CLICKER 4

INVERTER Shield

USER MANUAL

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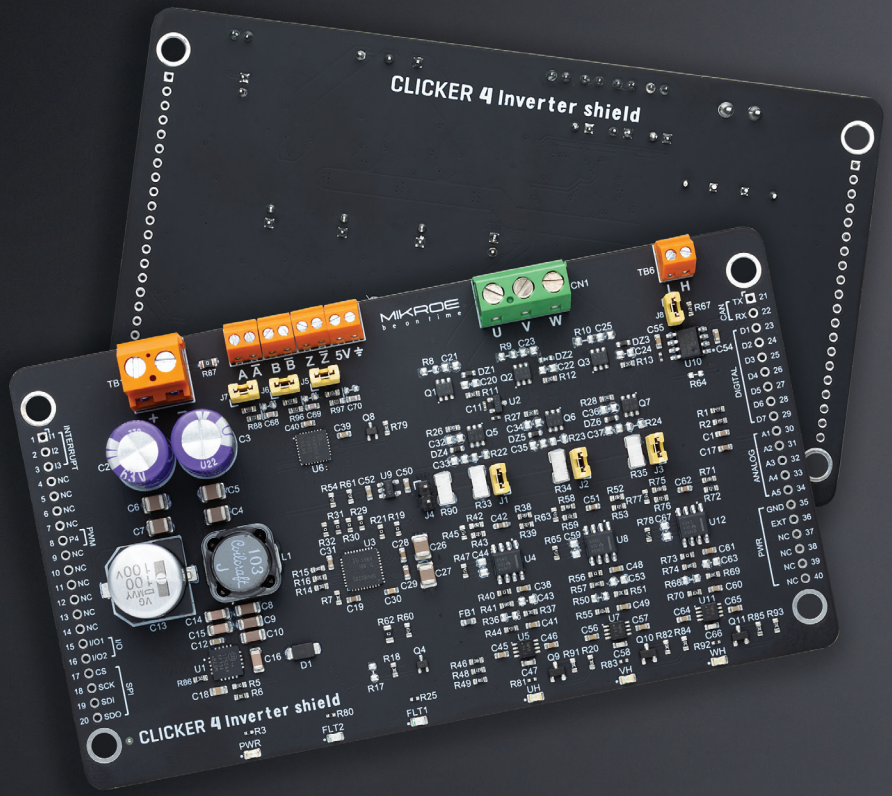


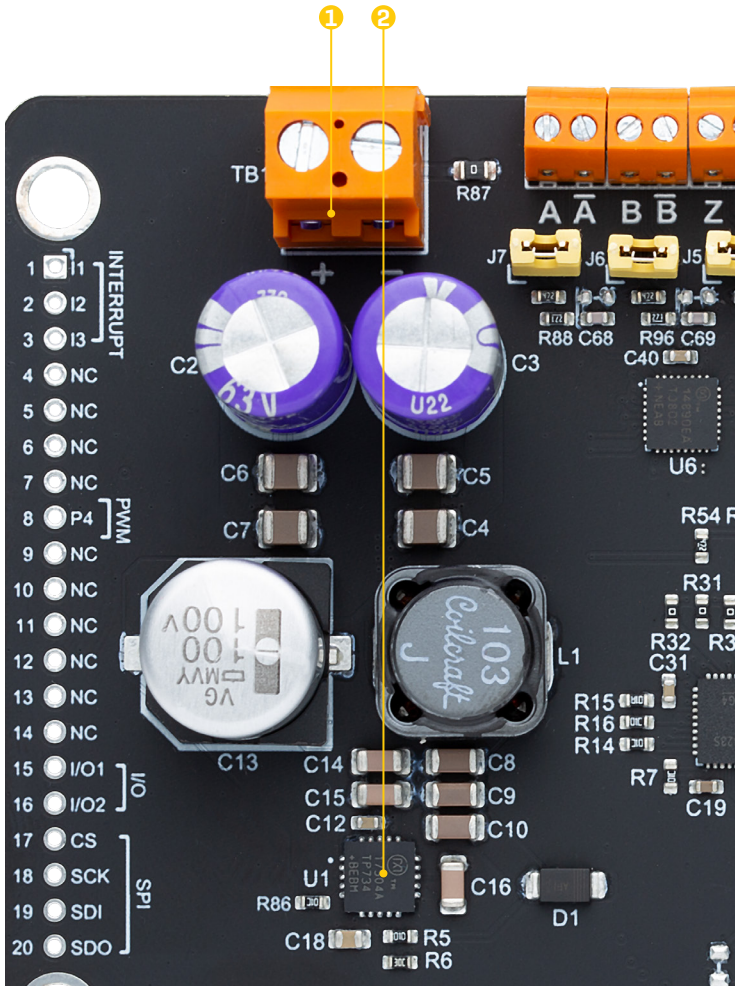
Clicker 4 Inverter Shield is an extension for Clicker 4 series boards from MIKROE.

