TABLE of CONTENTS

ISOLATION TRANSFORMERS

10BASE-T
   Electrical Specifications: Surface Mount and Through Hole ........................................... .2

ETHERNET
   Electrical Specifications: Surface Mount and Through Hole ........................................... .3

APPLICATION CIRCUITS
   10Base-T ................................................................................................................................. .4
   Ethernet ................................................................................................................................. .5

SCHEMATICS .............................................................................................................................. .6

MECHANICALS
   Surface Mount ....................................................................................................................... .8
   Through Hole ........................................................................................................................... .10
ISOLATION TRANSFORMERS
FOR 10BASE-T
For Adapter Cards, MAUs, Hubs, and Motherboard Applications

- Designed to meet or exceed IEEE 802.3, 10Base-T specifications
- Available with common mode chokes for EMI suppression
- Surface mount, IC grade, transfer-molded package withstands 235°C peak temperature profile
- Through hole, auto-insertable, 16-pin DIP package

Electrical Specifications @ 25°C — Operating Temperature 0°C to 70°C

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Turns Ratio (±5%)</th>
<th>Primary Pins</th>
<th>Common Mode Choke</th>
<th>Sine Wave Inductance OCL¹ (µH MIN)</th>
<th>Interwinding Capacitance Cww ² (pF MAX)</th>
<th>Leakage Inductance Ll ³ (µH MAX)</th>
<th>DCR (Ω MAX)</th>
<th>Hi-Pot (Vrms)</th>
<th>Schem.</th>
<th>Mech.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENSE MOUNT ²</td>
<td>Transmit</td>
<td>Receive</td>
<td>pp. 6-7</td>
<td>pp. 8-9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE-65454</td>
<td>1:√2</td>
<td>1:1</td>
<td>3-4/1-2</td>
<td>X</td>
<td>140</td>
<td>12</td>
<td>0.2</td>
<td>0.4</td>
<td>2000</td>
<td>T1</td>
</tr>
<tr>
<td>E5017</td>
<td>1CT:1CT</td>
<td>1CT:1CT</td>
<td>1-3/6-8</td>
<td></td>
<td>200</td>
<td>10</td>
<td>0.25</td>
<td>1.0</td>
<td>1500</td>
<td>T6</td>
</tr>
<tr>
<td>PE-65726</td>
<td>1CT:1CT</td>
<td>1CT:1CT</td>
<td>1-3/6-8</td>
<td></td>
<td>200</td>
<td>10</td>
<td>0.2</td>
<td>0.3</td>
<td>2000</td>
<td>T4</td>
</tr>
<tr>
<td>23Z114SM</td>
<td>1CT:1CT</td>
<td>1CT:1CT</td>
<td>1-3/6-8</td>
<td></td>
<td>200</td>
<td>12</td>
<td>0.3</td>
<td>0.3</td>
<td>2000</td>
<td>T4</td>
</tr>
<tr>
<td>PE-68048</td>
<td>1CT:√2CT</td>
<td>1CT:1CT</td>
<td>6-8/1-3</td>
<td>X</td>
<td>110</td>
<td>15</td>
<td>0.4</td>
<td>1.0</td>
<td>1500</td>
<td>T5</td>
</tr>
<tr>
<td>PE-65745</td>
<td>1CT:√2CT</td>
<td>1CT:1CT</td>
<td>6-8/1-3</td>
