

KingMagnetics

Nanocrystalline and Amorphous
Cores and Components

--- Inductive the future ---

RoHS Compliance



High Performance

Nanocrystalline and Amorphous Cores



Company Profile

Zhuhai King Magnetics Technology Co., Ltd. locates at Zhuhai Nanping Science and Technology Industrial Park, mainly engaged in development, production and sales of nanocrystalline and amorphous materials, ribbons, cores and components .

Our company has advanced production equipments and precision test instruments. We have annual production capacity of ten million pieces of nanocrystalline and amorphous cores. Thanks to advanced production technology and production management system, our nanocrystalline and amorphous cores are high quality, high performance, good consistency and high stability.

We specialize in research of innovative nanocrystalline and amorphous magnetic materials. We can design special nanocrystalline and amorphous cores and components for customers, and help customers develop the best application solutions.

Contents

1. Nanocrystalline cores for common mode chokes	- P6 -
2. Nanocrystalline cores for High Frequency Power Transformers	- P8 -
3. Amorphous C cores	- P10 -
4. Nanocrystalline C cores	- P11 -
5. Epoxy coated nanocrystalline cores and bead cores	- P12 -
6. Nanocrystalline cores for magnetic amplifier (Mag-Amp)	- P13 -
7. Amorphous and nanocrystalline gap cores	- P14 -
8. Custom-made products	- P15 -

Zhuhai King Magnetics Technology Co., Ltd.

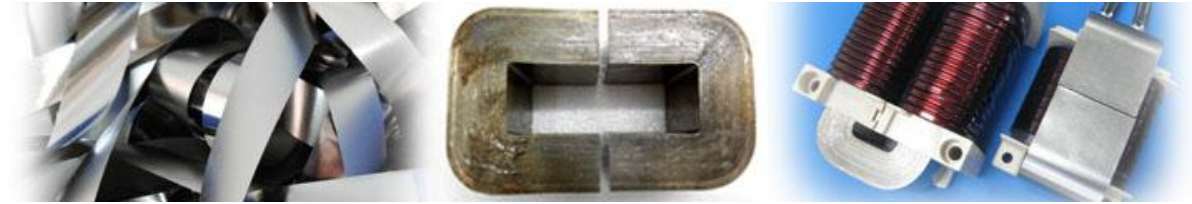
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Nanocrystalline Material



Fe-based nanocrystalline material with composition of mostly Fe with Cu,Nb,Si,B, which first by rapid quenching technology to form amorphous ribbon, then by crystalline heat treatment to gain fine grains with nano scale. Through this revolutionary process, we can get superior magnetic properties with high saturation flux density, high initial permeability, low coercivity, low core loss. Nanocrystalline material is an environmental protection, green, low carbon,high efficiency new magnetic material.

Fe-based nanocrystalline material can be applied to cores for common mode chokes, high frequency transformers, current transformers, driver transformers, network transformers, bead cores, magnetic amplifiers, filter inductors, reactors, PFC chokes in various electrical and electronic area, now have been widely used in switched mode power supply, household electrical appliance, industrial electrical equipment, communication power supply, network power supply, solar energy equipment, wind power generator, IGBT inverter power supply, laser power supply and medical equipment power supply.

Characteristic:

- > High permeability -- increasing inductance and reducing winding turns
- > High saturation induction -- minimizing size of component
- > High frequency -- suitable used in frequency range from 50Hz up to 100KHz
- > High curie temperature -- higher working temperature, continuous working at up to 120°C
- > Low coercivity -- increasing the efficiency and reducing hysteresis loss
- > Low core loss -- reducing energy consumed and minimizing temperature rise
- > Low magnetostriction -- low audible noise compared to traditional magnetic materials
- > Excellent thermal stability -- extremely small deviations from -20°C to 120°C
- > Low cost -- good choice to replace traditional materials like permalloy

Magnetic Properties:

