TRANSISTORS, MATCHED DUAL, NPN,

BASED ON TYPES MD2369A AND MD2369AF

ESCC Detail Specification No. 5207/008

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Pages 1 to 24

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ESA/SCC Detail Specification No. 5207/008

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 2	June 1986	-	
Revision 'A'	February 1992		

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 1 and incorporates all modifications agreed on the basis of Policy DCR 21022 (Changes due to format amendment) and the following DCR's:-		
		Cover page	: Title amended	22394
		DCN		None
		Table of Contents	: New Para. 1.6 added, 1.6 renumbered "1.7"	22394
			: Paras. 4.7.2 and 4.7.3, "Power" added to Burn-in	22394
			: New Table 1(a) and 1 renumbered "1(b)"	22394
			: Table 2, d.c. and a.c. Parameters specified	22394
			: Table 5, "Power" added to Burn-in	22394
			: Figure 2, expanded to 2(a) and 2(b)	22394
			: New Figure 3(a) added and 3 renumbered "3(b)"	22394
			: Figure 5, "Power" added to Burn-in	22394
		Para. 1.1	: After MD2369A, "and MD2369AF" added	22394
		Para. 1.2	: Paragraph details added	22394
		Para. 1.3	: Table amended to "1(b)"	22394
		Para. 1.5	: Figure 2 amended to "2(a) and 2(b)"	22394
		Para. 1.6	: New Para. 1.6 added, 1.6 renumbered "1.7" and amended	22394
		Table 1(a)	: New Table 1(a) added	22394
		Table 1	: Table 1 renumbered to "1(b)"	22394
			: No. 4, "(Continuous)" added to Characteristics and "(10s pulse)" deleted	22394
			: No. 5, Variants added and values and layout amended	22394
			: No. 1, 2, 3, Breakdown voltage references deleted	22394

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		Table 1	: No. 6, existing details deleted. New No. 6 added	22394
			: No. 7, under max. Ratings, −55 amended to "−65"	22394
			: No. 9, Symbol amended	22394
			: In Notes, Notes 3 and 4 added	22394
		Figure 1	: Figure replaced with new Figure	22394
		Figure 2	: New subheading added, Figure and Notes changed and Figure changed to "2(a)"	22394
		Figure 2(b)	: New Figure added, Figure 3 moved to Page 10, renumbered "3(a)" and retitled "Pin Assignment TO-78 Can"	22394
		Figure 3(a)	: Additional Figure 3(a) "Flat Package" added. New Figure 3(b) added and all subsequent pages renumbered	22394
		Para. 2	: Subpara. C deleted	22394
		Para. 4.2.2	: PIND Test and Condition added	22394
		Para. 4.2.3	: H.T.R.B. Test deleted	22394
		Para. 4.3.2	: Paragraph amended	22394
		Para. 4.3.3	: "3 bends at 45°" added and duration deleted	22394
		Para. 4.4.2	: Paragraph amended	22394
		Para. 4.5.2	: Paragraph amended	22394
		Para. 4.5.3	: Option added	22394
		Para. 4.5.4	: Generic amended to Basic	22394
		Paras. 4.7.2 and 4.7.3	: Title and text amended to read "Power Burn-in"	22394
		Para. 4.7.4	: Paragraph deleted	22394

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		Table 2	: No. 9, Limit amended, I_{CBO} added and complete Table reformatted, renumbered and harmonised	22394
			: In Notes, new Notes 2 and 3 added	22394
		Table 2 a.c.	: No. 4 amended to 2 Test Numbers and T_{on} Test Conditions amended, Test Figures renumbered	22394
			: Table reformatted and numbered sequentially from Table 2 d.c.	22394
			: In Notes, Note deleted and new Note added	22394
		Table 3	: No. 4, $T_{amb} = +125°C$ added, Table reformatted and renumbered as per Table 2	22394
			: In Notes, Note deleted and new Notes 1 and 2 added	22394
		Table 4	: Table moved to Page 20 and all subsequent pages renumbered	22394
			: Table reformatted and renumbered as per Table 2 and Note expanded	22394
		Figure 4	: Figure retitled, new subheadings and Figures added, old subtitles and Figures deleted	22394
		Table 5	: Heading amended, in Burn-in Table Variants added to No. 2 and No. 3 Condition amended to "30"	22394
			: High Temperature Reverse Bias Table deleted	22394
		Figure 5	: Heading amended and diagrams deleted	22394
		Table 6	: Nos. 5 and 7 Limits amended, I_{CBO} added, Table reformatted and renumbered as per Table 2	22394

