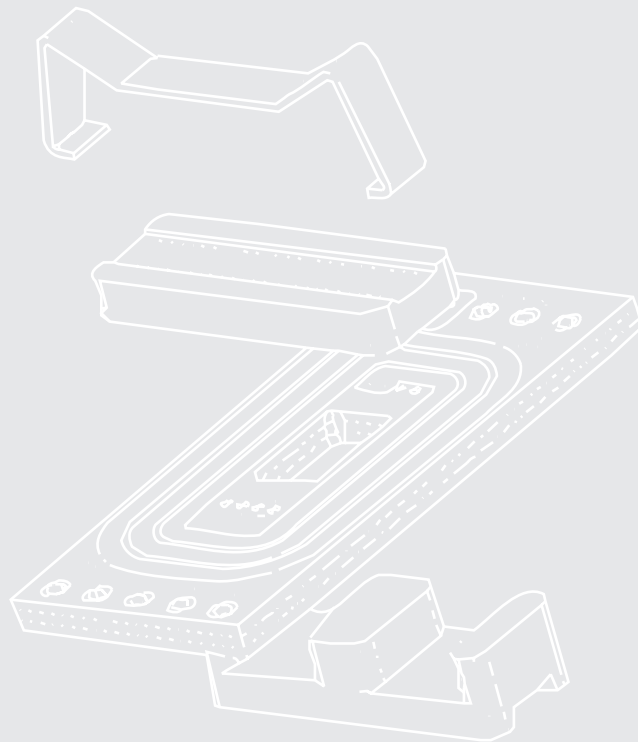


Planar E Cores

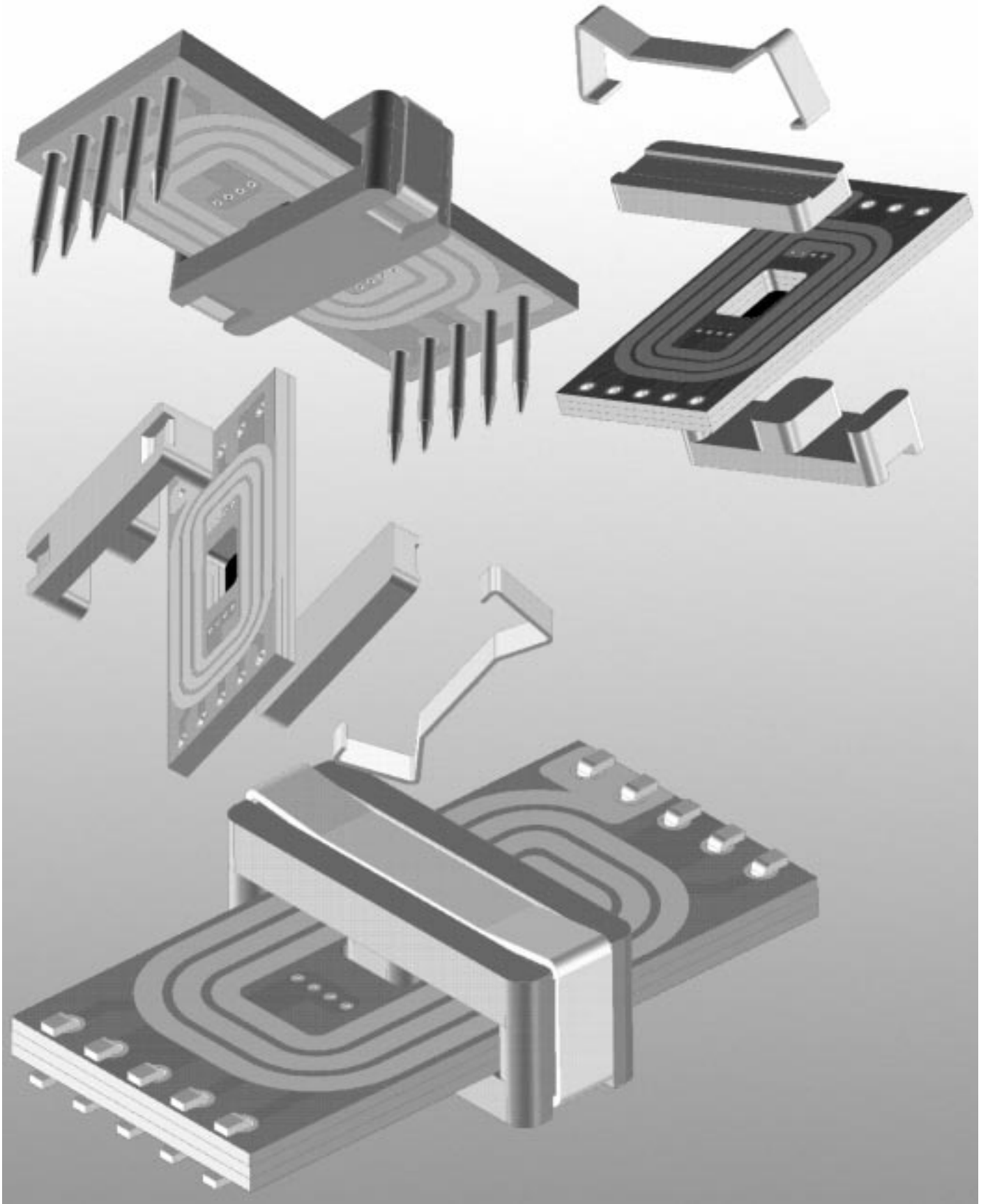


Let's make things better.

Planar E Cores

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Planar E core transformers

1. Introduction

Planar magnetics offer an attractive alternative to conventional core shapes when low profile magnetic devices are required. Basically this is a construction method of inductive components with windings made of printed circuit tracks or copper stampings separated by insulating sheets or constructed with multi-layer circuit boards. These windings are placed between low-profile ferrite cores. Planar devices can be constructed in several ways. The closest to conventional devices is a stand-alone component to replace components on a mono-layer or any other circuit board. The height of a stand-alone component can be reduced by sinking the core through a slot in the mother board until its windings rest on the mother board. One step further is a hybrid type, where part of the windings are in the mother board while others are joined as a separate multi-layer circuit board. The mother board must have slots cut out to accept the ferrite core. The last version is achieved by total integration in a multi-layer mother board.

Just like for wire-wound components, the core halves can be assembled either by gluing or by clamping, depending on the capabilities and preferences of the manufacturer. Philips Components manufacture a range of planar E cores, which is presented in this brochure. In addition, a whole range of low profile RM cores is available. For more information, please consult our DATA HANDBOOK MA01 or Product Selection Guide.

