LI5040SA

2/3 inch Diagonal 5.33MP CMOS Sensor on 180pin LGA with 3.4µm Square Pixels at 120fps.

DESCRIPTION

LI5040SA is a CMOS type of solid-state image sensor with a 2/3 inch effective pixel array of 5.33M pixels.

It uses a global shutter feature as a charge storage period control.

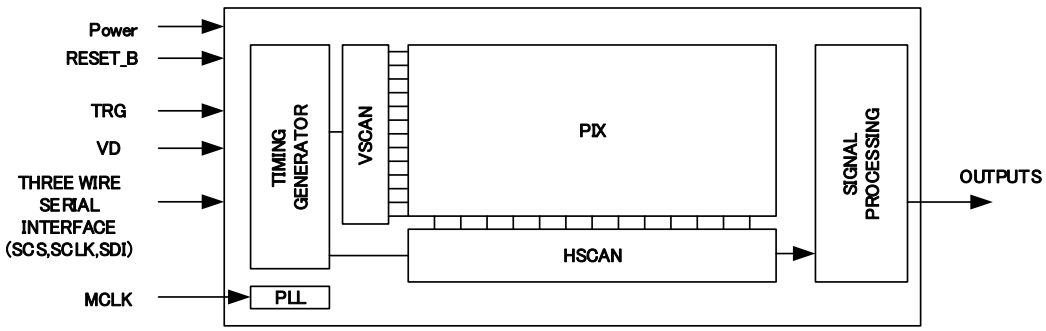
It can output an effective 2592 x 2056 pixels of video at 120 fps and 12bit via 12 channels of digital signal output.

*LI5040SA series consists of LI5040SAC (color), LI5040SAM (monochrome) and LI5040SAI (RGBIR).

FEATURES

- LI5040SAM: Monochrome sensor
- LI5040SAC: Color sensor (RGB on-chip color filter)
- LI5040SAI: RGBIR sensor (RGB IR on-chip color filter)
- Global shutter / Progressive scan
- Recording screen size: 2/3 inch equivalent (8.8 mm x 7.0 mm)
- Number of effective pixels: 2592 x 2056 (Horizontal x Vertical)
- Pixel size: 3.4 µm x 3.4 µm
- Number of output channels Data: 12 lanes, Clock: 2 lanes
- Main clock frequency: 36 MHz (recommended)
- Output format: LVDS output maximum 864 Mbps @12 bit
- Analog gain: 0 to 36 dB
- Digital gain: 0 to 24 dB
- Maximum of 8 areas (horizontal 8, vertical 8) of optional segmentation (ROI: Region Of Interest) feature
- Horizontal and vertical inverted output feature
- External trigger exposure control feature (Overlap trigger feature)
- Sensitivity (Green) of LI5040SAC: 30,000 e/lx/sec @Analog gain x1
- Sensitivity (Green) of LI5040SAI: 30,000 e/lx/sec @Analog gain x1
- Sensitivity of LI5040SAM: 54,000 e/lx/sec @Analog gain x1
- Saturation: 12,000 e @Analog gain x1, 60fps, Dynamic Range Priority Mode
- Saturation: 7,000 e @Analog gain x1, 120fps, Frame Rate Priority Mode
- Dark random noise: 2.6 e rms @Analog gain x1
- Dark current: 1.3 e/sec @Analog gain x1, room temperature
- Power consumption: 510 mW(Typ.) @using all pixels 120 fps
- Power consumption: 440 mW(Typ.) @using all pixels 42 fps
- Power supply voltages: 3.3 V, 1.2 V
- 180 pin ceramic LGA
- Package size: 18.96mm x 18.10mm x 2.51mm

