FEB112-001 User's Guide
100W Power Factor Corrected Supply

Featured Fairchild Products: FAN7527B

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1. General Board Description

The FEB112-001 Evaluation Board is a power factor corrected 100 W off-line power supply. The supply has a single 400 Volt output and operates over an input voltage range of 85 VAC to 265 VAC. The Evaluation Board uses a boost PFC the FAN7527B IC. In order to examine the waveforms of the FEB112-001 Evaluation Board a DC source ranging from 120 to 375 volts may be used for the input.

The FAN7527B IC is a critical conduction mode discontinuous Power Factor Controller (PFC). It includes discontinuous current mode PFC section, along with a Flip-Flop, and Gate Drive Output.

When operating the FEB112-001 Evaluation Board there are two things to keep in mind. A minimum load of 5 to 10 watts is required to prevent VCC from decaying to the undervoltage lockout point. This will provide continuous operation and prevent the PFC from periodic shutdown due to undervoltage lockout. Also, there is no current inrush limiting included in the Evaluation Board. Because of this it is suggested that the input voltage is always ramped up slowly.

1.1 Contents of the FEB112-001 Evaluation Kit

The FEB112-001 Evaluation Kit contains the following items:

- FEB112-001 evaluation board
- FEB112-001 evaluation board user's guide
- CD ROM containing the following:
  - FEB112-001 evaluation board user's guide
  - FAN7527B data sheet
  - 1N4148 data sheet
  - GBU45, KBL06, and KBU4J data sheets
  - AN-4121 Power Factor Correction circuit using the FAN7527B
  - AN-42047 Power Factor Correction Basics

1.2 Power Supply Specification Table

Table 1. Power supply specifications

Description	Min	Typ	Max	Units
Output Power			100	W
Input Voltage (VIN)	85		265	VRMS
Line Frequency (FLINE)		60		Hz
Output Voltage (VOUT)		400		V
Output Ripple Voltage (VRIPPLE)		8		V
Efficiency		90		%

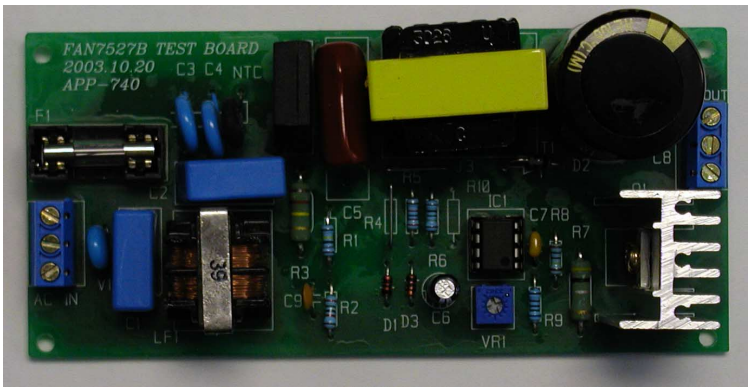
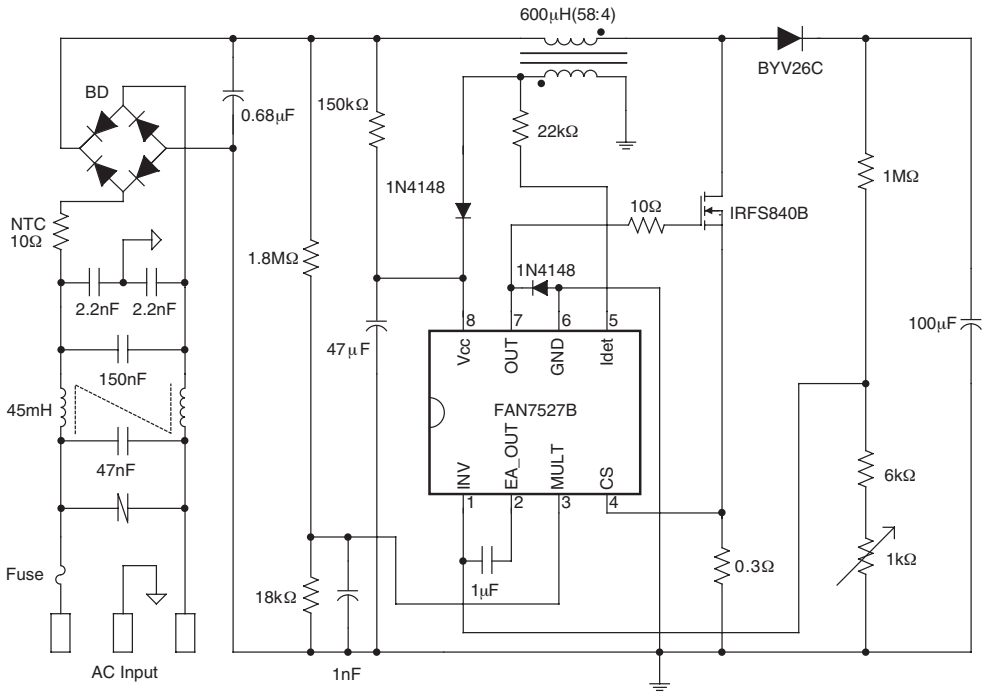


