

FEATURES 特征

- Fe base metal material core provides large saturation current.
采用金属铁磁芯，具有更高的饱和电流
- Metallization on ferrite core results in excellent shock resistance and damage-free durability.
在磁芯上金属化电极，抗跌落冲击强，经久耐用
- Closed magnetic circuit design reduces leakage flux and Electro Magnetic Interference (EMI).
闭合磁路结构设计，漏磁少，抗EMI能力强
- Low DCR decreases power loss, small and slim take up less PCB real estate.
低直流电阻降低能量损耗，省电省空间
- Automatic production ensures high quality and consistency.
全自动化生产，产品品质高，一致性好
- Operating Temp : -45°C~+125°C(Including self heating).
工作温度范围:-45°C~+125°C(包括自身温度上升)



APPLICATIONS 用途

- Smart phone, set top box, VR, AR.
智能手机，机顶盒，虚拟现实，增强现实
- Notebooks, desktop computers, servers.
笔记本电脑，台式电脑，服务器
- Portable gaming devices, personal navigation systems, personal multimedia devices.
便携式游戏机，个人导航系统，多媒体

PART NUMBERING 产品型号

PNR
4020
-
2R2
M

①
②
③
④

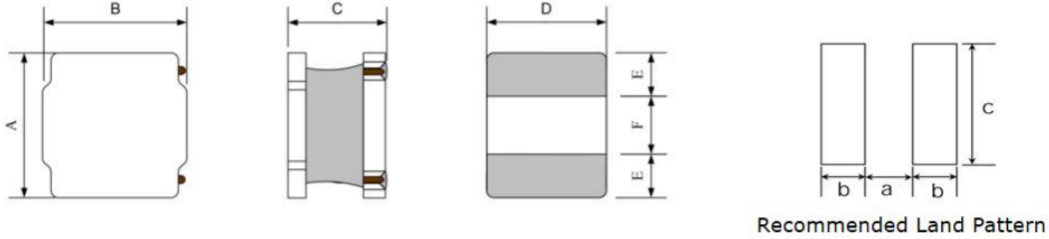
| ① Series Name | |
|---------------|--------------------------------|
| PNR | Wire Wound SMD Power Inductors |

| ③ Nominal Inductance | |
|----------------------|-------------------------------|
| Code (example) | Nominal Inductance [μ H] |
| R47 | 0.47 |
| 1R0 | 1 |
| 100 | 10 |

| ② External Dimensions[LxWxH mm] | |
|---------------------------------|-------------|
| 201610 | 2.0×1.6×1.0 |
| 252010 | 2.5×2.0×1.0 |
| 252012 | 2.5×2.0×1.2 |
| 3012 | 3.0×3.0×1.2 |
| 3015 | 3.0×3.0×1.5 |
| 4012 | 4.0×4.0×1.2 |
| 4020 | 4.0×4.0×2.0 |

| ④ Inductance Tolerance | |
|------------------------|------|
| M | ±20% |
| N | ±30% |

DIMENSIONS & RECOMMENDED LAND PATTERN 尺寸及推荐焊盘



Unit: mm

| Series | A | B | C | D | E | F | a | b | c |
|-----------|---------|---------|------|---------|------|------|------|-----|-----|
| | | | Max. | | Typ. | Typ. | Typ. | | |
| PNR201610 | 2.0±0.3 | 1.6±0.3 | 1.05 | 1.2±0.2 | 0.6 | 0.8 | 0.7 | 0.7 | 1.4 |
| PNR252010 | 2.5±0.3 | 2.0±0.3 | 1.0 | 2.0±0.2 | 0.8 | 0.9 | 0.7 | 1.0 | 2.2 |
| PNR252012 | 2.5±0.3 | 2.0±0.3 | 1.2 | 2.0±0.2 | 0.8 | 0.9 | 0.7 | 1.0 | 2.2 |
| PNR3012 | 3.0±0.2 | 3.0±0.2 | 1.2 | 2.5±0.2 | 0.9 | 1.2 | 1.0 | 1.1 | 2.7 |
| PNR3015 | 3.0±0.2 | 3.0±0.2 | 1.5 | 2.5±0.2 | 0.9 | 1.2 | 1.0 | 1.1 | 2.7 |
| PNR4012 | 4.0±0.2 | 4.0±0.2 | 1.2 | 3.4±0.2 | 1.0 | 2.0 | 1.8 | 1.2 | 3.6 |
| PNR4020 | 4.0±0.2 | 4.0±0.2 | 2.0 | 3.3±0.2 | 1.0 | 2.0 | 1.8 | 1.2 | 3.5 |

