SGS-THOMSON MICROELECTRONICS

APPLICATION NOTE

# 250W HIGH POWER FACTOR SUPPLY FOR TV

## INTRODUCTION

This application has been designed to provide a complete supply for colour TV. The system has been configured using a Flyback DC-DC converter with an upstream PFC section in order to improve the characteristics of the whole supply. The architecture of the system consists of a L4981A controller with the relevant circuitry for the PFC section, and of a TEA2261 synchronised, in master-slave configuration, with a TEA5170 at 15 kHz switching frequency. When the supply is in stand-by condition, the TEA2261 controller operates in burst mode.

System block diagram. (fig.1)

System Main Features:

- Input Voltage Range: 176 to 270 Vac
- Rated Output Power: 250W
- Power Factor at max. Output Power: 0.98
- Input Power in Stand-by mode: 3W
- DC Preregulated Voltage: 400
- Efficiency: > 80%
- Operating Frequency: 15kHZ Synchronised (only Fly-Back Section)
- Minimum Output Power Synchronised : 8.5 W
- Others: Short Circuit, Overload and Open Load Protection.

## DESCRIPTION.

How to use the demoboard:

The evaluation board is provided with a multi-contact switch (sw.1) which allows to simulate the TVC operations. The procedure is very simple:

1) Put the switch (1) in s-by position and then switch on the board.

In this condition no pulses are coming from the TEA5170 I.C. , T1 is in on state grounding C9 (at soft start pin of L4981) and so the PFC section is not working. It is possible to test the voltage at the output of the step-up (PFC) section C23. It must be about 308 V (depending on the mains voltage). The outputs of the converter should be measured, and the values can be adjusted with P1 placed at the primary side.

Here below the schematic diagram is shown in Fig 2a, PCB and components layout in Fig. 2b.

