

HAECHITECH SENSOR SOLUTION

YEAR 2024

System architecture

Sensor IC and module

Algorithm and software

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Haechitech

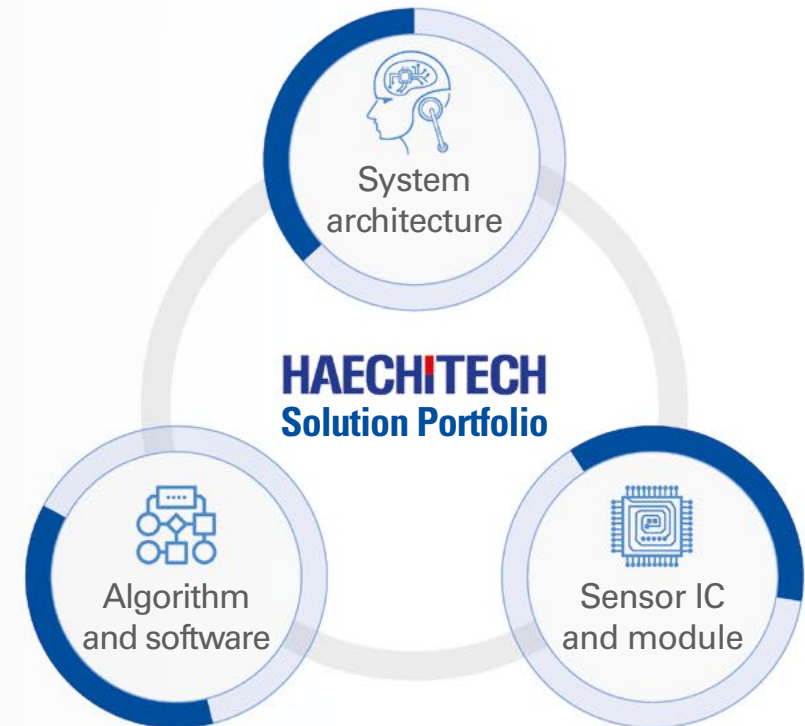
Over 10 Years of Sensor Business

- 2023
 - MXG4300 mass production over 100Mpcs
- 2022
 - Shipment to the global No.1 smartphone manufacturer
- 2021
 - High accuracy temperature sensor launching
- 2020
 - Brand-new e-Compass mass production (MXG4300)
- 2019
 - I3C interface 3D digital Hall sensor launching
- 2018
 - MXM1120 mass production over 100Mpcs
- 2017
 - M-company sensor business was transferred to Haechitech Corporation
- 2016
 - Temperature & humidity sensor mass production
- 2015
 - e-Compass mass production
- 2014
 - Magnetic sensor mass production
- 2013
 - Started R&D of temperature & humidity sensor
- 2012
 - Sensor business unit established in M-company
 - Started R&D of e-Compass and magnetic sensor

Haechitech

Intergrated Sensor Solution Provider

We enable a creative mind to advance the World with bridging solutions among Human, Machine and Environment



Haechi(獅多)

An imaginary animal in ancient Korean history which is a judicious arbiter for right and wrong or a sensor for inflammable energy

Product Portfolio

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e-Compass

MXG5300
MXG4300
MXG3300
MXG2320

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Hall Sensor

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Environment Sensor

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MXH1130	
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Solution & Tool

MAGIC Algorithm
Motion Tracking
StarTracking (StarGraphy™)
Contactless Slide Key
Rotary Knob
Sliding Distance Measurement
Folding Angle Measurement
Temperature & Humidity Dongle
Multi-evaluation System
Evaluation Tool

e-Compass Selection Guide

MXG5300

1.8V/1.2V I3C Supporting e-Compass



Key Features

- ◆ Package: 0.8mm x 0.8mm x 0.5mm 4-ball WLCSP
- ◆ Operating voltage
 - VDD 1.65V ~ 1.95V
 - SCL/SDA I3C 1.1V ~ VDD
 - SCL/SDA I²C 1.1V ~ VDD
- ◆ Maximum measurable range: $\pm 4912\mu\text{T}$
- ◆ Sensitivity: $0.15\mu\text{T/LSB}$
- ◆ Output data width: 16-bit
- ◆ Output data rate: max. 100Hz
- ◆ Embedded FIFO: 16 frames

Applications



Smartphone



Tablet



Navigation

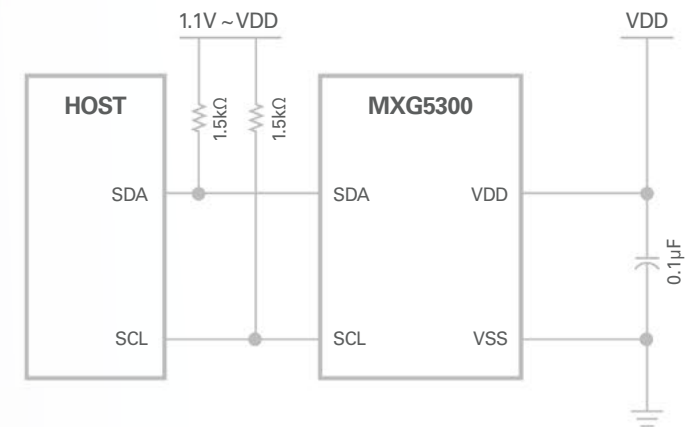


Wearable device

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 1.95V SCL/SDA I3C 1.1V ~ VDD SCL/SDA I ² C 1.1V ~ VDD
Sensitivity	$0.15\mu\text{T/LSB}$
Output data width	16-bit
Measurable range	$\pm 4912\mu\text{T}$
Output data rate	Max. 100Hz
Current consumption	$1\mu\text{A}$ @ power down 1.4mA @ 100Hz operation
Operating temperature	$-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$
Interface	I ² C, I3C
Others	Embedded FIFO: 16 frames

Application Circuit



e-Compass Selection Guide

MXG4300

Market-leading Tiny Form Factor



Key Features

- ◆ Package: 0.8mm x 0.8mm x 0.5mm 4-ball WLCSP
- ◆ Maximum measurable range: $\pm 4914\mu\text{T}$
- ◆ Sensitivity: $0.15\mu\text{T/LSB}$
- ◆ Output data width: 16-bit
- ◆ Output data rate: max. 200Hz
- ◆ Pin compatible with A****18

Applications



Smartphone



Tablet



Navigation

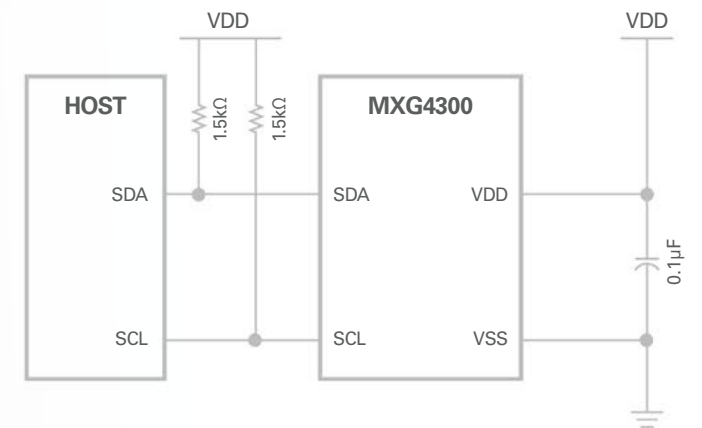


Wearable device

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 1.95V
Sensitivity	$0.15\mu\text{T/LSB}$
Output data width	16-bit
Measurable range	$\pm 4914\mu\text{T}$
Output data rate	Max. 200Hz @ normal mode Max. 100Hz @ high accuracy mode
Current consumption	$1\mu\text{A}$ @ power down 1.5mA @ 100Hz operation
Operating temperature	$-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$
Pin-compatibility	A****18

