

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

TCD1702C

The TCD1702C is a high sensitive and low dark current 7500 elements CCD image sensor.
 The sensor is designed for facsimile, imagescanner and OCR.
 The device contains a row of 7500 elements photodiodes which provide a 24 lines/mm (600DPI) across a A3 size paper. The device is operated by 5V (pulse), and 12V power supply.

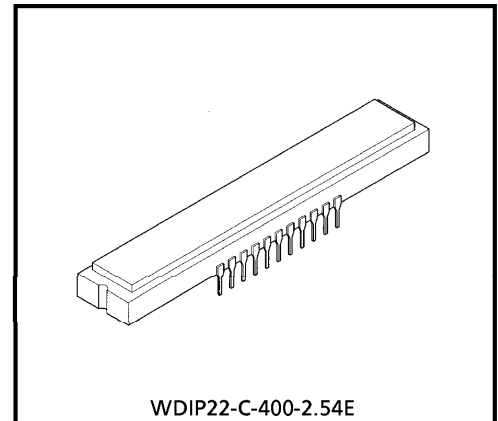
FEATURES

- Number of Image Sensing Elements : 7500 elements
- Image Sensing Element Size : 7 μm by 7 μm on 7 μm centers
- Photo Sensing Region : High sensitive and low voltage dark signal pn photodiode
- Clock : 2 phase (5V)
- Package : 22 pin DIP

MAXIMUM RATINGS (Note 1)

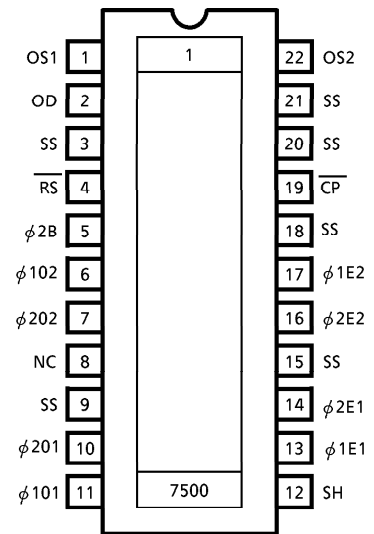
CHARACTERISTIC	SYMBOL	RATING	UNIT
Clock Pulse Voltage	V_{ϕ}	- 0.3~8	V
Shift Pulse Voltage	V_{SH}		
Reset Pulse Voltage	V_{RS}		
Clamp Pulse Voltage	V_{CP}		
Power Supply Voltage	V_{OD}	- 0.3~15	
Operating Temperature	T_{opr}	- 25~60	°C
Storage Temperature	T_{stg}	- 40~100	°C

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



WDIP22-C-400-2.54E
 Weight : 6.6 g (Typ.)