FUNCTIONAL BLOCK DIAGRAM



3. Pixel Arrangement

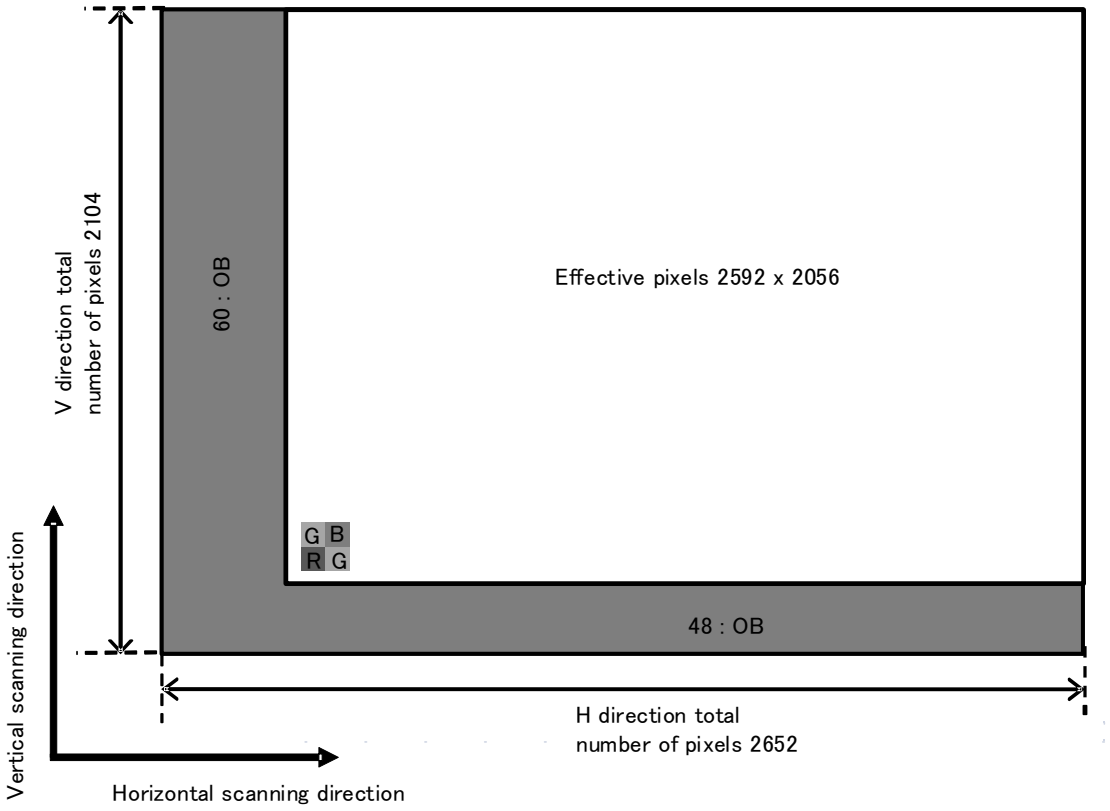


Figure 3-1. Pixel Data Format (Physical Arrangement)

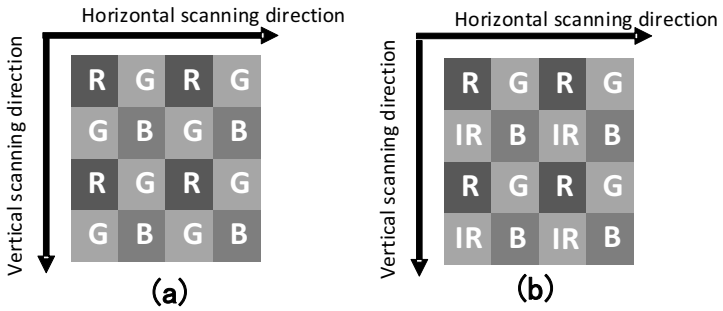


Figure 3-2. Pixel Color Filter Arrangement

* Figure 3-2 (a) is color sensor (LI5040SAC) pixel pattern .
Color filters are not installed in Monochrome sensor (LI5040SAM).
Figure 3-2(b) is RGBIR sensor(LI5040SAI) pixel pattern.

