

# DATA SHEET

**NEC**  
ELECTRON DEVICE

## MOS INTEGRATED CIRCUIT

# $\mu$ PD3571

### 5 000 BIT CCD LINEAR IMAGE SENSOR

The  $\mu$ PD3571 is a 5 000 bit linear image sensor that converts light to voltage. It consists of a 5 000-bit photosensor array, two 2 518-bit CCD charge transfer registers, and an output amplifier.

The photosensor has a pitch of 7  $\mu$ m pitch.

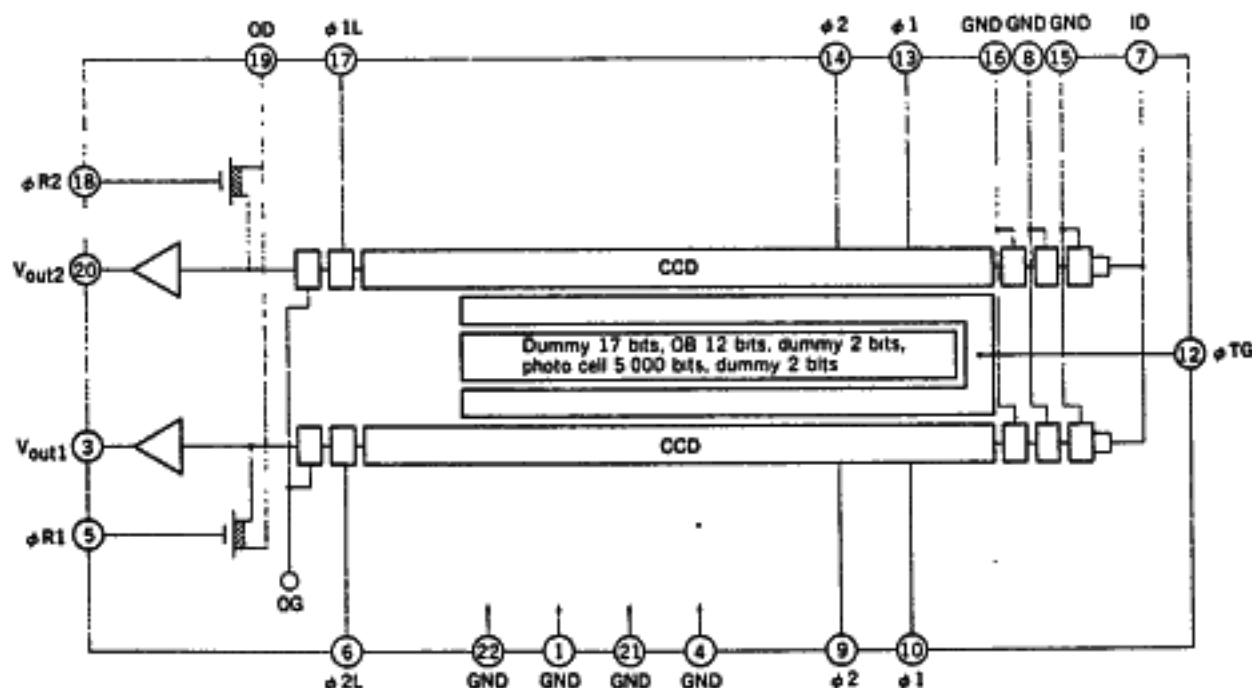
#### FEATURES

- Built-in output signal amplifier circuit
- High response to the fluorescent lamp source, which is five times as sensitive as the previous NEC  $\mu$ PD791D model
- Peak response: 550 nm green
- Data rate: 24 MHz high speed driving
- High resolution reading of A3-width at 16 dot/nm
- Single 12 V power drive

#### ORDERING INFORMATION

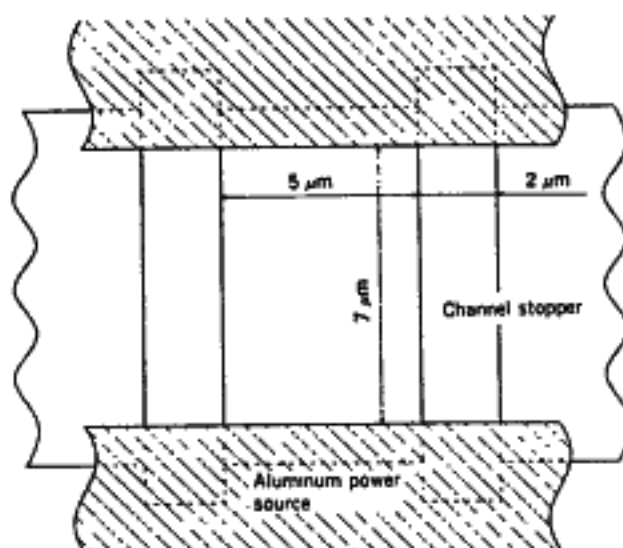
Part Number	Package
$\mu$ PD3571D	22-pin ceramic DIP (CERDIP) (400 mil)

