



**DIODES, SILICON, POWER RECTIFIER,  
FAST RECOVERY,  
BASED ON TYPES 1N5615, 1N5617, 1N5619,  
1N5621, 1N5623, 1N5615US, 1N5617US, 1N5619US,  
1N5621US, 1N5623US  
ESCC Detail Specification No. 5103/021**

**ISSUE 1  
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**ESA/SCC Detail Specification No. 5103/021**



**space components  
coordination group**

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**APPENDICES (Applicable to specific Manufacturers only)**

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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, Power Rectifier, Fast Recovery, based on Types 1N5615, 1N5617, 1N5619, 1N5621, 1N5623, 1N5615US, 1N5617US, 1N5619US, 1N5621US and 1N5623US. 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 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 precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling.

The components are categorised as Class 3 with a Minimum Critical Path Failure Voltage of > 15 000V.

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





**SGC**

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

(1) VARIANT	(2) BASED ON TYPE	(3) CASE	(4) FIGURE	(5) BREAKDOWN VOLTAGE $I_R = 50\mu A$ $V_{(BR)}(V)$	(6) WORKING PEAK REVERSE VOLTAGE $V_{RWM}(V)$	(7) REVERSE RECOVERY TIME $t_{rr}(ns)$	(8) CAPACITANCE  C(pF)	(9) LEAD/END-CAP MATERIAL AND FINISH
01	1N5615	A	2(a)	220	200	150	45	A3 or A4
02	1N5617	A	2(a)	440	400	150	35	A3 or A4
03	1N5619	A	2(a)	660	600	250	25	A3 or A4
04	1N5621	A	2(a)	880	800	300	20	A3 or A4
05	1N5623	A	2(a)	1100	1000	500	15	A3 or A4
06	1N5615	AA	2(b)	220	200	150	45	K3 or K4
07	1N5617	AA	2(b)	440	400	150	35	K3 or K4
08	1N5619	AA	2(b)	660	600	250	25	K3 or K4
09	1N5621	AA	2(b)	880	800	300	20	K3 or K4
10	1N5623	AA	2(b)	1100	1000	500	15	K3 or K4
11	1N5615US	MELF	2(c)	220	200	150	45	O4
12	1N5617US	MELF	2(c)	440	400	150	35	O4
13	1N5619US	MELF	2(c)	660	600	250	25	O4
14	1N5621US	MELF	2(c)	880	800	300	20	O4
15	1N5623US	MELF	2(c)	1100	1000	500	15	O4



