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# LSM303DLM compass

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# First generation digital compass: LSM303DLH



## LSM303DLH

### Key features

- 3-axis accelerometer: from  $\pm 2$  to  $\pm 8$  g
- 3-axis magnetic sensor: up to 8.1 gauss
- Independent sensing power management
- Magnetic resolution: 8 mgauss
- I<sup>2</sup>C interface
- Package: LGA-28, 5.0 x 5.0 x 1.0 mm<sup>3</sup>



# New generation digital compass: LSM303DLM



## LSM303DLM

### Key features

- 3-axis accelerometer: from  $\pm 2$  to  $\pm 8$  g
- 3-axis magnetic sensor: up to 8.1 gauss
- Low power consumption
- Independent sensing power management
- Magnetic resolution: 5 mgauss
- I<sup>2</sup>C interface
- Package: LGA-28, 5.0 x 5.0 x 1.0 mm<sup>3</sup>



# The benefits of using LSM303DLM



The LSM303DLM replaces the LSM303DLH compass and introduces additional improvements:

- 50% less power consumption
- 30% increase in magnetic resolution
- No need for a dedicated digital supply voltage for magnetic digital core

All this in a package which has the same size and is pin-to-pin compatible with the previous generation compass

# Magnetic characteristics comparison



Parameter *	LSM303DLH	LSM303DLM
Magnetic measurement range	1.3 to 8.1 gauss	1.3 to 8.1 gauss
Magnetic sensitivity – X,Y axis	0.9 to 4.3 mgauss/digit	0.9 to 4.3 mgauss/digit
Magnetic sensitivity – Z axis	1 to 4.8 mgauss/digit	1 to 4.8 mgauss/digit
Magnetic resolution	8 mgauss	5 mgauss

\* Refer to product datasheet for test conditions

# Electrical characteristics comparison



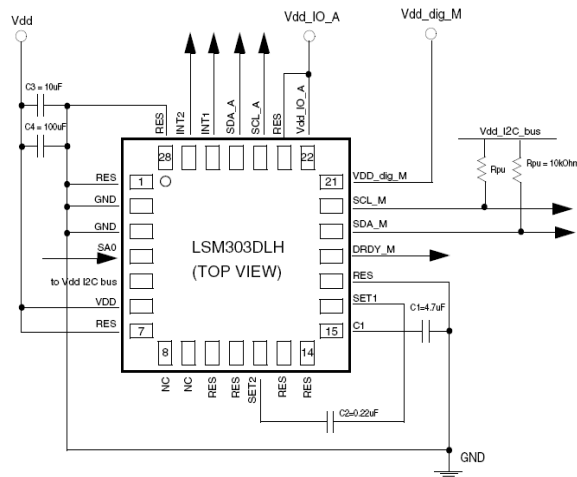
Parameter *	LSM303DLH	LSM303DLM
Supply voltage ( $V_{dd}$ )	2.5 to 3.3 V	2.16 to 3.6 V
Dedicated magnetic digital power supply	1.71 to 2.0 V	Not needed
Current consumption	830 $\mu$ A	360 $\mu$ A
Operating temperature range	-30 to 85 $^{\circ}$ C	-40 to 85 $^{\circ}$ C

\* Refer to product datasheet for test conditions

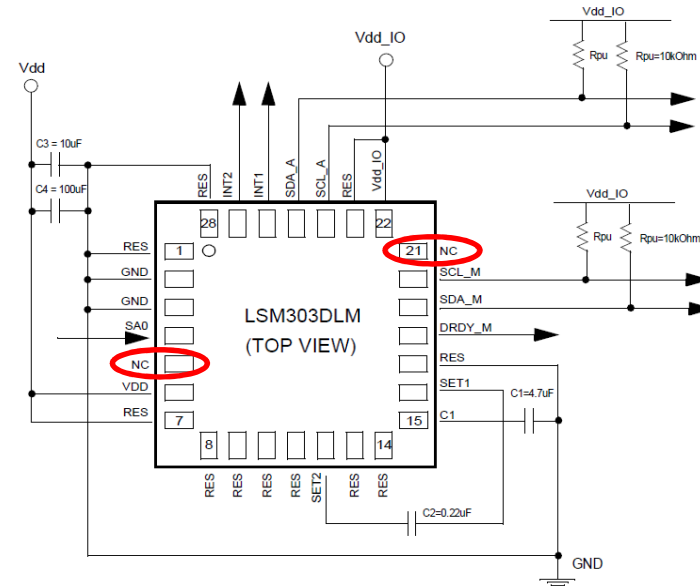
# Application hints comparison



## LSM303DLH



## LSM303DLM



No need for a dedicated digital supply voltage for the magnetic digital core  
In LSM303DLM, pins 5 and 21 are not internally connected