ELECTRICAL CHARACTERISTICS 特性规格表

● PNR201610 Series

| Part Number | Inductance | Inductance Tolerance | DC Resistance | Heat Rating Current | | Saturation Current | |
|----------------|------------|----------------------|---------------|---------------------|------|--------------------|------|
| | @1MHz, 1V | | Max. | Max. | Typ. | Max. | Typ. |
| Units | μH | - | Ω | A | | A | |
| Symbol | L | - | DCR | Irms | | Isat | |
| PNR201610-R24□ | 0.24 | M,N | 0.04 | 3 | 3.45 | 4.5 | 5.5 |
| PNR201610-R33□ | 0.33 | M,N | 0.049 | 2.7 | 3.1 | 4.4 | 5.2 |
| PNR201610-R47□ | 0.47 | M,N | 0.049 | 2.7 | 3.1 | 4 | 4.7 |
| PNR201610-R68□ | 0.68 | M,N | 0.065 | 2.5 | 2.8 | 3.5 | 4 |
| PNR201610-1R0□ | 1 | M,N | 0.095 | 2 | 2.3 | 3.3 | 3.8 |
| PNR201610-1R5□ | 1.5 | M,N | 0.13 | 1.7 | 2 | 1.95 | 2.3 |
| PNR201610-2R2M | 2.2 | M | 0.18 | 1.4 | 1.6 | 1.9 | 2.15 |
| PNR201610-3R3M | 3.3 | M | 0.307 | 1.1 | 1.3 | 1.4 | 1.6 |
| PNR201610-4R7M | 4.7 | M | 0.425 | 0.9 | 1 | 1.1 | 1.4 |
| PNR201610-6R8M | 6.8 | M | 0.62 | 0.7 | 0.82 | 0.95 | 1.1 |
| PNR201610-8R2M | 8.2 | M | 0.87 | 0.66 | 0.76 | 0.86 | 1 |
| PNR201610-100M | 10 | M | 0.875 | 0.6 | 0.7 | 0.8 | 0.95 |

ELECTRICAL CHARACTERISTICS 特性规格表
● PNR252010 Series

| Part Number | Inductance | Inductance Tolerance | DC Resistance | Heat Rating Current | | Saturation Current | |
|----------------|------------|----------------------|---------------|---------------------|------|--------------------|------|
| | @1MHz,1V | | Max. | Max. | Typ. | Max. | Typ. |
| Units | μH | - | Ω | A | | A | |
| Symbol | L | - | DCR | Irms | | Isat | |
| PNR252010-R24□ | 0.24 | M,N | 0.033 | 3.7 | 4.5 | 6.1 | 7.1 |
| PNR252010-R33□ | 0.33 | M,N | 0.039 | 3.5 | 4.05 | 4.8 | 5.5 |
| PNR252010-R47□ | 0.47 | M,N | 0.045 | 3.2 | 3.6 | 4.4 | 5.2 |
| PNR252010-R68□ | 0.68 | M,N | 0.059 | 2.75 | 3.2 | 3.2 | 3.6 |
| PNR252010-1R0□ | 1 | M,N | 0.085 | 2.2 | 2.6 | 3.1 | 4 |
| PNR252010-1R5□ | 1.5 | M,N | 0.106 | 2 | 2.3 | 2.6 | 3 |
| PNR252010-2R2M | 2.2 | M | 0.155 | 1.5 | 1.8 | 1.9 | 2.2 |
| PNR252010-3R3M | 3.3 | M | 0.252 | 1.2 | 1.4 | 1.6 | 1.8 |
| PNR252010-4R7M | 4.7 | M | 0.34 | 1 | 1.1 | 1.3 | 1.5 |
| PNR252010-6R8M | 6.8 | M | 0.48 | 0.95 | 1 | 1 | 1.15 |
| PNR252010-100M | 10 | M | 0.74 | 0.65 | 0.75 | 0.9 | 1 |

