



## DOCUMENT CHANGE REQUEST

DCR number            154            Changes required for: General  
Date: 2005/03/30            Date sent: 2005/03/30  
Status: IMPLEMENTED

Originator: S Thacker  
Organisation: ESA/ESTEC

Title: Transistors Low Power NPN, based on type 2N2484

Number: 5201/001            Issue: 2

Other documents affected:

Page:

Total re-write

Paragraph:

Total re-write

Original wording:

Proposed wording:

Total reformat of this Detail Specification (the first in the range of various ESCC Detail Specifications for discrete semiconductor components under Generic Specification No.5000) as part of the ongoing conversion to the ESCC format. See below for summary of changes and attached Issue 3 Draft A of the specification.

note: known support for active procurement against this specification includes the following Manufacturers:  
STM/F (ESCC QPL listed with qualified Variants 01, 02, 04, 05)  
SEMELAB/UK (not ESCC qualified but willing to support procurement of Variant 01)

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 Circuit, mechanical paragraph.
3. Para 1.7 High Temperature Test Precautions requirements moved to be a note to the Maximums 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 Requirements moved to be a note to the Maximum Ratings table.
6. Para 4.3.2 Weight requirements moved to Component Type Variants table.



## DOCUMENT CHANGE REQUEST

DCR number 154 Changes required for: General

Date: 2005/03/30

Date sent: 2005/03/30

Originator: S Thacker

Organisation: ESA/ESTEC

Status: IMPLEMENTED

7. Para 4.4.1 Case requirements for Variants 01 & 02 corrected to reflect a TO-18 metal can.
8. Delete requirement for marking of the testing level letter from the ESCC Component Number as per latest ESCC No. 21700.
9. Table 2 symbol "ICBO" corrected to be "IEBO".
10. Table 2 parameter "High Frequency Current Gain 1 & 2": name corrected to be "High Frequency Small Signal Current Gain 1 & 2". Mil-Std-750 Test method corrected to be 3306 (was 3206).
11. Table 2 symbol "hoc" corrected to be "hoe".
12. Table 2 Wide Band noise: symbol amended & Mil-Std-750 Test method 3246 added.
13. Table 2 Spot noise figure: symbols amended (e.g. NF1 (was NFN1)); bandwidth condition for NFN3 (NF3) corrected to be "f + or - 10%" (was 2Hz).
14. Table 2: Replace LTPD7 sample for AC parameters tests (designated by "Note 2") by an equivalent fixed sample of 32 components with 0 failures (or 100%).
15. Table 3 (High & Low Temp Electrical's): change 100% inspection to be a sample of 5 components with 0 failures (or 100%) (in line with new generic 5000 issue 2 draft F).
16. Table 4: Absolute limits from table 2 have been added for information.
17. 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. STM Procedure number corrected to be 0076637 (was 0011828)
18. 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:

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 154 Changes required for: General

Date: 2005/03/30

Date sent: 2005/03/30

Originator: S Thacker

Organisation: ESA/ESTEC

Status: IMPLEMENTED

3. To make the content consistent with the proposed ESCC format Generic Specification No.5000 issue 2 draft F (currently under review with ESCC).

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:

5201001.pdf, null

Modifications:

N/A

Approval signature:

Date signed:

2005-03-30



Pages 1 to 15

## **TRANSISTORS, LOW POWER, NPN**

**BASED ON TYPE 2N2484**

**ESCC Detail Specification No. 5201/001**

Issue 3 - Draft A	January 2005
-------------------	--------------



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

**LEGAL DISCLAIMER AND COPYRIGHT**

European Space Agency, Copyright © 2005. All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without the prior permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

- copied in whole, in any medium, without alteration or modification.
- copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.

**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**

<b>1.</b>	<b><u>GENERAL</u></b>	<b>5</b>
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	7
1.6.1	Metal Can Package (TO-18) - 3 lead	7
1.6.2	Chip Carrier Package (CCP) - 3 terminal	8
1.7	Functional Diagram	9
1.8	Materials and Finishes	9
<b>2.</b>	<b><u>REQUIREMENTS</u></b>	<b>9</b>
2.1	General	9
2.1.1	Deviations from the Generic Specification	9
2.2	Marking	9
2.3	Terminal Strength	10
2.4	Electrical Measurements at Room, High and Low Temperatures	10
2.4.1	Room Temperature Electrical Measurements	10
2.4.2	High and Low Temperatures Electrical Measurements	12
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: 520100101

- Detail Specification Reference: 5201001
- 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	2N2484	TO-18	D2	0.4
02	2N2484	TO-18	D3 or D4	0.4
04	2N2484	CCP	2	0.06
05	2N2484	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.

