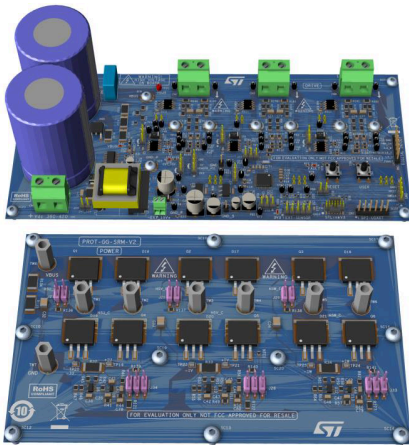


1 kW, 400 V_{DC} three-phase switched reluctance motor drive



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](#)
 - Three insulated current sensors (ICS) for phase-current reading
 - Hardware support for three-shunt topology via three [TSV9911LT](#) op-amp amplifiers
- Power board (STEVAL-CTM015A2)
 - Insulated metal substrate (IMS)
 - Hosts six [STGB30H65FB](#) IGBTs and six [STTH15RQ06G2-TR](#) diodes in a D2PAK-2 package
 - Decoupling gate resistors
 - NTC sensing network for overheat protection
 - [LMV331ICT](#) comparators for overcurrent protection
- 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, [STGB30H65FB](#) trench gate field-stop, and [STTH15RQ06](#) Turbo 2 soft ultrafast recovery diode.

By default, the **STEVAL-CTM015V1** features insulated current sensors (ICS) for phase-current reading, but a three-shunt resistor current-sensing network based on [TSV991IL](#) is also available.

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 IGBT, HB series 650 V, 30 A high speed in a D2PAK package	STGB30H65FB
600 V, 15 A turbo 2 soft ultrafast recovery diode	STTH15RQ06
600 V, 15 A turbo 2 soft ultrafast recovery diode	L6395D
Power supply for auxiliary voltage generation	VIPER26L LD1117S50
DC-link voltage to 15 V, 5 V, 3.3 V	LD1117S33C
Applications	Motor Control

1 Schematic diagrams

Figure 1. STEVAL-CTM015V1 circuit schematic (1 of 12)

Gate Drivers

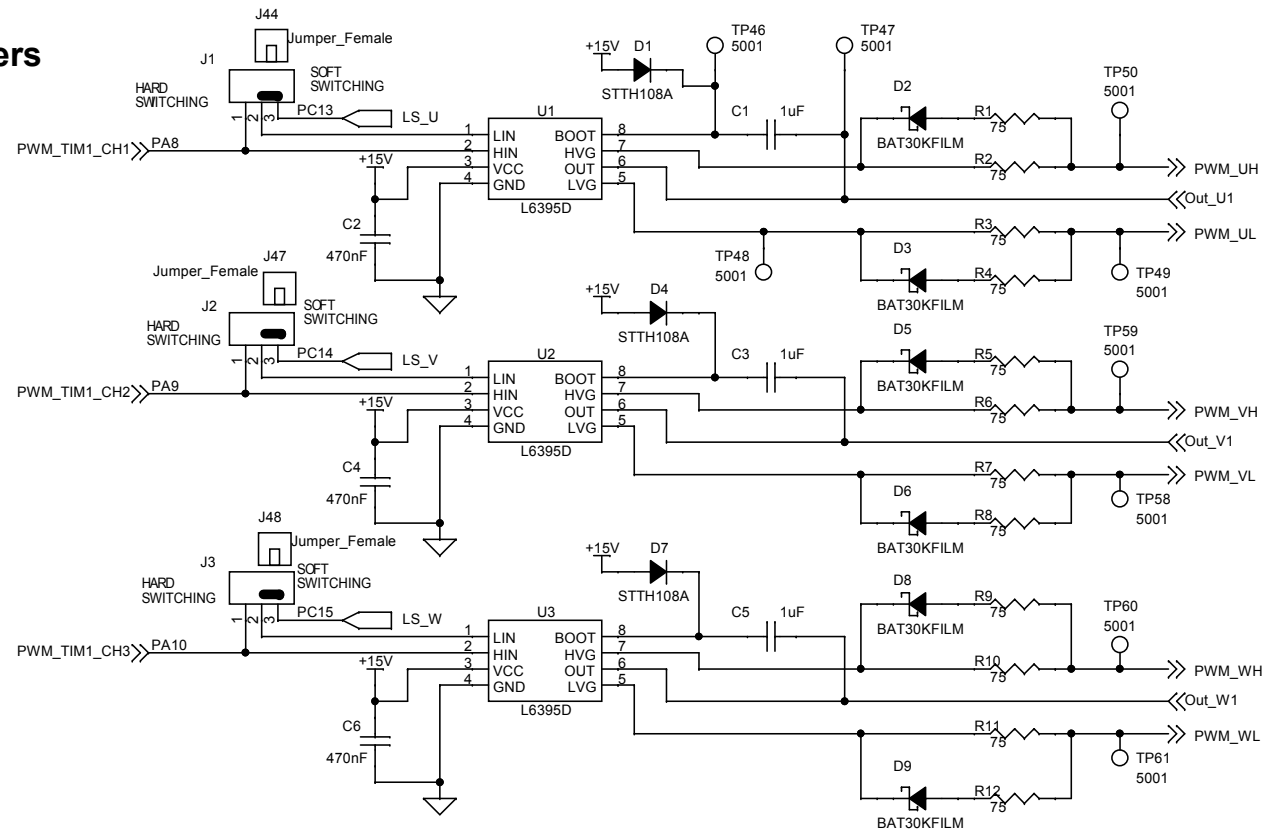
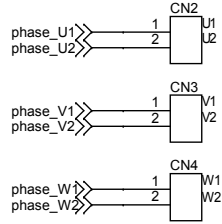
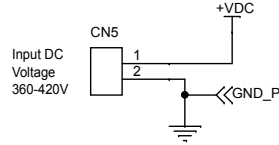


