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User Guide for

FEBFSB127H_T001

Evaluation Board

FSB127H 100 kHz Power Switch for ATX Standby 16 W

Featured Fairchild Product:

FSB127H

Direct questions or comments about this Evaluation Board to: "Worldwide Direct Support"

Fairchild Semiconductor.com

Table of Contents

This user guide supports the 16 W evaluation board for ATX standby using FSB127H. It should be used in conjunction with the FSB127H datasheet as well as Fairchild's application notes and technical support team. Please visit Fairchild's website at www.fairchildsemi.com.

1. Overview

The highly integrated FSB-series consists of an integrated Current Mode Pulse Width Modulator (PWM) and an avalanche-rugged 700 V SenseFET. It is specifically designed for high-performance offline Switch Mode Power Supplies (SMPS) with minimal external components.

Compared with a discrete MOSFET and controller or RCC switching converter solution, the FSB-series reduces total component count, design size, and weight while increasing efficiency, productivity, and system reliability. These devices provide a basic platform for the design of cost-effective flyback converters, as in PC auxiliary power supplies.

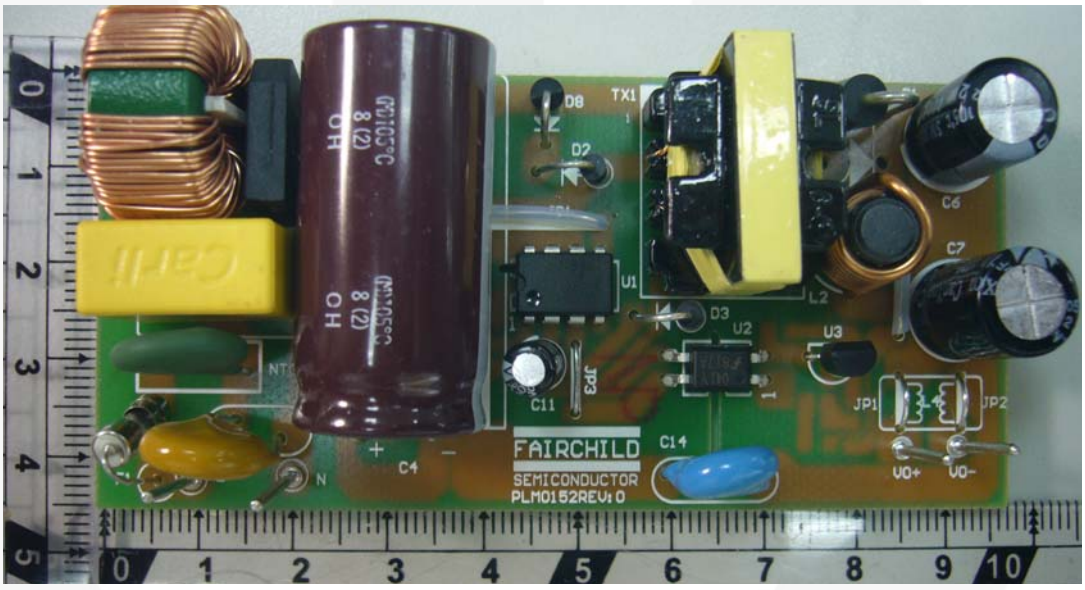


Figure 1. Photo of FEBFSB127H_T001

2. Board Configuration

- Input Voltage: 90 V_{AC} – 264 V_{AC}
- Output Voltage: 5 V
- Output Current: 0 – 3.2 A
- Operation Frequency: 100 kHz

