

# IP4064CX8/LF; IP4364CX8/LF

Integrated SIM card passive filter array with ESD protection to IEC61000-4-2, level 4

Rev. 01 — 12 November 2007

Product data sheet

## 1. Product profile

### 1.1 General description

The IP4064CX8/LF and IP4364CX8/LF are 3-channel RC low-pass filter arrays which are designed to provide filtering of undesired RF signals in the 800 MHz to 3000 MHz frequency band. In addition, the IP4064CX8/LF and IP4364CX8/LF incorporate diodes to provide protection to downstream components against Electrostatic Discharge (ESD) voltages as high as  $\pm 15$  kV contact and  $> \pm 15$  kV air discharge, far exceeding IEC61000-4-2, level 4. The IP4064CX8/LF and IP4364CX8/LF are fabricated using monolithic silicon technology and integrate three resistors and seven high-level ESD-protection diodes in a single wafer level chip-scale package. These features make the IP4064CX8/LF and IP4364CX8/LF ideal for use in applications requiring component miniaturization, such as mobile phone handsets, cordless telephones and personal digital devices.

### 1.2 Features

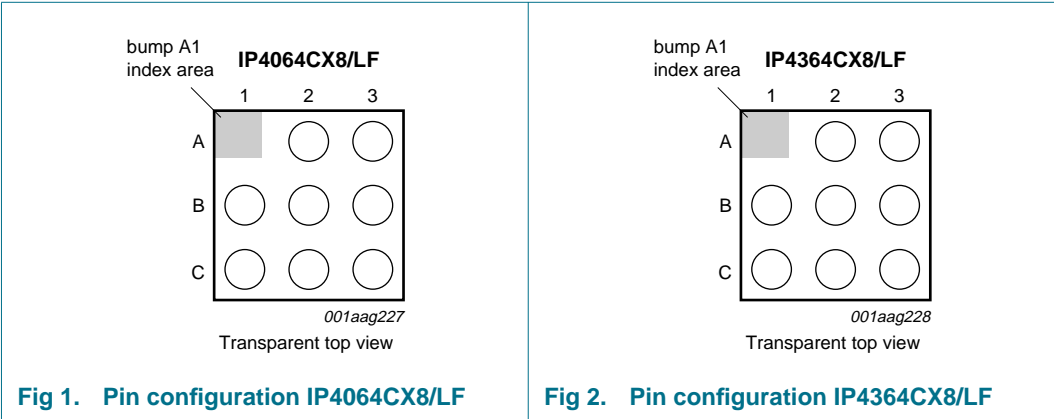
- Pb-free and RoHS compliant
- 3-channel SIM card interface integrated RC-filter array
- 100  $\Omega$ /100  $\Omega$ /47  $\Omega$  series channel resistors integrated
- Downstream ESD protection up to  $\pm 15$  kV (contact) exceeding IEC61000-4-2, level 4
- Wafer level chip-scale package with 0.4 mm (IP4364CX8/LF) and 0.5 mm (IP4064CX8/LF) pitch