Figure 2. STEVAL-CTM015V1 circuit schematic (2 of 12)

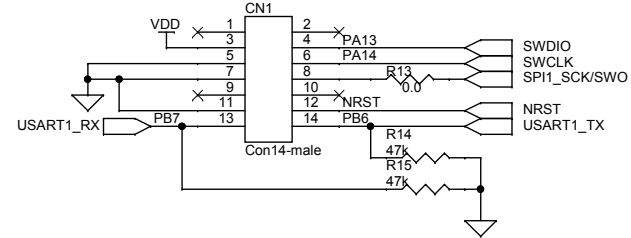
Motor windings connectors



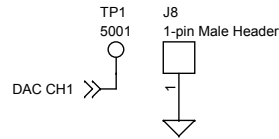
DC Bus Voltage Connector



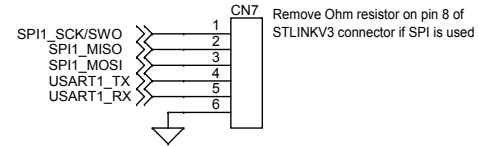
STLinkV3 Connector



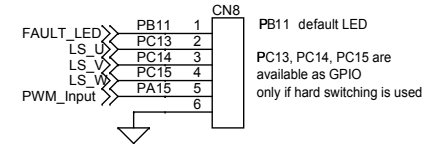
Debug Output



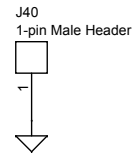
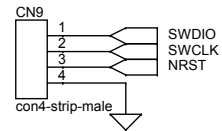
MCU SPI and USART



Digital GPIO Input and Output



SWD



External 15W (optional)

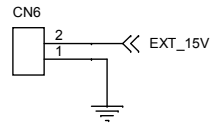


Figure 3. STEVAL-CTM015V1 circuit schematic (3 of 12)

