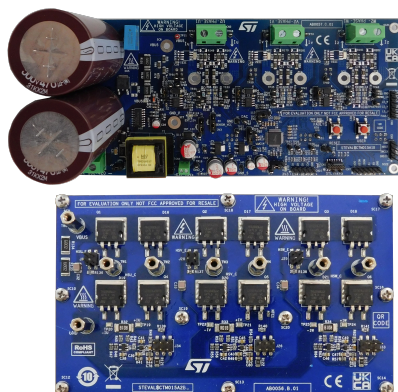


1 kW, 400 V_{DC} three-phase switched reluctance motor drive



Features

- Driver board (STEVAL-CTM015A1)
 - Based on three [L6395D](#) high voltage single-chip high and low-side gate drivers, with independent control of high and low-side
 - [STM32F303CBT6](#) microcontroller
 - Support for quadrature incremental encoder and Hall effect rotor position sensor
 - DC-DC power supply based on [VIPER26LD](#), [LD1117S50TR](#), and [LD1117S33CTR](#)
 - Support to host three Insulated Current Sensors (ICS) for phase current reading
- Power board (STEVAL-CTM015A2)
 - Insulated metal substrate (IMS)
 - Hosts six [STGB30H60DFB](#) IGBTs and six [STTH15RQ06](#) diodes in a D2PAK-2 package
 - Decoupling gate resistors
 - NTC sensing network for overheat protection
 - [LMV331ICT](#) comparators for overcurrent protection
 - Three-shunt resistors sensing network and TSV9911L OpAmps for three-phase current reading
- Heat sink for heat dissipation featuring a thermal resistance of 1 K/W

Description

The [STEVAL-CTM015V1](#) evaluation kit provides a complete solution for a three-phase switched reluctance motor (SRM) drive based on asymmetric half bridge flexible converter topology.

The kit consists of the STEVAL-CTM015A1 driver board, the STEVAL-CTM015A2 power board and a 1 K/W heat sink already assembled.

The driver board features a DC-DC power supply based on [VIPER26L](#), [LD1117S50](#), [LD1117S33C](#), [STM32F303CBT6](#) as MCU, and [L6395D](#) high voltage, single-chip high and low-side gate drivers for N-channel power MOSFETs or IGBTs.

The power board features an insulated metal substrate (IMS), NTCs for thermal protection, decoupling gate resistors for each IGBT, [LMV331I](#) comparators for overcurrent protection, [STGB30H60DFB](#) trench gate field-stop, and [STTH15RQ06](#) Turbo 2 soft ultrafast recovery diode.

By default, the [STEVAL-CTM015V1](#) features the three-shunts resistors current sensing network based on [TSV9911L](#), but it can also host three Insulated Current Sensors (ICSs).

Soft-chopping speed control firmware, based on [STM32F303CBT6](#) microcontroller, is available.

Product summary	
1 kW, 400 Vdc three-phase switched reluctance motor drive	STEVAL-CTM015V1
Trench gate field-stop 600 V, 30 A high speed HB series IGBT	STGB30H60DFB
600 V, 15 A turbo 2 soft ultrafast recovery diode	STTH15RQ06
Single-chip 600 V high and low-side driver for N-channel power MOSFETs or IGBTs	L6395D
Power supply for auxiliary voltage generation	VIPER26L LD1117S50
DC-link voltage to 15 V, 5 V, 3.3 V	LD1117S33C
Applications	Motor Control

Schematic diagrams

Figure 1. STEVAL-CTM015A1 circuit schematic (1 of 12)