- > Saturation induction B_s -- 1.25 T
- > Saturation magnetostriction λ_s -- 2×10^{-6}
- > Curie temperature T_c -- 560 °C
- > Crystallization temperature T_x -- 510°C
- > Ribbon thickness -- 25 μm
- > Density d -- 7.25 g/cm^3
- > Resistivity ρ -- 115 $\mu\Omega\cdot\text{cm}$
- > Vicker's Hardness H_v -- 880 kg/mm^2

Magnetic Properties Comparison

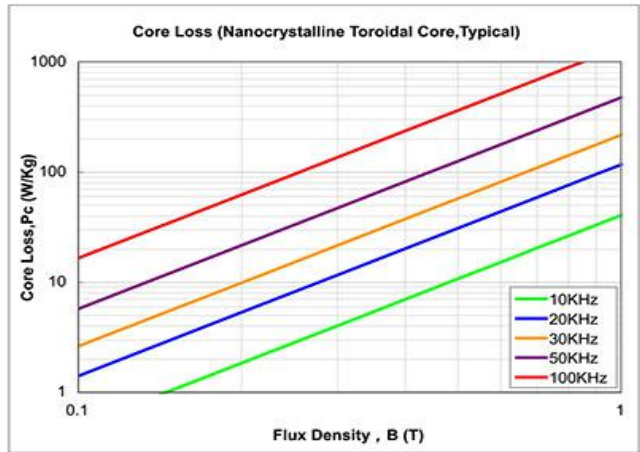
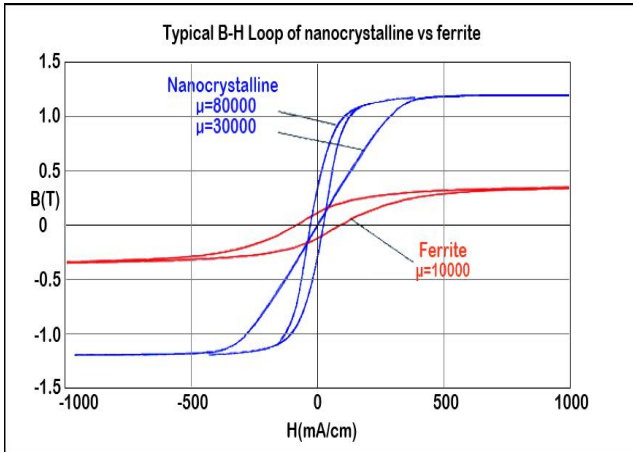
between Amorphous and Nanocrystalline Materials and Traditional Soft Magnetic Materials:

Magnetic Properties	Fe-Si Steel	Mn-Zn Ferrite	50Ni Permalloy	80Ni Permalloy	Cobalt-based Amorphous	Fe-based Amorphous	Fe-based Nanocrystalline
Saturation Flux Density Bs(T)	2.03	0.5	1.55	0.74	0.58	1.56	1.25
Coercivity Hc (A/m)	40	8	12	2.4	0.4	2.4	1.2
Initial Permeability μ_i	1500	3000	6000	40000	100000	5000	80000
Max Permeability μ_m	20000	6000	60000	200000	1000000	50000	400000
Electrical Resistivity ($\mu\Omega.cm$)	50	5×10^7	30	60	140	130	115
Curie Temperature Tc(°C)	750	220	500	450	250	399	570

