

## CHARGER 12 CLICK

PID: MIKROE-3744

Weight: 18 g

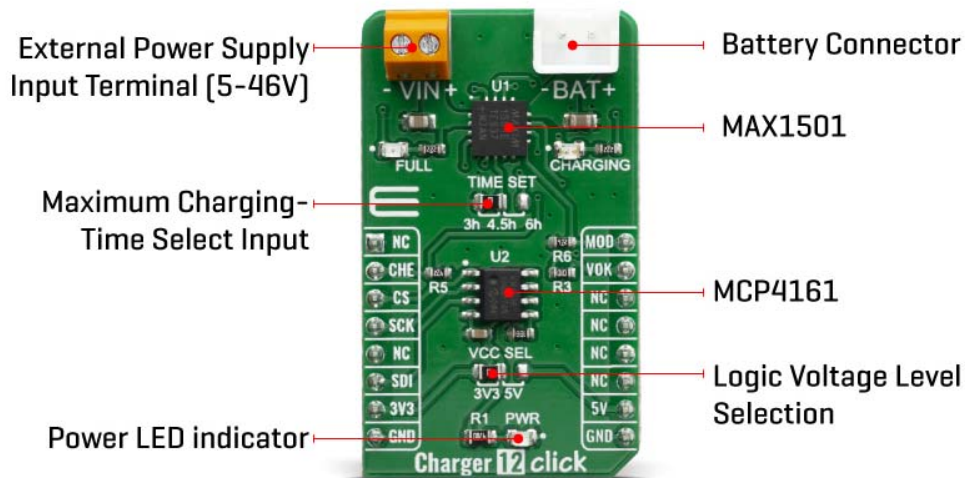
**Charger 12 Click** is a single lithium-ion (Li+) cell or three-cell NiMH/NiCd battery charger. This click can be used for Low-Cost Li-Ion battery chargers, or Power Tools, toys, backup energy storage solutions, etc. Charger 12 click is based on MAX1501 controller which has some extra features enabling charging without too much hassle. This click board has charging current control which uses SPI interface through MCP4161 IC, which is an 8-bit digital potentiometer. On the board, there is a Power LED and two extra LED's which can be used for charging indications.

Charger 12 click is supported by a mikroSDK compliant library, which includes functions that simplify software development. This Click board™ comes as a fully tested product, ready to be used on a system equipped with the mikroBUS™ socket.

As a Lithium Ion batteries require a very accurate current and voltage for charging, Charger 12 click can be a perfect solution for such a task. Charger 12 click is equipped with a highly integrated Li-Ion battery charger, supporting intelligent, constant-current, constant voltage (CCCV), temperature-regulated battery charger charges a single lithium-ion (Li+) cell or three-cell NiMH/NiCd batteries. This click has a charging current control IC over SPI interface which ensures perfect and efficient charging. Charger 12 click can be used as a part of the power supply and distribution system in many applications: different kinds of handheld appliances, portable media players, portable audio players, and other general-purpose battery-operated electronic devices.

## HOW DOES IT WORK?

Charger 12 click is based on the [MAX1501](#) - highly Integrated, linear battery charger with thermal regulation for portable applications, from [Maxim Integrated](#). MAX1501 is an efficient Lithium ion battery charger, thanks to Microprocessor-Controlled specific charge algorithms for Li-Ion batteries to achieve optimal capacity and safety in shortest charging time possible. Along with its small physical size, the low number of external components makes this IC ideally suitable for various applications. The 4.2V factory preset reference voltage simplifies design. The fast charge constant current is set by a digital potentiometer. On this Click it is MCP4161 – an 8-bit digital potentiometer from Microchip, with external 1.5KΩ resistor in series. Thanks to proprietary programmable die temperature regulation, MAX1501 can limit the charge current based on the temperature during high power or high ambient conditions. This thermal regulation optimizes the charge cycle time while maintaining device reliability.



The MAX1501 IC is designed with reliability in mind: the IC prevents draining the battery below the critical level, protects it from overheating (if thermistor is used), offers prequel charging (for deeply depleted batteries), features an overvoltage protection, charging status monitoring and so on. The Click board™ itself is equipped with a set of indicators used to monitor both charging process and power distribution.

- CHARGE LED indicates the charge-in-progress status.
- FAULT LED indicates an error during charging process.

The digital potentiometer on Charger 12 click is MCP4161 which offers a wide range of product offerings using a SPI interface. WiperLock technology allows application-specific calibration settings to be secured in EEPROM. This digital pot is tied with charger IC over its wiper (POW) pin. By assigning values on MCP4161 from 0 to 10 kilo ohms battery charging can be controlled. As there is a 1.5K resistor in series it can never be 0 ohms on MAX1501 chargers PROG pin. However, maximum resistance cannot exceed 11.5 kilohms. Fast charging can be regulated with 10K on PROG pin to get 130 mA. To get 1000 mA digital potentiometer needs to go down to 0 ohm, along with external resistor, which makes 1,5 K. Communication with digital potentiometer on this Click and that way controlling the charger is done through SPI interface.