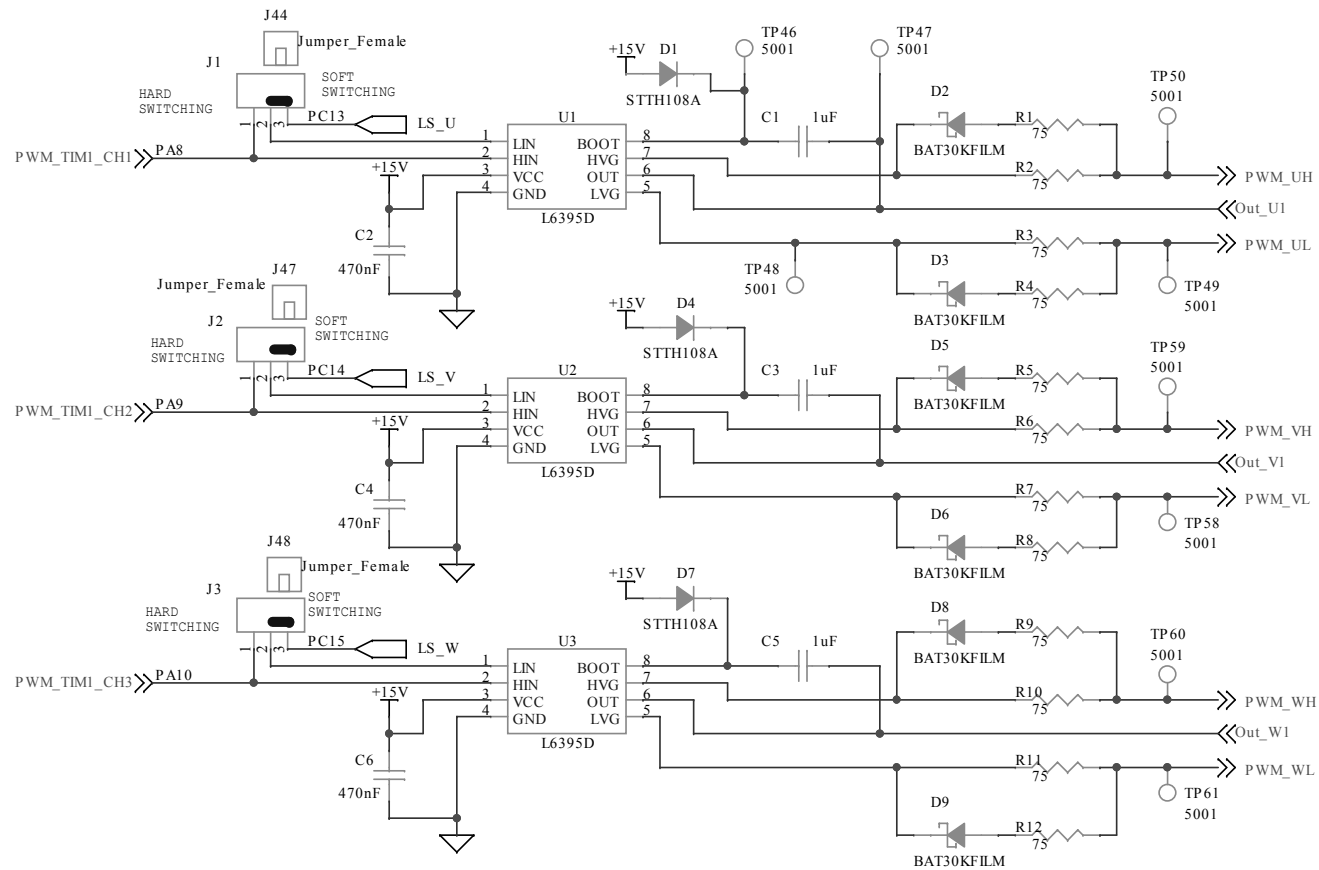
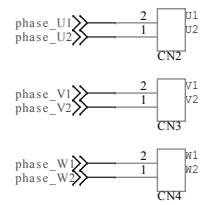
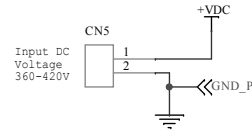


Figure 2. STEVAL-CTM015A1 circuit schematic (2 of 12)

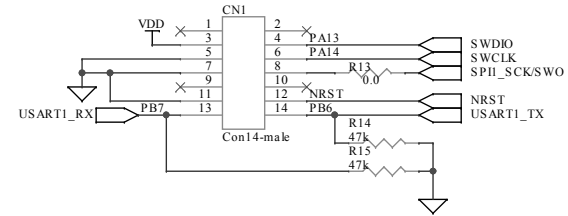
Motor windings connector



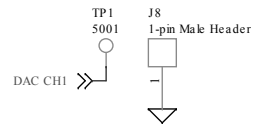
DC Bus Voltage Connector



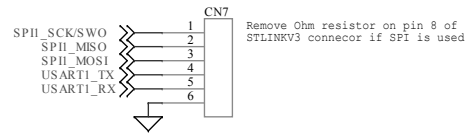
STLinkV3 Connector



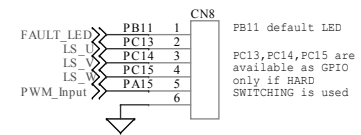
Debug Output



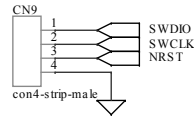
MCU SPI and USART



Digital GPIO Input & Output



SWD



External 15V (optional)

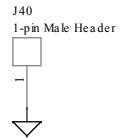
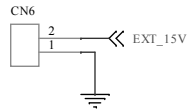
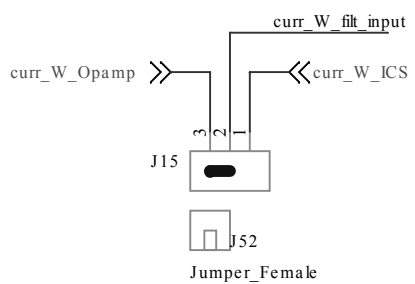
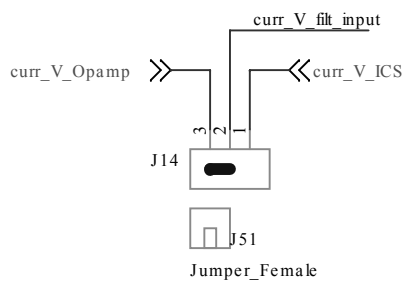
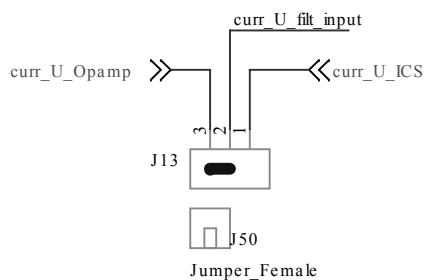