<td></td>
<td>140</td>
<td>12</td>
<td>0.2</td>
<td>0.3</td>
<td>2000</td>
<td>T4</td>
</tr>
<tr>
<td>23Z128SM</td>
<td>1CT:√2CT</td>
<td>1CT:1CT</td>
<td>6-8/1-3</td>
<td></td>
<td>200</td>
<td>15</td>
<td>0.5</td>
<td>0.4</td>
<td>2000</td>
<td>T4</td>
</tr>
<tr>
<td>E2023</td>
<td>1CT:2.5CT</td>
<td>1CT:1CT</td>
<td>6-8/1-3</td>
<td></td>
<td>200</td>
<td>15</td>
<td>0.5</td>
<td>0.4</td>
<td>2000</td>
<td>T4</td>
</tr>
<tr>
<td>EX2024 ³</td>
<td>1CT:2.5CT</td>
<td>1CT:1CT</td>
<td>6-8/1-3</td>
<td></td>
<td>350</td>
<td>30</td>
<td>0.8</td>
<td>0.6</td>
<td>2000</td>
<td>T10</td>
</tr>
<tr>
<td>23Z356SM</td>
<td>1CT:√2CT</td>
<td>1CT:1CT</td>
<td>6-8/1-3</td>
<td></td>
<td>200</td>
<td>12</td>
<td>0.5</td>
<td>0.6</td>
<td>2000</td>
<td>T7</td>
</tr>
<tr>
<td>23Z355SM</td>
<td>2CT:1CT</td>
<td>1CT:1CT</td>
<td>1-3/6-8</td>
<td></td>
<td>100</td>
<td>10</td>
<td>0.4</td>
<td>0.5</td>
<td>2000</td>
<td>T4</td>
</tr>
<tr>
<td>PE-68052</td>
<td>2CT:1CT</td>
<td>1CT:1CT</td>
<td>1-3/6-8</td>
<td></td>
<td>140</td>
<td>12</td>
<td>0.3</td>
<td>1.0</td>
<td>1500</td>
<td>T6</td>
</tr>
<tr>
<td>E4001</td>
<td>1CT:2CT</td>
<td>1CT:1CT</td>
<td>1-3/6-8</td>
<td></td>
<td>3</td>
<td>0.3</td>
<td>0.8</td>
<td>1500</td>
<td>T5</td>
<td>SMT4</td>
</tr>
<tr>
<td>PE-68041</td>
<td>1CT:2CT</td>
<td>1CT:1CT</td>
<td>6-8/1-3</td>
<td></td>
<td>112</td>
<td>8</td>
<td>0.3</td>
<td>0.5</td>
<td>1500</td>
<td>T4</td>
</tr>
<tr>
<td>23Z487SM</td>
<td>1CT:2CT</td>
<td>1CT:1CT</td>
<td>6-8/1-3</td>
<td></td>
<td>140</td>
<td>12</td>
<td>0.2</td>
<td>0.6</td>
<td>2000</td>
<td>T7</td>
</tr>
<tr>
<td>PE-68023</td>
<td>1CT:2CT</td>
<td>1CT:1CT</td>
<td>1-3/6-8</td>
<td></td>
<td>200</td>
<td>12</td>
<td>0.3</td>
<td>1.0</td>
<td>1500</td>
<td>T6</td>
</tr>
<tr>
<td>PE-68042</td>
<td>2√2CT:1</td>
<td>1:1</td>
<td>2-4/7-9</td>
<td></td>
<td>200</td>
<td>14</td>
<td>1</td>
<td>0.5</td>
<td>1500</td>
<td>T9</td>
</tr>
<tr>
<td>PE-68810</td>
<td>—</td>
<td>1:1 (4X)</td>
<td>1-2/3-4</td>
<td></td>
<td>140</td>
<td>12</td>
<td>0.2</td>
<td>0.4</td>
<td>2000</td>
<td>T3</td>
</tr>
<tr>
<td>PE-68820</td>
<td>1:√2 (4X)</td>
<td>—</td>
<td>1-2/3-4</td>
<td></td>
<td>140</td>
<td>12</td>
<td>0.2</td>
<td>0.4</td>
<td>2000</td>
<td>T3</td>
</tr>
<tr>
<td>THROUGH HOLE</td>
<td>pp. 6-7</td>
<td>p. 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23Z435</td>
<td>2CT:1CT</td>
<td>1CT:1CT</td>
<td>1-3/6-8</td>
<td></td>
<td>80</td>
<td>10</td>
<td>0.4</td>
<td>0.5</td>
<td>2000</td>
<td>T4</td>
</tr>
<tr>
<td>23Z128</td>
<td>1CT:√2CT</td>
<td>1CT:1CT</td>
<td>6-8/1-3</td>
<td></td>
<td>140</td>
<td>15</td>
<td>0.5</td>
<td>0.4</td>
<td>2000</td>
<td>T4</td>
</tr>
<tr>
<td>PE-65263</td>
<td>1CT:1CT</td>
<td>1CT:1CT</td>
<td>1-3/6-8</td>
<td></td>
<td>200</td>
<td>15</td>
<td>0.25</td>
<td>0.3</td>
<td>2000</td>
<td>T4</td>
</tr>
</tbody>
</table>