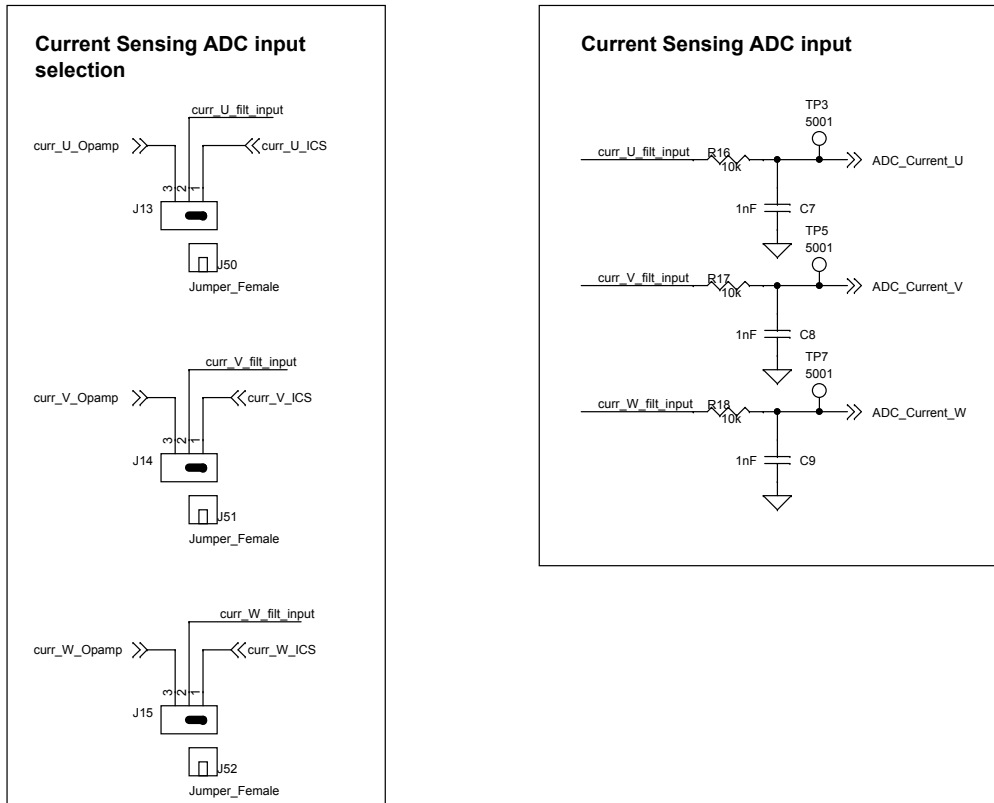
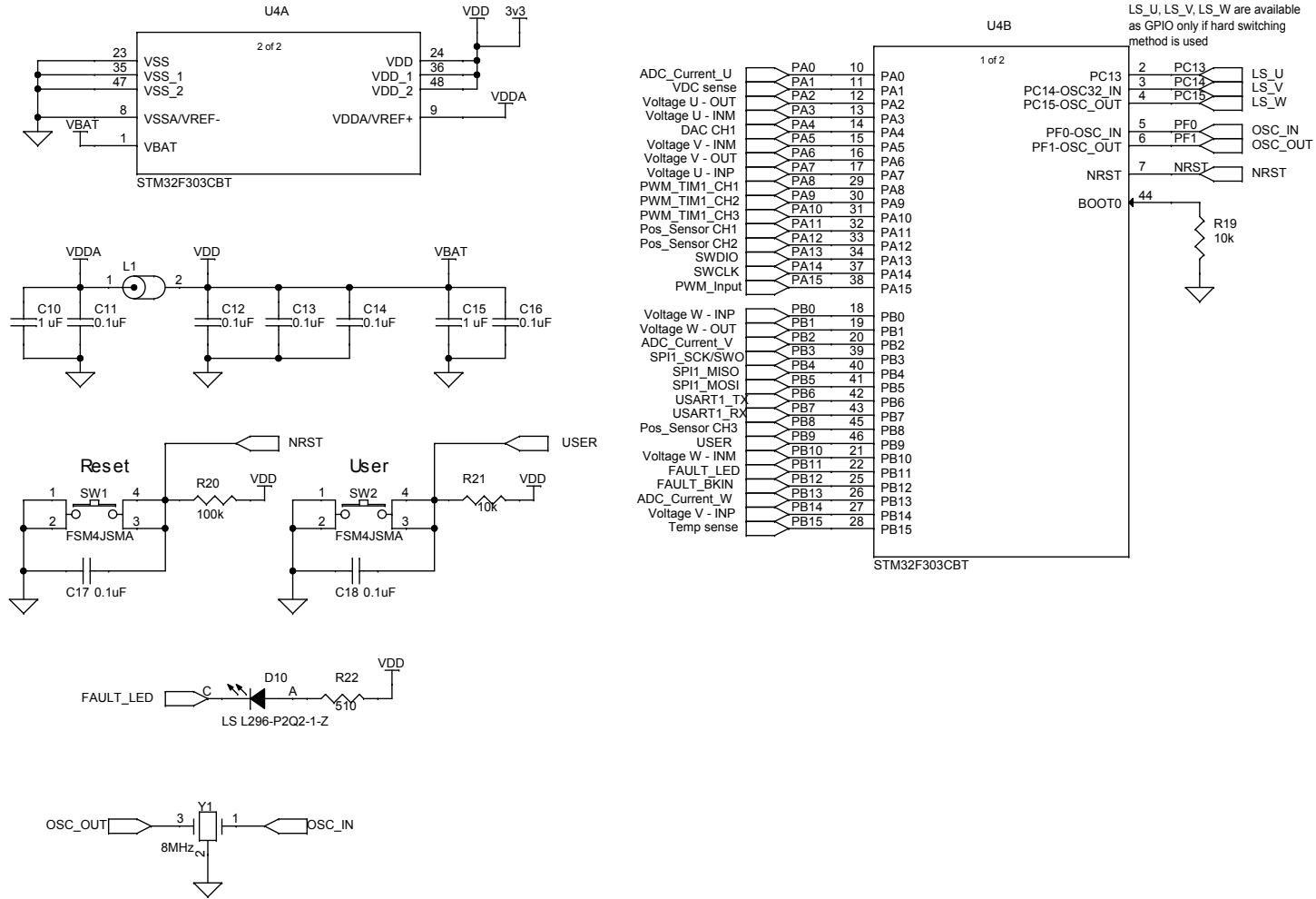


Figure 4. STEVAL-CTM015V1 circuit schematic (4 of 12)



LS_U, LS_V, LS_W are available as GPIO only if hard switching method is used



Figure 5. STEVAL-CTM015V1 circuit schematic (5 of 12)

