# DOCUMENT CHANGE REQUEST

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|---|---|---|---|
| DCR number 252 | Changes required for: General | Originator: S JEFFERY |
| Date: 2006/04/04 | Date sent: 2006/04/04 | Organisation: |
| Status: IMPLEMENTED | | |

| | | | |
|---|---|---|---|
| Title: | Transistors Low Power PNP, based on type 2N2907A | | |
| Number: | 5202/001 | Issue: | 1 |

Other documents affected:

Page:

Total re-write

Paragraph:

Total re-write

Original wording:

Proposed wording:

Total reformat of this Detail 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 01, 02, 04 and 05)
SEMELAB/UK (not ESCC qualified but are currently willing to support the procurement of Variants 01 and 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 (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 D7 / Variant 03 from the available range (not supported by STM or Semelab).
5. Figure 1 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 .Physical Dimensions and Terminal Identification. and amended to reflect the TO-18 and CCP packages currently supplied.
8. Para. 4.4.1 Case requirements for Variants 01 and 02 corrected to reflect a TO-18 metal can.
9. Para. 4.4.2 Lead Material and Finish replaced by a reference to the Component Type Variants Para.
10. Delete requirement for marking of the test level letter from ESCC Component number as per latest ESCC No. 21700.
11. Table 2, Characteristic .D.C. Forward Current Transfer Ratio. has been changed to .Forward-Current Transfer Ratio..

# DOCUMENT CHANGE REQUEST

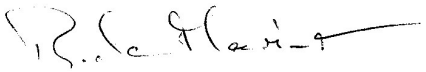
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12. Table 2, Characteristic .A.C. Forward Current Transfer Ratio. has been changed to .Magnitude of Small-Signal Short-Circuit Forward-Current Transfer Ratio., Symbol corrected to |hfe| (was hfe) and MIL-STD-750 Test Method corrected to 3306 (was 3206).
13. Table 2: Replace LTPD7 sampling for AC parameters tests (designated by .Note 2.) with an equivalent fixed sample of 32 components with 0 failures (or 100%).
14. Table 2 and Figure 4: The Switching Times characteristics have been amended to reflect the new format.
15. Table 3, High Temperature Electrical Measurements: Sense of the specified limit corrected to minus (i.e. .10µA). 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.
16. Table 4: Absolute limits have been added for information.
17. Tables 2, 3 and 4 . Test Conditions column: additoion of Test, or Bias, Conditions for referenced MIL-STD-750 Test Methods as and where applicable.
18. Table 5 . Test Conditions for High Temperature Reverse Bias amended: Tamb was +150°C, now +150(+0 .5)°C; Duration was 48(+4 .0) hours, now 48 hours minimum, in line with new Generic 5000 and MIL specifications.
19. Appendix A for STM: Para. 4.2.2 corrected to delete reference to .Para. 9.12. as this inspection is a specific in-process requirement to check die attachment per the STM procedure. The STM procedure is updated from 0011828 to 0076637.
20. Appendix A for STM: Addition of 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 STM within Appendix A which are considered technically acceptable (based on ESCC approved PID for this and other ESCC qualified components manufactured by STM).
5. To update the manufacturer.s current product availability.
6. To make corrections to technical errors in the previous issue.
7. Standardisation of the TO-18 and CCP packages in all applicable ESCC detail specs.

| |
|---|
| Attachments: |
| 5202001_Issue_2_-_Draft_A.pdf, null |
| Modifications: |
| Item 12: Change item 12 wording from “…(was hfe) and MIL-STD-750 Test Method corrected to 3306 (was 3206).” to “…(was hfe), MIL-STD-750 Test Method corrected to 3306 (was 3206) and IC Test Condition amended to be -20mA (was -50mA).” |
| Approval signature: |
|  |
| Date signed: |
| 2006-04-04 |

# TRANSISTORS, LOW POWER, PNP

## BASED ON TYPE 2N2907A

## ESCC Detail Specification No. 5202/001


| | |
|---|---|
| Issue 2 - Draft A | March 2006 |


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 |
|---|---|
| 187, TBD | Specification up issued to incorporate editorial and technical changes per DCR. |

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## 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: 520200101

- Detail Specification Reference: 5202001
- 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 Number | Based on Type | Case | Lead/Terminal Material and/or Finish | Weight max g |
|---|---|---|---|---|
| 01 | 2N2907A | TO-18 | D2 | 0.4 |
| 02 | 2N2907A | TO-18 | D3 or D4 | 0.4 |
| 04 | 2N2907A | CCP | 2 | 0.06 |
| 05 | 2N2907A | CCP | 4 | 0.06 |

The lead/terminal material and/or 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.

