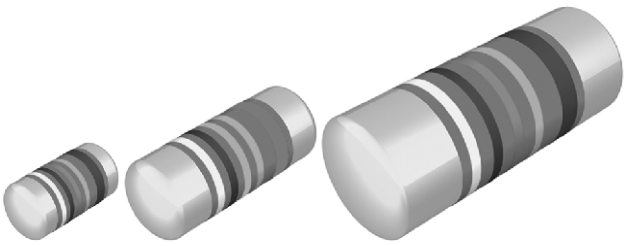
High Frequency MELF Resistors



FEATURES

- Speciality product for RF applications
- Low-inductance non-helical trimmed product
- Suitable for more than 10 GHz
- Force fitted steel caps, tin plated on nickel barrier
- Pure Sn termination on Ni barrier layer
- Compatible with lead (Pb)-free and lead containing soldering processes
- Lead (Pb)-free and RoHS compliant

APPLICATIONS

- Telecommunication equipment
- Industrial electronics.

MMU 0102 HF, MMA 0204 HF and MMB 0207 HF speciality thin film MELF resistors for RF applications are the perfect choice in high frequency circuit designs where the impedance change due to the parasitic inductance of regular and professional resistors can not be accepted. Typical applications are in the fields of telecommunication equipment and industrial electronics.

METRIC SIZE			
DIN:	0102	0204	0207
CECC:	RC 2211M	RC 3715M	RC 6123M

TECHNICAL SPECIFICATIONS

DESCRIPTION	MMU 0102 HF		MMA 0204 HF		MMB 0207 HF	
Metric CECC size	RC 2211M		RC 3715M		RC 6123M	
Resistance range	6.8 Ω to 470 Ω		1.5 Ω to 475 Ω		6.8 Ω to 470 Ω	
Resistance tolerance	± 2 %		± 1 %		± 2 %	
Temperature coefficient	± 50 ppm/K					
Operation mode	standard	power	standard	power	standard	power
Climatic category (LCT/UCT/days)	55/125/56	55/155/56	55/125/56	55/155/56	55/125/56	55/155/56
Rated dissipation, P_{70} [1]	0.2 W	0.3 W	0.25 W	0.4 W	0.4 W	1.0 W [2]
Operating voltage, U_{max} AC/DC	limited by P_{70}		limited by P_{70}		limited by P_{70}	
Film temperature	125 °C	155 °C	125 °C	155 °C	125 °C	155 °C
Max. resistance change at P_{70} for resistance range, $\|\Delta R/R\|$ max., after:	6.8 Ω to 470 Ω		1.5 Ω to 475 Ω		6.8 Ω to 470 Ω	
1000 h	≤ 0.25 %	≤ 0.5 %	≤ 0.25 %	≤ 0.5 %	≤ 0.25 %	≤ 0.5 %
8000 h	≤ 0.5 %	≤ 1.0 %	≤ 0.5 %	≤ 1.0 %	≤ 0.5 %	≤ 1.0 %
225 000 h	≤ 1.5 %	-	≤ 1.5 %	-	≤ 1.5 %	-
Permissible voltage against ambient (insulation):						
1 minute; U_{ins}	150 V		300 V		500 V	
continuous	75 V		75 V		75 V	
Failure rate	≤ 2.0×10^{-9}/h		≤ 0.7×10^{-9}/h		≤ 0.7×10^{-9}/h	

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.

[1] The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heatflow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded. Furthermore, a high level of ambient temperature or of power dissipation may raise the temperature of the solder joint, hence special solder alloys or board materials may be required to maintain the reliability of the assembly.

[2] Specified power rating requires dedicated heat-sink pads.

12NC INFORMATION

- The resistors have a 12-digit numeric code starting with 2312.
- The subsequent 4 digits indicate the resistor type, specification and packaging; see the 12NC table.
- The remaining 4 digits indicate the resistance value:
  - The first 3 digits indicate the resistance value.
  - The last digit indicates the resistance decade in accordance with the 12NC Indicating Resistance Decade table.

