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DIRECT

Electronics Tech.

(TRAM)

Surface Mount Spring RF Inductor

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▶ Product Introduction

The (TRAM) series features high Q value in the high frequency range.

Features :

- High frequency
- Excellent SRFs and high Q
- Good constitutive property and easy to operate

Applications :

- Pager, Cordless phone.
- High Freq. Communication Products.
- Intercom, CATV.

Direct offers The Smallest **Flat Top Air Core Coils (Spring Inductors)** for only (1.8 × 2.0 × 2.0 mm). The latest range of air core surface mount coils from Direct is fully compliant with RoHS legislation and available immediately in full production volumes. The (TRAM) series provides a cost effective and miniaturized alternative to the earlier version.

The wire-wound construction with a miniature core is ideal for high frequency applications. These new SMD coils measure 1.8 × 2.0 mm with a low 2.0 mm profile, which combined with a mould-sealed surface, makes them particularly suitable for high-density mounting.



Indeed, the (TRAM) series features high Q value in the high frequency range, offers stable inductance at high frequency and has high self-resonant frequency. Meanwhile, the low DC resistance design is ideal for low loss, high output and low power consumption. A wide range of devices in the series, with inductance values ranging from 3.9 to 538nH, allows designers to select the most appropriate part of their application.

These chip air core coils are aimed at high frequency circuits in telecommunications equipment, including power amplifiers, antenna modules, VCOs and SAWs, and in mobile phones, such as GSM, CDMA, and PDC. Other applications include digital TV tuners, wireless LAN and Bluetooth devices.

This new SMD inductor provides a narrow inductance deviation with a complete range of inductance values, making chip inductors an excellent choice for high frequency circuit matching. SMD coils can be customized designs and tighter tolerances available on request. Application of RF air core coil specific designs also available including different inductance values and Q specifications.

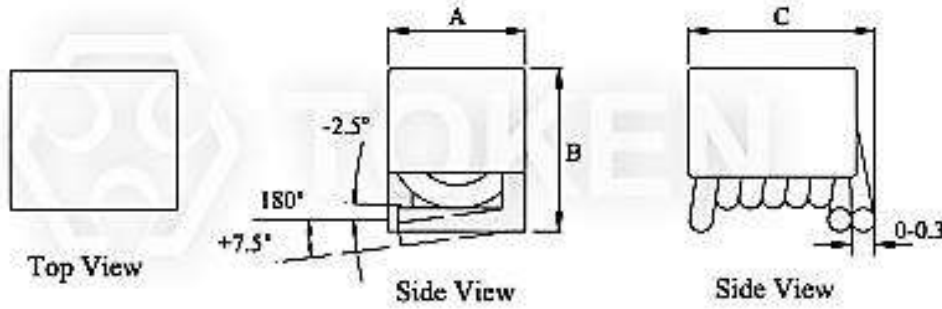
Custom parts are available on request. Direct will also produce devices outside these specifications to meet specific customer requirements, please contact our sales or link to Direct official website "[RF Inductors](http://www.direct-token.com)" for more information.



► Dimensions

Dimensions (Unit: mm) (TRAM0603 TRAM0805 TRAM1008)

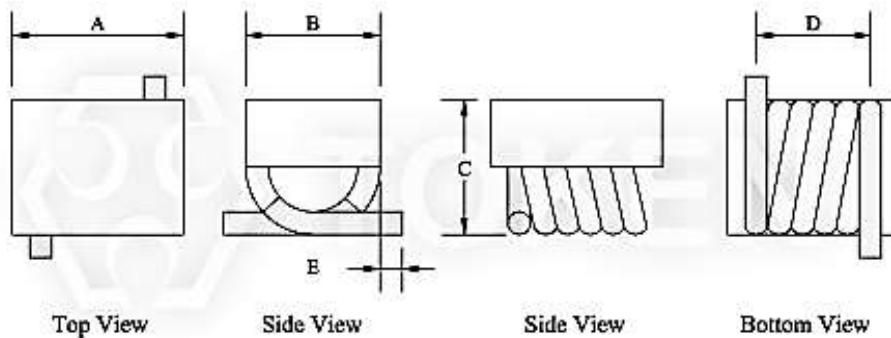
Type	A (max)	B (max)	C ± 0.2
TRAM0603	1.80	2.00	2.00
TRAM0805	1.80	2.10	2.85
TRAM1008	1.90	2.20	3.20



