
VL53L3CX maximum ranging performance improvements

Introduction

This application note describes the improvements made to the VL53L3CX software environment using the Maint6 driver release. These improvements specifically upgrade ranging performance.

1 Ranging performance

1.1 Measurement conditions

When taking ranging measurements, it is considered that:

- The full field of view (FoV) is covered (i.e. 25 °)
- Charts used as targets are grey (17 % reflectance, N4.74 Munsell) and white (88 % reflectance, N9.5 Munsell).
- Nominal voltage is 2.8 V and temperature is 23 °C
- The device is controlled through the driver using the default settings (refer to UM2780 for a description of the driver settings).
- The detection rate is considered as 90 % and 50 % which is the percentage of good measurements reported by the device.
- Indoor (no IR) means there is no light contribution in the bandwidth 940 nm ± 30 nm.
- Outdoor overcast conditions means a back light level of 0.7 W/m² on the sensor, in the bandwidth 940 nm ± 30 nm.
- No coverglass is present corresponding to 5KLux in AM1.5 sunlight equivalent

1.2 Minimum ranging distance

A target can be detected down to 10 mm and performance is specified down to 25 mm.

1.3 Maximum ranging distance

The table below shows the ranging specifications for a typical VL53L3CX bare module, without cover glass, at room temperature (23 °C), with nominal voltage (2.8 V), and full FoV covered.

Table 1. Maximum ranging capabilities with 33 ms timing budget in Medium distance mode

	Conditions	Indoor ⁽¹⁾		Outdoor overcast ⁽²⁾	
	Detection rate	50 %	90 %	50 %	90 %
Target reflectance level, full FoV (reflectance %)	88 %	5000 mm	4300 mm	1600 mm	1400 mm
	54 %	4400 mm	4000 mm	1300 mm	1100 mm
	17 %	2300 mm	1900 mm	1100 mm	900 mm

1. Indoor, no infrared

2. Outdoor: 0.7 W/m² corresponding to 5 kLux in AM1.5 sunlight equivalent

The ranging distances in the table below are those reported by the driver by the parameter called **RangeMeanMilliMeter**.

Table 2. Maximum ranging capabilities with 33 ms timing budget in Long distance mode

	Conditions	Indoor ⁽¹⁾		Outdoor overcast ⁽²⁾	
	Detection rate	50 %	90 %	50 %	90 %
Target reflectance level, full FoV (reflectance %)	88 %	4400 mm	3800 mm	1200 mm	1000 mm
	54 %	3200 mm	2900 mm	1100 mm	900 mm
	17 %	2000 mm	1800 mm	900 mm	700 mm

1. Indoor, no infrared

2. Outdoor: 0.7 W/m² corresponding to 5 kLux in AM1.5 sunlight equivalent

1.4 Ranging accuracy

Ranging accuracy is defined as follows:

$$RangingAccuracy = \frac{RangeMeanMillimeter}{TargetDistance} \times 100$$

The ranging accuracy is a direct evaluation of the measurement, including offset errors and output noise. This qualitative indicator includes measure-to-measure and part-to-part dispersion.

The table shows the ranging specifications for a typical VL53L3CX bare module, without cover glass, at room temperature (23 °C), with nominal voltage (2.8 V), and full FoV covered.

Table 3. Ranging accuracy with 33 ms timing budget

Target reflectance level, full FoV	Distance (mm)	Indoor ⁽¹⁾	Outdoor overcast ⁽²⁾
88 %	25-90	±8 mm	±9 mm
	90-110	±5%	±6 %
	>110	±4 %	±5 %
54 %	25-90	±8 mm	±9 mm
	90-110	±5 %	±7 %
	>110	±4 %	±8 %
17 %	25-90	±7 mm	±8 mm
	90-110	±6 %	±8 %
	>110	±5 %	±10 %

1. Indoor: no infrared

2. Outdoor: 0.7 W/m² corresponding to 5 kLux in AM1.5 sunlight equivalent

Revision history

Table 4. Document revision history

Date	Version	Changes
25-Sep-2020	1	Initial release

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