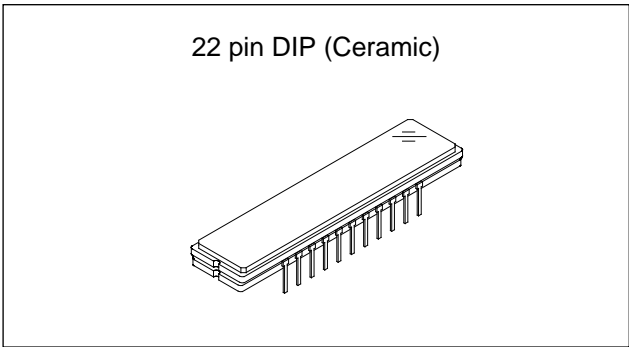


2048-pixel CCD Linear Image Sensor (B/W) with Shutter Function

Description

The ILX703A is a reduction type CCD linear sensor designed for facsimile, image scanner and OCR use. This sensor reads B4 size documents at a density of 200 DPI (Dot Per Inch). Featuring a shutter function, correspondences with the sensitivity correction, etc, is possible. A built-in timing generator and clock-drivers ensure direct drive at 5V logic for easy use.



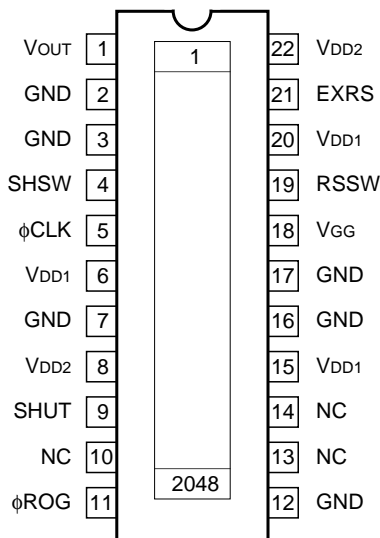
Features

- Number of effective pixels: 2048 pixels
- Pixel size: 14µm × 14µm (14µm pitch)
- Built-in timing generator and clock-drivers
- Shutter function
- Ultra low lag
- Maximum clock frequency: 5MHz

Absolute Maximum Ratings

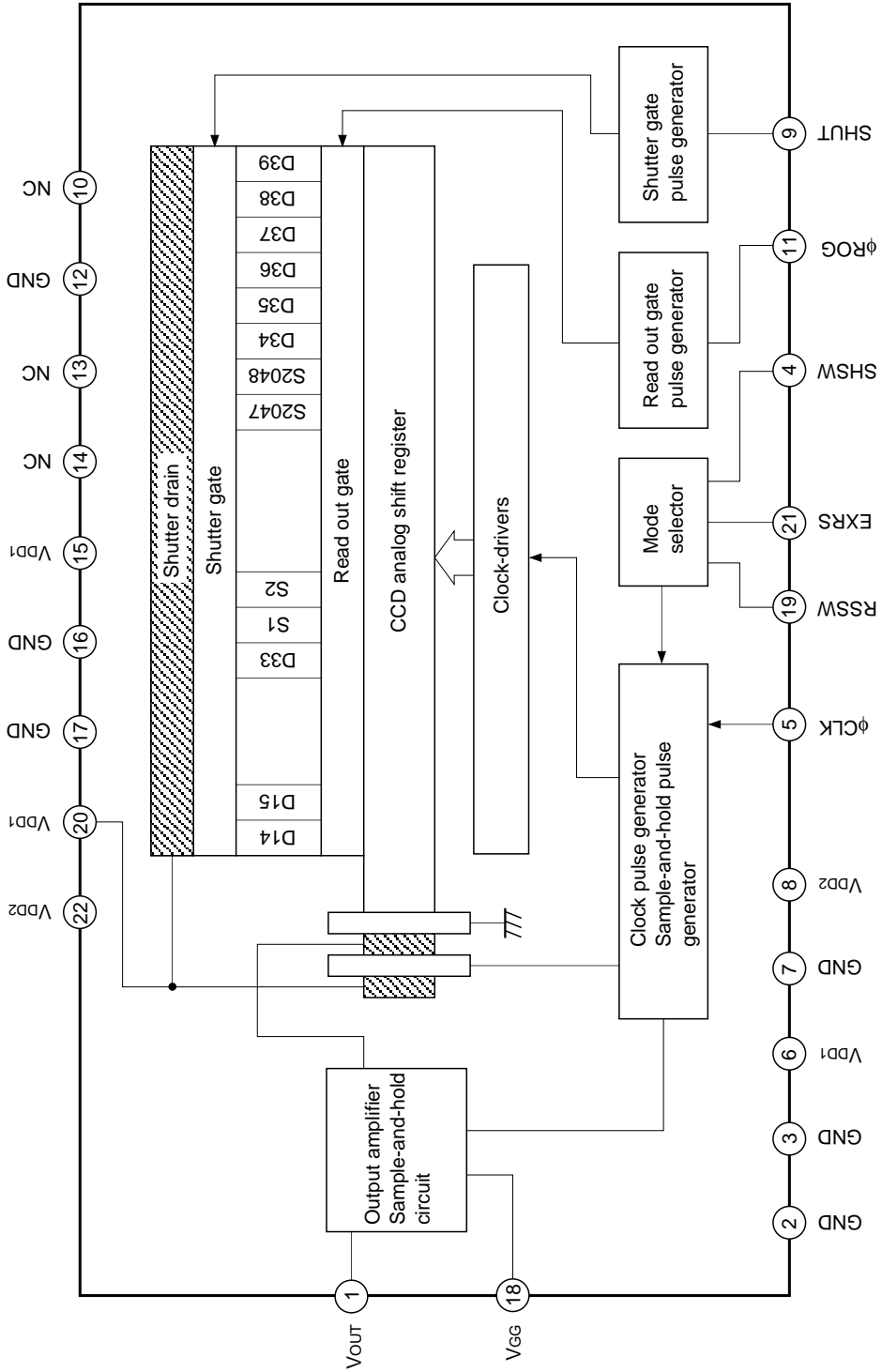
- Supply voltage V_{DD1} 11 V
V_{DD2} 6 V
- Operating temperature -10 to +55 °C
- Storage temperature -30 to +80 °C

Pin Configuration (Top View)



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Block Diagram



Pin Description

| Pin No. | Symbol | Description |
|---------|------------------|------------------------------------------------------------------------------------|
| 1 | V _{OUT} | Signal output |
| 2 | GND | GND |
| 3 | GND | GND |
| 4 | SHSW | Switch { with S/H → GND without S/H → V _{DD2} |
| 5 | φCLK | Clock pulse |
| 6 | V _{DD1} | 9V power supply |
| 7 | GND | GND |
| 8 | V _{DD2} | 5V power supply |
| 9 | SHUT | Shutter pulse |
| 10 | NC | NC |
| 11 | φROG | Clock pulse |
| 12 | GND | GND |
| 13 | NC | NC |
| 14 | NC | NC |
| 15 | V _{DD1} | 9V power supply |
| 16 | GND | GND |
| 17 | GND | GND |
| 18 | V _{GG} | Output circuit gate bias |
| 19 | RSSW | Reset pulse switchover pin (External RS → V _{DD2} , Internal RS → GND) |
| 20 | V _{DD1} | 9V power supply |
| 21 | EXRS | RS input pin during external RS pulse usage |
| 22 | V _{DD2} | 5V power supply |

Recommended Voltage

| Item | Min. | Typ. | Max. | Unit |
|------------------|------|------|------|------|
| V _{DD1} | 8.5 | 9.0 | 9.5 | V |
| V _{DD2} | 4.75 | 5.0 | 5.25 | V |

Note) Rules for raising and lowering power supply voltage

To raise power supply voltage, first raise V_{DD1} (9V) and then V_{DD2} (5V).

