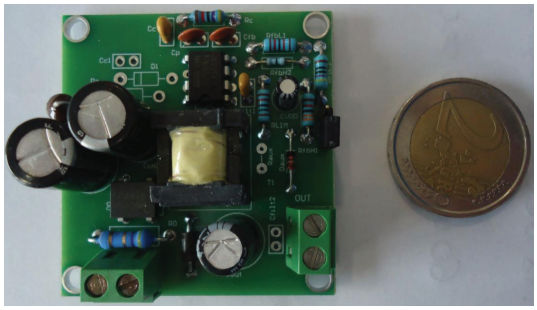
STEVAL-ISA112V1

Wide range non-isolated flyback demonstration board, single-output 12 V/4 W based on the VIPER06HN

Data brief

Features

- Universal input mains range:
  - input voltage 90 - 265 V_{AC}
  - frequency 45 - 65 Hz
- Single-output voltage: 12 V at 350 mA continuous operation
- Standby mains consumption: < 30 mW at 230 V_{AC}
- Average efficiency: > 75%
- Complying with EuP Lot 6 requirements
- Fully protected against short-circuit
- Fully protected against overheating
- Compliant to EMC norm EN55022-Class-B
- RoHS compliant



STEVAL-ISA112V1

The STEVAL-ISA112V1 demonstration board implements several forms of protection that considerably increase end-product safety and reliability: overload protection, feedback disconnection, thermal shutdown.

Description

The STEVAL-ISA112V1 demonstration board implements a 4 W single-output wide range mains power supply to be used in applications such as white goods, smaller home appliances, home automation, LED driver, etc.

The board uses the new VIPER06HN, a new offline high voltage converter from the VIPerPlus family by STMicroelectronics. The VIPER06 is specifically designed for fixed frequency flyback converters, combining a high-performance low voltage PWM controller chip and a max. 32 Ω RDS(on), 800 V BV(DSS), avalanche-rugged Power MOSFET in the same package.

The application is optimized for less than 30 mW standby consumption and meets the EPA 2.0 limits, therefore helping to meet the most stringent energy saving requirements.

Contents

1 Adapter features

The electrical specifications of the demonstration board are listed in *Table 1*.

Table 1. STEVAL-ISA112V1 electrical specifications

Parameter	Symbol	Value
Input voltage range	V_{IN}	90 V_{AC} - 265 V_{AC}
Output voltage	V_{OUT}	12 V
Max. output current	I_{OUT}	0.35 A
Precision of output regulation	Δ_{VOUT_LF}	± 5%
High frequency output voltage ripple	Δ_{VOUT_HF}	50 mV
Max. ambient operating temperature	T_{AMB}	60 ºC

2 Schematic, bill of material and layout

The schematic of the board is reported in *Figure 1* and the bom in *Table 2*.

