TRANSISTORS, POWER, NPN

BASED ON TYPE 2N2880

ESCC Detail Specification No. 5203/025

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Pages 1 to 22

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ESA/SCC Detail Specification No. 5203/025

space components
coordination group

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		SCCG Chairman	ESA Director General or his Deputy
Issue 3	January 1998		
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DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 2 and incorporates all modifications defined in Revision 'A' to Issue 2 and the changes agreed in the following DCR:-		
		Cover page	: "AND 2N2658" deleted from Title	221435
		DCN		None
		Para. 1.1	: "and 2N2658" deleted from first sentence	221435
		Para. 3	: Second sentence and definition deleted	221435
		Table 1(a)	: Variants 03 to 08 deleted	221435
			: Variants 09 and 10, Figure amended to "2(b)"	221435
		Table 1(b)	: No. 2, Characteristics and Maximum Ratings amended	221435
			: No. 6, Characteristics and Maximum Ratings amended	221435
			: New No. 10 added	221435
		Figure 1(b)	: Drawing and Notes amended	221435
		Figure 2(a)	: Title amended	221435
		Figure 2(b)	: Deleted in toto	221435
		Figure 2(c)	: Renumbered as "2(b)"	221435
		Figure 3(a)	: Title amended	221435
		Para. 4.7.6	: New paragraph added	221435
		Table 2 a.c.	: No. 12 deleted and all subsequent tests renumbered	221435
		Table 5(b)	: Conditions column amended	221435
		Table 7	: No. 3, Change Limits and Unit amended	221435
			: No. 6, Change Limits amended	221435
			: No. 7, Change Limits amended	221435
			: No. 8, Change Limits amended	221435
			: No. 9, Change Limits and Unit amended	221435
			: Existing Notes deleted and New Note 1 added	221435
'A'	Aug. '98	P1. Cover page		None
		P2. DCN		None
		P6. Table 1(a)	: Nos. 2, 6 and 10, "Variants 11 and 12" added	221482
			: In "Lead Material and Finish" column, "(1)" added for Variants 01, 02, 09 and 10, and "(2)" added for Variants 11 and 12	221482
			: Notes added	221482
		Table 1(b)	: Nos. 2, 6 and 10, In "Characteristics" column, "Variants 09 - 10" changed to "Variants 09 - 12"	221482
		P7. Figure 1(b)	: "Variants 09 - 10" changed to "Variants 09 - 12" in Figure and Test Conditions	221482
		P9A. Figure 2(c)	: New page and Figure added	221482
		P10. Figure 3(b)	: Title changed to "Variants 09 to 12"	221482
		P11. Para. 4.3.2	: In the text, reference to Variants 05 to 08 deleted	None
			: In the text, "Variants 09 and 10" changed to "Variants 09 to 12"	221482
		P12. Para. 4.3.3	: Sub-heading "Variants 01 to 04" changed to "Variants 01 to 02"	221482
			: Sub-heading and paragraph deleted for "Variants 05 to 08"	221482
			: Sub-heading "Variants 09 to 10" changed to "Variants 09 to 12"	221482
		P20. Table 5(b)	: No. 2, In "Conditions", "Variants 09 to 10" changed to "Variants 09 to 12"	221482

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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 a Transistor, Power, NPN, based on Type 2N2880. 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 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 as 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.

2. APPLICABLE DOCUMENTS

The following documents for 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.

TABLE 1(a) - TYPE VARIANTS

VARIANT	BASED ON TYPE	CASE	FIGURE	LEAD MATERIAL AND FINISH	
01	2N2880	TO111	2(a)	D2	(1)
02	2N2880	TO111	2(a)	D3 or D4	(1)
09	2N2880	TO257	2(b)	H2	(1)
10	2N2880	TO257	2(b)	H3 or H4	(1)
11	2N2880	TO257	2(c)	H2	(2)
12	2N2880	TO257	2(c)	H3 or H4	(2)

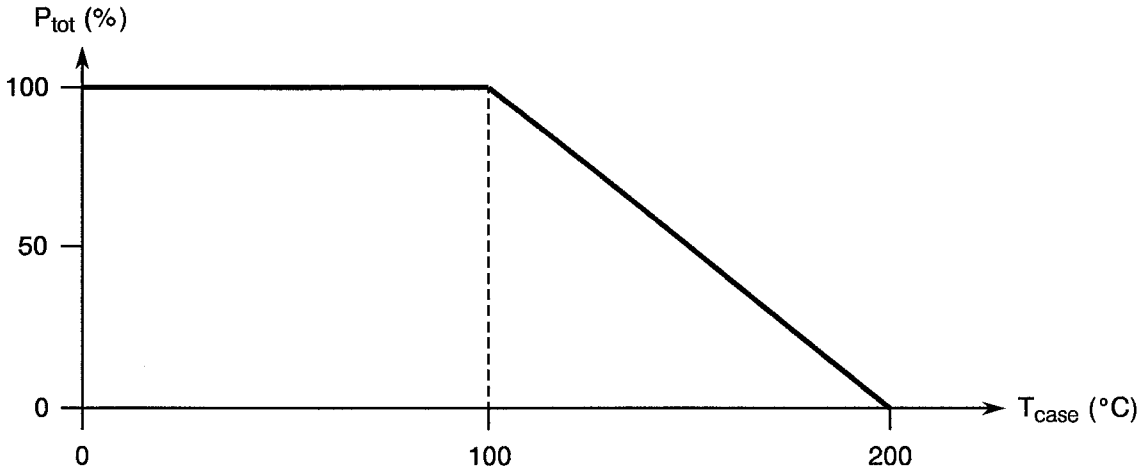
NOTES
1. Glass to metal seals.
2. Ceramic seals.

TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Collector - Base Voltage	V_{CB}	150	V	
2	Collector - Emitter Voltage Variants 01 - 02 Variants 09 - 12	V_{CE}	 100 80	V	
3	Emitter - Base Voltage	V_{EB}	8.0	V	
4	d.c. Collector Current (Continuous)	I_C	5.0	A	
5	d.c. Base Current (Continuous)	I_B	500	mA	
6	Power Dissipation (Continuous) Variants 01 - 02 Variants 09 - 12	P_{tot}	 30 20	W	Note 1
7	Operating Temperature Range	T_{op}	−65 to +200	°C	T_{case}
8	Storage Temperature Range	T_{stg}	−65 to +200	°C	
9	Maximum Soldering Temperature	T_{sol}	+260	°C	Note 2
10	Thermal Resistance Variants 01 - 02 Variants 09 - 12	$R_{TH(J-C)}$	 3.33 5.0	°C/W	

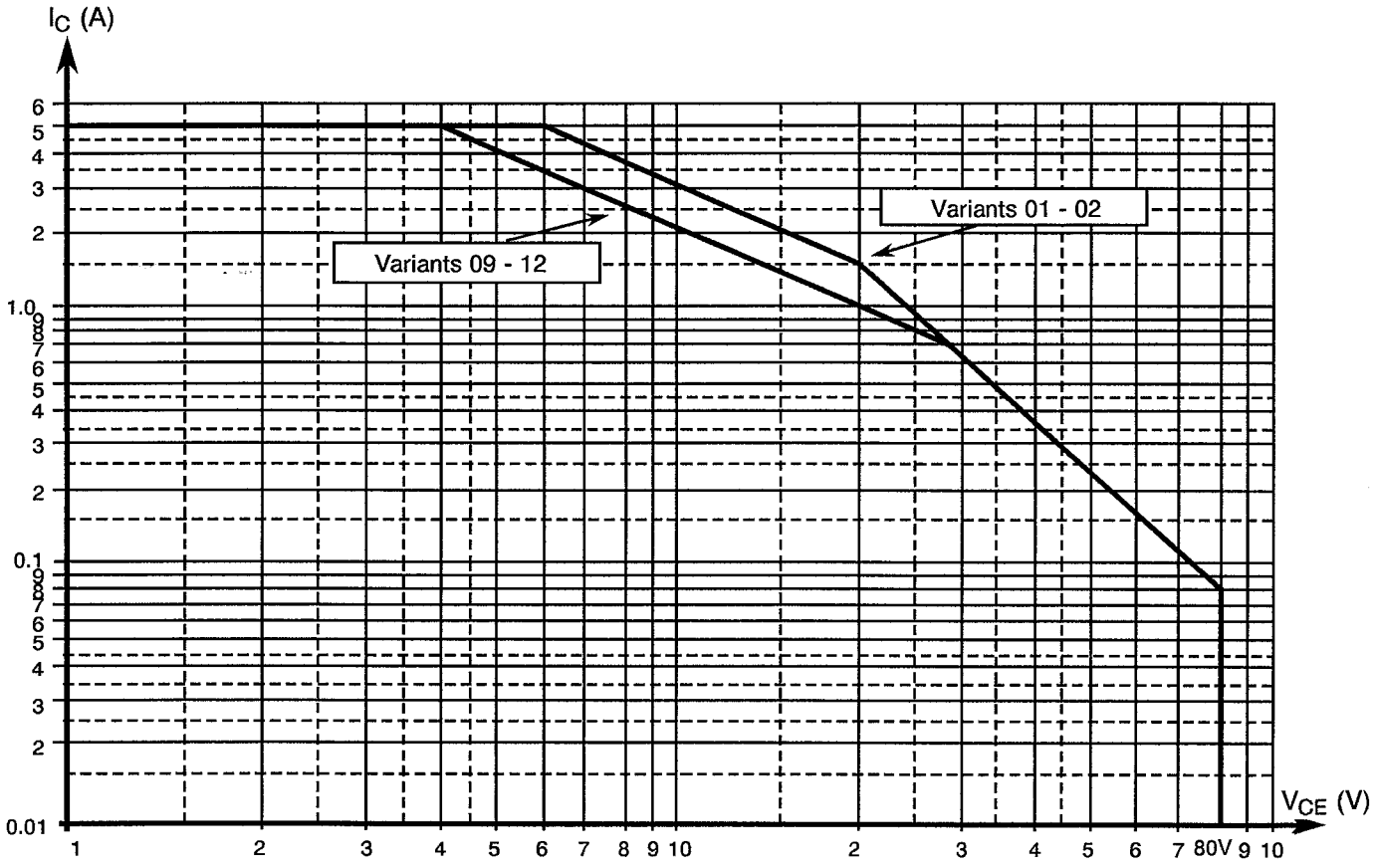
NOTES
1. At T_{case} = +100°C. For derating at T_{case} > +100°C, see Figure 1(a).
2. Duration 10 seconds maximum at a distance of not less than 1.5mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.

