

TENTATIVE TOSHIBA CCD LINEAR IMAGE SENSOR CCD(Charge Coupled Device)

# TCD1502C

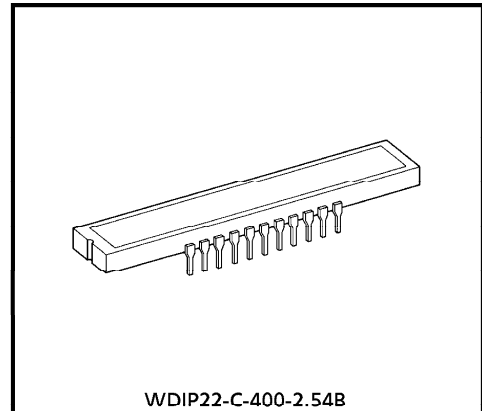
The TCD1502C is a high sensitive and low dark current 5000 elements CCD image sensor.

The sensor is designed for facsimile, imagescanner and OCR.

The device contains a row of 5000 elements photodiodes which provide a 16 lines/mm (400DPI) across a A3 size paper. The device is operated by 5V (pulse), and 12V power supply.

**FEATURES**

- Number of Image Sensing Elements : 5000 elements
- Image Sensing Element Size : 7μm by 7μm on 7μm centers
- Photo Sensing Region : High sensitive and low voltage dark signal pn photodiode
- Clock : 2 phase (5V)
- Package : 22pin DIP



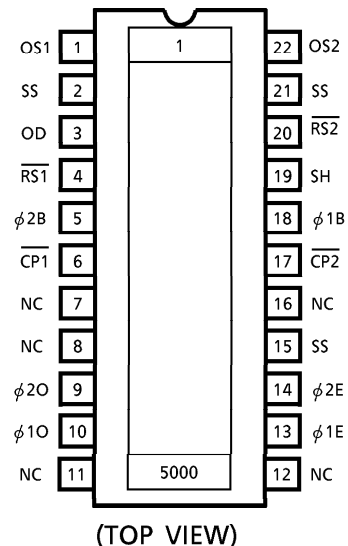
Weight : 5.4g (Typ.)

**MAXIMUM RATINGS (Note 1)**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Clock Pulse Voltage	$V_{\phi}$	- 0.3~8	V
Shift Pulse Voltage	$V_{SH}$		
Reset Pulse Voltage	$V_{RS}$		
Clamp Pulse Voltage	$V_{CP}$		
Power Supply Voltage	$V_{OD}$	- 0.3~15	
Operating Temperature	$T_{opr}$	- 25~60	°C
Storage Temperature	$T_{stg}$	- 40~100	°C

(Note 1) All voltage are with respect to SS terminals (Ground).