Figure 1. STEVAL-ISA112V1 electrical diagram

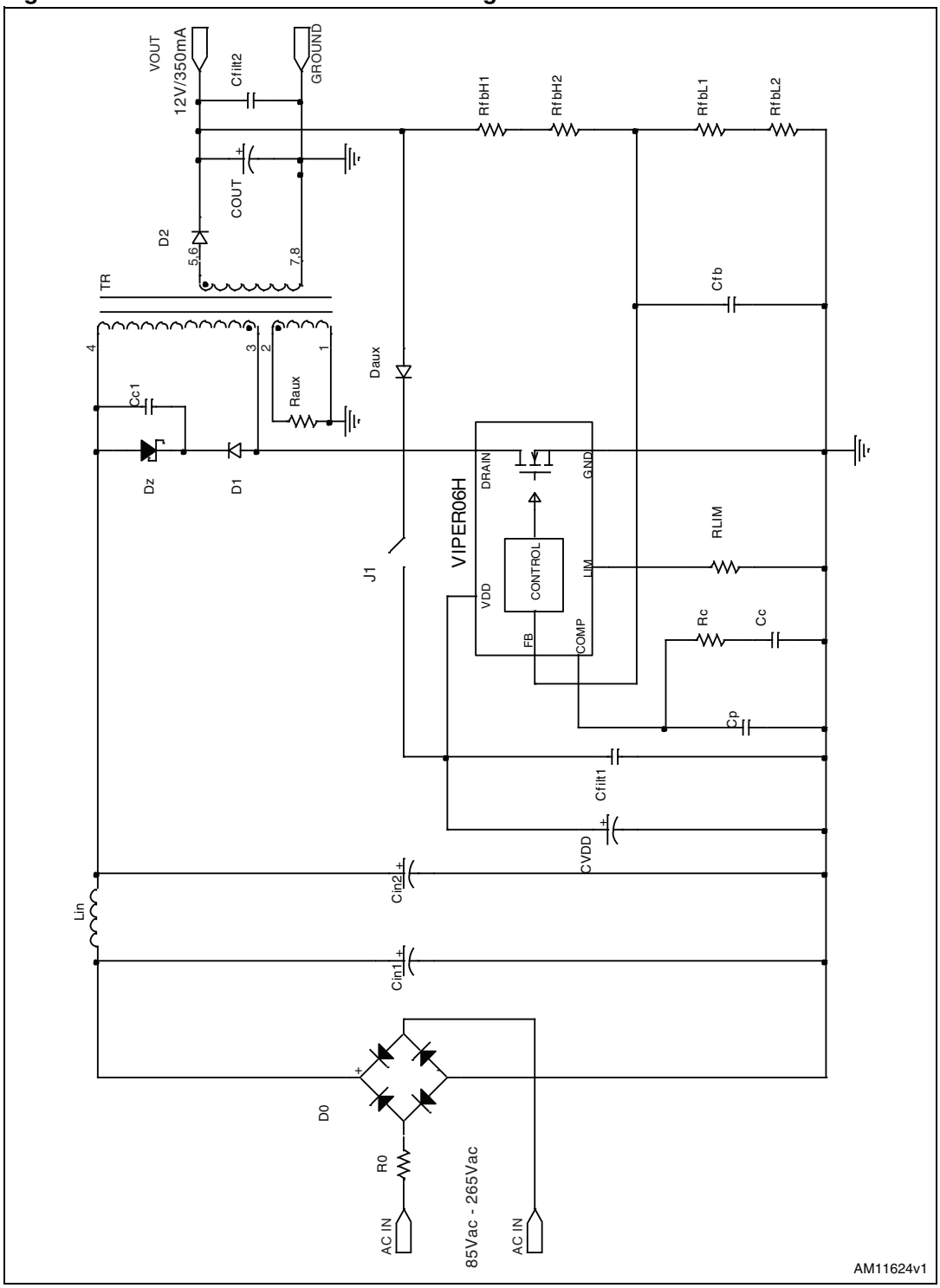
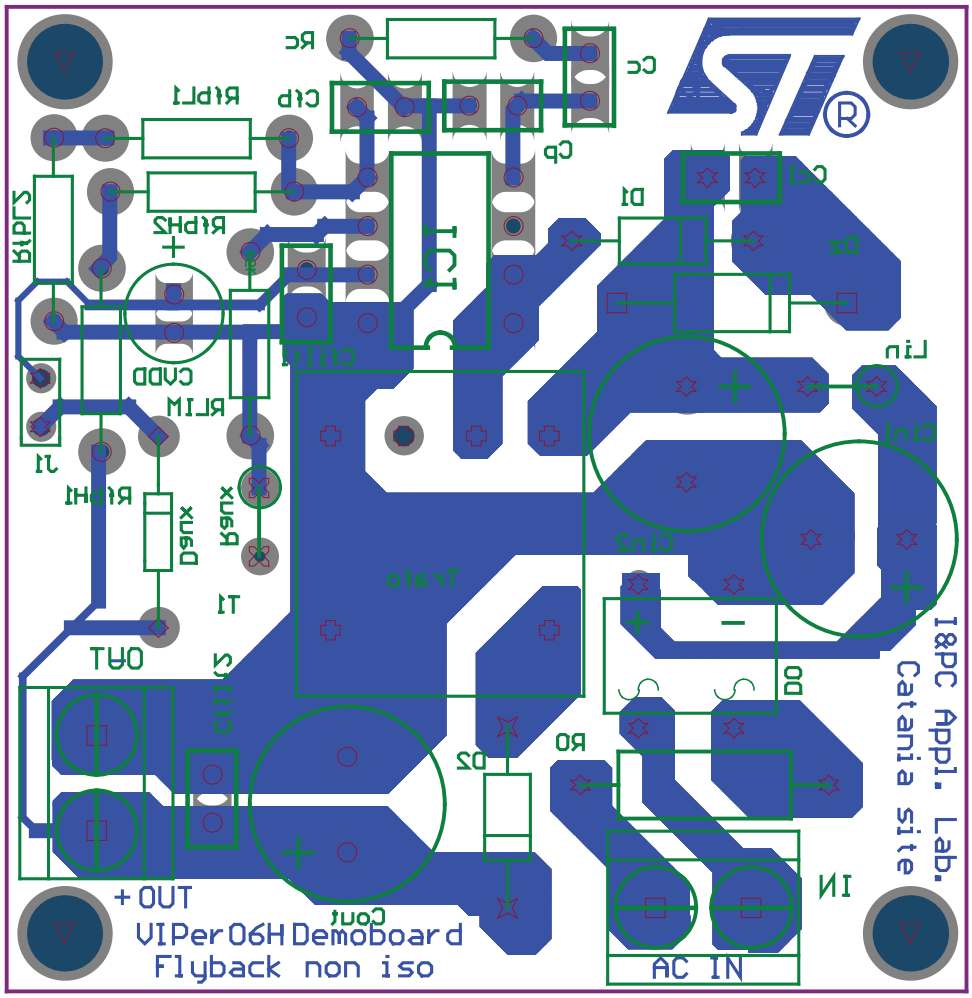


