

# SHARP

## LZ244D

Low-Voltage (5 V/12 V) Operation 1/4-type  
Color CCD Area Sensor with 220k Square Pixels

### ■ Description

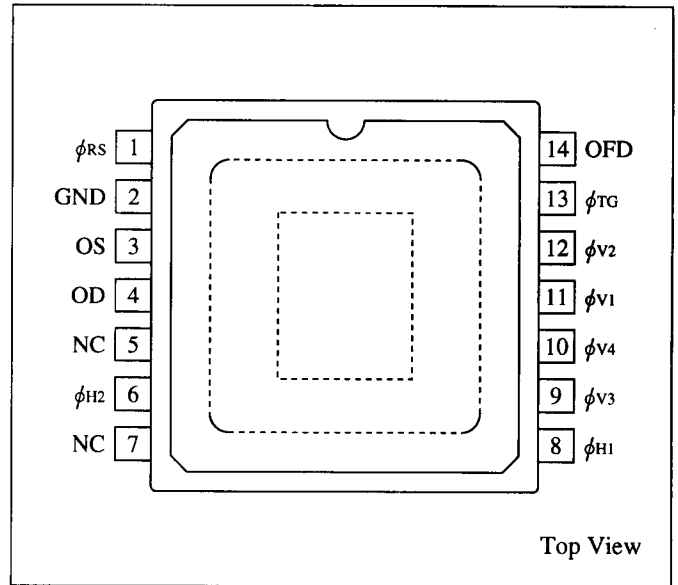
LZ244D is a 1/4-type (4.5 mm) solid state imaging device consisting of PN photo-diodes and CCDs (charge-coupled devices) driven by only positive voltages.

Having about 220 000 pixels (Horizontal 384×Vertical 582), it allows a stable color image to be obtained at high resolution.

### ■ Features

1. Low-voltage (5 V/12 V) operation
2. Number of video picture elements  
: Horizontal 362×Vertical 582  
Pixel pitch : Horizontal 13.6  $\mu\text{m}$ ×Vertical 6.3  $\mu\text{m}$   
Number of optically black pixel  
: Horizontal; front 2 and rear 20
3. Complementary color filters of Mg, G, Cy, and Ye
4. Built-in overflow drain voltage output circuit, and built-in reset gate bias output circuit
5. Reduced fixed pattern noise and lag
6. No sticking and no image distortion
7. Blooming suppression structure
8. Built-in output amplifier, voltage generator, pulse mix circuit
9. Variable electronic shutter
10. Package  
14-pin WDIP[Plastic](WDIP014-P-0400A)

### ■ Pin Connections



### ■ Pin Description

| No. | Symbol      | Pin name                        | Note |
|-----|-------------|---------------------------------|------|
| 1   | $\phi_{RS}$ | Reset transistor gate clock     | 1    |
| 2   | GND         | Ground                          |      |
| 3   | OS          | Video output                    |      |
| 4   | OD          | Output transistor drain         |      |
| 5   | NC          | No connection                   |      |
| 6   | $\phi_{H2}$ | Horizontal shift resistor clock |      |
| 7   | NC          | No connection                   |      |
| 8   | $\phi_{H1}$ | Horizontal Shift resistor clock |      |
| 9   | $\phi_{V3}$ | Vertical shift resistor clock   | 2    |
| 10  | $\phi_{V4}$ | Vertical shift resistor clock   |      |
| 11  | $\phi_{V1}$ | Vertical shift resistor clock   |      |
| 12  | $\phi_{V2}$ | Vertical shift resistor clock   |      |
| 13  | $\phi_{TG}$ | Transfer gate clock             | 3    |
| 14  | OFD         | Overflow drain                  | 1    |

Note 1.  $\phi_{RS}$ , OFD : Use the circuit parameter indicated in "System Configuration Example (P.7)", and do not connect to DC voltage directly.

When not using electrical shutter, connect OFD to GND through a 0.1  $\mu\text{F}$  capacitor and a 1 m $\Omega$  resistor.

Note 2.  $\phi_{V1}$ - $\phi_{V4}$  : Input the clock through a 0.1  $\mu\text{F}$  capacitor.

