

R6093U SPECIFICATION Ver1.0

Copyright © Microinfinity Co., Ltd.

MIBX-R001-1709SC-A240

<http://www.minfinity.com>

Contact Info.

EMAIL: support@minfinity.com, TEL: +82 31 546 7408 FAX: +82 31 546 7409

Contents

1. Functional Description	3
1.1. Overview	3
1.2. Block diagram	3
1.3. Features	4
1.4. System start-up	4
1.5. Installation	5
Mounting Information(Coordinate System)	5
Data Output	5
2. Mechanical Specification	6
2.1. Dimensions	6
2.2. Specification	6
3. Interface Specification	7
3.1. Pin Configuration	7
3.2. Pin Definition	7
4. Electrical Specification	8
5. Performance Specification	9
6. Protocol	10
6.1. System information	10
6.2. Integer output format	10
6.3. Software reset	11
7. Environmental Specification	12
8. Reflow Temperature Guideline	13
9. Packing Specification	14
9.1. Tray dimensions	14
9.2. Box Packing	15
10. RoHS Compliance	16
11. Handling Precaution	17
Contact Information	18
Corporate Office	18
USA	18

List of Figures

Figure 1: Functional diagram.....	3
Figure 2: The CruzCore R6093U coordinates system	5
Figure 3: Dimensions.....	6
Figure 4: Pin configuration of connectors.....	7
Figure 5: The CruzCore R6093U data packet format.....	10
Figure 6: Temperature conditions at reflow	13
Figure 7 : Packing tray	14

List of Tables

Table 1: Mechanical specification.....	6
Table 2: Pin definition	7
Table 3: Absolute maximum ratings.....	8
Table 4: The CruzCore R6093U electrical characteristics.....	8
Table 5: The CruzCore R6093U performance characteristics.....	9
Table 6. Serial setting	10
Table 7: The CruzCore R6093U data fields description.	11
Table 8: Software reset command.....	11
Table 9: Environment and mechanical test.	12
Table 10: Judgment criteria of environment and mechanical test.....	12

1. Functional Description

1.1. Overview

The CruzCore® R6093U is a 3 axis digital gyroscope and accelerometer. It's also working as attitude reference system that among others, can measure angular rate, acceleration and attitude(yaw is relative to initial orientation) under dynamic conditions. It is a highly compact, light, and fully self-contained module. Internally, the R6093U contains a 3 axis MEMS gyroscope and accelerometer, internal voltage regulator, signal processing circuitry, AD converter and a RISC microprocessor running our patented error correcting algorithm. The R6093U uses an adaptive reduced order Kalman filter to reduce the errors that affect this type of sensors (i.e. bias drift, scale factor, asymmetry), as the result it produces very accurate stabilized angular rates and heading angle. The start-up time is less than 1 second, which is used to compute bias parameters; it does not require further calibration thereafter. The R6093U is the best 3 axis attitude measuring solution for robot navigation applications.

