

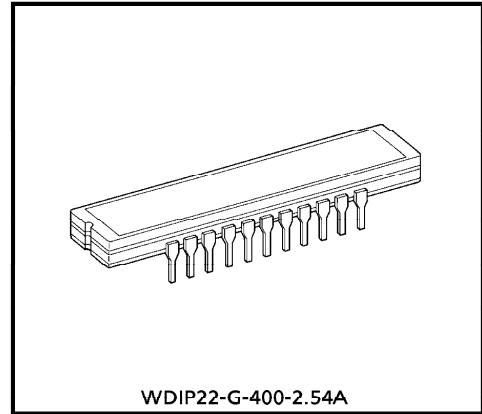
TOSHIBA CCD LINEAR IMAGE SENSOR CCD(Charge Coupled Device)

# TCD1300D

The TCD1300D is a high sensitive and low dark current 3648-elements linear image sensor. The sensor can be used for facsimile, imagescanner and OCR. The signal pre-processing circuit which is composed of Sample and Hold circuit and Pre-amplifier circuit. The device contains a row of 3648 photodiodes, which provide a 16 lines/mm (400DPI) across a A4 size paper.

**FEATURES**

- Number of Image Sensing Elements : 3648
- Image Sensing Element Size : 8μm by 8μm on 8μm centers
- Photo Sensing Region : High sensitive pn photodiode
- Clock : 2 phase
- Internal Circuit : S/H circuit, Pre-Amplifier circuit
- Package : 22 pin cerdip



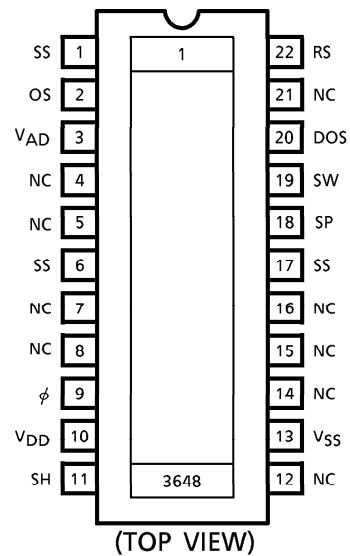
Weight : 4.4g (Typ.)

**MAXIMUM RATINGS (Note 1)**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Clock Pulse Voltage	$V_{\phi}$	- 0.3~15	V
Shift Pulse Voltage	$V_{SH}$		V
Reset Pulse Voltage	$V_{RS}$		V
Sample and Hold Pulse Voltage	$V_{SP}$		V
Switch Pulse Voltage	$V_{SW}$		V
Power Supply Voltage (Analog)	$V_{AD}$		V
Power Supply Voltage (Driver)	$V_{DD}$	V	
Operating Temperature	$T_{opr}$	- 25~60	°C
Storage Temperature	$T_{stg}$	- 40~100	°C

(Note 1) All voltage are with respect to SS and  $V_{SS}$  terminals (Ground).

