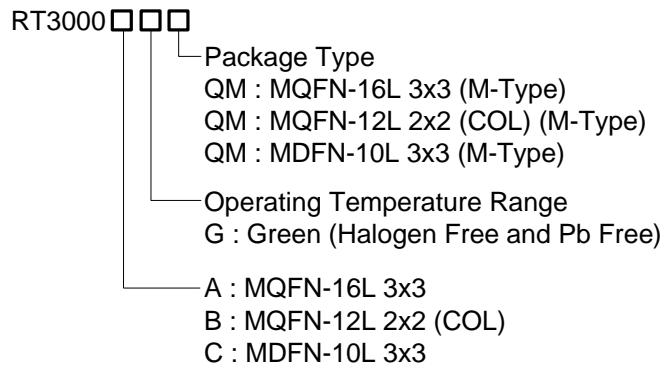


## 3-Axis Digital Accelerometer

### General Description

The RT3000 is a low power and high accuracy 3 axis acceleration sensor with digital output for portable device. The part has user selectable full scales ranges of  $\pm 2g$ ,  $\pm 4g$ ,  $\pm 8g$  and  $\pm 16g$ , and, it is capable of measuring accelerations with output data rates from 1Hz to 200Hz. The RT3000A is available in MQFN-16L 3x3, RT3000B in MQFN-12L 2x2 (COL) and RT3000C in MDFN-10L 3x3 package.

### Ordering Information

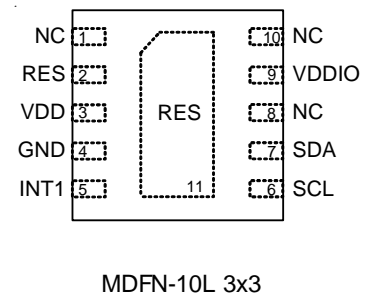
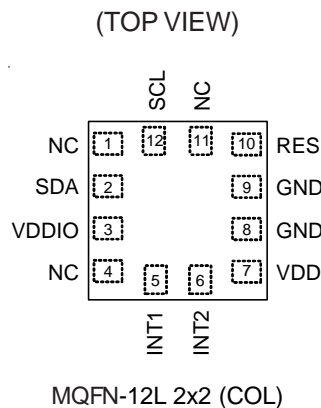
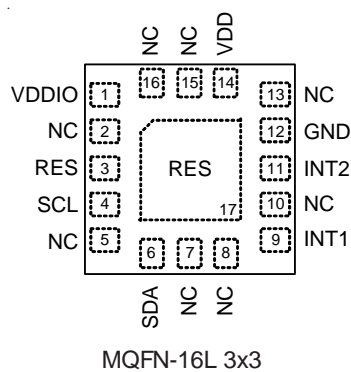


Note :

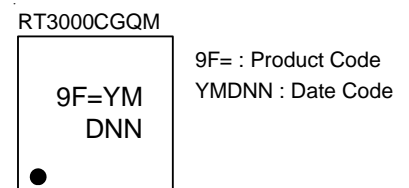
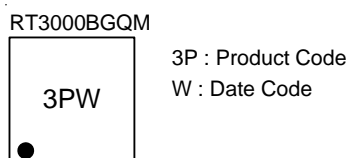
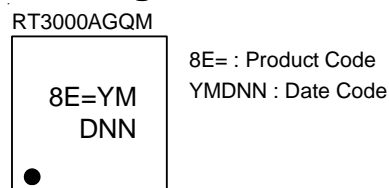
Richtek products are :

- ▶ RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- ▶ Suitable for use in SnPb or Pb-free soldering processes.

### Pin Configurations



### Marking Information



### Features

- User programmable  $\pm 2g/\pm 4g/\pm 8g/\pm 16g$  Full-Scale
- I<sup>2</sup>C Digital I/O Interface
- User Programmable Operation Modes : Power Down, Normal Mode and High Resolution Mode
- Programmable Interrupts For Motion and Orientation Detections
- Embedded FIFO
- Self-Test Function

### Applications

- Smartphones
- Tablet PC
- Notebook
- PND
- GPS
- Remote Controller
- Gaming
- Toys

## Function Pin Description

RT3000A (MQFN-16L 3x3)	Name	Description
14	VDD	Power Supply.
1	VDDIO	Power Supply For I/O Pins.
12	GND	Ground.
6	SDA	I <sup>2</sup> C Serial Data.
4	SCL	I <sup>2</sup> C Serial Clock.
9	INT1	Interrupt 1.
11	INT2	Interrupt 2.
2, 5, 7, 8, 10, 13, 15, 16	NC	No Internal Connection. (*Note 1)
3	RES	Reserved Pin. (*Note 2)
17 (Exposed Pad)	RES	Reserved Pin. (*Note 5)

RT3000B MQFN-12L 2x2 (COL)	Name	Description
7	VDD	Power Supply.
3	VDDIO	Power Supply For I/O Pins.
8, 9	GND	Ground.
2	SDA	I <sup>2</sup> C Serial Data.
12	SCL	I <sup>2</sup> C Serial Clock.
5	INT1	Interrupt 1.
6	INT2	Interrupt 2.
1, 4, 11	NC	No Internal Connection. (*Note 1)
10	RES	Reserved Pin (*Note 3)

RT3000C (MDFN-10L 3x3)	Name	Description
3	VDD	Power Supply.
9	VDDIO	Power Supply For I/O Pins.
4	GND	Ground.
7	SDA	I <sup>2</sup> C Serial Data.
6	SCL	I <sup>2</sup> C Serial Clock.
5	INT1	Interrupt 1.
1, 8, 10	NC	No Internal Connection. (*Note 1)
2	RES	Reserved Pin. (*Note 4)
11 (Exposed Pad)	RES	Reserved Pin. (*Note 5)

\*Note 1 : Recommend floating or connect to VDD or GND.

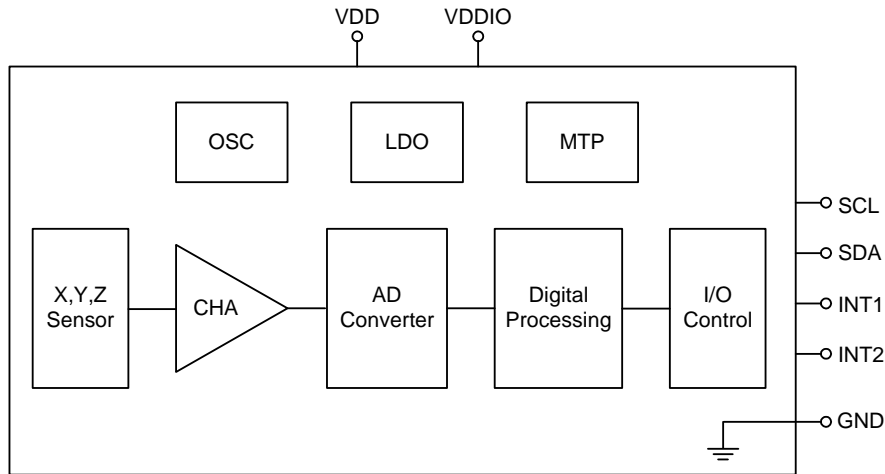
\*Note 2 : Must be floating or connect to VDDIO.

