european space agency
agence spatiale européenne

Pages 1 to 23

TRANSISTORS, NPN, POWER SWITCHING,

BASED ON TYPE 2N5074

ESA/SCC Detail Specification No. 5203/022

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 2	June 1983	-	-
Revision 'A'	February 1992		
Revision 'B'	August 1996		

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 DCRs 21019, 21022, 21025 and the following DCR's:-		
		Table 1(b)	: Notes 1, 2 and 3 rewritten	23111
		Figure 1	: Case references amended	23111
		Figure 2(b)	: Amendment of	
			- left-hand figure	23094
			- some dimensions	23094
		Figure 3	: Note rewritten	23111
'A'	Feb. '92	P1. Cover page		None
		P2. DCN		None
		P5. Para. 1.2	: Paragraph amended	21021
		P12. Para. 2	: "ESA/SCC Basic Spec. No. 23500" added	21025
		Para. 4.2.2	: PIND deviation deleted	21043
			: Bond Strength and Die Shear Test deviations deleted	23499
		P13. 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	: Reference to Note 2 deleted	21047
		Warning This specification previously had, by mistake, the front page of ESA/SCC Detail Specification No. 5203/017		
		This document has been transferred from hardcopy to electronic format. The content is unchanged but minor differences in presentation exist.		
'B'	Aug. '96	P1. Cover page		None
		P2. DCN		None
		P5. Para. 1.7	: Text amended	21083

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, NPN, Power Switching, based on Type 2N5074.

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 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-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.

1.8 BERYLLIUM OXIDE WARNING

TYPE VARIANTS 01, 02, 03 AND 04 CONTAIN BERYLLIUM OXIDE, THE DUST OF WHICH IS HIGHLY TOXIC. DISPOSAL BY PUBLIC WASTE SYSTEM IS STRICTLY FORBIDDEN.

TABLE 1(a) - TYPE VARIANTS

VARIANT	CASE	FIGURE	LEAD MATERIAL AND FINISH
01	TO111/I	2(a)	D2
02	TO111/I	2(a)	D3 or D4
03	TO228AA	2(b)	D2
04	TO228AA	2(b)	D3 or D4
05	TO111	2(c)	D2
06	TO111	2(c)	D3 or D4

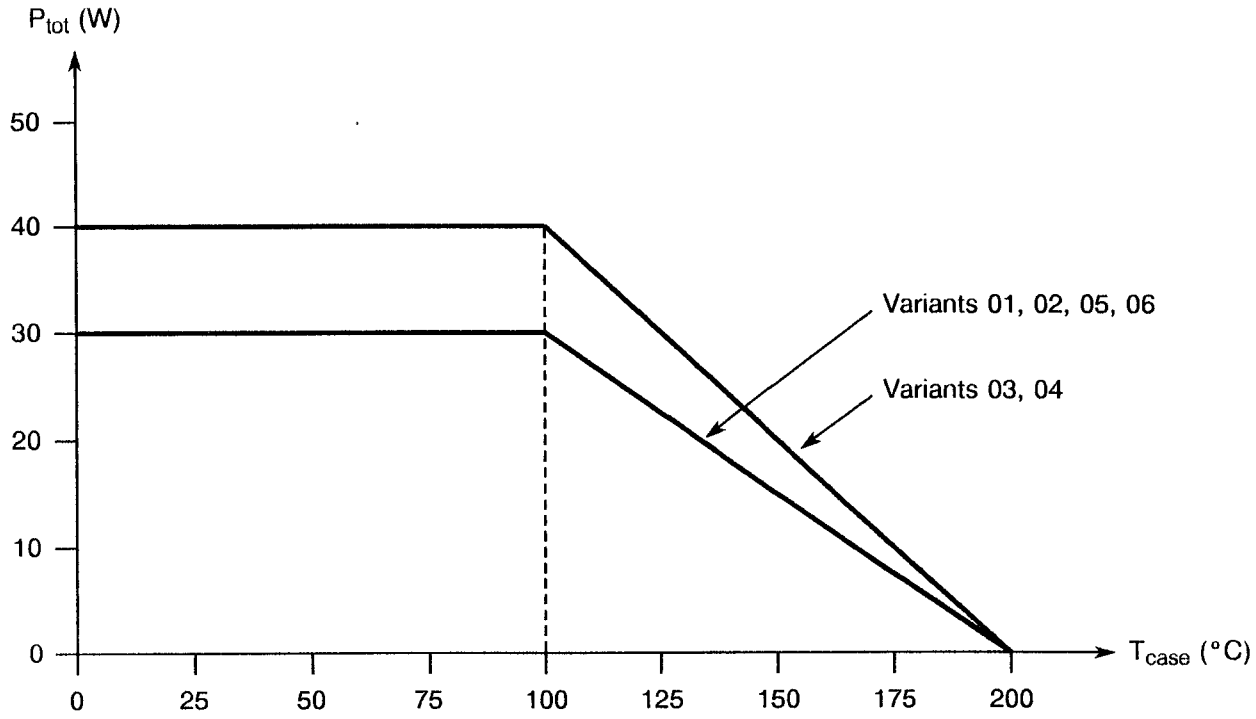
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Collector-Base Voltage	V_{CB}	200	V	
2	Collector-Emitter Voltage	V_{CE}	200	V	
3	Emitter-Base Voltage	V_{EB}	6.0	V	
4	Collector Current (Continuous)	I_C	5.0	A	
5	Power Dissipation (Continuous) Variants 01, 02, 05, 06 Variants 03, 04	P_{tot}	 30 (Note 1) 40 (Note 2)	W	Note 3
6	Operating Junction Temperature Range	T_{op}	−65 to +200	°C	
7	Storage Temperature Range	T_{stg}	−65 to +200	°C	
8	Soldering Temperature	T_{sol}	+260	°C	Note 4

