FC30

MEMS functional sensor: smart 3D orientation and click detection standalone device

Features

- 3D orientation sensor: 3 orthogonal directions (6 positions)
- Embedded click/double-click functionality
- Low power consumption
- Power down mode
- High shock survivability
- -40 °C to +85 °C temperature range
- Excellent quality and reliability
- Testable after assembly without movement
- Housed in a small, thin 3x5x0.9 SMD package
- ECOPACK®, RoHS and "Green" compliant

Applications

- Image rotation in mobile phones and portable devices
- Digital photo frames
- Orientation detection
- Button replacement
- Motion triggered wake up

Description

The FC30 is a stand-alone 3D orientation and click/double-click detection device.

When in a steady position, it is able to detect 6 different orientations with respect to the gravity field, with notification provided through dedicated signal lines.

LGA-14 (3x5x0.9mm)
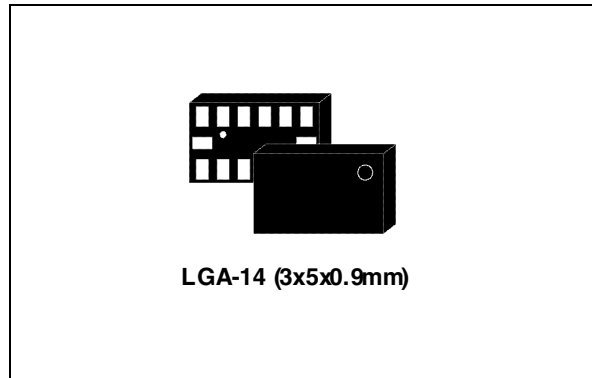
The device can be used for image rotation (portrait/landscape) and position-based applications.

When a single or double mechanical tap is detected, the FC30 provides an interrupt signal, enabling a "mouse button-like" function for intuitive man-machine interface solutions.

A power-down mode selectable through a dedicated input pin ensures very low current consumption in battery-operated devices.

The FC30 is available in an LGA-14 3x5x0.9mm SMD plastic full-moulded package compliant with lead-free, RoHS and halogen-free regulations. Compatible with a -40 °C to +85 °C temperature range, the FC30 is shipped in standard tape and reels for automatic pick and place machines and is washable after reflow due to its completely sealed and hermetic structure.

Table 1.   Order codes

Order code	Temp range (°C)	Package	Packing
FC30	-40 to +85	LGA-14	Tray
FC30TR	-40 to +85	LGA-14	Tape and reel

Contents

1 Pin configuration and description

Figure 1. Pin configuration
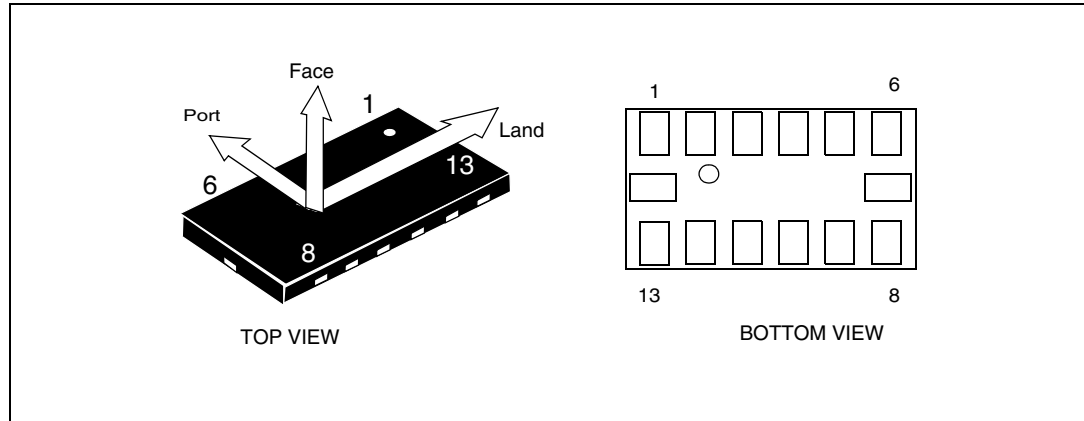
Table 2. Pin description