#### BLOCK DIAGRAM

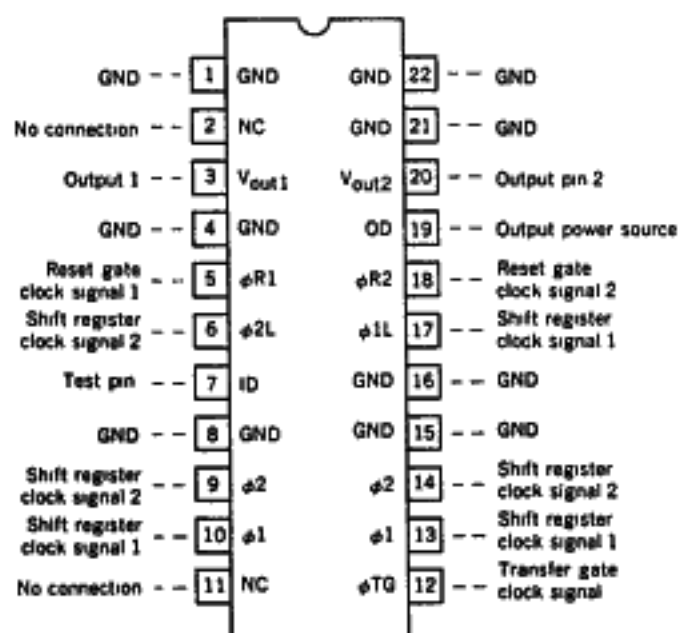


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## PHOTO ELEMENT CONFIGURATION DIAGRAM



## PIN CONFIGURATION DIAGRAM (Top View)



ABSOLUTE MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )

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Output drain voltage	$V_{OD}$	-0.3 to +15	V
Test pin ID voltage	$V_{ID}$	-0.3 to +15	V
Shift register clock signal voltage	$V_{1,2}$	-0.3 to +15	V
Reset signal voltage	$V_R$	-0.3 to +15	V
Transfer gate signal voltage	$V_{TG}$	-0.3 to +15	V
Operating ambient temperature	$T_{op1}$	-25 to +60	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-40 to +100	$^\circ\text{C}$

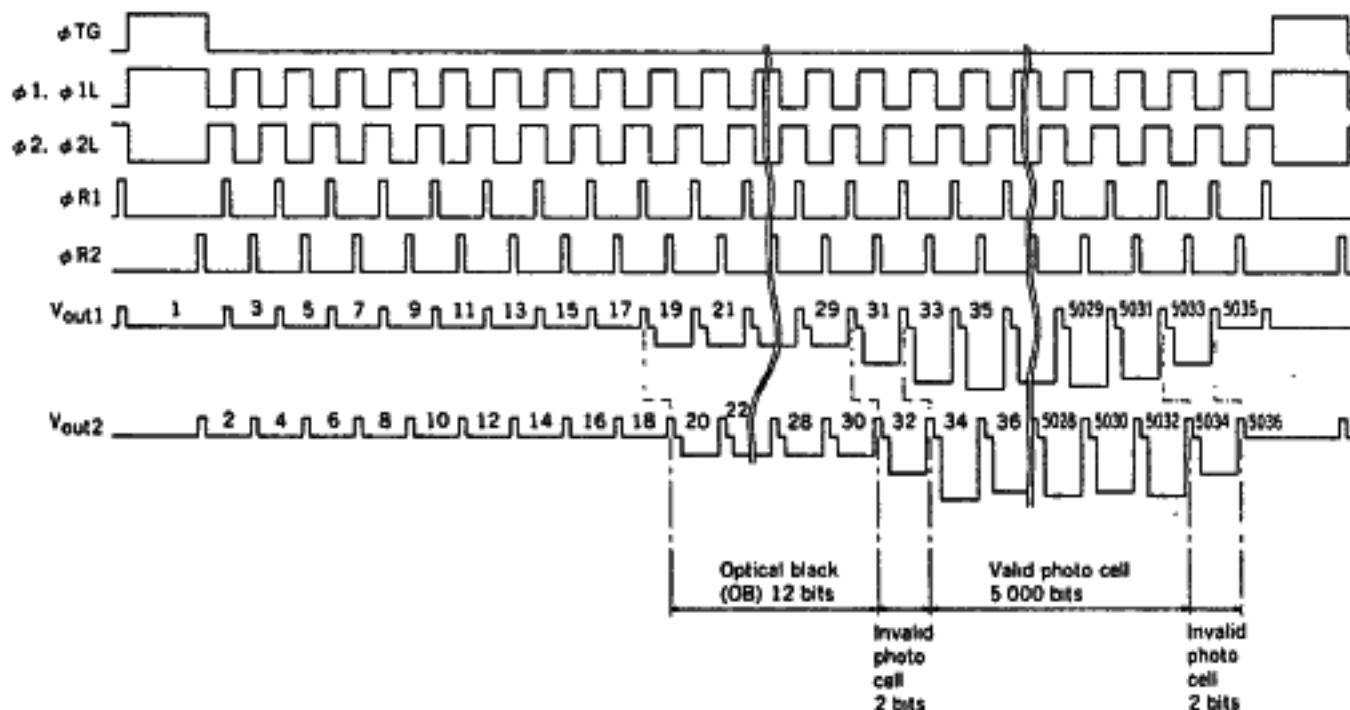
RECOMMENDED OPERATING CONDITIONS ( $T_a = -25$  to  $+60^\circ\text{C}$ )

