



**TODOS**  
Technologies

The future of food sensing



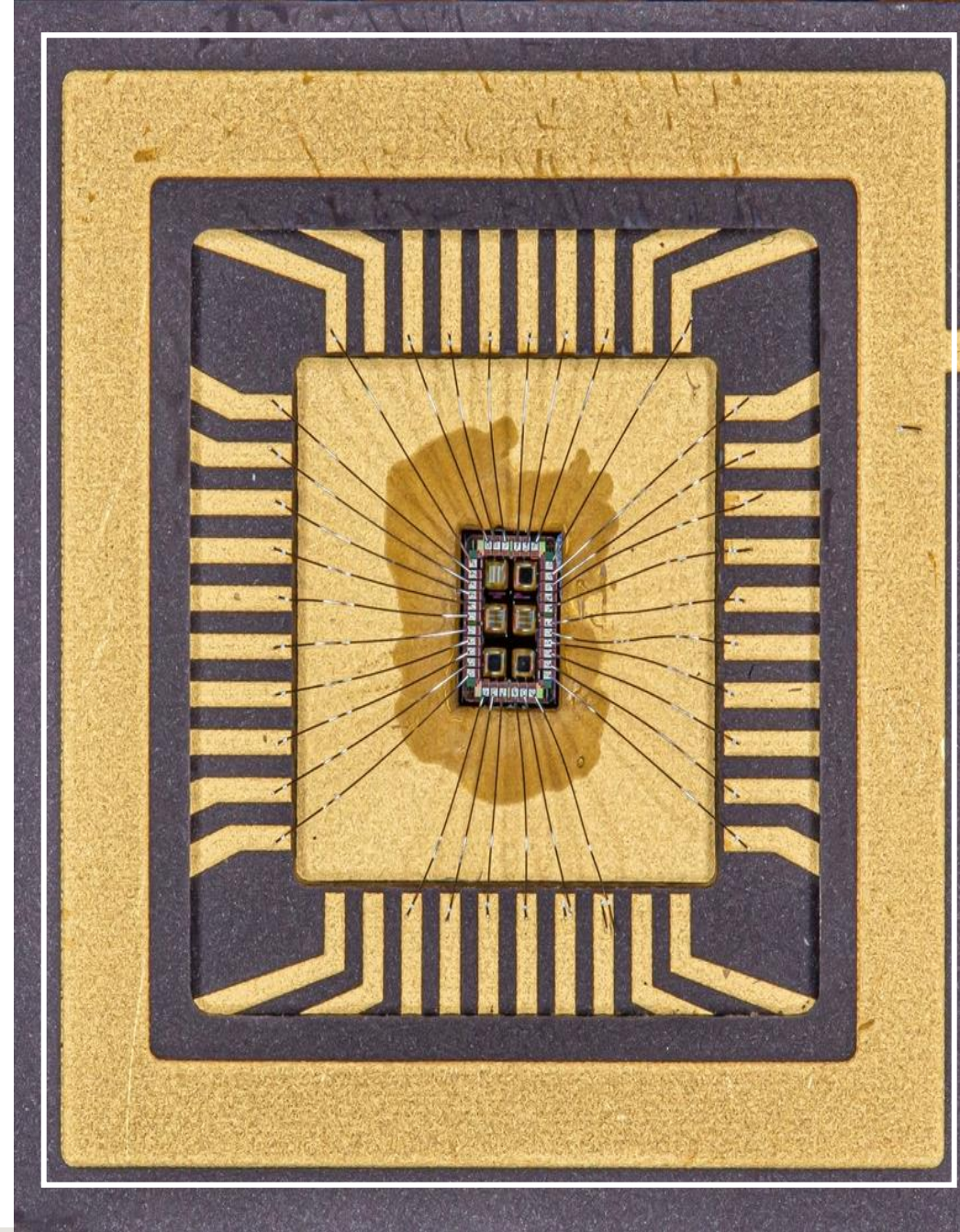
Introduced to you by Todos Technologies:

The new

## GMOS Gas sensor

A game-changing, selective,  
low power and low-cost Gas sensor

for **fruit freshness monitoring** and **food-waste reduction**





# Food Loss and Waste

**30-40%**

Of the food supply in the United States, is being wasted.<sup>1, 2</sup>

There are huge efforts to reduce this number.

