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Pages 1 to 21

DIODE, MICROWAVE, SCHOTTKY,

MIXER, SILICON

BASED ON TYPES BAT 14 AND BAT 15

ESA/SCC Detail Specification No. 5106/014

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 1	June 1991		
Revision 'A'	February 1992		
Revision 'B'	November 1993		
Revision 'C'	September 1995		

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	CHANGE Reference	CHANGE Item	Approved DCR No.
'A'	Feb. '92	P1. P2. P11.	Cover Page DCN Para. 4.2.4 : Reference to Bond Strength and Die-Shear deleted	None None 23499
'B'	Nov. '93	P1. P2. P3. P10. P11. P12. P13.	Cover Page DCN Table of Contents : Amended as relevant Para. 4.2.2 : Deviation about vibration added Para. 4.2.4 : Para. amended Para. 4.2.5 : Para. amended : Para. 4.4 transferred to Page 12 Para. 4.4 transferred from Page 11; Paras. 4.6 and 4.6.1 transferred to Page 13 Paras. 4.6 and 4.6.1 transferred from Page 12	None None None 221080 221080 221080 None None None
'C'	Sept. '95	P1. P2. P10. 	Cover Page DCN Header : Specification Number corrected Para. 4.2.2 : New Deviation (a) added and existing deviations renumbered	None None None 221258

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1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Diode, Microwave, Schottky, Mixer, Silicon, based on Types BAT 14 and BAT 15. It shall be read in conjunction with ESA/SCC Generic Specification No. 5010, the requirements of which are supplemented herein.

1.2 TYPE VARIANTS

Variants of the basic 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 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.

These components are categorised as Class 1 with a Minimum Critical Path Failure Voltage of 40Volts.

TABLE 1(a) - TYPE VARIANTS

(1) Variant	(2) Based on Type	(3) Figure	(4) Reverse Current I_R (μA)	(5) Forward Voltage V_F (V)		(6) Series Resistance R_F (Ω)	(7) Total Capacitance C_T (pF)	(8) Noise Figure NF (dB)
				I_F = 0.01mA	I_F = 1.0mA			
01	BAT 14 - 013	2(a)	1.0	0.31	0.44	3.5	0.60	5.5
02	BAT 14 - 014	2(b)	1.0	0.31	0.44	3.5	0.60	5.5
03	BAT 14 - 033	2(a)	1.0	0.31	0.44	4.5	0.60	6.5
04	BAT 14 - 034	2(b)	1.0	0.31	0.44	4.5	0.60	6.5
05	BAT 14 - 043	2(a)	1.0	0.32	0.45	4.0	0.35	5.5
06	BAT 14 - 044	2(b)	1.0	0.32	0.45	4.0	0.35	5.5
07	BAT 14 - 063	2(a)	1.0	0.32	0.45	5.0	0.35	6.5
08	BAT 14 - 064	2(b)	1.0	0.32	0.45	5.0	0.35	6.5
09	BAT 14 - 073	2(a)	1.0	0.33	0.46	5.5	0.30	5.5
10	BAT 14 - 074	2(b)	1.0	0.33	0.46	5.5	0.30	5.5
11	BAT 14 - 093	2(a)	1.0	0.33	0.46	6.5	0.30	6.5
12	BAT 14 - 094	2(b)	1.0	0.33	0.46	6.5	0.30	6.5
13	BAT 14 - 103	2(a)	1.0	0.35	0.48	7.0	0.25	6.0
14	BAT 14 - 104	2(b)	1.0	0.35	0.48	7.0	0.25	6.0
15	BAT 14 - 113	2(a)	1.0	0.35	0.48	8.0	0.25	7.5
16	BAT 14 - 114	2(b)	1.0	0.35	0.48	8.0	0.25	7.5
17	BAT 14 - 123	2(a)	1.0	0.36	0.50	9.0	0.22	9.0
18	BAT 14 - 124	2(b)	1.0	0.36	0.50	9.0	0.22	9.0
19	BAT 15 - 013	2(a)	5.0	0.15	0.28	3.5	0.60	5.5
20	BAT 15 - 014	2(b)	5.0	0.15	0.28	3.5	0.60	5.5
21	BAT 15 - 033	2(a)	5.0	0.15	0.28	4.5	0.60	6.5
22	BAT 15 - 034	2(b)	5.0	0.15	0.28	4.5	0.60	6.5
23	BAT 15 - 043	2(a)	5.0	0.17	0.30	4.0	0.35	5.5
24	BAT 15 - 044	2(b)	5.0	0.17	0.30	4.0	0.35	5.5
25	BAT 15 - 063	2(a)	5.0	0.17	0.30	5.0	0.35	6.5
26	BAT 15 - 064	2(b)	5.0	0.17	0.30	5.0	0.35	6.5
27	BAT 15 - 073	2(a)	5.0	0.18	0.31	5.5	0.30	5.5
28	BAT 15 - 074	2(b)	5.0	0.18	0.31	5.5	0.30	5.5
29	BAT 15 - 093	2(a)	5.0	0.18	0.31	6.5	0.30	6.5
30	BAT 15 - 094	2(b)	5.0	0.18	0.31	6.5	0.30	6.5
31	BAT 15 - 103	2(a)	1.0	0.19	0.32	7.0	0.25	6.0
32	BAT 15 - 104	2(b)	1.0	0.19	0.32	7.0	0.25	6.0
33	BAT 15 - 113	2(a)	1.0	0.19	0.32	8.0	0.25	7.5
34	BAT 15 - 114	2(b)	1.0	0.19	0.32	8.0	0.25	7.5
35	BAT 15 - 123	2(a)	1.0	0.20	0.33	9.0	0.22	9.0
36	BAT 15 - 124	2(b)	1.0	0.20	0.33	9.0	0.22	9.0

