LI3030SA

47.7mm Diagonal 2.76MP High NIR Sensitivity Analog CMOS Sensor on 180PGA with 19µm Square Pixels at 98fps

DESCRIPTION

This sensor is a solid-state CMOS area scan image sensor of 47.7mm diagonal (larger than 35 mm full frame) with 2.76 million effective 19µm square pixels.

As the successor to the 35MMFHDXS series, this new sensor features a larger detector area, higher effective resolution, higher frame rate, with lower power consumption and simpler power requirements.

The sensor also features vertical crop (98 fps in full area readout, 115 fps in 1080-row readout, and 300 fps in 360-row readout).

The large, high sensitivity, 19 µm x 19 µm pixel enables capturing motion imagery in night time environments.

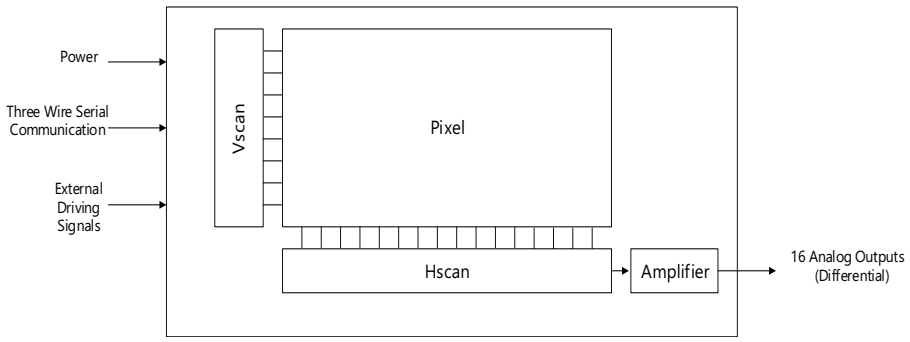
LI3030SA series is the NIR (Near-InfraRed) sensitivity improvement version of 35MMFHDXS_A series.

*LI3030SA series consists of LI3030SAM (high NIR sensitivity monochrome), LI3030SAI (high NIR sensitivity RGBIR) and LI3030SAC (high NIR sensitivity color). RGBIR sensor enable to get color image and NIR image at same time.

FEATURES

- LI3030SAM: Monochrome sensor
- LI3030SAI: RGBIR sensor
- LI3030SAC: Color sensor
- Rolling shutter
- Recording size: 41.04 mm x 24.32 mm
- Number of effective pixels: 2160 x 1280 (Horizontal x Vertical)
- Pixel size: 19 µm x 19 µm
- 16 ch analog outputs
- Drive frequency: 16 ch x 21 MHz
- High-speed frame rate by simultaneous readout from four vertical lines
- Full area readout: 98fps, 1080-row readout: 115 fps
- Vertically selectable region of interest
- Column amplifier gains: x1, x2, x4, x8, x16
- Serial communication
- High NIR sensitivity
- Full charge transfer of large area pixel
- Sensitivity: LI3030SAM 2,900,000 e/lx/sec, LI3030SAI (Green) 1,100,000 e/lx/sec, LI3030SAC (Green) 1,300,000 e/lx/sec
- Saturation: 70,000 e
- Quantum efficiency of LI3030SAM: 84%@525nm, 85%@560nm(peak), 51%@850nm
- Quantum efficiency of LI3030SAI Green: 67%@525nm, 67%@530nm(peak), IR: 54%@825nm(peak), 50%@850nm
- Quantum efficiency of LI3030SAC Green: 69%@525nm, 69%@530nm(peak), 46%@850nm
- Dark random noise: 3.4 e rms @gain x16, 40°C (package reverse side)
- Dark current: 0.04 e/sec @0°C (package reverse side), 300 e/sec @60°C (package reverse side)
- Power consumption: 1.7 W (Typ.) @All pixels readout at 60 fps
- Power supply voltages: 5.0 V, 2.5V and 3.3 V
- Operate with as few as three power supplies due to built-in power supply circuit (some modes require more power supplies)
- 180 pin ceramic PGA
- Package size: 60.9 mm x 44.6 mm x 3.57 mm (External electrodes are not included)