[Source 1](#) | [Source 2](#)



# Food Waste Effect

- 1 Directly affects economy
- 2 Indirectly affects emission of CO<sub>2</sub>, Methane and increases the pollution of our atmosphere

## Reducing the food waste:

- ✓ Reduces earth pollution
- ✓ Reduces water consumption
- ✓ Saves money

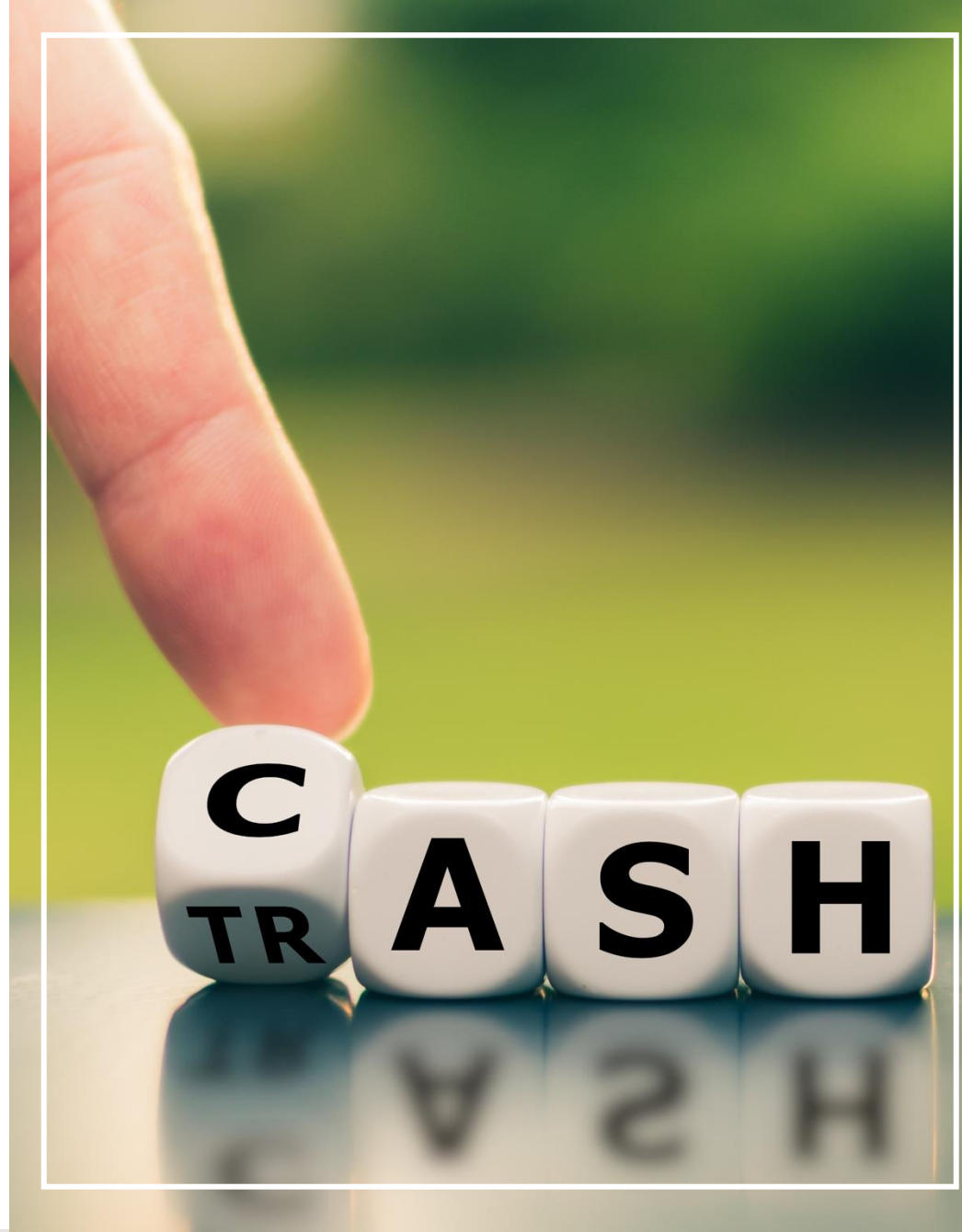




# Food Waste Effect

If we can save only 0.01% of the wasted food:

**We would save  
94,000,000 Dollars each  
year!**



# The Ethylene Gas

## The role of Ethylene in Food Waste Control

Climacteric fruits produce Ethylene.

