

Mn-Zn Ferrite

Material characteristics

Ferrite for switching power supplies

Ferrite for high-frequency power supplies

Ferrite Cores for EMI Suppression

Ferrite for telecommunication

REMINDERS FOR USING THESE PRODUCTS

Please be sure to read this manual thoroughly before using the products.

The products listed on this catalog are intended for use in general electronic equipment (AV equipment, telecommunications equipment, home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal operation and use condition.

The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble could cause serious damage to society, person or property.

Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below or for any other use exceeding the range or conditions set forth in this specification sheet.

If you intend to use the products in the applications listed below or if you have special requirements exceeding the range or conditions set forth in the each catalog, please contact us.

- | | |
|---|--|
| (1) Aerospace/aviation equipment | (7) Transportation control equipment |
| (2) Transportation equipment (cars, electric trains, ships, etc.) | (8) Public information-processing equipment |
| (3) Medical equipment | (9) Military equipment |
| (4) Power-generation control equipment | (10) Electric heating apparatus, burning equipment |
| (5) Atomic energy-related equipment | (11) Disaster prevention/crime prevention equipment |
| (6) Seabed equipment | (12) Safety equipment |
| | (13) Other applications that are not considered general-purpose applications |

When using these products in general purposes and standard use, it is recommended that protection circuits are used, devices are secured, and backup circuits are kept for increased safety.

Material characteristics list

Ferrite for switching power supplies

Product Area	Recommended Frequency Range	Material	Features	μ i	Pcv [kW/m ³]		Bs [mT]		Tc [°C]
				25°C	100kHz, 200mT 25°C	100°C	25°C	100°C	
For switching power supplies Low-loss, high saturation magnetic flux density material	<100kHz	PE22	For general purpose and large cores	1800	-	520	510	410	>200
	<100kHz	PC40	For general purpose and large cores	2300	-	420	500	380	>200
	<300kHz	PC47	Lowest loss at 100°C	2500	600	250	530	420	>230
	<300kHz	PC90	High saturation magnetic flux density, low loss	2200	680	320	540	450	>250
For switching power supplies PC95 Series	<300kHz	PC95	Low loss in wide temperature range	3300	350	290	530	410	>215
	<300kHz	PEL95	Low loss in wide temperature range and large shape	4100	290	360	500	370	>180
	<300kHz	PEM95	Low loss in wide temperature range and large shape	2900	440	320	520	410	>210
For Switching Power Supplies Hi- μ i materials	<100kHz	HS10	High permeability	10000	-	-	400	-	>120
	<300kHz	HS72	High permeability	7500	-	-	430	-	>130

Test core : T31 x 8 x 19

Ferrite for high-frequency power supplies

Product Area	Recommended Frequency Range	Material	Features	μ i	Pcv [kW/m ³]		Bs [mT]		Tc [°C]
				25°C	25°C	100°C	25°C	100°C	
For high frequency power supplies	300 to 700kHz	PCT50	High frequency and wide temperature range low loss	1400	*1 100	*1 70	460	370	>230
	300 to 700kHz	PC50	High frequency low loss	1400	*1 130	*1 80	470	380	>240
	700kHz to 4MHz	PC200	High frequency low loss	800	*2 145	*2 180	485	410	>280

Test core : T31 x 8 x 19

*1 : 500kHz, 50mT

*2 : 1MHz, 50mT

Ferrite Cores for EMI Suppression, telecommunication

Product Area	Recommended Frequency Range	Material	Features	μ i	Pcv [kW/m ³]		Bs [mT]		Tc [°C]
				25°C	25°C	100°C	25°C	100°C	
For EMC	60kHz to 1MHz	HF90	High impedance	5000	-	-	485	-	>165
	1MHz <	HF60	High impedance	1600	-	-	300	-	>130
For communication equipment	< 100kHz	HP5	Stable permeability over wide temperature range	5000	-	-	400	-	>140
	< 100kHz	H5A	Stable permeability over wide temperature range	4000	-	-	410	-	>130
	< 100kHz	H5B2	Stable permeability over wide temperature range	7500	-	-	420	-	>130
	< 100kHz	H5C2	High permeability	10000	-	-	400	-	>120

