DIODES, SWITCHING,

BASED ON TYPE 1N4151-1

ESCC Detail Specification No. 5101/025

ISSUE 1

October 2002

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space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 2	September 1998		pp

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 1 and incorporates all modifications defined in Revision 'A' to Issue 1 and the changes agreed in the following DCRs:-		
		Cover page		None
		DCN		None
		Para. 2	: Item (d) deleted	221441
		Table 1(b)	: No. 1, completely amended	221441
			: New No. 2 added	221441
			: Existing No. 2 renumbered to "8" and Characteristics and Symbol amended	221441
			: No. 3, "Note 1" replaced by "At $T_{amb} \leq +25°C$."	221441
			: New No. 4 added	221441
			: Existing Nos. 4 and 5, Renumbered to "5" and "6" respectively and Maximum Ratings amended	221441
			: Existing No. 6, Renumbered as "7" and Remarks deleted and replaced by "Note 2"	221441
			: No. 8, moved from existing No. 2	221441
			: New No. 9 added	221441
			: Notes, Note 1 amended and new Note 2 added	221441
		Figure 1	: Derating amended to "I_O(mA)" and "T_L(°C)"	221441
			: Slope amended to occur between 75 and 175 °C and "2.0mA/°C" added	221441
			: Subtitle amended	221441
		Para. 4.2.2	: New Deviation "(d)" added and subsequent deviations renumbered to (e) and (f) respectively	221441
			: New Deviation "(g)" added	221441
		Para. 4.5.1	: Existing text deleted and new text added	221441
		Para. 4.5.2	: Title and text amended	221441
		Para. 4.5.5	: Paragraph deleted in toto	221441
		Table 2 d.c.	: No. 1, "1" added to Characteristics and Symbol, and "(1)" added to Conditions	221441
			: New No. 2 added and subsequent tests renumbered	221441
			: No. 3, "D.C. Method" added to conditions	221441
			: Existing No. 4 renumbered to "9" and moved to Table 2 a.c.	221441
			: Note 1 added	221441
		Table 2 a.c.	: "(Note 1)" added to Test Conditions of existing tests	221441
			: Existing No. 6, Test Method and Conditions amended	221441
			: New Nos. 7 and 8 added	221441
			: No. 9 added from Table 2 d.c. No. 2 with Symbol, Conditions, Limits and Units amended	221441
			: New Notes 2 and 3 added	221441
		Table 3	: No. 2 renumbered as "3" and "D.C. Method" added to Conditions	221441
		Table 4	: No. 1, In Characteristics and Symbol "1" added	221441
			: No. 2 renumbered as "3"	221441
		Table 5(b)	: Existing Table deleted and new Table added	221441
		Table 6	: First Nos. 1 and 2 amended	221441
			: Second Nos. 1 and 2 deleted	221441
		Appendix 'A'	: New Appendix 'A' added	221441

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APPENDICES (Applicable to specific Manufacturers only)

1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Diodes, Switching, based on Type 1N4151-1. It shall be read in conjunction with ESA/SCC Generic Specification No. 5000, the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS

Variants of the basic type 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 parameter 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 HIGH TEMPERATURE TEST PRECAUTIONS

For tin-lead plated or solder-dipped lead finish, all tests to be performed at a temperature that exceeds +125°C shall be carried out in 100% inert atmosphere.

1.8 HANDLING PRECAUTIONS

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

These components are categorised as Class 3 with a Minimum Critical Path Failure Voltage of 6 500V.

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. 5000 for Discrete Semiconductors.

(b) MIL-STD-750, Test Methods and Procedures for Semiconductor Devices.

(c) MIL-STD-202, Test Methods for Electronic and Electrical Component Parts.

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.

