

Analog & Sensor Highlights





Discover the Internet of Things
Design **SMART** Products



What is **SMART**?

RUTRONIK SMART is a new range of bundled hardware, software and services, bringing together entire solutions, consisting of selected Sensors, Wireless Components, Security Solutions and Cloud Services for devices on the Internet of Things. The featured products are optimized for the typical requirements like space limitations, ultra-low-power and offer a high level of integration.

Our Product Portfolio

- Semiconductors
- Boards & Systems
- Passive Components
- Storage Technologies
- Electromechanical Components
- Wireless Technologies
- Displays & Monitors

Our Initiatives



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Committed to Excellence

Consult – Know-how. Built-in.

The Technical Competence from RUTRONIK

Worldwide and individual consulting on the spot: by competent sales staff, application engineers and product specialists.

Components – Variety. Built-in.

The Product Portfolio from RUTRONIK

Wide product range of semiconductors, passive and electro-mechanical components, displays & monitors, boards & systems, storage and wireless technologies for optimum coverage of your needs.

Logistics – Reliability. Built-in.

The Delivery Service from RUTRONIK

Innovative and flexible solutions: from supply chain management to individual logistics systems.

Quality – Security. Built-in.

Quality without Compromise from RUTRONIK

The integrated management system (IMS) encompasses quality control, information security, environmental protection, occupational health and safety.

Analog & Sensor Highlights

Your Reliable Source for Analog & Sensor Solutions

Rutronik Analog



Rutronik Analog Connects the Analog and Digital Worlds

Operational amplifier & comparators, converter & digital potentiometer, voltage references & supervisor as well as timer IC and interfaces – this is our comprehensive analog offer.

Analog products connect the physical and the digital worlds by translating sensor signals into 1s and 0s - useable in electronics.

A broad selection of devices that are characterized by small footprint, high level of integration and low-power consumption will help you to solve design challenges.

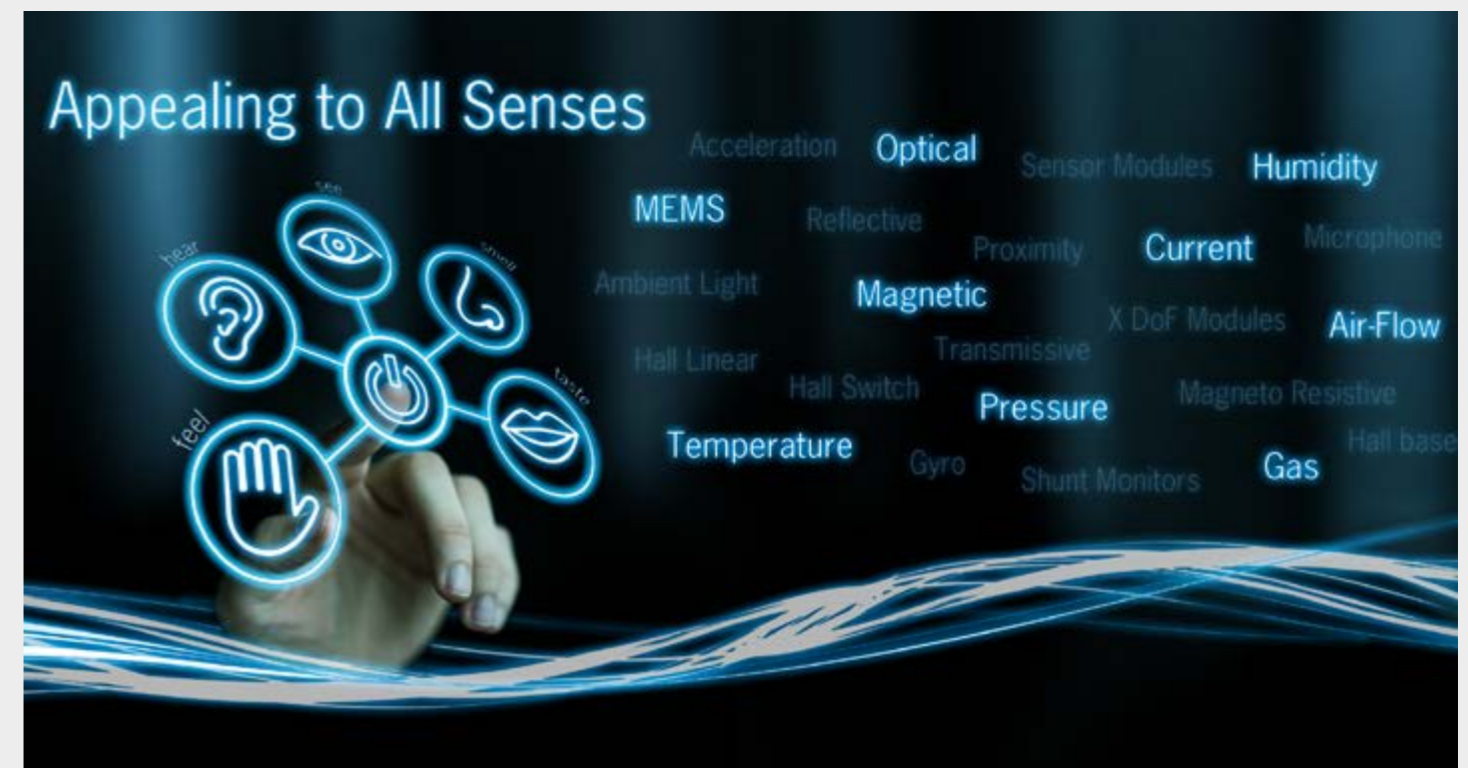


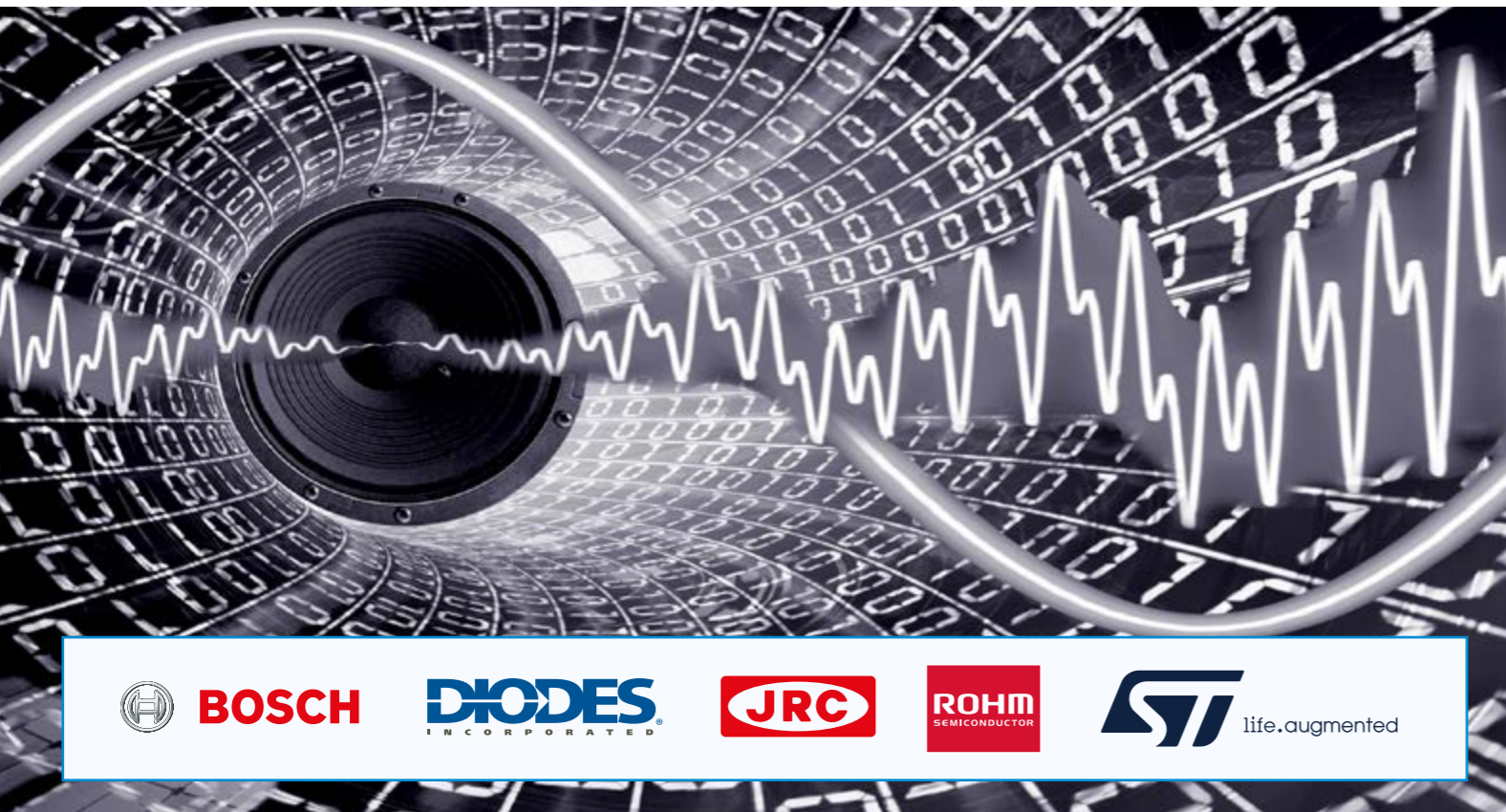
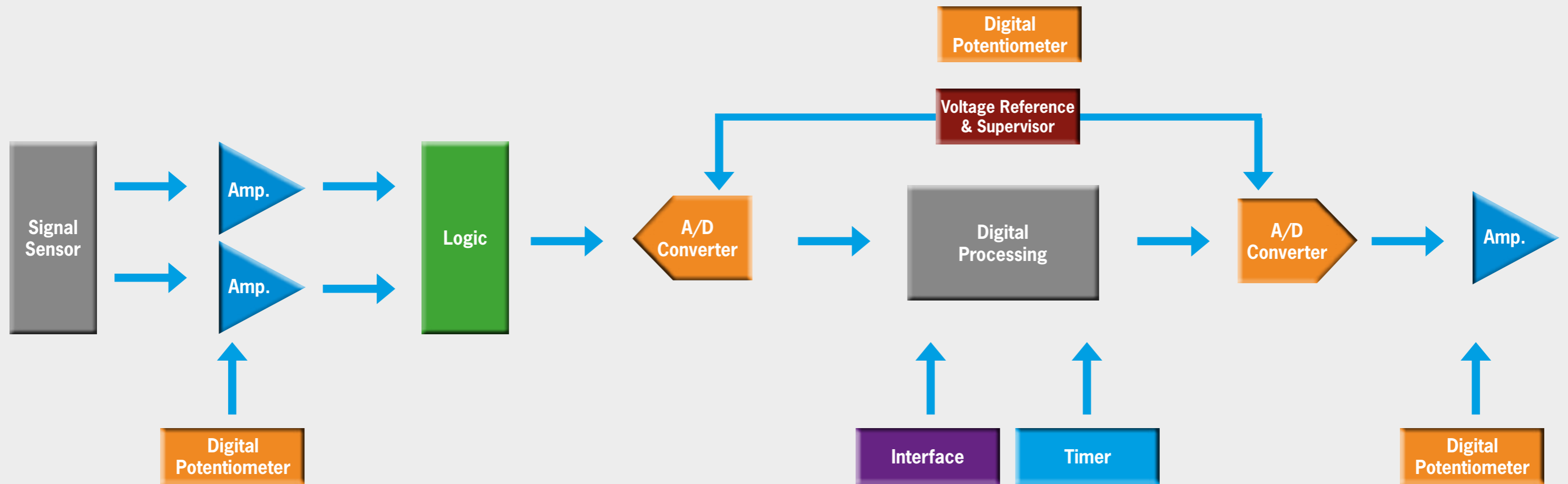
Rutronik Sensors



Rutronik – THE Sensor Distributor

This is our self-conception when it comes to sensors. An industry leading sensor portfolio combined with state of the art products and an exemplary solution selling approach makes it easy for you to realize your sensing application. Let's go and appeal to all senses!





Analog Portfolio

Products	Page	Bosch AE	Diodes	NJRC	Rohm	ST	Products		
Amplifier	9						Amplifier		
Comparator			A	I	A	I	Comparator		
Current Shunt Amplifier			A	I			Current Shunt Amplifier		
Operational Amplifier			A	I	A	I	Operational Amplifier		
Converter & Digital Potentiometer	18						Converter & Digital Potentiometer		
A / D-Converter				A	I		A / D-Converter		
D / A-Converter					I		D / A-Converter		
Voltage References & Supervisor	19						Voltage References & Supervisor		
Supervisor				A	I	A	I	Supervisor	
Voltage References			A	I			A	I	Voltage References
Timer	20						Timer		
Oscillator				I				Oscillator	
Real-Time-Clock				I		I	A	I	Real-Time-Clock
Interface	22						Interface		
CAN			A	I					CAN

A Automotive qualified preferred I Industrial

Appealing to All Senses



Acceleration Optical Sensor Modules Humidity
 MEMS Reflective Proximity Current Microphone
 Ambient Light Magnetic X DoF Modules Air-Flow
 Hall Linear Transmissive Magneto Resistive
 Hall Switch Pressure Gas Hall based ICs
 Temperature Gyro Shunt Monitors



Sensor Portfolio

Sensor Products	Page	Bosch AE	Bosch Sensortec	BYD	Comus	Diodes	Epson	Everlight	Infineon	LiteOn	Melexis	Murata	NJRC	Omron	Osram	Panasonic	Rohm	Sensirion	ST	TDK/Micronas	Toshiba	Vishay	Sensor Products		
MEMS																									
Absolute Orientation	24		I																					Absolute Orientation	
Acceleration		A	I																A	I				Acceleration	
eCompass			I																					eCompass	
Gyroscope		A	I																A	I				Gyroscope	
IMU (Acceleration + Gyro)		A	I																					IMU (Acceleration + Gyro)	
Microphone																								Microphone	
Environmental																									
Air-Flow	38																							Air-Flow	
Gas																								Gas	
Humidity																			A					Humidity	
Pressure		A	I						A	I	A													Pressure	
Temperature																							A	I	Temperature
Particulate Matter																									Particulate Matter
Optical																									
Ambient Light	51												A	I		A	I						A	I	Ambient Light
Camera Modules																									Camera Modules
Far Infrared/Infrared											A	I													Far Infrared/Infrared
Fingerprint																									Fingerprint
Image																									Image
Proximity																									Proximity
Radar																									Radar
Reflective																									Reflective
Time-of-Flight																									Time-of-Flight
Transmissive																									Transmissive
Ultrasonic																									Ultrasonic
Magnetic																									
Geomagnetic	64																								Geomagnetic
Hall Linear	non programmable																								non programmable
	programmable																								programmable
Hall Switch	single																								single
	dual																								dual
Hall Switch	speed																								speed
	programmable																								programmable
Magnetoresistive	switch																								switch
	3D switch																								3D switch
Magnetoresistive	linear																								linear
	2D sensor																								2D sensor
Multiaxis Hall																									Multiaxis Hall
TMR																									TMR
Current																									
Hall based ICs	90																								Hall based ICs
Sensor Modules																									Sensor Modules
Shunt Monitors																									Shunt Monitors

A Automotive qualified preferred I Industrial



RUTRONIK SMART



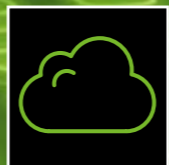
Sensors



Wireless



Security



Cloud

Discover the Internet of Things
Design **SMART** Products



RUTRONIK **SMART** offers you a new range of bundled hardware, software and services. RUTRONIK **SMART** brings together entire solutions to build applications for:

- Health
- Home
- Retail
- Tracking

More information:
www.rutronik.com/smart



Current Monitors – The DIODES Advantage

ZXCT Current Monitors

ZXCT current monitors convert a high-side current measurement to a ground referred current/voltage output; greatly simplifying high-sided current measurements.

Features

- Measures current without upsetting the ground reference point
- Current output versions provide simple programmability of gain
- Voltage output versions reduces component count
- ZXCT1008/1009/1107/1109 in tiny SOT23 package
- ZXCT108x common-mode sensing up to 60V lines
- ZXCT1xxxQ Automotive-compliant versions supporting PPAP documentation

Part Number	Autom. Compliant PPAP & AEC-Q100	Output Type	Min. V _{CC} /V _S Supply Voltage (V)	Max. V _{CC} /V _S Supply Voltage (V)	Min. S+ Common-Mode Sense Voltage (V)	Max. S+ Common-Mode Sense Voltage (V)	Maximum Output Voltage (V)	Max. Sense Voltage (V)	Accuracy @ V _{SENSE} =100 mV(%)	Quiescent Current (µA)	Gain Output/V _{SENSE}	Bandwidth (MHz)	Ambient Temperature Range (°C)	Packages
ZXCT1008	ZXCT1008Q	Current	N/A	N/A	2.5	20	V _S + -2.5	0.5	2.5	4	10mA/V	2	-40 to +125	SOT23
ZXCT1009	ZXCT1009Q	Current	N/A	N/A	2.5	20	V _S + -2.5	2.5	2.5	4	10mA/V	2	-40 to +85	SM-8
ZXCT1010	N	Current	N/A	N/A	2.5	20	V _S - -1.0	2.5	2.5	3,5	10mA/V	2	-40 to +85	SOT25
ZXCT1011	N	Current	N/A	N/A	2.5	20	V _S - -1.0	0.5	0.5	4	10mA/V	1.5	-40 to +125	SOT25
ZXCT1020	N	Current	2.7	20	2.5	V _b	V _S - -1.0	0.5	0.5	25	Ext. resistor	3	-40 to +125	SOT25
ZXCT1021	N	Voltage	2.5	20	2.5	20	V _S - -1.0	1.5	-	25	25	1	-40 to +85	SOT25
ZXCT1022	N	Voltage	2.5	20	2.5	20	V _S - -1.0	0.18	-	25	100	1	-40 to +85	SOT25
ZXCT1023	N	Voltage	2.5	20	2.5	20	V _S - -1.0	0.38	-	3,5	50	1	-40 to +85	TDFN1812-4
ZXCT1030	N	Voltage	2.2	20	2.2	V _{CC}	V _{CC} -2.0	0.5	-	270	10	6	-40 to +85	SO-8
ZXCT1032	N	Voltage	9.5	21	9.5	21	V _S - -1.0	0.25	-	1600	N/A	-	-40 to +85	SOT25
ZXCT1041	N	Voltage	N/A	N/A	2.7	20	V _S - -1.0	0.8	-	35	10	0.3	-40 to +85	SOT25
ZXCT1050	N	Current	2.7	20	0	V _{CC} -2	V _{CC} -2.0	0.5	3.0	50	Ext. resistor	0.8	-40 to +125	SOT25
ZXCT1051	N	Voltage	2.5	20	0	V _{CC} -2	V _{CC} -2.0	0.3	3.0	50	10	2	-40 to +125	SOT25
ZXCT1080	ZXCT1080Q	Voltage	4.5	12	3	60	V _S - -1.5	0.15	-	30	10	0.5	-40 to +125	SOT25
ZXCT1081	ZXCT1081Q	Voltage	4.5	12	3	40	V _S - -1.5	0.15	-	30	10	0.5	-40 to +125	SOT25
ZXCT1082	ZXCT1082Q	Current	2.7	60	2.7	60	V _S - -1.0	0.5	2.0	2	Ext. resistor	0.5	-40 to +125	SOT25
ZXCT1083	ZXCT1083Q	Current	2.7	40	2.7	40	V _S - -1.0	0.5	2.0	2	Ext. resistor	0.5	-40 to +125	SOT25
ZXCT1084	ZXCT1084Q	Voltage	2.7	60	2.7	60	V _S - -1.0	0.5	2.0	2	25	0.5	-40 to +125	SOT25
ZXCT1085	ZXCT1085Q	Voltage	2.7	40	2.7	40	V _S - -1.0	0.5	2.0	2	25	0.5	-40 to +125	SOT25
ZXCT1086	ZXCT1086Q	Voltage	2.7	60	2.7	60	V _S - -1.0	0.5	2.0	2	50	0.2	-40 to +125	SOT25
ZXCT1087	ZXCT1087Q	Voltage	2.7	40	2.7	40	V _S - -1.0	0.5	2.0	2	50	0.2	-40 to +125	SOT25
ZXCT1107	ZXCT1107Q	Current	N/A	N/A	N/A	36	V _S + -2.5	0.8	3.4	3	4mA/V	0.3	-40 to +125	SOT23
ZXCT1109	ZXCT1109Q	Current	N/A	N/A	N/A	36	V _S + -2.5	0.8	3.4	3	4mA/V	0.3	-40 to +125	SOT23
ZXCT1110	ZXCT1110Q	Current	N/A	N/A	N/A	36	V _S - -1.0	0.8	1.8	3	4mA/V	0.3	-40 to +125	SOT23 - 5

Operational Amplifiers & Comparators

- Industry-standard general-purpose op-amps and comparators: AS3xx/LM290x series
- Industry-standard low-voltage general-purpose op-amps and comparators: LMV3, AZV8 and AZV3 series
- Single, dual and quad configurations
- Automotive compliant LM290xQ family

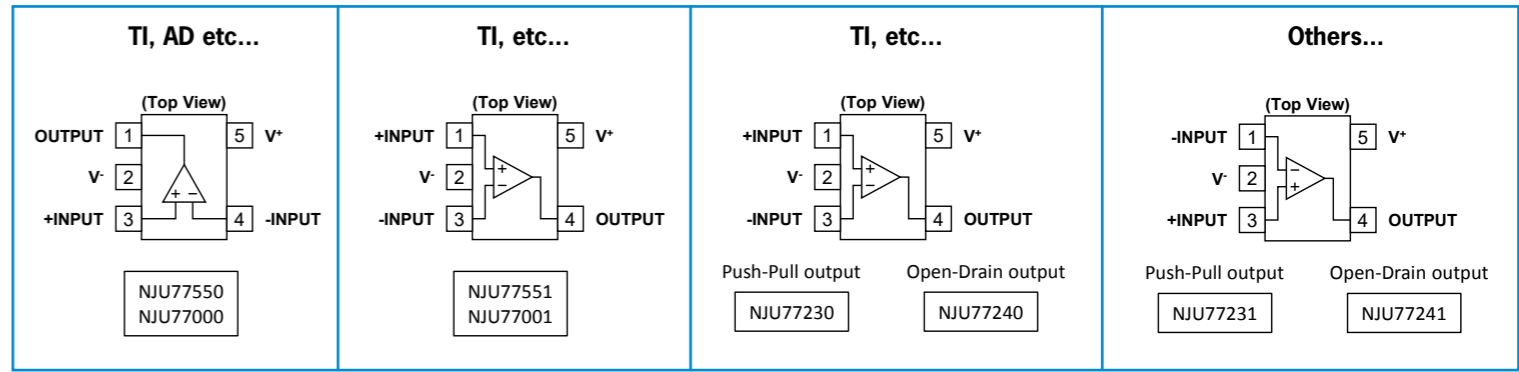


Amplifier

Part Number	No. of Channels	Min. Supply Voltage (V)	Max. Supply Voltage (V)	Supply Current @ 5V (per Op Amp) (mA)	Input Offset Voltage typ (mV)	Input Bias Current typ (nA)	Min Input Common Mode Voltage (V)	Max Input Common Mode Voltage (V)	Output Current Source (mA)	Output Current Sink (mA)	Rail-Rail	Operating Ambient Temp Range (°C)	Packages
AP358	2	3	32	0.5	2	45	V-	V+ -1.5	40	20	None	0 to +70	MSOP-8, SO-8
APX321	1	2.5	5.5	0.11	1.7	15	V+ +0.2	V+ +0.2	60	90	In/output	-40 to +85	SOT25, SOT353
APX324	4	2.5	5.5	0.34	1.7	15	V+ +0.2	V+ -0.2	60	90	In/output	-40 to +85	TSSOP-14
APX358	2	2.5	5.5	0.19	1.7	15	V+ +0.2	V+ -0.2	60	90	In/output	-40 to +85	MSOP-8, SO-8
APX4558	2	5	15	1.25	0.5	150	V+ +3	V+ -3	30	30	None	0 to +70	SO-8
APX4558I	2	5	15	1.25	0.5	150	V+ +3	V+ -3	30	30	None	-40 to +105	SO-8
AS321	1	3	36	0.35	2	20	V-	V+ -1.5	40	15	None	-40 to +85	SOT25
AS324	4	3	36	0.7	2	20	V-	V+ -1.5	40	15	None	-40 to +85	SO-14, TSSOP-14
AS324A	2	3	36	0.7	2	20	V-	V+ -1.5	40	15	None	-40 to +85	SO-14
AS358	2	3	36	0.5	2	20	V-	V+ -1.5	40	15	None	-40 to +85	MSOP-8, SO-8, TSSOP-8
AS358A	2	3	36	0.5	2	20	V-	V+ -1.5	40	15	None	-40 to +85	MSOP-8, SO-8, TSSOP-8
AS358B	2	3	36	0.5	-	20	V-	V+ -1.5	40	15	None	-40 to +85	TSSOP-8
AZ386	1	4	16	6	-	10	V-	V+ -1.5	500	500	None	0 to +75	SO-8
AZ4558C	2	2	18	2.5	1	70	V+ +3	V+ -3	35	60	None	-40 to +85	PDIP-8, SO-8
AZ4580	2	2	18	4	0.5	150	V+ +3	V+ -3	45	80	None	-40 to +85	SO-8, TSSOP-8
AZV321	1	2.7	5.5	-	1.7	11	V- -0.1	V+ +0.8	60	160	Output	-40 to +85	SOT25, SOT353
AZV358	2	2.7	5.5	-	1.7	-	Vw- -0.1	V+ +0.8	60	160	Output	-40 to +85	MSOP-8, SO-8, TSSOP-8
AZV831	1	1.6	5.5	0.9	-	0.001	V- -0.2	V+ +0.2	-	10	In/output	-40 to +85	SOT25
AZV832	2	1.6	5.5	0.9	0.5	0.001	V- -0.2	V+ +0.2	-	-	In/output	-40 to +85	MSOP-8, SO-8
LM2902	4	3	36	0.9	2	25	V-	V+ -1.5	16	16	None	-40 to +125	SO-14, TSSOP-14
LM2902A	4	3	36	0.9	1	25	V-	V+ -1.5	16	16	None	-40 to +125	SO-14, TSSOP-14
LM2902AQ	4	3	36	0.9	1	25	V-	V+ -1.5	16	16	None	-40 to +125	SO-14, TSSOP-14
LM2902Q	4	3	36	0.9	2	25	V-	V+ -1.5	16	16	None	-40 to +125	SO-14, TSSOP-14
LM2904	2	3	36	0.6	2	25	V-	V+ -1.5	16	16	None	-40 to +125	MSOP-8, SO-8, TSSOP-8
LM2904A	2	3	36	0.6	1	25	V-	V+ -1.5	16	16	None	-40 to +125	MSOP-8, SO-8, TSSOP-8
LM2904AQ	2	3	36	0.6	1	25	V-	Vcc-1.5	16	16	None	-40 to +125	MSOP-8, SO-8, TSSOP-8
LM2904Q	2	3	36	0.6	2	25	V-	V+ -1.5	16	16	None	-40 to +125	MSOP-8, SO-8, TSSOP-8
LM358	2	3	32	0.5	2	45	V-	V+ -1.5	40	20	None	0 to +70	SO-8
LMV321	1	2.5	5.5	0.11	1.7	15	V-	V+ -1	60	90	Output	-40 to +125	SOT25, SOT353
LMV324	4	2.5	5.5	0.34	1.7	15	V-	V+ -1	60	90	Output	-40 to +125	SO-14, TSSOP-14
LMV358	2	2.5	5.5	0.19	1.7	15	V-	V+ -1	60	90	Output	-40 to +125	MSOP-8, SO-8
TL072	2	5	15	2.8	3	0.065	V+ +4	V+ -4	25	25	None	-40 to +85	SO-8
TL082	2	5	15	2.8	3	0.08	V+ +4	V+ -4	25	-	None	-40 to +85	SO-8
TLC271AC	1	3	16	0.28	0.9	0.0006	V- -0.2	V+ -1.0	15	15	None	0 to +70	SO-8
TLC271AI	1	4	16	0.28	0.9	0.0006	V- -0.2	V+ -1.0	15	15	None	-40 to +125	SO-8
TLC271BC	1	3	16	0.28	0.24	0.0006	V- -0.2	V+ -1.0	15	15	None	0 to +70	SO-8
TLC271BI	1	4	16	0.28	0.24	0.0006	V- -0.2	V+ -1.0	15	15	None	-40 to +125	SO-8
TLC271C	1	3	16	0.28	1.1	0.0006	V- -0.2	V+ -1.0	15	15	None	0 to +70	SO-8
TLC271I	1	4	16	0.28	1.1	0.0006	V- -0.2	V+ -1.0	15	15	None	-40 to +125	SO-8
TLC271IAC	1	3	16	0.01	0.9	0.0006	V- -0.2	V+ -1.0	15	15	None	0 to +70	SO-8
TLC271IAI	1	4	16	0.01	0.9	0.0006	V- -0.2	V+ -1.0	15	15	None	-40 to +125	SO-8
TLC271IBC	1	3	16	0.1	0.24	0.0006	V- -0.2	V+ -1.0	15	15	None	0 to +70	SO-8
TLC271IBI	1	4	16	0.1	0.24	0.0006	V- -0.2	V+ -1.0	15	15	None	-40 to +125	SO-8
TLC271IC	1	3	16	280	0.24	0.0006	V- -0.2	V+ -1.0	15	15	None	0 to +70	SO-8
TLC271IIC	1	4	16	0.01	1.1	0.0006	V- -0.2	V+ -1.0	15	15	None	-40 to +125	SO-8
TLV271C	1	2.7	16	0.55	0.5	0.001	V-	V+ -1.35	13	12	Output	0 to +70	SO-8, SOT25
TLV271I	1	2.7	16	0.55	0.5	0.001	V-	V+ -1.35	13	12	Output	-40 to +125	SO-8, SOT25
TLV272C	2	2.7	16	0.55	0.5	0.001	V-	V+ -1.35	13	12	Output	0 to +70	MSOP-8, SO-8
TLV272I	2	2.7	16	0.55	0.5	0.001	V-	V+ -1.35	13	12	Output	-40 to +125	MSOP-8, SO-8

Comparator

Part Number	No. of Channels	Min Supply Voltage (V)	Max Supply Voltage (V)	Supply Current @ 5V (per Op Amp) (mA)	Input Offset Voltage (Typ/Max) (mV)	Input Bias Current typ (nA)	Min Input Common Mode Voltage (V)	Max Input Common Mode Voltage (V)	Output Current Sink (mA)	Output Type	Operating Ambient Temperature Range (°C)	Packages
ACS393MTR	1	2	36	0.4	4 to 8	150	0	Vcc-1.5	16	Open Collector	0 to +70	SO-8
AP331A	1	2	36	0.4	4 to 8	150	0	Vcc-1.5	16	Open collector	0 to +70	SOT25
APX339	4	2.5	5.5	0.24	1.7 to 7	10	V+ +0.2	V+ -0.2	60	Open Collector	-40 to +85	TSSOP-14
APX393	2	2.5	5.5	0.15	1.7 to 7	10	V+ +0.2	V+ -0.2	60	Open Collector	-40 to +85	MSOP-8, SO-8
AS331	1	2	36	0.4	1 to 5	25	0	Vcc-1.5	16	Open collector	-40 to +85	SOT25
AS339	4	2	36	0.9	2 to 5	25	0	Vcc-1.5	16	Open collector	-40 to +85	SO-14, TSSOP-14
AS339A	4	2	36	0.9	2 to 3	25	0	Vcc-1.5	16	Open collector	-40 to +85	SO-14
AS393	2	2	36	0.6	1 to 5	25	0	Vcc-1.5	16	-	-40 to +85	MSOP-8, SO-8, TSSOP-8
AS393A	2	2	36	0.6	1 to 3	25	0	Vcc-1.5	16	Open collector	-40 to +85	SO-8
AS393MTR	-	-	-	-	-	-	-	-	-	-	-40 to +85	SO-8
AZV3001	1	1.3	5.5	0.006	0.5 to 3	0.001	Vee	Vcc	-	Push-pull	-40 to +85	X2-DFN1410-6
AZV3002	2	1.3	5.5	0.006	0.5 to 3	0.001	Vee	Vcc	-	Push-pull	-40 to +85	U-FLGA1616-8
AZV331	1	2.5	5.5	0.04	1.7 to 7	10	-0.1	Vcc-0.8	23	Open collector	-40 to +85	SOT25, SOT353
AZV393	2	2.5	5.5	0.07	1.7 to 7	10	-0.1	Vcc-0.8	23	Open collector	-40 to +85	MSOP-8, SO-8, TSSOP-8
AZV5001	1	1.6	5.5	7.5	-	-	-	-	-	Open-drain	-40 to +85	X2-DFN1210-6
AZV5002	2	1.6	5.5	7.5	-	-	-	-	-	Open-drain	-40 to +85	U-QFN1418-10
LM2901	4	2	36	0.9	2 to 7	25	0	Vcc-1.5	16	Open collector	-40 to +125	SO-14, TSSOP-14
LM2901A	4	-	36	0.9	1 to 2	25	0	Vcc-1.5	16	Open collector	-40 to +125	SO-14, TSSOP-14
LM2901AQ	4	2	36	0.9	1 to 2	25	-	Vcc-1.5	16	Open collector	-40 to +125	SO-14, TSSOP-14
LM2901Q	4	2	36	0.9	2 to 7	25	-	Vcc-1.5	16	Open collector	-40 to +125	SO-14, TSSOP-14
LM2903	2	2	36	0.6	2 to 7	25	0	Vcc-1.5	16	-	-40 to +125	MSOP-8, SO-8, TSSOP-8
LM2903A	2	2	-	0.6	-	25	0	Vcc-1.5	16	Open collector	-40 to +125	MSOP-8, SO-8, TSSOP-8
LM2903AQ	2	2	36	0.6	1 to 2	25	-	Vcc-1.5	16	Open collector	-40 to +125	MSOP-8, SO-8, TSSOP-8
LM2903Q	2	2	36	0.6	2 to 7	25	-	Vcc-1.5	16	Open collector	-40 to +125	MSOP-10, SO-8, TSSOP-8
LMV331	1	2.7	5.5	0.04	1.7 to 7	10	-0.1	Vcc-8.0	23	Open collector	-40 to +125	SOT25, SOT353
LMV393	2	2.7	5.5	0.07	-	10	-0.1	Vcc-8.0	23	-	-40 to +125	MSOP-8, SO-8



Pin compatibility – two types of pin connection in SOT-23 and SC-88A

Operational Amplifiers & Comparators

New Japan Radio is a leading analog/linear semiconductor manufacturer holding the 3rd position in the worldwide operational amplifier and comparator market. More than 50 years experience in analog technology, its own wafer diffusion with in-house assembly and a commitment to highest quality results in a very high customer satisfaction. Especially in times with dramatic changes in the semiconductor vendor landscape a long-time supply commitment becomes more and more important to customers in most industries. NJR offers a wide product range of operational amplifiers and comparators with a rich feature mix including: Rail-to-rail input/output, high RF immunity, low-noise, low-power, high-precision, high-efficiency, small-sized packages, J-FET/bipolar and CMOS technologies.

If you are you looking for a second source in order to secure your production?

Then you should check NJR's competitive operational amplifiers and comparators which could replace products from other vendors by offering a flexible pinning compatible with many products on the market.

