DOCUMENT CHANGE REQUEST

DCR number 396	Changes required for: N/A	Originator: Samuel SAVIN
Date: 2008/02/28	Date sent: 2008/02/28	Organisation: CNES
Status: IMPLEMENTED		

Title:	Diodes, Power Rectifier, High Efficiency Fast Recovery , based on Type BYV 54-200		
Number:	5103/031	Issue:	3

Other documents affected:

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Paragraph 1.4.2, page 5
Paragraph 1.5, page 6
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Paragraph 2.4.3, page 9
Paragraph 2.5, page 10
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Paragraph:

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Paragraph 2.4.2, page 9
Paragraph 2.4.3, page 9
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Original wording:

Proposed wording:

See attached document

Justification:

New variant 02 (hot solder dip) introduction with TO254 package for European customers need.
New variant 03 (gold finish) and 04 (hot solder dip) introduction with TO254AA low ohmic package for European customers need.

Paragraph 1.5 MAXIMUM RATINGS correction error of note 3 for variant 01 and 02 (see explanation on attached document) and new derating added for variant 03 and 04 in the note 3.

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Attachments:

DCR396markup.pdf, DCR396att.pdf, null

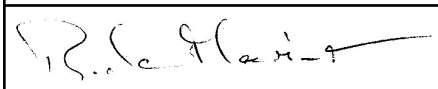
Modifications:

DCR details are replaced by the following as discussed and agreed with the Manufacturer ST:
Pages affected:
5, 6, 7, 9, 10, 11
Paras affected:
1.4.2, 1.5, 1.6, 1.7, 1.8, 2.4.1, 2.4.2, 2.4.3, 2.5, 2.6, 2.7, 2.8

Proposed Wording of Change
See attached hand mark-up for full details.
Summary of changes:
- Addition of new variants 02 to 05, new lead material & finishes and new low-ohmic package.
- Io derating in Para 1.5, Maximum Ratings, amended for variant 01 (and defined for all new variants).
- Forward Voltage limits defined for the new variants in all tables.
- Forward Voltage limit in Para 2.6, Intermediate and End-Point Electrical Measurements, amended for variant 01 and Vf2 is added with applicable limits.

Justification
- Introduction of new variants 02 to 05 for European customer.
- Io derating for variant 01 (& 02, 03) is amended in order to correct a previous calculation error:
Max power derating = Tj – (Io x Vf x Rth(j-c)) = 150 – (40 x 1.5 x 1) = 90C (not 110C)
- Forward Voltage in Para 2.6 for variant 01 (& 02, 03) is amended to correct a previous typographic error.

Approval signature:



Date signed:

2008-02-28

1.4.2 Component Type Variants

Variant Number	Based on Type	Case	Description	Lead Material and Finish	Weight Max g
01	BYV54-200	TO254	Single diode	H9	10
02	BYV54-200	TO254	Single diode	H4	10
03	BYV54-200	TO254AA	Single diode	S9	10
04	BYV54-200	TO254AA	Single diode	S4	10

Justification :
Variant 02: new variant introduction with TO254 package for European customer
Variant 03: new variant introduction with TO254AA low ohmic package for European customer
Variant 04: new variant introduction with TO254AA low ohmic package for European customer

1.5 MAXIMUM RATINGS

NOTES

3. At T_{case} > +90°C, derate linearly to 0A at +150°C for variant 01 and variant 02.

   At T_{case} > +99°C, derate linearly to 0A at +150°C for variant 03 and 04.

Justification :
For variant 01 and 02
Calcul of the derating is wrong:
For max rating 40A we have used f max at 30A instead of 40A with I0 max at 30A.
The right calculation is:
for I0 max 40A, Vf max = 1.5V (issued from ST data characterization).
Formula applied:
Max power derating = Tj – (Io x Vf x Rth(j-c)) = 150 – (40 x 1.5 x 1) = 90°C

The new limit for the derating is 90°C

For variant 03 and 04
Max power derating = Tj – (Io x Vf x Rth(j-c)) = 150 – (40 x 1.26 x 1) = 99°C

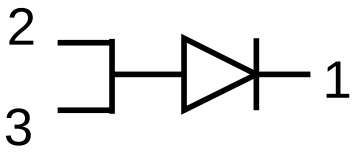
1.8 FUNCTIONAL DIAGRAM

Variant 01 and variant 02

Terminal 1 : Cathode
Terminal 2 : N.C.
Terminal 3 : Anode

Variant 03 and 04

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



Justification :
Variant 02: new variant introduction with TO254 package for European customer
Variant 03: new variant introduction with TO254AA low ohmic package for European customer
Variant 04: new variant introduction with TO254AA low ohmic package for European customer

