TRANSISTORS, LOW POWER R.F., NPN,

BASED ON TYPE 2N3019

ESCC Detail Specification No. 5201/011

ISSUE 1

October 2002

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ESA/SCC Detail Specification No. 5201/011

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 2	February 2001		

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 DCRs:-		
		Cover page		None
		DCN		None
		P6. Table 1(a)	: New Variant added	221595
		P12. Para. 4.4.2	: Text amended to include ", or Type '7'"	221595
		P13. Para. 4.6.2	: Second sentence " − 65" amended to " − 55"	221595
		P16. Table 3(b)	: "$T_{amb} = -65$" amended to "$T_{amb} = -55$"	221595

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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 Transistors, Low Power, R.F., NPN, based on Type 2N3019.

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 transistors specified herein, which are also covered by this specification, are listed 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 100% inert atmosphere.

TABLE 1(a) - TYPE VARIANTS

VARIANT	CASE TYPE	FIGURE	LEAD MATERIAL AND FINISH
01	TO5	2	D2
02	TO5	2	D3 or D4
03	TO39	2	D2
04	TO39	2	D3 or D4
05	TO39	2	D7

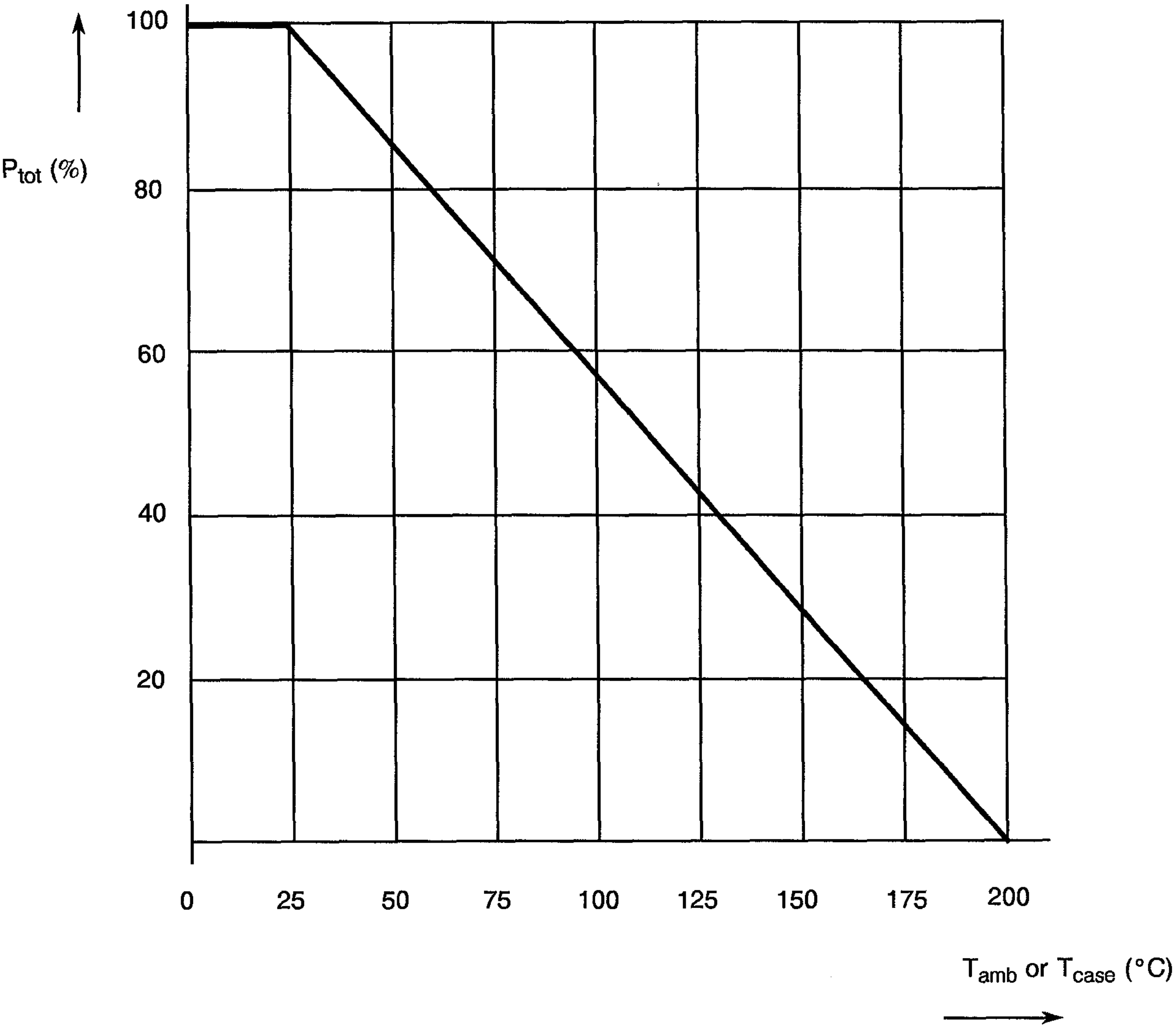
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATING	UNIT	REMARKS
1	Collector-Emitter Voltage	V_{CE}	80	Vdc	
2	Collector-Base Voltage	V_{CB}	140	Vdc	
3	Emitter-Base Voltage	V_{EB}	7.0	Vdc	
4	Collector Current (Continuous)	I_C	1.0	Adc	
5	Continuous Device Dissipation $T_{amb} = +25°C$	P_{tot}	0.8	W	Note 1
6	Continuous Device Dissipation $T_{case} = +25°C$	P_{tot}	5.0	W	Note 2
7	Operating Junction Temperature Range	T_{op}	−65 to +200	°C	
8	Storage Temperature Range	T_{stg}	−65 to +200	°C	
9	Soldering Temperature	T_{sol}	+260	°C	Note 3

