

## Reference Design RD-268

PFC+PWM Combination Controller FAN4800A, Fairchild Power Switch, FPS™ FSBH0370 and Supervisor IC SG6520 - 300W Design (80 Plus)

Featured Device	Application	Input Voltage Range	Output Voltage (Rated Current)	Rated Output Power	Topology
FAN4800A FSBH0370 SG6520	ATX PC Power	85~265V <sub>AC</sub>	12V1 (6A) 12V2 (10.5A) 5V (9A) 3.3V (13.5A) -12V (0.3A) 5V <sub>SB</sub> (2A)	300W	CCM Boost PFC + Two Switch Forward + Flyback

### Key Features

#### FAN4800A

- Pin-to-Pin Compatible with ML4800, FAN4800 , CM6800, and CM6800A
- PWM Configurable for Current-Mode or Feedforward Voltage-Mode Operation
- Internally Synchronized Leading-Edge PFC and Trailing-Edge PWM in One IC
- Low Operating Current
- Innovative Switching-Charge Multiplier Divider
- Average-Current Mode for Input-Current Shaping
- PFC Over-Voltage, Under-Voltage, and Feedback Open-Loop Protection
- Cycle-by-Cycle Current Limiting for PWM
- Power-On Sequence Control and Soft-Start
- Brownout Protection

#### FSBH0370

- Internal Avalanche-Rugged SenseFET (700V) in TO220 Package
- Constant Power Limit
- Advanced Burst-Mode Operation and Green-Mode Function for Low Standby Power Consumption
- Internal High Voltage Startup Circuit
- Various Protection Functions: Over-Voltage Protection (OVP), Overload Protection (OLP), Internal Thermal Shutdown Function (TSD), Brownout Protection
- Built-in Slope Compensation
- Built-in Soft-Start: 5ms

#### SG6520

- Two 12V Sense Input Pins: VS12 and VS12B
- Over-Voltage Protection (OVP), Over-Current Protection (OCP), and Under-Voltage Protection (UVP) for 3.3V, 5V, and Two 12V
- Open-Drain Output for PGO and FPO Pins
- 300ms Power Good Delay
- 300ms Turn-on Delay for 3.3V, 5V, and Two 12V
- 2.8ms PSON Control to FPO Turn-off Delay and 48ms PSON Control Delay
- No Lockup During the Fast AC Power On/Off
- Wide Supply Voltage Range: 4.2V to 15V
- Programmable Over-Temperature Protection (OTP)