Note 3.  $\phi_{TG}$  : Use the circuit parameter indicated in "System Configuration Example (P.7)"

## Absolute Maximum Rating

(Ta=25 °C)

| Parameter                               | Symbol                 | Rating            | Unit | Note |
|---|------------------------|-------------------|------|------|
| Output transistor drain voltage         | V <sub>OD</sub>        | 0 to +15          | V    |      |
| Reset gate clock voltage                | V $\phi$ <sub>RS</sub> | (Internal output) | V    | 1    |
| Vertical shift register clock voltage   | V $\phi$ <sub>V</sub>  | 0 to +7.5         | V    |      |
| Horizontal shift register clock voltage | V $\phi$ <sub>H</sub>  | -0.3 to +7.5      | V    |      |
| Transfer gate clock voltage             | V $\phi$ <sub>TG</sub> | -0.3 to +15       | V    |      |
| Overflow drain voltage                  | V <sub>OFD</sub>       | (Internal output) | V    | 2    |
| Storage temperature                     | T <sub>stg</sub>       | -40 to +85        | °C   |      |
| Operating ambient temperature           | T <sub>opr</sub>       | -20 to +70        | °C   |      |

Note 1. Do not connect to DC voltage directly. When  $\phi$  RS is connected to GND, connect V<sub>OD</sub> to GND. Reset gate clock is applied below 8 V<sub>p-p</sub>.

Note 2. Do not connect to DC voltage directly. When OFD is connected to GND, connect V<sub>OD</sub> to GND. Overflow drain clock is applied below 13 V<sub>p-p</sub>.

## Recommended Operating Conditions

| Parameter                                 |            | Symbol  | MIN.  | TYP.  | MAX. | Unit | Note |
|---|------------|---|-------|-------|------|------|------|
| Operating ambient temperature             |            | T <sub>opr</sub>  |       | 25    |      | °C   |      |
| Output transistor drain voltage           |            | V <sub>OD</sub>   | 12    | 12.5  | 13   | V    |      |
| Overflow drain clock                      | P-P level  | V $\phi$ <sub>OFD</sub>   | 12    | 12.5  | 13   | V    | 1    |
| Ground voltage                            |            | GND   |       | 0     |      | V    |      |
| Transfer gate clock                       | LOW level  | V $\phi$ <sub>TGL</sub>   | -0.05 | 0     | 0.05 | V    |      |
|   | HIGH level | V $\phi$ <sub>TGH</sub>   | 12    | 12.5  | 13   | V    |      |
| Vertical shift register clock             | P-P level  | V $\phi$ <sub>V1</sub> , V $\phi$ <sub>V2</sub> , V $\phi$ <sub>V3</sub> , V $\phi$ <sub>V4</sub> | 4.7   | 5.0   | 5.5  | V    | 2    |
| Horizontal shift register clock           | LOW level  | V $\phi$ <sub>H1L</sub> , V $\phi$ <sub>H2L</sub>   | -0.05 | 0     | 0.05 | V    |      |
|   | HIGH level | V $\phi$ <sub>H1H</sub> , V $\phi$ <sub>H2H</sub>   | 4.7   | 5.0   | 5.5  | V    |      |
| Reset gate clock                          | P-P level  | V $\phi$ <sub>RS</sub>  | 4.5   | 5.0   | 5.5  | V    | 3    |
| Vertical shift register clock frequency   |            | f $\phi$ <sub>V1</sub> , f $\phi$ <sub>V2</sub> , f $\phi$ <sub>V3</sub> , f $\phi$ <sub>V4</sub> |       | 15.63 |      | kHz  |      |
| Horizontal shift register clock frequency |            | f $\phi$ <sub>H1</sub> , f $\phi$ <sub>H2</sub>   |       | 6.75  |      | MHz  |      |
| Reset gate clock frequency                |            | f $\phi$ <sub>RS</sub>  |       | 6.75  |      | MHz  |      |

Note 1. OFD : Use the circuit parameter indicated in "System Configuration Example (P.7)", and do not connect to DC voltage directly.

Note 2.  $\phi$  V1 -  $\phi$  V4 : Use the circuit parameter indicated in "System Configuration Example (P.7)", and do not connect to DC voltage directly.

Note 3.  $\phi$  RS : Use the circuit parameter indicated in "System Configuration Example (P.7)", and do not connect to DC voltage directly.

