



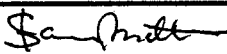

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Pages 1 to 21

**TRANSISTORS, DUAL, PNP,
BASED ON TYPES MD2905A AND MD2905AF
ESA/SCC Detail Specification No. 5207/013**



**space components
coordination group**

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SCC

ESA/SCC Detail Specification
No. 5207/013

PAGE 2

ISSUE 2

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 1 and incorporates all modifications defined in Revisions 'A', 'B' and 'C' to Issue 1 and the changes agreed in the following DCR's:- Cover page DCN Para. 1.8	: New paragraph added	None None 21083

**TABLE OF CONTENTS**

	<u>Page</u>
1. <u>GENERAL</u>	5
1.1 Scope	5
1.2 Component Type Variants	5
1.3 Maximum Ratings	5
1.4 Parameter Derating Information	5
1.5 Physical Dimensions	5
1.6 Pin Assignment	5
1.7 Functional Diagram	5
1.8 High Temperature Test Precautions	5
2. <u>APPLICABLE DOCUMENTS</u>	5
3. <u>TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS</u>	5
4. <u>REQUIREMENTS</u>	11
4.1 General	11
4.2 Deviations from Generic Specification	11
4.2.1 Deviations from Special In-process Controls	11
4.2.2 Deviations from Final Production Tests	11
4.2.3 Deviations from Burn-in and Electrical Measurements	11
4.2.4 Deviations from Qualification Tests	11
4.2.5 Deviations from Lot Acceptance Tests	11
4.3 Mechanical Requirements	11
4.3.1 Dimension Check	11
4.3.2 Weight	11
4.3.3 Terminal Strength	11
4.4 Materials and Finishes	12
4.4.1 Case	12
4.4.2 Lead Material and Finish	12
4.5 Marking	12
4.5.1 General	12
4.5.2 Lead Identification	12
4.5.3 The SCC Component Number	12
4.5.4 Traceability Information	12
4.5.5 Marking of Small Components	13
4.6 Electrical Measurements	13
4.6.1 Electrical Measurements at Room Temperature	13
4.6.2 Electrical Measurements at High and Low Temperatures	13
4.6.3 Circuits for Electrical Measurements	13
4.7 Burn-in Tests	13
4.7.1 Parameter Drift Values	13
4.7.2 Conditions for High Temperature Reverse Bias Burn-in	13
4.7.3 Conditions for Power Burn-in	13
4.7.4 Electrical Circuits for High Temperature Reverse Bias and Power Burn-in	13
4.8 Environmental and Endurance Tests	20
4.8.1 Electrical Measurements on Completion of Environmental Tests	20
4.8.2 Electrical Measurements at Intermediate Points and on Completion of Endurance Tests	20
4.8.3 Conditions for Operating Life Tests	20
4.8.4 Electrical Circuit for Operating Life Tests	20
4.8.5 Conditions for High Temperature Storage Test	20



TABLES

Page



1(a)	Type Variants	6
1(b)	Maximum Ratings	6
2	Electrical Measurements at Room Temperature - d.c. Parameters	14
	Electrical Measurements at Room Temperature - a.c. Parameters	15
3	Electrical Measurements at High and Low Temperatures	16
4	Parameter Drift Values	18
5	Conditions for High Temperature Reverse Bias and Power Burn-in and Operating Life Tests	18
6	Electrical Measurements at Intermediate Points and on Completion of Endurance Testing	21

FIGURES

1	Parameter Derating Information	7
2	Physical Dimensions	8
3(a)	Pin Assignment	10
3(b)	Functional Diagram	10
4	Circuits for Electrical Measurements	17
5	Electrical Circuit for High Temperature Reverse Bias and Power Burn-in and Operating Life Tests	19

APPENDICES (Applicable to specific Manufacturers only)

None.

 	<p style="text-align: center;">ESA/SCC Detail Specification No. 5207/013</p>		<p>PAGE 5 ISSUE 2</p>
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1. **GENERAL**

1.1 **SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Transistor, Dual, PNP, based on Types MD2905A and MD2905AF. 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 showing lead identification, of the transistors specified herein, is shown in Figure 3(b).

1.8 **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.
- (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.