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
Output drain voltage	$V_{OD}$	11.4	12.0	12.6	V
Test pin $G_1$ voltage	$V_{G1}$		0		V
Test pin $G_2$ voltage	$V_{G2}$		0		V
Test pin ID voltage	$V_{ID}$		12.0		V
Test pin $\phi IR$ voltage	$V_{\phi IR}$		0		V
Shift register clock $\phi 1$ signal high level	$V_{\phi 1H}$	8.0	12.0	12.6	V
Shift register clock $\phi 1$ signal low level	$V_{\phi 1L}$	-0.3	0	0.5	V
Shift register clock $\phi 2$ signal high level	$V_{\phi 2H}$	8.0	12.0	12.6	V
Shift register clock $\phi 2$ signal low level	$V_{\phi 2L}$	-0.3	0	0.5	V
Reset signal $\phi R1H$ high level	$V_{\phi R1H}$	8.0	12.0	13.0	V
Reset signal $\phi R1L$ low level	$V_{\phi R1L}$	-0.3	0	0.5	V
Reset signal $\phi R2H$ high level	$V_{\phi R2H}$	8.0	12.0	13.0	V
Reset signal $\phi R2L$ low level	$V_{\phi R2L}$	-0.3	0	0.5	V
Transfer gate signal high level	$V_{\phi TGH}$	8.0	12.0	12.6	V
Transfer gate signal low level	$V_{\phi TGL}$	-0.3	0	0.5	V
Data rate	$f_{\phi R}$		2	24	MHz

ELECTRIC CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ ,  $V_{DD} = 12.0\text{ V}$ ,  $f_{\phi 1} = 1\text{ MHz}$ , data rate = 2 MHz, storage time = 10 ms,  
light source: 2 856 K tungsten bulb)

