



# XENSIV™ magnetic switch sensor solutions for home appliances

September 2022



# Table of contents

---

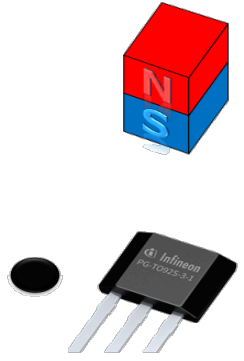
1	Infineon sensor use-cases and where to find them	3
	Refrigerator	
	Dryer	
	Washing machine	
	Dishwasher	
	Coffee machine	
2	Magnetic switch sensor solutions	11
3	Tools and kits	20

# Table of contents

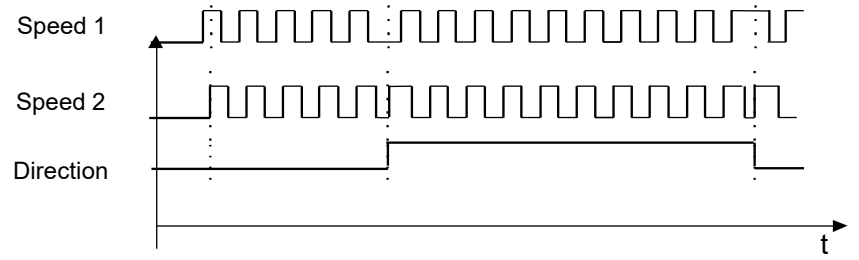
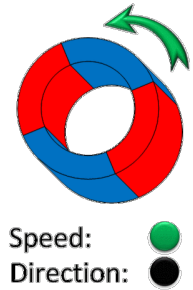
1	Infineon sensor use-cases and where to find them	3
	Refrigerator	
	Dryer	
	Washing machine	
	Dishwasher	
	Coffee machine	
2	Magnetic switch sensor solutions	11
3	Tools and kits	20

# XENSIV™ – magnetic switch use-cases

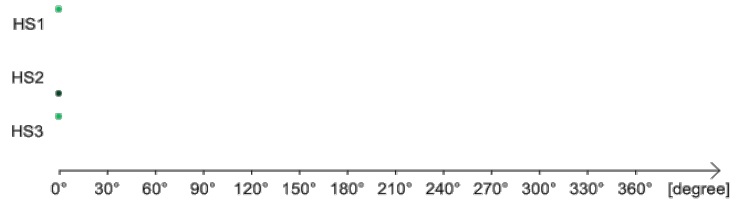
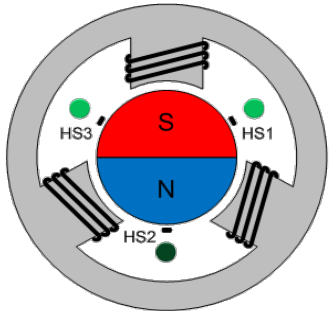
## Position sensing with Hall switches



## Speed and direction detection with double Hall latches

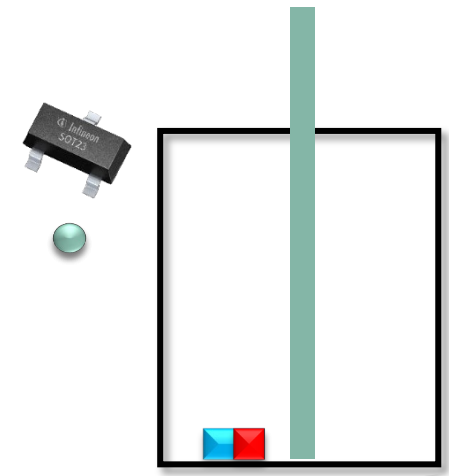


## Motor commutation with Hall latches



© 2012 Infineon Technologies AG

## Level sensing with Hall switches



# XENSIV™ – magnetic switch applications in home appliances

Fan control

Dispenser control

Door / lid switch and lock

Motor control

Drum control

Ice auger and maker



Water control

# XENSIV™ – magnetic switch applications in refrigerators

## Position sensing

- > Refrigerator door position
- > Drawer/compartiment door position
- > Temperature dials control position and buttons

