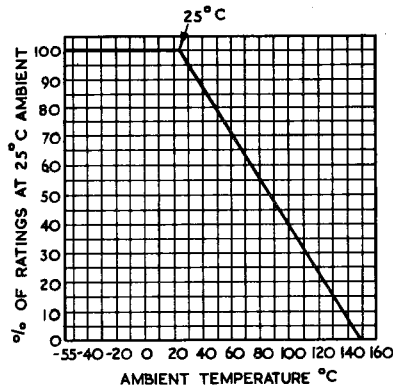


FIG.2.

SURGE RATING AT 25°C

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

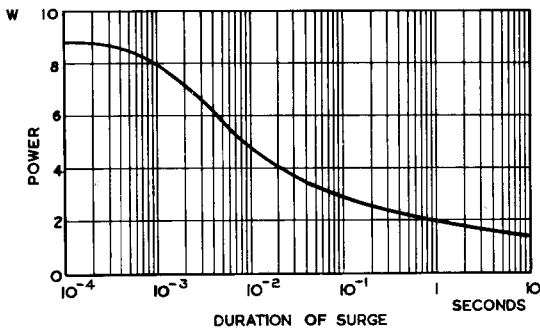
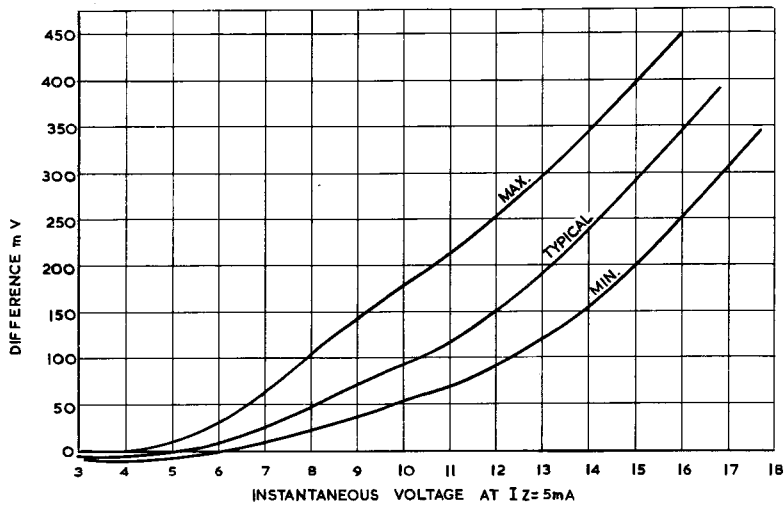


FIG. 3      CORRELATION BETWEEN INSTANTANEOUS  
VOLTAGE AND EQUILIBRIUM VOLTAGE



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	$\Omega$
	<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	$\mu\text{A}$
	<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 $-55^\circ\text{C}$ 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	<b>Fatigue</b>  <u>Post Fatigue Test</u>	No Voltages		IC				
5.F.2	Operating Voltage (1)	As in Group B	6.5		V <sub>Z</sub>	Col. 2 Table II	Col. 3 Table II	V
11.4	<b>Shock</b>  <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 <sub>Z</sub>	Col. 2 Table II	Col. 3 Table II	V
5.F.2	Operating Voltage (2)	As in Group B	6.5		V <sub>Z</sub>	Col. 4 Table II	Col. 5 Table II	V
5.F.5	Reverse Current	As in Group B	6.5		I <sub>R</sub>	-	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 <sub>Z</sub>	Col. 2 Table II	Col. 3 Table II	V
5.F.2	Operating Voltage (2)	As in Group B			V <sub>Z</sub>	Col. 4 Table II	Col. 5 Table II	V ←
5.F.5	Reverse Current	As in Group B			I <sub>R</sub>	-	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 <sub>Z</sub>	Col. 2 Table II	Col. 3 Table II	V