PIN CONNECTIONS

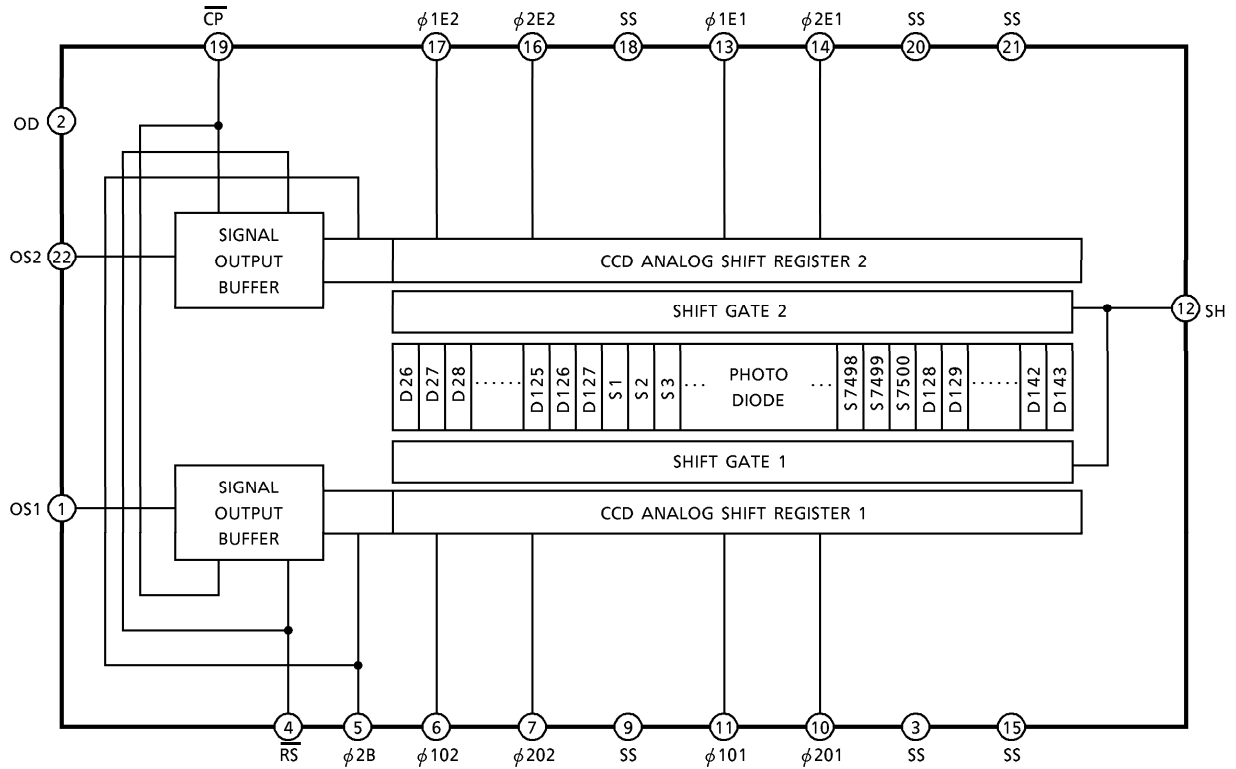


(TOP VIEW)

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CIRCUIT DIAGRAM



PIN NAME

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

OPTICAL / ELECTRICAL CHARACTERISTICS(Ta = 25°C, V_{OD} = 12 V, V_φ = V_{SH} = V_{RS} = V_{CP} = 5 V, f_φ = 1 MHz,t_{INT} (INTEGRATION TIME) = 10 ms, LIGHT SOURCE = DAYLIGHT FLUORESCENT LAMP

LOAD RESISTANCE = 100 kΩ)

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 _{SAT}	1.5	2	—	V	(Note 3)
Saturation Exposure	SE	0.14	0.22	—	lx·s	(Note 4)
Dark Signal Voltage	V _{DRK}	—	1	2.5	mV	(Note 5)
Dark Signal Non Uniformity	DSNU	—	1	2.5	mV	(Note 5)
DC Power Dissipation	P _D	—	300	364	mW	
Total Transfer Efficiency	TTE	92	—	—	%	
Output Impedance	Z _o	—	0.5	1	kΩ	
Dynamic Range	DR	—	2000	—	—	(Note 6)
DC Signal Output Voltage	V _{OS1}	3.5	4.5	6	V	(Note 7)
	V _{OS2}	3.5	4.5	6	V	(Note 7)
DC Differential Error Voltage	V _{OS1} -V _{OS2}	—	—	300	mV	

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

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

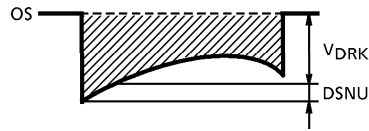
Where \bar{x} is average of total signal outputs and Δx is maximum deviation from \bar{x} under uniform illumination. (Channel 1)

In the case of 3750 elements (Channel 2), the condition is the same as above too.

(Note 3) : V_{SAT} is defined as minimum saturation output voltage of all effective pixels.

