



MLX75026 Webinar

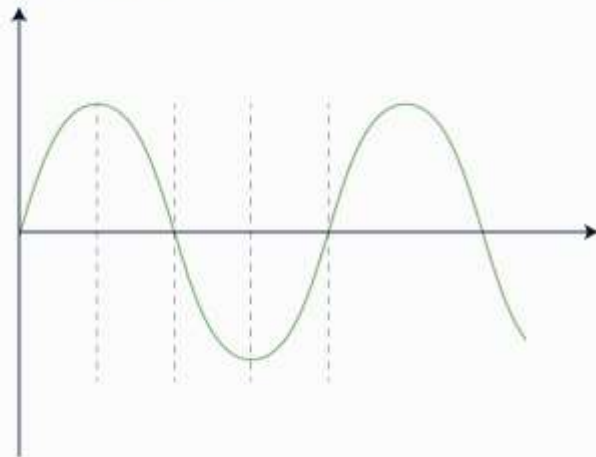


Introduction

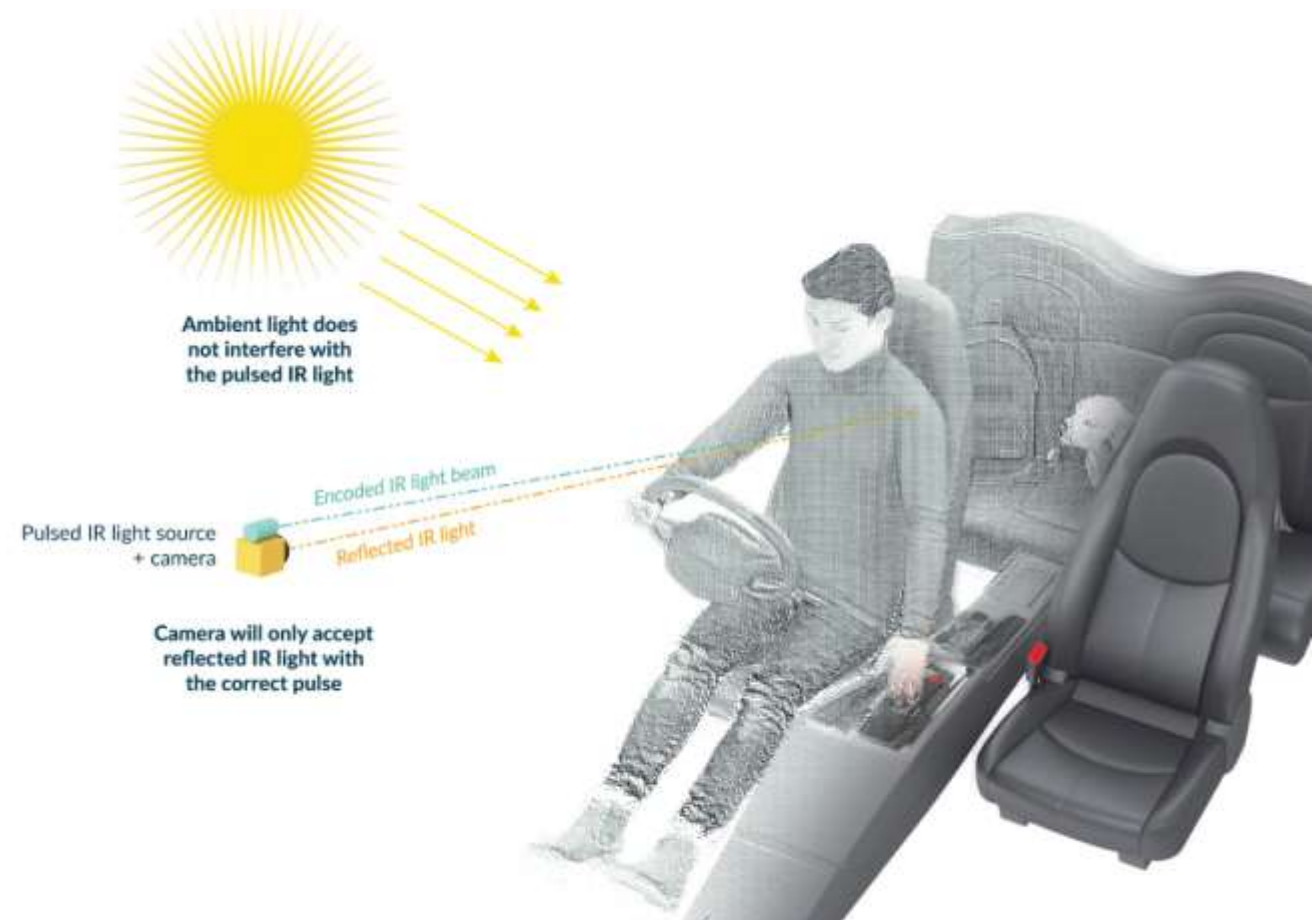
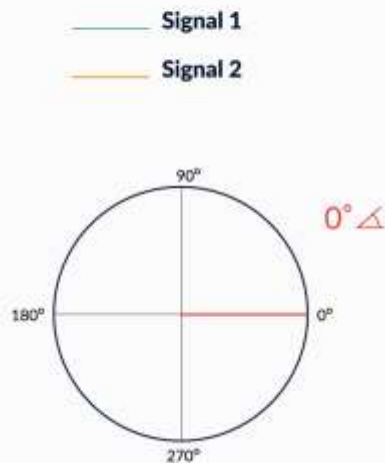
Time-of-flight principle

ToF is a 3D sensing technology that is able to detect people and objects, their absolute position, movement and shape in 3 dimensions.