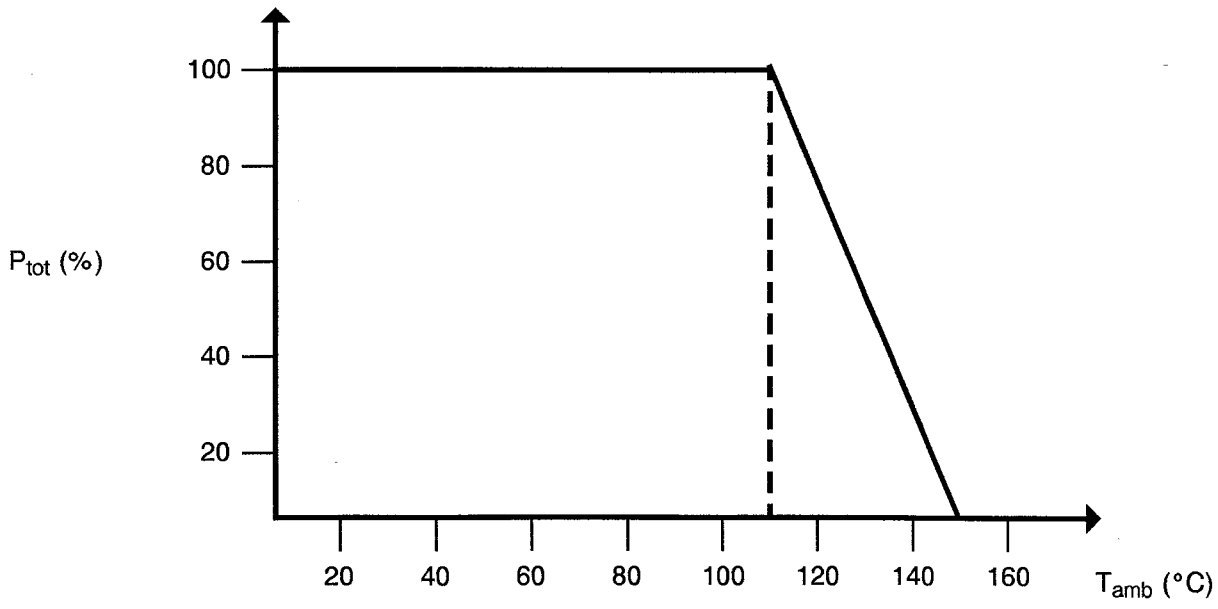
TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristic	Symbol	Maximum Ratings	Unit	Remarks
1	D.C. Reverse Voltage	V_R	3.0	V	
2	D.C. Forward Current Variants 01 to 08 and 19 to 26 Variants 09 to 18 and 27 to 36	I_F	 100 50	mA	
3	Power Dissipation Variants 01 to 08 and 19 to 26 Variants 09 to 18 and 27 to 36	P_{tot}	 100 50	mW	Note 1
4	Burn-out Energy Variants 01 to 08 and 19 to 26 Variants 09 to 16 and 27 to 34 Variants 17 to 18 and 35 to 36	E_B	 5.0 2.0 1.0	Erg	Note 2
5	Operating Temperature Range	T_{op}	-55 to +150	°C	T_{amb}
6	Storage Temperature Range	T_{stg}	-55 to +175	°C	
7	Soldering Temperature	T_{sol}	+220	°C	Note 3