TABLE 1(a) - TYPE VARIANTS

VARIANT	BASED ON TYPE	CASE	FIGURE	LEAD MATERIAL AND FINISH
01	MD2905AF	Flat Pack	2(a)	G2
02	MD2905A	6-Pin Can	2(b)	D2
03	MD2905AF	Flat Pack	2(a)	G3 or G4
04	MD2905A	6-Pin Can	2(b)	D3 or D4

TABLE 1(b) - MAXIMUM RATINGS

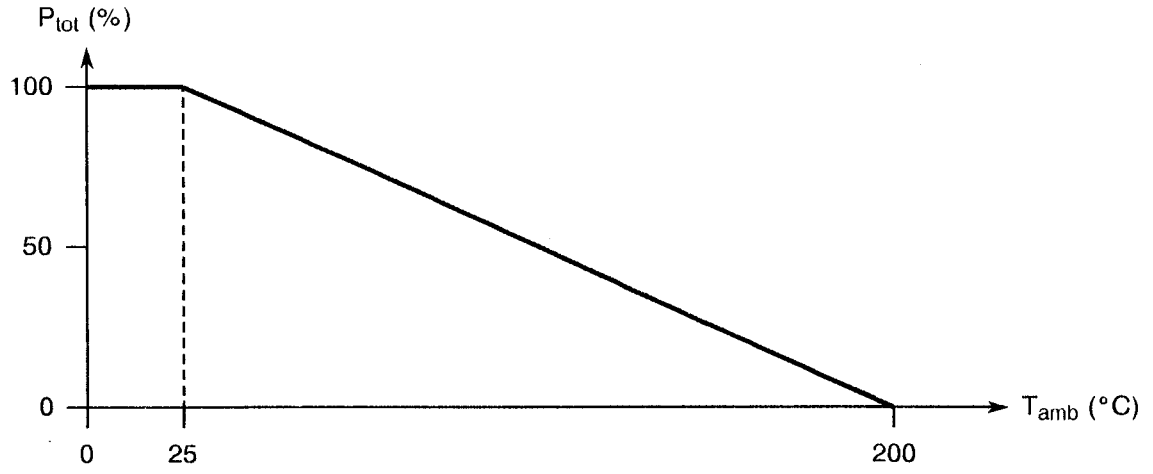
No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Collector-Base Voltage	V_{CBO}	- 60	V	
2	Collector-Emitter Voltage	V_{CEO}	- 60	V	
3	Emitter-Base Voltage	V_{EBO}	- 5.0	V	
4	Collector Current (Continuous)	I_C	600	mA	
5	Power Dissipation (Continuous) Variants 01 and 03 Variants 02 and 04	P_{tot}	0.35 (Note 1) 0.40 (Note 2) 0.575 (Note 1) 0.625 (Note 2)	W	Note 3
6	Operating Temperature Range	T_{op}	- 65 to +200	°C	T_{amb}
7	Storage Temperature Range	T_{stg}	- 65 to +200	°C	
8	Soldering Temperature	T_{sol}	+ 260	°C	Time: ≤ 10s Distance from case ≥ 1.5mm

NOTES

- One side.
- Both sides.
- At $T_{amb} \leq +25^\circ\text{C}$. For derating at $T_{amb} > +25^\circ\text{C}$, see Figure 1.



