Engineering Test Report
12V/500mA

Main featured STMicroelectronics product:

ALTAIR05T-800

Engineering Test Report 12V/500mA

1. Introduction

The purpose of this document is to provide information on the Switched Mode Power Supply board for evaluation. It is an isolated SMPS capable of delivering 12V/500mA over wide input voltage range, designed for Wireless Routers application focused on providing a cost-effective solution. This board uses primary regulation based on ALTAIR05T-800 – a High-Voltage all-primary sensing switcher intended for operating directly from the rectified mains with minimum external parts. It combines a high-performance low voltage PWM controller chip and an 800V avalanche-rugged power section in the same package.

This document contains a fundamental technical description of the demonstration board (schematic diagram, transformer construction and bill of materials) as well as basic measurements as: Line and Load regulations, efficiency and thermal behavior).

2. Features

- Constant voltage and constant current output regulation (CV/CC) with no optocoupler.
- Tight regulation also in presence on heavy load transients.
- 800V avalanche rigged power section.
- Quasi-resonant (QR) operation.
- Low standby power consumption.
- Automatic self-supply.
- Output cable drop compensation.
- SO16 package.

3. Input Requirements

Input Voltage: 85Vac – 264Vac
Input Frequency: 60Hz

4. Test Equipment

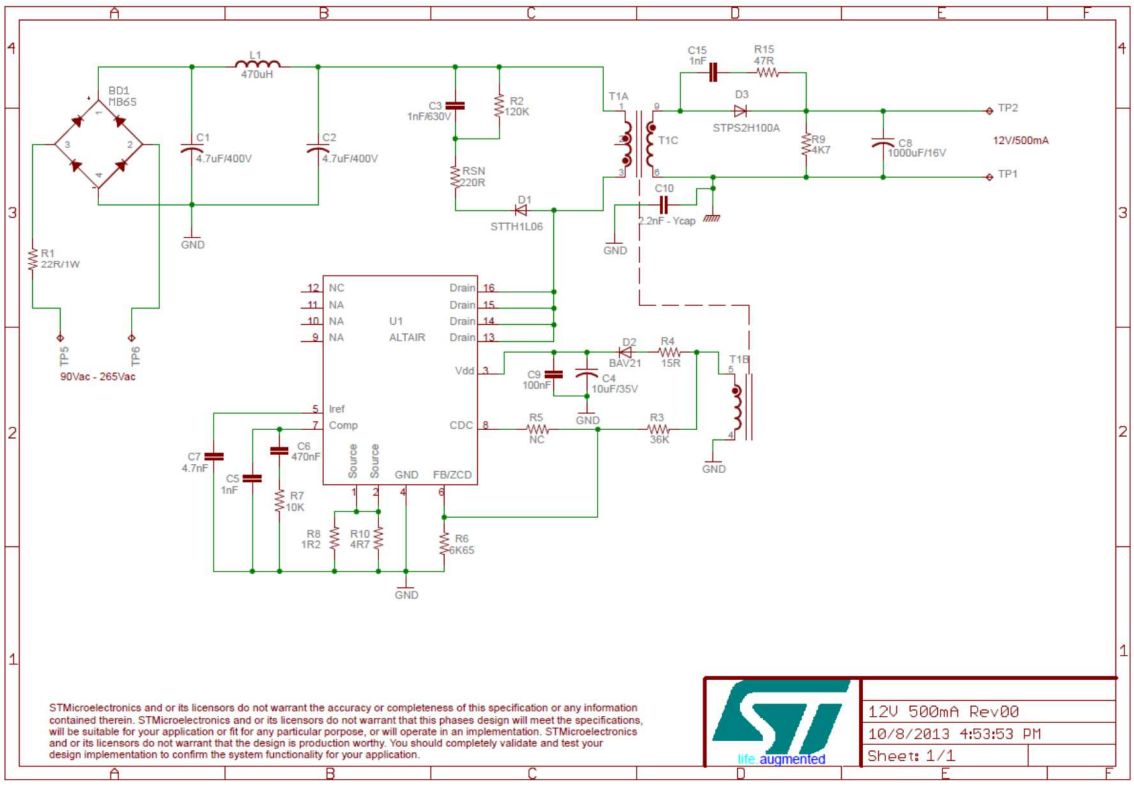
- Oscilloscope Tektronix TPS2014.
- Current probe Tektronix 1103.
- AC Power Source Instek APS-9501.
- Electronic Load Chroma 63010.
- Thermal couple.
- Multimeter Fluke 189.

