



## CMA

- **Speciality Product for EMC Sensitive Applications**
- **Special Carbon Film Technology for Maximum Heat Stress Capability**
- **Up to 4 kV or 70 W Pulse Load Capability**
- **Resistance Range: 10  $\Omega$  ... 100 k $\Omega$**
- **Size           DIN:           0204**  
                  **CECC:           RC 3715**

**CMA Speciality MELF Resistors with advanced pulse load capability are the perfect choice for circuitries exposed to high levels of electromagnetic interference or electrostatic discharge. The resistors are used as well in the protection circuitry of signal and mains input lines for the protection from surge pulses. The applications are in all fields of automotive, telecommunication and industrial equipment.**

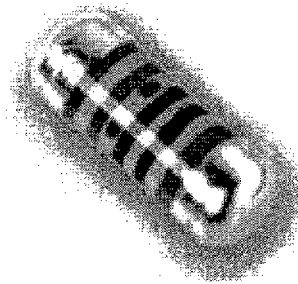
The production of the **CMA Speciality MELF Resistors** with advanced pulse load capability strictly follows an extensive set of instructions established for reproducibility. A homogeneous and dense carbon film is deposited on a high grade (85 %  $\text{Al}_2\text{O}_3$ ) ceramic body. Nickel plated steel termination caps are firmly pressed on the coated 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 resistors are covered by a base coating and a light blue outer lacquer. This encapsulation provides electrical, mechanical and climatic protection. Four or five colour code rings designate the resistance value and tolerance according to **IEC 60 062**.

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 according to **IEC 60 286-3** or bulk case according to **IEC 60 286-6**.

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.

The resistors are tested according to **IEC 60 115** and **IEC 60 068**. They meet the requirements of **CECC 40 401-803** and **EN 140 400**, where applicable.

BEYSCHLAG has achieved "**Approval of Manufacturer**" according to **EN 100 114-1**.



CMA 0204

MELF  
Resistor Products



**Resistance Range**

	Tolerance	IEC Series	CMA 0204
	2 %	E24	10 Ω - 100 kΩ

**Electrical Data**

Style		CMA 0204	
Climatic Category		55 / 125 / 56	
Operation Mode (see A4)		Standard	Power
Film Temperature	°C	125	155
Specified Lifetime	h	8 000	

The specification for standard operation mode ensures a maximum temperature of 110 °C at the solder joint on test boards according to CECC 00 B02

Thermal Resistance $R_{th}$	K/W	200	
Rated Dissipation $P_{70}$	W	0,25	0,4

<b>Voltage Pulse Load Capability</b>			
Pulse Voltage, $U_{max}$	V	up to 700	
Single Pulse IEC 1,2 / 50	V	up to 4 000	
<b>Energy Pulse Load Capability</b>			
Single Pulse, $P_{max}$	W	up to 70	
Continuous Pulses, $P_{max}$	W	up to 40	
Current Noise, $A_1$	µV/V	down to 0,2	
Attenuation 3rd Harmonic, $A_3$	dB	up to 90	

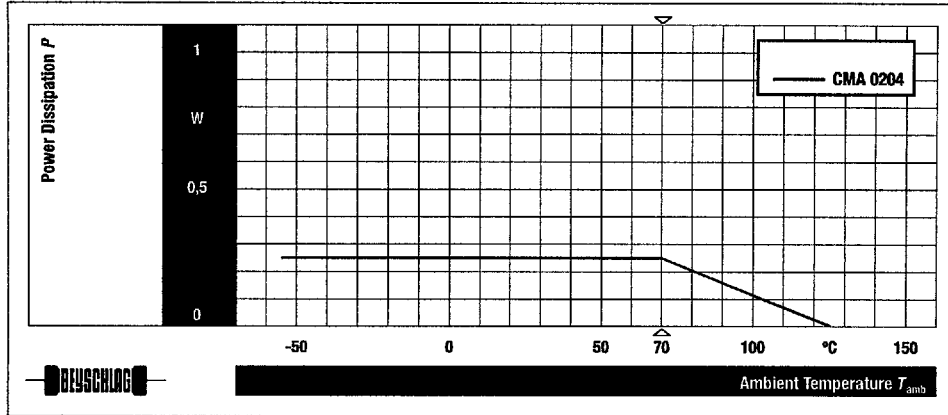
Max. Resistance Change at $P_{70}$ for Resistance Range		10 Ω - 100 kΩ	
<b>Δ R/R after ...</b>			
... 1 000 h	%	± 1	± 2
... 8 000 h	%	+ 3 - 1	+ 5 - 2

