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# DIRECT

## Electronics Tech.

# (TRMI) Multilayer Ferrite Chip Inductors

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**▶ Product Introduction****||| New options in chip multilayer ferrite inductor.****Features :**

- Sizes EIA 0603 / EIA 0805 / EIA 1206.
- Closed magnetic circuit avoids crosstalk.
- Suitable for high density installation, re-flow soldering.

**Applications :**

- Portable Equipment.
- Personal Computers.
- CD-ROM, Hard Disk, Modem, Printers.

Direct (TRMI) series is a multilayer ferrite technology with good overall characteristics in a cost effective package. The (TRMI) multilayer inductor series is available in 0603, 0805, and 1206 sizes. Inductance values range from 10 to 33000nH, and tolerances are as tight as  $\pm 10\%$ . This product provides a good blend of electrical performance and low cost.

The (TRMI) devices utilize closed magnetic circuit construction to avoid crosstalk. These are suitable for EMI reduction on DC power lines and low speed signal lines where the smaller packaging reduces board space. Conform to the RoHS directive and Lead-free. Package of multilayer Ferrite TRMI chip is suitable for automatic pick and place equipment and is mounted in a surface mount package which assures mechanical stability and excellent lead planarity.

Multilayer Ferrite RF Chip Inductor can be customized designs and tighter tolerances available on request. Application of specific designs also available including different inductance values and Q specifications adjusted to frequency requirements.

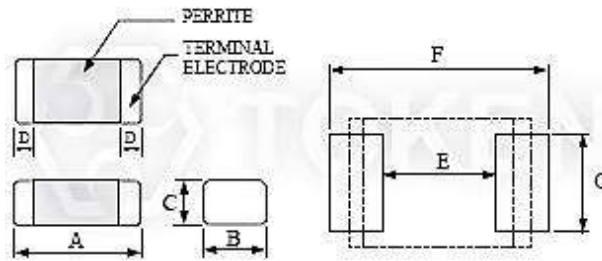
Custom parts are available on request. Direct will also produce devices outside these specifications to meet specific customer requirements, Contact us with your specific needs. For more information, please link to Direct official website "[RF Inductors](#)".



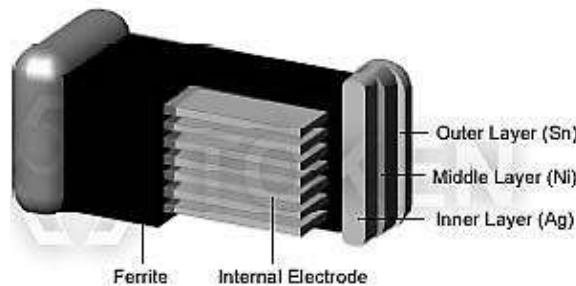
► **Config. & Dim.**

**Configurations & Dimensions (Unit: mm) (TRMI)**

Type	A	B	C	D	E	F	G
TRMI160808 (0603)	1.6 ± 0.2	0.8 ± 0.2	0.8 ± 0.2	0.3 ± 0.2	0.8	2.4~3.4	0.6
TRMI201209 (0805)	2.0 ± 0.2	1.25 ± 0.2	0.9 ± 0.2	0.5 ± 0.3	1.2	3.0~4.0	1.0
TRMI201212 (0805)	2.0 ± 0.2	1.25 ± 0.2	1.25 ± 0.2	0.5 ± 0.3	1.2	3.0~4.0	1.0
TRMI321611 (1206)	3.2 ± 0.2	1.6 ± 0.2	1.1 ± 0.2	0.5 ± 0.3	2.0	4.2~5.2	1.2



