STEVAL-ISA117V1

Wide range isolated flyback demonstration board, single output 12 V/4.2 W based on the VIPER16LN

Data brief

STEVAL-ISA117V1

GIPD1712121716FSR

Features

- Universal input mains range:
  - input voltage 90 - 264 V_{AC}
  - frequency 45 - 65 Hz
- Single output voltage: 12 V at 0.35 A continuous operation
- Stand-by mains consumption: < 30 mW at 230 V_{AC}
- Average efficiency: > 75 %
- Fully protected against faults (overload, feedback disconnection and overheating)
- EMI: according to EN55022-Class-B

Description

This board implements a 4 W single-output wide range mains power supply set in flyback isolated topology, using the VIPER16LN, an off-line high voltage converter by STMicroelectronics.

The features include an 800 V avalanche rugged power section, PWM operation at 60 kHz with frequency jittering for lower EMI, current limiting with adjustable set point, on-board soft-start, a safe auto-restart after a fault condition and a low stand-by power.

The device does not require a biasing circuit to operate because the IC can be supplied by an internal current generator, therefore saving the cost of the transformers auxiliary winding. If the device is biased through an auxiliary winding, the demonstration board can reach very low standby consumption (< 30 mW at 230 V_{AC}, with output load disconnected).

The IC implements several protections that considerably increase end-product safety and reliability: thermal shutdown with hysteresis, delayed overload protection, open loop failure protection (the last one available only if the device is biased through the auxiliary winding).

Contents

1 Adapter features

The electrical specifications of the demonstration board are listed below:

Table 1: Electrical specification

Parameter	Symbol	Value
Input voltage range	V_{IN}	[$90V_{AC}$; $265V_{AC}$]
Output voltage	V_{OUT}	12V
Max output current	I_{OUT}	0.35A
Precision of output regulation	ΔV_{OUT_LF}	±5%
High frequency output voltage ripple	ΔV_{OUT_HF}	50mV
Max. ambient operating temperature	T_{AMB}	60 ºC