### 1.3 Applications

- SIM interfaces in e.g. cellular and PCS mobile handsets

2. Pinning information

2.1 Pinning



2.2 Pin description

Table 1. Pin description

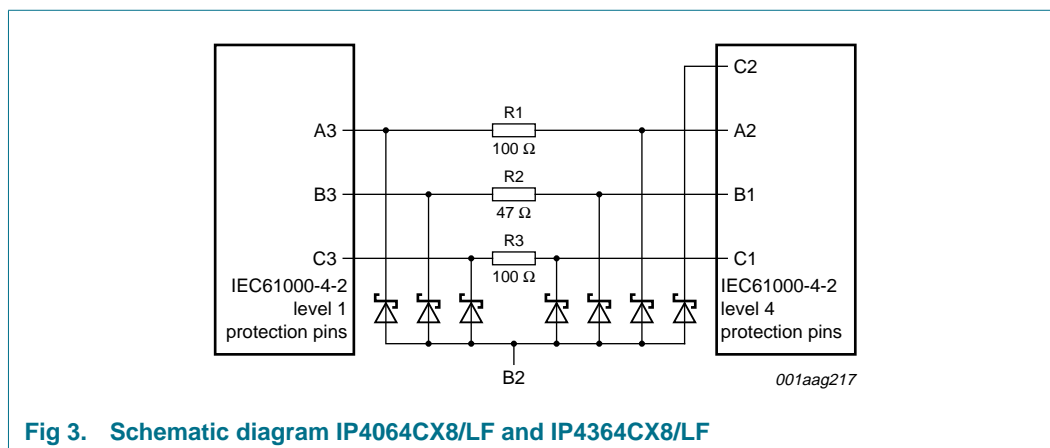
Pin	Description
A2	external pin 1
A3	internal pin 1
B1	external pin 2
B2	ground
B3	internal pin 2
C1	external pin 3
C2	supply ESD protection
C3	internal pin 3

3. Ordering information

Table 2. Ordering information

Type number	Package		Version
	Name	Description	
IP4064CX8/LF	WLCSP8	wafer level chip-size package; 8 bumps; 1.41 × 1.41 × 0.7 mm	IP4064CX8/LF
IP4364CX8/LF	WLCSP8	wafer level chip-size package; 8 bumps; 1.16 × 1.16 × 0.66 mm	IP4364CX8/LF

## 4. Functional diagram



## 5. Limiting values

**Table 3. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit
$V_I$	input voltage		-0.5	+5.5	V
$V_{ESD}$	electrostatic discharge	pins A2, B1, C1, C2 to B2			
		contact discharge	[1] -15	+15	kV
		air discharge	[1] -15	+15	kV
		IEC 61000-4-2, Level 4, pins A2, B1, C1, C2 to B2			
		contact discharge	-8	+8	kV
		air discharge	-15	+15	kV
		IEC 61000-4-2, Level 1, all other pins to B2			
		contact discharge and air discharge	-2	+2	kV
$P_{ch}$	channel power dissipation	continuous power; $T_{amb} = 70\text{ °C}$	-	60	mW
$P_{tot}$	total power dissipation	$T_{amb} = 70\text{ °C}$	-	180	mW
$T_{stg}$	storage temperature		-55	+150	°C
$T_{reflow(peak)}$	peak reflow temperature	10 s maximum	-	260	°C
$T_{amb}$	ambient temperature		-30	+85	°C

[1] Device is tested with 1000 pulses of  $\pm 15\text{ kV}$  contact discharges each, according the IEC61000-4-2 model and so exceeds the specified level 4 (8 kV contact discharge) by far.

## 6. Characteristics

**Table 4. Characteristics***T<sub>amb</sub> = 25 °C unless otherwise specified.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R <sub>s(ch)</sub>	channel series resistance	R1, R3	75	100	125	Ω
		R2	35.2	47	58.8	Ω
C <sub>ch</sub>	channel capacitance	including diode capacitance; V <sub>I</sub> = 0 V; f = 1 MHz	-	-	20	pF
V <sub>BR</sub>	breakdown voltage	I <sub>test</sub> = 1 mA	6	-	10	V
I <sub>LR</sub>	reverse leakage current	V <sub>I</sub> = 3 V	-	-	50	nA

## 7. Application information

### 7.1 Insertion loss

The IP4064CX8/LF and IP4364CX8/LF is mainly designed as an EMI/RFI filter for SIM card interfaces. The insertion loss in a 50  $\Omega$  system for all three channels of the IP4364CX8/LF is shown in [Figure 5](#) as an example. The insertion loss of IP4064CX8/LF is identical. The insertion loss of the three channels was measured with a test PCB utilizing laser drilled micro-via holes that connect the PCB ground plane to the ground pins.

