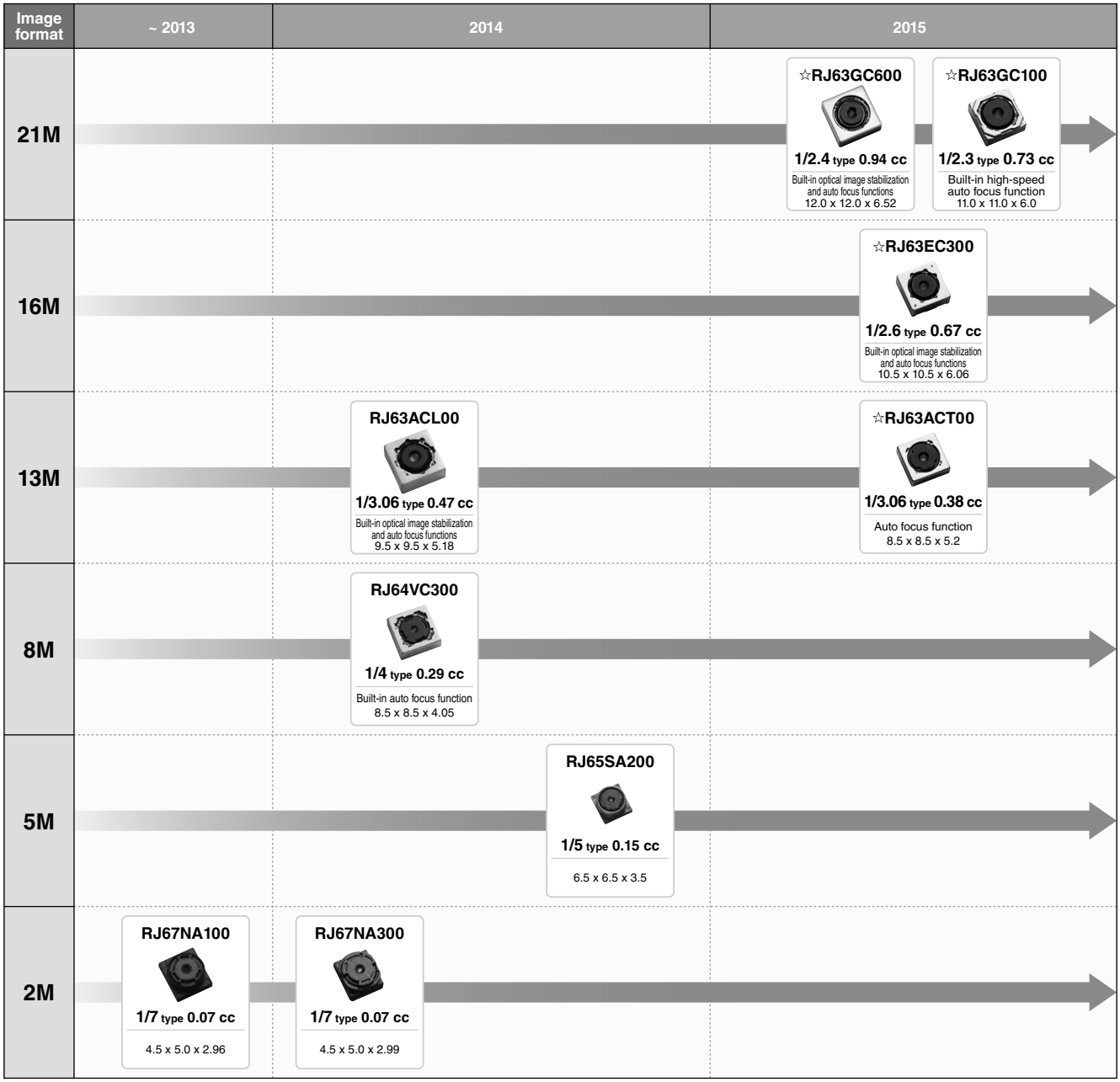
CMOS CAMERA MODULES ROAD MAP

☆New product

■CMOS Camera Modules Road Map



Model No.

Optical format & volume

Outline dimensions (D x W x H) TYP. (mm)

Notice
In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that may occur in equipment using any SHARP devices shown in catalogs, data books, etc.
Except where specially indicated, models listed on this page comply with the RoHS Directive*. For details, please contact SHARP.
*RoHS Directive: Prohibits use of lead, cadmium, hexavalent chromium, mercury and specific brominated flame retardants (PBBs and PBDEs), with certain exceptions.
Contact SHARP in order to obtain the latest device specification sheets before using any SHARP device.

☆New product

■CMOS Camera Modules

Module configuration: CMOS image sensor, CDS/AGC/10-bit ADC, timing generator, DSP, lens
Color filter: R, G, B primary color mosaic filters
Operating temperature: –20 to 60°C

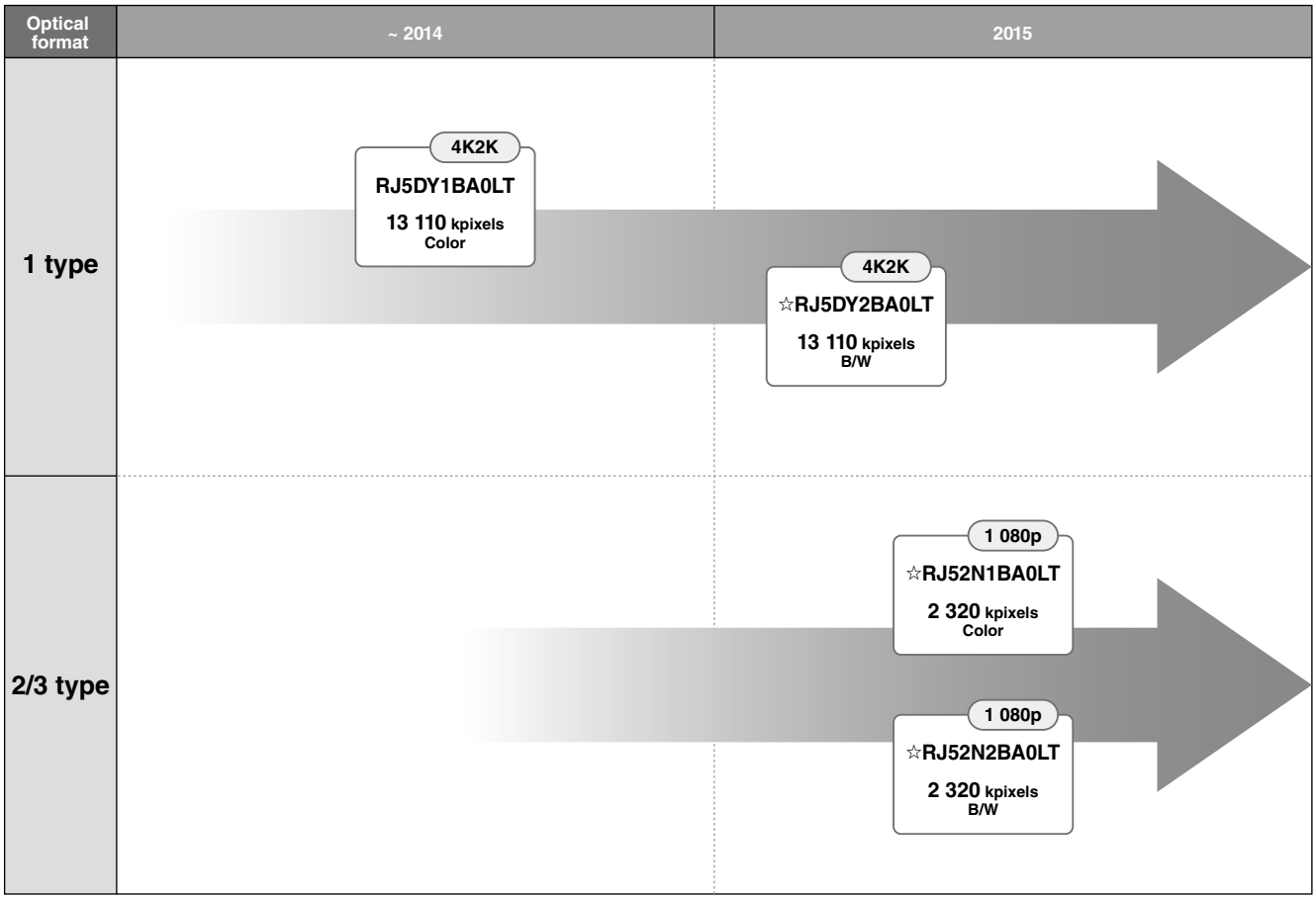
Optical format	Image format	Optical function	Model No.	Video performance	Output pixels (H x V) MAX.	Lens			Output signal	Supply voltage (V) TYP.	Outline dimensions*2 (D x W x H) TYP. (mm)	Package*1
						F No.	Configu-ration	Horizon-tal viewing angle (°)				
1/2.4 type	21M	OIS function, auto focus function	☆RJ63GC600	21M 24 fps 4K2K 30 fps 1 080p 60 fps (Normal/HDR)	5 344 x 4 016	F2.0	6 pcs.	64	RAW (Mipi, 4 lanes)	3.0/2.5/ 1.8/1.1	12.0 x 12.0 x 6.52	FPC type
1/2.3 type	20M	High-speed auto focus function	☆RJ63GC100	20M 12 fps 1 080p 30 fps	5 248 x 3 936	F2.2	5 pcs.	66	RAW (Mipi, 4 lanes)	2.8/2.7/ 1.8/1.0	11.0 x 11.0 x 6.0	
1/2.6 type	16M	OIS function, auto focus function	☆RJ63EC300	16M 30 fps 1 080p 60 fps	5 344 x 3 000	F2.0	6 pcs.	69	RAW (Mipi, 4 lanes)	3.0/2.8/ 1.8/1.05	10.5 x 10.5 x 6.06	
1/3.06 type	13M	OIS function, auto focus function	RJ63ACL00	13M 30 fps (Normal/HDR) 1 080p 60 fps (Normal/HDR)	4 208 x 3 120	F2.0	5 pcs.	64	RAW (Mipi, 4 lanes)	3.0/2.7/ 1.8/1.0	9.5 x 9.5 x 5.18	
		Auto focus function	☆RJ63ACT00	13M 30 fps 1 080p 60 fps	4 208 x 3 120	F2.2	4 pcs.	61		3.0/2.7/ 1.8/1.0	8.5 x 8.5 x 5.2	
1/4 type	8M	Auto focus function	RJ64VC300	1 080p 30 fps	3 264 x 2 448	F2.4	5 pcs.	67	RAW (Mipi, 2 lanes)	2.8/1.8/ 1.2	8.5 x 8.5 x 4.05	
1/5 type	5M	—	RJ65SA200	5M 30 fps 1 080p 60 fps	2 560 x 1 920	F2.2	4 pcs.	77	RAW (Mipi, 2 lanes)	2.8/1.8/ 1.2	6.5 x 6.5 x 3.5	
1/7 type	2M		RJ67NA300	1 080p 60 fps	1 976 x 1 200	F2.4	4 pcs.	80	RAW (Mipi, 2 lanes)	2.8/1.8/ 1.2	4.5 x 5.0 x 2.99	
			RJ67NA100				3 pcs.	61		2.8/1.8/ 1.2	4.5 x 5.0 x 2.96	

*1 Contact a SHARP sales office regarding FPC type package.
*2 Height (H) includes the protruding lens section.