Test core : T31 x 8 x 19

Ferrite for switching power supplies

Low Loss, High Saturation Magnetic Flux Density Material

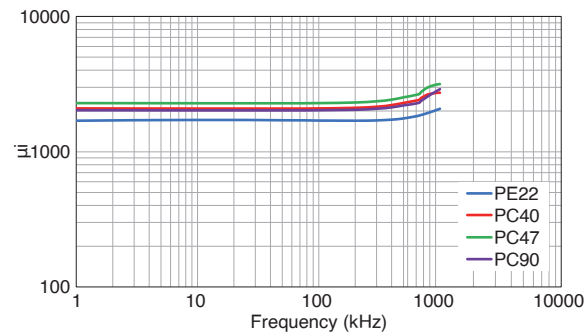
Material characteristics

Material			PE22	PC40	PC47	PC90
Initial permeability	μ_i	25°C	1800±25%	2300±25%	2500±25%	2200±25%
Unit volume core loss	P _{cv} [kW/m ³] 100kHz, 200mT	25°C	890	670	600	680
		60°C	620	500	400	470
		100°C	520	420	250	320
		120°C	600	490	360	460
	P _{cv} [kW/m ³] 25kHz, 200mT	25°C	-	120	-	-
		100°C	80	70	-	-
Saturation magnetic flux density	B _s [mT] H=1194A/m	25°C	510	500	530	540
		60°C	470	450	480	500
		100°C	410	380	420	450
		120°C	370	350	390	420
Remanent flux density	B _r [mT] H=1194A/m	25°C	140	125	180	170
		60°C	-	65	100	95
		100°C	-	40	60	60
		120°C	-	40	60	60
Coercive force	H _c [A/m] H=1194A/m	25°C	16	15	13	13
		60°C	-	10	9	9
		100°C	-	9	6	6.5
		120°C	-	8	7	7
Curie temperature	T _c [°C]		>200	>200	>230	>250
Density	D _s [kg/m ³] × 10 ³		4.8	4.8	4.9	4.9
Electrical resistivity	ρ [Ωm]		3	6.5	4	4

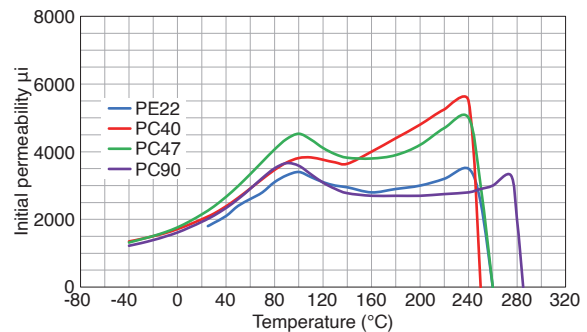
Test core : T31 x 8 x 19

Typical value if tolerance is not specified

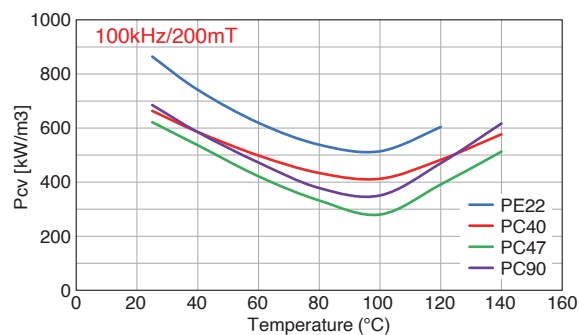
μ_i Frequency characteristics (Typ.)



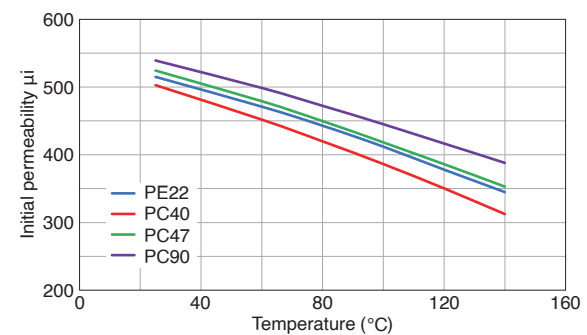
μ_i Temperature characteristics (Typ.)



Core loss Temperature characteristics (Typ.)



B_s Temperature characteristics (Typ.)



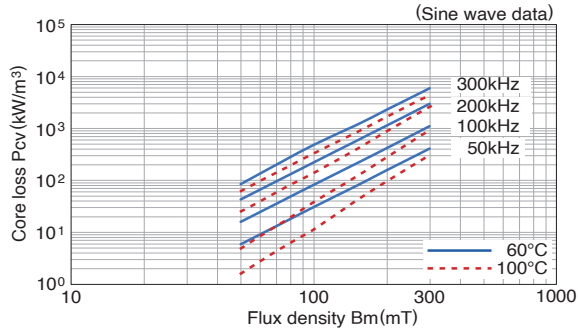
⚠ Please be sure to request delivery specifications that provide further details on the features and specifications of the products for proper and safe use. Please note that the contents may change without any prior notice due to reasons such as upgrading.

Ferrite for switching power supplies

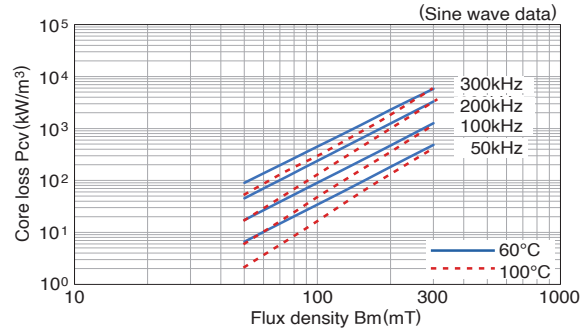
Low Loss, High Saturation Magnetic Flux Density Material


Core loss Bm characteristics (Typ.)