Comparator

Part Number	Output Type	Channels	Response Time [ns]	Supply Current [mA]	Operating Voltage [V]	Vio max [mV]	Operating Temperature [°C]	Package	Specification	Applications
NJM2903C	Open-collector	2	1300	0.45	2.0 to 3.6	5	-40 to +125	SOP8 DMP8 MSOP8(TVSP8) SSOP8 EQFN14-D7	<ul style="list-style-type: none"> Single-power supply Open collector output Direct interface to TTL, MOS and bipolar technology 	<ul style="list-style-type: none"> Portable and battery-powered applications Alarm and surveillance circuits Industrial instruments Sensor applications
NJM2901C		4		0.8				SSOP14 SOP14		
NJU7116	Push-pull	1	3300	0.001	1.8 to 3.6	2.5	-40 to +105	SOT-23-5 DFN6-G1(ESON6-G1)	<ul style="list-style-type: none"> Single-power supply Push-pull output Low operating current Low bias current (1pA typ) CMOS 	
NJU77230	Push-pull	1	780	0.006	1.8 to 5.5	6	-40 to +125	SOT-23-5 SC-88A	<ul style="list-style-type: none"> Rail-to-rail input Push-pull output low-power CMOS 	
NJU77231								SOT-23-5 SC-88A DFN6-G1(ESON6-G1)		
NJU77232								MSOP8(TVSP8) DFN8-U1(ESON8-U1)		
NJU77240								SOT-23-5 SC-88A		
NJU77241	Open-drain	1	840	0.006	1.8 to 5.5	6	-40 to +125	SOT-23-5 SC-88A DFN6-G1(ESON6-G1)	<ul style="list-style-type: none"> Rail-to-rail input Open-drain output Low-power CMOS 	
NJU77242								MSOP8(TVSP8) DFN8-U1(ESON8-U1)		

Operational Amplifier

Types	No. of Channels	GBW [MHz]	Slew Rate [V/μsec]	Operating Voltage [V]	Supply Current [mA]	Vio max [mV]	Voltage Noise [mV/√Hz]	Operating Temperature [°C]	Package	Specification	Applications
PRECISION											
NJU7076	1	1.3	0.5	2.2 to 5.5	0.6	0.15	10	-40 to +125	SOT-23-5	Precision, low-noise, rail-to-rail output, RF noise immunity, CMOS	<ul style="list-style-type: none"> Thermocouple amplifier Strain gauge amplifier Photo diodes amplifier Medical instrumentation Precision current sensing High-precision data acquisition High-precision current sensing Handheld test equipment Low-side current sensing
NJU7077	2				1.2				MSOP8(VSP8)		
NJU7078	4				2.3				SSOP14		
NJU7098A	1	2-5	3	3 to 10	0.7	0.015	120	-40 to +105	SOT-23-6-1	Zero-drift, single supply rail-to-rail output, shutdown mode, RF noise immunity, CMOS	
LOW-POWER											
NJU77000	1	0.001	0.001	1.5 to 5.5	0.00029	1.8	600	-40 to +105	SOT-23-5	Ultra-low-power, rail-to-rail input/output RF noise immunity CMOS	<ul style="list-style-type: none"> Battery-powered instruments Micro power oxygen and gas sensor Power line monitoring Micropower current sensing Healthcare instruments
NJU77001	1				0.00046				SOP8 JEDEC 150mil MSOP8(TVSP8) DFN8-U1(ESON8-U1)		
NJU77002	2	0.001	0.001		0.00092	2.2			SSOP14		
NJU77004	4				0.013				SC-88A; SOT-23-5	Ultra-low-power 13μA/ch, rail-to-rail output RF noise immunity CMOS	<ul style="list-style-type: none"> Battery-powered instruments Current sensor amplifiers Voltage/current monitoring Power line monitoring Photodiode amplifiers
NJU7026	1				0.026	4	50	-40 to +125	DFN8-U1(ESON8-U1) MSOP8(TVSP8)		
NJU7027	2	0.16	0.05	1.8 to 5.5	0.048				SSOP14		
NJU7028	4				0.045				SC-88A; SOT-23-5		
NJU77550	1				0.045				SC-88A; SOT-23-5	Low-power, high GBW @ 45uA/ch RF noise immunity rail-to-rail input/output	<ul style="list-style-type: none"> Battery-powered equipment Audio, healthcare, security systems Smart meter, sensor interfaces Gas/smoke sensor, active filter Photodiode amplifier
NJU77551	1				0.090	5	24	-40 to +125	SOP8; MSOP8(TVSP8)		
NJU77552	2	1.6	0.7	1.8 to 5.5	0.18				SSOP14		
NJU77554	4										
LOW-NOISE											
NJU77806	1	4.4	1.1	1.8 to 5.5	0.5	2	5.5	-40 to +105	SC-88A	Low-noise, low-power, rail-to-rail output, RF noise immunity, CMOS	<ul style="list-style-type: none"> Low-noise microphone amplifier Photodiode preamplifier Sensor application Security equipment Wireless LAN Radio systems
NJM8530	1				0.32				SOT-23-5		<ul style="list-style-type: none"> Battery-powered instruments, audio, Sensor applications, medical, security High-side/low-side current sensing amplifiers/active filters analog-to-digital digital-to-analog buffers, handheld test equipment
NJM8532	2	1	0.4	1.8 to 14	0.58	4	10	-40 to +125	MSOP8(TVSP8); DMP8, SSOP8	Low-noise, low-power wide bandwidth rail-to-rail input/output	
NJM8534	4				1.2				SSOP14		
HIGH SLEW RATE											
NJU77701	1	34	35	2.4 to 5.5	3.8	1.5	5	-40 to +125	SOT-23-5	High GBW, high-speed, low-noise rail-to-rail I/O, RF noise immunity CMOS	<ul style="list-style-type: none"> Low-noise signal processing, ADC buffers DAC output amplifier Current sense amplifier Radio systems
NJU7046	1				1.4				SOT-23-5; SC-88A		<ul style="list-style-type: none"> High-speed sensor amplifiers Current sensor amplifiers Photodiode amplifiers ADC front ends Battery-powered instruments
NJU7047	2	5	9	2.7 to 5.5	2.7	5	20	-40 to +125	SOP8 JEDEC 150mil MSOP8(TVSP8) DFN8-U1(ESON8-U1)	High-speed, rail-to-rail I/O, RF noise immunity, CMOS	
NJU7048	4				5.3				SOP14; SSOP14		





Operational Amplifiers & Comparators

OpAmps

- The largest portfolio of micropower OpAmps for battery-powered, portable devices
- An ever-increasing range of precision amplifiers
- Space-optimized solutions, with tiny DFN, QFN and SC-70 packages
- Extensive choice of low- & high-voltage rail-to-rail OpAmps
- High-temperature (+150°C) qualified devices
- A large portfolio of automotive qualified OpAmps

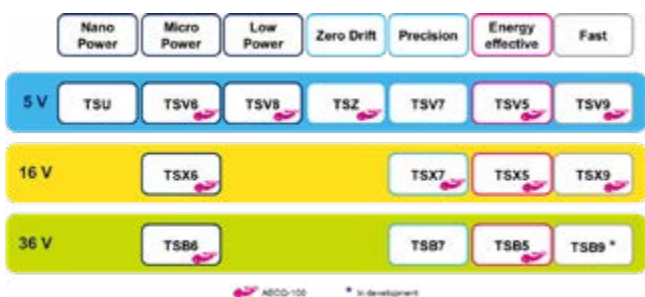
Series	Main Features	Ideal for
TSB5 TSB6 TSB7	• 36V BiCMOS • New generation of high-voltage OpAmps	• Industrial equipment • Automotive equipment
TSV5 - TSV6 TSV8 - TSV9	• Micropower 5V CMOS • Low-voltage	• Sensor signal conditioning • Battery operated devices
TSV7 TSZ1	• High-precision • Micropower 5V CMOS	• Sensor signal conditioning • Medical instrumentation • Handheld equipment • High-precision current sensing
TSX5 - TSX6 TSX7 - TSX9	• Micropower 16V CMOS • Excellent power/bandwidth ratio	• Power applications (12V, 15V, +/- 5V) • AFE for high-voltage sensors
TSU1	• Ultra-low-current consumption	• Gas, CO, smoke detectors • Energy harvesting systems • Battery operated systems

Comparators

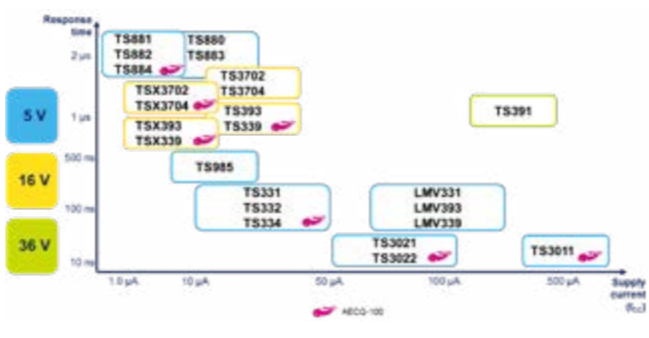
- A broad range of industry-standard devices
- High-speed comparators
- Micropower comparators
- Space-optimized solutions, with tiny DFN, SC-70 and 6-Bump CSP packages
- High-temperature (+150°C) qualified devices
- A large portfolio of automotive qualified comparators

Series	Main Features	Ideal for
TS880 TS881 TS883 TS882 TS884	• Nanopower • Very low-voltage • Push-pull and open-drain versions	• Gas, CO, smoke detectors • Battery operated security systems
TS3011 TS3021 TS3022	• Nano second response time • High efficiency	• Optical modules • High frequency systems
TS985	• Micropower • Tiny packages	• Smartphones, smartwatches • Digital cameras • Internet of things (IoT) devices • Portable test equipment
TSX393 TSX339 TSX3702 TSX3704	• Micropower • Fast response time • High ESD tolerance	• Industrial equipment • Automotive equipment

High-Performance OpAmps



High-Performance Comparators



High-Precision Operational Amplifiers

High-Bandwidth Chopper OpAmps

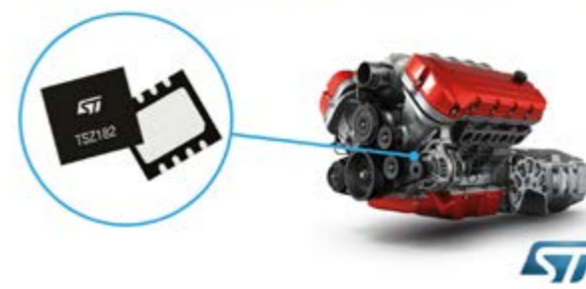
TSZ18 Series

- Very high-accuracy and stability: Offset voltage
 - 25µV max. at 25°C
 - 35µV max. vs. temperature
- Gain bandwidth product: 3 MHz
- Low supply voltage:
 - 2.2 to 5.5 V
- Low-power consumption:
 - 800µA (typical)
- Save board space (no external trimming components)
- Smallest package in the market: DFN6 (1.2x1.3 mm) for single, DFN8 (2.0x2.0 mm) for dual
- Automotive-qualified variant
- High-temperature variant (+150°C)

Applications

- High-accuracy signal conditioning
- Automotive current measurement
- Battery-powered instrumentation
- Portable instrumentation

3 MHz chopper op amp for high-accuracy signal conditioning



Precision OpAmps

TSV7 Series

- Low offset voltage: 200µV max
- Low input offset voltage drift: $dV_{io}/dT = 10\mu V/^\circ C$ max.
- Operating voltage: 1.5 to 5.5 V
- Excellent speed/power ratio:
 - 10µA (typ. at 5V)/120kHz for TSV71x
 - 60µA (typ. at 5V)/850kHz for TSV73x
- Low bias current 1pA
- Rail-to-rail input & output
- High ESD protection: 4kV HBM
- Tiny packages: SC70-5, SOT23-5, DFN8 (2.0x2.0 mm)

Applications

- Precision medical system, glucose meter
- Test & measurement equipment
- Handheld devices
- Factory automation
- Telecom infrastructure
- Optical networking

X-NUCLEO-IKA01A1

Multifunctional Expansion Board

Based on ST's operational amplifiers:

- TSZ124
- TSU104
- TSV734



Tiny Nano-Power Op Amp For longer battery life

TSU111 Ideal for high accuracy



TSX series for robust circuit design

16 V CMOS comparators, space-saving packages



Nano-Power Operational Amplifiers & Comparators

Nano-Power OpAmps

TSU11 Series

- Nano-power consumption: 900 nA typ.
- Low offset voltage reduces output error
 - 150 μ V max. at 25 $^{\circ}$ C
 - 235 μ V max. over temperature range (-40 to +85 $^{\circ}$ C)
- Low-noise over 0.1 to 10 Hz bandwidth: 3.6 μ Vpp
- Low supply voltage: 1.5 to 5.5 V
- Rail-to-rail input & output
- Gain bandwidth product: 11.5 kHz
- Tiny packages: DFN6 (1.2 x 1.3 x 0.5 mm), SOT323-5L, DFN8 (2.0 x 2.0 x 0.5 mm), QFN16 (3.0 x 3.0 x 0.9 mm)

Applications

- Gas/water metering systems
- Battery/solar operated systems
- Alarm & monitoring systems
- Portable medical equipment

Nano-Power Comparators

TS88 Series

- Ultra-low-current consumption: 210 nA typ.
- Propagation delay: 2 μ s typ.
- Rail-to-rail inputs
- Push-pull output (TS881, TS882, TS884) and open-drain (TS880, TS883)
- Supply operation from 0.85 to 5.5 V
- Wide temperature range: -40 to +125 $^{\circ}$ C
- ESD tolerance: 8 kV HBM/300 V MM
- Tiny packages: SC70-5, SOT23-5L, MiniSO8 and DFN8 (2.0 x 2.0 x 0.5 mm)

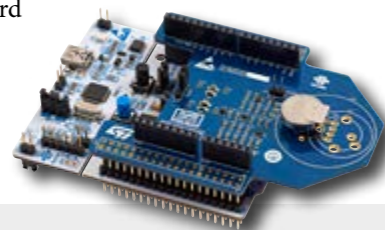
Applications

- Portable systems
- Signal conditioning
- Medical equipment

P-NUCLEO-IKA02A1

Demo Board Package

STM32 Nucleo pack for electrochemical gas sensors expansion board for CO-sensor. Can be extended with sub-GHz or Wi-Fi board to become a cloud sensor.



ST OpAmps App
All-in-one design toolkit and smart selector on tablets and smartphones.

High-Voltage CMOS for Robust Circuit Design

16 Vcc Precision OpAmp

TSX7 Series

- Low input offset voltage: 200 μ V max.
- Rail-to-rail input and output
- Low-current consumption: 800 μ A max.
- Gain bandwidth product: 2.7 MHz
- Low supply voltage: 2.7 to 16 V
- Unity gain stable
- Low input bias current: 50 pA max.
- High ESD tolerance: 4 kV HBM
- Extended temp. range: -40 to +125 $^{\circ}$ C
- Tiny packages: SOT23-5, MiniSO8
- Automotive-qualified variant

Applications

- Battery-powered instrumentation
- High independence sensor interface
- Current sensing (high and low-side)

For industrial and smart home applications.

36 V Low-Power OpAmps

TSB5 / TSB6/ TSB7 Series

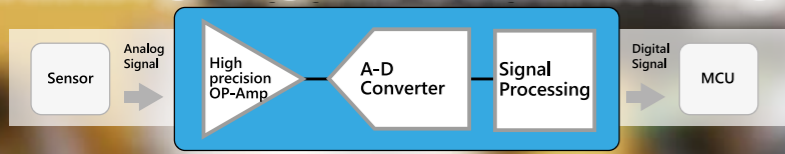
- Rail-to-rail input and output (TSB5, TSB7)
- Wide supply voltage: 2.7 to 36 V (TSB6, TSB7)
- Excellent speed/power ratio:
 - 380 μ A/2.5 MHz for TSB571, TSB572
 - 100 μ A/560 kHz for TSB611
 - 1.8 mA/6 MHz for TSB711, TSB712
 - 1.8 mA/22 MHz for TSB7191, TSB7192
- High-precision (TSB7)
- Stable @ high cap values (TSB5)
- High ESD protection 4 kV HBM
- Tiny packages:
 - SOT23-5 (Single)
 - MiniSO8 & DFN8 (Dual)
- Automotive-qualified variant

Applications

- Industrial
- Power supplies
- Automotive
- Active filtering
- Low-side and high-side current sense

CP	Description	Package
TS3011YQ3T	5V, rail-to-rail high-speed comparator	DFN8 2x2 WF
LM2903YQ3T	36V, general-purpose dual-channel comparator	DFN8 2x2 WF
TSB572YQ2T	36V, low-power, 2.5MHz, rail-to-rail I/O, BiCMOS op amp	DFN8 3x3 WF
TS972YQ2T	Output rail-to-rail, very low-noise op amp	DFN8 3x3 WF

Analog Signal Conditioning



NJU9101 Low power, Strong RF noise immunity capability
NJU9103 Built-in PGA with up to 512x gain



AFE Conditions

An Analog Sensor Signal for MCU Processing

NJU9101

The NJU9101 is an analog front end (AFE) ideal for low-power sensor applications providing a signal processing solution.

The NJU9101 offers two low-power/low-noise operational amplifiers connected to a 16 bit $\Delta\Sigma$ ADC which can be used to build e.g. an electrochemical gas sensor. Integrated input filter offers best-in-class RF-immunity and makes the IC suitable for applications operated close to RF transceiver.

Features

- Supply voltage (2.4 to 3.6V)/(-40 to +85°C)
- Low-current consumption/low-noise amplifier
- Unique RF immunity characteristics
- On-chip temperature sensor & AUX input
- Programmable cell bias voltage & gain pre-amplifier
- High-resolution programmable gain ADC
- System calibration for offset & gain drift
- Interface I²C for MCU and I²C master for EEPROM
- Package (EQFN-24-LE (4.0 x 4.0 mm))

Applications

- Gas monitor
- Blood glucose meter
- Current-/photodiode sensing systems
- Portable & low-power systems

NJU9103

The NJU9103 is a sophisticated analog front end (AFE) in a small package offering a high gain PGA, a 16 Bit $\Delta\Sigma$ ADC and best-in-class RF immunity characteristics.

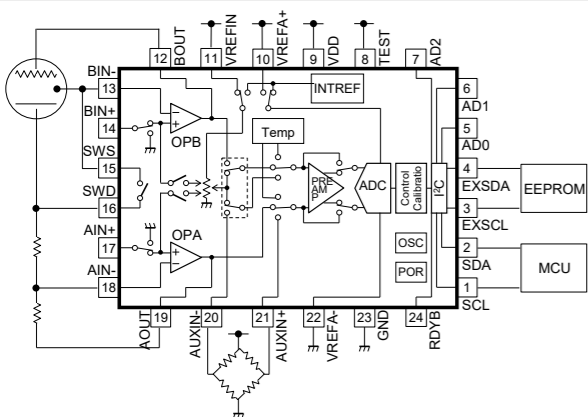
External sensors can be connected as single-ended, differential or pseudo-differential input. The NJU9103 can operate as frontend providing the optimum gain to e.g. pressure sensors, flow sensors by a wide and flexible range of gain settings.

Features

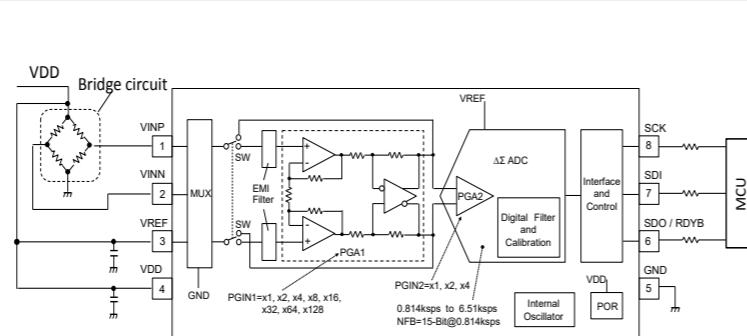
- Supply voltage 2.7 to 3.6 V (-40 to +125°C)
- ADC resolution 16 Bit (no missing codes)
- Conversion rate 0.814 to 6.51 ksp/s
- PGA 1 V/V to 512 V/V
- System calibration for offset & gain drift
- Conversion mode single/continuous
- Interface SPI
- Package DFN8 (ESON8-V1) or SSOP8

Applications

- Pressure sensors
- PLC
- Flowmeters
- Digital panel meters
- Thermostat



NJU9101 – Analog Front End IC



NJU9103 – Analog Front End IC

Voltage References & Shunt Regulators



Shunt Voltage Regulators

DIODES' shunt regulator range covers industry standard 2.5 V (AS431 and AN431) and 1.24 V (AZ431L) versions with extended temperature ranges for industrial and commercial applications. For applications requiring lower standby currents the AP431S operates with lower cathode currents. For automotive applications DIODES has its automotive-compliant ZTL431Q, ZTL432Q, TLV431Q in SOT23 and SOT25.

Features

- 2.5 V (TL431/2) equivalents
- 1.24 V (TLV431) equivalents
- Extra-low cathode current (IK) AP431S shunt regulator
- Automotive Compliant (Q) Shunt regulators

Voltage References

DIODES' voltage references are cost-effective industry standard pin out shunt references providing excellent temperature stability. ZXRE330 provides an accurate 3.3 V reference voltage with only a 1 μ A minimum cathode current.

Features

- LM4040/1 equivalents with automotive compliant versions
- Low cathode current 1.2, 2.5, 3.3 and 5 V shunt references
- 1 μ A cathode current 3.3 V shunt reference

Benefits of Shunt Regulators & Voltage References

- Wide temperature range, most with -40 to +125°C
- Simplifies component choice and stocking
- 0.2%, 0.5% and 1% tolerance references
- Matches needs of a wide range of applications
- ZXR references provide lower minimum operating currents
- Suitable for portable/battery-powered applications
- Automotive-compliant versions (AEC-Q100 Grade 1) LM4040Q/41Q, ZTL431Q/432Q and TLV431Q
- Suitable for automotive applications
- SOT23, SOT25 and SOT363 (SC70) package options (plus TO92)
- Small, cost-effective surface mount options



Voltage References

STMicroelectronics offers a wide range of fixed and adjustable voltage references, ranging from general-purpose high-power shunts, suitable for industrial, automotive and SMPS applications, to high-precision and low-consumption devices, suitable for battery-powered applications.

General Features

- Max. cathode current up to 100 mA
- Min. cathode current as low as 40 μ A
- Output voltage from 0.6 to 36 V
- Initial precision as low as 0.1%
- Packages: SO-8, TO92, SOT23 and SOT323



These cost-effective devices offer reliability and service performance thanks to ST's high-volume production capacity, integrated front-end and multiple back-end lines, as well as partnerships with major subcontractors.

The **TS4061** and **LM4041** are low-power shunt voltage references providing a stable 1.225 or 1.25 V output voltage over an extended temperature range. Available in SOT23 and SC70 surface mount packages, they can be designed in applications where high-precision and space saving are critical.

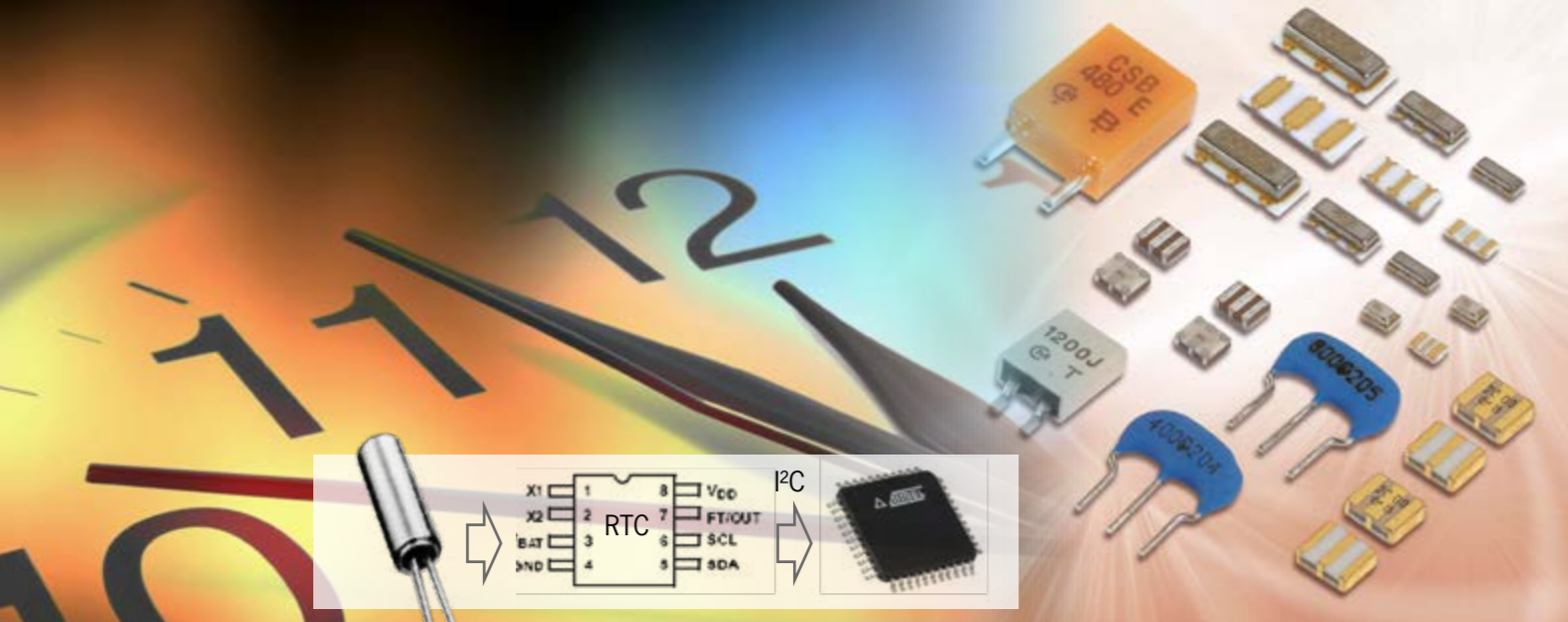
TS4061

- Fixed 1.225 and 1.25 V typ. output voltage
- SC70 or SOT23 package
- Ultra-low operating current: 10 μ A at 25°C
- High-precision: 0.1% @ 25°C
- Temp. range: -40 to +85°C
- 10 ppm typ. temperature coefficient

LM4041

- Fixed 1.225 V typical output voltage
- SC70 or SOT23 package
- Low operating current: 40 μ A at 25°C
- High-precision: 0.1% @ 25°C
- Extended temp. range: -40 to +125°C
- 36 ppm typ. temperature coefficient





Clock & Timing Solutions

Select the Right Timing Solutions for your Application

The selection of the oscillator for electronic devices is a major factor for the system performance. In electronics and especially synchronous digital circuits, a clock signal is a particular type of signal that oscillates between a high and a low state and is utilized like a metronome to coordinate actions of digital circuits. Circuits using the clock signal for synchronization.



Real-time-clocks are present in any electronic devices that needs to keep accurate time

Type	Advantages	Applications	Supplier
Ceramic Resonators	<ul style="list-style-type: none"> Cost savings Quicker rise of oscillation than a crystal resonator Mechanical stability/high shock resistance Load capacitance included 	<ul style="list-style-type: none"> Consumer electronics TV, games, radios 	Kyocera Murata
Crystal	<ul style="list-style-type: none"> Very accurate 	<ul style="list-style-type: none"> Microcontroller Watches 	Epson HKC Kyocera Murata
Quartz Oscillators	<ul style="list-style-type: none"> Very accurate Ultra-low phase jitter 	<ul style="list-style-type: none"> Networking High-speed telecommunications 	Epson HKC Kyocera
Timer	<ul style="list-style-type: none"> Low frequency for kHz Very simple to use Programmed by external resistors and capacitor Timing from microseconds to hours 	<ul style="list-style-type: none"> General timing applications Pulse generation Sequential timing Time delay generation Pulse wide modulation Pulse position modulation Missing pulse detector 	Diodes Incorporated NJRC
Real-Time-Clocks (RTC)	<ul style="list-style-type: none"> Provides critical real time information The real-time-clock tracks time with separate registers for hours, minutes and seconds RTC has calendar registers for date, month, year and days Fully accessible through the serial Interface I²C Selectable frequency outputs Oscillator temperature compensation 	Any system utilizing time information will need an RTC: <ul style="list-style-type: none"> Utility meters POS equipment Printers and copiers HVAC equipment Audio/video components Home appliances Smart meters Smart grids Medical Handhelds GPS Digital cameras 	STM

Real-Time-Clock (RTC)

Real-time-clock products offer a diverse range of real-time-clock (RTC) solutions for networking and embedded applications. The primary function of RTC is to keep time and calendar data.

- **RTC with integrated crystal:** The PT7C4337AC provides high-accuracy at low-voltage (1.2V) in a SOIC-16 standard package and the smallest 4x4 mm DFN package. With its integrated crystal, it can help you reduce development and testing time, as well as simplify the overall testing process.
- **I²C and 3-wire interface RTCs:** With their simple design, small footprint, and reduced pin count, these devices provide the lowest cost timekeeping solution. Available in a wide range of packages, including SOP, MSOP, TSSOP, and DFN.

Part Number	Description	Time Display	NV Ram	Interface	Alarm Interrupt	Battery Backup	Clock Calibration	Packages
PT7C4302	3-wire interface RTC with 31 Byte NVRAM	12, 24	31x8	3-wire	0	1	0	SOIC (W8) MSL1 Sn, TDFN (ZE8) MSL1 Sn
PT7C4307	I ² C interface with 56Byte NVRAM RTC	12, 24	56x8	I ² C	0	1	0	SOIC (W8) MSL1 Sn
PT7C4311	I ² C interface with 56Byte NVRAM RTC	24	56x8	I ² C	0	1	1	SOIC (W8) MSL1 Sn, TDFN (ZE8) MSL1 Sn
PT7C43190	3-wire interface RTC and low-power consumption	12, 24		3-wire	1	0	1	TSSOP (L8) MSL1 Sn, SOIC (W8) MSL1 Sn
PT7C4337	I ² C interface and low time keeping voltage RTC	12, 24		I ² C	1	0	0	TSSOP (L8) MSL1 Sn, MSOP (U8) MSL1 Sn, SOIC (W8) MSL1 Sn, TDFN (ZE8) MSL1 Sn
PT7C4337A	I ² C interface RTC and fully compatible with DS1337	12, 24		I ² C	1	0	0	SOIC (W8) MSL1 Sn
PT7C4337AC	I ² C interface RTC module with internal Crystal	12, 24		I ² C	1	0	0	SOIC (S16) MSL1 Sn
PT7C4337B	Real-time-clock (I ² C)	12, 24	N/A	I ² C	1	0	0	MSOP-8, SOIC (W8) MSL1 Sn, TDFN (ZE8) MSL1 Sn, TSSOP-8, TSSOP (L8) MSL1 Sn, MSOP (U8) MSL1 Sn
PT7C433833	I ² C interface RTC and low-power RTC	12, 24	56x8	I ² C	0	1	0	MSOP (U8) MSL1 Sn, SOIC (W8) MSL1 Sn
PT7C433833A	Real-time-clock (I ² C)	12, 24	56x8	I ² C	0	1	0	MSOP (U8) MSL1 Sn, SOIC (W8) MSL1 Sn, TDFN (ZE8) MSL1 Sn
PT7C4339	Low-power consumption and I ² C RTC	12, 24		I ² C	1	1	0	MSOP (U8) MSL1 Sn, SOIC (W8) MSL1 Sn
PT7C43390	I ² C interface and low-power consumption RTC	12, 24		I ² C	1	0	1	TSSOP (L8) MSL1 Sn, SOIC (W8) MSL1 Sn
PT7C4363	Low-power consumption and I ² C RTC	24		I ² C	1	0	0	SOIC (W8) MSL1 Sn
PT7C4363B	Real-time-clock (I ² C)	24	N/A	I ² C	1	0	0	SOIC (W8) MSL1 Sn, TDFN (ZE8) MSL1 Sn
PT7C4363BQ	Automotive real-time-clock	Yes	N/A	I ² C	Yes	N/A	N/A	SOIC (W8) MSL1 Sn
PT7C4372A	I ² C interface RTC with digital clock precision adjustment function	12, 24		I ² C	1	0	1	TSSOP (L8) MSL1 Sn, SOIC (W8) MSL1 Sn, TDFN (ZE8) MSL1 Sn
PT7C4563	Low-power consumption and I ² C RTC	24		I ² C	1	0	0	TSSOP (L8) MSL1 Sn, MSOP (U8) MSL1 Sn, SOIC (W8) MSL1 Sn
PT7C4563B	Real-time-clock (I ² C)	24	N/A	I ² C	1	0	0	MSOP (U8) MSL1 Sn, SOIC (W8) MSL1 Sn, TDFN (ZE8) MSL1 Sn, TSSOP (L8) MSL1 Sn
PT7C4563BQ	Automotive real-time-clock	Yes	N/A	I ² C	Yes	N/A	N/A	SOIC (W8) MSL1 Sn

ICs for Automotive and Industrial Use

Low-Side Power Switches

CJ950 and CJ960

Low-side power switches are typically used in engine management control units. They control all kinds of loads and functions around the engine. Enhanced monitoring functions ensure safe operation.

CJ950 and CJ960 are controlled via micro-second-channel bus (MSC). In addition, CJ960 offers an optional SPI control mode. For safe operation, supply voltage and MSC bus are permanently monitored. If supply voltage gets out of range or communication is interrupted, outputs will be disabled. Diagnostic functions include detection of short circuit to battery, short circuit to ground, open load or over-temperature.

Eighteen-Fold Low-Side Power Switch CJ950

Parameter	Unit	Out 1.3	Out 2.4	Out 5..10	Out 11..14	Out 15..16	Out 17..18
Ron (25 °C)	mΩ	150	260	500	500	1800	1800
Iout (nominal)	A	4 / 8	3	2.2	2.2	0.6	0.6

Features

- Clamping voltage on all outputs: 55 V
- Operating temp.: -40 to +150 °C
- Package: PSO36



Eight-Fold Low-Side Power Switch CJ960

Parameter	Unit	Out 1..4	Out 5..6	Out 7..8
Ron (25 °C)	mΩ	230	700	550
Iout (nominal)	A	3	1	1

Features

- Clamping voltage on all outputs: 55 V
- Operating temp.: -40 to +150 °C
- Package: TQFP64 with exposed pad



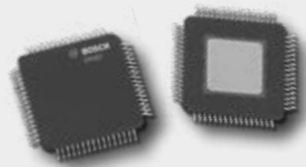
System Basis ICs

CY326 and CY327

System basis ICs for powertrain and transmission control combine several important ECU functions in one central chip: Power supply to the μC, other on-board devices and peripheral sensors. All voltages are permanently monitored; an intelligent watchdog (VDA E-Gas-compliant) checks the microcontroller for proper function.

Main relay control allows power-saving deactivation of the entire board, a digital stop counter with 1s resolution enables long-time measurements. Communication between μC and CY326/7 is controlled via SPI interface.

Integrated CAN and LIN drivers support the bus communication with other control units.



Features	CY326	CY327
Pre-regulator	Boost & buck regulator for battery voltages down to 4 V	Boost & buck regulator for battery voltages down to 3 V
Supply voltages	Linear regulators: 5.0V, 3.3V, 2.6V, 1.5V 1V (Standby)	Linear regulators: 5.0V, 3.3V External linear regulator MOSFET switchable between 3.3V and 5.0V core supply: Buck regulator, can be set to 0.9 to 1.525V ±2% via 3 pins
Quiescent current	60 μA typically	50 μA typically
Coordinated soft start	Yes for all regulators	Yes for all regulators
External sensor supply	2x5V	3x5V and one diagnosis pin for external voltage tracker
Main relay control	Yes	Yes
Reset circuit	Yes	Yes
Intelligent watchdog	Yes	Yes
SPI control interface	Yes	Yes
Communication interface	None	1x LIN 2.1 1x CAN driver with wake-up capability
Timer	22-bit stop counter with 1sec res. and wake-up	24-bit stop counter with 1sec resolution and wake-up
Ignition input	Yes	Yes
Wake-up input	1x wake-up 1x additional wake-up input for CAN signal	3x wake-up
Operating temp. T _j	-40 to +150 °C	-40 to +150 °C
Package	TQFP64 with exposed pad	TQFP64/100 with exposed pad

Monolithic B6 Bridge

CJ260

CJ260 can drive either BLDC motors up to 60W with three phases (in B6 bridge mode) or DC motors (in H-bridge mode). It includes protection against unwanted driver activation in case of over-/undervoltage, overcurrent, overtemperature or short circuit and can detect open loads.

Features

- Integrated drivers
- Direct μC control
- Dual release concept for safety
- Diagnosis and recovery functions
- Slew rate control, four stages
- SPI interface, compatible with 3.3 and 5 V logic μC
- Package: PowerSSO-36, Body 7.5 x 10.3 mm



Benefits

- Pre-drivers, logic and HS/LS powerstages in one package
- Extensive protection and diagnosis features
- B6 operation for higher torque

Parameter	Value
Power stage active at	4.5 to 28V
Load dump pulse robustness	40V
Inverse current robustness on VS	5A
Half bridge resistance at 3 A _{rms} , 150 °C	Max. 540mΩ
Current limit setting, 3 ranges	4 to 8.6 A
Continuous load current	3A _{rms}
Digital supply voltage	4.5 to 5.3V
Operating temperature T _j	-40 to +150 °C
Output switching frequency	Max. 20kHz
Output rise/fall slew rate setting at 3A	Typ. 1.7 to 45V/μs

4/8 Channel Pyro Fuse Driver

CG9x2, CG985

Pyro fuse drivers provide additional safety function for electrical systems in (H)EVs. Controlled by the battery management system, CG985 and CG912 can ignite up to four, CG902 up to eight pyro fuses. The pyro fuses safely disconnect the HV battery from the vehicle's electrical system.

Key Benefits

- High- & low-side drivers for highest system safety
- Selectable firing modes for optimum adaption to the pyro fuses
- Supports diagnostics
- Power supply for system MCU
- Microcontroller monitoring
- Automated diagnostic routines
- Designed for systems with requirements up to ASIL B (D)
- Qualified (AEC-Q100)

CG912 and CG902 only

Parameter	CG985	CG912	CG902
Firing loops	4 x	4 x	8 x
Firing modes	1.2 A for 2 ms 1.75 A for 0.5 & 1.0 ms	Different firing modes programmable by SPI: • Static mode I: 1.85A for 0.7 ms • Static mode II: 1.75A for 0.5 ms • Static mode III: 1.2A for 2 ms • Dynamic mode V: 1.75A for 0.7 ms, automatic extension to 1.2A for 2.0 ms • Dynamic mode VI: 1.5A for 1.5 ms, automatic extension up to 3.0 ms	
Features	<ul style="list-style-type: none"> Sophisticated safety concept Monitoring of voltages, power stage and firing loop diagnosis, STB and STG diagnosis, squib resistance measurement 4-bit firing current counter per firing loop 		
Interfaces	SPI, 16-bit, (3.3 or 4.9V)	SPI, 32-bit (3.3 V), K-Line/LIN	
V _{DD} typ. [V]	3.3 + 4.9	3.3	
V _{ZF} typ. [V]	14	14	
V _{VER} typ. [V]	25 or 33	23.75 or 33 (programmable)	
Oper. Temp. T _j	-40 to +150 °C	-40 to +150 °C	



Motion Sensors

Bosch Sensortec – At the Core of Everyday Life

Our portfolio of motion sensors includes products for motion, orientation and gesture detection. Motion sensors are designed for several consumer electronics and IoT applications in the field of smartphones, wearables, smart home, drones, toys, virtual and augmented reality, gaming, as well as industrial applications.

