

Chip Thin-Film Inductors

**Thin Film Chip inductors
provide small-format protection (TRAL)**

▶ Preview

Token TRAL chip inductors provide reliable protection against challenging EMI problems in high frequency filtering applications. This miniature wirewound inductor features a low seated height that stands only 0.23mm above the circuit board. It protects sensitive electronic circuitry and ensures high performance operation in a wide range of compact devices that are shrinking ever smaller in physical size.

Token TRAL series uses a thin-film technology for high reliability and precision tolerances to 1% or $\pm 0.1\text{nH}$. The TRAL thin-film inductor series is available in 0603, 0402, and 0201 sizes, in inductance values from 0.1 to 100nH, in tolerances down to 0.1nH or 1%, and with SRF (self-resonant frequency) tightly controlled.

The technology characteristics make it ideal for the latest cellphone and PDA applications in addition to wireless network and Bluetooth enabled devices.

Application of specific designs also available including different inductance values and Q specifications adjusted to frequency requirements. Customized designs and tighter tolerances are available on request. Thin Film Inductor is mounted in a surface mount package which assures mechanical stability, excellent lead coplanarity, and suitable for automatic pick and place equipment.

The TRAL series is lead-free and RoHS compliant. Detailed specifications, both mechanical and electrical, please contact Token sales representative for more information.

Features :

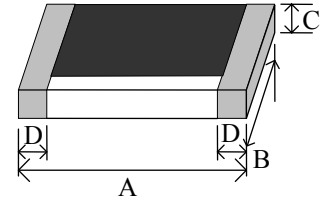
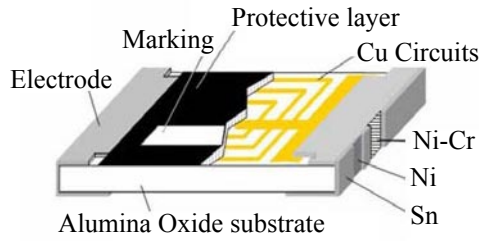
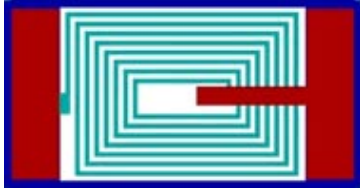
- Tight Tolerance of $\pm 1\%$ or $\pm 0.1\text{nH}$.
- Highly Stable Design for Critical Needs.
- Stable Inductance in High Frequency Circuit.
- Self Resonant Frequency Controlled within 10%.
- A Photo Lithographic Single Layer Ceramic Chip.
- High SRF, Excellent Q, Superior Temperature Stability.

Applications :

- Communication Appliances.
- Wireless LAN, Bluetooth Module.
- VCO, TCXO Circuit and RF Transceiver Module.
- Cellular Telephone, Pagers and GPS Products.



► Configurations & Dimensions (Unit: mm)



| Codes | A | B | C | D |
|---------------|----------------|----------------|-----------------|-----------------|
| TRAL01 (0201) | 0.6 ± 0.05 | 0.3 ± 0.05 | 0.23 ± 0.05 | 0.15 ± 0.05 |
| TRAL02 (0402) | 1.0 ± 0.05 | 0.5 ± 0.05 | 0.32 ± 0.05 | 0.2 ± 0.10 |
| TRAL03 (0603) | 1.6 ± 0.10 | 0.8 ± 0.10 | 0.45 ± 0.10 | 0.3 ± 0.20 |