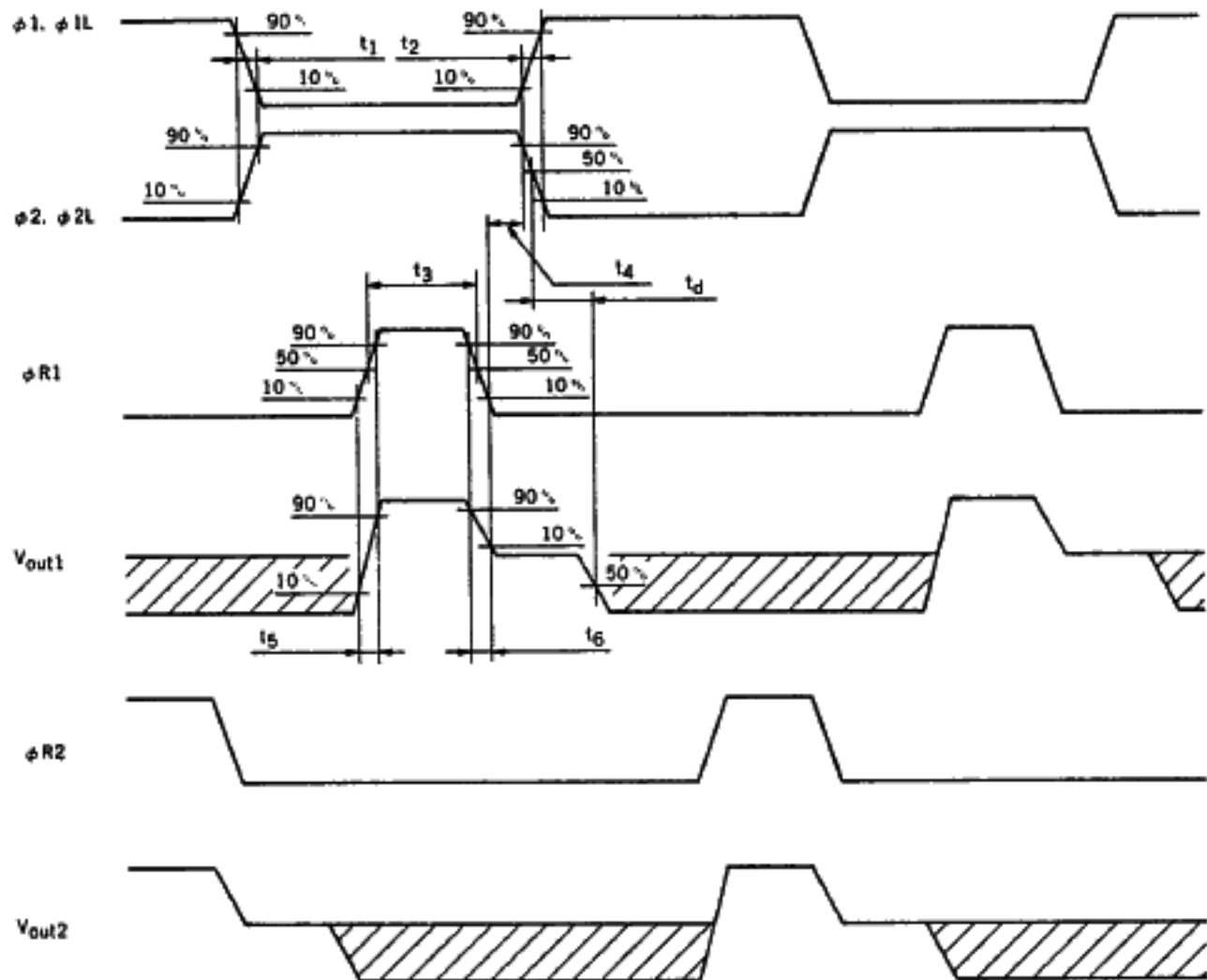
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Saturation voltage	$V_{sat}$	1.0	1.5		V	
Saturation exposure	SE		1.0		Lxs	White fluorescent lamp
Photo response non-uniformity	PRNU		$\pm 5$	$\pm 10$	%	$V_{out}$ : 500 mV, White fluorescent lamp
Average dark signal	ADS		1	5	mV	Light input interruption
Dark signal non-uniformity	DSNU		2	10	mV	Light input interruption, peak value
Power consumption	$P_W$		100		mW	
Output impedance	$Z_o$		0.5	1	k $\Omega$	
Sensitivity	R	3.85	5.5	7.15	V/Lxs	W lamp
	R	1.05	1.5	1.95	V/Lxs	White fluorescent lamp
Response peak wavelength			550		nm	
Offset level	$V_{os}$	4.0	7.0	9.0	V	
Shift register clock pin input capacity	$C_{\phi 1}$		450	600	pF	
Reset pin input capacity	$C_{\phi R}$		10	15	pF	
Transfer gate signal pin input capacity	$C_{\phi TG}$		150	200	pF	
Output setup delay time	$t_d$		20	50	ns	