FUNCTIONAL BLOCK DIAGRAM



3. Pixel Arrangement

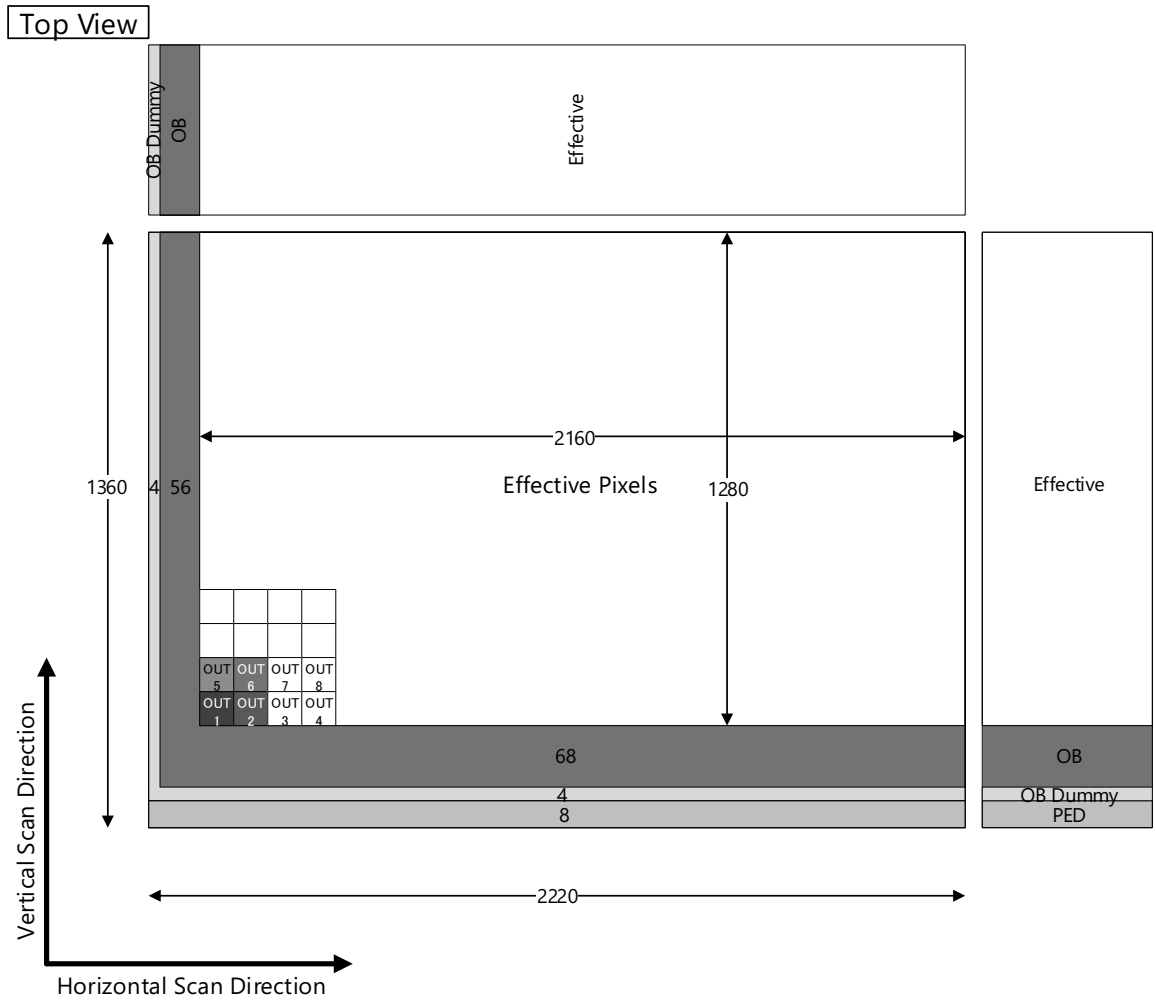


Figure 3-1. Pixel Data Format (Physical Arrangement)