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
'A'	Feb. '92	P1. Cover page		None
		P2C. DCN	: Page added	None
		P5. Para. 1.2	: Paragraph amended	21021
		P11. Para. 2	: "ESA/SCC Basic Spec. No. 23500" added	21025
		Para. 4.2.2	: Bond Strength and Die Shear Test deviations deleted	23499
			: PIND deviation deleted	21043
		P12. Para. 4.2.3	: Radiographic Inspection deviation deleted	21049
		Para. 4.2.4	: Bond Strength and Die Shear Test deviations deleted	23499
		P19. Table 3	: Note 1 deleted, subsequent Note renumbered	21047
		This document has been transferred from hardcopy to electronic format. The content is unchanged but minor differences in presentation exist.		

TABLE OF CONTENTS

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, NPN, based on Types MD2369A and MD2369AF.

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

See 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 PIN ASSIGNMENT

The pin assignment of the transistors specified herein, is shown in Figure 3(a).

1.7 FUNCTIONAL DIAGRAM

The functional diagram, of the transistors specified herein, is shown in Figure 3(b).

TABLE 1(a) - TYPE VARIANTS

VARIANT	BASED ON TYPE	CASE	FIGURE	LEAD MATERIAL AND FINISH
01	MD2369A	TO78	2(a)	D2
02	MD2369AF	FLAT PACK	2(b)	G2

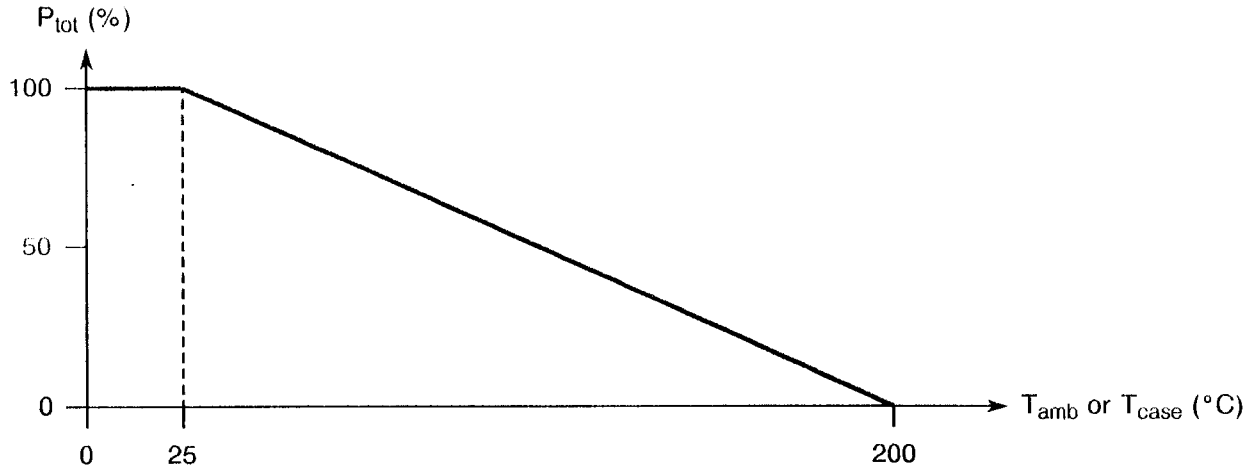
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Collector - Base Voltage	V_{CBO}	40	V	
2	Collector - Emitter Voltage	V_{CEO}	15	V	
3	Emitter - Base Voltage	V_{EBO}	4.5	V	
4	Collector Current (Continuous)	I_C	500	mA	
5	Power Dissipation Variant 01 Variant 02	P_{tot}	 0.55 (Note 1) 0.60 (Note 2) 0.35 (Note 1) 0.40 (Note 2)	W	Note 3
6	Power Dissipation Variant 01 Variant 02	P_{tot}	 1.4 (Note 1) 2.0 (Note 2) 0.7 (Note 1) 1.4 (Note 2)	W	Note 4
7	Operating Temperature Range	T_{op}	−65 to +200	°C	T_{amb}
8	Storage Temperature Range	T_{stg}	−65 to +200	°C	
9	Soldering Temperature	T_{sol}	+260	°C	Time: ≤10s Distance from case ≥1.5mm

NOTES

1. One side.
2. Both sides.
3. At T_{amb} = +25°C. For derating at T_{amb} > +25°C, see Figure 1.
4. At T_{case} = +25°C. For derating at T_{case} > +25°C, see Figure 1.

