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Pages 1 to 16

**DIODES, POWER, SCHOTTKY BARRIER,**

**BASED ON TYPE 1N6391**

**ESA/SCC Detail Specification No. 5106/015**



**space components  
coordination group**

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**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 a Diode, Power, Schottky Barrier, based on Type 1N6391. 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 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**

After application of lead finish, all tests which are performed at a temperature that exceeds +125°C shall be carried out in a 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.



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

VARIANT	BASED ON TYPE	CASE	FIGURE	LEAD MATERIAL AND FINISH
01	1N6391	DO4	2	A3

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

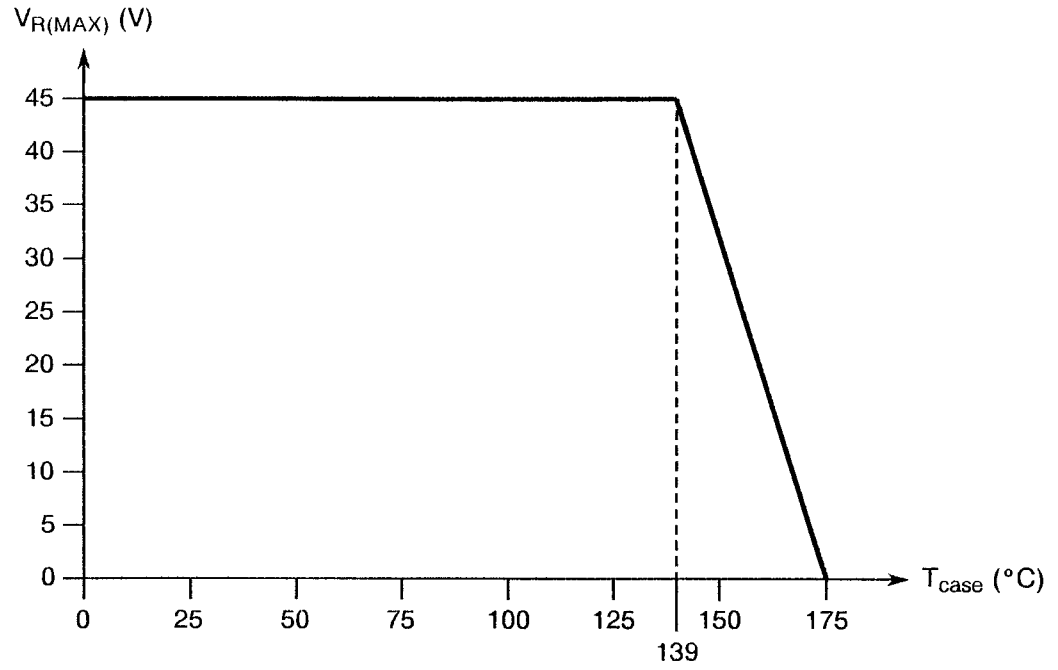
No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Reverse Voltage	$V_R$	45	V	Note 1
2	Peak Reverse Transient Voltage	$V_{RSM}$	54	Vpk	-
3	Average Output Rectified Current	$I_O$	22.5	A	Note 2
4	Forward Current (Peak Repetitive)	$I_{FRM}$	25	Apk	Note 3
5	Forward Surge Current	$I_{FSM}$	600	Apk	Note 4
6	Operating Temperature Range	$T_{amb}$	- 55 to + 175	°C	$T_{case}$
7	Storage Temperature Range	$T_{stg}$	- 55 to + 175	°C	-
8	Soldering Temperature	$T_{sol}$	+ 260	°C	Note 5
9	Thermal Resistance (Junction to Case)	$R_{TH(J-C)}$	2.0	°C/W	-

**NOTES**

- At  $T_{case} = +139^\circ\text{C}$ . For derating at  $T_{case} > +139^\circ\text{C}$ , see Figure 1.
- $T_{case} = +125^\circ\text{C}$ . Average current with an applied sine wave peak value equal to the magnitude of full rated  $V_R$ . Derate linearly at  $0.58\text{Adc}/^\circ\text{C}$  for  $T_{case} > +125^\circ\text{C}$ .
- $T_{case} = +125^\circ\text{C}$ . Average current with a 50% duty cycle square wave including reverse amplitude equal to the magnitude of full rated  $V_{RWM}$ . Derate linearly at  $0.64\text{Adc}/^\circ\text{C}$  for  $T_{case} > +125^\circ\text{C}$ .
- Peak duration 8.3ms.
- 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.



