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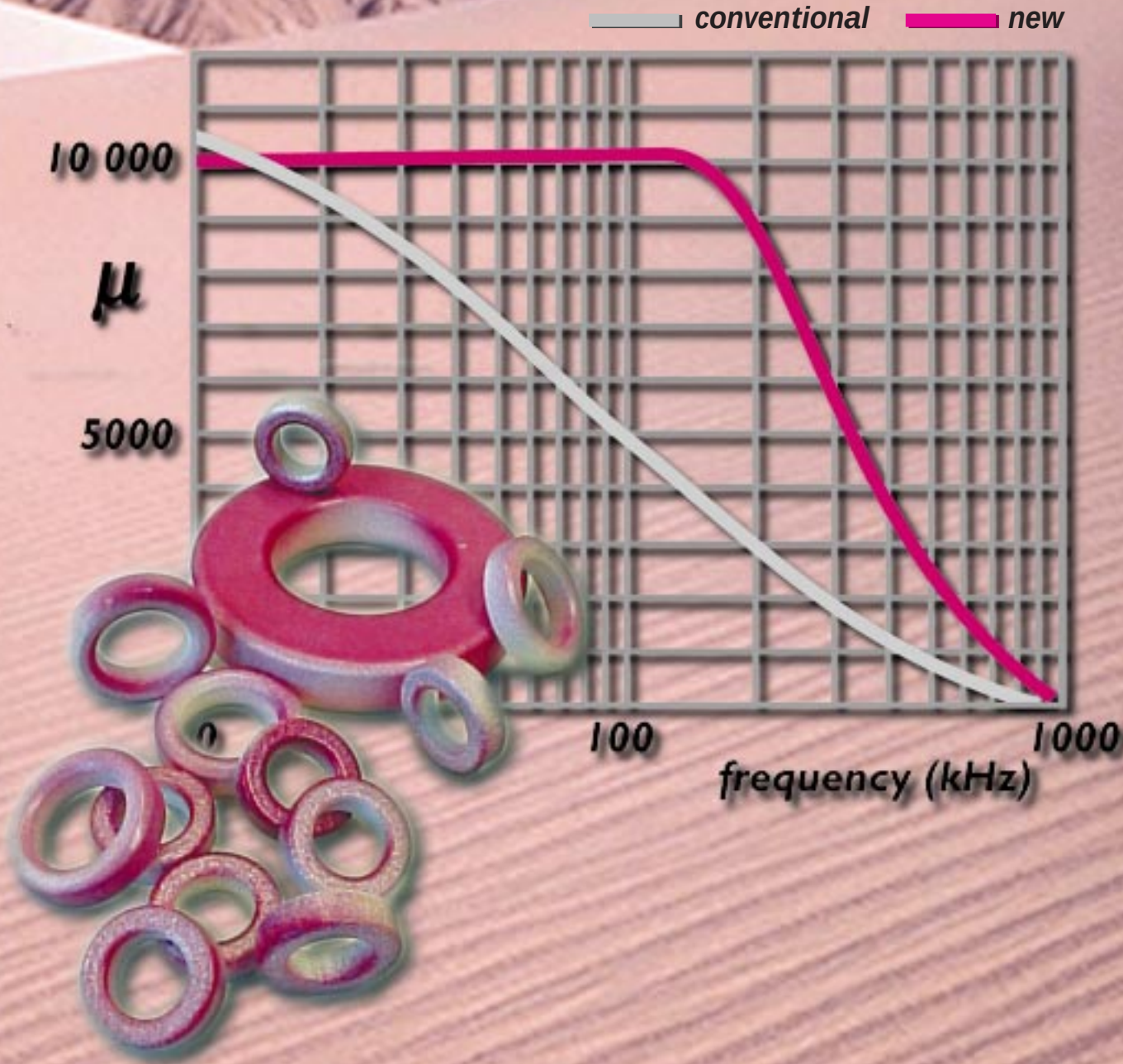
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PHILIPS
Let's make things better.

Breaking frontiers with new μ 10 000 ferrite toroids



PHILIPS
Let's make things better.

3E6 Toroids of a New Generation

Philips Components' very high permeability 3E6 ferrite toroids are mainly used in wideband transformers and common-mode chokes. In many of these applications a high inductance combined with a small occupied volume is of key importance. Toroids, with their closed magnetic circuit in a high permeability ferrite material are ideal for realizing such design targets. However, reaching a very high permeability in a ferrite often leads to a rather low material resistivity. This results in excessive eddy-currents at elevated frequencies, especially in larger toroids. When these eddy-currents occur, the applied magnetic field is partly cancelled out inside the ferrite core, resulting in a decreased effective permeability. This spoils the cores' permeability and impedance behaviour as a function of frequency.

