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MITSUBISHI CMOS IMAGE SENSORS & DIGITAL IMAGING SOLUTIONS



INTRODUCTION 1

■ The Advantages of CMOS Image Sensor

Items \ Target	CMOS Image Sensor	CCD (Charge Coupled Device)
Image Quality	<ul style="list-style-type: none">● Larger dynamic range (60 ~ 100dB)● Lower S/N (>50 dB)	<ul style="list-style-type: none">● Large dynamic range (~60 dB)● Larger S/N (>60 dB)
Consumption Power	<ul style="list-style-type: none">● Single supply voltage (3.3 or 5.0V)● Lower consumption power (<100 mW)	<ul style="list-style-type: none">● Multiple supply voltage● Larger consumption power (>100 mW)
System Requirements	<ul style="list-style-type: none">● Low cost MCU is able to handle● A/D converter is included in the sensor	<ul style="list-style-type: none">● ASSP device is required● External A/D converter is required
Others	<ul style="list-style-type: none">● Digital Interface● Multiple data output modes	<ul style="list-style-type: none">● Analog Interface● Complex control circuits
Total Cost	<ul style="list-style-type: none">● Lower (\$10 ~ \$25)	<ul style="list-style-type: none">● Higher (>\$25)



INTRODUCTION 2

■ Mitsubishi CMOS Image Sensors

◆ Lower Resolution Family

- ☐ 32x32 and 128x128 pixels
- ☐ extremely low power consumption (15 mW for 128x128 pixels)
- ☐ Simple image processing capability
(edge enhancement, projection, random access of the image)
- ☐ Low cost MCU interface (connect to M16C/6x MCU w/o glue logic)

◆ Higher Resolution Family

- ☐ CIF and VGA(planning) size
- ☐ Bayer color mask & micro lens options for PC video camera
- ☐ Simple logic interface (digital output & serial interface)

◆ Module

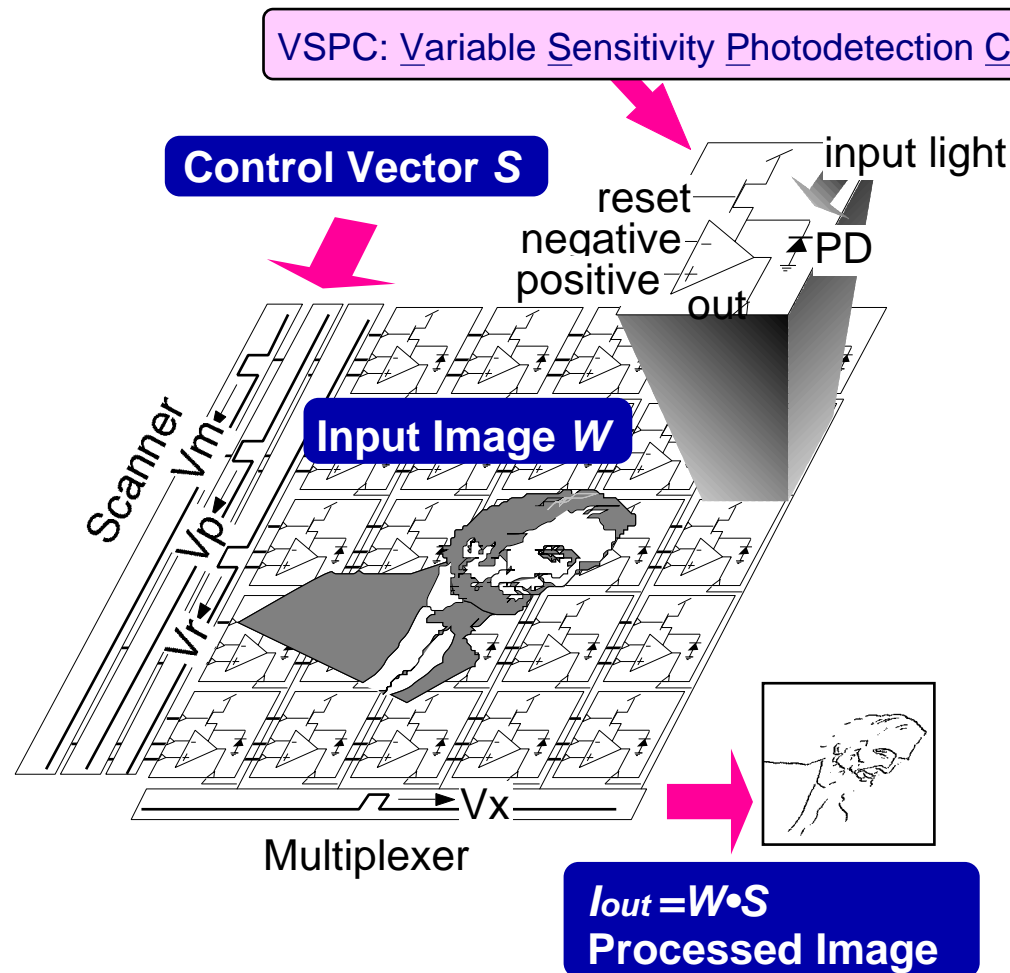
- ☐ standard module including a sensor, MCU, and an optical system