Ethylene is an indicator of fruit ripening  
Ethylene also promotes ripening of nearby fruits, and can be used for intentional promoting of fruit ripening.

Ethylene concentration needs to be controlled and monitored!



# Monitoring Ethylene can reduce the loss of fruit in the whole supply chain:

- ✓ Cold storage
- ✓ Fruit transportation
- ✓ Ripening / Storage Room
- ✓ Supermarket's storage
- ✓ Home refrigerators





# From competition to opportunity

Commercial Ethylene Sensors versus GMOS:

Parameters:	Electrochemical	MOX	Pellistor	GMOS
Sensor size reduction	Limited	Available	Limited	Available
Power Consumption [mW]	> 10	> 10	> 100	1 - 10
Price [\$]	> 150	> 30	> 60	~10
Sensitivity	Good	Good	Medium	Good
Selectivity	Poor	Poor	Poor	Good



# GMOS – Addressing the Market Challenges

TODOS game-changing GMOS answer all the requirements and offers:



## Sensitivity

Detection level at very low concentrations



## Selectivity

Can detect separate gases



## Reliability

High immunity to false alarms



## Lower cost

Standard FABs and matured CMOS technology



## Low power consumption

Lower power operation at subthreshold (battery time)



## Calibration time

Short, no need to re-calibrate



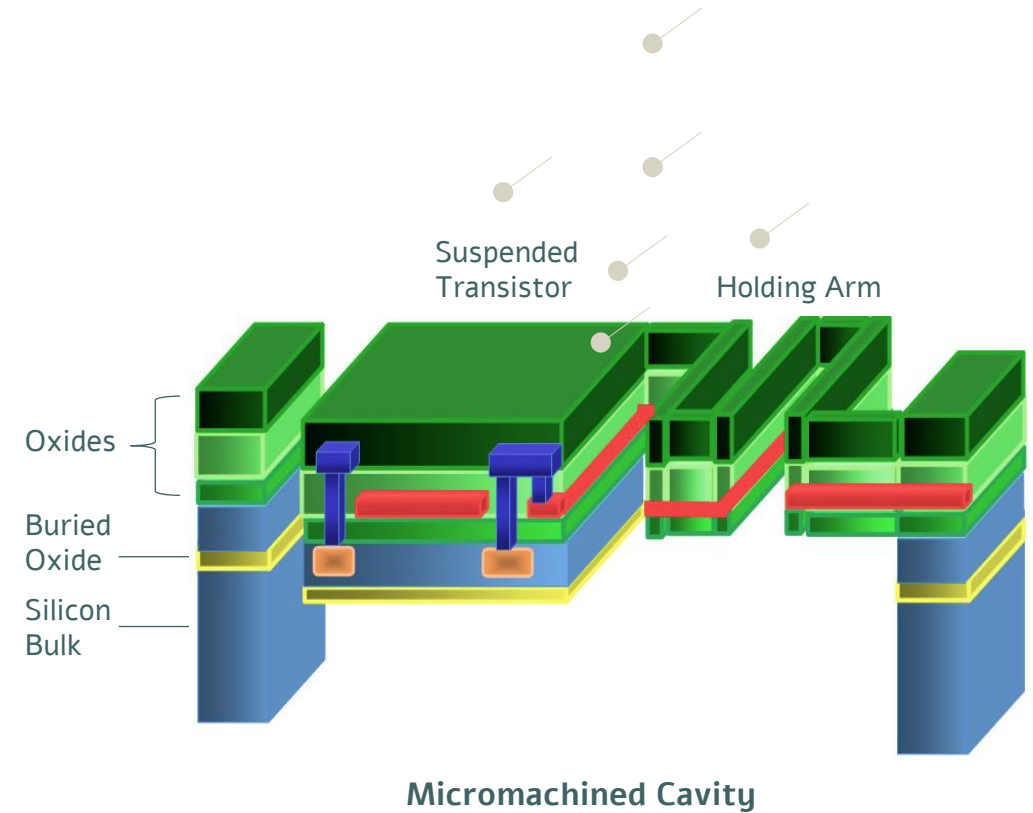
## Compatibility

Compatible with mobile applications, IoT, automotive industry, etc.