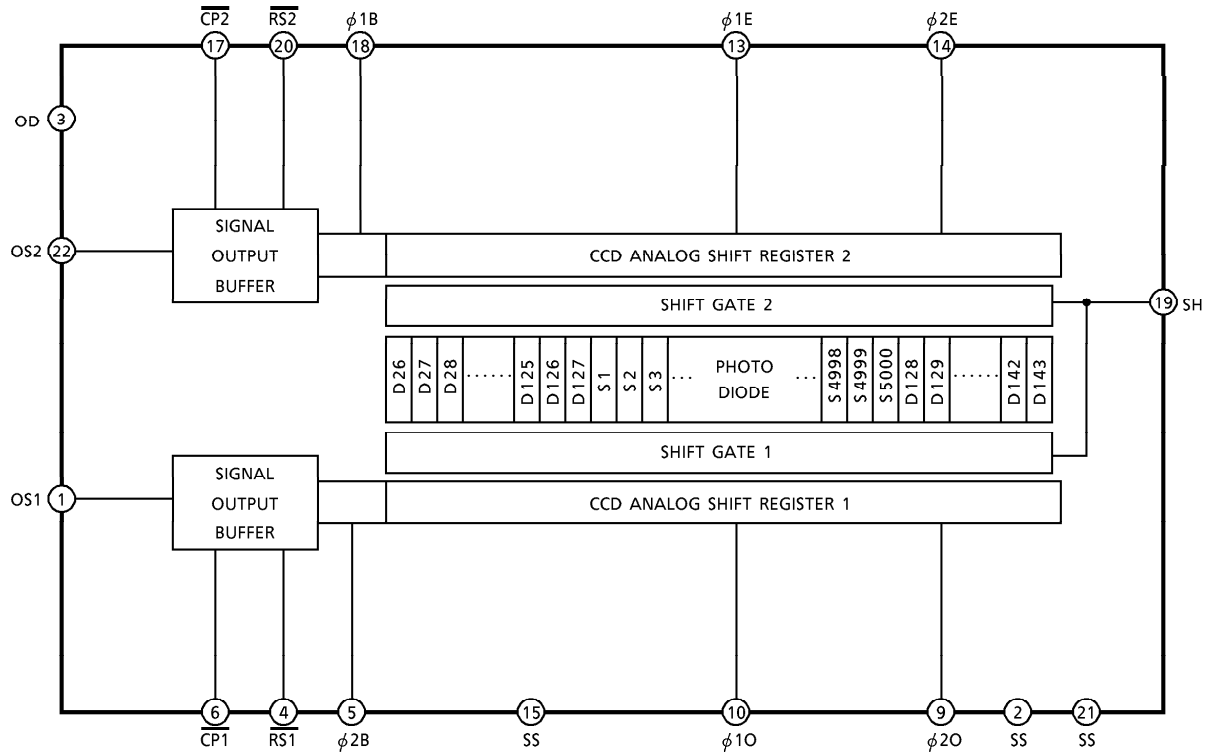
**PIN CONNECTIONS**



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CIRCUIT DIAGRAM



PIN NAME

$\phi$ 1E, O	Clock (Phase 1)
$\phi$ 2E, O	Clock (Phase 2)
$\phi$ 1B	Final Stage Clock (Phase 1)
$\phi$ 2B	Final Stage Clock (Phase 2)
SH	Shift Gate
RS	Reset Gate
CP	Clamp Gate
OS1	Signal Output 1
OS2	Signal Output 2
OD	Power
SS	Ground
NC	Non Connection

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**OPTICAL / ELECTRICAL CHARACTERISTICS**

(Ta = 25°C, V<sub>OD</sub> = 12V, V<sub>φ</sub> = V<sub>SH</sub> = V<sub>RS</sub> = V<sub>CP</sub> = 5V, f<sub>φ</sub> = 1MHz,

t<sub>INT</sub> (INTEGRATION TIME) = 10ms, LIGHT SOURCE = DAYLIGHT FLUORESCENT LAMP,

LOAD RESISTANCE = 100kΩ)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Sensitivity	R	7.2	9	10.8	V / lx·s	
Photo Response Non Uniformity	PRNU	—	—	10	%	(Note 2)
	PRNU (3)	—	4	8	mV	(Note 8)
Saturation Output Voltage	V <sub>SAT</sub>	1.5	2	—	V	(Note 3)
Saturation Exposure	SE	0.14	0.22	—	lx·s	(Note 4)
Dark Signal Voltage	V <sub>DRK</sub>	—	1	2.5	mV	(Note 5)
Dark Signal Non Uniformity	DSNU	—	1	2.5	mV	(Note 5)
DC Power Dissipation	P <sub>D</sub>	—	300	364	mW	
Total Transfer Efficiency	TTE	92	—	—	%	
Output Impedance	Z <sub>O</sub>	—	0.5	1	kΩ	
Dynamic Range	DR	—	2000	—	—	(Note 6)
DC Signal Output Voltage	V <sub>OS1</sub>	3.5	4.5	6	V	(Note 7)
	V <sub>OS2</sub>	3.5	4.5	6		
DC Differential Error Voltage	V <sub>OS1</sub> -V <sub>OS2</sub>	—	—	300	mV	