1.2. Block diagram

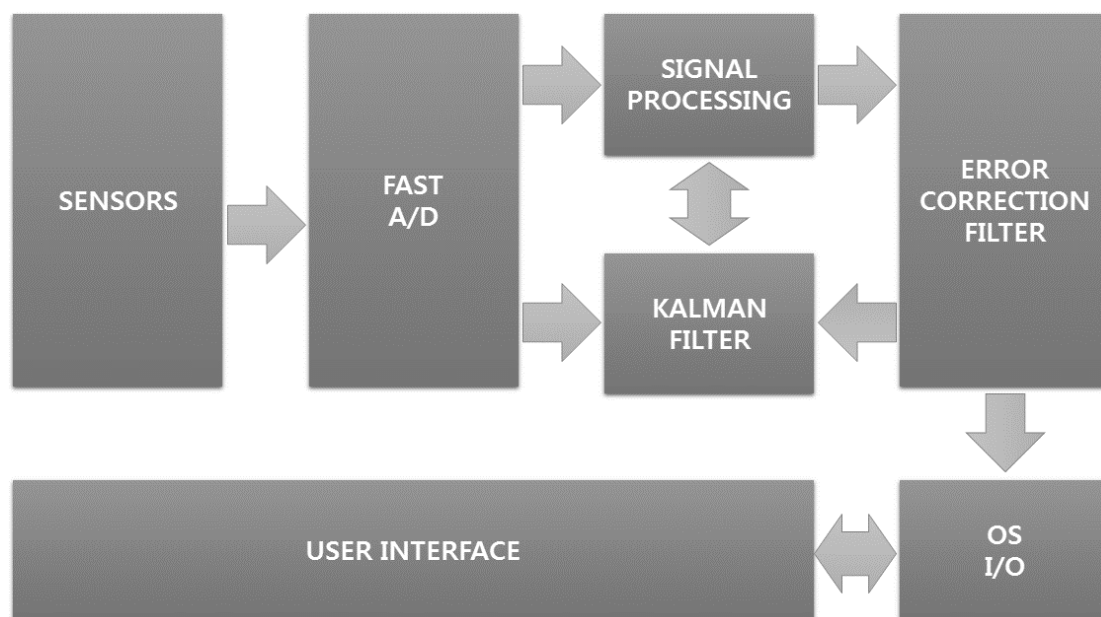
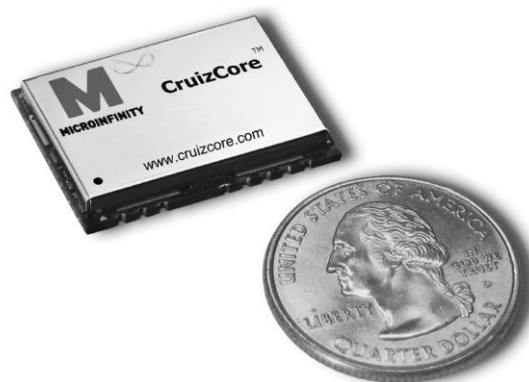


Figure 1: Functional diagram.

1.3. Features

- UART output
- Low power consumption
- Compact package
- Fast startup
- Fully self-contained
- 3 axis Rate output
- 3 axis Angle output
- 3 axis acceleration output



1.4. System start-up

The CruzCore R6093U startup time is less than one second. It internally compensates for errors due to changes in temperature. However, sudden temperature changes shortly after powering-on the unit can cause static rate errors. If such temperature changes are expected, we recommend leaving the gyro stationary for 5 seconds after startup. During startup time, it is required that the CruzCore R6093U is stationary on a level surface to obtain the best performance.

1.5. Installation

Mounting Information(Coordinate System)

To mount the CruzCore R6093U on your system, please refer to Figure 2, Coordinate System. To obtain accurate attitude, please recall that mounting is very important and mounting error can cause attitude errors. If you want to use another coordinate system, please contact us.

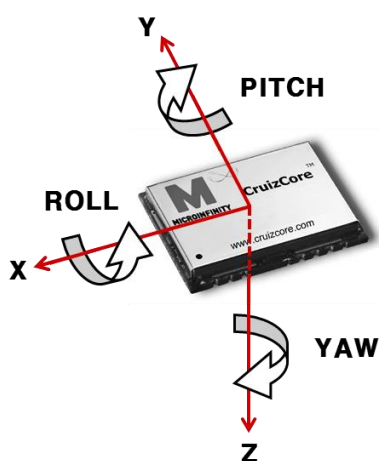


Figure 2: The CruzCore R6093U coordinates system

Data Output

The UART serial settings are 38400, 8, 1, N with no handshaking.