To lower voltage, first lower V_{DD2} (5V) and then V_{DD1} (9V).

Mode Description

| Mode in use | | Pin condition | | |
|-------------|-----|------------------|------------------|------------------|
| RS | S/H | 4 pin SHSW | 19 pin RSSW | 21 pin EXRS |
| Internal | Yes | GND | GND | V _{DD2} |
| | No | V _{DD2} | GND | V _{DD2} |
| External | No | V _{DD2} | V _{DD2} | φRS |

Input Capacity of Pins

| Item | Symbol | Min. | Typ. | Max. | Unit |
|----------------------------|-------------------|------|------|------|------|
| Input capacity of φCLK pin | C _{φCLK} | — | 10 | — | pF |
| Input capacity of φROG pin | C _{φROG} | — | 10 | — | pF |
| Input capacity of SHUT pin | C _{SHUT} | — | 10 | — | pF |
| Input capacity of EXRS pin | C _{EXRS} | — | 10 | — | pF |

Recommended Input Pulse Voltage

| Parameter | Min. | Typ. | Max. | Unit |
|------------------------|------|------|------|------|
| Input clock high level | 4.5 | 5.0 | 5.5 | V |
| Input clock low level | 0.0 | — | 0.5 | V |

Electro-optical Characteristics

(Ta = 25°C, V_{DD1} = 9V, V_{DD2} = 5V, Clock frequency: 1MHz,
Light source = 3200K, IR cut filter: CM-500S (t = 1.0mm)),
When Internal RS (Pin 19 = GND, Pin 21 = V_{DD2})

| Item | Symbol | Min. | Typ. | Max. | Unit | Remarks |
|---------------------------|-------------------|------|-------|------|------------|---------|
| Sensitivity 1 | R1 | 22.5 | 30 | 37.5 | V/(lx · s) | Note 1 |
| Sensitivity 2 | R2 | — | 95 | — | V/(lx · s) | Note 2 |
| Sensitivity 3 | R3 | — | 20 | — | V/(lx · s) | Note 3 |
| Sensitivity 4 | R4 | — | 500 | — | V/(lx · s) | Note 4 |
| Sensitivity nonuniformity | PRNU | — | 2.0 | 8.0 | % | Note 5 |
| Saturation output voltage | V _{SAT} | 1.5 | 1.8 | — | V | — |
| Dark voltage average | V _{DRK} | — | 0.3 | 2.0 | mV | Note 6 |
| Dark signal nonuniformity | DSNU | — | 0.5 | 3.0 | mV | Note 6 |
| Image lag | IL | — | 0.02 | — | % | Note 7 |
| Dynamic range | DR | — | 6000 | — | — | Note 8 |
| Saturation exposure | SE | — | 0.060 | — | lx · s | Note 9 |
| 9V supply current | I _{VDD1} | — | 8.0 | 14.0 | mA | — |
| 5V supply current | I _{VDD2} | — | 3.0 | 6.0 | mA | — |
| Total transfer efficiency | TTE | 92.0 | 97.0 | — | % | — |
| Output impedance | Z _o | — | 600 | — | Ω | — |
| Offset level | V _{OS} | — | 4.5 | — | V | Note 10 |
| Shutter lag | SHUT | 0 | 1.0 | 5.0 | % | Note 11 |

Notes)

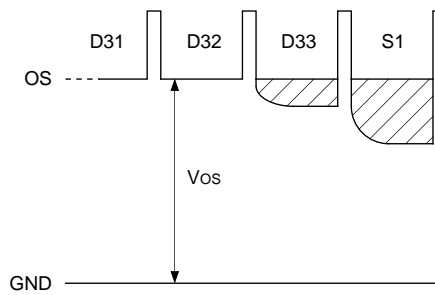
- 1) For the sensitivity test light is applied with a uniform intensity of illumination.
- 2) W lamp (2854K)
- 3) Light source: LED λ = 570nm
- 4) Light source: LED λ = 660nm
- 5) PRNU is defined as indicated below. Ray incidence conditions are the same as for Note 1.

$$\text{PRNU} = \frac{(V_{\text{MAX}} - V_{\text{MIN}})/2}{V_{\text{AVE}}} \times 100 [\%]$$

The maximum output is set to V_{MAX}, the minimum output to V_{MIN} and the average output to V_{AVE}.

- 6) Integration time is 10ms.
- 7) V_{OUT} = 500mV
- 8) DR = V_{SAT}/V_{DRK}
When optical accumulated time is shorter, the dynamic range gets wider because dark voltage is in proportion to optical accumulated time.
- 9) SE = V_{SAT}/R1

10) Vos is defined as indicated below.



