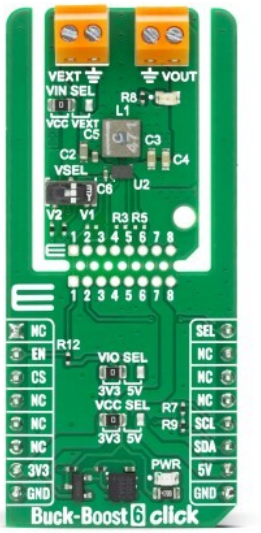
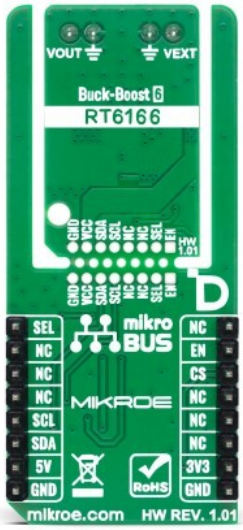
MIKROELEKTRONIKA D.O.O, Batajnički drum 23, 11000 Belgrade, Serbia
VAT: SR105917343 Registration No. 20490918
Phone: + 381 11 78 57 600 Fax: + 381 11 63 09 644 E-mail: office@mikroe.com
www.mikroe.com

Buck-Boost 6 Click





PID: MIKROE-6981

Buck-Boost 6 Click is a compact add-on board designed for regulated DC-DC power conversion in battery-powered and mixed-supply embedded systems. This board is based on the RT6166DP-A, a low-quiescent, high-efficiency single-inductor synchronous buck-boost converter from Richtek. Key features include an input voltage range from 2V to 5.5V, programmable output voltage from 1.8V to 4.975V in 25mV steps, up to 3A output current under suitable conditions, automatic transition between buck, buck-boost, and boost modes, dynamic voltage scaling, ultra-sonic mode, and integrated protection functions. The board supports I2C communication, EN and SEL control pins, external input and output terminals, voltage-selection jumpers, status LEDs, ClickID, and Click Snap support. It is suitable for smartphones, tablets, portable devices, wearable electronics, wireless modules, USB VCONN supplies, point-of-load regulators, and TWS earbud charging cases.

For more information about **Buck-Boost 6 Click** visit the official product page.

How does it work?

Buck-Boost 6 Click is based on the RT6166DP-A from Richtek, a low-quiescent, high-efficiency, single-inductor synchronous buck-boost converter with an I2C interface. The RT6166 is designed to regulate a stable output voltage even when the input voltage is lower than, higher than, or close to the selected output voltage, making it suitable for battery-powered and mixed-supply embedded systems. It operates from an input voltage range of 2V to 5.5V and supports a digitally programmable output voltage from 1.8V to 4.975V in 25mV steps. Depending on the operating conditions, it can deliver up to 3A of output current, making Buck-Boost 6 Click suitable for point-of-load regulation, portable electronics, wireless modules, USB VCONN supplies, wearable devices, and TWS earbud charging cases.

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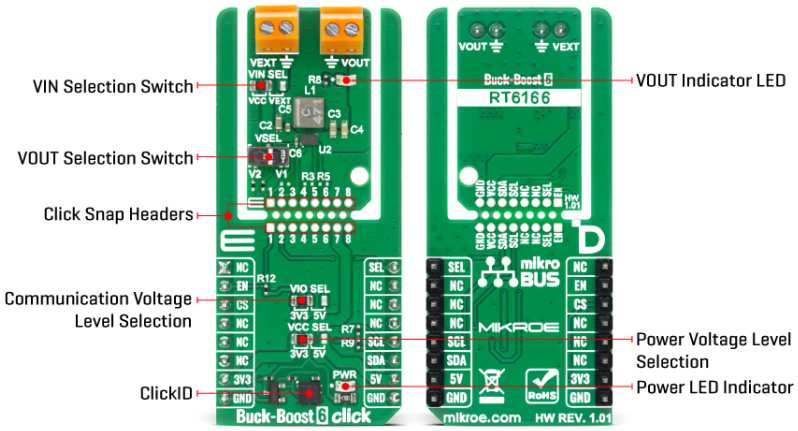

The RT6166 uses Richtek's Advanced Constant On-Time control architecture to provide fast line and load transient response, stable operation with small ceramic capacitors, and transition between buck, buck-boost, and boost operating modes. At light loads, the device operates in automatic PFM mode to maintain high efficiency with very low quiescent current, while at higher loads it automatically switches to fixed-frequency PWM operation at 2.2MHz to reduce output ripple and support compact filtering components. The IC also supports forced PWM operation, ultra-sonic mode, dynamic voltage scaling, programmable slew-rate control, output discharge, and load disconnect during shutdown. Integrated protection functions include overcurrent protection, input undervoltage lockout, over-temperature protection, overvoltage protection, and undervoltage protection, which help improve reliability in portable and embedded power supply designs.

Buck-Boost 6 Click communicates with the host MCU through the mikroBUS™ I2C interface, using the SCL and SDA pins for register-based configuration and status monitoring. Through I2C, the MCU can program the output voltage, configure control modes, adjust dynamic voltage scaling behavior, and read the device status. The RT6166DP-A uses the 0x75 I2C peripheral address. In addition to I2C communication, the board uses the EN pin routed to the mikroBUS™ RST pin to enable or disable the converter, while the SEL line is routed to the mikroBUS™ PWM pin and is used to select between the VOUT1 and VOUT2 output-voltage registers. The CS pin is used for ClickID communication, allowing compatible host systems to identify the board automatically.

