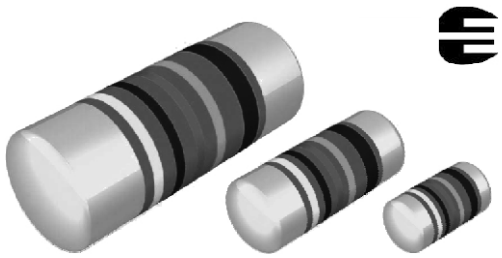
MELF Resistors with Established Reliability



MMU 0102 VG03, MMA 0204 VG03 and MMB 0207 VG03 thin film MELF resistors with established reliability are the perfect choice for all high-reliability applications typically found in military, aircraft and spacecraft electronics. These versions supplement the families of professional and precision MELF resistors MMU 0102, MMA 0204 and MMB 0207.

FEATURES

- Approved to EN 140401-803, version E
- Established reliability, failure rate level E6
- Advanced thin film technology
- Pure matte Sn termination on Ni barrier layer
- Single Lot Date Code
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
GREEN (5-2008)

APPLICATIONS

- Medical
- Military
- Aerospace

METRIC SIZE			
DIN	0102	0204	0207
EN/CECC	RC2211M	RC3715M	RC6123M

TECHNICAL SPECIFICATIONS			
DESCRIPTION	**MMU 0102 VG03**	**MMA 0204 VG03**	**MMB 0207 VG03**
EN/CECC style (size)	RC2211M	RC3715M	RC6123M
Resistance range	100 Ω to 2.21 MΩ; 0 Ω	1 Ω to 5.11 MΩ; 0 Ω	1 Ω to 10 MΩ; 0 Ω
Resistance tolerance	± 1 %; ± 0.1 %		
Temperature coefficient	± 50 ppm/K; ± 15 ppm/K		
Rated dissipation, P_{70}	0.2 W	0.25 W	0.4 W
Operating voltage, $U_{max.}$ AC/DC	150 V	200 V	300 V
Permissible film temperature, $\vartheta_{F\ max.}$	125 °C		
Operating temperature range	- 55 °C to 125 °C		
Max. resistance change at P_{70} for resistance range, $\lvert\Delta R/R\rvert$ after:	100 Ω to 221 kΩ	1 Ω to 332 kΩ	1 Ω to 1 MΩ
1000 h	≤ 0.15 % (1)		
8000 h	≤ 0.3 % (1)		
225 000 h	≤ 1 %		
Permissible voltage against ambient (insulation):			
1 min; U_{ins}	200 V	300 V	500 V
Continuous	75 V	75 V	75 V
Assessed failure rate level	E6 = 10^{-6}/h		
Quality factor, π_Q	0.3		
Failure rate: $FIT_{observed}$	< 0.1 x 10^{-9}/h		

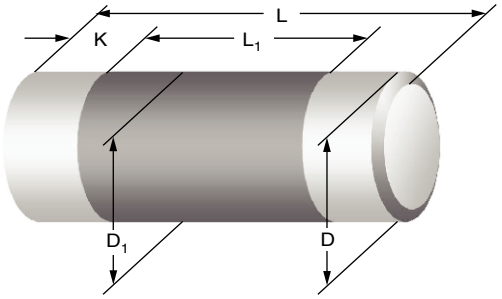
Notes

- 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.
- The failure rate level E6 (10^{-6}/h, π_Q = 0,3), corresponding to MIL level P, is superior to level E5 (10^{-5}/h, π_Q = 1) and thus may be used as a replacement.

(1) These tightened requirements provide a user advantage over the requirements of EN 140401-803.

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DIMENSIONS

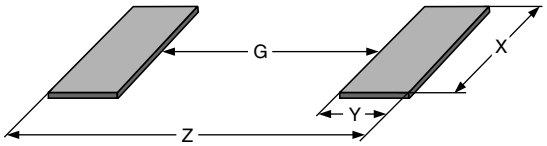


DIMENSIONS AND MASS						
TYPE	L (mm)	D (mm)	$L_{1\ min.}$ (mm)	D_1 (mm)	K (mm)	MASS (mg)
MMU 0102 VG03	2.2 + 0/- 0.1	1.1 + 0/- 0.1	1.2	D + 0/- 0.1	0.4 ± 0.05	8
MMA 0204 VG03	3.6 + 0/- 0.2	1.4 + 0/- 0.1	1.8	D + 0/- 0.15	0.8 ± 0.1	22
MMB 0207 VG03	5.8 + 0/- 0.15	2.2 + 0/- 0.2	3.2	D + 0/- 0.2	1.15 ± 0.1	80

Note

- Color code marking is applied according to IEC 60062 (3) 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 approximately 50 % wider than the other bands. An interrupted blue band between the 1st and 2nd full band indicates the failure rate level E6. An interrupted orange band between the 4th and 5th full band indicates the temperature coefficient of 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)
MMU 0102 VG03	0.7	1.2	1.5	3.1	1.1	0.8	1.3	2.7
MMA 0204 VG03	1.5	1.5	1.8	4.5	1.7	1.2	1.6	4.1
MMB 0207 VG03	2.8	2.1	2.6	7.0	3.2	1.7	2.4	6.6

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.