FIGURE 1(a) - PARAMETER DERATING INFORMATION



Power Dissipation versus Temperature

FIGURE 1(b) - FORWARD BIAS SAFE OPERATING AREA (MAXIMUM CONTINUOUS d.c.)



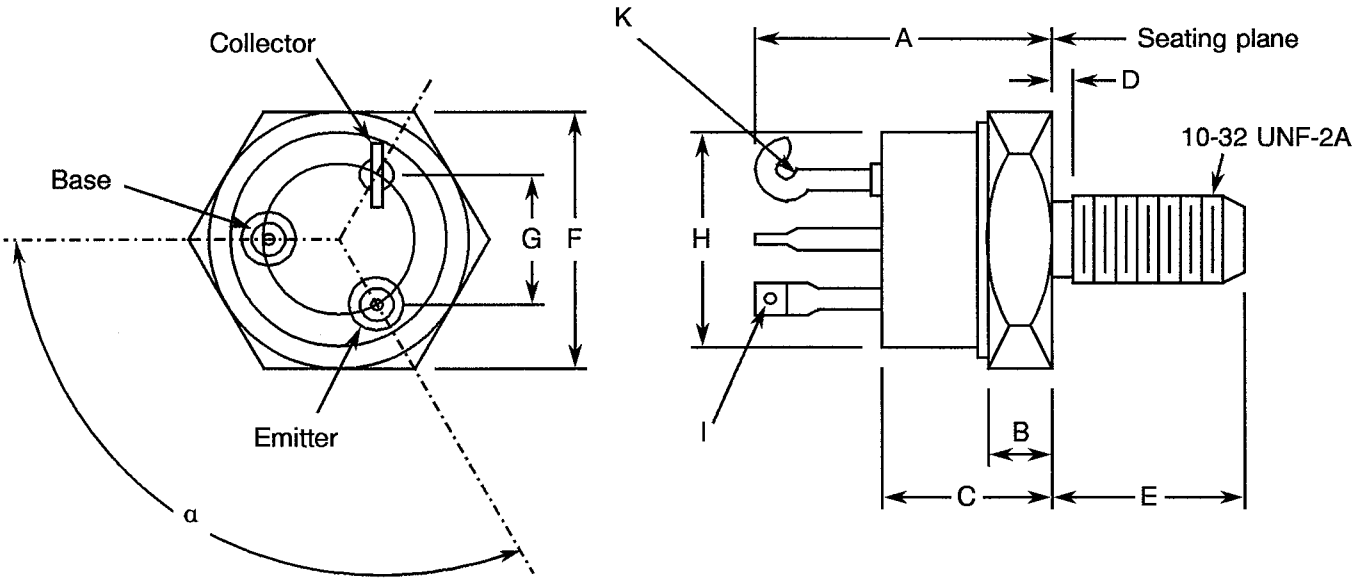
	Variants 01 - 02	Variants 09 - 12
Test 1:	V_{CE} = 80V. I_C = 80mA.	V_{CE} = 80V. I_C = 80mA.
Test 2:	V_{CE} = 20V. I_C = 1.5A.	V_{CE} = 29V. I_C = 0.68A.

