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Pages 1 to 20

DIODES, MICROWAVE, SILICON, SCHOTTKY

GENERAL PURPOSE,

BASED ON TYPE BAS 70

ESA/SCC Detail Specification No. 5512/020

SCC

**space components
coordination group**

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		SCCG Chairman	ESA Director General or his Deputy
Issue 1	March 1995	<i>P. Pommelet</i>	<i>[Signature]</i>



SCC

ESA/SCC Detail Specification
No. 5512/020

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ISSUE 1

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.

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**1. GENERAL****1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Diode, Microwave, Silicon, General Purpose, based on Type BAS 70. It shall be read in conjunction with ESA/SCC Generic Specification No. 5010, the requirements of which are supplemented herein.

1.2 TYPE VARIANTS

Variants of the basic diodes specified herein, which are also covered by this specification are given in Table 1(a).

1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the diodes specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The derating information applicable to the diodes specified herein is shown in Figure 1.

1.5 PHYSICAL DIMENSIONS

The physical dimensions of the diodes specified herein are shown in Figure 2.

1.6 FUNCTIONAL DIAGRAM

The functional diagram, showing lead identification, of the diodes specified herein, is shown in Figure 3.

1.7 HANDLING PRECAUTIONS

These devices are susceptible to damage by electrostatic discharge. Therefore, suitable precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling.

These components are Categorised as Class 1 with a Minimum Critical Path Failure Voltage of 1000V.

2. APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

- (a) ESA/SCC Generic Specification No. 5010 for Discrete Microwave Semiconductor Components.
- (b) MIL-STD-750, Test Methods for Semiconductor Devices.

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESA/SCC Basic Specification No. 21300 shall apply. In addition, the following symbols are used:

C_T = Total Capacitance.

TABLE 1(a) - TYPE VARIANTS

VARIANT	BASED ON TYPE	CASE	FIGURE	END-CAP BODY-LID AND LEAD MATERIAL AND FINISH
01	BAS 70-094	T1	2(a)	E2
02	BAS 70-B	HPAC-140	2(b)	D2

TABLE 1(b) - MAXIMUM RATINGS

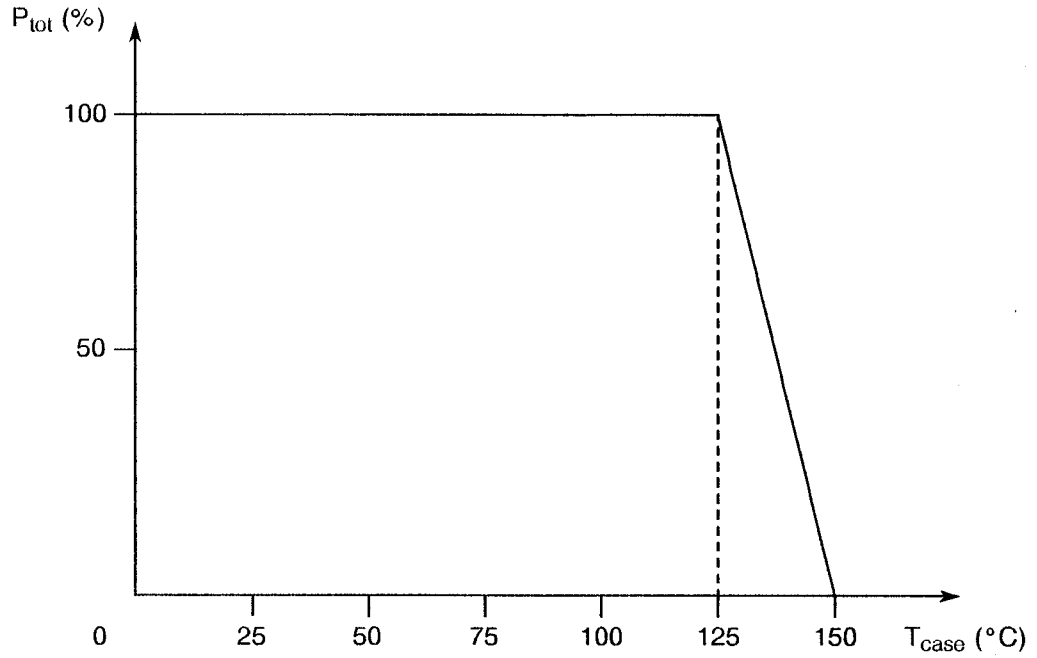
No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	D.C. Reverse Voltage	V_R	- 70	V	
2	D.C. Forward Current	I_F	70	mA	
3	Surge Forward Current	I_{FSM}	85	mApk	Note 1
4	Power Dissipation Variant 01 Variant 02	P_{tot}	0.25 1.0	W	Notes 2 and 3
5	Operating Temperature Range	T_{op}	- 55 to + 150	°C	T_{case}
6	Storage Temperature Range	T_{stg}	- 55 to + 150	°C	
7	Soldering Temperature	T_{sol}	+ 250	°C	Note 4
8	Junction Temperature	T_J	+ 150	°C	
9	Thermal Resistance	$R_{TH(J-C)}$	100	°C/W	