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

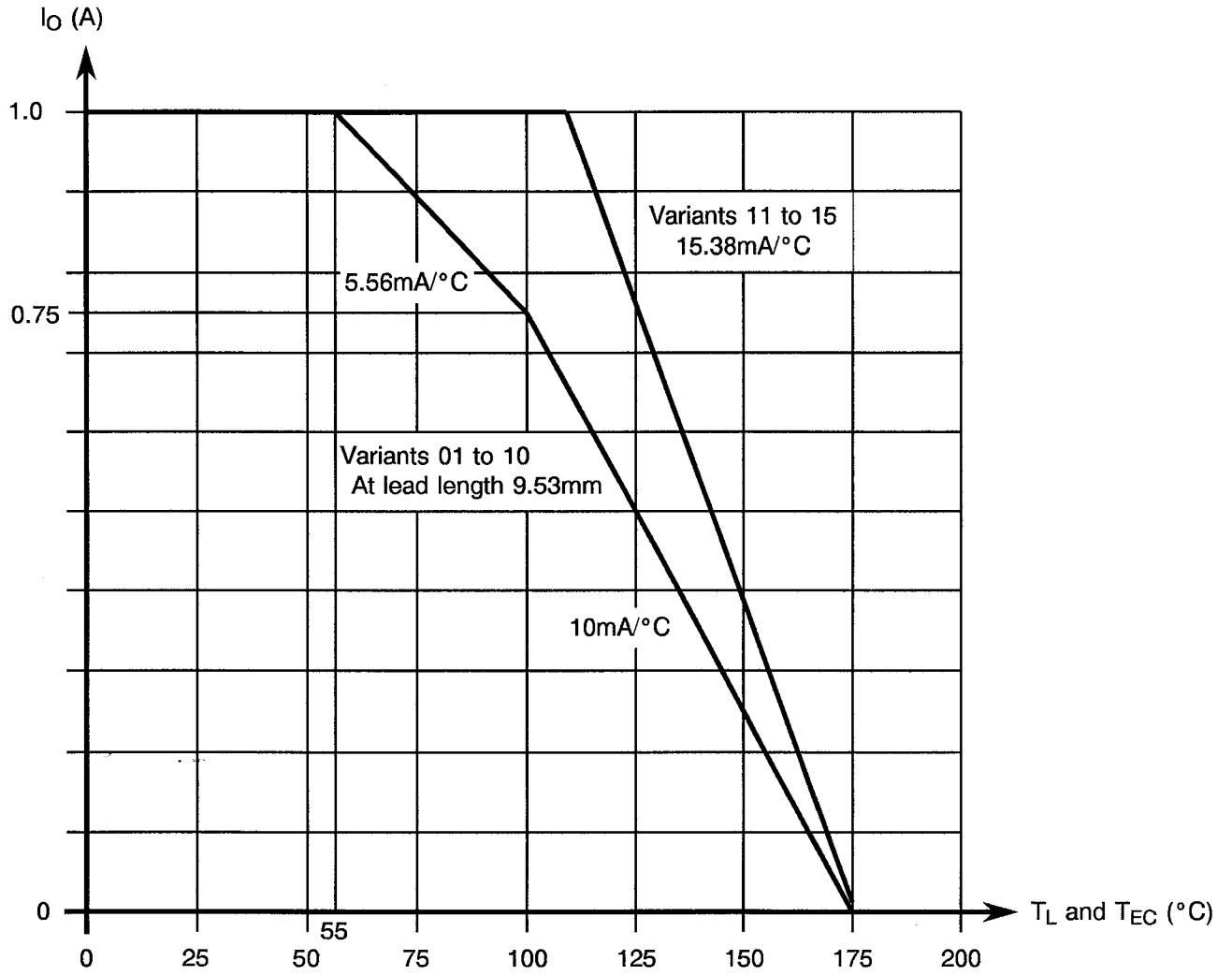
NO.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Forward Surge Current	$I_{FSM}$	25	A(pk)	At $T_{amb} \leq +100^{\circ}C$ $I_O = 750mA$ (Note 1)
2	Working Peak Reverse Voltage	$V_{RWM}$	Note 2	V(pk)	At $T_{amb} \leq +25^{\circ}C$
3	Average Output Rectified Current	$I_O$	1.0 (3)	A	Notes 5 and 6
			0.75 (4)		
4	Operating Temperature Range	$T_{op}$	- 65 to + 175	$^{\circ}C$	$T_{amb}$
5	Storage Temperature Range	$T_{stg}$	- 65 to + 175	$^{\circ}C$	
6	Soldering Temperature Variants 01 to 10 Variants 11 to 15	$T_{sol}$	+ 260	$^{\circ}C$	Note 7 Note 8
			+ 245		
7	Thermal Resistance (Junction to Lead)	$R_{TH(J-L)}$	38	$^{\circ}C/W$	Note 5
8	Thermal Resistance (Junction to End-Cap)	$R_{TH(J-EC)}$	7.0	$^{\circ}C/W$	

**NOTES**

1. Sinusoidal, with period = 8.3ms maximum.
2. See Column 6 of Table 1(a).
3. At  $T_L \leq +55^{\circ}C$  for Variants 01 to 10 and  $T_{EC} = +110^{\circ}C$  for Variants 11 to 15. For derating at  $T_L > +55^{\circ}C$  to  $T_L \leq +100^{\circ}C$  and  $T_{EC} > +110^{\circ}C$ , see Figure 1.
4. At  $T_L = +100^{\circ}C$  for Variants 01 to 10. For derating at  $T_L > +100^{\circ}C$ , see Figure 1.
5. Leads shall be maintained at ambient temperature 9.53mm from the body.
6. No special mounting, heat-sinking or forced-air flow across exposed areas of the device is necessary.
7. 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.
8. Duration 10 seconds maximum and the same termination shall not be resoldered until 3 minutes have elapsed.



