



Page 1 of 14

FUSES, 0.14 TO 3.5 AMPS

BASED ON TYPE MGA-S

ESCC Detail Specification No. 4008/001

Issue 5	September 2015
---------	----------------



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

LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2015. 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
950	Specification upissued to incorporate changes per DCR.

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 and Range of Components	5
1.5	MAXIMUM RATINGS	6
1.6	PARAMETER DERATING INFORMATION	7
1.7	PHYSICAL DIMENSIONS	7
1.8	MATERIALS AND FINISHES	8
2	REQUIREMENTS	8
2.1	GENERAL	8
2.1.1	Deviations from the Generic Specification	8
2.1.1.1	Deviations from Chart F4 - Qualification and Periodic Tests	8
2.2	MARKING	8
2.3	TEST CONDITIONS FOR CURRENT CARRYING CAPACITY	8
2.4	TEST CONDITIONS AND LIMITS FOR OVERLOAD OPERATION	9
2.5	TEST CONDITIONS AND LIMITS FOR VERIFICATION OF OVERLOAD OPERATION AT DC RATED VOLTAGE	9
2.6	TEST CONDITIONS AND LIMITS FOR INSULATION RESISTANCE	10
2.7	TEST CONDITIONS AND LIMITS FOR THERMAL VACUUM	10
2.8	ROOM TEMPERATURE ELECTRICAL MEASUREMENTS	11
2.9	INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS	11
2.10	BURN-IN CONDITIONS	12
2.11	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. 4008.

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: 400800101

- Detail Specification Reference: 4008001
- Component Type Variant Number: 01 (as required)

1.4.2 Component Type Variants and Range of Components

The component type variants and range of components applicable to this specification are as follows:

Variant Number	Rated Current I_R at $T_{amb} = +23^\circ\text{C}$ (Note 1) (A)	AC Rated Voltage (V)	DC Rated Voltage (V)	Cold Resistance (m Ω)		Voltage Drop at Nominal Current (mV) (Note 2)		Weight Max (g)
				Min	Max	Min	Max	
01	0.14	125	125	867	1173	205	310	0.035
02	0.175	125	125	680	920	200	300	0.035
03	0.262	125	125	307	415	132	198	0.035
04	0.35	125	125	204	290	120	180	0.035
05	0.525	125	125	92.2	138.5	80	120	0.035
06	0.7	125	125	83.9	113.4	99	148	0.035
07	1.05	125	125	47.6	64.3	84	126	0.035
08	1.4	125	125	33.1	44.8	78	118	0.035

Variant Number	Rated Current I_R at $T_{amb} = +23^\circ\text{C}$ (Note 1) (A)	AC Rated Voltage (V)	DC Rated Voltage (V)	Cold Resistance (m Ω)		Voltage Drop at Nominal Current (mV) (Note 2)		Weight Max (g)
				Min	Max	Min	Max	
09	1.75	125	125	25	33.9	72	108	0.035
10	2.1	125	125	20.4	27.7	70	106	0.035
11	2.8	63	125	14.4	19.5	67	100	0.035
12	3.5	32	125	11.4	15.5	70	110	0.035

NOTES:

1. The Rated Current I_R is the maximum continuous current a fuse is capable of carrying without blowing. See Parameter Derating Information.
2. Nominal Current = 143% Rated Current and is the maximum current a fuse is capable of carrying for 4 hours minimum without blowing.

1.5 **MAXIMUM RATINGS**

The maximum ratings shall not be exceeded at any time during use or storage.

