Siemens Matsushita Components

Ferrites and Accessories

Ring Cores

Ring cores with the new blue epoxy coating from Siemens Matsushita Components

Ring cores are firmly established in a large variety of advanced equipment and systems in electrical and electronic engineering. In telecommunications they are found in interface transformers for ISDN applications and in chokes for data and signal lines. EMC solutions with input and output chokes in switch-mode power supplies are just as dependent on ring cores as the filters of frequency converters used in electric drives for traction applications and elevators. Lighting engineering needs them too – ring cores in drive transformers for power transistors in electronic ballasts have long been state of the art.

Core point: benefits that pay off

Ring cores offer exceptional advantages compared to other types of core, advantages that are indispensable for special requirements. They include in particular high inductance for small space needs, low parasitic capacitance and – because of the smaller number of turns – the low ohmic resistance of chokes and transformers. A further benefit is that ring cores have low magnetic leakage.

New: coating made to measure

We offer a wide selection of uncoated and coated ring cores. The type of coating depends on the materials used in different size categories. We work with the following variants: parylene (Galxyl) is used for small diameter (< 10 mm) ring cores, polyamide is the material for ring core diameters from 4 to 30 mm.

For ring cores of larger diameters and those of high-permeablility materials (e.g. T46), we have a new development called *blue epoxy coating*. This is an electrostatically deposited powder coating exhibiting decisive advantages compared to conventional polyamide coating:

- No drop in A_L unlike uncoated cores of high-permeability materials (T38 and T46)
- Much higher voltage strength
- Noticeably higher mechanical strength
- Substantially higher temperature resistance (up to 200 °C)

In future we will make general use of the advantages of epoxy coating for all cores ≥ 30 mm in diameter. It will also be offered as a special coating for cores of other diameters.

For further information contact the Siemens office near you or write us at
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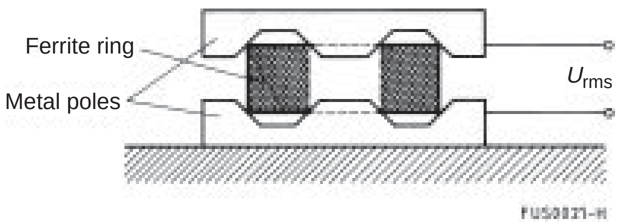
- Our product line includes a wide range of ring cores with finely graded diameters ranging from 2,5 to 200 mm (see overview of available types). Other core heights can be supplied on request. All cores are available in the usual materials.
  Ring cores are available in different coating versions, thus offering the appropriate solution for every application. The coating not only offers protection for the edges but also provides an insulation function.

  The following test setup is used to test the dielectric strength of the insulating coating: A copper ring is pressed to the top edge of the ring. It touches the ferrite ring at the edges (see diagram). The test duration is 2 seconds; the test voltages specified in the table are minimum values:



Core size	U_{rms}
R 4 thru R 10	1,0 kV
R 12,5 thru R 20	1,5 kV
> R 20	2,0 kV

For cores with high permeability, increased spread of the A_L values of several percent must be expected due to the polyamide coating (K version). This effect can be avoided by using an epoxy resin coating (L version).

For small ring cores, we have introduced a parylene coating (Galxyl) which features a low coating thickness and high dielectric strength.

- Ring cores are used primarily for pulse and broadband transformers, baluns and chokes. Owing to the magnetically closed circuit, high flux densities can be achieved at small volume. Magnetic leakage is negligible.
- Ring cores are also increasingly used for power applications. Here, the typical values for amplitude permeability and power loss, as summarized in the section on SIFERRIT materials (Data Book "Ferrites and Accessories", 1997), are applicable to the special power materials.
- In the list of preferred types, the A_{L1min} value (measurement conditions 320 mT, 100 °C, 10 kHz) is also specified for power applications, in addition to a limiting value for power loss under the relevant measurement conditions. This provides a guarantee of the minimum amplitude permeability.
- Characteristic data for cores not included among the preferred types are available on request.