(Note 2) Measured at 50% of SE (Typ.)

$$\text{Definition of PRNU : PRNU} = \frac{\Delta x}{\bar{x}} \times 100 (\%)$$

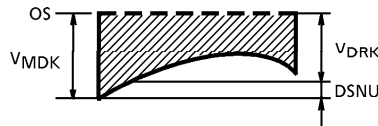
Where  $\bar{x}$  is average of total signal outputs and  $\Delta x$  is maximum deviation from  $\bar{x}$  under uniform illumination. (Channel 1)

In the case of 2500 elements (Channel 2), the condition is the same as above too.

(Note 3) V<sub>SAT</sub> is defined as minimum saturation output voltage of all effective pixels.

(Note 4) Definition of SE :  $SE = \frac{V_{SAT}}{R} (lx \cdot s)$

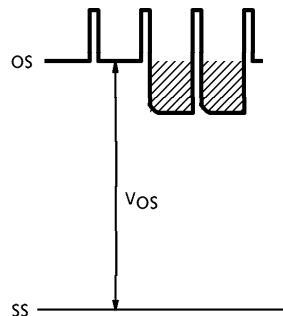
(Note 5)  $V_{DRK}$  is defined as average dark signal voltage of all effective pixels.  
 DSNU is defined as different voltage between  $V_{DRK}$  and  $V_{MDK}$  when  $V_{MDK}$  is maximum dark signal voltage.



(Note 6) Definition of DR :  $DR = \frac{V_{SAT}}{V_{DRK}}$

$V_{DRK}$  is proportional to  $t_{INT}$  (Integration Time).  
 So the shorter  $t_{INT}$  condition makes wider DR values.

(Note 7) DC signal output voltage and DC compensation output voltage are defined as follows:



(Note 8) PRNU (3) is defined as maximum voltage with next pixel, where measured 5% of SE (Typ.)

