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**DIODES, SWITCHING, RECTIFIER, LOW POWER,
HIGH VOLTAGE,
BASED ON TYPE F60A**

ESA/SCC Detail Specification No. 5101/012



**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 1 and incorporates all modifications defined in the following DCR's:-		
		Cover Page		None
		DCN		None
		Table of Contents	: After Figures, Appendices heading added	21019
		Para. 1.3	: Table reference amended to "1(b)"	23476
		Para. 1.4	: Text standardised	23476
		Table 1(b)	: No. 6, symbol corrected	23476
		Para. 2	: Reference to ESA/SCC Basic Specification No. 23500 added	21025
		Para. 4.1	: Second paragraph added	21019
		Para. 4.2.1	: Title corrected	23476
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		Table 2 D.C.	: Format, sequence standardised	23476
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		Figure 5	: First Title numbered "5(b)" and corrected	23476
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		Para. 4.8.2	: Second sentence added	23476
		Para. 4.8.3	: Table reference amended to "5(b)"	23476
		Para. 4.8.4	: Figure reference amended to "5(b)"	23476
		Table 6	: Format and numbering standardised	23476

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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 Diodes, Switching, Rectifier, Low Power, High Voltage, based on Type F60A. 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**

All tests to be performed at a temperature that exceeds +125°C shall be carried out in a 100% inert atmosphere.

TABLE 1(a) - TYPE VARIANTS

VARIANT	BASED ON TYPE	LEAD MATERIAL AND/OR FINISH
01	F60A	1
02	F60A	3 or 4

TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATING	UNIT	REMARKS
1	Forward Surge Current	I_{FSM}	2.5	A	
2	DC Blocking Voltage	V_R	6000	V	
3	Working Peak Reverse Voltage	V_{RM}	6000	V	
4	Average Output Rectified Current	I_O	50	mA	Note 1
5	Preak Forward Surge Current	I_{FSM}	2.5	A	
6	Operating Temperature Range	T_{op}	- 65 to + 175	°C	T_{amb}
7	Storage Temperature Range	T_{stg}	- 193.8 to + 200	°C	
8	Soldering Temperature	T_{sol}	+ 245	°C	Note 2

NOTES

1. Up to $T_C = +55^\circ\text{C}$. For derating of I_O with T_C see Figure 1.
2. Duration 10 seconds maximum at a distance of not less than 1.5mm from the can and the same lead shall not be resoldered until 3 minutes have elapsed.