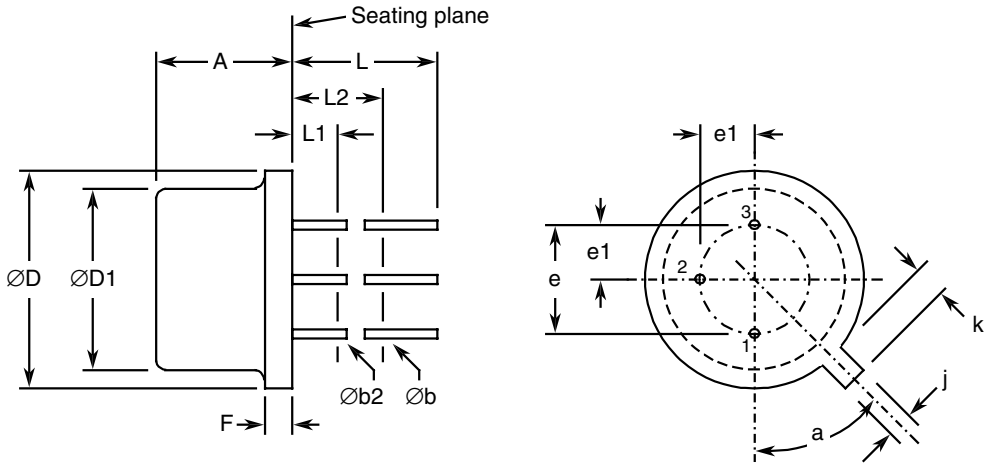
| Characteristics | Symbols | Maximum Ratings | Unit | Remarks |
|---|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | -60 | V | Over entire operating temperature range |
| Collector-Emitter Voltage | $V_{CEO}$ | -60 | V | |
| Emitter-Base Voltage | $V_{EBO}$ | -5 | V | |
| Collector Current<br>For TO-18<br>For CCP | $I_C$ | <br>-600<br>-500 | mA | Continuous |
| Power Dissipation<br>For TO-18 and CCP | $P_{tot1}$ | 0.4 | W | At $T_{amb} \leq +25^oC$<br>Note 1 |
| For CCP | $P_{tot2}$ | 0.73 (Note 2) | W | |
| For TO-18 | $P_{tot3}$ | 1.8 | W | At $T_{case} \leq +25^oC$<br>Note 1 |
| Operating Temperature Range | $T_{op}$ | -65 to +200 | $^oC$ | Note 3 |
| Storage Temperature Range | $T_{stg}$ | -65 to + 200 | $^oC$ | Note 3 |
| Soldering Temperature<br>For TO-18<br>For CCP | $T_{sol}$ | <br>+260<br>+245 | $^oC$ | <br>Note 4<br>Note 5 |

**NOTES:**

1. For $T_{amb}$ or $T_{case} > +25^oC$, derate linearly to 0W at $+200^oC$.
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 $T_{amb} > +125^oC$ 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-18) - 3 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 BSC | | 4 |
| e1 | 1.27 BSC | | 4 |
| F | - | 0.762 | |
| j | 0.914 | 1.17 | |
| k | 0.711 | 1.22 | 5 |
| L | 12.7 | - | 2 |
| L1 | - | 1.27 | 3 |
| L2 | 6.35 | - | 3 |
| a | $45^{o}$ BSC | | 1, 4, 6 |

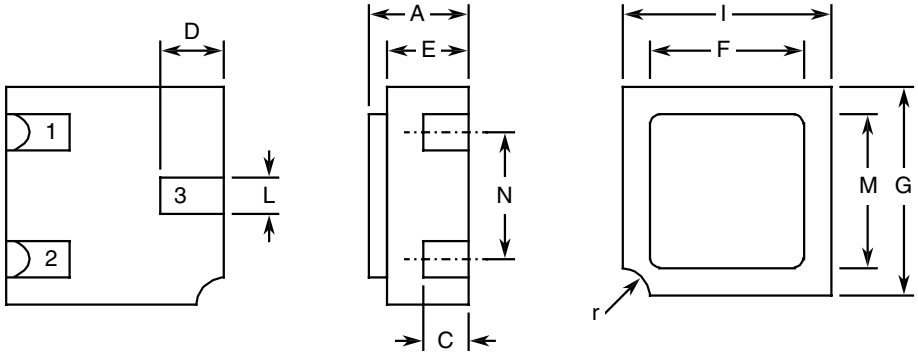
**NOTES:**

1. Terminal identification is specified by reference to the tab position where lead 1 = emitter, lead 2 = base, 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. 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) - 3 terminal