● PNR252012 Series

| Part Number | Inductance | Inductance Tolerance | DC Resistance | Heat Rating Current | | Saturation Current | |
|----------------|------------|----------------------|---------------|---------------------|------|--------------------|------|
| | @1MHz,1V | | Max. | Max. | Typ. | Max. | Typ. |
| Units | μH | - | Ω | A | | A | |
| Symbol | L | - | DCR | Irms | | Isat | |
| PNR252012-R24□ | 0.24 | M,N | 0.023 | 4.05 | 4.7 | 6.5 | 7.8 |
| PNR252012-R33□ | 0.33 | M,N | 0.035 | 3.7 | 4.3 | 5.35 | 6.3 |
| PNR252012-R47□ | 0.47 | M,N | 0.035 | 3.45 | 4 | 4.9 | 5.6 |
| PNR252012-R68□ | 0.68 | M,N | 0.045 | 3.1 | 3.6 | 3.8 | 4.5 |
| PNR252012-1R0□ | 1 | M,N | 0.054 | 3 | 3.4 | 3.6 | 4 |
| PNR252012-1R5□ | 1.5 | M,N | 0.100 | 2.4 | 2.8 | 2.9 | 3.5 |
| PNR252012-2R2M | 2.2 | M | 0.120 | 1.9 | 2.15 | 2.6 | 3 |
| PNR252012-3R3M | 3.3 | M | 0.215 | 1.5 | 1.8 | 1.7 | 2.1 |
| PNR252012-4R7M | 4.7 | M | 0.26 | 1.25 | 1.45 | 1.6 | 1.9 |
| PNR252012-5R6M | 5.6 | M | 0.336 | 1.1 | 1.2 | 1.3 | 1.4 |
| PNR252012-6R8M | 6.8 | M | 0.366 | 0.95 | 1.1 | 1.2 | 1.4 |
| PNR252012-8R2M | 8.2 | M | 0.46 | 0.88 | 1.06 | 1.15 | 1.36 |
| PNR252012-100M | 10 | M | 0.48 | 0.85 | 1 | 1.1 | 1.35 |
| PNR252012-150M | 15 | M | 1 | 0.6 | 0.7 | 0.77 | 0.9 |
| PNR252012-220M | 22 | M | 1.09 | 0.55 | 0.65 | 0.6 | 0.75 |

ELECTRICAL CHARACTERISTICS 特性规格表
● PNR3012 Series

| Part Number | Inductance | Inductance Tolerance | DC Resistance | Heat Rating Current | | Saturation Current | |
|--------------|------------|----------------------|---------------|---------------------|------|--------------------|------|
| | @1MHz,1V | | Max. | Max. | Typ. | Max. | Typ. |
| Units | μH | - | Ω | A | | A | |
| Symbol | L | - | DCR | Irms | | Isat | |
| PNR3012-R47□ | 0.47 | M,N | 0.033 | 3.9 | 4.3 | 6.8 | 8 |
| PNR3012-1R0□ | 1 | M,N | 0.054 | 2.7 | 3.1 | 4.2 | 5.2 |
| PNR3012-1R5□ | 1.5 | M,N | 0.074 | 2.5 | 2.9 | 3.4 | 4.1 |
| PNR3012-2R2M | 2.2 | M | 0.108 | 2.05 | 2.35 | 2.8 | 3.35 |
| PNR3012-3R3M | 3.3 | M | 0.155 | 1.7 | 2 | 2.2 | 2.6 |
| PNR3012-4R7M | 4.7 | M | 0.235 | 1.3 | 1.5 | 2 | 2.2 |
| PNR3012-6R8M | 6.8 | M | 0.34 | 1.1 | 1.25 | 1.6 | 1.9 |
| PNR3012-100M | 10 | M | 0.474 | 1 | 1.15 | 1.2 | 1.45 |