Continuous research, the use of improved raw materials and well controlled process conditions have led to strong improvements in 3E6 toroids. This new generation of toroids features a permeability (μ) of 10 000 up to 100 kHz (Fig.1), lower eddy-current losses (Fig.2) and a much higher impedance level at frequencies around 1 MHz (Fig.3). In addition, the curve of permeability as a function of temperature shows moderate variations over a broad temperature range (Fig.4).

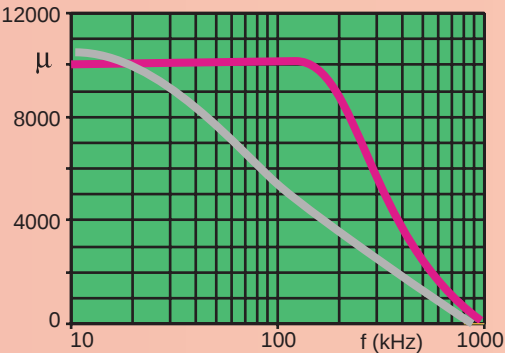
Results are a better response to high frequency pulses in wideband transformers and more effective damping of harmonics in mains input filters.



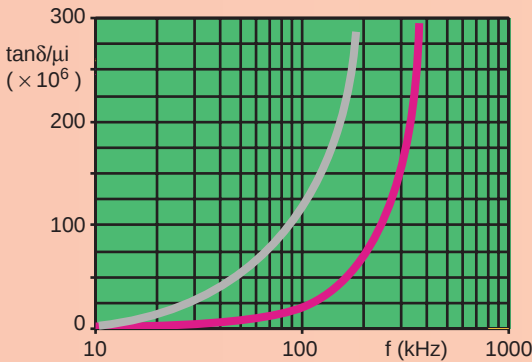
Features

- Very high permeability at frequencies up to well over 100 kHz*
- Stable temperature behaviour in the usual operating range
- Comparatively high T_c of more than 130 °C

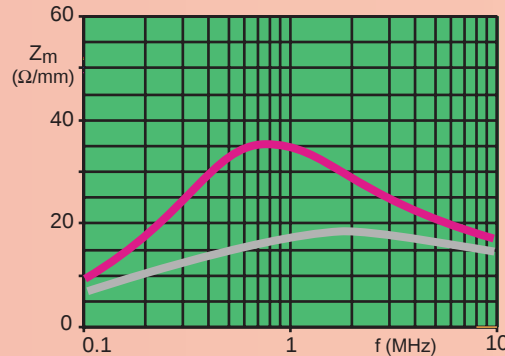
* For large sizes the influence of eddy current losses can result in a lower cut-off frequency.



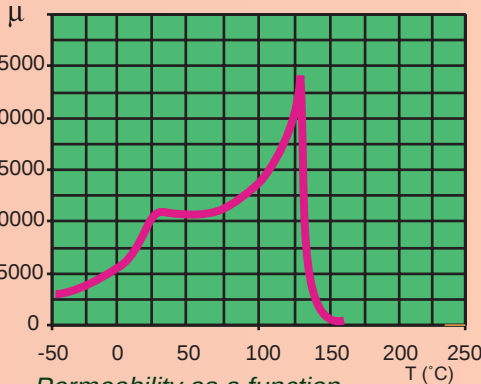
Effective permeability as a function of frequency



