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Pages 1 to 19

TRANSISTORS, MATCHED DUAL, PNP,

BASED ON TYPES 2N3810 AND 2N3811

ESA/SCC Detail Specification No. 5207/005

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 6	January 1999		
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DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 5 and incorporates all modifications defined in Revision 'A' to Issue 5 and the changes agreed by the following DCRs:-		
		Cover Page		None
		DCN		None
		Para. 1.1	: Existing text deleted and new text added	221491
		Para. 2	: Item (c) deleted	221491
		Table 1(a)	: Lead Material Column heading amended	221491
			: "(a)" added to existing Figure 2 entries	221491
			: Variants 07 and 08 added	221491
		Table 1(b)	: No. 5, Characteristics, Symbol, Maximum Ratings and Remarks amended	221491
			: No. 6 , Renumbered as "7" and Remarks amended	221491
			, New No. 6 added	221491
			: No. 7, Renumbered as "8"	221491
			: No. 8, Renumbered as "9" and Characteristics, Maximum Ratings and Remarks amended	221491
			: Notes added	221491
		Figure 1	: Graph amended and Notes added	221491
		Figure 2	: Subtitle added and Imperial Dimensions deleted from the Table and Notes	221491
		Para. 4.3.2	: Text extended	221491
		Para. 4.3.3	: "For Variants 01 to 06," added to the beginning of the second sentence	221491
			: Applied Force added	221491
		Para. 4.4	: Existing text modified and new text added	221491
		Para. 4.4.1	: Existing text modified and new text added	221491
		Para. 4.5.1	: Existing text deleted and new text added	221491
		Para. 4.5.5	: Deleted in toto	221491
		Para. 4.6.3	: Title amended, text deleted and "Not applicable" added	221491
		Para. 4.7.2	: Renumbered as "4.7.3" and second sentence amended	221491
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		Para. 4.7.3	: Renumbered as "4.7.5" and text amended	221491
		Para. 4.7.4	: Title amended, text deleted and new text added	221491
		Table 2 d.c.	: No. 6, Variants 07 and 08 added to Test Conditions	221491
			: For h_{FE2}, Max. Limit amended for Variants 01, 02, 05	221491
		Table 2 a.c.	: No. 15, Variants 07 and 08 added to Test Conditions	221491
			: No. 16, Variants 07 and 08 added to Test Conditions	221491
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		Table 3	: No. 10, Renumbered as "10(a)"	221491
		Table 5	: Main Title deleted	221491
			: First Subtitle amended	221491
			: Second Subtitle and Table amended	221491
			: Notes deleted and new Notes added	221491
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			: Both Subtitles amended	
		Para. 4.8.1	: "Unless otherwise stated," added at the beginning of the second sentence	221491
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		Para. 4.8.3	: Second sentence amended	221491
		Table 6	: No. 6, Variants 07 and 08 added to Test Conditions	221491
			: Second No. 10, Renumbered as 10(a)	221491

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'A'	Jul. '99	P1. Cover page		None
		P2A. DCN	: Page added	None
		P9. Figure 2(b)	: In the Table, Dimension 'C' amended	23911
'B'	Nov. '99	P1. Cover page		None
		P2A. DCN		None
		P6. Table 1(a)	: Variants 09 and 10 added	221536
		Table 1(b)	: Nos. 5 and 9, Variant numbers amended	221536
		P7. Figure 1	: Legend changed to "Variants 07 to 10"	221536
		P9. Figure 2(b)	: Title amended	221536
		Figure 3	: Changed to read "Variants 07 to 10"	221536
		P10. Para. 4.3.2	: Sentence amended to read "...Variants 07 to 10"	221536
		P11. Para. 4.4.1	: Sentence amended to read, "Variants 07 to 10"	221536
		Para. 4.4.2	: New sentence added	221536
		P13. Table 2 d.c.	: No. 6, Conditions amended to include Variants 09 and 10	221536
		P15. Table 2 a.c.	: No. 17, Conditions amended to include Variants 09 and 10	221536
		P19. Table 6	: No. 6, Conditions amended to include Variants 09 and 10	221536

TABLE OF CONTENTS

Page

TABLES

FIGURES

APPENDICES (Applicable to specific Manufacturers only)
None.

