



DIODE, RECTIFIER, HIGH VOLTAGE

BASED ON TYPES STTH40200 AND STTH60200

ESCC Detail Specification No. 5103/033

Issue 1	July 2019
---------	-----------



LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2019. 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

TABLE OF CONTENTS

1	GENERAL	5
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	6
1.6	HANDLING PRECAUTIONS	6
1.7	PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION	7
1.7.1	Metal Flange Mount Package (TO-254AA) - 3 Lead	7
1.7.2	Surface Mount Package (SMD1) - 3 Terminal	8
1.7.3	Notes to Para. 1.7 Physical Dimensions and Terminal Identification	8
1.8	FUNCTIONAL DIAGRAM	9
1.9	MATERIALS AND FINISHES	9
2	REQUIREMENTS	9
2.1	GENERAL	9
2.1.1	Deviations from the Generic Specification	9
2.2	MARKING	10
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	11
2.4.3	Notes to Para. 2.4 Electrical Measurements Tables	11
2.5	PARAMETER DRIFT VALUES	12
2.6	INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS	12
2.7	HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS	12
2.8	POWER BURN-IN CONDITIONS	13
2.9	OPERATING LIFE CONDITIONS	13
	APPENDIX 'A'	14

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](#)

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: 510303301

- Detail Specification Reference: 5103033
- Component Type Variant Number: 01

1.4.2 Component Type Variants

The component type variants applicable to this specification are as follows:

Variant Number	Based on Type	Case	Average Output Rectified Current per Device (I _o)	Lead/Terminal Material and Finish	Weight Max (g)
01	STTH40200	TO-254AA	40	H14	9.4
02	STTH40200	TO-254AA	40	H4	9.4
03	STTH60200	SMD1	60	Q14	1.84

The lead/terminal 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
Forward Surge Current	I_{FSM}	300	A	Notes 1, 2
Working Peak Reverse Voltage	V_{RWM}	200	V	
Average Output Rectified Current Variants 01, 02 (per diode): Variants 01, 02 (per device): Variant 03 (per diode): Variant 03 (per device):	I_o	40 40 40 60	A	Note 3
Operating Temperature Range (Case Temperature)	T_{op}	-65 to +175	°C	
Junction Temperature	T_j	+175	°C	
Storage Temperature Range	T_{stg}	-65 to +175	°C	
Soldering Temperature	T_{sol}	+245	°C	Note 4
Thermal Resistance, Junction to Case Variants 01, 02 (per diode): Variants 01, 02 (per device): Variant 03 (per diode): Variant 03 (per device):	$R_{th(j-c)}$	1.4 1 2.4 2	°C/W	
Thermal Resistance, Junction to Ambient Variants 01, 02 (per diode): Variants 01, 02 (per device): Variant 03 (per diode): Variant 03 (per device):	$R_{th(j-a)}$	45 45 55 55	°C/W	

NOTES:

1. Sinusoidal pulse of 10ms duration.
2. At $T_{amb} \leq 25^\circ\text{C}$.
3. For Variant 01, 02 per diode, at $T_{case} > +110^\circ\text{C}$, derate linearly to 0A at $+175^\circ\text{C}$.
For Variant 01, 02 per device, at $T_{case} > +134^\circ\text{C}$, derate linearly to 0A at $+175^\circ\text{C}$.
For Variant 03 per diode at $T_{case} > +64^\circ\text{C}$, derate linearly to 0A at $+175^\circ\text{C}$.
For Variant 03 per device at $T_{case} > +44^\circ\text{C}$, derate linearly to 0A at $+175^\circ\text{C}$.
4. Duration 5s maximum and the same package shall not be resoldered until 3 minutes have elapsed.