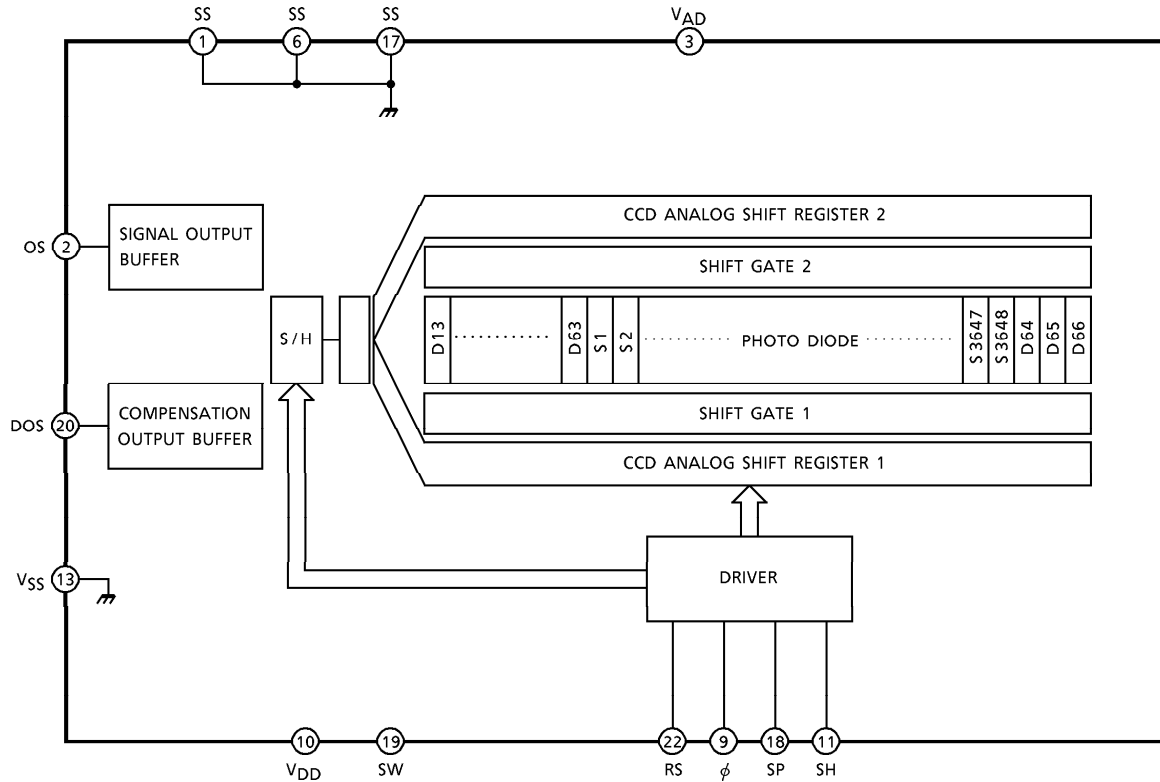
**PIN CONNECTIONS**



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CIRCUIT DIAGRAM



PIN NAMES

$\phi$	Clock
SH	Shift Gate
RS	Reset Gate
SP	Sample Hold Gate
OS	Signal Output
DOS	Compensation Output
V <sub>AD</sub>	Power (Analog)
V <sub>DD</sub>	Power (Driver)
SS	Ground (Analog)
V <sub>SS</sub>	Ground (Driver)
SW	Final Clock Select Switch
NC	Non Connection

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**OPTICAL / ELECTRICAL CHARACTERISTICS**

(Ta = 25°C, VAD = 12V, VDD = 12V, Vφ = VSH = VRS = 5V (PULSE), fφ = 0.5MHz, fRS = 1MHz, tINT (INTEGRATION TIME) = 10ms, LIGHT SOURCE = DAYLIGHT FLUORESCENT LAMP)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Sensitivity	R	4.6	5.8	7	V / lx·s	
Photo Response Non Uniformity	PRNU (1)	—	—	10	%	(Note 2)
	PRNU (3)	—	—	8	mV	(Note 3)
Register Imbalance	RI	—	—	3	%	(Note 4)
Saturation Output Voltage	V <sub>SAT</sub>	1.0	1.5	—	V	(Note 5)
Saturation Exposure	SE	—	0.3	—	lx·s	(Note 6)
Dark Signal Voltage	V <sub>DRK</sub>	—	—	3	mV	(Note 7)
Dark Signal Non Uniformity	DSNU	—	—	3	mV	(Note 7)
Analog Current Dissipation	I <sub>AD</sub>	—	16	25	mA	
Driver Current Dissipation	I <sub>DD</sub>	—	8	15	mA	
Total Transfer Efficiency	TTE	92	—	—	%	
Output Impedance	Z <sub>O</sub>	—	0.5	1	kΩ	
DC Signal Output Voltage	V <sub>OS</sub>	3.5	4.5	6	V	(Note 8)
DC Compensation Output Voltage	V <sub>DOS</sub>	3.5	4.5	6	V	(Note 8)
DC Mismatch Voltage	V <sub>OS</sub> -V <sub>DOS</sub>	—	—	100	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 the maximum deviation from  $\bar{x}$  under uniform illumination.

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

(Note 4) Measured at 50% of SE (Typ.)

RI is defined as follows:

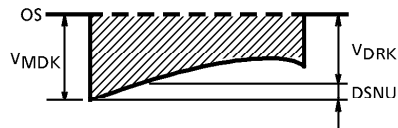
$$RI = \frac{\sum_{n=1}^{3647} |x_n - x_{n+1}|}{3647 \times \bar{x}} \times 100 (\%)$$

Where  $x_n$  and  $x_{n+1}$  are signal outputs of each pixel.  $\bar{x}$  is average of total signal outputs.

