■ General Description

OCH1973 is a 3D magnetic position sensor IC with high sensitivity and wide measurement range utilizing our latest Hall sensor technology.

The OCH1973 provides a 16-bit ADC to convert the internal X, Y and Z axes magnetic field signal into a digital output. These digital values are available via I^2C, where the OCH1973 is a slave on the bus.

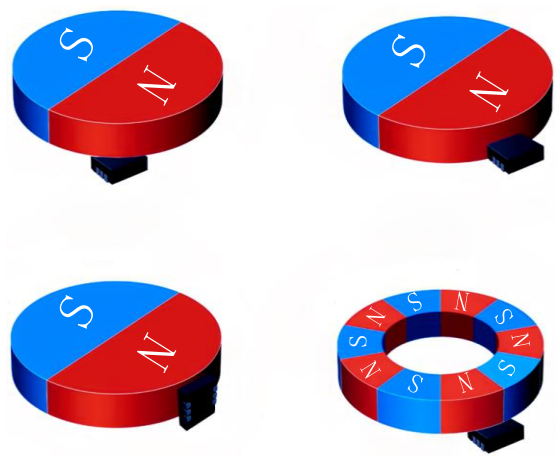
OCH1973 also provides an angle calculate information via 8-bit ADC output. The IC supports XY、XZ、YZ plane angle output by register setting.

Our ultra-small package of OCH1973 incorporates magnetic sensors, chopper stabilized signal, amplifier chain, and all necessary interface logic for detecting weak to strong magnetic fields in the X, Y and Z planes independently. From its compact foot print, thin package, and extremely low power consumption, it is suitable for a smartphone and wearable application.

The OCH1973 is available in DFN1616-6L DFN1209-5L and SOT23-6L package and is rated over the -40℃ to 85℃.

■ Features

- Operating supply voltage: +1.7V to +3.6V
- Operating temperatures: -40℃~+85℃
- 16 bit data out for each 3-axis magnetic component
- Programmable threshold 3-axis magnetometer
- Selectable sensor measurement range and sensitivity setting:
  ★High sensitivity setting
  Sensitivity: 1.1 μT/LSB (typ.)
  Measurement range: ± 36 mT
  ★Wide range setting
  Sensitivity: 3.1 μT/LSB (typ.)
  Measurement range: ± 50.7 mT(X/Y), ±101.5mT(Z)
- Selectable sensor drive
  ★Low power driver / Low noise drive
- Serial interface：
  ★I2C bus interface
- Operation mode：
  ★Power-down
  ★Single measurement
  ★Continuous measurement
- Output pin for event notification
- Magnetic sensor overflow monitor function
- Switch or Burst_out output flag
- Butt_out output flag
- 8 bit cordic angle information output
- Package：
  ★DFN1616-6L: 1.6mm x 1.6mm x 0.55mm
  ★DFN1209-5L: 1.2mm x 0.9mm x 0.37mm
  ★SOT23-6L
- RoHS Compliant

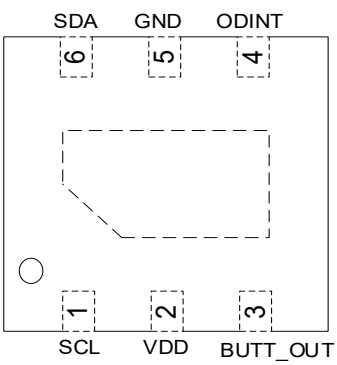


■ Applications

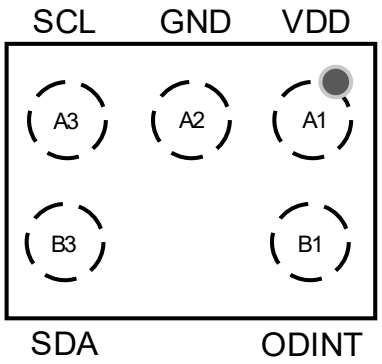
- Smartwatch
- Knob Switch
- Position Detection
- Battery-operated appliances

■ Pin Configuration

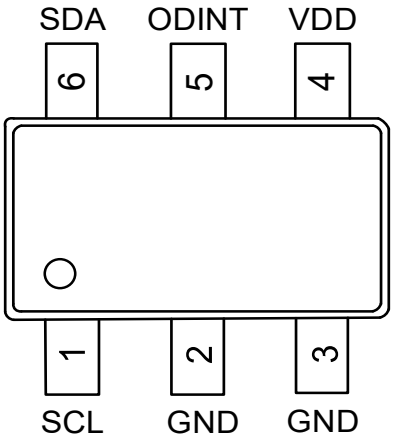
(Top View)



DFN1616-6L



DFN1209-5L



SOT23-6L

Figure 1, Pin Assignments of OCH1973

Pin Name	DFN1616-6L	DFN1209-5L	SOT23-6L	Pin Function
SCL	1	A3	1	SCL: Control clock input pin Input: Schmitt trigger, Output: Open-drain
VDD	2	A1	4	Positive power supply pin
BUTT_OUT	3	-	-	Open-drain interrupt pin, for button event notification.
OD_INT	4	B1	5	Open-drain interrupt pin, for event notification.
GND	5	A2	2,3	Ground pin
SDA	6	B3	6	SDA: Control data input/output pin Input: Schmitt trigger, Output: Open-drain

■ Typical Application Circuit

I2C bus interface:

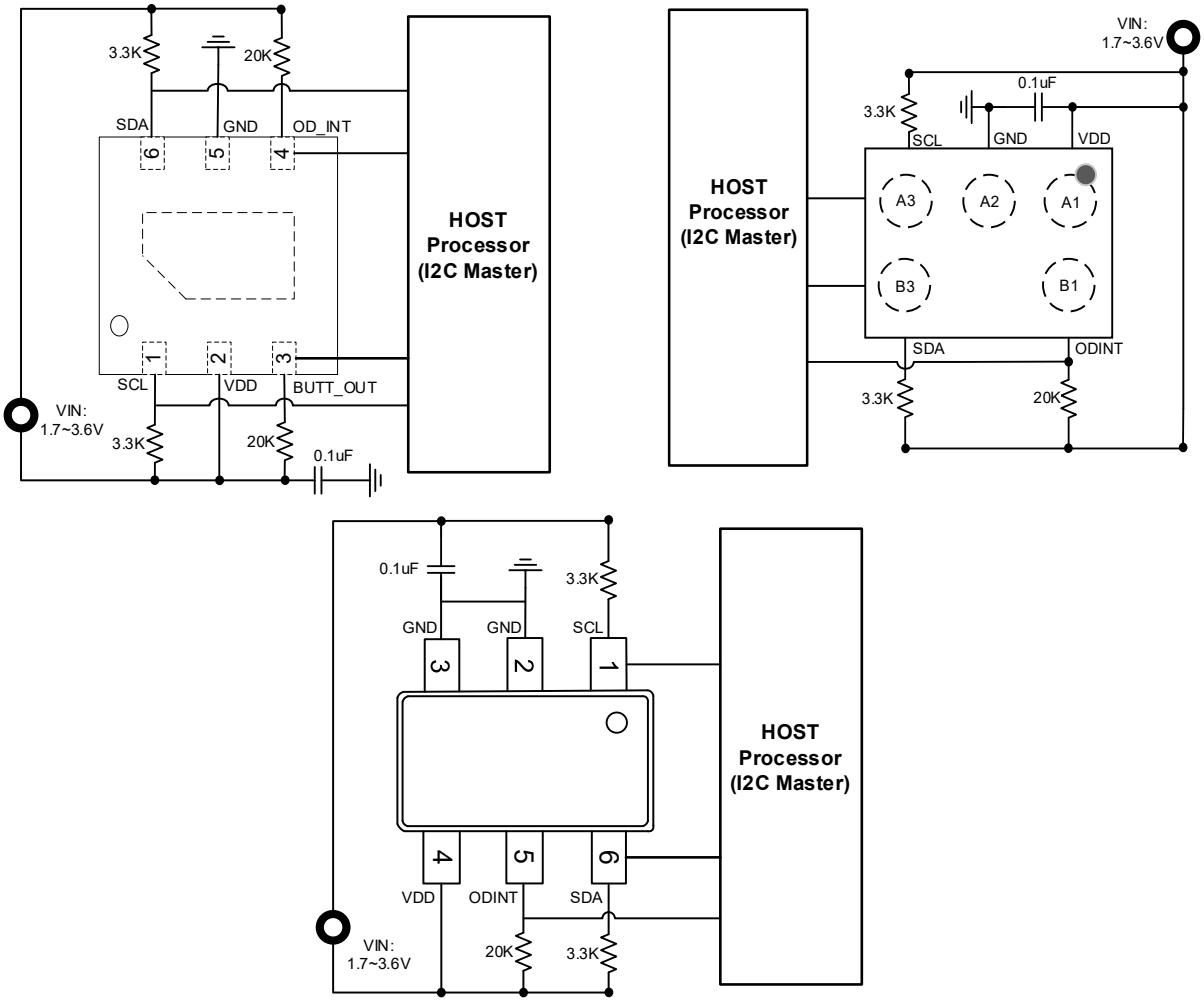


Figure 2, Typical Application Circuit of OCH1973

■ Ordering Information

Part Number	Package Type	Packing Qty.	Temperature	Eco Plan	Lead
OCH1973EV6AD	DFN1616-6L	3000	-40~ +85℃	ROHS	Cu
OCH1973FVAD	DFN1209-5L	3000	-40~ +85℃	ROHS	Cu
OCH1973WAD	SOT23-6L	3000	-40~ +85℃	ROHS	Cu

■ Block Diagram

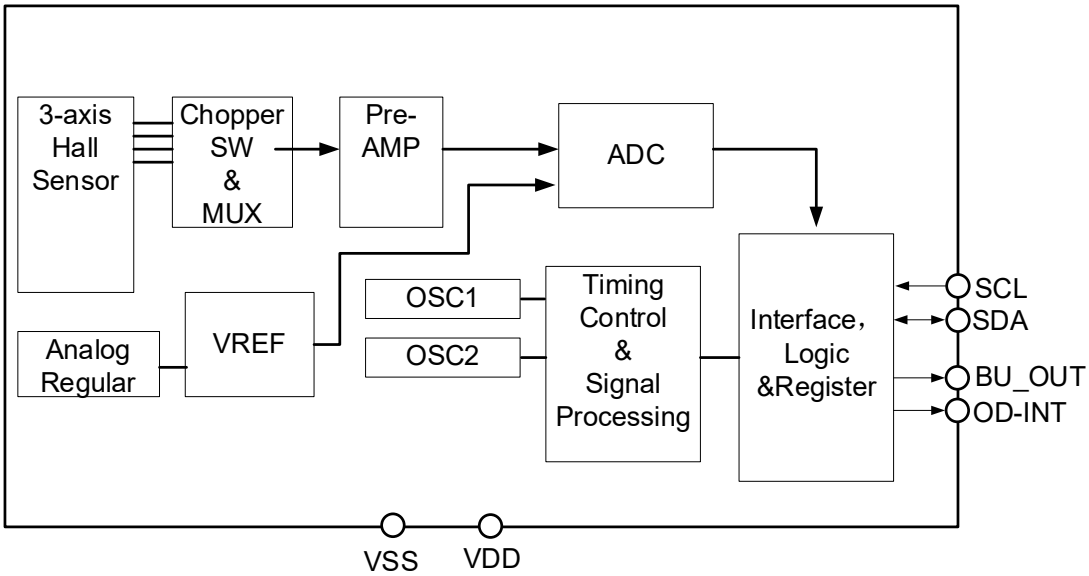


Figure 3, Block Diagram of OCH1973

■ Absolute Maximum Ratings* [1] (T_A=25°C, unless otherwise noted)

Parameter	Symbol	Rating	Unit
V_{DD} Pin to GND	V_{DD}	-0.3~+4.3	V
Input voltage	V_{IN}	-0.3~V_{DD}+0.3	V
Input current	I_{IN}	-10~+10mA	mA
Junction temperature	T_J	150	°C
Storage Temperature Range	T_S	-55 to +150	°C
Thermal Resistance	θJA	250	℃/W
Operating Junction Temperature Range	T_J	-40 to +150	°C
Maximum Soldering Temperature (at leads, 10 sec)	T_{LEAD}	260	°C

■ Recommended Operating Conditions* [2]

Parameter	Symbol	Rating	Unit
V_{DD} Pin Voltage to GND	V_{DD}	1.7 to 3.6	V
Operating junction Temperature Range	T_{OP}	-40 to +85	℃

Note:
1. Stresses above those listed in absolute maximum ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one absolute maximum rating should be applied at any one time.
2. The device is not guaranteed to function outside of its operating conditions.

■ Electrical Characteristics

The following conditions apply unless otherwise noted: V_{DD} = 1.7V to 3.6V, Temperature range = -40~+85℃, Typical condition: V_{DD} = 1.8 V, Temperature = 25 ℃。

DC Characteristics

Parameter	Symbol	Pin	Conditions	Min.	Typ.	Max.	Unit
High level input voltage	VIH	SCL SDA	-	0.95	-	V_{DD}	V
Low level input voltage	VIL		-	-0.3	-	0.4	V
Input current	IIN		VIN=VSS or VDD	-10	-	+10	μA
Hysteresis input voltage* [3]	VHS	SCL SDA	VDD≥2V	5%V_{DD}	-	-	V
			VDD＜2V	10%V_{DD}	-	-	
Low level output voltage* [4]	VOL	SDA ODINT BUTT_OUT	IOL2≤+3mA VDD≥2V	-	-	0.4	V
			IOL2≤+3mA VDD＜2V	-	-	20%V_{DD}	V
Current consumption* [5]	IDD1	VDD	Power-down mode	-	9	13	μA
	IDD2		Standby current	-	9	13	μA
	IDD3		When magnetic sensor is driven	-	1.6	-	mA
	IDD4		SDR=0, ODR=100HZ	-	110	-	μA
	IDD5		SDR=1, ODR=100HZ	-	40	-	μA

Notes:
3. Schmitt trigger input (reference value for design).
4. Output is open-drain. Connect to a pull-up resistor externally.
5. Without any resistance load.

AC Characteristics

Parameter	Symbol	Pin	Condition	Min.	Typ.	Max.	Unit
Power supply rise time* [6]	PSUP	VDD	Period of time that VDD changes from 0.2V to Vdd.			50	ms
POR completion time* [6]	PORT		Period of time after PSUP to Power-down mode* [7]			100	us
Power supply turn off voltage* [6]	SDV	VDD	Turn off voltage to enable POR to restart* [7]			0.2	V
Power supply turn on interval* [6]	PSINT	VDD	Period of time that voltage lower than SDV needed to be kept to enable POR to restart	100			us
Wait time before mode setting	Twait			100			us

Notes:
6. Reference value for design.
7. When POR circuit detects the rise of VDD voltage, it resets internal circuits and initializes the registers. After reset, OCH1973 transits to Power-down mode.

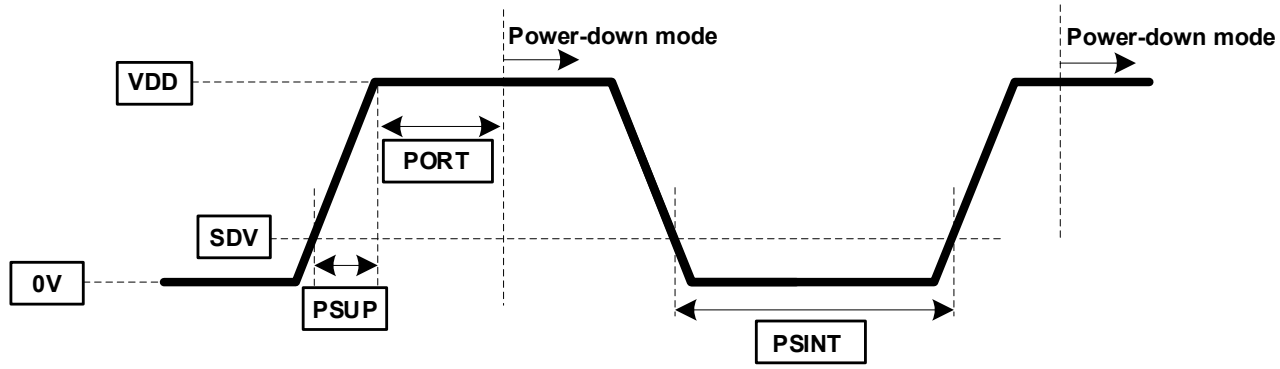


Figure 4, Reset condition

AC Characteristics of ODINT and BUTT_OUT

Parameter	Symbol	Pin	Conditions	Min.	Typ.	Max.	Unit
Fall time of OD-INT	Tf_ODINT	OD_INT	CL = 50 Pf RL=20k Ω (typ.)	-	-	1	us
Fall time of BU_OUT	Tf_BUTT_OUT	BUTT_OUT	CL = 50 Pf RL=20k Ω (typ.)	-	-	1	us

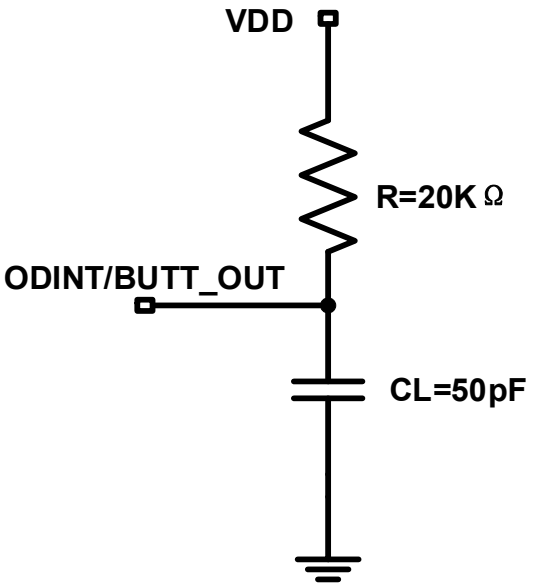


Figure 5, Output load circuit of OD-INT (recommended circuit)

Rise time and fall time：

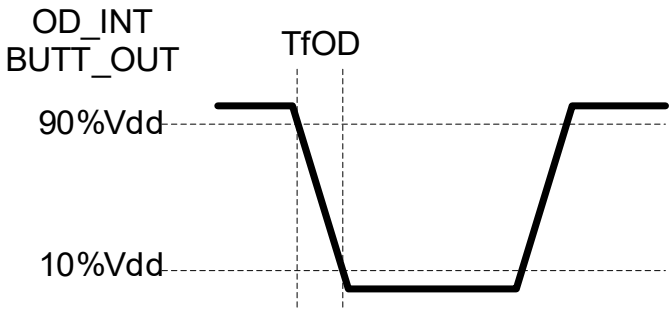


Figure 6, fall time

■ Overall Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Measurement data output bit	DBIT	-	-	16	-	Bit
Cordic Angle data output bit	DBIT	Ta=25℃, Angle_EN=1		8		Bit
Time for measurement	TSM	SDR=0 (Low noise drive)	-	0.75	-	ms
		SDR=1 (Low power drive)	-	0.32	-	
Magnetic sensor sensitivity1	BSE1	Ta=25℃, SMR bit = "0"	0.99	1.1	1.21	μT/LSB
Magnetic sensor sensitivity2	BSE2	Ta=25℃, SMR bit = "1"	2.79	3.1	3.41	μT/LSB
Angle sensor sensitivity	ASE	Ta=25℃, Angle_EN=1		1.4		deg/LSB
Magnetic sensor measurement range1	BRG1	Ta=25℃, SMR bit = "0"	±32.44	±36.04	±39.64	mT
Magnetic sensor measurement range2	BRG2	Ta=25℃, X and Y-axis, SMR bit = "1"	±45.71	±50.79	±55.87	mT
		Ta=25℃, Z-axis, SMR bit = "1"	±91.42	±101.57	±111.73	
Magnetic sensor initial offset* [8]	BOF1	Ta=25℃, SMR bit = "0" X and Y-axis	-614	-	+614	LSB
		Ta=25℃, SMR bit = "0" Z-axis	-868	-	+868	LSB
Magnetic sensor initial offset* [8]	BOF2	Ta=25℃, SMR bit = "1" X and Y-axis	-218	-	+218	LSB
		Ta=25℃, SMR bit = "1" Z-axis	-308	-	+308	LSB
Operation angle calculation magnetic field* [9]	B_O	Ta=25℃, Angle_EN=1	10	20	-	mT
Angel INL error* [10]	INL	Ta=25℃, Angle_EN=1 B=20mT	-	0.7	-	Deg
Magnetic Noise* [10]	BNIS	SMR=0 SDR=0 (Low noise drive)	-	9.7	-	μTrms
		SMR=0 SDR=1 (Low power drive)	-	19.5	-	
		SMR=1 SDR=0 (Low noise drive)		11.8		
		SMR=1 SDR=1 (Low power drive)		23.9		
Angle Noise* [10]	ANIS	SMR=0 SDR=0 (Low noise drive)	-	0.08	-	degrms
		SMR=0 SDR=1 (Low power drive)		0.16		
		SMR=1 SDR=0 (Low noise drive)		0.14		
		SMR=1 SDR=1 (Low power drive)		0.20		

Note:
8. Value of measurement data register on shipment test without applying magnetic field on purpose.
9. If the magnetic field is too small, the cordic Angle accuracy will be affected, and the magnetic field don't exceed the measurement range.
10. Reference value for design. Under steady magnetic field.

