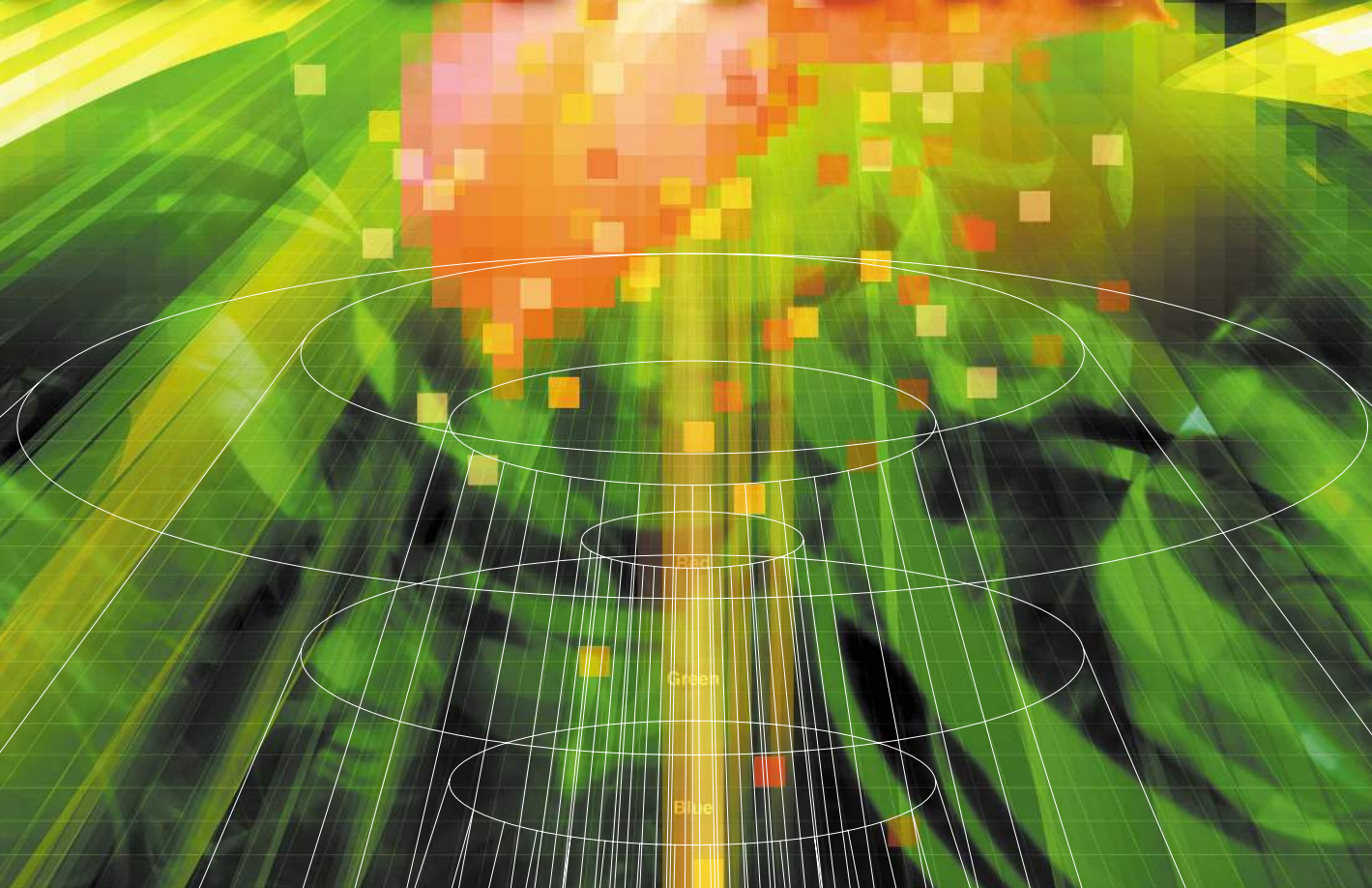


SHARP

CCDs/CMOS IMAGE SENSORS
OCT. 2004

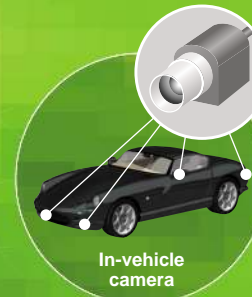
CCD / CMOS
IMAGE SENSOR



Green

Blue

Digital Network



Digital Information Network Sensors that Connect People with Nature : SHARP CCDs and CMOS Image Sensors.

An image sensor that visually captures objects in nature is seen as a key electronics device for the 21st century.

Since the development of such new market applications as incorporation of a camera in cellular phones, camera-equipped cellular phones have become the de facto standard for the industry in recent years.

In addition to increasing the functionality of application products, SHARP has actively worked on market development of devices outside the conventional application range, such as the integration of a cellular phone and a digital camera, as well as of a digital camera and a camcorder.

Recently, since the need for safety-conscious applications has been increasing, SHARP has advanced the development of devices for in-vehicle cameras and security cameras, looking ahead into the future of the market.

SHARP has continued to develop and provide timely image sensor devices by taking advantage of the experience and superior technology we have gained over the years.



CCD / CMOS IMAGE SENSOR

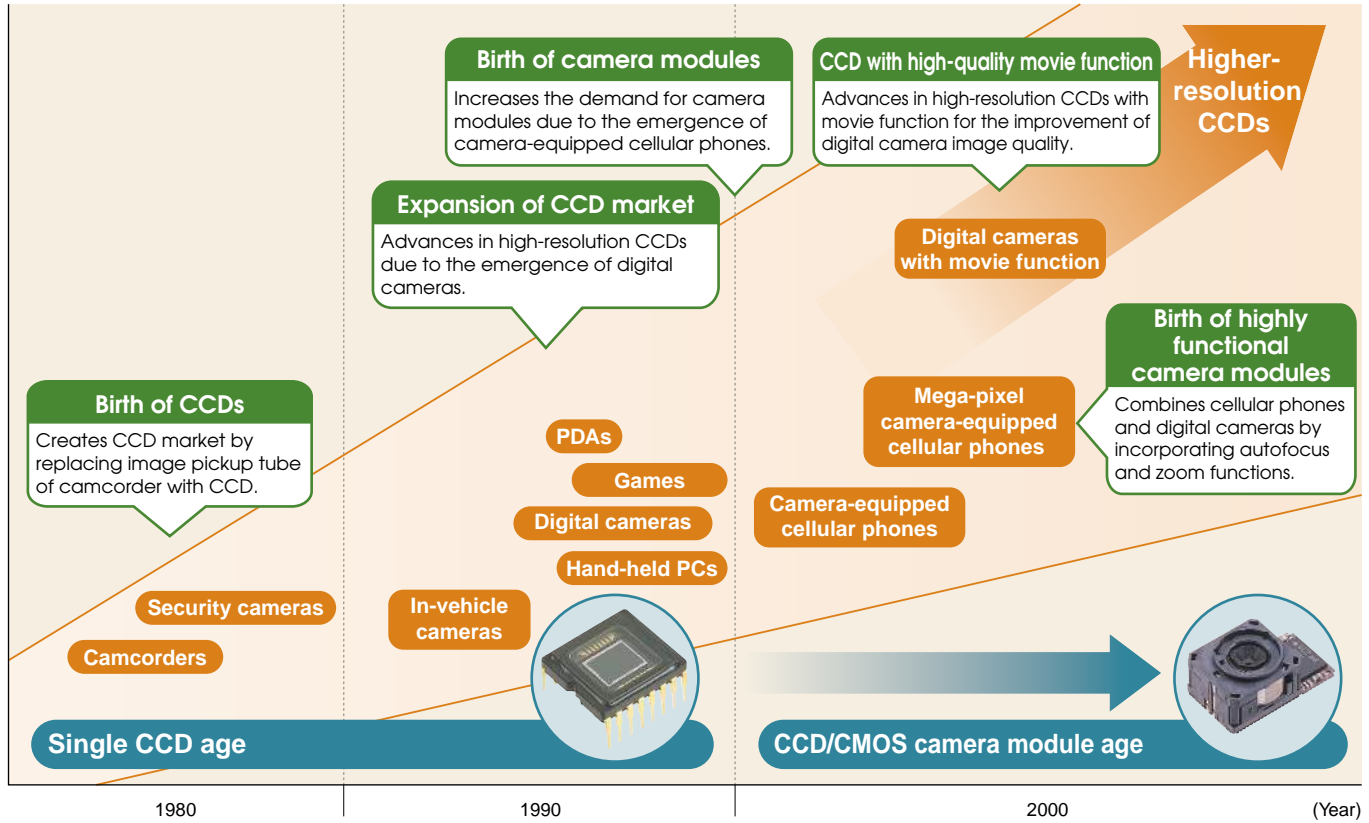
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- 7 ■ CCD Camera Modules for Cellular Phones
- 9 ■ CMOS Camera Modules for Cellular Phones
- 11 ■ CCDs for Digital Cameras
- 13 ■ CCDs for Security Cameras
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SHARP's CCDs and CMOS Image Sensors

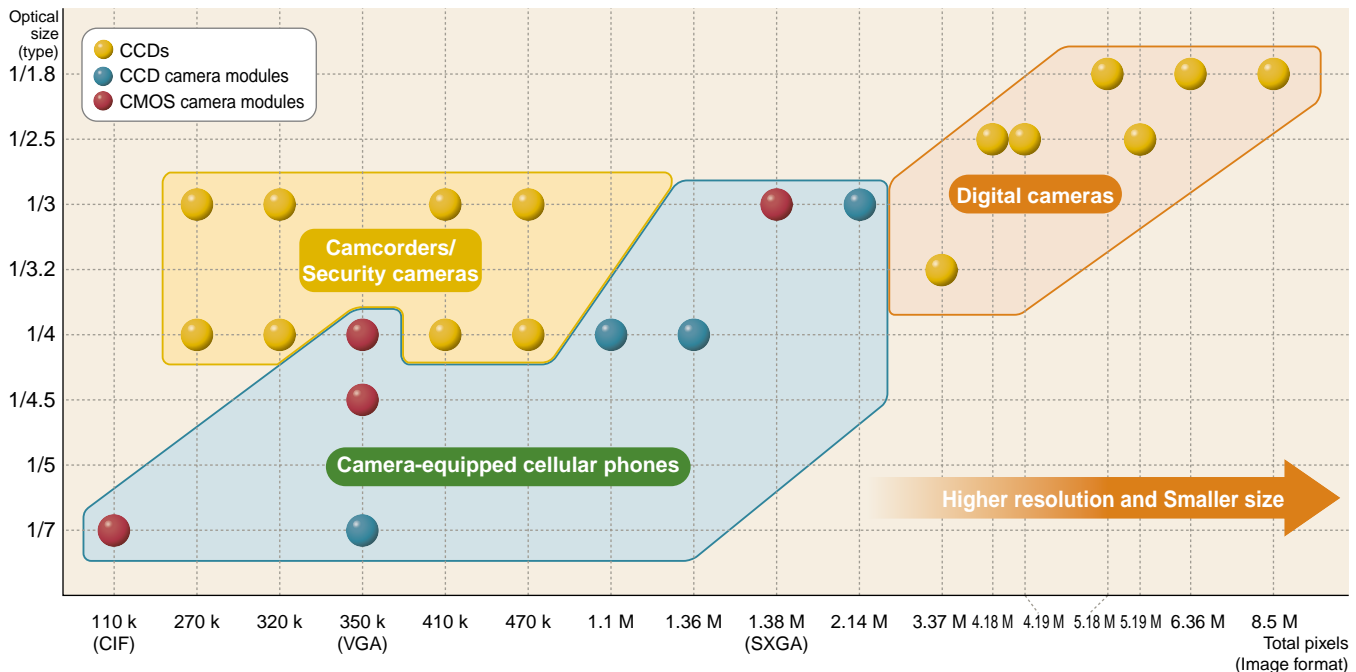
Application Trend

Expansion of Application Range of CCDs and CMOS Image Sensors



Product Lineup

SHARP has developed a varied product lineup of image devices, including compact camera modules in a range from CIF to millions of pixels for cellular phones, higher-resolution CCDs for digital cameras, as well as lower-pixel CCDs for camcorders and security cameras, deploying a wide range of devices suited for wide-ranging applications.