Accelerometers

Part Number	Sensing Range (g)	Sensing Axis	Sensitivity (LSB/g)	Output Interface	Bandwidths (Hz)	Supply Voltage (V)	Supply Current	Operating Temp. (°C)	Package Type/Size (mm)
BMA253	±2, ±4, ±8, ±16	X, Y, Z	1024, 512, 256, 128	SPI, I ² C, 2 digital interrupt pins	8 to 1000	V _{DD} : 1.62 to 3.6 V _{DDIO} : 1.2 to 3.6	6.5 µA @40 Hz data rate (low-power mode) 130 µA @2kHz data rate (full operation)	-40 to +85	2.0x2.0x0.95
BMA280	±2, ±4, ±8, ±16	X, Y, Z	4096, 2048, 1024, 512	SPI, I ² C, 2 digital interrupt pins	8 to 500	V _{DD} : 1.62 to 3.6 V _{DDIO} : 1.2 to 3.6	6.5 µA @40 Hz data rate (low-power mode) 130µA @2kHz data rate (full operation)	-40 to +85	2.0x2.0x0.95
BMA400	±2, ±4, ±8, ±16	X, Y, Z	1024, 512, 256, 128	SPI, I ² C, 2 digital interrupt pins	0.24xODR or 0.48xODR (ODR from 12.5...800)	V _{DD} : 1.72 to 3.6 V _{DDIO} : 1.2 to 3.6	14 µA (max. performance) < 8 µA (typical use case) < 4 µA Independent of ODR (lower power mode)	-40 to +85	2.0x2.0x0.95
BMA423	±2, ±4, ±8, ±16	X, Y, Z	1024, 512, 256, 128	SPI, I ² C, 2 digital interrupt pins	5 Hz to 684 Hz (ODR: 12.5 Hz to 1.6 kHz)	V _{DD} : 1.62 to 3.6 V _{DDIO} : 1.2 to 3.6	14µA @ 50Hz ODR (low-power mode) 150 µA (full operation)	-40 to +85	2.0x2.0x0.95
BMA456	±2, ±4, ±8, ±16	X, Y, Z	16384, 8192, 4096, 2048	SPI, I ² C, 2 digital interrupt pins	5 Hz to 684 Hz (ODR: 12.5 Hz to 1.6 kHz)	V _{DD} : 1.62 to 3.6 V _{DDIO} : 1.2 to 3.6	13 µA @50 Hz data rate (low-power mode) 150 µA (full operation)	-40 to +85	2.0x2.0x0.65
BMA490L	±2, ±4, ±8, ±16	X, Y, Z	1024, 512, 256, 128	SPI, I ² C, 2 digital interrupt pins	5 Hz to 684 Hz (ODR: 12.5 Hz to 1.6 kHz)	V _{DD} : 1.62 to 3.6 V _{DDIO} : 1.2 to 3.6	14µA @ 50Hz ODR (LPM) 150 µA (full operation)	-40 to +85	2.0x2.0x0.95

Gyroscopes

Part Number	Sensing Range (°/s)	Sensing Axis	Output Interface	Zero Rate Output (°/s)	Turn On Time (ms)	Supply Voltage (V)	Supply Current (mA)	Operating Temp. (°C)	Package Type/Size (mm)
BMG250	±125, ±250, ±500, ±1000, ±2000	X, Y, Z	for primary UI IF: I ² C up to 1MHz 3w/4w SPI 2x digital interrupts for secondary OIS/EIS IF: 3w SPI up to 10MHz	±3	Suspend to normal mode 55 ms (typical) Fast start-up to normal mode 10 ms (typical)	V _{DDIO} : 1.2 to 3.6 V _{DD} : 1.7 to 3.6	Full operation 850 µA Suspend mode 3 µA Fast start-up 500 µA	-40 to +85	2.5x3.0x0.8

Inertial Measurement Units

Part Number	Output Interface	Sensing Range	Sensing Axis	Supply Voltage (V)	Supply Current (mA)	Operating Temp. (°C)	Package Type/Size (mm)
BMI055	I ² C, SPI, 4x digital interrupts	(A): ± 2 g, ± 4 g, ± 8 g, ± 16 g (G): ± 125°/s, ± 250°/s, ± 500°/s, ± 1000°/s, ± 2000°/s	6-axis	V _{DD} : 2.4 to 3.6 V _{DDIO} : 1.2 to 3.6	Full operation: 5.15 mA Suspend mode: 6 µA	-40 to +85	3.0x4.5x0.95
BMI085	I ² C, SPI, 4x digital interrupts	(A): ± 2 g, ± 4 g, ± 8 g, ± 16 g (G): ± 125°/s, ± 250°/s, ± 500°/s, ± 1000°/s, ± 2000°/s	6-axis	V _{DD} : 2.4 to 3.6 V _{DDIO} : 1.2 to 3.6	5.15 mA	-40 to +85	3.0x4.5x0.95
BMI088	I ² C, SPI, 4x digital interrupts	(A): ± 3 g, ± 6 g, ± 12 g, ± 24 g (G): ± 125°/s, ± 250°/s, ± 500°/s, ± 1000°/s, ± 2000°/s	6-axis	V _{DD} : 2.4 to 3.6 V _{DDIO} : 1.2 to 3.6	5.15 mA	-40 to +85	3.0x4.5x0.95
BMI160**	I ² C, SPI, 4x digital interrupts	(A): ± 2 g, ± 4 g, ± 8 g, ± 16 g (G): ± 125°/s, ± 250°/s, ± 500°/s, ± 1000°/s, ± 2000°/s	6-axis	V _{DD} : 1.71 to 3.6 V _{DDIO} : 1.2 to 3.6	Full operation: 950 µA Suspend mode: 3 µA	-40 to +85	2.5x3.0x0.8
BMI270	SPI, 2x digital interrupts	(A): ± 2 g, ± 4 g, ± 8 g, ± 16 g (G): ± 125°/s, ± 250°/s, ± 500°/s, ± 1000°/s, ± 2000°/s	6-axis	V _{DD} : 1.7 to 3.6 V _{DDIO} : 1.2 to 3.6	Full operation: 685 µA Suspend mode: 5 µA	-40 to +85	2.5x3.0x0.9
BMI090L	I ² C and SPI 4 x digital interrupts	(A): ±3 g, ± 6 g, ±12 g, ±24 g (G): ±125°/s, ± 250°/s, ± 500°/s, ±1000°/s, ±2000°/s	6-axis	V _{DD} : 2.4 to 3.6 V _{DDIO} : 1.2 to 3.6	5.15	-40 to +85	3.0x4.5x0.95

Absolute Orientation Sensors

Part Number	Output Interface	Linear Acceleration Full Scale (g)	Angular Rate Full Scale (dps)	Magnetic Full Scale Range (gauss)	Resolution	Supply Voltage (V)	Supply Current (Acc+Mag+Gyro) (mA)	Operating Temperature (°C)	Package Type/Size (mm)
BMX055	I ² C, SPI	(A): ± 2, ± 4, ± 8, ± 16	(G): ± 125°/s, ± 250°/s, ± 500°/s, ± 1000°/s, ± 2000°/s	±1300 µT (x, y axis) ±2500 µT (z axis)	(A): 0.98 mg (G): 0.004°/s (M): 0.3 µT	V _{DD} : 2.4 to 3.6 V _{DDIO} : 2.4 to 3.6	Gyro @ full operation: 5 mA Acc @ full operation: 130 µA Acc @ wake-up mode: < 10µA Magnet sensor @ 10Hz ODR: 0.5 mA	-40 to +85	3.0x4.5x0.95
BMX160	I ² C, SPI	(A): ± 2, ± 4, ± 8, ± 16	(G): ± 125°/s, ± 250°/s, ± 500°/s, ± 1000°/s, ± 2000°/s	±1300 µT (x, y axis) ±2500 µT (z axis)	(A): 0.061mg (G): 0.004°/s (M): 0.3 µT	V _{DD} : 1.71 to 3.6 V _{DDIO} : 1.2 to 3.6	Gyro @ full operation: 850 µA Gyro + Acc + Geomag: 1585 µA Geomag @ full operation: 660 µA Acc @ full operation: 180 µA Suspend mode: 5 µA Significant motion: 30 µA Step detector: 30 µA	-40 to +85	2.5x3.0x0.95

Magnetometers

Part Number	Sensing Range (gauss)	Sensing Axis	Sensitivity (%/K)	Output Interface	Output Noise (mgauss RMS)	Supply Voltage (V)	Supply Current (µA Max)	Operating Temperature (°C)	Package Type/Size (mm)
BMM150	±13 (x,y-axis) ±25 (z-axis)	X, Y and Z axis	± 0.01	I ² C and SPI (2 interrupt pins)	x, y-axis: 1.0 µT z-axis: 1.4 µT	V _{DD} : 1.62 to 3.6 V _{DDIO} : 1.2 to 3.6	170 µA (low-power preset) 500 µA (normal mode)	-40 to +85	CSWLP. (12 pin) 1.56x1.56x0.6 0.4mm diagonal ball pitch

(A): Accelerometer, (G): Gyro, (M): Magnetometer ** Queexo FingerSense Compatible



Bosch Sensortec – At the Core of Everyday Life

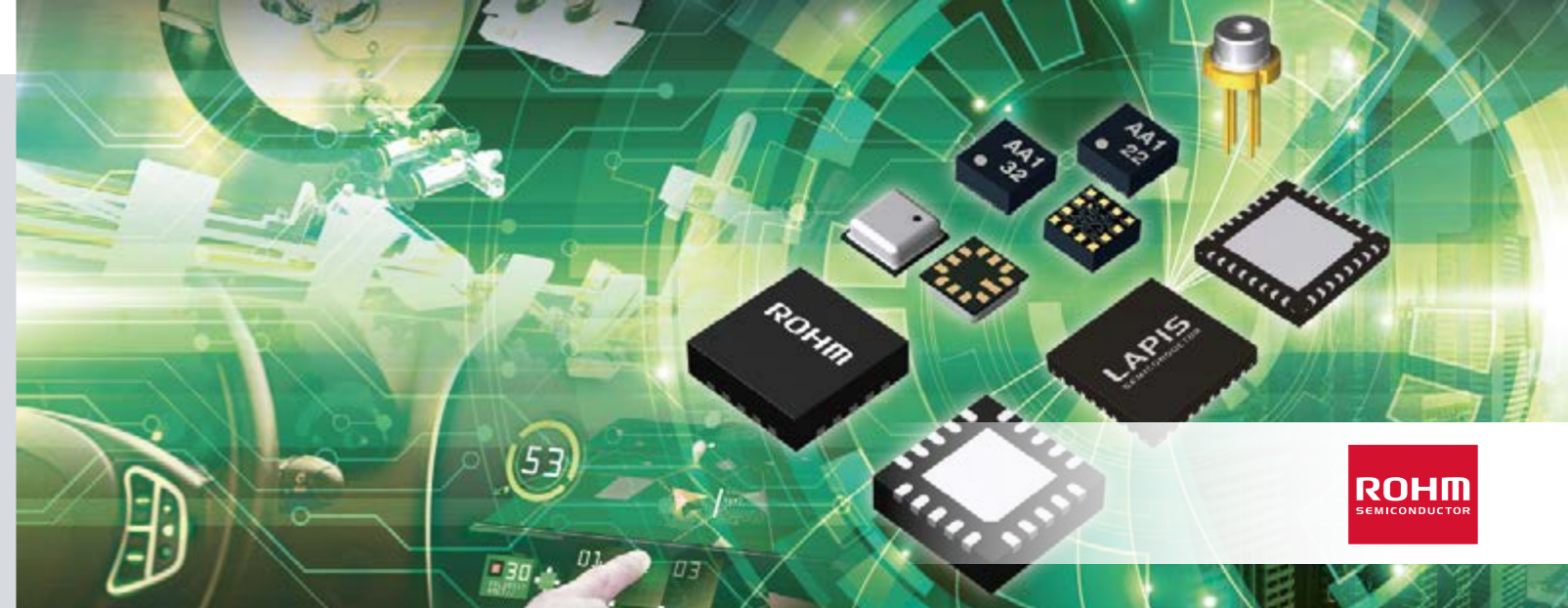
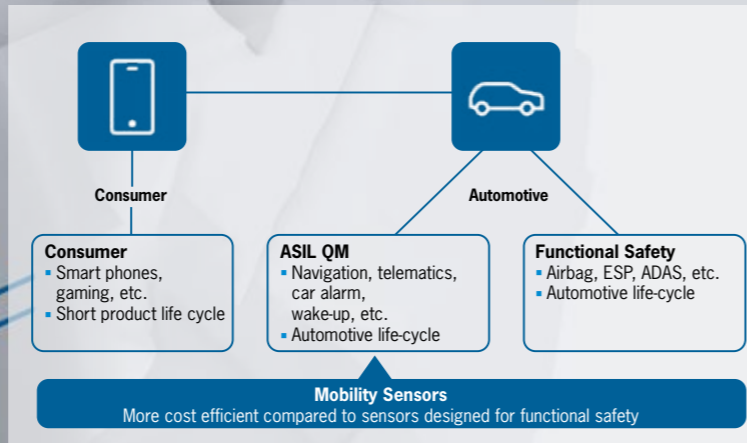
Smart Sensors

Our portfolio of smart sensors is specifically designed for always-on sensor applications in smartphones, wearables and tracking devices. It offers flexible, low-power solutions for motion sensing and sensor data processing.



Part Number	Integrated Processor	Software Library	Software	Output Interface	Sensing Range (g)	Bandwidth Typ (Hz)	Current Consumption (mA Typ. @100 Hz ODR)	Supply Voltage (V)	Package Type / Size (mm)
BNO055	32 bit cortex M0+ microcontroller	BSX 3.0 full fusion	n/a	I ² C, UART, HID-I ² C	± 2 g, ± 4 g, ± 8 g, ± 16 g	BSX3 (Fusion) output data rate: 1000, 500, 250, 125, 63, 31, 16, 8	Suspend mode: 40 μA 9DOF @ 100Hz Output data rate: 12.3mA	V _{DD} : 2.4 to 3.6 V _{DDIO} : 1.7 to 3.6	3.8x5.2x1.13
BMF055	32 bit cortex M0+ microcontroller, 256kB flash memory and 32kB SRAM memory	BSX fusion lite as additional lib. custom programmable.	n/a	I ² C, UART, HID-I ² C	± 2 g, ± 4 g, ± 8 g, ± 16 g	Depends on the custom specific sensor fusion	Depends on the custom specific sensor fusion	V _{DD} : 2.4 to 3.6 V _{DDIO} : 1.7 to 3.6	3.8x5.2x1.13
BHA250B	32 bit floating-point ARC EM4 MCU running @ 10 MHz 1.6 DMIPS/MHz performance, 3.41 CoreMarks/MHz 96 kByte ROM, 48 kByte RAM shared RAM for FIFO, features & extensions optimized for ultra-low-power sensor data fusion	BSX 3.0 fusion activity recognition, gesture recognition step detector, step counter	n/a	I ² C up to 3.4 MBit/s 3xGPIO, 1xHost-INT	± 2 g, ± 4 g, ± 8 g, ± 16 g	BSX3 (Fusion) output data rate: 200, 100, 50, 25, 12.5	<ul style="list-style-type: none"> eCompass @ 100 Hz ODR: 630 μA Hub+Acc @ 100 Hz ODR: 430 μA Activity recognition: 200 μA Significant motion: 100 μA Step detector: 100 μA Suspend mode: 11 μA 	V _{DD} : 1.71 to 3.6 V _{DDIO} : 1.2 to 3.6	2.2x2.2x0.95
BHA260AB	32 bit floating-point ARC EM4 CPU with (up to 3.6 CoreMark/MHz) 256 kByte SRAM, 144 kByte ROM	BSX 4.0 fusion activity recognition, gesture recognition step detector, step counter custom programmable	n/a	<ul style="list-style-type: none"> Host interface configurable as SPI or I²C 2 master interfaces (1 selectable SPI/I²C and 1 I²C) Up to 12 GPIOs 	± 2 g, ± 4 g, ± 8 g, ± 16 g	BSX4 (Fusion) output data rate: 800, 400, 200, 100, 50, 25, 12.5, 6.25, 3.125, 1.5625	<ul style="list-style-type: none"> Fuser2 (running CoreMark) long run mode (20 MHz): 950 μA turbo mode (50 MHz): 2.8 mA Sensor algorithm operation (incl. Sensor) significant motion: 32 μA step counter: 46 μA activity recognition: 77 μA Standby current: 8 μA 	1.8	2.7x2.6x0.8
BHI160B	32 bit floating-point ARC EM4 MCU running @ 10 MHz 96 kByte ROM, 48 kByte RAM	BSX 3.0 fusion activity recognition, gesture recognition step detector, step counter	n/a	I ² C up to 3.4 MBit/s 3xGPIO, 1xHost-INT	(A): ± 2 g, ± 4 g, ± 8 g, ± 16 g (G): ± 125°/s, ± 250°/s, ± 500°/s, ± 1000°/s, ± 2000°/s	BSX3 (Fusion) output data rate: 200, 100, 50, 25, 12.5	<ul style="list-style-type: none"> full 6DoF PDR: 1.3 mA full 6DoF Fusion @ 100 Hz ODR: 1.2 mA full 9DoF Fusion @ 100 Hz ODR: 1.3 mA significant motion: 128 μA step detector: 131 μA suspend mode: 11 μA 	V _{DD} : 1.71 to 3.6 V _{DDIO} : 1.2 to 3.6	3.0x3.0x0.95
BHI260AB	32 bit floating-point ARC EM4 CPU with (up to 3.6 CoreMark/MHz) 256 kByte SRAM, 144 kByte ROM	BSX 4.0 fusion activity recognition, gesture recognition step detector, step counter custom programmable	n/a	<ul style="list-style-type: none"> Host interface configurable as SPI or I²C 3 master interfaces (selectable out of 2xSPI master and 2xI²C master) Up to 25 GPIOs 	(A): ± 2 g, ± 4 g, ± 8 g, ± 16 g (G): ± 125°/s, ± 250°/s, ± 500°/s, ± 1000°/s, ± 2000°/s	BSX4 (Fusion) output data rate: 800, 400, 200, 100, 50, 25, 12.5, 6.25, 3.125, 1.5625	<ul style="list-style-type: none"> Fuser2 (running CoreMark) long run mode (20 MHz): 950 μA turbo mode (50 MHz): 2.8 mA Sensor Fusion (Hub+IMU) operation (calculating Game Rotation Vector) 800 Hz ODR: 1.2 mA 100 Hz ODR: 1.0 mA Standby current: 8 μA 	1.8	4.1x3.6x0.83

(A): Accelerometer, (G): Gyro, (M): Magnetometer



Inertial Sensors for Automotive Comfort Functions

Comfort functions are a rapidly growing application field for MEMS sensors. Bosch offers a complete set of sensors specifically designed for motion detection in navigation and telematics systems, car alarm, car key modules, eCall systems, vehicle dynamics data logging or platform stabilization. Benefits: AEC-Q100 qualified, small footprint, low-power consumption, cost-attractive.

6-Axis Inertial Combo Sensor

Gyroscope & Accelerometer
SMI230

- Programmable measurement range:
 - ±125 to ±2000 dps (gyro)
 - ±2 to ±16 g (accel.)
- Resolution: gyro 16 bit, accelerometer 16 bit, temperature sensor 11 bit
- Embedded filters with programmable bandwidth & self-test
- Interfaces: SPI and I²C
- Synchronized gyro & acc data output
- Supply voltage (V_{DD}): 2.4 - 3.6 V
- Operating temp. (T_A): -40 to +105 °C
- AEC-Q100 Grade 2 qualified
- RoHS compliant
- Package: LGA16 (3.0 x 4.5 x 0.95 mm)



6-Axis Inertial Combo Sensor

Gyroscope & Accelerometer
SMI130

- Same functionality and parameters as SMI230, with the following differences:
- Resolution: gyro 16 bit, accelerometer 12 bit, temperature sensor 8 bit
 - Operating temp. (T_A): -40 to +85 °C
 - Extended operating temp. (T_A): -40 to +105 °C (for details see TCD)
 - AEC-Q100 Grade 3 qualified

3-Axis Gyroscope Sensor

SMG130

Gyro parameters identical to SMI130/SMI230



3-Axis Accelerometer Sensor

SMA130*

- Programmable measurement range: ± 2 g to ± 16 g
- Resolution: accelerometer 14 bit, temperature sensor 8 bit
- Embedded filters with programmable bandwidth
- Embedded self-test
- Interface: SPI and I²C
- Supply voltage (V_{DD}): 1.62 - 3.6 V
- Supply current: 130 μA (power save modes: 1 μA ... 66 μA)
- Operating temp. (T_A): -40 +85 °C
- Extended operating temperature (T_A): -40 to +105 °C (for details see TCD)
- AEC-Q100 Grade 3 qualified
- Package: LGA12 (2.0 x 2.0 x 0.95 mm)

* Variant with reduced performance:
SMA131



Rohm Sensing Networks – MEMS Sensors

With Kionix/Rohm expands its portfolio by including MEMS sensors to detect motion and even recognize different types of movement. This enables more intuitive operation when used as an input interface. Rohm is now able to supply a wide range of accelerometers optimized for a variety of applications. Ultra-low-current consumption combined with improved shock resistance and superior temperature characteristics result in industry-leading performance. In addition, the portfolio includes 6-axis combo sensors integrating a 3-axis accelerometer with a 3-axis magnetometer that delivers high-performance with low-current consumption. Kionix also offers a geomagnetic sensor IC that combines a MI sensor capable of detecting magnetic-fields in 3 directions with a control IC into a compact package, making it ideal for portable applications”

High G and High Bandwidth Accelerometers

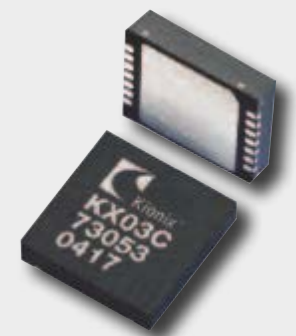
	KX222(2x2mm) Consumer	KX224(3x3mm) Industrial	KX132 (2x2mm)	KX134 (2x2mm)	KX135 (2x2mm)
Grange	±32 g	±32g	±16 g	±32 g	±50 g
Sampling rate (ODR)	Up to 25,600 Hz	Up to 25,600Hz	Up to 25,600Hz	Up to 25,600Hz	Up to 25,600Hz
Mechanical res.	6,000Hz	6,000Hz	3,000Hz	6,000Hz	8,000Hz
Power (0.781 Hz)	~1.8 μA	~1.8 μA	<1 μA	<1 μA	<1 μA
FIFO	2kB	384B	512B	512B	512B
Operating temperature	-40 to +85 °C	-40 to +85 °C	-40 to +105 °C	-40 to +105 °C	-40 to +105 °C
Embedded engines	Wake-up, tap, rotation, free fall	Wake-up, tap, rotation, free fall	Wake-up, tap, rotation, free fall, RMS engine	Wake-up, tap, rotation, free fall, RMS engine	Wake-up, tap, rotation, free fall, RMS engine

Applications

- Machine health | Shock detection | Higher-frequency detection | Sport trainer

KX03C - High Stability Accelerometer

	Accelerometer for Industrial & Automotive Applications
Digital interface	I2C/SPI
Operating voltage	2.4 to 5.5 V
Operating temperature	-40 to +125 °C
Package	5x5x1.2mm DFN (wetttable flanks)
Og offset drift (Life Time) @ 25°C	±30 mg (typ.), ±90 mg(max)
Grange	±2g, ±4g, ±8g, ±16g
Power consumption	~ 12 μA(typ.)
Bandwidth	Signal bandwidth: 3500(XY), 1 B00(XY), LPF bandwidth: 800Hz
Og offset variation from 25°C over temperature	0.1 mg/°C(typ.), 0.5 mg/°C(max)
Long-life support	10 years

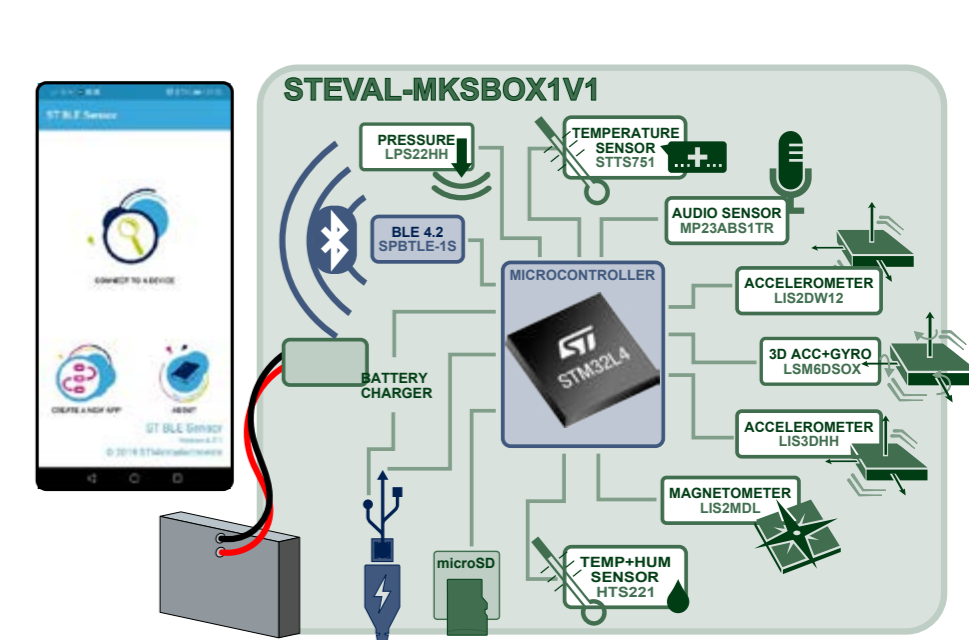


Applications

- Inclinometers
- Level meters
- IMU
- Long term stability applications
- Tilt compensation
- Solar trackers

Analog Accelerometer

	KX94-xxx Low-Noise	KXD94-xxxx Low-Noise	KX220-xxxx Higher-G	KXTC94-xxxx Standard
Grange	±1 g to ±4 g	±5 g to ±15 g	±5 g to ±40 g	±2 g to ±6 g
Operating temperature	-40 to +85 °C (+125 °C opt.)	-40 to +85 °C (+125 °C opt.)	-40 to +85 °C	-40 to +85 °C
Sensitivity	1,000 mV/g	200 mV/g	33 mV/g	660 mV/g
Noise density	45 μg/√Hz	100 μg/√Hz	800 μg/√Hz	150 μg/√Hz



MEMS Sensors

Murata develops and produces high-performance and highly reliable accelerometers, gyro sensors and inclinometers. Murata MEMS sensors robust structures that are very sensitive to inertial forces but are insensitive to other environmental variables and causes of failure. Murata's silicon capacitive sensors are made of single crystal silicon and glass. These materials and proprietary sensor designs ensure reliability, high-accuracy and excellent stability over time and temperature. Murata's inertial sensors robustness and design make them suitable for their target markets with stringent operating conditions such as safety critical automotive, industrial and medical applications.

SensorTile.Box – STEVAL-MKSBOX1V1



The STEVAL-MKSBOX1V1 (SensorTile.Box) is a ready-to-use box kit with wireless IoT and wearable sensor platform to help you use and develop apps based on remote motion and environmental sensor data, regardless of your level of expertise.

Accelerometer

SCA3300

Digital 3-Axis Accelerometers

- User selectable measurement range: $\pm 1.5\text{ g}$, $\pm 3\text{ g}$, $\pm 6\text{ g}$
- Extensive self-diagnostics features
- Mechanically damped sensing element design for superior tolerance against mechanical shocks and vibrations
- SPI digital interface
- -40 to $+125^\circ\text{C}$ operating range
- $3.0 - 3.6\text{ V}$ supply voltage with 1 mA current consumption
- Proven capacitive 3D-MEMS technology
- AEC-Q100 qualified

Benefits

- Best-in-class linearity
- Excellent bias stability
- Vibration robustness

Applications

- Inertial measurement units for heavy Machine and automotive (ADAS)
- Tilt compensation
- Angle measurement and control
- Motion analysis and control
- Intelligent transmission control navigation systems



Inclinometer

SCL3300

Digital 3-Axis Inclinometer

- 3-axis digital inclinometer with acceleration and true angle output
- User selectable measurement range and filter $\pm 10^\circ$ to $\pm 90^\circ$
- Temperature compensated output
- Extensive self-diagnostics features
- Mechanically damped sensing element
- Design for superior tolerance against mechanical shocks and vibrations
- SPI digital interface
- 15 to $20\ \mu\text{g}/\sqrt{\text{Hz}}$ noise density

Benefits

- Robust design
- Excellent bias stability
- Low-noise level
- High-performance

Applications

- Professional leveling
- Angle measurement and control
- Platform levelling and stabilization
- Rotating laser levels
- Leveling instruments



Acceleration & Gyroscope

SCC2000 – Combined X or Z-Axis Gyroscope and 3-Axis Accelerometer

- Gyroscope $\pm 125\ \text{°/s}$ or $\pm 300\ \text{°/s FS}$
- Accelerometer $\pm 2\text{ g}$ or $\pm 6\text{ g FS}$
- SPI Digital Interface
- User-selectable low-pass filters using SPI
- -40 to $+125^\circ\text{C}$ operating range
- $3.0 - 3.6\text{ V}$ supply voltage
- Size $15.0 \times 8.5 \times 4.35\text{ mm}$ (l x w x h)
- AEC-Q 100 Certification

Benefits

- Extensive self diagnostics features
- Excellent bias stability, low-noise level and good vibration robustness
- Proven capacitive 3D-MEMS technology

Applications

- Inertial measurement units (IMUs) for highly demanding environments
- Platform stabilization and control
- Machine control systems
- Electronic stability control (ESC)
- Hill start assist (HSA)
- Roll over detection
- Navigation systems



The SensorTile.Box board fits into a small plastic box with a long-life rechargeable battery, and the ST BLE sensor app on your smartphone connects via bluetooth to the board and allows you to immediately begin using the wide range of default IoT and wearable sensor applications.

In expert mode, you can build custom apps from your selection of SensorTile.Box sensors, operating parameters, data and output types, and special functions and algorithms. This multi sensor kit therefore allows you to design wireless IoT and wearable sensor applications quickly and easily, without performing any programming.

SensorTile.Box includes a firmware programming and debugging interface that allows professional developers to engage in more complex firmware code development using the STM32 open development environment (STM32 ODE), which includes a sensing AI function pack with neural network libraries.

Description	Type
Low-voltage local digital temperature sensor	STTS751
iNEMO 6DoF inertial module	LSM6DSOX
3-axis MEMS accelerometer	LIS2DW12
3-axis digital output accelerometer	LIS3DHH
Digital 3-axis magnetometer	LIS2MDL
Digital nano pressure sensor	LPS22HH
MEMS analog bottomport microphone	MP23ABS1
Digital sensor for relative humidity and temperature	HTS221
Bluetooth smart connectivity v4.2	(SPBTLE-1S)
Programming and debugging interface for professional firmware development	Other

You can download the free ST BLE sensor app on your smartphone and almost immediately begin commanding the board with any of the following applications with ST high-precision sensors on the board:

- **Barometer app:** Allows you to configure the STTS751 temperature, LPS22HH pressure and HTS221. Humidity sensors to monitor environmental information in real time on your smartphone, or collect and graph the data against time on a plot screen.
- **Compass and level app:** Allows you to configure the LSM6DSOX accelerometer and gyroscope and LIS2MDL magnetometer sensors to monitor real time bearing and inclination sensor feedback data and plot the information over time.
- **Step counter app:** Allows you to configure the LSM6DSOX accelerometer to monitor you walking and running speeds and plot the information over time.
- **Baby crying app:** Allows you to configure the MP23ABS1 microphone sensor to detect human voice events such as a baby crying and send an alert to your smartphone as well as activate a LED on the sensor board.
- **Vibration monitoring app:** Allows you to configure the LSM6DSOX accelerometer and set up your board to "learn" the normal operation of motorized domestic or industrial equipment, and then monitor the same equipment for anomalous vibration for predictive maintenance purposes.
- **Data recorder and vehicle/goods tracking app:** Allows you to select and configure appropriate environmental and motion sensors to log the transportation and storage conditions that selected merchandise is subject to over time.
- **Compensated magnetometer app:** Allows you to build additional apps from the magnetometer output and a sensor fusion algorithm to compensate for disturbances from external magnetic-fields.





MEMS & Sensors

The Most Diversified and Complete MEMS and Sensors Supplier

ST has shipped more than 13 billion micro-electromechanical sensors and has one of the industry's most extensive sensor portfolio including proximity and MEMS accelerometers, gyroscopes, digital compasses, inertial modules, microphones, and environmental sensors such as pressure, temperature and humidity sensors.

Benefits

- A unique sensor portfolio, from discrete to fully-integrated solutions, to meet all design needs
- High-volume manufacturing capacity to provide cost competitive solutions, fast time-to-market and security of supply
- High-performance sensor fusion to improve the accuracy of multi-axis sensor systems in order to enable emerging and highly-demanding applications, such as indoor navigation and location-based services
- High-quality products, already tested in different application fields, including mobile, portable, gaming, consumer, automotive and health care segments
- Multiple sites dedicated to MEMS, with full in-house dual-sourcing, guaranteeing 100% security of supply

Sensors for Improving Wearable Applications

- Athlete performance monitoring
- Movement recognition through shoes and wearable sensors (AXL, GYRO, PS)
 - Sport equipment swing detection swing detection (AXL, GYRO, MAG)
 - Body tracking recognition (AXL, GYRO, MAG, PS)

Watches, Personal Navigation Devices, PND and Pedometers (AXL, GYRO, MAG, PS)

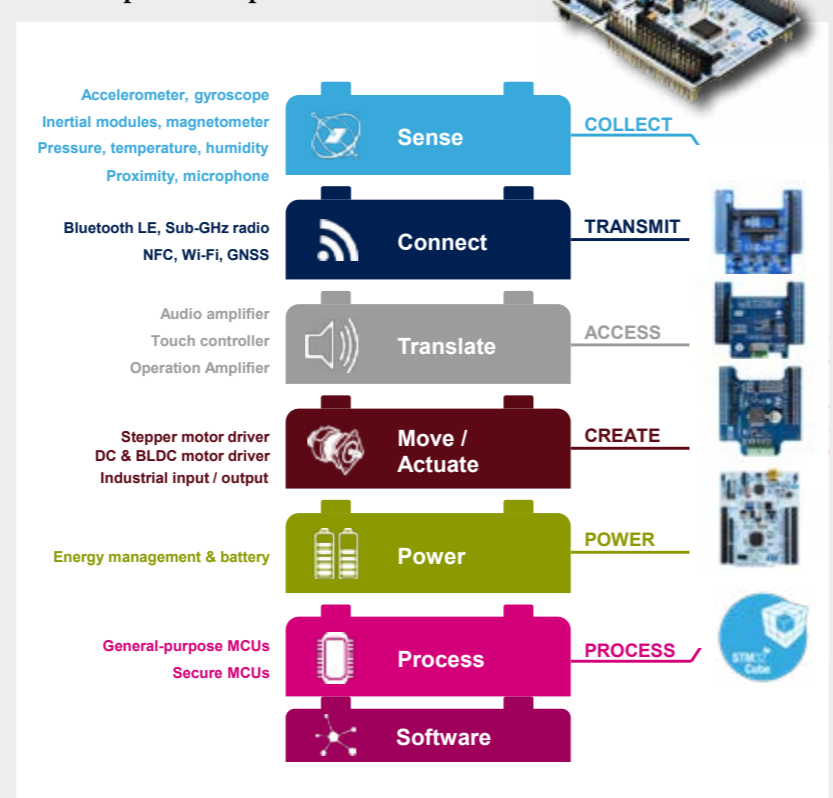
- Map orientation
- Heading and navigation
- Power-saving using auto-wake-up functionality
- Taps display activation

Complete Solution

- Large sensor portfolio
- 100% security of supply
- Integrated hardware and software solutions
- Scalability of solutions
- Quality is a must for ST
- ST is MEMS market leader



STM32 Open Development Environment



MEMS Sensors for Smart Industry 4.0

High-Performance & Ultra-Low-Power Sensing Solutions

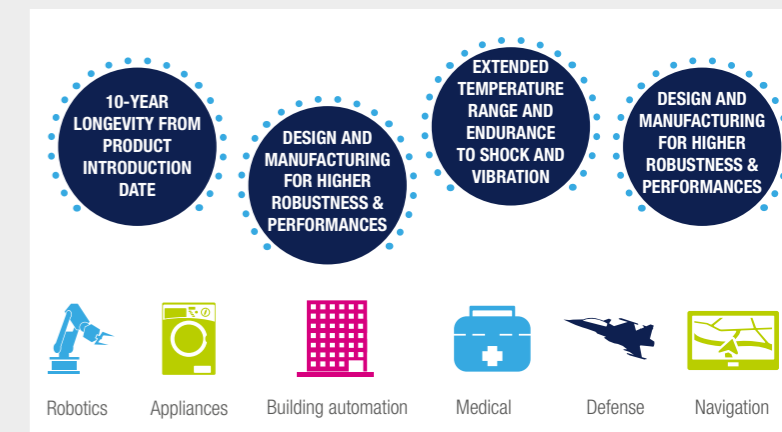
ST's broad range of sensors includes 3-axis miniaturized accelerometers, 6-axis inertial modules, magnetometers/eCompass and pressure sensors. Scalable modules with up to 6-axis (3-axis accelerometer + 3-axis gyroscope or 3-axis magnetic, 3-axis magnetic, 1 pressure or temperature) with drivers as well as ST's open. MEMS catalog of free and easy-to-use software libraries and the STM32 open development environment.

Key Applications

- Predictive maintenance and early failure detection
- Industrial IoT and connected devices
- Robotics, automation and drones
- Power saving and motion-activated functions
- Inertial navigational systems and motion tracking
- Antenna and platform pointing, leveling and stabilization
- Precision inclinometer and leveling instruments
- Optical image and lens stabilization
- Anti-tampering in smart meters
- Positional and distance sensor
- Presence detection, magnetic switch
- Variable magnetic-field monitoring
- Asset and parcel tracking, monitoring and shock detection and logging
- Building and structure monitoring



Benefits of 10-Year Product Longevity Commitment Program



Part No.	Description	Key Parameters	Package
IISDWB	Ultra-wide bandwidth, low-noise 3-axis digital accelerometer	<ul style="list-style-type: none"> • User-selectable full-scale: $\pm 2/\pm 4/\pm 8/\pm 16$ g • Ultra-wide and flat frequency response range: from dc to 5 kHz ± 3 dB point) • Ultra-low-noise density: down to 90 $\mu\text{g}/\sqrt{\text{Hz}}$ in 3-axis mode /IIS3DWB 65 $\mu\text{g}/\sqrt{\text{Hz}}$ in singleaxis mode 	LGA-14L 2.5x3.0x0.83mm
IIS2DH	3-axis accelerometer with digital output	3 μA consumption at 10Hz ODR; 185 μA consumption at wide bandwidth and ODR 5.3 KHz	LGA-12L 2.0x2.0x1.0mm
IIS2DLPC	Ultra-low-power high-performance 3-axis linear accelerometer with digital I ² C/SPI output interface	<ul style="list-style-type: none"> • $\pm 2\text{g}/\pm 4\text{g}/\pm 8\text{g}/\pm 16\text{g}$ full scale • Ultra-low power consumption: 50 nA in power-down mode, below 1 μA in active low-power mode, 120 μA in high-performance mode • 10000 g high shock survivability 	LGA 12L 2.0x2.0x0.7mm
ISM330DHCX	System-in-package featuring a high-performance 3D digital accelerometer and 3D digital gyroscope tailored for Industry 4.0 applications	<ul style="list-style-type: none"> • Accelerometer with selectable full scale: $\pm 2/\pm 4/\pm 8/\pm 16$ g • 3D gyroscope with extended selectable full scale: $\pm 125/\pm 250/\pm 500/\pm 1000/\pm 2000/\pm 4000$ dps • Machine Learning Core and smart embedded functions and interrupts: tilt detection, free-fall, wakeup, 6D/4D orientation, click and double-click and high shock survivability 	LGA 14L 2.5x3.0x0.83 mm
ISM330DLC	iNEMO inertial module: 3-axis accelerometer and 3-axis gyroscope	Rate noise density in high-performance mode (HPM) Gyroscope: 3.8 mdps/ $\sqrt{\text{Hz}}$; Accelerometer: 90 $\mu\text{g}/\sqrt{\text{Hz}}$	LGA-14L 2.5x3.0x0.83 mm
IIS3DHHC	High-performance 3-axis inclinometer with digital output	Meas. range: FS ± 2.5 g offset change with temp < 0.4 mg/C Noise density: 45 $\mu\text{g}/\sqrt{\text{Hz}}$	CC LGA-16 5.0x5.0x1.7 mm Ceramic
IIS2MDC	High-accuracy, ultra-low-power, 3-axis: Digital output magnetometer	± 50 gauss magnetic dynamic range. 3 magnetic-field channels noise 3mGauss (rms)	LGA-12 2.0x2.0x0.7mm
ISM303DAC	eCompass, 3-axis magnetometer +3-axis accelerometer, high-performance, low-power, compact	3-axis mag. FS $\pm 50\text{Ga}$ and 3-axis axl FS $\pm 16\text{g}$ High-resolution,High frequency and Low Power modes	LGA-12L 2.0x2.0x1.0mm



iNEMO-Inertial Modules

iNEMO inertial modules are inertial measurement units (IMU) which integrate complementary types of sensors to offer more compact, robust, and easy-to-assemble solutions compared to discrete MEMS products.

iNEMO System-in-packages (SiP) combine accelerometer, gyroscope and magnetometer in a monolithic 6-axis or 9-axis solution. The integration of multiple sensor outputs bring motion sensing systems to the level of accuracy required for the most demanding applications, such as enhanced gesture recognition, gaming, augmented reality, indoor navigation and localization-based services. To further save power at system level, ST have designed iNEMO inertial modules with an embedded machine learning core. The MLC runs an in-sensor classification engine, offloading the main processor to either run different tasks or to be put to sleep and save power, while the built-in sensors identify motion data.

LSM6DSOX – Motion Sensor with Machine Learning for High-Accuracy, Battery-Friendly Activity Tracking

The LSM6DSOX is a system-inpackage IMU featuring a 3D digital accelerometer and a 3D digital gyroscope boosting performance and enabling always-on low-power features for an optimal motion estimation and user experience.

The LSM6DSOX contains a decision-tree and a machine learning core to classify motion data based on known patterns. Relieving this first stage of activity tracking from the main processor saves energy and accelerates motion-based apps such as fitness logging, wellness monitoring, personal navigation and fall detection.

Features

- Machine learning core (MLC) for advanced motion recognition and classification
- Finite state machine (FSM) for up to 16 custom movement recognition in low-power mode
- Dedicated OIS or control core with AUX interface
- I²C interface
- Data acquisition from up to 4 external sensors (sensor hub)
- High-accuracy, HW configurable, step counter 2.0
- Up to 9kB FIFO sensor data in compressed mode (3.5 kB uncompressed)

Applications

- Motion tracking and gesture detection
- Sensor hub
- Indoor navigation
- IoT and connected devices
- Smart power saving for battery-operated devices
- EIS and OIS for camera applications
- Forklift/robots and machine control
- Vibration monitoring and compensation

Motion Sensors



Accelerometers

ST's state-of-the-art MEMS accelerometers include analog and digital sensors featuring up to ± 400 g acceleration full scale and from 1.71 to 3.6 V supply voltage. Accelerometers have advanced power-saving features that make them suitable for ultra-low-power applications. These features include low-power mode, auto wake-up function and a FIFO buffer that can be used to store data, thus reducing the host processor loading and system power consumption. The small size and embedded features of ST's accelerometers make them an ideal choice for wearable applications and where long battery life is required.

Features

- Low-power consumption and smart ultra-low-power operating modes including always-on
- High-resolution: accuracy and stability
- Smart embedded features for less power hungry systems
- Ultra compact devices in packages smaller than 4 mm³
- Selectable full-scale up to 16g
- Advanced digital features
- Pin-to-pin compatible product family



Part Number	Description	Power cons. in PD Low-Power Mode Normal Mode (μ A)	Key Parameters	Package Size (mm)
LIS2DW12	3-axis accelerometer, 12 to 14 bit resolution	0.05 0.38 @1.6Hz, 3 / 16 @50Hz 120 in HPM @50Hz	32-level, FIFO, self test, temp sensor, high-resolution very low-power	LGA-12, 2.0x2.0x0.7
LIS2DH12	3-axis accelerometer, 8 to 12 bit resolution	0.5 2 @1Hz, 6 @ 50Hz, 11 @50Hz	32-level, FIFO, self test, temp sensor, 12-bit resolution, low-power, cost-effective	LGA-12, 2.0x2.0x1.0
LIS2DE12	3-axis accelerometer, 8 bit resolution	0.5 2 @1Hz, 6 @50Hz	32-level, FIFO, self test, temp sensor, 8bit resolution, low-power	LGA-12, 2.0x2.0x1.0

Digital Compasses

ST's digital compasses include combo solutions, with an accelerometer and magnetic sensor integrated in a single LGA package and standalone magnetometer, to give the possibility of designing a solution locating the magnetic sensor in the best position on the board in order to minimize magnetic interference.

