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**DIODES, SILICON, SWITCHING,  
BASED ON TYPES 1N3595-1 AND 1N3595US-1  
ESA/SCC Detail Specification No. 5101/028**



**space components  
coordination group**

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ISSUE 1

**DOCUMENTATION CHANGE NOTICE**

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
'A'	Jan. '98	P1. Cover Page P2. DCN P6. Table 1(b) P7. Figure 1 P15. Table 5(a)	: Notes 1 and 2 amended : Figure amended : Item 2, Condition corrected to " - 100"	None None 221448 221448 221448

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

This specification details the ratings, physical and electrical characteristics, test and inspection data for Diodes, Silicon, Switching, based on Types 1N3595-1 and 1N3595US-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 diodes specified herein, which are also covered by this specification, are listed 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 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.



**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.

**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.

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**TABLE 1(a) - TYPE VARIANTS**

VARIANT <sup>(1)</sup>	BASED ON TYPE <sup>(2)</sup>	CASE <sup>(3)</sup>	FIGURE <sup>(4)</sup>	LEAD/END-CAP MATERIAL AND FINISH <sup>(5)</sup>
01	1N3595-1	DO-35	2(a)	L4
02	1N3595US-1	MELF	2(b)	O4

**TABLE 1(b) - MAXIMUM RATINGS**

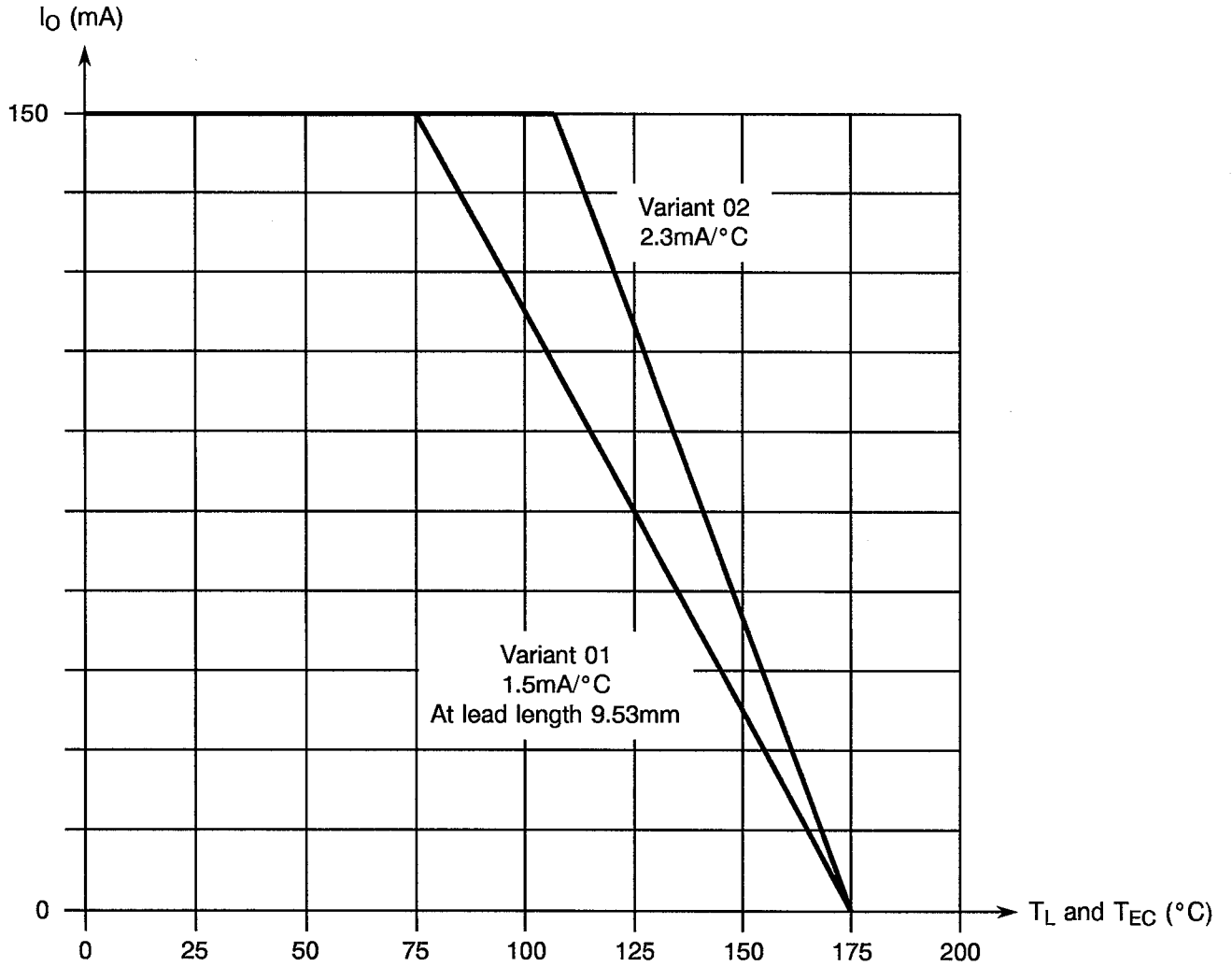
No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Breakdown Voltage	$V_{(BR)}$	150	V	
2	Forward Surge Current 1	$I_{FSM1}$	500	mA(pk)	$t_p = 1.0s$
3	Forward Surge Current 2	$I_{FSM2}$	4.0	A(pk)	$t_p = 1.0\mu s$
4	Average Output Rectified Current	$I_O$	150	mA	Notes 1 and 2
5	Operating Temperature Range	$T_{op}$	- 65 to + 175	°C	$T_{amb}$
6	Storage Temperature Range	$T_{stg}$	- 65 to + 175	°C	
7	Soldering Temperature Variant 01 Variant 02	$T_{sol}$	+ 260 + 245	°C	Note 3 Note 4
8	Thermal Resistance (Junction to Lead)	$R_{TH(J-L)}$	160	°C/W	Note 2
9	Thermal Resistance (Junction to End Cap)	$R_{TH(J-EC)}$	25	°C/W	