Phase shift



Melexis
INSPIRED ENGINEERING

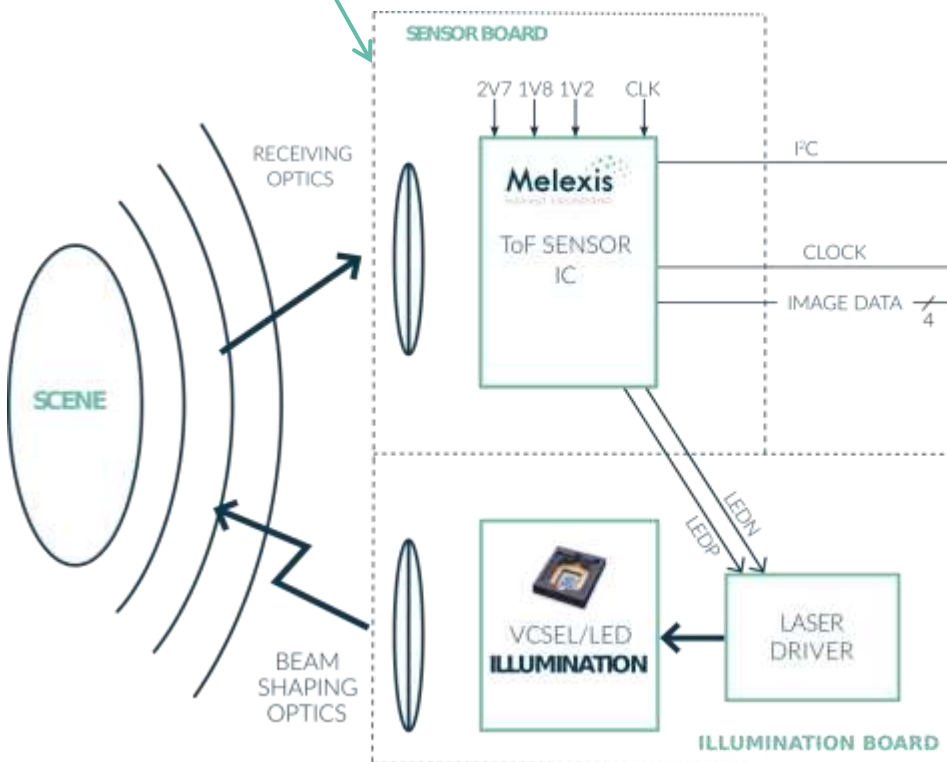


Introduction

System overview

ToF Sensor/Chipset

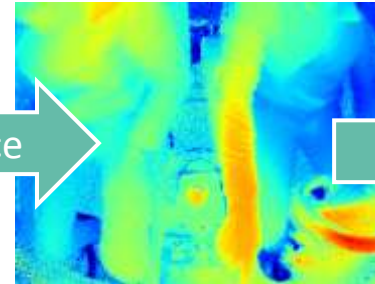
MCU takes care of
processing the raw data
into distance data