Features

- Ultra-compact high-performance magnetometer module
- Wide magnetic sensor dynamic range and ultra-low magnetic offset
- Pin-to-pin compatible product family
- Embedded self test and temp. compensated



Part Number	Full Scale	Noise Density (Typ.)	Package Size (mm)	Key Features
LSM303AGR	2, ± 4 , ± 8 , ± 16 g, ± 50 gauss	220 μ g/ \sqrt Hz, 3 mgauss	LGA-12, 2.0x2.0x1.0	Ultra-low-power, high-perform., 3D digital accelerator sensor and 3D digital magnetic sensor
LSM303AH	± 2 , ± 4 , ± 8 , ± 16 g, ± 50 gauss	120 μ g/ \sqrt Hz, 3 mgauss	LGA-12, 2.0x2.0x1.0	Ultra-compact, high-perform., e-compass 3D accelerometer and 3D magnetometer module
LIS2MDL	± 50 gauss full scale	3 mgauss	LGA-12, 2.0x2.0x0.7	3-axis magnetometer standalone, power consumption (@ODR=20Hz): 200 μ A in high-resolution, 50 μ A in low-power & 2 μ A in power down

iNEMO[®] Inertial Modules

iNEMO System-in-packages (SiP) combine accelerometer, gyroscope and magnetometer in a monolithic 6-axis or 9-axis solution. The integration of multiple sensor outputs bring motion sensing systems to the level of accuracy required for the most demanding applications, such as enhanced gesture recognition, gaming, augmented reality, indoor navigation and localization-based services.

Features

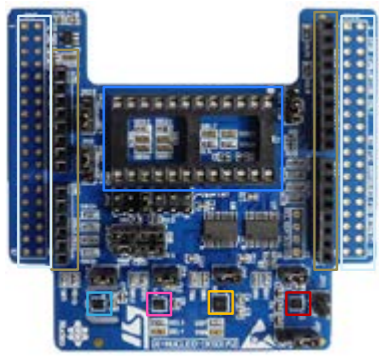
- Always-on 3D accelerometer and 3D gyroscope
- Android M compliant
- Pedometer, step detector and step counter
- Rate noise density 4mdps/ \sqrt Hz (high perf. mode)
- Embedded self test and temperature sensor



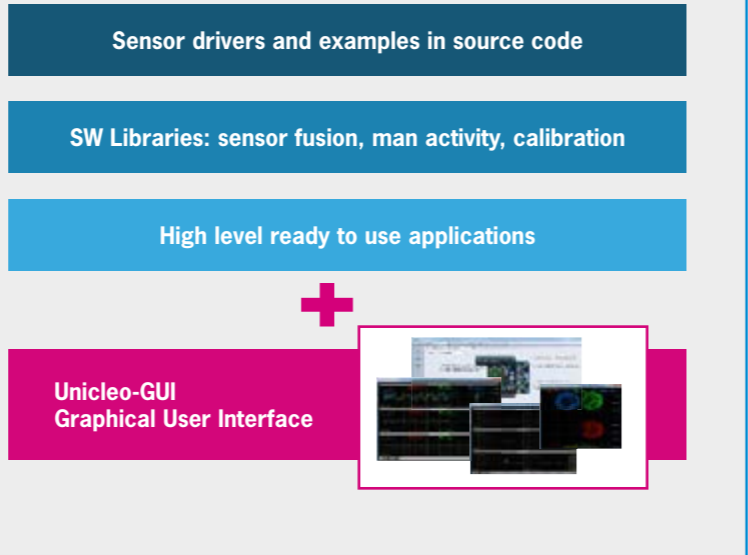
Part Number	General Description	Common Features	Current Consumpt. (μ A)			
			Normal Mode) typ	High-Performance Mode typ	Low-Power Mode typ	Power Down Mode typ
LSM6DSRX	iNEMO inertial module: 3D accelerometer and 3D gyroscope with embedded machine learning core. Digital output	<ul style="list-style-type: none"> Sensing Axes: X, Y, Z, Yaw, Pitch, Roll Package (mm): VFLGA 2.5X3X0.86 14L Angular Rate Range ($^{\circ}$/s) typ: 2000 	700	1200	290	3
ASM330LHH	Automotive 6-axis inertial module: 3D accelerometer and 3D gyroscope	<ul style="list-style-type: none"> Range (g) typ: ± 2; ± 4; ± 8; ± 16 Supply Voltage (V) min.: 1.71 / typ.: 1.8 to 3.6 	1300	-	-	3
ISM330DHCX	iNEMO inertial module: always-on 3D accelerometer and 3D gyroscope with digital output for industrial applications		-	-	350	100
LSM6DSL	iNEMO 6DoF inertial measurement unit (IMU), for smart phones and battery operated IoT, gaming, wearable and consumer electronics. ultra-low-power and high-accuracy. Digital output		450	650	290	3
LSM6DSO	iNEMO 6DoF inertial measurement unit (IMU), with advanced digital function, finite state machine. For battery operated IoT, gaming, wearable and consumer electronics. Digital output. Low-power consumption applications		-	550	26	3
LSM6DSR	iNEMO inertial module: 3D accelerometer and 3D gyroscope. Digital output for high-accuracy applications		700	1200	290	3
LSM6DSOX	iNEMO 6DoF inertial measurement unit (IMU), with Machine Learning Core, Finite State Machine and advanced Digital Function with full-scale acceleration range of $\pm 2/\pm 4/\pm 8/\pm 16$ g and an angular rate range of $\pm 125/\pm 250/\pm 500/\pm 1000/\pm 2000$ dps		-	0.55 mA	-	-



Sensors Ecosystem: HW + SW



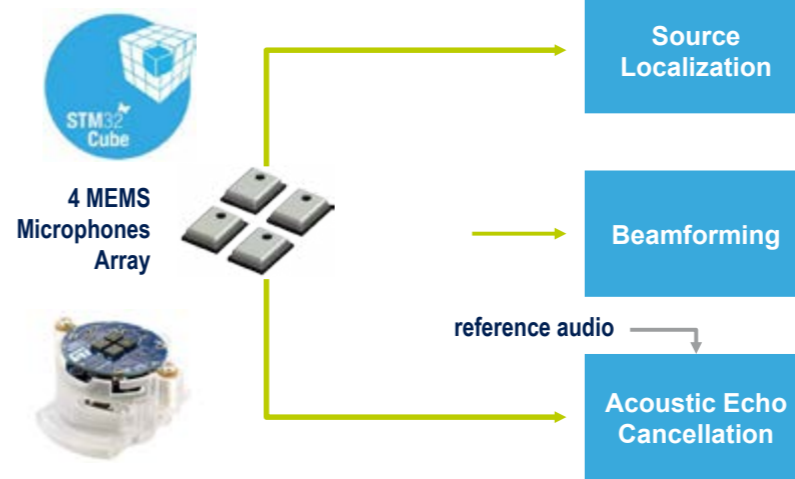
- ST Morpho connector
- Humidity
- 6-axis IMU
- Arduino UNO R3 connector
- Pressure
- E-Compass
- DIL 24-pin



Design Support

ST has a wide product portfolio for wearable applications and provides solution to solve the most complex design challenge: Single product evaluation boards, fast prototyping and development boards, solution evaluation boards and software development tools.

Smart Acoustic1 Software Package



- User-selectable angle resolution
- User-selectable activation threshold
- Based on 4 MEMS microphones
- 360° localization range

- User-selectable beam direction
- User-selectable beamforming algorithm
- Based on 4 MEMS microphones
- GUI highlights the chosen microphone couple

- Based on a single MEMS microphone
- Reference audio is stored on STM32 FLASH
- Uses Audio OUT to play back audio while streaming cleaned speech on USB

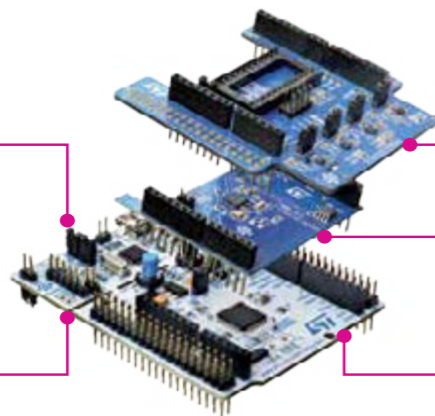


BlueCoin Development Kit

The STEVAL-BCNKT01V1 integrated development and prototyping platform for augmented acoustic and motion sensing for IoT applications builds on the listening and balancing capabilities of the human ear.



- STM32 Nucleo Development boards**
 - Set of boards based on STM32 microcontroller families
 - Debugger/programmer functionality
 - Expansion capabilities
- STM32Cube Development software**
 - SW libraries for each STM32 microcontroller family



- X-NUCLEO STM32 Nucleo expansion boards**
 - Set of boards with additional functions to STM32 Nucleo ones
 - Pluggable boards on top of the STM32 Nucleo or stacked on another expansion board
- X-CUBE STM32Cube expansion software**
 - SW drivers of each X-NUCLEO

The STM32 open development environment is compatible with a number of IDEs including IAR EWARM, Keil MDK-ARM, ARM® mbed™ and GCC-based environments.

Product Evaluation Boards

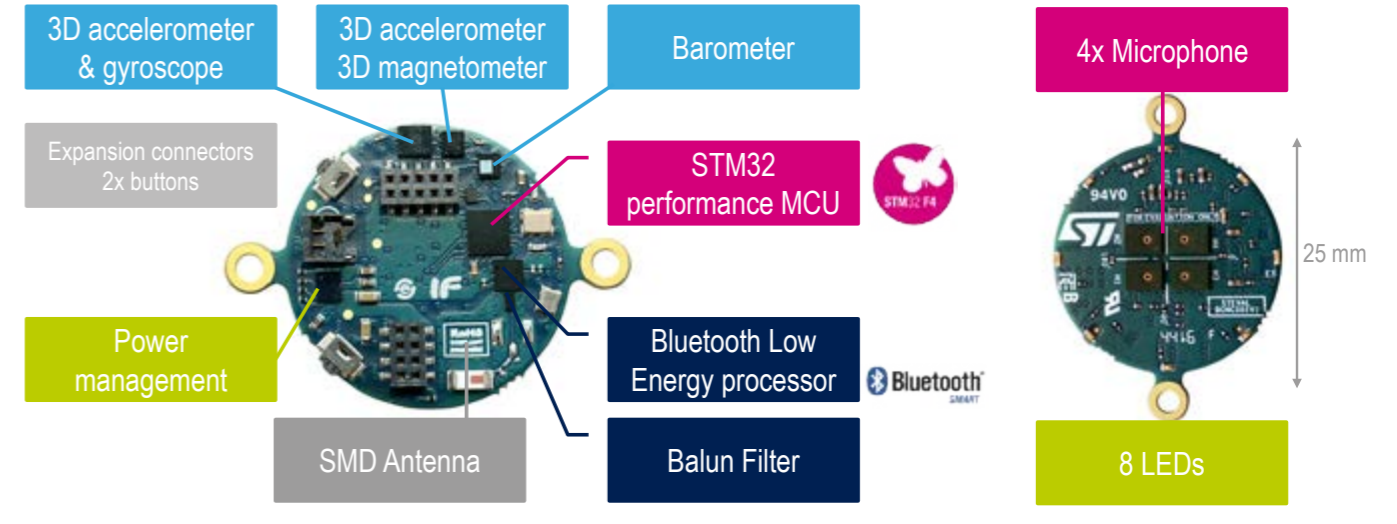
ST proposes a wide range of evaluation boards that may be used to perform a comprehensive evaluation of ST's products reducing your development time. For MEMS and Environmental sensors, ST features the X-NUCLEO-IKS01A3 and X-NUCLEO-IKS02A1 boards which are compatible with the Arduino UNO R3 connector layout. Both boards interface with the STM32 microcontroller via the I²C pin, and it is possible to change the default I²C port. The X-NUCLEO-IKS01A3 is a motion MEMS and environmental sensor evaluation board and features motion, humidity, temperature and pressure sensors.

The X-NUCLEO-IKS02A1 is an industrial motion MEMS Sensor expansion board and it embeds industrial motion sensors and the IMP34DT05 digital microphone.

STM32 Open Development Environment

The STM32 open development environment is a fast and affordable way to prototype and develop innovative applications with state-of-art ST components based on the STM32 32-bit micro controller family and a comprehensive set of functions for sensing, connectivity, power, audio, motor control and more.

Augmented Hearing and Motion Sensing

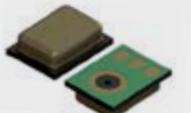


MEMS Microphones

Voice control is a wide spreading trend across many portable applications, making the interaction easier, faster and smoother. It enables fashionable designs by reducing the number of button.

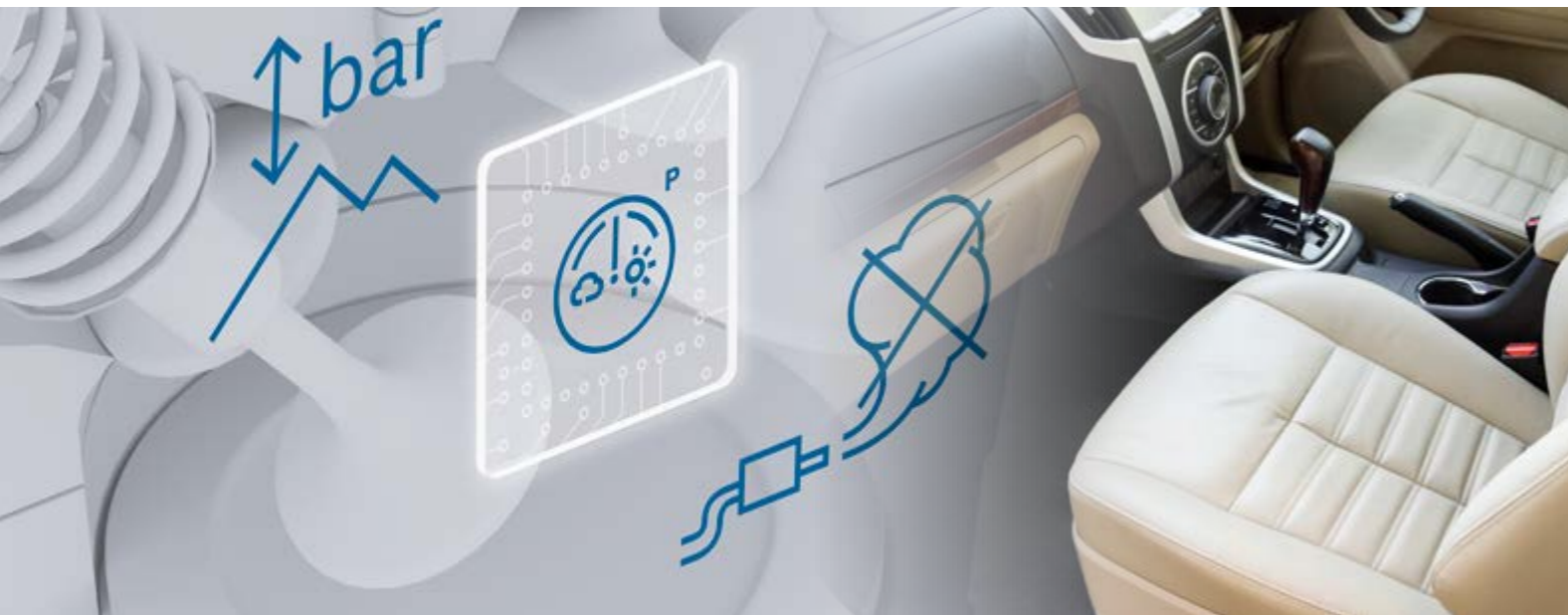
Features

- Tiny packages
- Low-power consumption
- High-performance
- Solution to integrate more sensors in a single package



Part Number	General Description	Package	Output Type	Port location	Signal to noise ratio (dB)*	Sensitivity (dBFS)	Frequency response	Power supply rejection ratio	Supply Voltage (V) min	Supply Voltage (V) typ	Supply Voltage (V) max
MP34DT05	MEMS audio sensor omnidirectional digital microphone for industrial applications	HCLGA 4.0x3.0x1.0mm MICRO	Digital	Top	-	-26 dBFS ±3 dB	20Hz-20Khz	-72	1.6	1.8	3.6
MP23ABS1	High performance MEMS audio sensor single ended analog bottom-port microphone	RHLGA 2.65x3.5x1.08(max.)mm 4L	Analog	Bottom	64	-38 dBV ±1 dB	20Hz-20Khz	60	1.52	2.75	3.6
MP34DT05-A	MEMS audio sensor omnidirectional digital microphone	HCLGA 4.0x3.0x1.0mm MICRO	Digital	Top	64	-26 dBFS ±3 dB	20Hz-20Khz	-72	1.6	1.8	3.6
MP34DT06J	MEMS audio sensor omnidirectional stereo digital microphone	HCLGA 4.0x3.0x1.0mm MICRO	Digital	Top	64	-26 dBFS ±1 dB	20Hz-20Khz	-72	1.6	1.8	3.6

*A-weighted @ 1 Khz



Barometric Pressure Sensors for Automotive Applications SMP580

Barometric pressure sensors are key components in engine control units. They detect the ambient barometric pressure, which continuously fluctuates based on altitude, weather conditions and ambient temperature. The engine management system utilizes the sensor data to adjust the optimum air-fuel mixture. Another application for SMP580 is measuring the air pressure in pneumatic seats. The sensor data are used for controlling form-adjustable lumbar supports, side bolsters and seat massage functions.

Features

- Measurement range:
40 to 115 kPa (engine management)
60 to 165 kPa (seating systems)
- Accuracy:
±1.0 kPa from -40 to +125 °C (engine management)
±1.0 kPa from 0 to +85 °C (seating systems)
- Resolution: 10, 12, or 16 bit
- Interface: SPI
- Supply voltage (V_{DD}): 3.3 to 5 V
- Supply current ≤ 5 mA ($<15 \mu\text{A}$ in power-down mode)
- Operating temperature (T_A): -40 to +125 °C
- RoHS compliant, AEC-Q100 qualified
- Package: SOIC8

Benefits

- Digital interface for pressure and temperature output
- Customizable pressure ranges and transfer functions upon request



Environmental Sensors for IoT & Consumer Electronics Applications

Our portfolio of environmental sensors includes barometric pressure sensors, as well as integrated environmental sensors. These integrated environmental sensors combine barometric pressure, relative humidity, gas and ambient temperature sensing functions. Environmental sensors are ideally suited for indoor air quality measurement, sport & fitness monitoring, weather forecast, home automation control, internet of things, GPS-enhancement and indoor navigation.



Humidity and Gas

Part Number	Description	Output Interface	Measurement Range	Power Consumption	Supply Voltage (V)	Operating Temp. (°C)	Package Type/Size (mm)
BME280	The unit combines individual high linearity, high-accuracy sensors for pressure, humidity and temperature.	I ² C, SPI	Humidity 0...100% rH Pressure 300 ... 1100 hPa Temperature -40 ... +85°C	Sleep mode 0.1 μA 1.8 μA @ 1Hz (H,T) 2.8 μA @1Hz (P, T) 3.6 μA @ 1Hz (H, P, T)	V_{DDIO} : 1.2 to 3.6V V_{DD} : 1.71 to 3.6V	-40 to +85	2.5x2.5x0.93
BME680	The unit integrates for the first time low-power and highly accurate gas, pressure, humidity and temperature sensors in one tiny package.	I ² C, SPI	Gas 0 to 500 IAQ (equivalent to 0.2 to 20 mg/m ³ TVOC levels) Humidity 0 to 100 % rH Pressure 300 to 1100 hPa Temperature -40 ... +85°C	Sleep mode 0.15 μA 2.1 μA @ 1Hz (H,T) 3.1 μA @ 1Hz (P, T) 3.7 μA @ 1 Hz (H, P, T) 0.09 - 12 mA (P/H/T/Gas) depending on operation mode	V_{DDIO} : 1.2 to 3.6V V_{DD} : 1.71 to 3.6V	-40 to +85	3.0x3.0x0.93

Barometric Pressure Sensors

Part Number	Pressure Range	Pressure Type*	Digital Interface	Supply Voltage (V)	Supply Current (mA)	Operating Temperature (°C)	Package Type/Size (mm)
BMP280	300 to 1100 hPa	B	I ² C and SPI	V_{DDIO} : 1.2 to 3.6 V_{DD} : 1.71 to 3.6	2.74 μA @ 1 Hz	-40 to +85	2.0x2.5x0.95
BMP388	300 to 1250 hPa	B	I ² C and SPI	V_{DDIO} : 1.2 to 3.6 V_{DD} : 1.65 to 3.6	3.4 μA @ 1 Hz	-40 to +85	2.0x2.0x0.75
BMP390L	300 to 1250 hPa	B	I ² C and SPI	V_{DDIO} : 1.2 to 3.6 V_{DD} : 1.65 to 3.6	3.2 μA @ 1Hz	-40 to +85	2.0x2.0x0.75



Digital Barometric Air Pressure Sensor

Infineon's digital barometric air pressure sensors are best choice for enhanced navigation experience, activity level monitoring, gesture recognition and weather monitoring just as well as for mobile applications and wearables.

DPS310

DPS310 provides ultra-high-precision up to ± 5 cm and ± 0.06 hPa relative accuracy. The pressure sensing element is based on a unique capacitive principle, which is totally different from piezoelectric technology employed in most of the pressure sensors available in today's market. The capacitive technology enables high-accuracy during temperature changes, which is important for smartphones, wearable and personal navigation devices.

DPS368

DPS368 pressure sensor environmentally protected against water (IPx8), dust and humidity. DPS368 is a miniaturized digital barometric air pressure sensor with a high precision (± 2 cm) and a low current consumption, capable of measuring both pressure and temperature. Due to its robust package, it can withstand 50 m under water for one hour (IPx8). The pressure sensor element is based on a capacitive sensing principle which guarantees high precision during temperature changes. The small package makes the DPS368 ideal for mobile applications and wearable devices.

Target Applications

- Internet of things
- Wearable electronics e.g. health and sports gadgets
- Indoor navigation floor detection e.g. in shopping malls and parking garages
- Outdoor navigation in personal navigation devices
- Dead-reckoning e.g. in tunnels
- Local weather station

Application Benefits

- Ultra-high-precision
- High measurement accuracy over wide pressure and temperature range
- Easy implementation due to compact size
- Low system level energy consumption due to FIFO

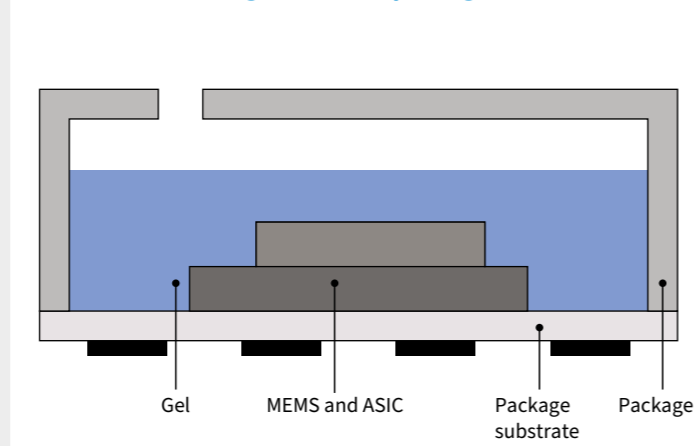
DPS422

The DPS422 is a monolithic chip solution and ultra-small critical area (sensitive area) and offers robustness against environment. It is capable of measuring both pressure and temperature. Pressure sensing is carried out using a capacitive sensor element, guaranteeing high-accuracy over temperature. The small $2.0 \times 2.5 \times 0.73$ mm package makes the DPS422 ideal for mobile applications and wearable devices

Specifications

Parameter	DPS310	DPS368	DPS422
Accuracy	Relative accuracy ± 0.06 hPa; Absolute accuracy ± 1 hPa; Precision 0.002 hPa (or ± 2 cm)	Relative accuracy ± 0.06 hPa (or ± 0.5 m); Absolute accuracy ± 1 hPa (or ± 8 m); Precision: ± 0.002 hPa (or ± 0.02 m)	Relative accuracy ± 0.06 hPa; Absolute accuracy ± 1 hPa; Precision ± 0.005 hPa (or ± 5 cm)
Interface	I ² C with optional interrupt, 4-wire SPI, 3-wire SPI with optional interrupt	I ² C and SPI (both with optional interrupt)	I ² C with optional interrupt, 4-wire SPI, 3-wire SPI with optional interrupt
Pressure Range	300 to 1200 hPa	300 to 1200 hPa	300 to 1200 hPa
Supply Voltage Range	1.7 to 3.6 V	1.7 to 3.6 V	1.7 to 3.6 V
Temperature range	-40 to +85 °C	-40 to +85 °C	-40 to +85 °C
Package	8-pins LGA $2.0 \times 2.5 \times 1.0$ mm ³	8-pin LGA $2.0 \times 2.5 \times 1.1$ mm ³	8-pins WLGA $2.0 \times 2.5 \times 0.73$ mm ³

Schematic drawing of DPS368 package



Air Quality and Environment Sensors

Monitoring environmental conditions in our surroundings greatly increase our comfort and quality of life. For example, we can use weather information to plan outdoor activities or create a comfortable sleeping environment. The superior sensitivity and performance offered by Omron sensors help manufacturers to create more effective air purifiers and air quality control systems.

2JCIE Environment Sensor

Omron's environment sensor provides reliable tracking information of six environmental parameters: temperature, light, UV index, humidity, barometric pressure and noise. This information can be uploaded to a smartphone app using the bluetooth low energy interface, recorded and used to create status updates and alerts.

Features

- Power supply: button lithium battery rated at 3.0 V
- Sensors: temperature, humidity, light, UVI, barometric pressure and noise
- Communication range: approx. 10 m
- Operating temperature: -10 to +60 °C
- Operating humidity: 30 to 85 % RH
- Battery life: approx. 6 months (5 min. measurement interval)
- Dimensions: Approx. 46 x 39 x 15 mm

Applications

- Room condition monitoring
- Monitoring of infants, elders and pets
- Heatstroke prevention
- Weather alert
- UV alert

Important

For embedded and USB versions with VOC measurement, please contact your local Rutronik support.

Air Quality Sensor B5W-LD0101

Air pollution from vehicle emissions as well as many industrial sources became a major concern for the health. Public authorities and consumers in general are more aware of the importance of implementing solutions in their daily life to improve air quality. Omron's B5W-LD0101 offers a high-sensitivity and performance solution for air quality applications.

Omron's air quality sensor module has high sensibility event while utilizing LED, and can detect particles as small as half a micron (up to 0.5 μ m diameter), which surpasses by far the PM2.5 standard for fine particulate matter specified by European Union regulations.

The module's original duet structure can breathe in air stably and effectively allows particulates to flow through the sensor, making it much more responsive to environmental changes. Its size 52.3 x 39.3 x 17.6 mm provides high flexibility for designs.

Applications

- Air purifiers/air conditioners
- Air quality monitoring
- HVAC





OMRON



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Pressure Sensors

Barometric Pressure Sensor 2SMP-02

The new 2SMP-02 pressure sensor measures atmospheric pressure and temperature with high-precision. It can be used as an altimeter in position detection, making it ideal for weather stations, barometers, GPS navigation and activity monitoring equipment. Its tiny size makes it perfect for wearable devices. It is also used in portable games, smartphones and tablets.

Features

- Pressure range from 30 to 110 kPa
- Maximum pressure 800 kPa
- Measurement type: absolute pressure
- MEMS piezoresistive type with digital control and output via I²C/SPI interface
- Operating voltage 1.8 V (typ.)
- Operating temperature: -40 to +85 °C
- Two available versions 2SMPB-02B and 2SMPB-02E. 2SMPB-02E has a calibration parameter for wider pressure & temperature range
- Absolute pressure accuracy ± 50 Pa (typ.) (2SMPB-02E)
- Relative pressure accuracy ± 3.9Pa (33 cm) (ultra high-accuracy mode)
- Low-power 4.1 μA (1 sample/sec.high-speed mode)
- Small package 2.0 x 2.5 x 0.85 mm

Applications

- Altimeter
- Indoor navigation (floor detection)
- Car navigation (to distinguish highway & frontage road)
- Building automation
- Smartphone/Tablet
- Drones
- Activity monitor (to detect up and down of stairs)
- Weather forecast navigation

Miniature Gauge Pressure Sensor 2SMPP-02

Omron's miniature 2SMPP pressure sensor combines low temperature influence, small offset and span voltage variation and low-power consumption. Its compactness and precision make it ideal for many medical applications, including respiratory machines and pumps, laboratory and diagnostic equipment and home care devices. As it accurately controls air movement, leaks and levels, the 2SMPP is also widely used in industrial and environmental control systems.

Features

- Pressure range: 0 to 37 kPa
- Pressure type: gauge pressure
- MEMS piezoresistive type
- Small package: 6.1 x 4.7 x 8.2 mm
- Low-power consumption of 0.2 mW
- Sensing type: piezoresistive
- Withstand pressure max. 53 kPa
- Ambient operating temperature range 0 to +50 °C (with no condensation or icing)
- Ambient operating humidity range 15 to 95 % (with no condensation or icing)

Applications

- Respiratory devices and anesthesia
- Laboratory/diagnostic equipment and home care
- Home appliance
- Air movement control
- Level indicators and leak detection
- Pressure controller

Digital Differential Pressure Sensor D6F-PH

Features & Benefits

- The D6F-PH provides differential pressure measurement based on Omron's MEMS thermal flow chip. It features a new digital correction algorithm that achieves 3% RD precision, contributing to optimization of control efficiency.
- Stable measurement with 0.5% repeatability over wide temperature range is compensated by incorporated ASIC. Internal microprocessor carries out digital correction and enables cutting-edge performance but also add new functionalities.
- High flow impedance to reduce the influence of bypass configuration: By increasing the sensor's flow resistance, the influence of bypass pipe length and diameter has been reduced, leading to more stable measurement.
- The sensor's dimensions were reduced to 26 x 22 x 18 mm to increase installation flexibility. Anomaly detection: Sensor element „open,“ „short circuit,“ and „power supply voltage“ anomaly detection provides greatly enhanced reliability.

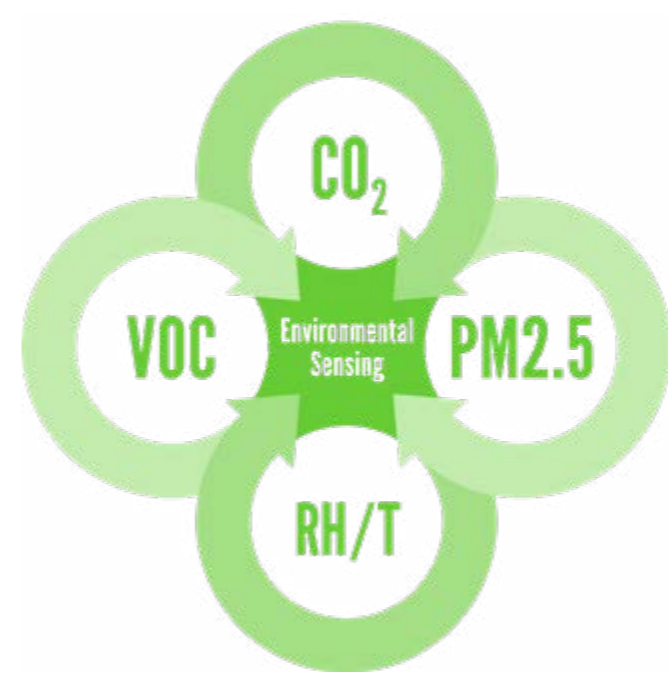
The D6F-PH is a thermal flow-type sensor that measures with superior sensitivity and reproducibility in low pressure environments and with a wider pressure range than the commonly-used capacitance-type and piezoelectric-type differential pressure sensors. Embedded ASICs carry out digital correction making the D6F-PH more precise and less influenced by temperature than conventional analog output sensors. The D6F-PH will make it possible to optimize business and household air conditioning and ventilation control in order to maximize energy efficiency, and also increase the accuracy of gas flow control and monitoring in digital medical equipment and industrial applications.

Specifications

Model	D6F-PH0025AD1	D6F-PH0505AD3	D6F-PH5050AD3
Measurement range ¹	0 to 250Pa	±50Pa	±500Pa
Calibration gas ²	Air		
Port type	Barb joint, maximum outside diameter: 4.9mm		
Power supply	2.3 to 3.6 V _{DC}		
Current consumption	20 mA max. With no load and V _{CC} of 3.3 V _{DC} , GND=0V _{DC} , 25 °C		
Resolution	12-bit		
Zero point toleration	±0.2Pa		
Span tolerance	±3% R.D.		
Temperature compensation	Yes		
Span shift due to temp. variation	<±0.5% R.D. per 10 °C		
Response time	25ms typ. at 12-bit resolution (50ms max.) The processing time is 6ms typical at 12-bit resolution		
Gas flow through sensor	<63 mL/min	<23 mL/min	<100 mL/min
Interface	I ² C		
Case material	PPS		
Degree of protection	IEC IP40		
Withstand pressure	10kPa		
Operating temperature	-20 to +80 °C (with no condensation or icing)		
Operating humidity	35 to 80% RH (with no condensation or icing)		
Storage temperature	-40 to +80 °C (with no condensation or icing)		
Storage humidity	35 to 80% RH (with no condensation or icing)		
Insulation resistance	Between sensor outer cover and lead terminals: 20 Ω min (500 V _{DC})		
Dielectric strength	Between sensor outer cover and lead terminals: 500 V _{AC} , 50/60 Hz min. for 1 minute (leakage current: 1 mA max.)		
Weight	5.2 g		

1) At standard atmospheric pressure (1013.25 hPa)
2) Dry gas not containing dust, oil, or mist





Environmental Sensing

We Measure the Key Environmental Parameters



Environmental conditions have a major impact on our well-being, comfort, and productivity. Sensirion's sensor solutions provide detailed and reliable data on key environmental parameters such as humidity, temperature, volatile organic compounds (VOCs), particulate matter (PM2.5), and CO₂. Environmental sensing opens up new possibilities to create smarter devices that improve our comfort and well-being as well as increase energy efficiency in a wide variety of applications.

Particulate Matter Sensor SPS30

The SPS30 particulate matter (PM) sensor represents a new technological breakthrough in optical PM sensors. Its measurement principle is based on laser scattering and makes use of Sensirion's innovative contamination-resistance technology. This technology, together with high-quality and long-lasting components, enables accurate measurements from the device's first operation and throughout its lifetime of more than eight years. PM2.5 and PM10 refer to particulate matter with particle diameter up to 2.5 microns and 10 microns, respectively, and are among the most dangerous air pollutants. Due to their small size, PM2.5 particles can travel deep into the human lung and cause a variety of health issues; for instance, by triggering asthma attacks or contributing to cardiovascular disease. The SPS30 will enable the implementation of innovative air quality monitoring devices that prevent air pollution damage.

- Features**
- Unique long-term stability due to Sensirion's innovative contamination-resistance technology
 - Advanced particle size binning provided through calibrated digital output
 - Mass concentration: PM1.0, PM2.5, PM4 and PM10
 - Number concentration: PM0.5, PM1.0, PM2.5, PM4 and PM10
 - Small, ultra-slim package

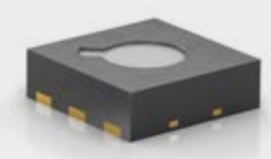
- Applications**
- Air purifiers
 - HVAC equipment
 - Demand-controlled ventilation systems
 - Air conditioners
 - Air quality and environmental monitors
 - Smart home and IoT devices



Multi-Pixel Gas Sensor Platform SGP30

The multi-pixel gas sensor platform SGP creates new possibilities for the measurement of indoor air quality. The SGP offers a complete gas sensor system integrated into a very small 2.45x2.45x0.9 mm DFN package featuring an I²C interface and fully calibrated air quality output signals. Sensirion's MOXSens[®] Technology provides the SGP with an unmatched robustness against contamination by siloxanes resulting in unique long-term stability and accuracy. The SGP further combines multiple metal-oxide sensing elements – the pixels – on one chip to provide more detailed air quality signals. The unprecedented combination of long-term stability and multi-pixel technology makes the SGP a perfect choice for indoor air quality monitoring in mobile, smart home and appliance applications.

- Features**
- Outstanding long-term stability based on Sensirion's MOXSens[®] Technology
 - Calibrated indoor air quality signals
 - SGP30: tVOC, CO₂eq
 - SGPC3: tVOC (ultra-low-power consumption)
 - Very small DFN package and I²C interface



Temperature Sensor STS3x

The STS3x is Sensirion's newest high-accuracy digital temperature sensor series. The STS3x temperature sensor utilizes the industry-proven CMOSens[®] Technology and wins over users with its increased intelligence, reliability, and improved accuracy specifications. The STS3x temperature sensor gives a fully calibrated, linearized, and supply-voltage-compensated digital output and has an outstanding accuracy of up to ±0.1°C (typical). There are three versions available: the standard version, STS31, guarantees an accuracy of ±0.2°C over a temperature range of 0 to 90°C, while the low-cost version, STS30, has a temperature range of 0 to +65°C. The high-end version STS35 is the most accurate temperature sensor available with an accuracy of ±0.1°C over a temperature range of +20 to +60°C.

- Features**
- Compact package: 2.5 x 2.5 x 0.9 mm
 - Wide supply voltage range: 2.15-5.5 V
 - Alert function, two user selectable I²C addresses
 - Outstanding accuracy of up to ±0.1°C (typical)



CO₂ and RH/T Sensor Module SCD30

CMOSens[®] Technology for IR detection enables highly accurate carbon dioxide measurement at a competitive price. Along with the NDIR measurement technology for CO₂ detection, a best-in-class Sensirion humidity and temperature sensor is also integrated on the same sensor module. Ambient humidity and temperature can be outputted by Sensirion's algorithm expertise through modeling and compensating of external heat sources without the requirement for any additional components. Thanks to the dual-channel principle for the measurement of carbon dioxide concentration, the sensor compensates for long-term drifts automatically by design. The very small module height allows easy integration into different applications.