NOTES

1. At T_{amb} = 110°C. For derating at T_{amb} > +110°C, see Figure 1.
2. Quoted for a single discharge of Torry line during the first 2.4ns current flow in the forward direction. General criterion for burn-out energy is a 3dB increase in Noise Figure.
3. Duration 5 seconds maximum (at a distance of not less than 1.5mm from the body for the T1 package) and the same termination shall not be resoldered until 3 minutes have elapsed.

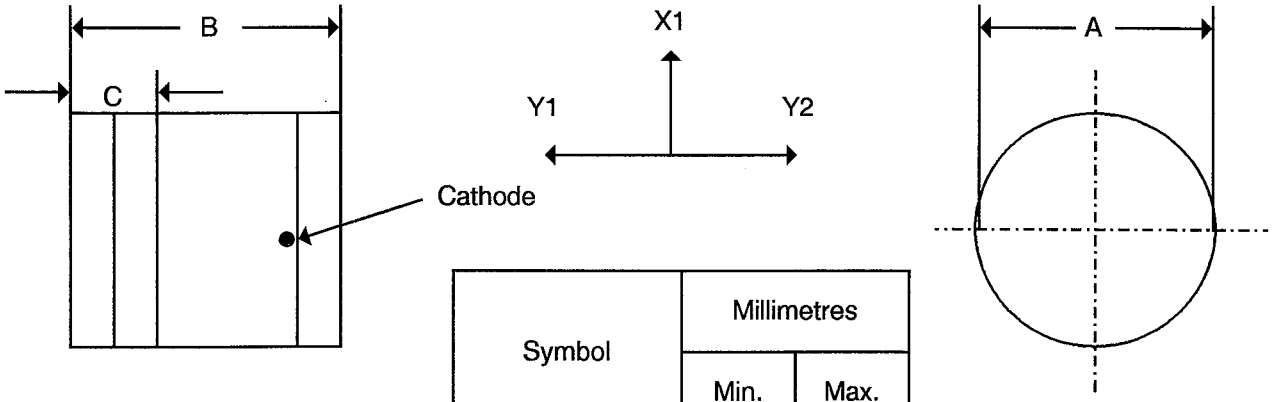
FIGURE 1 - PARAMETER DERATING INFORMATION