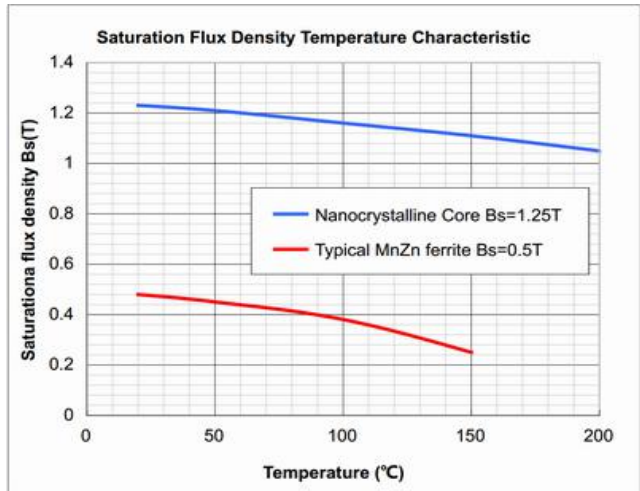
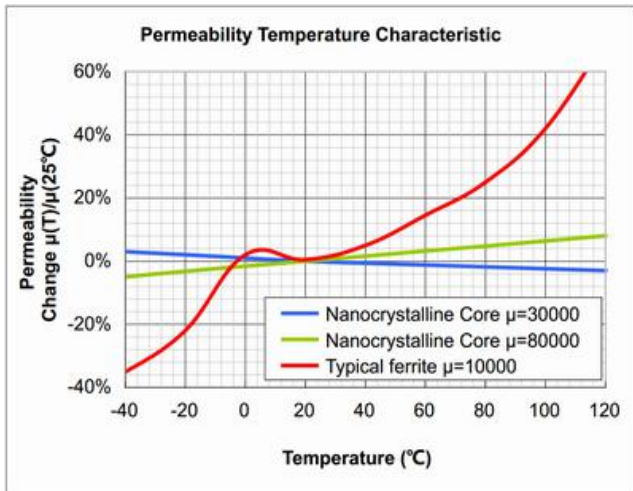
Applications of Amorphous and Nanocrystalline Cores:

Application	Fe-based Amorphous	Co-based Amorphous	Fe-based Nanocrystalline
EMC Common Mode Choke, EMI Filter			√
High Frequency Transformer			√
Current Transformer			√
Magnetic Amplifier		√	√
Network transformer, driver transformer		√	√
Solar Inverter Reactor	√		
Car Audio output inductor	√		
PFC choke, Out filter inductor	√		

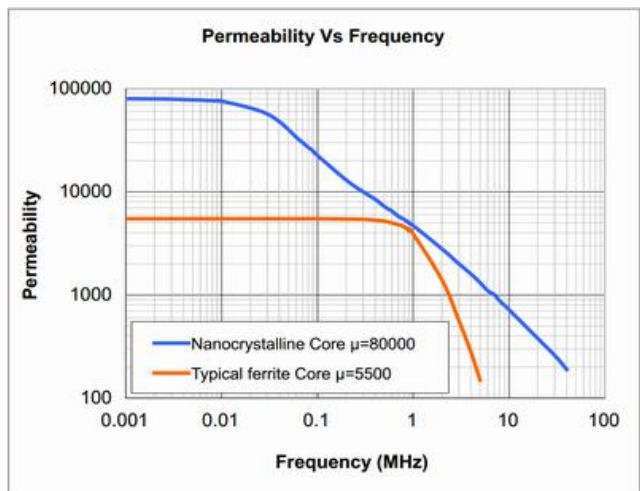
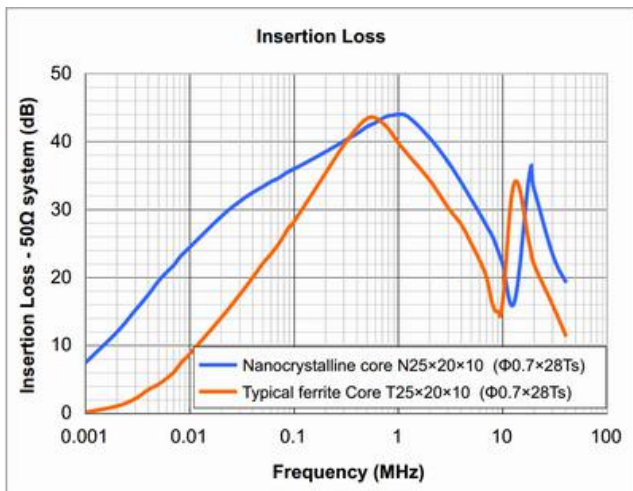
Typical hysteresis loop and core loss characteristics:



Typical temperature characteristics:



Typical frequency characteristics: Nanocrystalline core vs. Ferrite



Nanocrystalline Cores for EMC Common Mode Chokes



Amorphous and nanocrystalline technologies are very important technology in modern magnetic materials, cores and inductive components. After long term experiment and development, King Magnetics has developed series of high quality nanocrystalline cores for common mode chokes.