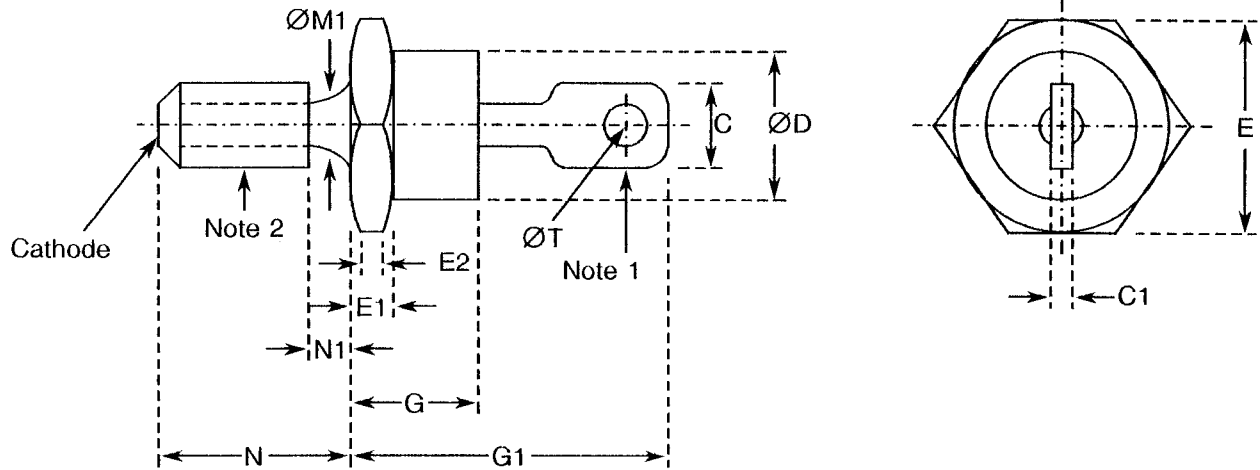
**FIGURE 1 - PARAMETER DERATING INFORMATION**



$V_{R(MAX)}$  versus Case Temperature



**FIGURE 2 - PHYSICAL DIMENSIONS**



SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
C	-	6.35	1
C1	0.46	1.65	
ØD	6.74	10.76	
E	10.67	11.18	
E1	1.91	4.44	3
E2	1.53	4.44	
G	7.62	10.28	
G1	15.24	20.32	4
ØM1	4.14	4.80	
N	10.72	11.50	
N1	-	1.98	
ØT	1.52	2.62	

**NOTES**

1. Angular orientation and contour of this terminal undefined.
2. Pitch diameter 10-32 UNF-2A (coated).
3. Chamfer or undercut on one or both ends of hexagonal portions is optional.
4. Length of incomplete or undercut threads of ØM1.

**FIGURE 3 - FUNCTIONAL DIAGRAM**



1. Anode
2. Cathode

**NOTES**

1. The cathode end shall be connected to the mounting stud.





#### 4. REQUIREMENTS

##### 4.1 GENERAL

The complete requirements for procurement of the diodes specified herein are 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": Shall not be performed.
- (b) Para. 9.2.2, "Die Shear Test": Shall not be performed.
- (c) Para. 9.9.3, "Electrical Measurements at Room Temperature": Prior to Table 2 a.c. measurements, a Peak Reverse Energy Test shall be performed as shown in Figure 4. The Schottky rectifier under test must be capable of absorbing the energy as defined, and on completion meet the electrical requirements defined in Table 2 a.c.
- (d) Para. 9.7, "Particle Impact Noise Detection (PIND) Test": Shall be performed in accordance with Condition 'A'.

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

None.

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

- (a) Para. 9.2.1, "Bond Strength": Shall not be performed.
- (b) Para. 9.2.2, "Die Shear Test": Shall be replaced by a Thermal Resistance Test in accordance with MIL-STD-750, Method 4081.

