



BALANCER 3 CLICK PID: MIKROE-3737 Weight: 22 g

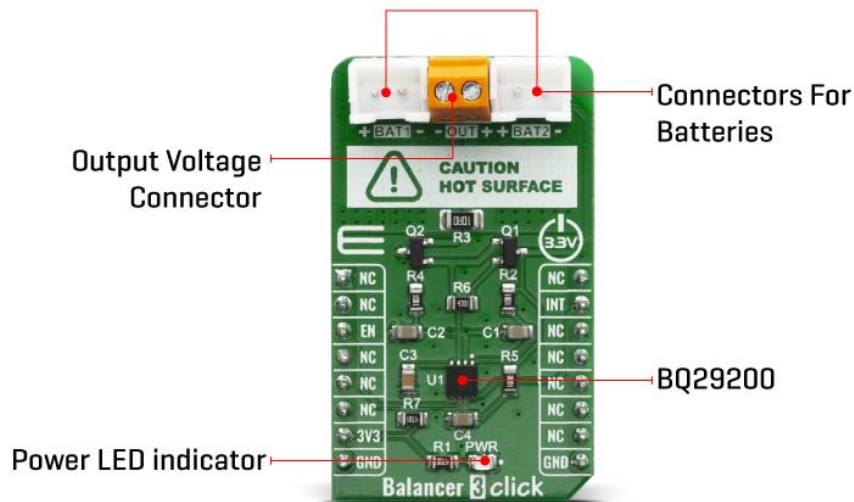
Balancer 3 Click is overvoltage protection device for 2-series cell lithium-ion battery packs that incorporates a high-accuracy precision overvoltage detection circuit and automatic cell imbalance correction. It can be used for various applications, ranging from smartphones, notebook / laptops, power tools, portable equipment and instrumentation, to energy storage systems (ESS), while providing the output voltage at the same time.

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

Features like the automatic cell imbalance correction, external capacitor-controlled delay timer, external resistor-controlled cell balance current, and low power consumption make the Balancer 3 click specialized two batteries balancer, used to provide the same voltage on two in-series cells of Li-Ion Batteries. Balancer 3 click, combined with a LiPo/Li-Ion battery charger can be used in a wide range of applications that can benefit from reliable and efficient battery charging circuit, like the mobile phones, multimedia players, digital cameras, portable medical equipment, and many more.

HOW DOES IT WORK?

The core component of Balancer 3 click is the BQ29200, Voltage Protection with Automatic Cell Balance for 2-Series Cell Li-Ion Batteries from Texas Instruments. It includes all necessary components for the BQ29200 to ensure the proper functionality of the Click board™ and maintain the monitoring precision. Therefore, Balancer 3 click has two separate onboard battery connectors, as well as output voltage screw terminal, to ensure the straight forward connecting of peripherals, and therefore the ease of use.



The BQ29200 can operate in two different modes: internal cell balancing mode and external cell balancing mode. When internal cell balancing mode is used, the BQ29200 is capable of handling up to 15 mA of balancing current. Although it is enough for many use-cases, this Click board™ is operating in external cell balancing mode, in which the external MOSFETs are used to regulate the balancing current. More precisely, one N-type MOSFET is wired between the positive and middle point of the batteries, and one P-type MOSFETs is wired between the middle point of the batteries and the ground. Resistor R3 is connected in series between the batteries and the middle point of the MOSFETs, and therefore limits the maximum balancing current, which is by default about 350mA.

The voltage of each cell in a 2-series cell battery pack is compared to an internal reference voltage. If either cell reaches an overvoltage condition, the BQ29200 device starts a timer that provides a delay proportional to the capacitance on the CD pin. Upon expiration of the internal timer, the OUT pin changes from low to high state. Therefore, the OUT pin from the bq29200 is connected to the INT pin of the mikroBUS™ socket, enabling the user to write the desired interrupt routine in case of battery overvoltage, as well as disable the device, using the CS pin of the mikroBUS™.

The Click board™ is designed to work with 3.3V only. When using it with MCUs that use 5V levels for their communication, a proper level translation circuit should be used.

SPECIFICATIONS

Type	Battery charger
Applications	Balancer 3 click can be used for smartphones, notebook / laptops, power tools, portable equipment and instrumentation, to energy storage systems (ESS)
On-board modules	BQ29200, Voltage Protection with Automatic Cell Balance for 2-Series Cell Li-Ion Batteries from Texas Instruments
Key Features	Balancer click features automatic cell imbalance correction, external capacitor-controlled delay timer, external resistor-controlled cell balance current, and low power consumption
Interface	GPIO
Click board size	M (42.9 x 25.4 mm)
Input Voltage	3.3V

PINOUT DIAGRAM

This table shows how the pinout on Balancer 3 click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin					Pin	Notes
		1	AN	PWM	16		
	NC	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	INT	Interrupt Out
Enable	EN	3	CS	RX	14	NC	

	NC	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	NC	
	NC	6	MOSI	SDA	11	NC	
Power Supply	3.3V	7	3.3V	5V	10	NC	
Ground	GND	8	GND	GND	9	GND	Ground

ONBOARD SETTINGS AND INDICATORS

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
BAT1	BAT1	-	Battery connector
BAT2	BAT2	-	Battery connector
TB1	OUT	-	Output voltage terminal block

BALANCER 3 CLICK ELECTRICAL SPECIFICATIONS

Description	Min	Typ	Max	Unit
Operating current consumption	-	-	3	μA
Battery balancing current	300	-	450	mA
Overvoltage Protection accuracy	-	25	-	mV

SOFTWARE SUPPORT

We provide a library for the Balancer 3 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

This library allows user to perform a control of the Balancer 3 Click board and to check the Overvoltage condition status. This click also can be used for power supply with the voltage range from 6V to 8.4V. For more details check documentation.

