

We should appreciate what we have because we can lose it at any time.

René Scheu

CEO's Note

Dear Reader,

The corona virus has shown the world the limits. That is the finding that we have to accept. Much of what was taken for granted is no longer. Not only that we were virtually "locked up" by the lockdown. Also that a small virus - it may come from a city in China that most people have never heard of - has more or less paralyzed the economic machine around the world.

Well, to date, the economic impact does not show its dangerous face too much. Unfortunately, I am convinced, that this will come. The growth in China has already declined noticeably in recent years and accelerated downwards. As a growth locomotive, this country has weakened a lot in its global economic role. And the trade war with the United States didn't exactly contribute to an investment-friendly climate.

Added to this is the fact that the climate debate - without evaluating it - and the diesel scandal also

contributed to putting the automotive industry in particularly bad grip. Now, total insecurity has broken out and I understand when people think twice whether they want to buy a new car now.

All of this is fueling a downward spiral that is probably difficult to break. A hard landing seems inevitable. Unfortunately, much that we have got used to is likely to fall by the wayside. Let us hope that it will not take too long and that we do not have to accept too many reports of disasters.

The big question that naturally arises is that of growth. Do we really want to grow until the Earth collapses? Well, I am convinced that we have no choice. If we don't drive our progress and growth, others will. I think that's a gene in humanity. Still, modesty would be good sometimes. Anyone can contribute to this.

Beat De Coi

Cliff detection with TOF>frame611

Today's best robot vacuums are full of high-tech features. Connected to WLAN they can be controlled by smart phone and even via a voice assistant.

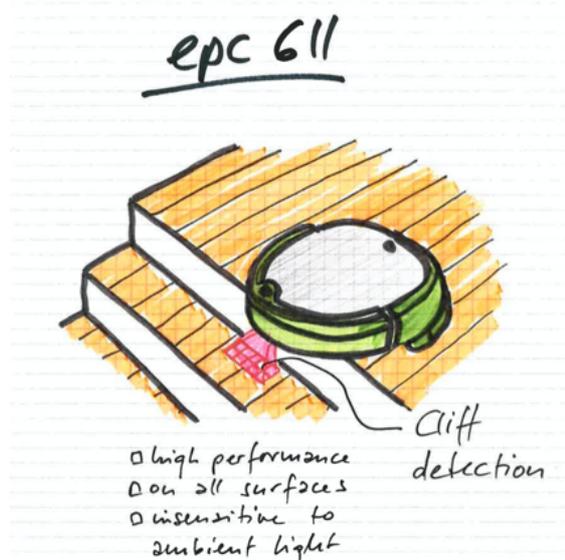
The combination of many sensors and software allows the robots to drive around obstacles, map the rooms and plan the most economic cleaning path. For all this costly equipment falling down a stair or only tipping would be disastrous. With its TOF>frame 611 ESPROS offers the most efficient anti drop and anti bump sensor on the market. Based on cost-effective epc611 time of flight (TOF) imager it guarantees best performance in the dark as likewise under full sunlight conditions. The compact sensor design with integrated infrared illumination and fast communication interface allows an economic integration in modern consumer and industrial robots.

About the TOF>frame 611

The TOF>frame 611 is a miniaturized and cost optimized 3D TOF camera. It is based on the ESPROS proprietary time-of-flight technology using the epc611 TOF chip and a small LED to illuminate the scenery. The camera controls the illumination and the imager chip to obtain distance and confidence images. Due to the high performance of the imager chip with its unique ambient light suppression, the camera can be used in outdoor applications at full sunlight. This very small module is easy to use because it delivers fully calibrated

and compensated 3D images. All the complex engineering and time consuming design tasks regarding optics, illumination and signal processing are already solved.

More information in the [datasheet](#) or contact our sales: sales@espros.com



Cliff detection with 3D TOF>frame611

What are your responsibilities at ESPROS?

Duties include Business Development, sales and coordination of technical support with the factory and price negotiations associated with customer specific projects for our Semiconductor and 3D modules business.

How long have you been working with ESPROS?

2 years.

Where do you come from?

I am living with my family in Winston-Salem, North Carolina.

What do you like about your job and working for ESPROS?

We work with amazing engineers on cutting edge technology to solve real-world problems you read about daily. To see and be part of the transformation of industries from Autonomous Driving, Robotics, and AI, based around 3D TOF perception is far from boring. Having the best TOF technology allows us to accomplish things for clients other semiconductor manufactures struggle with.

Can you tell us about your hobbies?

I love playing golf during my off time and enjoy the therapy and solace of a good range session. After

college I spent 6 years as a touring professional. The people I have met along the way through the game has been quite enriching.



The importance of illumination in a TOF system

Due to high illumination power, significant heat generation by the illumination warms up not only the illuminator, but the whole camera. Thus, good thermal management is key. Heat dissipation is required to keep the illumination as cold as possible. It is to note, that the illumination power decreases significantly with higher temperature. The radiance of the LED in Figure 1 drops by 20% from room temperature to 100°C (junction) which reduces the operating range of the TOF camera at high temperature.

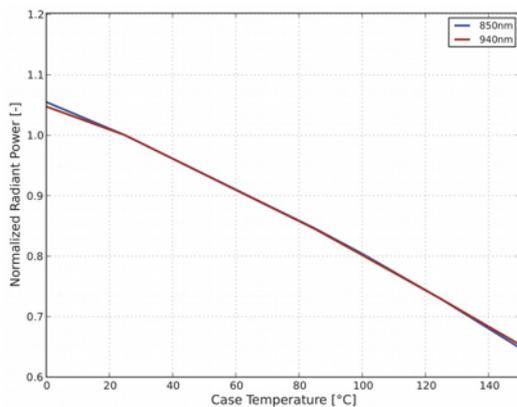


Figure 1: LED radiance vs. temperature (Source: Lumileds)

It is also to note, that the rise and fall time of LEDs is current dependent, shown in Figure 2. The lower the current, the longer the rise and fall time. A variation in rise or fall time generates a significant distance shift. In the example shown in Figure 2, the change of rise/fall time is approx. 18ns between a current of 100 and 3000mA. Without extra

calibration and compensation, a distance shift of 2.7m can be observed! This is really significant.

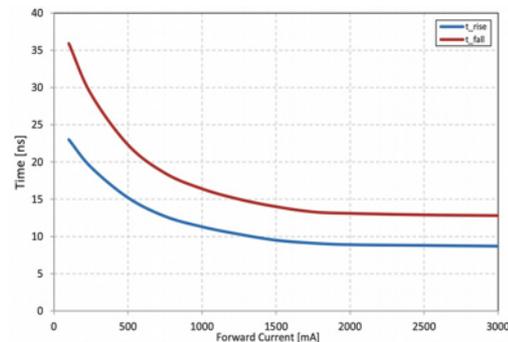


Figure 2: Rise and fall time vs. operating current (Source: Lumileds)

Rules of thumb:

- A good thermal management of the illumination is key.
- When operating the camera with different LED currents, a separate calibration with at least offset compensation is required.
- Constant illumination power during the whole measurement cycle is key.
- Make sure that the illumination covers the required field of view, but not more.
- The modulation waveform is not important because 4th order harmonics or other effects are calibrated and compensated during runtime.

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