1 Features and Benefits

- 16-bit Digital Output for magnetic and temperature data
- Three Wake-up on change / Interrupt modes
- Data Ready output for µC synchronization
- Built-in chip temperature compensation
- Runtime selectable modes (on-the-fly)
- Integrated configurable digital filter
- Individually selectable magnetic axes
- Four user selectable configurations of the magnetic range ±65 mT, ±130 mT, ±260 mT & ±520 mT
- I^2C compatible with 0.1 MHz, 0.4 MHz & 1.0 MHz
- External synchronized measurement via I^2C
- Two selectable I^2C slave addresses in one device
- Power Down mode of 5nA current consumption
- Wide supply voltage from 1.7 V to 3.6 V
- Ambient temperature range from -40 °C to 125 °C
- TSOT23-6L (SE) package: RoHS, Green and Halogen free compliant

2 Application Examples

- Anti-tampering – E-meters, Doors & Windows
- White goods – Smart knob & liquid levels
- Battery powered tools – Hairdryer & drill trigger
- Smart home – HMI thermostat & electronic lock
- Wearables – Smart watch digital crown & bezel
- Industrial – Linear & pneumatic actuators
- Gaming – Joystick, D-pads & Trigger buttons
- E-bikes – Forks and Gear position
- PC peripheral – Mouse roller

3 Description

MLX90391 is a 3-axis magnetometer suitable for a myriad of position sensors applications. The device, especially designed for micropower applications, measures magnetic fields along the 3-axis (X, Y & Z). Those measurements and the IC temperature are converted into 16-bit words which are transferred over an I^2C communication channel. Measurements can be made upon request or continuously with selectable refresh rates.

MLX90391 offers high magnetic flux measurements despite its small 6-pin package, while keeping current consumption low across multiple settings and configurations.

MLX90391's wake-up modes allow the user to put their entire system in deep sleep, until the IC detects a magnetic field change on the selected axes either versus an initial measurement (Static Delta), or previous measurement (Dynamic Delta). Thus, both fast-changing as well as slowly-drifting magnetic fields can be registered, while the device automatically toggles between active and sleep mode.

The MLX90391 has synchronization options through an external trigger pin or through an I^2C command. Two I^2C addresses (per device) are available by swapping SDA and INTB pins. Furthermore, it is available in two versions, to offer more variety in I^2C address options. In total four pre-programmed MLX90391 can be placed on a single I^2C bus.

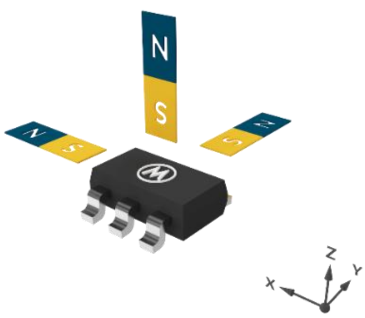


Figure 1 TSOT23-6L

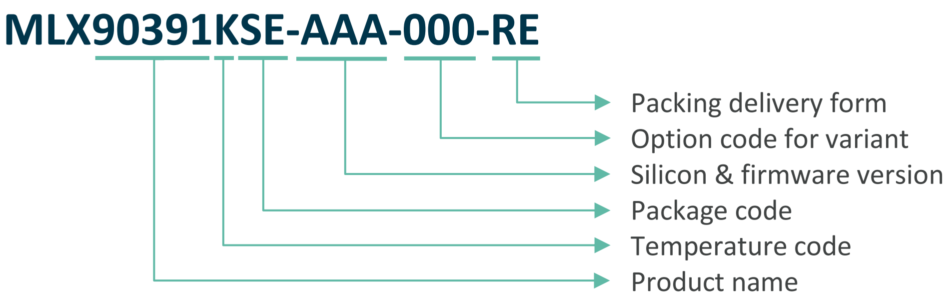
CONTENTS

4 Ordering information

4.1 Production versions

Product code	Temperature	Package	Range	Output	Packing
MLX90391KSE-AAA-001-RE	-40 to 125 °C	TSOT23-6L	±65 mT, ±130 mT, ±260 mT, ±520 mT	I^2C (0x12 / 0x13)	Reel
MLX90391KSE-AAA-002-RE	-40 to 125 °C	TSOT23-6L	±65 mT, ±130 mT, ±260 mT, ±520 mT	I^2C (0x62 / 0x63)	Reel

Table 1 – Production product codes



5 Pins description and block diagram

5.1 Pins description

5.1.1 Pins description for TSOT23-6L package (Production versions)

Pin #	Name	I/O[1]	Description
1	SCL	I/O	I^2C Bus Clock
2	GND	S	Ground
3	NC		Not connected
4	VDD	S	Supply
5	INTB	I/O	I^2C Bus Data Input/Output, WOC Interrupt Output, Synchronization Output, External trigger input
6	SDA	I/O	I^2C Bus Data Input/Output, WOC Interrupt Output, Synchronization Output, External trigger input

Table 2 – TSOT-23 package pins description

For optimal EMC behavior connect the unused pins (NC) to ground.

[1] [S] Supply, [I] input, [O] output

5.2 Block diagram

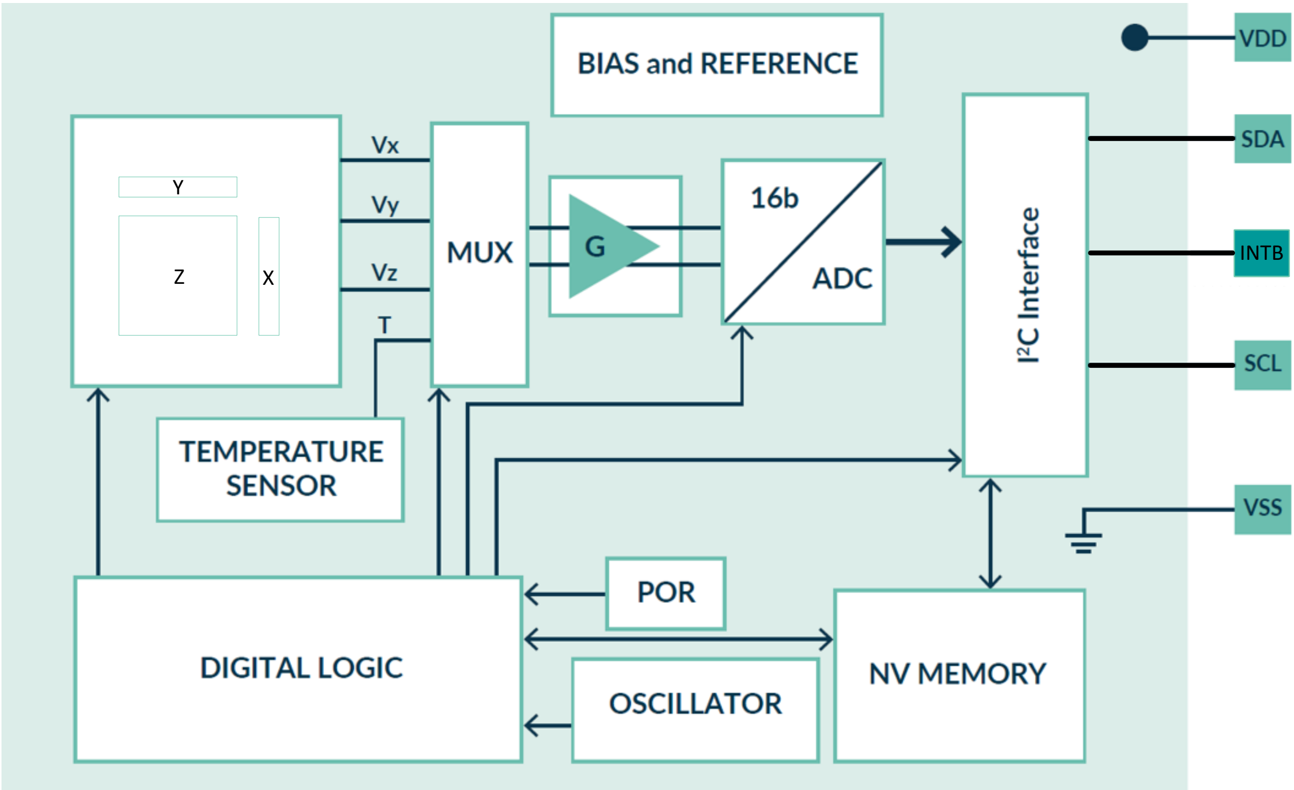


Figure 2 IC block diagram

MLX90391 uses a time-multiplexed conversion for the three magnetic axes and the temperature (optional). The X and Y axes' voltages are provided by vertical Hall sensor structures, whereas the Z axis is sensed by a horizontal Hall sensor structure. The amplified signal is then converted to digital form by an on-chip Analog-to-Digital Converter (ADC). The conversion result is compensated for temperature dependency towards the desired temperature coefficient along with offset and gain compensation. The 16-bit magnetic and temperature data is then output through a standard I²C communication interface.

6 Conditions and specifications

6.1 Absolute Maximum Ratings (AMR)

Parameter	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V_{DD}	-0.3	4	V	
Output voltage	V_{SDA}, V_{SCL}, V_{INTB}	-0.3	4	V	
ESD voltage	$V_{ESD\text{-}HBM}$	-	± 2	kV	HBM (AEC-Q100-002), all pins
	$V_{ESD\text{-}CDM}$	-	± 500	V	CDM (AEC-Q100-011)
Storage temperature	T_{STG}	-55	165	°C	
Operating temperature	T_O	-40	125	°C	Ambient temperature
Junction Temperature	T_{JUNC}	-	130	°C	
Magnetic Flux density	B_{MAX}	Unlimited		T	

Table 3 – Absolute Maximum Ratings

Exceeding the absolute maximum ratings may cause permanent damage.
Exposure to absolute maximum-rated conditions for extended periods may affect the device reliability.