NOTES

1. See Para. 4.7.6

FIGURE 2 - PHYSICAL DIMENSIONS

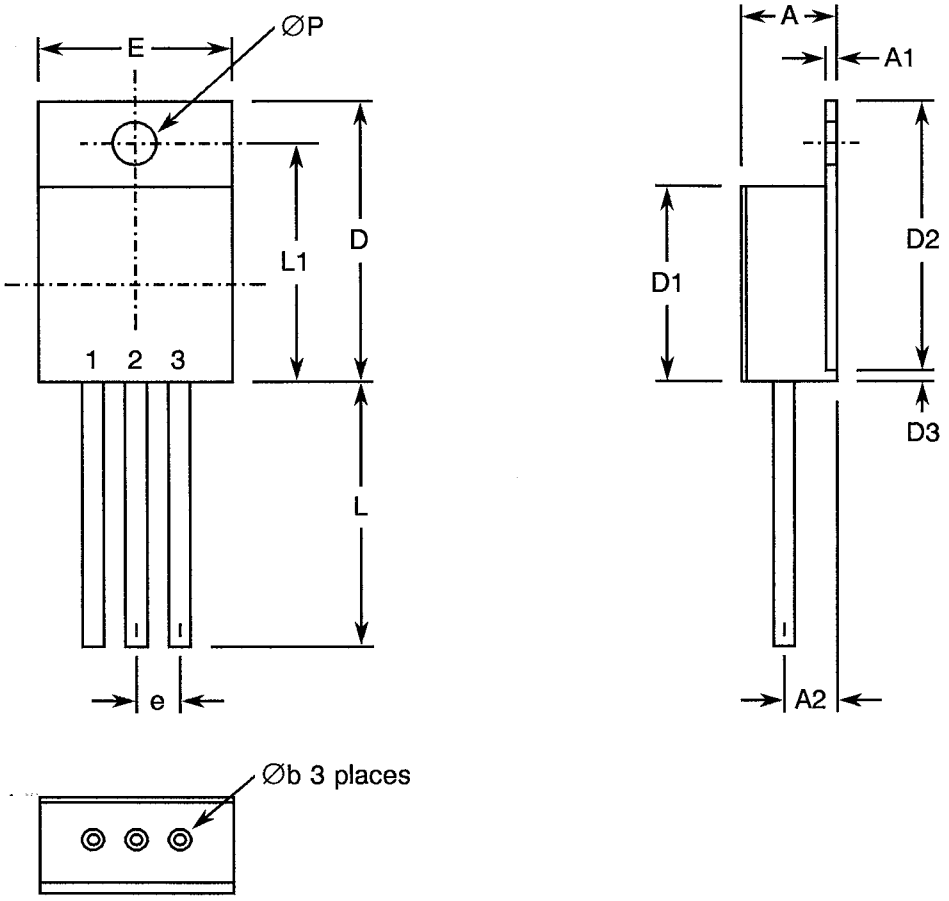
FIGURE 2(a) - VARIANTS 01 TO 02



SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	14.5	19.4
B	2.3	3.8
C	8.1	11.9
D	-	2.0
E	10.1	11.6
F	10.8	11.1
G	3.2	4.2
H	8.1	9.7
I	1.0	1.6
K	1.0	1.8
α	120°	

FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(b) - VARIANTS 09 TO 10

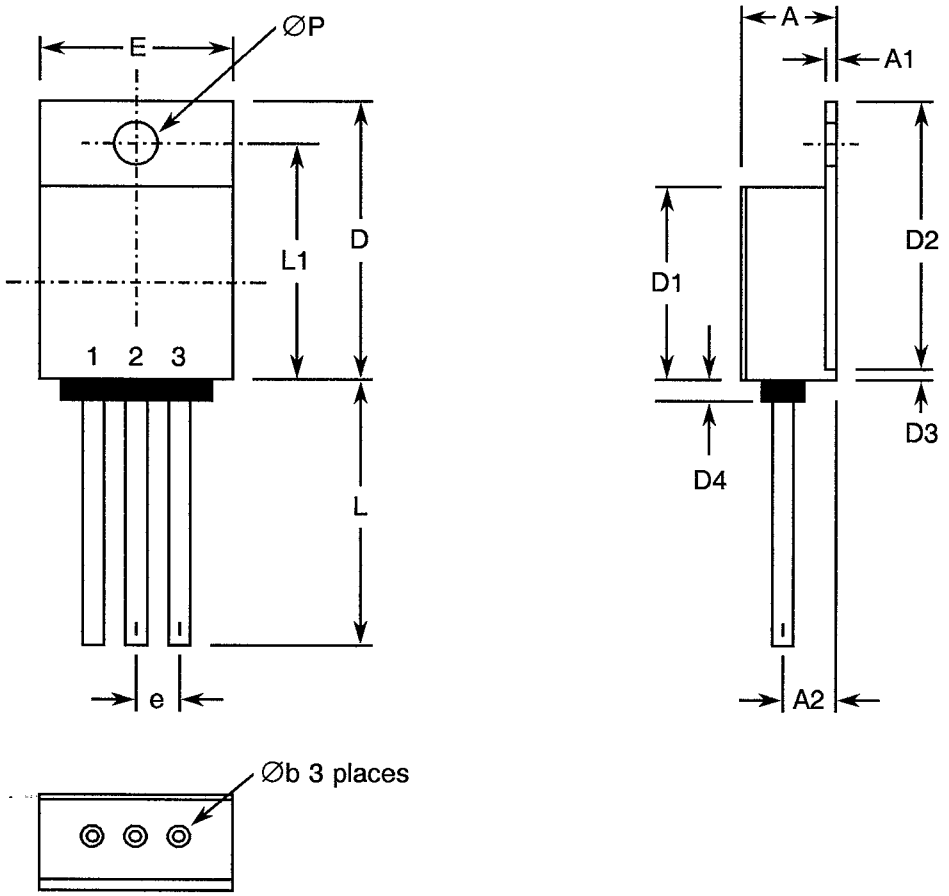


SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	-	5.33
A1	0.64	0.89
A2	2.79 TYPICAL	
Øb	0.89	1.14
D	16.26	17.02
D1	10.41	10.92
D2	16.26	17.02
D3	-	0.51
e	2.54 TYPICAL	
E	10.41	10.92
L	12.70	14.73
L1	13.20	13.72
ØP	3.56	3.81