## Level sensing

- > Ice bucket fill-level
- > Drain pan level
- > Water and ice dispenser level

## Motor commutation

- > Pump
- > Cooling fan
- > Ice maker pump
- > Ice auger motor



Sensor solution

### TLx4961/4/8-xM/xL

Family of magnetic switches and latches in standardized leaded and SMD packages

Customer value

**Contactless, reliable and cost-efficient sensor with wide operating temperature range**

# XENSIV™ – magnetic switch applications in dryers

## Position / level sensing

- > Dryer door position
- > Load detection
- > Dial position
- > Lint filter

## Motor commutation

- > Cooling fan
- > Drum motor
- > Condense water pump

## Speed and direction

- > Rotating drum
- > Broken belt detection

Sensor solution

### TLx4961/4/8-xM/xL

Family of magnetic switches and latches in standardized leaded and SMD packages

### TLx4966-xG/xL

Speed and direction detection in one sensor

Customer value

**Contactless, reliable and cost-efficient sensor with wide operating temperature range**



# XENSIV™ – magnetic switch applications in washing machines

## Position / level sensing

- > Door position
- > Load detection
- > Dial position
- > Flow meter
- > Detergent/water level
- > Inlet/drain valves

## Motor commutation

- > Water pump
- > Drum motor

## Speed and direction

- > Rotating drum

Sensor solution

### TLx4961/4/8-xM/xL

Family of magnetic switches and latches in standardized leaded and SMD packages

### TLx4966-xG/xL

Speed and direction detection in one sensor

Customer value

**Contactless, reliable and cost-efficient sensor with wide operating temperature range**





# XENSIV™ – magnetic switch applications in dishwashers

## Position sensing

- > Dishwasher door position
- > Rotating spray arm position
- > Flow meter
- > Inlet/drain valves

## Level sensing

- > Water level
- > Water softener level

## Motor commutation

- > Pump
- > Cooling fan

Sensor solution

### TLx4961/4/8-xM/xL

Family of magnetic switches and latches in standardized leaded and SMD packages

Customer value

**Contactless, reliable and cost-efficient sensor with wide operating temperature range**



# XENSIV™ – magnetic switch applications in coffee machines

## Position sensing

- > Open/close detection of the brewing unit
- > Water tank presence detection
- > Water flow meter
- > HMI

## Level sensing

- > Coffee grinder fill detection

## Motor commutation

- > Coffee grinder



Sensor solution

### TLx4961/4/8-xM/xL

Family of magnetic switches and latches in standardized leaded and SMD packages

Customer value

**Contactless, reliable and cost-efficient sensor with wide operating temperature range**

# Table of contents

<b>1</b>	<b>Infineon sensor use-cases and where to find them</b>	<b>3</b>
	Refrigerator	
	Dryer	
	Washing machine	
	Dishwasher	
	Coffee machine	
<b>2</b>	<b>Magnetic switch sensor solutions</b>	<b>11</b>
<b>3</b>	<b>Tools and kits</b>	<b>20</b>

# XENSIV™ - magnetic switch families

Tailored to your needs



## Key value

Position  
detection

### TLx4964-xM

Family of **32V** high precision automotive/industrial/consumer qualified **unipolar Hall switches**



**Low current consumption**

### TLx4965-xM

Family of **5V** high precision automotive/industrial qualified **unipolar Hall switches**



**Enables cost-effective PCB based systems**

Speed  
direction

### TLx4966-xG

Family of **24V** high precision automotive/industrial qualified **double Hall latches**



**Saves cost and PCB space**

Motor  
commutation

### TLx4961-xM

Family of **32V** high precision automotive/industrial/consumer qualified Hall latches



**High stability of magnetic thresholds**

### TLx4963-xM

Family of **5V** high precision automotive/industrial qualified Hall latches



**Enables cost-effective PCB based systems**

### TLx4968-xM

**High precision** automotive/industrial qualified **32V bipolar Hall switch**



**Small hysteresis → highly sensitive**

# TLx496x family

## 3<sup>rd</sup> generation of Hall switches and latches



### Automotive - TLE496x -

- > **Temperature:**  
-40° to 170°C
- > **Package:**  
PG-SOT23  
PG-SSO3
- > **Supply voltage:**  
3.0 to 5.5V  
3.0 to 32.0V
- > **Current consumption:**  
1.5 to 1.6mA



### Industry - TLI496x -

- > **Temperature:**  
-40° to 125°C
- > **Package:**  
PG-SOT23  
PG-SSO3
- > **Supply voltage:**  
3.0 to 5.5V  
3.0 to 32.0V
- > **Current consumption:**  
1.5 to 1.6mA