NOTES

- $t \leq 10ms$, Duty Cycle = 10%.
- At $T_{case} = +125^\circ C$. For derating at $T_{case} > +125^\circ C$, see Figure 1.
- For Variant 02, it is possible to stress each diode with 0.25W simultaneously, resulting in the total dissipation of 1.0W.
- Duration 5 seconds maximum at a distance of not less than 0.5mm from the device body and the same termination shall not be resoldered until 3 minutes have elapsed.



FIGURE 1 - PARAMETER DERATING INFORMATION

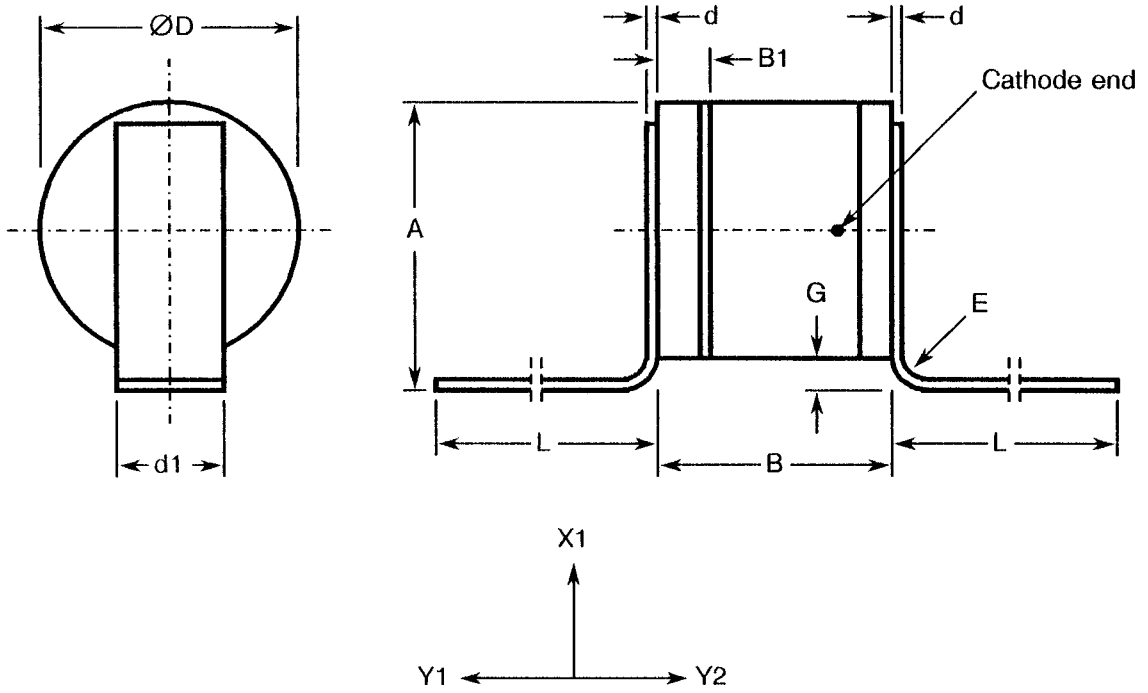


Power Dissipation versus Temperature



FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) - T1 PACKAGE

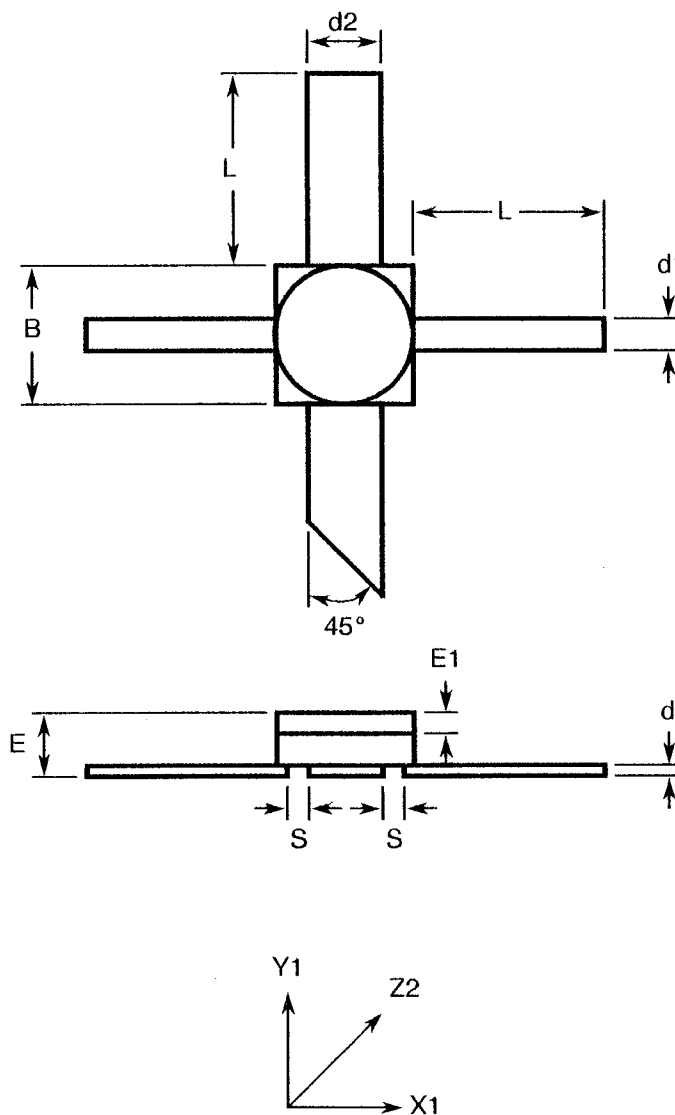


