DOCUMENT CHANGE REQUEST

DCR number 328
Changes required for: General
Originator: S JEFFERY
Date: 2007/04/17
Date sent: 2007/04/17
Organisation: ESA/ESTEC
Status: IMPLEMENTED

Title:	Matched Dual Transistors NPN, based on type 2N3350		
Number:	5207/003	Issue:	1

Other documents affected:

Page:

Total re-write

Paragraph:

Total re-write

Original wording:

Proposed wording:

Total reformat of this specification (under Generic Specification No. 5000) 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:

STMICROELECTRONICS/F (ESCC QPL listed with qualified Variants 02, 03, 04 and 05)

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

1. Rewording and restructure 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 (e.g. changes described in DCR No. 203).
2. Deletion of any redundant paragraphs and information, e.g.: Mechanical Requirements.
3. Para. 1.7 High Temperature Test Precautions requirements moved to be a note in the Maximum Ratings table.
4. Deletion of obsolete lead finish D2 / Variant 01 from the available range (not supported by STMicroelectronics).
5. Figure 1(a) Parameter Derating Information moved to be a note in the Maximum Ratings table.
6. Para. 4.3.2 Weight requirements moved to Component Type Variants table.
7. Figure 2 re-named â..Physical Dimensions and Terminal Identificationâ.; Figure 2(a) amended to reflect the TO-77 package currently supplied; Figure 2(b) amended to reflect the CCP package currently supplied.
8. Figure 3 Functional Diagram amended and Notes added.
9. Para. 4.3.3 Terminal Strength: Erroneous text â..Applied Force: 2.5Â±0.1 Newtonsâ. deleted.
10. Para. 4.4.1 Case requirements corrected to reflect a TO-77 metal can package.
11. Para. 4.4.2 Lead Material and Finish replaced by a reference to the Component Type Variants Para.
12. Para. 4.5.1 Required part marking corrected: Lead Identification amended (only applies to CCP package) and ESCC

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qualified components symbol added.
13. Delete requirement for marking of the test level letter from the ESCC Component Number as per latest ESCC No. 21700.
14. Table 2 Collector-Base Breakdown Voltage: sense of IC Test Condition corrected (-ve).
15. Table 2 Collector-Emitter Breakdown Voltage: sense of IC Test Condition corrected (-ve).
16. Table 2 Emitter-Base Breakdown Voltage: sense of IC Test Condition corrected (-ve).
17. Table 2 Collector-Base Cut-off Current: sense of VCB Test Condition corrected (-ve).
18. Table 2 Emitter-Base Cut-off Current: sense of VEB Test Condition corrected (-ve).
19. Table 2, Characteristic â..D.C. Forward Current Transfer Ratioâ. has been changed to â..Forward-Current Transfer Ratioâ. and sense of IC and VCE Test Conditions corrected (-ve).
20. Table 2, Characteristic â..Collector Saturation Voltageâ. corrected to â..Collector-Emitter Saturation Voltageâ. and sense of IC and IB Test Conditions corrected (-ve).
21. Table 2 Base-Emitter Saturation Voltage: sense of IC and IB Test Conditions corrected (-ve).
22. Table 2, Characteristic â..D.C. Current Gain Ratioâ. has been changed to â..Forward-Current Transfer Ratio Comparisonâ.; symbol has been amended from
hFE1/hFE2 to hFE1-1/hFE1-2 ; Test Method â..-1â. deleted; sense of IC and VCE Test Conditions corrected (-ve).

23. Table 2 Base-Emitter Voltage Differential: Applicable Test Method (3066) added; sense of IC and VCE Test Conditions corrected (-ve).
24. Table 2 Current Gain Bandwidth Product: sense of IC and VCE Test Conditions corrected (-ve).
25. Table 2, Characteristic â..Small Signal Common Emitter Forward Current Transfer Ratioâ. has been changed to â..Small-Signal Short-Circuit Forward Current Transfer Ratioâ.; symbol has been corrected to hfe (was hFE); sense of IC and VCE (corrected â.. was VCB) Test Conditions corrected (-ve).
26. Table 2 Noise Figure: symbol corrected to NF (was NF); Test Method â..-1â. deleted; sense of IC and VCE Test Conditions corrected (-ve).
27. Table 2 Small Signal Input Impedance and Small Signal Output Impedance: sense of IC and VCE Test Conditions corrected (-ve).
28. Output Capacitance: sense of VCB Test Condition corrected (-ve).
29. Input Capacitance: sense of VEB Test Condition corrected (-ve).
30. Table 2: Replace LTPD7 sampling for AC parameters tests (designated by â..Note 2â.) with an equivalent fixed sample of 32 components with 0 failures (or 100%).
31. Table 3 Collector-Base Cut-off Current: tolerance added to test temperature; senses of VCB Test Condition and Max. limit corrected (-ve).
32. Table 3, Characteristic â..D.C. Forward Current Transfer Ratioâ. has been changed to â..Forward-Current Transfer Ratio 2â.; tolerance added to test temperature; sense of IC and VCE Test Conditions corrected (-ve).
33. Table 3, Characteristic â..D.C. Current Gain Ratioâ. has been changed to â..Forward-Current Transfer Ratio Comparisonâ.; symbol has been amended from hFE1/hFE2 to hFE1-1/hFE1-2 ; sense of IC and VCE Test Conditions corrected (-ve).
34. Base-Emitter Voltage Differential Change: tolerances added to test temperatures; sense of IC and VCE Test Conditions corrected (-ve).
35. 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.
36. Table 4: Absolute limits have been added for information.

