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Automotive

Ferrite and Powder Cores in EVs and (P)HEVs

SAMWHA ELECTRONICS

About Samwha Electronics

Since its establishment in 1976, Samwha Electronics has been the leading manufacturer of soft magnetic cores and the core materials for electronics parts by striving to become the world's most prestigious brand.

Our main product site and head quarter is located in Korea but in order to establish production and sales base to be globalized, we have established and made an effort to stabilize China factory. By that effort, now we have become the most cost-effective and best performance company.

With specialized technologies and developing various magnetic materials to meet EVs and (P)HEVs requirements, Samwha Electronics has started to produce high performance ferrite and powder materials for OBCs, LDCs. Ferrite cores and magnetic powder cores (MPC) with High Flux(Ni-Fe), Sendust (Fe-Si-Al), Super Flux (Fe-Si) materials are under mass production.

Samwha Electronics will make continuous efforts to achieve customer satisfaction by supplying high-efficiency products that meet the needs of the eco-friendly automobile market.

Contents

Samwha Electronics makes superior materials and cores for EVs, (P)HEVs

Materials Selection Guide for Automotive

Applications	Usage	Preferred materials	Main core shapes	Mainly required characteristics
Evs and (P)HEVs - On Board Chargers (OBCs) - Low DC/DC Converters (LDCs)	PFC	PL-13 PL-15 High Flux	PQ, EER cores Toroids	High Saturation
	Rectifier IGBT/FET	PL-15 Super Flux	EE cores Toroids	High Saturation
	Inverters	PL-15	EE cores	Low losses
	Inductors	PL-13 PL-15	PQ cores EER(ETD) cores Planer cores	High Saturation Low losses
	Main Transformers	PL-13 PL-15 PL-17YH	PQ cores EER(ETD) cores Planer cores	Low Losses in Wide temp. range
	Common mode Filters/chokes	SM-70T SM-85T SM-100T	Toroids EE cores	High Curie Temperature
	EMC suppression	SM-70T	Toroids	High Impedance
	Current transformers	SM-70T	EP cores	High permeability
Electric Power Steering	Filters	SM-85T Sendust	Square cores Toroids	High permeability High saturation
Battery Management System (BMS)	Common mode Filters/chokes	SM-70T	Toroids EER cores	High permeability
	Transformers	PL-13	EFD cores EE cores	Low losses
Quick Charger	PFC	High Flux	Large Toroids	Low losses High saturation
	Inductor	PL-13	EE cores	High saturation
	Transformer	PL-13	PQ cores	Low Losses
	EMI Filter	SM-70T	Toroids	High Impedance
Low Frequency antenna	Antenna	SM-23T SM-43T	BAR cores	Temperature stability
Motor inverters	Common mode Filters/chokes	SM-70T SM-85T SM-100T	Toroids	High Curie Temperature
	Gate drive transformers	PL-13 PL-15	E cores	Low Losses SMD types
Battery Junction box	Bus bars	SM-70T SM-85T	U cores Rectangular shapes SS cores	High Impedance
Wireless charging	Common mode Filters/chokes	SM-70T SM-85T SM-100T	Toroids	High Impedance

◆ Benefit of Samwha Ferrite Cores

● Power Materials for LDCs and OBCs

1. PL-13 : Moderate Flux Density and Core losses

PL-13 material has a moderate saturation magnetic flux density and low core losses over the entire temperature range, making it an excellent choice for any type of electric vehicle. This material shows the best efficiency at frequencies below 200kHz.

2. PL-15 : Higher Flux density and lowest core losses at 100 degree Celsius

High Flux Density of PL-15 helps to achieve high output while reducing the volume of the core. By slowing down saturation even at high currents, it reduces the heat generated by transformers and inductors, allowing for more reliable designs.

3. PL-17YH : Extremely Low Losses at wide temperature range

Our power material, PL-17YH shows a stable overall performance without sudden energy loss at room temperature as well as at high temperatures of 140 degrees or higher. This enables maximum efficiency in a wide temperature range required by eco-friendly vehicles.

● Low Frequency (LF) Antenna

1. SM-23T : Stable permeability regardless of temperature change

SM-23 material maintains certain characteristics from extreme sub-zero temperatures to desert regions where the hot sun shines. Due to this high reliability, it is widely applied to LF antennas.

2. SM-43T : Higher permeability and insensitive to temperature changes

SM-43T with permeability of 4300 can be a good choice if you need higher permeability than SM-23T, which shows 2300 of permeability. SM-43T also has very little change in both low and high temperature range, so it is also a proper material to LF antennas.

● High Curie Temperature Materials

1. SM-70T : Higher Curie temperature, more than 180 degree Celsius

Filters used in electric vehicles must maintain electromagnetic properties even at high temperatures. Since SM-70T does not lose its unique characteristics even at 180 degrees Celsius, designers can use it with confidence.

2. SM-85T : Higher permeability with high Curie temperature

The higher the permeability, the wider the range of applications for designers. In addition, materials with high permeability show high impedance characteristics. This SM-85T material also maintains its properties up to 180 degrees Celsius.

3. SM-100T : Higher Curie temperature with permeability of 10000

Generally, the higher the Curie temperature, the lower the permeability. However, our SM-100T is a material that can withstand temperatures up to 145 degrees Celsius, making it a great option for designers.

OBCs

The battery should be charged from a standard power outlet, no matter what kinds of type, battery electrical vehicles and plug-in hybrid electrical vehicles. The On-Board Charger (OBC) provides the means to recharge the battery from the AC mains either at home or from outlets found in private or public charging stations.
On-Board Chargers should be met to the today's requirement which need highest possible efficiency and reliability. The goal is to make charging faster with smaller space and weight.
Samwha Electronics has a wide offer of discrete soft ferrites cores including cost-effective and energy-efficient solutions for implementing these challenging converters.
PL-13, PL-15 and PL-17YH materials have good performance at high temperature, so they are widely used for modern design of electrical vehicles.

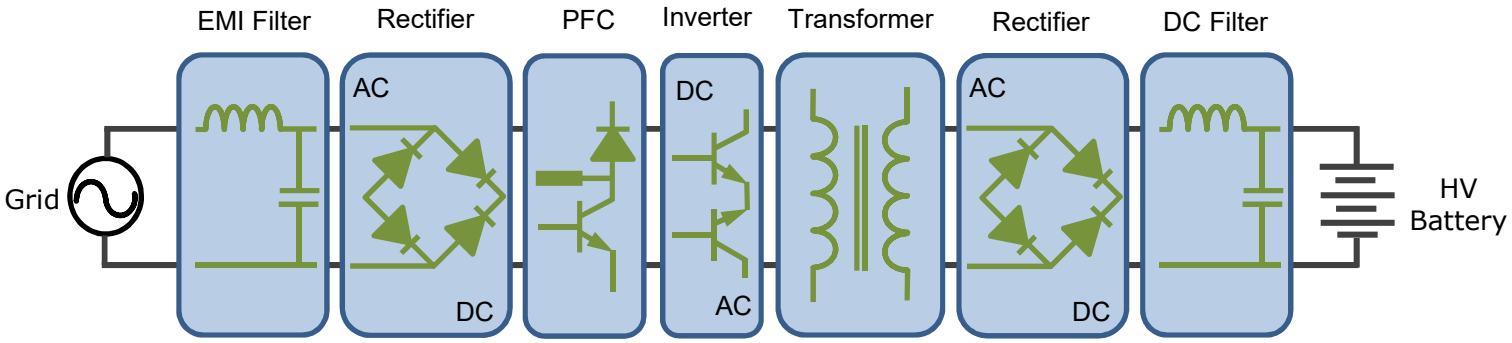


Fig 1. Simplified diagram of On Board Chargers(OBCs)

LDCs

LDCs are a low-voltage DC/DC converters that consists of a DC input and DC output devices in a HEV/EV/FCEV vehicles. It converts the accumulated electrical energy into a low voltage, HV to 48V, HV to 12V, and 48V to 12V in the various configurations of electric vehicles, and supplies the operating power of the vehicle electric load. The key design requirements for DC-DC converters are low losses, high efficiency, low volume and light weight.
Samwha Electronics has a suitable materials such as PL-13, PL-15 and PL-17YH that meets these requirements and has built up a cooperative relationship with customers for a long time.
We are confident that our various shapes and materials which accumulated over the years will help our customers design effective and efficient.