1.6 HANDLING PRECAUTIONS

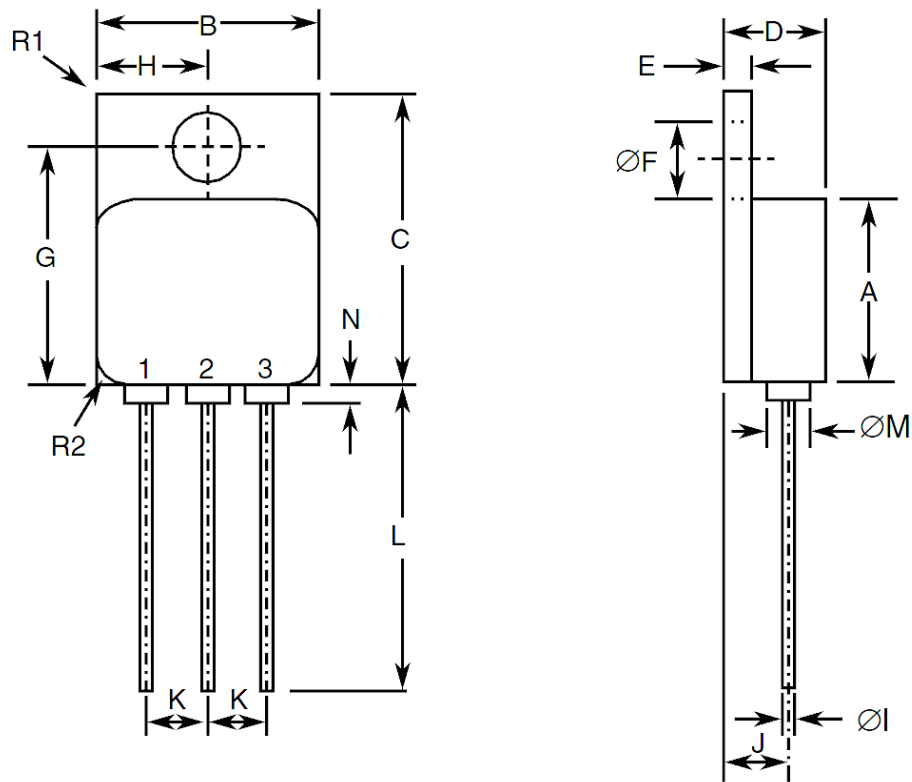
These devices are susceptible to damage by electrostatic discharge. Therefore, suitable precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling.

These components are categorised as Class 3 per ESCC Basic Specification No. [23800](#) with a Minimum Critical Path Failure Voltage of 8kV.

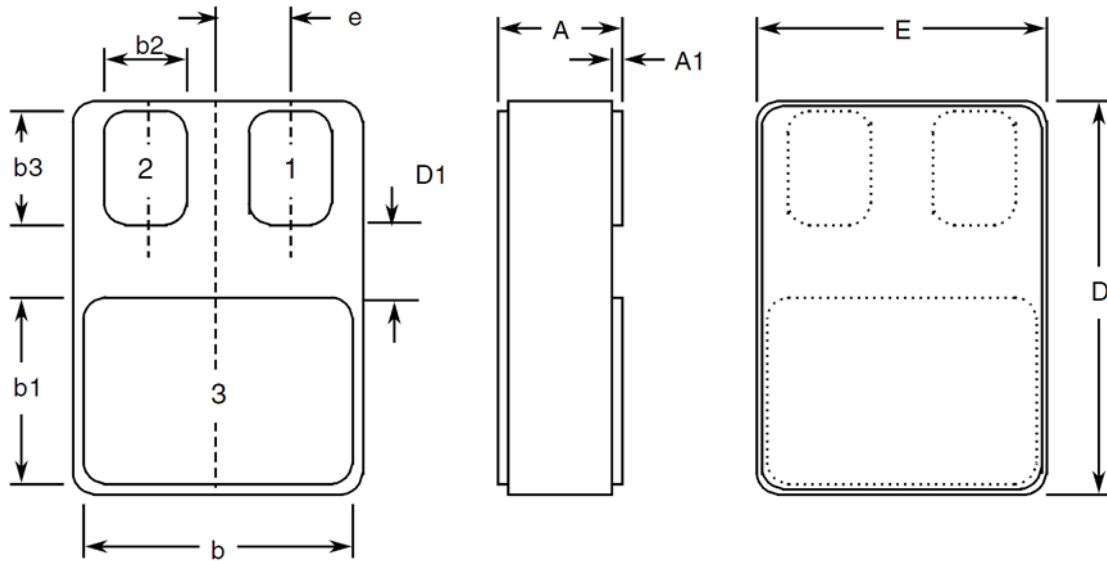
The TO-254AA package contains Beryllium Oxide (BeO) and therefore must not be ground, machined, sandblasted or subjected to any mechanical operation which will produce dust. The case must not be subjected to any chemical process (e.g. etching) which will produce fumes.

