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 number¹</th>
<th>Turns</th>
<th>Inductance²</th>
<th>Leakage Inductance³</th>
<th>DCR max⁴ (mOhms)</th>
<th>Volt-time product⁵ (V-µsec)</th>
<th>Schematic</th>
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<tr>
<td>120</td>
<td>POE120PL-33L_</td>
<td>12 — 2</td>
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<td>0.20</td>
<td>1.37 4.4 117</td>
<td>117 D</td>
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</table>

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

| Packaging | Blank | 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 ($25 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. To order a PL160 or PL300 with an optional auxiliary winding, add an “X” and the turn count after the PL160 (PL300), e.g. PL160X3-100LB. Turn counts of 2, 3, 4, 5, 7 and 9 are available for the auxiliary winding. Parts with auxiliary windings are not stocked. |

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.

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

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 refloows at +260°C, parts cooled to room temperature between cycles
Moisture Sensitivity Level (MSL) 1 (unlimited floor life at <30°C / 85% relative humidity)
Failures in Time (FIT) / Mean Time Between Failures (MTBF)
10.06 per billion hours / 9.940E+07 hours, calculated per Telcordia SR-332
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 (%) = \( \frac{P_{OUT} - (\text{CORE}_\text{loss} + \text{COPPER}_\text{loss})}{P_{OUT}} \times 100 \)

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

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

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

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

Copper loss is a function of \( \text{I}_{\text{rms}} \) and DC resistance of each winding. Use the following equation for calculating copper loss.

\[ \text{COPPER}_\text{loss} = \text{Irms}^{2} \times \text{DCR}^{2} + \text{Irms}^{2} \times \text{DCR}^{2} \]
Planar Transformers

- **POE120-12L**: 250/13” reel
  - Plastic tape: 44 mm wide, 0.5 mm thick, 32 mm pocket spacing, 9.40 mm pocket depth

- **POE120-24L**: 200/13” reel
  - Plastic tape: 44 mm wide, 0.5 mm thick, 28 mm pocket spacing, 9.98 mm pocket depth

- **POE120-33L**: 200/13” reel
  - Plastic tape: 44 mm wide, 0.5 mm thick, 28 mm pocket spacing, 10.68 mm pocket depth

- **POE120-50L**: 250/13” reel
  - Plastic tape: 44 mm wide, 0.5 mm thick, 32 mm pocket spacing, 9.78 mm pocket depth

**Part Details**

- **Weight**: 11.1 – 11.9 g
- **Packaging**: 36 per tray

- **POE120PL-12**: 250/13” reel
  - Plastic tape: 44 mm wide, 0.5 mm thick, 32 mm pocket spacing, 9.40 mm pocket depth

- **POE120PL-24**: 200/13” reel
  - Plastic tape: 44 mm wide, 0.5 mm thick, 28 mm pocket spacing, 9.98 mm pocket depth

- **POE120PL-33**: 200/13” reel
  - Plastic tape: 44 mm wide, 0.5 mm thick, 28 mm pocket spacing, 10.68 mm pocket depth

- **POE120PL-50**: 250/13” reel
  - Plastic tape: 44 mm wide, 0.5 mm thick, 32 mm pocket spacing, 9.78 mm pocket depth

**Dimensions**

- **Weight**: 22.5 – 26.0 g
- **Packaging**: 25 per tray

**Recommended Land Pattern**

<table>
<thead>
<tr>
<th>Part number</th>
<th>Height max (in / mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL300-100L</td>
<td>0.410 / 10.4</td>
</tr>
<tr>
<td>PL300-101L</td>
<td>0.410 / 10.4</td>
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<tr>
<td>PL300-102L</td>
<td>0.450 / 11.4</td>
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<tr>
<td>PL300-103L</td>
<td>0.450 / 11.4</td>
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<tr>
<td>PL300-104L</td>
<td>0.475 / 12.1</td>
</tr>
</tbody>
</table>

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Planar Transformers

Weight: 53.9 g
Packaging: 16 per tray

Dimensions are in inches (mm)

- **NA5519-AL**
  - Internal code
  - Dot indicates pin 1
  - 1.37 max / 34.7
  - Weight: 53.9 g
  - Packaging: 16 per tray

- **NA5871-AL**
  - Internal code
  - Dot indicates pin 1
  - 1.91 max / 48.3
  - Weight: 60 g
  - Packaging: 20 per tray

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RoHS/REACH compliant.

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Please check web site for latest information.
# 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>
<thead>
<tr>
<th>Power (W)</th>
<th>Output Voltage (V)</th>
<th>Turns</th>
<th>Part Number</th>
<th>Primary L (µH)</th>
<th>DCR (mOhms)</th>
<th>Leakage L (µH)</th>
<th>Designed for</th>
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<tbody>
<tr>
<td>33</td>
<td>3.3 V, 10 A</td>
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<td>A9784-BL</td>
<td>1300</td>
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<td>0.018</td>
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