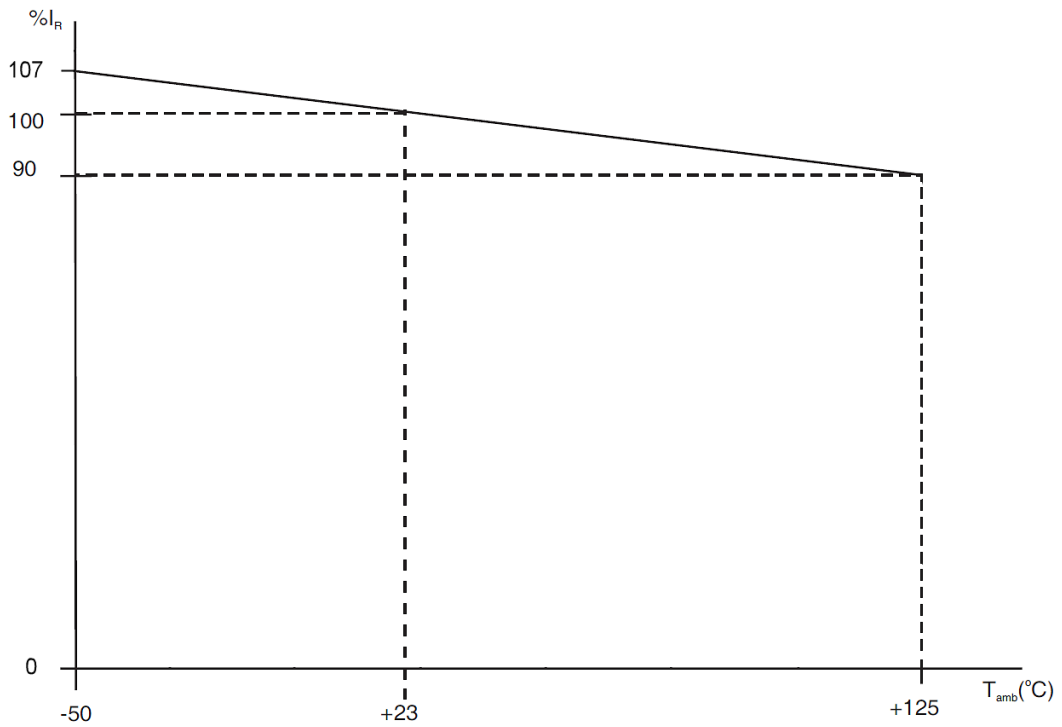
Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Units	Remarks
Rated Current	I_R	Note 1	A	At $T_{amb} = +23^\circ\text{C}$ AC and DC Note 2
Rated Voltage	U_R	Note 1	V	AC or DC
AC Interrupt Current	-	50	A	At maximum AC Rated Voltage. Power factor > 0.95
DC Interrupt Current	-		A	At maximum DC Rated Voltage. Time Constant $\leq 1\text{ms}$
Variants 01 to 10 Variants 11 and 12		300 50		
Operating Temperature Range	T_{op}	-50 to +125	$^\circ\text{C}$	T_{amb} 107% I_R to 90% I_R Note 2
Storage Temperature Range	T_{stg}	-55 to +150	$^\circ\text{C}$	
Soldering Temperature	T_{sol}	+260	$^\circ\text{C}$	Note 3

NOTES:

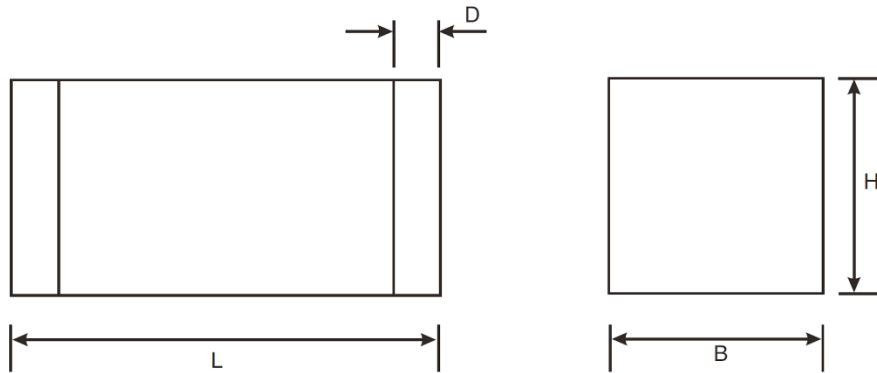
1. The Rated Current and maximum AC and DC Rated Voltage are specified in Component Type Variants and Range of Components.
2. See Parameter Derating Information.
3. 10 seconds maximum and the same terminal may only be resoldered on one more occasion and after a minimum of 10 minutes have elapsed.

