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Pages 1 to 17

DIODES, SILICON, FAST RECOVERY RECTIFIER,

BASED ON TYPE BYW56

ESA/SCC Detail Specification No. 5101/015



**space components
coordination group**

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**DOCUMENTATION CHANGE NOTICE**

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 2 and incorporates all modifications defined in Issue 2 and the following DCR's:-		
		Cover Page		None
		DCN		None
		Para. 1.4	: Text standardised	23476
		Table 1(a)	: 3rd column deleted	21021
		Table 1(b)	: No. 7, symbol corrected	23476
		Para. 2	: Reference to ESA/SCC Basic Specification No. 23500 added	21025
		Para. 4.2.2	: PIND deviation entry standardised	21043
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		Table 5	: Reference to H.T.R.B. deleted	23476
		Figure 5	: Reference to H.T.R.B. deleted	23476
		Para. 4.8.1	: Second sentence standardised	23476
		Para. 4.8.2	: Second sentence added	23476
		Table 6	: Format and numbering standardised	23476

**TABLE OF CONTENTS**

	<u>Page</u>
1. <u>GENERAL</u>	5
1.1 Scope	5
1.2 Component Type Variants	5
1.3 Maximum Ratings	5
1.4 Parameter Derating Information	5
1.5 Physical Dimensions	5
1.6 Functional Diagram	5
2. <u>APPLICABLE DOCUMENTS</u>	9
3. <u>TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS</u>	9
4. <u>REQUIREMENTS</u>	9
4.1 General	9
4.2 Deviations from Generic Specification	9
4.2.1 Deviations from Special In-process Controls	9
4.2.2 Deviations from Final Production Tests	9
4.2.3 Deviations from Burn-in and Electrical Measurements	10
4.2.4 Deviations from Qualification Tests	10
4.2.5 Deviations from Lot Acceptance Tests	10
4.3 Mechanical Requirements	10
4.3.1 Dimension Check	10
4.3.2 Weight	10
4.3.3 Terminal Strength	10
4.4 Materials and Finishes	10
4.4.1 Case	10
4.4.2 Lead Material and Finish	10
4.5 Marking	11
4.5.1 General	11
4.5.2 Lead Identification	11
4.5.3 The SCC Component Number	11
4.5.4 Traceability Information	11
4.5.5 Marking of Small Components	11
4.6 Electrical Measurements	11
4.6.1 Electrical Measurements at Room Temperature	11
4.6.2 Electrical Measurements at High and Low Temperatures	11
4.6.3 Circuits for Electrical Measurements	11
4.7 Burn-in Tests	12
4.7.1 Parameter Drift Values	12
4.7.2 Conditions for Burn-in	12
4.7.3 Electrical Circuits for Burn-in	12
4.8 Environmental and Endurance Tests	16
4.8.1 Electrical Measurements on Completion of Environmental Tests	16
4.8.2 Electrical Measurements at Intermediate Points and on Completion of Endurance Tests	16
4.8.3 Conditions for Operating Life Tests	16
4.8.4 Electrical Circuits for Operating Life Tests	16
4.8.5 Conditions for High Temperature Storage Test	16



TABLES

	<u>Page</u>
1(a) Type Variants	6
1(b) Maximum Ratings	6
2 Electrical Measurements at Room Temperature - D.C. Parameters	13
Electrical Measurements at Room Temperature - A.C. Parameters	13
3 Electrical Measurements at High and Low Temperatures	13
4 Parameter Drift Values	14
5 Conditions for Burn-in and Operating Life Test	15
6 Electrical Measurements at Intermediate Points and on Completion of Endurance Tests	17

FIGURES

1 Parameter Derating Information	7
2 Physical Dimensions	8
3 Functional Diagram	8
4 Circuits for Electrical Measurements	14
5 Electrical Circuit for Burn-in and Operating Life Test	15

APPENDICES (Applicable to specific Manufacturers only)

None.