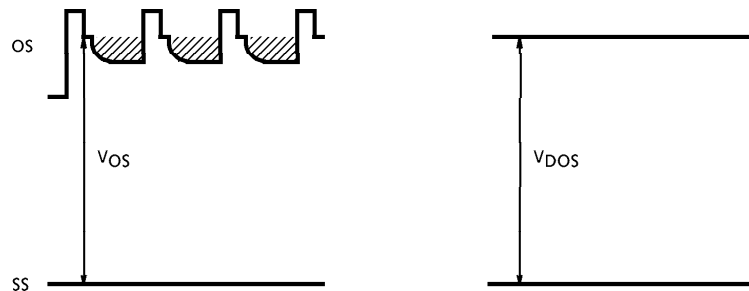
(Note 5) V<sub>SAT</sub> is defined as minimum saturation output voltage of all effective pixels.

(Note 6) Definition of SE : SE =  $\frac{V_{SAT}}{R}$  (lx·s)

(Note 7)  $V_{DRK}$  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 8) DC signal output voltage and DC compensation output voltage are defined as follows:



**OPERATING CONDITION**

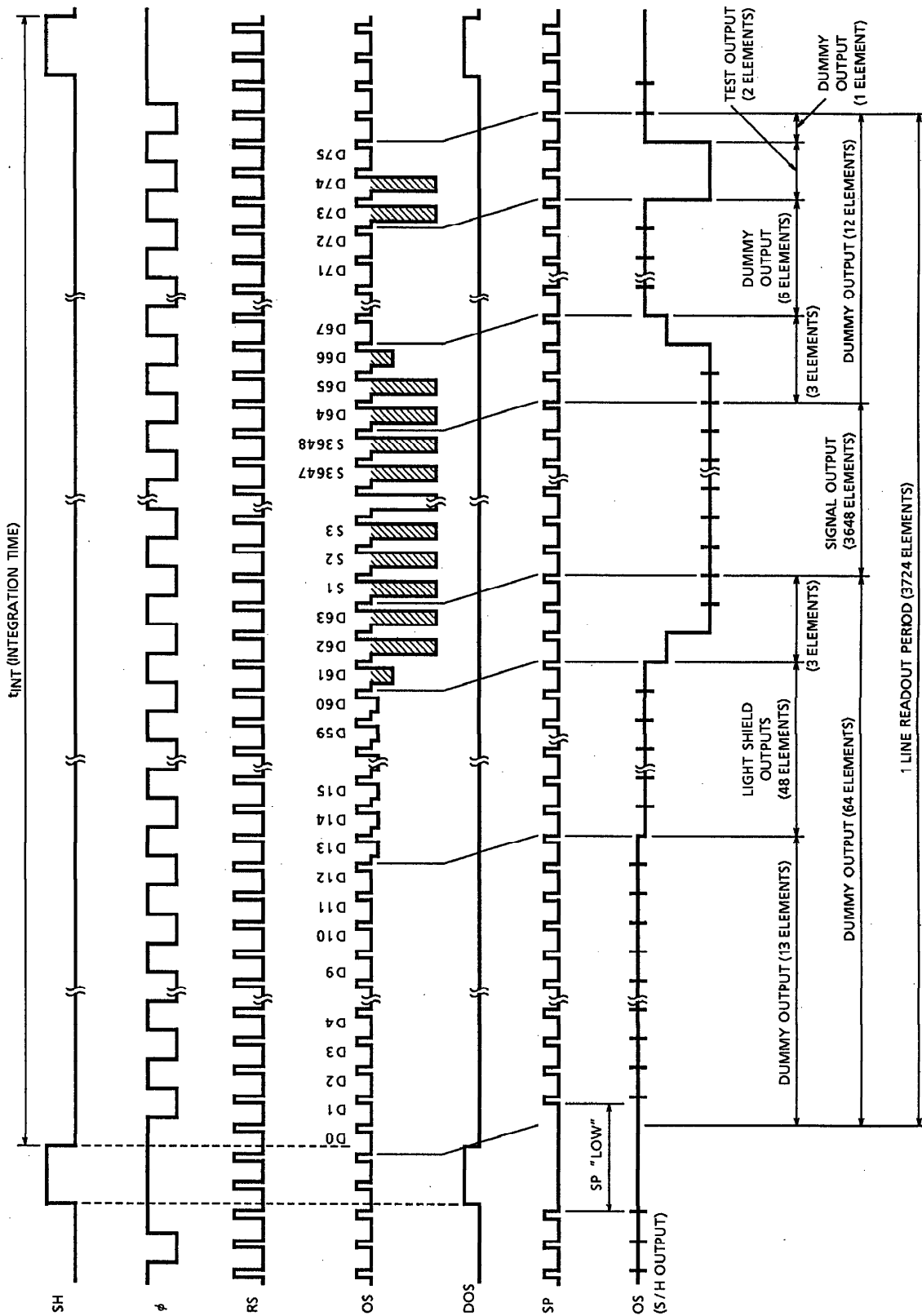
CHARACTERISTIC		SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock Pulse Voltage	"H" Level	$V_{\phi}$	4.5	5.0	13	V
	"L" Level		0	—	0.5	
Shift Pulse Voltage	"H" Level	$V_{SH}$	4.5	5.0	13	V
	"L" Level		0	—	0.5	
Reset Pulse Voltage	"H" Level	$V_{RS}$	4.5	5.0	13	V
	"L" Level		0	—	0.5	
Sample and Hold Pulse Voltage (Note 9)	"H" Level	$V_{SP}$	4.5	5.0	13	V
	"L" Level		0	—	0.5	
Switch Pulse Voltage	"H" Level	$V_{SW}$	4.5	5.0	13	V
	"L" Level		0	—	0.5	
Power Supply Voltage (Analog)		$V_{AD}$	11.4	12	13	V
Power Supply Voltage ((Driver)		$V_{DD}$	11	12	13	V

