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_{AC}	12V1 (6A) 12V2 (10.5A) 5V (9A) 3.3V (13.5A) -12V (0.3A) 5V_{SB} (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

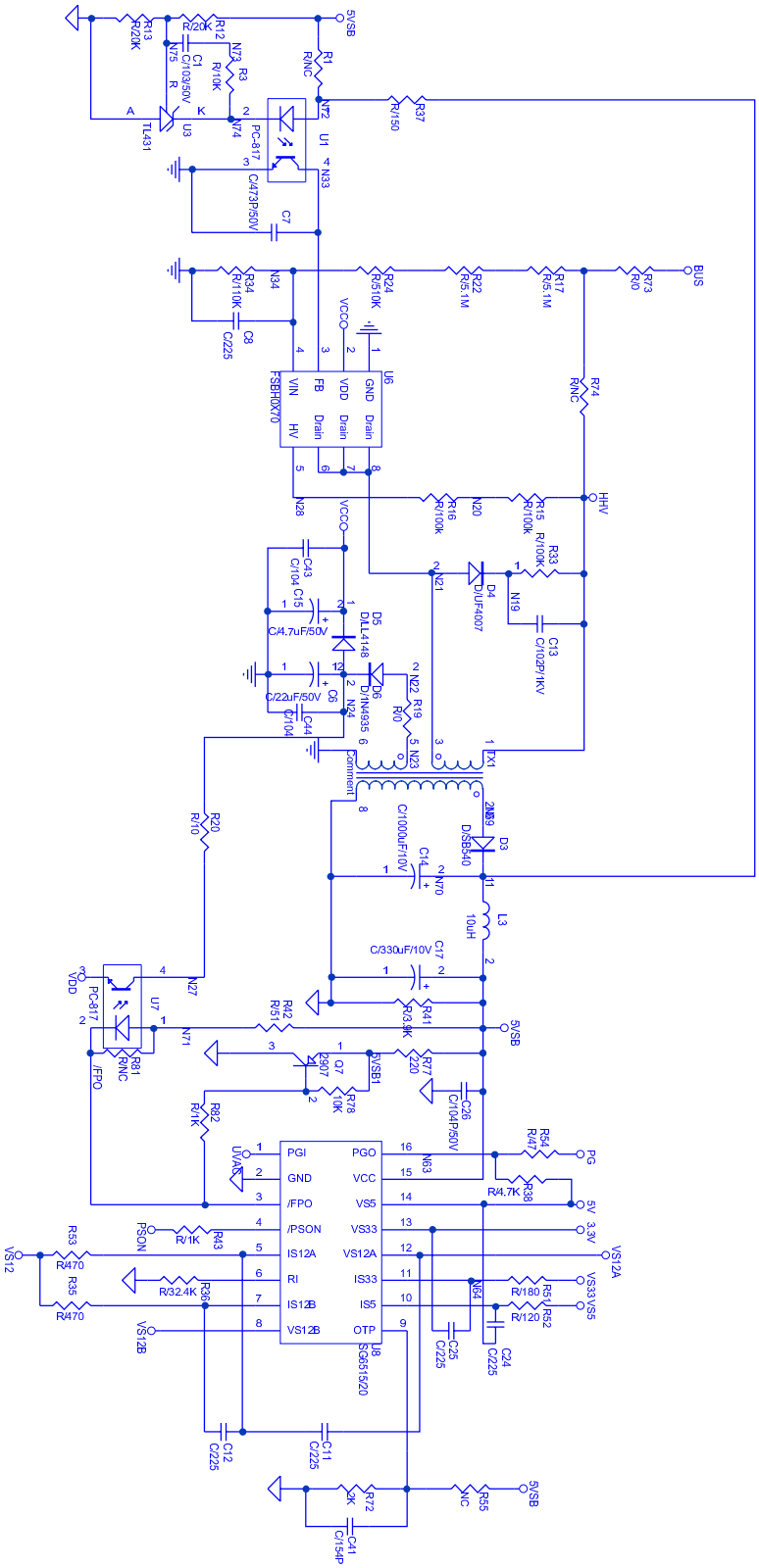

Figure 1. Schematic of Auxiliary Power (FSBH0X70) and Supervisory IC (SG6515/20)

