TRANSISTORS, MICROWAVE, SILICON, BIPOLAR, SMALL SIGNAL

BASED ON TYPES BFY405, BFY420 AND BFY450

ESCC Detail Specification No. 5611/008

Issue 4	November 2016

Document Custodian: European Space Agency – see https://escies.org

LEGAL DISCLAIMER AND COPYRIGHT

DOCUMENTATION CHANGE NOTICE

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

DCR No.	CHANGE DESCRIPTION
1024	Specification upissued to incorporate changes per DCR.

TABLE OF CONTENTS

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: 561100801

- Detail Specification Reference: 5611008
- 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 Material and Finish	Weight max g
01	BFY405	Micro-X	G2	0.03
02	BFY420	Micro-X	G2	0.03
03	BFY450	Micro-X	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 (Note 1)	Units	Remarks
Collector-Emitter Voltage	V_{CEO}	4.5	V	
Collector-Base Voltage	V_{CBO}	15	V	
Emitter-Base Voltage	V_{EBO}	1.5	V	
Collector Current Variant 01 Variant 02 Variant 03	I_C	 12 35 100	mA	
Base Current Variant 01 Variant 02 Variant 03	I_B	 1 3 10	mA	
Power Dissipation Variant 01 Variant 02 Variant 03	P_{tot}	 55 160 450	mW	 $T_S \leq +145°C$ $T_S \leq +129°C$ $T_S \leq +110°C$ Note 2
Operating Temperature Range	T_{op}	-65 to +175	°C	T_S
Storage Temperature Range	T_{stg}	-65 to +175	°C	
Junction Temperature	T_j	+175	°C	
Thermal Resistance, Junction-to-Soldering Point Variant 01 Variant 02 Variant 03	$R_{th(j-s)}$	 545 285 145	°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.
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 = +175°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.

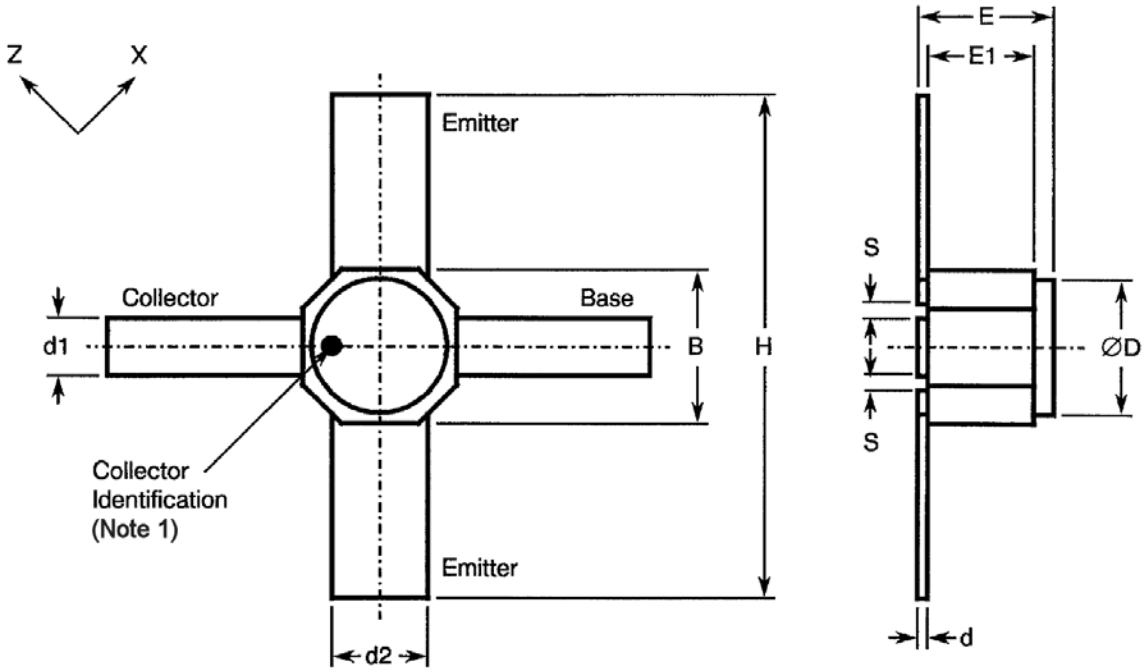
1.6 HANDLING PRECAUTIONS

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 70V for Variant 01, 100V for Variant 02 and 190V for Variant 03.

1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

Micro-X Package

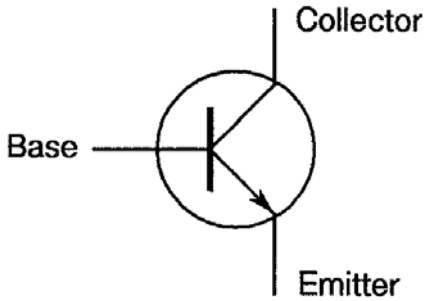


Symbols	Dimensions mm		Notes
	Min	Max	
B	1.68	1.88	2
d	0.07	0.15	3
d1	0.4	0.6	2
d2	0.92	1.12	2
ØD	1.55	1.85	
E	0.85	1.25	3
E1	0.66	0.86	3
H	4	4.4	2
S	0.08	0.3	4