# I<sup>2</sup>C serial interface



- The registers embedded inside the LSM303DLH and LSM303DLM are accessible through two separate I<sup>2</sup>C serial interfaces, one for the accelerometer core and the other for the magnetometer core

Device	Magnetic sensor I <sup>2</sup> C address	Linear acceleration sensor I <sup>2</sup> C address
LSM303DLH	0011110b	If the SA0 = 1, address: 0011001b If the SA0 = 0, address: 0011000b
LSM303DLM	0011110b	If the SA0 = 1, address: 0011001b If the SA0 = 0, address: 0011000b

# Magnetic field sensing register comparison



## LSM303DLH

### CRA\_REG\_M (00h)

Table 56. CRA\_REG\_M register

0	0	0	DO2	DO1	DO0	MS1	MS0
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Table 57. CRA\_REG\_M description

CRA7 to CRA5	These bits must be cleared for correct operation.
DO2 to DO0	Data output rate bits. These bits set the rate at which data is written to all three data output registers
MS1 to MS0	Measurement configuration bits. These bits define the measurement flow of the device, specifically whether or not to incorporate an applied bias to the sensor into the measurement

Table 58. CRA\_REG\_M description

DO2	DO1	DO0	Minimum data output rate (Hz)
0	0	0	0.75
0	0	1	1.5
0	1	0	3.0
0	1	1	7.5
1	0	0	15
1	0	1	30
1	1	0	75
1	1	1	Not used

Table 59. CRA\_REG\_M description

MS1	MS0	Magnetic sensor operating mode
0	0	Normal measurement configuration (default). In normal measurement configuration the device follows normal measurement flow.
0	1	Positive bias configuration.
1	0	Negative bias configuration.
1	1	This configuration is not used

## LSM303DLM

### CRA\_REG\_M (00h)

Table 70. CRA\_REG\_M register

TEMP_EN	0 <sup>(1)</sup>	0 <sup>(1)</sup>	DO2	DO1	DO0	0 <sup>(1)</sup>	0 <sup>(1)</sup>
---------	------------------	------------------	-----	-----	-----	------------------	------------------

1. This bit must be set to '0' for correct working of the device

Table 71. CRA\_REG\_M description

TEMP_EN	Temperature Sensor Enable. 0: temperature sensor disabled (default), 1: temperature sensor enabled
DO2 to DO0	Data Output Rate Bits. These bits set the rate at which data is written to all three data output registers. Refer to <a href="#">Table 72</a> . Default value: 100

Table 72. Data Rate Configurations

DO2	DO1	DO0	Minimum Data Output Rate (Hz)
0	0	0	0.75
0	0	1	1.5
0	1	0	3.0
0	1	1	7.5
1	0	0	15
1	0	1	30
1	1	0	75
1	1	1	220



**220 Hz output data rate is available**

# Magnetic field sensing register comparison



## LSM303DLH

CRB\_REG\_M (01h)

## LSM303DLM

CRB\_REG\_M (01h)

Minor differences in gain values between the two versions

Table 60. CRA\_REG register

GN2	GN1	GN0	0	0	0	0	0
-----	-----	-----	---	---	---	---	---

Table 61. CRA\_REG description

CRB7 to CRB5	Gain configuration bits. These bits configure the gain for the device. The gain configuration is common for all channels
CRB7 to CRB5	This bit must be cleared for correct operation

Table 62. Gain setting

GN2	GN1	GN0	Sensor input field range [Gauss]	Gain X/Y and Z [LSB/Gauss]	Gain Z [LSB/Gauss]	Output range
0	0	1	±1.3	1055	950	0xF800–0x07FF (-2048–2047)
0	1	0	±1.9	795	710	
0	1	1	±2.5	635	570	
1	0	0	±4.0	430	385	
1	0	1	±4.7	375	335	
1	1	0	±5.6	320	285	
1	1	1	±8.1	230	205	

Table 73. CRA\_REG register

GN2	GN1	GN0	0 <sup>(1)</sup>	0 <sup>(1)</sup>	0 <sup>(1)</sup>	0 <sup>(1)</sup>	0 <sup>(1)</sup>
-----	-----	-----	------------------	------------------	------------------	------------------	------------------

1. This bit must be set to '0' for correct working of the device

CRA\_REG description

GN1-0	Gain Configuration Bits. The gain configuration is common for all channels. Refer to <a href="#">Table 74</a> .
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Table 74. Gain setting

