DIODES, SILICON, SWITCHING,

BASED ON TYPES 1N6639, 1N6640, 1N6641,

1N6639US, 1N6640US AND 1N6641US

ESCC Detail Specification No. 5101/027

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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 1N6639, 1N6640, 1N6641, 1N6639US, 1N6640US and 1N6641US. 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.

1.8 HANDLING PRECAUTIONS

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

These components are catogorised as Class 3 with a Minimum Critical Path Failure Voltage of 5800V.

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.

TABLE 1(a) - TYPE VARIANTS

(1) VARIANT	(2) BASED ON TYPE	(3) CASE	(4) FIGURE	(5) BREAKDOWN VOLTAGE $V_{(BR)}$ (V)	(6) WORKING PEAK REVERSE VOLTAGE V_{RWM} (V)	(7) LEAD/END-CAP MATERIAL AND FINISH
01	1N6639	DO-35	2(a)	100	75	L4
02	1N6640	DO-35	2(a)	75	50	L4
03	1N6641	DO-35	2(a)	75	50	L4
04	1N6639US	MELF	2(b)	100	75	O4
05	1N6640US	MELF	2(b)	75	50	O4
06	1N6641US	MELF	2(b)	75	50	O4

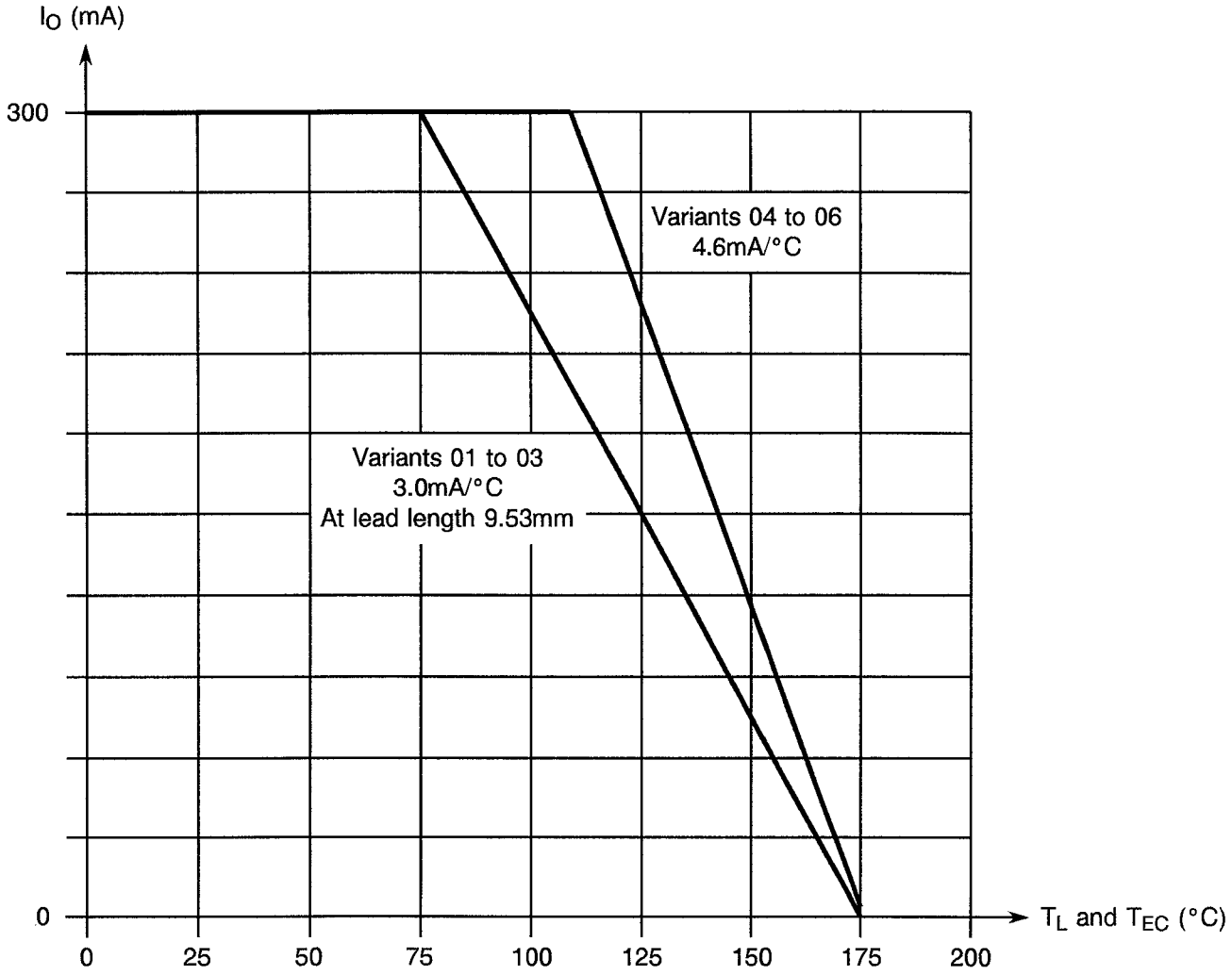
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Forward Surge Current	I_{FSM}	2.5	A(pk)	At $T_{amb} \leq +25°C$ (Note 1)
2	Working Peak Reverse Voltage	V_{RWM}	Note 2	V(pk)	At $T_{amb} \leq +25°C$
3	Average Output Rectified Current	I_O	300	mA	Notes 3 and 4
4	Operating Temperature Range	T_{op}	−65 to +175	°C	T_{amb}
5	Storage Temperature Range	T_{stg}	−65 to +175	°C	
6	Soldering Temperature Variants 01 to 03 Variants 04 to 06	T_{sol}	 +260 +245	°C	 Note 5 Note 6
7	Thermal Resistance (Junction to Lead)	$R_{TH(J-L)}$	160	°C/W	Note 4
8	Thermal Resistance (Junction to End Cap)	$R_{TH(J-EC)}$	50	°C/W	

