

## 合金电阻器 Alloy Resistor

- 焊接电阻系列 Welding Resistance Series.
- 符合 ROHS 要求 Complies With ROHS Requirements.
- 符合车规 AEC-Q200 测试 Conforms To Vehicle-specific AEC-200 Tests.

### ■ 产品图示(product illustration)



| ■ 产品特点(Features)                                                                                                                                                  | ■ 应用领域(Applications)                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ 高功率, 功率可达 15W<br/>High power rating up to 15watts</li> </ul>                                                             | <ul style="list-style-type: none"> <li>■ 汽车电子<br/>Automotive electronics</li> </ul>                     |
| <ul style="list-style-type: none"> <li>■ 超低感值: <math>\leq 3\text{nH}(1\text{MHz})</math><br/>Low inductance: <math>\leq 3\text{nH}(1\text{MHz})</math></li> </ul> | <ul style="list-style-type: none"> <li>■ 空调/变频器<br/>Air conditioner/Variable frequency drive</li> </ul> |
| <ul style="list-style-type: none"> <li>■ 耐冲击<br/>ideal for pulse application</li> </ul>                                                                           | <ul style="list-style-type: none"> <li>■ 工业/轻工业<br/>industry/lite industry</li> </ul>                   |
| <ul style="list-style-type: none"> <li>■ 印字方式: 激光打标<br/>Printing method:laser marking</li> </ul>                                                                  | <ul style="list-style-type: none"> <li>■ 手机、电脑、消费性电子<br/>Mobile phones、Computers 、Consumer</li> </ul>   |

### ■ 料号标识:示例 RL2512F4R003= RL 系列 2512 尺寸 4W 1% 3mΩ

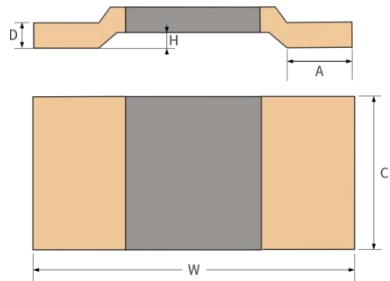
| RL        | 2512                            | F                                       | 4                                                                | R003                                                                        |
|-----------|---------------------------------|-----------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 产品系列 Type | 尺寸 Size<br>2512<br>3920<br>5930 | 公差<br>Tolerance<br>F:1%<br>G:2%<br>J:5% | 额定功率<br>Rated Power<br>A=1/2W<br>B= 3/4W<br>1=1W<br>2=2W<br>3=3W | 阻值<br>Resistance Value<br>R50m=0.5mΩ<br>R002=2mΩ<br>R010=10mΩ<br>1R5m=1.5mΩ |