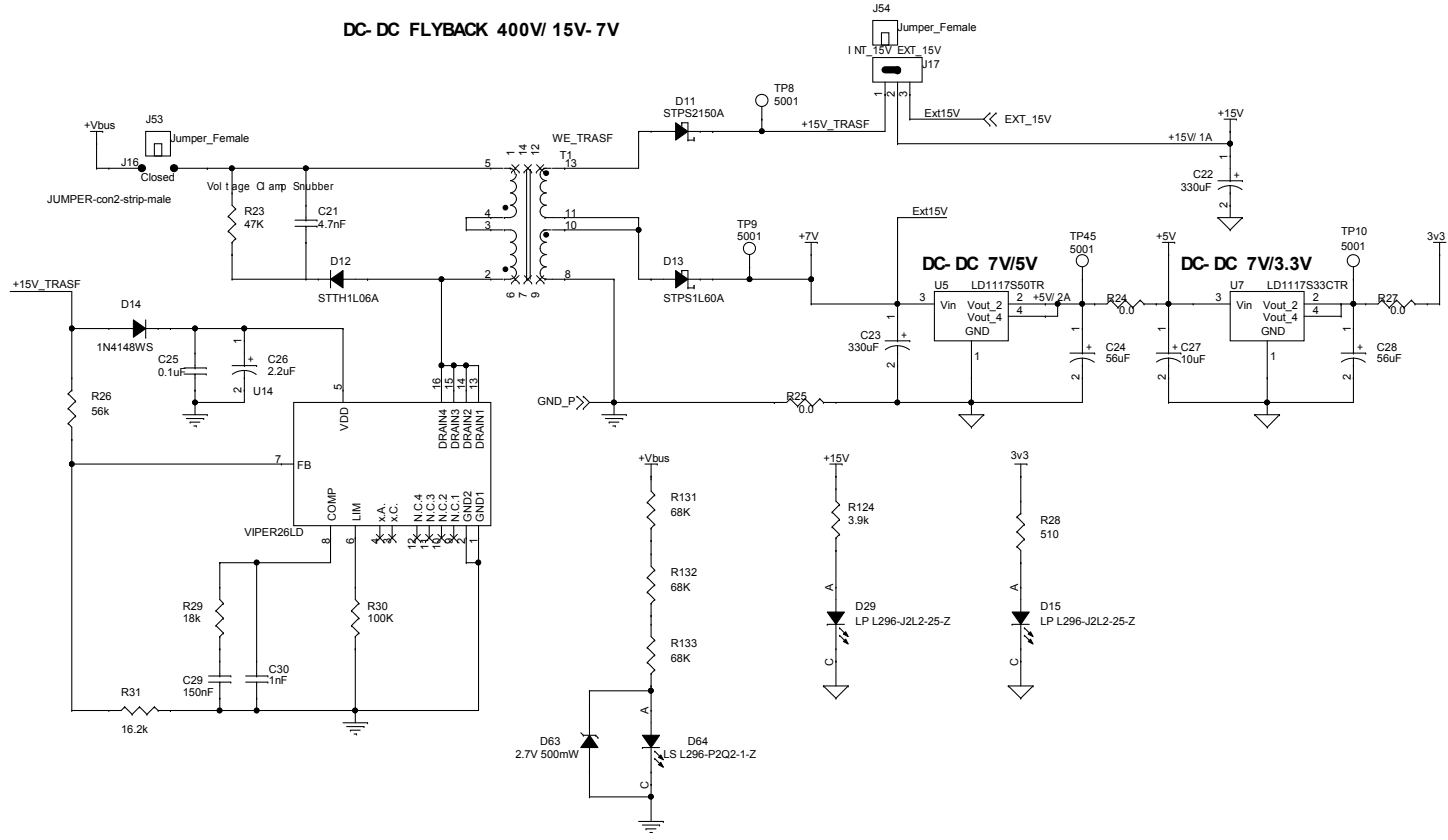
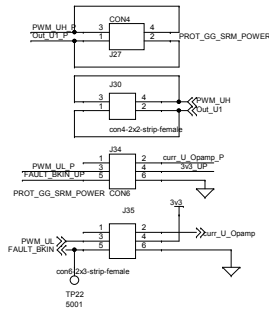
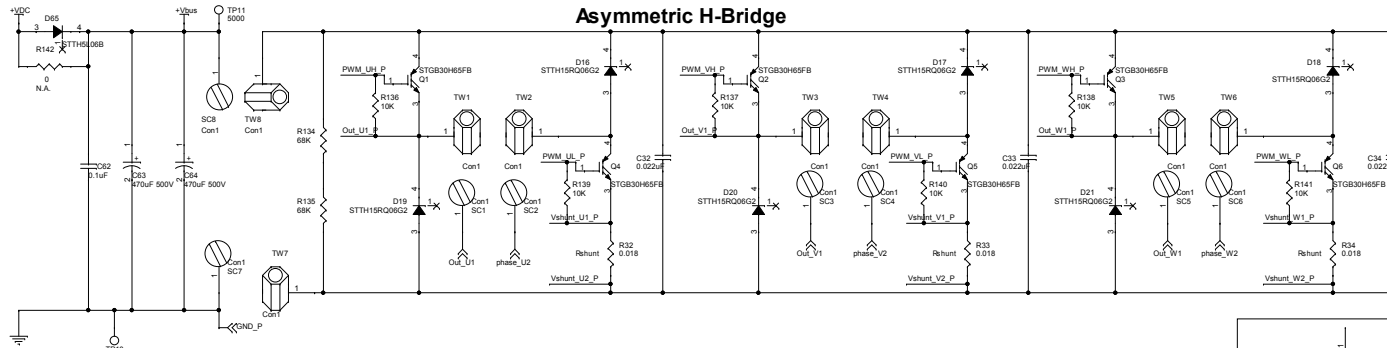
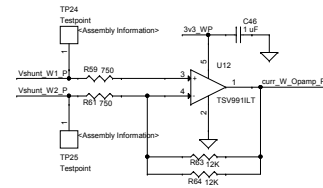
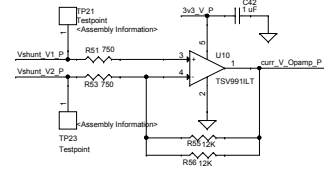
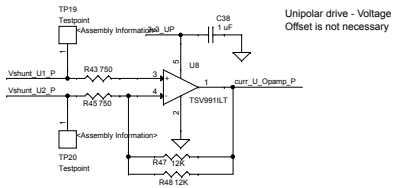