CMOS IMAGE SENSORS FOR DIGITAL CAMERAS/ DIGITAL CAMCORDERS

☆New product

■Road Map for CMOS Image Sensors for Digital Cameras/Digital Camcorders



■CMOS Image Sensors for Digital Cameras/Digital Camcorders

Optical format	Total pixels	Color filter	Model No.	Video performance	Resolution Image pixels (H × V)	Pixel size H × V (μm)	Sensitivity (mV/Lux-sec) TYP.	Package
1 type	13 110 k	R, G, B primary color mosaic filters	RJ5DY1BA0LT	4K2K 60 fps	4 144 × 3 096	3.1 × 3.1	1 420	N-LCC120-R898
		B/W	☆RJ5DY2BA0LT				2 390	
2/3 type	2 320 k	R, G, B primary color mosaic filters	☆RJ52N1BA0LT	1 080p 120 fps	1 984 × 1 116	5.0 × 5.0	3 240	N-LCC120-R898A
		B/W	☆RJ52N2BA0LT				6 080	

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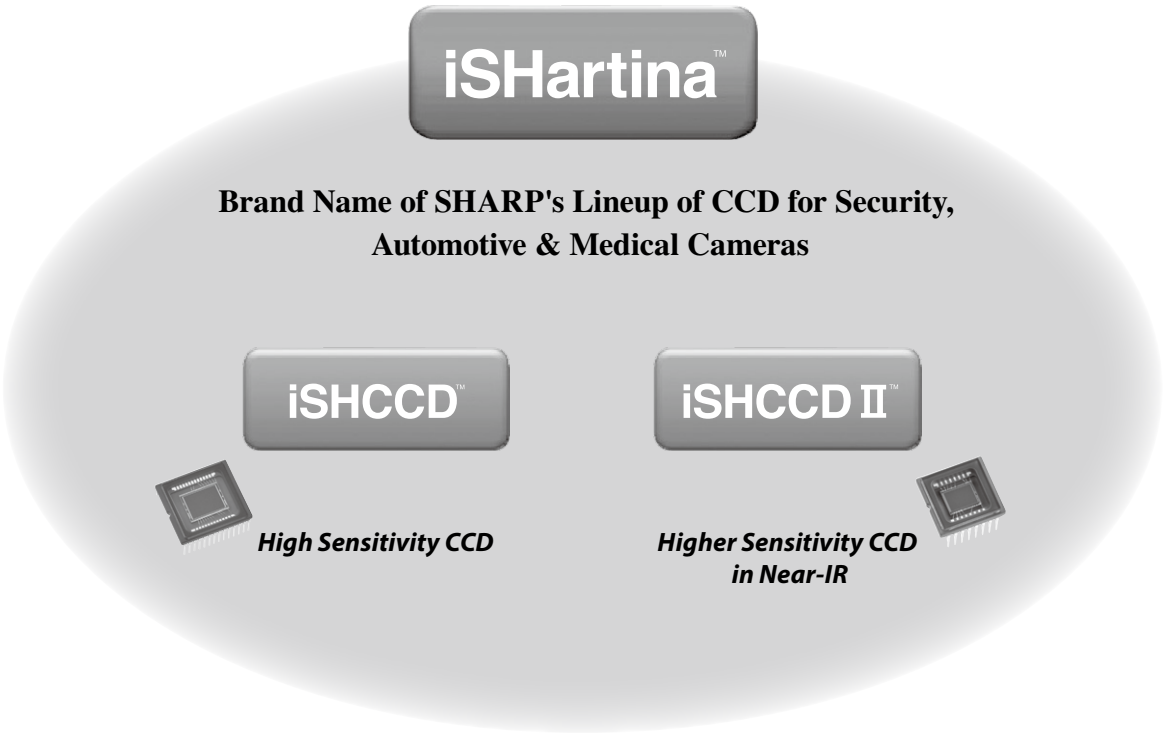
■Image Sensor Related Devices for Security, Automotive and Medical Cameras

Sharp introduces a new line of image sensor related devices for security, automotive and medical cameras under the name of "iSHartina", hoping to provide safety and reassurance with our high-performance devices.

●Brand portfolio



iSHCCD

The "iSHCCD" is the CCD image sensor that introduced high-sensitivity and high-efficiency technologies developed by Sharp.

iSHCCD II

The "iSHCCD II" is an advanced CCD image sensor that drastically improves light efficiency by including the near-infrared light region as a basic structure of "iSHCCD".

☆New product

RoHS

High-Sensitivity Image Sensors for Security Usage

■Progressive CCDs

Optical format	Total pixels	Model No.		Video performance	Color filter	Resolution Image pixels (H x V)	Pixel size H x V (μm)	Sensitivity*1 (mV) TYP.	Smear ratio (dB) TYP.	Package
1/3 type	VGA	☆RJ33B3AA0DT	iSHCCD II	VGA 120 fps (1 ch output)	Primary color	660 x 494	7.4 x 7.4	3 000	–125	P-DIP024-0400
		☆RJ33B4AA0DT			B/W			4 500		
		☆RJ33B3AD0DT		VGA 200 fps (2 ch output)	Primary color			3 000		
		☆RJ33B4AD0DT			B/W			4 500		
	520 k	RJ3331AA0PB	—	NTSC 650 TV lines	Complementary color	976 x 494	5.0 x 7.4	1 500	–120	P-DIP016-0450
	610 k	RJ3341AA0PB	—	PAL 650 TV lines	Complementary color	976 x 582	5.0 x 6.3			
	1 350 k	RJ33J3BA0DT	iSHCCD	1.3M 30 fps 720p 30 fps	Primary color	1 320 x 976	3.75 x 3.75	790	–120	P-DIP024-0400
		RJ33J4BA0DT			B/W			1 190		
		RJ33J3CA0DT	iSHCCD II		Primary color			950		
		RJ33J4CA0DT			B/W			1 430		
	2 170 k	RJ33N3AA0LT	iSHCCD II	1 080p 25 fps	Primary color	1 928 x 1 088	2.8 x 2.8	470	–110	N-LCC040-R350B
		RJ33N4AA0LT			B/W			650		
		RJ33N3AD0LT		1 080p 50 fps (2 ch output)	Primary color			470		
		RJ33N4AD0LT			B/W			650		
1/2.5 type	2 980 k	☆RJ33P3AA0LT	iSHCCD II	3M 17 fps	Primary color	1 984 x 1 504	2.9 x 2.9	470	–110	
		☆RJ33P4AA0LT			B/W			650		
1/2 type	2 170 k	RJ31N3EA0DT	iSHCCD II	1 080p 25 fps	Primary color	1 928 x 1 088	3.65 x 3.65	750	–115	
		RJ31N4EA0DT			B/W			1 150		
		RJ31N3ED0DT		1 080p 50 fps (2 ch output)	Primary color			750		
		RJ31N4ED0DT			B/W			1 150		
1/1.8 type	2 100 k	RJ31N3AA0DT	iSHCCD	2M 25 fps	Primary color	1 644 x 1 236	4.4 x 4.4	1 100	–120	P-DIP028-0566
		RJ31N4AA0DT			B/W			1 650		
	2 130 k	RJ31N3AD0DT	iSHCCD	2M 50 fps (2 ch output)	Primary color			1 100		
		RJ31N4AD0DT			B/W			1 650		
	2 960 k	RJ31P3AA0DT	iSHCCD II	2.8M 17 fps	Primary color	1 940 x 1 460	3.69 x 3.69	750	–115	
		RJ31P4AA0DT			B/W			1 150		
		RJ31P3AD0DT		2.8M 30 fps (2 ch output)	Primary color			750		
		RJ31P4AD0DT			B/W			1 150		

*1 The average G signal output voltage (the average output voltage in the case of the complementary color filter) when a 1,000-lux light source with a 90% reflector is imaged by a lens of F4 at 1/30 sec (1/25 sec in the case of RJ3341AA0PB) frame accumulation.

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iSHCCD II: The "iSHCCD II" is an advanced CCD image sensor that drastically improves light efficiency by including the near-infrared light region as a basic structure of "iSHCCD".

☆New product

RoHS

■Progressive CCDs (cont'd)

Optical format	Total pixels	Model No.		Video performance	Color filter	Resolution Image pixels (H x V)	Pixel size H x V (μm)	Sensitivity*1 (mV) TYP.	Smear ratio (dB) TYP.	Package
2/3 type	5 240 k	RJ32S3AA0DT	iSHCCD	5M 9 fps	Primary color	2 456 x 2 058	3.45 x 3.45	530	–110	P-DIP028-0566
		RJ32S4AA0DT			B/W			800		
		RJ32S3AD0DT		5M 15 fps (2 ch output)	Primary color			530		
		RJ32S4AD0DT			B/W			800		
		RJ32S3AF0DT	iSHCCD II	5M 30 fps (4 ch output)	Primary color	2 456 x 2 056		580	–110	P-DIP064-1000
		RJ32S4AF0DT			B/W			870		
1/1 type	6 090 k	RJ3DT3AA0DT	iSHCCD II	6M 8 fps (1 ch output)	Primary color	2 758 x 2 208	4.54 x 4.54	1 150	–125	P-DIP064-1000
		RJ3DT4AA0DT			B/W			1 750		
		RJ3DT3AD0DT		6M 15 fps (2 ch output)	Primary color			1 150		
		RJ3DT4AD0DT			B/W			1 750		
		RJ3DT3AF0DT		6M 30 fps (4 ch output)	Primary color			1 150		
		RJ3DT4AF0DT			B/W			1 750		
	8 290 k	☆RJ3DV3AF0DT	iSHCCD II	8M 25 fps (4 ch output)	Primary color	3 320 x 2 496	3.88 x 3.88	750	–120	
		☆RJ3DV4AF0DT			B/W			1 100		

*1 The average G signal output voltage (the average output voltage in the case of the complementary color filter) when a 1,000-lux light source with a 90% reflector is imaged by a lens of F4 at 1/30 sec (1/25 sec in the case of RJ3341AA0PB) frame accumulation.

iSHCCD: The "iSHCCD" is the CCD image sensor that introduced high-sensitivity and high-efficiency technologies developed by Sharp.
iSHCCD II: The "iSHCCD II" is an advanced CCD image sensor that drastically improves light efficiency by including the near-infrared light region as a basic structure of "iSHCCD".