NOTES

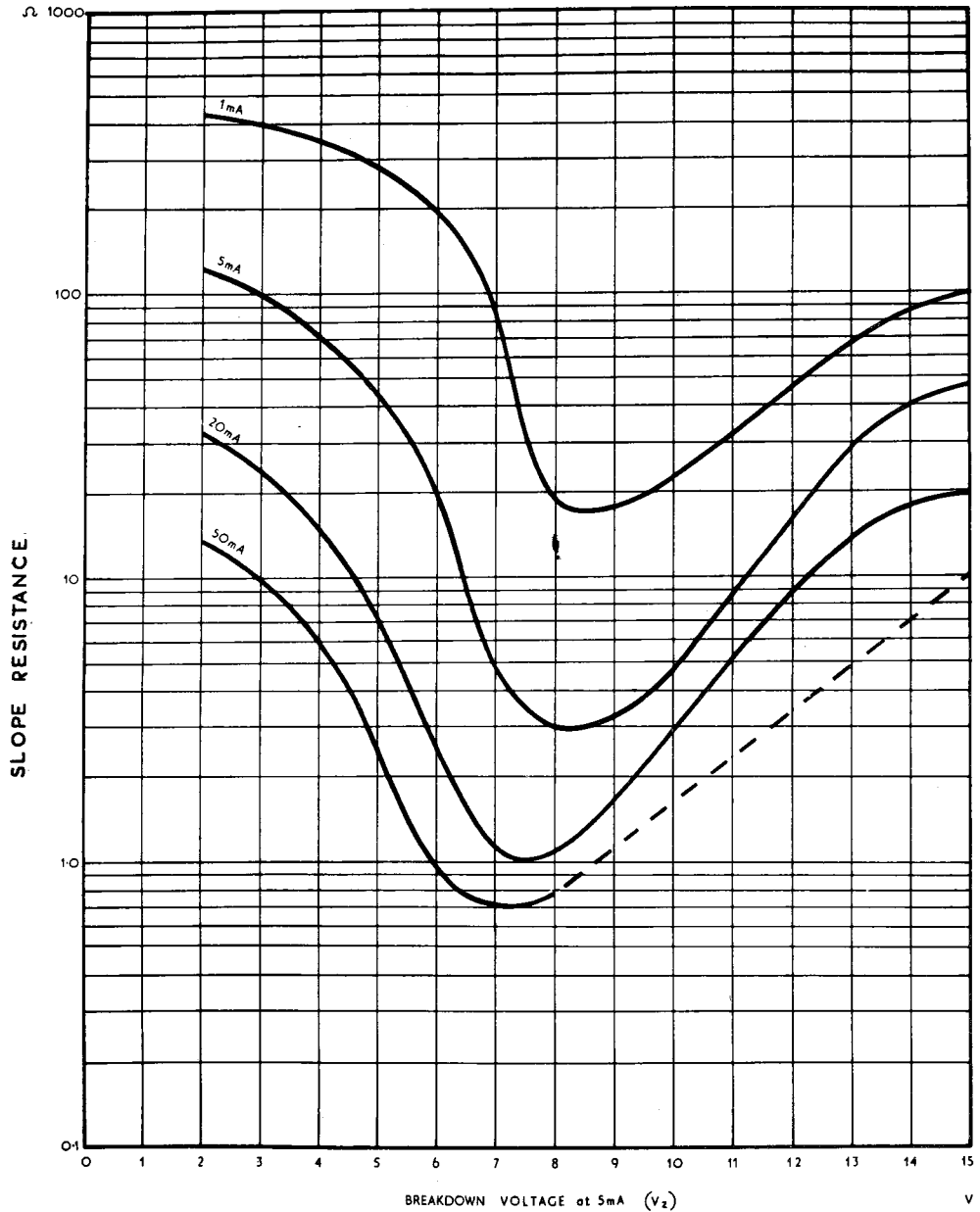
- The sample of diodes shall be subjected to conditioning in accordance with K1007/10.1 and shall then be subjected to temperature cycling and climatic cycling in sequence and shall then pass the post temperature and post climatic cycling tests.
- Diodes used for this test must have undergone at least 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 <sub>Z</sub> (1) @ 5 mA	Max. V <sub>Z</sub> (1) @ 5 mA	Min. V <sub>Z</sub> (2) @ 1 mA	Max. V <sub>Z</sub> (2) @ 1 mA	Max. r <sub>Z</sub> @ 5 mA	V <sub>R</sub>	Max. I <sub>R</sub> @ 100°C	Max. I <sub>R</sub> 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