Application Circuit



e-Compass Selection Guide

MXG3300

32-Frame FIFO Embedded e-Compass



Key Features

- ◆ Package: 1.2mm x 0.8mm x 0.5mm 5-ball WLCSP
- ◆ Maximum measurable range: $\pm 4914\mu\text{T}$
- ◆ Sensitivity: $0.15\mu\text{T/LSB}$ or $0.6\mu\text{T/LSB}$
- ◆ Output data width: 16-bit / 14-bit configurable
- ◆ Output data rate: max. 200Hz
- ◆ Embedded FIFO: 32 frames
- ◆ Pin compatible with A****16

Applications



Smartphone



Tablet



Navigation

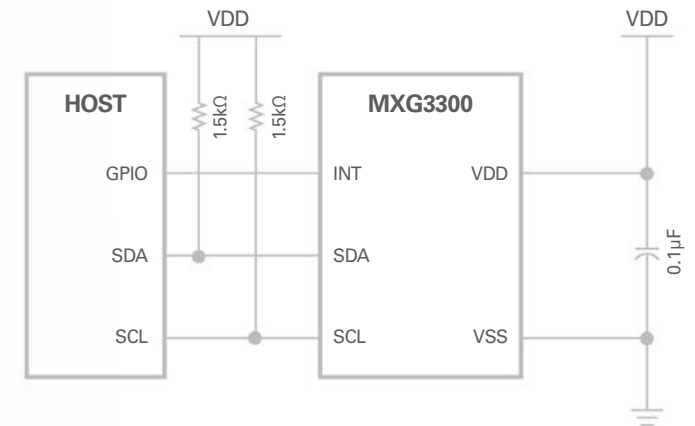


Wearable device

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 1.95V
Sensitivity	$0.15\mu\text{T/LSB}$ @ 16-bit output or $0.6\mu\text{T/LSB}$ @ 14-bit output
Output data width	16-bit or 14-bit
Measurable range	$\pm 4914\mu\text{T}$
Output data rate	Max. 200Hz @ normal mode Max. 100Hz @ high accuracy mode
Current consumption	$1\mu\text{A}$ @ power down 1.5mA @ 100Hz operation
Operating temperature	$-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$
Pin-compatibility	A****16

Application Circuit



e-Compass Selection Guide

MXG2320

3.3V Operating e-Compass



Key Features

- ◆ Package: 1.2mm x 1.2mm x 0.5mm 8-ball WLCSP
- ◆ Maximum measurable range: $\pm 4914\mu\text{T}$
- ◆ Sensitivity: $0.6\mu\text{T/LSB}$
- ◆ Output data width: 14-bit
- ◆ Support for Qualcomm/MTK platforms
- ◆ Pin compatible with A****11

Applications



Smartphone



Tablet



Navigation

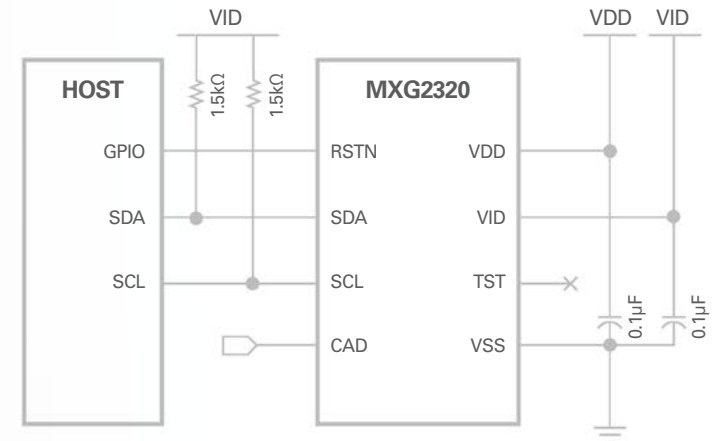


Wearable device

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 2.5V ~ 3.6V VID 1.65V ~ VDD
Sensitivity	$0.6\mu\text{T/LSB}$
Output data width	14-bit
Measurable range	$\pm 4914\mu\text{T}$
Output data rate	Max. 100Hz
Current consumption	$1\mu\text{A}$ @ power down 2.0mA @ 100Hz operation
Operating temperature	$-30^{\circ}\text{C} \sim +85^{\circ}\text{C}$
Pin-compatibility	A****11

Application Circuit



Hall Sensor Selection Guide

MXM2130

Stereoscopic Digital Hall Sensor



Key Features

- ◆ Package: 1.2mm x 0.8mm x 0.5mm 6-ball WLCSP
- ◆ Operating voltage
 - VDD 1.65V ~ 1.95V
 - SCL/SDA 1.1V ~ VDD
- ◆ Interface: I²C
- ◆ Resolution: 16-bit digital output for Z-axis
- ◆ Measurement range: 20mT / 40mT / 80mT / 120mT
- ◆ Support for measurement of X-axis gradation
- ◆ Support for 3 slave addresses
- ◆ Selectable output types (interrupt output, switch output)
- ◆ Support for stand-alone operation mode

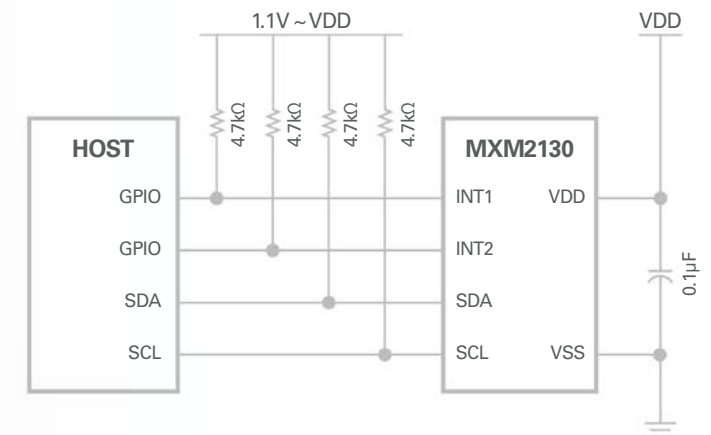
Applications

Smartphone
slide button

Foldable phone

Wireless
earphoneElectrical
Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 1.95V SCL/SDA 1.1V ~ VDD
Output data width	Z-axis: 16-bit
Measurable range	20mT / 40mT / 80mT / 120mT
Output data rate	5Hz / 20Hz / 100Hz / 200Hz / 1kHz
Current consumption	6μA @ 10Hz operation 0.5μA @ power down
Interface	I ² C
Others	Stand-alone operation mode Interrupt / switch output

Application
Circuit

Hall Sensor Selection Guide

MXM2121

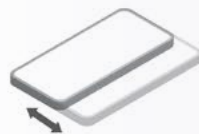
Low Noise 3D Digital Hall Sensor



Key Features

- ◆ Package: 1.2mm x 0.8mm x 0.5mm 5-ball WLCSP
- ◆ Operating voltage
 - VDD 1.65V ~ 1.95V
 - SCL/SDA 1.1V ~ VDD
- ◆ Interface: I²C, I3C
- ◆ 16-bit digital output for each X/Y/Z-axis
- ◆ Measurement range
 - High sensitivity mode: X/Y/Z ±36mT
 - Wide range mode: X/Y ±36mT, Z ±108mT
- ◆ Support for 2 slave addresses
- ◆ Selectable operation mode (low noise, low power)
- ◆ Output pin for Interrupt or switch function

Applications



Rollable phone



Foldable phone

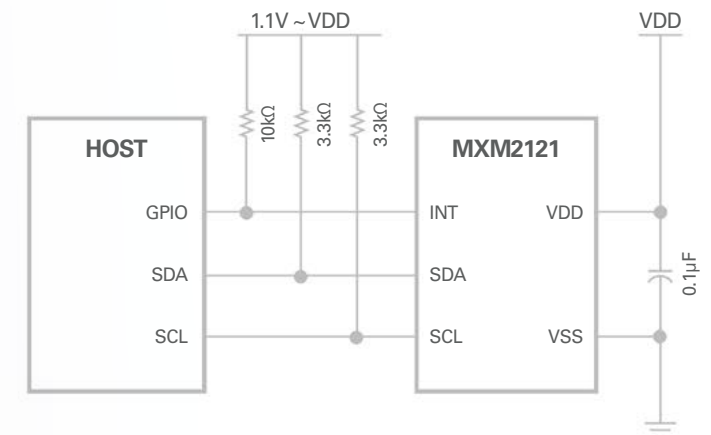


Camera zoom lens

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 1.95V SCL/SDA 1.1V ~ VDD
Output data width	X/Y/Z-axis: 16-bit
Measurable range	X/Y/Z ±36mT @ high sensitivity X/Y ±36mT, Z ±108mT @ low power
Output data rate	Max. 500Hz @ low noise mode Max. 2kHz @ low power mode
Current consumption	1μA @ power down 12μA @ low noise mode, 10Hz 5.5μA @ low power mode, 10Hz
Interface	I ² C, I3C
Others	Programmable switch function Self-test function