Eddy-current losses as a function of frequency



Specific impedance as a function of frequency



Permeability as a function of temperature

conventional μ 10000 toroids

new generation μ 10000 toroids

The product range

Type Number	OD	ID	h	core factor	Ve (mm ³)	le (mm)	Ae (mm ²)	AL ± 30% (nH)
TC2.5/1.3/1.3-3E6	2.54±0.13	1.27±0.13	1.27±0.13	7.14	4.29	5.53	0.78	1835
TC2.5/1.5/0.8-3E6	2.5±0.1	1.5±0.1	0.8-0.1	16.4	2.21	6.02	0.37	765
TC2.5/1.5/1-3E6-S	2.5±0.1	1.5±0.1	1.0±0.1	12.3	2.94	6.02	0.489	1020
TC4/2.2/1.1-3E6	4±0.15	2.2±0.1	1.1±0.1	9.55	8.82	9.18	0.961	1315
TC4/2.2/1.6-3E6	4±0.15	2.2±0.1	1.6±0.1	6.57	12.84	9.2	1.4	1915
TC4/2.2/1.8-3E6	4±0.15	2.2±0.1	1.78±0.1	5.9	14.3	9.18	1.56	2130
TC5.8/3.1/3.2-3E6	5.84±0.15	3.05±0.15	3.18±0.15	3.04	55.8	13	4.27	4130
TC6/4/2-3E6	6±0.15	4±0.15	2±0.1	7.75	30.2	15.3	1.97	1620
TC6.3/3.8/2.5-3E6	6.3±0.25	3.8±0.15	2.5±0.15	4.97	46.5	15.2	3.06	2530
TC9/6/3-3E6	9±0.2	6±0.2	3±0.15	5.17	102	22.9	4.44	2435
TC9.5/4.8/3.2-3E6	9.5±0.35	4.75±0.15	3.2±0.15	2.83	151	20.7	7.3	4390
TL10/6/4-3E6	10.25±0.4	5.75±0.3	4.25±0.3	3.07	188	24.1	7.8	4085
TX13/7.1/4.8-3E6	12.95±0.25	6.85±0.25	5±0.15	2.28	381	29.5	12.3	5400
TL13/7.5/5-3E6	12.75±0.4	7.25±0.35	5.25±0.3	2.46	368	30.1	12.2	5095
TX13/7.9/6.4-3E6	12.95±0.25	7.65±0.25	6.6±0.25	2.09	465	31.2	14.9	5900
TL14/9/5-3E6	14.25±0.4	8.75±0.35	5.25±0.3	2.84	430	35	12.3	4415
TL14/9/9-3E6	14.25±0.4	8.75±0.35	9.25±0.4	1.58	774	35	22.1	7955
TX16/9.1/4.7-3E6	16.13±0.13	8.82±0.18	4.95±0.13	2.527	547	37.2	14.72	5200
TL16/9.6/6.3-3E6	16.25±0.5	9.3±0.4	6.55±0.4	1.95	760	38.5	19.7	6430
TL20/10/7-3E6	20.25±0.6	9.78±0.4	7.25±0.45	1.3	1465	43.6	33.6	9685
TX22/14/6.4-3E6	22.35±0.43	13.47±0.3	6.6±0.25	2.185	1346	54.18	24.8	6000
TL22/14/13-3E6	22.35±0.7	13.47±0.3	12.95±0.6	1.064	2756	54.18	50.9	12080
TX22/14/13-3E6	22.35±0.43	13.47±0.3	12.95±0.25	1.064	2756	54.18	50.9	12080
TL25/15/10-3E6	25.25±0.7	14.75±0.6	10.25	1.23	2944	602	48.9	10200
TL29/19/7.5-3E6	29.25±0.7	18.75±0.6	7.75±0.5	1.98	2704	73.2	36.9	6340
TL29/19/15-3E6	29.25±0.7	18.75±0.6	15.45±0.6	0.978	5481	73.2	74.9	12850
TX36/23/10-3E6	36.25±0.7	22.75±0.5	10.42±0.25	1.451	5538	89.7	61.8	9090
TL36/23/15-3E6	36.25±0.9	22.75±0.7	15.25±0.6	0.935	8596	89.6	95.9	13400
TX36/23/15-3E6	36.25±0.7	22.75±0.5	15.5±0.38	0.953	8439	89.7	94.1	13600
T50/30/19-3E6	50±1	30±0.7	19±0.5	0.65	22378	120.4	186	19400
TX51/32/19-3E6	51.05±1.2	31.5±0.64	19.3±0.38	0.73	21500	125	172	17300
TL74/39/13-3E6	73.91±1.52	38.61±0.76	12.95±0.51	0.774	35298	165	207	15775
T87/56/13-3E6	87±1.25	56±0.9	12.7±0.25	1.123	42133	217.5	194	11190

Coating characteristics

T: Uncoated

TC: Parylene C coating

UL94-V2, file E94133(M)
max. operating temp. 90°C
uncoloured
isolation voltage:
>1000V

TL: Lacquer coating

UL94-V2, file E45228(M)
max. operating temp. 90°C
colour: purple/white
isolation voltage:
>1000V (OD < 12mm)
>1500V (12 ≤ OD ≤ 20)
>2000V (OD > 20)

TX: Epoxy coating

UL under approval
max. operating temp. 90°C
colour: purple/white
isolation voltage:
>1000V (OD < 12mm),
>1500V (12 ≤ OD ≤ 20)
>2000V (OD > 20)

Note: Table reflects our current product range which is continually expanding