Pin#	Name	Function
1	Vdd_IO	Power supply for I/O pins
2	GND	0V supply
3	Vdd	Power supply
4	Res	Connect to 0V supply
5	GND	0V supply
6	Vdd	Power supply
7	Res	Leave unconnected
8	PC	Portrait interrupt (logic 1: portrait orientation)
9	LC	Landscape interrupt (logic 1: landscape orientation)
10	Res	Connect to 0V supply
11	PD	Power-down (logic 0: power-down mode; logic 1: normal mode)
12	SIGN	Sign interrupt for landscape/portrait/face orientation
13-14	Res	Leave unconnected

2 Device functionality

2.1 Orientation detection

The device output can be configured to provide its orientation relative to gravity based on orientation definitions, as illustrated in *Figure 2* below.
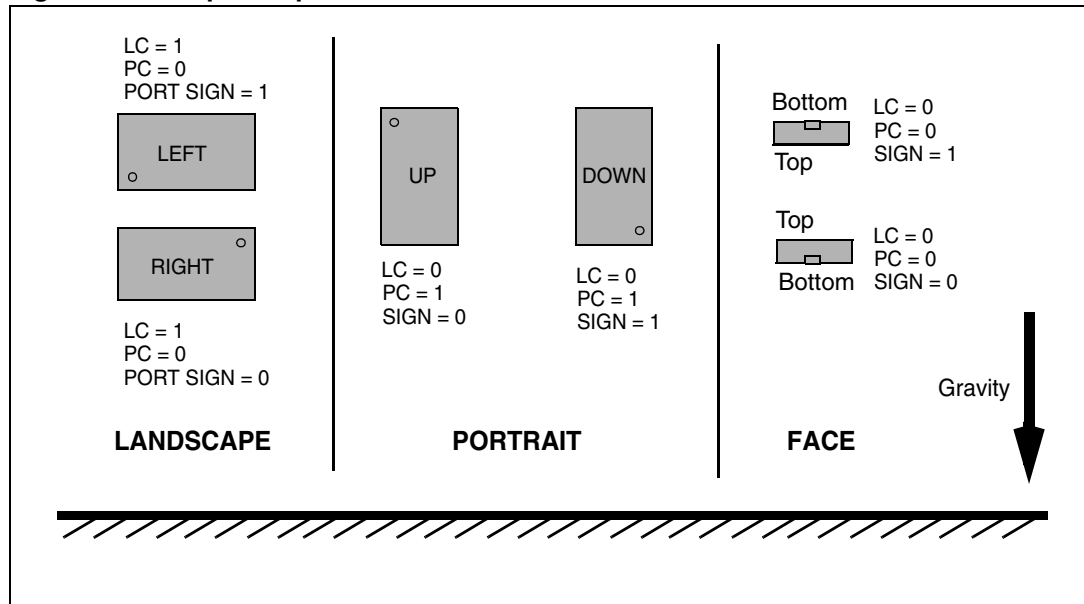
Figure 2. Orientation definitions
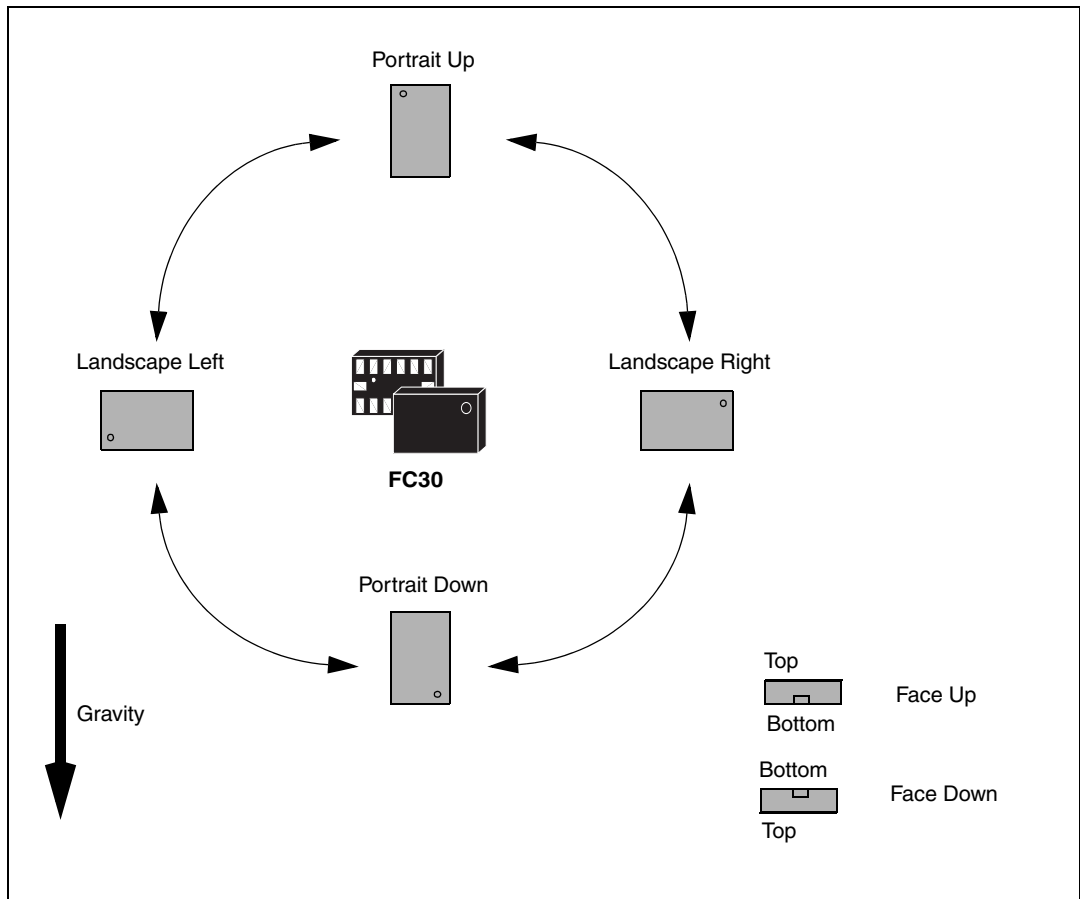
2.1.1 Output response vs. orientation