Operating Voltage, $U_{max}$ AC / DC	V	200	
Permissible Voltage against Ambient ...			
... 1 minute	V	300	
... continuous	V	75	
Isolation Resistance	Ω	> 10 <sup>10</sup>	

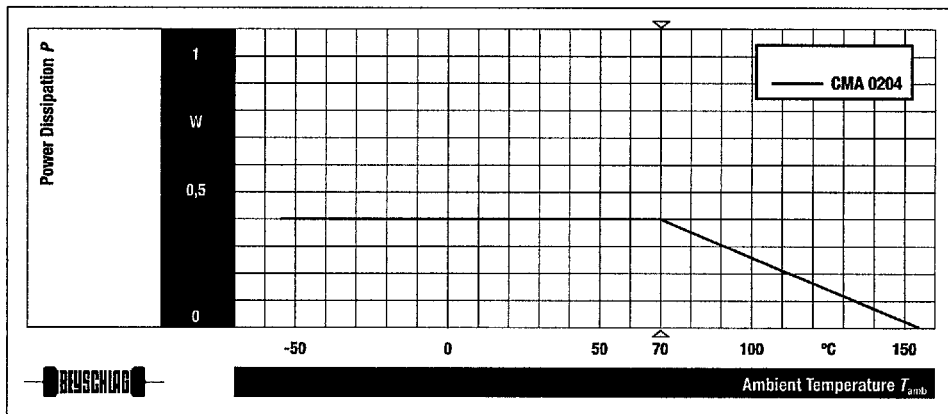
Failure Rate	10 <sup>9</sup> /h	≤ 1	
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**Derating • Standard Operation**