GN2	GN1	GN0	Sensor Input Field range [Gauss]	Gain X/Y and Z [LSB/Gauss]	Gain Z [LSB/Gauss]	Output Range
0	0	1	±1.3	1100	980	0xF800–0x07FF (-2048–2047)
0	1	0	±1.9	855	760	
0	1	1	±2.5	670	600	
1	0	0	±4.0	450	400	
1	0	1	±4.7	400	355	
1	1	0	±5.6	330	295	
1	1	1	±8.1	230	205	

# Magnetic field sensing register comparison



## LSM303DLH

### OUT\_X\_M (03-04h)

Table 66. OUTXH\_M register

DXRH7	DXRH6	DXRH5	DXRH4	DXRH3	DXRH2	DXRH1	DXRH0
-------	-------	-------	-------	-------	-------	-------	-------

Table 67. OUTXL\_M register

DXRL7	DXRL6	DXRL5	DXRL4	DXRL3	DXRL2	DXRL1	DXRL0
-------	-------	-------	-------	-------	-------	-------	-------

### OUT\_Y\_M (05-06h)

Table 68. OUT\_YH\_M register

DYRH7	DYRH6	DYRH5	DYRH4	DYRH3	DYRH2	DYRH1	DYRH0
-------	-------	-------	-------	-------	-------	-------	-------

Table 69. OUT\_YL\_M register

DYRL7	DYRL6	DYRL5	DYRL4	DYRL3	DYRL2	DYRL1	DYRL0
-------	-------	-------	-------	-------	-------	-------	-------

### OUT\_Z\_M (07-08h)

Table 70. OUTZH\_M register

DZRH7	DZRH6	DZRH5	DZRH4	DZRH3	DZRH2	DZRH1	DZRH0
-------	-------	-------	-------	-------	-------	-------	-------

Table 71. OUTZL\_M register

DZRL7	DZRL6	DZRL5	DZRL4	DZRL3	DZRL2	DZRL1	DZRL0
-------	-------	-------	-------	-------	-------	-------	-------

## LSM303DLM

### OUT\_X\_M (03-04h)

Table 75. OUT\_XH\_M register

DXRH7	DXRH6	DXRH5	DXRH4	DXRH3	DXRH2	DXRH1	DXRH0
-------	-------	-------	-------	-------	-------	-------	-------

Table 76. OUT\_XL\_M register

DXRL7	DXRL6	DXRL5	DXRL4	DXRL3	DXRL2	DXRL1	DXRL0
-------	-------	-------	-------	-------	-------	-------	-------

### OUT\_Z\_M (05-06h)

Table 77. OUT\_ZH\_M register

DZRH7	DZRH6	DZRH5	DZRH4	DZRH3	DZRH2	DZRH1	DZRH0
-------	-------	-------	-------	-------	-------	-------	-------

Table 78. OUT\_ZL\_M register

DZRL7	DZRL6	DZRL5	DZRL4	DZRL3	DZRL2	DZRL1	DZRL0
-------	-------	-------	-------	-------	-------	-------	-------

### OUT\_Y\_M (07-08h)

Table 79. OUT\_YH\_M register

DYRH7	DYRH6	DYRH5	DYRH4	DYRH3	DYRH2	DYRH1	DYRH0
-------	-------	-------	-------	-------	-------	-------	-------

Table 80. OUT\_YL\_M register

DYRL7	DYRL6	DYRL5	DYRL4	DYRL3	DYRL2	DYRL1	DYRL0
-------	-------	-------	-------	-------	-------	-------	-------

Y – Z axes have different addresses in LSM303DLH and LSM303DLM

# Magnetic field sensing register comparison

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- SR\_REG\_M (09h) and IR\_REG\_M (0Ah/0Bh/0Ch) registers provide the same information in both LSM303DLH and LSM303DLM

# LSM303DLH/LSM303DLM ID procedure



**LSM303DLH**



**LSM303DLM**



Acceleration Sensor			Magnetic Sensor		
I2C address	Register Address	Register Value	I2C address	Register Address	Register Value
If the SA0 = '1': 0011001b	0Fh	00110010b	0011110b	0Fh	00000000b
If the SA0 = '0': 0011000b					
If the SA0 = '1': 0011001b	0Fh	00110010b	0011110b	0Fh	00111100b
If the SA0 = '0': 0011000b					

**LSM303DLH**



**LSM303DLM**



Acceleration Sensor		Magnetic Sensor	
Register Address	Register Value	Register Address	Register Value
0Fh	32h	0Fh	0h
0Fh	32h	0Fh	3Ch



# MEMS compasses

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