FIGURE 1 - PARAMETER DERATING INFORMATION

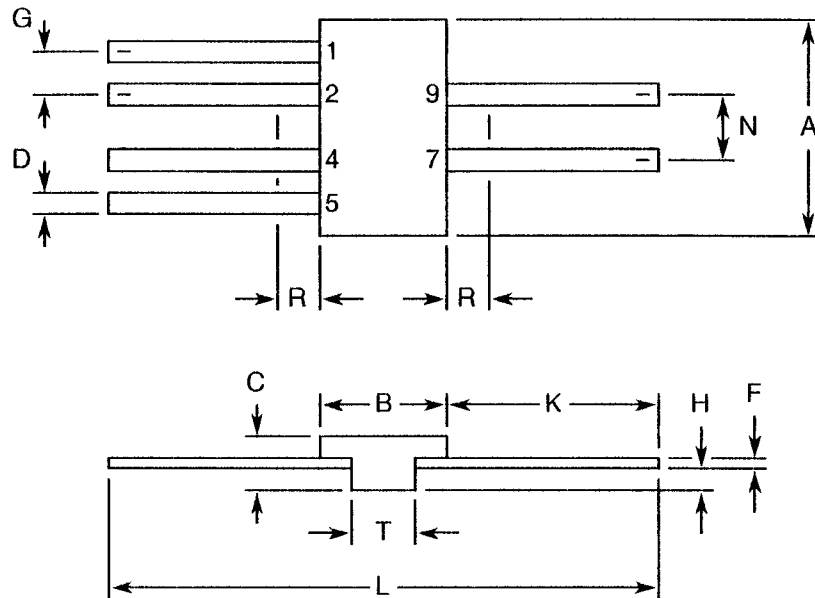


Power Dissipation versus Temperature



FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) - VARIANTS 01 AND 03, FLAT PACKAGE



SYMBOL	MILLIMETRES		INCHES (NOTE 1)		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	2, 3
F	0.076	0.15	0.003	0.006	2
G	1.27 BSC		0.050 BSC		2, 3
H	0.127	0.89	0.005	0.035	
K	3.81	-	0.150	-	
L	10.54	-	0.415	-	
N	2.54 BSC		0.100 BSC		3
R	-	1.27	-	0.050	
T	1.65	2.03	0.065	0.080	

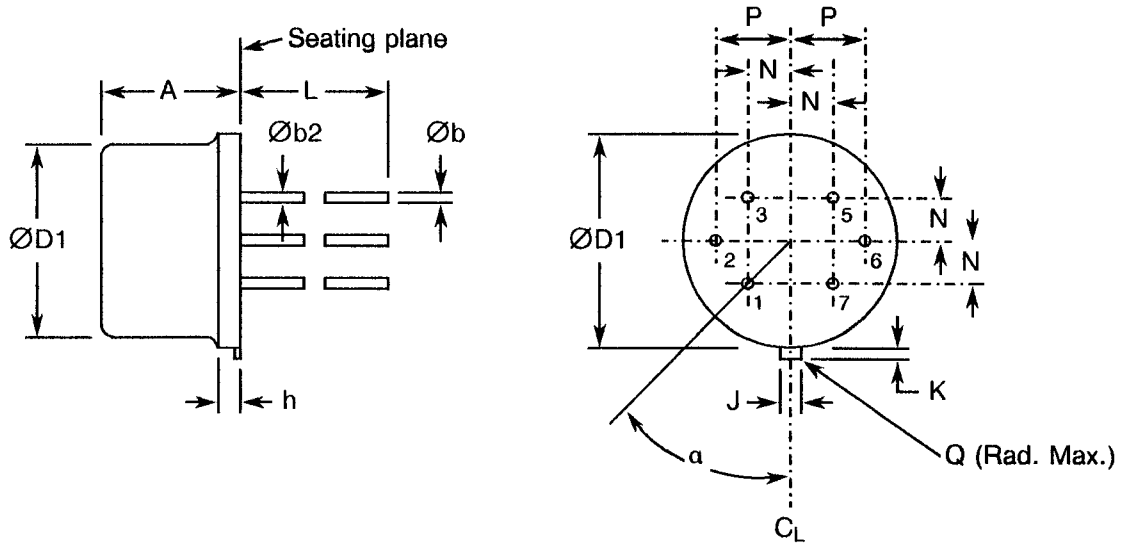
NOTES

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 6 leads.
3. Measure within zone 'R'.



FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(b) - VARIANTS 02 AND 04, 6-PIN CAN