2. Mechanical Specification

2.1. Dimensions

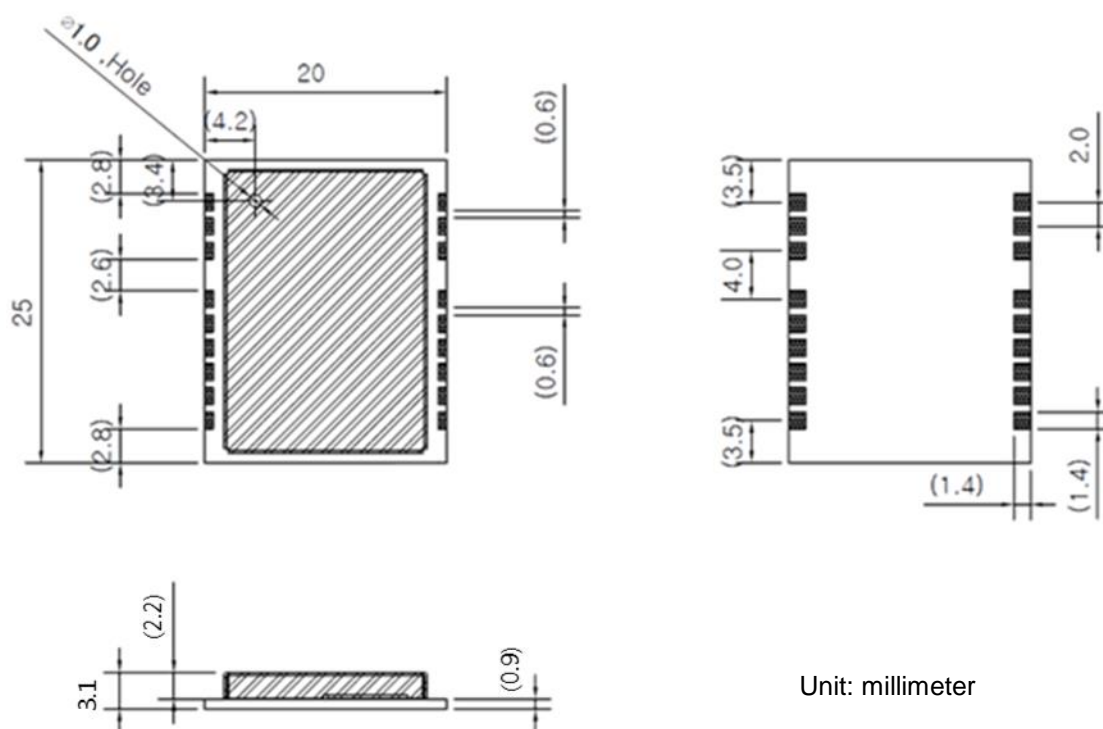


Figure 3: Dimensions

2.2. Specification

Table 1: Mechanical specification

Parameter	Specification	Tolerance	Comment
Length	25.0	±0.2	Unit: millimeter.
Width	20.0	±0.2	
Height	3.1	±0.3	
Weight	3.0	-1.5	Unit: gram

3. Interface Specification

3.1. Pin Configuration

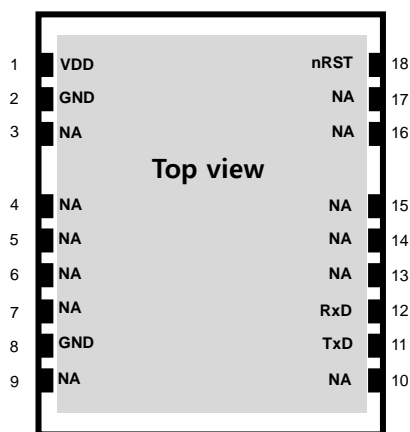


Figure 4: Pin configuration of connectors

3.2. Pin Definition

Table 2: Pin definition

Pin No.	Pin name	I/O	Description
1	VDD	-	Main power (2.9V ~ 5.5VDC)
2, 8	GND	-	Power ground
11	TxD	O	UART transmit data
12	RxD	I	UART receive data
18	nRST	I	System reset input. Must be driven by and open drain or equivalent output.
-	NA	-	Not available (leave open)

4. Electrical Specification

Table 3: Absolute maximum ratings

Parameter	Symbol	Value	Unit	Note
Power supply voltage	V _{DD}	-0.3 ~ 6.0	V	GND=0V
nRST Input voltage	V _{nRST}	-0.3 ~ 4.0	V	GND=0V
Port Input voltage	V _{IO}	-0.3 ~ 4.0	V	GND=0V
Operating temperature	T _{OPR}	-20 ~ +80	°C	
Storage temperature	T _{STG}	-40 ~ +85	°C	

Table 4: The CruzCore R6093U electrical characteristics

Parameter			Value			Unit
			Min.	Typ.	Max.	
Supply power	Input voltage	Operating	2.9		5.5	V
		Recommended		3.0		V
	Current	@ 3.0 V		13		mA
	Power consumption	@ 3.0 V		39		mW
I/O voltage	Pins for communication	Input "L"			1.2	V
		Input "H"	1.6			V
		Output "L"			0.4	V
		Output "H"	2.4			V
	nRST ¹	Input "L"			0.6	V
		Input "H"	2.4			V

* Data voltage levels can vary slightly due to internal load changes.