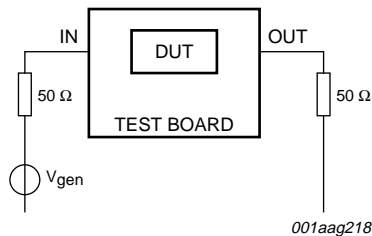
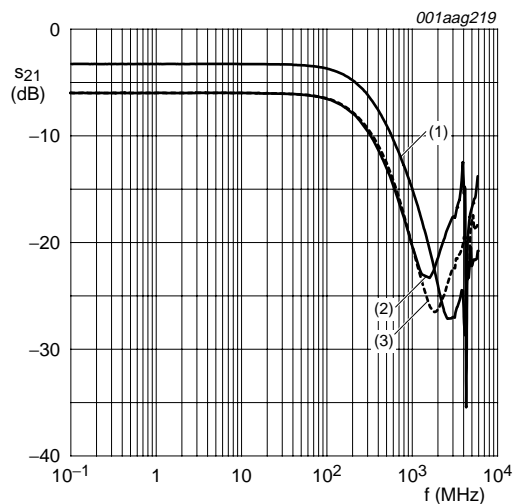


Fig 4. Frequency response set-up



- (1) Pin B1 to B3.
- (2) Pin A2 to A3.
- (3) Pin C1 to C3.

Fig 5. Typical IP4064CX8/LF and IP4364CX8/LF frequency response curves

## 7.2 Crosstalk

The set-up for crosstalk measurements in a 50  $\Omega$  system from one channel to another is shown in [Figure 6](#). Four typical examples of crosstalk measurement results are depicted in [Figure 7](#). Channels not shown there behave similar. Unused channels are terminated with 50  $\Omega$  to ground.

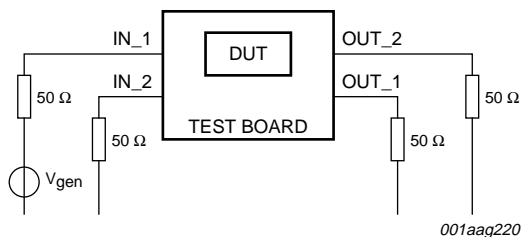
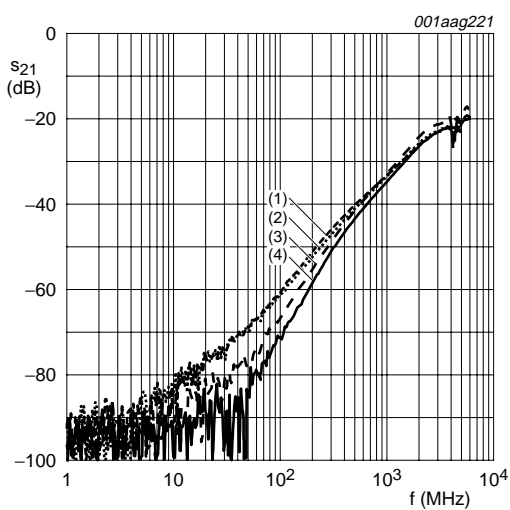


Fig 6. Crosstalk measurement configuration



- (1) Pin C1 to B3.
- (2) Pin B1 to C3.
- (3) Pin B1 to A3.
- (4) Pin A2 to C3.

