Intro to high speed comparators

How to use high speed comparators for Time-of-Flight distance measurements

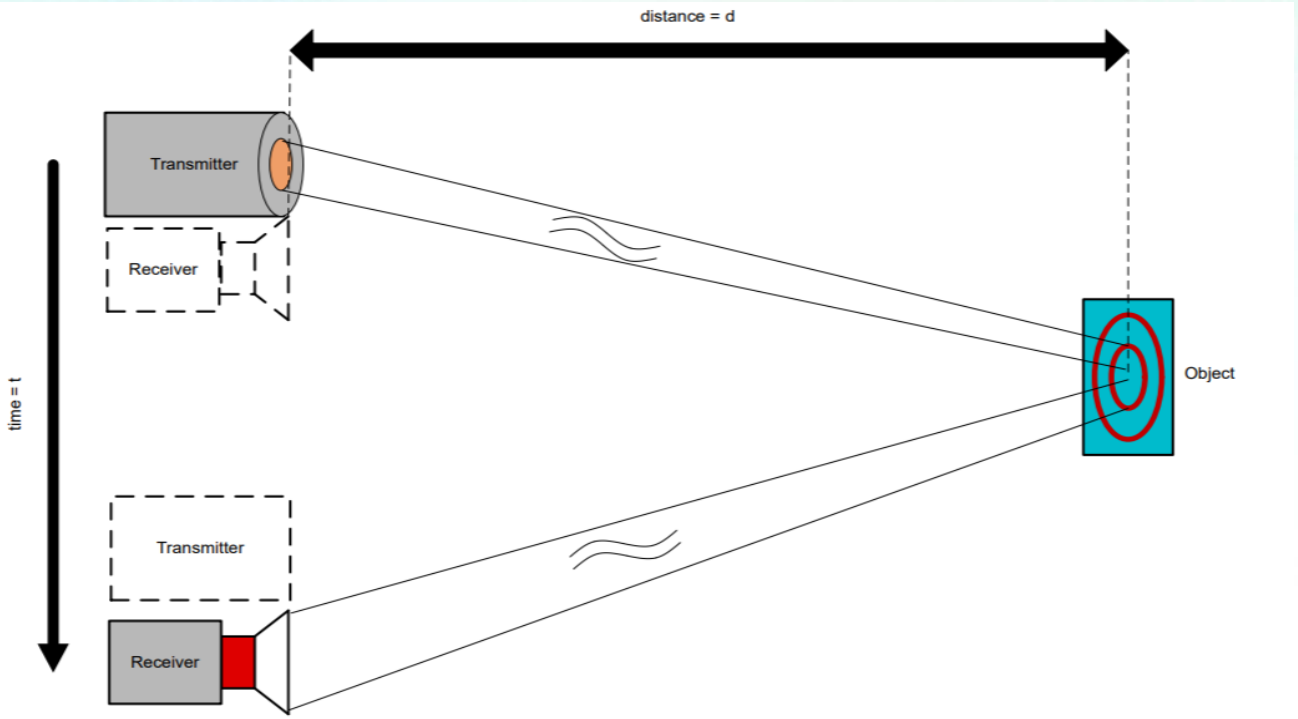
Agenda

- ToF principle
- How comparators are used in ToF applications
- Key comparator specs

