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IP4365CX11

Integrated (U)SIM card passive filter array and USB full speed ESD protection to IEC 61000-4-2 level 4

Rev. 01 — 26 March 2010 Product data sheet

1. Product profile

1.1 General description

The IP4365CX11 is a fully integrated smart card interface device according ISO/IEC 7816-3 for the Subscriber Identity Module (SIM) card interface and according ISO/IEC 7816-12 for the Universal Subscriber Identity Module (USIM) Universal Serial Bus (USB) interface. It is designed to provide ElectroMagnetic Interference (EMI) filtering and ElectroStatic Discharge (ESD) protection for the conventional digital interface and also for the USB interface.

The 3-channel EMI filter is identical to the filter available as ESD protection and EMI filter IP4366CX8 (which does not contain the additional USB full speed ESD protection). It also provides RC low-pass filtering of undesired Radio Frequency (RF) signals in the 800 MHz to 3000 MHz frequency band. The IP4365CX11 is designed to provide protection to downstream components from ESD voltages as high as ±15 kV contact discharge and > ±15 kV air discharge according the IEC 61000-4-2 model, far exceeding standard level 4.

The device is fabricated using monolithic silicon technology and integrate three resistors and several high-level ESD-protection diodes in a single Wafer-Level Chip-Scale Package (WLCSP). These features make the IP4365CX11 ideal for use in applications requiring the utmost in miniaturization such as mobile phone handsets, cordless telephones and personal digital devices.

1.2 Features and benefits

- Pb-free, RoHS compliant and free of halogen and antimony (Dark Green compliant)
- 3-channel SIM card interface integrated RC filter array
- Integrated 100 Ω/100 Ω/47 Ω series channel resistors
- 2-channel USB full speed compliant ESD protection for USIM
- 1-channel ESD protection for card supply
- 10 pF channel capacitance
- EMI filter compatible with IP4366CX8
- Integrated ESD protection withstanding ±15 kV contact discharge and > ±15 kV air discharge, far exceeding IEC 61000-4-2 level 4
- WLCSP with 0.4 mm pitch

1.3 Applications

- USIM, SIM and similar smart card interfaces in e.g. cellular and Personal Communication System (PCS) mobile handsets and wireless modems

2. Pinning information

2.1 Pinning

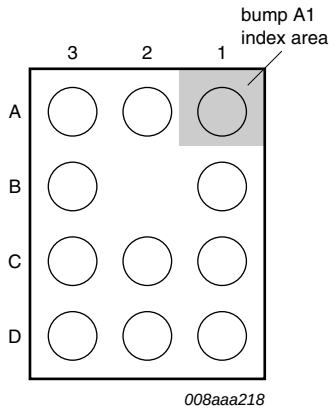


Fig 1. Pin configuration

2.2 Pin description

Table 1. Pinning

Pin	Description
A1	internal pin RST or I/O channel
A2	ground
A3	external pin RST or I/O channel
B1	internal pin CLK channel
B2	not connected (missing ball)
B3	external pin CLK channel
C1	internal pin I/O or RST channel
C2	ground
C3	external pin I/O or RST channel
D1	external ESD protection (USB data or supply)
D2	external ESD protection (USB data or supply)
D3	external ESD protection (USB data or supply)

3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
IP4365CX11/P	WLCSP11	wafer level chip-size package; 11 bumps (3 × 4 - B2)	IP4365CX11/P