※ To apply power, first connect GND and then turn on V<sub>OD</sub> and then turn on other powers and pulses.

Do not connect the device to or disconnect it from the plug socket while power is being applied.

## ■ Electrical Characteristics

- Drive method : Field accumulation
- DC and AC conditions : The typical values under the recommended operating conditions.
- Ambient temperature : 25 °C
- Temperature of light source : 3 200 K
- Infrared absorbing filter (CM-500,1 mm) is used.

| Parameter                     | Symbol            | MIN. | TYP. | MAX. | Unit | Note  |
|-------------------------------|-------------------|------|------|------|------|-------|
| Standard output voltage       | V <sub>o</sub>    |      | 150  |      | mV   | 2     |
| Photo response non-uniformity | PRNU              |      |      | 15   | %    | 3     |
| Saturation output voltage     | V <sub>sat</sub>  | 550  |      |      | mV   | 4     |
| Dark output voltage           | V <sub>dark</sub> |      | 0.5  |      | mV   | 1, 5  |
| Dark signal non-uniformity    | DSNU              |      | 0.5  |      | mV   | 1, 6  |
| Sensitivity                   | R                 |      | 400  |      | mV   | 7     |
| Smear ratio                   | SMR               |      | -85  |      | dB   | 8     |
| Image lag                     | AI                |      |      | 1.0  | %    | 9     |
| Blooming suppression ratio    | ABL               | 1000 |      |      |      | 10    |
| Current dissipation           | I <sub>OD</sub>   |      | 4.0  | 8.0  | mA   |       |
| Output impedance              | R <sub>o</sub>    |      | 400  |      | Ω    |       |
| Vector breakup                |                   |      |      | 10   | °, % | 11    |
| Line crawling                 |                   |      |      | 3.0  | %    | 12    |
| Luminance flicker             |                   |      |      | 2.0  | %    | 1, 13 |

Note 1. Ta=60 °C

Note 2. The standard output voltage is defined as 150 mV by the average output voltage under uniform illumination.

Note 3. The image area is divided into 10×10 segments. The voltage of a segment is the average of output voltage from all the pixels within the segment.

PRNU is defined by  $(V_{max} - V_{min}) / V_o$ , where V<sub>max</sub> and V<sub>min</sub> are the maximum and the minimum values of each segment's voltage respectively, when the average output voltage V<sub>o</sub> is 150 mV.

Note 4. The image area is divided into 10×10 segments. The saturation signal is defined as the minimum of each segment's voltage which is the average of output voltage from all the pixels within the segment, when the exposure level is set as 10 times, compared to standard level.

Note 5. The average output voltage under a non-exposure condition.

Note 6. The image area is divided into 10×10 segments.

DSNU is defined by  $(V_{dmax} - V_{dmin})$  under the non-exposure condition where V<sub>dmax</sub> and V<sub>dmin</sub> are the maximum and the minimum values of each segment's voltage, respectively, that is the average output voltage over all pixels in the segment.

Note 7. The average output voltage when a 1000 lux light source attached with a 90% reflector is imaged by a lens of F4, f50 mm.

Note 8. The sensor is adjusted to position a V/10 square at the center of image area where V is the vertical length of the image area. SMR is defined by the ratio of the output voltage detected during the vertical blanking period to the maximum of the pixel voltage in the V/10 square.

Note 9. The sensor is exposed at the exposure level corresponding to the standard condition preceding non-exposure condition. AI is defined by the ratio between the output voltage measured at the 1st field during the non-exposure period and the standard output voltage.

Note 10. The sensor is adjusted to position a V/10 square at the center of image area.

ABL is the ratio between the exposure at the standard condition and the exposure at a point where a blooming is observed.

