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**TRANSISTORS, MICROWAVE, SMALL SIGNAL, SILICON,  
BIPOLAR**

**BASED ON TYPE BFY640**

**ESCC Detail Specification No. 5611/009**

Issue 1	September 2012
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Document Custodian: European Space Agency - see <https://escies.org>

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## 1. GENERAL

### 1.1 SCOPE

This specification details the ratings, physical and electrical characteristics and test and inspection data for Transistors, Microwave, Small Signal, Silicon, Bipolar based on Type BFY640. It shall be read in conjunction with ESCC Generic Specification No. 5010, the requirements of which are supplemented herein.

### 1.2 COMPONENT TYPE VARIANTS

The variants of the basic type components specified herein, which are also covered by this specification are given in Table 1(a).

### 1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the components specified herein, are scheduled in Table 1(b).

### 1.4 PARAMETER DERATING INFORMATION (FIGURE 1)

The derating information applicable to the components specified herein is shown in Figure 1.

### 1.5 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

The physical dimensions and terminal identification of the components specified herein are shown in Figure 2.

### 1.6 FUNCTIONAL DIAGRAM

The functional diagram, showing lead identification, for the components specified herein is shown in Figure 3.

### 1.7 HANDLING PRECAUTIONS

These devices are susceptible to damage by electrostatic discharge. Therefore suitable precautions shall be employed for protection during all phases of manufacture, test, packaging, shipping and handling.

These components are categorised as Class 1 per ESCC Basic Specification No. 23800 with a minimum Critical Path Failure Voltage of 100V.

## 2. APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

- (a) ESCC Generic Specification No. 5010 for Discrete Microwave Semiconductor Components.
- (b) MIL-STD-750, Test Methods for Semiconductor Devices.

## 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.

**TABLE 1(a) - TYPE VARIANTS**

Variant Number	Based on Type	Case (Note 1)	Noise Figure f=1.8GHz NF <sub>1.8</sub> (dB)	Noise Figure f=6GHz NF <sub>6</sub> (dB)
01	BFY640-01	Micro-X	≤1	-
02	BFY640-03	Micro-X	≤1	≤1.6
03	BFY640-04	Micro-X	≤0.8	≤1.4

**NOTES:**

1. See Figure 2.

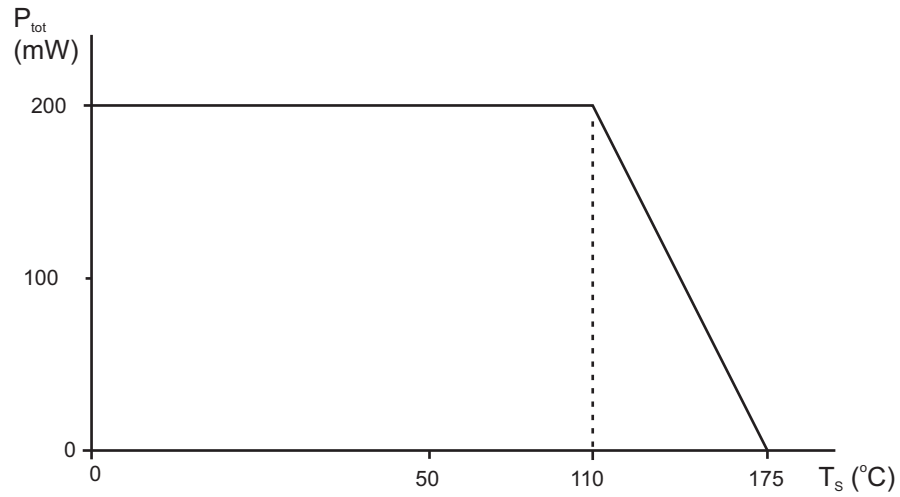
**TABLE 1(b) - MAXIMUM RATINGS**

Characteristics	Symbols	Maximum Ratings	Units	Remarks
Collector-Emitter Voltage T <sub>amb</sub> > 0°C T <sub>amb</sub> ≤ 0°C	V <sub>CEO</sub>	4 3.7	V	
Collector-Emitter Voltage	V <sub>CES</sub>	13	V	
Collector-Base Voltage	V <sub>CBO</sub>	13	V	
Emitter-Base Voltage	V <sub>EBO</sub>	1.2	V	
Collector Current	I <sub>C</sub>	50	mA	
Base Current	I <sub>B</sub>	3	mA	Note 1
Power Dissipation	P <sub>tot</sub>	200	mW	Note 2
Operating Temperature Range	T <sub>op</sub>	-65 to +175	°C	T <sub>amb</sub>
Storage Temperature Range	T <sub>stg</sub>	-65 to +175	°C	
Junction Temperature	T <sub>j</sub>	+175	°C	
Soldering Temperature	T <sub>sol</sub>	+250	°C	Note 3
Thermal Resistance Junction to Soldering Point	R <sub>TH(J-S)</sub>	325	°C/W	

