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STEVAL-IHM006V1

AC/AC chopper driver

Data Brief

Features

- AC to AC chopper drive
- Motor type: asynchronous with capacitor
- Input: 230Vac @ 50/60Hz
- Motor voltage: 230Vac
- Motor current: 1.5A

Description

The AC-Chopper is an application which has been developed for voltage regulation in an AC motor or AC load up to 300W. When connected to a motor or AC load, it allows the user to demonstrate smooth, silent, and efficient regulation with respect to triac solutions.

The main applications of this reference design are AC asynchronous mono-phase motors like refrigerators, hydraulic pumps, fans, lamps, etc.



ST Components

- ST7FLITE05 : 8-bit MCU with single voltage flash memory, data EEPROM, ADC, timers, SPI
- STGP7NC60H : N-channel 14A - 600V very fast PowerMESH™ IGBT
- VIPer12ADIP: low power off line SMPS primary switches
- L78L05A: positive voltage regulator
- STTH108 : High voltage ultrafast rectifier
- STTH3R06 : Turbo 2 ultrafast high voltage rectifier

1 General circuit description

Currently, the most widely used method to vary the AC mono-phase load voltage in applications such as refrigerators, hydraulic pumps, fans and lamps consists in using the phase partialization technique via a triac device. Although this simple and low cost solution has been used for several years, it creates excessive harmonic distortion and has a consequent low efficiency. Typical applications used to solve this problem are systems based on a complex inverter drive, which are quite expensive.

The presented patented solution can solve third harmonic problems thanks to its switching work mode. The induction motor is driven in high frequency mode by an innovative switch topology, which delivers a silent and cost effective variable speed drive. The speed is controlled by the motor voltage: the power switch runs in PWM mode and its duty cycle changes linearly to control the speed versus the torque.

The base circuit can be viewed as a double chopper that operates on a sinusoidal bus directly from the 50-60Hz mains, without a preliminary AC-DC conversion type.

The double chopper is able to energize the load from any level of the sinusoidal voltage wave and demagnetize it via a free-wheeling current system, obtaining the voltage regulation and the current. This means that the circuit operates as an AC-AC converter or transformer and the form of the current load is a perfect sinusoidal shape. The proposed circuit does not have any load type limitations. It works with any inductive-ohmic load with notable angles between the current and the voltage.

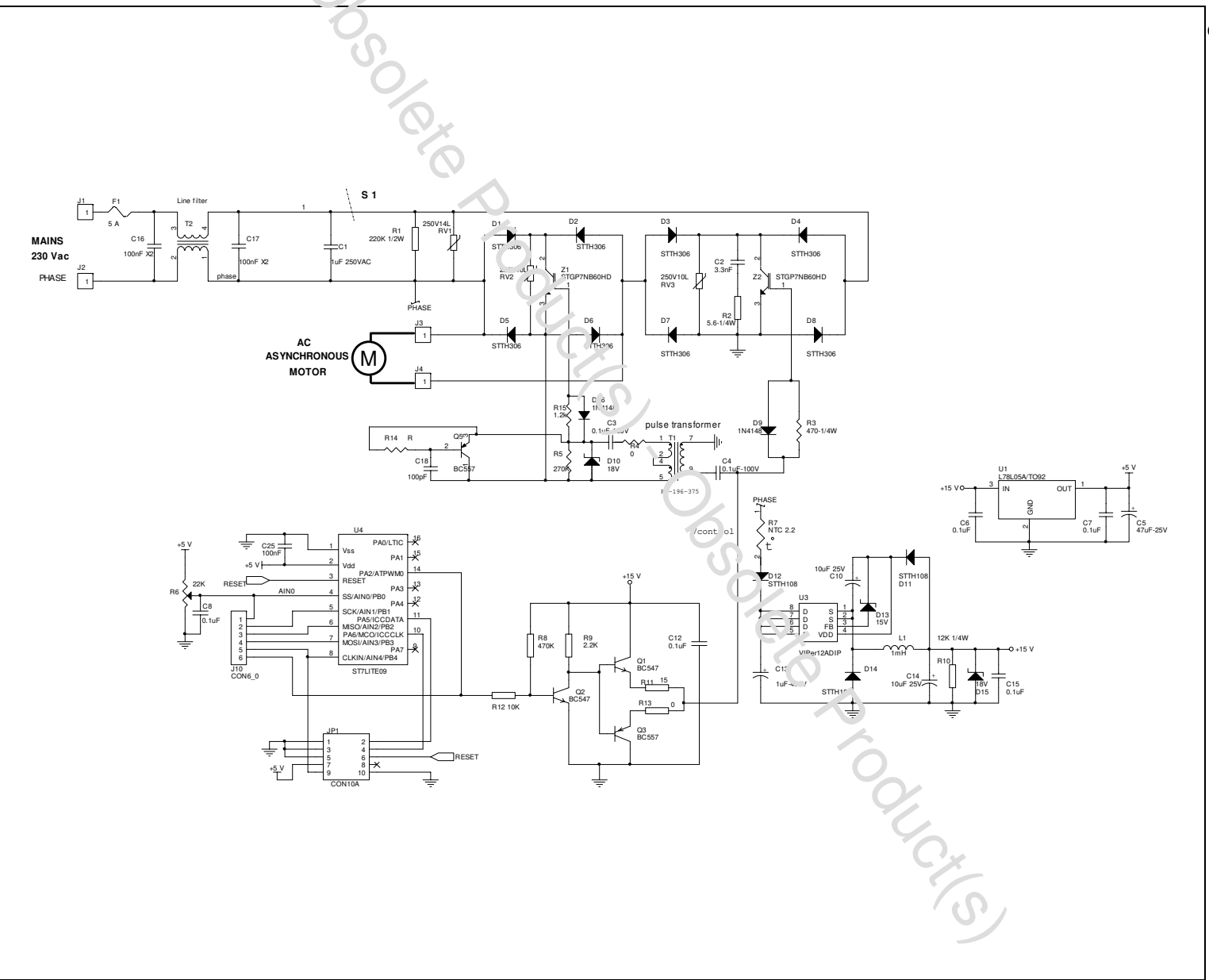
The power can be controlled by varying the duty cycle of the PWM signal where the shape of the current is sinusoidal due to the filtering effect of the inductive nature of the load.

If the load has a reactive power, it can transit between load and line grid independently from the power level and is not blocked or dissipated in any electronic parts of the circuit.

The control parameters (PWM modulation, reference signal and current sensing) are controlled through an MCU. The AC/AC chopper driver evaluation board is based on the ST7FLITE05 microcontroller (8-bit MCU with single voltage flash memory, ADC, timers, SPI, 1% internal RC oscillator).

2 Board schematic

Figure 1. Scheme



3 Revision history

Table 1. Revision history

Date	Revision	Changes
20-Jul-2007	1	Initial release.

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