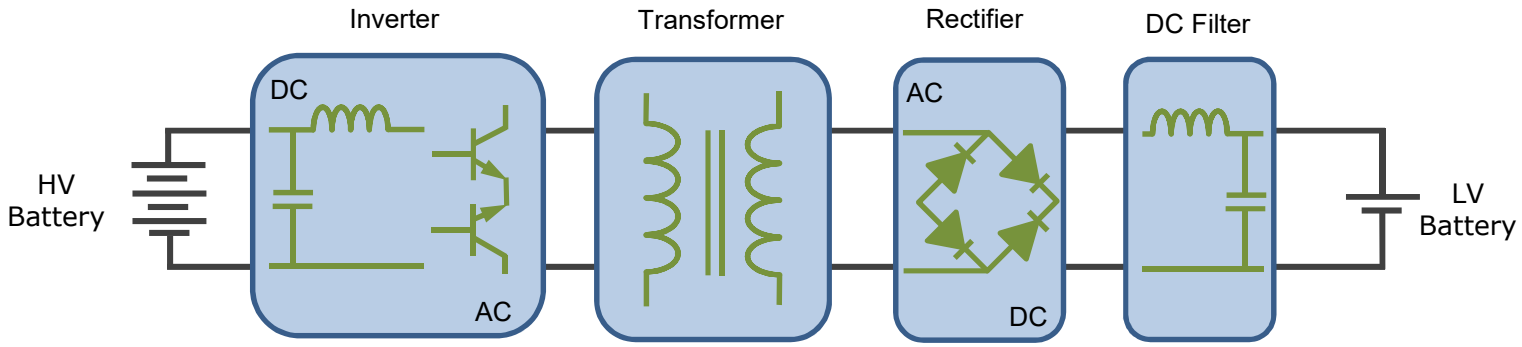


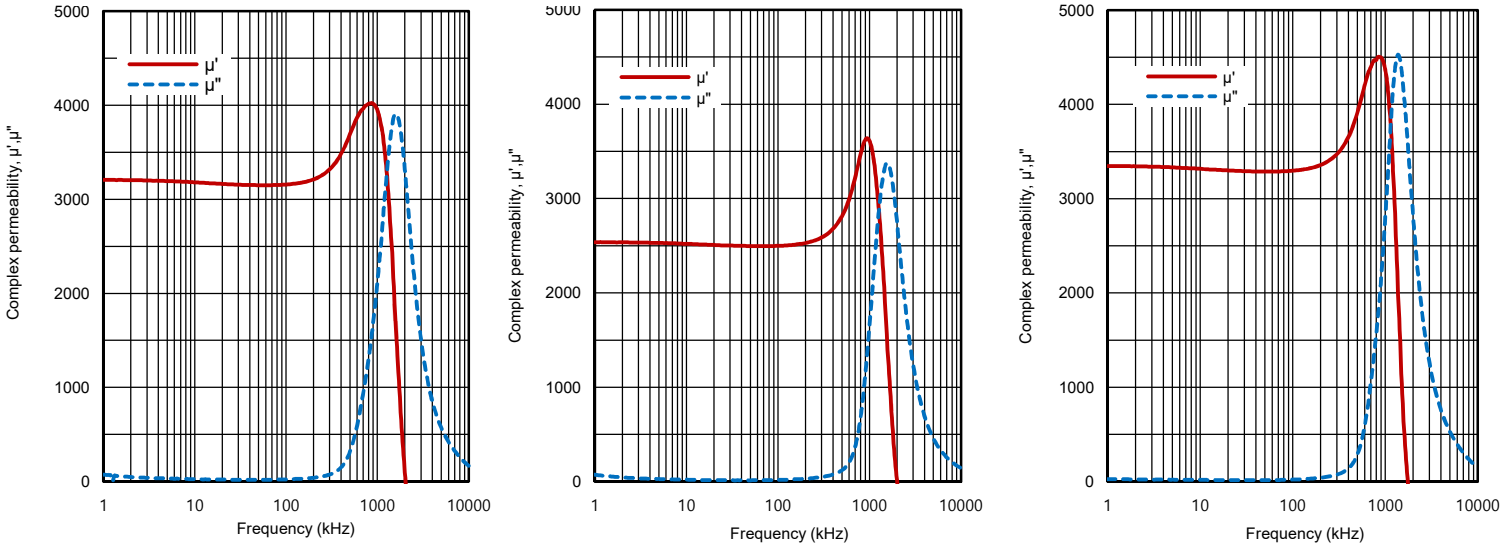
Fig 2. Simplified diagram of Low DC/DC Converters(LDCs)

Power Materials for OBCs and LDCs

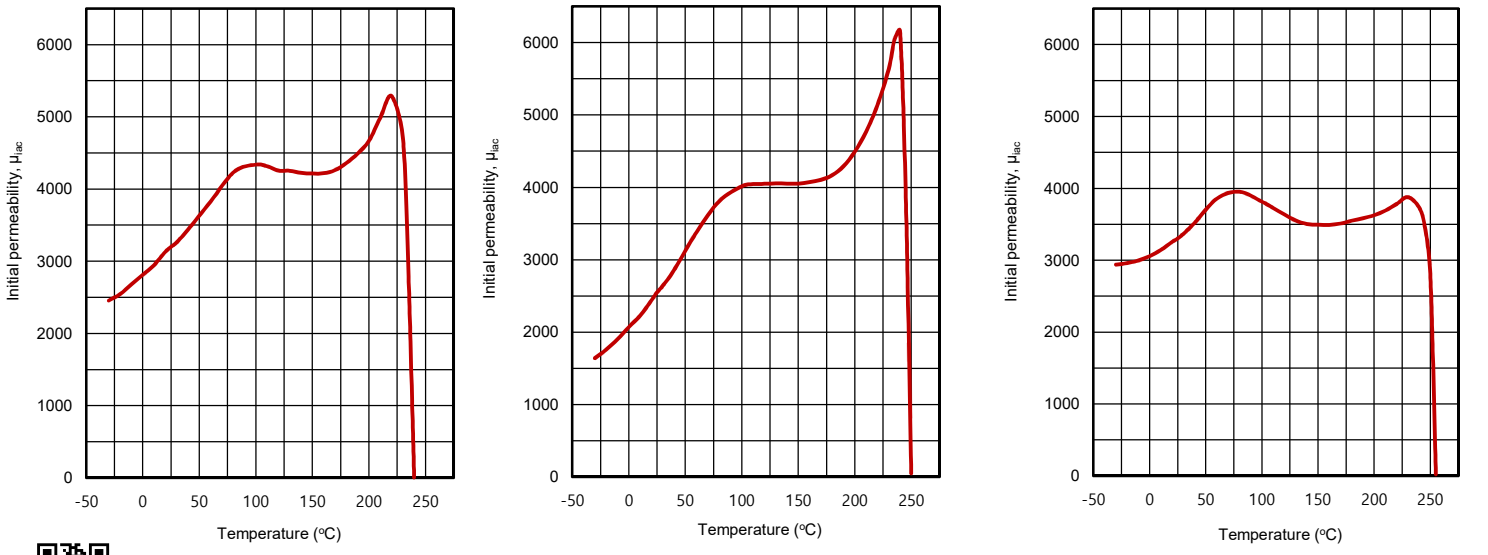
Characteristics	Symbol	Unit	Conditions	PL-13	PL-15	PL-17YH
Initial permeability	μ_{iac}		25℃	3200 ±25%	2500 ±25%	3300 ±25%
Core loss (100kHz, 200mT)	Pcv	kW/m^3	25℃	400	600	350
			80℃	300	320	280
			100℃	340	250	310
			120℃	400	350	350
Saturation flux density (1194A/m)	Bs	mT	25℃	520	530	530
			100℃	410	420	420
Remanence	Br	mT	25℃	60	150	55
Coercivity	Hc	A/m	25℃	8	10	7
Curie temperature	Tc	℃		> 220	> 230	> 220
Density	d	kg/m^3		4.90×10^3	4.90×10^3	4.90×10^3
Resistivity	ρ	Ω·m	25℃	> 7.0	> 5.0	> 7.0