It is the perfect way to expand the functionalities of your Clicker 4 board to provide highly efficient control and drive solutions for brushless DC (BLDC) motors.

The board features a 3-phase inverter using Toshiba's low RDS(ON) power MOSFETs, used in combination with an integrated gate driver easily configurable through the SPI interface. It also carries an incremental encoder receiver, and a CAN transceiver, rounding out the functionality of the board ideal for various motor control applications.

1. Power Supply

Clicker 4 Inverter Shield is compatible with a wide range input voltage from 12V to 48V DC. To power the board, connect the power source to terminal block TB1 **(1)** making sure to follow the polarity marked on board. A high-efficiency, synchronous step-down DC-DC Converter MAX17504 **(2)** from Maxim Integrated is on-board. This is an advanced integrated buck converter, which provides a 5V/2A regulated power source. The 5V output is also connected to pin 36 (EXT) of HDR2 side header, and can be used to power the controller board.

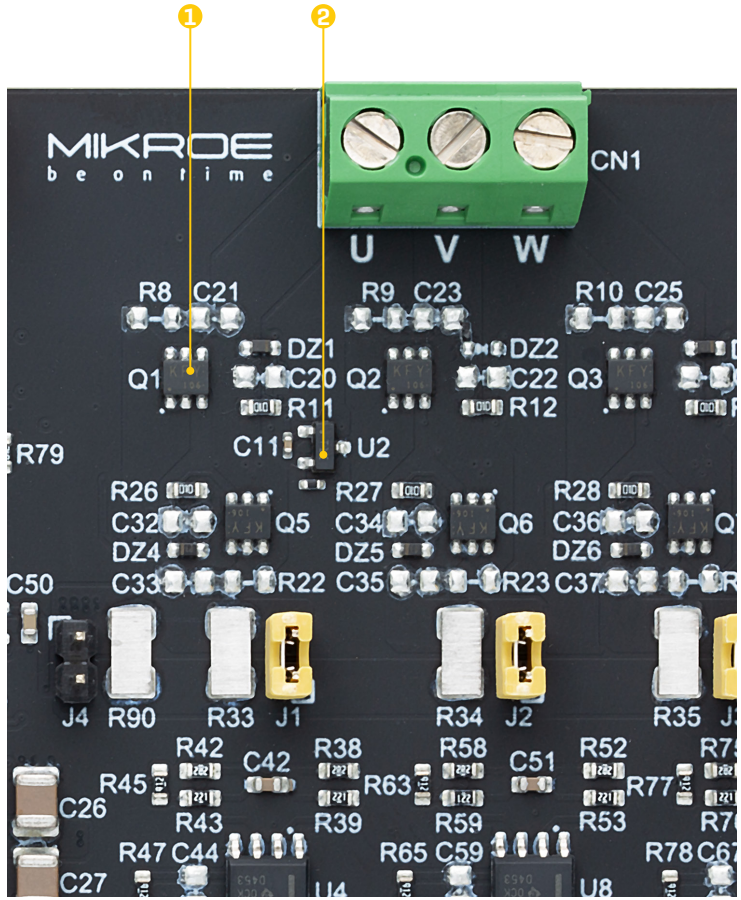


2. MOSFET Power Stage

The 3-phase inverter design is based on the Toshiba's SSM6K819R,LF low RDS(ON) power MOSFETs **(1)**, which meet the increasing need for smaller, efficient MOSFETs, providing the industry leading performance. They are part of Toshiba's smaller package portfolio which offers a wide choice of package sizes ranging from 1 x 1 mm-class ultra-small packages to 3 x 3 mm, which contributes to miniaturization of sets by reducing the mounting area and increasing power density.

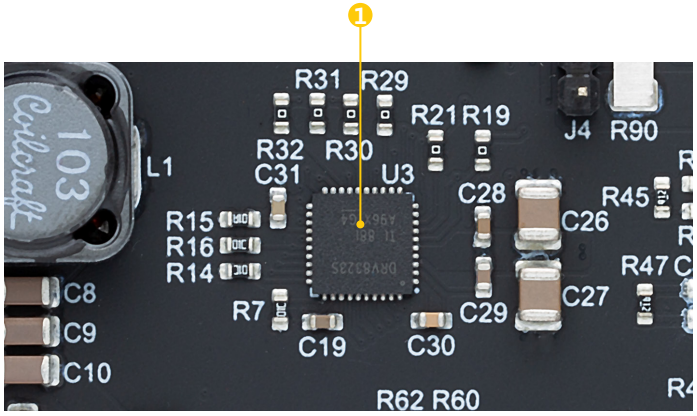
