IKΛLOGIC

SE254

Datasheet and user manual

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SE254 Overview

SE254 is a compact, affordable 4-channel logic analyzer designed specifically for education, hobbyists, and entry-level embedded systems debugging. It offers reliable performance with a maximum sampling frequency of 250 MHz (4 ns timing resolution) on all four channels. The device connects to a host computer via a USB 2.0 interface, making it suitable for educational environments where simplicity, reliability, and affordability are key.

SE254 is designed to be user-friendly, with a simple setup process and intuitive software interface. It is ideal for capturing and analyzing digital signals in various applications, including basic embedded systems debugging, learning serial protocol analysis (I2C, SPI, UART, etc.), and general electronics teaching.

SE254 is equipped with a single adjustable logic threshold level, allowing users to fine-tune the input signal levels from 1.2 V to 5 V in 100 mV increments. This feature enhances the device's versatility, enabling it to work with a wide range of digital signals.

Thanks to Flexitrig® technology, SE254 allows sophisticated triggering capabilities, enabling users to capture specific events or patterns in the digital signals. This feature is particularly useful for debugging complex systems where rare events need to be captured.

Like all other Ikalogic products, SE254 is designed to function with **_ScanaStudio_** software, which provides a powerful and user-friendly interface for capturing, analyzing, and visualizing digital signals. ScanaStudio is available for Windows, macOS, and Linux operating systems.

Principle of operation

SE254 Logic Analyzer connects to a computer via a USB cable. A free software - called ScanaStudio - is used to configure the device and display captured signals. The software can also be used to further analyze the captured samples by decoding protocols like I2C, SPI or UART.

This diagram shows a simple setup where the SE254 (2) is attached a computer (1) via a USB cable (3). The device is connected to a target system using the provided probes (4). The software running on the computer allows the user to configure the device, capture signals, and analyze the data.
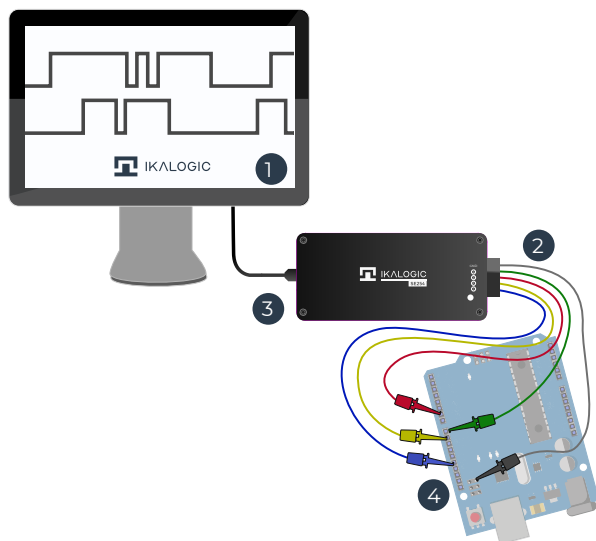
Embedded Memory and samples compression

SE254 features 256 Mb (32MB) embedded HyperRAM memory for capturing samples. It stores captured signals internally before transferring them to the host computer. Although SE254 does not allow live streaming, samples can still be displayed, analyzed and decoded using ScanaStudio software while being transferred to the host computer.

The device uses a compression algorithm to reduce the amount of data transferred, allowing for efficient storage and usage of the available memory. This feature is particularly useful for long-duration captures or when working with limited bandwidth. With this compression feature, the device can capture and store long captures. The table below shows example of the maximum capture time for different usage scenarios:

Use case	Maximum capture time
I2C, 100KHz, 10 transactions per second	50 seconds
UART, 115200 bps, 100 transactions per second	10 seconds
SPI, 1MHz, 500 transactions per second	5 seconds

The figures shown in this table are estimates, and may vary depending on your exact signals (like voltage levels, noise, edge alignment between signals, etc).

Please note that for all those usage scenarios, SE254 Logic Analyzer is capturing samples at the maximum sampling rate of 250MHz.