4. Pin Specifications

Table 4-1. Pin Specifications 1

Pin No.	Pin Name	Type	Content	Remarks
tA1	DGND	G	Digital GND	-
tA2	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tB1	(NC)	-	-	-
tA3	(NC)	-	-	-
tB2	(NC)	-	-	-
tC1	(NC)	-	-	-
tB3	(NC)	-	-	-
tC2	(NC)	-	-	-
tD1	AGND1	G	Analog GND	-
tC3	SGND	G	Sensor GND	-
tD2	SVDD	P	3.3 V sensor power supply	Capacity 0.1 μF, 10 μF (±10%) relative to SGND
tE1	AVDDH1	P	3.3 V analog power supply	Capacity 0.1 μF, 10 μF (±10%) relative to AGND
tD3	(NC)	-	-	-
tE2	VD	I	Digital signal (VD) input	Logic input
tF1	CLK	I	Digital signal (Main CLK) input	Logic input
tE3	TRG	I	Digital signal (external trigger) input	Logic input
tF2	DGND	G	Digital GND	-
tG1	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tF3	RESET_B	I	Digital signal (reset) input	Asynchronous, Low active
tG2	TESTSIG1	O	Digital monitor output	Open. Connect to check pin if necessary
tH1	(NC)	-	-	-
tG3	(NC)	-	-	-
tH2	AVDDH1	P	3.3 V analog power supply	Capacity 0.1 μF, 10 μF (±10%) relative to AGND
tI1	SVDD	P	3.3 V sensor power supply	Capacity 0.1 μF, 10 μF (±10%) relative to SGND
tH3	SGND	G	Sensor GND	-
tI2	AGND1	G	Analog GND	-
tJ1	AIN1_1	I	External signal input terminal	AGND short circuit through 0 Ω
tI3	AIN1_2	I	External signal input terminal	AGND short circuit through 0 Ω
tJ2	(NC)	-	-	-
tK1	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tJ3	DGND	G	Digital GND	-
tK2	DVDDH	P	3.3 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tL1	SGND	G	Sensor GND	-
tK3	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tL2	DGND	G	Digital GND	-

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

Table 4-2. Pin Specifications 2

Pin No.	Pin Name	Type	Content	Remarks
Gt1	(NC)	-	-	-
Ht2	(NC)	-	-	-
Ft1	AOUT1	O	Analog Output	Open
Gt2	AOUT2	O	Analog Output	Open
Ht3	(NC)	-	-	-
Ft2	(NC)	-	-	-
Gt3	VINT01	I/O	Built-in power supply monitor / external input	4.7 uF±10% relative to AGND
Ht4	VINT02	I/O	Built-in power supply monitor / external input	4.7 uF±10% relative to AGND
Ft3	VINT03	I/O	Built-in power supply monitor / external input	4.7 uF±10% relative to AGND
Gt4	AVDDH2	P	3.3 V analog power supply	Capacity 0.1 μF, 10 μF (±10%) relative to AGND
Ht5	VINT04	I/O	Built-in power supply capacitance connection	10 uF±10% relative to AGND
Ft4	VINT05	I/O	Built-in power supply capacitance connection	10 uF±10% relative to AGND
Gt5	VINT06	I/O	Built-in power supply capacitance connection	4.7 uF±10% relative to AGND
Ht6	AGND2	G	Analog GND	-
Ft5	AGND2	G	Analog GND	-
Gt6	AVDDH2	P	3.3 V analog power supply	Capacity 0.1 μF, 10 μF (±10%) relative to AGND
Ht7	RREF1	I/O	Ramp reference resistance connection	1 kΩ±1%, shielded by AGND
Ft6	CR1	I/O	Ramp capacitance connection	1000 pF±1% relative to AGND
Gt7	CR2	I/O	Ramp capacitance connection	1000 pF±1% relative to AGND
Ht8	AGND2	G	Analog GND	-
Ft7	VINT07	I/O	Built-in power supply capacitance connection	4.7 uF±10% relative to AGND
Gt8	VINT08	I/O	Built-in power supply capacitance connection	10 uF±10% relative to AGND
Ht9	VINT09	I/O	Built-in power supply capacitance connection	10 uF±10% relative to AGND
Ft8	VINT10	I/O	Built-in power supply monitor / external input	4.7 uF±10% relative to AGND
Gt9	AVDDH2	P	3.3 V analog power supply	Capacity 0.1 μF, 10 μF (±10%) relative to AGND
Ht10	AGND2	G	Analog GND	-
Ft9	RREF2	I/O	Current reference resistance connection	7.5 kΩ±1% relative to AGND, shielded by AGND
Gt10	AVDDH2	P	3.3 V analog power supply	Capacity 0.1 μF, 10 μF (±10%) relative to AGND
Ht11	(NC)	-	-	-
Ft10	(NC)	-	-	-
Gt11	AOUT4	O	Analog Output	Open
Ht12	AOUT3	O	Analog Output	Open
Ft11	(NC)	-	-	-
Gt12	(NC)	-	-	-