# Todos Innovation

## TMOS Operation Principle:

- Nano-machined thermally isolated transistor
- Absorbed radiation increases the TMOS temperature
- Transistor voltage detects temperature changes at subthreshold

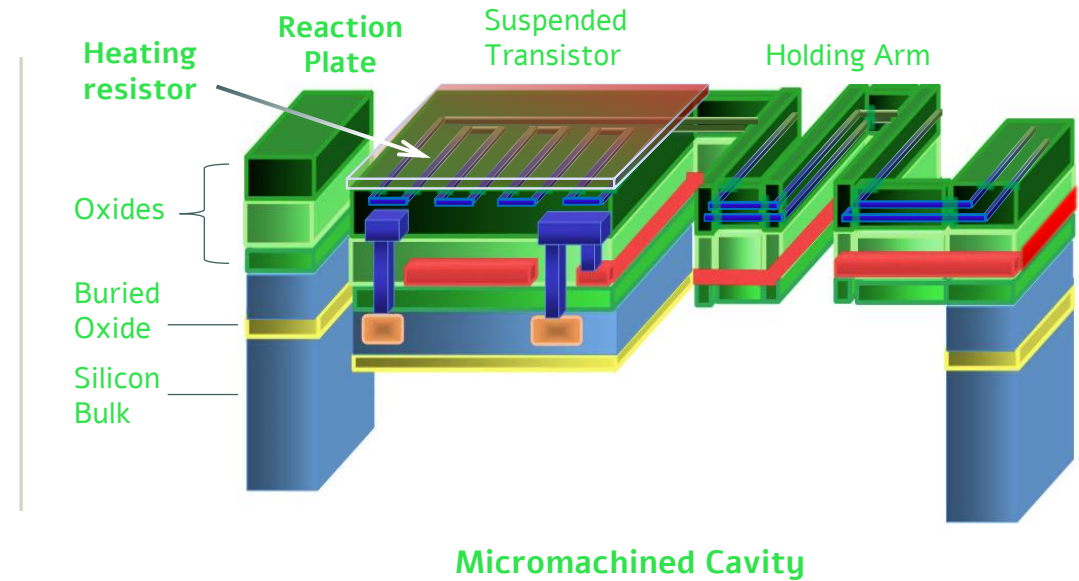




# Patented TMOS as Gas Sensor

TMOS version for Gas detection (GMOS):

- Heated catalytic reaction plate
- Reaction of Volatile Organic Components generates heat which is detected by the TMOS transistor



