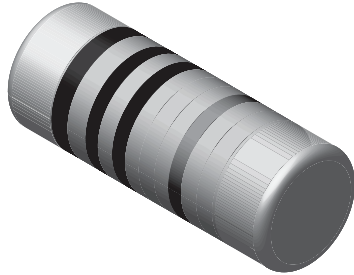


## Thin Film Mini-MELF Resistors



### FEATURES

- Advanced thin film technology
- AEC-Q200 qualified
- Low TCR and tight tolerances
- Excellent stability in different environmental conditions
- Pure tin termination on nickel barrier, plated on press fit steel caps
- Compliant to RoHS Directive 2002/95/EC

AUTOMOTIVE GRADE



RoHS COMPLIANT

GREEN (5-2008)\*\*

### STANDARD ELECTRICAL SPECIFICATIONS

MODEL	POWER RATING $P_{70}$ W	LIMITING ELEMENT VOLTAGE DC or AC <sub>RMS</sub> V	TEMPERATURE COEFFICIENT ppm/K	TOLERANCE %	RESISTANCE RANGE $\Omega$	E-SERIES
SMM0204	0.25	200	$\pm 15$	$\pm 0.1$ $\pm 0.25$ $\pm 0.5$	43R to 221K 22R to 221K 10R to 221K	24; 96; 192
SMM0204	0.25	200	$\pm 25$	$\pm 0.1$ $\pm 0.25$ $\pm 0.5$	43R to 511K 22R to 511K 10R to 1M0	24; 96; 192
SMM0204	0.25	200	$\pm 50$	$\pm 0.5$ $\pm 1$	10R to 1M0 R82 to 10M	24; 96; 192 24; 96
SMM0204	0.25	200	$\pm 100$	$\pm 5$	R22 to 10M	24
Zero-Ohm-Resistor: OMM0204 $R_{max.} = 10\text{ m}\Omega$ $I_{max.} = 3\text{ A}$						

#### Notes

- SMM0204 EN803 E0 and OMM0204 EN803 E0 respectively are available versions with IECQ-CECC approval to EN 140401-803, version A, with nominal failure rate level E0.
- The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature of 155 °C is not exceeded.

### TECHNICAL SPECIFICATIONS

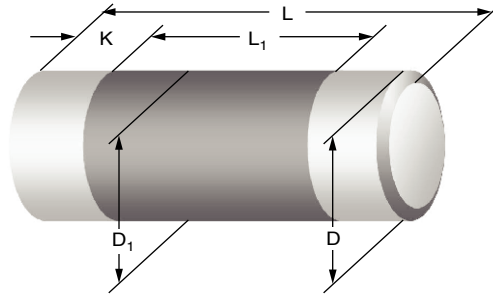
PARAMETER	UNIT	SMM0204
Power rating $P_{70}$	W	0.25
Limiting element voltage, DC or AC <sub>RMS</sub>	V	200
Insulation voltage (1 min), DC or AC <sub>PEAK</sub>	V	300
Insulation resistance	$\Omega$	$\geq 10^{10}$
Category temperature range	°C	- 55 to + 125 (+ 155)
Failure rate: FIT <sub>observed</sub>		$\leq 0.1 \times 10^{-9}/\text{h}$

#### Notes

- The upper temperature limit of 125 °C reflects the prescriptions of the detail specification EN 140401-803. However, the products may be operated up 155 °C, if the tradeoff through decreased drift stability is acceptable to the specific application.
- The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature of 125 °C or 155 °C respectively is not exceeded.
- The specification of this product is based on a test board according to EN 140400, providing a thermal resistance of approximately 220 K/W.
- 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 IECQ-CECC approved product versions SMM0204 EN803 E0 and OMM0204 EN803 E0 respectively feature a quality factor  $\pi_Q = 3$  for the purpose of system MTBF calculations, compared with  $\pi_Q = 10$  for the standard versions.

