DOCUMENT CHANGE REQUEST

DCR number 265

Changes required for: General

Originator: Ron Fidler

Date: 2006/07/24

Date sent: 2006/07/24

Organisation: ESA/ESTEC

Status: IMPLEMENTED

Title:	Transistors Low Power NPN, based on type 2N2219A		
Number:	5201/003	Issue:	1

Other documents affected:

Page:

Total re-write - see below

Paragraph:

Total re-write - see below

Original wording:

Proposed wording:

Total reformat of this Detail 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 Manufacturer:
STM/F (ESCC QPL listed with qualified Variants 01, 02)

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.

2. Deletion of any redundant paragraphs and information, e.g. Test circuits and mechanical paragraph.

3. Para 1.7 - High Temperature Test Precautions requirements moved to be a note to the Maximum Ratings table.

4. Deletion of Variant 03, 04 and 05 from the available range (not supported by STM).

5. Figure 1 Parameter Derating Requirements - moved to be a note to the Maximum Ratings table.

6. Figure 2 - Dimensions .a. and .b. corrected from "NOMINAL" to "BSC". The drawing harmonized with TO-39 outlines for similar STM components.

7. Para 4.3.2 - Weight requirements moved to Component Type Variants table.

8. Para 4.4.1 - Case requirements for Variants 01 & 02 corrected to reflect a TO-39 metal can.

9. Requirement for marking of the testing level letter from the ESCC Component Number deleted as per latest ESCC No. 21700.

10. Table 2 - .Bias Condition D. added to all Breakdown Voltage test conditions and also to IEBO and ICBO test conditions in place of the zero current condition.

11. Table 2 . .Test Condition A. added to the VBE(SAT) conditions.

12. Table 2 . Test Method, Characteristic and Symbol for hfe corrected. This now complies with the MIL spec test definition.

13. Table 2 and Figure 4 - MIL test method deleted from tON and tOFF and new Notes 3 and 4 added which fully define the tests based upon the actual test circuits and conditions used by STM and show the test circuit and the waveforms. For the tOFF the test condition for the Base Current was corrected.

14. Table 2 - The LTPD7 sample for AC parameters tests (designated by "Note 2") replaced by an equivalent fixed sample of 32 components with 0 failures (or 100%).

15. Table 3 (High & Low Temp Electricals) - 100% inspection changed to a sample of 5 components with 0 failures (or 100%) (In line with new generic 5000 Issue 2). New Note 1 added to cover this. Tolerances added to the test temperatures.

16. Table 4 - Absolute limits from Table 2 have been added for information.

17. New Appendix A for STMICROELECTRONICS (F) - added.

Note - STM is an ESCC QPL listed manufacturer and this device is ESCC qualified; accordingly there is an ESCC approved PID for this device. These amendments are considered technically acceptable on this basis. DCR 154 also covers these changes and has been approved.

Justification:

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 (e.g. 54HCMOS and CMOS 4000B series of ESCC IC specifications).

DOCUMENT CHANGE REQUEST

DCR number 265

Changes required for: General

Originator: Ron Fidler

Date: 2006/07/24

Date sent: 2006/07/24

Organisation: ESA/ESTEC

Status: IMPLEMENTED

3. To make the content consistent with the proposed ESCC format Generic Specification No.5000 issue 2

4. To incorporate specific deviations requested by manufacturer STM within appendix A which are considered technically acceptable (based on the ESCC approved PID for this and other ESCC qualified components manufactured by STM).

5. Update manufacturers' current products availability.

6. To make corrections to several technical errors in the previous issue.

Attachments:

5201003.pdf, null

Modifications:

N/A

Approval signature:

Date signed:

2006-07-24

Pages 1 to 15

TRANSISTORS, LOW POWER, NPN

BASED ON TYPE 2N2219A

ESCC Detail Specification No. 5201/003

Issue 2- Draft A	July 2006

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

LEGAL DISCLAIMER AND COPYRIGHT

DOCUMENTATION CHANGE NOTICE

(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 5

1.1 Scope 5
1.2 Applicable Documents 5
1.3 Terms, Definitions, Abbreviations, Symbols and Units 5
1.4 The ESCC Component Number and Component Type Variants 5
1.4.1 The ESCC Component Number 5
1.4.2 Component Type Variants 5
1.5 Maximum Ratings 5
1.6 Physical Dimensions and Terminal Identification 6
1.7 Functional Diagram 7
1.8 Materials and Finishes 8

