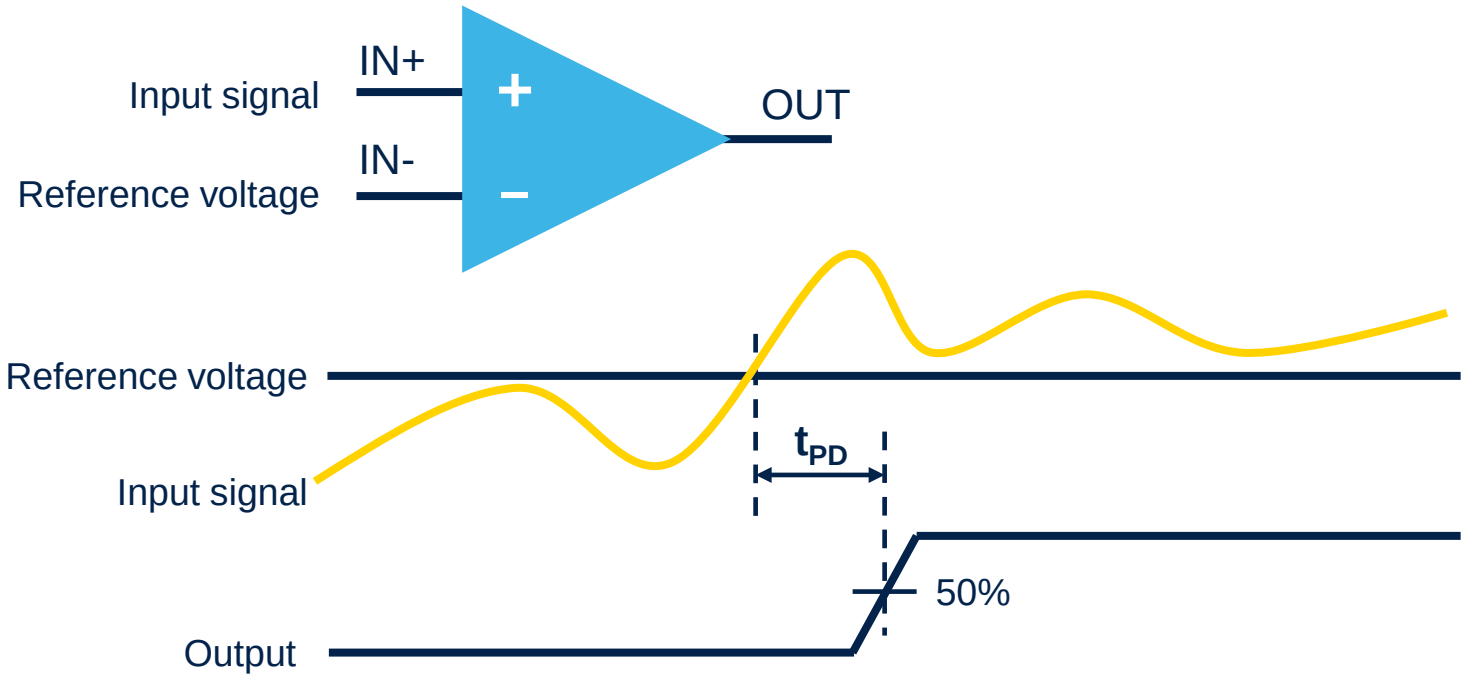
High-speed 5 V comparators

October 2025

ST Op Amps

What is propagation delay?



5 V high-speed comparators		
t_{PD}	part number	
8 ns	TS3011	
38 ns	TS3021	
60 ns	TS3121	

What is propagation delay?