FIGURE 1 - AVERAGE OUTPUT RECTIFIED CURRENT DERATING WITH CASE TEMPERATURE

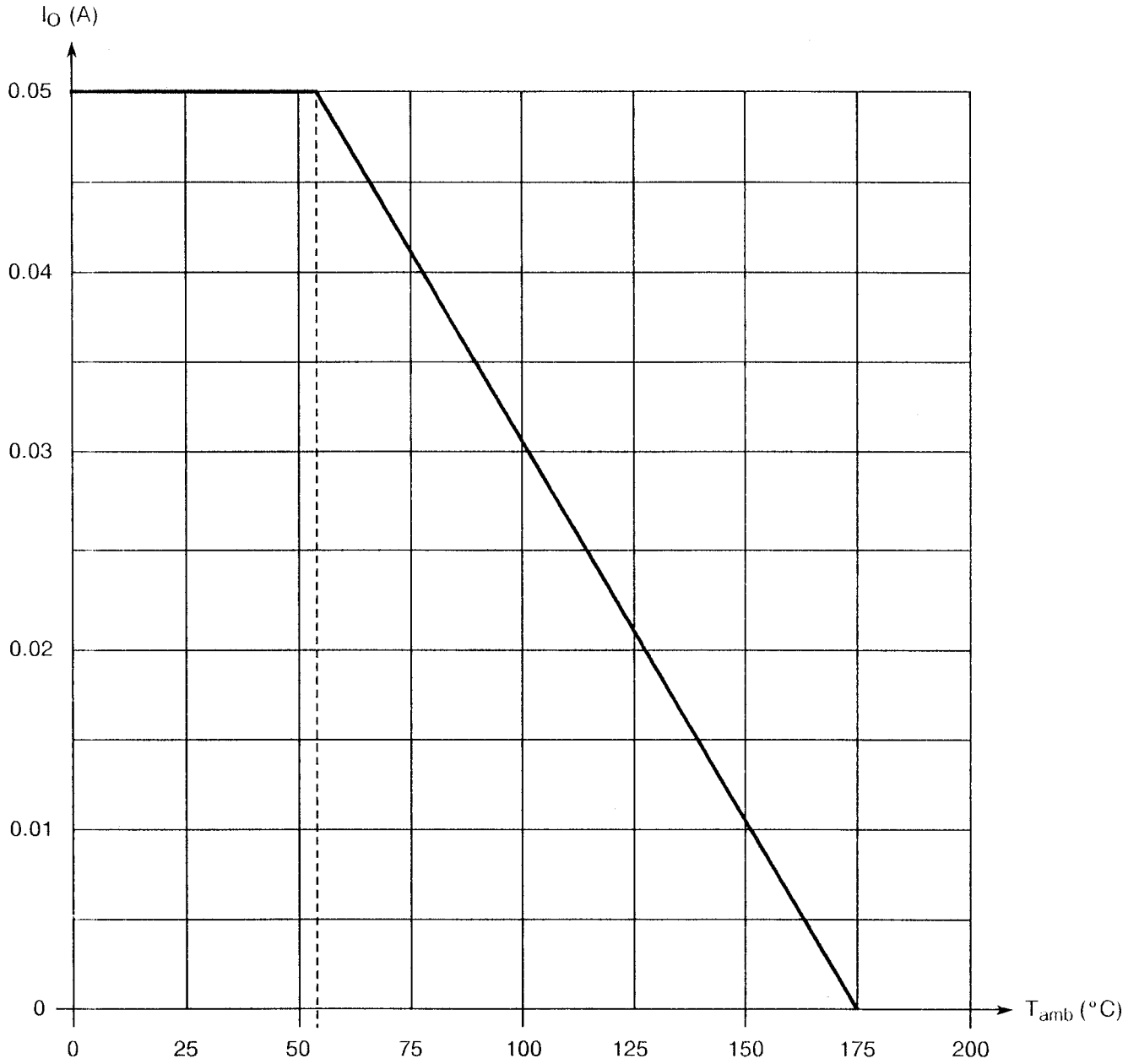
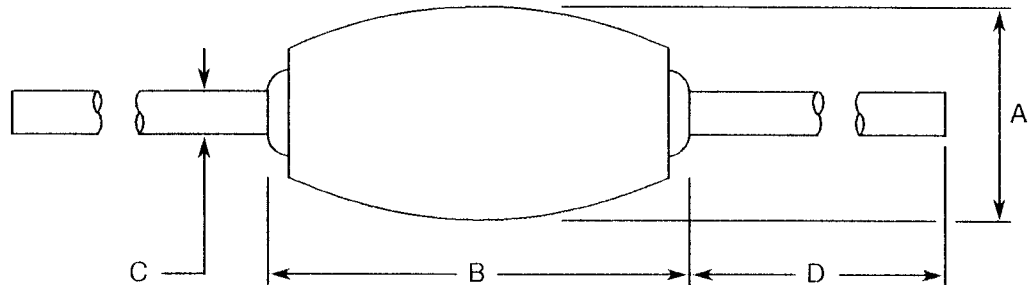


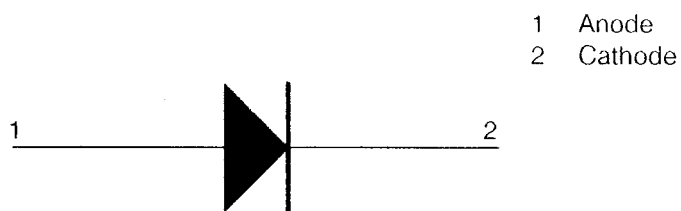


FIGURE 2 - PHYSICAL DIMENSIONS





SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	1.397	1.778
B	6.35	6.985
C	0.4064	0.5842
D	25.4	31.75

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) MIL-STD-105, Sampling Procedures and Tables for Inspection by Attributes.
- (d) 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. 9.2.1, Bond Strength Test : Not applicable
- (b) Para. 9.6, Constant Acceleration: Not applicable.
- (c) Para. 9.8.1, Seal Test Fine: Not Applicable.
- (d) Para. 9.8.2, Seal Test, Gross: Change Test Condition to 'E'.