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

This specification details the ratings, physical and electrical characteristics, test and inspection data for Diodes, Silicon, Fast Recovery Rectifier, based on Type BYW56. 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.

TABLE 1(a) - TYPE VARIANTS

VARIANT	BASED ON TYPE
01	BYW56

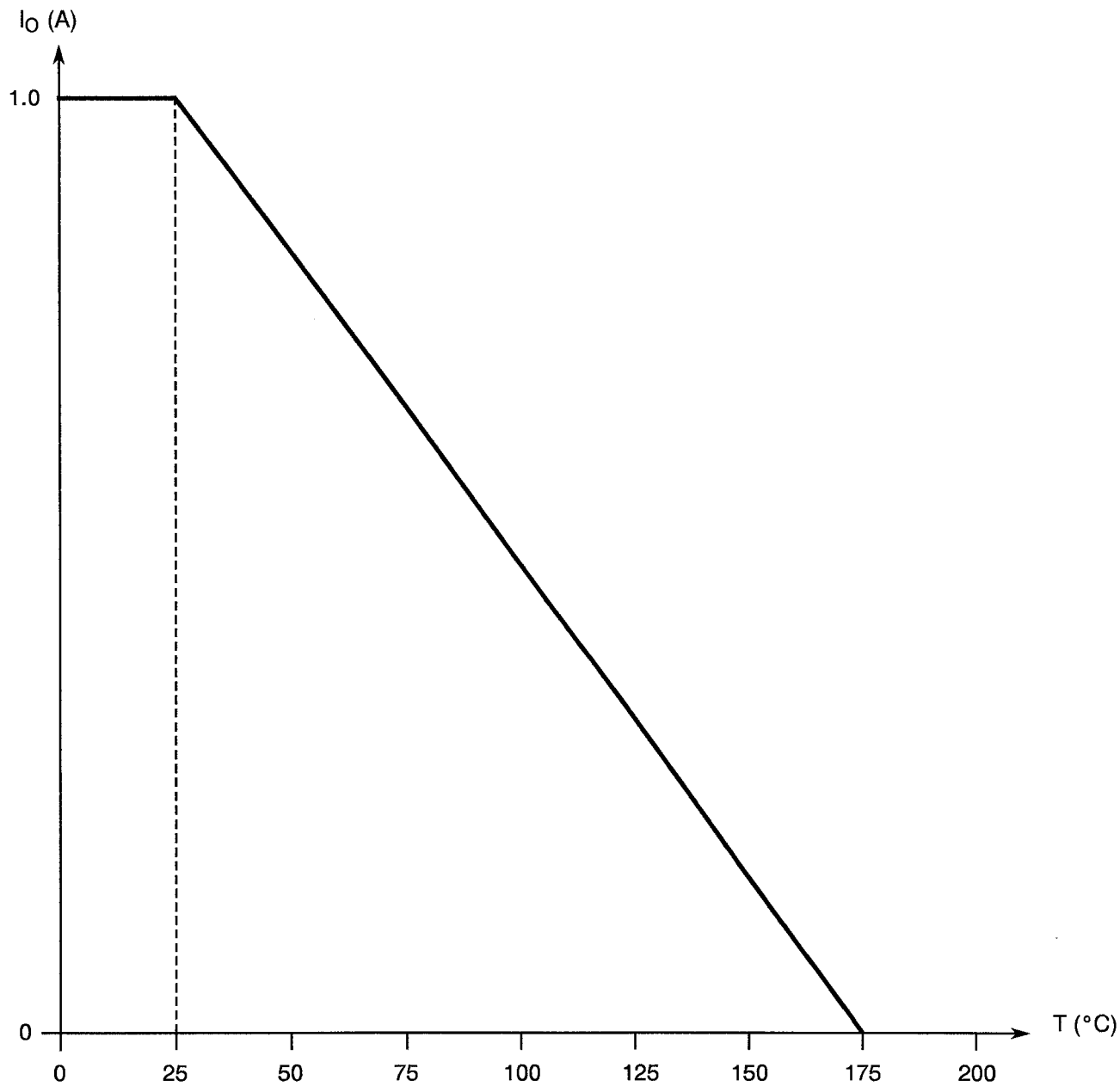
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATING	UNIT	REMARKS
1	Avalanche Voltage	V_{Rmax}	1600	V	$I_R = 100\mu A$
2	Average Output Current	I_O	1.0	A	Note 1
3	Peak Surge Forward Current	I_{FSM}	25	A	$T_{amb} = +100^\circ C$ Time = 8.3ms
4	Pulse Energy in Avalanche Mode	E_R	30	mWs	$I_R = 1.0A$ $T_{amb} = +22^\circ C$
5	Operating Junction Temperature Range	T_j	-55 to +175	$^\circ C$	-
6	Storage Temperature Range	T_{stg}	-65 to +175	$^\circ C$	-
7	Soldering Temperature	T_{sol}	+260	$^\circ C$	Time: 10s; Distance from case: $\geq 1.5mm$