Table 2. Bill of material

Ref.	Part	Description	Manufacturer
Cin1		3.3 µF, 400 V NHG series electrolytic capacitor	
Cin2		3.3 µF, 400 V NHG series electrolytic capacitor	
CVDD		1 µF, 50 V electrolytic capacitor	
Cfilt1		100 nF, 50 V ceramic capacitor	
Cc		10 nF, 50 V ceramic capacitor	
Cp		1 nF, 50 V ceramic capacitor	
Cfb		1 nF, 50 V ceramic capacitor	
Cout		330 µF, 16 V ZL series ultra-low ESR electrolytic capacitor	Rubycon
Ccl	Not mounted		
Cfilt2	Not mounted		
D0	DF06M	600 V 1 A diode bridge	Vishay
D1	Not mounted		
D2	STPS2H100	100 V, 2 A, power Schottky rectifier	ST
Daux	1N4148	Small signal diode	
Dz	Not mounted		
R0		4.7 Ω 3/4 W resistor	
RLIM		15 kΩ 5% 1/4 W resistor	
Rc		47 kΩ 5% 1/4 W resistor	
RfbH1		33 kΩ 1% 1/4 W resistor	
RfbH2		0 Ω	
RfbL1		12 kΩ 1% 1/4 W resistor	
RfbL2		0.47 kΩ 1% 1/4 W resistor	
Raux	Not mounted		
IC1	VIPer06HN	Offline high-voltage PWM controller	ST
T1	1921.0040	Transformer	Magnetica
Lin	B82144A2105J000	1 mH inductor LBC series	Epcos

Figure 2. Demonstration board layout



3 Transformer

The transformer characteristics are listed in the table below.

Table 3. Transformer characteristics

Parameter	Value	Test Conditions
Manufacturer	Magnetica	
Part number	1921.0040	
Primary inductance (pins 3-4)	1.2 mH ± 15%	Measured at 1 kHz 0.1 V
Leakage inductance	2.8%	Measured at 10 kHz 0.1 V
Primary to secondary turn ratio (3 - 4)/(5 - 8)	6.11 ± 5%	Measured at 10 kHz 0.1 V
Primary to auxiliary turn ratio (3 - 4)/(2 - 1)	5 ± 5%	Measured at 10 kHz 0.1 V

The images below show size and pin distances ([mm]) of the transformer.

