TRANSISTORS, MICROWAVE, SILICON, BIPOLAR, SMALL SIGNAL

BASED ON TYPES BFY181, BFY182, BFY183, BFY193, BFY193C, BFY193F AND BFY196

ESCC Detail Specification No. 5611/006

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DOCUMENTATION CHANGE NOTICE

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1401	Specification upissued 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. 5010

(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: 561100603

- Detail Specification Reference: 5611006
- Component Type Variant Number: 03 (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 Material and Finish	Weight max g
03	BFY181	Micro-X1	G2	0.03
04	BFY182	Micro-X1	G2	0.03
05	BFY183	Micro-X1	G2	0.03
06	BFY193	Micro-X1	G2	0.03
07	BFY196	Micro-X1	G2	0.03
08	BFY193C	Micro-X1	G2	0.03
09	BFY193F	Micro-X1	G2	0.03

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	Units	Remarks
Collector-Emitter Voltage	V_{CEO}	12	V	
Collector-Emitter Voltage	V_{CES}	20	V	
Collector-Base Voltage	V_{CBO}	20	V	
Emitter-Base Voltage	V_{EBO}	2	V	
Collector Current Variant 03 Variant 04 Variant 05 Variants 06, 08, 09 Variant 07	I_C	 20 35 65 80 100	mA	
Base Current Variant 03 Variant 04 Variant 05 Variants 06, 08, 09 Variant 07	I_B	 2 4 5 10 12	mA	Note 1
Power Dissipation Variant 03 Variant 04 Variant 05 Variants 06, 08, 09 Variant 07	P_{tot}	 175 250 450 580 700	mW	 $T_S \leq +137°C$ $T_S \leq +136°C$ $T_S \leq +99°C$ $T_S \leq +104°C$ $T_S \leq +105°C$ Note 2
Operating Temperature Range	T_{op}	-65 to +200	°C	T_S
Storage Temperature Range	T_{stg}	-65 to +200	°C	
Junction Temperature	T_j	+200	°C	
Thermal Resistance, Junction-to-Soldering Point Variant 03 Variant 04 Variant 05 Variants 06, 08, 09 Variant 07	$R_{th(j-s)}$	 360 255 225 165 135	°C/W	
Soldering Temperature	T_{sol}	+250	°C	Note 3

NOTES:

1. Maximum ratings must not be exceeded under any combination of DC ratings and RF voltage/current swings except as specified in Para. 2.5.1.
2. T_S is measured on the collector lead at the soldering point to the PCB. For T_S greater than specified, P_{tot} derates linearly to 0W at $T_S = +200°C$.
3. Duration 5 seconds maximum at a distance of not less than 0.5mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.