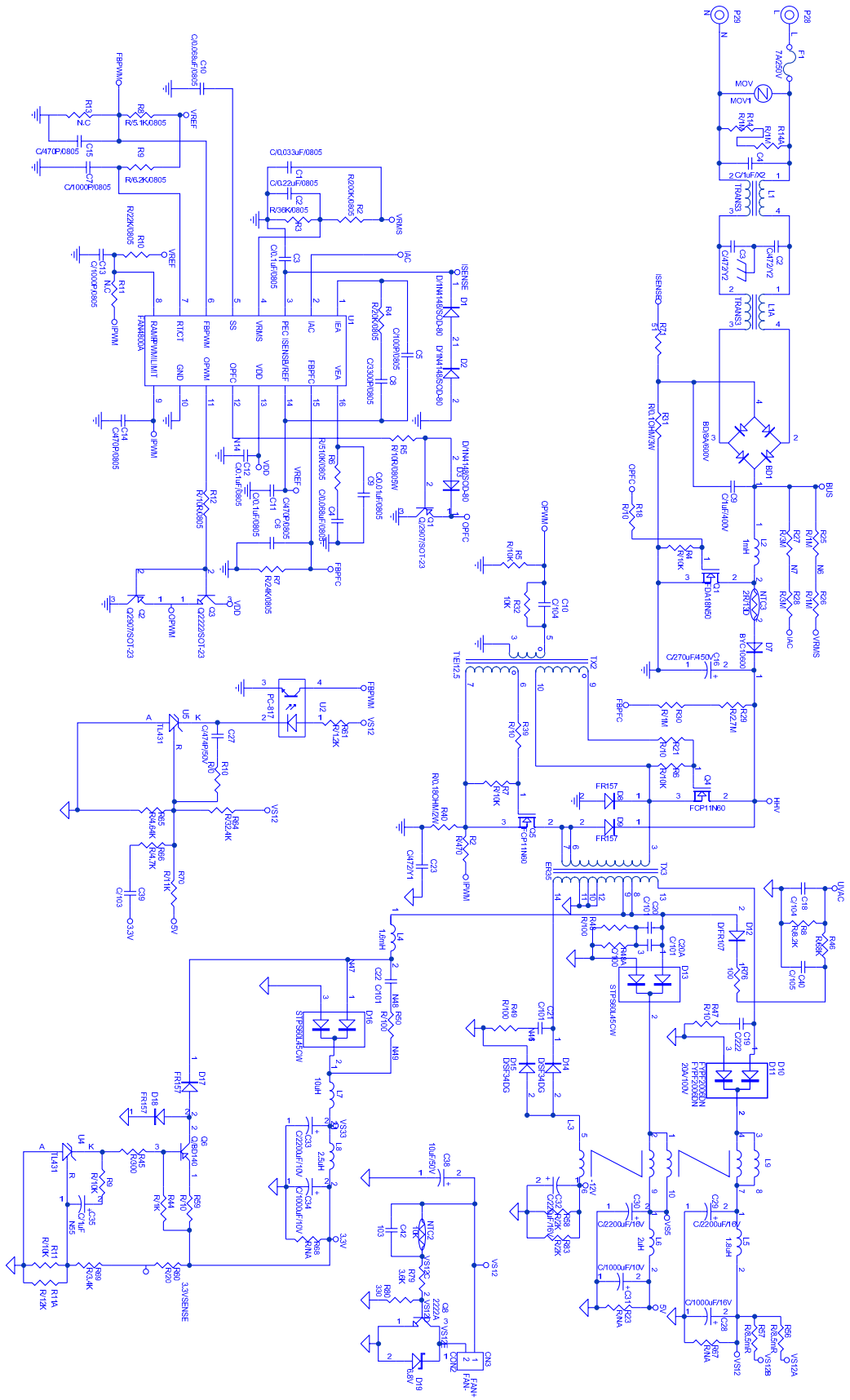

Figure 2. Schematic of Main Power Stage (FAN4800A)