Figure 1. Photograph of evaluation board

1.3 FEB112-001 100W Evaluation Board Schematic



2. Test Procedure

For a complete theory of operation refer to Application Note, AN4121, included in the FEB112-001 Evaluation Board package.

CAUTION!

The FEB112-001 Evaluation Board contains voltage potentials capable of causing serious injur y, and components that may shatter or explode if they fail. Appropriate precautions must be taken to prevent injur y should such situations occur. The use of protective eyeware is strongly recommended.

To safely observe circuit waveforms, an isolation transformer should be used between the Evaluation Board and the AC line.

Do Not operate this board with DC/AC voltages outside the design limits.

Replace circuit components only with those recommended in the par ts list of this User's Guide.

3. Test Results

3.1 Performance Data

To measure the Evaluation Board performance across the range of permissible input voltages use an isolated Variac or adjustable AC source. It is suggested that the input voltage is increased slowly as the evaluation board has no inrush current limiting.

A typical FEB112-001 evaluation board will have the performance characteristics shown in Table 1 when operated as specified in the Test Conditions.

Table 1. FEB112-001 Evaluation Board Test Results

Vin(RMS)	Power Factor	Vo(V)	THD(%)
85	0.997	398.0	7.18
100	0.998	398.0	5.38
120	0.998	399.0	3.81
140	0.997	399.7	4.11
160	0.996	400.7	4.85
180	0.995	400.7	5.60
200	0.993	400.7	6.51
220	0.990	401.0	7.45
240	0.986	401.0	8.61
265	0.981	401.3	9.97

Test Conditions: 100 Watt load on output at 25°C

Equipment Used: Prodigit 3325 (500V, 6A, 1800W) load.

3.2 Power Ratings

The FEB112-001 Evaluation Board is designed to provide up to 100W output with an input of 85VAC.

3.3 Typical Waveforms

Figures 1 and 2 represent the first, second, and third harmonic content of the input current.