1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Transistor, Matched Dual, PNP, based on Types 2N3810 and 2N3811. 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 transistors 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 transistors specified herein are scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The derating information applicable to the transistors specified herein is shown in Figure 1.

1.5 PHYSICAL DIMENSIONS

The physical dimensions of the transistors specified herein are shown in Figure 2.

1.6 FUNCTIONAL DIAGRAM

The functional diagram showing lead identification, of the transistors 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 a 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 Semiconductor Components.

(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 symbols are used:-

$|V_{BE1} - V_{BE2}|$ - Absolute value of base-emitter voltage differential between the individual sections.

$|\Delta(V_{BE1} - V_{BE2})\Delta T_{amb}|$ - Absolute value of the algebraic difference between the base-emitter voltage differentials between the individual sections at two different temperatures.

I_{LK} - Leakage current between active devices.

TABLE 1(a) - TYPE VARIANTS

VARIANT	BASED ON TYPE	CASE	FIGURE	LEAD MATERIAL AND/OR FINISH
01	2N3810	TO78	2(a)	D2
02	2N3810	TO78	2(a)	D3 or D4
03	2N3811	TO78	2(a)	D2
04	2N3811	TO78	2(a)	D3 or D4
05	2N3810	TO78	2(a)	D7
06	2N3811	TO78	2(a)	D7
07	2N3810	LCCC6	2(b)	2
08	2N3811	LCCC6	2(b)	2
09	2N3810	LCCC6	2(b)	4
10	2N3811	LCCC6	2(b)	4