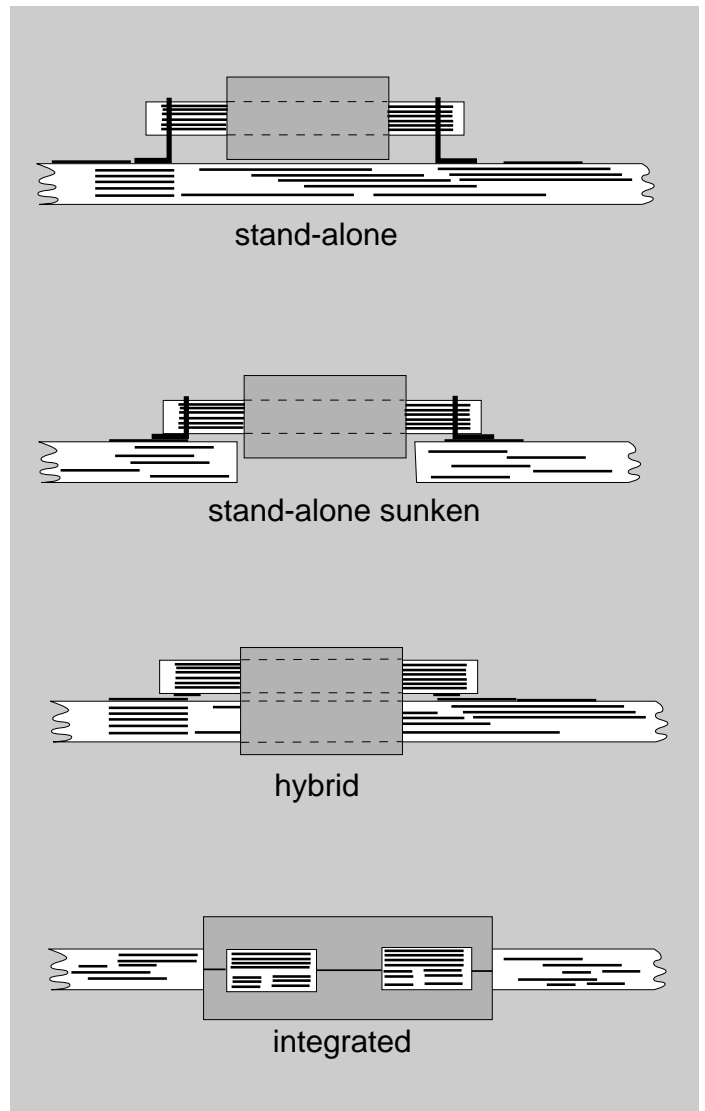


Fig.1 Several types of planar devices

2. Advantages of planar technology

There are many advantages of planar magnetic technology over conventional wire-wound inductive components. An obvious advantage is a very low build height, which promotes planar in dense rack-mount and portable equipment.

Planar magnetics are very well suited for design of high performance switch-mode power converters. Low AC copper losses and good coupling increase conversion efficiency. Levels higher than 95 % can be achieved, provided that the core is ungapped or only has a moderate air gap. In addition, low leakage inductance reduces voltage spikes and oscillations that can damage MOSFETs and increase interference emission.

Good heat management leads to very high throughput power density, up to twice the value for conventional transformers. Very good repeatability of parasitics enables high switching frequencies and resonant topologies. Cores are available in material 3F4 for switching frequencies up to 3 MHz.

Planar technology is straight forward and reliable in production. Advantages and limitations are listed in following tables.

2.a. Design advantages		
<i>Feature</i>	<i>stand-alone</i>	<i>Integrated</i>
• Mechanical characteristics		
Very low profile	x	x x
Compact and rigid construction	x	x x
• Electrical characteristics		
Little skin and proximity effect in flat copper tracks	x	x
Good coupling of closely stacked transformer windings	x	x x
Excellent repeatability due to fixed winding layout	x	x
• Heat management		
High core surface (cooling) to volume (dissipation) ratio	x	x
Compact coil with good heat conduction	x	x
Large core surface for heat sink contact	x	x

2.b. Manufacturing advantages		
<i>Feature</i>	<i>stand-alone</i>	<i>Integrated</i>
• Forward integration		
No coil former required	x	x
No separate windings required		x
No pinning / leads required		x
Independence of component assembler		x
• Manufacturability		
No winding operation	x	x
No soldering operation		x
Compatible with SMD technology	x	x
• Reliability		
No winding errors / short circuit	x	x
No solder contact problems		x

2.c. Limitations		
<i>Feature</i>	<i>Stand-alone</i>	<i>Integrated</i>
• General		
Only if multi-layer mother board		X
Cost of planar windings versus copper wire (1)	X	
Design & production knowledge needed by board assembler		X
Every design needs its own prefab winding	X	X X
• Design		
Low copper cross-section to window area ratio	X	X X
Parasitic capacitance limits winding design possibilities	X	X X
Designs with large air gap are unfavourable	X	X
• Manufacturing		
The batch to batch spread can't be compensated with the turns	X	X

Note (1) The price of multi-layer PCB is coming down. Overall cost : no coil former and smaller core.

2.d. Integrated versus stand-alone

Integrated planar components are used if the complexity of the surrounding circuitry already demands for multi-layer PCB. Typical applications can be found in low power conversion and signal processing and use mostly E / plate combination of the small sizes. Main design considerations for planar here are flatness and high frequency electrical characteristics.

Stand-alone components are used otherwise. Typical applications can be found in high power conversion and use mostly E / E combination of the large sizes. Main design consideration for planar here is heat management. The type of windings depends partly on the current rating.

Low : multi-layer PCB (most compact) or stacked mono-layer PCB (standard windings)

Medium : stacked flex foil leadframes (thick tracks) or ceramic substrates (good heat conduction)

High : self-supporting leadframes (nut & bolt type)

Sunken stand-alone components reduce the build height without changing component layout.

Hybrid components make use of the mother board tracks to reduce the number of stand-alone tracks, whereas these are completely eliminated with an integrated component. Combinations of the foregoing types are also possible. For example, a power converter could have the primary winding and mains filter choke (fixed) in the mother board and the secondary winding and output choke (custom) in stand-alone PCB's (see Fig. 2).

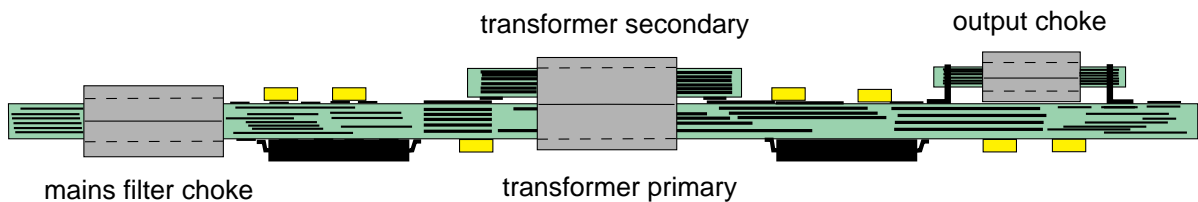


Fig.2 Hybrid design with planar magnetics.

2.e. Gluing versus clamping

The choice between gluing and clamping depends mainly on the capabilities and preferences of the manufacturer, but also the application requirements can favour one of the two.

- **Reasons for gluing**

- Simple production automation
- Uniform core cross-section (saturation)
- Low build height (no clamp arc)
- Smaller PCB cut-out (integrated version)
- Fixation of cores to the PCB (no rattle/noise)

- **Reasons for clamping**

- Clean assembly process
- No environmental influence on assembly process
- No problems in high temperature application
- No increase of parasitic gap (high permeability)

3.Applications

The first applications for planar E cores were in power conversion. Correspondingly, material grades were medium and high frequency power ferrites. The inductance of the mains filter choke can be increased by substituting the power ferrite for a high permeability grade. In pulse transmission, a wideband transformer between pulse generating IC and cable provides isolation and impedance matching. For an S or T-interface, this should also be a high permeability ferrite. Cores in the high permeability material 3E6 have been added to our range. A listing of applications, likely to profit from planar, is given below.

3.a.Power conversion

- **Components**

- power transformer, output or resonant choke(s), mains filter choke

- **AC/DC converter (mains-fed power supply)**

- Stand-alone SMPS

- Battery charger (mobile phone, portable computers)
- Instrumentation & control

- **DC/DC converter (distributed or battery-fed power supply)**

- Power converter modules

- Telecommunications network switch (distributed supply)

- Mobile phone (main power supply)

- Portable computer (main power supply)

- Electric car (traction voltage to 12 V down converter)

- **AC/AC converter (mains-fed power supply)**

- Compact fluorescent lamps

- Induction heating, welding

- **DC/AC inverter (battery-fed power supply)**

- Mobile phone (LCD backlighting)

- Portable computer (LCD backlighting)

- Gas discharge car headlamp (ballast)

- Car rear window heating (step-up converter)

3.b.Pulse transmission

- **Component**

- wideband transformer

- S₀ interface (subscriber telephone line)

- U interface (subscriber ISDN line)

- T1/T2 interface (trunk line between network switches)

- ADSL interface (Asynchronous Digital Subscriber Line)

- HDSL interface (High Digital Subscriber Line)

4. Product range

Philips Components offer an extensive product range of planar E cores. Sizes range from 14 to 64 mm. The cross-sectional area is always uniform for the basic version for gluing to make optimum use of the ferrite volume. Every size has an E core and corresponding plate (PLT). A core set consists of either an E core and a plate or two E cores, in which case the winding window height doubles. The smallest 3 sizes also have an E/PLT version for clamping. The E core has recesses (E/R) while the plate has a slot (PLT/S). A clamp (CLM) snaps into the recesses and provides a firm grip, pressing the plate on two points. The slot prohibits the plate from sliding out even in case of strong shocks or vibrations and provides alignment. For the E / E combination there are no clips.