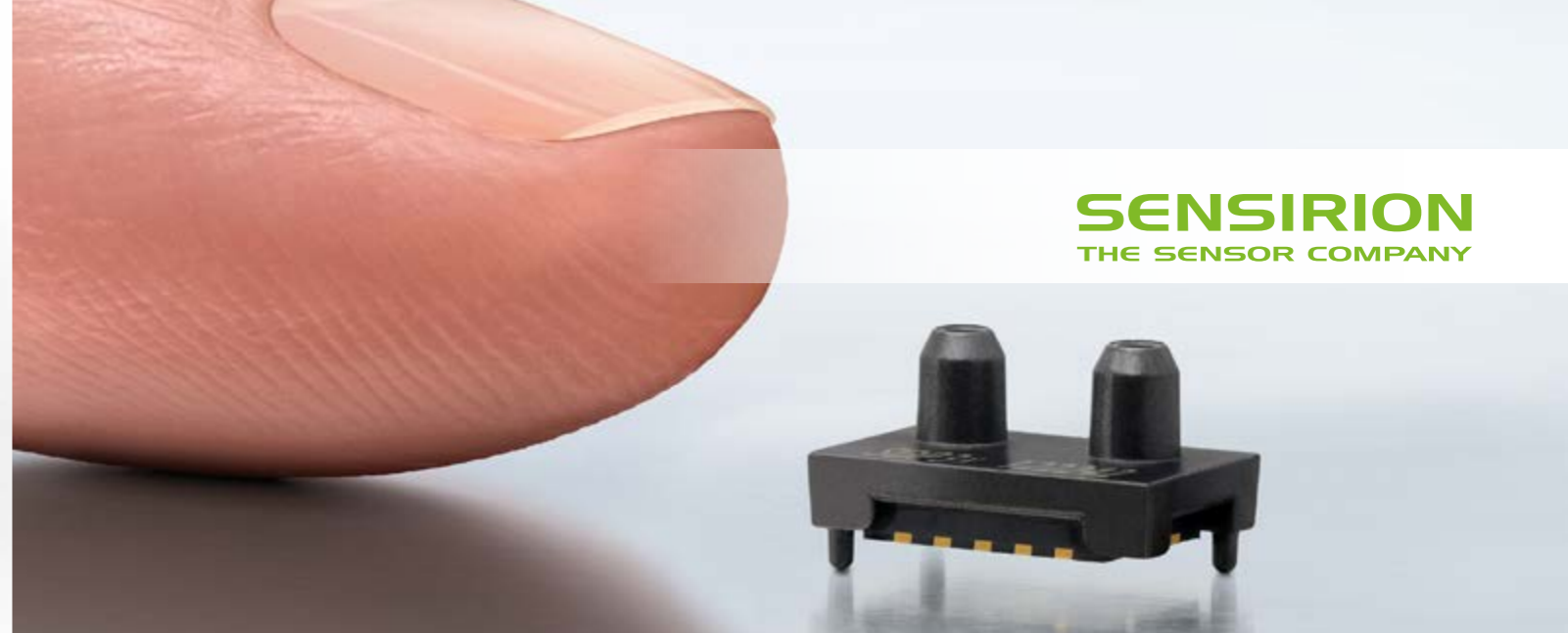
- Features**
- Outstanding stability due to compensation of long-term drifts by dual channel principle
 - Three sensor signals based on Sensirion CMOSens[®] Technology
 - Absolute carbon dioxide concentration
 - Relative humidity and temperature
 - Small form factor and thinnest package



* Coming up soon: the first miniaturized CO₂ and RH/T sensor based on photoacoustic principle SCD40



SENSIRION
THE SENSOR COMPANY



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Humidity Sensors

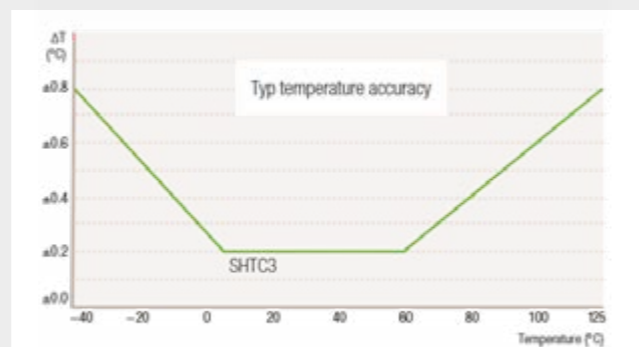
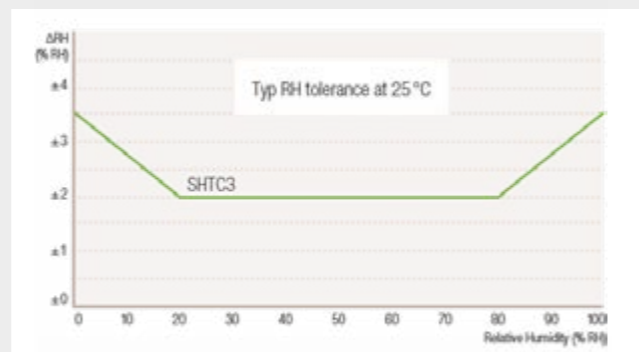
Sensirion is a leading manufacturer of digital relative humidity sensors. By pioneering digital humidity sensors 15 years ago, Sensirion has defined an industry standard with the SHTxx series. Best-in-class products, unprecedented experience, and excellent application support make Sensirion the no. 1 partner for humidity sensing. Each sensor is individually calibrated and tested for quality and accuracy. Additionally, the reliability is demonstrated by qualification based on the AEC-Q100 automotive standard.

Top Products

Product	Typ. RH Accuracy (%RH)	Typ T Accuracy (°C)	VDD Range (V)	Interface	Package Size (mm)	Protective Options	Automotive Version available
SHT30	±2 @ 10-90% RH	±0.2 @ 0 to +65°C	2.15 to 5.5	I ² C, analog voltage	2.5x2.5x0.9		yes
SHT31	±2 @ 0-100% RH	±0.2 @ 0 to +90°C	2.15 to 5.5	I ² C, analog voltage	2.5x2.5x0.9	Protective cover Filter membrane	yes
SHT35	±1.5 @ 0-80% RH	±0.1 @ +20 to +60°C	2.15 to 5.5	I ² C	2.5x2.5x0.9	Filter membrane	yes
SHTW2	±3 @ 20-80% RH	±0.3 @ +0 to +60°C	1.8	I ² C	1.3x0.7x0.5		
SHTC3	±2 @ 20-80% RH	±0.2 @ +5 to +60°C	1.62 to 3.6	I ² C	2.0x2.0x0.75		
SHTC1	±3 @ 20-80% RH	±0.3 @ +5 to +60°C	1.62 to 1.98	I ² C	2.0x2.0x0.75		
SHT85	±1.5 @ 0-80% RH	±0.1 @ +20 to +50°C	2.15 to 5.5	I ² C	17.8x4.9x2.1		

Digital Humidity Sensor SHTC3 (RH/T)

The SHTC3 digital humidity sensor builds on the success of the proven SHTC1 sensor. Thanks to a broader supply voltage range (1.62 – 3.6 V) and higher accuracy (±2% RH, ±0.2°C) than its predecessor, it enables greater flexibility. Sensirion's CMOSens[®] Technology offers a complete sensor system on a single-chip, consisting of a capacitive humidity sensor, a bandgap temperature sensor, analog and digital signal processing, A/D converter, calibration data memory, and a digital communication interface supporting I²C fast mode. The small 2.0x2.0x0.75 mm DFN package enables applications in even the most limited space. The sensor covers a humidity measurement range of 0 to 100% RH and a temperature measurement range of -40 to +125°C with a typical accuracy of ±2% RH and ±0.2°C. The broad supply voltage of 1.62 to 3.6 V and an energy budget below 1 μJ per measurement make the SHTC3 perfectly suited to mobile or wireless applications powered by battery.



Analog | Sensors

Differential Pressure Sensors

Sensirion's differential pressure sensors are fully calibrated and temperature compensated. Their excellent accuracy, long-term stability and no zero-point drift make them the perfect choice for any application. The sensors of the SDP3x and SDP800 series come either with a digital I²C interface or analog voltage output. The digital versions offer measurement speeds up to 2 kHz, smart averaging functions and multiple measurement modes.

Extremely Small Differential Pressure Sensor SDP3x

The SDP3x differential pressure is ideal for the measurement of mass flow in a bypass configuration. The sensor is reflow solderable, and provides extended functionality, such as multiple I²C addresses and interrupt functions as well as fast sampling time. The SDP3x features excellent accuracy and long-term stability and has no zero-point drift.

Thanks to its small size, the SDP3x creates new dimensions of integration and application possibilities, where small size is essential. The sensor is based on the next generation of the CMOSens[®] sensor chip and is the heart of Sensirion's new sensor platform for measuring differential pressure and mass flow.

Features

- Smallest size (5.0x8.0x5.0 mm)
- Measurement range
±500 Pa (±2 in. H₂O) or ±125 Pa (±0.5 in. H₂O)
- Excellent accuracy and repeatability, even below 1 Pa
- No zero-point offset, no drift
- Calibrated and temperature compensated
- Fast sampling time of 2 kHz at 16 bit resolution
- Digital I²C and analog output versions
- Reflow solderable, shipped in tape and reel for pick and place

Applications

- Medical home care applications
- Portable medical devices
- Smart inhalers
- Lifestyle and consumer (IoT)
- Appliances
- Drones
- Wind speed meters

Differential Pressure Sensors SDP800

The SDP800 series is based on Sensirion's patented CMOSens[®] Technology, which combines the sensor element, signal processing and digital calibration on a small CMOS chip. The differential pressure is measured by a thermal sensor element using the flow-through principle.

Thanks to this, Sensirion's CMOSens[®] differential pressure sensors outperform traditional piezo-resistive membrane sensors in terms of sensitivity at low differential pressures, offset drift and hysteresis as well as position sensitivity, shock resistance and temperature variations.

Features

- No offset, no zero-point drift, hysteresis free
- Outstanding accuracy and long-term stability
- Digital (I²C) or analog output
- Pressure range of up to ±500 Pa
- Excellent accuracy and repeatability (even below 1 Pa)
- Fully calibrated and temperature compensated
- For air and non-aggressive gases
- Manifold or tube connection

Applications

- HVAC
- Gas boilers, pellet stoves and fuel cells
- Filter monitoring
- VAV control
- Heat recovery
- Medical



Environmental Sensors

Collect Humidity, Atmospheric Pressure and Temperature Accurate Data for Environmental Awareness



Pressure Sensors

ST's absolute digital output barometer integrates ST's consolidated pressure sensor with the new fully molded package to further improve robustness, reliability and moisture resistance while reducing package thickness. The device may be configured to generate interrupt events based on: threshold crossing, availability of new set of data and FIFO status.

LPS22HH

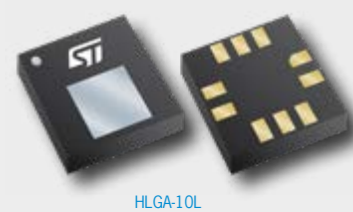
The LPS22HB is housed in a fully molded package that provides the best thermal and mechanical robustness (high shock survivability > 20,000 g). This new MEMS technology called "Bastille" allows the use of fully molded HLGA (holed land grid array) packages, that in contrast to a traditional cavity package protect the ASIC and the bond wires from aggressive gases or water.

LPS33HW, LPS33W, LPS27HHW

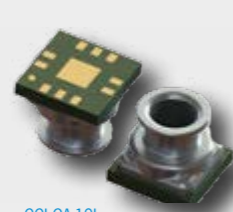
The LPS33HW shows resistance also to chemicals like chlorine, bromine and salt water, making it the ideal sensor for swimming in pools and sea. It is also resistant to soaps and detergents used when showering or cleaning. Gel inside the IC contributes to its resistance of up to 10 bar water or air pressure.

Benefits

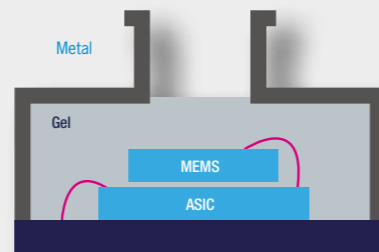
- Ultra-small footprint
- Low-power consumption
- Fully-molded package ensure stability and robustness in any condition and water resistance



HLGA-10L



CCLGA-10L



Part Number	Description	I _{DD}	Key Parameters	Package
LPS22HB	High-accuracy miniature pressure sensor in fully molded package	15 μA (HP mode) 3 μA (LP mode)	Noise RMS (HPM): 0.75 hPa Absolute accuracy: ± 1 hPa	HLGA-10L 2.0x2.0x0.76mm
LPS33HW	Pressure sensor water resistant up to 10 ATM ceramic package with metal lid	15 μA (HP mode) 3 μA (LP mode)	Absolute accuracy: ± 2.5 hPa Noise RMS: 0.8 Pa	CCLGA-10L 3.3x3.3x2.9mm

Temperature Sensors

STMicroelectronics' temperature sensors include both analog and digital temperature sensor ICs.

Digital Temperature Sensor

- One-shot mode for power saving
- Dual alarm
- Tiny package
- Low supply current
- Programmable resolution



Analog Temperature Sensor

- Ultra small package: UDFN-4L (1.0 x 1.3 mm)
- Ultra-low supply current: 4.8 μA typ.
- Operating temperature: -55 to +130 °C



Part Number	Description	Voltage Range Current	Temp. Range	Accuracy	Resolution	Package
STTS22H	Low-voltage, ultra-low-power, I ² C/SMBus 3.0 Temperature sensor	1.5 to 3.6 V	-40 to +125 °C	0.5 °C	9 bit	UDFN 6L 2.0x2.0x0.55mm
STTS751	Programmable digital temperature sensor	2.25 V to 3.6 V I _{dd} 20 μA	-40 to +125 °C	±1.0 °C @ 25 °C (typ), ±2.5 °C @ 125 °C (max)	9 to 12 bit	UDFN-6L 1.0x1.3x0.5mm
STLM75	Digital temperature sensor	2.7 V to 5.5 V 125 μA (typ)	-55 to +125 °C	±0.5 °C (typ), ±3.0 °C (max)	9 bit	MSOP-8 3.0x3.0x1.1 mm
STLM20W87F	Analog temperature sensor	2.4 V to 5.5 V I _q 4.8 μA	-55 to +130 °C	±0.5 °C @ 25 °C (typ), ±2.5 °C @ 130 °C (max)	analog	SOT323-5L 1.8x1.15x0.8mm
STLM20DD9F	Analog temperature sensor	2.4 V to 5.5 V I _q 4.8 μA	-40 to +85 °C	±0.5 °C @ 25 °C (typ), ±2.1 °C @ 85 °C (max)	analog	UDFN-4L 1.0x1.3x0.5mm

Humidity & Temperature Sensors

The HTS221 is an ultra-compact sensor that measures relative humidity and temperature. Housed in a tiny but robust HLGA package (2x2x0.9 mm), the HTS221 is suitable for wearable and portable devices and all applications where comfort, health and safety might be negatively impacted by humidity and temperature variations.

Benefits

- Ultra-small footprint
- Low-power consumption to address wearable devices
- Allows customized calibration for best design flexibility

Part Number	General Description	Supply Voltage min-max (V)	Humidity (RH) min-max (% RH)	Interfaces	Package
HTS221	Capacitive digital sensor for relative humidity and temperature	1.7 – 3.6	0 – 100	SPI, I ² C	HLGA-6L 2.0x2.0x0.9 mm



Pressure Sensor

BM1383GLV

Piezo-Resistive Pressure Sensor

Rohm's BM1383GLV piezo-resistive pressure sensors offers a pressure accuracy and stable measurement at both low and high temperatures due to a built-in temperature correction function. The piezo-resistive sensing element provides a signal that is proportional to atmospheric pressure. This signal is processed by integrated logic to yield accurate pressure information which is stable for the full temperature range. The sensor offers low-power consumption especially for high accurate measurements.

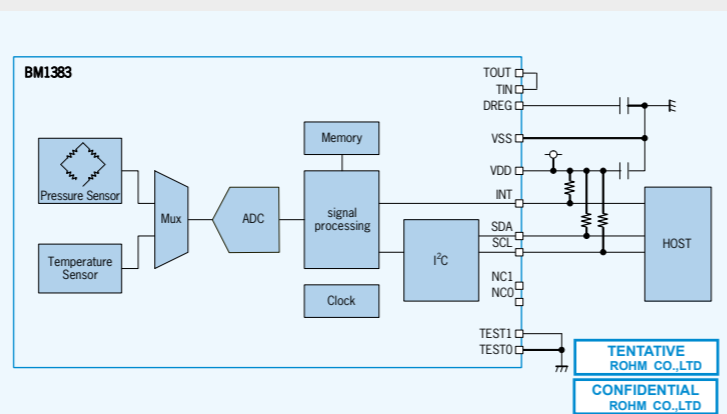
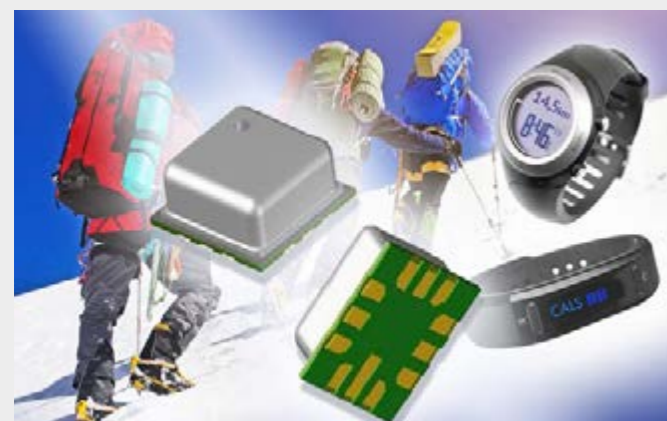
The built-in I²C interface provides access to the measurement results in any kind of mobile or battery driven application. The sensor can detect differences in height (altitude) through pressure changes and capture movement data which suit them for use in wearable devices, activity monitors, altimeters and advanced detection for indoor navigation in smartphones and tablets.

Features

- Piezo-resistive pressure sensor
- Pressure range is from 300 to 1100 hPa
- Built-in temperature and offset compensation function
- I²C interfaces
- Small package 2.5 x 2.5 x 1.0 mm
- Temp. range -40 to +85 °C
- Voltage supply 1.7 to 3.6 V

Key Specifications

- Pressure range: 300 to 1100 hPa
- Relative pressure accuracy: ±0.12 hPa (Typ)
- Absolute pressure accuracy: ± 1 hPa (Typ)
- Average current consumption: 3 μA (Typ)



Optical Sensors

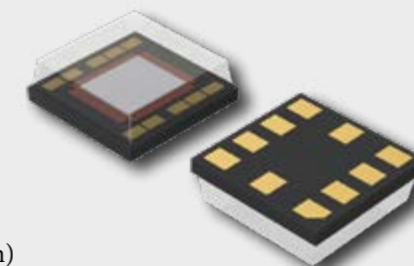
BH1790GLC

Sensor IC for Heart Rate Monitoring

BH1790GLC is an optical sensor for heart rate monitoring in which LED driver and green light detection photo-diode are incorporated. This device drives LED and measures the intensity of light reflected from body. LED brightness can be adjusted by LED driver current and light emitting period. The photodiode having the high-sensitivity for green light, excellent wavelength selectivity and excellent IR Cut characteristics achieves accurate pulse wave detection.

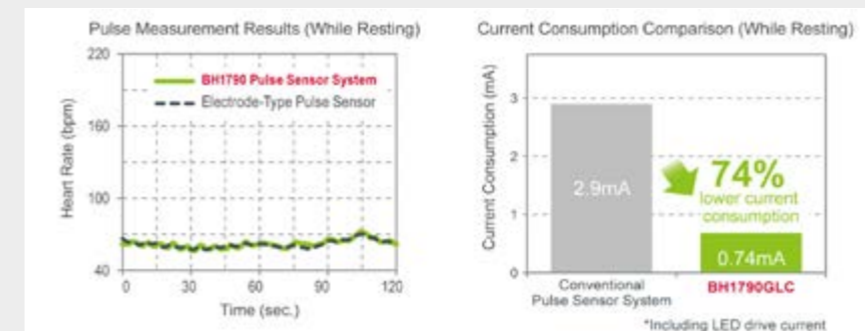
Features

- Green filter with excellent wavelength selectivity
- Built-in IR Cut filter
- LED driver with current selection
- Correspond to 1.8 V
- I²C interface
- V_{CC1} voltage range: 2.5 to 3.6 V
- V_{CC2} voltage range: 1.7 to 3.6 V
- Current consumption: 200 μA (Typ)
- Standby mode current: 0.8 μA (Typ)
- WLGA010V28 (2.8 x 2.8 x max. 1.0 mm)
- Operating temperature range: -20 to +85 °C



Applications

- Wearable device
- Smartphone
- Tablet/PC



BH1749

Color Sensor

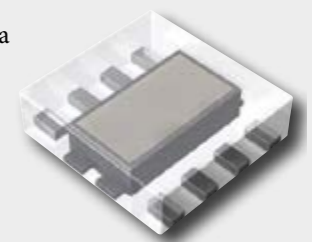
BH1749NUC is a digital color sensor IC with I²C bus interface. This IC senses red, green, blue (RGB) and infrared and converts them to digital values. The high-sensitivity, wide dynamic range and excellent IR Cut characteristics make it possible for this IC to obtain the accurate illuminance and color temperature of ambient light.

Features

- Built-in IR Cut filter
- Rejecting 50 Hz / 60 Hz light noise
- I²C bus interface (f/s mode support)
- It is possible to select 2 type of I²C bus slave address
- Correspond to 1.8 V logic interface
- Resolution 0.0125 lx/count (Typ) (In highest gain and longest measurement time setting)

Applications

- LCD TV
- Mobile phone
- Portable game machine
- Tablet PC
- Note PC
- Digital camera





Pyroelectric Infrared Sensors

A low-cost, high-sensitivity, high-RFI (Radio Frequency Immunity) and high-WLI (White Light Immunity) characteristic lead-type infrared sensor.

The IRA-S series has an improved RFI characteristic for the security market to comply with EN regulation for detection levels, such as peripheral circuitry. Its high-sensitivity and high reliability make a great contribution to ergonomics and energy conservation for a wide range of appliances.

Features

- Good RFI
- Good WLI
- Easy human movement detection
- Wide detection area using lens

Applications

- Security systems



Thermistors – NCP Series

The NCP series offers chip type temperature sensors ideal for temperature sensing and compensation. Available in sizes 0.6 x 0.3 to 1.6 x 0.8 mm, NCP sensors are widely used in many electronics which have heat spot problems.

FEATURES

- Sintered non-oxide ceramic made:
 - Manganese (Mn), Nickel (Ni)
 - Cobalt (Co) and other elements
- An electrode is formed in this ceramic
- The lead-type and chip type are common appearance shapes

APPLICATIONS

- Battery management
- Power management
- RF in M2M cellular module for IoT.



Time-of-Flight (ToF) Signal Processing ICs

The time-of-flight ICs enable low-cost, low-power, and long range optical distance sensing when combined with an external emitter and detector.

With Osram you can find the perfect fit within the Rutronik portfolio for emitters and detectors for your personal designed time-of-flight solution. This gives you more freedom to choose your parameters.

OSRAM Emitters and Detectors for Discrete ToF-Solutions

SFH 4550 – Infrared Emitter (850 nm)

Features

- High-power infrared LED
- Narrow emission angle $\pm 3^\circ$
- Very high radiant intensity
- UL version available (details & test conditions on request)

Applications

- Infrared illumination for cameras
- Data transmission
- Sensor technology
- Smoke detectors



SFH 213 FA – Silicon PIN Photodiode

Features

- Wavelength range (S10%) 750 to 1100 nm
- Short switching time (typ. 5 ns)
- 5 mm LED plastic package

Applications

- High-speed photointerrupters
- Industrial electronics
- For control and drive circuits



Optical Sensors for Health Monitoring and Fitness Tracking

Osram Opto Semiconductors presents two new sensors for monitoring fitness levels. Their main benefit is the excellent signal quality for heart rate measurements, which allows the derivation of secondary measurement parameters such as blood pressure. The SFH 7072 has also been further optimized for determining the oxygen saturation of blood (SpO2).

SFH 7070

The SFH 7070 is a sensor specifically designed for pulse rate measurements at the wrist. It consists of two green emitters and one photodiode, the sensitivity of which is very high in the green spectrum and is greatly suppressed for infrared light. This minimizes the noise signal on the detector, which is created when ambient light penetrates the part of the body being measured and is dispersed. This effect is particularly strong for infrared wavelengths. Compared to the previous version, the SFH 7051, the arrangement of the individual components has also been optimized with regard to signal quality. The green emitters sit on both sides of the photodiode – separated by optical barriers. That way more light hits the detector and there are fewer measurement artifacts caused by the user's movements. The photodiode is almost twice the size of the one in the SFH 7051, which significantly increases the signal strength. What's more, the emitters in the new sensor produce almost four times more brightness per chip – an optical output of 11.7 mW at a current of 20 mA for each chip. This has been achieved by larger chips and a white housing which absorbs less light. Thanks to this, a sensor could be created which ensures excellent signal quality even at a low operating current.

Features

- Multi chip package featuring two green emitters and one detector
- Package size: 7.5 x 3.9 x 0.9 mm
- Light barriers to block optical crosstalk
- Optimized for strong PPG signal
- Wavelength 530 nm

Applications

- Heart rate monitoring & pulse oximetry for:
- Wearable devices (e.g. smart watches, fitness trackers, ...)
 - Mobile devices



SFH 7072

The new features described for the SFH 7070 have also been implemented in the SFH 7072. This sensor has the same dimensions as the SFH 7070.

Apart from two green emitters and one photodiode with an infrared filter, it also contains one red and one infrared emitter as well as a broadband photodiode. The distance between the three latter components was increased so that more light is reflected onto the detector.

The improved signal quality of the measurements with infrared and red light simplifies the calculation of the oxygen saturation of blood (SpO2).

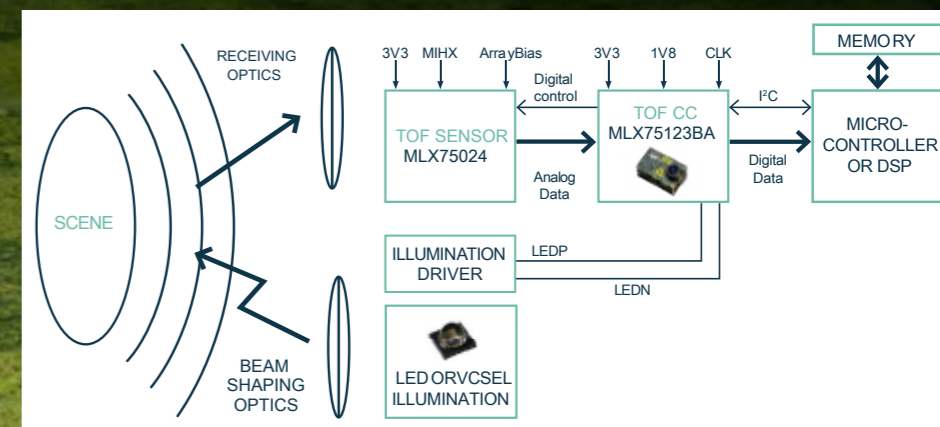
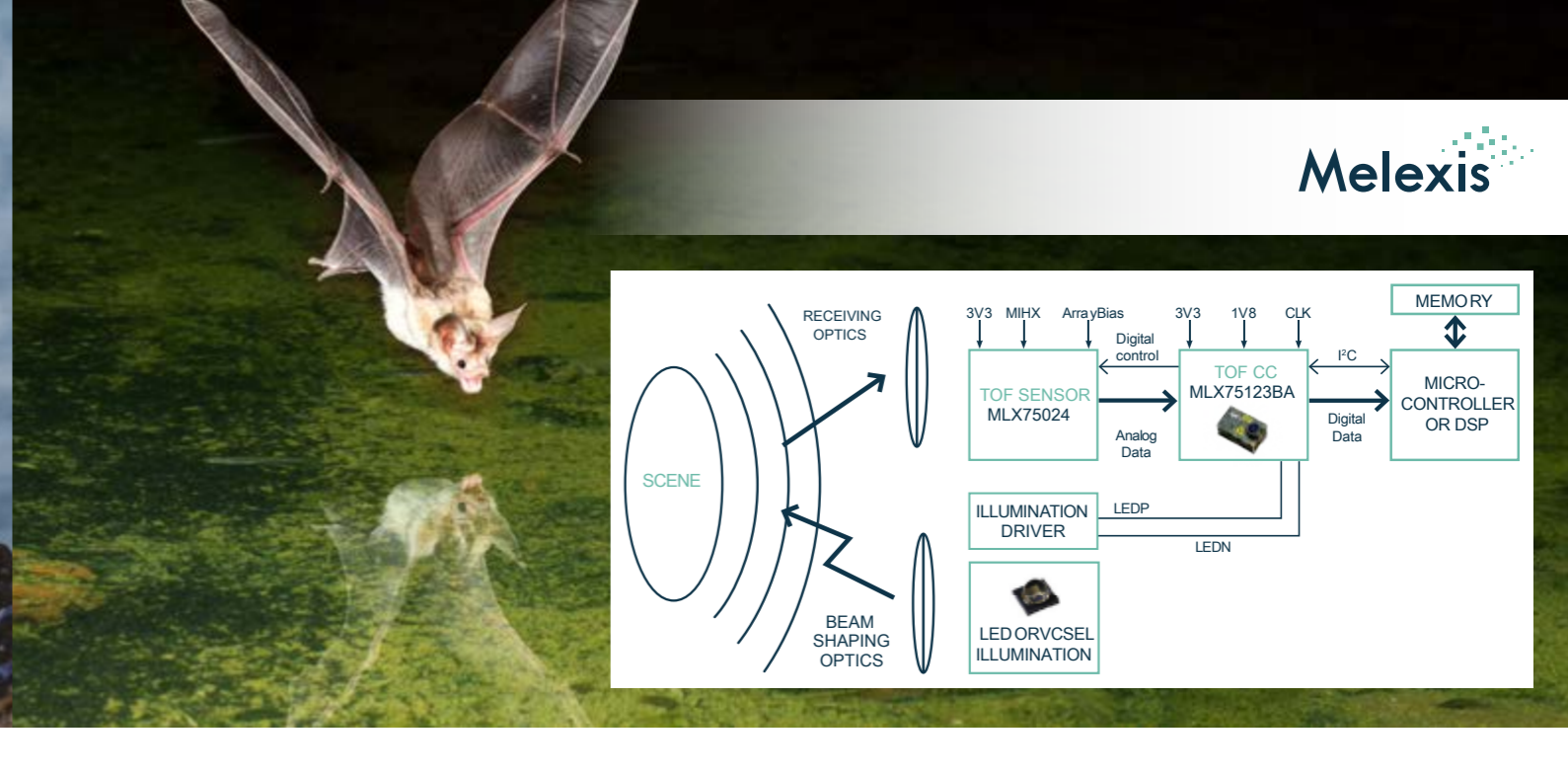
Features

- Multi chip package featuring two green emitters, one photodiode with IR filter, one red, one IR emitter and one broadband photodiode
- Package size: 7.5 x 3.9 x 0.9 mm
- Wavelengths 950 nm/660 nm/530 nm

Applications

- Heart rate monitoring for:
- Wearable devices (e.g. smart watches, fitness trackers, ...)
 - Mobile devices





32X24 Pixel Thermal Imager MLX90640 & MLX90641 – Infrared Array

Analog Ratiometric / PWM MLX90340 – Position Sensor

QVGA Time-of-Flight Chipset MLX75024 & MLX75123 – Real-Time- 3D Imaging with Time-of-Flight Sensor

See the Unseen

Like the pit viper, get access to the thermal world around you. This thermal camera sensor includes optics, a calibrated I²C output and comes in two resolutions:

- 16 x 12 pixels (MLX90641)
- 32 x 24 pixels (MLX90640)

Features

- Measures calibrated object temperature between -40 to +300 °C
- Typical target object temperature accuracy of ±1 °C
- Two different field of view (FoV) options: 55° x 35° or 110° x 75° (wide angle)
- Low-noise equivalent temperature difference (NETD) 0.1K RMS at 4Hz refresh rate
- Enhanced thermal stability (MLX90641)
- Extended operating temperature range (MLX90641: -40 to +125°C)
- Programmable refresh rate (0.5 ... 64 Hz)
- I²C compatible digital interface
- No re-calibration needed
- 4-pin TO39 package including optics
- Evaluation board available

Applications

- People detection, for example in building automation systems
- Fire detection/prevention
- Industrial and cooking applications
- Surveillance and air conditioning systems
- Automotive interior comfort (MLX90641)

Flexible Sensing for Industrial Solutions

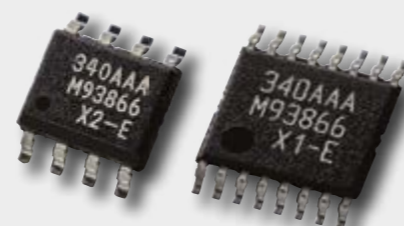
The MLX90340 is an absolute position sensor based on the Melexis Triaxis® Hall technology targeted for various applications in consumer and industrial markets. With a reduced set of core parameters compared to other Triaxis sensors in the portfolio, the MLX90340 only targets the essential: position sensing with the greatest ease of designing a magnet. It still offers the best flexibility to measure a 360 degrees rotational (end-of-shaft or through-shaft) and up to a +/- 20 mm linear magnet movement.

Features

- Absolute position sensor (± 1° accuracy) – 12 bits resolution
- Programmable linearization algorithm: arbitrary points (4 points) or 17 points piecewise linear output compensation
- Programmable magnetic mapping XY, XZ, YZ
- 5 V supply
- Magnet field range from 20 to 70 mT
- SOIC-8 package and redundant TSSOP-16 package
- Temperature range: Heavy-duty industrial [-40 to +150 °C] - Industrial [-40 to +85 °C] - Consumer [-20 to +85 °C]
- Ratiometric analog output or PWM open-drain/push-pull output [100 Hz to 1 kHz]
- 4 different pre-programmed analog version [90, 180, 270, 360°]

Applications

- Motorcycle
- Heavy-duty industrial
- Consumer



The MLX75024 time-of-flight sensor together with the new MLX75123 companion chip provides enhanced performances with backward compatibility with the previous QVGA ToF Sensor MLX75023. The MLX75024 ToF sensor supports up to QVGA resolution with a two times higher sensitivity and has a built-in temperature sensor for easier system calibration. The new MLX75123, which controls the ToF sensor, the illumination unit and delivers the data stream to the host processor, has now four general purpose outputs and a new power-up control circuit to further simplify the design of a very compact 3D camera.

MLX75024 ToF Sensor

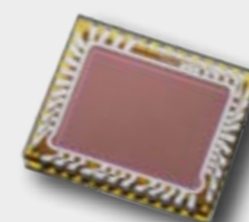
- 1/3" optical time-of-flight sensor (4.8 x 3.6 mm)
- QVGA resolution, 320 x 240 pixels with selectable gain
- Up to 600 Hz raw correlation frame rate @ 40 MS/s, Tint = 100 s
- BGA package 6.6 x 5.5 x 0.6 mm with anti-reflective coating
- Demodulation frequency up to 40 MHz
- Embedded temperature sensor

MLX75123 Companion Chip

- Programmable modulation frequencies to avoid module-to-module crosstalk
- Up to 8 raw phases per frame
- Pre-processed difference & sum output modes to reduce the data bandwidth
- Continuous or triggered operation modes
- Region-of-interest (ROI) selection and binning
- Per-phase statistics & diagnostic
- 4 general-purpose output
- 12-bit parallel camera interface up to 80 Mpix/s
- Configurable over I²C up to 400 kHz
- Chipset is available for automotive (-40/+105) and industrial (-20/+85) temperature ranges

Evaluation Board

The EVK75024 is available to evaluate the MLX75024 & MLX75123 ToF chipset under extreme background light conditions. The flexible design enables any designer to develop the necessary system know-how and experience for use in their application. Its modular concept allows to use the chipset board standalone and combine it with the user's illumination and image processing solution.





Long-Distance Ranging Time-of-Flight (ToF) Sensor

This new generation VL53L1X module includes a lens and a low-power microcontroller running advanced digital firmware which ensures an unprecedented absolute distance measurement up to four meters. It is also possible to program the size and the position of the region-of-interest (ROI) on the receiving array to reduce the sensor field-of-view (FoV).

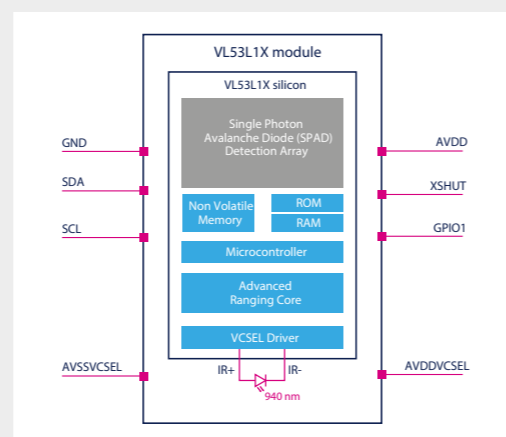
The VL53L1X is the Third-Generation Laser-Ranging Sensor Based on ST's Patented FlightSense™ Technology

Key Benefits

- Long range: up to 400 cm absolute distance measurement
- Fast: up to 50 Hz ranging frequency
- High-accuracy ranging
- Low-power presence detection: <1.5mW
- Fully integrated miniature module: 4.9x2.5x1.56 mm
- Can be hidden behind cover glass
- Programmable sensor field-of-view

Targeted Applications

- Advanced user detection for power-saving and improved security in personal computers and IoT devices
- Long distance and rapid obstacle detection for robotics and smart buildings
- Hovering and landing assistance for drones
- Gesture recognition
- Camera and video assist (ultra-fast autofocus)



Technology

The VL53L1X is a state-of-the-art long-distance ranging ToF sensor. It contains a sensing array of SPADs (single photon avalanche diode), an integrated 940 nm invisible light source based on an eye-safe Class 1 VCSEL (vertical cavity surface-emitting laser) and a low-power embedded microcontroller. This new generation sensor integrates a lens above the SPAD array,

which enables measuring distances up to four meters, and offers excellent ranging performance under challenging operating conditions, even when the sensor is hidden behind a colored cover window. Unlike conventional IR sensors, the VL53L1X uses ST's patented FlightSense™ technology which ensures absolute distance measurements what-

ever the target color and reflectance. Thanks to advanced on-board algorithms, it is also possible to reduce the sensor FoV by programming the size and the position of the region-of-interest (ROI) on the receiving array. An "autonomous low-power" mode is available, based on thresholding and interrupts, specially tuned for advanced presence detection. It allows significant system power-saving, switching-off or waking-up the host automatically when a human or an object is detected. The VL53L1X is supplied with a complete documentation package, example source code and a software API (application programming interface) which is compatible with a range of microcontrollers and processors. The application software development and the physical integration into customers' devices is easy thanks to the X-NUCLEO expansion board, breakout boards and associated development ecosystem.

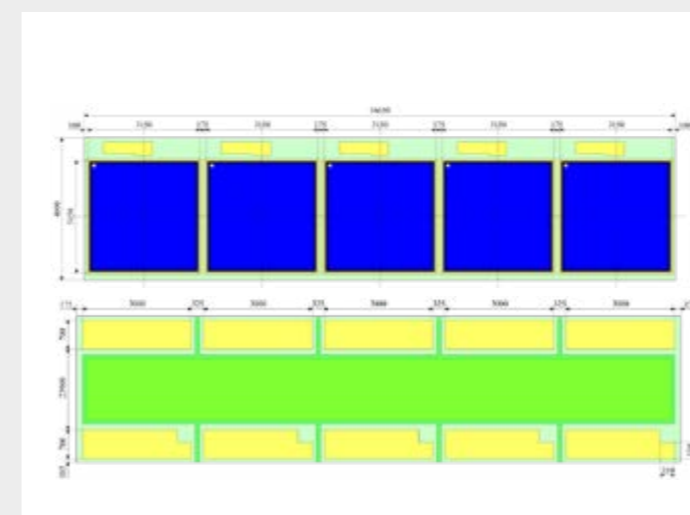
Part Number	Package Size (mm)	Operating Range	Power Consumption	Supply Voltage	Optimum Operating Temp.
VL53L1CXV0FY/1	4.9x2.5x1.56	up to 4 meters	HW standby (typ.): 5µA Ranging: <1 mW (*)	2.6 to 3.5 V	-20 to +85 °C
VL53L0CXV0DH/1	4.4x2.4x1.0	up to 2 meters	HW standby (typ.): 5µA Ranging: <20mW (*)	2.6 to 3.5 V	-20 to +70 °C
VL6180XV0NR/1	4.8x2.8x1.0	0 - 10 cm up to 40 cm ⁽¹⁾	Standby: < 1 µA ALS: < 300 µA (active) Ranging: 30µA (low-power) to 1.7 mA (active) ⁽²⁾	2.6 to 3.0 V	-20 to +70 °C

* Average power consumption at 10Hz, with 33ms ranging operation (1) with calibration depending on final application and hardware (2) Typical average assuming 10Hz, 17% reflective target at 50mm

Photo-Diode Array Based on NJL6195R Si Photo-Diodes

Photo-diode Array available in a compact or in a cascade build order, which allows usage in various applications. Available with visible cut off filter (NJL6195R) or with clear mold (NJL6195R-W).