● PNR3015 Series

| Part Number | Inductance | Inductance Tolerance | DC Resistance | Heat Rating Current | | Saturation Current | |
|--------------|------------|----------------------|---------------|---------------------|------|--------------------|------|
| | @1MHz,1V | | Max. | Max. | Typ. | Max. | Typ. |
| Units | μH | - | Ω | A | | A | |
| Symbol | L | - | DCR | Irms | | Isat | |
| PNR3015-R24□ | 0.24 | M,N | 0.022 | 3 | 3.5 | 5.5 | 6 |
| PNR3015-R33□ | 0.33 | M,N | 0.035 | 4 | 4.5 | 9 | 10 |
| PNR3015-R47□ | 0.47 | M,N | 0.04 | 3.5 | 4 | 7.5 | 8 |
| PNR3015-1R0□ | 1 | M,N | 0.048 | 3.3 | 3.8 | 5.8 | 7 |
| PNR3015-1R5□ | 1.5 | M,N | 0.072 | 2.2 | 2.7 | 4.6 | 5.5 |
| PNR3015-2R2M | 2.2 | M | 0.115 | 2 | 2.3 | 4 | 4.5 |
| PNR3015-3R3M | 3.3 | M | 0.175 | 2 | 2.5 | 3.4 | 4 |
| PNR3015-4R7M | 4.7 | M | 0.215 | 1.8 | 2.4 | 3 | 3.3 |
| PNR3015-6R8M | 6.8 | M | 0.29 | 1.5 | 2 | 2 | 2.5 |
| PNR3015-100M | 10 | M | 0.46 | 1.5 | 2 | 1.5 | 2 |
| PNR3015-150M | 15 | M | 0.85 | 1 | 1.2 | 1.4 | 1.8 |
| PNR3015-220M | 22 | M | 0.975 | 0.75 | 0.9 | 1.15 | 1.4 |
| PNR3015-470M | 47 | M | 1.88 | 0.45 | 0.58 | 0.65 | 0.88 |

ELECTRICAL CHARACTERISTICS 特性规格表

● PNR4012 Series

| Part Number | Inductance | Inductance Tolerance | DC Resistance | Heat Rating Current | | Saturation Current | |
|--------------|------------|----------------------|---------------|---------------------|------|--------------------|------|
| | @1MHz,1V | | Max. | Max. | Typ. | Max. | Typ. |
| Units | μH | - | Ω | A | | A | |
| Symbol | L | - | DCR | Irms | | Isat | |
| PNR4012-R33□ | 0.33 | M,N | 0.032 | 4.3 | 4.9 | 10.3 | 11.5 |
| PNR4012-R47□ | 0.47 | M,N | 0.041 | 3.5 | 4.4 | 7 | 9.9 |
| PNR4012-R68□ | 0.68 | M,N | 0.041 | 3.2 | 4.4 | 5.5 | 6.35 |
| PNR4012-1R0□ | 1 | M,N | 0.059 | 3 | 3.7 | 5 | 6.6 |
| PNR4012-1R2□ | 1.2 | M,N | 0.059 | 3.2 | 3.7 | 4 | 4.8 |
| PNR4012-1R5□ | 1.5 | M,N | 0.07 | 2.9 | 3.3 | 3.9 | 4.6 |
| PNR4012-2R2M | 2.2 | M | 0.079 | 2.7 | 3.1 | 2.8 | 3.3 |
| PNR4012-3R3M | 3.3 | M | 0.125 | 2.1 | 2.5 | 2.8 | 3.3 |
| PNR4012-4R7M | 4.7 | M | 0.166 | 1.9 | 2.2 | 2.3 | 2.6 |
| PNR4012-6R8M | 6.8 | M | 0.226 | 1.6 | 1.85 | 1.6 | 2.2 |
| PNR4012-100M | 10 | M | 0.335 | 1.3 | 1.5 | 1.55 | 1.85 |
| PNR4012-150M | 15 | M | 0.632 | 0.9 | 1.25 | 1.2 | 1.6 |
| PNR4012-220M | 22 | M | 0.679 | 0.9 | 1.05 | 1.05 | 1.3 |

● PNR4020 Series

| Part Number | Inductance | Inductance Tolerance | DC Resistance | Heat Rating Current | | Saturation Current | |
|--------------|------------|----------------------|---------------|---------------------|------|--------------------|------|
| | @1MHz,1V | | Max. | Max. | Typ. | Max. | Typ. |
| Units | μH | - | Ω | A | | A | |
| Symbol | L | - | DCR | Irms | | Isat | |
| PNR4020-R22□ | 0.22 | M,N | 0.013 | 8.2 | 9.5 | 18.7 | 22 |
| PNR4020-R47□ | 0.47 | M,N | 0.022 | 6.4 | 7.4 | 13.4 | 15.5 |
| PNR4020-R68□ | 0.68 | M,N | 0.022 | 6.4 | 7.4 | 8.7 | 11.1 |
| PNR4020-1R0□ | 1 | M,N | 0.026 | 5.8 | 6.7 | 8.7 | 11.1 |
| PNR4020-1R5□ | 1.5 | M,N | 0.036 | 5.2 | 6 | 7.7 | 9.6 |
| PNR4020-2R2M | 2.2 | M | 0.048 | 4.3 | 5 | 6.1 | 7.6 |
| PNR4020-3R3M | 3.3 | M | 0.072 | 3.45 | 4 | 4.7 | 5.9 |
| PNR4020-4R7M | 4.7 | M | 0.108 | 2.85 | 3.3 | 4 | 4.9 |
| PNR4020-6R8M | 6.8 | M | 0.156 | 2.4 | 2.8 | 3 | 4.2 |
| PNR4020-100M | 10 | M | 0.216 | 2 | 2.35 | 2.8 | 3.5 |
| PNR4020-220M | 22 | M | 0.545 | 0.95 | 1.1 | 1.3 | 1.5 |
| PNR4020-330M | 33 | M | 0.85 | 0.7 | 0.86 | 1.2 | 1.4 |
| PNR4020-470M | 47 | M | 1.2 | 0.56 | 0.66 | 1.1 | 1.3 |