SYMBOL	MILLIMETRES		NOTES
	MIN	MAX	
A	1.40	1.95	All terminations Radius
B	1.15	1.35	
B1	-	0.40	
d	0.06	0.10	
d1	0.40	0.60	
$\varnothing D$	1.30	1.45	
E	-	0.30	
G	0.10	0.50	
L	5.50	-	



FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(b) - HPAC-140 PACKAGE

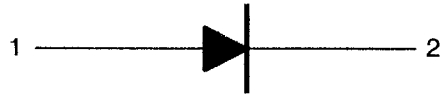


SYMBOL	MILLIMETRES	
	MIN	MAX
B	3.40	3.60
d	0.07	0.15
d1	0.50	0.70
d2	1.90	2.10
E	-	1.60
E1	0.10	0.20
L	6.00	-
S	0.10	0.40



FIGURE 3 - FUNCTIONAL DIAGRAM

VARIANT 01

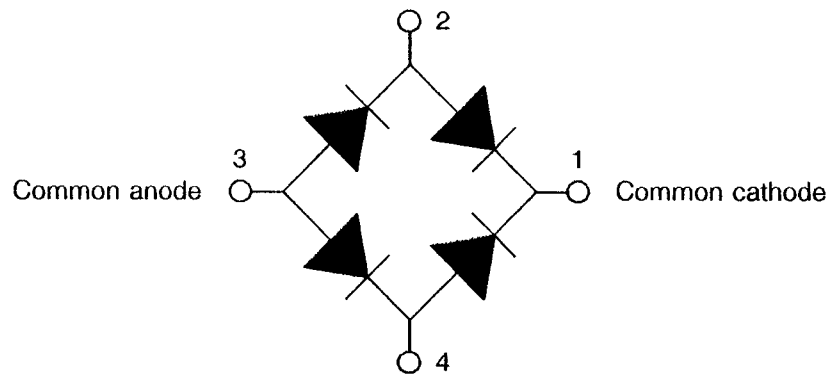


- 1. Anode
- 2. Cathode

NOTES

- 1. The cathode end shall be marked with a black dot or band. The marking will not be on the cathode connection but adjacent to it.

