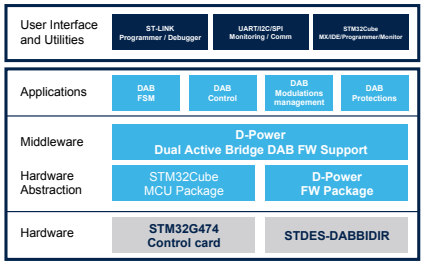
STSW-DABBIDIR

Data brief

Firmware for dual active bridge bidirectional power converter for EV charging and battery energy storage systems



Product summary	
Firmware for STDES-DABBIDIR	STSW-DABBIDIR
25 kW, dual active bridge bidirectional power converter for EV charging and battery ESS	STDES-DABBIDIR
Mainstream Arm Cortex-M4	STM32G474RET3
Applications	EV Charging/Battery Storage Systems for Commercial/ Uninterruptalbe Power Supply (UPS)

Features

- DAB bidirectional control algorithm
- Soft switching at wide load/voltage ranges enabled by enhanced modulation techniques
- Embedded controls:
  - Voltage control loop
  - Current control loop
  - Optimized selection of modulation technique based on operating conditions
  - Soft startup
- Protections:
  - Overcurrent, voltage, power protections
  - Input, output, operating voltage range protections
- Development environment:
  - D-Power conversion firmware package for application parameters customization
  - Full integration on STM32Cube software ecosystem
- Based on the STM32G474RE MCU
  - Customizable full digital solution with high performance mixed-signal behavior
  - High-resolution timer version 2
  - Integrated advanced analog peripherals (comparator, op-amps, DAC)
  - Hardware math accelerator

Description

STSW-DABBIDIR provides a complete and sophisticated solution to control a dual active bridge (DAB) bidirectional DC-DC power converter, exploiting a mixed-signal digital platform optimized for digital power applications.

A complete software solution is provided to exploit several application advantages offered by the flexible DAB topology.

The provided firmware allows operating the DAB converter with extended soft switching thanks to the adaptive modulation techniques and enhanced voltage and load control at wide range.

The STM32G474RET3 high performance MCU allows maximizing the DAB topology advantages in DC-DC applications, such as EV DC fast charging, energy storage systems, and UPS applications.

Additional firmware features like input and output protections, and soft startup are provided.

1 Block diagram

This application offers a solution to control a bidirectional DAB power converter. Full digital control algorithm is obtained by a mixed signal integrated control platform (STM32G474RET3).

The benefits of this solution are simple implementation, low cost and high performance.

The control structure is based on a complete and customizable solution. STM32Cube development environment is fully integrated to extend and simplify the user approach.

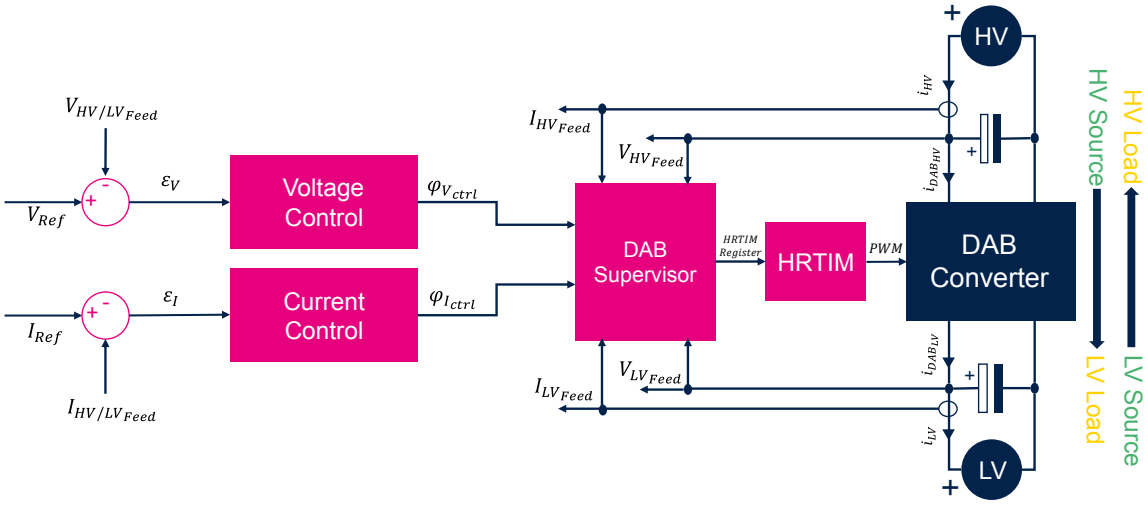
The block diagram shows the main part of the DAB control embedded in the microcontroller.

Voltage and current regulation are used to obtain an actual phase shift between primary and secondary side.

The DAB supervisor is used to optimize phase shift control demand, to extend soft switching DAB behavior at wide voltage and load range.

Switches driving module exploiting the high-resolution timers allows obtaining the best performance in switching and dead time management, according to DAB strict requirements.

Figure 1. Block diagram of the DAB control (HV/LV & LV/HV)



Revision history

Table 1. **Document revision history**

Date	Revision	Changes
15-Dec-2022	1	Initial release.