# Fairchild Reference Design

The following reference design supports inclusion of FL7930B, FLS1800XS and FAN7346 in design of LED illumination. It should be used in conjunction with the FL7930B, FLS1800XS and FAN7346 datasheet as well as Fairchild’s application notes and technical support team. Please visit Fairchild’s website at [www.fairchildsemi.com](http://www.fairchildsemi.com).

<table>
<thead>
<tr>
<th>Application</th>
<th>Fairchild Device</th>
<th>Input Voltage Range</th>
<th>Rated Output Power</th>
<th>Output Voltage (Rated Current)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Illumination</td>
<td>FL7930B, FLS1800XS FAN7346</td>
<td>90 ~ 265 VAC</td>
<td>100 W</td>
<td>100 V (4-CH: 250 mA/CH) (1-CH: 1.0 A)</td>
</tr>
</tbody>
</table>

## 1. Key Features of Main Controller

### 1.1. FL7930B
- Additional OVP Detection Pin
- Input Voltage Absent Detection Circuit
- Internal Soft-Start without Overshoot
- Internal Total Harmonic Distortion (THD) Optimizer
- Precise Adjustable Output Over-Voltage Protection
- MOSFET Over-Current Protection

### 1.2. FLS1800XS
- Variable Frequency Control with 50% Duty Cycle High Efficiency through Zero Voltage Switching (ZVS)
- Up to 300 KHz Operating Frequency
- Auto-Restart Operation for All Protections with External LVCC
- Protection Functions: Over-Voltage Protection (OVP), Over-Current Protection (OCP), Abnormal Over-Current Protection (AOCP), Internal Thermal Shutdown (TSD)

### 1.3. FAN7346
- Linear Balance Control for 4-Channel LED Arrays
- Wide input Voltage Range: 10 V to 100 V
- Precision Current Accuracy Trimmed to 1.5%
- Support Wide Dimming Ratio: 0.5% ~ 100%
- Protection Functions: Channel Individual Open-LED Protection (OLP), Channel Individual Short-LED Protection (SLPR), Channel Individual Over-Current Protection (OCP), Thermal Shutdown Function (Auto-Recovery)
2. Schematic of the Evaluation Board

2.1 PFC Part

![Figure 1. Schematic for PFC part](image)

2.2 DC-DC Converter and Current Balance Controller Part

![Figure 2. Schematic for DC-DC Converter and Current Balance Part for Multi Output](image)
2.3 DC-DC Converter and CC/CV Part

Figure 3. Schematic for DC-DC Converter and CC/CV Part for Single Output
3 Magnetic Component Specifications

3.1 TM1 Specification for PFC

✓ Core : EER3019N (SAMHWA PL-7)
✓ Bobbin : 10 pin

![Transformer Schematic]

Figure 4. Transformer Specifications & Construction

Table 1. Winding Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Winding</th>
<th>Pin (S → F)</th>
<th>Wire</th>
<th>Turns</th>
<th>Winding Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Np</td>
<td>3, 4 → 1, 2</td>
<td>0.1φ×50</td>
<td>39 Ts</td>
<td>Solenoid Winding</td>
</tr>
<tr>
<td>2</td>
<td>NauxA</td>
<td>10 → 9</td>
<td>0.3φ</td>
<td>5 Ts</td>
<td>Solenoid Winding</td>
</tr>
<tr>
<td>3</td>
<td>NauxB</td>
<td>6 → 7</td>
<td>0.3φ</td>
<td>5 Ts</td>
<td>Solenoid Winding</td>
</tr>
</tbody>
</table>

Table 2. Electrical Characteristics

<table>
<thead>
<tr>
<th>Pin</th>
<th>Specification</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductance</td>
<td>3, 4 → 1, 2</td>
<td>280 μH ±5%</td>
</tr>
</tbody>
</table>
3.2 TM2 Specification for LLC Resonant Converter