Typical Applications

SE254 is ideal for educational use cases, such as:

· Basic embedded systems debugging

· Learning serial protocol analysis (I2C, SPI, UART, etc.)

· General electronics teaching and workshops

· Entry-level embedded systems projects

· Hobbyist projects requiring basic logic analysis

Product Highlights

· 4 digital logic input channels

· 250 MHz maximum sampling rate

· Adjustable input threshold (fine tunable from 1.1 V to 5 V, in 100 mV increments)

· USB 2.0 interface

Comparison with SP259 Series

SE254 Logic Analyzer is derived from the more powerful and feature-rich **SP259 logic analyzer** series. It inherits the essential performance aspects, making it ideal for education and introductory applications while being more cost-effective. The following table summarizes the main differences between the SE254 and the SP259 series.

Feature	SE254	SP259
Logic input channels	4 channels	9 channels
Embedded memory size	256 Mb	1 Gb
USB interface	USB 2.0	USB 3.0
Streaming capability	✖	Supported
Trigger IN / Trigger OUT	✖	Available (via SMA connectors)
External clock input	✖	Available on channel 9
Enclosure material	FR4	ABS plastic
Threshold adjustment groups	1 adjustable group	3 adjustable groups

SE254 provides core logic analysis capabilities derived from the SP259, making it an ideal choice for educational environments and basic embedded debugging tasks.

Warning

Read **Safety Information** section carefully before using this instrument.

System Architecture

SE254 architecture is simplified in the diagram below. where an input stage capture the signals with high impedance and low capacitance. The signals are then sampled by the FPGA at a maximum rate of 250 MHz. The samples are stored in the embedded memory before being transferred to the host computer via USB 2.0 interface. the system is powered from the USB interface and consumes less than 150mA.
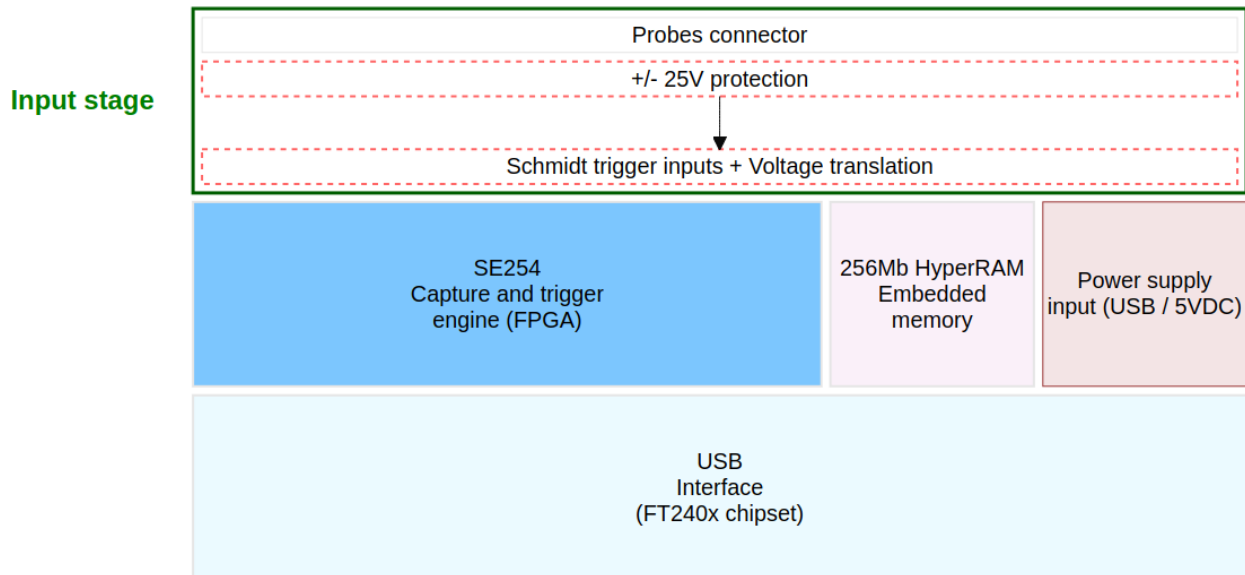
SE254 Architecture diagram