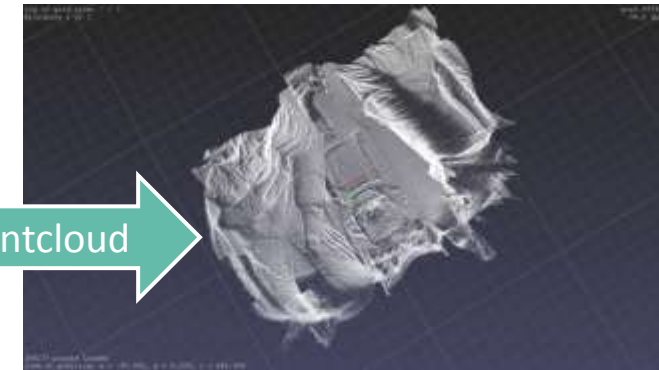
Amplitude



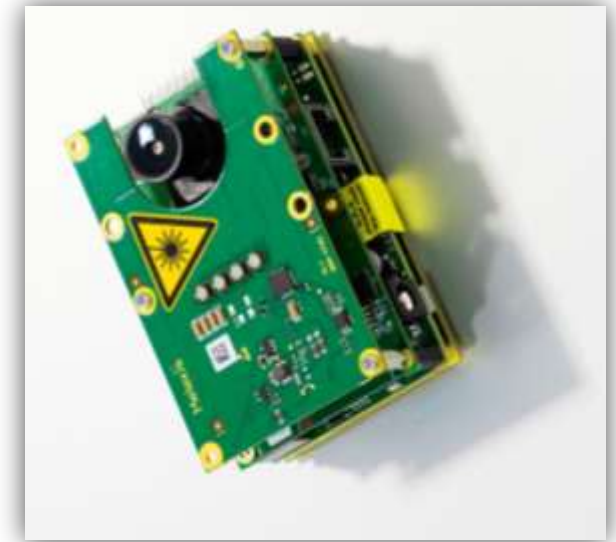
Distance



Pointcloud

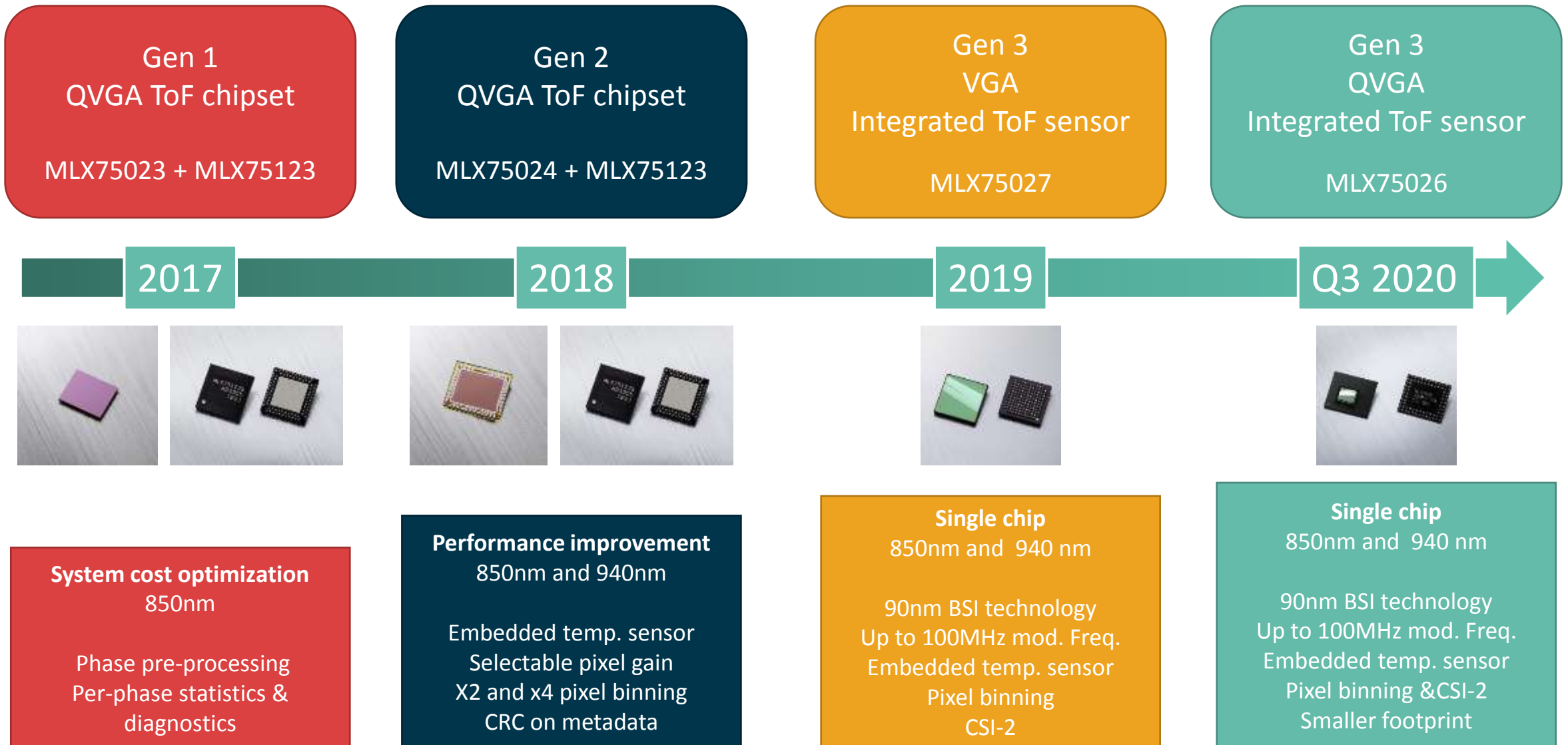


Pointcloud projecting every pixel information
in 3D space taking into account the camera
parameters



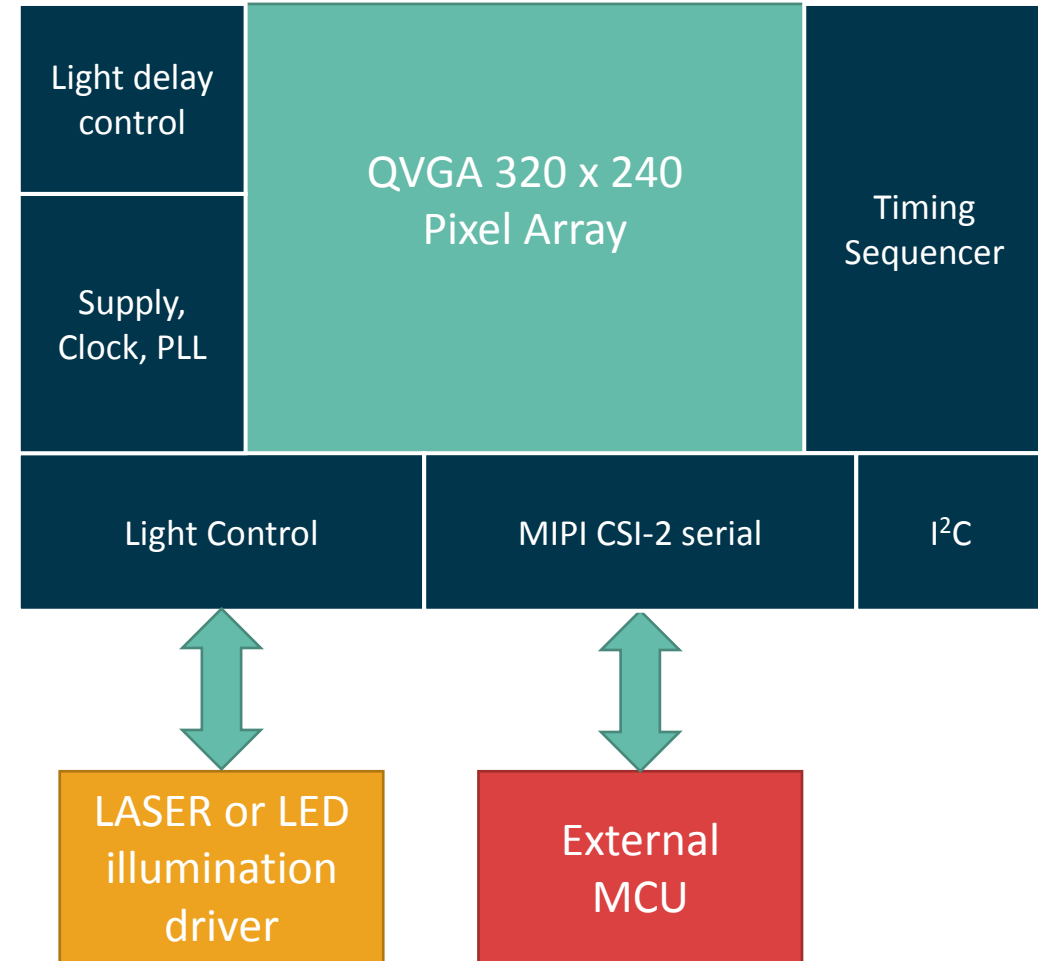
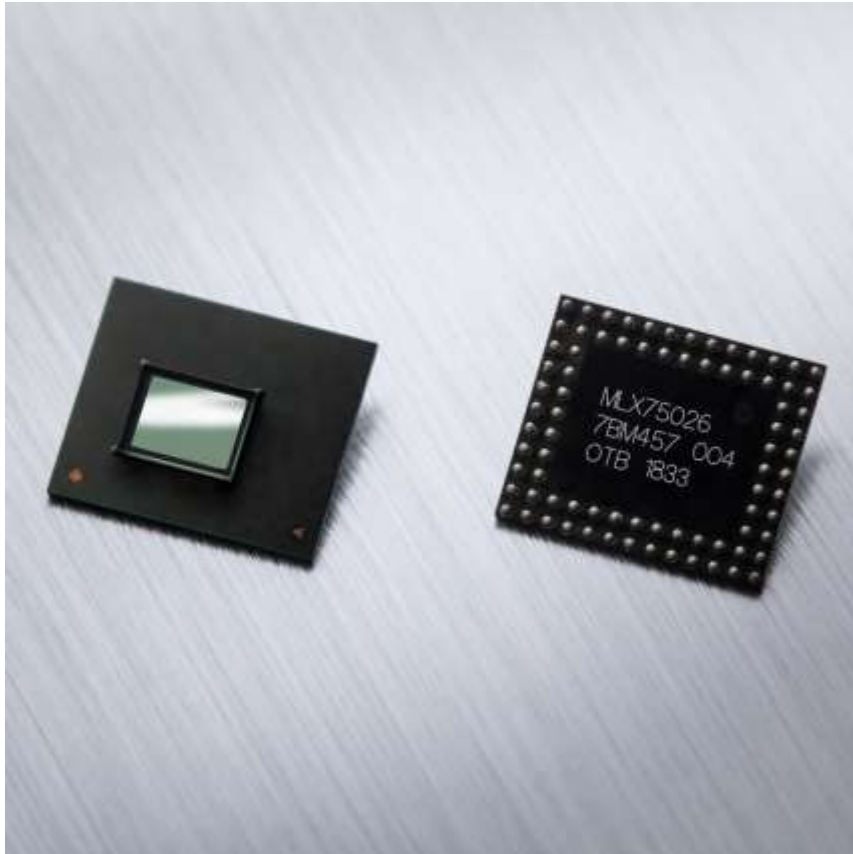
EVK75027
(Complete ToF camera system)