■ 1/3-type CCDs

Total pixels	Standard		Model No.		Resolution Horizontal TV lines	Resolution Image pixels (H x V)	Pixel size H x V (μm)	Sensitivity*1 (mV) TYP.	Smear ratio (dB) TYP.	Package
270 k	Color	NTSC	RJ2315EA0PB	iSHCCD	330	512 x 492	9.6 x 7.5	4 200	–140	P-DIP016-0450
			RJ2315FA0PB	iSHCCD II				4 500		
320 k		PAL	RJ2325EA0PB	iSHCCD		512 x 582	9.6 x 6.34	4 200		
			RJ2325FA0PB	iSHCCD II				4 500		
410 k		NTSC	RJ2355DA0PB	iSHCCD	480	768 x 494	6.4 x 7.5	2 700	–135	
			RJ2355EA0PB	iSHCCD II				3 000		
470 k		PAL	RJ2365DA0PB	iSHCCD		752 x 582	6.53 x 6.39	2 700		
			RJ2365EA0PB	iSHCCD II				3 000		
520 k		NTSC	RJ2331BA0PB	iSHCCD	650	976 x 494	5.0 x 7.4	2 400	–125	
			RJ2331CA0PB	iSHCCD II				2 600		
610 k		PAL	RJ2341BA0PB	iSHCCD		976 x 582	5.0 x 6.3	2 400		
			RJ2341CA0PB	iSHCCD II				2 600		

*1 The average output voltage measured when imaging a 90% reflector illuminated by a 1,000-lux light source through an optical system set at an f number of F4.0.

iSHCCD: The "iSHCCD" is the CCD image sensor that introduced high-sensitivity and high-efficiency technologies developed by Sharp.
iSHCCD II: The "iSHCCD II" is an advanced CCD image sensor that drastically improves light efficiency by including the near-infrared light region as a basic structure of "iSHCCD".

RoHS

■ 1/4-type CCDs

Total pixels	Standard		Model No.		Resolution		Pixel size H x V (µm)	Sensitivity*1 TYP. (mV)	Smear ratio TYP. (dB)	Package
					Horizontal TV lines	Image pixels (H x V)				
270 k	Color	NTSC	RJ2411FA0PB	—	330	512 x 492	7.2 x 5.6	1 800	–130	P-DIP014-0400A
320 k		PAL	RJ2421FA0PB	—		512 x 582	7.2 x 4.73	1 650		
410 k		NTSC	RJ2455DA0PB	iSHCCD	480	768 x 494	4.9 x 5.6	1 350	–120	
470 k		PAL	RJ2465DA0PB	iSHCCD		752 x 582	5.0 x 4.77			
520 k		NTSC	RJ2431AA0PB	iSHCCD	650	976 x 494	3.75 x 5.56	1 400		
610 k		PAL	RJ2441AA0PB	iSHCCD		976 x 582	3.75 x 4.47			

*1 The average output voltage measured when imaging a 90% reflector illuminated by a 1,000-lux light source through an optical system set at an f number of F4.0.

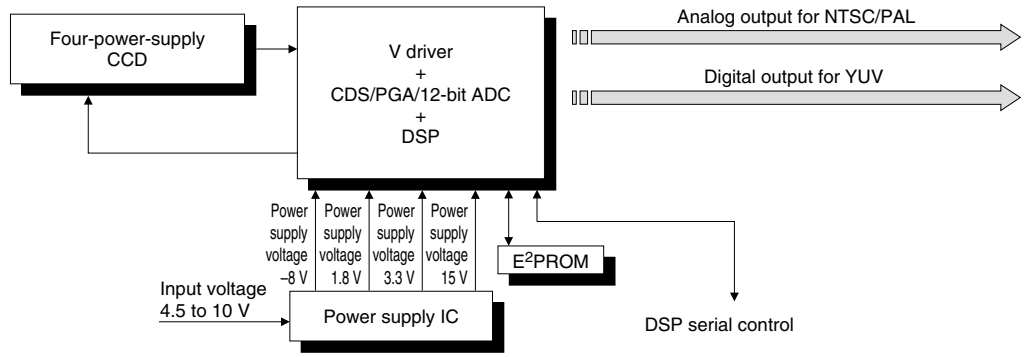
iSHCCD: The “iSHCCD” is the CCD image sensor that introduced high-sensitivity and high-efficiency technologies developed by Sharp.

■ DSPs for CCDs

Description	Model No.	Features		Package
V driver + CDS/PGA/ADC + DSP	LR38653	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 2, 2-level output circuit for electronic shutter <CDS/PGA/ADC> 25 MHz, high-speed S/H circuit, high-gain PGA circuit, 12-bit ADC <DSP> 10-bit DAC, synchronous signal generation circuit, CCD drive timing generator, AE control function, AWB control function, lens shading correction function, auto white blemish compensation function, mirror image function, YUV digital output, NTSC/PAL analog output	P-LFBGA171-0811
	LR38654	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 2, 2-level output circuit for electronic shutter <CDS/PGA/ADC> 25 MHz, high-speed S/H circuit, high-gain PGA circuit, 12-bit ADC <DSP> 10-bit DAC, synchronous signal generation circuit, CCD drive timing generator, AE control function, AWB control function, lens shading correction function, auto white blemish compensation function, mirror image function, electronic optical axis adjustment function, YUV digital output, NTSC/PAL analog output	P-LFBGA171-0811
CDS/PGA/ADC + DSP	LR36B16	For 270-k/320-k/410-k/470-k/ 520-k/610-kpixel CCDs	<CDS/PGA/ADC> High-speed S/H circuit, high-gain PGA circuit, 12-bit ADC <DSP> 75-ohm video amplifier, mechanical iris control function, 10-bit DAC, synchronous signal generation circuit, CCD drive timing generator, AE control function, AWB control function, LED light control function, DWDR (gamma transition function), lens shading correction function, auto white blemish compensation function, mirror image function, OSD function (5 languages: En., Ch., Fr., Por., Sp.), privacy mask function, highlight compensation, motion detection function, 2D noise reduction, high resolution function, AF detection value output, NTSC/PAL analog output, Y/C analog output, UYVY digital output (ITU-R BT656 compatible)	P-HQFN072-1010

●System Configuration Examples

<Color Security Camera System with Two-chip Configuration [Low Power Consumption Type]>

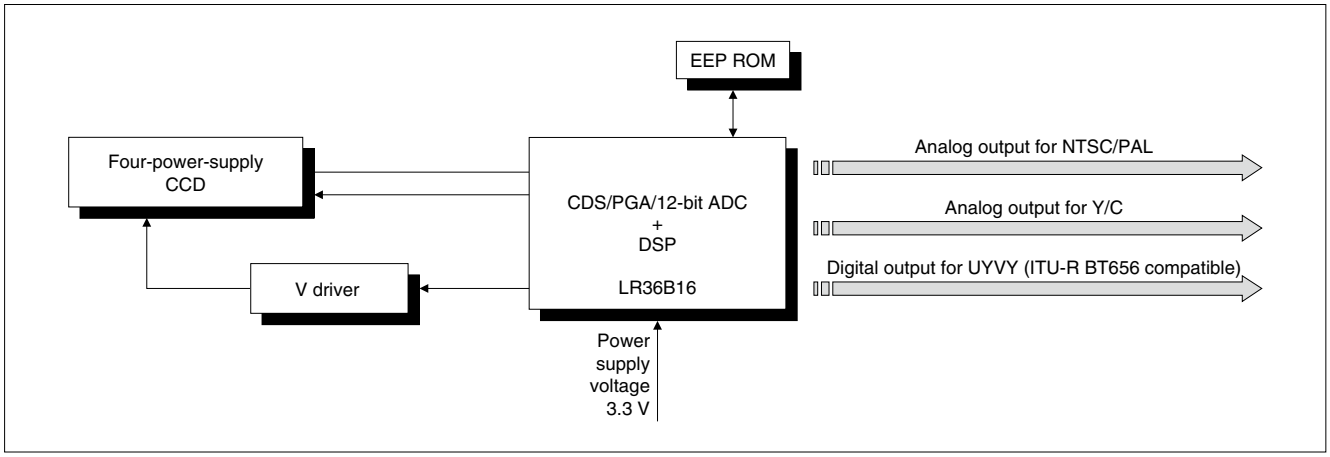


* This system shows the configuration example for LR38654 below.