A SE254 Logic Analyzer system consists of:

1. SE254 main device unit containing an input circuitry, FPGA and embedded HyperRAM memory
2. USB 2.0 cable (type-A to Micro USB)
3. Host computer running ScanaStudio software (Windows/Mac/Linux)
4. 5-point probe set (4 channels + Ground)

Main Characteristics

Operating Conditions

Parameter	Conditions
Temperature	10°C to 40°C
Relative humidity	< 80% non-condensing
Altitude	< 2000 m

Timing and Measurements

Parameter	Conditions
Maximum sampling rate	250 MSPS
Digital bandwidth (inputs)	50 MHz
Embedded memory	256 Mb

Logic Inputs Specifications

Parameter	Conditions
Number of channels	4
Input impedance	200 kΩ
	8 pF
target voltage adjustment range	1.1 V to 5 V (100 mV steps)
Absolute max voltage on inputs	±25 V

Power Requirements

Parameter	Conditions
Input power connector	Micro USB 2.0 female
Input current	150 mA (maximum)
Input voltage	5 V ±0.5 V

SE254 Interfaces

Below are the different interfaces available on the SE254 device.

(1) USB 2.0 connector (micro-B type)

(2) Probes connector (2.54mm pin header)

(3) Activity LED (More about **status led behavior**)

Versatile Trigger System

Unlike other competitor devices, and like all Ikalogic logic analyzer, SE254 features a embedded trigger engine that allows to trigger on a wide range of events. The trigger engine is based on the Flexitrig® technology, which allows to define complex triggering conditions, that may include timed events on multiple channels. Having the trigger engine embedded in the device (as opposed to capturing all the samples and then filtering them in the software) allows to reduce the amount of data to be transferred to the host computer, and thus to increase the speed of the transfer and allow the make the best usage of the available memory resources of the device.

Further more, SE254 features two independent trigger engines that can be cascaded in several manners to allow the user to define complex triggering conditions. Each trigger engine can be configured to trigger on a wide range of events summerized in the table below.:

Trigger Option	Description
Logic change	Triggers on a signal change on one or more channels.
Edge Trigger	Triggers on a specific (rising or falling) edge on a specific channel.
Pulse Width Trigger	Triggers when a signal pulse width is greater or less than a specified value.
Multi-step Pattern Trigger	Triggers when a specific pattern is detected across multiple channels.
Protocol triger	Triggers on specific protocol events (e.g., I2C, SPI, UART).[7]

> **Note about multi-step pattern trigger**: Each trigger engine can store up to 128 trigger steps, and each step can be defined with specific logic mask and level, as well as timing constraints.

With two trigger engines (named A & B in the table below) it's possible to defines the following trigger scenarios:

Trigger order	Description
A or B	Triggers when either trigger A or trigger B conditions are met (in any order).
A and B	Triggers when both trigger A and trigger B conditions are met (in any order).
A then B	Triggers on trigger A (while trigger engine B is disabled), and then waits for trigger B to occur.
B then A	Triggers on trigger B (while trigger engine A is disabled), and then waits for trigger A to occur.

Last but not least, SE254 Logic Analyzer has the ability to define the amount of pre-trigger samples. This allows to capture a number of samples before the trigger event occurs. This is useful for analyzing the context of the trigger event and understanding the behavior of the

system leading up to it.

More detailed information about the trigger can be found here: *https://ikalogic.com/kb/Logic-Analyzer-trigger/*

[1] While Protocol trigger definition is loaded on the SE254 device, it requires specific implementation in ScanaStudio software, and depends on each and every protocol implementation.