Products portfolio



MLX75026

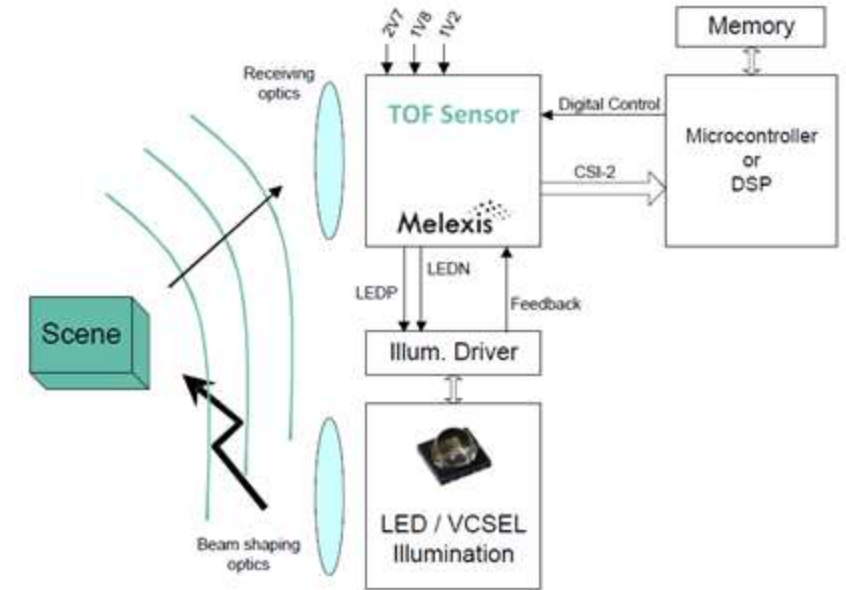
Single chip QVGA ToF sensor



MLX75026

Single chip QVGA ToF sensor

- Fully integrated QVGA TOF Sensor (320 x 240)
- Modulation frequency up to 100 MHz
- Optimized for 940 nm illumination
- CSI-2 serial data output, MIPI D-PHY, 2 or 4 data lanes
- Region of interest (ROI), binning, Horizontal & vertical flip/mirror modes
- 9.2 x 7.8 x 1.0 mm encapsulated BGA package with glass lid, double ARC coating
- Ambient temperature range -40° to +105°C



Key advantages of Gen3 QVGA

Against Melexis Gen2 chipset

Feature	Gen3 QVGA MLX75026	Gen2 QVGA MLX75024 & MLX75123BA	Advantages of Gen3 QVGA
Resolution	320 x 240	320 x 240	Same resolution
Pixel size	10x10um ²	15x15um ²	<ul style="list-style-type: none"> Smaller pixel size (smaller footprint) Better optical performances
External quantum efficiency (Typ)	51% @ 850 nm 28% @ 940 nm	22% @ 850 nm 13% @ 940 nm	
optical filter or ARC	Double-sided ARC, 940nm IR BP filter optional	Double-sided ARC	
Sensor format	1/4"	1/3"	MLX75026 has a smaller sensor format ➔ Smaller and Cheaper Lens
Readout time	0.8 ms	0.96 ms	
Built-in temp. sensor	Tj accuracy +/-5 °C absolute		
Max mod. frequency	Up to 100 MHz	Up to 40 MHz	Highest distance accuracy possible
Data interface	CSI-2 D-Phy 2 or 4-Lane	12 bits parallel camera interface	Up to date communication interface
Sensor footprint	9.2x7.8 mm = 71.8 mm ²	(6.6x5.5)+(7x7) = 85.3 mm ²	MLX75026 has a very small package
Power supply	2.7V, 1.8V and 1.2V	3V3, 2V, -3V3, 1V8	Simple and compact PSU architecture
Power consumption	117 mW	384 mW	30 FPS, 250 µs integration time, 40 MHz mod. freq.