Four-power-supply CCDs and peripheral IC/LSIs

CCD			V driver + CDS/PGA/ADC + DSP
1/3 type	270 kpixels	RJ2315EA0PB	LR38653/LR38654
		RJ2315FA0PB	
	320 kpixels	RJ2325EA0PB	
		RJ2325FA0PB	
	410 kpixels	RJ2355DA0PB	
		RJ2355EA0PB	
	470 kpixels	RJ2365DA0PB	
		RJ2365EA0PB	
1/4 type	270 kpixels	RJ2411FA0PB	
	320 kpixels	RJ2421FA0PB	
	410 kpixels	RJ2455DA0PB	
	470 kpixels	RJ2465DA0PB	

<Color Security Camera System with Three-chip Configuration>



Four-power-supply CCDs and peripheral ICs/LSIs

CCD			CDS/PGA/ADC + DSP + Video amplifier
1/3 type	270 kpixels	RJ2315EA0PB	LR36B16
		RJ2315FA0PB	
	320 kpixels	RJ2325EA0PB	
		RJ2325FA0PB	
	410 kpixels	RJ2355DA0PB	
		RJ2355EA0PB	
	470 kpixels	RJ2365DA0PB	
		RJ2365EA0PB	
	520 kpixels	RJ2331BA0PB	
		RJ2331CA0PB	
	610 kpixels	RJ2341BA0PB	
		RJ2341CA0PB	
1/4 type	270 kpixels	RJ2411FA0PB	
	320 kpixels	RJ2421FA0PB	
	410 kpixels	RJ2455DA0PB	
	470 kpixels	RJ2465DA0PB	
	520 kpixels	RJ2431AA0PB	
	610 kpixels	RJ2441AA0PB	

☆New product

RoHS

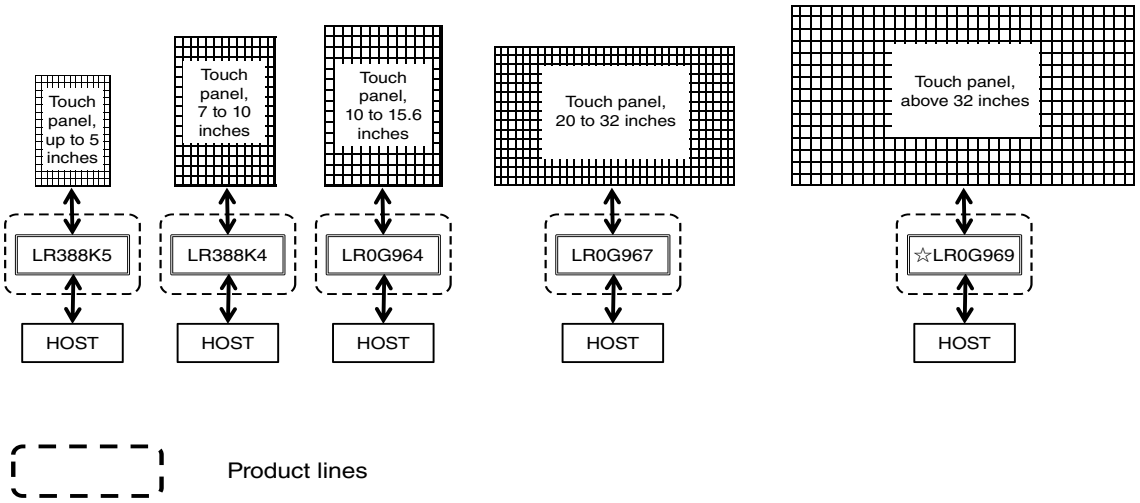
■Touch Panel System

●Features

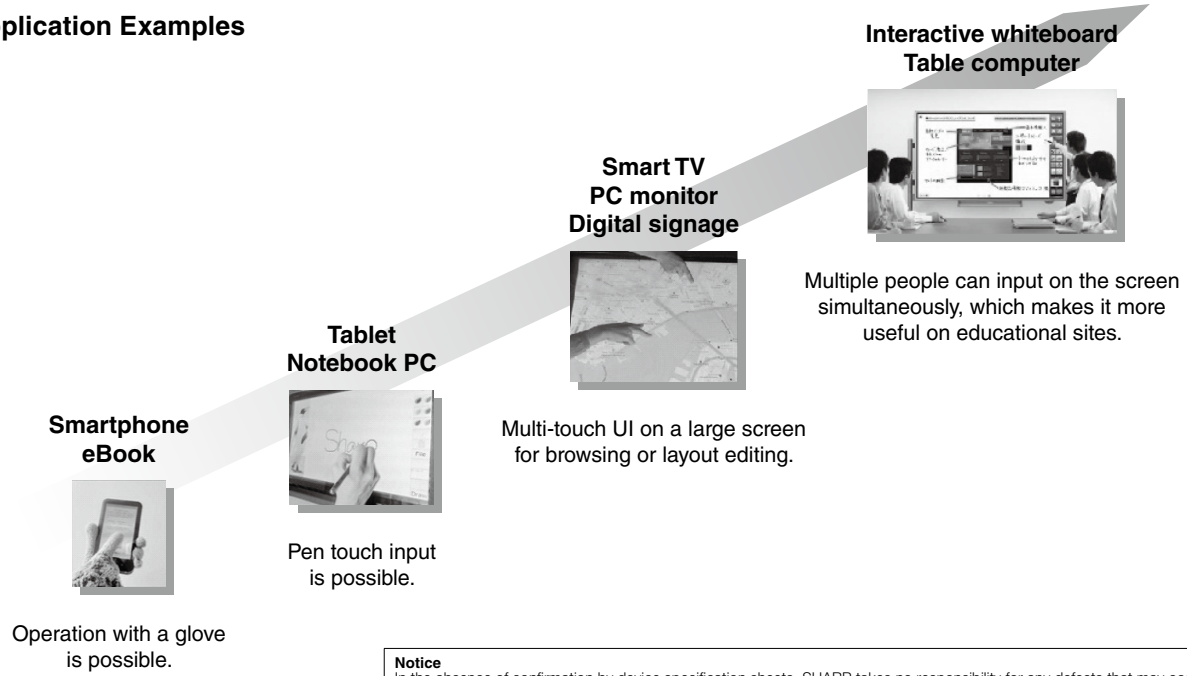
1. **By adopting Sharp's proprietary method, approximately eight times more sensitivity (comparison by Sharp) has been achieved compared with the conventional sequential driving method.***
   Capable of sensing a ϕ2 mm pen touch, multi-touch operation and touch operation using a glove.
2. **Contributes to a thinner design of a touch panel display.**
   A thinner design is achievable because the design is insusceptible to the noise effect, which makes space for the sensor sheets and the display modules unnecessary.
3. **Common user interface from small to large screens allows for a reduction in software development cost.**

* When comparing an S/N ratio of 3.58 determined through the conventional sequential driving method using pen-touch writing on a 20-inch screen with an S/N ratio of 30.65 determined through Sharp's proprietary parallel driving method (measured by Sharp).

●System Configuration



●Application Examples

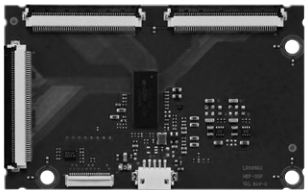


☆New product

■Touch Panel System / System LSIs

Model No.	Function	Features	Supply voltage (V)	Package
LR388K5	Touch panel controller for small-size screens (up to 5 inches)	• 10-finger multi-touch detection • Scanning speed: 120 Hz • Capable of sensing a ϕ2 mm pen touch • I²C/SPI interface	I/O: 1.62 to 3.6 Analog: 2.7 to 3.6	P-VFBGA96P-0606
LR388K4	Touch panel controller for tablets (7 to 10 inches)	• 10-finger multi-touch detection • Scanning speed: 240 Hz • Capable of sensing a ϕ2 mm pen touch • USB/I²C/SPI interface • Built-in palm cancellation feature	Core: 1.2±0.12 I/O: 3.3±0.3 Analog: 3.3±0.3	P-VFBGA360P-0613

■Touch Panel System / Touch Panel Controller Module



Model No.	Function	Features	Supply voltage (V)	Outline dimensions (W × D) (mm)
LR0G964	Touch panel controller module for midium-size screens (10 to 15.6 inches)	• 10-finger multi-touch detection • Scanning speed: 240 Hz • Capable of sensing a ϕ2 mm pen touch • Built-in palm cancellation feature • USB interface • Built-in power supply circuit	5	74 × 46
LR0G967	Touch panel controller module for midium-size screens (15 to 32 inches)	• 10-finger multi-touch detection • Scanning speed: 240 Hz • Capable of sensing a ϕ2 mm pen touch • Built-in palm cancellation feature • USB interface • Built-in power supply circuit	5	60 × 80
☆LR0G969	Touch panel controller module for large-size screens (Over 32 inches)	• 50-finger multi-touch detection • Scanning speed: 240 Hz • Capable of sensing a ϕ2 mm pen touch • Built-in palm cancellation feature • USB interface • Built-in power supply circuit	5	130 × 100 (Main) 220 × 100 (AFE)

RoHS

■Low Power-Loss Voltage Regulators

●TO-220 Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings				Electrical characteristics			Built-in functions					Lead forming available	Package	
		Output current Io (A)	Input voltage Vin (V)	Power dissipation (W) Pd*1	Power dissipation (W) Pd*2	Output voltage Vo*3 (V) TYP.	Output voltage precision (%)	Dropout voltage VI-O*5 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage			Package shape type*7
PQxxxRDA1SZH series	ASO protection function, low dissipation current at OFF state (Iqs: 5 µA (MAX.))	1	24	1.4	15	3.3, 5, 9, 12	±3	0.5	○	○	○	○			TO-220	A
PQxxxRDA2SZH series		2	20			3.3, 5, 9, 12	±2.5	1.0	○	○	○	○				A
PQ30RV11J00H	Variable output voltage	1	35	1.5	15	1.5 to 30	±2*4	0.5	○	○	△*6		○	○		B
PQ30RV21J00H		2			18				○	○	△*6		○	○		B
PQ30RV31J00H		3		2	20				○	○	△*6		○	○		B

*1 At self-cooling
*2 With infinite heat sink attached
*3 The xxx in the model No. refer to the output voltage values of the model (e.g. 050 for 5 V, 120 for 12 V, 015 for 1.5 V).
*4 Reference voltage precision
*5 Current ratings are defined individually.
*6 △ : Available by adding circuit
*7 Refer to page 35

■Surface Mount Type Low Power-Loss Voltage Regulators

●SOT-89 Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings			Electrical characteristics			Built-in functions					Package
		Output current Io (A)	Input voltage Vin (V)	Power dissipation Pd*1 (W)	Output voltage Vo*2 (V) TYP.	Output voltage precision (%)	Dropout voltage VI-O*3 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage	
PQ1LAxx5MSPQ	Compact, high radiation package, ceramic capacitor compatible	0.5	15	0.9	1.2, 1.5, 1.8, 2.5, 3.3, 5.0	±2.0	0.7	○	○	○	○		SOT-89
PQ1LAX95MSPQ	Ceramic capacitor compatible, variable output voltage				1.5 to 9.0	±2.0*4		○	○	○	○	○	