▶ (EIA 0201) Standard Electrical Specifications

| Part No. | Inductance (nH) | Tolerance (% or nH) | Q (min) | DCR (Ω)(max) | IDC (mA)(max) | SRF (GHz)(min) |
|--------------|-----------------|---------------------|------------|--------------|---------------|----------------|
| TRAL01*TR0N1 | 0.1 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.20 | 400 | 9 |
| TRAL01*TR0N2 | 0.2 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.20 | 400 | 9 |
| TRAL01*TR0N3 | 0.3 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.20 | 400 | 9 |
| TRAL01*TR0N4 | 0.4 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.25 | 350 | 9 |
| TRAL01*TR0N5 | 0.5 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.25 | 350 | 9 |
| TRAL01*TR0N6 | 0.6 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.25 | 350 | 9 |
| TRAL01*TR0N7 | 0.7 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.30 | 300 | 9 |
| TRAL01*TR0N8 | 0.8 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.30 | 300 | 9 |
| TRAL01*TR0N9 | 0.9 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.30 | 300 | 9 |
| TRAL01*TR1N0 | 1.0 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.30 | 300 | 9 |
| TRAL01*TR1N1 | 1.1 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.35 | 300 | 9 |
| TRAL01*TR1N2 | 1.2 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.35 | 300 | 9 |
| TRAL01*TR1N3 | 1.3 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.45 | 250 | 9 |
| TRAL01*TR1N4 | 1.4 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.45 | 250 | 9 |
| TRAL01*TR1N5 | 1.5 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.45 | 250 | 9 |
| TRAL01*TR1N6 | 1.6 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.55 | 200 | 9 |
| TRAL01*TR1N7 | 1.7 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.55 | 200 | 9 |
| TRAL01*TR1N8 | 1.8 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.55 | 200 | 9 |
| TRAL01*TR1N9 | 1.9 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.55 | 200 | 9 |
| TRAL01*TR2N0 | 2.0 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.70 | 200 | 8 |
| TRAL01*TR2N1 | 2.1 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.70 | 200 | 8 |
| TRAL01*TR2N2 | 2.2 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.70 | 200 | 8 |
| TRAL01*TR2N3 | 2.3 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.80 | 150 | 8 |
| TRAL01*TR2N4 | 2.4 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.80 | 150 | 8 |
| TRAL01*TR2N5 | 2.5 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.80 | 150 | 8 |
| TRAL01*TR2N6 | 2.6 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.80 | 150 | 8 |
| TRAL01*TR2N7 | 2.7 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 0.80 | 150 | 8 |
| TRAL01*TR2N8 | 2.8 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.00 | 150 | 6 |
| TRAL01*TR2N9 | 2.9 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.00 | 150 | 6 |
| TRAL01*TR3N0 | 3.0 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.00 | 150 | 6 |
| TRAL01*TR3N1 | 3.1 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.00 | 150 | 6 |
| TRAL01*TR3N2 | 3.2 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.00 | 150 | 6 |
| TRAL01*TR3N3 | 3.3 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.00 | 150 | 6 |
| TRAL01*TR3N4 | 3.4 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.20 | 150 | 6 |
| TRAL01*TR3N5 | 3.5 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.20 | 150 | 6 |
| TRAL01*TR3N6 | 3.6 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.20 | 150 | 6 |
| TRAL01*TR3N7 | 3.7 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.20 | 150 | 6 |
| TRAL01*TR3N8 | 3.8 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.20 | 150 | 6 |
| TRAL01*TR3N9 | 3.9 | ± 0.1, 0.2, 0.3nH | 8 / 500MHz | 1.20 | 150 | 6 |

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| Part No. | Inductance (nH) | Tolerance (% or nH) | Q (min) | DCR (Ω)(max) | IDC (mA)(max) | SRF (GHz)(min) |
|--------------|-----------------|------------------------------|------------|-----------------------|---------------|----------------|
| TRAL01*TR4N0 | 4.0 | $\pm 0.1, 0.2, 0.3\text{nH}$ | 8 / 500MHz | 1.20 | 150 | 6 |
| TRAL01*TR4N4 | 4.4 | $\pm 0.1, 0.2, 0.3\text{nH}$ | 8 / 500MHz | 1.30 | 140 | 6 |
| TRAL01*TR4N7 | 4.7 | $\pm 0.1, 0.2, 0.3\text{nH}$ | 8 / 500MHz | 1.40 | 130 | 6 |
| TRAL01*TR4N9 | 4.9 | $\pm 0.1, 0.2, 0.3\text{nH}$ | 8 / 500MHz | 1.60 | 130 | 6 |
| TRAL01*TR5N6 | 5.6 | $\pm 2, \pm 5\%$ | 8 / 500MHz | 1.80 | 130 | 4 |
| TRAL01*TR6N1 | 6.1 | $\pm 2, \pm 5\%$ | 8 / 500MHz | 2.00 | 120 | 4 |
| TRAL01*TR6N8 | 6.8 | $\pm 2, \pm 5\%$ | 8 / 500MHz | 2.30 | 110 | 4 |
| TRAL01*TR7N4 | 7.4 | $\pm 2, \pm 5\%$ | 8 / 500MHz | 2.80 | 110 | 4 |
| TRAL01*TR8N2 | 8.2 | $\pm 2, \pm 5\%$ | 8 / 500MHz | 3.00 | 110 | 3 |
| TRAL01*TR9N1 | 9.1 | $\pm 2, \pm 5\%$ | 8 / 500MHz | 3.25 | 100 | 3 |
| TRAL01*TR9N2 | 9.2 | $\pm 2, \pm 5\%$ | 8 / 500MHz | 3.25 | 100 | 3 |
| TRAL01*TR10N | 10 | $\pm 2, \pm 5\%$ | 8 / 500MHz | 3.50 | 80 | 2 |