Last Digit of 12NC Indicating Resistance Decade

RESISTANCE DECADE	LAST DIGIT
1 Ω to 9.99 Ω	8
10 Ω to 99.9 Ω	9
100 Ω to 999 Ω	1

12NC Example

The 12NC of a MMU 0102 HF resistor, value 50 Ω and TCR 50 with ± 2 % tolerance, supplied in blister tape of 3000 units per reel is: 2312 168 0500 9.

12NC - resistor type and packaging

DESCRIPTION			ORDERING CODE 2312						
			BLISTER TAPE ON REEL					BULK CASE	
TYPE	TCR	TOL.	B1	B2	BL	B7	B0	M3	M8
MMU 0102 HF	± 50 ppm/K	± 2 %	173 0....	-	168 0....	-	178 0....	-	063 0....
MMA 0204 HF	± 50 ppm/K	± 1 %	143 0....	-	158 0....	-	148 0....	043 0....	-
MMB 0207 HF	± 50 ppm/K	± 2 %	183 0....	198 0....	-	188 0....	-	-	-

PART NUMBER AND PRODUCT DESCRIPTION[1)]

PART NUMBER[2)]: MMA0204AC5009FBL00

M	M	A	0	2	0	4	A	C	5	0	0	9	F	B	L	0	0

MODEL/SIZE	SPECIAL CHARACTER	TC	VALUE	TOLERANCE	PACKAGING[3)]	SPECIAL
MMU0102 **MMA0204** **MMB0207**	**A =** High Frequency	**C =** ± 50 ppm/K	3 digit value 1 digit multiplier **Multiplier** **8** = $*10^{-2}$ **9** = $*10^{-1}$ **0** = $*10^{0}$	**F =** ± 1 % **G =** ± 2 %	**B1** **B3** **B0** **B2** **B7** **M3** **M8**	up to 2 digits **00** = standard

PRODUCT DESCRIPTION: MMA 0204-50 1 % HF BL 50R

MMA	0204	- 50	1 %	HF	BL	50R
MODEL **MMU** **MMA** **MMB**	SIZE **0102** **0204** **0207**	TCR ± **50** ppm/K	TOLERANCE **± 1 %** **± 2 %**	SUFFIX **HF** = High Frequency	PACKAGING[3)] **B1** **BL** **B0** **B2** **B7** **M3** **M8**	RESISTANCE VALUE **50R** = 50 Ω

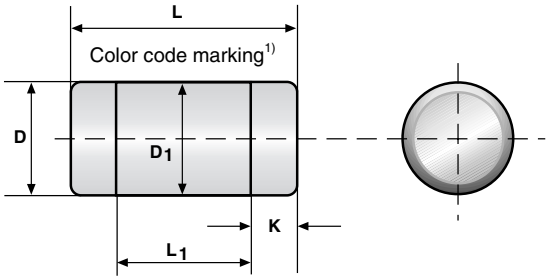
Note

1. Products can be ordered using either the PRODUCT DESCRIPTION or the 12NC.
2. The PART NUMBER is shown to facilitate the introduction of a unified part numbering system. Currently, this PART NUMBER is applicable in the Americas and in Asia/Pacific only.
3. Please refer to table PACKAGING, see below.

PACKAGING

MODEL	BLISTER TAPE ON REEL ACC. IEC 60286 -3			BULK CASE ACC. IEC 60286 -6	
	DIAMETER	PIECES/REEL	CODE	PIECES/BULK CASE	CODE
MMU 0102 HF	180 mm/7"	1000	B1	8000	M8
	180 mm/7"	3000	B3 = BL		
	330 mm/13"	10 000	B0		
MMA 0204 HF	180 mm/7"	1000	B1	3000	M3
	180 mm/7"	3000	B3 = BL		
	330 mm/13"	10 000	B0		
MMB 0207 HF	180 mm/7"	1000	B1	-	-
	180 mm/7"	2000	B2		
	330 mm/13"	7000	B7		