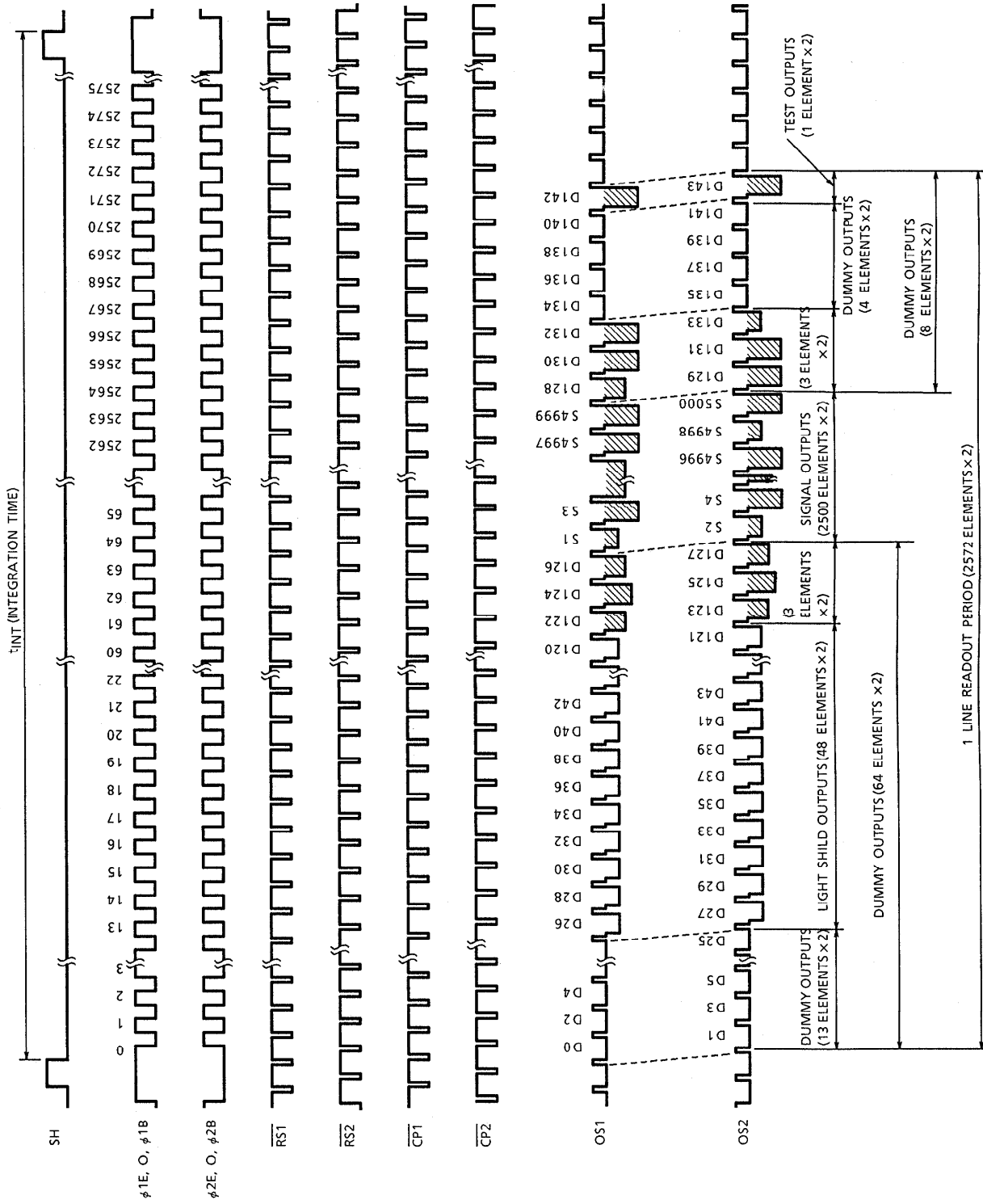
**OPERATING CONDITION**

CHARACTERISTIC		SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock Pulse Voltage	"H" Level	$V_{\phi 1E, O}$	4.5	5	5.5	V
	"L" Level	$V_{\phi 2E, O}$	0	—	0.5	
Final Stage Clock Voltage	"H" Level	$V_{\phi 1B}$	4.5	5	5.5	V
	"L" Level	$V_{\phi 2B}$	0	—	0.5	
Shift Pulse Voltage	"H" Level	$V_{SH}$	4.5	5	5.5	V
	"L" Level		0	—	0.5	
Reset Pulse Voltage	"H" Level	$V_{RS1}$	4.5	5	5.5	V
	"L" Level	$V_{RS2}$	0	—	0.5	
Clamp Pulse Voltage	"H" Level	$V_{CP1}$	4.5	5	5.5	V
	"L" Level	$V_{CP2}$	0	—	0.5	
Power Supply Voltage		$V_{OD}$	11.4	12.0	13.0	V

**CLOCK CHARACTERISTICS (Ta = 25°C)**

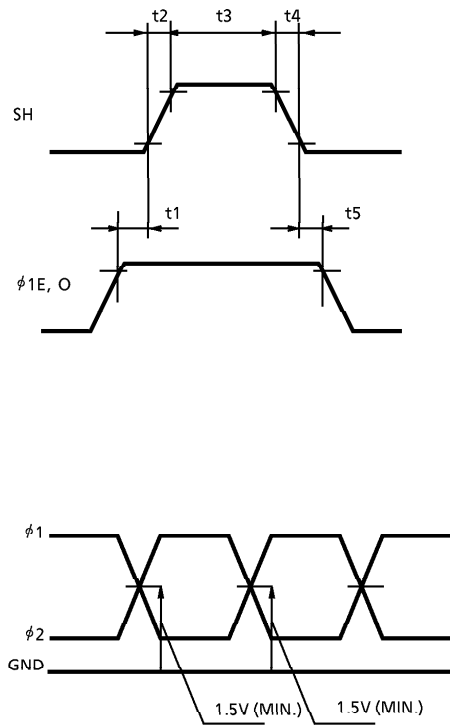
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock Pulse Frequency	$f_{\phi}$	—	1	10	MHz
Reset Pulse Frequency	$f_{RS}$	—	1	10	MHz
Clock Capacitance	$C_{\phi E}$	—	350	450	pF
	$C_{\phi O}$	—	350	450	
Final Stage Clock Capacitance	$C_{\phi B}$	—	10	20	pF
Shift Gate Capacitance	$C_{SH}$	—	10	20	pF
Reset Gate Capacitance	$C_{RS}$	—	10	20	pF
Clamp Gate Capacitance	$C_{CP}$	—	10	20	pF