*1 When mounted on a board
*2 The xx in the model No. refer to the output voltage values of the model (e.g. 25 for 2.5 V, 50 for 5.0 V).
*3 Current ratings are defined individually.
*4 Reference voltage precision

SURFACE MOUNT TYPE
LOW POWER-LOSS VOLTAGE REGULATORS

RoHS

●SC-63 Type (1) Output Voltage Fixed Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings					Electrical characteristics			Built-in functions						Package	
		Output current Io (A)			Input voltage Vin (V)	Power dissipation Pd*1 (W)	Output voltage Vo*2 (V) TYP.	Output voltage precision (%)	Dropout voltage VI-O*3 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage	Taped package		Package shape type*4
		0.5	1	1.5													
PQxxxDNA1ZPH series	Ceramic capacitor compatible, ASO protection function, low dissipation current at OFF state (Iqs: 5 µA (MAX.)), solder dip compatible lead shape		○		24	8	3.3, 5, 9, 12	±2.5	0.5	○	○	○	○	–	○	SC-63	F
PQxxxENA1ZPH series	Minimum operating input voltage: 2.35 V, ceramic capacitor compatible, solder dip compatible lead shape		○		10	8	1.5, 1.8, 2.5, 3.3	±2.0		○	○	○	○	–	○		F
PQxxxENB1ZPH series			○			5	1.2, 1.5, 1.8, 2.5, 3.3		0.3	○	○	○	○	–	○		F
PQxxxENAHZPH series				○		8	1.5, 1.8, 2.5, 3.3		0.9	○	○	○	○	–	○		F
PQxxxGN01ZPH series	Minimum operating input voltage: 1.7 V (Dual power supply type), ceramic capacitor compatible, solder dip compatible lead shape		○		5.5		1.0, 1.2	±30 mV	–	○	○			–	○		F
PQxxxGN1HZPH series				○						○	○			–	○		F

*1 With infinite heat sink attached
*2 The xxx in the model No. refer to the output voltage values of the model (e.g. 033 for 3.3 V, 050 for 5 V, 120 for 12 V).
*3 Current ratings are defined individually.
*4 Refer to page 35

●SC-63 Type (2) Output Voltage Variable Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings					Electrical characteristics			Built-in functions						Package	
		Output current Io (A)			Input voltage Vin (V)	Power dissipation Pd*1 (W)	Output voltage Vo (V) TYP.	Output voltage precision (%)	Dropout voltage VI-O*3 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage	Taped package		Package shape type*4
		0.5	1	1.5													
PQ070XNA1ZPH	Minimum operating input voltage: 2.35 V, ceramic capacitor compatible, solder dip compatible lead shape		○		10	8	1.5 to 7	±2.0*2	0.5	○	○	○	○	○	○	SC-63	F
PQ070XNAHZPH				○					0.9	○	○	○	○	○	○		F
PQ070XNA2ZPH				○ (2 A)					0.5	○	○	○	○	○	○		F
PQ070XNB1ZPH			○			5	1.2 to 7		0.3	○	○	○	○	○	○		F
PQ035ZN01ZPH	Reference voltage (Vref): 0.6 V, minimum operating input voltage: 1.7 V (Dual power supply type), ceramic capacitor compatible, solder dip compatible lead shape		○		5.5	8	0.8 to 3.5	±30 mV	–	○	○			○	○		F
PQ035ZN1HZPH				○					–	○	○			○	○		F
PQ200WNA1ZPH	Minimum operating input voltage: 3.5 V, ASO protection function, low dissipation current at OFF state (Iqs: 5 µA (MAX.)), ceramic capacitor compatible, solder dip compatible lead shape		○		24		3.0 to 20	±2.5*2	0.5	○	○	○	○	○	○		F
PQ200WN3MZPH	Minimum operating input voltage: 5.5 V, low dissipation current at OFF state (Iqs: 5 µA (MAX.)), ceramic capacitor compatible, current limit: 800 mA	○ (0.3)				6.8	5.0 to 20			○	○	○	○	○	○		F

*1 With infinite heat sink attached
*2 Reference voltage precision
*3 Current ratings are defined individually.
*4 Refer to page 35

RoHS

●SOP-8 Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings			Electrical characteristics		Built-in functions		Taped package	Package
		Output current Io (A)	Input voltage Vin (V)	Power dissipation Pd*1 (W)	Output voltage Vo (V) TYP.	Output voltage precision*2 (mV)	Overheat protection	Overcurrent protection		
PQ1DX095MZPQ	Built-in sink source function (For DDR II memory)	±0.8	6	0.6	V_{DD} x 1/2 (V_{DDQ}: 1.5 V (MIN.))	±25	○	○	○	SOP-8

*1 When mounted on a board
*2 Reference voltage precision

■Surface Mount Type Chopper Regulators (DC-DC Converters)

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings		Electrical characteristics					Package	
		Switching current Isw (A)	Power dissipation Pd*1 (W)	Input voltage range Vin (V)	Output voltage*2 Vo (V)	Output type	Oscillation frequency fo (Hz) TYP.	Output saturation voltage Vsat (V) TYP.		Outline shape type*4
PQ6CU12X2APQ	• High switching voltage: 40 V (MAX.) • For tuner power supply • Variable oscillation frequency • Ceramic capacitor compatible	0.25	0.35	3.0 to 5.5	up to 36	Step-up	300 k to 800 k	Ron TYP. 1.7Ω	SOT-23-6W	
PQ1CN38M2ZPH	• PWM chopper regulator (high oscillation frequency) • Output ON/OFF control function • Overcurrent/overheat protection circuits • For light load	0.8	8	4.5 to 40	V_{REF}*3 to 35 (step-down type)/ –V_{REF} to –30 (inverting type)	Step-down	300 k	0.9	SC-63	F
PQ1CN41H2ZPH	• PWM chopper regulator (high oscillation frequency) • Overcurrent/overheat protection circuits	1.5	8			Step-down	300 k	0.9		F
PQ1CX41H2ZPQ	• Bootstrap system for high efficiency (Efficiency 90% (TYP.)) • Low voltage output: 0.8 V (MIN.) • Ceramic capacitor compatible	1.5	0.8 When mounted on board	4.75 to 27	0.8 to 20	Step-down	400 k	RDSon TYP. 0.45Ω	SOP-8	
PQ1CX53H2MPQ	• Bootstrap system for high efficiency (Efficiency 89% (TYP.)) • Low voltage output: 0.8 V (MIN.) • Ceramic capacitor compatible	3.5	2 When mounted on board	4.75 to 27	0.8 to 16	Step-down	400 k	RDSon TYP. 0.15Ω	USB-8	
PQ1CX61H1ZPQ	• Bootstrap system for high efficiency (Efficiency 88% (TYP.)) • Low voltage output: 1.0 V (MIN.) • Ceramic capacitor compatible	1.5	0.8 When mounted on board	4.75 to 28	1.0 to 18.9	Step-down	900 k	RDSon TYP. 0.55Ω	SOP-8	

*1 With infinite heat sink attached or when mounted on a board listed in the specification sheets.
*2 Output variable range (step-down/inversion).
*3 V_{REF} nearly equal to 1.26 V
*4 Refer to page 35

RoHS

■Chopper Regulators (DC-DC Converters)

●TO-220 Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings		Electrical characteristics					Package	
		Switching current Isw (A)	Power dissipation Pd*1 (W)	Input voltage range Vin (V)	Output voltage Vo*2 (V)	Output type	Oscillation frequency fo (kHz) TYP.	Output saturation voltage Vsat (V) TYP.		Outline shape type*5
PQ1CG21H2FZH	• PWM chopper regulator • Built-in overcurrent/overheat protection circuits • Output ON/OFF control function	1.5*3	14	40	V_{REF}*4 to 35 (step-down type)/ $-V_{REF}$*4 to –30 (inverting type)	Step-down	100	1.0	TO-220	E
PQ1CG41H2FZH	• PWM chopper regulator (high oscillation frequency) • Built-in overcurrent/overheat protection circuits • Output ON/OFF control function						300	1.0		E
PQ1CG2032FZH	• PWM chopper regulator • Built-in overcurrent/overheat protection circuits • Output ON/OFF control function	3.5*3					70	1.4		E
PQ1CG3032FZH	• PWM chopper regulator (high oscillation frequency) • Built-in overcurrent/overheat protection circuits • Output ON/OFF control function						150			E

*1 With infinite heat sink attached
*2 Output voltage variable range
*3 Peak current
*4 V_{REF} nearly equal to 1.26 V (TYP.)
*5 Refer to page 35

☆New product

RoHS

■LED Drivers

●Built-in Step-up Circuit (1)

Model No.	Function	Features	No. of output circuits	Number of LEDs	Booster method	Constant current circuit	Switching transistor	Input voltage range (V)	Output*3 current (mA) MAX.	Oscillation frequency (Hz) TYP.	Package
PQ6CB11X1CP▲	White LED driver for backlight (for small panels)	• High voltage CMOS output: 30 V (MAX.) • Output ON/OFF control function • Overvoltage/overcurrent protection circuits • Soft start function	1	6 (Series connection)	PWM	*1	○	2.7 to 5.5	250*2	1.2 M	USB-6
PQ7L2020BP▲		• High voltage CMOS output: 37 V (MAX.) • Output ON/OFF control function • Overvoltage/overcurrent protection circuits • Soft start function • Possible to use a low-capacity (0.1 µF) output capacitor	1	9 (Series connection)		*1	○	2.9 to 5.5	500	1.0 M	USB-6
IR2E58U	White LED driver for backlight	• Capable of driving a maximum of 96 LEDs with 12 LEDs (in series) per channel • Built-in step-up DC-DC converter • High oscillation frequency (1.5 MHz) makes use of a small coil possible • Capable of controlling brightness using PWM control • Step-up output control according to LED-Vf	8	96	PWM	○	○	4.5 to 28	40/ch	500 k to 1.5 M	24HQFN
IR2E65U		• Capable of driving a maximum of 120 LEDs with 12 LEDs (in series) per channel • Built-in step-up DC-DC controller • High oscillation frequency (1.5 MHz) makes use of a small coil possible • Wider range of PWM brightness control possible, from simultaneous total output control to local dimming • Step-up output control according to LED-Vf	10	120		○	External	10 to 28	100/ch	500 k to 1.5 M	52HQFN
☆IR2E71Y	LED driver for backlight and call alert display (auto brightness adjustment)	• 2 ch (11 LEDs x 2 ch) LED driver for backlight • Auto brightness adjustment backlight LED • 6 ch RBG LED driver for illumination • Built-in switching regulator for LCD backlight • Built-in LCD controller power supply (+5.8 V / −5.8 V MAX.) • LDO 1 ch • Interface for digital-output proximity sensor with ambient light sensor • Built-in general purpose input/output port (7 ch MAX.)	Backlight 2 RGB 6	Backlight 22 RGB 6	PWM	○	○	3.0 to 4.5	Backlight 25.5/ch RGB 12.7/ch	10 k to 1 M	35WL-CSP

*1 LED constant current value can be set by external resistors.
*2 Peak switching current
*3 Constant current (MAX.)
The model marked with ▲ may not be available in the near future. Contact with SHARP for details before use.