NOTES

1. Sinusoidal, with period = 8.3ms maximum.
2. See Column 6 of Table 1(a).
3. At $T_L \leq +75°C$ for Variants 01 to 03 and $T_{EC} \leq +110°C$ for Variants 04 to 06. For derating at $T_L > +75°C$ and $T_{EC} > +110°C$, see Figure 1.
4. Leads shall be maintained at ambient temperature 9.53mm from the body.
5. 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.
6. Duration 10 seconds maximum and the same termination shall not be resoldered until 3 minutes have elapsed.

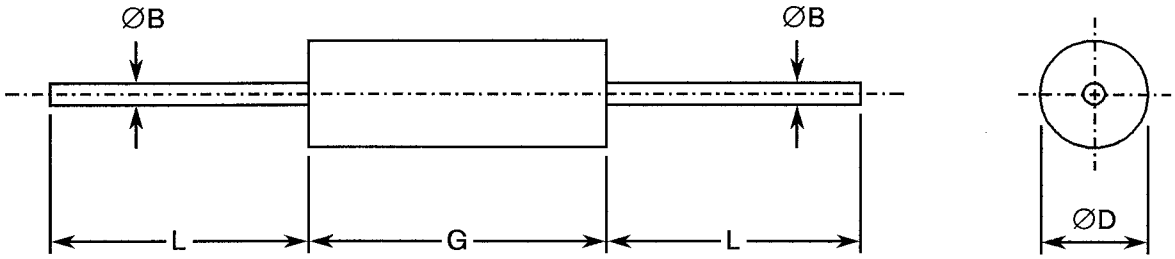
FIGURE 1 - PARAMETER DERATING INFORMATION



Average Output Rectified Current versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) - VARIANTS 01 TO 03



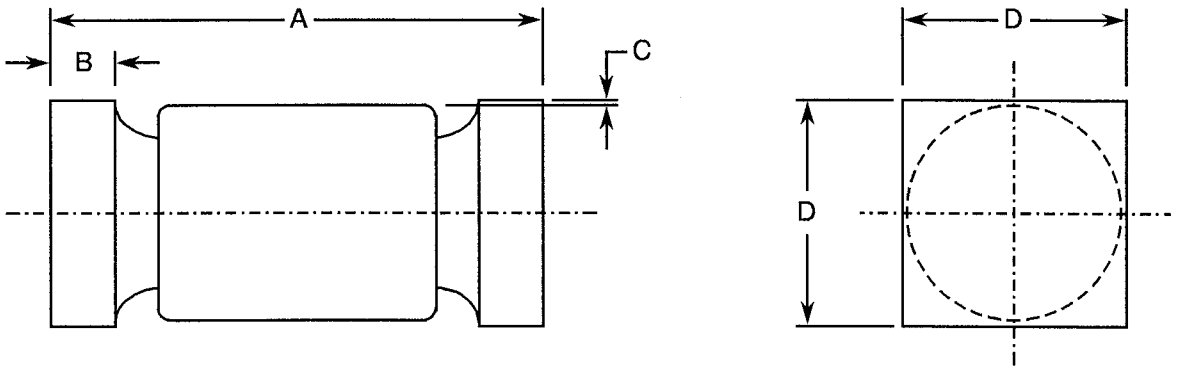
SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX	
ØB	0.46	0.56	1
ØD	1.42	1.91	2
G	-	4.57	-
L	25.40	38.10	-

NOTES

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

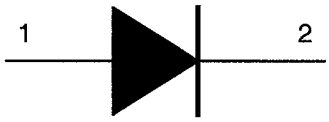
FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(b) - VARIANTS 04 TO 06



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 Variants 01 to 03, the cathode end shall be marked with a contrasting coloured band.
   For Variants 04 to 06, 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 11.

(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:
- IFSM = 2.5A(pk)

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

Immediately following Surge Current application, the sample devices shall be electronically tested in accordance with Table 2, Items 1 to 6 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 Variants 01 to 03 and 0.13 grammes for Variants 04 to 06.

4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of ESA/SCC Generic Specification No. 5000. For Variants 01 to 03, 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 Variants 01 to 03, 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 Variants 04 to 06, 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.