Engineering Test Report
12V/500mA

5. Board Pictures

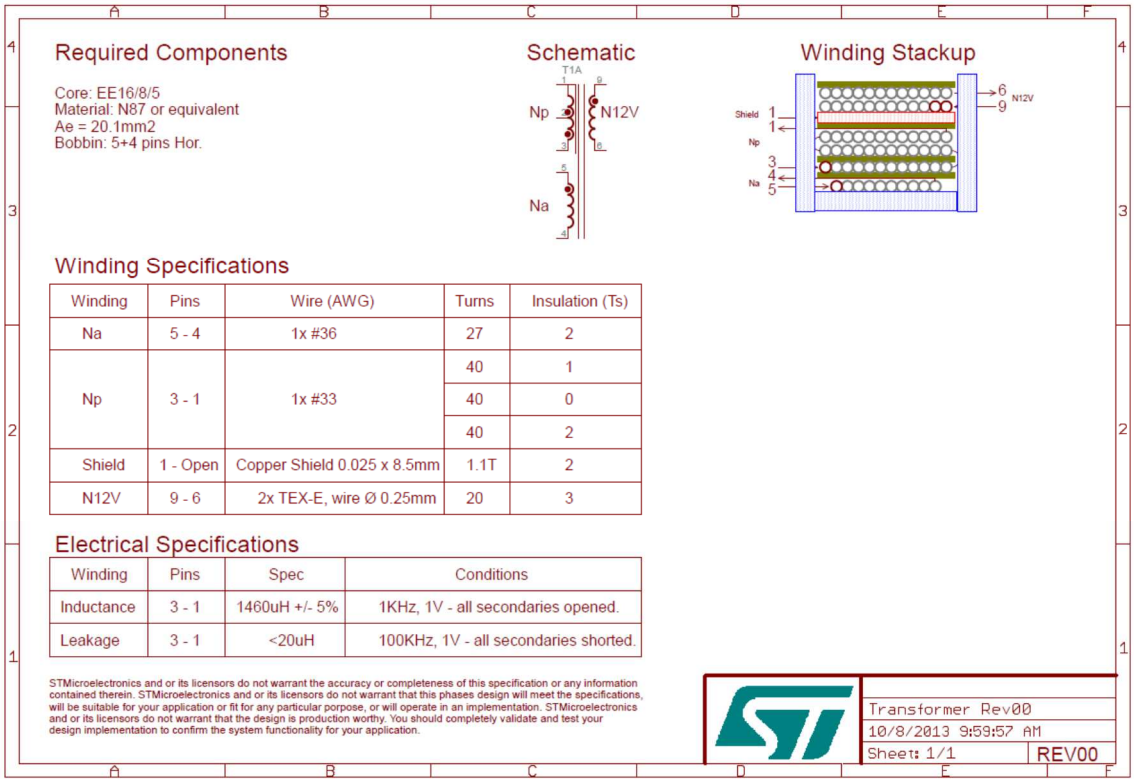
	
Top view	Bottom view

6. Schematic



Engineering Test Report 12V/500mA

7. Transformer.



8. BOM

Ref Des	Qty	Description	Manufacturer	Manf. P/N	Package
R1	1	Resistor, TH, 1W, 22R, 5% - wirewound	Any		
R2	1	Resistor, SMD, 1206, 120K, 5%	Any		1206
RSN	1	Resistor, TH, 1/4W, 220R, 5%	Any		
R3	1	Resistor, TH, 1/4W, 36K, 1%	Any		
R4	1	Resistor, TH, 1/4W, 10R, 5%	Any		
R6	1	Resistor, TH, 1/4W, 6K65, 1%	Any		
R7	1	Resistor, TH, 1/4W, 10K, 5%	Any		
R8	1	Resistor, TH, 1/4W, 1R2, 5%	Any		
R9	1	Resistor, SMD, 0805, 4K7, 5%	Any		0805
R10	1	Resistor, TH, 1/4W, 4R7, 5%	Any		0805
R15	1	Resistor, SMD, 1206, 47R, 5%	Any		1206
C1, C2	2	Capacitor, Al. El., 4.7uF, 400V, 105C, 20%	Any		10x16mm
C3	1	Capacitor, SMD, MLCC, 1nF, 630V, 15%, 1206	Any		1206
C4	1	Capacitor, Al. El., 10uF, 63V, 105C, 20%	Any		5x11mm
C5	1	Capacitor, Ceramic, 1nF, 50V, 10%, X7R	Any		
C15	1	Capacitor, Ceramic, 1nF, 100V, 10%, X7R, 0805	Any		0805
C6	1	Capacitor, Ceramic, 470nF, 50V, 10%, X7R	Any		
C7	1	Capacitor, Ceramic, 4.70F, 50V, 10%, X7R	Any		
C8	1	Capacitor, Al. El., 1000uF,16V, 105C, 20% - Low ESR	Epcos	41889 series	10x16mm
C9	1	Capacitor, Ceramic, 100nF, 50V, 10%, X7R	Any		

