

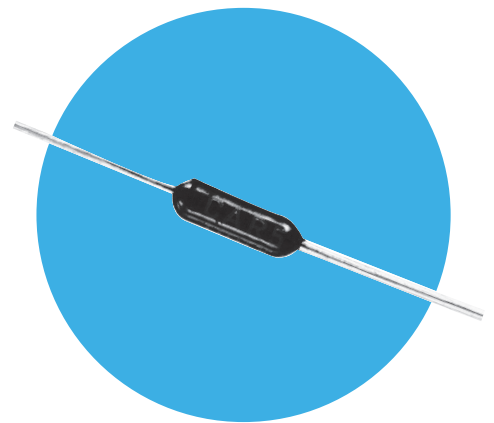
## Ultra Precision Metal Film Resistors

## CAR series

- Tolerance down to 0.01%
- Low TCR's
- High reliability
- Superior moisture performance
- Non standard values available
- Highest stability metal film available
- Matched sets and networks



All Pb-free parts comply with EU Directive 2011/65/EU amended by (EU) 2015/863 (RoHS3)



## Electrical Data

|                           |         | CAR5                                 | CAR6       | CAR7        | Notes                                |
|---------------------------|---------|--------------------------------------|------------|-------------|--------------------------------------|
| Power rating at 70°C      | watts   | 0.25                                 | 0.33       | 0.5         |                                      |
| Power rating at 85°C      | watts   | 0.125                                | 0.25       | 0.33        |                                      |
| Resistance range          | ohms    | 10R0 to 3M                           | 10R0 to 5M | 10R0 to 10M |                                      |
| Limiting element voltage  | volts   | 250                                  | 350        | 500         |                                      |
| TCR (20 to +70°C)         | ppm/°C  | 5, 10, 15, 25, 50                    |            |             | See tolerance/TCR combinations below |
| Resistance tolerance      | %       | 0.01, 0.02, 0.05, 0.1, 0.25, 0.5 & 1 |            |             |                                      |
| Standard values           |         | E24, E96 preferred                   |            |             |                                      |
| Thermal impedance         | °C/watt | 110                                  | 70         | 60          |                                      |
| Ambient temperature range | °C      | -55 to +155                          |            |             |                                      |

## Table of Resistance Restrictions

| TCR<br>ppm/°C  | Tolerance  |            |            |            |            |            |            |            |            |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
|                | CAR5       |            |            | CAR6       |            |            | CAR7       |            |            |
|                | 0.01-0.02% | 0.05%      | 0.1-1%     | 0.01/0.02% | 0.05%      | 0.1-1%     | 0.01-0.02% | 0.05%      | 0.1-1%     |
| 5 <sup>1</sup> | 50 to 300k | 10 to 500k | 10 to 500k | 50 to 500k | 10 to 500k | 10 to 500k | 50 to 750k | 10 to 750k | 10 to 750k |
| 10             | 50 to 300k | 10 to 1M   | 10 to 1M   | 50 to 500k | 10 to 1M   | 10 to 1M   | 50 to 750k | 10 to 1M   | 10 to 1.5M |
| 15             | 50 to 300k | 10 to 1M   | 10 to 1M   | 50 to 500k | 10 to 1M   | 10 to 1M   | 50 to 750k | 10 to 1M   | 10 to 3.5M |
| 25             | 50 to 300k | 10 to 1M   | 10 to 1.5M | 50 to 500k | 10 to 1M   | 10 to 3M   | 50 to 750k | 10 to 1M   | 10 to 5M   |
| 50             | 50 to 300k | 10 to 1M   | 10 to 3M   | 50 to 500k | 10 to 1M   | 10 to 5M   | 50 to 750k | 10 to 1M   | 10 to 10M  |

Note1: Based on sampling. 100% screened product is available.

## Physical Data

| Dimensions (mm) and Weight (g) |       |       |       |        |                      |                 |          |  |
|--------------------------------|-------|-------|-------|--------|----------------------|-----------------|----------|---------------------------------------------------------------------------------------|
| Type                           | L Max | D Max | f min | d nom. | PCB mounting centres | Min Bend Radius | Wt. nom. |                                                                                       |
| CAR5                           | 7.2   | 2.5   | 30    | 0.6    | 10.2                 | 0.6             | 0.24     |                                                                                       |
| CAR6                           | 10.0  | 3.7   | 30    | 0.6    | 12.7                 | 0.6             | 0.40     |                                                                                       |
| CAR7                           | 15.5  | 5.5   | 30    | 0.8    | 18.4                 | 1.2             | 1.15     |                                                                                       |
|                                |       |       |       |        |                      |                 |          |                                                                                       |

## General Note

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CAR series

Construction

Ceramic rods are coated with a metal film and plated steel caps are force fitted. A helical cut is used to adjust the film to its final value.  
Termination wires are welded to the caps and the resistor is protected with a specially formulated epoxy coating.

Terminations

- Material** Solderable finish copper wire.
- Strength** The terminations meet the requirements of IEC 68.2.21
- Solderability** The terminations meet the requirements of IEC 115-1, Clause 4.17.3.2

Marking

Type reference, TCR code, resistance value and tolerance code.  
The resistance value marking conforms to IEC 62.

Solvent Resistance

The body protection and marking are resistant to all normal industrial cleaning fluids suitable for printed circuits.