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

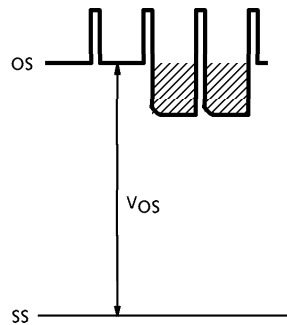
(Note 5) : V_{DRK} is defined as average dark signal voltage of all effective pixels.
 $DSNU$ is defined as different voltage between V_{DRK} and V_{MDK} when V_{MDK} is maximum dark signal voltage.



(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.

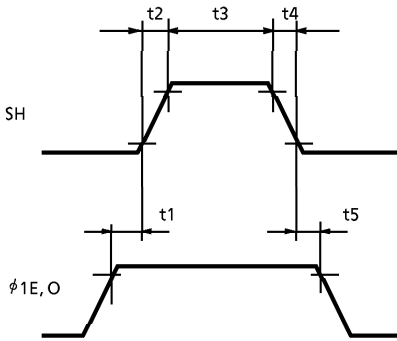
(Note 7) : DC signal output voltage and DC compensation output voltage are defined as follows :



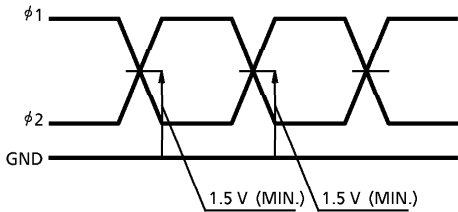
(Note 8) : PRNU (3) is defined as maximum voltage with next pixel, where measured 5% of SE (Typ.)

TIMING REQUIREMENTS

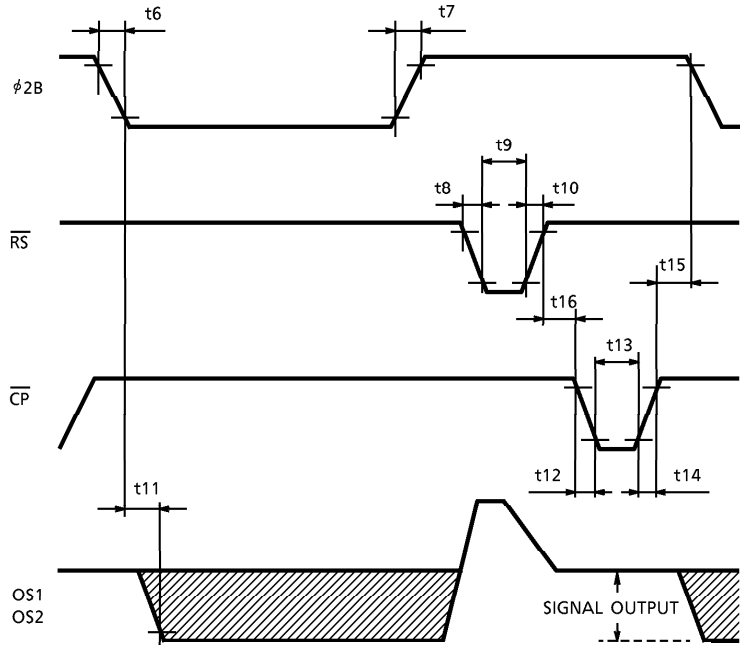
$\phi 1$, SH Timing



$\phi 1$, $\phi 2$ Cross Point



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



CHARACTERISTIC	SYMBOL	MIN.	TYP. (Note 9)	MAX.	UNIT
Pulse Timing of SH and $\phi 10, E$	t1, t5	150	300	—	ns
SH Pulse Rise Time, Fall Time	t2, t4	0	50	—	ns
SH Pulse Width	t3	500	1000	—	ns
$\phi 2$ 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	—	20	—	ns
\overline{CP} Pulse Rise Time, Fall Time	t12, t14	0	20	—	ns
\overline{CP} Pulse Width	t13	20	—	—	ns
Pulse Timing of $\phi 2B$ and \overline{CP}	t15	0	—	—	ns
Pulse Timing of \overline{RS} and \overline{CP}	t16	0	—	—	ns