Surface Mount (TRMI) Dimensions



Surface Mount (TRMI) Material Construction

## ► Electrical Characteristics

### Electrical Characteristics (TRMI160808) - EIA 0603

Part Number	Inductance (nH)	Tolerance	L/Q Freq. (MHz)	Q (min)	SRF (MHz)(min)	DCR (Ω)(max)	IDC (mA)(max)
TRMI160808 - 10N	10	± 20%	50MHz, 200mV	10	300	0.20	50
TRMI160808 - 33N	33	± 20%	50MHz, 200mV	10	270	0.20	50
TRMI160808 - 47N	47	± 20%	50MHz, 200mV	10	260	0.30	50
TRMI160808 - 56N	56	± 20%	50MHz, 200mV	10	255	0.30	50
TRMI160808 - 68N	68	± 20%	50MHz, 200mV	10	250	0.30	50
TRMI160808 - 82N	82	± 20%	50MHz, 200mV	10	245	0.30	50
TRMI160808 - R10	100	± 10,± 20%	25MHz, 200mV	15	240	0.50	50
TRMI160808 - R12	120	± 10,± 20%	25MHz, 200mV	15	205	0.50	50
TRMI160808 - R15	150	± 10,± 20%	25MHz, 200mV	15	180	0.60	50
TRMI160808 - R18	180	± 10,± 20%	25MHz, 200mV	15	165	0.60	50
TRMI160808 - R22	220	± 10,± 20%	25MHz, 200mV	15	150	0.80	50
TRMI160808 - R27	270	± 10,± 20%	25MHz, 200mV	15	136	0.80	50
TRMI160808 - R33	330	± 10,± 20%	25MHz, 200mV	15	125	0.85	35
TRMI160808 - R39	390	± 10,± 20%	25MHz, 200mV	15	110	1.00	35
TRMI160808 - R47	470	± 10,± 20%	25MHz, 200mV	15	105	1.35	35
TRMI160808 - R56	560	± 10,± 20%	25MHz, 200mV	15	95	1.55	35
TRMI160808 - R68	680	± 10,± 20%	25MHz, 200mV	15	85	1.70	35
TRMI160808 - R82	820	± 10,± 20%	25MHz, 200mV	15	75	2.10	35
TRMI160808 - 1R0	1000	± 10,± 20%	10MHz, 200mV	35	65	0.60	25
TRMI160808 - 1R2	1200	± 10,± 20%	10MHz, 200mV	35	60	0.80	25
TRMI160808 - 1R5	1500	± 10,± 20%	10MHz, 200mV	35	55	0.80	25
TRMI160808 - 1R8	1800	± 10,± 20%	10MHz, 200mV	35	50	0.95	25
TRMI160808 - 2R2	2200	± 10,± 20%	10MHz, 200mV	35	45	1.55	15
TRMI160808 - 2R7	2700	± 10,± 20%	10MHz, 200mV	35	40	1.35	15
TRMI160808 - 3R3	3300	± 10,± 20%	10MHz, 200mV	35	38	1.55	15
TRMI160808 - 3R9	3900	± 10,± 20%	10MHz, 200mV	35	35	1.70	15
TRMI160808 - 4R7	4700	± 10,± 20%	10MHz, 200mV	35	33	2.10	15
TRMI160808 - 5R6	5600	± 10,± 20%	4MHz, 200mV	35	22	1.55	5
TRMI160808 - 6R8	6800	± 10,± 20%	4MHz, 200mV	35	20	1.70	5
TRMI160808 - 8R2	8200	± 10,± 20%	4MHz, 60 mV	30	18	2.10	5
TRMI160808 - 100	10000	± 10,± 20%	2MHz, 60mV	30	17	2.55	5