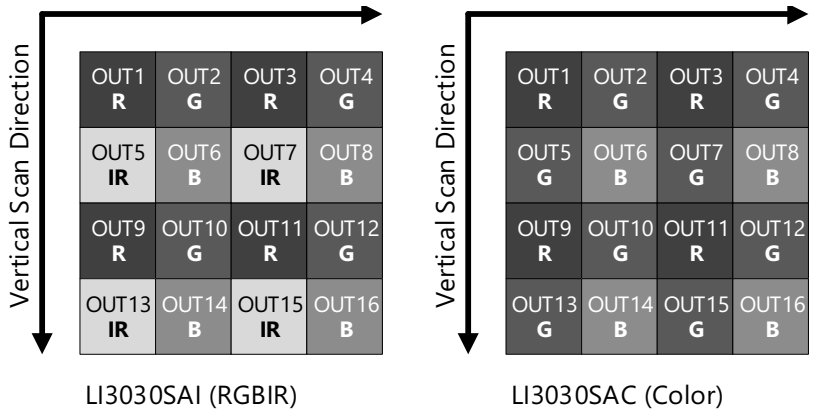


Figure 3-2. Pixel Color Filter Arrangement

*__Figure 3-2__ is RGBIR sensor (LI3030SAI) and Color sensor (LI3030SAC) version. Color filters are not installed in Monochrome sensor (LI3030SAM).

4. Pin Specifications

Table 4-1. Pin Specifications 1

Pin No	Pin Name	Type	Content	Remarks
A01	AVDD3	P	3.3V analog power supply	Analog Input1
A02	(NC)	-	-	Non-Connection
A03	VI10	P	Built-in power supply monitor / external input	Analog Input1
A04	CGND	G	Analog GND	Analog Input1 (GND)
A05	VI08	P	Built-in power supply monitor / external input	Analog Input1
A06	VI11	P	Built-in power supply monitor / external input	Analog Input1
A07	VI09	P	Built-in power supply monitor / external input	Analog Input1
A08	VI04	P	Built-in power supply monitor / external input	Analog Input1
A09	VI05	P	Built-in power supply monitor / external input	Analog Input1
A10	VI02	P	Built-in power supply monitor / external input	Analog Input1
A11	VI03	P	Built-in power supply monitor / external input	Analog Input1
A12	VEND1	O	End pulse of vertical shift register	Digital Output, Open, For debug.
A13	VI01	P	Built-in power supply monitor / external input	Analog Input1
A14	AVDD	P	5.0V analog power supply	Analog Input1
A15	AGND	G	Analog GND	Analog Input1 (GND)
A16	SVDD	P	5.0V sensor power supply	Analog Input1
A17	SGND	G	Sensor GND	Analog Input1 (GND)
A18	VI11	P	Built-in power supply monitor / external input	Analog Input1
A19	VI08	P	Built-in power supply monitor / external input	Analog Input1
A20	CGND	G	Analog GND	Analog Input1 (GND)
A21	VI10	P	Built-in power supply monitor / external input	Analog Input1
A22	AVDD3	P	3.3V analog power supply	Analog Input1
A23	AVDD3	P	3.3V analog power supply	Analog Input1
B01	CGND	G	Analog GND	Analog Input1 (GND)
B02	OUT16_P	O	Differential analog output (positive)	Analog Output
B03	OUT16_M	O	Differential analog output (negative)	Analog Output
B04	OUT08_P	O	Differential analog output (positive)	Analog Output
B05	OUT08_M	O	Differential analog output (negative)	Analog Output
B06	OUT11_P	O	Differential analog output (positive)	Analog Output
B07	OUT11_M	O	Differential analog output (negative)	Analog Output
B08	(NC)	-	-	Non-Connection
B09	(NC)	-	-	Non-Connection
B10	PI22	I	Pulse for driving internal circuit	Digital Input
B11	PI23	I	Pulse for driving internal circuit	Digital Input
B12	PI04	I	Pulse for driving internal circuit	Digital Input
B13	PI05	I	Pulse for driving internal circuit	Digital Input
B14	PI06	I	Pulse for driving internal circuit	Digital Input
B15	(NC)	-	-	Non-Connection
B16	OUT15_M	O	Differential analog output (negative)	Analog Output
B17	OUT15_P	O	Differential analog output (positive)	Analog Output
B18	OUT04_M	O	Differential analog output (negative)	Analog Output
B19	OUT04_P	O	Differential analog output (positive)	Analog Output
B20	OUT12_M	O	Differential analog output (negative)	Analog Output
B21	OUT12_P	O	Differential analog output (positive)	Analog Output
B22	CGND	G	Analog GND	Analog Input1 (GND)

Type G: Ground, P: Power, I: Input, O: Output

*Be sure to consider Latch-up when making system designs (see **"14.2 Latch-Up"**). Especially, Pin No A03, A05 ~ A10, A13, A18, A19, and A21 are used as the internal power supply.