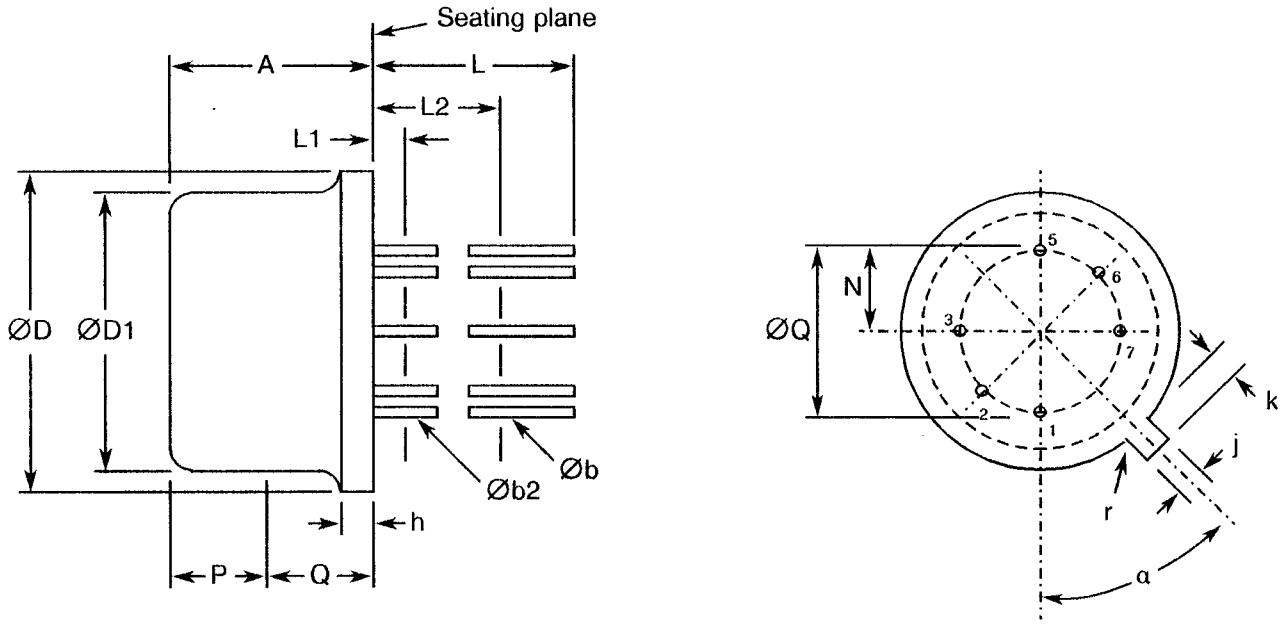
FIGURE 1 - PARAMETER DERATING INFORMATION



Power Dissipation versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) - VARIANT 01, TO-78 CAN