## ■ 电阻值范围及电气特性(Resistance Range and Electrical Characteristics)

| 类别<br>Type | 材料<br>Material | 阻值<br>Resistance | Rth(°C/W) | 温度系数 TCR<br>(ppm/°C) | D±0.1 (mm) | 最高额定功率@70°C(W)<br>Rated Power@70°C(W) |
|------------|----------------|------------------|-----------|----------------------|------------|---------------------------------------|
| 2512       | S              | 0.2mΩ            | 3         | ±175                 | 1.4        | 6                                     |
|            | M              | 0.3mΩ            | 5         | ±175                 | 1.5        | 6                                     |
|            |                | 0.5mΩ            | 6         | ±115                 | 0.93       | 6                                     |
|            |                | 1mΩ              | 10        | ±100                 | 0.45       | 5                                     |
|            |                | 1.2mΩ            | 10        | ±100                 | 0.42       | 6                                     |
|            | K/F            | 1.2mΩ            | 12        | ±70                  | 1.08       | 6                                     |
|            |                | 1.5mΩ            | 12        | ±70                  | 0.86       | 5                                     |
|            |                | 2mΩ              | 15        | ±70                  | 0.65       | 5                                     |
|            |                | 2.5mΩ            | 15        | ±70                  | 0.5        | 4                                     |
|            |                | 3mΩ              | 24        | ±70                  | 0.43       | 4                                     |
|            |                | 4mΩ              | 27        | ±70                  | 0.31       | 3                                     |
|            |                | 5mΩ              | 40        | ±70                  | 0.28       | 3                                     |
| 3920       | M              | 0.2mΩ            | 3         | ±200                 | 1.64       | 12                                    |
|            |                | 0.3mΩ            | 3.5       | ±150                 | 1.37       | 10                                    |
|            |                | 0.4mΩ            | 4         | ±100                 | 0.97       | 9                                     |
|            |                | 0.5mΩ            | 7         | ±70                  | 0.83       | 9                                     |
|            |                | 0.7mΩ            | 9         | ±70                  | 0.55       | 8                                     |
|            |                | 1mΩ              | 10        | ±50                  | 0.4        | 7                                     |
|            | K/F            | 1mΩ              | 7         | ±50                  | 1.16       | 8                                     |
|            |                | 1.5mΩ            | 13        | ±50                  | 0.75       | 6                                     |
|            |                | 2mΩ              | 14.5      | ±50                  | 0.56       | 6                                     |
|            |                | 2.5mΩ            | 16.5      | ±50                  | 0.47       | 5                                     |
|            |                | 3mΩ              | 22        | ±50                  | 0.37       | 5                                     |
|            |                | 4mΩ              | 24        | ±50                  | 0.28       | 5                                     |
|            |                | 5mΩ              | 30        | ±50                  | 0.28       | 4                                     |
| 5930       | S              | 0.1mΩ            | 2         | ±200                 | 2.0        | 15                                    |
|            | M              | 0.2mΩ            | 3         | ±100                 | 1.5        | 15                                    |
|            |                | 0.3mΩ            | 3         | ±100                 | 0.98       | 10                                    |
|            |                | 0.35mΩ           | 3         | ±100                 | 0.83       | 10                                    |
|            |                | 0.4mΩ            | 3         | ±100                 | 0.75       | 10                                    |
|            |                | 0.5mΩ            | 3.5       | ±75                  | 0.6        | 10                                    |
|            |                | 0.6mΩ            | 4.5       | ±75                  | 0.5        | 10                                    |
|            |                | 0.75mΩ           | 6         | ±75                  | 0.41       | 10                                    |
|            | K/F            | 1mΩ              | 7         | ±50                  | 0.86       | 9                                     |
|            |                | 1.5mΩ            | 10        | ±50                  | 0.61       | 8                                     |
|            |                | 2mΩ              | 13        | ±50                  | 0.4        | 7                                     |
|            |                | 2.5mΩ            | 17        | ±50                  | 0.34       | 7                                     |
|            |                | 3mΩ              | 17.5      | ±50                  | 0.29       | 7                                     |

TCR ( ppm/°C) : Test was conducted with the temperature from 20°C to 120°C , while 20°C worked as reference.

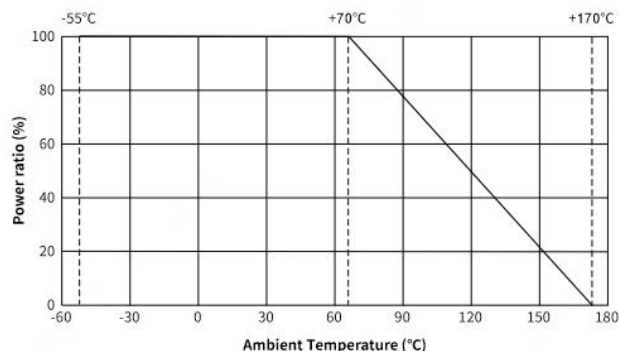
### ■ 产品尺寸(Dimension)

|  | 类型 Type | W           | A          | C          | H          |
|-----------------------------------------------------------------------------------|---------|-------------|------------|------------|------------|
|                                                                                   | 2512    | 6.3 ±0.2mm  | 1.2 ±0.2mm | 3.1 ±0.3mm | 0.5 ±0.1mm |
|                                                                                   | 3920    | 10.0 ±0.2mm | 2.2 ±0.2mm | 5.1 ±0.4mm | 0.5 ±0.1mm |
|                                                                                   | 5930    | 15.0 ±0.3mm | 4.2 ±0.3mm | 7.6 ±0.4mm | 0.5 ±0.1mm |