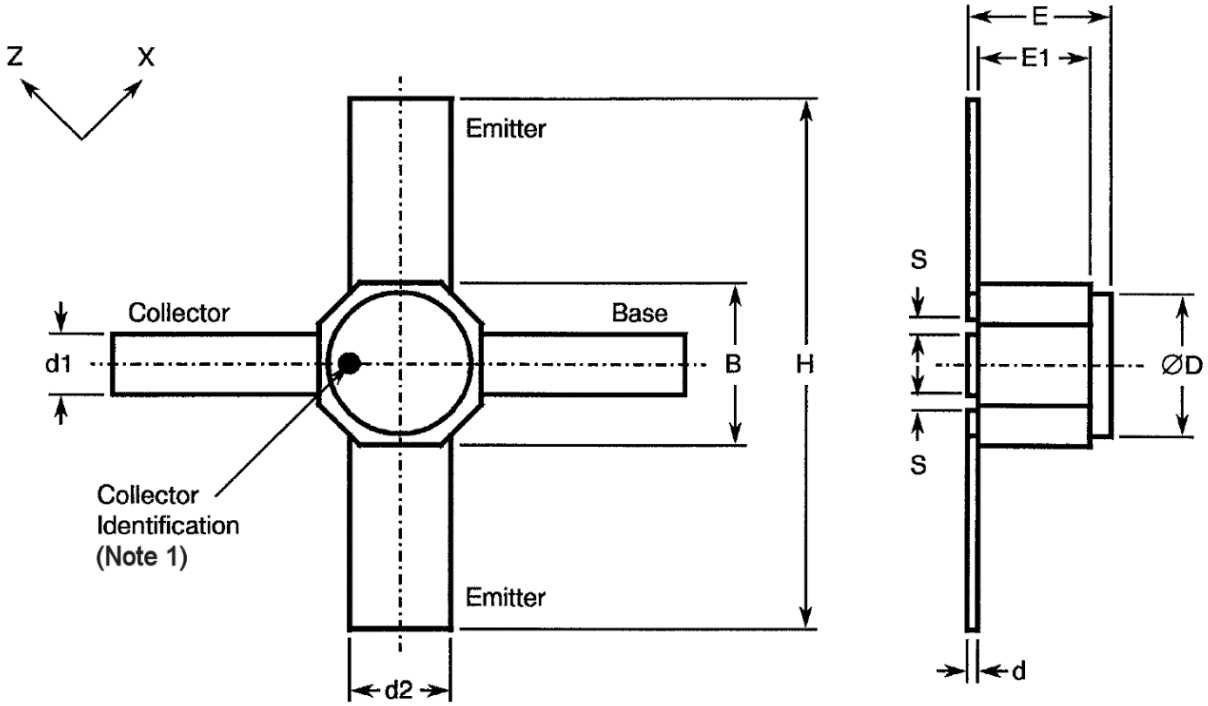
1.6 HANDLING PRECAUTIONS

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 500V for Variant 03 and 1000V for Variants 04 to 09.

1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

Micro-X1 Package

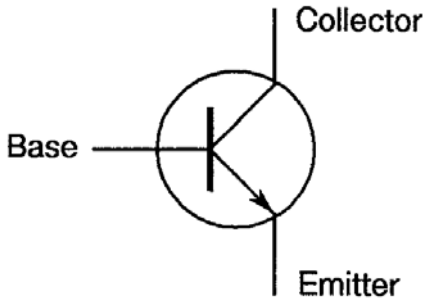


Symbols	Dimensions mm		Notes
	Min	Max	
B	1.68	1.88	2
d	0.07	0.15	3
d1	0.4	0.6	2
d2	0.92	1.12	2
ØD	1.55	1.85	
E	0.85	1.25	3
E1	0.66	0.86	3
H	4	4.4	2
S	0.08	0.3	4

NOTES:

1. The Collector terminal is identified by means of a black dot marked on the lid, with the three other terminals identifiable by the component's geometry.
2. Applies in two places.
3. Applies to all leads.
4. Applies in four places.

1.8 FUNCTIONAL DIAGRAM



NOTES:
1. The lid is connected to the Emitter terminal.

1.9 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 metal lid.

(b) Leads
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

2.1.1.1 Deviations from Screening Tests - Chart F3A

(a) Radiographic Inspection: shall be performed in the X and Z axes only.

2.1.1.2 Deviations from Qualification and Periodic Tests for Packaged Components - Chart F4A

(a) Mechanical Shock: Not applicable.
(b) Vibration: Not applicable.
(c) Constant Acceleration: Not applicable.

2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700. The information to be marked and the order of precedence shall be as follows:

(a) Terminal identification (see Para. 1.7).
(b) The ESCC qualified components symbol (for ESCC qualified components only).
(c) The ESCC Component Number (see Para. 1.4.1).
(d) Traceability information.

2.3 DIE SHEAR

In those cases where package clearances are such that a die shear test is not practicable, the die shall be pushed away with a suitable tool. The force required to remove the die need not be recorded. The die attachment area shall be inspected and the component shall be considered acceptable if more than 50% of the semiconductor material remains.

2.4 TERMINAL STRENGTH

The test conditions for terminal strength, tested as specified in the ESCC Generic Specification, shall be as follows:

- Test Condition A, tension, with a force of 2.23N and a duration of 5s.