\*Note 3 : Must be floating or connect to GND.

\*Note 4 : Must be floating or connect to VDD.

\*Note 5 : Must be floating.

**Functional Block Diagram**

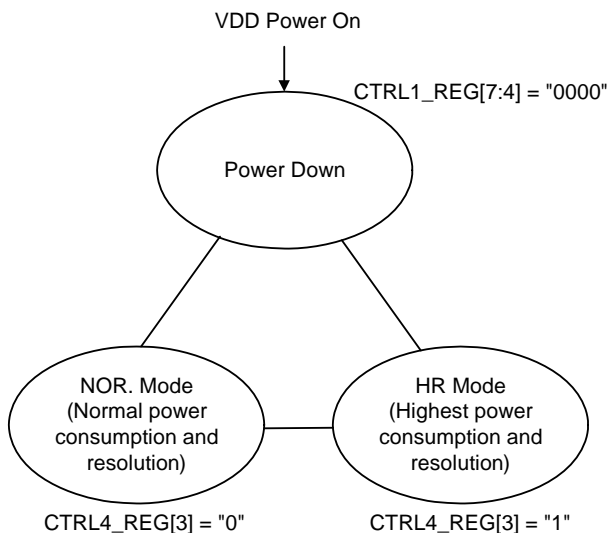


**Operation**

**Power Mode**

The RT3000 has three different power modes: power down mode, normal mode and high resolution mode to offer the customer different power consumption and effective resolution options.

The transitions between the power modes are illustrated in figure below



Different mode switch time : 12/ODR ms

When the RT3000 is in power-down mode, almost all internal blocks of the device are switched off except digital interfaces (I<sup>2</sup>C) are still active to allow communication with the device. The configuration registers content is preserved and output data registers keeping the last data sampled in memory before going into power-down mode.

In normal mode or high resolution mode, it's depending on customer's application to set related register.

**Self-Test**

The RT3000 has the self-Test feature for the sensor functionality check by applying electrostatic force to the sensor element. A static offset of the acceleration data could be observed when the self-test activate. The acceleration measurement range should be set to 2g before self-test is enabled. The self-test function is off when the self-test bit (STEN) is programmed to "0". When the self-test bit is programmed to "1" an actuation force is applied to the sensor, simulating a definite input acceleration. Table 1 shows the typical offset differences of self-test for each axes.

**Table 1. Typical Self-test offset difference values**

	X-Axis	Y-Axis	Z-Axis
Offset Difference	80mg	80mg	80mg

**FIFO**

The RT3000 included an integrated 32 frame FIFO for each axis. The FIFO which can be configured to operate in following mode

**FIFO Mode**

In FIFO mode the acceleration data of selected axis are stored in the buffer until full. When the buffer is full, the data collection is stopped. Once the buffer is full; a FIFO-full interrupt is generated if it has been enabled.

**Stream Mode**

In stream mode the acceleration data of selected axis are stored in the buffer until full. When the buffer is full, the data continues and oldest entry is discarded.

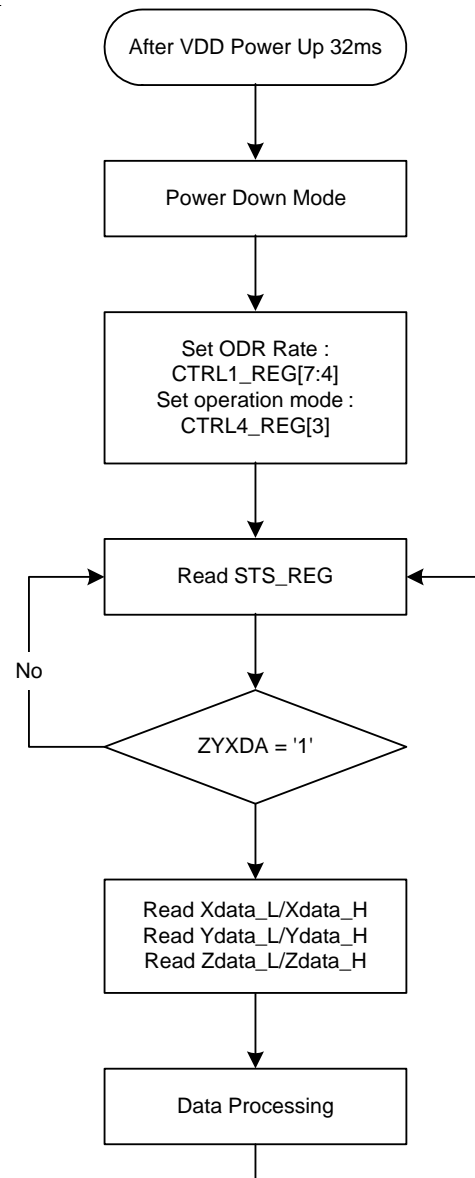
**Bypass Mode**

In bypass mode, only the current sensor data can be read out from the FIFO. The FIFO behaves like the stream mode with a depth of one, compared to reading the data from normal data register.

**Trigger Mode**

In trigger mode is a combination of the stream and FIFO modes described above. In this mode, the FIFO buffer starts operating in stream mode and switches to FIFO mode when the selected interrupt occurs.

**Start Up and Read Data Sequence**



**Absolute Maximum Ratings** (Note 1)

- VDD Supply Voltage ----- -0.2V to 4V
- VDDIO Supply Voltage ----- -0.2V to 4V
- SCL, SDA, INT1, INT2 ----- -0.2V to (VDDIO + 0.3V)
- Storage Temperature Range ----- -40°C to 125°C
- ESD Susceptibility (Note 2)
  - HBM (Human Body Model) ----- 2kV
  - CDM (Charged Device Model) ----- 1kV
- Mechanical Shock (Unpowered) ----- 10000g for 0.2ms

**Recommended Operating Conditions** (Note 3)

- Input Voltage Range ----- 2V to 3.6V
- Ambient Temperature Range ----- -40°C to 85°C