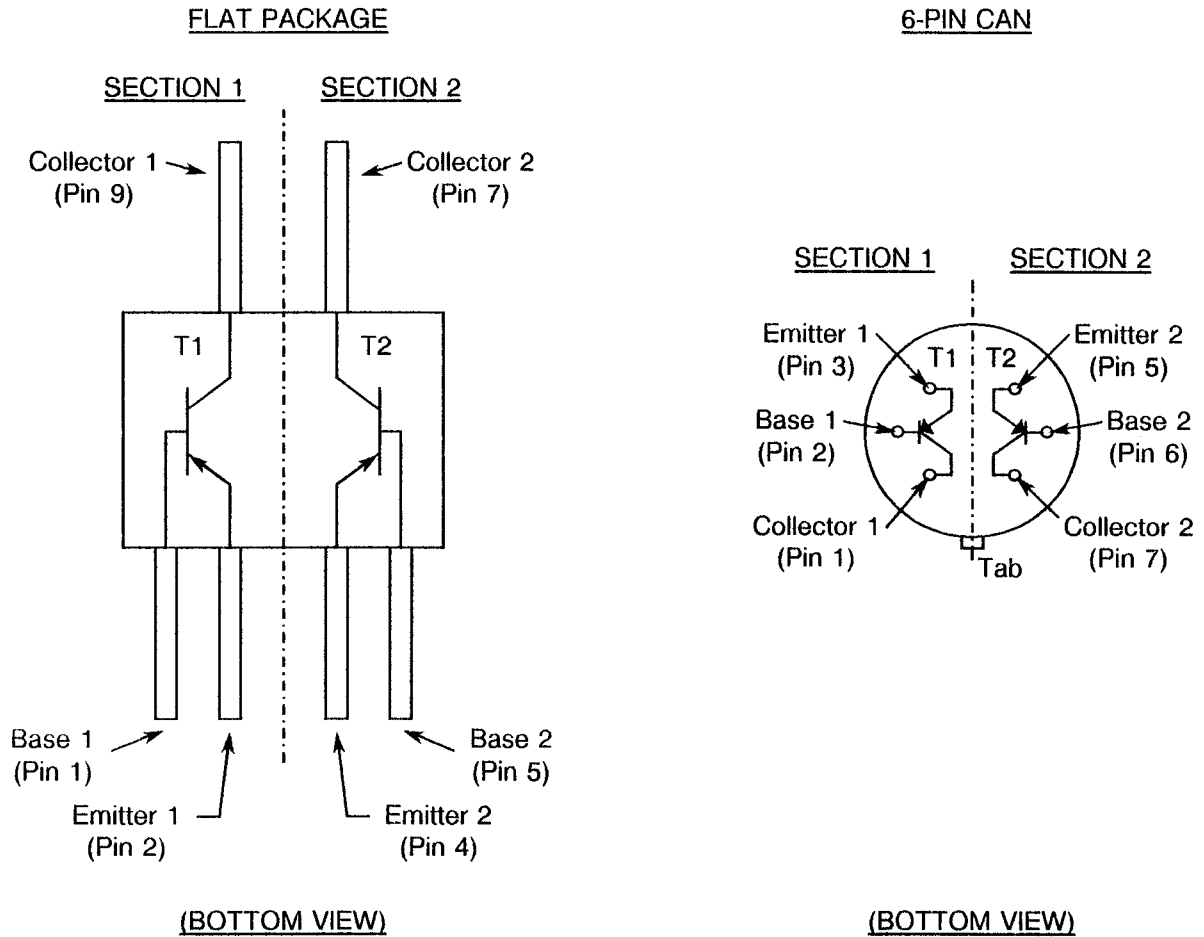
SYMBOL	MILLIMETRES		INCHES (NOTE 1)		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	3.81	4.57	0.150	0.180	
Øb	0.41	0.53	0.016	0.021	2, 6
Øb2	0.41	0.48	0.016	0.019	2, 6
ØD	8.51	9.40	0.335	0.370	
ØD1	7.75	8.51	0.305	0.335	
h	0.23	1.04	0.009	0.041	
j	0.71	0.86	0.028	0.034	7
k	0.74	1.14	0.029	0.045	5
L	12.70	44.45	0.500	1.750	6
N	1.80 TYP.		0.0707 TYP.		4
P	2.54 TYP.		0.100 TYP.		4
Q	-	0.18	-	0.007	
α	45° BSC.		45° 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. Measured in the zone beyond 6.35mm (0.25 inch) from the seating plane.
3. Measured in the zone beyond 1.27mm (0.050 inch) and 6.35mm (0.25 inch) from the seating plane.
4. When measured in a gauging plane 1.37(+0.03-0)mm (0.054(+0.001-0.000) inch) below the seating plane of the transistor, maximum diameter leads shall be within 0.18mm (0.007 inch) of their true location relative to a maximum diameter lead tolerance.
5. Measured from the maximum diameter of the actual device.
6. All 6 leads.
7. The device shall be measured by direct method or by gauge. This width to remain constant for a length of 0.56mm (0.022 inch).