NJL6195R-WA15

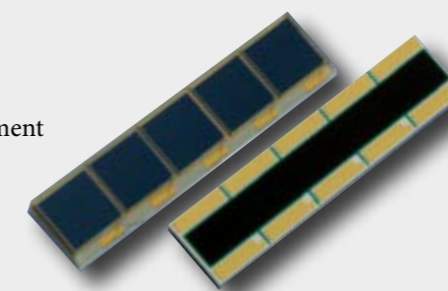


Features

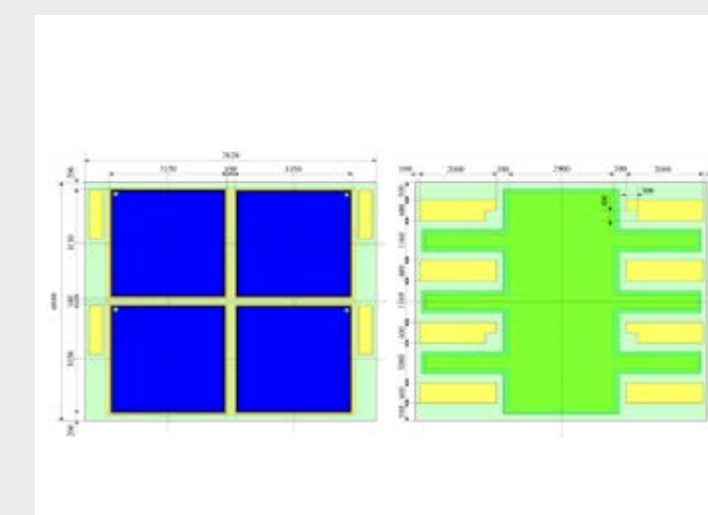
- 1 x 5 photo-diode array
- PD anode & cathode individually accessible
- Horizontally cascadable to build long PD strings
- Package size: 16.65 x 4.0 x 1.0 mm

Application

- ToF sensors
- Laser distance measurement
- Sensors
- Light barriers
- Energy harvesting

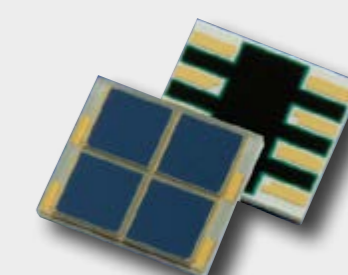


NJL6195R-WA22



Features

- 2 x 2 photo-diode array
- Package size: 7.82 x 6.88 x 1.0 mm





Microwave Distance Measurement Modules & Sensors



24 GHz Microwave Motion Sensors

NJR4262

Features & Benefits

- Analog signal output
- Miniaturized RF circuit with MMIC technology
- High accurate I-Q mixer
- High reliability and low deviation
- Built-in low-noise voltage regulator
- Long-term frequency stability
- Built-in patch antenna
- EU certification & FCC part 15.245

Applications

- Lighting equipment
- Safety and security systems
- Energy saving management
- Entrance and exit management



NJR4265

Features & Benefits

- Digital output
- All-in-one solution: Antenna, RF circuit, IF amp, MCU and voltage regulator are integrated in a small package (14x20.4x8.8 mm)
- Identification of movement direction (approaching and leaving)
- Low-voltage & low-power consumption
- Communication with PC/MCU is available by UART interface, but stand alone operation is also possible
- EU Certification & FCC Part 15.245

Applications

- Energy saving management
- Room access control
- Human detection sensor for various instruments



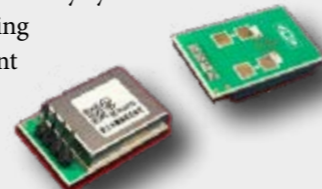
NJR4266

Features & Benefits

- Digital output
- All-in-one solution: antenna, microwave RF circuit, IF amp, MCU and voltage regulator are integrated in a low-profile package (17.2x27.3x5.2 mm)
- Low-power consumption: 1.9mA min. @ 3.3 V
- Sleep mode for power reduction
- Identification of direction for moving objects (approaching and leaving)
- Interface selectable from UART and digital output/analog sensitivity setting
- EU Certification & FCC Part 15.245

Applications

- Lighting equipment
- Entrance and exit management
- Safety and security systems
- Energy saving management



24 GHz Microwave Distance Measurement Sensor

NJR4234

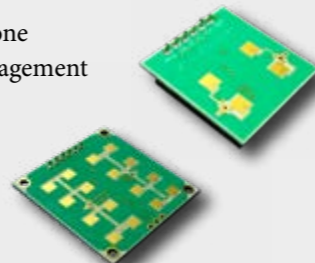
Features

- Digital output
- Measures distances up to 20 m
- All-in-one solution: antenna, microwave RF circuit, base-band IF circuit, MCU and signal processing are integrated in a low-profile package
- Low-power consumption: 37 mA @ 3.3 V power supply
- Unique signal processing/algorithm installation
- Distance measurement signal processing

- High-sensitivity for mobile object detection (patented technology)
- Automatic calibration and gain control
- Radio interference prevention
- Adopted UART and digital CMOS output for interface
- Usable for indoor and outdoor applications
- Versions with additional stationary object detection available
- EU certification & FCC part 15.245

Applications

- Various equipment controlled by moving objects detection and distance measurement
- Security equipment
- Traffic control systems
- FA robot
- Industrial drone
- Parking management system



Optical Sensors



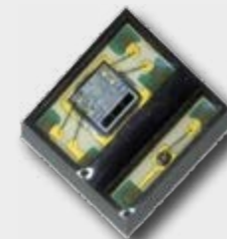
Position Encoder

NJL5820R

- Linear and rotary position detection
- Resolution of 50LPI (2 line pairs per mm)
- Recommended strip width: 0.25 mm
- High-speed resolution of 300 KHz (50000 rpm)
- Digital A/B phase output
- Detection of direction and speed
- Wide distance operation

Applications

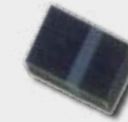
- Motor speed measurement
- Rotor position sensing
- Linear position sensing
- Operation dial



Reflective Sensors

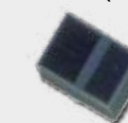
NJL5901R-2

- Output current: 165 μ A – 412 μ A
- Operation dark current: 5 μ A max.
- Package size: 1.4 x 1.0 x 0.6 mm



NJ5902R-2

- Output current: 62 μ A – 155 μ A
- Operation dark current: 0.5 μ A max.
- Package size: 1.7 x 1.2 x 0.6 mm



NJL5905R

- Output current: 270 – 567 μ A
- Operation dark current: 0.2 μ A max.
- Package size: 2.3 x 1.8 x 0.6 mm



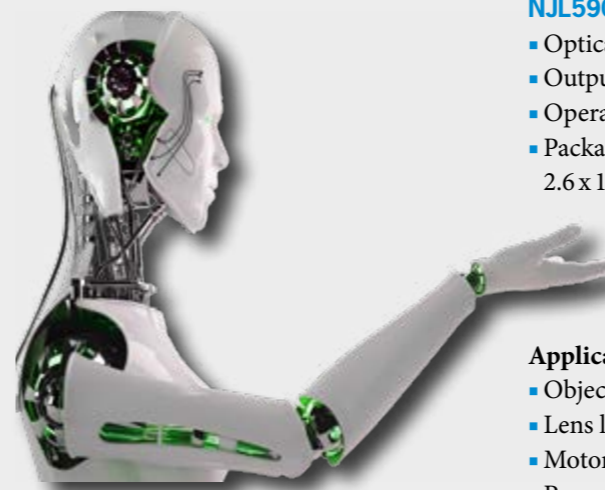
NJL5909RL-4

- Optical lenses focus distance: 4 mm
- Output current: 35 – 75 A
- Operation dark current: 0.2 μ A max.
- Package size: 2.6 x 1.9 x 1.6 mm



Applications

- Object detection
- Lens location detection
- Motor rotation detection
- Paper edge detection
- Optical end switch
- Replacement of fork light barrier



Ambient Light Sensors

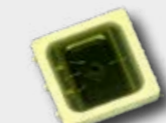
NJL3301FV1

- Current @1000 lx: 1.0 mA
- Half angle: \pm 40°
- Package: PLCC 5.0 x 5.3 x 0.95 mm



NJL3302FV1

- Digital output
- Half angle: \pm 40°
- Package: PLCC 5.0 x 5.3 x 0.95 mm



NJL6502R-1

- Current@1000 lx: 0.42 μ A
- Package: COBP 1.7 x 1.2 x 0.65 mm



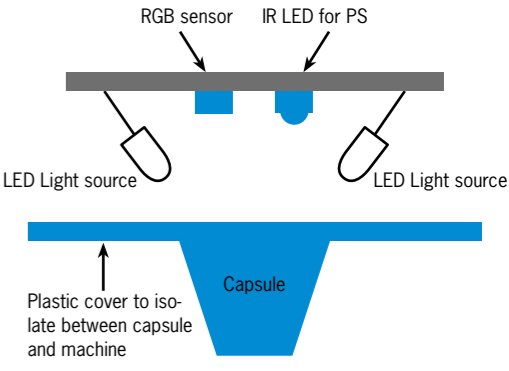
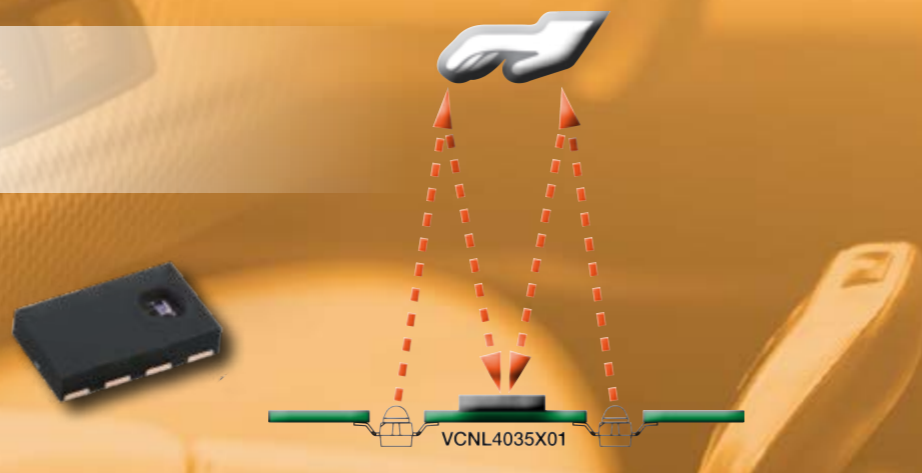
NJL7502L

- Current@1000 lx: 330 μ A
- Half angle: \pm 20°
- Package: lead pin type (\varnothing 3 mm)



Applications

- CCTV control
- Sun shade control
- Home automation
- Lighting equipment
- Ambient/backlight light control



Sensor functionality: Detect color mark of the capsule. Ensure original capsule from manufacturer & capsule flavor.
Suggestions: RGB sensor (LTR-381RGB), RGB sensor + Proximity sensor (LTR-581RGB)



Transmissive Optical Sensors

The new TCUT transmissive sensors in a compact transmissive sensor include two infrared emitters and three or four phototransistor detectors, located face-to-face in a surface mount package.

Fully Integrated Proximity & Ambient Light Sensors

Featuring Filtron technology, the sensor combines photo detectors for proximity and ambient light, a signal conditioning IC.

Optical Sensors Integrated RGBW Detectors

ALS Sensor

3-Channel Transmissive Optical Sensor for „Turn and Push“ Encoding TCUT1630X01

- Features**
- Combines infrared emitter and three phototransistors
 - Dimensions: 5.5 x 5.85 x 7.0 mm
 - AEC-Q101 qualified
 - Gap (in mm): 3
 - Aperture (in mm): 0.3
 - Typical output current under test: IC = 1.3 mA
 - Emitter wavelength: 950 nm
 - Operating temp.: -40 to +105°C
 - Moisture sensitivity level (MSL): 1

- Applications**
- Sensors for motion, speed and direction
 - Steering angle detection (ESP)
 - Sensors for “turn and push” encoding
 - Position sensors in climate control panels



4-Channel Transmissive Optical Sensor for Absolute and Incremental Encoding TCUT1800X01

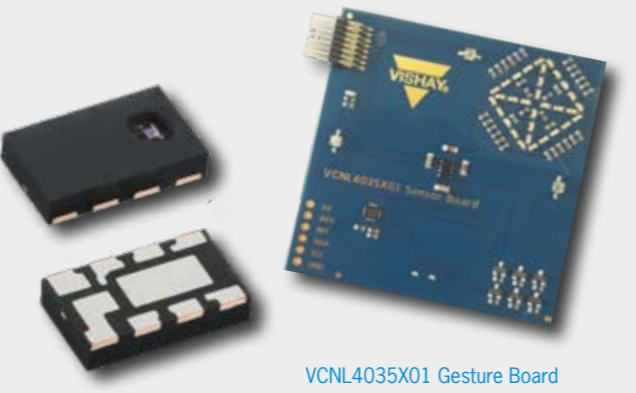
- Features**
- Combines two infrared emitters and four phototransistors
 - Dimensions: 5.5 x 5.85 x 7 mm
 - AEC-Q101 qualified
 - Gap (in mm): 3
 - Aperture (in mm): 0.3
 - Typical output current under test: IC = 1.3 mA
 - Emitter wavelength: 950 nm
 - Operating temp.: -40 to +105°C
 - Moisture sensitivity level (MSL): 1

- Applications**
- Optical encoders that requires high-resolution (can detect up to 16 positions)
 - Ignition locks and adaptive headlights
 - Encoder for interior turn knobs (climate panel, e-shifter, iDrive)
 - Control system valve or vane feedback position sensing



New Fully Integrated Automotive Grade Proximity and Ambient Light Sensor for Gesture Recognition VCNL4035X01

- Features**
- Offers excellent background light cancellation capabilities
 - AEC-Q101 qualified
 - Supports I²C bus communication interface
 - High object detection distances up to 500 mm
 - Ambient light photo-diode offers detection from 0.004 lx to 16 klx
 - High ALS accuracy of ± 10 %
 - Excellent temperature compensation: -40 to +105°C
 - Proximity function uses intelligent cancellation to eliminate cross-talk
 - Supply voltage range of 2.5 to 3.6 V
 - I²C bus voltage range from 1.8 to 5.5 V
 - A 16-bit ADC, and a driver for up to three external IREDS in one compact 4.0 x 2.36 x 0.75 mm surface-mount package



VCNL4035X01 Gesture Board

LTR-381RGB and LTR-382RGB

- Features**
- I²C interface (standard mode @100kHz or fast mode @400kHz)
 - Ambient light/advanced RGB technology and proximity sensing in one ultra-small ChipLED package
 - Very low-power consumption with sleep mode capability
 - Built-in temperature compensation circuit

- Benefits**
- Saving battery power
 - Automatic dimming of panel displays to maintain the same display appearance under all lighting conditions
 - Color temperature adjustment of display panels
 - 16 to 20 bits effective resolution
 - Wide dynamic range with linear response
 - Ideal for operation behind dark glass
 - Close to human eye spectral response

Part Number	Package (ChipLED)		Standalone Component			Operating Temp. Range (°C)	Sensitivity (100ms Int Time, Max Gain)
	LxW (mm)	H (mm)	RGB & Ambient Light Sensor	Proximity Sensor	IR Emitter		
LTR-381RGB	2.0x2.0	0.7	X			-40 to +85	0.0417 Lux/Count
LTR-382RGB	2.0x2.0	0.7	X			-40 to +85	0.0013 Lux/Count

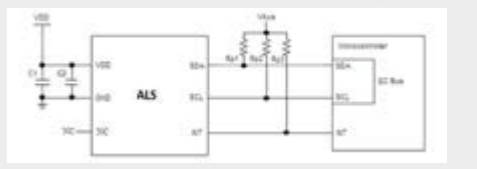


LTR-309ALS

- Features & Benefits**
- 16 bits effective resolution
 - Wide dynamic range (0.01 to 157K lux) with linear response
 - Close to human eye spectral response
 - Automatic rejection for 50 Hz/60 Hz lighting flicker
 - I²C interface (standard mode @100kHz or fast mode @400kHz)
 - Ambient light in one ultra-small chip led package
 - Very-low-power consumption with sleep mode capability
 - Operating temperature ranges: -40 to +85°C
 - Built-in temperature compensation circuit
 - RoHS and halogen free compliance
 - High-sensitivity up to 0.0012 lux/step
 - Dimension: 2.0 x 2.0 x 0.7 mm

- Applications**
- Control brightness of display panel in mobile, computing and customer service

Application Circuit





HVC-P2 (Human Vision Components)

Benefits

- People's conditions recognizable simply by mounting an HVC on equipment, regardless of the CPU performance of a customer's equipment, simply mounting an HVC on the equipment enables the customer to obtain the results of advanced image processing as a sensor output.
- Full range of functions, ten different sensing functions are incorporated to recognise the intentions and conditions of people from a variety of perspectives.
- High-precision: accurate recognition of people's conditions and intentions is enabled under a variety of situations in which a customer's equipment is used

Specifications

Part Number	B5T-007001-010
Horizontal detection area (angle of view)	50 deg: 54°±3°; 90 deg: 94°±5°
Vertical detection area (angle of view)	50 deg: 41°±3°; 90 deg: 76°±5°
Detection distance (differs per function)	3.2-16.7 m (HVC-P2 50 deg), 1.6-8.6 m (HVC-P2 90 deg)
Dimensions (WxLxH)	45x45x8.2mm (main board for both types), 25x25x8.7 mm (camera board 50deg type), 25x25x15.7mm (camera board 90deg type)

Outdoors

- Estimate interest and purchase behaviour of people to store goods of interest
- Vending machines recommending drinks to people

Home

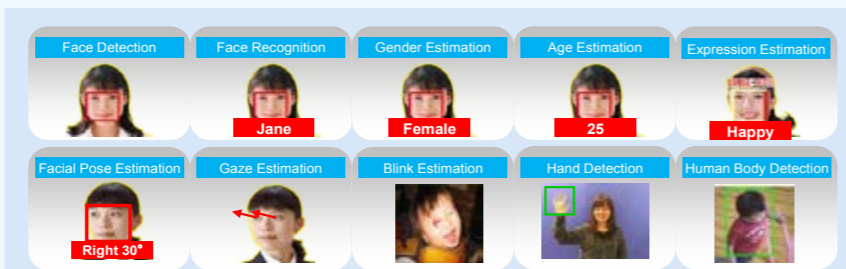
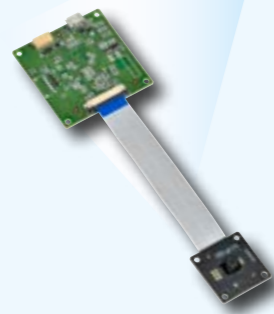
- Home appliances matching movement of people
- AC units targeting people
- Robots matching people
- Lights targeting only people

Workplace

- AC units targeting people
- Lights targeting only people
- Hands free machine operation
- Doors opening to registered people

Main Features

- Camera module angle of view: 2 models (50deg. and 90deg.) available
- Multiple functions (10 functions): Body detection, face detection, hand detection, face direction estimation, gaze estimation, blink estimation, age estimation, gender estimation, expression estimation and face recognition
- User friendly: easy implementation through UART or USB



Function	Result
Face Detection, Body Detection, Hand Detection	Result count (max:35), center coordinates (X & Y), detection size (pixel), degree of confidence
Face Direction Estimation	Yaw degree, pitch degree, roll degree, degree of confidence
Gaze Estimation	Yaw degree, pitch degree
Blink Estimation	Blink degree (left-side eye/right-side eye)
Age Estimation	Age, degree of confidence
Gender Estimation	Gender, degree of confidence
Expression Estimation	5 expressions: "neutral", "happiness", "surprise", "anger", "sadness" and their respective score, Expression degree (positive/negative)
Face Recognition	Individual recognition result, score
Image output	Choose one: none, 160x120 pixels, 320x240 pixels Image format: 8-bit Y data

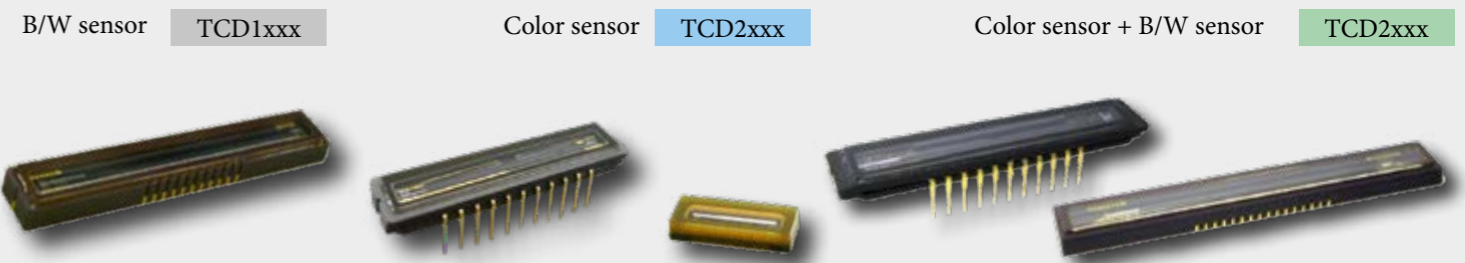
Linear Image Sensors

A linear image sensor is a solid-state device that converts an optical image into an analog signal in a line-by-line fashion. There are two types of linear image sensors with distinct circuit configurations: CMOS image sensors and CCD image sensors. Linear image sensors are suitable for applications such as copier scanning components, image scanners, barcode readers, the line scan camera used for a visual examinations (a film, printed matter, cloth, etc.), grain color sorter, etc. and bank note recognition systems in banking terminals. Toshiba will expand its portfolio of image sensors for sensing applications and is focused on the development of technologies and products applicable to a wide range of applications.

Features

- High-speed: 100 μs/line at 600 dpi
- High-sensitivity: time delay integration (TDI) sensor
- Low-noise and low EMI
- Integration clearing circuit (electronic shutter) helps keep output voltage constant which may vary with the intensity of input lights

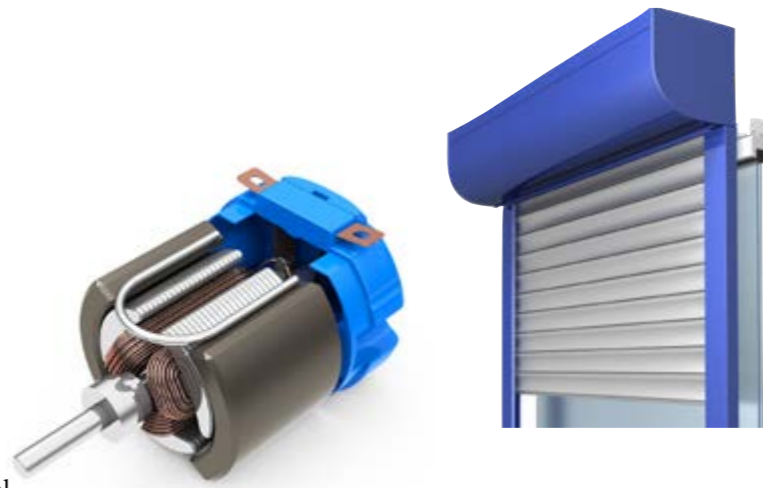
	Up to 1500 pix	Up to 2500 pix	Up to 3648 pix	Up to 5400 pix	Up to 7500 pix	Up to 10680 pix
Up to 140 MHz					TCD2719DG	
Up to 120 MHz					TCD2708DG	
					TCD2712DG	
Up to 100 MHz					TCD1706DG	
					TCD2714DG	
Up to 70 MHz					TCD2713DG	
					TCD2711DG	
					TCD2720BFG	
					TCD2724DG-1	
					TCD2725BFG	
					TCD2722BFG	
Up to 60 MHz					TCD2723BFG	
					TCD1711DG	
Up to 35 MHz				TCD2565BFG	TCD2717BFG	TCD2919BFG
				TCD2566BFG		TCD2918BFG
				TCD2567BFG		TCD2915BFG
				TCD2569BFG		
Up to 20 MHz		TCD1209DG				
Up to 5 MHz	TCD1103GFG	TCD1254GFG	TCD1304DG			
		TCD1256GAG				



Magnetic Sensors

Hall & MR Switches

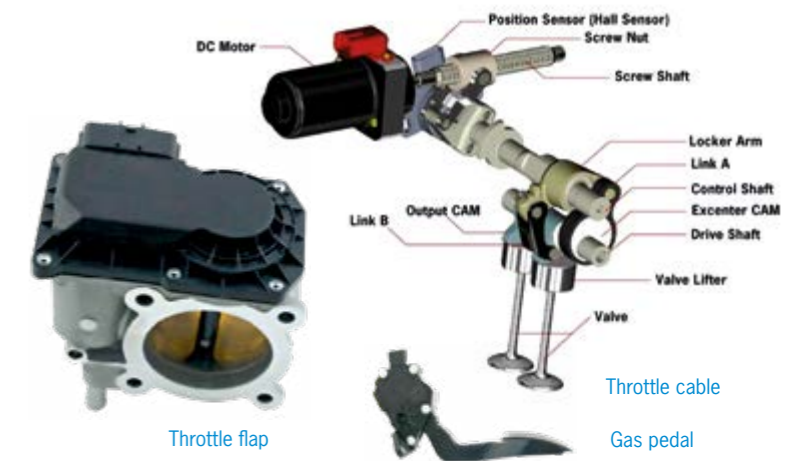
Hall switches are commonly used for end-position detection. The sensor detects the presence of a magnetic-field and signalizes ON or OFF state. How the sensor detects the field depends on the sensor technology. Hall sensors measure vertical magnetic-fields, MR sensors in contrast detect parallel fields.



Magnetic Sensors

Linear & Angular Sensors

In many applications, linear sensors are used to provide a signal proportional to the linear movement being measured. The output signals can be analog or digital. Linear Hall effect sensors are widely used to replace conventional potentiometers.



Supplier	Series	Magnetic Characteristics Typical @25°C		Type					Configuration	Package	Temperature Range CJ (°C)	Application				
		Bon (mT)	Boff (mT)	Unipolar	Bipolar	Latch	Omnipolar	Differential				Position detection	Direction detection	RPM	Brushless DC Motor	Rotating Speed
Hall Switches																
Micronas	HAL1xy	2.6 to 34	-14 to 24	x				3-Wire	T092; SOT89	-20 to +125	x		x	x		
	HAL2xy	-5.2 to 34	-14 to 27.1	x	x			3-Wire	T092; SOT89	-40 to +140	x		x	x		
	HAL5xy	-5.5 to 46.6	-14 to 52.5	x	x	x		2-Wire; 3-Wire	T092; SOT89	-40 to +170	x		x	x		
	HAL15xy	0.5 to 27	-13.5 to 27	x	x	x		3-Wire	T092; SOT23	-40 to +170	x		x	x		
	HAL100x	Programmable		x				3-Wire	T092	-40 to +170	x		x	x		
Infineon	TLE49x5	-6 to 26	-26 to 16	x	x	x		3-Wire	P-SSO-3	-40 to +170	x		x	x		
	TLE49x6	1 to 19	-19 to 12	x	x	x		2; 3; 4-Wire	P-SSO-3; P-SSO-4; SC59	-40 to +170	x	x	x	x		
	TLx496x	-0.2 to 38.8	-19.8 to 31.2	x	x	x		3-Wire	P-SSO-3; SC59; SOT23; T092	-40 to +170	x		x	x		
	TLE491x	2 to 7	1.2 to 6				x	3-Wire	TSOP6; SC59	-40 to +170	x		x	x		
	TLE492x	n.a	n.a					3-Wire; 4-Wire	P-SSO-3; P-SSO-4; PG-SSOM-2-11; PG-SSOM-3-11	-40 to +170		x	x	x		
	TLE494x	n.a	n.a					3-Wire	PGSSOM-2; PG-SSO-2	-40 to +170		x	x	x		
	TLE495x	n.a	n.a					3-Wire	P-SSO-2; PG-SSO-2; PGSSOM-3	-40 to +170		x	x	x		
	TLE498x	Programmable				x	x	3-Wire	P-SSO-3	-40 to +170			x	x		
	MLX922xx	2 to 12.5	-2 to 11.5	x	x	x		2-Wire; 3-Wire	T092; TSOT23	-40 to +170	x		x	x		
	MLX9225x	0.6 to 10	-40 to -0.6			x		4-Wire	TSOT-5	-40 to +170	x	x	x	x		
Melexis	MLX90224	0.6 to 10	-10 to -0.6				x	4-Wire	TSOT-5	-40 to +170	x		x	x		
	MLX92232/42	Programmable		x				2-Wire; 3-Wire	T092; SOT23	-40 to +170	x		x	x		
	MLX90217/54	n.a	n.a				x	3-Wire; 4-Wire	T092	-40 to +170		x	x			
	USx88x	-6 to 1	-4.5 to -6			x		3-Wire	T092; TSOT-3L	-40 to +170	x		x	x		
	US5x8y	5.5 to 20	3.5 to 20	x				3-Wire	T092; TSOT-3L	-40 to +170	x		x	x		
Diodes	AH1xyz	6 to 13	> 1	x	x	x		3-Wire	SIP3; SC59; SOT23; DFN2020	-40 to +105	x		x	x		
	AH9xy	0.9 to 2.7	0.4 to 2.2				x	3-Wire	SC59; T092; SOT23	-40 to +105	x		x	x		
	AH2xy	10	10			x		4-Wire	SIP4	-20 to +105	x		x	x		
	AH3xy	4 to 15	3 to 9	x	x	x		3-Wire	SIP3; SC59; SOT23; DFN2020	-40 to +170	x		x	x		
	AH9xy	4 to 15	3 to 9	x	x	x		3-Wire	SIP3; SC59; SOT23; DFN2020	-40 to +150	x		x	x		
Rohm	BU52xyzq	3 to 6.3	-6.3 to -3	x		x		4-Wire	SSOP5; VCSP50L; HVSOF5;...	-40 to +105	x		x	x		
	BD7411G	3.4	-3.4				x	4-Wire	SSOP5	-40 to +105	x		x			
Panasonic	AN812xyUA-NL	3	24	x	x			3-Wire	SOIC8	-40 to +125	x		x	x		
	AN89xyzA-NL	3	24	x	x			3-Wire	SOIC8	-40 to +105	x		x	x		
	AN488xyA-NL	4 to 8	-4 to -8				x	3-Wire	SMINI-5DE	-40 to +105	x		x	x		
Toshiba	TCS1xy	1.8	0.8	x				3-Wire	UFV; SOT23F	-40 to +105	x		x	x		
	TCS20	3.4	2	x				3-Wire	UFV; SOT23F	-40 to +105	x		x	x		
MR Switches																
Murata	VF401	n/a	n/a				x	2-Wire	T092	-40 to +150		x	x	x		
	MRMSxyz	0.5	2.5				x	3-Wire	2.8x2.9x1.1	-40 to +85	x		x	x		
	MRUSxyz	0.5	4.7				x	3-Wire	1.5x1.8x0.8	-40 to +85	x		x	x		

Hall Switches – Easy Replacement of Micro Switches and Fast Implementation

- Buckle switch
- Motor commutation
- Fan control
- Roller shutter
- Refrigerator light control
- Flow meter
- Gear box
- Backlight (car)
- ABS

Supplier	Series	Pro-gramm-able	Magnetic Range (mT)	Type							Configuration	Package	Junction Temp. CJ (°C)	Applications					Angular Measur.		
				Setpoints	PSIS	Analog	PWM	Serial / SPI / I2C	Differential	LIN				SENT	Linear Movement	Current Measur.	Rotary Position	Leveling	Torque Measur.	< 90°	< 180°
Linear Hall Sensor																					
Micro-nas	HAL8xy	x	-150 to 150	2; 32		x	x			2-Wire; 3-Wire	T092; SOT89; SOIC8	-40 to +170	x	x	x	x	x				
	HAL18xy	x	-160 to 160	2		x				3-Wire	T092; SOT89	-40 to +170		x	x	x					
	HAL28xy	x	-160 to 160	2			x			3-Wire	T092	-40 to +170	x	x	x	x					
	HAL24xy	x	-160 to 160	2; 16		x	x			3-Wire	T092; SOIC8; TSSOP14	-40 to +170	x	x	x	x	x				
	TLE499x	x	-200 to 200	2		x	x			3-Wire	PG-SSO-3-10; SOIC8	-40 to +170	x	x	x	x					
Melexis	MLX902xy	x	-15 to 400	2		x	x	x		2-Wire; 3-Wire	T092; SOT23	-40 to +170	x	x	x	x					
Diodes	AH49xyz		-65 to 100			x				3-Wire	T092; SOT23	-40 to +105	x	x	x						
	AH850x		37 to 43			x				3-Wire	UDFN2020-6	-40 to +85	x	x	x						
Vishay	981HE					x	x			3-Wire	Module	-45 to +125			x	x	x				
	20LHE					x	x			3-Wire	Module	-45 to +85	x	x	x	x					
2D/3D Hall Sensor																					
Micro-nas	HAX37xy	x	-100 to 100	33		x	x			3-Wire	T092; SOIC8	-40 to +170	x	x	x	x	x				
	HAL39xy	x	-130 to 130	32		x	x	x		3-Wire	T092; SOIC8	-40 to +170	x	x	x	x	x				
Infineon	TLV493D		-130 to 130					x		3-Wire	PG-TSOP-6-6-5	-40 to +125	x	x	x	x					
Melexis	MLX903xy	x	progr.	16		x	x	x		3-Wire	TSSOP16	-40 to +170	x	x	x	x					
GMR Sensor																					
Infineon	TLx50xy	x	-200 to 200	2		x	x	x			SOIC8	-40 to +170	x		x	x	x				
AMR Sensor																					
Infineon	TLE5309D					x					SOIC8	-40 to +150			x	x	x				
Diodes	ZMZ-20					x				4-Wire	T092	-40 to +150	x	x	x	x					
MI Sensor																					
Rohm	BM1422GMV	x	-1.2 to 1.2	2				x		3-Wire	MLGA010V020A	-40 to +85			x		x				
TMR																					
Infineon	TLE5501		20 to 100							6-Wire	PG-DSO-8	-40 to +150			x						
	TAD214x	x	20 to 80			x			x	6-Wire	TO6/TSSOP16	-40 to +175			x						
TDK	TAS2240		20 to 80			x	x			4-Wire	DFN-4	-40 to +85			x						
	TMS1142		20 to 80			x				4-Wire	DFN-4	-40 to +85			x						

Applications

- Throttle position sensor
- Steering torque sensor
- Accelerator pedal module
- Gear position sensor
- Transmission tange sensor
- Exhaust gas recirculation system
- Headlight adjustment
- Suspension control
- Bending light module
- Fuel tank level
- Steering angle
- Rotary position sensor



Grade 0 Automotive-Compliant Omnipolar Hall Switches AH356xQ-Series - Harsh Automotive Applications

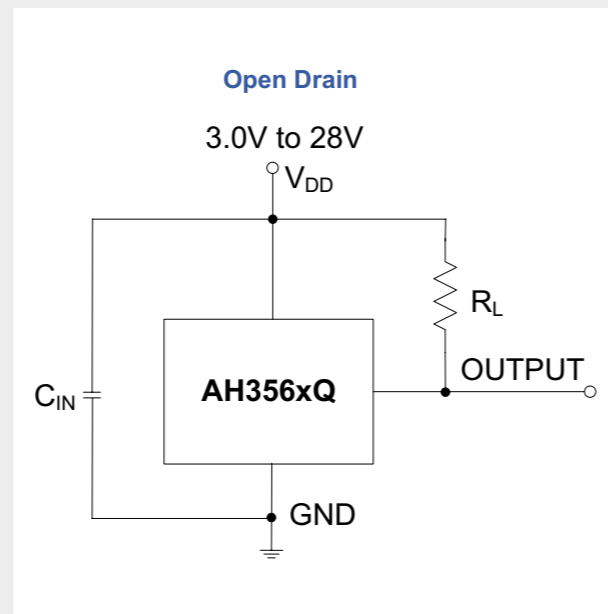
AH356xQ are automotive-compliant, qualified to AEC-Q100 Grade 0, high-sensitivity omnipolar Hall effect switches that support PPAP documentation. The AH356xQ has three sensitivity options with extremely tight switch points and best-in-class drift over temperature and supply voltage.

Benefits

- Precise and stable omnipolar Hall switch points
 - Maintains integrity of switch and release points across all operating range ensuring correct system operation
- Wide operating voltage range, 3 to 28 V
 - Supports whole automotive battery range
- Wide (-40 to +150°C) operating temperature range
 - Flexible solution for different automotive application conditions
- High ESD (8kV) and multiple protection functions
 - Robust and rugged solution for automotive proximity detection
- Industry standard SOT23 and SIP-3 packages
 - Ease of use and placement

Circuit Functions

- Position and proximity sensing in automotive applications
- Open and close detect
- Level detect
- Contact-less switches



Part Number	AECQ-100	Output Type	Operating Voltage (V)	Average Supply (mA)	Reverse Protection	Current Limit	ESD HBM/CDM (kV)	Operating Point (Bop) (Gauss)	Release Point (Brp) (Gauss)	Temperature Range (°C)	Package
AH3562Q	Grade 0	Open-drain	3 to 28	3	Yes	Yes	8/2	±20	±10	-40 to +150	SOT23, SIP-3
AH3563Q	Grade 0	Open-drain	3 to 28	3	Yes	Yes	8/2	±30	±20	-40 to +150	SOT23, SIP-3
AH3564Q	Grade 0	Open-drain	3 to 28	3	Yes	Yes	8/2	±40	±25	-40 to +150	SOT23, SIP-3

High-Voltage Hall Effect Omnipolar Switches AH357x and AH3582 - Market Leading Performance

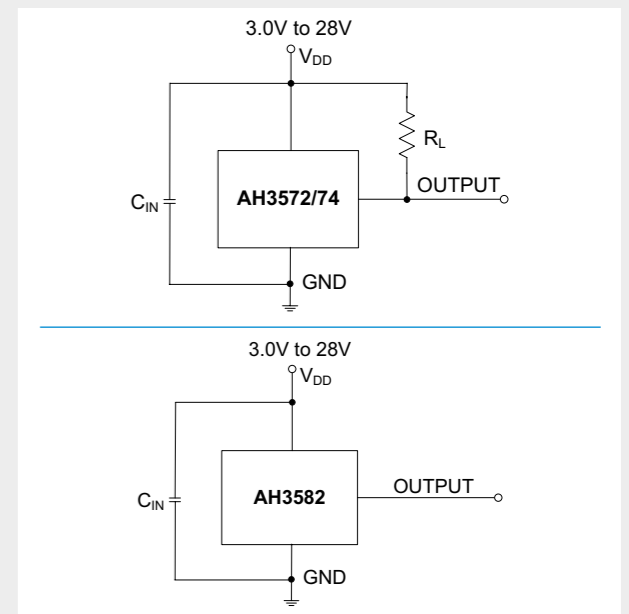
With its chopper stabilized architecture the AH3572/74/82 provide a reliable solution across its whole operating range. For robustness and protection, the device has a reverse blocking diode with Zener clamp on the supply pin and an over-current limit with a Zener clamp on its output.