**NOTES:**

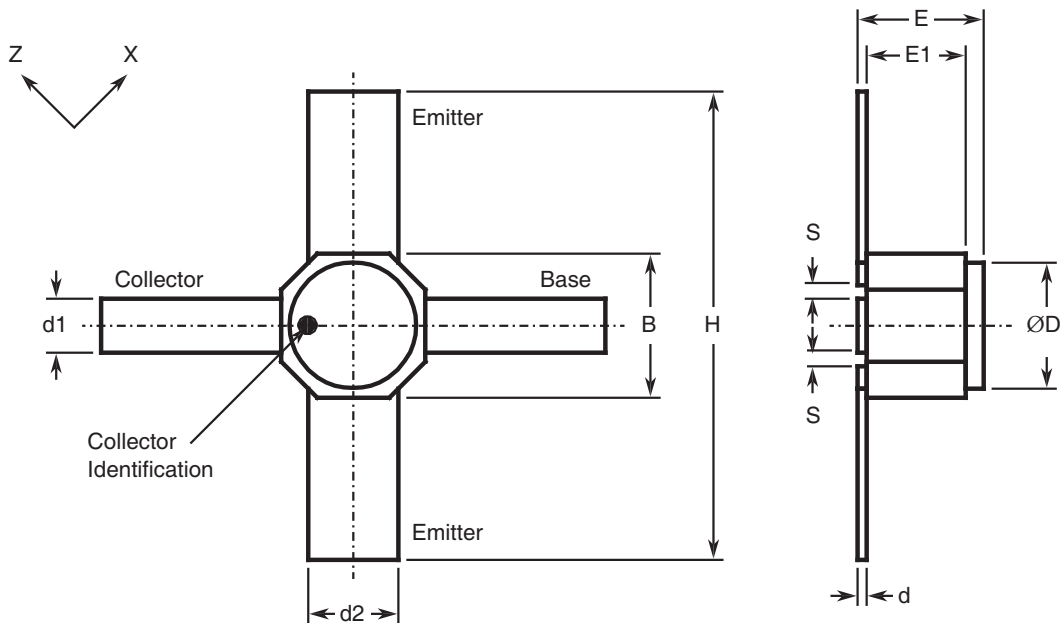
1. Maximum ratings must not be exceeded under any condition of DC ratings and RF voltage/current swings, except that the maximum base current can be exceeded for the purpose of Base-Emitter Forward Voltage pulsed measurement provided that the pulse duration < 1s and I<sub>C</sub> = 0A.
2. At soldering point T<sub>S</sub> ≤ +110°C, where T<sub>S</sub> is measured on the emitter leads at the soldering point to the PCB. For derating at T<sub>S</sub> > +110°C, see Figure 1.
3. Duration 5s maximum and the same lead shall not be resoldered until 3 minutes have elapsed.

**FIGURE 1 - PARAMETER DERATING INFORMATION**



Power Dissipation versus Solder-Point Temperature

**FIGURE 2 - PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION**



Symbols	Dimensions mm	
	Min	Max
B	1.68	1.88
d	0.07	0.15
d1	0.4	0.6
d2	0.92	1.12
ØD	1.55	1.85

