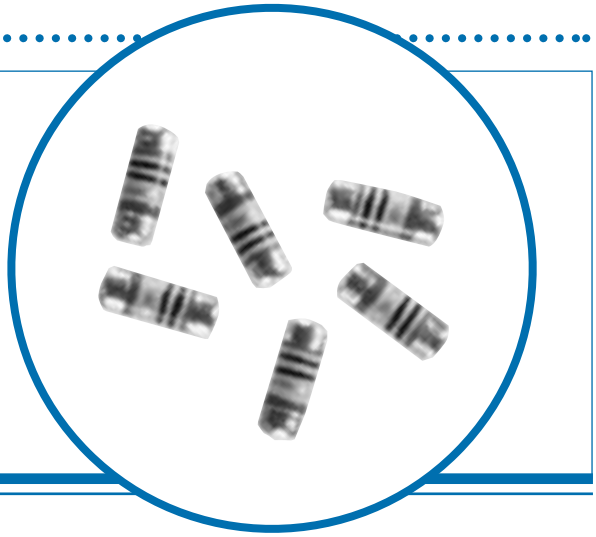
Mini Melf Resistors

TT electronics
Welwyn Components

WRM Series

- **High reliability**
- **Predictable pulse handling capability**
- **Tolerances down to 0.1%**
- **TCR down to 5 ppm/°C**



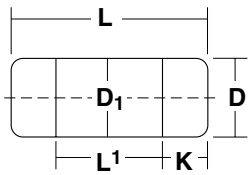
Electrical Data

		WRM 0102	WRM 0204	WRM 0207
Power rating at 70°C	watts	0.2	0.25	0.4
Resistance range	ohms	R22 – 2M21	R22 – 10M	R22 – 8M2
Limiting element voltage	volts	150	200	300
TCR	ppm/°C	15, 25, 50	5, 15, 25, 50	25, 50
Resistance tolerance	%	0.1, 0.25, 0.5, 1.0		
Standard values		E24 & E96		
Thermal impedance	k/W	250	200	140
Ambient temperature range	°C	-55 to +125		
Insulation resistance	ohms	$>10^{10}$		

Physical Data

Dimensions (mm) and weight (g)

Type	L max	L^1 min	D max	D^1 max	D^1 min	K max	K min	Weight t per unit
WRM 0102	2.2	1.2	1.1	1.1	1.06	0.45	0.35	0.01
WRM 0204	3.6	1.8	1.4	1.4	1.25	0.85	0.5	0.02
WRM 0207	5.8	2.8	2.2	2.2	2.0	1.4	1.1	0.08



Construction

A metal film is deposited onto a high dissipation ceramic former to which solder plated teminating caps are fitted.

The resistor is adjusted to value by a helical cut in the film and the body is protected by a lacquer coating.

Marking

Resistance values are colour coded with 5 bands.
The TCR is also colour coded as detailed below.
TCR 50 ppm – No Dot
TCR 25 ppm – Yellow Dot
TCR 15 ppm – Orange Dot

Terminations

Material Plated steel cap.

Solderability The terminal caps have a multi-layer coating of nickel-copper-nickel and pure tin. The pure tin finish produces ageing free contacts on which low melting solders can be used. Dipped area shall be covered with a smooth and bright solder coating after 3 seconds immersion at 215°C.

Solvent Resistance

The body protection and marking are resistant to all normal industrial cleaning solvents suitable for printed circuit boards.

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TCR and Tolerance Range

Type Reference	TCR			Tolerance Professional		Tolerance Precision	
		5%	2%	1.0%	0.5%	0.25%	0.1%
WRM0102	±50ppm	R22 – R91	IRO – 9R1	10R – 2.21M	47RS – 221K	100R – 221K	–
WRM0102	±25ppm	–	–	10R – 221K	47R5 – 221K	100R – 221K	100R – 100K
WRM0102	±15ppm	–	–	–	100R – 100K	100R – 100K	100R – 100K
WRM0102	±10ppm	–	–	–	–	–	–
WRM0102	±05ppm	–	–	–	–	–	–
WRM0204	±50ppm	R22 – R91	–	1R – 10M	10R – 475K	22R – 332K	43R – 332K
WRM0204	±25ppm	–	–	10R – 475K	10R – 475K	22R – 332K	43R – 332K
WRM0204	±15ppm	–	–	–	10R – 221K	22R – 221K	43R – 221K
WRM0204	±10ppm	–	–	–	–	22R – 221K	43R – 221K
WRM0204	±05ppm	–	–	–	–	100R – 100K	100R – 100K
WRM0207	±50ppm	R22 – R91	–	1R – 8.2M	10R – 1M	–	–
WRM0207	±25ppm	–	–	–	10R – 1M	–	–
WRM0207	±15ppm	–	–	–	–	–	–
WRM0207	±10ppm	–	–	–	–	–	–
WRM0207	±05ppm	–	–	–	–	–	–

* TC 10ppm & 5ppm is specified over the temperature range -10°C to +85°C.