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

Table 4-3. Pin Specifications 3

Pin No.	Pin Name	Type	Content	Remarks
tM8	DGND	G	Digital GND	-
tL7	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tL8	SGND	G	Sensor GND	-
tK6	DVDDH	P	3.3 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tK7	DGND	G	Digital GND	-
tK8	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tJ6	(NC)	-	-	-
tJ7	AIN2_2	I	External signal input terminal (for evaluation)	AGND short circuit through 0 Ω
tJ8	AIN2_1	I	External signal input terminal (for evaluation)	AGND short circuit through 0 Ω
tI6	AGND1	G	Analog GND	-
tI7	SGND	G	Sensor GND	-
tI8	SVDD	P	3.3 V sensor power supply	Capacity 0.1 μF, 10 μF (±10%) relative to SGND
tH6	AVDDH1	P	3.3 V analog power supply	Capacity 0.1 μF, 10 μF (±10%) relative to AGND
tH7	(NC)	-	-	-
tH8	(NC)	-	-	-
tG6	TESTSIG2	O	Digital monitor output	Open. Connect to check pin if necessary
tG7	SCANTEST	I	Scan test input	DGND short circuit through 0 Ω
tG8	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tF6	DGND	G	Digital GND	-
tF7	SCS	I	Digital signal (3-wire serial) input	-
tF8	SDI	I	Digital signal (3-wire serial) input	-
tE6	SCLK	I	Digital signal (3-wire serial) input	-
tE7	(NC)	-	-	-
tE8	AVDDH1	P	3.3 V analog power supply	Capacity 0.1 μF, 10 μF (±10%) relative to AGND
tD6	SVDD	P	3.3 V sensor power supply	Capacity 0.1 μF, 10 μF (±10%) relative to SGND
tD7	SGND	G	Sensor GND	-
tD8	AGND1	G	Analog GND	-
tC6	(NC)	-	-	-
tC7	(NC)	-	-	-
tC8	(NC)	-	-	-
tB6	(NC)	-	-	-
tB7	(NC)	-	-	-
tB8	(NC)	-	-	-
tA6	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
tA7	DGND	G	Digital GND	-

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

Table 4-4. Pin Specifications 4

Pin No.	Pin Name	Type	Content	Remarks
Bt12	DGND	G	Digital GND	-
At12	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
Ct11	D33N	O	LVDS data output	100 Ω terminal
Bt11	D33P	O	LVDS data output	
At11	D32N	O	LVDS data output	100 Ω terminal
Ct10	D32P	O	LVDS data output	
Bt10	D31N	O	LVDS data output	100 Ω terminal
At10	D31P	O	LVDS data output	
Ct9	LVCK2N	O	LVDS clock output	100 Ω terminal
Bt9	LVCK2P	O	LVDS clock output	
At9	D41N	O	LVDS data output	100 Ω terminal
Ct8	D41P	O	LVDS data output	
Bt8	D42N	O	LVDS data output	100 Ω terminal
At8	D42P	O	LVDS data output	
Ct7	D43N	O	LVDS data output	100 Ω terminal
Bt7	D43P	O	LVDS data output	
At7	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
Ct6	DGND	G	Digital GND	-
Bt6	D23P	O	LVDS data output	100 Ω terminal
At6	D23N	O	LVDS data output	
Ct5	D22P	O	LVDS data output	100 Ω terminal
Bt5	D22N	O	LVDS data output	
At5	D21P	O	LVDS data output	100 Ω terminal
Ct4	D21N	O	LVDS data output	
Bt4	LVCK1P	O	LVDS clock output	100 Ω terminal
At4	LVCK1N	O	LVDS clock output	
Ct3	D11P	O	LVDS data output	100 Ω terminal
Bt3	D11N	O	LVDS data output	
At3	D12P	O	LVDS data output	100 Ω terminal
Ct2	D12N	O	LVDS data output	
Bt2	D13P	O	LVDS data output	100 Ω terminal
At2	D13N	O	LVDS data output	
Ct1	DVDD	P	1.2 V digital power supply	Capacity 0.1 μF, 10 μF (±10%) relative to DGND
Bt1	DGND	G	Digital GND	-

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

* Be sure to consider ESD when making system designs. Especially, Pin No. Ht5, Ft4, Gt5.