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 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 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.
(b) The ESCC qualified components symbol (for ESCC qualified components only).
(c) The ESCC Component Number.
(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	I_{CBO}	3036	Bias Condition D V_{CB} = 5V Variant 01 Variant 02 Variant 03	 - - -	 10 30 100	nA
Emitter-Base Cut-off Current	I_{EBO}	3061	Bias Condition D V_{EB} = 1.5V Variant 01 Variant 02 Variant 03	 - - -	 5 20 50	µA
Collector-Emitter Cut-off Current	I_{CEX}	3041	V_{CE} = 4.5V Variant 01: I_B = 0.1µA Variants 02, 03: I_B = 1µA	 - -	 20 200	µA
Forward-Current Transfer Ratio	h_{FE}	3076	V_{CE} = 1V Variant 01: I_E = 2mA Variant 02: I_E = 5mA Variant 03: I_E = 20mA	50	150	-
Collector-Base Capacitance	C_{CB}	3241	V_{CB} = 2V, V_{BE} = 0V, f = 1MHz Variant 02 Note 1	-	0.9	pF

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Emitter-Base Capacitance	C_{EB}	3241	V_{EC} = 500mV, V_{CB} = 0V, f = 1MHz Variant 02 Note 2	-	3	pF
Collector-Emitter Capacitance	C_{CE}	3241	V_{CE} = 2V, V_{BE} = 0V, f = 1MHz Variant 01 Variant 02 Variant 03 Note 3	 - - -	 0.48 0.85 2.6	pF
Insertion Power Gain	$\|S_{21}\|^2$	-	V_{CE} = 2V, f = 1.8GHz Variant 01: I_C = 5mA Variant 02: I_C = 20mA Variant 03: I_C = 50mA Notes 5, 6	 14 14 8	 - - -	dB
Noise Figure	NF	-	V_{CE} = 2V, f = 1.8GHz Variant 01: I_C = 2mA Variant 02: I_C = 5mA Variant 03: I_C = 10mA Note 4	 - - -	 1.8 1.7 2	dB
Transition Frequency	f_T	-	V_{CE} = 3V Variant 01: I_C = 10mA, f = 2GHz Variant 02: I_C = 30mA, f = 2GHz Variant 03: I_C = 90mA, f = 1GHz Note 5	 20 20 18	 - - -	GHz

NOTES:

1. The emitter is connected to the ground terminal.
2. The collector is connected to the ground terminal.
3. The base is connected to the ground terminal.
4. Input tuned for NF_{min}.
5. Measured in a 50Ω system using a suitable network analyser.
6. Small signal measurement.

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	I_{CBO}	3036	T_{amb} = +150 (+0 -5)°C Bias Condition D V_{CB} = 5V, Note 1 Variant 01 Variant 02 Variant 03	 - - -	 10 30 100	µA
Forward-Current Transfer Ratio	h_{FE}	3076	T_{amb} = -55 (+5 -0)°C V_{CE} = 1V, Note 2 Variant 01: I_C = 2mA Variant 02: I_C = 5mA Variant 03: I_C = 20mA	10	-	-

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 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	I_{CBO}	±10 or (2) ±100%			nA
Variant 01			-	10	
Variant 02			-	30	
Variant 03			-	100	
Emitter-Base Cut-off Current	I_{EBO}				µA
Variant 01		±1 or (2) ±100%	-	5	
Variant 02		±5 or (2) ±100%	-	20	
Variant 03		±10 or (2) ±100%	-	50	
Forward-Current Transfer Ratio	h_{FE}	±10%	50	150	-

NOTES:

1. Δ1 = Δ2.
2. Whichever is greater.

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 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}			nA
Variant 01		-	10	
Variant 02		-	30	
Variant 03		-	100	
Emitter-Base Cut-off Current	I_{EBO}			µA
Variant 01		-	5	
Variant 02		-	20	
Variant 03		-	50	
Collector-Emitter Cut-off Current	I_{CEX}			µA
Variant 01		-	20	
Variants 02, 03		-	200	
Forward-Current Transfer Ratio	h_{FE}	50	150	-

2.8 BURN-IN 1 CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Soldering Point Temperature	T_S	+150 (+0 -5)	°C
Collector-Emitter Voltage	V_{CES}	12	V
Base-Emitter Voltage	V_{BE}	0	V

2.9 BURN-IN 2 CONDITIONS

Characteristics	Symbols	Test Conditions (Note 1)	Units
Soldering Point Temperature	T_S		°C
Variant 01		≥ +145	
Variant 02		≥ +129	
Variant 03		≥ +110	
Junction Temperature	T_j	+175 (+0 -5)	°C
Power Dissipation	P_{tot}	≤ P_{tot} given in Maximum Ratings	mW
Collector-Emitter Voltage	V_{CE}		V
Variants 01, 02		4	
Variant 03		3.5	

NOTES:

1. 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 for Burn-in 2.

APPENDIX A

AGREED DEVIATIONS FOR INFINEON TECHNOLOGIES AG (D)

Items Affected	Description of Deviations
Deviations from Generic Specification: Special In-Process Controls (Chart F2)	Internal Visual Inspection: Shall include verification of the length, height and shape of the wire bonding.
	Dimension Check: May be performed during Chart F3 testing.
Deviations from Generic Specification: Screening Tests (Chart F3)	Temperature Cycling: Shall be replaced by a Thermal Shock test in accordance with MIL-STD-202, Test Method 107, Test Condition B, 20 cycles.
	Radiographic Inspection: Shall not be performed.
Deviations from Generic Specification: Qualification and Periodic Tests (Chart F4)	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.
Deviations from Generic Specification: Final Customer Source Inspection	Final Customer Source Inspection shall be limited to witnessing of the DC and 1MHz parameters specified in Room Temperature Electrical Measurements.
Deviations from 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.