Figure 3. Transformer size and pin diagram pin distances

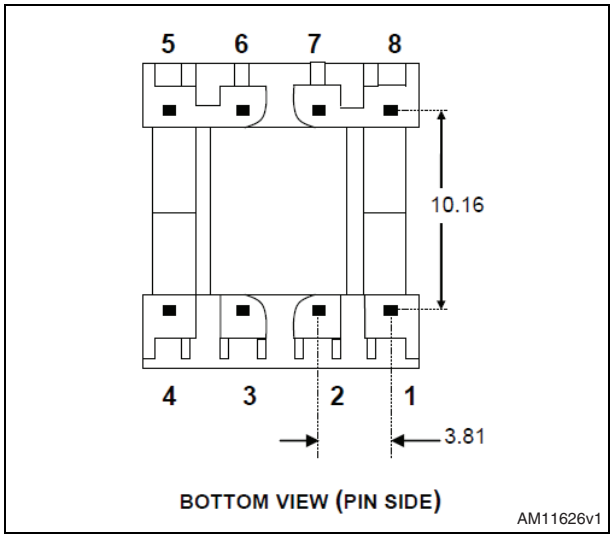


Figure 4. Transformer size and pin diagram electrical diagram

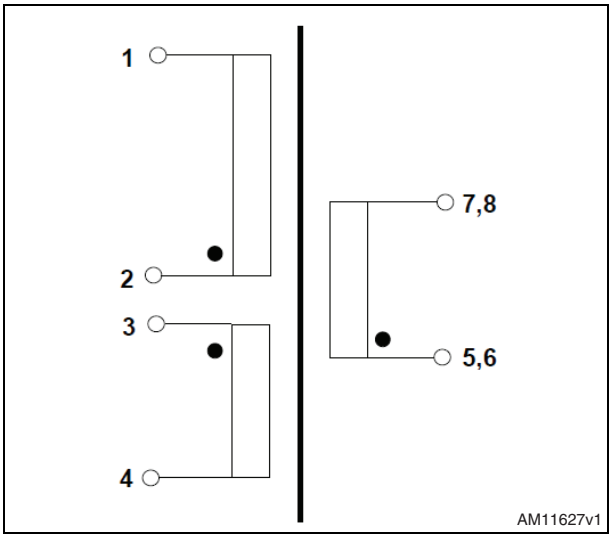


Figure 5. Transformer size side view 1

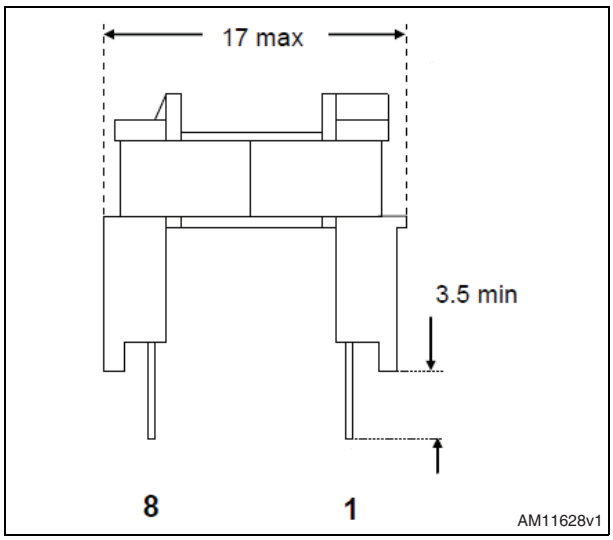
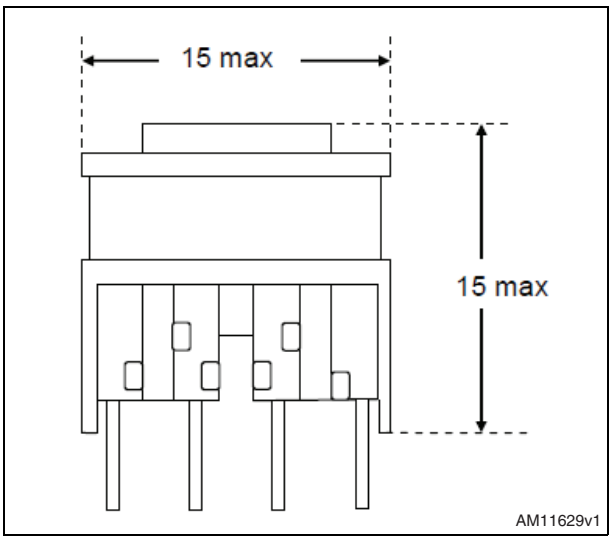


Figure 6. Transformer size side view 2



4 Measurements

4.1 Electrical performance

Figure 7. Standby consumption at no load: IC supplied from the output (J1 selected)

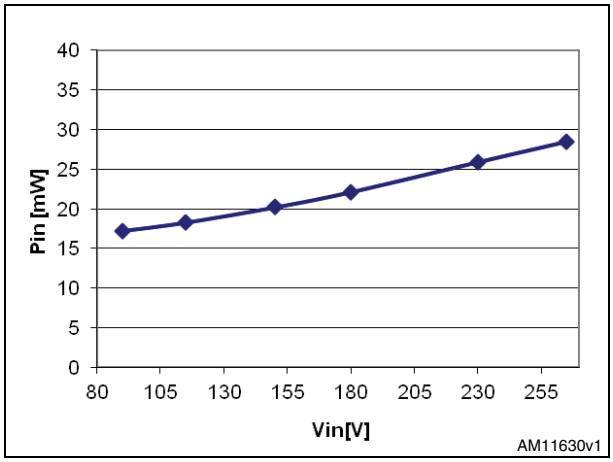


Figure 8. Standby consumption at no load: IC self-supplied (J1 not selected)