■ I2C Bus Interface

I2C bus interface is compliant with Standard mode and Fast mode. Standard/Fast is selected automatically by fSCL.

Standard mode (fSCL≤100 kHz)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
SCL clock frequency	fSCL	-	-	-	100	kHz
SCL clock “High” time	tHIGH	-	4.0	-	-	us
SCL clock “Low” time	tLOW	-	4.7	-	-	us
SDA and SCL rise time	tR	-	-	-	1000	ns
SDA and SCL fall time	tF		-	-	300	ns
Start Condition hold time	tHD:STA	-	4.0	-	-	us
Start Condition setup time	tSU:STA	-	4.7	-	-	us
SDA hold time (vs. SCL falling edge)	tHD:DAT	-	0.05	-	3.45	us
SDA setup time (vs. SCL rising edge)	tSU:DAT	-	0.25	-	-	us
Stop Condition setup time	tSU:STO	-	4.0	-	-	us
Bus free time	tBUF	-	4.7	-	-	us
Capacitive load for SCL and SDA	C_B		-	-	0.4	nF

Fast mode (100 kHz ＜fSCL≤400 kHz)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
SCL clock frequency	fSCL	-	-	-	400	kHz
SCL clock “High” time	tHIGH	-	0.6	-	-	us
SCL clock “Low” time	tLOW	-	1.3	-	-	us
SDA and SCL rise time	tR	-	-	-	300	ns
SDA and SCL fall time	tF		-	-	300	ns
Start Condition hold time	tHD:STA	-	0.6	-	-	us
Start Condition setup time	tSU:STA	-	0.6	-	-	us
SDA hold time (vs. SCL falling edge)	tHD:DAT	-	0.05	-	0.9	us
SDA setup time (vs. SCL rising edge)	tSU:DAT	-	0.1	-	-	us
Stop Condition setup time	tSU:STO	-	0.6	-	-	us
Bus free time	tBUF	-	1.3	-	-	us
Noise suppression pulse width	tSP	-	-	-	50	ns
Capacitive load for SCL and SDA	C_B	-	-	-	0.4	nF

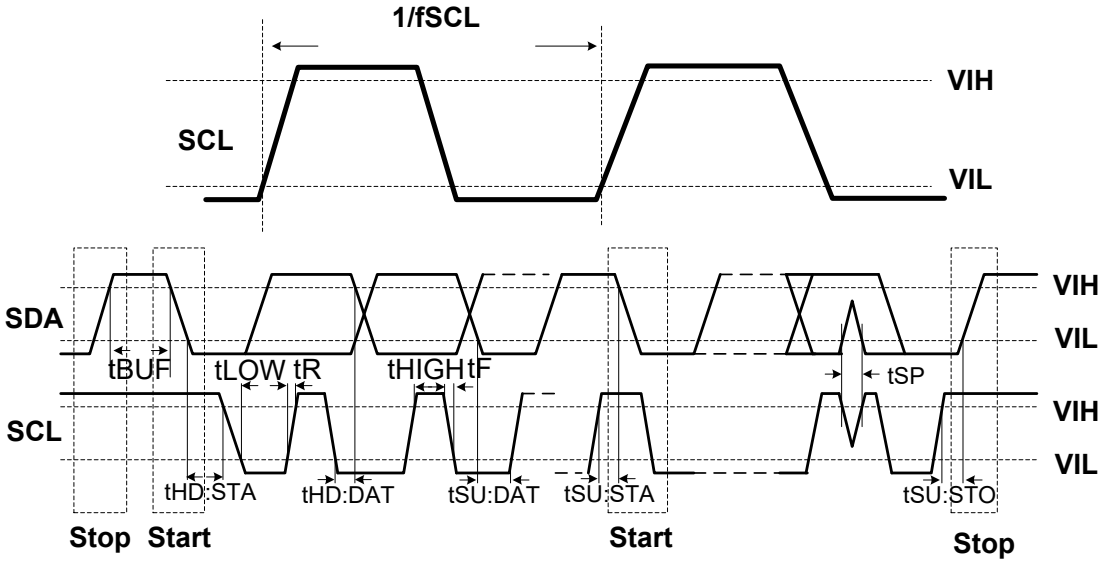
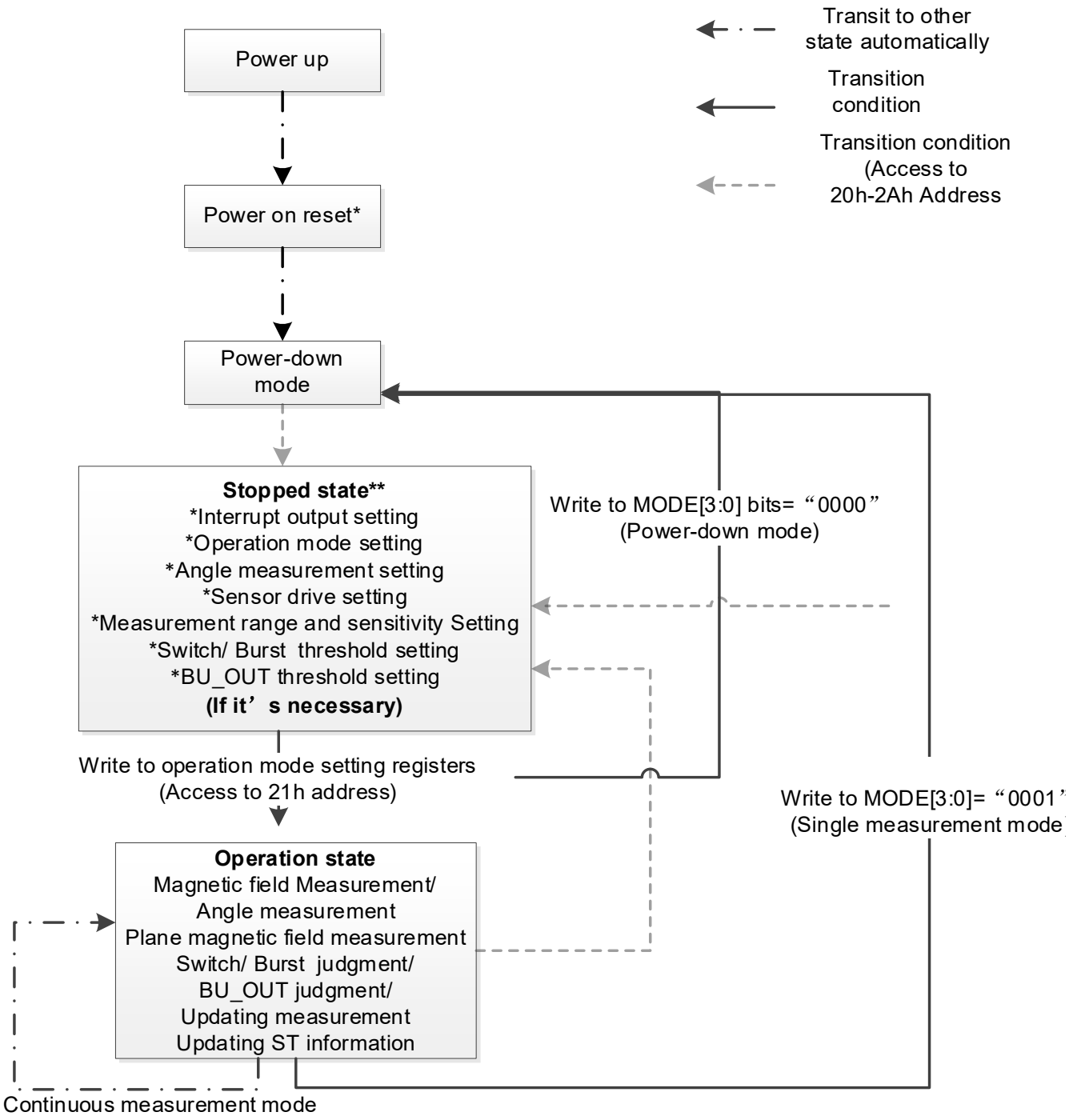


Figure 7, I2C bus interface timing

■ State Transition Diagram



*After reset is completed, all registers are initialized and OCH1973 transits to Power-down mode automatically.

Figure 8, State transition diagram

■ Power States

When VDD is turned on from Vdd = OFF (0 V), all registers in OCH1973 are initialized by POR circuit and transit to Power-down mode automatically.

Table 1, Power States

State	VDD	Power state
1	OFF (0V)	OFF (0V). It doesn't affect external interface.
2	1.7V to 3.6V	ON

■ Reset Functions

OCH1973 has two types of reset;

I. Power on Reset (POR)
When VDD rise is detected, POR circuit operates, and OCH1973 is reset. After reset is completed, all registers are initialized and OCH1973 transits to Power-down mode.

II. Soft reset
OCH1973 is reset by setting SRST bit = "1". After reset is completed, all registers are initialized and OCH1973 transits to Power-down mode automatically.

■ Operation modes

OCH1973 has following eight operation modes:

(1) Power-down mode (MODE[4:0] bits = "00000")
(2) Single measurement mode (MODE[4:0] bits = "00001")
- Sensor is measured for one time and data is output. Transits to Power-down mode automatically after measurement ended.

(3) Continuous measurement mode 1 (MODE[4:0] bits = "00010")
- Sensor is measured periodically in 5 Hz. Transits to other operation mode by writing MODE[4:0] bits directly.

(4) Continuous measurement mode 2 (MODE[4:0] bits = "00100")
- Sensor is measured periodically in 10 Hz. Transits to other operation mode by writing MODE[4:0] bits directly.

(5) Continuous measurement mode 3 (MODE[4:0] bits = "00110")
- Sensor is measured periodically in 20 Hz. Transits to other operation mode by writing MODE[4:0] bits directly.

(6) Continuous measurement mode 4 (MODE[4:0] bits = "01000")
- Sensor is measured periodically in 50 Hz. Transits to other operation mode by writing MODE[4:0] bits directly.

(7) Continuous measurement mode 5 (MODE[4:0] bits = "01010")
- Sensor is measured periodically in 100 Hz. Transits to other operation mode by writing MODE[4:0] bits directly.

(8) Continuous measurement mode 6 (MODE[4:0] bits = "01100")
- Sensor is measured periodically in 500 Hz. Transits to other operation mode by writing MODE[4:0] bits directly.

(9) Continuous measurement mode 7 (MODE[4:0] bits = "01110")
- Sensor is measured periodically in 1000 Hz. Transits to other operation mode by writing MODE[4:0] bits directly.

(10) Continuous measurement mode 8 (MODE[4:0] bits = "10000")
- Sensor is measured periodically in 2000 Hz. Transits to other operation mode by writing MODE[4:0] bits directly. This mode only enables when OCH1973 is set Low power mode (SDR bit = "1"). When set this mode on Low noise mode (SDR bit = "0"), sensor is measured periodically in 1000 Hz.

By setting CNTL2 registers MODE[4:0] bits, the operation set for each mode is started.
When power is turned ON and reset action, OCH1973 is in Power-down mode. When a specified value is set to MODE[4:0] bits, OCH1973 transits to the specified mode and starts operation.

■ Description of Each Operation Mode

Power-down Mode

Power to almost all internal circuits is turned off, all registers are accessible in Power-down mode and data stored in read/write registers still remains. They can be reset by soft reset function.

Single Measurement Mode

When Single measurement mode (MODE[4:0] bits = “00001”) is set, magnetic sensor measurement is started. After magnetic sensor measurement and signal processing is finished, measurement magnetic data is stored to measurement data registers (HX, HY, HZ, ANGLE and PLANE registers), then OCH1973 transits to Power-down mode automatically. On transition to Power-down mode, MODE[4:0] bits turns to “00000”. At the same time, DRDY bit in ST register turns to “1” and SW bits in ST register turns to another state when measurement magnetic data exceed a setup threshold value.

Continuous Measurement Mode 1,2,3,4,5,6,7 and 8

When Continuous measurement modes (1 to 8) are set, magnetic sensor measurement is started periodically at 5Hz, 10 Hz, 20 Hz, 50 Hz, 100 Hz, 500 Hz,1000Hz and 2000Hz respectively. After magnetic sensor measurement and signal processing is finished, measurement magnetic data is stored to measurement data registers and all circuits except for the minimum circuit required for counting cycle length are turned off (Power Save: PS). When the next measurement timing comes, OCH1973 wakes up automatically from PS and starts measurement again. Continuous measurement mode ends when a different operation mode is set or threshold value is reset. It repeats measurement until other operation mode is set or threshold value is reset. When user access to Setting Registers (address 20h to 2Ah), OCH1973 stops updating switch states and measurement data registers. After CNTL2 register (address 21h) is set again, a new measurement starts. ST register (without DRDY bit and DOR bit) and measurement data registers will not be initialized by this.

Table 2, Continuous measurement modes

Operation mode	Register setting (MODE[4:0] bits)	Measurement frequency [Hz]	Average current [uA] (SDR=0/SDR=1)
Continuous measurement mode 1	00010	5	16 / 12
Continuous measurement mode 2	00100	10	21 / 14
Continuous measurement mode 3	00110	20	31 / 17
Continuous measurement mode 4	01000	40	61 / 25
Continuous measurement mode 5	01010	100	114 / 41
Continuous measurement mode 6	01100	500	513 / 158
Continuous measurement mode 7	01110	1000	925 / 278
Continuous measurement mode 8	10000	2000	564 (SDR=1)

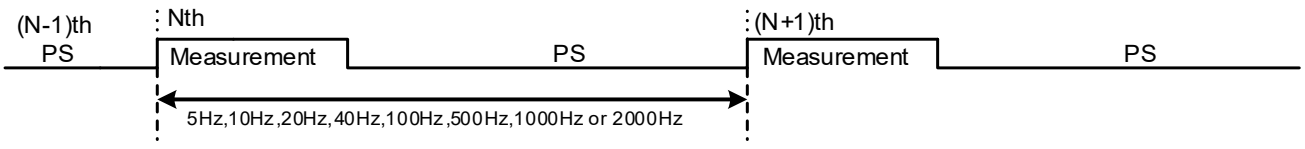


Figure 9, Continuous measurement modes

■ Data Ready

When measurement data is stored and ready to be read, DRDY bit in ST1 register turns to “1”. This is called “Data Ready”. When DRDYEN bit in CNTL1 register is ”1”, OD-INT pin notify user of the Data Ready state. When any of measurement data register (HX, HY, HZ, ANGLE and PLANE registers) is read all the way through or access to Setting Registers (address 20h to 2Ah), DRDY bit turns to “0”.

Normal Measurement Data Read Sequence

(1) Check Data Ready or not by any of the following method.
Monitor OD-INT pin
Polling DRDY bit of ST register
When Data Ready, proceed to the next step.

(2) Read ST and measurement data
When ST register and any of measurement data register (HX, HY, HZ, ANGLE and PLANE registers) is read all the way through, or access to Setting Registers (address 20h to 2Ah), OCH1973 judges that data reading is finished. When data reading is finished, DRDY bit and DOR bit turns to “0”

When measurement data register is accessed, OCH1973 judges that data reading is started. Stored measurement data is protected during data reading and data is not updated. By reading measurement data register is finished, this protection is released. OCH1973 needs to stay in the PS stage When reading measurement data register is finished.