PL-13 **PL-15** **PL-17YH**

Complex permeability vs. Frequency



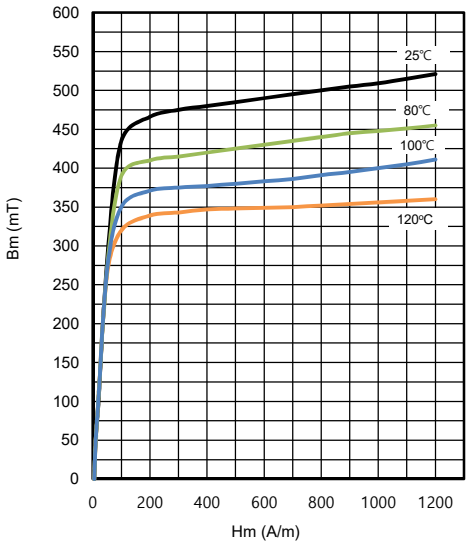
Initial permeability vs. Temperature



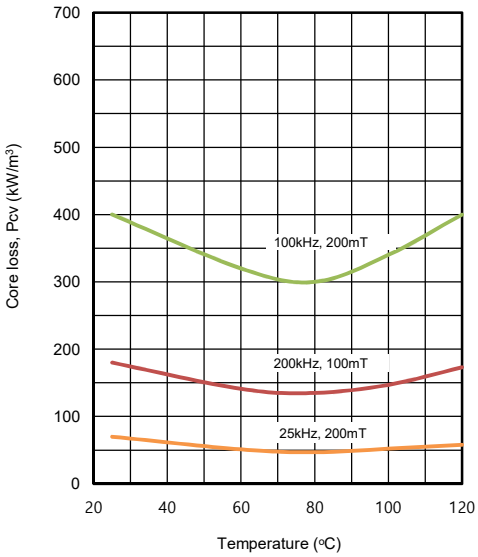
Power Materials for OBCs and LDCs

PL-13

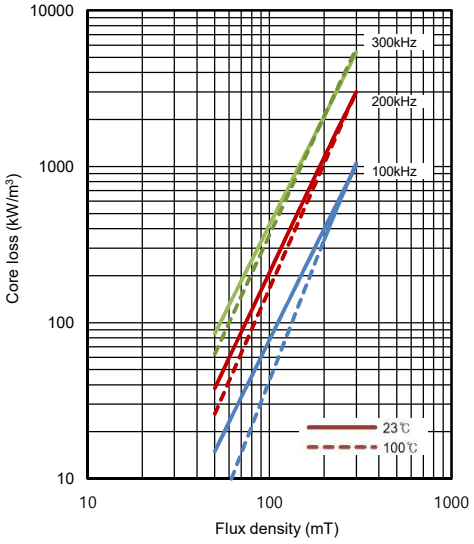
Bm vs. Hm



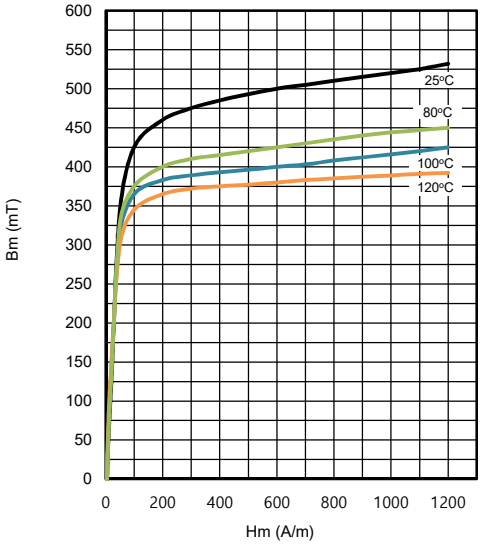
Core loss vs. Frequency

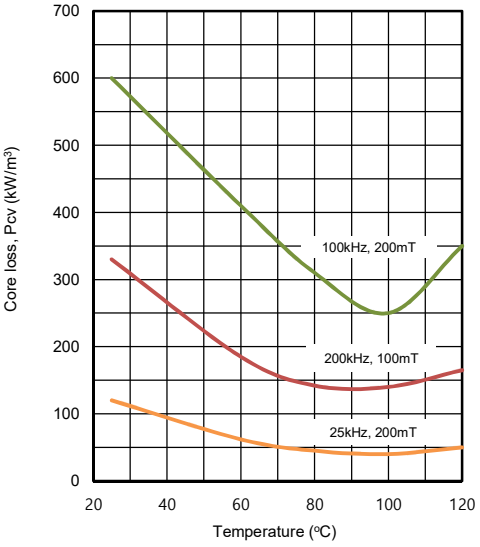


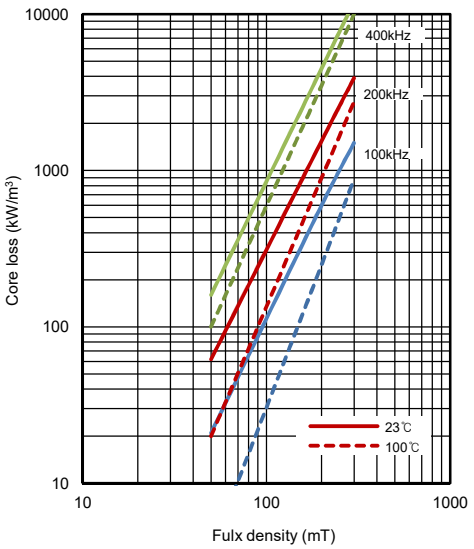
Core loss vs. Flux density



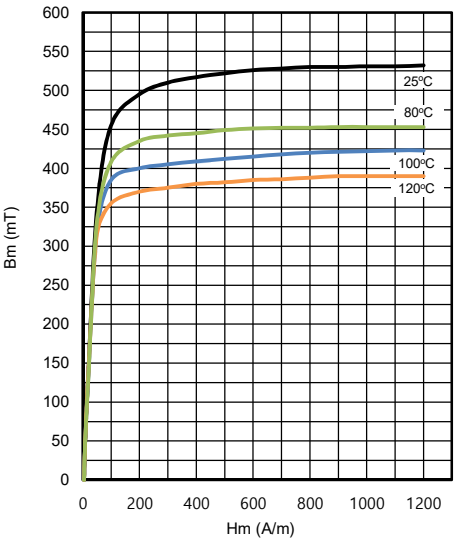
PL-15

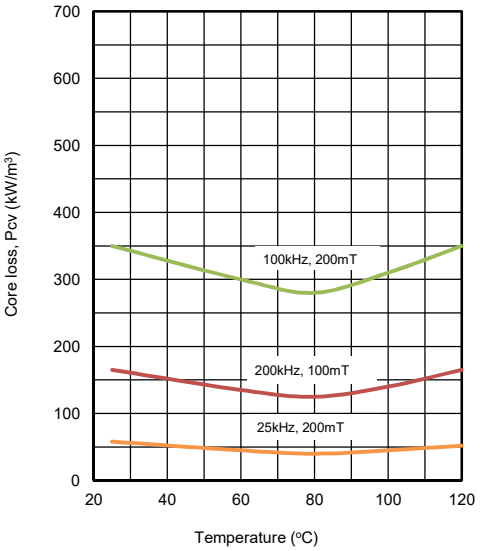


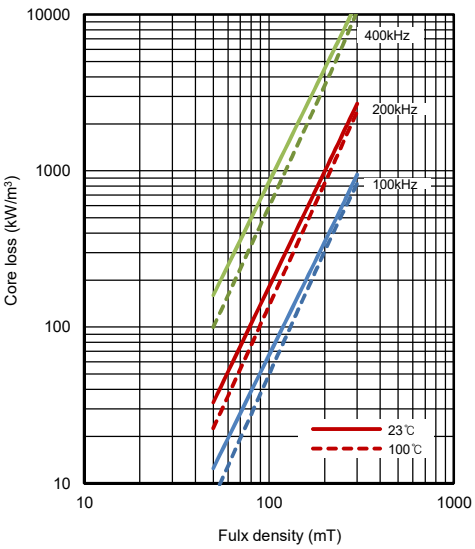




PL-17YH





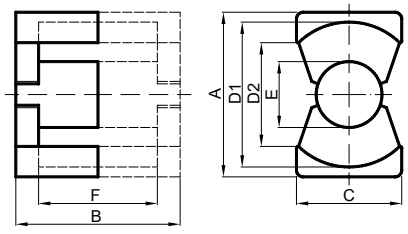


Products List for OBCs and LDCs

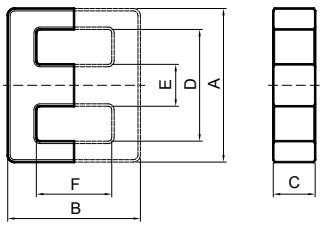
Part no.	Available materials	A	B	C	D, D1	D2 (min)	E	F	Fig.
PQ1716	PL-13, PL-15, PL-17YH	17.00	16.20	11.00	13.00	9.00	7.00	10.30	PQ
PQ2020	PL-13, PL-15, PL-17YH	20.50	20.20	14.00	18.00	12.00	8.80	14.30	PQ
PQ2625	PL-13, PL-15, PL-17YH	26.50	24.75	19.00	22.50	15.50	12.00	16.10	PQ
PQ3019	PL-13, PL-15, PL-17YH	30.00	19.00	20.50	25.25	18.50	13.30	13.00	PQ
PQ3220	PL-13, PL-15, PL-17YH	32.00	20.55	22.00	27.50	19.00	13.45	11.50	PQ
PQ3230	PL-13, PL-15, PL-17YH	32.00	30.35	22.00	27.50	19.00	13.45	11.50	PQ
PQ3535	PL-13, PL-15, PL-17YH	35.10	34.75	26.00	32.00	23.50	14.35	25.00	PQ
PQ3813	PL-13, PL-15, PL-17YH	38.00	13.00	21.32	32.80	25.84	14.30	7.00	PQ
PQ4040	PL-13, PL-15, PL-17YH	40.50	39.75	28.00	37.00	28.00	14.90	29.50	PQ
PQ5050	PL-13, PL-15, PL-17YH	50.00	49.95	32.00	44.00	31.50	20.00	36.10	PQ
PQ5550	PL-13, PL-15, PL-17YH	55.00	49.95	32.00	49.00	38.50	20.00	36.10	PQ
PQ6060	PL-13, PL-15, PL-17YH	60.48	60.60	39.20	50.62	35.14	28.00	46.60	PQ
PQ7070	PL-13, PL-15, PL-17YH	70.00	65.40	40.00	60.00	46.70	30.00	49.40	PQ
EE4242	PL-13, PL-15, PL-17YH	42.00	42.40	20.00	29.50	-	12.20	30.00	EE
EE5555	PL-13, PL-15, PL-17YH	55.15	55.00	24.70	38.10	-	16.95	37.60	EE
EE6565	PL-13, PL-15, PL-17YH	65.15	65.00	27.00	45.10	-	19.65	45.20	EE
EE7066	PL-13, PL-15, PL-17YH	70.00	33.00	31.60	48.60	-	21.50	22.20	EE
EE8076	PL-13, PL-15, PL-17YH	80.00	76.10	20.00	60.00	-	20.00	56.10	EER
EER3032(ETD29)	PL-13, PL-15, PL-17YH	29.80	31.60	9.50	22.70	-	9.50	22.00	EER
EER3435(ETD34)	PL-13, PL-15, PL-17YH	34.20	34.60	10.80	26.30	-	10.80	24.20	EER
EER3940(ETD39)	PL-13, PL-15, PL-17YH	39.10	39.60	12.50	30.10	-	12.50	29.20	EER
EER4045	PL-13, PL-15, PL-17YH	40.00	44.80	13.30	29.70	-	13.30	30.80	EER
EER4445(ETD44)	PL-13, PL-15, PL-17YH	44.00	44.60	14.80	33.30	-	14.80	33.00	EER
EER4950(ETD49)	PL-13, PL-15, PL-17YH	48.70	49.40	16.30	37.00	-	16.30	36.20	EER
EER5455(ETD54)	PL-13, PL-15, PL-17YH	54.50	55.20	18.90	41.20	-	18.90	40.40	EER
EER6062(ETD59)	PL-13, PL-15, PL-17YH	59.80	62.00	21.65	44.70	-	21.65	45.00	EER

Other shapes and materials are available.