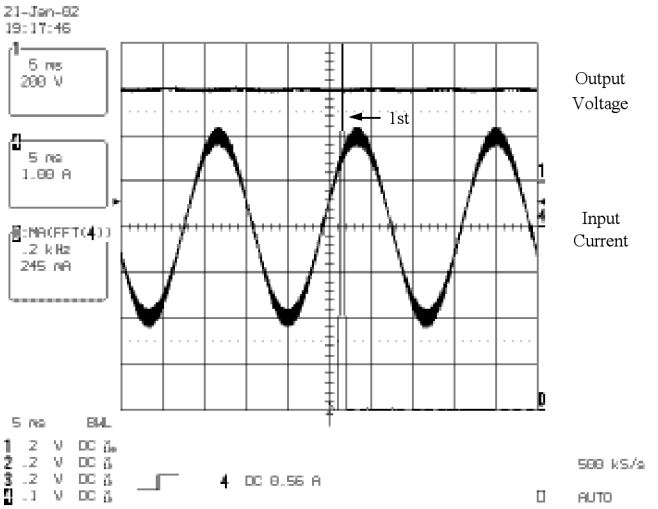


Figure 1: Input Current Harmonic Content @ 85Vac

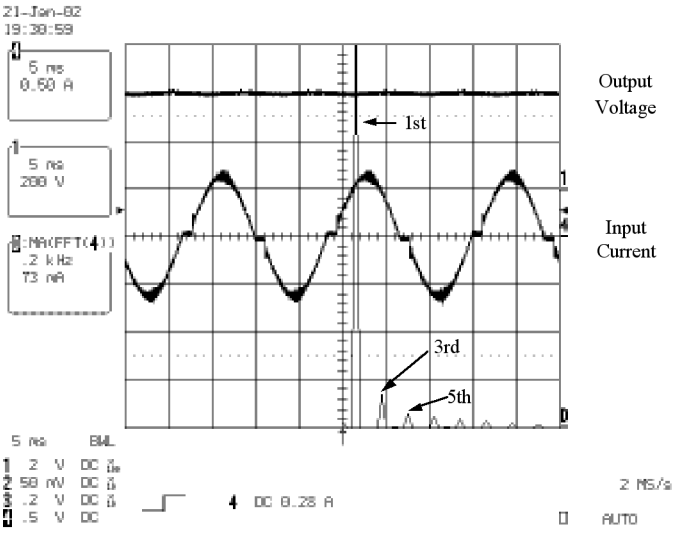


Figure 2: Input Current Harmonic Content @ 265Vac

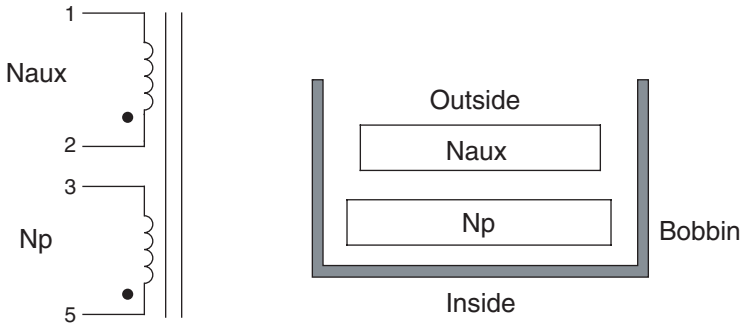
4. FEB112-001 Evaluation Board Parts List

Reference	Description	Part Number	Manufacturer
R1	1.8MΩ	1/4W	—
R2	22kΩ	1/4W	—
R3	120kΩ	1W	—
R5	22kΩ	1/4W	—
R6	10Ω	1/4W	—
R7	0.4Ω	1W	—
R8	1MΩ	1/4W	—
R9	6kΩ	1/4W	—
VR1	103	Variable resistor	—
C1	47nF, 275vac	Box-Cap	—
C2	150nF, 275vac	Box-Cap	—
C3, 4	2200pF, 3000V	Y-Cap	—
C5	0.68μF, 630V	Miller-Cap	—
C6	47μF, 35V	Electrolytic	—
C7	1μF	MLCC	—
C8	100μF, 450V	Electrolytic	—
C9	1nF, 25V	Ceramic	—
BD1	600V/4A	Bridge Diode	Fairchild
D1, 3	75V, 150mA	1N4148	Fairchild
D2	600V, 1A	BYV26C	—
LF1	45mH	Line Filter	—
T1	0.6mH(58T:4T)	EI3026	—
Q1	500V, 4.6A	IRFS840B	Fairchild
F1	250V, 3A	Fuse	—
V1	470V	471	—
NTC	10Ω	10D09	—
		ICI	Fairchild, Note:RAN7527B

