

# MNR50\*\* Series

## Wire Wound SMD Power Inductors

### FEATURES

- Magnetic-resin shielded construction reduces buzz noise to ultra-low levels
- Metallization on ferrite core results in excellent shock resistance and damage-free durability
- Closed magnetic circuit design reduces leakage flux and Electro Magnetic Interference (EMI)
- 30% higher current rating than conventional inductors of equal size
- Takes up less PCB real estate and save more power
- Operate temperature range ....  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$  (Including self temp. rise)
- RoHS compliant



### APPLICATIONS

- Smart phone, smart TV, set top box, notebook
- Car navigation systems, telecomm base stations
- VR, AR
- LED lighting

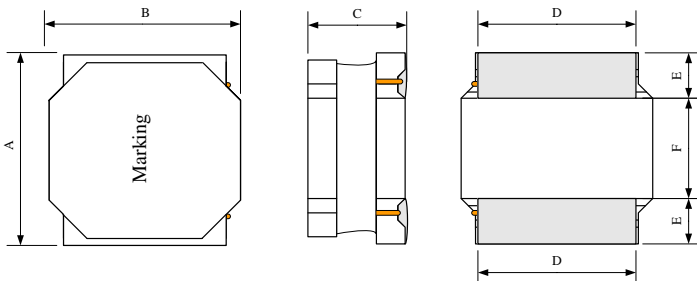
### Explanation of Part Number

MNR 5040 T1R0 M T

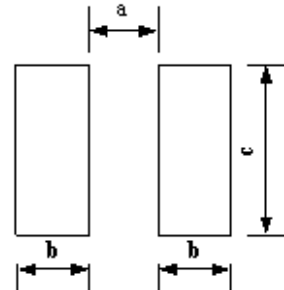
1 2 3 4 5 6

- ◆ 1:Product Series:Wire Wound SMD Power Inductors
- ◆ 2:Dimensions:
- ◆ 3: Feature Type:T Type
- ◆ 4: Initial inductance value: 1R0 = 1.0uH
- ◆ 5: Tolerance of Inductance:M:+/-20%, N:+/-30%
- ◆ 6:Packing:Tape Carrier Package

### Dimensions: [mm]



### Recommended Land Pattern



Unit: mm

| Series  | A       | B       | C        | D       | E        | F       | a Typ. | b Typ. | c Typ. |
|---------|---------|---------|----------|---------|----------|---------|--------|--------|--------|
| MNR5012 | 5.0±0.2 | 5.0±0.2 | 1.2 Max. | 4.0±0.2 | 1.25±0.2 | 2.5±0.2 | 2.3    | 1.4    | 4.2    |
| MNR5020 | 5.0±0.2 | 5.0±0.2 | 2.0 Max. | 4.0±0.2 | 1.25±0.2 | 2.5±0.2 | 2.3    | 1.4    | 4.2    |
| MNR5040 | 5.0±0.2 | 5.0±0.2 | 4.0 Max. | 4.0±0.2 | 1.25±0.2 | 2.5±0.2 | 2.3    | 1.4    | 4.2    |

## Electrical Characteristics List

### MNR5012 Series

| Part Number   | Inductance  | DC Resistance |       | Self-resonant Frequency | Saturation Current <sup>*3</sup> |      | Heat Rating Current <sup>*4</sup> |      |
|---------------|-------------|---------------|-------|-------------------------|----------------------------------|------|-----------------------------------|------|
|               | @100kHz, 1V | Max.          | Typ.  | Min.                    | Max.                             | Typ. | Max.                              | Typ. |
| Units         | μH          | Ω             |       | MHz                     | A                                |      | A                                 |      |
| Symbol        | L           | DCR           |       | S.R.F                   | Isat                             |      | Irms                              |      |
| MNR5012T1R0MT | 1.0±20%     | 0.068         | 0.057 | 103                     | 4.40                             | 4.70 | 2.00                              | 2.40 |
| MNR5012T1R5MT | 1.5±20%     | 0.086         | 0.072 | 68                      | 3.70                             | 3.80 | 1.90                              | 2.20 |
| MNR5012T2R2MT | 2.2±20%     | 0.108         | 0.090 | 50                      | 3.10                             | 3.20 | 1.70                              | 2.00 |
| MNR5012T3R3MT | 3.3±20%     | 0.151         | 0.126 | 34                      | 2.40                             | 2.60 | 1.40                              | 1.70 |
| MNR5012T4R7MT | 4.7±20%     | 0.197         | 0.164 | 31                      | 2.20                             | 2.30 | 1.30                              | 1.50 |
| MNR5012T6R8MT | 6.8±20%     | 0.294         | 0.245 | 22                      | 1.70                             | 1.90 | 1.00                              | 1.20 |
| MNR5012T100MT | 10±20%      | 0.413         | 0.344 | 17                      | 1.40                             | 1.50 | 0.85                              | 1.00 |
| MNR5012T150MT | 15±20%      | 0.523         | 0.436 | 13                      | 1.20                             | 1.30 | 0.80                              | 0.92 |
| MNR5012T220MT | 22±20%      | 0.858         | 0.780 | 16                      | 0.88                             | 0.98 | 0.60                              | 0.68 |