Figure 6. STEVAL-CTM015V1 circuit schematic (6 of 12)



Stator windings Current Sensing - Three Shunts and Ext. OPAMPs



Over Current Protection (OCP)

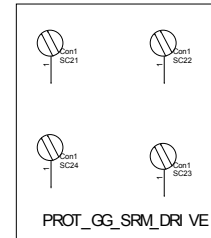
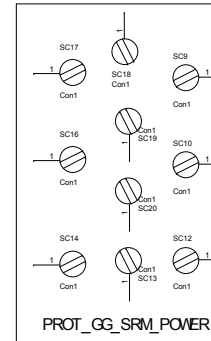
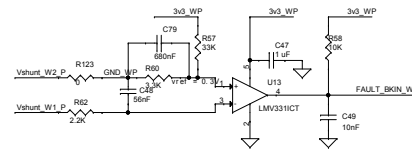
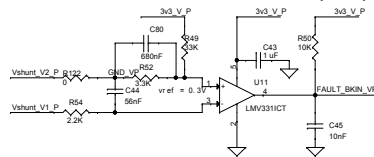
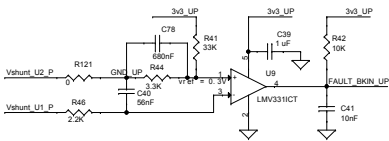
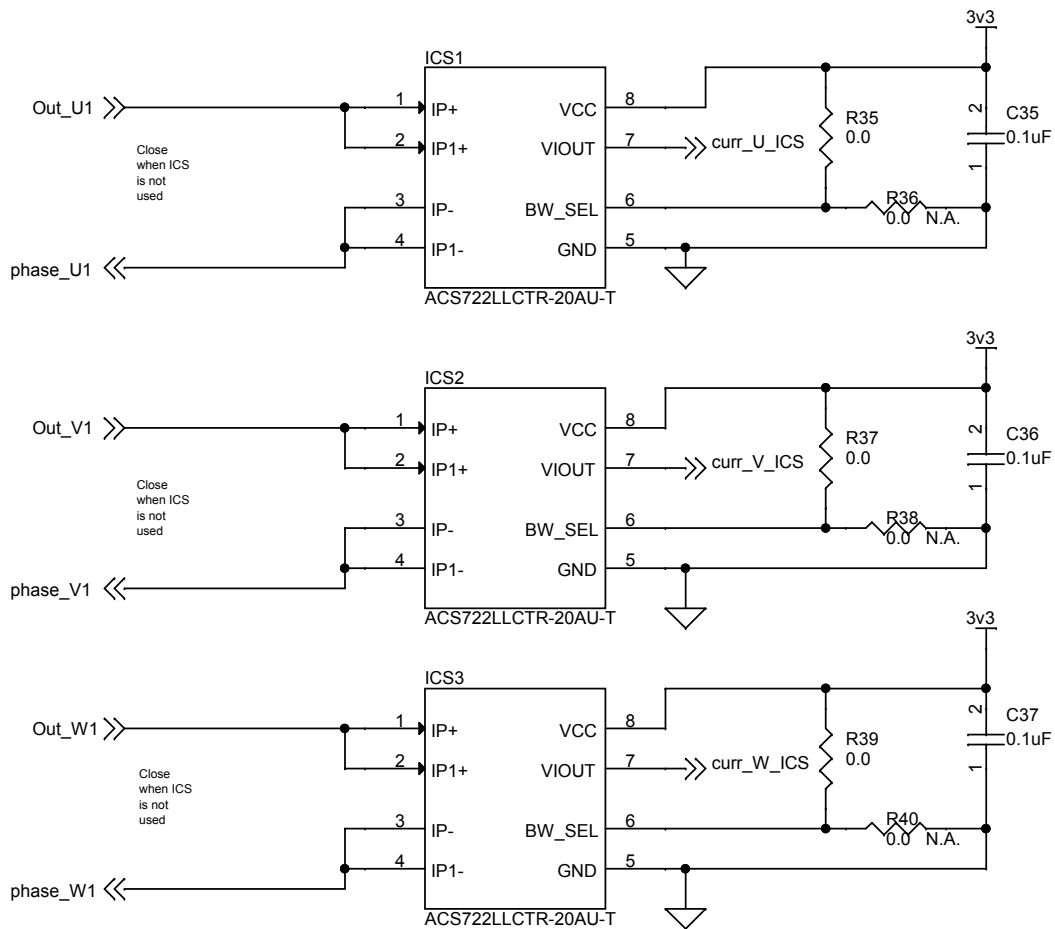


Figure 7. STEVAL-CTM015V1 circuit schematic (7 of 12)

Stator windings Current Sensing - ICS



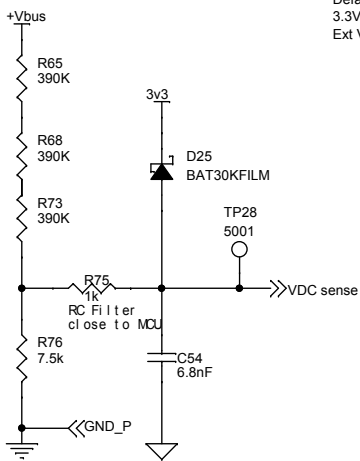
ICS Internal bandwidth (BW) selection table