NOTES

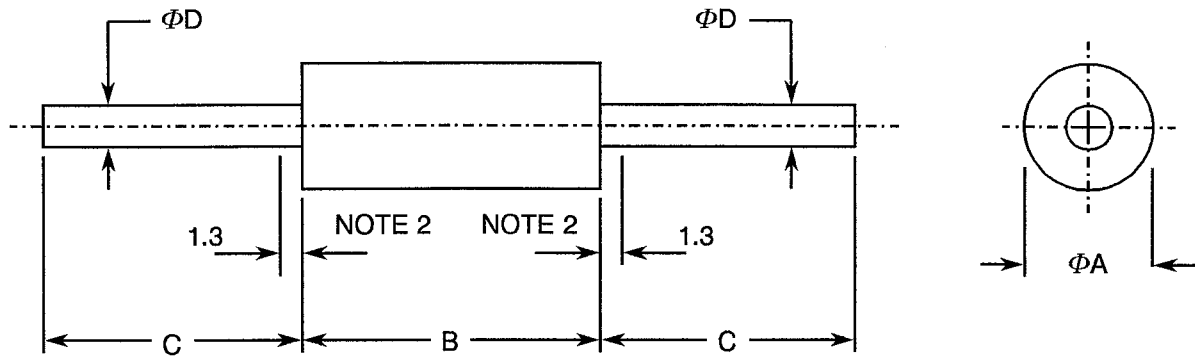
1. Rectifier operation: $f = 50Hz$. No heat-sinking through-leads.

FIGURE 1 - PARAMETER DERATING INFORMATION



Rated Average Output Current versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS

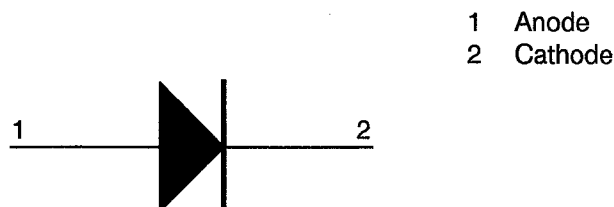


SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
ΦA	2.6	3.3	1
B	4.0	4.6	1
C	30.5	-	-
D	0.75	0.85	-

NOTES



1. Package contour optional within cylinder of diameter A and length B. Slugs, if any, shall be included within this cylinder but shall not be subject to the minimum limit of A.
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



NOTES

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

 	ESA/SCC Detail Specification No. 5101/015	PAGE 9 ISSUE 3
---	--	-------------------

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) ESA/SCC Basic Specification No. 23500, Requirements for Lead Materials and Finishes for Space Application.

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.

