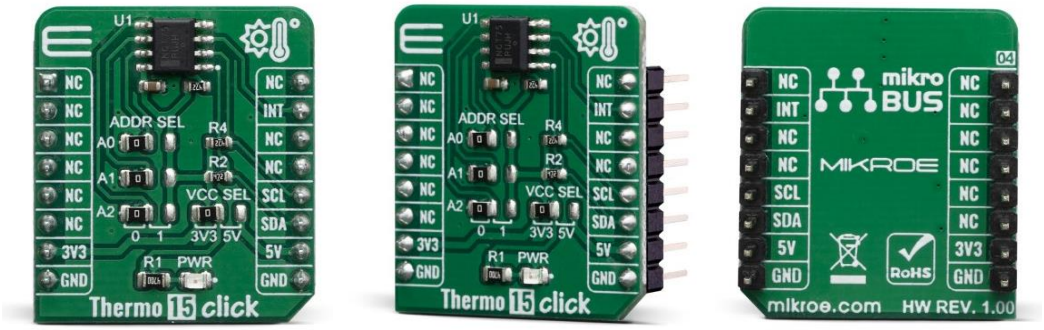


THERMO 15 CLICK

PID: MIKROE-3658
Weight: 17 g

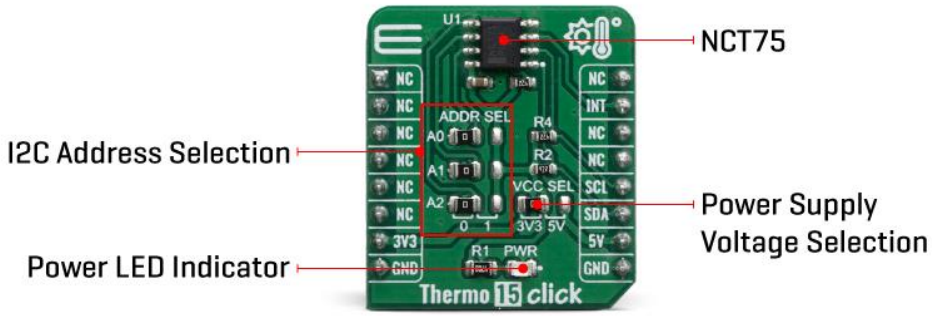
Thermo 15 Click is a Click board™ equipped with the sensor IC, which can digitize temperature measurements between -55°C and +125°C so that the temperature measurement data can be processed by the host MCU. Thermo 15 click provides an accuracy of ±1°C in the range from 0°C to 70°C. The sensor used on this Click board™ has a great combination of features that make it a perfect choice for any temperature measurement application: low temperature drift, low power consumption, programmable alert engine, compact sensor size, critical temperature warnings, and more. The sensor itself requires almost no external components, which simplifies the design, reducing the cost and cutting the time to market.

Thermo 15 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.

The Click board™ is specially designed so it retains the specified characteristics of the sensor IC. Equipped with this sophisticated, accurate and simple to use sensor IC, it can be used for measuring and monitoring the temperature in a whole range of applications, such as the PC case and other internal components temperature monitoring, office equipment and entertainment systems thermal monitoring, general purpose thermal measurement, and similar digital thermal measurement applications, that require a precise thermal measurement and an overtemperature alert.

HOW DOES IT WORK?

The active temperature sensing component on Thermo 15 click is the NCT75, a high accuracy temperature sensor IC with the 2-Wire interface, from ON Semiconductor. The Click board™ itself has a reasonably small number of components because most of the measurement circuitry is already integrated on the NCT75 sensor. The I2C / SMBus compatible serial interface lines, along with the INT pin, which also works in the open drain configuration, are pulled up by the onboard resistors. The 2-Wire lines are routed to the respective I2C lines of the mikroBUS™ (SCK and SDA), while the INT pin is routed to the INT pin of the mikroBUS™



The sensor IC uses the I2C/SMBus compatible communication interface. There are six registers for configuring and reading the teperature: the address pointer register, 4 data registers and a one-shot register. The address pointer register is used to select which register is to respond to a read or write operation. The data registers are used to set the high and low temperature limits, temperature hysteresis for the interrupt events, and all the working parameters. One of the data registers is Stored Temperature as well, used to store the sampled temperature data. The measured temperature is stored in this 16-bit read only register in twos complement format with the MSB as the sign bit.

More information about all the registers can be found in the NCT75 datasheet. However, provided library contains functions that simplify the use of the Thermo 15 click. The included application example demonstrates their functionality and it can be used as a reference for custom design.