Key advantages of Gen3 QVGA

Comparison with Gen3 VGA

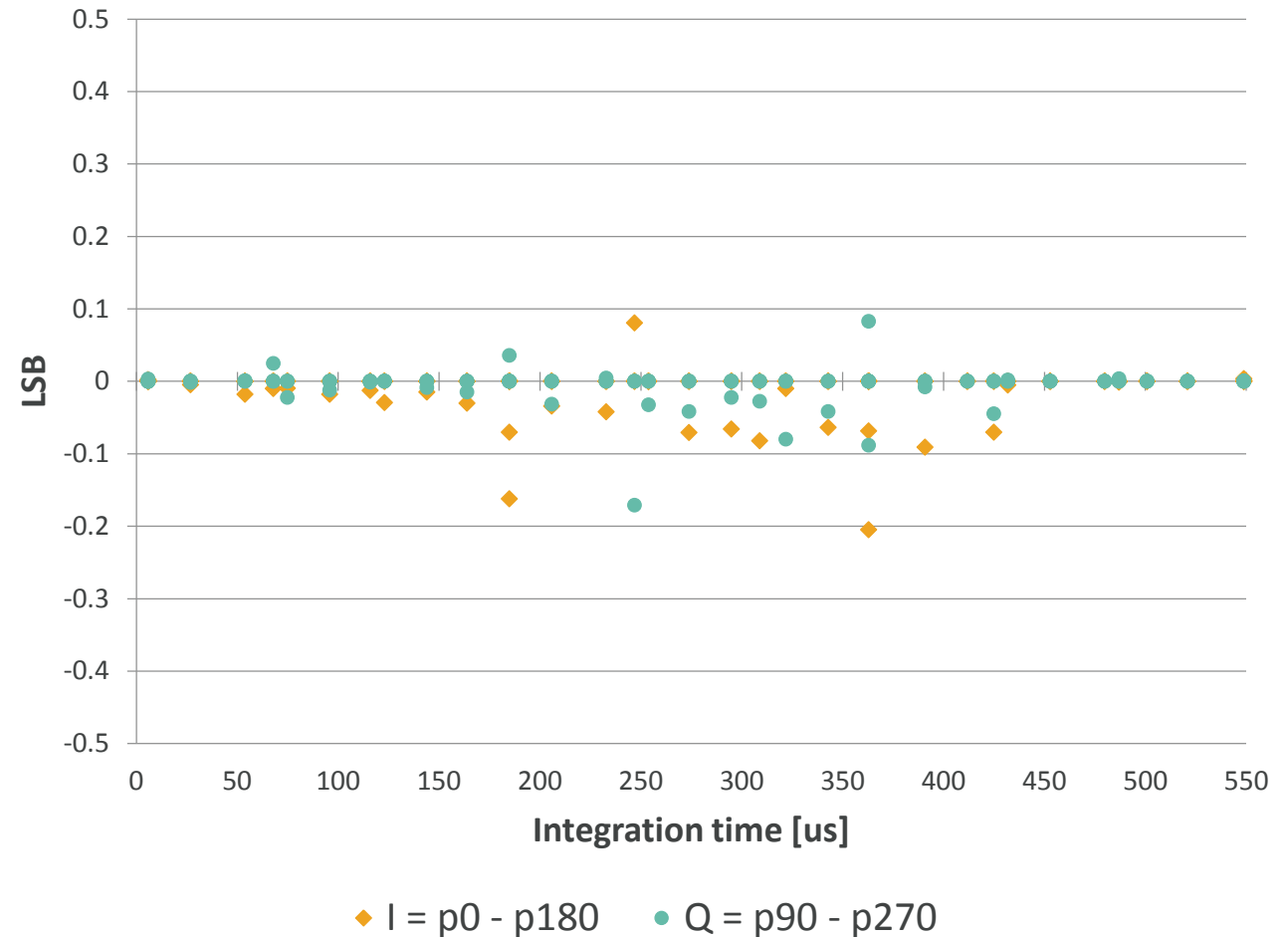
Feature	Gen3 QVGA MLX75026	Gen3 VGA MLX75027	Advantages of Gen3 QVGA
Resolution	320 x 240	640 x 480	Smaller data size (25%) → Higher FPS
Pixel size	10x10um ²		<ul style="list-style-type: none">• Same pixels• Same optical performances• Possibility of integrated BP filter
External quantum efficiency (Typ)	51% @ 850 nm 28% @ 940 nm		
optical filter or ARC	Double-sided ARC, 940nm IR BP filter optional	Double-sided ARC	
Sensor format	1/4"	1/2"	MLX75026 has a smaller sensor format → Smaller and Cheaper Lens
Readout time	0.8 ms	1.5 ms	
Built-in temp. sensor	Tj accuracy +/-5 °C absolute		
Max mod. frequency	Up to 100 MHz		
Data interface	CSI-2 D-Phy 2 or 4-Lane		
Sensor footprint	9.2 x 7.8 mm	14 x 14 mm	MLX75026 has a very small package
Power supply	2.7V, 1.8V and 1.2V		Same PSU architecture
Power consumption	120 mW 220 mW	221 mW 523mW	30 FPS, 250 μs integration time, 60 MHz mod. freq. 60 FPS, 600 μs integration time, 100 MHz mod. freq.

