

# Thin Film Products Components

Thin film surface mount resistors

Current sensing surface mount resistors

Thick film surface mount resistors

Power choke coils

High frequency surface mount components

Sample kits



## Using Susumu's products means being "eco-friendly"

- The thin film process uses the least amount of resistive material among all the resistor producing processes.
- Compared to other resistor-producing processes, the thin film process employs fewer sintering and curing processes and as well as using a lower temperature. Therefore, it utilizes less power and has a smaller carbon footprint.
- Susumu's thin film products are small without losing functionality. They contribute to conserving the earth's resources.
- Because Susumu uses environmentally low impact processes and products, you can be assured that by using Susumu products, you are contributing to environmental protection.



## Susumu's products are made of "thin film" and are "eco-friendly"

Susumu's products are all RoHS compliant and totally lead-free even within the RoHS exempted areas where lead can be utilized. Some of Susumu's products are halogen-free as well.

■ The logos below are used for labeling products throughout this catalogue. \_\_\_\_\_



## ■ About REACH \_\_\_\_\_

○ REACH was established by the European Chemical Agency (ECHA) in 2007 in order to manage the risk that chemicals pose to health and the environment. REACH stands for

**R**egistration, **E**valuation, and **A**uthorization of **C**hemicals.

**73 Substances listed in SVHC.(Updated in Feb 2011)**

### Typical composition of RG/RM products

| Materials              | Weight (wt%) |        |        |        |        |        | RoHS restricted material composition |              |              |                     |              |              |
|------------------------|--------------|--------|--------|--------|--------|--------|--------------------------------------|--------------|--------------|---------------------|--------------|--------------|
|                        | RG1005       | RG1608 | RG2012 | RG3216 | RM2012 | RM3216 | Heavy metal                          |              |              |                     | PBB          | PBDE         |
|                        |              |        |        |        |        |        | Cadmium                              | Lead         | Mercury      | Hexavalent Chromium |              |              |
| Substrate              | 83.2         | 87     | 87.6   | 89.5   | 87.8   | 92.86  | <1ppm                                | <1ppm        | <5ppm        | <1ppm               | Not detected | Not detected |
| Resistive material     | 0.02         | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | Not detected                         | Not detected | Not detected | Not detected        | Not detected | Not detected |
| Inner electrode        | 0.65         | 0.13   | 0.11   | 0.15   | 0.15   | 0.1    | Not detected                         | Not detected | Not detected | Not detected        | Not detected | Not detected |
| Intermediate electrode | 8.33         | 5.82   | 5.58   | 4.83   | 5.87   | 2.96   | Not detected                         | Not detected | Not detected | Not detected        | Not detected | Not detected |
| Outer electrode        | 5.45         | 3.81   | 3.66   | 3.16   | 3.84   | 1.94   | Not detected                         | Not detected | Not detected | Not detected        | Not detected | Not detected |
| Protective coating     | A            |        |        |        |        |        | Not detected                         | Not detected | Not detected | Not detected        | Not detected | Not detected |
|                        | B            | 2.35   | 2.88   | 2.67   | 2.06   | 1.95   | <2ppm                                | <2ppm        | <2ppm        | <2ppm               | <5ppm        | <5ppm        |
|                        | C            |        |        |        |        |        | <5ppm                                | <10ppm       | <1ppm        | <6ppm               | Not detected | Not detected |
| Marking ink            | —            | 0.34   | 0.36   | 0.28   | 0.37   | 0.25   | <2ppm                                | 7ppm         | <2ppm        | <2ppm               | <2ppm        | Not detected |
| Product weight         | 0.72mg       | 2.07mg | 4.12mg | 8.26mg | 4.11mg | 7.96mg |                                      |              |              |                     |              |              |

Some of our products' life span is quite long, therefore contributes to the efficient use of resources.

Examples: RG series, **P.07** RM series **P.09**

- In addition to our reliable precision RR series, we also offer the RG series which has a life span that is 8 times longer than that of the RR series. Under normal temperature and humidity, the RG series is expected to drift less than 0.1% after 116 years.

### Comparison of RR vs. RG

| Resistor type                 | Series name | Criteria   | Years          |
|-------------------------------|-------------|------------|----------------|
| Metal thin film chip resistor | RG series   | 0.1% drift | over 116 years |
|                               | RR series   |            | 14 years       |

Test conditions: 85°C , 85% RH, 10% of rated power, 90min. on; 30min. off

The use of thin film technology enabled Susumu to make smaller products resulting in the conservation of resources.

### Examples: RL series

Comparison with our conventional products, unit: mm

| Power | Conventional size | RL      | Area ratio  |
|-------|-------------------|---------|-------------|
| 0.1W  | 1.6×0.8           | 1.0×0.5 | about 1/2.5 |
| 1W    | 6.4×3.2           | 3.7×2.0 | about 1/4   |
| 2W    | 11.5×7.0          | 7.5×2.0 | about 1/5   |

### Examples: RG series

Comparison with our conventional products, unit: mm

| Power | Conventional size | RGH      | Area ratio |
|-------|-------------------|----------|------------|
| 1/8W  | 1.6×0.8           | 1.0×0.5  | about 1/4  |
| 1/4W  | 3.2×1.6           | 2.0×1.25 | about 1/2  |

**Together, the Susumu group companies are striving to manufacture environmentally friendly products in order to maintain the earth's sustainability.**

### Susumu group's ISO 14001 certification status

| Company               | Facility                        | Certification date | Certification body | Certification # |
|-----------------------|---------------------------------|--------------------|--------------------|-----------------|
| Susumu Co. Ltd        | Obama factory                   | 2000.12.15         | JQA                | EM1184          |
|                       | headquarters, all sales offices |                    |                    |                 |
| Yokohama Denshi Seiko | Niigata factory                 | 2001.03.09         | JQA                | EM1388          |
| Cyntec                | Hsin-Chu (Taiwan)               | 2002.08.26         | UL                 | A11463          |
|                       | Suzhou (China)                  | 2003.10.22         | UL                 | A11463          |

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| ■ Products list                                                                                                                                                                                                                                                                                                                                                                                                                                    | 03 |
| In order for customers to choose the best parts for their requirements, the following pages contain tables that provide an outline for each product series. For details, please refer to the specification pages or contact our sales office.<br>All RoHS compliant products(with Sn termination) withstand threesoldering cycles at 260 °C or 10 seconds at 260°C, have an MSL of 1, meet J-STD-020C, and compatible with SnPb soldering process. |    |
| ■ Selection guide                                                                                                                                                                                                                                                                                                                                                                                                                                  | 05 |
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| Product group                       | New series name                             | Old series name | Rated power (W) |      |      |      |     |     |     | Resistance tolerance (%) |       |      |       |      |      |     | Environmental compliance |               |            |         |              | Specification pages |       |
|-------------------------------------|---------------------------------------------|-----------------|-----------------|------|------|------|-----|-----|-----|--------------------------|-------|------|-------|------|------|-----|--------------------------|---------------|------------|---------|--------------|---------------------|-------|
|                                     |                                             |                 | 1/32            | 1/20 | 1/16 | 1/10 | 1/8 | 1/6 | 1/4 | ±0.02                    | ±0.05 | ±0.1 | ±0.25 | ±0.5 | ±1.0 | ±20 | EU-RoHS                  | REACH SVHC 15 | CHINA RoHS | Pb free | Hologen free |                     |       |
| Thin film surface mount resistors   | Metal film chip resistors (ultra precision) |                 |                 |      |      |      |     |     |     |                          |       |      |       |      |      |     |                          |               |            |         |              |                     | 07-08 |
|                                     | RGseries                                    | RGseries        | ●               |      | ●    | ●    | ●   |     | ●   | ●                        | ●     | ●    | ●     |      |      | ●   | ●                        | ●             | ●          | ●       |              |                     |       |
|                                     | RGseries                                    | RGHseries       |                 |      |      |      | ●   | ●   | ●   |                          |       | ●    |       |      |      | ●   | ●                        | ●             | ●          | ●       |              |                     |       |
|                                     | Metal film chip resistor networks           |                 |                 |      |      |      |     |     |     |                          |       |      |       |      |      |     |                          |               |            |         |              |                     | 09-10 |
|                                     | RMseries                                    | —               |                 | ●    | ●    | ●    |     |     |     |                          | ●     | ●    | ●     |      |      | ●   | ●                        | ●             | ●          | ●       |              |                     |       |
|                                     | Metal film chip resistors (precision)       |                 |                 |      |      |      |     |     |     |                          |       |      |       |      |      |     |                          |               |            |         |              |                     | 11    |
|                                     | RRseries                                    | —               |                 | ●    | ●    | ●    | ●   |     | ●   |                          |       | ●    |       | ●    | ●    |     | ●                        | ●             | ●          | ●       | ●            |                     |       |
| Metal film trimmable chip resistors |                                             |                 |                 |      |      |      |     |     |     |                          |       |      |       |      |      |     |                          |               |            |         |              | 12                  |       |
| RTseries                            | —                                           |                 | ●               | ●    | ●    |      |     |     |     |                          |       |      |       |      | ●    | ●   | ●                        | ●             | ●          | ●       |              |                     |       |

| Product group                           | New series name                                                              | Old series name | Rated power (W) |     |     |     |     |     |     |     |   |     |   |   |   |   | Resistance tolerance (%) |       |       |       | Environmental compliance |         |               |            |         | Specification pages |              |       |
|-----------------------------------------|------------------------------------------------------------------------------|-----------------|-----------------|-----|-----|-----|-----|-----|-----|-----|---|-----|---|---|---|---|--------------------------|-------|-------|-------|--------------------------|---------|---------------|------------|---------|---------------------|--------------|-------|
|                                         |                                                                              |                 | 1/8             | 1/6 | 1/5 | 1/4 | 1/3 | 1/2 | 2/3 | 3/4 | 1 | 1.5 | 2 | 3 | 4 | 5 | 6                        | ± 0.5 | ± 1.0 | ± 2.0 | ± 5.0                    | EU-RoHS | REACH SVHC 15 | CHINA RoHS | Pb free |                     | Hologen free |       |
| Current sensing surface mount resistors | Low resistance chip resistors (long-side terminal)                           |                 |                 |     |     |     |     |     |     |     |   |     |   |   |   |   |                          |       |       |       |                          |         |               |            |         |                     |              |       |
|                                         | PRLseries                                                                    | —               |                 |     |     |     | ●   |     | ●   |     | ● |     | ● |   |   |   |                          | ●     | ●     | ●     | ●                        |         | ●             | ●          | ●※1     | ●※1                 | ●            | 13-14 |
|                                         | RLseries                                                                     | —               |                 |     |     |     |     |     |     | ●   |   | ●   |   |   |   |   |                          | ●     | ●     | ●     | ●                        |         | ●             | ●          | ●※1     | ●※1                 | ●            |       |
|                                         | Low resistance chip resistors (short-side terminal)                          |                 |                 |     |     |     |     |     |     |     |   |     |   |   |   |   |                          |       |       |       |                          |         |               |            |         |                     |              |       |
|                                         | RLseries                                                                     | RLseries        | ●               | ●   | ●   | ●   | ●   | ●   |     |     | ● |     |   |   |   |   |                          | ●     | ●     | ●     | ●                        |         | ●             | ●          | ●※1     | ●※1                 | ●※2          | 15-16 |
|                                         | RLseries                                                                     | RPseries        |                 |     | ●   | ●   |     |     |     |     |   |     |   |   |   |   |                          |       | ●     | ●     | ●                        | ●       |               | ●          | ●※1     | ●※1                 | ●            |       |
|                                         | Metal foil surface mount low resistance chip resistors (long-side terminal)  |                 |                 |     |     |     |     |     |     |     |   |     |   |   |   |   |                          |       |       |       |                          |         |               |            |         |                     |              |       |
|                                         | KRLseries                                                                    | —               |                 |     |     |     |     |     |     |     | ● | ●   |   | ● | ● | ● | ●                        |       | ●     | ●     | ●                        |         | ●             | ●          | ●       | ●                   | ●            | 17    |
|                                         | Metal foil surface mount low resistance chip resistors (short-side terminal) |                 |                 |     |     |     |     |     |     |     |   |     |   |   |   |   |                          |       |       |       |                          |         |               |            |         |                     |              |       |
|                                         | KRLseries                                                                    | —               |                 |     |     |     | ●   | ●   |     | ●   |   |     | ● |   |   | ● |                          |       | ●     | ●     | ●                        |         | ●             | ●          | ●       | ●                   | ●            | 18    |
|                                         | Metal foil low resistance chip resistors (4 teminals type)                   |                 |                 |     |     |     |     |     |     |     |   |     |   |   |   |   |                          |       |       |       |                          |         |               |            |         |                     |              |       |
|                                         | KRLseries                                                                    | —               |                 |     |     |     |     |     |     |     | ● |     | ● |   |   |   |                          |       | ●     | ●     |                          |         | ●             | ●          | ●       | ●                   | ●            | 19    |
|                                         | High Current Surface Mount Jumper Chip                                       |                 |                 |     |     |     |     |     |     |     |   |     |   |   |   |   |                          |       |       |       |                          |         |               |            |         |                     |              |       |
|                                         | YJPseries                                                                    | —               |                 |     |     |     |     |     |     |     |   |     |   |   |   |   |                          |       |       |       |                          | ●       | ●             | ●          | ●       | ●                   | ●            | 20    |
|                                         | Metal plate low resistance chip resistors                                    |                 |                 |     |     |     |     |     |     |     |   |     |   |   |   |   |                          |       |       |       |                          |         |               |            |         |                     |              |       |
|                                         | RLseries                                                                     | —               |                 |     |     |     |     | ●   |     |     | ● |     | ● |   |   |   |                          |       | ●     | ●     | ●                        |         | ●             | ●          | ●       | ●                   | ●            | 21    |
|                                         | Thick film low resistance chip resistors                                     |                 |                 |     |     |     |     |     |     |     |   |     |   |   |   |   |                          |       |       |       |                          |         |               |            |         |                     |              |       |
|                                         | RLTseries                                                                    | —               |                 |     |     | ●   |     | ●   |     | ●   | ● |     |   |   |   |   |                          |       | ●     | ●     | ●                        |         | ●             | ●          | ●       | ●                   | ●            | 22    |

※1 : This product is RoHS compliant but not completely lead-free. Plated nickel contains 10s of ppm level lead.  
 ※2 : All products except the RL0510 series are halogen-free. We are working on eliminating halogen from the RL0510 series.

| Product group                      | New series name           | Old series name | Rated power (W) |       |       |              |              | Resistance tolerance (%) |      |      |      | Environmental compliance |               |            |         |              | Specification pages |
|------------------------------------|---------------------------|-----------------|-----------------|-------|-------|--------------|--------------|--------------------------|------|------|------|--------------------------|---------------|------------|---------|--------------|---------------------|
|                                    |                           |                 | 1/32W           | 1/20W | 1/16W | 31mW/element | 63mW/element | ±0.5                     | ±1.0 | ±2.0 | ±5.0 | EU-RoHS                  | REACH SVHC 15 | CHINA RoHS | Pb free | Hologen free |                     |
| Thick film surface mount resistors | Thick film chip resistors |                 |                 |       |       |              |              |                          |      |      |      |                          |               |            |         |              |                     |
|                                    | PFR・GFR series            | —               | ●               | ●     | ●     |              | ●            | ●                        | ●    | ●    | ●    | ●                        |               | ●          | ●       | 23           |                     |

| Product group     | New series name         | Old series name | Inductance (μH) |            |           |           |           |      |            | Rated current (A) |           |           |             |        |         | Environmental compliance |            |         |              |    | Specification pages |
|-------------------|-------------------------|-----------------|-----------------|------------|-----------|-----------|-----------|------|------------|-------------------|-----------|-----------|-------------|--------|---------|--------------------------|------------|---------|--------------|----|---------------------|
|                   |                         |                 | 0.1 ~ 0.49      | 0.5 ~ 0.99 | 1.0 ~ 2.9 | 3.0 ~ 4.9 | 5.0 ~ 9.9 | 10 ~ | 0.45 ~ 0.9 | 1.0 ~ 4.9         | 5.0 ~ 9.9 | 10 ~ 19.9 | 20.0 ~ 34.9 | 35.0 ~ | EU-RoHS | REACH SVHC 15            | CHINA RoHS | Pb free | Hologen free |    |                     |
| Power choke coils | Power choke coils       |                 |                 |            |           |           |           |      |            |                   |           |           |             |        |         |                          |            |         |              | 24 |                     |
|                   | PCMB series             | —               | ●               | ●          | ●         | ●         | ●         | ●    | ●          | ●                 | ●         | ●         | ●           | ●      | ●       | ●                        | ●          | ●       |              |    |                     |
|                   | Small power choke coils |                 |                 |            |           |           |           |      |            |                   |           |           |             |        |         |                          |            |         |              | 24 |                     |
|                   | PCMB・PS series          | —               | ●               | ●          | ●         | ●         | ●         | ●    | ●          | ●                 | ●         |           |             |        | ●       | ●                        | ●          | ●       |              |    |                     |

| Product group                           | New series name                          | Old series name | Attenuation (dB) |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | Attenuation tolerance (dB) |           |           |           |           | Environmental compliance |           |           |         |               | Specification pages |            |         |              |
|-----------------------------------------|------------------------------------------|-----------------|------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----------------------------|-----------|-----------|-----------|-----------|--------------------------|-----------|-----------|---------|---------------|---------------------|------------|---------|--------------|
|                                         |                                          |                 | 0                | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 20                         | $\pm 0.3$ | $\pm 0.4$ | $\pm 0.5$ | $\pm 0.7$ | $\pm 0.8$                | $\pm 1.0$ | $\pm 2.5$ | EU-RoHS | REACH SVHC 15 |                     | CHINA RoHS | Pb free | Hologen free |
| High frequency surface mount components | Precision chip attenuators               |                 |                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                            |           |           |           |           |                          |           |           |         |               |                     |            |         |              |
|                                         | PAT·RAT series                           | —               | ●                | ● | ● | ● | ● | ● | ● | ● | ● | ● | ●  | ●  | ●  | ●  | ●  | ●  | ●  | ●                          | ●         | ●         | ●         | ●         | ●                        | ●         | ●         | ●       | ●             | ●                   | ●          | 25      |              |
|                                         | Temperature-compensated chip attenuators |                 |                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                            |           |           |           |           |                          |           |           |         |               |                     |            |         |              |
|                                         | P*Vseries                                | —               | ●                | ● | ● | ● | ● | ● | ● | ● | ● | ● |    |    |    |    | ●  |    |    |                            | ●         |           |           |           |                          |           | ●         | ●       |               | ●                   | ●          | 26      |              |

| Product group | Electrical characteristics                                       | Rated power (W) |      |      |     |     |     | Resistance tolerance (%) |           |           | Temperature coefficient of resistance (ppm) |          | Specification pages |
|---------------|------------------------------------------------------------------|-----------------|------|------|-----|-----|-----|--------------------------|-----------|-----------|---------------------------------------------|----------|---------------------|
|               |                                                                  | 1/32            | 1/16 | 1/10 | 1/8 | 1/6 | 1/4 | $\pm 0.05$               | $\pm 0.1$ | $\pm 0.5$ | $\pm 25$                                    | $\pm 10$ |                     |
| Sample kits   | Surface mount thin film resistors/metal thin film chip resistors |                 |      |      |     |     |     |                          |           |           |                                             |          | 27                  |
|               | RR0816PD-KIT                                                     |                 | ●    |      |     |     |     |                          |           |           | ●                                           | ●        |                     |
|               | RR1220PD-KIT                                                     |                 |      | ●    |     |     |     |                          |           |           | ●                                           | ●        |                     |
|               | RG1005PD-KIT                                                     | ●               | ●    |      | ●   |     |     |                          |           |           | ●                                           | ●        |                     |
|               | RG1608PD-KIT                                                     |                 | ●    | ●    |     | ●   |     |                          |           |           | ●                                           | ●        |                     |
|               | RG2012PD-KIT                                                     |                 |      | ●    | ●   |     | ●   |                          |           |           | ●                                           | ●        |                     |
|               | RG1005PB-KIT                                                     | ●               | ●    |      | ●   |     |     |                          | ●         |           | ●                                           | ●        |                     |
|               | RG1608PB-KIT                                                     |                 | ●    | ●    |     | ●   |     |                          | ●         |           | ●                                           | ●        |                     |
|               | RG2012PB-KIT                                                     |                 |      | ●    | ●   |     | ●   |                          | ●         |           | ●                                           | ●        |                     |
|               | RG1005NW-KIT                                                     | ●               | ●    |      | ●   |     |     | ●                        |           |           |                                             | ●        |                     |
|               | RG1608NW-KIT                                                     |                 | ●    | ●    |     | ●   |     | ●                        |           |           |                                             | ●        |                     |
|               | RG2012NW-KIT                                                     |                 |      | ●    | ●   |     | ●   | ●                        |           |           |                                             | ●        |                     |

| Product group | Product name                                                          | Rated power (W) |     |     |     | Resistance tolerance(%) | Specification pages |
|---------------|-----------------------------------------------------------------------|-----------------|-----|-----|-----|-------------------------|---------------------|
|               |                                                                       | 1/3             | 1/2 | 1.0 | 2.0 | ±1.0                    |                     |
| Sample kits   | Current sensing surface mount resistors/low resistance chip resistors |                 |     |     |     |                         |                     |
|               | RL1220-KIT                                                            | ●               |     |     |     | ●                       | 27                  |
|               | RL3720W-KIT                                                           |                 |     | ●   |     | ●                       |                     |