RoHS

●Built-in Step-up Circuit (2)

Model No.	Function	Features	No. of output circuits	Number of LEDs	Booster method	Constant current circuit	Switching transistor	Input voltage range (V)	Output*1 current (mA) MAX.	Oscillation frequency (Hz) TYP.	Package
IR2E67M	White LED driver for backlight	• Built-in 10 ch. constant-current control amplifier (external output transistor) • Enables driving LEDs up to external transistor voltage limit • Built-in timing controller for lighting • Wider range of PWM brightness control possible, from simultaneous total output control to local dimming • Step-up output control according to LED-Vf	10	*2	*3	*4	External	4.5 to 5.5	*5	–	80LQFP-1420
IR2E70N	White LED driver for backlight	• Built-in step-up DC-DC controller for 2 ch individual control • Capable of 2 ch individual PWM brightness control • LED current value adjustable by external signal (voltage input / PWM signal) • Brightness control possible at high contrast ratio 3000:1 • Step-up output control according to LED-Vf	2	*2	PWM	*6	External	4.5 to 5.5 8 to 28	*5	100 k to 500 k	24SSOP

*1 Constant current (MAX.)
*2 Determined by external transistor voltage limit.
*3 Built-in feedback voltage-generating circuit for external power supply.
*4 Built-in constant-current control amplifier (external output transistor)
*5 Determined by external resistor.
*6 Constant current can be controlled by LED anode voltage control.

RoHS

■AC-DC Conversion Type ICs for LED Lighting

Model No.	Features	Operating temperature range (°C)	Supply voltage range (V)	Dissipation current (mA) TYP.	Switching frequency (kHz)*1 TYP.	Gate driver capacity		System	Package
						Low (Ω)	High (mA)		
IR3M92N4	Overvoltage/overheat/overcurrent circuits, high-speed activation, stand-by feature, PWM brightness control	–30 to +100	10 to 18	1	160	MAX. 15	MIN. 40	Flyback Step-down	SOP-8

*1 When operating a flyback converter

■Power Amplifiers for Wireless LAN

Model No.	Application	Supply voltage Vcc (V) TYP.	Control voltage Vbb (V) TYP.	Linear output power*1 (dBm)	Dissipation current (mA) TYP.	Gain (dB) TYP.	Detection circuit	Matching circuit	Package (mm)
IRM068U7	For 2.4 GHz single-band wireless LAN (IEEE802.11b/g/n)	3.3	2.8	18	115	27	○	Built-in (IN)	HQFN6 pin (1.5 × 1.5 × 0.4 mm)
QM2A1UA003				20	150	28	○	Built-in (IN)	
IRM053U7	For 5 GHz single-band wireless LAN (IEEE802.11a/n)			18	170	30	○	Built-in (IN/OUT)	HQFN10 pin (2 × 2 × 0.4 mm)
QM2A1UA004				20	225	31	○	Built-in (IN/OUT)	
IRM067U6	For 2.4/5 GHz dual-band wireless LAN (IEEE802.11a/b/g/n)		2.9	17	100	28	○	Built-in (IN/OUT)	HQFN16 pin (3 × 3 × 0.4 mm)
				17	140	30			

*1 At time of OFDM 64QAM modulating wave input.

■Front-End Modules for Wireless LAN

Model No.	Application	Features	Supply voltage (V) TYP.	Control voltage (V) TYP.	Transmitter section			Receiver section		Package
					EVM (%)/ Output power (dBm)	Dissipation current (mA)/ Output power (dBm)	Gain (dB) TYP.	Noise figure (dB) TYP.	Gain: Normal/ Bypass (dB) TYP.	
QM2A1UB028/ 032A	Front-end IC for 2.4 GHz wireless LAN (802.11b/g/n/ac) (SP3T SW + PA + LNA)	• Built-in detection circuit, high efficiency / high linear-output power amplifier • .11ac-compliant low EVM design • Low-noise amplifier with bypass mode • Built-in input/output matching circuit • Compact and thin package	3.6	3.3	2/19*1	200/19	27	2	13/-5.5	HQFN16 pin (2.5 × 2.5 × 0.4 mm)
QM2A1UB029/ 033A	Front-end IC for 5 GHz wireless LAN (802.11a/n/ac) (SPDT SW + PA + LNA)				2/18*2	180/18	28	2.5	13/-7	

*1 MCS7 HT20 at 64QAM input
*2 MCS7 HT40 at 64QAM input

RoHS

■CSP

●CSP (Chip Size Package)

The FBGA (commonly known as CSP) has an area array terminal structure with solder balls on the bottom, to give it a near chip-size footprint. This high-density, compact and low-profile package technology will greatly help in the design of compact mobile equipment, such as mobile phones and digital cameras.

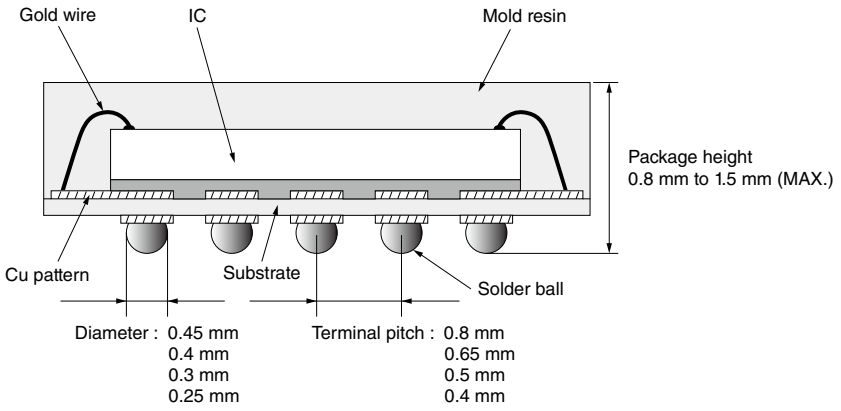
FBGA (CSP)

Features

- **Compact and lightweight**
  Ability to create a near-chip size and lighter-weight package in comparison with conventional plastic packages.
- **High reliability**
  Comparable high reliability with that of conventional plastic packages.
- **Mountability**
  Conventional mounting system is available for CSP. SOP and QFP can be mounted together with CSP.

Terminal pitch	0.8 mm	0.65 mm	0.5 mm	0.4 mm
Maximum terminal counts	352 (16 mm x 16 mm)	352 (16 mm x 16 mm)	372 (16 mm x 16 mm)	264 (10 mm x 10 mm)
Nominal dimensions	6 mm x 6 mm to 16 mm x 16 mm			5 mm x 5 mm to 10 mm x 10 mm

Cross section example



●Wafer-level CSP

The wafer-level CSP (WL-CSP) is a kind of chip-size package which is manufactured by assembling directly onto the finished wafer.

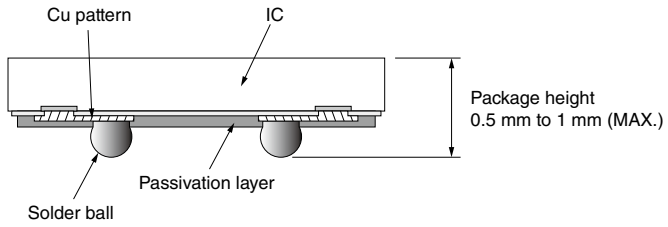
Features

- **Compact and thinner size**
  It makes it possible to create an almost IC-size and lighter-weight package.
- **Mountability**
  The conventional CSP mounting system can be also used in that of wafer-level CSP, which facilitates chip mounting more than bare-chip mounting does. It can be mounted together with other existing packages and passive components.

Chip size*	4 mm x 4 mm		3.5 mm x 3.5 mm		3 mm x 3 mm	
Pad pitch	0.5 mm	0.4 mm	0.5 mm	0.4 mm	0.5 mm	0.4 mm
Maximum terminal counts	49 (7 x 7)	81 (9 x 9)	36 (6 x 6)	49 (7 x 7)	25 (5 x 5)	36 (6 x 6)

* Rectangular chip form is also available.

Cross section example



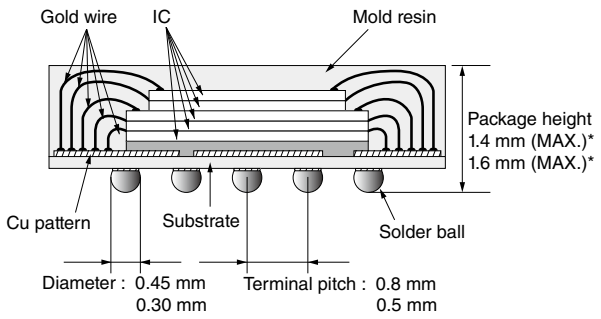
Packages

RoHS

■SiP (System in Package)

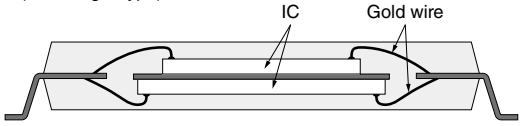
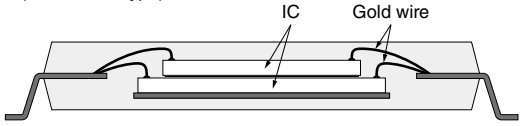
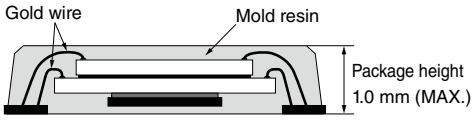
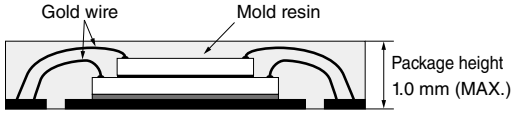
System in Package is SHARP's original high-density mounting technology that achieves high-density memory capacity and multiple functions by stacking multiple ICs or multiple packages. The System in Package technology means chip-stacked package technology that can achieve up to 5-chip mounting by stacking ICs in a single package. The System in Package technology contributes to higher functionality of applications, such as mobile phones and digital cameras, as well as to reduction in size and weight.