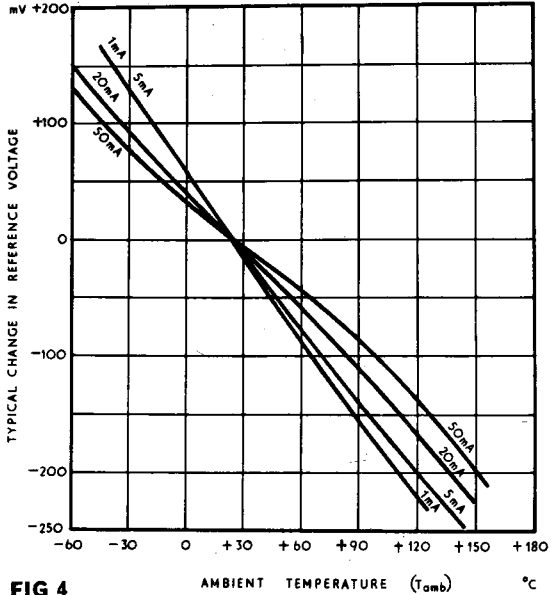


FIG 4

CV7100

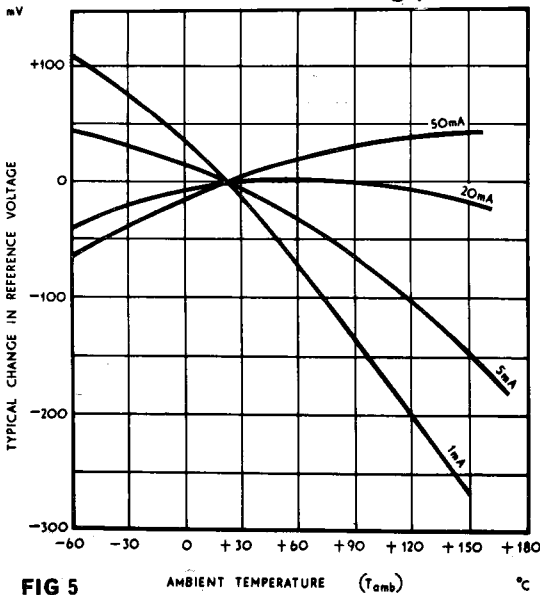


FIG 5

CV7106

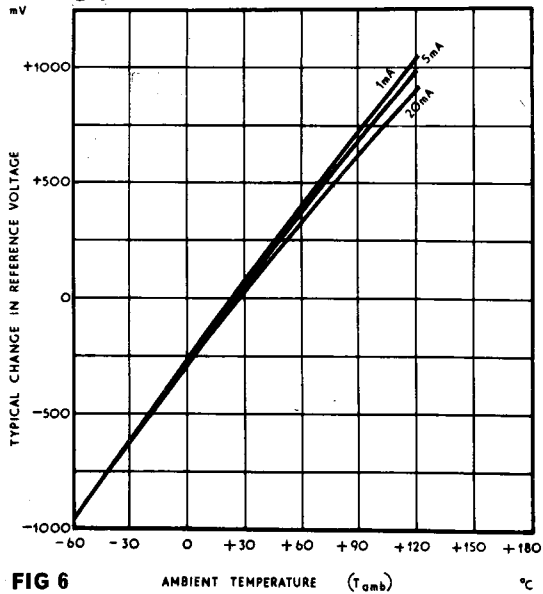


FIG 6