C10	1	Capacitor, Y1, 2.2nF, 250Vac, 4KV	Any		
BD1	1	Bridge Rectifier, SMD, 600V, 0.5A	Any		SO-4L
D1	1	Diode, Ultra-Fast Rectifier, 600V, 1A	STMicroelectronics	STTHH1L06	DO-41
D2	1	Diode, small signal, 250V, 200mA	Any	BAV21	DO-35
D3	1	Diode, Shottky Rectifier, 100V, 2A	STMicroelectronics	STPS2H100A	SMA
U1	1	IC, QR PWM Controller+FET, 800V, SMD	STMicroelectronics	Altair05T-800	SO16N
L1	1	Inductor, TH, 470uH, 10%, 170mA	Any		
T1	1	EE16, 1460uH	Any	Custom	EE16

9. Input current

9.1 Test Condition

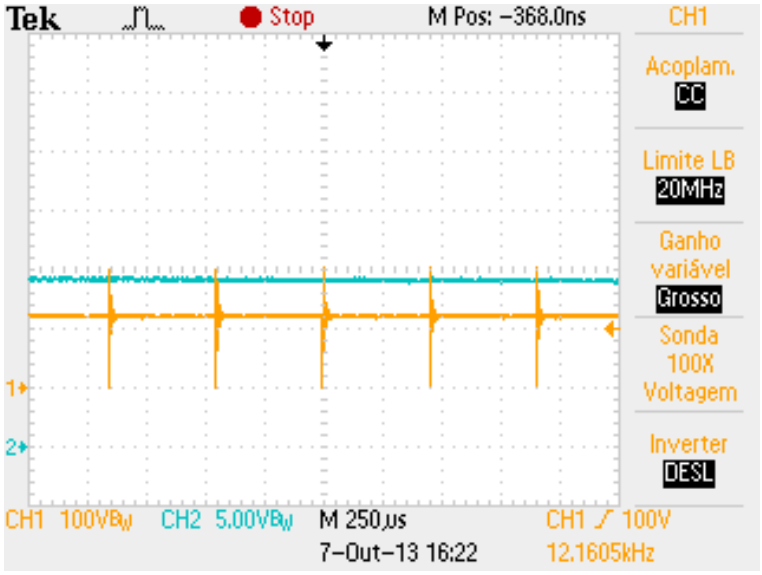
Measure the AC input current at maximum load (500mA).

