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.



STEVAL-IHM006V1

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

Obsolete Product(s) - Obsolete Product(s)

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 busdirectly 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 voltagewave 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.

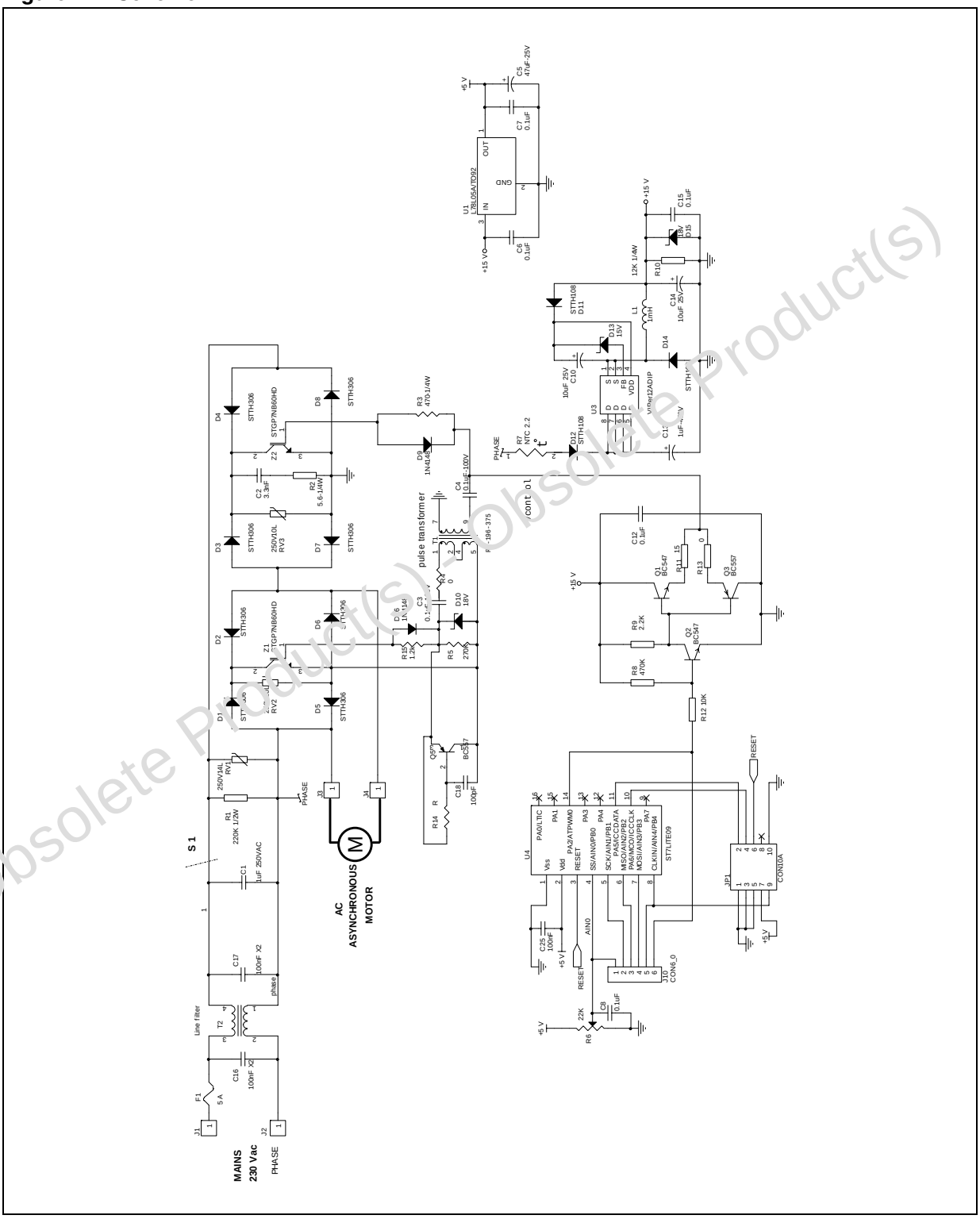
If the load has a reactive power it can transit between load and line grid independently from the power level and is not blocked or dissipated in any electronic parts of the circuit.

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).

Obsolete Product(s) - Obsolete Product(s)

2 Board schematic

Figure 1. Scheme



3 Revision history

Table 1. Revision history

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

Obsolete Product(s) - Obsolete Product(s)

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST’s terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST’S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER’S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

Obsolete Product(s) - Obsolete Product(s)

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2007 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com