DIMENSIONS



DIMENSIONS - MELF resistor types, mass and relevant physical dimensions

TYPE	L (mm)	D (mm)	$L_{1\ min}$ (mm)	D_1 (mm)	K (mm)	MASS (mg)
MMU 0102 HF	2.2 + 0/- 0.1	1.1 + 0/- 0.1	1.2	D + 0/- 0.1	0.4 ± 0.05	7
MMA 0204 HF	3.6 + 0/- 0.2	1.4 + 0/- 0.1	1.8	D + 0/- 0.15	0.8 ± 0.1	19
MMB 0207 HF	5.8 + 0/- 0.2	2.2 + 0/- 0.2	2.8	D + 0/- 0.2	1.25 ± 0.15	79

1) Color code marking is applied according to IEC 60062* in four bands (E24 series) or five bands (E96 series). Each colour 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 approx, 50 % wider than the other bands. An interrupted band between the 3rd and 4th full band identifies the special high frequency type.

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

DESCRIPTION		RESISTANCE VALUE1)		
TCR	TOLERANCE	MMU 0102 HF	MMA 0204 HF	MMB 0207 HF
± 50 ppm/K	± 2 %	50 Ω, 6.8 Ω to 470 Ω	-	50 Ω, 6.8 Ω to 470 Ω
	± 1 %	-	50 Ω, 1.5 Ω to 475 Ω	-

1) Resistance value to be selected from E24 series for ± 2 % tolerance and from E96 series for ± 1 % tolerance, for other values please contact the factory.

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 (85 % Al_2O_3, for MICRO-MELF: 96 % Al_2O_3) ceramic body and conditioned to achieve the desired temperature coefficient. Nickel plated steel termination caps are firmly pressed on the metallised rods. A special laser is used to achieve the target value by smoothly cutting a non helical pattern with a resulting low inductivity 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 pure tin on nickel plating. Four or five color code rings designate the resistance value and tolerance in accordance with **IEC 60062***. Additional black dots near the 3rd colour ring identify the special HF product.

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. Only accepted products are laid directly into the blister tape in accordance with **IEC 60286-3*** or bulk case in accordance with **IEC 60286-6*.**

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase as shown in **IEC 61760-1***. Excellent solderability is proven, even after extended storage in excess of 10 years. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The resistors are completely lead (Pb)-free, the pure tin plating provides compatibility with lead (Pb)-free soldering processes. The immunity of the plating against tin whisker growth has been proven under extensive testing.

All products comply with the **GADSL**[1] and the **CEFIC-EECA-EICTA**[2] list of legal restrictions on hazardous substances. This includes full compliance with the following directives:

- 2000/53/EC End of Vehicle life Directive (ELV) and Annex II (ELV II)
- 2002/95/EC Restriction of the use of Hazardous Substances Directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

[1] Global Automotive Declarable Substance List, see www.gadsl.org

[2] CEFIC (European Chemical Industry Council), EECA (European Electronic Component Manufacturers Association), EICTA (European trade organisation representing the information and communications technology and consumer electronics), see www.eicta.org -> issues -> environment policy -> chemicals -> chemicals for electronics