Product Development

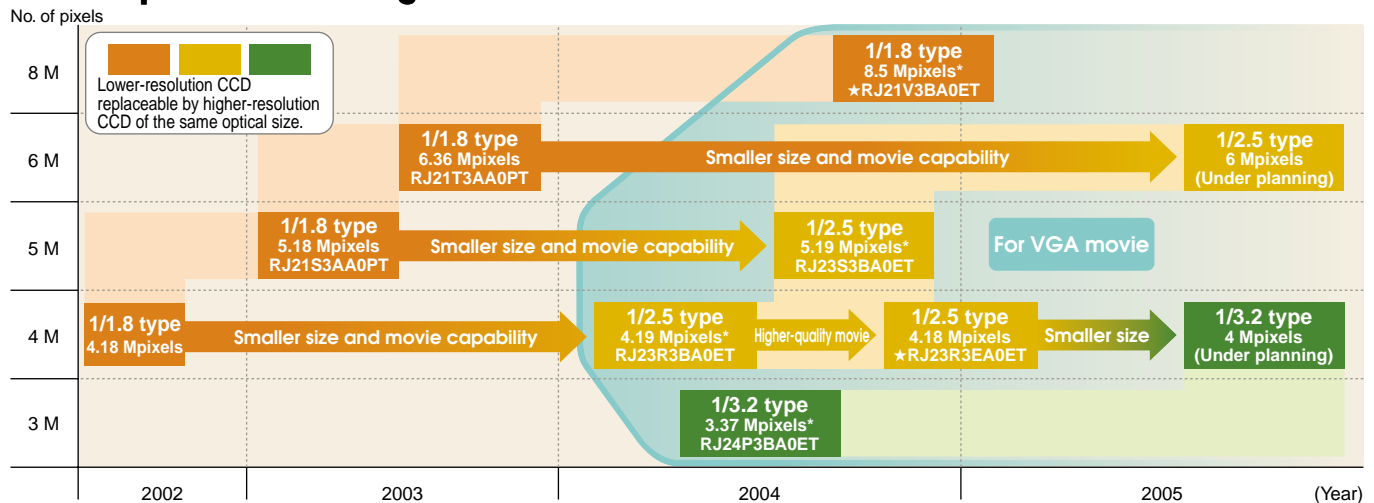
Product Development of Camera Modules

Unit : mm

	110 kpixels	350 kpixels	1.1 Mpixels	1.36 Mpixels	2.14 Mpixels	3 Mpixels	
CCD camera modules		<p>Smaller type 1/7 type 0.45 cc★ 10.4 x 8.0 x (H) 5.4</p> <p>Thinner type 1/7 type 0.60 cc 10.0 x 13.0 x (H) 4.6</p>	<p>1/4 type 1.65 cc Built-in macro function 14.0 x 12.0 x (H) 9.8</p>	<p>Smaller type 1/4 type 1.51cc★ Built-in macro function 12.8 x 12.0 x (H) 9.82</p> <p>Thinner type 1/4 type 1.97 cc Built-in macro function 19.45 x 11.9 x (H) 8.5</p> <p>1/4 type 1.95 cc★ Built-in auto focus function/power supply IC 16.2 x 12.8 x (H) 9.4</p>	<p>1/3 type 2.68 cc Built-in auto focus function 22.0 x 13.0 x (H) 9.38</p> <p>1/3 type 3.34 cc Built-in 2x optical zoom/auto focus functions 18.9 x 9.2 x (H) 19.2</p>	<p>Built-in 2x optical zoom/auto focus functions (Under planning)</p>	
	For high-end mega-pixel camera-equipped cellular phones →						
CMOS camera modules	CIF	VGA	Higher-quality image →		UXGA		
	<p>1/7 type 0.28 cc 7.0 x 6.5 x (H) 6.2</p> <p>1/7 type 0.21 cc 6.5 x 6.5 x (H) 4.9</p> <p>Wider angle lens 1/7 type 0.17 cc 6.5 x 6.5 x (H) 4.1</p>	<p>1/4.5 type 0.40 cc 8.5 x 8.5 x (H) 5.6</p> <p>1/4 type 0.36 cc 8.0 x 8.0 x (H) 5.7</p> <p>1/6 type (Under planning)</p>	<p>1/3 type 0.71 cc★ Built-in macro function 10.0 x 10.0 x (H) 7.1</p>		<p>(Under planning)</p>		

(H) : Maximum height

Development Plan of Higher-resolution CCDs



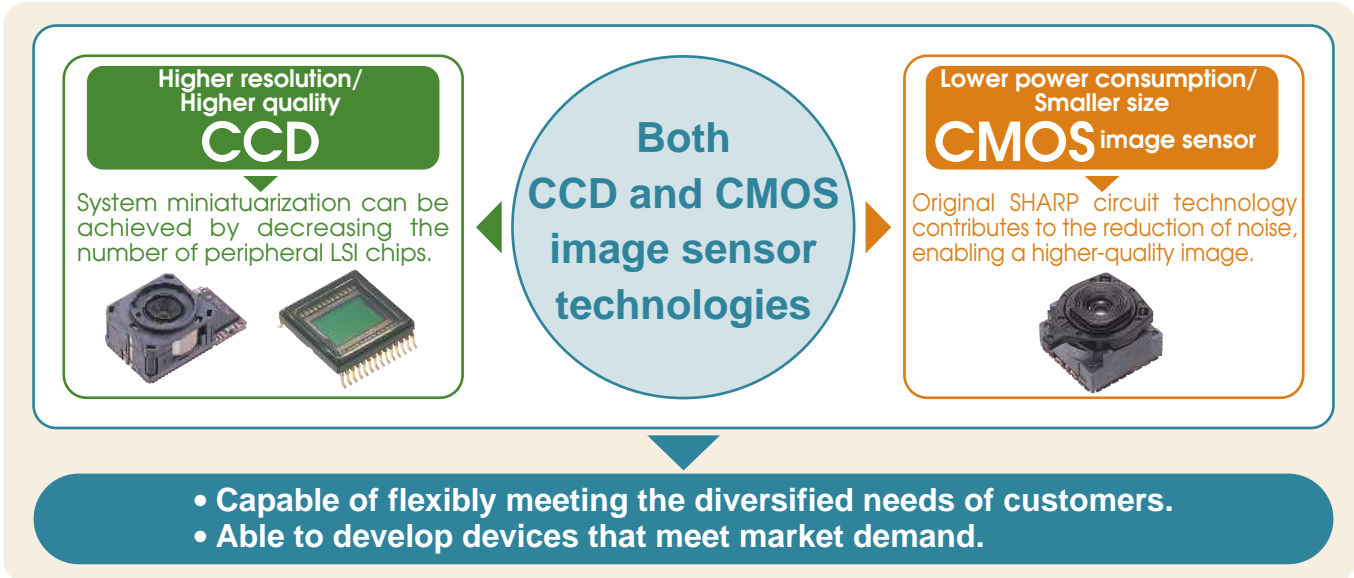
* The device without movie function is also available.

Support Technologies

Technologies that support SHARP's CCDs and CMOS Image Sensors

Both CCD and CMOS image sensor technologies

SHARP has both CCD technology which features higher pixel resolution as well as higher picture quality, and CMOS image sensor technology which features smaller size and lower power consumption, enabling the development of a variety of image sensors, including single CCDs, CCD and CMOS camera modules, to meet a wide range of customer's needs.

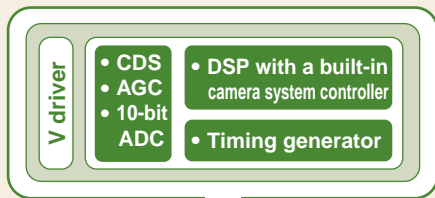


Compact camera system thanks to original SHARP mounting technology

To achieve a compact camera system, SHARP provides a system in combination with peripheral LSIs, such as DSP, timing generator, CDS/PGA/ADC and V driver, together with image sensor, thanks to the employment of original SHARP mounting technology. In addition, a varied lineup of camera modules which integrate an image sensor, a lens and peripheral LSIs are fully developed and can contribute to making cellular phones compact.