2. Flyback Converter Transformer (TX1)

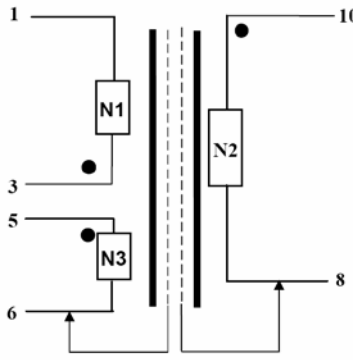

Figure 3. Transformer Schematic Diagram

2.1. Winding Specification

No	Pin (S- F)	Wire	Turns	Winding Method
$N_1/2$	3→2	0.27Φ	90Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
N_2	10→8	0.55Φ*2	11Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
$N_1/2$	2→1	0.27Φ*4	58Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
N_3	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)

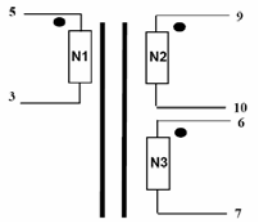

Figure 4. Transformer Schematic Diagram

3.1. Winding Specification

No	Pin (S - F)	Wire	Turns	Winding Method
N_1	5→3	0.2Φ	15Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.025mm, 3 Layer				
N2	9→10	0.2Φ	18Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.025mm, 1 Layer				
N_3	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)

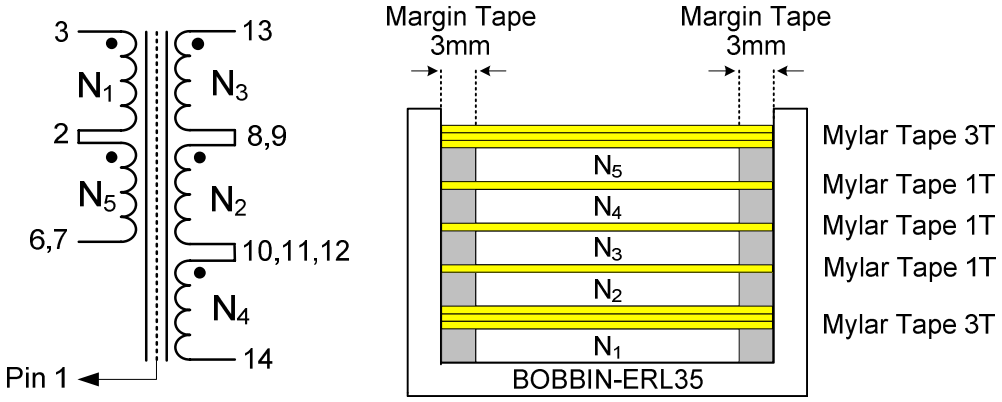

Figure 5. Transformer Schematic Diagram

4.1. Winding Specification

No	Pin (S - F)	Wire	Turns	Winding Method
N_1	3-2	0.6Φ	37Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 3 Layer				
N2	8,9-10,11,12	Copper-Foil 10mil	3Ts	Copper-Foil Width 18mm
Insulation: Mylar® Tape t = 0.03mm, 1 Layer				
N_3	13-8,9	1.0Φ*4	4Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 1 Layer				
N4	10,11,12-14	0.4Φ	6Ts	Solenoid Winding
Insulation: Mylar® Tape t = 0.03mm, 1 Layer				
N5	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_1	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)