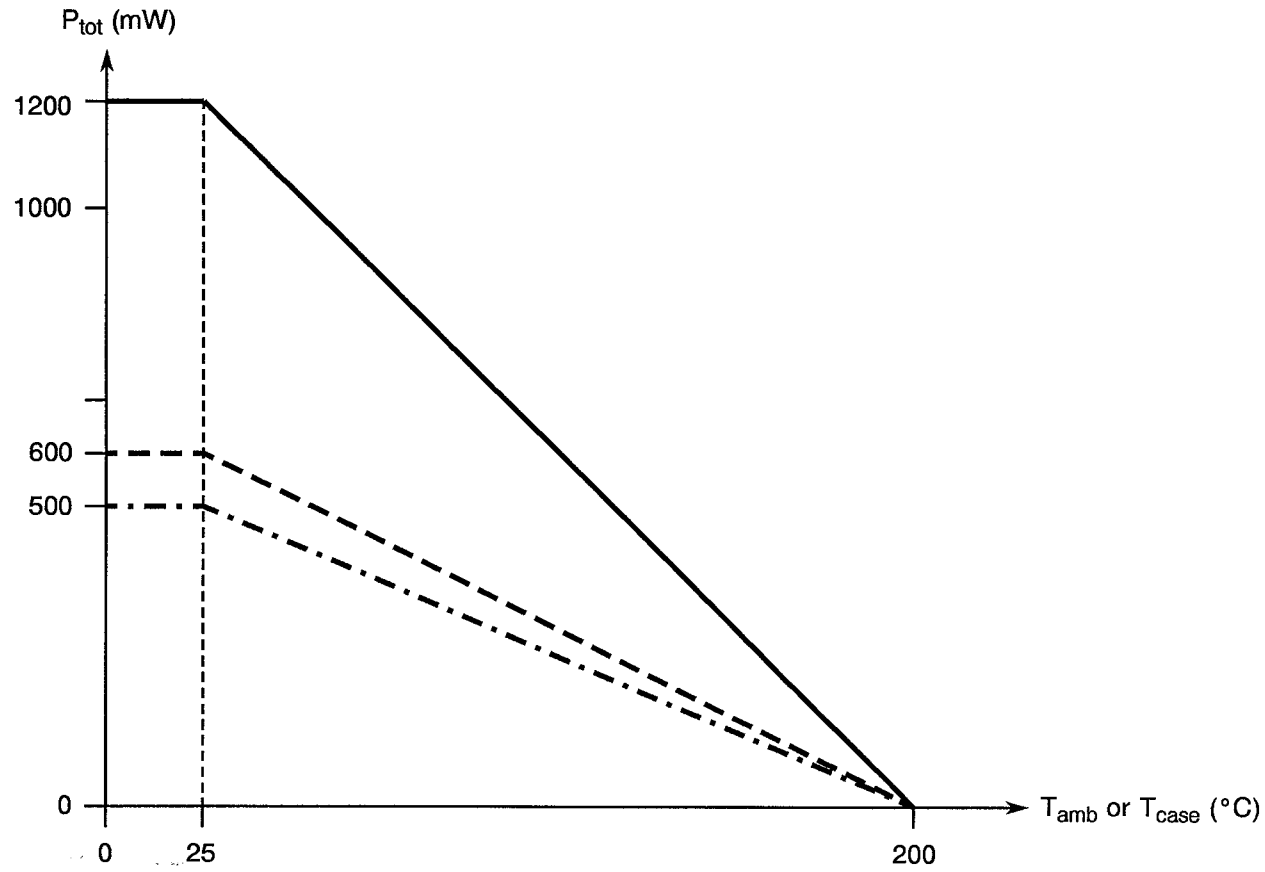
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Collector-Base Voltage	V_{CBO}	−60	V	
2	Collector-Emitter Voltage	V_{CEO}	−60	V	
3	Emitter-Base Voltage	V_{EBO}	−5.0	V	
4	Collector Current (Continuous)	I_C	50	mA	
5	Power Dissipation 1 All Variants	P_{tot1}	0.5 (Note 1) 0.6 (Note 2)	W	$T_{amb} \leq +25°C$
	Variants 07 to 10		0.6 (Notes 1 and 2) 1.2 (Notes 1 and 3)		
6	Power Dissipation 2 Variants 01 to 06	P_{tot2}	0.5 (Note 1) 0.6 (Note 2)	°C	$T_{case} \leq +25°C$
7	Operating Temperature Range	T_{op}	−55 to +200	°C	T_{amb} or T_{case}
8	Storage Temperature Range	T_{stg}	−65 to +200	°C	
9	Soldering Temperature Variants 01 to 06 Variants 07 to 10	T_{sol}	 +260 +245	°C	 Note 4 Note 5

NOTES

1. One section. For derating at T_{amb} or $T_{case} > +25°C$, see Figure 1.
2. Both sections. For derating at T_{amb} or $T_{case} > +25°C$, see Figure 1.
3. When mounted on a 15 x 15 x 0.6 mm substrate.
4. 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.
5. Duration 5 seconds maximum and the same terminal shall not be resoldered until 3 minutes have elapsed.