Figure 3. STEVAL-CTM015A1 circuit schematic (3 of 12)

Current Sensing ADC input selection



Current Sensing ADC input

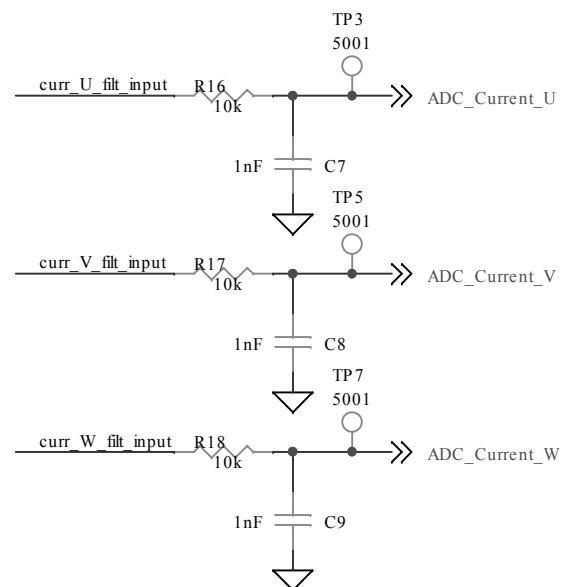
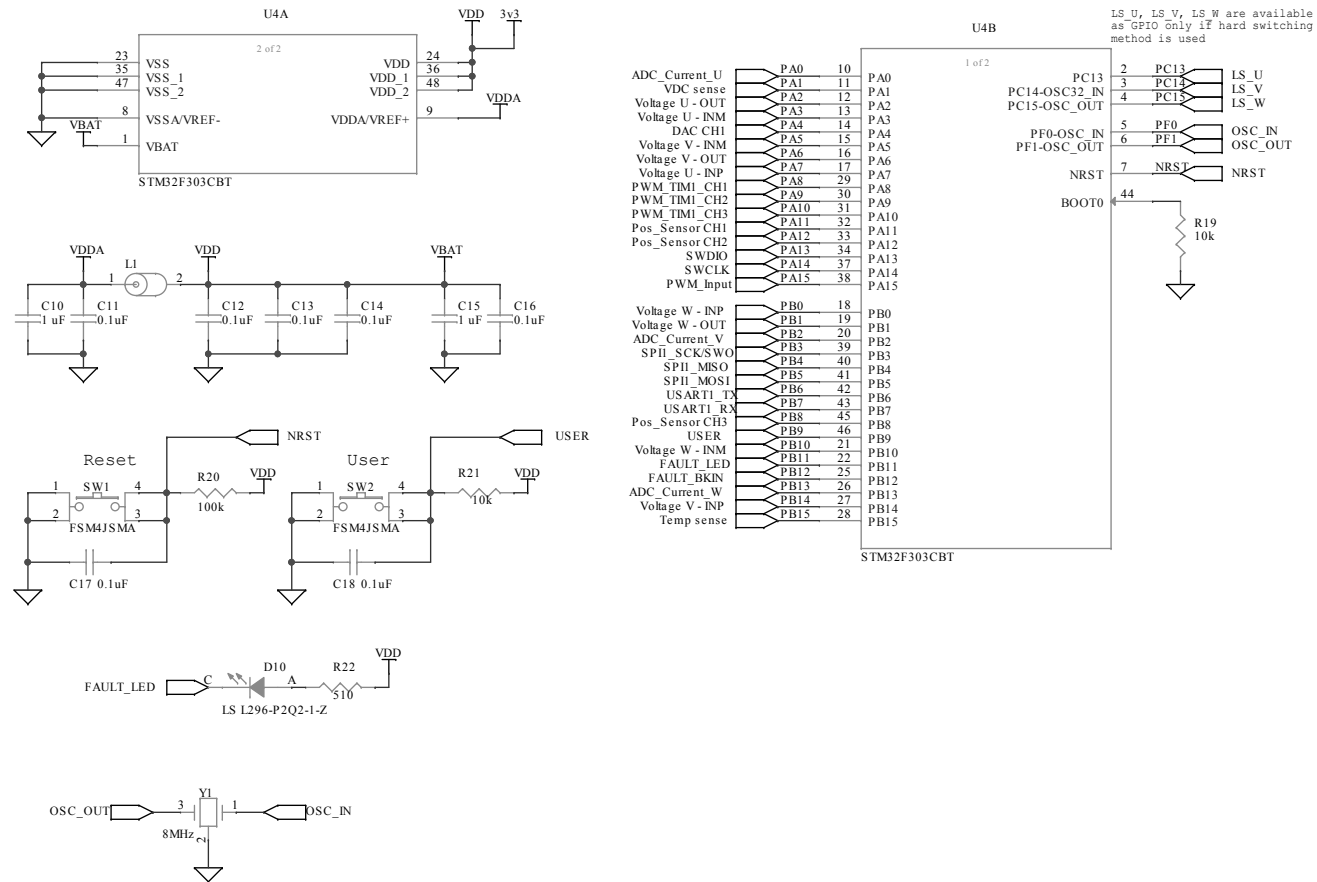