### Consumer - TLV496x -

- > **Temperature:**  
-40° to 125°C  
-40° to 85°C
- > **Package:**  
PG-SOT23  
PG-TO92S
- > **Supply voltage:**  
3.0 to 26.0V
- > **Current consumption**  
1.6mA



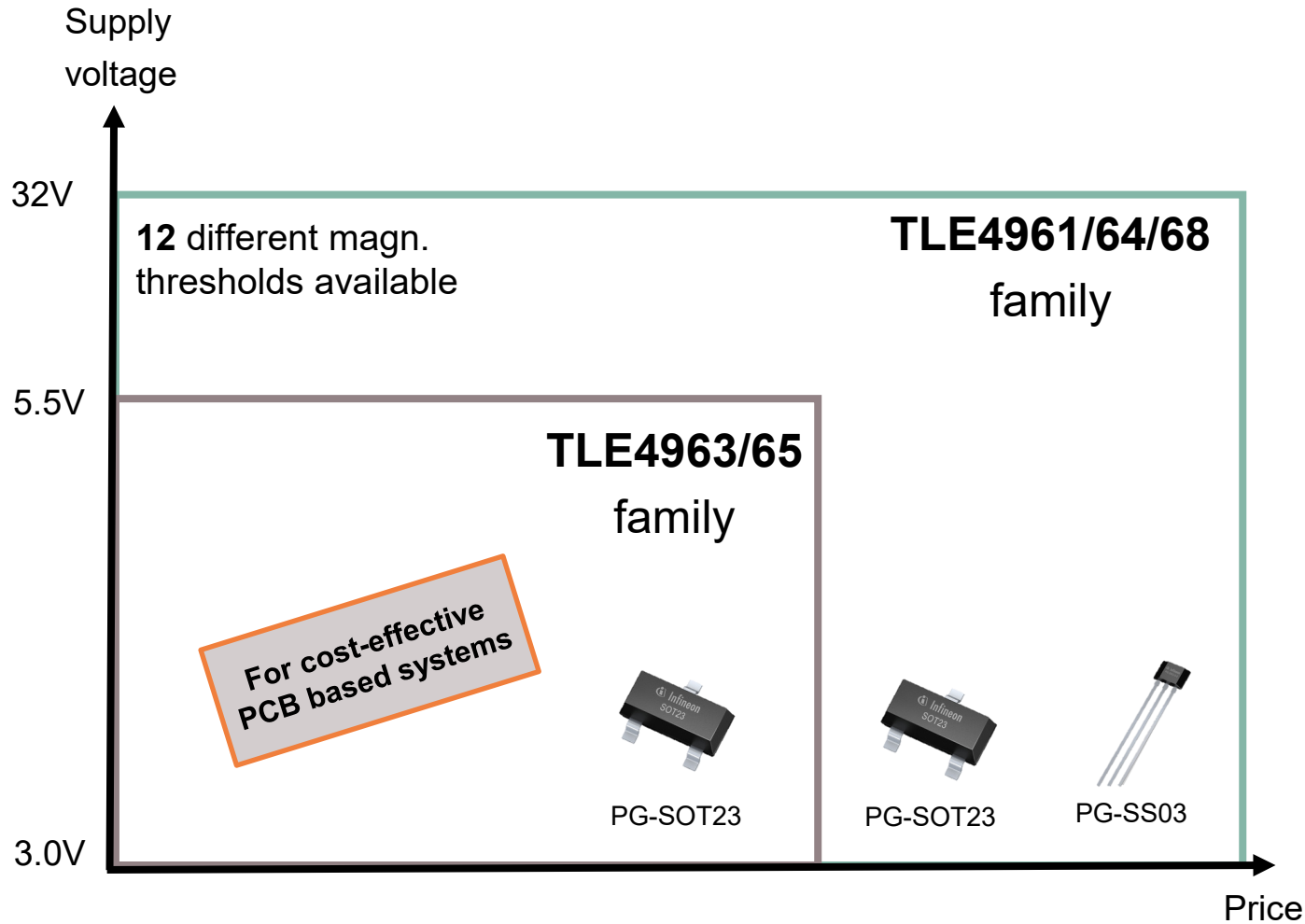
PRICE

PRICE

**Broad portfolio of available thresholds**

# TLE4961/63/68 and TLE4964/65 family

## For motor commutation and position sensing



### Product highlights

- > 3.0 to 5.5/32V operating supply voltage
- > Low current consumption of ~1.5mA
- > Low jitter (typ. 0.35µs)
- > High stability of the magnetic thresholds
- > Active error compensation
- > High ESD performance
- > Operating temperature range from -40 to +170°C