Versions

Version	Ordering code
● Uncoated	B64290-**A**...
● Coated with polyamide; thickness of coating approx. 0,2 to 0,4 mm	B64290-**K**...
● Coated with parylene; thickness of coating approx. 10 to 15 µm, standard coating for small cores (≤ R 4)	B64290-**P**...
● Coated with epoxy resin; thickness of coating approx. 0,15 to 0,3 mm, coating for cores ≥ R 30	B64290-**L**...

Application: Ring cores to suppress line interference

With the ever-increasing use of electrical and electronic equipment, it becomes increasingly important to be able to ensure that all facilities will operate simultaneously in the context of electromagnetic compatibility (EMC) without interfering with each others' respective functions. The EMC legislation which came into force at the beginning of 1996 applies to all electrical and electronic products marketed in the EU, both new and existing ones. So the latter may have to be modified so that they are neither susceptible to electromagnetic interference, nor emit spurious radiation. Ferrite cores are ideally suited for this purpose since they are able to suppress interference over a wide frequency range.

At frequencies above 1 MHz, ferrite rings slipped over a conductor lead to an increase in the impedance of this conductor. The real component of this impedance absorbs the interference energy.

A ferrite material´s suitability for suppressing interference within a specific frequency spectrum depends on its magnetic properties, which vary with frequency. Before the right material can be selected, the impedance IZI must be known as a function of frequency.

The curve of impedance as a function frequency is characterized by the sharp increase in loss at resonance frequency.

Measurement results:

The measurements shown here were made at room temperature (23 ± 3 °C) using an HP 4191A RF impedance analyzer with a flux density of B ≤ 1 mT.

The maximum of the impedance curve shifts to lower frequencies as the number of turns increases; this is due to the capacitive effect of the turns (figure 1, using R25/15 as an example).

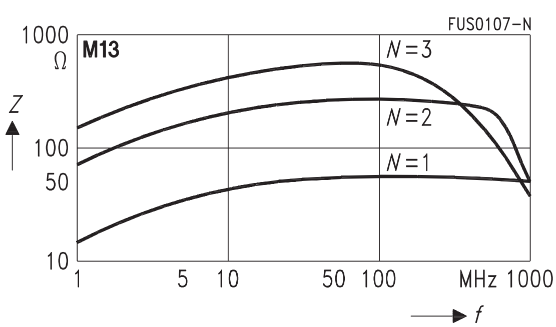


Figure 1

For direct comparison of the typical suppression characteristics of differenct ferrite materials, the impedance curves were normalized using the equation $|Z|_n = |Z| / N^2 \times \Sigma (l_e / A_e)$; the geometry factor was calculated on the basis of the core dimensions (figure 2).

These normalized impedance curves are guide values, mostly measured using ring core R 10 with a number of turns N = 1 (wire diameter 0,7 mm); they may vary slightly, depending on the geometry.