By combining the latest wafer processes with low-resistance packaging technologies, an industry-leading low ON-resistance level MOSFET is achieved.

The LM61 device **(2)**, a precision, integrated-circuit temperature sensor is also in this section, providing a easy to read linear output to acquire board temperature.



3. Integrated Driver

The DRV8323 **(1)** is an integrated gate driver for three-phase motor drive applications. These devices integrate three independent half-bridge gate drivers, charge pump, and linear regulator for the supply voltages of the high-side and low-side gate drivers, and significantly decrease system component count, cost, and complexity. A standard serial peripheral interface (SPI) provides a simple method for configuring the various device settings and reading fault diagnostic information through an MCU on the Clicker 4 board.



The DRV8323 integrates three bidirectional current sense amplifiers for monitoring the current level through each of the external half-bridges using a low-side shunt resistor. The gain setting of the current sense amplifier can be adjusted through the SPI or hardware interface. The SPI method provides additional flexibility to adjust the output bias point.

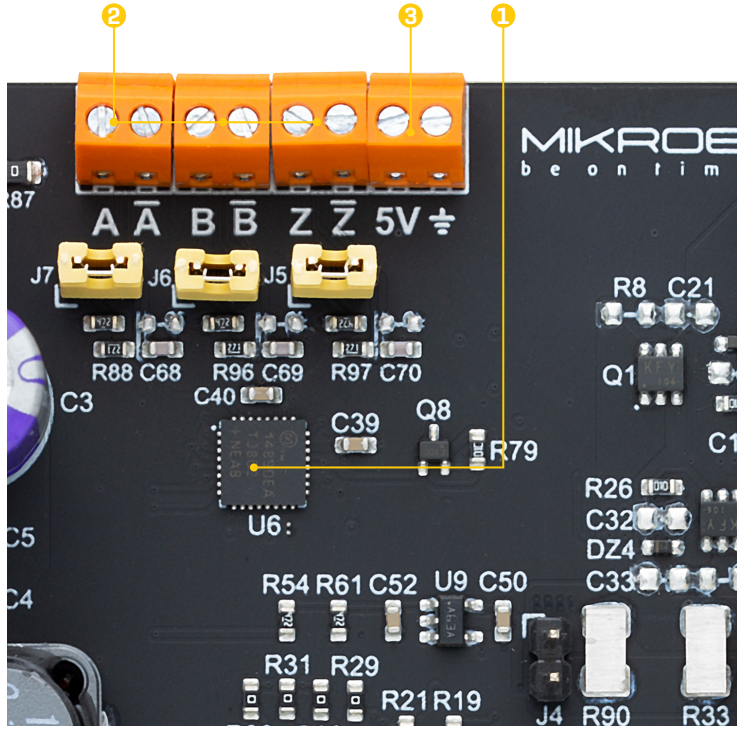
Several on-board jumpers are available to enable either single or three-phase current monitoring. To enable single phase measurement connect jumpers J1, J2, and J3, for three-phase measurement only jumper J4 should be connected. Current monitoring signals are also connected to side headers for external measurement, appropriate SMD jumpers configuration is needed to switch between on-board and external measurement.

