DIODES, VOLTAGE REGULATOR, SILICON,

BASED ON TYPES 1N6485 THROUGH 1N6491

AND 1N4460 THROUGH 1N4465

ESCC Detail Specification No. 5102/020

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ESA/SCC Detail Specification No. 5102/020

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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, Voltage Regulator, Silicon, based on Types 1N6485 through 1N6491 and 1N4460 through 1N4465. 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 of diode 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.

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. In addition, the following abbreviation is used:-

Z_K - Knee Impedance

TABLE 1(a) - TYPE VARIANTS

(1) Variant	(2) Based on Type	(3) V_Z min. (V)	(4) V_Z nom. (V)	(5) V_Z max. (V)	(6) I_Z Test Current (mA)	(7) I_{ZM} (mA)	(8) I_{ZSM} (Note 1) (mA)	(9) Z_Z (Ω)	(10) V_R (V)	(11) I_R (μA)	(12) T_{CVZ} (%/°C)	(13) I_R LifeTest End Point (μA)	(14) I_R (Note 2) (μA)	(15) I_{ZK} Test Current (mA)	(16) Z_K Knee Impedance (Ω)	(17) V_Z Voltage Regulator (V)	(18) Lead Material and Finish
01	1N6485	3.14	3.3	3.46	76	433	4 200	10	1.0	50	-0.075	75	500	1.0	400	0.90	A4
02	1N6486	3.42	3.6	3.78	69	397	3 900	10	1.0	50	-0.070	75	200	1.0	400	0.80	A4
03	1N6487	3.71	3.9	4.09	64	366	3 600	9.0	1.0	35	-0.060	50	100	1.0	400	0.75	A4
04	1N6488	4.09	4.3	4.51	58	332	3 300	9.0	1.0	5.0	+0.050	7.5	100	1.0	400	0.70	A4
05	1N6489	4.47	4.7	4.93	53	304	3 000	8.0	1.0	4.0	±0.025	6.0	100	1.0	500	0.60	A4
06	1N6490	4.85	5.1	5.35	49	280	2 700	7.0	1.0	1.0	±0.030	2.0	100	1.0	500	0.50	A4
07	1N6491	5.32	5.6	5.88	45	255	2 500	5.0	2.0	0.5	±0.040	1.0	100	1.0	600	0.40	A4
08	1N4460	5.89	6.2	6.51	40	230	2 300	4.0	3.72	10	+0.050	20	50	1.0	200	0.35	A4
09	1N4461	6.46	6.8	7.14	37	210	2 100	2.5	4.08	5.0	+0.057	10	20	1.0	200	0.30	A4
10	1N4462	7.13	7.5	7.87	34	191	1 900	2.5	4.50	1.0	+0.061	2.0	10	0.5	400	0.35	A4
11	1N4463	7.79	8.2	8.61	31	174	1 700	3.0	4.92	0.5	+0.065	1.0	5.0	0.5	400	0.40	A4
12	1N4464	8.65	9.1	9.55	28	157	1 600	4.0	5.46	0.3	+0.068	0.6	3.0	0.5	500	0.45	A4
13	1N4465	9.5	10	10.5	25	143	1 400	5.0	8.0	0.3	+0.071	0.6	3.0	0.25	500	0.50	A4

NOTES
1. Measured at T_{amb} = +100°C.
2. Measured at T_{amb} = +150°C.

TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATING	UNIT	REMARKS
1	Power Dissipation	P_{tot}	1 500	mW	Note 1
2	Operating Temperature Range	T_{op}	−65 to +175	°C	T_{amb}
3	Storage Temperature Range	T_{stg}	−65 to +200	°C	-
4	Soldering Temperature	T_{sol}	+260	°C	Note 2
5	Thermal Resistance	$R_{TH(J-C)}$	Note 3	°C/W	Note 3

NOTES

1. At T_{amb} = +25°C. For derating at T_{amb} > +25°C, see Figure 1.
2. Duration 10 seconds maximum, at a distance of not less than 1.5mm from the body and the same termination shall not be resoldered until 3 minutes have elapsed.
3. See Figure 1.

FIGURE 1 - PARAMETER DERATING INFORMATION

P_{tot}(W)

L = 0.00
L = 3.18
L = 6.35
L = 9.53
L = 19.05

10
9
8
7
6
5
4
3
2
1
0

0 25 50 75 100 125 150 175 Tamb (°C)

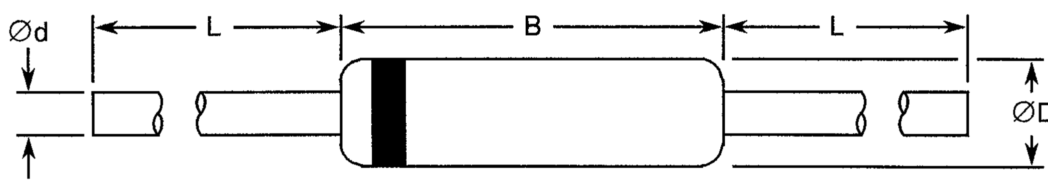
Power Dissipation versus Temperature

NOTES

1. Maximum lead temperature in °C at length L from body (see Table below) for maximum operating junction temperature of +175°C with equal two-leads conditions.