1.6 PARAMETER DERATING INFORMATION



Maximum Continuous Current vs. Operating Temperature

1.7 PHYSICAL DIMENSIONS



Symbols	Dimensions mm	
	Min	Max
L	3	3.4
B	1.35	1.75
H	1.35	1.75
D	0.3	0.7

1.8 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

- (a) Body: Ceramic
- (b) Terminal material: Copper
- (c) Terminal plating: Electrolytic nickel of thickness 1µm minimum and 5µm maximum over electrolytic copper of thickness 0.3µm minimum and 2µm maximum, with an electrolytic tin-lead final finish of thickness 5µm minimum and 15µm maximum. The composition of the tin-lead shall be 65 to 95% tin, remainder lead.

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 Chart F4 - Qualification and Periodic Tests*

- (a) Vibration: 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.

2.3 TEST CONDITIONS FOR CURRENT CARRYING CAPACITY

Ref. Current Carrying Capacity in the ESCC Generic Specification.

- Test Current: Nominal Current = 143% Rated Current (DC), as specified in Component Type Variants and Range of Components.
- Duration: 4 hours minimum.
- Test temperature: +22 ±3°C.

2.4 TEST CONDITIONS AND LIMITS FOR OVERLOAD OPERATION
 Ref. Overload Operation in the ESCC Generic Specification.

Overload current conditions and pre-arcing times shall be as follows:

Sample	Overload Current (DC)	Pre-arcing Time (ms)	
		Min	Max
i	357% I _R (Note 1)	2	5000
ii	571% I _R (Note 1)	0.5	10
iii	857% I _R (Note 1)	0.05	2

NOTES:

1. See Component Type Variants and Range of Components for value of I_R.

After each fuse has blown, the test circuit shall remain energized for 30 seconds minimum without any indication of closing. The fuses shall be visually examined and there shall be no evidence of damage to the body or terminals.

2.5 TEST CONDITIONS AND LIMITS FOR VERIFICATION OF OVERLOAD OPERATION AT DC RATED VOLTAGE

Ref. Verification of Overload Operation at DC Rated Voltage in the ESCC Generic Specification.

Overload current conditions and pre-arcing times shall be as follows:

At T_{amb} = +22 ±3°C

Sample	Overload Current (DC)	Pre-arcing Time (ms)	
		Min	Max
i	357% I _R (Note 1)	2	5000
ii	571% I _R (Note 1)	0.5	10
iii	50A	N/A	
iv (Note 2)	300A	N/A	

At T_{amb} = -50 (+5, -0)°C

Sample	Overload Current (DC)	Pre-arcing Time (ms)	
		Min	Max
i	382% I _R (Note 1)	2	5000
ii	611% I _R (Note 1)	0.5	10
iii	50A	N/A	
iv (Note 2)	300A	N/A	

NOTES:

1. See Component Type Variants and Range of Components for value of I_R.
2. Not applicable for Variants 11 and 12.

After each fuse has blown, the test circuit shall remain energized for 30 seconds minimum without any indication of closing. The fuses shall be visually examined and there shall be no evidence of damage to the body or terminals.

2.6 TEST CONDITIONS AND LIMITS FOR INSULATION RESISTANCE

Ref. Insulation Resistance in the ESCC Generic Specification.

- Test Condition: A.
- Test Temperature: $T_{amb} = +22 \pm 3^{\circ}\text{C}$.
- Test Limit: 20k Ω minimum.

2.7 TEST CONDITIONS AND LIMITS FOR THERMAL VACUUM

Ref. Thermal Vacuum in the ESCC Generic Specification.

The current applied to blow one half of the sample of fuses shall be 571% I_R (DC). See Component Type Variants and Range of Components for value of I_R .

The maximum limit of the current clearing I^2t value for each component type variant is given below.

Variant Number	Maximum Current Clearing I^2t at 571% I_R (DC) ($\text{A}^2 \text{s}$)
01	0.0064
02	0.01
03	0.0225
04	0.04
05	0.09
06	0.16
07	0.36
08	0.64
09	1
10	1.44
11	2.56
12	4

2.8 ROOM TEMPERATURE ELECTRICAL MEASUREMENTS

The measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

Characteristics	Symbols	Test Method and Conditions	Limits		Units
			Min	Max	
Cold Resistance	R	ESCC No. 4008	Note 1		mΩ
Voltage Drop	VD	ESCC No. 4008 (Note 2)	Note 1		mV

NOTES:

1. See Component Type Variants and Range of Components for the applicable limits.
2. Test current: Nominal Current = 143% Rated Current (DC), as specified in Component Type Variants and Range of Components.