Ultra-Miniature (TRAM0603 TRAM0805 TRAM1008) Dimensions

Dimensions (Unit: mm) (TRAM2215 TRAM4015 TRAM132)

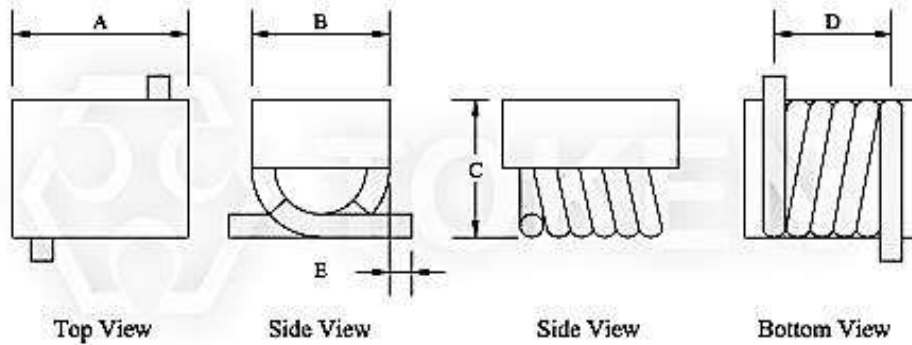
Type	A	B	C	D	E
TRAM2215	2.2 ± 0.3	1.4 ± 0.2	1.4 ± 0.2	1.8 ± 0.3	0.9 ± 0.3
TRAM4015	4.0 ± 0.3	1.4 ± 0.2	1.4 ± 0.2	3.5 ± 0.3	0.9 ± 0.3
TRAM132	9.0(max)	4.4 ± 0.3	4.6 ± 0.4	8.0 ± 0.5	1.3 ± 0.4



Ultra-Miniature (TRAM2215 TRAM4015 TRAM132) Dimensions

Dimensions (Unit: mm) (TRAM3730 TRAM7030)

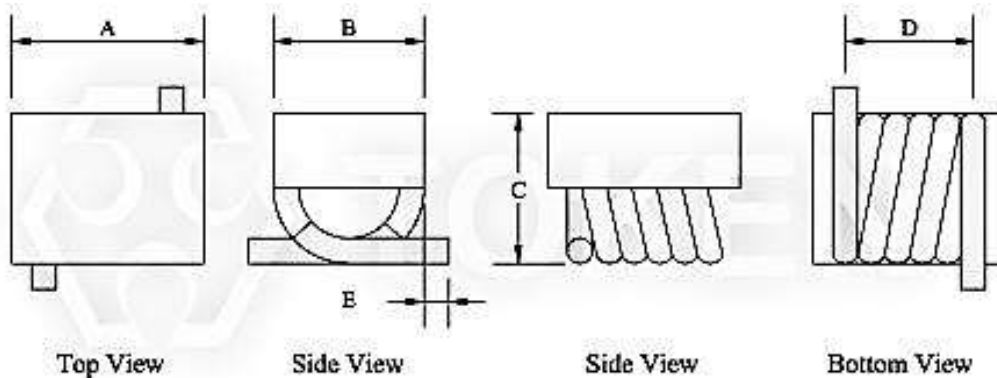
Type	A ± 0.3	B ± 0.2	C ± 0.2	D ± 0.3	E ± 0.2
TRAM3730	3.30	2.60	2.70	2.90	0.70
TRAM7030	6.30	3.60	3.70	5.80	0.70



Ultra-Miniature (TRAM3730 TRAM7030) Dimensions

Dimensions (Unit: mm) (TRAM1812)

Type	A ± 0.3	B ± 0.2	C ± 0.2	D ± 0.4	E ± 0.3
TRAM1812	4.90	3.50	3.50	4.30	1.00



Ultra-Miniature (TRAM1812) Dimensions

► Electrical Characteristics

Electrical Characteristics (TRAM 0603)

