DOCUMENT CHANGE REQUEST

DCR number 384	Changes required for: General	Originator: S Jeffery
Date: 2007/10/16	Date sent: 2007/10/16	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

Title:	Transistors Low Power NPN, based on type 2N2857		
Number:	5201/014	Issue:	1

Other documents affected:

Page:

Total re-write.

Paragraph:

Total re-write.

Original wording:

Proposed wording:

Total reformat of this specification as part of the ongoing conversion to the ESCC format. See below for summary of changes and attached Issue 2 Draft A of the specification.

Note: Known support for active procurement against this specification includes the following manufacturers:

SEMELAB/UK (not ESCC qualified but are currently willing to support the procurement of Variant 01).

Summary of changes to the current format, layout and content is as follows:

1. Rewording and restructuring of various sections and paragraphs of the specification, plus other editorial changes based on the layout and editorial content of other Detail Specifications already converted to ESCC format.

2. Deletion of redundant paragraphs and information such as Mechanical Requirements.

3. Maximum Ratings table: Remark "Over entire operating temperature range" added for Collector-Base, Collector-Emitter and Emitter-Base voltages.

4. Figure 1 Parameter Derating Information moved to be a note (Note 1) to the Maximum Ratings table.

5. Para. 4.3.2 Weight requirements moved to Component Type Variants table.

6. Figure 2 re-named "Physical Dimensions and Terminal Identification" and revised (drawing and dimensions amended and notes added).

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7. Para. 4.2 Deviations from Generic Specification: Deviations revised/re-written per the latest ESCC Generic Specification.

8. Para. 4.4.1 Case requirements corrected to reflect the TO-72 metal can package.

9. Para. 4.4.2 Lead Material and Finish replaced by a reference to the Component Type Variants Para.

10. Para. 4.5.1 Required part marking corrected: Lead Identification deleted (not applicable to "TO-" packages) and ESCC qualified components symbol added.

11. Delete requirement for marking of the test level letter from the ESCC Component Number as per latest ESCC No. 21700.

12. Table 2, Characteristic "D.C. Forward Current Transfer Ratio" re-named "Forward-Current Transfer Ratio".

13. Table 2, Characteristic "Small Signal Power Gain" re-named "Small-Signal Power Gain"; Test Method reference "This Spec. Figure 4" deleted.

14. Table 2, Characteristic "A.C. Forward Current Transfer Ratio" re-named "High Frequency Small-Signal Current Gain".

15. Table 2: Replace LTPD7 sampling for AC parameters tests (designated by "Note 1") with an equivalent fixed sample of 32 components with 0 failures (or 100%).

16. Table 2: Note 2 amended from "Case lead grounded" to "Shield lead connected to ground".

17. Figure 4 amended and moved to be a note (Note 3) to Room Temperature Electrical Measurements.

18. Table 3, Characteristic "D.C. Forward Current Transfer Ratio" re-named "Forward-Current Transfer Ratio".

19. Table 3 (High and Low Temperature Electrical Measurements): 100% inspection has been replaced by a sample of 5 components with 0 failures, or 100%, in line with the new Generic 5000 Issue 3.

20. Table 4: Absolute limits have been added for information.

21. Table 4, Characteristic "D.C. Forward Current Transfer Ratio" re-named "Forward-Current Transfer Ratio".

22. Tables 2, 3 and 4 - Test Conditions column: addition of Test, or Bias, Conditions for referenced MIL-STD-750 Test Methods as and where applicable.

23. Table 5: Ambient Temperature condition amended (was +25deg.C, now +22+/-3deg.C).

24. Table 6, Characteristic "D.C. Forward Current Transfer Ratio" re-named "Forward-Current Transfer Ratio".

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25. Appendix A deleted (redundant information as manufacturer SGS Italy no longer manufactures this part type to this specification).

Justification:

(see also change details for each item above)

1. Part of the ongoing activity of conversion of cover-sheeted ESA/SCC Specifications to the ESCC format.

2. To make the format and presentation consistent with the various other ESCC Detail Specifications already converted to ESCC format.