TIMING CHART

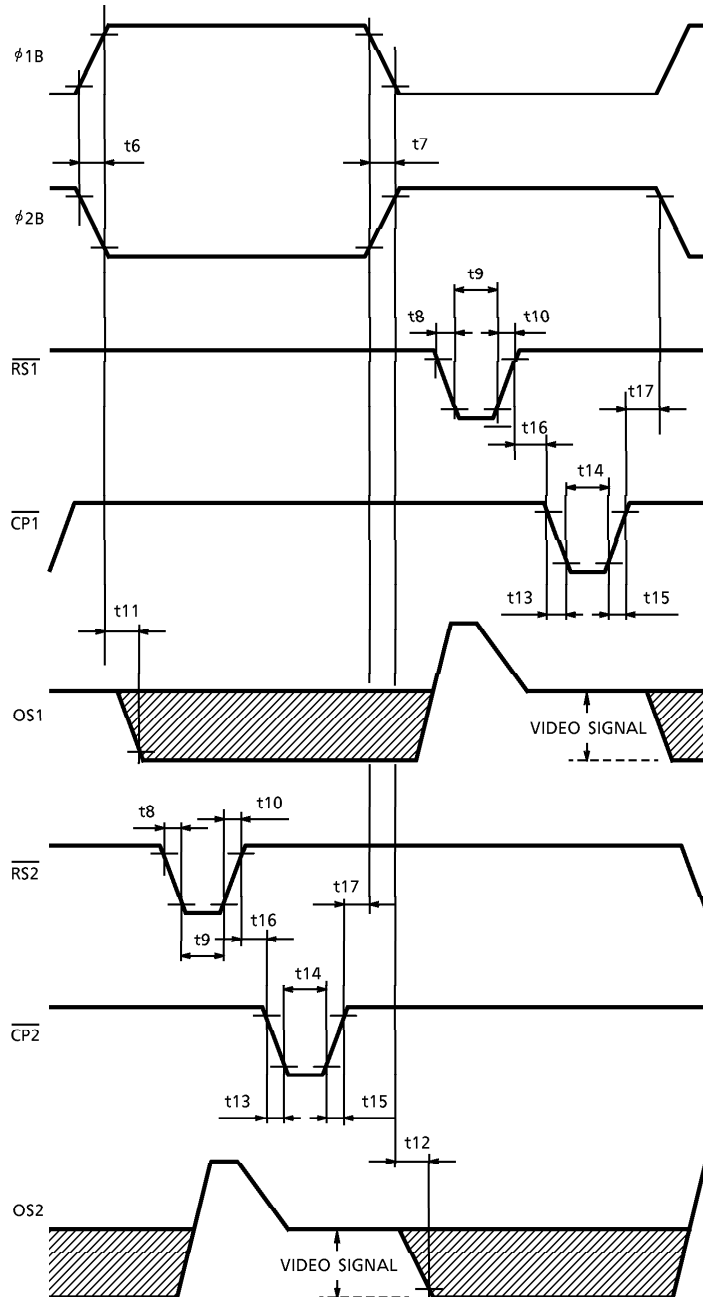


TIMING REQUIREMENTS

SH,  $\phi 1$  Timing



$\phi 1, \phi 2, \overline{RS}, \overline{CP}, OS$  Timing



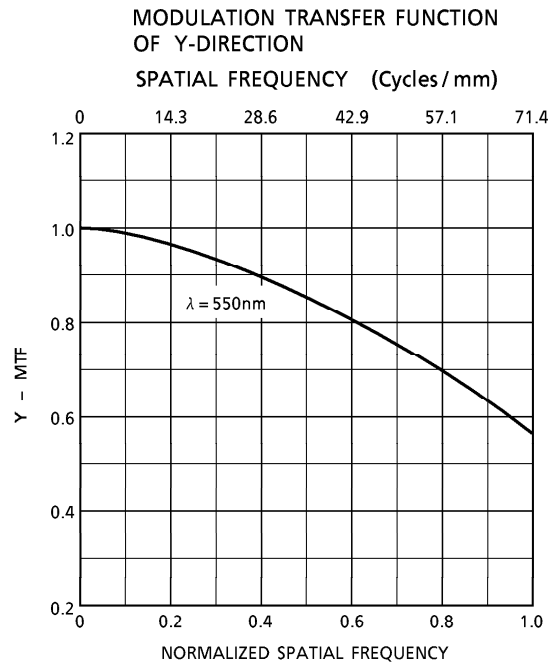
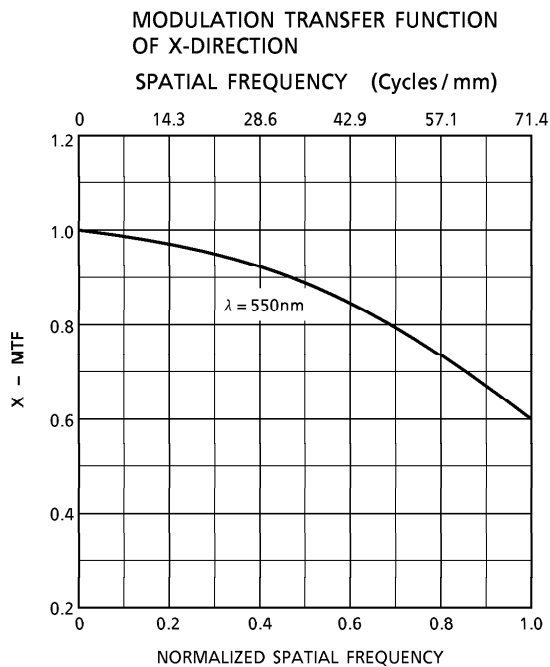
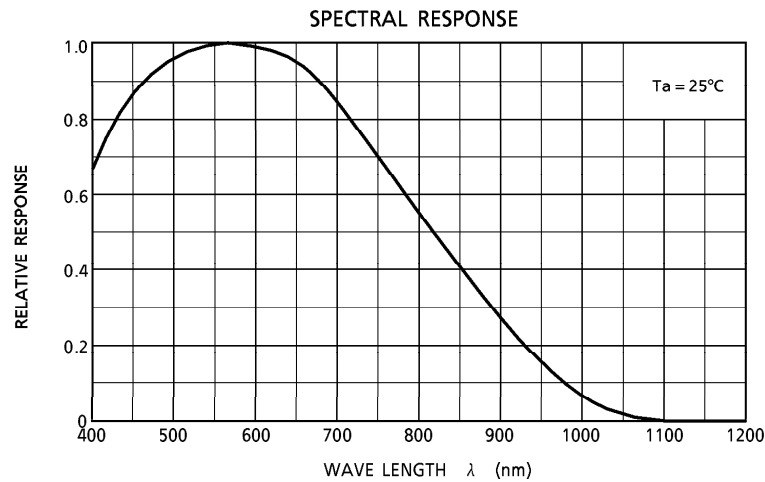
CHARACTERISTIC	SYMBOL	MIN.	TYP. (Note 9)	MAX.	UNIT
Pulse Timing of SH and $\phi_{10}, E$	t1, t5	100	300	—	ns
SH Pulse Rise Time, Fall Time	t2, t4	0	50	—	ns
SH Pulse Width	t3	500	1000	—	ns
$\phi_1, \phi_2$ Pulse Rise Time, Fall Time	t6, t7	0	100	—	ns
$\overline{RS}$ Pulse Rise Time, Fall Time	t8, t10	0	20	—	ns
$\overline{RS}$ Pulse Width	t9	20	250	—	ns
Video Data Delay Time (Note 10)	t11, t12	—	20	—	ns
$\overline{CP}$ Pulse Rise Time, Fall Time	t13, t15	0	20	—	ns
$\overline{CP}$ Pulse Width	t14	20	—	—	ns
Pulse Timing of $\overline{RS}$ and $\overline{CP}$	t16	0	—	—	ns
Pulse Timing of $\phi_{1B}, \phi_{2B}$ and $\overline{CP}$	t17	0	—	—	ns