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

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

OPERATING CONDITION

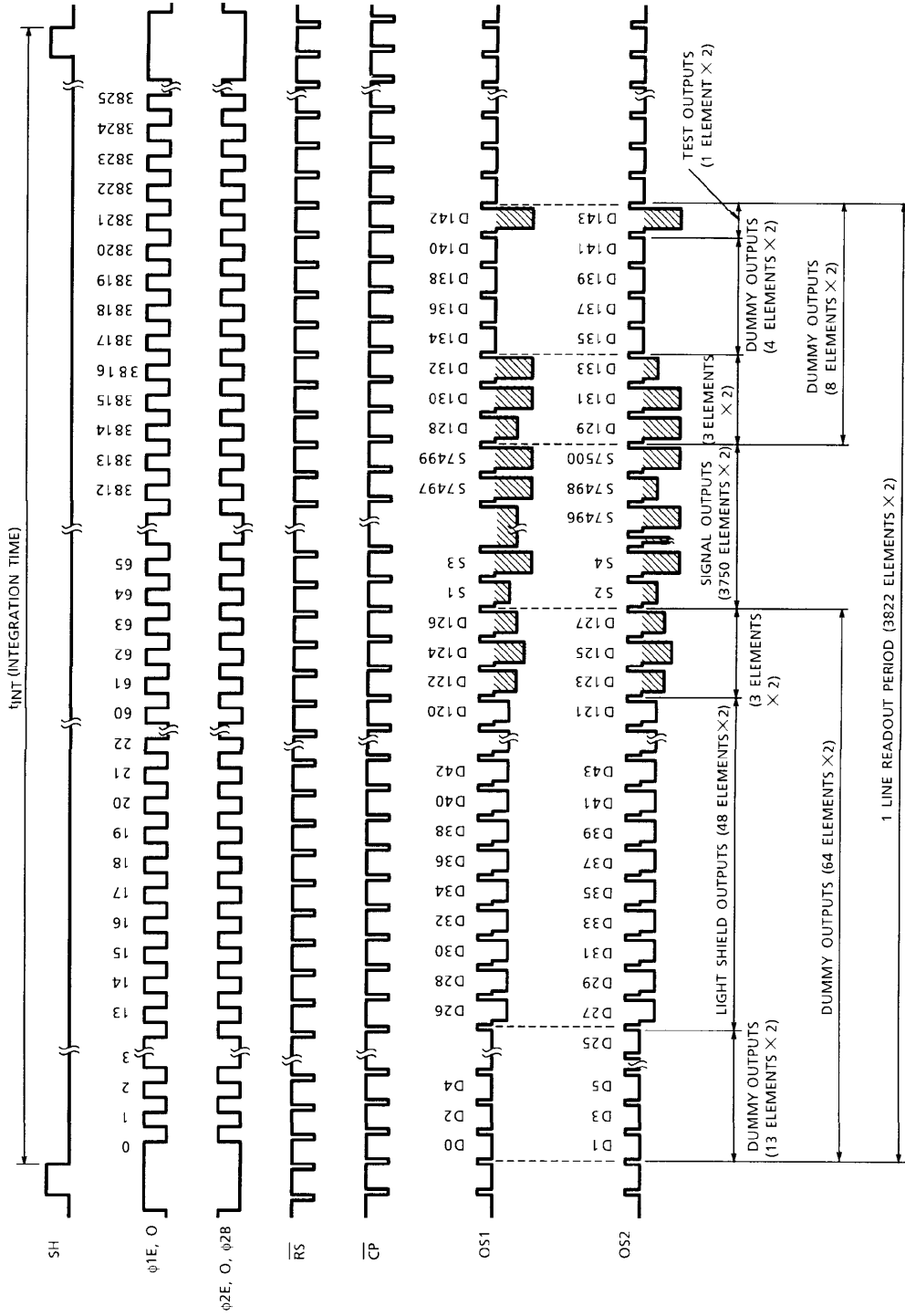
CHARACTERISTIC		SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock Pulse Voltage	"H" Level	$V_{\phi 1E, O}$	4.5	5	5.5	V
	"L" Level	$V_{\phi 2E, O}$	0	—	0.5	
Final Stage Clock Voltage	"H" Level	$V_{\phi 2B}$	4.5	5	5.5	V
	"L" Level		0	—	0.5	
Shift Pulse Voltage	"H" Level	(Note)	$V_{\phi E, 0} \text{ "H"} - 0.5$	$V_{\phi E, 0} \text{ "H"}$	$V_{\phi E, 0} \text{ "H"}$	V
	"L" Level	V_{SH}	0	—	0.5	
Reset Pulse Voltage	"H" Level	\overline{VRS}	4.5	5	5.5	V
	"L" Level		0	—	0.5	
Clamp Pulse Voltage	"H" Level	\overline{VCP}	4.5	5	5.5	V
	"L" Level		0	—	0.5	
Power Supply Voltage		V_{OD}	11.4	12	13	V