Example of CCD camera module structure

Higher quality (high sensitivity/low noise)



Example of CMOS camera module structure

Lower power consumption

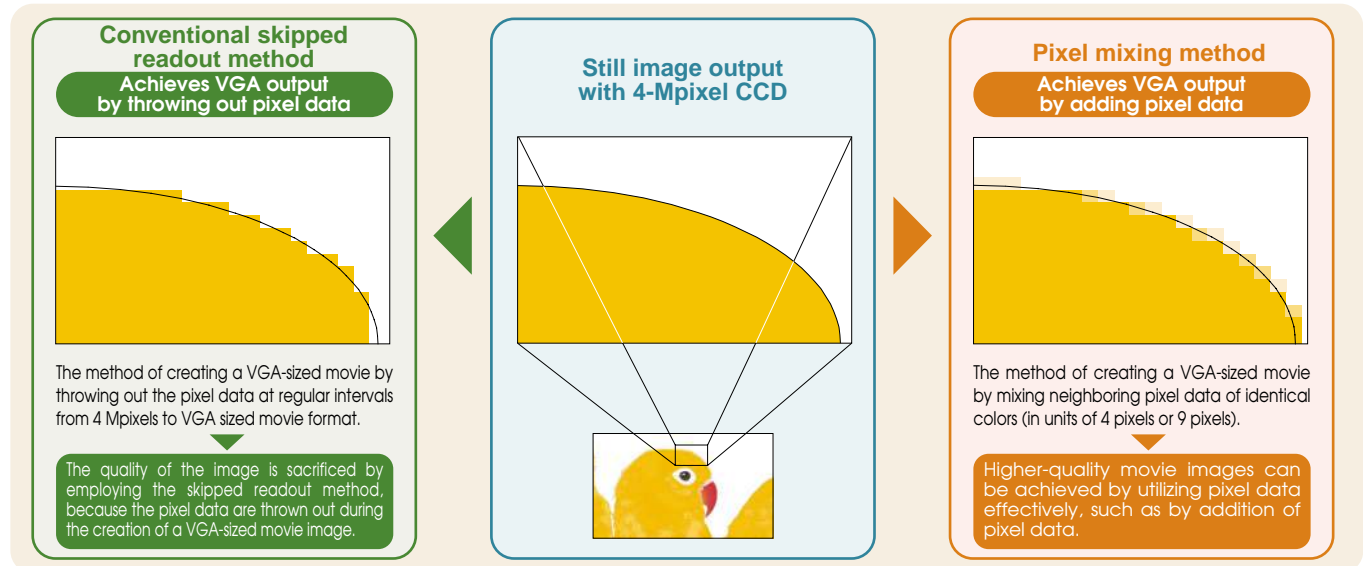
Smaller size



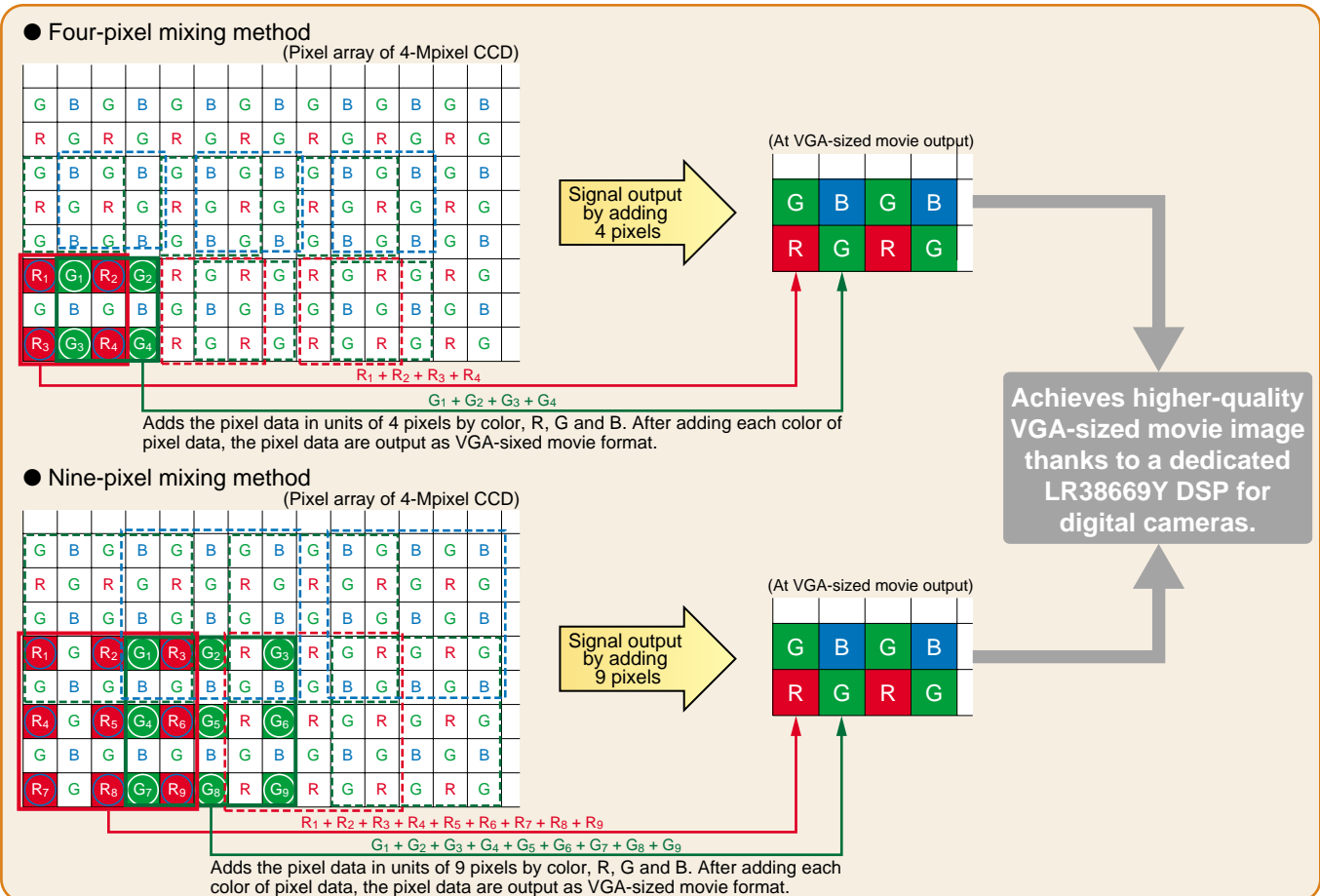
Original SHARP Technology Improves the Movie Performance of Digital Cameras ~Pixel Mixing Technology~

With the improvement of digital camera movie functions, the need for a VGA-sized 30 frames/s movie which is indispensable for displaying natural movies has become increasingly evident. To achieve a 30 frames/s movie output with higher-resolution CCDs, the image data must be read out by adjusting the pixel data to the VGA format.

Now SHARP has achieved the improvement of the movie image, by employing SHARP's original pixel mixing technology, which enables higher-quality VGA-sized 30 frames/s movies, by addition of neighboring pixel data of identical colors and effective utilization of pixel data.



Examples of Pixel Mixing Method



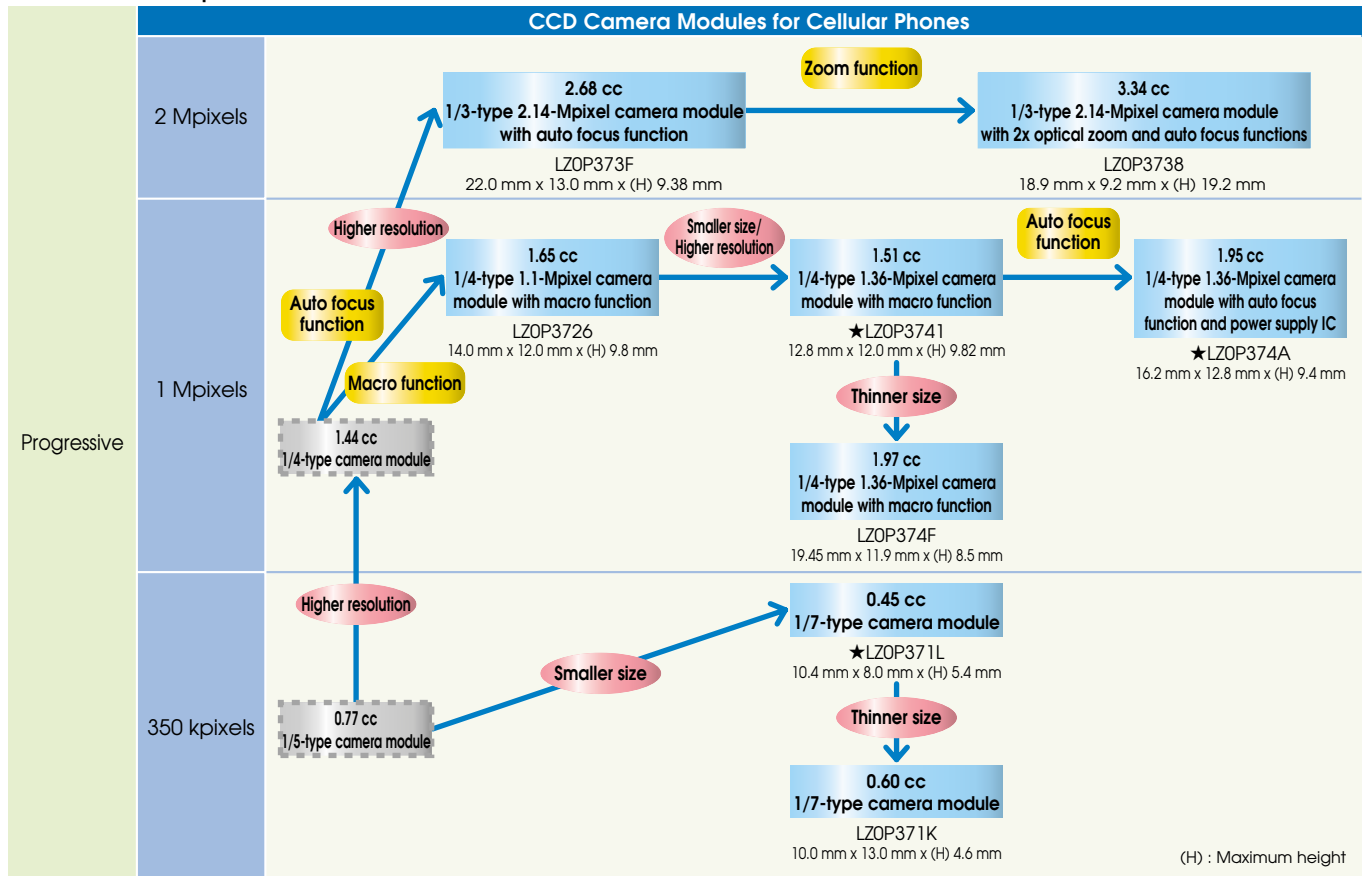
CCD Camera Modules for Cellular Phones

★ Under development

Original SHARP high-density multi-chip mounting technology can help create a CCD camera module which incorporates a CCD, a DSP, a CDS/AGC/ADC, a timing generator, a V driver and a lens. This camera module also enables a single power supply drive, in combination with a dedicated power supply IC.