◆ Recognition Algorithm



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THE CONCEPT OF FOCAL PLANE IMAGE PROCESSING



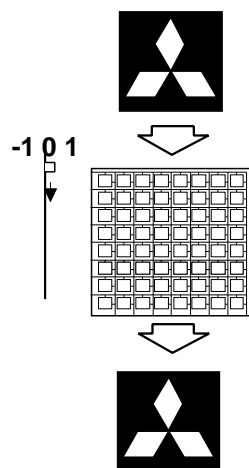
Features

- Programmable image processor
- Realtime image processing
(Frame Rate: 1 ~ 256 Hz)
- Single power supply (5V)
- Low power consumption
(typ. 15mW, 10 times lower than CCD)
- Low cost

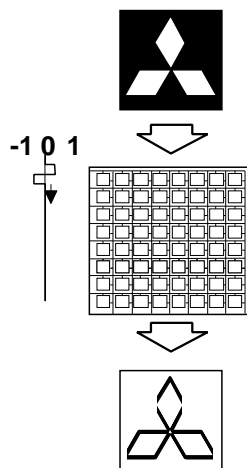


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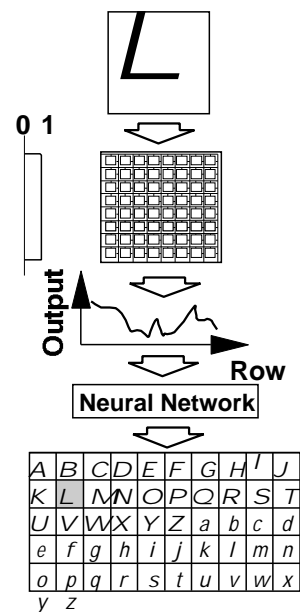
IMAGE PROCESSING EXAMPLES



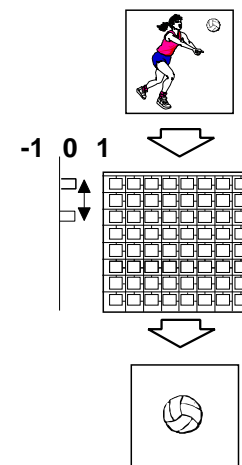
(a) Image Acquisition



(b) Edge Extraction



(c) 2D -> 1D Projection

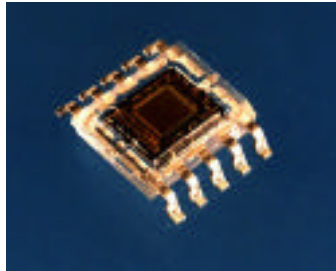
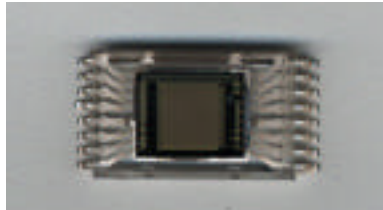

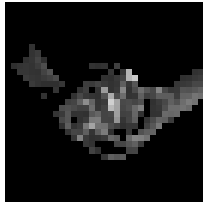





(d) Random Access



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MITSUBISHI CMOS IMAGE SENSOR FAMILY 1