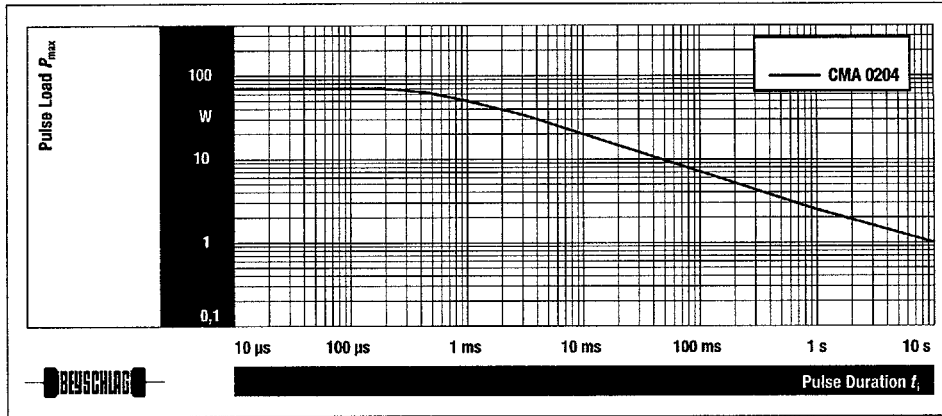


**Derating • Power Operation**



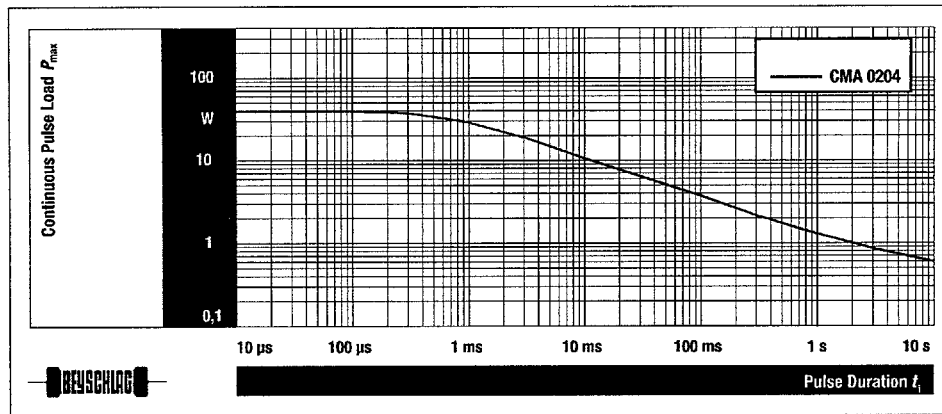
### Single Pulse

Maximum Pulse Load (single pulse; see A2)



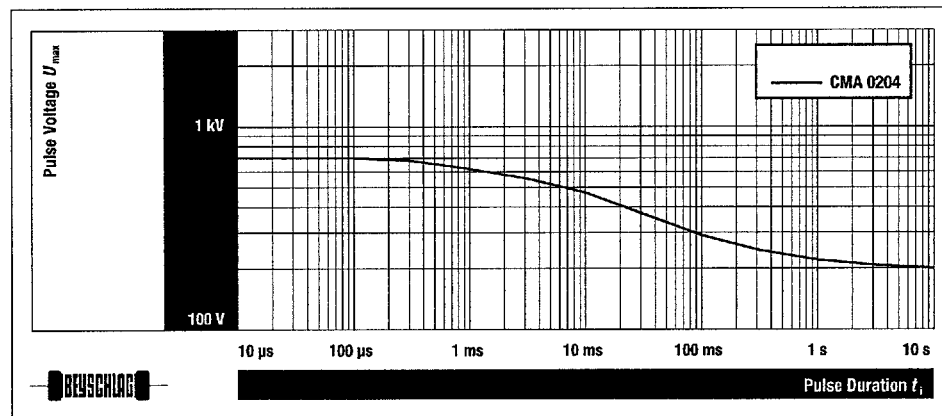
### Continuous Pulses

Maximum Pulse Load (continuous pulses; see A2)



### Pulse Voltage

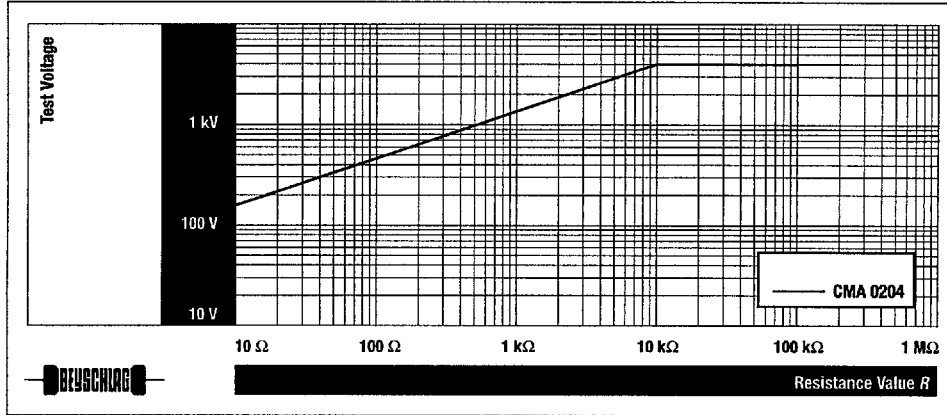
Maximum Pulse Voltage (single and continuous pulses; see A2)