2.4.1 ROOM TEMPERATURE ELECTRICAL MEASUREMENTS

CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS Note 5	LIMITS		UNIT
				MIN.	MAX.	
Forward Voltage	V_{F1}	4011	Pulse Method I_F= 20 A, Note 1 Variant 01 and 02 Variant 03 and 04	-	 1.1 0.95	V
	V_{F2}	4011	Pulse Method I_F= 30 A, Note 1 Variant 01 and 02 Variant 03 and 04	-	 1.3 1.1	V

Justification :
Variant 02: new variant introduction with TO254 package for European customer
Variant 03: new variant introduction with TO254AA low ohmic package for European customer
Variant 04: new variant introduction with TO254AA low ohmic package for European customer

2.4.2 HIGH AND LOW TEMPERATURES ELECTRICAL MEASUREMENTS

CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS Note 4 and 5	LIMITS		UNIT
				MIN.	MAX.	
Forward Voltage	V_{F1}	4011	T_{case}=+125(+0 -5)°C Pulse Method I_F= 20 A, Note 1 Variant 01 and 02 Variant 03 and 04	-	 1 0.85	V
			T_{case}=-55(+5 -0)°C Pulse Method I_F= 20 A, Note 1 Variant 01 and 02 Variant 03 and 04		 1.3 1.15	V
	V_{F2}	4011	T_{case}=+125(+0 -5)°C Pulse Method I_F= 30 A, Note 1 Variant 01 and 02 Variant 03 and 04	-	 1.1 1	V

Justification :
Variant 02: new variant introduction with TO254 package for European customer
Variant 03: new variant introduction with TO254AA low ohmic package for European customer
Variant 04: new variant introduction with TO254AA low ohmic package for European customer

2.4.3 Notes to Electrical Measurements Tables
note 5 added: For Variant 03 and 04 measurement done when pin 2 and 3 tied together.

Justification :
Variant 02: new variant introduction with TO254 package for European customer
Variant 03: new variant introduction with TO254AA low ohmic package for European customer
Variant 04: new variant introduction with TO254AA low ohmic package for European customer

2.5 PARAMETER DRIFT VALUES

note 2 added: For Variant 03 and 04 measurement done when pin 2 and 3 tied together.

Justification :
Variant 03: new variant introduction with TO254AA low ohmic package for European customer
Variant 04: new variant introduction with TO254AA low ohmic package for European customer

2.6 INTERMEDIATE AND END-POINTS ELECTRICAL MEASUREMENTS

CHARACTERISTICS	SYMBOL	LIMITS		UNITS
		MIN.	MAX.	
Forward Voltage 1 Variant 01 and 02 Variant 03 and 04	V_{F1}	-	 1.1 0.95	V

note 1 added: For Variant 03 and 04 measurement done when pin 2 and 3 tied together.

Justification :

Variant 02: new variant introduction with TO254 package for European customer
Variant 03: new variant introduction with TO254AA low ohmic package for European customer
Variant 04: new variant introduction with TO254AA low ohmic package for European customer

MARK-UP FOR DCR 396
S. Thacker
17/07/08.

DIODES, POWER RECTIFIER, HIGH EFFICIENCY, FAST RECOVERY

BASED ON TYPE BYV54-200

ESCC Detail Specification No. 5103/031

Issue 3 → 4	April 2007 → July 2008

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

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DOCUMENTATION CHANGE NOTICE

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

DCR No.	CHANGE DESCRIPTION
~~287~~ 396	Specification up issued to incorporate editorial and technical 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. 5000
(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: 510303101

- Detail Specification Reference: 5103031
- 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	Description	Lead Material and Finish	Weight max g
01	BYV54-200	TO-254	Single diode	H9	10

* (Add variants 02 to 05 see attached)

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	Unit	Remarks
Forward Surge Current	I_{FSM}	400	A	Note 1
Repetitive Peak Reverse Voltage	V_{RRM}	200	V	Note 2

Thacker, Steve

Para 1.4.2 Component Type Variants

Variant Number	Based on Type	Case	Description	Lead Material and Finish	Weight Max g
01	BYV54-200	TO-254	Single diode	H9	10
02	BYV54-200	TO-254	Single diode	H14	10
03	BYV54-200	TO-254	Single diode	H4	10
04	BYV54-200	TO-254AA	Single diode-Low Ohmic Package	S14	10
05	BYV54-200	TO-254AA	Single diode-Low Ohmic Package	S4	10

Characteristics	Symbols	Maximum Ratings	Unit	Remarks
Average Output Rectified Current	I_O	40	A	50% Duty Cycle Note 3
RMS Forward Current	$I_{F(rms)}$	60	A	
Operating Temperature Range (Case Temperature)	T_{op}	-55 to +150	°C	Note 4
Junction Temperature	T_j	+150	°C	
Storage Temperature Range	T_{stg}	-55 to +150	°C	Note 4
Soldering Temperature	T_{sol}	+260	°C	Note 5
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1	°C/W	Note 6

