Key devices looking ahead into the visual information age, providing sharp image and vivid color reproduction

The CCD (charge-coupled device) is one of the keys that lead you to the next era. Panasonic uses its leading-edge technology and provides world-wide CCD products as key devices for image data. Manufacturers are actively making efforts at developing products that are more compact, lightweight, and less power-consuming than conventional ones. This trend is especially prominent in the current consumer market.

Devices producing electronic images are making progress at an increasing tempo in a wide range of applications including multimedia, information, communications, medical, security, distribution, and traffic applications as well as digital still cameras, video cameras, and professional TV cameras.

In the future, the key differentiating a company will depend on how the company can provide consumers with ideal and timely consumer-oriented products and technology.

In order to meet diversified consumer needs for high-degree applications, Panasonic will develop and offer each one of such products in a timely and wide variety as core products providing electronic images.
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CCD Image Sensors are compared to electronic eyes to capture visual information in a wide variety of consumer and industrial electronics fields. Indeed, with the rapid spread of computers and image processing devices, the application range of CCD Image Sensors is almost infinite. Already they have been contributing toward increasing the sensitivity of a variety of devices accompanied by a decrease in their weight.

### Application Examples of CCD Image Sensors

#### AV (Audio-visual) use
- Camcorders
- DSC

#### Industrial use
- Broadcast camera
- Security camera and FA use
- Medical camera
- 2D bar-code reader

#### Information and communications use
- Cellular phone
- TV door camera
- PC camera
- Teleconference system
- PDA

#### ITS (Intelligent Transport System)
- Car-to-car distance check camera
- License plate recognition camera
- Backside check camera
Roadmap of CCD Image Sensors

The above graphs indicate the technical trend of CCD Image Sensors toward an increase in pixels. The graphs, however, do not mean that all products were or will be commercialized.

---

Trend of Digital Still Cameras

Applications

<table>
<thead>
<tr>
<th>Size</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
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<tbody>
<tr>
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<td>Type-1/2.5</td>
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<td>3M pixels</td>
<td>4M pixels</td>
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<td>Type-1/3.2</td>
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<td>3M pixels</td>
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<td>Type-1/4</td>
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Trend of Camcorder, Broadcast and Industrial Applications

<table>
<thead>
<tr>
<th>Pixel count of image elements</th>
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<th>2004</th>
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<td>2.2M pixels (1080p) IT</td>
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<td>680k/810k pixels</td>
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<td>Type-1/4</td>
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<td>520k/600k pixels</td>
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<td>Type-2/3</td>
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<tr>
<td>2.2M pixels (1080p)</td>
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<td>Type-2/3</td>
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<td>270k/320k pixels</td>
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<td>Type-2/3</td>
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<td>2M pixels</td>
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<td>Type-1/4</td>
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</table>

(P): Progressive scan   Others: Interlace scan
CCD Image Sensor Technology

The development of high-performance CCD Image Sensors has been supported by Panasonic's basic element techniques that have been accumulated in the past. Panasonic has always been looking ahead into the future and challenging technical innovation.

- **Gapless Lens and Inner-layer Lens**

Panasonic adopted a gapless lens that greatly increases the light received by the photodiode and significantly improves light-collecting efficiency by clearing the gap between condensers. The Inner-Layer Lens, another new technology, efficiently focuses rays of light on the photodiode after the incident light is captured by the gapless lens. These technologies, combined in Panasonic’s groundbreaking CCD, prevent the deterioration of sensitivity which was an inevitable result of downsizing CCDs. Instead, they make it possible to reproduce crisp, clear, sharp, actual images regardless of the degree of subjective contrast while ensuring compact size and high performance.

- **Color Filter Arrays**

Color filter arrays in a wide variety are available including the RGB Bayer array and Panasonic’s unique complementary filter array arranged in color difference progression. Select the most suitable one according to the application. Furthermore, complementary and RGB filters of pigment dispersion type, which have excellent light-exposure properties are available.