Several indication LEDs are available on board, UH (LD4), VH (LD5), WH (LD6) LEDs (Blue) are used to indicate the state of High-side gate driver control inputs. FLT1 LED (Red) is a fault indicator, this LED turns on during a fault condition.

4. Encoder

On board encoder ensures simple processing of the feedback signals. The MAX14890E **[1]** incremental encoder receiver from Maxim Integrated contains four differential receivers and two single-ended receivers. On the Clicker 4 Inverter Shield three differential inputs are exposed over terminal blocks TB2, TB3 and TB4 **[2]**. Additional terminal block TB5 **[3]** provides a 5V power source for externall components. The differential receivers can be operated in RS-422 or differential high-threshold logic (HTL) modes and are optionally configurable for single-ended TTL/HTL operation.

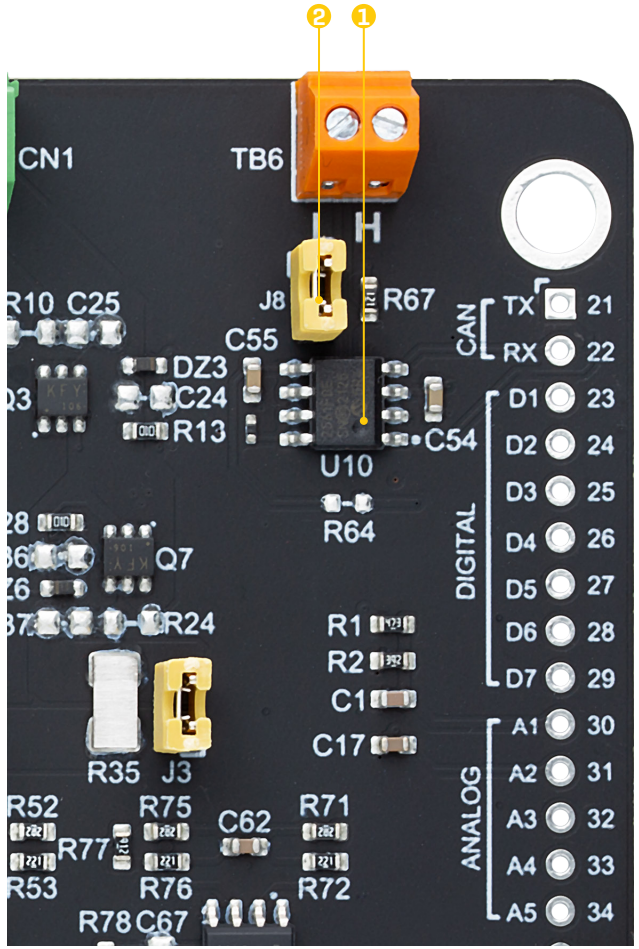
All receiver input signals are fault protected to voltage shorts in the ±40V range. The MAX14890E features a SPI interface connected on the side header of the Inverter Shield, for easy configuring and reading information through an MCU on the Clicker 4 board. The MAX14890E detects common RS-422/HTL/TTL/DI faults. These faults include low differential input signals, open-wire, short-circuits, and inputs voltages that are outside the normal operating voltage range. FLT2 LED (Red) turn on when a fault condition occurs.