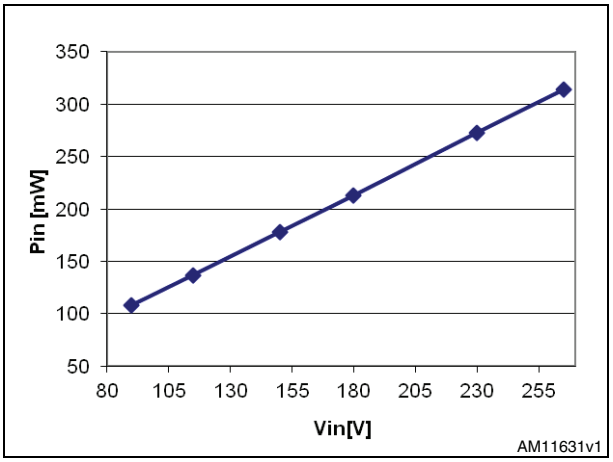


Figure 9. Efficiency at different input voltages: IC supplied from the output (J1 selected)

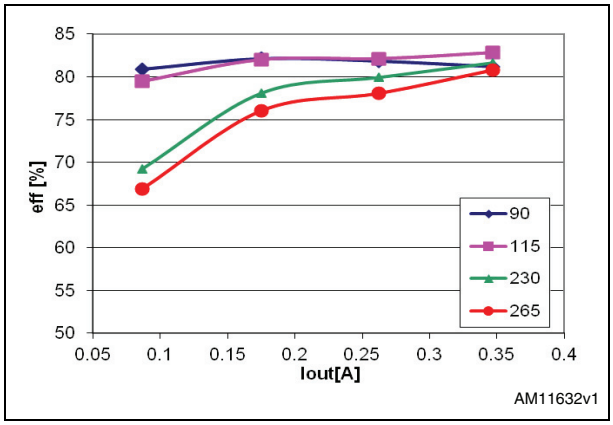


Figure 10. Efficiency at different input voltages: IC self-supplied (J1 not selected)

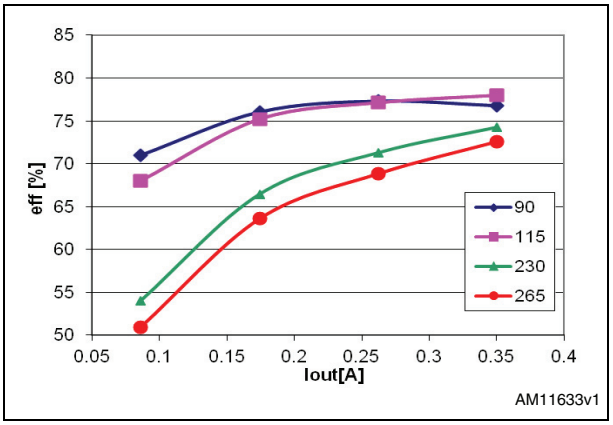


Figure 11. Line regulation at different loads: IC supplied from the output (J1 selected)

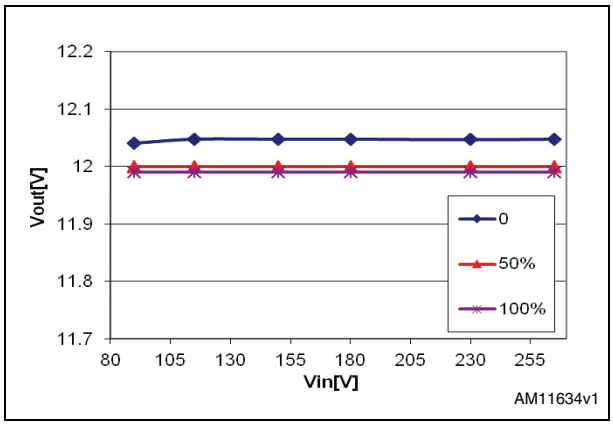


Figure 12. Line regulation at different loads: IC self-supplied (J1 not selected)