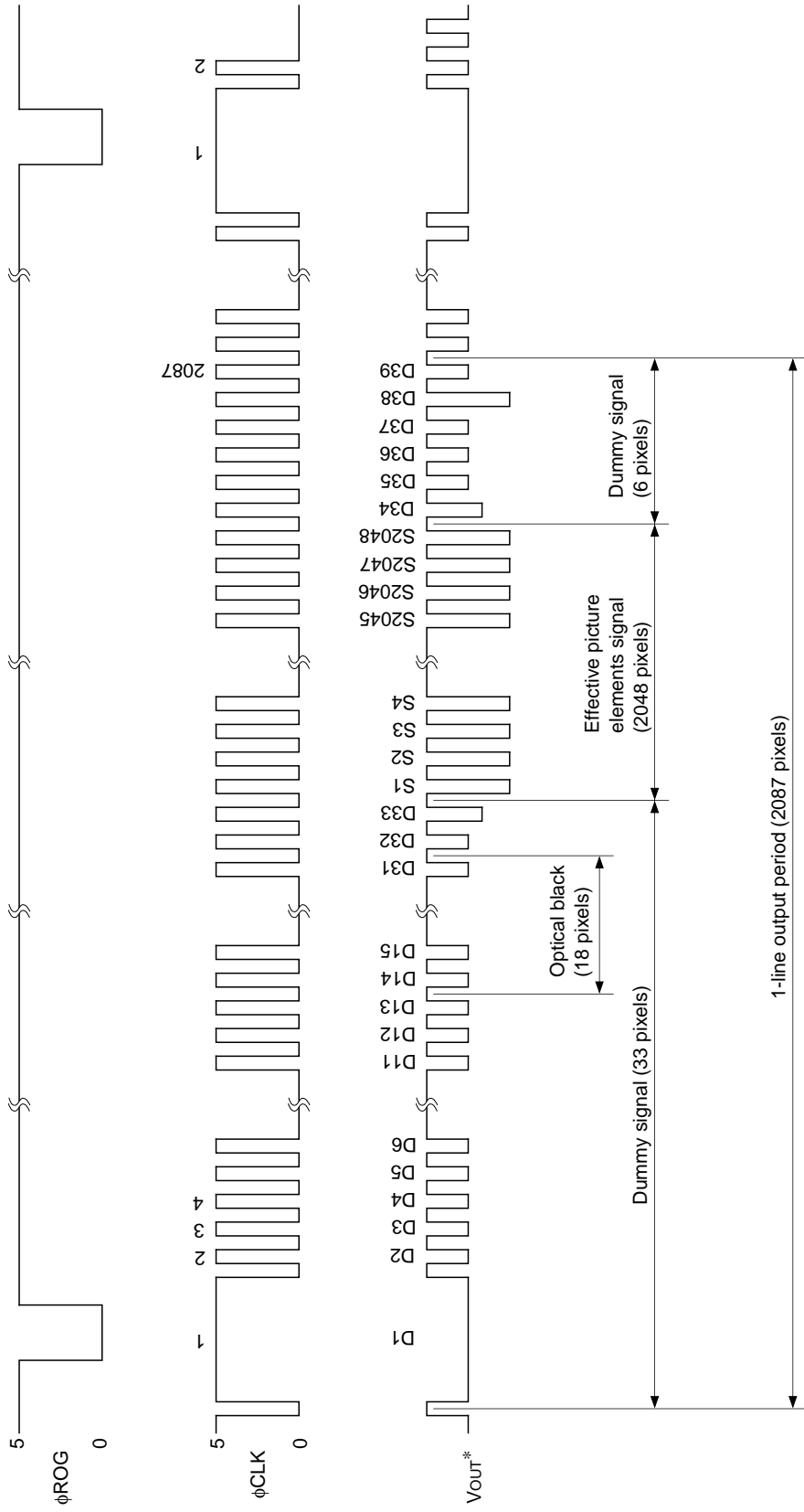
11) To stipulate the lag during shutter operation, use the formula below.

Place the output voltage average value during shutter operation at V_{SHUT} and the output voltage average value when the shutter is not in operation at V_{AVE} . (Refer to Figure 7.)

$$SHUT = \frac{V_{SHUT}}{V_{AVE}} \times 100 [\%]$$

Please note that the shutter pulse at this time accord with Figure 6.

Figure 1. Clock Timing Diagram (For internal RS mode)



* Internal S/H is not in use (Pin4 \rightarrow VDD2)

Figure 2. Clock Timing Diagram (For external RS mode)

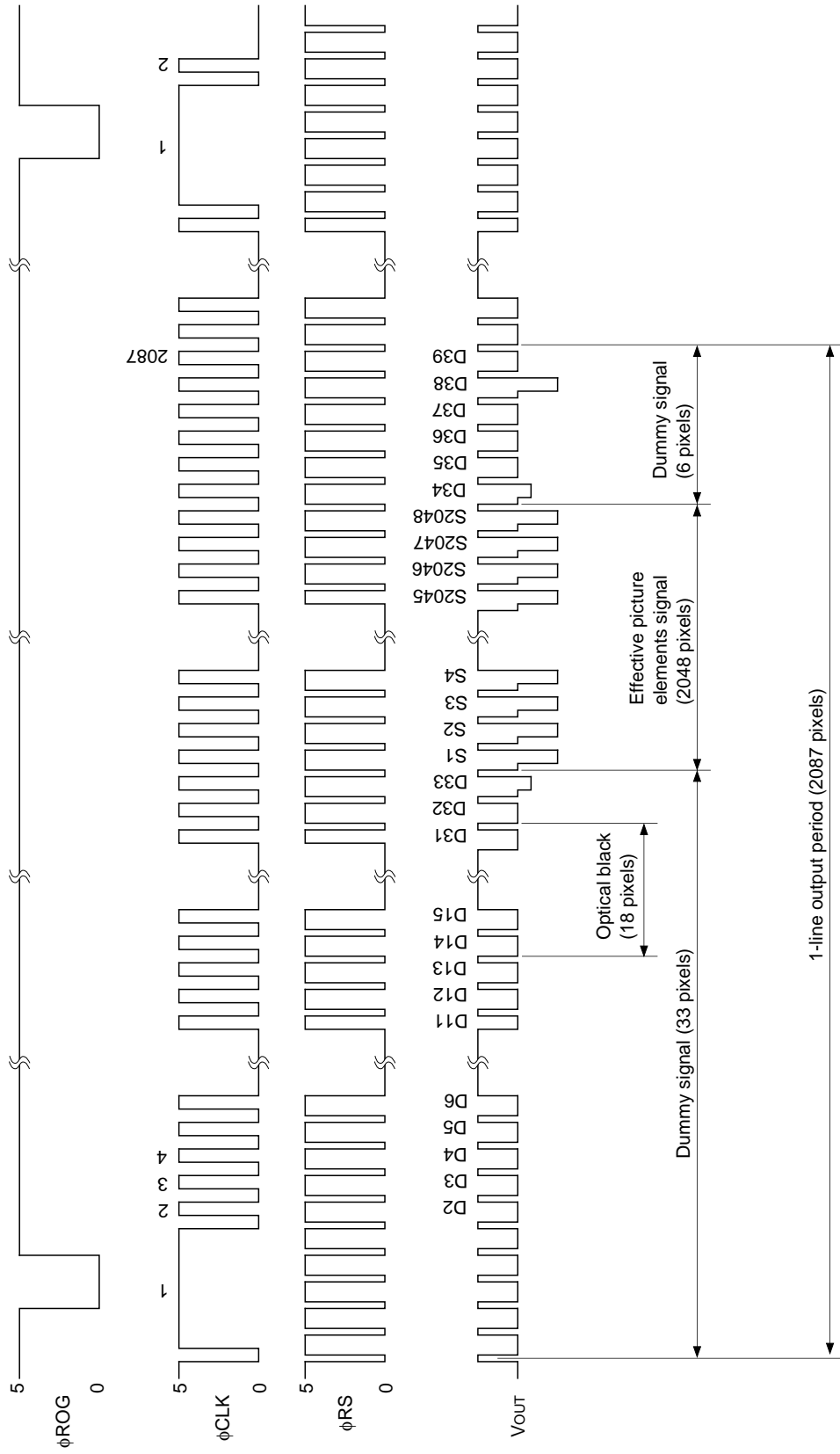
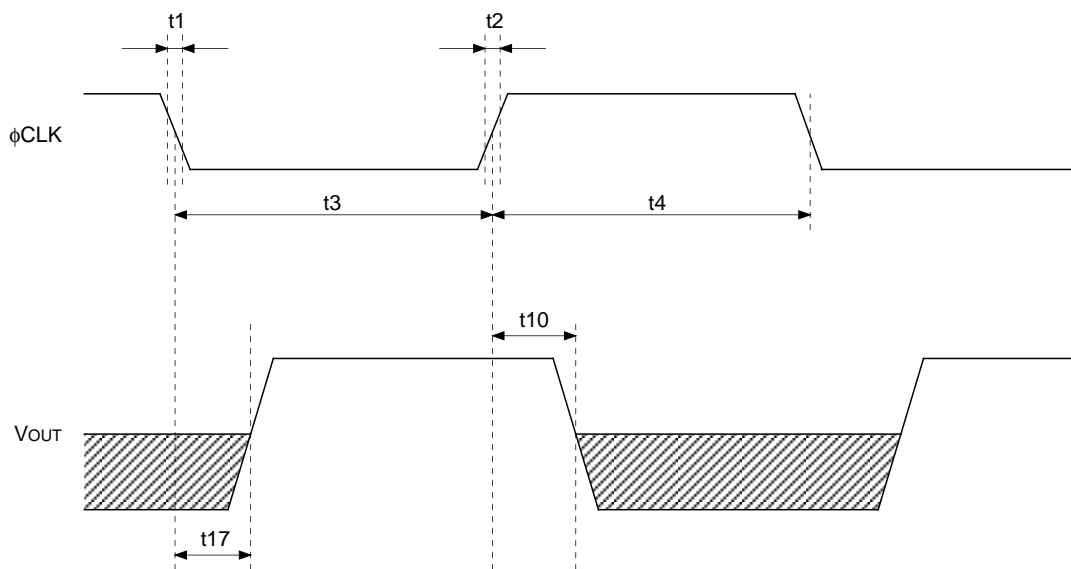