Name	M64285FP	M64283FP (Clear Mold PKG) M64283K (Ceramic PKG)	M64287U (Monochrome Type) M64289U (Color Type)
Resolution	32x32	128x128	352x288
Photograph (Configuration)	 (6.13mmx5.3mm)	 M64283FP (11.1mmx6.9mm)	 M64287U (11.0mmx14.0mm)
Output Image Sample			 Monochrome Type  Color Type
Features	<ul style="list-style-type: none">◆ Positive and negative image output◆ Edge enhancement / extraction◆ Row / column image projection◆ Built-in CDS circuit◆ Output level and gain tuning◆ Automatic Black level adjustment◆ Variable data rate (2μs~32μs/Pixel)◆ Controlled by 8bit MCU	<ul style="list-style-type: none">◆ Positive and negative image output◆ Edge enhancement/extraction◆ Row/column image projection◆ Random access function◆ Output level and gain tuning◆ Black level tuning	<ul style="list-style-type: none">◆ Sleep mode◆ RGB gain control circuits (Color type)◆ 2D filtering function◆ Built-in CDS circuits◆ Built-in ADC circuits◆ Output level and gain tuning◆ Black level tuning
Status	3Q/1999	Now	2Q/1999



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MITSUBISHI CMOS IMAGE SENSOR FAMILY 2

Name	Resolution	Function outline	PKG	Applications	Sample time		
	Category				ES	CS	MP
M64283FP	128x128 B&W standard	<ul style="list-style-type: none"> ◆ edge enhancement / detection ◆ 2D to 1D projection ◆ Random access 	16C9-B	Game, PDC PC interface	NOW	98/4Q	98/4Q
M64283K	128x128 B&W standard	<ul style="list-style-type: none"> ◆ edge enhancement / detection ◆ 2D to 1D projection ◆ Random access 	20 pins Ceramic SOP	Surveillance camera, security	NOW	98/4Q	98/4Q
M64285FP	32x32 B&W standard	<ul style="list-style-type: none"> ◆ edge enhancement / detection ◆ 2D to 1D projection ◆ Variable data rate 	10C2-C	Game, PC interface	98/4Q	99/2Q	99/2Q
M64287U	352x288 B&W standard	<ul style="list-style-type: none"> ◆ 2D filtering (optional) ◆ Built-in AD converter 	36 pin Ceramic LCC	Fingerprint Recognition Security	98/4Q	99/2Q	99/2Q
M64289U	352x288 Color standard	<ul style="list-style-type: none"> ◆ Built-in AD converter ◆ Bayer RGB color mask 	36 pins Ceramic LCC	Game, PC camera	98/4Q	99/2Q	99/2Q
M642xxU	640x480 Color standard	<ul style="list-style-type: none"> ◆ Built-in AD converter ◆ Bayer RGB color mask 	36 pins Ceramic LCC	Game, PC camera	under development		
M64270P	480x144 Color custom	<ul style="list-style-type: none"> ◆ Built-in AD converter ◆ Stripe RGB color mask 	20 pins DIP	Game, PC camera	98/4Q	99/3Q	99/3Q



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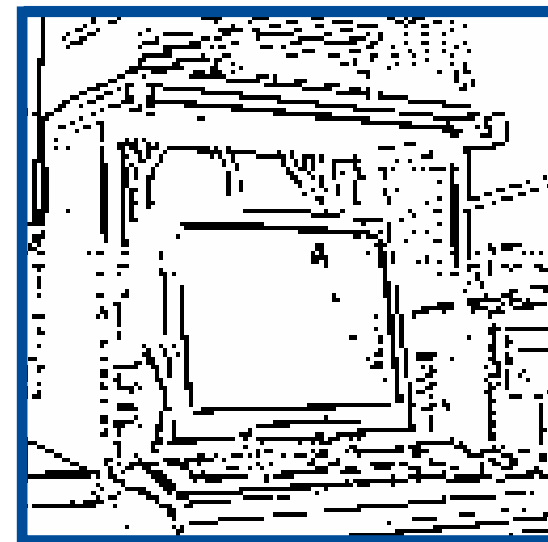
SAMPLE IMAGES (128X128 PIXELS)



