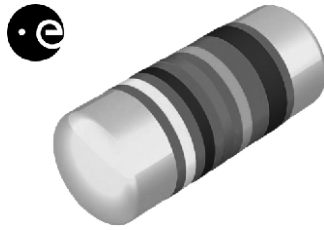


Hi-Rel Thin Film MINI-MELF Resistors



MS1 ESCC high-reliability thin film MINI-MELF resistors are the premium choice for the design and manufacture of equipment where matured technology and proven reliability are of the utmost importance. They are regularly used in communication and research satellites and fit equally well into aircraft and military electronic systems.

Approval of the MS1 ESCC is granted by the European Space Components Coordination and registered in the ESCC Qualified Parts List, REP005.

FEATURES

- High-reliability product
- ESA approved to ESCC 4001/022
- Advanced thin film technology
- SnPb termination plating, minimum 6 % Pb

APPLICATIONS

- Aerospace
- Avionics
- Military

METRIC SIZE

DIN	0204
CECC	RC3715M

TECHNICAL SPECIFICATIONS

DESCRIPTION	MS1 ESCC
CECC size	RC3715M
Resistance range	2.21 Ω to 5.11 M Ω
Resistance tolerance	$\pm 1 \%$; $\pm 0.5 \%$; $\pm 0.1 \%$
Temperature coefficient	± 50 ppm/K; ± 25 ppm/K; ± 15 ppm/K
Rated dissipation P_{70}	0.25 W
Operating voltage, U_{max} , AC _{RMS} or DC	200 V
Permissible film temperature, $\vartheta_{F max}$.	125 °C
Operating temperature range	- 55 °C to 125 °C
Max. resistance change at P_{70} , $ \Delta R $ max., after:	
1000 h	$\leq (0.35 \% R + 50 \text{ m}\Omega)$
2000 h	$\leq (0.5 \% R + 50 \text{ m}\Omega)$
Permissible voltage against ambient (insulation):	
1 min; $U_{ins RMS}$	500 V
Storage temperature range	-65 °C to +155 °C

Note

- These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

DESCRIPTION		RESISTANCE RANGE
TCR	TOLERANCE	MS1 ESCC
± 50 ppm/K	$\pm 1 \%$	2.21 Ω to 5.11 M Ω
± 25 ppm/K	$\pm 0.5 \%$	10.0 Ω to 1.00 M Ω
	$\pm 0.1 \%$	43.2 Ω to 1.00 M Ω
± 15 ppm/K	$\pm 0.1 \%$	43.2 Ω to 221 k Ω

Notes

- The indicated combinations of TCR, tolerance and resistance range are a subset of those combinations approved to ESCC 4001/022
- According to ESCC 4001/022, resistance values are to be selected from the E96 series only



PART NUMBER AND PRODUCT DESCRIPTION

PART NUMBER: MS1ESCC0E5620BBX00

M	S	1	E	S	C	C	0	E	5	6	2	0	B	B	X	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TYPE MS1ESCC	VERSION 0 = ESCC 4001/022	TCR C = ± 50 ppm/K D = ± 25 ppm/K E = ± 15 ppm/K	RESISTANCE 3 digit value 1 digit multiplier MULTIPLIER 8 = *10 ⁻² 9 = *10 ⁻¹ 0 = *10 ⁰ 1 = *10 ¹ 2 = *10 ² 3 = *10 ³ 4 = *10 ⁴	TOLERANCE F = ± 1 % D = ± 0.5 % B = ± 0.1 %	PACKAGING LX BX
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PRODUCT DESCRIPTION: MS1 15 562R 0.1 % BX ESCC 4001/022

MS1	15	562R	0.1 %	BX	ESCC 4001/022
TYPE MS1	TCR ± 50 ppm/K ± 25 ppm/K ± 15 ppm/K	RESISTANCE 562R = 562 Ω 4K64 = 4.64 kΩ	TOLERANCE ± 1 % ± 0.5 % ± 0.1 %	PACKAGING LX BX	SPECIFICATION ESCC 4001/022

Note

- Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION.