## TIMING CHART

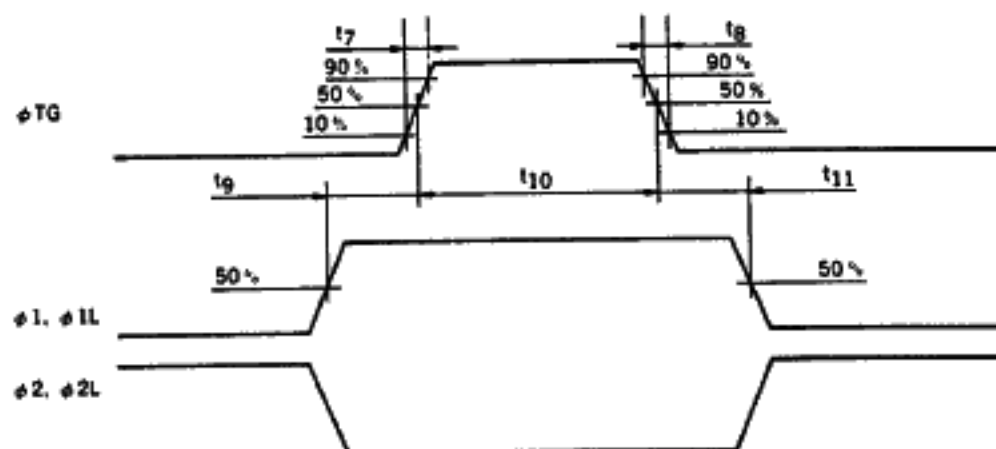


\*  $\phi 1$ ,  $\phi 1L$ ,  $\phi 2$ ,  $\phi 2L$ ,  $\phi R1$ ,  $V_{out1}$ ,  $V_{out2}$  timing charts

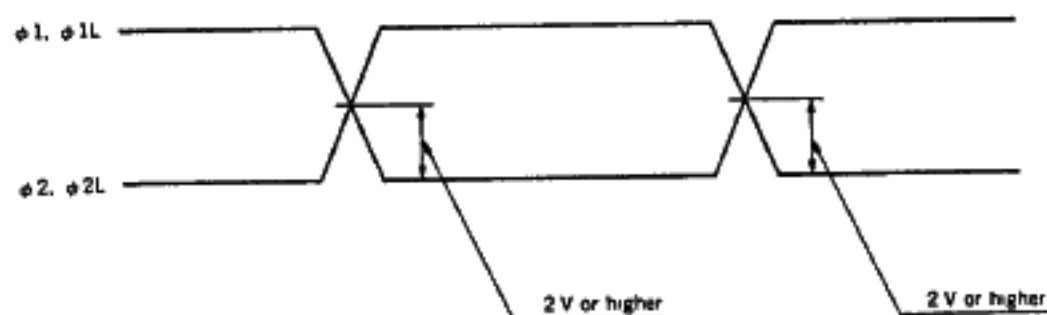
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\*  $\phi TG$ ,  $\phi 1$ ,  $\phi 1L$ ,  $\phi 2$ ,  $\phi 2L$  timing charts



\*  $\phi 1$ ,  $\phi 1L$ ,  $\phi 2$ ,  $\phi 2L$  cross points



Name	MIN.	TYP.	MAX.
$t_1, t_2$	0	100	200
$t_3$	20	100	-
$t_4$	0	20	-
$t_5, t_6$	0	20	50
$t_7, t_8$	0	50	100
$t_9, t_{11}$	10	100	-
$t_{10}$	300	1000	-

(ns)

# DEFINITIONS OF SPECIAL TERMS

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## 1. Saturation Voltage ( $V_{sat}$ )

The point at which the response linearity is lost.

## 2. Saturation Exposure (SE)

The multiple of storage time (s) and illumination (lx) at which saturation voltage is reached.

## 3. Photo Response Non-Uniformity (PRNU)

The ratio of the peak bottom to the average output voltage of all valid bits. Obtained from the following formula.

$$PRNU(\%) = \left( \frac{V_{MAX. \text{ or } V_{MIN.}} - 1}{\frac{1}{n} \sum_{j=1}^n V_j} \right) \times 100$$

$n$  : Number of valid bits

$V_j$  : Output voltage of each bit



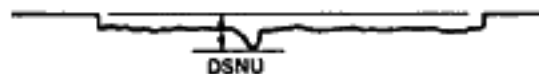
## 4. Average Dark Signal (ADS)

Average output voltage during light interruption.

$$ADS(mV) = \frac{1}{n} \sum_{j=1}^n V_j$$

## 5. Dark Signal Non-uniformity (DSNU)

The peak output voltage against the idle level during light interruption.



## 6. Output Impedance ( $Z_o$ )

Output impedance observed externally.