NOTES

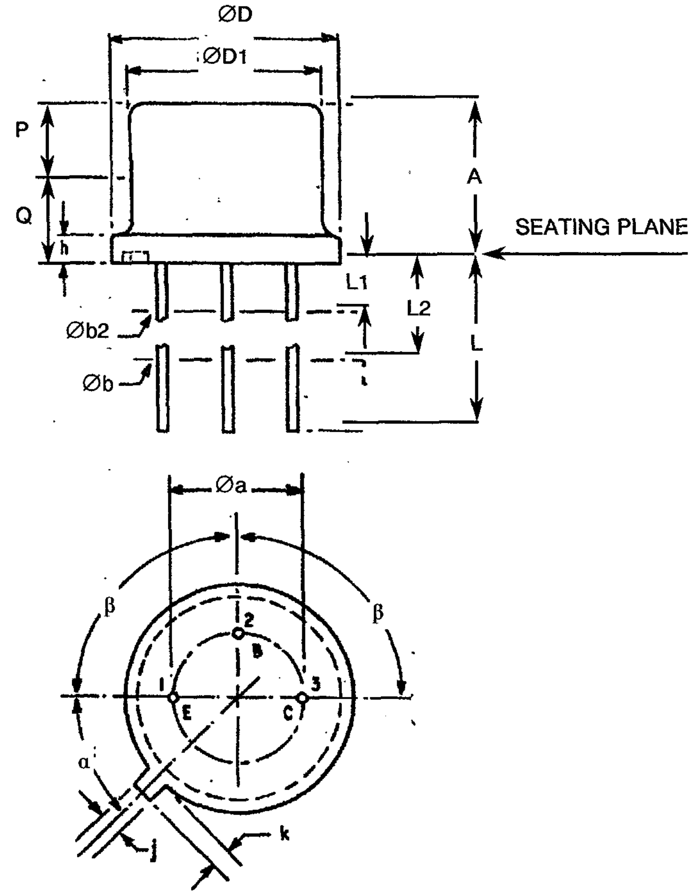
1. For $T_{amb} > +25°C$ derate at 4.6 mW/°C up to +200°C.
2. For $T_{case} > +25°C$ derate at 28.6 mW/°C up to +200°C.
3. Duration 10 seconds maximum at a distance of not less than 1.5mm from the can and the same lead shall not be resoldered until three minutes have elapsed.