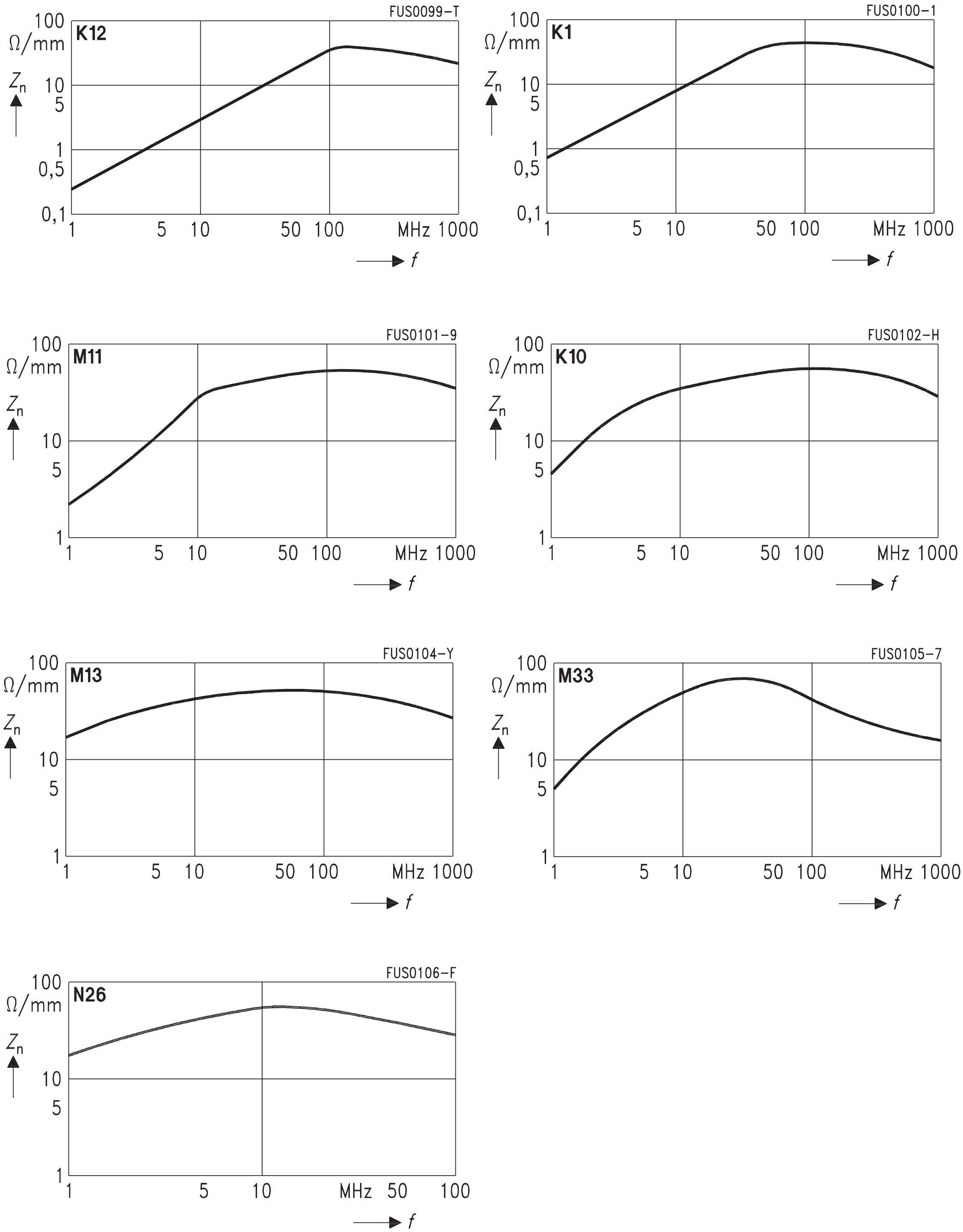

K12
FUS0099-T
K1
FUS0100-1
M11
FUS0101-9
K10
FUS0102-H
M13
FUS0104-Y
M33
FUS0105-7
N26
FUS0106-F
Ω/mm
Z_n
MHz
f

Figure 2

Ring cores are also available in split versions, which can easily be clipped onto cables. The residual air gap inevitable in the reassembled ferrite ring affects its impedance characteristic only slightly in the upper frequency range (figure 3, using R25/15 as an example).

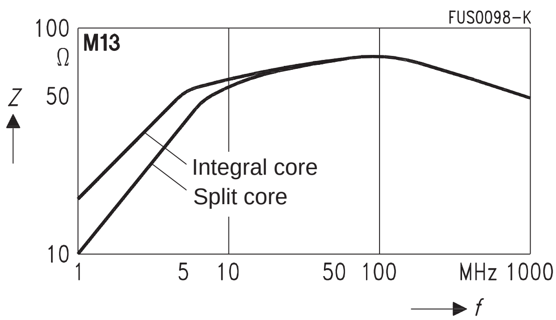


Figure 3

The residual air gap has a positive effect on performance with dc biasing because magnetic saturation is not reached until higher signal levels (figure 4, using R25/15 as an example).