6.2 Electrical operating conditions & specifications

Unless otherwise specified, the electrical specifications are valid for a temperature range from -40 °C to 125 °C, and a supply voltage range from 1.7 V to 3.6 V.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage	V_{DD}	1.7	1.8	3.6	V	
Supply ramp rate	SR_{VDD}	0.004	-	4	V / µs	
Magnetic axes conversion current	I_{DDCXY}	-	2.8	4	mA	X or Y conversion current
	I_{DDCZ}	-	2.1	3.1		Z conversion current
Temperature conversion current	$I_{DD,CONVT}$	-	0.8	1.1	mA	
Counting state current	$I_{DD,CNT}$	-	3.6	5.5	µA	
Digital Signal Processing Current	$I_{DD,DSP}$	- -	450 500	- -	µA	T_EN=0 T_EN=1
Power Down current	$I_{DD,PD}$		5		nA	

Table 4 – Electrical operating conditions

The average current consumption in Continuous measurement mode can be calculated using the following formula:

$$I_{DD} = \frac{T_{Temp} \cdot I_{DD,CONVT} + 2 \cdot T_{XY} \cdot I_{DD,CONVXY} + T_Z \cdot I_{DD,CONVZ} + T_{DSP} \cdot I_{DD,DSP} + T_{Counting} \cdot I_{DD,CNT}}{T_{refresh}}$$

Where T_{Temp}, T_{XY} and T_Z are controlled by **DIG_FILT_HALL_XY**, **DIG_FILT_HALL_Z**, **DIG_FILT_TEMP**, **OSR_TEMP, OSR_HALL** and **T_EN**. T_{DSP} can be set according to the timing specification in Table 10. $T_{Counting}$ is defined as

$$T_{Counting} = T_{refresh} - (T_{Temp} + 2 \cdot T_{XY} + T_Z + T_{DSP})$$

In case less than three magnetic axis measurement is intended, the respective terms can be removed from the equations above.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Temperature sensor sensitivity[2]	TSS	-	50	-	LSB16 / °C	0 LSB corresponds to 0 °C
Temperature sensor accuracy	TSA	-3	-	3	°C	± 3σ variation

Table 5 – Temperature sensor specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Input Level High	VIH	53	65	71	% VDD	SDA (INTB), SCL
Input Level Low	VIL	37	49	54	% VDD	SDA (INTB), SCL
Input Level Hysteresis	VIHYST	9	16	21	% VDD	SDA (INTB), SCL
Output ON resistance	Rdson	-	7.6	15	Ω	SCL
		-	4	7		SDA (INTB)
Output leakage current	I_{LEAK}	-	-	0.1	µA	SCL, SDA, INTB

Table 6 – I²C DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
SDA pull up resistance	R_{SDA}	1	-	-	kΩ	When not using SDA pin
INTB pull up resistance	R_{INTB}	1	-	-	kΩ	When not using INTB pin

Table 7 – I²C bus and external connection requirements

6.3 Thermal operating conditions & specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Thermal resistance	R_{thja}	-	250	-	K/W	Single layer PCB, JEDEC standard test boards, still air (LFPM=0)

Table 8 – Thermal specifications TSOT23-6L

6.4 Magnetic operating conditions & specifications

Unless otherwise specified, the magnetic specifications are valid for a temperature range from -40 °C to 125 °C, and a supply voltage range from 1.7 V to 3.6 V.

Table 9 – Magnetic specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Magnetic sensor measurement range	B_{RANGE}	± 60	± 65	± 70	mT	CONFIG = 3, Ta = 35 °C
		± 120	± 130	± 140		CONFIG = 2, Ta = 35 °C
		± 240	± 260	± 280		CONFIG = 1, Ta = 35 °C
		± 480	± 520	± 560		CONFIG = 0, Ta = 35 °C
Digital output resolution[2]		-	16	-	bit	X, Y, Z and T
Magnetic sensitivity	$SENS_{XYZ}$	454	504	554	$\frac{LSB}{mT}$	CONFIG = 3, Ta = 35 °C
		227	252	277		CONFIG = 2, Ta = 35 °C
		113	126	139		CONFIG = 1, Ta = 35 °C
		57	63	69		CONFIG = 0, Ta = 35 °C
Magnetic resolution	RES_{XYZ}	1.8	1.985	2.2	$\frac{\mu T}{LSB}$	CONFIG = 3, Ta = 35 °C
		3.6	3.97	4.4		CONFIG = 2, Ta = 35 °C
		7.2	7.94	8.8		CONFIG = 1, Ta = 35 °C
		14.5	15.9	17.5		CONFIG = 0, Ta = 35 °C
RES_{XYZ} thermal drift	RES_{TD1}	- 300	-	300	$\frac{ppm}{°C}$	vs. Ta = 35 °C, T_EN=1
RES_{XY} thermal drift	RES_{TDXY0}	- 1000	-	1000		vs. Ta = 35 °C, T_EN=0
RES_{Z} thermal drift	RES_{TDZ0}	- 1500	-	1500		
Magnetic offset of X and Y axes[3]	B_{OFFXY}	- 0.6	-	0.6	mT	CONFIG = 3, Ta = 35 °C
		- 0.4	-	0.4		CONFIG = 2, Ta = 35 °C
		- 0.4	-	0.4		CONFIG = 1, Ta = 35 °C
		- 0.7	-	0.7		CONFIG = 0, Ta = 35 °C
Magnetic offset of Z axis[3]	B_{OFFZ}	- 0.1	-	0.1		CONFIG = 3, Ta = 35 °C
		- 0.1	-	0.1		CONFIG = 2, Ta = 35 °C
		- 0.1	-	0.1		CONFIG = 1, Ta = 35 °C
		- 0.2	-	0.2		CONFIG = 0, Ta = 35 °C
Magnetic offset thermal drift for X and Y axes	$B_{OFFTDXY}$	- 0.9	-	0.9		vs. Ta = 35 °C
Magnetic offset thermal drift for Z axis	B_{OFFTDZ}	- 0.15	-	0.15		
Noise density X or Y axis[4]	B_{NXY3}	-	0.9	-	$\frac{\mu T}{\sqrt{Hz}}$	CONFIG=3, Ta = 27 °C
	B_{NXY2}	-	0.9	-		CONFIG=2, Ta = 27 °C
	B_{NXY1}	-	0.9	-		CONFIG=1, Ta = 27 °C
	B_{NXY0}	-	1.4	-		CONFIG=0, Ta = 27 °C
Noise density Z axis[4]	B_{NZ3}	-	0.15	-		CONFIG=3, Ta = 27 °C
	B_{NZ2}	-	0.28	-		CONFIG=2, Ta = 27 °C
	B_{NZ1}	-	0.28	-		CONFIG=1, Ta = 27 °C
	B_{NZ0}	-	0.65	-		CONFIG=0, Ta = 27 °C

[2] The data format is 2's complement
[3] No external magnetic field applied. The offset values for CONFIG0 and CONFIG3 are obtained through the recalculation, described in paragraph 8.2
[4] No external magnetic field applied. Verified by device characterization.
The noise density is expressed as $B_{NXYZ0123} = \frac{B_{NXYZ0123\_rms}}{\sqrt{\frac{1}{T_{conv}}}}$. T_{conv} is taken from Figure 3

6.5 General timing specifications

Unless otherwise specified, the electrical specifications are valid for a temperature range from -40 °C to 125 °C, and a supply voltage range from 1.7 V to 3.6 V.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Output refresh rate[5]	FR	5	100	1400	Hz	
Oscillator trimming accuracy	K_{OSC_TRIM}	-5	0	5	%	
Oscillator Thermal drift	K_{OSC_TD}	-5	0	5	%	
WOC pulse on SCL	WOC_{PULSE}	14.4	16	17.6	µs	Default configuration
DSP time single axis	T_{DSP1}	25.6	27	28.4	µs	
DSP time two axes	T_{DSP2}	47.5	50	52.5	µs	
DSP time three axes	T_{DSP3}	69.3	73	76.7	µs	
DSP time single axis and temperature	T_{DSP1T}	59.8	63	66.2	µs	
DSP time two axes and temperature	T_{DSP2T}	81.7	86	90.3	µs	
DSP time three axes and temperature	T_{DSP3T}	104.5	110	115.3	µs	
DSP time temperature	T_{DSPT}	19	20	21	µs	
Start-up time	$T_{Startup}$	-	0.15	0.4	ms	From start-up to Power Down mode
External trigger duration	T_{trg}	3	-	-	µs	On SDA or INTB pin

Table 10 – Timing specifications

[5] FR is defined as the inverse of the period between two sets of measurements. It is relevant for the Continuous measurement and WOC modes and is defined by the parameter MODE[3:0]. FR is adjustable with the following settings: 5Hz, 10Hz, 15Hz, 50Hz, 100Hz, 200Hz, 500Hz, 700Hz 1000Hz, 1400Hz. The default value in the non-volatile memory is 100Hz. It is up to the user to make sure that the FR setting corresponds to the time needed to measure the selected axes with their respective filter settings, together with the DSP time, which depends on whether T_EN is set or reset.

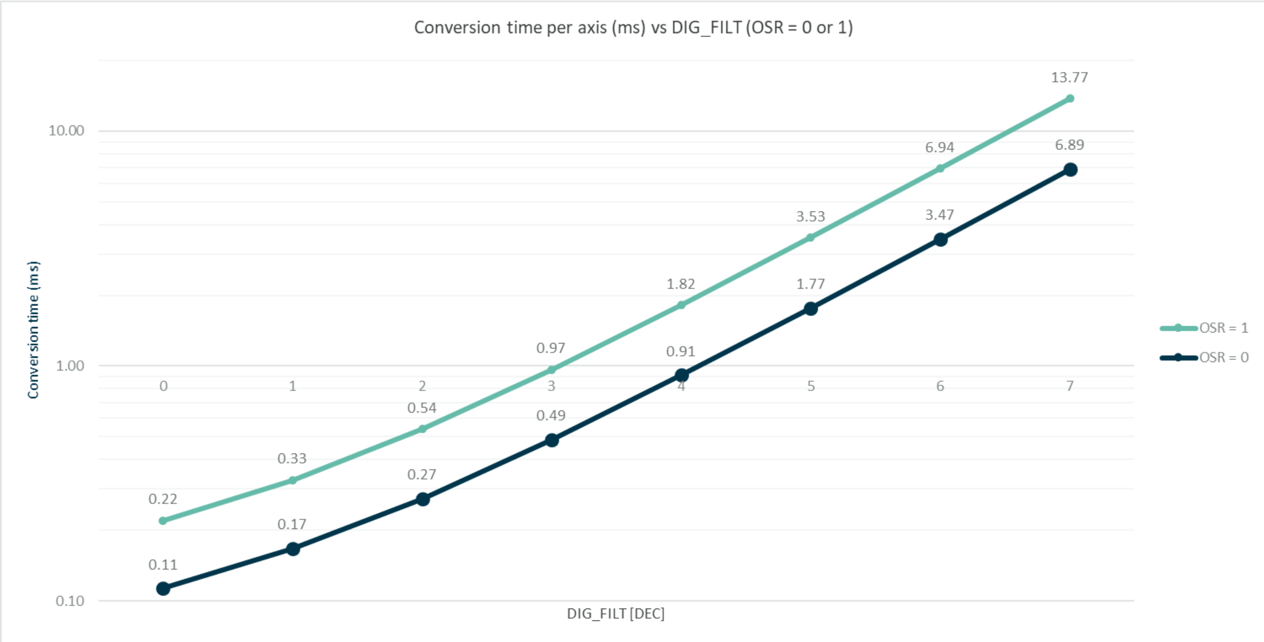


Figure 3 Conversion time for magnetic axis or temperature, where DIG_FILT is DIG_FILT_HALL_XYZ or DIG_FILT_TEMP and OSR is OSR_HALL or OSR_TEMP

The above graph can be expressed with the following formula:

$$T_{conv}(DIG\_FILT) = \frac{16 + 2^{(OSR+5)} \cdot \left(2^{(DIG\_FILT+2)} + 4\right)}{F_{clk}}$$

$$F_{clk} = 2.4\ MHz\ (typ)$$

7 Functional description & interfaces

7.1 Device Configuration for Magnetic measurements

MLX90391 has four possible configurations, depending on the desired magnetic range. Depending on the selected range, the noise performance will also be different as indicated in Table 9.