Power Dissipation versus Temperature

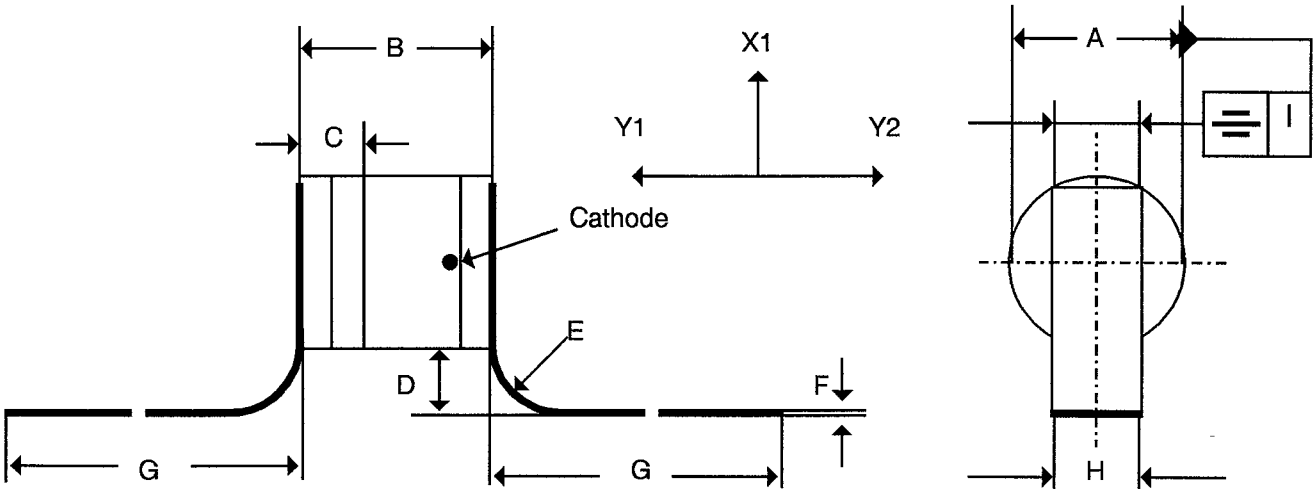
FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) - "T" PACKAGE



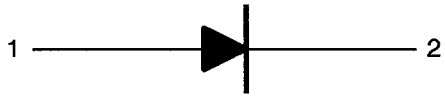
Symbol	Millimetres	
	Min.	Max.
A	1.30	1.45
B	1.15	1.35
C	-	0.40

FIGURE 2(b) - "T1" PACKAGE



Symbol	Millimetres	
	Min.	Max.
A	1.30	1.45
B	1.15	1.35
C	-	0.40
D	0.10	0.50
E	-	0.30
F	0.06	0.10
G	5.50	-
H	0.40	0.60
I	-	0.25

FIGURE 3 - FUNCTIONAL DIAGRAM



1. Anode
2. Cathode

NOTES 1. The cathode end shall be marked with a black dot or band.

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. 5010 for Discrete Microwave Semiconductor Components.

(b) MIL-STD-750, Test Methods 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. In addition the following symbols are used:

C_T = Total Capacitance

NF = Noise Figure

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. 5010 for Discrete Microwave Semiconductor Components. 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

(a) Para. 5.3, Wafer Lot Acceptance: Prior to the start of high reliability processing, 3 randomly chosen encapsulated samples shall be submitted to the User for wafer approval. These samples shall be shipped to the Orderer. When the User has tested the samples and granted his approval, the Orderer shall inform the Manufacturer who will then continue processing the wafer to ESA/SCC requirements.

4.2.2 Deviations from Final Production Tests (Chart II)

(a) Para. 6.2, Pre-burn-in: Shall not be performed.

(b) Para. 9.6, Constant Acceleration: Shall not be performed.

(c) Para. 9.14, Vibration, Variable Frequency: Shall not be performed.

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

(a) Para. 7.1.1(a), High Temperature Reverse Bias Burn-in: Shall be performed at 50% of rated V_R.

