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Pages 1 to 16

DIODES, SWITCHING,  
BASED ON TYPE 1N3600

ESA/SCC Detail Specification No. 5101/007



space components  
coordination group

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		SCCG Chairman	ESA Director General or his Deputy
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		Table of Contents	: After Figures, Appendices heading added	21019
		Para. 1.2	: New text	21021
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		Table 6	: Format and numbering standardised	23476



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'A'	June'94	P1. Cover page P2A DCN P12. Table 2	: Page added : Max. limit of $I_B$ changed to 0.1 $\mu$ A	None None 221167
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**APPENDICES (Applicable to specific Manufacturers only)**

None.

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1. **GENERAL**

1.1 **SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Switching Diodes, based on Type 1N3600. 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.

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.

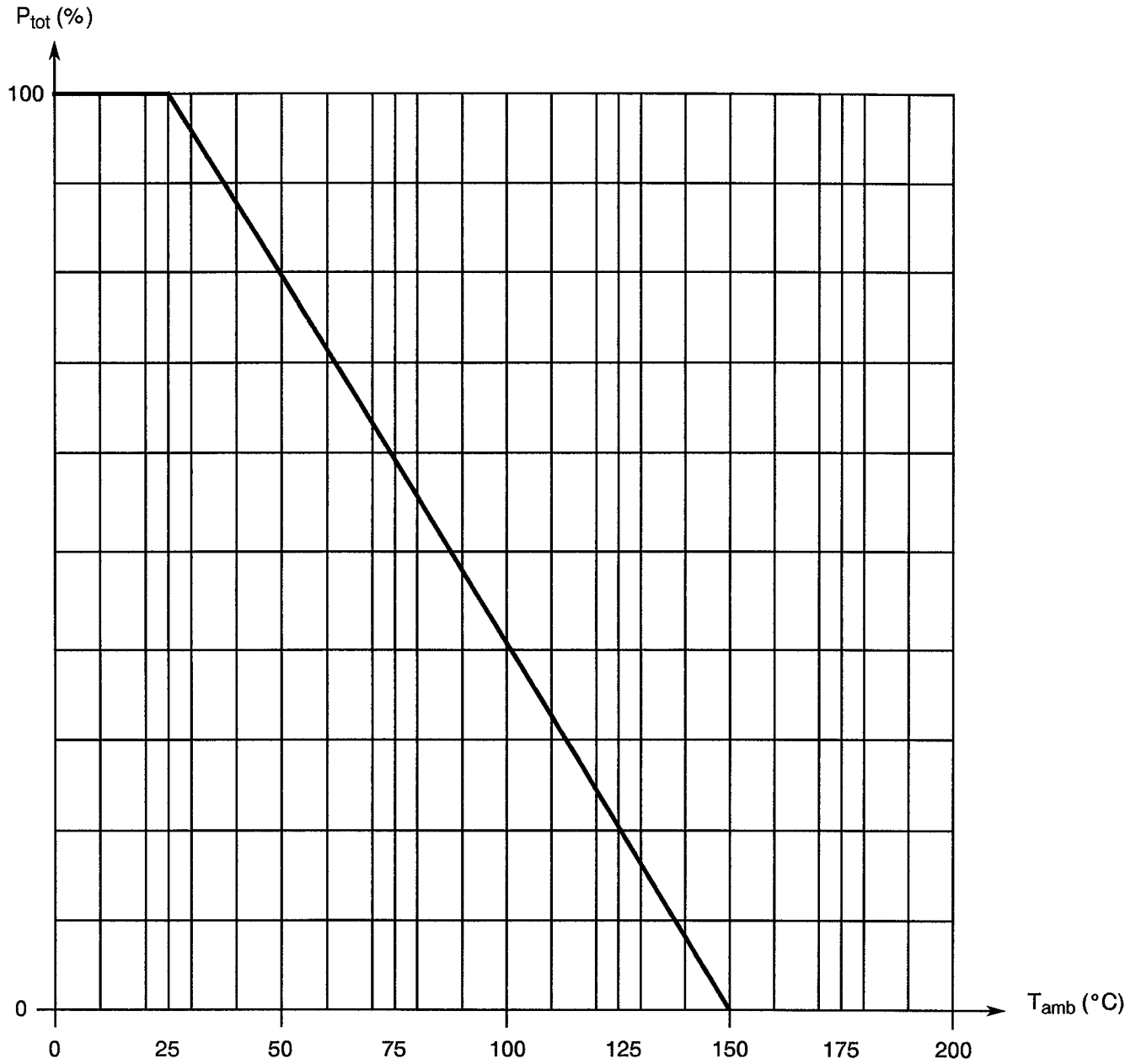
**TABLE 1(a) - TYPE VARIANTS**

VARIANT	BASED ON TYPE
01	1N3600

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

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATING	UNIT	REMARKS
1	DC Reverse Voltage	$V_R$	75	V	-
2	Total Power Dissipation	$P_{tot}$	500	mW	-
3	Average Rectified Current	$I_O$	200	mA	-
4	DC Forward Current	$I_F$	400	mA	-
5	Peak Forward Current (Recurrent)	$I_{FM}$	900	mA	-