**FIGURE 1 - PARAMETER DERATING INFORMATION**

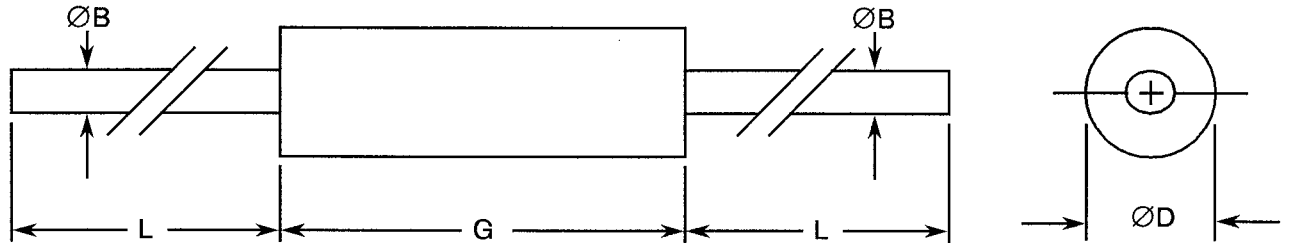


Average Output Rectified Current versus Temperature



**FIGURE 2 - PHYSICAL DIMENSIONS**

**FIGURE 2(a) - VARIANTS 01 TO 05**

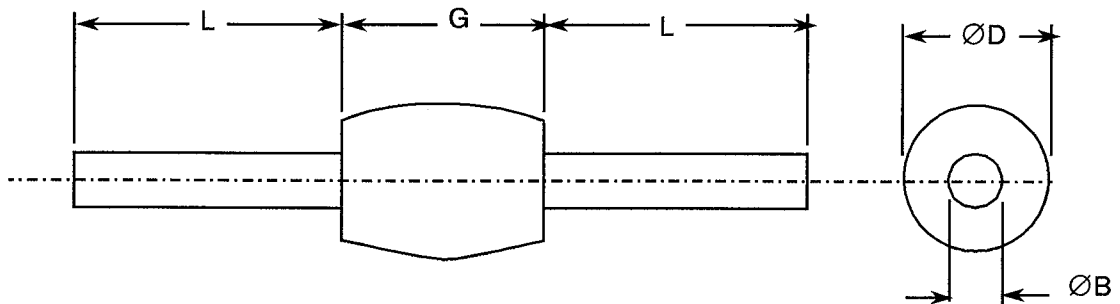


SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
ØB	0.66	0.84	-
ØD	1.65	2.79	1
G	3.18	6.35	2
L	17.78	33.02	-

**NOTES**

1. Dimension ØD shall be measured at the largest diameter.
2. Dimension G shall include the sections of the lead over which the diameter is uncontrolled. This uncontrolled area is defined as the zone between the edge of the diode body and extending 1.27mm onto the leads.

**FIGURE 2(b) - VARIANTS 06 TO 10**



SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
ØB	0.75	0.85	-
ØD	2.70	3.50	1
G	3.90	4.60	2
L	25.00	31.70	-

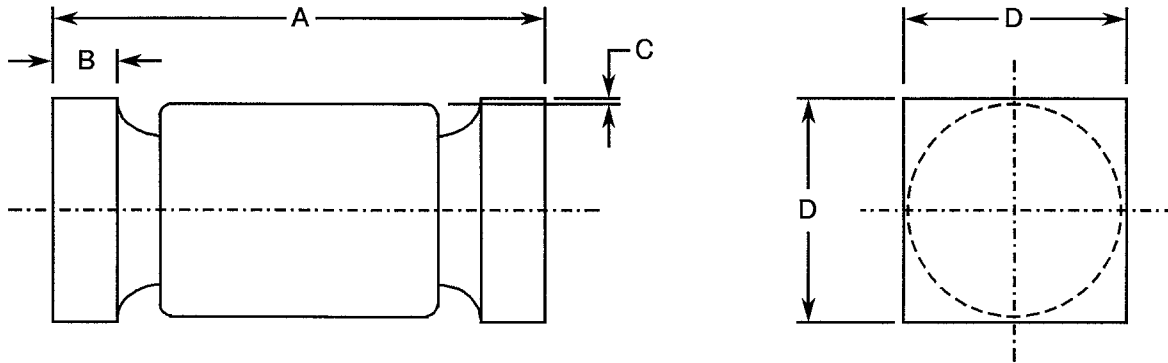
**NOTES**

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



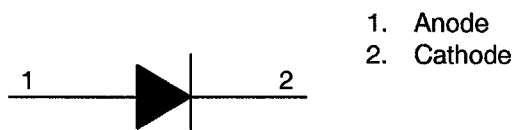
**FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)**

**FIGURE 2(c) - VARIANTS 11 TO 15**



SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	4.27	5.08
B	0.48	0.71
C	0.08	-
D	2.31	2.62

**FIGURE 3 - FUNCTIONAL DIAGRAM**



**NOTES**

1. For Variants 01 to 10, the cathode end shall be marked with a contrasting coloured ring.

For Variants 11 to 15, 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 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 Test: Shall not be performed.
- (b) Para. 9.2.2, Die-shear Test: Shall not be performed.
- (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 6 of this specification.
- (d) Para. 9.6, Constant Acceleration: Shall not be performed.
- (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:

- $I_{FSM} = 25A(pk)$ .
- $I_O = 750mA$ .
- $V_{RWM} = \text{See Column 6 of Table 1(a)}$ .
- At  $T_{amb} = +25^{\circ}C$ .