### ■ 字码标示(Marking on the Resistor's Body)

|           |      |                                                                                                 |            |                  |            |                  |            |
|-----------|------|-------------------------------------------------------------------------------------------------|------------|------------------|------------|------------------|------------|
| 图例 legend |      | <br>R001=1mΩ |            |                  |            |                  |            |
|           |      | 阻值<br>resistance                                                                                | 代码<br>code | 阻值<br>resistance | 代码<br>code | 阻值<br>resistance | 代码<br>code |
| 0.5mΩ     | R50m | 25mΩ                                                                                            | R025       | 80mΩ             | R080       | 200mΩ            | R200       |
| 1mΩ       | R001 | 30mΩ                                                                                            | R030       | 90mΩ             | R090       | 220mΩ            | R220       |
| 1.5mΩ     | 1R5m | 35mΩ                                                                                            | R035       | 100mΩ            | R100       | 250mΩ            | R250       |
| 2mΩ       | R002 | 40mΩ                                                                                            | R040       | 120mΩ            | R120       | 270mΩ            | R270       |
| 3mΩ       | R003 | 50mΩ                                                                                            | R040       | 130mΩ            | R130       | 300mΩ            | R300       |
| 5mΩ       | R005 | 57mΩ                                                                                            | R057       | 140mΩ            | R140       | 330mΩ            | R330       |
| 10mΩ      | R010 | 60mΩ                                                                                            | R060       | 150mΩ            | R150       | 360mΩ            | R360       |
| 15mΩ      | R015 | 68mΩ                                                                                            | R068       | 160mΩ            | R160       | 400mΩ            | R400       |
| 20mΩ      | R020 | 75mΩ                                                                                            | R075       | 180mΩ            | R180       | 500mΩ            | R500       |

### ■ 功率衰减曲线(power attenuation curve)



工作温度范围 (Operating Temperature Range) : -55°C~+170°C。

当电阻在高于 70°C 的周围环境中工作时, 最大负载功率应该按照以上曲线减少。

When the resistor is operating in an ambient environment above 70 °C, the maximum load power should be reduced according to the above curve.

### ■ 额定电流(rated current)

额定电流计算方式如下

The rated current is calculated by the following formula:

$$I = \sqrt{P/R}$$

I: 额定电流 (Rated current) (A)

P: 额定功率 (Rated Power) (W)

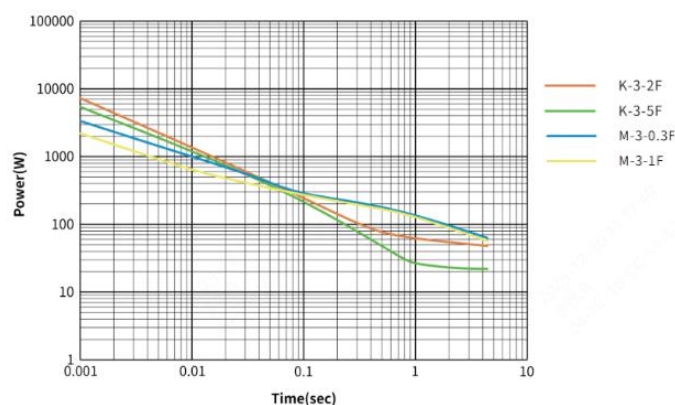
R: 额定电阻 (Resistance) (ohm)

如果计算出的电流超过此型号的最大工作电流, 则此型号的最大工作电流为此电阻的额定电流。

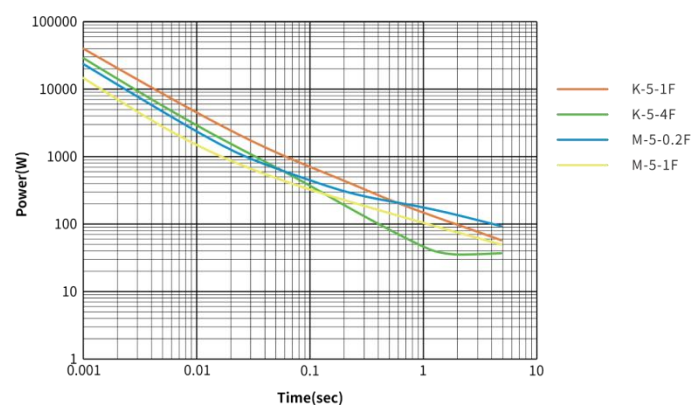
In case the value calculated by the formula exceed the maximum working current as above table, the maximum working current shall be regarded as rated current.

