

# IP4220CZ6

Dual USB 2.0 integrated ESD protection to IEC 61000-4-2 level 4

Rev. 04 — 12 September 2005

Product data sheet

## 1. Product profile

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### 1.1 General description

The IP4220CZ6 is designed to protect I/O lines sensitive to capacitive load, such as USB 2.0, ethernet, DVI etc. from damage due to ElectroStatic Discharge (ESD). It incorporates four pairs of ultra-low capacitance rail-to-rail diodes plus an additional Zener diode to provide protection to signal and supply components from ESD voltages as high as  $\pm 8$  kV contact discharge. Protection is supply voltage independent due to the rail-to-rail diodes being connected to the Zener diode. The IP4220CZ6 integrates four pairs of ultra-low capacitance rail-to-rail ESD protection diodes in a miniature 6-lead SOT457 package.

### 1.2 Features

- ESD IEC 61000-4-2 level 4,  $\pm 8$  kV contact discharge compliant protection
- Four pairs of ultra-low input capacitance (1 pF typ.) ESD rail-to-rail protection diodes
- Low voltage clamping due to integrated Zener diode
- Small 6 lead SO6 (SOT457) package
- IEC 61000-4-5 15A Lightning (8/20  $\mu$ s)

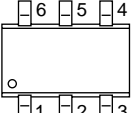
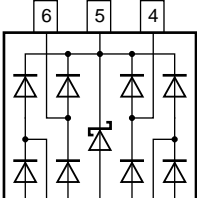
### 1.3 Applications

- General-purpose downstream ESD protection for high frequency analog signal ports and high-speed serial data transmission ports in:
  - ◆ Cellular and PCS mobile handsets
  - ◆ PC-/notebook USB 2.0/IEEE1394 ports
  - ◆ DVI interfaces
  - ◆ Cordless telephones
  - ◆ Wireless data (WAN/LAN) systems
  - ◆ PDAs
  - ◆ HDMI

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## 2. Pinning information

Table 1: Pinning

Pin	Description	Simplified outline	Symbol
1	ESD protection I/O 1		
2	GND		
3	ESD protection I/O 2		
4	ESD protection I/O 3		
5	Supply voltage $V_P$		
6	ESD protection I/O 4		

001aac379

## 3. Ordering information

Table 2: Ordering information

Type number	Package		
	Name	Description	Version
IP4220CZ6	-	plastic surface mounted package; 6 leads	SOT457

## 4. Limiting values

Table 3: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{I/O}$	I/O DC input voltage		0	5.5	V
$V_{esd}$	electrostatic discharge; all pins	IEC 61000-4-2, level 4, contact	-8	+8	kV
$T_{stg}$	storage temperature		-55	+125	°C

## 5. Recommended operating conditions

Table 4: Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb}$	ambient temperature		-40	-	+85	°C

## 6. Characteristics

**Table 5: Characteristics**

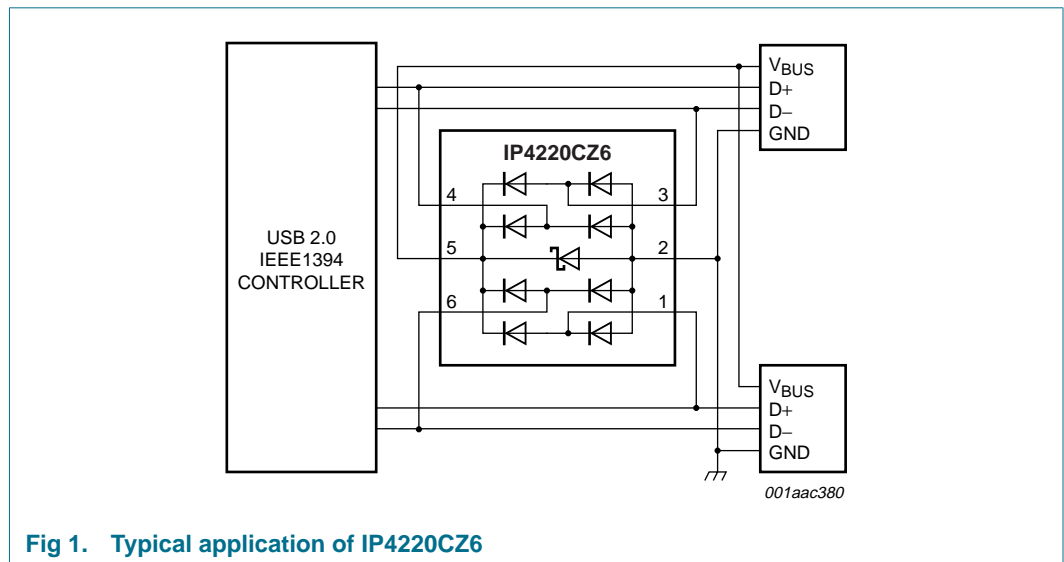
$T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_{I/O(n)}$	pin capacitance to ground, pins 1, 3, 4 and 6	$V_{I/O(n)} = 0\text{ V}$ ; $f = 1\text{ MHz}$ ; $V_P = +3.0\text{ V}$	-	1.0	-	pF
$I_{L(n)}$	diode reverse leakage current, pins 1, 3, 4 and 6 to ground	$V_{I/O(n)} = +3.0\text{ V}$	-	-	100	nA
$C_{d(\text{Zener})}$	Zener diode capacitance to ground, pin 5 to pin 2	$V_{I/O(n)} = 0\text{ V}$ ; $f = 1\text{ MHz}$ ; $V_P = +3.0\text{ V}$	-	40	-	pF
$V_{BR(\text{Zener})}$	Zener diode breakdown voltage, pin 5 to pin 2	$I = 1\text{ mA}$	6	-	9	V
$V_F$	forward voltage		-	0.7	-	V