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 Detail 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 9.1, Internal Visual Inspection: Not applicable.
- (b) Para. 9.2.1, Bond Strength Test: Not applicable.
- (c) Para 9.2.2, Die Shear Test: Not applicable.
- (d) Para 9.6, Constant Acceleration: Not applicable. Instead, a pull test shall be performed under the following conditions:-
 Force 20N; $I_F = 100\text{mA}$. During this test, the V_F curve shall be observed and the V_F change shall not be more than 25mV.
- (e) Para 9.7, Particle Impact Noise Detection (PIND) Test: Not applicable.
- (f) Para 9.8, Seal Test: Not applicable. Instead, a fluorescence test shall be performed in accordance with MIL-STD-750, Method 1071, Condition 'E'.
- (g) Para 9.9.3: Just before "Electrical Measurements at Room Temperature", the following loads shall be applied to the component:-
 - (a) Surge: current load according to MIL-STD-750, Method 4066 and the following conditions:-
 $I_{\text{surge}} = 1.0\text{A}$; number of pulses: 5; duration of each pulse: 8.3ms; pulse form: sinusoidal.
 - (b) Pulse energy load according to the following conditions:-
 $I_R = 1.0\text{A}$; pulse form: sawtooth; $L = 120\text{mH}$; $T_{\text{amb}} = +22 \pm 3^\circ\text{C}$.

	ESA/SCC Detail Specification No. 5101/015	PAGE 10 ISSUE 3
---	--	--------------------

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

- (a) Para 7.1.1(a), H.T.R.B. Test: Not applicable.
- (b) Para 9.8, Seal Test: Not applicable.

4.2.4 Deviations from Qualification Tests (Chart IV)

- (a) Para. 9.13, Shock Test: Not applicable.
- (b) Para. 9.14, Vibration: Not applicable.
- (c) Para. 9.15, Constant Acceleration: Not applicable. Instead, a pull test shall be performed under the following conditions:-
 Force: 20N; $I_F = 100\text{mA}$.
 During this test, the V_F curve shall be observed and it shall not change more than 10mV.
- (d) Para 9.8, Seal Test: Not applicable and shall be replaced by a fluorescence test in accordance with MIL-STD-750, Method 1071, Test Condition 'E'.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

Identical to the requirements specified in Para 4.2.4 above. The Bond Strength and Die Shear tests shall not be performed.

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 0.4 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 : 18 Newtons.
- Duration : 3 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

Sintered glass.

4.4.2 Lead Material and Finish

The lead material shall be Copper clad wire, iron core Type CCFE 80 with Type '4' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500.

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. Each component shall be marked in respect of:-

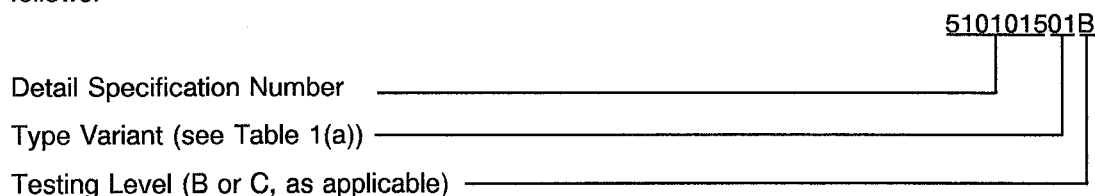
- (a) Lead Identification.
- (b) The SCC Component Number.
- (c) Traceability Information.

4.5.2 Lead Identification

Lead identification shall be as shown in Figures 2 and 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.

4.5.5 Marking of Small Components

When it is considered that the component is too small to accommodate the marking as specified above, as much as space permits shall be marked. The order of precedence shall be as follows:-

- (a) Lead identification.
- (b) The SCC Component number.
- (c) Traceability information.

The marking information in full shall accompany each component in its primary package.

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 $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$.

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.

	ESA/SCC Detail Specification No. 5101/015		PAGE 12 ISSUE 3
---	--	--	--------------------

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 Burn-in

The requirements for Burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5000. The conditions for Burn-in shall be as specified in Table 5 of this specification.