VARIANT 02



NOTES

- 1. The common cathode terminal shall be identified by cropping the lead at an angle of 45°.



4. **REQUIREMENTS**

4.1 **GENERAL**

The complete requirements for procurement of the diodes specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 5010 for Discrete Microwave Semiconductor Components. Deviations from the Generic Specification applicable to this specification only, are listed in Para. 4.2.

Deviations from the applicable Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESA/SCC requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.

4.2 **DEVIATIONS FROM GENERIC SPECIFICATION**

4.2.1 **Deviations from Special In-process Controls**

(a) Para. 5.3, Wafer Lot Acceptance: Shall be performed as an S.E.M. Inspection only.

4.2.2 **Deviations from Final Production Tests (Chart II)**

(a) Para. 6.2, Pre-burn-in: Shall not be performed.

(b) Para. 9.6, Constant Acceleration: Shall not be performed.

(c) Para. 9.7, Particle Impact Noise Detection (PIND) Test: May be performed at any point after the position indicated in Chart II.

(d) Para. 9.14, Vibration, Variable Frequency: Shall not be performed.

4.2.3 **Deviations from Burn-in and Electrical Measurements (Chart III)**

(a) Para. 9.12, Radiographic Inspection: Shall be performed in X and Z axes only.

4.2.4 **Deviations from Qualification Tests (Chart IV)**

(a) Para. 9.13, Shock Test: Shall not be performed.

(b) Para. 9.14, Vibration Test: Shall not be performed.

(c) Para. 9.15, Constant Acceleration: Shall not be performed.

(d) Para. 9.20, Operating Life: Shall be performed at 1 temperature only on 30 pieces.

(e) Para. 9.23, Special Testing: Shall not be performed.

4.2.5 **Deviations from Lot Acceptance Tests (Chart V)**

(a) Para. 9.13, Shock Test: Shall not be performed.

(b) Para. 9.14, Vibration Test: Shall not be performed.

(c) Para. 9.15, Constant Acceleration: Shall not be performed.

(d) Para. 9.20, Operating Life: Shall be performed at 1 temperature only on 16 pieces.

(e) Para. 9.23, Special Testing: Shall not be performed.

4.3 **MECHANICAL AND ENVIRONMENTAL REQUIREMENTS**

4.3.1 **Dimension Check**

The dimensions of the diodes specified herein shall be checked. They shall conform to those shown in Figure 2.



4.3.2 Weight

The maximum weight of the diodes specified herein shall be 0.02 grammes for Variant 01 and 0.3 grammes for Variant 02.

4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The test conditions shall be as follows:-

Variant 01:

- (a) Condition: 'A' (Tension).
- (b) Force: 1.5N.
- (c) Duration: 5 seconds.

Variant 02:

- Condition: 'A' (Tension).
- Force: 5.0N.
- Duration: 5 seconds.

4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the diodes specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material shall not guarantee acceptance of the finished product.

4.4.1 Case

The case shall be hermetically sealed and have a ceramic body. The lid shall be welded or preform soldered.

4.4.2 Lead Materials and Finish

The lid, end cap and lead material shall be either Type 'D' or Type 'E' with Type '2' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500. (See Table 1(a) for Type Variants).

4.5 MARKING

4.5.1 General

The marking of components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany the component in its primary package.

The information to be marked and the order of precedence, shall be as follows:-

- (a) Cathode Identification.
- (b) The SCC Component Number.
- (c) Traceability Information.

The primary package shall bear an "ESD Sensitive" label.