### MNR5020 Series

| Part Number   | Inductance  | DC Resistance |       | Self-resonant Frequency | Saturation Current <sup>*3</sup> |       | Heat Rating Current <sup>*4</sup> |      |
|---------------|-------------|---------------|-------|-------------------------|----------------------------------|-------|-----------------------------------|------|
|               | @100kHz, 1V | Max.          | Typ.  | Min.                    | Max.                             | Typ.  | Max.                              | Typ. |
| Units         | μH          | Ω             |       | MHz                     | A                                |       | A                                 |      |
| Symbol        | L           | DCR           |       | S.R.F                   | Isat                             |       | Irms                              |      |
| MNR5020TR22NT | 0.22±30%    | 0.011         | 0.009 | 280                     | 9.00                             | 12.00 | 5.30                              | 6.00 |
| MNR5020TR24NT | 0.24±30%    | 0.011         | 0.009 | 248                     | 8.00                             | 10.00 | 5.30                              | 6.00 |
| MNR5020TR47NT | 0.47±30%    | 0.017         | 0.013 | 160                     | 6.15                             | 6.70  | 4.60                              | 5.00 |
| MNR5020TR56NT | 0.56±30%    | 0.022         | 0.017 | 137                     | 8.50                             | 9.60  | 3.80                              | 4.20 |
| MNR5020TR68NT | 0.68±30%    | 0.022         | 0.017 | 120                     | 5.50                             | 6.00  | 4.00                              | 4.40 |
| MNR5020TR82NT | 0.82±30%    | 0.022         | 0.017 | 117                     | 5.50                             | 6.00  | 4.00                              | 4.40 |
| MNR5020T1R0MT | 1.0±20%     | 0.026         | 0.020 | 114                     | 4.10                             | 5.00  | 3.80                              | 4.10 |
| MNR5020T1R2MT | 1.2±20%     | 0.029         | 0.022 | 83                      | 4.50                             | 4.90  | 3.55                              | 3.90 |
| MNR5020T1R5MT | 1.5±20%     | 0.034         | 0.026 | 68                      | 4.10                             | 4.50  | 3.20                              | 3.50 |
| MNR5020T2R2MT | 2.2±20%     | 0.042         | 0.032 | 57                      | 3.20                             | 4.00  | 2.90                              | 3.10 |
| MNR5020T2R7MT | 2.7±20%     | 0.049         | 0.038 | 52                      | 2.90                             | 3.50  | 2.70                              | 2.90 |
| MNR5020T3R0MT | 3.0±20%     | 0.049         | 0.038 | 49                      | 2.55                             | 2.80  | 2.70                              | 2.90 |
| MNR5020T3R3MT | 3.3±20%     | 0.056         | 0.043 | 46                      | 2.55                             | 3.00  | 2.50                              | 2.70 |
| MNR5020T3R6MT | 3.6±20%     | 0.056         | 0.043 | 43                      | 2.80                             | 3.00  | 2.50                              | 2.70 |
| MNR5020T3R9MT | 3.9±20%     | 0.056         | 0.043 | 40                      | 2.30                             | 2.80  | 2.50                              | 2.70 |
| MNR5020T4R3MT | 4.3±20%     | 0.074         | 0.057 | 37                      | 2.50                             | 3.00  | 2.20                              | 2.40 |
| MNR5020T4R7MT | 4.7±20%     | 0.074         | 0.057 | 37                      | 2.50                             | 2.70  | 2.20                              | 2.40 |
| MNR5020T5R1MT | 5.1±20%     | 0.083         | 0.064 | 32                      | 2.25                             | 2.60  | 2.05                              | 2.20 |
| MNR5020T5R6MT | 5.6±20%     | 0.083         | 0.064 | 32                      | 2.30                             | 2.50  | 2.05                              | 2.20 |
| MNR5020T6R8MT | 6.8±20%     | 0.108         | 0.083 | 30                      | 2.05                             | 2.20  | 1.80                              | 1.90 |
| MNR5020T7R5MT | 7.5±20%     | 0.117         | 0.090 | 26                      | 1.85                             | 2.00  | 1.75                              | 1.90 |
| MNR5020T8R2MT | 8.2±20%     | 0.127         | 0.098 | 26                      | 1.85                             | 2.00  | 1.65                              | 1.80 |
| MNR5020T9R1MT | 9.1±20%     | 0.143         | 0.110 | 24                      | 1.70                             | 1.80  | 1.55                              | 1.70 |
| MNR5020T100MT | 10±20%      | 0.143         | 0.110 | 24                      | 1.70                             | 1.80  | 1.55                              | 1.70 |