Road Map

Drive mode No. of pixels



CCD Camera Modules

Model No.	Configuration	Features	Image sensor			Lens			DSP control interface	Output signal	Supply voltage (V)	Power consumption (mW) TYP.	Operating temp. (°C)	Package		
			Optical size	Total pixels	Color filter	Output pixels (H x V) MAX.	F No.	Con-struction							Horizontal viewing angle (°)	
LZOP3738*1	CCD, DSP, CDS/AGC/10-bit ADC, timing generator, V driver, lens, peripheral components	<ul style="list-style-type: none"> 1 632 x 1 224 to SubQCIF 4.7 fps at UXGA/10 fps at VGA (16 Mps MAX.) 2x optical zoom 5x electronic zoom at QVGA size (MAX.) Image inversion function (right and left) 	1/3 type	2.14 M	Primary color mosaic filters	1 632 x 1 224	F3.3 to 4.9	5 pcs.	Wide : 52.6 Tele : 28.4	DSP serial	8-bit parallel, UYVY	-20 to 60	1.8, 3.1, 15, -8	400 [1 200 to 1 300 at motor drive] (at 4.7 fps)	40FPC type*5	
LZOP3738F*1		<ul style="list-style-type: none"> 1 632 x 1 224 to SubQCIF 4.7 fps at UXGA/10 fps at VGA (16 Mps MAX.) 5x electronic zoom at QVGA size (MAX.) Image inversion function (right and left) 											50	1.8, 2.6 to 3.1 (external I/F), 3.1, 15, -8	400 (at 4.7 fps)	63LCC type*6
★LZOP374A*1,*2		<ul style="list-style-type: none"> 1 280 x 960 to SubQCIF 7.5 fps at 1 144 x 880/15 fps at QVGA (16 Mps MAX.) 4x electronic zoom at QVGA size (MAX.) Image inversion function (right and left) 	1/4 type	1.36 M	1 280 x 960	F2.8	3 pcs.	46	3 pcs.	54	3.4 to 4.5	TBD	-20 to 60	3.4 to 4.5	TBD	50LCC type*7
LZOP374F*3		<ul style="list-style-type: none"> 1 144 x 880 to SubQCIF 7.5 fps at 1 144 x 880/15 fps at QVGA (16 Mps MAX.) 3.6x electronic zoom at QVGA size (MAX.) Image inversion function (right and left) 												1.8, 2.6 to 3.1 (external I/F), 3.1, 15, -8	366 (at 7.5 fps)	61LCC type*8
★LZOP3741*3		<ul style="list-style-type: none"> 1 144 x 880 to SubQCIF 7.5 fps at 1 144 x 880/15 fps at QVGA (16 Mps MAX.) 3.6x electronic zoom at QVGA size (MAX.) Image inversion function (right and left) 	1.1 M	1 144 x 880	F2.4	2 pcs.	58	2 pcs.	58	2.5, 3.1, 15, -8	430 (at 7.5 fps)	-20 to 60	-20 to 60	3.4 to 4.5	430 (at 7.5 fps)	54LCC type*9
LZOP3726*3		<ul style="list-style-type: none"> 1 144 x 880 to SubQCIF 7.5 fps at 1 144 x 880/15 fps at QVGA (16 Mps MAX.) 3.6x electronic zoom at QVGA size (MAX.) Image inversion function (right and left) 	350 k	640 x 480*4										36LCC type*10		
LZOP371K		<ul style="list-style-type: none"> VGA/CIF/QVGA/QCIF/SubQCIF 15 fps (12 Mps MAX.) 2x electronic zoom at QVGA size (MAX.) Image inversion function (right and left) 	1/7 type	350 k	640 x 480*4	F2.4	2 pcs.	58	2 pcs.	58	1.8, 3.1, 15, -8	240 (at 12 fps)	-20 to 60	36LCC type*11		
★LZOP371L		<ul style="list-style-type: none"> VGA/CIF/QVGA/QCIF/SubQCIF 15 fps (12 Mps MAX.) 2x electronic zoom at QVGA size (MAX.) Image inversion function (right and left) 	1/7 type	350 k	640 x 480*4	F2.4	2 pcs.	58	2 pcs.	58	1.8, 3.1, 15, -8	240 (at 12 fps)	-20 to 60	36LCC type*12		

*1 Built-in auto focus function *2 Built-in power supply IC *3 Built-in macro function *4 at VGA output *5 Outline dimensions : 18.9 mm x 9.2 mm x 19.2 mm
 *6 Outline dimensions : 22.0 mm x 13.0 mm x 9.38 mm *7 Outline dimensions : 16.2 mm x 12.8 mm x 9.4 mm *8 Outline dimensions : 19.45 mm x 11.9 mm x 8.5 mm
 *9 Outline dimensions : 12.8 mm x 12.0 mm x 9.82 mm *10 Outline dimensions : 14.0 mm x 12.0 mm x 9.8 mm *11 Outline dimensions : 10.0 mm x 13.0 mm x 4.6 mm
 *12 Outline dimensions : 10.4 mm x 8.0 mm x 5.4 mm

■ Power supply ICs for CCDs

Model No.	Features	Output voltage 1 [for CCD](V)	Output voltage 2 [for CCD](V)	Output voltage 3 [for CCD](V)	Output voltage 4 [for DSP](V)	Output voltage 5 [for I/O](V)	Input voltage (V)	Package
IR3M47U6	Multi-output power supply for 1/4-type 1.1-Mpixel CCD camera modules, built-in LED driver for back light/RGB LED driver	15/13	–	–	–	–	2.7 to 3.3	P-VQFN036-0505
IR3M48U6	Multi-output power supply for 1/7-type 350 kpixel CCD camera modules	15	–8	–	1.8	–	2.7 to 3.2	P-VQFN032-0505
IR3M49U6	Multi-output power supply for 1/3-type 2.14-Mpixel, 1/4-type 1.1-Mpixel/1.36-Mpixel CCD camera modules			3.1	1.8/2.5	–	2.7 to 4.5*1	P-VQFN036-0505
★IR3M52Y6	Multi-output power supply for 1/3-type 2.14-Mpixel, 1/4-type 1.1-Mpixel/1.36-Mpixel CCD camera modules			2.5 to 3.3	1.2/1.8	2.5 to 3.3		WL-CSP*2

*1 Since output voltages 3, 4 and 5 are outputs for LDO, an input voltage higher than the output voltages (0.2 to 0.3 V), is required. *2 WL-CSP : Wafer Level CSP

Features of CCD Camera Modules

● Compact profile

Using high-density multi-chip mounting technology, this module integrates a CCD, a DSP, a CDS/AGC/ADC, a timing generator, a V driver and a lens, with the following outline dimensions :

Model No.	Outline dimensions (mm)	Volume (cc)
LZ0P3738	18.9 x 9.2 x (H) 19.2	3.34
LZ0P373F	22.0 x 13.0 x (H) 9.38	2.68
★LZ0P374A	16.2 x 12.8 x (H) 9.4	1.95
LZ0P374F	19.45 x 11.9 x (H) 8.5	1.97
★LZ0P3741	12.8 x 12.0 x (H) 9.82	1.51
LZ0P3726	14.0 x 12.0 x (H) 9.8	1.65
LZ0P371K	10.0 x 13.0 x (H) 4.6	0.60
★LZ0P371L	10.4 x 8.0 x (H) 5.4	0.45

(H) : Maximum height

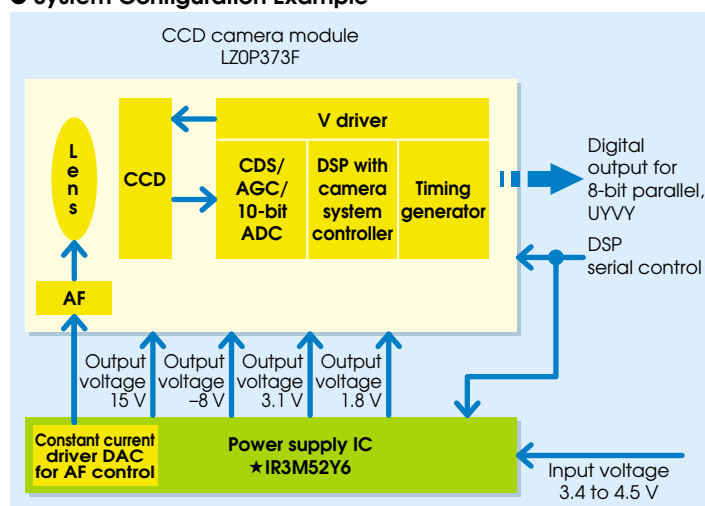
● Single power supply

Capable of being driving by a single power supply, in combination with the following power supply ICs :

Model No.	Recommended power supply IC
LZ0P3738*	★IR3M52Y6
LZ0P373F	
★LZ0P374A*	
LZ0P374F	
★LZ0P3741*	
LZ0P3726	IR3M48U6
LZ0P371K*	
★LZ0P371L*	

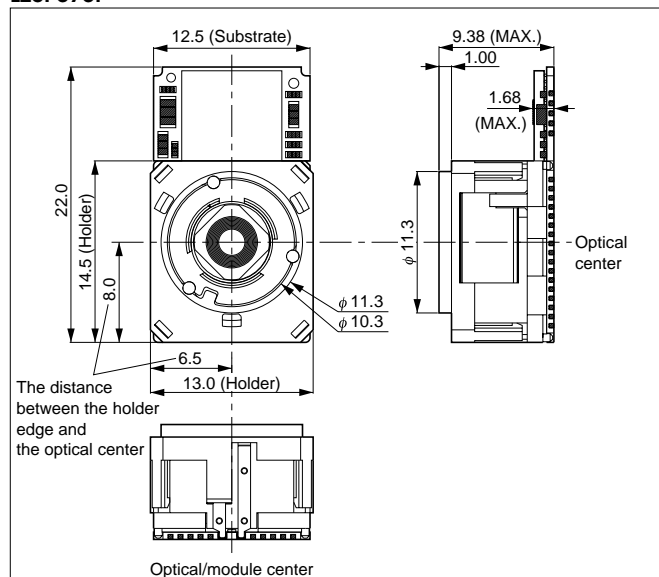
* With a built-in control signal for power supply IC

