

Fairchild Reference Design

The following user guide supports the demonstration kit for the FLS3217N. It should be used in conjunction with the FLS3217N 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	FLS3217N	90-265V _{AC}	6.5W	24V(0.27A)

Key Features

- 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 (11~28V) : $< \pm 2.60\%$
- Constant current regulation vs line voltage change (90~265Vac) : $< \pm 2.78\%$
- Output open & short circuit protection with auto restart
- System efficiency up to 86.9%
- PF and THD: PF(> 0.9), THD($< 20\%$)

1. Schematics

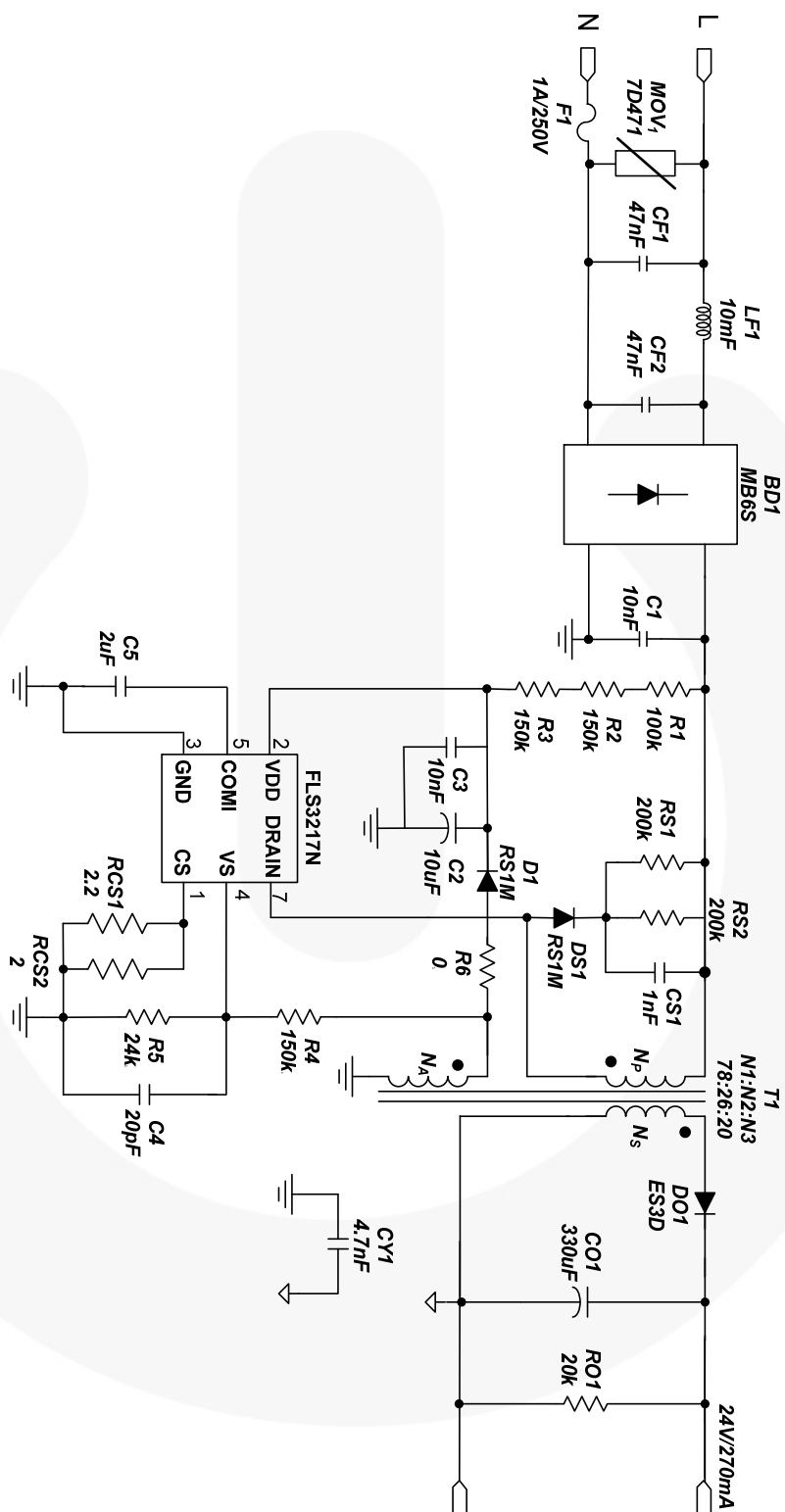


Figure 1. Schematic

2. Bill of Material

Item No.	Part Reference	Value	Qty	Description	Manufacturer
1	BD1	MB6S	1	Bridge Diode	Fairchild
2	CF1, CF2	PX473K3IC2	2	473/275Vac, X-Capacitor	Carli
3	CS1	C1206C102KDRACTU	1	102/1kV, SMD Capacitor 3216	Samwha
4	CY1	SCFz2E472M10BW	1	472/250V, Y-Capacitor	Samwha
5	Co1	KMG 330uF/35V	1	330u/35V, Electrolytic Capacitor	Samyoung
6	C1	MPE 400V/103K	1	103/400V, Film Capacitor	Sungho
7	C2	KMG 10uF/35V	1	10u/35V, Electrolytic Capacitor	Samyoung
8	C3	C0805C104K3RACTU	1	104/25V, SMD Capacitor 2012	Kemet
9	C4	C0805C200M3GACTU	1	200/25V, SMD Capacitor 2012	Kemet
10	C5	C1206C205K3PACTU	1	205/25V, SMD Capacitor 2012	Kemet
11	DS1, D1	RS1M	2	1A/1000V, Diode	Fairchild
12	Do1	ES3D	1	3A/200V, Fast Rectifier	Fairchild