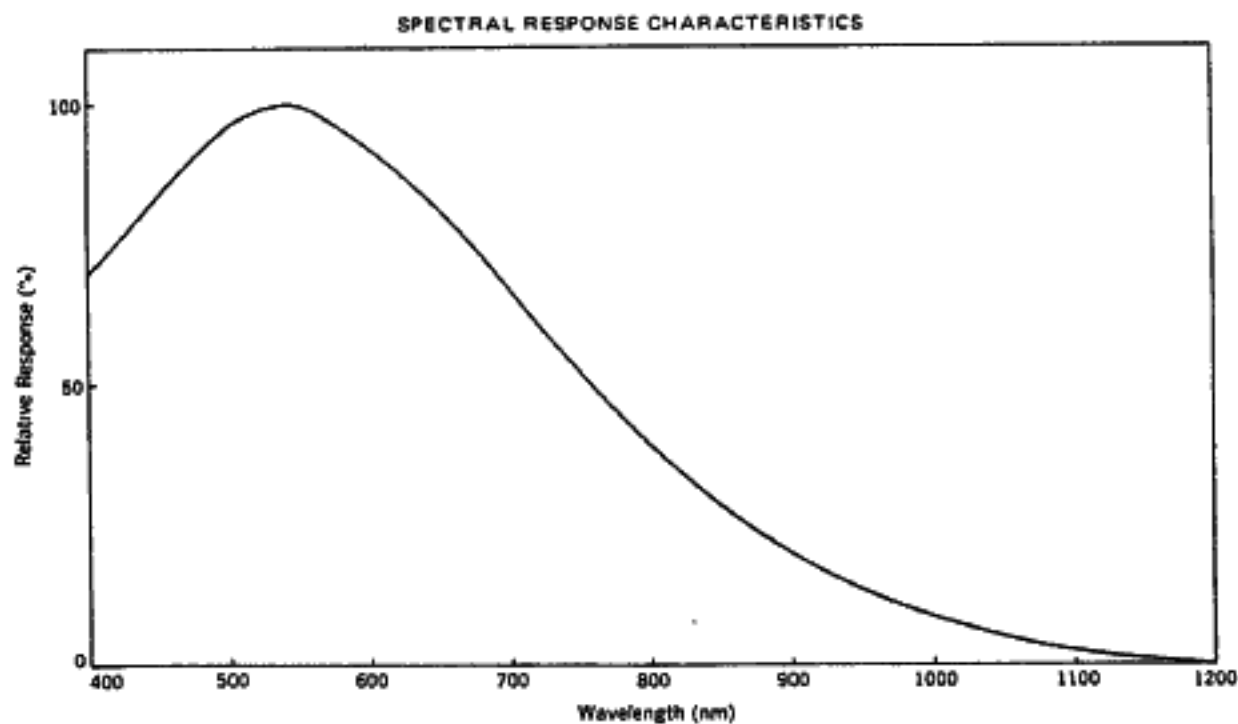
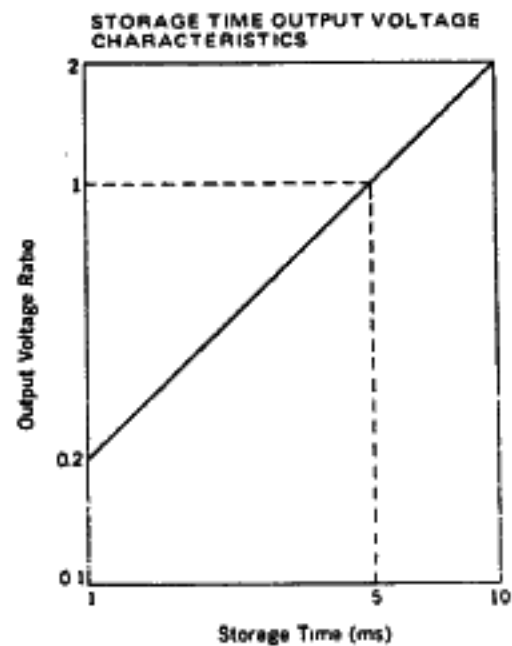
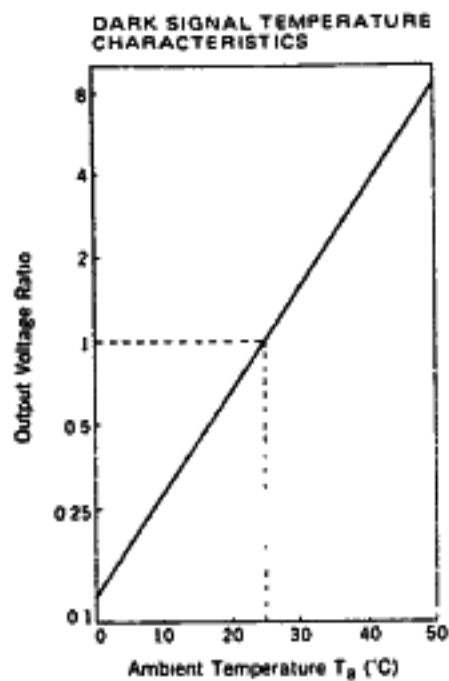
## 7. Response (R)

The quotient of output voltage divided by exposure (lx·s).