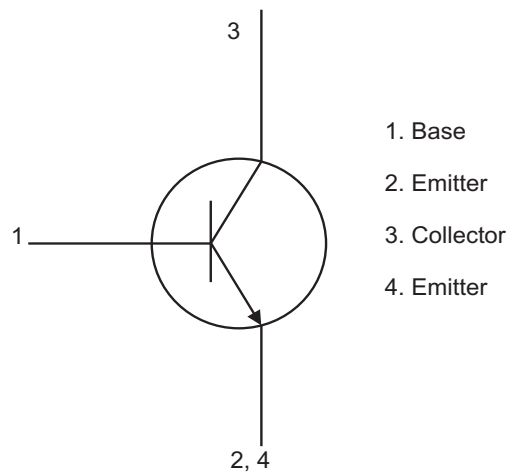


Symbols	Dimensions mm	
	Min	Max
E	0.85	1.25
E1	0.66	0.86
H	4	4.4
S	0.08	0.3

**NOTES:**

1. Terminal identification: The collector is identified by a black dot marked on the top of the body.

**FIGURE 3 - FUNCTIONAL DIAGRAM**



**4. REQUIREMENTS**

**4.1 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.

**4.2 DEVIATIONS FROM THE GENERIC SPECIFICATION**

**4.2.1 Deviations from Production Control**

None.

**4.2.2 Deviation from Final Production Tests (Chart II(b))**

- (a) Para. 9.5, Thermal Shock: May also be performed in accordance with MIL-STD-883, Test Method 1010, Test Condition C.

- (b) Para. 9.7, Particle Impact Noise Detection (PIND) Test: May be performed at any point after the position indicated in Chart II(b), but before the final seal test, fine and gross leak, in Chart III(b).
- (c) Para. 9.9.3, Electrical Measurements at Room Temperature: RF parameters as specified in Table 2 shall be optional at the Manufacturer's discretion.

#### 4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III(b))

- (a) Para. 9.9.2, Electrical Measurements at High and Low Temperatures: May be performed at any point after Power Burn-in.
- (b) Para. 9.9.3, Electrical Measurements at Room Temperature: May be performed at any point after Power Burn-in.

#### 4.2.4 Deviations from Qualification Tests (Chart IV)

- (a) Para 9.8.1 and 9.8.2, Seal immediately following Constant Acceleration: Shall not be performed.
- (b) Para. 9.13, Shock: Shall not be performed.
- (c) Para. 9.14, Vibration: Shall not be performed.
- (d) Para. 9.15, Constant Acceleration: Shall not be performed.
- (e) Assembly Capability Subgroup II: Components rejected during Radiographic Inspection, Seal or External Visual Inspection may also be used for these tests if they are considered capable of passing the Assembly Capability test sequence.

#### 4.2.5 Deviations from Lot Acceptance Tests (Chart V)

- (a) Para 9.8.1 and 9.8.2, Seal immediately following Constant Acceleration: Shall not be performed.
- (b) Electrical Subgroup - Electrical Measurements (and Para. 9.9.2): Table 3(b) measurements shall not be performed.
- (c) Para. 9.13, Shock: Shall not be performed.
- (d) Para. 9.14, Vibration: Shall not be performed.
- (e) Para. 9.15, Constant Acceleration: Shall not be performed.
- (f) Electrical Subgroup - Assembly Capability Tests (and Para 8.2.3(d)): Components rejected during Radiographic Inspection, Seal or External Visual Inspection may also be used for these tests if they are considered capable of passing the Assembly Capability test sequence.

### 4.3 MECHANICAL REQUIREMENTS

#### 4.3.1 Dimension Check

The dimensions of the components specified herein shall be checked. They shall conform to those shown in Figure 2.

#### 4.3.2 Weight

The maximum weight of the components specified herein shall be 30mg.

#### 4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of the ESCC Generic Specification. The test conditions shall be as follows:

- (a) Condition: A (Tension)
- (b) Force: 2.2N

(c) Duration: 5s

#### 4.3.4 Bond Strength

The requirements for bond strength are specified in Section 9 of the ESCC Generic Specification. The test conditions shall be as follows:

- (a) Test Condition: A
- (b) Bond Strength: 0.015N minimum for pre-seal tests; 0.012N minimum for post-seal tests.

#### 4.3.5 Die Shear

The requirements for die shear are specified in Section 9 of the ESCC Generic Specification. The test conditions shall be as follows:

Minimum acceptable Die Shear strength: 0.4N.

In those cases where the clearances in the package do not allow application of the shear force, the die shall be pushed away with a suitable tool, and the die attach area inspected afterwards. Sufficient die attach quality is achieved if more than 50% semiconductor material remains.

### 4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the components specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

#### 4.4.1 Case

The case shall be hermetically sealed and have a ceramic body.

#### 4.4.2 Lead Material and Finish

The lead material shall be D with Type 2 finish in accordance with the requirements of ESCC Basic Specification No. 23500.

### 4.5 MARKING

#### 4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the marking information, in full shall accompany the component in its primary package.