4. Functional diagram

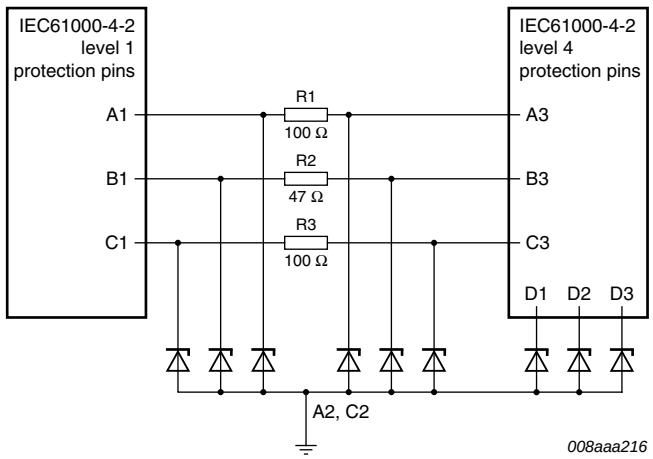


Fig 2. Schematic diagram

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 voltage	pins A3, B3, C3, D1, D2 and D3 to ground (A2, C2)				
		contact discharge	[1]	−15	+15	kV
		air discharge	[1]	−15	+15	kV
		IEC 61000-4-2 level 4; pins A3, B3, C3, D1, D2 and D3 to ground (A2, C2)				
		contact discharge		−8	+8	kV
		air discharge		−15	+15	kV
		IEC 61000-4-2 level 1; pins A1, B1 and C1 to ground (A2, C2)				
		contact discharge		−2	+2	kV
		air discharge		−2	+2	kV
P_{ch}	channel power dissipation	continuous power; T_{amb} = 70 °C		-	60	mW
P_{tot}	total power dissipation	continuous power; T_{amb} = 70 °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			−35	+85	°C

[1] Device is qualified with 1000 pulses of ±15 kV contact discharges each, according to the IEC61000-4-2 model and far exceeds the specified level 4 (8 kV contact discharge).

6. Characteristics

Table 4. Electrical characteristics

T_{amb} = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{s(ch)}$	channel series resistance	R1 and R3		75	100	125	Ω
		R2		35.2	47.0	58.8	Ω
C_{ch}	channel capacitance	channel A1 to A3, channel B1 to B3, channel C1 to C3, pins D1, D2 and D3; $V_{bias(DC)}$ = 0 V; f = 1 MHz	[1]	8	10	12	pF
V_{BR}	breakdown voltage	I_{test} = 1 mA		6	-	10	V
I_{LR}	reverse leakage current	V_I = 3 V		-	-	50	nA

[1] Guaranteed by design.

7. Application information

7.1 Application diagram

A typical application diagram showing IP4365CX11 in a SIM card interface using the standard digital and the USB full speed interface is depicted in Figure 3. The 2 kV ESD compliant pins (A1, B1 and C1) are connected to the baseband interface side while the six 15 kV ESD compliant pins (pins A3, B3, C3, D1, D2 and D3) are connected to the USIM card. Pins D1, D2 and D3 are identical and can be used as required. Also the channel A1 to A3 and the channel C1 to C3 can be exchanged in case this is required for an easier routing.

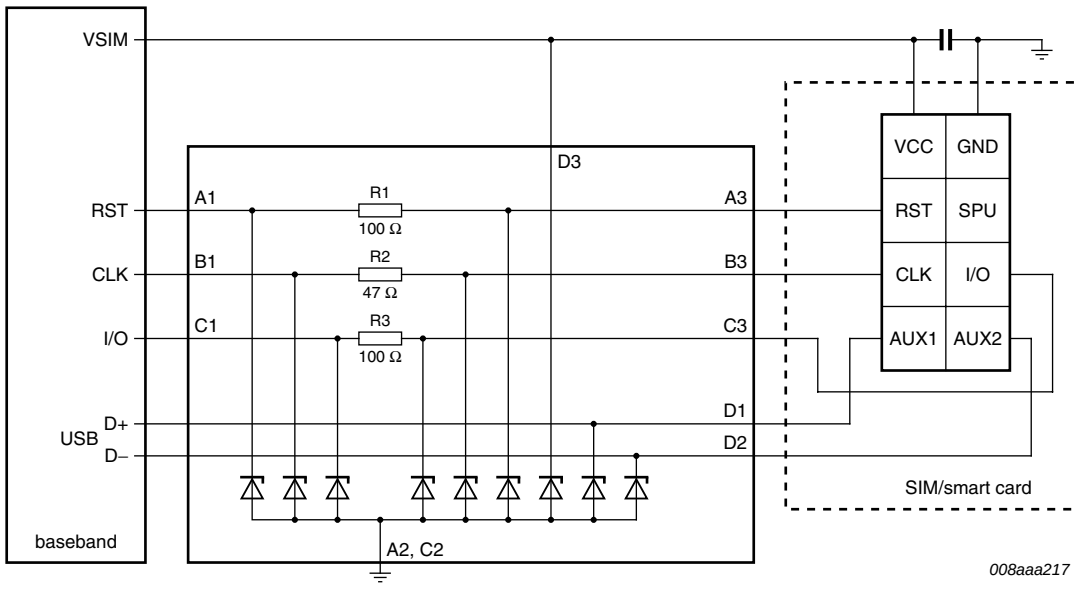


Fig 3. Typical application diagram

7.2 Insertion loss

The IP4365CX11 is mainly designed as an EMI/RFI filter for SIM card interfaces. The insertion loss measurement configuration of a typical 50 Ω NetWork Analyzer (NWA) system for evaluation of the IP4365CX11 is shown in Figure 4.