1. Use open collector logic when using the nRST function.

5. Performance Specification

Table 5: The CruizCore R6093U performance characteristics

Parameter		Value			Unit
		Min.	Typ.	Max.	
Start-up time ¹	Fast warm-up		0.5		sec
	Full alignment			5	min
Measurement range ²	Angular rate			± 250	deg/sec
	Acceleration			± 2	g
Bandwidth ³	Angular rate		12		Hz
	Acceleration		62.5		Hz
Yaw axis angular rate ⁴	Scale factor error		0.3		%
	Bias drift		10		deg/hr
Yaw axis relative angle ⁴	Proportional error		0.3		%
	Drift error		10		deg/hr
Roll, pitch accuracy ⁴	Static error		0.3		deg
	Dynamic error		0.7		deg
Resolution ⁵	Angular rate		0.01		deg/sec
	Angle		0.01		deg
	Acceleration		1		mg
Data rate ⁵	Adjustable		100		Hz

* The system must be installed in the correct position.

** @T_{OPR}=+25°C, V_{DD}=3.0V.

1. Full alignment: Total time that takes for full bias error calibration and temperature compensation. It is the worst case on condition that the temperature goes up suddenly without temperature compensation.
2. Other measurement range is available by customizing option(angular rate range is available up to 2000 deg/sec, acceleration range is available up to 16g). Please contact us
3. Other bandwidth is available by customizing option. Angular rate and acceleration each bandwidth are available up to 523Hz and 1kHz.
4. Guaranteed only under conditions: full alignment, steady-state room temperature, start-up on a level surface, under moderate dynamics (250 deg/sec angular rate).
5. Other data rate and resolution are available by customizing option.

6. Protocol

The CruizCore® R6093U provides rate, angle and acceleration outputs. The output format is shown in Figure 5 and is described in Table 7. The output consists on a 2 byte header, a 1byte index, a 4byte reserved, a 22 byte data section and 1 byte checksum. The checksum is the sum of all bytes in the data packet, excluding the header and checksum field. The output voltage level of the serial port is 2.8V. If you want another data format, please contact us.

Table 6. Serial setting

Baudrate	Data bits	Parity bit	Stop bits
38400	8	None	1

6.1. System information

When the CruizCore R6093U is powered up, it transmits the system information. For example:

```
%R60X3U
%VX. XX
```

The system information output can be changed without notice.

6.2. Integer output format

Following the system information the CruizCore R6093U starts transmitting the sensor data packages. The angular rate and angle provides measurements with 0.01 degree resolution, i.e. a 0.1 degree angle will be displayed as 10 (or 0x0A HEX).

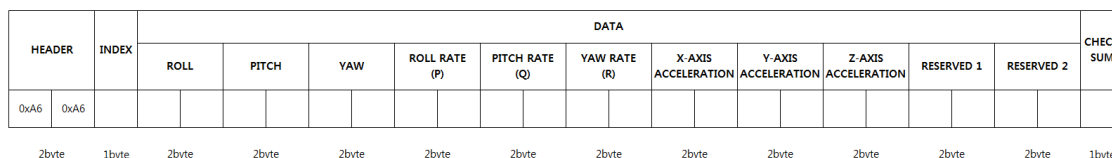


Figure 5: The CruizCore R6093U data packet format

Table 7: The CruzCore R6093U data fields description.

Output data	Byte	Comments
HEADER	1-2	Hex value is: 0xA6A6
INDEX	3	0x00 ~ 0xFF
ANGLE ¹ (ROLL, PITCH, YAW)	4-9	Provided in 0.01 resolved deg.
RATE ¹	10-15	Provided in 0.01 resolved deg/sec.
ACCELERATION ¹	16-21	Provided in 1mg resolution.
RESERVED	22-25	
CHECKSUM ²	26	Sum of all bytes excluding the header.