2.9 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

Unless otherwise specified, 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 where specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

Test Reference per ESCC No. 4008	Characteristics	Symbols	Limits		Units
			Min	Max	
Resistance to Soldering Heat Final Measurements	Cold Resistance	R	Note 1		mΩ
	Voltage Drop	VD	Note 1		mV
Rapid Change of Temperature Final Measurements	Cold Resistance	R	Note 1		mΩ
	Voltage Drop	VD	Note 1		mV
Vibration Final Measurements	Cold Resistance	R	Note 1		mΩ
	Voltage Drop	VD	Note 1		mV
Shock Final Measurements	Cold Resistance	R	Note 1		mΩ
	Voltage Drop	VD	Note 1		mV
Damp Heat, Steady State Final Measurements	Cold Resistance	R	Note 1		mΩ
	Voltage Drop	VD	Note 1		mV

Test Reference per ESCC No. 4008	Characteristics	Symbols	Limits		Units
			Min	Max	
Thermal Vacuum Final Measurements Blown fuses	Insulation Resistance (Note 2)	R _i	Note 2	-	kΩ
Remaining fuses	Cold Resistance	R	Note 1		mΩ
Operating Life Initial Measurements	Cold Resistance (Note 3)	R	Note 1		mΩ
	Voltage Drop (Note 3)	VD	Note 1		mV
Intermediate Measurements (1000h)	Cold Resistance	R	Note 1		mΩ
Final Measurements (2000h)	Cold Resistance	R	Note 1		mΩ
	Voltage Drop	VD	Note 1		mV
	Voltage Drop Drift (from initial measurement)	$\frac{\Delta V}{VD}$	-	±20	
Robustness of Terminations Final Measurements	Cold Resistance	R	Note 1		mΩ
	Voltage Drop	VD	Note 1		mV

NOTES:

1. See Component Type Variants and Range of Components for the applicable limits.
2. See Test Conditions and Limits for Insulation Resistance.
3. This test need not be repeated. The most recent result from the previous test may be used instead.

2.10

BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T _{amb}	+80 (+0 -3)	°C
Test Current	I	95.7% I _R (DC) (Note 1)	A

NOTES:

1. See Component Type Variants and Range of Components for value of I_R.

2.11 OPERATING LIFE CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	+125 (+0 -3)	°C
Test Current	I	95% I_R (DC) (Note 1)	A

NOTES:

1. See Component Type Variants and Range of Components for value of I_R .

APPENDIX 'A'
AGREED DEVIATIONS FOR SCHURTER (CH)

Items Affected	Description of Deviations
Deviations from Screening Tests - Chart F3	<p>External Visual Inspection:</p> <ul style="list-style-type: none"> • Any void in the ceramic with a maximum surface diameter and depth of $\leq 0.12\text{mm}$ shall be considered acceptable. • Any discoloured areas on the ceramic with a diameter $\leq 0.5\text{mm}$ shall be considered acceptable. • Any metallic particle on the ceramic with an area $\leq 0.02\text{mm}^2$ shall be considered acceptable.
Deviations from Qualification and Periodic Tests - Chart F4	Rapid Change of Temperature: Number of cycles shall be 200.
	<p>External Visual Inspection:</p> <ul style="list-style-type: none"> • Any void in the ceramic with a maximum surface diameter and depth of $\leq 0.12\text{mm}$ shall be considered acceptable. • Any discoloured areas on the ceramic with a diameter $\leq 0.5\text{mm}$ shall be considered acceptable. • Any metallic particle on the ceramic with an area $\leq 0.02\text{mm}^2$ shall be considered acceptable.
	Thermal Vacuum: The vacuum chamber pressure during Thermal Vacuum test shall be $\leq 5 \times 10^{-2}$ torr (6.7Pa).
	Solderability: Any void in the solder which is $\leq 0.3\text{mm}$ deep shall be considered acceptable.