Compatible QVGA & VGA
Easy algorithm transfer between QVGA and VGA

Key advantages of Gen3 Pixels

Sunlight robustness

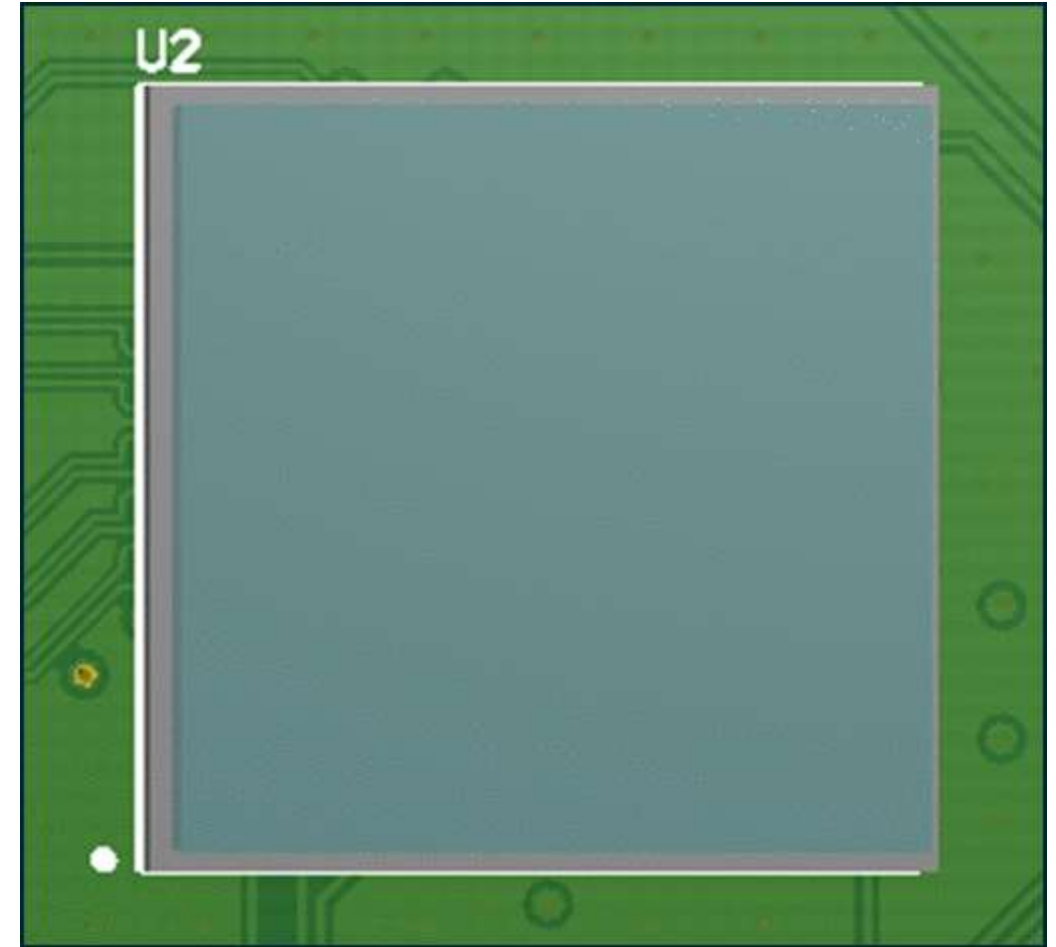
- ✓ Distance measurement accuracy is not affected by sunlight.
- ✓ Distance shift with constant light can be observed by monitoring I and Q values.
- ✓ Melexis Gen 3 ToF sensor shows no deviation (<0.2 LSBs) of the I, Q values under strong sunlight.



Migration from VGA to QVGA

Package size

- ✓ Decrease in package size :
 - MLX75027 :
 - $14 \times 14 \text{ mm} = 196 \text{ mm}^2$
 - MLX75026 :
 - $9.2 \times 7.8 \text{ mm} = 72 \text{ mm}^2$
- ✓ 63% decrease in surface
 - Compact modules can benefit from the size reduction
 - Smaller & thus cheaper lenses can be used