Original Image



Edge Extracted Image



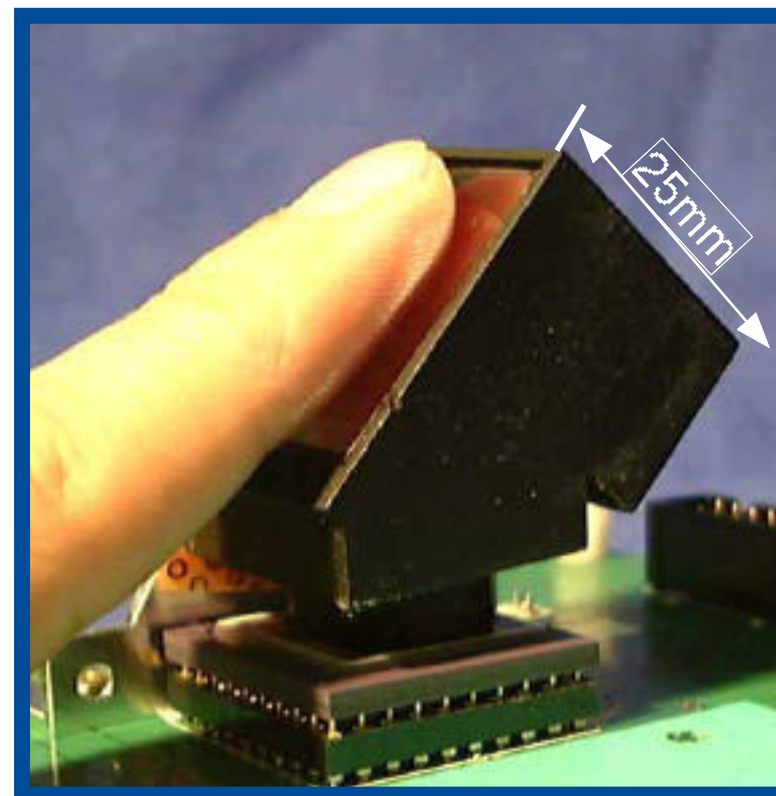
Binary Image

Processed Image



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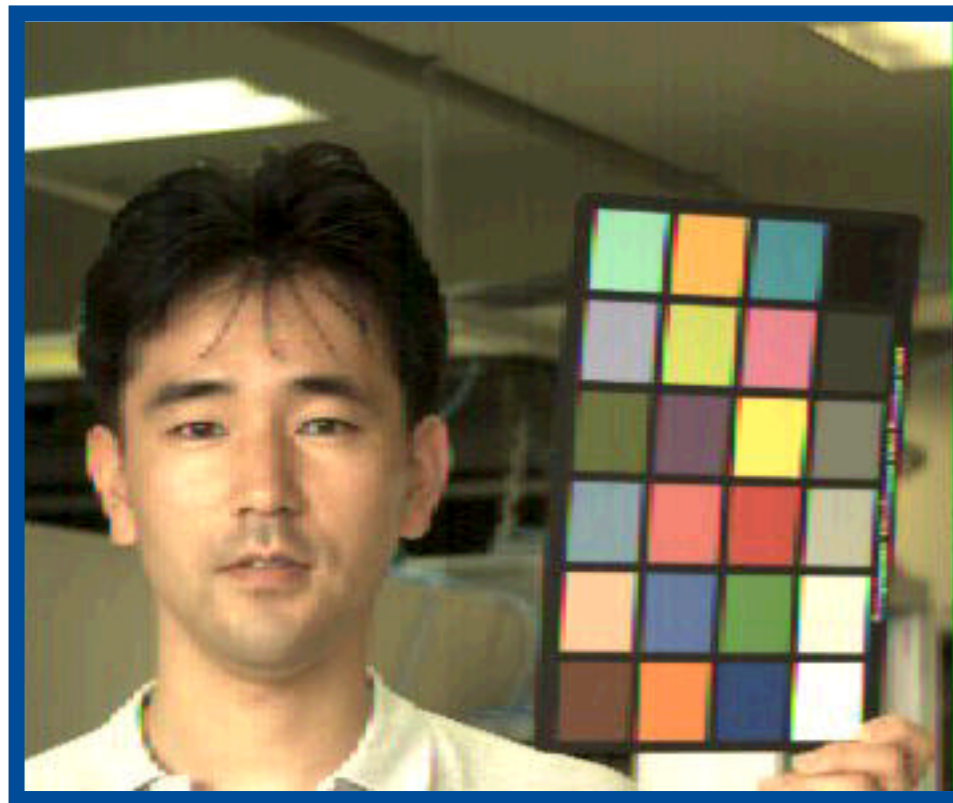
SAMPLE IMAGES - FINGERPRINTING (CIF SIZE IMAGE)