NOTES:

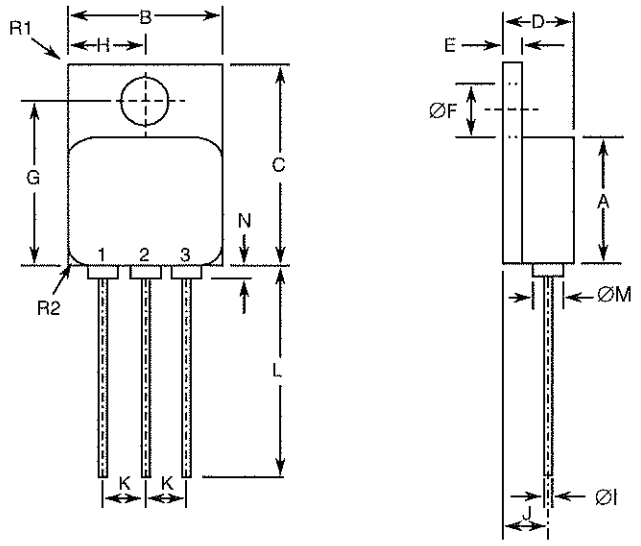
1. Sinusoidal pulse of 10ms duration.
2. Pulsed, duration 5ms, f = 50Hz.
3. ~~At T_{case} > +110°C, derate linearly to 0A at +150°C.~~ At T_{case} > +90°C, derate linearly to 0A at +150°C for Variants 01, 02, 03. At T_{case} > +99°C, derate linearly to 0A at +150°C for Variants 04, 05.
4. For Variants 01, 03, 05, with hot solder dip lead finish, all testing performed at T_{amb} > +125°C shall be carried out in a 100% inert atmosphere.
5. Duration 10 seconds maximum at a distance of not less than 1.5mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.
6. Package mounted on an infinite heatsink.

1.6 HANDLING PRECAUTIONS

The TO-254 and TO-254AA packages contain 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

Metal Flange Mount Package (TO-254 & TO-254AA) - 3 lead



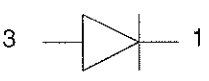
Symbols	Dimensions mm		Notes
	Min	Max	
A	13.59	13.84	
B	13.59	13.84	
C	20.07	20.32	
D	6.3	6.7	
E	1	1.35	
ØF	3.5	3.9	
G	16.89	17.4	
H	6.86 BSC		
ØI	0.89	1.14	2
J	3.81 BSC		
K	3.81 BSC		
L	12.95	14.5	
ØM	3.05 Typical		2
N	-	0.71	2
R1	-	1	3
R2	1.65 Typical		4

NOTES:
1. The terminal identification is specified by the components geometry. See Functional Diagram for the terminal connections.
2. 3 places.
3. Radius of heatsink flange corner, 4 places.
4. Radius of body corner, 4 places.

1.8 FUNCTIONAL DIAGRAM

* Variants 01, 02, 03

Terminal 1: Cathode
Terminal 2: Not connected
Terminal 3: Anode



* Add new figure - see attached

NOTES:
1. The case is not connected to any lead.

1.9 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

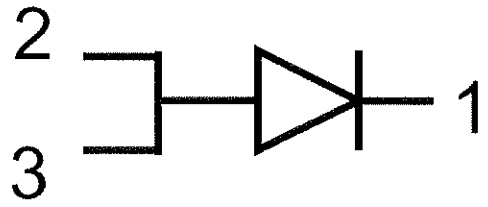
a) Case
The case shall be hermetically sealed and have a metal body. The leads pass through ceramic eyelets brazed into the frame and the lid shall be welded.

Para 1.8

*

Variants 04, 05

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



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 - Chart F4

(a) Constant Acceleration is not applicable.

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.
(c) Traceability information.
(d) Warning sign for Berryllium Oxide.

2.3 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 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 after the Tables.

2.4.1 Room Temperature Electrical Measurements

The measurements shall be performed at T_{amb}=+22 ±3°C.