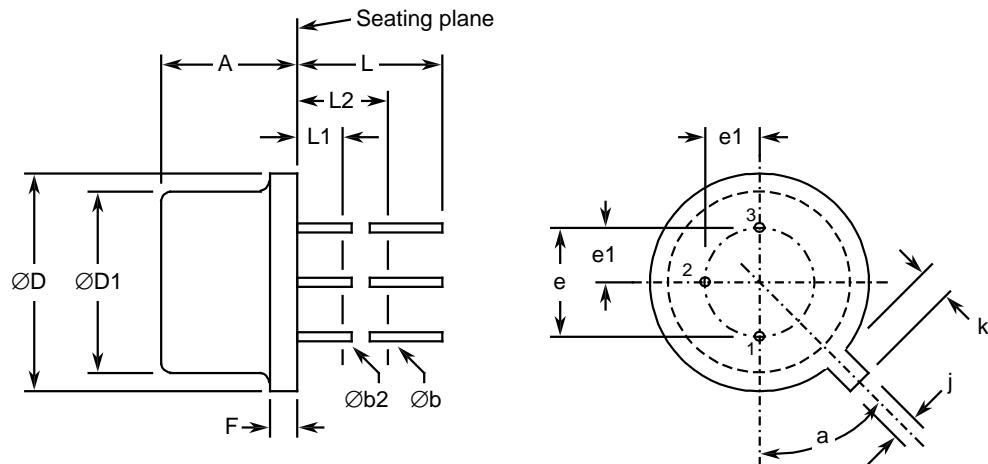
Characteristics	Symbols	Maximum Ratings	Unit	Remarks
Collector-Base Voltage	$V_{CBO}$	60	V	Over entire operating temperature range
Collector-Emitter Voltage	$V_{CEO}$	60	V	
Emitter-Base Voltage	$V_{EBO}$	6	V	
Collector Current (Continuous)	$I_C$	50	mA	-
Power Dissipation For TO-18 and CCP For CCP For TO-18	$P_{tot1}$	0.36	W	At $T_{amb} \leq +25^\circ C$ Note 1
	$P_{tot2}$	0.73 (Note 2)	W	
	$P_{tot3}$	1.2	W	At $T_{case} \leq +25^\circ C$ Note 1
Operating Temperature Range	$T_{op}$	-65 to +200	$^\circ C$	Note 3
Storage Temperature Range	$T_{stg}$	-65 to + 200	$^\circ C$	Note 3
Soldering Temperature For TO-18 For CCP	$T_{sol}$	+260	$^\circ C$	Note 4
		+245		Note 5

**NOTES:**

- For  $T_{amb}$  or  $T_{case} > +25^\circ C$ , derate linearly to 0W at  $+200^\circ C$ .
- When mounted on a 15 x 15 x 0.6mm ceramic substrate.
- 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.
- 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.
- 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



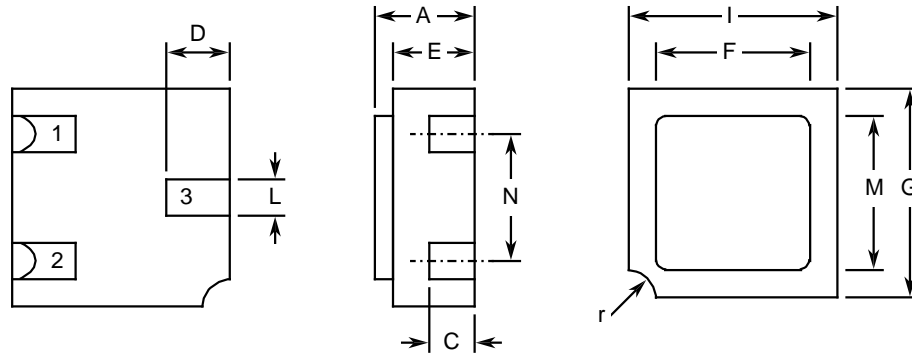
Symbols	Dimensions mm		Notes
	Min	Max	
A	4.32	5.33	
$\varnothing b$	0.406	0.533	1
$\varnothing b2$	0.406	0.483	1
$\varnothing D$	5.31	5.84	
$\varnothing D1$	4.52	4.95	
e	2.54 TYPICAL		2
e1	1.27 TYPICAL		2
F	-	0.762	
j	0.914	1.17	
k	0.711	1.22	3
L	12.7	-	1
L1	-	1.27	1
L2	6.35	-	1
a	45° TYPICAL		4

**NOTES:**

1. (Three leads)  $\varnothing b2$  applies between L1 and L2.  $\varnothing b$  applies between L2 and 12.7mm from the seating plane. Diameter is uncontrolled within L1 and beyond 12.7mm from the seating plane.
2. 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.
- 3. Measured from the maximum diameter of the actual device.
- 4. Tab centreline.