FIGURE 3(a) - PIN ASSIGNMENT



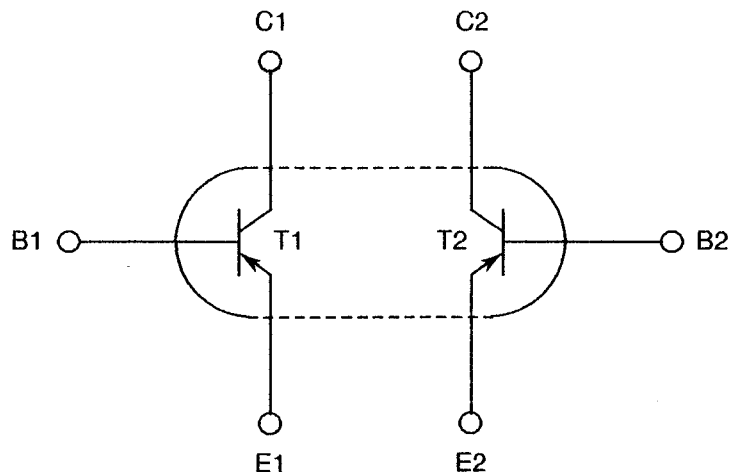
NOTES

1. Pins 3, 6, 8 and 10 are omitted.

NOTES

1. Pins 4 and 8 are omitted.

FIGURE 3(b) - FUNCTIONAL 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)

(a) Para. 9.8.2, Seal Test (Gross Leak): For Variant 01, this test to be performed to Step 1 only.

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

(a) Para. 9.8.2, Seal Test (Gross Leak): For Variant 01, this test to be performed to Step 1 only.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.8.2, Seal Test (Gross Leak): For Variant 01, this test to be performed to Step 1 only.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.8.2, Seal Test (Gross Leak): For Variant 01, this test to be performed to Step 1 only.

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 0.32 grammes for the flat package and 2.8 grammes for the 6-Pin can.

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:-

Variants 01 and 03

Test Condition: 'E' (Lead Fatigue).

Applied Force: 1.0 ± 0.1 Newtons, 3 bends at 45°.

Variants 02 and 04

Test Condition: 'A' (Tension).

Applied Force: 7.5 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 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 or ceramic body with hard glass seals and the lid shall be welded, brazed, preform soldered or glass frit sealed.

4.4.2 Lead Material and Finish

The lead material shall be either Type 'D' or Type 'G' with either Type '2' or Type '3 or 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 the requirements of ESA/SCC Basic Specification No. 21700. Each component shall be marked in respect of:-

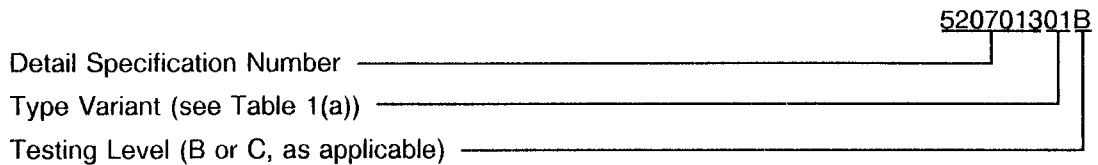
- (a) Lead Identification.
- (b) The SCC Component Number.
- (c) Traceability Information.

4.5.2 Lead Identification

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



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.

 	ESA/SCC Detail Specification No. 5207/013		PAGE 13 ISSUE 2
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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. The measurements shall be performed at $T_{amb} = -55(+5 - 0)$ and $+150(+0 - 5)$ °C respectively.

4.6.3 Circuits for Electrical Measurements

Circuits for use in performing the electrical measurements listed in Table 2 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 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 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 of this specification.