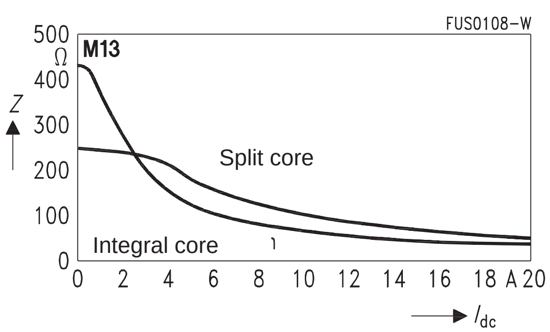
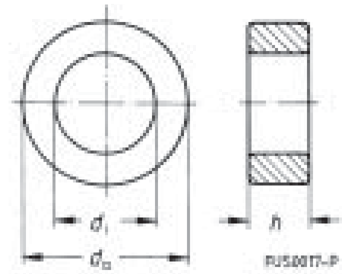


Figure 4



Overview of available types

Type	Dimensions			Magnetic characteristics				Approx. weight
	d_a[1)] mm	d_i[1)] mm	h[1)] mm	$\Sigma l/A$ mm^{-1}	l_e mm	A_e mm^2	V_e mm^3	g
R 2,5	2,5 ± 0,12	1,5 ± 0,1	1,0 ± 0,1	12,30	6,02	0,49	3,0	0,02
R 3,0	3,05 ± 0,2	1,27 ± 0,2	1,27 ± 0,2	5,65	5,99	1,06	6,4	0,04
R 3,9	3,94 ±0,12	2,24 ±0,12	1,3 ± 0,12	8,56	9,21	1,08	9,9	0,05
R 3,9/2	3,94 ±0,12	2,24 ±0,12	2,0 ± 0,12	5,56	9,21	1,66	15,3	0,07
R 4,0	4,0 ± 0,12 (4,5 max)	2,4 ± 0,12 (1,9 min)	1,6 ± 0,1 (2,1 max)	7,69	9,63	1,25	12,0	0,06
R 5,8	5,84 ±0,12 (6,36 max)	3,05 ±0,12 (2,53 min)	1,52 ±0,12 (2,05 max)	6,36	13,03	2,05	26,7	0,1
R 5,8/3	5,84 ±0,12 (6,36 max)	3,05 ±0,12 (2,53 min)	3,0 ± 0,12 (3,55 max)	3,22	13,03	4,04	52,6	0,3
R 6,3	6,3 ± 0,15 (7,25 max)	3,8 ± 0,12 (2,85 min)	2,5 ± 0,12 (3,4 max)	4,97	15,21	3,06	46,5	0,2
R 9,5/2	9,53 ±0,19 (10,5 max)	4,75 ±0,12 (3,8 min)	2,0 ± 0,1 (2,9 max)	4,51	20,72	4,59	95,1	0,5
R 9,5	9,53 ±0,19 (10,5 max)	4,75 ±0,12 (3,8 min)	3,17 ±0,15 (4,1 max)	2,85	20,72	7,28	151	0,8
R 10	10,0 ± 0,2 (11,0 max)	6,0 ± 0,15 (5,05 min)	4,0 ± 0,15 (4,95 max)	3,07	24,07	7,83	188	0,9
R 12,5	12,5 ± 0,3 (13,6 max)	7,5 ± 0,2 (6,5 min)	5,0 ± 0,15 (5,95 max)	2,46	30,09	12,23	368	1,8
R 13,3	13,3 ± 0,3 (14,4 max)	8,3 ± 0,3 (7,2 min)	5,0 ± 0,15 (5,95 max)	2,67	32,70	12,27	401	1,8
R 14	14,0 ± 0,3 (15,1 max)	9,0 ± 0,25 (7,95 min)	5,0 ± 0,2 (6,0 max)	2,84	34,98	12,30	430	2,0
R 15	15,0 ± 0,5 (16,3 max)	10,4 ± 0,4 (9,2 min)	5,3 ± 0,3 (6,4 max)	3,24	39,02	12,05	470	2,4