6	Forward Surge Current	$I_{FSM}$	500	mA	$t_p = 1.0s$
			4.0	A	$t_p = 1.0\mu s$
7	Operating Temperature Range	$T_{op}$	-55 to +150	°C	-
8	Storage Temperature Range	$T_{stg}$	-65 to +175	°C	-
9	Soldering Temperature	$T_{sol}$	+260	°C	Time: < 10s; Distance to case: > 1.5mm

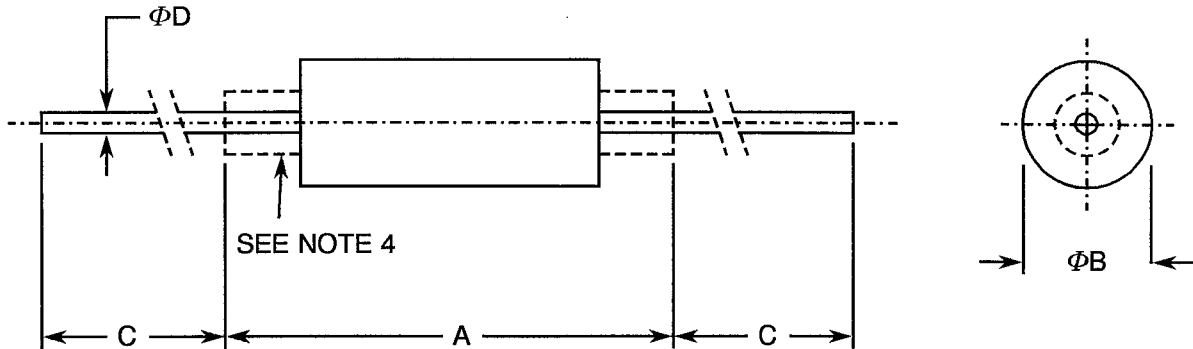
**FIGURE 1 - PARAMETER DERATING INFORMATION**



Power Dissipation versus Temperature



**FIGURE 2 - PHYSICAL DIMENSIONS**

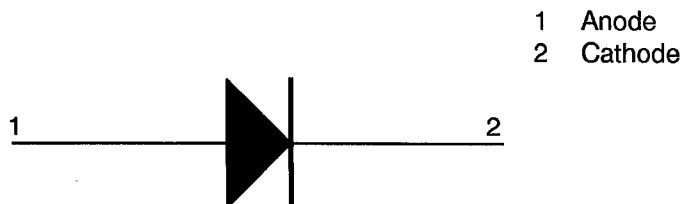


SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
A	4.96	7.62	-
B	1.98	2.72	2, 3
C	25.40	38.10	1
D	0.46	0.56	5

**NOTES**


1. Both leads shall be within the specified limits (see Para. 3.3.1).
2. The maximum diameter of dimension B shall apply for dimension A.
3. The minimum diameter of dimension B shall apply over at least 1.91mm of dimension A.
4. Ferrule is optional for dimension A.
5. The specified lead diameter applies in the zone between 1.27mm and 25.4mm from the diode body to the end of the lead. Outside of this zone, the lead diameter shall not exceed diameter B.

**FIGURE 3 - FUNCTIONAL DIAGRAM**



**NOTES**

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

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**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 are 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. 9.2.1, Bond Strength Test: Shall not be performed.
- (b) Para. 9.7, Particle Impact Noise Detection (PIND) Test: Not applicable.
- (c) Para. 9.5.1, Thermal Shock Test: Shall be performed in accordance with Test Method 107, Condition 'B' of MIL-STD-202.