The insertion loss in a 50 Ω NWA system for all three resistor equipped channels of IP4365CX11 is depicted in Figure 5. The insertion loss is measured with a test Printed-Circuit Board (PCB) utilizing laser drilled micro-via holes that connect the PCB ground plane to the ground pins.

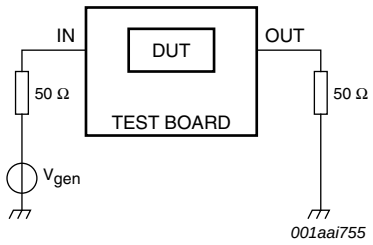
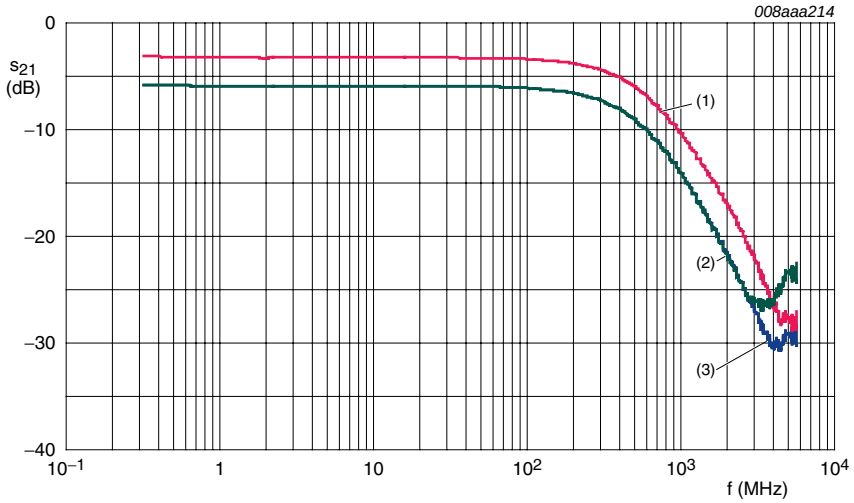


Fig 4. Frequency response measurement configuration



(1) Channel B1 to B3.

(2) Channel C1 to C3.

(3) Channel A1 to A3.

Fig 5. Measured insertion loss magnitudes

7.3 Crosstalk

The crosstalk measurement configuration of a typical 50 Ω NWA system for evaluation of the IP4365CX11 is shown in Figure 6.

Six typical examples of crosstalk measurement results of IP4365CX11 are depicted in Figure 7. Unused channels are terminated with 50 Ω to ground.

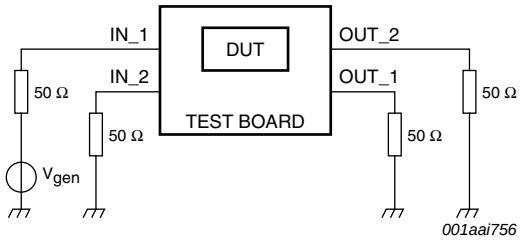
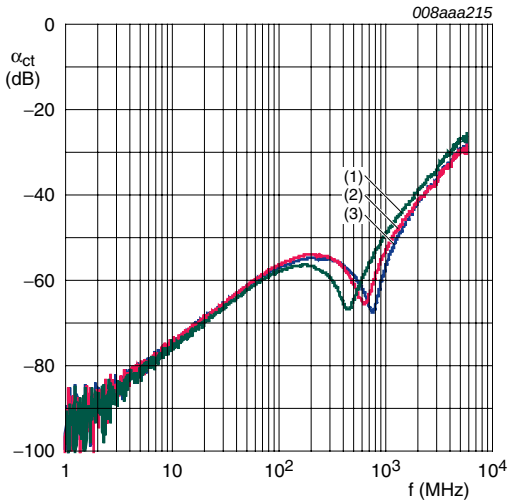


Fig 6. Crosstalk measurement configuration



(1) Pin B1 to pin C3.