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SAMPLE IMAGES - COLOR CIF SIZE IMAGE

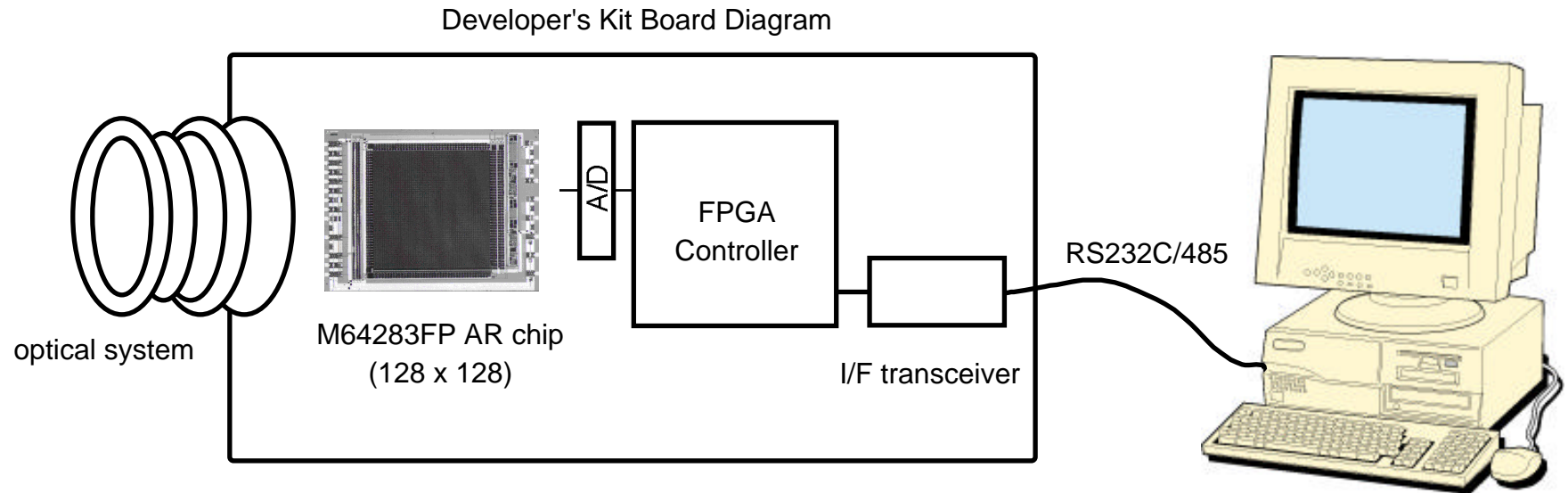


*) spatial frequency filter is not incorporated.