13	F1	SS-5-1A	1	1A/250V, Fuse	Bussmann
14	LF1	R06103KT00	1	10mH, 8Ø Filter inductor	Bosung
15	MOV1	SVC 471D07	1	Varistor	Samwha
16	RS1,RS2	RC1206JR-07200KL	2	200kΩ, SMD Resistor 3216	Yageo
17	Rcs1	RC1206JR-072R2L	1	2.2Ω, SMD Resistor 3216	Yageo
18	Rcs2	RC1206JR-072RL	1	2.0Ω, SMD Resistor 3216	Yageo
19	Ro1	RC1206JR-0720KL	1	20kΩ, SMD Resistor 3216	Yageo
20	R2,R3,R4	RC1206JR-07150KL	3	150kΩ, SMD Resistor 3216	Yageo
21	R1	RC1206JR-07100KL	1	100kΩ, SMD Resistor 3216	Yageo
22	R5	RC1206JR-0724KL	1	24kΩ, SMD Resistor 3216	Yageo
23	R6	RC1206JR-070RL	1	0Ω, SMD Resistor 3216	Yageo
24	T1	RM6	1	Transformer	TDK
25	U1	FLS3217N	1	Main Controller	Fairchild

3. Transformer

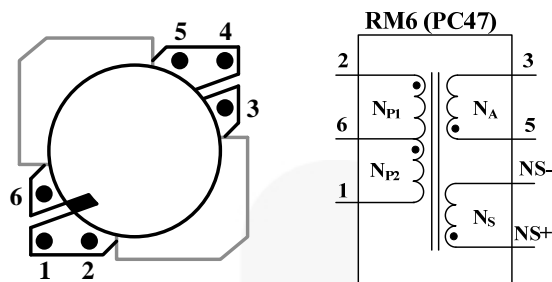


Figure 2. Transformer Bobbin Structure and Pin Configuration

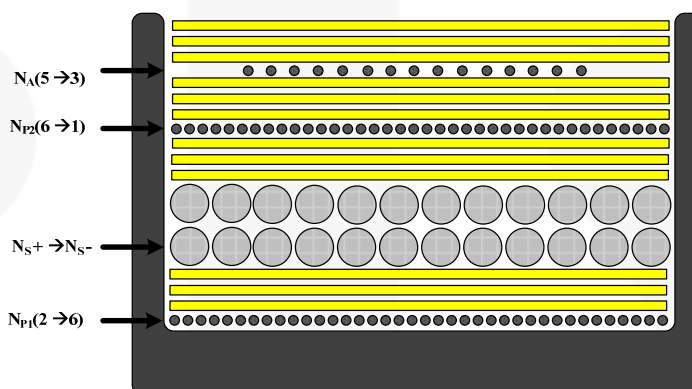


Figure 3. Transformer Winding Structure

Table 1. Winding specifications.

No	Winding	Pin(S → F)	Wire	Turns	Winding Method
1	N_{P1}	2 → 6	0.2φ	52 Ts	Solenoid winding
2	Insulation : Polyester Tape t = 0.025mm, 2Layers				
3	N_S	NS + → NS-	0.25φ (TIW)	26 Ts	Solenoid winding
4	Insulation : Polyester Tape t = 0.025mm, 2Layers				
5	N_{P1}	6 → 1	0.2φ	26 Ts	Solenoid winding
6	Insulation : Polyester Tape t = 0.025mm, 2Layers				
7	N_A	5 → 3	0.2φ	20 Ts	Solenoid winding
8	Insulation : Polyester Tape t = 0.025mm, 6Layers				

Table 2. Electrical Characteristics.