3. To make the content consistent with ESCC Generic Specification No. 5000 Issue 3.

4. To introduce a standard note about testing at temperatures >+125Â°C which was missing from the previous issue.

5. To make corrections to technical errors in the previous issue.

6. Standardisation of the TO-72 package in all applicable ESCC Detail Specifications.

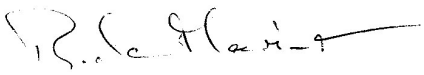
Attachments:

5201014_Issue_2_-_Draft_A.pdf, null

Modifications:

N/A

Approval signature:



Date signed:

2007-10-16

TRANSISTORS, LOW POWER, NPN

BASED ON TYPE 2N2857

ESCC Detail Specification No. 5201/014

Issue 2 - Draft A	October 2007

Document Custodian: European Space Agency - see https://escies.org

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DOCUMENTATION CHANGE NOTICE

(Refer to https://escies.org for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION
TBD	Specification up issued to incorporate editorial and technical changes per DCR.

TABLE OF CONTENTS

1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

1.2 APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

(a) ESCC Generic Specification No. 5000
(b) MIL-STD-750, Test Methods and Procedures for Semiconductor Devices

1.3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

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

1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

1.4.1 The ESCC Component Number

The ESCC Component Number shall be constituted as follows:

520101401

- Detail Specification Reference: 5201014
- Component Type Variant Number: 01

1.4.2 Component Type Variants

The component type variants applicable to this specification are as follows:

Variant Number	Based on Type	Case	Lead/Terminal Material and Finish	Weight max g
01	2N2857	TO-72	D2	0.4

The lead/terminal material and finish shall be in accordance with the requirements of ESCC Basic Specification No. 23500.

1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

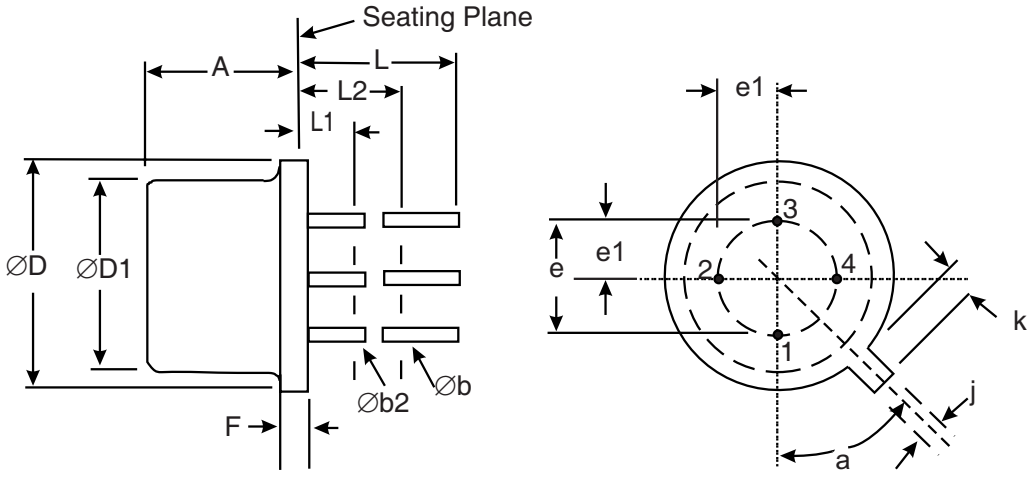
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Unit	Remarks
Collector-Base Voltage	V_{CBO}	30	V	Over entire operating temperature range
Collector-Emitter Voltage	V_{CEO}	15	V	
Emitter-Base Voltage	V_{EBO}	2.5	V	
Collector Current	I_C	40	mA	Continuous
Power Dissipation	P_{tot}	200	mW	At $T_{amb} \leq +25^oC$ Note 1
Operating Temperature Range	T_{op}	-55 to +175	^oC	
Storage Temperature Range	T_{stg}	-65 to +200	^oC	
Soldering Temperature	T_{sol}	+235	^oC	Note 2

NOTES:
1. For $T_{amb} > +25^oC$, derate linearly to 0W at $+175^oC$.
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.