Application Circuit



Hall Sensor Selection Guide

MXM2120

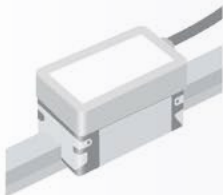
I3C Digital 3D Hall Sensor



Key Features

- ◆ Package: 1.4mm x 0.8mm x 0.5mm 6-ball WLCSP
- ◆ Operating voltage: VDD 1.65V ~ 1.95V
- ◆ Interface: I3C, I²C
- ◆ Built-in 14-bit ADC for digital output data
- ◆ Compensation for magnet variation
- ◆ Run-time programmable operating/release point (Bop/Brp)
- ◆ Output data rate: 5Hz ~ 1kHz programmable
- ◆ Programmable interrupt conditions
- ◆ Support for low power mode

Applications



Linear encoder



Foldable phone

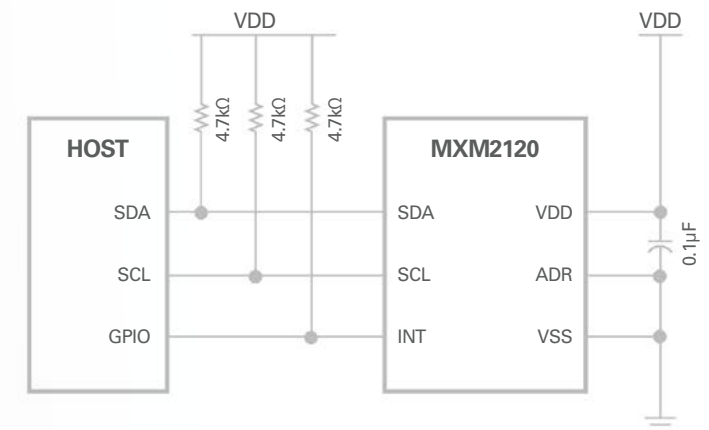


Smart watch

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 1.95V
Output data width	Z-axis: 14-bit X/Y-axis: 10-bit
Measurable range	Programmable ±2mT ~ ±100mT
Output data rate	Programmable 5Hz ~ 1kHz
Current consumption	0.5μA @ power down 25μA @ 5Hz operation
Operating/release point	Programmable 10-bit values
Interface	I3C, I ² C
Others	Magnetic polarity detection Magnet compensation

Application Circuit



Hall Sensor Selection Guide

MXM1161

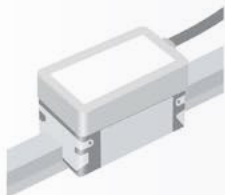
Digital Angular 3D Hall Sensor



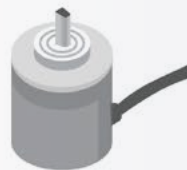
Key Features

- ◆ Package: 1.5mm x 1.5mm x 0.5mm 9-ball WLCSP
- ◆ Wide operating voltage: VDD 1.65V ~ 3.6V
- ◆ Built-in 12-bit ADC for digital output data
- ◆ Absolute angle detection
- ◆ Run-time programmable operating/release point (Bop/Brp)
- ◆ Output data rate: 5Hz ~ 1kHz programmable
- ◆ Programmable interrupt conditions
 - Over Bop and below Brp
 - Between Bop and Brp
 - Wake-up by magnet movement
- ◆ Compensation for magnet variation

Applications



Linear encoder



Rotary encoder

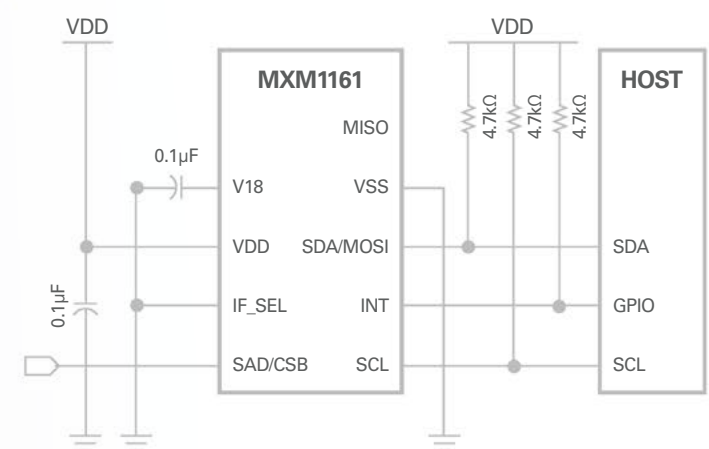


Smart watch

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 3.6V
Output data width	Z-axis: 12-bit X/Y-axis: 8-bit
Measurable range	Programmable Digital mode: $\pm 2\text{mT} \sim \pm 40\text{mT}$ Angle mode: $\pm 30\text{mT} \sim \pm 90\text{mT}$
Output data rate	Programmable Digital mode: 5Hz ~ 1kHz
Current consumption	0.5 μA @ power down 10 μA @ 5Hz operation
Operating/release point	Programmable 10-bit values
Interface	I ² C, SPI, PWM, Quadrature A/B
Others	Magnetic polarity detection Magnet compensation System INL : typ. ± 0.6 degree

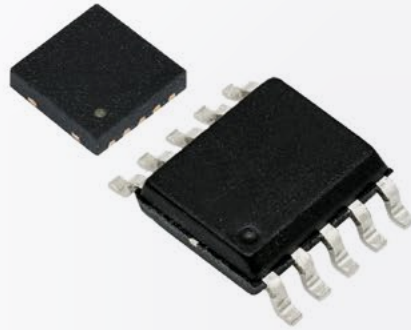
Application Circuit



Hall Sensor Selection Guide

MXM1400

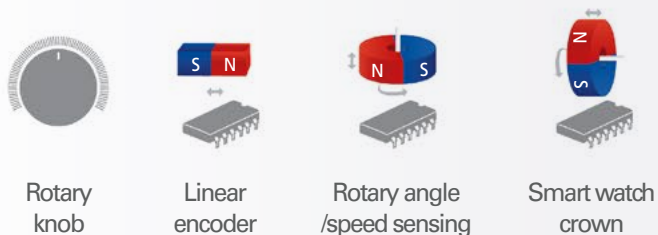
Digital Angular 3D Hall Sensor



Key Features

- ◆ Package
 - 3.0mm x 3.0mm x 0.8mm 10-pin DFN
 - 6.0mm x 4.9mm x 1.7mm 10-pin SOP
- ◆ Wide operating voltage: VDD 1.65V ~ 3.6V
- ◆ Built-in 12-bit ADC for digital output data
- ◆ Absolute angle detection
- ◆ Run-time programmable operating/release point (Bop/Brp)
- ◆ Output data rate: 5Hz ~ 1kHz programmable
- ◆ Programmable interrupt conditions
 - Over Bop and below Brp
 - Between Bop and Brp
 - Wake-up by magnet movement
- ◆ Compensation for magnet variation