Part Number	Inductance (L)(nH)	Q (min)	Test Freq. (MHz)	SRF (MHz)(min)	DCR (mΩ)(max)	IDC (mA)(max)
TRAM0603 - 3N9K	3.9	80	300	>3000	3.0	950
TRAM0603 - 4N7K	4.7	80	300	>3000	3.6	900
TRAM0603 - 5N6K	5.6	80	300	>3000	3.8	950
TRAM0603 - 6N8K	6.8	80	300	>3000	4.5	900
TRAM0603 - 8N2K	8.2	80	300	>3000	5.3	840
TRAM0603 - 10NK	10.0	70	300	>3000	6.9	600
TRAM0603 - 12NK	12.0	70	300	>3000	8.3	600
TRAM0603 - 15NK	15.0	70	300	2500	11.5	500
TRAM0603 - 18NK	18.0	70	300	2500	12.8	500
TRAM0603 - 22NK	22.0	70	300	2400	11.3	550
TRAM0603 - 27NK	27.0	70	300	1600	17.0	500
TRAM0603 - 33NK	33.0	70	300	1600	26.9	320
TRAM0603 - 39NK	39.0	70	300	1500	30.7	320
TRAM0603 - 47NK	47.0	70	300	1500	34.5	320
TRAM0603 - 56NK	56.0	70	300	1300	38.4	320



Electrical Characteristics (TRAM 0805)

Part Number	Inductance (L)(nH)	Q (min)	Test Freq. (MHz)	SRF (MHz)(min)	DCR (mΩ)(max)	IDC (mA)(max)
TRAM0805 - 3N9K	3.9	80	300	>3000	2.6	1200
TRAM0805 - 4N7K	4.7	80	300	>3000	3.6	900
TRAM0805 - 5N6K	5.6	80	300	>3000	3.7	950
TRAM0805 - 6N8K	6.8	80	300	>3000	4.5	900
TRAM0805 - 8N2K	8.2	80	300	>3000	5.3	840
TRAM0805 - 10NK	10.0	70	300	>3000	5.4	900
TRAM0805 - 12NK	12.0	70	300	>3000	6.3	900
TRAM0805 - 15NK	15.0	70	300	2500	7.2	900
TRAM0805 - 18NK	18.0	70	300	2500	12.5	500
TRAM0805 - 22NK	22.0	70	300	2400	12.9	550
TRAM0805 - 27NK	27.0	70	300	1600	14.5	550
TRAM0805 - 33NK	33.0	70	300	1600	18.7	500
TRAM0805 - 39NK	39.0	70	300	1500	25.7	380
TRAM0805 - 47NK	47.0	70	300	1500	34.5	320
TRAM0805 - 56NK	56.0	70	300	1300	38.4	320
TRAM0805 - 68NK	68.0	70	300	1300	42.2	320



Electrical Characteristics (TRAM 1008)

Part Number	Inductance (L)(nH)	Q (min)	Test Freq. (MHz)	SRF (MHz)(min)	DCR (mΩ)(max)	IDC (mA)(max)
TRAM1008 - 6N8K	6.8	80	300	>3000	4.0	1200
TRAM1008 - 8N2K	8.2	80	300	>3000	5.0	950
TRAM1008 - 10NK	10.0	70	300	>3000	6.0	950
TRAM1008 - 12NK	12.0	70	300	>3000	6.5	900
TRAM1008 - 15NK	15.0	70	300	2500	7.3	900
TRAM1008 - 18NK	18.0	70	300	2500	9.6	840
TRAM1008 - 22NK	22.0	70	300	2400	10.8	840
TRAM1008 - 27NK	27.0	70	300	1600	13.9	600
TRAM1008 - 33NK	33.0	70	300	1600	19.5	500
TRAM1008 - 39NK	39.0	70	300	1500	21.6	500
TRAM1008 - 47NK	47.0	70	300	1500	25.2	470
TRAM1008 - 56NK	56.0	70	300	1300	27.5	470
TRAM1008 - 68NK	68.0	70	300	1300	37.1	380
TRAM1008 - 82NK	82.0	70	300	1000	51.5	320
TRAM1008 - R10K	100.0	70	300	1000	55.5	320
TRAM1008 - R12K	120.0	70	300	950	63.4	320

Electrical Characteristics (TRAM 2215)

Part Number	Turns	Inductance (L)(nH)	Q (min)	Test Freq. (MHz)	SRF (GHz)(min)
TRAM2215 - 02	2	1.65 ± 10%	100	800	>3.0
TRAM2215 - 03	3	2.55 ± 10%	100	800	>3.0
TRAM2215 - 04	4	3.85 ± 10%	100	800	>3.0
TRAM2215 - 05	5	5.45 ± 5%	100	800	>3.0

Electrical Characteristics (TRAM 4015)

Part Number	Turns	Inductance (L)(nH)	Q (min)	Test Freq. (MHz)	SRF (GHz)(min)
TRAM4015 - 06	6	5.60 ± 5%	100	800	>3.0
TRAM4015 - 07	7	7.15 ± 5%	100	800	>3.0
TRAM4015 - 08	8	8.80 ± 5%	100	800	>3.0
TRAM4015 - 09	9	9.85 ± 5%	100	800	>3.0
TRAM4015 - 10	10	12.55 ± 5%	100	800	>3.0



