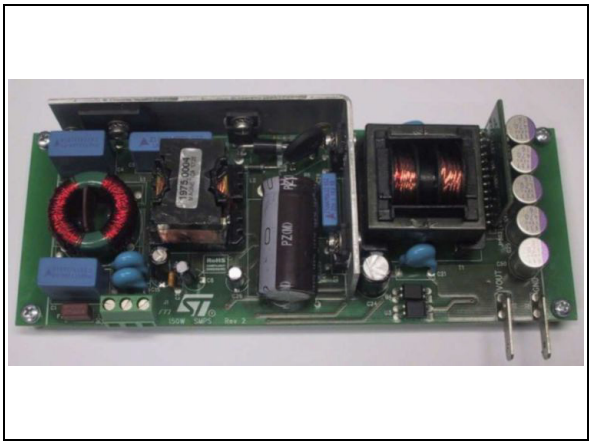
STEVAL-ISA143V1

12 V - 150 W resonant converter with synchronous rectification using the L6563H, L6699 and SRK2000

Data brief



Features

- Input mains range: 90 - 264 VAC, 45 - 65 Hz
- Output voltage: 12 V at 12.5 A continuous operation
- Mains harmonics: in accordance with EN61000-3-2 Class-D or JEITA-MITI Class-D
- No load consumption: < 0.15 W according to European CoC Tier 2 for external power supplies
- Minimum four points average efficiency in active mode: > 89% according to European CoC Tier 2 for external power supplies
- Minimum efficiency in active mode at 10% load of full rated output current: > 79% according to European CoC Tier 2 for external power supplies
- Light load efficiency: complies with ErP Lot 6 Tier 2 (> 50% @ 250 mW)
- Efficiency at nominal load: > 91% at 115 VAC
- EMI: in accordance with EN55022 Class-B
- Safety: in accordance with EN60950
- Dimensions: 65 x 154 mm, maximum component height = 28 mm
- PCB: double-sided, 70 µm, FR-4, mixed PTH/SMT
- RoHS compliant

1 Description

The STEVAL-ISA143V1 system evaluation board is made up of two stages: a front-end PFC using the L6563H, an LLC resonant converter based on the L6699 and the SRK2000, controlling the SR MOSFETs on the secondary side. The SR driver and the rectifier MOSFETs are mounted on a daughterboard.

The L6563H is a current mode PFC controller operating in transition mode and implements a high voltage startup source to power on the converter.

The L6699 integrates all the functions necessary to properly control the resonant converter with a 50% fixed duty cycle and work with variable frequency.

The output rectification is managed by the SRK2000, an SR driver dedicated to LLC resonant topology.

The PFC stage works as pre-regulator and powers the resonant stage with a constant voltage of 400 V. The downstream converter operates only if the PFC is on and regulating. In this way, the resonant stage can be optimized for a narrow input voltage range.

The L6699's LINE pin (pin 7) is dedicated to this function. It is used to prevent the resonant converter from working with too low an input voltage, which can cause incorrect capacitive mode operation. If the bulk voltage (PFC output) is below 380 V, the resonant startup is not allowed. The L6699 LINE pin internal comparator has a hysteresis allowing the turn-on and turn-off voltage to be independently set. The turn-off threshold is set to 300 V, allowing the resonant stage to operate in case of mains sag and consequent PFC output dip.

The transformer uses the integrated magnetic approach, incorporating resonant series inductance. Therefore, no external, additional coil is needed for the resonance. The transformer configuration chosen for the secondary winding is center tap.

