Fairchild Reference Design

The following user guide supports the demonstration kit for the FL7730. It should be used in conjunction with the FL7730 datasheet as well as Fairchild's application notes and technical support team. Please visit Fairchild's website at www.fairchildsemi.com

Application	Fairchild Device	Input Voltage Range	Output Power	Output Voltage (Rated Current)
LED Bulb	FL7730	180-265V_{AC}	8.4W	22V(0.38A)

Key Features

- ✓ Compatible with traditional TRIAC control
- ✓ Cost effective solution without input bulk capacitor and feedback circuitry
- ✓ Power Factor Correction
- ✓ Accurate constant-current (CC) Control
- ✓ Linear frequency control for better efficiency and easy design
- ✓ Constant current regulation vs output voltage change (10~28V) : <± 3.1%
- ✓ Constant current regulation vs line voltage change (180~265Vac) : <± 1.9%
- ✓ Output open & short circuit protection with auto restart
- ✓ System efficiency up to 84.5%
- ✓ PF and THD at nominal voltages (220 ~ 230Vac): PF(>0.92), THD(<18%)

1. Schematics

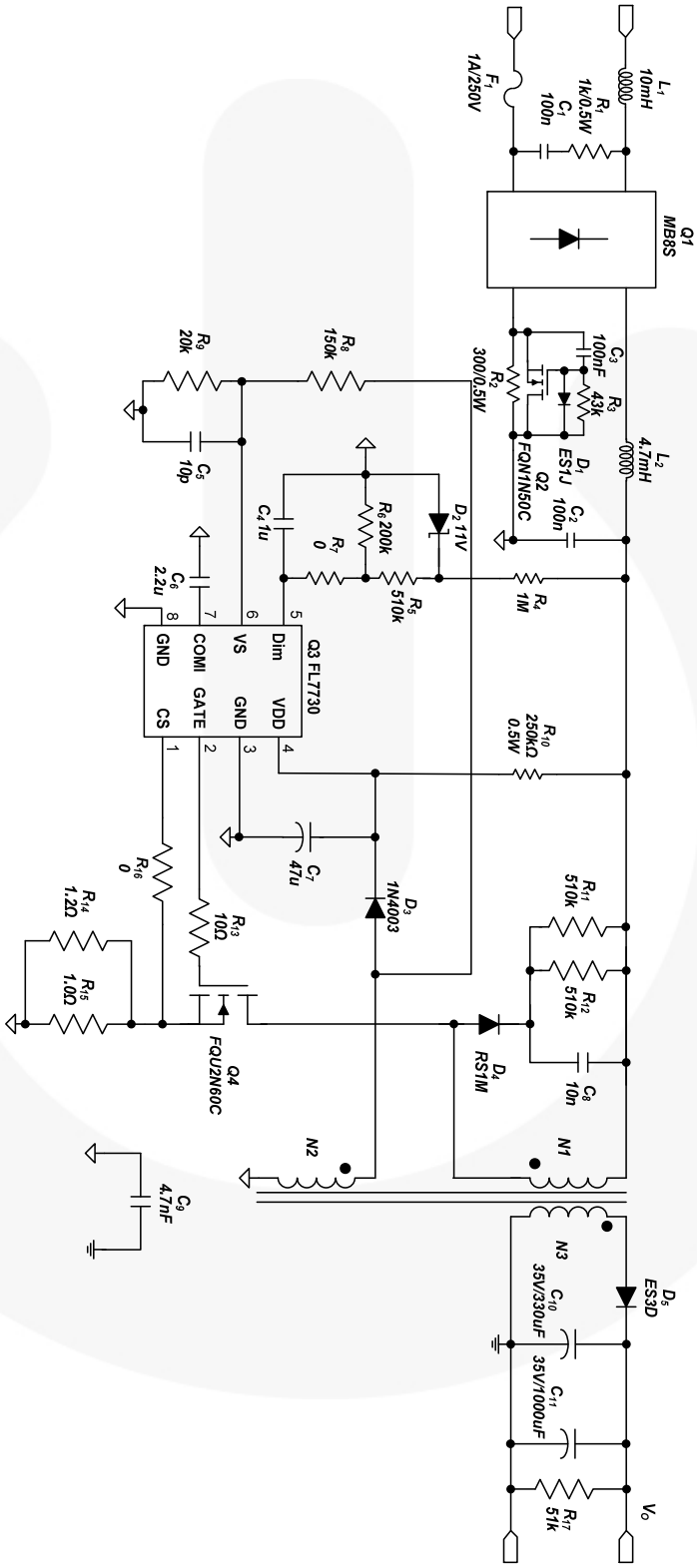

Figure 1. Schematic

2. Bill of Material

Item No.	Part Reference	Part number	Qty	Description	Manufacturer
1	Q1	MB8S	1	Bridge Diode	Fairchild
2	Q2	FQN1N50C	1	1A/500V active damper MOSFET	Fairchild
3	Q3	FL7730MY_F116	1	Main controller	Fairchild
4	Q4	FQU2N60C	1	5A/600V Main switch	Fairchild
5	F1	SS-5-1A	1	1A/250V Fuse	Bussmann
6	L1	R06103KT00	1	10mH Filter inductor	Bosung
7	L2	R06472KT00	1	4.7mH Filter inductor	Bosung
8	D1	ES1J	1	1A/600V Diode	Fairchild
9	D2	1N5241	1	11V Zener Diode	Fairchild