- All test data is referenced to 20°C ambient.
- Rated current: Isat or Irms, whichever is smaller.
- Isat: DC current at which the inductance drops approximate 30% from its value without current.
- Irms: DC current that causes the temperature rise ($\Delta T = 40^\circ C$) from 20°C ambient.
- PNR2016 & PNR2520 & PNR3012 & PNR3015 size inductors, absolute maximum voltage DC 25V;
For PNR4012 & PNR4020 size inductors, absolute maximum voltage DC 40V;

RELIABILITY TEST 可靠性测试

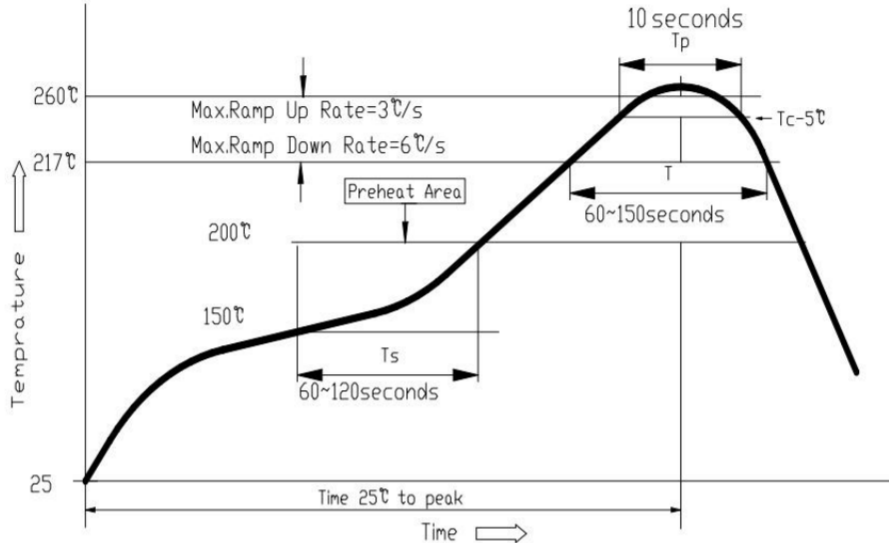
| Item | | Requirements | Test Methods and Remarks |
|------|---------------------------|---|--|
| 1 | Low temperature storage | Inductance shall be within $\pm 10\%$ of the initial value. | Placed at -40°C for 500 hours, then measured at room ambient temperature after placing 24 hours |
| 2 | High temperature storage | Inductance shall be within $\pm 10\%$ of the initial value. | Placed at $+125^{\circ}\text{C}$ for 500 hours, then measured at room ambient temperature after placing 24 hours |
| 3 | Thermal shock | Inductance shall be within $\pm 10\%$ of the initial value. | Condition for 1 cycle: $-40^{\circ}\text{C}, 30\text{min.} \sim +125^{\circ}\text{C}, 30\text{min}$ Number of cycles: 5 |
| 4 | Humidity resistance | Inductance shall be within $\pm 10\%$ of the initial value. Insulation resistance $> 100\text{M}\Omega$ at DC. | Placed at 90 to 95%RH, $+50^{\circ}\text{C}$ for 500 hours, then measured at room ambient temperature after placing 24 hours. |
| 5 | Drop | Inductance shall be within $\pm 10\%$ of the initial value. | Drop specimen three times on concrete floor from a height of 1 meter which mounted on test board. |
| 6 | Vibration | Inductance shall be within $\pm 10\%$ of the initial value. | Frequency: 10~55~10Hz Amplitude: 1.5mm or 10G Sweep time: 1 oct/min Test Directions: X, Y, Z Test Time: 2 hours each direction. |
| 7 | Terminal strength | No detachment of terminal pin and no breakage of wire. | Add static load 4.9N(500gf) to inductor through hole of test board for 10 ± 2 sec. |
| 8 | Soldering heat resistance | Inductance shall be within $\pm 10\%$ of the initial value. Appearance: No damage. | Dip Inductor's terminal in solder bath of following conditions: 1) $260 \pm 5^{\circ}\text{C}$, 10 ± 1 sec, 2) $350 \pm 10^{\circ}\text{C}$, 3.5 ± 0.5 sec |