TABLE 1(a) - TYPE VARIANTS

VARIANT	BASED ON TYPE	LEAD MATERIAL AND FINISH
01	1N4151-1	C3 or C4
02	1N4151-1	L3 or L4

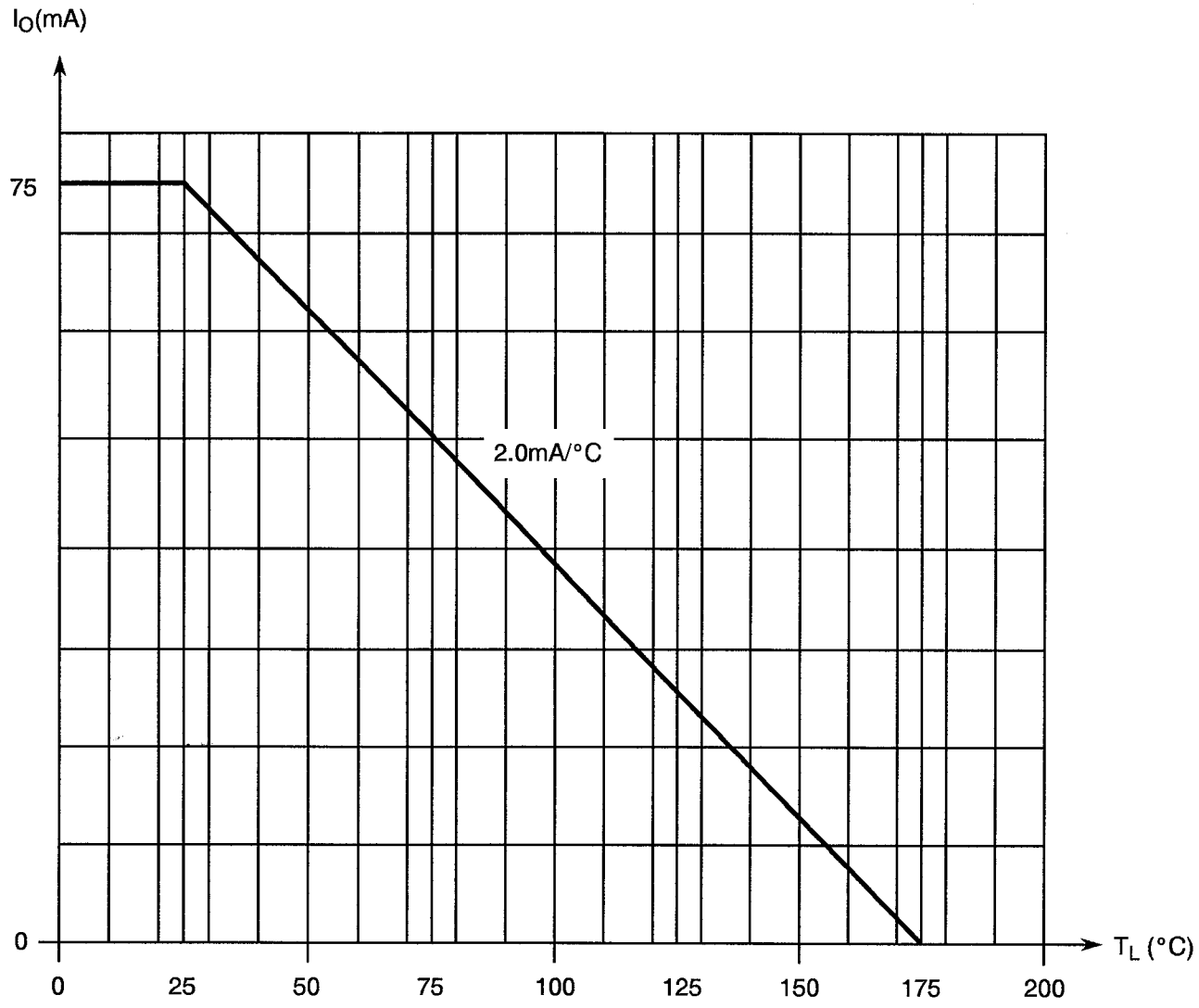
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATING	UNIT	REMARKS
1	Working Peak Reverse Voltage	V_{RWM}	50	V(pk)	
2	Average Output Rectified Current	I_O	200	mA	Note 1
3	Total Power Dissipation	P_{tot}	500	mW	At $T_{amb} \leq +25°C$
4	Forward Surge Current	I_{FSM}	0.5	A	$t_p = 10s$
			4.0	A	$t_p = 1.0\mu s$
5	Operating Temperature Range	T_{op}	−65 to +175	°C	T_{amb}
6	Storage Temperature Range	T_{stg}	−65 to +175	°C	
7	Soldering Temperature	T_{sol}	+260	°C	Note 2
8	Breakdown Voltage	$V_{(BR)}$	75	V	
9	Thermal Resistance (Junction to Lead)	$R_{TH(J-L)}$	250	°C/W	