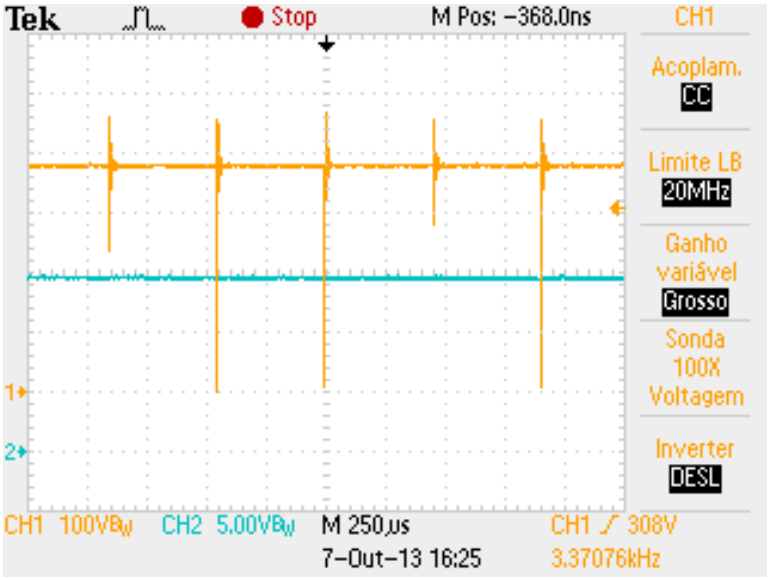
9.2 Test result

Input Voltage	Input current	Spec
85Vac	147mA	
264Vac	67mA	

10. No load operation

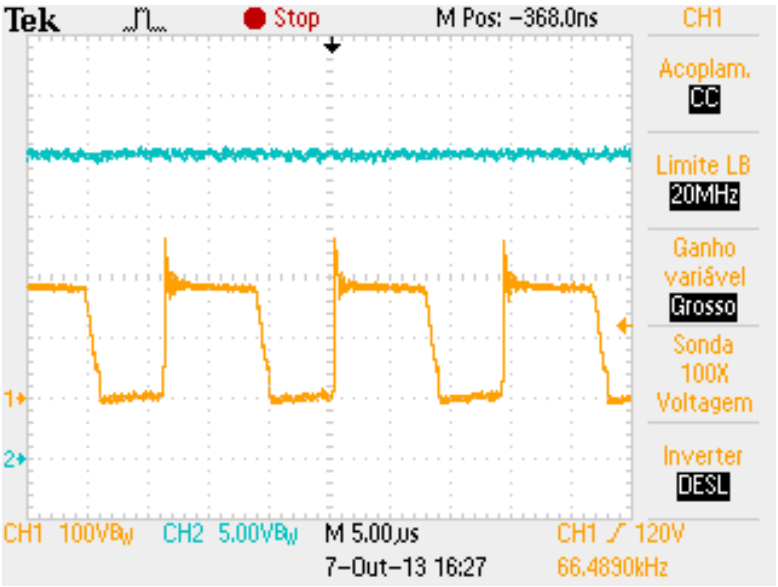
10.1 Measured waveform

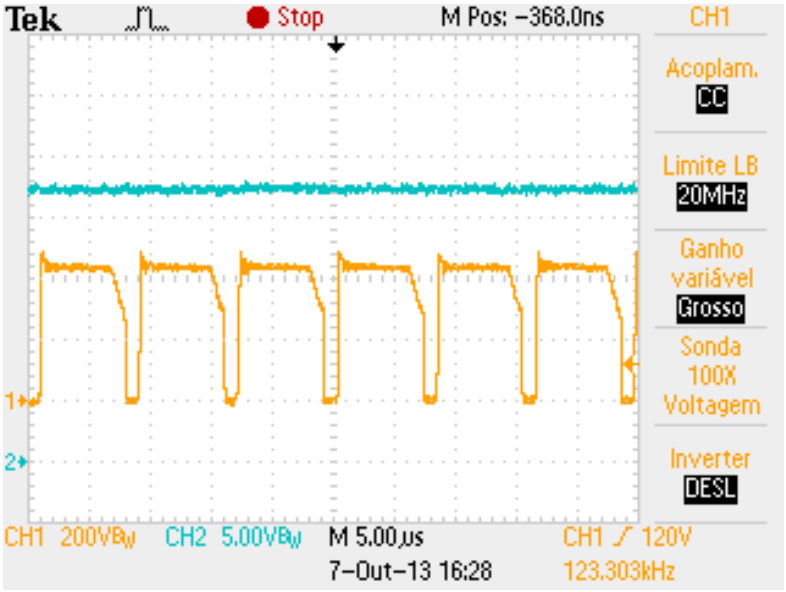
85Vac – No load	
	CH1=Vdrain CH2=Vdd

264Vac – No load	
	CH1=Vdrain CH2=Vdd

11. Max load operation

11.1 Measured waveform

85Vac – Max load	
	CH1=Vdrain CH2=Vdd

264Vac – Max load	
	CH1=Vdrain CH2=Vdd

12. Line regulation and load regulation

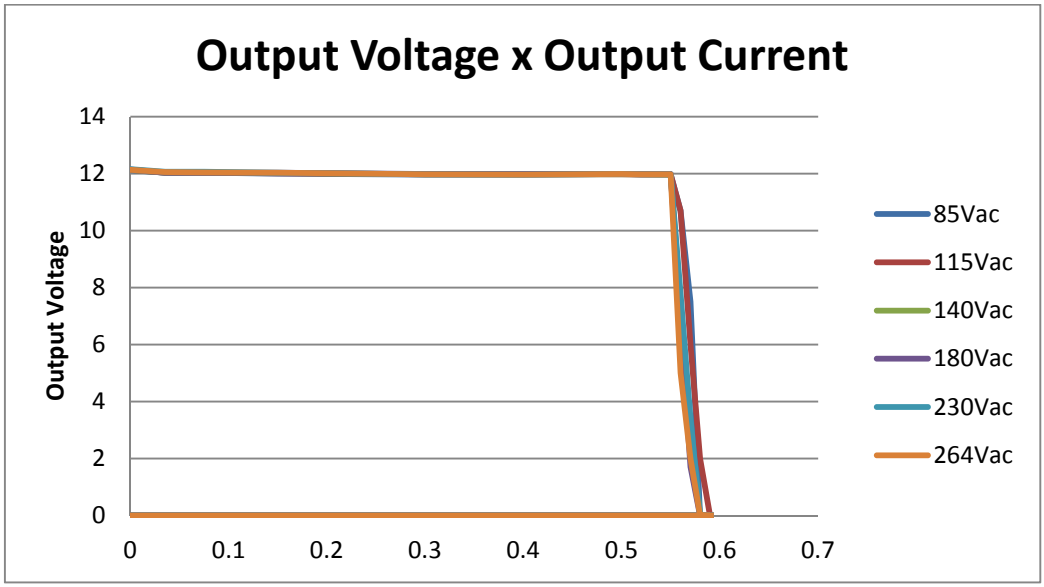
12.1 Test condition

Measure line regulation (the difference between Min and Max values) and load regulation (considering Nominal Output Voltage = 12V) at the board (not at the end of cable) according to the table below.

12.2 Test result

Input Voltage	Output Voltage at max. load (V)	Output Voltage at no load (V)	Load reg. (%)	Spec
85Vac	11.99V	12.13V	-0.08% +1.08%	
115Vac	11.98V	12.14V	-0.16% +1.17%	
140Vac	11.98V	12.14V	-0.16% +1.17%	
180Vac	11.99V	12.15V	-0.08% +1.25%	
230Vac	11.99V	12.16V	-0.08% +1.33%	
264Vac	11.99V	12.14V	-0.08% +1.17%	
Line reg. (%)	0.08%	0.25%		