ESCC 4001/022 COMPONENT NUMBER AND ELECTRICAL CHARACTERISTICS

Example of the component number and electrical characteristics for a resistor: MS1 15 562R 0.1 % ESCC 4001/022

400102201 5620B1

The elements used in the component number have the following meaning:

4001022	Detail specification number, ESCC 4001/022
01	Type variant, 01 for all MS1 product

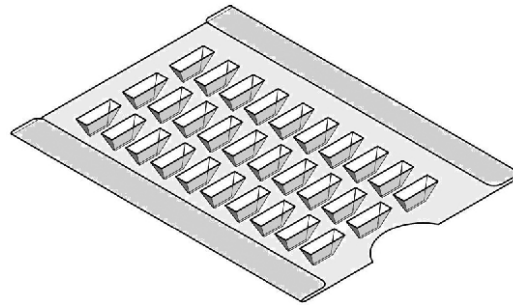
The elements used in the electrical characteristics have the following meaning:

5620	Resistance acc. IEC 60062, four-character code system
B	Tolerance on rated resistance acc. IEC 60062
1	Temperature coefficient of resistance:
3 ± 50 ppm/K
2 ± 25 ppm/K
1 ± 15 ppm/K

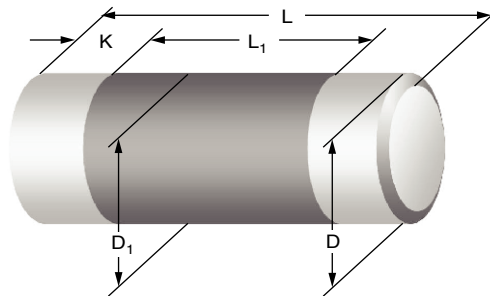
PACKAGING						
TYPE	CODE	QUANTITY ⁽¹⁾	PACKAGING STYLE	WIDTH	PITCH	PACKAGING DIMENSIONS
MS1 ESCC	BX	100 to 499	Antistatic blister tape acc. IEC 60286-3 ⁽²⁾ Type II	8 mm	4 mm	Box
		500 to 3000				Reel Ø 180 mm
	LX	1 to 30	Matrix case ⁽³⁾	-	7.8 mm x 15 mm	92 mm x 70 mm x 6 mm

Notes

- (1) Minimum order quantity is 30 pieces, except for samples for Lot Validation Testing
 (2) Leader is extended to 500 mm cover tape, including 200 mm carrier tape with empty compartments
 (3) The matrix case is not specified dissipative or conductive and thus may not be suitable for use in ESD protected areas



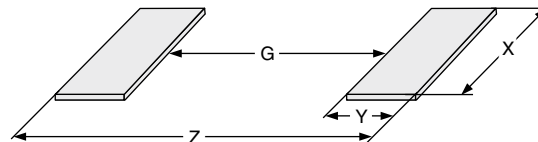
Matrix Case

DIMENSIONS


DIMENSIONS AND MASS						
TYPE	L (mm)	D (mm)	L ₁ min. (mm)	D ₁ (mm)	K (mm)	MASS (mg)
MS1	3.60 + 0/- 0.15	1.5 + 0/- 0.2	1.65	D + 0/- 0.15	0.7 ± 0.2	18

Note

- Color code marking is applied according to IEC 60062 ⁽¹⁾ in five bands. Each color band appears as a single solid line, voids are permissible if at least 2/3 of the band is visible from each radial angle of view. The last color band for tolerance is wider than the other bands. The body coating is of light green color, temperature coefficients other than ± 50 ppm/K are marked with color dots, yellow for ± 25 ppm/K or orange for ± 15 ppm/K.

PATTERN STYLES FOR MELF RESISTORS


RECOMMENDED SOLDER PAD DIMENSIONS								
TYPE	WAVE SOLDERING				REFLOW SOLDERING			
	G (mm)	Y (mm)	X (mm)	Z (mm)	G (mm)	Y (mm)	X (mm)	Z (mm)
MS1	1.5	1.5	1.8	4.5	1.6	1.25	1.7	4.1

Note

- The given solder pad dimensions reflect the considerations for board design and assembly as outlined e.g. in standards IEC 61188-5-x, or in publication IPC-7351. They do not guarantee any supposed thermal properties, however, they will be found adequate for most general applications.



DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a high grade ceramic body (Al_2O_3) and conditioned to achieve the desired temperature coefficient. Nickel plated steel termination caps are firmly pressed on the metallized rod. A special laser is used to achieve the target value by smoothly cutting a helical groove in the resistive layer without damaging the ceramics. The resistor elements are covered by a protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final SnPb plating, controlled for a minimum lead content of 6 %. Five color code rings designate the resistance value and tolerance in accordance with **IEC 60062** ⁽¹⁾.

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. Only accepted products are placed into a special matrix case packaging or into antistatic blister tape in accordance with **IEC 60286-3** ⁽¹⁾.

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow, or vapor phase as shown in **IEC 61760-1** ⁽¹⁾. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters, and aqueous solutions. The suitability of conformal coatings, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system. Solderability is specified for 2 years after production. The permitted storage time is 20 years.

APPROVALS

The resistors are approved to **ESCC 4001/022**. Conformity is indicated by the **ESCC Qualified Components** logo on the package label. Approval is granted by the European Space Components Coordination and registered in the ESCC Qualified Parts List, REP005.

SCREENING TESTS

These products are subjected to a screening test according to the ruling of the generic specification **ESCC 4001** and the detail specification **ESCC 4001/022**.

The production is succeeded by production test sequences for resistance, plating properties, solderability, and dimensions. This sequence is followed by screening tests for overload, non-linearity, temperature coefficient, resistance at room temperature, and a visual inspection. A certificate of conformity provides summary information by reporting the numbers of rejects for each test or inspection.

The requirements for burn-in with measurement of resistance drift, for a test of bend strength of the end face plating, and for a vibration test are waived by the detail specification **ESCC 4001/022**. The seal test is not applicable since MS1 is not a hermetically sealed product.

LOT VALIDATION TESTS

Execution of Lot Validation Tests according to the ruling of **ESCC 4001** is available as a separate order item. This is to be combined with the dedicated order line for the required amount of samples, using packaging code "LX".

The applicable scope of the Lot Validation Tests, graduated to Group 1, Group 2, and Group 3, is illustrated in the datasheet with the number of samples required for each level.

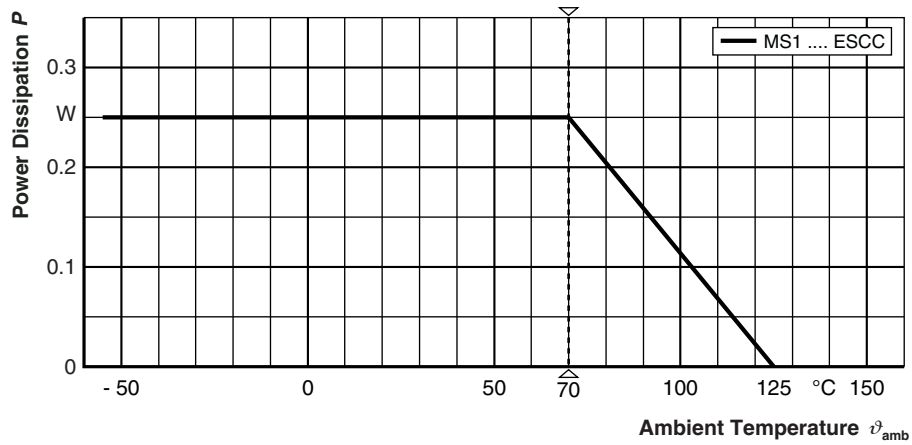
Deliverable item to the Lot Validation Tests is the test report together with the used samples.