1. First byte is the least significant.

2. CHECKSUM is 1 byte and the overflowed more than 1 byte is ignored.

6.3. Software reset

The CruzCore R6093U can accept reset input command.

Table 8: Software reset command.

Function	Command
Software reset	\$MIB,RESET*87

This command '\$MIB,RESET*87' resets the device. Refer to 1.4. for other details about sensor initialization.

7. Environmental Specification

Table 9: Environment and mechanical test.

No.	Items	Test condition	Test criteria
1	High temperature storage	85°C x 120h	Refer to table 10
2	Low temperature Storage	-40°C x 72h	Refer to table 10
3	Temperature and Humidity cycling	25°C, 60%RH(4h) / 55°C, 95%RH(10h) / -30°C(2h) / 75°C(2h), 10cycles	Refer to table 10
4	Thermal shock	-40°C ↔ 85°C 1hour at each temperature, 10cycles	Refer to table 10
5	Drop	Free drop from 750mm height on a wooden board for 3 times	Refer to table 10
6	Vibration	10Hz to 55Hz amplitude 0.75mm, 55Hz to 500Hz acceleration 98m/s ² , 10Hz→500Hz→10Hz 15min/cycle, 6h(2h x 3directions)	Refer to table 10
7	ESD	R(330Ω) C(150pF), Contact discharge, 5times	Refer to table 10

* After each test, there should be no visible damage and the measured values shall be met Table 10.

Table 10: Judgment criteria of environment and mechanical test.

Items	Units	Judgment criteria
Yaw axis angular error	degree	When CW 1 rev, 0±3.6deg. After CW 1 rev, CCW 1 rev, 0±3.6deg.
ESD	voltage	1kV (No deviations) 2kV (Self-recoverable deviations)

8. Reflow Temperature Guideline

Recommended temperature conditions at reflow is shown on the following Figure 6.