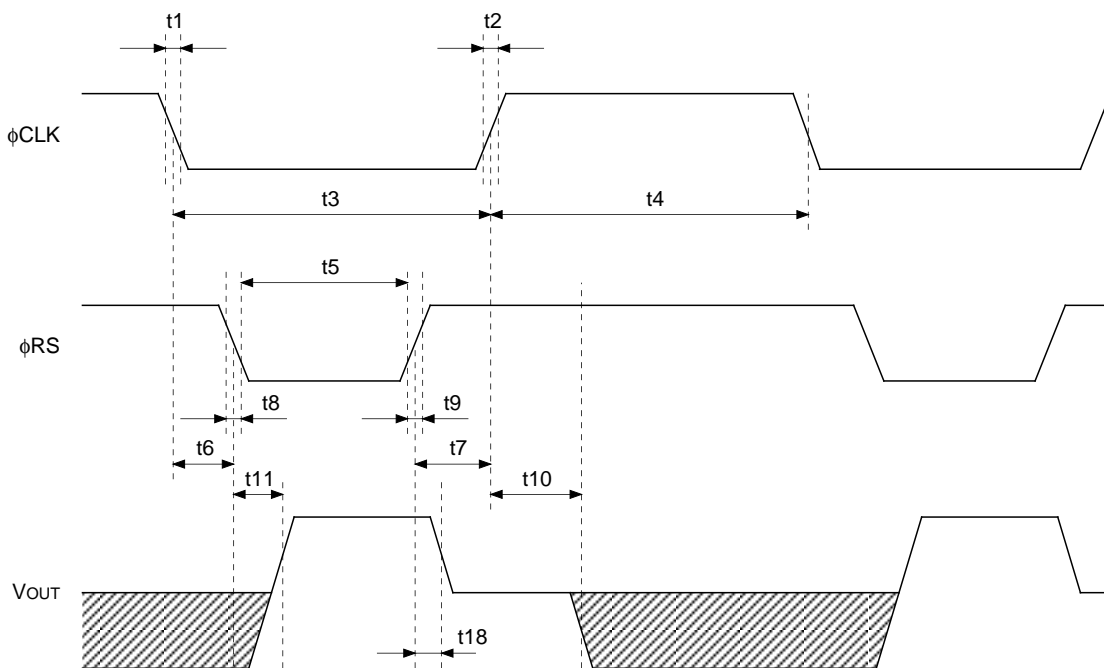
Figure 3. ϕ CLK, V_{OUT} Timing (For internal RS mode)



| Item | Symbol | Min. | Typ. | Max. | Unit |
|---------------------------------|------------|------|------|------|------|
| ϕ CLK pulse rise/fall time | t_1, t_2 | 0 | 10 | — | ns |
| ϕ CLK pulse duty*1 | — | 40 | 50 | 60 | % |
| ϕ CLK – V_{OUT} 1 | t_{10} | 50 | 80 | 110 | ns |
| ϕ CLK – V_{OUT} 2 | t_{17} | 30 | 75 | 120 | ns |

*1 $100 \times t_3 / (t_3 + t_4)$

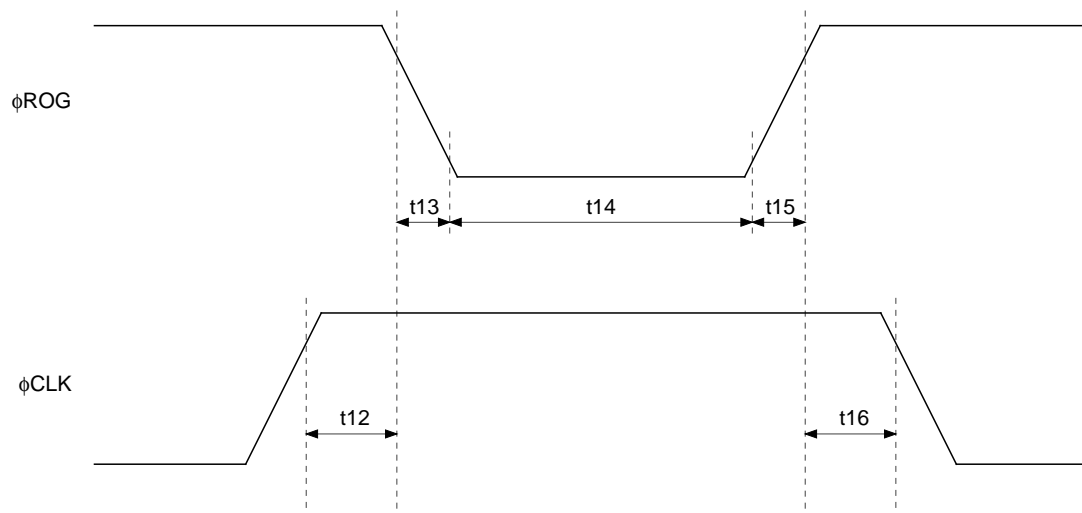
Figure 4. ϕ CLK, ϕ RS, V_{out} Timing (For external RS mode)



| Item | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------------------------|----------------|------|------|------|------|
| ϕ CLK, ϕ RS pulse rise/fall time | t1, t2, t8, t9 | — | 10 | 50 | ns |
| ϕ CLK pulse duty*1 | — | 40 | 50 | 60 | % |
| ϕ CLK – ϕ RS pulse timing | t6 | 0 | 100 | — | ns |
| ϕ CLK – ϕ RS pulse timing | t7 | 50 | 100 | — | ns |
| ϕ RS pulse period | t5 | 50 | 100 | — | ns |
| ϕ CLK – V_{out} | t10 | 50 | 80 | 110 | ns |
| ϕ RS – V_{out} | t11, t18 | 30 | 50 | 70 | ns |

