

PAC7352 USB 2.0 VGA Camera SoC

General Description

The USB 2.0 VGA PC Camera SoC is a highly integrated and cost-effective solution for USB 2.0 PC-Camera based applications. It is fully compliant with USB Video Class 1.0.

UVC defined image processing functions are supported by ISP engine. The USB 2.0 VGA PC Camera SoC integrates partial color processing function, integrates regulators, noise reduction, and outputs YUV VGA (640x480) resolution.

System Features

- Power consumption: < 70 mA
- 3.3V power input, on-chip 3.3V, 2.8V, and 1.8V regulator for I/O, USB, sensor, and core logic.
- Built-in oscillator, external crystal is not needed.
- 5 GPIO, including KEY and LED
- Flash/EEPROM Serial Peripheral Interface (SPI) Compatible

USB Features

- USB 2.0 and USB video class 1.0 compliance.
- 3 Endpoints: CONTROL, Interrupt IN, and Isochronous IN

Micro Controller Features

- Built-in micro controller with 1K bytes SRAM data memory
- 24K bytes mask ROM and 4K bytes SRAM for program memory
- Software controlled connection to USB bus for re-enumeration and soft reset.
- Firmware is upgradeable from PC via USB connection

Key Specification

Supply Voltage	3.3V ± 10%
Resolution	Up to 640 (H) x 480 (V)
Frame Rate	Up to 30 fps
Power consumption	< 70 mA
Optical format	1/9" Lens
Pixel Size	2.5 um
Chief Ray Angle	21 °
Sensitivity	1720 mV/lux*sec
Color filter	RGB Bayer Pattern
Scan Mode	Progressive
S/N Ratio	37 dB
Dynamic range	73 dB
Power noise	0.4 LSB (8Bits RAW, 16x Gain)

Ordering Information

Part number	Package Type	Package Size(mm)
PAC7352LT	29-ball CSP	3.2 x 2.9

1. Pin Description

Pin No.	Category	Name	Type	Description
A1	USB PHY	RREF	IN	Reference for USB
A2	USB PHY	DP	IO	USB D+
A3	USB PHY	DM	IO	USB D-
A4	USB PHY	VDD18_PHY	POWER-IN	1.8V digital power
A5	Power	VSSD	GND	Ground
A6	Power	VDDIO	POWER-IN	I/O power
B1	Power	VDD18_O	POWER-OUT	1.8V power output
B2	Power	GND_PHY	GND	Ground
B3	USB PHY	VDD33_HSRT	POWER-IN	Analog power for USB transceiver
B4	SPI	SPI_CSB	OUT	SPI chip select
B5	Power	VDD18K	POWER-IN	1.8V digital power
B6	SPI	SPI_SCK	OUT	SPI clock
C1	Power	VDD28_O	POWER-OUT	2.8V power output
C2	Power	VDD33A	POWER-IN	3.3V input from VBUS
C4	SPI	SPI_SO	OUT	SPI data output
C5	GPIO	GIPO6/LED	IO/OUT	General purpose IO / LED indicator
C6	SPI	SPI_SI	IN	SPI data input
D1	Power	DVDD28/AVDD28	POWER-IN	2.8V input from VDD28_O
D2	Reserved	TESTMD	IN	reserved for test
D3	Reserved	REG_SDA	IN/OUT	reserved for test
D4	GPIO	GPIO2	IO	General purpose IO
D5	GPIO	GPIO0	IO	General purpose IO
D6	GPIO	GPIO5/KEY	IO/IN	General purpose IO / snapshot; active low
E1	Power	VDDAY_O/VDDAY_I	POWER-IN/OUT	Power for internal use
E2	Power	VSSA/VSSAY	GND	Ground
E3	Reserved	OSCMD	IN	reserved for test
E4	Reserved	REG_SCL	IN	reserved for test
E5	Reserved	VPP	IN	reserved for test
E6	GPIO	GPIO1	IO	General purpose IO

2. Electrical Characteristics

2.1 Absolute Maximum Ratings

Exceeding the Absolute Maximum Ratings shown below invalidates all AC and DC electrical specifications and may result in permanent device damage.