4.7.4 Electrical Circuits for High Temperature Reverse Bias and Power Burn-in

Electrical circuits for use in performing the high temperature reverse bias and power burn-in tests is 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 to 2	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	3001	$I_C = -10\mu A$ $I_E = 0A$	-60	-	V
3 to 4	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011	$I_C = -10mA$ $I_B = 0A$ Note 1	-60	-	V
5 to 6	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026	$I_E = -10\mu A$ $I_C = 0A$	-5.0	-	V
7 to 8	Collector-Emitter Cut-off Current	I_{CEX}	3041	$V_{CE} = -30V$ $V_{BE} = 0.5V$	-	-50	nA
9 to 10	Emitter-Base Cut-off Current	I_{EBO}	3061	$V_{EB} = -4.0V$ $I_C = 0A$	-	-30	nA
11 to 12	D.C. Forward Current Transfer Ratio 1	h_{FE1}	3076	$I_C = -100\mu A$ $V_{CE} = -10V$	75	-	-
13 to 14	D.C. Forward Current Transfer Ratio 2	h_{FE2}	3076	$I_C = -1.0mA$ $V_{CE} = -10V$	100	-	-
15 to 16	D.C. Forward Current Transfer Ratio 3	h_{FE3}	3076	$I_C = -10mA$ $V_{CE} = -10V$	100	-	-
17 to 18	D.C. Forward Current Transfer Ratio 4	h_{FE4}	3076	$I_C = -150mA$ $V_{CE} = -10V$ Note 1	100	300	-
19 to 20	D.C. Forward Current Transfer Ratio 5	h_{FE5}	3076	$I_C = -500mA$ $V_{CE} = -10V$ Note 1	50	-	-
21 to 22	Collector-Emitter Saturation Voltage 1	$V_{CE(sat)1}$	3071	$I_C = -150mA$ $I_B = -15mA$ Note 1	-	-0.4	V
23 to 24	Collector-Emitter Saturation Voltage 2	$V_{CE(sat)2}$	3071	$I_C = -500mA$ $I_B = -50mA$ Note 1	-	-1.6	V

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	
25 to 26	Base-Emitter Saturation Voltage 1	$V_{BE(sat)1}$	3066	$I_C = -150mA$ $I_B = -15mA$ Note 1	-	-1.3	V
27 to 28	Base-Emitter Saturation Voltage 2	$V_{BE(sat)2}$	3066	$I_C = -500mA$ $I_B = -50mA$ Note 1	-	-2.6	V
29 to 30	Collector-Base Cut-off Current	I_{CBO}	3036	$V_{CB} = -50V$ $I_E = 0A$	-	-10	nA

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST FIG.	TEST CONDITIONS (NOTE 2)	LIMITS		UNIT
						MIN	MAX	
31 to 32	Current Gain Bandwidth Product	f_t	3301	-	$I_C = -50mA$ $V_{CE} = -20V$ $f = 100MHz$	200	-	MHz
33 to 34	Saturated Turn-on Switching Time	t_{on}	-	4(a)	$V_{CC} = -30V$ $I_C = -150mA$ $I_B = -15mA$	-	45	ns
35 to 36	Saturated Turn-off Switching Time	t_{off}	-	4(b)	$V_{CC} = -30V$ $I_C = -150mA$ $I_{B1} = I_{B2} = -15mA$	-	300	ns
37 to 38	Output Capacitance	C_{obo}	3236	-	$V_{CB} = -10V$ $I_E = 0A$ $100kHz < f < 1.0MHz$	-	8.0	pF
39 to 40	Input Capacitance	C_{ibo}	3240	-	$V_{BE} = -2.0V$ $I_C = 0A$ $100kHz < f < 1.0MHz$	-	30	pF

NOTES

1. Pulsed measurement: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2.0\%$.
2. Measurements shall be performed on a sample basis, LTPD7 or less.