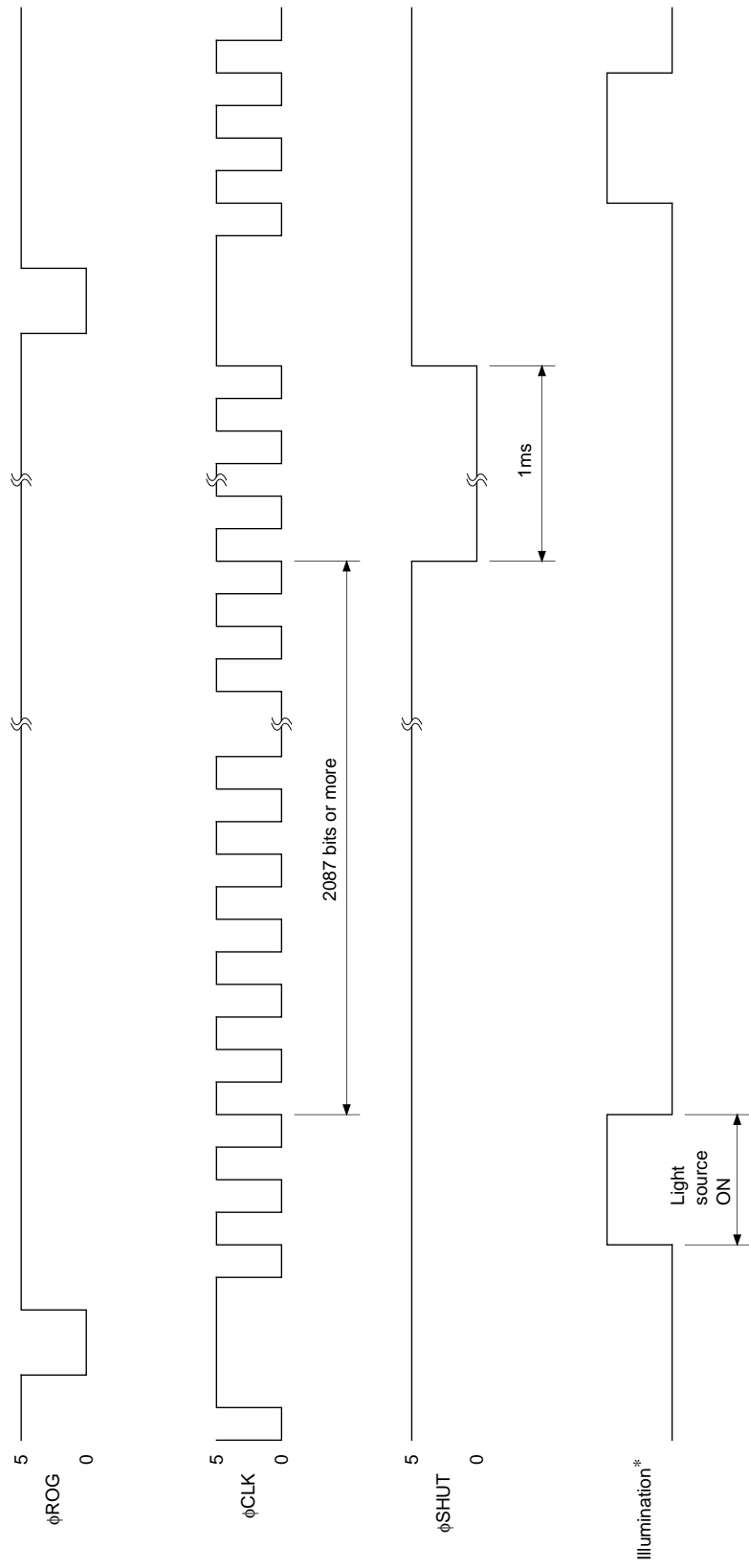
*1 $100 \times t3/(t3 + t4)$

Figure 5. ϕ ROG, ϕ CLK Timing



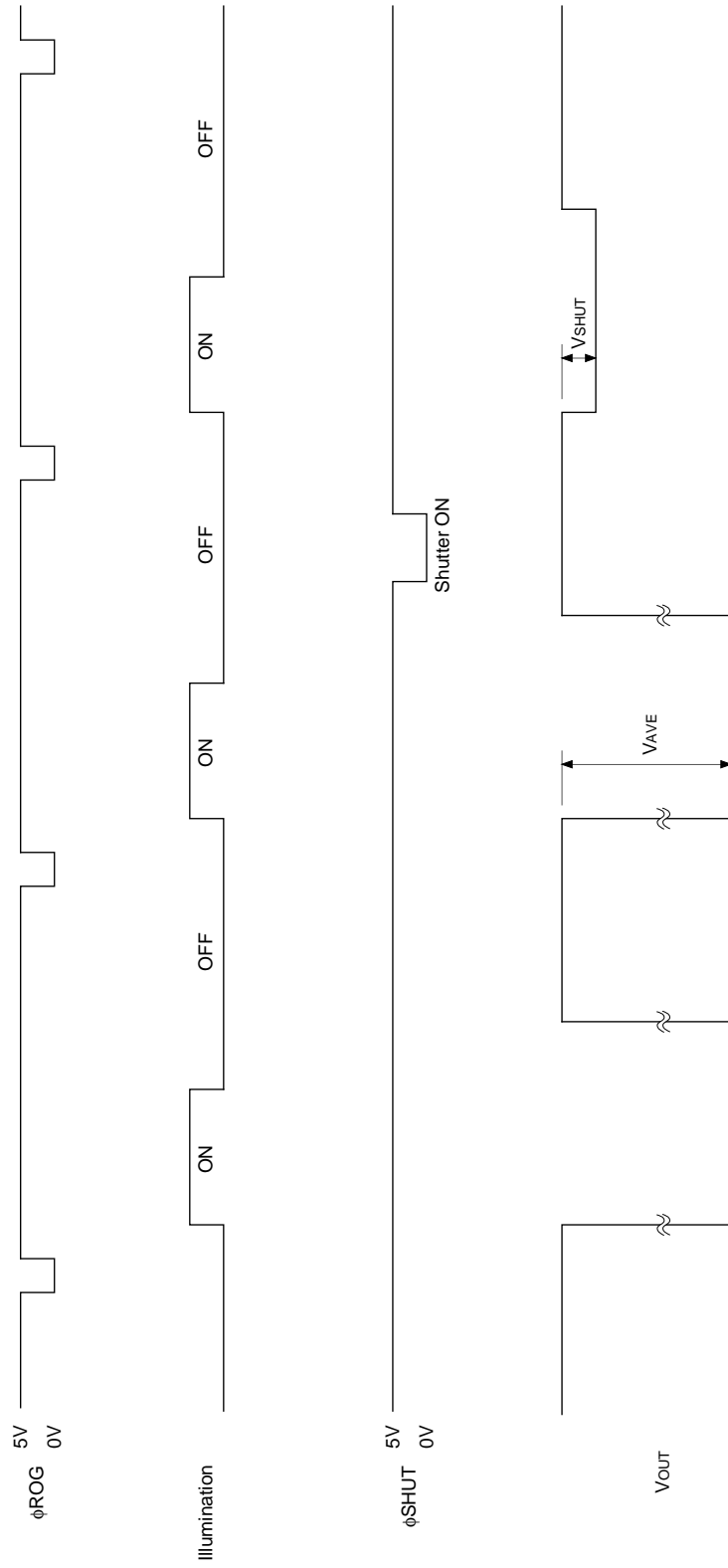
| Item | Symbol | Min. | Typ. | Max. | Unit |
|-------------------------------------|----------|------|------|------|------|
| ϕ ROG, ϕ CLK pulse timing | t12, t16 | 500 | 1000 | — | ns |
| ϕ ROG pulse rise/fall time | t13, t15 | 0 | 10 | — | ns |
| ϕ ROG pulse period | t14 | 500 | 1000 | — | ns |