1) Values in parentheses apply to coated cores, ring cores made of NiZn ferrite may exceed the specified dimensions by up to 5 %

Type	Dimensions			Magnetic characteristics				Approx. weight
	d_a[1)] mm	d_i[1)] mm	h[1)] mm	$\Sigma l/A$ mm^{-1}	l_e mm	A_e mm^2	V_e mm^3	g
R 16	16,0 ± 0,4 (17,2 max)	9,6 ± 0,3 (8,5 min)	6,3 ± 0,2 (7,3 max)	1,95	38,52	19,73	760	3,7
R 17	17,0 ± 0,4 (18,2 max)	10,7 ± 0,3 (9,6 min)	6,8 ± 0,2 (7,8 max)	2,00	42,0	21,04	884	4,4
R 20/7	20,0 ± 0,4 (21,2 max)	10,0 ±0,25 (8,7 min)	7,0 ± 0,4 (8,2 max)	1,30	43,55	33,63	1465	7,6
R 22	22,1 ± 0,4 (23,3 max)	13,7 ± 0,3 (12,6 min)	6,35 ±0,3 (7,4 max)	2,07	54,15	26,17	1417	6,8
R23/8	22,6 ± 0,4 (23,8 max)	14,7 ± 0,2 (13,7 min)	7,6 ± 0,2 (8,6 max)	1,92	56,82	29,56	1680	8,1
R23/9	22,6 ± 0,4 (23,8 max)	14,7 ± 0,2 (13,7 min)	9,2 ± 0,2 (10,2 max)	1,59	56,82	35,78	2033	9,8
R 25/10	25,3 ± 0,7 (26,8 max)	14,8 ± 0,5 (13,5 min)	10,0 ± 0,2 (11,0 max)	1,17	60,07	51,26	3079	16
R 25/15	25,3 ± 0,7 (26,8 max)	14,8 ± 0,5 (13,5 min)	15,0 ± 0,4 16,2 max)	0,78	60,07	76,89	4619	24
R 25/20	25,3 ± 0,7 (26,8 max)	14,8 ± 0,5 (13,5 min)	20,0 ± 0,5 (21,3 max)	0,59	60,07	102,5	6157	33
R 29	29,5 ± 0,7 (31,0 max)	19,0 ± 0,5 17,7 min	14,9 ± 0,4 (16,1 max)	0,96	73,78	76,98	5680	27
R 30	30,5 ± 1,0 (32,3 max)	20,0 ± 0,6 (18,2 min)	12,5 ± 0,4 (13,7 max)	1,19	77,02	64,66	4980	25
R 34/10	34,0 ± 0,7 (35,5 max)	20,5 ± 0,5 (19,2 min)	10,0 ± 0,3 (11,1 max)	1,24	82,06	66,08	5423	27
R 34/12,5	34,0 ± 0,7 (35,5 max)	20,5 ± 0,5 (19,2 min)	12,5 ± 0,3 (13,6 max)	0,99	82,06	82,60	6778	33
R 36	36,0 ± 0,7 (37,5 max)	23,0 ± 0,5 (21,7 min)	15,0 ± 0,4 (16,2 max)	0,94	89,65	95,89	8597	43
R 40	40,0 ±1,0 (41,8 max)	24,0 ± 0,7 (22,5 min)	16,0 ± 0,4 (17,2 max)	0,77	96,29	125,3	12070	61
R 42	41,8 ± 1,0 (43,6 max)	26,2 ± 0,6 (24,8 min)	12,5 ± 0,3 (13,6 max)	1,08	103,0	95,75	9862	48
R 50	50,0 ± 1,0 (51,8 max)	30,0 ± 0,7 (28,5 min)	20,0 ± 0,5 (21,3 max)	0,62	120,4	195,7	23560	118
R 58	58,3 ± 1,0 (60,1 max)	40,8 ± 0,8 (39,2 min)	17,6 ± 0,4 (18,8 max)	1,00	152,4	152,4	23230	115