FIGURE 1 - PARAMETER DERATING INFORMATION



Power Dissipation versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS



SYMBOL	MILLIMETRES		REMARKS
	MIN.	MAX.	
Øa	4.83	5.33	
A	6.10	6.60	
Øb	0.406	0.533	Note 2
Øb2	0.406	0.483	Note 2
ØD	8.51	9.40	
ØD1	7.75	8.51	
h	0.229	3.81	
j	0.711	0.864	
k	0.737	1.14	Note 3
L	38.10	44.45	Note 2, Variants 01 and 02
L	12.70	19.05	Note 2, Variants 03 and 04
L1	-	1.27	Note 2
L2	6.35	-	Note 2
P	2.54	-	Note 1
Q	-	1.27	Note 4
α	45° Nominal		
β	90° Nominal		

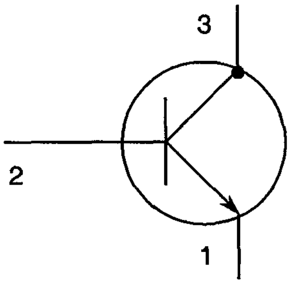
NOTES: See Page 10.

FIGURE 2 - PHYSICAL DIMENSIONS

NOTES

1. This zone is controlled for automatic handling. The variation in actual diameter within this zone shall not exceed 0.010 inches (0.254mm).
2. (Three leads) ∅b2 applies between L1 and L2. ∅ b applies between L2 and 0.5" (12.70mm) from seating plane. Diameter is uncontrolled in L1 and beyond 0.5" (12.70mm) from seating plane.
3. Measured from maximum diameter of the actual device.
4. Details of outline in this zone optional.
5. The collector is electrically connected to the case.

FIGURE 3 - FUNCTIONAL DIAGRAM



1. Emitter
2. Base
3. Collector

NOTES

1. 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 Semiconductors.

(b) MIL-STD-750, Test Methods and Procedures for Semiconductor Devices.

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESA/SCC Basic Specification No. 21300 shall apply.

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 for Discrete Semiconductors. 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)

(a) The electrical measurements specified at the end of Subgroup I and II tests shall be carried out as stated in Table 6 of this specification.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) The electrical measurements referenced 9.9.3 shall be performed as stated in Table 6 of this specification.

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 2.0 grammes.

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, and the lid shall be welded, brazed or preform-soldered.

4.4.2 Lead Material and Finish

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).

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:

520101102B

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

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, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3. The measurements shall be performed at $T_{amb} = +150\ (+0-5)$ °C and $-55\ (+5-0)$ °C respectively.

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, where applicable, in MIL-STD-750 and Figure 4 of this specification.

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, the 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 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 (Figure 5)

Not applicable.