RECOMMENDED SOLDERING TECHNOLOGIES 回流焊建议

Soldering Materials

- ◆ (1) Solder: Sn-3.0Ag-0.5Cu
- ◆ (2) Flux: Use rosin-based flux, but not strongly acidic flux (with chlorine exceeding 0.2wt%). Do not use water-soluble flux.

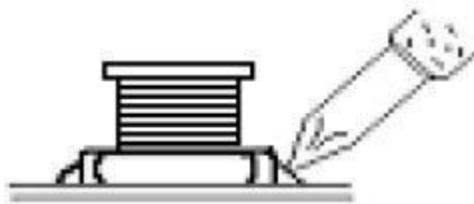
Reflow Soldering Profile



Soldering Iron

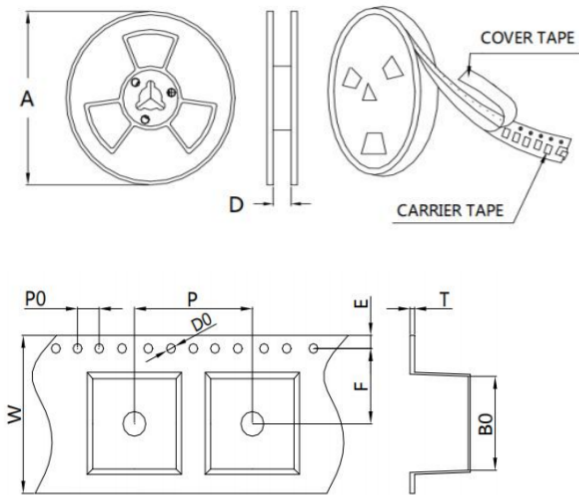
Reworking with electric soldering iron must preheating at 150°C for 1 minute is required, and do not directly touch the core with the tip of the soldering iron. The reworking soldering conditions are as follows.

- ◆ Temperature of soldering iron tip: 350°C;
- ◆ Soldering iron power output: ≤30W;
- ◆ Diameter of soldering iron end: ≤1.0mm;
- ◆ Soldering time: <3 s



PACKAGING 包装

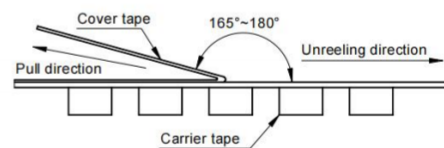
- Packaging (unit: mm)



| Size | A | D |
|--------|----------|------|
| 201610 | Φ178+2.0 | 8.5 |
| 252010 | Φ178+2.0 | 8.5 |
| 252012 | Φ178+2.0 | 8.5 |
| 3012 | Φ178+2.0 | 8.5 |
| 3015 | Φ178+2.0 | 8.5 |
| 4012 | Φ330+2.0 | 12.4 |
| 4020 | Φ330+2.0 | 12.4 |