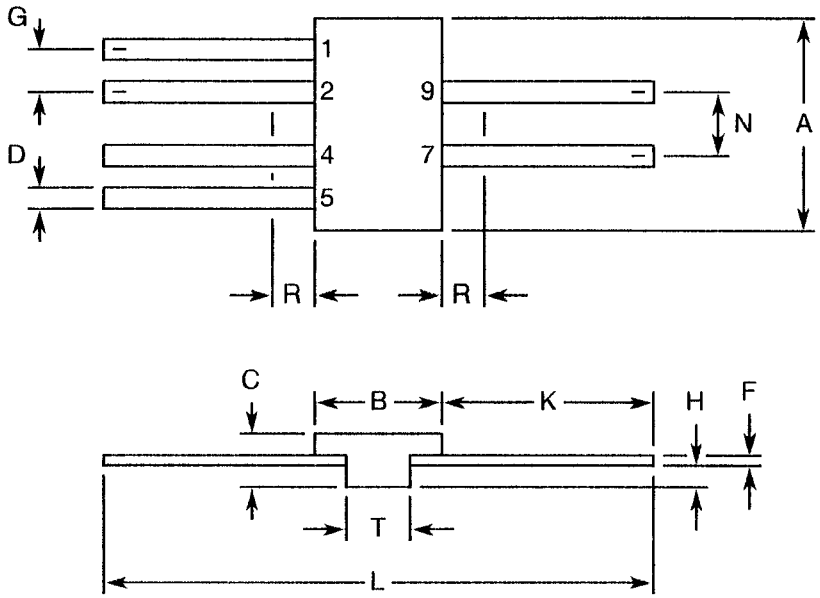
SYMBOL	MILLIMETRES		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	8.51	9.40	0.335	0.370	
B	7.75	8.51	0.305	0.335	
C	3.81	4.70	0.150	0.185	
D	0.41	0.53	0.016	0.021	2
G	5.08 BSC		0.200 BSC		
H	0.71	0.86	0.028	0.034	
J	0.74	1.14	0.029	0.045	
K	12.70	-	0.500	-	2
M	45° BSC		45° BSC		
N	2.54 BSC		0.100 BSC		

NOTES

1. Imperial equivalents (to the nearest 0.001 inch) are given for general information only and are based on 25.4mm = 1.0 inch.
2. All 6 leads.

FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(b) - VARIANT 02, FLAT PACKAGE



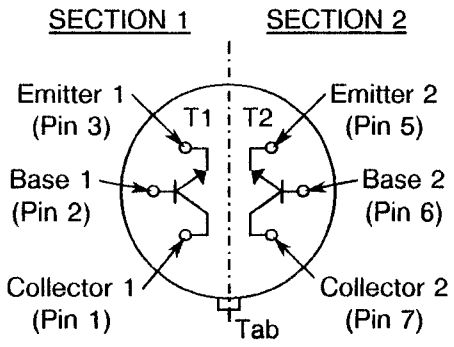
SYMBOL	MILLIMETRES		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	6.10	7.37	0.240	0.290	
B	2.92	4.06	0.115	0.160	
C	0.76	2.03	0.030	0.080	
D	0.36	0.48	0.014	0.019	3, 4
F	0.08	0.15	0.003	0.006	3
G	1.27 BSC		0.050 BSC		3, 4
H	0.13	0.89	0.005	0.035	
K	3.81	-	0.150	-	
L	10.54	-	0.415	-	
N	2.54 BSC		0.100 BSC		4
R	-	1.27	-	0.050	
T	1.65	2.03	0.065	0.080	

NOTES

1. Imperial equivalents (to the nearest 0.001 inch) are given for general information only and are based on 25.4mm = 1.0 inch.
2. All leads electrically insulated from case and each section electrically isolated from the other.
3. All 6 leads.
4. Measure within zone 'R'.

FIGURE 3(a) - PIN ASSIGNMENT

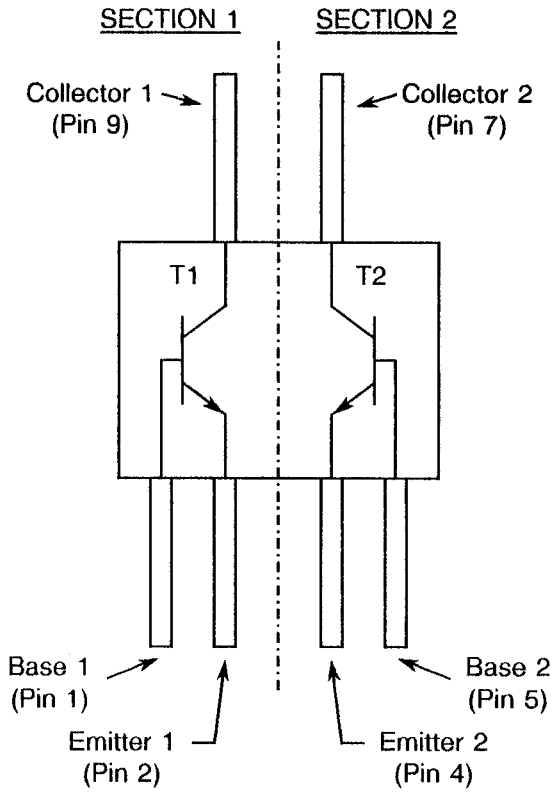
TO-78 PACKAGE



BOTTOM VIEW

NOTES
1. Pins 4 and 8 are omitted.