## 7. Application information

### 7.1 Universal serial bus 2.0 protection

The IP4220CZ6 is optimized to protect, for example, two USB 2.0 ports from ESD. Each device is capable of protecting both USB data lines and the  $V_{BUS}$  supply. A typical application is shown in [Figure 1](#).



7.2 IP4220CZ6 spice model

Table 6: Diodes spice parameters

Symbol	Parameter	Value									Unit	
		D1	D2	D3	D4	D5	D6	D7	D8	DZ		
CJO	zero-bias junction capacitance	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	27	pF
VJ	junction potential	650	778	650	778	650	778	650	778	640		mV
M	grading coefficient	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36		-
BV	reverse breakdown voltage	50	50	50	50	50	50	50	50	7.3		V

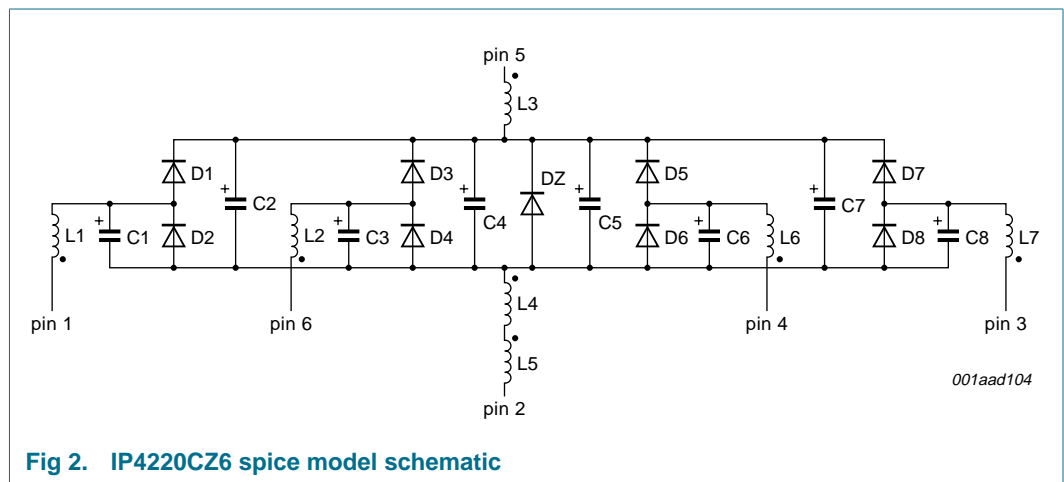


Fig 2. IP4220CZ6 spice model schematic

Table 7: Spice model list of components; see Figure 2

Component	Parameter	Value	Unit
L1	inductance	880	pH
	resistance	200	mΩ
L2	inductance	800	pH
	resistance	200	mΩ
L3	inductance	440	pH
	resistance	200	mΩ
L4	inductance	480	pH
	resistance	200	mΩ
L5	inductance	800	pH
	resistance	200	mΩ
L6	inductance	640	pH
	resistance	200	mΩ
L7	inductance	640	pH
	resistance	200	mΩ
C1		160	fF
C2		160	fF
C3		160	fF