(Note) : $V_{\phi E, 0} \text{ "H"}$ means the value of high level voltage at $V_{\phi E, 0}$, when SH pulse is high level.

CLOCK CHARACTERISTICS (Ta = 25°C)

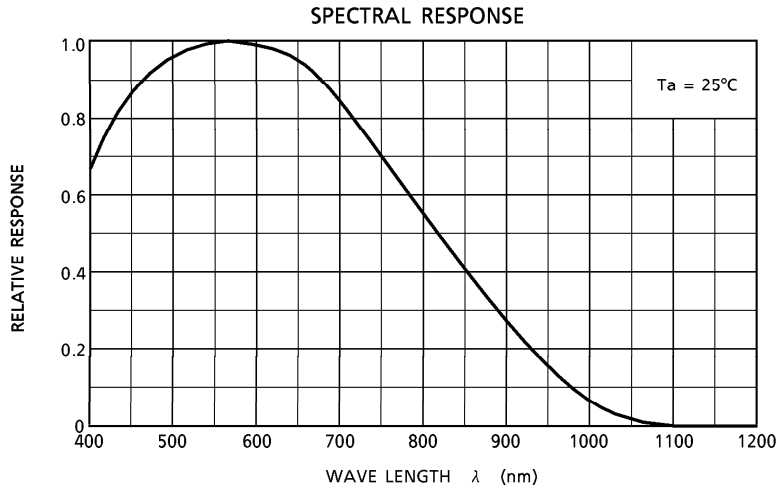
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock Pulse Frequency	f_{ϕ}	—	1	10	MHz
Reset Pulse Frequency	$f_{\overline{RS}}$	—	1	10	MHz
Clock Capacitance	$C_{\phi E}$	—	350	450	pF
	$C_{\phi O}$	—	350	450	pF
Final Stage Clock Capacitance	$C_{\phi B}$	—	10	20	pF
Shift Gate Capacitance	C_{SH}	—	350	450	pF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