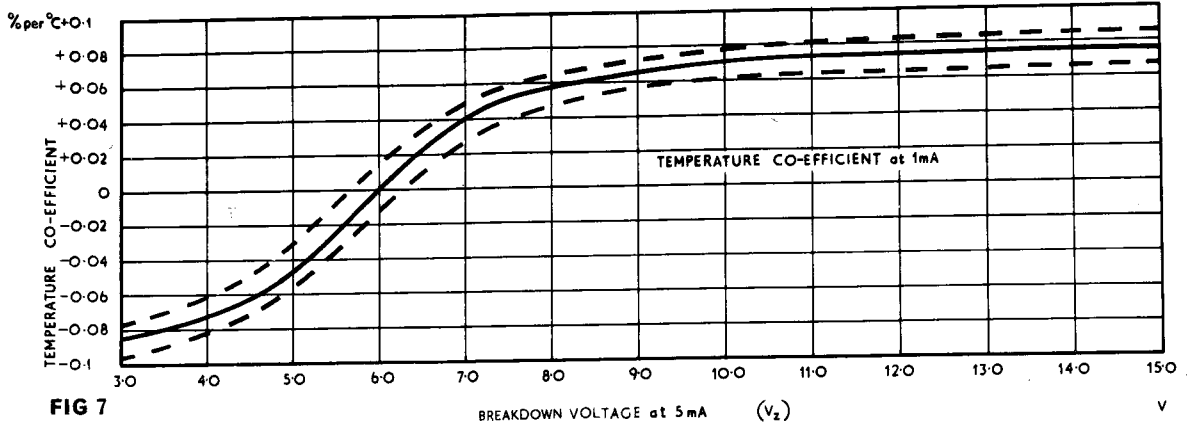


FIG 7

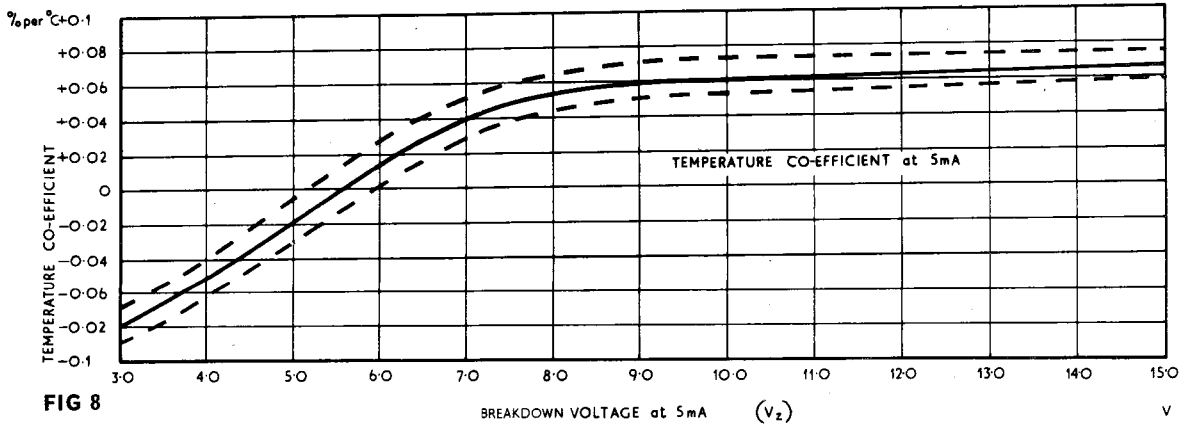


FIG 8

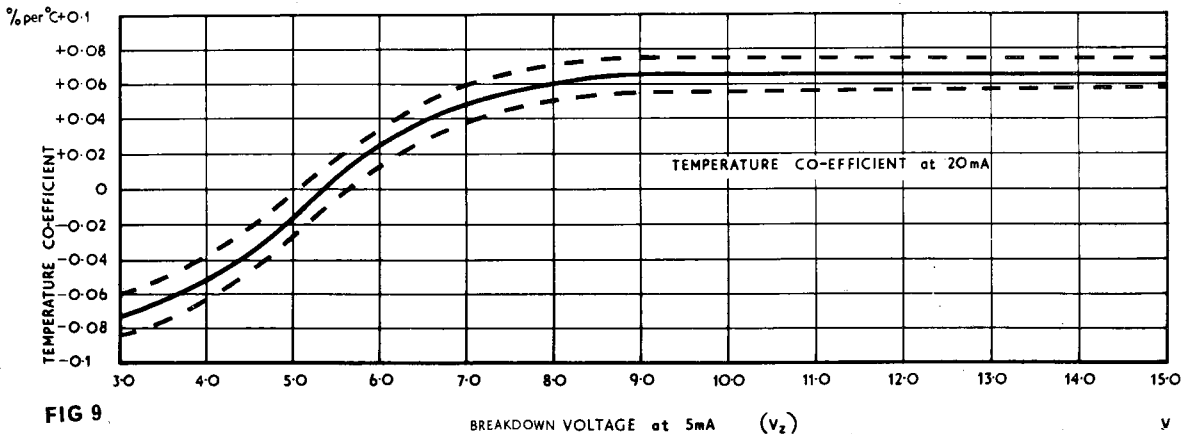


FIG 9

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).