(Note 9) Supply "H" level to SP terminal when sample-and-hold circuitry is not used.

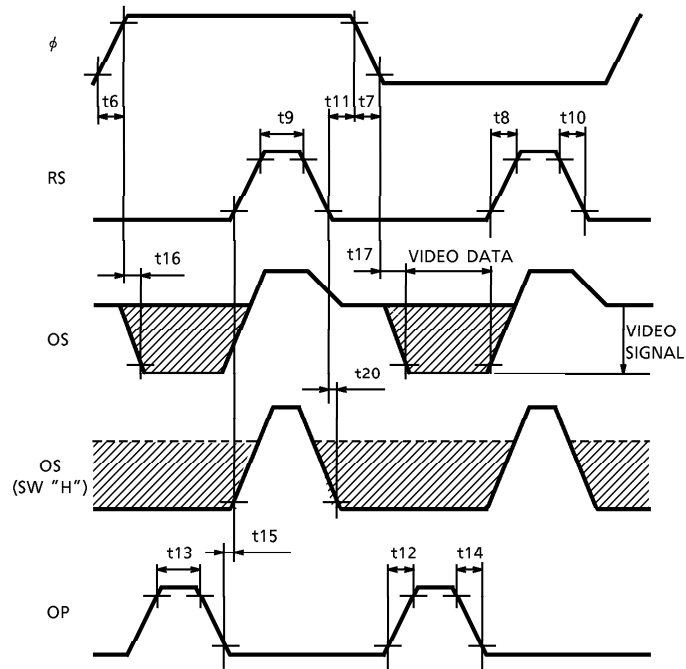
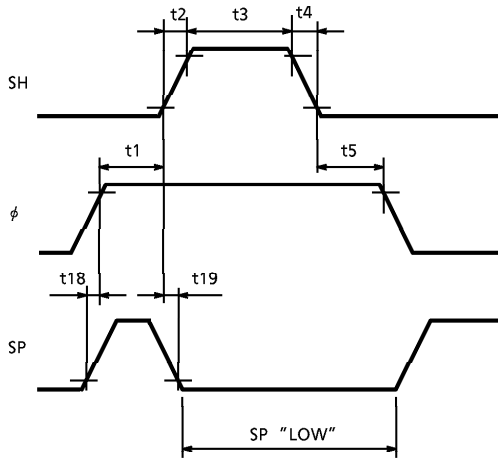
**CLOCK CHARACTERISTICS (Ta = 25°C)**

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock Pulse Frequency	$f_{\phi}$	—	0.5	1.5	MHz
Reset Pulse Frequency	$f_{RS}$	—	1	3	MHz
Sample and Hold Pulse Frequency	$f_{SP}$	—	1	3	MHz
Clock Capacitance	$C_{\phi}$	—	20	40	pF
Shift Gate Capacitance	$C_{SH}$	—	20	40	pF
Reset Gate Capacitance	$C_{RS}$	—	10	20	pF
Sample and Hold Gate Capacitance	$C_{SP}$	—	10	20	pF
Switch Gate Capacitance	$C_{SW}$	—	10	20	pF