3. Schematic

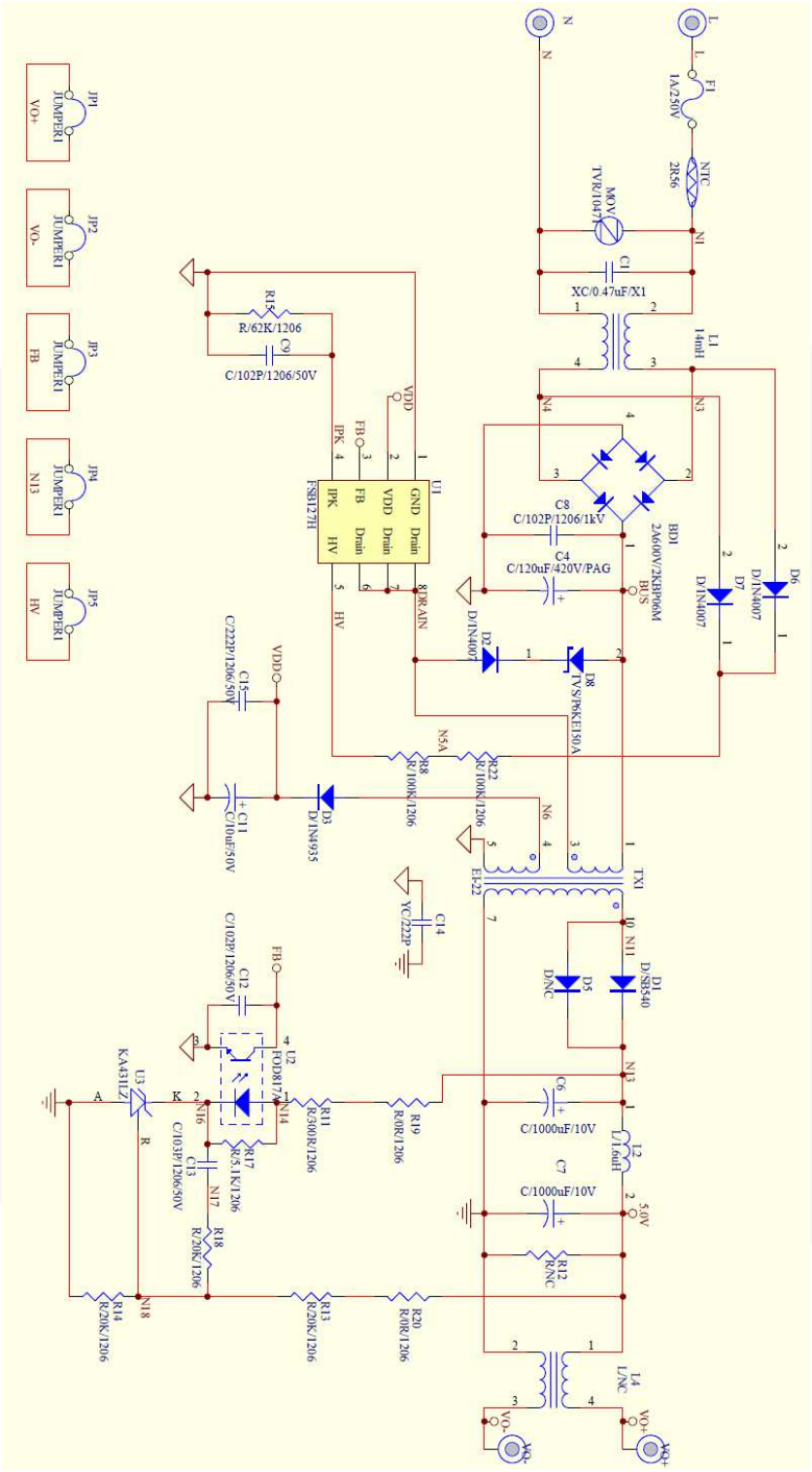


Figure 2. Evaluation Board Schematic

4. PCB Layout

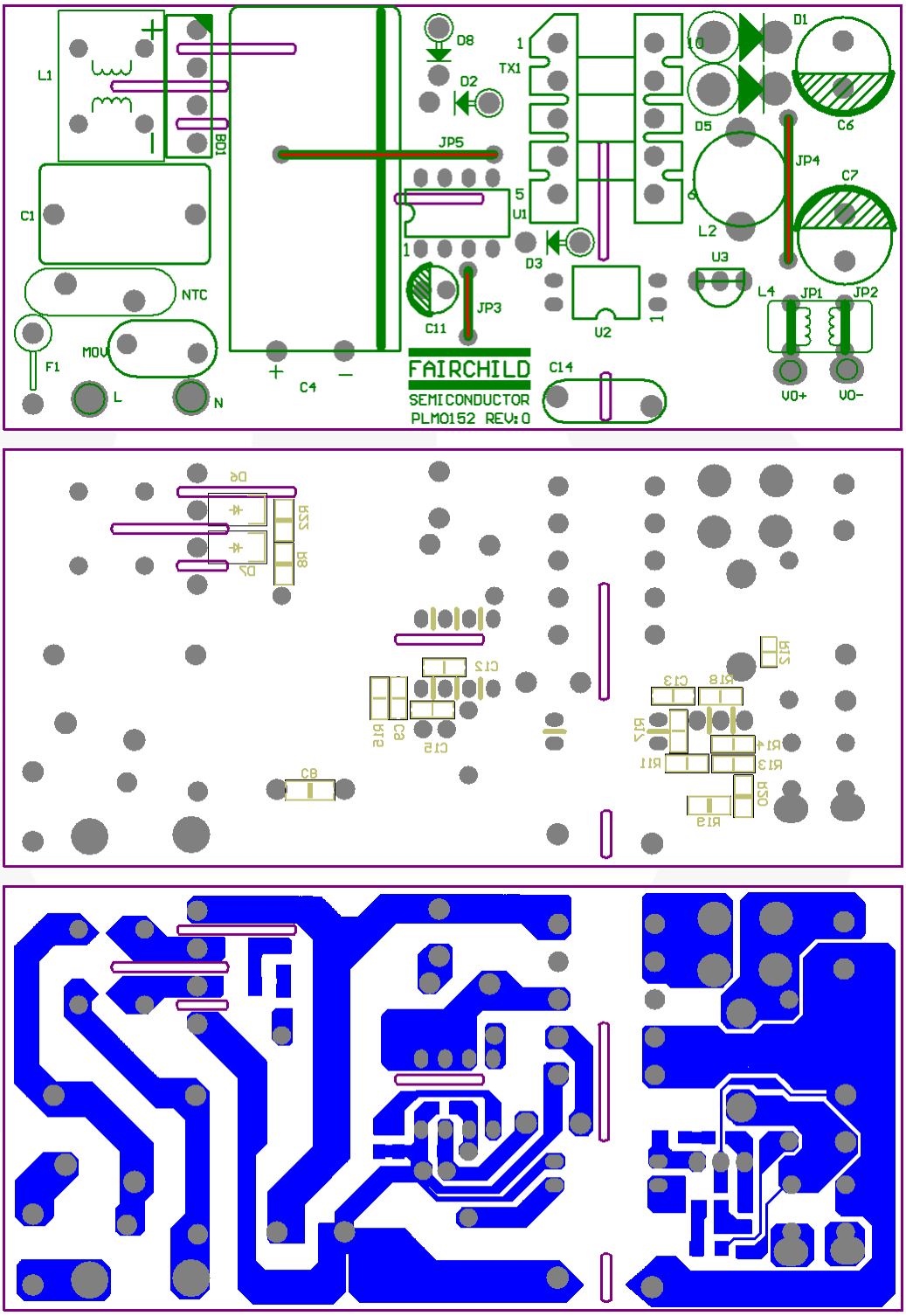


Figure 3. Evaluation Board PCB Layout

5. Test Results

5.1. Brown-in / Brownout

5.1.1. Test Condition

Decrease input AC voltage gradually and measure the turn-off threshold.

After AC power off, increase input voltage and measure the recovery threshold.

5.1.2. Test Result

R_{HV}=200 kΩ	Minimum Load	Maximum Load
Turn off	70 V_{AC}	68 V_{AC}
Turn on	81 V_{AC}	81 V_{AC}

5.2. AC Trim Up and Trim Down

5.2.1. Test Condition

Switch the input voltage from 90 V_{AC} to 264 V_{AC} or from 264 V_{AC} to 90 V_{AC}; the output voltages should be normal.

5.2.2. Test Result

	Minimum Load	Maximum Load
90 V_{AC} → 264 V_{AC}	Pass	Pass
264 V_{AC} → 90 V_{AC}	Pass	Pass

5.3. Line and Load Regulation

5.3.1. Test Condition

Line regulation: 1% maximum.

Load regulation: 5% maximum.

5.3.2. Test Result

Input Voltage	Max. Load	Min. Load	Load Regulation (%)
90 V_{AC} / 60 Hz	4.971 V	5.013 V	0.84%
264 V_{AC} / 50 Hz	4.988 V	5.013 V	
Line Regulation (%)	0.34%	0%	

5.4. DC Output Rise Time

5.4.1. Test Condition

Load: maximum load and minimum load. DC-output rise time: 20 ms, maximum.