Fig 7. Typical IP4064CX8/LF and IP4364CX8/LF crosstalk behavior

8. Package outline

WLCSP8: wafer level chip-size package; 8 bumps; 1.41 x 1.41 x 0.7 mm

IP4064CX8/LF

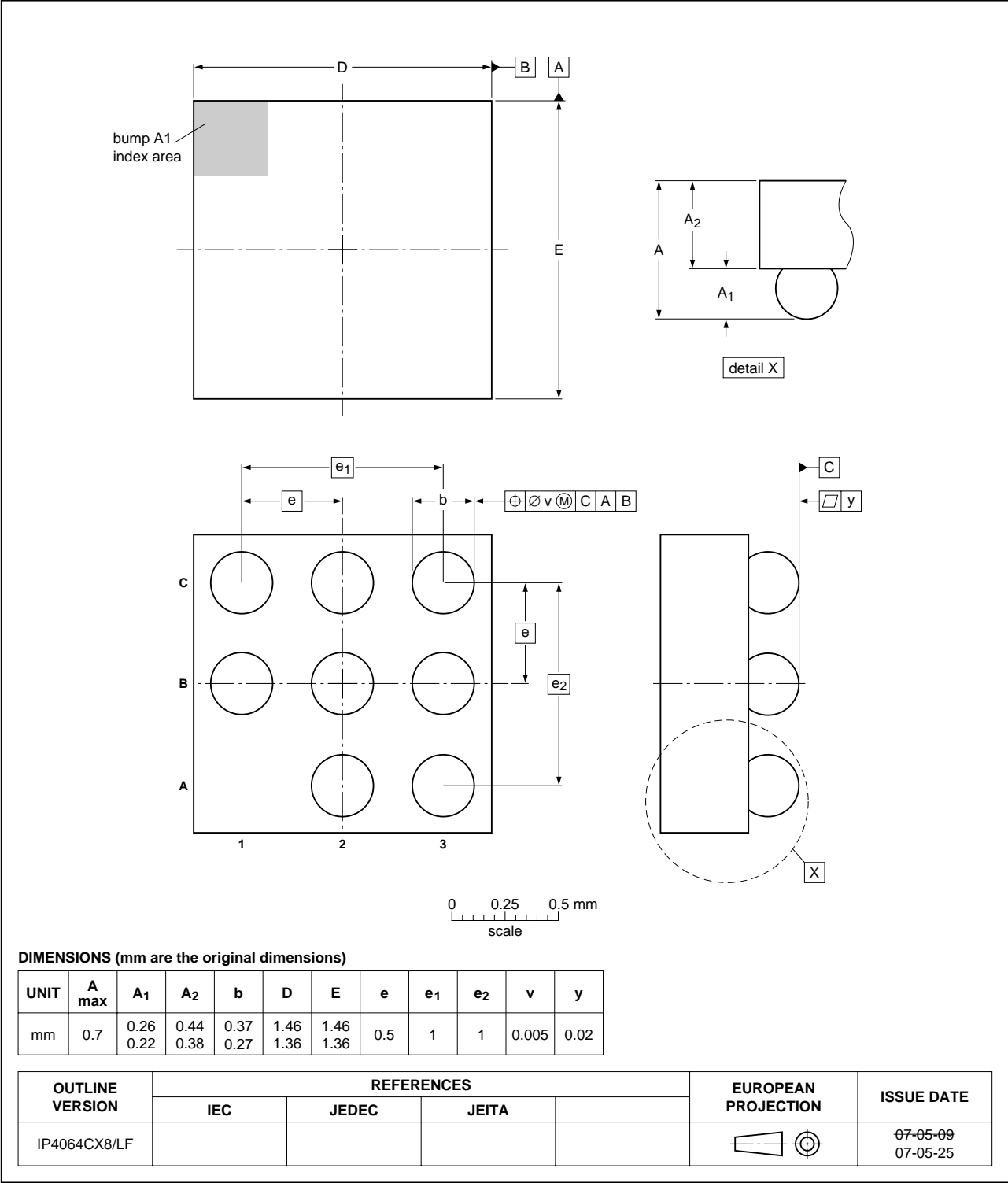


Fig 8. Package outline IP4064CX8/LF (WLCSP8)