# 1. Schematics

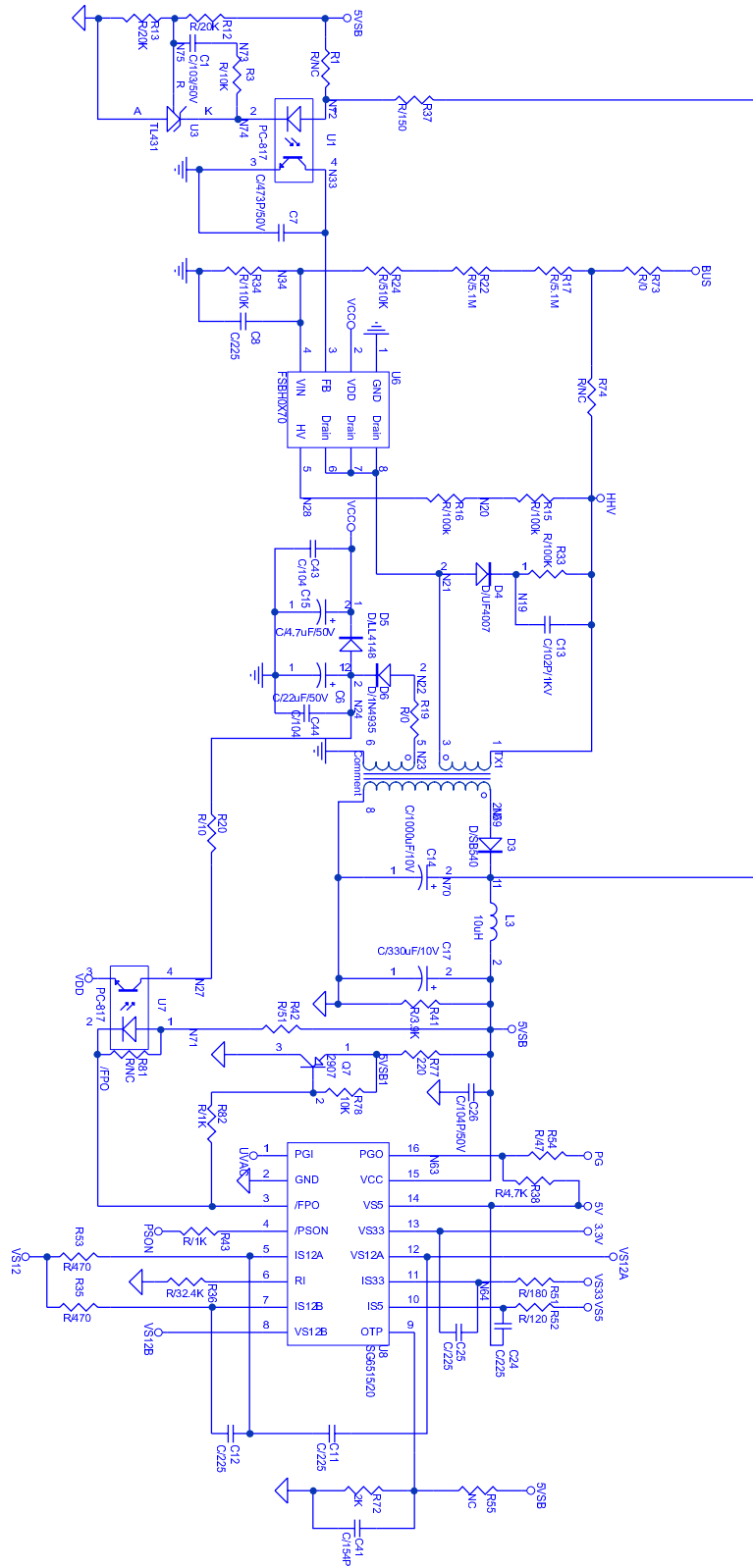


Figure 1. Schematic of Auxiliary Power (FSBH0X70) and Supervisory IC (SG6515/20)



## 2. Flyback Converter Transformer (TX1)

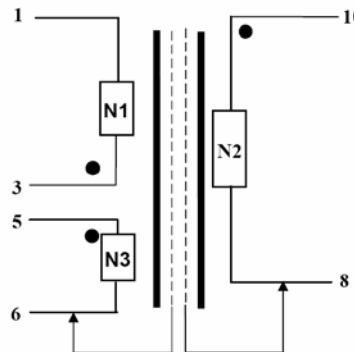


Figure 3. Transformer Schematic Diagram

### 2.1. Winding Specification

No	Pin (S- F)	Wire	Turns	Winding Method
N <sub>1</sub> /2	3→2	0.27Φ	90Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
N <sub>2</sub>	10→8	0.55Φ*2	11Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
N <sub>1</sub> /2	2→1	0.27Φ*4	58Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
N <sub>3</sub>	5→6	0.15Φ	31Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				

Core: EEL19  
Bobbin: EEL19

### 2.2. Electrical Characteristics

	Pin	Specification	Remark
Primary-Side Inductance	2-3	1.25mH ± 5%	100kHz, 1V

Mylar® is a registered trademark of Dupont Tejin Films

### 3. Gate Drive Pulse Transformer (TX2)

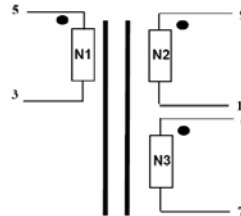


Figure 4. Transformer Schematic Diagram

#### 3.1. Winding Specification

No	Pin (S - F)	Wire	Turns	Winding Method
N <sub>1</sub>	5→3	0.2Φ	15Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.025mm, 3 Layer				
N <sub>2</sub>	9→10	0.2Φ	18Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.025mm, 1 Layer				
N <sub>3</sub>	6→7	0.2Φ	18Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				