| Size | Item | W | B0 | P | T | E | F | D0 | P0 |
|--------|------|----------|----------|---------|----------|----------|----------|----------|---------|
| 201610 | (mm) | 8.0±0.1 | 2.2±0.1 | 4.0±0.1 | 0.25±0.1 | 1.75±0.1 | 3.50±0.1 | 1.50±0.1 | 4.0±0.1 |
| 252010 | (mm) | 8.0±0.3 | 2.65±0.2 | 4.0±0.1 | 0.25±0.1 | 1.75±0.1 | 3.50±0.1 | 1.50±0.1 | 4.0±0.2 |
| 252012 | (mm) | 8.0±0.3 | 2.65±0.2 | 4.0±0.1 | 0.25±0.1 | 1.75±0.1 | 3.50±0.1 | 1.50±0.1 | 4.0±0.2 |
| 3012 | (mm) | 8.0±0.3 | 3.3±0.15 | 4.0±0.1 | 0.3±0.1 | 1.75±0.1 | 3.50±0.1 | 1.50±0.1 | 4.0±0.1 |
| 3015 | (mm) | 8.0±0.3 | 3.3±0.15 | 4.0±0.1 | 0.3±0.1 | 1.75±0.1 | 3.50±0.1 | 1.50±0.1 | 4.0±0.1 |
| 4012 | (mm) | 12.0±0.3 | 4.3±0.1 | 8.0±0.1 | 0.3±0.05 | 1.75±0.1 | 5.50±0.1 | 1.50±0.1 | 4.0±0.1 |
| 4020 | (mm) | 12.0±0.3 | 4.3±0.1 | 8.0±0.1 | 0.3±0.05 | 1.75±0.1 | 5.50±0.1 | 1.50±0.1 | 4.0±0.1 |

- Peel-off strength: 10~100gf.
- Peel-off angle: 165°-180°.
- Peel-off speed: 300mm/min.



- Carton Dimensions and Packing Quantity:

| Product Series | Quantity / Reel |
|----------------|-----------------|
| PNR201610 | 2000Pcs |
| PNR252010 | 2000Pcs |
| PNR252012 | 2000Pcs |
| PNR3012 | 2000Pcs |
| PNR3015 | 2000Pcs |
| PNR4012 | 4500Pcs |
| PNR4020 | 3000Pcs |

■ PRECAUTIONS ON USE 使用注意事项

- Precautions.
 - Surface mounting
 - ◆ Mounting and soldering condition should be checked beforehand.
 - ◆ Applicable soldering process to this product is reflow soldering only.
 - ◆ Recommended conditions for repair by soldering iron:
Preheat the circuit board with product to repair at 150℃ for about 1 minute.
Put soldering iron on the land-pattern.
Soldering iron's temperature: 350℃ maximum/Duration: 3 seconds maximum/1 time for each terminal.
The soldering iron should not directly touch the inductor.
Product once removes from the circuit board may not be used again.Put soldering iron on the land-pattern.
 - Handling
 - ◆ Keep the products away from all magnets and magnetic objects.
 - ◆ Be careful not to subject the products to excessive mechanical shocks.
 - ◆ Please avoid applying impact to the products after mounted on pc board.
 - ◆ Avoid ultrasonic cleaning.
 - Storage
 - ◆ To maintain the solderability of terminal electrodes and to keep the packing material in good condition, temperature and humidity in the storage area should be controlled.
 - ◆ Recommended conditions: -10℃~40℃, 70%RH (Max.)
 - ◆ Even under ideal storage conditions, solderability of products electrodes may decrease as time passes. For this reason, product should be used with one year from the time of delivery.
 - ◆ In case of storage over 6 months, solderability shall be checked before actual usage.
 - Guarantee
 - ◆ The guaranteed operating conditions of the products are in accordance with the conditions specified in this specification.
 - ◆ Please note that APV takes no responsibility for any failure and/or abnormality which is caused by use under other than the aforesaid operating conditions.

■ SAFETY REMINDERS 注意事项

SAFETY REMINDERS

The Company shall not guarantee the suitability, performance, or quality for the following applications that require a high level of safety and reliability, or where equipment failure, malfunction, or abnormal operation may cause damage to human life, physical well-being, or property, and may have significant social impacts (hereinafter referred to as "specific applications"). If you intend to use this product in the application scenarios listed below, or if you have special requirements exceeding the scope or conditions specified in each product catalog, please contact us.

- (1) Aerospace/aviation equipment
- (2) Transportation equipment (cars, electric trains, ships, etc.)
- (3) Medical equipment
- (4) Power-generation control equipment
- (5) Atomic energy-related equipment
- (6) Seabed equipment
- (7) Transportation control equipment
- (8) Public information-processing equipment
- (9) Military equipment
- (10) Electric heating apparatus, burning equipment
- (11) Disaster prevention/crime prevention equipment
- (12) Safety equipment
- (13) Other applications that are not considered general-purpose applications

When designing your equipment even for general-purpose applications, you are kindly requested to take into consideration securing protection circuit/device or providing backup circuits in your equipment.