| Part Number   | Inductance  | DC Resistance |       | Self-resonant Frequency | Saturation Current <sup>3</sup> |      | Heat Rating Current <sup>4</sup> |      |
|---------------|-------------|---------------|-------|-------------------------|---------------------------------|------|----------------------------------|------|
|               | @100kHz, 1V | Max.          | Typ.  | Min.                    | Max.                            | Typ. | Max.                             | Typ. |
| Units         | μH          | Ω             |       | MHz                     | A                               |      | A                                |      |
| Symbol        | L           | DCR           |       | S.R.F                   | Isat                            |      | Irms                             |      |
| MNR5020T120MT | 12±20%      | 0.182         | 0.140 | 22                      | 1.50                            | 1.60 | 1.40                             | 1.50 |
| MNR5020T150MT | 15±20%      | 0.215         | 0.165 | 20                      | 1.35                            | 1.40 | 1.25                             | 1.30 |
| MNR5020T180MT | 18±20%      | 0.260         | 0.200 | 16                      | 1.25                            | 1.30 | 1.15                             | 1.20 |
| MNR5020T220MT | 22±20%      | 0.294         | 0.226 | 14                      | 1.15                            | 1.20 | 1.10                             | 1.20 |
| MNR5020T330MT | 33±20%      | 0.507         | 0.390 | 10                      | 0.92                            | 1.00 | 0.90                             | 0.99 |
| MNR5020T470MT | 47±20%      | 0.680         | 0.523 | 7                       | 0.77                            | 0.84 | 0.77                             | 0.84 |
| MNR5020T560MT | 56±20%      | 0.819         | 0.630 | 6                       | 0.77                            | 0.84 | 0.70                             | 0.77 |
| MNR5020T680MT | 68±20%      | 0.962         | 0.740 | 6                       | 0.65                            | 0.70 | 0.64                             | 0.70 |
| MNR5020T820MT | 82±20%      | 1.158         | 0.965 | 6                       | 0.65                            | 0.75 | 0.50                             | 0.60 |
| MNR5020T101MT | 100±20%     | 1.430         | 1.100 | 6                       | 0.53                            | 0.58 | 0.53                             | 0.58 |
| MNR5020T121MT | 120±20%     | 1.755         | 1.350 | 6                       | 0.42                            | 0.53 | 0.40                             | 0.50 |
| MNR5020T221MT | 220±20%     | 2.60          | 2.00  | 4.5                     | 0.30                            | 0.33 | 0.40                             | 0.45 |