Pin 1 = Base
Pin 2 = Collector
Pin 3 = Emitter

FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(c) - VARIANTS 11 TO 12

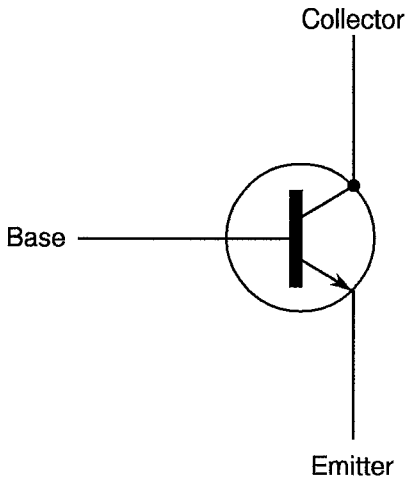


SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	-	5.33
A1	0.64	0.89
A2	2.79 TYPICAL	
Øb	0.89	1.14
D	16.26	17.02
D1	10.41	10.92
D2	16.26	17.02
D3	-	0.51
D4	-	0.64
e	2.54 TYPICAL	
E	10.41	10.92
L	12.70	14.73
L1	13.20	13.72
ØP	3.56	3.81

Pin 1 = Base
Pin 2 = Collector
Pin 3 = Emitter

FIGURE 3 - FUNCTIONAL DIAGRAM

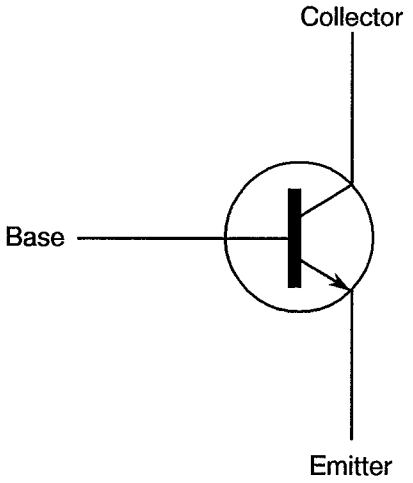
FIGURE 3(a) - VARIANTS 01 TO 02



NOTES

1. The collector is internally connected to the case.

FIGURE 3(b) - VARIANTS 09 TO 12



NOTES

1. The collector is isolated from the case.

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 are 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

(a) Para. 5.2.1, "Total Dose Irradiation Testing": Shall be performed during qualification and extension of qualification.

(b) Para. 5.2.1, "Total Dose Irradiation Testing": Shall be performed during procurement on a lot acceptance basis at the total dose irradiation level specified in the purchase order.

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. 7.1.1(a), "High Temperature Reverse Bias" test and subsequent electrical measurements related to this test shall be omitted.

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 to 02 and 5.0 grammes for Variants 09 to 12.

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 to 02

Test Condition:	'A' (Tension)
Weight to be applied:	67 Newtons
Duration:	15 seconds

Test Condition:	'D2' (Stud-Torque)
Torque to be applied:	20Nm
Duration:	15 seconds

Variants 09 to 12

Test Condition:	'A' (Tension)
Weight to be applied:	20 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 body with hard glass/ceramic seals and the lid shall be welded, brazed or preform soldered.

4.4.2 Lead Material and Finish

The lead material shall be either Type 'D' or Type 'H' 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 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.

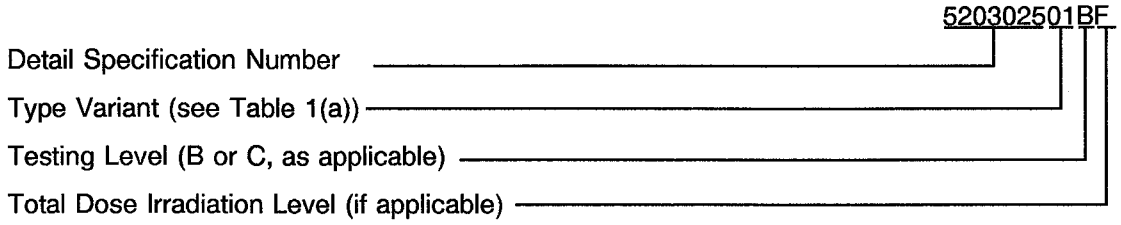
(c) Traceability Information.

4.5.2 Lead Identification

Lead identification shall be as shown in Figure 2.

4.5.3 The SCC Component Number

Each component shall bear the SCC Component Number which shall be constituted and marked as follows:-



The Total Dose Irradiation Level designation shall be added for those devices for which a sample has been successfully tested to the level in question. For these devices, a code letter shall be added in accordance with the requirements of ESA/SCC Basic Specification No. 22900.

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 $T_{amb} = +25 \pm 3$ °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 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 $T_{amb} = +25 \pm 3$ °C. The parameter drift values (Δ) applicable to the parameters scheduled shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit value specified in Table 2 shall not be exceeded.

4.7.2 Conditions for High Temperature Reverse Bias Burn-in

Not applicable.

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 Circuit for High Temperature Reverse Bias Burn-in

Not applicable.

4.7.5 Electrical Circuit for Power Burn-in

Not applicable.

4.7.6 Verification of Safe Operating Area

The requirements for verification of safe operating area testing are specified in Section 9 of ESA/SCC Generic Specification No. 5000.