NOTES

1. TO111/I outline (Variants 01 and 02) and TO111 outline (Variants 05 and 06).
2. TO228AA square pack (Variants 03 and 04).
3. At $T_{case} \leq +100°C$. For $T_{case} > +100°C$, derate at:
   - Variants 01, 02: TO111/I: 0.3W/°C.
   - Variants 05, 06: TO111: 0.3W/°C.
   - Variants 03, 04: TO228AA: 0.4W/°C.
4. Duration 10 seconds maximum at a distance of not less than 1.5mm from the can and the same lead shall not be resoldered until 3 minutes have elapsed.

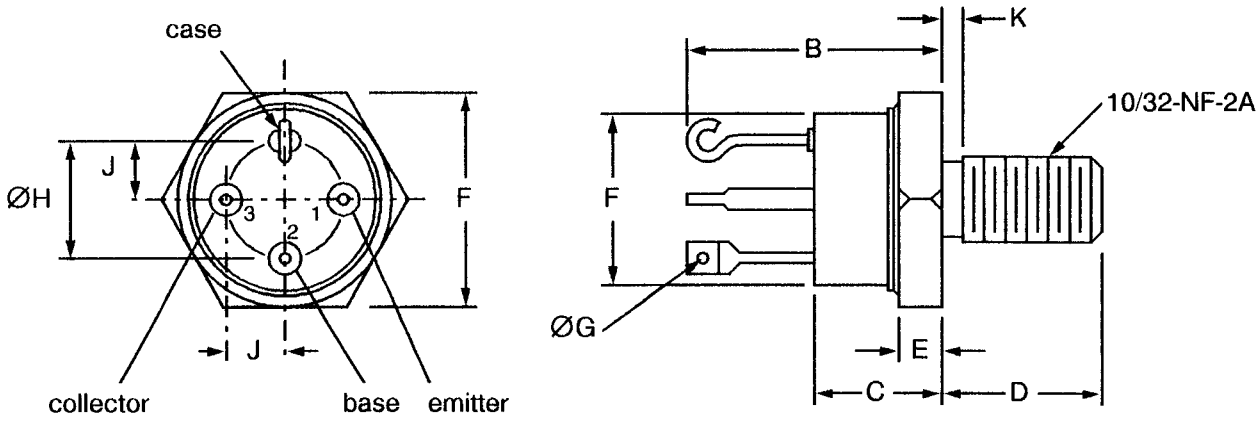
FIGURE 1 - PARAMETER DERATING INFORMATION