7.2 Configuration of SDA and INTB pin function

SDA and INTB pins can both be used interchangeably as I²C bus data input/output. Which pin will be used for data communication is automatically detected upon start of communication. It is required that the pin not used for communication is tied to VDD always through a pull-up resistor. This is needed to avoid accidental short circuit current due to pin misuse – accidental wrong configuration by the user.

When not used as an I²C data pin, SDA or INTB pin can be configured for one of the functions, as described in Table 11.

SDA / INTB	DRDY_EN	INTB_SCL_B	MODE [3:0]	Description	Reference
Interrupt output in WOC mode	0	1	1-6, 10-14	Interrupt on SDA or INTB	see 7.3.3
	0	0		Interrupt on SCL	
DRDY flag output	1	x		DRDY flag on SDA or INTB	see 7.3.2.1
External trigger input	x	x	7	Trigger on SDA or INTB	

Table 11 – Unused communication pin function selection

When SDA (or INTB) is configured as an external trigger input, a single measurement can be started upon pulling the SDA (or INTB) low for a duration T_{trig}. Even if the user holds SDA or INTB longer, the measurement will start irrespective of the longer duration the pin is held low. This functionality enables the synchronized measurement of two or more devices on the I^{2}C bus without using I^{2}C communication, which is also supported by the device (see 7.5.2.2).

Pin #	Pin Name	Connected to	I^{2}C Slave Address	Function
6	SDA	SDA bus line	0x12h	I^{2}C Bus Data Input/Output
5	INTB	Tied to VDD through a pull-up resistor		WOC Interrupt output, Synchronization output, Trigger input or not used

Table 12 MLX90391KSE-AAA-001-RE interface with SDA pin connected to the SDA bus line

Pin #	Pin Name	Connected to	I^{2}C Slave Address	Function
6	SDA	Tied to VDD through a pull-up resistor	0x13h	WOC Interrupt output, Synchronization output, Trigger input or not used
5	INTB	SDA bus line		I^{2}C Bus Data Input/Output

Table 13 MLX90391KSE-AAA-001-RE interface with INTB pin connected to the SDA bus line

Pin #	Pin Name	Connected to	I^{2}C Slave Address	Function
6	SDA	Tied to VDD through a pull-up resistor	0x62h	WOC Interrupt output, Synchronization output, Trigger input or not used
5	INTB	SDA bus line		I^{2}C Bus Data Input/Output

Table 14 MLX90391KSE-AAA-002-RE interface with SDA pin connected to the SDA bus line

Pin #	Pin Name	Connected to	I^{2}C Slave Address	Function
6	SDA	Tied to VDD through a pull-up resistor	0x63h	WOC Interrupt output, Synchronization output, Trigger input or not used
5	INTB	SDA bus line		I^{2}C Bus Data Input/Output

Table 15 MLX90391KSE-AAA-002-RE interface with INTB pin connected to the SDA bus line

MLX90391 has a predefined default I^{2}C address 0x12h (MLX90391KSE-AAA-001-RE). The address can be changed to 0x13h if SDA and INTB pins are swapped. This enables the coexistence of two identical MLX90391 devices on the same I^{2}C bus. Similarly, MLX90391KSE-AAA-002-RE features I^{2}C slave addresses 0x62 and 0x63.

7.3 Operating modes

MLX90391 has the following Operating modes

1. Single measurement mode
2. Continuous measurement mode (5Hz, 10Hz, 15Hz, 50Hz, 100Hz, 200Hz, 500Hz, 700Hz, 1000Hz, 1400Hz)
3. Wake-up on change (5Hz, 10Hz, 15Hz, 50Hz, 100Hz, 200Hz, 500Hz, 700Hz, 1000Hz, 1400Hz)
4. Power Down mode (Deep Sleep)
5. Power Down mode (Deep Sleep) with external trigger

Both Continuous and Wake-up on change modes measure periodically the magnetic field and (or) the temperature with a duty cycle defined by OSR_HALL, OSR_TEMP, DIG_FILT_HALL_XY, DIG_FILT_HALL_Z and DIG_FILT_TEMP.

7.3.1 Single measurement mode

When the *Single measurement mode* is set, a magnetic measurement is started. After a measurement and when the signal processing is finished, the measurement data is stored to the data registers (**X**, **Y** and **Z**). After this, the sensor will go to the *Power Down mode* automatically.

While going to the *Power Down mode*, **MODE[3:0]** bits turns to “0”. At the same time, **DRDY** bit (Data Ready) in **STAT1** register turns to “1”.
When any of measurement data register (**X**, **Y** and **Z**) is read, **DRDY** bit turns to Low. It remains High when switching from *Power Down mode* to another mode.

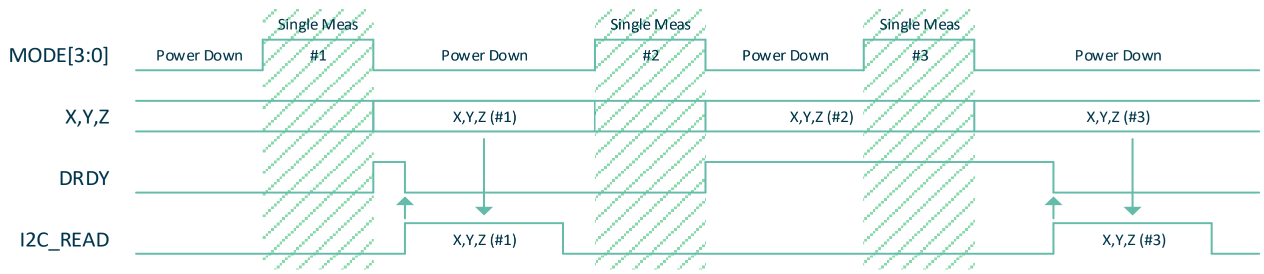


Figure 4 Single measurement mode when data is read out of measurement period

When the sensor is measuring, the data registers (**X**, **Y** and **Z**) keep the previous data. Therefore, it is possible to read out data even during measurement periods.

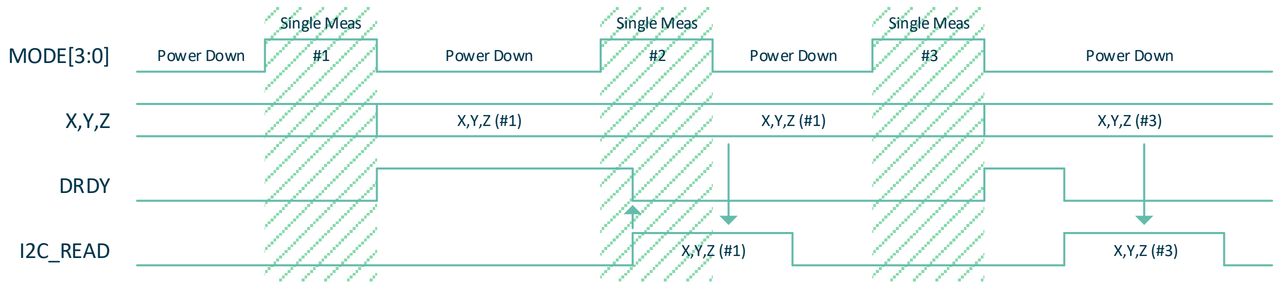


Figure 5 Single measurement mode when data read started during measurement period

7.3.2 Continuous measurement Mode

When the *Continuous measurement* mode is set, the measurement starts periodically. After measurement and signal processing is finished, the measurement data is stored to the data registers (**X**, **Y**, and **Z**).
Almost all internal blocks are disabled (*Counting* power state).

After a measurement period, the device wakes up automatically from *Counting* power state and starts a new measurement.

The *Continuous measurement mode* ends when *Power Down mode* (**MODE[3:0]** = 0) is set. If the measurement period is changed while the device is already configured in *Continuous measurement mode*, a new measurement starts.

STAT1 and measurement data registers (**X**, **Y** and **Z**) will not be initialized by this.

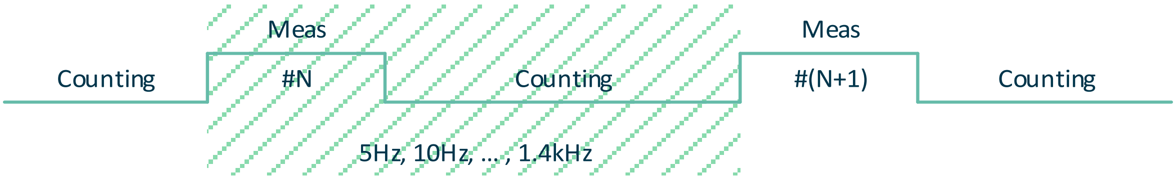


Figure 6 Continuous measurement mode

7.3.2.1 Data Ready

When the measurement data is stored and ready to be read, the **DRDY** bit (Data Ready) in **STAT1** register is set to High. When a measurement is performed correctly, the device sets the Data Ready bit before going back to *Counting* or *Wake-up on Change* power state.

7.3.2.2 Normal Read Sequence

The stored measurement data is protected during the data reading. There is no update of the data during this time. Consequently, the following sequence should be followed:

1. Check if the Data is Ready or not by polling **DRDY** bit of **STAT1** register
   a. **DRDY**: Data Ready. The Data is ready when set High.
2. Reading of the **STAT1** register will not trigger the protection.
3. **Read measurement data** - When any of the measurement data register (**X**, **Y**, or **Z**) is read, the device enables the protection as soon as the register is copied into the I^2C sending register. When data reading starts, **DRDY** (Data Ready) bit turns Low.
4. **Read STAT2 register (required for data consistency - provides information on overflow and data skip)**

When this read sequence is followed and there is no attempted I^2C read during measurement, reading of **STAT2** sets the **DOR** (Data Overrun) bit to low.

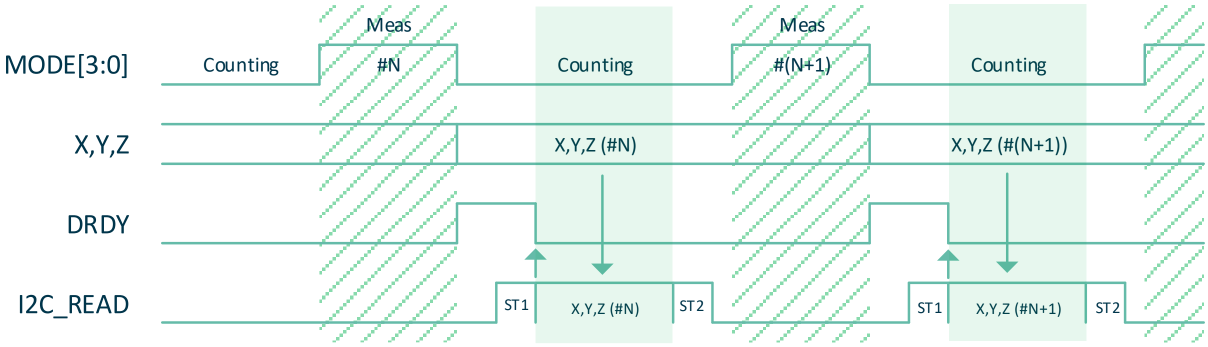


Figure 7 Normal read sequence

7.3.2.3 Data Read Start during Measurement

When the sensor is measuring, the measurement data registers (**X**, **Y** and **Z**) keep the previous data. Therefore, it is possible to read out data even in measurement period.