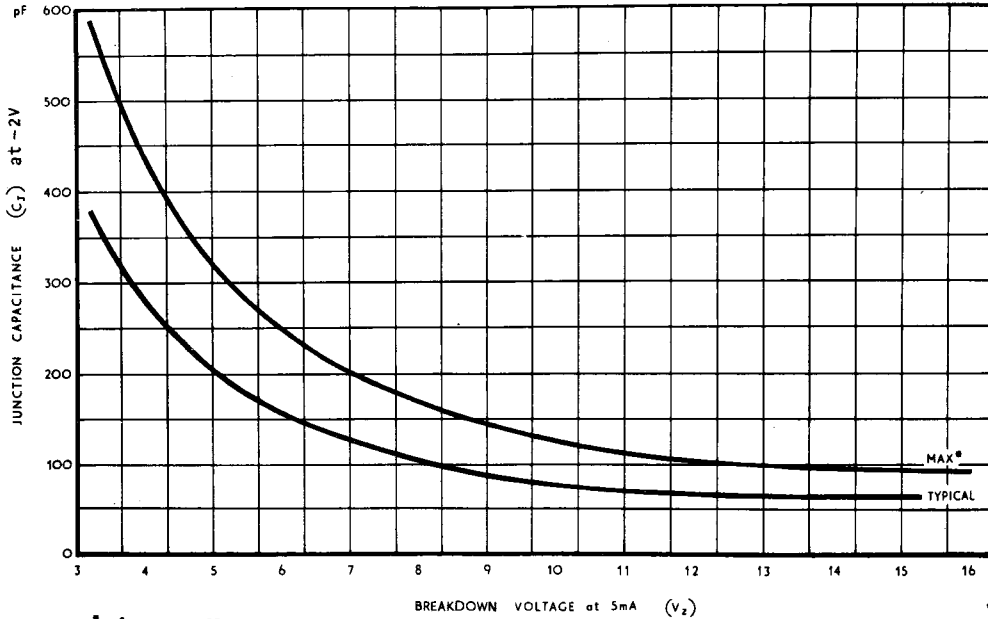


FIG 10 95% CONFIDENCE

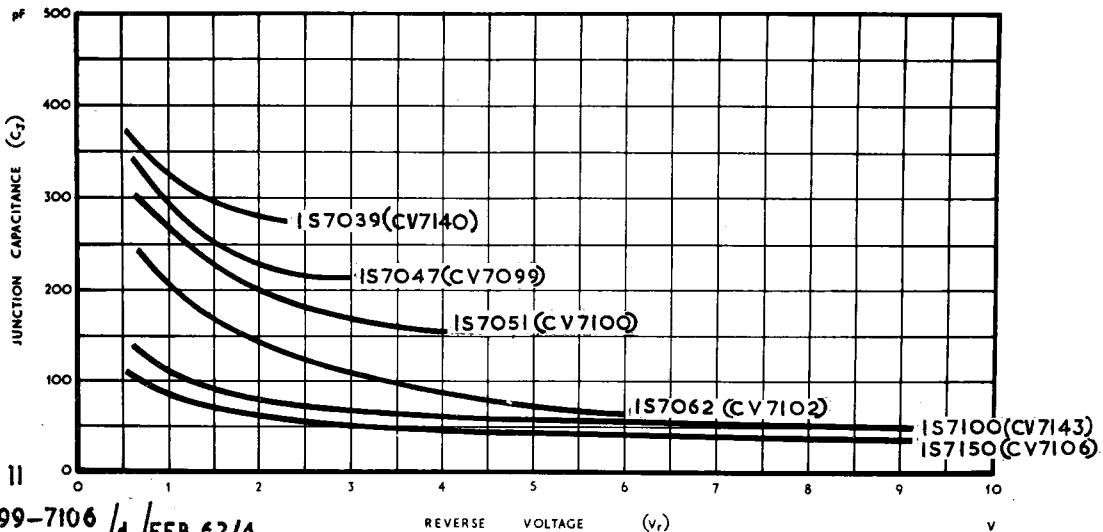


FIG 11

TYPICAL REVERSE CURRENT AT -2V