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37. Table 4, Characteristic â..D.C. Current Gain Ratioâ. corrected to â..Forward-Current Transfer Ratio 1â..
38. 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.
39. Table 6 Collector-Base Cut-off Current: sense of Max. limit corrected (-ve).
40. Table 6, Characteristic â..D.C. Forward Current Transfer Ratioâ. has been changed to â..Forward-Current Transfer Ratio 1â..
41. Table 6, Characteristic â..Collector Saturation Voltageâ. corrected to â..Collector-Emitter Saturation Voltageâ. and sense of Max. limit corrected (-ve).
42. Table 6, Characteristic â..D.C. Current Gain Ratioâ. has been changed to â..Forward-Current Transfer Ratio Comparisonâ.; symbol has been amended from hFE1/hFE2 to hFE1-1/hFE1-2.
43. Table 6, Characteristic: â..Absolute value ofâ. deleted.
44. Table 6: Note 1 amended.
45. Appendix A for STM added:
a) To introduce a deviation to Special In-process Controls Internal Visual Inspection for CCP packages. A sample radiographic inspection to verify the die attach process per STMicroelectronics procedure 0076637 may replace the standard inspection criteria.
b) To introduce a note about wafer level pilot lot testing in that AC characteristics during screening may be considered guaranteed but not tested. Note STM is an ESCC QPL listed manufacturer and this device is ESCC qualified; accordingly there is an ESCC approved PID for this device. This amendment is considered technically acceptable on this basis.

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 incorporate specific deviations requested by manufacturer STMicroelectronics within Appendix A which are considered technically acceptable (based on ESCC approved PID for this and other ESCC qualified components manufactured by STM).
5. Update manufacturerâ..s current product availability.
6. To make corrections to technical errors in the previous issue.
7. Standardisation of the TO-77 and CCP packages in all applicable ESCC Detail Specifications.

Attachments:
5207003_Issue_2_-_Draft_A.pdf, null
Modifications:
N/A
Approval signature:
Date signed:
2007-04-17

Pages 1 to 15

TRANSISTORS, MATCHED DUAL, PNP

BASED ON TYPE 2N3350

ESCC Detail Specification No. 5207/003

Issue 2- Draft A	February 2007

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

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

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

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:

Example: 520700302

- Detail Specification Reference: 5207003
- Component Type Variant Number: 02 (as required)

1.4.2 Component Type Variants

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

Variant No.	Based on Type	Case	Lead/Terminal Material and Finish	Weight max g
02	2N3350	TO-77	D3 or D4	0.95
03	2N3350	TO-77	D7	0.95
04	2N3350	CCP	2	0.2
05	2N3350	CCP	4	0.2

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.