1.6.2 Chip Carrier Package (CCP) - 3 terminal

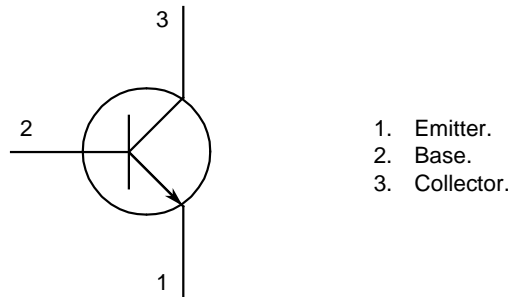


Symbols	Dimensions mm		Notes
	Min	Max	
A	1.15	1.5	
C	0.45	0.56	1
D	0.6	0.91	1
E	0.91	1.12	
F	1.9	2.15	
G	2.9	3.25	
I	2.4	2.85	
L	0.4	0.6	1
M	2.4	2.65	
N	1.8	2	
r	0.3 TYPICAL		

**NOTES:**

- 1. The three terminals have the same dimensions.

## 1.7 FUNCTIONAL DIAGRAM



### **NOTES:**

1. For TO-18, the collector is internally connected to the case.

## 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

- (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) Terminal identification.
- (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-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  $T_{amb}=+22 \pm 3^{\circ}\text{C}$ .

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	3001	$I_C = 10\mu A$	60	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011	$I_C = 10mA$ Note 1	60	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026	$I_E = 10\mu A$	6	-	V
Collector-Base Cut-off Current	$I_{CBO}$	3036	$V_{CB} = 45V$	-	10	nA
Emitter-Base Cut-off Current	$I_{EBO}$	3061	$V_{EB} = 5V$	-	10	nA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	3071	$I_C=1mA$ $I_B=0.1mA$ Note 1	-	350	mV
Forward Current Transfer Ratio	$h_{FE1}$	3076	$V_{CE}=5V ; I_C = 1\mu A$	30	-	-
	$h_{FE2}$	3076	$V_{CE}=5V ; I_C = 10\mu A$	100	500	-
	$h_{FE3}$	3076	$V_{CE}=5V ; I_C = 100\mu A$	175	550	-
	$h_{FE4}$	3076	$V_{CE}=5V ; I_C = 1mA$	250	650	-
	$h_{FE5}$	3076	$V_{CE}=5V ; I_C = 10mA$ Note 1	-	800	-
High Frequency Small Signal Current Gain	$h_{fe1}$	3306	$V_{CE}=5V,$ $I_C=50\mu A$ $f=5MHz$ Note 2	3	-	-
	$h_{fe2}$	3306	$V_{CE}=5V,$ $I_C=500\mu A$ $f=30MHz$ Note 2	2	-	-
Small Signal Current Gain	$h_{fe3}$	3206	$V_{CE}=5V,$ $I_C=1mA$ $f=1kHz$ Note 2	150	900	-
Output Capacitance	$C_{obo}$	3236	$V_{CB}=5V,$ $I_E=0A$ $f=1MHz$ Note 2	-	6	pF
Input Capacitance	$C_{ibo}$	3240	$V_{EB}=500mV$ $I_C=0A$ $f=1MHz$ Note 2	-	6	pF

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Small Signal Input Impedance	$h_{ie}$	3201	$V_{CE}=5V$ , $I_C=1mA$ $f=1kHz$ Note 2	3.5	24	$k\Omega$
Small Signal Output Admittance	$h_{oe}$	3216	$V_{CE}=5V$ , $I_C=1mA$ $f=1kHz$ Note 2	-	40	$\mu mho$
Small Signal Reverse Voltage Transfer Ratio	$h_{re}$	3211	$V_{CE}=5V$ , $I_C=1mA$ $f=1kHz$ Note 2	-	$8 \times 10^{-4}$	-
Wide-Band Noise Figure	$NF_W$	3246	$f=10Hz$ to $10kHz$ $V_{CE}=5V$ , $I_C=10\mu A$ $R_S=10k\Omega$ Note 2	-	3	dB
Spot Noise Figure	NF1 NF2 NF3	3246	$V_{CE}=5V$ , $I_C=10\mu A$ $R_S=10k\Omega$ $BW=f \pm 10\%$ $f=100Hz$ $f=1kHz$ $f=10kHz$ Note 2	- - -	10 3 2	dB