**Figure 1.**

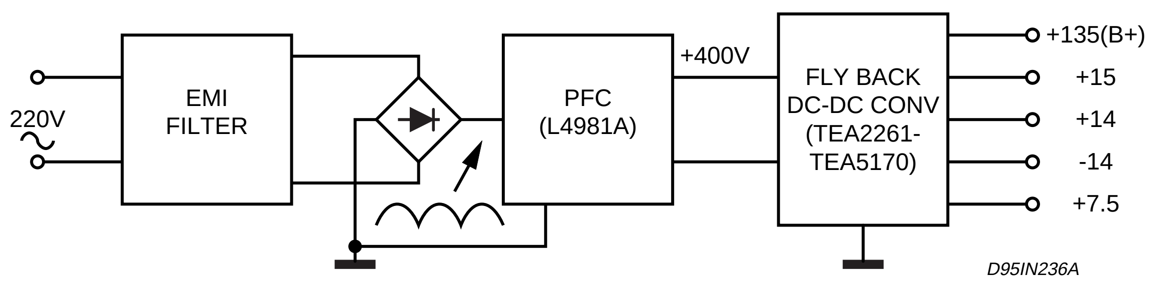


**Figure 2a:** Schematic Diagram.

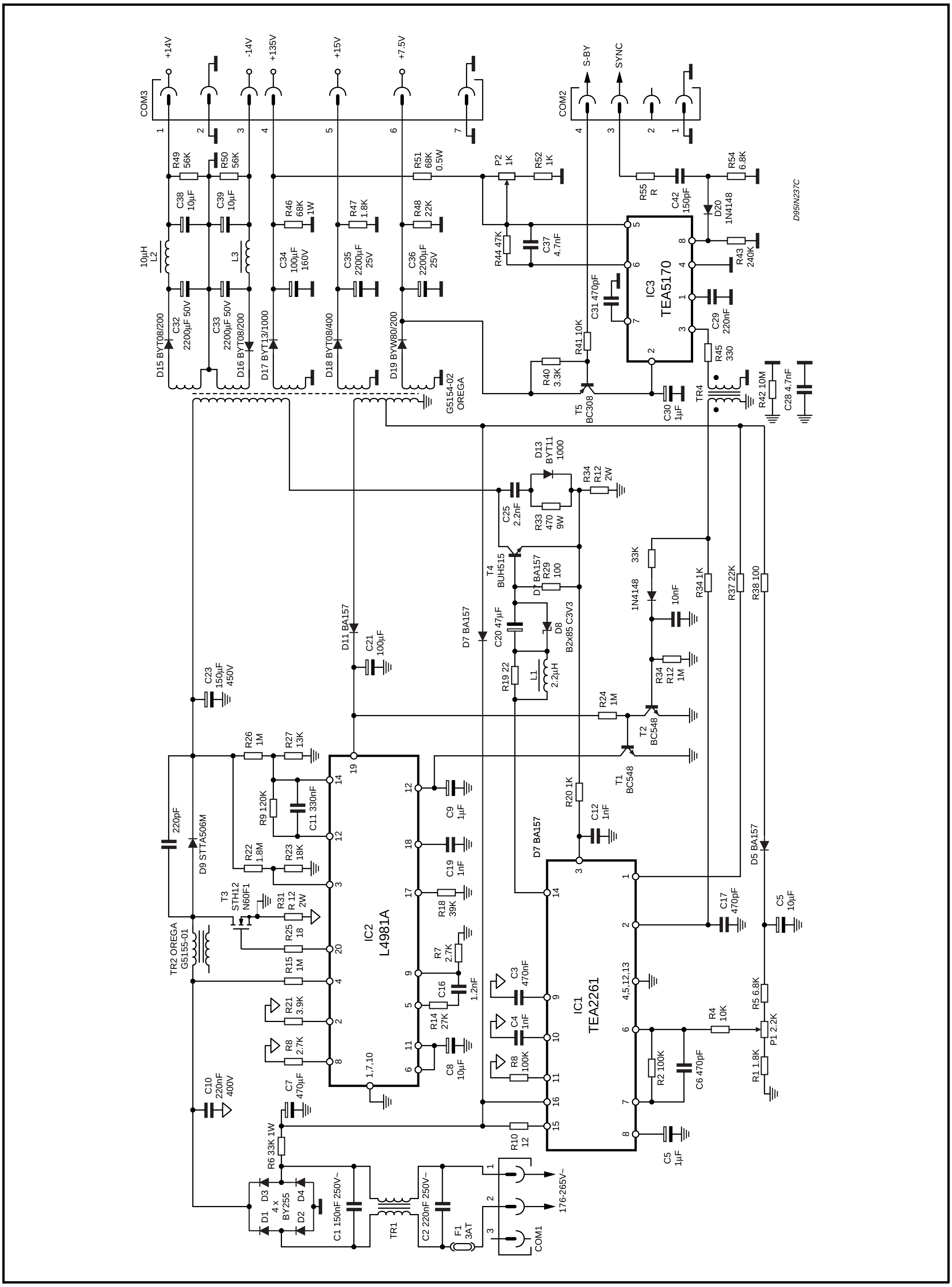


**Figure 2b:** PCB and components layout.

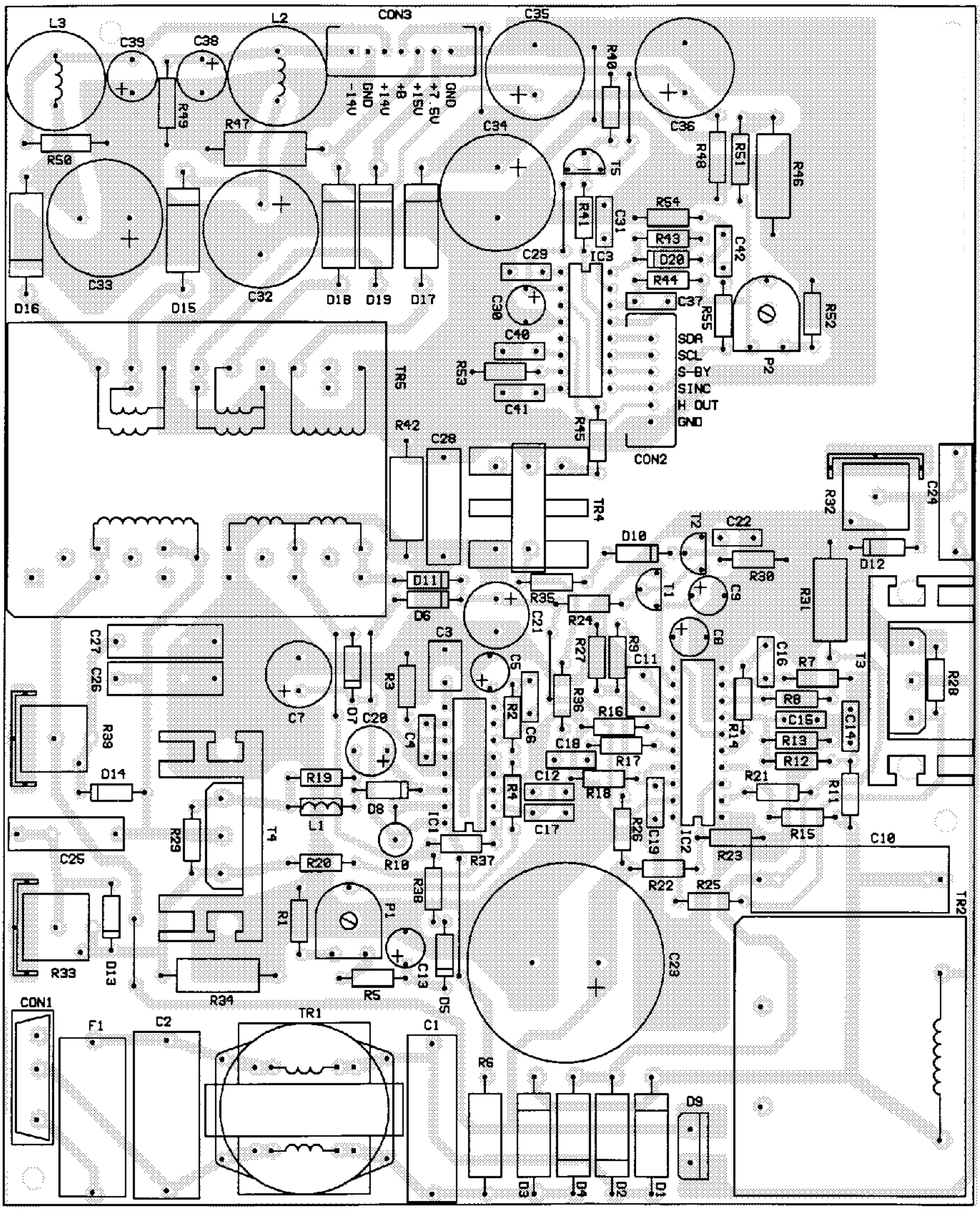
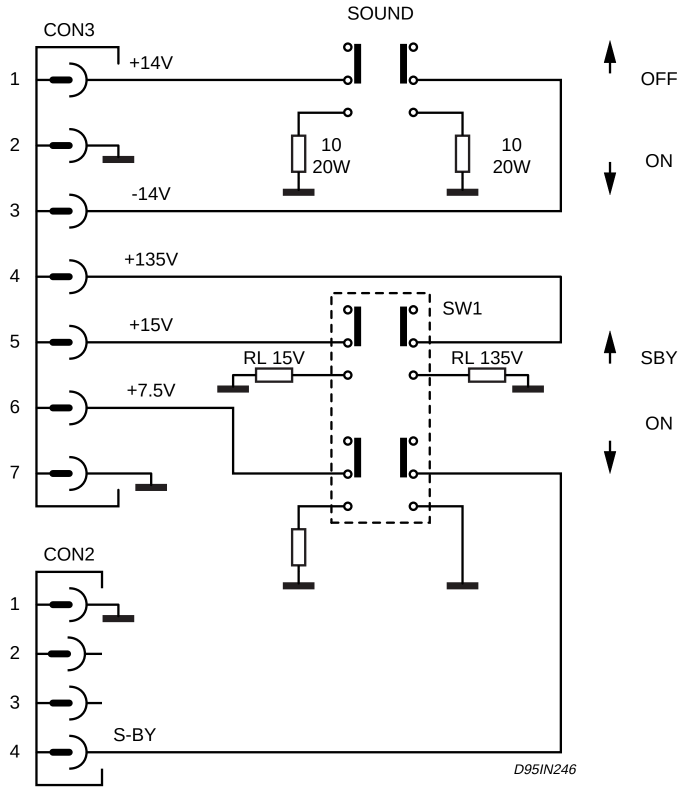


**Figure 3:** TVC Simulation with External Resistive Loads.




$R_L$ must be dimensioned according to the required output power

On the evaluated board (refer to CON3 in fig.3) the adjusted voltage values are:

Voltage at out 1 = +16.5V

Voltage at out 3 = -16.5V

Voltage at out 4 = +13.7V

Voltage at out 1 = +15.7V

Voltage at out 1 = +10V

As the " stand-by " output values have been set, put the switch in ON position The loads are now connected and all the circuits of