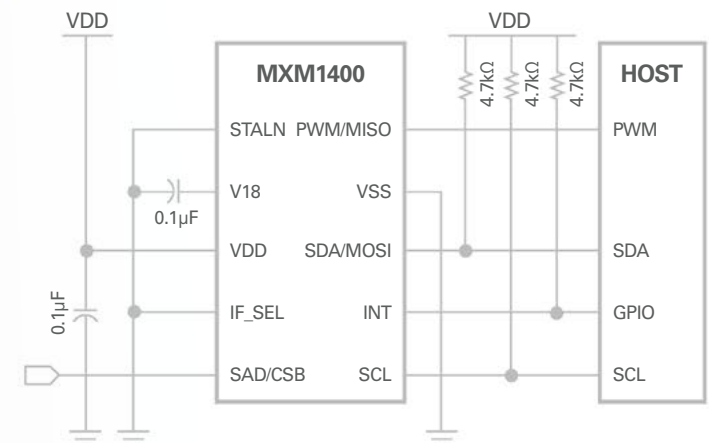
Applications



Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 3.6V
Output data width	Z-axis: 12-bit X/Y-axis: 8-bit
Measurable range	Programmable Digital mode: $\pm 2\text{mT} \sim \pm 40\text{mT}$ Angle mode: $\pm 30\text{mT} \sim \pm 90\text{mT}$
Output data rate	Programmable Digital mode: 5Hz ~ 1kHz Angular mode: 500rpm
Current consumption	0.5 μA @ power down 10 μA @ 5Hz operation
Operating/release point	Programmable 10-bit values
Interface	I ² C, SPI, PWM, Quadrature A/B
Others	Magnetic polarity detection Magnet compensation System INL : typ. ± 0.6 degree

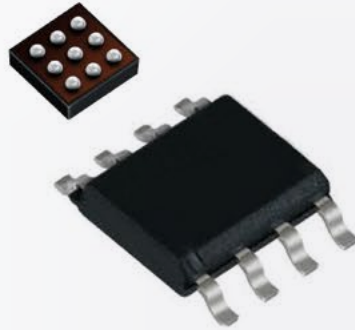
Application Circuit



Hall Sensor Selection Guide

MXM1120

Digital Hall Sensor



Key Features

- ◆ Package
 - 1.3mm x 1.3mm x 0.5mm 9-ball WLCSP
 - 4.9mm x 6.0mm x 1.6mm 8-pin SOP
- ◆ Built-in 10-bit ADC for digital output data
- ◆ Configurable sensitivity and measurable range
- ◆ Run-time programmable operating/release point (Bop/Brp)
- ◆ Programmable interrupt conditions
 - Over Bop and below Brp
 - Between Bop and Brp
- ◆ Compensation for magnet variation

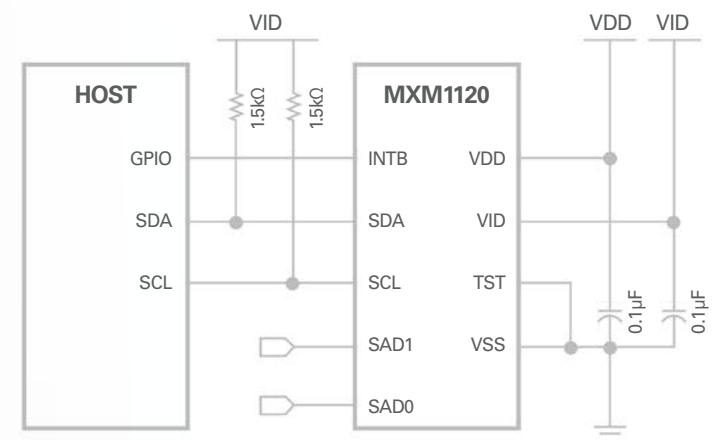
Applications

Smartphone
pop-up camera

Foldable phone

Air/water level
detectionElectrical
Characteristics

Parameter	MXM1120	MXM1120SO
Operating voltage	VDD 2.7V ~ 3.6V VID 1.65V ~ VDD	
Sensitivity	Programmable 5 μ T/LSB ~ 80 μ T/LSB	Programmable 75 μ T/LSB ~ 120 μ T/LSB
Output data width	10-bit or 8-bit	
Measurable range	Programmable ± 2.5 mT ~ ± 40 mT	Programmable ± 3.8 mT ~ ± 61.2 mT
Output data rate	Programmable 5Hz ~ 80Hz	
Current consumption	1 μ A @ power down	
	18 μ A @ 10Hz operation	
Operating/release point	Programmable 10-bit values	
Interface	I ² C, interrupt	
Others	Magnetic polarity detection Magnet compensation	

Application
Circuit

Hall Sensor Selection Guide

MXM1300

Linear Hall Sensor
For Current Sensing



Key Features

- ◆ Package: 5.2mm x 3.7mm x 1.6mm SIP 4-lead
- ◆ Operating voltage: VCC 3.0V ~ 5.5V
- ◆ Selectable measurement range: 5mT ~ 1T
- ◆ Single wire serial interface for programming
 - Programmable offset and sensitivity
 - Selectable output mode (ratiometric, non-ratiometric)
- ◆ Protection circuit for 12V surge
- ◆ ESD 4kV
- ◆ Under/over voltage protection

Applications



Motor



Energy storage
system

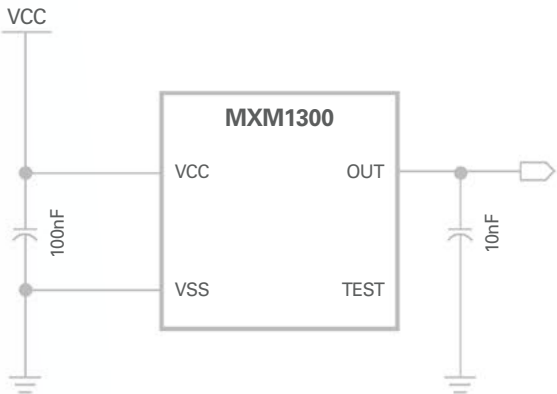


Smart meter

Electrical
Characteristics

Parameter	Value
Operating voltage	VCC 3.0V ~ 5.5V
Measurement range	5mT ~ 1T
Output bandwidth	Max. 1MHz
Operating temperature	-40°C ~ +150°C
Output mode	Ratiometric/non-ratiometric
Others	Programmable offset Programmable sensitivity

Application
Circuit



Hall Sensor Selection Guide

MXM1282

High-accuracy 30V Hall Switch



Key Features

- ◆ Package
 - 2.9mm x 1.6mm x 1.2mm SOT23
 - 4.0mm x 3.1mm x 1.5mm TO92
- ◆ Wide operating supply voltage: 2.5V~30V
- ◆ Self-test during power-on time
- ◆ Various factory programmable parameters
- ◆ Superior temperature stability
- ◆ Protection functions
 - Reverse voltage protection: -24V
 - Over current protection

Applications



BLDC motor



Electric power tool



Electric bicycle

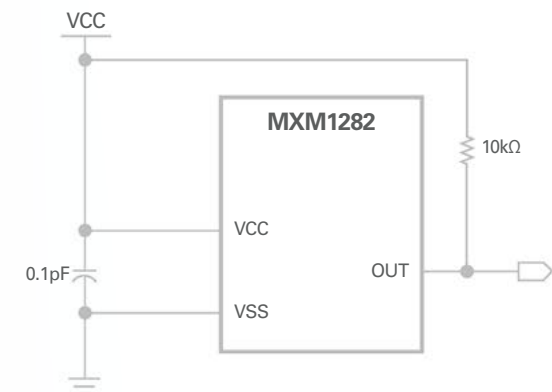


Washing machine

Electrical Characteristics

Parameter	Value
Operating voltage	2.5V ~ 30V
Operating temperature	-40°C ~ 125°C
Current consumption	2.4mA
Polarity	Factory programmable (Omni/bi/uni-polar)
Operating/release point	Factory programmable (1.5 mT ~ 15.0 mT)
Output Type	Factory programmable (Open drain, internal pull-up)
Others	Self-test during power-on time