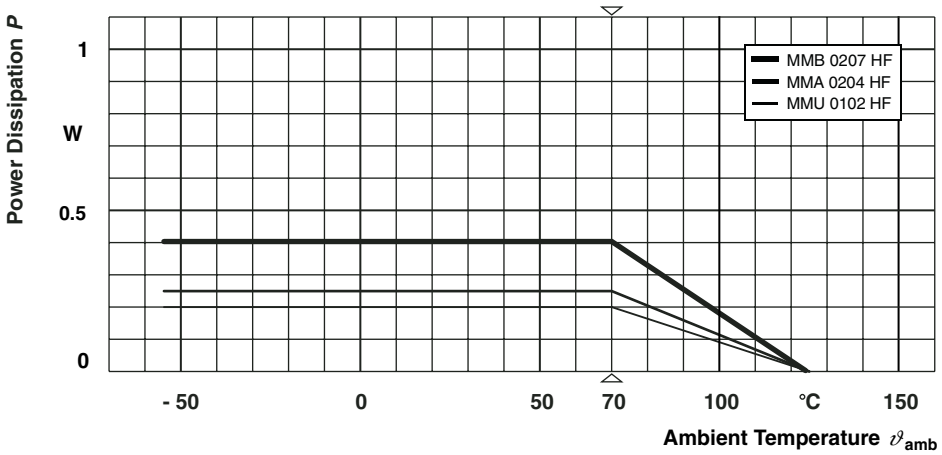
APPROVALS

Where applicable the resistors are tested in accordance with **EN 140401-803** (superseding **CECC 40401-803**) which refers to **EN 60115-1, EN 140400** and the variety of enviromental test procedures of the **IEC 60068*** series.

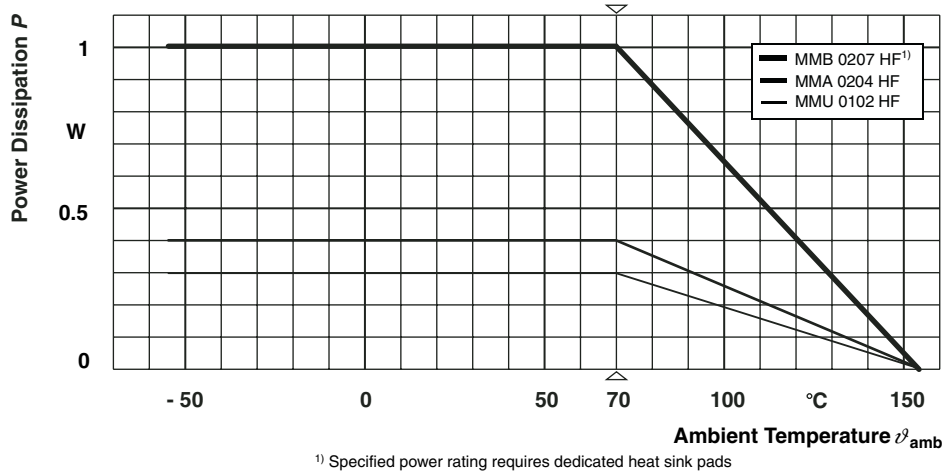
Vishay BEYSCHLAG has achieved **"Approval of Manufacturer"** in accordance with **IEC QC 001002-3, clause 2**. The release certificate for **"Technology Approval Schedule"** in accordance with **CECC 240001** based on **IEC QC 001002-3, clause 6** is granted for the Vishay BEYSCHLAG manufacturing process.

Note:
* The quoted IEC standards are also released as EN standards with the same number and identical contents.