Product	B <sub>op</sub> /B <sub>rp</sub> [mT]	Type	Package
<a href="#">TLE4963-1M</a>	2.0 / -2.0	5V latch	PG-SOT23
<a href="#">TLE4965-5M</a>	7.5 / 5.0	5V switch	PG-SOT23
<a href="#">TLE4961-3M/L</a>	7.5 / -7.5	32V latch	PG-SOT23 PG-SSO3
<a href="#">TLE4964-2M</a>	28.0 / 22.5	32V switch	PG-SOT23
<a href="#">TLE4968-1M/L</a>	1 / -1	32V switch	PG-SOT23 PG-SSO3

# TLE4913 and TLV4961/4/8 – xTA/TB

## Specialized products for special requirements

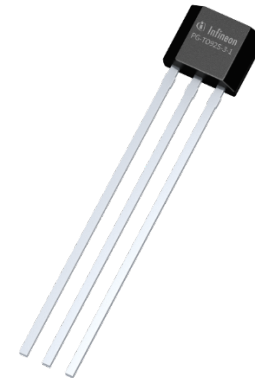
### TLE4913 – low power Hall switch

- › Micro power design (average current in standby mode ~4μA)
- › 2.4 to 5.5V battery operation
- › High sensitivity and high stability of the magnetic switching points
- › High resistance to mechanical stress
- › Digital output signal
- › Switching for both poles of a magnet - **omnipolar**
- › Standardized SMD package PG-SC59



### TLV4961/4/8 – xTA/TB – low cost consumer version

- › 3.0 to 26.0V operating supply voltage
- › Operation from unregulated power supply
- › Output overcurrent & overtemperature protection
- › Active error compensation
- › High stability of magnetic thresholds
- › High ESD performance
- › Leaded, halogen-free package **PG-T092S**
- › JESD47 qualified



### Product highlights

- › **Speed-speed or direction-speed detection** due to two integrated Hall sensor elements
- › **Excellent sensitivity and stability** of the magnetic **switching points**
- › **Operation** even from an **unregulated power supply**
- › **Reverse battery protection** (-18V)
- › Mounting flexibility - **horizontal (H)** and **vertical (V) sensing** possibility
- › **Different** operating supply **voltage ranges** available  
2.7 to 24V  
3.5 to 32V
- › **Overvoltage capability** up to 42V without external resistor
- › Automotive and industrial qualified sensors available
- › Different **temperature ranges**  
-40° to 170°C  
-40° to 125°C

Experience our [evaluation boards](#)



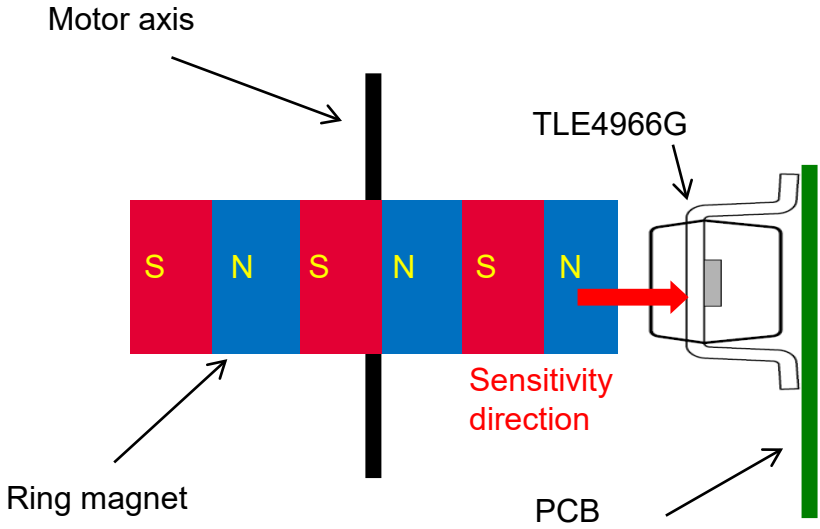
Product	$B_{op}/B_{rp}$ [mT]	Detection	Sensing	Package
<a href="#">TLE4966L</a>	7.5 / -7.5	speed-direction	H	PG-SSO3
<a href="#">TLI4966G</a>	7.5 / -7.5	speed-direction	H	PG-TSOP6
<a href="#">TLE4966-2G</a>	7.5 / -7.5	speed-speed	H	PG-TSOP6
<a href="#">TLE4966-3G</a>	2.5 / -2.5	speed-direction	H	PG-TSOP6
<a href="#">TLE4966V-1G</a>	2.5 / -2.5	speed-direction	V	PG-TSOP6