Token is capable of manufacturing the optional spec based on customer's requirement.

▶ (EIA 0402) Standard Electrical Specifications

| Part No. | Inductance (nH) | Tolerance (% or nH) | Q (min) | DCR (Ω)(max) | IDC (mA)(max) | SRF (GHz)(min) |
|---------------|-----------------|---------------------|-------------|-----------------------|---------------|----------------|
| TRAL02*TR0N2 | 0.2 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.10 | 800 | 14 |
| TRAL02*TR0N4 | 0.4 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.10 | 800 | 14 |
| TRAL02*TR0N8 | 0.8 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.15 | 700 | 14 |
| TRAL02*TR1N0 | 1.0 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.15 | 700 | 12 |
| TRAL02*TR1N2 | 1.2 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.15 | 700 | 12 |
| TRAL02*TR1N5 | 1.5 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.25 | 700 | 10 |
| TRAL02*TR1N6 | 1.6 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.25 | 560 | 10 |
| TRAL02*TR1N8 | 1.8 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.25 | 560 | 10 |
| TRAL02*TR2N0 | 2.0 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.35 | 560 | 8 |
| TRAL02*TR2N2 | 2.2 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.35 | 440 | 8 |
| TRAL02*TR2N7 | 2.7 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.35 | 440 | 8 |
| TRAL02*TR3N1 | 3.1 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.45 | 380 | 6 |
| TRAL02*TR3N3 | 3.3 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.45 | 380 | 6 |
| TRAL02*TR3N6 | 3.6 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.55 | 380 | 6 |
| TRAL02*TR3N9 | 3.9 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.55 | 340 | 6 |
| TRAL02*TR4N7 | 4.7 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.65 | 320 | 6 |
| TRAL02*TR5N6 | 5.6 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.85 | 280 | 6 |
| TRAL02*TR5N9 | 5.9 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 0.85 | 280 | 6 |
| TRAL02*TR6N8 | 6.8 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 1.05 | 260 | 6 |
| TRAL02*TR7N2 | 7.2 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 1.05 | 260 | 6 |
| TRAL02*TR8N0 | 8.0 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 1.25 | 220 | 5.5 |
| TRAL02*TR8N2 | 8.2 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 1.25 | 220 | 5.5 |
| TRAL02*TR9N1 | 9.1 | 0.1/0.2/0.3(nH) | 13 / 500MHz | 1.25 | 220 | 5.5 |
| TRAL02*TR10N | 10 | 1/2/3/5(%) | 13 / 500MHz | 1.35 | 200 | 4.5 |
| TRAL02*TR12N | 12 | 1/2/3/5(%) | 13 / 500MHz | 1.55 | 180 | 3.7 |
| TRAL02*TR13N8 | 13.8 | 1/2/3/5(%) | 13 / 500MHz | 1.75 | 180 | 3.7 |
| TRAL02*TR15N | 15 | 1/2/3/5(%) | 13 / 500MHz | 1.75 | 130 | 3.3 |
| TRAL02*TR17N | 17 | 1/2/3/5(%) | 13 / 500MHz | 1.95 | 100 | 3.1 |
| TRAL02*TR18N | 18 | 1/2/3/5(%) | 13 / 500MHz | 2.15 | 100 | 3.1 |
| TRAL02*TR20N8 | 20.8 | 1/2/3/5(%) | 13 / 500MHz | 2.55 | 90 | 2.8 |
| TRAL02*TR22N | 22 | 1/2/3/5(%) | 13 / 500MHz | 2.65 | 90 | 2.8 |
| TRAL02*TR27N | 27 | 1/2/3/5(%) | 13 / 500MHz | 3.25 | 75 | 2.5 |
| TRAL02*TR33N | 33 | 1/2/3/5(%) | 13 / 500MHz | 3.75 | 75 | 2.5 |