ToF principle

ToF principle

Start Event



Stop Event

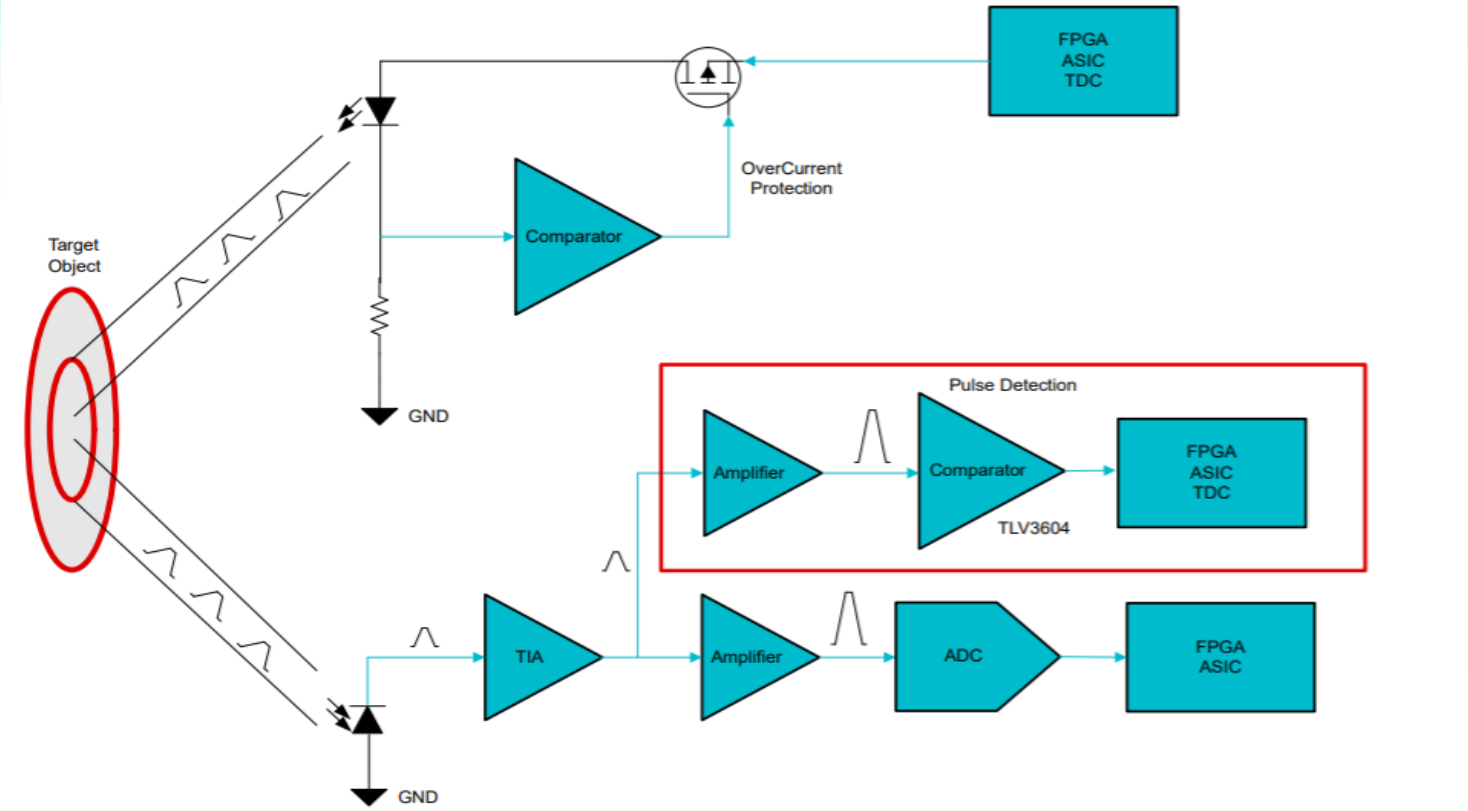
$$d = \frac{c * \Delta t}{2}$$

$$d = Distance$$

$$c = Speed\ of\ Light\ (3 * 10^8\ {}^{m}/_{s})$$

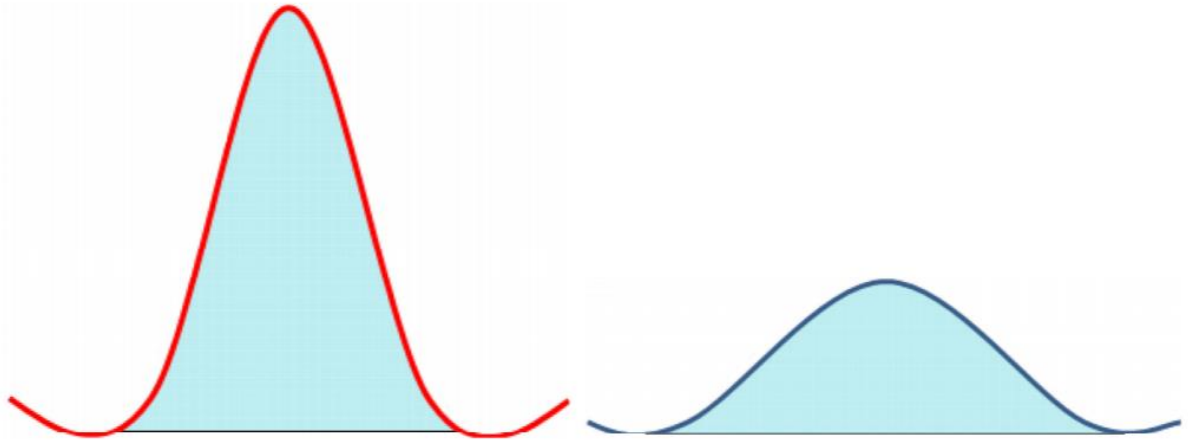
$$\Delta t = Time\ between\ Start\ and\ Stop\ Event$$