10	D3	1N4003	1	1A/200V Diode	Fairchild
11	D4	RS1M	1	1A/1000V Diode	Fairchild
12	D5	ES3D	1	3A/200V Fast Rectifier	Fairchild
13	C1	MPE 400V104K 14S	1	104/400V Film Capacitor	Sungho
14	C2	MPE 400V104K 14S	1	104/400V Film Capacitor	Sungho
15	C3	C0805C104K3RACTU	1	104/25V SMD Capacitor 2012	Kemet
16	C4	C1206C105K3PACTU	1	105/25V SMD Capacitor 3216	Kemet
17	C5	C0805C100M3GACTU	1	10/25V SMD Capacitor 2012	Kemet
18	C6	C2012Y5V1E225Z	1	225/25V SMD Capacitor 2012	TDK
19	C7	KMG 47uF/35V	1	47u/35V Electrolytic Capacitor	Samyoung
20	C8	C1206C103KDRACTU	1	103/1kV SMD Capacitor 3216	Kemet
21	C9	SCFz2E472M10BW	1	472/250V Y-Capacitor	Samwha
22	C10	KMG 330uF/35V	1	330u/35V Electrolytic Capacitor	Samyoung
23	C11	RM 1000uF/35V	1	1000u/35V Electrolytic Capacitor	Samwha
24	R1	SFR2500001001FR500	1	1kΩ/0.5W Metal Resistor	Vishay
25	R2	RNF12JTD300R	1	300Ω/0.5W Metal Resistor	Stackpole Elec.
26	R3	RC1206JR-0720KL	1	20kΩ SMD Resistor 3216	Yageo
27	R4	RC1206JR-071ML	1	1MΩ SMD Resistor 3216	Yageo
28	R5	RC0805JR-07510KL	1	510kΩ SMD Resistor 2012	Yageo
29	R6	RC0805JR-07200KL	1	200kΩ SMD Resistor 2012	Yageo
30	R7	0	1	-	
31	R8	RC0805JR-07150KL	1	150kΩ SMD Resistor 2012	Yageo
32	R9	RC0805JR-0720KL	1	20kΩ SMD Resistor 2012	Yageo
33	R10	RNF12GTD250K	1	250kΩ/0.5W Metal Resistor	Stackpole Elec.
34	R11, R12	RC1206JR-07510KL	2	510kΩ SMD Resistor 3216	Yageo
35	R13	RC0805JR-0710RL	1	10Ω SMD Resistor 2012	Yageo
36	R14	RC1206JR-071R2L	1	1.2Ω SMD Resistor 3216	Yageo
37	R15	RC1206FR-071RL	1	1.0Ω SMD Resistor 3216	Yageo
38	R16	RC0805JR-070RL	1	0Ω SMD Resistor 2012	Yageo
39	R17	RC1206JR-0751KL	1	51kΩ SMD Resistor 3216	Yageo