### MNR5040 Series

| Part Number   | Inductance  | DC Resistance |       | Self-resonant Frequency | Saturation Current <sup>3</sup> |       | Heat Rating Current <sup>4</sup> |      |
|---------------|-------------|---------------|-------|-------------------------|---------------------------------|-------|----------------------------------|------|
|               | @100kHz, 1V | Max.          | Typ.  | Min.                    | Max.                            | Typ.  | Max.                             | Typ. |
| Units         | μH          | Ω             |       | MHz                     | A                               |       | A                                |      |
| Symbol        | L           | DCR           |       | S.R.F                   | Isat                            |       | Irms                             |      |
| MNR5040TR22NT | 0.22±20%    | 0.008         | 0.006 | 289                     | 18.00                           | 20.00 | 6.50                             | 7.50 |
| MNR5040TR24NT | 0.24±30%    | 0.008         | 0.006 | 251                     | 15.70                           | 18.00 | 6.40                             | 7.40 |
| MNR5040TR47NT | 0.47±20%    | 0.009         | 0.007 | 171                     | 10.00                           | 11.50 | 6.60                             | 7.60 |
| MNR5040T1R0MT | 1.0±20%     | 0.016         | 0.012 | 117                     | 7.35                            | 8.20  | 4.90                             | 5.10 |
| MNR5040T1R2MT | 1.2±20%     | 0.021         | 0.016 | 110                     | 6.50                            | 7.10  | 4.15                             | 4.30 |
| MNR5040T1R5MT | 1.5±20%     | 0.020         | 0.015 | 86                      | 6.30                            | 7.30  | 4.30                             | 4.80 |
| MNR5040T1R8MT | 1.8±20%     | 0.021         | 0.016 | 55                      | 5.50                            | 6.40  | 4.15                             | 4.30 |
| MNR5040T2R2MT | 2.2±30%     | 0.025         | 0.019 | 50                      | 4.90                            | 5.60  | 3.80                             | 4.30 |
| MNR5040T2R7MT | 2.7±30%     | 0.029         | 0.022 | 37                      | 4.30                            | 5.10  | 3.60                             | 4.10 |
| MNR5040T3R0MT | 3.0±30%     | 0.029         | 0.022 | 37                      | 4.15                            | 4.80  | 3.60                             | 4.20 |
| MNR5040T3R3MT | 3.3±30%     | 0.031         | 0.024 | 32                      | 3.95                            | 4.60  | 3.40                             | 3.90 |
| MNR5040T3R6MT | 3.6±20%     | 0.031         | 0.026 | 30                      | 3.80                            | 4.40  | 3.30                             | 3.70 |
| MNR5040T3R9MT | 3.9±30%     | 0.035         | 0.027 | 29                      | 3.55                            | 4.20  | 3.20                             | 3.70 |
| MNR5040T4R7MT | 4.7±30%     | 0.039         | 0.030 | 28                      | 3.50                            | 3.90  | 3.00                             | 3.30 |
| MNR5040T5R6MT | 5.6±20%     | 0.046         | 0.035 | 27                      | 3.00                            | 4.10  | 2.80                             | 3.10 |
| MNR5040T6R8MT | 6.8±20%     | 0.056         | 0.043 | 21                      | 2.90                            | 3.50  | 2.50                             | 2.80 |
| MNR5040T8R2MT | 8.2±20%     | 0.062         | 0.048 | 20                      | 2.70                            | 3.00  | 2.30                             | 2.60 |
| MNR5040T100MT | 10±20%      | 0.083         | 0.064 | 18                      | 2.35                            | 2.90  | 2.10                             | 2.40 |
| MNR5040T120MT | 12±20%      | 0.100         | 0.077 | 14                      | 2.20                            | 2.50  | 2.00                             | 2.10 |
| MNR5040T150MT | 15±20%      | 0.112         | 0.086 | 13                      | 2.00                            | 2.30  | 2.00                             | 2.10 |
| MNR5040T180MT | 18±20%      | 0.155         | 0.119 | 12                      | 1.70                            | 2.00  | 1.45                             | 1.65 |
| MNR5040T220MT | 22±20%      | 0.168         | 0.129 | 11                      | 1.60                            | 1.90  | 1.50                             | 1.60 |
| MNR5040T270MT | 27±20%      | 0.244         | 0.188 | 9.8                     | 1.52                            | 1.75  | 1.10                             | 1.25 |
| MNR5040T330MT | 33±20%      | 0.244         | 0.188 | 9                       | 1.30                            | 1.50  | 1.20                             | 1.40 |
| MNR5040T470MT | 47±20%      | 0.354         | 0.272 | 7                       | 1.10                            | 1.30  | 1.00                             | 1.10 |
| MNR5040T510MT | 51±20%      | 0.494         | 0.380 | 6                       | 1.00                            | 1.20  | 1.00                             | 1.10 |
| MNR5040T560MT | 56±20%      | 0.494         | 0.380 | 6                       | 1.05                            | 1.20  | 0.80                             | 0.90 |

