Fairchild Reference Design

The following reference design supports inclusion of FL7930B, FLS2100XS and FAN7346 in design of LED illumination. It should be used in conjunction with the FL7930B, FLS2100XS and FAN7346 datasheet as well as Fairchild’s application notes and technical support team. Please visit Fairchild’s website at 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, FLS2100XS, FAN7346</td>
<td>90 ~ 265V_{AC}</td>
<td>160W</td>
<td>115V (4-CH : 350mA/CH)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1-CH : 1.4A)</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. FLS2100XS

- 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 LV_{CC}
- 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: 10V to 100V
- 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

![Schematic for PFC part](image1)

**Figure 1.** Schematic for PFC part

2.2 DC-DC Converter and Current Balance Controller Part

![Schematic for DC-DC Converter and Current Balance Part for Multi Output](image2)

**Figure 2.** Schematic for DC-DC Converter and Current Balance Part for Multi Output

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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: 10pin

![Transformer specifications & construction.](image)

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>5Ts</td>
<td>Solenoid winding</td>
</tr>
</tbody>
</table>

Table 2. Electrical Characteristics.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Spec.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,4 → 1,2</td>
<td>194μH ±5%</td>
<td>100KHz, 1V</td>
</tr>
</tbody>
</table>
### 3.2 TM2 Specification for LLC Resonant Converter

- Core: EER3543
- Bobbin: 16pin

![Transformer specifications & construction.](image)

#### 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>36Ts</td>
<td>Solenoid winding</td>
</tr>
<tr>
<td>2</td>
<td>Insulation: Polyester Tape t = 0.025mm, 3Layers</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 = 0.025mm, 3Layers</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>19 Ts</td>
<td>Solenoid winding</td>
</tr>
<tr>
<td>6</td>
<td>Insulation: Polyester Tape t = 0.025mm, 3Layers</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>19Ts</td>
<td>Center Solenoid winding</td>
</tr>
<tr>
<td>8</td>
<td>Insulation: Polyester Tape t = 0.025mm, 3Layers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table 4. Electrical Characteristics.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Spec.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary-Side Inductance (Lp)</td>
<td>2 – 8</td>
<td>630uH ±5%</td>
</tr>
<tr>
<td>Primary-Side Effective Leakage (LR)</td>
<td>2 – 8</td>
<td>135uH Max</td>
</tr>
</tbody>
</table>
4. Electrical Performances

4.1 Overall System Efficiency

![System Efficiency Graph]

**Figure 6. System Efficiency**

4.2 Power Factor

![Power Factor Graph]

**Figure 7. Power Factor (PF) Test Result**

4.3 Current and Voltage Regulation Performance of Single Output

![CC/CV Performance Graph]

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

![Dimming Characteristic](image)

Figure 9. Dimming Characteristics Curve (P_LED vs. V_ADIM)

5. Related Resources

- Datasheet link FL7930B
- Datasheet link FLS2100XS
- Datasheet link FAN7346

http://www.fairchildsemi.com/referencedesign/
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