TIMING CHART



TIMING REQUIREMENTS



Video Data Delay Time (Note 9)

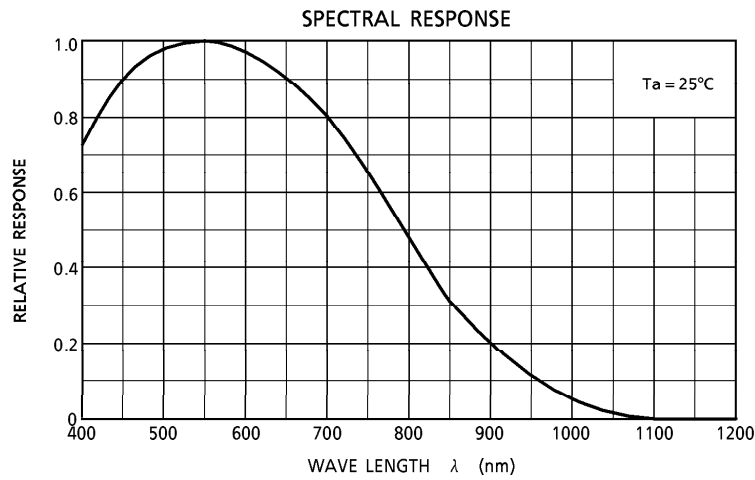
CHARACTERISTIC	SYMBOL	MIN.	TYP. (Note 10)	MAX.	UNIT
Pulse Timing of SH and $\phi$	t1, t5	60 (Note 12)	1000	—	ns
SH Pulse Rise Time, Fall Time	t2, t4	0	50	—	ns
SH Pulse Width	t3	500	1000	—	ns
$\phi$ Rise Time, Fall Time	t6, t7	0	50	—	ns
RS Rise Time, Fall Time	t8, t10	0	20	—	ns
RS Pulse Width	t9	20	250	—	ns
Pulse Timing of $\phi$ and RS	t11	0	100	—	ns
SP Rise Time, Fall Time	t12, t14	10	100	—	ns
SP Pulse Width	t13	20	100	—	ns
Pulse Timing of SP and RS	t15	0	50	—	ns
Video Data Delay Time (Note 11)	t16, t17	—	95	105	ns
	t20	—	80	90	ns
Pulse Timing of $\phi$ and SP	t18	0	250	—	ns
Pulse Timing of SH and SP	t19	20	450	—	ns

(Note 10) TYP. is the case of  $f_{RS} = 1\text{MHz}$ .

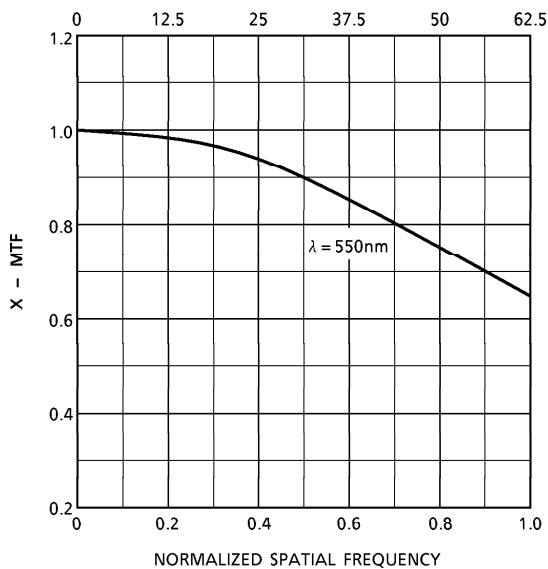
(Note 11) Load Resistance is  $100\text{k}\Omega$ .

(Note 12) The Case of Non Using the Dos 0ns.