PQ



EE



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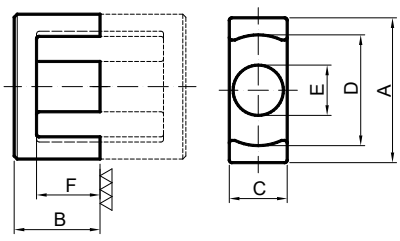
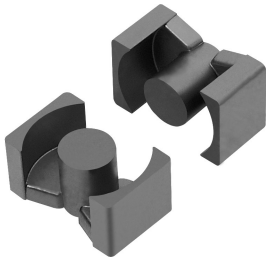
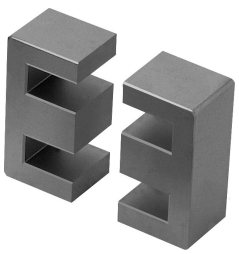
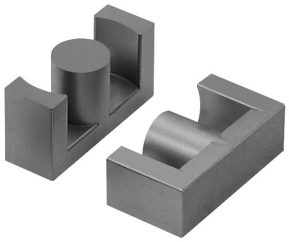








High Curie Temperature Materials

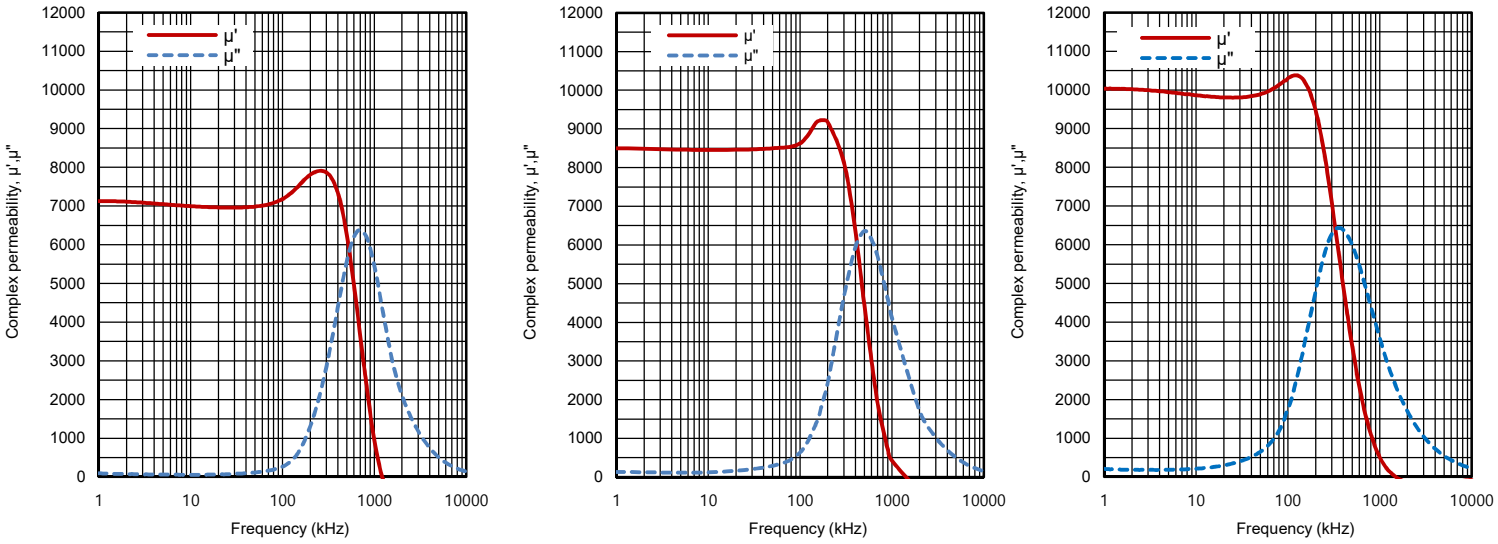
Electric vehicles are composed of power conversion devices such as inverters, converters, OBCs, and LDCs, as well as charging modules, and require high-voltage power.
The high-voltage battery charged through an external quick charger and OBCs. HV battery supply electricity to the LDC, motor control unit, etc. through the power conversion device and BUS BARs. In this process, the function of the filter is essential, and a ferrite material that maintains high-performance impedance characteristics even in a high-temperature environment is required.
The high curie temperature and high permeability materials produced by Samwha Electronics are designed to exhibit performance up to 145~180 degree Celsius without losing its inherent properties. The customer can easily select the material that implements the required electromagnetic properties according to the permeability and will be satisfied with the performance.

Material characteristics

Characteristics	Symbol	Unit	Conditions	SM-70T	SM-85T	SM-100T NEW
Initial permeability	μ_{iac}		25℃	7000 ±25%	8500 ±25%	10000 ±30%
Relative loss factor	$\tan\delta/\mu_{iac}$	x 10^{-6}	10kHz, 25℃	< 1.5	1.5	< 3.0
Saturation flux density (1194A/m)	Bs	mT	25℃	480	480	440
			100℃	340	340	270
Remanence	Br	mT	25℃	80	80	110
Coercivity	Hc	A/m	25℃	4	4	4
Relative temp. factor	αμr	x10^{-6}/℃	20~60℃	-0.1~0.5	-1~0.5	-0.5 ~ 0.5
Hysterisis material constant	ηB	x10^{-6}/mT	10kHz, 25℃	< 0.5	< 0.5	<0.5
Curie temperature	Tc	℃		> 180	> 180	> 145
Density	d	kg/m^3		4.90×10^3	4.90×10^3	4.95×10^3
Resistivity	ρ	Ω·m	25℃	> 0.5	> 0.5	> 0.2