Figure 3 shows the three interrupt output lines for the selected orientation.

Figure 3.   Output response vs. orientation

2.2   Tap detection

The device can be configured to send an interrupt signal on a dedicated pin when "clicked" in any direction (see *Figure 4*).

A more advanced feature also allows the detection of a "double click" event, with a programmable time interval between the first and second click, to enable a "mouse button-like" functionality.

These functions can be fully programmed. For additional information, please contact your local STMicroelectronics sales office.

Figure 4.   Tap or "click" detection
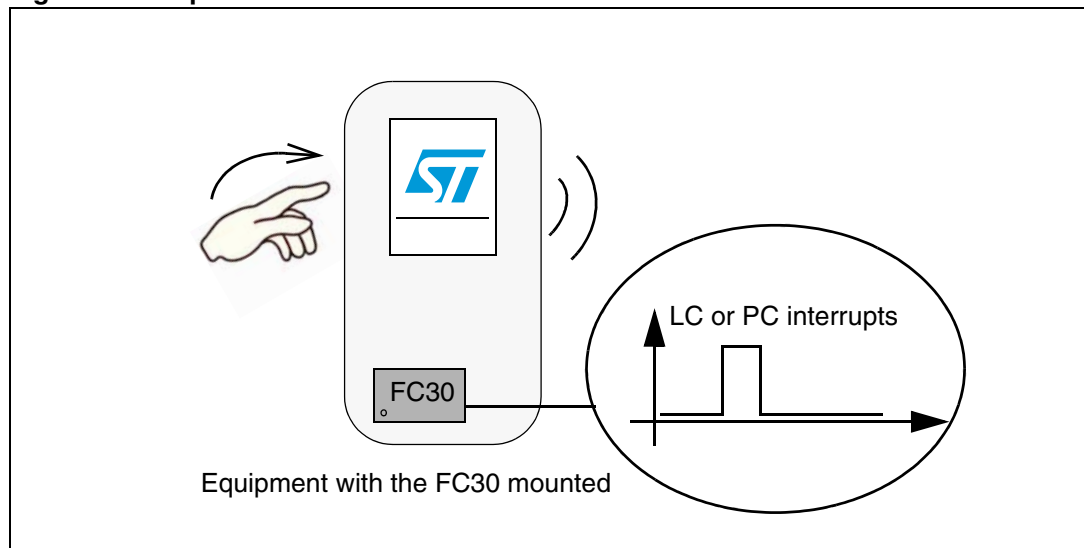
2.3 Post assembly device verification

A special function allows the user to check the sensor functionality without moving the device (device verification). This functionality is enabled by connecting the FC30 to an MCU. For the connection scheme and additional information, please contact your local STMicroelectronics sales office.