Table 4-2. Pin Specifications 2

Pin No	Pin Name	Type	Content	Remarks
C01	AVDD	P	5.0V analog power supply	Analog Input1
C02	OUT03_P	O	Differential analog output (positive)	Analog Output
C03	OUT03_M	O	Differential analog output (negative)	Analog Output
C04	OUT14_P	O	Differential analog output (positive)	Analog Output
C05	OUT14_M	O	Differential analog output (negative)	Analog Output
C06	OUT06_P	O	Differential analog output (positive)	Analog Output
C07	OUT06_M	O	Differential analog output (negative)	Analog Output
C08	(NC)	-	-	Non-Connection
C09	(NC)	-	-	Non-Connection
C10	PI24	I	Pulse for driving internal circuit	Digital Input
C11	PI21	I	Pulse for driving internal circuit	Digital Input
C12	PI02	I	Pulse for driving internal circuit	Digital Input
C13	PI03	I	Pulse for driving internal circuit	Digital Input
C14	PI55	I	Pulse for driving internal circuit	Digital Input
C15	(NC)	-	-	Non-Connection
C16	(NC)	-	-	Non-Connection
C17	OUT02_M	O	Differential analog output (negative)	Analog Output
C18	OUT02_P	O	Differential analog output (positive)	Analog Output
C19	OUT10_M	O	Differential analog output (negative)	Analog Output
C20	OUT10_P	O	Differential analog output (positive)	Analog Output
C21	OUT07_M	O	Differential analog output (negative)	Analog Output
C22	OUT07_P	O	Differential analog output (positive)	Analog Output
C23	AVDD	P	5.0V analog power supply	Analog Input1
D01	AGND	G	Analog GND	Analog Input1 (GND)
D02	OUT09_P	O	Differential analog output (positive)	Analog Output
D03	OUT09_M	O	Differential analog output (negative)	Analog Output
D04	OUT01_P	O	Differential analog output (positive)	Analog Output
D05	OUT01_M	O	Differential analog output (negative)	Analog Output
D06	(NC)	-	-	Non-Connection
D07	DVDD	P	5.0V digital power supply	Analog Input1
D08	DVDD	P	5.0V digital power supply	Analog Input1
D09	DVDD	P	5.0V digital power supply	Analog Input1
D10	(NC)	-	-	Non-Connection
D11	DGND	G	Digital GND	Analog Input1 (GND)
D12	DGND	G	Digital GND	Analog Input1 (GND)
D13	DGND	G	Digital GND	Analog Input1 (GND)
D14	(NC)	-	-	Non-Connection
D15	CGND	G	Analog GND	Analog Input1 (GND)
D16	PI01	I	Pulse for driving internal circuit	Digital Input
D17	CGND	G	Analog GND	Analog Input1 (GND)
D18	OUT05_M	O	Differential analog output (negative)	Analog Output
D19	OUT05_P	O	Differential analog output (positive)	Analog Output
D20	OUT13_M	O	Differential analog output (negative)	Analog Output
D21	OUT13_P	O	Differential analog output (positive)	Analog Output
D22	AGND	G	Analog GND	Analog Input1 (GND)

Type G: Ground, P: Power, I: Input, O: Output

*Be sure to consider Latch-up when making system designs (see **"14.2 Latch-Up"**).