1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.7.1 Metal Flange Mount Package (TO-254AA) - 3 Lead



Symbols	Dimensions mm		Notes
	Min	Max	
A	13.59	13.84	
B	13.59	13.84	
C	20.07	20.32	
D	6.3	6.7	
E	1	1.35	
ØF	3.5	3.9	
G	16.89	17.4	
H	6.86 BSC		
ØI	0.89	1.14	2
J	3.81 BSC		
K	3.81 BSC		
L	12.95	14.5	
ØM	3.05 Typical		2
N	-	0.71	2
R1	-	1	3
R2	1.65 Typical		4

1.7.2 Surface Mount Package (SMD1) - 3 Terminal


Symbols	Dimensions mm		Notes
	Min	Max	
A	3.3	3.61	
A1	0.25	0.51	
b	9.4	9.65	
b1	10.41	10.67	
b2	3.43	3.68	5
b3	3.86	4.11	5
D	15.75	16	
D1	0.76	-	5
E	11.3	11.56	
e	2.67 BSC		5

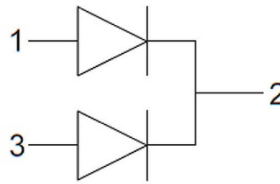
 1.7.3 Notes to Para. 1.7 Physical Dimensions and Terminal Identification

1. Terminal identification is specified by the component's geometry. See Para. 1.8 Functional Diagram for the terminal connections.
2. 3 places.
3. Radius of heatsink flange corner, 4 places.
4. Radius of body corner, 4 places.
5. 2 places.

1.8 FUNCTIONAL DIAGRAM

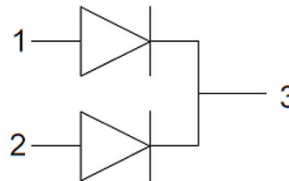
Terminal 1: Anode 1
Terminal 2: Common Cathode
Terminal 3: Anode 2

Variants 01 and 02



Terminal 1: Anode 1
Terminal 2: Anode 2
Terminal 3: Common Cathode

Variant 03



NOTES:

1. For Variants 01 and 02, the case is not connected to any lead.
2. For Variant 03, the lid is not connected to any terminal.

1.9 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

- (a) Case
For the metal flange mount package the case shall be hermetically sealed and have a metal body. The leads pass through ceramic eyelets brazed into the frame and the lid shall be welded.
For the surface mount package the case shall be hermetically sealed and have a ceramic body with a Kovar lid.
- (b) Lead/Terminal Finish
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 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.
- (d) Warning sign for beryllium oxide (applicable to Variants 01 and 02 only).

2.3 TERMINAL STRENGTH

For Variants 01 and 02, the test conditions for Terminal Strength, tested as specified in the ESCC Generic Specification, shall be as follows:

- Test Condition: A, tension, with an applied force of 10N for a duration of 10s.

2.4 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

Electrical measurements shall be performed at room, high and low temperatures. Consolidated notes are given in Para. 2.4.3.

2.4.1 Room Temperature Electrical Measurements

The measurements shall be performed at $T_{amb} = +25 \pm 3^{\circ}C$.

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions Note 1	Limits		Units
				Min	Max	
Reverse Current	I_R	4016	DC Method $V_R = 200V$	-	30	μA
Forward Voltage 1	V_{F1}	4011	$I_{F1} = 5A$, Note 2	-	0.87	V
Forward Voltage 2	V_{F2}	4011	$I_{F2} = 10A$, Note 2	-	0.92	V
Forward Voltage 3	V_{F3}	4011	$I_{F3} = 20A$, Note 2	-	1.02	V
Forward Voltage 4	V_{F4}	4011	$I_{F4} = 30A$, Note 2	-	1.09	V
Forward Voltage 5	V_{F5}	4011	$I_{F5} = 40A$, Note 2	-	1.15	V
Capacitance	C	4001	$V_R = 10V$ $V_{sig} = 30mV$ (p-p) max $f = 1MHz$	-	225	μF
Reverse Recovery Time	t_{rr}	4031	$I_F = 1A$ $V_R = 30V$ $dI_F/dt = -50A/\mu s$	-	60	ns
Thermal Impedance, Junction to Case	$Z_{th(j-c)}$	3101	Note 3	ΔV_F , Note 4		$^{\circ}C/W$