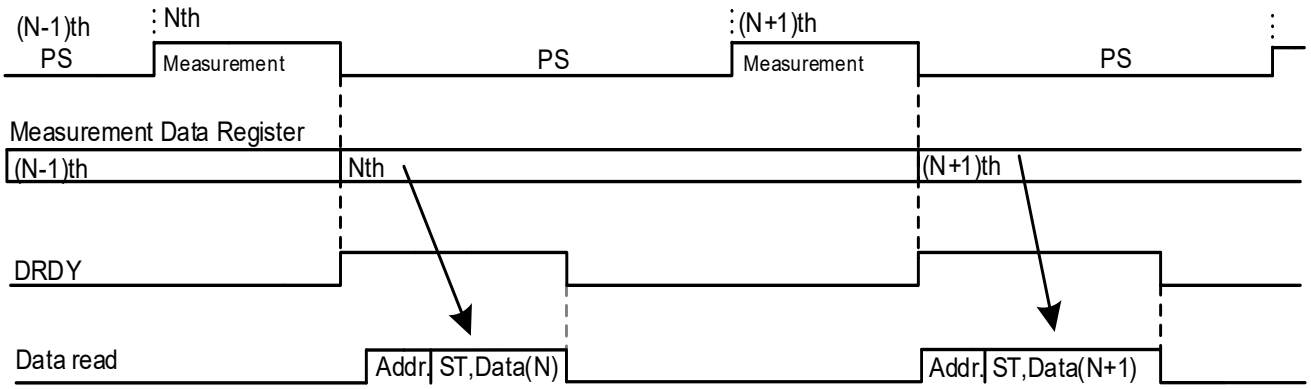


Figure 10, Timing chart of Measurement data read

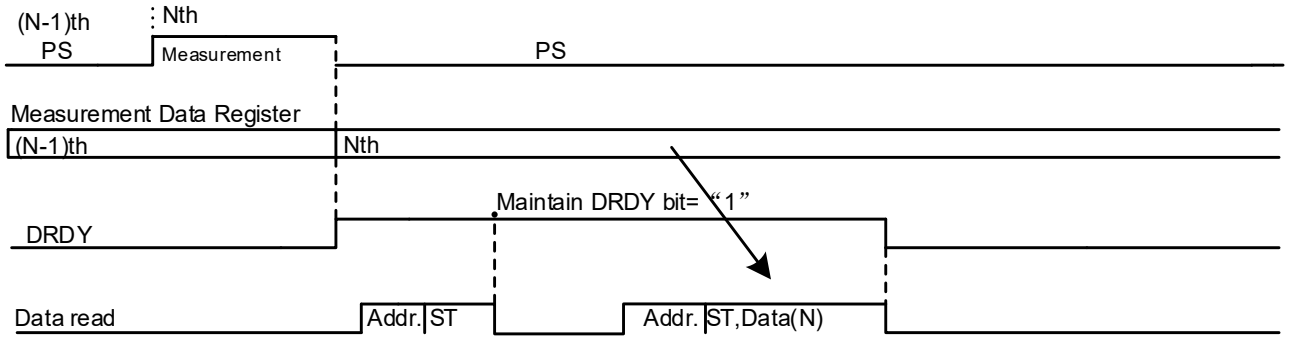


Figure 11, Timing chart of ST data read

Data Skip

When Nth data was not read before (N+1)th measurement ends, Data Ready remains until data is read. In this case, a set of measurement data is skipped so that DOR bit turns to “1”. DOR bit turns to “0” at the (N+2)th measurement ended.

When data reading started after Nth measurement ended and did not finish reading before (N+1)th measurement ended, Nth measurement data is protected to keep correct data. In this case, a set of measurement data is not skipped and stored after finish reading Nth measurement data so that DOR bit=”0”.

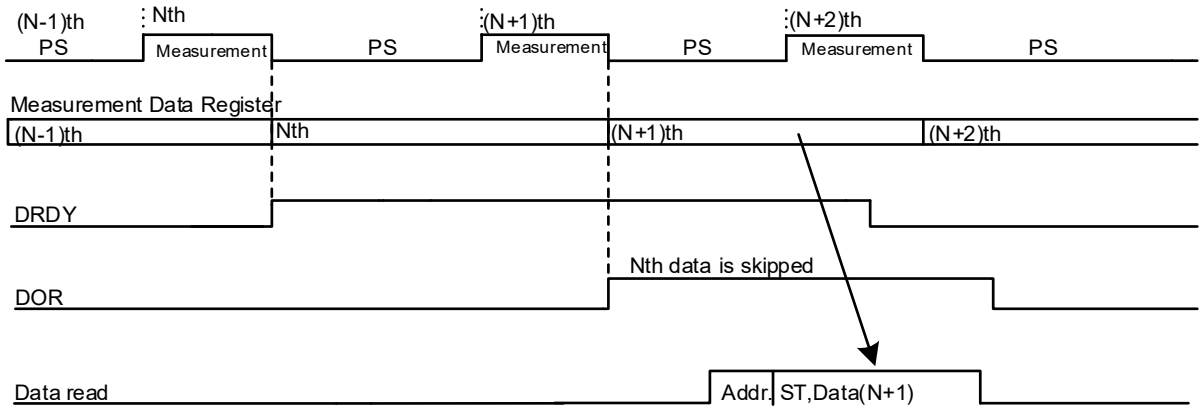


Figure 12, Data Skip: When data is not read

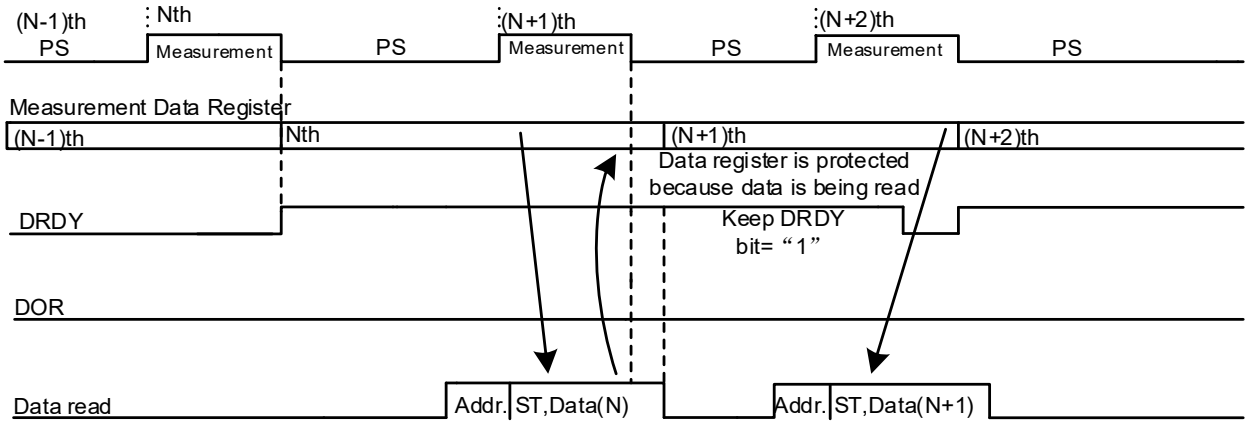


Figure 13, Data Not Skip: When data read has not been finished before the next measurement end

End Operation

Set Power-down mode (MODE[4:0] bits = “00000”) to end Continuous measurement mode.

■ Programmable Switch Function

OCH1973 has a programmable switch function created by setting switch threshold values (operating threshold[*11] and returning threshold[*12]), switch function enable. When measurement magnetic data or angle data exceed the operating threshold value, switch event bit (SW bits[*13]) turns to "1". When measurement magnetic data or angle data is lower than the returning threshold, SW bits turns to "0". The switch function is used to check the magnitude relation between the measurement data and the switch threshold values. After the magnetic sensor measurement and signal processing has finished, measurement data is stored to the measurement data register. Then the OCH1973 compares the measurement data with the defined switch threshold values and outputs the comparison result at the SW bits in ST register. Switch thresholds can be free to set (Settable range: same as measurement range. Settable sensitivity: same as measurement sensitivity).

Note:
11. Magnetic threshold：BOPX1[15:0], BOPX2[15:0], BOPY1[15:0], BOPY2[15:0], BOPZ1[15:0], BOPZ2[15:0]
    Angle threshold：BOPA1[7:0]
12. Magnetic threshold：BRPX1[15:0], BRPX2[15:0], BRPY1[15:0], BRPY2[15:0], BRPZ1[15:0], BRPZ2[15:0],
    Angle threshold：BRPA1[7:0]
13. SWX1 bit, SWX2 bit, SWY1 bit, SWY2 bit, SWZ1 bit, SWZ2 bit and SWA1 bit

Table 3, Relation between threshold values and SWX1 bit[*14]

Relation between BOPX1 and BRPX1	Magnitude relation between measurement data and threshold values	SWX1 bit result
BOPX1 ≤ BRPX1 (Switch function disable)	Don't care	Don't care
BOPX1 > BRPX1 (Switch function enable)	BOPX1 < HX	1
	BRPX1 > HX	0
	Other relations	Previous result

Table 4, Relation between threshold values and SWX2 bit[*14]

Relation between BOPX2 and BRPX2	Magnitude relation between measurement data and threshold values	SWX2 bit result
BOPX2 ≤ BRPX2 (Switch function disable)	BOPX2 > HX	1
	BRPX2 < HX	0
	Other relations	Previous result
BOPX2 > BRPX2 (Switch function enable)	Don't care	Don't care

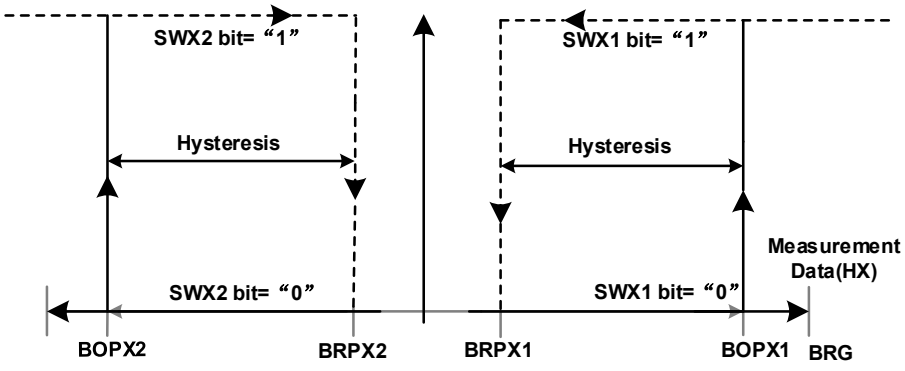


Figure 14, Relation between threshold values and SWX1, SWX2 bit[*14]

Note:
14. SWY1 bit, SWY2 bit, SWZ1 bit, SWZ2 bit and SWA1 bit exhibits the same relationship.

■ Button Function

OCH1973 has a Button function created by setting Button threshold values and SWBUTTEN set “1”, Button function enable. When the selected plane magnetic data exceed the operating threshold value, Button event bit (SWBUTT bit) turns to “1”. When the selected plane magnetic data is lower than the returning threshold, SWBUTT bit turns to “0”.

Table 5, Relation between threshold values of B_{XY}[*15] and SWBUTT bit

Relation between BOPBUTT and BRPBUTT	Magnitude relation between measurement data and threshold values	SWBUTT bit result
BOPBUTT ≤ BRPBUTT (Button function disable)	Don’t care	Don’t care
BOPBUTT > BRPBUTT (Button function enable)	BOPBUTT ≤ B_{XY}[*15]	1
	BRPBUTT > B_{XY}	0
	Other relations	Previous result

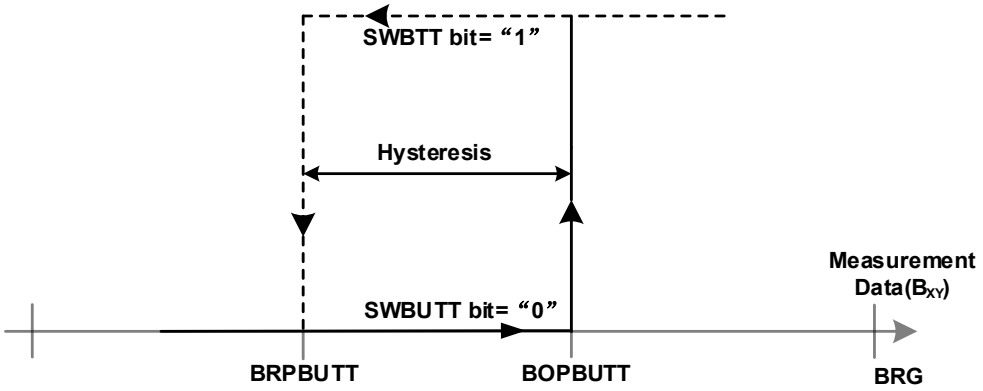


Figure 15, Relation between threshold values of B_{XY} and SWBUTT bit

Note:

15. B_{XY} is the value of the magnetic field in the X-axis and Y-axis planes. B_{YZ} and B_{XZ} exhibits the same relationship.

■ Burst Function

OCH1973 has a Burst function created by setting burst threshold values. When BURSTEN is set “1”, BOPX1, BOPY1, BOPZ1, and BOP_A1 can be set in the SW register configuration, while the Settings of other relevant registers are invalid. When ANGLEEN is set “1”, the angle burst can be used. If |Bn-Bn-1| or |An-An-1| exceed the burst threshold value, burst event bit (BURST bit) turns to “1”. When read address 11h to 17h, 19h to 1Ch or write address 20h to 2Ah, BURST bit turns to “0”.

Table 6, Relation between burst threshold values of X-axis[*16] and BURST bit

Magnitude relation between measurement data and burst threshold values	BURST bit result
BOPX1 ⩽ |Bn-Bn-1|	**1**
BOPX1 ＞|Bn-Bn-1|	**Previous result**

Note:

16. X-axis, Y-axis, Z-axis and Angle exhibits the same relationship.

■ Magnetic Sensor Overflow

OCH1973 has a limitation for measurement range, where the absolute value of X-axis, Y-axis and Z-axis should be smaller than 36.04 mT (High sensitivity mode) or X-axis and Y-axis should be smaller than 50.79 mT (Wide range mode), Z-axis should be smaller than 101.5mT (Wide range mode). When the magnetic field exceeds this limitation, OCH1973 outputs limitation value at the X-axis and Y-axis (fixed value: 36.04 mT or 50.79 mT). This is called magnetic sensor overflow. When magnetic sensor overflow occurs, ERRXY bit turns to “1”. When the magnetic field less than limitation value, measurement data register (HX and HY) and ERRXY bit are updated.

■ ADC Overflow

OCH1973 has a limitation for ADC range, when the magnetic field exceeded this limitation, data stored at measurement data registers (HX, HY and HZ) are not correct. This is called ADC overflow. When ADC overflow occurs, ERRADC bit turns to “1”. When measurement data registers are updated, ERRADC bit is updated.

■ Interrupt Function

OCH1973 has two Open-drain interrupt pins (OD-INT pin and BUTT_OUT pin). When CNTL1 register is set and interrupt event occurred, OCH1973 outputs selected interrupt event at OD-INT pin and BUTT_OUT pin. OCH1973 can output four type of interrupt events (Switch event, Data ready, Burst-out，Error event) to OD-INT pin and a Button event to BUTT_OUT. Switch event occurs when measurement data is higher than BOP value and ODINTEN bit = "1" or when measurement data is lower than BRP value and ODINTEN bit = "0". When interrupt Switch event or Data ready or Burst-out or Error event occurs, OD-INT pin turns to "L". Button event occurs when measurement data is higher than BOPBUTT value and BUTTEN bit = "1" or when measurement data is lower than BRPBUTT value and ODINTEN bit = "0". When interrupt Button event occurs, BUTT_OUT pin turns to "L".

Table 7, Relation between threshold values of X-axis and OD-INT pin*17

Relation between BOPX1 and BRPX1	Magnitude relation between measurement data and threshold values	ODINT-pin	
		ODINTEN= "0"	ODINTEN= "1"
BOPX1 ≤ BRPX1 (Switch function disable)	Don't care	Don't care	
BOPX1 > BRPX1 (Switch function enable)	BOPX1 < HX	H	L
	BRPX1 > HX	L	H
	Other relations	Previous result	

Table 8, Relation between threshold values of X-axis and OD-INT pin*17

Relation between BOPX2 and BRPX2	Magnitude relation between measurement data and threshold values	ODINT-pin	
		ODINTEN= "0"	ODINTEN= "1"
BOPX2 ≤ BRPX2 (Switch function enable)	BOPX2 > HX	H	L
	BRPX2 < HX	L	H
	Other relations	Previous result	
BOPX2 > BRPX2 (Switch function disable)	Don't care	Don't care	

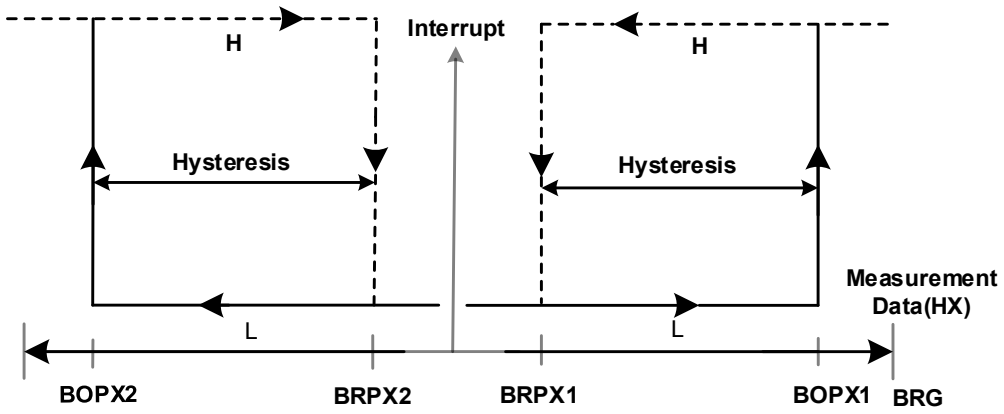


Figure 16, Open drain interrupt pin (ODINTEN bit = "0")

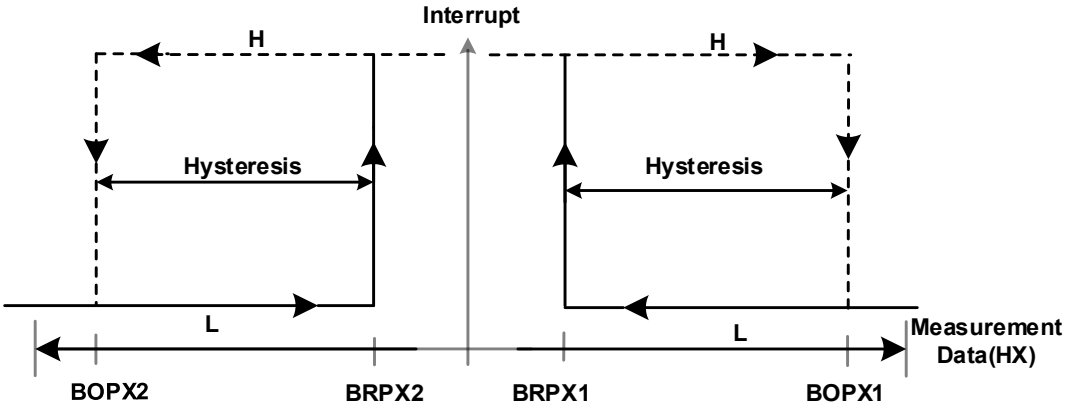


Figure 17, Open drain interrupt pin (ODINTEN bit = “1”)