PC47



PC90



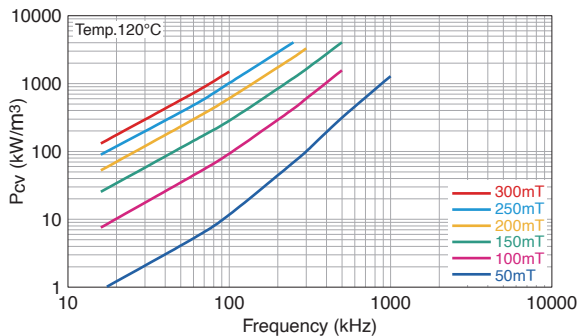
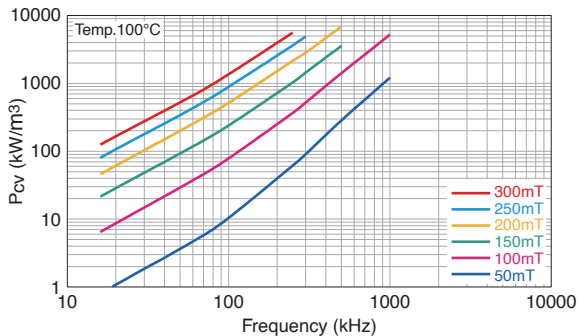
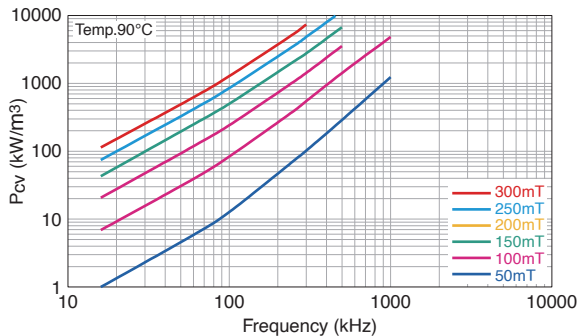
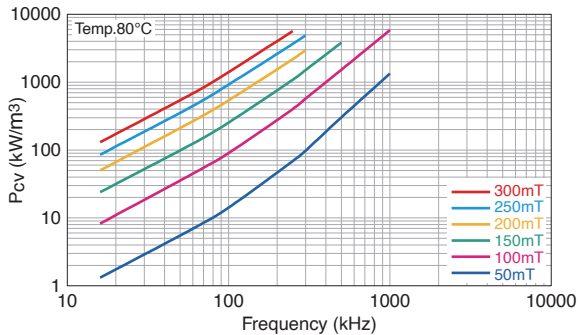
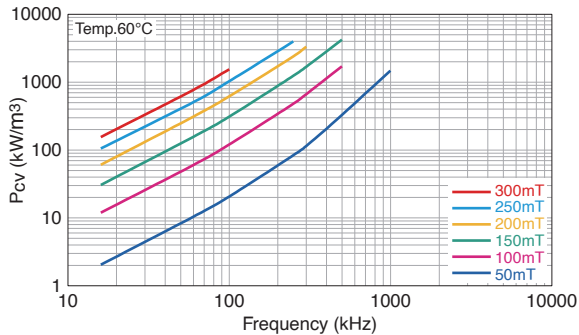
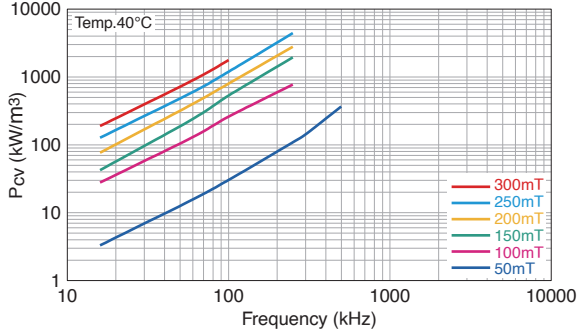
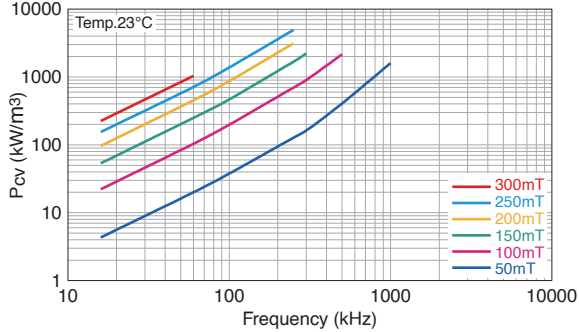
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Ferrite for switching power supplies

Low Loss, High Saturation Magnetic Flux Density Material

Core loss Frequency characteristics (Typ.)