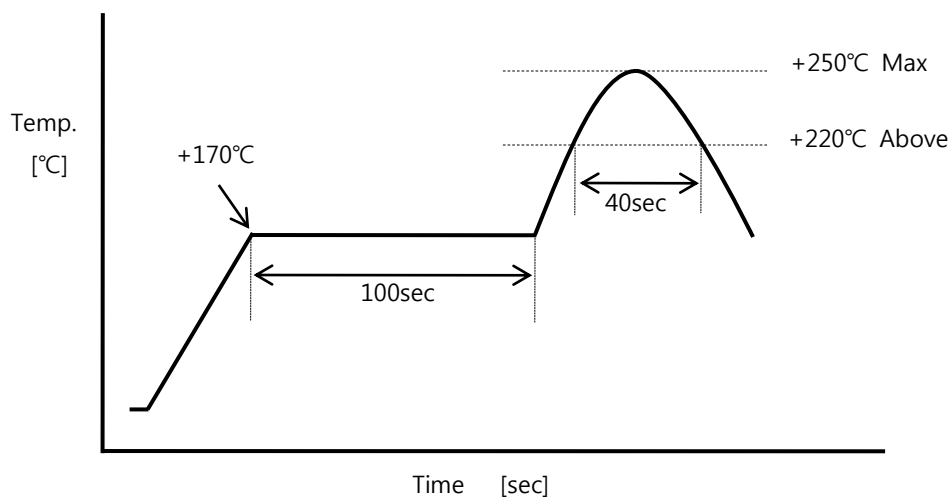


Figure 6: Temperature conditions at reflow

Pre-heating temperature: +170°C

Pre-heating time: 100sec

Heating temperature: +220°C

Heating time: 40sec

Peak temperature \leq +250°C

9. Packing Specification

9.1. Tray dimensions

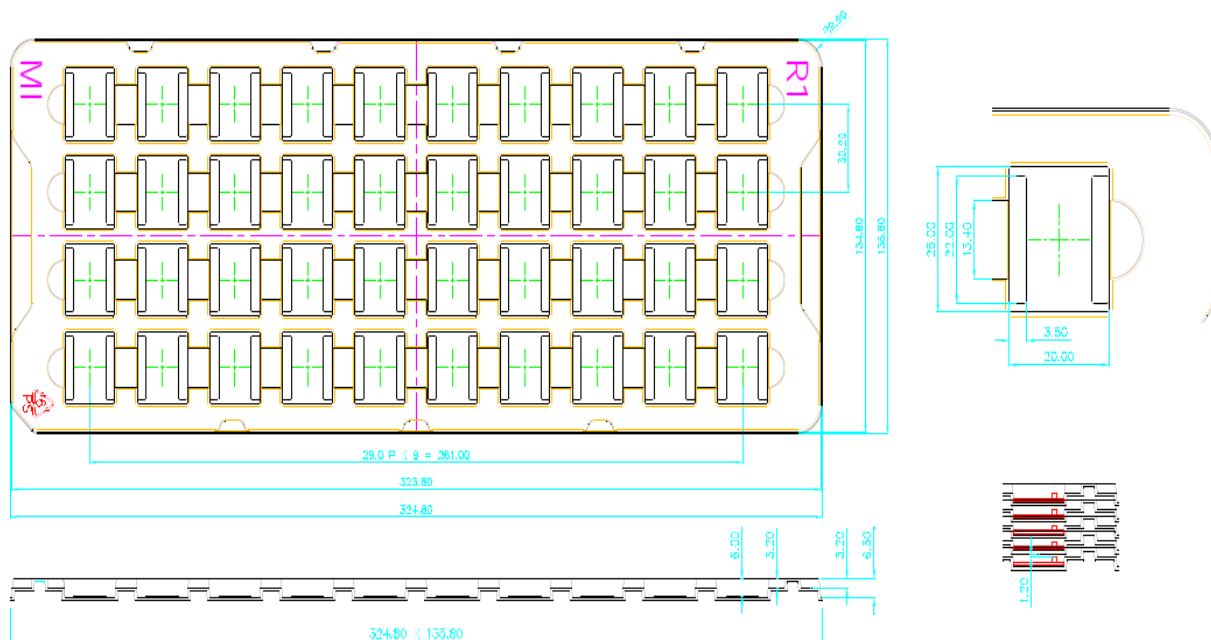


Figure 7 : Packing tray

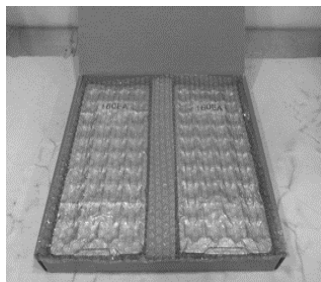
9.2. Box Packing



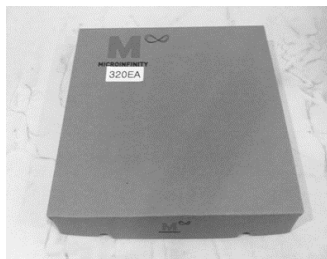
R6093U



- 40pcs/Tray (4x10)
- Stack 5 tray (including one empty tray)
- Totally 160pcs (40x4)



- Vacuum sealing
- Cushion bar and bubble sheet
- Totally 320pcs (160x2)



320pcs/Inner box



- 1,280pcs/Carton (320x4)
- Stack 4 inner box

10. RoHS Compliance

The CruzCore® R6093U module and its homogeneous materials comply with European Union's restriction on use of hazardous substances("RoHS") Directive, 2002/95/EC.

11. Handling Precaution

This product includes MEMS sensor. Please handle carefully paying attention to the next points. We recommend to avoid mechanical shocks during handling and transport. The excessive shock may make the characteristic of product change or deteriorate. So please set up your site so that the shock becomes as small as possible. Please be sure to check the characteristics in case that the product is dropped from the desktop and too much shock is applied to the products. This product has built-in protections against high electrostatic discharges or electric fields. However, when the excessive static electricity is charged, product may break. So please use conductive ones for packing and carrying containers.

Contact Information

Corporate Office

MicroInfinity Co., Ltd.
8F KANC, 109 Gwanggyo-ro
Yengtong-gu Suwon-si
Gyeonggi-do, 443-270, Korea
Tel : +82 31 546 7408
Fax : +82 31 546 7409
Email: support@minfinity.com

USA

P.O. Box 131284
Ann Arbor, MI 48105, USA
Tel : +1 734 223 5904
Fax : +1 866 400 3125
Email: usa.support@minfinity.com

Homepage: <http://www.minfinity.com>