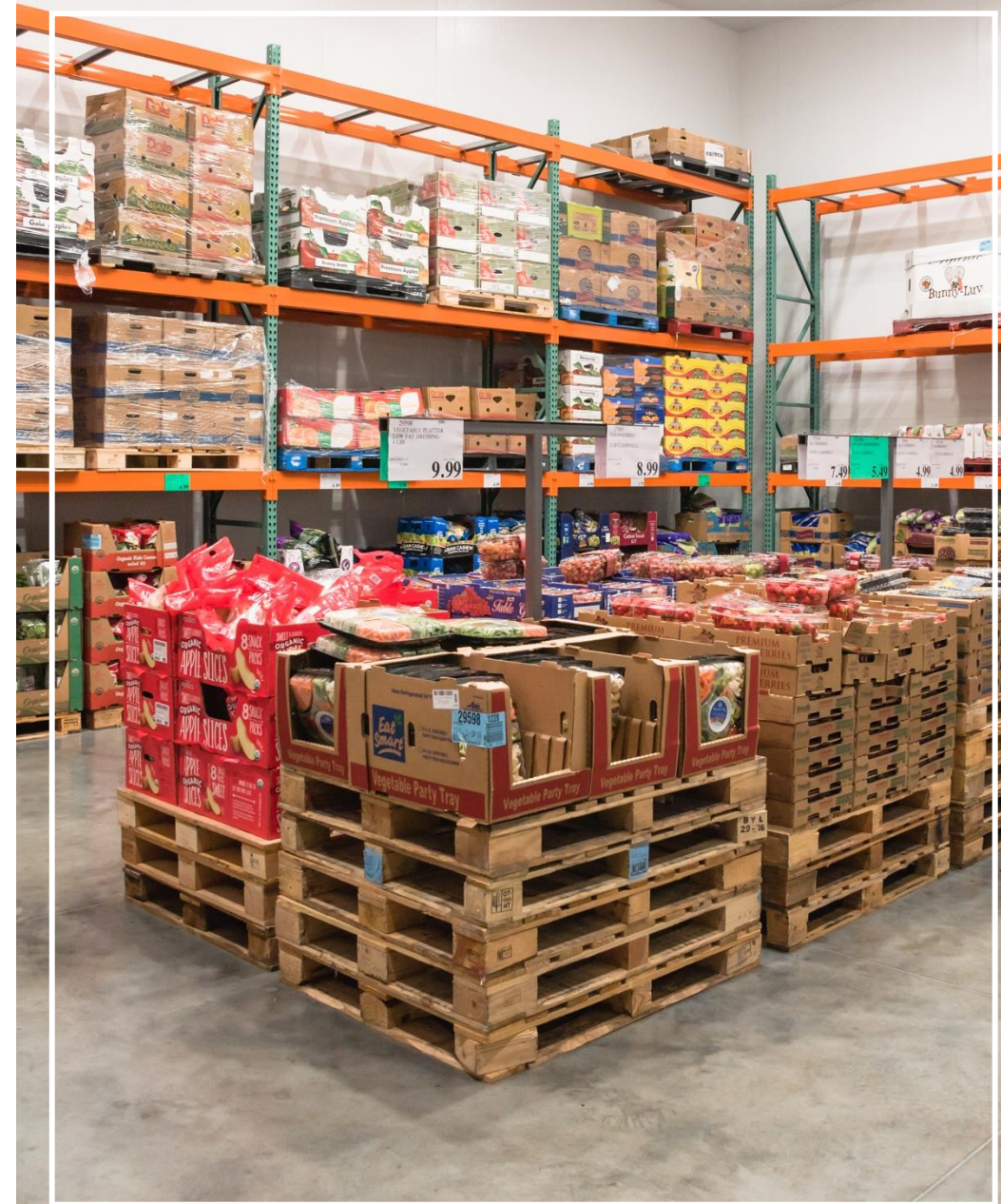




# Data driven supply chain

Our system will give the cold storage/supermarket/ logistics center the advantage of **knowing a specific package or area's shelf life.**

With that information, it can decide to advance the fruits to the supermarket shelf with a proper pricing, return to the supplier or direct it towards different path (jam or juice making).



# Data driven Refrigerator

Smart, intelligent refrigerator that can sense, adapt and control without manual intervention to provide optimum cooling experience to the client's feed items, keeping the food fresh by using the ethylene level to control ventilation, and informing when reaching an ethylene level which will cause the food to start or accelerate the ripening process.

For a better business model, the sensor will be suitable for two years of work.





# AI – predictive fruit monitoring\*

All the data will be stored on Todos cloud system and using AI the client will have predictions regarding the freshness level of the fruit.

By combining the data of the Ethylene and ethanol concentrations with temperature, humidity, season, fruit farm, location during transportation and location in the store – **the AI engine will predict the shelf life of each fruit package.**

\* Relevant for cold storage, transportation, ripening process and warehouses. In the future will be combined with RFID for smart refrigerators.



# Our Scope for Gas Sensors

Utilizing TMOS Technology **we reduce the price barrier** and create reliable solution for:



**Drivers' Ethanol**  
Breath Monitoring



**Acetone** gas sensor,  
embedded on  
smartphone / wearable



**Ethylene** sensor for  
controlling the ripening of  
fruits and plants



**CO** detector, and  
other selective air  
quality sensors.







Thank You

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