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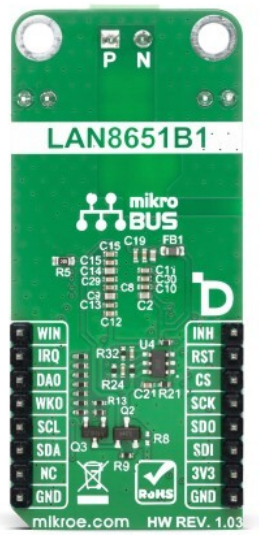
Two-Wire ETH 3 Click



PID: MIKROE-6550

Two-Wire ETH 3 Click is a compact add-on board designed for single-pair Ethernet connectivity in industrial and embedded systems, providing 10BASE-T1S communication over a single balanced pair of conductors for long-reach and noise-resilient networking. The board is based on the LAN8651B1 single-port 10BASE-T1S MAC-PHY Ethernet controller with SPI interface from Microchip, developed in compliance with IEEE 802.3cg and OPEN Alliance TC-6 specifications. By integrating both MAC and PHY in a single low-power device, the LAN8651B1 allows low-cost MCUs to directly access 10BASE-T1S networks via a high-speed SPI interface, supporting 10Mbit/s half-duplex communication, cut-through data transfer for reduced latency, and industrial-grade EMC and EMI compliance. A key feature of this Click board is the inclusion of an industrially isolated output stage using a WE-STST signal transformer (74930030) from Würth Elektronik, ensuring high galvanic isolation, long-distance signal integrity, and PoE capability. This Click board is ideally suited for industrial automation, factory networking, building automation, and other applications requiring robust, long-reach Ethernet communication over single-pair cabling.

For more information about **Two-Wire ETH 3 Click** visit the official product page.

How does it work?

Two-Wire ETH 3 Click is based on the LAN8651B1, a low-power, single-port 10BASE-T1S MAC-PHY Ethernet controller with SPI interface from Microchip, developed in accordance with IEEE Std 802.3cg-2019 and OPEN Alliance TC-6 10BASE-T1x MAC-PHY Serial Interface specifications. By integrating both the Media Access Controller and PHY in a single device, the LAN8651B1 enables low-cost microcontrollers to directly access 10BASE-T1S networks, supporting 10Mbit/s half-duplex data transmission and reception over a single balanced pair of conductors

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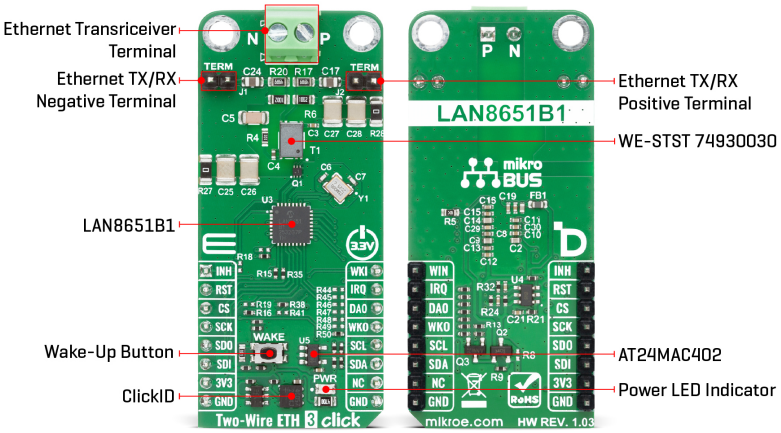
connected to the onboard Ethernet terminal. This architecture significantly reduces system complexity while maintaining reliable communication, and the device is fully compliant with stringent industrial EMC and EMI requirements, making it suitable for use in industrial and functional safety-related environments.



The most important design feature is the addition of an industrially isolated output stage using the 74930030 WE-STST signal transformer from Würth Elektronik, providing enhanced galvanic isolation and signal integrity for industrial installations. The WE-STST transformer like this one is optimized for long-reach, high-speed communication, allowing data transmission over extended distances without compromising performance or reliability, and supports applications such as industrial communication networks across large facilities, SHDSL-based long-distance links, and telecom infrastructure where stable and noise-resistant signal transformation is critical. The integrated transformer supports data rates up to 10/100/1GBase-T, features a 1:1 turns ratio with 350µH inductance, and enables Power over Ethernet support up to 350mA, ensuring efficient signal coupling, low insertion loss, and high isolation levels.