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PART NUMBER AND PRODUCT DESCRIPTION

Part Number: MMA0204WC4999FB300
Part Number: MMA0204WZ0000ZB300

M	M	A	0	2	0	4	W	C	4	9	9	9	F	B	3	0	0
M	M	A	0	2	0	4	W	Z	0	0	0	0	Z	B	3	0	0

TYPE/SIZE	VERSION	TCR	RESISTANCE	TOLERANCE	PACKAGING
MMU 0102 **MMA 0204** **MMB 0207**	**W** = EN 140401-803, "Version E"; failure rate level E6	**C** = ± 50 ppm/K **E** = ± 15 ppm/K **Z** = Jumper	**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** = $*10^{4}$ **5** = $*10^{5}$ **0000** = Jumper	**F** = ± 1 % **B** = ± 0.1 % **Z** = Jumper	**B1** **B3** **B0** **B2** **B7**

Product Description: MMA 0204-50 1 % VG03 BL 49R9
Product Description: MMA 0204 VG03 BL 0R0

MMA 0204	-50	1 %	VG03	BL	49R9
MMA 0204	**-**	**-**	**VG03**	**BL**	**0R0**
TYPE/SIZE	TCR	TOLERANCE	VERSION	PACKAGING	RESISTANCE
MMU 0102 **MMA 0204** **MMB 0207**	± **50** ppm/K ± **15** ppm/K	**± 1 %** **± 0.1 %**	**VG03** = EN 140401-803, "Version E"; failure rate level E6	**B1** **BL** **B0** **B2** **B7**	**49R9** = 49.9 Ω **4K64** = 4.64 kΩ **0R0** = Jumper

Notes

- The products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION.
- Products within a packaging unit are single lot date code.

PACKAGING

TYPE	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	REEL DIAMETER
MMU 0102 VG03	B1	1000	Antistatic blister tape acc. IEC 60286-3 Type II	8 mm	4 mm	180 mm/7"
	B3 = BL	3000				
	B0	10 000				330 mm/13"
MMA 0204 VG03	B1	1000	Antistatic blister tape acc. IEC 60286-3 Type II	8 mm	4 mm	180 mm/7"
	B3 = BL	3000				
	B0	10 000				330 mm/13"
MMB 0207 VG03	B1	1000	Antistatic blister tape acc. IEC 60286-3 Type II	12 mm	4 mm	180 mm/7"
	B2	2000				
	B7	7000				330 mm/13"

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EN 140401-803 ORDERING INFORMATION

Example of the ordering information for a resistor: MMA 0204-50 1 % VG03 49R9

EN140401-803EZRC3715MR49R9FE6

Example of the ordering information for a zero ohm jumper: MMA 0204 VG03 0R0

EN140401-803EZRC3715M-0R00-E6

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

EN140401-803	EN detail specification number
EZ	Assessment level for the zero-defect approach
RC3715M	Style (size)
R	Temperature coefficient, according to EN 60062 R = ± 50 ppm/K; P = ± 15 ppm/K
49R9	Resistance, according to EN 60062, 4 characters
F	Tolerance on rated resistance, according to EN 60062 F = ± 1 %; B = ± 0.1 %
E6	Failure rate level according to EN 60115-1, annex ZR

Notes

- The ordering information according to EN 140401-803:2007 shown above succeeds and replaces the ordering information according to earlier versions of the detail specification EN 140401-803 or its predecessor CECC 40401-803, for example:

  CECC 40401-803 EZ RC3715M C 49R9 F E6

  CECC 40401-803 S RC3715 C 49R9 F E6

  with EZ; S — Assessment level, where EZ is successor to and superior replacement for S

  RC3715M; RC3715 — Style, with added suffix M for “metric”

  C — Temperature coefficient, according to the detail specification C = ± 50 ppm/K; E = ± 15 ppm/K.

- EN 140401-803 succeeds the prior specifications CECC 40401-803, CECC 40401-001 (now “Version E”) and CECC 40401-005 (now “Version A”).