(b) Para. 9.12, Radiographic Inspection: Shall be performed in X and Z axes only, exposure 100kV, duration 5 minutes.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Subgroup I tests: Shall not be performed.

(b) Para. 9.5, Thermal Shock Test: Shall be performed in Subgroup II prior to Moisture Resistance Test.

(c) Subgroup II tests: Shall be performed on 12 diodes.

(d) Para. 9.23, Special Testing: Shall not be performed.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.13, Shock Test: Shall not be performed.

(b) Para. 9.14, Vibration: Shall not be performed.

(c) Para. 9.15, Constant Acceleration: Shall not be performed.

(d) Para. 9.5, Thermal Shock and Para. 9.16, Moisture Resistance: Shall be done in sequence on all 6 components of the Environmental/Mechanical Subgroups.

(e) Para. 9.23, Special Testing: Shall not be performed.

4.3 MECHANICAL AND ENVIRONMENTAL 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 0.01 grammes for the 'T' package and 0.02 grammes for the 'T1' package.

4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The test conditions shall be as follows:-

(a) Condition: 'A' (Tension)

(b) Force: 1.22N.

(c) Duration: 5 seconds.

N.B. To be performed on 'T1' package only.

4.3.4 Bond Strength

The requirements for bond strength are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The test conditions shall be as follows:-

(a) Condition: 'A'.

(b) Separating Force: 0.05N minimum.

4.3.5 Die Shear

The requirements for die shear are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The test conditions shall be as follows:-

(a) Semiconductor Material Remaining: 50% minimum.

4.3.6 High Temperature Stabilisation Bake

The requirements for high temperature stabilisation bake are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The temperature to be applied shall be +150 (+0 -3) °C.

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 shall not guarantee acceptance of the finished product.

4.4.1 Case

The case shall be hermetically sealed and have a ceramic body.

4.4.2 Lead Materials and Finish

The end cap and lead material shall be Type 'E' with Type '2' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500.

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. Each component shall be marked in respect of:-

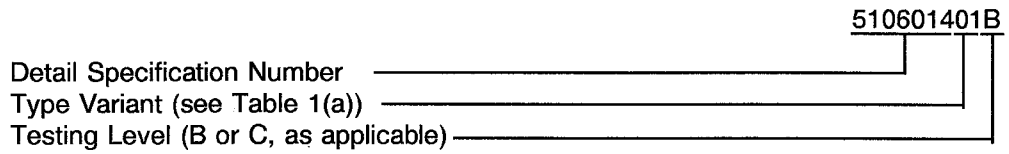
(a) The SCC Component Number.

(b) Cathode Identification.

(c) Traceability Information.

4.5.2 The SCC Component Number

Each component shall bear the SCC Component Number which shall be constituted and marked as follows:



4.5.3 Cathode Identification

Cathode identification shall be as shown in Figures 2 and 3 of this specification.

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) Cathode 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. Unless otherwise specified, the measurements shall be performed at T_{amb} = +25 ± 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 shall be performed at +150(+0-5) °C.

4.6.3 Circuits for Electrical Measurements

Circuits for use in performing electrical measurements listed in Table 2 of this specification are shown in Figure 4.

4.7 BURN-IN TEST

Burn-in shall be Category 3 of Chart III(a).

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} = +25 ± 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 High Temperature Reverse Bias Burn-in

The requirements for the high temperature reverse bias burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5010. 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. 5010. 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 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 Fig.	Test Conditions	Limits		Unit
						Min.	Max.	
1	Breakdown Voltage	$V_{(BR)}$	4021	4(a)	I_R = 10μA	3.0	-	V
2	Reverse Current	I_R	4016	4(a)	V_R = -2.0V	-	Note 1	μA
3 to 4	Forward Voltage	V_F	4011	4(a)	I_F = 0.01mA and I_F = 1.0mA	-	Note 2	V
5	Series Resistance	R_F	-	4(a)	I_{F1} = 10mA I_{F2} = 50mA $R_F = \frac{V_{F2} - V_{F1}}{40mA}$	-	Note 3	Ω

NOTES
1. See Column 4 of Table 1(a).
2. See Column 5 of Table 1(a).
3. See Column 6 of Table 1(a).