The information to be marked and the order of precedence, shall be as follows:

- (a) Terminal Identification.
- (b) The ESCC Component Number.
- (c) The traceability Information

The primary package shall bear an "ESD Sensitive" label.

#### 4.5.2 Terminal Identification

Terminal identification shall be as shown in Figure 2 of this specification.

#### 4.5.3 The ESCC Component Number

Each component shall bear the ESCC Component Number which shall be constituted and marked as follows:

Detail Specification Number	5611009
Type Variant (see Table 1(a))	01
Testing Level (B or C, as applicable)	B

#### 4.5.4 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESCC Basic Specification No. 21700.

### 4.6 ELECTRICAL MEASUREMENTS

#### 4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ .

#### 4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3. Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +150(+0 -5)^{\circ}\text{C}$  and  $-55(+5 -0)^{\circ}\text{C}$ .

### 4.7 BURN-IN TESTS

Burn-in shall be according to Chart III(b).

#### 4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ . The parameter drift values ( $\Delta$ ) applicable to the scheduled parameters shall not be exceeded. In addition to these drift value requirements, the appropriate limit value specified for a given parameter in Table 2 shall not be exceeded.

#### 4.7.2 Conditions for High Temperature Reverse Bias Burn-in

The requirements for High Temperature Reverse Bias Burn-in are specified in Section 9 of the ESCC Generic Specification. The conditions for High Temperature Reverse Bias Burn-in shall be as specified in Table 5(a) of this specification.

#### 4.7.3 Conditions for Power Burn-in

The requirements for Power Burn-in are specified in Section 9 of the ESCC Generic Specification. The conditions for power burn-in shall be as specified in Table 5(b) of this specification.

**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE**

No.	Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
					Min	Max	
1	Collector to Emitter Cut-off Current 1	$I_{CES1}$	3041	$V_{CE}=13V$ Bias Condition C	-	1000	nA
2	Collector to Emitter Cut-off Current 2	$I_{CES2}$	3041	$V_{CE}=10.5V$ Bias Condition C	-	100	nA
3	Collector to Emitter Cut-off Current 3	$I_{CES3}$	3041	$V_{CE}=5V$ Bias Condition C	-	20	nA
4	Collector to Emitter Cut-off Current 4	$I_{CEX4}$	3041	$V_{CE}=4V,$ $I_B=100nA$	20	100	$\mu A$
5	Emitter to Base Cut-off Current 1	$I_{EBO1}$	3061	$V_{EB}=1.2V$ Bias Condition D	-	5	$\mu A$
6	Emitter to Base Cut-off Current 2	$I_{EBO2}$	3061	$V_{EB}=0.5V$ Bias Condition D	-	100	nA
7	DC Forward Current Transfer Ratio 1	$h_{FE1}$	3076	$V_{CE}=3V,$ $I_C=30mA$	135	250	-
8	DC Forward Current Transfer Ratio 2	$h_{FE2}$	3076	$V_{CE}=3V, I_C=20\mu A$	150	300	-
9	Base Emitter Forward Voltage	$V_{FBE}$	4011	$I_B=12mA, I_C=0A$ Note 1	-	960	mV
10	Collector-Emitter Capacitance	$C_{CE}$	3236	$V_{CE}=2V, I_B=0A$ $f=1MHz$ Common Base Configuration	-	0.5	pF
11	Collector-Base Capacitance	$C_{CB}$	3236	$V_{CB}=2V, I_E=0A$ $f=1MHz$ Common Emitter Configuration	-	0.12	pF
12	Emitter-Base Capacitance	$C_{EB}$	3236	$V_{EB}=0.5V, I_C=0A$ $f=1MHz$ Common Collector Configuration	-	0.8	pF
13	Insertion Power Gain (at 1.8GHz)	$ S_{21} ^2_{1.8}$	-	$f=1.8GHz,$ $V_{CE}=3V,$ $I_C=30mA$ Notes 2, 3	20.5	-	dB
14	Insertion Power Gain (at 6GHz)	$ S_{21} ^2_6$	-	$f=6GHz, V_{CE}=3V,$ $I_C=30mA$ Notes 2, 3	10.5	-	dB
15	Maximum Stable / Available Gain (at 1.8GHz)	MSG/ MAG	-	$f=1.8GHz,$ $V_{CE}=3V,$ $I_C=30mA$ Notes 2, 3, 4	23	-	dB