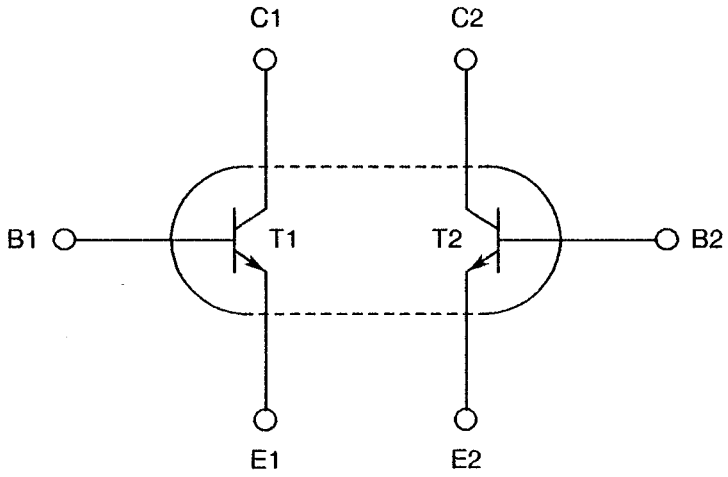
FLAT PACKAGE



BOTTOM VIEW

NOTES
1. Pins 3, 5, 8 and 10 are omitted.

FIGURE 3(b) - FUNCTIONAL DIAGRAM



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.

(c) ESA/SCC Basic Specification No. 23500, Requirements for Lead Materials and Finishes for Components 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 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)

(a) Para. 9.22, High Temperature Reverse Bias (H.T.R.B.) test: Shall not be performed.

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 0.8 grammes for Variant 01 and 0.32 grammes for Variant 02.

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: 'E', Lead Fatigue.
Applied Force: 2.5 ± 0.1 Newtons, 3 bends at 45°.

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

The case shall be hermetically sealed and have a metal body with hard glass seals or a ceramic body and the lid shall be welded, brazed, preform soldered or glass frit sealed.

4.4.2 Lead Material and Finish

For TO-78 can, the lead material shall be gold plated KOVAR, with nickel underplating, in accordance with Type 'D2' of ESA/SCC Basic Specification No. 23500.

For Flat Packages, the lead material shall be gold plated Type 42 Alloy, with nickel underplating in accordance with Type 'G2' 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.

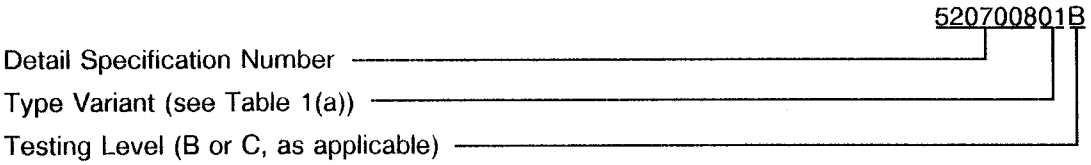
(c) Traceability Information.

4.5.2 Lead Identification

Lead identification shall be as shown in Figures 2 and 3(a).

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.

4.5.5 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. 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

Circuits for use in performing the electrical measurements listed in Tables 2 and 3 of this specification 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 (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 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 of this specification.