3. Transformer

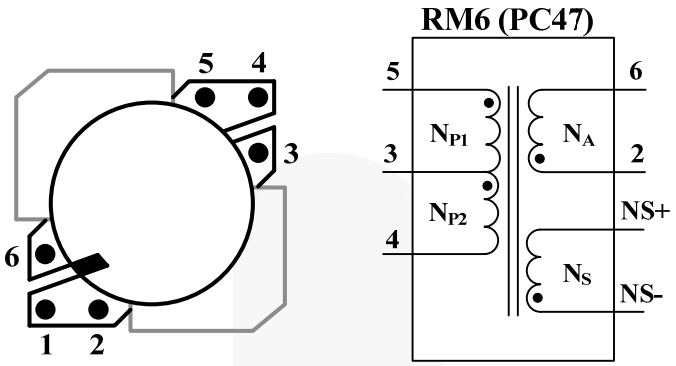

Figure 2. Transformer Bobbin Structure and Pin Configuration

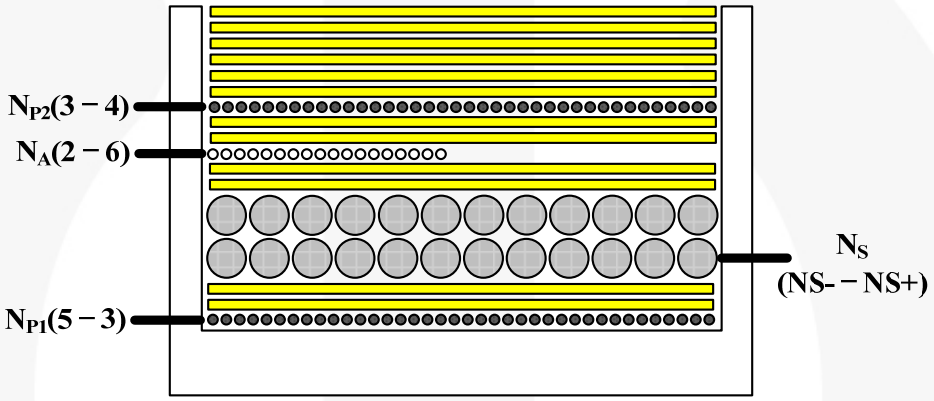

Figure 3. Transformer Winding Structure

Table 1. Winding specifications.

No	Winding	Pin(S → F)	Wire	Turns	Winding Method
1	N_{P1}	5 → 3	0.13φ	38 Ts	Solenoid winding
2	Insulation : Polyester Tape t = 0.025mm, 2Layers				
3	N_S	NS- → NS+	0.3φ (TIW)	24 Ts	Solenoid winding
4	Insulation : Polyester Tape t = 0.025mm, 2Layers				
5	N_A	2 → 6	0.13φ	18 Ts	Solenoid winding
6	Insulation : Polyester Tape t = 0.025mm, 2Layers				
7	N_{P2}	3 → 4	0.13φ	38 Ts	Solenoid winding
8	Insulation : Polyester Tape t = 0.025mm, 6Layers				

Table 2. Electrical Characteristics.

	Pin	Spec.	Remark
Inductance	1– 2	1 mH ± 10%	50kHz, 1V
Leakage	1– 2	8 uH	50kHz, 1V Short all output pins