NOTES

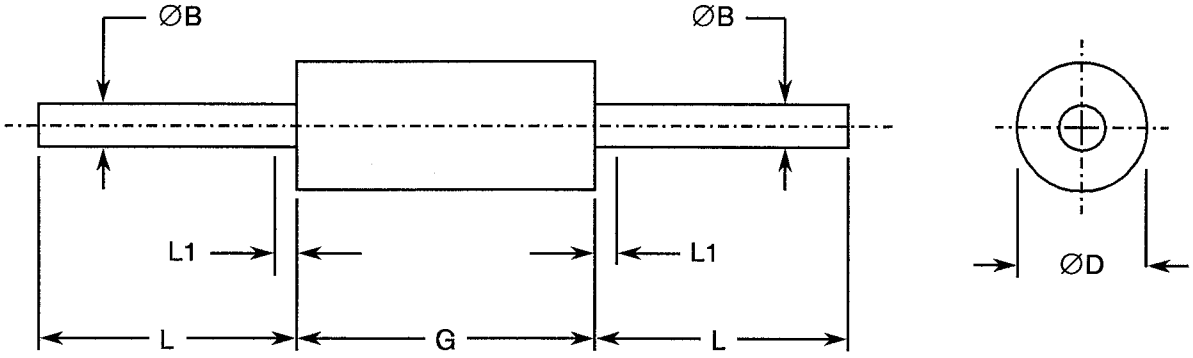
1. At $T_L \leq +75°C$ at 9.53mm from the body. For derating at $T_L > +75°C$, see Figure 1.
2. Duration 10 seconds maximum at a distance of not less than 1.5mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.

FIGURE 1 - PARAMETER DERATING INFORMATION



Average Output Rectified Current versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS



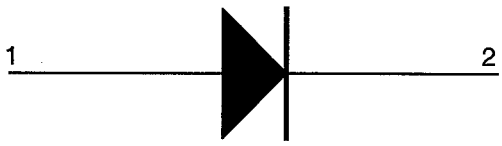
SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
ØB	0.458	0.558	-
ØD	1.53	2.28	1
G	3.05	5.08	1
L	12.70	-	-
L1	-	1.27	2

NOTES

1. Package contour optional within cylinder of diameter ØD and length G. Slugs, if any, shall be included within this cylinder but shall not be subject to the minimum limit of ØD.
2. Lead diameter not controlled in this zone to allow for flash, lead finish build-up, and minor irregularities other than slugs.

FIGURE 3 - FUNCTIONAL DIAGRAM

1 Anode
2 Cathode



NOTES

1. The cathode end shall be marked with a coloured ring.

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. 5000 for Discrete Semiconductors. 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

None.

4.2.2 Deviations from Final Production Tests (Chart II)

(a) Para. 9.2.1, Bond Strength Test: Not applicable.

(b) Para. 9.2.2, Die Shear Test: Not applicable.

(c) Para. 9.5.1, Thermal Shock Test: Shall be performed in accordance with Test Method 107, Condition 'B' of MIL-STD-202.

(d) At any time following Para. 9.5.1, Thermal Shock Test, Thermal Impedance measurements shall be performed in accordance with MIL-STD-750, Test Method 3101 as specified in Table 2, Item 9.

(e) Para. 9.6, Constant Acceleration: Not applicable.

(f) Para. 9.7, Particle Impact Noise Detection (PIND) Test: Not applicable.

(g) Immediately following Para. 9.9.3, Electrical Measurements at Room Temperature, a Surge Current test shall be performed on a sample basis, LTPD = 7 or lower, in accordance with MIL-STD-750, Test Method 4066 using the following conditions:

- $I_{FSM} = 2.0A(pk)$.