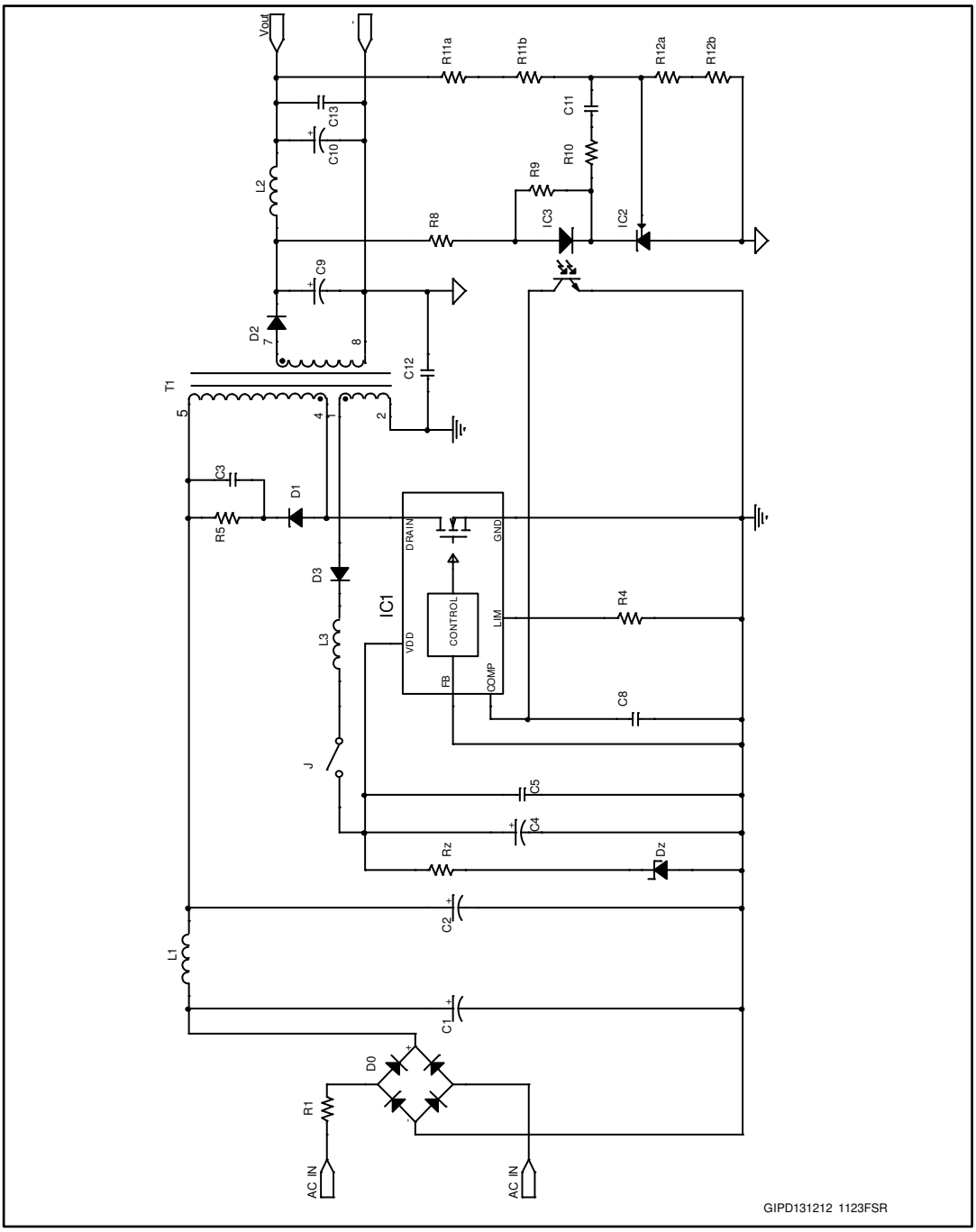
2 BOM and schematic

Table 2: Bill of material

Reference	Part	Description	Manufacturer
D0	DF06M	Diode bridge	VISHAY
C1, C2	4.7µF, 400V	Electrolytic capacitor, NHG series	PANASONIC
C3	Not mounted		
C4	10µF, 35V	Electrolytic capacitor, GA series	PANASONIC
C5	100nF, 50V	Ceramic capacitor, SR series	AVX
C8	3.3nF, 100V	Ceramic capacitor	
C9	470µF, 25V	Ultra-low ESR electrol. Cap., ZL serie	Rubycon
C10	Not mounted	Electrolytic capacitor	
C11	33nF, 50V	Ceramic capacitor B3798x serie	EPCOS
C12	2.2nF	Y1 capacitor 440L serie	VISHAY
C13	100nF, 50V	Ceramic capacitor, SR serie	AVX
D1	Not mounted	Clamp diode	
D2	STPS2H100	Output diode 2A, 100V	STMicroelectronics
D3	BAT46	Small signal diode	STMicroelectronics
Dz	18V	Zener diode	
Rz	6.8kΩ	1/4W resistor	
R1	4.7Ω	1W resistor	TYCO Electronics
R4	Not mounted	1/4W resistor	
R5	Not mounted	1/2W resistor	
R8	8.2kΩ	1/4 W resistor	
R9	15kΩ	1/4 W resistor	
R10	680kΩ	1/4W resistor	
R11a	120kΩ	1/4W resistor	
R11b	27kΩ	1/4W resistor	
R12a	15kΩ	1/4W resistor	
R12b	1.8kΩ	1/4W resistor	
IC1	VIPER16LN	PWM controller	STMicroelectronics
IC2	TS431	Voltage reference	STMicroelectronics
IC3	PC817	Optocoupler	
L1	1mH	Filter inductor BC type	EPCOS
L2	Short-circuit		
L3	1µH	Small signal inductor	

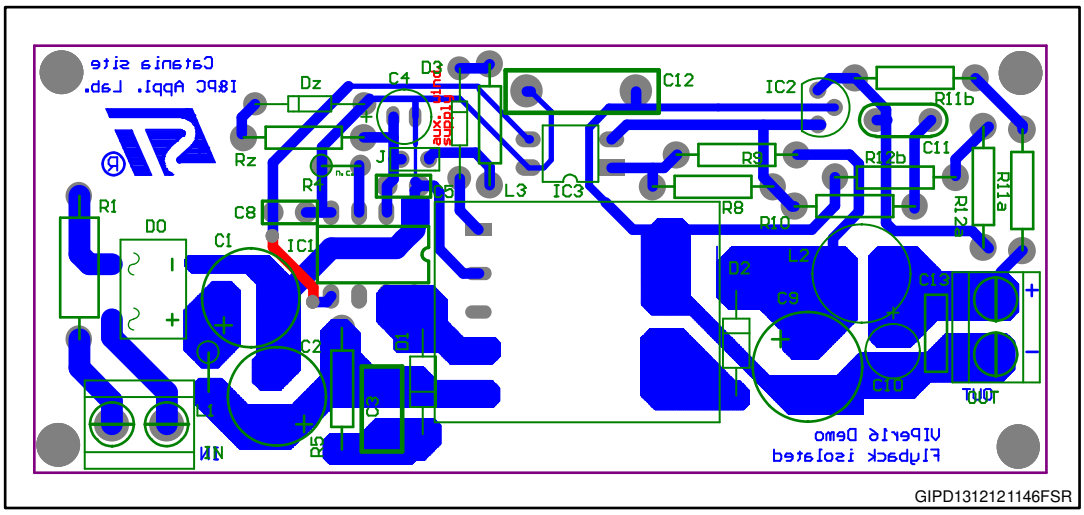
Reference	Part	Description	Manufacturer
T1	1335.0062	Transformer	MAGNETICA
J	Jumper		