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

DESCRIPTION		RESISTANCE		
TCR	**TOLERANCE**	**MMU 0102 VG03**	**MMA 0204 VG03**	**MMB 0207 VG03**
± 50 ppm/K	± 1 %	100 Ω to 2.21 MΩ	1 Ω to 5.11 MΩ	1 Ω to 10 MΩ
± 15 ppm/K	± 0.1 %	100 Ω to 100 kΩ	75 Ω to 100 kΩ	75 Ω to 499 kΩ
Jumper		≤ 10 mΩ; $I_{max.}$ = 2 A	≤ 10 mΩ; $I_{max.}$ = 3 A	≤ 10 mΩ; $I_{max.}$ = 5 A

Note

- According to EN 140401-803, resistance values are to be selected from the E96 series for ± 1 % tolerance and from the E192 series for ± 0.1 % tolerance.

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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 rods. 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 pure tin on nickel plating. Five color code rings designate the resistance value and tolerance in accordance with **IEC 60062** [3].

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. This includes pulse load screening (for $R \geq 10\ \Omega$) and additional non-linearity screening (for $R \geq 30\ \Omega$) for the elimination of products with a potential risk of early life failures according to EN 140401-803, 2.1.2.2. Only accepted products are laid directly into the blister tape in accordance with **IEC 60286-3** [3]**, Type II**. Products within a package unit are from the same production lot and carry the same date code.

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** [3]. Solderability is specified for 2 years after production or requalification, however, excellent solderability is proven after extended storage in excess of 10 years. The permitted storage time is 20 years.

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.

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.

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)
- 2011/65/EU Restriction of the use of Hazardous Substances directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

APPROVALS

The resistors are approved within the IECQ-CECC Quality Assessment System for Electronic Components to the detail specification **EN 140401-803** which refers to **EN 60115-1**, **EN 140400** and the variety of environmental test procedures of the **IEC 60068** [3] series.

Conformity is attested by the use of the **CECC** logo ( ) as the mark of conformity on the package label.

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.

The Vishay BEYSCHLAG production facility is registered with the CAGE code D9539.

RELATED PRODUCTS

A wider range of TCR, tolerance and resistance values, plus the option of values from a different E series is available with products approved to **EN 140401-803**, Version A, without established reliability, nominal failure rate level E0 (quality factor $\pi_Q = 3$). See the datasheets:

- "Professional MELF Resistors" (www.vishay.com/doc?28713)
- "Precision MELF Resistors" (www.vishay.com/doc?28714)
- "High Precision MELF Resistor" (www.vishay.com/doc?28715)

Notes

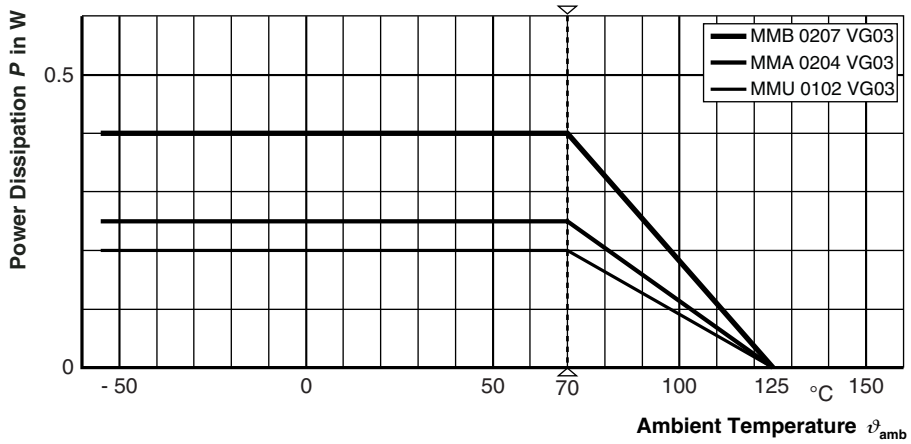
[1] Global Automotive Declarable Substance List, see www.gadsl.org.

[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/index.php?id=995 → issues → environment policy → chemicals → chemicals for electronics.