Thin film surface mount resistors

Current sensing surface mount resistors

Thick film surface mount resistors

Power choke coils

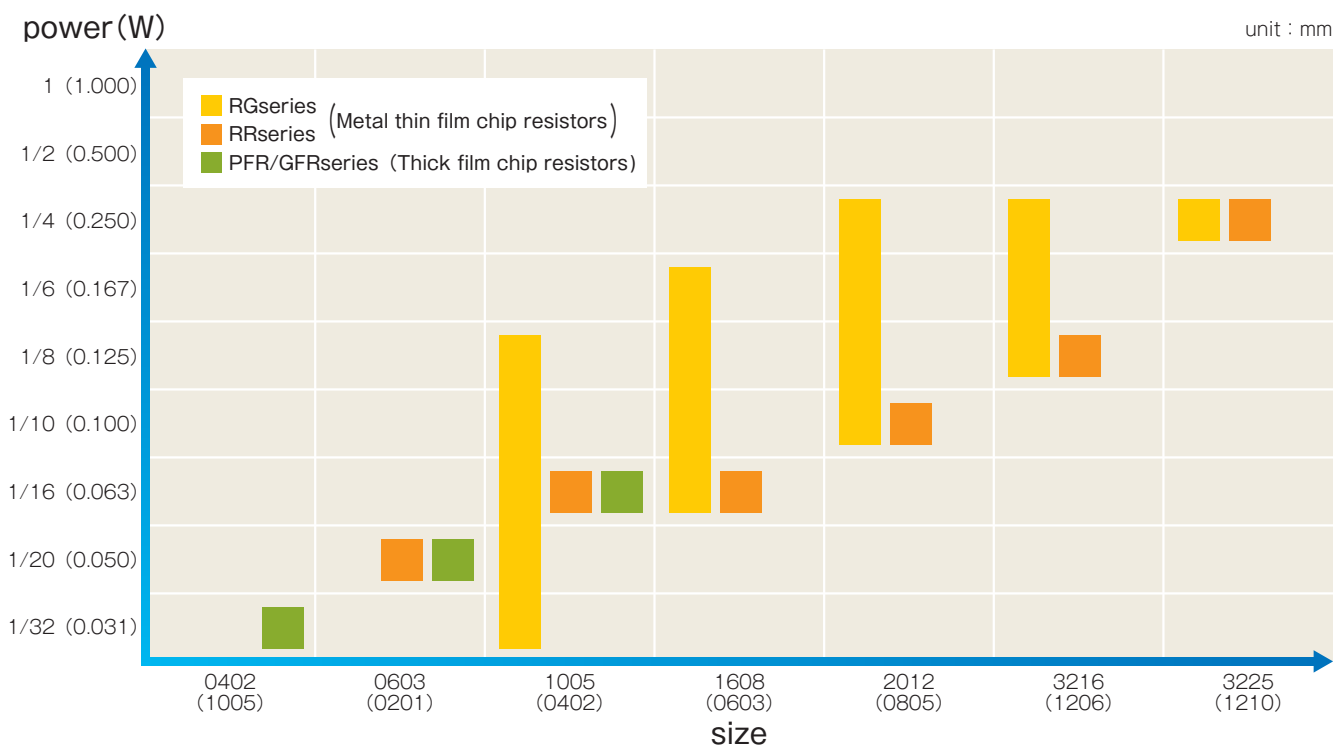
High frequency surface mount components

Sample kits

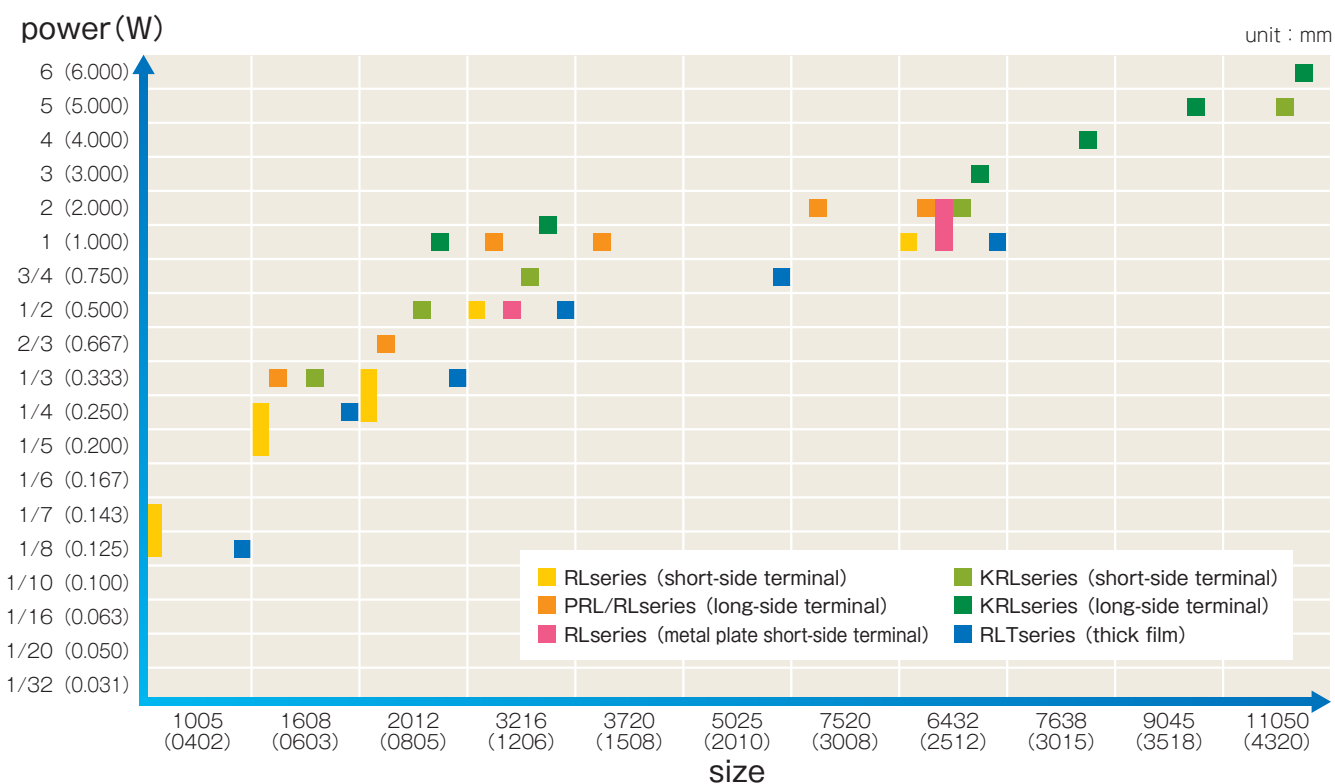
## Selection guide

We offer a variety of features among metal thin film chip resistors, thick film chip resistors, and current sensing surface mount resistors. In order to help customers choose the correct series of components, the following charts show the relationship of each component size to its rated power.

### Metal thin film chip resistors; thick film chip resistors



### Current sensing surface mount resistors





## E series resistance values (IEC designated series of resistance values)

| series | Values |      |      |      |      |      |      |      |      |      |      |      |      |      |
|--------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| E-6    | 1.00   | 1.50 | 2.20 | 3.30 | 4.70 | 6.80 |      |      |      |      |      |      |      |      |
| E-12   | 1.00   | 1.20 | 1.50 | 1.80 | 2.20 | 2.70 | 3.30 | 3.90 | 4.70 | 5.60 | 6.80 | 8.20 |      |      |
| E-24   | 1.00   | 1.10 | 1.20 | 1.30 | 1.50 | 1.60 | 1.80 | 2.00 | 2.20 | 2.40 | 2.70 | 3.00 | 3.30 | 3.60 |
|        | 4.30   | 4.70 | 5.10 | 5.60 | 6.20 | 6.80 | 7.50 | 8.20 | 9.10 |      |      |      |      |      |
| E-96   | 1.00   | 1.02 | 1.05 | 1.07 | 1.10 | 1.13 | 1.15 | 1.18 | 1.21 | 1.24 | 1.27 | 1.30 | 1.33 | 1.37 |
|        | 1.43   | 1.47 | 1.50 | 1.54 | 1.58 | 1.62 | 1.65 | 1.69 | 1.74 | 1.78 | 1.82 | 1.87 | 1.91 | 1.96 |
|        | 2.05   | 2.10 | 2.15 | 2.21 | 2.26 | 2.32 | 2.37 | 2.43 | 2.49 | 2.55 | 2.61 | 2.67 | 2.74 | 2.80 |
|        | 2.94   | 3.01 | 3.09 | 3.16 | 3.24 | 3.32 | 3.40 | 3.48 | 3.57 | 3.65 | 3.74 | 3.83 | 3.92 | 4.02 |
|        | 4.22   | 4.32 | 4.42 | 4.53 | 4.64 | 4.75 | 4.87 | 4.99 | 5.11 | 5.23 | 5.36 | 5.49 | 5.62 | 5.76 |
|        | 6.04   | 6.19 | 6.34 | 6.49 | 6.65 | 6.81 | 6.98 | 7.15 | 7.32 | 7.50 | 7.68 | 7.87 | 8.06 | 8.25 |
|        | 8.66   | 8.87 | 9.09 | 9.31 | 9.53 | 9.76 |      |      |      |      |      |      |      |      |

## Three-letter codes for resistance value (Codes for E96 series preferred numbers)

For RR0816 series and RG1608 series, Susumu uses special 3 letter codes to designate E96 values. (\*uses E24)

| code | E96 value | code | E96 value | code | E96 value | code | E96 value | code | E96 value | code | E96 value | code | E96 value | code | E96 value |
|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|
| 01   | 100*      | 13   | 133       | 25   | 178       | 37   | 237       | 49   | 316       | 61   | 422       | 73   | 562       | 85   | 750*      |
| 02   | 102       | 14   | 137       | 26   | 182       | 38   | 243       | 50   | 324       | 62   | 432       | 74   | 576       | 86   | 768       |
| 03   | 105       | 15   | 140       | 27   | 187       | 39   | 249       | 51   | 332       | 63   | 442       | 75   | 590       | 87   | 787       |
| 04   | 107       | 16   | 143       | 28   | 191       | 40   | 255       | 52   | 340       | 64   | 453       | 76   | 604       | 88   | 806       |
| 05   | 110       | 17   | 147       | 29   | 196       | 41   | 261       | 53   | 348       | 65   | 464       | 77   | 619       | 89   | 825       |
| 06   | 113       | 18   | 150*      | 30   | 200*      | 42   | 267       | 54   | 357       | 66   | 475       | 78   | 634       | 90   | 845       |
| 07   | 115       | 19   | 154       | 31   | 205       | 43   | 274       | 55   | 365       | 67   | 487       | 79   | 649       | 91   | 866       |
| 08   | 118       | 20   | 158       | 32   | 210       | 44   | 280       | 56   | 374       | 68   | 499       | 80   | 665       | 92   | 887       |
| 09   | 121       | 21   | 162       | 33   | 215       | 45   | 287       | 57   | 383       | 69   | 511       | 81   | 681       | 93   | 909       |
| 10   | 124       | 22   | 165       | 34   | 221       | 46   | 294       | 58   | 392       | 70   | 523       | 82   | 698       | 94   | 931       |
| 11   | 127       | 23   | 169       | 35   | 226       | 47   | 301       | 59   | 402       | 71   | 536       | 83   | 715       | 95   | 953       |
| 12   | 130*      | 24   | 174       | 36   | 232       | 48   | 309       | 60   | 412       | 72   | 549       | 84   | 732       | 96   | 976       |

code for power of 10

| code | power            |
|------|------------------|
| A    | 10 <sup>0</sup>  |
| H    | 10 <sup>1</sup>  |
| C    | 10 <sup>2</sup>  |
| D    | 10 <sup>3</sup>  |
| E    | 10 <sup>4</sup>  |
| F    | 10 <sup>5</sup>  |
|      |                  |
|      |                  |
|      |                  |
| R    | 10 <sup>-1</sup> |
| S    | 10 <sup>-2</sup> |

(example) 1780Ω : 178 × 10<sup>1</sup> → 25H

## Disclaimer and handling care of our products

### Disclaimer

- 1.The contents of this catalogue are only for reference purposes and its contents may be changed without prior notification. Official specifications will be submitted to each customer. For ordering, please contact our sales representatives.
- 2.The products listed in this catalogue are for general purpose electronic equipment. Please consult with us if you require specific qualities or reliability as in nuclear or aerospace applications.
- 3.When you incorporate our products in your design, please utilize them within their specified operating conditions such as rated power and recommended operating temperature. We cannot guarantee our products and cannot take responsibility for the failure of our products if they are used under improper conditions or outside of the parameters of our specified conditions.
- 4.No part of this publication may be reproduced by any means without the permission of Susumu Co. Ltd.

### Handling and care

#### < Consideration during mounting >

- (1)Before, during and after mounting, take care not to damage the protective coating of the products. Damage to the protective coating may result in weakening the humidity tolerance.
- (2)When using a soldering iron, the heat should be applied to the land pattern not directly to the component. The tip of the soldering iron should not touch the resistors directly. In addition, when the tip of the soldering iron is hot, please do soldering as quick as possible(Below 350℃ within 3 seconds).
- (3)Flux residue can cause corrosion and electro-migration resulting in the deterioration of humidity tolerance. If you utilize highly activated flux, such as flux containing chlorine, please consult with us prior to usage.
- (4)Ionized foreign material contamination or residue can also cause corrosion and electro-migration resulting in the deterioration of humidity tolerance. Do not touch the components with bare hands prior to or after mounting.
- (5)If the soldering operation takes place at very high temperatures and for a prolonged period of time, the terminal may dissolve into the solder.
- (6)When mounted components are embedded into resin or polymer, the resin/polymer selection must consider heat tolerance, humidity tolerance, mechanical properties, and chemical or ion composition.

#### < Operating environment; condition >

- (1)If these components are utilized for unusual conditions, the reliability and characteristics should be verified in advance. Such conditions include:
  - ①Exposure of the component to water, salt water, oils, acids, alkaline, or solvents
  - ②Exposure of the component to direct sunlight, outdoor weather conditions, or heavy dust
  - ③Exposure to frost
  - ④Possible exposure to corrosive air or gas such as a marine atmosphere, HCl, Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>x</sub>.
- (2)Usage under high temperatures and high humidity
- (5)When components are used under high temperature conditions, assess the potential temperatures surrounding the components considering the other heat-producing neighboring components, and regulate your power usage following the specified derating curve.
- (6)If the components are used under high humidity conditions or at temperatures below the dew point, the products can experience positive resistance drift or even an open circuit.
- (3)Use our products under the rated power when the pulse current or voltage is applied. The peak voltage of the pulse should remain under the rated voltage.



# Metal thin film chip resistors (Ultra-precision)

■ RG series (This series now includes the former RGH series.)