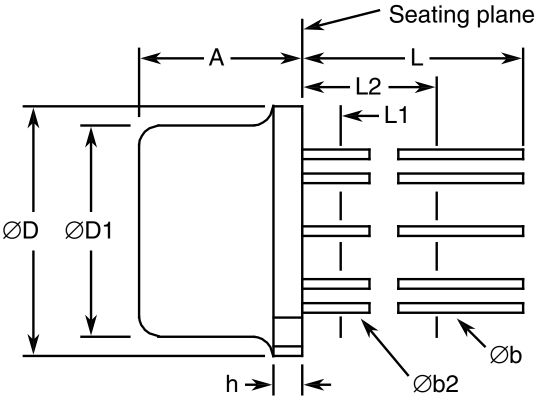
Characteristics	Symbols	Maximum Ratings	Unit	Remarks
Collector-Base Voltage	V_{CBO}	-60	V	Over entire operating temperature range
Collector-Emitter Voltage	V_{CEO}	-45	V	
Emitter-Base Voltage	V_{EBO}	-6	V	
Collector Current	I_C	30	mA	Continuous
Power Dissipation (One Section)				At $T_{amb} \leq +25^{\circ}C$ Note 1
For TO-77 and CCP	P_{totO1}	0.3	W	
For CCP	P_{totO2}	0.6 (Note 2)	W	
For TO-77	P_{totO3}	0.6	W	At $T_{case} \leq +25^{\circ}C$ Note 1
Power Dissipation (Both Sections)				At $T_{amb} \leq +25^{\circ}C$ Note 1
For TO-77 and CCP	P_{totB1}	0.6	W	
For CCP	P_{totB2}	1.2 (Note 2)	W	
For TO-77	P_{totB3}	1.2	W	At $T_{case} \leq +25^{\circ}C$ Note 1
Operating Temperature Range	T_{op}	-55 to +200	°C	Note 3
Storage Temperature Range	T_{stg}	-65 to +200	°C	Note 3
Soldering Temperature	T_{sol}		°C	
For TO-77		+260		Note 4
For CCP		+245		Note 5

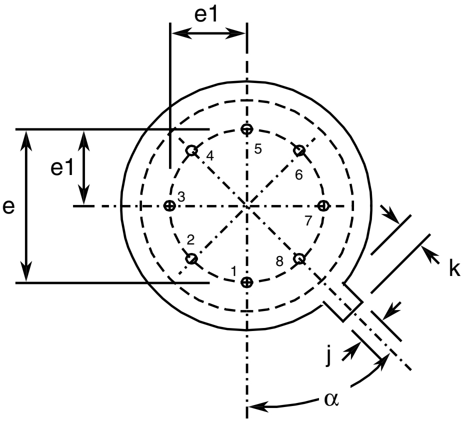
NOTES:

1. For T_{amb} or $T_{case} > +25^{\circ}C$, derate linearly to 0W at +200°C.
2. When mounted on a 15 x 15 x 0.6mm ceramic substrate.
3. For Variants with tin-lead plating or hot solder dip lead finish all testing performed at $T_{amb} > +125^{\circ}C$ shall be carried out in a 100% inert atmosphere.
4. 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.
5. Duration 5 seconds maximum and the same terminal shall not be resoldered until 3 minutes have elapsed.

1.6 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.6.1 Metal Can Package (TO - 77) - 6 lead





Symbols	Dimensions mm		Notes
	Min	Max	
A	6.1	6.6	
∅b	0.406	0.533	2, 3
∅b2	0.406	0.483	2, 3
∅D	8.51	9.4	
∅D1	7.75	8.51	
e	5.08 BSC		4
e1	2.54 BSC		4
h	-	1.02	
j	0.711	0.864	
k	0.737	1.14	5
L	12.7	-	2
L1	-	1.27	3
L2	6.35	-	3
α	45° BSC		1, 4, 6

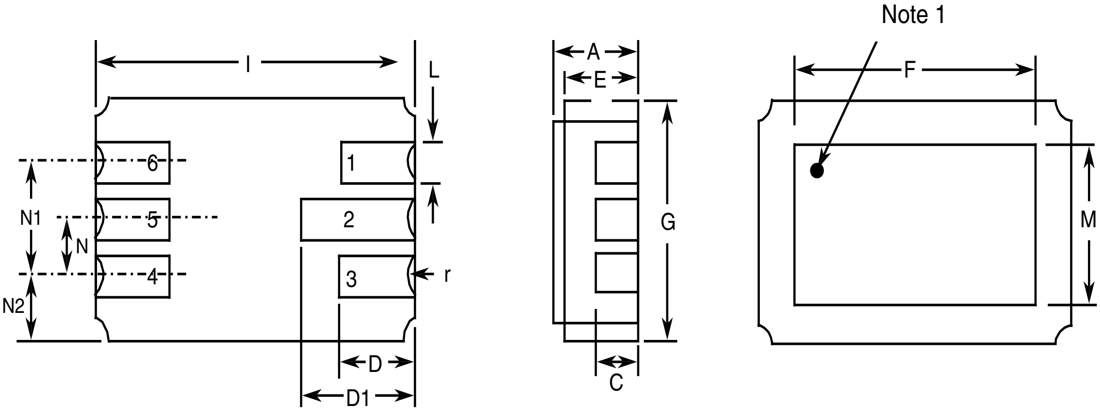
NOTES:

1. Terminal identification is specified by reference to the tab position where lead 1 = collector 1, lead 2 = base 1, lead 3 = emitter 1, lead 5 = emitter 2, lead 6 = base 2 and lead 7 = collector 2. Lead numbers 4 and 8 are not present on the actual package; they are shown in the drawing for information only.
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. 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.