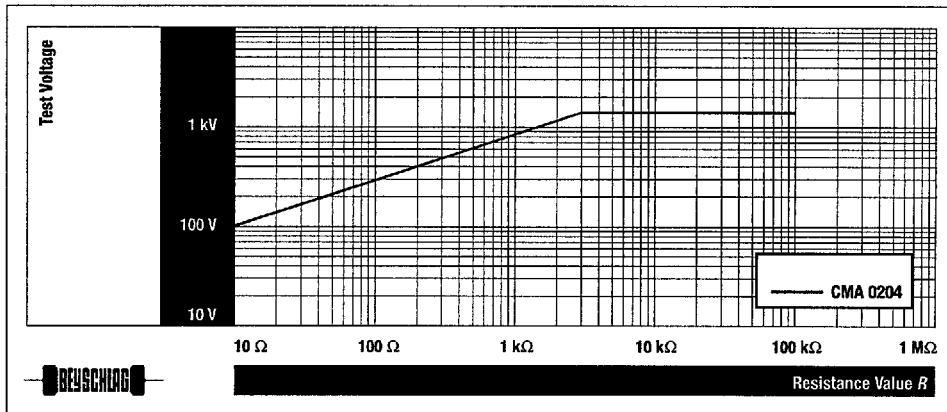
### 1,2/50 Pulse

Pulse Load Rating acc. to clause 4.27 of IEC 60 115-1 1,2  $\mu$ s / 50  $\mu$ s (see A1)



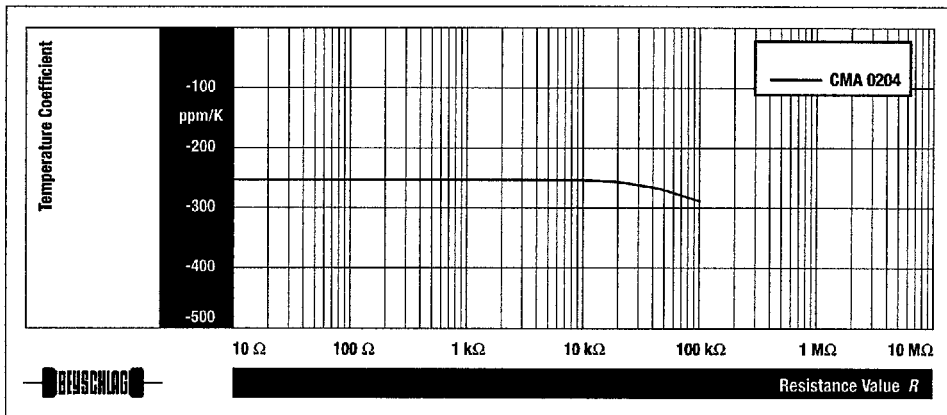
### 10/700 Pulse

Pulse Load Rating acc. to clause 4.27 of IEC 60 115-1 10  $\mu$ s / 700  $\mu$ s (see A1)