Note

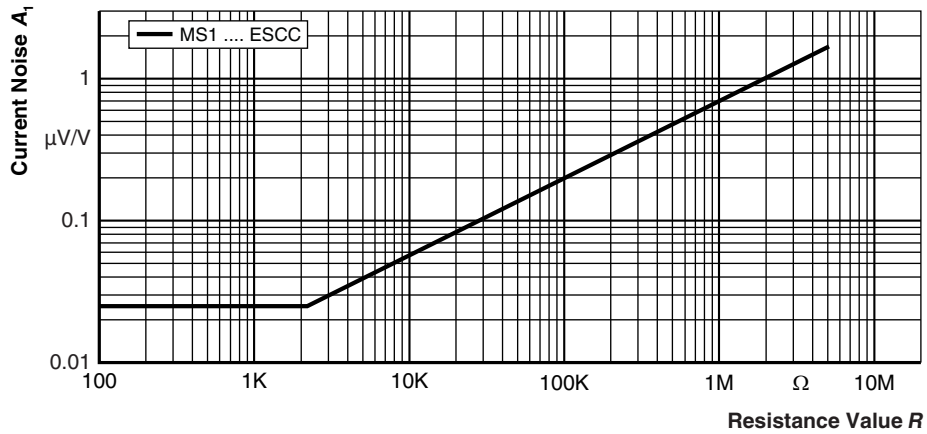
⁽¹⁾ The quoted IEC standards are also released as EN standards with the same number and identical contents