2.4 Power down

The power down function allows the device to be put in an ultra-low power consumption mode by applying a "logic 0" voltage value to the PD pad. In this state the measurement chain is powered off.

3   Electrical specifications

3.1   Electrical characteristics

Table 3.   Electrical characteristics[1] [2]

Symbol	Parameter	Test conditions	Min.	Typ.[3]	Max.	Unit
Vdd	Supply voltage		2.16	2.5	3.6	V
Vdd_IO	I/O pins supply voltage		1.71		Vdd+0.1	V
Idd	Supply current	T = 25°C		0.3	0.4	mA
IddPdn	Current consumption in power-down mode	T = 25°C		1		µA
Ton	Turn-on time[4]			30		ms
Ac	Accuracy[5]			±3		deg
Top	Operating temperature range		-40		+85	°C
Wh	Product weight			30		mg

1. The product is factory calibrated at 2.5 V. The device can be used from 2.16 V to 3.6 V

2. All the parameters are specified @ Vdd=2.5 V, T = 25 °C unless otherwise noted

3. Typical specification are not guaranteed

4. Time to obtain valid data after exiting power-down mode

5. Accuracy defines the angle around the three orthogonal directions where orientation is detected (see *Figure 5*)

Figure 5.   Orientation accuracy angle
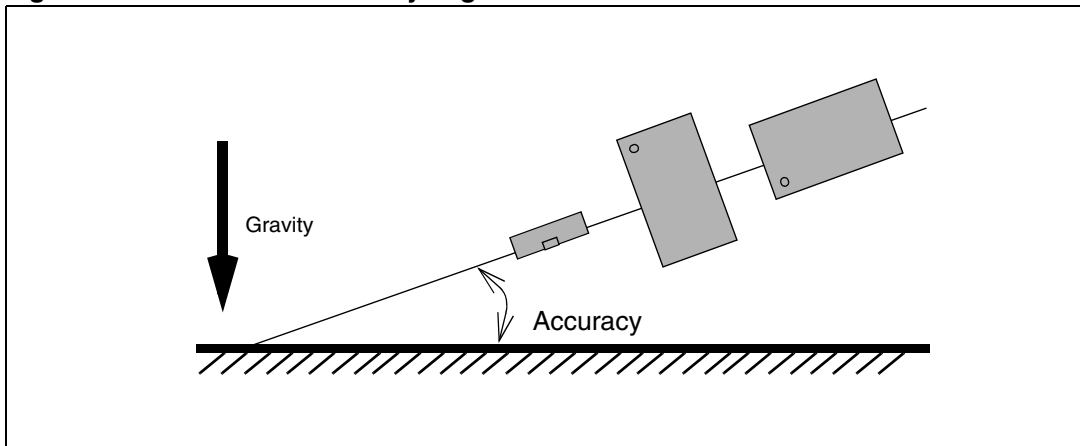
3.2   Absolute maximum ratings

Stresses above those listed as "absolute maximum ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Table 4. **Absolute maximum ratings**

Symbol	Ratings	Maximum Value	Unit
Vdd, Vdd_IO	Supply voltage and I/O pins supply voltage	-0.3 to 6	V
Vin	Input voltage on any control pin	-0.3 to Vdd_IO +0.3	V
A_{MAX}	Acceleration (any axis, powered and unpowered)	10000 g for 0.1ms	g
T_{OP}	Operating temperature range	-40 to +85	°C
T_{STG}	Storage temperature range	-40 to +125	°C
ESD	Electrostatic discharge protection	4.0 (HBM)	kV
		200 (MM)	V
		1.5 (CDM)	kV

This is a Mechanical Shock sensitive device, improper handling can cause permanent damage to the part

This is an ESD sensitive device, improper handling can cause permanent damage to the part

4   Device and technology information

The FC30 is an ultra-compact, low power 3-dimensional orientation and click/double-click sensor. Manufactured with MEMS technology, the FC30 offers many advantages compared to the conventional fabrication technology used nowadays in portable devices, including:

● Potential for additional strong miniaturization, leveraging the characteristics of micromachining technology