2. REQUIREMENTS 8

2.1 General 8
2.1.1 Deviations from the Generic Specification 8
2.1.1.1 Deviation from Screening Tests - Chart F3 8
2.2 Marking 8
2.3 Terminal Strength 8
2.4 Electrical Measurements at Room, High and Low Temperatures 8
2.4.1 Room Temperature Electrical Measurements 9
2.4.2 High and Low Temperatures Electrical Measurements 13
2.5 Parameter Drift Values 13
2.6 Intermediate and End-Point Electrical Measurements 13
2.7 Power Burn-in Conditions 14
2.8 Operating Life Conditions 14

APPENDIX ‘A’ 15

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: 520100301

- Detail Specification Reference: 5201003
- Component Type Variant Number: 01 (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 Material and Finish	Weight max g
01	2N2219A	TO-39	D2	1.2
02	2N2219A	TO-39	D3 or D4	1.2

The lead 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.

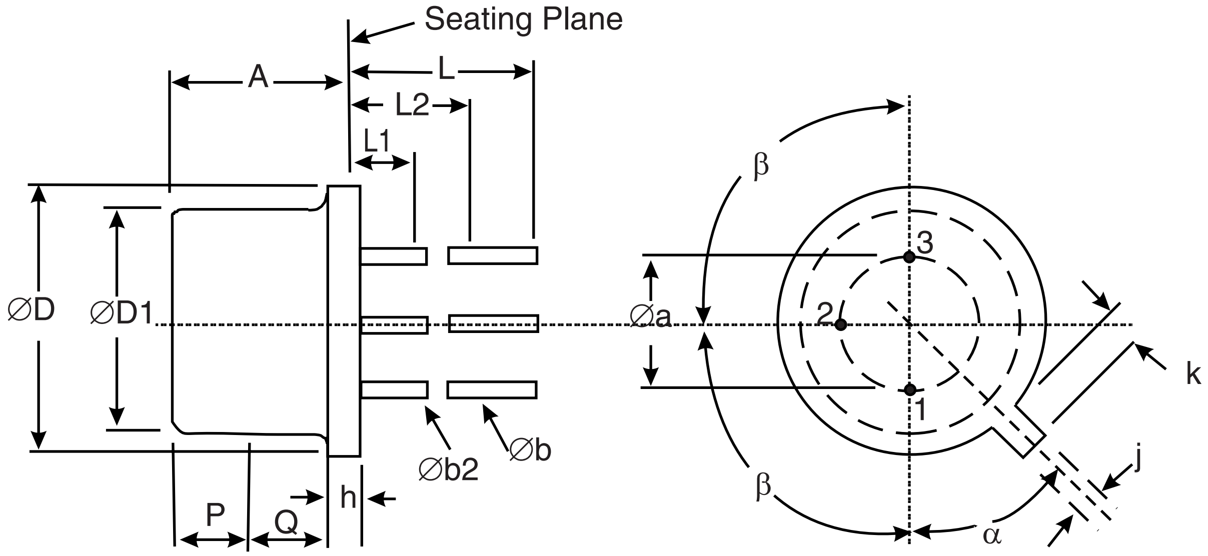
Characteristics	Symbols	Maximum Ratings	Unit	Remarks
Collector-Base Voltage	V_{CBO}	75	V	Over entire operating temperature range
Collector-Emitter Voltage	V_{CEO}	40	V	
Emitter-Base Voltage	V_{EBO}	6	V	
Collector Current	I_C	800	mA	Continuous
Power Dissipation	P_{tot1}	0.8	W	At $T_{amb} \leq +25^{\circ}C$ Note 1
	P_{tot2}	3	W	At $T_{case} \leq +25^{\circ}C$ Note 1
Operating Temperature Range	T_{op}	-65 to +200	°C	Note 2
Storage Temperature Range	T_{stg}	-65 to + 200	°C	Note 2
Soldering Temperature	T_{sol}	+260	°C	Note 3

NOTES:

1. For T_{amb} or $T_{case} > +25^{\circ}C$, derate linearly to 0W at +200˚C.
2. 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.
3. 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