L (mm)	$R_{TH(J-C)}$ (°C/W)
0.00	20
3.18	25
6.35	33
9.53	42
19.05	70

FIGURE 2 - PHYSICAL DIMENSIONS

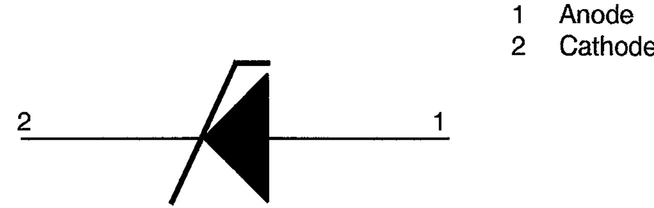


SYMBOL	MILLIMETRES	
	MIN.	MAX.
B	3.18	4.06
Ød	0.71	0.81
ØD	2.16	3.30
L	20.32	33.02

NOTES

1. Package contour optional within ØD and B. Heat slugs, if any, shall be included within this cylinder but shall not be subject to the minimum limit of ØD.
2. The specified lead diameters apply in the zone between 1.27mm from the diode body and the end of the lead.

FIGURE 3 - FUNCTIONAL DIAGRAM



1 Anode
2 Cathode

NOTES

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

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 Semiconductor Components. 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. 9.2.2, Die Shear Test: Shall not be performed.

(c) Para. 9.7, Particle Impact Noise Detection (PIND) Test: Shall not be performed.

(d) Para. 9.8.1, Seal Test, Fine Leak: Shall not be performed.

(e) Para. 9.8.2, Seal Test, Gross Leak: Shall be performed in accordance with MIL-STD-750, Test Method 1071, Condition 'E'.

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

(a) Para. 7.1.1, High Temperature Reverse Bias Test: Shall not be performed.

(b) Para. 9.8.1, Seal Test, Fine Leak: Shall not be performed.

(c) Para. 9.8.2, Seal Test, Gross Leak: Shall be performed in accordance with MIL-STD-750, Test Method 1071, Condition 'E'.

(d) Para. 9.12, Radiographic Inspection: Shall not be performed.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.2.1, Bond Strength Test: Shall not be performed.

(b) Para. 9.2.2, Die Shear Test: Shall be not be performed.

(c) Para. 9.8.1, Seal Test, Fine Leak: Shall not be performed.

(d) Para. 9.8.2, Seal Test, Gross Leak: Shall be performed in accordance with MIL-STD-750, Test Method 1071, Condition 'E'.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.8.1, Seal Test, Fine Leak: Shall not be performed.

(b) Para. 9.8.2, Seal Test, Gross Leak: Shall be performed in accordance with MIL-STD-750, Test Method 1071, Condition 'E'.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the diode 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 0.35 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 : 44.4 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 hermetically sealed and have a glass body with glass seals.

4.4.2 Lead Material and Finish

The lead material shall be Type 'A' with 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 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) Cathode Identification.

(b) The SCC Component Number.

(c) Traceability Information.

4.5.2 Cathode Identification

Cathode 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:

	510202001B
Detail Specification Number	5102
Type Variant (see Table 1(a))	02001
Testing Level (B or C, as applicable)	B

4.5.4 Traceability Information

Each component shall be marked in respect of traceability information as defined in ESA/SCC Basic Specification No. 21700.

4.6 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 shall be performed at $T_{amb} = +125(+0-3)$ °C and -65(+3-0) °C respectively.

4.6.3 Circuits for Electrical Measurements

Not applicable.

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 High Temperature Reverse Bias Burn-in

Not applicable.

4.7.3 Electrical Circuit for High Temperature Reverse Bias Burn-in

Not applicable.

4.7.4 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 are specified in Table 5(b) of this specification.