4.7.3 Electrical Circuits for Power Burn-in

Circuits for use in performing the power burn-in tests are shown in Figure 5 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	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	3001 Bias Cond. 'D'	$I_C = 10\mu A$ $I_E = 0A$	40	-	V
2	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011 Bias Cond. 'D'	$I_C = 10mA$ $I_B = 0A$ Note 1	15	-	V
		$V_{(BR)CES}$	3011 Bias Cond. 'C'	$I_C = 10\mu A$	40	-	
3	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026 Bias Cond. 'D'	$I_E = 10\mu A$ $I_C = 0A$	4.5	-	V
4	Collector-Emitter Cut-off Current	I_{CES}	3041 Bias Cond. 'C'	$V_{CE} = 20V$	-	400	nA
		I_{CEX}	3041 Bias Cond. 'A'	$V_{CE} = 10V$ $V_{BE} = 0.25V$	-	300	
5	Emitter-Base Cut-off Current	I_{EBO}	3061 Bias Cond. 'D'	$V_{EB} = 4.0V$ $I_C = 0A$	-	250	nA
6	Collector-Base Cut-off Current	I_{CBO}	3036 Bias Cond. 'D'	$V_{CB} = 20V$ $I_E = 0A$	-	200	nA
7	D.C. Forward Current Transfer Ratio	h_{FE1}	3076	$I_C = 10mA$, $V_{CE} = 0.35V$ Note 1	40	120	-
		h_{FE2}		$I_C = 30mA$, $V_{CE} = 0.4V$ Note 1	30	120	
		h_{FE3}		$I_C = 10mA$, $V_{CE} = 1.0V$ Note 1	40	120	
		h_{FE4}		$I_C = 100mA$, $V_{CE} = 1.0V$ Note 1	40	120	

NOTES: See Page 17.

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	Collector-Emitter Saturation Voltage	$V_{CE(sat)1}$	3071	I_C = 10mA I_B = 1.0mA Note 1	-	0.20	V
		$V_{CE(sat)2}$		I_C = 30mA I_B = 3.0mA Note 1	-	0.25	
		$V_{CE(sat)3}$		I_C = 100mA I_B = 10mA Note 1	-	0.50	
9	Base-Emitter Saturation Voltage	$V_{BE(sat)1}$	3066 Test Cond. 'A'	I_C = 10mA I_B = 1.0mA	-	0.90	V
		$V_{BE(sat)2}$		I_C = 30mA I_B = 3.0mA Note 1	-	1.15	
		$V_{BE(sat)3}$		I_C = 100mA I_B = 10mA Note 1	-	1.60	
10	D.C. Forward Current Transfer Ratio Match	$\frac{h_{FE1}}{h_{FE2}}$	3076	I_C = 3.0mA V_{CE} = 1.0V Notes 1 and 2	0.9	1.0	-
11	Base-Emitter Voltage Differential	$\lvert V_{BE1} - V_{BE2} \rvert$	3066	I_C = 3.0mA V_{CE} = 1.0V	-	5.0	mV
12	Insulation Test	R_{INS}	-	$V_{(C1 \text{ to } C2)}$ = 100V	100	-	MΩ

NOTES

1. Pulse measurement: Pulse Length ≤ 300µs, Duty Cycle ≤ 2.0%
2. The smallest measurement recorded in this test shall be taken as h_{FE1}.
3. Measurements performed on a sample basis, LTPD7 or less.

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST FIG.	TEST CONDITIONS (NOTE 3)	LIMITS		UNIT
						MIN	MAX	
13	Current Gain Bandwidth Product	f_T	3206	-	I_C = 1.0mA V_{CE} = 5.0V f = 30MHz Note 1	60	240	MHz
14	Small Signal Short Circuit Forward Current Transfer Ratio	h_{fe}	3306	-	I_C = 10mA V_{CE} = 10V f = 100MHz Note 1	5.0	-	-
15	Output Capacitance	C_{obo}	3236	-	V_{CB} = 5.0V I_E = 0A f = 1.0MHz	-	4.0	pF
16	Input Capacitance	C_{ibo}	3240	-	V_{EB} = 0.5V I_C = 0A f = 1.0MHz	-	5.0	pF
17	Charge Storage Time	t_s	3251 Test Cond. 'B'	4(a)	V_{CC} = 10V I_C = 10mA $I_{B1} = -I_{B2}$ = 10mA	-	13	ns
18	Turn-on Switching Time	t_{on}	3251 Test Cond. 'B'	4(b)	V_{CC} = 3.0V I_C = 10mA I_{B1} = 3.0mA $V_{BE(OFF)}$ = 1.5V	-	12	ns
19	Turn-off Switching Time	t_{off}	3251 Test Cond. 'B'	4(c)	V_{CC} = 3.0V I_C = 10mA I_{B1} = 3.0mA I_{B2} = −1.5mA	-	18	ns

NOTES: See Page 17.