PE22



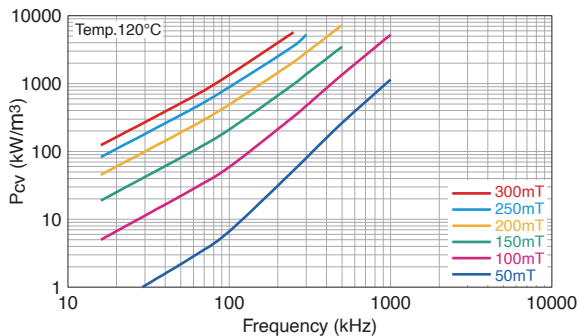
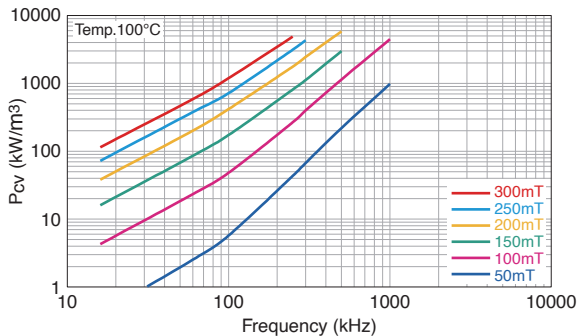
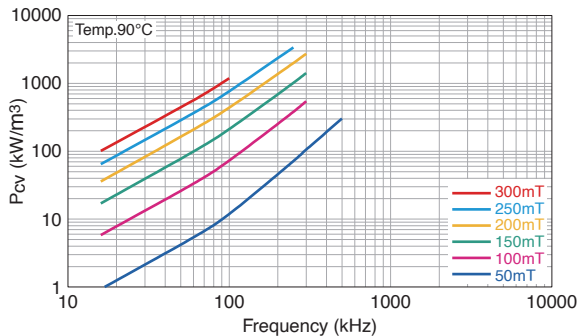
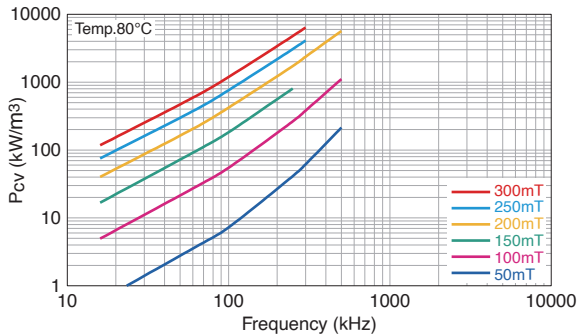
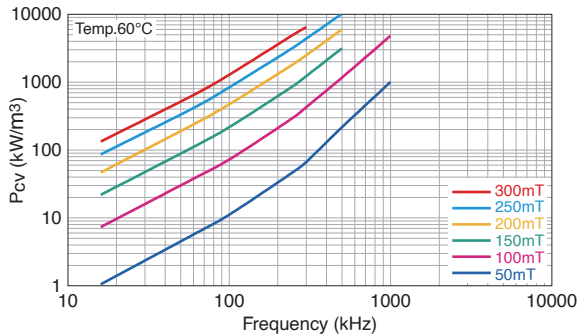
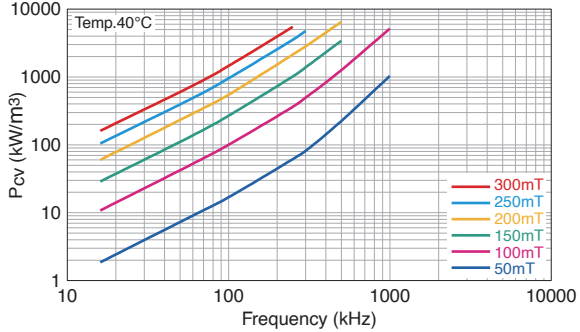
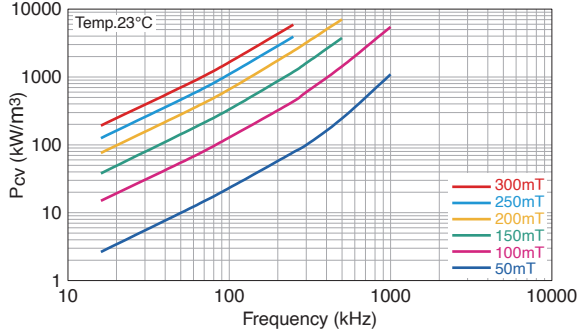
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Ferrite for switching power supplies

Low Loss, High Saturation Magnetic Flux Density Material

Core loss Frequency characteristics (Typ.)

PC40



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Ferrite for switching power supplies PC95 Series

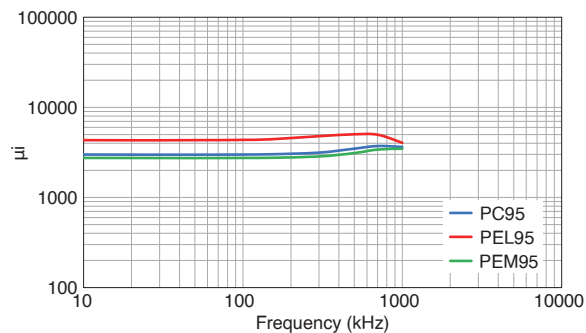
Material characteristics

Material			PC95	PEL95	PEM95
Initial permeability	μ_i	25°C	3300±25%	4100±25%	2900±25%
Unit volume core loss	P_{cv} [kW/m ³] 100kHz, 200mT	25°C	350	290	440
		60°C	300	290	360
		100°C	290	360	320
		120°C	350	420	340
Saturation magnetic flux density	B_s [mT] H=1194A/m	25°C	530	500	520
		60°C	480	460	480
		100°C	410	370	410
		120°C	380	330	370
Remanent flux density	B_r [mT] H=1194A/m	25°C	85	65	85
		60°C	70	60	70
		100°C	60	60	55
		120°C	55	50	50
Coercive force	H_c [A/m] H=1194A/m	25°C	9.5	7	9
		60°C	7.5	6	8
		100°C	6.5	5	6
		120°C	6	5	6
Curie temperature	T_c [°C]		>215	>180	>210
Density	D_s [kg/m ³] × 10 ³		4.9	4.9	4.9
Electrical resistivity	ρ [Ωm]		6	9	9