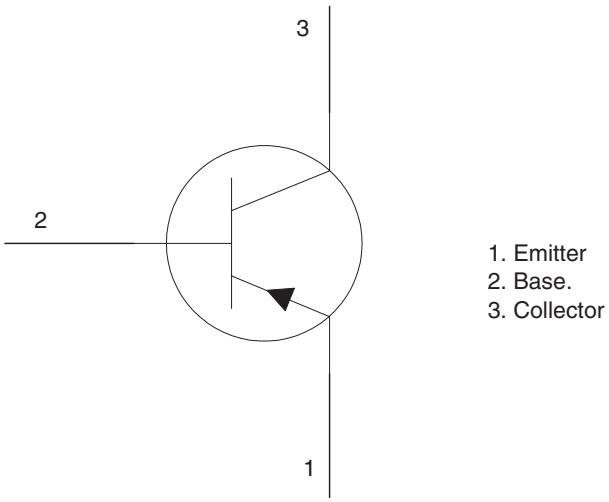



| Symbols | Dimensions mm | | Notes |
|---|---|---|---|
| | Min | Max | |
| A | 1.15 | 1.5 | |
| C | 0.45 | 0.56 | 2 |
| D | 0.6 | 0.91 | 2 |
| E | 0.91 | 1.12 | |
| F | 1.9 | 2.15 | |
| G | 2.9 | 3.25 | |
| I | 2.4 | 2.85 | |
| L | 0.4 | 0.6 | 2 |
| M | 2.4 | 2.65 | |
| N | 1.8 | 2 | |
| r | 0.3 TYPICAL | | 1 |

**NOTES:**

1. Terminal identification is specified by reference to the corner notch position where terminal 1 = emitter, terminal 2 = base, terminal 3 = collector.
2. Applies to all terminals.

1.7 FUNCTIONAL DIAGRAM




**NOTES:**
1. For TO-18, the collector is internally connected to the case.
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) 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:

For TO-18, 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

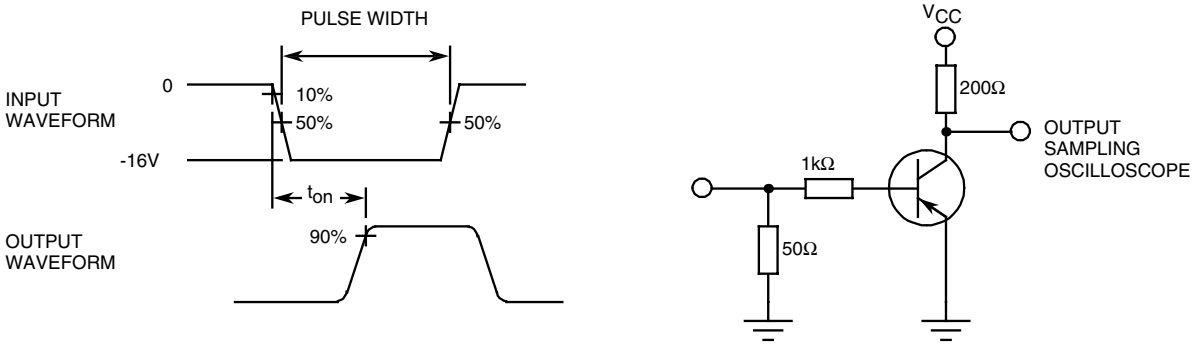
The measurements shall be performed at $T_{amb}$=+22 ±3°C.

| Characteristics | Symbols | MIL-STD-750 Test Method | Test Conditions | Limits | | Units |
|---|---|---|---|---|---|---|
| | | | | Min | Max | |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CEO}$ | 3011 | $I_C$ = -10mA<br>Note 1<br>Bias condition D | -60 | - | V |
| Collector-Base Breakdown Voltage | $V_{(BR)CBO}$ | 3001 | $I_E$ = -10µA<br><br>Bias condition D | -60 | - | V |
| Emitter-Base Breakdown Voltage | $V_{(BR)EBO}$ | 3026 | $I_E$ = -10µA<br>Bias condition D | -5 | - | V |
| Collector-Emitter Cut-off Current | $I_{CEX}$ | 3041 | $V_{CE}$ = -30V<br>$V_{BE}$=500mV<br>Bias condition D | - | -50 | nA |
| Collector-Base Cut-off Current | $I_{CBO}$ | 3036 | $V_{CB}$ = -50V<br>Bias condition D | - | -10 | nA |
| Forward-Current Transfer Ratio | $h_{FE1}$ | 3076 | $V_{CE}$=-10V ; $I_C$ =-100nA | 75 | - | - |
| | $h_{FE2}$ | 3076 | $V_{CE}$=-10V ; $I_C$ =-10mA | 100 | - | - |
| | $h_{FE3}$ | 3076 | $V_{CE}$=-10V ;<br>$I_C$ =-150mA<br>Note 1 | 100 | 300 | - |
| | $h_{FE4}$ | 3076 | $V_{CE}$=-10V ;<br>$I_C$ =-500mA<br>Note 1 | 50 | - | - |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | 3071 | $I_C$=-150mA<br>$I_B$=-15mA<br>Note 1 | - | -400 | mV |
| Base-Emitter Saturation Voltage | $V_{BE(sat)}$ | 3066 | $I_C$=-150mA<br>$I_B$=-15mA<br>Test condition A<br>Note 1 | - | -1.3 | V |
| Magnitude of Small-Signal Short-Circuit Forward-Current Transfer Ratio | $\|h_{fe}\|$ | 3306 | $I_C$=-20mA,<br>$V_{CE}$=-20V<br>f=100MHz<br>Note 2 | 2 | - | - |
| Output Capacitance | $C_{obo}$ | 3236 | $V_{CB}$=-10V,<br>$I_E$=0mA<br>f=100kHz≤f≤1MHz<br>Note 2 | - | 8 | pF |
| Turn-on Time | $t_{on}$ | - | $V_{CC}$=-30V<br>$I_C$=-150mA<br>$I_B$=-15mA<br>Notes 2, 3 | - | 45 | ns |