Power Dissipation versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS

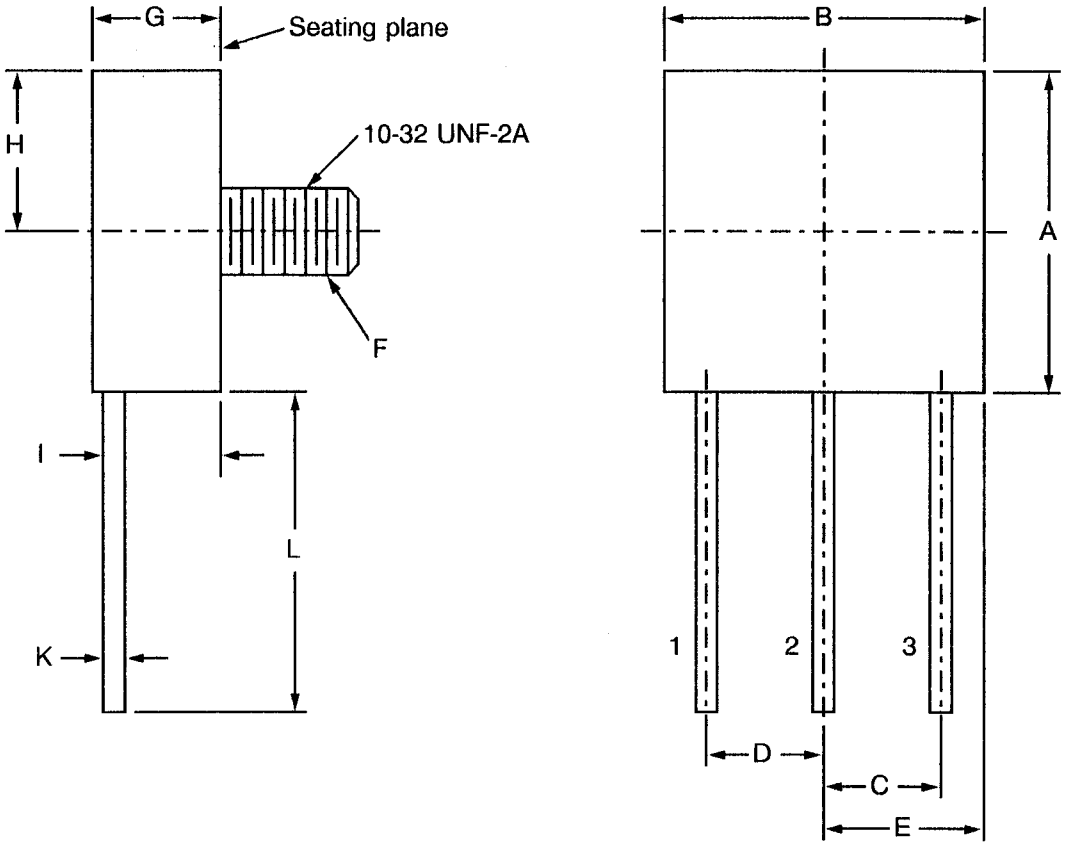
FIGURE 2(a) - VARIANTS 01 AND 02, TO111/I PACKAGE



SYMBOL	INCHES		MILLIMETRES	
	MIN.	MAX.	MIN.	MAX.
A	0.427	0.437	10.85	11.10
B	0.610	0.705	15.49	17.91
C	0.345	0.400	8.76	10.16
D	0.400	0.440	10.16	11.18
E	0.105	0.125	2.67	3.18
F	0.340	0.355	8.64	9.02
ØG	0.050	0.065	1.27	1.65
ØH	0.175	0.205	4.45	5.21
J	0.088	0.103	2.23	2.61
K	-	0.078	-	1.98

FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

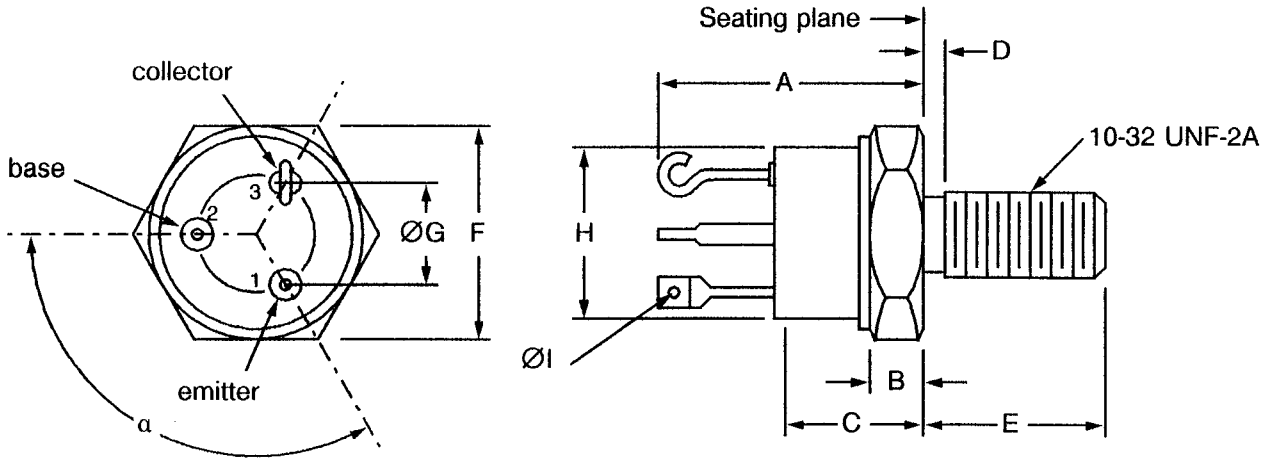
FIGURE 2(b) - VARIANTS 03 AND 04, TO228AA PACKAGE



SYMBOL	INCHES		MILLIMETRES	
	MIN.	MAX.	MIN.	MAX.
A	0.475	0.525	12.07	13.33
B	0.475	0.525	12.07	13.33
C	0.143	0.153	3.64	3.88
D	0.143	0.153	3.64	3.88
E	0.238	0.262	6.05	6.65
F	0.390	0.440	9.91	11.17
G	0.300	0.350	7.62	8.89
H	0.238	0.262	6.05	6.65
I	0.201	0.238	5.15	6.03
K	0.035	0.045	0.89	1.14
L	0.475	0.525	12.07	13.33

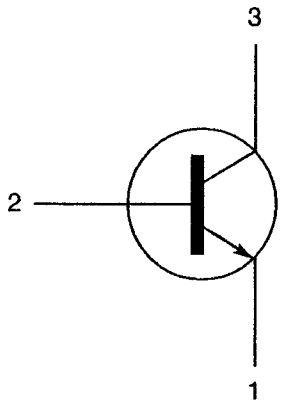
FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(c) - VARIANTS 05 AND 06, TO111 PACKAGE



SYMBOL	INCHES		MILLIMETRES	
	MIN.	MAX.	MIN.	MAX.
A	0.570	0.763	14.50	19.40
B	0.090	0.150	2.30	3.80
C	0.320	0.468	8.10	11.90
D	-	0.078	-	2.00
E	0.400	0.455	10.10	11.60
F	0.424	0.437	10.80	11.10
ØG	0.125	0.165	3.20	4.20
H	0.318	0.380	8.10	9.70
ØI	0.040	0.065	1.00	1.60
K	0.040	0.070	1.00	1.80
α	120°		120°	

FIGURE 3 - FUNCTIONAL DIAGRAM



1. Emitter.
2. Base.
3. Collector.

NOTES

1. Variants 01, 02, 03 and 04: The collector is isolated from the case.
   Variants 05 and 06: The collector is electrically connected to the case.

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) MIL-STD-105, Sampling Procedures and Tables for Inspection by Attributes.

(d) 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)

(a) Constant Acceleration: The Test Condition shall be 10 000g.

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

(a) 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 7.0 grammes for Variants 01, 02, 05 and 06 and 11 grammes for Variants 03 and 04.