5.4.2. Measured Waveforms

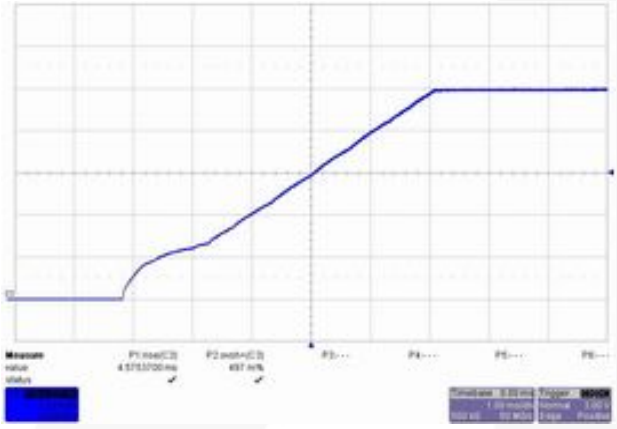


Figure 4. 90 V_{AC} / 60 Hz Maximum Load

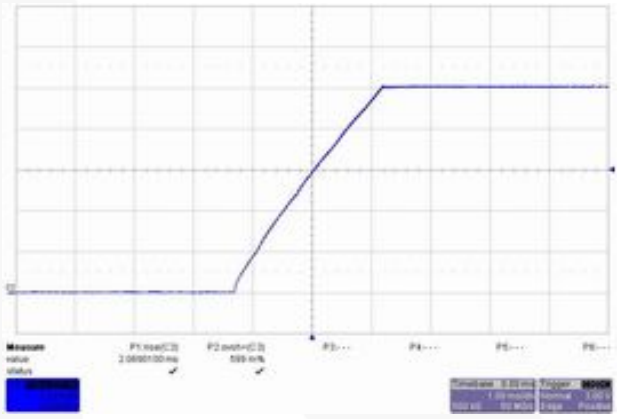


Figure 5. 90 V_{AC} / 60 Hz Minimum Load

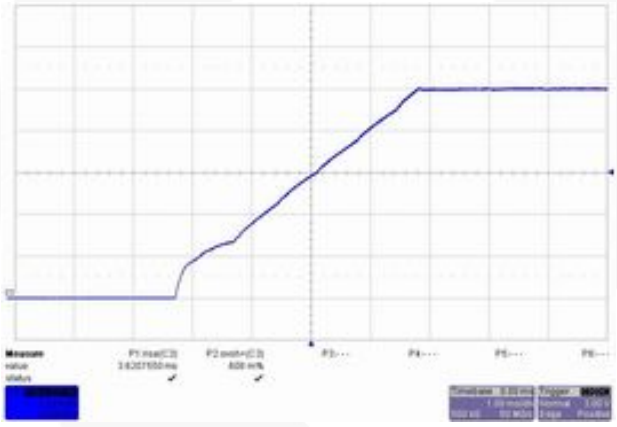


Figure 6. 264 V_{AC} / 50 Hz Maximum Load

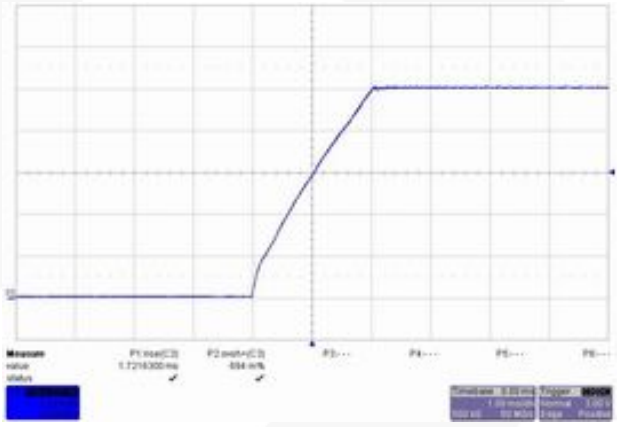


Figure 7. 264 V_{AC} / 50 Hz Minimum Load

5.5. DC Transient Response

5.5.1. Test Condition

From 10% to 90% of the maximum load, with a 2.5 A/µs slew rate. Output load frequency is 100 Hz with 50% duty cycle.

5.5.2. Measured Waveforms

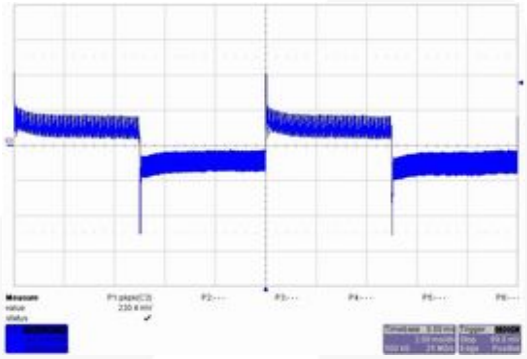


Figure 8. 90 V_{AC} / 60 Hz

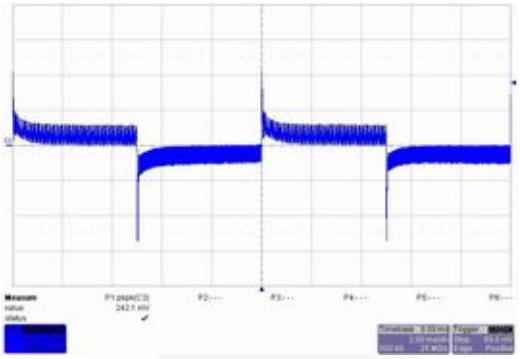


Figure 9. 264 V_{AC} / 50 Hz

5.6. Ripple and Noise

5.6.1. Test Condition

Ripple and noise are measured using a 20 MHz bandwidth-limited oscilloscope with a 10 µF electrolytic capacitor paralleled with a high-frequency 0.1 µF ceramic across each output.

5.6.2. Measured Waveform

Ripple and noise are measured using a 20 MHz bandwidth-limited oscilloscope with a 10 µF electrolytic capacitor paralleled with a high-frequency 0.1 µF ceramic across each output.