TIMING CHART

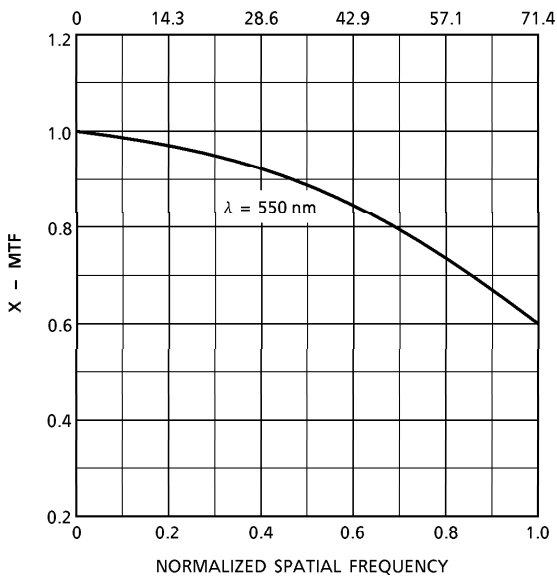


TCD1702C-7

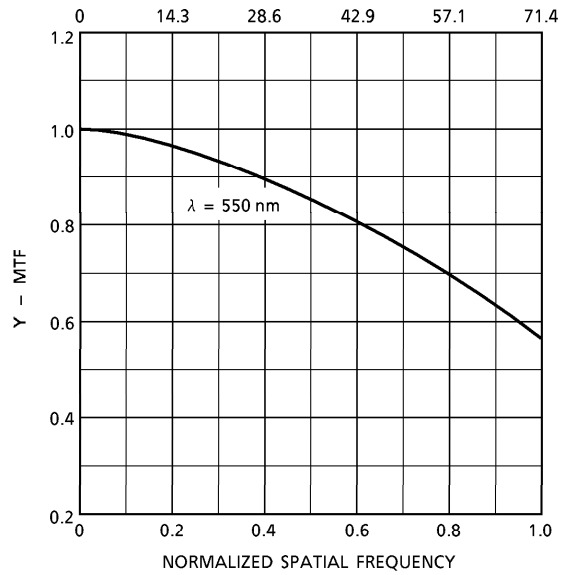
TYPICAL PERFORMANCE CURVES



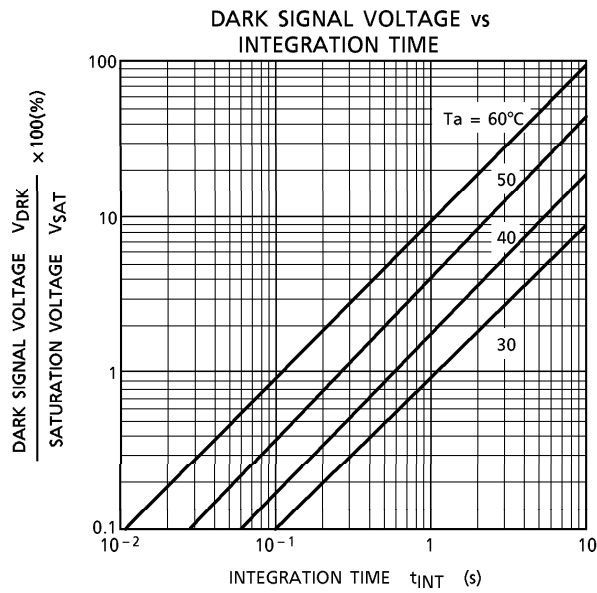
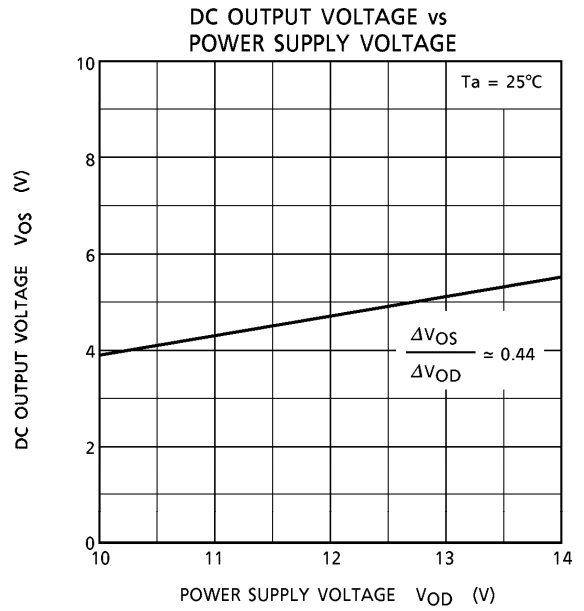
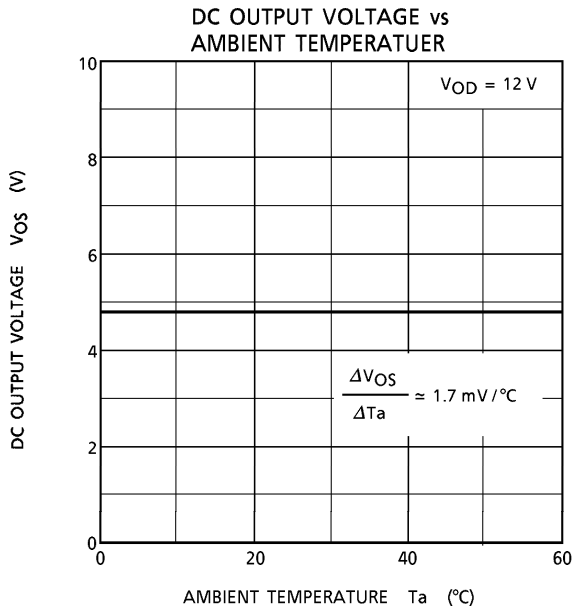
MODULATION TRANSFER FUNCTION
OF X-DIRECTION
SPATIAL FREQUENCY (Cycles/mm)