The tests and Test Methods shall be as follows:-

(a) Maximum Continuous d.c., in accordance with MIL-STD-750, Method 3051 and Figure 1(b) of this specification, at T_{case} = +100°C and for an operating time of 1.0 seconds maximum. Two tests shall be performed.

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 Sustaining Voltage	$BV_{CEO(SUS)}$	3011 Bias Cond. D	I_C = 100mA Note 1	100	-	V
2	Emitter-Base Breakdown Voltage	BV_{EBO}	3026 Bias Cond. D	I_E = 10µA	8.0	-	V
3	Collector-Base Cut-off Current	I_{CBO}	3036 Bias Cond. D	V_{CB} = 60V	-	0.1	µA
4	Collector-Emitter Cut-off Current 1	I_{CEO}	3041 Bias Cond. D	V_{CE} = 50V	-	100	µA
5	Collector-Emitter Cut-off Current 2	I_{CEX}	3041 Bias Cond. A	V_{CE} = 150V V_{EB} = 0.5V	-	10	µA
6	Emitter-Base Cut-off Current	I_{EBO}	3061 Bias Cond. D	V_{EB} = 5.0V	-	100	nA
7	D.C. Forward Current Transfer Ratio 1	h_{FE1}	3076	V_{CE} = 5.0V I_C = 1.0A Note 1	40	120	-
8	D.C. Forward Current Transfer Ratio 2	h_{FE2}	3076	V_{CE} = 5.0V I_C = 5.0A Note 1	15	-	-
9	Collector-Emitter Saturation Voltage 1	$V_{CE(SAT)1}$	3071	I_C = 1.0A I_B = 100mA Note 1	-	0.25	V
10	Collector-Emitter Saturation Voltage 2	$V_{CE(SAT)2}$	3071	I_C = 5.0A I_B = 500mA Note 1	-	2.0	V
11	Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	3066 Bias Cond. A	I_C = 1.0A I_B = 100mA Note 1	-	1.2	V

NOTES: See Page 16.

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	
12	High Frequency Forward Current Gain	h_{fe}	3306	-	V_{CE} = 10V I_C = 1.0A f = 10MHz Note 1	3.0	-	-
13	Open Circuit Output Capacitance	C_{obo}	3236	-	V_{CB} = 10V f = 1.0MHz	-	150	pF
14	Pulse Rise Time (Unsaturated) 1	$t_{r(1)}$	-	4(a)	V_{CC} = 25V I_C = 1.0A I_B = 100mA V_{BB} = 10V	-	80	ns
15	Pulse Storage Time (Unsaturated) 1	$t_{s(1)}$	-	4(a)	V_{CC} = 25V I_C = 1.0A I_B = 100mA V_{BB} = 10V	-	60	ns
16	Pulse Fall Time (Unsaturated) 1	$t_{f(1)}$	-	4(a)	V_{CC} = 25V I_C = 1.0A I_B = 100mA V_{BB} = 10V	-	80	ns
17	Pulse Rise Time (Saturated) 2	$t_{r(2)}$	-	4(b)	V_{CC} = 20V I_C = 1.0A I_B = 100mA	-	300	ns
18	Pulse Storage Time (Saturated) 2	$t_{s(2)}$	-	4(b)	V_{CC} = 20V I_C = 1.0A I_B = 100mA	-	2.0	µs
19	Pulse Fall Time (Saturated) 2	$t_{f(2)}$	-	4(b)	V_{CC} = 20V I_C = 1.0A I_B = 100mA	-	350	ns

NOTES

1. Pulsed measurement, pulse width ≤330us, duty cycle 2.0%.
2. Measurements shall be performed on a sample basis, LTPD7 or less.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