2.5 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

2.5.1 Room Temperature Electrical Measurements

The measurements shall be performed at T_{amb} = +25 ±3°C.

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Base Cut-off Current 1	I_{CBO1}	3036	Bias Condition D V_{CB} = 20V	-	100	µA
Collector-Base Cut-off Current 2	I_{CBO2}	3036	Bias Condition D V_{CB} = 10V	-	50	nA
Emitter-Base Cut-off Current 1	I_{EBO1}	3061	Bias Condition D V_{EB} = 2V	-	25	µA
Emitter-Base Cut-off Current 2	I_{EBO2}	3061	Bias Condition D V_{EB} = 1V	-	500	nA
Collector-Emitter Cut-off Current (Note 1)	I_{CEX}	3041	V_{CE} = 12V Variant 03: I_B = 0.1µA Variant 04: I_B = 0.2µA Variant 05: I_B = 0.3µA Variants 06, 08, 09: I_B = 0.5µA Variant 07: I_B = 1µA	 - - - - -	 100 200 300 600 1000	µA
Forward-Current Transfer Ratio	h_{FE}	3076	V_{CE} = 6V; I_C = 5mA Variant 03 Variant 04 Variant 05	 55 55 55	 175 170 160	 - - -
			V_{CE} = 8V; I_C = 30mA Variants 06, 08, 09	 50	 175	 -
			V_{CE} = 5V; I_C = 50mA Variant 07	 50	 175	 -
Base-Emitter Forward Voltage	V_{FBE}	4011	I_C = 0A Variant 03: I_E = 15mA Variant 04: I_E = 20mA Variants 05, 06, 08, 09: I_E = 30mA Variant 07: I_E = 50mA Note 2	-	1	V

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Base Capacitance	C_{CB}	3236	I_E = 0A, V_{CB} = 10V, f = 1MHz			pF
			Variant 03	-	0.29	
			Variant 04	-	0.36	
			Variant 05	-	0.44	
			Variants 06, 08, 09	-	0.75	
			Variant 07	-	1.3	
			Note 3			
Emitter-Base Capacitance	C_{EB}	3236	V_{EB} = 500mV, I_C = 0A, f = 1MHz			pF
			Variant 03	-	0.6	
			Variant 04	-	1.1	
			Variant 05	-	1.4	
			Variants 06, 08	-	2.5	
			Variant 07	-	4.3	
			Variant 09	-	2.7	
			Note 4			
Insertion Power Gain	$\|S_{21}\|^2$	-	V_{CE} = 5V, f = 2GHz			dB
			Variant 03: I_C = 10mA	10	-	
			Variant 04: I_C = 15mA	10	-	
			Variant 05: I_C = 20mA	9	-	
			Variants 06, 08, 09: I_C = 40mA	8	-	
			Variant 07: I_C = 70mA	4	-	
			Notes 5, 6			
Noise Figure	NF	-	V_{CE} = 5V, f = 2GHz			dB
			Variant 03: I_C = 4mA	-	2.9	
			Variant 04: I_C = 5mA	-	2.9	
			Variant 05: I_C = 8mA	-	2.9	
			Variants 06, 08: I_C = 15mA	-	2.9	
			Variant 07: I_C = 20mA	-	3.5	
			Variant 09: I_C = 15mA	-	2.2	
			Notes 7, 10			
Maximum Available / Stable Gain	MAG / MSG	-	V_{CE} = 5V, f = 2GHz			dB
			Variant 03: I_C = 10mA	13.5	-	
			Variant 04: I_C = 15mA	13.5	-	
			Variant 05: I_C = 20mA	12.5	-	
			Variants 06, 08, 09: I_C = 40mA	12.5	-	
			Variant 07: I_C = 70mA	10	-	
			Notes 5, 8			
Gain Bandwidth Product	f_T	-	V_{CE} = 5V, f = 500MHz			GHz
			Variant 03: I_C = 10mA	6.5	-	
			Variant 04: I_C = 15mA	6.5	-	
			Variant 05: I_C = 20mA	6.5	-	
			Variants 06, 08, 09: I_C = 40mA	6.5	-	
			Variant 07: I_C = 70mA	6	-	
			Notes 5, 9			
Output Power	P_{out}	-	V_{CE} = 5V, f = 2GHz			dBm
			Variant 05: I_C = 30mA, P_{in}= 7dBm	13.5	-	
			Variants 06, 08, 09: I_C = 50mA, P_{in} = 10dBm	16.5	-	
			Variant 07: I_C = 80mA, P_{in} = 15dBm	18.5	-	
			Notes 5, 11			