FIGURE 1 - PARAMETER DERATING INFORMATION



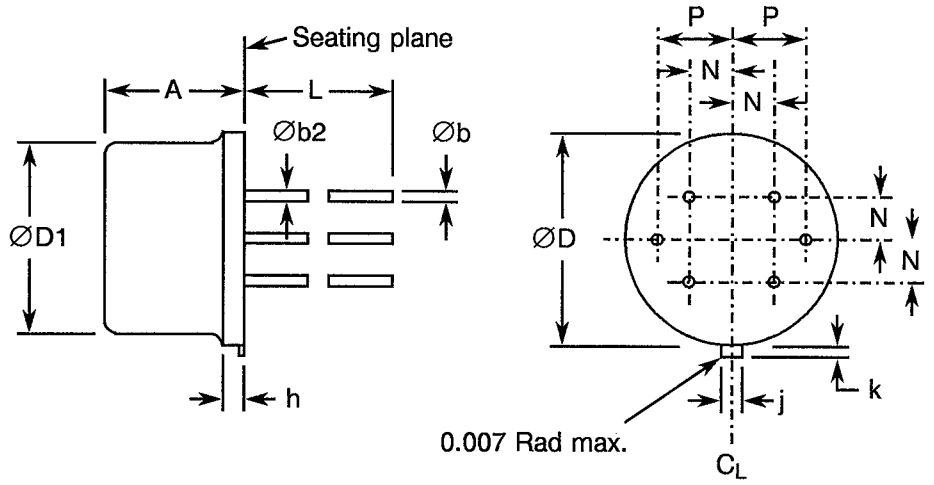
Power Dissipation versus Temperature

Legend

- Variants 01 to 06, T_{amb} or T_{case} one section.
- Variants 01 to 06, T_{amb} or T_{case} both sections.
- Variants 07 to 10, T_{amb} one section, when mounted on a 15 x 15 x 0.6mm ceramic substrate.
- Variants 07 to 10, T_{amb} both sections, when mounted on a 15 x 15 x 0.6 mm ceramic substrate.

FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) - VARIANTS 01 TO 06



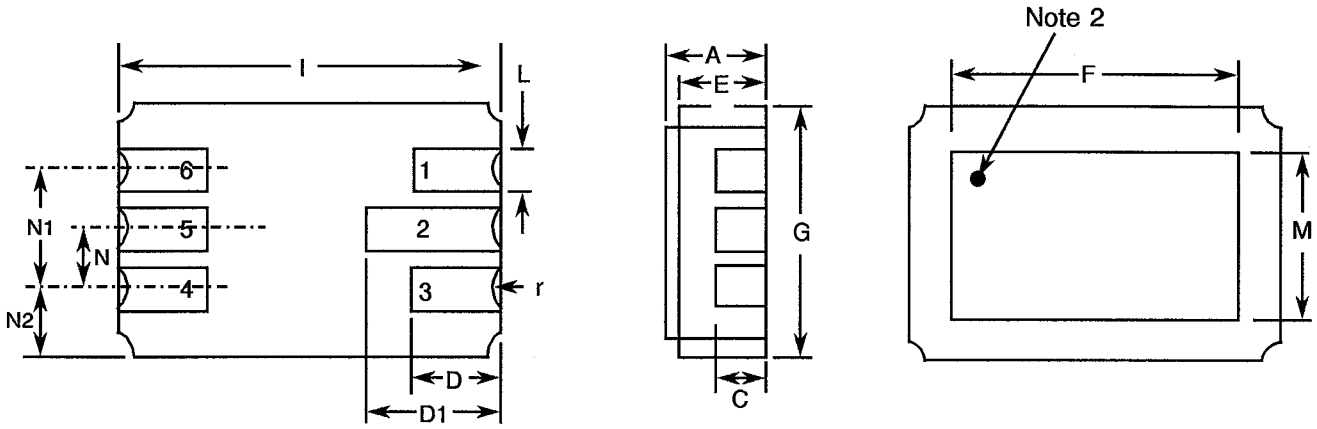
SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
A	3.81	4.57	
Øb	0.41	0.53	1, 6
Øb2	0.41	0.48	2, 6
ØD	8.51	9.40	
ØD1	7.75	8.51	
h	0.23	1.04	
j	0.71	0.86	7
k	0.74	1.14	5
L	12.70	44.45	6
N	1.80 NOM.		3
P	2.54 NOM.		3

NOTES

1. Measured in the zone beyond 6.35mm from the seating plane.
2. Measured in the zone beyond 1.27mm and 6.35mm from the seating plane.
3. When measured in a gauging plane 1.37(+ 0.03 – 0)mm below the seating plane of the transistor, maximum diameter leads shall be within 0.18mm of their true location relative to a maximum-width-tab. Smaller diameters shall fall within the outline of the maximum diameter lead tolerance.
4. All leads electrically insulated from case and each section electrically isolated from each other.
5. Measured from the maximum diameter of the actual device.
6. All 6 leads.
7. The device may be measured by direct method or by gauge. This width to remain constant for a length of 0.55mm.

FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(b) - VARIANTS 07 TO 10



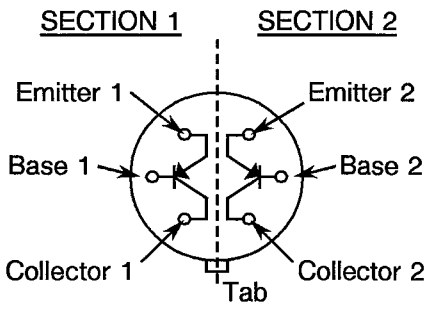
SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
A	1.53	1.96	
C	0.89 TYP.		1
D	1.52	1.78	
D1	2.09	2.49	
E	1.25	1.55	
F	5.76	5.91	
G	4.19	4.45	
I	6.09	6.35	
L	0.55	0.71	1
M	3.86	4.01	
N	1.14	1.4	
N1	2.41	2.67	
N2	0.89 TYP.		
r	0.23 TYP.		

NOTES

1. Dimensions are the same for the 6 leads.
2. From topside view, pin 1 is indicated by a black ink dot.

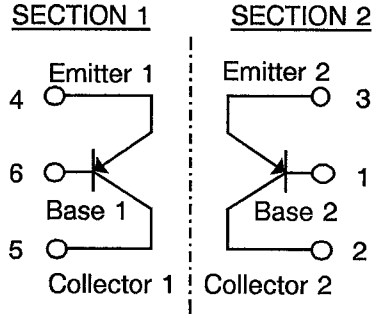
FIGURE 3 - FUNCTIONAL DIAGRAM

VARIANTS 01 TO 06



CONNECTION DIAGRAM

VARIANTS 07 TO 10



CONNECTION DIAGRAM

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the transistors specified herein are stated in this specification and ESA/SCC Generic Specification No. 5000. 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)

None.

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

None.

4.2.4 Deviations from Qualification Tests (Chart IV)

None.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the transistors specified herein shall be checked. They shall conform to those shown in Figure 2.

4.3.2 Weight

The maximum weight of the transistors specified herein shall be 0.95 grammes for Variants 01 to 06 and 0.2 grammes for Variants 07 to 10.

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 06, the test conditions shall be as follows:-

Test Condition : 'E', Lead Fatigue.
Applied Force : 2.5 ± 0.1 Newtons.

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 transistors 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

For Variants 01 to 06, the case shall be hermetically sealed and have a metal body with hard glass seals and the lid shall be welded, brazed, preform soldered or glass frit sealed.

For Variants 07 to 10, the case shall be hermetically sealed and have a ceramic body with a kovar lid.

4.4.2 Lead Material and Finish

For Variants 01 to 06, the lead material shall be Type 'D' with either Type '2', Type '3 or 4' or Type '7' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500. (See Table 1(a) for Type Variants).

For Variants 07 to 08, the terminal material shall have Type '2' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500. (See Table 1(a) for Type Variants).

For Variants 09 to 10, the terminal material shall have 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 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) Lead Identification.

(b) The SCC Component Number.

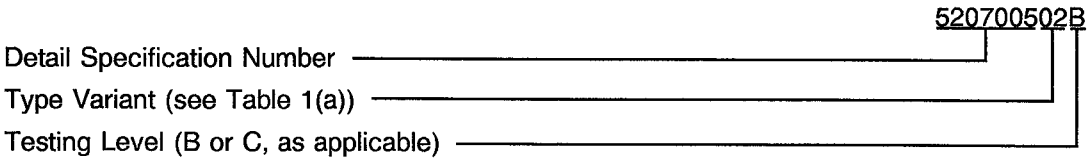
(c) Traceability Information.

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 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, 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 (Figure 4)

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 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 specified in Table 5(b) of this specification.

4.7.4 Electrical Circuits for High Temperature Reverse Bias Burn-in

Circuits for used in performing the high temperature reverse bias burn-in are shown in Figure 5(a) of this specification.

