



TRANSISTORS, LOW POWER, NPN

BASED ON TYPE 2ST15300

ESCC Detail Specification No. 5201/020

Issue 4	October 2023
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DOCUMENTATION CHANGE NOTICE

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

DCR No.	CHANGE DESCRIPTION
1592	Specification updated to incorporate 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
- (c) [MIL-STD-883](#), Test Methods and Procedures for Micro-electronics.

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: 520102001

- Detail Specification Reference: 5201020
- Component Type Variant Number: 01 (as required)
- Total Dose Radiation Level Letter: R (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	Terminal Material and Finish	Weight max g	Total Dose Radiation Level Letter
01	2ST15300	SMD.5	Q14	2	R [100krad(Si)]
02	2ST15300	SMD.5	Q4	2	R [100krad(Si)]

The terminal material and finish shall be in accordance with the requirements of ESCC Basic Specification No. [23500](#).

Total dose radiation level letters are defined in ESCC Basic Specification No. [22900](#). If an alternative radiation test level is specified in the Purchase Order, the letter shall be changed accordingly.

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.

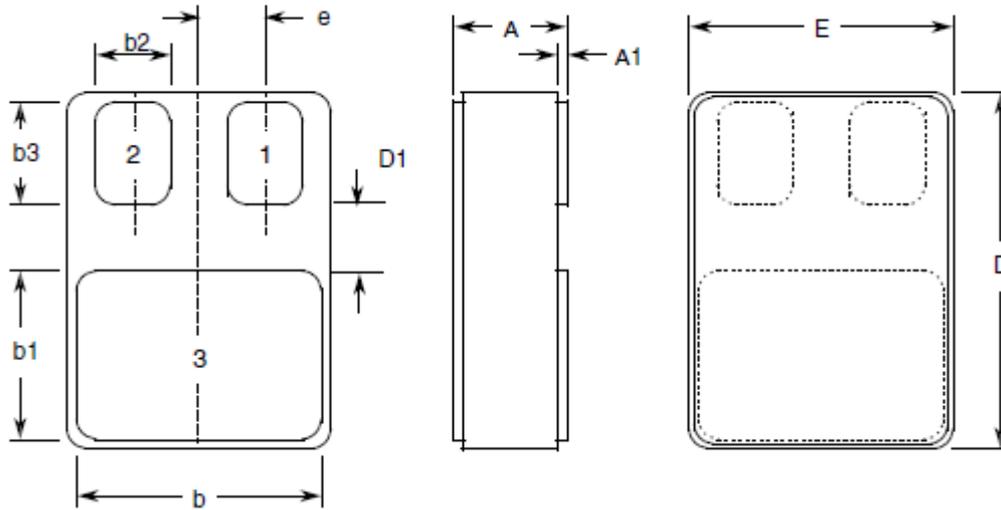
Characteristics	Symbols	Maximum Ratings	Units	Remarks
Collector-Base Voltage	V_{CBO}	300	V	Over entire operating temperature range
Collector-Emitter Voltage	V_{CEO}	100	V	
Emitter-Base Voltage	V_{EBO}	6	V	
Collector Current	I_C	5	A	Continuous
Power Dissipation	P_{tot1}	2.2	W	At $T_{amb} \leq +25^{\circ}C$ Note 1
	P_{tot2}	40		At $T_{case} \leq +25^{\circ}C$ Note 1
Thermal Resistance, Junction-to-Ambient	$R_{th(j-a)}$	80	$^{\circ}C/W$	
Thermal Resistance, Junction-to-Case	$R_{th(j-c)}$	4.38	$^{\circ}C/W$	
Junction Temperature	T_j	+200	$^{\circ}C$	
Operating Temperature Range	T_{op}	-65 to +200	$^{\circ}C$	
Storage Temperature Range	T_{stg}	-65 to +200	$^{\circ}C$	
Soldering Temperature	T_{sol}	+245	$^{\circ}C$	Note 2

NOTES:

- For T_{amb} or $T_{case} > +25^{\circ}C$, derate linearly to 0W at +200 $^{\circ}C$.
- 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 Surface Mount Package (SMD.5) - 3 terminal

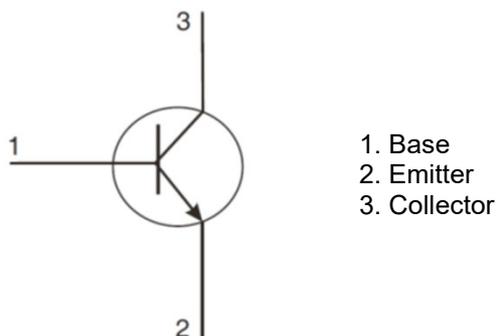


Symbols	Dimensions mm		Remarks
	Min	Max	
A	2.84	3.15	
A1	0.25	0.51	
b	7.13	7.39	
b1	5.58	5.84	
b2	2.28	2.54	2 places
b3	2.92	3.18	2 places
D	10.03	10.28	
D1	0.76	-	2 places
E	7.39	7.64	
e	1.91 BSC		2 places

NOTES:

- Terminal identification is specified by the components geometry where Terminal 1 = base, Terminal 2 = emitter and Terminal 3 = collector.

1.7 FUNCTIONAL DIAGRAM



NOTES:

- The lid is not connected to any terminal.

1.8 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

- (a) Case
The case shall be hermetically sealed and have a ceramic body with a Kovar lid.
- (b) Terminals
As specified in Para. 1.4.2 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 or its primary package shall be:

- (a) The ESCC qualified components symbol (for ESCC qualified components only).
- (b) The ESCC Component Number (see Para. 1.4.1).
- (c) Traceability information.

2.3 TERMINAL STRENGTH

The test conditions for terminal strength, tested as specified in the ESCC Generic Specification, shall be in accordance with [MIL-STD-883, Test Method 2004](#), Test Condition D.

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

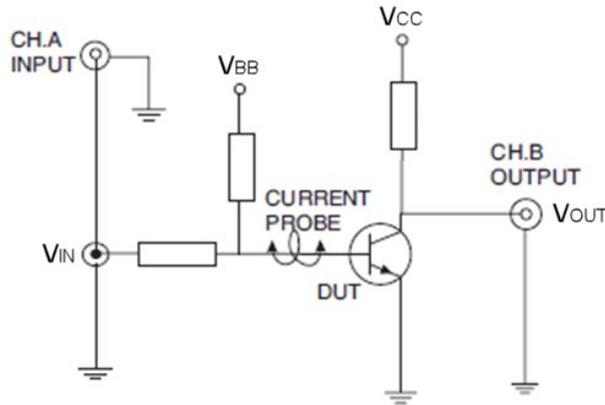
The measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011	$I_C = 10\text{mA}$ Bias condition D Note 1	100	-	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	3001	$I_C = 10\text{mA}$ Bias condition D	300	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026	$I_E = 10\mu\text{A}$ Bias condition D	6	-	V
Collector-Base Cut-off Current	I_{CBO}	3036	$V_{CB} = 300\text{V}$ Bias condition D	-	10	μA
Emitter-Base Cut-off Current	I_{EBO}	3061	$V_{EB} = 6\text{V}$ Bias condition D	-	50	μA
Forward-Current Transfer Ratio	h_{FE1}	3076	$V_{CE} = 0.6\text{V}; I_C = 50\text{mA}$	50	-	-
	h_{FE2}		$V_{CE} = 0.6\text{V}; I_C = 250\text{mA}$	55	-	-
	h_{FE3}		$V_{CE} = 5\text{V}; I_C = 1\text{A}$	55	-	-
	h_{FE4}		$V_{CE} = 5\text{V}; I_C = 5\text{A}$	35	-	-
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	3071	$I_C = 5\text{A}, I_B = 1\text{A}$ Note 1	-	0.7	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	3066	$I_C = 5\text{A}, I_B = 1\text{A}$ Test condition A Note 1	-	1.4	V
Output Capacitance	C_{obo}	3236	$V_{CB} = 10\text{V}, I_E = 0\text{A}$ $f = 1\text{MHz}$ Note 2	-	120	pF
Turn-on Time	t_{on}	-	$V_{CC} = 30\text{V}, V_{BB} = -8\text{V}$ $I_C = 3\text{A}$	-	0.4	μs
Turn-off Time	t_{off}	-	$I_{B1} = I_{B2} = 300\text{mA}$ Notes 2, 3	-	3.5	μs