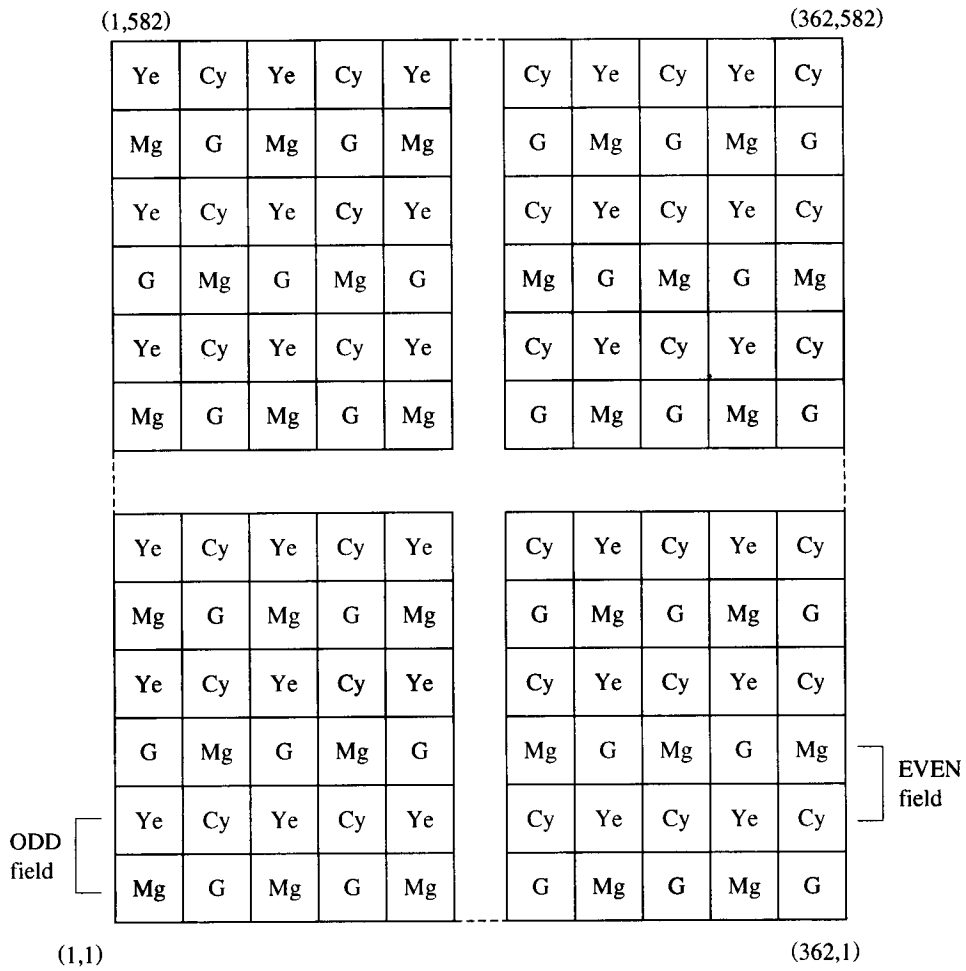
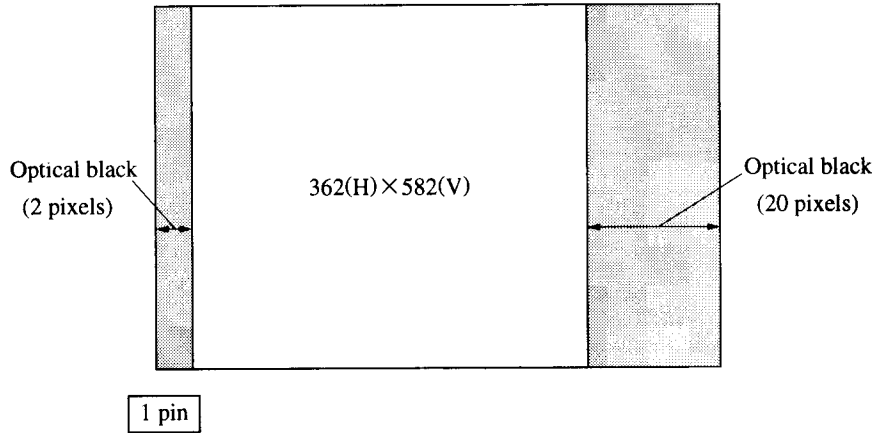
Note 11. Observed with a vector scope when the color bar chart is imaged under the standard exposure condition.

Note 12. The difference between the average output voltage of the (Mg + Ye), (G + Cy) line and the (Mg + Cy), (G + Ye) line under the standard exposure condition.

Note 13. The difference between the average output voltage of the odd field and the even field.

