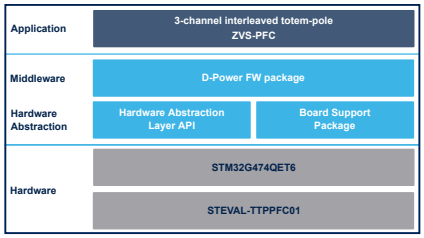
STSW-TTPPFC01

Data brief

Firmware for the 99.3% efficiency, 2 kW, 3-channel interleaved totem-pole PFC with resonant ZVS digital control



Product summary	
Firmware for the 2 kW 3-channel interleaved totem-pole PFC with resonant ZVS digital control	STSW-TTPPFC01
2 kW 3-channel interleaved totem-pole PFC with resonant ZVS digital control	STEVAL-TTPPFC01
Mainstream Arm® Cortex® - M4 MCU (512 Kbytes of flash memory, Math Accelerator, HR Timer, High Analog level integration)	STM32G474QET6
Applications	Server & Telecom Power/TV PSU/PFC Converter - Single Phase Input/Digital Power

Features

- Zero voltage switching (ZVS) control algorithm for power factor correction (PFC)
- Hysteresis cycle-by-cycle current mode control
- Variable switching frequency
- Three-channel interleaved control with phase shedding
- Output DC bus regulation with input voltage and load feedforwards
- Soft startup, inrush current limiter function, and burst mode operation at light load
- Overcurrent, overvoltage, and overtemperature protections
- Based on the STM32G474QET6 Arm Cortex-M4 MCU and STM32CubeMX architecture

Description

The STSW-TTPPFC01 provides a highly sophisticated control for the STEVAL-TTPPFC013-channel interleaved bridgeless totem-pole PFC with resonant ZVS digital control, to boost the conversion efficiency.

The STSW-TTPPFC01 is fully implemented in the STM32G474QET6. It includes: a slow outer voltage loop for the output voltage regulation, a faster inner current loop for the inductor currents control, and an input rectification function for the mains synchronization.

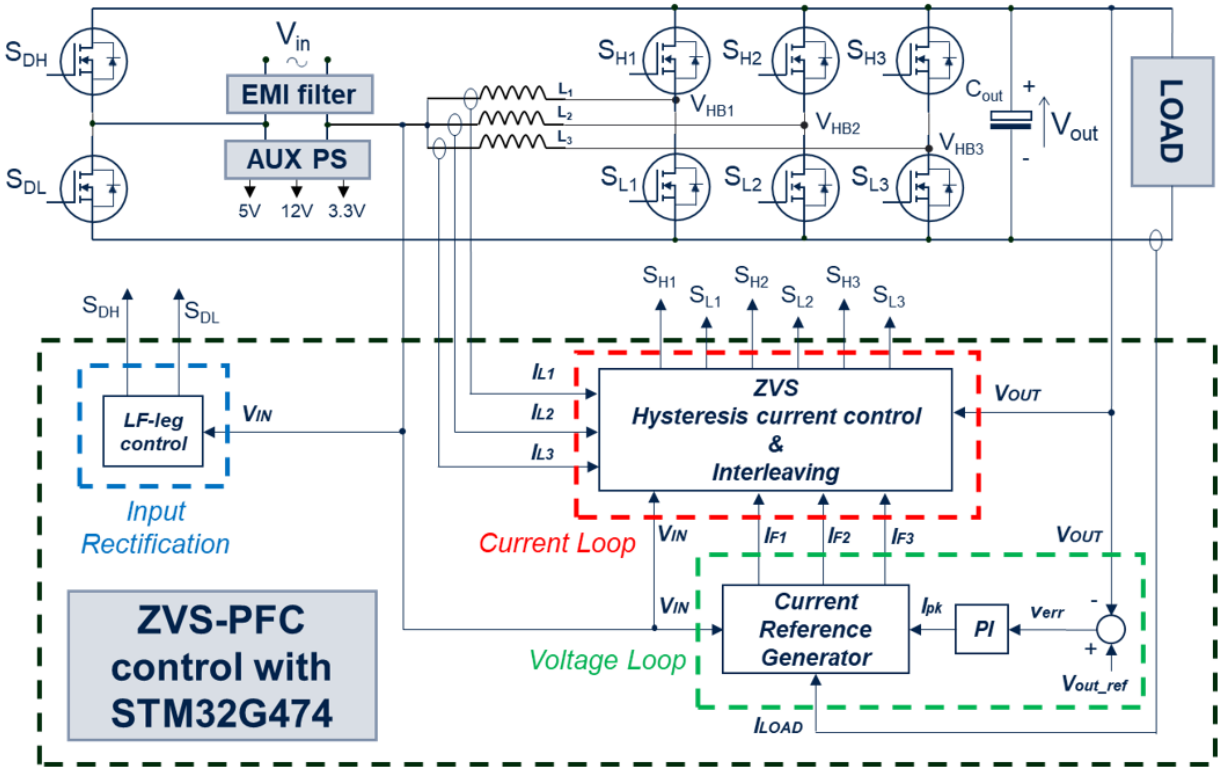
The sophisticated and high performance inner current loop is a hysteresis current control implemented through internal DACs, fast comparators, and the powerful HRTIM peripheral of the STM32G474QET6. Thus, the highest possible bandwidth and cycle-by-cycle regulation are ensured.

The outer voltage loop is performed through a digital PI controller with a fast input and load feedforward. It enhances the PFC dynamic response if a load step or an input voltage variation occurs.

1 Block diagram

The following figure shows a detailed block diagram of the ZVS-PFC control. More in detail, the green dashed rectangle represents the slow outer voltage loop for the output voltage regulation, the red dashed rectangle indicates the faster inner current loop for the high-frequency half-bridges control, and the blue dashed rectangle includes the input rectification function of the low-frequency half-bridges.

Figure 1. Block diagram of the ZVS-PFC control included in the STSW-TTPPFC01



Revision history

Table 1. **Document revision history**

Date	Revision	Changes
11-Oct-2022	1	Initial release.
25-Oct-2022	2	Updated document title.