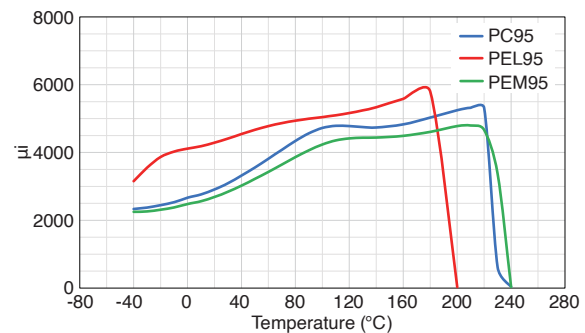
Test core : T31 x 8 x 19

Typical value if tolerance is not specified

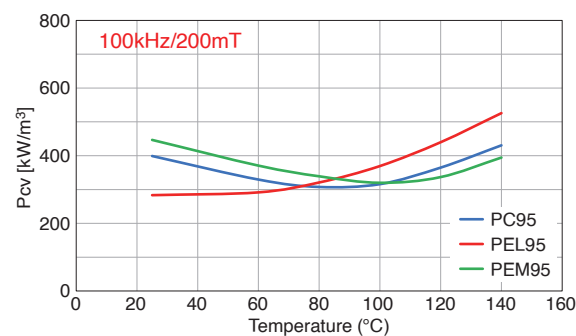
μ_i Frequency characteristics (Typ.)



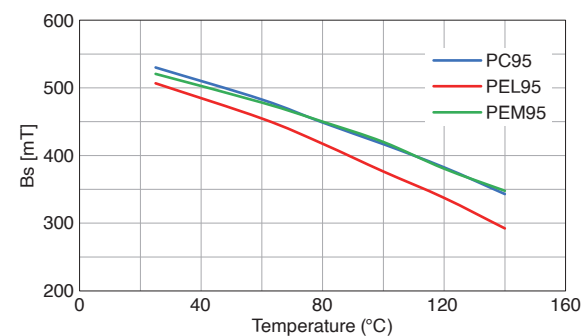
μ_i Temperature characteristics (Typ.)



Core loss Temperature characteristics (Typ.)



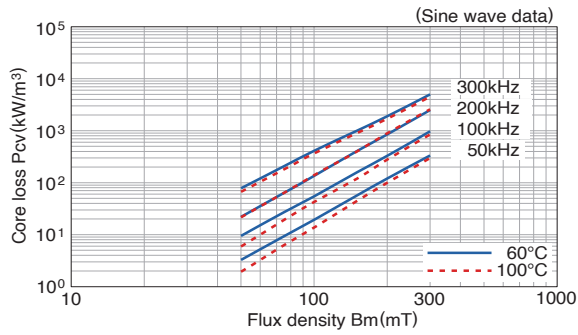
B_s Temperature characteristics (Typ.)



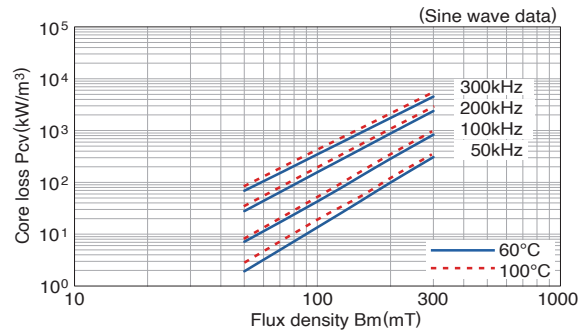
Ferrite for switching power supplies PC95 Series

Core loss Bm characteristics (Typ.)

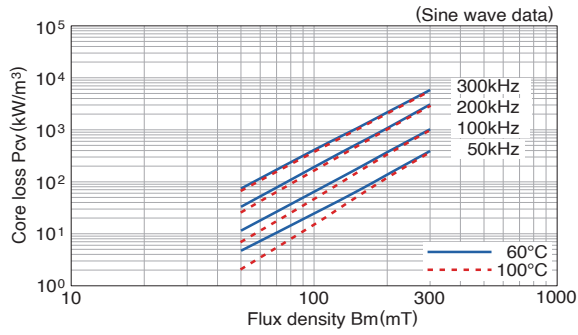
PC95




PEL95



PEM95



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High- μ Ferrite for switching power supplies

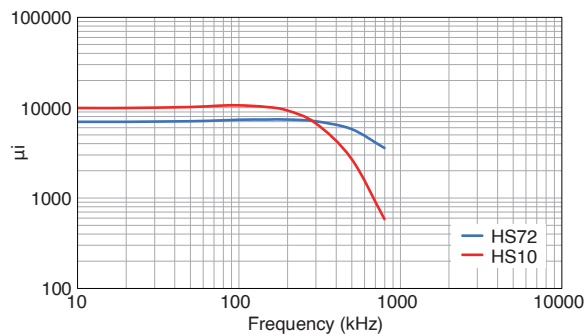
Material characteristics

Material		HS72	HS10
Initial permeability	μ	100kHz	7500 \pm 25%
		500kHz	2000min.
Relative loss factor	$\tan\delta/\mu \times 10^{-6}$	100kHz	30
Saturation magnetic flux density	B_s [mT]	25°C	430
	$H=1194A/m$		400
Remanent flux density	B_r [mT]	25°C	55
	$H=1194A/m$		70
Coercive force	H_c [A/m]	25°C	4
	$H=1194A/m$		3
Curie temperature	T_c [°C]	>130	>120
Density	D_s [kg/m ³] $\times 10^3$	4.9	4.9
Electrical resistivity	ρ [Ωm]	0.2	0.2