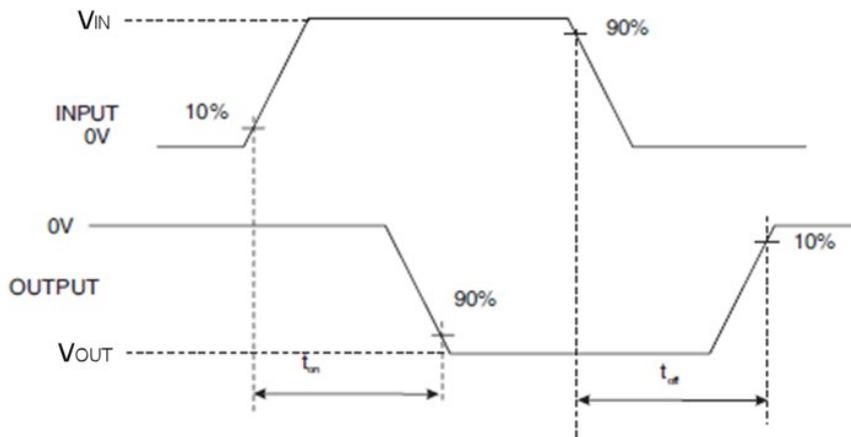
NOTES:

1. Pulse measurement: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.
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} and t_{off} shall be measured as follows:



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	$T_{amb} = +150 (+0 -5)^{\circ}C$ $V_{CB} = 300V$ Bias condition D	-	100	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 $T_{amb} = +22 \pm 3^{\circ}C$.

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.4.1 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}	± 100 or (1) $\pm 100\%$	-	10	μA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$\pm 30mV$ or (1) $\pm 15\%$	-	0.7	V
Forward-Current Transfer Ratio 2	h_{FE2}	$\pm 15\%$	55	-	-

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

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.4.1 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	μA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	-	0.7	V
Forward-Current Transfer Ratio 2	h_{FE2}	55	-	-

2.7 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+150 (+0 -5)	$^{\circ}\text{C}$
Collector-Base Voltage	V_{CB}	100	V
Duration	t	48 minimum	Hours

2.8 POWER BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+20 to +50	$^{\circ}\text{C}$
Power Dissipation	P_{tot}	As per Para. 1.5 Maximum Ratings. Derate P_{tot1} at the chosen T_{amb} using the specified $R_{th(j-a)}$.	W
Collector-Base Voltage	V_{CB}	20 to 50	V

2.9 OPERATING LIFE CONDITIONS

The conditions shall be as specified in Para. 2.8 Power Burn-in Conditions.

2.10 TOTAL DOSE RADIATION TESTING

All lots shall be irradiated in accordance with ESCC Basic Specification No. [22900](#), low dose rate (window 2: 36 to 360 rad(Si)/hour).

2.10.1 Bias Conditions and Total Dose Level for Total dose Radiation Testing

The following bias conditions shall be used for Total Dose Radiation Testing:

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T _{amb}	+20 ±5	°C
Bias Condition 1: Collector-Base Voltage	V _{CBS}	≥ 80% V _{(BR)CBO}	V
Bias Condition 2: Collector-Emitter Voltage	V _{CES}	0	V

The total dose level applied shall be as specified in Para. 1.4.2 or in the Purchase Order.

2.10.2 Electrical Measurements for Radiation Testing

Prior to irradiation testing, the devices shall have successfully met Para. 2.4.1 Room Temperature Electrical Measurements.