(2) Pin B1 to pin A3.

(3) Pin A1 to pin B3.

Fig 7. Measured crosstalk between different channels

8. Package outline

WLCSP11: wafer level chip-size package; 11 bumps (3 x 4 - B2)

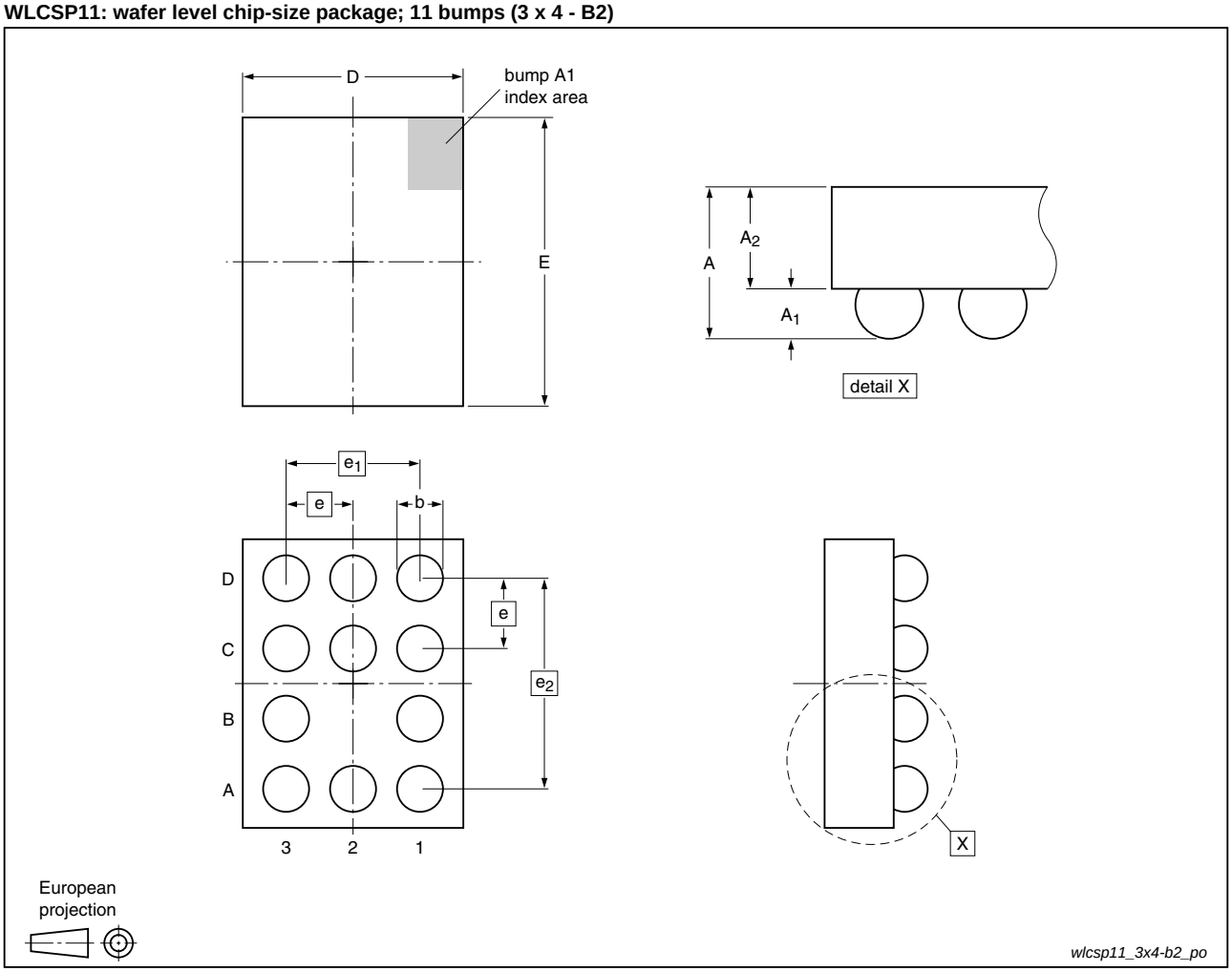


Fig 8. Package outline IP4365CX11 (WLCSP11)