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

- (a) Para. 7.1.1(b), Burn-in Duration: Shall be 240 hours.
- (b) The following test shall be added after Para. 9.9.2, Electrical Measurements at High and Low Temperatures, and before Para. 9.9.3, Electrical Measurements at Room Temperature:-

Surge Current in accordance with MIL-STD-750, Test Method 4066.

The following test conditions shall apply:-

T_{amb}	=	+ 100°C.
I_{FSM}	=	750mA.
Number of pulses	=	10.
Pulse rate	=	1 pulse/minute.
t_p	=	1/120 second.
V_R	=	1000V.
I_O	=	25mA.



4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.2.3, Bond Strength Test : Not applicable

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 1.0 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 : 13.4 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

The case shall be a corrosion-resistant fused metal oxide, inorganic, homogeneous compound.

4.4.2 Lead Material and Finish

The lead material shall be 99.9% pure silver with Type '1' or Type '3' or 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.

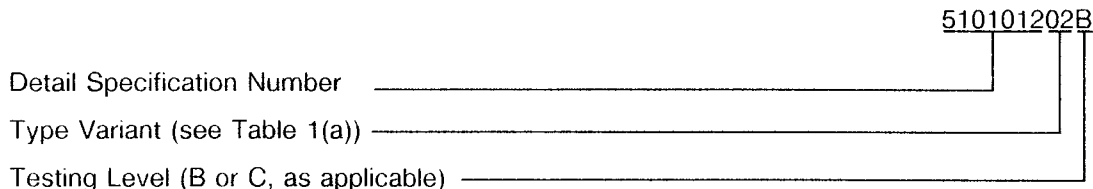
4.5.2 Lead Identification

Lead identification shall be as shown in 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.

4.5.5 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, where applicable, in MIL-STD-750.

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 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

Not applicable.

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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	$I_F = 50\text{mA}$	-	8.0	Vdc
2	DC Reverse Current	I_R	4016	$V_R = 6000\text{Vdc}$	-	0.25	μAdc
3	Breakdown Voltage	$V_{(BR)}$	4021	$I_r = 10\mu\text{Adc (1)}$	6000	-	Vdc

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
4	Capacitance	C	4001	$V_R = 100\text{V}$ $f = 1.0\text{MHz}$ Note 1	-	1.0	pF
5	Reverse Current Recovery Time	t_{rr}	4031	$I_R = 100\text{mA}$ Note 2	-	300	ns

NOTES

1. If more than 20 units have to be measured, the measurements shall be performed on a sample basis in accordance with Inspection Level II, Table IIA, AQL = 1.0 of MIL-STD-105.
2. t_{rr} is measured when rectifier recovers to 25mA.

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	$T_{amb} = +100(+0 - 5) ^\circ C$ $V_R = 6000Vdc$	-	10	μA_{dc}

NOTES

- Measurements at low temperature are not applicable.

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
2	DC Reverse Current	I_R	As per Table 2	As per Table 2	± 0.1 or (1) ± 100	μA_{dc} %

NOTES

- Whichever is the greater.

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

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+ 100(+ 0 – 5)	°C
2	DC Blocking Voltage	V_R	6000	V
3	MIL-STD-750 Test Method 1038	-	'A'	-
4	Duration	t	96	Hrs

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

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	25 ± 3.0	°C
2	DC Blocking Voltage	V_R	6000	V
3	MIL-STD-750 Test Method 1038	-	'B'	-
4	Rectified Current	I_O	50	mA
5	Duration	t	240	Hrs

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.



- 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 6. 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 during and on completion of endurance tests are as 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
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.

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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.	
1	DC Forward Voltage	V_F	As per Table 2	As per Table 2	-	8.0	Vdc
2	DC Reverse Current	I_R	As per Table 2	As per Table 2	-	0.25	μ Adc
3	Reverse Recovery Time	t_{rr}	As per Table 2	As per Table 2	-	300	ns