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


- (a) Para. 9.12, Radiographic Inspection: Not applicable.

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

- (a) Para. 9.2.3, Bond Strength Test: Shall not be performed.

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

None.

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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 0.25 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 : 5.0 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

Glass, hermetically sealed.

4.4.2 Lead Material and Finish

The lead material shall be Type 'C' with Type '3' 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:-

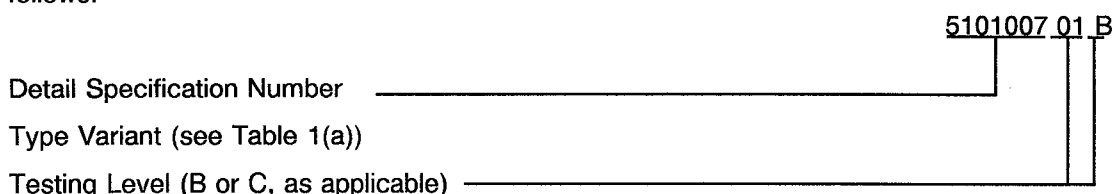
- (a) Lead Identification.
- (b) The SCC Component Number.
- (c) Traceability Information.

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  $T_{amb} = +22 \pm 3$  °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.

**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 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 H.T.R.B. and Power Burn-in**

The requirements for H.T.R.B. and Power Burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5000. The conditions for H.T.R.B. and Power Burn-in shall be as specified in Tables 5(a) and 5(b) of this specification.

**4.7.3 Electrical Circuits for H.T.R.B. and Power Burn-in**

Circuits for use in performing the H.T.R.B. and Power Burn-in tests are shown in Figures 5(a) and 5(b) 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 1	$V_{F1}$	4011	$I_F = 10\text{mA}$	0.66	0.74	V
2	DC Forward Voltage 2	$V_{F2}$	4011	$I_F = 50\text{mA}$ (1)	0.77	0.86	V
3	DC Forward Voltage 3	$V_{F3}$	4011	$I_F = 200\text{mA}$ (1)	0.87	1.0	V
4	DC Reverse Current	$I_R$	4016	$V_R = 50\text{V}$	-	0.1	$\mu\text{A}$
5	Breakdown voltage	$V_{BR}$	4021	$I_R = 5.0\mu\text{A}$	75	-	V

**NOTES**

- Pulsed operation,  $t_p = 300\mu\text{s}$ ;  $\delta > 2\%$ .

**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	Capacitance	C	4001	$V_R = 0$ $f = 1.0\text{MHz}$ Note 1	-	2.5	pF
6	Reverse Current Recovery Time	$t_{rr}$	4031, Condition 'B'	$I_F = I_R = 10\text{-}200\text{mA}$ $R_L = 100\Omega$ $i_{rr} = 0.1 I_F$	-	4.0	ns

**NOTES**

- Measurements shall be performed on a sample basis, Inspection Level 2, AQL = 2.5%.

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
4	DC Reverse Current	$I_R$	4016	$T_{amb} = +150^{\circ}C$ $V_R = 50V$	-	100	$\mu A$

**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

Not applicable

**TABLE 4 - PARAMETER DRIFT VALUES**

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS	UNIT
3	DC Forward Voltage 3	$V_{F3}$	As per Table 2	As per Table 2	$\pm 100$	mV
4	DC Reverse Current	$I_R$	As per Table 2	As per Table 2	$\pm 100$ or (1) $\pm 100$	% nA

**NOTES**

1. Whichever is the greater.

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

No.	CHARACTERISTIC	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	$T_{amb}$	+ 150 (Note 1)	°C
2	Reverse Voltage	$V_R$	50	V
3	Duration	t	72	Hrs

**NOTES**

- At the end of the H.T.R.B. Burn-in,  $T_{amb}$  shall be decreased to room temperature and the reverse-bias shall remain applied until  $T_{amb}$  is less than +35°C.

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


No.	CHARACTERISTIC	SYMBOL	CONDITION	UNIT
1	Working Voltage	$V_{WK}$	50V(PK)	V
2	Average Rectified Current	$I_O$	200	mA
3	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 TEST**

Not applicable.

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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(b) 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(b) 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.



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**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.	
3	DC Forward Voltage 3	$V_{F3}$	As per Table 2	As per Table 2	0.85	1.05	V
4	DC Reverse Current	$I_R$	As per Table 2	As per Table 2	-	0.20	$\mu A$