Core: ERL35  
Bobbin: ERL35

#### 3.2. Electrical Characteristics

	Pin	Specification	Remark
Primary-Side Inductance	5 - 3	210μH ± 5%	100kHz, 1V

## 4. Forward Converter Transformer (TX3)

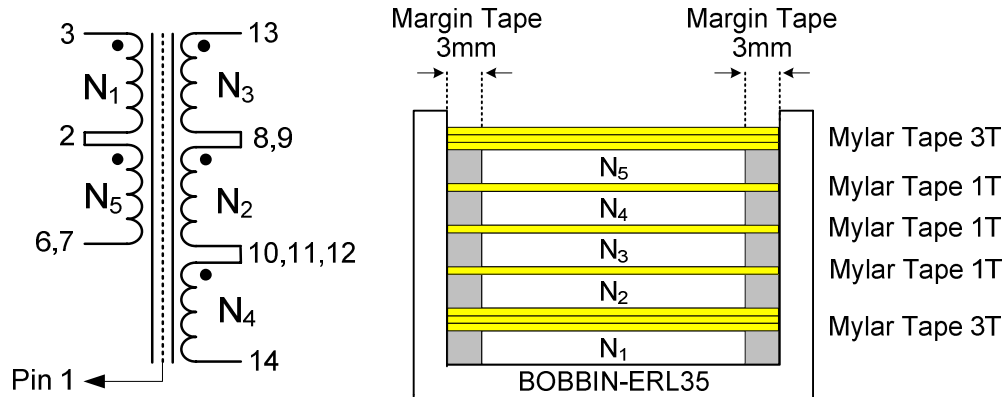


Figure 5. Transformer Schematic Diagram

### 4.1. Winding Specification

No	Pin (S - F)	Wire	Turns	Winding Method
N <sub>1</sub>	3-2	0.6Φ	37Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
N <sub>2</sub>	8,9-10,11,12	Copper-Foil 10mil	3Ts	Copper-Foil Width 18mm
Insulation: Mylar® Tape t = 0.03mm, 1 Layer				
N <sub>3</sub>	13-8,9	1.0Φ*4	4Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 1 Layer				
N <sub>4</sub>	10,11,12-14	0.4Φ	6Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 1 Layer				
N <sub>5</sub>	2-6,7	0.6Φ	37Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
Core-ERL35				
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
Insulation: Copper-Foil Tape t = 0.05mm-Pin 1 Open Loop				
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				

Core: ERL35  
Bobbin: ERL35

### 4.2. Electrical Characteristics

	Pin	Specification	Remark
Primary-Side Inductance	2 - 3	13mμH ± 5%	100kHz, 1V

## 5. Boost Inductor (L2)

### 5.1. Winding Specification

No	Pin (S - F)	Wire	Turns	Winding Method
N <sub>1</sub>	1→2	0.8Φ	117Ts	

Core: Toroid core (CM270060)

### 5.2. Electrical Characteristics

	Pin	Specification	Remark
Primary-Side Inductance	1 - 2	900μH ± 5%	1kHz, 1V

## 6. Forward Output Inductor (L7)

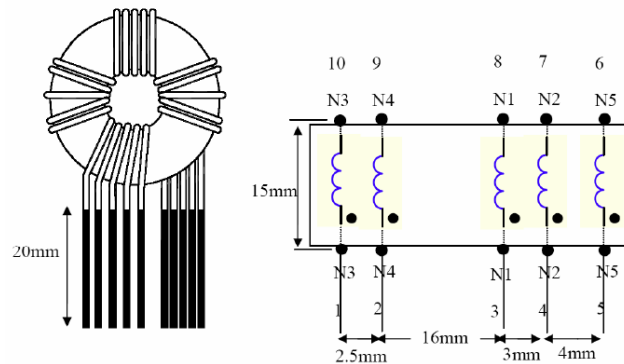


Figure 6. Inductor Schematic Diagram

### 6.1. Winding Specification

No	Pin (S - F)	Wire	Turns	Winding Method
N1	3→8	1.0Φ	24.5Ts	
N2	4→7	1.0Φ	24.5Ts	
N3	1→10	1.0Φ	10.5Ts	
N4	2→9	1.0Φ	10.5Ts	
N5	5→6	0.5Φ	23.5Ts	