**Mechanical Characteristics**

(V<sub>DD</sub> = 2.5V, T<sub>A</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Acceleration Range	FS <sub>2g</sub>	Customer programmable via serial digital interface	--	±2	--	g
	FS <sub>4g</sub>		--	±4	--	g
	FS <sub>8g</sub>		--	±8	--	g
	FS <sub>16g</sub>		--	±16	--	g
Sensitivity	S <sub>2g</sub>	FS <sub>2g</sub>	--	16384	--	LSB/g
	S <sub>4g</sub>	FS <sub>4g</sub>	--	8192	--	LSB/g
	S <sub>8g</sub>	FS <sub>8g</sub>	--	4096	--	LSB/g
	S <sub>16g</sub>	FS <sub>16g</sub>	--	2048	--	LSB/g
Zero-g Offset	Offset <sub>2g</sub>	FS <sub>2g</sub>	--	±45	--	mg
Zero-g Offset Temperature Shift	TCO <sub>2g</sub>	FS <sub>2g</sub> , -40°C ≤ T <sub>A</sub> ≤ 85°C	--	±1	--	mg/°C
Sensitivity Temperature Shift	TCS <sub>2g</sub>	FS <sub>2g</sub> , -40°C ≤ T <sub>A</sub> ≤ 85°C	--	±0.05	--	%/°C
Nonlinearity	NL	Max. deviation to best fit straight line	--	±0.5	--	%FS
Noise	N <sub>rms</sub>	FS <sub>2g</sub>	--	3	--	mg
Cross Axis Sensitivity	CAS	Relative contribution from the other to axes	--	±1.25	--	%

**Electrical Characteristics**

(V<sub>DD</sub> = 2.5V, T<sub>A</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage - Core	V <sub>DD</sub>		2	2.5	3.6	V
Supply Voltage - I/O	V <sub>DDIO</sub>		1.5	2.5	3.6	V
Input Voltage Low	V <sub>IL</sub>	I <sup>2</sup> C	--	--	0.3 V <sub>DDIO</sub>	V
Input Voltage High	V <sub>IH</sub>	I <sup>2</sup> C	0.7 V <sub>DDIO</sub>	--	--	V

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage Low	V <sub>OL</sub>		--	--	0.2 V <sub>DDIO</sub>	V
Output Voltage High	V <sub>OH</sub>		0.8 V <sub>DDIO</sub>	--	--	V
Current Consumption @ Normal Mode	I <sub>DDN</sub>	ODR = 200Hz	--	120	--	μA
Current Consumption @ Normal Mode	I <sub>DDN</sub>	ODR = 25Hz	--	15	--	μA
Current Consumption @ Power Down Mode	I <sub>DDS</sub>		--	1	--	μA
Wake-Up Time	twu	Time from power down mode to normal mode or high resolution mode	--	1.8	--	ms
Start-Up Time	tsu	Time for power on reset.	--	40	--	ms

## Electrical Characteristics : I<sup>2</sup>C Interface

Parameter	Symbol	Standard mode		Fast mode		Unit
		Min	Max	Min	Max	
SCL Clock Frequency	f <sub>SCLK</sub>	10	100	10	400	kHz
Hold Time After (Repeated) Start Condition. After This Period, The First Clock Is Generated	t <sub>HDSTA</sub>	4	--	0.6	--	μs
LOW Period Of The SCL Clock	t <sub>LOW</sub>	4.7	--	1.3	--	μs
HIGH Period Of The SCL Clock	t <sub>HIGH</sub>	4.0	--	0.6	--	μs
Set-Up Time For A Repeated START Condition	t <sub>SUSTA</sub>	4.7	--	0.6	--	μs
Data Hold Time	t <sub>HDDAT</sub>	--	120	--	120	ns
ts <sub>UDAT</sub> Data Set-Up Time	ts <sub>UDAT</sub>	250	--	100		ns
Rise Time Of Both SDA And SCL Signals	t <sub>r</sub>	--	1000	--	300	ns
Fall Time Of Both SDA And SCL Signals	t <sub>f</sub>	--	300	--	300	ns
Set-Up Time For STOP Condition	t <sub>SUSTO</sub>	4.0	--	0.6	--	μs
Bus Free Time Between A STOP And START Condition		4.7	--	1.3	--	μs

**Note 1.** Stresses beyond those listed "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions may affect device reliability.