	Pin	Spec.	Remark
Inductance	2– 1	1.4mH ± 10%	60kHz, 1V
Leakage	2– 1	10 uH	60kHz, 1V Short all output pins

4. Performance

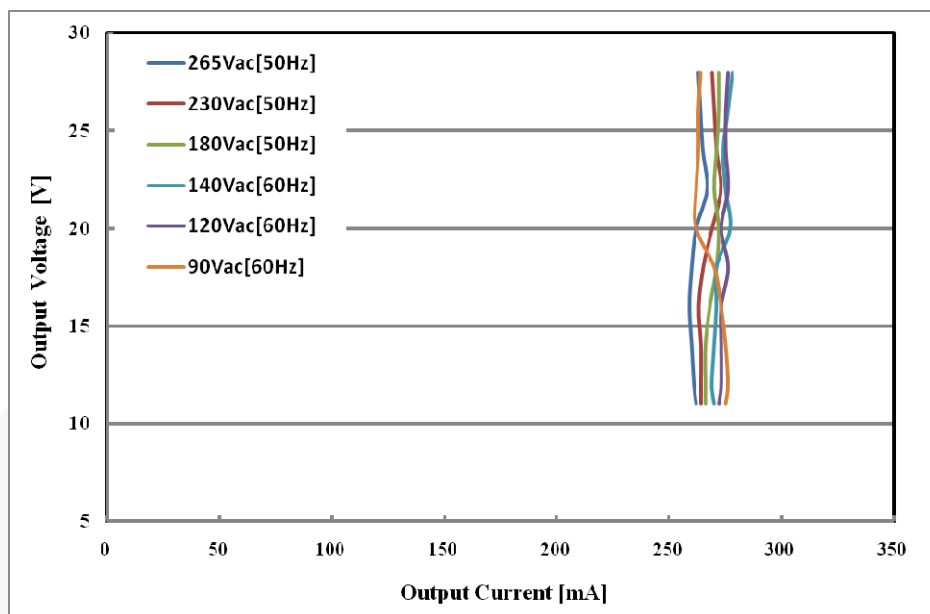


Figure 4. Constant Current Regulation – Measured by E-load [CR mode]

Table 3. Constant Current Regulation by Output Voltage Change (11~28V)

Input Voltage	Min Current	Max Current	Tolerance
90V _{AC} [60Hz]	262mA	276mA	± 2.60%
120V _{AC} [60Hz]	272mA	276mA	± 0.73%
140V _{AC} [60Hz]	269mA	278mA	± 1.65%
180V _{AC} [50Hz]	266mA	272mA	± 1.12%
230V _{AC} [50Hz]	263mA	273mA	± 1.87%
265V _{AC} [50Hz]	259mA	267mA	± 1.52%

Table 4. Constant Current Regulation by Line Voltage Change (90~265Vac)

Output Voltage	90V _{AC} [60Hz]	120V _{AC} [60Hz]	140V _{AC} [60Hz]	180V _{AC} [50Hz]	220V _{AC} [50Hz]	265V _{AC} [50Hz]	Tolerance
26V	263 mA	275 mA	274 mA	272 mA	270 mA	264 mA	± 2.41%
24V	263 mA	275 mA	275 mA	271 mA	271 mA	265 mA	± 2.23%
22V	262 mA	276 mA	277 mA	270 mA	273 mA	267 mA	± 2.60%
20V	262 mA	273 mA	271 mA	272 mA	269 mA	262 mA	± 2.78%