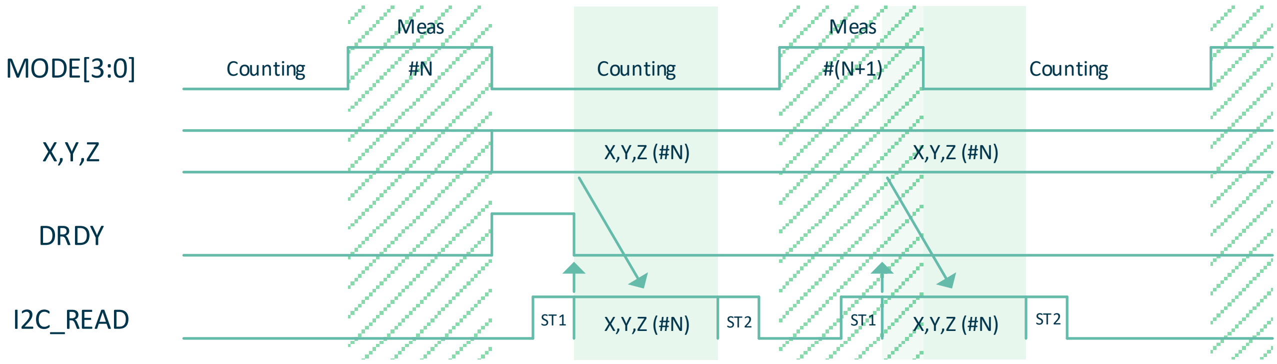


Figure 8 Data read start during measurement

7.3.2.4 Data skip

If the available data is not read before a new measurement ends, the **DRDY** bit (Data Ready) remains High. However, a new set of measurement data will replace the previous one.

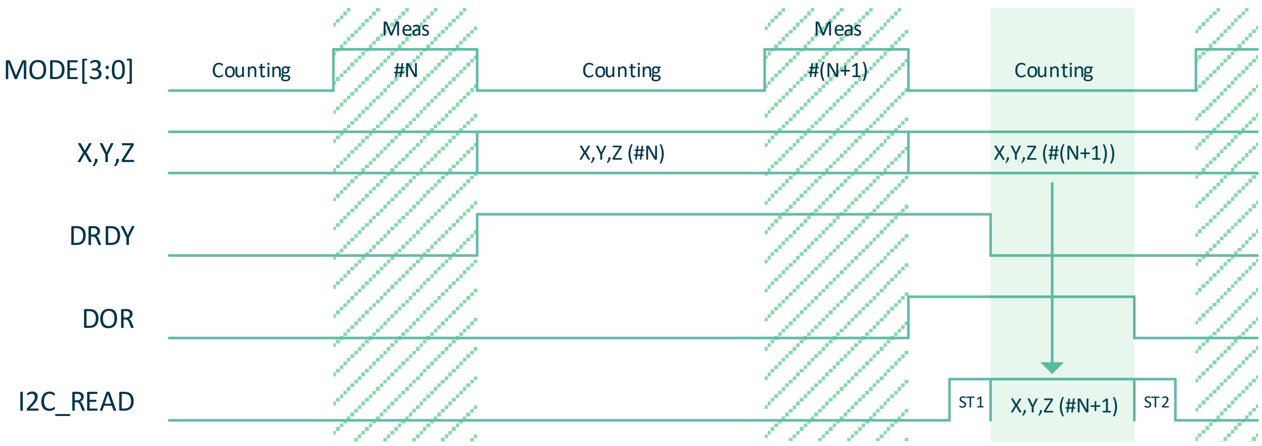


Figure 9 Data Skip: When data is not read

If the available data is read while a new measurement is being performed, this set of data will be protected. This is also the case even if the reading procedure finishes after the measurement.

Consequently, this new set of data is skipped.

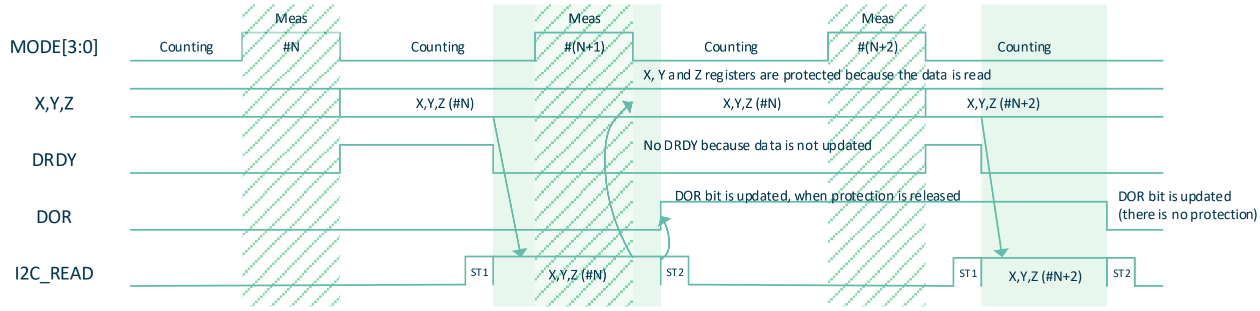


Figure 10 Data Skip: When data read has not been finished before the next measurement end

7.3.2.5 End Operation

Set the Power Down mode (**MODE[3:0]** = 0) to end the Continuous measurement mode.

7.3.3 Wake-up On Change Mode (WOC Mode)

This mode of operation can be enabled when setting the **SWOC** bit. As in Continuous measurement mode, the device wakes up periodically and measures the enabled axes and the temperature if enabled. When the current reading, the difference or the differential of the reading of any of the enabled axes exceeds a predefined threshold defined by the user, MLX90391 issues an interrupt. The interrupt can be configured to be signaled in two ways through **INTB_SCL_B** bit:

1. Pulling the SCL line low for 16 µs. The duration of the pulse is configurable: 8µs, 16µs, 32µs, 64µs by changing the **INTDUR[1:0]** bits
2. Latching low of INTB or SDA pin, depending on the connection to the I^2C bus

The condition for interrupt can be Static Delta or Dynamic Delta:

1. Static Delta - the measured field is greater in magnitude **with a predefined threshold, compared to the first** converted value after WOC enter. The threshold in **X(Y/Z)_THR[15:0]** is interpreted as an unsigned 15-bit value. Set **X(Y/Z)_THR[15]=0**[6].
2. Dynamic Delta - the measured field is greater in magnitude **with a predefined threshold, compared to the previous** converted value. The threshold in **X(Y/Z)_THR[15:0]** is interpreted as an unsigned 15-bit value. Set **X(Y/Z)_THR[15]=0**[6].

Which condition is used in the application is controlled by **WOC_MODE[1:0]** in the user address space.

When an interrupt condition occurs, the **INT** flag is set in the **STAT1** register. It is cleared upon reading **STAT1** register. The figures below describe the behavior of the interrupt.

[6] In case X(Y/Z)_THR[15]=1, MLX90391 will not issue an interrupt, irrespective of the threshold value

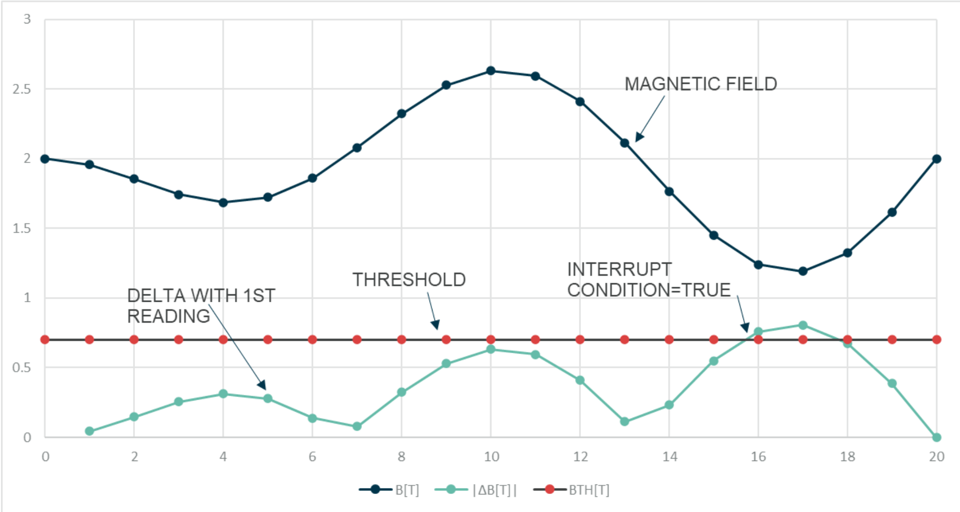


Figure 11 Conceptual representation of Static Delta WOC behavior

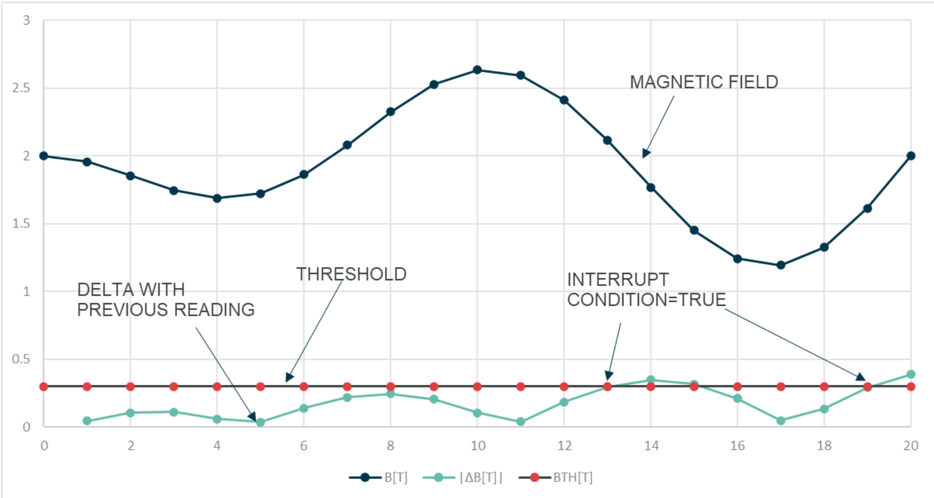


Figure 12 Conceptual representation of Dynamic Delta WOC behavior

The wake-up on change (WOC) interrupt can be configured (**INTREPB=0** (default)) so that it keeps repeating until WOC mode is exit, regardless of whether **STAT1** was read or not, once an interrupt condition is detected. Reading **STAT1** will clear the interrupt until the next measurement only.
If **INTREPB=1**, then the interrupt will stop repeating when **STAT1** register is read even though WOC mode was not exited.