**Note 2.** Devices are ESD sensitive. Handling precaution is recommended.

**Note 3.** The device is not guaranteed to function outside its operating conditions.

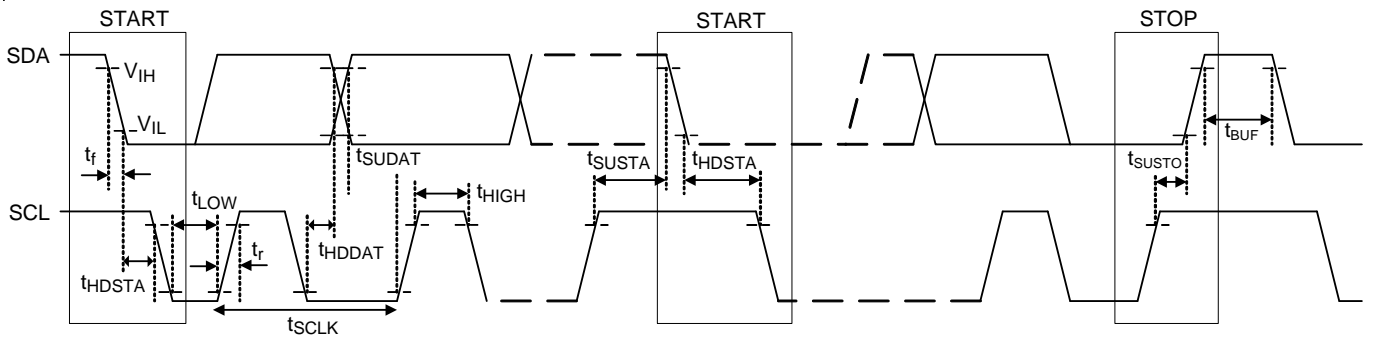


Figure 1. Timing Chart of the I2C

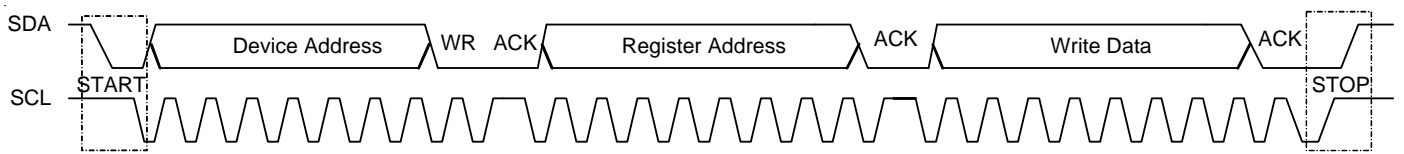


Figure 2. Write Command

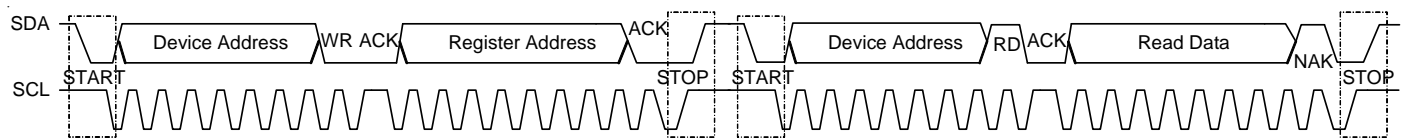
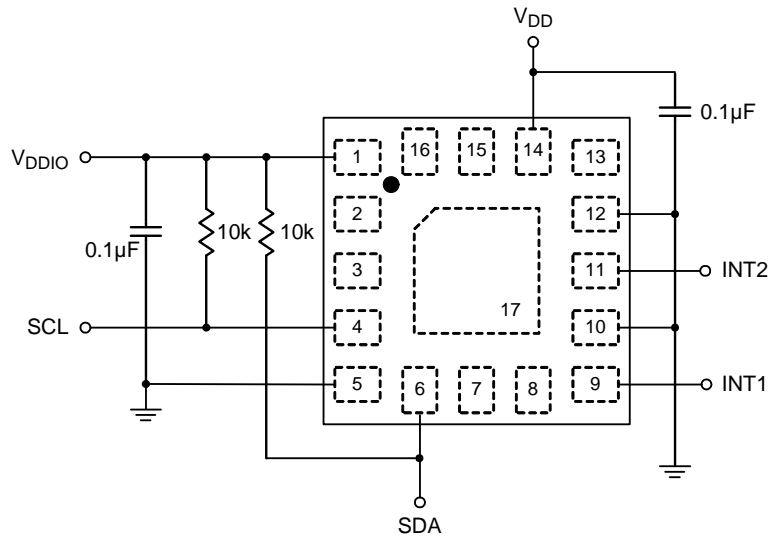


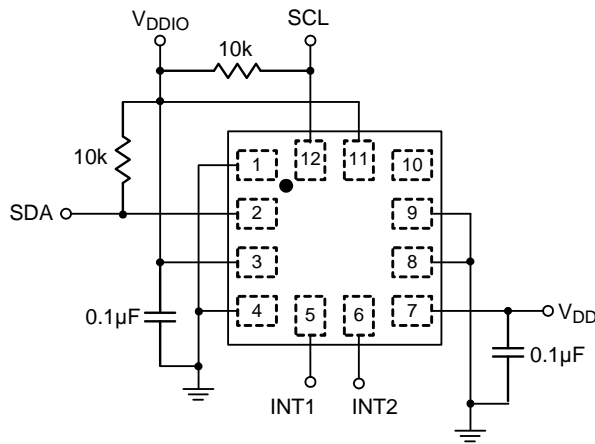
Figure 3. Read Data

## Typical Application Circuit

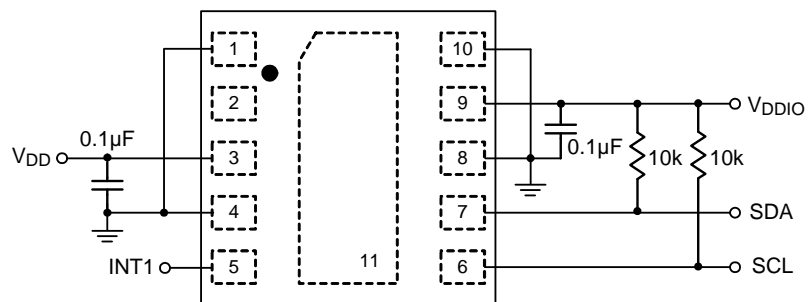
### RT3000A (MQFN-16L 3x3)



### RT3000B (MQFN-12L 2x2)



### RT3000C (MDFN-10L 3x3)





**Register Map**

Register Address	Type	Name	Default Value	Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0x06	R/W	CTRL_REG0	0000 0000	0	0	LIR_CLICK	--	0	INAEN	CLICKEN	AOIEN
0x0F	R	WHO_AM_I	0011 0011	0	0	1	1	0	0	1	1
0x20	R/W	CTRL_REG1	0000 0111	ODR3	ODR2	ODDR1	ODR0	0	ZEN	YEN	XEN
0x21	R/W	CTRL_REG2	0000 0000	--	--	HPCF2	HPCF1	FDOUT	HPCLICK	--	HPIS1
0x22	R/W	CTRL_REG3	0000 0000	I1_CLICK	I1_AOI	I1_INACT	I1_DRDY1	--	I1_WTM	I1_ORUN	--
0x23	R/W	CTRL_REG4	0000 0000	BDU	BIGEN	FS1	FS0	HR	--	STEN	--
0x24	R/W	CTRL_REG5	0000 0000	BOOT	FIFOEN	0	0	LIR_AOI	ODS_AOI	--	--
0x25	R/W	CTRL_REG6	0000 0000	I2_CLICK_EN	I2_AOI	--	I2_BOOT	--	--	HL_ACTIVE	--
0x27	R	STS_REG	--	ZYXOVER	ZOVER	YOVER	XOVER	ZYXDA	ZDA	YDA	XDA
0x28	R	OUT_X_L	Output	XD7	XD6	XD5	XD4	XD3	XD2	XD1	XD0
0x29	R	OUT_X_H	Output	XD15	XD14	XD13	XD12	XD11	XD10	XD9	XD8
0x2A	R	OUT_Y_L	Output	YD7	YD6	YD5	YD4	YD3	YD2	YD1	YD0
0x2B	R	OUT_Y_H	Output	YD15	YD14	YD13	YD12	YD11	YD10	YD9	YD8
0x2C	R	OUT_Z_L	Output	ZD7	ZD6	ZD5	ZD4	ZD3	ZD2	ZD1	ZD0
0x2D	R	OUT_Z_H	Output	ZD15	ZD14	ZD13	ZD12	ZD11	ZD10	ZD9	ZD8
0x2E	R/W	FIFO_CFG	0000 0000	FM1	FM0	TR	FTH4	FTH3	FTH2	FTH1	FTH0
0x2F	R	FIFO_SRC	--	WTM	OVRN_FIFO	EMPTY	FSS4	FSS3	FSS2	FSS1	FSS0
0x30	R/W	AOI_CFG	0000 0000	AOI1	AOI0	ZHIE/ ZUPE1	ZLIE/ ZDOWNE1	YHIE/ YUPE1	YLIE/ YDOWNE1	XHIE/ XUPE1	XLIE/ XDOWNE1
0x31	R	AOI_SRC	--	--	IA1	ZH1	ZL1	YH1	YL1	XH1	XL1
0x32	R/W	AOI_THS	0000 0000	--	AOIH6	AOIH5	AOIH4	AOIH3	AOIH2	AOIH1	AOIH0
0x33	R/W	AOI_DUR	0000 0000	--	AOID6	AOID5	AOID4	AOID3	AOID2	AOID1	AOID0
0x38	R/W	CLICK_CFG	0000 0000	--	--	ZDEN	ZSEN	YDEN	YSEN	XDEN	XSEN
0x39	R	CLICK_SRC	--	--	IA	DCCLICK	SCCLICK	CLICK_SIGN	ZCLICK	YCLICK	XCLICK
0x3A	R/W	CLICK_THS	0000 0000	--	CTHS6	CTHS5	CTHS4	CTHS3	CTHS2	CTHS1	CTHS0
0x3B	R/W	TIME_LIMIT	0000 0000	--	TLI6	TLI5	TLI4	TLI3	TLI2	TLI1	TLI0
0x3C	R/W	TIME_LATENCY	0000 0000	TLA7	TLA6	TLA5	TLA4	TLA3	TLA2	TLA1	TLA0
0x3D	R/W	TIME_WINDOW	0000 0000	TW7	TW6	TW5	TW4	TW3	TW2	TW1	TW0
0x3E	R/W	INACT_THS	0000 0000	INACT_STS	INAH6	INAH5	INAH4	INAH3	INAH2	INAH1	INAH0
0x3F	R/W	INACT_DUR	0000 0000	INAD7	INAD6	INAD5	INAD4	INAD3	INAD2	INAD1	INAD0