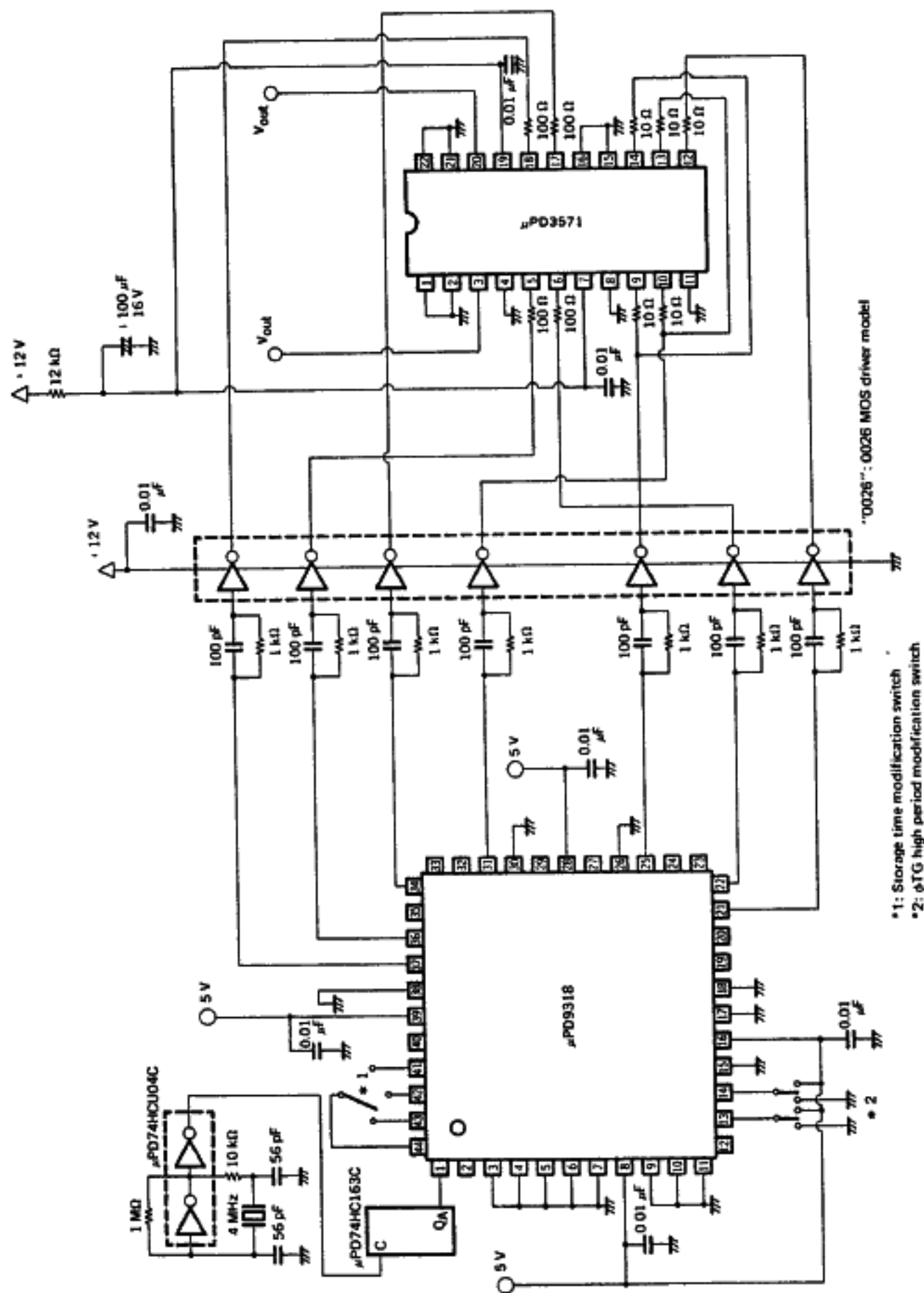
Response may vary with the use of light sources not designated in the electric characteristics section.