An analog signal from the thermal sensor is sampled by the internal ADC converter, with the resolution of 12 bits. Thanks to high resolution ADC, the step size can be as small as 0.0625°C. If an 8 bit (1°C resolution) reading is required then a single byte read is sufficient. The INT pin is used to trigger an interrupt event on the host MCU. This pin can operate in two different modes – overtemperature mode and SMBus alert mode. Since the Click board™ features a pull-up resistor, it is advised to set the polarity so that the asserted state drives the pin to a LOW logic level. A critical temperature values are stored in the data registers.

The INT pin can operate in comparator and interrupt event modes. When working in the Comparator mode, these pins will be triggered whenever a temperature limit is exceeded. The pins stays asserted until the temperature drops below the hysteresis level. Both values are set in the respective temperature registers (limit and hysteresis). This mode is useful for thermostat-like applications: it can be used to power down a system in case of overheating or turn off the cooling fan if the temperature is low enough.

If set to work in the therm mode, the INT pin will stay asserted when the temperature exceeds the value in the high limit register. When the temperature drops below the hysteresis level, the INT pin will be cleared. This mode is used to trigger an interrupt on the host MCU, which is supposed to read the sensor when the interrupt event is generated.

The device can be set to work in several different power modes. It can be set to continuously sample the temperature measurements, it can be set to work in the one-shot mode, and it can be set to stay in the shutdown mode. The shutdown mode consumes the least power, keeping all the internal sections but the communication section, unpowered. The one-shot mode allows the device to stay in the shutdown mode, run a single conversion cycle on demand, and the revert back to the shutdown mode. This allows for a lower power consumption. The design of the Click board™ itself is such that the thermal radiation from other components, which might affect the environmental temperature readings of the sensor, is reduced. The onboard SMD jumper labeled as VCC SEL allows voltage selection for interfacing with both 3.3V and 5V MCUs, while the ADDR SEL jumpers allows the user to switch between different I2C addresses.

SPECIFICATIONS

Type	Temperature
Applications	It can be used for the PC case temperature monitoring, office equipment, and entertainment systems thermal monitoring, general purpose thermal measurement, etc.
On-board modules	NCT75, a high accuracy temperature sensor IC with the 2-Wire interface, from ON Semiconductor.
Key Features	Low temperature drift, low power consumption, programmable alert engine, compact sensor size, critical temperature warnings, and more.

Interface	I2C
Input Voltage	3.3V or 5V
Click board size	S (28.6 x 25.4 mm)

PINOUT DIAGRAM

This table shows how the pinout on Thermo 15 click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin					Pin	Notes
	NC	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	**INT**	Interrupt output
	NC	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

ONBOARD SETTINGS AND INDICATORS

Label	Name	Default	Description
JP1-3	ADDR SEL	Left	I2C address selection: left position 0, right position1
JP4	VCC SEL	Left	Power supply voltage selection: left position 3V3, right position 5V
LD1	PWR	-	Power LED indicator

THERMO 15 CLICK ELECTRICAL SPECIFICATIONS

Description	Min	Typ	Max	Unit
Temperature Range (accuracy ±0.25˚C)	-55	-	+125	°C
Temperature Range (accuracy ±1˚C)	0	-	70	°C
Communication speed	0	-	400	kHz

SOFTWARE SUPPORT

We provide a library for the Thermo 15 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
The library initializes and defines the I2C bus driver and drivers that offer a choice for read data form register. The library includes function for read Temperature data and function for read and set temperature hysteresis and limit. The user also has the function for configuration chip and read Interrupt (INT pin) state.

Key functions:

- `float thermo15_getAmbientTemperatureData(uint8_t tempIn)` - Ambient temperature data.
- `void thermo15_setTempRegister(uint8_t tempReg, float temp)` - Set temperature register.
- `void thermo15_configuration(uint8_t cfgData)` - Configuration register.

Examples description

The application is composed of three sections :

- System Initialization - Initializes I2C module and sets INT pin as INPUT.
- Application Initialization - Initializes the driver init, configures the module and reads the temperature hysteresis and limit values that are set.
- Application Task - Reads ambient temperature data and this data logs to USBUART every 1500ms.

```
void applicationTask()
{
    float Temperature;


    Temperature = thermo15_getAmbientTemperatureData( _THERMO15_TEMP_IN_CELSIUS );
    FloatToStr(Temperature, demoText);
    mikrobus_logWrite("** Temperature : ", _LOG_TEXT);
    mikrobus_logWrite(demoText, _LOG_LINE);


    mikrobus_logWrite( " ---------------------------- ", _LOG_LINE);


    Delay_ms( 1500 );
}
```

The full application code, and ready to use projects can be found on our LibStock page.

Other mikroE Libraries used in the example:

- I2C Library.
- UART Library.
- Conversions Library.

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.

DOWNLOADS

mikroBUS™ Standard specification

LibStock: mikroSDK

Click board catalog

Thermo 15 click Libstock

NCT75 datasheet

Thermo 15 click 2D and 3D files

Thermo 15 click schematic