Metal Can Package (TO - 39) - 3 Lead



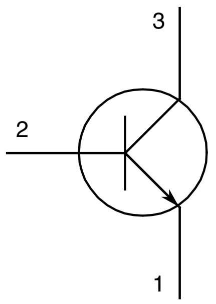
Symbols	Dimensions mm		Notes
	Min	Max	
Øa	4.83	5.35	

Symbols	Dimensions mm		Notes
	Min	Max	
A	6	6.6	
∅b	0.4	0.533	2, 3
∅b2	0.4	0.483	2, 3
∅D	8.31	9.4	
∅D1	7.75	8.51	5
h	0.229	3.18	
j	0.71	0.864	
k	0.737	1.14	4
L	12.7	19	2
L1	-	1.27	2, 3
L2	6.35	-	2, 3
P	2.54	-	5
Q	-	-	6
α	45° BSC		1, 7
β	90° BSC		1

NOTES:

1. Terminal identification is specified by reference to the tab position where Lead 1 = emitter, Lead 2 = base and Lead 3 = collector.
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. This zone is controlled for automatic handling. The variation in actual diameter within this zone shall not exceed 0.254mm.
6. The details of outline in this zone are optional.
7. Measured from the Tab Centreline.

1.7 FUNCTIONAL DIAGRAM



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

NOTES:

1. The collector 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
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

2.1.1.1 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.

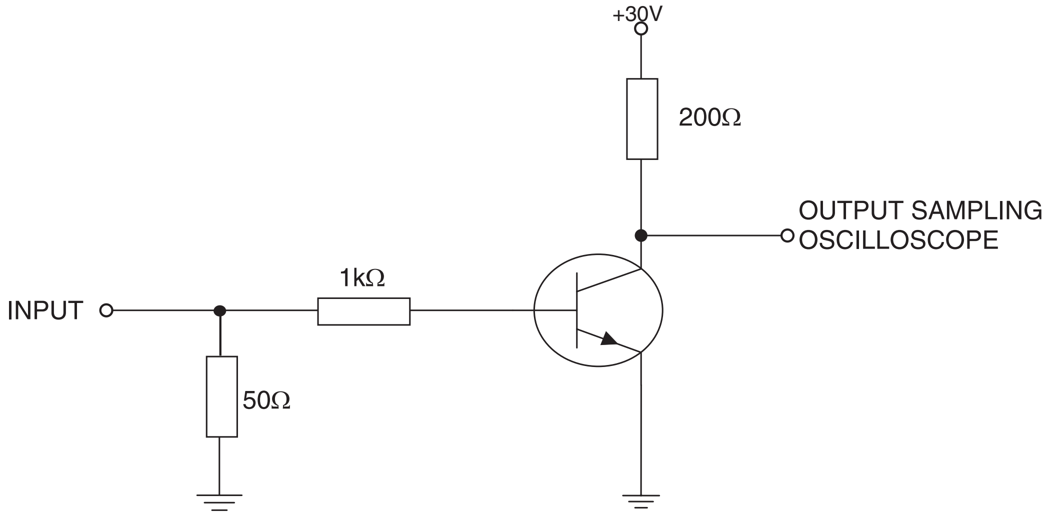
2.4.1 Room Temperature Electrical Measurements