| Part Number   | Inductance | DC Resistance |       | Self-resonant Frequency | Saturation Current <sup>*3</sup> |      | Heat Rating Current <sup>*4</sup> |      |
|---------------|------------|---------------|-------|-------------------------|----------------------------------|------|-----------------------------------|------|
|               | @100kHz,1V | Max.          | Typ.  | Min.                    | Max.                             | Typ. | Max.                              | Typ. |
| Units         | μH         | Ω             |       | MHz                     | A                                |      | A                                 |      |
| Symbol        | L          | DCR           |       | S.R.F                   | Isat                             |      | Irms                              |      |
| MNR5040T680MT | 68±20%     | 0.520         | 0.40  | 6                       | 0.90                             | 1.10 | 0.80                              | 0.90 |
| MNR5040T750MT | 75±20%     | 0.585         | 0.450 | 6                       | 0.85                             | 0.95 | 0.72                              | 0.80 |
| MNR5040T101MT | 100±20%    | 0.728         | 0.560 | 5                       | 0.75                             | 0.90 | 0.70                              | 0.80 |
| MNR5040T151MT | 150±20%    | 0.975         | 0.750 | 3.7                     | 0.65                             | 0.67 | 0.60                              | 0.70 |
| MNR5040T221MT | 220±20%    | 1.820         | 1.400 | 3.0                     | 0.48                             | 0.55 | 0.40                              | 0.50 |
| MNR5040T301MT | 300±20%    | 2.600         | 2.000 | 2.7                     | 0.50                             | 0.58 | 0.35                              | 0.40 |
| MNR5040T331MT | 330±20%    | 2.730         | 2.100 | 2.7                     | 0.42                             | 0.47 | 0.40                              | 0.50 |
| MNR5040T471MT | 470±20%    | 3.900         | 3.000 | 2.7                     | 0.37                             | 0.43 | 0.35                              | 0.40 |
| MNR5040T561MT | 560±20%    | 4.920         | 3.780 | 1.5                     | 0.31                             | 0.36 | 0.31                              | 0.35 |
| MNR5040T681MT | 680±20%    | 5.070         | 3.900 | 1.60                    | 0.30                             | 0.35 | 0.25                              | 0.30 |

※1: All test data is referenced to 20°C ambient;

※2: Rated current: Isat or Irms, whichever is smaller;

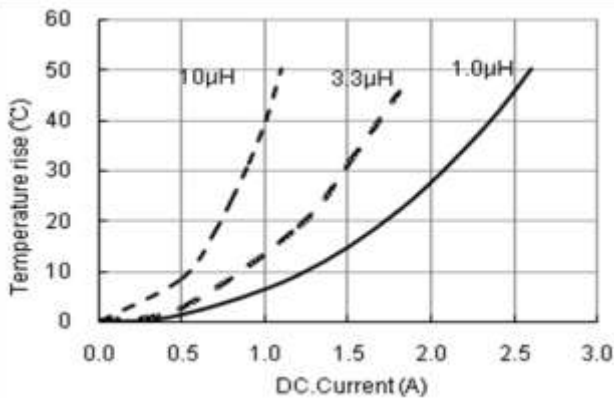
※\*3: Isat: DC current at which the inductance drops approximate 30% from its value without current;

※\*4: Irms: DC current that causes the temperature rise ( $\Delta T = 40^\circ\text{C}$ ) from 20°C ambient.