●Chip Stacked CSP

Features	● **Wide variety of lineup** It is possible to provide a wide lineup of stacked CSPs, including 2-chip, 3-chip, 4-chip and 5-chip stacked CSPs, to respond to customer needs. ● **Compact and thinner size** Encapsulating multiple ICs into an existing plastic package contributes to decreasing the mounting area. In addition, SHARP's wafer thinning technology makes it possible to achieve 1.4 mm (MAX.) package height. ● **Multiple functions** Multiple ICs of different sizes and functions, such as logic LSIs and memories, can be incorporated in a single package, making possible multiple functions. ● **Same-size IC stacking technology** SHARP's stacking technology enables stacking of multiple same-size ICs, contributing to higher memory density. **(4-chip stacked CSP)** When using a SHARP four-chip stacked CSP, the mounting area and weight of a package can be decreased by half in comparison with using two 2-chip stacked CSPs, or a 3-chip stacked CSP and a conventional CSP.
Cross section example	(5-chip stacked CSP)  * At 0.8 mm terminal pitch

RoHS

●Chip Stacked TSOP/QFP*/VQFN/HQFN

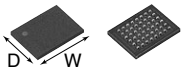
Features	● **Decreased mounting area** By encapsulating two identical or different types of ICs into a single conventional plastic package, the mounting area of the package can be decreased. ● **Multiple functions** Thanks to the incorporation of different sizes and functions of multiple ICs, such as logic LSIs and memories, the functionality increases. ● **Higher memory density** When incorporating two identical memory ICs into a single package, memory density doubles on the same mounting area.
Cross section example	(TSOP, QFP*) (Hamburger type)  (Turtle stack type)  (VQFN)  (HQFN) 

* Including TQFP and LQFP.

RoHS

■ Package Lineup

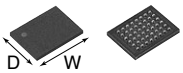
●Surface-Mount Type

Package type	Appearance (Package material)	Package code	No. of terminals	Terminal pitch mm	Nominal dimensions mm	Package depth & width (D x W) x (seated height [MAX.]) mm
FBGA (CSP)	 (Plastic)	P-LFBGA048-0606	48	0.8	6 x 6	6.0 x 6.0 x (1.4)
		P-TFBGA048-0608			6 x 8	6.0 x 8.0 x (1.2)
		P-TFBGA048-0808			8 x 8	8.0 x 8.0 x (1.2)
		P-TFBGA056-0808	56			
		P-TFBGA060-0811	60 (48)*		8 x 11	8.0 x 11.0 x (1.2)
		P-TFBGA064-0811	64			
		P-TFBGA072-0811	72 (64)*			
		P-LFBGA072-0811				8.0 x 11.0 x (1.4) / (1.6)
		P-TFBGA081-0808	81		8 x 8	8.0 x 8.0 x (1.2)
		P-LFBGA085-0811	85		8 x 11	8.0 x 11.0 x (1.4) / (1.6)
		P-LFBGA087-0811	87			
		P-LFBGA088-0811	88			
		P-LFBGA088-0912			9 x 12	9.0 x 12.0 x (1.4) / (1.6)
		P-LFBGA090-0811	90		8 x 11	8.0 x 11.0 x (1.4) / (1.6)
		P-TFBGA096-1010	96		10 x 10	10.0 x 10.0 x (1.2)
		P-LFBGA107-0912	107		9 x 12	9.0 x 12.0 x (1.4) / (1.6)
		P-TFBGA111-1010	111		10 x 10	10.0 x 10.0 x (1.2)
		P-TFBGA112-1010	112			
		P-LFBGA115-0914	115		9 x 14	9.0 x 14.0 x (1.4) / (1.6)
		P-LFBGA116-1010	116		10 x 10	10.0 x 10.0 x (1.4) / (1.6)
		P-LFBGA130-1013	130		10 x 13	10.0 x 13.0 x (1.4) / (1.6)
		P-TFBGA144-1111	144		11 x 11	11.0 x 11.0 x (1.2)
		P-TFBGA160-1212	160		12 x 12	12.0 x 12.0 x (1.2)
		P-LFBGA168-1212	168			12.0 x 12.0 x (1.4) / (1.6)
		P-TFBGA180-1212	180			12.0 x 12.0 x (1.2)
		P-TFBGA184-1212	184			
		P-TFBGA240-1414	240		14 x 14	14.0 x 14.0 x (1.2)
		P-LFBGA280-1616	280		16 x 16	16.0 x 16.0 x (1.5)
		P-LFBGA352-1616	352			
		P-TFBGA064-0606	64	0.65	6 x 6	6.0 x 6.0 x (1.2)
		P-LFBGA140-0909	140		9 x 9	9.0 x 9.0 x (1.4)
		P-LFBGA160-1010	160		10 x 10	10.0 x 10.0 x (1.4) / (1.6)
		P-TFBGA180-1313	180		13 x 13	13.0 x 13.0 x (1.2)
		P-LFBGA192-1010	192		10 x 10	10.0 x 10.0 x (1.4) / (1.6)
		P-LFBGA208-1212	208		12 x 12	12.0 x 12.0 x (1.4) / (1.6)
		P-LFBGA224-1313	224		13 x 13	13.0 x 13.0 x (1.4) / (1.6)
		P-TFBGA260-1313	260			13.0 x 13.0 x (1.2)

* Figures in brackets indicate available terminal counts.

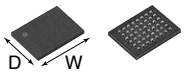
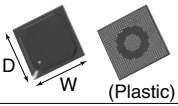
RoHS

●Surface-Mount Type (cont'd)

Package type	Appearance (Package material)	Package code	No. of terminals	Terminal pitch mm	Nominal dimensions mm	Package depth & width (D x W) x (seated height [MAX.]) mm
FBGA (CSP)	 (Plastic)	P-VFBGA057-0505	57	0.5	5 x 5	5.0 x 5.0 x (0.9)
		P-VFBGA075-0505	75			
		P-TFBGA064-0606	64		6 x 6	6.0 x 6.0 x (1.1)
		P-TFBGA068-0606	68			
		P-VFBGA081-0606	81			6.0 x 6.0 x (0.9)
		P-TFBGA084-0606	84			6.0 x 6.0 x (1.1)
		P-VFBGA100-0606	100			6.0 x 6.0 x (0.9)
		P-VFBGA100-0707			7 x 7	7.0 x 7.0 x (0.9)
		P-TFBGA100-0707				7.0 x 7.0 x (1.1)
		P-VFBGA108-0707	108			7.0 x 7.0 x (0.9)
		P-TFBGA108-0707				7.0 x 7.0 x (1.1)
		P-VFBGA120-0707	120			7.0 x 7.0 x (0.9)
		P-TFBGA120-0707				7.0 x 7.0 x (1.1)
		P-TFBGA132-0707	132			
		P-TFBGA133-0808	133		8 x 8	8.0 x 8.0 x (1.1)
		P-VFBGA144-0808	144			8.0 x 8.0 x (0.9)
		P-LFBGA144-0808				8.0 x 8.0 x (1.3) / (1.5)
		P-LFBGA144-0811			8 x 11	8.0 x 11.0 x (1.3)
		P-TFBGA152-0808	152		8 x 8	8.0 x 8.0 x (1.1)
		P-VFBGA171-0811	171		8 x 11	8.0 x 11.0 x (0.9)
		P-LFBGA171-0811				8.0 x 11.0 x (1.3) / (1.5)
		P-VFBGA176-0909	176		9 x 9	9.0 x 9.0 x (0.9)
		P-TFBGA176-0909				9.0 x 9.0 x (1.1)
		P-TFBGA180-0909	180			
		P-TFBGA188-0909	188			
		P-VFBGA188-1111			11 x 11	11.0 x 11.0 x (0.9)
		P-VFBGA208-1010	208		10 x 10	10.0 x 10.0 x (0.9)
		P-TFBGA208-1010				10.0 x 10.0 x (1.1)
		P-TFBGA245-1010	245			
		P-LFBGA245-1010				10.0 x 10.0 x (1.3)
		P-FBGA424-1414	424		14 x 14	14.0 x 14.0 x (1.8)
		P-WFBGA144-0606	144	0.4	6 x 6	6.0 x 6.0 x (0.75)
		P-WFBGA121-0606	121			6.0 x 6.0 x (0.8)
		P-WFBGA145-0606	145			
		P-TFBGA168-0707	168		7 x 7	7.0 x 7.0 x (1.0)
		P-TFBGA204-0808	204		8 x 8	8.0 x 8.0 x (1.0)
		P-WFBGA205-0808	205			8.0 x 8.0 x (0.8)
		P-WFBGA261-0808	261			

RoHS

●Surface-Mount Type (cont'd)