**NOTES**

- At  $T_L \leq +75^\circ C$  for Variant 01 and  $T_{EC} \leq +110^\circ C$  for Variant 02. For derating at  $T_L > +75^\circ C$  and  $T_{EC} < +110^\circ C$ , see Figure 1.
- Lead temperature is measured at 9.53mm from the device body.
- 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.
- Duration 10 seconds maximum and the same termination shall not be resoldered until 3 minutes have elapsed.



**FIGURE 1 - PARAMETER DERATING INFORMATION**

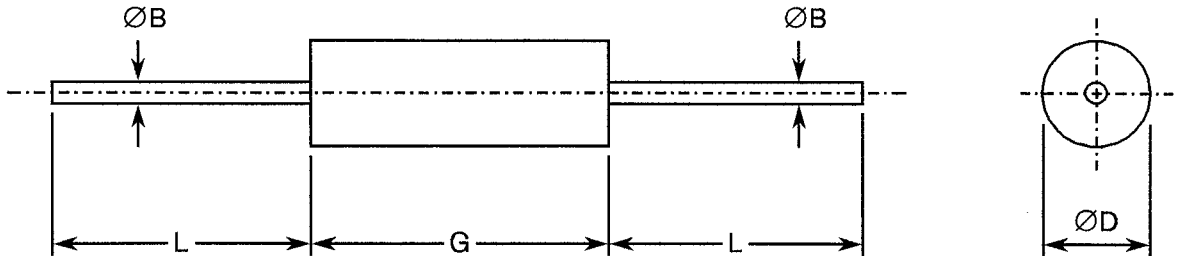


Average Output Rectified Current versus Temperature



**FIGURE 2 - PHYSICAL DIMENSIONS**

FIGURE 2(a) - VARIANT 01



SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX	
ØB	0.46	0.56	1
ØD	1.42	1.91	2
G	-	4.57	-
L	25.40	38.10	-

**NOTES**

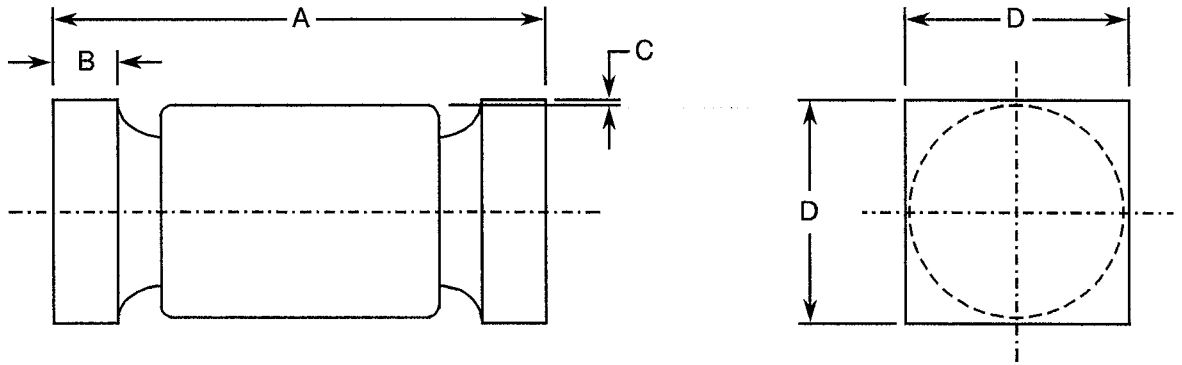
1. Dimension G shall include all uncontrolled areas of the device leads.
2. Dimension ØD shall be measured at the largest diameter.