What's in the Box

Your SE254 Logic Analyzer includes:

1. SE254 device
2. USB 2.0 cable (Micro-B to Type-A)
3. 5 leads hook-style probes set (4 signals + 1 ground)

Unpacking and First Usage

To start using SE254:

1. Connect the device via USB to your computer.
2. Launch ScanaStudio software and create a workspace by selecting "SE254." from the list
3. Connect the provided probes to your signal sources.
4. Ensure the ground probe is correctly connected.
5. Press the Start button in ScanaStudio to initiate signal capture.

Status LEDs Behavior

Parameter	Conditions
Green (steady)	Device powered up
Green (blinking)	Device active, detecting signals on logic inputs

Software Quick Start Guide

Download and install ScanaStudio software from www.ikalogic.com.

Capturing Your First Signal

Follow the steps mentioned above in ***"Unpacking and First Usage."***

Mechanical Data

Device

SE254 is made of layers of FR4 as enclosure material, providing durability for educational and lab environments at low cost. The image below shows the dimensions of the device.

SE254 Mechanical Dimensions (in mm)
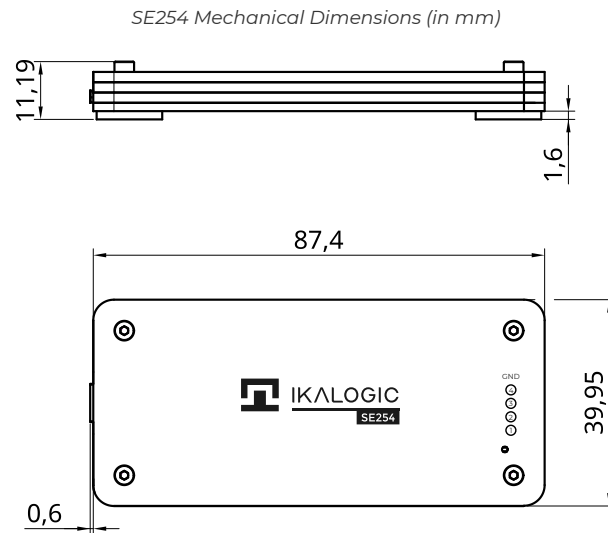
Weight: Approximately 35 g

Probes

The device comes with 5 gripper probes harness (1 GND and 4 signal probes). The probes are 25 cm long.

SE254 Probes Dimensions (in mm)

250mm ± 5mm
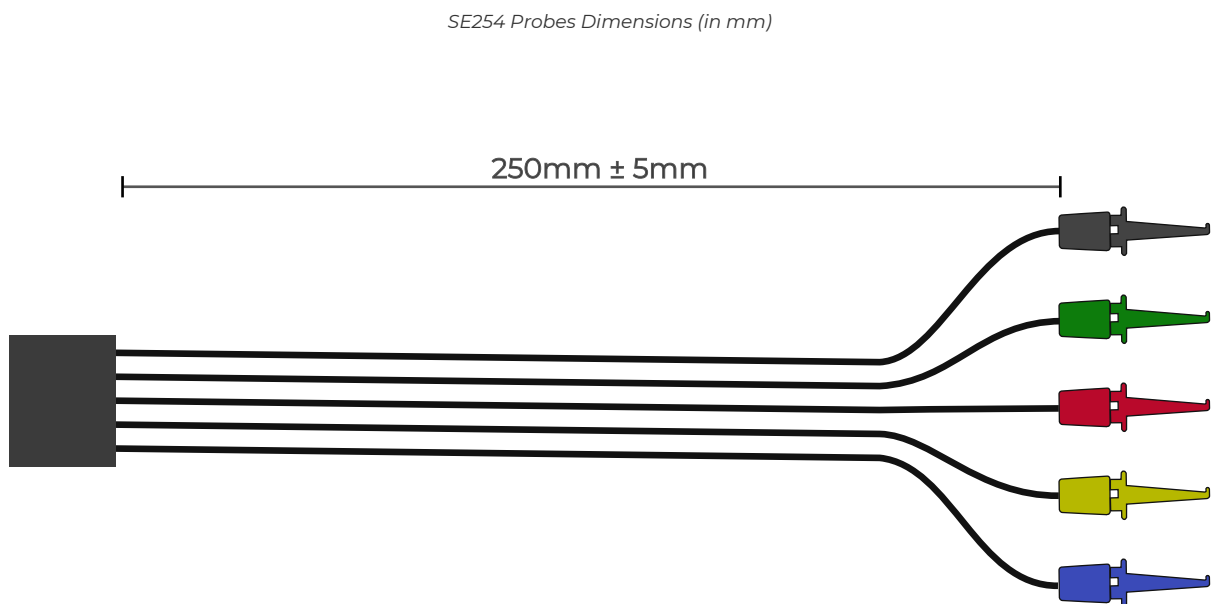
Software Technical Requirements