Performance Data

|                                                  |       | Values 10 ≤ 250k   |         | Values > 250k      |         |
|--------------------------------------------------|-------|--------------------|---------|--------------------|---------|
|                                                  |       | Actual Performance |         | Actual Performance |         |
|                                                  |       | Maximum            | Typical | Maximum            | Typical |
| Load at rated power : 1000 hrs at 70°C (or 85°C) | ΔR %  | 0.05               | 0.02    | 0.25               | 0.05    |
| Load at rated power : 8000 hrs at 70°C (or 85°C) | ΔR %  | 0.1                | 0.04    | 0.5                | 0.1     |
| Dry heat : 1000 hrs at 155°C                     | ΔR %  | 0.15               | 0.08    | 1                  | 0.2     |
| Shelf life : 12 months at room temperature       | ΔR %  | 0.01               | 0.003   | 0.04               | 0.02    |
| Derating from rated power at 70°C (or 85°C)      |       | Zero at 155°C      |         | Zero at 155°C      |         |
| Short term overload                              | ΔR %  | 0.01               | 0.001   | 0.08               | 0.01    |
| Climatic                                         | ΔR %  | 0.05               | 0.02    | 0.2                | 0.05    |
| Climatic category                                |       | 55/155/56          |         | 55/155/56          |         |
| Long term damp heat                              | ΔR %  | 0.05               | 0.02    | 0.2                | 0.05    |
| Temperature rapid change                         | ΔR %  | 0.04               | 0.02    | 0.25               | 0.05    |
| Resistance to solder heat                        | ΔR %  | 0.02               | 0.003   | 0.05               | 0.005   |
| Vibration and bump                               | ΔR %  | 0.02               | 0.002   | 0.06               | 0.02    |
| Noise (in a decade of frequency)                 | μV/V  | 0.2                | 0.03    | 1                  | 0.1     |
| Voltage coefficient of resistance                | ppm/V | 0.3                | <0.05   | 0.2                | <0.05   |

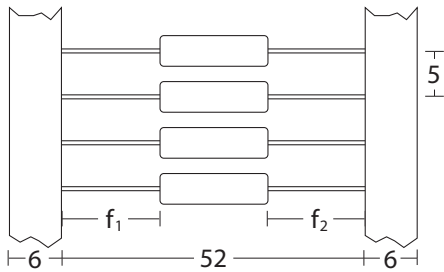
Application Notes

Matched Sets

Resistors can be supplied matched for tolerance and TCR down to ±0.005% and ±1ppm/°C respectively.

Packaging

CAR5 and CAR6 standard packing is in tape, as shown below, whilst CAR7 is bulk packed.



Body location  $f_1 - f_2 \leq 1.4 \text{ mm}$

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CAR series

Ordering Procedure

This product has two valid part numbers:

European (Welwyn) Part Number: CAR5V-31K6PI (CAR5 with TCR  $\pm 5\text{ppm}/^\circ\text{C}$  at 31.6 kilohms  $\pm 0.02\%$ , Pb-free)

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C | A | R | 5 | V | - | 3 | 1 | K | 6 | P | I |
| 1 |   | 2 | 3 |   |   | 4 | 5 |   |   |   |   |

| 1<br>Type | 2<br>TCR (ppm/°C) | 3<br>Value           | 4<br>Tolerance   | 5<br>Finish, Screening & Packing                         |      |                |
|-----------|-------------------|----------------------|------------------|----------------------------------------------------------|------|----------------|
| CAR5      | V = $\pm 5$       | E24 = 3/4 characters | L = $\pm 0.01\%$ | I = Standard packing & Pb-free                           |      |                |
| CAR6      | T = $\pm 10$      | E96 = 4/5 characters | P = $\pm 0.02\%$ | SC = Standard packing & Pb-free<br>with 5ppm/°C screened |      |                |
| CAR7      | Y = $\pm 15$      | R = ohms             | W = $\pm 0.05\%$ |                                                          |      |                |
|           | D = $\pm 25$      | K = kilohms          | B = $\pm 0.1\%$  | PB = Standard packing & SnPb                             |      |                |
|           | C = $\pm 50$      | M = megohms          | C = $\pm 0.25\%$ | CAR5                                                     | Ammo | Up to 5000/box |
|           |                   |                      | D = $\pm 0.5\%$  | CAR6                                                     | Ammo | Up to 2500/box |
|           |                   |                      | F = $\pm 1\%$    | CAR7                                                     | Bulk | 250/box        |

USA (IRC) Part Number: CAR5LFV3162PA (CAR5 with TCR  $\pm 5\text{ppm}/^\circ\text{C}$  at 31.6 kilohms  $\pm 0.02\%$ , Pb-free)

|   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | A | R | 5 | L | F | V | 3 | 1 | 6 | 2 | P | A |
| 1 |   | 2 | 3 | 4 |   |   | 5 | 6 |   |   |   |   |

| 1<br>Type | 2<br>Termination | 3<br>TCR (ppm/°C) | 4<br>Value            | 5<br>Tolerance   | 6<br>Packing |                          |
|-----------|------------------|-------------------|-----------------------|------------------|--------------|--------------------------|
| CAR5      | Omit for SnPb    | V = $\pm 5$       | 3 digits + multiplier | L = $\pm 0.01\%$ | A            | CAR5 Ammo up to 5000/box |
| CAR6      | LF = Pb-free     | T = $\pm 10$      | R = ohms for          | P = $\pm 0.02\%$ |              | CAR6 Ammo up to 2500/box |
| CAR7      |                  | Y = $\pm 15$      | values <100 ohms      | W = $\pm 0.05\%$ | B            | CAR7 Bulk 250/box        |
|           |                  | D = $\pm 25$      |                       | B = $\pm 0.1\%$  |              |                          |
|           |                  | C = $\pm 50$      |                       | C = $\pm 0.25\%$ |              |                          |
|           |                  |                   |                       | D = $\pm 0.5\%$  |              |                          |
|           |                  |                   |                       | F = $\pm 1\%$    |              |                          |

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