Table 5. Dimensions for Figure 8

Symbol	Min	Typ	Max	Unit
A	0.57	0.61	0.65	mm
A_1	0.18	0.20	0.22	mm
A_2	0.39	0.41	0.43	mm
b	0.21	0.26	0.31	mm
D	1.11	1.16	1.21	mm
E	1.51	1.56	1.61	mm
e	-	0.4	-	mm
e_1	-	0.8	-	mm
e_2	-	1.2	-	mm

9. Design and assembly recommendations

9.1 PCB design guidelines

For optimum performance it is recommended to use a Non-Solder Mask Defined (NSMD), also known as a copper-defined design, incorporating laser-drilled micro-vias connecting the ground pads to a buried ground-plane layer. This results in the lowest possible ground inductance and provides the best high frequency and ESD performance. For this case, refer to Table 6 for the recommended PCB design parameters.

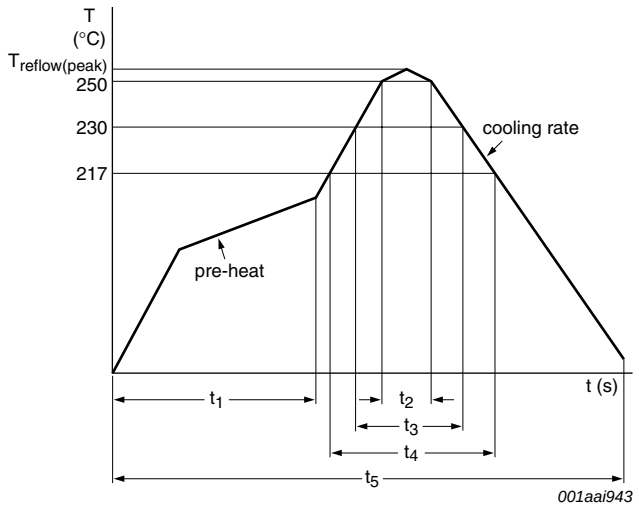
Table 6. Recommended PCB design parameters

Parameter	Value or specification
PCB pad diameter	200 μm
Micro-via diameter	100 μm (0.004 inch)
Solder mask aperture diameter	370 μm
Copper thickness	20 μm to 40 μm
Copper finish	AuNi
PCB material	FR4

9.2 PCB assembly guidelines for Pb-free soldering

Table 7. Assembly recommendations

Parameter	Value or specification
Solder screen aperture diameter	330 μm
Solder screen thickness	100 μm (0.004 inch)
Solder paste: Pb-free	SnAg (3 % to 4 %) Cu (0.5 % to 0.9 %)
Solder / flux ratio	50 / 50
Solder reflow profile	see Figure 9



The device is capable of withstanding at least three reflows of this profile.

Fig 9. Pb-free solder reflow profile

Table 8. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{reflow(peak)}$	peak reflow temperature		230	-	260	°C
t_1	time 1	soak time	60	-	180	s
t_2	time 2	time during T ≥ 250 °C	-	-	30	s
t_3	time 3	time during T ≥ 230 °C	10	-	50	s
t_4	time 4	time during T > 217 °C	30	-	150	s
t_5	time 5		-	-	540	s
dT/dt	rate of change of temperature	cooling rate	-	-	–6	°C/s
		pre-heat	2.5	-	4.0	°C/s

10. Abbreviations

Table 9. Abbreviations

Acronym	Description
DUT	Device Under Test
EMI	ElectroMagnetic Interference
ESD	ElectroStatic Discharge
FR4	Flame Retard 4
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
NSMD	Non-Solder Mask Defined
NWA	NetWork Analyzer
PCB	Printed-Circuit Board
PCS	Personal Communication System
RF	Radio Frequency
RFI	Radio Frequency Interference
RoHS	Restriction of Hazardous Substances
SIM	Subscriber Identity Module
USB	Universal Serial Bus
USIM	Universal Subscriber Identity Module
WLCSP	Wafer-Level Chip-Scale Package

11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
IP4365CX11_1	20100326	Product data sheet	-	-

12. Legal information

12.1 Data sheet status

Document status[1][2]	Product status[3]	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".

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