ToF system

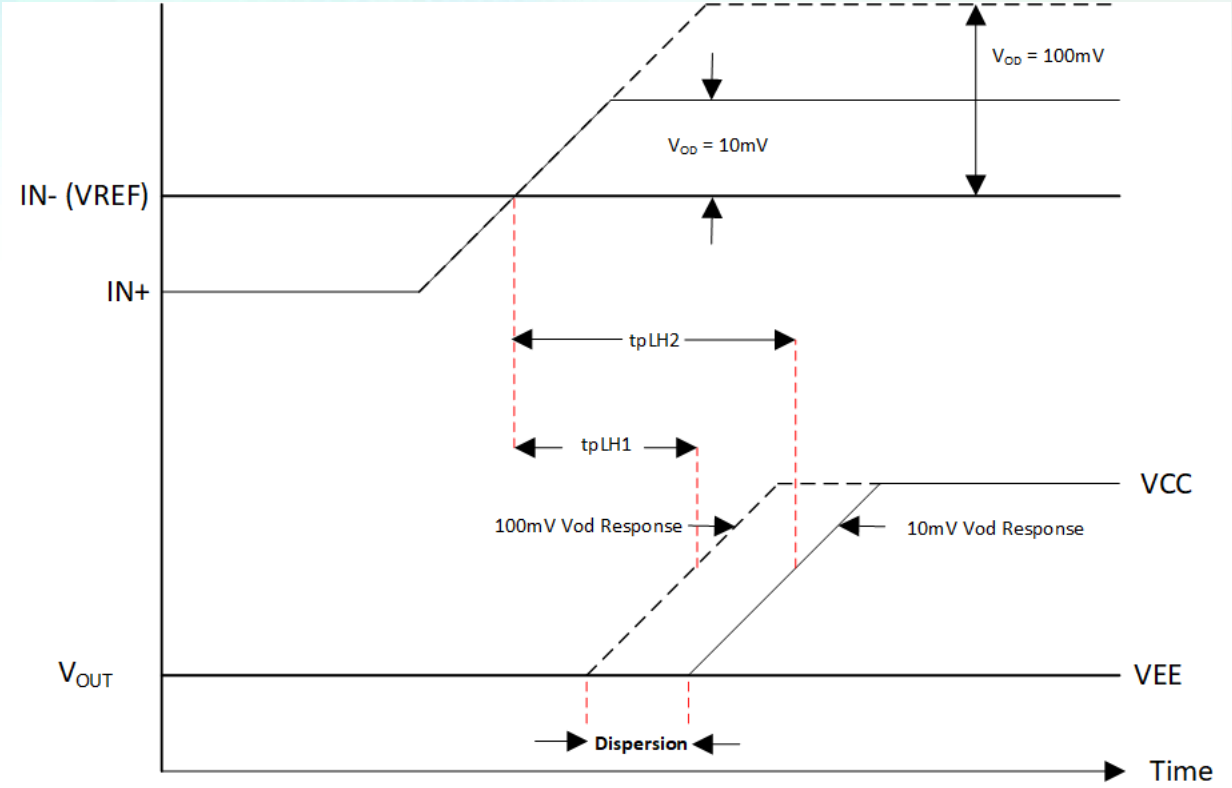

FPGA
ASIC
TDC
OverCurrent
Protection
Comparator
Target
Object
GND
Pulse Detection
Amplifier
Comparator
TLV3604
FPGA
ASIC
TDC
TIA
Amplifier
ADC
FPGA
ASIC
GND

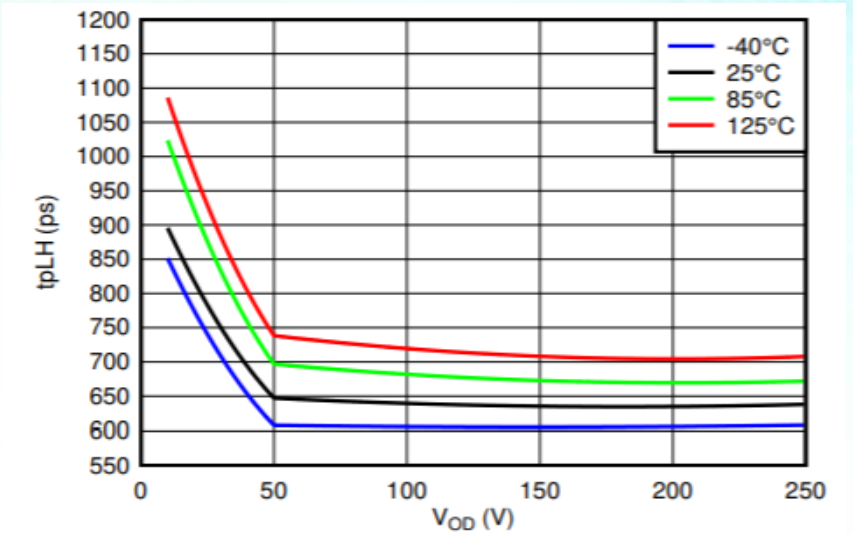
Importance of min. pulse width

- Limitations to the amount of wattage the laser emits due to safety concerns
  - Narrower pulse width detection capability means distance to objects further away can be calculated at the same wattage
  - Note: Area under curves is same meaning the pulses have the same wattage with different amplitude and pulse width



Importance of overdrive dispersion





TLV3604/5

800 ps prop delay | High speed comparator with LVDS output

Key features

- Single Supply: 2.4V~5.5V
- Rail-to-Rail Input, LVDS output
- Propagation Delay: 800 ps
- Propagation Delay Dispersion: < 450ps
- Minimal Pulse Width: 600 ps
- Input Signal Toggle Rate: 3.0Gbps
- Power Supply Current: 12mA
- Input Offset Max Over Temperature: 5mV
- Package: SC70(6)
  QFN(12)

Applications

- Proximity sensor
- Golf finder
- Automotive Lidar
- Drone
- Lab equipment
- High speed line receivers threshold detection
- Automatic test equipment (ATE)
- High speed instrumentation

Benefits

- Suitable for very high speed applications
- LVDS outputs for easy interfacing to FPGAs
- **P2P to Competition while providing:**
  - **Higher precision measurements**
  - **Extended range**

Pulse detection (laser scanner, logic analyzer, Lidar, etc)

High speed front end for LIDAR & laser scanners