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-Emitter Cut-off Current	I_{CEX}	3041 Bias Cond. 'A'	T_{amb} = +125°C V_{CE} = 10V, V_{BE} = 0.25V	-	30	µA
6	Collector-Base Cut-off Current	I_{CBO}	3036	T_{amb} = +150°C V_{CB} = 20V I_E = 0A	-	30	µA
7	D.C. Forward Current Transfer Ratio	h_{FE3}	3076	T_{amb} = −55°C I_C = 10mA, V_{CE} = 1.0V Note 1	20	-	-
8	Collector-Emitter Saturation Voltage	$V_{CE(sat)1}$	3071	T_{amb} = +125°C I_C = 10mA, I_B = 1.0mA Note 1	-	300	mV
9	Base-Emitter Saturation Voltage	$V_{BE(sat)1}$	3066 Cond. 'A'	I_C = 10mA, I_B = 1.0mA T_{amb} = +125°C T_{amb} = −55°C Note 1	0.59 -	- 1.02	V
11	Base-Emitter Voltage Differential Change	$\lvert \frac{\Delta(V_{BE1} - V_{BE2})}{\Delta T_{amb}} \rvert$	3066	T_{amb} = −55 to +25 °C I_C = 3.0mA V_{CE} = 1.0V	-	0.8	mV
				T_{amb} = +25 to +125 °C I_C = 3.0mA V_{CE} = 1.0V	-	1.0	

NOTES

1. Pulsed measurement: Pulse Width ≤300µs, Duty Cycle ≤2.0%.

TABLE 4 - PARAMETER DRIFT VALUES

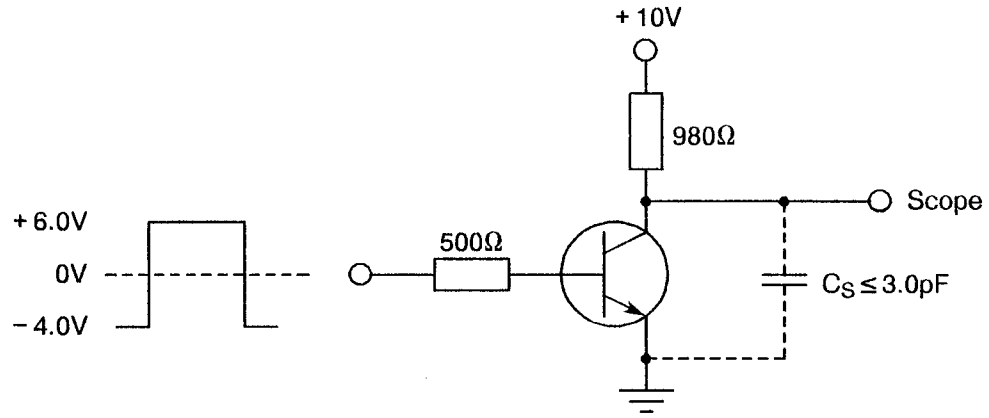
No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
4	Collector-Emitter Cut-off Current	I_{CES}	As per Table 2	As per Table 2	±25 or (1) ±100	nA %
7	D.C. Forward Current Transfer Ratio	h_{FE3}	As per Table 2	As per Table 2	±15	%
8	Collector-Emitter Saturation Voltage	$V_{CE(sat)1}$	As per Table 2	As per Table 2	±15 or (1) ±15	mV %