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

No.	Characteristics	Symbol	MIL-STD-750 Test Method	Test Fig.	Test Conditions	Limits		Unit
						Min.	Max.	
6	Total Capacitance	C_T	4001	4(a)	V_R = 0V f = 1.0MHz	-	Note 1	pF
7	Noise Figure	NF	4126	4(b)	I.F. = 30MHz LO Power = 0dBm LO_f = 9.375GHz Note 2	-	Note 3	dB

NOTES
1. See Column 7 of Table 1(a).
2. Measurements to be performed on a sample basis, LTPD 7 or less.
3. See Column 8 of Table 1(a).

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	MIL-STD-750 Test Method	Test Fig.	Test Conditions	Limits		Unit
						Min.	Max.	
2	Reverse Current	I_R	4016	-	V_R = -2V Variants 01 to 18 Variants 19 to 36	 - -	 10 10	 µA mA

TABLE 4 - PARAMETER DRIFT VALUES

No.	Characteristics	Symbol	Spec.and/or Test Method	Test Conditions	Change Limits (Δ)	Unit
2	Reverse Current	I_R	As per Table 2	As per Table 2	+100 (1) - 50 (1)	%
3 to 4	Forward Voltage	V_F	As per Table 2	As per Table 2	±5 (1)	%
6	Total Capacitance	C_T	As per Table 2	As per Table 2	±10 (1)	%