✓ Core: EER3543
✓ Bobbin: 16 pin

Figure 5. Transformer Specifications & Construction

Table 3. Winding Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Winding</th>
<th>Pin(S → F)</th>
<th>Wire</th>
<th>Turns</th>
<th>Winding Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Np</td>
<td>8 → 2</td>
<td>0.1φ×20</td>
<td>38 Ts</td>
<td>Solenoid Winding</td>
</tr>
<tr>
<td>2</td>
<td>Insulation: Polyester Tape t = 0.025 mm, 3-Layer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Ns1</td>
<td>10 → 9</td>
<td>0.3φ</td>
<td>2 Ts</td>
<td>Solenoid Winding</td>
</tr>
<tr>
<td>4</td>
<td>Insulation: Polyester Tape t = 0.025 mm, 3-Layer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Ns2</td>
<td>13 → 11</td>
<td>0.1φ×20</td>
<td>17 Ts</td>
<td>Solenoid Winding</td>
</tr>
<tr>
<td>6</td>
<td>Insulation: Polyester Tape t = 0.025 mm, 3-Layer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Ns3</td>
<td>16 → 14</td>
<td>0.1φ×10</td>
<td>17 Ts</td>
<td>Center Solenoid Winding</td>
</tr>
<tr>
<td>8</td>
<td>Insulation: Polyester Tape t = 0.025 mm, 3-Layer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Electrical Characteristics

<table>
<thead>
<tr>
<th>Pin</th>
<th>Specification</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 – 8</td>
<td>Primary-Side Inductance (Lp)</td>
<td>850 µH ±5%</td>
</tr>
<tr>
<td>2 – 8</td>
<td>Primary-Side Effective Leakage (LR)</td>
<td>170 µH Max.</td>
</tr>
</tbody>
</table>
4. Electrical Performances

4.1. Overall System Efficiency

![System Efficiency Graph](image)

Figure 6. System Efficiency

4.2. Power Factor

![Power Factor Graph](image)

Figure 7. Power Factor (PF) Test Result

4.3. Current and Voltage Regulation Performance of Single Output

![CC/CV Performance Graph](image)

Figure 8. CC/CV Performance
4.4. Analog Dimming Performance of FAN7346

![Figure 9. Dimming Characteristics Curve (PLED vs. VADIM)](image)

5. Related Resources

- Datasheet link FL7930B
- Datasheet link FLS1800XS
- Datasheet link FAN7346

http://www.fairchildsemi.com/referencedesign/
Reference Design Disclaimer

Fairchild Semiconductor Corporation ("Fairchild") provides these reference design services as a benefit to our customers. Fairchild has made a good faith attempt to build for the specifications provided or needed by the customer. Fairchild provides this product "as is" and without "recourse" and MAKES NO WARRANTY, EXPRESSED, IMPLIED OR OTHERWISE, INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Customer agrees to do its own testing of any Fairchild reference designs in order to ensure design meets the customer needs. Neither Fairchild nor Customer shall be liable for incidental or consequential damages, including but not limited to, the cost of labor, requalifications, rework charges, delay, lost profits, or loss of goodwill arising out of the sale, installation or use of any Fairchild product.

Subject to the limitations herein, Fairchild will defend any suit or proceeding brought against Customer if it is based on a claim that any product furnished hereunder constitutes an infringement of any intellectual property rights. Fairchild must be notified promptly in writing and given full and complete authority, information and assistance (at Fairchild's expense) for defense of the suit. Fairchild will pay damages and costs therein awarded against Customer but shall not be responsible for any compromise made without its consent. In no event shall Fairchild's liability for all damages and costs (including the costs of the defense by Fairchild) exceed the contractual value of the products or services that are the subject of the lawsuit. In providing such defense, or in the event that such product is held to constitute infringement and the use of the product is enjoined, Fairchild, in its discretion, shall procure the right to continue using such product, or modify it so that it becomes noninfringing, or remove it and grant Customer a credit for the depreciated value thereof. Fairchild's indemnity does not extend to claims of infringement arising from Fairchild's compliance with Customer's design, specifications and/or instructions, or the use of any product in combination with other products or in connection with a manufacturing or other process. The foregoing remedy is exclusive and constitutes Fairchild's sole obligation for any claim of intellectual property infringement and Fairchild makes no warranty that products sold hereunder will not infringe any intellectual property rights.

All solutions, designs, schematics, drawings, boards or other information provided by Fairchild to Customer are confidential and provided for Customer's own use. Customer may not share any Fairchild materials with other semiconductor suppliers.