Figure 1: Application schematic



3 Layout

Figure 2: Board layout



4 Transformer

The transformer characteristics are listed in the table below.

Table 3: Transformer characteristics

Parameter	Value	Test conditions
Manufacturer	MAGNETICA	
Part number	1335.0062	
Primary inductance	1.2mH ±15%	Measured at 1kHz 0.1V
Leakage inductance	2.9%	Measured at 10kHz 0.1V
Primary to secondary turn ratio (4 - 5)/(7, 8)	7.85 ±5%	Measured at 10kHz 0.1V
Primary to auxiliary turn ratio (4 - 5)/(1 - 2)	7.33 ±5%	Measured at 10kHz 0.1V

The following figures show size and pins distances (mm) of the transformers.

Figure 3: Transformers pins distances

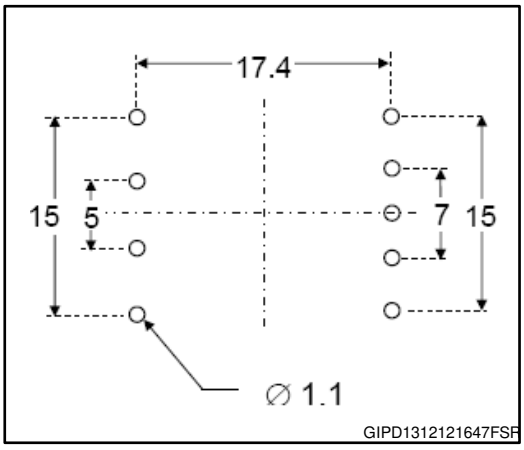


Figure 4: Transformer electrical diagram

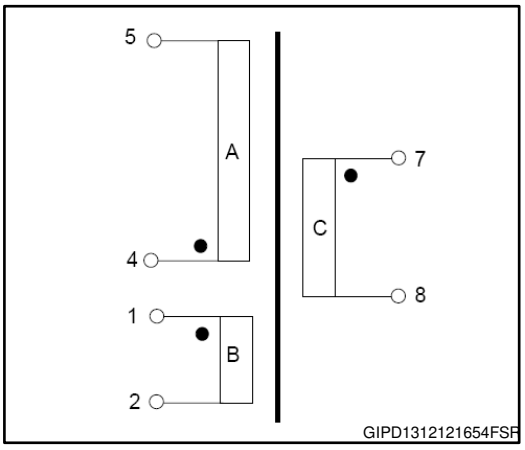


Figure 5: Transformer side view

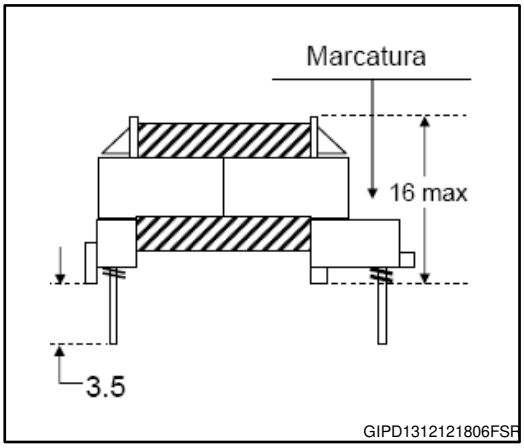
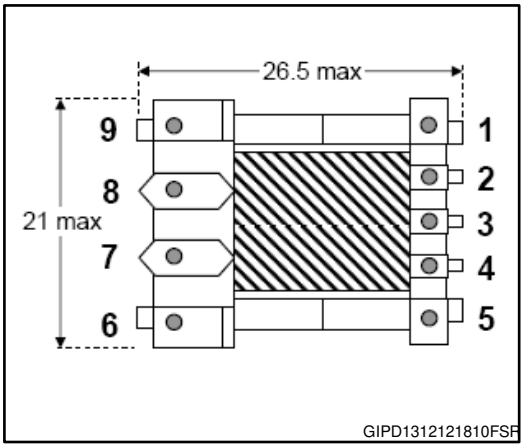