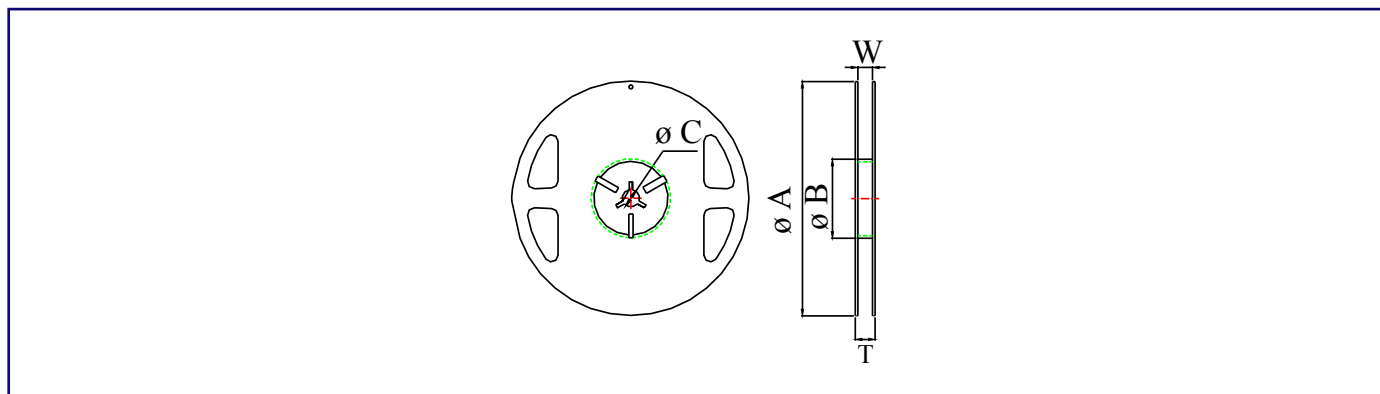
Token is capable of manufacturing the optional spec based on customer's requirement.

