STEVAL-ISA007V1

High power 3-phase auxiliary power supply evaluation board Based on L5991 and ESBT STC08DE150HV

Preliminary Data

Features

- 3-phase 150W auxiliary dual output SMPS
- Input: 400Vac +/- 20%
- Output voltage 1: 24V, 6.25A @ 90kHz
- Output voltage 2: 5V, 0.075A @ 90kHz
- Auxiliary output voltage: 15V, 0.01A
- Maximum output power : 150W
- Efficiency > 85%
- Switching frequency > 90kHz
- Stand-by switching frequency > 35kHz
- Feedback: secondary regulation

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Description

Auxiliary SMPS is particularly affected since it is the entry point for all the biasing of control ICs and cooling system powering. Standardization towards "universal input" is reflected in more stressful conditions for the power transistor used as the main switch both in terms of blocking voltage or current capability. Since almost all auxiliary power supplies are based on fly-back converters, the need for a blocking voltage as high as 1500V and over, coupled with high switching frequency operations, make the ESBTs the perfect choice for such power supplies. The STC08DE150HV, in conjunction with the PWM L5991, perfectly fulfills the requirements and brings high efficiency to the system

ST components

- STC08DE150HV Emitter Switched Bipolar Transistor, 5A, 1500V, TO247-4L HV leads
- L5991A PWM SMPS controller, DIP-16
- TL431AI shunt reference, 2.5V, 1mA...100mA, TO-91
- PN2222A small signal bipolar transistor, NPN, 40V, 0.6A, 330mW,TO-92
- STTH102 high voltage ultrafast diode, 200V, 1A, DO-41
- 1.5KE400A transil, 400V, 1.5kW, DO-201
- STTH108 high voltage ultrafast diode, 800V, 1A, DO-41
- STTH3002CT high efficiency ultrafast diode, 200V, 30A, TO-220AC

1 Reference design general description

A dedicated reference design with ESBT has been developed, featuring the high power wide input range requirement of a highly demanding industrial market.

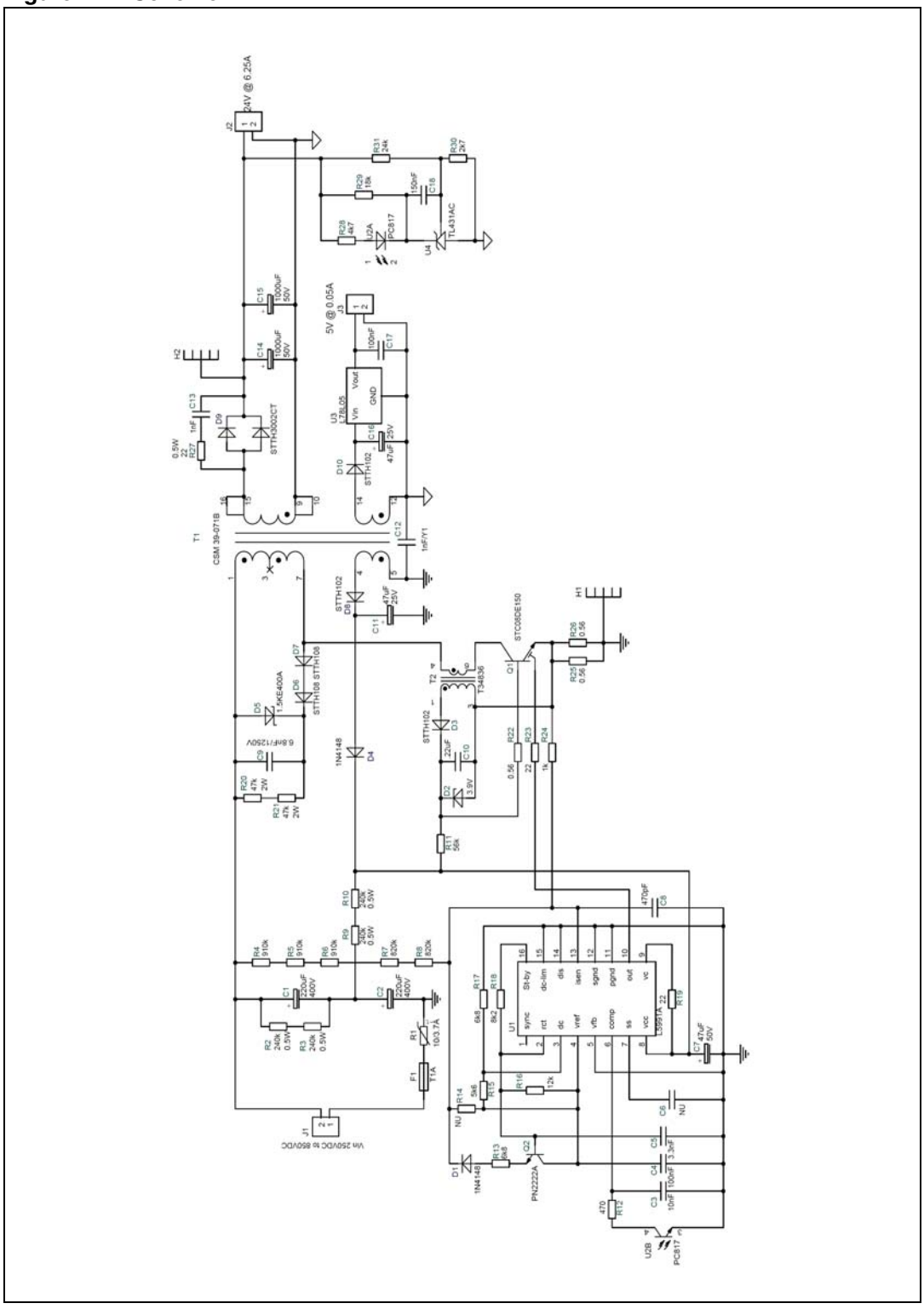
The maximum output power is 150W. Generally speaking, the necessity to handle both high output power and wide input voltage leads to the design of a fly-back stage working in mixed operation mode: continuous and discontinuous:

The continuous current mode introduces a right half plan zero in the loop-transfer function which makes the feedback stabilization difficult. At the input voltage range, and after a brief description of the differences between continuous and discontinuous mode, it will soon be clear that it is very difficult and inconvenient to design a fly-back converter working in discontinuous mode. Finally, referring to the power spec of our demo, it is clear that discontinuous mode cannot be used because it would determine a very high primary and secondary peak current with a higher cost of all the main components involved: power transistor, secondary diode and output capacitor.

Thanks to the adoption of the PWM L5991, the converter is able to operate in mixed mode. For higher power levels with a switching frequency close to 90kHz, the converter operates in Continuous Current Mode (CCM), while in stand-by and for power levels lower than 25W, the converter works in Discontinuous Current Mode (DCM) at a switching frequency of about 35kHz.

2 Board schematic

Figure 1. Scheme



3 Revision history

Table 1. Revision history

Date	Revision	Changes
06-Mar-2006	1	Initial release.
27-Jun-2007	2	ESBT device has been updated

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