Figure 6. Shutter Operation Mode Clock



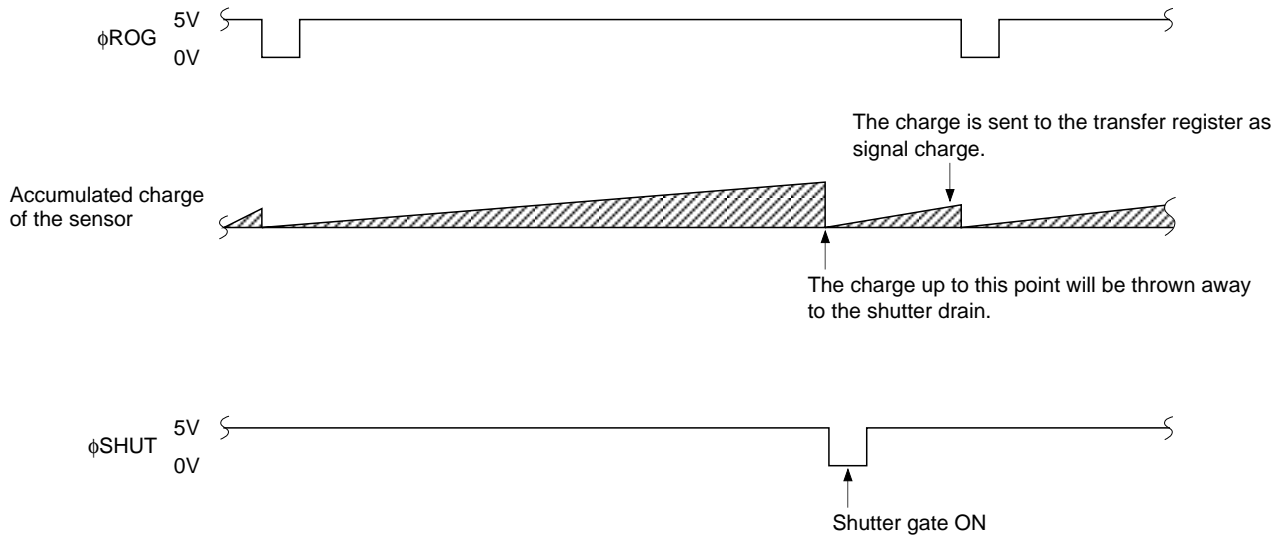
* During shutter lag evaluation, the light source will be accompanied by a flash.

Figure 7. Shutter Pulse and Output Voltage



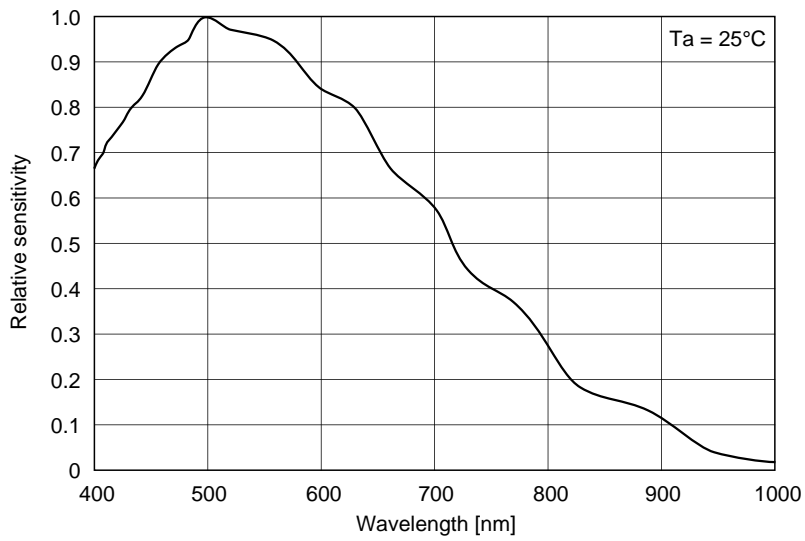
* Description of Shutter Pin 9

- 1) The state at 5V is when the shutter is not in operation.
- 2) When dropped to 0V, the shutter gate will open, letting the accumulated charge of the sensor be thrown away to the shutter drain.