WLCSP8: wafer level chip-size package; 8 bumps; 1.16 x 1.16 x 0.66 mm

IP4364CX8/LF

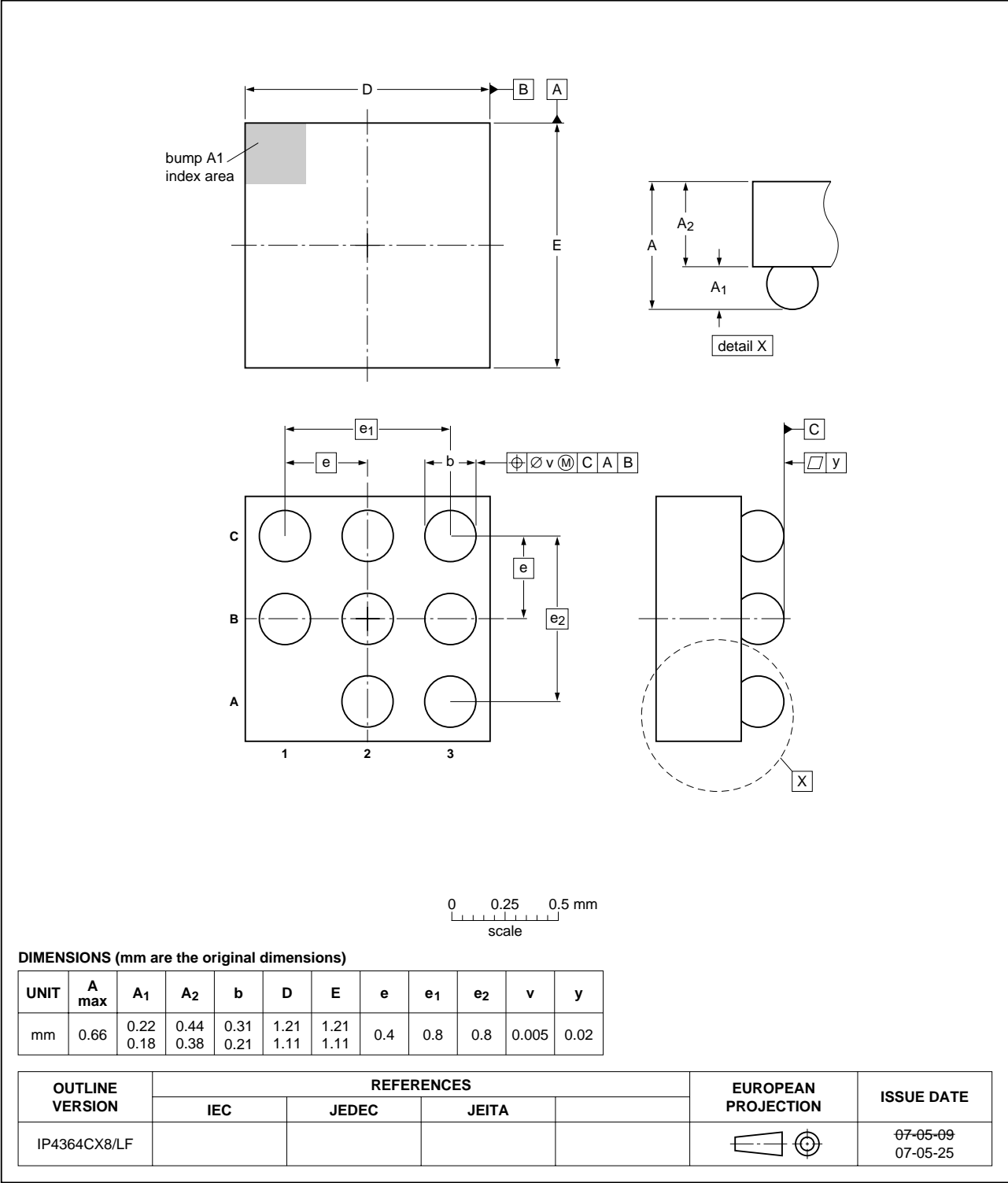


Fig 9. Package outline IP4364CX8/LF (WLCSP8)



## 9. Soldering

### 9.1 Introduction to soldering WLCSP packages

This text provides a very brief insight into a complex technology. A more in-depth account of soldering WLCSP (Wafer Level Chip-Size Packages) can be found in application note AN10439 "Wafer Level Chip Scale Package" and in application note AN10365 "Surface mount reflow soldering description".

Wave soldering is not suitable for this package.

All NXP WLCSP packages are lead-free.