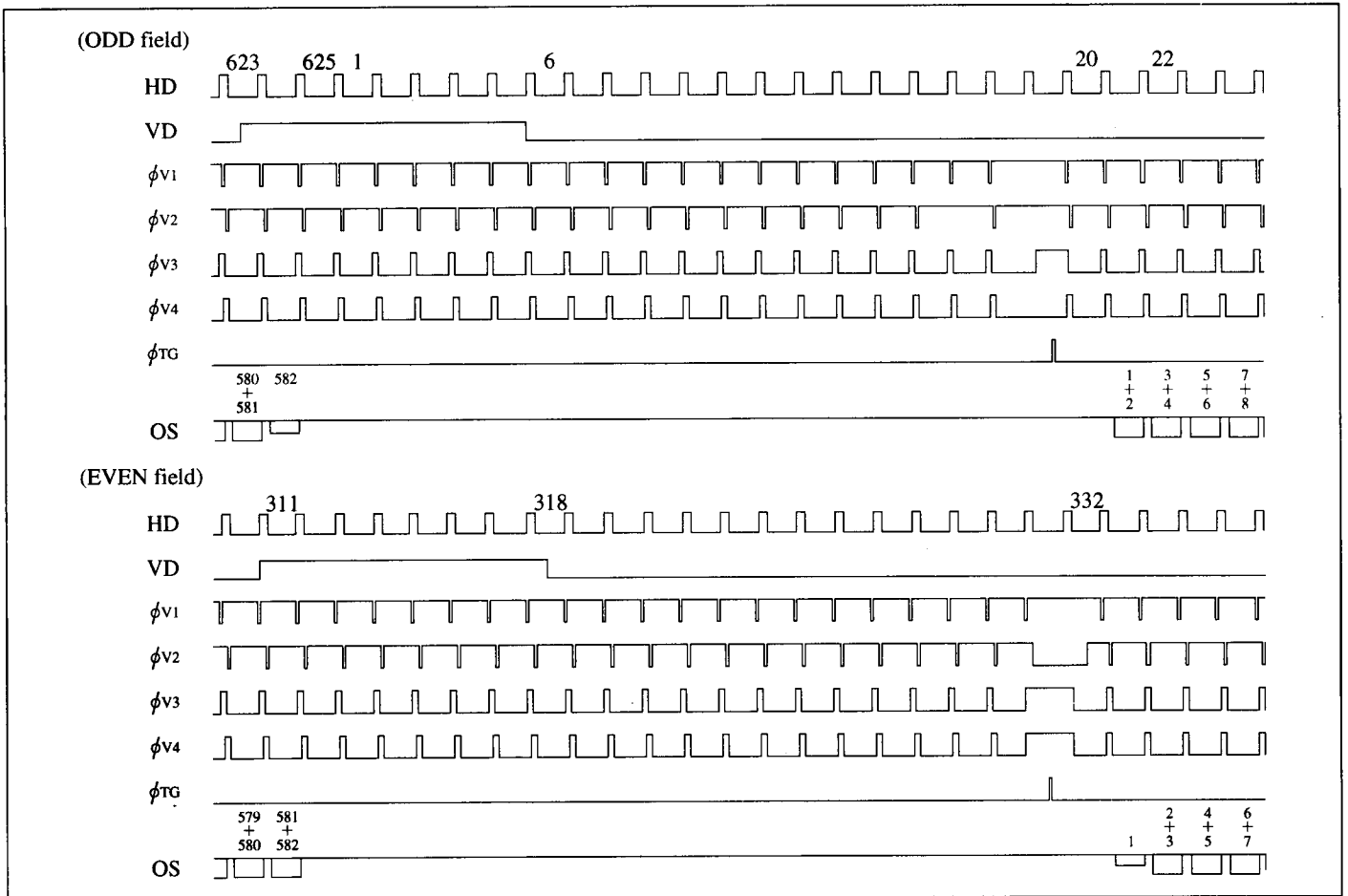
※ Within the recommended operating condition of V<sub>OD</sub>, V<sub>OFD</sub> of the internal output satisfy with ABL larger than 1000 times exposure of the standard exposure condition, and V<sub>sat</sub> larger than 450 mV.