Note:
17. X-axis, Y-axis, Z-axis and Angle exhibits the same relationship

Table 9, Interrupt event and interrupt function

Content of interrupt event	Conditions of event		ODINTEN bit	OD-INT pin output
Data ready	DRDYEN bit = ”1”	DRDY bit = “0”→ “1”	0	L→H
			1	H→L
		DRDY bit = “1”→ “0”	0	H→L
			1	L→H
Magnetic sensor Overflow	ERRXYEN bit =”1”	ERRXY bit =“0”→ “1”	0	L→H
			1	H→L
		ERRXY bit =“1”→ “0”	0	H→L
			1	L→H
Magnetic sensor Overflow	ERRZEN bit =”1”	ERRZ bit =“0”→ “1”	0	L→H
			1	H→L
		ERRZ bit =“1”→ “0”	0	H→L
			1	L→H
Switch event	SWEN bit[*18] =”1”	SW bit[*19]=“0”→ “1”	0	L→H
			1	H→L
		SW bit=“1”→ “0”	0	H→L
			1	L→H
Burst event	BURST_ODEN bit =”1”	BURST bit = “0”→ “1”	0	L→H
			1	H→L
		BURST bit =“1”→ “0”	0	H→L
			1	L→H
-	Other than those above condition		0	L
			1	H

Note:
18. SWX1EN bit, SWY1EN bit, SWZ1EN bit, SWA1EN, SWX2EN bit, SWY2EN bit, SWZ2EN
19. SWX1 bit, SWX2 bit, SWY1 bit, SWY2 bit, SWZ1 bit, SWZ2 bit and SWA1bit

Table 10, Relation between threshold values of B_{XY}* [20] and BUTT_OUT pin

Relation between BOPBUTT and BRPBUTT	Magnitude relation between measurement data and threshold values	BUTT_OUT pin	
		BUTTEN= "0"	BUTTEN= "1"
BOPBUTT ≤ BRPBUTT (Button function disable)	Don't care	Don't care	
BOPBUTT > BRPBUTT (Button function enable)	BOPBUTT ≤ B_{XY}*20	H	L
	BRPBUTT > B_{XY}	L	H
	Other relations	Previous result	

Note:

20. B_{XY} is the value of the magnetic field in the X-axis and Y-axis planes. B_{YZ} and B_{XZ} exhibits the same relationship

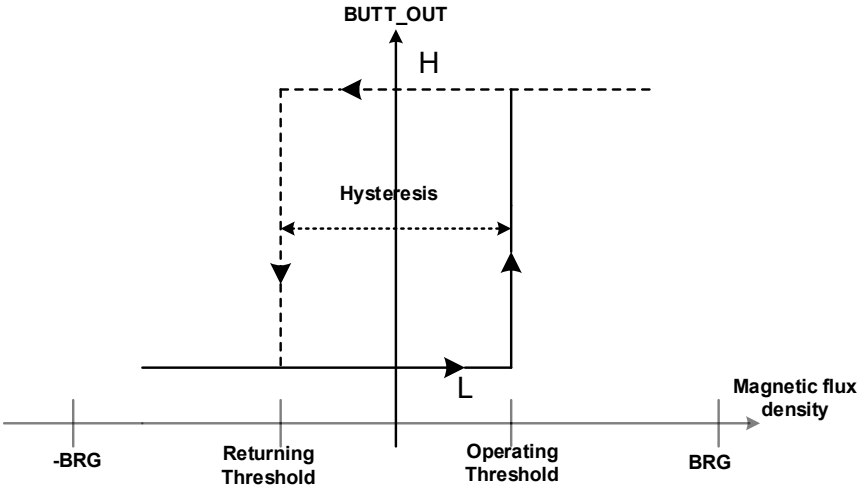


Figure 18, Open drain BUTT_OUT pin (BUTTEN bit = "0")

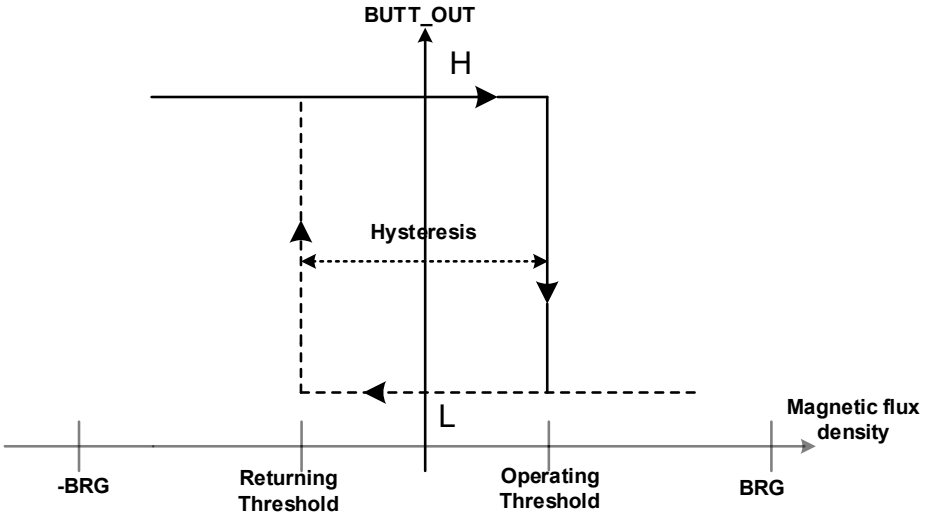


Figure 19, Open drain BUTT_OUT pin (BUTTEN bit = "1")

Timing of DRDY Interrupt Function Operation

Timing of interrupt function operation is given below.

Table 11, Timing of interrupt function operation (ODINTEN bit = “1”)

Pin name	Output transition	Timing of transition	Remarks
OD-INT pin	H → L	End of measurement	-
	L → H	Read address 11h~17h, 19h~1Ch or Write address 20h – 2Ah	During access to address, OD-INT pin is always “H” state.

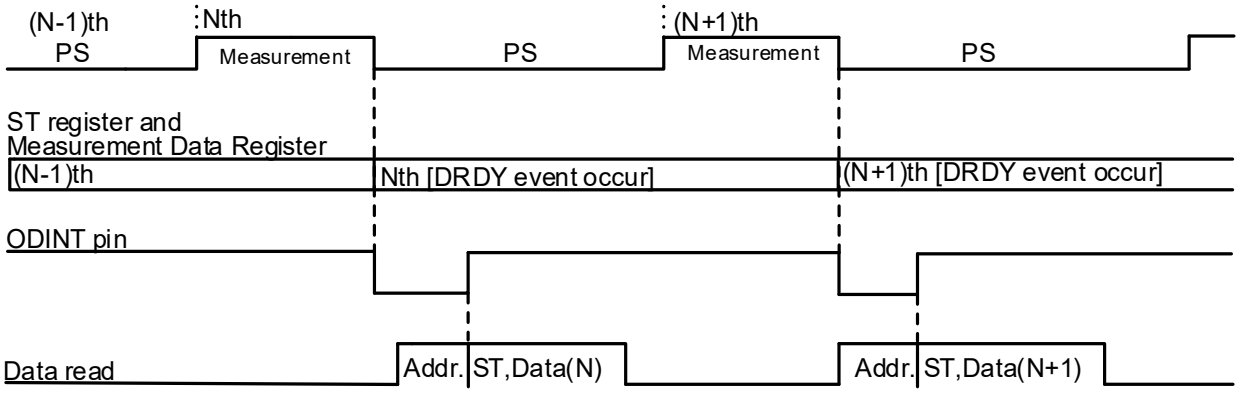


Figure 20, Timing chart of DRDY interrupt function (Normal read sequence)

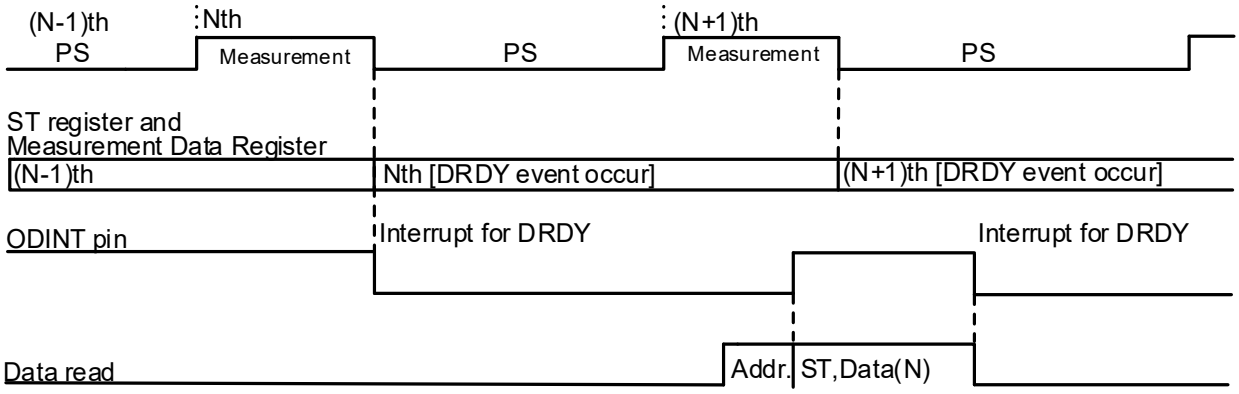


Figure 21, Timing chart of DRDY interrupt function
(When Nth data is read start immediately before (N+1)th measurement end)

Timing of Switch/Error/Burst/Button Interrupt Function Operation

When user assigns OD-INT pin to SW event output, Error event output or/and Burst event output, BUTT_OUT pin to Button event output, OD_INT pin and BUTT_OUT pin notifies user of these event. Timing of these interrupt function operation is given below.

Table 12, Timing of SW/ERROR interrupt function operation (ODINTEN bit = “1”)

Pin name	Output transition	Timing of transition
OD-INT pin	H → L	End of measurement (SW/ERROR)
	L → H	End of measurement (SW/ERROR) or Write address 20h – 2Ah

Table 13, Timing of BUTTON interrupt function operation (BUTTONEN bit = “1”)

Pin name	Output transition	Timing of transition
BUTT_OUT pin	H → L	End of measurement (BUTTON)
	L → H	End of measurement (BUTTON) or Write address 20h – 2Ah

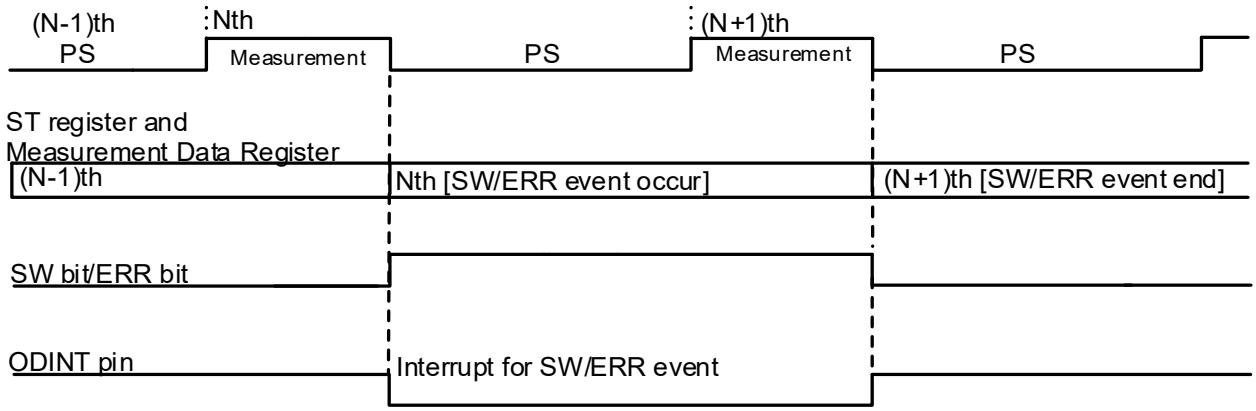


Figure 22, Timing chart of SW/ERROR interrupt function

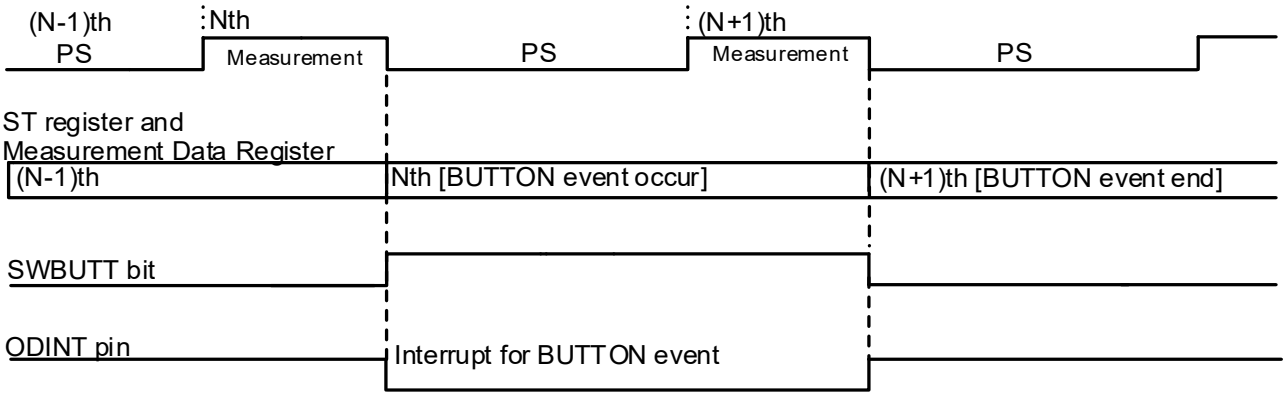


Figure 23, Timing chart of BUTTON interrupt function

Table 14, Timing of BURST interrupt function operation (ODINTEN bit = “1”)

Pin name	Output transition	Timing of transition
OD-INT pin	H → L	End of measurement (BURST)
	L → H	read address 11h to 17h, 19h to 1Ch or Write address 20h – 2Ah

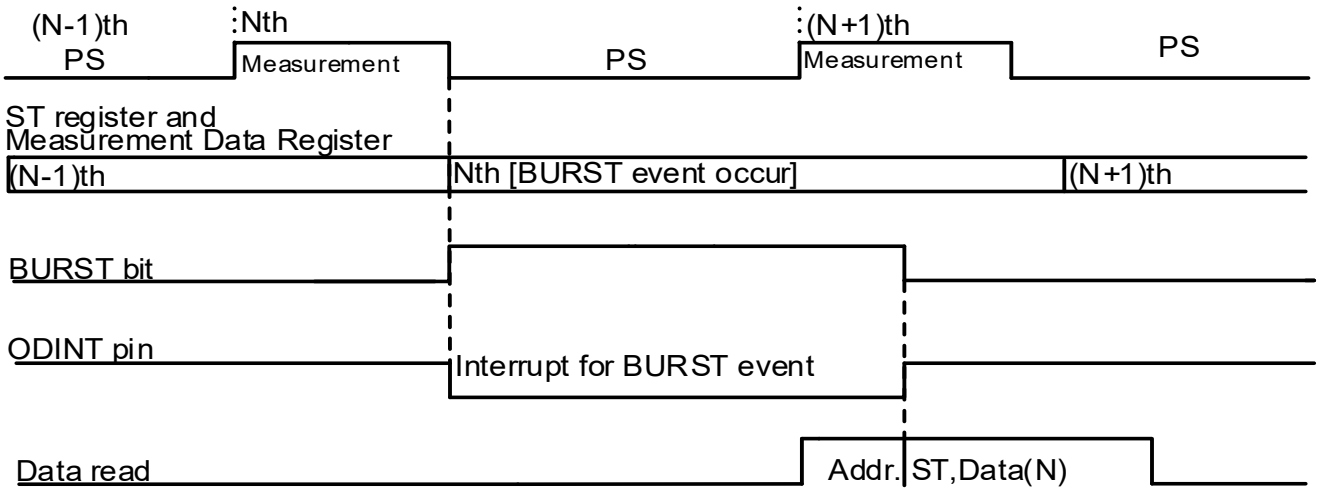


Figure 24, Timing chart of BURST interrupt function

■ Sensor Drive Select

Users can choose “Low power” or “Low noise” drive by the SDR bit.
“Low power” is used to save the current consumption and “Low noise” is used to reduce the noise of the OCH1973. When Low noise (SDR bit = “0”) is set, output magnetic data noise is more reduced than Low power (about 50% of Low power). When Low power (SDR bit = “1”) is set, average current consumption at 100 Hz repetition rate is saved from 110 μA to 40 μA (VDD=1.8V, +25˚C). Default SDR bit is Low noise enable (SDR bit = “0”).

■ Sensor Measurement Range and Sensitivity Select

Users can choose “High sensitivity (Normal measurement range and high sensitivity)” or “Wide range (Wide measurement range and normal sensitivity)” setting.
“High sensitivity” is used to measure with high magnetic sensitivity and “Wide range” is used to measure strong magnetic field (apply only to Z-axis). When High sensitivity (SMR bit = “0”) is set, magnetic sensor sensitivity is about three times higher than Wide range (3.1 μT/LSB →1.1μT/LSB). When Wide range (SMR bit = “1”) is set, Z-axis measurement range is about three times wider than High sensitivity (Z-axis measurement range:±36.04 mT→ ±101.57 mT). Default SMR bit is High sensitivity enable (SMR bit = “0”).

■ Angle Measurement and Magnetic Measurement Select

Users can choose Angle Measurement or Magnetic measurements (Normal measurement) setting.
When ANGLEEN is set “1”, the magnetic sensor will measure the Angle value.

■ Plane Axis Select

Users can choose different plane axes.
AXIS1, AXIS0 = (0,0) is chosen Plane XY
AXIS1, AXIS0 = (0,1) is chosen Plane YZ
AXIS1, AXIS0 = (1,0) is chosen Plane XZ
AXIS1, AXIS0 = (1,1) is chosen Plane XY

■ K Compensation

When applied off-axis, there may be a situation where the magnetic field amplitudes of the two axes are different, which can be corrected through K compensation. “K” is the amplitude ratio of the two axes currently used to calculate the plane Angle.

When the XY plane is selected, K compensation is applied to the Y axis, then K=$\left|\frac{(|Bx\ max|+|Bx\ min|)}{(|By\ max|+|By\ min|)}\right| * 128.$

When the YZ plane is selected, K compensation is applied to the Z axis, then K=$\left|\frac{(|By\ max|+|By\ min|)}{(|Bz\ max|+|Bz\ min|)}\right| * 128.$

When the XZ plane is selected, K compensation is applied to the Z axis, then K=$\left|\frac{(|Bx\ max|+|Bx\ min|)}{(|Bz\ max|+|Bz\ min|)}\right| * 128.$

■ Offset Compensation

When applied off-axis, there will be upward or downward offsets of the two planes for calculating the Angle, which will cause the absolute values of the maximum and minimum amplitudes to be unequal. This can be corrected through offset compensation.