Nanocrystalline cores have very high permeability over low frequency to high frequency. They are very suitable for common mode chokes used as EMC filters to suppress conducted common mode noise. Compared to traditional ferrite cores, nanocrystalline cores have a lot of advantages as high inductance, good filter effective, small size and volume, lower turns of copper wire, lower power consumption and high efficiency.

Nanocrystalline cores have very high curie temperature about 560°C, much higher than traditional ferrite core about 200°C. High curie temperature make nanocrystalline core excellent thermal stability, and can continuous working at up to 120°C environment.

Nanocrystalline cores is the best choice for application of common mode choke.

Applications:

- > EMC common mode choke, EMI Filter
- > Switched mode power supply
- > Computer power supply, server power supply
- > Communication and network power supply
- > Laser and X-ray power supply
- > Welding equipment and Electrical plating power supply
- > Solar energy equipment and Wind power generator
- > Household electrical appliance, like air conditioner
- > Uninterruptable power supply (UPS)
- > Variable Frequency converter and motor
- > high-speed railway power supplies
- > Electric vehicles and charger devices

Characteristics:

- > High permeability -- increasing inductance and reducing size and winding turns
- > High saturation flux density -- not easy to saturation
- > Low loss -- increasing efficiency and reducing power consumption
- > High unbalance current withstand -- suitable for high unbalance current application

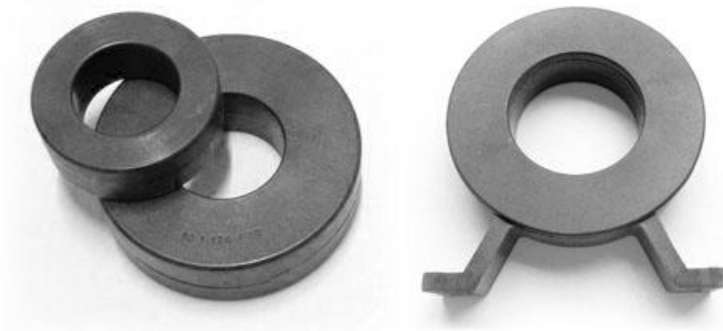
Specifications:**Nanocrystalline cores for EMC common mode chokes**