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

Unless otherwise specified, the test methods and test conditions shall be as per the corresponding test defined in Para. 2.4.1 Room Temperature Electrical Measurements.

The parameters to be measured during and on completion of irradiation testing are shown below.

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Emitter Breakdown Voltage	V _{(BR)CEO}	See Para. 2.4.1	See Para. 2.4.1	100	-	V
Collector-Base Breakdown Voltage	V _{(BR)CBO}	See Para. 2.4.1	See Para. 2.4.1	240	-	V
Emitter-Base Breakdown Voltage	V _{(BR)EBO}	See Para. 2.4.1	See Para. 2.4.1	6	-	V
Collector-Base Cut-off Current	I _{CBO}	See Para. 2.4.1	See Para. 2.4.1 except V _{CB} = 240V	-	10	µA
Emitter-Base Cut-off Current	I _{EBO}	See Para. 2.4.1	See Para. 2.4.1	-	50	µA
Forward-Current Transfer Ratio (post irradiation gain calculation) (Note 1)	[h _{FE1}]	3076	V _{CE} = 0.6V; I _C = 50mA	[25]	-	-
	[h _{FE2}]		V _{CE} = 0.6V; I _C = 250mA	[27.5]	-	-
	[h _{FE3}]		V _{CE} = 5V; I _C = 1A	[27.5]	-	-
	[h _{FE4}]		V _{CE} = 5V; I _C = 5A	[17.5]	-	-
Collector-Emitter Saturation Voltage	V _{CE(sat)}	See Para. 2.4.1	See Para. 2.4.1	-	0.7	V
Base-Emitter Saturation Voltage	V _{BE(sat)}	See Para. 2.4.1	See Para. 2.4.1	-	1.4	V

NOTES:

- The post-irradiation gain calculation of [h_{FE}], made using h_{FE} measurements from prior to and on completion of irradiation testing and after each annealing step if any, shall be as specified in [MIL-STD-750 Method 1019](#).

Appendix A

AGREED DEVIATIONS FOR STMICROELECTRONICS (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS																				
Para. 2.1.1, Deviations from the Generic Specification: Para. 8, Test Methods and Procedures	For qualification and qualification maintenance, or procurement of qualified or unqualified components, the following replacement test method specifications shall be used instead of the following ESCC Basic Specifications: <ul style="list-style-type: none"> No. 20400, Internal Visual Inspection: replaced by MIL-STD-750 Test Method 2072. No. 20500, External Visual Inspection: replaced by MIL-STD-750 Test Method 2071. No. 20900, Radiographic Inspection of Electronic Components: replaced by MIL-STD-750 Test Method 2076. 																				
Para. 2.1.1, Deviations from the Generic Specification: Deviations from Screening Tests - Chart F3	Solderability is not applicable unless specifically stipulated in the Purchase Order.																				
Para. 2.4.1, Room Temperature Electrical Measurements	All AC characteristics (see Para. 2.4.1 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.																				
Para. 2.4.2, 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.																				
Para. 2.10, Total Dose Radiation Testing Para. 2.10.2, Electrical Measurements for Radiation Testing	In addition to the minimum 3 exposures required by ESCC No. 22900 (see deviation below), an exposure at 30krad(Si) shall also be performed. The parameters to be measured after exposure at 30krad(Si) shall be as specified in Para. 2.10.2 except as follows: <table border="1" data-bbox="464 1480 1442 1760"> <thead> <tr> <th rowspan="2">Characteristics</th> <th rowspan="2">Symbols</th> <th rowspan="2">MIL-STD-750 Test Method and Conditions</th> <th colspan="2">Limits</th> <th rowspan="2">Units</th> </tr> <tr> <th>Min</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>Collector-Base Breakdown Voltage</td> <td>$V_{(BR)CBO}$</td> <td>See Para. 2.4.1</td> <td>270</td> <td>-</td> <td>V</td> </tr> <tr> <td>Collector-Base Cut-off Current</td> <td>I_{CBO}</td> <td>See Para. 2.4.1 except $V_{CB} = 270V$</td> <td>-</td> <td>10</td> <td>μA</td> </tr> </tbody> </table>	Characteristics	Symbols	MIL-STD-750 Test Method and Conditions	Limits		Units	Min	Max	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	See Para. 2.4.1	270	-	V	Collector-Base Cut-off Current	I_{CBO}	See Para. 2.4.1 except $V_{CB} = 270V$	-	10	μA
Characteristics	Symbols				MIL-STD-750 Test Method and Conditions	Limits		Units													
		Min	Max																		
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	See Para. 2.4.1	270	-	V																
Collector-Base Cut-off Current	I_{CBO}	See Para. 2.4.1 except $V_{CB} = 270V$	-	10	μA																