Benefits

- High-performance omnipolar sensing
 - Two tight tolerance sensitivity options with tight operating window and low temperature coefficients for switch points
 - Chopper stabilized design - minimizes switch point drift
 - Magnetic characteristics specified across the whole operating range
 - Fast "power on" of 10 μs and response time of 3.75 μs
- Product flexibility
 - 3 to 28 V and -40 to +125°C – supports wide range of apps
 - Industry standard SOT23 and SIP-3 package options
- Reliability and robustness
 - Output clamps with current limit
 - Input 32 V reverse voltage protection with clamps
 - High ESD (HBM) rating of 6kV

Circuit Functions

- Position and proximity sensing
- Open and close detect
- Level detect
- Contact-less switches



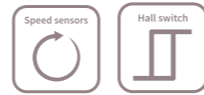
Part Number	Output Type	Operating Voltage (V)	Supply Current(mA)	Reverse Protection	Current Limit	ESD (kV)	Operating Point (Bop) (Gauss)	Release Point (Brp) (Gauss)	Temperature Range (°C)	Package
AH3572	Open-drain	3 to 28	3	Yes	Yes	6	±20	±10	-40 to +125	SOT23, SIP-3
AH3574	Open-drain	3 to 28	3	Yes	Yes	6	±40	±25	-40 to +125	SOT23, SIP-3
AH3582	Int. pull-up	3 to 28	3	Yes	Yes	6	±40	±25	-40 to +125	SOT23, SIP-3





Two-in-One Double Hall Sensor

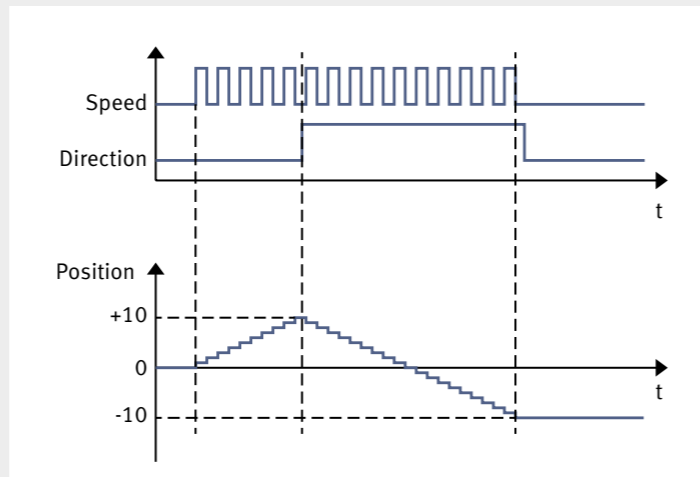
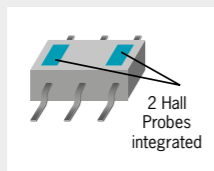
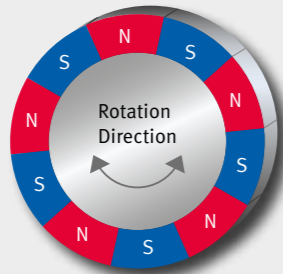
TLE4966: Sensor to Detect Rotation Direction and Rotation Speed



TLE4966 features two integrated, calibrated sensor elements for detecting direction and counting indexes. This two-in-one feature eliminates the need for a second sensor, which in turn cuts engineering and production costs. Using just one sensor also raises system quality and reliability. The vertical orientation of the Hall plates of TLE4966V enable measurement of magnetic-fields, in parallel to package and PCB surface. This brand-new sensor concept helps customers designing automotive systems, being previously not feasible. All devices are AECQ-100 qualified.

Features

- Two Hall probes
- Excellent matching between the two Hall probes
- Hall plate distance of 1.45 mm
- Industry standard
- Outstanding quality
- Information on direction and speed
- TSOP6 package
- AECQ100



Applications

- Window lifter (index counting)
- Power closing (index counting)
- Driver controls (index counting)

Product	Type	Operating Point B_{OP}	Release Point B_{RP}	Hysteresis ΔB_{HY}	Automotive	Package
TLE4966K/L	Double Hall, speed and direction output	7.5	-7.5	15	x	TSOP6/PG-SS0-4
TLE4966-2K	Double Hall, two independent outputs	7.5	-7.5	15	x	TSOP6
TLE4966-3K	Double Hall, speed and direction output	2.5	-2.5	5	x	TSOP6
TLE4966V-1K	Vertical Double Hall, speed and direction output	2.5	-2.5	5	x	TSOP6
TLE4966G	Double Hall, speed and direction output	7.5	-7.5	15	x	TSOP6
TLI4966G	Double Hall, speed and direction output	7.5	-7.5	15	x	TSOP6

Infineon XENSIV™ Sensors – Online Simulation Tool

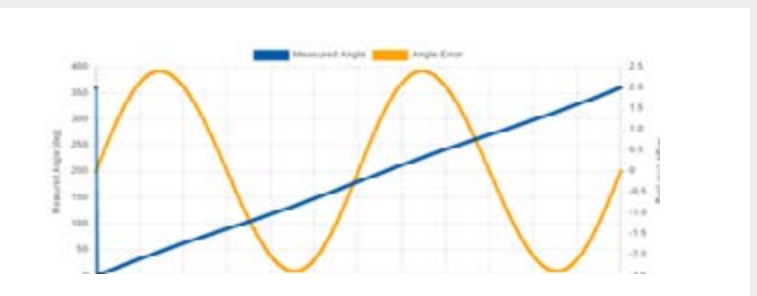
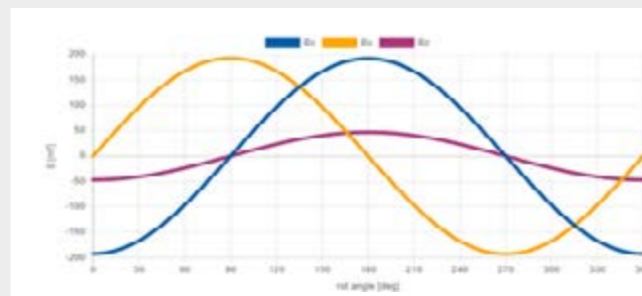
Simulate Online and Reduce Time-to-Market

Reducing the design-in effort by offering effective digital tools saves valuable time and speeds up time-to-market. Infineon's Online Simulation Tool for XENSIV™ Sensors allows customers to preview and analyze the behavior of magnetic sensors in their specific application environment. Infineon is providing this online service for its Hall switches, 3D magnetic and angle sensors. The simulation tool itself allows customers to imitate and calculate the field of a permanent magnet and assess the impact of mounting and assembly tolerances on the product performance.

Step-by-step the user gets guided through the simulation setup process enabling an intuitive evaluation of the respective application. First, customers can define and select the desired magnetic sensor (Hall switch, angle, 3D magnetic) as well as the magnet type.



Here, Infineon is offering full flexibility to the users allowing to choose between predefined magnets as well as selecting customer and application specific magnet parameters (i.e. strength, shape, magnetization type). In a last step the tool will calculate the magnetic-field at the sensor positions as a function of the magnet movement. Parameter variations like mounting tolerances (e.g. axial displacements in an angle measurement application) will affect the product performance and increase the simulated measurement error.





Hall Switches in SOT23

Fit for Future: Energy Efficient Hall Switch Family TLE496x-xM/L



TLE496x-xM/L

Integrated Hall Effect Sensors Specially Designed for Highly Accurate Applications

Benefits

- Energy saving: with current consumption of 1.6 mA, TLE496x-xM/L products can cut energy consumption by up to 50 percent compared with similar competitor products
- Precise: small magnetic hysteresis enables precise switching points in the system. The integrated temperature profile compensates magnetic drifts and enables stable performance over temperature and lifetime
- Compact: offered in the smallest package SOT23, thus reducing height by 10 percent compared with predecessor products
- The new Hall switch sensors also feature an integrated functionality test for better system control
- Wide portfolio of productive devices

Features

- Current consumption of just 1.6 mA
- 3 to 32 V supply voltage range
- 7kV ESD protection (HBM)
- Overtemp. and overcurrent protection
- Temperature compensated
- Automotive qualified
- Temperature range -40 to +170 °C

Applications

- Window lifter (index counting)
- Robotics (index counting)
- Power closing (index counting)
- System position (position detection)
- Gear stick (position detection)
- Seat belt (position detection)
- Brushless DC motor commutation
- Flap and valve position

Product	Type	Operating Point B _{OP}	Release Point B _{RP}	Hysteresis ΔB _{HY}	Automotive	Package
TLE4961-1M/L	Latch	2.0	-2.0	4.0	x	SOT23/PG-SSO-3
TLE4961-2M	Latch	5.0	-5.0	10.0	x	SOT23
TLE4961-3M	Latch	7.5	-7.5	15.0	x	SOT23
TLE4961-3M/L	Latch	7.5	-7.5	15.0	x	SOT23/PG-SSO-3
TLE4961-4M	Latch	10.0	-10.0	20.0	x	SOT23
TLE4961-5M	Latch	15.0	-15.0	30.0	x	SOT23
TLE4964-1M	Switch	18.0	12.5	5.5	x	SOT23
TLE4964-2M	Switch	28.0	22.5	5.5	x	SOT23
TLE4964-3M	Switch	12.5	9.5	3.0	x	SOT23
TLE4964-4M	Switch	10.0	8.5	1.5	x	SOT23
TLE4964-5M	Switch	7.5	5.0	2.5	x	SOT23
TLE4964-6M	Switch	3.5	2.5	1.0	x	SOT23
TLE4968-1M/L	Bipolar	1.0	-1.0	2.0	x	SOT23/PG-SSO-3

High-Precision Hall Effect Sensors



TLV496x-xTA/B

Hall Switches in Leaded Package for Consumer Applications

The TLV496x-xTA/B Hall sensor family comprises a line of Hall switches for contactless position sensing. The sensors are specially designed to provide an easy-to-use and cost-effective solution for position sensing applications. They are available in TO92 package with straight and banded leads.

Features

- 3.0 to 26 V operating supply voltage
- Low-current consumption 1.6 mA
- ESD protection 4 kV HBM
- Operating temperature range: -40 to +125 °C
- Leaded package PG-TO92S

TLE496x-xM/TLI496x-xM

5V Hall Switched for Automotive/Industrial Applications

Integrated Hall effect sensors specially designed for highly accurate applications. The sensors provide an easy-to-use and cost-effective solution for position sensing applications, requiring high temperature stability of the magnetic threshold. By offering an excellent magnetic behavior Infineon's switches are ideally suited for:

- Index counting application with a pole wheel
- Rotor position detection (BLDC motors)
- Open/close detection

Features

- 3 - 5.5 V operating s. voltage
- Low-current cons. 1.4 mA
- ESD protection 4 kV HBM
- AEC-Q100 qualified
- Operating temperature range:
 - TLE496x-xM -40 to +170 °C
 - TLI496x-xM -40 to +125 °C
- Small SMD package SOT23

Product	Type	Operating Point B _{OP}	Release Point B _{RP}	Hysteresis ΔB _{HY}	Automotive	Industrial	Consumer	Package
TLE496x-xM								
TLE4963-1M	Latch	2.0	-2.0	4.0	x	x	x	PG-SOT23-3-15
TLE4963-2M	Latch	5.0	-5.0	10.0	x	x	x	PG-SOT23-3-15
TLE4965-5M	Unipolar switch	7.5	5.0	2.5	x	x	x	PG-SOT23-3-15
TLI496x-xM								
TLI4963-1M	Latch	2.0	-2.0	4.0		x	x	PG-SOT23-3-15
TLI4963-2M	Latch	5.0	-5.0	10.0		x	x	PG-SOT23-3-15
TLI4965-5M	Unipolar switch	7.5	5.0	2.5		x	x	PG-SOT23-3-15
TLV496x-xTA/B								
TLV4961-1TA	Latch	2.0	-2.0	4.0			x	PG-TO92S-3-1
TLV4961-1TB	Latch	2.0	-2.0	4.0			x	PG-TO92S-3-2
TLV4961-3TA	Latch	7.5	-7.5	15.0			x	PG-TO92S-3-1
TLV4961-3TB	Latch	7.5	-7.5	15.0			x	PG-TO92S-3-2
TLV4964-4TA	Unipolar switch	10.0	8.5	1.5			x	PG-TO92S-3-1
TLV4964-4TB	Unipolar switch	10.0	8.5	1.5			x	PG-TO92S-3-2
TLV4964-5TA	Unipolar switch	7.5	5.0	2.5			x	PG-TO92S-3-1
TLV4964-5TB	Unipolar switch	7.5	5.0	2.5			x	PG-TO92S-3-2
TLV4968-1TA	Latch	1.0	-1.0	2.0			x	PG-TO92S-3-1
TLV4968-1TB	Latch	1.0	-1.0	2.0			x	PG-TO92S-3-2



Magnetic Speed Sensors



Infineon's Hall- and GMR-based magnetic speed sensors are designed to measure speed in safety and powertrain applications such as speedometers, ABS, camshafts/crankshafts and automatic transmissions. They are also used in similar applications in the industrial sector. The sensors use a ferromagnetic gear tooth or encoder structure to measure linear or rotational speed and position. Hall sensor measuring rotational speed with a gear tooth and a magnetic encoder wheel.

Product	ATV	Sensor Technology	Industrial	AEC-Q100 Qualified	RoHS	HAL free	Product Status
TLE4921	yes	Differential Hall	yes	yes	yes	yes	In production
TLE4922	yes	Mono Hall	yes	yes	yes	yes	In production
TLE4924	yes	Differential Hall	yes	yes	yes	yes	In production
TLE4926	yes	Differential Hall		yes	yes	yes	In production
TLE4927	yes	Differential Hall	yes	yes	yes	yes	In production
TLE4928	yes	Differential Hall		yes	yes	yes	In production
TLE4941	yes	Differential Hall	yes	yes	yes	yes	In production
TLE4941plusC	yes	Differential Hall	yes	yes	yes	yes	In production
TLE4942	yes	Differential Hall	yes	yes	yes	yes	In production
TLE4951	yes	Differential Hall	yes	yes	yes	yes	In production
TLE4953	yes	Differential Hall		yes	yes	yes	In production
TLE4954	yes	Differential Hall	yes	yes	yes	yes	In production
TLE4957	yes	Differential Hall	yes	yes	yes	yes	In production
TLE4983	yes	Mono Hall		yes	yes	yes	In production
TLE4984	yes	Mono Hall		yes	yes	yes	In production
TLE4986	yes	Mono Hall		yes	yes	yes	In production
TLE5025	yes	iGMR		yes	yes	yes	In production
TLE5027	yes	iGMR		yes	yes	yes	In production
TLE5041plusC	yes	iGMR		yes	yes	yes	In production
TLE5045iC	yes	iGMR		yes	yes	yes	In production
TLE5046iC	yes	iGMR		yes	yes	yes	In production

TLE4921-5U

Highly Robust and Cost-Effective Speed Sensor

TLE4921-5U is a highly robust and cost-effective solution for measuring speed in a wide range of automotive and industrial applications.

This differential Hall sensor delivers outstanding performance while enabling simple, low-cost magnetic circuit designs, making it ideal for all entry-level speed sensing applications.

Features

- Good sensing performance and high-sensitivity
- Well suited to harsh environments thanks to dynamic offset cancellation, EMI robustness, reverse polarity and overvoltage protection
- Configurable interface: two-wire, three-wire
- Automotive qualified

Application

- Engine speed and position (e.g. crankshaft)
- Transmission speed
- Speedometer
- Industrial speed and position sensing
- Wheel speed (e.g. ABS)

TLE4941plusC

Analog and Digital Signal Processing One a Single-Chip

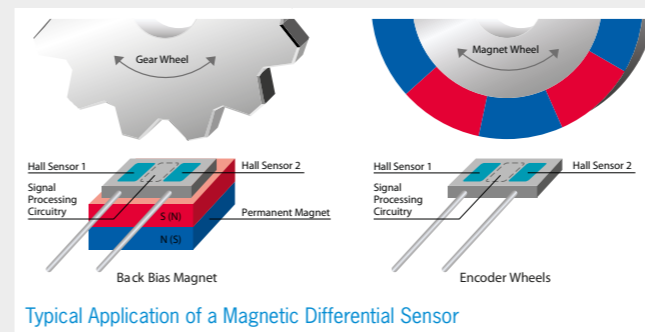
TLE4941plusC is a differential Hall sensor that magnetically measures a car's wheel speed. It is the latest addition to Infineon's extremely successful TLE4941 family and also its drop-in replacement. Like its predecessors, TLE4941plusC is a single-chip solution that combines Hall sensor elements as well as analog and digital signal processing on a single-chip. Its differential principle makes it immune to any kind of undesired magnetic-fields and disturbances. The distance between Hall elements has been reduced to 2 mm, thus making it suitable for smaller encoders.

Features

- Two-wire current interface for minimum wiring
- Dynamic self-calibration principle to compensate offsets
- High-sensitivity for large air gap applications
- Suitable for encoders and tonewheels, and also available with an integrated magnet for back bias applications
- Integrated 1.8nF overmolded capacitor enhances EMC & microbreak resistance with no external components needed

Application

- Wheel speed sensing in automotive applications
- Antilock braking systems (ABS)
- Electronic stability programs (ESP)
- Automatic transmissions
- Industrial speed sensing



Typical Application of a Magnetic Differential Sensor

TLE4924/26/27/28C

High-Performance Speed Sensor Family

Infineon's TLE492x differential Hall speed sensors are designed for a broad range of speed sensing applications. Thanks to the hysteresis and dynamic selfcalibration algorithm, they are ideally suited to high-performance speed sensing applications in harsh environments. All sensors have a three-wire voltage interface, fast start-up time, symmetrical switching thresholds and optional south or north pole pre-induction.

Features

- High-sensitivity and large operating air gaps
- Excellent switching performance down to a 1Hz cut-off frequency
- Strong EMC robustness and micro-cut performance thanks to module-style package with integrated 47 nF/4.7 nF capacitors
- Automotive qualified

Application

- Engine speed and position (i.e. crankshaft)
- Transmission speed
- Speedometer
- Industrial speed and position sensing

Type	Hysteresis	Comment	Package Standard
TLE4924C-1	Visible fixed		PG-SSO-3-9
TLE4924C-2	Visible adaptive		PG-SSO-3-9
TLE4926C	Hidden fixed		PG-SSO-3-9
TLE4926C-HT	Hidden fixed	High temp.	PG-SSO-3-9
TLE4927C	Hidden adaptive		PG-SSO-3-9
TLE4928C	Hidden fixed	200ms watchdog reset	PG-SSO-3-9





Mono-Hall Speed Sensor

TLE4922 – Highly Robust, Easy-to-Use with Twist Independent Mounting



The sensor is specially designed to provide an easy-to-use, robust and cost-effective solution for vehicle or industrial speed sensing applications. Therefore, TLE4922 can be back biased, using a simple, low-cost bulk magnet while providing good air gap performance and switching accuracy. Its hidden adaptive hysteresis and calibration algorithm enable good accuracy over air gap jumps and immunity to vibration and run-out events. With the use of mono-cell design, the TLE4922 is the perfect choice for applications requiring twist independent mounting. As a result, the TLE4922 is well suited for replacing passive sensors like variable reluctance (VR) sensors, in automotive and 2-wheeler applications by providing the user with higher accuracy and better jitter performance.

Applications

- 2-wheeler
- Automotive vehicle speed
- Industrial applications

Features

- Large operating air gap capability
- Twist independent mounting
- Hidden adaptive hysteresis
- Low-current consumption
- Reverse magnetic polarity capability
- Advanced protection technology
 - Reverse voltage protection at Vs-pin
 - Short circuit protection
 - Over temperature protection
- Wide op. temperature ranges of -40°C to +150°C
- High ESD robustness up to ±4 kV HBM
- 3-wire PWM voltage interface

Angle Sensors

iGMR Based Angle Sensors



Infineon's iGMR sensors are ideal for applications with a wide angle range, for example BLDC motor or steering sensors. They are pre-calibrated and ready to use. Different levels of signal processing integration enable designers to optimize system partitioning.

TLE5009

Analog iGMR Sensor with Temperature Compensation

TLE5009 features a differential or single-ended analog interface for sine and cosine values as well as internal temperature drift compensation for gain and offset. Also available in dual-sensor package.

TLE5012B(D)

iGMR Sensor with Integrated Angle Calculation and Multiple Interfaces

- Integrated angle calculation
- 42 μs update rate at 15 bit resolution
- Range of selectable interfaces
- SPI, bi-directional up to 8Mbit/s
- Pulse width modulation (PWM)
- Hall switch mode (HSM) for motor commutation
- Incremental interface (IIF)
- Temperature compensation and auto-calibration algorithm
- Diagnostic function for sensor elements and circuitry with PRO-SIL™ support
- Dual-sensor SMD package (TLE5012BD)
- Redundancy (TLE5012BD)

Differential Speed Sensor

TLE4959-5U-FX & TLE4959-5U

Hall based differential speed sensor with high magnetic sensitivity Infineon's TLE4959-5U magnetic sensor comes in a RoHS compliant four-pin package, qualified for automotive usage. The recommended capacitors increase the EMC robustness of the device. In 12V applications it is further recommended to use a serial resistor RSupply for protection on the supply line. A pull-up resistor RLoad is mandatory on the output pin and determines the maximum current flowing through the output transistor. A value of 1.2 kΩ is recommended for the 5V application.

Features

- High magnetic sensitivity
- Large operating airgap
- Dynamic self-calibration principle
- Adaptive hysteresis
- Direction of rotation detection
- High vibration suppression capabilities
- Three wire PWM voltage interface
- Magnetic encoder and ferromagnetic wheel app.
- High immunity against ESD, EMC and mechanical stress, improved voltage dropout capability
- Automotive operating temperature range
- AEC-100 qualified

iAMR Sensors



Infineon's iAMR sensors are ideal for applications with the highest accuracy requirements. Their iAMR technology offers best performance over temperature, lifetime and magnetic-field range. They are pre-calibrated and ready to use.

TLE5109A16

Analog iAMR Sensor with Temperature Compensation

- Features a differential or single-ended analog interface for sine and cosine values
- Internal temperature drift compensation for gain and offset
- Also available as a dual-sensor-package
- ISO 26262 ready

TLE5309D

180° iAMR and GMR Sensor with Analog Interface

- Differential or single-ended analog interface for sine and cosine values
- Internal temperature drift compensation for gain and offset
- Dual-sensor with technology diversity



Angle Sensors

XENSIV™ TLE5014(D)



Infineon's New Digital GMR Angle Sensor for Functional Safety Applications

TLE5014 magnetic angle sensors meet ISO 26262 ASIL C for the single die and ISO 26262 ASIL D for the dual die versions. Therefore, all products are ready for applications with the highest functional safety requirements. The sensors show an extremely small angle error of less than 1° across the entire temperature profile and lifetime. This is particularly helpful in applications with the need for very accurate position sensing such as steering angle sensing or motor commutation. Further application areas range from rotor position measurement, EPS (Electric Power Steering), pedal position to any other kind of position measurement.

General Features

- Integrated magnetic-field sensing for angle measurement
- High-voltage and reverse polarity capability
- EEPROM for storage of configuration (e.g. zero angle) and customer-specific ID
- 12-bit representation of absolute angle value on the output
- Max. 1° angle error over lifetime and temperature range
- Developed according to ISO 26262 with process complying to ASIL D
- Interfaces: PWM, SPC, SENT (based on SAE J2716-2010)
- Available as single and dual die product

iGMR, iAMR & iTMR Sensor Technologies

Product	Technology	Die configuration	ISO 26262	Sin/cos output	Angle output	Second interface	Accuracy	Package
TLE5009	GMR	Single die	Ready	Analog sin/cos	-	-	0.9°	DSO-8
TLE5009A16(D)	GMR	Dual die	Ready	Analog sin/cos	-	-	1.0°	TDSO-16
TLE5011	GMR	Single die	Ready	SSC (SPI)	-	-	1.6°	DSO-8
TLE5012B	GMR	Single die	Ready	SSC (SPI)	SSC (SPI)	PWM/1IF/SPC/HSM	1.9°	DSO-8
TLE5012B(D)	GMR	Single & dual die	Ready	SSC (SPI)	SSC (SPI)	PWM/1IF/SPC/HSM	1.0°	DSO-8/ TDSO-16
TLE5014C16(D)	GMR	Single & dual die	Compliant	-	SPC	-	1.0°	TDSO-16
TLE5014P16(D)	GMR	Single & dual die	Compliant	-	PWM	-	1.0°	TDSO-16
TLE5014S16(D)	GMR	Single & dual die	Compliant	-	SENT	-	1.0°	TDSO-16
TLE5109A16(D)	AMR	Single & dual die	Ready	Analog sin/cos	-	-	0.5°	TDSO-16
TLE5309D	AMR + GMR	Dual die	Ready	Analog sin/cos	SSC (SPI)	-	AMR 0.5°, GMR 1.0°	TDSO-16
TLE5501	TMR	Single die	Compliant	Analog sin/cos	-	-	1.0°	DSO-8

XENSIV™ TLE5501

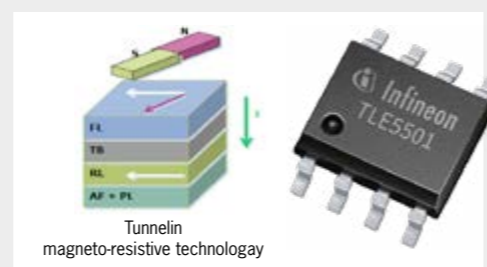


XENSIV™ TLE5501 – Infineon's First Analog TMR Angle Sensor

- The TLE5501 family consists of two derivatives TLE5501 E0001 and TLE5501 E0002
- TLE5501 E0001: the AEC-Q100 compliant QM version (pin-compatible to TLE5009)
- TLE5501 E0002: the ISO26262 ASIL D-compliant version (requires use of external safety mechanisms)

Features

- Large output signals of up to 0.37 V/V for direct microcontroller connection
- Discrete bridge with differential sine and cosine output
- Supply current: ~2 mA
- Magnetic-field range (20 to 100 mT)
- Typ. angle error to 1.0° (over temperature and lifetime)
- Designed for safety: 2 independent dual channel sensors
- DSO-8 package
- Automotive qualified Q100, Grade 0: TA = -40 to +150°C (ambient temperature)
- Functional safety: safety manual and safety analysis summary report available on request



3D Hall Magnetic Sensors

XENSIV™ TLx493D



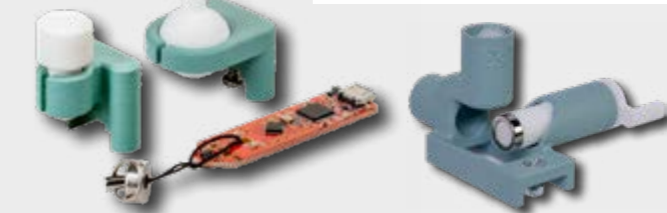
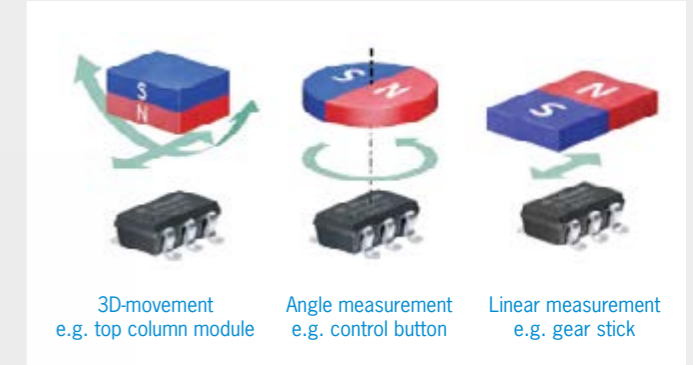
3D Magnetic Measurements in Consumer, Industrial & Automotive Applications

The TLx493D sensor realizes accurate three-dimensional sensing with extremely low-power consumption in a small 6-pin package. Capable of detecting the magnetic-field in the x, y, and z-direction, the sensor is ideally suited for the measurement of linear travel, rotational or three-dimensional movements. Thanks to its small package and low-power consumption, the TLx493D family can be used in new applications, replacing potentiometer and optical solutions – in consumer, industrial and automotive applications. Featuring contactless position sensing and high temperature stability of the magnetic threshold, this system concept keeps getting smaller, more accurate and more robust. The sensor provides a standard 2-wire digital I²C interface, which enables high-speed bi-directional communication between the sensor and microcontroller.

3D Hall Sensor	Product ID	Qualification	Linear Magnetic Range	Resolution	Temperature Range	Matching Drift	IDD
TLI493D-A2B6	SP001689844	JESD47	± 160 mT (min)	130uT/LSB 65uT/LSB1	-40 to +105°C	X/Y: ±3.5% XY/Z: ±15%	7 nA – 3.3 mA
TLV493D-A1B6	SP001286056	JESD47	± 130 mT (typn)	98uT/LSB	-40 to +125°C	X/Y: typ. ±5% XY/Z: typ. ±20%	7 nA – 3.3 mA
TLE493D-W2B6 A0	SP001605334	AECQ-100	± 160 mT (min)	130uT/LSB	-40 to +125°C	X/Y: ±3.5%	7 nA – 3.3 mA
TLE493D-W2B6 A1	SP001605340	AECQ-100	± 160 mT (min)	65uT/LSB1	-40 to +125°C	XY/Z: ±15%	7 nA – 3.3 mA
TLE493D-W2B6 A2	SP001605344	AECQ-100	± 160 mT (min)	130uT/LSB	-40 to +125°C	X/Y: ±3.5%	7 nA – 3.3 mA
TLE493D-W2B6 A3	SP001605348	AECQ-100	± 160 mT (min)	65uT/LSB1	-40 to +125°C	XY/Z: ±15%	7 nA – 3.3 mA
TLE493D-A2B6	SP001689848	AECQ-100	± 160 mT (min)	130uT/LSB	-40 to +125°C	X/Y: ±3.5%	7 nA – 3.3 mA

3D Magnetic Sensor 2GO Kit

- Budget-priced evaluation board equipped with Infineon magnetic sensor combined with an ARM® Cortex™-M0 CPU
- 2 Go Kit has a complete set of on-board devices, including an on-board debugger.
- A dedicated GUI can be downloaded from <https://www.infineon.com/cms/en/product/promopages/sensors-2go/> for evaluation
- Available with TLV493D-A1B6, TLE493D-A2B6 and TLE493D-W2B6
- TLE493D-W2B6 3D 2GO KIT (SP001707578)
- TLV493D-A1B6 3D 2GO KIT (SP001707574)
- TLE493D-A2B6 3D 2GO KIT (SP001707582)



Micropower Triaxis Magnetometer MLX90393 – World’s Smallest 3D Magnetometer for Position Sensing

The MLX90393 is offering maximal flexibility at minimal size. With its 3x3 mm or 2.5x2 mm footprint, it can fit in the tiniest of assemblies. It provides a digital output proportional to the sensed magnetic flux density along the 3 perpendicular axes of symmetry of the sensor.

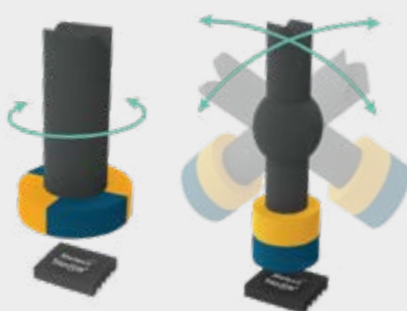
But the miniature sensor is mostly characterized by the fact that it can interchange measurement speed for both current consumption and noise on the digital output signal, making it the raw building block for any magnetic sensing application up to 85°C. An external microcontroller can then combine the measurement data in order to define the position of the magnet with respect to the sensor. All this at a selectable dutycycle of 0.1 to 100%.

Features & Benefits

- Micropower (2.2 – 3.6 V, 2.5 µA idle current)
- Low-voltage I/O (1.8 V – V_{dd})
- SPI (3+4-wire) & I²C interface, slave node
- 16-bit XYZ magnetic and thermal measurement
- QFN3x3 package, 16 leads
- UTDFN-8 2.5x2.0 mm
- In-application programmable (gain, mode, axes, ...)
- T_a = -20 to +85°C

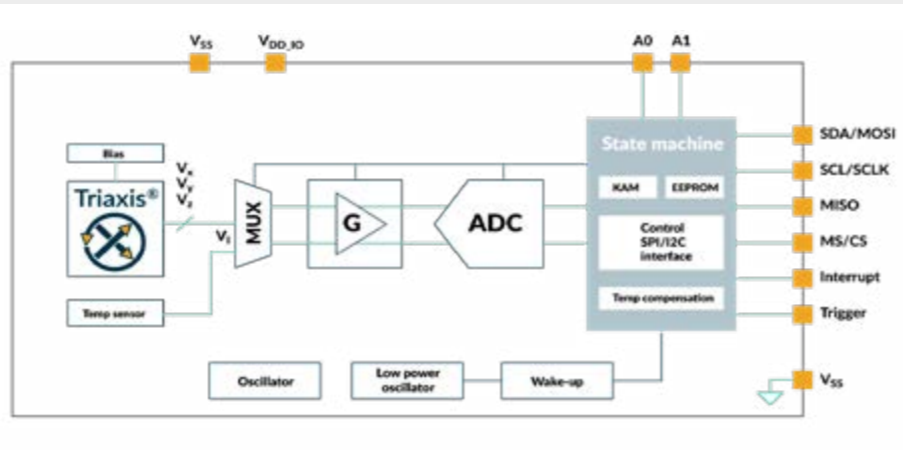
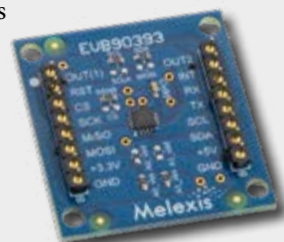
Applications

- Sensing element for the internet of things (IoT)
- Metering
 - Impeller-based meters 360° impeller position detection incl. anti tampering
 - Meter mechanical counter digit readout
 - General tri-axial anti tampering detection
 - Gauss-meter
- HMI
 - Joystick w/push
 - Rotary knob w/push
 - Lever/slide switch linear stroke
- Valve position, industrial sensing
- Robotics & factory automation
- Home security
 - Tamper proof door/window opening detection



HMI: Human-Machine Interface

The MLX90393 lends itself for a wide variety of human-machine interfaces such as joystick (gimball, ball & socket) with push detection, rotary knobs with push function and linear strokes by levers or sliding switches.



Hall Latch & Switches MLX92211/21/31/32/41/42– Programmable & Pre-programmed

Melexis presents a revolutionary concept: a perfectly customized Hall latch or switch for your applications. A virtually unlimited set of versions at a great price.

Programmable

You programme the latch/switch.

Available Types

- 2-wire latch/switch: MLX92242
- 3-wire latch/switch: MLX92232

Benefits

- Rapid prototyping
- High-accuracy



Key Applications

- Smart appliances and consumer devices
- Building automation and energy
- Industry and medical
- Automotive and transportation

Pre-Programmed

Melexis programmes the latch/switch.

Available Types

- 2-wire latch: MLX92221
- 2-wire switch: MLX92241
- 3-wire latch: MLX92211
- 3-wire switch: MLX92231

Benefits

- Drop-in replacements and second sourcing
- Total cost of ownership (TCO) optimization

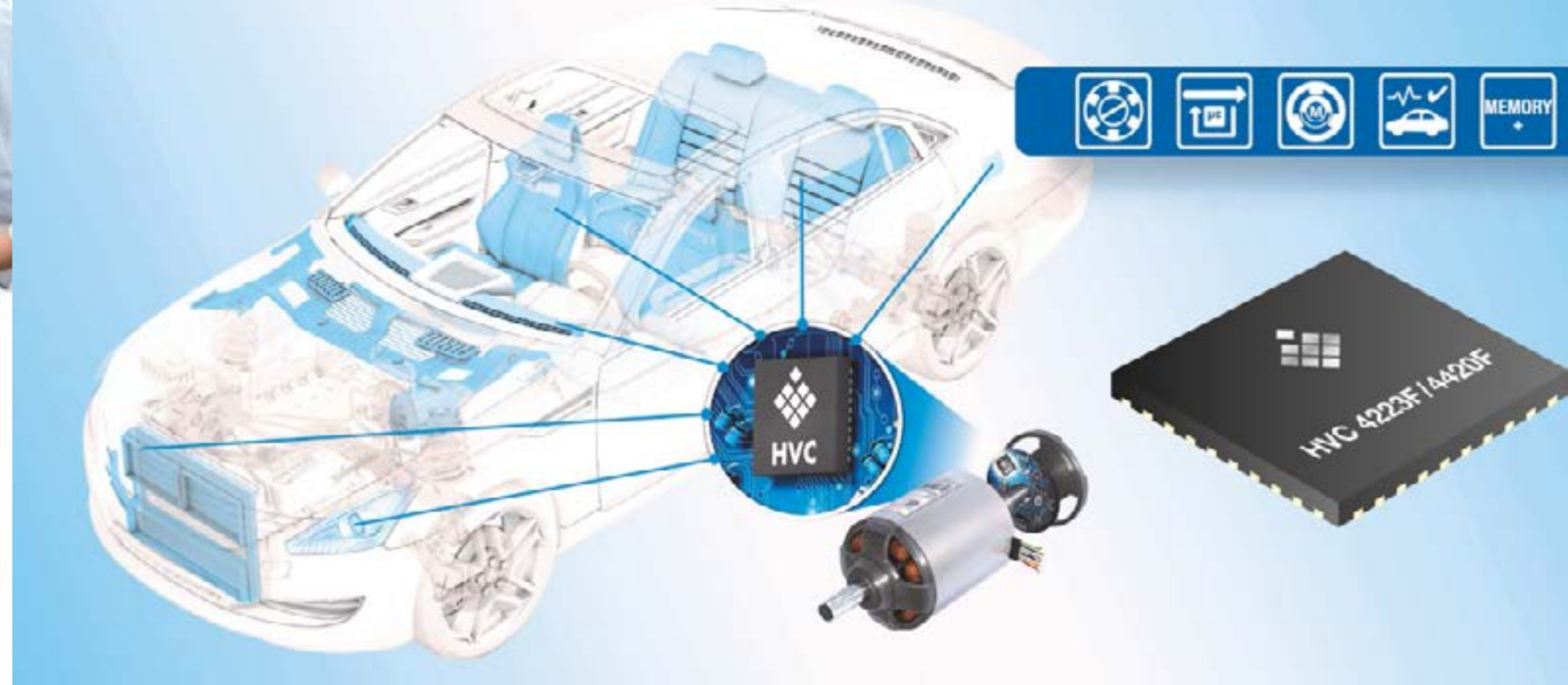
Key Specifications

- Wide magnetic latch range: ±0.4 mT to ±80 mT
- Wide magnetic switch range: ±1.5 mT to ±66 mT
- Programmable hysteresis: 0 mT to 36 mT
- Programmable magnet T_C coefficient: 0 to -2000 ppm/°C
- Wide operating voltage range: from 2.7 to 24 V



Evaluation Tool





Full Integrated Embedded Motor Controller HVC4223F/4420F



Direct and Universal Brush/Brushless/Stepper Motor Control (Sensored/Sensorless)

- 300/600 mA integrated half bridges (0.6/1A peak) for small motors
- Virtual start point and comparators
- Current scaling and shaping

Direct Vbat-Supply up to 18V

- Automotive OEM requirements including load-dump 40V
- Switchable BVDD power supply output

HVC 4420F – New Features

- 64 KB Flash, 4 KB SRAM
- Integrated memory protection unit (MPU) supports RTOS requirements

Target Applications

- AGM/AGS (Grille Shutter)
- Adaptive headlights & -fan
- HVAC flap control
- Seat climatization/seat actuator
- EPS force feedback
- Automatic flap
- Charge door
- Cover of rear view camera
- Milimetric wace radar unit
- OEM diagnose

ARM Cortex M3 and Toolchain

- 32 KB Flash, 2 kB RAM, 512 byte of EEPROM
- On-chip oscillators with active EMI suppression
- Extensive support to store diagnostic data

Host Interfaces

- LIN 2.2A & SAE J2602-2 compliant transceiver
- PWM, UART, Analog

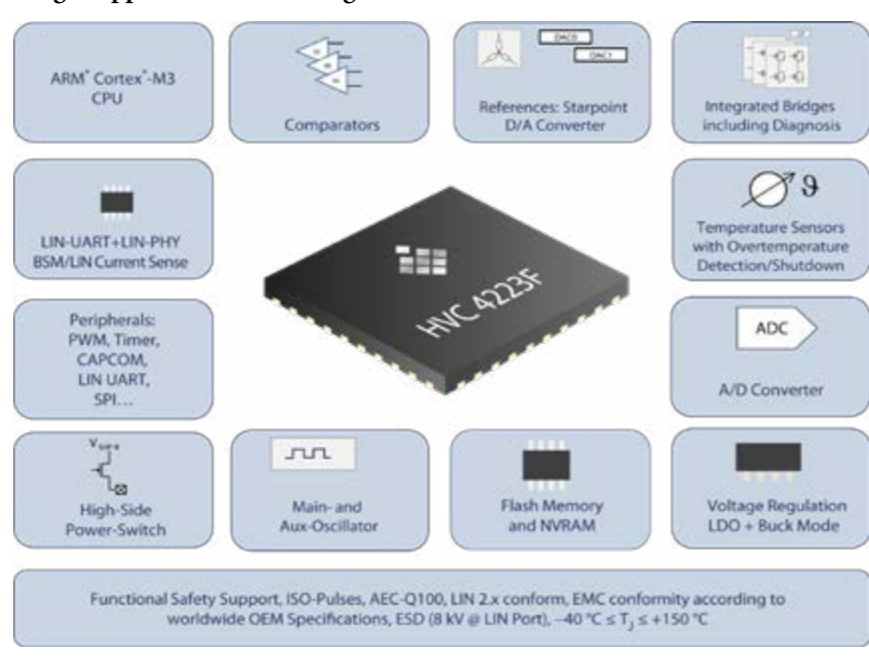
Built-in Safety Features

- Protection logic, supply/clock/temp supervision, start-stop retention mode
- FuSa support (=Safetymanual, FIT-Rates etc.)
- Several diagnostic features to supervise internal as well as application status