Figure 4. STEVAL-CTM015A1 circuit schematic (4 of 12)



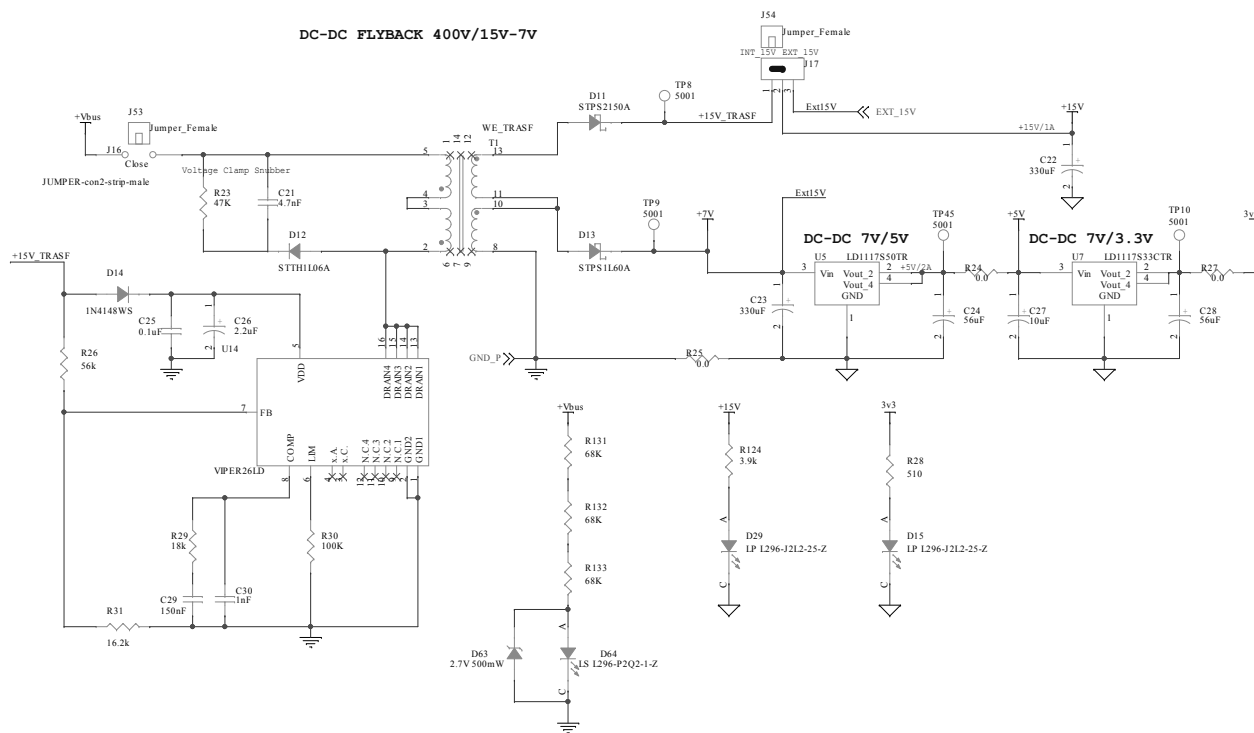
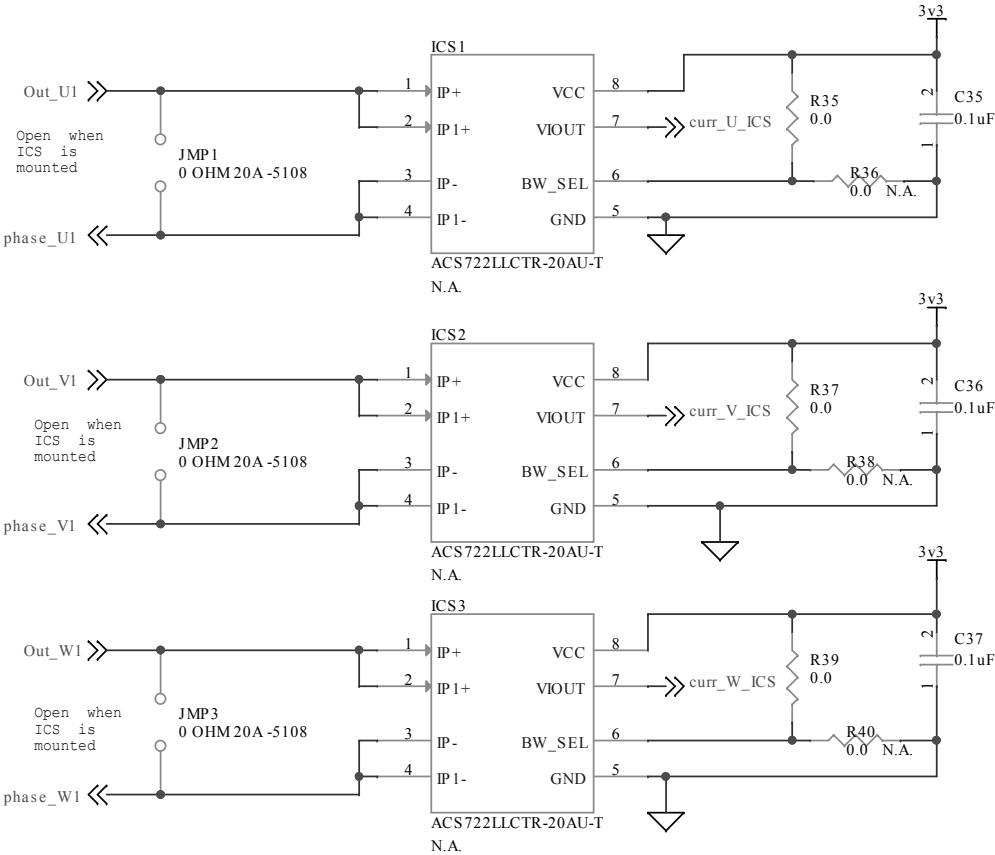