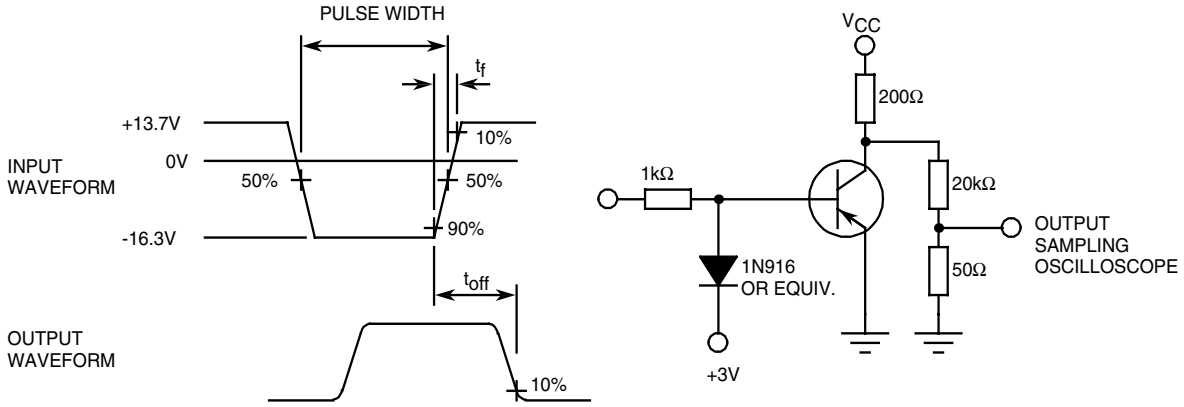
| Characteristics | Symbols | MIL-STD-750 Test Method | Test Conditions | Limits | | Units |
|---|---|---|---|---|---|---|
| | | | | Min | Max | |
| Turn-off Time | $t_{off}$ | - | $V_{CC}$=-30V<br>$I_C$=-150mA<br>$I_B$=-15mA<br>Notes 2, 4 | - | 300 | ns |

**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, $t_r$ ≤ 2ns, Pulse Width = 200 ±10ns, Duty Cycle ≤ 2%. The output waveform shall be monitored on an oscilloscope with the following characteristics: $Z_{IN}$ ≥ 100kΩ, input capacitance ≤ 12pF, $t_r$ ≤ 5ns.




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, $t_f$ ≤ 2ns, Pulse Width = 10 to 100µs, Duty Cycle ≤ 2%. The output waveform shall be monitored on an oscilloscope with the following characteristics: $Z_{IN}$ ≥ 100kΩ, input capacitance ≤ 12pF, $t_r$ ≤ 5ns.



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<br>$V_{CB}$=-50V<br>Bias condition D | - | -10 | µA |

**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 | $I_{CBO}$ | ±2<br>or (1)<br>±100% | - | -10 | nA |
| Forward-Current Transfer Ratio 3 | $h_{FE3}$ | ±15% | 100 | 300 | - |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | ±50<br>or (1)<br>±15% | - | -400 | mV |

**NOTES:**
1. Whichever is the greater referred to 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 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 |
| Forward-Current Transfer Ratio 3 | $h_{FE3}$ | 100 | 300 | - |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | - | -400 | mV |

2.7 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

| Characteristics | Symbols | Test Conditions | Units |
|---|---|---|---|
| Ambient Temperature | $T_{amb}$ | +150 (+0 -5) | $^{o}C$ |
| Collector-Base Voltage | $V_{CB}$ | -50 | V |
| Duration | t | 48 minimum | Hours |

2.8 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 $P_{tot1}$ derated at the chosen $T_{amb}$ | W |
| Collector-Base Voltage | $V_{CB}$ | 40 | 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.<br>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.<br><br>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. |