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

None.



#### 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 18 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' (Tension).  
Applied Force : 20 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

Metal case, hermetically sealed, similar to DO4.

##### 4.4.2 Lead Material and Finish

The lead material shall be Type 'A' with Type '3' 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 as 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) Lead Identification.
- (b) The SCC Component Number.
- (d) Traceability Information.

##### 4.5.2 Lead Identification

Lead 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:

	510601501B
Detail Specification Number _____	
Type Variant (see Table 1(a)) _____	
Testing Level (B or C, as applicable) _____	

#### 4.5.4 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of 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  $T_{amb} = +22 \pm 3$  °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. Unless otherwise specified, the measurements in Table 3(a) shall be performed at  $T_{case} = +125(+0 - 5)$  °C and the measurements in Table 3(b) at  $T_{case} = -55(+5 - 0)$  °C

#### 4.6.3 Circuits for Electrical Measurements

Circuits for use in performing electrical measurements 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 ( $\Delta$ ) applicable to the parameters scheduled, shall not be exceeded. In addition to these drift value requirements, the appropriate limit value specified for a given parameter in Table 2 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	Reverse Current	$I_R$	4016	$V_R = 45V_{pk}$ Note 1	-	15	mApk
2	Forward Voltage 1	$V_{F1}$	4011	$I_F = 50A_{pk}$ Note 1	-	0.68	Vpk
3	Forward Voltage 2	$V_{F2}$	4011	$I_F = 5.0A_{pk}$ Note 1	-	0.48	Vpk
4	Thermal Resistance	$R_{TH(J-C)}$	4081	$I_{F1} = 10A$ minimum to 30A maximum $I_{F2} = 100mA$ Notes 2 and 3	-	2.0	°C/W

**NOTES**

1. Pulsed measurement: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2.0\%$ .
2. To be performed instead of the Die Shear Test in Chart IV only.
3.  $T_{case}$  shall be held to equilibrium within the range of +20°C to +70°C during the power application and shall be measured at the hexagonal flat.

**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	Total Capacitance	$C_O$	4001	$V_R = 5.0V$ $100kHz \leq f \leq 1.0MHz$	-	2000	pF
6	Breakdown Voltage (Pulsed)	$V_{(BR)}$	4016	$I_R = 2.0A_{pk}$ Note 1	54	-	Vpk

**NOTES**

1. To be measured during Chart II only, as part of the Peak Reverse Energy Test, go-no-go.

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
1	Reverse Current	$I_R$	4016	$V_R = 45V_{pk}$ $T_{case} = +125^{\circ}C$ Note 1	-	40	mApk
1(a)	Reverse Current	$I_R$	4016	$V_R = 45V_{pk}$ $T_{case} = +175^{\circ}C$ Note 1	-	400	mApk

**NOTES**

1. Pulsed measurement: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2.0\%$ .

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
1	Reverse Current	$I_R$	4016	$V_R = 45V_{pk}$ $T_{case} = -55^{\circ}C$ Note 1	-	400	mApk
3	Forward Voltage	$V_{F2}$	4011	$I_F = 5.0A_{pk}$ $T_{case} = -55^{\circ}C$ Note 1	-	0.59	Vpk