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:-

Terminals

Test Condition:	'A' (Tension).
Applied force:	15 lb.f. for Variants 01, 02, 05 and 06. 10 lb.f. for Variants 03 and 04.
Duration:	15 seconds.

Stud

Test Condition:	'D2' (Stud Torque).
Applied Torque:	15 lb.f.inch.
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 body with hard glass seals.

4.4.2 Lead Material and Finish

The lead material shall be Type 'D' 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.

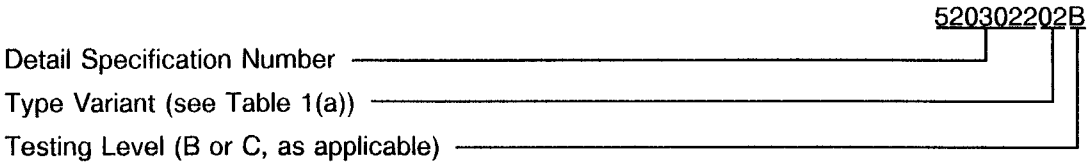
(c) Traceability Information.

4.5.2 Lead Identification

Leads shall be positioned as shown in Figure 2. No lead identification shall be marked on the part.

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 $T_{amb} = +25 \pm 3$ °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.

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 $T_{amb} = +25 \pm 3$ °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 Burn-in

The requirements for burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5000. The conditions for burn-in shall be as specified in Table 5 of this specification.

4.7.3 Electrical Circuits for 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	Collector-Emitter Breakdown Voltage (Sustaining)	$V_{(BR)CEO}$	3011 Bias Cond. D	I_C = 100mA I_B = 0A Note 1	200	-	V
2	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3066 Bias Cond. D	I_E = 10A I_C = 0A	8.0	-	V
3	Collector-Emitter Cut-off Current	I_{CEX}	3041 Bias Cond. A	V_{CE} = 225V V_{EB} = 1.0V	-	10	µA
4	Emitter-Base Cut-off Current	I_{EBO}	3061 Bias Cond. D	V_{EB} = 5.0V I_C = 0A	-	1.0	µA
5	D.C. Forward Current Transfer Ratio 1	h_{FE1}	3076	I_C = 0.5A V_{CE} = 5.0V Note 1	30	120	-
6	D.C. Forward Current Transfer Ratio 2	h_{FE2}	3076	I_C = 3.0A V_{CE} = 5.0V Note 1	10	-	-
7	Collector Saturation Voltage	$V_{CE(SAT)}$	3071	I_C = 3.0A I_B = 0.3A Note 1	-	2.0	V
8	Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	3066	I_C = 3.0A I_B = 0.3A Note 1	-	2.2	V
9	Insulation Resistance	I_R	1016	V_{IR} = 500V Test between case and C, E, B connected together Note 2	-	1000	mΩ

NOTES

1. Pulsed measurement: Pulse Width ≤300µs, Duty Cycle ≤2.0%.
2. If more than 20 units have to be measured, the measurements shall be made on a sample basis in accordance with Para. 7.4.2 of ESA/SCC Generic Specification No. 5000, Inspection Level II with an AQL = 1.0%.

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS (NOTE 2)	LIMITS		UNIT
					MIN	MAX	
10	Small Signal Current Gain	h_{fe}	3206	$I_C = 1.0A$ $V_{CE} = 10V$ f = 10MHz Note 1	3.0	-	-
11	Output Capacitance	C_{obo}	3236	$V_{CB} = 10V$ $I_C = 0A$	-	150	pF
12	Turn-on Time	t_{on}	-	$V_{CC} = 30V$ $I_C = 1.5A$ $I_{B1} = I_{B2} = 0.15A$ See Figure 4	-	0.2	µs
13	Storage Time	t_{store}	-	$V_{CC} = 30V$ $I_C = 1.5A$ $I_{B1} = I_{B2} = 0.15A$ See Figure 4	-	1.8	µs
14	Fall Time	t_{fall}	-	$V_{CC} = 30V$ $I_C = 1.5A$ $I_{B1} = I_{B2} = 0.15A$ See Figure 4	-	0.4	µs