When the XY plane is selected, OFFSET1P is applied to the X axis and OFFSET2P is applied to the Y axis, then OFFSET1P=$\frac{(Bx\ max + Bx\ min)}{2}$, OFFSET2P=$\frac{(By\ max + By\ min)}{2}$.

When the YZ plane is selected, OFFSET1P is applied to the Y axis and OFFSET2P is applied to the Z axis, then OFFSET1P=$\frac{(By\ max + By\ min)}{2}$, OFFSET2P=$\frac{(Bz\ max + Bz\ min)}{2}$.

When the XZ plane is selected, OFFSET1P is applied to the X axis and OFFSET2P is applied to the Z axis, then OFFSET1P=$\frac{(Bx\ max + Bx\ min)}{2}$, OFFSET2P=$\frac{(Bz\ max + Bz\ min)}{2}$.

■ Plane Magnetic Field Strength

The OCH1973 had an 16bit plane magnetic field strength output. The plane magnetic field value is calculated by CORDIC algorithm, The value corresponding to the actual magnetic field strength=$\frac{B[15:0]*0.60725}{\text{Sensitivity}}$.

■ Plane Magnetic Field Angle

The OCH1973 had an 8bit absolute Angle output. The selected plane magnetic field Angle=$\frac{A[7:0]*360^{\circ}}{2^8}$.

■ I²C Bus Interface

The I2C bus interface of OCH1973 supports the Standard mode (100 kHz max.) and the Fast mode (400 kHz max.).

Data Transfer

To access OCH1973 on the bus, generate a start condition first.
Next, transmit a one-byte slave address including a device address. At this time, OCH1973 compares the slave address with its own address. If these addresses match, OCH1973 generates an acknowledgement, and then executes READ or WRITE instruction. At the end of instruction execution, generate a stop condition.

Change of Data

A change of data on the SDA line must be made during “Low” period of the clock on the SCL line. When the clock signal on the SCL line is “High”, the state of the SDA line must be stable. (Data on the SDA line can be changed only when the clock signal on the SCL line is “Low”.)
During the SCL line is “High”, the state of data on the SDA line is changed only when a start condition or a stop condition is generated.

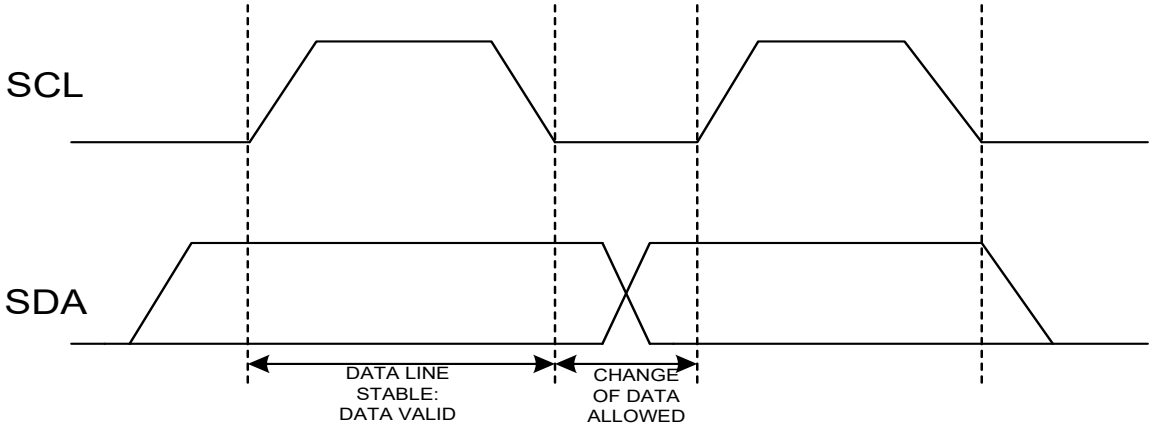


Figure 25, Data Change

Start/Stop Condition

If the SDA line is driven to “Low” from “High” when the SCL line is “High”, a start condition is generated. Every instruction starts with a start condition.
If the SDA line is driven to “High” from “Low” when the SCL line is “High”, a stop condition is generated. Every instruction stops with a stop condition.

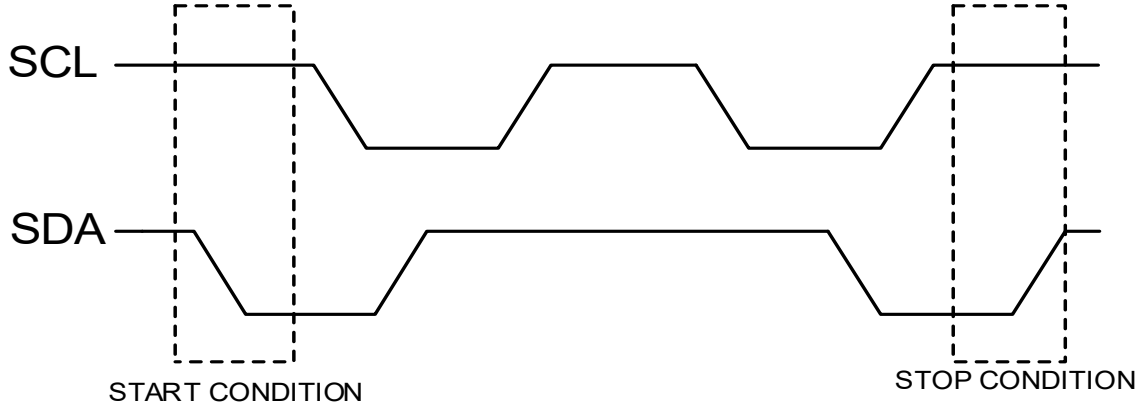


Figure 26, Start and stop condition

Acknowledge

The IC that is transmitting data releases the SDA line (in the “High” state) after sending 1-byte data. The IC that receives the data drives the SDA line to “Low” on the next clock pulse. This operation is referred as an acknowledge. With this operation, whether data has been transferred successfully can be checked. OCH1973 generates an acknowledge after receipt of the start condition and slave address.

When a WRITE instruction is executed, OCH1973 generates an acknowledge after every byte that is received.

When a READ instruction is executed, OCH1973 generates an acknowledge then transfers the data stored at the specified address. Next, OCH1973 releases the SDA line then monitors the SDA line. If a master IC generates an acknowledge instead of a stop condition, OCH1973 transmits the 8-bit data stored at the next address. If no acknowledge is generated, OCH1973 stops data transmission.

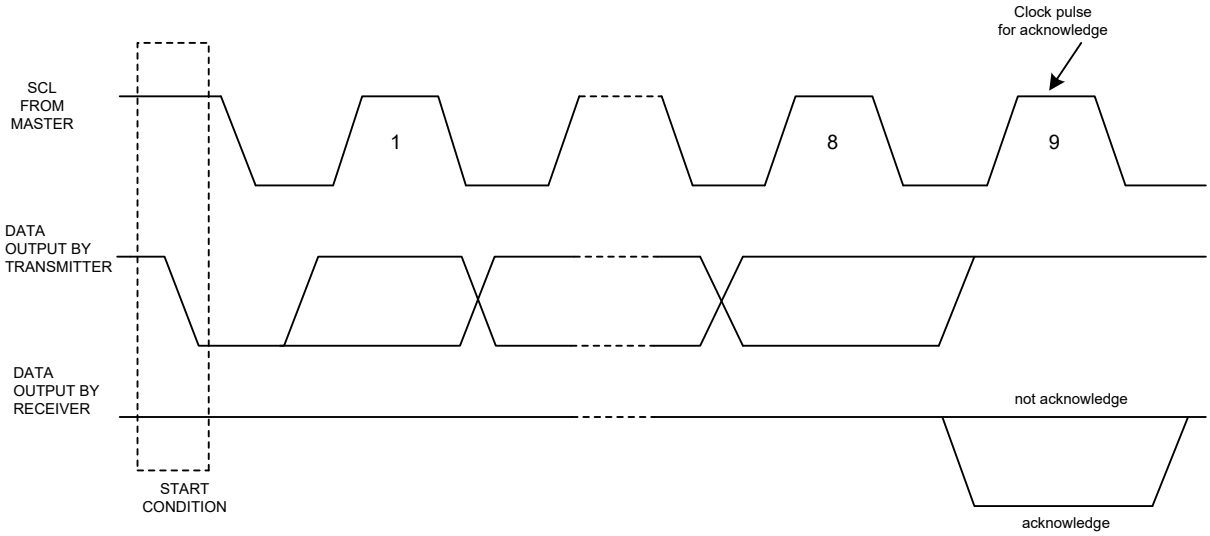


Figure 27, Generation of acknowledge

Slave Address

The slave address of OCH1973 is 0Ch.

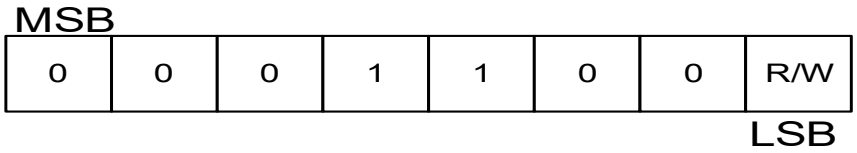


Figure 28, Slave address

The first byte including a slave address is transmitted after a start condition, and an IC to be accessed is selected from the ICs on the bus according to the slave address.

When a slave address is transferred, the IC whose device address matches the transferred slave address generates an acknowledge then executes an instruction. The 8th bit (least significant bit) of the first byte is a R/W bit.

When the R/W bit is set to “1“, READ instruction is executed. When the R/W bit is set to “0“, WRITE instruction is executed.

WRITE Instruction

When the R/W bit is set to “0”, OCH1973 performs write operation.

In write operation, OCH1973 generates an acknowledge after receiving a start condition and the first byte (slave address) then receives the second byte. The second byte is used to specify the address of an internal control register and is based on the MSB-first configuration.

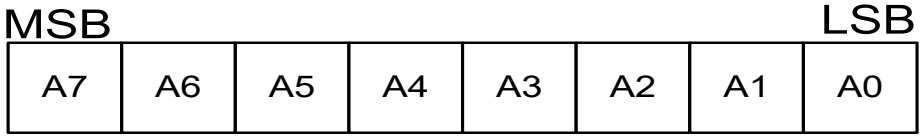


Figure 29, Register address

After receiving the second byte (register address), OCH1973 generates an acknowledge then receives the third byte. The third and the following bytes represent control data. Control data consists of 8-bit and is based on the MSB-first configuration. OCH1973 generates an acknowledge after every byte is received. Data transfer always stops with a stop condition generated by the master.

Figure 30, Control data

OCH1973 can write multiple bytes of data at a time.
After reception of the third byte (control data), OCH1973 generates an acknowledge then receives the next data. If additional data is received instead of a stop condition after receiving one byte of data, the address counter inside the LSI chip is automatically incremented and the data is written at the next address.
The address is incremented from 20h to 2Ah. When the address is between 20h and 2Ah, the address is incremented 20h →21h →22h →23h…2Ah,and the address goes back to 20h after 2Ah.
Actual data is written only to Read/Write registers.

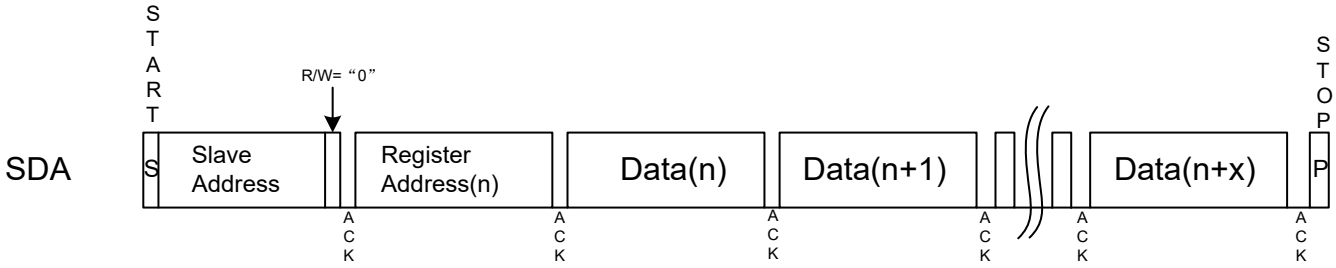


Figure 31, WRITE Instruction

READ Instruction
When the R/W bit is set to "1", OCH1973 performs read operation.
If a master IC generates an acknowledge instead of a stop condition after OCH1973 transfers the data at a specified address, the data at the next address can be read.
Address can be 20h to 2Ah. When the address is between 20h and 2Ah, the address is incremented 20h → 21h → 22h → 23h ... →2Ah, and the address goes back to 20h after 2Ah. OCH1973 supports one byte read and multiple byte read.

Current Address Read
OCH1973 has an address counter inside the LSI chip. In current address read operation, the data at an address specified by this counter is read.
The internal address counter holds the next address of the most recently accessed address.
For example, if the address most recently accessed (for READ instruction) is address "n", and a current address read operation is attempted, the data at address "n+1" is read.
In current address read operation, OCH1973 generates an acknowledge after receiving a slave address for the READ instruction (R/W bit = "1"). Next, OCH1973 transfers the data specified by the internal address counter starting with the next clock pulse, then increments the internal counter by one. If the master IC generates a stop condition instead of an acknowledge after OCH1973 transmits one byte of data, the read operation stops.

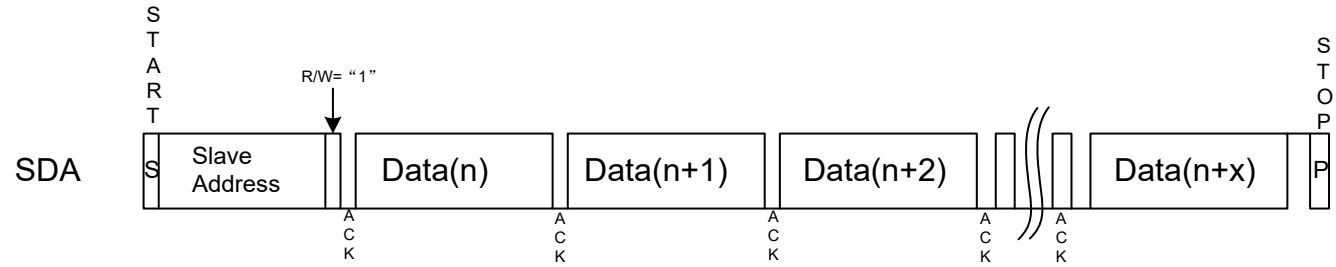


Figure 32, Current address read

Random Address Read

By random address read operation, data at an arbitrary address can be read.

The random address read operation requires to execute WRITE instruction as dummy before a slave address for the READ instruction (R/W bit = “1”) is transmitted. In random read operation, a start condition is first generated then a slave address for the WRITE instruction (R/W bit = “0”) and a read address are transmitted sequentially.

After OCH1973 generates an acknowledge in response to this address transmission, a start condition and a slave address for the READ instruction (R/W bit = “1”) are generated again. OCH1973 generates an acknowledge in response to this slave address transmission. Next, OCH1973 transfers the data at the specified address then increments the internal address counter by one. If the master IC generates a stop condition instead of an acknowledge after data is transferred, the read operation stops.

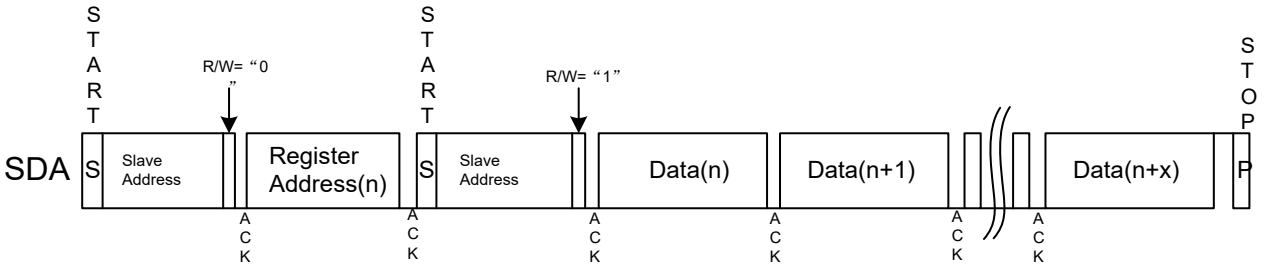


Figure 33, Random address read

■ Registers

Description of Registers

OCH1973 has registers of 26 addresses as indicated in Table 15. Every address consists of 1-byte to 8-byte data. Data is transferred to or received from the external CPU via the serial interface described previously.