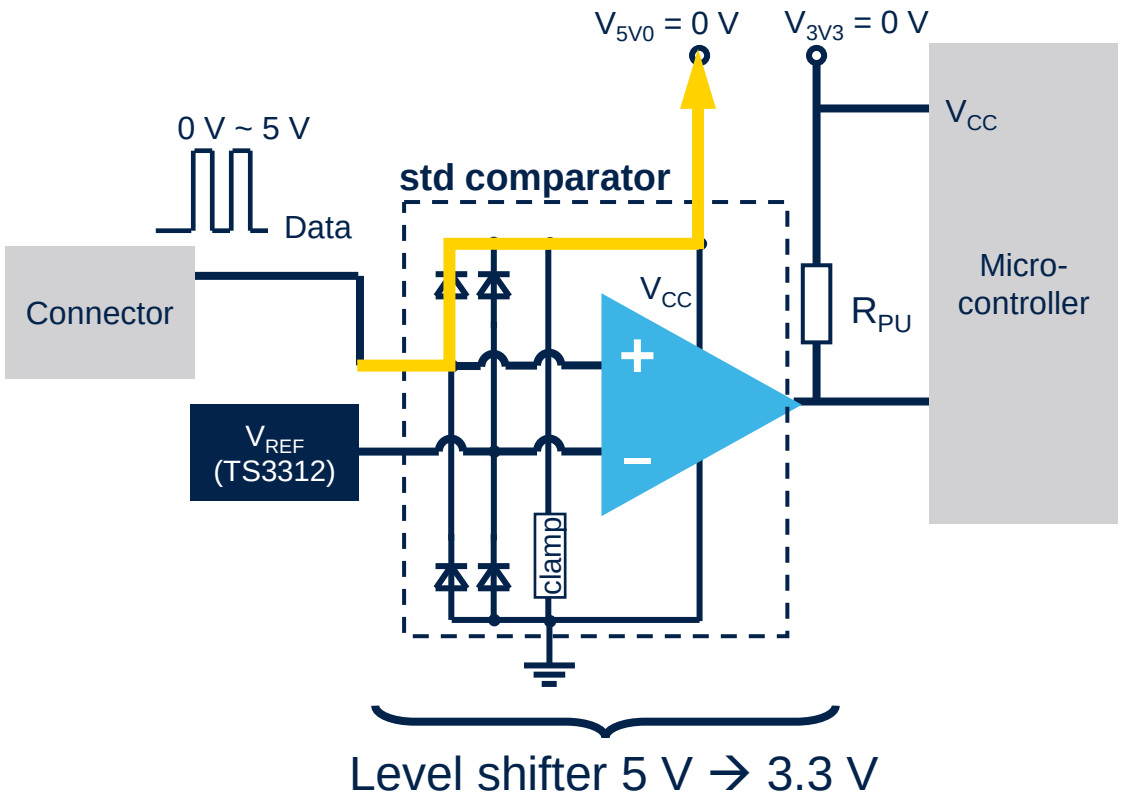
Propagation delay refers to the time that it takes for a signal to travel from the input to the output. It's a crucial factor in designing communication systems and it's a key parameter when choosing a comparator.

When is a short propagation delay necessary?

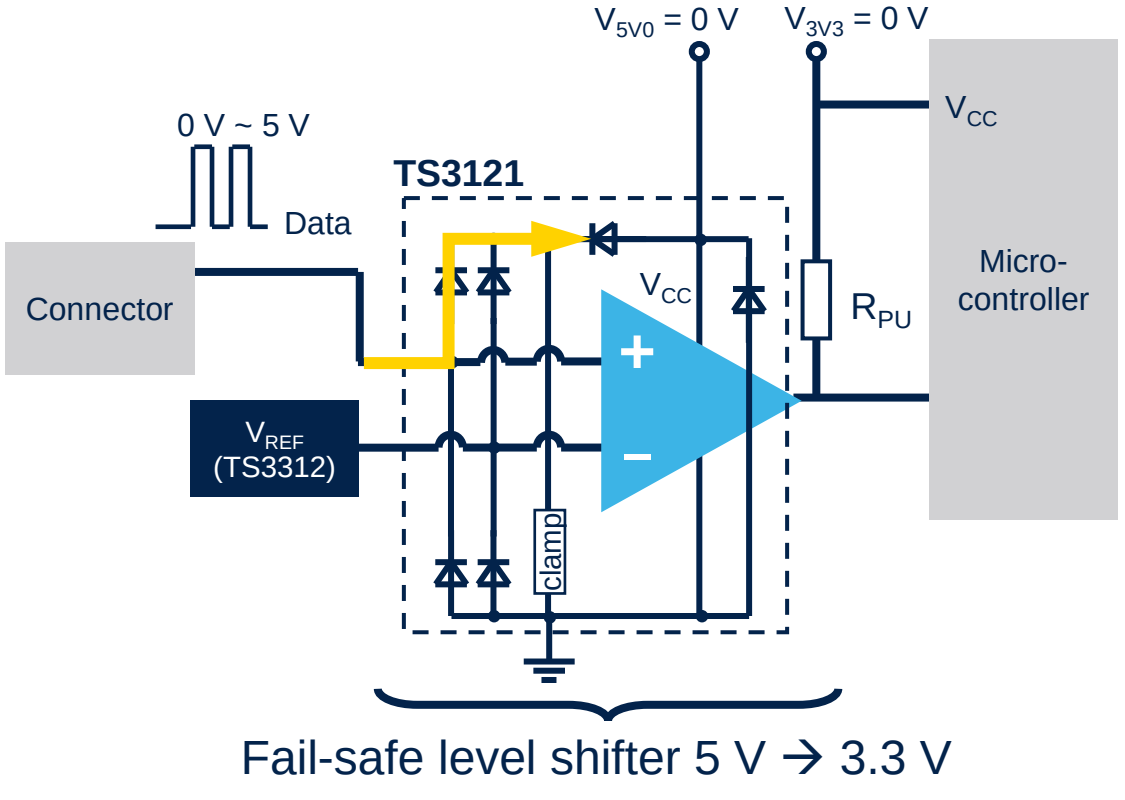
Various applications such as zero-crossing detectors and level shifters, overcurrent, or overvoltage detection in DC-DC converters or detection of trigger events of photo diodes in LIDAR typically.