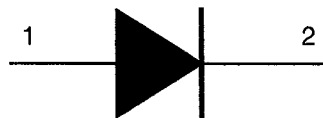
**FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)**

FIGURE 2(b) - VARIANT 02



SYMBOL	MILLIMETRES	
	MIN.	MAX
A	4.19	4.95
B	0.48	0.71
C	0.08	-
D	1.78	2.16

**FIGURE 3 - FUNCTIONAL DIAGRAM**



- 1. Anode.
- 2. Cathode.

**NOTES**

- 1. For Variant 01, the cathode end shall be marked with a contrasting coloured band.  
For Variant 02, the cathode end shall be marked with a minimum of 3 contrasting coloured dots or a black band.



#### 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) 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 10.
- (d) Para. 9.6, Constant Acceleration: Not applicable.
- (e) Para. 9.7, Particle Impact Noise Detection (PIND) test: Not applicable.
- (f) Para. 9.8.1, Seal Test Fine Leak: 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:
  - $I_{FSM} = 0.5A(pk)$ .
  - $I_F = 150mA$ .
  - 10 surges at a rate of 1 per minute maximum and of duration 1.0 seconds.

Immediately following Surge Current application, the sample devices shall be electronically tested in accordance with Table 2, Items 1, 7 and 8 of this specification.

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

- (a) Para. 9.9.5, Safe Operating Area: Not applicable.
- (b) Para. 9.8.1, Seal Test Fine Leak: Not applicable.
- (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. 9.15, 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. 9.15, 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 for Variant 01 and 0.13 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. 5000. For Variant 01, the test conditions shall be as follows:-

Test Condition: A.  
Applied Force: 5 Newtons.  
Duration: 15 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

Transparent glass, hermetically sealed.

##### 4.4.2 Lead Material and Finish

For Variant 01, the lead material shall be Type 'L' with Type '4' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500. (See Table 1(a) for Type Variants).

For Variant 02, the termination material shall be Type 'O' with Type '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 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.

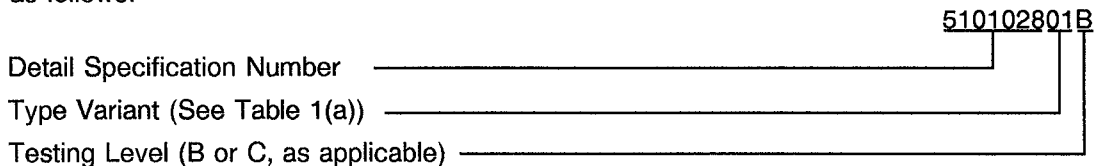


4.5.2 Polarity

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. Unless otherwise stated, 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 Tables 3(a) and 3(b). Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +150(+0-5)$  and  $-55(+5-0)$  °C respectively.

4.6.3 Circuits for Electrical Measurements (Figure 4)

Not applicable.

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 ( $\Delta$ ) applicable to the parameters scheduled, shall not be exceeded. In addition to these drift value requirements, the appropriate limit value specified in Table 2 for a given parameter shall not be exceeded.

4.7.2 Conditions for High Temperature Reverse Bias Burn-in

The requirements for high temperature reverse bias burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5000. 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. 5000. The conditions for power burn-in shall be as specified in Table 5(b) of this specification.

4.7.4 Electrical Circuits for High Temperature Reverse Bias Burn-in (Figure 5(a))

Not applicable.

4.7.5 Electrical Circuits for Power Burn-in (Figure 5(b))

Not applicable.