Electrical Characteristics (TRAM 132)

Part Number	Turns	Inductance (L)(nH)	Q (min)	Test Freq. (MHz)	SRF (GHz)(min)
TRAM132 - 09	9	90 ± 5%	100	50	>1.0
TRAM132 - 10	10	111 ± 5%	100	50	>1.0
TRAM132 - 11	11	130 ± 5%	100	50	>0.9
TRAM132 - 12	12	169 ± 5%	100	50	>0.8
TRAM132 - 13	13	206 ± 5%	100	50	>0.7
TRAM132 - 14	14	222 ± 5%	100	50	>0.6
TRAM132 - 15	15	246 ± 5%	100	50	>0.6
TRAM132 - 16	16	307 ± 5%	100	50	>0.5
TRAM132 - 17	17	380 ± 5%	100	50	>0.5
TRAM132 - 18	18	422 ± 5%	100	50	>0.4
TRAM132 - 19	19	491 ± 5%	100	50	>0.4
TRAM132 - 20	20	538 ± 5%	100	50	>0.4

Electrical Characteristics (TRAM 3730)

Part Number	Turns	Inductance (L)(nH)	Q (min)	Test Freq. (MHz)	SRF (GHz)(min)
TRAM3730 - A01T	1	2.5 ± 10%	145	150	>3.0
TRAM3730 - A02T	2	5.0 ± 10%	140	150	>3.0
TRAM3730 - A03T	3	8.0 ± 10%	140	150	>3.0
TRAM3730 - A04T	4	12.5 ± 5%	137	150	>3.0
TRAM3730 - A05T	5	18.5 ± 5%	132	150	>2.5

Electrical Characteristics (TRAM 7030)

Part Number	Turns	Inductance (L)(nH)	Q (min)	Test Freq. (MHz)	SRF (GHz)(min)
TRAM7030 - B06T	6	17.5 ± 5%	100	150	>2.2
TRAM7030 - B07T	7	22.0 ± 5%	100	150	>2.0
TRAM7030 - B08T	8	28.0 ± 5%	100	150	>1.8
TRAM7030 - B09T	9	35.5 ± 5%	100	150	>1.2
TRAM7030 - B10T	10	43.5 ± 5%	100	150	>1.0

Electrical Characteristics (TRAM 1812)

Part Number	Inductance (L)(nH)	Q (min)	Test Freq. (MHz)	SRF (GHz)(min)
TRAM1812 - 22NK	22	100	150	3.20
TRAM1812 - 27NK	27	100	150	2.70
TRAM1812 - 33NK	33	100	150	2.50
TRAM1812 - 39NJ	39	100	150	2.10
TRAM1812 - 47NJ	47	100	150	2.10
TRAM1812 - 56NJ	56	100	150	1.50
TRAM1812 - 68NJ	68	100	150	1.50
TRAM1812 - 82NJ	82	100	150	1.30
TRAM1812 - R10J	100	100	150	1.20
TRAM1812 - R12J	120	100	150	1.10



Order Codes

Order Codes (TRAM0603 TRAM0805 TRAM1008)

TRAM		1008		-	6N8		K	
Part Number		Size (L×W) (mm)			Inductance		Tolerance	
TRAM					6N8	6.8nH	K	10%
	0603	1.80×2.00mm			10N	10.0nH	M	20%
	0805	1.80×2.10mm			R10	100.00nH		
	1008	1.90×2.20mm						

Order Codes (TRAM2215 TRAM4015 TRAM132)

TRAM		2215		-	K	
Part Number		Size (L×W) (mm)			Turns	
TRAM						
	2215	2.20×1.40mm				
	4015	4.00×1.40mm				
	132	9.00×4.40mm				

Order Codes (TRAM3730 TRAM7030)

TRAM		3730		-	A01T	
Part Number		Size (L×W) (mm)			Turns	
TRAM						
	3730	3.30×2.60mm				
	7030	6.30×3.60mm				

Order Codes (TRAM1812)

TRAM		1812		-	22N		K	
Part Number		Size (L×W) (mm)			Inductance		Tolerance	
TRAM					22N	22nH	J	5%
	1812	4.90×3.50mm			R10	100nH	K	10%



► 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.