4. Performance

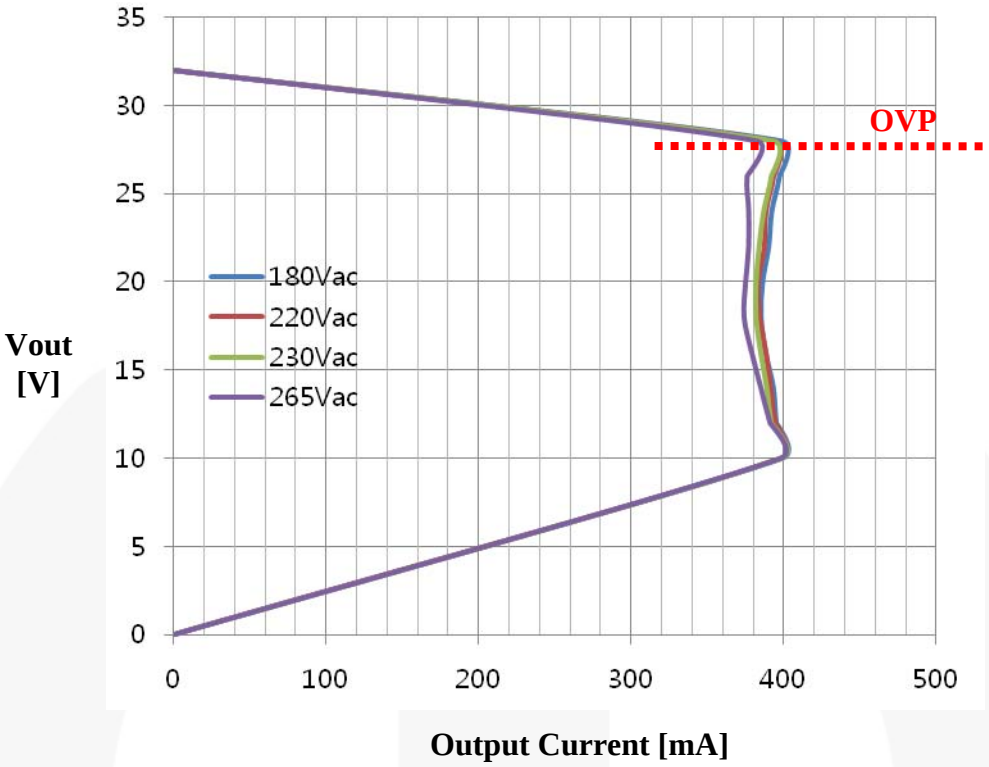

Figure 4. Constant Current Regulation – Measured by E-load [CR mode]

Table 3. Constant Current Regulation by Output Voltage Change (10~28V)

Input Voltage	Min Current	Max Current	Tolerance
180VAC /60Hz	385mA	399mA	± 1.8%
220VAC /60Hz	383mA	398mA	± 1.9%
230VAC /60Hz	382mA	399mA	± 2.2%
265VAC /60Hz	374mA	398mA	± 3.1%

Table 4. Constant Current Regulation by Line Voltage Change (180~265Vac)

Output Voltage	90Vac	110Vac	120Vac	140Vac	Tolerance
20V	392mA	388mA	387mA	377mA	± 1.9%
22V	390mA	387mA	384mA	377mA	± 1.7%
24V	386mA	383mA	382mA	375mA	± 1.4%

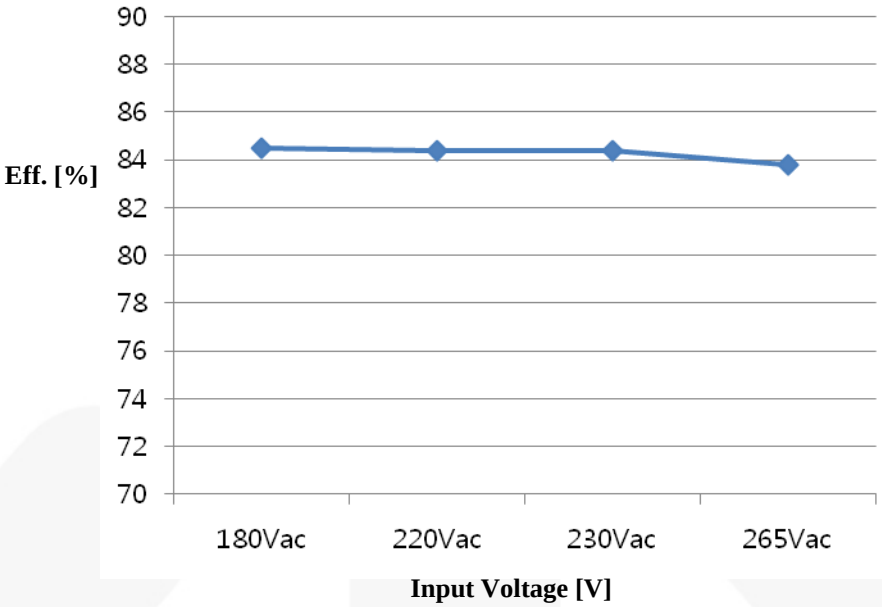

Figure 5. System Efficiency

Table 5. System Efficiency

Input Voltage	Input Power	Output Current	Output Voltage	Output Power	Efficiency
180Vac	10.13W	392mA	21.84V	8.56W	84.5%
220Vac	9.97W	386mA	21.80V	8.41W	84.4%
230Vac	9.94W	385mA	21.79V	8.39W	84.4%
265Vac	9.76W	376mA	21.75V	8.18W	83.8%