NOTES:
1. OCL, Cww and Ll are measured at 20 mVrms, 100 kHz.
2. To order Tape & Reel packaging for surface mount parts, add the suffix “T” to the part number.
   Example: PE-65454T. The “T” will appear on all paper work, but will not be marked on parts.
3. Part numbers denoted “EX” are extended temperature parts -40°C to 85°C, electrical specifications @ 25°C.
Low leakage inductance and coupling capacitance for faster rise times
Small form factor, 50 mil lead spacing
Through hole, auto-insertable, 16-pin DIP package

### Electrical Specifications @ 25°C — Operating Temperature 0°C to 70°C

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Turns Ratio (±5%)</th>
<th>Primary Pins</th>
<th>Primary Sine Wave OCL&lt;sup&gt;1&lt;/sup&gt; (µH ±20%)</th>
<th>Primary ET-Constant (V-µs MIN)</th>
<th>Rise Time&lt;sup&gt;2&lt;/sup&gt; (ns MAX)</th>
<th>Interwinding Capacitance C&lt;sub&gt;ww&lt;/sub&gt;&lt;sup&gt;3&lt;/sup&gt; (pF MAX)</th>
<th>Leakage Inductance L&lt;sub&gt;L&lt;/sub&gt;&lt;sup&gt;4&lt;/sup&gt; (µH MAX)</th>
<th>DCR (Ω MAX)</th>
<th>Schem.</th>
<th>Mech.</th>
<th>Hipot (Vrms)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SURFACE MOUNT&lt;sup&gt;3&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E6002</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>40 (MIN)</td>
<td>2.1</td>
<td>3.0</td>
<td>8</td>
<td>0.20</td>
<td>0.25</td>
<td>T2</td>
<td>SMT4</td>
<td>2000</td>
</tr>
<tr>
<td>PE-65723</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>75</td>
<td>1.8</td>
<td>3.0</td>
<td>8</td>
<td>0.20</td>
<td>0.30</td>
<td>T2</td>
<td>SMT4</td>
<td>2000</td>
</tr>
<tr>
<td>PE-68801</td>
<td>1:1</td>
<td>1-2/3-4/5-6</td>
<td>75</td>
<td>1.8</td>
<td>3.0</td>
<td>12</td>
<td>0.20</td>
<td>0.30</td>
<td>T8</td>
<td>SMT3</td>
<td>2000</td>
</tr>
<tr>
<td>23Z90SM</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>75</td>
<td>2.4</td>
<td>3.0</td>
<td>10</td>
<td>0.20</td>
<td>0.20</td>
<td>T2</td>
<td>SMT5</td>
<td>2000</td>
</tr>
<tr>
<td>PE-65728</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>100</td>
<td>1.8</td>
<td>3.0</td>
<td>9</td>
<td>0.20</td>
<td>0.30</td>
<td>T2</td>
<td>SMT4</td>
<td>2000</td>
</tr>
<tr>
<td>23Z91SM</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>100</td>
<td>2.4</td>
<td>3.0</td>
<td>10</td>
<td>0.20</td>
<td>0.30</td>
<td>T2</td>
<td>SMT5</td>
<td>2000</td>
</tr>
<tr>
<td>PE-65727</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>150</td>
<td>1.2</td>
<td>3.0</td>
<td>12</td>
<td>0.20</td>
<td>0.30</td>
<td>T2</td>
<td>SMT4</td>
<td>2000</td>
</tr>
<tr>