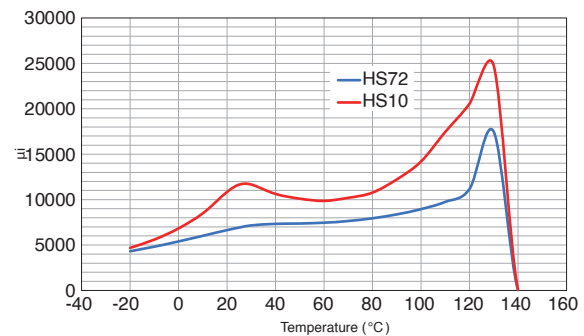
Test core : T31 x 8 x 19

Typical value if tolerance is not specified

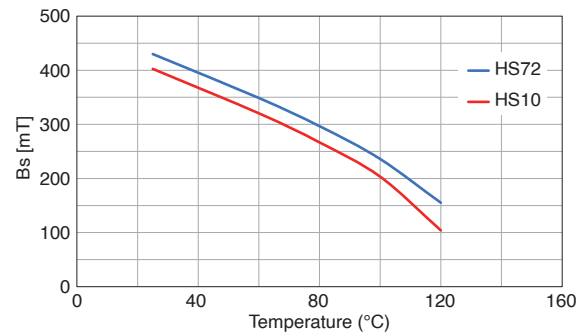
μ Frequency characteristics (Typ.)



μ Temperature characteristics (Typ.)



B_s Temperature characteristics (Typ.)



Ferrite for high-frequency power supplies

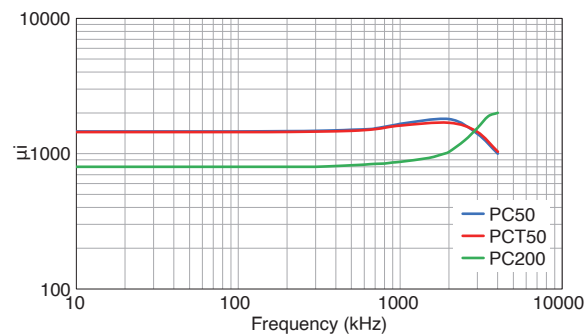
Material characteristics

Material			PC50	PCT50	PC200
Initial permeability	μ	25°C	1400±25%	1400±25%	800±25%
Unit volume core loss	P_{cv} [kW/m ³] 500kHz, 50mT	25°C	130	100	60
		60°C	80	70	60
		100°C	80	70	70
		120°C	90	80	90
	P_{cv} [kW/m ³] 1000kHz, 50mT	25°C	440	400	145
		60°C	470	420	170
		100°C	560	490	180
		120°C	690	580	205
	P_{cv} [kW/m ³] 2000kHz, 30mT	25°C	-	-	160
		60°C	-	-	180
		100°C	-	-	200
		120°C	-	-	220
Saturation magnetic flux density	B_s [mT]	25°C	470	460	480
	$H=1194A/m$	100°C	380	370	410
Remanent flux density	B_r [mT]	25°C	140	117	141
	$H=1194A/m$	100°C	98	97	144
Coercive force	H_c [A/m]	25°C	37	33	51
	$H=1194A/m$	100°C	27	28	48
Curie temperature	T_c [°C]		>240	>230	>280
Density	D_s [kg/m ³] × 10 ³		4.8	4.8	4.9
Electrical resistivity	ρ [Ωm]		30	30	22

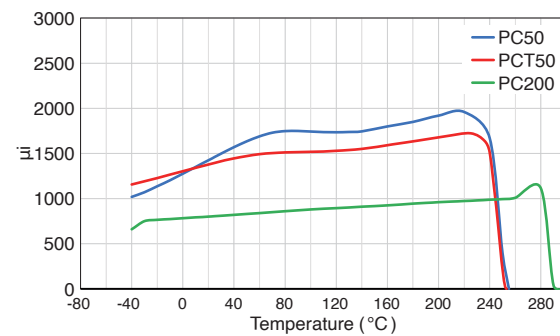
Test core : T31 x 8 x 19

Typical value if tolerance is not specified

μ Frequency characteristics (Typ.)

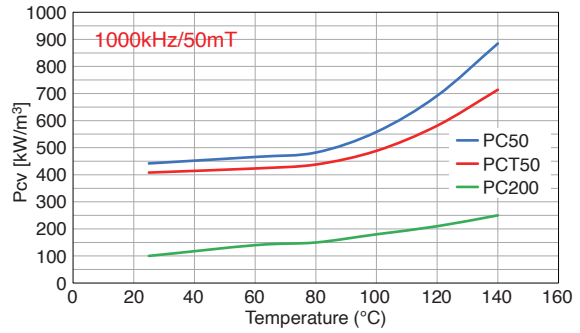
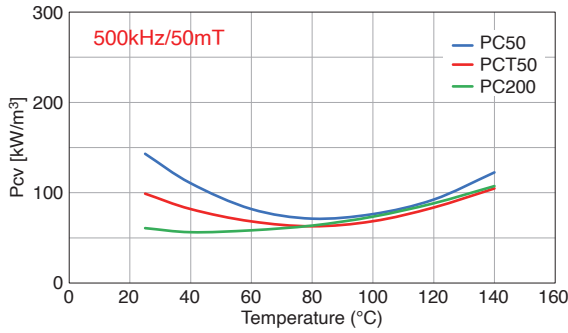


μ Temperature characteristics (Typ.)