NOTES: See Page 17

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

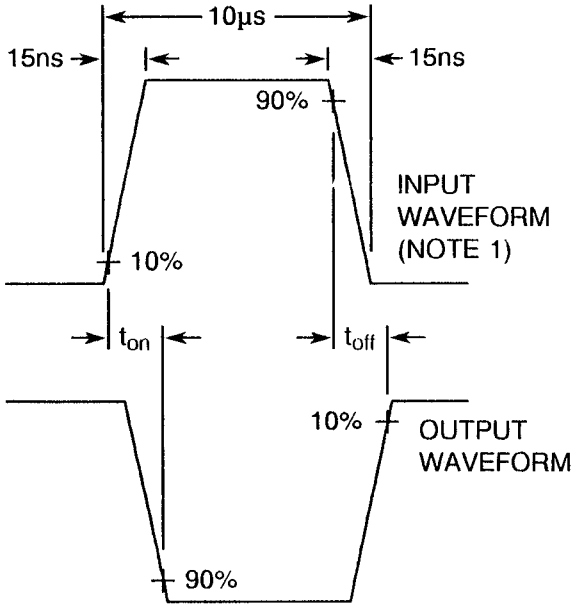
No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN	MAX	
3	Collector-Emitter Cut-off Current	I_{CEX}	3041 Bias Cond. A	T_{case} = +150°C V_{CE} = 225V V_{BE} = 0V	-	500	µA
5	D.C. Forward Current Transfer Ratio	h_{FE1}	3076	T_{amb} = −55°C V_{CE} = 5.0V I_C = 0.5A Note 1	12	-	-

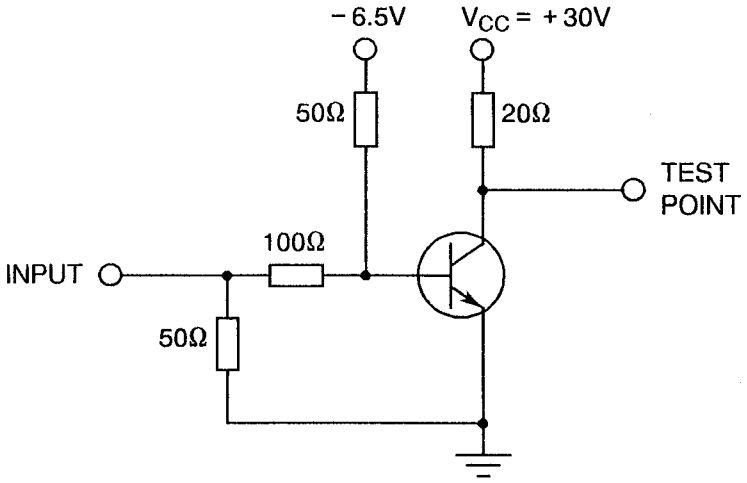
NOTES

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

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

TURN ON AND TURN OFF TIMES





NOTES

1. Input pulse repetition rate is 500Hz.

TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
3	Collector-Emitter Cut-off Current	I_{CEX}	As per Table 2	As per Table 2	± 1.0	µA
5	D.C. Forward Current Transfer Ratio 1	h_{FE1}	As per Table 2	As per Table 2	± 25	%
7	Collector Saturation Voltage	$V_{CE(SAT)}$	As per Table 2	As per Table 2	± 200	mV

TABLE 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE TESTS

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Case Temperature	T_{case}	+ 100(+ 0 − 5)	°C
2	Collector-Emitter Voltage	V_{CE}	10	V
3	Power Dissipation Variants 01, 02, 05, 06 Variants 03, 04	P_{tot}	 30 40	W

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 $T_{amb} = +25 \pm 3$ °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 of this specification. The measurements shall be performed at $T_{amb} = +25 \pm 3$ °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 burn-in test.

4.8.4 Electrical Circuits 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 conditions for high temperature storage shall be $T_{amb} = +200(+0-5)$ °C.

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.	
3	Collector-Emitter Cut-off Current	I_{CEX}	As per Table 2	As per Table 2	-	10	µA
5	D.C. Forward Current Transfer Ratio 1	h_{FE1}	As per Table 2	As per Table 2	30	120	-