\*\* Please see document "Vishay Material Category Policy": [www.vishay.com/doc?999902](http://www.vishay.com/doc?999902)

**DIMENSIONS**

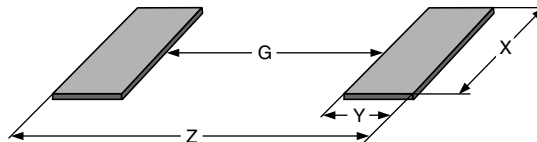


DIMENSIONS AND MASS						
TYPE	L (mm)	D <sub>max.</sub> (mm)	L <sub>1</sub> min. (mm)	D <sub>1</sub> (mm)	K (mm)	MASS (mg)
SMM0204 OMM0204	3.6 + 0/- 0.15	1.4	1.75	D + 0/- 0.15	0.85 + 0/- 0.35	18

**Notes**

- Color code marking is applied according to IEC 60062 in four bands for 5 % tolerance, or in five bands. Each color band appears as a single solid line, voids are permissible if at least <sup>2</sup>/<sub>3</sub> 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.
- The color of the body coating is light green for jumpers and for a temperature coefficient of ± 50 ppm/K or of ± 100 ppm/K, pink for ± 25 ppm/K, or violet for ± 15 ppm/K.
- Zero ohm jumper are marked with one centered black band.

**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)
SMM0204 OMM0204	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.



PART NUMBER AND PRODUCT DESCRIPTION																	
Part Number: SMM02040C5620FB000																	
Part Number: OMM02040000000B000																	
S	M	M	0	2	0	4	0	C	5	6	2	0	F	B	0	0	0
O	M	M	0	2	0	4	0	0	0	0	0	0	0	B	0	0	0
MODEL			VERSION				TCR			RESISTANCE				TOLERANCE		PACKAGING	
SMM0204 OMM0204			0 = Neutral V = EN 140401-803, version A, nominal failure rate level E0				E = ± 15 ppm/K D = ± 25 ppm/K C = ± 50 ppm/K B = ± 100 ppm/K 0 = Jumper			3 digit value 1 digit multiplier 0000 = Jumper MULTIPLIER 7 = *10 <sup>-3</sup> 2 = *10 <sup>2</sup> 8 = *10 <sup>-2</sup> 3 = *10 <sup>3</sup> 9 = *10 <sup>-1</sup> 4 = *10 <sup>4</sup> 0 = *10 <sup>0</sup> 5 = *10 <sup>5</sup> 1 = *10 <sup>1</sup>				B = ± 0.1 % C = ± 0.25 % D = ± 0.5 % F = ± 1 % J = ± 5 % 0 = Jumper		B1 B3 B0 M3	
Product Description: SMM0204 50 562R 1 % B0																	
Product Description: OMM0204 0R0 B0																	
SMM0204		50		562R		1 %		B0		-		-		-		-	
OMM0204		-		0R0		-		B0		-		-		-		-	
MODEL		TCR		RESISTANCE		TOLERANCE		PACKAGING		VERSION		-		-		-	
SMM0204 OMM0204		± 15 ppm/K ± 25 ppm/K ± 50 ppm/K ± 100 ppm/K		100R = 100 Ω 2M21 = 2.21 MΩ 0R0 = Jumper		± 0.1 % ± 0.25 % ± 0.5 % ± 1 % ± 5 %		B1 B3 B0 M3		-		-		-		-	

Note

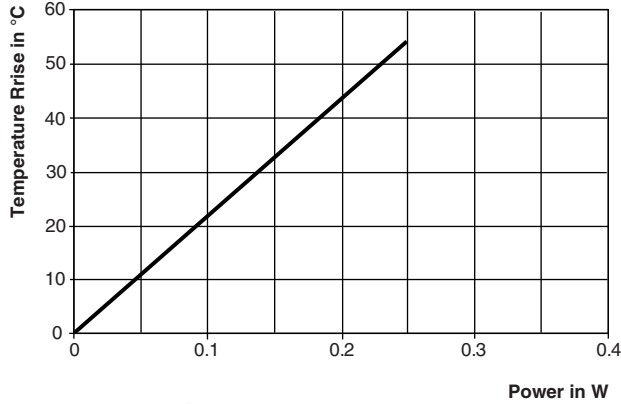
- Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION.