The LAN8651B1 communicates with the host MCU through a standard Serial Peripheral Interface (SPI) supporting high clock speed up to 25MHz. Ethernet data transfer as well as command/status commands are performed over a single, serial interface. The serial interface allows of both transmit and receive packets simultaneously between the station controller and the LAN8651B1. Packets are typically stored within the LAN8651B1 before being forwarded to either the station MCU or the network. Alternatively, packets may be transferred in a cut-through mode, with minimal buffering, for applications needing reduced latency. In addition to the Ethernet terminal mentioned above, this board has two jumper settings for enabling termination at the ends of a 10BASE-T1S segment. Both jumpers must be populated to allow edge termination.

Alongside SPI pins of the mikroBUS™ socket, this Click board™ also has a multi-function interrupt IRQ pin, GPIO interface on DA0 and WK0, and a general reset signal to reset the LAN8651B1. In addition to hardware reset, the possibility of a Power-On reset is also provided, achieved using the MIC2790. It also has a Wake-Up function, accomplished by the WKI pin or the WAKE button, and an additional INH output pin used to control the shutdown behavior of external voltage regulators. To make identification as simple as possible, this board also has an additional EEPROM memory, the AT24MAC402, accessible via the I2C interface.

NOTE: To enable the general-purpose I/O functionality on the WK0 pin, a 0Ω resistor must be populated in the corresponding resistor footprint for that signal on the board.

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This Click board™ can only be operated with a 3.3V logic voltage level. The board must perform appropriate logic voltage level conversion before using MCUs with different logic levels.

Specifications

Type	Ethernet
Applications	Ideal for industrial automation, factory networking, building automation, and other applications requiring robust, long-reach Ethernet communication over single-pair cabling
On-board modules	LAN8651B1 - single-port 10BASE-T1S MAC-PHY Ethernet Controller with SPI from Microchip 74930030 - WE-STST signal transformer with PoE from Würth Elektronik
Key Features	Single-port 10BASE-T1S MAC-PHY Ethernet controller with SPI interface, compliance with IEEE 802.3cg-2019 and OPEN Alliance TC-6 specifications, integrated MAC and PHY enabling direct MCU connection, 10Mbit/s half-duplex communication over a single balanced pair, industrial-grade galvanic isolation using a WE-STST signal transformer, long-reach and noise-resistant signal transmission, and more
Interface	GPIO,I2C,SPI
Feature	ClickID
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V

Pinout diagram

This table shows how the pinout on Two-Wire ETH 3 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
Power Inhibit Output	**INH**	1	AN	PWM	16	**WKI**	Wakeup Input
Reset / ID SEL	**RST**	2	RST	INT	15	**IRQ**	Interrupt
SPI Select / ID COMM	**CS**	3	CS	RX	14	**DA0**	Digital I/O
SPI Clock	**SCK**	4	SCK	TX	13	**WK0**	Wake Output / Digital I/O
SPI Data OUT	**SDO**	5	MISO	SCL	12	**SCL**	I2C Clock
SPI Data IN	**SDI**	6	MOSI	SDA	11	**SDA**	I2C Data
Power Supply	**3.3V**	7	3.3V	5V	10	NC	
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

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Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
T1	WAKE	-	Wakeup Button

Two-Wire ETH 3 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	-	3.3	-	V
Ethernet Data Rate	-	10	-	Mbit/s
Transformer Inductance	-	350	-	µH

Software Support

This Click board currently comes without dedicated MIKROE mikroSDK support in the form of libraries, functions, or example code. The software support is provided by our development partner on this project - Microchip. Please visit the Microchip's LAN8651B1-E/LM product page or Github repository to get protocol driver support for this IC.

For Technical support questions, the customers can submit a support case to Microchip by following the procedure.

Resources

mikroBUS™

Click board™ Catalog

Click boards™

ClickID

Downloads

AT24MAC402 datasheet

MIC2790 datasheet

Two-Wire ETH 3 click 2D and 3D files v103

Two-Wire ETH 3 click schematic v103

LAN8651B1 datasheet

74930030 datasheet