### TC

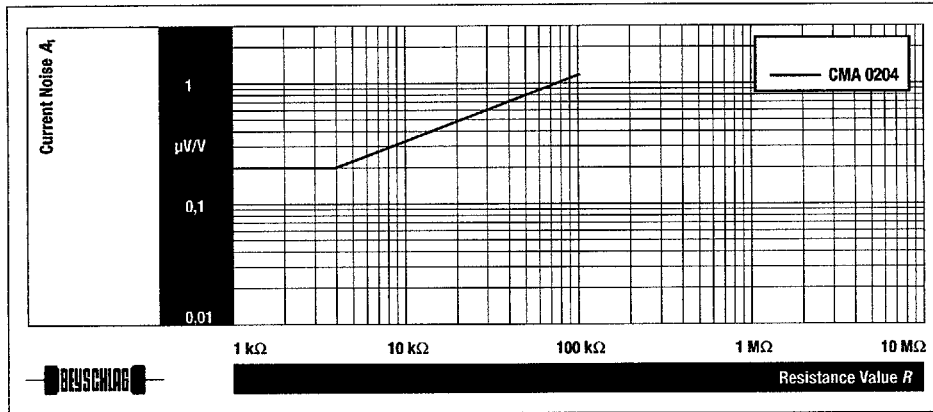
Temperature Coefficient of Resistance





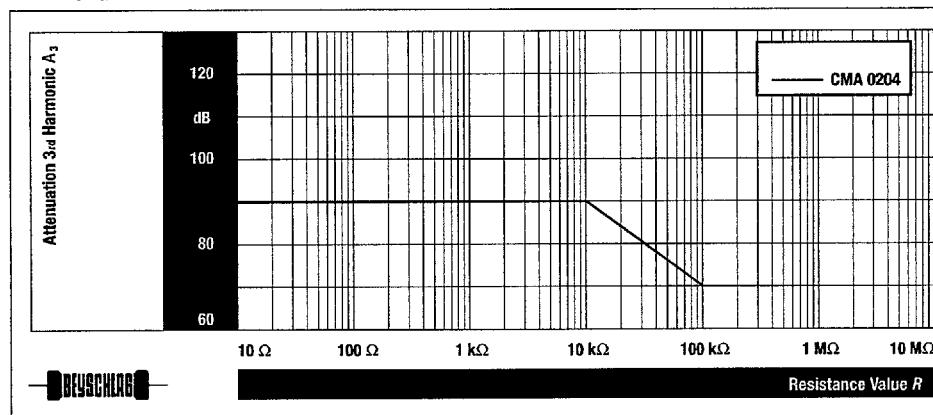
### Current Noise

Current Noise  $A_1$ , IEC 60 195



### Nonlinearity

Nonlinearity  $A_3$ , IEC 60 440







## Performance Characteristics

BEYSCHLAG Carbon Film MELF Resistors fulfill the requirements of the following specifications:

EN 140 000      Generic specification: Fixed Resistors  
EN 140 400      Sectional specification: Fixed low power non-wirewound SMD resistors

## Tests

IEC 60 115-1 Clause	IEC 68 068-2 (Method)	Test Condition	Permissible Change $\Delta R$
		<b>CMA 0204</b>	10 $\Omega$ - 100 k $\Omega$

Short-Time Overload *)	4.13		2,5 x rated voltage / 2 x $U_{max}$ for 2 s	$\pm (1\%R+0,1\Omega)$
Low Temperature Operation		1 (Aa)	- 55 °C / 2 h	$\pm (0,5\%R+0,1\Omega)$
Resistance to Soldering Heat	4.18.2	20 (Tb)	+ 260 °C / 10 s	$\pm (0,5\%R+0,1\Omega)$
Rapid Change of Temperature *)	4.19	14 (Na)	5 cycles between - 55 °C / + 125 °C	$\pm (0,5\%R+0,1\Omega)$
Endurance at ...	4.25.1		Rated voltage / $U_{max}$ 1,5 h on / 0,5 h off	
... +70 °C / 1 000 h				$\pm (2\%R+0,05\Omega)$
... + 70 °C / 8 000 h				$\pm (4\%R+0,05\Omega)$
Climatic Sequence *)	4.23	30 (D)	Dry heat – damp heat (1 cycle) – cold – low air pressure – damp heat (5 cycles)	$\pm (4\%R+0,1\Omega)$
Damp Heat, Steady State 50 Days *)	4.24	3 (Ca)	+ 40 °C / 93 % R.H.	$\pm (4\%R+0,1\Omega)$
Endurance at UCT / 1 000 h	4.25.3	27 (Ba)		
UCT = + 125 °C				$\pm (4\%R+0,1\Omega)$