Condition X: if X_EN = 1'b1, |X (#N+n) - X(#N)| > X(THR) -> TRUE/FALSE
or
Condition Y: If Y_EN = 1'b1, |Y (#N+n) - Y(#N)| > Y(THR) -> TRUE/FALSE
or
Condition Z: If Z_EN = 1'b1, |Z (#N+n) - Z(#N)| > Z(THR) -> TRUE/FALSE

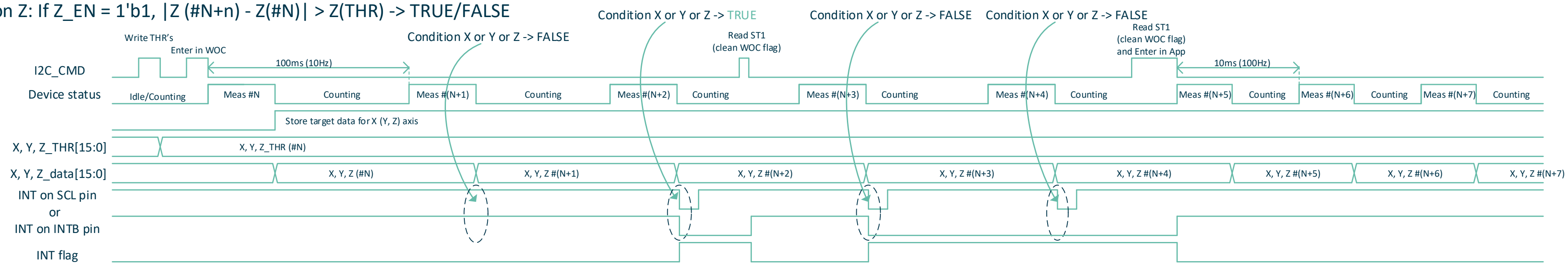


Figure 13 Static Delta WOC example with first measurement after WOC enter. Repetitive interrupt

Condition X: if X_EN = 1'b1, |X (#N+n) - X(#N+n-1)| > X(THR) -> TRUE/FALSE
or
Condition Y: If Y_EN = 1'b1, |Y (#N+n) - Y(#N+n-1)| > Y(THR) -> TRUE/FALSE
or
Condition Z: If Z_EN = 1'b1, |Z (#N+n) - Z(#N+n-1)| > Z(THR) -> TRUE/FALSE

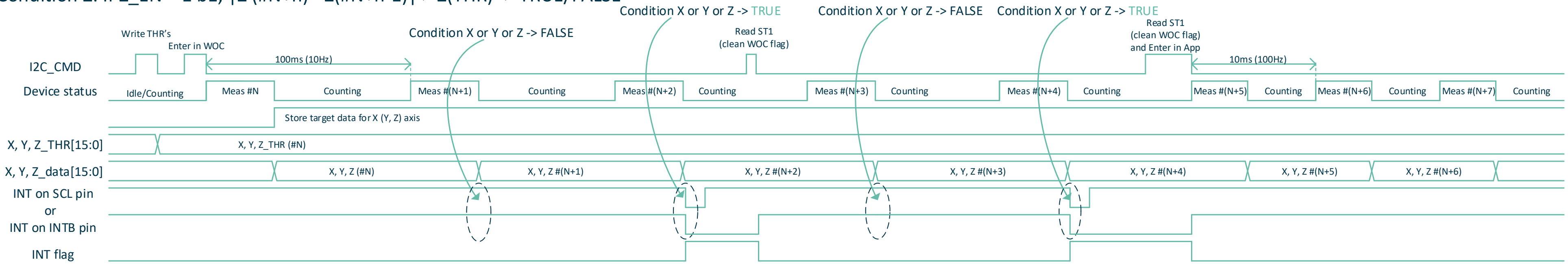


Figure 14 Dynamic Delta WOC example. Comparison of each measurement with the threshold after WOC enter. Single interrupt

7.3.4 Power Down (Deep Sleep)

In Power Down mode, the device is in minimal power consumption state (see Table 4). All internal blocks including the oscillator are disabled except the POR circuit. Only the communication over the I^2C interface is maintained. The digital handling of the communication is clocked by the I^2C master clock. All registers remain accessible and the data stored in read/write registers remains.

7.3.5 Power Down (Deep Sleep) with external trigger

In this mode, the device is in Power Down state as described in 7.3.4, where wake-up and single measurement can be achieved by means of pulling the SDA or INTB pin low for a period of time T_{trig}, apart from sending an I^2C command. Whether SDA or INTB is pulled depends on which of the two pins is not used for I^2C communication. This mode is entered by setting **MODE [3:0]** = 7.

7.4 Magnetic Sensor Overflow

The device has a built-in overflow detection

2's complement	Hex	Dec	Magnetic flux density [µT]			
			CONFIG = 3	CONFIG = 2	CONFIG = 1	CONFIG = 0
0111_1111_1111_0000	7FF0	32752	65 000	130 000	260 000	520 000
|	|	|	|	|	|	|
0000_0000_0000_0001	0001	1	1.985	3.97	7.94	15.88
0000_0000_0000_0000	0000	0	0	0	0	0
1111_1111_1111_1111	FFFF	-1	-1.985	-3.97	-7.94	-15.88
|	|	|	|	|	|	|
1000_0000_0001_0000	8010	-32752	-65 000	-130 000	-260 000	-520 000

Table 16 Measurement magnetic data format

When the magnetic field exceeds the limitation, the stored measurement data is not correct. In this case, Magnetic Sensor Overflow occurs.

For X axis overflow flag condition is: |X| > 32,752
When the condition is fulfilled, HOFL_X bit turns to “1”.

For Y axis overflow flag condition is: |Y| > 32,752
When the condition is fulfilled, HOFL_Y bit turns to “1”.

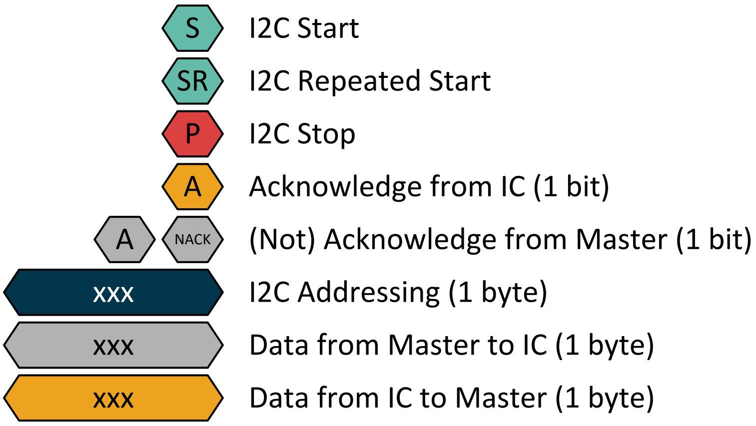
For Z axis overflow check is: |Z| > 32,752 If the condition is fulfilled, the HOFL_Z bit turns to “1”.
When measurement data register (X, Y and Z) is updated, HOFL_X, HOFL_Y and HOFL_Z bits are updated, too.

7.5 Output protocol (I^2C) description

The following I^2C commands are implemented:

- **MEM_DIRECT_READ**: reads data from memory space, starting from the default address 0x00
- **MEM_READ**: reads data from memory space, where the start address will be specified in the command and the address will be incremented for continuous reading until an I^2C stop is detected
- **MEM_WRITE**: writes data to memory space, where the start address will be specified followed by the data to be stored at addresses starting from the given start address and incremented until an I^2C stop is detected
- **GENERAL_CALL_MEM_WRITE:** writes data to the memory space for all MLX90391 devices on the I^2C bus, where the start address will be specified in the command and the address will be incremented for continuous reading until an I^2C stop is detected
- **ADDRESSED_RESET**: reset of the device, based on the I^2C Slave Address (reset of addressed devices on the I^2C bus only)
- **GLOBAL_RESET**: resets all MLX90391 devices on the I^2C bus

In the next sections, the format of the different I^2C commands is explained.
The following legend is used:



7.5.1 Read Commands

There are two read commands that are implemented

- MEM_DIRECT_READ: reads data from memory space, starting from the default address 0x00
- MEM_READ: the start address will be specified in the command and the address will be incremented for continuous reading until an I^2C stop is detected.

7.5.1.1 MEM_DIRECT_READ (direct read) command

MEM_DIRECT_READ: reads data from memory space, starting from the default address 0x00

Figure 15 I^2C - MEM_DIRECT_READ (direct read) Command

NOTES:

- Incremental readout – return 0x00 when the address is out of the valid address space
- **NACK** is needed from the master to allow going to STOP

7.5.1.2 MEM_READ (addressed read) command

MEM_READ: the start address will be specified in the command and the address will be incremented for continuous reading until an I²C stop (P) is detected.
Incremental read-out starting at a given address (Register Start Address).
Continuous transmission of data in sequential register addresses until the communication is terminated by the master.

Figure 16 I²C - MEM_READ (addressed read)

Important! A repeated START is required to perform an "Addressed read". Without repeated START, the command will be seen as a "Direct read".

As soon as incremental addressing leaves the address space, the slave will respond with all 0x00.
NOTES:

- Incremental readout – return 0x00 when address out of valid space
- NAK is needed from master to allow going to STOP

7.5.2 Write Commands

7.5.2.1 MEM_WRITE (addressed write) command

MEM_WRITE: the start address will be specified followed by the data to be stored at addresses starting from the given start address and incremented until an I²C stop (P) is detected.
Incremental write starting at a given address (Register Start Address).
Normally only 1x register is written, but optionally the master can continue to transmit data of sequential register addresses to reduce the communication time when a lot of registers should be written.

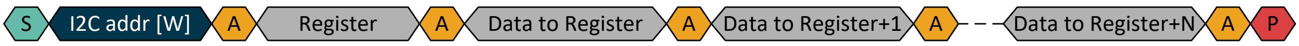


Figure 17 I²C - MEM_WRITE (addressed write) command

The slave sends AK/NACK based on the fact whether it was able to write data
The slave automatically increments the address of the read out byte, independent if it gave an AK or a NACK to the master. It is up to the master to re-write the byte afterwards.
When the device is busy with the write operation, new write commands will be ignored. A read operation will return invalid data.

7.5.2.2 GENERAL_CALL_MEM_WRITE: General call for synchronized measurement

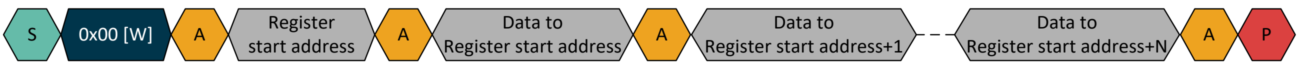


Figure 18 GENERAL_CALL_MEM_WRITE command

This command is used to write data to all MLX90391 devices on the I²C bus at once. This functionality is particularly useful when synchronized measurements between devices are needed. If a measurement is configured, it starts right after the communication is finished.

7.5.2.3 ADDRESSED_RESET: Addressed reset

Figure 19 ADDRESSED_RESET command

The addressed reset command brings the device back into a state like it was after power-on.

The I²C Slave Address is used, which means that only the addressed devices on the I²C bus are reset.

7.5.2.4 *GLOBAL_RESET: Global reset*

Figure 20 GLOBAL_RESET command

The global reset command brings all MLX90391 devices on the I²C bus back into a state like it was after power-on.

7.6 Memory items description

7.6.1 Memory structure

Each address in the address space consists of 8-bit data. Data is transferred to or received from the external microcontroller via I²C interface.