**Complementary Filter (in Color Difference Progression)**
- Adopted by most camcorders
- Two vertical pixels can be mixed
- Suitable for moving images but independent image data reading is possible
- High-sensitivity luminance
- High-resolution luminance

**RGB Filter (Bayer Array)**
- Adopted by a large number of models employing progressive scanning
- Independent image data reading only
- High color S/N
- High color reproducibility
- Simple color processing circuit available
**Image Scanning and Signal Reading**

Panasonic’s progressive scan (PS) CCD, which is ideal for PC (personal computer) graphic input use and DSC (digital still camera) applications, is supported by three-layer polysilicon processing technology. This technology has made it possible for the CCD in PS mode to provide finer images with higher resolution than conventional CCD models in IS (interlace scan) mode.

### Comparison of Image Scanning Methods

- **TV scan in IS mode**

- **PC display in PS mode**

### Comparison of Signal Reading Methods

- **IS CCD**
  - Electric charges for two-pixel signals are mixed and transferred by the vertical CCD.

- **PS CCD**
  - An electric charge for each pixel is independently transferred by the vertical CCD.
Overview
Providing a variety of CCD Image Sensors for the multimedia application field that is expanding almost infinitely. The industry's state-of-the-art technology employed ensures higher performance and expanded functions than those of conventional models, thus offering a wide range of applications.

Features
- Offering a lineup of models with 350k to 5.36M pixels in total
- Providing high-resolution images almost as fine as photographs
- High sensitivity, a wide dynamic range
- A newly developed plastic package employed
- Ensuring ease of system construction with peripheral ICs/LSIs

Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Size</th>
<th>Nominal pixel count in total</th>
<th>Effective pixel count (H)</th>
<th>Scanning mode</th>
<th>Saturation output Typ. (mV)</th>
<th>Sensitivity (F8.0) Typ. (mV)</th>
<th>Aspect ratio</th>
<th>Package</th>
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<td>350k</td>
<td>659 x 494</td>
<td>PS</td>
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<td>200</td>
<td>4 : 3</td>
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<td>MN39472PJ</td>
<td>6.0 mm (Type-1/3.2)</td>
<td>2.11M</td>
<td>1648 x 1236</td>
<td>IS</td>
<td>550</td>
<td>300</td>
<td>4 : 3</td>
<td>WDIP016-P-0500C</td>
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<tr>
<td>▲MN39400</td>
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<td>2088 x 1550</td>
<td>IS</td>
<td>800</td>
<td>350</td>
<td>4 : 3</td>
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<td>MN39592PJ</td>
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<td>3.34M</td>
<td>2088 x 1550</td>
<td>IS</td>
<td>550</td>
<td>300</td>
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<td>4.24M</td>
<td>2336 x 1774</td>
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<td>800</td>
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<td>4 : 3</td>
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</tbody>
</table>

*+: The effective pixel count includes the transient pixels.  ▲: Under development

| Symbols | PS: Progressive Scan | IS: Interlace Scan |

Peripheral ICs/LSIs

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Operating voltage (V)</th>
<th>Process</th>
<th>Function</th>
<th>Package</th>
<th>Pin count</th>
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<td>Timing generator</td>
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<td>48</td>
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<td>Vertical driver</td>
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<td>CMOS</td>
<td>Multi-power supply type</td>
<td>SSOP</td>
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<td>Digital Pre-processor</td>
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</tr>
<tr>
<td>AN12012A</td>
<td>2.7 to 3.6</td>
<td>CMOS</td>
<td>CDS + AGC + 10-bitADC incorporated</td>
<td>LOFP</td>
<td>48</td>
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<td>AN12013A</td>
<td>2.7 to 3.6</td>
<td>CMOS</td>
<td>CDS + AGC + 12-bitADC incorporated</td>
<td>LOFP</td>
<td>48</td>
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<td>AN12050A</td>
<td>2.7 to 3.6</td>
<td>CMOS</td>
<td>TG + CDS + AGC + 10-bitADC incorporated</td>
<td>LOFP</td>
<td>48</td>
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<td>Digital Signal processor</td>
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<td>CMOS</td>
<td>Compatible with over 1.33M pixels CCD</td>
<td>CSP</td>
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</table>