Performance Data

Test		**Results Δ R/R ±**		
Description		Stability class		
		0.25	0.5	1.0
		75 Ω – <100 kΩ	10 Ω – <75 Ω >100 kΩ – 332 kΩ	0.22 Ω – <10 Ω >332 kΩ – 10 MΩ
Short time overload*		≤ 0.05% + 0.01 Ω	≤ 0.1% + 0.01 Ω	≤ 0.25% + 0.05 Ω
Bending test*		≤ 0.05% + 0.01 Ω	≤ 0.1% + 0.01 Ω	≤ 0.25% + 0.05 Ω
Resistance to soldering heat		≤ 0.05% + 0.01 Ω	≤ 0.1% + 0.01 Ω	≤ 0.25% + 0.05 Ω
Temperature rapid change		≤ 0.05% + 0.01 Ω	≤ 0.1% + 0.01 Ω	≤ 0.25% + 0.05 Ω
Endurance*				
Load life	1000h	≤ 0.25% + 0.05 Ω	≤ 0.25% + 0.05 Ω	≤ 0.5% + 0.05 Ω
	8000 h	≤ 0.5% + 0.05 Ω	≤ 0.5% + 0.05 Ω	≤ 1.0% + 0.05 Ω
Climatic sequence*		≤ 0.25% + 0.05 Ω	≤ 0.5% + 0.05 Ω	≤ 1.0% + 0.05 Ω
Damp heat steady state*		≤ 0.25% + 0.05 Ω	≤ 0.5% + 0.05 Ω	≤ 1.0% + 0.05 Ω
Current noise		< 0.05 µV/V	< 0.25 µV/V	< 3 µV/V
Solderability		Dipped area shall be covered with a smooth and bright solder coating of at least 96%		
Voltage coefficient		< 0.5 . 10^6/V		
Voltage proof		No flashover or breakdown		

* Resistors to be mounted on a PC-board according to IEC 115-1, clause 4.27.1

Pulse Handling Information

The permissible pulse load is determined by the resistance change as given for the endurance test after 8000 hours.

1 Pulse Voltage Limit

The maximum permissible impulse voltage $\hat{V}_{max}$ is the voltage pulse short overload depending on the impulse time t_i. High ohmic values are protected by the interdependence of voltage limit and impulse time. This function is given by the equation.

$$\hat{V}_{max} = \frac{2{,}5 \cdot V_{max}}{1 + t_i \cdot K} + V_{max}$$

V_{max} = maximum permissible continuous voltage,

t_i = pulse time and K = 100 s^{-1}.

2 Maximum Pulse Load

The average load $\bar{P}$ must not exceed the rated dissipation. For resistance values above the critical resistance the rated dissipation is given by the resistance value and the limiting element voltage V_{max}. It is required

$$\bar{P} = \frac{1}{t_p \cdot R} \int_{t_1}^{t_2} V^2(t)\, dt \leq P_\vartheta$$

That means:

R	nominal resistance values
t_p	time of the pulse period (t_p^{-1} = pulse frequency)
$V(t)$	pulse voltage
$\hat{V}$	peak voltage of the pulse
P_ϑ	rated dissipation of the resistor at ambient temperature
$t_2 - t_1$	impulse time t_i

3 Continuous and Single Pulse Load

There is a difference between repetitive pulse load

$$(\bar{P} = \frac{t_i}{t_p} \cdot P_\sim \text{, with = power at the pulse time } t_i)$$

or single pulse load (eg switching events $\bar{P} \to 0$).
A higher pulse load P_{max} is accepted in the latter case.

4 Pulse Shapes

The diagrams show the maximum pulse load for a rectangular pulse shape.

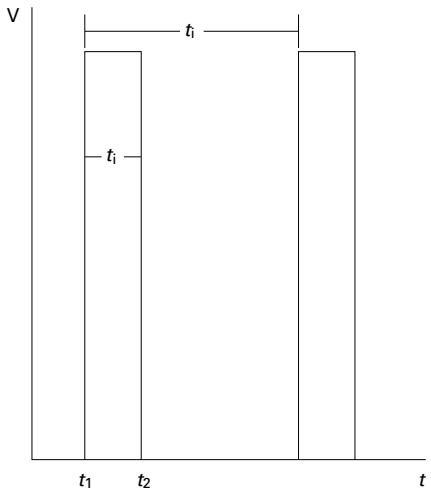
$$\bar{P} = \frac{t_i \cdot \hat{V}^2}{t_p \cdot R}$$

Other pulses should be converted into rectangular pulse shape, having the same energy at given peak voltage.

