Planar Transformers

- Low profile power transformers
- Very high efficiency; low DCR
- Can be used in a wide range of topologies
- 1500 Vrms, one minute isolation (hipot) between windings
- Power range: 120 – 800 Watts
- Frequency range up to 700 kHz

Planar transformers are an ideal solution for high frequency switch mode power converters. They offer higher power density and higher current handling capability in a lower profile compared with traditional wire wound transformers.

A new planar transformer design, constructed with flat coil windings and copper plates rather than multi-layer PCBs, increases the power level (up to 800 W) and lowers the leakage inductance. This design exceeds the critical electrical requirement for topologies such as push pull, half bridge, or full bridge. The POE120PL, PL160, PL300, MA5519-AL, and NA5871-AL are new generation planar transformers offering efficiency up to 98%.

Coilcraft custom designed planar transformers are used in a wide variety of IC reference designs, as shown on page 6. For applications not covered in the table, custom designs are available on request.

POE120PL
- Designed for active clamp forward topology
- Operates at 200 kHz, with 36 – 72 Volt input
- Provides 0.009” (0.229 mm) clearance above the seating plane
- Includes a 12-Volt auxiliary winding

PL160
- Designed to operate between 200 kHz and 700 kHz with a nominal 48 V input.
- Provides 0.009” (0.229 mm) clearance above the seating plane
- May be special ordered with an auxiliary winding

PL300
- Designed to operate between 200 kHz and 700 kHz with a nominal 48 V input.
- Provides 0.009” (0.229 mm) clearance above the seating plane
- May be special ordered with an auxiliary winding

MA5519-AL
- Developed for Texas Instruments PMP9219 LM5045 based 720 W Power Converter
- Provides 0.009” (0.229 mm) clearance above the seating plane
- Designed to operate at 400 kHz with 36 – 75 V input
- 12 V, 60 A output
- Listed as T2 on Texas Instruments BOM-PMP9219

NA5871-AL
- Developed for Texas Instruments PMP6712 Dual-Channel 800 Watt Full-Bridge Converter for PoE Power Sourcing (PSE)
- Designed to operate at 400 kHz with 38 – 60 V input
- 54 V, 15 A output
- Listed as T2 and T4 on Texas Instruments BOM-PMP6712
- Insulated bottom surface
## Planar Transformers

<table>
<thead>
<tr>
<th>Power (W)</th>
<th>Part number</th>
<th>Turns</th>
<th>Inductance</th>
<th>Leakage Inductance</th>
<th>DCR max</th>
<th>Volt-time product</th>
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<td>Pri2</td>
<td>Sec</td>
<td>(µH)</td>
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</table>

1. When ordering the POE120PL or the PL160, specify **packaging** code:

   - **POE120PL-24LD**
   - **Packaging**: Blank In trays, 36 per tray
   - D = Optional tape and reel (additional cost), 13” machine-ready reel. EIA-481 embossed plastic tape. Quantities less than full reel available: in tape (not machine ready) or with leader and trailer (S25 charge). See tape and reel specifications on page 2.
   - B = Optional tape and reel (additional cost), less than full reel. In an effort to simplify our part numbering system, Coilcraft is eliminating the need for multiple packaging codes. When ordering, simply change the last letter of your part number from B to D.

2. Inductance measured on an Agilent/HP 4284 at 200 kHz, 0.5 Vrms, 0 Adc between pins 2 and 5 with pins 3 and 4 connected.
3. Leakage inductance is for the primary connected in series with all secondary pins shorted.
4. DCR is measured across all windings.
5. Volt-time product is for the primary.
6. Electrical specifications at 25°C.

Refer to Doc 362 “Soldering Surface Mount Components” before soldering.

### Schematics

- **Schematics A**
- **Schematics B**
- **Schematics C**
- **Schematics D**

### Core material

- **Ferrite**

### Terminations

- Matte tin over nickel over brass.

### Ambient temperature

- –40°C to +120°C

### Storage temperature

- Component: –40°C to +125°C.
- Tray and tape and reel packaging: –40°C to +80°C

### Resistance to soldering heat

- Max three 40 second reflows at +260°C, parts cooled to room temperature between cycles

### Moisture Sensitivity Level (MSL)

- 1 (unlimited floor life at <30°C / 85% relative humidity)

### PCB washing

- Tested to MIL-STD-202 Method 215 plus an additional aqueous wash. See Doc787_PCB_Washing.pdf.
Planar Transformers

Calculating Efficiency

This graph represents core loss versus flux density for each series. By determining core loss and copper loss, the overall efficiency can be estimated.