Migration from VGA to QVGA

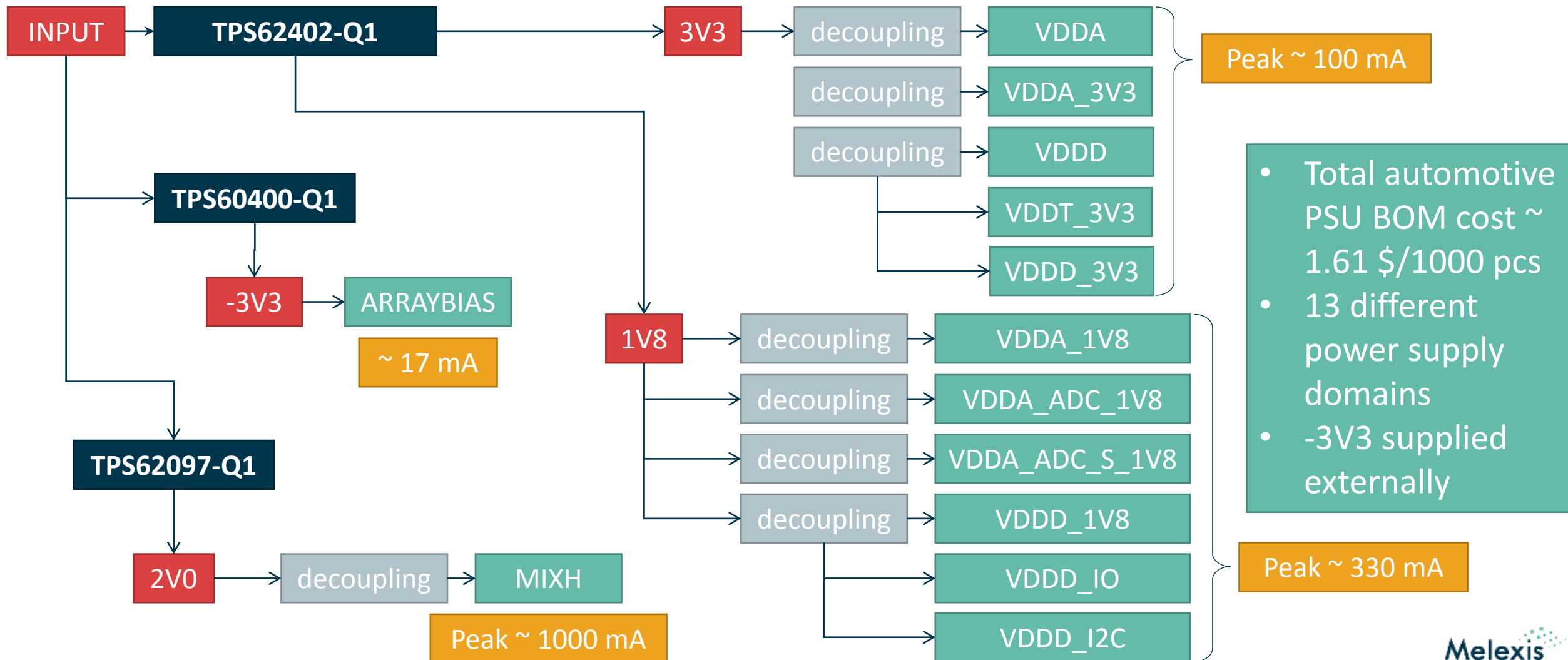
Registers updates

- MLX75026 & MLX75027 share similar registers structure :
 - Key application registers have the same addresses :
 - Integration time, Modulation frequency, Frame time, etc.
- Video output configuration, modes of operation and data output mode are identical.
- Register values needs to be adapted due to different HMAX values.
- Initialization maps are different.

Maximum software
compatibility between Gen3
VGA & QVGA sensors.

MLX75024 & MLX75123 – PSU Architecture

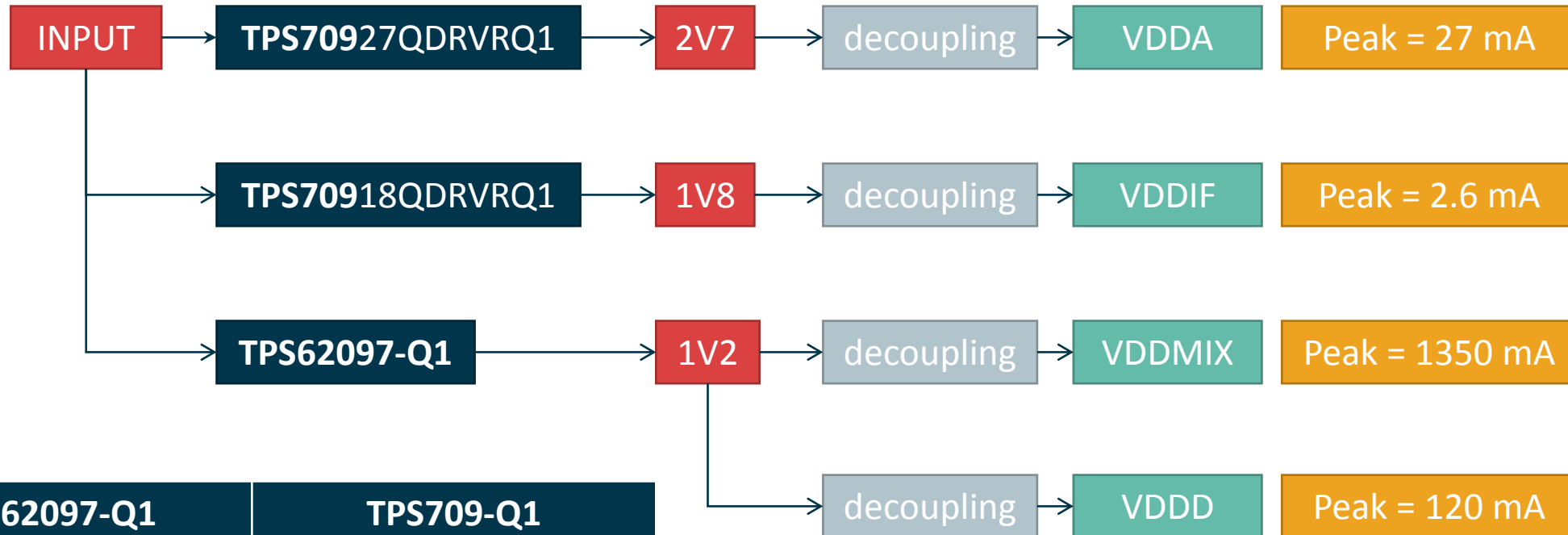
2.7 – 6V



MLX75026 – PSU Architecture

Simple and cost effective

2.7 – 6V



TPS62097-Q1	TPS709-Q1
Step-down converter	LDO voltage regulator
2000 mA	150 mA
TI recommended price <u>\$0.63 / 1000pc</u>	TI recommended price <u>\$0.47 / 1000pc</u>

- Total automotive PSU BOM cost < 1.57 \$/1000 pcs
- Only 4 domains reducing complexity and enabling smaller designs