AEC-Q200 Compliant

## Features

- Ultimate chip resistors: the result of all of our thin film technology expertise including inorganic passivation
- Resistance drift: less than  $\pm 0.1\%$  after 10000 hour accelerated reliability test
- $\pm 0.02\%$  of resistance tolerance and  $\pm 5\text{ppm}/^\circ\text{C}$  of temperature coefficient of resistance
- Excellent tolerance to power surges

## Applications

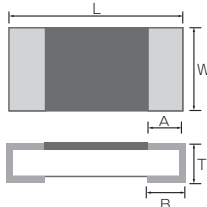
- Any applications that require precision resistors such as automotive electronics, industrial test and measurement equipment, and consumer electronics

## Specifications

\* Standard stock item: E-24 series with TCR P, Q, and R grades, as well as tolerance D and B grades. Other E-24 grades and E-96 series are made to order

unit : mm

### Dimensions



| Dimension (inch) | RG1005 (0402)<br>OLD:RGH1005-2B included | RG1608 (0603)<br>OLD:RGH1608-2C included | RG2012 (0805)<br>OLD:RGH2012-2E included | RG3216 (1206)   |
|------------------|------------------------------------------|------------------------------------------|------------------------------------------|-----------------|
| L                | 1.00 $\pm$ 0.05                          | 1.60 $\pm$ 0.20                          | 2.00 $\pm$ 0.20                          | 3.20 $\pm$ 0.20 |
| W                | 0.50 $\pm$ 0.05                          | 0.80 $\pm$ 0.20                          | 1.25 $\pm$ 0.20                          | 1.60 $\pm$ 0.20 |
| A                | 0.20 $\pm$ 0.10                          | 0.30 $\pm$ 0.20                          | 0.40 $\pm$ 0.20                          | 0.50 $\pm$ 0.25 |
| B                | 0.25 $\pm$ 0.05                          | 0.30 $\pm$ 0.20                          | 0.40 $\pm$ 0.20                          | 0.50 $\pm$ 0.20 |
| T                | 0.35 $\pm$ 0.05                          | 0.40 $\pm$ 0.10                          | 0.40 $\pm$ 0.10                          | 0.40 $\pm$ 0.10 |

**NOTE** Obsolete : RGH1005-2B (0402) RGH1608-2C (0603) RGH2012-2E (0805)  
Alternative P/N : RG1005 (0402) RG1608 (0603) RG2012 (0805)

### Electrical characteristics

| Series name                                    |                           | RG1005                  |           |             |           | RG1608                  |           |             |             |            |            |
|------------------------------------------------|---------------------------|-------------------------|-----------|-------------|-----------|-------------------------|-----------|-------------|-------------|------------|------------|
| Rated power*1                                  | High power application    | 1/8W (OLD : RGH1005-2B) |           |             |           | 1/6W (OLD : RGH1608-2C) |           |             |             |            |            |
|                                                | Regular power application | 1/16W                   |           |             |           | 1/10W                   |           |             |             |            |            |
|                                                | High precision            | 1/32W                   |           |             |           | 1/16W                   |           |             |             |            |            |
| E series offered                               |                           | E-24, E-96              |           |             |           |                         |           |             |             |            |            |
| Resistance range (Ω)                           |                           | 10 ~ 46.4               | 47 ~ 97.6 | 100 ~ 2.94k | 3k ~ 100k | 10 ~ 46.4               | 47 ~ 97.6 | 100 ~ 4.99k | 5.1k ~ 270k | 274 ~ 332k | 340 ~ 360k |
| Resistance tolerance (%)                       | ±0.02% (P)                | —                       | —         | ○           | —         | —                       | —         | ○           | —           | —          | —          |
|                                                | ±0.05% (W)                | —                       | ○         | ○           | ○         | —                       | ○         | ○           | ○           | —          | —          |
|                                                | ±0.1% (B)                 | —                       | ○         | ○           | ○         | —                       | ○         | ○           | ○           | ○          | —          |
|                                                | ±0.25% (C)                | —                       | ○         | ○           | ○         | —                       | ○         | ○           | ○           | ○          | —          |
|                                                | ±0.5% (D)                 | ○                       | ○         | ○           | ○         | ○                       | ○         | ○           | ○           | ○          | ○          |
| Temperature coefficient of resistance (ppm/°C) | ±5 (V)                    | —                       | —         | ○           | —         | —                       | —         | ○           | —           | —          | —          |
|                                                | ±10 (N)                   | —                       | ○         | ○           | ○         | —                       | ○         | ○           | ○           | —          | —          |
|                                                | ±25 (P)                   | —                       | ○         | ○           | ○         | —                       | ○         | ○           | ○           | ○          | ○          |
|                                                | ±50 (Q)                   | —                       | —         | —           | —         | ○                       | —         | —           | —           | —          | —          |
|                                                | ±100 (R)                  | ○                       | —         | —           | —         | —                       | —         | —           | —           | —          | —          |
| Maximum voltage                                |                           | 50V                     |           |             |           | 100V                    |           |             |             |            |            |
| Operating temperature                          |                           | -55℃~ 155℃              |           |             |           | -55℃~ 155℃              |           |             |             |            |            |
| Packaging                                      | 5,000pcs                  | CodeT5                  |           |             |           | CodeT5                  |           |             |             |            |            |
|                                                | 10,000pcs                 | CodeT10                 |           |             |           | —                       |           |             |             |            |            |

| Series name                                    |                           | RG2012                 |           |           |              |           | RG3216      |           |             |          |
|------------------------------------------------|---------------------------|------------------------|-----------|-----------|--------------|-----------|-------------|-----------|-------------|----------|
| Rated power*1                                  | High power application    | 1/4W(OLD : RGH2012-2E) |           |           |              |           | —           |           |             |          |
|                                                | Regular power application | 1/8W                   |           |           |              |           | 1/4W        |           |             |          |
|                                                | High precision            | 1/10W                  |           |           |              |           | 1/8W        |           |             |          |
| E series offered                               |                           | E-24, E-96             |           |           |              |           |             |           |             |          |
| Resistance range(Ω)                            |                           | 10 ~ 46.4              | 47 ~ 97.6 | 100 ~ 10k | 10.2k ~ 475k | 487k ~ 1M | 10 ~ 46.4   | 47 ~ 97.6 | 100 ~ 33.2k | 34k ~ 1M |
| Resistance tolerance (%)                       | ±0.02% (P)                | —                      | —         | ○         | —            | —         | —           | —         | ○           | —        |
|                                                | ±0.05% (W)                | —                      | —         | ○         | ○            | —         | —           | ○         | ○           | ○        |
|                                                | ±0.1% (B)                 | —                      | ○         | ○         | ○            | ○         | —           | ○         | ○           | ○        |
|                                                | ±0.25% (C)                | —                      | ○         | ○         | ○            | ○         | —           | ○         | ○           | ○        |
|                                                | ±0.5% (D)                 | ○                      | ○         | ○         | ○            | ○         | ○           | ○         | ○           | ○        |
| Temperature coefficient of resistance (ppm/°C) | ±5 (V)                    | —                      | —         | ○         | —            | —         | —           | —         | ○           | —        |
|                                                | ±10 (N)                   | —                      | ○         | ○         | ○            | —         | —           | ○         | ○           | ○        |
|                                                | ±25 (P)                   | —                      | ○         | ○         | ○            | ○         | —           | ○         | ○           | ○        |
|                                                | ±50 (Q)                   | ○                      | —         | —         | —            | —         | ○           | —         | —           | —        |
|                                                | Maximum voltage           |                        | 150V      |           |              |           |             | 200V      |             |          |
| Operating temperature                          |                           | -55℃ ~ 155℃            |           |           |              |           | -55℃ ~ 155℃ |           |             |          |
| Packaging                                      | 5,000pcs                  | CodeT5                 |           |           |              |           | CodeT5      |           |             |          |

\*1 Depending on customer's reliability requirements, power rating between high power and regular power can be selected.  
· Contact us for RG3225 with 1/2W rated power.

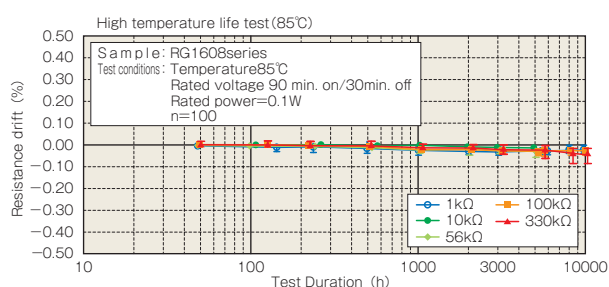


## Reliability characteristics

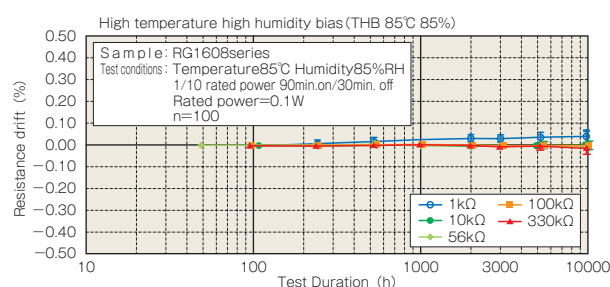
| Item                      | Test Method                                                                                                                              | Specification: drift limits for each power rating |        |         |        |      |        | (Typical) |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------|---------|--------|------|--------|-----------|
|                           |                                                                                                                                          | Low                                               |        | Regular |        | High |        |           |
|                           |                                                                                                                                          | ≤47Ω                                              | ≥47Ω   | ≤47Ω    | ≥47Ω   | ≤47Ω | ≥47Ω   |           |
| Short time Overload       | Applied voltage : 2.5 times. Test duration: 5 seconds. (When maximum operating voltage: 2 times or less)                                 | ±0.10%                                            | ±0.05% | ±0.10%  | ±0.05% | —    | ±0.10% | ±(0.01%)  |
| Load Life                 | Test temperature : 85℃ (When high voltage : 70℃ ). Applied voltage : rated voltage. Repeat 1000 hours as follow : 90 mins on/30mins off. | ±0.25%                                            | ±0.10% | ±0.50%  | ±0.25% | —    | ±0.50% | ±(0.01%)  |
| Moisture load life        | Test condition: 85℃, 85% RH. Applied power : 1/10 rated power. Repeat 1000 hours as follow : 90 mins on/30mins off.                      | ±0.25%                                            | ±0.10% | ±0.50%  | ±0.25% | —    | ±0.50% | ±(0.05%)  |
| Temperature Cycle         | Repeat 1000 cycle as follow :<br>—55℃ (30 min.)/Room Temp.(2 min.) / +125℃ (30min.)/Room Temp.(2min.)                                    | ±0.25%                                            | ±0.10% | ±0.25%  | ±0.10% | —    | ±0.10% | ±(0.01%)  |
| High temperature Exposure | +155℃ for 1000 hours with no load                                                                                                        | ±0.25%                                            | ±0.10% | ±0.25%  | ±0.10% | —    | ±0.10% | ±(0.01%)  |

## 10000 hour reliability test data

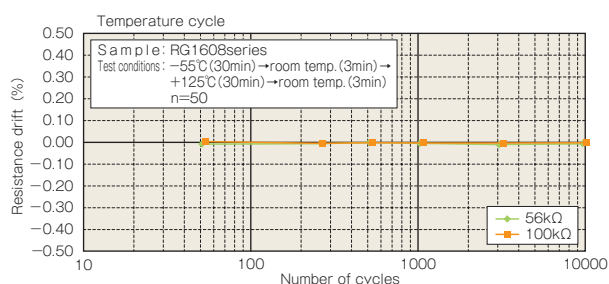
## Life test



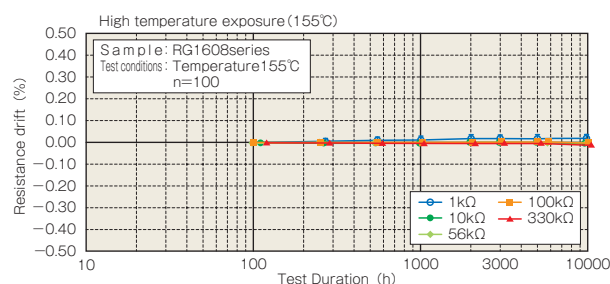
## High temperature high humidity bias test



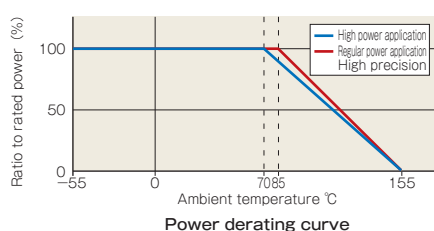
## Temperature cycle test



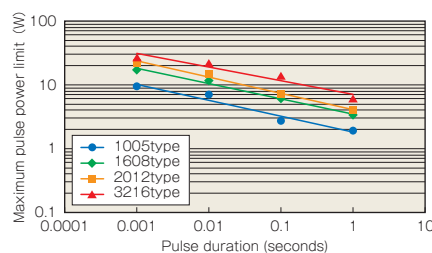
## High temperature exposure test



## Power derating characteristics



## Maximum pulse power limit

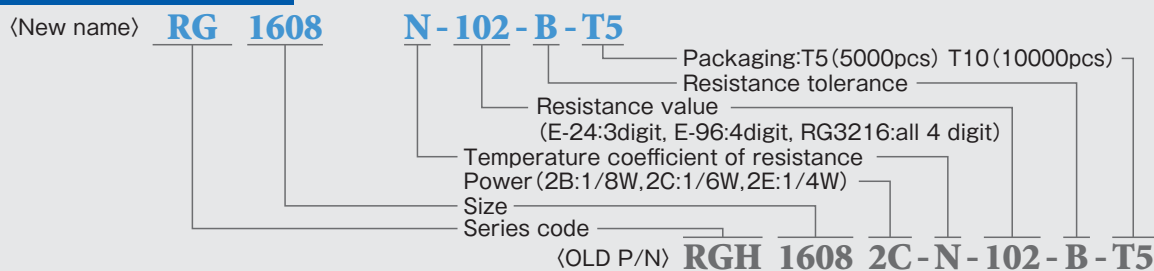


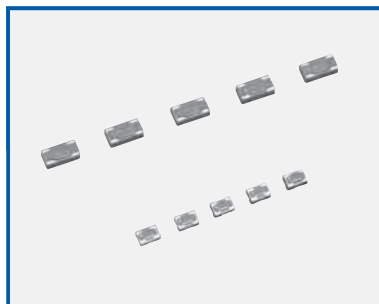
## Test procedure

Voltage pulse is applied to the test samples mounted on the test board.

After each pulse, resistance drift is measured. Pulse voltage is increased until the drift exceeds  $\pm 0.5\%$ . The power at that voltage is defined as the maximum pulse power.

## Part numbering system





# Metal thin film resistor networks

■ RM series

AEC-Q200 Compliant

## Features

- Ultra accuracy: relative resistance tolerance  $\pm 0.01\%$ , relative TCR  $\pm 1\text{ppm}/^\circ\text{C}$
- Ultra reliability: 10,000 hours of  $85^\circ\text{C}/85\text{RH}$  test or 10,000 of  $155^\circ\text{C}$  high temperature exposure test causes less than  $\pm 0.1\%$  resistance drift

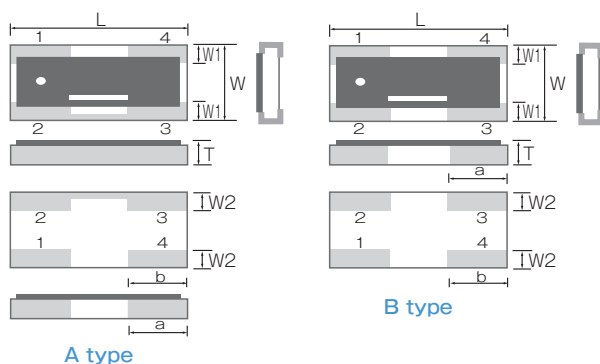
## Applications

- Applications that require a precise relative resistance ratio such as voltage dividers, and gain-setting circuits for amplifiers.

## Specifications

\* All products are made to order.

### Dimensions



| Dimension (inch) | RM2012 (0805)   | RM3216 (1206)   |
|------------------|-----------------|-----------------|
| L                | $2.00 \pm 0.20$ | $3.20 \pm 0.20$ |
| W                | $1.25 \pm 0.20$ | $1.60 \pm 0.20$ |
| W1               | $0.40 \pm 0.20$ | $0.40 \pm 0.25$ |
| W2               | $0.35 \pm 0.20$ | $0.40 \pm 0.20$ |
| a                | $0.50 \pm 0.20$ | $1.00 \pm 0.25$ |
| b                | $0.60 \pm 0.20$ | $1.00 \pm 0.20$ |
| T                | $0.40 \pm 0.10$ | $0.40 \pm 0.10$ |

(unit : mm)

### Electrical characteristics

| Series name                                                    | RM2012                                     |                             | RM3216                                     |                             |
|----------------------------------------------------------------|--------------------------------------------|-----------------------------|--------------------------------------------|-----------------------------|
| Rated power                                                    | High power application                     |                             | 0.05W/Element, 0.1W/Package                |                             |
| Resistance range ( $\Omega$ )                                  | 100 ~ < 300                                |                             | 300 ~ 100k $\Omega$                        |                             |
| Resistance tolerance (%)                                       | $\pm 0.05$ (W)                             | —                           | —                                          | —                           |
|                                                                | $\pm 0.1$ (B)                              | ○                           | ○                                          | ○                           |
|                                                                | $\pm 0.5$ (D)                              | ○                           | ○                                          | ○                           |
| Relative resistance tolerance (%)                              | $\pm 0.01$ (L)                             | Resistance ratio=1          |                                            | Resistance ratio=1          |
|                                                                | $\pm 0.02$ (P)                             | Resistance ratio $\leq 10$  |                                            | Resistance ratio $\leq 10$  |
|                                                                | $\pm 0.05$ (W)                             | Resistance ratio $\leq 100$ |                                            | Resistance ratio $\leq 100$ |
| Temperature coefficient of resistance (ppm/ $^\circ\text{C}$ ) | $\pm 10$ (N)                               | —                           | —                                          | —                           |
|                                                                | $\pm 25$ (P)                               | ○                           | ○                                          | ○                           |
| Relative TCR (ppm/ $^\circ\text{C}$ )                          | $\pm 1$ (X)                                | Resistance ratio=1          |                                            | Resistance ratio=1          |
|                                                                | $\pm 2$ (W)                                | 1<Resistance ratio $\leq 3$ |                                            | 1<Resistance ratio $\leq 3$ |
|                                                                | $\pm 5$ (V)                                | Resistance ratio>3          |                                            | Resistance ratio>3          |
| Maximum voltage /element                                       | 25V                                        |                             | 50V                                        |                             |
| Operating temperature                                          | $-55^\circ\text{C} \sim 155^\circ\text{C}$ |                             | $-55^\circ\text{C} \sim 155^\circ\text{C}$ |                             |
| Packaging                                                      | 1,000pcs                                   | Code10                      | Code10                                     | Code10                      |
|                                                                | 5,000pcs                                   | Code50                      | Code50                                     | Code50                      |

\* Relative resistance tolerance is defined as the ratio of the actual  $R2/R1$  against the specified  $R2/R1$  as expressed:

$$\left[ \frac{\text{actual } R2/R1}{\text{specified } R2/R1} - 1 \right] \times 100$$

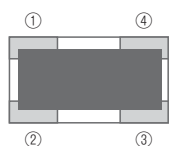
\* Relative TCR is defined as : (TCR of  $R2$ )-(TCR of  $R1$ )

### Standard resistance value pairings

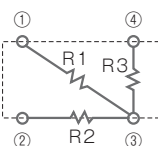
| Ratio | R1 ( $\Omega$ ) | R2 ( $\Omega$ ) | Ratio | R1 ( $\Omega$ ) | R2 ( $\Omega$ ) | Ratio | R1 ( $\Omega$ ) | R2 ( $\Omega$ ) | Ratio  | R1 ( $\Omega$ ) | R2 ( $\Omega$ ) | Ratio  | R1 ( $\Omega$ ) | R2 ( $\Omega$ ) | Ratio   | R1 ( $\Omega$ ) | R2 ( $\Omega$ ) |
|-------|-----------------|-----------------|-------|-----------------|-----------------|-------|-----------------|-----------------|--------|-----------------|-----------------|--------|-----------------|-----------------|---------|-----------------|-----------------|
| 1 : 1 | 1k              | 1k              | 1 : 3 | 1k              | 3k              | 1 : 5 | 1k              | 5k              | 1 : 9  | 1k              | 9k              | 1 : 20 | 1k              | 20k             | 1 : 50  | 1K              | 50k             |
|       | 10k             | 10k             |       | 10k             | 30k             |       | 2k              | 10k             |        | 10k             | 90k             |        | 2k              | 40k             |         | 2K              | 100k            |
|       | 100k            | 100k            |       | 100k            | 300k            |       | 10k             | 50k             |        | 1k              | 10k             |        | 5k              | 100k            |         | 1K              | 100k            |
| 1 : 2 | 1k              | 2k              | 1 : 4 | 1k              | 4k              | 1 : 6 | 1k              | 6k              | 1 : 10 | 2k              | 20k             | 1 : 25 | 1k              | 25k             | 1 : 100 | 2K              | 200k            |
|       | 10k             | 20k             |       | 10k             | 40k             |       | 10k             | 60k             |        | 10k             | 100k            |        | 2k              | 50k             |         |                 |                 |
|       | 100k            | 200k            |       |                 |                 |       |                 |                 |        |                 |                 |        |                 |                 |         |                 |                 |

## Standard circuits

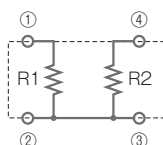
## 2012/3216Size



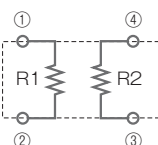
Outside appearance



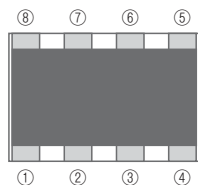
Circuit diagram : 3 element type



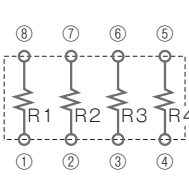
Circuit diagram : A type



Circuit diagram : B type

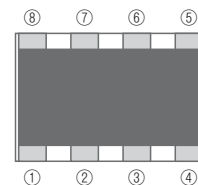
3216Size 4 element type  
(array, network with different resistance values)