Efficiency (%) = \( \frac{P_{\text{OUT}} - (\text{CORE loss} + \text{COPPER loss})}{P_{\text{OUT}}} \times 100 \)

where \( P_{\text{OUT}} = \text{desired V} \times I \)

Core loss is a function of core material, flux density swing (\( \Delta B = 2 \times B_{\text{PK}} \)), frequency, and core size. Use the following equation for calculating peak flux density (\( B_{\text{PK}} \)) and then read CORE loss from Y-axis on the graph.

\[ B_{\text{PK}} = K \times \text{Vin} \times \text{Dmax} / (\text{Freq} \times N) \]

Where:
- \( K \) = series factor (see table)
- \( \text{Vin} \) = primary DC voltage
- \( \text{Dmax} \) = maximum duty cycle
- \( \text{Freq} \) = switching frequency in kHz
- \( N \) = number of primary turns

Copper loss is a function of Irms and DC resistance of each winding. Use the following equation for calculating copper loss.

\[ \text{COPPER loss} = \text{Irms(pri)}^2 \times \text{DCR(pri)} + \text{Irms(sec)}^2 \times \text{DCR(sec)} \]
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Weight: 11.1 – 11.9 g
Packaging: 36 per tray
Optional tape and reel packaging
POE120-12: 250/13” reel
Plastic tape: 44 mm wide, 0.5 mm thick, 32 mm pocket spacing, 9.40 mm pocket depth
POE120-24: 200/13” reel
Plastic tape: 44 mm wide, 0.5 mm thick, 28 mm pocket spacing, 9.98 mm pocket depth
POE120-33: 200/13” reel
Plastic tape: 44 mm wide, 0.5 mm thick, 28 mm pocket spacing, 10.68 mm pocket depth
POE120-50: 250/13” reel
Plastic tape: 44 mm wide, 0.5 mm thick, 32 mm pocket spacing, 9.78 mm pocket depth

Weight: 12.0 – 12.8 g
Packaging: 36 per tray

Recommended Land Pattern

Part number | Height max (in / mm)
--- | ---
PL300-100L | 0.410 / 10.4
PL300-101L | 0.410 / 10.4
PL300-102L | 0.450 / 11.4
PL300-103L | 0.450 / 11.4
PL300-104L | 0.475 / 12.1

Recommended Land Pattern

Part number | Height max (in / mm)
--- | ---
PE-100L | 0.352 / 8.94
PE-101L | 0.352 / 8.94
PE-102L | 0.380 / 9.64
PE-103L | 0.380 / 9.64
PE-104L | 0.375 / 9.53
PE-105L | 0.375 / 9.53

Dimensions are in inches mm

Dash Height max number (inches / mm)

-12L 0.352 / 8.94
-24L 0.380 / 9.64
-33L 0.407 / 10.34
-50L 0.375 / 9.53

Recommended Land Pattern

Part number | Height max (in / mm)
--- | ---
PL160-100L | 0.352 / 8.94
PL160-101L | 0.360 / 9.14
PL160-102L | 0.375 / 9.53
PL160-103L | 0.375 / 9.53

Recommended Land Pattern

Part number | Height max (in / mm)
--- | ---
PE-100L | 0.352 / 8.94
PE-101L | 0.380 / 9.64
PE-102L | 0.407 / 10.34
PE-103L | 0.375 / 9.53

Recommended Land Pattern

Part number | Height max (in / mm)
--- | ---
PL300-100L | 0.410 / 10.4
PL300-101L | 0.410 / 10.4
PL300-102L | 0.450 / 11.4
PL300-103L | 0.450 / 11.4
PL300-104L | 0.475 / 12.1

Weight: 22.5 – 26.0 g
Packaging: 25 per tray

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Specification subject to change without notice.
Please check web site for latest information.

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Weight: 53.9 g
Packaging: 16 per tray

Dimensions are in inches

Weight: 60 g
Packaging: 20 per tray

Dimensions are in mm

Dot indicates pin 1
Internal code

Insulator

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## Planar Transformers

Coilcraft planar transformers have been designed in a wide variety of applications. Though designed for specific chipsets, these transformers can also be used in other applications and with many other integrated circuits. Visit [www.coilcraft.com/prod_planar.cfm](http://www.coilcraft.com/prod_planar.cfm) for additional information.

<table>
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<th>Power (W)</th>
<th>Output (V)</th>
<th>Input voltage (V)</th>
<th>Turns</th>
<th>Part number</th>
<th>Primary L (µH)</th>
<th>DCR (mOhms)</th>
<th>Leakage L (µH)</th>
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<td>33</td>
<td>3.3 V, 10 A</td>
<td>36 – 75</td>
<td>24 : 4</td>
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