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.

- (h) Immediately following the Surge Current test specified in (g) above, a "Scope-display Evaluation" shall be made of the reverse breakdown characteristics as follows:
  - Display calibration: 5.0 to 20 $\mu$ A and 50 to 200V per division.
  - Reverse current over the knee:  $\geq 50$  and  $< 500\mu A$  (pk).

Any discontinuity or dynamic instability of the trace shall be cause for rejection.



#### 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 0.4 grammes for Variants 01 to 05, 0.5 grammes for Variants 06 to 10 and 0.3 grammes for Variants 11 to 15.

#### 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 10, the test conditions shall be as follows:-

Test Condition : 'A' (Tension).  
Applied Force : 10 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

The case shall be hermetically sealed and have a sintered glass body.

#### 4.4.2 Lead Material and Finish

For Variants 01 to 10, the lead material shall be either Type 'A' or Type 'K' 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).

For Variants 11 to 15, the termination material shall be Type '0' 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:-

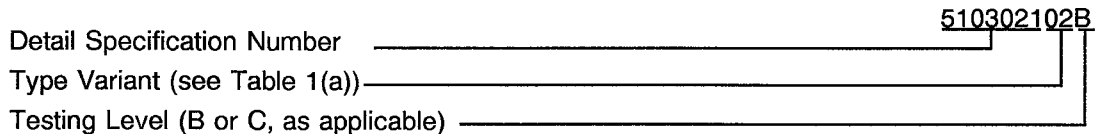
- (a) Polarity.
- (b) The SCC Component Number.
- (c) Traceability Information.

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

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 the electrical measurements listed in Tables 2 and 3 are shown in Figure 4 of this specification.

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, the measurements shall be performed at  $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$ . 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 shown 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	TEST METHOD MIL-STD-750	TEST CONDITION	LIMITS		UNIT
					MIN.	MAX.	
1	Forward Voltage	$V_F$	4011	$I_F = 3.0A$ (Note 1)	0.8	1.6	V(pk)
2	Reverse Current	$I_R$	4016	D.C. Method $V_R = V_{RWM} = \text{Note 2}$	-	0.5	$\mu A$
3	Breakdown Voltage	$V_{(BR)}$	4021	$I_R = -50\mu A$	(3)	-	V

**NOTES**

1. Pulsed Measurement: Pulse length  $\leq 300\mu s$ ; Duty Cycle  $\leq 2\%$ .
2. See Column 6 of Table 1(a).
3. See Column 5 of Table 1(a).

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

No.	CHARACTERISTICS	SYMBOL	TEST METHOD MIL-STD-750	TEST CONDITION	LIMITS		UNIT
					MIN.	MAX.	
4	Reverse Recovery Time	$t_{rr}$	4031 Cond. 'B'	$I_F = 0.5A$ $I_R = 1.0A$ $I_{RR} = 0.25A$ See Figure 4(a) (Note 1)	-	(2)	$\mu s$
5	Capacitance	C	4001	$V_R = 12V$ $0.1MHz \leq f < 1.0MHz$ (Note 1)	-	(3)	pF
6	Thermal Impedance	$Z_{TH(J-C)}$	3101	$I_H = 10A$ $t_H = 10ms$ $I_M = 10mA$ $t_{md} = 100\mu s$ maximum (Note 4)	-	4.5	$^{\circ}C/W$

**NOTES**

1. Measurements shall be performed on a sample basis, LTPD = 7 or lower.
2. See Column 7 of Table 1(a).
3. See Column 8 of Table 1(a).
4. During Chart II only.



**TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES**

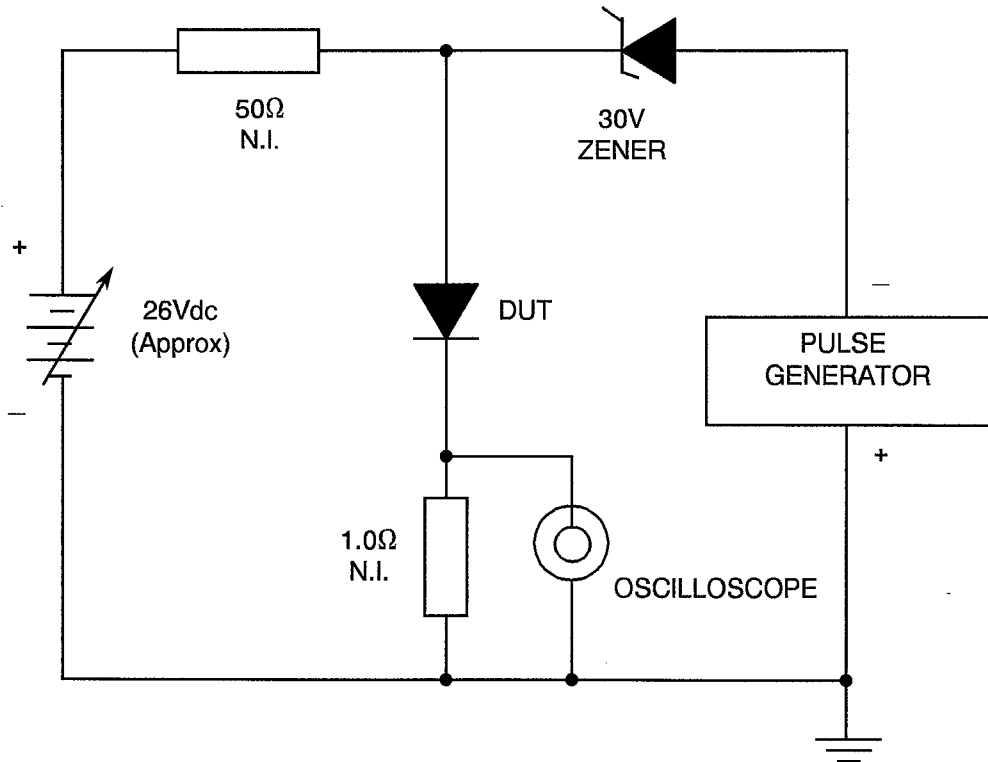
No.	CHARACTERISTICS	SYMBOL	TEST METHOD MIL-STD-750	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
2	Reverse Current	$I_R$	4016	D.C. Method $V_R = V_{RWM} = \text{Note 1}$ $T_{amb} = +100(+0-5)^\circ\text{C}$ (Note 2)	-	25	$\mu\text{A}$

**NOTES**

1. See Column 6 of Table 1(a).
2. Measurements at low temperature are not applicable.

**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

**FIGURE 4(a) - REVERSE RECOVERY TIME**



**NOTES**

1. Oscilloscope :  $t_r \leq 7.0\text{ns}$ ;  $Z_{IN} = 1.0\text{M}\Omega$ ,  $22\text{pF}$ .
2. Pulse Generator :  $t_r \leq 10\text{ns}$ ;  $Z_S = 50\Omega$ .

**TABLE 4 - PARAMETER DRIFT VALUES**

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITION	CHANGE LIMITS ( $\Delta$ )	UNIT
1	Forward Voltage	$V_F$	As per Table 2	As per Table 2	$\pm 100$	mV
2	Reverse Current	$I_R$	As per Table 2	As per Table 2	$\pm 100$ 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 (+0 - 5)	$^{\circ}\text{C}$
2	Reverse Voltage	$V_R$	Variants 01, 06, 11 : 160 Variants 02, 07, 12 : 320 Variants 03, 08, 13 : 480 Variants 04, 09, 14 : 640 Variants 05, 10, 15 : 800	V
3	Duration	t	72	Hours

**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	$^{\circ}\text{C}$
2	Working Peak Reverse Voltage	$V_{RWM}$	Note 1	V
3	Average Output Rectified Current	$I_o$	1.0 f = 50 to 60 Hz	A

**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. 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 test.

**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 conditions for high temperature storage 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	Forward Voltage	$V_F$	As per Table 2	As per Table 2	$\pm 0.1V$	0.8	1.6	V(pk)
2	Reverse Current	$I_R$	As per Table 2	As per Table 2	$\pm 100nA$ or (1) $\pm 100\%$	-	0.5	$\mu A$

**NOTES**

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



**APPENDIX 'A'**

AGREED DEVIATIONS FOR MICROSEMICONDUCTOR CORPORATION (U.S.A.)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 4.2.2 Para. 4.2.4	Internal (Pre-encapsulation) Visual Inspection may be performed to Method 2074 of MIL-STD-750.
Para. 4.2.2) Para. 4.2.3) Para. 4.2.4) Para. 4.2.5)	External Visual Inspection may be performed to Method 2071 of MIL-STD-750.
Para. 4.2.2	Thermal Shock tests may be performed to Method 1056, Condition 'A' of MIL-STD-750.

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**APPENDIX 'B'**Page 1 of 1AGREED 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'.