NOTES 1. Δ1 = Δ2 = Δ3

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

FIGURE 4(a) - D.C. PARAMETERS AND TOTAL CAPACITANCE

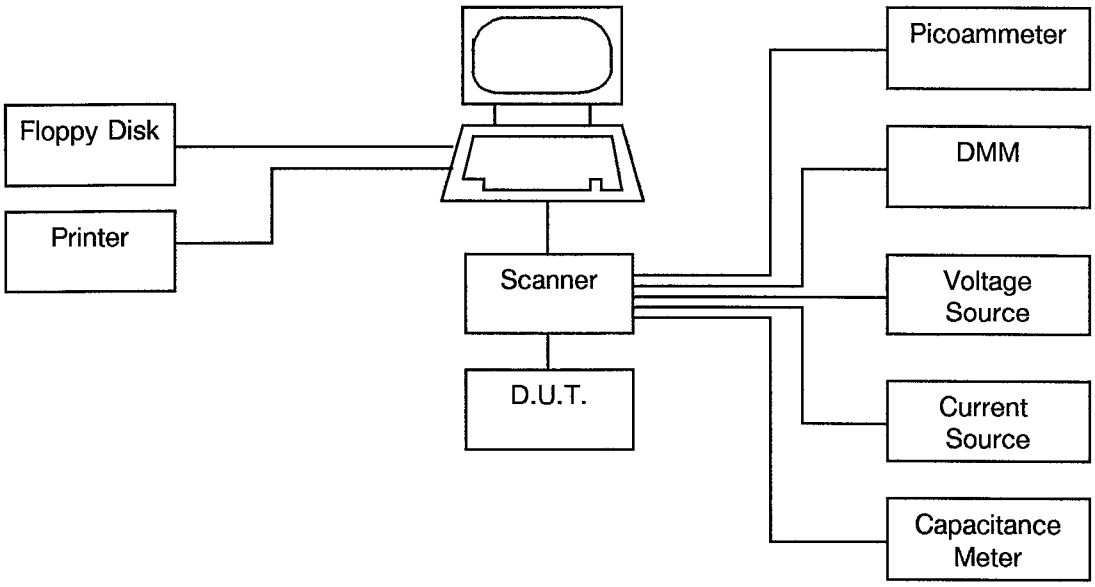


FIGURE 4(b) - NOISE FIGURE

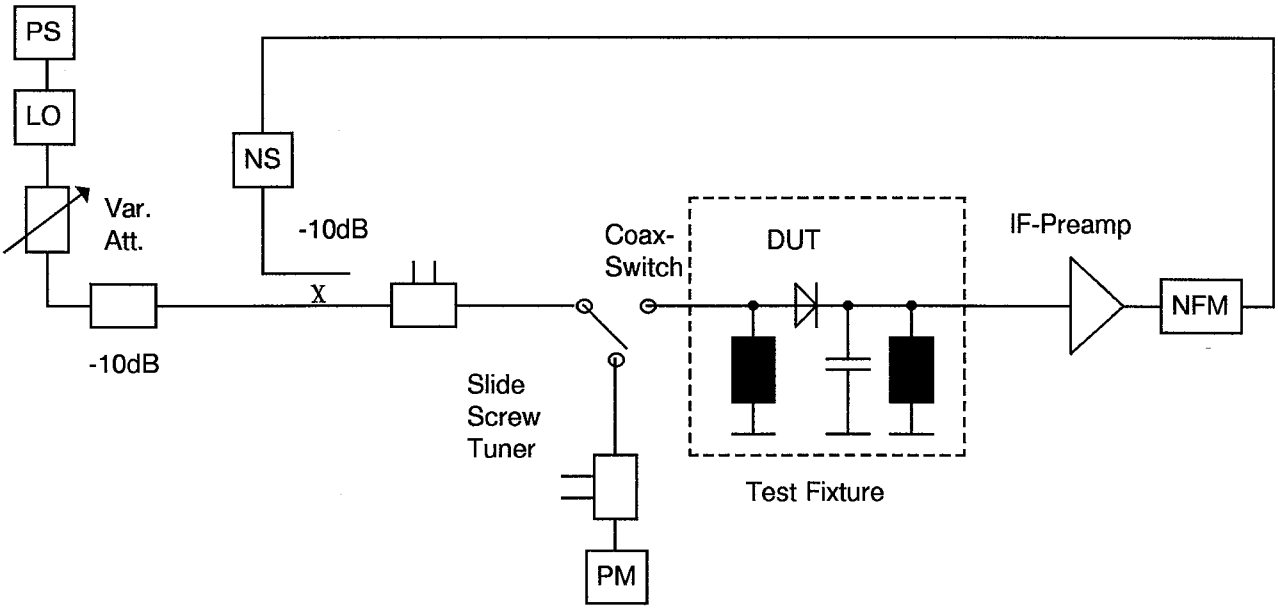


TABLE 5(a) - CONDITIONS FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN

No.	Characteristics	Symbol	Conditions	Unit
1	Ambient Temperature	T_{amb}	+150(+0-3)	°C
2	Reverse Voltage	V_R	-1.5	V

TABLE 5(b) - CONDITIONS FOR POWER BURN-IN

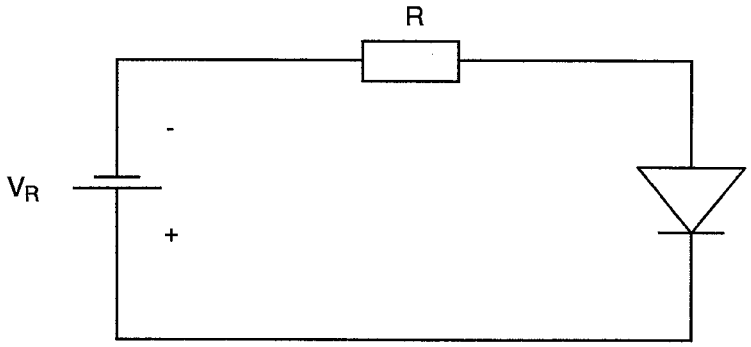
No.	Characteristics	Symbol	Conditions	Unit
1	Ambient Temperature	T_{amb}	+130(+0-3)	°C
2	Forward Current Variants 01 to 08 and 19 to 26 Variants 09 to 18 and 27 to 36	I_F	 50 25	mA