7. Absolute Maximum Ratings

Table 7-1. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Notes
Power supply voltage 1.2 V	DVDD	-	1.44	V	-
Power Supply voltage 3.3V	AVDDH DVDDH SVDD	-	3.9		-
Input voltage	Digital Input	GND -0.3	DVDDH +0.3		Do not exceed 3.9V
Output voltage 1.2V	Digital Output	GND -0.3	DVDD		Do not exceed 1.44V
Storage Temperature	T_{str}	-30	105	°C	T_a: ambient temperature
Maximum Junction Temperature	T_{jmax}	-	100	°C	T_j: Junction Temperature

8. Recommended Operating Temperature

Table 8-1. Recommended Operating Temperature

Item	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Temperature	T_{opr}	-20	-	80	°C	Tj: Junction Temperature

Typ.: Typical

15. Package Specification

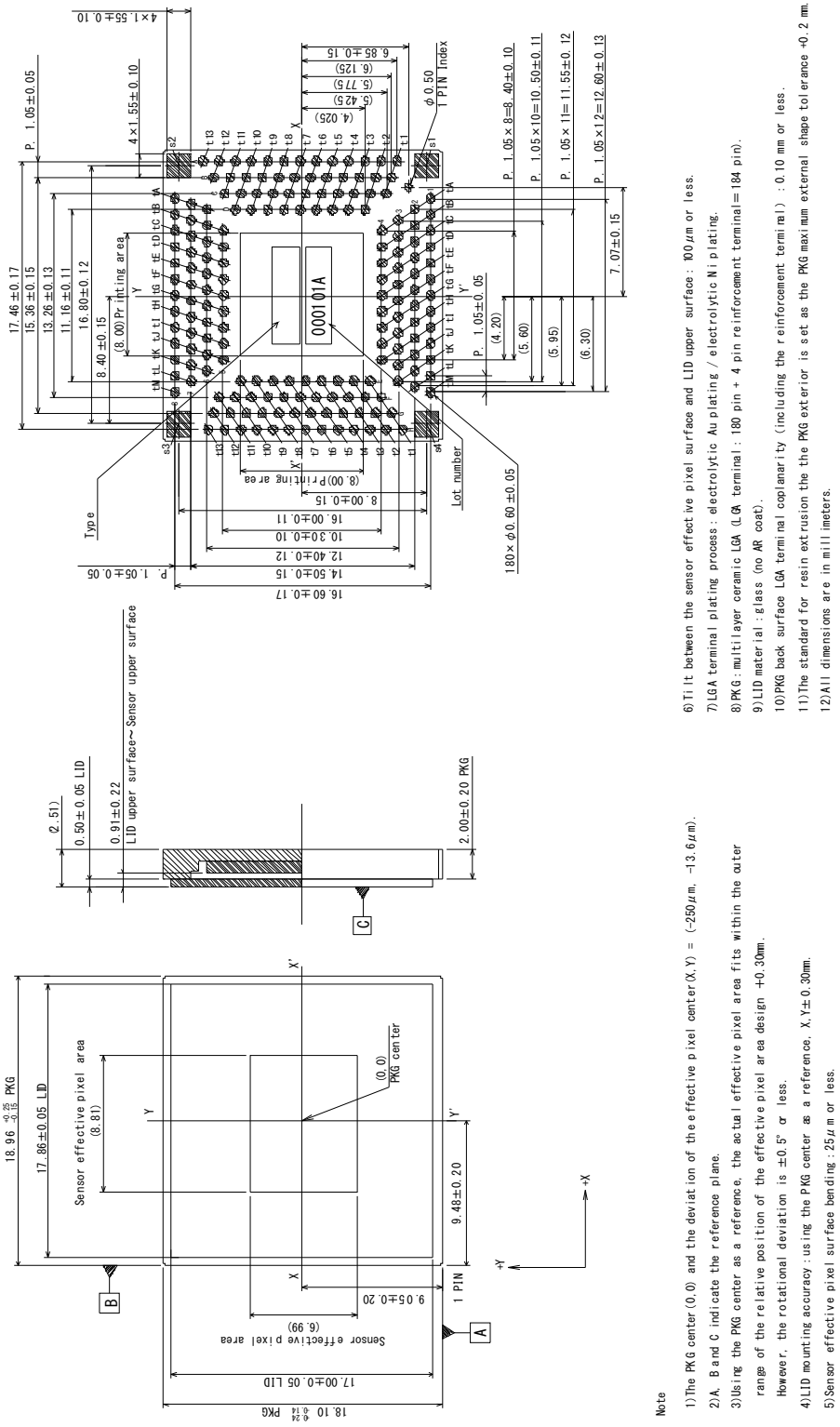


Figure 15-1. Package Specification