NOTES

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

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

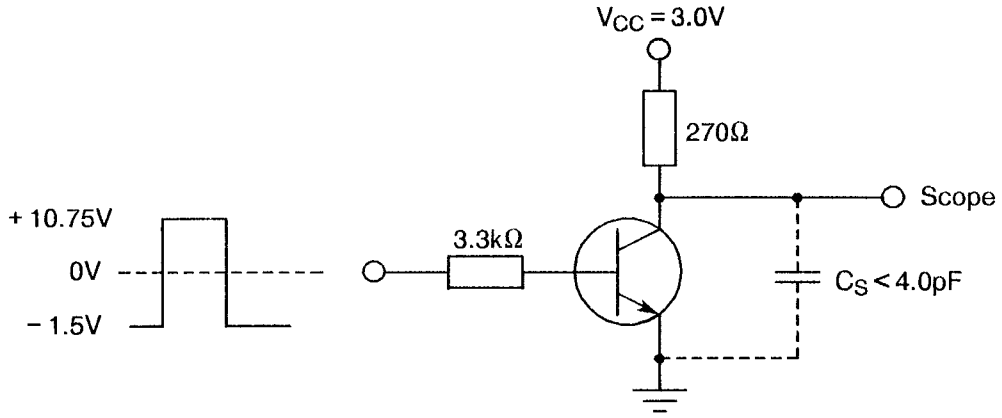
FIGURE 4(a) - CHARGE STORAGE TIME



NOTES

1. Pulse Width = 300ns, $t_f \leq 1.0$ns, Duty Cycle ≤ 2.0%.

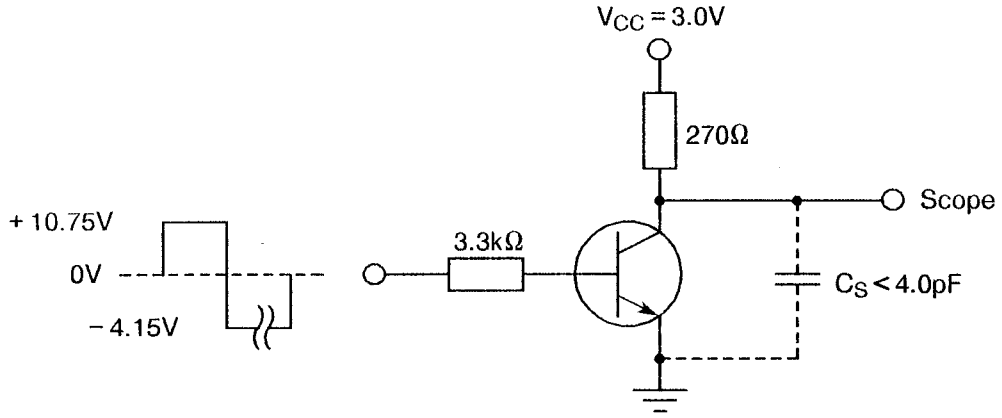
FIGURE 4(b) - TURN-ON SWITCHING TIME



NOTES

1. Pulse Width = 300ns, $t_f \leq 1.0$ns, Duty Cycle ≤ 2.0%.

FIGURE 4(c) - TURN-OFF SWITCHING TIME



NOTES

1. Pulse Width = 300ns, $t_f \leq 1.0$ns, Duty Cycle ≤ 2.0%.

TABLE 5 - CONDITIONS FOR POWER BURN-IN

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	T_{amb}	$+22 \pm 3$	°C
2	Collector-Base Voltage	V_{CB}	12	V
3	Power Dissipation	P_{tot}	Variant 01: 0.60 Variant 02: 0.40 (Note 1)	W

NOTES

1. Total power dissipation both sections.

FIGURE 5 - ELECTRICAL CIRCUIT FOR POWER BURN-IN

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. 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.

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 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 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.

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-Emitter Cut-off Current	I_{CEX}	As per Table 2	As per Table 2	-	300	nA
5	Emitter-Base Cut-off Current	I_{EBO}	As per Table 2	As per Table 2	-	250	nA
6	Collector-Base Cut-off Current	I_{CBO}	As per Table 2	As per Table 2	-	200	nA
7	D.C. Forward Current Transfer Ratio	h_{FE3}	As per Table 2	As per Table 2	40	120	-
		h_{FE4}	As per Table 2	As per Table 2	20	120	
8	Collector-Emitter Saturation Voltage	$V_{CE(sat)1}$	As per Table 2	As per Table 2	-	0.20	V
10	D.C. Forward Current Transfer Ratio Match	$\frac{h_{FE1}}{h_{FE2}}$	As per Table 2	As per Table 2	0.9	1.0	-
11	Base-Emitter Voltage Differential	$\lvert V_{BE1} - V_{BE2} \rvert$	As per Table 2	As per Table 2	-	5.0	mV
11	Base-Emitter Voltage Differential Change	$\lvert \frac{\Delta(V_{BE1} - V_{BE2})}{\Delta T_{amb}} \rvert$	As per Table 3	As per Table 3 Note 1	-	0.8	mV
				As per Table 3 Note 1	-	1.0	

NOTES

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