**NOTES:**

1. Pulse measurement: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 1\%$
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-883 Test Method	Test Conditions Note 1	Limits		Units
				Min	Max	
Collector-Base Cut-off Current	$I_{CBO}$	3036	$T_{amb}=+150(+0-5)^{\circ}C$ $V_{CB}=45V$	-	10	$\mu A$
Forward Current Transfer Ratio 2	$h_{FE2}$	3076	$T_{amb}=-55(+5-0)^{\circ}C$ $V_{CE}=5V$ $I_C=10\mu A$	20	-	-

**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  $T_{amb}=+22 \pm 3^{\circ}C$ .

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

The drift values ( $\Delta$ ) 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 $\Delta$	Absolute		
			Min	Max	
Collector-Base Cut-off Current	$I_{CBO}$	$\pm 5$ or (1) $\pm 100\%$	-	10	nA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	$\pm 30$ or (1) $\pm 15\%$	-	350	mV
Forward Current Transfer Ratio 4	$h_{FE4}$	$\pm 15\%$	250	650	-

**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  $T_{amb}=+22 \pm 3^{\circ}C$ .

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
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	-	350	mV
Forward Current Transfer Ratio 4	$h_{FE4}$	250	650	-



## 2.7 POWER BURN-IN CONDITIONS

Characteristics	Symbols	Limits	Units
Ambient Temperature	$T_{amb}$	+20 to +50	$^{\circ}\text{C}$
Power Dissipation	$P_{tot}$	As per Maximum Ratings $P_{tot}$ derated at the chosen $T_{amb}$	W
Collector-Base Voltage	$V_{CB}$	27	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 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.  Characteristics $h_{fe1}$ , and $C_{ibo}$ , shall be as follows: <table border="1" data-bbox="549 974 1461 1328"> <thead> <tr> <th data-bbox="549 974 740 1086" rowspan="2">Characteristics</th> <th data-bbox="740 974 879 1086" rowspan="2">Symbols</th> <th data-bbox="879 974 1051 1086" rowspan="2">MIL-STD-750 Test Method</th> <th data-bbox="1051 974 1203 1086" rowspan="2">Test Conditions</th> <th colspan="2" data-bbox="1203 974 1382 1008">Limits</th> <th data-bbox="1382 974 1461 1086" rowspan="2">Units</th> </tr> <tr> <th data-bbox="1203 1008 1294 1086">Min.</th> <th data-bbox="1294 1008 1382 1086">Max.</th> </tr> </thead> <tbody> <tr> <td data-bbox="549 1086 740 1209">High Frequency Small Signal Current Gain 1</td> <td data-bbox="740 1086 879 1209"><math>h_{fe1}</math></td> <td data-bbox="879 1086 1051 1209">3306</td> <td data-bbox="1051 1086 1203 1209"><math>V_{CE}=5V</math> <math>I_C=50\mu A</math> <math>f=5MHz</math> Note 2</td> <td data-bbox="1203 1086 1294 1209">1</td> <td data-bbox="1294 1086 1382 1209">-</td> <td data-bbox="1382 1086 1461 1209">-</td> </tr> <tr> <td data-bbox="549 1209 740 1328">Input Capacitance</td> <td data-bbox="740 1209 879 1328"><math>C_{ibo}</math></td> <td data-bbox="879 1209 1051 1328">3240</td> <td data-bbox="1051 1209 1203 1328"><math>V_{EB}=500mV</math> <math>I_C=0A</math> <math>f=1MHz</math> Note 2</td> <td data-bbox="1203 1209 1294 1328">-</td> <td data-bbox="1294 1209 1382 1328">15</td> <td data-bbox="1382 1209 1461 1328">pF</td> </tr> </tbody> </table>						Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units	Min.	Max.	High Frequency Small Signal Current Gain 1	$h_{fe1}$	3306	$V_{CE}=5V$ $I_C=50\mu A$ $f=5MHz$ Note 2	1	-	-	Input Capacitance	$C_{ibo}$	3240	$V_{EB}=500mV$ $I_C=0A$ $f=1MHz$ Note 2	-	15	pF
Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units																							
				Min.	Max.																								
High Frequency Small Signal Current Gain 1	$h_{fe1}$	3306	$V_{CE}=5V$ $I_C=50\mu A$ $f=5MHz$ Note 2	1	-	-																							
Input Capacitance	$C_{ibo}$	3240	$V_{EB}=500mV$ $I_C=0A$ $f=1MHz$ Note 2	-	15	pF																							