## Register Table Lists (I2C slave address : 19h)

### Register 0x06 (CTRL\_REG0)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	0	LIR_CLICK	0	0	INAEN	CLICKEN	AOIEN

Bit	Type	Name	Default	Description
5	R/W	LIR_CLICK	0	Latch click event interrupt. 0 : disable; 1 : enable
2	R/W	INAEN	0	Inactivity detection. 0 : disable; 1 : enable
1	R/W	CLICKEN	0	Click detection. 0 : disable; 1 : enable
0	R/W	AOIEN	0	AOIEN detection. 0 : disable; 1 : enable

### Register 0x0F (WHO\_AM\_I)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	0	1	1	0	0	1	1

Bit	Type	Name	Default	Description
[7:0]	R	ID7:ID0	00110011	Device ID

### Register 0x20 (CTRL\_REG1)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
ODR3	ODR2	ODR1	ODR0	0	ZEN	YEN	XEN

Bit	Type	Name	Default	Description
[7:4]	R/W	ODR3:ODR0	0000	Data rate selection. 0000 : Power down mode 0001 : 1Hz 0010 : 10Hz 0011 : 25Hz 0100 : 50Hz 0101 : 100Hz 0110 : 200Hz
2	R/W	ZEN	1	Z axis enable. 0 : disable; 1 : enable
1	R/W	YEN	1	Y axis enable. 0 : disable; 1 : enable
0	R/W	XEN	1	X axis enable. 0 : disable; 1 : enable

**Register 0x21 (CTRL\_REG2)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	0	HPCF2	HPCF1	FDOUT	HPCLICK	0	HPIS1

Bit	Type	Name	Default	Description
[5:4]	R/W	HPCF2 : HPCF1	00	High pass filter cut off frequency selection. 00 : ODR/12.5 01 : ODR/25 10 : ODR/50 11 : ODR/75
3	R/W	FDOUT	0	Filtered data selection. 0: high pass filter bypassed; 1: data from high pass filter sent to output register and FIFO
2	RW	HPCLICK	0	High pass filter enabled for CLICK function. 0 : disable; 1 : enable
0	R/W	HPIS1	0	High pass filter enabled for AOI function. 0: disable; 1 : enable

**Register 0x22 (CTRL\_REG3)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
I1_CLICK	I1_AOI	I1_INACT	I1_DRDY1	0	I1_WTM	I1_ORUN	0

Bit	Type	Name	Default	Description
7	R/W	I1_CLICK	0	Click interrupt on INT1. 0 : disable; 1 : enable
6	R/W	I1_AOI	0	AOI interrupt on INT1. 0 : disable; 1 : enable
5	R/W	I1_INACT	0	Inactivity interrupt on INT1. 0 : disable; 1 : enable
4	R/W	I1_DRDY1	0	Data-ready interrupt on INT1. 0 : disable; 1 : enable
2	R/W	I1_WTM	0	FIFO watermark interrupt on INT1. 0 : disable; 1 : enable
1	R/W	I1_ORUN	0	FIFO overrun interrupt on INT1. 0 : disable; 1 : enable

**Register 0x23 (CTRL\_REG4)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
BDU	BIGEN	FS1	FS0	HR	0	STEN	0

Bit	Type	Name	Default	Description
7	R/W	BDU	0	Block data update. 0: disable; 1: enable
6	R/W	BIGEN	0	Big endian enable. 0: Data LSB @ lower address. 1 : Data MSB @ lower address
[5:4]	R	FS1:FS0	00	Full scale range selection. 00 : ±2G; 01 : ±4G; 10 : ±8G; 11 : ±16G
3	R/W	HR	0	High resolution mode. 0 : disable; 1 : enable
1	R/W	STEN	0	Self-test mode. 0 : disable; 1 : enable

### Register 0x24 (CTRL\_REG5)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
BOOT	FIFOEN	0	0	LIR_AOI	ODS_AOI	0	0

Bit	Type	Name	Default	Description
7	R/W	BOOT	0	Reboot. 0: disable; 1 : enable
6	R/W	FIFOEN	0	FIFO enable. 0 : disable; 1 : enable
3	R/W	LIR_AOI	0	Latch AOI event interrupt. 0 : disable; 1 : enable
2	R/W	ODS_AOI	0	Orientation detection selection. 0: 6D orientation; 1: 4D orientation

### Register 0x25 (CTRL\_REG6)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
I2_CLICK_EN	I2_AOI	0	I2_BOOT	0	0	HL_ACTIVE	0

Bit	Type	Name	Default	Description
7	R/W	I2_CLICK_EN	0	Click interrupt on INT2 pin. 0 : disable; 1 : enable
6	R/W	I2_AOI	0	AOI interrupt on INT2 pin. 0 : disable; 1 : enable
4	R/W	I2_BOOT	0	Boot status on INT2 pin. 0 : disable; 1 : enable
1	R/W	HL_ACTIVE	0	Active high/low level for interrupt pins. 0: active high; 1: active low

### Register 0x27 (STS\_REG)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
ZYXOVER	ZOVER	YOVER	XOVER	ZYXDA	ZDA	YDA	XDA

Bit	Type	Name	Default	Description
7	R	ZYXOVER	0	X, Y and Z axis data overrun. 0 : normal; 1: overrun
6	R	ZOVER	0	Z axis data overrun. 0: normal; 1 : overrun
5	R	YOVER	0	Y axis data overrun. 0: normal; 1 : overrun
4	R	XOVER	0	X axis data overrun. 0: normal; 1 : overrun
3	R	ZYXDA	0	X, Y and Z axis new data available. 0 : not available; 1 : available
2	R	ZDA	0	Z axis new data available. 0 : not available; 1 : available
1	R	YDA	0	Y axis new data available. 0 : not available; 1 : available
0	R	XDA	0	X axis new data available. 0 : not available; 1 : available

**Register 0x28 (OUT\_X\_L)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
XD7	XD6	XD5	XD4	XD3	XD2	XD1	XD0

Bit	Type	Name	Default	Description
[7:0]	R	XD7:XD0	00000000	Low byte of X axis data.