Table 15, Register Table

Address	READ/ WRITE	Description	Byte width	Remarks
00H	READ	Company ID, Device ID	4	Device Information
10H		Status	2	ST data
11H		Status and Measurement Magnetic Data	4	ST + X-axis data
12H			4	ST + Y-axis data
13H			6	ST + X + Y-axis data
14H			4	ST + Z-axis data
15H			6	ST + X + Z-axis data
16H			6	ST + Y + Z-axis data
17H			8	ST + X + Y + Z-axis data
18H		Status and Measurement Magnetic Data (Angle and Plane magnetic field of measurement data register)	2	ST data
19H			5	ST+ Angle+ Plane magnetic
1AH			7	ST + X + Y + Angle
1BH			7	ST + X + Z + Angle
1CH			7	ST + Y + Z + Angle
20H	READ/ WRITE	Control 1	2	Interrupt function settings
21H		Control 2	1	Operation Mode, Sensor Drive, Measurement Range and Sensitivity
22H		Control 3 (Switch threshold value)	4	X-axis threshold 1 settings
23H			4	X-axis threshold 2 settings
24H			4	Y-axis threshold 1 settings
25H			4	Y-axis threshold 2 settings
26H			4	Z-axis threshold 1 settings
27H			4	Z-axis threshold 2 settings
28H			2	Angle threshold 1 settings
29H		Control 4	6	Plane Axis Select，K Compensation and OFFSET Compensation
2AH		Control 5 (BUTT_OUT threshold value)	4	BUTTON threshold settings
30H		Reset	1	Soft reset

Addresses 20h to 2Ah are compliant with automatic increment function of serial interface respectively. When the address is in 20h to 2Ah, the address is incremented 20h→ 21h → 22h → 23h ... →2Ah, and the address goes back to 20h after 2Ah

Register Map

Table 16, Register Map

Addr.	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Read only register								
00H	WIA[15:8]	WIA[7:0]	RSV[15:8]	RSV[7:0]	-	-	-	-
10H	ST[15:8]	ST[7:0]	-	-	-	-	-	-
11H	ST[15:8]	ST[7:0]	HX[15:8]	HX[7:0]	-	-	-	-
12H	ST[15:8]	ST[7:0]	HY[15:8]	HY[7:0]	-	-	-	-
13H	ST[15:8]	ST[7:0]	HY[15:8]	HY[7:0]	HX[15:8]	HX[7:0]	-	-
14H	ST[15:8]	ST[7:0]	HZ[15:8]	HZ[7:0]	-	-	-	-
15H	ST[15:8]	ST[7:0]	HZ[15:8]	HZ[7:0]	HX[15:8]	HX[7:0]	-	-
16H	ST[15:8]	ST[7:0]	HZ[15:8]	HZ[7:0]	HY[15:8]	HY[7:0]	-	-
17H	ST[15:8]	ST[7:0]	HZ[15:8]	HZ[7:0]	HY[15:8]	HY[7:0]	HX[15:8]	HX[7:0]
18H	ST[15:8]	ST[7:0]	-	-	-	-	-	-
19H	ST[15:8]	ST[7:0]	ANGLE[7:0]	PLANE[15:8]	PLANE[7:0]	-	-	-
1AH	ST[15:8]	ST[7:0]	HX[15:8]	HX[7:0]	HY[15:8]	HY[7:0]	ANGLE[7:0]	-
1BH	ST[15:8]	ST[7:0]	HX[15:8]	HX[7:0]	HZ[15:8]	HZ[7:0]	ANGLE[7:0]	-
1CH	ST[15:8]	ST[7:0]	HY[15:8]	HY[7:0]	HZ[15:8]	HZ[7:0]	ANGLE[7:0]	-
1DH								
1EH								
1FH								
Read/Write register								
20H	CNTL1[15:8]	CNTL1[7:0]	-	-	-	-	-	-
21H	CNTL2[7:0]	-	-	-	-	-	-	-
22H	BOP1X[15:8]	BOP1X[7:0]	BRP1X[15:8]	BRP1X[7:0]	-	-	-	-
23H	BOP2X[15:8]	BOP2X[7:0]	BRP2X[15:8]	BRP2X[7:0]	-	-	-	-
24H	BOP1Y[15:8]	BOP1Y[7:0]	BRP1Y[15:8]	BRP1Y[7:0]	-	-	-	-
25H	BOP2Y[15:8]	BOP2Y[7:0]	BRP2Y[15:8]	BRP2Y[7:0]	-	-	-	-
26H	BOP1Z[15:8]	BOP1Z[7:0]	BRP1Z[15:8]	BRP1Z[7:0]	-	-	-	-
27H	BOP2Z[15:8]	BOP2Z[7:0]	BRP2Z[15:8]	BRP2Z[7:0]	-	-	-	-
28H	BOP1A[7:0]	BRP1A[7:0]	-	-	-	-	-	-
29H	CNTL3[7:0]	GAIN[7:0]	OFFSET1P[15:8]	OFFSET1P[7:0]	OFFSET2P[15:8]	OFFSET2P[7:0]	-	-
2AH	BOPBUTT[15:8]	BOPBUTT[7:0]	BRPBUTT[15:8]	BRPBUTT[7:0]	-	-	-	-
30H	SRST[7:0]	-	-	-	-	-	-	-
40H	RESERVE	RESERVE	-	-	-	-	-	-
41H	RESERVE	-	-	-	-	-	-	-

Table 17, Further details about Register Map (D[7:0])

Register name	Bit number (D[7:0])							
	7	6	5	4	3	2	1	0
WIA[7:0]	1	1	0	0	0	0	0	0
RSV[7:0]	RSV7	RSV6	RSV5	RSV4	RSV3	RSV2	RSV1	RSV0
ST[7:0]	ERRXY	SWZ2	SWZ1	SWY2	SWY1	SWX2	SWX1	DRDY
HX[7:0]	HX7	HX6	HX5	HX4	HX3	HX2	HX1	HX0
HY[7:0]	HY7	HY6	HY5	HY4	HY3	HY2	HY1	HY0
HZ[7:0]	HZ7	HZ6	HZ5	HZ4	HZ3	HZ2	HZ1	HZ0
ANGLE[7:0]	A7	A6	A5	A4	A3	A2	A1	A0
PLANE[7:0]	P7	P6	P5	P4	P3	P2	P1	P0
CNTL1[7:0]	ERRXYEN	SWZ2EN	SWZ1EN	SWY2EN	SWY1EN	SWX2EN	SWX1EN	DRDYEN
CNTL2[7:0]	ANGLEEN	SDR	SMR	MODE4	MODE3	MODE2	MODE1	MODE0
BOP1X[7:0]	BOP1X7	BOP1X6	BOP1X5	BOP1X4	BOP1X3	BOP1X2	BOP1X1	BOP1X0
BRP1X[7:0]	BRP1X7	BRP1X6	BRP1X5	BRP1X4	BRP1X3	BRP1X2	BRP1X1	BRP1X0
BOP2X[7:0]	BOP2X7	BOP2X6	BOP2X5	BOP2X4	BOP2X3	BOP2X2	BOP2X1	BOP2X0
BRP2X[7:0]	BRP2X7	BRP2X6	BRP2X5	BRP2X4	BRP2X3	BRP2X2	BRP2X1	BRP2X0
BOP1Y[7:0]	BOP1Y7	BOP1Y6	BOP1Y5	BOP1Y4	BOP1Y3	BOP1Y2	BOP1 Y1	BOP1Y0
BRP1Y[7:0]	BRP1Y7	BRP1Y6	BRP1Y5	BRP1Y4	BRP1Y3	BRP1Y2	BRP1Y1	BRP1Y0
BOP2Y[7:0]	BOP2Y7	BOP2Y6	BOP2Y5	BOP2Y4	BOP2Y3	BOP2Y2	BOP2Y1	BOP2Y0
BRP2Y[7:0]	BRP2Y7	BRP2Y6	BRP2Y5	BRP2Y4	BRP2Y3	BRP2Y2	BRP2Y1	BRP2Y0
BOP1Z[7:0]	BOP1Z7	BOP1Z6	BOP1Z5	BOP1Z4	BOP1Z3	BOP1Z2	BOP1Z1	BOP1Z0
BRP1Z[7:0]	BRP1Z7	BRP1Z6	BRP1Z5	BRP1Z4	BRP1Z3	BRP1Z2	BRP1Z1	BRP1Z0
BOP2Z[7:0]	BOP2Z7	BOP2Z6	BOP2Z5	BOP2Z4	BOP2Z3	BOP2Z2	BOP2Z1	BOP2Z0
BRP2Z[7:0]	BRP2Z7	BRP2Z6	BRP2Z5	BRP2Z4	BRP2Z3	BRP2Z2	BRP2Z1	BRP2Z0
BOP1A[7:0]	BOP1A7	BOP1A6	BOP1A5	BOP1A4	BOP1A3	BOP1A2	BOP1A1	BOP1A0
BRP1A[7:0]	BRP1A7	BRP1A6	BRP1A5	BRP1A4	BRP1A3	BRP1A2	BRP1A1	BRP1A0
CNTL3[7:0]	0	0	0	0	0	0	AXIS1	AXIS0
GAIN[7:0]	GAIN7	GAIN6	GAIN5	GAIN4	GAIN3	GAIN2	GAIN1	GAIN0
OFFSET1P[7:0]	OFFSET1P7	OFFSET1P6	OFFSET1P5	OFFSET1P4	OFFSET1P3	OFFSET1P2	OFFSET1P1	OFFSET1P0
OFFSET2P[7:0]	OFFSET2P7	OFFSET2P6	OFFSET2P5	OFFSET2P4	OFFSET2P3	OFFSET2P2	OFFSET2P1	OFFSET2P0
BOPBUTT[7:0]	BOPBUTT7	BOPBUTT6	BOPBUTT5	BOPBUTT4	BOPBUTT3	BOPBUTT2	BOPBUTT1	BOPBUTT0
BRPBUTT[7:0]	BRPBUTT7	BRPBUTT6	BRPBUTT5	BRPBUTT4	BRPBUTT3	BRPBUTT2	BRPBUTT1	BRPBUTT0
SRST[7:0]	0	0	0	0	0	0	0	SRST

Table 18, Further details about Register Map (D[15:8])

Register name	Bit number (D[15:8])							
	15	14	13	12	11	10	9	8
WIA[15:8]	0	1	0	0	1	0	0	0
RSV[15:8]	RSV15	RSV14	RSV13	RSV12	RSV11	RSV10	RSV9	RSV8
ST[15:8]	1	1	ERRADC	BURST	SWBUTT	SW1A	DOR	ERRZ
HX[15:8]	HX15	HX14	HX13	HX12	HX11	HX10	HX9	HX8
HY[15:8]	HY15	HY14	HY13	HY12	HY11	HY10	HY9	HY8
HZ[15:8]	HZ15	HZ14	HZ13	HZ12	HZ11	HZ10	HZ9	HZ8
PLANE[15:8]	P15	P14	P13	P12	P11	P10	P9	P8
CNTL1[15:8]	ERRADCEN	BURSTEN	SWBUTTEN	BURST_ODEN	SWA1EN	BUTTEN	ODINTEN	ERRZEN
BOP1X[15:8]	BOP1X15	BOP1X14	BOP1X13	BOP1X12	BOP1X11	BOP1X10	BOP1X9	BOP1X8
BRP1X[15:8]	BRP1X15	BRP1X14	BRP1X13	BRP1X12	BRP1X11	BRP1X10	BRP1X9	BRP1X8
BOP2X[15:8]	BOP2X15	BOP2X14	BOP2X13	BOP2X12	BOP2X11	BOP2X10	BOP2X9	BOP2X8
BRP2X[15:8]	BRP2X15	BRP2X14	BRP2X13	BRP2X12	BRP2X11	BRP2X10	BRP2X9	BRP2X8
BOP1Y[15:8]	BOP1Y15	BOP1Y14	BOP1Y13	BOP1Y12	BOP1Y11	BOP1Y10	BOP1Y9	BOP1Y8
BRP1Y[15:8]	BRP1Y15	BRP1Y14	BRP1Y13	BRP1Y12	BRP1Y11	BRP1Y10	BRP1Y9	BRP1Y8
BOP2Y[15:8]	BOP2Y15	BOP2Y14	BOP2Y13	BOP2Y12	BOP2Y11	BOP2Y10	BOP2Y9	BOP2Y8
BRP2Y[15:8]	BRP2Y15	BRP2Y14	BRP2Y13	BRP2Y12	BRP2Y11	BRP2Y10	BRP2Y9	BRP2Y8
BOP1Z[15:8]	BOP1Z15	BOP1Z14	BOP1Z13	BOP1Z12	BOP1Z11	BOP1Z10	BOP1Z9	BOP1Z8
BRP1Z[15:8]	BRP1Z15	BRP1Z14	BRP1Z13	BRP1Z12	BRP1Z11	BRP1Z10	BRP1Z9	BRP1Z8
BOP2Z[15:8]	BOP2Z15	BOP2Z14	BOP2Z13	BOP2Z12	BOP2Z11	BOP2Z10	BOP2Z9	BOP2Z8
BRP2Z[15:8]	BRP2Z15	BRP2Z14	BRP2Z13	BRP2Z12	BRP2Z11	BRP2Z10	BRP2Z9	BRP2Z8
BOP1A[15:8]	-	-	-	-	-	-	-	-
BRP1A[15:8]	-	-	-	-	-	-	-	-
CNTL3[15:8]	-	-	-	-	-	-	-	-
GAIN[15:8]	-	-	-	-	-	-	-	-
OFFSET1P[15:8]	OFFSET1P15	OFFSET1P14	OFFSET1P13	OFFSET1P12	OFFSET1P11	OFFSET1P10	OFFSET1P9	OFFSET1P8
OFFSET2P[15:8]	OFFSET2P15	OFFSET2P14	OFFSET2P13	OFFSET2P12	OFFSET2P11	OFFSET2P10	OFFSET2P9	OFFSET2P8
BOPBUTT[15:8]	BOPBUTT15	BOPBUTT14	BOPBUTT13	BOPBUTT12	BOPBUTT11	BOPBUTT10	BOPBUTT9	BOPBUTT8
BRPBUTT[15:8]	BRPBUTT15	BRPBUTT14	BRPBUTT13	BRPBUTT12	BRPBUTT11	BRPBUTT10	BRPBUTT9	BRPBUTT8
SRST[15:8]	-	-	-	-	-	-	-	-

Detailed Description of Registers
WIA[15:0] Company ID and Device ID

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read-only register									
00h	**WIA[7:0]**	1	1	0	0	0	0	0	0
Addr.	**Register name**	**D15**	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**
Read-only register									
00h	**WIA[15:8]**	0	1	0	0	1	0	0	0

WIA[7:0] bits: Device ID of OCS. It is described in one byte and fixed value. C0h: fixed
WIA[15:8] bits: Company ID of OCH1973. It is described in one byte and fixed value. 48h: fixed

RSV[15:0]: Reserved Register

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read-only register									
00h	**RSV[7:0]**	RSV7	RSV6	RSV5	RSV4	RSV3	RSV2	RSV1	RSV0
Addr.	**Register name**	**D15**	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**
Read-only register									
00h	**RSV[15:8]**	RSV15	RSV14	RSV13	RSV12	RSV11	RSV10	RSV9	RSV8

RSV[7:0] bits/ RSV[15:8] bits: Reserved register for OCS.

ST[15:0]: Status

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read-only register									
10h-1Ch	ST[7:0]	ERRXY	SWZ2	SWZ1	SWY2	SWY1	SWX2	SWX1	DRDY
Reset		0	0	0	0	0	0	0	0
Addr.	**Register name**	**D15**	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**
Read-only register									
10h-1Ch	ST[15:8]	1	1	ERRADC	BURST	SWBUTT	SW1A	DOR	ERRZ
Reset		1	1	0	0	0	0	0	0

DRDY bit: Data Ready

"0": Normal
"1": Data is ready

DRDY bit turns to "1" when data is ready in Single measurement mode and Continuous measurement mode 1, 2, 3, 4, 5, 6, 7 and 8. It returns to "0" when any one of measurement data register (HX, HY, HZ, ANGLE or/and PLANE register) is read all the way through or access to Setting Registers (address 20h to 2Ah).

DOR bit: Data Overrun
“0”: Normal
“1”: Data overrun

DOR bit turns to “1” when data has been skipped in Continuous measurement mode 1, 2, 3, 4, 5, 6, 7 or 8. DOR bit turns to “0” at the after the next measurement ended.

SWX1 bit, SWY1 bit, SWZ1 bit, SWA1: Measurement data of X, Y, Z-axis and Angle exceed switch threshold 1
“0”: Measurement data of X, Y, Z axis and Angle exceed returning threshold 1
“1”: Measurement data of X, Y, Z axis and Angle exceed operating threshold 1

SWX2 bit, SWY2 bit, SWZ2 bit: Measurement data of X, Y, Z-axis and Angle exceed switch threshold 2
“0”: Measurement data of X, Y, Z-axis and Angle exceed returning threshold 2
“1”: Measurement data of X, Y, Z-axis and Angle exceed operating threshold 2

ERRXY bit: Magnetic sensor overflow
“0”: Normal
“1”: Magnetic sensor overflow occurred (X and/or Y-axis)

ERRZ bit: Magnetic sensor overflow
“0”: Normal
“1”: Magnetic sensor overflow occurred (Z-axis)

SWBUTT bit: Measurement data of selected plane exceed Button threshold
“0”: Measurement data of selected plane exceed returning threshold
“1”: Measurement data of selected plane exceed operating threshold

Burst bit: Magnetic sensor wakes up
“0”: Normal
“1”: Magnetic sensor wakes up occurred

ERRADC bit: ADC overflow
“0”: Normal
“1”: ADC overflow occurred

HX[15:0]/HY[15:0]/HZ[15:0]/ANGLE[7:0]/PLANE[15:0]:Measurement Data

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read-only register									
11h | 1Ch	**HX[7:0]**	HX7	HX6	HX5	HX4	HX3	HX2	HX1	HX0
	HY[7:0]	HY7	HY6	HY5	HY4	HY3	HY2	HY1	HY0
	HZ[7:0]	HZ7	HZ6	HZ5	HZ4	HZ3	HZ2	HZ1	HZ0
	ANGLE[7:0]	A7	A6	A5	A4	A3	A2	A1	A0
	PLANE[7:0]	P7	P6	P5	P4	P3	P2	P1	P0
Reset		0	0	0	0	0	0	0	0
Addr.	**Register name**	**D15**	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**
Read-only register									
11h | 1Ch	**HX[15:8]**	HX15	HX14	HX13	HX12	HX11	HX10	HX9	HX8
	HY[15:8]	HY15	HY14	HY13	HY12	HY11	HY10	HY9	HY8
	HZ[15:8]	HZ15	HZ14	HZ13	HZ12	HZ11	HZ10	HZ9	HZ8
	PLANE[15:8]	P15	P14	P13	P12	P11	P10	P9	P8
Reset		0	0	0	0	0	0	0	0

Measurement data of magnetic sensor X-axis/Y-axis/Z-axis
HX[7:0] bits: X-axis measurement data lower 8-bit
HX[15:8] bits: X-axis measurement data higher 8-bit
HY[7:0] bits: Y-axis measurement data lower 8-bit
HY[15:8] bits: Y-axis measurement data higher 8-bit
HZ[7:0] bits: Z-axis measurement data lower 8-bit
HZ[15:8] bits: Z-axis measurement data higher 8-bit
Angle[7:0] bits: Angle measurement data lower 8-bit
Plane[7:0] bits: Plane measurement data lower 8-bit
Plane[15:8] bits: Plane measurement data higher 8-bit

Measurement data is stored in two's complement. Measurement range of each axis is -32768 to 32767 in 16-bit output (High sensitivity setting). Measurement range of X and Y-axis are -11264 to 11264 in 16-bit output, Z-axis is -32768 to 32767 in 16-bit output (Wide range setting).