5. Measured from the maximum diameter of the actual device.
6. Tab centreline.

1.6.2 Chip Carrier Package (CCP) - 6 terminal

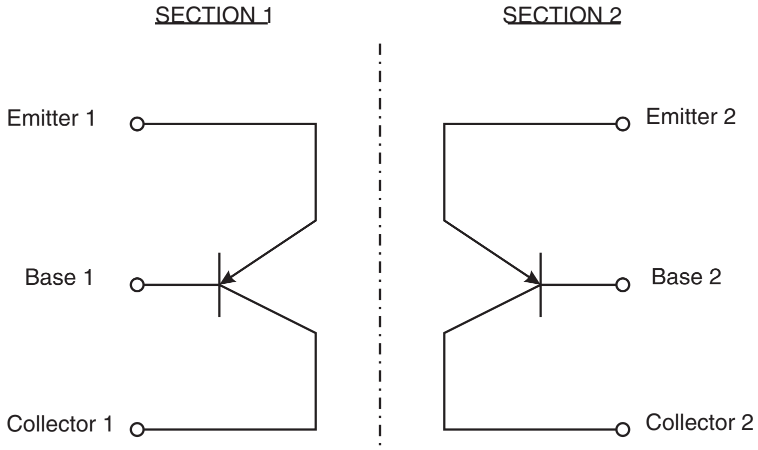


Symbols	Dimensions mm		Notes
	Min	Max	
A	1.53	1.96	
C	0.89 TYPICAL		2
D	1.52	1.78	
D1	2.08	2.49	
E	1.24	1.55	
F	5.76	5.92	
G	4.19	4.45	
I	6.1	6.35	
L	0.55	0.71	2
M	3.86	4.01	
N	1.14	1.4	
N1	2.41	2.67	
N2	0.89 TYPICAL		
r	0.23 TYPICAL		2

NOTES:

1. Terminal identification is specified, when viewing the top side of the package, by reference to a black ink dot adjacent to terminal 1 = base 2. Terminal 2 = collector 2, terminal 3 = emitter 2, terminal 4 = emitter 1, terminal 5 = collector 1 and terminal 6 = base 1.
2. Applies to all terminals.

1.7 FUNCTIONAL DIAGRAM



NOTES:

1. For TO-77, the case is not connected to any lead.
2. For CCP, the lid is not connected to any terminal.

1.8 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

a) Case
For the metal can package the case shall be hermetically sealed and have a metal body with hard glass seals.
For the chip carrier package the case shall be hermetically sealed and have a ceramic body with a Kovar lid.

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

None.

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) Terminal identification (CCP package only).
(b) The ESCC qualified components symbol (for ESCC qualified components only).
(c) The ESCC Component Number.
(d) Traceability information.

2.3 TERMINAL STRENGTH

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

For TO-77, 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	$I_C = -10\mu A$, Bias Condition D	-60	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011	$I_C = -10mA$, Bias Condition D Note 1	-45	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026	$I_E = -10\mu A$, Bias Condition D	-6	-	V
Collector-Base Cut-off Current	I_{CBO}	3036	$V_{CB} = -45V$, Bias Condition D	-	-10	nA
Emitter-Base Cut-off Current	I_{EBO}	3061	$V_{EB} = -5V$, Bias Condition D	-	-2	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	3071	I_C=-10mA I_B=-500µA Note 1	-	-500	mV
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	3066	I_C=-10mA I_B=-1mA Test Condition A Note 1	-	900	mV
Forward-Current Transfer Ratio	h_{FE1}	3076	I_C=-10µA ; V_{CE} =-5V	100	300	-
	h_{FE2}	3076	I_C=-1mA ; V_{CE} =-5V	150	-	-
Forward-Current Transfer Ratio Comparison	h_{FE1-1}/ h_{FE1-2}	3076	I_C=-10µA ; V_{CE} =-5V	0.9	1.1	-
Base-Emitter Voltage Differential	$\lvert V_{BE1}-V_{BE2}\rvert$	3066	I_C=-10µA V_{CE}=-5V Test Condition B	-	5	mV
Current Gain Bandwidth Product	f_T	3206	I_C=-1mA V_{CE}=-5V f=30MHz Note 2	60	240	MHz
Small-Signal Short-Circuit Forward-Current Transfer Ratio	h_{fe}	3206	I_C=-1mA V_{CE}=-5V f=1kHz Note 2	150	600	-
Output Capacitance	C_{obo}	3236	V_{CB}=-5V I_E=0A f=1MHz Note 2	-	6	pF
Input Capacitance	C_{ib}	3240	V_{EB}=-500mV I_C=0A f=1MHz Note 2	-	12	pF