**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	$I_F = 200\text{mA}$ (Note 1)	0.83	1.00	V
2	D.C. Forward Voltage 2	$V_{F2}$	4011	$I_F = 100\text{mA}$ (Note 1)	0.79	0.92	V
3	D.C. Forward Voltage 3	$V_{F3}$	4011	$I_F = 50\text{mA}$ (Note 1)	0.74	0.88	V
4	D.C. Forward Voltage 4	$V_{F4}$	4011	$I_F = 10\text{mA}$ (Note 1)	0.65	0.80	V
5	D.C. Forward Voltage 5	$V_{F5}$	4011	$I_F = 5.0\text{mA}$ (Note 1)	0.60	0.75	V
6	D.C. Forward Voltage 6	$V_{F6}$	4011	$I_F = 1.0\text{mA}$ (Note 1)	0.52	0.68	V
7	Reverse Current	$I_R$	4016	D.C. Method $V_R = -125\text{V}$	-	1.00	nA

**NOTES**

1. Pulsed measurement: Pulse length  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
8	Total Capacitance	$C_T$	4001	$V_R = 0\text{V}$ $f = 1.0\text{MHz}$ (Note 1)	-	8.0	pF
9	Reverse Recovery Time	$t_{rr}$	4031 Condition 'A'	$I_F = I_{RM} = 10\text{mA}$ $V_R = -35\text{V}$ $I_{rr} = -0.35\text{mA}$ $R_L = 1.0\text{k}\Omega$ $C_L = 10\text{pF}$ Recovered under $100\text{k}\Omega$ (Note 1)	-	3.0	$\mu\text{s}$
10	Thermal Impedance	$Z_{TH(J-C)}$	3101	$I_H = 1.0\text{A}$ $t_H = 10\text{ms}$ $I_M = 1.0\text{mA}$ $t_{md} = 70\mu\text{s}$ maximum (Note 2)	-	25	$^{\circ}\text{C/W}$

**NOTES**

1. Measurements shall be performed on a sample basis, LTPD7 or lower.
2. During Chart II only.

**TABLE 3(a) - ELECTRICAL MEASUREMENTS AT HIGH TEMPERATURE**

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
7	Reverse Current	$I_R$	4016	D.C. Method $V_R = -125V$	-	3.0	$\mu A$

**TABLE 3(b) - ELECTRICAL MEASUREMENTS AT LOW TEMPERATURE**

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
11	Breakdown Voltage	$V_{(BR)}$	4021	$I_R = -100\mu A$	150	-	V

**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

Not applicable.

**TABLE 4 - PARAMETER DRIFT VALUES**

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMIT ( $\Delta$ )	UNIT
1	D.C. Forward Voltage 1	$V_{F1}$	As per Table 2	As per Table 2	$\pm 50$	mV
7	Reverse Current	$I_R$	As per Table 2	As per Table 2	$\pm 0.5$ or (1) $\pm 100$	nA  %

**NOTES**

1. Whichever is greater, referred to the initial value.

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

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	$T_{amb}$	+ 150	°C
2	Reverse Voltage	$V_R$	- 100	V
3	Duration	t	72	Hrs

**NOTES**

- At the end of the high temperature reverse bias burn-in,  $T_{amb}$  shall be decreased to room temperature and the reverse bias shall remain until  $T_{amb}$  is  $< +35^{\circ}\text{C}$ .

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

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	$T_{amb}$	MIL-STD-750	°C
2	Working Peak Reverse Voltage	$V_{RWM}$	125	Vac
3	Average Output Rectified Current	$I_O$	150	mA
4	Frequency	f	50 to 60	Hz

**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 testing are scheduled in Table 6 of this specification. 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 power burn-in.
- 4.8.4 Electrical Circuits for Operating Life Tests (Figure 5(b))  
Not applicable.
- 4.8.5 Conditions for High Temperature Storage Test (Part of Endurance Testing)  
The requirements for the high temperature storage test are specified in Section 9 of 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 ( $\Delta$ )	LIMITS		UNIT
						MIN.	MAX.	
1	D.C Forward Voltage 1	$V_{F1}$	As per Table 2	As per Table 2	$\pm 0.05V$	-	1.0	V
7	Reverse Current	$I_R$	As per Table 2	As per Table 2	$\pm 0.5nA$ or (1) $\pm 100\%$	-	1.0	nA

**NOTES**

1. Whichever is greater, referred to the initial value.

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**APPENDIX 'A'**

AGREED DEVIATIONS FOR MICROSEMI (IRL)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
<p>Para. 4.2.2</p>	<p>Para. 9.5.1, Thermal Shock may be performed in accordance with MIL-STD-750, Test Method 1051, Test Condition 'C'. The maximum load temperature shall be + 175°C.</p> <p>Para. 9.8.2, Seal Test Gross Leak may be performed using Test Condition 'E'.</p>