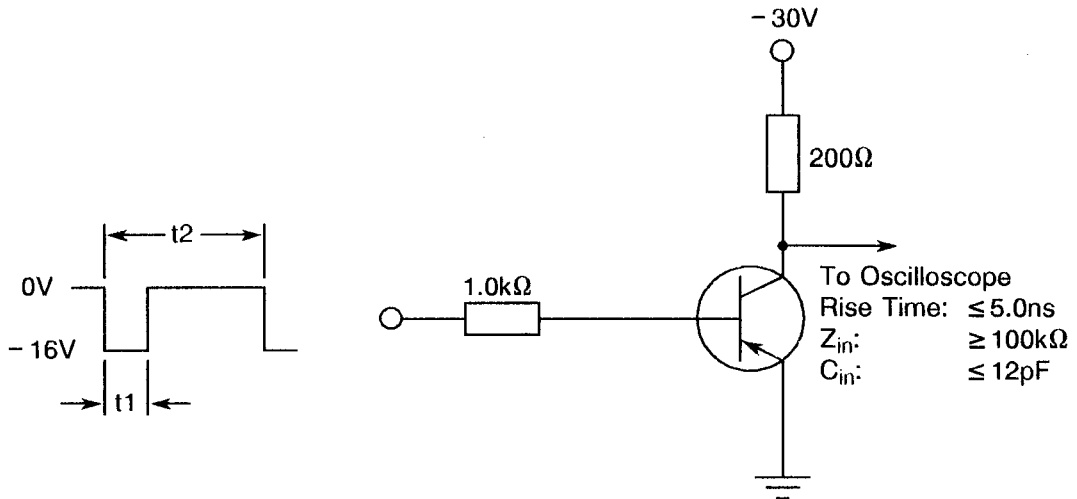
TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN	MAX	
7 to 8	Collector-Emitter Cut-off Current	I_{CEX}	3041	$T_{amb} = +150^{\circ}C$ $V_{CE} = -30V$ $V_{BE} = 0.5V$	-	-30	μA
9 to 10	Emitter-Base Cut-off Current	I_{EBO}	3061	$T_{amb} = +150^{\circ}C$ $V_{BE} = -4.0V$ $I_C = 0A$	-	-50	μA
13 to 14	D.C. Forward Current Transfer 2	h_{FE2}	3076	$T_{amb} = -55^{\circ}C$ $V_{CE} = -10V$ $I_C = -1.0mA$	50	-	-



FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

FIGURE 4(a) - SATURATED TURN-ON SWITCHING TIME



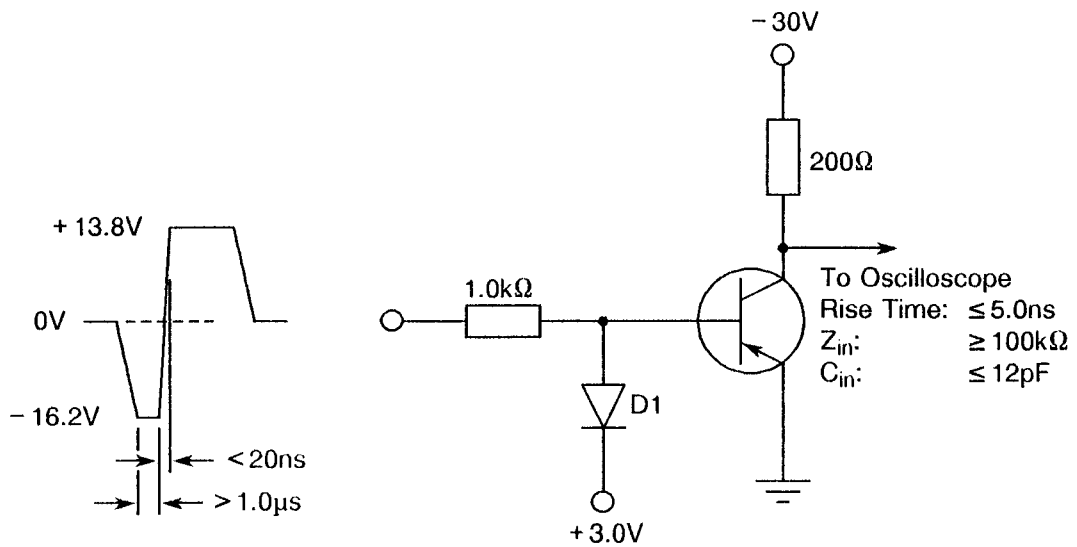
Input:

Rise time $\leq 2.0\text{ns}$

Duty Cycle $\leq 2.0\% = \frac{t_1}{t_2}$

$t_1 > 200\text{ns}$.