### ■ 脉冲功率曲线 Pulse power curve

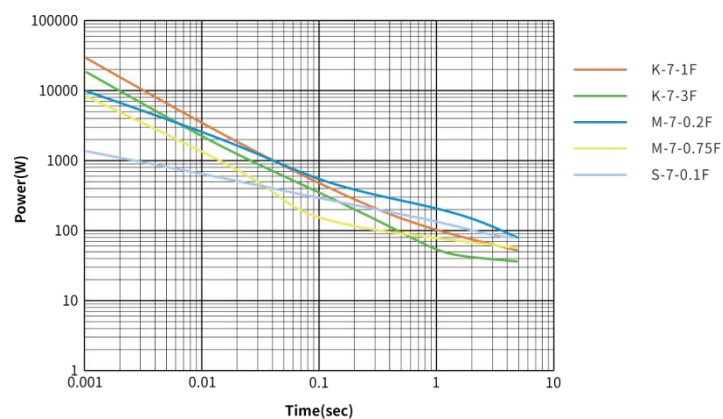
#### RL-2512



#### RL-3920



RL-5930

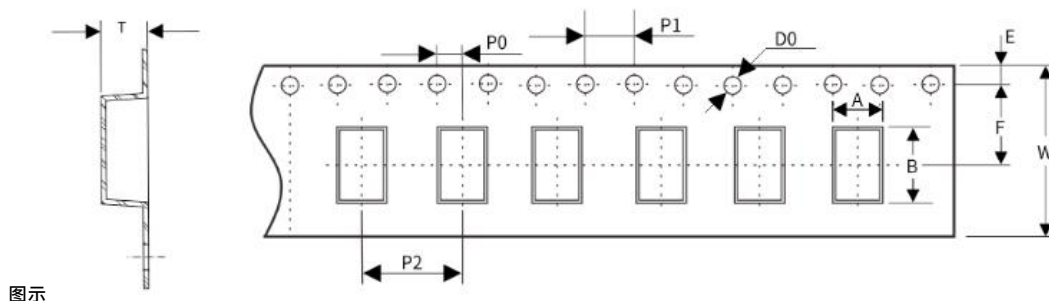


### ■ 信赖性试验项目(Performance Reliability Test Methods)

| 项目 project                                 | 测试方法 test                                                                                                                                                                                                                                                     | 条件 condition          | 标准 norms             |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|
| 高温高湿<br>high temperature and high humidity | 加载 10%额定功率, 85°C/85%RH, 持续通电 1000H, 试验结束<br>24±4 小时后进行测试.<br>1000 hours 85°C/85%RH.<br>Note: Specified conditions: 10% of operating power.<br>Measurement at 24±4 hours after test conclusion.                                                                | MIL-STD-202Method 103 | ±0.5%                |
| 高温运行寿命<br>High Temperature Operating Life  | 1000 小时 (T=125°C), 产品间歇性地施加长期运行电流:<br>90 分钟开, 30 分钟关; 测试结束后 24±4 小时进行测量。<br>1000 hrs.(T =125°C). Long-term operating current was applied to the products intermittently: 90 minutes ON and 30 minutes OFF . Measurement at 24±4 hours after test conclusion . | MIL-STD-202Method 108 | ±0.5%                |
| 抗焊锡热<br>Resistance to Soldering Heat       | 250°C±5°C, 30s±5s                                                                                                                                                                                                                                             | MIL-STD-202Method 210 | ±0.5%                |
| 可焊性<br>weldability                         | 沾助焊剂后浸入锡炉, 锡炉温度 245±5°C, 时间 2~3 秒。<br>Dip the terminal in a flux and then dip into a soldering bath at 245±5°C for 2~3sec.                                                                                                                                    | J-STD-002             | 95% Coverage Minimum |
| 振动<br>Vibration                            | 5g's 的力 20 分钟, 12 个循环, 测试频率从 10-2000 赫兹, 测量试验前后阻值变化率。<br>5g's for 20min.12cycles, 10-2000Hz . Measure the variation of resistance.                                                                                                                            | MIL-STD-202Method 204 | ±0.5%                |