12.3 Graph: Output Voltage (Vdc) x Output Current (mA)



13. Output ripple and noise

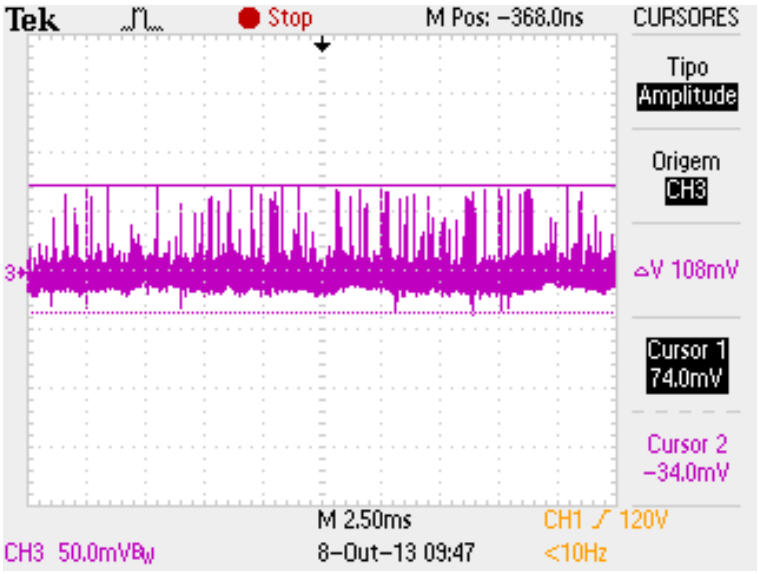
13.1 Test condition

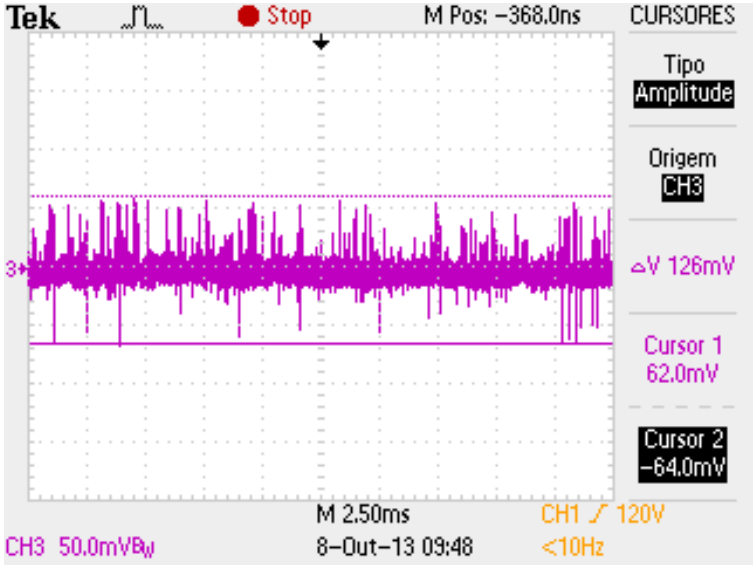
Ripple and noise are measured by using 20MHz bandwidth limited oscilloscope with a 10uF paralleled with a high-frequency 0.1uF capacitor across the output. Used a very short lead of ground probe.

13.2 Test result

Input Voltage	Max. load (mV)	Spec
115Vac	108mV	
230Vac	126mV	

13.3 Measured waveform

115Vac – Max. load	
	CH3=Vout

230Vac –Max load	
	CH3=Vout

14. Voltage Stress on MOSFET and Rectifier

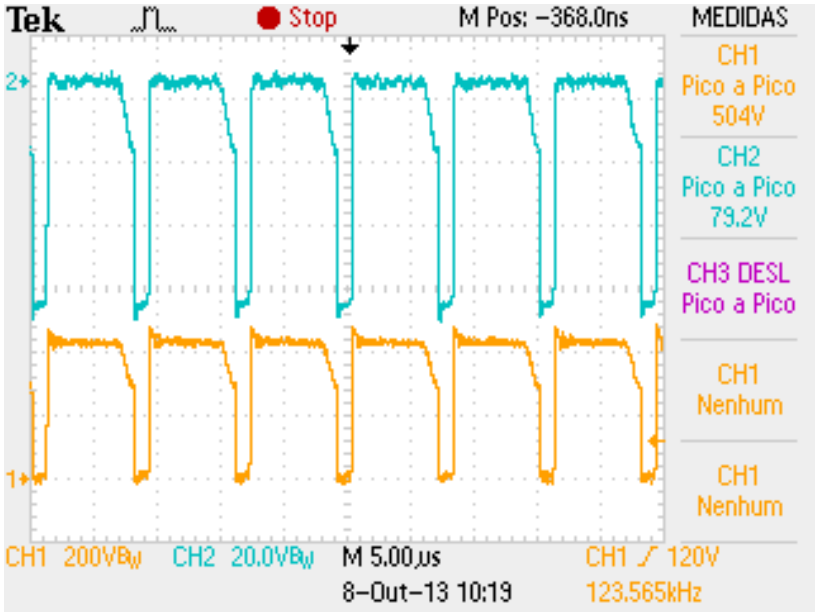
14.1 Test condition

Measure the voltage stress on MOSFET and secondary rectifier under below specified conditions.

14.2 Test result

Condition	Stress on MOSFET	Rating	Stress on rectifier	Rating
264Vac, max load	504V	800V	79.2V	100V

14.3 Measured waveform

264Vac – Max. load	
	CH1=Vdrain CH2=Vrrm

15. Thermal Characteristics

15.1 Test condition

Measure the temperature on the package of the devices below at maximum load.
Room temperature is 23.0°C.

15.2 Test result

Devices	85Vac	264Vac	Spec
Altair05T-800	52.2°C	50.8°C	
Diode STPS2H100A	46.5°C	56.7°C	
Transformer (Core)	43.2°C	49.9°C	