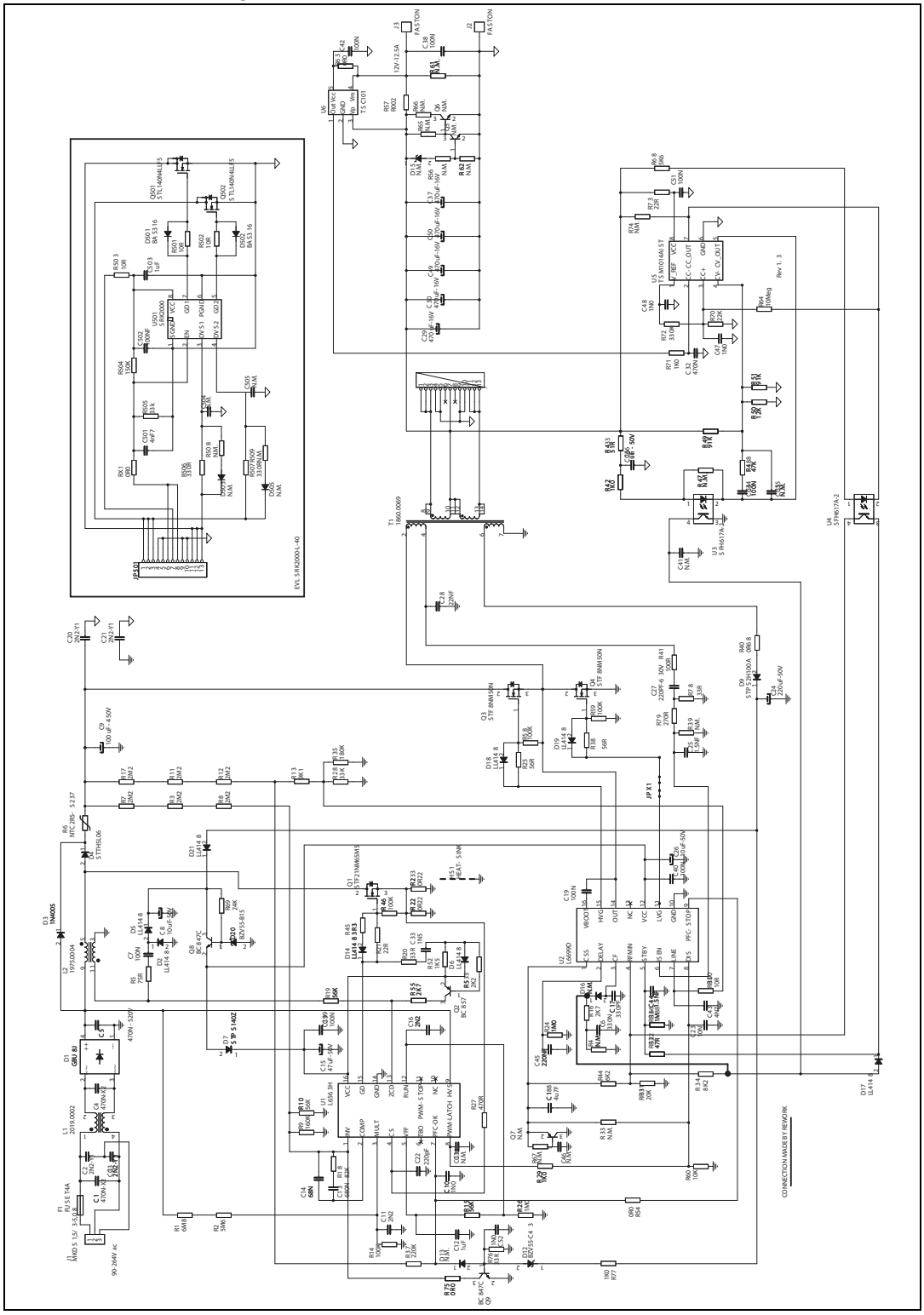
On the secondary side, the SRK2000 core function switches on each synchronous rectifier MOSFET whenever the corresponding transformer half-winding starts conducting (i.e. when the MOSFET body diode starts conducting) and then switches it off when the flowing current approaches zero. For this purpose, the IC is provided with two pins (DVS1 and DVS2) sensing the MOSFETs' drain voltage level.

The SRK2000 automatically detects light load operation and enters Sleep mode, disabling MOSFET driving and decreasing its own consumption. This function allows greater power saving at light load compared to benchmark SR solutions.

In order to decrease the output capacitor size, aluminum solid capacitors with very low ESR were favored over standard electrolytic ones. Therefore, high frequency output voltage ripple is limited and output LC filter is not required. This choice allows saving of output inductor power dissipation which can be significant in high output current applications such as this.

2 Schematic diagram

Figure 1. STEVAL-ISA143V1 circuit schematic



3 Revision history

Table 1. Document revision history

Date	Revision	Changes
15-Jan-2014	1	Initial release.
08-May-2014	2	Added new features.

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