4.7.5 Electrical Circuit for Power Burn-in

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 = Note 1	-	(2)	µA
2	Forward Voltage 1	V_{F1}	4011	I_{F1} = 200mA	-	1.0	V
3	Forward Voltage 2	V_{F2}	4011	I_{F2} = 1.0A	-	1.5	V
4	Voltage Regulation	V_Z	4022	I_Z = Notes 3 and 4	(5)	(6)	Vdc

NOTES

1. See column (10) of Table 1(a).
2. See column (13) of Table 1(a).
3. See column (6) of Table 1(a).
4. The test current shall be applied until thermal equilibrium is attained (90s maximum) prior to reading the breakdown voltage. For this test, the diode shall be suspended by its leads with mounting clips whose inside edge is located at 9.53mm form the body and the lead temperature at inside edge of the mounting clips shall be maintained at a temperature of 25(+8,-2) °C. This measurement may be performed after a shorter time following application of the test current than that which provides thermal equilibrium if correlation to established readings can be established to the satisfaction of the Orderer.
5. See column (3) of Table 1(a).
6. See column (5) of Table 1(a).

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	Small Signal Breakdown Impedance	Z_Z	4051	I_Z = Note 1 I_{sig} = 10% of I_Z	-	(2)	Ω
6	Knee Impedance	Z_K	4051	I_{ZK} = Note 3 I_{sig} = 10% of I_{ZK}	-	(4)	Ω

NOTES

1. See column (6) of Table 1(a).
2. See column (9) of Table 1(a).
3. See column (15) of Table 1(a).
4. See column (16) of Table 1(a).

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 = Note 1 T_{amb} = +150°C	-	(2)	µA
7	Temperature Coefficient of Breakdown Voltage	TCV_Z	4071	I_Z = Note 5 T_1 = +25°C T_2 = +125°C Note 3	-	(4)	%/°C

TABLE 3(b) - ELECTRICAL MEASUREMENTS AT LOW TEMPERATURE

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
7	Temperature Coefficient of Breakdown Voltage	TCV_Z	4071	I_Z = Note 6 T_1 = +25°C T_2 = +55°C Note 3	-	(4)	%/°C

NOTES
3. Temperature coefficient of breakdown voltage. The device shall be temperature stabilized with current applied prior to reading breakdown voltage at the specified ambient temperature.
1. See column (10) of Table 1(a).
2. See column (13) of Table 1(a).
4. See column (12) of Table 1(a).
5. See column (6) of Table 1(a).
6. See column (7) of Table 1(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
1	Reverse Current	I_R	As per Table 2	As per Table 2	+50 or (1) ±100	nA %
2	Forward Voltage 1	V_{F1}	As per Table 2	As per Table 2	±50	mV
4	Voltage Regulation	V_Z	As per Table 2	As per Table 2	±1.0	%

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

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

Not applicable.

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

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	$+25 \pm 3$	°C
2	Working Current	I_{ZM}	Note 1	mA

NOTES
1. 50% of the value of I_{ZM} specified in column (7) of Table 1(a).

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

4.8.4 Electrical Circuit 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.

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 (Δ)	ABSOLUTE		UNIT
						MIN.	MAX.	
1	Reverse Current	I_R	4016	V_R = Column 10 of Table 1(a)	±50nA or ±100% Note 2	-	Column 14 of Table 1(a)	µA
2	Forward Voltage 1	V_{F1}	4011	I_F = 200mAdc	±0.05%	-	1.0	V
4	Voltage Regulation	V_Z	4022	I_Z = Column 7 of Table 1(a) Note 1	±1.0%	Column 3 of Table 1(a)	Column 5 of Table 1(a)	V
5	Small Signal Reverse Breakdown Impedance	Z_Z	4051	I_Z = Column 7 of Table 1(a) I_{sig} = 10% of I_Z	-	-	Column 9 of Table 1(a)	Ω
6	Knee Impedance	Z_K	4051	I_{ZK} = Column 15 of Table 1(a) I_{sig} = 10% of I_{ZK}	-	-	Column 16 of Table 1(a)	Ω

NOTES

1. The test current shall be applied until thermal equilibrium is attained (90 seconds maximum) prior to reading the breakdown voltage. For this test, the diode shall be suspended by its leads with mounting clips whose inside edge is located at 9.53mm from the body and the mounting clips shall be maintained at a temperature of 25(+8-2) °C. This measurement may be performed after a shorter time following application of the test current than that which provides thermal equilibrium if correlation to established readings can be established to the satisfaction of the Orderer.
2. Whichever is greater, referred to the initial value.

APPENDIX 'A'

AGREED DEVIATIONS FOR MICROSEMI (USA)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
General Deviations from ESA/SCC Generic Specification No. 5000	Para. 9.1, Internal Visual Inspection: Test Method 2074 of MIL-STD-750 may be used. Internal Visual Inspection may be performed at any point prior to painting the diode. Para. 9.10, External Visual Inspection: Test Method 2071 of MIL-STD-750 may be used. Para. 9.18, Permanence of Marking: Test Method 1022 of MIL-STD-750 may be used.