**Register 0x29 (OUT\_X\_H)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
XD15	XD14	XD13	XD12	XD11	XD10	XD9	XD8

Bit	Type	Name	Default	Description
[7:0]	R	XD15:XD8	00000000	High byte of X axis data.

**Register 0x2A (OUT\_Y\_L)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
YD7	YD6	YD5	YD4	YD3	YD2	YD1	YD0

Bit	Type	Name	Default	Description
[7:0]	R	YD7:YD0	00000000	Low byte of Y axis data.

**Register 0x2B (OUT\_Y\_H)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
YD15	YD14	YD13	YD12	YD11	YD10	YD9	YD8

Bit	Type	Name	Default	Description
[7:0]	R	YD15:YD8	00000000	High byte of Y axis data.

**Register 0x2C (OUT\_Z\_L)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
ZD7	ZD6	ZD5	ZD4	ZD3	ZD2	ZD1	ZD0

Bit	Type	Name	Default	Description
[7:0]	R	ZD7:ZD0	0	Low byte of Z axis data.

**Register 0x2D (OUT\_Z\_H)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
ZD15	ZD14	ZD13	ZD12	ZD11	ZD10	ZD9	ZD8

Bit	Type	Name	Default	Description
[7:0]	R	ZD15:ZD8	0	High byte of Z axis data.

### Register 0x2E (FIFO\_CFG)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
FM1	FM0	TR	FTH4	FTH3	FTH2	FTH1	FTH0

Bit	Type	Name	Default	Description
[7:6]	R/W	FM1:FM0	00	FIFO mode selection. 00 : Bypass mode 01 : FIFO mode 10 : Stream mode 11 : Trigger mode
5	R/W	TR	0	Trigger selection. 0 : Trigger event linked to trigger signal on AOI 1 : Trigger event linked to trigger signal on CLICK
[4:0]	R/W	FTH4:FTH0	00000	FTH[4:0] bits are intended to define the watermark level. When FIFO content exceeds this value, the WTM flag is set to "1" in the FIFO_SRC register.

### Register 0x2F (FIFO\_SRC)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
WTM	OVRN_FIFO	EMPTY	FSS4	FSS3	FSS2	FSS1	FSS0

Bit	Type	Name	Default	Description
7	R	WTM	0	WTM flag is set high when FIFO content exceeds watermark level.
6	R	OVRN_FIFO	0	OVRN flag is set high when FIFO buffer is full, this means that the FIFO buffer contains 32 unread samples.
5	R	EMPTY	0	EMPTY flag is set high when all FIFO samples have been read and FIFO is empty.
[4:0]	R	FSS4:FSS0	00000	FSS[4:0] field always contains the current number of unread samples stored in the FIFO buffer.

**Register 0x30 (AOI\_CFG)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
AOI1	AOI0	ZHIE/ ZUPE1	ZLIE / ZDOWNE1	YHIE / YUPE1	YLIE / YDOWNE1	XHIE / XUPE1	XLIE / XDOWNE1

Bit	Type	Name	Default	Description
[7:6]	R/W	AOI1:AOI0	00	Motion detection mode selection. 00 : wakeup 01 : 6D/4D movement 10 : free-fall 11 : 6D/4D position
5	R/W	ZHIE/ZUPE1	0	Z-axis high-g interrupt generation for AOI function. 0: disable; 1: enable
4	R/W	ZLIE/ZDOWNE1	0	Z-axis low-g interrupt generation for AOI function. 0: disable; 1: enable
3	R/W	YHIE/YUPE1	0	Y-axis high-g interrupt generation for AOI function. 0: disable; 1: enable
2	R/W	YLIE/YDOWNE1	0	Y-axis low-g interrupt generation for AOI function. 0: disable; 1: enable
1	R/W	XHIE/XUPE1	0	X-axis high-g interrupt generation for AOI function. 0: disable; 1: enable
0	R/W	XLIE/XDOWNE1	0	X-axis low-g interrupt generation for AOI function. 0: disable; 1: enable

**Register 0x31 (AOI\_SRC)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	IA1	ZH1	ZL1	YH1	YL1	XH1	XL1

Bit	Type	Name	Default	Description
6	R	IA1	0	AOI status. 0: no event; 1: one or more events have been generated
5	R	ZH1	0	Z-axis high-g event status for AOI function. 0: inactive; 1: active
4	R	ZL1	0	Z-axis low-g event status for AOI function. 0: inactive; 1: active
3	R	YH1	0	Y-axis high-g event status for AOI function. 0: inactive; 1: active
2	R	YL1	0	Y-axis low-g event status for AOI function. 0: inactive; 1: active
1	R	XH1	0	X-axis high-g event status for AOI function. 0: inactive; 1: active
0	R	XL1	0	X-axis low-g event status for AOI function. 0: inactive; 1: active

Register 0x32 (AOI\_THS)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	AOIH6	AOIH5	AOIH 4	AOIH3	AOIH2	AOIH1	AOIH0

Bit	Type	Name	Default	Description
[6:0]	R/W	AOIH6:AOIH0	0000000	AOI threshold.

Register 0x33 (AOI\_DUR)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	AOID6	AOID5	AOID4	AOID3	AOID2	AOID1	AOID0

Bit	Type	Name	Default	Description
[6:0]	R/W	AOID6:AOID0	0000000	AOI duration. Unit: 1/ODR

Register 0x38 (CLICK\_CFG)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	0	ZDEN	ZSEN	YDEN	YSEN	XDEN	XSEN

Bit	Type	Name	Default	Description
5	R/W	ZDEN	0	Double click detection on z-axis. 0 : disable; 1 : enable
4	R/W	ZSEN	0	Single click detection on z-axis. 0 : disable; 1 : enable
3	R/W	YDEN	0	Double click detection on y-axis. 0 : disable; 1 : enable
2	R/W	YSEN	0	Single click detection on y-axis. 0 : disable; 1 : enable
1	R/W	XDEN	0	Double click detection on x-axis. 0 : disable; 1 : enable
0	R/W	XSEN	0	Single click detection on x-axis. 0 : disable; 1 : enable



**Register 0x39 (CLICK\_SRC)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	IA	DCLICK	SCLICK	CLICK_SIGN	ZCLICK	YCLICK	XCLICK

Bit	Type	Name	Default	Description
6	R	IA	0	Click interrupt status. 0 : inactive; 1 : active
5	R	DCLICK	0	Double-click interrupt status. 0 : inactive; 1 : active
4	R	SCLICK	0	Single-click interrupt status. 0 : inactive; 1 : active
3	R	CLICK_SIGN	0	Sign of click event status. 0 : positive; 1 : negative
2	R	ZCLICK	0	Click event detection status on z-axis. 0 : not detected; 1 : detected
1	R	YCLICK	0	Click event detection status on y-axis. 0 : not detected; 1 : detected
0	R	XCLICK	0	Click event detection status on x-axis. 0 : not detected; 1 : detected

**Register 0x3A (CLICK\_THS)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	CTHS6	CTHS5	CTHS4	CTHS3	CTHS2	CTHS1	CTHS0

Bit	Type	Name	Default	Description
[6:0]	R/W	CTHS6: CTHS0	0000000	Click threshold.