Application Circuit



Hall Sensor Selection Guide

MXM1260

Ultra Low Power Hall Switch



Key Features

- ◆ Package
 - 1.6mm x 2.9mm SOT23
 - 1.3mm X 2.9mm SOT23N
 - 1.0mm x 1.0mm 4-pin DFN
- ◆ Operating voltage: VDD 1.65V ~ 5.5V
- ◆ Ultra low power consumption
 - Stand-by: 0.5μA @ 3V
 - Normal: 1.0μA @ 3V, 5Hz
- ◆ Operating/release point: Bop 4.5mT, Brp 2.5mT
- ◆ Customizable parameters

	Default	Options
ODR	5Hz	20Hz, 200Hz, 4kHz
Polarity	Omnipolar	Unipolar

Applications



Wireless earphone



Digital door lock

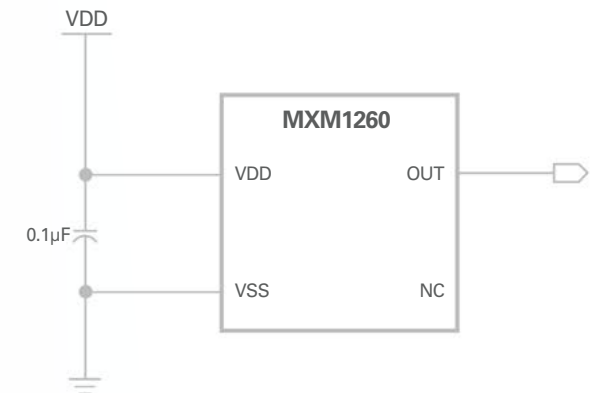


Smart meter

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 5.5V
Operating temperature	-30°C ~ 85°C
Current consumption	0.5μA @ stand-by, 3V 1.0μA @ 5Hz operation, 3V
Polarity	Omni/bi/uni-polar
Operating/release point	Bop 4.5mT, Brp 2.5mT
Output type	Push-pull

Application Circuit



Hall Sensor Selection Guide

MXM1170

1.8V Mobile Hall Switch



Key Features

- ◆ Package
 - 1.2mm x 1.6mm x 0.4mm 4-pin DFN
 - 0.8mm x 0.6mm x 0.5mm 4-ball WLCSP
 - 1.6mm x 2.9mm SOT23
- ◆ Operating voltage: VDD 1.65V ~ 1.95V
- ◆ Ultra-small outline package
- ◆ Polarity: Omni/Omnipolar
- ◆ Output type: push-pull
- ◆ Operating/release point

		MXM1170			B***56		
		Min	Typ	Max	Min	Typ	Max
Operating point	BopS (mT)	+3.8	+4.6	+6.4	-	4.6	6.4
Release point	BrpS (mT)	+2.0	+3.8	+4.6	2.0	3.8	-

Applications



Open/close detection



Smart meter security

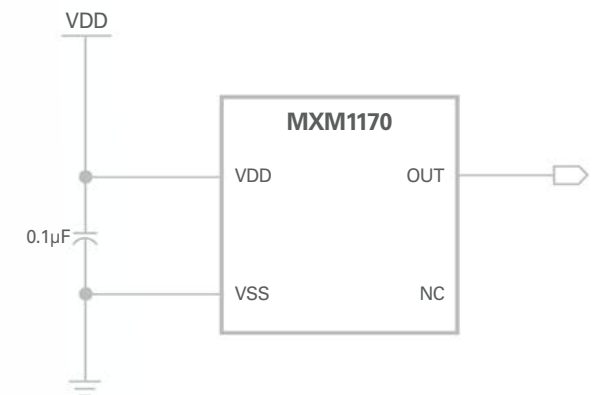


Wearable device position detection

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.65V ~ 1.95V
Operating temperature	-30°C ~ 85°C
Current consumption	3.0μA @ stand-by 4.0μA @ normal operation 1.5mA @ measurement
Polarity	Omni/uni-polar
Operating/release point	Bop 4.6mT, Brp 3.8mT
Output type	Push-pull
Pin-compatibility	B***56

Application Circuit



Hall Sensor Selection Guide

MXM1250

30V Automotive Hall Switch



Key Features

- ◆ Package: 4.0mm x 3.2mm x 1.5mm TO92
- ◆ Various factory programmable parameters
- ◆ Protection functions
 - Reverse voltage protection: -40V
 - HBM 8KV ESD Protection
 - Over voltage/current protection

Applications



BLDC motor



Electric power tool



Electric bicycle



Washing machine

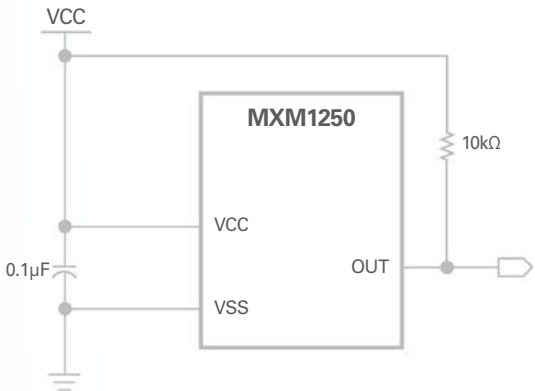
Electrical Characteristics

Parameter	MXM1250
Operating voltage	3.8V ~ 30V
Operating temperature	-40°C ~ 150°C
Current consumption	2.1mA @ 12V
AEC-Q100 qualification	O
Polarity	Factory programmable (default: bi-polar latch)
Operating/ release point	Factory programmable (default: Bop/Brp ±4.2mT)
Output type	Factory programmable (default: open drain)

Absolute Maximum Range

Parameter	MXM1250
Supply voltage	-40V ~ 40V
Junction temperature	-40°C ~ 170°C
Output voltage	-0.5V ~ 30V

Application Circuit



Environment Sensor Selection Guide

MXH1330

Tiny Low Power Temperature Sensor



Key Features

- ◆ Package: 0.8mm x 0.8mm WLCSP
- ◆ Operating voltage: VDD 1.4V ~ 3.6V
- ◆ Interface: I2C, SMBUS
- ◆ 12-bit digital output (0.0625°C/LSB)
- ◆ Measurement range: -40°C ~ +125°C
- ◆ Low power consumption
- ◆ Pin compatible with T**103

Applications



Smartphone



Memory

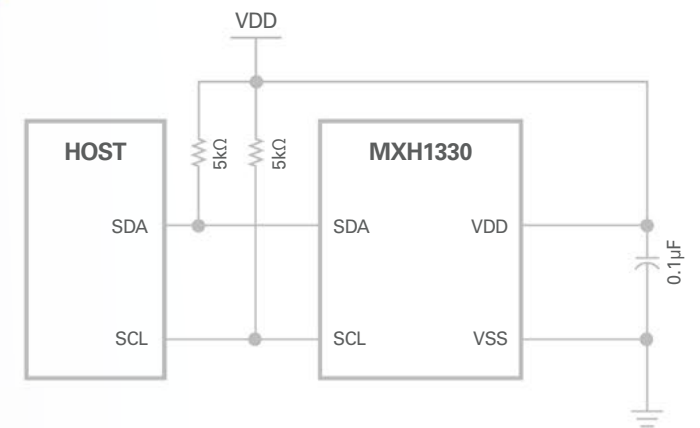


IoT Device

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.4V ~ 3.6V
Measurement range	-40°C ~ +125°C
Output data width	12-bit (0.0625°C/LSB)
Accuracy (Max.)	±1.0°C @ -40°C ~ +125°C
Output data rate	0.25Hz ~ 8Hz
Current consumption	0.5μA @ shutdown 7μA @ 4Hz operation, 3.3V
Interface	I²C, SMBUS

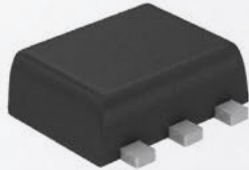
Application Circuit



Environment Sensor Selection Guide

MXH1321

Low Power Digital Temperature Sensor



Key Features

- ◆ Package: 1.6mm x 1.6mm SOT563
- ◆ Operating voltage: VDD 1.4V ~ 3.6V
- ◆ Interface: I²C, SMBUS
- ◆ 12-bit digital output (0.0625°C/LSB)
- ◆ Measurement range: -40°C ~ +125°C
- ◆ Low power consumption
- ◆ 4 slave addresses
- ◆ Programmable interrupt conditions
- ◆ Pin compatible with T**102