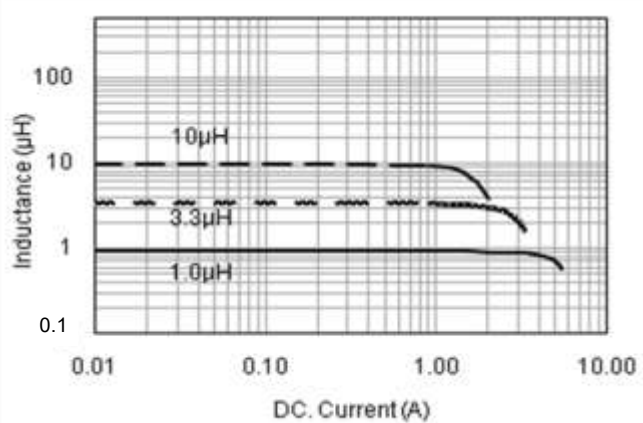
## TYPICAL ELECTRICAL CHARACTERISTICS

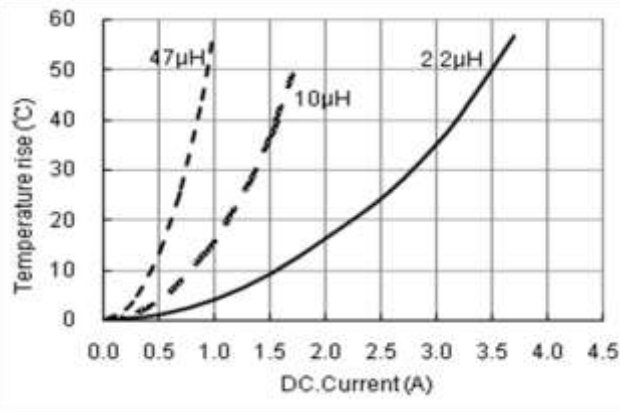
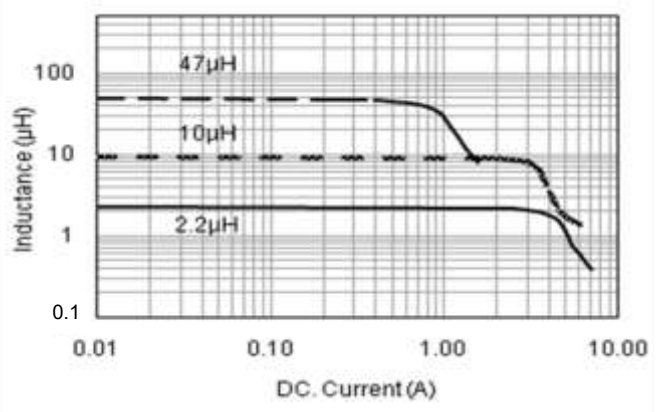
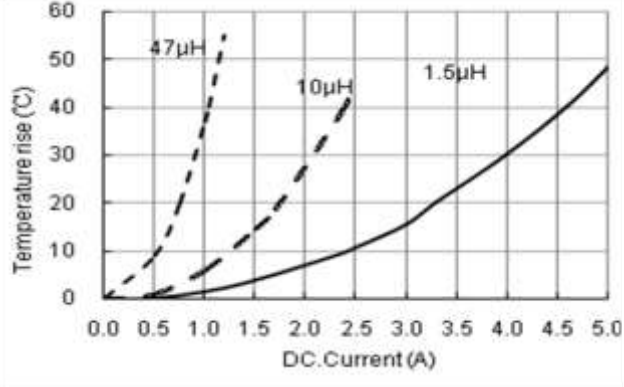
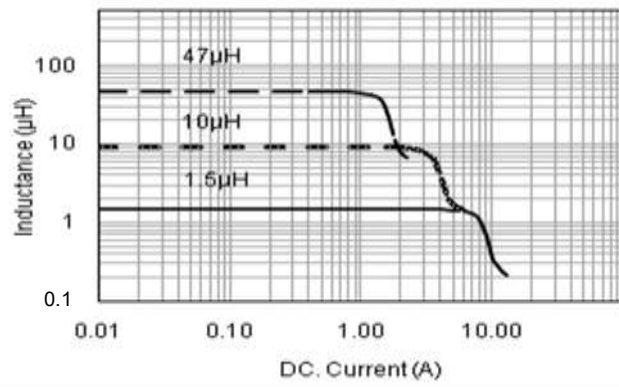
### MNR5012 Series