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
1/f Noise	F_{10Hz}	-	V_{CE} = 3V, f = 10Hz, I_C = 8mA, R = 2kΩ Variant 08 Notes 12, 13	-	300	nV/√Hz

NOTES:

1. Verification of the minimum Collector-Emitter Breakdown Voltage, $V_{(BR)CEO}$.
2. Pulsed measurement, pulse duration < 1s, single pulse. I_B may exceed that specified in Para. 1.5.
3. The emitter is connected to the ground terminal.
4. The collector is connected to the ground terminal.
5. Measured in a 50Ω system using a suitable network analyser.
6. Small signal measurement.
7. Input tuned for NF_{min}.
8. MAG if K ≥ 1; MSG if K < 1.
9. $f_T=f\times|h_{21}|$, $h_{21}=\frac{-2.S_{21}}{(1-S_{11})(1+S_{22})+(S_{12}.S_{21})}$
10. Measurements shall be performed on a sample of 15 components with the maximum allowed limit reduced by 0.2dB. In the event of any failure a 100% inspection shall be performed and the specified limit shall apply.
11. Measurements shall be performed on a sample of 15 components with the minimum allowed limit increased by 0.5dB. In the event of any failure a 100% inspection shall be performed and the specified limit shall apply.
12. Measurements shall be performed on a sample of 15 assembled components per wafer. In the event of any failure a 100% inspection shall be performed.
13. Measured using a suitable noise analyser.

2.5.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Base Cut-off Current 2	I_{CBO2}	3036	T_{amb} = +150 (+0 -5)°C Bias Condition D V_{CB} = 10V, Note 1	-	10	µA
Forward-Current Transfer Ratio	h_{FE}	3076	T_{amb} = -55 (+5 -0)°C Note 2 V_{CE} = 6V; I_C = 5mA, Variants 03, 04, 05	30	-	-
			V_{CE} = 8V; I_C = 30mA Variants 06, 08, 09	30	-	-
			V_{CE} = 5V; I_C = 50mA Variant 07	30	-	-

NOTES:

1. Measurements shall be performed on a sample of 5 components. In the event of any failure a 100% inspection shall be performed.
2. 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.

2.6 PARAMETER DRIFT VALUES

Unless otherwise specified, the measurements shall be performed at T_{amb} = +25 ±3°C.

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.5.1 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 (1) Δ	Absolute		
			Min	Max	
Collector-Base Cut-off Current 2	I_{CBO2}	±10 or (2) +100/-50%	-	50	nA
Emitter-Base Cut-off Current 2	I_{EBO2}	±10 or (2) +100/-50%	-	500	nA
Forward-Current Transfer Ratio	h_{FE}	±10%			-
Variant 03			55	175	
Variant 04			55	170	
Variant 05			55	160	
Variants 06, 07, 08, 09			50	175	
Base-Emitter Forward Voltage	V_{FBE}	±10% (3)	-	1	V

NOTES:

1. Δ1 = Δ2.
2. Whichever is greater.
3. The total change over both Burn-in 1 and Burn-in 2 referred to the initial value made prior to Burn-in 1.

2.7 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at T_{amb} = +25 ±3°C.