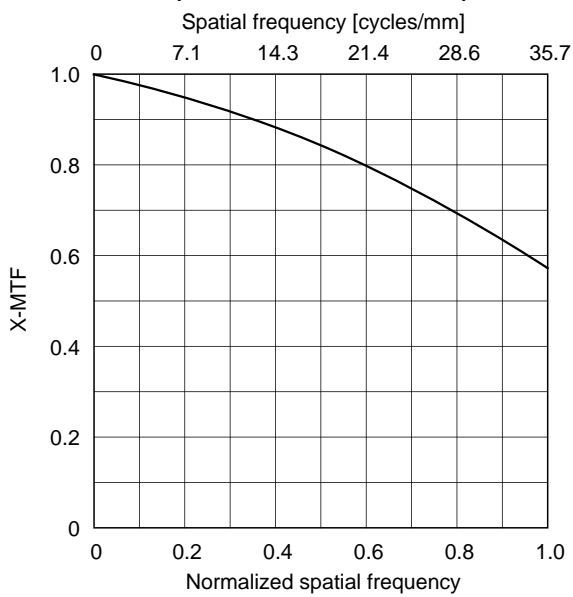


Example of Representative Characteristics

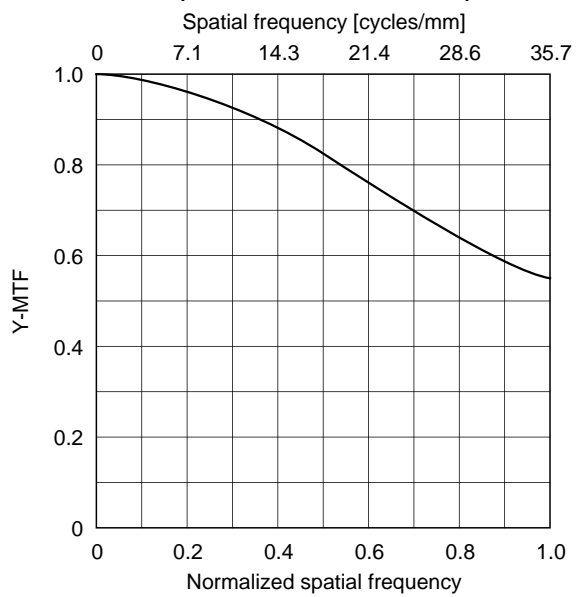
Spectral sensitivity characteristics
(Standard characteristics)



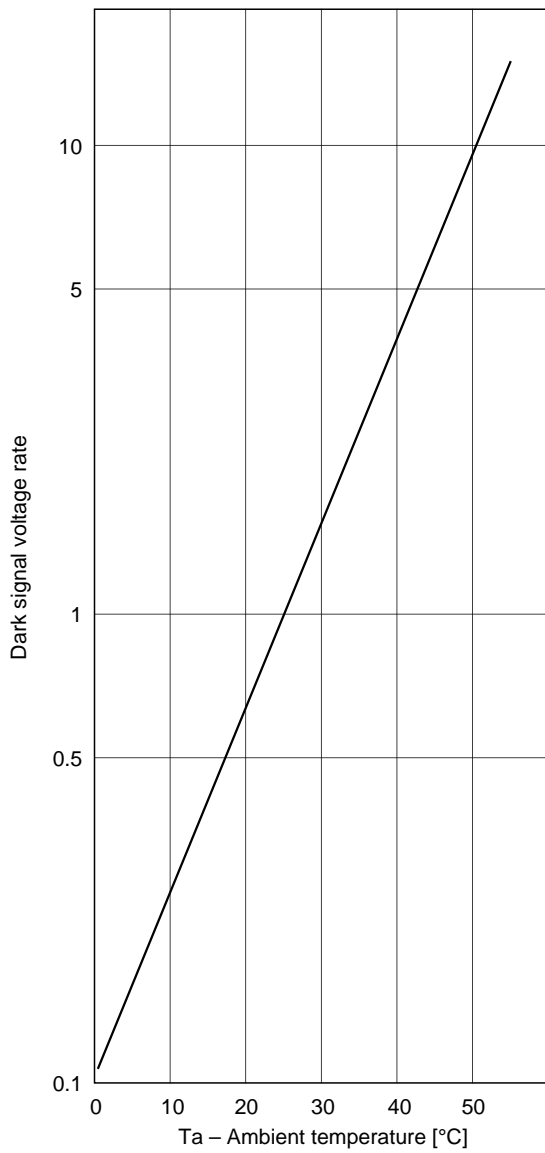
MTF of main scanning direction
(Standard characteristics)



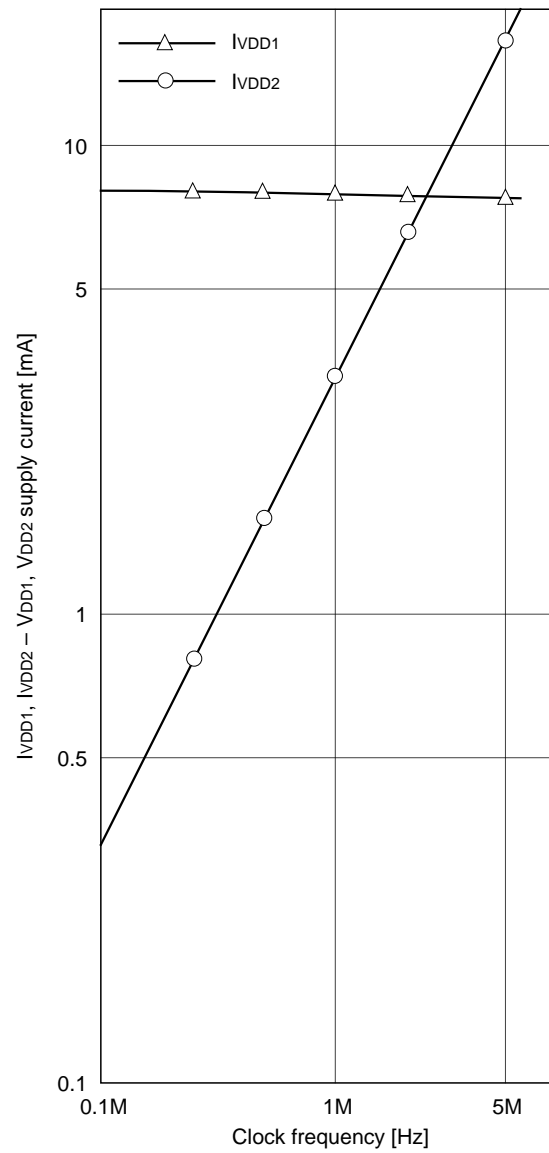
MTF of sub scanning direction
(Standard characteristics)