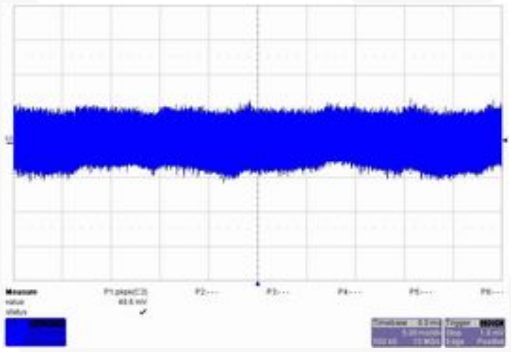


Figure 10. 90 V_{AC} / 60 Hz Maximum Load

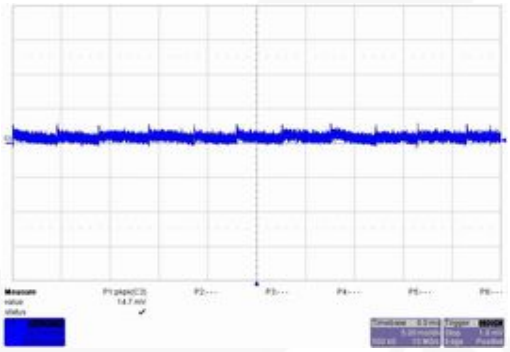


Figure 11. 90 V_{AC} / 60 Hz Minimum Load

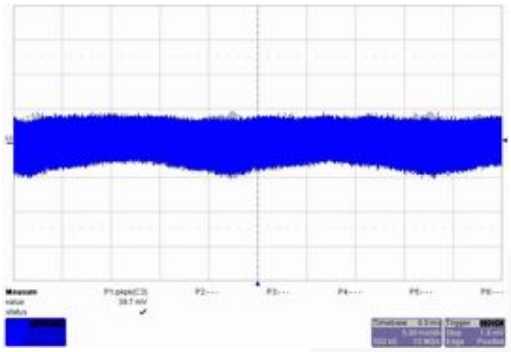


Figure 12. 264 V_{AC} / 50 Hz Maximum Load

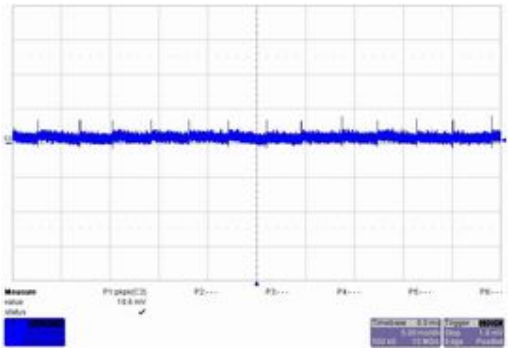


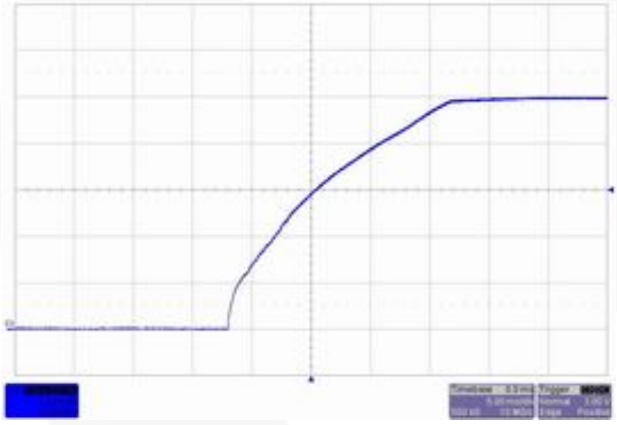
Figure 13. 264 V_{AC} / 50 Hz Minimum Load

5.7. Capacitive Load

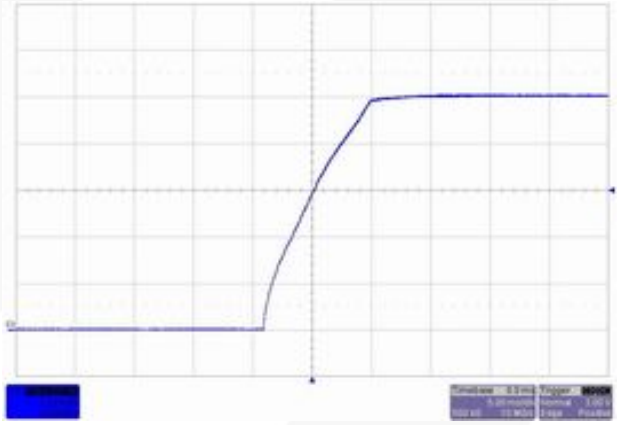
5.7.1. Test Condition

Output Capacitive Load = 12000 µF

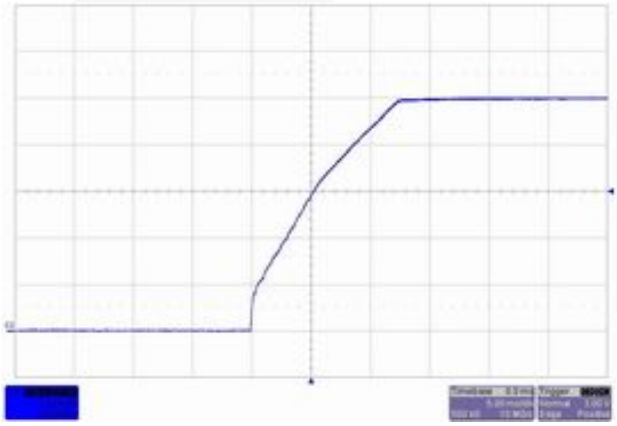
5.7.2. Measured Waveforms



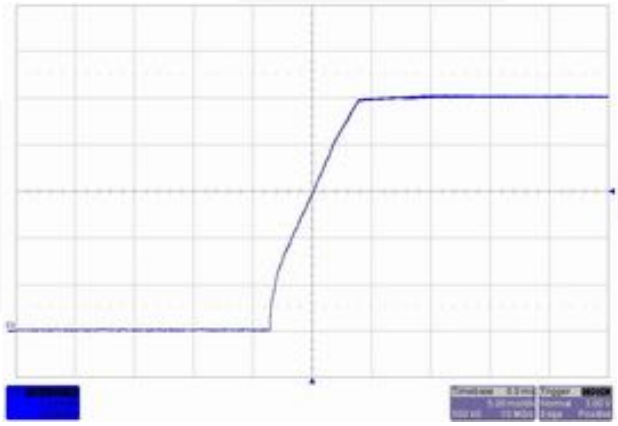
90 V_{AC} / 60 Hz Maximum Load



90 V_{AC} / 60 Hz Minimum Load



264 V_{AC} / 50 Hz Maximum Load



264 V_{AC} / 50 Hz Minimum Load

5.8. Power Saving

5.8.1. Test Condition

The input wattage is < 1 W in Standby Mode with 0.5 W loading for 2010 EuP.