SM-70T **SM-85T** **SM-100T**

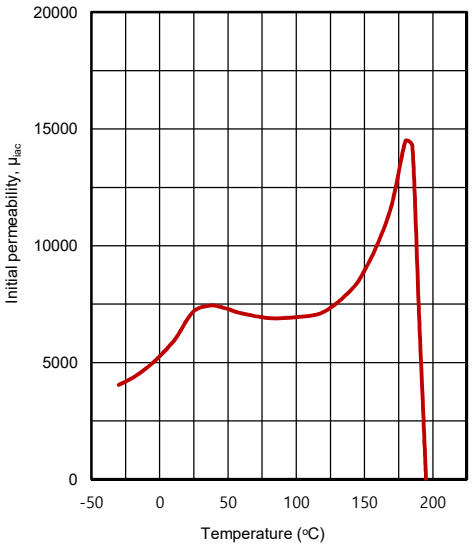
Complex permeability vs. Frequency



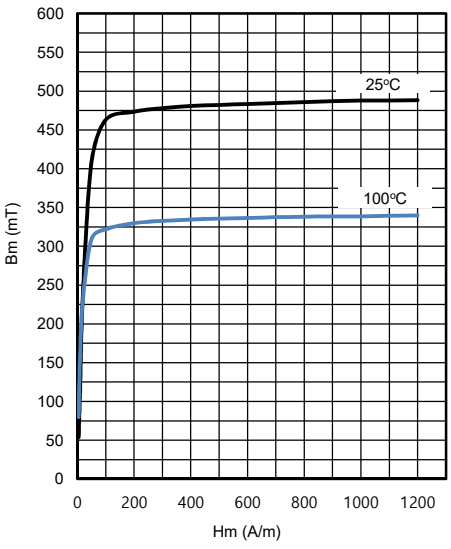
High Curie Temperature Materials

SM-70T

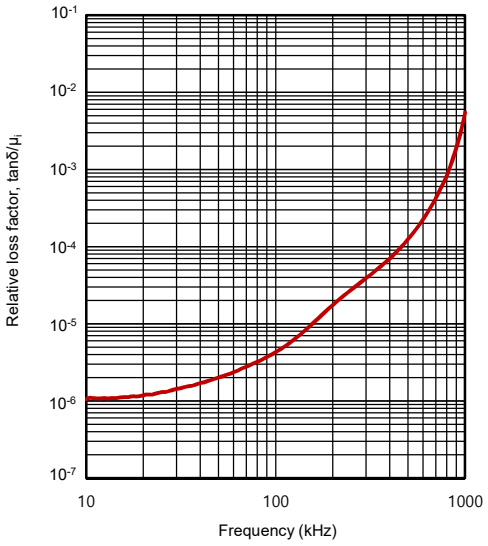
Initial permeability vs. Temperature



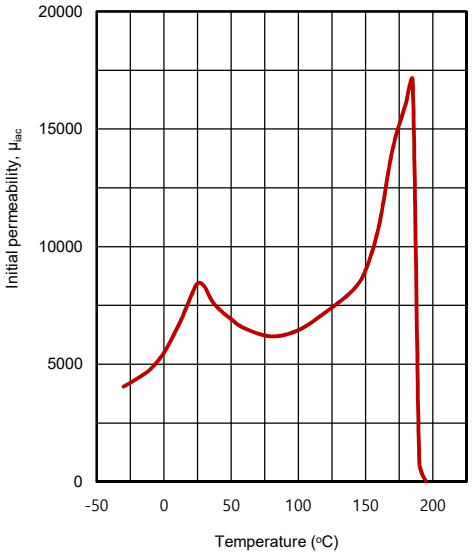
Bm vs. Hm

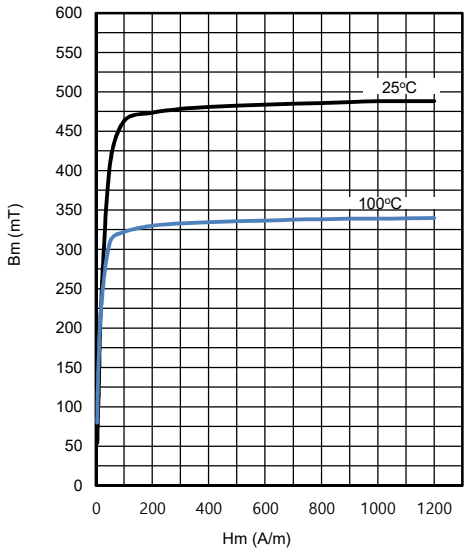


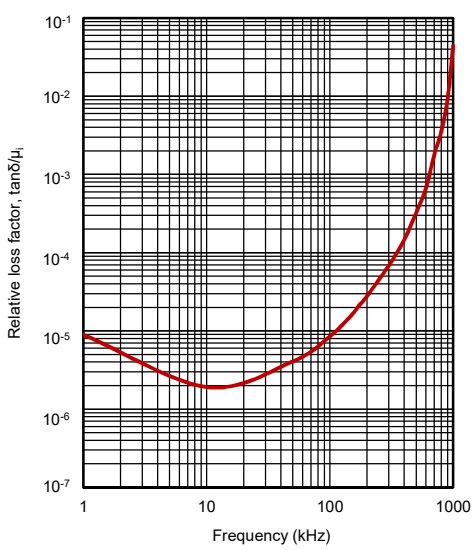
tanδ/μi vs. Frequency



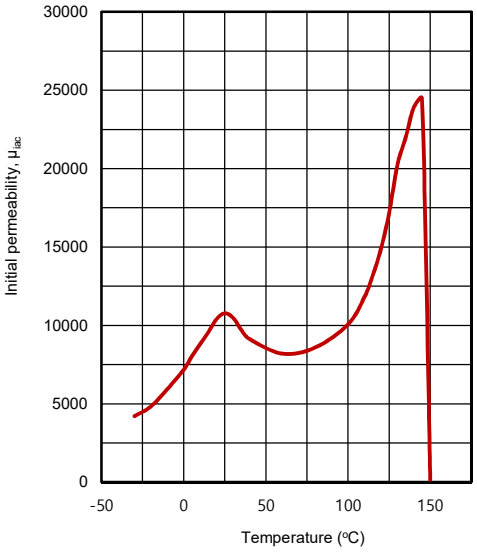
SM-85T

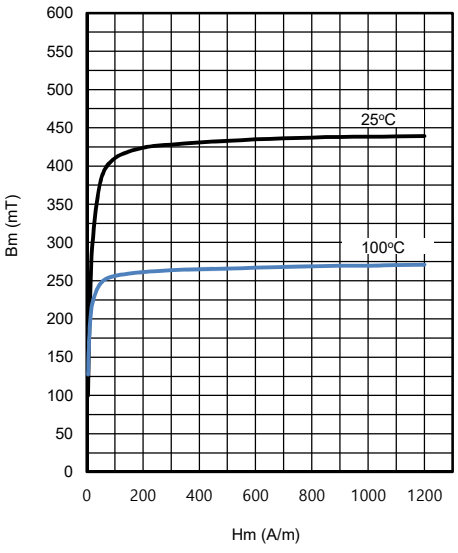


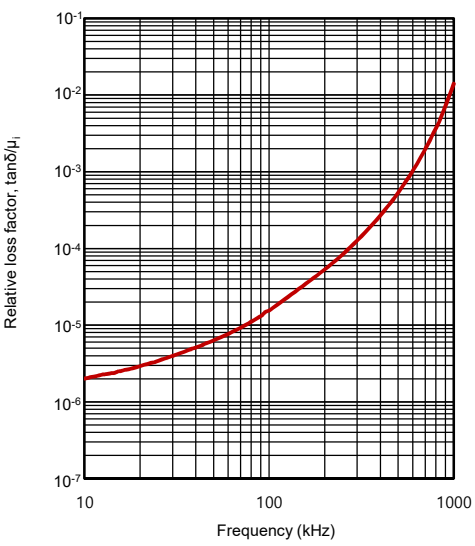




SM-100T





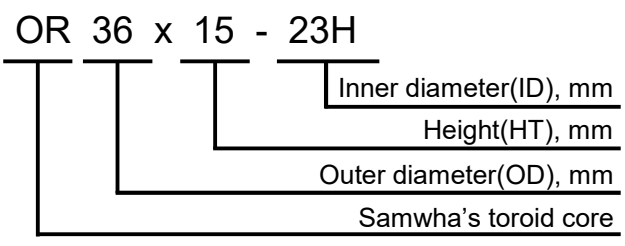


Products List for High Curie Temperature

Part No.	Dimensions[mm] OD × ID × HT			Core constant C1 [mm^{-1}]	Effective Path Length ℓe [mm]	Effective Cross Section Ae [mm^2]	Window Area Aw [mm^2]	Effective Volume Ve [mm^3]
	Before Coating [mm]							
OR10×4-6H	10.00	6.00	4.00	3.080	24.1	7.8	28.3	188
OR12.7×4.7-7.1H	12.70	7.10	4.70	2.300	29.4	12.8	39.6	376
OR14×7-7.5H	14.00	7.50	7.00	1.440	31.7	22.0	44.2	698
OR16x7-10H	14.00	10.00	7.00	1.907	39.3	20.6	78.5	810
OR19×10-10H	19.00	10.00	10.00	0.920	42.1	45.7	75.4	1923
OR20×10-10H	20.00	10.00	10.00	0.910	43.6	48.1	78.5	2092
OR22.1×6.35-13.7H	22.10	13.70	6.35	2.070	54.2	26.2	147.3	1417
OR25×12.5-15H	25.00	15.00	12.50	0.980	60.2	61.2	176.6	3681
OR26×15-16H	26.00	16.00	15.00	0.860	63.5	73.5	201.0	4666
OR28×13-16H	28.00	16.00	13.00	0.860	65.6	76.0	201.0	4988
OR29×7.5-19H	29.00	19.00	7.50	1.980	73.2	37.0	28.4	2704
OR31×13-19H	31.00	19.00	13.00	0.990	75.5	76.5	283.4	5772
OR36×15-23H	36.00	23.00	15.00	0.930	89.7	95.9	415.3	8596
OR38×13-19H	38.00	19.00	13.00	0.720	82.9	115.7	284.9	9585
OR40×16-24H	40.00	24.00	16.00	0.769	96.3	125.3	452.0	12066
OR41.8x17.5-26.2H	41.80	26.20	17.50	0.769	103.0	134.0	539.0	13800
OR44.6×16-20H	44.60	20.00	15.90	0.493	91.4	185.4	314.0	16946
OR48×16-30H	48.00	30.00	16.00	0.840	118.1	141.4	706.5	16700
OR49×16-34H	49.10	33.80	15.90	1.060	127.2	120.2	896.8	15298
OR51.5×13.5-31.5HU	51.50	31.50	13.50	0.988	125.3	126.8	779.0	15888
OR60×18-40H	60.00	40.00	18.00	0.860	152.9	177.6	1256.0	27140
OR63×25-38H	63.00	38.00	25.00	0.490	152.0	306.0	1133.5	46512
OR74×13-39H	73.66	38.86	12.70	0.770	165.3	213.6	1185.4	35298

Epoxy and powder coating are optional. Other shapes and materials are available.

● Part numbering system



Low Frequency (LF) Antenna

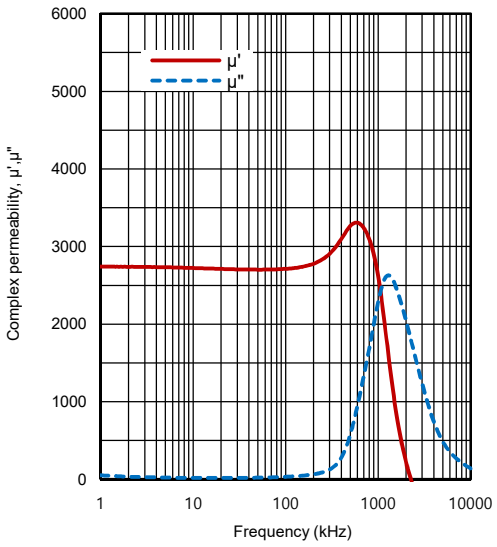
The function of the smart key is the addition of LF(Low frequency) communication technology to the remote key function. LF communication is a technology that identifies the location of a smart key held by a driver using an antenna installed on the vehicle. Through this, the smart key holder unlocks the lock by pressing the door button at the front of the car, and can start the engine by pressing it.
LF communication technology accurately determines the location of the smart key, estimates the location of the holder, and operates the function, so accurate recognition distance is very important.
To meet these requirements, Samwha Electronics' ferrite materials are designed with extremely stable properties no matter what the temperature change, from polar and tropical regions. SM-23T which has the permeability of 2300 is widely used for this LF antenna application, and in case that higher permeability is required, SM-43T shows best performance as well.

Temperature Stability Materials

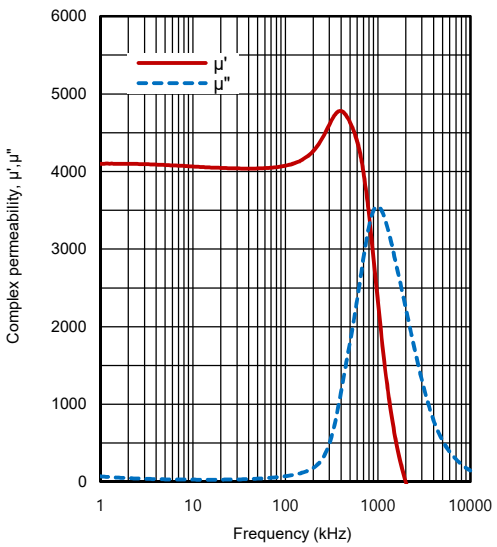
Characteristics	Symbol	Unit	Conditions	SM-23T	SM-43T
Initial permeability	μ_{iac}		25℃	2300 ±25%	4300 ±25%
Relative loss factor	$\tan\delta/\mu_{iac}$	x 10^{-6}	10kHz, 25℃	< 3.0	< 5
Saturation flux density (1194A/m)	Bs	mT	25℃	460	450
Remanence	Br	mT	25℃	60	40
Coercivity	Hc	A/m	25℃	10	5
Relative temp. factor	αμr	x 10^{-6}/℃	-30~20℃	-0.5 ~ 0.5	-0.5 ~ 0.5
			0~20℃	-0.5 ~ 0.5	0 ~ 1.0
			20~70℃	0 ~ 1.0	0 ~ 1.0
Hysterisis material constant	ηB	x 10^{-6}/mT	10kHz, 25℃	<0.5	<0.8
Curie temperature	Tc	℃		> 170	> 160
Density	d	kg/m^3		4.80×10^3	4.80×10^3
Resistivity	ρ	Ω·m	25℃	> 7	> 5