All sizes are available in power materials 3F3 (frequencies up to 500 kHz) and 3F4 (500 kHz - 3 MHz). The largest 5 sizes are also available in 3C85 (frequencies up to 200 kHz), as large cores are often used in low frequency, high power applications. The smallest 3 sizes are available in high permeability 3E6 (μ_i 12000) as well for mains filter chokes and wideband transformers.

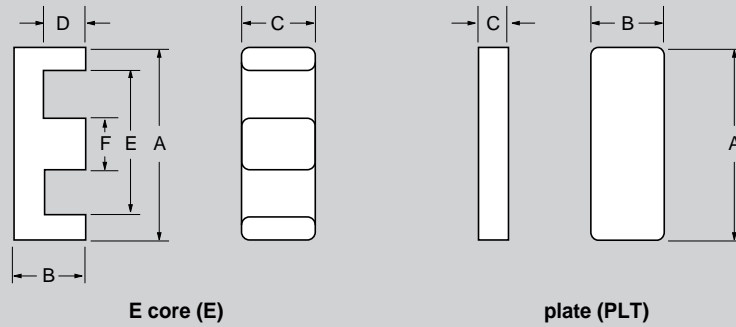
All E cores in power materials can be gapped, preferably in a standard range of A_L values. Every A_L value corresponds to 2 slightly different gaps, depending on whether the mating part is another E core or a plate (P). Default is asymmetric gap (A) ; the mating part is a plate or an ungapped E core. The largest 5 sizes have their largest gaps symmetrical (E) ; the mating part is an identical gapped E core.

For an overview of the type number system : see section 8.

4.a. Material grades

PARAMETER	SYMBOL	UNIT	TEST CONDITIONS	3C85	3F3	3F4	3E6
Initial permeability	μ_i	-	f = ≤ 10 kHz, B < 0.1mT, T = 25 °C	2000	1800	900	12000
Saturation flux density at Field strength	B_s	mT	f = 10 kHz, T = 25 °C	≈ 500	≈ 500	≈ 450	≈ 400
	H	A/m		3000	3000	3000	250
Remanence	B_r	mT	T = 25 °C	≈ 160	≈ 150	≈ 150	≈ 100
Coercivity	H_c	A/m	T = 25 °C	≈ 15	≈ 15	≈ 60	≈ 4
Power loss density (typical, sinewave excitation)	P_v	kW/m ³	f = 25kHz, B = 200mT, T = 100 °C	100	70	-	-
			f = 100kHz, B = 100mT, T = 100 °C	120	50	200	-
			f = 500kHz, B = 50mT, T = 100 °C	-	180	180	-
			f = 1MHz, B = 30mT, T = 100 °C	-	300	140	-
			f = 3MHz, B = 10mT, T = 100 °C	-	-	240	-
Curie temperature	T_c	°C	-	≥ 200	≥ 200	≥ 220	≥ 130
Resistivity (DC)	ρ	Ωm	T = 25 °C	≈ 2	≈ 2	≈ 10	≈ 0.5
Density		g/cm ³	T = 25 °C	≈ 4.8	≈ 4.8	≈ 4.7	≈ 4.9

4.b. Cores for gluing (without recess)

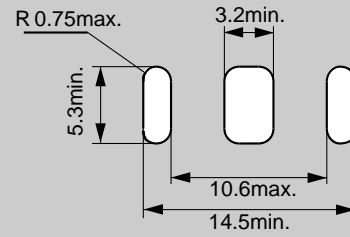


Core type	dimensions (mm)						effective core parameters				
	A	B	C	D	E	F	core factor $\Sigma I/A$ (mm ⁻¹)	eff. volume V_e (mm ³)	eff. length l_e (mm)	eff. ¹⁾ area A_{e^2} (mm ²)	mass of core half (g)
E14/3.5/5 (E-E combination)	14 ± 0.3	3.5 ± 0.1	5 ± 0.1	2 ± 0.1	11 ± 0.25	3 ± 0.05	1.43	300	20.7	14.5	≈ 0.6
PLT14/5/1.5 (E-PLT combination)	14 ± 0.3	5 ± 0.1	1.5 ± 0.05	-	-	-	1.16	240	16.7	14.5	≈ 0.5
E18/4/10 (E-E combination)	18 ± 0.35	4 ± 0.1	10 ± 0.2	2 ± 0.1	14 ± 0.3	4 ± 0.1	0.616	960	24.3	39.5	≈ 2.4
PLT18/10/2 (E-PLT combination)	18 ± 0.35	10 ± 0.2	2 ± 0.05	-	-	-	0.514	800	20.3	39.5	≈ 1.7
E22/6/16 (E-E combination)	21.8 ± 0.4	5.7 ± 0.1	15.8 ± 0.3	3.2 ± 0.1	16.8 ± 0.4	5 ± 0.1	0.414	2550	32.5	78.5	≈ 6.5
PLT22/16/2.5 (E-PLT combination)	21.8 ± 0.4	15.8 ± 0.3	2.5 ± 0.05	-	-	-	0.332	2040	26.1	78.5	≈ 4
E32/6/20 (E-E combination)	31.75 ± 0.64	6.35 ± 0.13	20.32 ± 0.41	3.18 ± 0.13	24.9 min	6.35 ± 0.13	0.323	5380	41.7	129	≈ 13
PLT32/20/3 (E-PLT combination)	31.75 ± 0.64	20.32 ± 0.41	3.18 ± 0.13	-	-	-	0.278	4560	35.9	129	≈ 10
E38/8/25 (E-E combination)	38.1 ± 0.76	8.26 ± 0.13	25.4 ± 0.51	4.45 ± 0.13	30.23 min	7.62 ± 0.15	0.272	10200	52.6	194	≈ 25
PLT38/25/4 (E-PLT combination)	38.1 ± 0.76	25.4 ± 0.51	3.81 ± 0.13	-	-	-	0.226	8460	43.7	194	≈ 18
E43/10/28 (E-E combination)	43.2 ± 0.9	9.5 ± 0.13	27.9 ± 0.6	5.4 ± 0.13	34.7 min	8.1 ± 0.2	0.276	13900	61.7	225	≈ 35
PLT43/28/4 (E-PLT combination)	43.2 ± 0.9	27.9 ± 0.6	4.1 ± 0.13	-	-	-	0.226	11500	50.8	225	≈ 24
E58/11/38 (E-E combination)	58.4 ± 1.2	10.5 ± 0.13	38.1 ± 0.8	6.5 ± 0.13	50 min	8.1 ± 0.2	0.268	24600	81.2	305	≈ 62
PLT58/38/4 (E-PLT combination)	58.4 ± 1.2	38.1 ± 0.8	4.1 ± 0.13	-	-	-	0.224	20800	68.3	305	≈ 44
E64/10/50 (E-E combination)	64.01 ± 1.27	10.2 ± 0.13	50.80 ± 1.02	5.1 ± 0.13	53.80 ± 1.07	10.2 ± 0.2	0.156	40700	79.7	511	≈ 100
PLT64/50/5 (E-PLT combination)	64.01 ± 1.27	50.8 ± 1.02	5.08 ± 0.13	-	-	-	0.136	35500	69.6	511	≈ 78