▶ (EIA 0603) Standard Electrical Specifications

| Part No. | Inductance (nH) | Tolerance (% or nH) | Q (min) | DCR (Ω)(max) | IDC (mA)(max) | SRF (GHz)(min) |
|--------------|-----------------|---------------------|-------------|-----------------------|---------------|----------------|
| TRAL03*TR1N0 | 1.0 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.35 | 800 | 13 |
| TRAL03*TR1N2 | 1.2 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.35 | 800 | 13 |
| TRAL03*TR1N5 | 1.5 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.35 | 800 | 10 |
| TRAL03*TR1N8 | 1.8 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.35 | 300 | 10 |
| TRAL03*TR2N2 | 2.2 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.35 | 300 | 8 |
| TRAL03*TR2N7 | 2.7 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.45 | 300 | 6 |
| TRAL03*TR3N3 | 3.3 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.45 | 300 | 6 |
| TRAL03*TR3N9 | 3.9 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.45 | 300 | 6 |
| TRAL03*TR4N7 | 4.7 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.55 | 300 | 5 |
| TRAL03*TR5N6 | 5.6 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.65 | 300 | 5 |
| TRAL03*TR6N8 | 6.8 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.75 | 300 | 5 |
| TRAL03*TR8N2 | 8.2 | 0.1/0.2/0.3(nH) | 15 / 300MHz | 0.95 | 300 | 4 |
| TRAL03*TR10N | 10 | 1/2/3/5(%) | 15 / 300MHz | 0.95 | 300 | 4 |
| TRAL03*TR12N | 12 | 1/2/3/5(%) | 15 / 300MHz | 1.05 | 300 | 3 |
| TRAL03*TR15N | 15 | 1/2/3/5(%) | 15 / 300MHz | 1.35 | 300 | 3 |
| TRAL03*TR18N | 18 | 1/2/3/5(%) | 15 / 300MHz | 1.65 | 300 | 2 |
| TRAL03*TR22N | 22 | 1/2/3/5(%) | 15 / 300MHz | 1.95 | 250 | 2 |
| TRAL03*TR27N | 27 | 1/2/3/5(%) | 15 / 300MHz | 2.35 | 250 | 2 |
| TRAL03*TR33N | 33 | 1/2/3/5(%) | 15 / 300MHz | 2.75 | 250 | 1.5 |
| TRAL03*TR39N | 39 | 1/2/3/5(%) | 15 / 300MHz | 3.00 | 200 | 1.5 |
| TRAL03*TR47N | 47 | 1/2/3/5(%) | 15 / 300MHz | 3.00 | 200 | 1.5 |
| TRAL03*TR56N | 56 | 1/2/3/5(%) | 15 / 300MHz | 5.00 | 150 | 1 |
| TRAL03*TR68N | 68 | 1/2/3/5(%) | 15 / 300MHz | 5.00 | 150 | 1 |
| TRAL03*TRR10 | 100 | 1/2/3/5(%) | 15 / 300MHz | 7.50 | 100 | 1 |

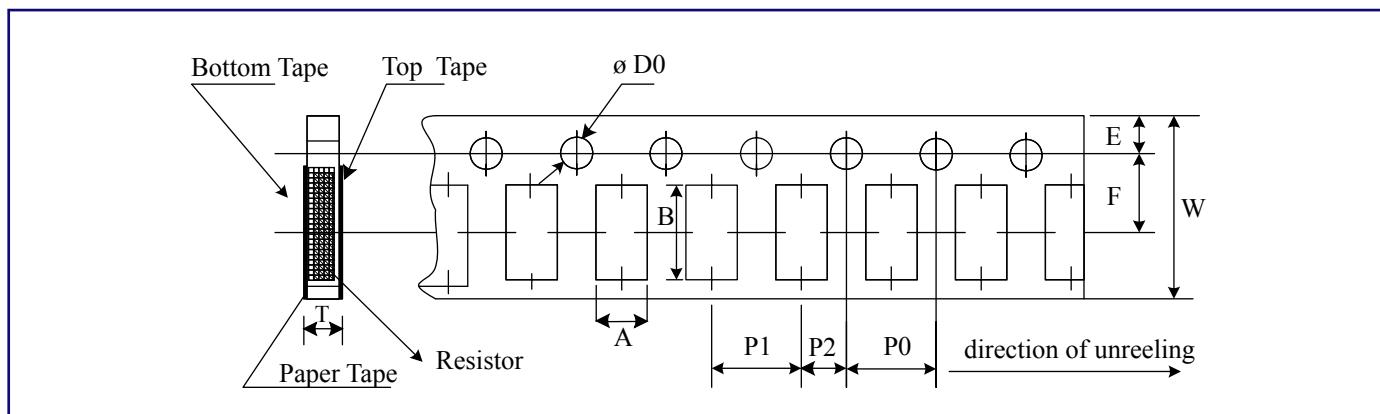
Token is capable of manufacturing the optional spec based on customer's requirement.