Outside appearance

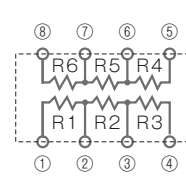


Circuit diagram

## 3216Size 6 element type



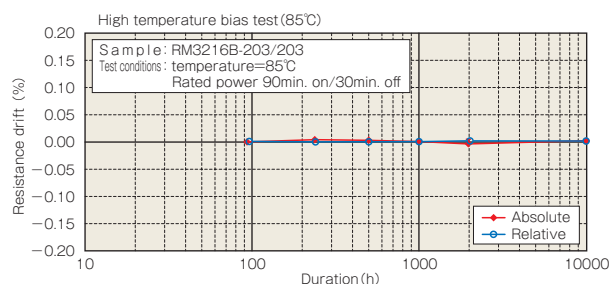
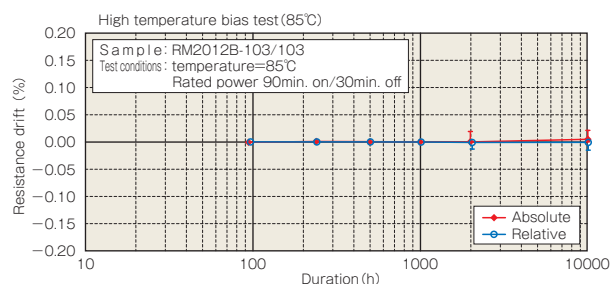
Outside appearance



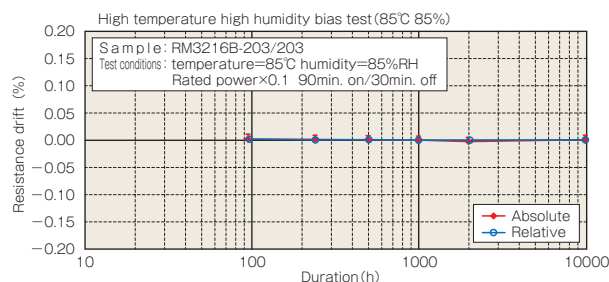
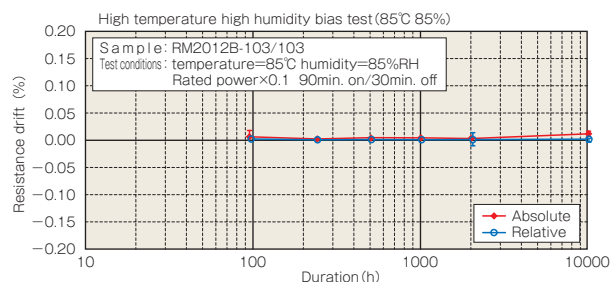
Circuit diagram

## 10000 hour reliability test data

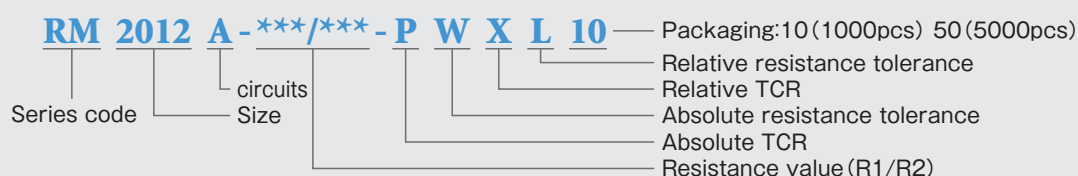
## Life test



## High temperature high humidity bias test



## Part numbering system



Please contact us for specific custom requirements for resistance values, resistance ratios, number of elements, circuitry and any others.



# Metal thin film chip resistors (precision)

## RR series

### Features

- Excellent characteristics in resistance tolerance, temperature coefficient of resistance, current noise, and linearity

### Applications

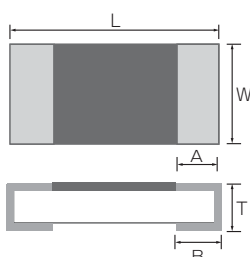
- Any electronics applications that require accuracy and reliability such as automotive electronics, industrial test and measurement, consumer electronics and many others.

### Specifications

\* Stocked items: E-24 series (TCR P and Q, resistance tolerance D), other E-24 and E-96 series are made to order.

#### Dimensions

unit : mm



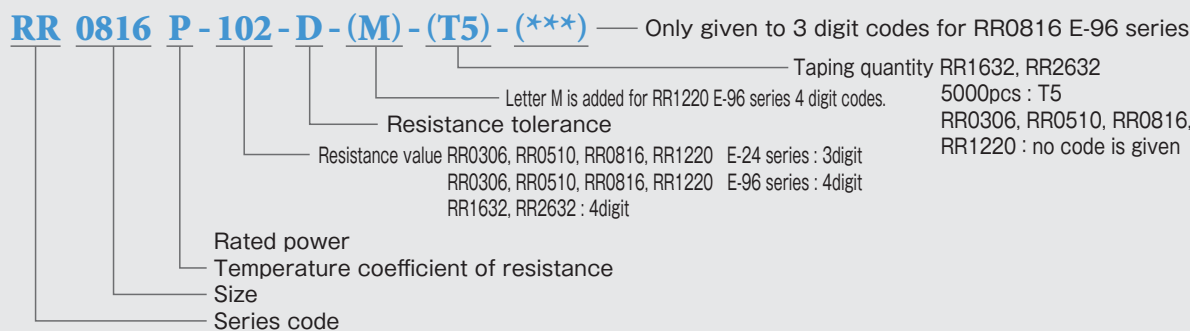
| Dimension (inch) | RR0306 (0201) | RR0510 (0402) | RR0816 (0603) | RR1220 (0805) | RR1632 (1206) | RR2632 (1210) |
|------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| L                | 0.60±0.05     | 1.00±0.05     | 1.60±0.20     | 2.00±0.20     | 3.20±0.20     | 3.20±0.20     |
| W                | 0.30±0.05     | 0.50±0.05     | 0.80±0.20     | 1.25±0.20     | 1.60±0.20     | 2.60±0.20     |
| A                | 0.12±0.05     | 0.20±0.10     | 0.30±0.20     | 0.40±0.20     | 0.50±0.20     | 0.50±0.20     |
| B                | 0.12±0.05     | 0.25±0.05     | 0.30±0.20     | 0.40±0.20     | 0.45±0.20     | 0.45±0.20     |
| T                | 0.23±0.03     | 0.35±0.05     | 0.40±0.10     | 0.40±0.10     | 0.40±0.10     | 0.40±0.10     |

#### Electrical characteristics

| Series name                                    | RR0306                                      | RR0510          | RR0816          | RR1220        | RR1632                 | RR2632                 |
|------------------------------------------------|---------------------------------------------|-----------------|-----------------|---------------|------------------------|------------------------|
| power                                          | 1/20W                                       | 1/16W           | 1/16W           | 1/10W         | 1/8W                   | 1/4W                   |
| E series offered                               | E-24                                        | E-24            | E-24            | E-24, E-96    | E-24, E-96             | E-24, E-96             |
| Resistance range (Ω)                           | 10~30, 33~22k                               | 10~91, 100~100k | 10~91, 100~360k | 10~91, 100~1M | 10~47, 51~1M, 100~200k | 10~47, 51~1M, 100~200k |
| Resistance tolerance (%)                       | ±0.1% (B), ±0.5% (D), ±1.0% (F)             | —, —, —         | —, —, —         | —, —, —       | —, —, —                | —, —, —                |
| Temperature coefficient of resistance (ppm/°C) | ±5 (V), ±10 (N), ±25 (P), ±50 (Q), ±100 (R) | —, —, —         | —, —, —         | —, —, —       | —, —, —                | —, —, —                |
| Maximum voltage                                | 15V                                         | 25V             | 75V             | 100V          | 150V                   | 200V                   |
| Operating temperature                          | -55°C ~ 125°C                               |                 |                 |               |                        |                        |
| Packaging                                      | 5,000pcs, 10,000pcs                         | —, —            | —, —            | —, —          | —, —                   | —, —                   |

Contact us for the jumper resistor in RR0816 size (part number: RL0816-JMP)

### Part numbering system





# Metal thin film trimmable chip resistors

## RT series

### Features

- Patented trimming method ( patent# 1921853) allows high trimming accuracy, excellent reliability after trimming and short trimming time
- Small sizes down to 0.6mm x 0.3mm

### Applications

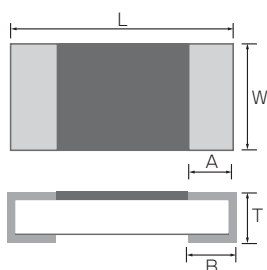
- Sensor circuits that require high precision such as automotive electronics
- PA modules in mobile phones
- Devices that require strong vibration tolerance such as microphones

### Specifications

\* All made to order.

#### Dimensions

unit : mm



| Dimension (inch) | RT0603 (0201) | RT0510 (0402) | RT0816 (0603) | RT1220 (0805) |
|------------------|---------------|---------------|---------------|---------------|
| L                | 0.60±0.05     | 1.00±0.07     | 1.60±0.20     | 2.00±0.20     |
| W                | 0.30±0.03     | 0.50±0.07     | 0.80±0.20     | 1.25±0.20     |
| A                | 0.12±0.05     | 0.20±0.10     | 0.30±0.20     | 0.40±0.20     |
| B                | 0.15±0.05     | 0.25±0.20     | 0.30±0.20     | 0.40±0.20     |
| T                | 0.25±0.03     | 0.35±0.05     | 0.40±0.10     | 0.40±0.10     |

#### Electrical characteristics

| Series name                                    | RT0603        |      |      | RT0510        |      |      | RT0816        |      |      |      |     | RT1220        |      |     |      |      |      |      |      |
|------------------------------------------------|---------------|------|------|---------------|------|------|---------------|------|------|------|-----|---------------|------|-----|------|------|------|------|------|
| power                                          | 1/20W         |      |      | 1/16W         |      |      | 1/16W         |      |      |      |     | 1/10W         |      |     |      |      |      |      |      |
| Initial resistance value (Ω)                   | 150           | 330  | 1.5k | 100           | 270  | 1.5k | 100           | 330  | 1.0k | 3.3k | 10k | 33            | 100  | 330 | 1.0k | 3.3k | 10k  | 33k  | 100k |
| Targeted resistance value (Ω)                  | 1.0k          | 1.9k | 10k  | 820           | 2.1k | 10k  | 2.7k          | 8.0k | 8.8k | 37k  | 40k | 4.7k          | 8.2k | 15k | 15k  | 100k | 120k | 120k | 220k |
| Initial value tolerance (%)                    | ±20% (M)      |      |      | ±20% (M)      |      |      | ±20% (M)      |      |      |      |     | ±20% (M)      |      |     |      |      |      |      |      |
| Temperature coefficient of resistance (ppm/°C) | ±25 (P)       | ○    | ○    | —             | ○    | ○    | —             | ○    | ○    | ○    | —   | —             | ○    | ○   | ○    | —    | —    | —    | —    |
|                                                | ±50 (Q)       | —    | —    | —             | —    | —    | —             | —    | —    | —    | —   | ○             | —    | —   | —    | —    | —    | —    | —    |
|                                                | ±100 (R)      | —    | —    | ○             | —    | —    | ○             | —    | —    | —    | ○   | ○             | —    | —   | —    | ○    | ○    | ○    | ○    |
| Maximum voltage                                | 15V           |      |      | 25V           |      |      | 75V           |      |      |      |     | 100V          |      |     |      |      |      |      |      |
| Operating temperature                          | -55°C ~ 125°C |      |      | -55°C ~ 125°C |      |      | -55°C ~ 125°C |      |      |      |     | -55°C ~ 125°C |      |     |      |      |      |      |      |
| Packaging                                      | 5,000pcs      | —    |      |               | —    |      |               | ○    |      |      |     |               | ○    |     |      |      |      |      |      |
|                                                | 10,000pcs     | —    |      |               | ○    |      |               | —    |      |      |     |               | —    |     |      |      |      |      |      |
|                                                | 15,000pcs     | ○    |      |               | —    |      |               | —    |      |      |     |               | —    |     |      |      |      |      |      |

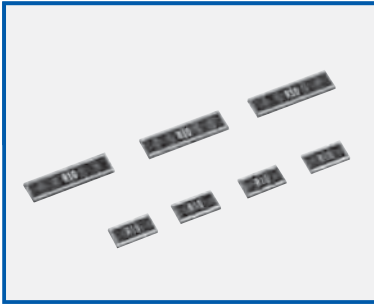
### Part numbering system

**RT 0816 P - 102 - M**

Resistance tolerance  
Resistance value  
Temperature coefficient of resistance  
Size  
Series code

# Low resistance chip resistors (long side terminal type)

■ This series includes (some of) former PRL/RL series



## Features

- The distinctive structure that encourages heat dissipation and radiation limits the rise of the surface temperature, allows the realization of smaller sizes, and reduces influence of heat on surrounding components. Low ESL contributes to less noise. This product also withstands temperature cycles very well.

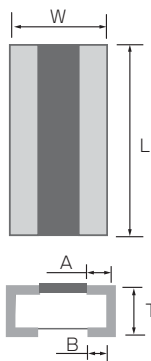
## Applications

- PCs, power sources, inverters, automotive electronics, adaptors and industrial machining equipment.

## Specifications

\* All made to order.

### Dimensions



| Dimension (mm) | PRL0816 (0603) | PRL1220 (0805) | PRL1632 (1206) | PRL3264 (2512) | RL3720W (1508) | RL7520W (3008) |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| L              | 1.60±0.20      | 2.00±0.20      | 3.20±0.20      | 6.40±0.20      | 3.75±0.30      | 7.50±0.30      |
| W              | 0.80±0.20      | 1.25±0.20      | 1.60±0.20      | 3.20±0.20      | 2.00±0.20      | 2.00±0.20      |
| A              | —              | —              | —              | —              | 0.40±0.20      | 0.40±0.20      |
| B              | 0.20±0.10      | 0.35±0.15      | 0.45±0.15      | 0.90±0.15      | 0.40±0.20      | 0.40±0.20      |
| T              | 0.40±0.10      | 0.50±0.10      | 0.50±0.10      | 0.50±0.10      | 0.50±0.20      | 0.50±0.20      |

(unit : mm)

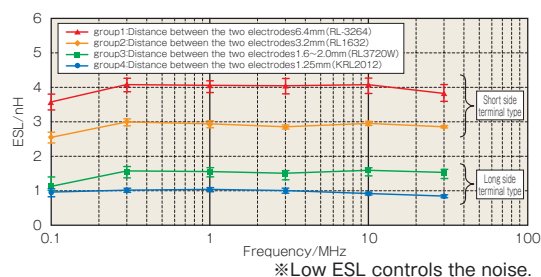
### Electrical characteristics

| Series name                                         |           | PRL0816                 |               | PRL1220                  |                |               | PRL1632                  |          | PRL3264                  |                 |                 |           |
|-----------------------------------------------------|-----------|-------------------------|---------------|--------------------------|----------------|---------------|--------------------------|----------|--------------------------|-----------------|-----------------|-----------|
| Power                                               |           | 1/3W                    |               | 2/3W                     |                |               | 1W                       |          | 2W                       |                 |                 |           |
| E series offered                                    |           | E-24                    |               | E-24<br>1mΩstep(7m~10mΩ) |                |               | E-24<br>1mΩstep(5m~10mΩ) |          | E-24<br>1mΩstep(3m~10mΩ) |                 |                 |           |
| Initial resistance value(Ω)                         |           | 0.01~<br>0.039          | 0.043~<br>0.1 | 0.007~<br>0.009          | 0.01~<br>0.043 | 0.047~<br>0.1 | 0.005~<br>0.009          | 0.01~0.1 | 0.003~<br>0.004          | 0.005~<br>0.009 | 0.010~<br>0.043 | 0.047~0.1 |
| Resistance<br>tolerance<br>(%)                      | ±0.5% (D) | —                       | ○             | —                        | —              | ○             | —                        | ○        | —                        | —               | —               | ○         |
|                                                     | ±1.0% (F) | ○                       | ○             | —                        | ○              | ○             | ○                        | ○        | —                        | —               | ○               | ○         |
|                                                     | ±2.0% (G) | —                       | —             | ○                        | ○              | ○             | ○                        | ○        | —                        | ○               | ○               | ○         |
|                                                     | ±5.0% (J) | —                       | —             | —                        | —              | —             | —                        | —        | ○                        | —               | —               | —         |
| Temperature coefficient of<br>resistance<br>(ppm/℃) |           | 15mΩ or less 0~350ppm/℃ |               | 7m~9mΩ 0~350ppm/℃        |                |               | 9mΩ or less 0~350ppm/℃   |          |                          |                 |                 |           |
|                                                     |           | 18m~27mΩ 0~200ppm/℃     |               | 10m~18mΩ 0~200ppm/℃      |                |               | 10m~18mΩ 0~200ppm/℃      |          |                          |                 |                 |           |
|                                                     |           | 33m~68mΩ ±100ppm/℃      |               | 20m~51mΩ ±100ppm/℃       |                |               | 20m~51mΩ ±100ppm/℃       |          |                          |                 |                 |           |
|                                                     |           | 75m~100mΩ ±50ppm/℃      |               | 56m~100mΩ ±50ppm/℃       |                |               | 56m~100mΩ ±50ppm/℃       |          |                          |                 |                 |           |
| Maximum voltage                                     |           | $\sqrt{P \cdot R}$      |               |                          |                |               |                          |          |                          |                 |                 |           |
| Operating temperature                               |           | -55℃~125℃               |               |                          |                |               |                          |          |                          |                 |                 |           |
| Packaging                                           | 5,000pcs  | ○                       |               |                          |                |               |                          |          |                          |                 |                 |           |

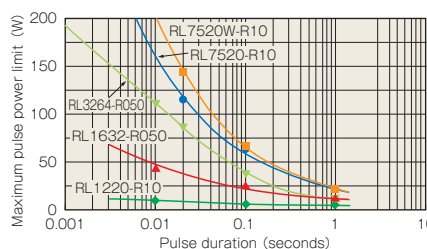
| Series name                                    | RL3720W                   |               |               |           | RL7520W                   |               |               |            |
|------------------------------------------------|---------------------------|---------------|---------------|-----------|---------------------------|---------------|---------------|------------|
| power                                          | 1W                        |               |               |           | 2W                        |               |               |            |
| E series offered                               | E-24<br>1mΩstep (1m~10mΩ) |               |               |           | E-24<br>1mΩstep (1m~10mΩ) |               |               |            |
| Initial resistance value (Ω)                   | 0.001 ~ 0.004             | 0.005 ~ 0.009 | 0.010 ~ 0.091 | 0.1 ~ 1.0 | 0.001 ~ 0.004             | 0.005 ~ 0.009 | 0.010 ~ 0.091 | 0.1 ~ 0.47 |
| Resistance tolerance (%)                       | ±1.0% (F)                 | ○             | ○             | ○         | ○                         | ○             | ○             | ○          |
|                                                | ±2.0% (G)                 | ○             | ○             | ○         | ○                         | ○             | ○             | ○          |
|                                                | ±5.0% (J)                 | —             | —             | —         | ○                         | ○             | —             | —          |
|                                                | 0~+50 (Q)                 | —             | —             | —         | —                         | —             | —             | ○          |
| Temperature coefficient of resistance (ppm/°C) | 0~+100 (R)                | —             | —             | —         | —                         | —             | ○             | ○          |
|                                                | 0~+200 (S)                | —             | ○             | ○         | —                         | —             | —             | ○          |
|                                                | 0~+350 (T)                | ○             | ○             | ○         | —                         | —             | ○             | —          |
|                                                | 0~+420 (T)                | —             | —             | —         | —                         | ○             | —             | —          |
|                                                | 0~+800 (T)                | —             | —             | —         | ○                         | —             | —             | —          |
|                                                | —                         | —             | —             | —         | —                         | —             | —             | —          |
| Maximum voltage                                | $\sqrt{P \cdot R}$        |               |               |           |                           |               |               |            |
| Operating temperature                          | -55°C ~ 125°C             |               |               |           |                           |               |               |            |
| Packaging                                      | 4,000pcs                  |               |               |           |                           |               |               |            |



## ESL



## Resistance to power pulse



## Test procedure

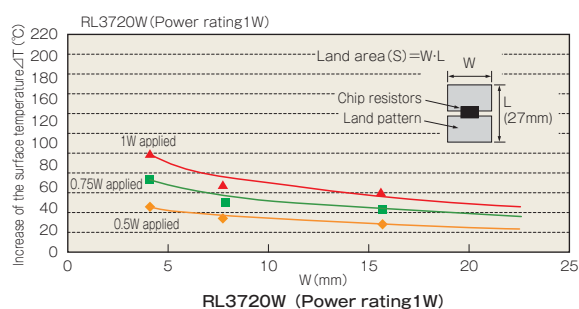
Voltage pulse is applied to the test samples mounted on the test board.