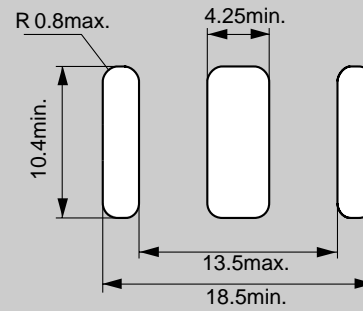
1) $A_{\min} = A_e$

Properties under power conditions

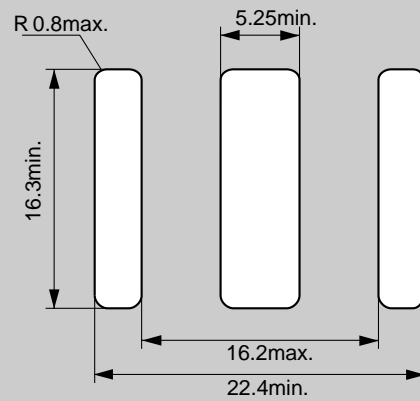
Core combination	B(mT) at					
	250 A/m 10 kHz 100 °C	core loss (W)				
		25 kHz	100 kHz	400 kHz	1 MHz	3 MHz
		200 mT 100 °C	100 mT 100 °C	50 mT 100 °C	30 mT 100 °C	10 mT 100 °C
E+E14-3F3	≥300	–	≤0.033	≤0.060	–	–
E+PLT14-3F3	≥300	–	≤0.027	≤0.048	–	–
E+E14-3F4	≥250	–	–	–	≤0.090	≤0.11
E+PLT14-3F4	≥250	–	–	–	≤0.072	≤0.088
E+E18-3F3	≥300	–	≤0.11	≤0.19	–	–
E+PLT18-3F3	≥300	–	≤0.092	≤0.16	–	–
E+E18-3F4	≥250	–	–	–	≤0.29	≤0.35
E+PLT18-3F4	≥250	–	–	–	≤0.24	≤0.29
E+E22-3F3	≥300	–	≤0.28	≤0.50	–	–
E+PLT22-3F3	≥300	–	≤0.23	≤0.40	–	–
E+E22-3F4	≥250	–	–	–	≤0.77	≤0.90
E+PLT22-3F4	≥250	–	–	–	≤0.62	≤0.72
E+E32-3C85	≥320	≤0.84	≤0.97	–	–	–
E+PLT32-3C85	≥320	≤0.71	≤0.82	–	–	–
E+E32-3F3	≥320	–	≤0.59	≤1.00	–	–
E+PLT32-3F3	≥320	–	≤0.50	≤0.85	–	–
E+E32-3F4	≥250	–	–	–	≤1.60	≤2.00
E+PLT32-3F4	≥250	–	–	–	≤1.36	≤1.70
E+E38-3C85	≥320	≤1.60	≤1.80	–	–	–
E+PLT38-3C85	≥320	≤1.35	≤1.50	–	–	–
E+E38-3F3	≥320	–	≤1.20	≤2.00	–	–
E+PLT38-3F3	≥320	–	≤1.00	≤1.65	–	–
E+E38-3F4	≥250	–	–	–	≤3.00	≤3.50
E+PLT38-3F4	≥250	–	–	–	≤2.50	≤2.90
E+E43-3C85	≥320	–	≤2.50	–	–	–
E+PLT43-3C85	≥320	–	≤2.10	–	–	–
E+E43-3F3	≥320	–	≤1.60	≤2.70	–	–
E+PLT43-3F3	≥320	–	≤1.35	≤2.25	–	–
E+E43-3F4	≥250	–	–	–	≤4.20	≤5.00
E+PLT43-3F4	≥250	–	–	–	≤3.50	≤4.15
E+E58-3C85	≥320	–	≤4.40	–	–	–
E+PLT58-3C85	≥320	–	≤3.75	–	–	–
E+E58-3F3	≥320	–	≤2.70	≤4.70	–	–
E+PLT58-3F3	≥320	–	≤2.30	≤4.00	–	–
E+E58-3F4	≥250	–	–	–	≤7.40	≤8.00
E+PLT58-3F4	≥250	–	–	–	≤6.25	≤6.80
E+E64-3C85	≥320	–	≤7.30	–	–	–
E+PLT64-3C85	≥320	–	≤6.40	–	–	–
E+E64-3F3	≥320	–	≤4.50	≤7.80	–	–
E+PLT64-3F3	≥320	–	≤3.95	≤6.80	–	–
E+E64-3F4	≥250	–	–	–	≤12.0	≤15.0
E+PLT64-3F4	≥250	–	–	–	≤10.5	≤13.0



E14/3.5/5-core



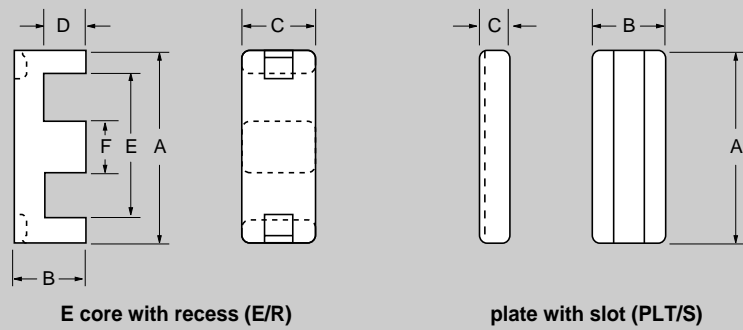
E18/4/10-core



E22/6/16-core

Fig 3 PCB cut out proposal for glued cores

4.c. Cores for clamping



Core type		E14/3.5/5/R	PLT14/5/1.5/S (E-PLT combination)	E18/4/10/R	PLT18/10/2/S (E-PLT combination)	E22/6/16/R	PLT22/16/2.5/S (E-PLT combination)
effective core parameters	core factor $\Sigma l/A(\text{mm}^{-1})$	-	1.15	-	0.498	-	0.324
	eff. volume $V_e (\text{mm}^3)$	-	230	-	830	-	2100
	eff. length $l_e (\text{mm})$	-	16.4	-	20.3	-	26.1
	eff. area $A_e (\text{mm}^2)$	-	14.2	-	40.8	-	80.4
	min. area $A_{\min} (\text{mm}^2)$	-	10.9	-	35.9	-	72.6
	mass of core half (g)	≈ 0.6	≈ 0.5	≈ 2.4	≈ 1.7	≈ 6.5	≈ 4
dimensions (mm)	A	14 ± 0.3	14 ± 0.3	18 ± 0.35	18 ± 0.35	21.8 ± 0.4	21.8 ± 0.4
	B	3.5 ± 0.1	5 ± 0.1	4 ± 0.1	10 ± 0.2	5.7 ± 0.1	15.8 ± 0.3
	C	5 ± 0.1	1.8 ± 0.05	10 ± 0.2	2.4 ± 0.05	15.8 ± 0.3	2.9 ± 0.05
	D	2 ± 0.1	-	2 ± 0.1	-	3.2 ± 0.1	-
	E	11 ± 0.25	-	14 ± 0.3	-	16.8 ± 0.4	-
	F	3 ± 0.05	-	4 ± 0.1	-	5 ± 0.1	-
mounting parts	CLM		E14/PLT14		E18/PLT18		E22/PLT22

Core type		E14/3.5/5/R	E18/4/10/R	E22/6/16/R
Matching plates		PLT14/5/1.5/S	PLT18/10/2/S	PLT22/16/2.5/S
core HALVES for use in combination with a plate	3F3	A63-P	A100-P	A160-P
		A100-P	A160-P	A250-P
		A160-P	A250-P	A315-P
		1300	A315-P	A400-P
			3100	A630-P
				5000
	3F4	A63-P	A100-P	A160-P
		A100-P	A160-P	A250-P
		A160-P	A250-P	A315-P
		780	A315-P	A400-P
			1800	A630-P
				2900
3E6	6400	15500	26000	

A_L value (nH) measured at $\hat{B} \leq 0.1$ mT, $f \leq 10$ kHz, $T = 25^\circ\text{C}$

A_L tolerance: ± 3% ± 5% ± 8% ± 25% + 40%
- 30%

A63-P	_____	gapped core half with asymmetrical gap (A), $A_L = 63$ nH measured in combination with a plate.
1280	_____	ungapped core half, $A_L = 1280$ nH measured in combination with a plate.