## Electrical Characteristics (TRMI201209) - EIA 0805

Part Number	Inductance (nH)	Tolerance	L/Q Freq. (MHz)	Q (min)	SRF (MHz)(min)	DCR (Ω)(max)	IDC (mA)(max)
TRMI201209 - 47N	47	± 20%	50MHz, 200mV	20	320	0.20	300
TRMI201209 - 56N	56	± 20%	50MHz, 200mV	20	320	0.20	300
TRMI201209 - 68N	68	± 20%	50MHz, 200mV	20	280	0.20	300
TRMI201209 - 82N	82	± 20%	50MHz, 200mV	20	255	0.20	300
TRMI201209 - R10	100	± 10,± 20%	25MHz, 200mV	20	235	0.30	250
TRMI201209 - R12	120	± 10,± 20%	25MHz, 200mV	20	220	0.30	250
TRMI201209 - R15	150	± 10,± 20%	25MHz, 200mV	20	200	0.40	250
TRMI201209 - R18	180	± 10,± 20%	25MHz, 200mV	20	185	0.40	250
TRMI201209 - R22	220	± 10,± 20%	25MHz, 200mV	20	170	0.50	250
TRMI201209 - R27	270	± 10,± 20%	25MHz, 200mV	20	150	0.50	250
TRMI201209 - R33	330	± 10,± 20%	25MHz, 200mV	20	145	0.55	250
TRMI201209 - R39	390	± 10,± 20%	25MHz, 200mV	25	135	0.65	200
TRMI201209 - R47	470	± 10,± 20%	25MHz, 200mV	25	125	0.65	200
TRMI201209 - R56	560	± 10,± 20%	25MHz, 200mV	25	115	0.75	150
TRMI201209 - R68	680	± 10,± 20%	25MHz, 200mV	25	105	0.80	150
TRMI201209 - R82	820	± 10,± 20%	25MHz, 200mV	25	100	1.00	150
TRMI201209 - 1R0	1000	± 10,± 20%	10MHz, 200mV	45	75	0.40	50
TRMI201209 - 1R2	1200	± 10,± 20%	10MHz, 200mV	45	65	0.50	50
TRMI201209 - 1R5	1500	± 10,± 20%	10MHz, 200mV	45	60	0.50	50
TRMI201209 - 1R8	1800	± 10,± 20%	10MHz, 200mV	45	55	0.60	50
TRMI201209 - 2R2	2200	± 10,± 20%	10MHz, 200mV	45	50	0.65	30

## Electrical Characteristics (TRMI201212) - EIA 0805

Part Number	Inductance (nH)	Tolerance	L/Q Freq. (MHz)	Q (min)	SRF (MHz)(min)	DCR (Ω)(max)	IDC (mA)(max)
TRMI201212 - 2R7	2700	± 10,± 20%	10MHz, 200mV	45	45	0.75	30
TRMI201212 - 3R3	3300	± 10,± 20%	10MHz, 200mV	45	41	0.80	30
TRMI201212 - 3R9	3900	± 10,± 20%	10MHz, 200mV	45	38	0.90	30
TRMI201212 - 4R7	4700	± 10,± 20%	10MHz, 200mV	45	35	1.00	30
TRMI201212 - 5R6	5600	± 10,± 20%	4MHz, 200mV	45	32	0.90	15
TRMI201212 - 6R8	6800	± 10,± 20%	4MHz, 200mV	45	29	1.00	15
TRMI201212 - 8R2	8200	± 10,± 20%	4MHz, 200mV	45	26	1.10	15
TRMI201212 - 100	10000	± 10,± 20%	2MHz, 60mV	45	24	1.15	15
TRMI201212 - 120	12000	± 10,± 20%	2MHz, 60mV	45	22	1.25	15
TRMI201212 - 150	15000	± 10,± 20%	1MHz, 60mV	30	19	0.80	5
TRMI201212 - 180	18000	± 10,± 20%	1MHz, 60mV	30	18	0.90	5
TRMI201212 - 220	22000	± 10,± 20%	1MHz, 60mV	30	16	1.10	5



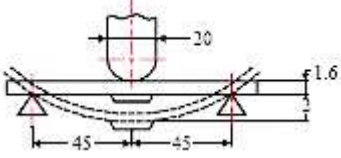
## Electrical Characteristics (TRMI) - EIA 1206