Address	Name	Description	R/W	7	6	5	4	3	2	1	0
0x00	STAT1[7:0]	Status Register 1	R	-	-	-	INT	RT	-	-	DRDY
0x01	X[7:0]	X-axis Measurement Magnetic Data [7:0]	R	Y[7:0]							
0x02	X[15:8]	X-axis Measurement Magnetic Data [15:8]	R	Y[15:8]							
0x03	Y[7:0]	Y-axis Measurement Magnetic Data [7:0]	R	X[7:0]							
0x04	Y[15:8]	Y-axis Measurement Magnetic Data [15:8]	R	X[15:8]							
0x05	Z[7:0]	Z-axis Measurement Magnetic Data [7:0]	R	Z[7:0]							
0x06	Z[15:8]	Z-axis Measurement Magnetic Data [15:8]	R	Z[15:8]							
0x07	STAT2	Status Register 2	R	-	-	-	-	DOR	HOVF_Z	HOVF_X	HOVF_Y
0x08	T[7:0]	Temperature Measurement Data Lower 8-bit	R	T[7:0]							
0x09	T[15:8]	Temperature Measurement Data Higher 8-bit	R	T[15:8]							
0x0A	CID[7:0]	Company ID [7:0]	R	Company ID [7:0]							
0x0B	DID[7:0]	Device ID [7:0]	R	Device ID [7:0]							
0x0C	CTRL1[7:0]	Control Register 1	R/W	SWOC	Z_EN	X_EN	Y_EN	MODE[3:0]			
0x0D	CTRL2[7:0]	Control Register 2	R/W	CONFIG[1:0]		INTDUR[1:0]		INTB_SCL_B	INTREPB	WOC_MODE[1:0]	
0x0E	CTRL3[7:0]	Control Register 3	R/W	OSR_HALL	OSR_TEMP	DIG_FILT_HALL_XY[2:0]			DIG_FILT_TEMP[2:0]		
0x0F	CTRL4[7:0]	Control Register 4	R/W	DNC=1	DNC=0	T_EN	DNC=0	DRDY_EN	DIG_FILT_HALL_Z[2:0]		
0x10		Reserved		-	-	-	-	-	-	-	-
0x11	RST	Reset = 0x06	R/W	-	-	-	-	-	-	-	-
0x12		Reserved		-	-	-	-	-	-	-	-
0x13		Reserved		-	-	-	-	-	-	-	-
0x14	X_THR[7:0]	X axis WOC threshold low byte	R/W	Y_THR[7:0]							
0x15	X_THR[15:8]	X axis WOC threshold high byte	R/W	Y_THR[15:8]							
0x16	Y_THR[7:0]	Y axis WOC threshold low byte	R/W	X_THR[7:0]							
0x17	Y_THR[15:8]	Y axis WOC threshold high byte	R/W	X_THR[15:8]							
0x18	Z_THR[7:0]	Z axis WOC threshold low byte	R/W	Z_THR[7:0]							
0x19	Z_THR[15:8]	Z axis WOC threshold high byte	R/W	Z_THR[15:8]							

Figure 21 Memory map

In the memory map, the abbreviation DNC stands for Do Not Change. The default values of these bits are indicated in order to preserve them when writing data in CTRL4.

The **STAT1** register is mapped on address 0x00, since it is the default address of **MEM_DIRECT_READ** (direct read) command.
The user has to read the status bits **DRDY** first to check if there is new data and if there is new data, to continue the command to read the registers **X**, **Y** and **Z**.

7.6.2 I/O registers description

Address 0x00 – STAT1 Register

7	6	5	4	3	2	1	0
STAT1_7	STAT1_6	STAT1_5	INT	RT	STAT1_2	STAT1_1	DRDY
RW-0	RW-0	RW-0	RW-0	RW-1	RW-0	RW-0	RW-0

NOTE: R=Read access; W=Write access; value following dash (-) = value after initialization

Bit 7 – 5 **STAT1[7:5].** Reserved (Not used)

Bit 4 **INT**. Interrupt bit turns to "1" when the interrupt condition is satisfied during WOC. It returns to "0" when the STAT1 register is read. It is reset to “0” upon power on reset and upon entering WOC mode
0 – The Interrupt is not active
1 – The Interrupt is active

Bit 3 **RT**. The device is reset
0 – The device was not reset
1 – The device was reset and this is the first reading. Automatically set to 0 when the first reading of STAT1 register is done

Bit 2 – 1 **STAT1[2:1].** Reserved (Not used)

Bit 0 **DRDY**. Data Ready.
DRDY bit turns to “1” when data is ready in "*Single measurement*" mode (1, 9), "*Continuous measurement*" mode (2, 3, 4, 5, 6, 10, 11, 12, 13, 14) or "*Self-test*" mode (7).
It returns to “0” when any of the measurement data registers (**X**, **Y** or **Z**) is read
0 – Normal
1 – Data is ReaDY

Addresses 0x01 – 0x06

Magnetic measurement data for **X**, **Y** and **Z** axes.

Address 0x07 – STAT2 Register

7	6	5	4	3	2	1	0
STAT2_7	STAT2_6	STAT2_5	STAT2_4	DOR	HOVF_Z	HOVF_Y	HOVF_X
RW-0	RW-0	RW-0	RW-0	RW-0	RW-0	RW-0	RW-0

NOTE: R=Read access; W=Write access; value following dash (-) = value after initialization

Bit 7 – 4 **STAT2[7:4].** Reserved (Not used)

Bit 3 **DOR**. Data Overrun
DOR bit turns to "1" when data has been skipped in "*Continuous measurement*" mode (2, 3, 4, 5, 6, 10, 11, 12, 13, 14).
It returns to "0" when any of the measurement data registers (X, Y or Z) is read.
0 – Normal
1 – Data OverRun

Bit 2 **HOVF_Z.** Magnetic sensor overflow for Z axis measurement
0 – Normal
1 – Magnetic sensor overflow for Z axis occurred

Bit 1 **HOVF_Y**. Magnetic sensor overflow for Y axis measurement
0 – Normal
1 – Magnetic sensor overflow for Y axis occurred

Bit 0 **HOVF_X**. Magnetic sensor overflow for X axis measurements
0 – Normal
1 – Magnetic sensor overflow for X axis occurred

Addresses 0x08 – 0x09
Temperature measurement data

Addresses 0x0A
Company ID = 0x91

Addresses 0x0B
Device ID = 0xAA

Address 0x0C – CTRL1 Register

7	6	5	4	3	2	1	0
SWOC	Z_EN	Y_EN	X_EN	MODE3	MDOE2	MODE1	MODE0
RW-0	RW-1	RW-1	RW-1	RW-0	RW-0	RW-0	RW-0

NOTE: R=Read access; W=Write access; value following dash (-) = value after initialization

Bit 7 **SWOC**. Start Wake-up On Change mode
- **0** – Disable
- **1** – Enable

Bit 6 **Z_EN**. Control magnetic measurement for Z axis
- **0** – Disable
- **1** – Enable

Bit 5 **Y_EN**. Control magnetic measurement for Y axis
- **0** – Disable
- **1** – Enable

Bit 4 **X_EN**. Control magnetic measurement at X axis
- **0** – Disable
- **1** – Enable

Bit 3 – 0 **MODE[3:0].** Application Mode
- **0** – Power-down mode
- **1** – Single measurement mode
- **2** – Continuous measurement mode 5Hz
- **3** – Continuous measurement mode 10Hz
- **4** – Continuous measurement mode 15Hz
- **5** – Continuous measurement mode 50Hz
- **6** – Continuous measurement mode 100Hz
- **7** – Power Down with External trigger mode
- **8** – Power-down mode
- **9** – Single measurement mode
- **10** – Continuous measurement mode 200Hz
- **11** – Continuous measurement mode 500Hz
- **12** – Continuous measurement mode 700Hz
- **13** – Continuous measurement mode 1.0kHz
- **14** – Continuous measurement mode 1.4kHz
- **15** – Power-down mode

NOTE: Care shall be taken to set the correct configuration of **OSR_HALL** and **DIG_FILT_HALL_XYZ** when selecting a certain refresh rate. The chosen settings have to ensure that the total conversion time fits into the update period selected. The total conversion time is composed of the axes conversion time, the temperature conversion time and the DSP time. The DSP time additionally depends on the number of axes measured (Table 10) and whether the temperature measurement is enabled or not by setting or resetting T_EN.

Address 0x0D – CTRL2 Register

7	6	5	4	3	2	1	0
CONFIG1	CONFIG0	INTDUR1	INTDUR0	INTB_SCL_B	INTREPB	WOC_MODE1	WOC_MODE0
RW-0	RW-0	RW-0	RW-0	RW-1	RW-0	RW-0	RW-0

NOTE: R=Read access; W=Write access; value following dash (-) = value after initialization

Bit 7 - 6 **CONFIG[1:0].** Range Configuration
- **0** – Configuration 0
- **1** – Configuration 1
- **2** – Configuration 2
- **3** – Configuration 3

Bit 5 - 4 **INTDUR[1:0].** Configuration of interrupt pulse duration on SCL pin
- **0** – 2 x OSC_SLOW clocks = 16us
- **1** – 4 x OSC_SLOW clocks = 32us
- **2** – 8 x OSC_SLOW clocks = 64us
- **3** – 1 x OSC_SLOW clocks = 8us

Bit 3 **INTB_SCL_B.** Select interrupt function on SCL pin or INTB pin
- **0** – Interrupt on SCL pin
- **1** – Interrupt on INTB pin

Bit 2 **INTREPB.** Interrupt repetition configuration
- **0** – Interrupt repeat after first time when condition is TRUE till WOC exit
- **1** – Interrupt repeat only if condition is TRUE

Bit 1 - 0 **WOC_MODE[1:0**]. WOC mode configurations
- **0** – Difference to 1st measurement in WOC (Static Delta)
- **1** – Difference to previous measurement in WOC (Dynamic Delta)
- **2** – Not used
- **3** – Not used

Address 0x0E – CTRL3 Register

7	6	5	4	3	2	1	0
OSR_ HALL	OSR_ TEMP	DIG_FILT_ HALL_XY2	DIG_FILT_ HALL_XY1	DIG_FILT_ HALL_XY0	DIG_FILT_ TEMP2	DIG_FILT_ TEMP1	DIG_FILT_ TEMP0
RW-1	RW-1	RW-1	RW-0	RW-0	RW-0	RW-0	RW-1

NOTE: R=Read access; W=Write access; value following dash (-) = value after initialization

Bit 7 **OSR_HALL.** OSR setting for Hall Measurement
Bit 6 **OSR_TEMP.** OSR setting for Temperature Measurement
Bit 5 – 3 **DIG_FILT_HALL_XY[2:0].** Digital filter setting for X and Y Hall Measurements
Bit 2 – 0 **DIG_FILT_TEMP[2:0].** Digital filter setting for Temperature Measurement

Address 0x0F – CTRL4 Register

7	6	5	4	3	2	1	0
CTRL4_7	CTRL4_6	T_EN	CTRL4_4	DRDY_EN	DIG_FILT_HALL_Z2	DIG_FILT_HALL_Z1	DIG_FILT_HALL_Z0
RW-1	RW-0	RW-0	RW-1	RW-0	RW-1	RW-0	RW-1

NOTE: R=Read access; W=Write access; value following dash (-) = value after initialization

CTRL4_7. Reserved (keep set to 1 for proper operation)
CTRL4_6. Reserved (keep set to 0 for proper operation)
T_EN. Enable Temperature Measurement
CTRL4_4. Reserved (keep set to 0 for proper operation)
DRDY_EN. Enables DRDY flag on INTB or SDA pin (depending on the connection interface)

- **0** – DRDY flag output disabled
- **1** – DRDY flag output enabled. If used, **INTB_SCL_B** must be set

DIG_FILT_HALL_Z[2:0]. Digital filter setting for Z Hall Measurement

Address 0x11 – RESET Register

Writing 0x06 in this register resets the IC

Addresses 0x14 – 0x15

X axis WOC threshold low (0x14) and high (0x15) byte

Addresses 0x16 – 0x17

Y axis WOC threshold low (0x16) and high (0x17) byte

Addresses 0x18 – 0x19

Z axis WOC threshold low (0x18) and high (0x19) byte

These registers are initialized at 0 and are to be set by the user.