Table 4-3. Pin Specifications 3

Pin No	Pin Name	Type	Content	Remarks
E01	DGND	G	Digital GND	Analog Input1 (GND)
E02	MCLK_P1U	O	Test Pin	Digital output, Open, For debug.
E03	T1_A1	-	Test Pin	Connect to GND
E04	T1_K1	-	Test Pin	Connect to GND
E05	PI13	I	Pulse for driving internal circuit	Digital Input
E06	PI12	I	Pulse for driving internal circuit	Digital Input
E07	PI35	I	Pulse for driving internal circuit	Digital Input
E08	PI44	I	Pulse for driving internal circuit	Digital Input
E09	PI53	I	Pulse for driving internal circuit	Digital Input
E10	PI51	I	Pulse for driving internal circuit	Digital Input
E11	PI52	I	Pulse for driving internal circuit	Digital Input
E12	PI41	I	Pulse for driving internal circuit	Digital Input
E13	PI25	I	Pulse for driving internal circuit	Digital Input
E14	PI37	I	Pulse for driving internal circuit	Digital Input
E15	PI43	I	Pulse for driving internal circuit	Digital Input
E16	VEND2	O	End pulse of vertical shift register	Digital Output, Open, For debug.
E17	SDATA	I	3-wire serial Data	Digital Input
E18	PI12	I	Pulse for driving internal circuit	Digital Input
E19	PI13	I	Pulse for driving internal circuit	Digital Input
E20	T2_K2	-	Test Pin	Connect to GND
E21	T2_K1	-	Test Pin	Connect to GND
E22	MCLK_P1D	O	Test Pin	Digital Output, Open, For debug.
F01	DVDD	P	5.0V digital power supply	Analog Input1
F02	MCLK_P2U	O	Test Pin	Digital Output, Open, For debug.
F03	T1_A2	-	Test Pin	Connect to GND
F04	T1_K2	-	Test Pin	Connect to GND
F05	PI11	I	Pulse for driving internal circuit	Digital Input
F06	HEND1	O	End pulse of horizontal shift register	Digital Output, Open, For debug.
F07	PI32	I	Pulse for driving internal circuit	Digital Input
F08	PI42	I	Pulse for driving internal circuit	Digital Input
F09	PI24	I	Pulse for driving internal circuit	Digital Input
F10	PI21	I	Pulse for driving internal circuit	Digital Input
F11	PI02	I	Pulse for driving internal circuit	Digital Input
F12	PI03	I	Pulse for driving internal circuit	Digital Input
F13	PI26	I	Pulse for driving internal circuit	Digital Input
F14	PI39	I	Pulse for driving internal circuit	Digital Input
F15	(NC)	-	-	Non-Connection
F16	PI54	I	Pulse for driving internal circuit	Digital Input
F17	SCLK	I	3-wire serial Clock	Digital Input
F18	HEND2	O	End pulse of horizontal shift register	Digital Output, Open, For debug.
F19	PI11	I	Pulse for driving internal circuit	Digital Input
F20	T2_A2	-	Test Pin	Connect to GND
F21	T2_A1	-	Test Pin	Connect to GND
F22	MCLK_P2D	O	Test Pin	Digital Output, Open, For debug.
F23	AMON2	O	Test Pin	Analog Output, Open, For debug.

Type G: Ground, P: Power, I: Input, O: Output

*Be sure to consider Latch-up when making system designs (see **"14.2 Latch-Up"**). Especially, Pin No F23 is used for debugging, so they cannot be used when incorporating the device into a product.