5. Transformer Specification

FEB112-001 T1 BOOST TRANS

1. Schematic Diagram. (Top View)



2. Winding Specification

	PIN	WIRE	TURNS
Np	5 → 3	0.1φ/40	58
Naux	2 → 1	0.25φ	4

3. CORE & BOBBIN
   CORE: EI3026
   BOBBIN: EI3026

6. Printed Circuit Board

6.1 Layout Considerations

Because the OVP function is sensitive to the noise, the compensation capacitor must be as close to pins 1 and 2 as possible. Any other PCB traces must be far from pins 1 and 2, and the compensation capacitor to minimize any stray capacitance. Noise can be reduced by using a common mode filter capacitor (these capacitors are C3 and C4 shown in the application circuit of AN4121) connected to the earth ground. If a heat sink is connected to ground, the noise is also reduced.

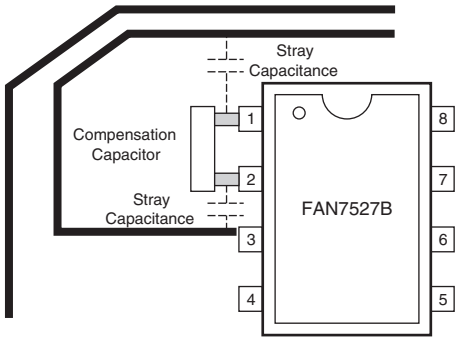


Figure 3: Error amp pin layout

To improve the noise immunity, the output voltage sensing resistors should be positioned close to pin 1. If the sensing resistors are far from the IC like Fig.4, then the switching noise can flow into pin 1 because the impedances of sensing resistors are high.

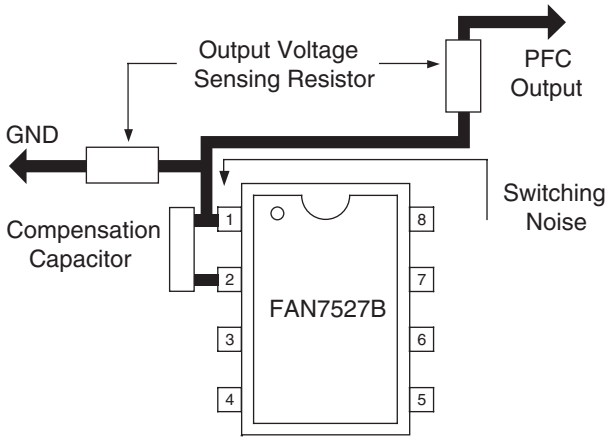


Figure 4: Poor PCB layout case for output voltage sensing resistors

Figure 5 shows the proper PCB layout case. The switching noise will flow to the PFC output side instead of flowing into pin 1.

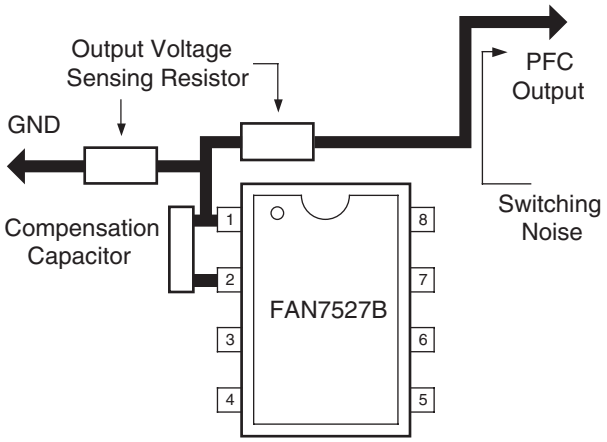


Figure 5: Good PCB layout case for output voltage sensing resistors

To reduce the stray inductance of the gate drive line, its line length must be short and the loop area must be minimized. If the gate line is too long and the loop area is wide, the input current waveform can be distorted. In order to protect pin 7 from going negative in this situation, place a diode between pin 6 and pin 7 (see below) like in the application note AN4121 circuit diagram. The OUT pin voltage is clamped to be less than 14V internally; the diode connected between pin 6 and pin 7 is to protect the IC from going more than -0.7V below pin 6.