Properties under power conditions

Core combination	B(mT) at 250 A/m 10 kHz 100 °C	Core loss (W) at				
		25 kHz 200 mT 100 °C	100 kHz 100 mT 100 °C	400 kHz 50 mT 100 °C	1 MHz 30 mT 100 °C	3 MHz 10 mT 100 °C
E+PLT14-3F3	≥300	—	≤0.032	≤0.058	—	—
E+PLT14-3F4	≥250	—	—	—	≤0.086	≤0.11
E+PLT18-3F3	≥300	—	≤0.12	≤0.20	—	—
E+PLT18-3F4	≥250	—	—	—	≤0.30	≤0.37
E+PLT22-3F3	≥300	—	≤0.29	≤0.52	—	—
E+PLT22-3F4	≥250	—	—	—	≤0.80	≤0.93

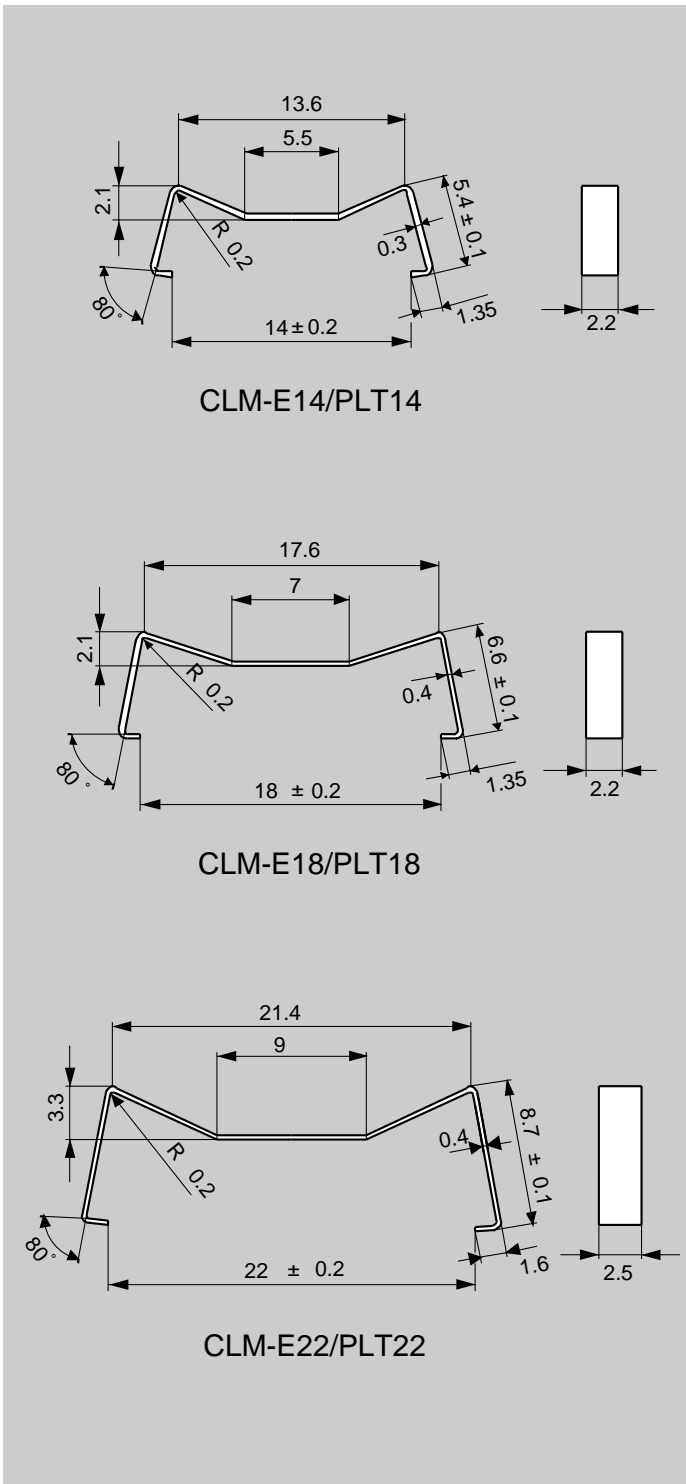


Fig.4 Clamps for E/PLT combinations.