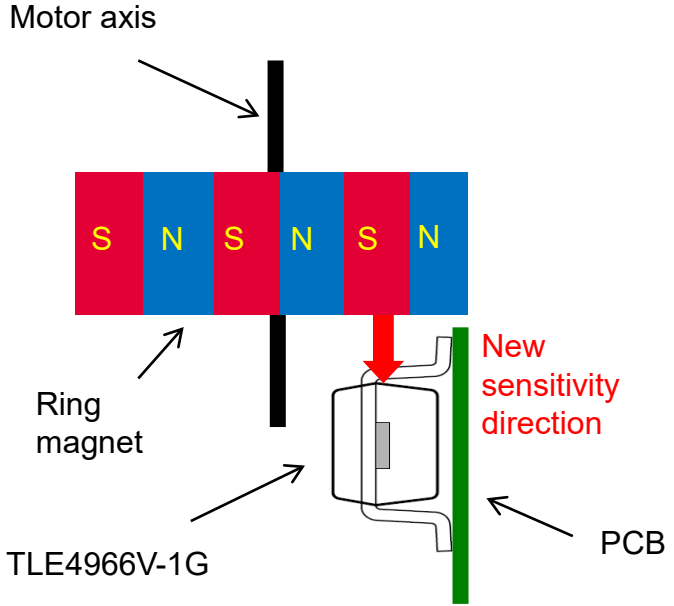
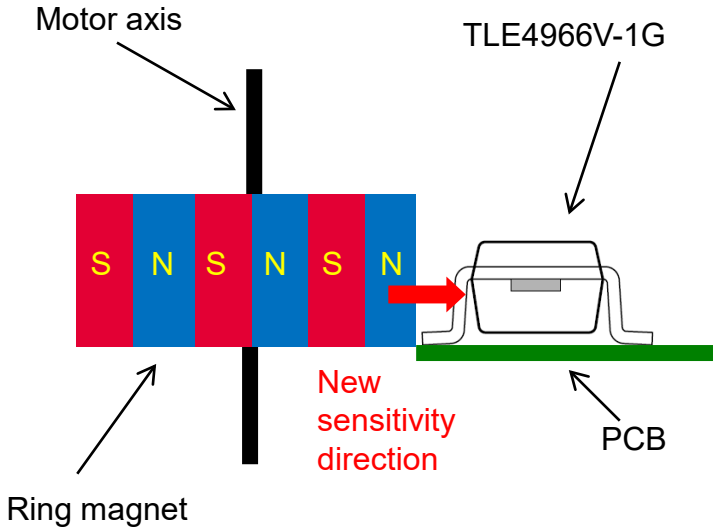
# Horizontal and vertical Hall element positioning