PQFN40 6 x 6 mm Package

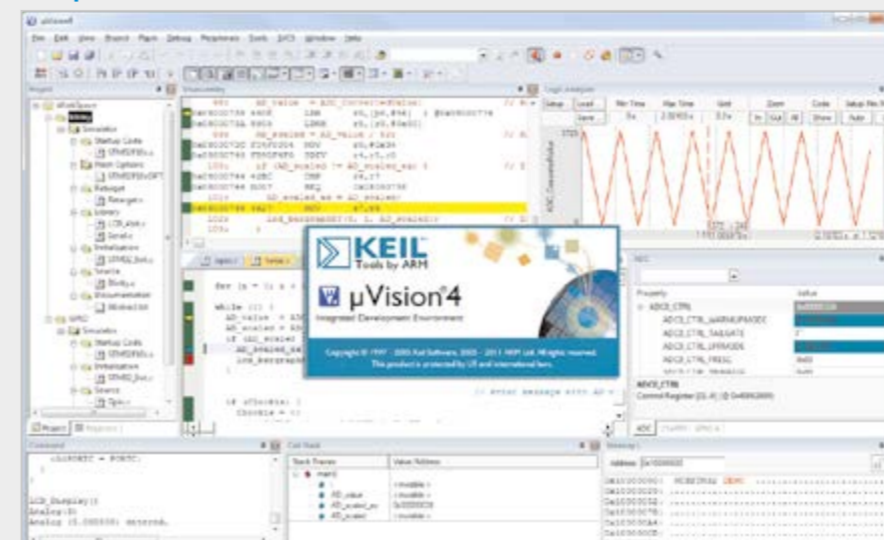
- Operation -40 to +125 °C ambient temperature

Target Application: OEM Diagnose



Tool Chain – SW and Documentation

Compiler



KEIL MDK for ARM Cortex™-M3

Debugger/Programmer



ULINK-ME



J-Link



ULINK-2

Boards and Software

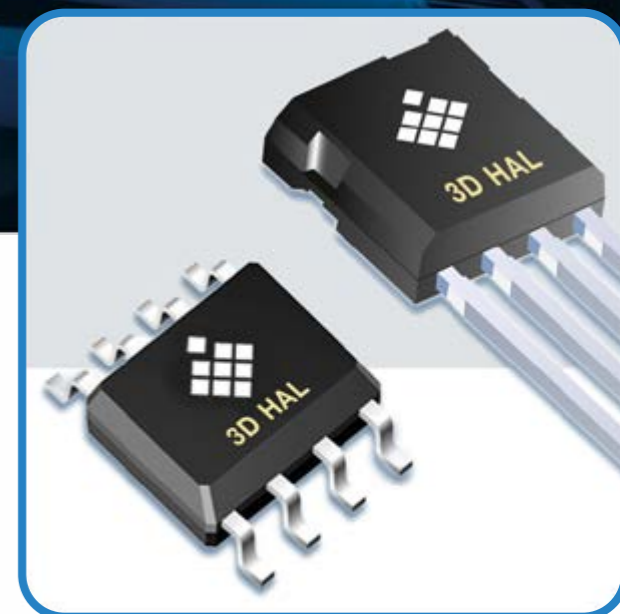
- Applications notes /SW
 - Stepper-motor
 - Sensored BLDC motor six step commutation
 - Sensorless BLDC motor six step commutation
 - Sensored BLDC motor Space vector modulation
 - LIN demo software
 - Software snippets
- Production-ready firmware
 - Professional SW stack implemented by professional design house
 - Covering the entire embedded motor control functionality with ASPICE/MISRA guidelines



SDB-1



APB



Low-Power Hall Switch

First ISO 26262 Compliant Low-Power Hall Switch

HAL 15xy Series

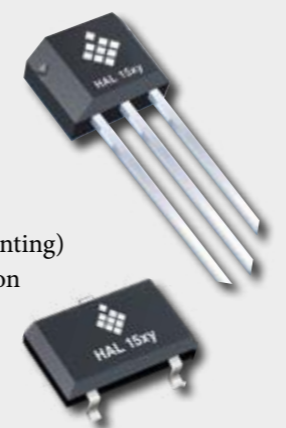
Features & Benefits

- ASIL-A ready device
- Very-low-current consumption of typ. 1.6 mA (3-wire)
- Wide supply voltage operation from 2.7 to 24 V, over-voltage protection capability up to 40 V
- Highest HBM ESD performance ± 8 kV

- Reverse-voltage protection at supply pin
- Operating with static and dynamic magnetic-fields up to 12 kHz at lowest output jitter of max. 0.72 μ s (RMS)
- Temperature range: Tj. -40 to +170 °C
- SOT23 Jedec TO92UA package

Applications

- Buckle switch
- Seat track position
- Gear shift lever
- Window lifter (index counting)
- BLDC motor commutation
- Brake light switch
- Clutch pedal position



Version	Type	Switching Behavior	Switching Points (typ.)		TC ppm/K	2-wire Isup low
			B _{ON}	B _{OFF}		
3-wire	HAL1502	Latching	2.5mT	-2.5mT	-1000	na
	HAL1501	Bipolar	0.4mT	-0.4mT	0	na
	HAL1503	Unipolar	5.5mT	3.7mT	-1000	na
	HAL1507	Unipolar	28.2mT	23.9mT	-300	na
	HAL1504	Latching	7.6mT	-7.6mT	-1200	na
	HAL1505	Latching	13.5mT	-13.5mT	-1200	na
	HAL1506	Unipolar	18.9mT	17.3mT	-1200	na
	HAL1508	Unipolar	-5.5mT	-3.7mT	-1000	na
	HAL1509	Unipolar inverted	3.7mT	5.5mT	-1000	na
	HAL1510	Unipolar	12mT	7mT	-1200	na
2-wire	HAL1514	Latching	5mT	-5mT	0	na
	HAL1561	Latching	4mT	-4mT	0	5 to 7 mA
	HAL1563	Unipolar inverted	7.6mT	9.4mT	0	5 to 7 mA
	HAL1564	Unipolar inverted	4.1mT	6mT	-1000	2 to 5 mA
	HAL1562	Latching	12mT	-12mT	0	5 to 7 mA
	HAL1565	Unipolar	6mT	4.1mT	-1000	2 to 5 mA
	HAL1566	Unipolar	9.4mT	7.6mT	0	5 to 7 mA

Multi-Axis Sensor

For Direct Angle and Linear Position

HAL 37xy/HAR 37xy/HAC 37xy

Key Features

- Unique „virtual offset feature“ to
 - reduce magnet size & cost
 - Accuracy of <0.5% full scale for linear or angular measurements
- No output linearization required for rotary applications
- High ESD protection according to stringent requirements of the automotive industry - ESD protection 8 kV (active Pins)
- Wide junction temp. range from -40 to +170 °C
- SOIC-8 SMD and TO92UG four pin leaded package
- TO92UF package with caps
- “Open source” programming interface & software
- ISO 26262 Ready

Additional Features

- Supply voltage range 4.5 to 5.5 V
- Programming via sensors output TTL-Level (0 V... 5 V)
- Memory w. redundancy & lock function
- AEC-Q100 qualification

Various Safety Features

- Wire-break & over/undervoltage detection
- Full signal path & memory supervision
- Overflow and state machine self-test
- Magnet lost detection



HAR 37xy
Redundancy in SOIC8 package thanks to stacked die technology



HAC 37xy SOP
HAC 37xy integrated caps in robust and compact single mold leaded package TO92UF

Device Number	Output Format	Magnetic-Field Axis	Accuracy [%FS]	Min. Magnetic-Field Amplitude [mT]	Setpoints	Magnetic Setup
HAL/HAR/HAC3725	Analog	XY	± 0.75	± 20	33	End of shaft
HAL/HAR/HAC3726		YZ	**			Off-axis or linear position
HAL/HAR/HAC3727		XZ	**			Off-axis or linear position
HAL/HAR/HAC3735	PWM or SENT SAE-J2716 Rev. 2010	XY	$\pm 0.5\%$			End of shaft
HAL/HAR/HAC3736		YZ	**			Off-axis or linear position
HAL/HAR/HAC3737		XZ	**			Off-axis or linear position

** Available on request. Depends on magnetic setup

Target Applications

- Clutch position
- Turbo-charger actuators
- Chassis position sensors
- Fuel level
- EGR Valve
- Transmission
- Various valves for engine management



3D HAL[®] Technology Based Stray Field Robust Position Sensor Family

HAL 39xy

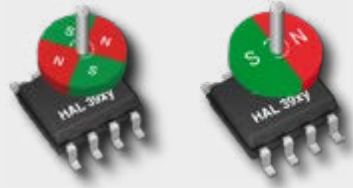
HAL 39xy is a new generation of 3D position sensors from TDK-Micronas addressing the need for stray field robust linear and rotary position detection as well as ISO 26262 compliant developments.

Features & Benefits

- Four measurement modes
- Linear position
- Rotary position up to 360°
- Rotary position up to 180° (homogenous + gradient stray fields)
- 3D magnetic-field (w/o stray field comp.)
- Enables fast development of device variants
- Customizable firmware for fast prototyping
- Easy adaptation to interface standards such as SENT
- Programmable via output pin
- ISO 26262 and ASIL-B ready

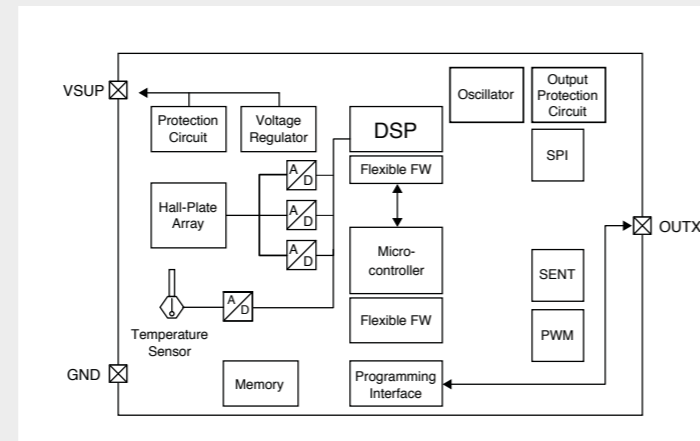
Target applications

- Transmission (parklock, gear position, etc.)
- Joysticks
- EGR valves and turbo-charger actuator position sensors
- Brake pedal position
- Shifter position and steering angle
- Charging plug lock



Samples available
SOP Q2/2020
Lead Version HAL3930 SOP in CW14

Types	HAL [®] 3900, 3930
Package	SOIC8
Dimensions	6.0x4.9x1.595 mm
Interface	SPI, SENT, PWM
Magnetic-field range	bis ±130 mT
Angular error w/o aging	±0.6°
Additional error after aging	Target less than ±0.6°
Error due to stray field	<0.1°
Noise error	±0.17%



High-Precision and Robust Multi-Purpose Linear Hall Sensors For Distance & Small Angle Measurements

HAL 18xy Universal and Cost-Effective

HAL188x/HAL1890 are entry-level linear HALL-Effect sensors with ratiometric linear analog or SENT output (SAE J2716 Rev. 4). They offer a cost-effective solution for small distance or angle measurement. HAL 1880 and HAL 1890 are programmable. HAL 1881-1883 are pre-programmed.

HAL/C 83x Robustness Proven in Use

This family brings over 10 years know-how and a proven-in-use quality experience. It offers high temperature stability, EMC robustness with HAC830 and flexibility thanks to selectable output (Analog & PWM) for HAL835.

HAL/R 24xy Versatile and High-Precision

The versatile HAL/R 24x5 family offers extended measurement for distance up to two times magnet length & angle up to 180° and state-of-the-art diagnostic functions for applications under stringent conditions. Single and dual versions in different packages are offered.

HAL 18xy

HAL 188x/HAL 1890 is a universal, value-optimized Hall-effect sensor family



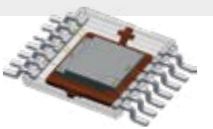
HAC830

Proven linear technology in smallest form factor on the market including capacitors



HAR24xy

Redundancy in a very thin package

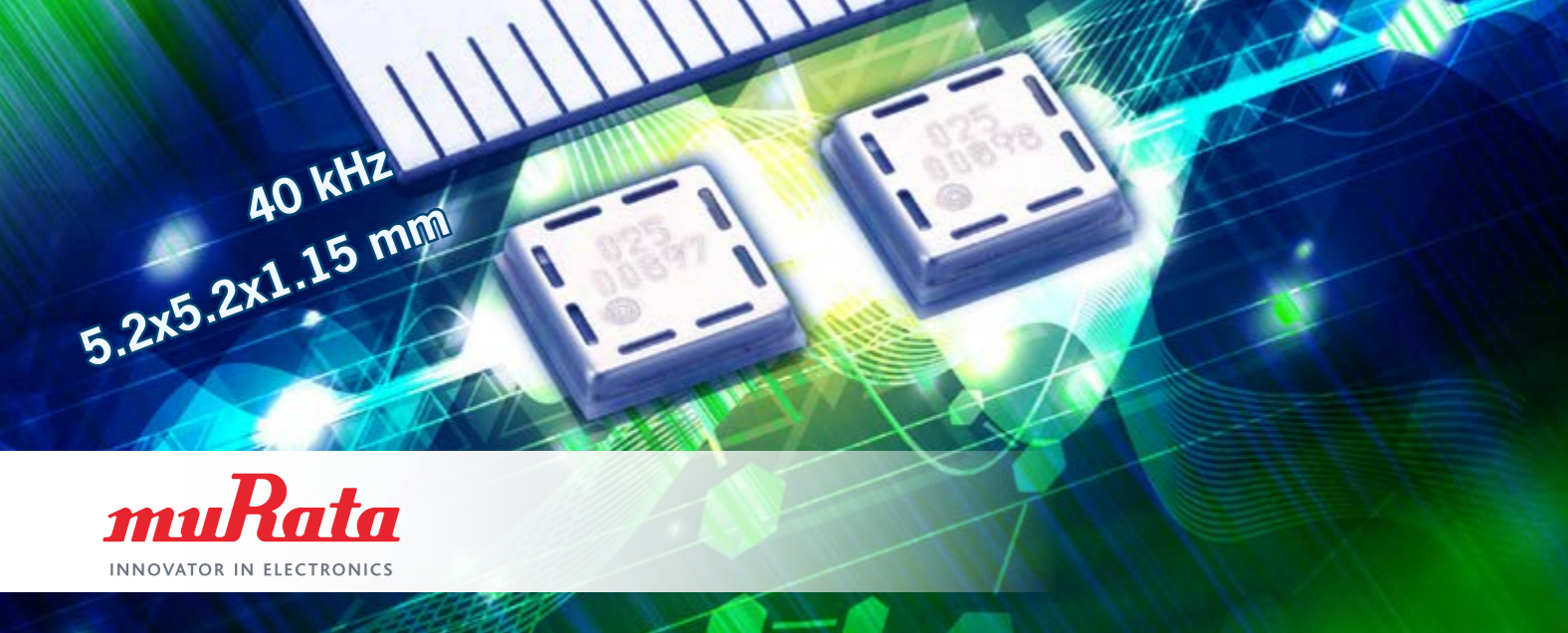


Device	Characteristics	Output	Package
HAL 1880	± 40 to ± 160 mT magnetic range	Analog (10-bits)	T092UA
HAL 1881- HAL 1883	± 50 to ± 100 mT magnetic range	Analog (10-bits)	T092UA
HAL 1890	± 40 to ± 160 mT magnetic range	SENT (SAE J2716 Rev. 4) (10-bits)	T092UA
HAL 830/HAC 830	± 30 to ± 150 mT magnetic range	Analog (12-bits)	T092UT/T092UP
HAL835	± 15 to 150 mT magnetic range	Analog (12-bits) & PWM (125Hz, 11bits)	T092-UT
HAL2420	± 25 to 200 mT magnetic range Programmable temperature compensation for sensitivity and offset continuous self-test	Analog (12-bits)	T092-UT, SOIC8
HAL2425		Analog (12-bits) with 16 programmable set points	T092-UT, SOIC8
HAL2455		PWM (2kHz, 12-bits) with 16 programmable set points	T092-UT, SOIC8

Target Applications

- Pedal
- Throttle
- EGR
- Turbo-charger
- Transmission
- Joystick
- Gear position sensor





Surface Mounted Ultrasonic & AMR Sensors

Murata has Developed World's First Surface Mount Ultrasonic Sensor

Through the use of an exclusive structural design, including the ceramic element, Murata manufacturing has succeeded in developing what it believes to be the world's first surface-mount device (SMD)-type ultrasonic sensor. Since it is a surface-mount device (SMD), the new sensor requires minimal mounting space, and it enables improved functionality for distance measurement and position detection through the use of ultrasonic waves.

Partnumber	MA40S4R	MA40S4S	MA40H1S-R
Type	Lead-type	Lead-type	SMD type
S/R	Receiver	Transducer	Transducer
Normal frequency	40 kHz	40 kHz	40 kHz
Sensitivity	-63 dB typ (0 dB=10 V/Pa)	NA	-65 dB min (0 dB=1V/Pa)
Sound pressure level	NA	120 dB typ.	100 dB typ.
Directivity	80° (typ)	80° (typ)	80° (typ)
Capacitance	2550 pF	2550 pF	4500 pF
Operating temp.	-40 to +85 °C	-40 to +85 °C	-20 to +60 °C
Max. input voltage		20 Vp-p	7.2 Vp-p

Murata has Expanded their AMR Sensor Portfolio

Suitable for non-contact sensor in combination with a magnet, high-sensitivity and low current consumption, independent of magnetic pole and competitive price.

Applications

- Metering
- Position detection
- Motor control
- Coffee machine

Part Number	Sensitivity [mT]	Supply voltage [V]	Frequency [Hz]	Size WxLxH [mm]
MRMS201A-001	>=2.5	1.6 to 3.5	20 (typical)	2.9x2.8x1.1
MRMS205A-001	>=2.5	3.0 to 5.5	20 (typical)	2.9x2.8x1.1
MRMS501A-001	>=2.5	1.6 to 3.5	20 (typical)	1.45x1.45x0.55
MRMS511X-001	>=2.0	1.6 to 3.5	20 (typical)	2.9x2.8x1.1
MRSS29DR-001	>=3.0	5 to 30	5k (minimum)	2.9x2.8x1.1



Motor Position Sensor

MLX90380 - High-Speed Operation and Flexible Through-Shaft Positioning

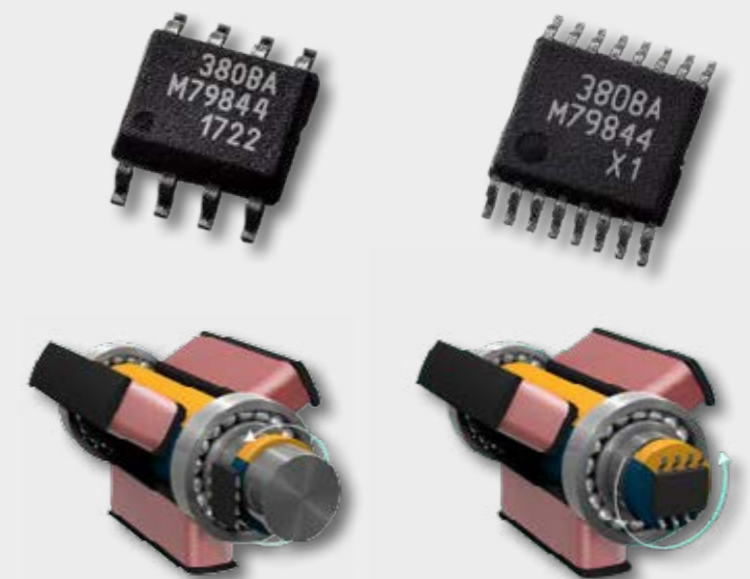
MLX90380 is a fast pre-programmed magnetic resolver IC for brushless motors. It is ideally suited to automotive applications as well as other applications that need fast position readouts. Its ability to measure the absolute angle enables more efficient and safer motor control algorithms such as field oriented control algorithms. Fast in this case means 2µs sampling per field component and 4µs for two components. The MLX90380 provides sine and cosine analog ratiometric outputs. Its option code includes the ability to select sensitivity from 10 to 70 mT and five different configurations for the magnetic-field axis. Flexible mechanical designs are possible as designers can select the field component to be measured. As such, it is even possible to design off axis magnetic readouts.

Features and Benefits

- Sine and cosine analog outputs
- Output refresh rate: 4 µs
- Flexible mechanical design enabled by selectable magnetic-field axis (X/Y - X/Z - Z/Y)
- End-of-shaft/through-shaft operation
- RoHS compliant packages:
 - Single die – SOIC-8
 - Dual die fully redundant – TSSOP-16

Applications

- Absolute rotary position sensor
- Brushless motor control
- Permanent magnet synchronous motor
- Brushless DC motor (BLDC)
- Field-oriented motor control



MLX90380 is for motor commutation in brushless motors. The magnetic resolver IC can be placed off axis (left) and end-of-shaft (right).



Gen III Triaxis® Rotary and Linear Position Sensor IC (Analog or PWM Output)

3-Wire ASIL-B Hall Sensor IC with Lateral Sensing

MLX90371 – Triaxis® Position Processor

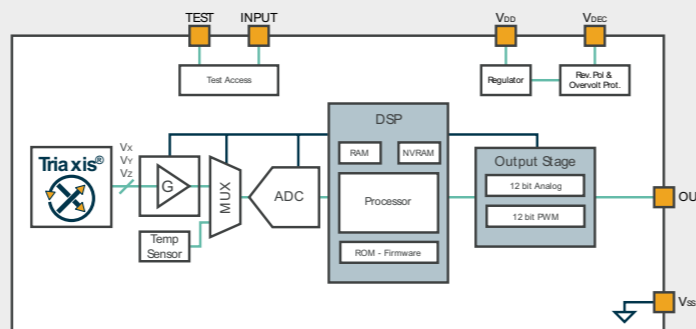
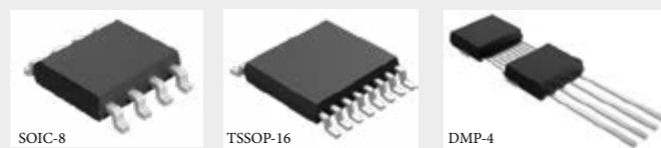
The MLX90371 is a monolithic sensor sensitive to the three components of the flux density applied to the IC (i.e. BX, BY and BZ). This allows the MLX90371 with the correct magnetic circuit to decode the absolute position of any magnet moving in its vicinity (e.g. rotary position from 0 to 360 degrees or linear displacement, see Figure 2). The MLX90371 reports a programmable ratiometric analog output signal compatible with any resistive potentiometer or programmable linear Hall sensor. Through programming, the MLX90371 can provide a digital PWM (Pulse Width Modulation) output characteristic.

Features and Benefits

- On-chip signal processing for robust absolute position sensing
- ISO26262
- ASIL-B safety element out-of-context
- Programmable measurement range
- Programmable linear transfer characteristic (Multi-points 4 or 8 points or piece-wise-linear 16 or 32 segments)
- Selectable analog (ratiometric) or PWM output
- 12 bit resolution - 10 bit thermal accuracy
- 48 bit ID number option
- Robustness against stray-field

Applications

- Absolute rotary position sensor
- Absolute linear position sensor
- Pedal position sensor
- Throttle position sensor
- Ride height position sensor
- Steering wheel position sensor
- Float-level sensor
- Non-contacting potentiometer



MLX92292/MLX92291

3-Wire μ Power Programmable ASIL-B Capable Hall Effect Latch/Switch

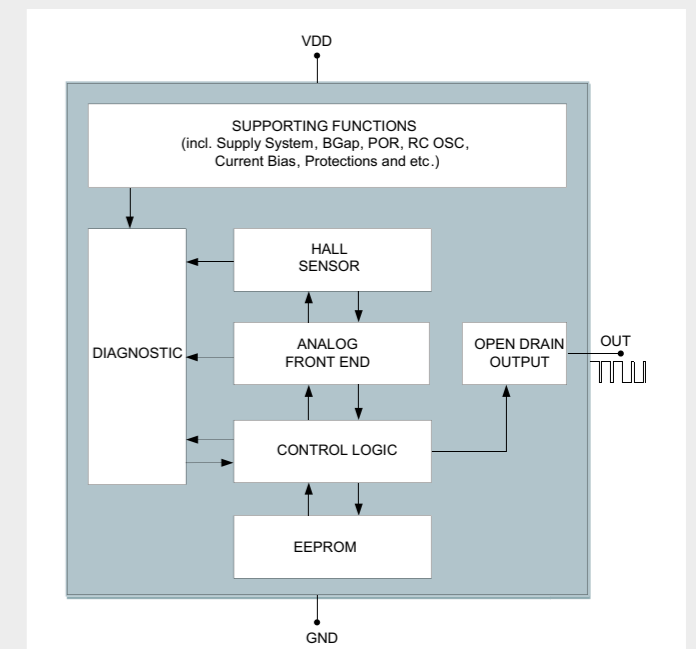
Melexis has made a major advance in magnetic sensing technology that will have widespread implications for modern automobile design the MLX92292 - effectively represents a whole new way of sensing. This device delivers switch functions, but unlike existing products on the market it can determine the presence of magnetic-fields that are lateral, not just orthogonal, to it. The uniqueness of this offering is taken further by the fact that the MLX92292 switch is supporting an ASIL-B safety integrity level (in accordance with ISO 26262), with an array of built-in diagnostic mechanisms available.

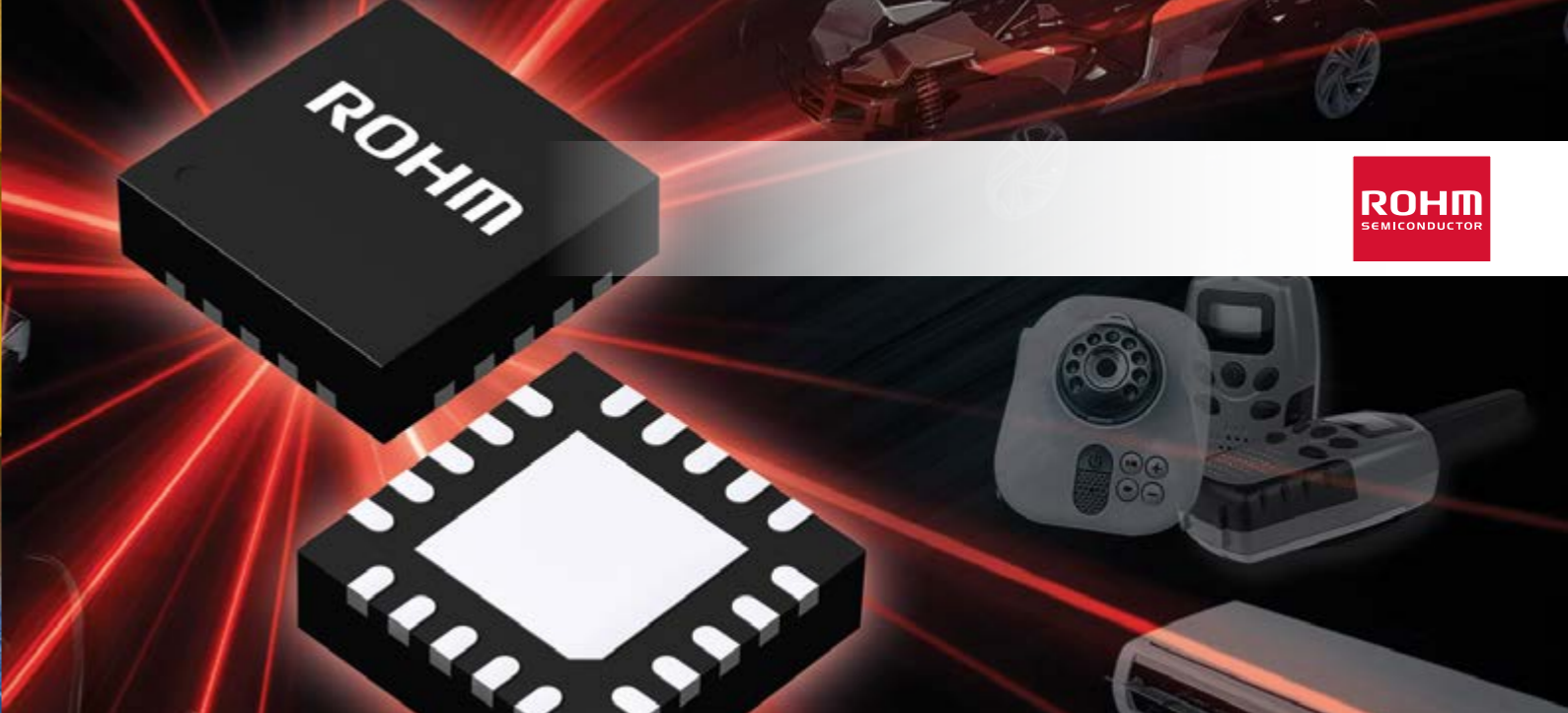
Features and Benefits

- Wide operating voltage range: from 3.3 to 18 V
- Less than 10 μ A average supply current in μ -power mode
- Flexible magnetic thresholds and temperature coefficient
- Integrated self-diagnostic functions activating dedicated safe mode
- Reverse supply voltage protection
- Under-voltage reset protection
- Thermal protection
- Optional IMC integration for lateral sensing
- Customer end-of-line programming
- Wide programmable magnetic latch/switch range
- Developed according to ISO26262-10, 9 as safety
- HW element out of context with ASIL-B level
- Temperature: -40 to +150 °C

Applications

- Automotive, consumer and industrial
- Brake light wake-up switch
- Electronic steering column lock
- Door latch system
- Seat positioning
- Sunroof/tailgate opener
- Transmission applications
- Electrical power steering





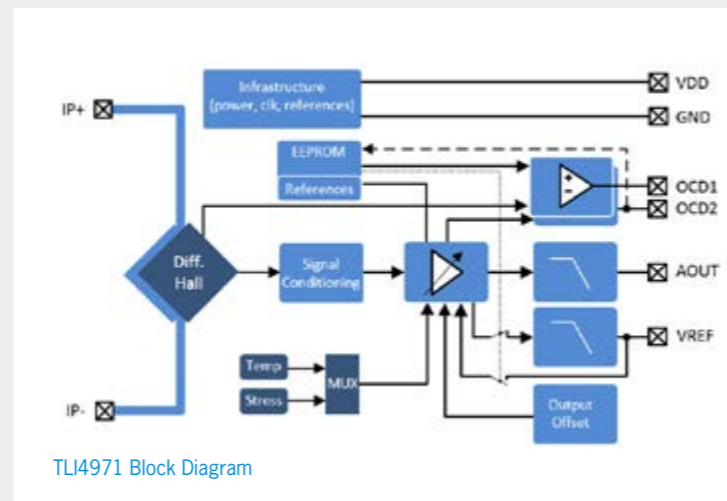
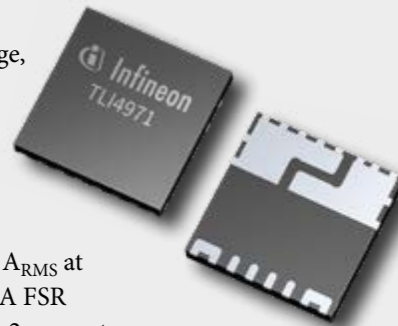
XENSIV™ Magnetic Current Sensor

TLI4971 – High-Precision Coreless Sensor for Industrial Applications



The TLI4971 is a high-precision current sensor for bi-directional AC and DC measurements. The device has an analog interface and two fast overcurrent detection outputs which support protection of the power circuitry. Galvanic isolation is provided due to magnetic sensing principle. Infineon's well-established and robust monolithic Hall technology enables accurate and highly linear measurement of currents with a full scale up to 120 A.

Negative effects, like saturation and hysteresis, commonly known from core based sensor techniques are not present in the Infineon open loop, core less sensors principle. The smart current rail design (double U-shape) combined with a differential signal sensing makes the current sensor robust against stray fields. The integrated primary conductor (current rail) with very low insertion resistance minimizes the power loss and enables miniaturization of the sensing circuit. Two separate overcurrent pins (OCD1/OCD2) provide a fast output signal in case the current exceeds a pre-set threshold. The sensor is shipped as a fully calibrated product without requiring any customer end-of-line calibration and comes in a small 8x8 mm TISON-8 leadless package, which allows standard SMD assembly.



TLI4971 Block Diagram

Product Highlights

- Key features
- Measurement up to 70 A_{RMS} at 690 V_{RMS} within ±120 A FSR
- Typical error at 25 °C < 2 percent
- Current rail resistance specified at 225 μΩ typical
- Analog output signal with 120 kHz bandwidth

Key Applications

- Fast overcurrent detection up to 2 x I_{FSR} (typ. response time 1 μs)
- Industrial inverter and drives up to 690 V_{RMS}
- Battery management
- Photovoltaic inverters
- Power supplies
- Overload or overcurrent detection in high-voltage power circuits
- White goods
- Power tools
- Robot applications

Product Name	UL certified	Ordering Code	Output Mode	Measurement Range (A)	Sensitivity (typ.) (mV/A)	Temperature Ts (°C)	V _{DD}	Package
TLI4971-A120T5-U-E0001	Yes	SP005272936	Semi-differential mode, non-ratiometric	±120	10	-40 to +105	3.3	TISON-8
TLI4971-A120T5-E0001	No	SP005344532	Semi-differential mode, non-ratiometric	±120	10	-40 to +105	3.3	TISON-8

Contactless Current Sensor

BM14270MUV-LB – High-Precision Coreless Sensor for Industrial Applications

This is the product that guarantees long time support in industrial market. BM14270MUV-LB is coreless non-contact type current sensor of the magnetic detection using MI sensor. It's able to measure the current line in non-contact, and therefore it's possible to measure current without loss.

Features

- Measurement range: ±50 A
- 14-bit digital output
- Resolution 0.008A/LSB

Applications

- Power meter
- Power conditioner
- UPS

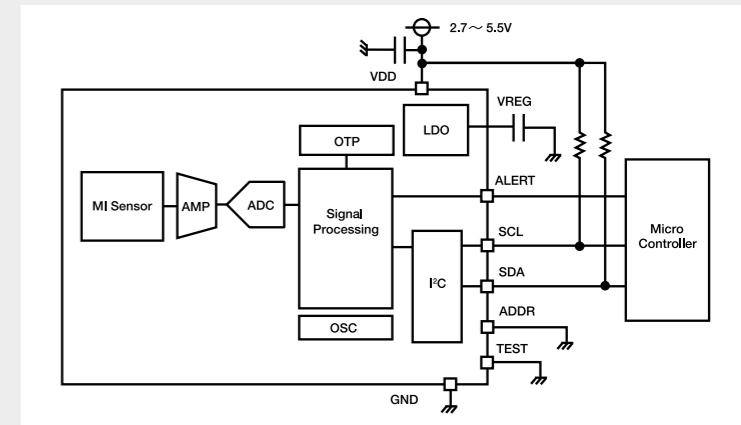
Key Specifications

- Input voltage range: 2.7 to 5.5 V
- Operating current (20 SPS): 70 μA(Typ)
- Magnetic measurable range: ±280 μT(Typ)
- Magnetic sensitivity: 0.045 μT/LSB(Typ)
- Operating temperature range: -40 to +125 °C

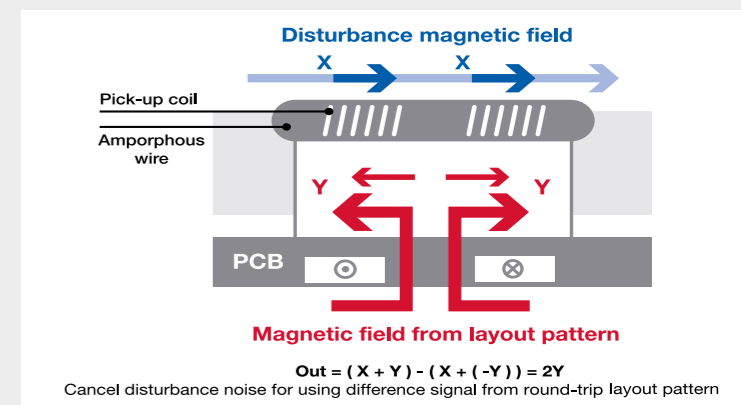
Package

- VQFN20QV3535
- 3.5 x 3.5 x 1.0 mm

Magnetic Impedance Sensor Block Diagram

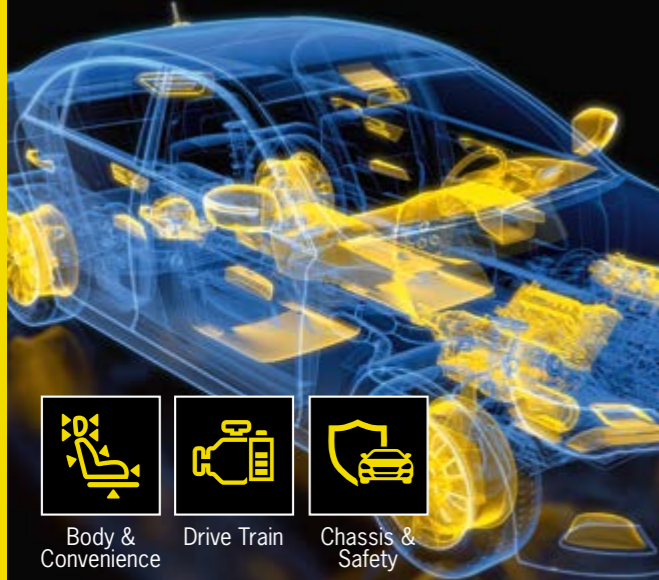


Coreless Current Sensor Using MI (Magnetic Impedance) Sensor





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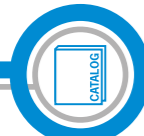


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2. Catalog All Roads Lead to Us.

Are you looking for a particular electronic component? Our Rutronik24 catalog will guide you reliably to the right choice: Our Product Groups Search will enable you to find the product you are looking for in a maximum of three steps. The product groups are divided into semiconductors, passive and electromechanical components, storage technologies, displays & boards as well as wireless technologies. Using the full-text and part number search, you can select results after entering parts of the product or manufacturer's name.



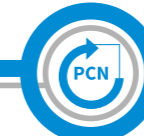
3. Procurement Everything at a Glance.

The Rutronik24 "Procurement" module provides you with a complete overview of your orders, item lists, stocks, contracts and delivery times. You can conveniently download all the lists in Excel format and import them into your inventory control system, for example. Take the opportunity to save time.



4. Mass Quotation Everything in Just a Few Seconds.

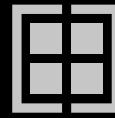
Rutronik24 offers you the opportunity to access all the information about our products very quickly. We have developed the "Mass quotation" tool for the fast and simple evaluation of your individual material. Upload your comprehensive item lists to our system in one file and this will then be returned to you, complete with current prices and additional information, just a few moments later.



5. PCN Everything from a Single Source.

Be fully informed of changes. Our Rutronik24 "PCN" module keeps you up-to-date with current product changes from our manufacturers. Not only do you have access to an extensive PCN database, but the product changes are also linked directly to the respective product. This gives you the opportunity to react in good time to the changes.




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