On the left side of the click board is an input screw terminal with corresponding markings, where the recommended external voltage of 6V can be applied. The left screw terminal is reserved for a Lithium Iron Phosphate battery with GND and VBAT+ markings. When connected to power source, the green PWR LED will indicate it. Red LED1 and green LED2 can be used for visual charge monitoring. As those two LEDs are multipurpose, they can be used for various things.

The voltage range which can be used to power up the BATT-MON click, allows for it to work with both 3.3V and 5V capable MCUs. It can be selected by soldering a small SMD jumper, labeled as VCC SEL to the correct position.


## SPECIFICATIONS

<b>Type</b>	Battery charger
<b>Applications</b>	Charger 12 is a perfect choice for development lithium-ion (Li+) cell or three-cell NiMH/NiCd battery charging applications.
<b>On-board modules</b>	MAX1501, highly Integrated, linear battery charger with thermal regulation for portable applications, from Maxim Integrated.
<b>Key Features</b>	Intelligent, constant-current, constant voltage (CCCV), temperature-regulated battery charger
<b>Interface</b>	GPIO,SPI

<b>Click board size</b>	M (42.9 x 25.4 mm)
<b>Input Voltage</b>	3.3V,5V

## PINOUT DIAGRAM

This table shows how the pinout on Charger 12 click corresponds to the pinout of the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin					Pin	Notes
	NC	1	AN	PWM	16	<b>MOD</b>	Mode Select Input
Charging Enable	<b>CHE</b>	2	RST	INT	15	<b>VOK</b>	Input Voltage Range
Chip Enable	<b>SDN</b>	3	CS	RX	14	NC	
Serial Clock	<b>SCK</b>	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	NC	
Serial Data In	<b>SDI</b>	6	MOSI	SDA	11	NC	
Power Supply	<b>3.3V</b>	7	3.3V	5V	10	<b>5V</b>	Power Supply
Ground	<b>GND</b>	8	GND	GND	9	<b>GND</b>	Ground

## SOFTWARE SUPPORT

We provide a library for the Charger 12 click on our [LibStock](#) page, as well as a demo application (example), developed using MikroElektronika [compilers](#). The demo can run on all the main MikroElektronika [development boards](#).

## Library Description

Library contains functions for getting and setting GPIO pin states Library contains function for mode selection Library contains function for SPI transfer operation Library contains function for SPI get register operation Library contains functions for incrementing and decrementing wiper position

Key functions:

- `uint8_t charger12_mode_select( uint8_t mode_select )` - selects device operation mode by setting RST(CHGEN) and PWM(MODE) pins
- `void charger12_spi_increment_wiper( void )` - increments wiper position by sending 8bit increment wiper command
- `void charger12_spi_decrement_wiper( void )` - decrements wiper position by sending 8bit decrement wiper command

## Examples description

The application is composed of three sections :

- System Initialization - Initializes GPIO pins, SPI and LOG modules
- Application Initialization - Initializes SPI driver
- Application Task - Executes additional functions based on user input

```
void applicationTask( )
{
    uart_ready = UART_Data_Ready( );

    if (uart_ready == 1)
    {
        uart_char = UART_Read( );

        switch (uart_char)
        {
            case '+' :
            {
                charger12_case_Plus( );
                break;
            }
            case '-' :
            {
                charger12_case_Minus( );
```

```

        break;
    }
    case '1' :
    {
        charger12_case_One( );
        break;
    }
    case '2' :
    {
        charger12_case_Two( );
        break;
    }
    case '3' :
    {
        charger12_case_Three( );
        break;
    }
    case '4' :
    {
        charger12_case_Four( );
        break;
    }
    default :
    {
        mikrobus_logWrite( "> Invalid command", _LOG_LINE );
        break;
    }
}
}
}

```

#### Additional Functions :

- charger12\_case\_Plus() - Increments Wiper position
- charger12\_case\_Minus() - Decrements Wiper position
- charger12\_case\_One() - Selects 1st mode of operation
- charger12\_case\_Two() - Selects 2nd mode of operation

- charger12\_case\_Three() - Selects 3rd mode of operation
- charger12\_case\_Four() - Selects 4th mode of operation

The full application code, and ready to use projects can be found on our [LibStock](#) page.  
Other mikroE Libraries used in the example:

- SPI
- UART
- Conversions

### Additional notes and informations

Depending on the development board you are using, you may need [USB UART click](#), [USB UART 2 click](#) or [RS232 click](#) to connect to your PC, for development systems with no UART to USB interface available on the board. The terminal available in all MikroElektronika [compilers](#), or any other terminal application of your choice, can be used to read the message.

## MIKROSDK

This Click board™ is supported with [mikroSDK](#) - MikroElektronika Software Development Kit. To ensure proper operation of mikroSDK compliant Click board™ demo applications, mikroSDK should be downloaded from the [LibStock](#) and installed for the compiler you are using.

For more information about mikroSDK, visit the [official page](#).



<https://www.mikroe.com/charger-12-click/9-25-19>