1.6 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.6.1 Metal Can Package (TO-72) - 4 lead

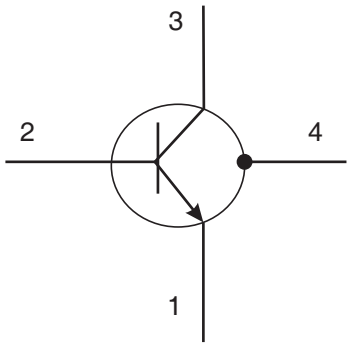


Symbols	Dimensions mm		Notes
	Min	Max	
A	4.32	5.33	
Øb	0.406	0.533	2, 3
Øb2	0.406	0.483	2, 3
ØD	5.31	5.84	
ØD1	4.52	4.95	
e	2.54 TP		5

Symbols	Dimensions mm		Notes
	Min	Max	
e1	1.27 TP		5
F	-	0.762	
j	0.914	1.17	
k	0.711	1.22	4
L	12.7	-	2, 3
L1	-	1.27	2, 3
L2	6.35	-	2, 3
a	45° TP		5, 6

NOTES:
1. Terminal identification is specified by reference to the tab position where lead 1 = emitter, lead 2 = base, lead 3 = collector and lead 4 = shield lead (connected to the case).
2. Applies to all leads.
3. Øb2 applies between L1 and L2. Øb applies between L2 and 12.7mm from the seating plane. Diameter is uncontrolled within L1 and beyond 12.7mm from the seating plane.
4. Measured from the maximum diameter of the actual device.
5. Leads having maximum diameter 0.483mm measured in the gauging plane 1.37(+0.025,-0)mm below the seating plane of the device shall be within 0.178mm of their true position relative to a maximum-width-tab.
6. Measured from the tab centreline.

1.7 FUNCTIONAL DIAGRAM



1. Emitter.
2. Base.
3. Collector.
4. Shield Lead.

NOTES:
1. The shield lead is internally connected to the case.

1.8 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

a) Case
The case shall be hermetically sealed and have a metal body with hard glass seals.

b) Leads/Terminals
As specified in Component Type Variants.

2. REQUIREMENTS

2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

2.1.1 Deviations from the Generic Specification

(a) Deviation from Screening Tests - Chart F3
High Temperature Reverse Bias Burn-in and the subsequent Final Measurements for HTRB shall be omitted.

2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component shall be:

(a) The ESCC qualified components symbol (for ESCC qualified components only).
(b) The ESCC Component Number.
(c) Traceability information.

2.3 TERMINAL STRENGTH

The test conditions for terminal strength, tested as specified in the ESCC Generic Specification, shall be as follows:

Test Condition: E, lead fatigue.

2.4 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

Electrical measurements shall be performed at room, high and low temperatures.

2.4.1 Room Temperature Electrical Measurements

The measurements shall be performed at T_{amb}=+22 ±3°C.

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	3001	I_C =1µA, Bias Condition D	30	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011	I_C =3mA, Bias Condition D	15	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026	I_E = 10µA, Bias Condition D	2.5	-	V
Collector-Base Cut-off Current	I_{CBO}	3036	V_{CB}= 15V, Bias Condition D	-	10	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	3071	I_C=10mA I_B=1mA	-	400	mV
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	3066	I_C=10mA I_B=1mA Condition A	-	1	V
Forward-Current Transfer Ratio	h_{FE}	3076	V_{CE}=1V; I_C =3mA	30	150	-
High Frequency Small-Signal Current Gain	h_{fe}	3306	V_{CE}=6V, I_C=5mA f=100MHz Notes 1, 2	10	-	–
Input Capacitance	C_{ibo}	3240	V_{EB}=500mV I_E=0A f=1MHz Notes 1, 2	-	2	pF
Output Capacitance	C_{obo}	3236	V_{CB}=10V, I_E=0A f=1MHz Note 1	-	1.7	pF
Noise Figure	NF	3246	V_{CE}=10V I_C=1.5mA f=450MHz R_C=50Ω Note 1	-	5	dB
Small-Signal Power Gain	G_{pe}	-	V_{CE}=6V I_C=1.5mA f=450MHz Notes 1, 3	12.5	21	dB

NOTES:

1. For AC characteristics read and record measurements shall be performed on a sample of 32 components with 0 failures allowed. Alternatively a 100% inspection may be performed.
2. Shield lead connected to ground.
3. Small-signal power gain shall be measured using the circuit shown below. Each transistor shall be tuned for maximum power gain. The measuring circuit shall be decoupled from the transistor supply.