the application run. The TEA5170 is now supplied and it sends PWM pulses from the secondary to the primary side of the converter. T2 is turned on, is T1 is cut-off, thus enabling the L4981A to start. As the PFC runs, the voltage at the bulk capacitor C23 reaches 400V.

**TEST RESULTS:**

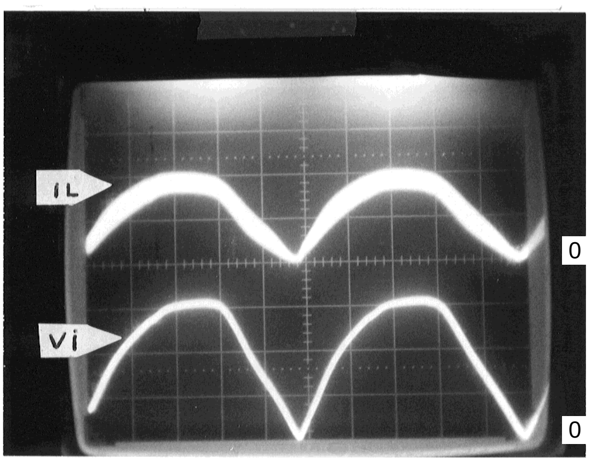
| | |
|---|---|
| Output Voltage | 405V (at 230W output power). |
| Output Power | 10 to 250W |
| Efficiency | 85% (at Max. output power) |
| Power Factor | 0.998 |
| THD at max. output power: | 3.5% |
| Power Factor in Stand-by Mode: | 0.3 |
| THD in Stand-by Mode: | 70% |
| Efficiency at min. Output Power: | 0.5 (Pi min = 17W) |
| Minimum Output Power = 8.5W | 135V · 18mA + 15V · 300mA + 7.5V · 250mA |