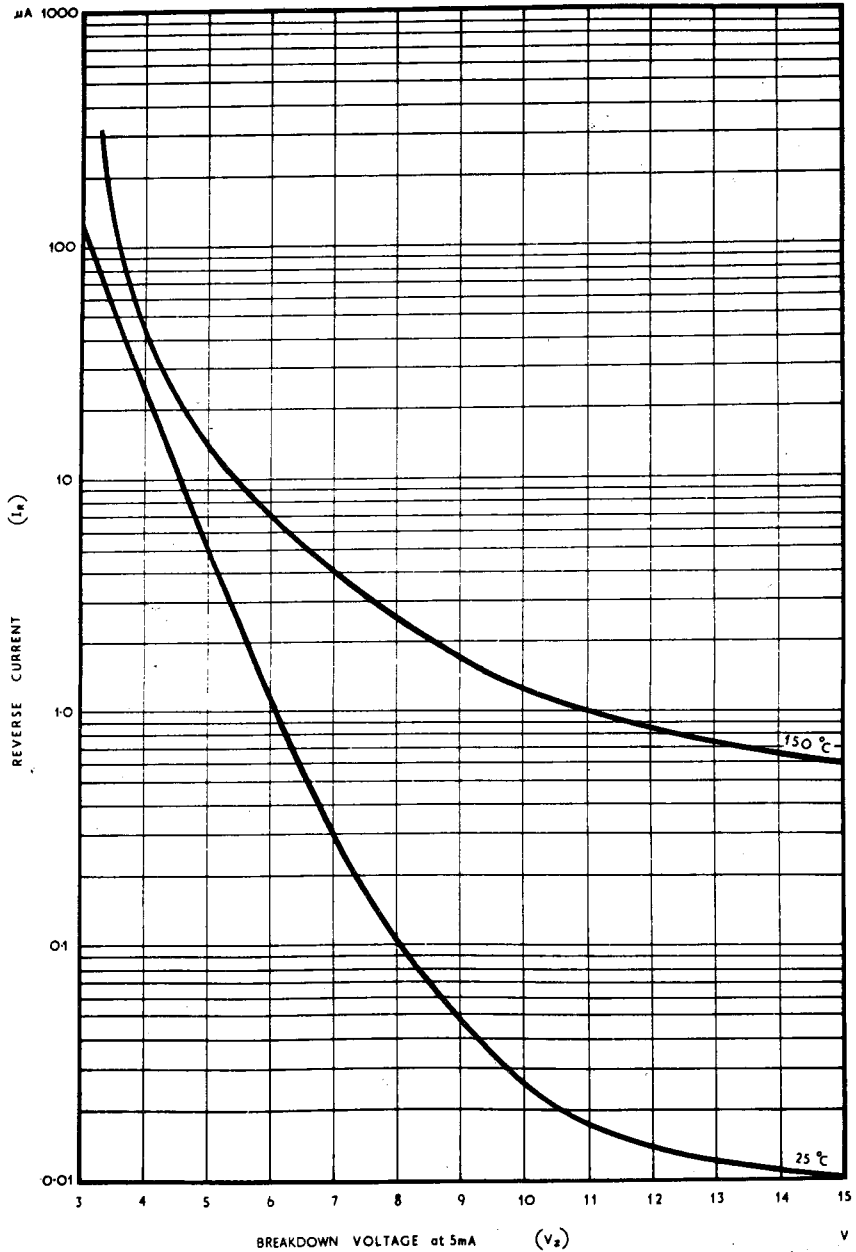


FIG 12

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

FORWARD CHARACTERISTICS

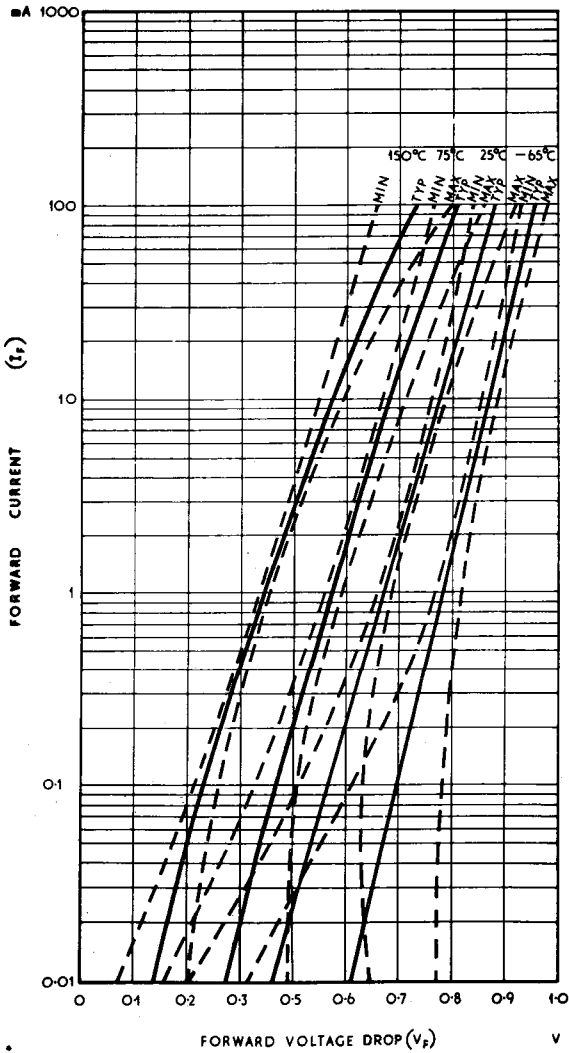


FIG 13