Part Number	Inductance (nH)	Tolerance	L/Q Freq. (MHz)	Q (min)	SRF (MHz)(min)	DCR (Ω)(max)	IDC (mA)(max)
TRMI321611 - 47N	47	± 20%	50MHz, 200mV	20	320	0.15	300
TRMI321611 - 56N	56	± 20%	50MHz, 200mV	20	280	0.25	300
TRMI321611 - 68N	68	± 20%	50MHz, 200mV	20	280	0.25	300
TRMI321611 - 82N	82	± 20%	50MHz, 200mV	20	250	0.25	300
TRMI321611 - R10	100	± 10,± 20%	25MHz, 200mV	20	235	0.25	250
TRMI321611 - R12	120	± 10,± 20%	25MHz, 200mV	20	220	0.30	250
TRMI321611 - R15	150	± 10,± 20%	25MHz, 200mV	20	200	0.30	250
TRMI321611 - R18	180	± 10,± 20%	25MHz, 200mV	20	185	0.40	250
TRMI321611 - R22	220	± 10,± 20%	25MHz, 200mV	20	170	0.40	250
TRMI321611 - R27	270	± 10,± 20%	25MHz, 200mV	20	150	0.50	250
TRMI321611 - R33	330	± 10,± 20%	25MHz, 200mV	20	145	0.60	250
TRMI321611 - R39	390	± 10,± 20%	25MHz, 200mV	25	135	0.50	200
TRMI321611 - R47	470	± 10,± 20%	25MHz, 200mV	25	125	0.60	200
TRMI321611 - R56	560	± 10,± 20%	25MHz, 200mV	25	115	0.70	150
TRMI321611 - R68	680	± 10,± 20%	25MHz, 200mV	25	105	0.80	150
TRMI321611 - R82	820	± 10,± 20%	25MHz, 200mV	25	100	0.90	150
TRMI321611 - 1R0	1000	± 10,± 20%	10MHz, 200mV	45	75	0.40	100
TRMI321611 - 1R2	1200	± 10,± 20%	10MHz, 200mV	45	65	0.50	100
TRMI321611 - 1R5	1500	± 10,± 20%	10MHz, 200mV	45	60	0.50	80
TRMI321611 - 1R8	1800	± 10,± 20%	10MHz, 200mV	45	55	0.50	70
TRMI321611 - 2R2	2200	± 10,± 20%	10MHz, 200mV	45	50	0.60	60
TRMI321611 - 2R7	2700	± 10,± 20%	10MHz, 200mV	45	45	0.60	60
TRMI321611 - 3R3	3300	± 10,± 20%	10MHz, 200mV	45	41	0.70	60
TRMI321611 - 3R9	3900	± 10,± 20%	10MHz, 200mV	45	38	0.80	50
TRMI321611 - 4R7	4700	± 10,± 20%	10MHz, 200mV	45	35	0.90	50
TRMI321611 - 5R6	5600	± 10,± 20%	4MHz, 200mV	45	32	0.70	25
TRMI321611 - 6R8	6800	± 10,± 20%	4MHz, 200mV	45	29	0.80	25
TRMI321611 - 8R2	8200	± 10,± 20%	4MHz, 200mV	45	26	0.90	25
TRMI321611 - 100	10000	± 10,± 20%	2MHz, 60mV	45	24	1.00	25
TRMI321611 - 120	12000	± 10,± 20%	2MHz, 60mV	45	22	1.05	15
TRMI321611 - 150	15000	± 10,± 20%	1MHz, 60mV	35	19	0.70	5
TRMI321611 - 180	18000	± 10,± 20%	1MHz, 60mV	35	18	0.75	5
TRMI321611 - 220	22000	± 10,± 20%	1MHz, 60mV	35	16	0.90	5
TRMI321611 - 270	27000	± 10,± 20%	1MHz, 60mV	35	14	0.90	5
TRMI321611 - 330	33000	± 10,± 20%	1MHz, 60mV	35	13	1.05	5



## Characteristics

### Environmental Characteristics (TRMI)

Item	Specification	Test Methods
<b>Flexure Strength</b>	The forces applied on the right conditions must not damage the terminal electrode and the ferrite.	Test device shall be soldered on the substrate Dimension: 100×40×1.6 mm Deflection: 2.0mm Keeping Time: 30sec For 0402, substrate dimension is 100×40×0.8mm 
<b>Vibration</b>		Test device shall be soldered on the substrate Oscillation Frequency : 10 to 55 to 10Hz for 1min Amplitude : 1.5mm Time : 2hrs for each axis (X,Y&Z), total 6hrs
<b>Resistance to Soldering Heat</b>	Appearance: No damage More than 75% of the terminal. Electrode should be covered with solder. Inductance: within ± 15% of initial value Q: within ± 30% of initial value Inductance: within± 20% of initial value (0603 over 12uH)	Pre-heating: 150°C, 1min Solder Composition: Sn/Ag3.0/Cu0.5 (Pb-Free) Solder Temperature: 260 ± 5°C (Pb-Free) Immersion Time: 10 ± 1sec
<b>Solderability</b>	The electrodes shall be at least 90% covered with new solder coating	Pre-heating: 150°C, 1min Solder Composition: Sn/Ag3.0/Cu0.5 (Pb-Free) Solder Temperature: 245 ± 5°C (Pb-Free) Immersion Time: 4 ± 1sec
<b>Temperature Cycle</b>	Appearance: No damage L change: within± 10% of initial value Q change: within± 30% of initial value	One cycle: step1: -25 ± 3°C for 30min step2: 25 ± 2°C for 3.0min step3: 85 ± 3°C for 30min step4: 25 ± 2°C for 3.0min Total: 100cycles Measured after exposure in the room condition for 24hrs
<b>Humidity Resistance</b>		Temperature: 40 ± 2°C Relative Humidity: 90 ~ 95% Time: 1000hrs Measured after exposure in the room condition for 24hrs
<b>High Temperature Resistance</b>		Temperature: 125 ± 3°C Relative Humidity : 20% Applied Current: Rated Current Time: 1000hrs Measured after exposure in the room condition for 24hrs
<b>Low Temperature Resistance</b>		Temperature: -25 ± 3°C Relative Humidity : 0% Time: 1000hrs Measured after exposure in the room condition for 24hrs