▶ Reel & Packaging Quantity (Unit: mm)



| Codes | ΦA | ΦB | ΦC | W | T | Paper Tape (PCS) |
|--------|-------------|----------|------------|-----------|------------|------------------|
| TRAL01 | 178.0 ± 1.0 | 60 ± 1.0 | 13.5 ± 0.7 | 9.5 ± 1.0 | 11.5 ± 1.0 | 10,000 |
| TRAL02 | 178.0 ± 1.0 | 60 ± 1.0 | 13.5 ± 0.7 | 9.5 ± 1.0 | 11.5 ± 1.0 | 10,000 |
| TRAL03 | 178.0 ± 1.0 | 60 ± 1.0 | 13.5 ± 0.7 | 9.5 ± 1.0 | 11.5 ± 1.0 | 5,000 |

▶ Paper Tape (Unit: mm)



| Codes | A±0.05 | B±0.05 | W±0.10 | E±0.05 | F±0.05 | P0±0.10 | P1 | P2±0.05 | ΦD0 | T |
|--------|--------|--------|--------|--------|--------|---------|-----------|---------|-----------|-----------|
| TRAL01 | 0.40 | 0.70 | 8.00 | 1.75 | 3.5 | 4.00 | 2.00±0.05 | 2.00 | 1.55±0.03 | 0.42±0.02 |
| TRAL02 | 0.70 | 1.16 | 8.00 | 1.75 | 3.5 | 4.00 | 2.00±0.05 | 2.00 | 1.55±0.05 | 0.40±0.03 |
| TRAL03 | 1.10 | 1.90 | 8.00 | 1.75 | 3.5 | 4.00 | 4.00±0.10 | 2.00 | 1.55±0.05 | 0.60±0.03 |

Environmental Characteristics

| Item | Specification | Test Method |
|------------------------------|----------------------|-------------------------------------------------------------------------------------|
| Bending Test | As SPEC. | JIS-C-5202-6.1.4 Bending Amplitude 3mm for 10 seconds |
| Dielectric Withstand Voltage | >100V | MIL-STD-202F Method 301 Apply 100VA (rms) for 1minute. |
| Insulation Resistance | >1000MM | MIL-STD-202F Method 302 Apply 100VDC for 1minute. |
| Resistance to Soldering Heat | $\Delta L \leq 10\%$ | MIL-STD-202F Method 210E 260 \pm 5 $^{\circ}$ C, 10 \pm 1seconds |
| High Temperature Exposure | $\Delta L \leq 10\%$ | JIS-C-5202-7.2 85 \pm 2 $^{\circ}$ C, 1000 +48/-0 hours |
| Moisture Resistance | $\Delta L \leq 10\%$ | MIL-STD-202F Method 103B 40 \pm 2 $^{\circ}$ C, 90~95%RH, 1000 +48/-0 hours |
| Low Temperature Storage | $\Delta L \leq 10\%$ | JIS-C-5202-7.1 -40 \pm 3 $^{\circ}$ C, 1000 +48/-0 hours |
| Temperature Cycle | $\Delta L \leq 10\%$ | JIS-C-5202-7.4 -40/RT/85/RT, 10 cycles |
| Solderability | 95% min coverage | MIL-STD-202F Method 208H 235 $^{\circ}$ C \pm 5 $^{\circ}$ C, 2 \pm 0.5(sec) |

Note: Storage Temperature: 25 \pm 3 $^{\circ}$ C; Humidity < 80%RH

How to Order

TRAL

①

02

②

G

③

TR

④

10N

⑤

① Part Number: TRAL01, TRAL02, TRAL03

② Dimensions (L×W) (mm)

| Code | Dimensions (L×W) | EIA |
|------|------------------|---------|
| 01 | 0.60×0.30mm | EIA0201 |
| 02 | 1.00×0.50 mm | EIA0402 |
| 03 | 1.60×0.80 mm | EIA0603 |

③ Inductance Tolerance

| Code | Inductance Tolerance |
|------|----------------------|
| J | $\pm 5\%$ |
| H | $\pm 3\%$ |
| G | $\pm 2\%$ |
| F | $\pm 1\%$ |
| S | $\pm 0.3\text{nH}$ |
| C | $\pm 0.2\text{nH}$ |
| B | $\pm 0.1\text{nH}$ |

④ Packaging: TR (Taping Reel)

⑤ Inductance

| Code | Inductance |
|------|------------|
| 1N0 | 1.0nH |
| 10N | 10nH |
| 20N8 | 20.8nH |
| R10 | 100nHs |

Back to 1st Page - Chip Thin Film Inductors (TRAL)