7.7 Flowchart

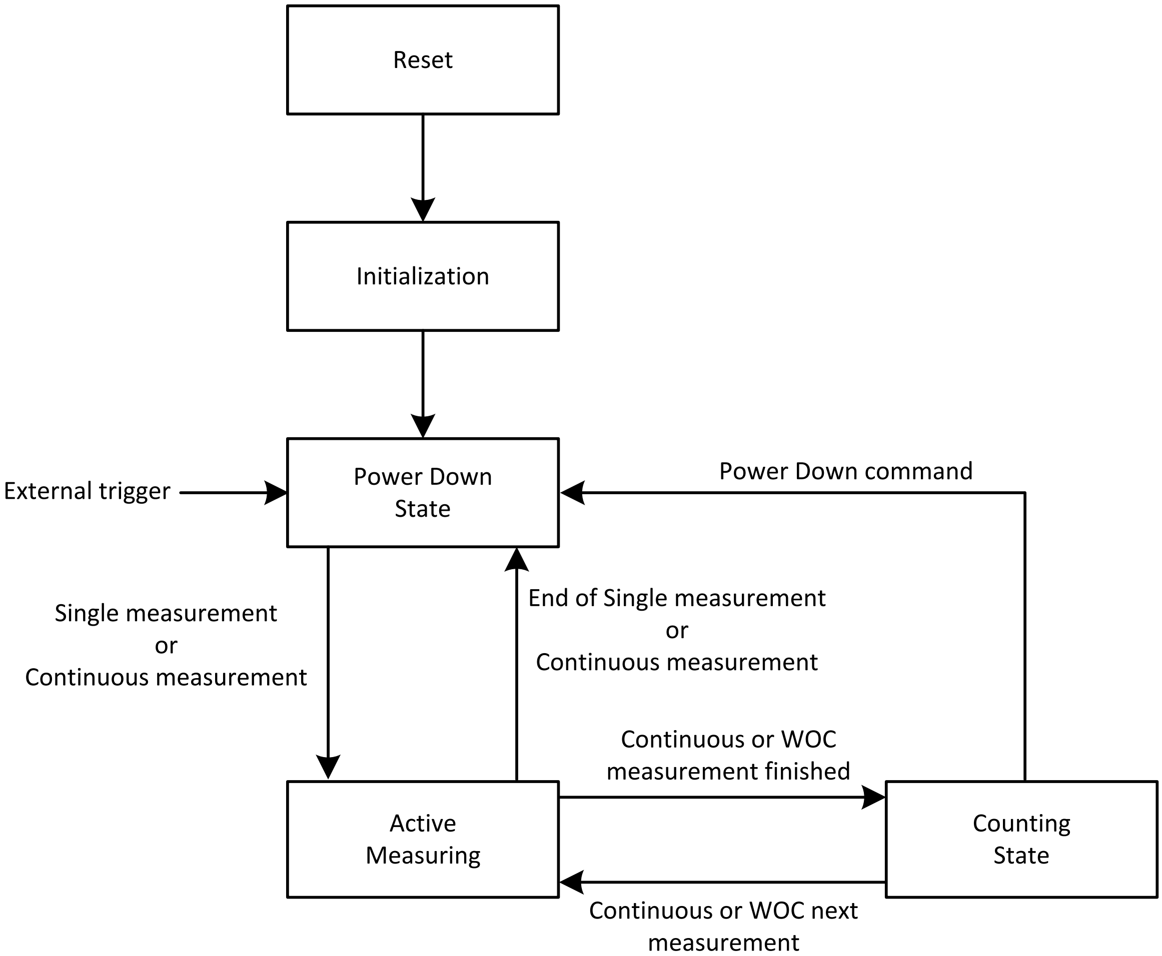


Figure 22 State sequence flowchart

8 Application

8.1 Recommended Application diagram

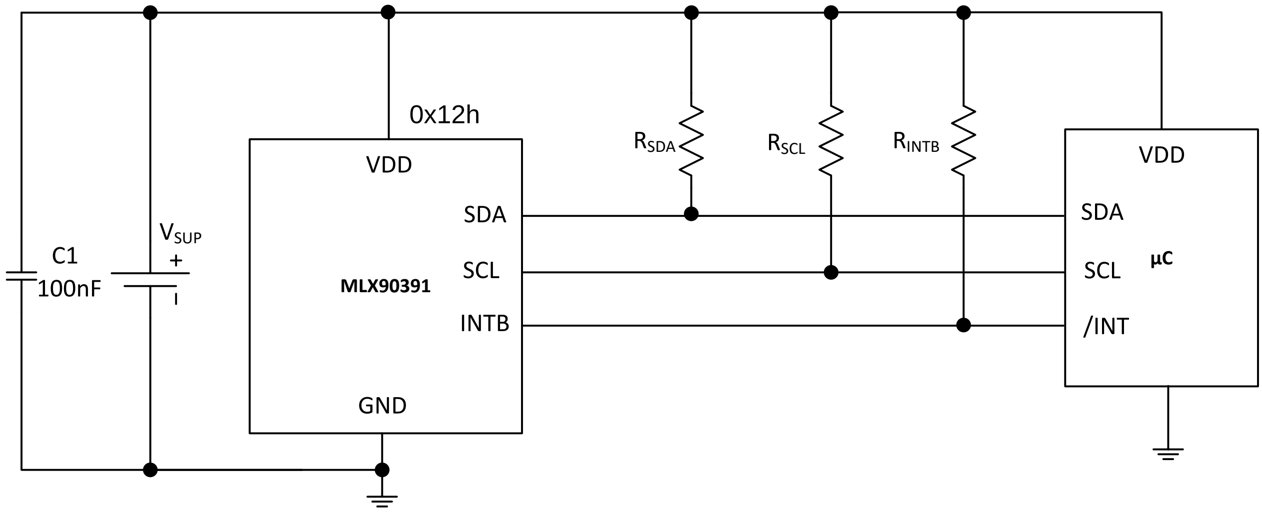


Figure 23 Recommended application diagram (single device on the I²C bus)

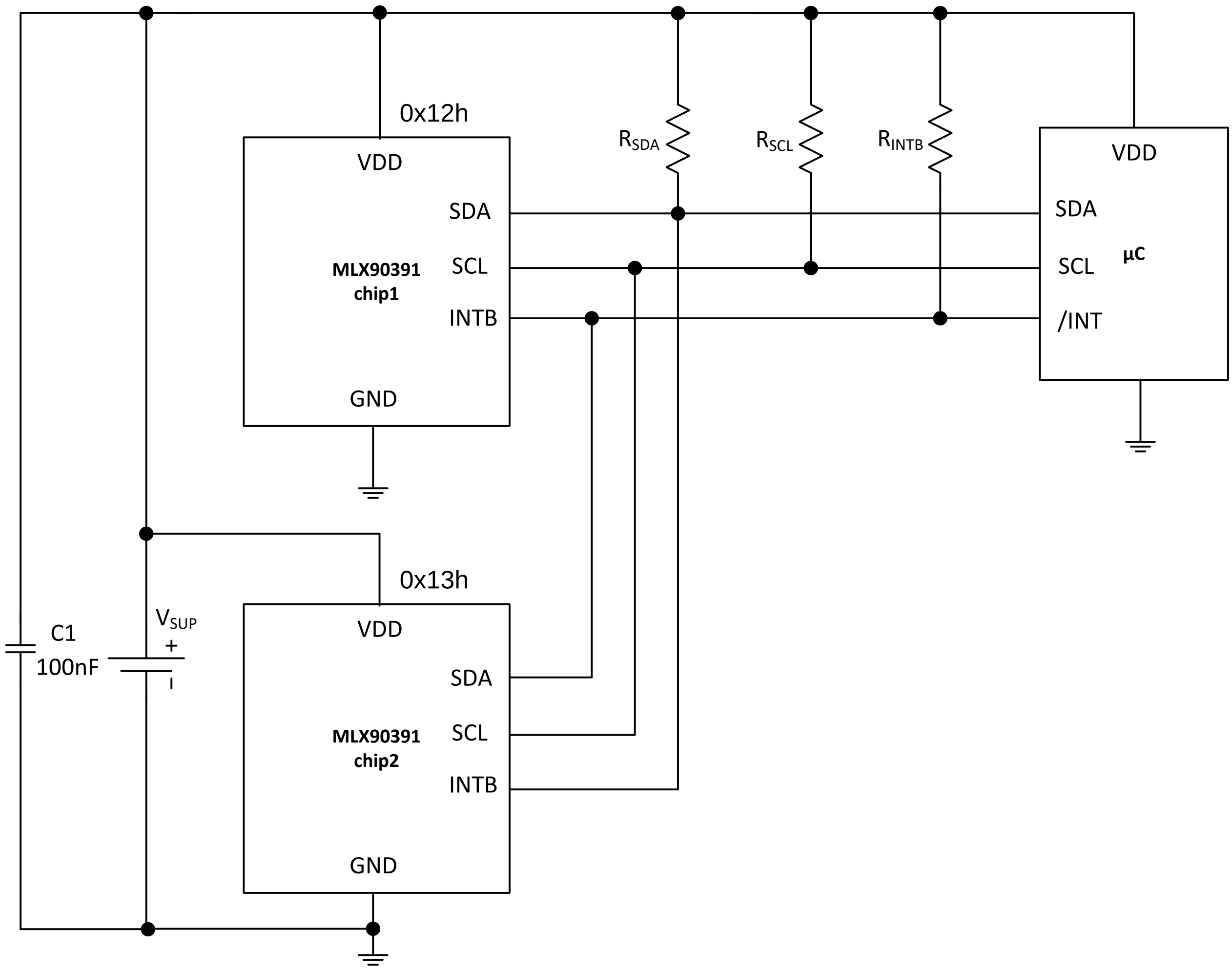


Figure 24 Recommended application diagram (two devices on the I²C bus)

8.2 Magnetic offset recalculation

CONFIG0 and CONFIG3 require that the offset trim values are initially read, scaled and stored. During normal operation, the stored trim values have to be subtracted from each result. The procedure below describes how to obtain the offset values and how to use them in CONFIG0 and CONFIG3.