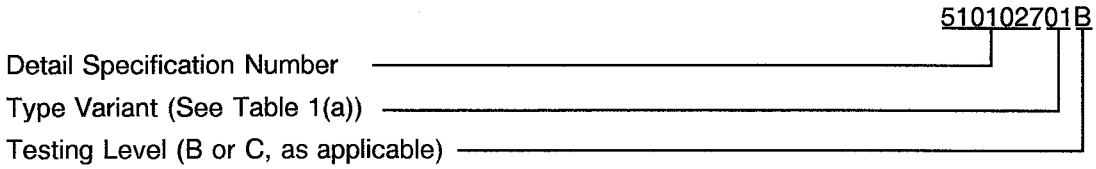
(c) Traceability Information.

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 (Δ) 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	Breakdown Voltage	$V_{(BR)}$	4021	$I_R = -10\mu A$	Note 1	-	V
2	D.C. Forward Voltage 1	V_{F1}	4011	$I_F = 500mA$ (Note 2) Variants 01, 04 $I_F = 200mA$ (Note 2) Variants 02, 05 Variants 03, 06	 - 0.87 -	 1.2 1.0 1.1	V
3	D.C. Forward Voltage 2	V_{F2}	4011	$I_F = 100mA$ (Note 2) Variants 02, 05	 0.82	 0.92	V
4	D.C. Forward Voltage 3	V_{F3}	4011	$I_F = 50mA$ (Note 2) Variants 02, 05	 0.76	 0.86	V
5	D.C. Forward Voltage 4	V_{F4}	4011	$I_F = 1.0mA$ (Note 2) Variants 02, 05	 0.54	 0.62	V
6	Reverse Current	I_R	4016	D.C. Method V_R = Note 3	-	100	nA

NOTES

1. See Column 5 of Table 1(a).
2. Pulsed measurement: $t_p = 300\mu s$ maximum.
3. See Column 6 of Table 1(a).

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
7	Total Capacitance	C_T	4001	$V_R = 0V$ $V_{sig} = 50mW(p-p)$ $f = 1.0MHz$ (Note 1) Variants 01, 02, 04, 05 Variants 03, 06	 - -	 2.5 5.0	pF
8	Reverse Recovery Time	t_{rr}	4031 Condition 'A'	$I_F = I_{RM} = 10$ to 100mA $I_{rr} = 10\%$ of I_{RM} (Note 1) Variants 01, 02, 04, 05 Variants 03, 06	 - -	 4.0 5.0	ns
9	Forward Recovery Time	t_{fr}	4026	$I_F = 200mA$ (Notes 1 and 2)	-	10	ns
10	Forward Recovery Voltage	V_{fr}	4026	$I_F = 200mA$ (Notes 1 and 2)	-	5.0	V(pk)
11	Thermal Impedance	$Z_{TH(J-C)}$	3101	$I_H = 1.0A$ $t_H = 10ms$ $I_M = 1.0mA$ to 10mA $t_{md} = 100\mu s$ maximum (Note 3)	-	25	°C/W

NOTES

1. Measurements shall be performed on a sample basis, LTPD7 or lower.
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(a) - ELECTRICAL MEASUREMENTS AT HIGH TEMPERATURE

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
6	Reverse Current	I_R	4016	D.C. Method V_R = Note 1	-	100	µA

NOTES
1. See Column 6 of Table 1(a).

TABLE 3(b) - ELECTRICAL MEASUREMENTS AT LOW TEMPERATURE

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
2	D.C. Forward Voltage 1	V_{F1}	4011	I_F = 500mA (Note 1) Variants 01, 04 I_F = 200mA (Note 1) Variants 02, 05 Variants 03, 06	 - - -	 1.3 1.1 1.2	V

NOTES
1. Pulsed measurement: t_p = 300µs maximum.

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 (Δ)	UNIT
1	Breakdown Voltage	$V_{(BR)}$	As per Table 2	As per Table 2	±15	%
2	D.C. Forward Voltage 1	V_{F1}	As per Table 2	As per Table 2	±0.03	V
6	Reverse Current	I_R	As per Table 2	As per Table 2	±15 or (1) ±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	80% of V_{RWM} (Note 1)	V
3	Duration	t	72	Hrs

NOTES
1. See Column 6 of Table 1(a).

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}	Note 1	V
3	Average Output Rectified Current	I_O	300 f = 50 to 60 Hz	mA

NOTES
1. See Column 6 of Table 1(a).

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 (Δ)	LIMITS		UNIT
						MIN.	MAX.	
2	D.C Forward Voltage 1	V_{F1}	As per Table 2	As per Table 2 Variants 01, 04, Variants 02, 05 Variants 03, 06	±0.03V	 - 0.87 -	 1.2 1.0 1.1	V
4	Reverse Current	I_R	As per Table 2	As per Table 2	±20nA 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 DEVIATIONS
Para. 4.2.2	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. Para. 9.8.2, Seal Test Gross Leak may be performed using Test Condition 'E'.