Figure 7. STEVAL-CTM015A1 circuit schematic (7 of 12)

Stator windings Current Sensing - ICS



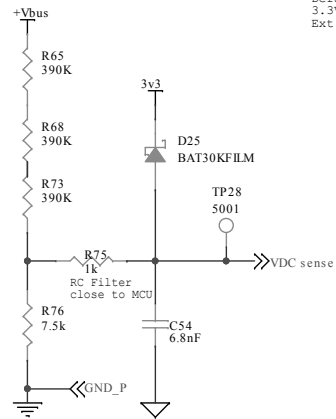
ICS Internal bandwidth (BW) Selection Table

BW	
20kHz	80kHz
BW SEL	Vcc GND

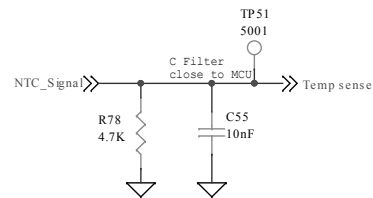


Figure 8. STEVAL-CTM015A1 circuit schematic (8 of 12)

DC Bus Voltage Sensing



Heatsink temperature sensing



Rotor Position/Speed Sensing

Default: 5V - Closed 2-3
 3.3V - Close 1-2
 Ext. Vcc (max 24V) directly on 2-4 pins

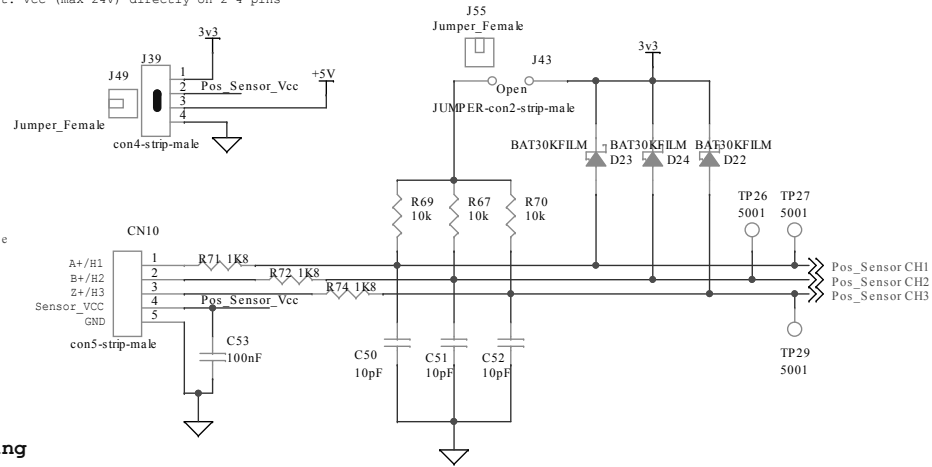


Figure 9. STEVAL-CTM015A1 circuit schematic (9 of 12)