## Requirements

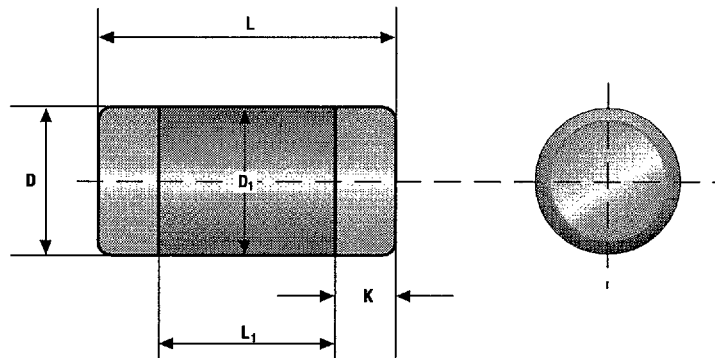
Terminal Adhesion (shear test)			CECC 00 802 / B.2 5 N / 10 s	No visible damage
Voltage Proof (dielectric with- standing voltage)	4.7		$V_{off} = 100 V / 60 s$	No flashover or breakdown
Solderability	4.17.2	20 (Ta)	+ 215 °C / 3 s	Dipped area shall be covered with a smooth and bright solder coating of at least 95 %
Resistance against Solvents *)		45 (xA)	Alcohols, ester, hydrous solution, + 23 °C, tooth brush method	No mechanical damage Marking must be legible

\*) Resistors mounted on a test board according to CECC 00 802



Product Dimensions

Style		MMU 0102	MMA 0204 CMA 0204	MMB 0207
DIN - Size		0102	0204	0207
CECC - Size		RC 2211	RC 3715	RC 6123
D	mm	max 1,1	max 1,4	max 2,2
D <sub>1</sub>	mm	min 1,06 / max 1,1	min 1,25 / max 1,4	min 2,0 / max 2,2
L	mm	max 2,2	max 3,6	max 5,8
L <sub>1</sub>	mm	min 1,2	min 1,8	min 2,8
K	mm	min 0,35 / max 0,45	min 0,5 / max 0,85	min 1,1 / max 1,4
Weight	mg	7,8	19	78

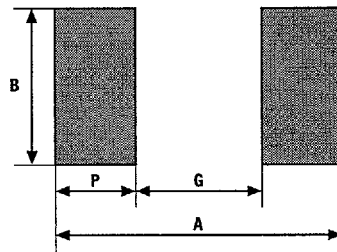




**PCB Layout Recommendations • Reflow Soldering**

Size		0102	0204	0207
CECC - Size		RC 2211	RC 3715	RC 6123
B	mm	1,3	1,6	2,5
P	mm	0,5	0,8	1,6
G	mm	1,3	2,2	2,9
A	mm	2,3	3,8	6,1

The used soldering process determines optimum pad size.  
 The pad size has an influence on the achievable power dissipation.  
 Alternative recommendations and comprehensive information are given in the American Standard IPC-SM-782:  
 Surface Mount Design and Land Pattern Standard.



**PCB Layout Recommendations • Wave Soldering**

Size		0102	0204	0207
CECC - Size		RC 2211	RC 3715	RC 6123
B	mm	1,3	1,6	2,5
P	mm	0,6	1,2	2,4
G	mm	1,3	1,8	2,8
A	mm	2,5	4,2	7,6

The used soldering process determines optimum pad size.  
 The pad size has an influence on the achievable power dissipation.  
 Alternative recommendations and comprehensive information are given in the American Standard IPC-SM-782:  
 Surface Mount Design and Land Pattern Standard.