MLX75026 – Power consumption

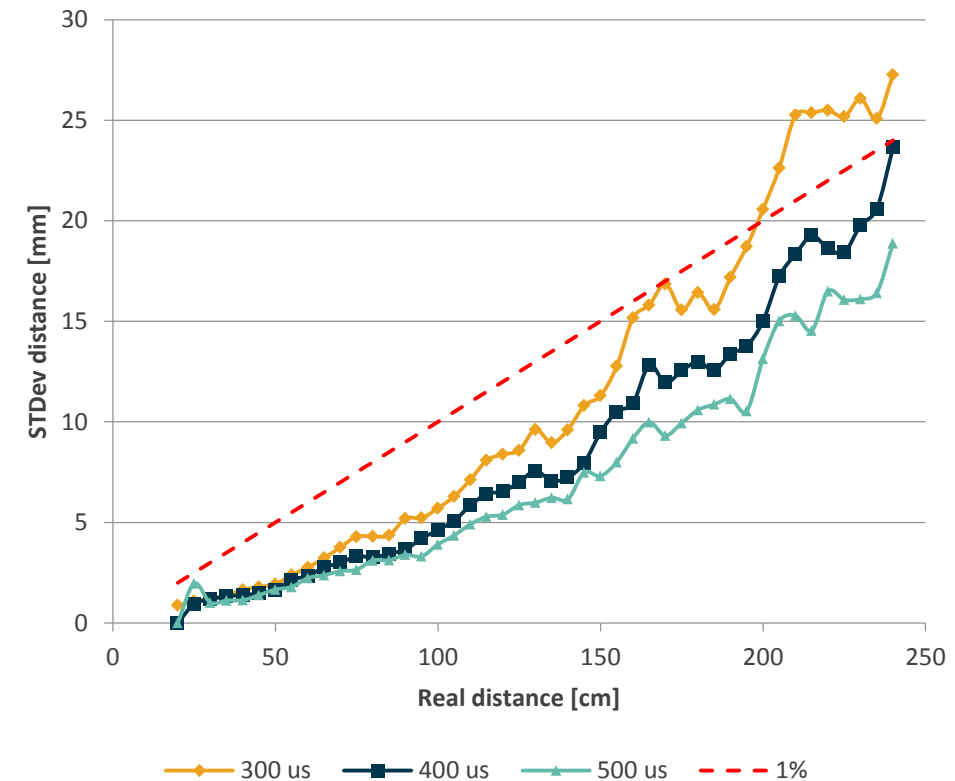
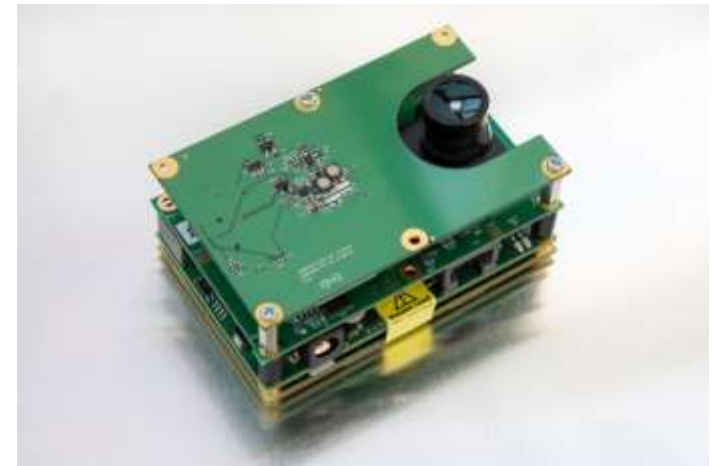
Key parameters

- ✓ MLX75026 typical power consumption is $\sim 99\text{mW}$
- ✓ MLX75026 worst case power is $\sim 163\text{ mW}$ (at low temperatures & typical conditions)
- ✓ Differences with Gen2 chipset :
 - ✓ No 3V3 & -3V3 domains required
 - ✓ Lower power consumption ($\sim 70\%$ less in typical application conditions)
- ✓ Differences with Gen3 VGA :
 - ✓ Lower power consumption ($\sim 50\%$ less in typical application conditions)

Tools

EVK75026-110-940-1

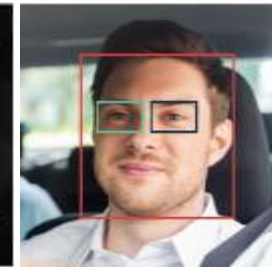
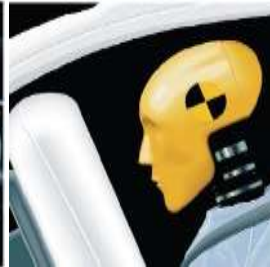
- EVK with automotive IU reference design
 - ✓ 1% distance precision with 2 VCSELs design (80 MHz modulation freq. & 97% reflectivity target).
 - ✓ Available with a 110° horizontal field-of-view.
 - ✓ 940 nm automotive qualified VCSELs.
 - ✓ Illumination design collaboration with Lumentum (VCSEL supplier) and Lextar (package house).



ToF technology strong points

- **Detection based on 2 simultaneous and different principles**
 - ToF 3D output (distance) → segmentation based on distance
 - ToF 2D output (amplitude) → segmentation based on scene contrast + measure of distance confidence (precision)
- **Distance measurement is insensitive to low contrast scenes**
- **Non intrusive in-car mounting**
 - ToF camera can be hidden behind a dark cover
- **Reported high algorithm detection performance**
 - Because of accurate distance → accurate segmentation
- **Reported robustness for intense sunlight**
 - Sunlight does not impact distance accuracy
 - Sunlight invariance
- **Reported low CPU load**
 - For image processing algorithms/neural networks

Automotive Use Cases



Comfort & UX

- Hand position detect
- Hand gestures
- Intuitive HMI, pointing finger
- Object detection, parcel classification
- Face and body recognition

Safety, NCAP, AD

- Driver monitoring, eye gaze/open/close..
- Driver activity detection
- Hands-on wheel
- Occupant classification, head & body pose
- Advanced seatbelt detection
- Child left behind

Security

- Anti-spoof (2D+3D based) face and body recognition
 - Access control
 - Secure authentication

Autonomous vehicles

- Blindspot detection
- Collision avoidance
- Autonomous parking
- Vehicle exterior cocoon
- Smart Access

Applications



Retail	Robotics	Smart cities	Logistics	Autonomous transport
<ul style="list-style-type: none">• People Counting• Shelf Analysis• Inventory monitoring	<ul style="list-style-type: none">• Collaborative robots• Safety perimeter• Human machine collaboration• Behavioral prediction• Workpiece identification	<ul style="list-style-type: none">• Smart street lighting• Free parking slots• Access control• People counting	<ul style="list-style-type: none">• Object identification and tracking• Sizing and damage control	<ul style="list-style-type: none">• AGVs• Path planning/SLAM• Precision approach and docking• Obstacle detection & collision avoidance