● No surface friction effects, wear effects and acoustic noise generation

● Embedded electronic signal conditioning allows reduced power consumption

5 Application hints

Figure 6. FC30 electrical connection for 3D orientation detection
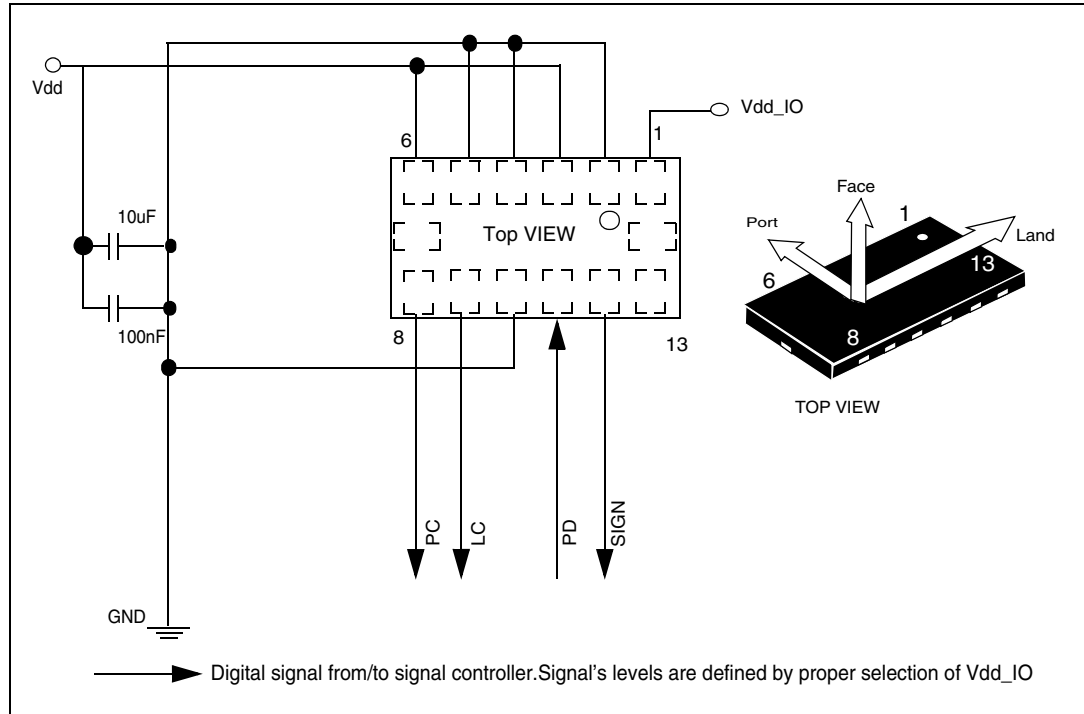
The diagram above refers to the electrical connection scheme for application of 3D orientation detection.

The device core is supplied through the Vdd line while the I/O pads are supplied through the Vdd_IO line. Power supply decoupling capacitors (100 nF ceramic, 10 μF Al) should be placed as near as possible to pin 6 of the device (common design practice).