**Coding**

Style	MMU 0102	MMA 0204	MMB 0207	CMA 0204
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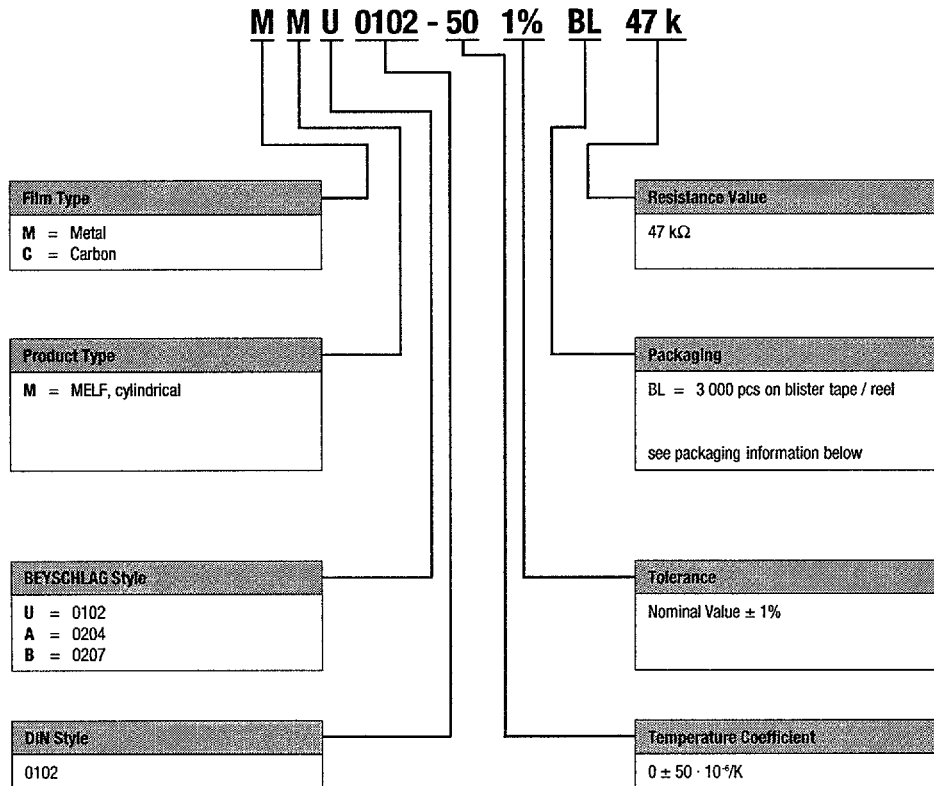
Product Coding vs. Tolerance	MMU 0102	MMA 0204	MMB 0207	CMA 0204
5 %	4 bands	4 bands	none	5 bands
2 %	4 bands	4 bands	-	
1 %	5 bands	5 bands	none	
0,5 %	5 bands	5 bands	none	
0,25 %	5 bands	5 bands	none	
0,1 %	5 bands	5 bands	none	

Jumpers are marked by one black colour band

Colour Dot Markings	MMU 0102	MMA 0204	MMB 0207	CMA 0204
	-	-	-	brown dots
TC 50	none	none	none	
TC 25	yellow dots	yellow dots	none	
TC 15	orange dots	orange dots	none	
TC 10	blue dots	blue dots	-	
TC 05	violet dots	violet dots	-	
HF	black dots	black dots	-	

According to IEC 60 062

### Order Code Example



Jumpers are ordered by the resistance value 0 Ω, e.g. **MMA 0204 BL 0R0**.  
For **CMA 0204** no temperature coefficient is specified.