Temperature vs. DC Current Characteristics



Inductance vs. DC Current Characteristics



**MNR5020 Series**
**Temperature vs. DC Current Characteristics**

**Inductance vs. DC Current Characteristics**

**MNR5040 Series**
**Temperature vs. DC Current Characteristics**

**Inductance vs. DC Current Characteristics**


## Reliability Test

| TEST ITEM                             | SPECIFICATION   | TEST CONDITION   |
|---------------------------------------|---|--|
| Withstanding voltage test             | After test, inductors shall have no evidence of electrical and mechanical damage.   | AC voltage of 100v and AC current of 1mA applied between inductor's terminal and core for 3 secs.  |
| Resistance to soldering heat          | 1. Inductor shall have no evidence of electrical and mechanical damage.<br>2. Inductance shall not change more than $\pm 5\%$ .<br>3. Q shall not change more than 20%. | a. Temp: $260 \pm 5$<br>b. Time: $10 \pm 1.0$ se   |
| Solderability test                    | The terminal shall be at least 95% covered with solder.   | After fluxing, the terminal shall be dipped in a melted solder bath at $245 \pm 5^\circ\text{C}$ for $4 \pm 1.0$ secs.   |
| High temperature & high humidity test | The anti-erosion quality of the surface and the specimen's inductance shall not change from the initial value within $\pm 10\%$   | a. Test condition<br>1)Temp.: $85^\circ\text{C}$ , R.H.:85%<br>2)Time: $144 \pm 2$ hours<br>b. Measurement method<br>The experimental component should be put at normal condition for 2 hours then to measure again after test                         |
| Salt spray test                       |   | a. Test condition<br>1)Temp.: $35 \pm 2^\circ\text{C}$<br>2)Time: $48 \pm 2$ hours<br>3)Salt solution PH:6.5~7.2<br>b. Measurement method<br>The experimental component should be put at normal condition for 2 hours then to measure again after test |
| Vibration test                        | 1. Inductance shall be within 10% of the initial value.<br>2. Appearance: no damage   | a. Frequency: 10 to 55<br>b. Amplitude: 1.5<br>c. Direction and time<br>X, Y and Z directions for 2 hours each.  |

| TEST ITEM                        | SPECIFICATION  | TEST CONDITION   |
|----------------------------------|--|--|
| Free fall test                   | No mechanical damage shall be noticed.   | Drop 5 times on a concrete floor from 1m the height  |
| Temperature Cycling test         | 1. Inductance shall be within 10% of the initial value<br>2. Appearance: No dama | a. Test conditi<br>1)Temp.: $-55^{\circ}\text{C}$ ,time: $30\pm 3\text{min}$<br>2)Temp.: $+125^{\circ}\text{C}$ ,time: $30\pm 3\text{min}$<br>3)Cycles times:12 cycles<br>b. Measurement method<br>The experimental component should be put at normal condition for 2 hours then to measure again after test |
| High Temperature resistance test |  | a. Test conditi<br>1)Applied rated current<br>2)Temp.: $85^{\circ}\text{C}\pm 2^{\circ}\text{C}$<br>3)Test time: $1000+24/-0\text{H}$<br>b. Measurement method<br>The experimental component should be put at normal condition for 24 hours then to measure again after test.                                |
| Low temperature resistance test  |  | a. Test conditi<br>1)Temp.: $-55^{\circ}\text{C}\pm 2^{\circ}\text{C}$<br>2)Test time: $1000+24/-0\text{H}$<br>b. Measurement method<br>The experimental component should be put at normal condition for 24 hours then to measure again after test.  |

We have suggested the storage period of lead-free product should not over 6 months.

### Structure (The structure of product.)



| NO | Components    | Material                                 |
|----|---------------|--|
| ①  | Core          | Ni-Zn Ferrite                            |
| ②  | Wire          | Polyurethane system enameled copper wire |
| ③  | Magnetic Glue | Epoxy resin and magnetic powder          |
| ④  | Plating       | AgNiSn or FeNiCu + Sn Alloy              |

**PACKAGING SPECIFICATION :**


| Type    | Tape Dimension (mm) |     |     |     |     |   | Reel Dimension (mm) |     |    | Quantity (Pcs/Reel) |
|---------|---------------------|-----|-----|-----|-----|---|---------------------|-----|----|---------------------|
|         | W                   | A0  | B0  | K0  | D   | P | A                   | B   | C  |                     |
| MNR5012 | 12                  | 5.3 | 5.3 | 1.4 | 1.5 | 8 | 330                 | 100 | 13 | 4500                |
| MNR5020 | 12                  | 5.3 | 5.3 | 2.3 | 1.5 | 8 | 330                 | 100 | 13 | 2500                |
| MNR5040 | 12                  | 5.3 | 5.3 | 4.2 | 1.5 | 8 | 330                 | 100 | 13 | 1500                |

**Re-flowing Profile:**