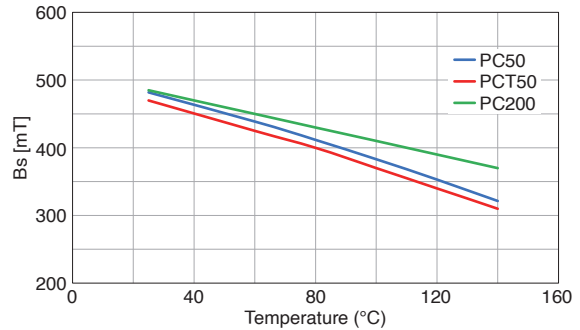
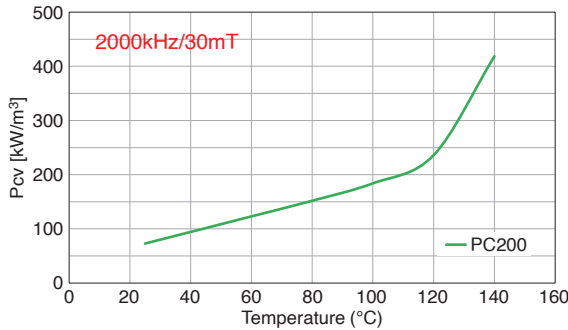


Ferrite for high-frequency power supplies

Core loss Temperature characteristics (Typ.)

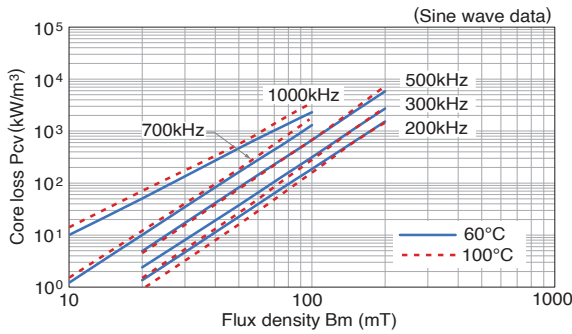


Bs Temperature characteristics (Typ.)

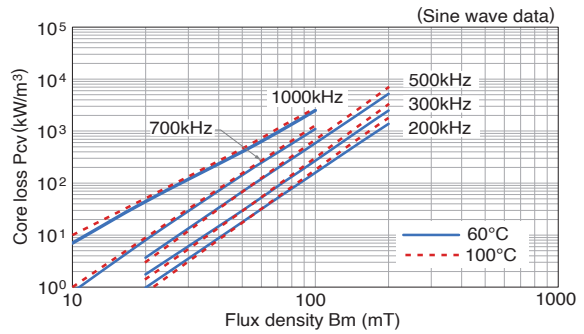


Core loss for each material (Typ.)

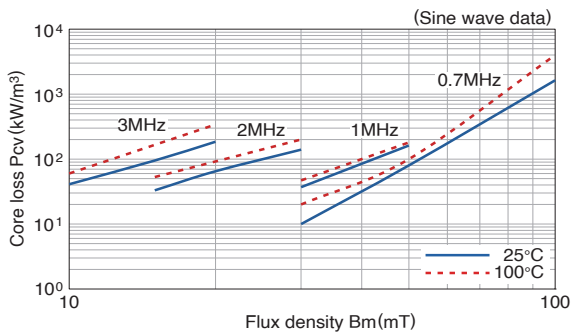
PC50




PCT50



PC200



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Ferrite for high-frequency power supplies PC200

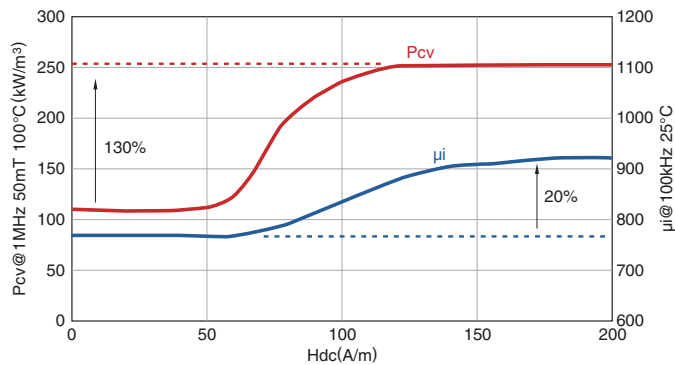
PRECAUTIONS FOR USE OF PC200 MATERIALS

The characteristics of the PC200 material change as follows depending on the application of a DC magnetic field such as a magnet or the magnitude of the applied magnetic field (Hdc) at the time of use.

The characteristics of the PC200 material are changed as follows in the reliability test.

PC200 material recommends use by a little low magnetic field of a special quality change.

Characteristic change due to applied magnetic field



Characteristics change by humidity endurance tests	Change rate (Typ.)
Pcv at 1MHz, 50mT, 100°C	±5% max.
μi at 100kHz, 25°C	±5% max.

Reliability test results

Characteristic change due to applied magnetic field	Change rate (Typ.)
Pcv at 1MHz, 50mT, 100°C	+130%
μi at 100kHz, 25°C	+20%

Test conditions: -40 to 125°C. 1000 cycles. Exposure time = 30 minutes

Characteristics change by thermal shock test	Change rate (Typ.)
Pcv at 1MHz, 50mT, 100°C	-18%
μi at 100kHz, 25°C	-7%

Test conditions: 125±2°C. Retention time = 2000 hours

Characteristic changes due to high temperature storage tests	Change rate (Typ.)
Pcv at 1MHz, 50mT, 100°C	-32%
μi at 100kHz, 25°C	-14%

Test conditions: -40±3°C. Retention time = 2000 hours

Characteristic changes due to low temperature storage tests	Change rate (Typ.)
Pcv at 1MHz, 50mT, 100°C	±5% max.
μi at 100kHz, 25°C	±5% max.