Table 7: Spice model list of components; see [Figure 2](#) ...continued

Component	Parameter	Value	Unit
C4		160	fF
C5		160	fF
C6		160	fF
C7		160	fF

8. Package outline

Plastic surface mounted package; 6 leads

SOT457

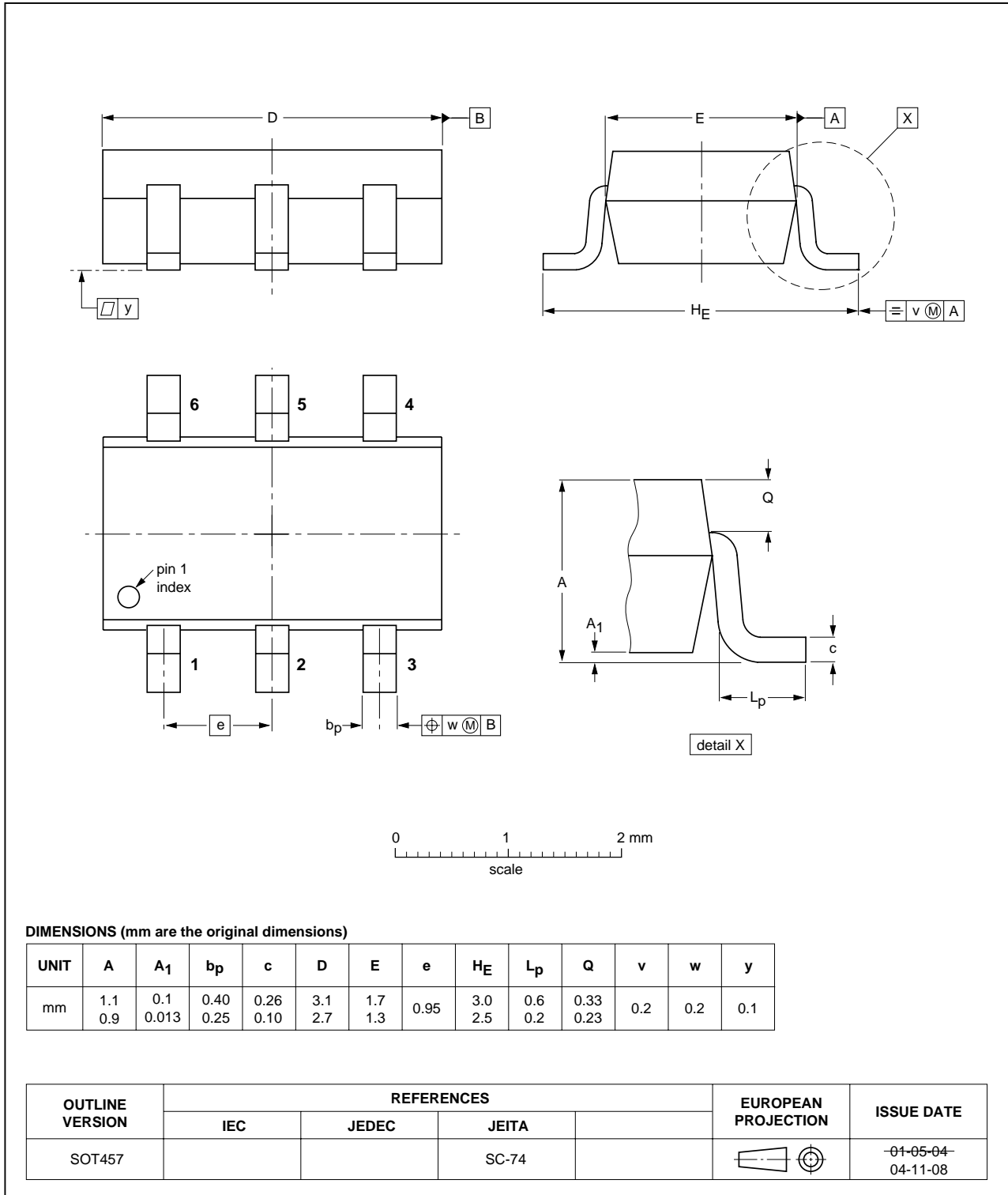


Fig 3. Package outline SOT457



## 9. Abbreviations

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**Table 8: Abbreviations**

<b>Acronym</b>	<b>Description</b>
DVI	Digital Video Interface
HDMI	High Definition Multimedia Interface
LAN	Local Area Network
PCS	Personal Communication System
PDA	Personal Digital Assistant
USB 2.0	Universal Serial Bus 2.0
WAN	Wide Area Network

## 10. Revision history

**Table 9: Revision history**

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
IP4220CZ6_4	20050912	Product data sheet	-	-	IP4220CZ6_3
Modifications:	• <a href="#">Section 7.2 "IP4220CZ6 spice model"</a> : units of C1 to C7 in spice model list changed from nF to fF.				
IP4220CZ6_3	20050712	Product data sheet	-	-	IP4220CZ6_2
IP4220CZ6_2	20050608	Product data sheet	-	9397 750 14555	IP4220CZ6_N_1
IP4220CZ6_N_1	20040917	Preliminary specification	-	n.a.	-



## 11. Data sheet status

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