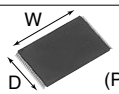
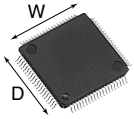
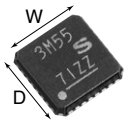
Package type	Appearance (Package material)	Package code	No. of terminals	Terminal pitch mm	Nominal dimensions mm	Package depth & width (D x W) x (seated height [MAX.]) mm
FBGA (CSP)	 (Plastic)	P-TFBGAXXX-0606	to 36	0.8	6 x 6	6.0 x 6.0 x (1.2)
		P-TFBGAXXX-0707	to 49		7 x 7	7.0 x 7.0 x (1.2)
		P-TFBGAXXX-0808	to 81		8 x 8	8.0 x 8.0 x (1.2)
		P-TFBGAXXX-0909	to 100		9 x 9	9.0 x 9.0 x (1.2)
		P-TFBGAXXX-1010	to 121		10 x 10	10.0 x 10.0 x (1.2)
		P-TFBGAXXX-1111	to 144		11 x 11	11.0 x 11.0 x (1.2)
		P-TFBGAXXX-1212	to 196		12 x 12	12.0 x 12.0 x (1.2)
		P-TFBGAXXX-1313	to 216		13 x 13	13.0 x 13.0 x (1.2)
		P-TFBGAXXX-1414	to 240		14 x 14	14.0 x 14.0 x (1.2)
		P-TFBGAXXX-1515			15 x 15	15.0 x 15.0 x (1.2)
		P-TFBGAXXX-1616	to 352		16 x 16	16.0 x 16.0 x (1.2)
		P-TFBGAXXX-0606	to 49	0.65	6 x 6	6.0 x 6.0 x (1.2)
		P-TFBGAXXX-0707	to 81		7 x 7	7.0 x 7.0 x (1.2)
		P-TFBGAXXX-0808	to 121		8 x 8	8.0 x 8.0 x (1.2)
		P-TFBGAXXX-0909	to 144		9 x 9	9.0 x 9.0 x (1.2)
		P-TFBGAXXX-1010	to 196		10 x 10	10.0 x 10.0 x (1.2)
		P-TFBGAXXX-1111	to 224		11 x 11	11.0 x 11.0 x (1.2)
		P-TFBGAXXX-1212	to 256		12 x 12	12.0 x 12.0 x (1.2)
		P-TFBGAXXX-1313	to 272		13 x 13	13.0 x 13.0 x (1.2)
		P-TFBGAXXX-1414	to 304		14 x 14	14.0 x 14.0 x (1.2)
		P-TFBGAXXX-1515	to 320		15 x 15	15.0 x 15.0 x (1.2)
		P-TFBGAXXX-1616	to 352		16 x 16	16.0 x 16.0 x (1.2)
		P-TFBGAXXX-0606	to 100	0.5	6 x 6	6.0 x 6.0 x (1.1)
		P-TFBGAXXX-0707	to 132		7 x 7	7.0 x 7.0 x (1.1)
		P-TFBGAXXX-0808	to 164		8 x 8	8.0 x 8.0 x (1.1)
		P-TFBGAXXX-0909	to 192		9 x 9	9.0 x 9.0 x (1.1)
		P-TFBGAXXX-1010	to 216		10 x 10	10.0 x 10.0 x (1.1)
		P-TFBGAXXX-1111	to 244		11 x 11	11.0 x 11.0 x (1.1)
		P-TFBGAXXX-1212	to 268		12 x 12	12.0 x 12.0 x (1.1)
		P-TFBGAXXX-1313	to 296		13 x 13	13.0 x 13.0 x (1.1)
		P-TFBGAXXX-1414	to 320		14 x 14	14.0 x 14.0 x (1.1)
		P-TFBGAXXX-1515	to 348		15 x 15	15.0 x 15.0 x (1.1)
		P-TFBGAXXX-1616	to 372		16 x 16	16.0 x 16.0 x (1.1)
		P-TFBGAXXX-0505	to 100	0.4	5 x 5	5.0 x 5.0 x (1.0)
		P-TFBGAXXX-0606	to 144		6 x 6	6.0 x 6.0 x (1.0)
		P-TFBGAXXX-0707	to 168		7 x 7	7.0 x 7.0 x (1.0)
		P-TFBGAXXX-0808	to 204		8 x 8	8.0 x 8.0 x (1.0)
		P-TFBGAXXX-0909	to 228		9 x 9	9.0 x 9.0 x (1.0)
		P-TFBGAXXX-1010	to 264		10 x 10	10.0 x 10.0 x (1.0)
PBGA (BGA)	 (Plastic)	P-BGA0356-2121	356	1.0	21 x 21	21.0 x 21.0 x (2.2)
		P-BGA0476-3535	476	1.27	35 x 35	35.0 x 35.0 x (2.63)
		P-BGA0528-3535	528			

XXX: Terminal counts

BGA is a trademark of Motorola Nippon Ltd.

RoHS

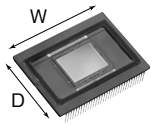
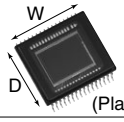
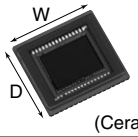
●Surface-Mount Type (cont'd)

Package type	Appearance (Package material)	Package code	No. of terminals	Terminal pitch mm (mil)	Nominal dimensions mm (mil)	Package depth & width (D x W) x (seated height [MAX.]) mm	Lead frame material	
							Alloy42	Copper alloy
TSOP	 (Plastic)	P-TSOP048-1220	48	0.5	12 x 20	12.0 x 18.4 x (1.2)	○	○
		P-TSOP056-1420	56		14 x 20	14.0 x 18.4 x (1.2)	○	○
QFP	 (Plastic)	P-QFP048-0707	48	0.5	7 x 7	7.0 x 7.0 x (1.65)	○	○
		P-QFP072-1010	72		10 x 10	10.0 x 10.0 x (1.8)	○	–
LQFP		P-LQFP080-1212	80	0.5	12 x 12	12.0 x 12.0 x (1.7)	○	–
		P-LQFP100-1414	100		14 x 14	14.0 x 14.0 x (1.7)	○	–
TQFP		P-TQFP048-0707	48	0.5	7 x 7	7.0 x 7.0 x (1.2)	○	–
		P-TQFP100-1414	100		14 x 14	14.0 x 14.0 x (1.2)	○	–
		P-TQFP128-1414	128	0.4			○	–
VQFN	 (Plastic)	P-VQFN020-0404	20	0.5	4 x 4	4.2 x 4.2 x (1.0)	–	○
		P-VQFN024-0404	24				–	○
		P-VQFN028-0505	28		5 x 5	5.2 x 5.2 x (1.0)	–	○
		P-VQFN032-0505	32				–	○
		P-VQFN036-0606	36		6 x 6	6.2 x 6.2 x (1.0)	–	○
		P-VQFN048-0707	48		7 x 7	7.2 x 7.2 x (1.0)	–	○
		P-VQFN036-0505	36	0.4	5 x 5	5.2 x 5.2 x (1.0)	–	○
		P-VQFN052-0707	52		7 x 7	7.2 x 7.2 x (1.0)	–	○
HQFN*		P-HQFN020-0404	20	0.5	4 x 4	4.0 x 4.0 x (1.0)	–	○
		P-HQFN024-0404	24			4.0 x 4.0 x (0.85)	–	○
						4.2 x 4.2 x (1.0)	–	○
		P-HQFN028-0505	28		5 x 5	5.0 x 5.0 x (1.0)	–	○
		P-HQFN052-0707	52	0.4	7 x 7	7.2 x 7.2 x (1.0)	–	○

* HQFN is a higher heat dissipation package of VQFN.

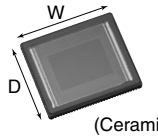
100 mil = 2.54 mm

●For CCDs

Package type	Appearance (Package material)	Package code	No. of terminals	Terminal pitch mm	Nominal dimensions mm (mil)	Package depth & width (D x W) x (seated height [TYP.]) mm
DIP	 (Plastic)	P-DIP014-0400A	14	1.27	10.16 (400)	10.0 x 10.0
		P-DIP016-0450	16	1.27	11.43 (450)	11.4 x 12.2
		P-DIP020-0500	20	1.27	12.2 (500)	12.0 x 13.8
		P-DIP024-0400	24	0.80	10.16 (400)	10.0 x 10.0
		P-DIP028-0566	28	1.11	14.4 (566)	14.2 x 16.0
		P-DIP064-1000	64	1.00	25.48 (1 000)	36.1 x 25.4
	(Ceramic)	N-DIP016-0450	16	1.27	11.43 (450)	11.4 x 12.2
SOP	 (Plastic)	P-SOP014-0400A	14	1.27	12 (470)	10.0 x 10.0 x (4.1)
		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 (3.92)
LCC	 (Ceramic)	N-LCC040-R350 (B)	40	0.65	8.9 (350)	8.3 x 8.9 x (1.52)
		N-LCC040-S433A		0.80	11.0 (433)	11.0 x 11.0 x (1.62)

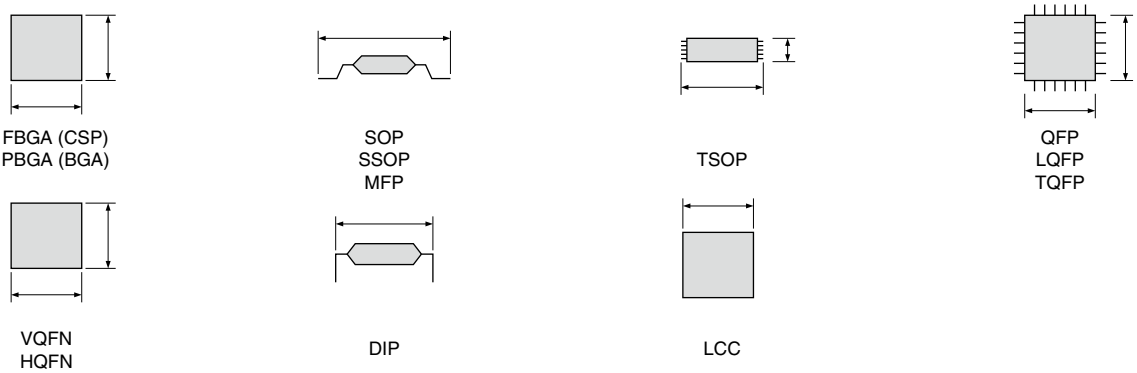
100 mil = 2.54 mm

●For CMOSs

Package type	Appearance (Package material)	Package code	No. of terminals	Terminal pitch mm	Nominal dimensions mm (mil)	Package depth & width (D x W) x (seated height [TYP.]) mm
LCC	 (Ceramic)	N-LCC120-R898	120	0.65	22.8 (898)	20.0 x 22.8 x (2.67)
		N-LCC120-R898A				

100 mil = 2.54 mm

Nominal dimensions



FBGA : fine-pitch ball grid array package
PBGA : plastic ball grid array package
SOP : small outline package
SSOP : shrink small outline package
MFP : mini flat package
TSOP : thin small outline package
QFP : quad flat package
LQFP : low profile quad flat package
TQFP : thin quad flat package
VQFN : very thin quad flat non-leaded package
HQFN : heat sink quad flat non-leaded package
DIP : dual inline package
LCC : leadless chip carrier

Ball Grid Array and BGA are trademarks of Motorola Nippon Ltd.