Applications



SSD



Display

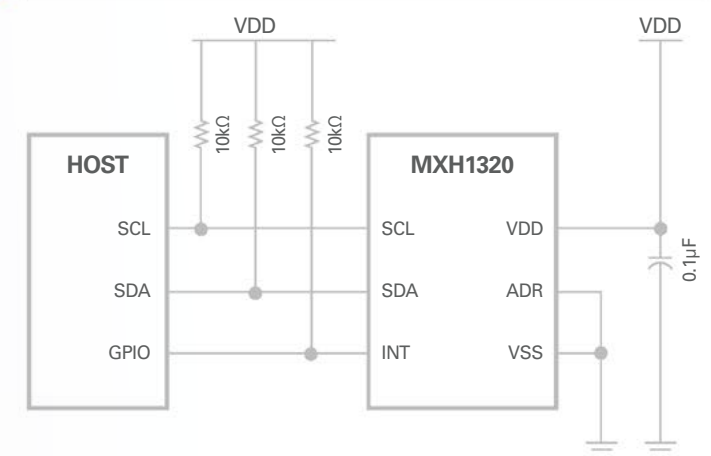


Drone

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 1.4V ~ 3.6V
Measurement range	-40°C ~ +125°C
Output data width	12-bit (0.0625°C/LSB)
Accuracy (Max.)	±1.0°C @ -40°C ~ +125°C
Output data rate	0.25Hz ~ 8Hz
Current consumption	0.5μA @ shutdown 7μA @ 4Hz operation, 3.3V
Interface	I ² C, SMBUS
Others	Programmable interrupt conditions 4 slave address

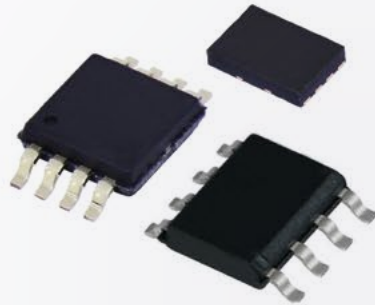
Application Circuit



Environment Sensor Selection Guide

MXH1310

Industry Standard Temperature Sensor



Key Features

- ◆ Package
 - 2.0mm x 3.0mm DFN 8-pin
 - 3.0mm x 3.0mm MSOP 8-pin
 - 4.9mm x 6.0mm SOIC 8-pin
- ◆ Operating voltage: VDD 2.7V ~ 5.5V
- ◆ Interface: I²C, SMBUS
- ◆ 12-bit digital output (0.0625°C/LSB)
- ◆ Measurement range : -40°C ~ +125°C
- ◆ Low power consumption
- ◆ 8 slave addresses
- ◆ Programmable interrupt conditions
- ◆ Pin compatible with T**75

Applications



CCTV



Notebook

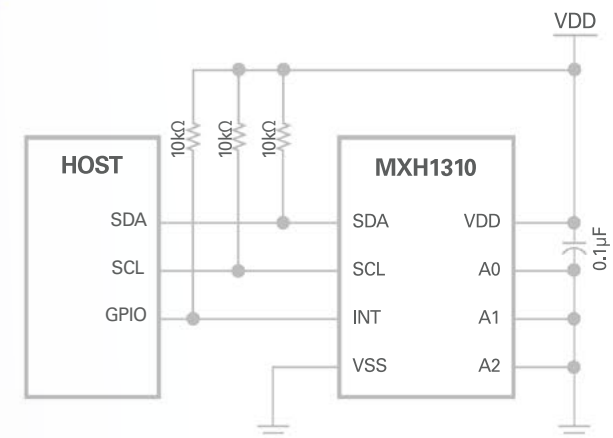


Office equipment

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 2.7V ~ 5.5V
Measurement range	-40°C ~ +125°C
Output data width	12-bit (0.0625°C/LSB)
Accuracy (Typical)	±0.5°C @ -10°C ~ +100°C ±1.0°C @ -40°C ~ +125°C
Output data rate	0.25Hz ~ 8Hz
Current consumption	1μA @ shutdown 3.5μA @ 0.25Hz operation, 3.3V
Interface	I ² C, SMBUS
Others	Programmable interrupt conditions 8 slave address

Application Circuit



Environment Sensor Selection Guide

MXH1130

5.0V Dual Analog Outputs
Temperature & Humidity Sensor



Key Features

- ◆ Package: 2.8mm x 3.6mm x 0.8mm 10-pin DFN with cavity
- ◆ Operating voltage: VCC 4.5V ~ 5.5V
- ◆ Embedded operational amplifier
- ◆ Various selectable outputs
 - Digital output by I²C
 - Dual PWM outputs
 - Dual analog outputs
- ◆ High accuracy tolerance: max. $\pm 3\%$, max. $\pm 0.5^{\circ}\text{C}$
- ◆ Programmable response time and analog output slew rate
- ◆ Excellent long-term stability
- ◆ BOM cost saving with embedded LDO, DAC and operational amplifier
- ◆ Robust operation against external noise
- ◆ Field-proven endurance under 85°C, 85% environment

Applications



Refrigerator



Air conditioner



Humidifier

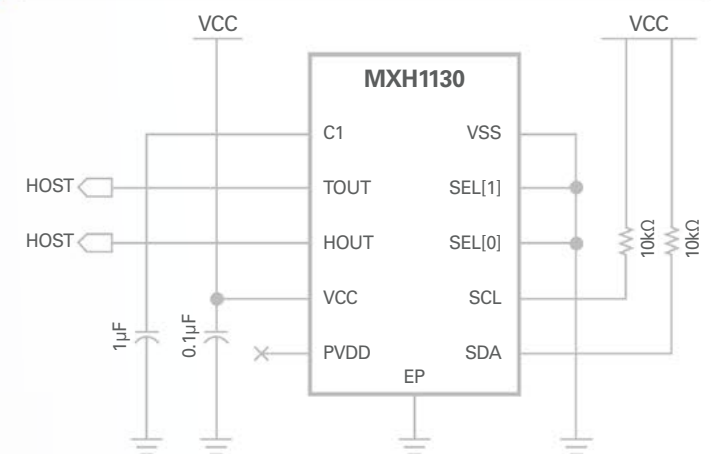


Laundry dryer

Electrical Characteristics

Parameter	Value
Operating voltage	VCC 4.5V ~ 5.5V
Operating temperature	-40°C ~ 125°C
Storage temperature	-55°C ~ 150°C
Measurement range	RH 0% ~ 100% Temperature -40°C ~ 125°C
Current consumption	65μA @ sleep 68μA @ average, 8-bit operation 270μA @ measurement 600μA @ HOUT and TOUT enabled
PWM frequency	120Hz
Measurement frequency	2Hz @ analog/PWM/PDM modes
HOUT/TOUT driving current	Typ. 30mA @ Vin-Vout=100mV
HOUT/TOUT sink current	Typ. 30mA @ Vout-Vin=100mV

Application Circuit



Environment Sensor Selection Guide

MXH1100

5.0V Single Analog Output
Temperature & Humidity Sensor



Key Features

- ◆ Package: 2.8mm x 3.6mm x 0.8mm 10-pin DFN with cavity
- ◆ Operating voltage: VCC 4.5V ~ 5.25V
- ◆ Various selectable outputs
 - I²C
 - PWM (humidity/temperature selectable)
 - PDM (humidity/temperature selectable)
 - Analog output (humidity only)
- ◆ High accuracy tolerance: max. ±3%, max. ±0.5°C
- ◆ Programmable response time and analog output slew rate
- ◆ Excellent long-term stability
- ◆ BOM cost saving with embedded LDO and DAC
- ◆ Robust operation against external noise
- ◆ Field-proven endurance under 85°C, 85% environment