After each pulse, resistance drift is measured. Pulse voltage is increased until the drift exceeds  $\pm 0.5\%$ . The power at that voltage is defined as the maximum pulse power.

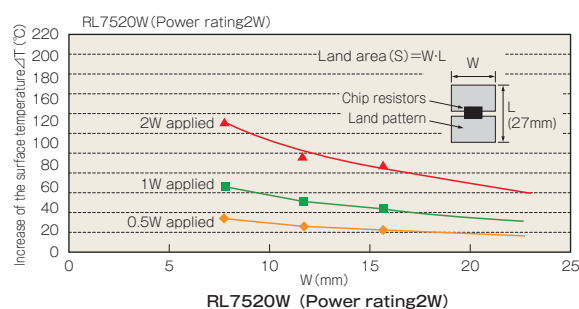
## Surface temperature data

## The high power type land pattern and surface temperature

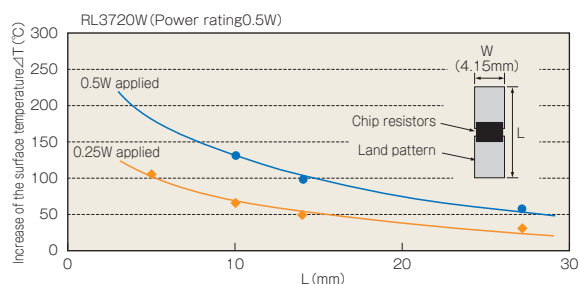
These high-power low resistance chip resistors are designed to dissipate heat efficiently through the land patterns on circuit boards. The actual temperature of the surface of the resistor is dependent upon the dimensions and the shape of the land patterns.



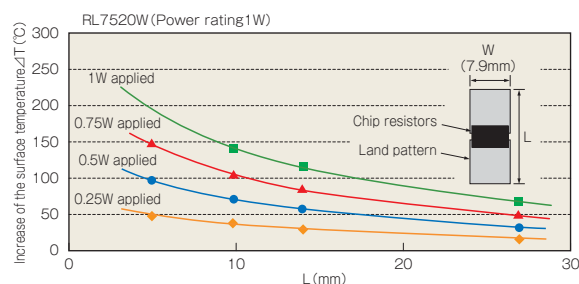
RL3720W (Power rating 1W)



RL7520W (Power rating 2W)

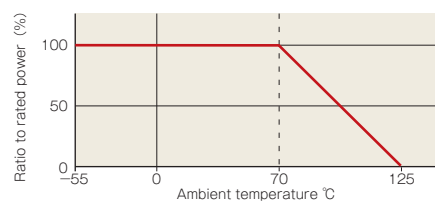
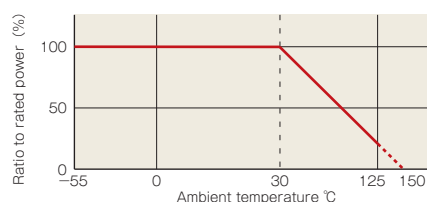


RL3720W (Power rating 0.5W)



RL7520W (Power rating 1W)

## Power derating characteristics

Power derating curve  
RL3720W

RL7520W

## Part numbering system

**PRL 1220 T-R10-F-(T5)**

Packaging: T5 (5000pcs)

Resistance tolerance

Resistance value

Temperature coefficient of resistance

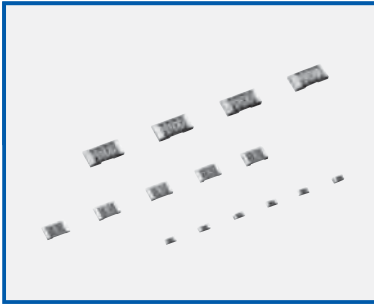
Size

Series code

(OLD P/N) **RL 3720W T-R10-F**

# Low resistance chip resistors (short side terminal)

■ This series includes (some of) former RP and RPH series



\* 1 : Except for RL0510、RL1632、RL3264

## Features

- The distinctive structure that encourages heat dissipation and radiation limits the rise of the surface temperature, allows the realization of smaller sizes, and reduces the influence of heat on surrounding components.

## Applications

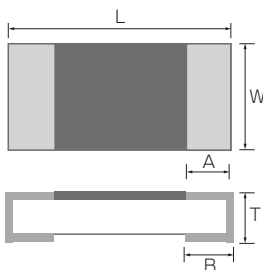
- PCs, power sources, mobile phones, automotive electronics, adaptor and industrial machining equipment.

## Specifications

\* All made to order.

### Dimensions

unit : mm



| Dimension (inch) | RL0510 (0402)<br>(OLD:RP1005 included) |           | RL0816 (0603)<br>(OLD:RP1608,RPH1608 included) |           | RL1220 (0805)<br>(OLD:RP2012 included) |           | RL1632 (1206) | RL3264 (2512) |
|------------------|----------------------------------------|-----------|------------------------------------------------|-----------|----------------------------------------|-----------|---------------|---------------|
|                  | R≤0.2Ω                                 | R>0.2Ω    | R≤0.082Ω                                       | R>0.091Ω  | R≤0.068Ω                               | R>0.075Ω  |               |               |
| L                | 1.00±0.05                              |           | 1.60±0.20                                      |           | 2.00±0.20                              |           | 3.20±0.20     | 6.40±0.20     |
| W                | 0.50±0.05                              |           | 0.80±0.20                                      |           | 1.25±0.20                              |           | 1.60±0.20     | 3.20±0.20     |
| A                | 0.15±0.10                              |           | 0.20±0.15                                      |           | 0.40±0.20                              |           | —             | —             |
| B                | 0.25±0.10                              | 0.15±0.10 | 0.25±0.20                                      | 0.20±0.15 | 0.40±0.20                              |           | 1.00±0.15     | 2.00±0.15     |
| T                | 0.35±0.15/-0.10                        | 0.35±0.10 | 0.45±0.15/-0.10                                | 0.45±0.10 | 0.50±0.20                              | 0.40±0.10 | 0.50±0.15     | 0.50±0.15     |

**NOTE** Obsolete: RP1005, RP1608, RPH1608, RP2012  
Alternative P/N: RL0510, RL0816, RL1220

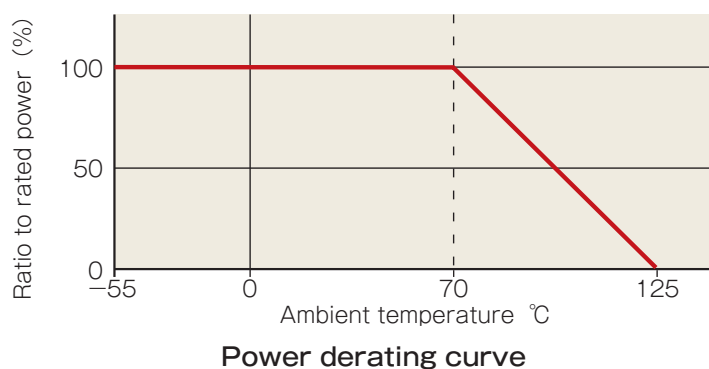
### Electrical characteristics

| Series name                                    | RL0510 (OLD : RP1005 included) |                                 |        | RL0816 (OLD:RP1608,RPH1608 included) |                        |        | RL1220 (OLD:RP2012 included) |             |                        |        |
|------------------------------------------------|--------------------------------|---------------------------------|--------|--------------------------------------|------------------------|--------|------------------------------|-------------|------------------------|--------|
| Power                                          | 1/8W                           | 1/6W<br>(OLD : RP1005 included) |        | 1/4W<br>(OLD : RPH1608)              | 1/5W<br>(OLD : RP1608) |        | 1/4W                         |             | 1/3W<br>(OLD : RP2012) |        |
| E series offered                               | E-24                           |                                 |        |                                      |                        |        |                              |             |                        |        |
| Resistance range (Ω)                           | R<0.05~0.1                     | 0.1~4.7                         | 5.1~47 | R<0.02~0.1                           | 0.1~6.8                | 7.5~68 | 0.01~0.039                   | 0.043~0.091 | 0.1~10                 | 11~100 |
| Resistance tolerance (%)                       | ±1.0 (F)                       | ○                               | ○      | ○                                    | ○                      | ○      | ○                            | ○           | ○                      | ○      |
|                                                | ±2.0 (G)                       | ○                               | ○      | ○                                    | —                      | ○      | ○                            | ○           | ○                      | ○      |
|                                                | ±5.0 (J)                       | —                               | —      | ○                                    | —                      | ○      | ○                            | ○           | ○                      | ○      |
| Temperature coefficient of resistance (ppm/°C) | 0~+100(R)                      | —                               | —      | —                                    | ○                      | —      | —                            | —           | ○                      | —      |
|                                                | 0~+200(S)                      | —                               | ○      | ○                                    | ○                      | ○      | —                            | ○           | ○                      | ○      |
|                                                | 0~+350(T)                      | ○                               | —      | —                                    | ○                      | —      | ○                            | ○           | —                      | —      |
| Maximum voltage                                | $\sqrt{P \cdot R}$             |                                 |        |                                      |                        |        |                              |             |                        |        |
| Operating temperature                          | -55 ~ 125°C                    |                                 |        |                                      |                        |        |                              |             |                        |        |
| Packaging                                      | 5,000pcs                       | —                               |        |                                      | ○                      |        |                              |             |                        |        |
|                                                | 10,000pcs                      | ○                               |        |                                      | —                      |        |                              |             |                        |        |

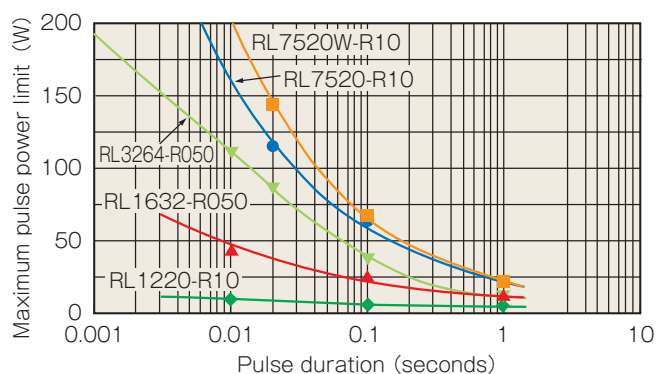
| Series name                                    | RL1632             |               |              |               |              |            |  |
|------------------------------------------------|--------------------|---------------|--------------|---------------|--------------|------------|--|
| Power                                          | 1/ 2W              |               |              |               |              |            |  |
| E series offered                               | E-24               |               |              |               |              |            |  |
| Resistance range (Ω)                           | 0.01 ~ 0.016       | 0.018 ~ 0.024 | 0.027 ~ 0.03 | 0.033 ~ 0.051 | 0.056 ~ 0.47 | 0.51 ~ 4.7 |  |
| Resistance tolerance (%)                       | ±0.5 (D)           | —             | —            | —             | —            | ○          |  |
|                                                | ±1.0 (F)           | —             | —            | ○             | ○            | ○          |  |
|                                                | ±2.0 (G)           | ○             | ○            | ○             | ○            | —          |  |
| Temperature coefficient of resistance (ppm/°C) | 0~+100(R)          | —             | —            | —             | ○            | ○          |  |
|                                                | 0~+200(S)          | —             | —            | —             | ○            | —          |  |
|                                                | 0~+350(T)          | —             | ○            | ○             | —            | —          |  |
|                                                | 0~+500(T)          | ○             | —            | —             | —            | —          |  |
| Maximum voltage                                | $\sqrt{P \cdot R}$ |               |              |               |              |            |  |
| Operating temperature                          | -55 ~ 125°C        |               |              |               |              |            |  |
| Packaging                                      | 5,000pcs           | ○             |              |               |              |            |  |

| Series name                                    |              | RL3264                                      |               |       |               |              |
|------------------------------------------------|--------------|---------------------------------------------|---------------|-------|---------------|--------------|
| Power                                          |              | 1W                                          |               |       |               |              |
| E series offered                               |              | Standard stock item : E-24series E-12series |               |       |               |              |
| Resistance range (Ω)                           |              | 0.01 ~ 0.015                                | 0.018 ~ 0.022 | 0.027 | 0.033 ~ 0.047 | 0.056 ~ 0.47 |
| Resistance tolerance (%)                       | ±0.1 (B)     | —                                           | —             | —     | —             | —            |
|                                                | ±0.5 (D)     | —                                           | —             | —     | —             | —            |
|                                                | ±1.0 (F)     | —                                           | —             | ○     | ○             | ○            |
|                                                | ±2.0 (G)     | ○                                           | ○             | ○     | ○             | ○            |
|                                                | ±5.0 (J)     | —                                           | —             | —     | —             | —            |
| Temperature coefficient of resistance (ppm/°C) | 0 ~ +100 (R) | —                                           | —             | —     | —             | ○            |
|                                                | 0 ~ +200 (S) | —                                           | —             | —     | ○             | —            |
|                                                | 0 ~ +350 (T) | —                                           | ○             | ○     | —             | —            |
|                                                | 0 ~ +500 (T) | ○                                           | —             | —     | —             | —            |
| Maximum voltage                                |              | $\sqrt{P \cdot R}$                          |               |       |               |              |
| Operating temperature                          |              | -55 ~ 125°C                                 |               |       |               |              |
| Packaging                                      | 5,000pcs     | ○                                           |               |       |               |              |

### Power derating characteristics



### Resistance to power pulse

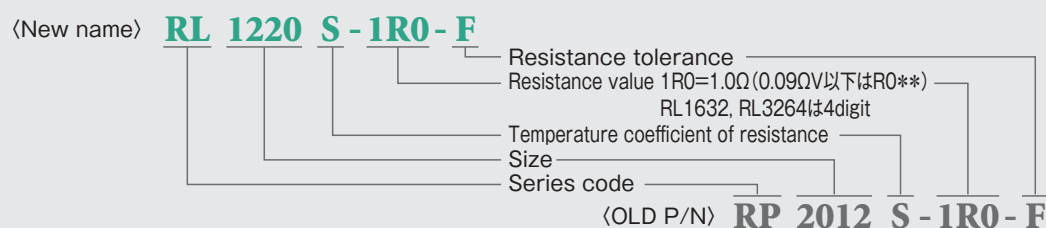


#### Test procedure

Voltage pulse is applied to the test samples mounted on the test board.

After each pulse, resistance drift is measured. Pulse voltage is increased until the drift exceeds  $\pm 0.5\%$ . The power at that voltage is defined as the maximum pulse power.

### Part numbering system



# Metal foil low resistance chip resistors (short-side terminals)

KRL series

AEC-Q200 Compliant

## Features

- The C type utilizes materials that withstand high temperatures and can be operated up to 175°C. The M type utilizes low emf materials that are stable up to 155°C. TCR is very stable for very low resistance:  $\pm 100\text{ppm}/^\circ\text{C}$  for  $5\text{m}\Omega \sim 9\text{m}\Omega$ , and  $\pm 50\text{ppm}/^\circ\text{C}$  for  $10\text{m}\Omega \sim$ . Face down mounting allows for accurate current measurement. Long and short side terminal types, as well as power ratings from 1/3W to 5W are offered to meet customers' specific requirements. The protective outer coating is halogen free in consideration of the environment.

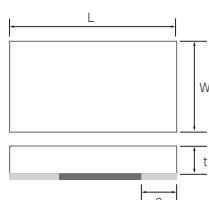
## Applications

- PCs, hard drive discs, audio visual equipments, power sources, inverters, automotive electronics, industrial machining equipments, industrial test and measurements, etc.

## Specifications

\* All made to order.