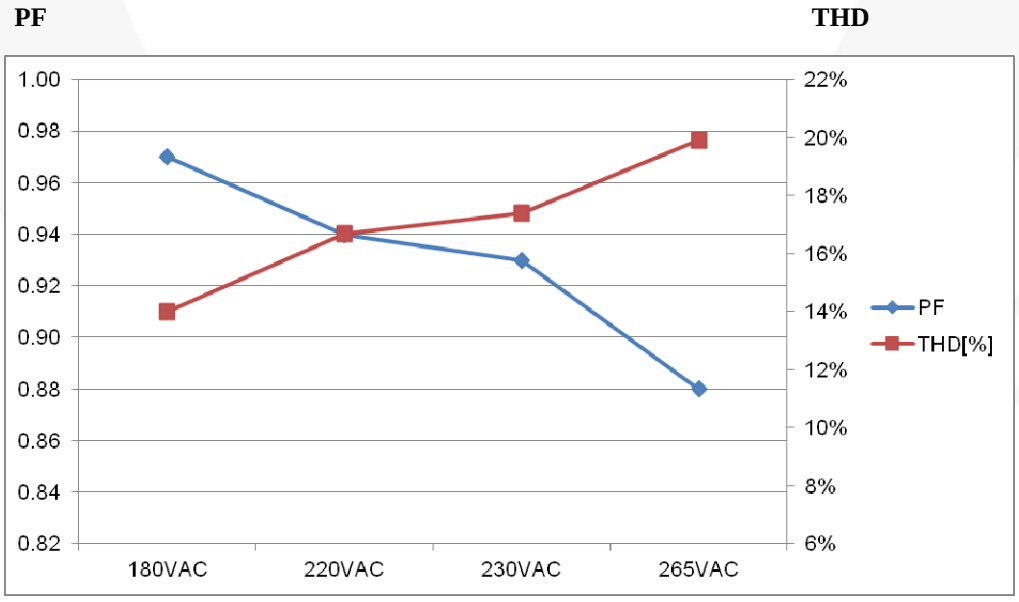

Figure 6. PF & THD (50Hz)

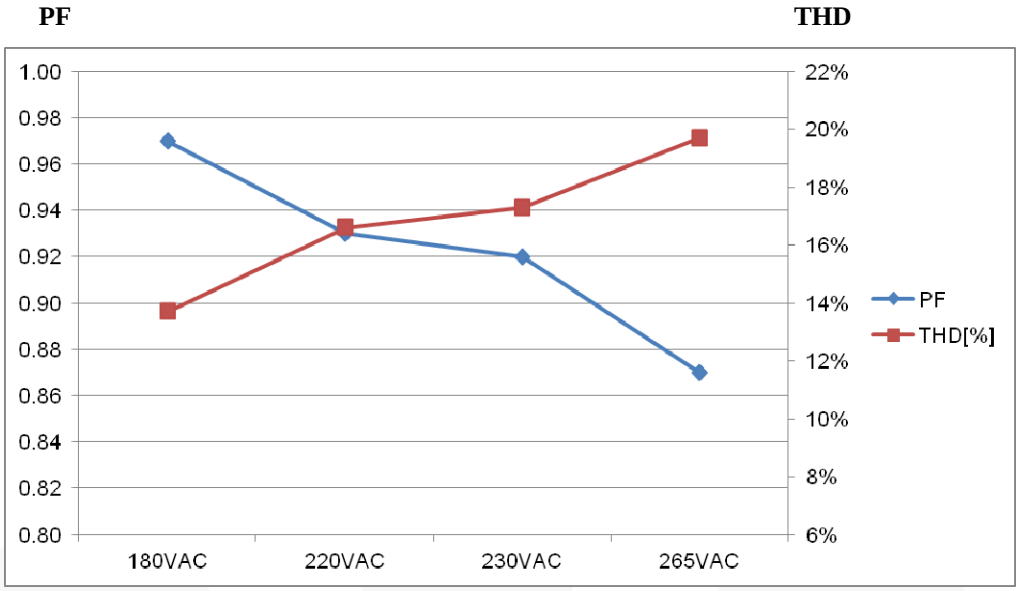

Figure 7. PF & THD (60Hz)