TABLE 5(c) - CONDITIONS FOR OPERATING LIFE TESTS

No.	Characteristics	Symbol	Conditions	Unit
1	Ambient Temperature 1	T_{amb1}	+130(+0-3)	°C
2	Forward Current Variants 01 to 08 and 19 to 26 Variants 09 to 18 and 27 to 36	I_F	 50 25	mA
3	Ambient Temperature 2	T_{amb2}	+140(+0-3)	°C
4	Forward Current Variants 01 to 08 and 19 to 26 Variants 09 to 18 and 27 to 36	I_F	 20 10	mA

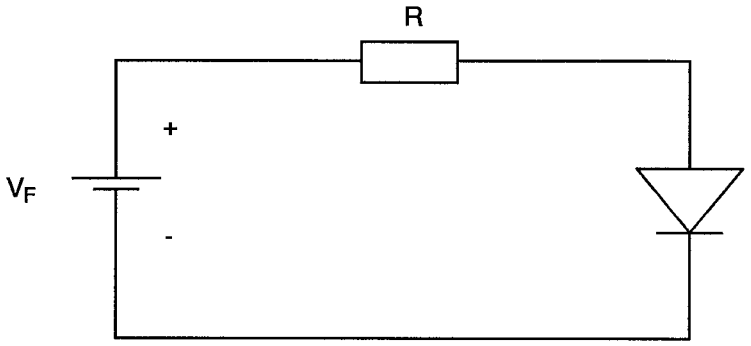
FIGURE 5 - ELECTRICAL CIRCUITS FOR BURN-IN

FIGURE 5(a) - ELECTRICAL CIRCUIT FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN



NOTES 1. At the end of the HTRB, T_{amb} shall be decreased to room temperature and the reverse bias shall remain applied until $T_{amb} < +35$ °C.

FIGURE 5(b) - ELECTRICAL CIRCUIT FOR POWER BURN-IN AND OPERATING LIFE TESTS



4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 5010)

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} = +25±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 tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at T_{amb} = +25±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. 5010. The conditions for operating life testing are specified in Table 5(c) of this specification.

4.8.4 Electrical Circuits for Operating Life Tests

The circuit to be used for performance of the operating life test shall be the same as shown in Figure 5(b) for Power Burn-in.

4.8.5 Conditions for High Temperature Storage Tests (Part of Endurance Testing)

The requirements for high temperature storage test are specified in ESA/SCC Generic Specification No. 5010. The temperature to be applied shall be the maximum storage temperature specified in Table 1(b) of this specification.

4.9 RADIATION TESTING

Not applicable.

4.10 SPECIAL TESTING

Not applicable.

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

No.	Characteristics	Symbol	Spec. and/or Test Method	Test Conditions	Limits		Unit
					Min.	Max.	
1	Breakdown Voltage	$V_{(BR)}$	As per Table 2	As per Table 2	As per Table 2		V
2	Reverse Current	I_R	As per Table 2	As per Table 2	As per Table 2		µA
3 to 4	Forward Voltage	V_F	As per Table 2	As per Table 2	As per Table 2		V
5	Series Resistance	R_F	As per Table 2	As per Table 2	As per Table 2		Ω
6	Total Capacitance	C_T	As per Table 2	As per Table 2	As per Table 2		pF

APPENDIX 'A'

AGREED DEVIATIONS FOR SIEMENS (D)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 4.2.2	For Internal Visual Inspection, the testing specified in GFW Specification A0476 shall also be performed.
Paras. 4.2.2 4.2.3	For External Visual Inspection, the testing specified in GFW Specification A0576 shall also be performed.