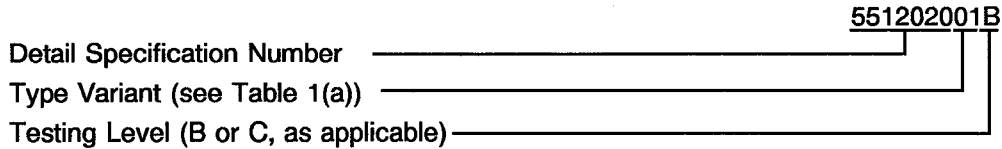
4.5.2 Cathode Identification

Cathode identification shall be as shown in Figures 2 and 3 of this specification.



4.5.3 The SCC Component Number

Each component shall bear the SCC Component Number which shall be constituted and marked as follows:



4.5.4 Traceability Information

Each component shall be marked in respect of traceability information as defined in ESA/SCC Basic Specification No. 21700.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °C.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3. Unless otherwise specified, the measurements shall be performed at $+150(+0 - 5)$ °C.

4.6.3 Circuits for Electrical Measurements (Figure 4)

Not applicable.

4.7 BURN-IN TESTS

Burn-in shall be Category 3 of Chart III(a).

4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °C. The parameter drift values (Δ) applicable to the scheduled parameters shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit value specified in Table 2 shall not be exceeded.

4.7.2 Conditions for High Temperature Reverse Bias Burn-in

The requirements for the high temperature reverse bias burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5010. The conditions for high temperature reverse bias burn-in shall be as specified in Table 5(a) of this specification.

4.7.3 Conditions for Power Burn-in

The requirements for power burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5010. The conditions for power burn-in shall be as specified in Table 5(b) of this specification.

4.7.4 Electrical Circuit for High Temperature Reverse Bias Burn-in

The circuit for use in performing the H.T.R.B burn-in tests is shown in Figure 5(a) of this specification.

4.7.5 Electrical Circuit for Power Burn-in

The circuit for use in performing the power burn-in tests is shown in Figure 5(b) of this specification.



TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - d.c. PARAMETERS

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS (NOTE 1)	LIMITS		UNIT
					MIN.	MAX.	
1	Breakdown Voltage	$V_{(BR)}$	4021	$I_R = -10\mu A$	70	-	V
2	Reverse Current	I_R	4016	$V_R = -56V$	-	100	nA
3	Forward Voltage 1	V_{F1}	4011	$I_F = 1.0mA$	0.3	0.44	V
4	Forward Voltage 2	V_{F2}	4011	$I_F = 10mA$	0.6	0.78	V
5	Forward Voltage 3	V_{F3}	4011	$I_F = 15mA$	0.8	1.00	V
6	Differential Forward Resistance	R_{FD}	-	$I_{F1} = 10mA$ $I_{F2} = 15mA$ Note 2	28	36	Ω

NOTES

- For Variant 02, to be performed for each diode using the following pin conditions: 3 to 2, 2 to 1, 3 to 4, 4 to 1.
- $R_{FD} = \frac{\Delta V_F}{5 \times 10^{-3}} \Omega$.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - a.c. PARAMETERS

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST FIG.	TEST CONDITIONS (NOTE 1)	LIMITS		UNIT
						MIN.	MAX.	
7	Total Capacitance	C_T	4001	-	$V_R = 0V$ $f = 1.0MHz$ Oscillator level = 15mV Note 2	1.2	2.0	pF

NOTES

- For Variant 02, to be performed for each diode using the following pin conditions: 3 to 2, 2 to 1, 3 to 4, 4 to 1.
- Package capacitance $C_P = 0.1pF$ typically.

MATCHING REQUIREMENTS FOR VARIANT 02

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	DELTA LIMITS (Δ) (NOTE 1)		UNIT
					MIN.	MAX.	
3	Forward Voltage 1	V_{F1}	4011	$I_F = 1.0mA$	-	0.01	V
7	Total Capacitance	C_T	4001	$V_R = 0V$ $f = 1.0MHz$ Oscillator level = 15mV	-	0.08	pF

NOTES

- Maximum permissible differences between all diodes in the package.



TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
2	Reverse Current	I_R	4016	$V_R = -56V$	-	100	μA
3	Forward Voltage 1	V_{F1}	4011	$I_F = 1.0mA$	-	0.35	V
4	Forward Voltage 2	V_{F2}	4011	$I_F = 10mA$	-	0.75	V
5	Forward Voltage 3	V_{F3}	4011	$I_F = 15mA$	-	0.95	V

NOTES

- For Variant 02, to be performed for each diode using the following pin conditions: 3 to 2, 2 to 1, 3 to 4, 4 to 1.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
2	Reverse Current	I_R	As per Table 2	As per Table 2	± 10 or (2) ± 50	nA %
4	Forward Voltage	V_F	As per Table 2	As per Table 2	± 20 or (2) ± 5.0	mV %

NOTES

- $\Delta 1 = \Delta 2 = \Delta 3$.
- Whichever is the greater, referred to the initial measurement.

**TABLE 5(a) - CONDITIONS FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN**

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	T_{amb}	+ 145(+ 0 – 5)	°C
2	Reverse Voltage	V_R	Variant 01: – 56 Variant 02: – 112	V

NOTES

- At the end of the H.T.R.B., T_{amb} shall be decreased to room temperature and the reverse bias shall remain applied until $T_{amb} < + 35^{\circ}\text{C}$.

TABLE 5(b) - CONDITIONS FOR POWER BURN-IN

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Junction Temperature	T_J	+ 150(+ 0 – 5)	°C
2	Power Dissipation	P_{tot}	Variant 01: 50 Variant 02: 200 (Note 1)	mW

NOTES

- Because the components are clamped within the Burn-in fixture, in order to achieve $T_J = + 150^{\circ}\text{C}$, $R_{TH(J-A)} = 800^{\circ}\text{C/W}$ for Variant 01 and $R_{TH(J-A)} = 200^{\circ}\text{C/W}$ for Variant 02 must be considered.

TABLE 5(c) - CONDITIONS FOR OPERATING LIFE TESTS

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Junction Temperature	T_J	+ 150(+ 0 – 5)	°C
2	Power	P	Variant 01: 50 Variant 02: 200 (Note 1)	mW

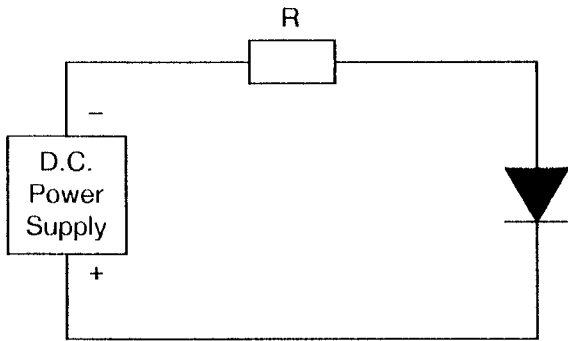
NOTES

- Because the components are clamped within the Burn-in fixture, in order to achieve $T_J = + 150^{\circ}\text{C}$, $R_{TH(J-A)} = 800^{\circ}\text{C/W}$ for Variant 01 and $R_{TH(J-A)} = 200^{\circ}\text{C/W}$ for Variant 02 must be considered.



FIGURE 5(a) - ELECTRICAL CIRCUIT FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN

VARIANT 01



VARIANT 02

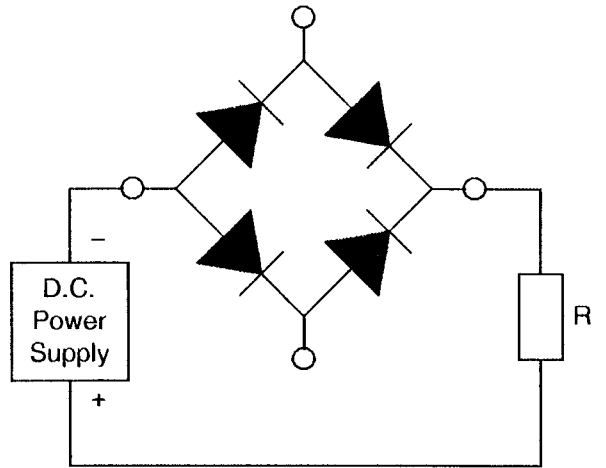
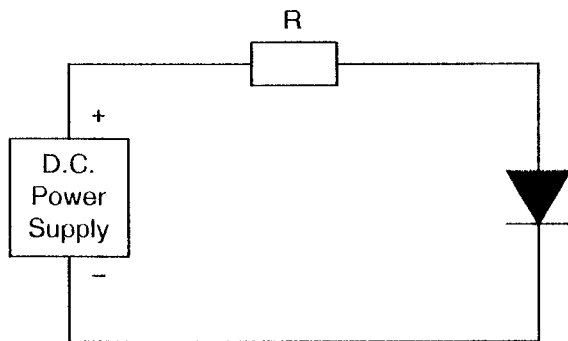
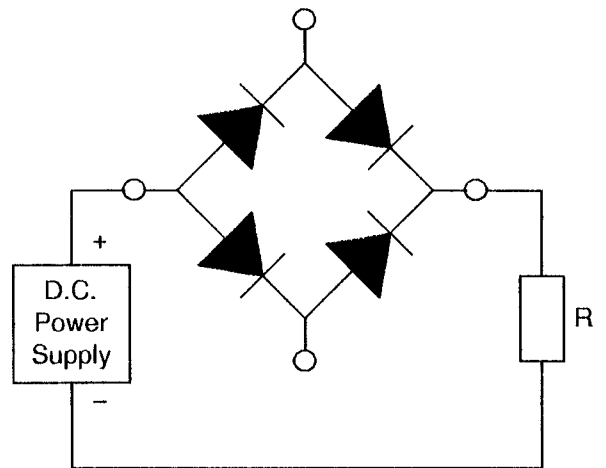


FIGURE 5(b) - ELECTRICAL CIRCUIT FOR POWER BURN-IN AND OPERATING LIFE TESTS

VARIANT 01



VARIANT 02





- 4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 5010)
- 4.8.1 Electrical Measurements on Completion of Environmental Tests
The parameters to be measured on completion of environmental tests are scheduled in Table 2. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °C.
- 4.8.2 Electrical Measurements at Intermediate Points and on Completion of Endurance Tests
The parameters to be measured at intermediate points and on completion of endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °C.
- 4.8.3 Conditions for Operating Life Tests (Part of Endurance Testing)
The requirements for operating life testing are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The conditions for operating life testing are specified in Table 5(c) of this specification.
- 4.8.4 Electrical Circuits for Operating Life Tests
The circuit to be used for performance of the operating life test shall be the same as shown in Figure 5(b) for Power Burn-in.
- 4.9 TOTAL DOSE IRRADIATION TESTING
Not applicable.
- 4.10 SPECIAL TESTING
Not applicable.

**TABLE 6 - ELECTRICAL MEASUREMENTS AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING**

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS (NOTE 1)	LIMITS		UNIT
					MIN.	MAX.	
1	Breakdown Voltage	$V_{(BR)}$	As per Table 2	As per Table 2	70	-	V
2	Reverse Current	I_R	As per Table 2	As per Table 2	-	100	nA
3	Forward Voltage 1	V_{F1}	As per Table 2	As per Table 2	0.3	0.44	V
4	Forward Voltage 2	V_{F2}	As per Table 2	As per Table 2	0.6	0.78	V
5	Forward Voltage 3	V_{F3}	As per Table 2	As per Table 2	0.8	1.00	V
6	Differential Forward Resistance	R_{FD}	As per Table 2	As per Table 2	28	36	Ω
7	Total Capacitance	C_T	As per Table 2	As per Table 2	1.2	2.0	pF

NOTES


- For Variant 02, to be performed for each diode using the following pin conditions: 3 to 2, 2 to 1, 3 to 4, 4 to 1.

FIGURE 6 - BIAS CONDITIONS FOR IRRADIATION TESTING

Not applicable.

TABLE 7 - ELECTRICAL MEASUREMENTS DURING AND ON COMPLETION OF IRRADIATION TESTING

Not applicable.

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APPENDIX 'A'

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AGREED DEVIATIONS FOR SIEMENS (D)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 4.2.3	Para. 9.12, Radiographic Inspection: Exposure 100kV, duration 5 minutes may be used.
Para. 4.2.5	Para. 9.5, Thermal Shock and Para. 9.16, Moisture Resistance: May be done in sequence on all 6 components of the Environmental/Mechanical subgroups.