5. CAN

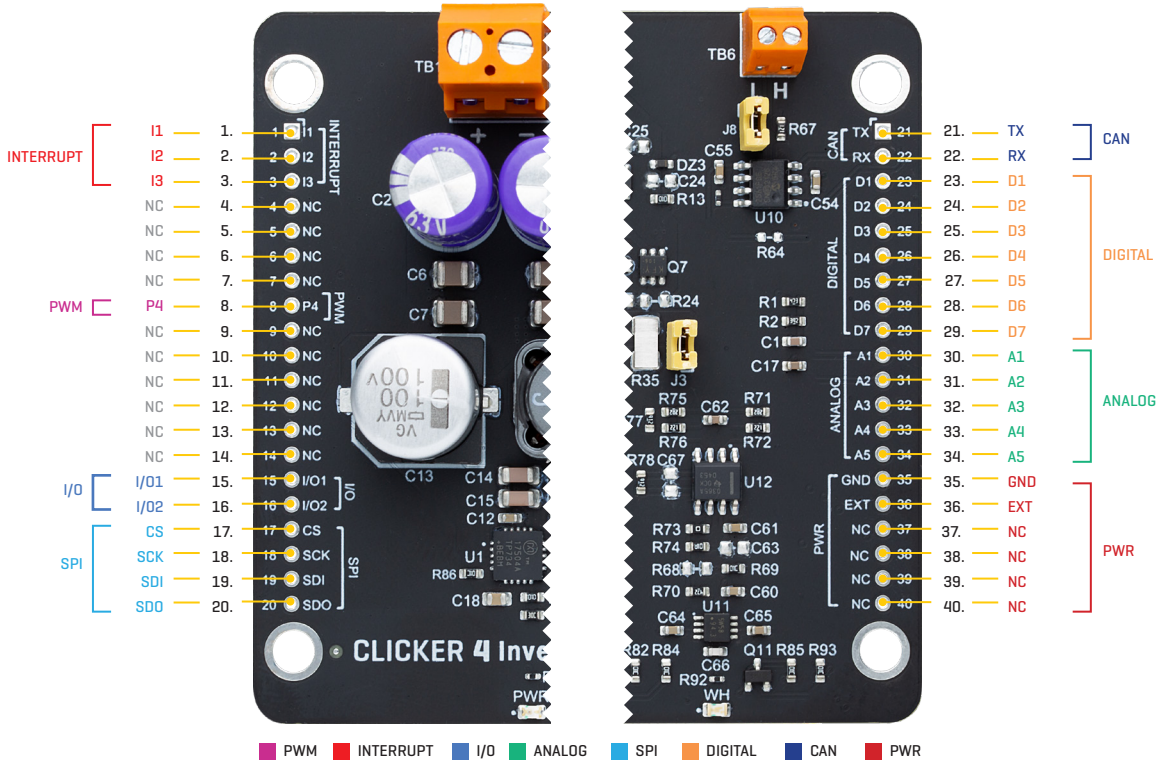
The CAN protocol is an ISO standard (ISO 11898) for serial communication. It is widely used in industrial automation as well as in automotive and mobile machine industry. The MCP2561/2FD **(1)** is a high-speed CAN transceiver from Microchip Technology. The device meets the automotive requirements for CAN FD bit rates exceeding 2 Mbps, low quiescent current, electromagnetic compatibility (EMC) and electrostatic discharge (ESD). CAN network differential signals CANL and CANH are exposed over terminal block TB6, and TX/RX signals are connected to side header.

The jumper labeled as J8 **(2)** is used to enable the 120 Ohm termination resistor.



6. Headers

All important signals are routed to two 1x20 pin headers, making them available for further connectivity.



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