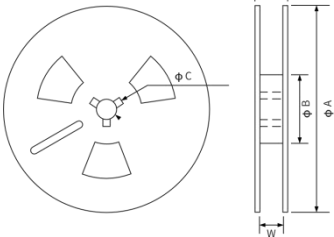
| ■ 信赖性试验项目(Performance Reliability Test Methods) |                                                                                                                                                                       |                             |                                                                                                                                        |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| 项目 project                                      | 测试方法 test                                                                                                                                                             | 条件 condition                | 标准 norms                                                                                                                               |
| 电路板弯曲测试<br>Board Flex Test                      | 对外电路板施加一次外力，至少弯曲 Dx=2 毫米，<br>持续时间 60+5 秒。<br>Apply an external force once to the circuit board, bend<br>at least Dx = 2mm, duration 60+5S .                           | AEC-Q200-005                | ±0.5%                                                                                                                                  |
| 终端强度<br>Terminal<br>Strength (SMD)              | 对测试设备的一侧施加一次外力，力为 17.7 牛顿 (1.8 千克) ，<br>持续时间 60 秒加 1 秒。<br>Apply an external force once to the side of the test<br>device, the force is 17.7N(1.8kg), duration 60+1S. | AEC-Q200-006                | ±0.5%                                                                                                                                  |
| 机械冲击<br>Mechanical<br>Shock                     | 半正弦，100g's，震动 6ms，速度 12.3 ft/s100Hz，<br>测量试验前后阻值变化率。<br>100g's, Normal duration is 6ms , half sine shock<br>pulse, Measure the variation of resistance.               | MIL-STD-<br>202H Method 213 | ±0.5%                                                                                                                                  |
| 静电放电<br>ESD                                     | 1)直接接触 (DC) : ±6 千伏;<br>2)空气放电 (AD) : ±12 千伏, ±16 千伏, ±25 千伏<br>1) Direct Contact (DC): ±6kV;<br>2) Air Discharge (AD): ±12kV, ±16kV, ±25kV .                         | AEC-Q200-002<br>REV-B       | ±0.5%                                                                                                                                  |
| 阻燃性<br>Flammability                             | 1) 测试电流: 100%, 115%, 130%, 150% (长期运行电流)<br>2)测试持续时间: 1 小时。<br>1) Test current: 100%, 115%,130%, 150% (Long-term<br>operating current)<br>2) Test duration: 1h .      | AEC-Q200-001                | 温度不超过 350°C 超过 10<br>秒，无火焰，无爆炸。<br>The temperature is not<br>higher than 350°C for<br>more than 10 seconds,<br>no flame, no explosion. |