4.7.5 Electrical Circuits for Power Burn-in

Circuits for use in performing the power burn-in tests are shown in Figure 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 MIN	LIMITS MAX	UNIT
1	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011	$I_C = 10mA$ $I_B = 0A$ Note 1	−60	-	V
2	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	3001	$I_C = 10\mu A$ $I_E = 0A$	−60	-	V
3	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026	$I_E = 10\mu A$ $I_C = 0A$	−5.0	-	V
4	Collector-Base Cut-off Current	I_{CBO}	3036	$V_{CB} = 50V$ $I_E = 0A$	-	−10	nA
5	Emitter-Base Cut-off Current	I_{EBO}	3061	$V_{EB} = 4.0V$ $I_C = 0A$	-	−20	nA
6	D.C. Forward Current Transfer Ratio	h_{FE1}	3076	$I_C = 10\mu A$, $V_{CE} = 5.0V$ Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 100 225	 - -	-
		h_{FE2}		$I_C = 100\mu A$, $V_{CE} = 5.0V$ Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 150 300	 450 900	
		h_{FE3}		$I_C = 500\mu A$, $V_{CE} = 5.0V$ Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 150 300	 450 900	
		h_{FE4}		$I_C = 1.0mA$, $V_{CE} = 5.0V$ Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 150 300	 450 900	
		h_{FE5}		$I_C = 10mA$, $V_{CE} = 5.0V$ Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 125 250	 - -	
7	Collector-Emitter Saturation Voltage	$V_{CE(SAT)1}$	3071	$I_C = 100\mu A$ $I_B = 10\mu A$ (Note 1)	-	−0.2	V
		$V_{CE(SAT)2}$		$I_C = 1.0mA$ $I_B = 100\mu A$ (Note 1)	-	−0.25	

NOTES: See Page 15.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - d.c. PARAMETERS (CONT'D)

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN	MAX	
8	Base-Emitter Saturation Voltage	$V_{BE(SAT)1}$	3066	$I_C = 100\mu A$ $I_B = 10\mu A$ (Note 1)	-	0.7	V
		$V_{BE(SAT)2}$		$I_C = 1.0mA$ $I_B = 100\mu A$ (Note 1)	-	0.8	
9	D.C. Forward Current Transfer Ratio Comparison	$\frac{h_{FE2-1}}{h_{FE2-2}}$	3076	$I_C = 100\mu A$ $V_{CE} = 5.0V$	0.91	1.1	-
10	Base-Emitter Voltage Differential	$\lvert V_{BE1} - V_{BE2} \rvert$	3066 Condition 'B'	$I_C = 10\mu A$ $V_{CE} = 5.0V$ (Note 2)	-	5.0	mV
				$I_C = 10mA$ $V_{CE} = 5.0V$ (Note 2)	-	5.0	
				$I_C = 100\mu A$ $V_{CE} = 5.0V$ (Note 2)	-	3.0	
11	Leakage Current between Active Devices	I_{LK}	-	V = 50V to E2, B2, C2 V = 0V to E1, B1, C1	-	5.0	µA

NOTES: See Page 15.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - a.c. PARAMETERS

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS (NOTE 3)	LIMITS		UNIT
					MIN	MAX	
12	Output Capacitance	C_{obo}	3236	V_{CB} = 5.0V I_E = 0A 100kHz < f < 1.0MHz	-	6.0	pF
13	Input Capacitance	C_{ibo}	3240	V_{EB} = 0.5V I_C = 0A 100kHz < f < 1.0MHz	-	15	pF
14	Current Gain Bandwidth Product	f_T	3076	I_C = 1.0mA V_{CE} = 5.0V f = 100MHz	80	500	MHz
15	Input Impedance	h_{ie}	3201	I_C = 1.0mA V_{CE} = 10V f = 1.0kHz Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 3.0 10	 30 40	kΩ
16	A.C. Forward Current Transfer Ratio	h_{fe}	3206	I_C = 1.0mA V_{CE} = 10V f = 1.0kHz Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 150 300	 600 900	
17	Noise Figure	N_{F1}	3246	I_C = 200μA V_{CE} = 5.0V R_S = 2.0kΩ f = 100Hz Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 - -	 7.0 4.0	dB
		N_{F2}		I_C = 200μA V_{CE} = 5.0V R_S = 2.0kΩ f = 1.0kHz Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 - -	 3.0 1.5	
		N_{F3}		I_C = 200μA V_{CE} = 5.0V R_S = 2.0kΩ BW = 10Hz to 15.7kHz Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 - -	 3.5 2.5	