Enables mounting flexibility

**Horizontal**  
- TLx4966G -



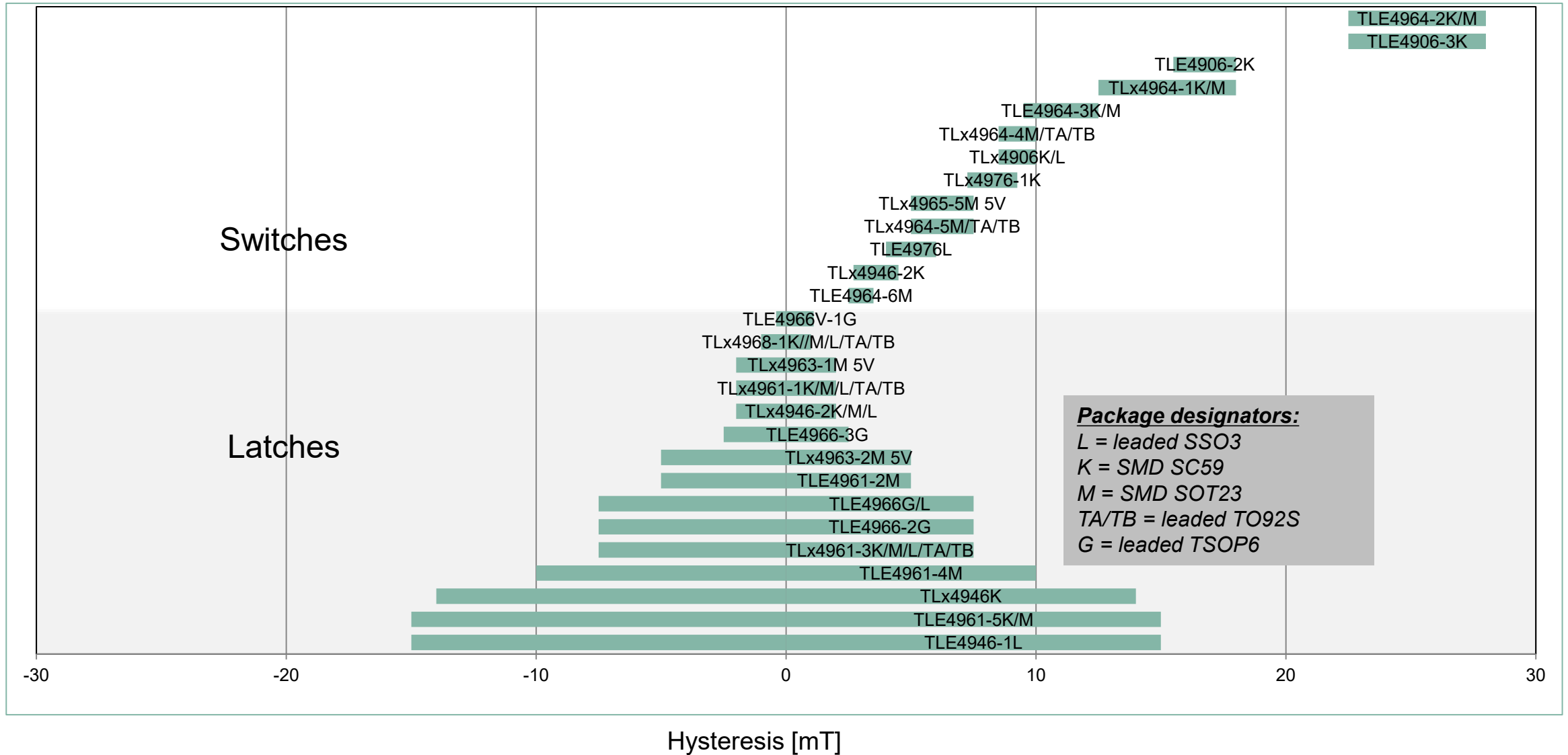
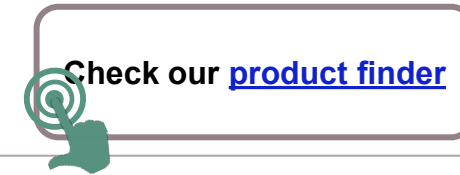
**Vertical**  
- TLE4966V-1G -



**Horizontal** and **vertical** sensing ensure flexibility in the system design and enable cost optimization measures (e.g. mounting position, system size)