● System Configuration Example

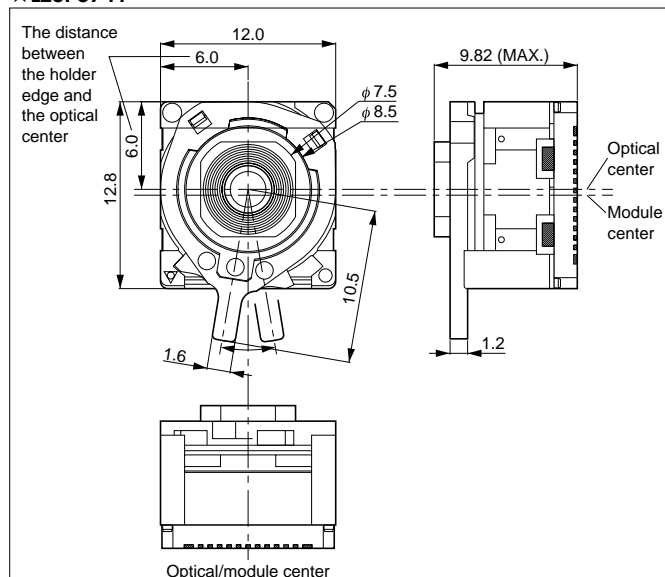


● Dimensions

LZ0P373F



★LZ0P3741



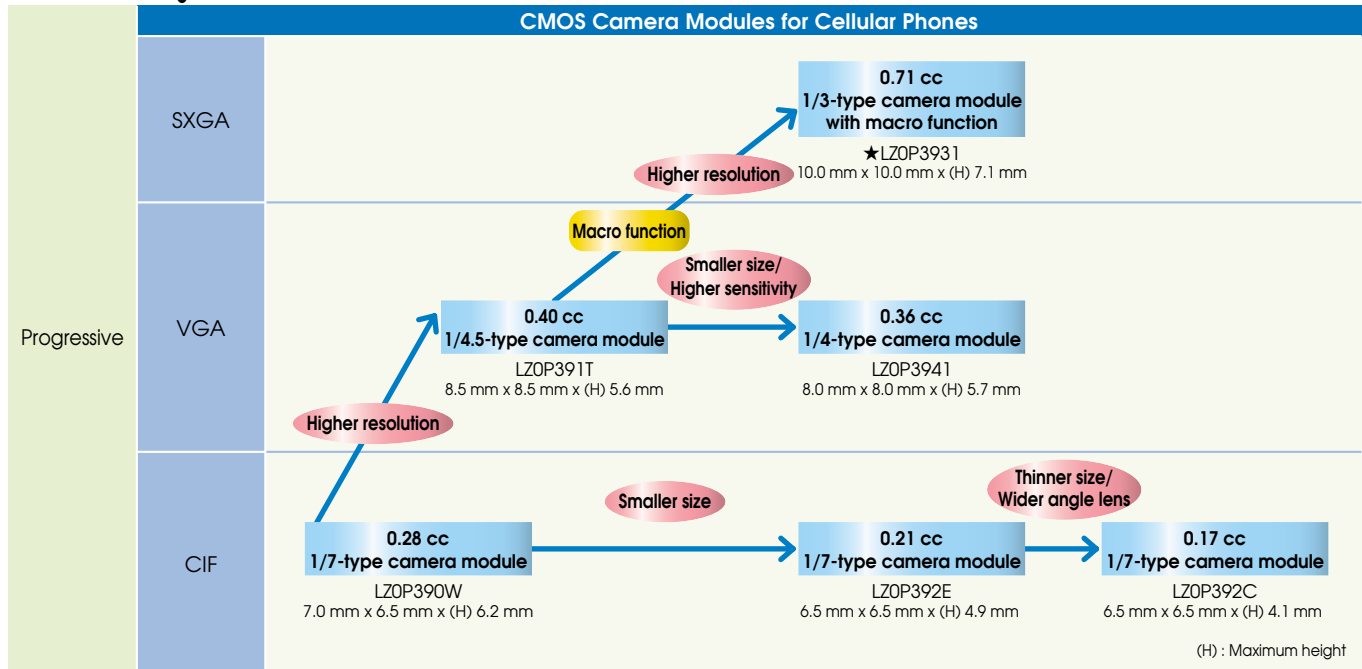
(Unit : mm)

CMOS Camera Modules for Cellular Phones ★ Under development

The CMOS camera module uses original SHARP high-density multi-chip mounting technology to integrate a CMOS image sensor, a DSP, a CDS/AGC/ADC, a timing generator and a lens, to create a super-compact camera module. This module not only reduces the power consumption of equipment, but its compact size also makes it easier to install in cellular phones.

Road Map

Drive mode Image format



CMOS Camera Modules

Model No.	Configuration	Features	Image sensor			Lens			DSP control interface	Output signal	Supply voltage (V)	Power consumption (mW) TYP.	Operating temp. (°C)	Package
			Optical size	Image format	Color filter	Output pixels (H x V) MAX.	F No.	Con-struction						
★LZOP3931	CMOS image sensor, CDS/AGC/10-bit ADC, timing generator, DSP, lens, peripheral components	<ul style="list-style-type: none"> SXGA to SubQCIF 15 fps at SXGA/30 fps at QSXGA (27 Mps MAX.) Macro function 4.2x electronic zoom at QVGA size (MAX.) Image inversion function (right and left) 	1/3 type	SXGA	Primary color mosaic filters	1280 x 1024*1	F2.8	3 pcs.	58	DSP serial	8-bit parallel, UYVY	-20 to 60	28LCC type*4	
LZOP3941		<ul style="list-style-type: none"> VGA to SubQCIF 30 fps at VGA (12 Mps MAX.) 2x electronic zoom at QVGA size Image inversion function (right and left) 	1/4 type	VGA		640 x 480*2	F2.4	2 pcs.	54				2.8 (I/O : 1.8 or 2.8)	170 (at 15 fps)
LZOP391T	CMOS image sensor, CDS/AGC/9-bit ADC, timing generator, DSP, lens, peripheral components	<ul style="list-style-type: none"> VGA/QVGA/QQVGA 30 fps at VGA (13.5 Mps MAX.) 2x electronic zoom at QVGA size Image inversion function (right and left) 	1/4.5 type	VGA	640 x 480*2	F2.4	2 pcs.	51	2.5 (I/O : 2.5 or 3.3)	70 (at 15 fps)	24LCC type*6			
LZOP390W	CMOS image sensor, CDS/AGC/8-bit ADC, timing generator, DSP, lens, peripheral components	<ul style="list-style-type: none"> CIF/QCIF 15 fps at CIF (4.5 Mps MAX.) Image inversion function (right and left) 	1/7 type	CIF	352 x 288*3	F2.8	Single	58	2.8 (I/O : 1.8 or 2.8)	45 (at 15 fps)	30LCC type*7			
LZOP392E	<ul style="list-style-type: none"> CIF/QCIF 30 fps at CIF (9 Mps MAX.) Image inversion function (right and left) 	65										24LCC type*8		
LZOP392C	<ul style="list-style-type: none"> CIF/QCIF 30 fps at CIF (9 Mps MAX.) Image inversion function (right and left) 												24LCC type*9	

*1 at SXGA output *2 at VGA output *3 at CIF output *4 Outline dimensions : 10.0 mm x 10.0 mm x 7.1 mm *5 Outline dimensions : 8.0 mm x 8.0 mm x 5.7 mm
 *6 Outline dimensions : 8.5 mm x 8.5 mm x 5.6 mm *7 Outline dimensions : 7.0 mm x 6.5 mm x 6.2 mm *8 Outline dimensions : 6.5 mm x 6.5 mm x 4.9 mm
 *9 Outline dimensions : 6.5 mm x 6.5 mm x 4.1 mm

Features of CMOS Camera Modules

● Compact profile

Using a high-density multi-chip mounting technology, this module integrates a CMOS image sensor, a DSP, a CDS/AGC/ADC, a timing generator and a lens, with the following outline dimensions :

Model No.	Outline dimensions (mm)	Volume (cc)
★LZ0P3931	10.0 x 10.0 x (H) 7.1	0.71
LZ0P3941	8.0 x 8.0 x (H) 5.7	0.36
LZ0P391T	8.5 x 8.5 x (H) 5.6	0.40
LZ0P390W	7.0 x 6.5 x (H) 6.2	0.28
LZ0P392E	6.5 x 6.5 x (H) 4.9	0.21
LZ0P392C	6.5 x 6.5 x (H) 4.1	0.17

(H) : Maximum height

● Low power consumption

This module achieves the low power consumption stated below. The module also has a standby function.

Model No.	Image format	Power consumption (mW) TYP.
★LZ0P3931	SXGA	170 (at 15 fps)
LZ0P3941	VGA	112 (at 30 fps)
LZ0P391T	CIF	70 (at 15 fps)
LZ0P390W		45 (at 15 fps)
LZ0P392E	CIF	30 (at 15 fps)
LZ0P392C		

● Wide-angle lens ideal for cellular videophones (LZ0P392C)

● Compatible with a variety of image formats

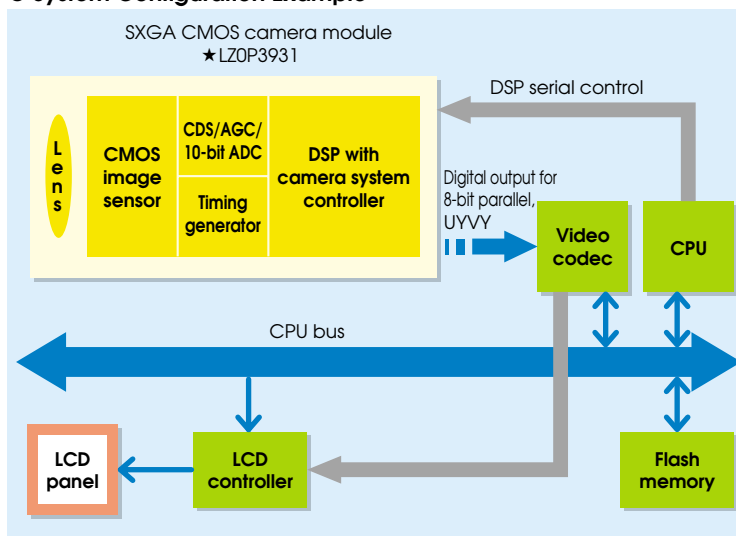
This module can be set for a variety of formats, as described below :

Model No.	Image format
★LZ0P3931	SXGA/XGA/SVGA/VGA/CIF/ QVGA/QCIF/QQVGA/SubQCIF
LZ0P3941	VGA/CIF/QVGA/QCIF/QQVGA/SubQCIF
LZ0P391T	VGA/QVGA/QQVGA
LZ0P390W	CIF/QCIF
LZ0P392E	
LZ0P392C	

< Image format >

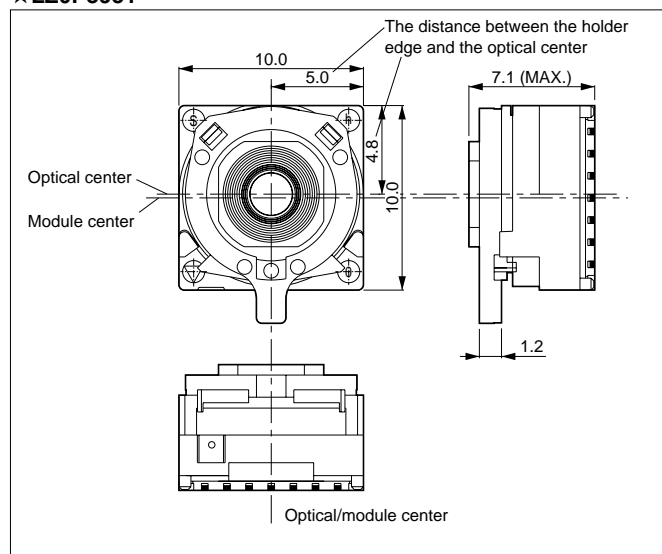
SXGA	: 1 280 x 1 024
XGA	: 1 024 x 768
SVGA	: 800 x 600
VGA	: 640 x 480
CIF	: 352 x 288
QVGA	: 320 x 240
QCIF	: 176 x 144
QQVGA	: 160 x 120
SubQCIF	: 128 x 96