Motor Terminal Voltage Sensing

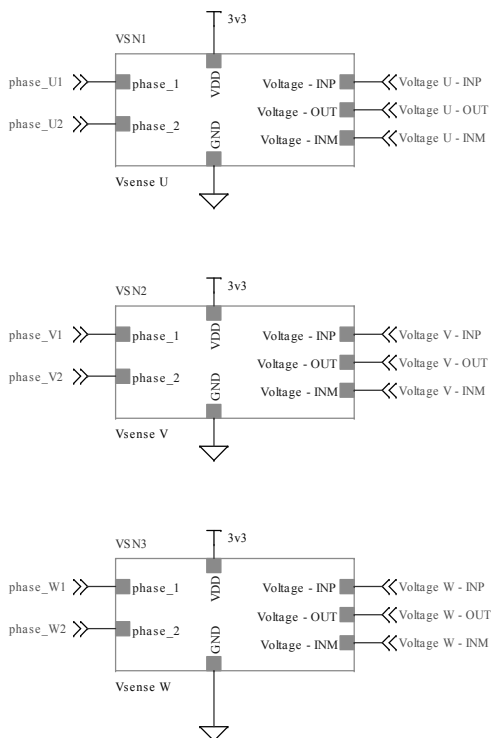


Figure 10. STEVAL-CTM015A1 circuit schematic (10 of 12)

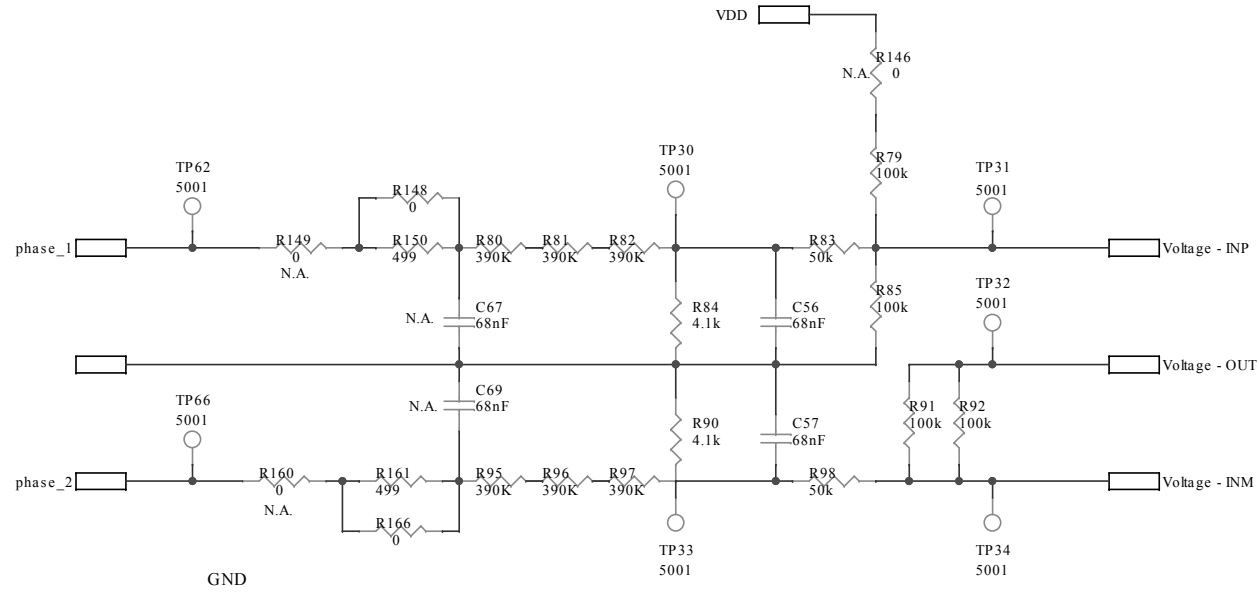


Figure 11. STEVAL-CTM015A1 circuit schematic (11 of 12)