FUNCTIONAL PERFORMANCE

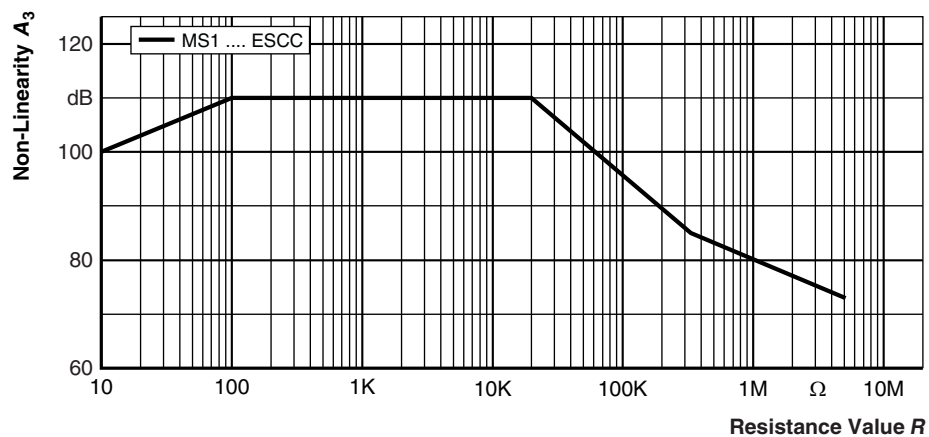


Derating



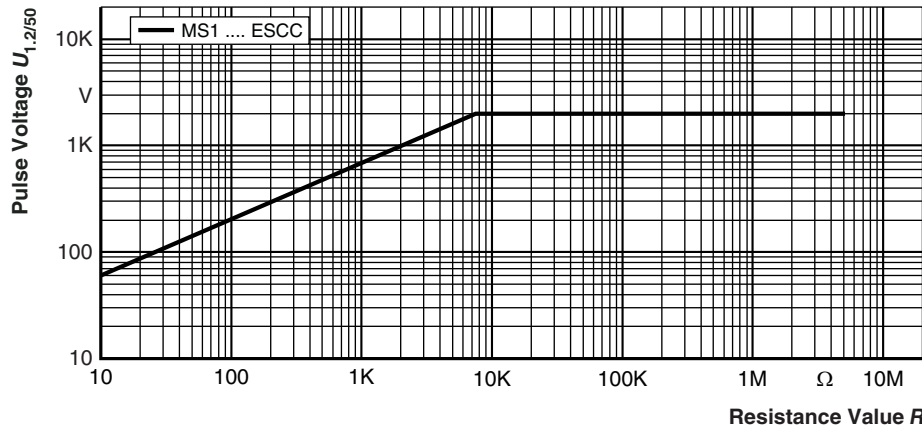
In accordance with IEC 60195

Current Noise - A_1



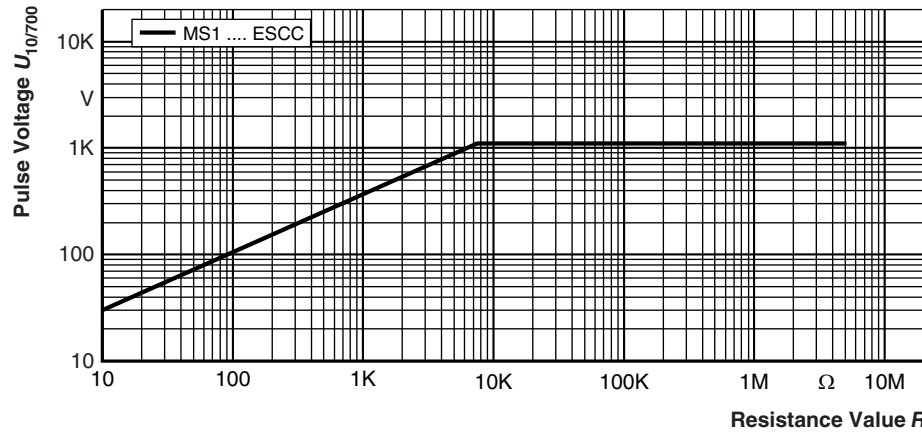
In accordance with IEC/TR 60440, superior requirements adopted from EN 140401-803

Non-linearity - A_3



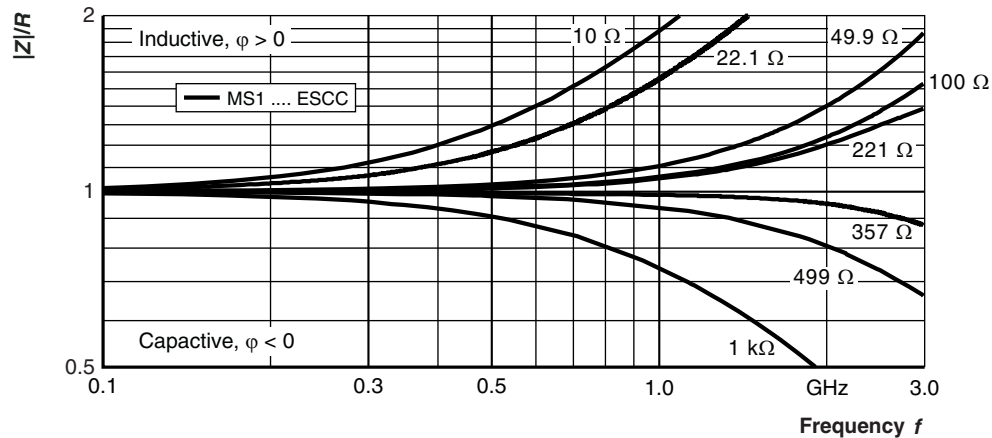
Pulse load rating in accordance with IEC 60115-1, 4.27; 1.2 μ s/50 μ s; 5 pulses at 12 s intervals; for permissible resistance change 0.5 %

1.2/50 Pulse



Pulse load rating in accordance with IEC 60115-1, 4.27; 10 μ s/700 μ s; 10 pulses at 1 min intervals; for permissible resistance change 0.5 %

10/700 Pulse



RF-Behaviour



TESTS AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

ESCC 4001, generic specification, issue 3 (2010)

ESCC 4001/022, detail specification, issue 3 (2010)

The components are approved within the ESCC system. For the full test schedule refer to the documents listed above.

The tests are carried out in accordance with the stated specifications.

Unless otherwise specified the following standard atmospheric conditions apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar)

The components are mounted for testing on printed-circuit boards in accordance with IEC 60115-1, 4.31, unless otherwise specified.