This Click board™ includes screw terminal connectors for the external input voltage and regulated output voltage, making it easier to connect external supplies and loads during evaluation or prototyping. The VIN SEL jumper selects whether the converter input is taken from the mikroBUS™ power rail or from the external VEXT terminal. The VCC SEL jumper selects the board supply level, while the VIO SEL jumper selects the communication voltage level for 3.3V or 5V host systems. An onboard VSEL switch provides hardware selection of the active output-voltage setting, while the PWR LED indicates that the board is powered and the VOUT LED provides visual indication of the regulated output. The board also supports Click Snap, allowing the main functional section to be separated from the mikroBUS™ section when required by the application layout.

Buck-Boost 6 Click can use 3.3V or 5V power rails from the mikroBUS™ socket, while the converter input can also be supplied externally through the VEXT terminal, depending on the VIN SEL jumper position. The logic level for communication can be selected between 3.3V and 5V through the VIO SEL jumper, supporting integration with different host MCU platforms. Buck-

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Boost 6 Click comes with a ready-to-use code example that demonstrates board initialization, I2C communication, converter control, output-voltage configuration, and status handling.

Click Snap

Click Snap is an innovative feature of our standardized Click add-on boards, designed to bring greater flexibility and optimize your prototypes. By simply snapping the PCB along predefined lines, you can easily detach the main sensor/IC/module area, reducing the overall size, weight, and power consumption - ideal for the final phase of prototyping. For more details about Click Snap, visit the official page dedicated to this feature.

Specifications

Type	Buck-Boost
Applications	Ideal for smartphones, tablets, portable devices, wearable electronics, wireless modules, USB VCONN supplies, point-of-load regulators, and TWS earbud charging cases
On-board modules	RT6166DP-A - low-quiescent, high-efficiency 3A buck-boost converter from Richtek
Key Features	Single-inductor buck-boost converter, 2V to 5.5V input range, programmable 1.8V to 4.975V output, up to 3A output current, I2C control, automatic buck/boost operation, external input/output terminals, Click Snap support, and more
Interface	I2C
Feature	Click Snap,ClickID
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V or 5V,External

Pinout diagram

This table shows how the pinout on Buck-Boost 6 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
	NC	1	AN	PWM	16	**SEL**	Voltage Output Selection
Enable	**EN**	2	RST	INT	15	NC	
ID COMM	**CS**	3	CS	RX	14	NC	
	NC	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	**SCL**	I2C Clock
	NC	6	MOSI	SDA	11	**SDA**	I2C Data
Power Supply	**3.3V**	7	3.3V	5V	10	**5V**	Power Supply
Ground	**GND**	8	GND	GND	9	**GND**	Ground

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Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
JP1	VCC SEL	Left	Voltage selection jumper
JP2	VIO SLE	Left	Communication voltage level selection jumper
LD2	VOUT	-	VOUT indicator LED
SW1	VSEL	Right	VOUT selection switch
JP3	VIN SEL	Left	VIN selection jumper

Buck-Boost 6 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.3	-	5.5	V
Output current	-	-	3	A
Efficiency	-	-	95	%
Digitally Programmable Steps	-	25mV	-	mV/steps

Software Support

Buck-Boost 6 Click demo application is developed using the NECTO Studio, ensuring compatibility with mikroSDK's open-source libraries and tools. Designed for plug-and-play implementation and testing, the demo is fully compatible with all development, starter, and mikromedia boards featuring a mikroBUS™ socket.

Example Description

This example demonstrates the use of the Buck-Boost 6 Click board for output voltage control. The application periodically sets the output voltage across the supported range and monitors the device status register for fault conditions.

Key Functions

- buckboost6_cfg_setup This function initializes Click configuration structure to initial values.
- buckboost6_init This function initializes all necessary pins and peripherals used for this Click board.
- buckboost6_default_cfg This function executes a default configuration of Buck-Boost 6 Click board.
- buckboost6_set_vout This function sets the VOUT output voltage.
- buckboost6_read_reg This function reads a single byte of data from the selected register.

Application Init

Initializes the logger and Buck-Boost 6 Click driver, and applies the default configuration.

Application Task

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Steps the output voltage from minimum to maximum value, reads the status register, and logs detected faults such as input undervoltage, output undervoltage, overcurrent, thermal shutdown, and power-not-good state.

Application Output

This Click board can be interfaced and monitored in two ways:

- Application Output - Use the "Application Output" window in Debug mode for real-time data monitoring. Set it up properly by following this tutorial.
- UART Terminal - Monitor data via the UART Terminal using a USB to UART converter. For detailed instructions, check out this tutorial.

Additional Notes and Information

The complete application code and a ready-to-use project are available through the NECTO Studio Package Manager for direct installation in the NECTO Studio. The application code can also be found on the MIKROE GitHub account.

Resources

mikroBUS™

mikroSDK

Click board™ Catalog

Click boards™

ClickID

Downloads

Buck-Boost 6 Click example package

Buck-Boost 6 Click 2D and 3D files v101

Buck-Boost 6 Click schematic v101

RT6166DP-A datasheet