- Timing generator
- Vertical driver
- Digital Pre-processor
- Digital Signal processor

Symbols:
PS: Progressive Scan
IS: Interlace Scan

Notes:
- The effective pixel count includes the transient pixels.
- ▲: Under development
System Configuration

CCD Camera System (I)

- CCD (5.36M pixels)
- Digital pre-processor (AN12013A)
- Timing generator (MN52B6CE)
- Vertical driver (AN20101A)
- SDRAM (64M)
- Video output
- Analog RGB
- Flash card

CCD Camera System (II)

- CCD (2.11M/3.34M pixels)
- Digital pre-processor (AN12050A)
- Timing generator
- Vertical driver (MN3114)
- SDRAM (64M)
- Video output
- Analog RGB
- Flash card
CCD Image Sensors for Camcorders

Overview
Providing a variety of CCD Image Sensors for the consumer camcorders application field.
The industry’s state-of-the-art technology employed ensures higher performance and expanded functions than those of conventional models, thus responding to a wide variety of needs.

Features
- Offering a lineup of models with 270k to 1.33M pixels in total
- High sensitivity with low smear
- Continuously variable electronic shutter function
- Ease of system construction with peripheral ICs/LSIs

Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Size</th>
<th>Nominal pixel count in total</th>
<th>Effective pixel count (H) (V)</th>
<th>Transfer mode</th>
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</table>

(*)1: The effective pixel count includes the transient pixels. ▲: Under development [Symbols]: IT: Interline Transfer method

Peripheral ICs/LSIs

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Operating voltage (V)</th>
<th>Process</th>
<th>Function</th>
<th>Package</th>
<th>Pin count</th>
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<tr>
<td>Digital pre-processor</td>
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<tr>
<td>AN12012A</td>
<td>2.7 to 3.6</td>
<td>CMOS</td>
<td>CDS + AGC + 10-bit A/D</td>
<td>LQFP</td>
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<td>MN67336</td>
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<td>CMOS</td>
<td>Color video digital encoder</td>
<td>TQFP</td>
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</table>
System Configuration

CCD Camera System (I)

- CCD (1.33M pixels)
- Digital pre-processor (AN12012A)
- Timing generator
- Vertical driver (MN31121SA)
- Digital Signal processor
- Video output
- Analog RGB

CCD Camera System (II)

- CCD (510H/768H)
- Digital pre-processor (AN12012A)
- Timing generator
- Vertical driver (MN3112SA)
- Digital Signal processor
- Digital Encoder (MN67336)
- Analog video output or Analog Y-output /C-output
- Microcomputer
- EEPROM

CCD Camera System (III)

- CCD (510H)
- Digital pre-processor
- Timing generator
- Vertical driver (MN3112SA)
- Digital Signal processor
- Digital Encoder (MN67336)
- Analog video output or Analog Y-output /C-output
- Microcomputer
- EEPROM
Overview

Providing a variety of CCD Color Image Sensors for the security camera application field that is expanding for diversified purposes. The industry’s state-of-the-art technology employed ensures higher performance and expanded functions than those of conventional models, thus responding to a wide range of needs.

Features

Color

- Offering a lineup of models with 270k to 480k pixels in total
- High sensitivity, a wide dynamic range
- A newly developed plastic package employed

Black-and-White

- Offering a lineup of models with 270k to 480k pixels in total
- Unique on-chip micro lens
- High sensitivity, a wide dynamic range
- A newly developed plastic package employed