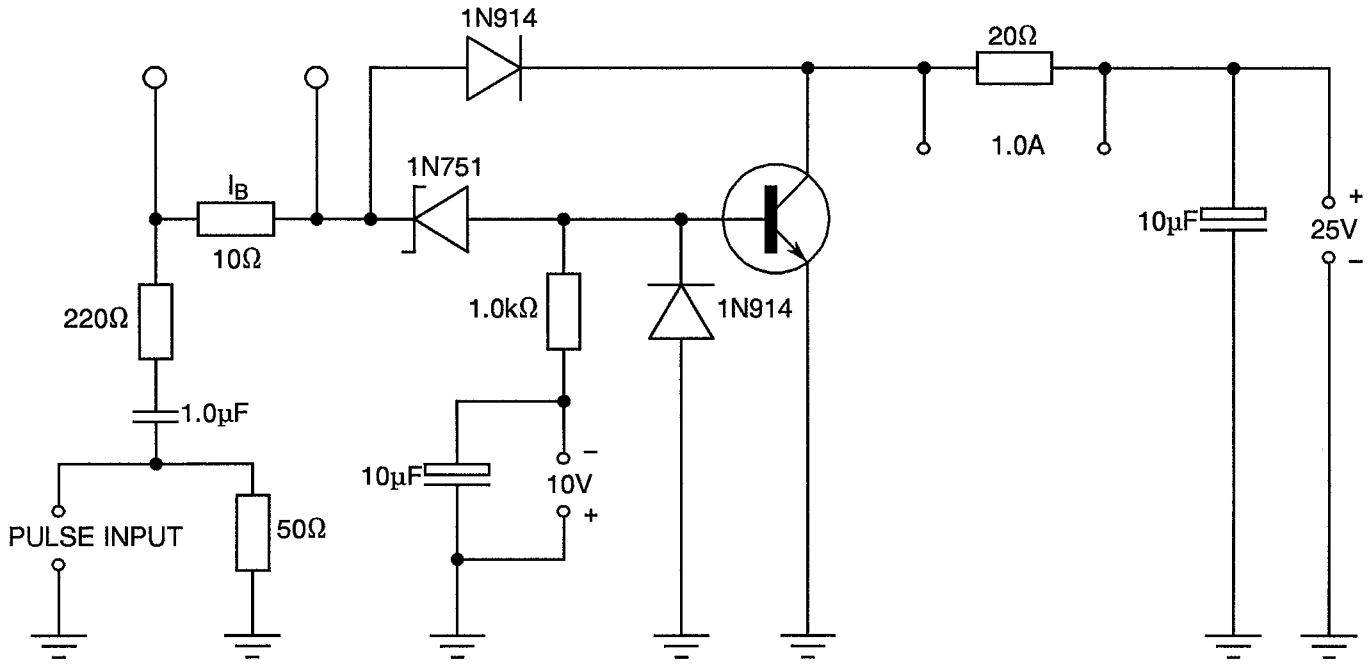
No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN	MAX	
3	Collector-Base Cut-off Current 1	I_{CBO}	As per Table 2	As per Table 2 T_{amb} = +150(+0−5) °C	-	50	µA
7	D.C. Forward Current Transfer Ratio 1	h_{FE1}	As per Table 2	As per Table 2 T_{amb} = −55(+5−0) °C	15	-	-

TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
5	Collector-Emitter Cut-off Current 2	I_{CEX}	As per Table 2	As per Table 2	1.0	µA
7	D.C. Forward Current Transfer Ratio 1	h_{FE1}	As per Table 2	As per Table 2	±25	%
9	Collector-Emitter Saturation Voltage 1	$V_{CE(SAT)1}$	As per Table 2	As per Table 2	±50	mV

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

FIGURE 4(a) - SWITCHING PARAMETERS (UNSATURATED MODE)



INPUT AND OUTPUT WAVEFORMS FOR SWITCHING PARAMETERS

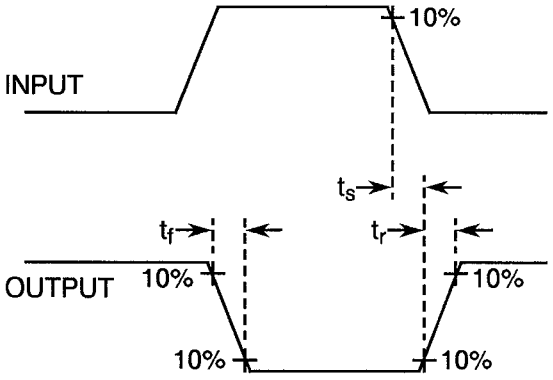


FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONTINUED)

FIGURE 4(b) - SWITCHING PARAMETERS (SATURATED MODE)