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS																																		
<p>ESCC Basic Specification No. 22900</p> <p>Para. 2.10, Total Dose Radiation Testing</p> <p>Para. 2.10.2, Electrical Measurements for Radiation Testing</p>	<p>ESCC No. 22900 Para. 4.2(b): Amend the required 3 minimum exposure levels for all Variants tested to the ESCC radiation hardness assurance, RHA, qualification level 100krad(Si) = letter R, to be as follows:</p> <table border="1" data-bbox="464 443 1441 568"> <thead> <tr> <th rowspan="2">Letter</th> <th colspan="2">RHA Level (TID)</th> <th colspan="2">Corresponding Exposure Levels</th> </tr> <tr> <th>rad(Si)</th> <th>Gy(Si)</th> <th>rad(Si)</th> <th>Gy(Si)</th> </tr> </thead> <tbody> <tr> <td>R</td> <td>100k</td> <td>1000</td> <td>25k (Note 1) / 50k / 100k</td> <td>250 (Note 1) / 500 / 1000</td> </tr> </tbody> </table> <p>NOTES:</p> <p>1. The parameters to be measured after exposure at 25krad(Si) / 250Gy(Si) shall be as specified in Para. 2.10.2 except as follows:</p> <table border="1" data-bbox="464 707 1441 987"> <thead> <tr> <th rowspan="2">Characteristics</th> <th rowspan="2">Symbols</th> <th rowspan="2">MIL-STD-750 Test Method and Conditions</th> <th colspan="2">Limits</th> <th rowspan="2">Units</th> </tr> <tr> <th>Min</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>Collector-Base Breakdown Voltage</td> <td>$V_{(BR)CBO}$</td> <td>See Para. 2.4.1</td> <td>270</td> <td>-</td> <td>V</td> </tr> <tr> <td>Collector-Base Cut-off Current</td> <td>I_{CBO}</td> <td>See Para. 2.4.1 except $V_{CB} = 270V$</td> <td>-</td> <td>10</td> <td>μA</td> </tr> </tbody> </table>	Letter	RHA Level (TID)		Corresponding Exposure Levels		rad(Si)	Gy(Si)	rad(Si)	Gy(Si)	R	100k	1000	25k (Note 1) / 50k / 100k	250 (Note 1) / 500 / 1000	Characteristics	Symbols	MIL-STD-750 Test Method and Conditions	Limits		Units	Min	Max	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	See Para. 2.4.1	270	-	V	Collector-Base Cut-off Current	I_{CBO}	See Para. 2.4.1 except $V_{CB} = 270V$	-	10	μA
Letter	RHA Level (TID)		Corresponding Exposure Levels																																
	rad(Si)	Gy(Si)	rad(Si)	Gy(Si)																															
R	100k	1000	25k (Note 1) / 50k / 100k	250 (Note 1) / 500 / 1000																															
Characteristics	Symbols	MIL-STD-750 Test Method and Conditions	Limits		Units																														
			Min	Max																															
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	See Para. 2.4.1	270	-	V																														
Collector-Base Cut-off Current	I_{CBO}	See Para. 2.4.1 except $V_{CB} = 270V$	-	10	μA																														