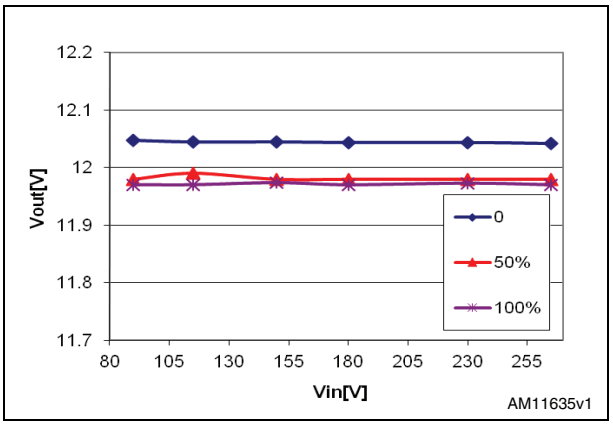


Figure 13. Load regulation at different input voltages: IC supplied from the output (J1 selected)

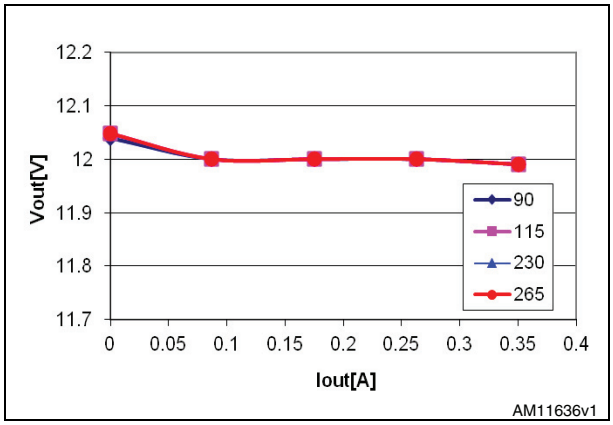
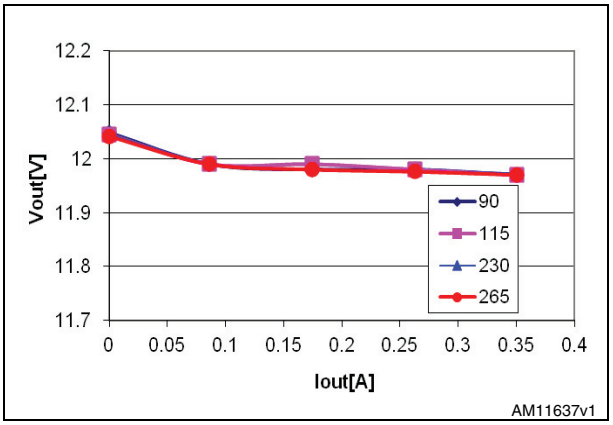


Figure 14. Load regulation at different input voltages: IC self-supplied (J1 not selected)



5 Thermal performances

A thermal analysis of the board has been performed using an IR camera for 85 V_{AC}, 115 V_{AC}, 230 V_{AC} and 265 V_{AC} mains input, full load condition, both with and without the self supply function. The results are shown in the following figures. When the self-supply function is used the VIPER06 temperature is higher, due to the power dissipated by the HV-startup generator.

Figure 15. Thermal map at V_{IN} = 85 V_{AC}, Iout = 350 mA, T_{AMB} = 25 °C: IC supplied from the output (J1 selected)

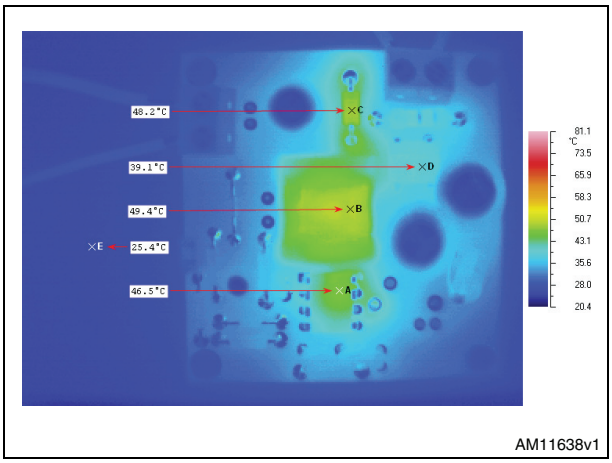


Figure 16. Thermal map at V_{IN} = 85 V_{AC}, Iout = 350 mA, T_{AMB} = 25 °C: IC self supplied (J1 not selected)