PACKAGING						
TYPE	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	REEL DIAMETER
SMM0204 OMM0204	B1 <sup>(1)</sup>	1000 <sup>(1)</sup>	Blister tape acc. IEC 60286-3 Type II	8 mm	4 mm	180 mm/7"
	B3	3000				330 mm/13"
	B0	10 000				
	M3	3000	Bulk case acc. IEC 60286-6	-	-	-
SMM0204 EN803 E0 OMM0204 EN803 E0	B1	1000	Blister tape acc. IEC 60286-3 Type II	8 mm	4 mm	180 mm/7"
	B3	3000				330 mm/13"
	B0	10 000				

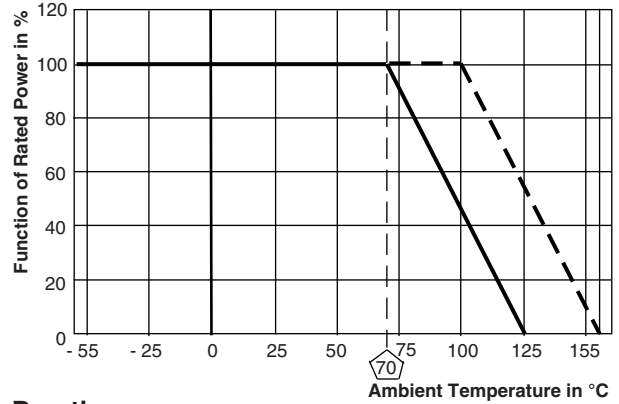
Note

- <sup>(1)</sup> Package of 1000 pieces, code B1, is available only for products with TCR ± 25 ppm/K or ± 15 ppm/K, and with tolerance ± 0.25 % or ± 0.1 %.