SM-23T

Complex permeability vs. Frequency



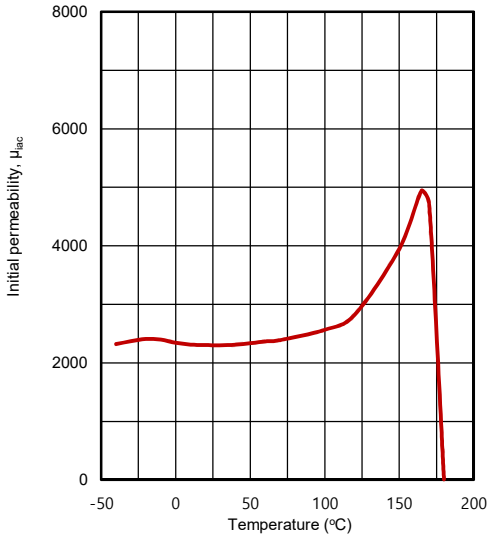
SM-43T



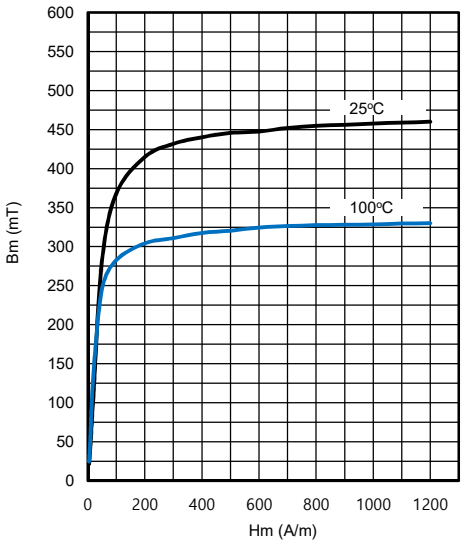
Temperature Stability Materials

SM-23T

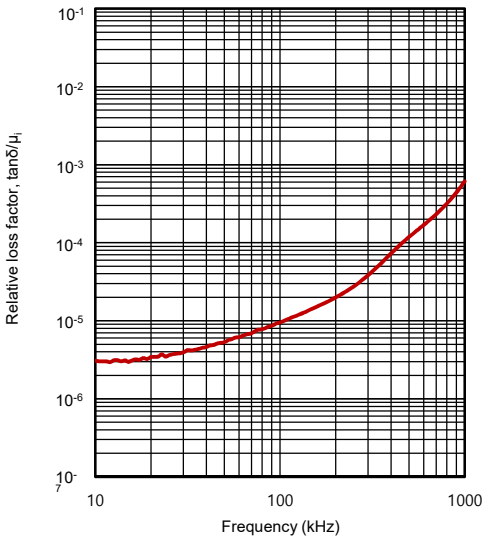
Initial permeability vs. Temperature



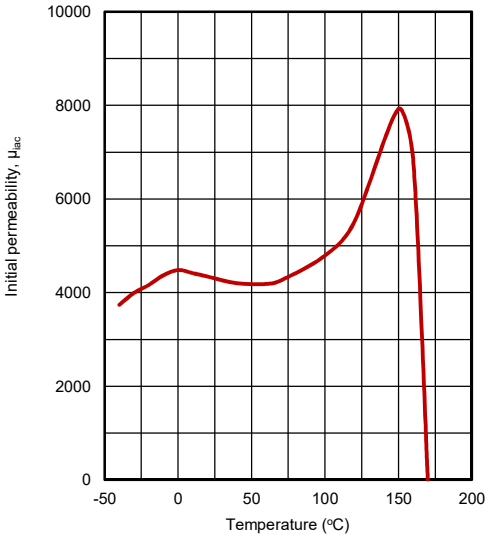
Complex permeability vs. Frequency

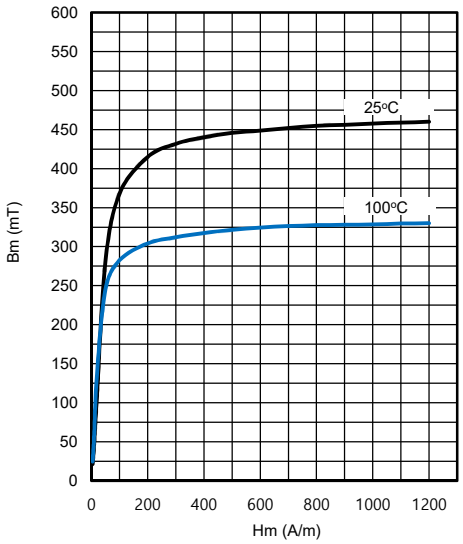


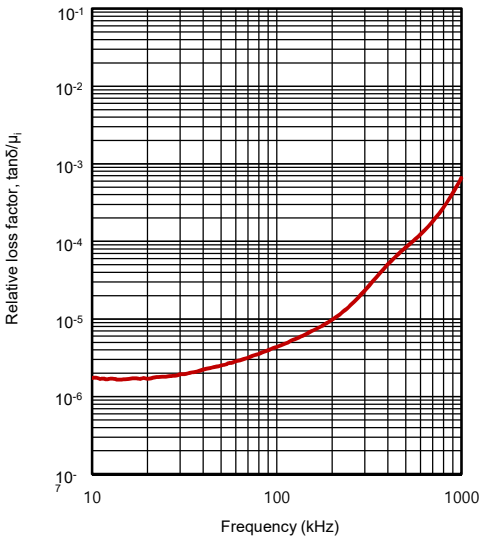
tanδ/μi vs. Frequency



SM-43T





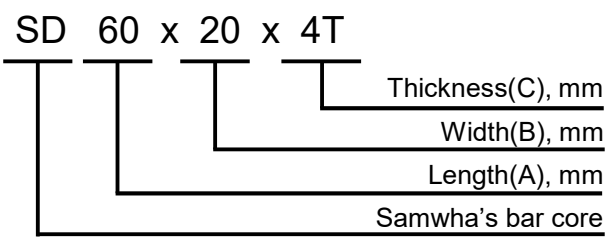


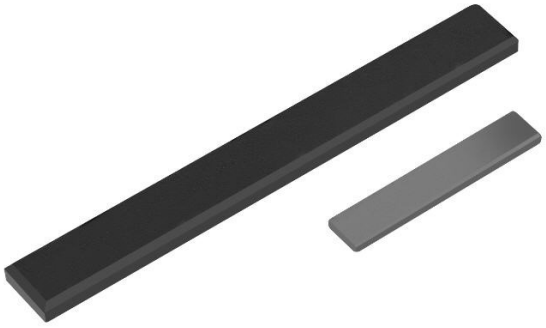
Products List for Low Frequency Antenna

Part no.	Materials	Length(A) [mm]	Width(B) [mm]	Thickness(C) [mm]
SD35×15×5T	SM-23T, SM-43T	35.00 ± 0.40	15.00 ± 0.30	5.00 ± 0.15
SD40×15×5T	SM-23T, SM-43T	40.00 ± 0.50	15.00 ± 0.30	5.00 ± 0.15
SD47×9×3T	SM-23T, SM-43T	47.00 ± 0.40	9.00 ± 0.20	3.00 ± 0.10
SD50×8×2.5T	SM-23T, SM-43T	50.00 ± 0.70	8.00 ± 0.15	2.50 ± 0.10
SD50×10×2.5T	SM-23T, SM-43T	50.00 ± 0.40	10.00 ± 0.20	2.50 ± 0.10
SD50×12×3T	SM-23T, SM-43T	50.00 ± 0.40	12.00 ± 0.20	3.00 ± 0.10
SD53×7×2T	SM-23T, SM-43T	53.00 ± 0.40	7.00 ± 0.15	2.00 ± 0.10
SD53×12×3T	SM-23T, SM-43T	53.00 ± 0.40	12.00 ± 0.20	3.00 ± 0.10
SD60×8×4T	SM-23T, SM-43T	60.00 ± 0.50	8.00 ± 0.20	4.00 ± 0.20
SD60×16×3.8T	SM-23T, SM-43T	60.00 ± 0.50	16.00 ± 0.20	3.80 ± 0.15
SD60×20×4T	SM-23T, SM-43T	60.00 ± 0.70	20.00 ± 0.30	4.00 ± 0.15
SD63×7×2.5T	SM-23T, SM-43T	63.00 ± 0.40	7.00 ± 0.15	2.50 ± 0.10
SD65×15×5T	SM-23T, SM-43T	65.00 ± 0.60	15.00 ± 0.20	5.00 ± 0.20
SD66×12×3T	SM-23T, SM-43T	65.60 ± 0.70	12.00 ± 0.20	3.00 ± 0.10
SD68×7×3T	SM-23T, SM-43T	68.00 ± 0.70	7.00 ± 0.20	3.00 ± 0.20
SD70×15×5T	SM-23T, SM-43T	70.00 ± 0.70	15.00 ± 0.30	5.00 ± 0.30
SD75×15×5T	SM-23T, SM-43T	75.00 ± 0.70	15.00 ± 0.30	5.00 ± 0.20
SD80×12×5T	SM-23T, SM-43T	80.00 ± 0.70	11.75 ± 0.30	4.90 ± 0.20
SD80×15×5T	SM-23T, SM-43T	80.00 ± 0.70	15.00 ± 0.30	5.00 ± 0.20
SD90×8×4T	SM-23T, SM-43T	90.00 ± 0.70	8.00 ± 0.20	4.00 ± 0.20
SD100×12×5T	SM-23T, SM-43T	100.00 ± 1.20	12.00 ± 0.30	5.00 ± 0.20
SD105×15×5T	SM-23T, SM-43T	105.00 ± 1.00	15.00 ± 0.20	5.00 ± 0.20
SD110×10×3.2T	SM-23T, SM-43T	110.00 ± 1.00	10.00 ± 0.20	3.20 ± 0.20
SD124×6.5×3T	SM-23T, SM-43T	124.00 ± 1.20	6.50 ± 0.20	3.00 ± 0.10

Other shapes and materials are available.