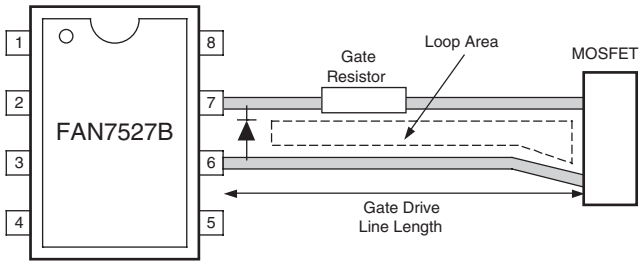
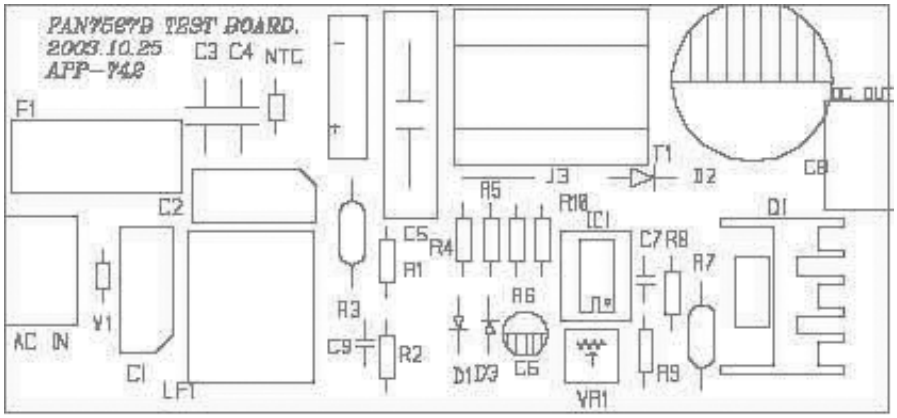


Figure 6: Gate drive pin layout

6.2 FEB112-001 Demo Board Top Silk Screen



7. Featured Products

7.1 FAN7527B Description

The FAN7527B provides simple and high performance active power factor correction. The FAN7527B is optimized for electronic ballasts and low power and high density power supplies which require minimum board size, reduced external components and low power dissipation. Because the R/C filter is included in the current sense block, the external R/C filter is not necessary. Special circuitry has also been added to prevent no load runaway conditions. Regardless of the supply voltage, the output drive clamping circuit limits the overshoot of the power MOSFET gate drive. It greatly enhances the system reliability.

7.1.1 FAN7527B Features

- Internal Start-Up Timer
- Internal R/C Filter Eliminates the Need for an External R/C Filter
- Very Precise Adjustable Output Over Voltage Protection
- Zero Current Detector
- One Quadrant Multiplier
- Trimmed 1.5% Internal Bandgap Reference
- Under Voltage Lockout with 3V of Hysteresis
- Totem Pole Output with High State Clamp
- Low Start-Up and Operating Current
- 8-Pin DIP or 8-Pin SOP

8. Resources/References

8.1 Application Notes

- AN-4127 Design of Power Factor Correction Circuit Using FAN7527B
- AN-42047 Power Factor Correction Basic

WARNING AND DISCLAIMER

This Evaluation Board may employ high voltages so appropriate safety precautions should be used when operating this board. Replace components on the Evaluation Board only with those parts shown on the parts list in the User's Guide. Contact an authorized Fairchild representative with any questions.

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