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M64283FP DEVELOPMENT KIT



Features

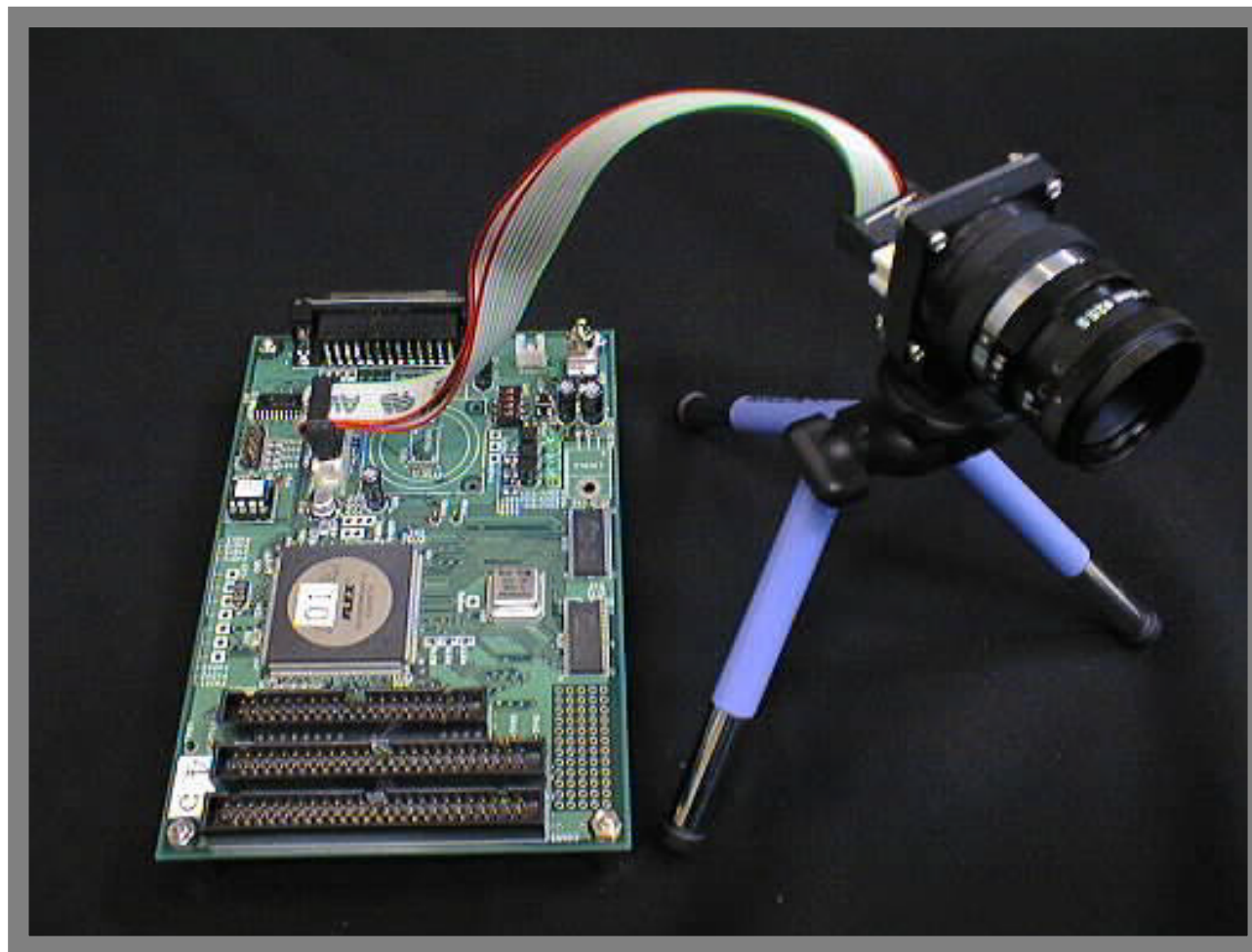
- 1) interactively check all functions of AR Chip
- 2) make user programs with AR library functions in C or C++ language.

OS : Windows 95/98



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DEVELOPMENT KIT PHOTOGRAPH





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Game/Toy

NINTENDO GAMEBOY POCKET CAMERA

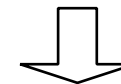


M64282FP

Feature Enhanced Image



Input Image



Output Image



CONCLUSION

- Mitsubishi CMOS Image Sensor offers low-cost, low-power, and compact solutions to digital imaging applications that may currently be using CCD's.
- Low resolution CMOS image sensors(M64283FP, M64285FP) are suitable for interactive game interfaces, machine vision applications, pattern recognition systems, and security applications.
- High resolution CMOS image sensors(M64287U, M64289U) are suitable for PC applications including USB video camera, fingerprint recognition systems, and digital consumer imaging applications.
- Mitsubishi offers not only image sensors but also microcontrollers that are suitable for developing system solutions.