**Register 0x3B (TIME\_LIMIT)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
0	TLI6	TLI5	TLI4	TLI3	TLI2	TLI1	TLI0

Bit	Type	Name	Default	Description
[6:0]	R/W	TLI6: TLI0	0000000	Click time limit. Unit : 1/ODR

**Register 0x3C (TIME\_LATENCY)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
TLA7	TLA6	TLA5	TLA4	TLA3	TLA2	TLA1	TLA0

Bit	Type	Name	Default	Description
[7:0]	R/W	TLA7: TLA0	00000000	Click time latency. Unit : 1/ODR

**Register 0x3D (TIME\_WINDOW)**

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
TW7	TW6	TW5	TW4	TW3	TW2	TW1	TW0

Bit	Type	Name	Default	Description
[7:0]	R/W	TW7: TW0	00000000	Click time window. Unit: 1/ODR

### Register 0x3E (INACT\_THS)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
INACT_STS	INAH6	INAH5	INAH4	INAH3	INAH2	INAH1	INAH0

Bit	Type	Name	Default	Description
7	R	INACT_STS	0	Inactivity interrupt status. 0 : inactive; 1 : active
[6:0]	R/W	INAH6 : INAH0	0000000	Inactivity threshold.

### Register 0x3F (INACT\_DUR)

Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
INAD7	INAD6	INAD5	INAD4	INAD3	INAD2	INAD1	INAD0

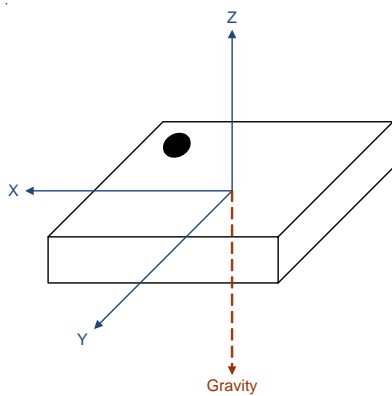
Bit	Type	Name	Default	Description
[7:0]	R/W	INAD7 : INAD0	00000000	Inactivity duration. Unit: 16/ODR

### Sensing Axes Orientation

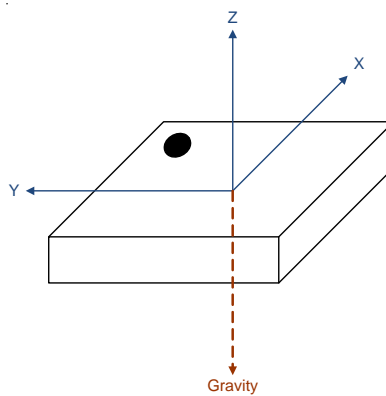
The sensor is at rest in gravity filed according to following figure, and the output signals are :

- ▶ 0g for the X-axis
- ▶ 0g for the Y-axis
- ▶ +1g for the Z-axis

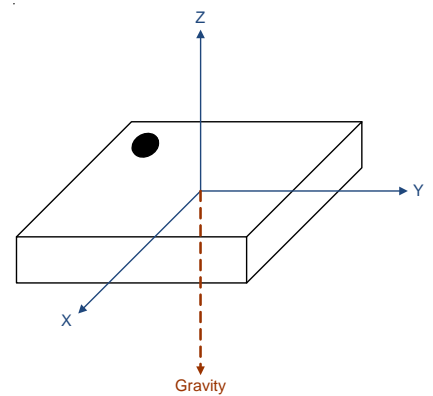
MQFN-16L 3x3



MQFN-12L 2x2 (COL)

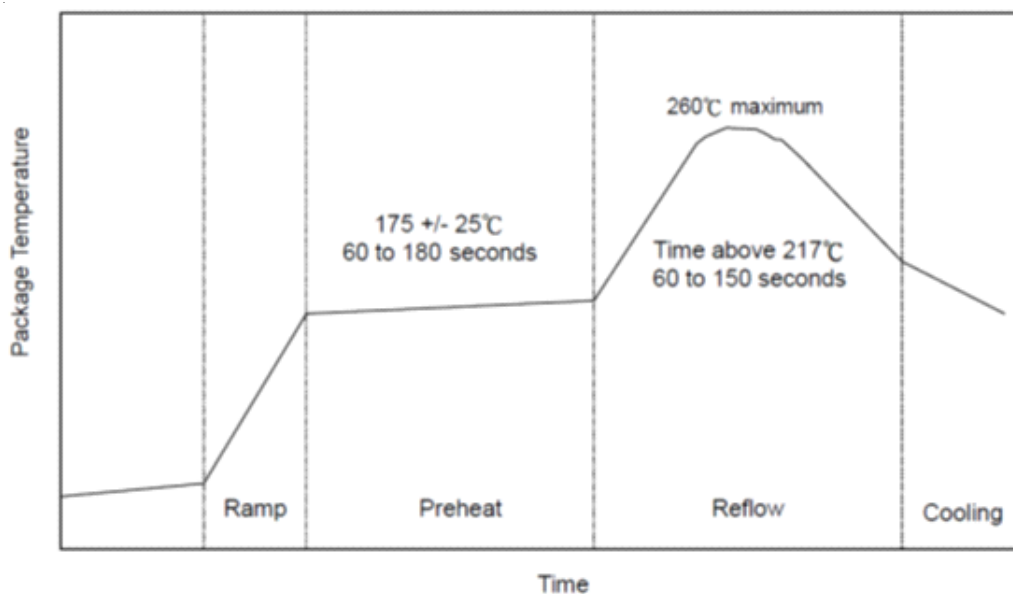


MDFN-10L 3x3



**Soldering Guidelines**

Condition	Contents
Preheat temperature 175 (±25)°C	60 to 180 seconds
Temperature maintained above 217°C	60 to 150 seconds
Time within 5°C of actual peak temperature	20 to 40 seconds
Peak temperature	260°C
Ramp-down rate	6°C /second max.
Time 25°C to peak temperature	8 minutes max.