	BW	
	20kHz	30kHz
BW_SEL	Vcc	GND

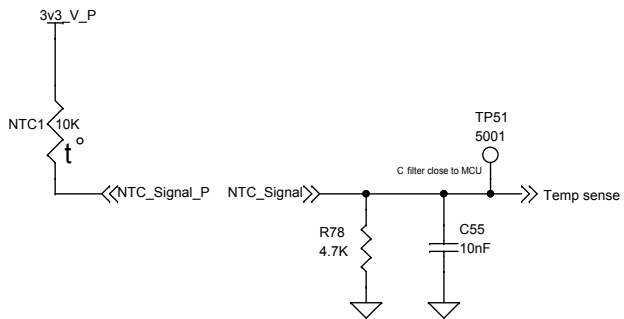


Figure 8. STEVAL-CTM015V1 circuit schematic (8 of 12)

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

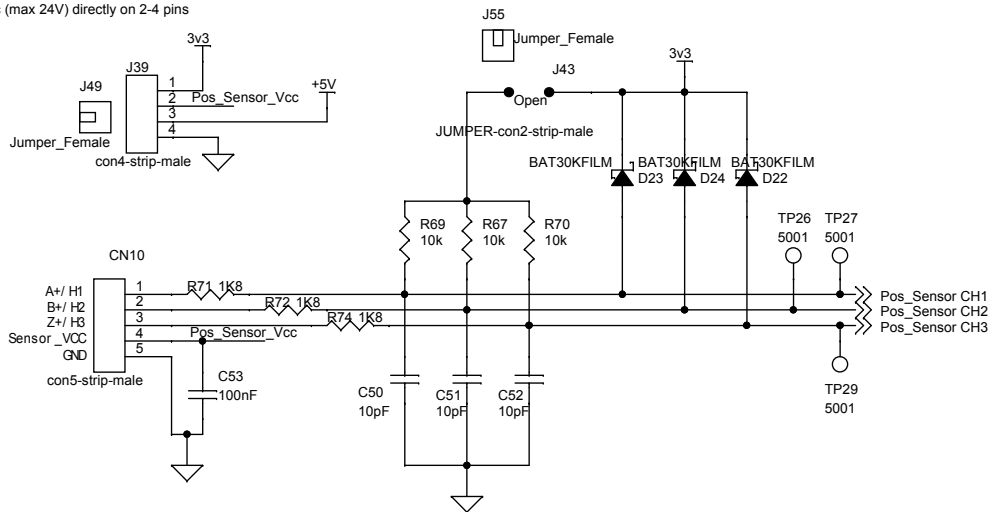


Figure 9. STEVAL-CTM015V1 circuit schematic (9 of 12)
Motor terminal voltage sensing

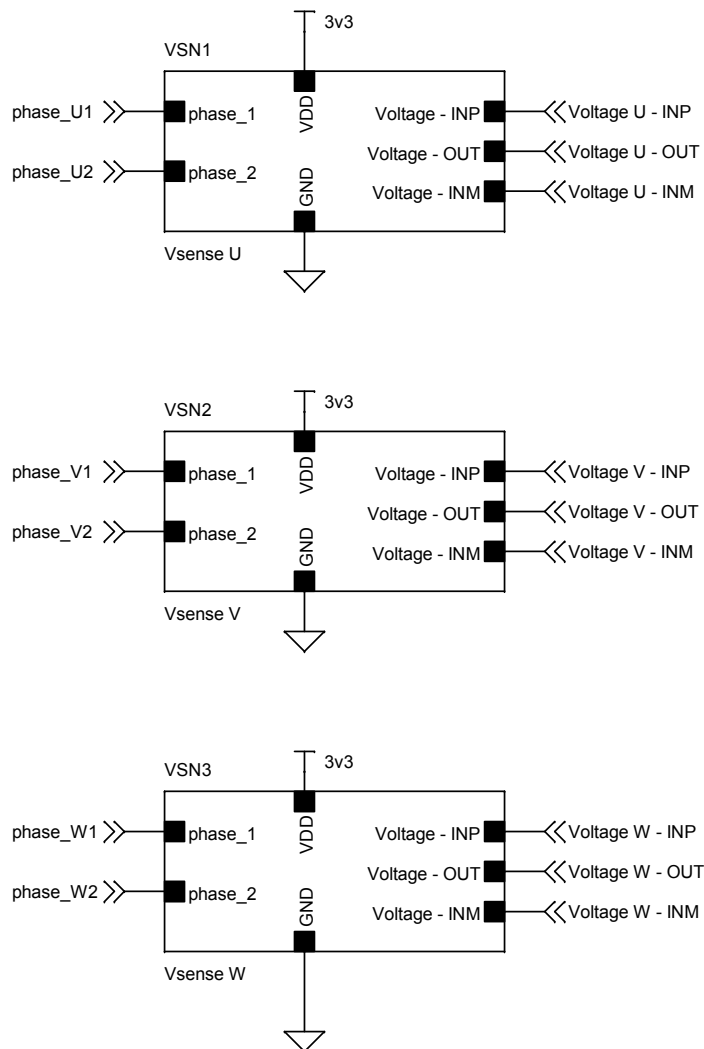


Figure 10. STEVAL-CTM015V1 circuit schematic (10 of 12)