4.7.3 Electrical Circuits for Burn-in

Circuits for use in performing the Burn-in tests are shown in Figure 5 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	DC Forward Voltage	V_F	4011	$I_F = 1.0A$	-	1.0	V
2	DC Reverse Current	I_R	4016	$V_R = 1000V$	-	1.0	μA

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
3	Reverse Current Recovery Time	t_{rr}	4031	$I_F = I_R = 100mA$ $I_{rr} = 10mA$ (see Figure 4)	-	10	μs
4	Junction Capacitance	C_j	4001	$V_R = 4.0V$ $f = 1.0MHz$	-	25	pF

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
2	DC Reverse Current	I_R	4016	$V_R = 1000V$ $T_{amb} = +100^\circ C$	-	25	μA

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

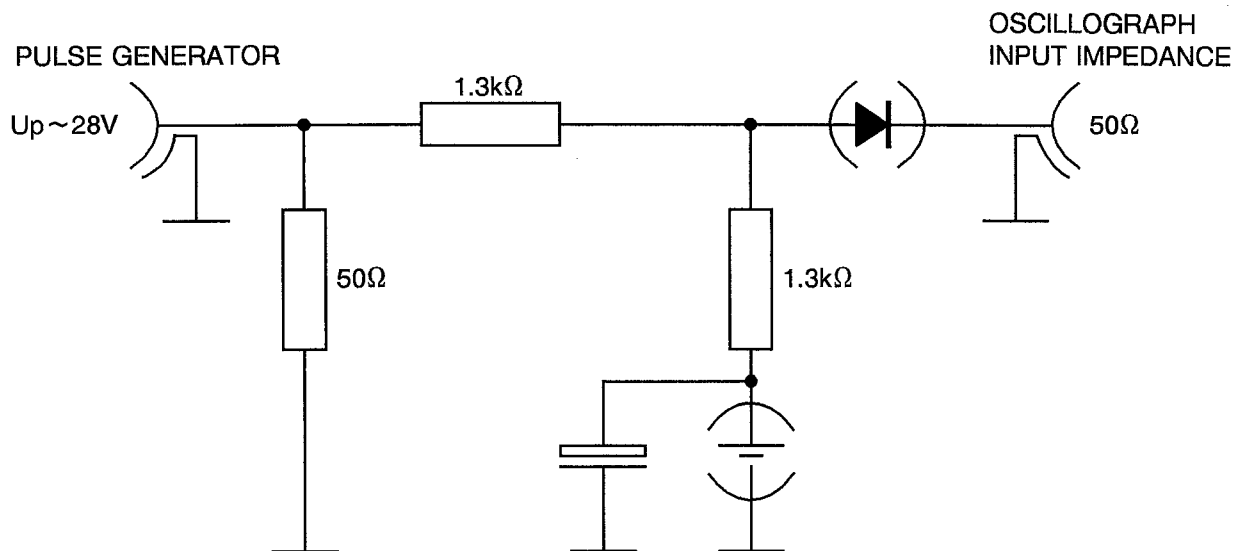


TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS	UNIT
1	DC Forward Voltage	V_F	As per Table 2	As per Table 2	± 100	mV
2	DC Reverse Current	I_R	As per Table 2	As per Table 2	± 0.2	μA

TABLE 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE TEST



No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Average Forward Current	$I_O = I_F$	1.0 (Note 1)	A
2	Ambient Temperature	T_{amb}	$+ 25 \pm 3$	°C
3	Working Voltage	V_{RM}	1000	V_{RRM} (2)

NOTES

1. Rectifier: I_O = sinusoidal; 50Hz; no heat-sinking through-leads.
2. Repetitive peak reverse voltage.

FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE TEST

Not applicable.

 	ESA/SCC Detail Specification No. 5101/015	PAGE 16 ISSUE 3
---	--	--------------------

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 $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

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 $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

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 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 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.

**SEA**ESA/SCC Detail Specification
No. 5101/015

PAGE 17

ISSUE 3

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

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
1	DC Forward Voltage	V_F	As per Table 2	As per Table 2	-	1.0	V
2	DC Reverse Current	I_R	As per Table 2	As per Table 2	-	1.0	μA