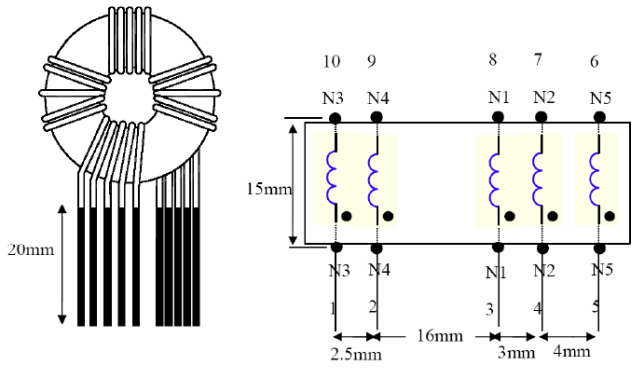

Figure 6. Inductor Schematic Diagram

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

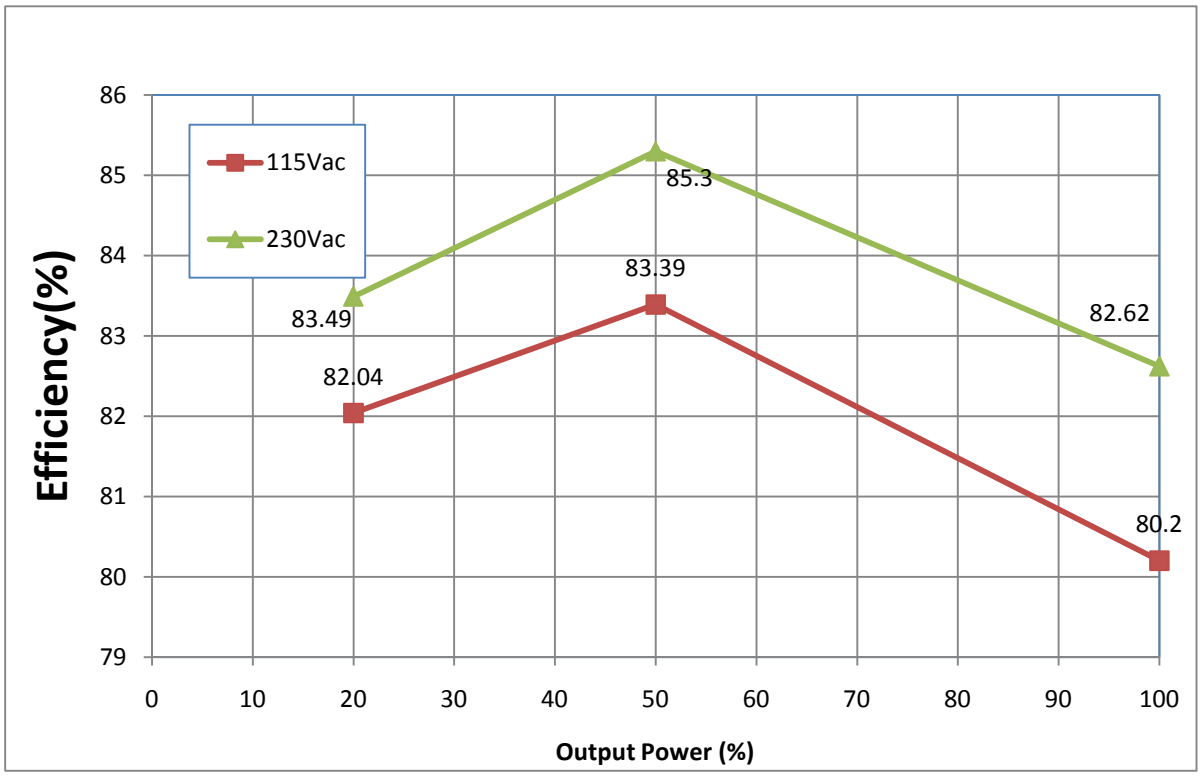

Figure 7. Efficiency

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