What is fail-safe?
Example of data connector with vs. without fail-safe

Short circuit from connector to GND



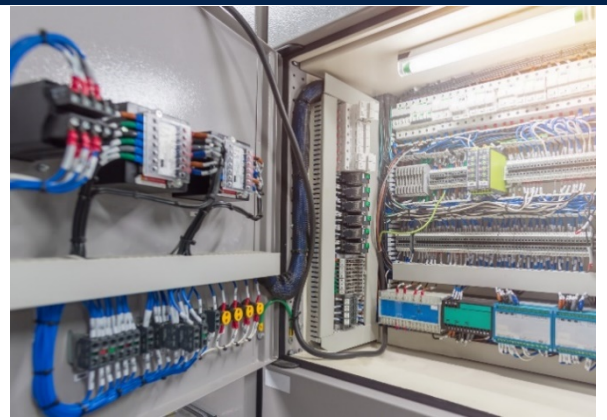
No short circuit with fail-safe inputs



Data signals coming from an external connector while the application is powered off (V_{CC} = 0 V) will lead to short circuits through the ESD structure. Fail-safe inputs allow voltages on the input pins even if V_{CC} = 0 V, hence protect against short circuits. ST's TS3121 has embedded fail-safe inputs.

Typical applications

Wide range of automotive and industrial applications thanks to a combination of high-performance parameters



- Industrial
- Automotive
- Power tools
- Smart metering
- Overcurrent detection
- Controllers and sensors
- Threshold detection

TS3121, TS3121A overview

Rail-to-rail, open-drain comparator with embedded fail-safe input/output

AEC-Q100 qualified

Simplifies MCU firmware

- Guaranteed start-up time for sequential on/off cycles of V_{CC}
- Fail-safe architecture

Excellent voltage level translation

- I/O pins can be higher than V_{CC}
- Wide supply voltage 1.7 to 5.5 V
- Rail-to-rail input, open-drain output

Efficient threshold detection

- Propagation delay: 60 ns
- Low offset voltage: 2 mV max @ 25°C (A-grade version)

Robustness

- High tolerance to ESD: 4 kV HBM
- Extended temperature range: -40 to 125°C
- Automotive grade version available

SOT23-5

SC70-5

TS3021, TS3022 overview

Rail-to-rail, 5 V push-pull comparators

AEC-Q100 qualified

Range detection

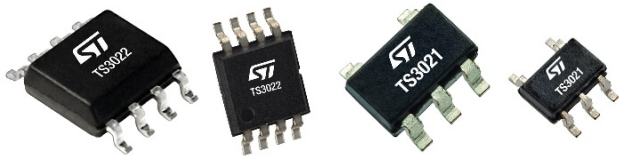
- Dual channel version available for window comparator (TS3022)
- High precision 0.5 mV typical input offset voltage
- Tiny package options

Increases flexibility

- Rail-to-rail inputs
- Wide supply voltage 1.8 to 5 V
- Standard pinout on various packages: SOT23-5, SC70-5, SO8, MiniSO8

Robustness

- High tolerance to ESD: 5 kV HBM
- Extended temperature range: -40 to 125°C
- High-temperature version available -40 to 150°C (H-grade)
- Automotive grade version available



SO8 MiniSO8 SOT23-5 SC70-5

TS3011 overview

Rail-to-rail, 5 V high-speed comparator

AEC-Q100 qualified

Protects SiC / GaN transistors

- 8 ns propagation delay for fast detection of overcurrent / desaturation
- Tiny package options

Increases flexibility

- Rail-to-rail inputs
- Wide supply voltage 2.2 to 5 V
- Standard pinout on various packages:
  SOT23-5, SC70-5, DFN8 2x2 mm

Robustness

- High tolerance to ESD: 2 kV HBM
- Extended temperature range: -40 to 125°C
- Automotive grade version available

SOT23-5

SC70-5

DFN8 2x2mm

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