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

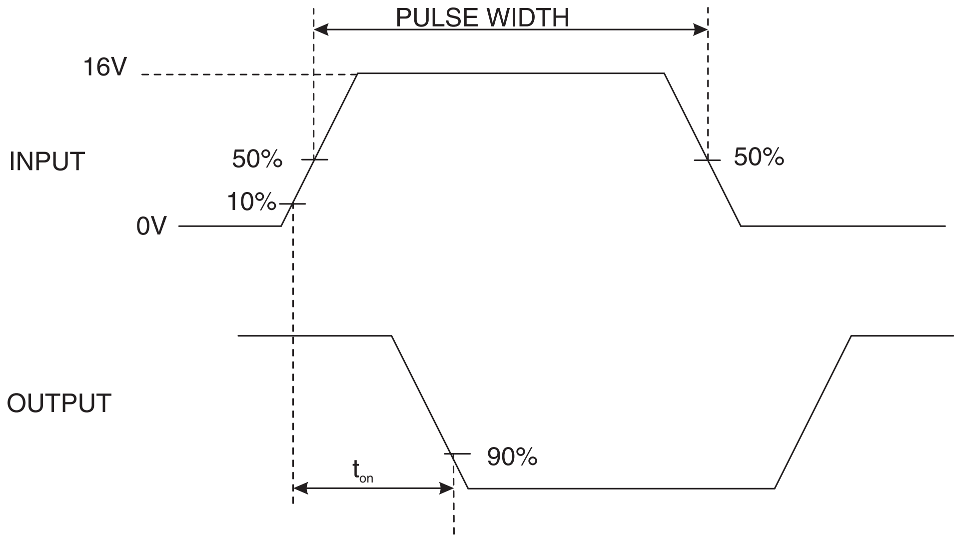
Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	3001	I_C = 10µA, Bias Condition D	75	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011	I_C = 10mA, Bias Condition D Note 1	40	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026	I_E = 10µA, Bias Condition D	6	-	V
Collector-Base Cut-off Current	I_{CBO}	3036	V_{CB} = 60V, Bias Condition D	-	10	nA
Emitter-Base Cut-off Current	I_{EBO}	3061	V_{EB} = 3V, Bias Condition D	-	10	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)1}$	3071	I_C=150mA I_B=15mA Note 1	-	300	mV
	$V_{CE(sat)2}$	3071	I_C=500mA I_B=50mA Note 1	-	1	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	3066	Test Condition A I_C=150mA I_B=15mA Note 1	-	1.2	V
Forward-Current Transfer Ratio	h_{FE1}	3076	V_{CE}=10V ; I_C =10mA Note 1	75	-	-
	h_{FE2}	3076	V_{CE}=10V ; I_C =150mA Note 1	100	300	-
	h_{FE3}	3076	V_{CE}=10V ; I_C =500mA Note 1	40	-	-
Magnitude of Small-Signal Short-Circuit Forward-Current Transfer Ratio	$\|h_{fe}\|$	3306	V_{CE}=20V, I_C=20mA f=100MHz Note 2	2.5	-	–
Output Capacitance	C_{obo}	3236	V_{CB}=10V I_E=0A 100kHz≤ f £1MHz Note 2	-	8	pF
Turn-on Time	t_{on}	-	I_C=150mA I_B=15mA Notes 2, 3	-	35	ns
Turn-off Time	t_{off}	-	I_C=150mA I_B=15mA Notes 2, 4	-	300	ns

NOTES:

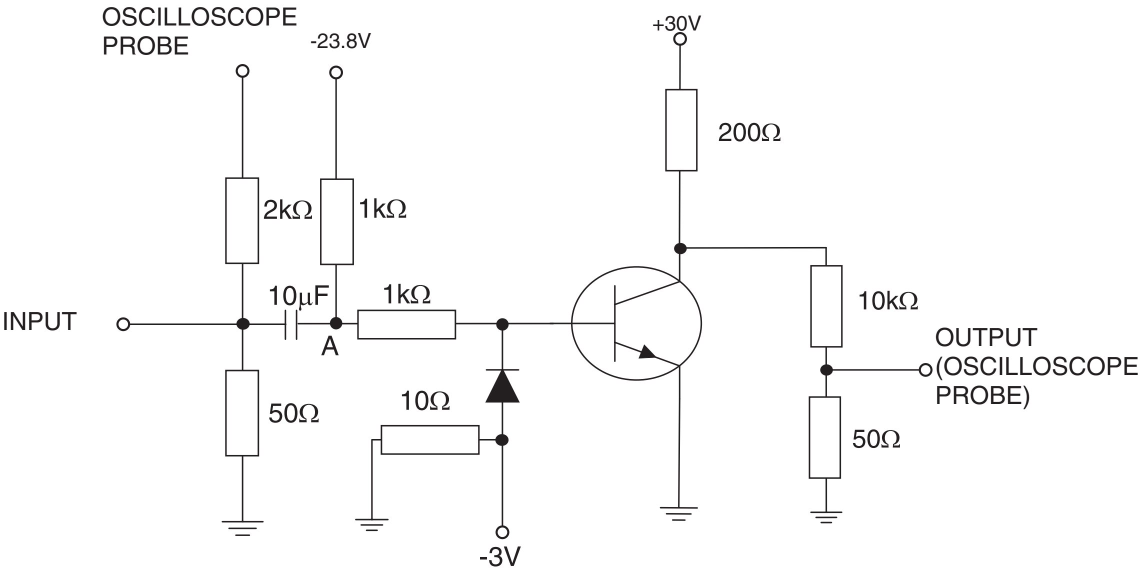
1. Pulse measurement: Pulse Width ≤ 300µs, Duty Cycle ≤ 2%
2. For AC characteristics read and record measurements shall be performed on a sample of 32 components with 0 failures allowed. Alternatively a 100% inspection may be performed.
3. t_{on} shall be measured using the following test circuit. The input waveform shall be supplied by a pulse generator with the following characteristics: Z_{OUT} = 50Ω, $t_r \leq$ 2ns, Pulse Width = 200 ±10ns, Duty Cycle ≤ 2%. The output waveform shall be monitored on an oscilloscope with the following characteristics: $Z_{IN} \geq$ 100kΩ, Input Capacitance ≤ 12pF, $t_r \leq$ 5ns.