Figure 6: Transformer size and pin diagram



5 Electrical performances

Figure 7: Standby consumption at no/light load: IC externally biased (J selected)

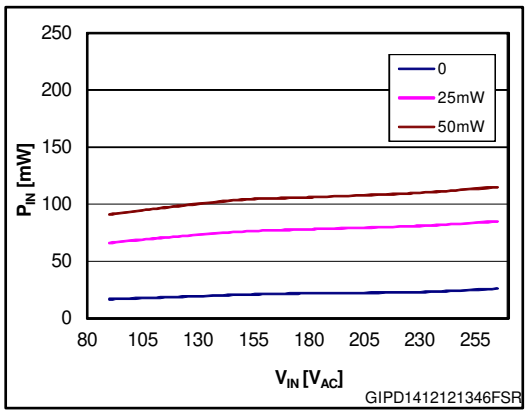


Figure 8: Standby consumption at no/light load: IC self biased (J not selected)

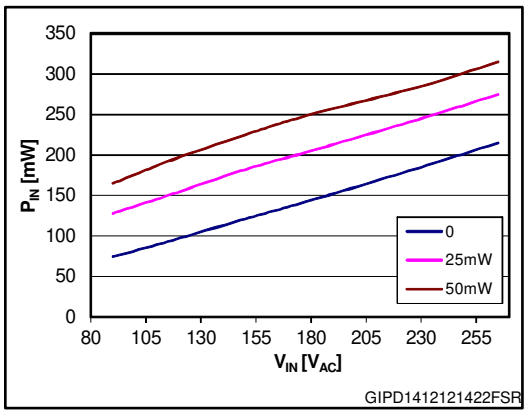


Figure 9: Line regulation

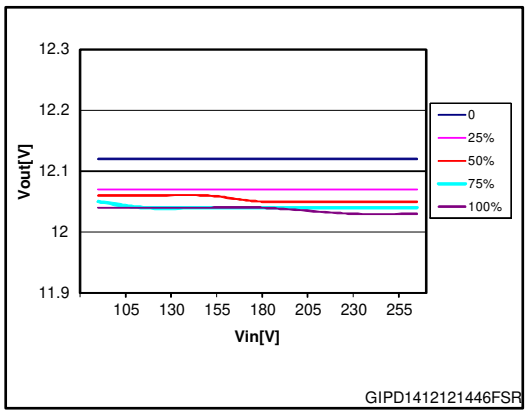


Figure 10: Load regulation

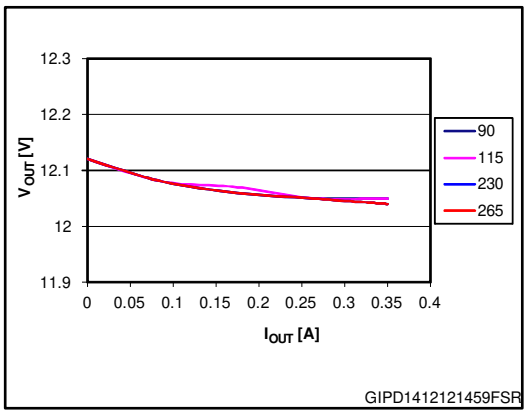


Figure 11: Efficiency @ PIN= 1W, IC externally biased

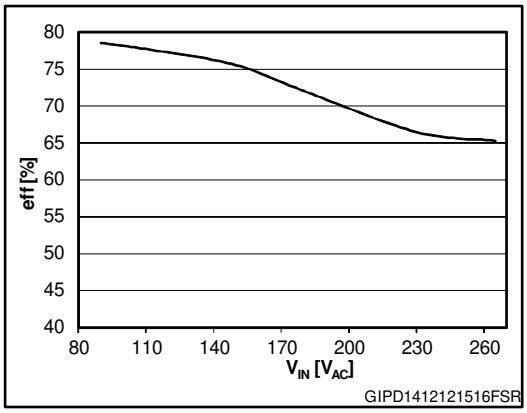