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions Notes 1 and 5	Limits		Units
				Min	Max	
Reverse Current	I _R	4016	T _{amb} = +125 (+0 -5) °C DC Method V _R = 200V	-	300	μA
Forward Voltage 1	V _{F1}	4011	T _{amb} = +125 (+0 -5) °C I _{F1} = 5A, Note 2	-	0.66	V
			T _{amb} = -55 (+5 -0) °C I _{F1} = 5A, Note 2	-	1.04	V
Forward Voltage 2	V _{F2}	4011	T _{amb} = +125 (+0 -5) °C I _{F2} = 10A, Note 2	-	0.75	V
			T _{amb} = -55 (+5 -0) °C I _{F2} = 10A, Note 2	-	1.07	V
Forward Voltage 3	V _{F3}	4011	T _{amb} = +125 (+0 -5) °C I _{F3} = 20A, Note 2	-	0.87	V
			T _{amb} = -55 (+5 -0) °C I _{F3} = 20A, Note 2	-	1.15	V
Forward Voltage 4	V _{F4}	4011	T _{amb} = +125 (+0 -5) °C I _{F4} = 30A, Note 2	-	0.95	V
			T _{amb} = -55 (+5 -0) °C I _{F4} = 30A, Note 2	-	1.2	V
Forward Voltage 5	V _{F5}	4011	T _{amb} = +125 (+0 -5) °C I _{F5} = 40A, Note 2	-	1.02	V
			T _{amb} = -55 (+5 -0) °C I _{F5} = 40A, Note 2	-	1.25	V

2.4.3 Notes to Para. 2.4 Electrical Measurements Tables

1. Measurement per each diode.
2. Pulsed measurement: Pulse Width ≤ 680μs, Duty Cycle ≤ 2%.
3. Performed only during Screening Tests Parameter Drift Values (Initial Measurements), go-no-go.
4. The limits for ΔV_F shall be defined by the Manufacturer on every lot in accordance with MIL-STD-750 Method 3101 and shall guarantee the R_{th(j-c)} limits specified in Para. 1.5 Maximum Ratings.
5. 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 $T_{amb} = +25 \pm 3^{\circ}C$.

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	
Reverse Current	I_R	± 5 or (1) $\pm 100\%$	-	30	μA
Forward Voltage 5	V_{F5}	± 0.05	-	1.15	V

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 $T_{amb} = +25 \pm 3^{\circ}C$.

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
		Min	Max	
Reverse Current	I_R	-	30	μA
Forward Voltage 5	V_{F5}	-	1.15	V

2.7 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+150 (+0 -5)	$^{\circ}C$
Reverse Voltage	V_R	160	V
Duration	t	≥ 48	Hours

2.8 POWER BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+25 (+0 -5)	°C
Junction Temperature	T_J	+175 (+0 -5)	°C
Average Output Rectified Current	I_o	Note 1	A
Duration	t	≥ 168	Hours

NOTES:

1. The output current may be adjusted, within the given limit range, to attain the specified junction temperature.

2.9 OPERATING LIFE CONDITIONS

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

APPENDIX 'A'
AGREED DEVIATIONS FOR STMICROELECTRONICS (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 2.1.1, Deviations from the Generic Specification: Deviations from Production Control – Chart F2	Special In-Process Controls - Internal Visual Inspection: Wedge bonds equal to 1.1 wire diameter are acceptable for bonding with a V-Groove tool.
Para. 2.1.1, Deviations from the Generic Specification: Deviations from Screening Tests for Packaged Components – Chart F3A	Solderability: Solderability is not applicable unless specifically stipulated in the Purchase Order. Room Temperature Electrical Measurements: Capacitance and Reverse Recovery Time may be considered guaranteed but not tested if successful pilot lot testing has been performed in accordance with STMicroelectronics “Acceptation wafers” internal procedure as specified in the PID, 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.