FUNCTIONAL PERFORMANCE

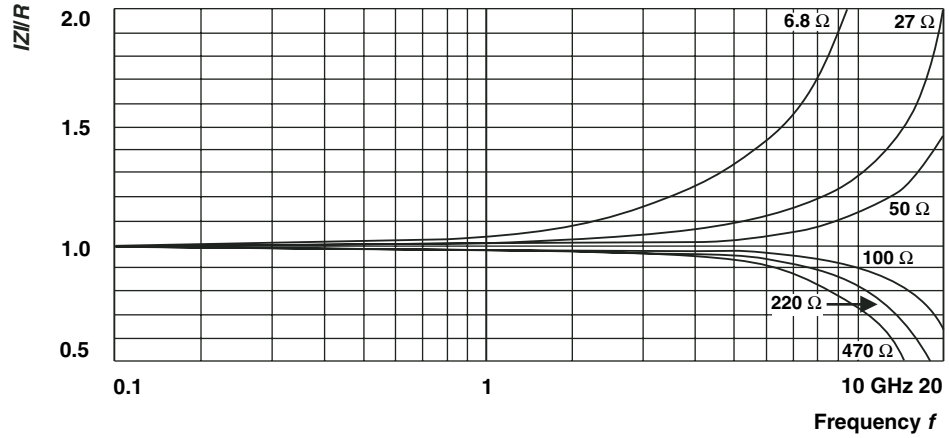


Derating - Standard Operation



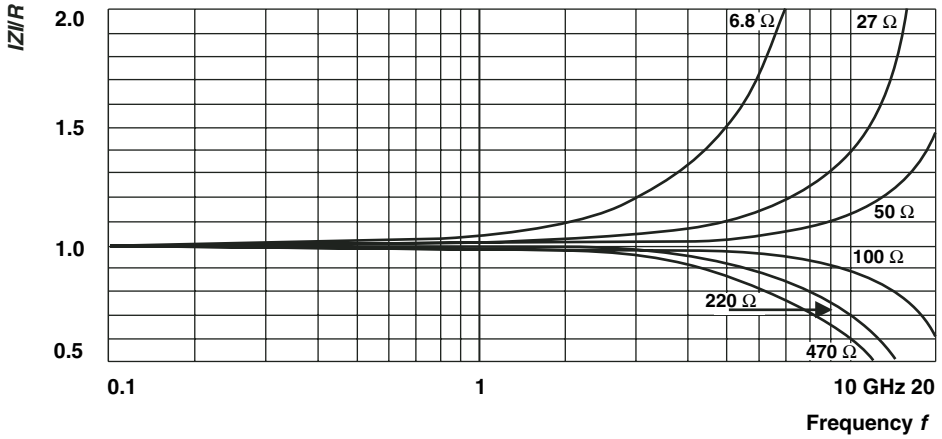
1) Specified power rating requires dedicated heat sink pads

Derating - Power Operation



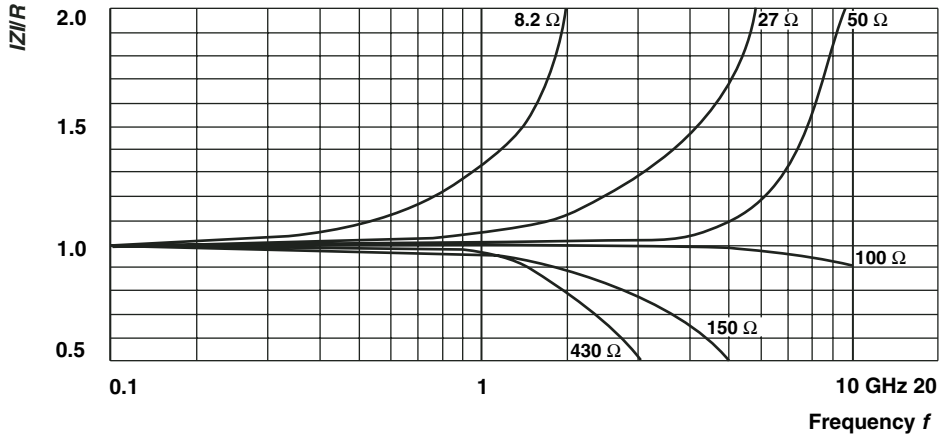
IZI/R for MMU 0102 HF

RF - Behavior



IZI/R for MMA 0204 HF

RF - Behavior



IZI/R for MMB 0207 HF

RF - Behavior

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the following specifications:

EN 60115-1, generic specification

EN 140400, sectional specification

EN 140401-803, detail specification

The Test Procedures and Requirements table contains the applicable tests selected from the documents listed above.

The tests are carried out in accordance with IEC 60068* and under standard atmospheric conditions in accordance with IEC 60068-1, 5.3.* Climatic category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days) is valid.

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar).

The components are mounted for testing on printed-circuit boards in accordance with EN 140400, 2.3.3, unless otherwise specified.

The requirements stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140401-803.