TEST PROCEDURES AND REQUIREMENTS				
ESCC 4001 PARAGRAPH	ESCC 4001/022 PARAGRAPH	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)
			Stability for product types: MS1 ESCC	2.21 Ω to 5.11 M Ω
PRODUCTION CONTROL (CHART F2)				
8.3.2	2.5.1	Resistance	(22 \pm 3) °C	\pm 1 % R; \pm 0.5 % R; \pm 0.1 % R
4.5	(ESCC 23500) 1.8.2	Plating - Thickness - Pb contents	X-ray fluorescence analysis	SnPb layer \geq 3 μ m \geq 6 % Pb
8.14	(IEC 60068-2-20, Ta)	Solderability	Solder bath method; SnPb40; non-activated flux; (235 \pm 5) °C; (2 \pm 0.5) s	Good tinning (\geq 95 % covered); No visible damage; \pm (0.15 % R + 50 m Ω)
8.6	1.6	Dimension check	-	-
SCREENING TESTS (CHART F3)				
8.1	2.3 1.5	Overload	$U = \sqrt{10 \times P_{70} \times R} \leq 630$ V 0.1 s	\pm (0.25 % R + 50 m Ω)
8.2	(IEC/TR 60440)	Non-linearity (3 rd harmonic ratio)	-	$A_3 \geq A_{3 \text{ min.}}$ according to diagram non-linearity; $(\bar{A}_3 - 2 \times \sigma)_{\text{Lot}} \leq A_3 \leq (\bar{A}_3 + 2 \times \sigma)_{\text{Lot}}$
8.3.3	2.5.2	Resistance at high and low temperature (temperature coefficient)	- (55 \pm 3) °C (125 \pm 3) °C	\pm 50 ppm/K; \pm 25 ppm/K; \pm 15 ppm/K
8.3.2	2.5.1	Resistance	(22 \pm 3) °C	\pm 1 % R; \pm 0.5 % R; \pm 0.1 % R
8.6	1.6	External visual inspection	-	-
QUALIFICATION AND PERIODIC TESTS (CHART F4)				
8.11.2	2.1.1.2	Robustness of terminations:		
8.11.2.1	(IEC 60115-1, 4.32)	Adhesion (shear test)	5 N; 10 s	No visible damage; \pm (0.25 % R + 50 m Ω)
8.12	(IEC 60068-2-20, Tb) 2.4	Resistance to soldering heat	Solder bath method; (260 \pm 5) °C; (10 \pm 1) s	\pm (0.15 % R + 50 m Ω)
8.10	1.5	Climatic sequence:		\pm (0.5 % R + 50 m Ω) $R_{\text{ins}} \geq 1$ G Ω
8.10.2	(IEC 60068-2-2, Ba)	Dry heat	125 °C; 16 h	
8.10.3	(IEC 60068-2-30, Db)	Damp heat, cyclic	55 °C; \geq 90 % RH; 24 h; 1 cycle	
8.10.4	(IEC 60068-2-1, Aa)	Cold	- 55 °C; 1 h off; 0.75 h on	
8.10.5	(IEC 60068-2-13, M)	Low air pressure	2 kPa; (25 \pm 10) °C; 1 h; $U = \sqrt{P_{70} \times R} \leq U_{\text{max.}}$	
8.10.6	(IEC 60068-2-30, Db)	Damp heat, cyclic	55 °C; \geq 90 % RH; 24 h; 5 cycles	
8.10.7	-	DC load	$U = \sqrt{P_{70} \times R} \leq U_{\text{max.}}$ 1 min	