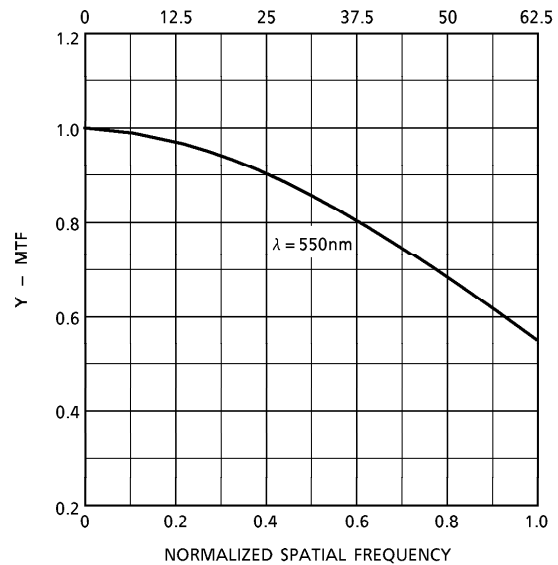
TYPICAL PERFORMANCE CURVES



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

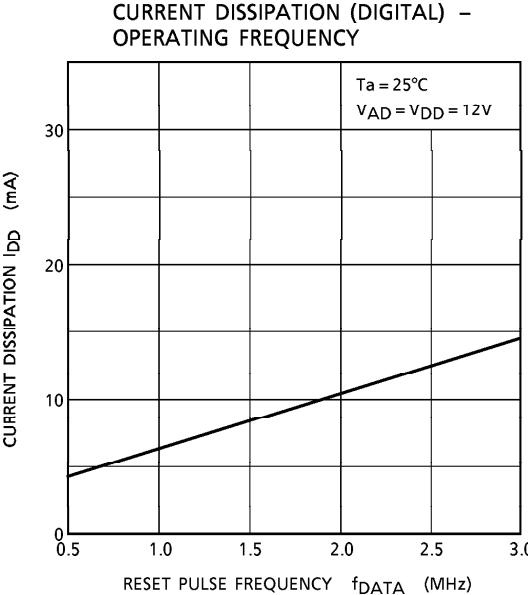
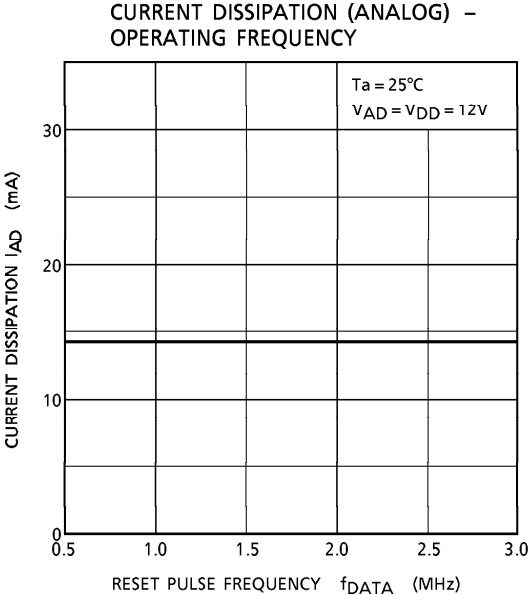