**Load Regulation:**

| | |
|---|---|
| a) 135V Output (4) = ±0.12% @ | Io4 (135V) = 0.05 to 1A<br>Io5 (15V) = 2.5A<br>Io6 (7.5V) = 2.5A<br>Io1 (14V0 = 1.3A<br>Io3 (-14V) = -1.3A |
| b) 135V Output (4) = ±0.75% @ | Io4 (135V) = 1A<br>Io5 (15V) = 2.5A to 0A<br>Io6 (7.5V) = 2.5A<br>Io1 (14V0 = 1.3A<br>Io3 (-14V) = -1.3A |
| c) 135V Output (4) = ±0.75% @ | Io4 (135V) = 1A<br>Io5 (15V) = 2.5A<br>Io6 (7.5V) = 2.5A to 0A<br>Io1 (14V0 = 1.3A<br>Io3 (-14V) = -1.3A |
| d) 135V Output (4) = ±0.1% @ | Io4 (135V) = 0.05A<br>Io5 (15V) = 2.5A<br>Io6 (7.5V) = 2.5A<br>Io1 + 3 (±14V) = -1.3A to 0A |
| ±14V Output (1 + 3) = +60% for | I = 1.3 to 0A |

**In the attached photos (1 to 4 ) the essential waveforms are depicted (ref. fig. 2a).**

**Photo 1:** PFC Section
(Pout = 230W; $I_L$ = 1A/div; Vi = 100V/div; t = 2ms/div)



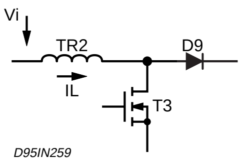
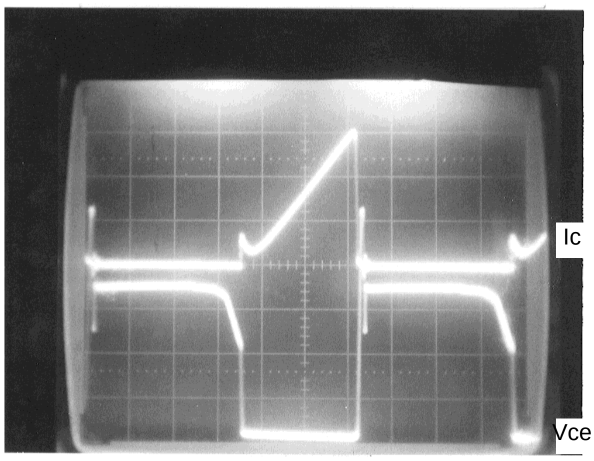




**Photo 2:** Flyback Section
(Pout = 230W; $I_C$ = 1A/div; Vce = 200V/div; t = 10µs/div)



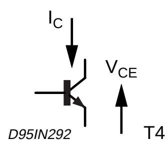
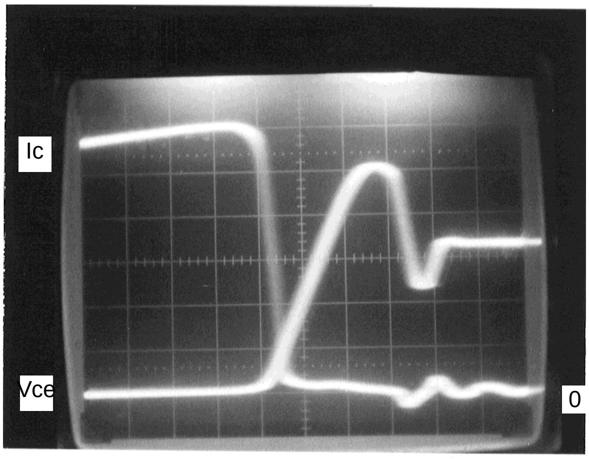



**Photo 3:** Stand-By Mode
Turn-off transistor BUH517 ($I_C$ = 0.5A/div; Vce = 200V/div; t = 0.5µs/div)



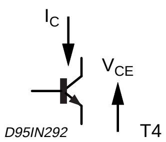




**Photo 4:** Stand-By Mode
PFC at Bulk Capacitor ($I_L$ = 0.5A/div; Vi = 100V/div; t = 2ms/div)