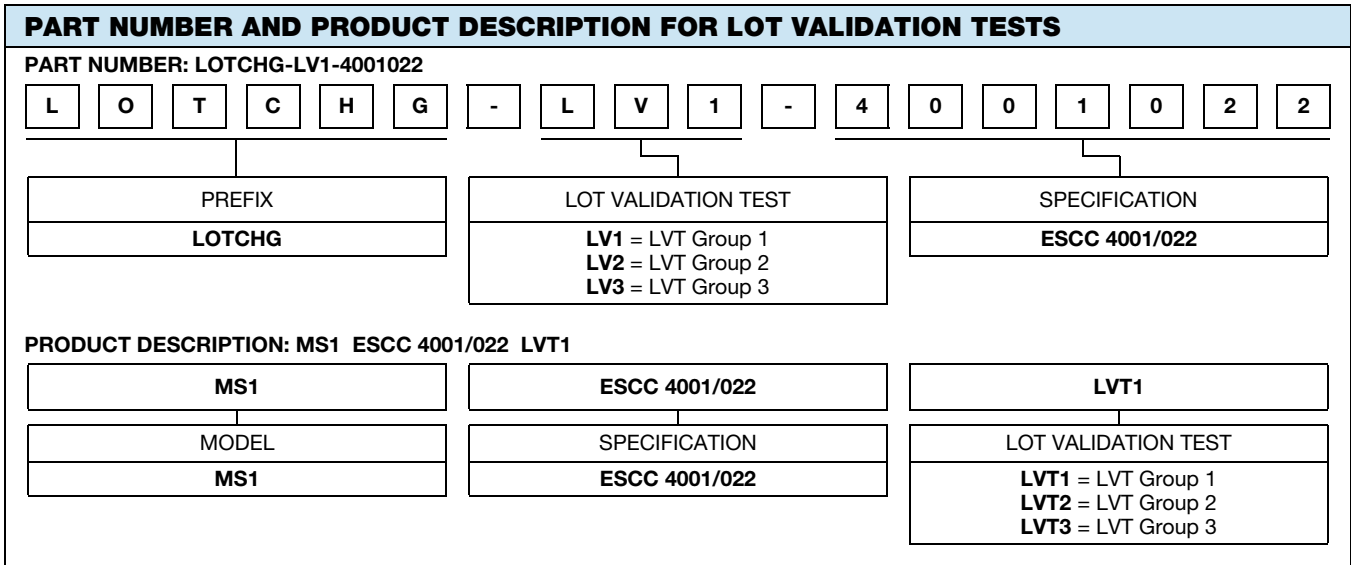


TEST PROCEDURES AND REQUIREMENTS				
ESCC 4001 PARAGRAPH	ESCC 4001/022 PARAGRAPH	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)
			MS1 ESCC	2.21 Ω to 5.11 M Ω
8.3.1.2.2	(IEC 60115-1, 4.6.1.5)	Insulation resistance	V-shaped test jig $U = 500$ V; 1 min	$R_{ins} \geq 1$ G Ω
8.3.1.3.2	(IEC 60115-1, 4.7) 1.5	Voltage proof	V-shaped test jig $U_{RMS} = 1.4 \times U_{ins RMS}$; $f = (50 \pm 10)$ Hz; 1 min	No breakdown; no flashover
8.13	2.7 1.5	Endurance at operating life	$U = \sqrt{P_{70} \times R} \leq U_{max.}$; 1.5 h on; 0.5 h off 70 °C; 1000 h 70 °C; 2000 h	$\pm (0.35 \% R + 50$ m Ω) $\pm (0.5 \% R + 50$ m Ω) $R_{ins} \geq 1$ G Ω
8.14	(IEC 60068-2-20, Ta)	Solderability	Solder bath method; SnPb40; non-activated flux (235 \pm 5) °C; (2 \pm 0.5) s	Good tinning (≥ 95 % covered); no visible damage; $\pm (0.15 \% R + 50$ m Ω)
8.15	(ESCC 24800)	Permanence of marking	a) Ethyl alcohol b) Isopropyl alcohol 25 °C; 3 x 1 min hard toothbrush; 3 x 10 strokes	Marking legible; no visible damage

LOT VALIDATION TESTS

Execution of Lot Validation Tests is available as a separate order item. Deliverable item to the Lot Validation Tests is the test report together with the used samples. The samples need to be ordered as a separate item.

SCOPE OF LOT VALIDATION TESTS			
GROUP 1	ENVIRONMENTAL AND MECHANICAL		48 samples
	Robustness of terminations: Shear (adhesion)	ESCC 4001, 8.11.2.1	(6 samples)
	Resistance to soldering heat	ESCC 4001, 8.12	(6 samples)
	Climatic sequence	ESCC 4001, 8.10	(12 samples)
GROUP 2	ENDURANCE		36 samples
	Endurance at operating life, 2000 h	ESCC 4001, 8.13	(15 samples)
GROUP 3	ELECTRICAL AND ASSEMBLY		21 samples
	Insulation resistance	ESCC 4001, 8.3.1.2.2	(15 samples)
	Voltage proof	ESCC 4001, 8.3.1.3.2	
	Solderability	ESCC 4001, 8.14	(6 samples)
	Permanence of marking	ESCC 4001, 8.15	



Note

- Execution of Lot Validation Tests can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION.

ORDER TEXT EXAMPLE

An order of a Lot Validation Tests shall be combined with a dedicated order line for the required amount of samples, using packaging code "LX", see the example below:

POS	QTY	ITEM	
...			
0010	650	MS1 15 562R 0.1 % BX ESCC 4001/022 400102201 5620B1	{Quantity for consumption}
0011	36	MS1 15 562R 0.1 % LX ESCC 4001/022 400102201 5620B1	{Quantity for LVT samples}
0012	1	MS1 ESCC 4001/022 LVT2	{Lot Validation Test, Group 2}
...			



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