**MODULATION TRANSFER FUNCTION OF Y-DIRECTION**  
SPATIAL FREQUENCY (Cycles/mm)

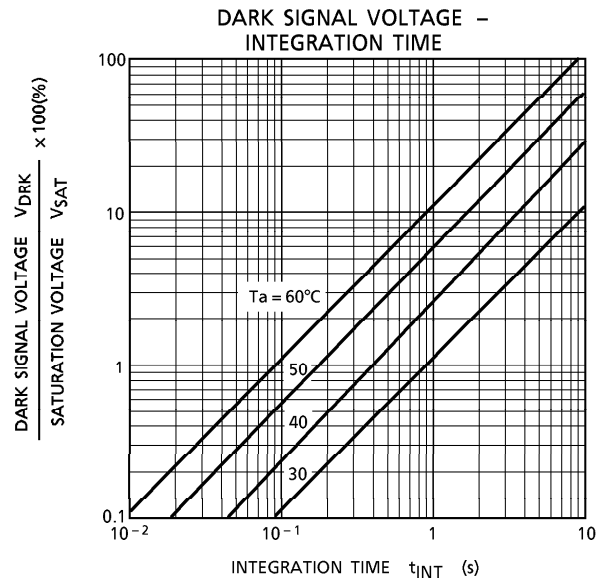
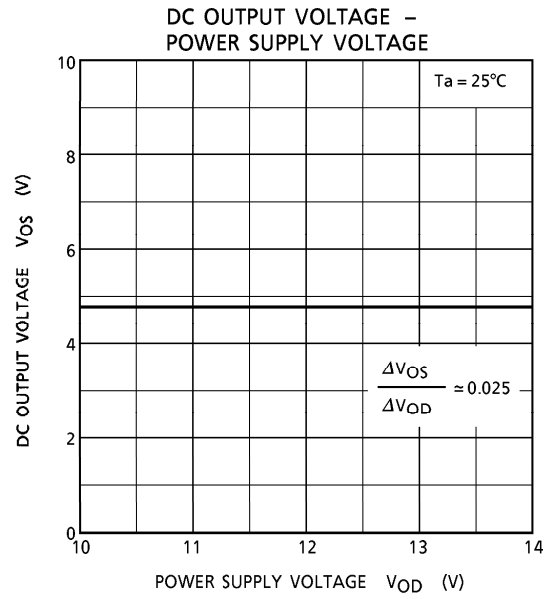
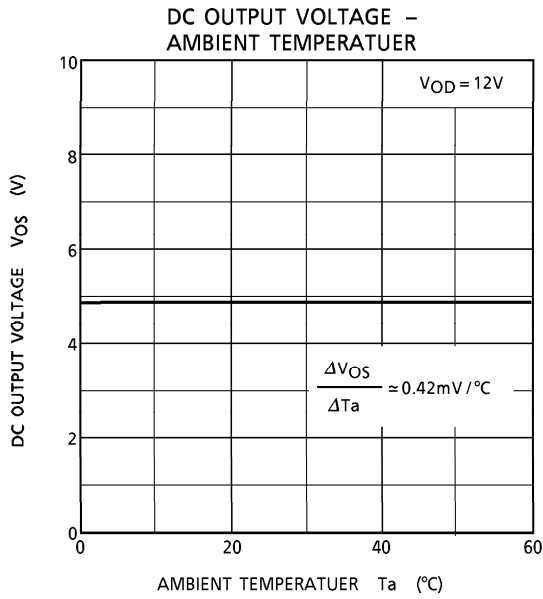




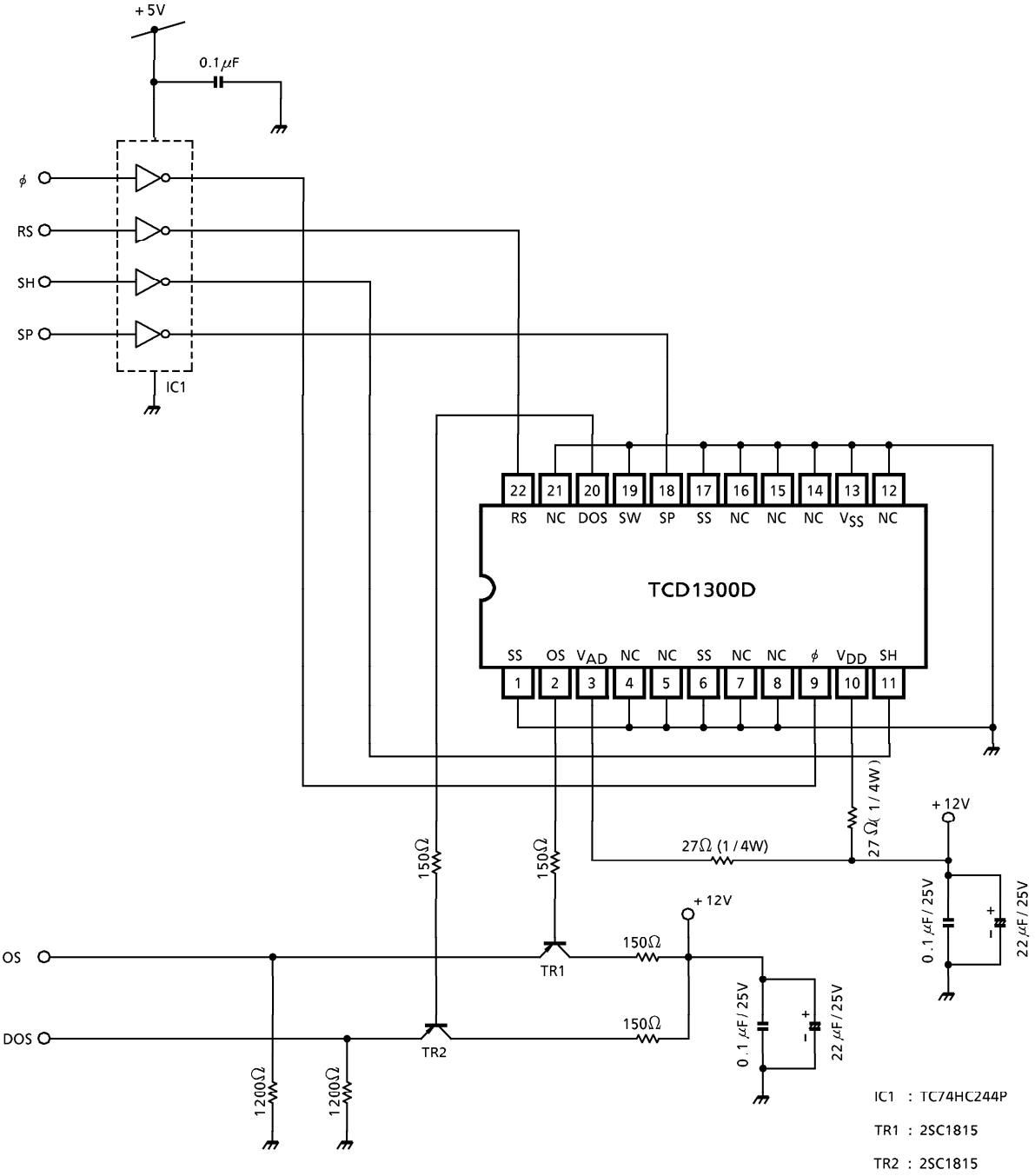
TYPICAL PERFORMANCE CURVES (Cont'd)