1) Values in parentheses apply to coated cores, ring cores made of NiZn ferrite may exceed the specified dimensions by up to 5 %

Type	Dimensions			Magnetic characteristics				Approx. weight
	d_a[1)] mm	d_i[1)] mm	h[1)] mm	$\Sigma l/A$ mm^{-1}	l_e mm	A_e mm^2	V_e mm^3	g
R 100	102,0 ± 2,0 (104,8 max)	65,8 ± 1,3 (63,7 min)	15,0 ± 0,5 (16,3 max)	0,96	255,3	267,2	68220	330
R 140	140,0 ± 3,0 (143,8 max)	103,0 ± 2,0 (100,2 min)	25,0 ± 1,0 (26,8 max)	0,82	375,8	458,9	172440	860
R 200	202,0 ± 4,0 (206,8 max)	153,0 ± 3,0 (149,2 min)	25,0 ± 1,0 (26,8 max)	0,90	550,5	608,6	335030	1600

1) Values in parentheses apply to coated cores, ring cores made of NiZn ferrite may exceed the specified dimensions by up to 5 %

Preferred types [1)]

Type	Mate-rial	A_L value nH (1mT, 10 kHz, 25°C)	A_{L1min} nH (320 mT, N49: 200 mT, 10 kHz, 100 °C)	Power loss per core (measurement conditions)	Ordering code B64290-	PU Pcs
R 2,5	N 30	440 ± 25%			-P35-X830	40000
	T 38	1020 ± 30%			-A35-X38	
	T 38	1020 +30/-40%			-P35-X38	
R 4	K 1	13 ± 25%			-A36-X1	16000
	M 33	123 ± 25%			-A36-X33	
	N 30	700 ± 25%			-K36-X830	
	T 38	1630 ± 30%			-A36-X38	
	T 38	1630 +30/-40%			-P36-X38	
	T46	2450 +30/-30%			-A36-X46	
R 6,3	K 1	20 ± 25%			-A37-X1	4000
	M 33	190 ± 25%			-K37-X33	
	N 49 [2)]	330 ± 25%	250	< 6 mW (50 mT/500 kHz/100°C)	-K37-X49	
	N 30	1090 ± 25%			-A37-X830	
	N 30	1090 ± 25%			-K37-X830	
	T38	2530 ± 30%			-A37-X38	
	T38	2530 +30/-40%			-K37-X38	
R 9,5 / 2	T46	4180 ± 30%			-A681-X46	
R 10	K1	33 ± 25%			-A38-X1	1000
	M33	308 ± 25%			-K38-X33	3000
	N49 [2)]	530 ± 25%	410	< 23 mW (50 mT/500 kHz/100°C)	-K38-X49	3000
	N30	1760 ± 25%			-A38-X830	1000
	N30	1760 ± 25%			-K38-X830	3000
	T38	4090 +30/-40%			-K38-X38	3000
R 12,5	N 49 [2)]	660 ± 25%	510	< 45 mW (50 mT/500 kHz/100°C)	-K44-X49	1500
	N27	1020 ± 25%	460	< 70 mW (200 mT/25 kHz/100°C)	-K44-X27	1500
	N 67	1070 ± 25%	460	< 280 mW (200 mT/100 kHz/100°C)	-K44-X67	1500
	N30	2200 ± 25%			-A44-X830	500
	N30	2200 ± 25%			-K44-X830	1500
	T 35	3060 ± 25%			-A44-X35	500
	T 35	3060 +25/-30%			-K44-X35	1500