10 surges at a rate of 1 per minute maximum and of duration 1/100 or 1/120 seconds.

Before and after Surge Current application, the sample devices shall be electronically tested in accordance with Table 6 of this specification.

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

(a) Para. 9.8.1, Seal Test, Fine Leak: Not applicable.

(b) Para. 9.8.2, Seal Test, Gross Leak: Shall be performed in accordance with Test Method 1071, Condition 'E' of MIL-STD-750.

(c) Para. 9.12, Radiographic Inspection: Not applicable.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.2.3, Bond Strength Test: Not applicable.

(b) Para. 9.2.4, Die Shear Test: Not applicable.

(c) Para. 9.8.1, Seal Test, Fine Leak: Not applicable.

(d) Para. 9.8.2, Seal Test, Gross Leak: Shall be performed in accordance with Test Method 1071, Condition 'E' of MIL-STD-750.

(e) Para. 9.15, Constant Acceleration: Not applicable.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.8.1, Seal Test, Fine Leak: Not applicable.

(b) Para. 9.8.2, Seal Test, Gross Leak: Shall be performed in accordance with Test Method 1071, Condition 'E' of MIL-STD-750.

(c) Para. 9.15, Constant Acceleration: Not applicable.

4.3 MECHANICAL 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 0.2 grammes.

4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of ESA/SCC Generic Specification No. 5000. The test conditions shall be as follows:-

Test Condition : 'A'.

Applied Force : 5.0 Newtons.

Duration : 10 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 does not guarantee acceptance of the finished product.

4.4.1 Case

Glass, hermetically sealed.

4.4.2 Lead Material and Finish

The lead material shall be Type 'C' or Type 'L' with Type '3 or 4' 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 all components delivered to this specification shall be in accordance with 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) Polarity.

(b) The SCC Component Number.

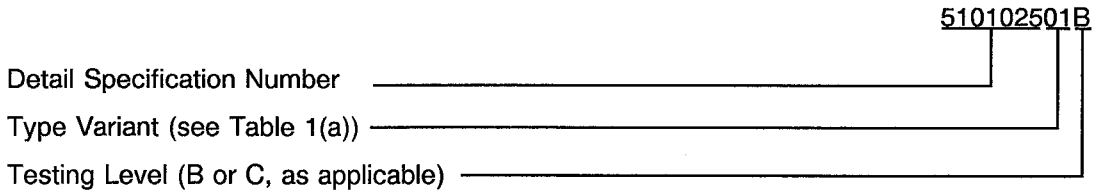
(c) Traceability Information.

4.5.2 Polarity

Polarity shall be as shown in Figure 3.

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. The measurements shall be performed at $T_{amb} = +22 \pm 3$ °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.

4.6.3 Circuits for Electrical Measurements

Circuits for use in performing electrical measurements listed in Tables 2 and 3 are shown in Figure 4.

4.7 BURN-IN TESTS

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, measurements shall be performed at $T_{amb} = +22 \pm 3$ °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 and Power Burn-in

The requirements for High Temperature Reverse Bias Burn-in and Power Burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5000. The conditions for High Temperature Reverse Bias Burn-in and Power Burn-in shall be as specified in Tables 5(a) and 5(b) of this specification.

4.7.3 Electrical Circuits for High Temperature Reverse Bias Burn-in and Power Burn-in

Circuits for use in performing the High Temperature Reverse Bias Burn-in and Power Burn-in tests are shown in Figures 5(a) and 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	LIMITS		UNIT
					MIN.	MAX.	
1	D.C. Forward Voltage 1	V_{F1}	4011	$I_F = 50mA$ (1)	-	1.0	V
2	D.C. Forward Voltage 2	V_{F2}	4011	$I_F = 200mA$ (1)	-	1.2	V
3	D.C. Reverse Current	I_R	4016	$V_R = -50V$ D.C. Method	-	50	nA
4	D.C. Breakdown Reverse Voltage	$V_{(BR)}$	4021	$I_R = -5.0\mu A$	75	-	V