### Dimensions



| Dimensions (mm)          | KRL0816 (0603)  | KRL1220 (0805)  | KRL1632 (1206)  | KRL3264 (2512)  | KRL50110 (4320) |
|--------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| L                        | $1.60 \pm 0.20$ | $2.00 \pm 0.20$ | $3.20 \pm 0.20$ | $6.30 \pm 0.20$ | $11.0 \pm 0.20$ |
| W                        | $0.80 \pm 0.20$ | $1.25 \pm 0.20$ | $1.60 \pm 0.20$ | $3.10 \pm 0.20$ | $5.00 \pm 0.20$ |
| t                        | $0.50 \pm 0.20$ | $0.50 \pm 0.20$ | $0.50 \pm 0.20$ | $0.50 \pm 0.20$ | $0.65 \pm 0.20$ |
| a (5.0 ~ 7.0m $\Omega$ ) | —               | $0.40 \pm 0.20$ | $1.10 \pm 0.20$ | $1.90 \pm 0.20$ | $3.60 \pm 0.30$ |
| a (8.0m $\Omega$ ~)      | —               |                 | $1.10 \pm 0.20$ | $1.90 \pm 0.20$ | $3.60 \pm 0.30$ |
| a (9.0m $\Omega$ ~)      | $0.30 \pm 0.20$ | —               | $0.50 \pm 0.20$ | $1.00 \pm 0.20$ | $2.36 \pm 0.30$ |

### Electrical characteristics

| Series name                                                    | KRL0816       | KRL1220                                    |            | KRL1632          |            | KRL3264          |             | KRL50110         |             |
|----------------------------------------------------------------|---------------|--------------------------------------------|------------|------------------|------------|------------------|-------------|------------------|-------------|
| Power                                                          | 0.3W          | 1/2W                                       |            | 3/4W             |            | 2W               |             | 5W               |             |
| E series offered                                               | E-12          | E-12                                       |            | 1m $\Omega$ STEP | E-12       | 1m $\Omega$ STEP | E-12        | 1m $\Omega$ STEP | E-12        |
| Resistance range ( $\Omega$ )                                  | 10m ~ 100m    | 5m ~ 9m                                    | 10m ~ 100m | 5m ~ 9m          | 10m ~ 500m | 5m ~ 9m          | 10m ~ 1000m | 5m ~ 9m          | 10m ~ 1000m |
| Resistance tolerance (%)                                       | $\pm 1.0$ (F) | ○                                          | —          | ○                | —          | ○                | —           | ○                | —           |
|                                                                | $\pm 2.0$ (G) | —                                          | ○          | —                | ○          | —                | ○           | —                | ○           |
| Temperature coefficient of resistance (ppm/ $^\circ\text{C}$ ) | $\pm 50$      | ○                                          | —          | ○                | —          | ○                | —           | ○                | —           |
|                                                                | $\pm 100$     | —                                          | ○          | —                | ○          | —                | ○           | —                | ○           |
| Operating temperature                                          | C             | $-55^\circ\text{C} \sim 175^\circ\text{C}$ |            |                  |            |                  |             |                  |             |
|                                                                | M             | $-55^\circ\text{C} \sim 155^\circ\text{C}$ |            |                  |            |                  |             |                  |             |
| Rated ambient temperature (at terminals)                       | C             | $120^\circ\text{C}$ or less                |            |                  |            |                  |             |                  |             |
|                                                                | M             | $100^\circ\text{C}$ or less                |            |                  |            |                  |             |                  |             |
| Packaging                                                      | 1,000pcs      | ○                                          | ○          | ○                | ○          | ○                | ○           | ○                | ○           |
|                                                                | 5,000pcs      | ○                                          | ○          | ○                | ○          | ○                | ○           | ○                | —           |

## Part numbering system

**KRL 1220E-C-R010-F-T1**

— Packaging: T1 (1000pieces) T5 (5000pieces)

— Resistance tolerance

— Resistance value

— Operating temperature: C (High temperature type) M (Low emf type)

— Lap electrode type: D (Bottom electrode) E (U-shape electrode)

— Size

— Series code



## Metal foil low resistance chip resistors (long-side terminals)

KRL series

AEC-Q200 Compliant

### Features

- The C type utilizes materials that withstand high temperatures and can be operated up to 175°C. The M type utilizes low emf materials that are stable up to 155°C. TCR is very stable for very low resistance:  $\pm 150\text{ppm}/^\circ\text{C}$  for 1mΩ,  $\pm 100\text{ppm}/^\circ\text{C}$  for 2mΩ, and  $\pm 50\text{ppm}/^\circ\text{C}$  for 3mΩ. Face down mounting allows for accurate current measurement. Long and short side terminal types, as well as power ratings from 1W to 6W are offered to meet customers' specific requirements. The protective outer coating is halogen free in consideration of the environment.

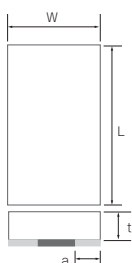
### Applications

- PCs, hard drive discs, audio visual equipments, power sources, inverters, automotive electronics, industrial machining equipments, industrial test and measurements, etc.

### Specifications

\*All made to order.

#### Dimensions



| Dimensions (mm) | KRL2012   | KRL3216   | KRL6432   | KRL7638   | KRL9045   | KRL11050   |
|-----------------|-----------|-----------|-----------|-----------|-----------|------------|
| L               | 2.00±0.20 | 3.20±0.20 | 6.30±0.20 | 7.60±0.20 | 9.00±0.20 | 11.00±0.20 |
| W               | 1.25±0.20 | 1.60±0.20 | 3.10±0.20 | 3.80±0.20 | 4.50±0.20 | 5.00±0.20  |
| t               | 0.50±0.20 | 0.50±0.20 | 0.50±0.20 | 0.50±0.20 | 0.50±0.20 | 0.50±0.20  |
| a (1.0mΩ)       | 0.55±0.20 | 0.55±0.20 | 1.20±0.20 | 1.35±0.20 | 1.60±0.20 | 1.60±0.20  |
| a (2.0mΩ~)      | 0.30±0.20 | 0.30±0.20 | 0.50±0.20 | 0.60±0.20 | 0.70±0.20 | 0.80±0.20  |

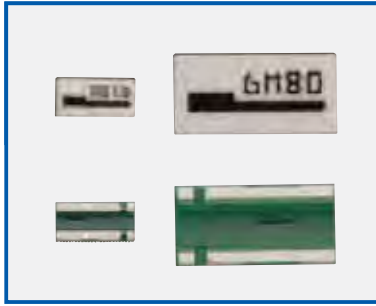
#### Electrical characteristics

| Series name                                    | KRL2012  |               |       |          | KRL3216  |    |       |          | KRL6432  |    |       |          | KRL7638  |    |       |          | KRL9045  |    |       |          | KRL11050 |    |       |          |
|------------------------------------------------|----------|---------------|-------|----------|----------|----|-------|----------|----------|----|-------|----------|----------|----|-------|----------|----------|----|-------|----------|----------|----|-------|----------|
| Power                                          | 1W       |               |       |          | 1.5W     |    |       |          | 3W       |    |       |          | 4W       |    |       |          | 5W       |    |       |          | 6W       |    |       |          |
| E series offered                               | 1mΩ STEP |               | E-6   |          | 1mΩ STEP |    | E-6   |          | 1mΩ STEP |    | E-6   |          | 1mΩ STEP |    | E-6   |          | 1mΩ STEP |    | E-6   |          | 1mΩ STEP |    | E-6   |          |
| Resistance range (Ω)                           | 1m       | 2m            | 3m~9m | 10m~500m | 1m       | 2m | 3m~9m | 10m~500m | 1m       | 2m | 3m~9m | 10m~500m | 1m       | 2m | 3m~9m | 10m~500m | 1m       | 2m | 3m~9m | 10m~500m | 1m       | 2m | 3m~9m | 10m~500m |
| Resistance tolerance (%)                       | ±1.0(F)  | —             | —     | ○        | —        | —  | ○     | —        | —        | —  | ○     | —        | —        | —  | ○     | —        | —        | —  | ○     | —        | —        | —  | ○     | —        |
|                                                | ±2.0(G)  | —             | ○     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        |
|                                                | ±5.0(J)  | ○             | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        |
| Temperature coefficient of resistance (ppm/°C) | ±50      | —             | —     | ○        | ○        | —  | —     | ○        | ○        | —  | —     | ○        | ○        | —  | —     | ○        | ○        | —  | —     | ○        | ○        | —  | —     | ○        |
|                                                | ±100     | —             | ○     | —        | —        | —  | ○     | —        | —        | —  | ○     | —        | —        | —  | ○     | —        | —        | —  | ○     | —        | —        | —  | ○     | —        |
|                                                | ±150     | ○             | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        | —        | ○  | —     | —        |
| Operating temperature                          | C        | -55°C ~ 175°C |       |          |          |    |       |          |          |    |       |          |          |    |       |          |          |    |       |          |          |    |       |          |
|                                                | M        | -55°C ~ 155°C |       |          |          |    |       |          |          |    |       |          |          |    |       |          |          |    |       |          |          |    |       |          |
| Rated ambient temperature (at terminals)       | C        | 120°C or less |       |          |          |    |       |          |          |    |       |          |          |    |       |          |          |    |       |          |          |    |       |          |
|                                                | M        | 100°C or less |       |          |          |    |       |          |          |    |       |          |          |    |       |          |          |    |       |          |          |    |       |          |
| Packaging                                      | 1,000pcs | ○             | ○     | ○        | ○        | ○  | ○     | ○        | ○        | ○  | ○     | ○        | ○        | ○  | ○     | ○        | ○        | ○  | ○     | ○        | ○        | ○  | ○     | ○        |
|                                                | 5,000pcs | ○             | ○     | ○        | ○        | ○  | ○     | ○        | ○        | ○  | ○     | ○        | ○        | ○  | ○     | ○        | ○        | ○  | ○     | ○        | ○        | ○  | ○     | ○        |

### Part numbering system

**KRL 2012 E - C - R010 - F - T1**

- Series code
- Size
- Lap electrode type: D (Bottom electrode) E (U-shape electrode)
- Operating temperature: C (High temperature type) M (Low emf type)
- Resistance value
- Resistance tolerance
- Packaging: T1 (1000pieces) T5 (5000pieces)



# Metal foil low resistance chip resistors (4 terminals type)

## KRL series

### Features

- According to the application, choose to suit high-temperature durable material or low emf materials (operating temperature~155°C) .
- Temperature Coefficient of Resistance at very low resistance value, 4~10mΩ : ±50ppm/°C, is extremely stable.
- Face down in the specification, you can achieve good detection accuracy.
- Rated power : 1W~2W.
- Exterior resin is halogen-free environment-friendly products.

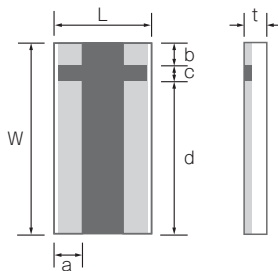


### Applications

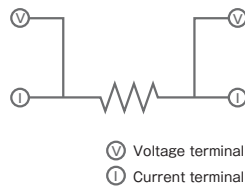
- Smart phones, mobile phones, PCs, hard drive discs, audio visual equipments, power sources, inverters, automotive electronics, industrial machining equipments, industrial test and measurements, etc.

### Specifications

#### Dimensions



#### Equivalent circuits



| Dimensions (mm) | KRL3216T4 (1206) | KRL6432T4 (2512) |
|-----------------|------------------|------------------|
| W               | 3.20±0.20        | 6.40±0.20        |
| L               | 1.60±0.20        | 3.20±0.20        |
| a               | 0.35±0.20        | 0.50±0.20        |
| b               | 0.35±0.15        | 0.70±0.15        |
| c               | 0.20±0.10        | 0.50±0.10        |
| d               | 2.65±0.15        | 5.20±0.15        |
| t               | 0.50±0.20        | 0.50±0.20        |

#### Electrical characteristics

| Series name                                    |          | KRL3216T4   |    |        |      |      |      | KRL6432T4 |    |        |      |      |      |
|------------------------------------------------|----------|-------------|----|--------|------|------|------|-----------|----|--------|------|------|------|
| Power                                          |          | 1W          |    |        |      |      |      | 2W        |    |        |      |      |      |
| E series offered                               |          | 1mΩSTEP     |    |        | E-6  |      |      | 1mΩSTEP   |    |        | E-6  |      |      |
| Resistance range (Ω)                           |          | 1m~2m       | 3m | 4m~10m | 100m | 200m | 500m | 1m~2m     | 3m | 4m~10m | 100m | 200m | 500m |
| Resistance tolerance (%)                       | ±1.0 (F) | —           | ○  | ○      | ○    | ○    | ○    | —         | ○  | ○      | ○    | ○    | ○    |
|                                                | ±2.0 (G) | ○           | —  | —      | —    | —    | —    | ○         | —  | —      | —    | —    | —    |
| Temperature coefficient of resistance (ppm/°C) | ±50      | —           | —  | ○      | ○    | ○    | ○    | —         | —  | ○      | ○    | ○    | ○    |
|                                                | ±100     | ○           | ○  | —      | —    | —    | —    | ○         | ○  | —      | —    | —    | —    |
| Operating temperature                          |          | -55°C~155°C |    |        |      |      |      |           |    |        |      |      |      |
| Rated ambient temperature                      |          | 70°C        |    |        |      |      |      |           |    |        |      |      |      |
| Packaging                                      | 1,000pcs | ○           |    |        |      |      |      | ○         |    |        |      |      |      |
|                                                | 5,000pcs | ○           |    |        |      |      |      | ○         |    |        |      |      |      |

### Part numbering system

**KRL 3216T4-M-R010-F-T1** — Packaging:T1 (1000pieces) T5 (5000pieces)

Resistance tolerance  
Resistance value  
Operating temperature:M (Low emf type)  
Size  
Series code



## Metal foil low resistance chip resistors (High Current Surface Mount Jumper Chip)

### YJP series

#### Features

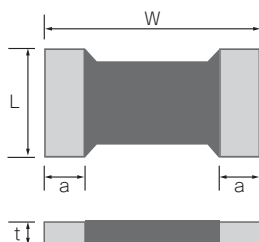
- Achieve a simplified circuit design, loop, switching the power supply line when the current change
- Resistance value is less than  $0.3\text{m}\Omega$  in the operating temperature range.
- Made it possible to surface mounting to facilitate the implementation by the replacement of Jumper lead
- Contribute to the reduction of power loss and voltage drop due to large current circuit
- Operating temperature :  $\sim 125^{\circ}\text{C}$ , high stability
- Exterior resin is halogen-free environment-friendly products.

#### Applications

- Mobile phones, smart phones, automotive electronics, power sources, servers, PCs, etc.

#### Specifications

##### Dimensions



| Dimensions (mm) | YJP1608         |
|-----------------|-----------------|
| L               | $0.80 \pm 0.20$ |
| W               | $1.60 \pm 0.20$ |
| t               | $0.30 \pm 0.10$ |
| a               | $0.30 \pm 0.20$ |

##### Electrical characteristics

|                               |                                                                                                                          |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Series name                   | YJP1608                                                                                                                  |
| Resistance range ( $\Omega$ ) | $0.2 \pm 0.1\text{m}\Omega$<br>Maximum resistance is less than $0.3\text{m}\Omega$ under the operating temperature range |
| Rated maximum current         | 10A (constant current)                                                                                                   |
| Operating temperature         | $-40 \sim +125^{\circ}\text{C}$                                                                                          |
| Rated ambient temperature     | $+70^{\circ}\text{C}$                                                                                                    |
| Packaging                     | 5,000pcs                                                                                                                 |

#### Part numbering system

**YJP 1608 - R001**

Maximum resistor value  
Size  
Series code

# Metal plate low resistance chip resistors

## RL series

### Features

- Operating temperature: stable up to 170°C
- Resistance tolerance: +/-1%, TCR +/-50ppm/°C
- Protective outer coating is halogen free in consideration of the environment.

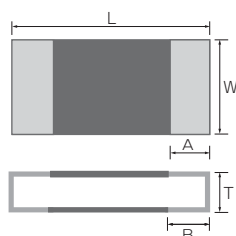
### Applications

- Power sources, servers, etc.

### Specifications

\* All made to order.

#### Dimensions



| Dimension (mm) | RL-0816-3 (0603) | RL-1220-4 (0805) | RL1632H (1206) | RL1632L4 (1206) | RL-1632-6C (1206)                      | RL-3264-0W (2512) | RL-3264-6C (2512)                                 | RL-3264-9W (2512) | RL3264L4 (2512) | RL-3637-0 (1514)                  |
|----------------|------------------|------------------|----------------|-----------------|----------------------------------------|-------------------|---------------------------------------------------|-------------------|-----------------|-----------------------------------|
| L              | 1.60±0.20        | 2.00±0.20        | 3.20±0.20      | 1.50±0.25       | 3.20±0.20                              | 6.35±0.25         | 6.35±0.25                                         | 6.35±0.25         | 3.20±0.25       | 9.14±0.25                         |
| W              | 0.80±0.20        | 1.30±0.20        | 1.60±0.20      | 3.15±0.25       | 1.60±0.20                              | 3.15±0.25         | 3.20±0.20                                         | 3.15±0.25         | 6.40±0.25       | 9.40±0.25                         |
| T              | 0.40±0.15        | 0.80±0.25        | 0.80±0.15      | 0.88±0.25       | 1.05±0.20 (5mΩ)<br>0.90±0.20 (10~40mΩ) | 0.80±0.20         | 1.05±0.15 (3m~5mΩ, 7mΩ)<br>0.80±0.15 (6mΩ, R>8mΩ) | 0.80±0.20         | 0.90±0.25       | 0.88±0.20                         |
| A              | 0.35±0.15        | 0.40±0.20        | 0.50±0.15      | 0.35±0.20       | 0.50±0.15                              | 0.95±0.30         | 0.90±0.25                                         | 0.95±0.30         | 0.70±0.20       | 3.50±0.25(1mΩ)<br>2.20±0.25(≥2mΩ) |
| B              | 0.35±0.15        | —                | —              | —               | —                                      | —                 | —                                                 | —                 | —               | —                                 |

#### Electrical characteristics

| Series name                                   |          | RL-0816-3          |   | RL-1220-4 |   | RL-1632H |   | RL-1632L4 |   |          |   | RL-1632-6C |   | RL-3264-0W |   | RL-3264-6C |   | RL-3264-9W |   |    | RL3264L4 |         |   | RL-3637-0 |   |        |   |         |   |      |   |      |   |        |   |    |   |    |   |        |   |       |   |       |  |
|-----------------------------------------------|----------|--------------------|---|-----------|---|----------|---|-----------|---|----------|---|------------|---|------------|---|------------|---|------------|---|----|----------|---------|---|-----------|---|--------|---|---------|---|------|---|------|---|--------|---|----|---|----|---|--------|---|-------|---|-------|--|
| Power                                         |          | 1/4W               |   | 1/2W      |   | 1/2W     |   | 1W        |   |          |   | 1W         |   | 3W         |   | 1W         |   | 2W         |   |    | 2W       |         |   | 3W        |   |        |   |         |   |      |   |      |   |        |   |    |   |    |   |        |   |       |   |       |  |
| Resistance range (Ω)                          |          | 10m~20m            |   | 21m~50m   |   | 10m~50m  |   | 5m~10m    |   | 11m~150m |   | 0.5m~0.75m |   | 1~2m       |   | 3~4m       |   | 5m         |   | 5m |          | 10m~40m |   | 2~4m      |   | 5m~50m |   | 3m~100m |   | 1.2m |   | 2~4m |   | 5m~50m |   | 1m |   | 3m |   | 5m~15m |   | 1~<2m |   | 2~10m |  |
| Resistance tolerance (%)                      | ±0.5(D)  | —                  | — | —         | — | —        | — | —         | — | —        | ○ | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — | —     |   |       |  |
|                                               | ±1.0(F)  | ○                  | ○ | ○         | ○ | ○        | ○ | ○         | ○ | ○        | ○ | ○          | ○ | ○          | ○ | ○          | ○ | ○          | ○ | ○  | ○        | ○       | ○ | ○         | ○ | ○      | ○ | ○       | ○ | ○    | ○ | ○    | ○ | ○      | ○ | ○  | ○ | ○  | ○ | ○      | ○ | ○     | ○ |       |  |
|                                               | ±2.0(G)  | ○                  | ○ | ○         | ○ | ○        | ○ | ○         | ○ | ○        | ○ | ○          | ○ | ○          | ○ | ○          | ○ | ○          | ○ | ○  | ○        | ○       | ○ | ○         | ○ | ○      | ○ | ○       | ○ | ○    | ○ | ○    | ○ | ○      | ○ | ○  | ○ | ○  | ○ | ○      | ○ | ○     | ○ |       |  |
|                                               | ±3.0(H)  | —                  | — | —         | — | —        | — | —         | — | —        | — | ○          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — | —     |   |       |  |
| Temperature coefficient of resistance (ppm/℃) | ±50      | —                  | — | —         | — | ○        | — | —         | — | —        | — | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — | —     | — |       |  |
|                                               | ±100     | —                  | — | —         | ○ | —        | — | —         | — | —        | — | —          | — | —          | — | —          | ○ | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — | —     | ○ |       |  |
|                                               | ±150     | —                  | — | —         | — | —        | — | —         | — | —        | ○ | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — | —     |   |       |  |
|                                               | ±200     | —                  | — | —         | — | —        | — | —         | — | —        | — | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — | —     |   |       |  |
|                                               | 0~150    | —                  | — | —         | — | —        | — | —         | — | —        | — | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | ○      | — |       |   |       |  |
|                                               | 0~250    | —                  | ○ | —         | — | —        | — | —         | — | —        | — | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — |       |   |       |  |
|                                               | 0~300    | —                  | — | —         | — | —        | — | —         | — | —        | — | —          | ○ | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      |   |       |   |       |  |
|                                               | 0~350    | ○                  | — | —         | — | —        | — | —         | — | —        | — | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — |       |   |       |  |
|                                               | 0~500    | —                  | — | —         | — | —        | — | —         | — | —        | — | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — |       |   |       |  |
|                                               | 0~250    | —                  | — | —         | — | —        | — | —         | — | —        | — | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — |       |   |       |  |
|                                               | 0~400    | —                  | — | —         | — | —        | — | —         | — | —        | — | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      | — |       |   |       |  |
| 0~700                                         | —        | —                  | — | —         | — | —        | — | —         | — | —        | — | —          | — | —          | — | —          | — | —          | — | —  | —        | —       | — | —         | — | —      | — | —       | — | —    | — | —    | — | —      | — | —  | — | —  | — | —      |   |       |   |       |  |
| Maximum voltage                               |          | $\sqrt{P \cdot R}$ |   |           |   |          |   |           |   |          |   |            |   |            |   |            |   |            |   |    |          |         |   |           |   |        |   |         |   |      |   |      |   |        |   |    |   |    |   |        |   |       |   |       |  |
| Operating temperature                         |          | -55℃~125℃          |   | -55℃~170℃ |   |          |   |           |   |          |   | -55℃~155℃  |   |            |   | -55℃~170℃  |   |            |   |    |          |         |   |           |   |        |   |         |   |      |   |      |   |        |   |    |   |    |   |        |   |       |   |       |  |
| Packaging                                     | 1,000pcs | —                  |   | —         |   | —        |   | —         |   |          |   | —          |   |            |   | —          |   | —          |   | —  |          |         | — |           |   | ○      |   |         |   |      |   |      |   |        |   |    |   |    |   |        |   |       |   |       |  |
|                                               | 2,000pcs | —                  |   | —         |   | —        |   | —         |   |          |   | —          |   |            |   | ○          |   | ○          |   | ○  |          |         | ○ |           |   | —      |   |         |   |      |   |      |   |        |   |    |   |    |   |        |   |       |   |       |  |
|                                               | 4,000pcs | —                  |   | ○         |   | ○        |   | —         |   |          |   | ○          |   |            |   | —          |   | —          |   | —  |          |         | — |           |   | —      |   |         |   |      |   |      |   |        |   |    |   |    |   |        |   |       |   |       |  |
|                                               | 5,000pcs | ○                  |   | —         |   | —        |   | —         |   |          |   | —          |   |            |   | —          |   | —          |   | —  |          |         | — |           |   | —      |   |         |   |      |   |      |   |        |   |    |   |    |   |        |   |       |   |       |  |