Symbol	Parameter	Min	Max	Unit	Notes
T _{STG}	Ambient storage temperature	-25	125	°C	
V _{DD33A}	DC supply voltage from USB	-0.3	3.6	V	
V _{DDIO}	IO voltage	-0.3	3.6	V	
V _{DD18K}	Digital core input voltage	-0.3	1.9	V	
ESD	ESD Rating, Human Body model	-	2	kV	

2.2 Operating Condition

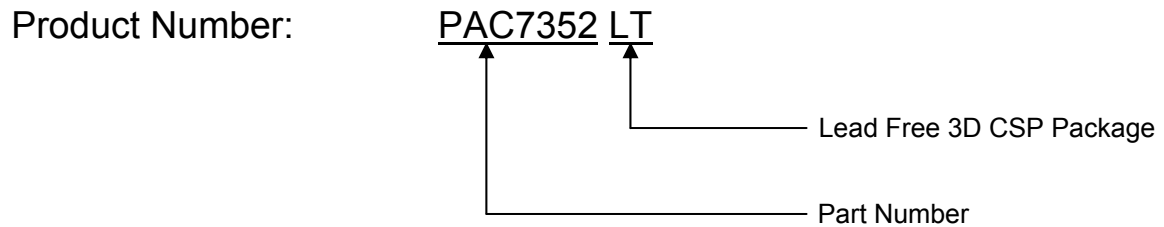
Symbol	Parameter	Min	Typ.	Max	Unit	Notes
T _A	Operating temperature	0	25	50	°C	
V _{DD33A}	DC supply voltage from USB	3.0	3.3	3.6	V	
V _{DDIO}	DC supply for GPIO	-	3.3	-	V	

2.3 DC Electrical Characteristics (T_A = 25°C, V_{BUS} = 3.3V, V_{DDIO} = 3.3V)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Notes
Type: Power						
I _{DD}	Operating Current	-	65	70	mA	VGA 30 fps
I _{PWDN}	Power Down current	-	310	400	uA	
Type: IN & I/O, Reset						
V _{IH}	Input voltage HIGH	V _{DDIO} × 0.6	-	-	V	
V _{IL}	Input voltage LOW	-0.3	-	V _{DDIO} × 0.3	V	
Type: OUT & I/O						
V _{OH}	Output voltage HIGH	2.4	-	-	V	I _{OH} = 8mA
V _{OL}	Output voltage LOW	-	-	0.4	V	I _{OL} = 8mA

3. Package Handling Information

3.1 Product Ordering Information



3.2 Material List

Items	Process	Material
1	Substrate Material	Silicon substrate
2	Cover Material	Solder Mask
3	Die Attach	Epoxy
4	Trace	Aluminum/ Ni/ Au
5	Sensor Cover	Glass
6	Marking	Laser
7	Lead Finish	Solder Ball Sn/Ag/Cu

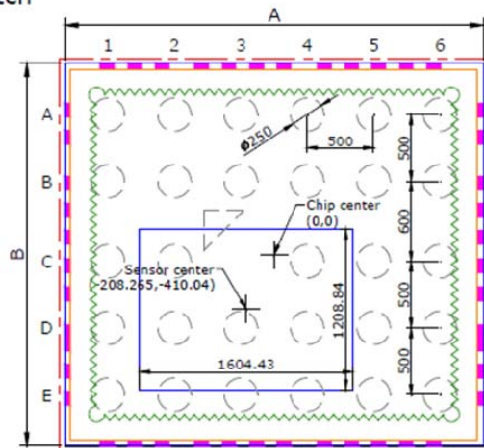
3.3 Package Outline Dimension

	Symbol	Nominal	Min. μm	Max.
Package Body Dimension X	A	3152	3127	3177
Package Body Dimension Y	B	2871.4	2846.4	2896.4
Package Height	C	760	700	820
Ball Height	C1	130	100	160
Package Body Thickness	C2	630	585	675
Thickness of Glass surface to wafer	C3	445	425	465
Ball Diameter	D	250	220	280
Total Pin Count	N	29		
Pin Count X axis	N1	6		
Pin Count Y axis	N2	5		
Pins Pitch X axis	J1	500		
Pins Pitch Y axis	J2	500/600		
Edge to Pin Center Distance along X	S1	326	296	356
Edge to Pin Center Distance along Y	S2	385.7	355.7	415.7