No.	Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
					Min	Max	
16	Maximum Stable / Available Gain (at 6GHz)	MSG/ MAG	-	f=6GHz, $V_{CE}=3V$ , $I_C=30mA$ Notes 2, 3, 4	12	-	dB
17	Noise Figure (at 1.8GHz)	$NF_{1.8}$	-	f=1.8GHz, $V_{CE}=3V$ , $I_C=5mA$ Notes 3, 5, 6	-	Note 7	dB
18	Noise Figure (at 6GHz)	$NF_6$	-	f=6GHz, $V_{CE}=3V$ , $I_C=5mA$ Variants 02, 03 only Notes 3, 5, 6	-	Note 7	dB

**NOTES:**

1. Pulsed measurement. Pulse Duration < 1 second. For the purpose of  $V_{FBE}$  measurement,  $I_{Bmax}$  may be exceeded during a pulsed measurement provided that the pulse length duration < 1 second and  $I_C = 0A$ .
2. Measured in a 50Ω system.
3. Small signal measurement.
4. MSG for  $K < 1$  ; MAG for  $K \geq 1$ .
5. Input tuned for minimum noise figure.
6. Measurements shall be performed on a sample of 15 components with the maximum allowed limit reduced by 0.07dB. In the event of any failure a 100% inspection shall be performed and the specified limit shall apply.
7. See Table 1(a) for limit value.

**TABLE 3(a) - ELECTRICAL MEASUREMENTS AT HIGH TEMPERATURE**

No.	Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
					Min	Max	
2	Collector to Emitter Cut-off Current 2	$I_{CES2}$	3041	$V_{CE}=10.5V$ Bias Condition C	-	5	μA
3	Collector to Emitter Cut-off Current 3	$I_{CES3}$	3041	$V_{CE}=5V$ Bias Condition C	-	1	μA
5	Emitter to Base Cut-off Current 1	$I_{EBO1}$	3061	$V_{EB}=1.2V$ Bias Condition D	-	50	μA
6	Emitter to Base Cut-off Current 2	$I_{EBO2}$	3061	$V_{EB}=0.5V$ Bias Condition D	-	1	μA
7	DC Forward Current Transfer Ratio 1	$h_{FE1}$	3076	$V_{CE}=3V$ , $I_C=30mA$	85	200	-

**TABLE 3(b) - ELECTRICAL MEASUREMENTS AT LOW TEMPERATURE**

No.	Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
					Min	Max	
5	Emitter to Base Cut-off Current 1	$I_{EBO1}$	3061	$V_{EB}=1.2V$ Bias Condition D Note 1	-	5	$\mu A$
7	DC Forward Current Transfer Ratio 1	$h_{FE1}$	3076	$V_{CE}=3V,$ $I_C=30mA$ Note 1	150	500	-

**NOTES:**

1. Measurements shall be performed on a sample of 5 assembled components per wafer. In the event of any failure a 100% inspection shall be performed.

**TABLE 4 - PARAMETER DRIFT VALUES**

No.	Characteristics	Symbols	Spec. and/or Test Method	Test Conditions	Change Limits ( $\Delta$ ) (1)	Units
2	Collector to Emitter Cut-off Current 2	$I_{CES2}$	As per Table 2	As per Table 2	$\pm 20$ or (2) $+100/-50$	nA % (3)
3	Collector to Emitter Cut-off Current 3	$I_{CES3}$	As per Table 2	As per Table 2	$\pm 5$ or (2) $+100/-50$	nA % (3)
5	Emitter to Base Cut-off Current 1	$I_{EBO1}$	As per Table 2	As per Table 2	$\pm 0.5$ or (2) $+100/-50$	$\mu A$ % (3)
6	Emitter to Base Cut-off Current 2	$I_{EBO2}$	As per Table 2	As per Table 2	$\pm 20$ or (2) $+100/-50$	nA % (3)
7	DC Forward Current Transfer Ratio 1	$h_{FE1}$	As per Table 2	As per Table 2	$\pm 10$	% (3)
9	Base-Emitter Forward Voltage	$V_{FBE}$	As per Table 2	As per Table 2	$\pm 20$	mV (4)

**NOTES:**

1. Unless otherwise specified  $\Delta 1 = \Delta 2$ .
2. Whichever is greater.
3. Referred to the initial value.
4. The total change over both High Temperature Reverse Bias Burn-in and Power Burn-in referred to the initial value before High Temperature Reverse Bias Burn-in.