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions (Note 1)	Limits Min	Limits Max	Units
Reverse Current	I_R	4016	DC Method V_R = 200V	-	50	µA
Forward Voltage	V_{F1}	4011	Pulse Method I_F=20A, Note 2	-	1.1 0.95	V
	V_{F2}	4011	Pulse Method I_F=30A, Note 2	-	1.3 1.1	V
Breakdown Voltage	$V_{(BR)}$	4021	I_R = 100µA	200	-	V
Capacitance	C	4001	V_R = 10V f = 1MHz	-	400	pF
Reverse Recovery Time	t_{rr}	4031	Test Condition A I_F=1A V_R= 30V dI_F/dt=-50A/µs	-	60	ns
Thermal Impedance, Junction to Case	$Z_{th(j-c)}$	3101	I_H = 15V to 40A t_H = 50ms I_M = 50mA t_{md} = 100µs Note 2 3	(Calculate ΔV_F, see Note 3) 4		°C/W

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions (Note 1, 5)	Limits Min	Limits Max	Units
Reverse Current	I_R	4016	T_{case}=+125(+0 -5)°C DC Method V_R = 200V	-	40	mA
Forward Voltage	V_{F1}	4011	T_{case}=+125(+0 -5)°C Pulse Method I_F=20A, Note 2	-	1 0.85	V
			T_{case}=-55(+5 -0)°C Pulse Method I_F=20A, Note 2	-	1.3 1.15	V
	V_{F2}	4011	T_{case}=+125(+0 -5)°C Pulse Method I_F = 30A, Note 2	-	1.1 1	V

2.4.3 Notes to Electrical Measurement Tables

2 1. Pulsed Width ≤ 300µs, Duty Cycle ≤ 2%.
3 2. Performed only during Screening Tests Parameter Drift Values (Initial Measurements), go-no-go.
4 3. 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 Maximum Ratings.
5 4. Read and record measurements shall be performed on a sample of 5 components with 0 failures

1. For Variants 04, 05 testing shall be performed with both anode terminals 2 and 3 tied together

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Para 2.4.1 Room Temperature Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions (Note 1)	Limits		Units
				Min	Max	
Forward Voltage 1	V_{F1}	4011	Pulse Method I_F= 20 A, Note 2 Variants 01, 02, 03 Variants 04, 05	-	 1.1 0.95	V
Forward Voltage 2	V_{F2}	4011	Pulse Method I_F= 30 A, Note 2 Variant 01 to 03 Variant 04 and 05	-	 1.3 1.1	V

Para 2.4.2 High and Low Temperature Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions (Notes 1, 5)	Limits		Units
				Min	Max	
Forward Voltage 1	V_{F1}	4011	T_{case}=+125(+0 -5)°C Pulse Method I_F= 20 A, Note 2 Variants 01, 02, 03 Variants 04, 05	-	 1 0.85	V
			T_{case}=-55(+5 -0)°C Pulse Method I_F= 20 A, Note 2 Variants 01, 02, 03 Variants 04, 05		 1.3 1.15	V
Forward Voltage 2	V_{F2}	4011	T_{case}=+125(+0 -5)°C Pulse Method I_F= 30 A, Note 2 Variants 01, 02, 03 Variants 04, 05	-	 1.1 1	V

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 ±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 Δ	Absolute		
			Min	Max	
Reverse Current	I_R	±6 or (1) ±100%	-	50	µA
Forward Voltage 1	V_{F1}	±0.07	-	1.1	V

* see changes as attached
* 0.95

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}=+22 ±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	
Reverse Current	I_R	-	50	µA
Forward Voltage 1	V_{F1}	-	*	V
*	V_{F2}	*	*	*

* (see changes attached Add V_{F2})

2.7 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

Characteristics	Symbols	Limits	Units
Ambient Temperature	T_{amb}	+150 (+0 -5)	°C
Reverse Voltage	V_R	160	V
Duration	t	≥48	hours

NOTES:

1. For Variants 04, 05 testing shall be performed with both anode terminals 2 and 3 tied together.

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Para 2.5 PARAMETER DRIFT VALUES

Characteristics	Symbols	Limits			Units
		Drift Value Δ	Absolute		
			Min	Max	
Forward Voltage 1 Variants 01, 02, 03 Variants 04, 05	V_{F1}	± 0.07	-	 1.1 0.95	V

Para 2.6 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Characteristics	Symbols	Limits		Units
		Min	Max	
Forward Voltage 1 Variants 01, 02, 03 Variants 04, 05	VF1	-	 1.1 0.95	V
Forward Voltage 2 Variants 01, 02, 03 Variants 04, 05	VF2	-	 1.3 1.1	V

2.8 POWER BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Case Temperature	T_{case}	+125 ±15, Note 1	°C
Junction Temperature	T_j	+150 (+0 -5)	°C
Average Output Rectified Current	I_O	≥ 10, Note 1	A

NOTES:

1. The case temperature and/or output current may be adjusted, within their given limit ranges, to attain the specified junction temperature.
2. For Variants 04, 05 testing shall be performed with both anode terminals 2 and 3 tied together.

2.9 OPERATING LIFE CONDITIONS

The conditions shall be as specified for Power Burn-in.

APPENDIX 'A'

AGREED DEVIATIONS FOR STMICROELECTRONICS (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Deviations from Production Control-Chart F2	Special In-process Control Internal Visual Inspection. Wedge bonds equal to 1.1 wire diameters are acceptable for bonding with a V-Groove tool.