Type	Mate-rial	A_L value nH (1mT, 10 kHz, 25°C)	A_{L1min} nH (320 mT, N49: 200 mT, 10 kHz, 100 °C)	Power loss per core (measurement conditions)	Ordering code B64290-	PU Pcs
R 16	N 49[1)]	840 ± 25%	640	< 95 mW (50 mT/500 kHz/100°C)	-K45-X49	2000
	N27	1290 ± 25%	580	< 140 mW (200 mT/25 kHz/100°C)	-K45-X27	2000
	N67	1350 ± 25%	580	< 500 mW (200 mT/100 kHz/100°C)	-K45-X67	2000
	N30	2770 ± 25%			-K45-X830	2000
	T35	3870 ± 25%			-A45-X35	1000
	T35	3870 +25/-30%			-K45-X35	2000
	T38	6440 ± 30%			-A45-X38	1000
	T38	6440 +30/-40%			-K45-X38	2000
R 20/7	N 27	1930 ± 25%	870	< 280 mW (200 mT/25 kHz/100°C)	-K632-X27	1000
	N 67	2030 ± 25%	870	< 1,2 W (200 mT/100 kHz/100°C)	-K632-X67	1000
	N 30	4160 ± 25%			-A632-X830	500
	N 30	4160 ± 25%			-K632-X830	1000
	T 35	5000 ± 25%			-A632-X35	500
	T 35	5000 +25/-30%			-K632-X35	1000
	T 38	8500 +30/-40%			-K632-X38	1000
R 22	N 27	1210 ± 25%	550	< 250 mW (200 mT/25 kHz/100°C)	-K638-X27	300
	N30	2610 ± 25%			-K638-X830	300
	T 35	3200 ± 25%			-A638-X35	500
	T 35	3200 +25/-30%			-K638-X35	300
R 25/10	N 27	2150 ± 25%	970	< 580 mW (200 mT/25 kHz/100°C)	-K618-X27	500
	N 67	2260 ± 25%	970	< 2,4 W (200 mT/100 kHz/100°C)	-K618-X67	500
	N 30	4620 ± 25%			-A618-X830	400
	N 30	4620 ± 25%			-K618-X830	500
	T 35	5400 ± 25%			-A618-X35	400
	T 35	5400 +25/-30%			-K618-X35	500
R 34/10	N 30	4360 ± 25%			-L58-X830	225
R 34/12,5	N 30	5460 ± 25%			-L48-X830	225

1) The preferred core types are available at short notice. Other cores on request.
2) Preliminary data

Type	Mate-rial	A_L value nH (1mT, 10 kHz, 25°C)	A_{L1min} nH (320 mT, N49: 200 mT, 10 kHz, 100 °C)	Power loss per core (measurement conditions)	Ordering code B64290-	PU Pcs
R 36	N 27	2670 ± 25%	1200	< 1,6 W (200 mT/25 kHz/100°C)	-L674-X27	200
	N 67	2810 ± 25%	1200	< 5,9 W (200 mT/100 kHz/100°C)	-L674-X67	
	N 30	5750 ± 25%			-A674-X830	
	N 30	5750 ± 25%			-L674-X830	
R 40	N 30	7000 ± 25%			-A659-X830	80
	N 30	7000 ± 25%			-L659-X830	
R 42	N 30	5000 ± 25%			-A22-X830	192
	N 30	5000 ± 25%			-L22-X830	
R 50	N 30	8700 ± 25%			-A82-X830	64
	N 30	8700 ± 25%			-L82-X830	
R 58	N 30	5400 ± 25%			-L40-X830	90
R 100	N 30	5500 ± 25%			-A84-X830	24
R 140	N 30	6200 ± 25%			-A705-X830	4
R 200	N 30	5500 ± 30%			-A711-X830	2

1) Preliminary data

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