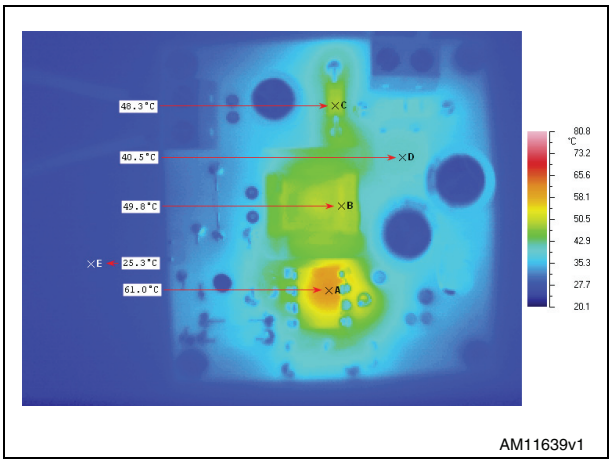


Figure 17. Thermal map at V_{IN} = 115 V_{AC}, Iout = 350 mA, T_{AMB} = 25 °C: IC supplied from the output (J1 selected)

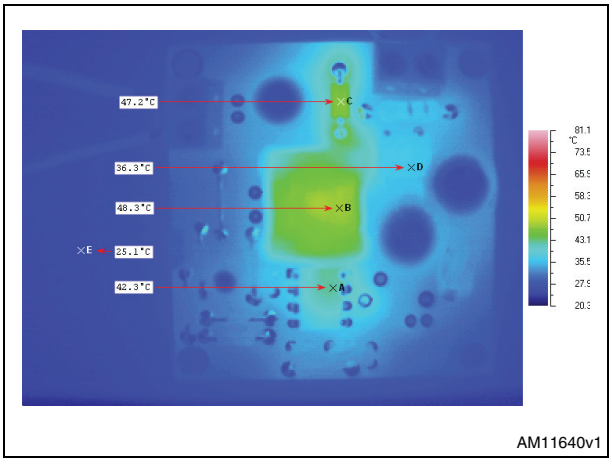


Figure 18. Thermal map at V_{IN} = 115 V_{AC}, Iout = 350 mA, T_{AMB} = 25 °C: IC self supplied (J1 not selected)

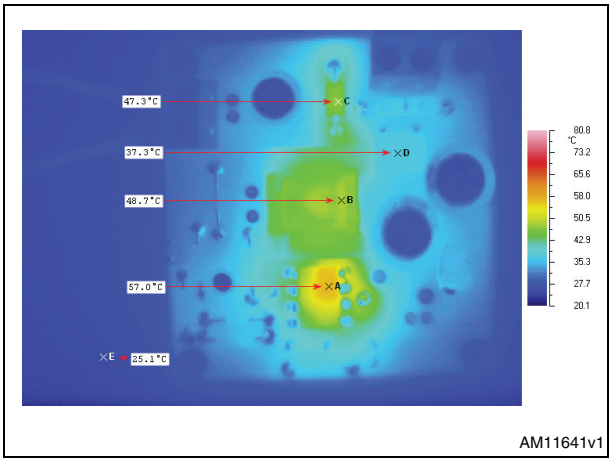


Figure 19. Thermal map at V_{IN} = 230 V_{AC}, Iout = 350 mA, T_{AMB} = 25 °C: IC supplied from the output (J1 selected)

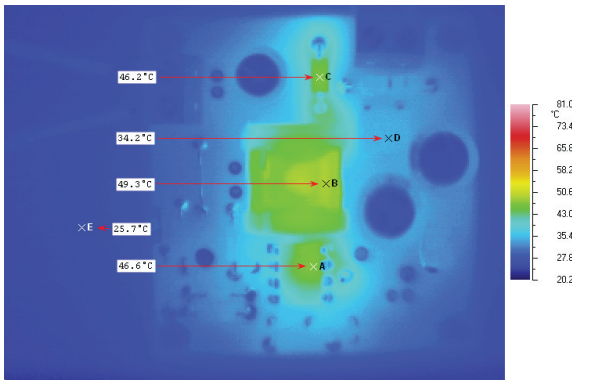


Figure 20. Thermal map at V_{IN} = 230 V_{AC}, Iout = 350 mA, T_{AMB} = 25 °C: IC self supplied (J1 not selected)

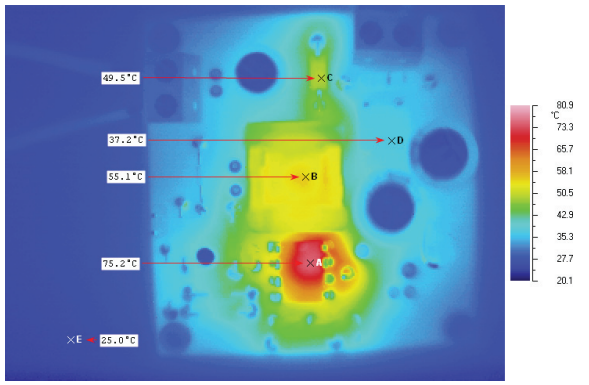


Figure 21. Thermal map at V_{IN} = 265 V_{AC}, Iout = 350 mA, T_{AMB} = 25 °C: IC supplied from the output (J1 selected)