The input wattage is < 0.5 W in Standby Mode with 0.25 W loading for 2013 EuP.

5.8.2. Test Result

FSB127H		Input Watts	Output Watts
A.	When V_{IN}= 230 V_{AC}, with 0.5 W Loading	0.713 W	0.5 W
	When V_{IN}= 240 V_{AC}, with 0.5 W Loading	0.715 W	0.5 W
	When V_{IN}= 264 V_{AC}, with 0.5 W Loading	0.733 W	0.5 W
B.	When V_{IN}= 230 V_{AC}, with 0.25 W Loading	0.384 W	0.25 W
	When V_{IN}= 240 V_{AC}, with 0.25 W Loading	0.389 W	0.25 W
	When V_{IN}= 264 V_{AC}, with 0.25 W Loading	0.406 W	0.25 W
C.	When V_{IN}= 230 V_{AC}, with No Loading	53 mW	x
	When V_{IN}= 240 V_{AC}, with No Loading	56 mW	x
	When V_{IN}= 264 V_{AC}, with No Loading	68 mW	x

5.9. Efficiency

5.9.1. Test Condition

Measure efficiency at minimum, mid-point, and maximum loading.

5.9.2. Test Result

FSB127H	Input Watts	Output Watts	Efficiency
When V_{IN}= 115 V_{AC}, at 100% Load	20.62 W	16 W	81.17%
When V_{IN}= 115 V_{AC}, at 75% Load	15.28 W	12 W	82.42%
When V_{IN}= 115 V_{AC}, at 50% Load	10.02 W	8 W	82.51%
When V_{IN}= 115 V_{AC}, at 25% Load	5.07 W	4 W	81.70%
When V_{IN}= 230 V_{AC}, at 100% Load	20.78 W	16 W	81.40%
When V_{IN}= 230 V_{AC}, at 75% Load	15.11 W	12 W	82.24%
When V_{IN}= 230 V_{AC}, at 50% Load	10.15 W	8 W	80.45%
When V_{IN}= 230 V_{AC}, at 25% Load	5.18 W	4 W	78.62%

5.10. Short-Circuit Protection

5.10.1. Test Condition

In the event of a short circuit on any DC output, the power supply should be protected from damage.

5.10.2. Test Result

	90 V_{AC} / 60 Hz	264 V_{AC} / 50 Hz
Minimum Load	PASS	PASS
Maximum Load	PASS	PASS

5.10.3. Measured Waveforms

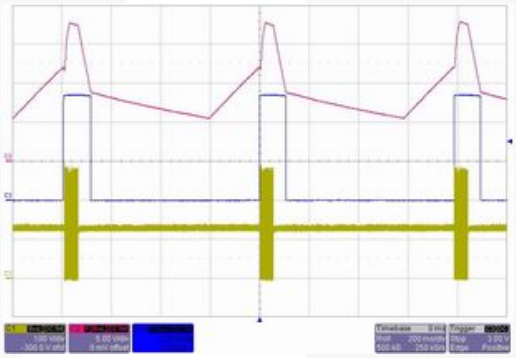


Figure 14. 90 V_{AC}/60 Hz, Output Short (Ch1: Drain, Ch2: V_{DD}, Ch3: FB)

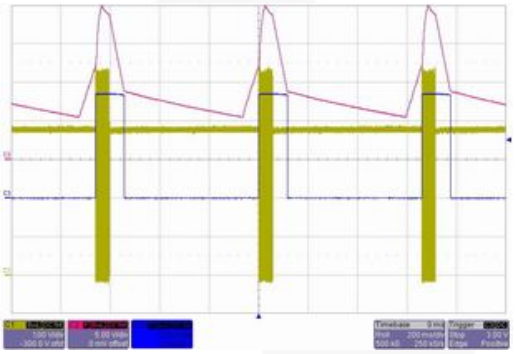


Figure 15. 264 V_{AC}/50 Hz Output Short (Ch1: Drain, Ch2: V_{DD}, Ch3: FB)

5.11. X-Cap Discharge

5.11.1. Test Condition

The X-capacitor voltage should decay to less than 37% of its original peak value in one second after the AC input is disconnected.