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

No.	CHARACTERISTICS	SYMBOL	TEST METHOD MIL-STD-750	TEST FIG	TEST CONDITION	LIMITS		UNIT
						MIN.	MAX.	
1	Collector-Base Breakdown Voltage	BV_{CBO}	3001, Bias Cond. D	-	$I_C = 100\mu Adc$ $I_E = 0$	140	-	Vdc
2	Collector-Emitter Breakdown Voltage	BV_{CEO}	3001, Bias Cond. D	-	$I_C = 30mAdc$ $I_B = 0$ See Note 1	80	-	Vdc
3	Emitter-Base Breakdown Voltage	BV_{EBO}	3026, Bias Cond. D	-	$I_E = 100\mu Adc$ $I_C = 0$	7.0	-	Vdc
4	Collector-Emitter Cut-off Current	I_{CES}	3041, Bias Cond. D	-	$V_{CE} = 90Vdc$	-	10	nAdc
5	Emitter-Base Cut-off Current	I_{EBO}	3061, Bias Cond. D	-	$V_{CB} = 5.0Vdc$ $I_C = 0$	-	10	nAdc
6	Forward Current Transfer Ratio (1)	h_{FE1}	3076	-	$V_{CE} = 10Vdc$ $I_C = 150mAdc$ See Note 1	100	300	-
7	Forward Current Transfer Ratio (2)	h_{FE2}	3076	-	$V_{CE} = 10Vdc$ $I_C = 0.1mAdc$	50	200	-
8	Forward Current Transfer Ratio (3)	h_{FE3}	3076	-	$V_{CE} = 10Vdc$ $I_C = 10mAdc$ See Note 1	90	-	-
9	Forward Current Transfer Ratio (4)	h_{FE4}	3076	-	$V_{CE} = 10Vdc$ $I_C = 500mAdc$ See Note 1	50	200	-
10	Forward Current Transfer Ratio (5)	h_{FE5}	3076	-	$V_{CE} = 10Vdc$ $I_C = 1.0Adc$ See Note 1	15	-	-

NOTES: See Page 16.

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

No.	CHARACTERISTICS	SYMBOL	TEST METHOD MIL-STD-750	TEST FIG	TEST CONDITION	LIMITS		UNIT
						MIN.	MAX.	
11	Collector-Emitter Saturation Voltage (1)	$V_{CE(SAT)1}$	3071	-	$I_C = 150mAdc$ $I_B = 15mAdc$ See Note 1	-	0.2	Vdc
12	Collector-Emitter Saturation Voltage (2)	$V_{CE(SAT)2}$	3071	-	$I_C = 500mAdc$ $I_B = 50mAdc$ See Note 1	-	0.5	Vdc
13	Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	3066	-	Test Cond. A $I_C = 150mAdc$ $I_B = 15mAdc$ See Note 1	-	1.1	Vdc

NOTES

1. Pulse test, pulse width ≤300µs, Duty Cycle =2.0%.
2. Test performed on a sample basis, Inspection Level II, Table IIA, AQL=1.0% of MIL-STD-105.
3. This parameter is measured by applying a RF signal voltage of 1.0V (r.m.s.) across the collector-base terminals, and measuring the a.c. voltage drop, V_{EB}, with a high impedance RF voltmeter across the emitter-base terminals. With f=79.8MHz used for the 1.0V signal the following calculation applies:

$\tau_C = 2 \times V_{EB}$

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

No.	CHARACTERISTICS	SYMBOL	TEST METHOD MIL-STD-750	TEST FIG	TEST CONDITION	LIMITS		UNIT
						MIN.	MAX.	
14	Small Signal Short Circuit Forward Current Transfer Ratio	h_{fe}	3206	-	$V_{CE} = 5.0V$ $I_C = 1.0mAdc$ See Note 2	80	400	-
15	Magnitude of Small Signal Short Circuit Forward Current Transfer Ratio	h_{fe}	3306	-	$V_{CE} = 10Vdc$ $I_C = 50mAdc$ $f = 20MHz$ See Note 2	5.0	20	-
16	Open Circuit Output Capacitance	C_{obo}	3241	-	$V_{CB} = 10Vdc$ $I_E = 0$ $f = 1.0MHz$ See Note 2	-	12	pF
17	Input Capacitance (Output Open Circuited)	C_{ibo}	3241	-	$V_{EB} = 0.5V$ $I_C = 0$ $f = 1.0MHz$ See Note 2	-	60	pF
18	Noise Figure	NF	3246	-	$V_{CE} = 10Vdc$ $I_C = 100\mu Adc$ $R_g = 1.0k\Omega$ Power Bandwidth = 200Hz See Note 2	-	4.0	dB
19	Collector-Base Time Constant	τ_C	-	-	$V_{CE} = 10Vdc$ $I_C = 10mAdc$ $f = 79.8MHz$ See Notes 2 and 3	-	400	ps
20	Pulse Response	$t_{on} + t_{off}$	-	4	See Note 2	-	30	ns