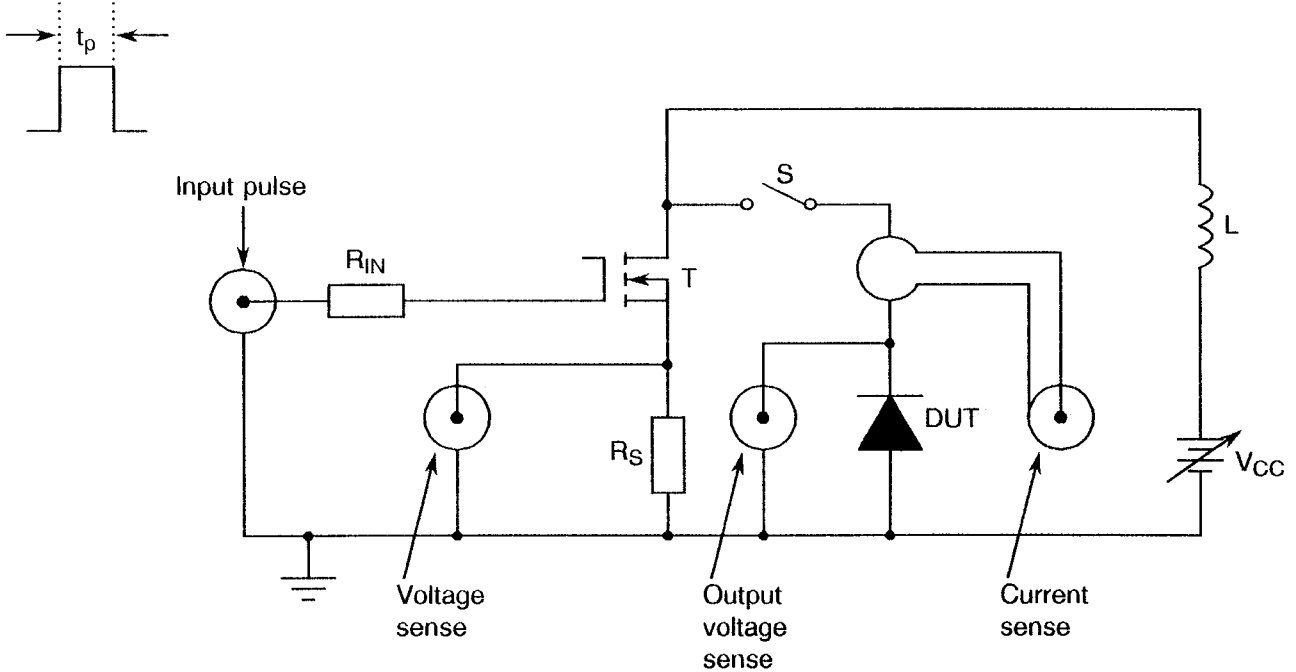
**NOTES**

1. Pulsed measurement: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2.0\%$ .



**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

PEAK REVERSE ENERGY TEST CIRCUIT



**NOTES**

1. Input Pulse
 

$V_{IN}$	= 10V	$R_{IN}$	= 50Ω, 1.0W.
$Z_{IN}$	= 50Ω	$R_S$	= 0.1Ω, 1.0W.
P.W.	≈ 30μs	$V_{CC}$	≈ 10V.
Duty Cycle	≤ 1.0%	L	= 260μH.
		T	= IRF130/2N6756 or equivalent.

2. Procedure:-

- (a) With S open, adjust pulse width to test current of 2.0A across  $R_S$ .
- (b) Close S, verify test current with current sense.
- (c) Verify Output Voltage (peak). Minimum 54V (pk).

**TABLE 4 - PARAMETER DRIFT VALUES**

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
1	Reverse Current	$I_R$	As per Table 2	As per Table 2	± 5.0 or (1) ± 100	mA %
2	Forward Voltage 1	$V_{F1}$	As per Table 2	As per Table 2	± 0.05	Vpk

**NOTES**

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

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

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	$T_{amb}$	+ 125( + 0 – 5)	°C
2	Reverse Voltage	$V_R$	36	V
3	Duration	t	48	Hrs

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

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Case Temperature	$T_{case}$	+ 125	°C
2	Average Forward Current	$I_O$	22.5	A
3	Peak Voltage	$V_{pk}$	45	Vpk
4	Frequency	f	50-60	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  $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$ .

4.8.2 Electrical Measurements at Intermediate Points and on Completion Endurance Tests

The parameters to be measured at intermediate points and on completion of endurance testing are as scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$ .

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 as specified in Table 5(b) of this specification.

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 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	Reverse Current	$I_R$	As per Table 2	As per Table 2	$\pm 5.0$ or (1) $\pm 100$	-	15	mApk %
2	Forward Voltage 1	$V_{F1}$	As per Table 2	As per Table 2	$\pm 0.05$	-	0.68	Vpk
3	Forward Voltage 2	$V_{F2}$	As per Table 2	As per Table 2	-	-	0.48	Vpk

**NOTES**

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