Table 19, Measurement magnetic data format (High sensitivity setting)

Measurement data (each axis) [15:0] bits			Magnetic flux density [mT]	ERRXY bit
Two's complement	Hex	Decimal		
0111 1111 1111 1111	7FFF	32767	>36.0437	1
0111 1111 1111 1111	7FFF	32767	36.0437	0
|	|	|	|	|
0000 0000 0000 0001	0001	1	0.0011	0
0000 0000 0000 0000	0000	0	0	0
1111 1111 1111 1111	FFFF	-1	-0.0011	0
|	|	|	|	|
1000 0000 0000 0000	8000	-32768	-36.0448	0
1000 0000 0000 0000	8000	-32768	<-36.0448	1

Table 20, Measurement magnetic data format (Wide range setting, X and Y-axis)

Measurement data (X and Y axis) [15:0] bits			Magnetic flux density [mT]	ERRXY bit
Two's complement	Hex	Decimal		
0010 1100 0000 0000	4000	16384	50.7904	1
0010 1100 0000 0000	3FFF	16383	50.7873	0
|	|	|	|	|
0000 0000 0000 0001	0001	1	0.0031	0
0000 0000 0000 0000	0000	0	0	0
1111 1111 1111 1111	FFFF	-1	-0.0031	0
|	|	|	|	|
1101 0100 0000 0000	C001	-16383	-50.7873	0
1101 0100 0000 0000	C000	-16384	<-50.7904	1

Table 21, Measurement magnetic data format (Wide range setting, Z-axis)

Measurement data (Z axis) [15:0] bits			Magnetic flux density [mT]
Two's complement	Hex	Decimal	
0111 1111 1111 1111	7FFF	32767	>101.5777
0111 1111 1111 1110	7FFE	32766	101.5746
|	|	|	|
0000 0000 0000 0001	0001	1	0.0031
0000 0000 0000 0000	0000	0	0
1111 1111 1111 1111	FFFF	-1	-0.0031
|	|	|	|
1000 0000 0000 0001	8001	-32767	-101.5777
1000 0000 0000 0000	8000	-32768	<-101.5808

CNTL1[15:0]: Interrupt Output Setting

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read/Write register									
20h	CNTL1[7:0]	ERRXYEN	SWZ2EN	SWZ1EN	SWY2EN	SWY1EN	SWX2EN	SWX1EN	DRDYEN
Reset		0	0	0	0	0	0	0	1
Addr.	**Register name**	**D15**	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**
Read/Write register									
20h	CNTL1[15:8]	ERRADCEN	BURSTEN	SWBUTTEN	BURST_ODEN	SWA1EN	BUTTEN	ODINTEN	ERRZEN
Reset		0	0	0	0	0	0	0	0

DRDYEN bit: DRDY event output
"0": DRDY event outputs disable
"1": DRDY event outputs enable

SWX1EN bit to SWZ2EN bit: Switch event output
"0": Switch event outputs disable
"1": Switch event outputs enable

ERRXYEN bit: ERRXY event output
"0": ERRXY event outputs disable
"1": ERRXY event outputs enable

ERRZEN bit: ERRZ event output
"0": ERRZ event outputs disable
"1": ERRZ event outputs enable

ODINTEN bit: Interrupt event output to OD-INT pin
"0": Negative logic output
"1": Positive logic output

BUTTEN bit: Interrupt event output to BUTT_OUT pin
"0": Negative logic output
"1": Positive logic output

SWA1EN bit: Angle event output
“0”: Angle event outputs disable
“1”: Angle event outputs enable

BURST_ODEN bit: Burst event output
“0”: Burst event outputs disable
“1”: Burst event outputs enable

SWBUTTEN bit: Button event output
“0”: Button event outputs disable
“1”: Button event outputs enable

BURSTEN bit: Burst function output
“0”: Burst function outputs disable
“1”: Burst function outputs enable

ERRADCEN bit: ERRADC event output
“0”: ERRADC event outputs disable
“1”: ERRADC event outputs enable

CNTL2[7:0]: Operation Mode, Sensor Drive, Measurement Range and Sensitivity setting

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read/Write register									
21h	CNTL2[7:0]	ANGLEEN	SDR	SMR	MODE4	MODE3	MODE2	MODE1	MODE0
Reset		0	0	0	0	0	0	0	0

MODE[4:0] bits: Operation mode setting

“00000”: Power-down mode
“00001”: Single measurement mode
“00010”: Continuous measurement mode 1
“00100”: Continuous measurement mode 2
“00110”: Continuous measurement mode 3
“01000”: Continuous measurement mode 4
“01010”: Continuous measurement mode 5
“01100”: Continuous measurement mode 6
“01110”: Continuous measurement mode 7
“10000”: Continuous measurement mode 8

SDR bit: Sensor drive setting
“0”: Low noise drive
“1”: Low power drive

SMR bit: Measurement range and sensitivity setting
“0”: High sensitivity setting
“1”: Wide measurement range setting

ANGLEEN bit: Output mode selection
“0”: Magnetic output mode
“1”: Angle output mode

BOP1,2 、BRP1,2 、BOPA1、BRPA1、BOPBUTT and BRPBUTT registers: Operating Threshold and Returning Threshold Setting of Programmable Switch Function

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read/Write register									
22h - 28h,2Ah	**BOP1X[7:0]**	BOP1X7	BOP1X6	BOP1X5	BOP1X4	BOP1X3	BOP1X2	BOP1X1	BOP1X0
	BRP1X[7:0]	BRP1X7	BRP1X6	BRP1X5	BRP1X4	BRP1X3	BRP1X2	BRP1X1	BRP1X0
	BOP2X[7:0]	BOP2X7	BOP2X6	BOP2X5	BOP2X4	BOP2X3	BOP2X2	BOP2X1	BOP2X0
	BRP2X[7:0]	BRP2X7	BRP2X6	BRP2X5	BRP2X4	BRP2X3	BRP2X2	BRP2X1	BRP2X0
	BOP1Y[7:0]	BOP1Y7	BOP1Y6	BOP1Y5	BOP1Y4	BOP1Y3	BOP1Y2	BOP1Y1	BOP1Y0
	BRP1Y[7:0]	BRP1Y7	BRP1Y6	BRP1Y5	BRP1Y4	BRP1Y3	BRP1Y2	BRP1Y1	BRP1Y0
	BOP2Y[7:0]	BOP2Y7	BOP2Y6	BOP2Y5	BOP2Y4	BOP2Y3	BOP2Y2	BOP2Y1	BOP2Y0
	BRP2Y[7:0]	BRP2Y7	BRP2Y6	BRP2Y5	BRP2Y4	BRP2Y3	BRP2Y2	BRP2Y1	BRP2Y0
	BOP1Z[7:0]	BOP1Z7	BOP1Z6	BOP1Z5	BOP1Z4	BOP1Z3	BOP1Z2	BOP1Z1	BOP1Z0
	BRP1Z[7:0]	BRP1Z7	BRP1Z6	BRP1Z5	BRP1Z4	BRP1Z3	BRP1Z2	BRP1Z1	BRP1Z0
	BOP2Z[7:0]	BOP2Z7	BOP2Z6	BOP2Z5	BOP2Z4	BOP2Z3	BOP2Z2	BOP2Z1	BOP2Z0
	BRP2Z[7:0]	BRP2Z7	BRP2Z6	BRP2Z5	BRP2Z4	BRP2Z3	BRP2Z2	BRP2Z1	BRP2Z0
	BOP1A [7:0]	BOP1A7	BOP1A6	BOP1A5	BOP1A4	BOP1A3	BOP1A2	BOP1A1	BOP1A0
	BRP1A [7:0]	BRP1A7	BRP1A6	BRP1A5	BRP1A4	BRP1A3	BRP1A2	BRP1A1	BRP1A0
	BOPBUTT[7:0]	BOPBUTT7	BOPBUTT6	BOPBUTT5	BOPBUTT4	BOPBUTT3	BOPBUTT2	BOPBUTT1	BOPBUTT0
	BRPBUTT[7:0]	BRPBUTT7	BRPBUTT6	BRPBUTT5	BRPBUTT4	BRPBUTT3	BRPBUTT2	BRPBUTT1	BRPBUTT0
Reset		0	0	0	0	0	0	0	0
Addr.	**Register name**	**D15**	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**
Read/Write register									
22h - 28h,2Ah	**BOP1X[15:8]**	BOP1X15	BOP1X14	BOP1X13	BOP1X12	BOP1X11	BOP1X10	BOP1X9	BOP1X8
	BRP1X[15:8]	BRP1X15	BRP1X14	BRP1X13	BRP1X12	BRP1X11	BRP1X10	BRP1X9	BRP1X8
	BOP2X[15:8]	BOP2X15	BOP2X14	BOP2X13	BOP2X12	BOP2X11	BOP2X10	BOP2X9	BOP2X8
	BRP2X[15:8]	BRP2X15	BRP2X14	BRP2X13	BRP2X12	BRP2X11	BRP2X10	BRP2X9	BRP2X8
	BOP1Y[15:8]	BOP1Y15	BOP1Y14	BOP1Y13	BOP1Y12	BOP1Y11	BOP1Y10	BOP1Y9	BOP1Y8
	BRP1Y[15:8]	BRP1Y15	BRP1Y14	BRP1Y13	BRP1Y12	BRP1Y11	BRP1Y10	BRP1Y9	BRP1Y8
	BOP2Y[15:8]	BOP2Y15	BOP2Y14	BOP2Y13	BOP2Y12	BOP2Y11	BOP2Y10	BOP2Y9	BOP2Y8
	BRP2Y[15:8]	BRP2Y15	BRP2Y14	BRP2Y13	BRP2Y12	BRP2Y11	BRP2Y10	BRP2Y9	BRP2Y8
	BOP1Z[15:8]	BOP1Z15	BOP1Z14	BOP1Z13	BOP1Z12	BOP1Z11	BOP1Z10	BOP1Z9	BOP1Z8
	BRP1Z[15:8]	BRP1Z15	BRP1Z14	BRP1Z13	BRP1Z12	BRP1Z11	BRP1Z10	BRP1Z9	BRP1Z8
	BOP2Z[15:8]	BOP2Z15	BOP2Z14	BOP2Z13	BOP2Z12	BOP2Z11	BOP2Z10	BOP2Z9	BOP2Z8
	BRP2Z[15:8]	BRP2Z15	BRP2Z14	BRP2Z13	BRP2Z12	BRP2Z11	BRP2Z10	BRP2Z9	BRP2Z8
	BOPBUTT[15:8]	BOPBUTT15	BOPBUTT14	BOPBUTT13	BOPBUTT12	BOPBUTT11	BOPBUTT10	BOPBUTT9	BOPBUTT8
	BRPBUTT[15:8]	BRPBUTT15	BRPBUTT14	BRPBUTT13	BRPBUTT12	BRPBUTT11	BRPBUTT10	BRPBUTT9	BRPBUTT8
Reset		0	0	0	0	0	0	0	0

Operating threshold data of magnetic sensor X-axis/Y-axis/Z-axis

BOPX1[7:0] bits: X-axis operating threshold 1 data lower 8-bit

BOPX1[15:8] bits: X-axis operating threshold 1 data higher 8-bit

BOPY1[7:0] bits: Y-axis operating threshold 1 data lower 8-bit

BOPY1[15:8] bits: Y-axis operating threshold 1 data higher 8-bit

BOPZ1[7:0] bits: Z-axis operating threshold 1 data lower 8-bit

BOPZ1[15:8] bits: Z-axis operating threshold 1 data higher 8-bit

BOPX2[7:0] bits: X-axis operating threshold 2 data lower 8-bit

BOPX2[15:8] bits: X-axis operating threshold 2 data higher 8-bit

BOPY2[7:0] bits: Y-axis operating threshold 2 data lower 8-bit

BOPY2[15:8] bits: Y-axis operating threshold 2 data higher 8-bit

BOPZ2[7:0] bits: Z-axis operating threshold 2 data lower 8-bit
BOPZ2[15:8] bits: Z-axis operating threshold 2 data higher 8-bit
BOP1A [7:0] bits: ANGLE operating threshold 1 data lower 8-bit
BOPBUTT[15:8] bits: BUTTON operating threshold 2 data higher 8-bit
BOPBUTT[7:0] bits: BUTTON operating threshold 2 data lower 8-bit
Returning threshold data of magnetic sensor X-axis/Y-axis/Z-axis
BRPX1[7:0] bits: X-axis returning threshold 1 data lower 8-bit
BRPX1[15:8] bits: X-axis returning threshold 1 data higher 8-bit
BRPY1[7:0] bits: Y-axis returning threshold 1 data lower 8-bit
BRPY1[15:8] bits: Y-axis returning threshold 1 data higher 8-bit
BRPZ1[7:0] bits: Z-axis returning threshold 1 data lower 8-bit
BRPZ1[15:8] bits: Z-axis returning threshold 1 data higher 8-bit
BRPX2[7:0] bits: X-axis returning threshold 2 data lower 8-bit
BRPX2[15:8] bits: X-axis returning threshold 2 data higher 8-bit
BRPY2[7:0] bits: Y-axis returning threshold 2 data lower 8-bit
BRPY2[15:8] bits: Y-axis returning threshold 2 data higher 8-bit
BRPZ2[7:0] bits: Z-axis returning threshold 2 data lower 8-bit
BRPZ2[15:8] bits: Z-axis returning threshold 2 data higher 8-bit
BRP1A [7:0] bits: ANGLE returning threshold 1 data lower 8-bit
BRPBUTT[15:8] bits: BUTTON returning threshold 2 data higher 8-bit
BRPBUTT[7:0] bits: BUTTON returning threshold 2 data lower 8-bit

OCH1973 can set Operating and Returning threshold in two's complement. It follows the same format as Measurement data. Switch thresholds can be free to set (Settable range: same as measurement range. Settable sensitivity: same as measurement sensitivity).

CNTL3[7:0]: Plane Axis Select

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read/Write register									
29h	CNTL3[7:0]	0	0	0	0	0	0	AXIS2	AXIS1
Reset		0	0	0	0	0	0	0	0

AXIS1 and AXIS0 bits: Angle output plane selection
"00": Output XY plane magnetic field Angle value
"01": Output YZ plane magnetic field Angle value
"10": Output XZ plane magnetic field Angle value
"11": Output XY plane magnetic field Angle value

GAIN[7:0]: K Compensation

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read/Write register									
29h	GAIN[7:0]	GAIN7	GAIN6	GAIN5	GAIN4	GAIN3	GAIN2	GAIN1	GAIN0
Reset		1	0	0	0	0	0	0	0

GAIN [7:0] bits: K Compensation

OFFSET1P[15:0], OFFSET2P[15:0]: OFFSET Compensation

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read/Write register									
29h	OFFSET1P,2P[7:0]	OFFSET1P7	OFFSET1P6	OFFSET1P5	OFFSET1P4	OFFSET1P3	OFFSET1P2	OFFSET1P1	OFFSET1P0
Reset		0	0	0	0	0	0	0	0
Addr.	**Register name**	**D15**	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**
Read/Write register									
29h	OFFSET1P,2P[15:0]	OFFSET1P15	OFFSET1P14	OFFSET1P13	OFFSET1P12	OFFSET1P11	OFFSET1P10	OFFSET1P9	OFFSET1P8
Reset		0	0	0	0	0	0	0	0

OFFSET1P[15:0] and OFFSET2P[15:0] bits: Plane Offset compensation

SRST[7:0]:Soft Reset

Addr.	Register name	D7	D6	D5	D4	D3	D2	D1	D0
Read/Write register									
2Ah	SRST[7:0]	0	0	0	0	0	0	0	SRST
Reset		0	0	0	0	0	0	0	0

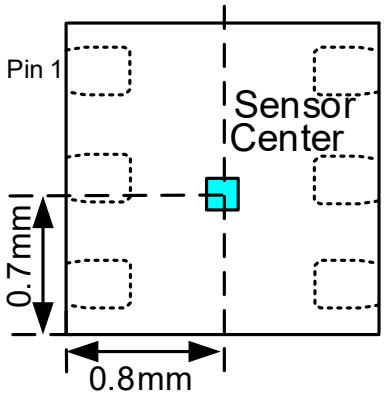
SRST bit: Soft reset

“0”: Normal
“1”: Reset

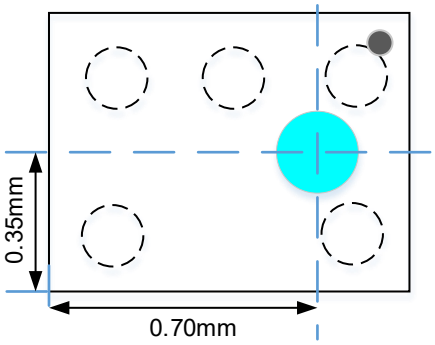
When “1” is set, all registers are initialized. After reset, SRST bit turns to “0” automatically.