# 包装尺寸(packing dimension)

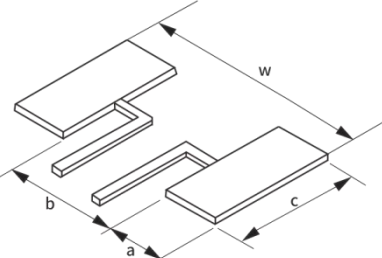


| 尺寸<br>Size | 电阻合金<br>Resistance<br>Alloy | 阻值范围<br>Resistance<br>Range (mΩ) | A±0.15 | B±0.15 | W±0.3 | E±0.15 | F±0.15 | Po±0.15 | P1±0.15 | P2±0.15 | Do±0.15 | 数量<br>Quantity<br>(pcs) | T±0.15                                                              |
|------------|-----------------------------|----------------------------------|--------|--------|-------|--------|--------|---------|---------|---------|---------|-------------------------|---------------------------------------------------------------------|
| 2512       | S                           | 0.2                              | 3.6    | 6.7    | 16    | 1.75   | 7.5    | 2       | 4       | 8       | 1.5     | 1000                    | 取决于产<br>品的厚度<br>Depends<br>on the<br>thickness<br>of the<br>product |
|            | M                           | 0.3                              | 3.7    | 6.9    | 16    | 1.75   | 7.5    | 2       | 4       | 8       | 1.5     | 1000                    |                                                                     |
|            |                             | 0.5                              | 3.5    | 6.7    | 12    | 1.75   | 5.5    | 2       | 4       | 4       | 1.5     | 2000                    |                                                                     |
|            |                             | 0.6~1                            | 3.5    | 6.7    | 12    | 1.75   | 5.5    | 2       | 4       | 4       | 1.5     | 3000                    |                                                                     |
|            | K/F                         | 1.1~1.5                          | 3.5    | 6.7    | 12    | 1.75   | 5.5    | 2       | 4       | 4       | 1.5     | 2000                    |                                                                     |
|            |                             | 1.5~5                            | 3.5    | 6.7    | 12    | 1.75   | 5.5    | 2       | 4       | 4       | 1.5     | 3000                    |                                                                     |
| 3920       | M                           | 0.2                              | 5.8    | 10.6   | 24    | 1.75   | 11.5   | 2       | 4       | 12      | 1.5     | 2000                    |                                                                     |
|            |                             | 0.3                              | 5.6    | 10.65  | 24    | 1.75   | 11.5   | 2       | 4       | 12      | 1.5     | 1500                    |                                                                     |
|            |                             | 0.4                              | 5.8    | 10.5   | 24    | 1.75   | 11.5   | 2       | 4       | 12      | 1.5     | 2500                    |                                                                     |
|            |                             | 0.5                              | 5.7    | 10.4   | 16    | 1.75   | 7.5    | 2       | 4       | 12      | 1.5     | 2500                    |                                                                     |
|            |                             | 0.7~1                            | 5.8    | 10.5   | 16    | 1.75   | 7.5    | 2       | 4       | 12      | 1.5     | 2500                    |                                                                     |
|            | K/F                         | 1                                | 5.8    | 10.5   | 24    | 1.75   | 11.5   | 2       | 4       | 12      | 1.5     | 2500                    |                                                                     |
|            |                             | 1.5~5                            | 5.8    | 10.5   | 16    | 1.75   | 7.5    | 2       | 4       | 12      | 1.5     | 2500                    |                                                                     |
| 5930       | S                           | 0.1                              | 8.5    | 15.7   | 24    | 1.75   | 11.5   | 2       | 4       | 12      | 1.5     | 1000                    |                                                                     |
|            | M                           | 0.2                              | 8.5    | 15.7   | 24    | 1.75   | 11.5   | 2       | 4       | 16      | 1.5     | 1000                    |                                                                     |
|            |                             | 0.3~0.35                         | 8.5    | 15.7   | 24    | 1.75   | 11.5   | 2       | 4       | 16      | 1.5     | 1500                    |                                                                     |
|            |                             | 0.4~0.5                          | 8.1    | 15.5   | 24    | 1.75   | 11.5   | 2       | 4       | 12      | 1.5     | 2000                    |                                                                     |
|            |                             | 0.6~0.8                          | 8.5    | 15.7   | 24    | 1.75   | 11.5   | 2       | 4       | 12      | 1.5     | 2000                    |                                                                     |
|            | K/F                         | 1                                | 8.1    | 15.5   | 24    | 1.75   | 11.5   | 2       | 4       | 12      | 1.5     | 2000                    |                                                                     |
|            |                             | 2~3                              | 8.5    | 15.7   | 24    | 1.75   | 11.5   | 2       | 4       | 12      | 1.5     | 2000                    |                                                                     |

**■ 卷盘尺寸 reel dimension(Unit:mm)**

|                                                                                   |            |              |              |              |              |      |
|-----------------------------------------------------------------------------------|------------|--------------|--------------|--------------|--------------|------|
|  | 尺寸<br>Size | 2512<br>W=12 | 2512<br>W=16 | 3920<br>W=24 | 3920<br>W=16 | 5930 |
|                                                                                   | ΦA         | 178          | 203          | 330          | 330          | 330  |
|                                                                                   | ΦB         | 60           | 60           | 100          | 100          | 100  |
|                                                                                   | ΦC         | 13           | 13           | 13           | 13           | 13   |
|                                                                                   | W          | 12.5         | 16.5         | 24.5         | 16.5         | 24.5 |
|                                                                                   | T          | 21           | 21           | 29           | 21           | 29   |

**■ 焊盘尺寸 Pad size(Unit:mm)**

|                                                                                    |               |     |      |     |     |
|------------------------------------------------------------------------------------|---------------|-----|------|-----|-----|
|  | Solder Pad Ty | w   | c    | a   | b   |
|                                                                                    | RL-S/M/K/F-3  | 7.0 | 3.4  | 1.8 | 3.4 |
|                                                                                    | RL-S/M/K/F-5  | 11  | 6.2  | 2.7 | 5.6 |
|                                                                                    | RL-S/M/K/F-7  | 16  | 8.75 | 5.2 | 5.6 |