(Note 9) TYP. is the case of  $f_{RS} = 1.0\text{MHz}$

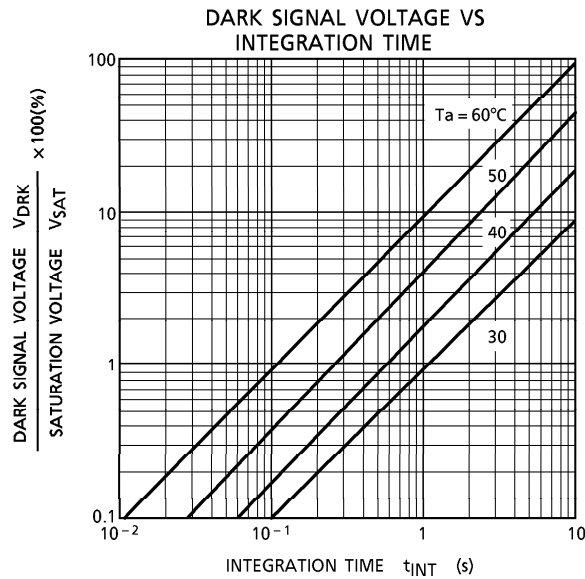
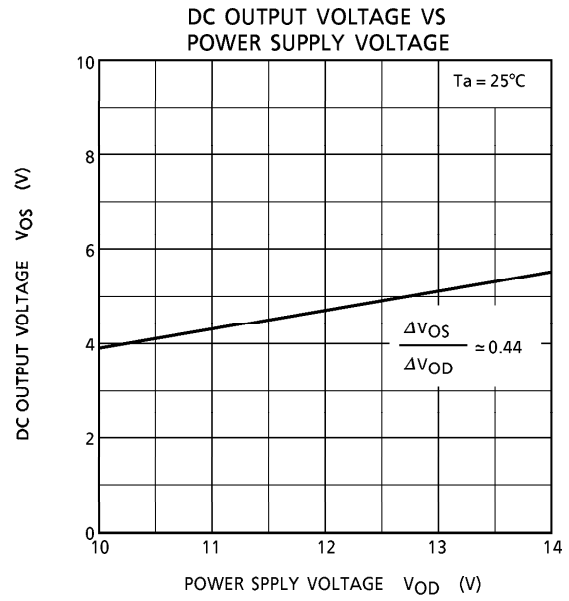
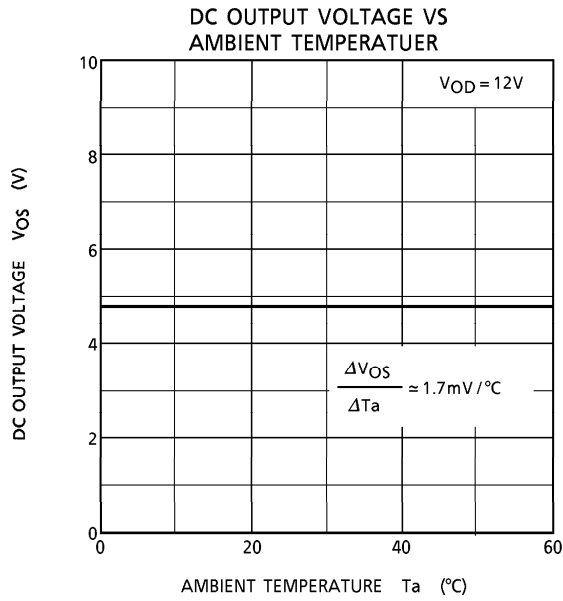
(Note 10) Load Resistance is  $100\text{k}\Omega$



