1.5 kW dual motor drive with digital PFC based on SLLIMM™ IPMs and STM32F3

Features

- Input voltage: 230 VAC 50 Hz / 60 Hz
- Max. power: up to 2 kW
- PFC topology: digital control, boost single stage
- PFC protections: overcurrent, overvoltage, and undervoltage lockout
- Inrush current limiter based on overvoltage protected AC switch
- Motor 1 stage:
  - STGIB10CH60TS-L, SLLIMM series IPM 15 A, 600 V, 3-phase IGBT inverter bridge
  - Max. current: up to 10 A, 0-to-peak (current sensing network threshold)
  - 1-, 2-, and 3-shunt resistors for current sensing
  - Protections: overcurrent, overtemperature, undervoltage lockout
- Motor 2 stage:
  - STGIPQ3H60T-HZ SLLIMM nano series IPM, 3 A, 600 V, 3-phase IGBT inverter bridge
  - Max. power: 60 W (no heatsink)
  - Max. current: up to 1 A, 0-to-peak (current sensor network threshold)
  - 1 shunt resistor for current sensing
  - Protections: overcurrent, overtemperature, undervoltage lockout
- Centralized driving (motor 1, motor 2, PFC) from single STM32F303RB MCU based on ARM Cortex-M4 core with DSP and FPU
- WEEE and RoHS compliant

Description

The STEVAL-CTM010V1 board embeds two sensorless 3-phase motor drives, plus a single stage digital PFC boost topology, all controlled by the STM32F303RB ARM based microcontroller. The ST FOC MC SDK firmware library enables this complete hardware and software solution, featuring FOC dual motor sensorless and PFC CCM mode. The inverter stages are based on SLLIMM™ IPM series of intelligent power modules for compact, high-performance AC motor drives in a simple, rugged design. It combines new ST proprietary driver ICs with an improved short-circuit rugged trench gate field-stop (TFS) IGBT, making it ideal for motor drives operating up to 20 kHz in hard-switching circuits.

The PFC section is based on the STTH30AC06C ultra-fast high voltage rectifier and STGW20H65FB trench gate field-stop IGBT. The board embeds the 2nd generation SLLIMM STGIB10CH60TS-L and STGIPQ3H60T-HZ intelligent power modules, which are tailored to drive motors for compressors and fans in outdoor units. The STEVAL-CTM010V1 is therefore ideal for evaluating room air conditioner solutions able to meet new efficiency standards requiring digital PFCs, and any single or dual motor application with power factor correction.
Figure 1. STEVAL-CTM010V1 block diagram

Main

AC-DC converter

PFC stage

+5V

+3.3V

+15V

Inrush current limit control

STTH30AC06CPF

STGWY20RTPFB

6 pwm

digital

FOC

dual

PFC

STM32F3

6 pwm + SD

1 shunt

IPM SLLIMM 2nd series

IPM SLLIMM nano 2nd series

Compressor

Fan

+350V

+350V

T123ST-8FP

+350V

+350V

+350V
Figure 2. STEVAL-CTM010V1 schematic diagram - SMPS
Figure 3. STEVAL-CTM010V1 schematic diagram - EMI and PFC
Figure 4. STEVAL-CTM010V1 schematic diagram - IPM1
Figure 5. STEVAL-CTM010V1 schematic diagram - IPM2
Figure 6. STEVAL-CTM010V1 schematic diagram - MCU
Figure 7. STEVAL-CTM010V1 schematic diagram - miscellaneous
# Revision history

**Table 1. Document revision history**

<table>
<thead>
<tr>
<th>Date</th>
<th>Version</th>
<th>Changes</th>
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<tbody>
<tr>
<td>12-Mar-2019</td>
<td>1</td>
<td>Initial release.</td>
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