● System Configuration Example

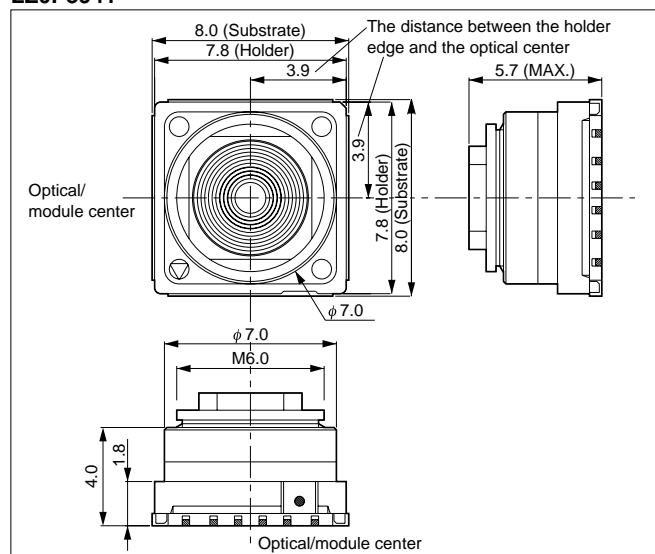


● Dimensions

★LZ0P3931

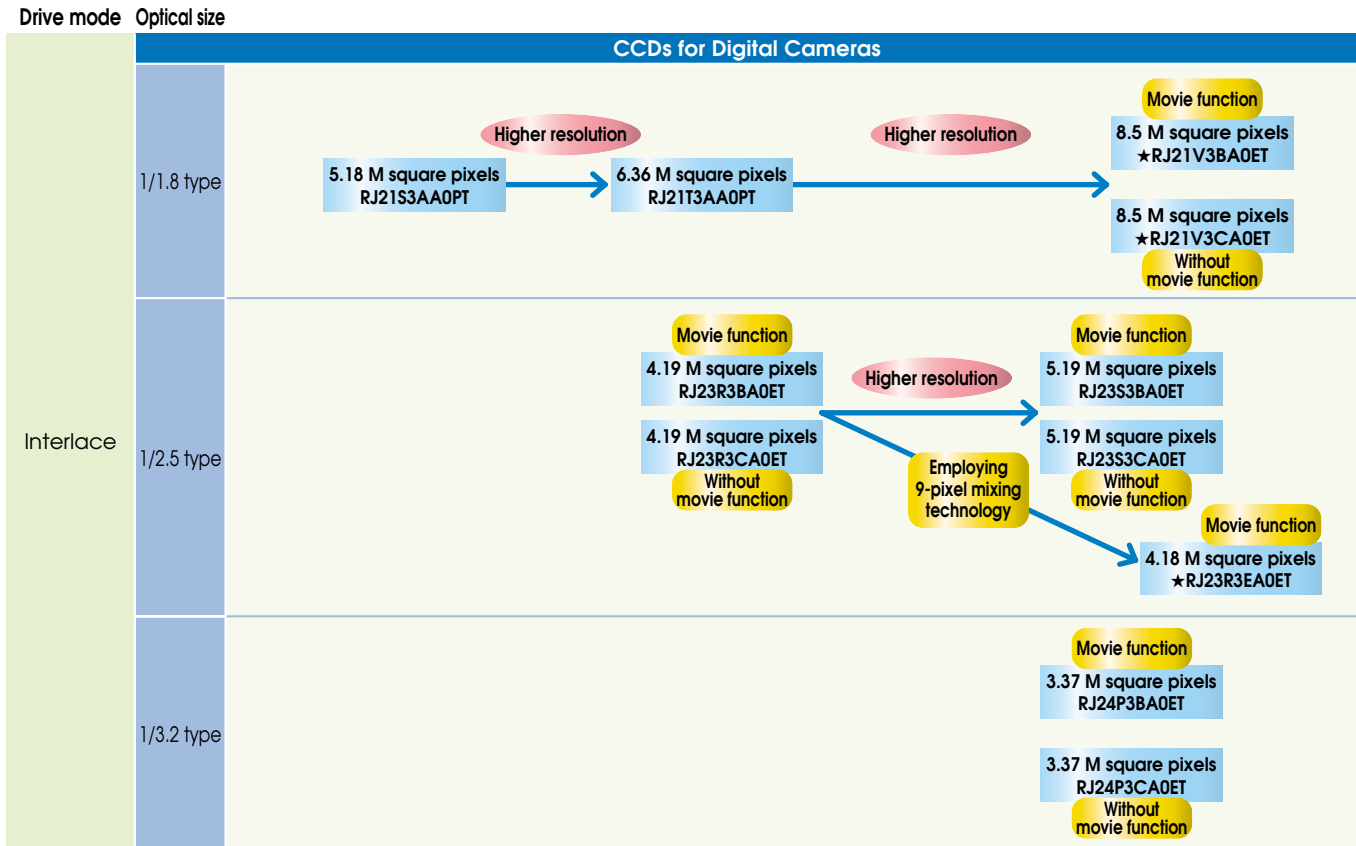


LZ0P3941



(Unit : mm)

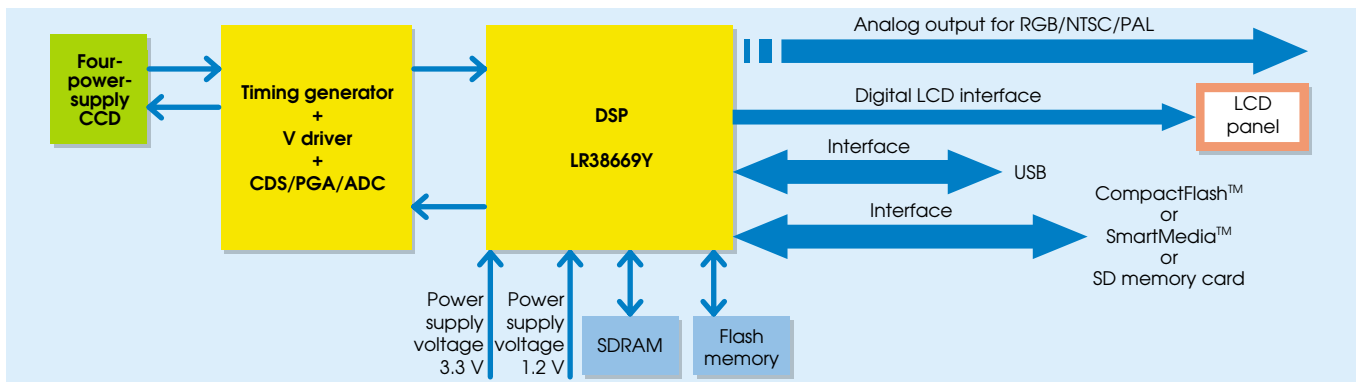
Road Map



High-resolution Digital Camera System with Three-chip Configuration

Selling Points

- Wide range of pixel size from 3.37 Mpixels to 8.5 Mpixels for digital camera system solutions.
- Incorporates JPEG hardware for high-speed photography. Incorporates resize hardware for high-speed zoom.
- Analog output (NTSC/PAL) capability.
- Built-in USB line driver, CompactFlash™/SmartMedia™/SD memory card interface and LCD interface.



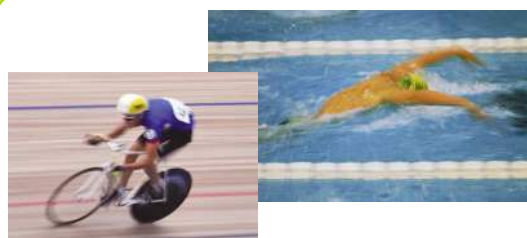
■ Four-power-supply CCDs and peripheral LSIs

CCD			30 fps VGA movie	Timing generator + V driver + CDS/PGA/ADC	DSP	
Interface	1/1.8 type	5.18 Mpixels	RJ21S3AA0PT	—	LR38647	LR38669Y
		6.36 Mpixels	RJ21T3AA0PT	—	LR38649	
		8.5 Mpixels	★RJ21V3BA0ET	○	★LR38674	
	1/2.5 type	4.18 Mpixels	★RJ23R3EA0ET	○	★LR386XX	
		4.19 Mpixels	RJ23R3BA0ET	○	LR38649	
			RJ23R3CA0ET	—		
			RJ23S3BA0ET	○		
		5.19 Mpixels	RJ23S3CA0ET	—	LR38667	
			1/3.2 type	RJ24P3BA0ET	○	
	RJ24P3CA0ET			—		

Features

LR38669Y

- Single-chip signal processor for digital cameras
- Built-in CCD signal processing circuit
- Built-in ARM core
- Ability to process VGA-sized movie at 30 fps with built-in JPEG encoder/decoder



Enables high-quality VGA movies

- Designed for 1.3-Mpixel to 10-Mpixel CCDs
- Support for CCDs with a movie function employing 4-pixel/9-pixel mixing technology
- Built-in memory controller
- Built-in video encoder : analog outputs for RGB/NTSC/PAL
- Built-in USB line driver
- Supports major media interfaces for CompactFlash™/SmartMedia™/SD memory cards
- Supports 4-bit SD bus mode
- Supports several types of LCD digital interfaces, such as an interface for CG silicon LCD panel
- Capable of reducing system power consumption by supporting mobile SDRAM (168 mW in monitoring mode)

- High-performance image-processing capability enables fast shooting interval time for digital cameras : less than 1.0 second at 4-Mpixel CCDs

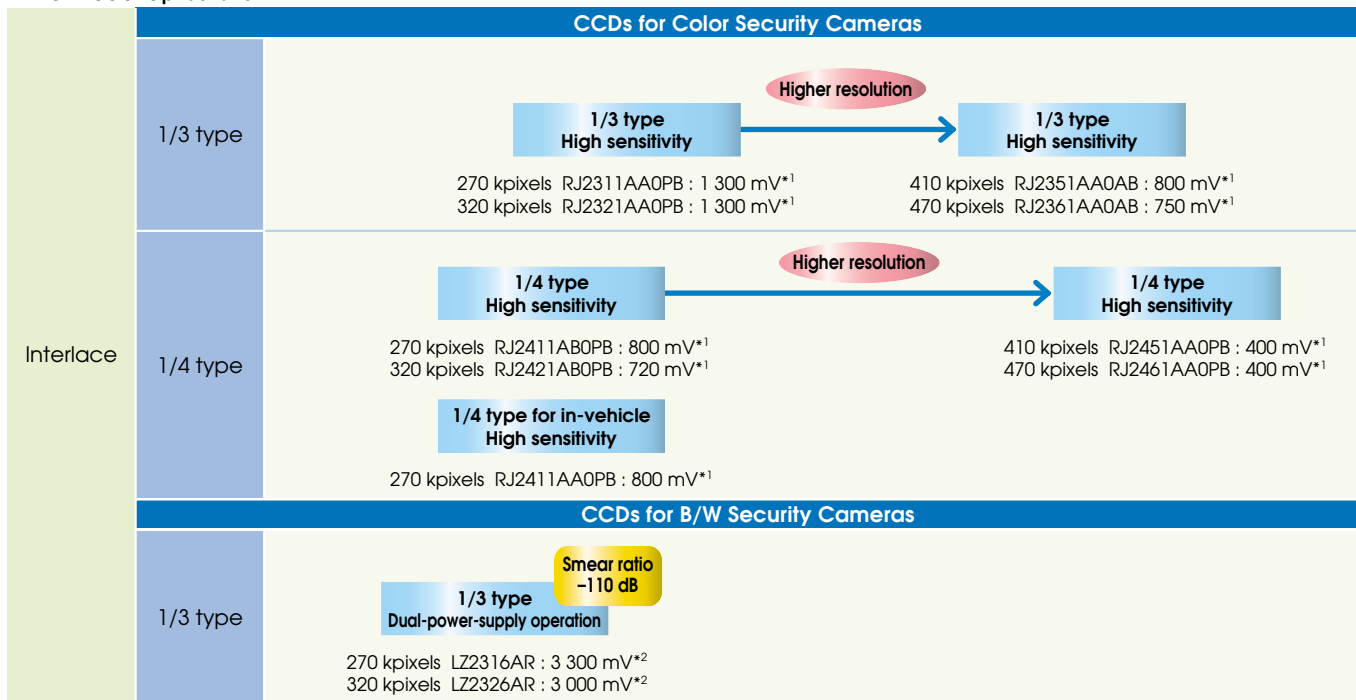


Supports up to 10-Mpixel still images

- Operating frequency : 64 MHz (MAX.)
- Lower voltage operation
 - Analog system : 3.0 to 3.6 V
 - Digital system (IO) : 3.0 to 3.6 V/2.25 to 2.75 V
 - Digital system (Core) : 1.08 to 1.32 V
- Built-in OSD (On Screen Display) function
- Package : 260 CSP