Test conditions: 60±2°C, 90-95%R.H.(III) Retention time = 2000 hours

Recommended shape

The larger the size of PC200 material, the less the material characteristics will be fully demonstrated.

It is recommended that PC200 be used in shapes with A dimensions of 50 mm or less.

* Evaluated by toroidal shape Pcv: Core loss μi: Initial permeability

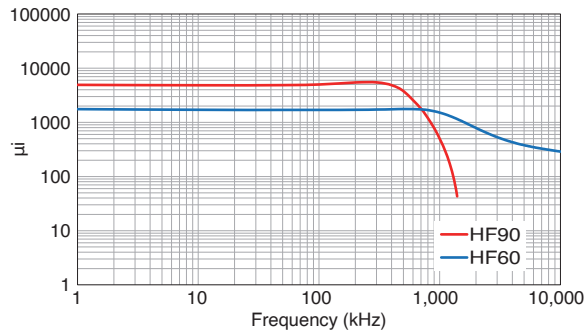
Ferrite Cores for EMI Suppression

Material characteristics

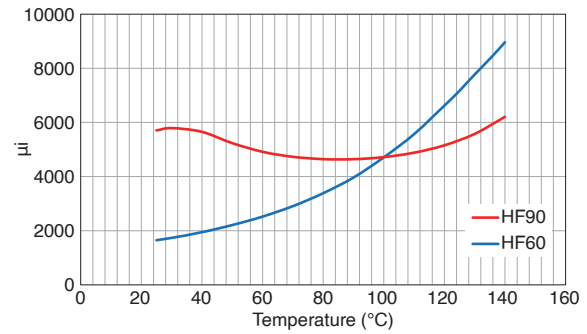
Material			HF90	HF60
Initial permeability	μ	25°C	5000	1600
Saturation magnetic flux density	Bs [mT] H=1194A/m	25°C	485	300
Curie temperature	Tc [°C]		>165	>130
Electrical resistivity	ρ [Ω m]		0.3	4

Test core : T31 x 8 x 19
Typical value if tolerance is not specified

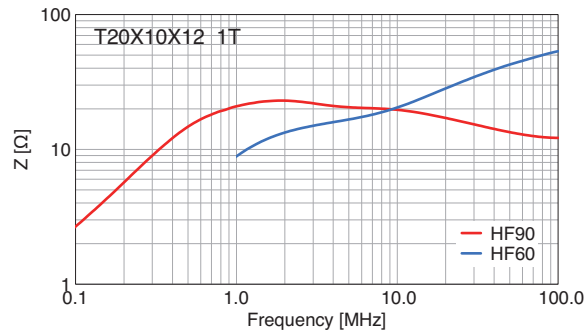
μ Frequency characteristics (Typ.)




μ Temperature characteristics (Typ.)



Impedance vs. Frequency characteristics



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Ferrite for telecommunication

Material characteristics

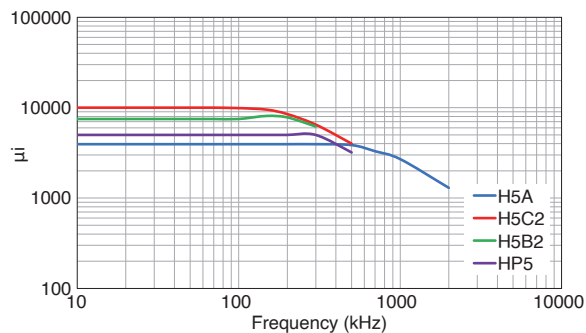
Material		H5A	H5B2	H5C2	HP5	
Initial permeability	μ	100kHz	3300 +40%/-0%	7500±25%	10000±30%	5000±20%
Relative loss factor	$\tan\delta/\mu \times 10^{-6}$	10kHz	<2.5	<6.5	<7.0	<3.5
		100kHz	<10	-	-	-
Temperature factor of initial permeability	$\alpha_{\mu ir}$	-30 to +20°C	-0.5 to 2.0	0 to 1.8	-0.5 to 1.5	-
		0 to 20°C	-	-	-	* ±12.5%
		20 to 70°C	-0.5 to 2.0	0 to 1.8	-0.5 to 1.5	* ±12.5%
Saturation magnetic flux density	B_s [mT] H=1194A/m	25°C	410	420	400	400
Remanent flux density	B_r [mT] H=1194A/m	25°C	100	40	90	65
Coercive force	H_c [A/m] H=1194A/m	25°C	8.0	5.6	7.2	7.2
Curie temperature	T_c [°C]		>130	>130	>120	>140
Hysteresis material constant	ηB [$10^{-6}/mT$]		<0.8	<1.0	<1.4	<0.4
Disaccommodation factor	DF $\times 10^{-6}$		<3	<3	<2	<3
Density	D_s [kg/m^3] $\times 10^3$		4.8	4.9	4.9	4.8
Electrical resistivity	ρ [Ωm]		1	0.1	0.15	0.15

Test core : T31 x 8 x 19

Typical value if tolerance is not specified

* $\Delta L/L$ Tref = 20°C

μ Frequency characteristics (Typ.)



μ Temperature characteristics (Typ.)

