

# 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 :

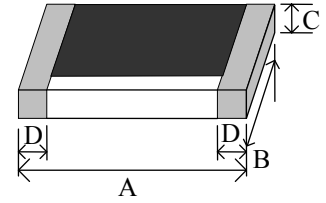
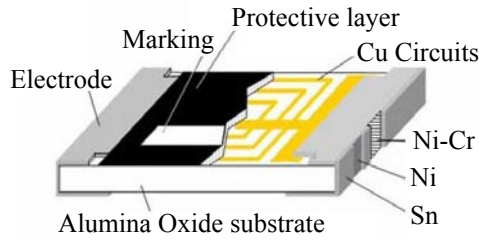
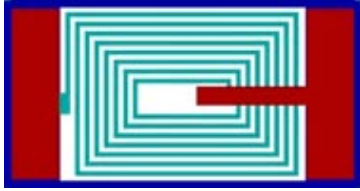
- Tight Tolerance of  $\pm 1\%$  or  $\pm 0.1\text{nH}$ .
- Highly Stable Design for Critical Needs.
- Stable Inductance in High Frequency Circuit.
- Self Resonant Frequency Controlled within 10%.
- A Photo Lithographic Single Layer Ceramic Chip.
- High SRF, Excellent Q, Superior Temperature Stability.

### 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)	$0.6 \pm 0.05$	$0.3 \pm 0.05$	$0.23 \pm 0.05$	$0.15 \pm 0.05$
TRAL02 (0402)	$1.0 \pm 0.05$	$0.5 \pm 0.05$	$0.32 \pm 0.05$	$0.2 \pm 0.10$
TRAL03 (0603)	$1.6 \pm 0.10$	$0.8 \pm 0.10$	$0.45 \pm 0.10$	$0.3 \pm 0.20$

► (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 ( $\Omega$ )(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

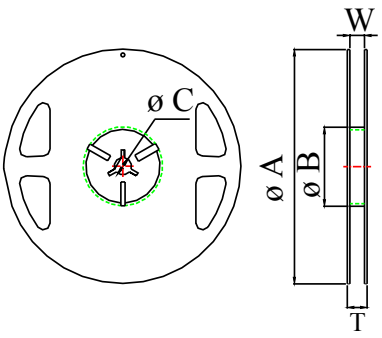
Token is capable of manufacturing the optional spec based on customer's requirement.

## ▶ (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

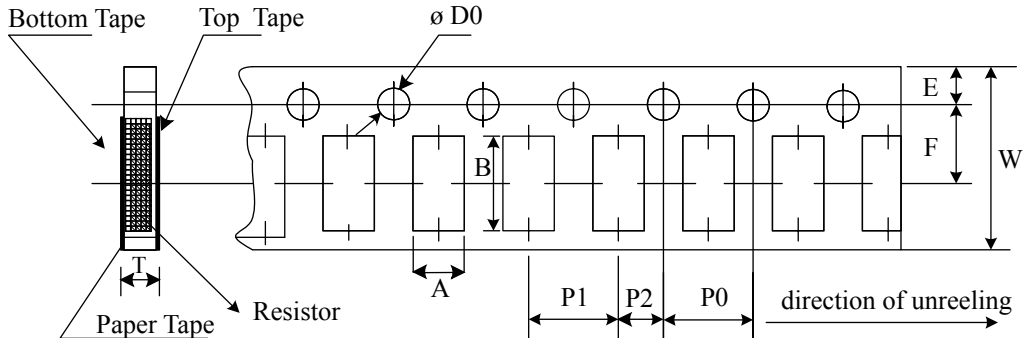
Token is capable of manufacturing the optional spec based on customer's requirement.

▶ 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

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