**TABLE 5(a) - CONDITIONS FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN**

No.	Characteristics	Symbols	Conditions (Note 1)	Units
1	Case Temperature	$T_{case}$	+150 (+0 -5)	°C
2	Collector-Emitter Voltage	$V_{CES}$	10.5	V
3	Base-Emitter Voltage	$V_{BE}$	0	V

**TABLE 5(b) - CONDITIONS FOR POWER BURN-IN AND OPERATING LIFE TESTS**

No.	Characteristics	Symbols	Conditions (Note 1)	Units
1	Ambient Temperature	$T_{amb}$	+125 (+0 -5) Note 2	°C
2	Junction Temperature	$T_j$	+175 (+0 -5)	°C
3	Power Dissipation	$P_{tot}$	105	mW
4	Collector-Emitter Voltage	$V_{CE}$	3.5	V

**NOTES:**

1. Maximum ratings shall not be exceeded during power up and power down sequences.
2.  $T_{amb}$  shall be adjusted to provide the required  $T_j$ .

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION NO. 5010)

4.8.1 Electrical Measurements on Completion of Environmental Tests

The parameters to be measured on completion of environmental tests are scheduled in Table 2. Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +25 \pm 3^\circ\text{C}$ .

4.8.2 Electrical Measurements at Intermediate Points and on Completion of Endurance Tests

The parameters to be measured at intermediate points and on completion of endurance testing are as scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +25 \pm 3^\circ\text{C}$ .

4.8.3 Conditions for Operating Life Tests (Part of Endurance Testing)

The requirements for operating life testing are specified in Section 9 of ESCC Generic Specification No. 5010. The conditions for operating life testing shall be as specified in Table 5(b) of this specification except that the duration shall be as specified in ESCC Generic Specification No. 5010, Para. 9.20.

4.8.4 Electrical Circuit for Operating Life Tests

Not applicable.

4.9 TOTAL DOSE IRRADIATION TESTING

Not applicable.



4.10 SPECIAL TESTING  
Not applicable.

**TABLE 6 - ELECTRICAL MEASUREMENTS AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING**

No.	Characteristics	Symbols	Spec and/or Test Method	Test Conditions	Limits			Units
					Change Limits	Min	Max	
2	Collector to Emitter Cut-off Current 2	$I_{CES2}$	As per Table 2	As per Table 2	$\pm 20$ or (1) $+100/-50$	-	100	nA % (2)
3	Collector to Emitter Cut-off Current 3	$I_{CES3}$	As per Table 2	As per Table 2	$\pm 5$ or (1) $+100/-50$	-	20	nA % (2)
5	Emitter to Base Cut-off Current 1	$I_{EBO1}$	As per Table 2	As per Table 2	$\pm 0.5$ or (1) $+100/-50$	-	5	$\mu A$ % (2)
6	Emitter to Base Cut-off Current 2	$I_{EBO2}$	As per Table 2	As per Table 2	$\pm 20$ or (1) $+100/-50$	-	100	nA % (2)
7	DC Forward Current Transfer Ratio 1	$h_{FE1}$	As per Table 2	As per Table 2	$\pm 10$	135	250	- % (2)
9	Base-Emitter Forward Voltage	$V_{FBE}$	As per Table 2	As per Table 2	$\pm 20$	-	960	mV (2)

**NOTES:**

1. Whichever is greater.
2. Referred to the initial value.

**APPENDIX A****AGREED DEVIATIONS FOR INFINEON TECHNOLOGIES (D)**

Items Affected	Description of Deviations
Para. 4.2.1 Deviations from Production Control	Paras. 5.2.4 and 10.5: If Wafer Lot Acceptance documentation is specified in the purchase order, such data will not be delivered but will be available for review at Infineon Technologies.
Para. 4.2.2 Deviation from Final Production Tests (Chart II(b))	Para. 9.11, Dimension Check: May be performed on a 100% basis during Chart III testing.
Para. 4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III(b))	Para. 9.12; Radiographic Inspection: Not applicable.
Para. 4.2.5 Deviations from Lot Acceptance Tests (Chart V)	Para. 8.2.3(e): Witnessing of LA3 testing by the Orderer shall be limited to the Electrical Measurements at Room Temperature - DC & 1MHz parameters. Notification of the Orderer shall be performed 5 working days before the commencement of this testing.