<td>PE-65733</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>350</td>
<td>2.6</td>
<td>3.5</td>
<td>16</td>
<td>0.30</td>
<td>0.35</td>
<td>T2</td>
<td>SMT4</td>
<td>2000</td>
</tr>
<tr>
<td>23Z108SM</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>350</td>
<td>2.5</td>
<td>3.5</td>
<td>16</td>
<td>0.30</td>
<td>0.35</td>
<td>T2</td>
<td>SMT5</td>
<td>2000</td>
</tr>
<tr>
<td><strong>THROUGH HOLE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE-64102</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>75</td>
<td>2.1</td>
<td>3.0</td>
<td>10</td>
<td>0.20</td>
<td>0.20</td>
<td>T2</td>
<td>TH4</td>
<td>500</td>
</tr>
<tr>
<td>PE-64107</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>75</td>
<td>2.4</td>
<td>3.5</td>
<td>10</td>
<td>0.25</td>
<td>0.30</td>
<td>T2</td>
<td>TH2</td>
<td>2000</td>
</tr>
<tr>
<td>PE-64502</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>75</td>
<td>2.1</td>
<td>3.0</td>
<td>10</td>
<td>0.20</td>
<td>0.20</td>
<td>T2</td>
<td>TH4</td>
<td>500</td>
</tr>
<tr>
<td>PE-64103</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>100</td>
<td>2.1</td>
<td>3.0</td>
<td>10</td>
<td>0.20</td>
<td>0.30</td>
<td>T2</td>
<td>TH4</td>
<td>500</td>
</tr>
<tr>
<td>PE-64108</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>100</td>
<td>2.1</td>
<td>3.5</td>
<td>10</td>
<td>0.25</td>
<td>0.40</td>
<td>T2</td>
<td>TH2</td>
<td>2000</td>
</tr>
<tr>
<td>PE-64503</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>100</td>
<td>2.1</td>
<td>3.0</td>
<td>10</td>
<td>0.20</td>
<td>0.30</td>
<td>T2</td>
<td>TH4</td>
<td>500</td>
</tr>
<tr>
<td>PE-64104</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>150</td>
<td>2.1</td>
<td>3.5</td>
<td>12</td>
<td>0.20</td>
<td>0.30</td>
<td>T2</td>
<td>TH4</td>
<td>500</td>
</tr>
<tr>
<td>PE-64109</td>
<td>1:1</td>
<td>1-2/4-5/7-8</td>
<td>150</td>
<td>3.0</td>
<td>3.0</td>
<td>15</td>
<td>0.20</td>
<td>0.45</td>
<td>T2</td>
<td>TH2</td>
<td>2000</td>
</tr>
</tbody>
</table>

**NOTES:**
1. OCL, C<sub>ww</sub> and L<sub>L</sub> are measured at 20 mVrms, 100 kHz.
2. Rise time is measured in 75 Ω systems.
3. To order Tape & Reel packaging for surface mount parts, add the suffix “T” to the part number.
   Example: PE-65723T. The “T” will appear on all paper work, but will not be marked on parts.
ISOLATION TRANSFORMERS

Typical Application Circuit

NOTES:
1. Connections at pins 12 and 13 apply to PE-68023 only. These are test points. Do not ground.
2. For specific information, see pages 2 and 3 in this catalog.
3. For specific connection, refer to National's Application Notes.
Typical 10Base-T Application Circuit