Table 6. PF & THD

Input Voltage	Output Current	Output Voltage	Frequency	PF	THD
180Vac	392mA	21.84V	50Hz	0.97	14.0%
			60Hz	0.97	13.7%
220Vac	386mA	21.80V	50Hz	0.94	16.7%
			60Hz	0.93	16.6%
230Vac	385mA	21.79V	50Hz	0.93	17.4%
			60Hz	0.92	17.3%
265Vac	376mA	21.75V	50Hz	0.88	19.9%
			60Hz	0.87	19.7%

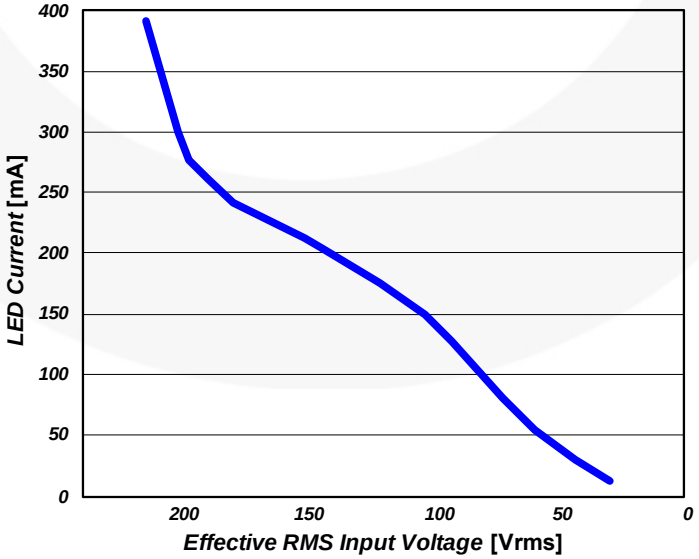

Figure 8. Dimming Curve (Effective RMS Input voltage vs. Output current) – Line voltage[220Vac]

Table 7. Dimmer Compatibility

Manufacturer	Dimmer	Condition	Max Current	Min Current	Flicker
LUTRON	S-600P-WH	120V/60Hz	330mA	40mA (12%)	No
LUTRON	CN-600P-WH	120V/60Hz	328mA	11mA (3%)	No
LUTRON	GL-600H	120V/60Hz	365mA	8mA (2%)	No
LUTRON	TG-603PGH-WH	120V/60Hz	252mA	12mA (5%)	No
LUTRON	TG-600PH-WH	120V/60Hz	333mA	14mA (4%)	No
LUTRON	LG-600P	120V/60Hz	327mA	3mA (1%)	No
LUTRON	CTCL-153PD	120V/60Hz	320mA	58mA (18%)	No
LUTRON	S-600-WH	120V/60Hz	324mA	0mA (0%)	No
LUTRON	DV-600P-WH	120V/60Hz	323mA	0mA (0%)	No
LUTRON	DV-603PG-WH	120V/60Hz	260mA	3mA (1%)	No
LUTRON	DV-10P	120V/60Hz	334mA	28mA (8%)	No
LUTRON	DVLV-600P	120V/60Hz	316mA	4mA (1%)	No
LUTRON	AY-600P-WH	120V/60Hz	329mA	8mA (2%)	No
LUTRON	D-600PH-DK	120V/60Hz	309mA	0mA (0%)	No
LUTRON	Q-600P-WH	120V/60Hz	333mA	21mA (6%)	No
LUTRON	SLV-600P	120V/60Hz	330mA	7mA (2%)	No
LUTRON	GLT05	120V/60Hz	316mA	22mA (7%)	No
LEVITON	6633-PL	120V/60Hz	383mA	11mA (3%)	No
LEVITON	6683	120V/60Hz	384mA	0mA (0%)	No
LEVITON	IP106	120V/60Hz	380mA	36mA (9.5%)	No
LEVITON	1C4005	120V/60Hz	344mA	0mA (0%)	No
LEVITON	6631-LW	120V/60Hz	340mA	0mA (0%)	No
Legrand	F 165H	120V/60Hz	344mA	3mA (0.9%)	No

5. Related Resources

Datasheet link FL7730

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

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