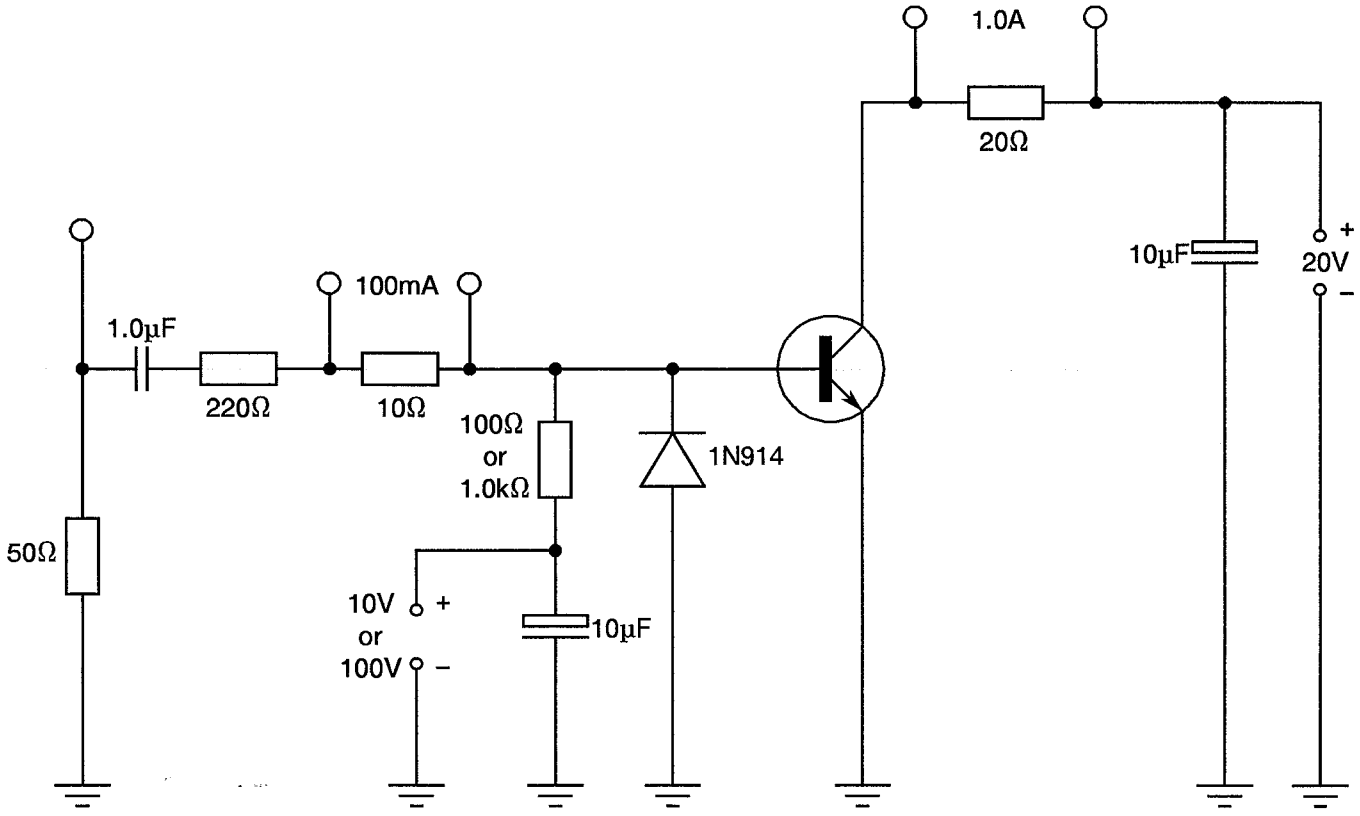


TABLE 5(a) - CONDITIONS FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN

Not applicable.

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

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Case Temperature	T_{case}	+100(+0−5)	°C
2	Power Dissipation	P_{tot}	Variants 01 to 02: 30 Variants 09 to 12: 20	W
3	Collector-Base Voltage	V_{CB}	10	V

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 $T_{amb} = +25 \pm 3$ °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. Unless otherwise stated, 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(b) for the power 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 temperature to be applied shall be the maximum storage temperature specified in Table 1(b) of this specification.

4.9 TOTAL DOSE IRRADIATION TESTING

4.9.1 Application

If specified in Para. 4.2.1 of this specification, total dose irradiation testing shall be performed in accordance with the requirements of ESA/SCC Basic Specification No. 22900.

4.9.2 Bias Conditions

Continuous bias shall be applied during irradiation testing as shown in Figure 6 of this specification.

4.9.3 Electrical Measurements

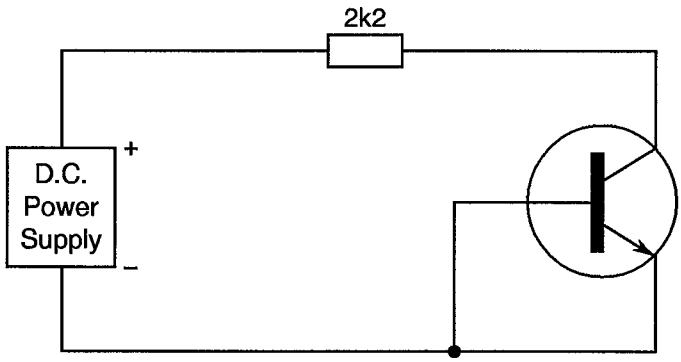
The parameters to be measured prior to irradiation exposure are scheduled in Table 2 of this specification. Only devices which meet the requirements of Table 2 shall be included in the test sample.

The parameters to be measured during and on completion of irradiation testing are scheduled in Table 7 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.	
5	Collector-Emitter Cut-off Current 2	I_{CEX}	As per Table 2	As per Table 2	-	10	µA
7	D.C. Forward Transfer Ratio 1	h_{FE1}	As per Table 2	As per Table 2	40	120	-
9	Collector-Emitter Saturation Voltage 1	$V_{CE(SAT)1}$	As per Table 2	As per Table 2	-	0.25	V

FIGURE 6 - BIAS CONDITIONS FOR IRRADIATION TESTING



NOTES

1. A bias of 70V shall be applied.

TABLE 7 - ELECTRICAL MEASUREMENTS DURING AND ON COMPLETION OF IRRADIATION TESTING

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
3	Collector-Base Cut-off Current	I_{CBO}	As per Table 2	As per Table 2	± 10	nA
6	Emitter-Base Cut-off Current	I_{EBO}	As per Table 2	As per Table 2	± 100	nA
7	D.C. Forward Current Transfer Ratio 1	h_{FE1}	As per Table 2	As per Table 2	Note 1	-
8	D.C. Forward Current Transfer Ratio 2	h_{FE2}	As per Table 2	As per Table 2	Note 1	-
9	Collector-Emitter Saturation Voltage 1	$V_{CE(SAT)1}$	As per Table 2	As per Table 2	± 75	mV

NOTES

1. The h_{FE} value shall not be lower than the minimum value specified in Table 2.