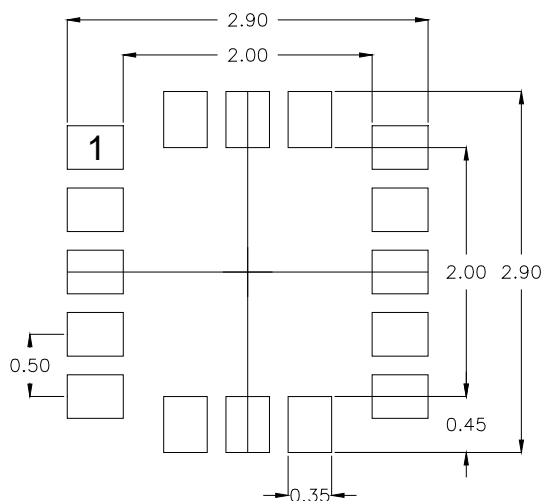


**Layout Considerations**

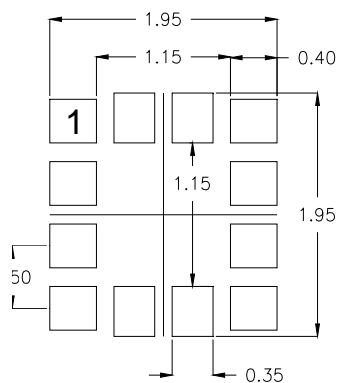
- ▶ No extra traces and components under the device.
- ▶ Do not place any components or vias at a distance less than 2 mm from the device.
- ▶ The solder mask opening must be larger than the land pad.
- ▶ Use a pick and place machine and the solder paste thickness must be as uniform as possible to avoid uneven stress.

## Recommended Land Pattern

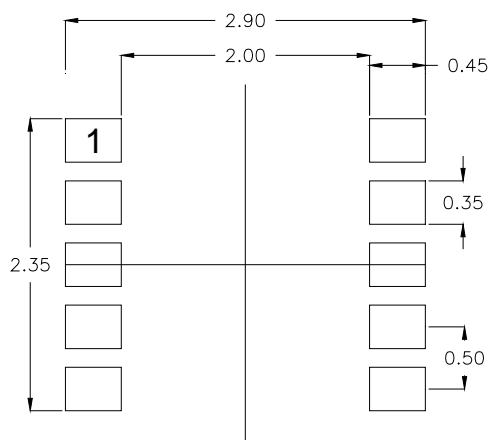
### RT3000A (MQFN-16L 3x3)



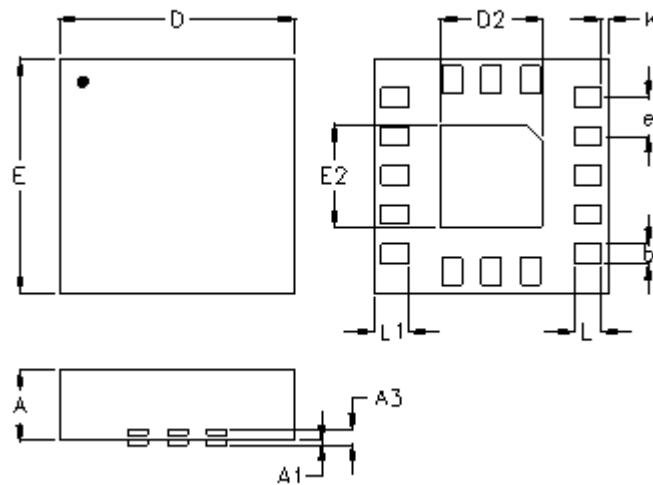
### RT3000B (MQFN-12L 2x2)



### RT3000C (MDFN-10L 3x3)

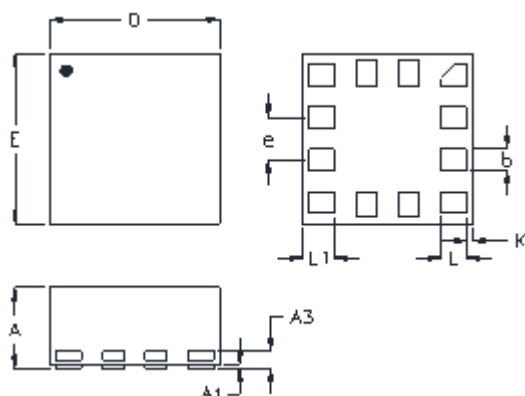


**Outline Dimension**



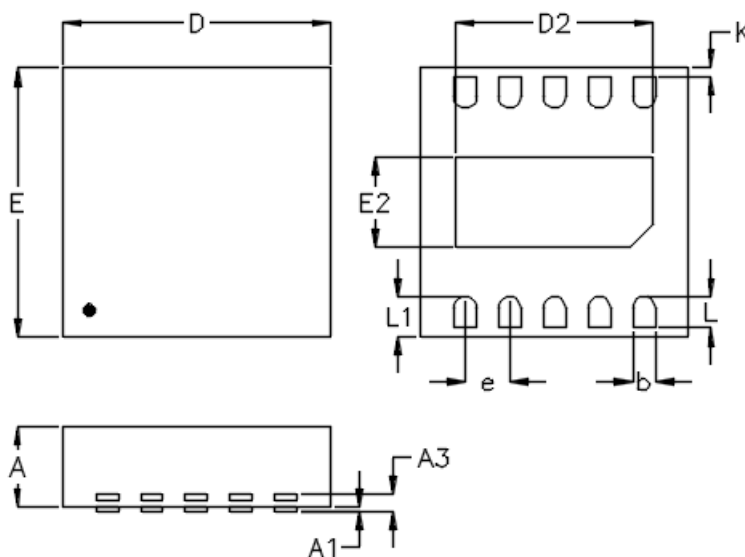
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.000	0.035	0.039
A1	0.000	0.050	0.000	0.002
A3	0.175	0.250	0.007	0.010
b	0.200	0.300	0.008	0.012
D	2.900	3.100	0.114	0.122
D2	1.250	1.350	0.049	0.053
E	2.900	3.100	0.114	0.122
E2	1.250	1.350	0.049	0.053
e	0.500		0.020	
L	0.300	0.400	0.012	0.016
L1	0.400	0.500	0.016	0.020
K	0.050	0.150	0.002	0.006

**M-Type 16L QFN 3x3 Package**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.000	0.035	0.039
A1	0.000	0.050	0.000	0.002
A3	0.175	0.250	0.007	0.010
b	0.200	0.300	0.008	0.012
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
e	0.500		0.020	
L	0.250	0.350	0.010	0.014
L1	0.325	0.425	0.013	0.017
K	0.025	0.125	0.001	0.005

**M-Type 12L QFN 2x2 (COL) Package**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.000	0.035	0.039
A1	0.000	0.050	0.000	0.002
A3	0.175	0.250	0.007	0.010
b	0.200	0.300	0.008	0.012
D	2.950	3.050	0.116	0.120
D2	2.150	2.250	0.085	0.089
E	2.950	3.050	0.116	0.120
E2	0.950	1.050	0.037	0.041
e	0.500		0.020	
L	0.300	0.400	0.012	0.016
L1	0.400	0.500	0.016	0.020
K	0.050	0.150	0.002	0.006

**M-Type 10L DFN 3x3 Package**

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