Applications



Refrigerator



Air conditioner



Humidifier

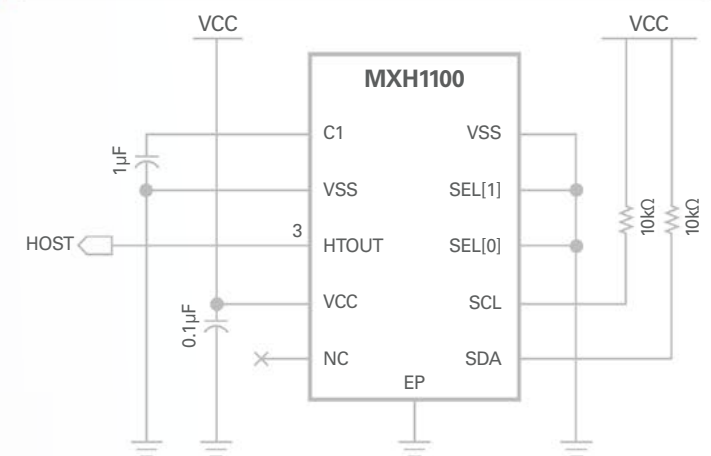


Laundry dryer

Electrical Characteristics

Parameter	Value
Operating voltage	VCC 4.5V ~ 5.5V
Operating temperature	-40°C ~ 125°C
Storage temperature	-55°C ~ 150°C
Measurement range	0% ~ 100% RH
Current consumption	65µA @ sleep 68µA @ average, 8-bit operation 270µA @ measurement 300µA @ HOUT enabled
PWM frequency	120Hz
Measurement frequency	2Hz @ analog/PWM/PDM modes
HTOUT driving load	Max. 10µF @ capacitive load Min. 1kΩ @ resistive load

Application Circuit



Environment Sensor Selection Guide

MXH2101

3.3V Digital Output
Temperature & Humidity Sensor



Key Features

- ◆ Package: 2.8mm x 3.6mm x 0.8mm 10-pin DFN with cavity
- ◆ Operating voltage: VDD 2.1V ~ 3.6V
- ◆ Various selectable outputs
 - I²C, SPI
 - PWM (humidity/temperature selectable)
 - PDM (humidity/temperature selectable)
- ◆ High accuracy tolerance: max. ±3%, max. ±0.5°C
- ◆ Low power consumption
- ◆ Programmable response time
- ◆ Adjustable output offset
- ◆ Excellent long-term stability
- ◆ Robust operation against external noise
- ◆ Field-proven endurance under 85°C, 85% environment

Applications



Weather station



Thermostat



Wearable

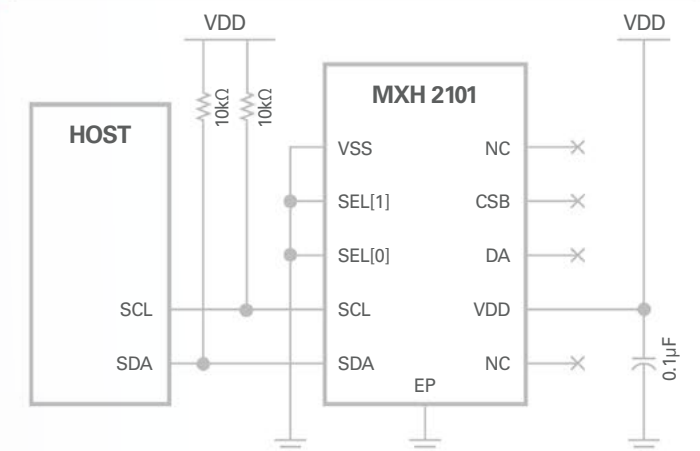


Agriculture system

Electrical Characteristics

Parameter	Value
Operating voltage	VDD 2.1V ~ 3.6V
Operating temperature	-40°C ~ 125°C
Storage temperature	-55°C ~ 150°C
Measurement range	0% ~ 100% RH
Current consumption	0.13μA @ sleep 68μA @ average, 8-bit operation
PWM frequency	120Hz
Measurement frequency	2Hz @ analog/PWM/PDM modes

Application Circuit



e-Compass Solutions

MAGIC Algorithm

Magnetometer Accelerometer Gyroscope Integral Calibration

Key Features

- ◆ 9-axis fusion algorithm
 - 3-axis e-compass, 3-axis accelerometer, 3-axis gyroscope
- ◆ Runtime automatic calibration by natural device movements
 - Conventional figure-8 motion
 - Tilt, single stroke swing, flip-flop motions
- ◆ Programmable parameter for accuracy and calibration speed
- ◆ Hard-iron compensation
- ◆ Virtual gyroscope in absence of physical gyroscope
- ◆ Memory-saving algorithm for light sensor hub
- ◆ Robust operation against external magnetic field disturbance

Value Propositions

- ◆ Modular configurable for memory size and performance
- ◆ Support for Qualcomm/MTK sensor hub and ARM platform
- ◆ Royalty-free library solution



Figure-8

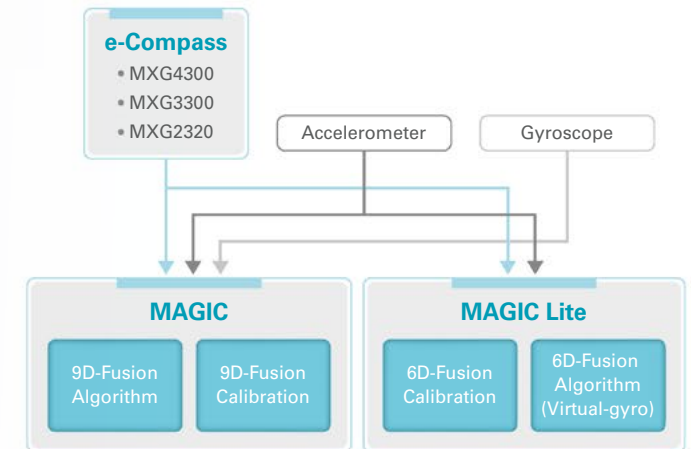
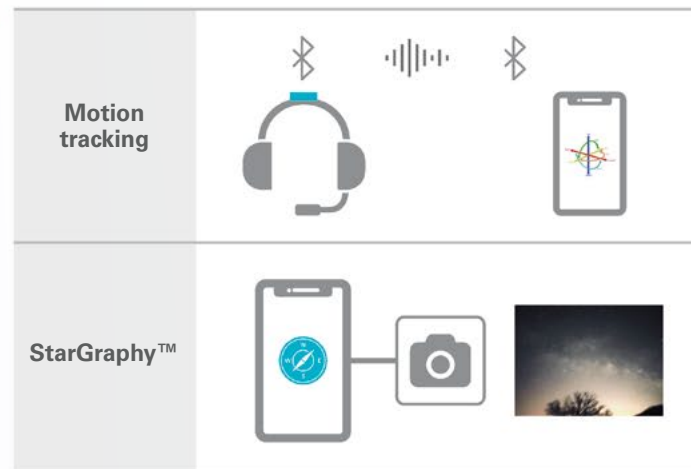


Tilt



Swing

Algorithm

MAGIC
Specialties
for Innovation

e-Compass Solutions

Motion Tracking

MAGIC Specialty IoT/VR/AR Solution for 3D Tracking

Key Features

- ◆ Real-time 3D tracking of object movement and orientation
 - Linear movement and acceleration
 - Rotation, spinning, tilting and swing movement
 - Object orientation angle to the north direction
- ◆ Relative orientation detection between multiple devices
- ◆ Low power consumption by battery-powered BLE
- ◆ Robust operation against external magnetic field disturbance

Value Propositions

- ◆ Off-the-shelf solution by library (Android, MS Windows) and reference boards
- ◆ Extended battery life with low power mode
- ◆ Optimized solution for VR & AR applications



Motion detection



3D virtual sound

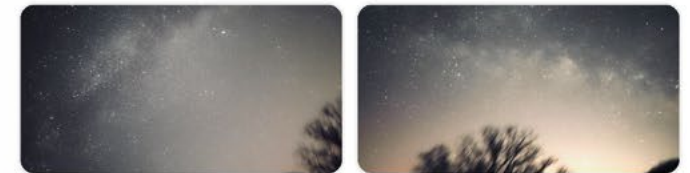
e-Compass Solutions

Star Tracking (StarGraphy™)