Specifications

<table>
<thead>
<tr>
<th>Color</th>
<th>Size</th>
<th>Nominal pixel count in total</th>
<th>Effective pixel count (+1)</th>
<th>Transfer mode</th>
<th>Format</th>
<th>Saturation output (+2)</th>
<th>Sensitivity (F8.0)</th>
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</thead>
<tbody>
<tr>
<td>Part No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Typ. (mV)</td>
<td>Typ. (mV)</td>
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<tr>
<td>MN39116KT</td>
<td>4.5 mm (Type-1/4)</td>
<td>270k</td>
<td>512 x 491</td>
<td>IT</td>
<td>NTSC</td>
<td>700</td>
<td>400</td>
</tr>
<tr>
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<tr>
<td>MN39216KT</td>
<td>4.5 mm (Type-1/4)</td>
<td>320k</td>
<td>512 x 581</td>
<td>IT</td>
<td>PAL</td>
<td>700</td>
<td>380</td>
</tr>
<tr>
<td>MN39143FT</td>
<td>6.0 mm (Type-1/3)</td>
<td>410k</td>
<td>771 x 492</td>
<td>IT</td>
<td>NTSC</td>
<td>800</td>
<td>450</td>
</tr>
<tr>
<td>MN39243FT</td>
<td>6.0 mm (Type-1/3)</td>
<td>480k</td>
<td>753 x 582</td>
<td>IT</td>
<td>PAL</td>
<td>800</td>
<td>450</td>
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</table>

Black-and-White

<table>
<thead>
<tr>
<th>Color</th>
<th>Size</th>
<th>Nominal pixel count in total</th>
<th>Effective pixel count (+1)</th>
<th>Transfer mode</th>
<th>Format</th>
<th>Saturation output (+2)</th>
<th>Sensitivity (F8.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part No.</td>
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<td>Typ. (mV)</td>
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<td>512 x 491</td>
<td>IT</td>
<td>EIA</td>
<td>900</td>
<td>650</td>
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<tr>
<td>MN39216AT</td>
<td>4.5 mm (Type-1/4)</td>
<td>320k</td>
<td>512 x 581</td>
<td>IT</td>
<td>CCIR</td>
<td>840</td>
<td>560</td>
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<tr>
<td>MN39143AT</td>
<td>6.0 mm (Type-1/3)</td>
<td>410k</td>
<td>771 x 492</td>
<td>IT</td>
<td>EIA</td>
<td>1400</td>
<td>750</td>
</tr>
<tr>
<td>MN39243AT</td>
<td>6.0 mm (Type-1/3)</td>
<td>480k</td>
<td>753 x 582</td>
<td>IT</td>
<td>CCIR</td>
<td>1400</td>
<td>750</td>
</tr>
</tbody>
</table>

(+1): The effective pixel count includes the transient pixels. [Symbols] IT: Interline Transfer method (+2): Carrier (color signal) saturation output
Overview
Providing a variety of CCD Image Sensors for a wide range of industrial application fields including HDTV (high-definition television), wide-TV, and high-class security cameras. The industry’s state-of-the-art technology employed ensures higher performance.

Features
- Offering a lineup of models with 520k to 2.2M pixels in total
- 11 mm (Type-2/3) models in IT (Interline Transfer), FIT (Frame-Interline Transfer) mode
- High sensitivity, high resolution, and low smear
- Continuously variable electronic shutter function

Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Size</th>
<th>Nominal pixel count in total</th>
<th>Effective pixel count (+1) (H) (V)</th>
<th>Transfer mode</th>
<th>Format</th>
<th>Saturation output (+2)</th>
<th>Typ. (mV)</th>
<th>Sensitivity (R&amp;D)</th>
<th>Typ. (mV)</th>
<th>Package</th>
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<td>PS</td>
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<td>1300</td>
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<td>MW39440AE</td>
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<td>966 × 492</td>
<td>IT</td>
<td>EIA</td>
<td>1800</td>
<td>1300</td>
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<td>1936 × 1086</td>
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<td>300</td>
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<td>WDIP032-G-0750</td>
<td></td>
</tr>
</tbody>
</table>

(+1): The effective pixel count includes the transient pixels.

[Symbols] IT: Interline Transfer method  FIT: Frame Interline Transfer method
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