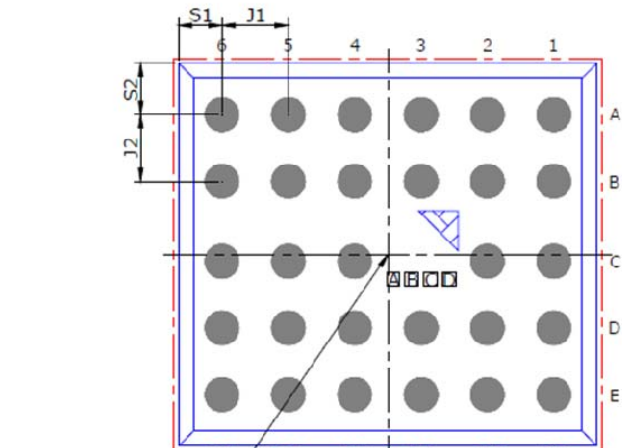
* 1. The thickness of Bond-1 glass is 400 μm (Green glass x 1pcs)

* 2. The material of solder ball is SAC305.

Mechanical Diagram

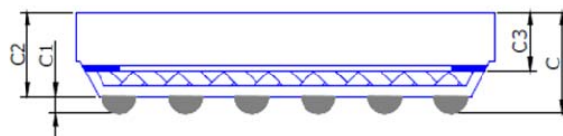


Top View (Bumps Down)



Center of BGA
= Center of Package

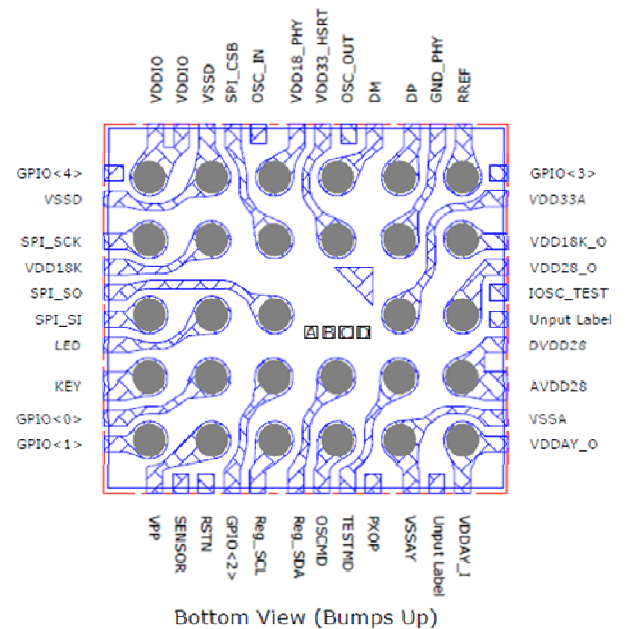
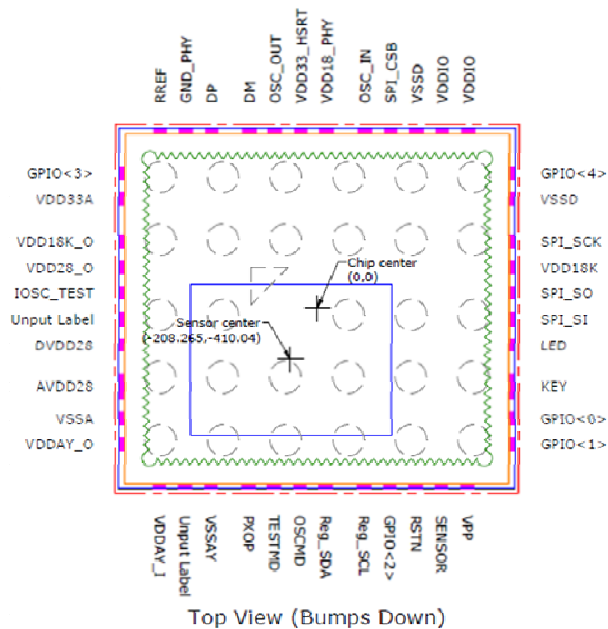
Bottom View (Bumps Up)