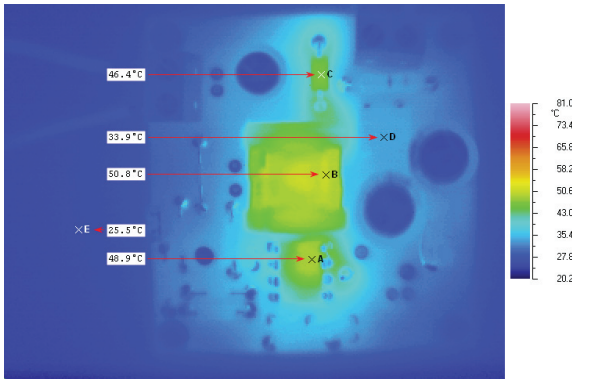
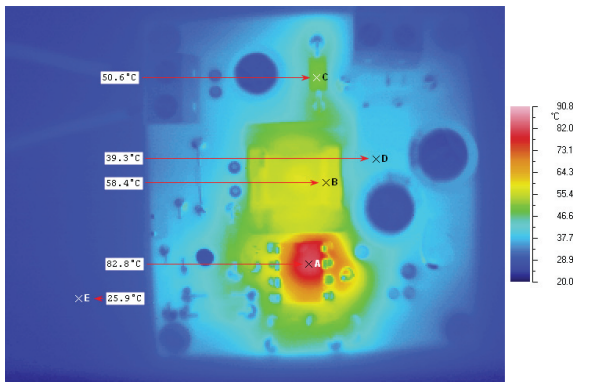


Figure 22. Thermal map at V_{IN} = 265 V_{AC}, Iout = 350 mA, T_{AMB} = 25 °C: IC self supplied (J1 not selected)



5.1 EMI performance

Figure 23. Average measurements at V_{IN} = 115 V_{AC}, full load, T_{AMB} = 25 °C; IC supplied from the output

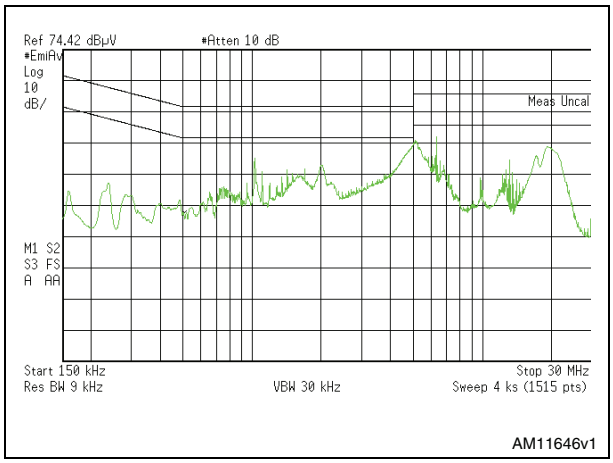
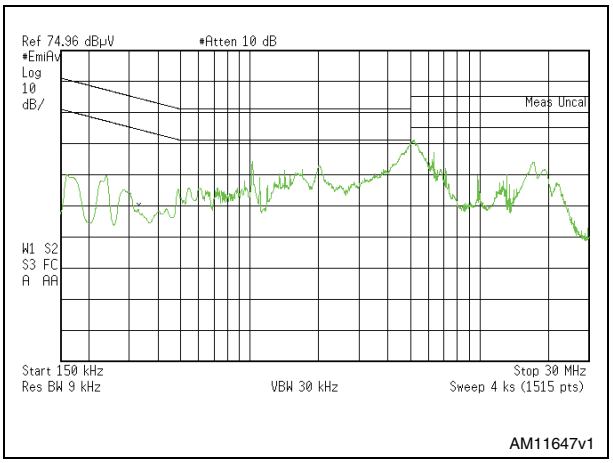


Figure 24. Average measurements at V_{IN} = 230 V_{AC}, full load, T_{AMB} = 25 °C; IC supplied from the output



6 Revision history

Table 4. Document revision history

Date	Revision	Changes
08-Jan-2013	1	Initial release.

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