### 9.2 Board mounting

Board mounting of a WLCSP requires several steps:

1. Solder paste printing on the PCB
2. Component placement with a pick and place machine
3. The reflow soldering itself

### 9.3 Reflow soldering

Key characteristics in reflow soldering are:

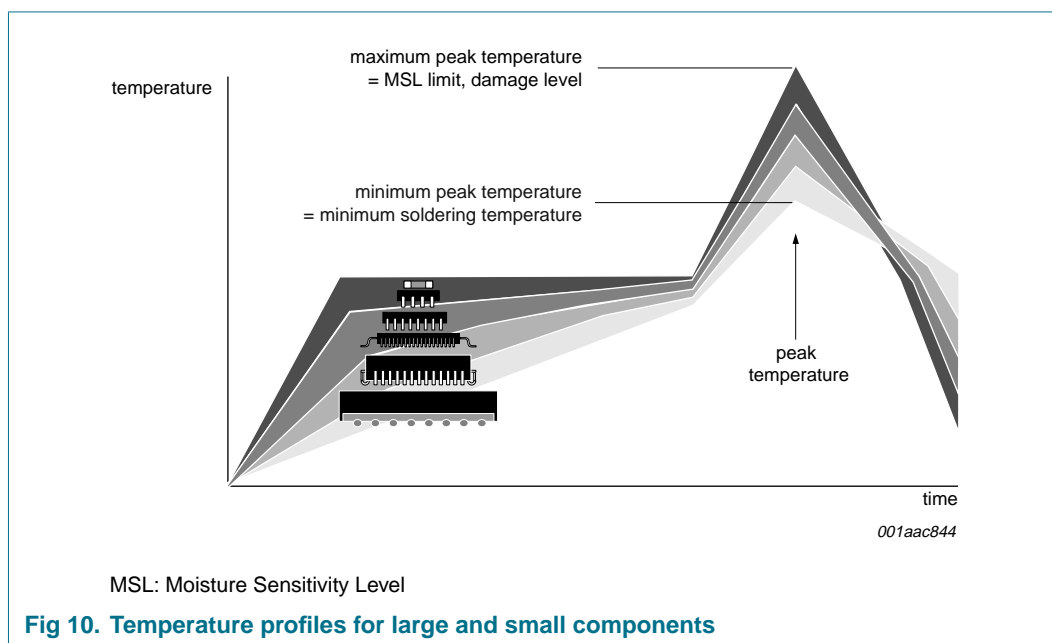
- Lead-free versus SnPb soldering; note that a lead-free reflow process usually leads to higher minimum peak temperatures (see [Figure 10](#)) than a PbSn process, thus reducing the process window
- Solder paste printing issues, such as smearing, release, and adjusting the process window for a mix of large and small components on one board
- Reflow temperature profile; this profile includes preheat, reflow (in which the board is heated to the peak temperature), and cooling down. It is imperative that the peak temperature is high enough for the solder to make reliable solder joints (a solder paste characteristic) while being low enough that the packages and/or boards are not damaged. The peak temperature of the package depends on package thickness and volume and is classified in accordance with [Table 5](#)

**Table 5. Lead-free process (from J-STD-020C)**

Package thickness (mm)	Package reflow temperature (°C)		
	Volume (mm <sup>3</sup> )		
	< 350	350 to 2000	> 2000
< 1.6	260	260	260
1.6 to 2.5	260	250	245
> 2.5	250	245	245

Moisture sensitivity precautions, as indicated on the packing, must be respected at all times.

Studies have shown that small packages reach higher temperatures during reflow soldering, see [Figure 10](#).



For further information on temperature profiles, refer to application note *AN10365 "Surface mount reflow soldering description"*.

### 9.3.1 Stand off

The stand off between the substrate and the chip is determined by:

- The amount of printed solder on the substrate
- The size of the solder land on the substrate
- The bump height on the chip

The higher the stand off, the better the stresses are released due to TEC (Thermal Expansion Coefficient) differences between substrate and chip.

### 9.3.2 Quality of solder joint

A flip-chip joint is considered to be a good joint when the entire solder land has been wetted by the solder from the bump. The surface of the joint should be smooth and the shape symmetrical. The soldered joints on a chip should be uniform. Voids in the bumps after reflow can occur during the reflow process in bumps with high ratio of bump diameter to bump height, i.e. low bumps with large diameter. No failures have been found to be related to these voids. Solder joint inspection after reflow can be done with X-ray to monitor defects such as bridging, open circuits and voids.