TYPICAL PERFORMANCE CURVES



TYPICAL DRIVE CIRCUIT



**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**

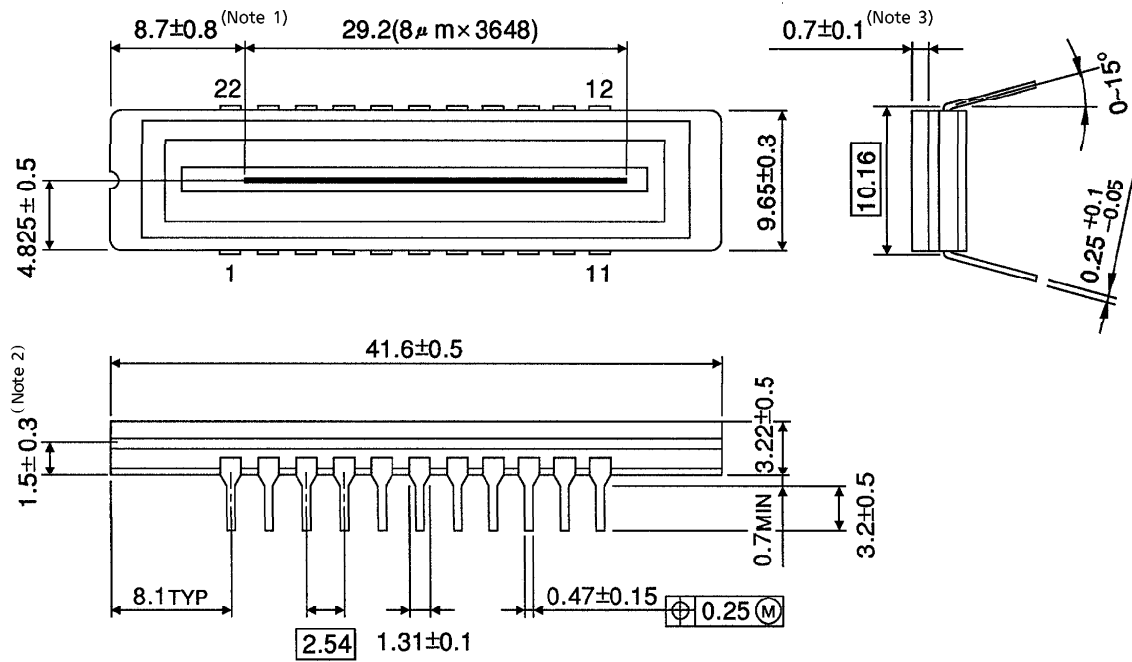
CCD sensor is sensitive to infrared light.

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

**OUTLINE DRAWING**

WDIP22-G-400-2.54A (F)

Unit : 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 : 4.4g (Typ.)