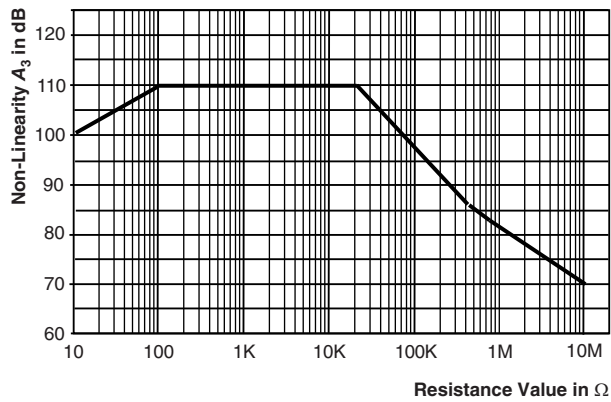
**FUNCTIONAL PERFORMANCE**



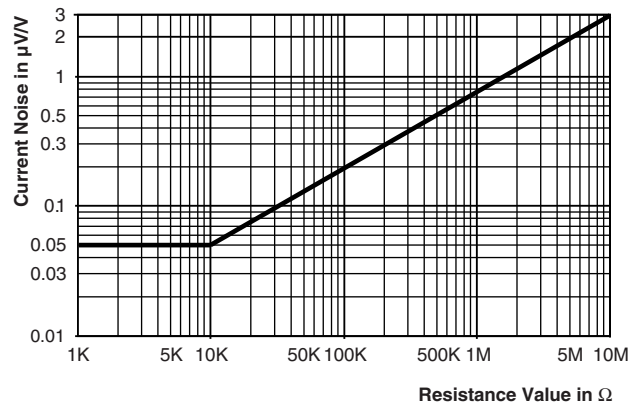
**Temperature Rise**



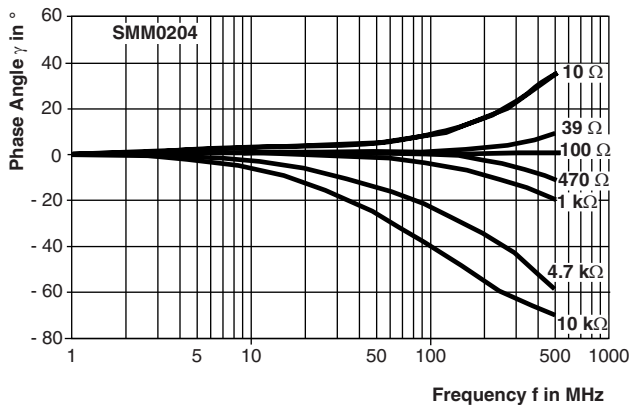
**Derating**



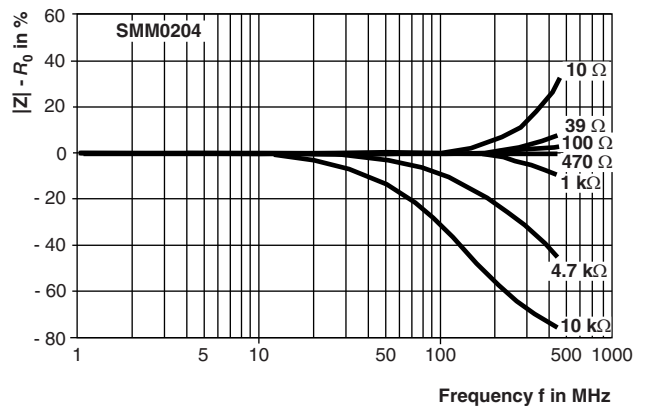
**Non-linearity**



**Current Noise**

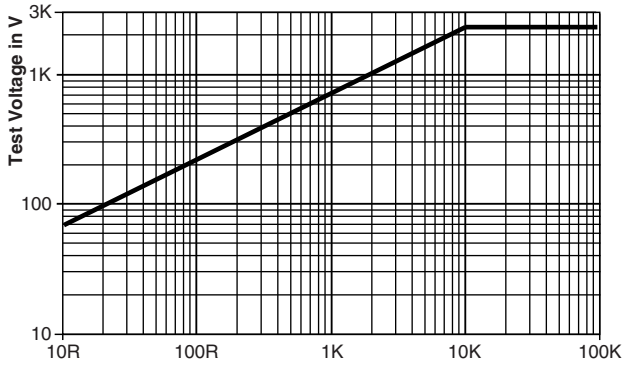


**HF - Performance**

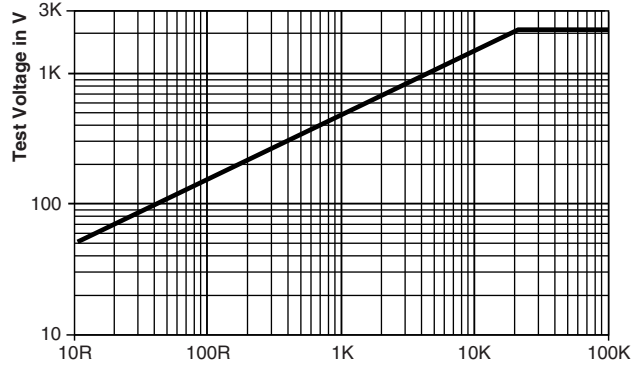


**HF - Performance**

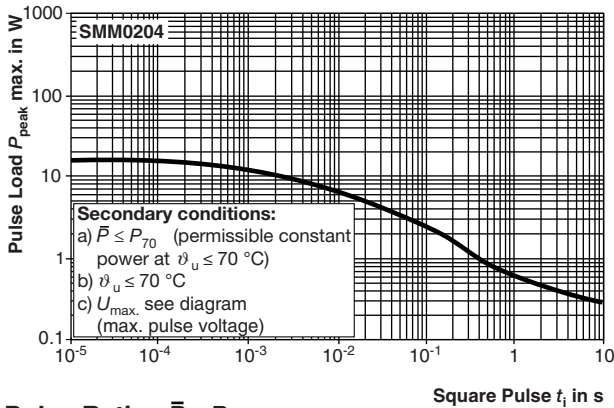
**FUNCTIONAL PERFORMANCE**



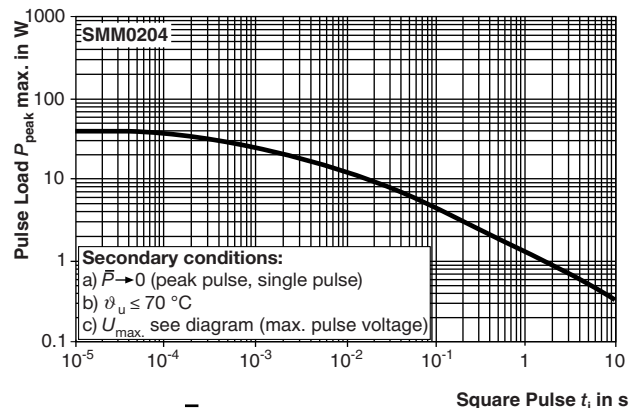
Single pulse high voltage overload capability  
1.2/50 acc. EN 60115-1, 4.27