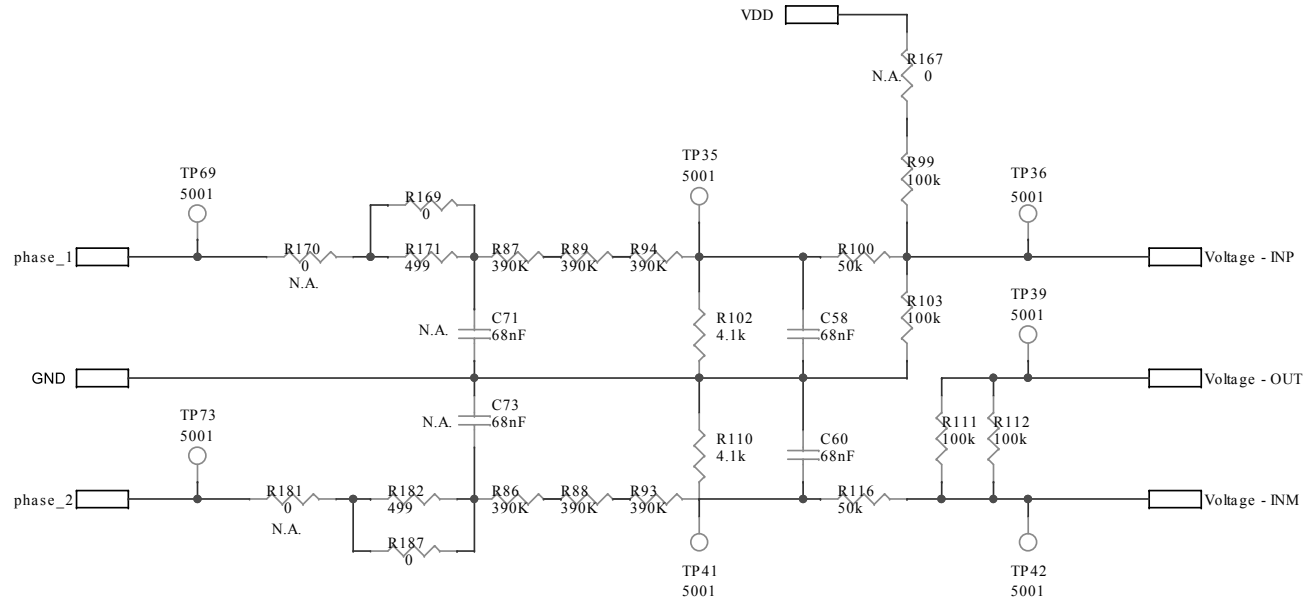


Figure 12. STEVAL-CTM015A1 circuit schematic (12 of 12)

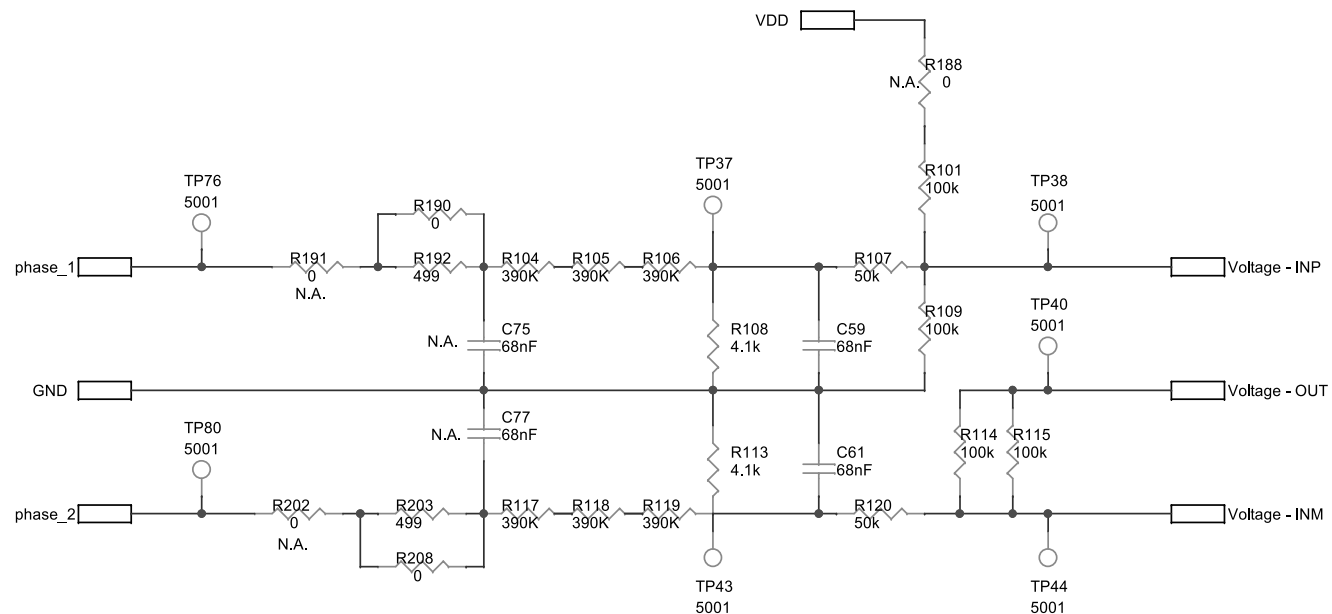
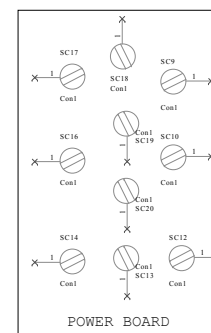
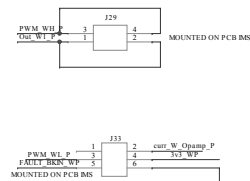
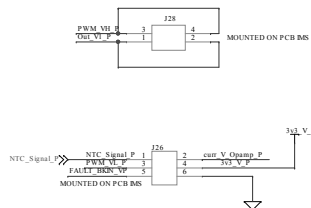
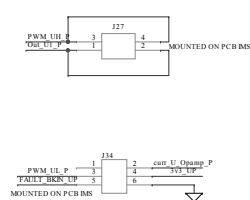
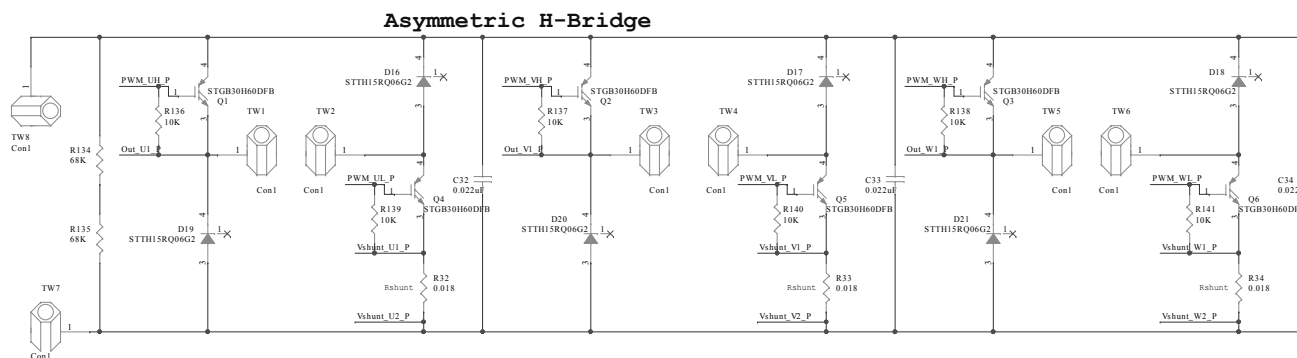