MAGIC Specialty Photo Solution for Tracking Stars in Night Sky

Key Features

- ◆ Patent-pending Haechitech proprietary IP
- ◆ Real-time stars tracking in night sky
 - Identifying the axis of the Earth rotation
 - Synthesizing multiple photos to amplify star light
- ◆ Compensating star trajectory with GPS and MAGIC



Value Propositions

- ◆ Milky way photo capturing tool with smartphone camera
- ◆ Unlimited exposure time regardless of the Earth rotation
- ◆ Unlimited ISO sensitivity by multiple photo stacking



Original image

Image composition
algorithm

Sharp and clear
image

Hall Sensor Solutions

Contactless Slide Key

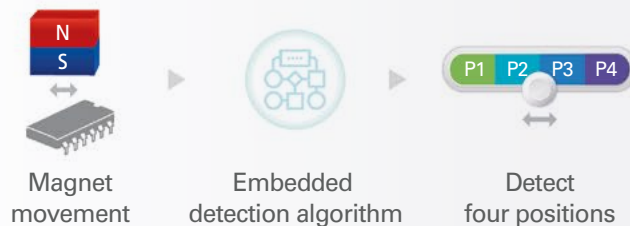
High Accuracy Robust Slide Key Solution

Key Features

- ◆ Detect 4 magnet positions without the host
- ◆ Low-cost solution with single chip stand-alone operation
- ◆ Robust and high accuracy with contactless switching
- ◆ Run-time programmable non-volatile Bop/Brp by the host
- ◆ Flexible output types (interrupt output, switch output)

Value Propositions

- ◆ Simple and low-cost solution
- ◆ High endurance operation without mechanical contacts
- ◆ Robust solution to environmental stress like water, humidity and dust



Hall Sensor Solutions

Rotary Knob

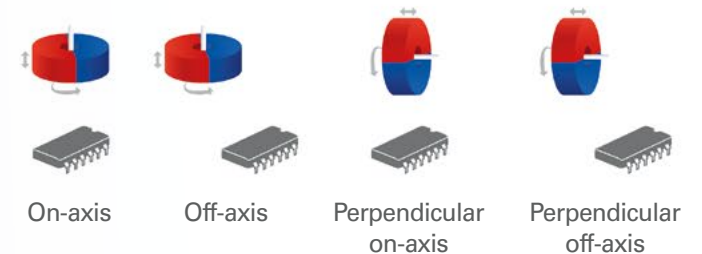
Low Power 3D Movement Detection Solution for Rotation Dial

Key Features

- ◆ Patent-pending Haechitech proprietary IP
- ◆ Real-time precise 360 degrees angle measurement
 - On/off-axis rotation
 - Perpendicular rotation
- ◆ Push-button detection by proximity measurement
- ◆ Robust operation against external magnetic field disturbance

Value Propositions

- ◆ Low power and reliable rotary knob solution
- ◆ Flexible design free from mechanical structure
- ◆ Waterproof and high endurance operation free from mechanical or electrical contacts



Hall Sensor Solutions

Sliding Distance Measurement

Contactless High Accuracy Magnetic Linear Encoder

Key Features

- ◆ Composed of MXM series sensor, magnet and MCU
 - Custom algorithm
 - I²C interface
- ◆ Support for absolute or incremental position detection
 - One sensor and one multi-pole magnet (incremental)
 - One sensor and one 2-layer multi-pole magnet (absolute)
 - Multiple sensors and one single-pole magnet (absolute)
- ◆ High accuracy and high resolution
 - Resolution: 10μm
 - Accuracy: ±20μm
 - Measurement rate: 500Hz

Value Propositions

- ◆ Off-the-shelf design solution (library, reference boards)
- ◆ High endurance operation with non mechanical contacts
- ◆ Robust solution to environmental stress like water, humidity and dust



Rollable phone



Rollable TV



Slide phone

Hall Sensor Solutions

Folding Angle Measurement

Contactless Magnetic Angle Detection Solution

Key Features

- ◆ Composed of MXM series sensor, magnet and MCU
 - Custom algorithm
 - I²C interface
- ◆ Optimal algorithm for converting 3D magnetic field to rotation angle
- ◆ High accuracy and high resolution
 - Measurement range: 0° ~ 180°
 - Resolution: 1°
 - Accuracy: ±3°
 - Measurement rate: 500Hz

Value Propositions

- ◆ Off-the-shelf design solution (library, reference boards)
- ◆ High endurance operation with non mechanical contacts
- ◆ Robust solution to environmental stress like water, humidity and dust



Foldable phone



Dual screen phone



Foldable display

Environment sensor Solutions

Temperature & Humidity Sensor Dongle

Compact USB & BLE Dongle for Temperature and Humidity Sensor Evaluation

Key Features

- ◆ Instant measurement with USB and BLE connectivity
 - Temperature and relative humidity of atmosphere
 - Thermal index, dew point and comfort index
- ◆ Multi-platform support from Android to MSWindows
- ◆ Evaluating accuracy and endurance of MXH series products
- ◆ Robust operation against salty air and harsh environment

Value Propositions

- ◆ Off-the-shelf application design by software suits and reference boards



Environment sensor Solutions

Multi Evaluation System

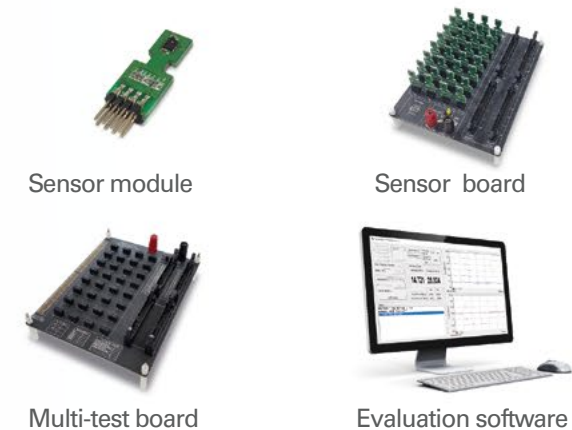
Massive Evaluation Tool for Haechitech MXHxxxx Product Series

Key Features

- ◆ Massive evaluation tool for temperature and humidity sensor
- ◆ Flexible evaluation capacity
 - 32 units per board
 - Max. 4 boards connection for analog output
 - Max. 2 boards connection for I²C digital interface
- ◆ Fully automated evaluation system (board, controller, software)

Value Propositions

- ◆ Off-the-shelf evaluation system by library and reference boards



Common Solutions

Product Evaluation Kit

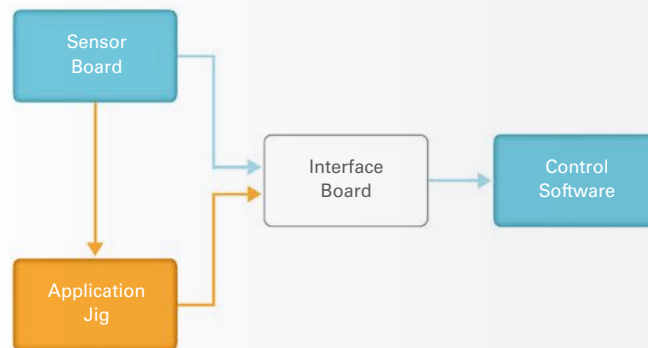
Universal Evaluation Kit for Haechitech Products

Configuration

- ◆ Universal kit to fully evaluate Haechitech products
 - Automated PC application (MS windows platform)
 - Easy control access to all registers and data for optimization
 - Graphical display of measurement output data
- ◆ Versatile evaluation jig to physically emulate target applications
- ◆ Signal post-processing capability for user algorithm development

Value Propositions

- ◆ Off-the-shelf evaluation and design by software suits and reference boards



Sensor Board



Application Jig



Interface Board



Control Software