NOTES: See Page 16.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

TABLE 3(a) - T_{amb} = +150(+0-5) °C

No.	CHARACTERISTICS	SYMBOL	TEST METHOD MIL-STD-750	TEST FIG	TEST CONDITIONS (Note 1)	LIMITS		UNIT
						MIN.	MAX.	
4	Collector-Emitter Cut-off Current	I_{CES}	3041 Bias Cond. C	-	V_{CE} = 90Vdc	-	10	µAdc

TABLE 3(b) - T_{amb} = −55(+5-0) °C

No.	CHARACTERISTICS	SYMBOL	TEST METHOD MIL-STD-750	TEST FIG	TEST CONDITIONS (Note 1)	LIMITS		UNIT
						MIN.	MAX.	
6	Forward Current Transfer Ratio (1)	h_{FE1}	3076	-	V_{CE} = 10Vdc I_C = 150mAdc See Note 1	40	-	-

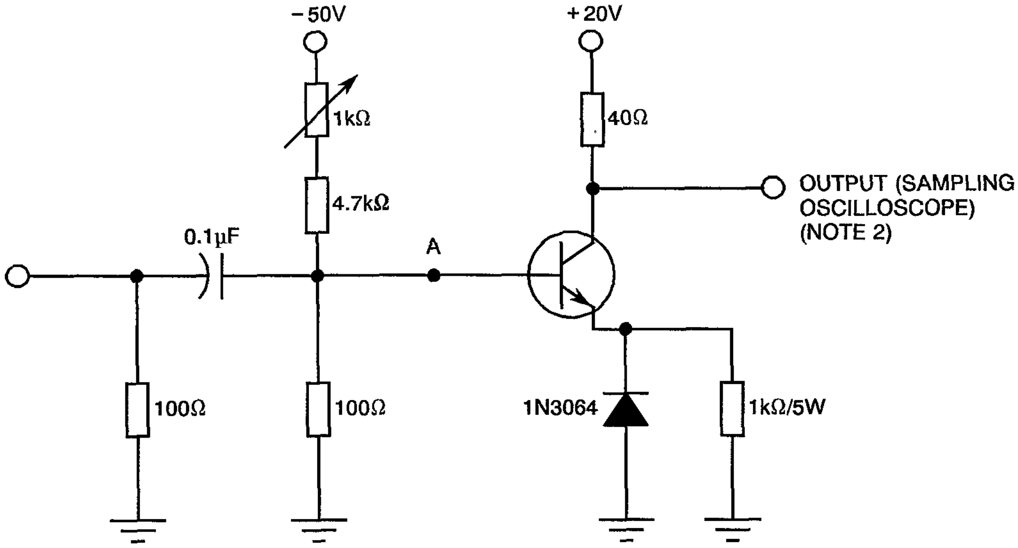
NOTES

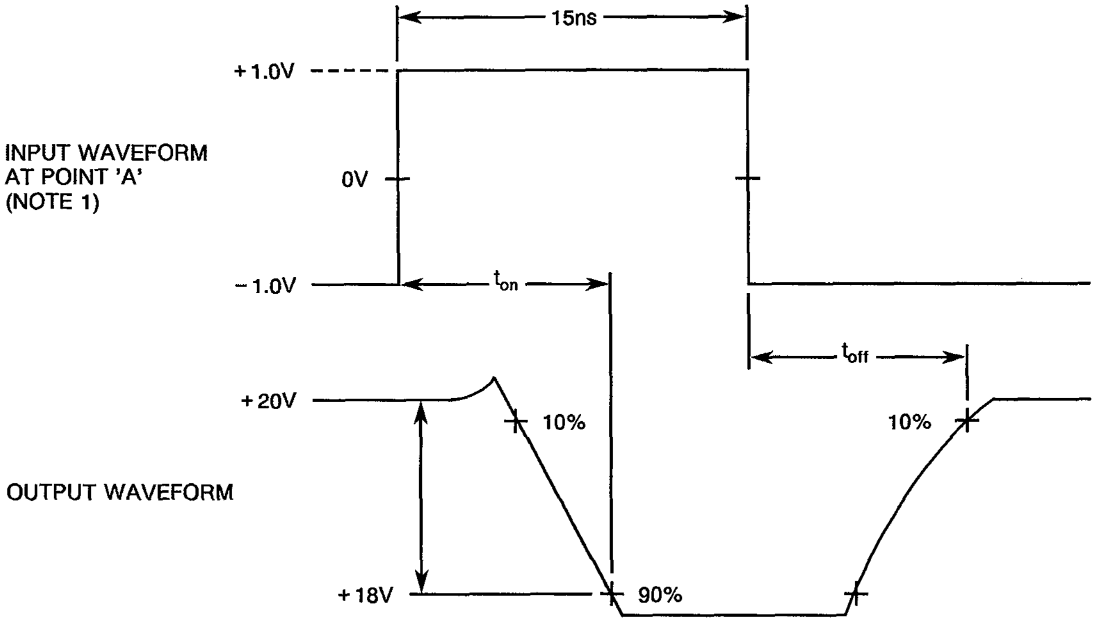
1. Pulse test, pulse width ≤300µs, Duty Cycle =2.0%.
2. This parameter is measured by applying a RF signal voltage of 1.0V (r.m.s.) across the collector-base terminals, and measuring the a.c. voltage drop, V_{EB}, with a high impedance RF voltmeter across the emitter-base terminals. With f = 79.8MHz used for the 1.0V signal the following calculation applies:

   $\tau_C = 2 \times V_{EB}$

FIGURE 4 - CIRCUIT FOR ELECTRICAL MEASUREMENTS

PULSE RESPONSE TEST





NOTES

1. $t_r \leq 2.0ns$, duty cycle $\leq 2.0\%$, $Z_{IN} = 50\Omega$.
2. Sampling Oscilloscope: $Z_{IN} \geq 100k\Omega$, $C_{IN} \leq 12pF$, $t_r \leq 5.0ns$.

TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITION	CHANGE LIMITS (Δ)	UNIT
4	Collector-Emitter Cut-off Current	I_{CES}	As per Table 2	As per Table 2	±100 or (1) ±5.0	% nA