Part No.	Core dimension (mm)			Case dimension (mm)			Eff. cross area (cm ²)	Mean path length (cm)	A _L (μH) 10KHz,0.25V	A _L (μH) 100KHz,0.25V
	od	id	h	OD	ID	H	A _e	L _m	A _L (Min)	A _L (Min)
KMN986545	9.8	6.5	4.5	11.3	5	6.1	0.06	2.6	14.2	3.0
KMN120805	12	8	5	14.4	6.5	7.0	0.08	3.1	15.6	3.7
KMN161006	16	10	6	17.9	8.1	8.1	0.14	4.1	25.9	5.2
KMN161008	16	10	8	17.8	8.4	9.9	0.19	4.1	34.6	6.9
KMN191510	19	15	10	21.2	13.5	12.3	0.16	5.3	22.0	4.4
KMN201208	20	12	8	21.7	10.8	9.9	0.25	5.0	37.4	7.5
KMN201210	20	12	10	22.6	10.5	12.5	0.31	5.0	46.8	9.4
KMN211510	21	15	10	23.6	12.8	12.7	0.23	5.7	31.2	6.2
KMN211308E*	21.3	13.6	8	22	13	8.8	0.24	5.5	33.0	6.6
KMN252010	25	20	10	28	17.2	13.2	0.20	7.1	20.8	4.2
KMN251610	25	16	10	28	14.0	13.1	0.35	6.4	41.1	8.2
KMN261610	25.5	16	10	28.4	13.9	13	0.39	6.6	44.6	8.9
KMN302010	30	20	10	33.2	17.8	13.3	0.39	7.9	37.4	7.5
KMN302015	30	20	15	33.6	17.8	17.8	0.59	7.9	56.2	11.2
KMN322010	32	20	10	34.4	18.0	13.1	0.47	8.2	43.2	8.6
KMN322015	32	20	15	34.6	17.9	18.2	0.70	8.2	64.8	13.0
KMN402515	40	25	15	43.8	21.6	18.8	0.88	10.2	64.8	13.0
KMN403215	40	32	15	44.9	28.8	18.8	0.47	11.3	31.2	6.2
KMN503220	50	32	20	53.8	28.5	23.8	1.40	12.9	68.5	16.4
KMN504020	50	40	20	53.6	37.1	23	0.78	14.1	34.7	8.3
KMN644025	64	40	25	67.4	37	29.2	2.34	16.3	90.0	21.6
KMN805020	80	50	20	83.8	46.6	25.0	2.34	20.4	72.0	17.3
KMN805025	80	50	25	84.0	47.0	29.0	2.93	20.4	90.0	21.6
KMN1008020	100	80	20	105	75	25	1.56	28.3	34.7	8.3
KMN1027625	102	76	25	107.9	70.0	30.3	2.54	27.9	57.0	13.7
KMN1309030	130	90	30	135.3	84.9	36.5	4.68	34.5	85.1	20.4
KMN16013025	160	130	25	165	125	30	2.93	45.5	40.3	9.7
KMN17012025	170	120	25	175	115	30	4.88	45.5	67.2	16.1
KMN20016030	200	160	30	207	153	37	4.50	56.5	41.6	12.5

These cores are our standard products with plastic case, we can design and produce high performance cores according to customer's requirements, including sizes, inductance and applications. We can help customers to select the best performance cores.

* Epoxy coated.

Nanocrystalline cores for High Frequency Power Transformers



Features:

Nanocrystalline cores for high frequency and high power transformers have high saturation flux density, high permeability, low core loss, low saturation magnetostriction and good temperature stability. Widely used as main transformer cores for uni-polar, push-pull or bi-polar type high frequency and high power switched mode power supply.

High saturation flux density and low core loss are the primary demands of a transformer, and nanocrystalline core has the both properties. Transformers with nanocrystalline cores have features of small size, high efficiency, low loss, low temperature rise and excellent temperature stability.

Applications:

- > High frequency and high power switched mode power supply
- > Laser power supply
- > Inverter welding machine
- > Electrical plating power supply
- > Medium and high frequency heating power supply
- > X-ray power supply
- > IGBT Inverter
- > Communication power supplies

Characteristics:

- > High saturation flux density -- reducing volume of transformer
- > High permeability and low coercivity -- improving efficiency and reducing magnetized current and reducing copper loss
- > Low core loss -- increasing efficiency and reducing power consumption
- > Excellent thermal stability -- continuous working at up to 120°C
- > Low magnetostriction -- low audible noise compared to other materials

Comparison: nanocrystalline cores vs. ferrite cores

Properties	Nanocrystalline cores	Ferrite cores
Saturate Flux Density (T)	1.25	0.5
Remanence (T) (20 kHz)	< 0.3	0.2
Core loss (20 kHz/0.2T) (W/Kg)	< 3.4	7.5
Core loss (20 kHz/0.5T) (W/Kg)	< 30	Can not use
Core loss (50 kHz/0.3T) (W/Kg)	< 40	Can not use
Permeability (20 kHz) (Gs/Oe)	> 20,000	2,000
Static Coercivity (A/m)	< 2	6
Saturation magnetostriction (10^{-6})	< 2	4
Electrical Resistivity ($\mu\Omega.cm$)	90	10^6
Curie temperature ($^{\circ}C$)	560	< 200
Stacking factor	> 0.75	N/A





Specifications:

Nanocrystalline Cores for High Frequency Power Transformers

Part No.	Core dimension (mm)			Case dimension (mm)			Eff. Cross area (cm ²)	Mean path length (cm)	Weight (g)	Power @ 20KHz (Kw)	Case Type *
	od	id	h	OD	ID	H	Ae	Lm	Wt	P	
KMN503220T	50	32	20	53.8	28.5	24	1.40	12.9	131	0.5-1	O
KMN644020T	64	40	20	68.2	37	23.5	1.87	16.3	222	1-3	O
KMN805025T	80	50	25	83.5	47.2	28.8	2.93	20.4	433	3-5	O
KMN805025T-2	80	50	25	83.5	47.2	28.8	2.93	20.4	433	3-5	Ω
KMN1006020T	100	60	20	106	55	25	3.12	25.1	568	5-7	O
KMN1006020T-2	100	60	20	106	55	25	3.12	25.1	568	5-7	Ω
KMN1207020T	120	70	20	125	65	26	3.90	29.8	843	7-10	O
KMN1207020T-2	120	70	20	125	65	26	3.90	29.8	843	7-10	Π
KMN1207030T	120	70	30	125	65	36	5.85	29.8	1265	10-15	O
KMN1207030T-2	120	70	30	125	65	36	5.85	29.8	1265	10-15	Π
KMN1308040T	130	80	40	136	75	46	7.80	33.0	1864	15-20	O
KMN1308040T-4	130	80	40	136	75	46	7.80	33.0	1864	15-20	H
KMN1308050T	130	80	50	136	75	56	9.75	33.0	2331	20-25	O
KMN1308050T-4	130	80	50	136	75	56	9.75	33.0	2331	20-25	H

Other specifications are available according to customer's requirements.

* Case Type:

O - Toroidal core	Ω and Π - Toroidal core with two legs		H - Toroidal core with 4 legs
O 	Ω 	Π 	H 

Amorphous C Cores

Features:

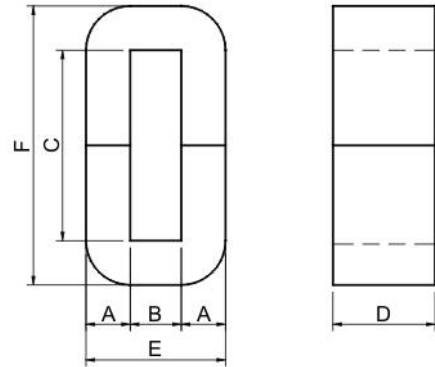
Amorphous C cores is CD type core for easy install and larger current. These cores have high saturation flux density, low core loss, high permeability. They are suitable for PFC choke, output filter inductor, solar inverter inductor, large current reactor and can be used under high frequency.

Applications:

- > Solar inverter
- > Large power Output filter inductor
- > Large current Reactor

Characteristics:

- > High saturation flux density -- Large DC bias
- > Low core loss -- Low temperature rise



Specifications:

Part No.	Core dimension (mm)						Mean path length (cm)	Eff. cross area (cm ²)	Weight (g)
	A	B	C	D	E	F	Lm	Ae	Wt
KMAC-20	11	13	50	30	35	72	15.7	2.94	331
KMAC-32	13	15	56	30	41	82	17.9	3.47	447
KMAC-40	13	15	56	35	41	82	17.9	4.05	522
KMAC-50	16	20	70	25	52	102	22.7	3.56	580
KMAC-63	16	20	70	30	52	102	22.7	4.27	696
KMAC-80	16	20	70	40	52	102	22.7	5.70	928
KMAC-100	16	20	70	45	52	102	22.7	6.41	1043
KMAC-125	19	25	83	35	63	121	27.2	5.92	1157
KMAC-160	19	25	83	40	63	121	27.2	6.76	1322
KMAC-200	19	25	83	50	63	121	27.2	8.46	1653
KMAC-250	19	25	90	60	63	128	28.6	10.15	2085
KMAC-320	22	35	85	50	79	129	30.6	9.79	2148
KMAC-400	22	35	85	65	79	129	30.6	12.73	2793
KMAC-500	25	40	85	55	90	135	32.5	12.24	2856
KMAC-630	25	40	85	70	90	135	32.5	15.58	3635
KMAC-800A	25	40	85	85	90	135	32.5	18.91	4414
KMAC-800B	30	40	95	85	100	155	36.1	22.70	5879
KMAC-1000	33	40	105	85	106	171	39.0	24.96	6994

Customers made and customers design are available.