Road Map

Drive mode Optical size

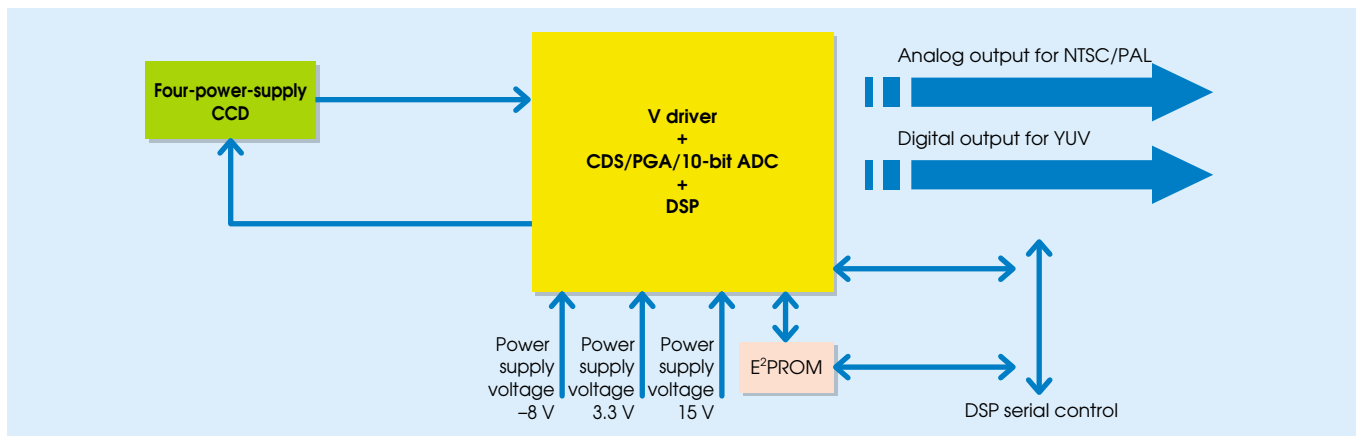


*1 Sensitivity *2 Sensitivity when IR cut-off filter is not used.

Color Security Camera System with Two-chip Configuration

Selling Points

- Analog output (NTSC/PAL) capability.
- Two-chip configuration helps reduce mounting surface area.
- Small optical size contributes to size reduction of camera products.



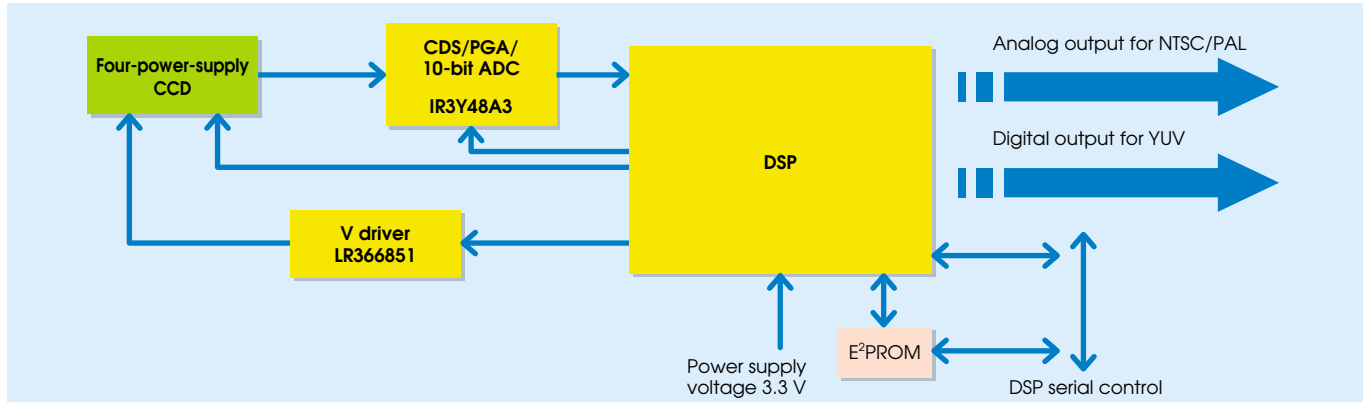
Four-power-supply CCDs and peripheral LSIs

CCD		V driver + CDS/PGA/ADC + DSP	
1/3 type	270 kpixels	RJ2311AA0PB	LR386431/★LR38645
	320 kpixels	RJ2321AA0PB	
	410 kpixels	RJ2351AA0AB	
	470 kpixels	RJ2361AA0AB	
1/4 type		RJ2411AA0PB	
	270 kpixels	RJ2411AB0PB	
	320 kpixels	RJ2421AB0PB	
	410 kpixels	RJ2451AA0PB	
	470 kpixels	RJ2461AA0PB	

■ Color Security Camera System with Four-chip Configuration

Selling Points

- Analog output (NTSC/PAL) capability.
- Camera system with four-chip configuration.
- Small optical size contributes to size reduction of camera products.



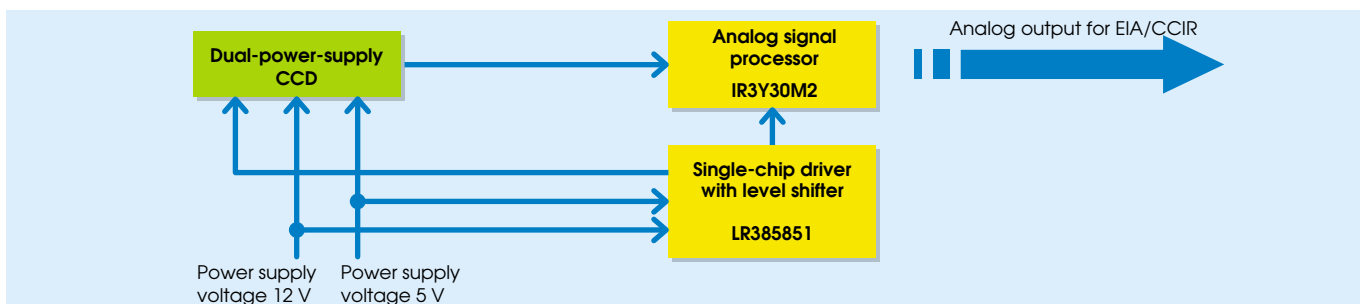
■ Four-power-supply CCDs and peripheral IC/LSIs

CCD		V driver	CDS/PGA/ADC	DSP
1/3 type	270 kpixels	LR366851	IR3Y48A3	LR386032/★LR38607
	320 kpixels			
	410 kpixels			
	470 kpixels			
1/4 type	270 kpixels			
	320 kpixels			
	410 kpixels			
	470 kpixels			

■ B/W Security Camera System

Selling Points

- Analog output (EIA/CCIR) capability.
- Camera system with three-chip configuration.
- High-sensitivity dual-power-supply CCDs make possible size reduction, lower cost and lower power consumption.



■ Dual-power-supply CCDs and peripheral IC/LSI for analog interface

CCD		Single-chip driver (Timing generator + Synchronous signal generator)	Signal processor
1/3 type	270 kpixels	LR385851	IR3Y30M2
	320 kpixels		

Features

LR386032

- Signal processor for 270 k/320 k/410 k/470 k-pixel CCDs
- Built-in 9-bit DAC
- Built-in synchronous signal generation circuit
- Built-in CCD drive timing generator
- Built-in processing circuit for AWB/AE control
- Built-in 2-Kbit E²PROM drive circuit
- Mirror image function
- Digital output for YUV
- Analog output for NTSC/PAL
- Supports monitoring output of IR3Y48A3
- Package : 80 LQFP (pin pitch : 0.5 mm)

■ CCDs

■ Higher-resolution CCDs

Optical size	Total pixels	Color filter	Model No.	30 fps VGA movie	Resolution		Pixel size H x V (μm ²)	Sensitivity (mV) TYP.	Smear ratio (dB) TYP.	Package	
					Image pixels (H x V)						
1/1.8 type	5 180 000	Primary color mosaic filters	RJ21S3AA0PT	-	2 592 x 1 944		2.8 x 2.8	155	-90	P-DIP020-0500	
	6 360 000		RJ21T3AA0PT		2 872 x 2 160		2.5 x 2.5	105			
	8 500 000		★RJ21V3BA0ET	○	3 320 x 2 496		2.2 x 2.2	90	-88	P-SOP032-0525	
			★RJ21V3CA0ET	-							
1/2.5 type	4 180 000	Primary color mosaic filters	★RJ23R3EA0ET	○	2 332 x 1 740		2.5 x 2.5	105	-88	P-SOP028-0400	
	4 190 000		RJ23R3BA0ET								-
			5 190 000	RJ23R3CA0ET	-	2 600 x 1 944		2.2 x 2.2	90		
	RJ23S3BA0ET			○							
	3 370 000		RJ23S3CA0ET	-	2 096 x 1 560		2.2 x 2.2	90	-88		P-SOP028-0400
			RJ24P3BA0ET	○							
RJ24P3CA0ET	-										