TYPICAL CHANGE IN FORWARD VOLTAGE

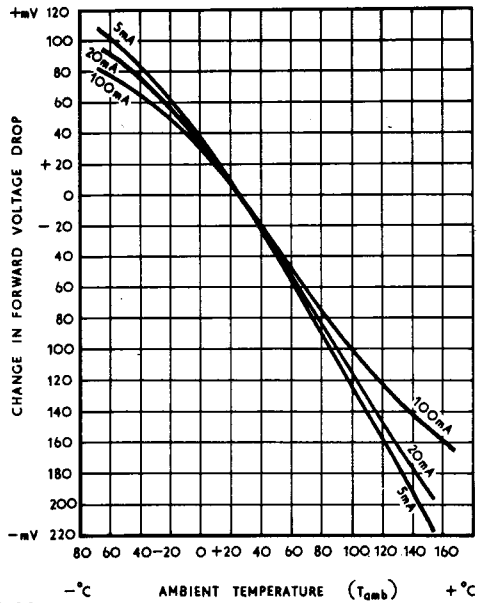


FIG 14

TYPICAL FORWARD SLOPE IMPEDANCE

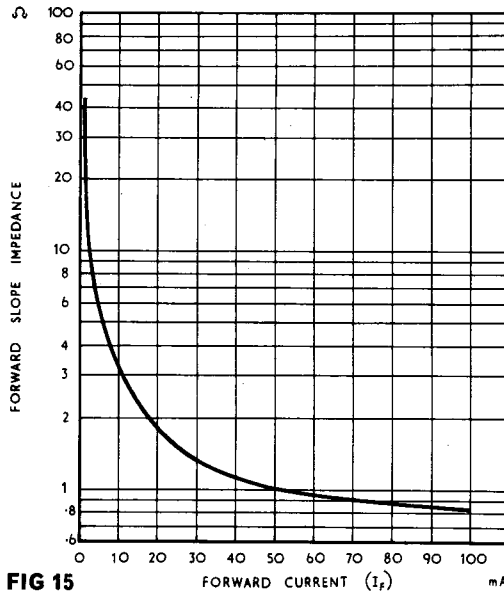


FIG 15