LXT914

TPDOP1
TPDON1
TPDOP2
TPDON2
TPDOP3
TPDON3
TPDOP4
TPDON4

TPDIP1
TPDIN1
TPDIP2
TPDIN2
TPDIP3
TPDIN3
TPDIP4
TPDIN4

TX 1:2

RX 1:1

PE-68820

PE-68810

PE-65723

ETHERNET TRANSFORMER

DB-15 CONNECTOR

CD-
CD+
RD-
RD+
TD-
TD+
ISOLATION TRANSFORMERS

Schematics

T1

T2

T3

T4

T5

T6

U.S: 858 674 8100 • U.K: 44 1483 401 700 • France: 33 3 84 35 04 04 • Singapore: 65 287 8998 • Taiwan: 886 2 2698 0228 • http://www.pulseeng.com
Schematics (continued)

T7

16 15 14 11 10 9

1 2 3 6 7 8

T8

12 11 10 9 8 7

1 2 3 4 5 6

T9

23 21 20 19 18 16 15 14

2 3 4 5 6 7 8 9 10 11

T10

16 14 11 9

1 2 3 6 7 8

15 10 9

1:1 1:2

Pin 5, 6, 12 and 13 not connected.
Surface Mount Mechanicals

**SMT1**

Dimensions: **Inches**  **mm**

Unless otherwise specified, all tolerances are ± .010

Weight  . . . . . . . . . . . .1.15 grams
Tube  . . . . . . . . . . . . . . . .25/tube
Tape & Reel  . . . . . . . . . .350/reel

**SMT2**

Dimensions: **Inches**  **mm**

Weight  . . . . . . . . . . . .0.22 grams
Tube  . . . . . . . . . . . . . . . .60/tube
Tape & Reel  . . . . . . . . . .1500/reel

**SMT3**

Dimensions: **Inches**  **mm**

Weight  . . . . . . . . . . . .0.28 grams
Tube  . . . . . . . . . . . . . . . .35/tube
Tape & Reel  . . . . . . . . . .1500/reel

U.S: 858 674 8100  •  U.K: 44 1483 401 700  •  France: 33 3 84 35 04 04  •  Singapore: 65 287 8998  •  Taiwan: 886 2 2698 0228  •  http://www.pulseeng.com
ISOLATION TRANSFORMERS

Surface Mount Mechanicals (continued)

SMT4

Dimensions: inches mm

Weight ..........0.82 grams
Tube ..........40/tube
Tape & Reel ..........900/reel

SUGGESTED PAD LAYOUT

SMT5

Dimensions: inches mm

Weight ..........0.85 grams
Tube ..........50/tube
Tape & Reel ...........750/reel
### ISOLATION TRANSFORMERS

#### Through Hole Mechanicals

**TH1**

```
1.000 MAX
2.54

Stand-off 4 PCS
```

**Dimensions:**
- **Inches**
- **mm**

- Unless otherwise specified, all tolerances are ± .010
- Weight: 2.17 grams
- Tube: 20/tube

**TH2**

```
1.000 MAX
2.54

```

**Dimensions:**
- **Inches**
- **mm**

- Unless otherwise specified, all tolerances are ± .010
- Weight: 2.18 grams
- Tube: 20/tube

**TH3**

```
0.800
20.32

```

**Dimensions:**
- **Inches**
- **mm**

- Unless otherwise specified, all tolerances are ± .005
- Weight: 1.7 grams
- Tube: .28/tube

**TH4**

```
0.800
20.32

```

**Dimensions:**
- **Inches**
- **mm**

- Unless otherwise specified, all tolerances are ± .010

For More Information:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Weight (Grams)</th>
<th>Tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE-64101/PE-64102/PE-64103</td>
<td>1.22</td>
<td>25</td>
</tr>
<tr>
<td>PE-64104/PE-64502/PE-64503</td>
<td>1.22</td>
<td>25</td>
</tr>
<tr>
<td>PE-65263</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Performance warranty of products offered on this data sheet is limited to the parameters specified. Data is subject to change without notice. Other brand and product names mentioned herein may be trademarks or registered trademarks of their respective owners.

©2000, Pulse Engineering, Inc.