Table 4-4. Pin Specifications 4

Pin No	Pin Name	Type	Content	Remarks
G01	AMON1	O	Test Pin	Analog Output, Open, For debug.
G02	AGND	G	Analog GND	Analog Input1 (GND)
G03	AVDD	P	5.0V analog power supply	Analog Input1
G04	(NC)	-	-	Non-Connection
G05	PI31	I	Pulse for driving internal circuit	Digital Input
G06	(NC)	I	-	Non-Connection
G07	VI14	P	Built-in power supply monitor / external input	Analog Input1
G08	(NC)	-	-	Non-Connection
G09	PI22	I	Pulse for driving internal circuit	Digital Input
G10	PI23	I	Pulse for driving internal circuit	Digital Input
G11	PI04	I	Pulse for driving internal circuit	Digital Input
G12	PI05	I	Pulse for driving internal circuit	Digital Input
G13	PI27	I	Pulse for driving internal circuit	Digital Input
G14	PI36	I	Pulse for driving internal circuit	Digital Input
G15	PI40	I	Pulse for driving internal circuit	Digital Input
G16	PI45	I	Pulse for driving internal circuit	Digital Input
G17	CSCMOS	I	3-wire serial Chip Select	Digital Input
G18	VI06	P	Built-in power supply monitor / external input	Analog Input1
G19	VSUB	P	2.5V analog power supply	Analog Input1
G20	AVDD	P	5.0V analog power supply	Analog Input1
G21	PI57	I	Pulse for driving internal circuit	Digital Input
G22	PI56	I	Pulse for driving internal circuit	Digital Input
H01	CGND	G	Analog GND	Analog Input1 (GND)
H02	VI10	P	Built-in power supply monitor / external input	Analog Input1
H03	VI08	P	Built-in power supply monitor / external input	Analog Input1
H04	(NC)	-	-	Non-Connection
H05	VI13	P	Built-in power supply monitor / external input	Analog Input1
H06	AVDD3	P	3.3V analog power supply	Analog Input1
H07	VI09	P	Built-in power supply monitor / external input	Analog Input1
H08	VI04	P	Built-in power supply monitor / external input	Analog Input1
H09	VI05	P	Built-in power supply monitor / external input	Analog Input1
H10	VI02	P	Built-in power supply monitor / external input	Analog Input1
H11	VI03	P	Built-in power supply monitor / external input	Analog Input1
H12	VI01	P	Built-in power supply monitor / external input	Analog Input1
H13	AVDD	P	5.0V analog power supply	Analog Input1
H14	AGND	G	Analog GND	Analog Input1 (GND)
H15	DGND	G	Digital GND	Analog Input1 (GND)
H16	DVDD	P	5.0V digital power supply	Analog Input1
H17	SVDD	P	5.0V sensor power supply	Analog Input1
H18	SGND	G	Sensor GND	Analog Input1 (GND)
H19	VI12	P	Built-in power supply monitor / external input	Analog Input1
H20	REXT	O	External resistor for current source	Connect 15kΩ to the ground. The accuracy of REXT influences sensor performance. Use high accuracy resistance greater than ±1%.
H21	VI08	P	Built-in power supply monitor / external input	Analog Input1
H22	CGND	G	Analog GND	Analog Input1 (GND)
H23	VI10	P	Built-in power supply monitor / external input	Analog Input1

Type G: Ground, P: Power, I: Input, O: Output

*Be sure to consider Latch-up when making system designs (see **"14.2 Latch-Up"**). Especially, Pin No G07, G18, H02, H03, H05, H07 ~ H10, H12, H19, H21, and H23 are used as the internal power supply. Also, Pin No G01 is used for debugging, so they cannot be used when incorporating the device into a product.

7. Absolute Maximum Ratings

Table 7-1. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Notes
Analog Power Supply (5.0V)	SVDD	-	6.0	V	-
Digital Power Supply (5.0V)	DVDD	-	6.0	V	-
Analog Power Supply (5.0V)	AVDD	-	6.0	V	-
Analog Power Supply (3.3V)	AVDD3	-	3.9	V	-
Analog Power Supply (2.5V)	VSUB	-	6.0	V	-
Negative Power Supply (-1.5V)	VI03	DVDD - 6.66	0	V	-
Digital Input Voltage	Vin	DGND - 0.30	DVDD + 0.30	V	-
Storage Temperature	T_{str}	-20	105	°C	T_j: Junction Temperature
Maximum Junction Temperature	T_{jmax}	-20	85	°C	T_j: Junction Temperature

8. Electrical Specifications

Table 8-1. D.C. Characteristics (Supply Currents when External Power Supplies are Used)

Symbol	Max.	Unit	Settings
SVDD	170	mA	5.0V
DVDD	160	mA	5.0V
AVDD	200	mA	5.0V
AVDD3	190	mA	3.3V
VSUB	10	mA	2.5V
VI01	10	mA	4.5V
VI02	10	mA	3.5V
VI03	10	mA	-1.5V
VI04	10	mA	4.5V
VI05	10	mA	0.4V
VI06	10	mA	2.6V
VI07	10	mA	1.0V (Internal supply only)
VI08	50	mA	2.5V
VI09	10	mA	2.5V
VI10	50	mA	2.5V
VI11	10	mA	2.5V
VI12	1	mA	1.5V
VI13	10	mA	4.4V
VI14	10	mA	2.0V