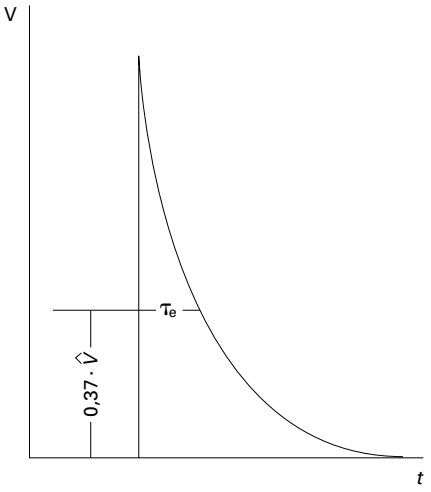
For exponential pulses the calculation follows:

$$\bar{P} = \frac{\tau_e}{2 \cdot t_p} \cdot \frac{\hat{V}^2}{R}$$

$$\text{with } \tau_e = R \cdot C \text{ or } \tau_e = \frac{L}{R}$$



Rectangular Pulses



Exponential Pulse

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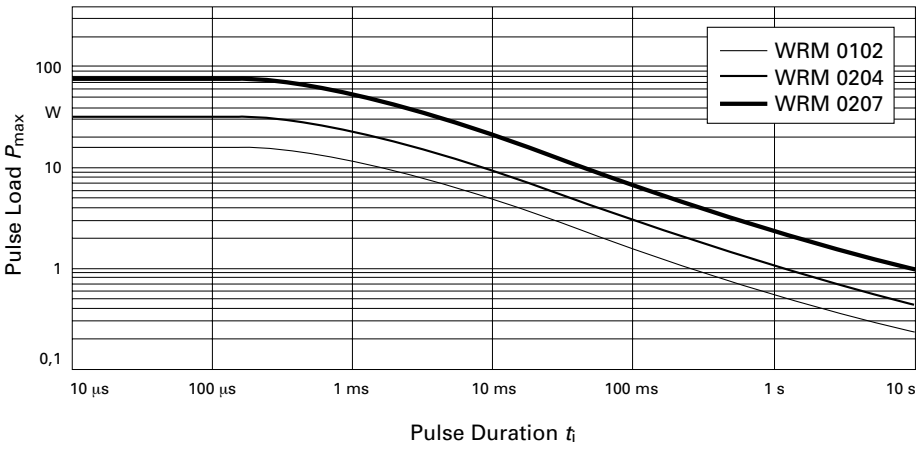
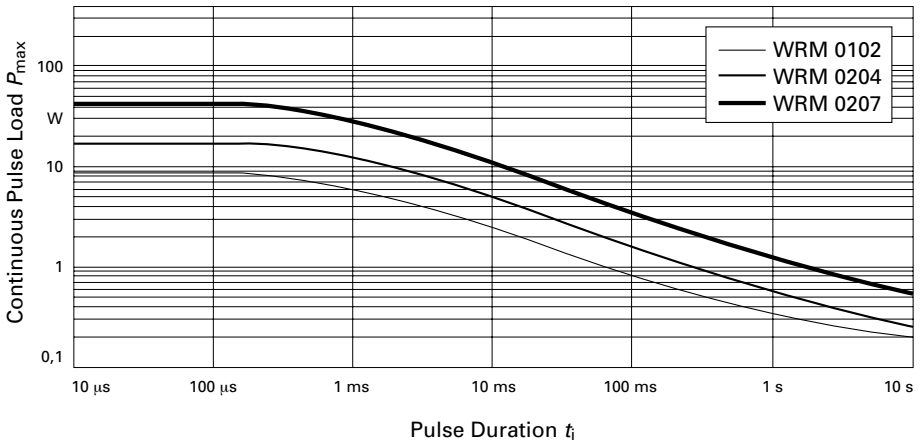
Single Pulse

Maximum Pulse Load



Continuous Pulses

Maximum Pulse Load



Packaging

The WRM 0102 and 0204 resistors are supplied reeled on 8mm blister tape. WRM 0207 resistors are supplied on 12mm blister tape.

Packaging complies with the requirements of IEC 286-3.

Bulk packaging is also available on request.

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