To operate SE254 Logic Analyzer, the user must use a computer with a USB port (USB2 or better).

The following operating systems are supported:

- Windows 7/8/10/11
- macOS 10.9 or later
- Ubuntu Linux 14.04 or later

SE254 includes a USB chip from FTDI (***https://www.ftdichip.com***), please make sure the latest drivers are downloaded and installed. On most recent systems, drivers are already included and no any installation is needed.

Ordering Information and Customer Support

For purchases, distributor information, or technical inquiries:

Visit www.ikalogic.com

Email: **support@ikalogic.com**

Accessories and Maintenance

Accessories and maintenance services (probes replacement) are available on our website: www.ikalogic.com or by contacting customer support (***support@ikalogic.com***).

Certifications and Regulations

SE254 complies with the following applicable European Directives: Electromagnetic Compatibility (EMC) Directive 2004/108/EC, Low-Voltage Directive 2006/95/EC, IEC 61326-2.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CAN ICES-3 (B) / NMB-3 (B)**

RoHS Compliant 2011/65/EC. This device does not contain any of the substances in excess of the maximum concentration values ("MCVs") defined in the EU RoHS Directive.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

· Reorient or relocate the receiving antenna.

· Increase the separation between the equipment and receiver.

· Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

· Consult the dealer or an experienced radio/TV technician for help.

CE Logo   ROHS Logo   WEEE Logo

Safety information

This product complies with safety standards IEC NF/EN 61010-1: 2010, IEC NF/EN 61010-2-030 and UL 61010-1: 2015 To prevent possible electrical shock, fire, personal injury, or damage to the product, read all safety information before you use the product. The following international symbols are used on the product and in this manual.

Important safety notes

⚠️ Warning, to avoid electrical shock or fire :

- Carefully read all instructions.

- Use the product only as specified, otherwise the protection supplied by the product can be compromised.

- Do not use the product if it operates incorrectly.

- Before use, inspect device casing, probes, test leads and accessories for mechanical damage and replace if damaged.

- Never attempt to repair a defective device. Contact after-sale service.

- Do not use the product or its accessories in case of any damage.

- Remove all probes, test leads and accessories that are not in use.

- Never use the device for measuring mains circuits.

- Never use the device for measuring circuits which are not isolated from mains.

- Do not touch electrical wires with bare hands.

- Keep away from children's sight or from animals.

- Do not expose to water, heat or moisture.

- The device's ground connection through the USB cable is for measurement purposes only. The logic analyzer does not have a protective safety ground.

- Ensure there is no significant voltage between device ground and the point to which you intend to connect it.

- Do not apply more than the rated voltage, between the terminals or between each terminal and ground.

- Do not apply input voltages above the rating of the instrument.

- Measure a known voltage first to make sure that the product operates correctly.

- Do not work alone.

- Comply with local and national safety codes. Use personal protective equipment (approved rubber gloves, face protection, and flame resistant clothes) to prevent shock.

- Do not use the device in wet or damp conditions, or around explosive gas or vapor.

- Do not operate the product with covers removed or the case open. Hazardous voltage exposure is possible.

- Do not use in a system in which the failure of the product might result in personal injury.

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Document Revisions

Date	Description
06-April-2025	Initial release of SE254 Logic Analyzer datasheet

Disclaimer

The information contained herein is subject to change without prior notice.