15. Package Specification

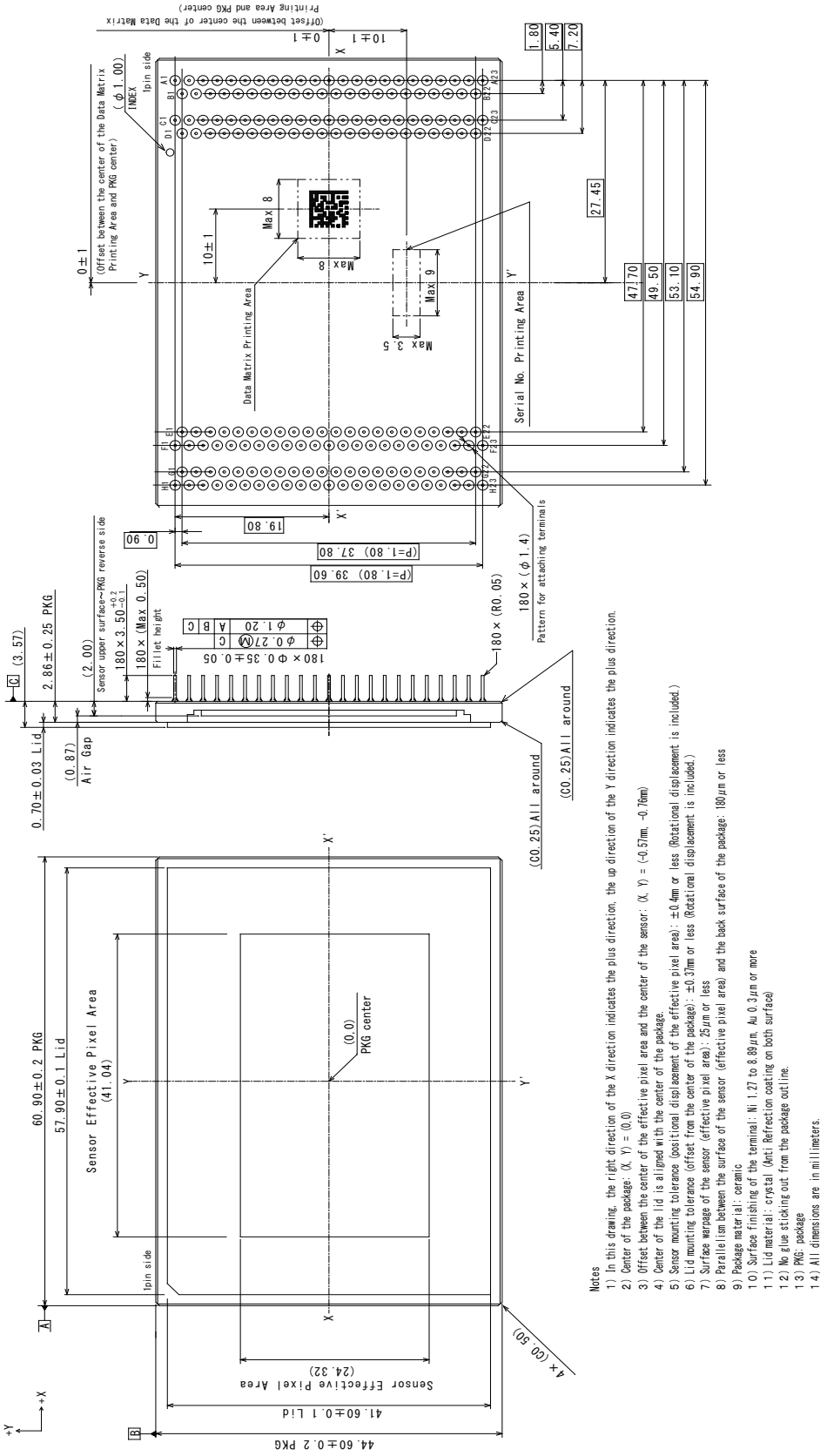


Figure 15-1. Package Specification