Key functions:

- `void balancer3_gpioDriverInit(T_BALANCER3_P gpioObj)` - This function initializes GPIO driver.
- `void balancer3_enable_cell_balance(uint8_t state)` - This function allows user to enable or disable Cell Balance (cell mismatch correction circuitry).
- `uint8_t balancer3_check_overvoltage_cond(void)` - This function checks the Overvoltage condition.

Examples description

The application is composed of three sections :

- System Initialization - Initializes peripherals and pins.
- Application Initialization - Initializes GPIO driver and sets the time interval variable (`time_inter`) to the 0, which is used for OV condition message logging.
- Application Task - (code snippet) - Allows user to enter a commands that can enable or disable cell balance and check the overvoltage condition. When OV condition is not detected, the status message will be sent after every 8 seconds. When OV condition is detected, the status message will be sent after every 2 seconds. Press '0' when you want to disable cell balance. Press '1' when you want to enable cell balance. Press '2' when you want to check the OV condition status immediately. Note : The voltage of each cell in a 2-series cell battery pack is compared to an internal reference voltage. If either cell reaches an overvoltage condition, the Balancer 3 click starts a timer that provides a delay proportional to the capacitance on the CD pin, in our example it's about 2 seconds. Upon expiration of the internal timer, the OV condition will be detected. If enabled, the Balancer 3 click performs automatic cell imbalance correction where the two cells are automatically corrected for voltage imbalance by loading the cell with the higher charge voltage with a small balancing current. When the cells are measured to be equal within nominally 0 mV, the load current is removed. It will be re-applied if the imbalance exceeds nominally 30 mV. The cell mismatch correction circuitry is controlled by the user.

```
void applicationTask()
{
    rx_dat = UART_Rdy_Ptr();

    if (rx_dat != _RX_NOT_READY)
```

```

{
    rx_dat = UART_Rd_Ptr();

    switch (rx_dat)
    {
        case '0' :
        {
            balancer3_enable_cell_balance( _BALANCER3_CELL_BALANCE_DIS );
            mikrobus_logWrite( "* Cell balance is disabled *", _LOG_LINE );
            break;
        }
        case '1' :
        {
            balancer3_enable_cell_balance( _BALANCER3_CELL_BALANCE_EN );
            mikrobus_logWrite( "* Cell balance is enabled *", _LOG_LINE );
            break;
        }
        case '2' :
        {
            time_inter = 8000;
            break;
        }
        default :
        {
            break;
        }
    }
}

ov_cond = balancer3_check_overnoltage_cond();

if ((time_inter == 8000) || (ov_cond == _BALANCER3_OV_COND_DETECTED))
{
    if (ov_cond == _BALANCER3_OV_COND_NOT_DETECTED)
    {
        mikrobus_logWrite( "* Overvoltage condition is not detected *", _LOG_LINE );
        time_inter = 0;
    }
}

```

```

    }
    else if (time_inter > 2000)
    {
        mikrobus_logWrite( "* Overvoltage condition is detected *", _LOG_LINE );
        time_inter = 0;
    }
    else
    {
        time_inter++;
    }
}
else
{
    time_inter++;
}

Delay_ms( 1 );
}

```

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

- UART

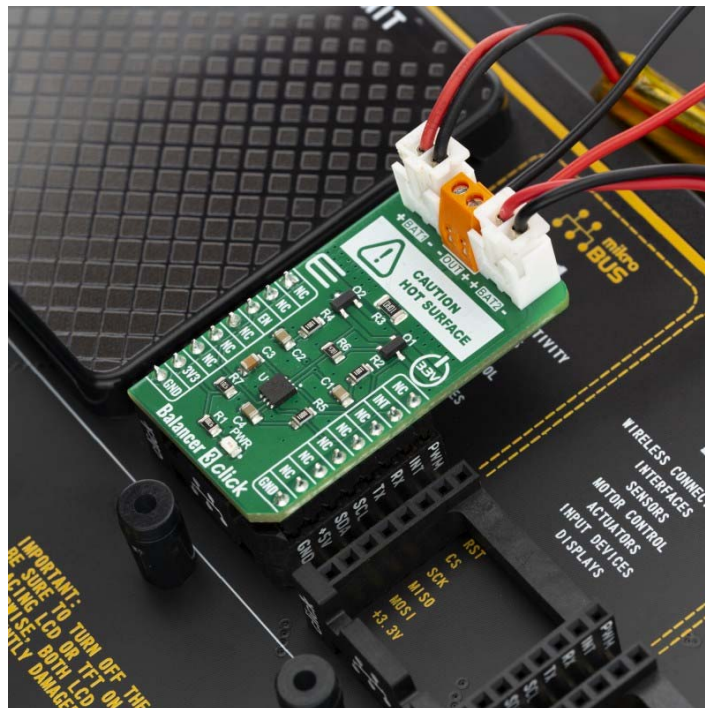
Additional notes and informations

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/balancer-3-click/9-20-19>