NOTES

1. Pulsed operation, $t_p = 300\mu s$, $\delta > 2.0\%$.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - A.C. PARAMETERS

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
5	Capacitance	C	4001	$V_R = 0$ $f = 1.0MHz$ (Note 1)	-	2.0	pF
6	Reverse Current Recovery Time	t_{rr}	4031, Condition 'A'	$I_F = I_{RM} = 10$ to $100mA$ $R_L = 100\Omega$ $C \geq 1.0nF$ $R \geq 1.0k\Omega$ (Note 1)	-	4.0	ns
7	Forward Recovery Time	t_{fr}	4026	$I_F = 200mA$ (Notes 1 and 2)	-	10	ns
8	Forward Recovery Voltage	V_{fr}	4026	$I_F = 200mA$ (Notes 1 and 2)	-	5.0	V(pk)
9	Thermal Impedance	$Z_{TH(J-C)}$	3101	$I_H = 300$ to $500mA$ $t_H = 10ms$ $I_M = 1.0$ to $10mA$ $t_{MD} = 70\mu s$ max. (Note 3)	-	70	°C/W

NOTES

1. Measurements shall be performed on a sample basis, LTPD = 7 or less.
2. Forward Recovery Time (t_{fr}) shall be measured as the interval between zero time and the point where the pulse has decreased to 110% of the steady-state value of V_F when $I_F = 200mA$. The maximum rise time of the response detector shall be 1.0ns. The maximum Forward Recovery Voltage (V_{fr}) shall be measured during the forward recovery interval.
3. During Chart II only.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
3	D.C. Reverse Current	I_R	4016	T_{amb} = +150°C V_R = −50V D.C. Method	-	50	µA

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	UNIT
1	D.C. Forward Voltage 1	V_{F1}	As per Table 2	As per Table 2	±50	mV
3	D.C. Reverse Current	I_R	As per Table 2	As per Table 2	±20 or (1) ±100	nA %

NOTES

1. Whichever is greater.

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

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	T_{amb}	+150	°C
2	Reverse Voltage	V_R	−50 (Note 1)	V
3	Duration	t	72	hrs

NOTES

1. At the end of the H.T.R.B. Burn-in, T_{amb} shall be decreased to room temperature and the reverse-bias shall remain applied until T_{amb} is less than +35°C.

TABLE 5(b) - CONDITIONS FOR POWER BURN-IN AND OPERATING LIFE TESTS

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	T_{amb}	MIL-STD-750	°C
2	Working Peak Reverse Voltage	V_{RWM}	50	V(pk)
3	Average Output Rectified Current	I_O	200 f = 50 to 60Hz	mA

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

Not applicable.

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

Not applicable.

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 5000)

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 $T_{amb} = +22 \pm 3$ °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 $T_{amb} = +22 \pm 3$ °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. 5000. The conditions for operating life testing shall be the same as specified in Table 5(b) for the burn-in test.

4.8.4 Electrical Circuits for Operating Life Tests

The circuit to be used for performance of the operating life tests shall be the same as shown in Figure 5(b) for burn-in.

4.8.5 Conditions for High Temperature Storage Test (Part of Endurance Testing)

The requirements for the high temperature storage test are specified in ESA/SCC Generic Specification No. 5000. The temperature to be applied shall be the maximum storage temperature specified in Table 1(b) of this specification.

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

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	LIMITS		UNIT
						MIN.	MAX.	
1	D.C. Forward Voltage 1	V_{F1}	As per Table 2	As per Table 2	±50mV	-	1.0	V
3	D.C. Reverse Current	I_R	As per Table 2	As per Table 2	±25nA or (1) ±100%	-	100	nA

NOTES

1. Whichever is greater referred to the initial value.

APPENDIX 'A'

AGREED DEVIATIONS FOR MICROSEMI (IRL)

ITEMS AFFECTED	DESCRIPTION OF DEVIATION
Table 2, No. 9 of this specification	The maximum limit for $Z_{TH(J-C)}$ in screening shall be derived by means of Lot Norm testing on each die lot being processed and shall not exceed 30°C/W.