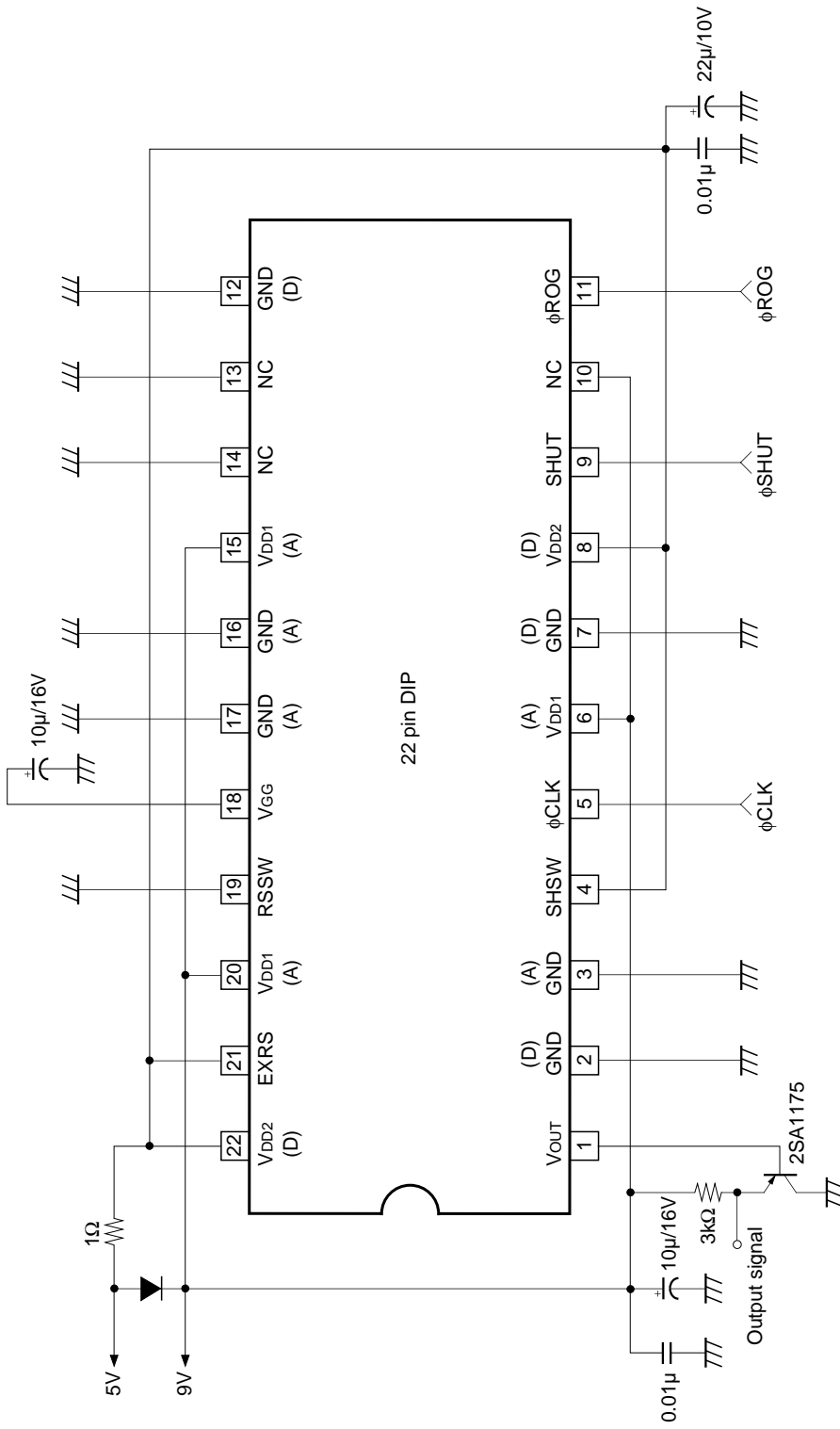
Dark signal voltage rate vs. Ambient temperature
(Standard characteristics)



VDD1, VDD2 supply current vs. Clock frequency
(Standard characteristics)



Application Circuit (When internal RS)



Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

Notes on Handling

- 1) Static charge prevention
CCD image sensors are easily damaged by static discharge. Before handling be sure to take the following protective measures.
 - a) Either handle bare handed or use non chargeable gloves, clothes or material. Also use conductive shoes.
 - b) When handling directly use an earth band.
 - c) Install a conductive mat on the floor or working table to prevent the generation of static electricity.
 - d) Ionized air is recommended for discharge when handling CCD image sensor.
 - e) For the shipment of mounted substrates, use boxes treated for the prevention of static charges.

- 2) Regulation for raising and lowering the power supply voltage
When raising the supply voltage, first raise V_{DD1} (9V) and then V_{DD2} (5V). Similarly, lower V_{DD2} (5V) first and then V_{DD1} (9V).

- 3) Soldering
 - a) Make sure the package temperature does not exceed 80°C.
 - b) Solder dipping in a mounting furnace causes damage to the glass and other defects. Use a grounded 30W soldering iron and solder each pin in less than 2 seconds. For repairs and remount, cool sufficiently.
 - c) To dismount an image sensor, do not use a solder suction equipment. When using an electric desoldering tool, ground the controller. For the control system, use a zero cross type.

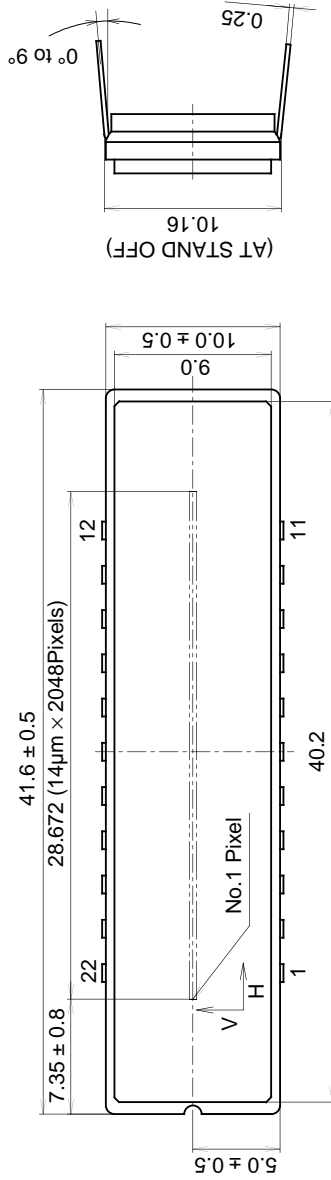
- 4) Dust and dirt protection
 - a) Operate in clean environments.
 - b) Do not either touch glass plates by hand or have any object come in contact with glass surfaces. Should dirt stick to a glass surface, blow it off with an air blower. (For dirt stuck through static electricity ionized air is recommended.)
 - c) Clean with a cotton bud and ethyl alcohol if the grease stained. Be careful not to scratch the glass.
 - d) Keep in a case to protect from dust and dirt. To prevent dew condensation, preheat or precool when moving to a room with great temperature differences.

- 5) Exposure to high temperatures or humidity will affect the characteristics. Accordingly avoid storage or usage in such conditions.

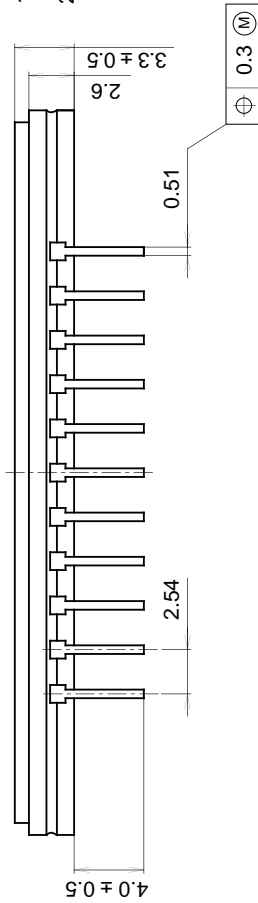
- 6) CCD image sensors are precise optical equipment that should not be subject to mechanical shocks.

Package Outline Unit: mm

22pin DIP (400mil)



1. The height from the bottom to the sensor surface is 1.61 ± 0.3 mm.
2. The thickness of the cover glass is 0.7mm, and the refractive index is 1.5.



PACKAGE STRUCTURE

| | |
|------------------|-------------|
| PACKAGE MATERIAL | Cer-DIP |
| LEAD TREATMENT | TIN PLATING |
| LEAD MATERIAL | 42 ALLOY |
| PACKAGE WEIGHT | 3.9g |