NOTES

1. Pulsed measurement: Pulse Width ≤300μs, Duty Cycle ≤2.0%.
2. Any device whose measurement values exceed the specified limits shall be removed from the lot, but only count for PDA when such values exceed twice the specified limits (i.e. 10mV and 6.0mV respectively).
3. Measurements shall be performed on a sample basis, LTPD7 or less.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN	MAX	
4	Collector-Base Cut-off Current	I_{CBO}	3036	T_{amb} = +150°C V_{CB} = 50V I_E = 0A	-	−10	µA
6	D.C. Forward Current Transfer Ratio	h_{FE2}	3076	T_{amb} = −55°C I_C = 100µA, V_{CE} = 5.0V	60	-	-
9	D.C. Forward Current Transfer Ratio Comparison	$\frac{h_{FE2-1}}{h_{FE2-2}}$	3076	T_{amb} = −55 to +125 °C I_C = 100µA V_{CE} = 5.0V	0.85	1.18	-
10(a)	Base-Emitter Voltage Differential Change	$\lvert \frac{\Delta(V_{BE1} - V_{BE2})}{\Delta T_{amb}} \rvert$	3066 Condition 'B'	T_{amb} = −55 to +25 °C I_C = 100µA V_{CE} = 5.0V	-	0.8	mV
				T_{amb} = +25 to +125 °C I_C = 100µA V_{CE} = 5.0V	-	1.0	

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 (Δ)	UNIT
4	Collector-Base Cut-off Current	I_{CBO}	As per Table 2	As per Table 2	±2.0 or (1) ±100	nA %
6	D.C. Forward Current Transfer Ratio	h_{FE2}	As per Table 2	As per Table 2	±15	%
7	Collector-Emitter Saturation Voltage	$V_{CE(SAT)2}$	As per Table 2	As per Table 2	±15 or (1) ±10	mV %

NOTES

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

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

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	T_{amb}	+150	°C
2	Collector-Base Reverse Voltage	V_{CB}	−45 (Note 1)	V
3	Duration	t	72	Hrs

NOTES

1. After completion of test at elevated temperature, the reverse bias shall not be removed until the case has cooled to +30°C.

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

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	T_{amb}	+25±3	°C
2	Collector-Base Voltage	V_{CB}	−45	V
3	Power Dissipation 1	P_{tot1}	Maximum rating at T_{amb} according to derating curve (Note 1)	W

NOTES

1. See Item 5 of Table 1(b) and Figure 1.

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 of this specification. 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

The circuit to be used for performance of the operating life tests shall be the same as shown in Figure 5(b) for power 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.

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.	
4	Collector-Base Cut-off Current	I_{CBO}	As per Table 2	As per Table 2	-	−20	nA
6	D.C. Forward Current Transfer Ratio	h_{FE2}	As per Table 2	As per Table 2 Variants 01, 02, 05, 07, 09 Variants 03, 04, 06, 08, 10	 150 300	 450 900	-
7	Collector-Emitter Saturation Voltage	$V_{CE(SAT)2}$	As per Table 2	As per Table 2	-	−0.25	V
9	D.C. Forward Current Transfer Ratio Comparison	$\frac{h_{FE2-1}}{h_{FE2-2}}$	As per Table 2	As per Table 2	0.85	1.18	-
10	Base-Emitter Voltage Differential	$\lvert V_{BE1} - V_{BE2} \rvert$	As per Table 2	$V_{CE} = 5.0V$ $I_C = 100\mu A$ (Note 1)	-	6.0	mV
10(a)	Base-Emitter Voltage Differential Change	$\lvert \Delta(V_{BE1} - V_{BE2}) \Delta T_{amb} \rvert$	As per Table 3	As per Table 3 (Note 1)	-	1.0	mV
				As per Table 3 (Note 1)	-	1.2	

NOTES

1. To be measured once, at completion of endurance tests.