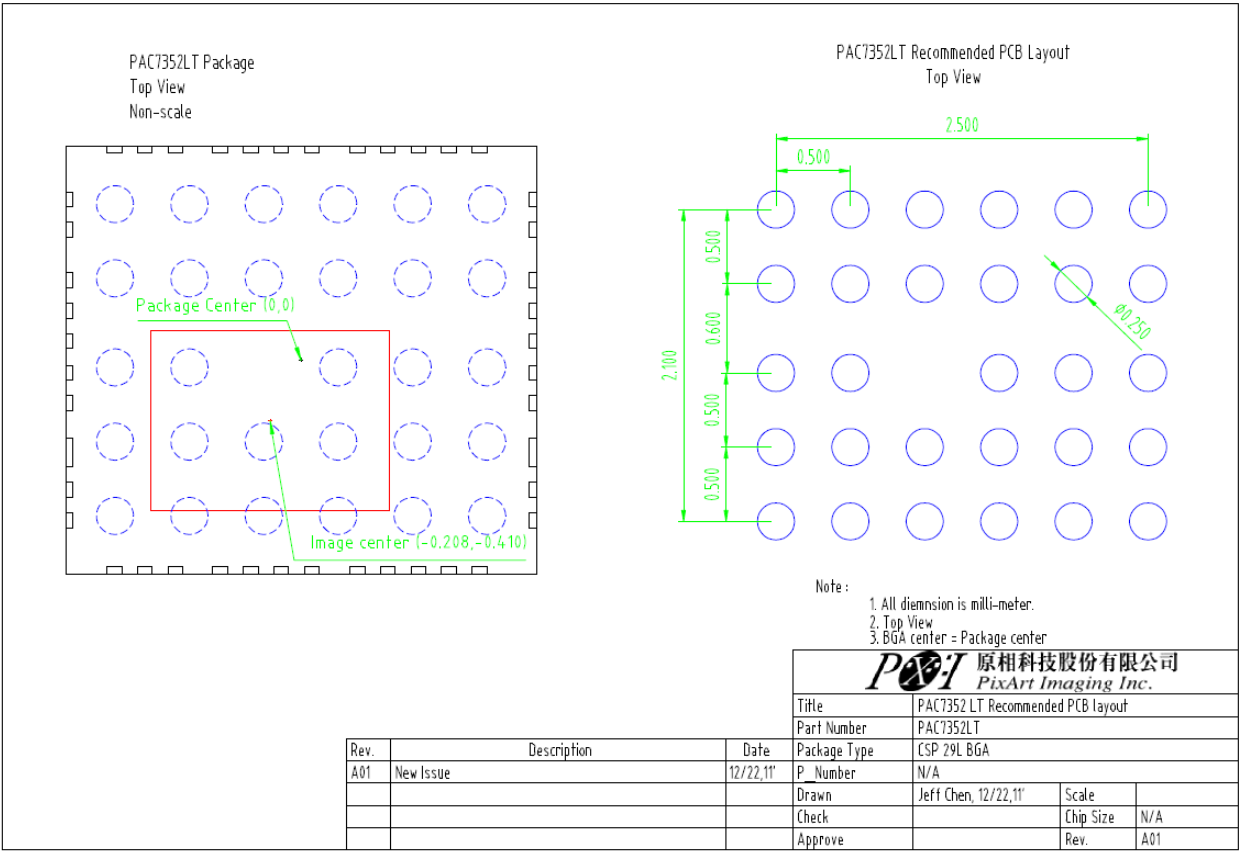
Side View

3.4 Ball Matrix Table

	1	2	3	4	5	6
A	RREF	DP	DM	VDD18_PHY	VSSD / VSSD	VDDIO / VDDIO
B	VDD18K_O	GND_PHY	VDD33_HSRT	SPI_CSB	VDD18K	SPI_SCK
C	VDD28_O	VDD33A		SPI_SO	LED	SPI_SI
D	DVDD28 / AVDD28	TESTMD	REG_SDA	GPIO<2>	GPIO<0>	KEY
E	VDDAY_O / VDDAY_I	VSSA / VSSAY	OSCMD	REG_SCL	VPP	GPIO<1>