5.11.2. Measured Waveforms

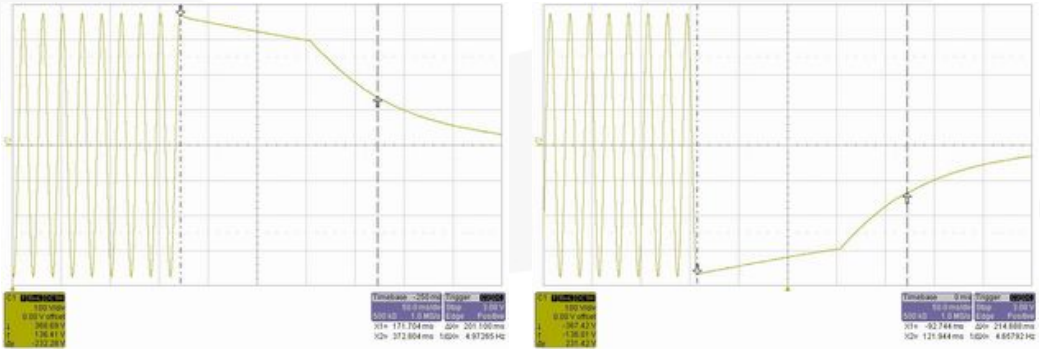


Figure 16. 264 V_{AC} / 50 Hz, No Load, X-Cap=0.47 µF, R_{HV}=200 kΩ

5.12. Over-Power Protection

5.12.1. Test Condition

An over-current from the output return line does not damage the power supply and the OLP protection is enabled.

5.12.2. Test Result

Input Voltage	90 V_{AC}	115 V_{AC}	132 V_{AC}	180 V_{AC}	230 V_{AC}	264 V_{AC}
OPP (W)	24.10 W	25.43 W	26.42 W	26.37 W	26.04 W	26.12 W

5.13. Surge and ESD

5.13.1. Test Result

L-PE ±6 kV	N-PE ±6 kV	L-N ±1 kV	AIR ±16 kV	Contact ±8 kV
Pass	Pass	Pass	Pass	Pass