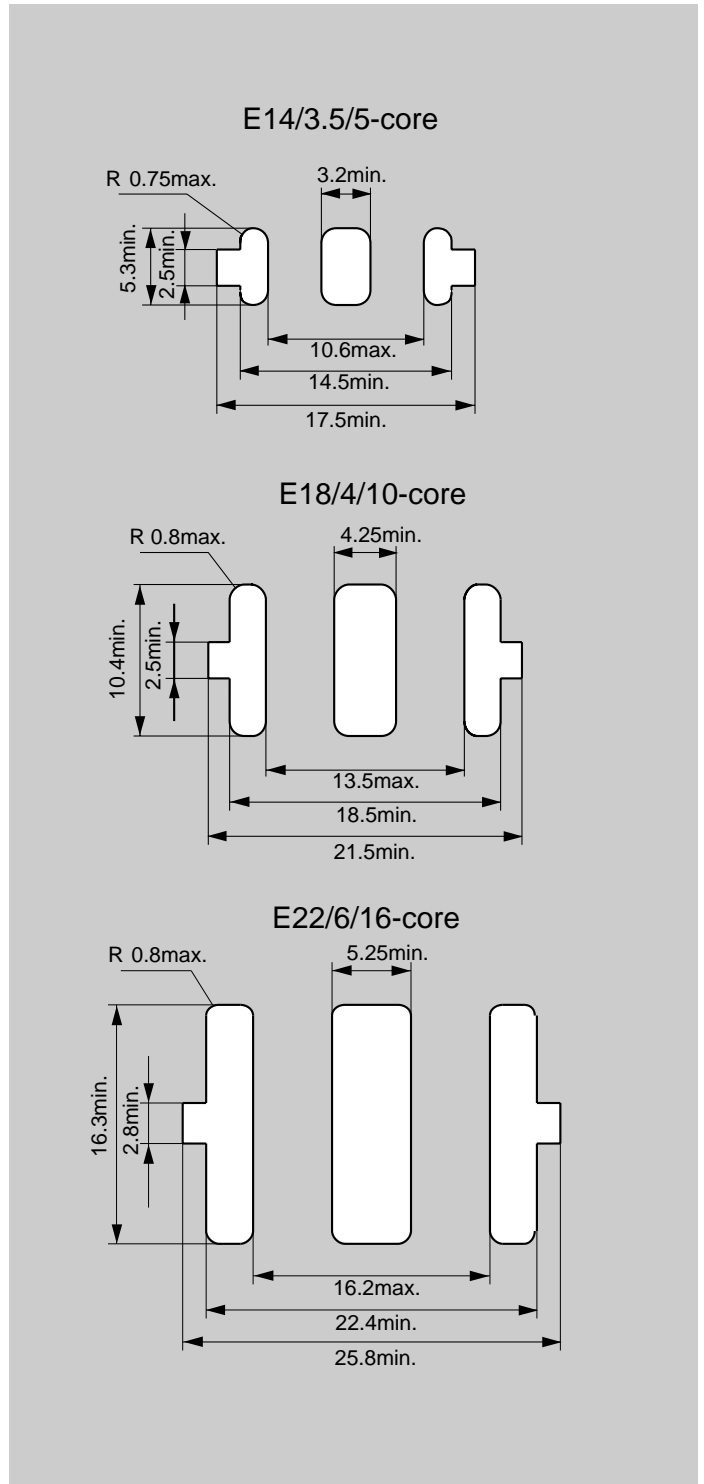


Fig.5 PCB cut out proposal for clamped cores

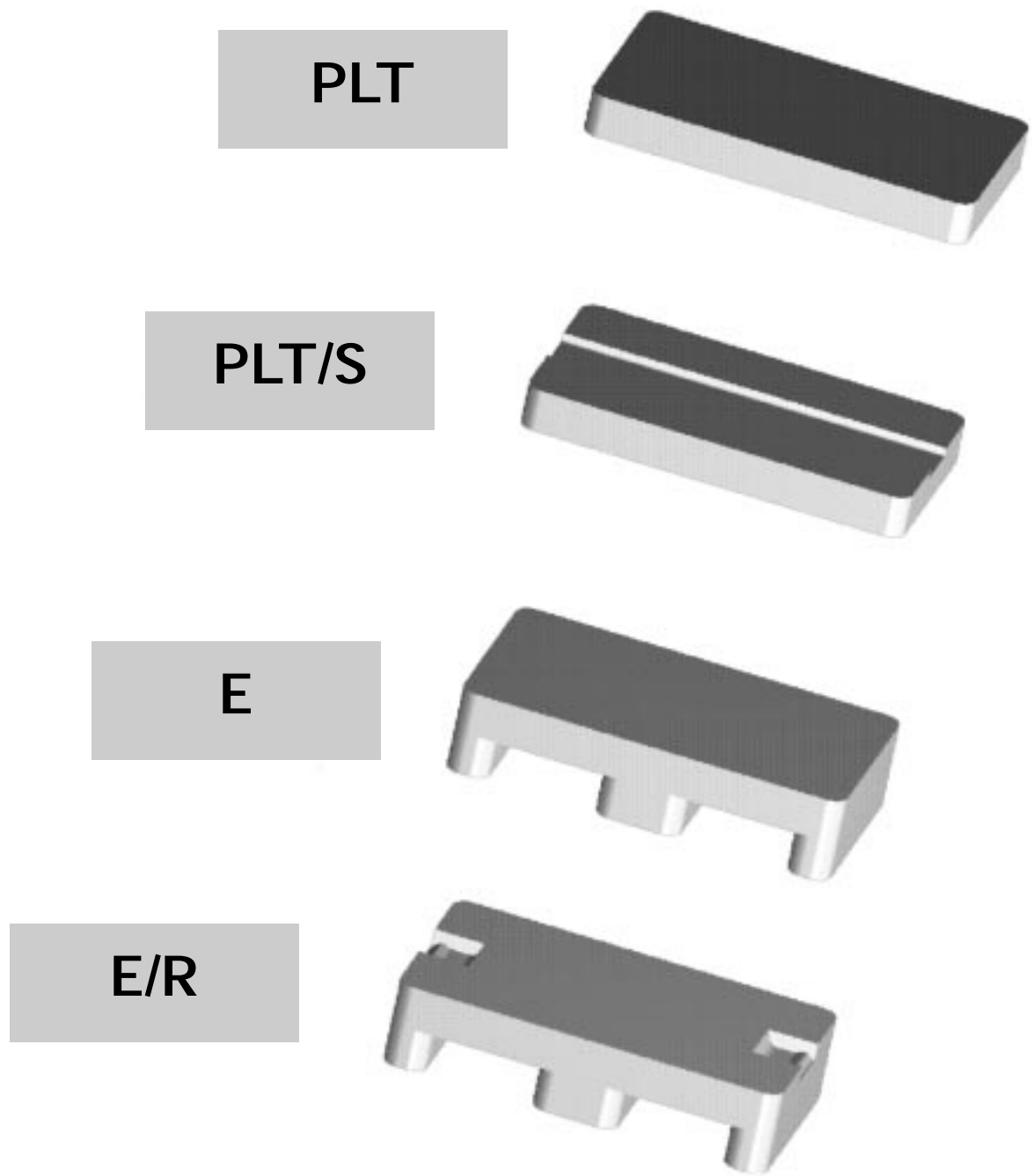


Fig.6 The different core shapes available for planar E transformers.

4.d. Packing

Standard packing for Planar E cores and Plates is a plastic blister tape. The plastic material (PET) is environmentally friendly.

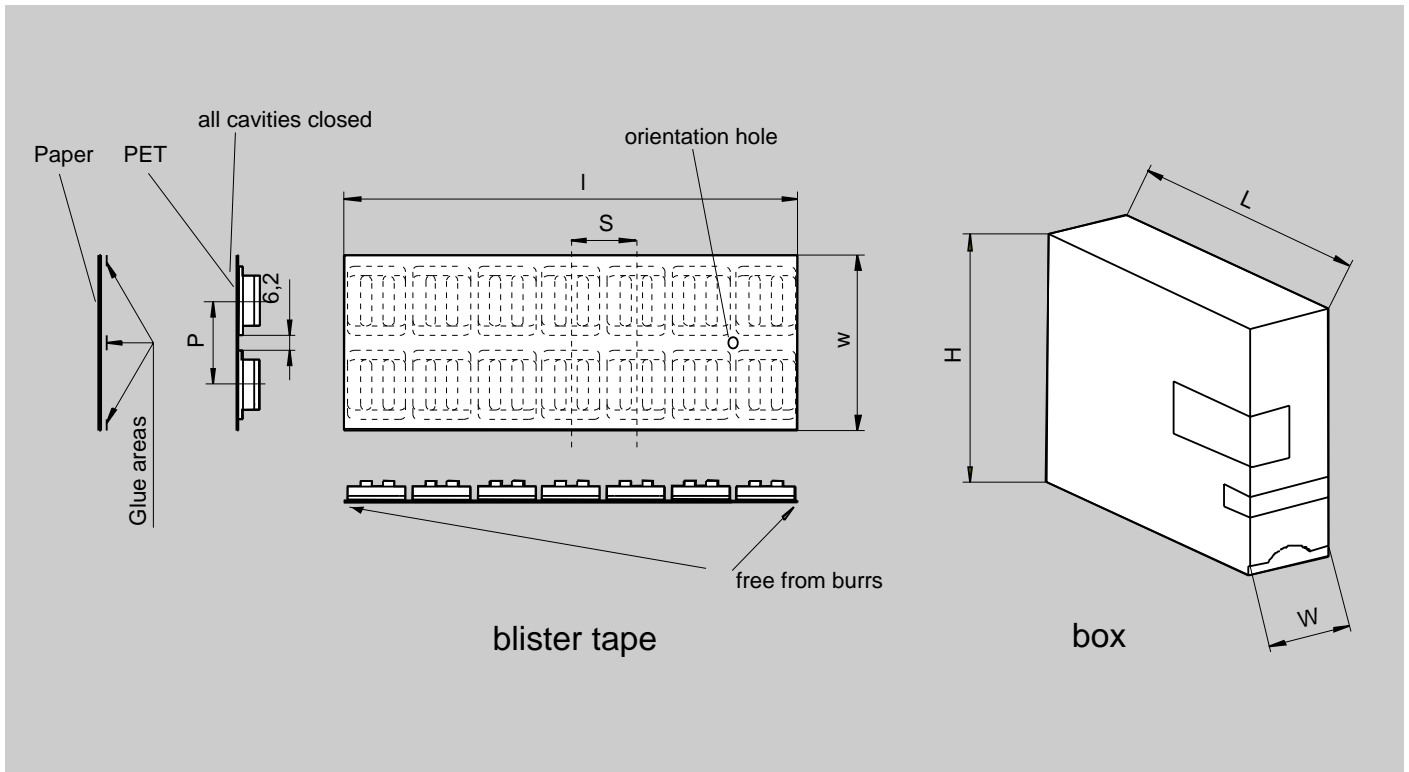


Fig 7 Blister tape packing

Cores in blister tape

Blister size	Pitch (P)	Box size (LxWxH)	Products / blister
340 x 60 mm	27.5 mm	355 x 70 x 210 mm	40
295 x 82 mm	38.5 mm	310 x 90 x 248 mm	20

Core size	Blisters / box	Core halves / box	Blister width
E14/3.5/5	50	2000	60 mm
E18/4/10	50	2000	60 mm
E22/6/16	25	500	82 mm

Clamps in bulk

Clamp size	Box size	clamps / box
CLM-E14/PLT14	170 x 100 x 70 mm	5000
CLM-E18/PLT18	170 x 100 x 70 mm	2500
CLM-E22/PLT22	170 x 100 x 70 mm	1500

For E14/3.5/5 and E18/4/10, a prototype version of tape on reel packing has been developed to facilitate automatic mounting with SMD pick & place equipment. The packing method is in accordance with IEC-286, part 3. The plastic material (0.3 mm PET) is environmentally friendly. Plates have the same packing as the corresponding E cores.