### 9.3.3 Rework

In general, rework is not recommended. By rework we mean the process of removing the chip from the substrate and replacing it with a new chip. If a chip is removed from the substrate, most solder balls of the chip will be damaged. In that case it is recommended not to re-use the chip again.

Device removal can be done when the substrate is heated until it is certain that all solder joints are molten. The chip can then be carefully removed from the substrate without damaging the tracks and solder lands on the substrate. Removing the device must be done using plastic tweezers, because metal tweezers can damage the silicon. The surface of the substrate should be carefully cleaned and all solder and flux residues and/or underfill removed. When a new chip is placed on the substrate, use the flux process instead of solder on the solder lands. Apply flux on the bumps at the chip side as well as on the solder pads on the substrate. Place and align the new chip while viewing with a microscope. To reflow the solder, use the solder profile shown in application note AN10365 "Surface mount reflow soldering description".

#### 9.3.4 Cleaning

Cleaning can be done after reflow soldering.

## 10. Abbreviations

Table 6. Abbreviations

Acronym	Description
DUT	Device Under Test
EMI	ElectroMagnetic Interference
ESD	ElectroStatic Discharge
PCB	Printed-Circuit Board
PCS	Personal Communication System
RFI	Radio Frequency Interference
RoHS	Restriction Of the use of certain Hazardous Substances directive
SIM	Subscriber Identity Module

## 11. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
IP4064CX8LF_IP4364CX8LF_1	20071112	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

### 12.2 Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet** — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

### 12.3 Disclaimers

**General** — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

**Right to make changes** — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or

malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Applications** — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

**Limiting values** — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) may cause permanent damage to the device. Limiting values are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of this document is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Terms and conditions of sale** — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, including those pertaining to warranty, intellectual property rights infringement and limitation of liability, unless explicitly otherwise agreed to in writing by NXP Semiconductors. In case of any inconsistency or conflict between information in this document and such terms and conditions, the latter will prevail.

**No offer to sell or license** — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

### 12.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

## 13. Contact information

For additional information, please visit: <http://www.nxp.com>

For sales office addresses, send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

## 14. Contents

<b>1</b>	<b>Product profile</b>	<b>1</b>
1.1	General description	1
1.2	Features	1
1.3	Applications	1
<b>2</b>	<b>Pinning information</b>	<b>2</b>
2.1	Pinning	2
2.2	Pin description	2
<b>3</b>	<b>Ordering information</b>	<b>2</b>
<b>4</b>	<b>Functional diagram</b>	<b>3</b>
<b>5</b>	<b>Limiting values</b>	<b>3</b>
<b>6</b>	<b>Characteristics</b>	<b>4</b>
<b>7</b>	<b>Application information</b>	<b>5</b>
7.1	Insertion loss	5
7.2	Crosstalk	6
<b>8</b>	<b>Package outline</b>	<b>7</b>
<b>9</b>	<b>Soldering</b>	<b>9</b>
9.1	Introduction to soldering WLCSP packages	9
9.2	Board mounting	9
9.3	Reflow soldering	9
9.3.1	Stand off	10
9.3.2	Quality of solder joint	10
9.3.3	Rework	10
9.3.4	Cleaning	11
<b>10</b>	<b>Abbreviations</b>	<b>11</b>
<b>11</b>	<b>Revision history</b>	<b>11</b>
<b>12</b>	<b>Legal information</b>	<b>12</b>
12.1	Data sheet status	12
12.2	Definitions	12
12.3	Disclaimers	12
12.4	Trademarks	12
<b>13</b>	<b>Contact information</b>	<b>12</b>
<b>14</b>	<b>Contents</b>	<b>13</b>

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

founded by

**PHILIPS**

© NXP B.V. 2007.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

Date of release: 12 November 2007

Document identifier: IP4064CX8LF\_IP4364CX8LF\_1