■ Composition of Pixels and Arrangement of Color Filters

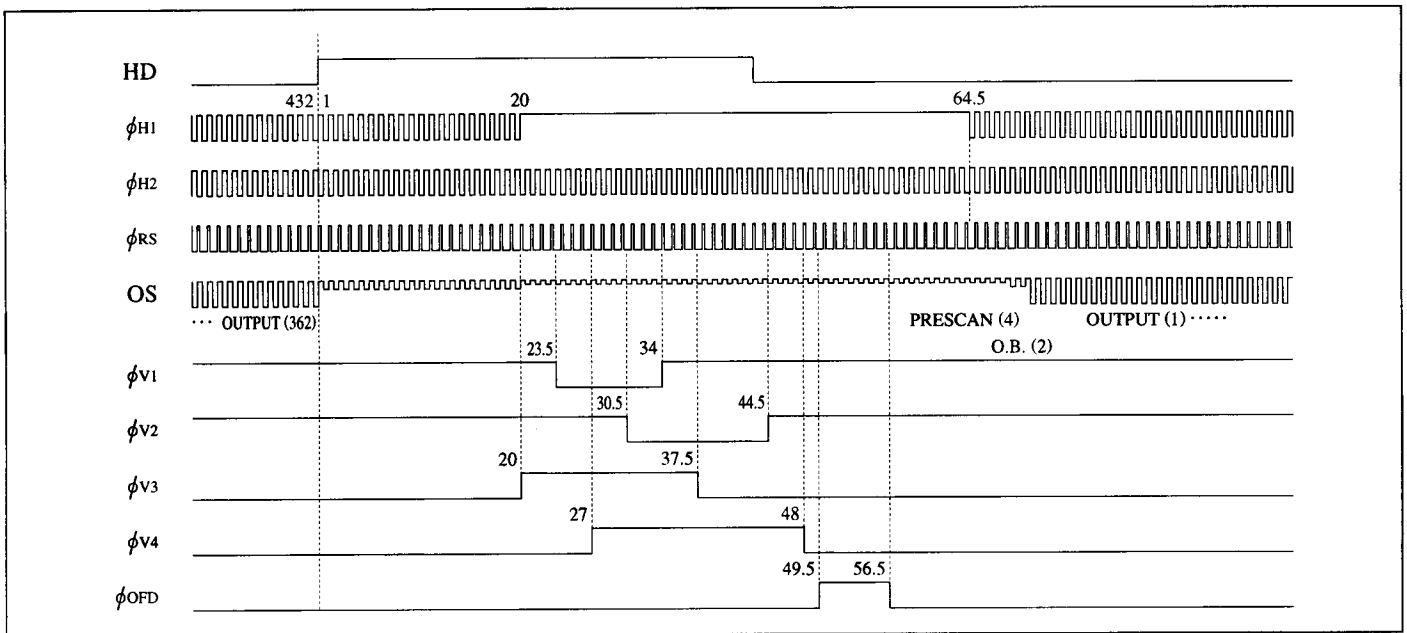


■ Timing Diagram

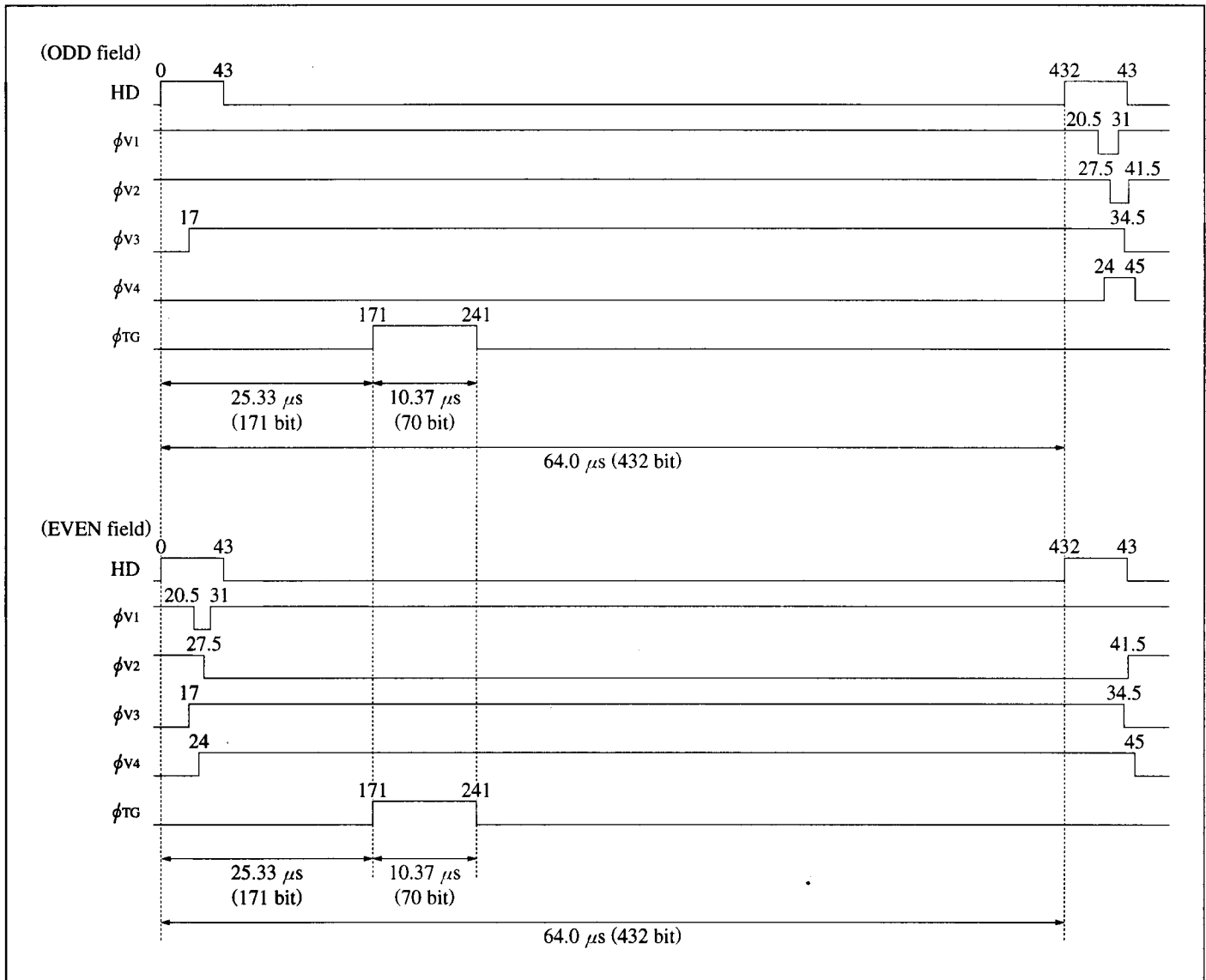
(1) Vertical Transfer Timing



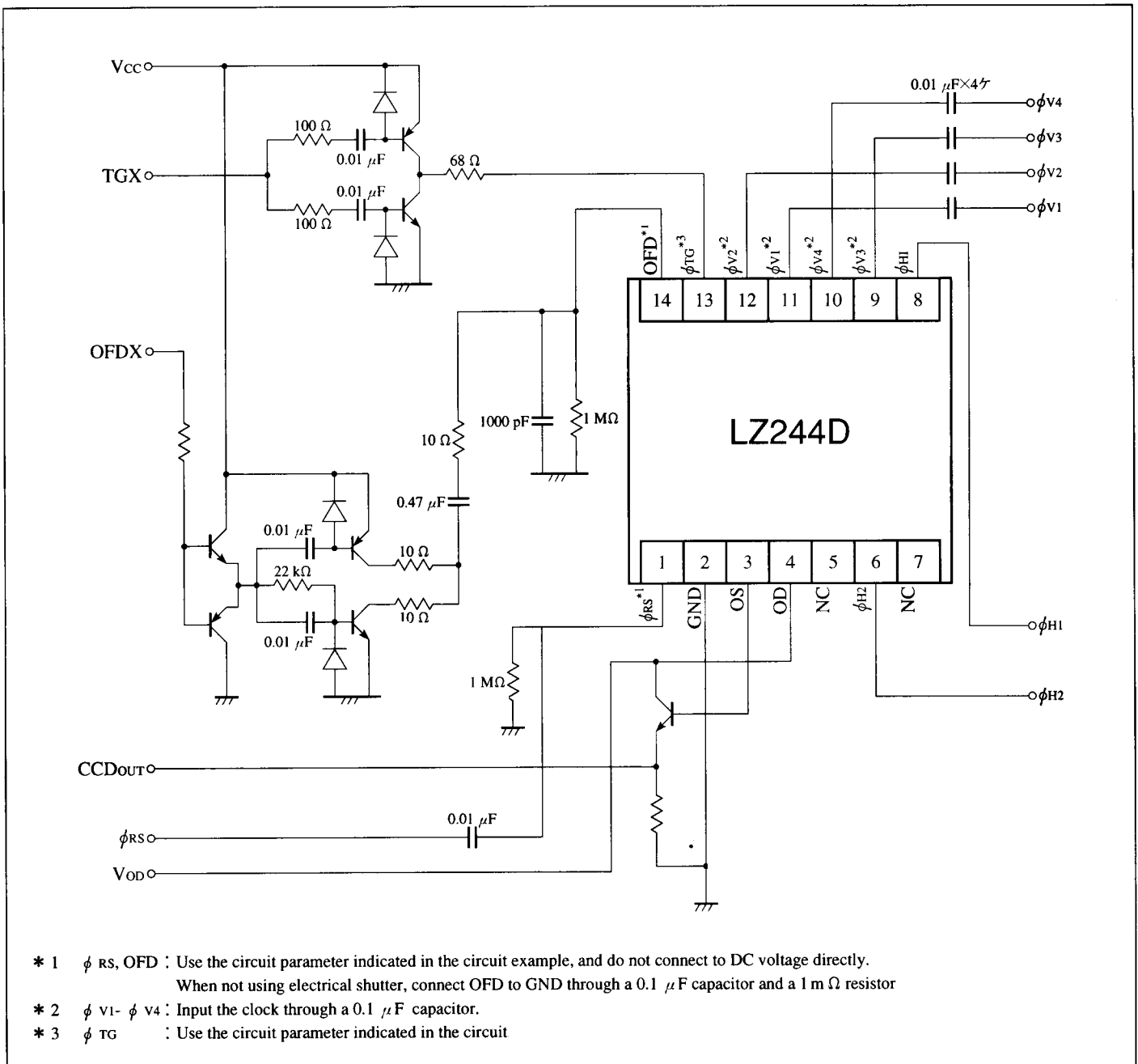
(2) Horizontal Transfer Timing



(3) Read Out Timing



System Configuration Example



Sharp's Product Line-up (Low-voltage (5 V/12 V) operation 1/4-type CCD Area Sensor)

★Under development

| No. of pixels | TV standard |      | Model No  | Electronic shutter (s) | Resolution          |                       | Pixels pitch H×V ( $\mu$ m <sup>2</sup> ) | Sensitivity TYP. (mV) | Smear ratio TYP. (%) | Package            |
|---------------|-------------|------|-----------|------------------------|---------------------|-----------------------|---|-----------------------|----------------------|--------------------|