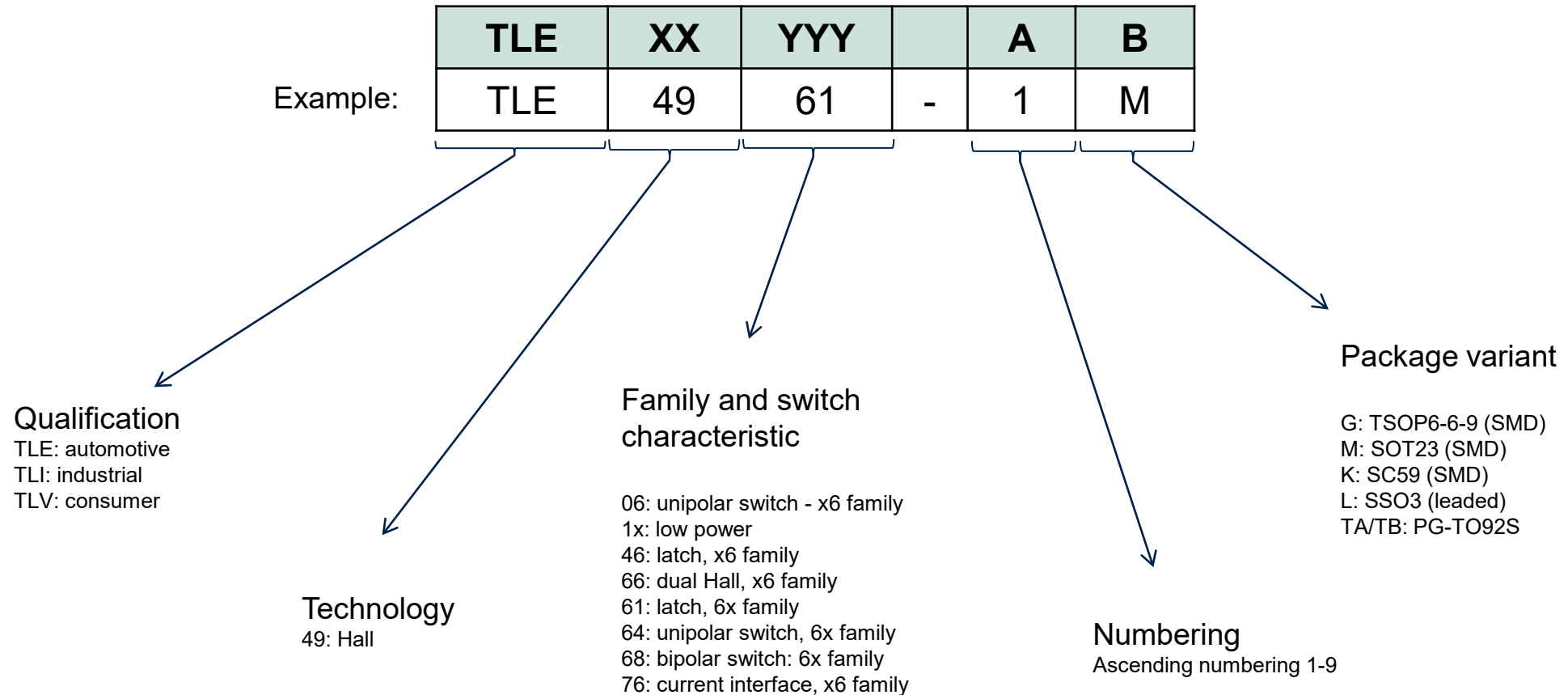
# Magnetic switch family sensitivity overview

More than 70 variants to support your concept



# Magnetic switches

## General sales number convention



# Table of contents

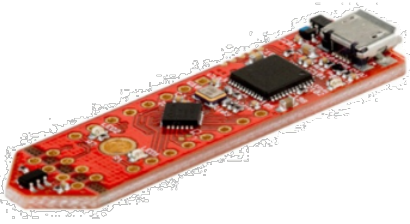
1	Infineon sensor use-cases and where to find them	3
	Refrigerator	
	Dryer	
	Washing machine	
	Dishwasher	
	Coffee machine	
2	Magnetic switch sensor solutions	11
3	Tools and kits	20

# XENSIV™ evaluation tool environment

## 2GO kit, Shield2GO and add-on

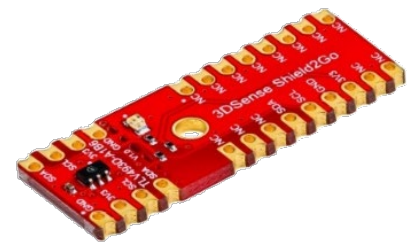
### 2GO kit

- > One Infineon sensor IC combined with an ARM® Cortex™-M0 CPU
- > USB connection for fast evaluation
- > On-board debugging



### Shield2GO

- > Comprise one board with one single Infineon IC
- > Solderless connectors included
- > Arduino based software



### Add-on

- > Several add-ons for different use cases available
- > Easy-to-use and mountable to our 2GO and Shield2Go kits



### GUI & code


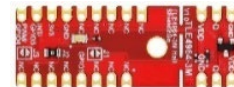
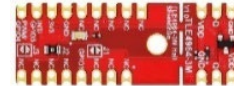

- > Graphical user interface (GUI)

- > Arduino library / GitHub



Check our [webpage](#) for all XENSIV™ kit material (e.g.: 3D printing files, user guides, details, ...)