6	Forward Current Transfer Ratio (1)	h_{FE1}	As per Table 2	As per Table 2	±15	%

NOTES

1. Whichever is greater referred to the initial value.

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

No.	CHARACTERISTIC	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+25	°C
2	Power Dissipation	P_{tot}	800	mW
3	Collector-Base Voltage	V_{CB}	60	V
4	Test Method 1039 of MIL-STD-750	-	B	-

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 6. The measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.8.2 Electrical Measurements at Intermediate Points during Endurance Tests

The parameters to be measured at intermediate points during endurance tests are scheduled in Table 6.

4.8.3 Electrical Measurements on Completion of Endurance Tests

The parameters to be measured on completion of endurance testing are as scheduled in Table 6. The measurements shall be performed at $T_{amb} = +22 + 3$ °C.

4.8.4 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.

4.8.5 Electrical Circuits for Operating Life Tests (Figure 5)

Not applicable.

4.8.6 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 $T_{amb} = +200$°C (+0-5) °C.

TABLE 6 - ELECTRICAL MEASUREMENTS AFTER ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITION	LIMITS		UNIT
					MIN.	MAX.	
4	Collector-Emitter Cut-off Current	I_{CES}	As per Table 2	As per Table 2	-	10	nA
6	Forward Current Transfer Ratio (1)	h_{FE1}	As per Table 2	As per Table 2	100	300	-
10	Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	As per Table 2	As per Table 2	-	0.8	V