To prevent damage to the transistor, the supply voltage shall be switched off before the transistor is inserted into the measuring jig.

Calibration Procedure

Input and output of the sweep generator are short-circuited by connecting A and B with the attenuator in position 10dB. The calibration voltage is adjusted to a calibration line of the sweep generator. Subsequently, A and B are connected to the measuring circuit and the total attenuation is adjusted to 10dB.

Transition Losses

After calibration of the sweep generator, a transistor is tuned for maximum power output in the circuit. Next, the transistor is replaced by a standard short and the input stub tuned to minimum attenuation.

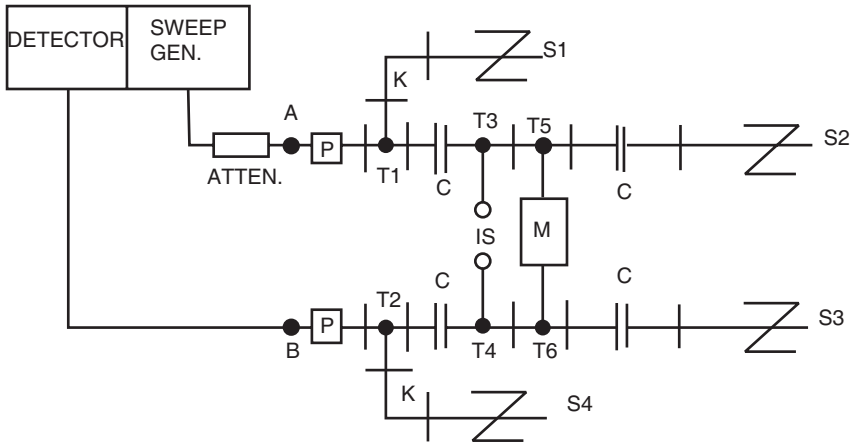
The loss in output impedance transition = total loss/2

The same procedure shall be repeated for input impedance transition.

The measurement values shall be corrected according to the losses in impedance.

Gain Measurement

After tuning for maximum output (gain), the small-signal power gain = measured gain + losses T_1 and T_2.



C = Coupling capacitor
K = Coaxial knee
S1, S2, S3, S4 = Coaxial stub
T1, T2, ...T6 = Coaxial “T”s
P = 3dB pad
IS = Bias insertion unit
M = Transistor mounting

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions Note 1	Limits		Units
				Min	Max	
Collector-Base Cut-off Current	I_{CBO}	3036	T_{amb}=+150(+0-5)°C V_{CB}=15V, Bias Condition D	-	1	µA
Forward-Current Transfer Ratio	h_{FE}	3076	T_{amb}=-55(+5-0)°C V_{CE}=1V I_C=3mA	10	-	-

NOTES:

1. Read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

2.5 PARAMETER DRIFT VALUES

Unless otherwise specified, the measurements shall be performed at T_{amb}=+22 ±3°C.

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The drift values (Δ) shall not be exceeded for each characteristic specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits			Units
		Drift Value Δ	Absolute		
			Min	Max	
Collector-Base Cut-off Current	I_{CBO}	±3	-	10	nA
Forward-Current Transfer Ratio	h_{FE}	±25%	30	150	-

2.6 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at T_{amb}=+22 ±3°C.

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits		Units
		Min	Max	
Collector Cut-off Current	I_{CBO}	-	10	nA
Forward-Current Transfer Ratio	h_{FE}	30	150	-

2.7 POWER BURN-IN CONDITIONS

Characteristics	Symbols	Conditions	Units
Ambient Temperature	T_{amb}	+22 ±3	^{o}C
Power Dissipation	P_{tot}	200	mW
Collector-Base Voltage	V_{CB}	12	V

2.8 OPERATING LIFE CONDITIONS

The conditions shall be as specified for Power Burn-in.