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2* TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)
			stability for product types:	
			MMU 0102 HF	6.8 Ω to 470 Ω
			MMA 0204 HF	1.5 Ω to 475 Ω
			MMB 0207 HF	6.8 Ω to 470 Ω
4.5	-	resistance	MMU 0102 HF, MMB 0207 HF: MMA 0204 HF:	± 2 % R ± 1 % R
4.8.4.2	-	temperature coefficient	at 20/- 55/20 °C and 20/125/20 °C	± 50 ppm/K
4.25.1	-	endurance at 70 °C: standard operation mode	$U = \sqrt{P_{70} \times R} \leq U_{max}$; 1.5 h on; 0.5 h off; 70 °C; 1000 h; 70 °C; 8000 h	 ± (0.25 % R + 0.05 Ω) ± (0.5 % R + 0.05 Ω)
		endurance at 70 °C: power operation mode	$U = \sqrt{P_{70} \times R} \leq U_{max}$; 1.5 h on; 0.5 h off; 70 °C; 1000 h 70 °C; 8000 h	 ± (0.5 % R + 0.05 Ω) ± (1 % R + 0.05 Ω)
4.25.3	-	endurance at upper category temperature	125 °C; 1000 h 155 °C; 1000 h	± (0.5 % R + 0.05 Ω) ± (1 % R + 0.05 Ω)
4.24	78 (Cab)	damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (0.5 % R + 0.05 Ω)
4.23		climatic sequence:		
4.23.2	2 (Ba)	dry heat	UCT; 16 h	
4.23.3	30 (Db)	damp heat, cyclic	55 °C; 24 h; ≥ 90 % RH; 1 cycle	
4.23.4	1 (Aa)	cold	LCT; 2 h	
4.23.5	13 (M)	low air pressure	8.5 kPa; 2 h; (25 ± 10) °C	
4.23.6	30 (Db)	damp heat, cyclic	55 °C; 24 h; ≥ 90 % RH; 5 cycles	
4.23.7	-	d.c. load	$U = \sqrt{P_{70} \times R} \leq U_{max}$; 1 min. LCT = - 10 °C; UCT = 85 °C	 ± (0.5 % R + 0.05 Ω)
-	1 (Aa)	cold	- 55 °C; 2 h	± (0.1 % R + 0.01 Ω)
4.19	14 (Na)	rapid change of temperature	30 minutes at - 55 °C; 30 minutes at 155°C; 5 cycles	± (0.25 % R + 0.05 Ω)

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2* TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\triangle R$)
			stability for product types:	
			MMU 0102 HF	6.8 Ω to 470 Ω
			MMA 0204 HF	1.5 Ω to 475 Ω
			MMB 0207 HF	6.8 Ω to 470 Ω
4.13	-	short time overload; standard operation mode	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max}$; 5 s	± (0.1 % R + 0.01 Ω)
		short time overload; power operation mode	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max}$; 5 s	± (0.1 % R + 0.01 Ω)
4.40	-	electrostatic discharge (Human Body Model)	IEC 61340-3-1*; 3 pos. + 3 neg. discharges MMU 0102 HF: 800 V MMA 0204 HF: 1000 V MMB 0207 HF: 2000 V	± (0.5 % R + 50 mΩ)
4.29	45 (XA)	component solvent resistance	isopropyl alcohol; 50 °C; method 2	no visible damage
4.30	45 (XA)	solvent resistance of marking	isopropyl alcohol; 50 °C; method 1, toothbrush	marking legible; no visible damage
4.17.2	58 (Td)	solderability	solder bath method; SnPb40; non-activated flux; (215 ± 3) °C; (3 ± 0.3) s	good tinning (≥ 95 % covered); no visible damage
			solder bath method; SnAg3Cu0.5 or SnAg3.5; non-activated flux; (235 ± 3) °C; (2 ± 0.2) s	good tinning (≥ 95 % covered); no visible damage
4.18.2	58 (Td)	resistance to soldering heat	solder bath method; (260 ± 5) °C; (10 ± 1) s	± (0.5 % R + 0.05 Ω)
4.32	21 (Ue_3)	shear (adhesion)	45 N	no visible damage
4.35	-	flammability	IEC 60 695-11-5*, needle flame test; 10 s	no burning after 30 s

Note:
* The quoted IEC standards are also released as EN standards with the same number and identical contents.

REVISION HISTORY

Compared to the prior revision of this datasheet, 26-Feb-04, the following changes have been applied:

- Introduction of a standardized part numbering system
- Additional emphasis on the clean balance of materials and on the compliance with various EU directives
- Introduction of a test and requirements for electrostatic discharge (ESD)
- No other change of technical contents
- No product change

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