STANDARD CHARACTERISTIC CURVES ( $T_a = 25^\circ\text{C}$ )

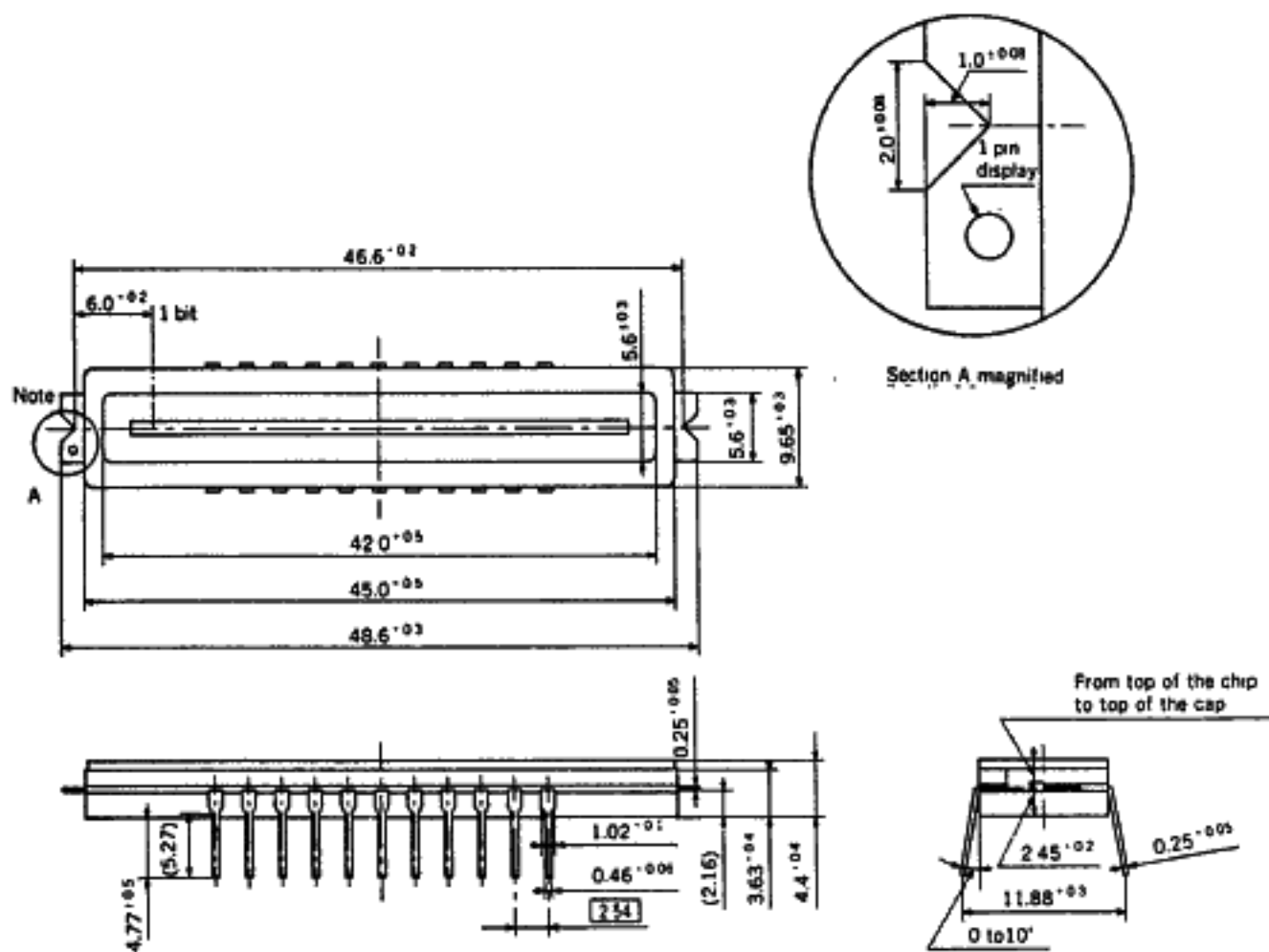
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PACKAGE DIMENSIONS (Unit: mm)



Name	Dimensions	Refraction
Glass cap	44.6 × 9.25 × 0.7	1.5

\* Note: Use the standard board in open state, without applying potential.