● Part numbering system





Magnetic Powder Cores

Magnetic Powder Cores (MPC) are metal powder alloy cores designed to have low loss in a wide range of frequencies by insulating magnetic metal alloy powder. Since all the fine particles that make up the core are insulated and evenly distributed in the core, it does not easily saturate even when a high current flows. MPC is classified into MPP, High Flux, Sendust, Fe-Si (our name is Super Flux), and each material has its own composition. Among them, the material used for general purpose is Sendust (Fe-Si-Al), but as the use of high current increases in Electric Vehicles, the market is rapidly shifting to High Flux (Ni-Fe) or Super Flux (Fe-Si).

Samwha Electronics offers good solutions not only for ferrite cores but also for metal powder cores. Designers will be able to optimal circuits design through Samwha's soft magnetic core in response to higher frequencies and higher currents.

Benefit of Samwha Powder Cores

1. Higher DC Biased Characteristics

- Sendust is very common for normal DCB characteristics , if higher required, High Flux and Super Flux could be best solution for designers.

2. Variety of Shapes

- Toroid cores are in common, and other shapes such as E and Cylinder, Blocks cores also available in production.

3. Variety of Coating materials

- For reinforcement of insulation for harsh environment, powder coating is recommended and process is in house. Spray coating method is also optional.

4. Temperature stability

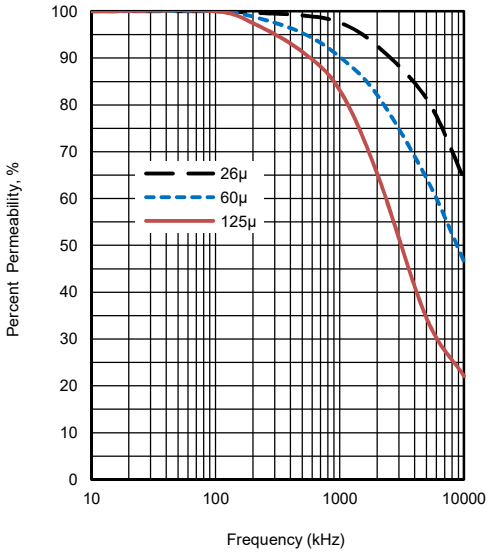
- Extremely stable with electrical characteristics for temperature change

Magnetic powder cores materials

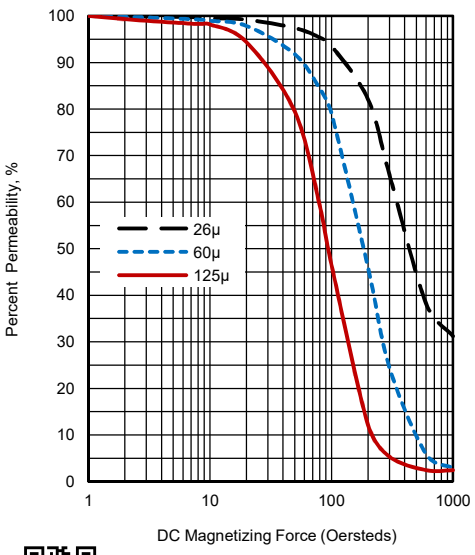
Characteristics	Symbol	Unit	Conditions	High Flux	Super Flux	Sendust
Material alloy				Ni-Fe	Fe-Si	Fe-Si-Al
Permeability	μ		25℃	26, 60, 125	26, 60, 90	26, 60, 125
Saturation flux density	Bs	G	25℃	15000	16000	10000
Core loss (Permeability 60μ)	Pcv	kW/m^3	25kHz, 1000G	130	280	130
			50kHz, 1000G	300	670	300
			100kHz, 1000G	750	1700	670
			200kHz, 1000G	2150	5300	2050
DC Biased (@100Oe)	DCB	%	26μ	93	-	75
			60μ	80	72	48
			90μ	-	56	30
			125μ	47	-	19
Curie temperature	Tc	℃		500	700	500
Density (Permeability 60μ)	d	kg/m^3		7.30×10^3	6.80×10^3	5.80×10^3