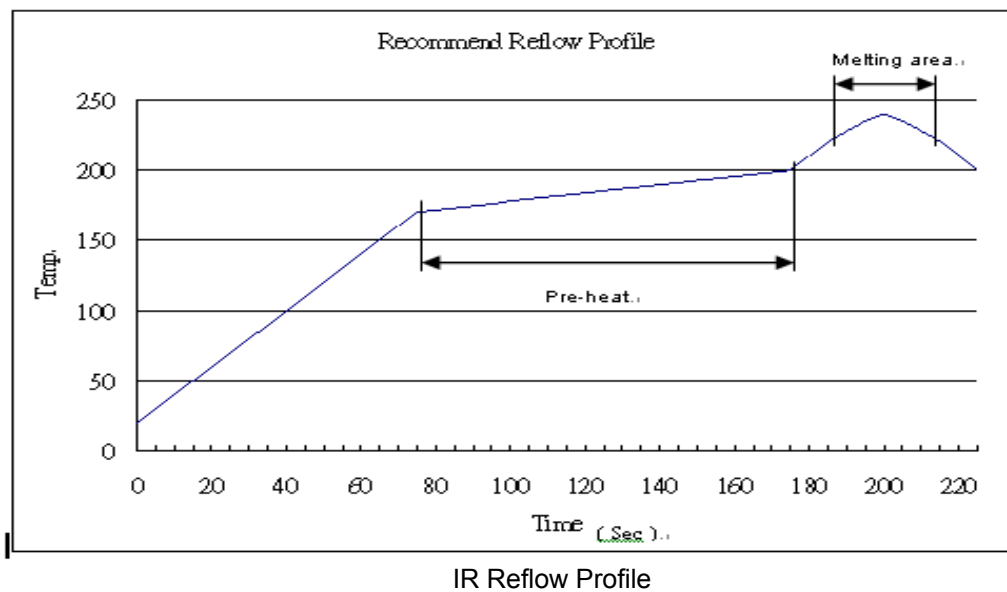
3.5 Recommended Layout PCB



3.7 Recommended Guideline for PCB Assembly

- Recommended vender and type for Pb-free solder paste
 1. Almit LFM-48W TM-HP
 2. Senju M705-GRN360-K
- IR Reflow Soldering Profile:

Temperature profile is the most important control in reflow soldering. It must be fine tuned to establish a robust process. The typical recommended IR reflow profile is showed in figure 8 below.



Reflow Profile :

1. Average Ramp-up Rate (30°C to preheat zone): 1.5~ 2.5 Degree C/ Sec
2. Preheat zone:
 - 2.1 Temp ramp from 170~ 200 degree C
 - 2.2 Exposure time: 90 +/- 30 sec
3. Melting zone:
 - 3.1 Melting area temp > 220 degree C for at least 30 ~ 50 sec
 - 3.2 Peak temperature : 245 degree C.

3.8 Handling precaution for the prevention of ESD

Explained below are procedures that must be taken in fabrication to prevent the electrostatic destruction of semiconductor devices.

The following basic rules must be obeyed.

1. Equalize potentials of terminals when transporting or storing.
2. Equalize the potentials of the electric device, work table, and operator's body that may come in contact with the IC's.
3. Prepare an environment that does not generate static electricity.
One method is keeping relative humidity in the work room to about 50%.

Operator

1. The operator should wear wrist straps.
(Must maintain electric contact with bare skin)
2. Wear cotton or antistatic-treated materials clothes and gloves.
3. When a conductive mat will be used, must be wear conductive shoes.
4. Do not touch the IC's leads. Touch the body of IC's when holding.

Equipment and tools

1. Any electrical equipments and tools located on the work table surface must be isolated from The work table surface, and ground the equipments and tools that are to be used.
2. Work table surface must be use conductive material or conductive mat.
(Should be ground through a 1MΩ resistor)