MODULATION TRANSFER FUNCTION
OF Y-DIRECTION
SPATIAL FREQUENCY (Cycles/mm)



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 N₂.

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

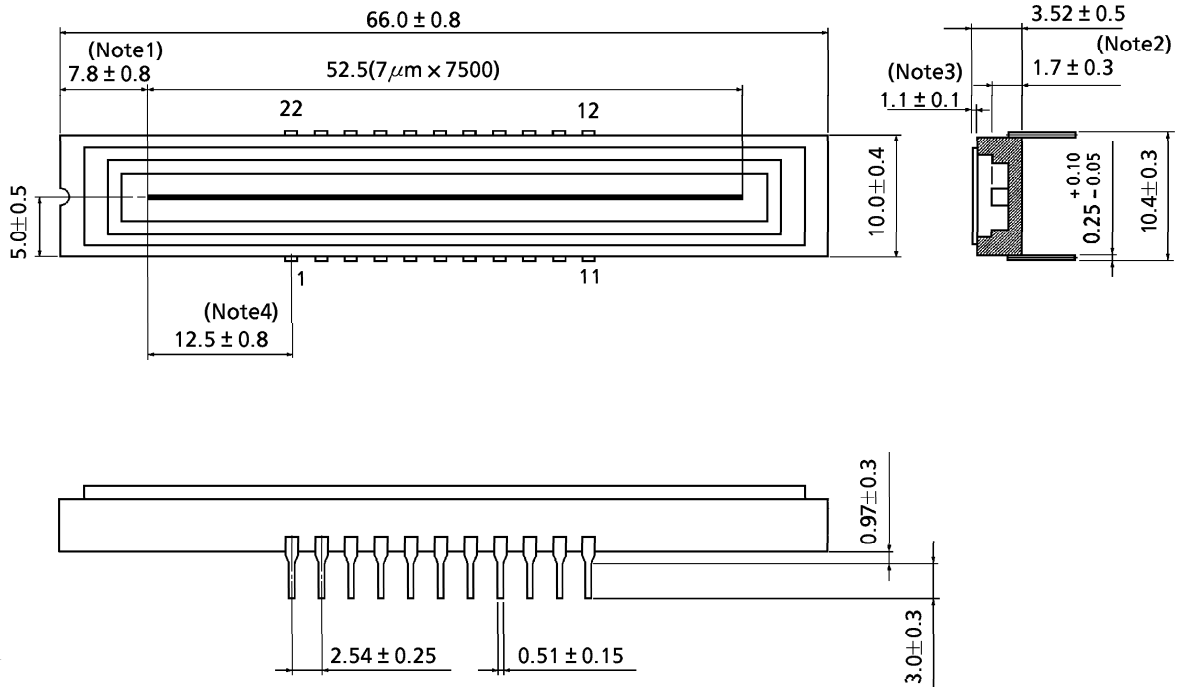
CCD sensor is sensitive to infrared light.

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

PACKAGE DIMENSIONS

WDIP22-C-400-2.54E (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)
- (Note 4) : No. 1 SENSOR ELEMENT (S1) TO CENTER OF No. 1 PIN.

Weight : 6.6 g (Typ.)