### Part numbering system

**RL 3264 - 6 - R002 - F - N** — Designates RoHS compliance

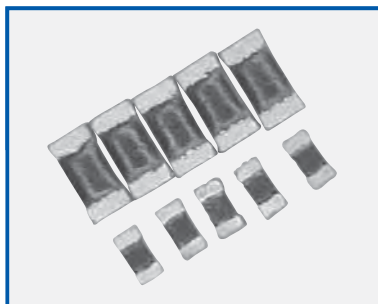
Resistance tolerance

Resistance value

Power : H (1/2W), 6 (1W), 9 (2W)

Size

Series code



# Thick film chip resistors

■ RLT series

## Features

- Offering a variety of sizes (0306-3264) and power ratings (1/10W-2W)
- Current sensing thick film chip resistors

## Applications

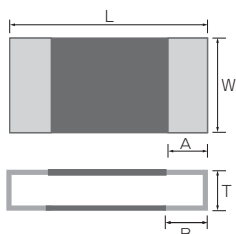
- PCs, HDDs, mobile phones, power sources, motors, etc.



## Specifications

\*E-24 series are standard stock items. E-96 series are made to order.

### Dimensions



| Dimension (mm) | RLT0306-C (0201) | RLT0510-2 (0402) | RLT0816-3 (0603) | RLT1220-F (0805) | RLT1632-4 (1206) | RLT3264-6 (2512) | RLT3264-9 (2512) |
|----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| L              | 0.60±0.03        | 1.00±0.10        | 1.60±0.15        | 2.00±0.20        | 3.20±0.20        | 6.30±0.15        | 6.30±0.25        |
| W              | 0.31±0.04        | 0.50±0.10        | 0.80±0.15        | 1.25±0.20        | 1.60±0.20        | 3.20±0.15        | 3.20±0.20        |
| T              | 0.27±0.04        | 0.35±0.15/-0.10  | 0.45±0.10        | 0.50±0.10        | 0.60±0.10        | 0.55±0.15        | 0.80±0.20        |
| A              | 0.14±0.06        | 0.25±0.10        | 0.30±0.20        | 0.40±0.20        | 0.50±0.25        | 0.60±0.20        | 0.80±0.30        |
| B              | 0.14±0.06        | 0.30±0.10        | 0.30±0.20        | 0.40±0.20        | 0.50±0.25        | 0.60±0.20        | 0.80±0.30        |

### Electrical characteristics

| Series name                                    | RLT0306-C          |        | RLT0510-2   |            | RLT0816-3 |         | RLT1220-F |         | RLT1632-4 |         | RLT3264-6 |         | RLT3264-9 |           |
|------------------------------------------------|--------------------|--------|-------------|------------|-----------|---------|-----------|---------|-----------|---------|-----------|---------|-----------|-----------|
| Power                                          | 1/10W              |        | 1/8W        |            | 1/4W      |         | 1/3W      |         | 1/2W      |         | 1W        |         | 2W        |           |
| E series offered                               | —                  |        | E24         | E24,E96    | E24       | E24,E96 | E24,E96   |         | E24       | E24,E96 | E24       | E24,E96 | —         |           |
| Resistance range (Ω)                           | 0.5~1.0            | 1.0~20 | 0.065~<0.60 | 0.060~<1.0 | 0.05~<0.1 | 0.1~<10 | 0.05~<0.1 | 0.1~<10 | 0.05~<0.1 | 0.1~<10 | 0.05~<0.1 | 0.1~<10 | 0.05~<0.1 | 0.1~<0.55 |
| Resistance tolerance (%)                       | ±1.0 (F)           | ○      | ○           | ○          | ○         | ○       | ○         | ○       | ○         | ○       | ○         | ○       | ○         | ○         |
|                                                | ±2.0 (G)           | ○      | ○           | ○          | ○         | ○       | ○         | ○       | ○         | ○       | ○         | ○       | ○         | ○         |
|                                                | ±5.0 (J)           | ○      | ○           | ○          | ○         | ○       | ○         | ○       | ○         | ○       | ○         | ○       | ○         | ○         |
| Temperature coefficient of resistance (ppm/°C) | 0~100              | —      | —           | —          | —         | —       | —         | —       | —         | —       | —         | —       | —         | ○         |
|                                                | 0~150              | —      | —           | —          | —         | —       | —         | —       | —         | —       | —         | —       | ○         | —         |
|                                                | 0~200              | —      | ○           | —          | ○         | —       | ○         | —       | ○         | —       | ○         | —       | —         | —         |
|                                                | 0~250              | —      | —           | —          | —         | —       | —         | —       | ○         | —       | —         | —       | —         | —         |
|                                                | 0~300              | ○      | —           | ○          | —         | ○       | —         | ○       | —         | —       | —         | —       | —         | —         |
|                                                | 0~800              | —      | —           | —          | —         | —       | —         | —       | —         | —       | —         | —       | —         | —         |
| Maximum voltage                                | $\sqrt{P \cdot R}$ |        |             |            |           |         |           |         |           |         |           |         |           |           |
| Operating temperature                          | -55°C ~ 125°C      |        |             |            |           |         |           |         |           |         |           |         |           |           |
| Packaging                                      | 2,000 pcs          | —      | —           | —          | —         | —       | —         | —       | —         | —       | ○         | —       | ○         | —         |
|                                                | 5,000 pcs          | —      | —           | —          | ○         | —       | ○         | —       | ○         | —       | —         | —       | —         | —         |
|                                                | 10,000 pcs         | ○      | —           | ○          | —         | —       | —         | —       | —         | —       | —         | —       | —         | —         |

## Part numbering system

**RLT 3264 - 6 - R002 - F NH**

— Pb free, halogen free

— Resistance tolerance  
— Resistance value

— Size

— Part code

Power rating: 2 (1/8W), 3 (1/4W),  
F (1/3W), 4 (1/2W),  
6 (1W), 9 (2W), C (1/10W)

# Thick film chip resistors

■ PFR series and GFR series

## Features

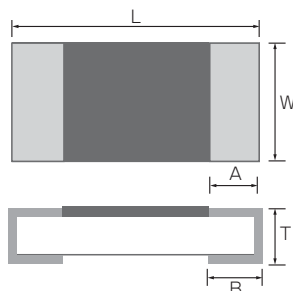
- TCR  $\pm 100\text{ppm}/^\circ\text{C}$  is realized for resistors over  $1\text{M}\Omega$
- The same terminal structure as thin film counterparts assures reliability
- In consideration of the environment, the glass passivation is Pb free and the resin passivation is halogen free.



## Specifications

\*E-24 series are standard stock items. E-96 series are made to order.

### Dimensions



| Dimension (mm) | PFR02S (01005S) | PFR03S (0201S)  | PFR05, GFR05 (0402) |
|----------------|-----------------|-----------------|---------------------|
| L              | $0.40 \pm 0.02$ | $0.60 \pm 0.03$ | $1.00 \pm 0.05$     |
| W              | $0.20 \pm 0.02$ | $0.30 \pm 0.03$ | $0.50 \pm 0.05$     |
| T              | $0.13 \pm 0.02$ | $0.23 \pm 0.03$ | $0.35 \pm 0.05$     |
| A              | $0.10 \pm 0.03$ | $0.10 \pm 0.05$ | $0.20 \pm 0.10$     |
| B              | $0.10 \pm 0.03$ | $0.15 \pm 0.05$ | $0.25 \pm 0.05$     |

### Electrical characteristics

| Series name                                            |           | PFR02S         |              |            |                | PFR03S       |                |              |            |               | PFR05       |              |                |              | GFR05       |               |                |             |
|--------------------------------------------------------|-----------|----------------|--------------|------------|----------------|--------------|----------------|--------------|------------|---------------|-------------|--------------|----------------|--------------|-------------|---------------|----------------|-------------|
| Power                                                  |           | Jumper         | 1/32W        |            |                | Jumper       | 1/20W          |              |            |               |             | Jumper       | 1/16W          |              | Jumper      | 1/16<br>W     |                |             |
| E series offered                                       |           | —              | E-24         | E-24,E96   | E-24           | —            | E-24           | E-24,E96     |            |               | E-24        | —            | E-24, E-96     |              | —           | E-24<br>E-96  |                |             |
| Resistance range (Ω)                                   |           | 50m<br>or less | 1.0 ~<br>9.1 | 10 ~<br>91 | 100 ~<br>1.62M | 100 ~<br>10M | 50m<br>or less | 1.0 ~<br>9.1 | 10 ~<br>91 | 100 ~<br>100K | 100 ~<br>1M | 100 ~<br>10M | 50m<br>or less | 10 ~<br>97.6 | 100 ~<br>1M | 1.02 ~<br>10M | 50m<br>or less | 10 ~<br>10M |
| Resistance<br>tolerance<br>(%)                         | ±0.5%(D)  | —              | —            | —          | —              | —            | —              | —            | —          | ○             | —           | —            | —              | ○            | ○           | —             | —              | ○           |
|                                                        | ±1.0%(F)  |                | —            | ○          | ○              | —            |                | ○            | ○          | —             | ○           | ○            |                | ○            | ○           |               |                |             |
|                                                        | ±2.0%(G)  |                | —            | —          | —              | ○            |                | —            | —          | —             | —           | ○            |                | —            | —           | —             |                |             |
|                                                        | ±5.0%(J)  |                | ○            | —          | —              | ○            |                | ○            | —          | —             | —           | ○            |                | —            | —           | —             |                |             |
| Temperature<br>coefficient of<br>resistance<br>(ppm/℃) | ±50       | —              | —            | —          | —              | —            | —              | —            | —          | —             | —           | —            | —              | —            | ○           | —             | —              | —           |
|                                                        | ±100      |                | —            | —          | —              | —            |                | —            | —          | —             | —           | —            |                | ○            | —           | ○             |                | —           |
|                                                        | ±200      |                | —            | —          | ○              | ○            |                | —            | —          | ○             | ○           | ○            |                | —            | —           | —             |                | ○           |
|                                                        | ±300      |                | —            | ○          | —              | —            |                | —            | ○          | —             | —           | —            |                | —            | —           | —             |                | —           |
|                                                        | +600~-200 |                | ○            | —          | —              | —            |                | ○            | —          | —             | —           | —            |                | —            | —           | —             |                | —           |
| Maximum voltage                                        |           | 0.5A           | 15V          |            |                | 1A           | 25V            |              |            |               |             | 1A           | 50V            |              | 1A          | 50V           |                |             |
| Operating temperature                                  |           | -55℃~125℃      |              |            |                |              |                |              |            |               |             |              |                |              |             |               |                |             |
| Packaging                                              | 10,000pcs | —              |              |            |                | ○            |                |              |            |               | ○           |              |                |              | ○           |               |                |             |
|                                                        | 20,000pcs | ○              |              |            |                | —            |                |              |            |               | —           |              |                |              | —           |               |                |             |

## Part numbering system

**PFR05 R - 102 - D - (2) - (T20)**

Packaging: Given to PFR02S 20,000/reel

"1" for PbSn and "2" for Sn are given only to PFR05 and GFR05

Resistance tolerance: PFR03, GFR05 jumpers: X

Resistance value: 3digit (E-24), 4digit (E-96), 000 (jumper)

Temperature coefficient of resistance: PFR03:S, GFR05 jumper: J

Part code



# Power choke coils

■ PCMB series,

## Features

- Low profile (3.0 mm max) and small size (7.3mm x6.6mm)
- Occupying small board spaces
- Low loss and high saturating current.

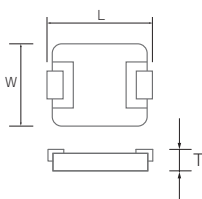
## Applications

- PCs, servers, power sources, mobile devices, flat screen TVs etc.

## Specifications

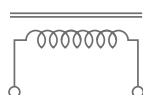
\*All made to order.

### Dimensions · Electrical characteristics



Rated current : the current that increases the temperature by 40°C  
Saturating current : The current that reduces inductance by 30% (PCMB/PS/PST/PL).  
\* Contact us for details.

### Equivalent circuits



## Part numbering system

PCMB \*\*\*\* - \*\*\* M N(S,T)

Material : refer to the table for electrical characteristics  
Inductance tolerance M=±20%  
Inductance value (R56=0.56μH, R68=0.68μH)  
Size  
(063T=6.6\*7.3\*3.0mm, 104T=10\*11.5\*4.0mm,  
133E=12.6\*13.8\*3.5mm, 135T=12.6\*13.8\*5.0mm)  
Part code



# Small choke coils

■ PCMB series, PS series

## Features

- Low DCR and large current for small sizes
- High efficiency and low loss

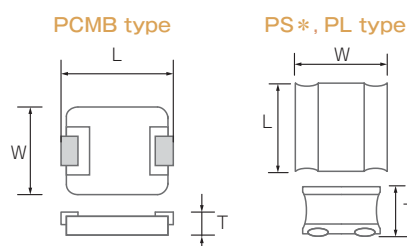
## Applications

- PCs, servers, power sources, mobile devices, flat screen TVs etc.

## Specifications

\*All made to order.

### Dimensions · Electrical characteristics



Rated current : the current that increases the temperature by 40°C  
Saturating current : The current that reduces inductance by 20% (PCMC) or 30% (PCMB/PS/PST/PL)  
\* Contact us for details.

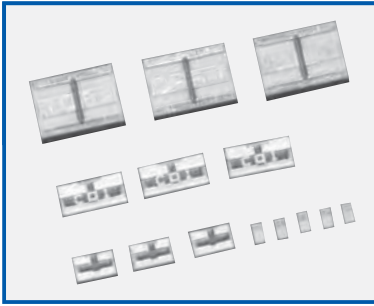
## Part numbering system

PS 031\* - \*\*\* M (S)

Material : refer to the table for electrical characteristics  
Resistance tolerance : ±20%  
Inductance value  
Size : B (2.9mm\*2.9mm\*1.2mm), T (2.9mm\*2.9mm\*1.0mm)  
Part code

# Precision chip attenuators

■ PAT series, RAT series



## Features

- Excellent noise characteristics, small stray/parasitic inductance and capacitance
- Excellent high frequency characteristics
- PAT0510S are the smallest and lightest thin film chip attenuators.

## Applications

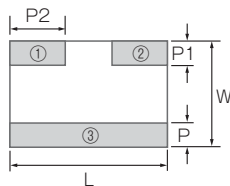
- Wireless communication devices, wireless communication modules, etc.

## Specifications

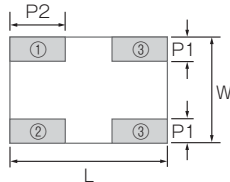
\* All made to order.