Core: Toroid Optimag Magnetic HF106060-2

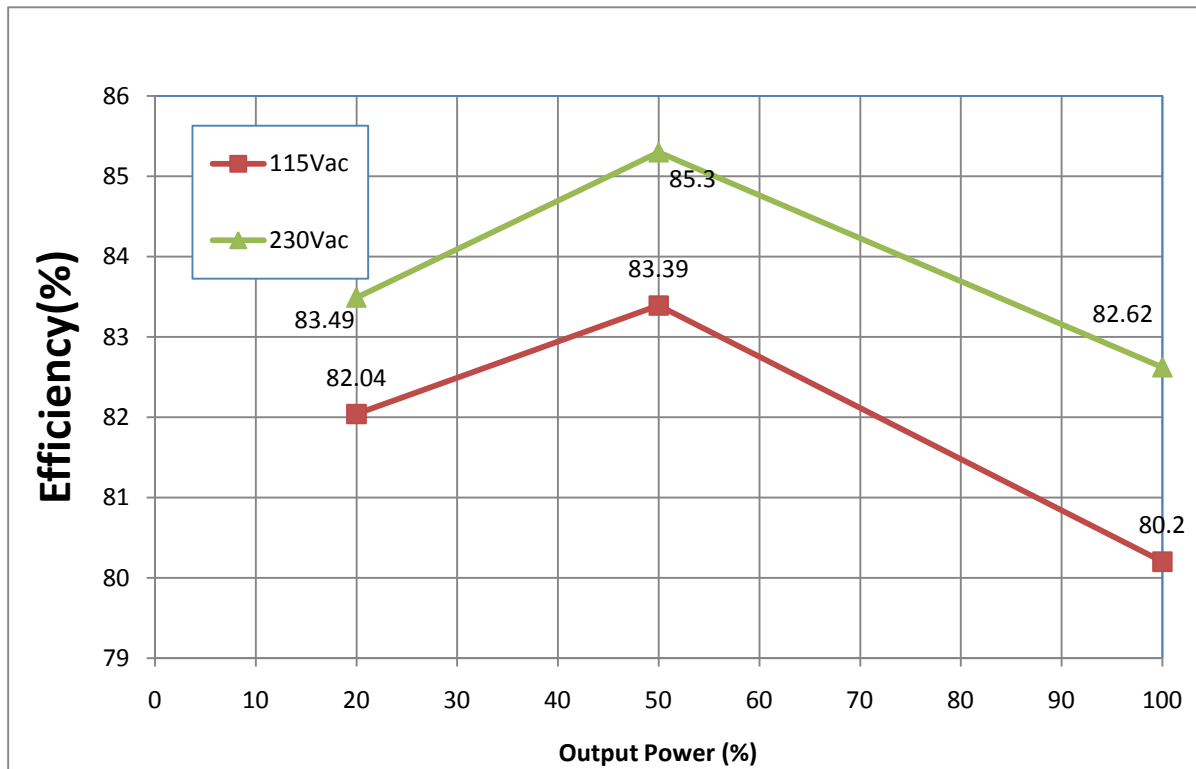
### 6.2. Electrical Characteristics

	Pin	Specification	Remark
Primary-Side Inductance	3 - 8	40μH ± 5%	1kHz, 1V

## 7. Typical Performance

**Table 1. Standby Power Consumption**

Operating Condition	Input Power
When $V_{IN} = 115V_{AC}$ , with 0.5W Loading	0.785W
When $V_{IN} = 230V_{AC}$ , with 0.5W Loading	0.913W
When $V_{IN} = 240V_{AC}$ , with 0.5W Loading	0.926W
When $V_{IN} = 264V_{AC}$ , with 0.5W Loading	0.958W



**Figure 7. Efficiency**



## 8. Related Resources

[FAN4800A — PFC/PWM Controller Combination Datasheet](#)

[FSBH0370 — Green Mode Power Switch \(FPS™\) Datasheet](#)

[SG6520 — PC Power Supply Supervisors Datasheet](#)

[AN-8027 — FAN480X PFC+PWM Combination Controller Application](#)

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