FIGURE 4(b) - SATURATED TURN-OFF SWITCHING TIME



Duty Cycle $\leq 2.0\%$

NOTES

1. D1 similar to 1N916, $t_{rr} \leq 5.0\text{ns}$.

**TABLE 4 - PARAMETER DRIFT VALUES**

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
7 to 8	Collector-Emitter Cut-off Current	I_{CEX}	As per Table 2	As per Table 2	± 8.0 or (1) ± 100	nA %
17 to 18	D.C. Forward Current Transfer Ratio 4	h_{FE4}	As per Table 2	As per Table 2	± 10	%
21 to 22	Collector-Emitter Saturation Voltage 1	$V_{CE(sat)1}$	As per Table 2	As per Table 2	± 50 or (1) ± 10	mV %

NOTES

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

TABLE 5 - CONDITIONS FOR HIGH TEMPERATURE REVERSE BIAS AND POWER BURN-IN AND OPERATING LIFE TESTSHIGH TEMPERATURE REVERSE BIAS BURN-IN

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	T_{amb}	+ 150(+ 0 - 3)	$^{\circ}C$
2	Collector-Base Voltage	V_{CB}	- 40	V
3	Duration	t	72	Hrs

POWER BURN-IN AND OPERATING LIFE TESTS

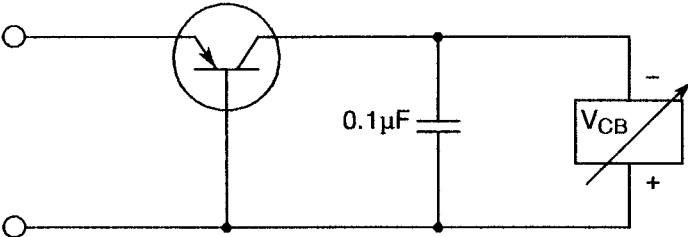
No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	T_{amb}	+ 25 \pm 3	$^{\circ}C$
2	Collector-Base Voltage	V_{CB}	- 40	V
3	Power Dissipation	P_{tot}	Variant 01: 0.40 Variant 02: 0.625 (Note 1)	W

NOTES

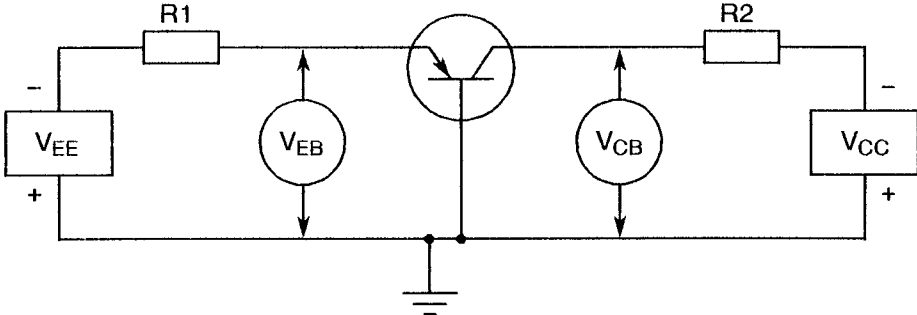
1. Total power dissipation both sections.

FIGURE 5 - ELECTRICAL CIRCUIT FOR HIGH TEMPERATURE REVERSE BIAS AND POWER BURN-IN AND OPERATING LIFE TESTS

HIGH TEMPERATURE REVERSE BIAS BURN-IN



POWER BURN-IN AND OPERATING LIFE TESTS





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. 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 for the power burn-in test.

4.8.4 Electrical Circuit 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 for the 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.	
7 to 8	Collector-Emitter Cut-off Current	I_{CEX}	As per Table 2	As per Table 2	-	- 50	nA
9 to 10	Emitter-Base Cut-off Current	I_{EBO}	As per Table 2	As per Table 2	-	- 30	nA
17 to 18	D.C. Forward Current Transfer Ratio 4	h_{FE4}	As per Table 2	As per Table 2	100	300	-
21 to 22	Collector-Emitter Saturation Voltage 1	$V_{CE(sat)1}$	As per Table 2	As per Table 2	-	- 0.4	V