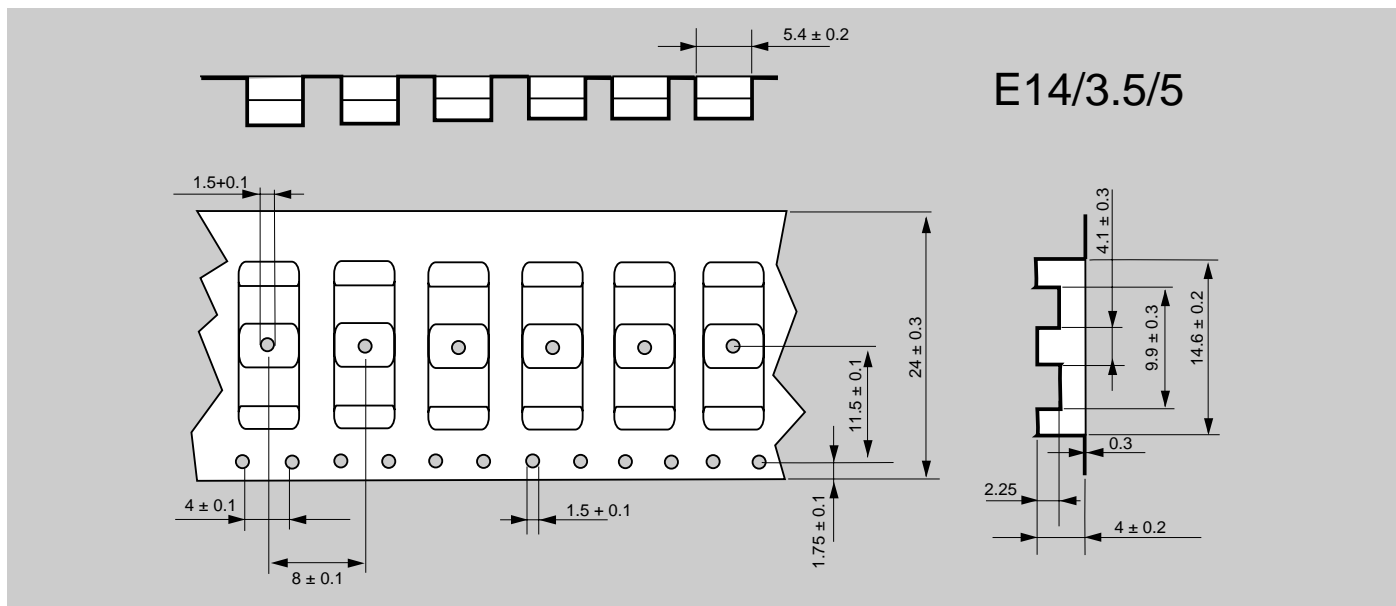


Fig 8 Tape on reel packing for E14/3.5/5.

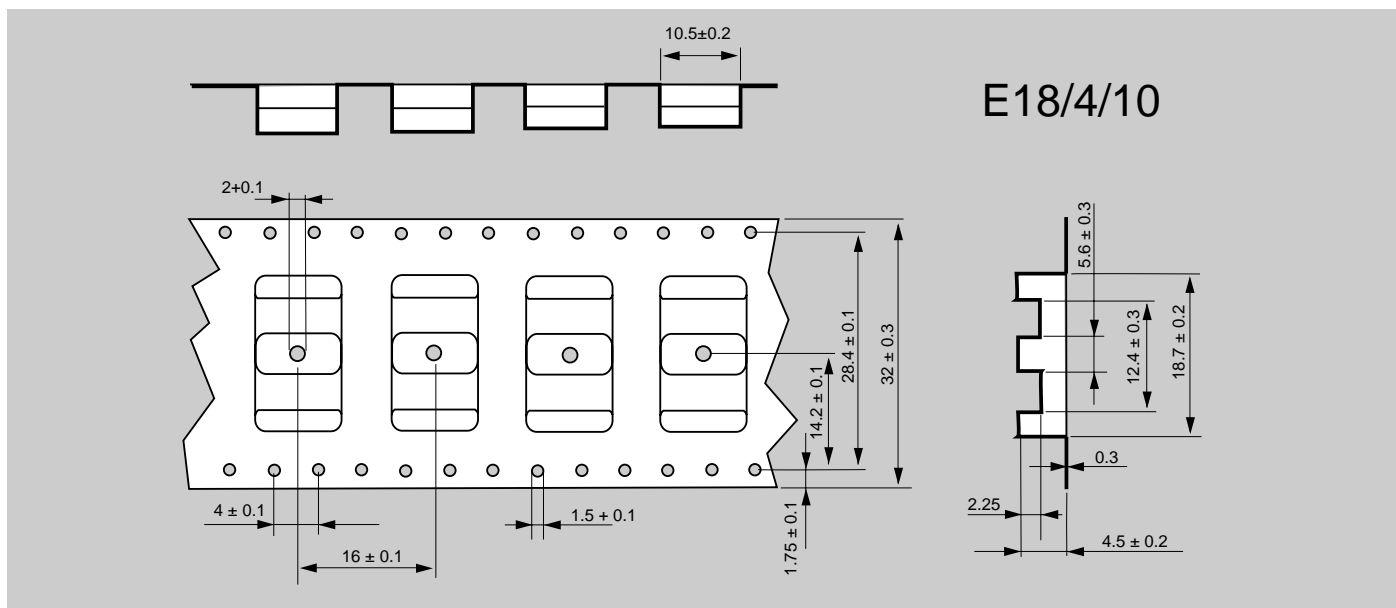


Fig 9 Tape on reel packing for E18/4/10.

Cores in tape on reel

Core size	Pitch	Tape width	Reel diameter	Core halves / reel
E14/3.5/5	8 mm	24 mm	330 mm	2000
E18/4/10	16 mm	32 mm	330 mm	900

5. Design

In order to make full use of the advantages of planar technology, the design concept must be different from a wire-wound design. A few points are highlighted below. For a complete design procedure of planar power transformers with examples, see the brochure "Design of Planar Power Transformers". For a completely worked-out example of a DC/DC converter, see the brochure "25 Watt DC/DC converter using integrated planar magnetics".

5.a. Core choice

Flux density

The improved heat management allows for up to twice the power loss of a conventional design with the same magnetic volume, so optimum flux density will be higher than for a conventional design.

Air gap

Large air gaps are not favourable in a planar design because of stray flux. The flux fringing factor depends on the ratio of winding window height to air gap length, which is lower for a flat core. If the window height is only a few times the gap length and the window breadth is several times the centre post width, then even considerable flux crossing between core top and bottom will occur. More flux fringing and flux crossing lead to higher eddy current loss in the winding.

5.b. Winding design

DC resistance

Often used copper track heights are 35 and 70 μm . If the copper cross-section is not enough for an acceptable DC resistance, then tracks can be connected in parallel for all or part of the turns.