## Measurement Equipments (TRMI)

Item	Specification	Test Methods
Inductance	Refer to standard electrical characteristic spec.	HP4291B
Q		HP4291B
SRF		HP4291B
DC Resistance RDC		AX-1152B
Rated Current IDC		Applied the current to coils, The inductance change should be less than 10% to initial value

## Order Codes

### Order Codes (TRMI)

TRMI160808	-	10N	M
Part Number		Inductance	Tolerance
TRMI160808		10N 10nH	S 0.3nH
TRMI201209		56N 56nH	J 5%
TRMI201212		R68 680nH	K 10%
TRMI321611		180 18000nH	M 20%





## ► General Information

### Direct Cuts Inductor Size and Cost

Direct utilizes the latest technology enabling the most cost-effective designs in manufacturing inductors. The 0402, 0603, 0805, 1206, 1210, to 1812 series of RF Miniature Inductors all contain wire wound or multi-layer technology with material substrate in ceramic or ferrite cores. Thus providing economic cost with the ultimate performance demanded by today's RF applications. Inductors feature high Q factor, SRFs (self-resonant or series resonant frequency), and  $I_{dc}$  (maximum current carrying capacity).

### How to quickly search RF inductors for all of the characteristics?

Searching and comparing data sheets of inductor manufacturers can be time consuming. Direct's Parameter Sorting Search Mode allows selection of inductors based on different parameters. To enter Searching Mode:

- By entering just the inductance value,
- By sorting parameter to narrow down searching range,
- Or by enter keyword / part number / size dimensions L\*W\*H to partial or exact searching.

### Inductors Selection Notes:

**For choke applications**, the SRFs (self-resonant or series resonant frequency) is the frequency that provides the best signal blocking.

- At the SRF, impedance is at its maximum.
- At frequencies below the SRF, impedance increases with frequency.
- At frequencies above the SRF, impedance decreases with frequency.

**For higher order filter or impedance matching applications**, in general, the choice of inductance value typically determines the SRF and vice versa. The higher the inductance value, the lower the SRF, due to increased winding capacitance. It is more important to have a relatively flat inductance curve (constant inductance vs. frequency) near the required frequency. This suggests selecting an inductor with an SRF well above the design frequency. A rule of thumb is to select an inductor with an SRF that is a decade (10X) higher than the operating frequency.

**What is Q factor?** High Q leads to low insertion loss, minimizing power consumption, and narrow bandwidth. It is important if the inductor is to be used as part of an LC (oscillator) circuit or in narrow band pass applications. In general, wire wound inductors have much higher Q values than multilayer inductors of the same size and value. Direct's material science and manufacturing expertise effectively bridges the gap between wire-wound performance and multi-layer inductors with its TRMF100505 (EIA 0402) and TRMI160808 (EIA 0603) series.

**How does current requirement affect inductor?** Higher current requires larger wire or more threads of the same wire size to keep losses and temperature rise to a minimum. Larger wire lowers the DCR and increases the Q factor. Using a ferrite core inductor with a lower turn count can achieve higher current capacity and lower DCR. Ferrite, however, may introduce new limitations such as larger variation of inductance with temperature, looser tolerances, lower Q, and reduced saturation current ratings. Direct's ferrite inductors with open magnetic structures, will not saturate, even at full rated current.