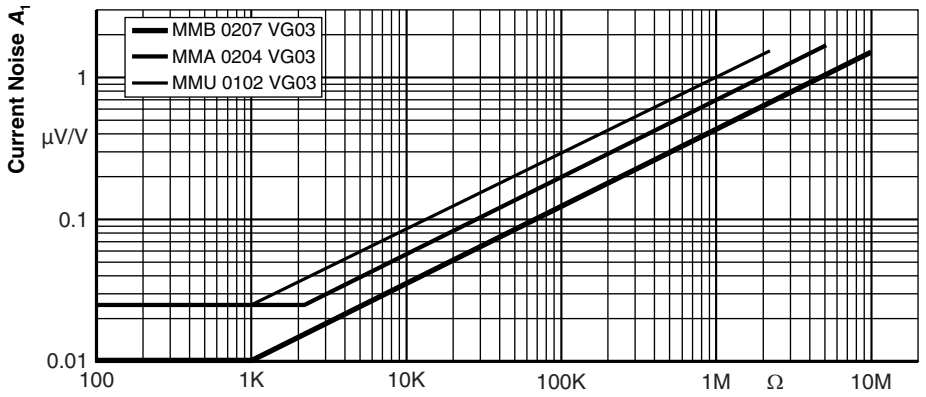
[3] The quoted IEC standards are also released as EN standards with the same number and identical contents.

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FUNCTIONAL PERFORMANCE

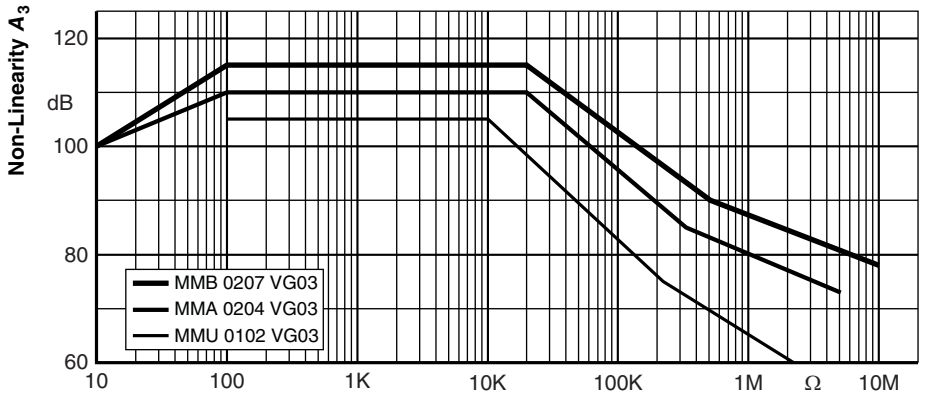


Derating



In accordance with IEC 60195

Current Noise - A_1



In accordance with IEC/TR 60440

Non-Linearity - A_3

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FUNCTIONAL PERFORMANCE

Further information on the performance of these products is given in the following datasheets:

- "Professional MELF Resistors", document no. 28713
- "Precision MELF Resistors", document no. 28714

TESTS AND REQUIREMENTS

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

For further information on the tests and requirements of these products please refer to the specifications mentioned above, and to the following datasheets:

- "Professional MELF Resistors" (www.vishay.com/doc?28713)
- "Precision MELF Resistors" (www.vishay.com/doc?28714)

HISTORICAL 12NC INFORMATION

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

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
1 kΩ to 9.99 kΩ	2
10 kΩ to 99.9 kΩ	3
100 kΩ to 999 kΩ	4
1 MΩ to 9.99 MΩ	5
10 MΩ	6

Historical 12NC Example

The 12NC of a MMU 0102 VG03 resistor, value 287K and TCR 50 with ± 1 % tolerance, supplied in blister tape of 3000 units per reel was: 2312 165 02874.

HISTORICAL 12NC - Resistor type and packaging

DESCRIPTION			2312			
			BLISTER TAPE ON REEL			BULK CASE
TYPE	**TCR**	**TOL.**	**B1 1000 PIECES**	**BL 3000 PIECES**	**B0 10 000 PIECES**	**M8 8000 PIECES**
MMU 0102 VG03	± 50 ppm/K	± 1 %	170 0....	165 0....	175 0....	060 0....
	± 15 ppm/K	± 0.1 %	172 0....	167 0....	177 0....	062 0....
	Jumper		172 90001	167 90001	177 90001	062 90001
TYPE	**TCR**	**TOL.**	**B1 1000 PIECES**	**BL 3000 PIECES**	**B0 10 000 PIECES**	**M3 3000 PIECES**
MMA 0204 VG03	± 50 ppm/K	± 1 %	140 0....	155 0....	145 0....	040 0....
	± 15 ppm/K	± 0.1 %	142 0....	157 0....	147 0....	042 0....
	Jumper		142 90001	157 90001	147 90001	042 90001
TYPE	**TCR**	**TOL.**	**B1 1000 PIECES**	**B2 2000 PIECES**	**B7 7000 PIECES**	
MMB 0207 VG03	± 50 ppm/K	± 1 %	180 0....	195 0....	185 0....	-
	± 15 ppm/K	± 0.1 %	182 0....	197 0....	187 0....	
	Jumper		182 90001	197 90001	187 90001	

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