Figure 12: Efficiency @ PIN= 1W, IC self biased

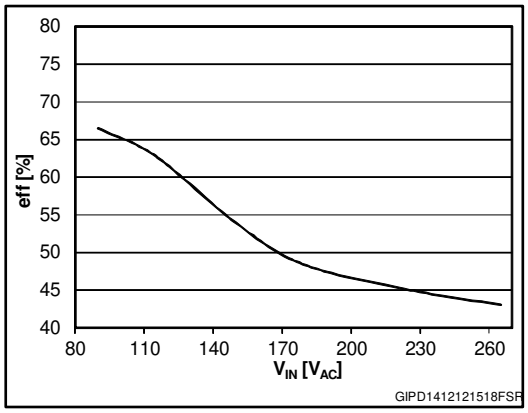


Figure 13: PIN @ POUT = 0.25W, IC externally biased

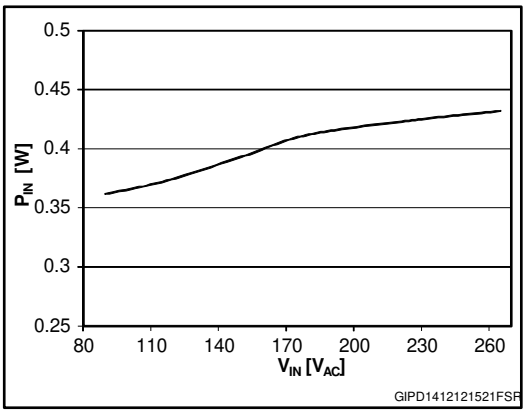


Figure 14: PIN @ POUT = 0.25W, IC self biased

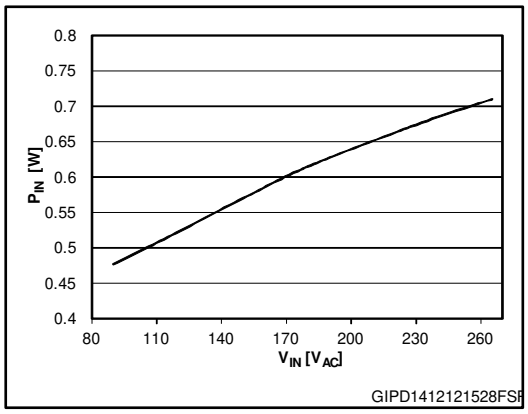
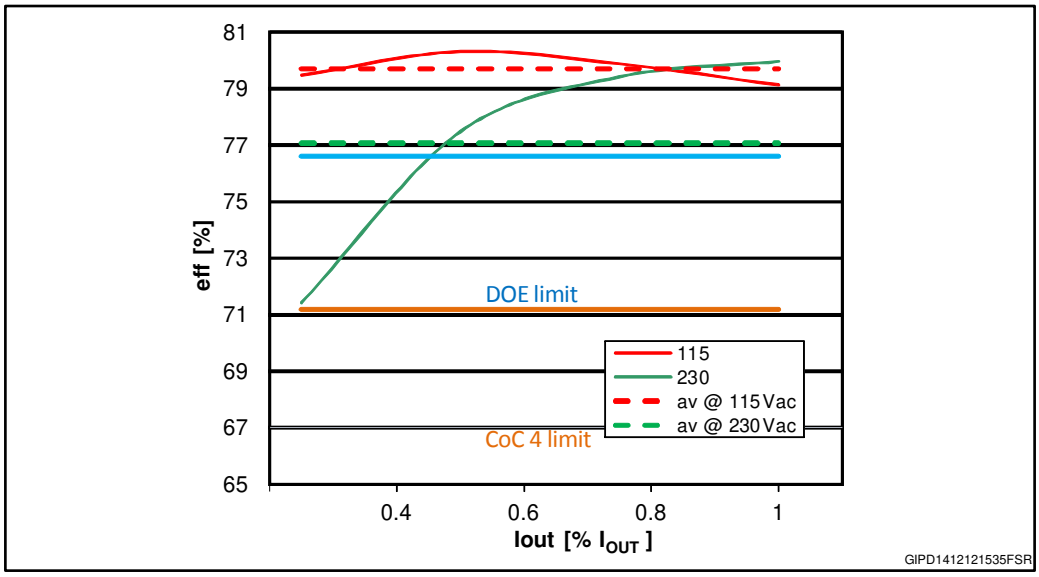


Figure 15: Active mode efficiency and comparison with energy efficiency standards (IC externally biased)



6 Revision history

Table 4: Document revision history

Date	Revision	Changes
21-May-2013	1	First release.

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