|               |             |      |           |                        | Horizontal TV lines | Effective pixel (H×V) |   |                       |                      |                    |
| 220 000       | Color       | PAL  | LZ244D*1  | 1/80 to 1/10 000       | 230                 | 362×582               | 9.4×9.4                                   | 400                   | 0.005                | 14WDIP (Plastic)*3 |
| 270 000       | Color       | NTSC | ★LZ2415*2 | 1/60 to 1/10 000       | 330                 | 512×492               | 7.2×5.6                                   | 310                   | 0.006                | 14WDIP (Plastic)*3 |
|               | B/W         | EIA  | LZ2416J*2 | 1/60 to 1/10 000       | 380                 | 512×492               | 7.2×5.6                                   | 450                   | 0.006                | 14WDIP (Plastic)*3 |
| 320 000       | Color       | PAL  | ★LZ2425*2 | 1/50 to 1/10 000       | 330                 | 512×582               | 7.2×4.7                                   | 280                   | 0.006                | 14WDIP (Plastic)*3 |
|               | B/W         | CCIR | LZ2426J*2 | 1/50 to 1/10 000       | 380                 | 512×582               | 7.2×4.7                                   | 400                   | 0.006                | 14WDIP (Plastic)*3 |

\*1 OFD voltage no adjust  
\*2 With mirror image function  
\*3 Pin - pitch 1.27 mm

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- Industrial control
- Audio visual equipment
- Consumer electronics

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LZ244D, CCD, sensor, imaging, area sensor, pattern recognition