■ Hall Sensor Location

(Top View)



DFN1616-6L



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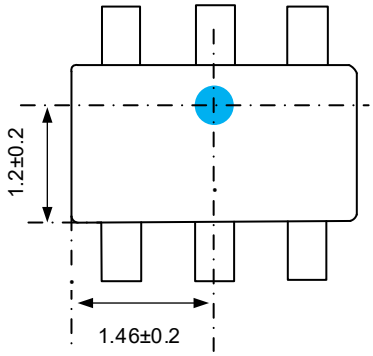
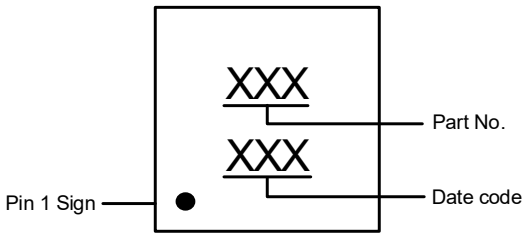


SOT23-6L

■ Marking Information



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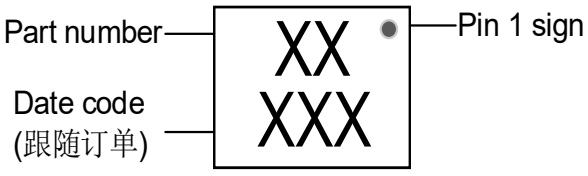

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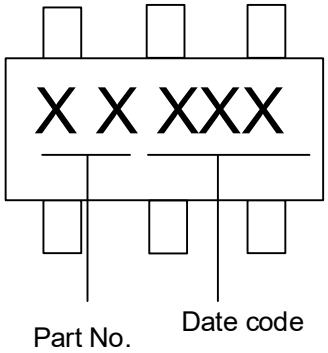
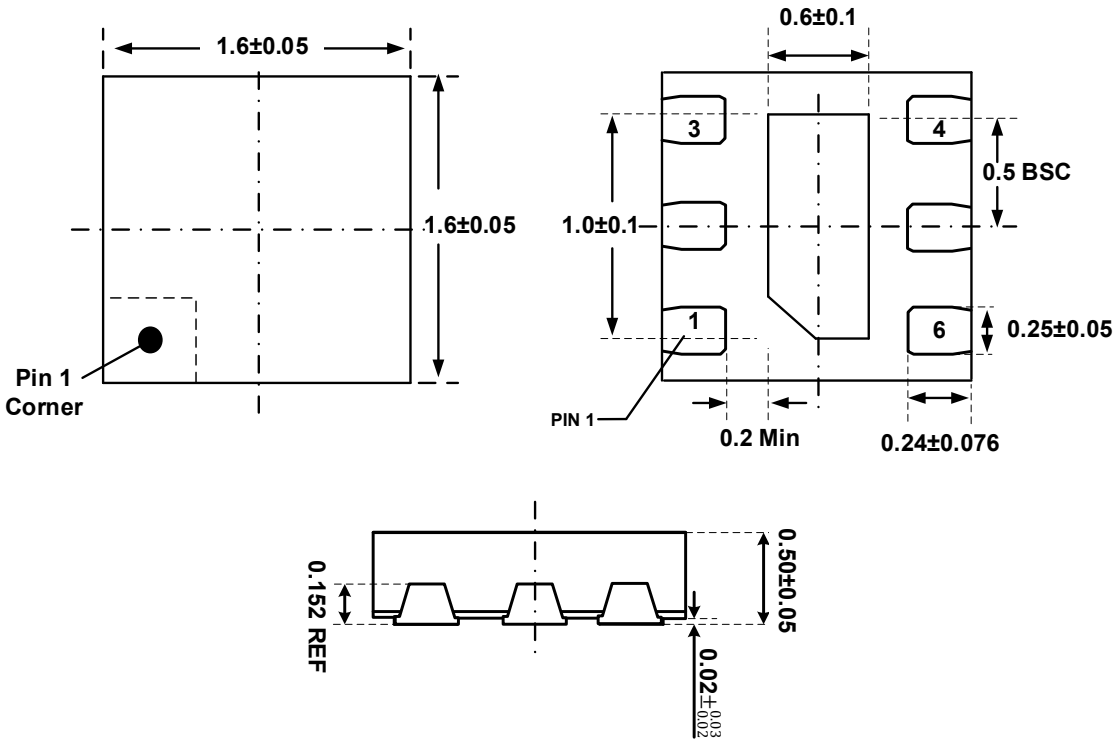


SOT23-6L

■ Package Information

DFN1616-6L:



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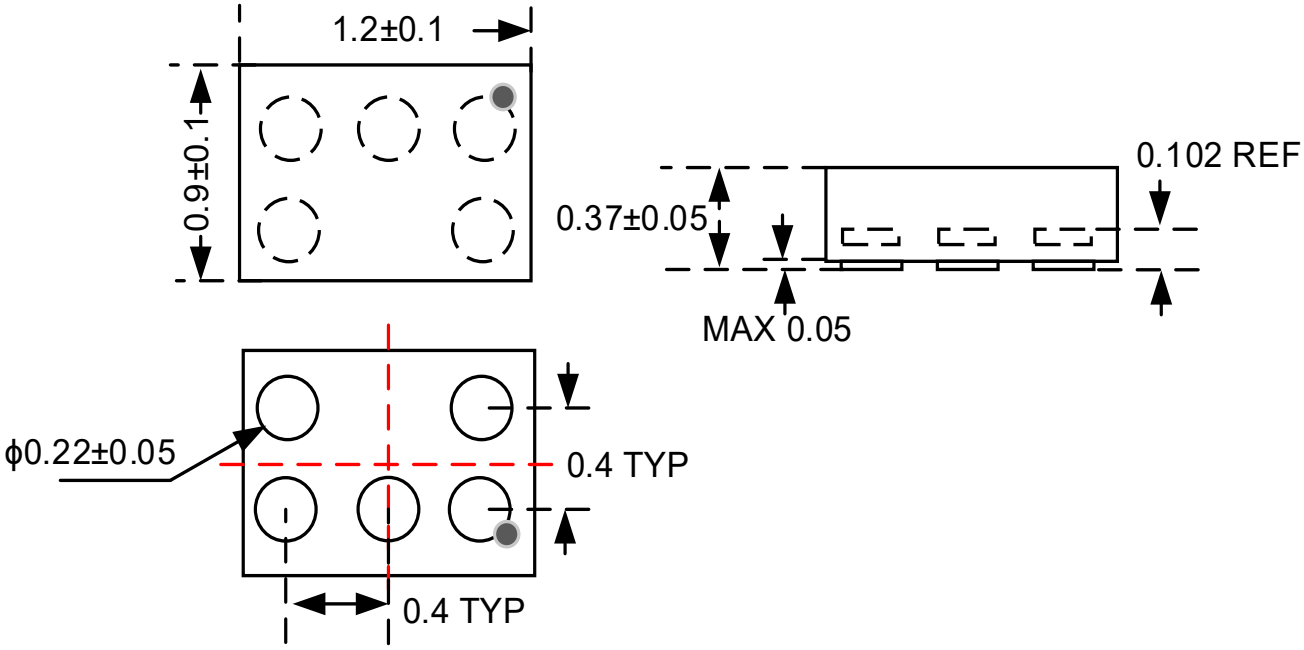

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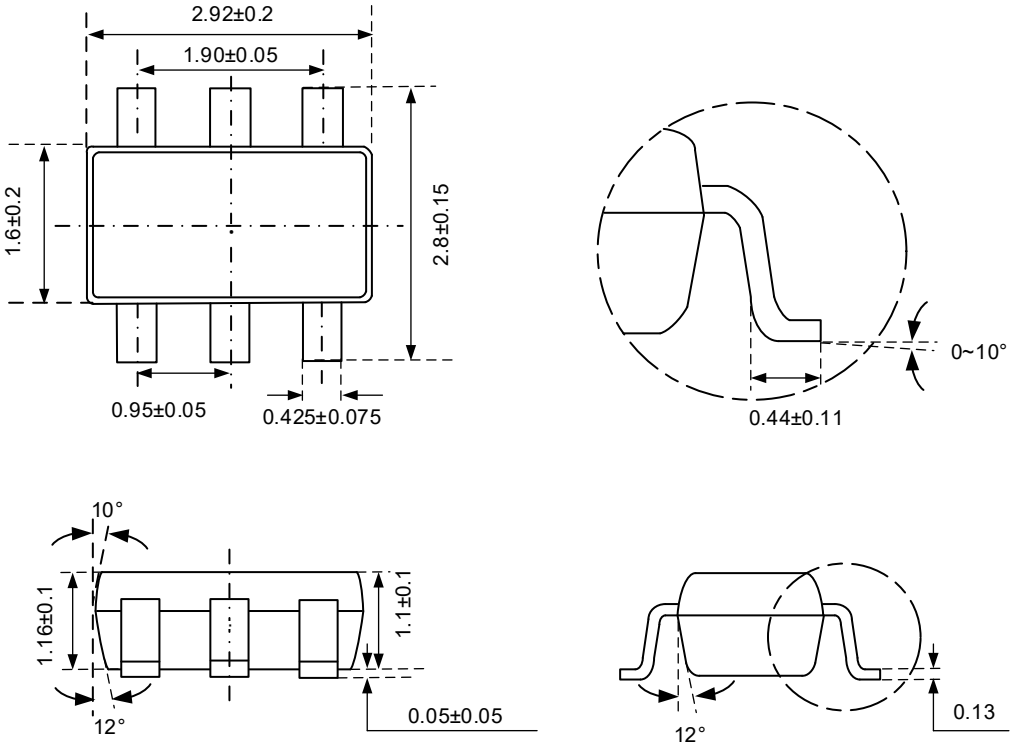
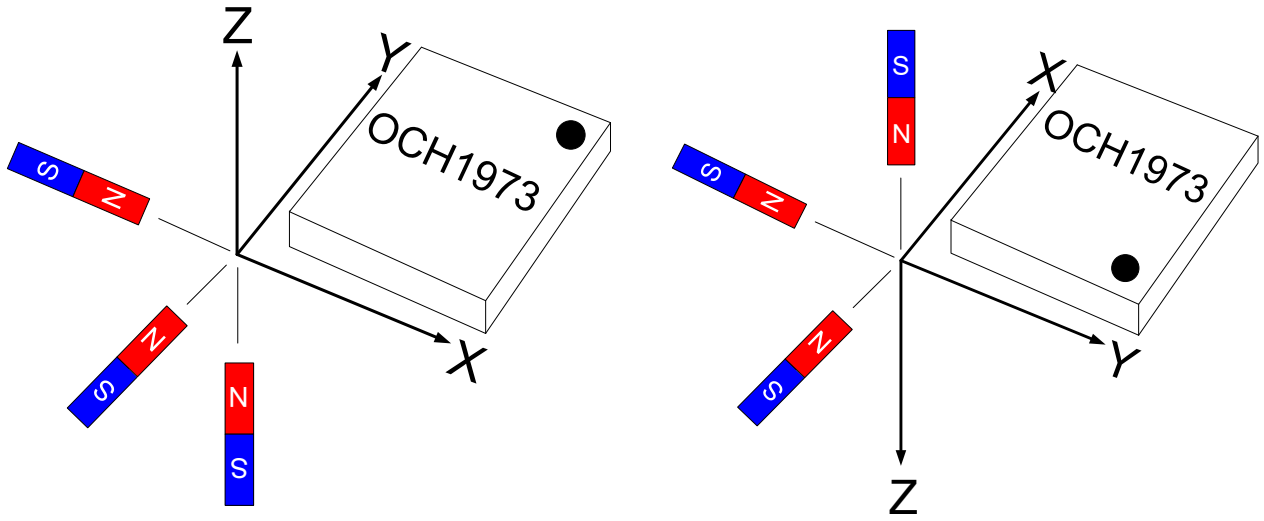
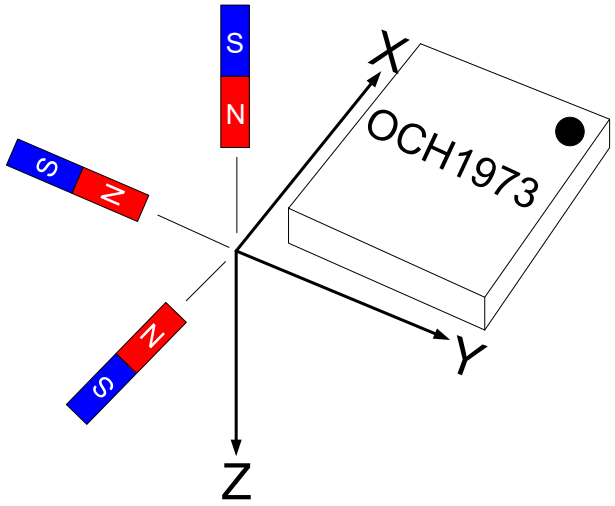


NOTE: All dimensions are in mm

■ Magnetic Orientation

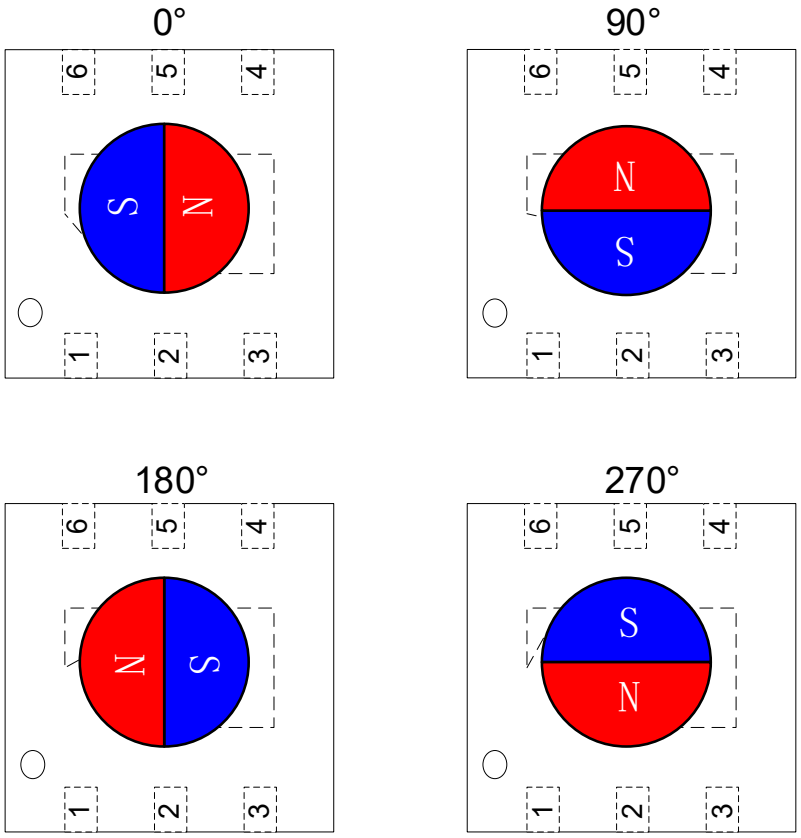


DFN1616-6L DFN1209-5L



SOT23-6L

■ Definition of mechanical angles and rotation directions



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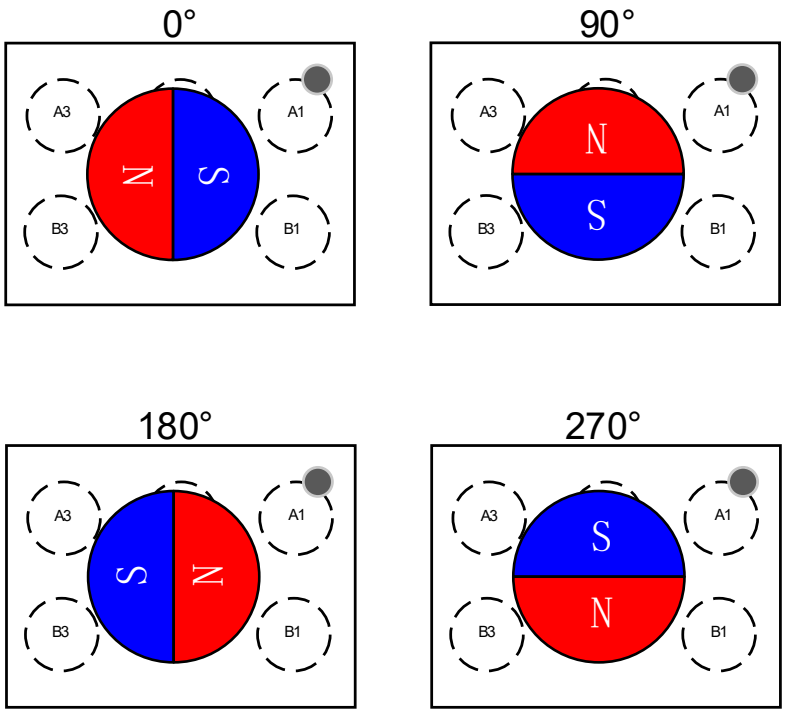

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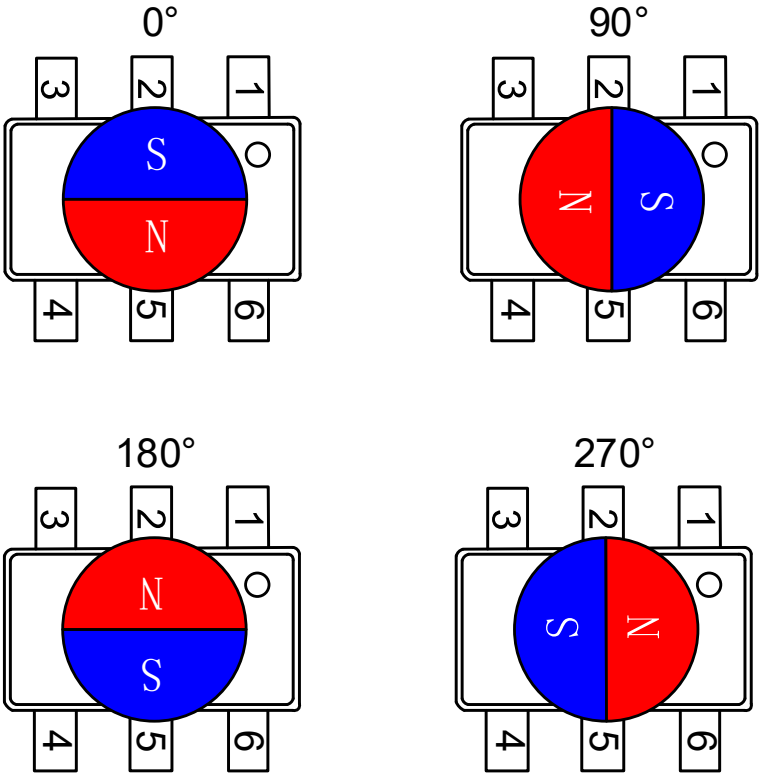
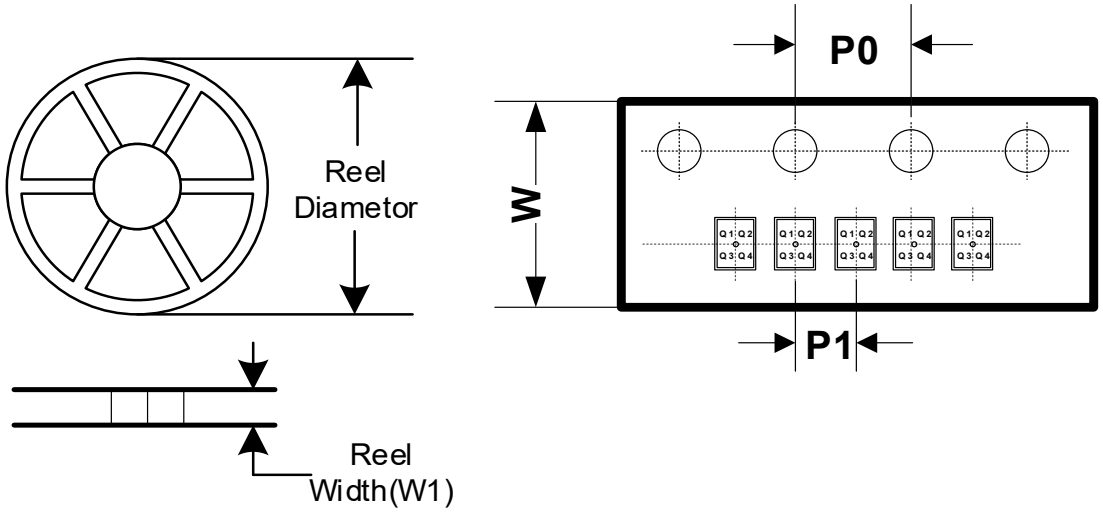


SOT23-6L

■ Packing Information



Package type	SPQ (PCS)	Reel Diameter (mm)	W (mm)	P1 (mm)	P0 (mm)	MSL	Pin 1 Quadrant
DFN1616-6L	3000	180	8.0	2.0	4.0	Level-1	Q1
DFN1209-5L	3000	180	8.0	2.0	4.0	Level-1	Q1
SOT23-6L	3000	180	8.0	4.0	4.0	Level-3	Q3

Note: Carrier Tape Dimension, Reel Size and Packing Minimum.

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