■ 1/3-type CCDs

Total pixels	Standard		Model No.	Electronic shutter (s)	Resolution		Pixel size H x V (μm ²)	Sensitivity (mV) TYP.	Smear ratio (dB) TYP.	Package
					Horizontal TV lines	Image pixels (H x V)				
270 000	Color	NTSC	RJ2311AA0PB	1/60 to 1/10 000	330	512 x 492	9.6 x 7.5	1 300	-120	P-DIP016-0500C
320 000		PAL	RJ2321AA0PB	1/50 to 1/10 000		512 x 582	9.6 x 6.3			
410 000		NTSC	RJ2351AA0AB	1/60 to 1/10 000	480	768 x 494	6.4 x 7.5	800	-105	N-DIP016-0450
470 000		PAL	RJ2361AA0AB	1/50 to 1/10 000		752 x 582	6.5 x 6.3			

■ 1/4-type CCDs

Total pixels	Standard		Model No.	Electronic shutter (s)	Resolution		Pixel size H x V (μm ²)	Sensitivity (mV) TYP.	Smear ratio (dB) TYP.	Package
					Horizontal TV lines	Image pixels (H x V)				
270 000	Color	NTSC	RJ2411AA0PB*	1/60 to 1/10 000	330	512 x 492	7.2 x 5.6	800	-105	P-DIP014-0400A
			RJ2411AB0PB							
320 000		PAL	RJ2421AB0PB	1/50 to 1/10 000	480	768 x 494	4.9 x 5.6	400	-90	
			RJ2451AA0PB	1/60 to 1/10 000						
410 000	NTSC									
470 000	PAL		RJ2461AA0PB	1/50 to 1/10 000		752 x 582	5.0 x 4.7			

* For in-vehicle use

■ Dual-power-supply (5 V/12 V) Operation 1/3-type CCDs*¹




Total pixels	Standard		Model No.	Electronic shutter (s)	Resolution		Pixel size H x V (μm ²)	Sensitivity (mV) TYP.	Smear ratio (dB) TYP.	Package
					Horizontal TV lines	Image pixels (H x V)				
270 000	B/W	EIA	LZ2316AR	1/60 to 1/10 000	380	512 x 492	9.6 x 7.5	3 300* ²	-110	N-DIP016-0500C
320 000		CCIR	LZ2326AR	1/50 to 1/10 000		512 x 582	9.6 x 6.3	3 000* ²		

*¹ With mirror image function*² When IR cut-off filter is not used.

■ CCD Peripheral ICs/LSIs

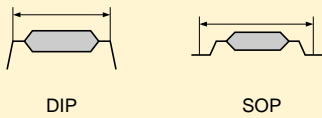
Description	Model No.	Features		Package
Single-chip driver (Timing generator + Synchronous signal generator)	LR385851	For 270-k/320-kpixel CCDs with dual-power-supply operation (5 V/12 V)	Electronic shutter, electronic exposure, mirror image function, for B/W CCDs, level shifter, smooth shutter, line lock	P-QFP048-0707
V driver	LR366851	Vertical pulse driver for CCDs, 2-level output x 2, 3-level output x 4, 2-level output circuit for electronic shutter		P-SSOP024-0275
	LR36687U/Y	Vertical pulse driver for CCDs, 2-level output x 10, 3-level output x 10, 2-level output circuit for electronic shutter		P-VQFN064-0808/ TFBGA068-0606
	LR36688U	Vertical pulse driver for CCDs, 2-level output x 4, 3-level output x 8, 2-level output circuit for electronic shutter		P-VQFN052-0707
Signal processor	IR3Y30M2	Available for signal processing from CCD output to 75 Ω video output, for B/W CCDs, comparator for electronic exposure, high-speed S/H circuit, H aperture, LPF, AGC		P-QFP048-0707
CDS/PGA/ADC	IR3Y48A3	Low power consumption [80 mW (TYP.)], high-speed S/H circuit, high-gain PGA circuit, 10-bit ADC (18 MHz)		P-QFP048-0707
	IR3Y50U6	Low power consumption [75 mW (TYP.)], high-speed S/H circuit, high-gain PGA circuit, 12-bit ADC (25 MHz)		P-VQFN036-0606
	IR3Y51U	Low power consumption [84 mW (TYP.) at 40 MHz, 63 mW (TYP.) at 27 MHz], high-speed S/H circuit, high-gain PGA circuit, 10-bit ADC (40 MHz)		P-VQFN052-0707
Timing generator + V driver + CDS/PGA/ADC	LR38647	For 1/1.8 type 5.18-Mpixel CCD	Timing generator : Monitoring mode/still mode V driver : Vertical pulse driver for CCDs, 2-level output x 2, 3-level output x 4, 2-level output circuit for electronic shutter CDS/PGA/ADC : 40 MHz, high-speed S/H circuit, high-gain PGA circuit, 10-bit ADC	LFBGA160-1010
	LR38649	For 1/1.8 type 6.36-Mpixel CCD, For 1/2.5 type 4.19-Mpixel, 1/3.2 type 3.37-Mpixel CCDs with/without movie function	Timing generator : Monitoring mode/still mode V driver : Vertical pulse driver for CCDs, 2-level output x 2, 3-level output x 4, 2-level output circuit for electronic shutter CDS/PGA/ADC : 25 MHz (LR38649)/ 30 MHz (LR38667/★LR386XX)/ 36 MHz (★LR38674), high-speed S/H circuit, high-gain PGA circuit, 12-bit ADC	LFBGA192-1010
	★LR386XX	For 1/2.5 type 4.18-Mpixel CCD with movie function employing 9-pixel mixing technology		
	LR38667	For 1/2.5 type 5.19-Mpixel CCDs with/without movie function		
★LR38674	For 1/1.8 type 8.5-Mpixel CCDs with/without movie function			
V driver + CDS/PGA/ADC + DSP	LR386431	For 270-k/320-k/410-k/ 470-kpixel CCDs	V driver : Vertical pulse driver for CCDs, 2-level output x 2, 3-level output x 4, 2-level output circuit for electronic shutter CDS/PGA/ADC : 18 MHz, high-speed S/H circuit, high-gain PGA circuit, 10-bit ADC DSP : YUV digital output, NTSC/PAL analog output, mirror image function, 9-bit DAC, synchronous signal generation circuit, CCD drive timing generator, processing circuit for AWB/AE control, supports monitoring output of IR3Y48A3	LFBGA168-1212
	★LR38645		V driver : Vertical pulse driver for CCDs, 2-level output x 2, 3-level output x 4, 2-level output circuit for electronic shutter CDS/PGA/ADC : 18 MHz, high-speed S/H circuit, high-gain PGA circuit, 10-bit ADC DSP : YUV digital output, NTSC/PAL analog output, mirror image function, 9-bit DAC, synchronous signal generation circuit, CCD drive timing generator, processing circuit for AWB/AE control, Y/C separation analog output, line lock function, supports monitoring output of IR3Y48A3	LFBGA180-1212
DSP	LR386032	For 270-k/320-k/410-k/ 470-kpixel CCDs	YUV digital output, NTSC/PAL analog output, mirror image function, 9-bit DAC, synchronous signal generation circuit, CCD drive timing generator, processing circuit for AWB/AE control, supports monitoring output of IR3Y48A3	P-LQFP080-1212
	★LR38607		YUV digital output, NTSC/PAL analog output, mirror image function, 9-bit DAC, synchronous signal generation circuit, CCD drive timing generator, processing circuit for AWB/AE control, Y/C separation analog output, line lock function, supports monitoring output of IR3Y48A3	P-LQFP100-1414
	LR38669Y	For 1.3-M to 10-Mpixel CCDs	CCD signal processing circuit, ARM core, JPEG (hardware), memory controller, video encoder (NTSC/PAL), USB line driver, supports CompactFlash™/SmartMedia™/SD memory card interfaces, 4-bit SD bus mode, supports several types of LCD digital interfaces, support for CCDs with movie function	TFBGA260-1313

■ Packages for CCDs

Package type	Appearance (Package material)	Package code	No. of pins	Pin pitch mm	Nominal dimensions mm (mil)	Package width & length x (seated height) mm [design value]
DIP	 (Plastic)	P-DIP014-0400A	14	1.27	10.16 (400)	10.0 x 10.0
		P-DIP016-0500C	16	1.78	12.7 (500)	12.4 x 14.0
		P-DIP020-0500	20	1.27	12.2	12.0 x 13.8
	 (Ceramic)	N-DIP016-0450	16	1.27	11.43 (450)	11.4 x 12.2
		N-DIP016-0500C		1.78	12.7 (500)	12.4 x 14.0
SOP	 (Plastic)	P-SOP028-0400	28	0.69	10.16 (400)	10.0 x 10.0 x (3.5)
		★P-SOP032-0525	32	0.78	13.3 (525)	12.0 x 13.8 x (3.9)

100 mil = 2.54 mm

Nominal dimensions



DIP : Dual Inline Package
SOP : Small Outline Package

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- CompactFlash is a trademark of SanDisc Corporation.
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CCD Camera Modules

LZ0P371K	7, 8
LZ0P371L	7, 8
LZ0P3726	7, 8
LZ0P3738	7, 8
LZ0P373F	7, 8
LZ0P3741	7, 8
LZ0P374A	7, 8
LZ0P374F	7, 8

Power Supply ICs for CCDs

IR3M47U6	8
IR3M48U6	8
IR3M49U6	8
IR3M52Y6	8

CMOS Camera Modules

LZ0P390W	9, 10
LZ0P391T	9, 10
LZ0P392C	9, 10
LZ0P392E	9, 10
LZ0P3931	9, 10
LZ0P3941	9, 10

CCDs

LZ2316AR	13, 14, 15
LZ2326AR	13, 14, 15
RJ21S3AA0PT	4, 11, 12, 15
RJ21T3AA0PT	4, 11, 12, 15
RJ21V3BA0ET	4, 11, 12, 15
RJ21V3CA0ET	11, 12, 15
RJ2311AA0PB	13, 14, 15
RJ2321AA0PB	13, 14, 15
RJ2351AA0AB	13, 14, 15

RJ2361AA0AB	13, 14, 15
RJ23R3BA0ET	4, 11, 12, 15
RJ23R3CA0ET	11, 12, 15
RJ23R3EA0ET	4, 11, 12, 15
RJ23S3BA0ET	4, 11, 12, 15
RJ23S3CA0ET	11, 12, 15
RJ2411AA0PB	13, 15
RJ2411AB0PB	13, 14, 15
RJ2421AB0PB	13, 14, 15
RJ2451AA0PB	13, 14, 15
RJ2461AA0PB	13, 14, 15
RJ24P3BA0ET	4, 11, 12, 15
RJ24P3CA0ET	11, 12, 15

CCD Peripheral ICs/LSIs

IR3Y30M2	14, 16
IR3Y48A3	14, 16
IR3Y50U6	16
IR3Y51U	16
LR366851	14, 16
LR36687U	16
LR36687Y	16
LR36688U	16
LR385851	14, 16
LR386032	14, 16
LR38607	14, 16
LR386431	13, 16
LR38645	13, 16
LR38647	12, 16
LR38649	12, 16
LR38667	12, 16
LR38669Y	11, 12, 16
LR38674	12, 16
LR386XX	12, 16

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