Nanocrystalline C Cores

Features:

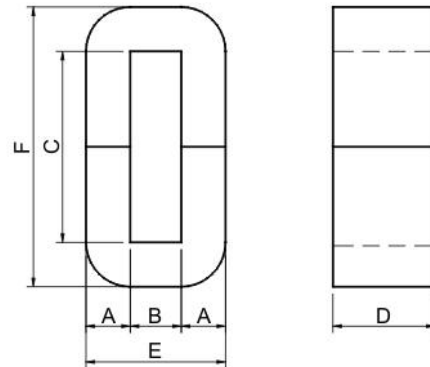
Nanocrystalline c cores are made of high permeability and low core loss nanocrystalline ribbon. Nanocrystalline c cores perform better than amorphous c cores. Suitable for high frequency transformer, audio transformer, PFC choke, output inductors.

Applications:

- > High frequency transformer
- > Audio transformer
- > PFC choke
- > Output inductor

Characteristics:

- > Low core loss -- can be used at frequency around 20KHz
- > High saturation induction -- 1.25T, much higher than ferrite core
- > Low magnetostriction -- low noise



Specifications:

Part No.	Core dimension (mm)						Mean path length (cm)	Eff. cross area (cm ²)	Weight (g)
	A	B	C	D	E	F	Lm	Ae	Wt
KMNC-6.3	10	11	33	20	31	53	12.8	1.56	146
KMNC-8	11	13	30	20	35	52	13.0	1.72	166
KMNC-10	11	13	40	20	35	62	15.0	1.72	192
KMNC-16A	11	13	40	25	35	62	15.0	2.15	240
KMNC-16B	11	13	50	25	35	72	17.0	2.15	272
KMNC-20	11	13	50	30	35	72	17.0	2.57	326
KMNC-25	13	15	56	25	41	82	19.4	2.54	366
KMNC-32	13	15	56	30	41	82	19.4	3.04	439
KMNC-50	16	20	70	25	52	102	24.4	3.12	567
KMNC-63	16	20	70	30	52	102	24.4	3.74	680

Customers made and customers design are available.

Epoxy Coated Nanocrystalline Cores and Bead Cores



Features:

Epoxy coated nanocrystalline cores enable reducing core volume and keeping excellent magnetic performance. It is convenience for engineer to design various dimensions of nanocrystalline cores. This kind of cores also reduce copper wires due to core volume reduced, reduce cost as well.

Applications:

- > Nanocrystalline bead core for noise suppressor for semiconductor components (e.g. Mosfet)
- > IGBT Driver transformer
- > Current transformer
- > High Frequency Power transformer
- > ISDN Network transformer
- > EMI/EMC Filter Common mode choke
- > HD camera signal transformer

Characteristics:

- > Small size - Reducing volume of component
 - Reducing copper wires
 - Reducing cost
- > Size can be custom made - Help customers quick design and mold cost free
- > High insulation strength - Withstand voltage meets 1000V requirement
- > High permeability - Much higher inductance value than ferrite core

Specifications:

Part No.	Core dimension (mm)			Finished dimension (mm)			Eff. cross area (cm ²)	Mean path length (cm)	A _L (μH) 10KHz,0.25V
	od	id	h	OD	ID	H	A _e	L _m	A _L (Min)
KMN040203E	4	2.2	3.2	4.5	1.7	3.8	0.021	0.97	10.0
KMN060303E	6	3	3.2	7.0	2.0	4.2	0.037	1.41	16.6
KMN060403E	6	4	3.2	7.0	3.0	4.2	0.025	1.57	10.0
KMN090503E	9	5	3.2	10.0	4.0	4.2	0.050	2.20	15.0
KMN120910E	11.8	8.7	10	12.8	7.7	11	0.121	3.22	25.0
KMN140905E	14	9	4.5	15	8	5.5	0.088	3.61	16.0
KMN211308E	21.3	13.6	8	22.3	12.6	9.0	0.240	5.48	33.0

Customers made and customers design are available.