AC resistance

AC copper losses due to skin and proximity effect are lower for flat copper tracks than for round wire with the same cross-sectional area. Eddy currents induced in the vicinity of a gap can be reduced by deleting a few turns where the flux density is maximum and perpendicular to the winding plane. The E / plate combination has somewhat less stray flux than the E / E combination because of the gap position.

Leakage inductance

With vertically stacked windings, the magnetic coupling will be very strong and coupling factors close to 100 % can be achieved (Fig.10a).

Parasitic capacitance

The former will lead to higher inter-winding capacitance. This capacitance can be reduced by projecting the tracks of a winding in between the tracks of the adjacent winding (Fig.10b).

Furthermore, the repeatability of the capacitance allows for either compensating it in the rest of the circuit or using it in a resonant design. In the latter case, a high capacitance could be chosen on purpose by placing the tracks of adjacent windings face to face (Fig.10c).

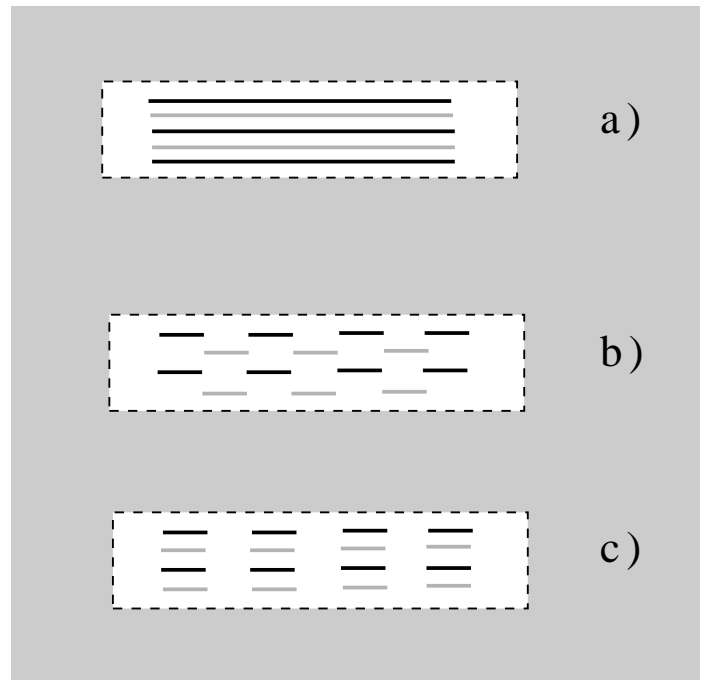


Fig.10 Different winding designs

6. Manufacturing

6.a. Assembly

Stand-alone : not essentially different from conventional.

For glue and curing proposals, see the application note "Gluing of ferrite cores". The high permeability ferrite 3E6 should not be glued between the mating faces, because the parasitic gap reduces effective permeability. Glue can be applied on the sides of the outer legs (Fig. 11).

Clamping is done by first pressing the clamp into the snap-fit and then aligning the plate in transversal direction.

Integrated : assembly is combined with mounting.

6.b. Mounting

Stand-alone : through-hole or SMD, not essentially different from conventional.

The flat core surface is well suited for pick & place systems.

Integrated : can best be done in 2 steps.

1). Glue one core half to the PCB. The same glue can be used as for attaching SMD components and this step is logically combined with SMD mounting on the same PCB side.

2). Glue or clamp the second core half to the first one. The same remarks apply here as for stand-alone assembly.

6.c. Soldering

Only applicable for stand-alone transformers.

In case of reflow soldering, hot air convection is preferred over IR radiation heating, because it equalises the temperature differences. With standard IR radiation heating, the good thermal conduction of the planar component can lead to a too low solder paste temperature or there can be a too high PCB temperature if radiation power is increased. In case of IR reflow soldering, it is advised to use modified solder paste and/or PCB material.

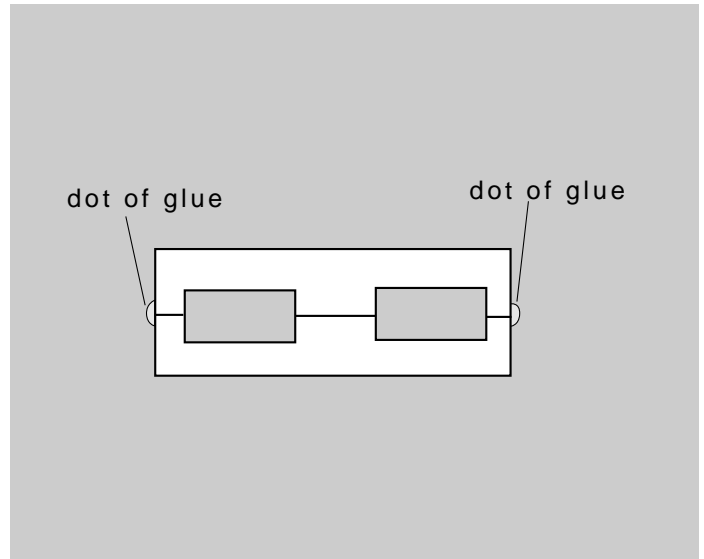


Fig 11 Gluing of planar E cores

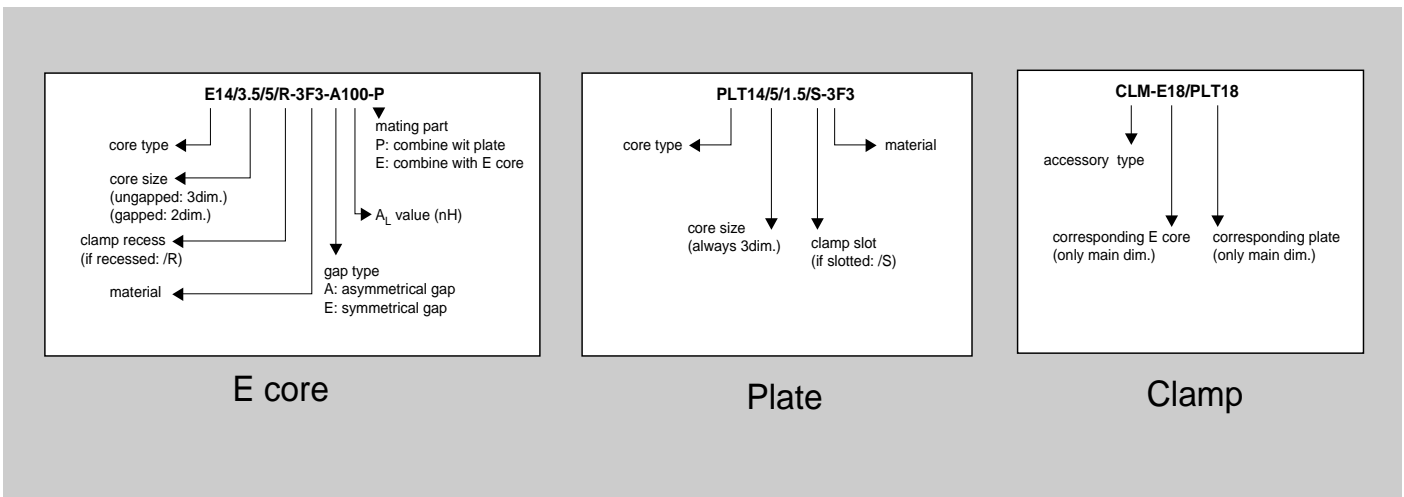
7. Literature & sample boxes

25 Watt DC/DC converter using integrated planar magnetics	9398 236 26011
Gluing of Ferrite Cores	9398 083 20011
Design of Planar Power Transformers	9398 083 39011
SAMPLEBOX7 : Small planar E cores in 3F3	4322 020 85131
SAMPLEBOX8 : Medium planar E cores in 3C85 & 3F3	4335 000 40971

8.Type number system

All planar core type numbers correspond to a core half. Therefore two core halves have to be ordered in the right combination. There are 4 core half types combined to 3 types of core sets :

E + E, E + PLT and E/R + PLT/S. The last one is completed with a clamp (CLM).



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