# Magnetic switch evaluation tools

Product group	Sales name	Ordering code	
<b>2GO kit (XMC included)</b>	TLE4966_MS2GO	SP005406992	
<b>Shield2GO</b>	S2GO_HALL_TLE4964-3M	SP004308590	
<b>Shield2GO</b>	S2GO_2_HALL_TLE4966K	SP004308598	
<b>Add-on</b>	OPENCLOSE2GOHS	SP005544849	

# GUI and code examples for XENSIV™ 2GO kits and Shield2GOs

## Keep it simple and fast



## Infineon developer community

- › Easy-to-use GUI for fast and simple evaluation without programming

The screenshot shows the Infineon Developer Center website. The 'Tools' section is active, displaying a grid of tools. The tools listed are:

- 3D Magnetic Design Tool**: XENSIV™ Sensor online simulation tool offering accurate three-dimensional sensing of the Infineon 3D magnetic Hall sensors products. Tags: Anglemeasurement, linearposition, j... [Open]
- HallDesk Magnetic Hall Switch Simulation**: XENSIV™ Sensor online simulation tool offering an accurate simulation of the magnetic field and the switching behavior of all Infineon Hall switch sensor products. Tags: Magneticfield, HallDesk, HallSwitch [Open]
- Magnetic Design Tool: Angle Sensors**: XENSIV™ Sensor online simulation tool measuring the valid air-gap (distances from magnet surface to sensor) given a certain magnet size and remanence (diametrical magnetization). Tags: Anglesensors, Magneticdesign [Open]
- Simulation Model Finder**: Parametric Selection Tool for finding Simulation Model products. Tags: SimulationModel, Spice, PSpice, Ple... [Open]
- TLE4966 Magnetic Sensor Evaluation App**: Evaluation software for TLE4966 Magnetic Sensor 2Go kits. Connect to evaluation board, observe and log real time sensor data, visualize it using the built in tool or save it to a file. Version: 1.0.4.202109230553. Tags: Embedded Software, Application & A... [Install] [Download]
- TLx493D Magnetic Sensor Evaluation App**: Evaluation software for TLx493D 3D Hall Sensor 2Go kits. Connect to sensors and use 2Go kit addons to test them in various scenarios. Version: 6.1.0.202108261231. Tags: TLx493D, 3D, Application, Embedde... [Install] [Download]

<https://www.infineon.com/infineon-developer-center>

## Arduino / GitHub library

- › Adjustable and easy-to-use code examples for fast and simple evaluation

The screenshot shows the Infineon GitHub repository page. The repository is named 'Infineon' and is located in Neuberg, Germany. It has 853 repositories, 11 packages, and 11 people. The 'Pinned' section shows several repositories:

- modustoolbox-software**: This README contains links and information on Cypress and third-party middleware for ModusToolbox, as well as BSPs and other resources. 14 stars, 4 forks.
- Code-Examples-for-ModusToolbox-Software**: This README links to all available code examples for ModusToolbox software. 37 stars, 15 forks.
- optiga-trust-m**: OPTIGA™ Trust M Software Framework. 60 stars, 35 forks.
- XMC-for-Arduino**: Integration of Infineon's XMC microcontrollers into the Arduino IDE. 77 stars, 48 forks.
- AURIX\_code\_examples**: This repository contains code example projects for the AURIX™ Development Studio. 162 stars, 138 forks.
- embedded-hw-peripheral-libs-quick-links**: Quick links to Infineon sensors, actuators, and application specific ICs software resources on GitHub. 6 stars, 1 fork.

The 'Repositories' section shows a search bar and filters for Type, Language, and Sort. The first repository listed is 'modustoolbox-software' with 14 stars, 4 forks, and 1 issue, updated 10 hours ago. The second repository is 'XMC-for-Arduino' with 77 stars, 48 forks, 2 issues, and 0 pull requests, updated 15 hours ago.

<https://github.com/Infineon>

Further information on our website

<https://www.infineon.com/magnetic-sensors>

- › Application notes
- › Presentations
- › Articles
- › Boards
- › eLearnings
- › Evaluation kits
- › Online simulation tools & product finders
- › Podcasts
- › Reference designs
- › White papers







Part of your life. Part of tomorrow.