5.14. EMI Conduction

5.14.1. Measured Waveforms

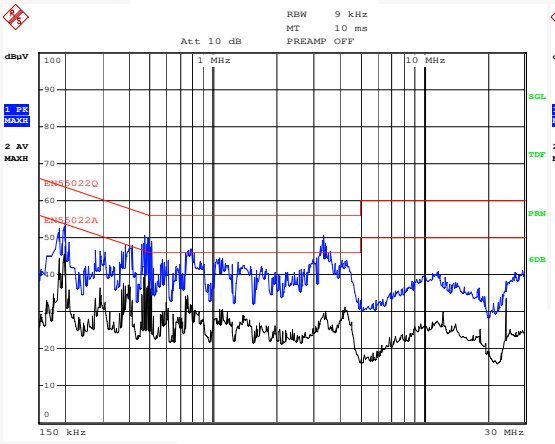


Figure 17. L: 115 V_{AC} / 60 Hz

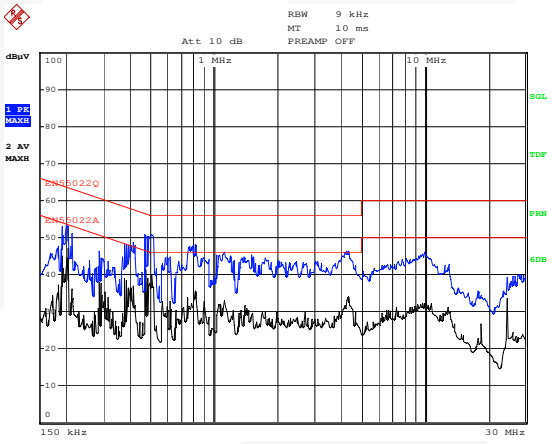


Figure 18. N: 115 V_{AC} / 60 Hz

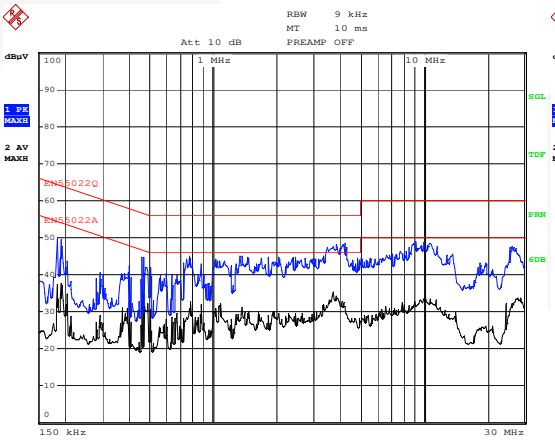


Figure 19. L: 230 V_{AC} / 50 Hz

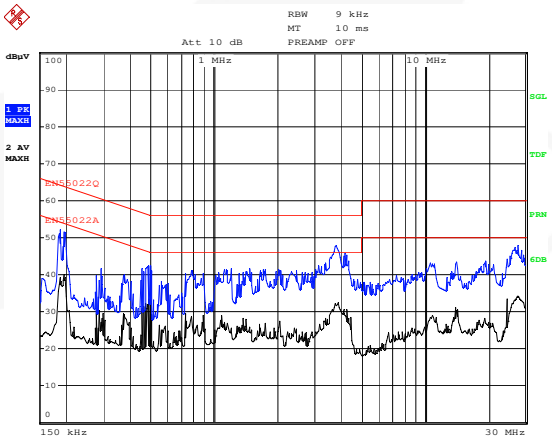


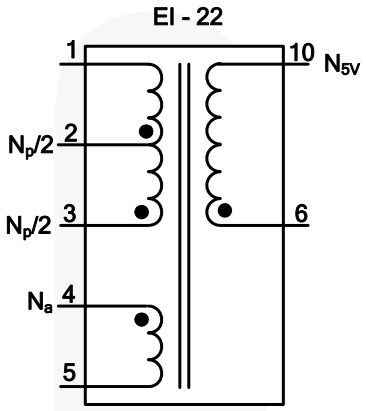
Figure 20. N: 230 V_{AC} / 50 Hz

6. Bill of Materials

Component	Qty	Part No.	Manufacturer	Reference
JUMPER WIRE 0.8Ø (mm)	5			JP1, JP2, JP3, JP4, JP5
Resistor 1206 0 Ω ±5%	2			R19, R20
Resistor 1206 100 kΩ ±5%	2			R8, R22
Resistor 1206 20 kΩ ±1%	3			R13, R14, R18
Resistor 1206 300 Ω ±5%	1			R11
Resistor 1206 51 kΩ ±5%	1			R17
Resistor 1206 62 kΩ ±1%	1			R15
NTC 13Ø 2 ΩSCK132	1			NTC
1206 MLCC X7R 102P 50 V ±10%	2			C9, C12
1206 MLCC X7R 102P 1 kV ±10%	1			C8
1206 MLCC X7R 103P 50 V ±10%	1			C13
1206 MLCC X7R 222P 50 V ±10%	1			C15
Electrolytic Capacitor 10 µF 50 V 105°C	1	LHK	JACKCON	C11
Electrolytic Capacitor 120 µF 420 V 105°C	1	LHK	PAG	C4
Electrolytic Capacitor 1000 µF 10 V 105°C	2	LHK	SAMXON	C6, C7
X2 Capacitor 0.47 µF 275 V ±20%	1			C1
Y1 Capacitor 222P 250 V ±20%	1			C14
Inductor 14 mH	1	TRN0183	SEN HUEI	L1
Inductor 2.5 µH	1	TRN0204	SEN HUEI	L2
Transformer EI-22 900 µH	1	TRN0317	SEN HUEI	TX1
Schottky Diode 5 A / 40 V	1	SB540	FAIRCHILD	D1
Fast Diode 1 A / 1000 V	1	1N4007	FAIRCHILD	D2
Fast Diode 1 A / 200 V	1	1N4935	FAIRCHILD	D3
SMD Fast Diode 1 A / 1000 V	2	S1M	FAIRCHILD	D6, D7
Bridge 2 A / 800 V	1	2KBP08M	FAIRCHILD	BD1
REGULATOR KA431L ±0.5%	1		FAIRCHILD	U3
IC FOD817A DIP	1		FAIRCHILD	U2
FUSE CERAMIC 250 V 1 A 3.6*10 mm	1	SLOW 37SG	SLEEK	F1
Varistor 7ψ470 V	1			MOV
TVS Breakdown Voltage 143 V–158 V	1	P6KE150A	FAIRCHILD	D8
Test Pin SG004-05	4			L N VO+ VO-
PCB PLM0152 REV0	1		FAIRCHILD	
FSB127HNY	1		FAIRCHILD	U1

7. Transformer

7.1. Transformer Specification



Core: EI-22 (Ae=37.5 mm^2)
Bobbin: EI-22

Figure 21. Transformer Specification

Table 1. Winding Specifications

	Pins (S → F)	Wire	Turns	Winding Method
$N_p/2$	3 → 2	0.27φ×1	31	Solenoid Winding
Insulation: Polyester Tape t = 0.025 mm, 3 Layer				
N_{5V}	6 → 10	0.55φ×2	5	Solenoid Winding
Insulation: Polyester Tape t = 0.025 mm, 3 Layers				
$N_p/2$	2 → 1	0.27φ×1	31	Solenoid Winding
Insulation: Polyester Tape t = 0.025 mm, 6 Layers				
N_a	4 → 5	0.15φ×1	12	Solenoid Winding
Insulation: Polyester Tape t = 0.025 mm, 3 Layers				

Table 2. Specifications

	Pins	Specifications	Remark
Primary-Side Inductance	1 - 3	900 µH ±10%	100 kHz, 1 V
Primary-Side Effective Leakage	1 - 3	< 30 ❍H Max.	Short All Other Pins

8. Revision History

Rev.	Date	Description
1.0.0	11/10/11	Initial release
1.0.1	02/04/13	Modify description of test condition

WARNING AND DISCLAIMER

Replace components on the Evaluation Board only with those parts shown on the parts list (or Bill of Materials) in the Users' Guide. Contact an authorized Fairchild representative with any questions.

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