### Packaging Information

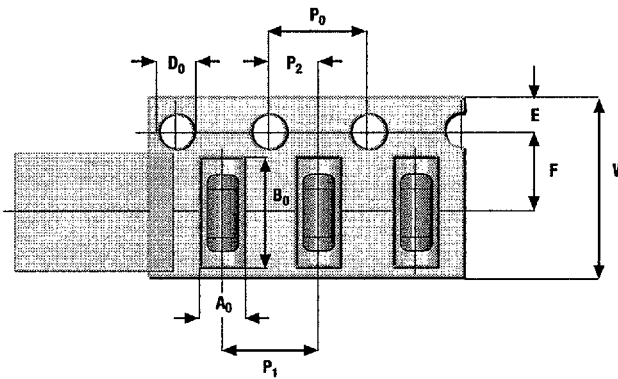
Style		MMU 0102	MMA 0204	MMB 0207	CMA 0204
Blister Tape	B1 * pcs.	1 000	1 000	–	–
	* precision only				
Blister Tape	B2 pcs.	–	–	2 000	–
Blister Tape	BL pcs.	3 000	3 000	–	3 000
Blister Tape	B7 pcs.	–	–	7 000	–
Blister Tape	B0 pcs.	10 000	10 000	–	10 000
Bulk Case	M3 pcs.	–	3 000	–	–
Bulk Case	M8 pcs.	8 000	–	–	–



**Blister Tape**

Style		MMU 0102	MMA 0204 GMA 0204	MMB 0207
A <sub>0</sub>	mm	1,3 <sup>0</sup> <sub>-0,05</sub>	1,55 ± 0,1	2,4 ± 0,1
B <sub>0</sub>	mm	2,45 <sup>+0,05</sup> <sub>0</sub>	3,7 ± 0,1	6,0 ± 0,1
E	mm	1,75 ± 0,1		
F	mm	3,5 ± 0,05	3,5 ± 0,05	5,5 ± 0,05
D <sub>0</sub>	mm	1,5 <sup>+0,1</sup> <sub>0</sub>		
P <sub>0</sub>	mm	4,0 ± 0,1		
P <sub>1</sub>	mm	4,0 ± 0,1		
P <sub>2</sub>	mm	2,0 ± 0,05		
W	mm	8,0 ± 0,3	8,0 ± 0,3	12,0 ± 0,3

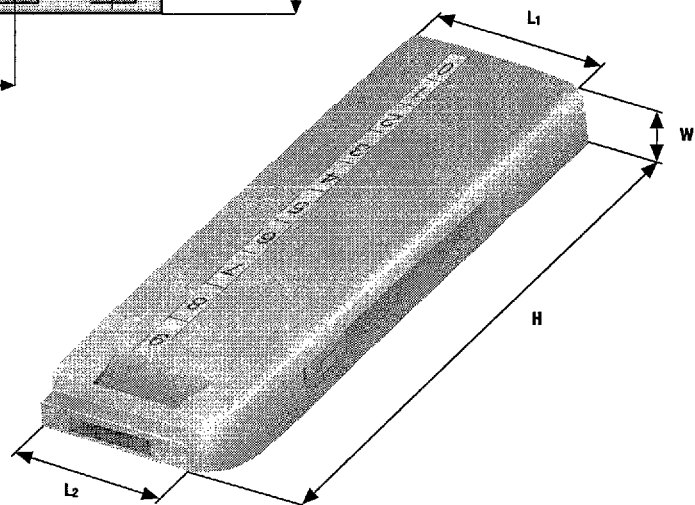
According to IEC 60 286-3 type II



**Bulk Case**

Style		MMU 0102 MMA 0204
L <sub>1</sub>	mm	36
H	mm	110
W	mm	12
L <sub>2</sub>	mm	31,5

According to IEC 60 286-6



Reel

Style		MMU 0102	MMA 0204	MMB 0207			
		B1, BL	B0	B1, BL	B0	B2	B7
A	mm	180	330	180	330	180	330
E	mm	2,5 ± 0,5					
D	mm	22,5 ± 2,0					
W <sub>1</sub>	mm	8,4 <sup>+1,5</sup> <sub>0</sub>	8,4 <sup>+1,5</sup> <sub>0</sub>	12,4 <sup>+1,5</sup> <sub>0</sub>			
C	mm	13,0 <sup>+0,5</sup> <sub>0,25</sub>					
N	mm	62					
W <sub>2</sub>	mm	max 14,4	max 14,4	max 18,4			