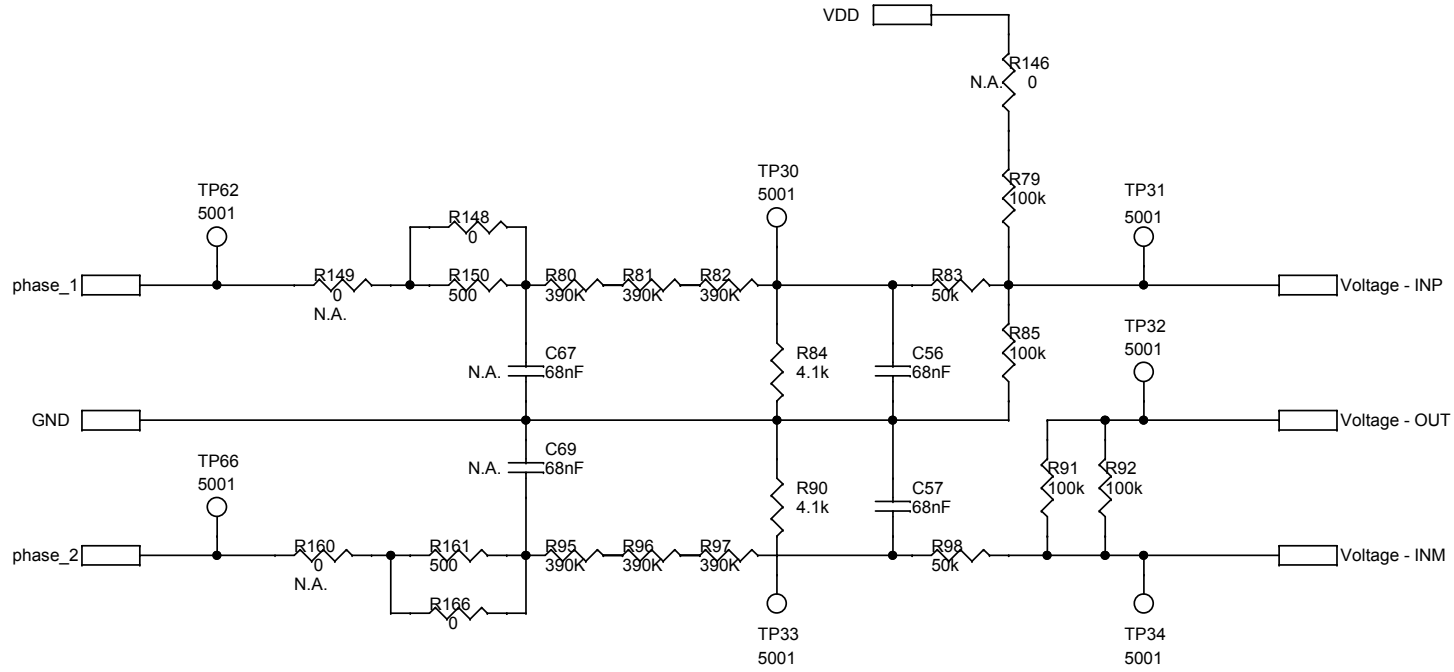


Figure 11. STEVAL-CTM015V1 circuit schematic (11 of 12)