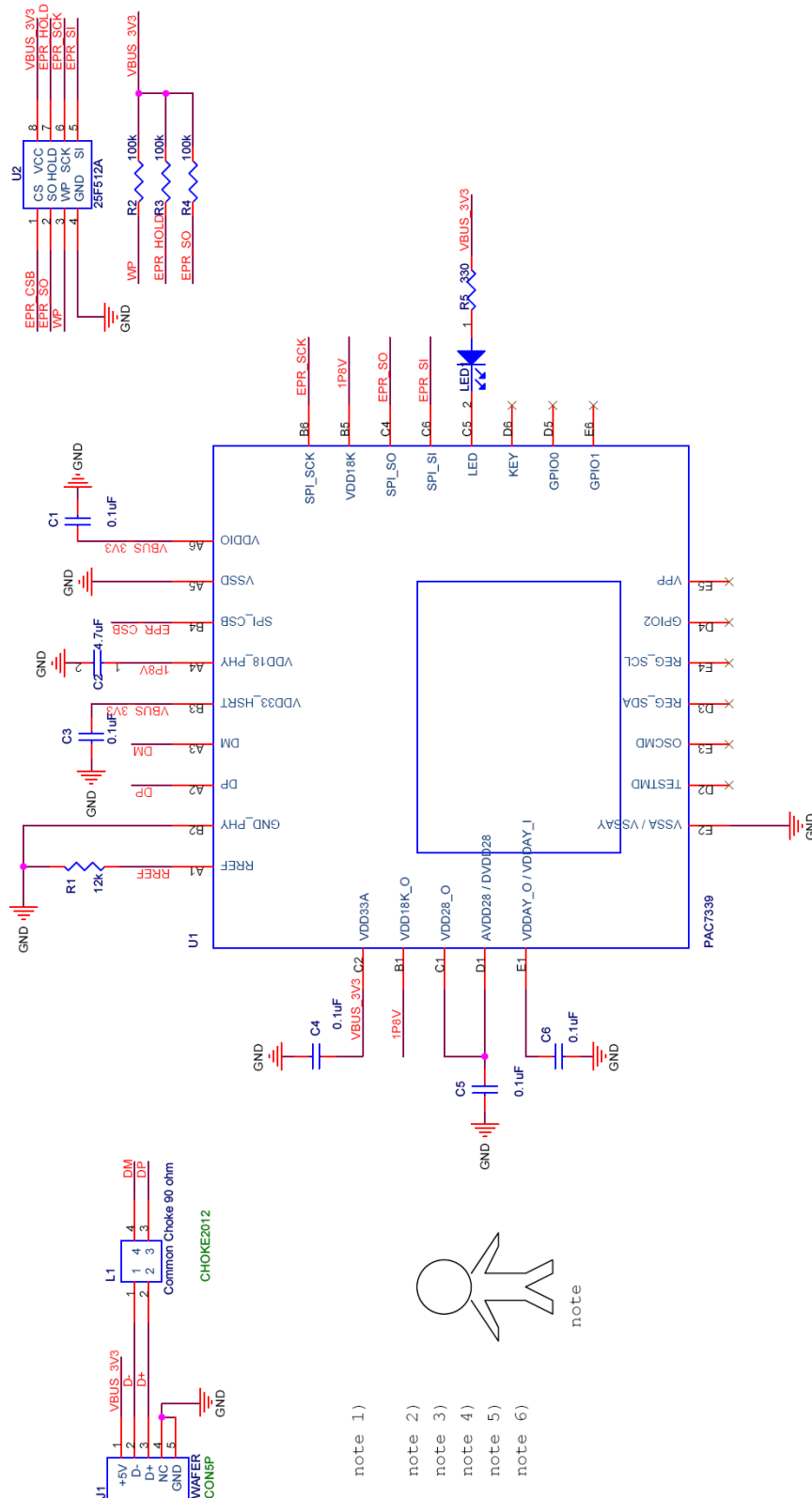
Transporting, storing and packing

1. Use conductive IC's tray, and conductive or shielding bag to store IC's.

Soldering operation

1. Use a soldering iron with a grounding wire.
2. When perform manual soldering operation, the operator should wear wrist straps.
3. Do not use the desoldering pump when removing the IC's from the PCB board. Use a solder-wick or equivalent.

4. Reference Application Circuit



5. Revision History

Revision	Comments	Issue Date
V0.10	Preliminary version	Nov. 10, 2011
V0.90	Update "Key Specification" Update section of "Package Handling Information"	Feb. 10, 2012
V1.0	Release to ECN. No content changes.	Feb. 14, 2012