VOLTAGE WAVEFORMS

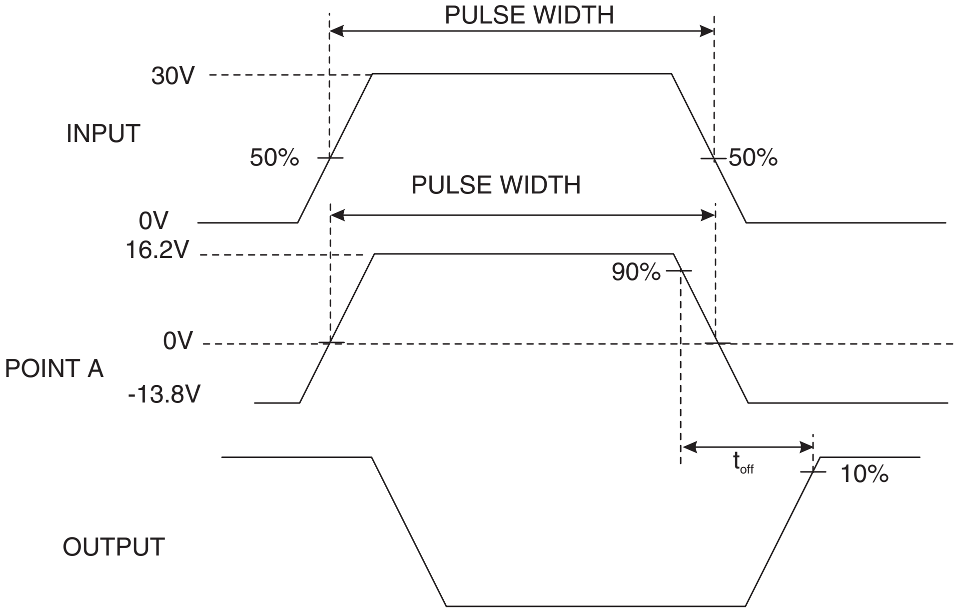


4. t_{off} shall be measured using the following test circuit. The input waveform shall be supplied by a pulse generator with the following characteristics: Z_{OUT} = 50Ω, $t_r \leq$ 2ns, Pulse Width = 10µs, Duty Cycle ≤ 2%. The output waveform shall be monitored on an oscilloscope with the following characteristics: $Z_{IN} \geq$ 100kΩ, Input Capacitance ≤ 12pF, $t_r \leq$ 5ns.



Diode is 1N916 or equivalent

VOLTAGE WAVEFORMS



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}=60V, Bias Condition D	-	10	µA
Forward-Current Transfer Ratio 1	h_{FE1}	3076	T_{amb}=-55(+5-0)˚C V_{CE}=10V I_C=10mA Note 2	35	-	-

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

2.5 PARAMETER DRIFT VALUES

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

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}	±2 or (1) ±100%	-	10	nA
Collector-Emitter Saturation Voltage 1	$V_{CE(sat)1}$	±30 or (1) ±15%	-	300	mV
Forward-Current Transfer Ratio 2	h_{FE2}	±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 ±3oC.

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-Base Cut-off Current	I_{CBO}	-	10	nA
Collector-Emitter Saturation Voltage 1	$V_{CE(sat)1}$	-	300	mV
Forward-Current Transfer Ratio 2	h_{FE2}	100	300	-

2.7 POWER BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+20 to +50	^{o}C
Power Dissipation	P_{tot}	As per Maximum Ratings P_{tot} derated at the chosen T_{amb}	W
Collector-Base Voltage	V_{CB}	10 to 40	V

2.8 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 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.