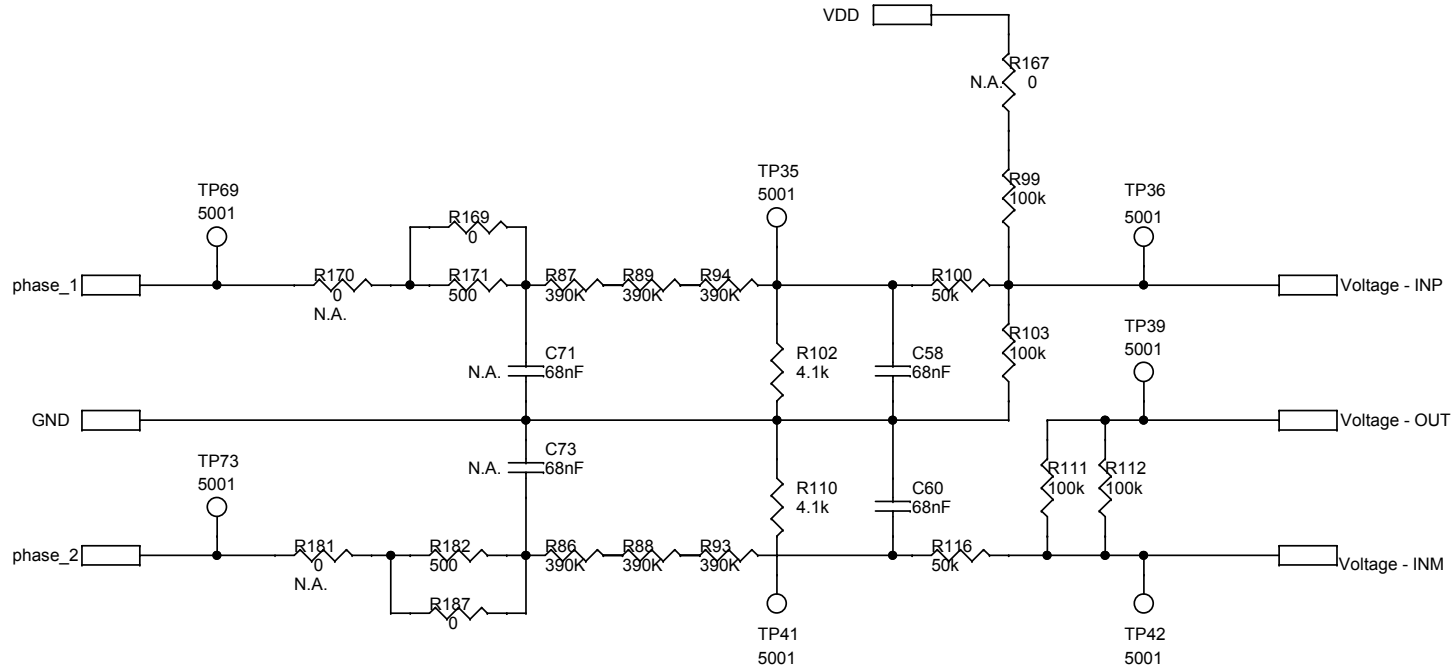
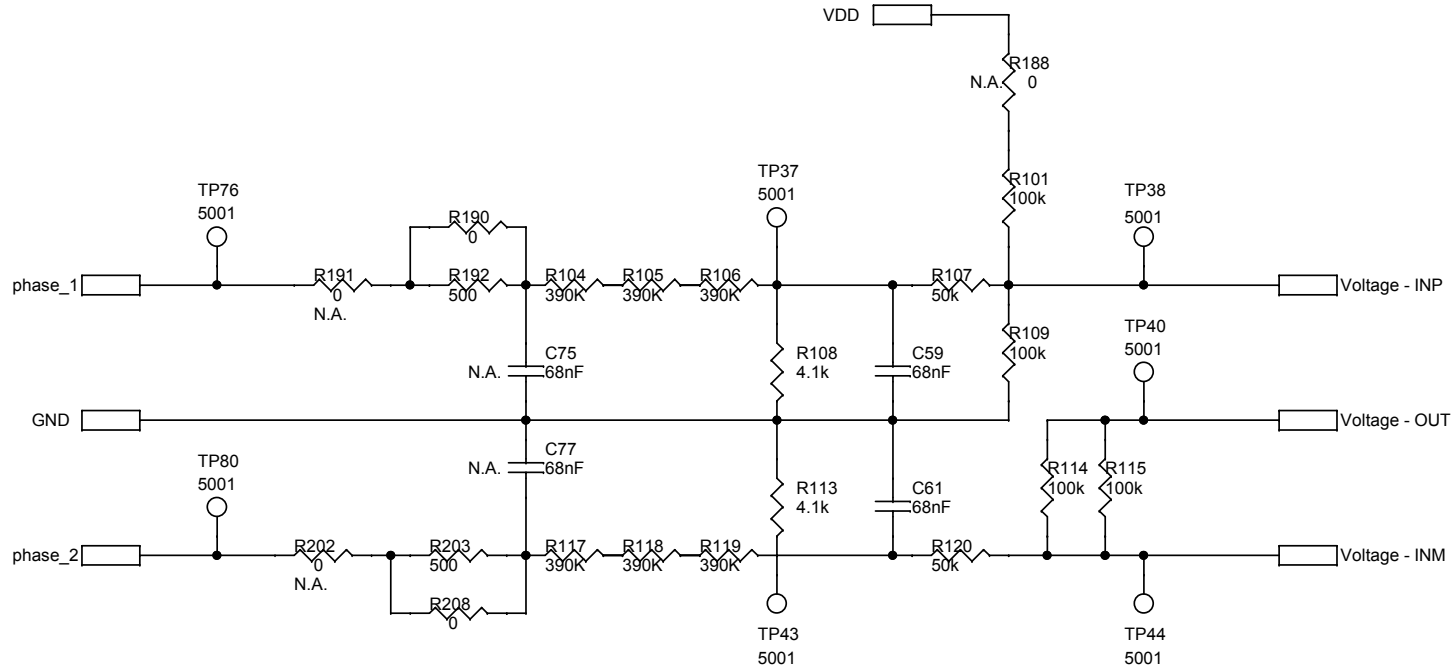


Figure 12. STEVAL-CTM015V1 circuit schematic (12 of 12)



2 Kit versions

Table 1. STEVAL-CTM015V1 versions

Finished good	Schematic diagrams	Bill of materials
STEVAL\$CTM015V1A ⁽¹⁾	STEVAL\$CTM015V1A schematic diagrams	STEVAL\$CTM015V1A bill of materials

1. This code identifies the STEVAL-CTM015V1 evaluation kit first version. The kit consists of the STEVAL-CTM015A1 driver board, whose version is identified by the code STEVAL\$CTM015A1A, the STEVAL-CTM015A2 power board, whose version is identified by the code STEVAL\$CTM015A2A, and a 1K/W heat sink already assembled.

Revision history

Table 2. Document revision history

Date	Revision	Changes
25-Oct-2021	1	Initial release.

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