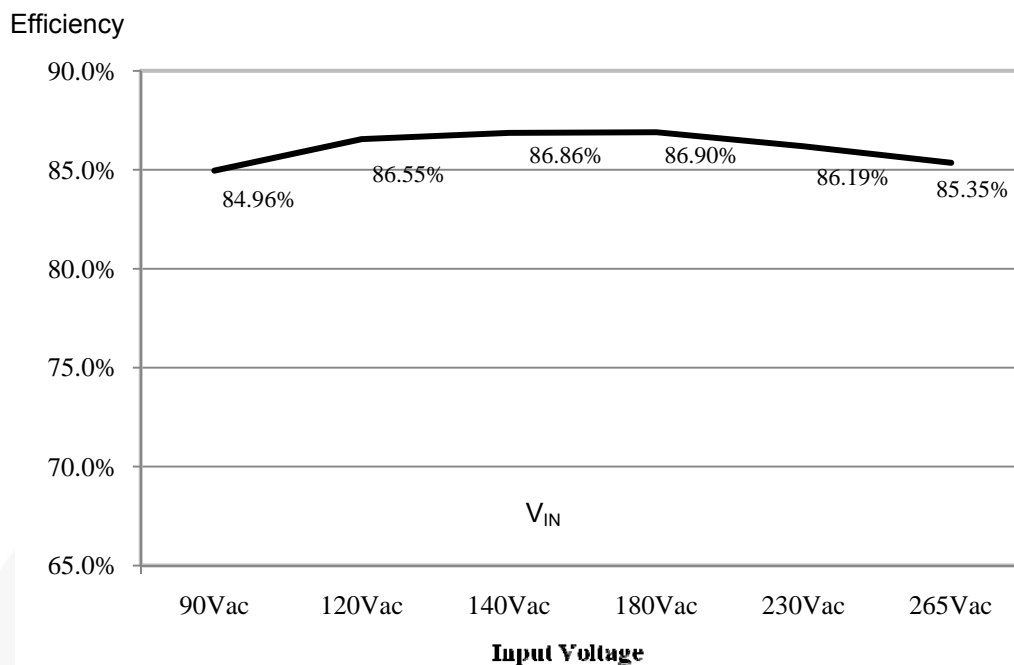


Figure 5. System Efficiency

Table 5. System Efficiency

Input Voltage	Input Power	Output Current	Output Voltage	Output Power	Efficiency
90Vac [60Hz]	7.46 W	264 mA	24.02 V	6.34 W	84.96%
120Vac [60Hz]	7.72 W	277 mA	24.13 V	6.68 W	86.55%
140Vac [60Hz]	7.65 W	275 mA	24.12 V	6.65 W	86.86%
180Vac [50Hz]	7.54 W	272 mA	24.07 V	6.55 W	86.90%
220Vac [50Hz]	7.56 W	271 mA	24.06 V	6.52 W	86.19%
265Vac [50Hz]	7.49 W	266 mA	24.02 V	6.39 W	85.35%

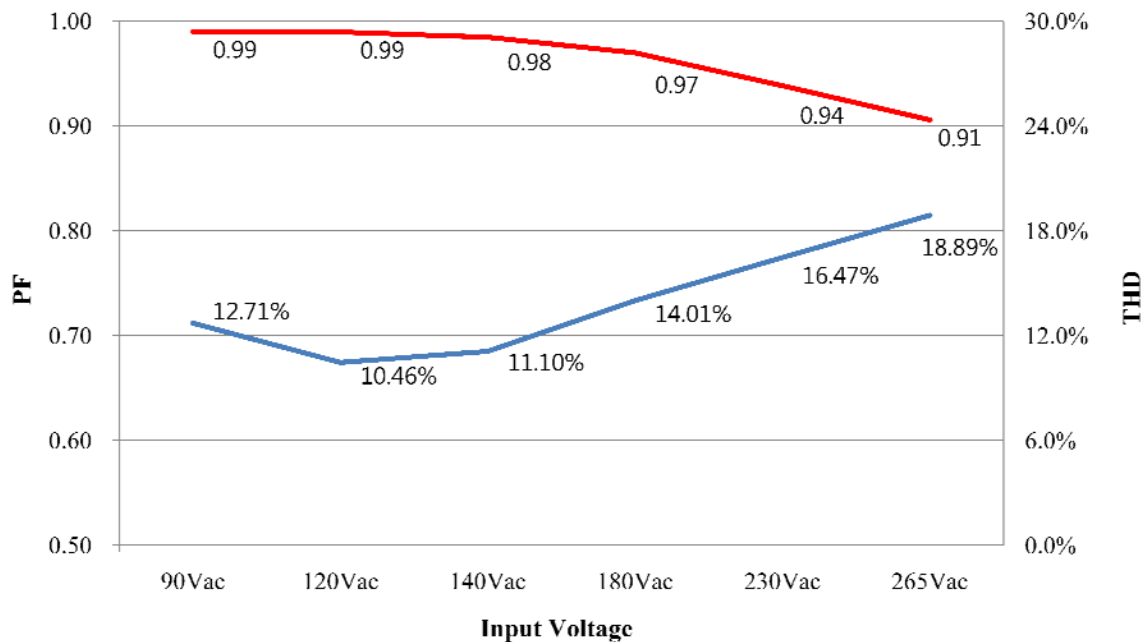


Figure 6. PF & THD

Table 6. PF & THD

Input Voltage	Output Current	Output Voltage	Power Factor	THD
90Vac [60Hz]	264 mA	24.02 V	0.99	12.71%
120Vac [60Hz]	277 mA	24.13 V	0.99	10.46%
140Vac [60Hz]	275 mA	24.12 V	0.98	11.10%
180Vac [50Hz]	272 mA	24.07 V	0.97	14.01%
230Vac [50Hz]	271 mA	24.06 V	0.94	16.47%
265Vac [50Hz]	266 mA	24.02 V	0.91	18.89%

5. Related Resources

[Datasheet link FLS3217](#)

<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.