## High Isolation Gate Drive Transformers

**PH9400.XXXNL and PH9400.XXXANL - SMT**

**Notes:**

1. The max ET is calculated to limit the core loss and temperature rise at 100KHz based on a bipolar flux swing of 2100Ga Peak. This value needs to be derated for higher frequencies using the temperature rise calculation.

2. The temperature rise of the component is calculated based on the total core loss and copper loss:
   - A. To calculate total copper loss (W), use the following formula:
     \[ \text{Copper Loss (W)} = I_{\text{rms}}^2 \times (\text{DCR Drive + (# of Gates) \times DCR Gates}) \]
   - B. To calculate total core loss (W), use the following formula:
     \[ \text{Copper Loss (W)} = 5.1E-10 \times (\text{Frequency in kHz})^{1.42} \times (K_1 \times ET)^{2.5} \]
     
     \[ \text{Where ET} = \frac{V \times \text{Duty Cycle}}{\text{Frequency}} \]
   - C. To calculate temperature rise, use the following formula:
     \[ \text{Temperature Rise (°C)} = 71 \times (\text{Core Loss(W) + Copper Loss (W)}) \]

3. Continuous isolation voltage confirmed by 125°C/1000hrs accelerated aging with the bias voltage applied between gate and drive windings.

4. ANL versions, which use triple insulated wire on both the drive and gate windings, are compliant with IEC 60950, IEC 61558, IEC 61010 & IEC 60601 for reinforced insulation.

   NL versions, which use triple insulated wire on just the drive winding, comply with basic insulation requirements.

5. 12mm package creepage distance satisfies IEC60950-1 & IEC61558-1/-2-16 reinforced isolation requirements for working voltage to 600Vrms max, OCV II, Pollution Degree 2 and altitude up to 2000m.

6. Unless otherwise specified, all testing is made at 100kHz, 0.1Vac.

7. Optional Tape & Reel packaging can be ordered by adding a "T" suffix to the part number (i.e. PH9400.111NL becomes PH9400.111NL T). Pulse complies to industry standard tape and reel specification EIA481.

### Electrical Specifications @ 25°C - Operating Temperature -40°C to +125°C

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Turns Ratio</th>
<th>ET (1-4) (V * μsec MAX)</th>
<th>Core Loss Factor K1</th>
<th>Primary Inductance (1-4) (mH +/-35%)</th>
<th>Leakage Inductance Drive to Gate (μH MAX)</th>
<th>Parasitic Capacitance Drive to Gate (pF MAX)</th>
<th>DCR Drive (1-4) (Ω MAX)</th>
<th>DCR Gates (5-6) (7-8) (Ω MAX)</th>
<th>Hi-Pot Drive-Gate (Vrms)</th>
<th>Gate-Gate (Vrms)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PH9400.XXXNL - Basic Insulation</strong></td>
<td>600Vrms continuous isolation</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>PH9400.111NL</td>
<td>1:1</td>
<td>315</td>
<td>0.67</td>
<td>4.5</td>
<td>5.0</td>
<td>60</td>
<td>1.8</td>
<td>2.5</td>
<td>4000</td>
<td>1500</td>
</tr>
<tr>
<td>PH9400.566NL</td>
<td>5:6:6</td>
<td>315</td>
<td>0.67</td>
<td>4.5</td>
<td>3.5</td>
<td>60</td>
<td>1.8</td>
<td>3.0</td>
<td>4000</td>
<td>1500</td>
</tr>
<tr>
<td>PH9400.122NL</td>
<td>12:2</td>
<td>250</td>
<td>0.84</td>
<td>2.88</td>
<td>3.5</td>
<td>60</td>
<td>1.5</td>
<td>4.2</td>
<td>4000</td>
<td>1500</td>
</tr>
<tr>
<td>PH9400.655NL</td>
<td>6:5:5</td>
<td>375</td>
<td>0.56</td>
<td>6.48</td>
<td>5.3</td>
<td>60</td>
<td>2.2</td>
<td>2.5</td>
<td>4000</td>
<td>1500</td>
</tr>
<tr>
<td>PH9400.211NL</td>
<td>2:1:1</td>
<td>375</td>
<td>0.56</td>
<td>6.48</td>
<td>8.0</td>
<td>60</td>
<td>2.2</td>
<td>1.6</td>
<td>4000</td>
<td>1500</td>
</tr>
</tbody>
</table>

| **PH9400.XXXANL - Reinforced Insulation** | 1000Vrms continuous isolation | | | | | | | |
| PH9400.111ANL | 1:1 | 160 | 1.32 | 1.21 | 2.5 | 45 | 0.9 | 0.9 | 5000 | 2000 |
| PH9400.566ANL | 5:6:6 | 155 | 1.36 | 1.12 | 3.0 | 45 | 0.9 | 1.0 | 5000 | 2000 |
| PH9400.233ANL | 2:3:3 | 125 | 1.68 | 0.72 | 2.0 | 45 | 0.7 | 1.0 | 5000 | 2000 |
| PH9400.655ANL | 6:5:5 | 185 | 1.14 | 1.62 | 3.0 | 45 | 1.0 | 0.9 | 5000 | 2000 |
| PH9400.211ANL | 2:1:1 | 185 | 1.14 | 1.62 | 3.5 | 45 | 1.0 | 0.55 | 5000 | 2000 |

**Basic and Reinforced Insulation**  
**Sidecar package with 12mm creepage**  
**Up to 5000Vrms gate to drive isolation**  
**1000Vrms continuous isolation between windings**  
**Up to 8W of Driver Power**  
**Patented:** US Patent 9,646,755
High Isolation Gate Drive Transformers
PH9400.XXXNL and PH9400.XXXANL - SMT

**Mechanicals**

**PH9400.XXXNL and PH9400.XXXANL**

- **PART NUMBER**
- **D.C. CITY MFG**
- **PAT 9.646.755**
- **12.70**
- **16.50 MAX**
- **8X 0.6**
- **3X 4.10 (+/- 12.3)**
- **14.20 MAX**
- **16.70 MAX**
- **0.10 MIN**
- **(4.10)**
- **3X 4.10 (+/- 12.3)**

- **SUGGESTED PAD LAYOUT**

**Schematics**

**PA9400.XXXNL**

- **Primary**
- **Secondary**
- **1 DRIVE**
- **2 DRIVE**
- **4 DRIVE**
- **8 GATE**
- **7 GATE**
- **6 GATE**

**PA9400.XXXANL**

- **Primary**
- **Secondary**
- **1 DRIVE**
- **2 DRIVE**
- **4 DRIVE**
- **8 GATE**
- **7 GATE**
- **6 GATE**

**Weight**..........................2.5 grams

**Tape & Reel**..................150/Reel

**Tray**..............................80/tray

**Dimension:**
- **Inches** mm
- **.010** mm

Unless otherwise specified, all tolerances are ± 0.25

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