### Dimensions

PAT0816, PAT1220, PAT1632



RAT1010X, PAT0510S, PAT3042S

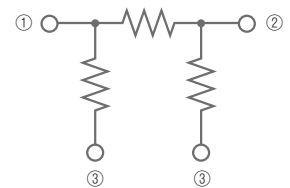


Back side

unit : mm

| Dimension (inch) | RAT1010X (0404) | PAT0510S (0402) | PAT0816 (0603) | PAT1220 (0805) | PAT1632 (1206) | PAT3042S (1712) |
|------------------|-----------------|-----------------|----------------|----------------|----------------|-----------------|
| L                | 1.00±0.05       | 1.00±0.05       | 1.60±0.10      | 2.00±0.10      | 3.20±0.20      | 4.20±0.20       |
| W                | 1.00±0.05       | 0.50±0.05       | 0.80±0.10      | 1.25±0.10      | 1.60±0.20      | 3.00±0.20       |
| P                | 0.25±0.05/-0.1  | —               | 0.20±0.10      | 0.35±0.20      | 0.40±0.20      | 0.90±0.20       |
| P1               | 0.25±0.05/-0.1  | 0.12±0.04       | 0.20±0.10      | 0.35±0.20      | 0.40±0.20      | 0.80±0.20       |
| P2               | 0.33±0.10       | 0.27±0.05       | 0.50±0.10      | 0.60±0.20      | 1.00±0.20      | 0.50±0.20       |
| T                | 0.42±0.05       | 0.34±0.05       | 0.40±0.10      | 0.40±0.10      | 0.40±0.10      | 0.80±0.15       |

### Equivalent circuits



### Electrical characteristics

| Series name                 | RAT1010X                 |         |         |           |        | PAT0510S             |         |          | PAT0816                                 |         |          | PAT1220                                                 | PAT1632  |                                    | PAT3042S                       |          |
|-----------------------------|--------------------------|---------|---------|-----------|--------|----------------------|---------|----------|-----------------------------------------|---------|----------|---------------------------------------------------------|----------|------------------------------------|--------------------------------|----------|
| Attenuation                 | 1 ~ 5dB                  | 6 ~ 9dB | 10dB    | 11 ~ 16dB | 20dB   | 0 ~ 3dB              | 4 ~ 7dB | 8 ~ 10dB | 0 ~ 3dB                                 | 4 ~ 7dB | 8 ~ 10dB | 0 ~ 10dB                                                | 0 ~ 10dB | 16dB                               | 0 ~ 10dB                       | 16, 20dB |
| Attenuation tolerance       | ±0.3dB                   | ±0.4dB  | ±0.75dB | ±0.8dB    | ±2.5dB | ±0.3dB               | ±0.5dB  | ±1.0dB   | ±0.3dB                                  | ±0.5dB  | ±0.7dB   | ±0.3dB                                                  | ±0.3dB   | ±0.5dB                             | ±0.3dB                         | ±0.5dB   |
| Impedance                   | 50Ω (C)                  |         |         |           |        | 50Ω (C)              |         |          | 50Ω (C)                                 |         |          | 50Ω (C)                                                 |          | 50Ω (C), 75Ω (D)                   |                                |          |
| VSWR                        | <1.3                     |         |         |           |        | <1.3                 |         |          | <1.3 ( ~ 6GHz ) ,<br><1.5 ( 6 ~ 10GHz ) |         |          | <1.3                                                    | <1.3     |                                    | <1.2 ( 50Ω ) ,<br><1.3 ( 75Ω ) |          |
| Operating frequency         | ~ 2.5GHz                 |         | ~ 3GHz  |           |        | DC ~ 10GHz           |         |          | DC ~ 10GHz                              |         |          | DC ~ 3GHz                                               |          | ~ 3GHz ( 50Ω ) ,<br>~ 2GHz ( 75Ω ) |                                |          |
| Rated power                 | 40mW                     |         |         |           |        | 32mW                 |         |          | 63mW                                    |         |          | 100mW                                                   | 125mW    |                                    | 250mW                          |          |
| Rated operating temperature | —                        |         |         |           |        | 70℃                  |         |          |                                         |         |          |                                                         |          |                                    |                                |          |
| Operating temperature       | -55℃ ~ + 125℃            |         |         |           |        |                      |         |          |                                         |         |          |                                                         |          |                                    |                                |          |
| Packaging                   | 10,000pcs/reel (no code) |         |         |           |        | 10,000pcs/reel (T10) |         |          | 5,000pcs/reel (T)                       |         |          | 100pcs/bag<br>1,000pcs/reel (T1),<br>5,000pcs/reel (T5) |          | 50pcs/bag<br>2,000pcs/reel (T2)    |                                |          |

- Contact us for 1.0 x 0.5mm GBA type PAT0510.
- Contact us for high power attenuators up to 10W.

## Part numbering system

**PAT 1632 - C - 3dB - T (5)**

T=Tape, B=Bulk () - indicates taping quantity. Refer to packaging in the table above.

Attenuation Rectangular Corner

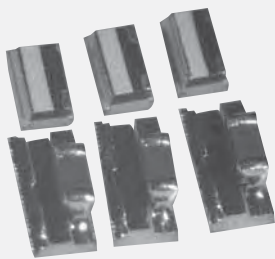
Impedance

Size, circuitry

Product code

(OLD P/N) **RAT 1010X - 3dB - C - B**





# Temperature compensated chip attenuators

P \* V series

## Features

- For simplifying temperature drift compensation of GaAs high frequency amplifiers
- Excellent high frequency characteristics

## Applications

- Base station and others



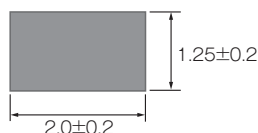
\* Except for Chinese RoHS

## Specifications

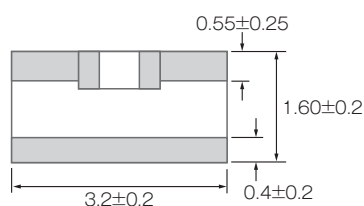
\* All made to order.

### Dimensions

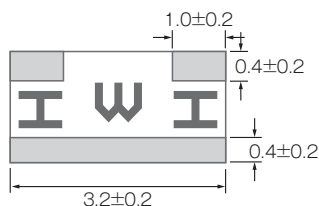
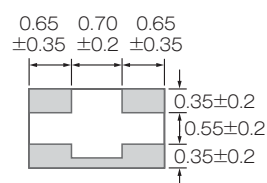
PXV1220S



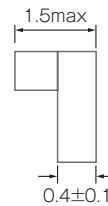
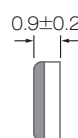
PBV1632S



Front side

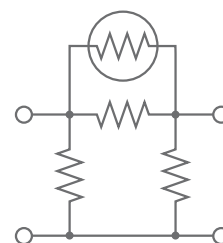


Back side



(unit:mm)

### Equivalent circuits



### Electrical characteristics

| Series name                            | PXV1220S (0805)                      | PBV1632S (1206)                                                                  |
|----------------------------------------|--------------------------------------|----------------------------------------------------------------------------------|
| Attenuation                            | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10dB      | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 16dB                                              |
| Attenuation tolerance                  | ±0.5dB (@25°C, no load)              |                                                                                  |
| Impedance                              | 50Ω                                  |                                                                                  |
| VSWR                                   | 1.3max.                              |                                                                                  |
| Temperature coefficient of attenuation | N1 ~ N8<br>(1 ~ 3dB : N1 ~ N9)       | N5 0.0041dB/dB*°C<br>N6 0.0035dB/dB*°C<br>N7 0.0026dB/dB*°C<br>N8 0.0019dB/dB*°C |
| Operating frequency                    | DC ~ 3GHz                            |                                                                                  |
| Rated power                            | 63mW                                 | 100mW                                                                            |
| Operating temperature                  | -40°C ~ +100°C                       |                                                                                  |
| Packaging                              | 100pcs/bag 200pcs/reel 1,000pcs/reel | min.20pcs/bag 1,000pcs/reel                                                      |

· Refer to the data book for details.

## Part numbering system

PXV 1220S - 6dB N1 - T

Packaging (T02=200, T1=1,000, B=Bulk)  
Temperature coefficient of attenuation  
Attenuation  
Size  
Product code



## Sample Kits

For development, testing and prototyping, sample kits are available for metal thin film chip resistors, low resistance chip resistors, and chip inductors. We encourage our customers to give them a try.

### Electrical characteristics

| Electrical characteristics                                       | Rated power (W) |      |      |     |     |     | Resistance tolerance (%) |      |      | Temperature coefficient of resistance(ppm) |     |
|------------------------------------------------------------------|-----------------|------|------|-----|-----|-----|--------------------------|------|------|--------------------------------------------|-----|
|                                                                  | 1/32            | 1/16 | 1/10 | 1/8 | 1/6 | 1/4 | ±0.05                    | ±0.1 | ±0.5 | ±25                                        | ±10 |
| Surface mount thin film resistors/metal thin film chip resistors |                 |      |      |     |     |     |                          |      |      |                                            |     |
| RR0816PD-KIT                                                     |                 | •    |      |     |     |     |                          |      | •    | •                                          |     |
| RR1220PD-KIT                                                     |                 |      | •    |     |     |     |                          |      | •    | •                                          |     |
| RG1005PD-KIT                                                     | •               | •    |      | •   |     |     |                          |      | •    | •                                          |     |
| RG1608PD-KIT                                                     |                 | •    | •    |     | •   |     |                          |      | •    | •                                          |     |
| RG2012PD-KIT                                                     |                 |      | •    | •   |     | •   |                          |      | •    | •                                          |     |
| RG1005PB-KIT                                                     | •               | •    |      | •   |     |     |                          | •    |      | •                                          |     |
| RG1608PB-KIT                                                     |                 | •    | •    |     | •   |     |                          | •    |      | •                                          |     |
| RG2012PB-KIT                                                     |                 |      | •    | •   |     | •   |                          | •    |      | •                                          |     |
| RG1005NW-KIT                                                     | •               | •    |      | •   |     |     | •                        |      |      |                                            | •   |
| RG1608NW-KIT                                                     |                 | •    | •    |     | •   |     | •                        |      |      |                                            | •   |
| RG2012NW-KIT                                                     |                 |      | •    | •   |     | •   | •                        |      |      |                                            | •   |

| Product name                                                          | Rated power (W) |     |     |     | Resistance tolerance (%) |
|-----------------------------------------------------------------------|-----------------|-----|-----|-----|--------------------------|
|                                                                       | 1/3             | 1/2 | 1.0 | 2.0 | ±1.0                     |
| Current sensing surface mount resistors/low resistance chip resistors |                 |     |     |     |                          |
| RL1220-KIT                                                            | •               |     |     |     | •                        |
| RL3720W-KIT                                                           |                 |     | •   |     | •                        |

### Part numbering system

**RG1005PD - KIT - BOX(FILE)**

Packaging(BOX=BOX Type, FILE=FILE BOOK Type)  
Designates sample kits  
Product series name

MEMO

[illegible]

# Overseas sales network and distributors

★ = Susumu's overseas subsidiary companies



## Europe

### GERMANY

#### ★ SUSUMU DEUTSCHLAND GmbH

Frankfurter Strasse 63-69, 7th Floor,  
D-65760, Eschborn / Germany

TEL +49-6196-9698407

FAX +49-6196-9698879

Mail ssmeuro@susumu.co.jp

#### 1 Endrich Bauelemente Vertriebs GmbH

Hauptstrasse 56,  
D-72202 Nagold / Germany

TEL +49-(0)74-526-0070

FAX +49-(0)74-526-00770

Mail endrich@endrich.com

URL www.endrich.com

### AUSTRIA

#### 2 Endrich Bauelemente Ges.m.b.H

Liebermannstr. A01/303-4  
A-2345 Brunn am Gebirge / Austria

TEL +43-1-6652525

FAX +43-1-6652524

Mail austria@endrich.com

URL www.endrich.com

### BENELUX

#### 3 HPR Techniek B.V.

Stolwijkstraat 33  
3079 DN ROTTERDAM / Netherlands

TEL +31-(0)10-292-8787

FAX +31-(0)10-292-8765

Mail info@hprtechniek.nl

URL www.hprtechniek.nl

#### 4 HPR Techniek B.V.

Leuvensesteenweg 613  
B-1930 Zaventem Zuid 7 / Belgium

TEL +32-(0)2-253-3120

FAX +32-(0)2-253-0897

URL www.hprtechniek.com

### CZECH REPUBLIC

#### 5 Has Lanskroun GmbH

Betrieb, Dolni Cermna 3  
561 53 Dolni Cermna / Czech Republic

TEL +420 465 500 300

FAX +420 465 500 324

Mail sekretariat@hasdc.cz

URL www.hasdc.cz/

### DENMARK

#### 6 Rhopoint Nordic Aps.

Hyrdeengen 11  
2625 Vallengbaek / Denmark

TEL +45 43 62 07 94

FAX +45 36 92 61 58

URL www.rhopointnordic.com

### FINLAND

#### 7 Oy Nylund-Group Ab

Masalanatie 375,  
FIN-02430 Masala / Finland

TEL +358-(0)9-2219-1400

FAX +358-(0)9-2219-1444

Mail nylund@nylund.fi

URL www.nylund.fi

### FRANCE

#### 8 Endrich Bauelemente Vertriebs GmbH

Office Angers

TEL +33-(0)2-41803354

FAX +33-(0)2-41806522

Mail endrich@endrich.com

URL www.endrich.com

#### 9 Endrich Bauelemente Vertriebs GmbH

Office Paris

TEL +33-(0)1-46059913

FAX +33-(0)1-46050136

GSM +33-(0)671735468

Mail endrich@endrich.com

URL www.endrich.com

#### 10 MANUDAX France

ZA Les Petites Haies  
28, rue de Valenton - BP302 / France  
94709 Maisons-Alfort cedex

TEL + 33 (0) 1 41 78 94 44

FAX + 33 (0) 1 48 99 41 86

Mail manudax@manudax.fr

### BULGARIA

#### 11 Famous Connections

44 Hr. Smirnenski  
1164 Sofia / Bulgaria

TEL +359 888 908 189

Mail office@famousconnections.eu

URL www.famousconnections.eu

### HUNGARY

#### 12 Endrich Bauelemente Vertriebs GmbH

Office Budapest

TEL +361-2974191

FAX +361-2974192

Mail endrich@endrich.com

URL www.endrich.com

### ITALY

#### 13 Avnet Abacus

Via Manzoni 44 20095 Cusano  
Milanino Milano / Italy

TEL +39 02 660 921

FAX +39 02 66092 332

Mail milano@avnet-abacus.eu

URL www.avnet-abacus.eu

#### 14 New Sumit Electronic Components sas

Via Gobetti 8  
20019 Settimo Milanese / Italy

TEL +39 0233576384

FAX +39 0233590208

Mail a.rosa@newsunit.it

URL www.newsunit.it

### SPAIN

#### 15 ENDRICH BAUELEMENTE S.L.

C/. Balmes 243  
E-08006 Barcelona

TEL +34-932173144

FAX +34-932179720

Mail endrich@endrich.net

URL www.endrich.com

### SWITZERLAND

#### 16 Novitronic AG

Thurgauerstrasse 74  
CH-8050 Zürich / Switzerland

TEL +41/4430691-91

FAX +41/4430691-81

URL www.novitronic.ch

### UNITED KINGDOM

#### 17 Rhopoint Components, Ltd.

Unit B, Rhopoint House,  
Imberhorne Lane, East Grinstead  
West Sussex, RH19 1QZ / U.K.

TEL +44-(0)1-883-717-988

FAX +44-(0)1-883-712-938

Mail systems@rhopoint.co.uk

URL www.rhopoint.co.uk

### SWEDEN

#### 18 Martinsson Elektronik AB

P.O. Box 9060 / SE-126 09  
Hägersten, Sweden.

TEL +46 8 7440300

FAX +46 8 7447922

URL www.martinsson.se



★ = Headquarters

★ = Susumu's overseas subsidiary companies

## Middle East

### ISRAEL

#### 1 BORAN TECHNOLOGIES LTD.

18 Hashaham St. P.O.Box 2627,  
Petah Tikva 49125, Israel

TEL +972-3-9274747

FAX +972-3-9274741

Mail boran@boran.co.il

URL www.boran.co.il

## Asia

### JAPAN

#### ★ SUSUMU CO., LTD.

14 Umamawashi-Cho Kamitoba,  
Minami-Ku Kyoto, 601-8177 Japan

TEL +81-75-671-7371

FAX +81-75-671-7374

Mail info@susumu.co.jp

URL www.susumu.co.jp

### TAIWAN

#### 1 CYNTEC CO., LTD.

No. 2 R&D 2nd Road,  
Science-Based Industrial Park,  
Hsin-Chu, Taiwan

TEL +886-35-799829

FAX +886-35-799827

Mail cyntec@shts.seed.net.tw

URL www.cyntec.com

### SINGAPORE

#### 2 NCH TECHNOLOGIES (S) PTE LTD.

629 Aljunied Road #03-20  
Cititech Industrial Building  
Singapore, 389838

TEL +65-6741-4070

FAX +65-6741-2971

Mail kazunaga@pacific.net.sg

### KOREA

#### 3 SAMYOUNG S&C Co., Ltd.

150 Sangdaewon-dong, Jungwon-gu,  
Sungnam-city, Kyoungki-do,  
462-807, Korea

TEL +82-31-741-1840

FAX +82-31-742-1821

Mail ksn@samyongsnc.com

URL www.samyongsnc.com

### CHINA

#### ★ SUSUMU INTERNATIONAL TRADING (SHANGHAI) CO., LTD

Room 402/416, Building C, Changjiang Road,  
Waogaoqiao Free Trade Zone,  
Shanghai City P.R.C, 200131

TEL +86-21-50464992

FAX +86-21-50464993

Mail susumu@susumu.sh.cn

#### 4 Suzhou Industrial Park

##### JingDian Electronics Co., Ltd

Room 401/416, Building C, Changjiang Energy  
Conservation Science and Technology Industrial  
Park, No 112, Yingchun South Road, Suzhou,  
Jiangsu, China.

TEL 0512-67077361/68566072

FAX 0512-67077391/68566071

Mail service@simon-jd.com

#### 5 Elematec (Shanghai) Trading Co., Ltd.

Rm.1101, Shanghai Lippo Plaza, 222  
Huaihaizhong Road, Shanghai, 200021,  
P.R.China

TEL +86-21-5383-8801

FAX +86-21-6391-0773

Agency Office : Shanghai, Nanjing, Wuxi,  
Suzhou, and Hangzhou

#### 6 Elematec International Trading (Shenzhen) Co., Ltd.

Rm.2501-2504, 25/F., Block C, Tianan  
International Bldg, Renmin Road South,  
Shenzhen, Guangdong, 518005, P.R.China

TEL +86-755-8217-0257

FAX +86-755-8217-0259

Agency Office : Shenzhen, Changsha, Xiamen,  
Guangzhou, Zhuhai, and Hong Kong

#### 7 Elematec (Tianjin) International Trading Co., Ltd.

Rm.2810, Golden Crown Building, No.20  
Nanjing Road, Hexi District, Tianjin, 300042,  
P.R.China

TEL +86-22-2316-1070

FAX +86-22-2316-1071

Agency Office : Tianjin, and Beijing

#### 8 Elematec Trading (Dalian) Co., Ltd.

Rm.606 Dalian Free Zone Market Mansion  
Dalian, Liaoning, 116600, P.R.China

TEL +86-411-8730-8830

FAX +86-411-8731-2199

Agency Office : Dalian

#### 9 Elematec (Qingdao) Trading Co., Ltd.

Rm.2108, Yihe International Building A, No.10  
Hongkong Middle Road, South City District,  
Qingdao, Shandong, 266071, P.R.China

TEL +86-532-6688-8228

FAX +86-532-6688-8338

Agency Office : Tsingtao

## North America

### SUSUMU INTERNATIONAL (USA) INC.

#### ★ East Coast Office (H.Q.)

460 Bergen Blvd., Suite 226  
Palisades Park, NJ 07650, USA

TEL +1-201-461-4861

FAX +1-201-461-4862

Mail info@susumu-usa.com

URL www.susumu-usa.com

#### 1 West Coast Office

4100 Moorpark Ave., Suite 221  
San Jose, CA 95117 USA

TEL +1-408-260-1112

FAX +1-408-260-1113

#### 2 Digi-Key Corporation

701 Brooks Ave.  
S. Theif River Falls, MN 56701-0677

TEL +1-218-681-6674

+1-800-344-4539

FAX +1-218-681-3380

URL www.digikey.com

#### 3 Newark InOne

4801 N. Ravenswood  
Chicago, IL 60640-4496

TEL +1-773-784-5100

+1-800-463-9275

FAX +1-888-551-4801

URL www.newark.com

#### 4 Future Electronics Inc.

237 Hyumus Blvd.  
Pointe-Claire, QC H9R 5C7

TEL +1-514-694-7710

+1-800-675-1619

FAX +1-514-695-370

URL www.futureelectronics.com

#### 5 Mouser Electronics, Inc.

1000 N. Main St.  
Mansfield, TX 76063

TEL +1-817-804-3749

+1-800-346-6873

FAX +1-817-804-3899

URL www.mouser.com

#### 6 Advanced MP Technology, Inc.

1010 Calle Sombra  
San Clemente, CA 92673

TEL +1-949-492-3113

+1-800-492-3113

FAX +1-949-492-9589

URL www.advancedmp.com



**Headquarters** 14Umamawashicho, Kamitoba, Minamiku, Kyoto, Japan 601-8177

**TEL** (075) 671-7371 **FAX** (075) 671-7374 **Email** [info@susumu.co.jp](mailto:info@susumu.co.jp)

<http://www.susumu.co.jp/>

This catalogue is current as of June, 2012.