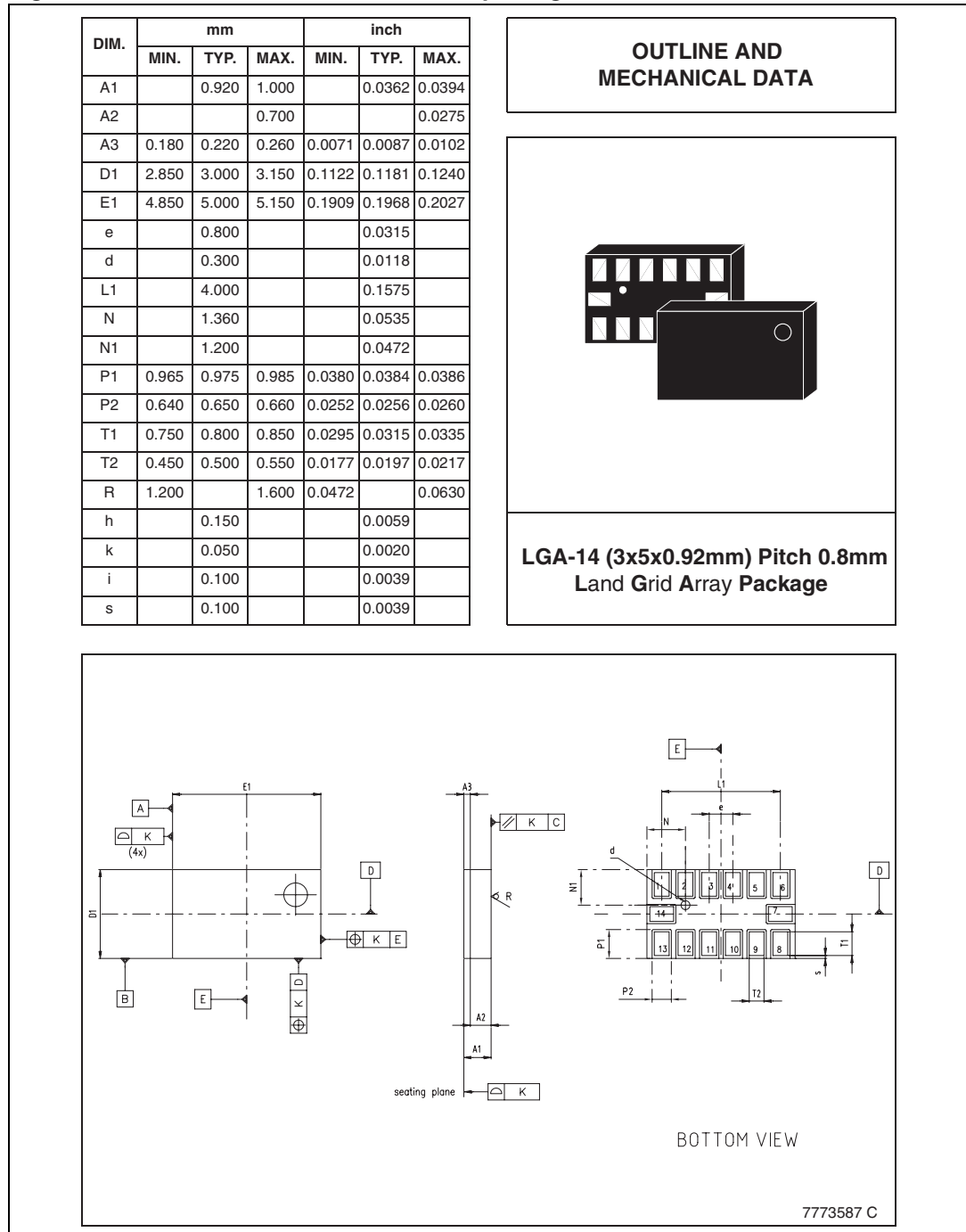All the voltage and ground supplies must be present at the same time for proper behavior of the IC (*Figure 6*).

5.1 Soldering information

The LGA package is compliant with the ECOPACK, RoHS and "green" standards. Leave the pin 1 indicator unconnected during soldering. Land pattern and soldering recommendations are available at www.st.com

6   Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

Figure 7.   LGA-14: mechanical data and package dimensions

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A1		0.920	1.000		0.0362	0.0394
A2			0.700			0.0275
A3	0.180	0.220	0.260	0.0071	0.0087	0.0102
D1	2.850	3.000	3.150	0.1122	0.1181	0.1240
E1	4.850	5.000	5.150	0.1909	0.1968	0.2027
e		0.800			0.0315	
d		0.300			0.0118	
L1		4.000			0.1575	
N		1.360			0.0535	
N1		1.200			0.0472	
P1	0.965	0.975	0.985	0.0380	0.0384	0.0386
P2	0.640	0.650	0.660	0.0252	0.0256	0.0260
T1	0.750	0.800	0.850	0.0295	0.0315	0.0335
T2	0.450	0.500	0.550	0.0177	0.0197	0.0217
R	1.200		1.600	0.0472		0.0630
h		0.150			0.0059	
k		0.050			0.0020	
i		0.100			0.0039	
s		0.100			0.0039	

OUTLINE AND MECHANICAL DATA

LGA-14 (3x5x0.92mm) Pitch 0.8mm **L**and **G**rid **A**rray **Package**

BOTTOM VIEW

7773587 C

7 Revision history

Table 5.   Document revision history

Date	Revision	Changes
29-May-2008	1	Initial release
10-Feb-2010	2	Updated *Table 2: Pin description*.

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