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.5.1 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 1	I_{CBO1}	-	120	µA
Collector-Base Cut-off Current 2	I_{CBO2}	-	60	nA
Emitter-Base Cut-off Current 2	I_{EBO2}	-	600	nA
Forward-Current Transfer Ratio	h_{FE}			-
Variant 03		50	190	
Variant 04		50	185	
Variant 05		50	175	
Variants 06, 07, 08, 09		45	190	
Base-Emitter Forward Voltage	V_{FBE}	-	1.1	V

2.8 BURN-IN 1 CONDITIONS

Characteristics	Symbols	Test Conditions (Note 1)	Units
Soldering Point Temperature	T_S	+150 (+0 -5)	°C
Collector-Emitter Voltage	V_{CES}	16	V
Base-Emitter Voltage	V_{BE}	0	V

NOTES:
1. Maximum ratings shall not be exceeded during power up and power down sequences.

2.9 BURN-IN 2 CONDITIONS

Characteristics	Symbols	Test Conditions (Notes 1, 2)	Units
Soldering Point Temperature Variant 03 Variant 04 Variant 05 Variants 06, 08, 09 Variant 07	T_S	 ≥ +137 ≥ +136 ≥ +99 ≥ +104 ≥ +105	°C
Junction Temperature	T_j	+200 (+0 -5)	°C
Power Dissipation	P_{tot}	≤ P_{tot} (see Para. 1.5)	mW
Collector-Emitter Voltage	V_{CE}	9.6	V

NOTES:
1. Maximum ratings shall not be exceeded during power up and power down sequences.
2. T_S and/or P_{tot} shall be adjusted to attain the specified T_j.

2.10 OPERATING LIFE CONDITIONS

The conditions shall be as specified in Para. 2.9 Burn-in 2 Conditions.

APPENDIX A

AGREED DEVIATIONS FOR INFINEON TECHNOLOGIES AG (D)

Items Affected	Description of Deviations
Para. 2.1.1 Deviations from the Generic Specification: Special In-Process Controls - Chart F2	Bond Strength: The following pre-seal bond strengths shall apply: • Variants 03, 04, 05: 0.015N minimum • Variants 06, 07, 08, 09: 0.03N minimum
	Die Shear: If Para. 2.3 does not apply the following shear strengths may be applied: • Variants 03, 04, 05, 06, 08, 09: 0.5N minimum • Variant 07: 0.7N minimum
	Dimension Check: May be performed during Chart F3A testing.
Para. 2.1.1.1 Deviations from Screening Tests - Chart F3A	Temperature Cycling: Shall be replaced by a Thermal Shock test in accordance with MIL-STD-202, Test Method 107, Test Condition B, 20 cycles.
Para. 2.1.1.2 Deviations from Qualification and Periodic Tests for Packaged Components - Chart F4A	Temperature Cycling: Shall be replaced by a Thermal Shock test in accordance with MIL-STD-202, Test Method 107, Test Condition B, 100 cycles.
	Assembly Capability Subgroup tests: In addition to the permitted use of empty packages or electrical rejects as test samples, components rejected during the following Screening Tests: • Radiographic Inspection • Seal • External Visual Inspection may be used on the condition that the cause for rejection has no possible impact on the tests, and they have been subjected to the same screening as the packages of the assembly lot with which they are associated.
	Bond Strength: The following post–seal bond strengths shall apply: • Variants 03, 04, 05: 0.012N minimum • Variants 06, 07, 08, 09: 0.025N minimum
	Die Shear: If Para. 2.3 does not apply the following shear strengths may be applied: • Variants 03, 04, 05, 06, 08, 09: 0.5N minimum • Variant 07: 0.7N minimum
Para. 2.1.1 Deviations from the Generic Specification: Final Customer Source Inspection	Final Customer Source Inspection shall be limited to witnessing of the DC and 1MHz parameters specified in Para. 2.5.1 Room Temperature Electrical Measurements.
Para. 2.1.1 Deviations from the Generic Specification: Data Documentation	Additional Documentation and Wafer Lot Acceptance Data: If Wafer Lot Acceptance Data is stipulated in the Purchase Order, such data will not be delivered but will be available for review at Infineon Technologies AG.