Nanocrystalline Cores for Magnetic Amplifiers for Switched Mode Power Supplies



Features:

Nanocrystalline cores for magnetic amplifiers(Mag-Amp), are heat treated by longitudinal magnetic field, have high saturation flux density(B_s), high rectangle ratio(B_r/B_m), low coercivity(H_c) and high curie temperature.

Mag-Amp used nanocrystalline core has virtues of high efficiency, low temperature rise, small reset current, large working current, high working temperature.

Applications:

- > Desktop personal computer power supply
- > Server computer power supply
- > Switched mode power supply

Characteristics:

- > High saturation flux density $B_s=1.25T$ - Small size, lower turns
- > High rectangle ratio $B_r/B_m \geq 94\%$ - Low dead angle voltage, large working current
- > Low coercivity $H_c \leq 36A/M @ 100KHz, 80A/M$ - Low reset current, high efficiency

Specifications:

Part No.	Core dimension (mm)			Finished dimension (mm)			Eff. cross area (cm ²)	Mean path length (cm)	Saturation Flux (μWb)
	od	id	h	OD	ID	H	Ae	Lm	2Φm
KMN100705Z	10	7	4.5	12	5	6.8	0.053	2.67	12.4
KMN120803Z	12	8.4	3.2	14.7	5.9	5.4	0.045	3.20	10.6
KMN120804Z	11.8	8.7	4.2	13.9	6.8	6.0	0.051	3.22	11.9
KMN120805Z	12	8	4.5	14.7	6.2	6.8	0.070	3.14	16.5
KMN151005Z	15	10	4.5	17	8	7.1	0.088	3.93	20.6
KMN191505Z	19	15	5	21	13	6.6	0.078	5.34	18.3

Customers made and customers design are available.

We can also custom made **Co-based amorphous cores** for magnetic amplifier. Co-base mag-amp core has more lower coercivity and higher efficiency, suitable for high-end computer power supplies.

Amorphous Gap Cores



Features:

Amorphous gap cores have high saturation flux density, low core loss, high permeability, can withstand large working current. They are suitable for PFC choke, output filter inductor, solar inverter inductor.

Applications:

- > PFC choke
- > Output filter inductor
- > Solar inverter

Characteristics:

- > High saturation flux density -- Not easy to saturate, Large DC bias
- > Gap core -- Withstand large working current
- > Low core loss -- Low temperature rise

Specifications:

Part No.	Core dimension (mm)			Finished dimension (mm)			Eff. cross area (cm ²)	Mean path length (cm)	Gap (mm)	AL Value*
	od	id	h	OD	ID	H	Ae	Lm	Lg	AL
KMAG201208	20	12	8	21.7	10.8	9.9	0.28	5.0	0.5	0.125
KMAG261610	26	16	10	28.3	14.0	12.8	0.44	6.6	0.5	0.165
KMAG402515	40	25	15	44.4	22.0	18.8	0.99	10.2	0.8	0.240
KMAG603525	60	35	25	64.0	31.0	29.0	2.75	14.9	5.0	0.148

Customers made and customers design are available.

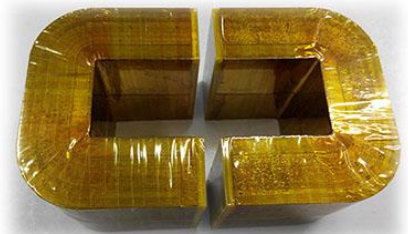
* AL Value is tested @ 1KHz, 0.25V, the value is only for reference. AL value is gap dependent, we can make different gap according to the inductance needed.

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Nanocrystalline and Amorphous
Cores and Components

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