High Flux

Permeability vs. Frequency

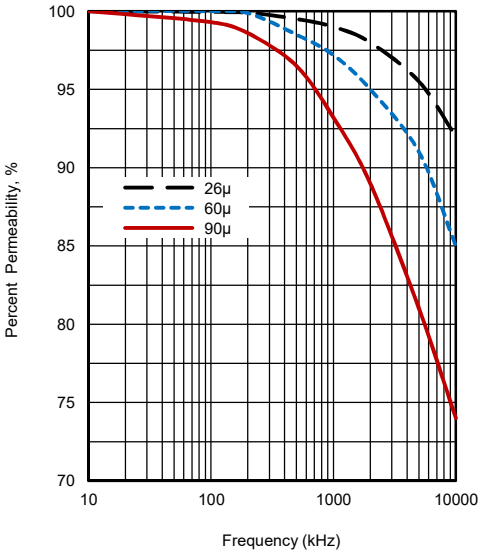


Permeability vs. DC Bias

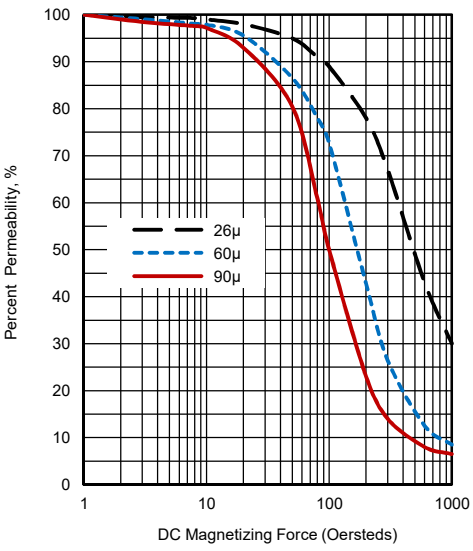


Super Flux

Permeability vs. Frequency

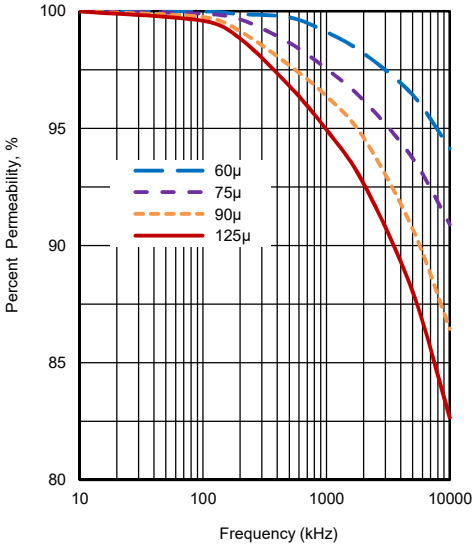


Permeability vs. DC Bias

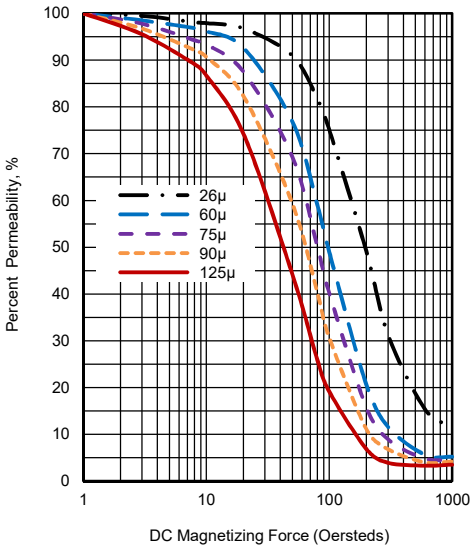


Sendust

Permeability vs. Frequency



Permeability vs. DC Bias



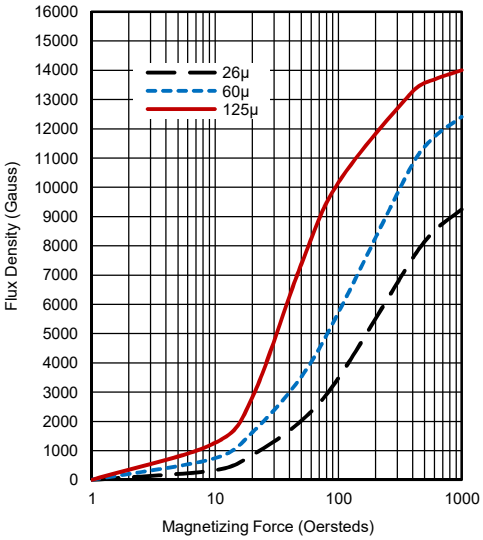
Magnetic powder cores materials

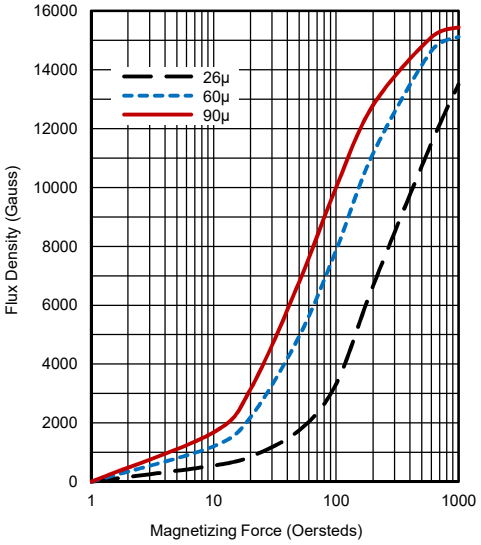
High Flux

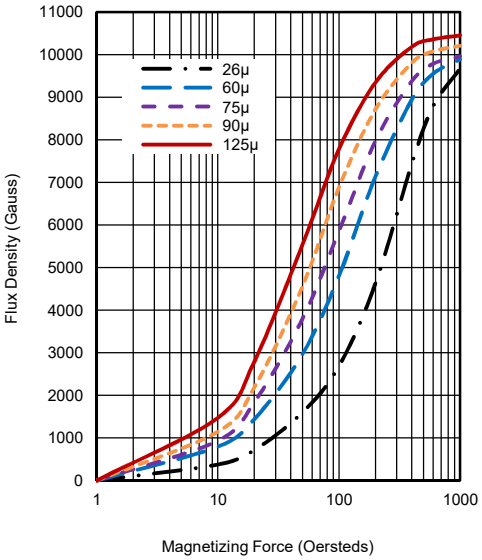
Super Flux

Sendust

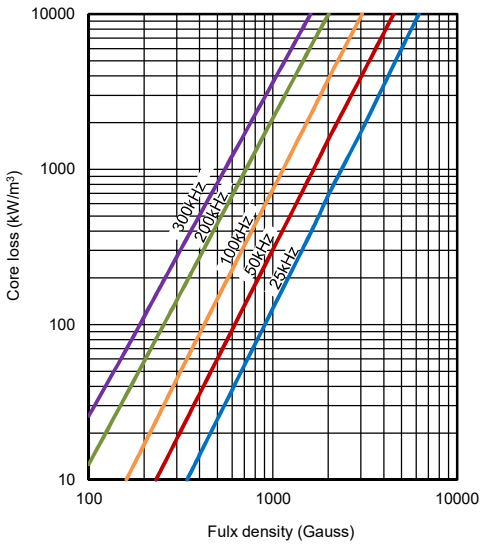
Normal magnetization

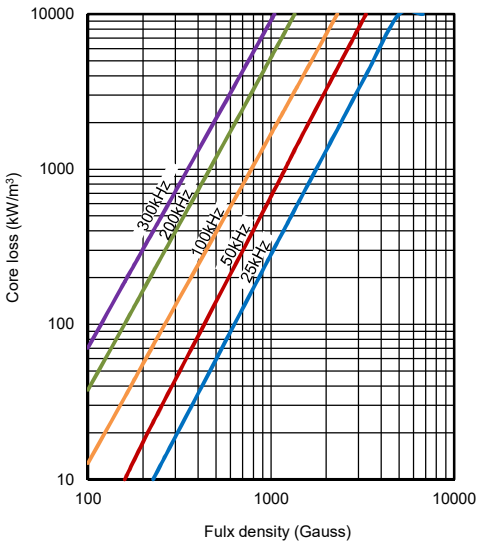


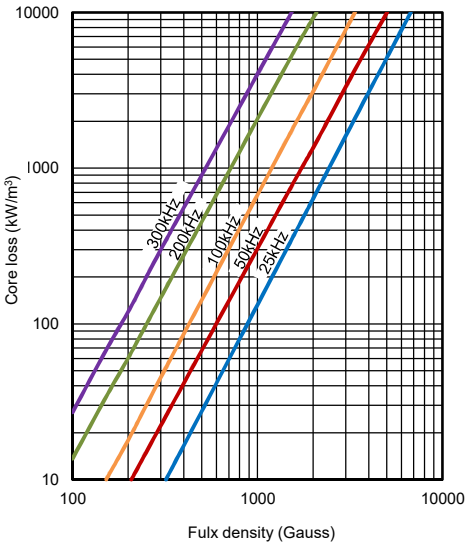




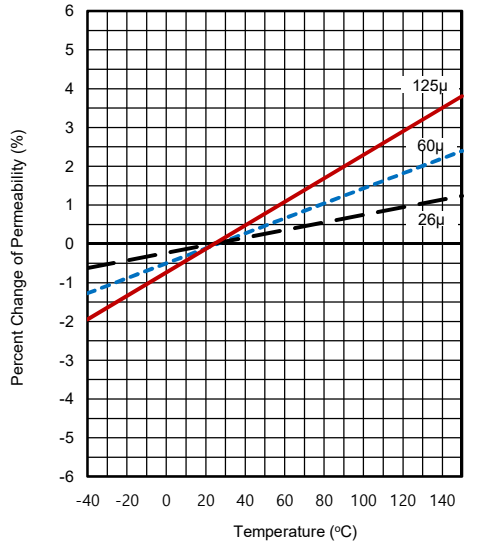
Typical core losses

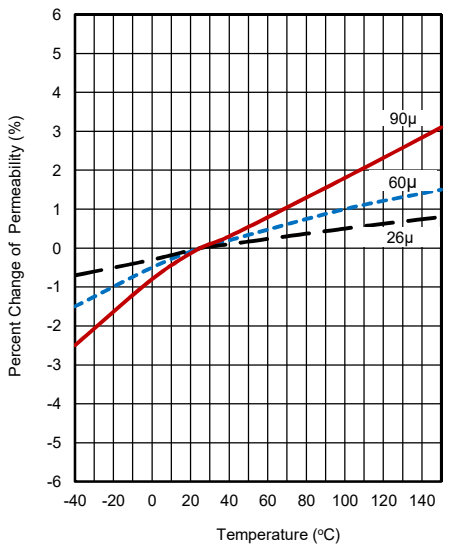


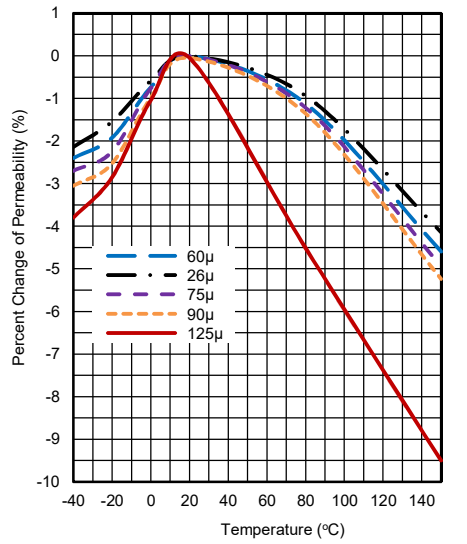




Temperature Stability







Products List of magnetic powder cores

Part No.	AL value [nH/N^2]					Dimensions[mm] OD(Max)×ID(Min)×HT(Max)			Magnetic Path Length ℓ [㎝]	Cross Section A [㎠]	Window Area Wa[㎠]	Volume V [㎤]
	026	060	075	090	125	After Coating [㎝]						
OR063□○○○	10	24	30	36	50	6.99	2.29	3.34	1.36	0.05	0.38	0.06
OR066□○○○	11	26	32	39	54	7.24	2.29	3.18	1.36	0.05	0.41	0.06
OR067□○○○	21	50	62	74	103	7.32	2.21	5.54	1.36	0.09	0.42	0.13
OR068□○○○	14	33	42	50	70	7.62	3.45	5.72	1.65	0.07	0.46	0.12
OR078□○○○	11	25	31	37	52	8.51	3.43	3.81	1.79	0.06	0.57	0.11
OR096□○○○	11	25	32	38	53	10.29	4.27	3.81	2.18	0.08	0.83	0.16
OR097□○○○	14	32	40	48	66	10.29	4.27	4.57	2.18	0.09	0.83	0.21
OR102□○○○	14	32	40	48	66	10.80	4.57	4.57	2.38	0.10	0.92	0.24
OR112□○○○	11	26	32	38	53	11.90	5.89	4.72	2.69	0.09	1.11	0.24
OR127□○○○	12	27	34	40	56	13.46	6.99	5.51	3.12	0.11	1.42	0.36
OR166□○○○	15	35	43	52	72	17.40	9.53	7.11	4.11	0.19	2.38	0.79
OR172□○○○	19	43	53	64	89	18.03	9.02	7.11	4.14	0.23	2.55	0.96
OR203□○○○	14	32	41	49	68	21.10	12.07	7.11	5.09	0.23	3.50	1.15
OR229□○○○	19	43	54	65	90	23.62	13.39	8.38	5.67	0.33	4.38	1.88
OR234□○○○	22	51	63	76	105	24.30	13.77	9.70	5.88	0.39	4.64	2.28
OR270□○○○	32	75	94	113	157	27.70	14.10	11.99	6.35	0.65	6.03	4.15
OR330□○○○	28	61	76	91	127	33.83	19.30	11.61	8.15	0.67	8.99	5.48
OR343□○○○	16	38	47	57	79	35.20	22.60	9.83	8.95	0.45	9.73	4.06
OR358□○○○	24	56	70	84	117	36.70	21.50	11.28	8.98	0.68	10.58	6.09
OR400□○○○	35	81	101	121	168	40.70	23.30	15.37	9.84	1.07	13.01	10.55
OR467□○○○	59	135	169	202	281	47.60	23.30	18.92	10.74	1.99	17.80	21.37
OR468□○○○	37	86	107	128	178	47.60	27.90	16.13	11.63	1.34	17.80	15.58
OR508□○○○	32	73	91	109	152	51.70	30.90	14.35	12.73	1.25	20.99	15.91
OR571□○○○	60	138	172	207	287	58.00	25.60	16.10	12.50	2.29	6.16	28.63
OR610□○○○	83	192	240	288	400	63.10	31.37	26.27	14.37	3.68	31.27	52.81
OR740□○○○	89	206	257	309	429	75.20	44.07	36.27	18.38	5.04	44.41	92.64
OR777□○○○	30	68	85	102	142	78.90	48.00	13.97	20.00	1.77	48.89	35.40
OR778□○○○	35	85	107	128	178	78.90	48.00	17.20	20.00	2.27	48.89	45.40
OR1016□○○○	47	112	137	164	228	103.10	55.70	17.80	24.27	3.52	24.36	85.48

Other shapes and materials are available.

● Part numbering system

OR 467 H 060

- 060: Permeability, 060: 60μ, 125: 125μ
- H: Material code, S: Sendust, F: Super Flux, H: High Flux
- 467: Outer diameter, 096: 9.6mm, 467: 46.7mm, 1016: 101.6mm
- OR: Samwha's toroid core

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