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Small-Signal Input Impedance	h_{ie}	3201	I_C=-1mA V_{CE}=-5V f=1kHz Note 2	3.7	20	kΩ
Small-Signal Output Impedance	h_{oe}	3216	I_C=-1mA V_{CE}=-5V f=1kHz Note 2	-	100	µmho
Noise Figure	NF	3246	I_C=-10µA V_{CE}=-5V R_S=10kΩ BW=15.7kHz Note 2	-	4	dB

NOTES:

1. Pulse measurement: Pulse Width ≤ 300µs, Duty Cycle ≤ 2%.
2. 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.

2.4.2 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}=-45V, Bias Condition D	-	-10	µA
Forward-Current Transfer Ratio 2	h_{FE2}	3076	T_{amb}=-55(+5-0)˚C I_C=-1mA V_{CE}=-5V	70	-	-
Forward-Current Transfer Ratio Comparison	h_{FE1-1}/ h_{FE1-2}	3076	T_{amb}=-55 to +125°C I_C=-10µA ; V_{CE} =-5V	0.9	1.1	-
Base-Emitter Voltage Differential Change	$\lvert\Delta(V_{BE1}-V_{BE2})\Delta T_{amb}\rvert$ 1	3066	T_{amb}=-55(+5-0)˚C to +25±3°C I_C=-10µA V_{CE}=-5V	-	800	µV
	$\lvert\Delta(V_{BE1}-V_{BE2})\Delta T_{amb}\rvert$ 2	3066	T_{amb}=+25±3°C to +125(+5-0)°C I_C=-10µA V_{CE}=-5V	-	1000	

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}	±1.5	-	-10	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	±15 or (1) ±15%	-	-500	mV
Forward-Current Transfer Ratio 1	h_{FE1}	±15%	100	300	-

NOTES:

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

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 either Room Temperature Electrical Measurements or High and Low Temperature Electrical Measurements, as applicable.

The limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits		Units
		Min	Max	
Collector-Base Cut-off Current	I_{CBO}	-	-10	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	-	-500	mV
Forward-Current Transfer Ratio 1	h_{FE1}	100	300	-
Forward-Current Transfer Ratio Comparison	h_{FE1-1}/h_{FE1-2}	0.85	1.15	-
Base-Emitter Voltage Differential	$|V_{BE1}-V_{BE2}|$	-	5	mV
Base-Emitter Voltage Differential Change (Note 1)	$|\Delta(V_{BE1}-V_{BE2})\Delta T_{amb}|1$	-	1	mV
	$|\Delta(V_{BE1}-V_{BE2})\Delta T_{amb}|2$	-	1.2	

NOTES:

1. To be measured after Operating Life test only.

2.7 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Case Temperature	T_{case}	+150 (+0 -5)	^oC
Collector-Base Voltage	V_{CB}	-60	V
Emitter-Base Voltage	V_{EB}	-6	V
Duration	t	72 minimum	hrs

2.8 POWER BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	$+25\pm3$	^oC
Power Dissipation (Both Sections)	P_{totB}	As per Maximum Ratings P_{totB1} derated at the chosen T_{amb}	W
Collector-Base Voltage	V_{CB}	-30	V

2.9 OPERATING LIFE CONDITIONS

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

APPENDIX 'A'

AGREED DEVIATIONS FOR STMICROELECTRONICS (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Deviations from Production Control-Chart F2	Special In-process Control Internal Visual Inspection. For CCP packages the criteria specified for voids in the fillet and minimum die mounting material around the visible die perimeter for die mounting defects may be omitted providing that a radiographic inspection to verify the die-attach process is performed on a sample basis in accordance with STMicroelectronics procedure 0076637.
Deviations from Room Temperature Electrical Measurements	All AC characteristics (Room Temperature Electrical Measurement Note 2) may be considered guaranteed but not tested if successful pilot lot testing has been performed on the wafer lot which includes AC characteristic measurements per the Detail Specification. A summary of the pilot lot testing shall be provided if required by the Purchase Order.
Deviations from High and Low Temperatures Electrical Measurements	All characteristics specified may be considered guaranteed but not tested if successful pilot lot testing has been performed on the wafer lot which includes characteristic measurements at high and low temperatures per the Detail Specification. A summary of the pilot lot testing shall be provided if required by the Purchase Order.