TYPICAL PERFORMANCE CURVES



TYPICAL PERFORMANCE CURVES (Cont'd)



**CAUTION****1. Window Glass**

The dust and stain on the glass window of the package degrade optical performance of CCD sensor. Keep the glass window clean by saturating a cotton swab in alcohol and lightly wiping the surface, and allow the glass to dry by blowing with filtered dry N<sub>2</sub>.

Care should be taken to avoid mechanical or thermal shock because the glass window is easily to damage.

**2. Electrostatic Breakdown**

Store in shorting clip or in conductive foam to avoid electrostatic breakdown.

**3. Incident Light**

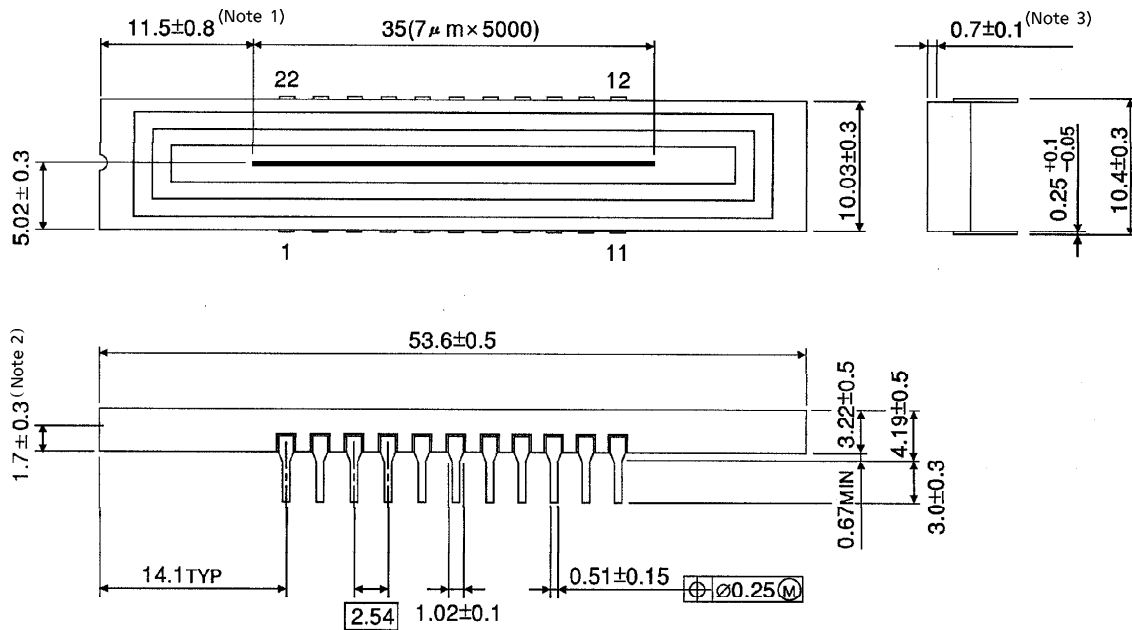
CCD sensor is sensitive to infrared light.

Note that infrared light component degrades resolution and PRNU of CCD sensor.

**PACKAGE OUTLINE**

WDIP22-C-400-2.54B (A)

Unit in mm



- (Note 1) No. 1 SENSOR ELEMENT (S1) TO EDGE OF PACKAGE.
- (Note 2) TOP OF CHIP TO BOTTOM OF PACKAGE.
- (Note 3) GLASS THICKNES (n = 1.5)

Weight : 5.4g (Typ.)