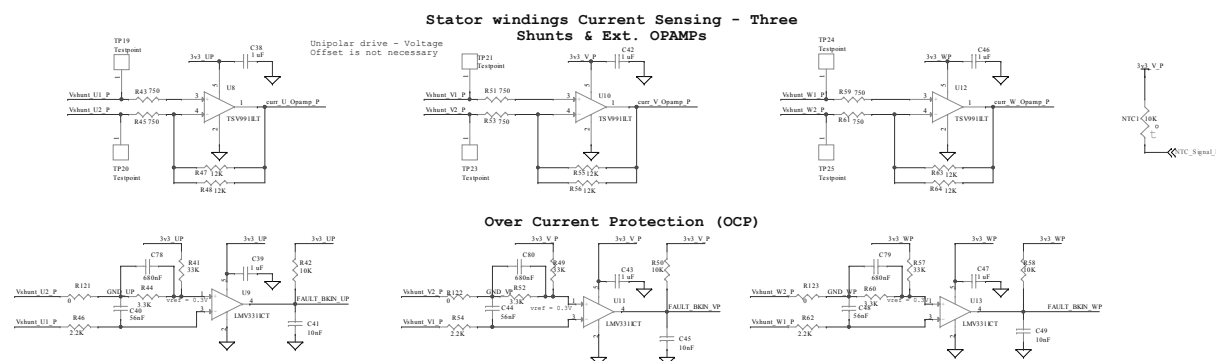
Figure 13. STEVAL-CTM015A2 circuit schematic (1 of 3)





STEVAl-CTM015V1

Schematic diagrams



2 Kit versions

Table 1. STEVAL-CTM015V1 versions

Finished good	Boards finished good	Schematic diagrams	Bill of materials
STEVAL\$CTM015V1A	STEVAL\$CTM015A1A	-	-
	STEVAL\$CTM015A2A		
STEVAL\$CTM015V1B ⁽¹⁾	STEVAL\$CTM015A1B	STEVAL\$CTM015V1B schematic diagrams	STEVAL\$CTM015V1B bill of materials
	STEVAL\$CTM015A2B		

1. This code identifies the STEVAL-CTM015V1 evaluation kit second version. The kit consists of the STEVAL-CTM015A1 driver board, whose version is identified by the code STEVAL\$CTM015A1B, the STEVAL-CTM015A2 power board, whose version is identified by the code STEVAL\$CTM015A2B, and a 1K/W heat sink already assembled. The STEVAL\$CTM015A2B board is mounted in the middle position between the STEVAL\$CTM015A1B and the heatsink. Additional information about the heatsink is available in the BOM list.

Revision history

Table 2. Document revision history

Date	Revision	Changes
25-Oct-2021	1	Initial release.
09-Jun-2023	2	Updated features, description and product summary in cover page. Updated Section 1 Schematic diagrams and Section 2 Kit versions .

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