1. Power-up the device
2. Set CTRL3[7:0] = 0xFF, CTRL4[7:0] = 0xA7, CTRL1[7:0] = 0x71 in this sequence and within 50ms
    1) Read addresses 0x80 (LSByte) and 0x81 (MSByte)
    2) Read addresses 0x82 (LSByte) and 0x83 (MSByte)
    3) Read addresses 0x84 (LSByte) and 0x85 (MSByte)
3. Concatenate the data in order to get a 16-bit word:
   $X_{OFF}[15:0]$ = concatenate (Data@address0x81, Data@address0x80)
   The data is in two's complement
4. Concatenate the data in order to get a 16-bit word:
   $Y_{OFF}[15:0]$ = concatenate (Data@address0x83, Data@address0x82)
   The data is in two's complement
5. Concatenate the data in order to get a 16-bit word:
   $Z_{OFF}[15:0]$ = concatenate (Data@address0x85, Data@address0x84).
   The data is in two's complement
6. Calculate the offset for CONFIG0
    1) Calculate and store $X_{APPOFF\_CONF0}[15:0] = X_{OFF}[15:0] * - 0.135$
    2) Calculate and store $Y_{APPOFF\_CONF0}[15:0] = Y_{OFF}[15:0] * - 0.135$
    3) Calculate and store $Z_{APPOFF\_CONF0}[15:0] = Z_{OFF}[15:0] * - 0.096$
7. Calculate the offset for CONFIG3
    4) Calculate and store $X_{APPOFF\_CONF3}[15:0] = X_{OFF}[15:0] * 0.650$
    5) Calculate and store $Y_{APPOFF\_CONF3}[15:0] = Y_{OFF}[15:0] * 0.650$
    6) Calculate and store $Z_{APPOFF\_CONF3}[15:0] = Z_{OFF}[15:0] * 0.462$
8. Load the settings needed for the application and use the device normally

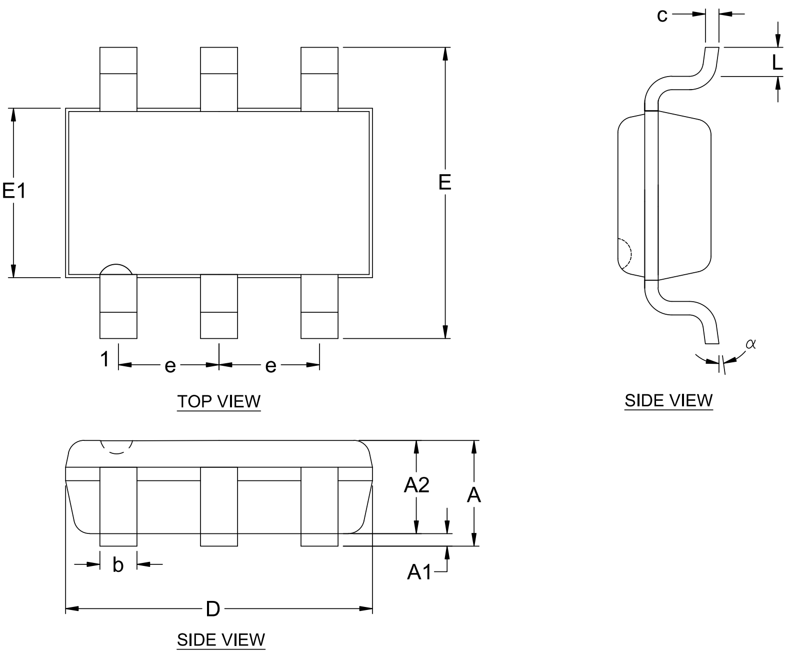
During application, subtract the stored $\mathbf{X/Y/Z}_{APPOFF\_CONF\mathbf{0/3}}[15:0]$ from every DSP result (X[15:0], Y[15:0] or Z[15:0] respectively) according to the used configuration (CONFIG0 or CONFIG3).

9 Package, IC handling and assembly

9.1 Package information

9.1.1 Package TSOT23-6L

9.1.1.1 Dimensions



SYMBOL	MINIMUM	MAXIMUM
A	– – –	1.00
A1	0.025	0.10
A2	0.85	0.90
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
L	0.30	0.50
b	0.30	0.45
c	0.10	0.20
e	0.95 BSC	
α	0°	8°

NOTE :

1. ALL DIMENSIONS IN MILLIMETERS (mm) UNLESS OTHERWISE STATED.
2. DIMENSION D DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS OF MAX 0.15 mm PER SIDE.
3. DIMENSION E1 DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS OF MAX 0.25 mm PER SIDE.
4. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION OF MAX 0.07 mm.
5. DIMENSION L IS THE LENGTH OF THE TERMINAL FOR SOLDERING TO A SUBTRATE.
6. FORMED LEAD SHALL BE PLANAR WITH RESPECT TO ONE ANOTHER WITH 0.076 mm SEATING PLANE.

Figure 25 Package outline drawing, TSOT23-6L

9.1.1.2 Pinout & marking

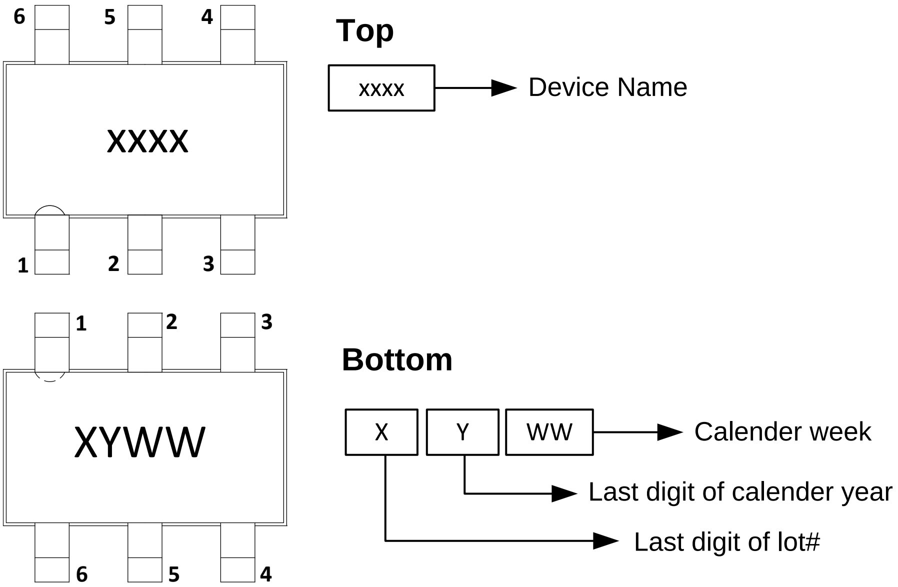


Figure 26 Pinout and marking, TSOT-6L

9.1.1.3 Sensing element location and field direction

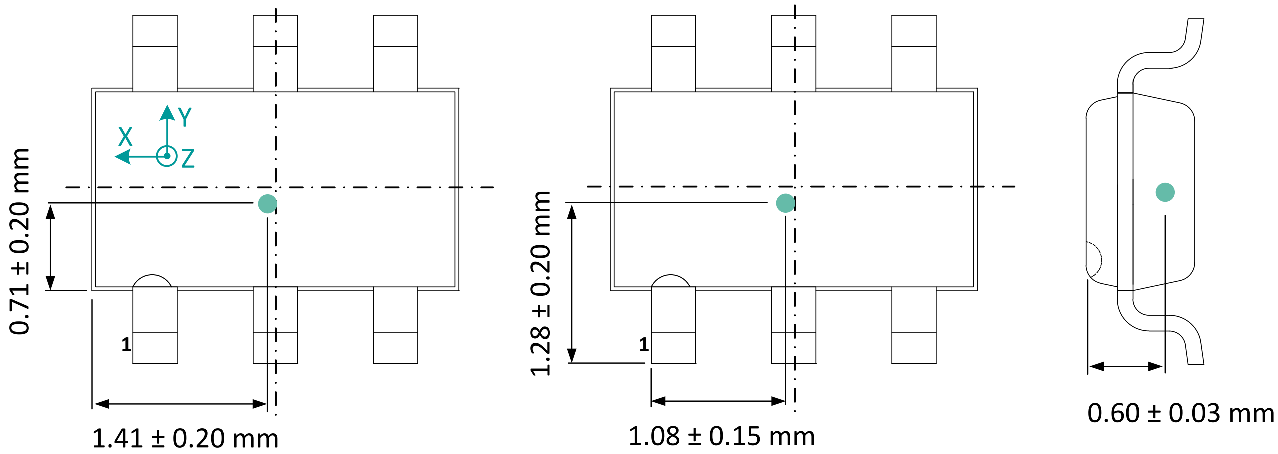


Figure 27 Pinout, sensing element location and field direction, TSOT-6L

9.2 Storage and handling of plastic encapsulated ICs

Plastic encapsulated ICs shall be stored and handled according to their MSL categorization level (specified in the packing label) as per J-STD-033.

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD). The component assembly shall be handled in EPA (Electrostatic Protected Area) as per ANSI S20.20

For more information refer to Melexis *Guidelines for storage and handling of plastic encapsulated ICs* [(7)]

9.3 Assembly of encapsulated ICs

For Surface Mounted Devices (SMD, as defined according to JEDEC norms), the only applicable soldering method is reflow.

For Through Hole Devices (THD), the applicable soldering methods are reflow, wave, selective wave and robot point-to-point. THD lead pre-forming (cutting and/or bending) is applicable under strict compliance with Melexis *Guidelines for lead forming of SIP Hall Sensors* [(7)].

Melexis products soldering on PCB should be conducted according to the requirements of IPC/JEDEC and J-STD-001. Solder quality acceptance should follow the requirements of IPC-A-610.

For PCB-less assembly refer to the relevant application notes [(7)] or contact Melexis.

Electrical resistance welding or laser welding can be applied to Melexis products in THD and specific PCB-less packages following the *Guidelines for welding of PCB-less devices*[(7)].

Environmental protection of customer assembly with Melexis products for harsh media application, is applicable by means of coating, potting or overmolding considering restrictions listed in the relevant application notes [(7)]

For other specific process, contact Melexis via www.melexis.com/technical-inquiry

9.4 Environment and sustainability

Melexis is contributing to global environmental conservation by promoting non-hazardous solutions.
For more information on our environmental policy and declarations (RoHS, REACH…) visit www.melexis.com/environmental-forms-and-declarations

[7] www.melexis.com/ic-handling-and-assembly

10 Glossary of terms & references

10.1 Glossary

Term	Description
NC	Not Connected
AMR	Absolute Maximum Ratings
ADC	Analog-to-digital converter
PCB	Printed Circuit Board
LSB	Least significant bit
JEDEC	Joint Electron Device Engineering Council
Gauss (G)	Units for magnetic flux density – 1mT = 10G
RMS	Root mean square
POR	Power On reset
NV	Non-volatile
DSP	Digital signal processing
WOC	Wake-up On Change
Ta	Ambient temperature
I^2C	Inter-Integrated Circuit
HBM	Human Body Model
CDM	Charged Device Model

Table 17 – Glossary

10.2 List of tables

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