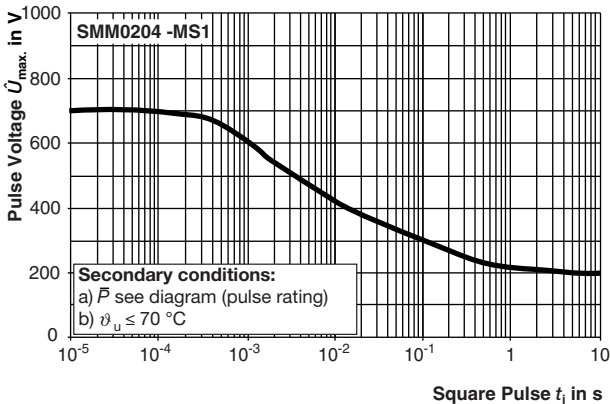
Single pulse high voltage overload capability  
10/700 acc. EN 60115-1, 4.27



Pulse Rating  $\bar{P} \leq P_{70}$



Pulse Rating  $\bar{P} \rightarrow 0$



Maximum Pulse Voltage



TEST PROCEDURES AND REQUIREMENTS					
TEST	CONDITIONS OF TEST	REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R$ )			
		STABILITY CLASS 0.25	STABILITY CLASS 0.5	STABILITY CLASS 1	STABILITY CLASS 2
		10 $\Omega$ to 332 k $\Omega$	1 $\Omega$ to 10 $\Omega$	< 1 $\Omega$	> 332 k $\Omega$
Endurance test at 70 °C IEC 60115-1, 4.25.1	$U = \sqrt{P_{70} \times R} \leq U_{max.};$ 1.5 h "on", 0.5 h "off"  at 70 °C, 1000 h  at 70 °C, 8000 h	$\pm (0.25 \% R + 0.05 \Omega)$  $\pm (0.5 \% R + 0.05 \Omega)$			$\pm (0.5 \% R + 0.05 \Omega)$  $\pm (1.0 \% R + 0.05 \Omega)$
Endurance at UCT IEC 60115-1, 4.25.3	at 125 °C, 1000 h	$\pm (0.25 \% R + 0.05 \Omega)$			$\pm (0.5 \% R + 0.05 \Omega)$
Damp heat steady state 40 °C/93 % RH IEC 60115-1, 4.24 and IEC 60068-2-78	56 days; $U = 0.1 \times \sqrt{P_{70} \times R};$ $U_{max.} = 20 V$	$\pm (0.25 \% R + 0.05 \Omega)$	$\pm (0.5 \% R + 0.05 \Omega)$		
Damp heat steady state accelerated 85 °C/85 % RH	1000 h; $U = 0.3 \times \sqrt{P_{70} \times R};$ $U_{max.} = 40 V$	$\pm 1.0 \% R + 0.05 \Omega$ <sup>(1)</sup>			
Rapid change of temperature; 1000 cycles IEC 60115-1, 4.19 and IEC 60068-2-14	30 min at LCT; 30 min at UCT; LCT = - 55 °C; UCT = 125 °C	$\pm (0.25 \% R + 0.05 \Omega)$			
Overload test IEC 60115-1, 4.13	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.};$ 2 s	$\pm (0.05 \% R + 0.01 \Omega)$			$\pm (0.1 \% R + 0.05 \Omega)$
Electrostatic discharge (HBM) IEC 60340-3-1	3 positive + 3 negative discharges 2 kV	$\pm (0.5 \% R + 0.05 \Omega)$			
Resistance to soldering heat IEC 60115-1, 4.18.2 and IEC 60068-2-58	Solder bath method (260 $\pm$ 5) °C; 10 s	$\pm (0.05 \% R + 0.01 \Omega)$	$\pm (0.1 \% R + 0.05 \Omega)$		

**Note**

<sup>(1)</sup> For resistance > 2M21:  $\pm (2.0 \% R + 0.05 \Omega)$ .

APPLICABLE SPECIFICATIONS	
• EN 60115-1	Generic specification
• EN 140400	Sectional specification
• EN 140401-803	Detail specification
• IEC 60068-2-x	Variety of environmental test procedures
• IEC 60286-3	Packaging of SMD components



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