

TOSHIBA CCD LINEAR IMAGE SENSOR CCD(Charge Coupled Device)

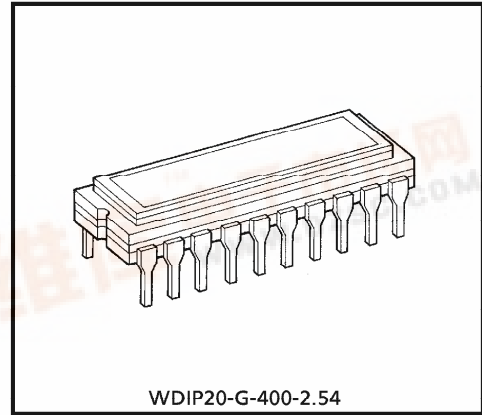
# TCD132D

The TCD132D is a 1024-elements linear image sensor which includes CCD drive circuit and signal processing circuit. The CCD drive circuit consists of the pulse generator and the CCD driver; therefore it is possible to get easy drive by applying simple pulses ( $\phi_M$ ,  $\phi_{CCD}$  and SH).

The signal processing circuit which consists of the clamp circuit and S/H circuit and pre-amplifier.

**FEATURES**

- Number of Image Sensing Elements : 1024
- Image Sensing Element Size :  $14\mu\text{m}$  by  $14\mu\text{m}$  on  $14\mu\text{m}$  centers
- Photo Sensing Region : Low dark current pn photodiode
- Clock : 3 Input pulses 5V
- Internal Circuit : Clamp circuit (for optical black level reference)  
Sample & hold circuit  
Pre-amplifier
- Package : 22 pin cerdip



WDIP20-G-400-2.54

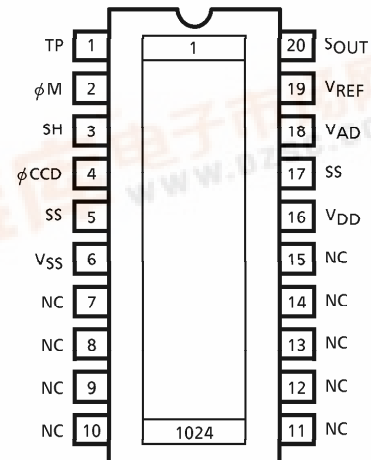
Weight : 3.1g (Typ.)

**MAXIMUM RATINGS (Note 1)**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Master Clock Voltage	$V_{\phi M}$	- 0.3~15	V
CCD Clock Voltage	$V_{\phi CCD}$		V
Shift Pulse Voltage	$V_{SH}$		V
Reference Voltage	$V_{REF}$		V
Power Supply Voltage (Analog)	$V_{AD}$		V
Power Supply Voltage (Digital)	$V_{DD}$		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**

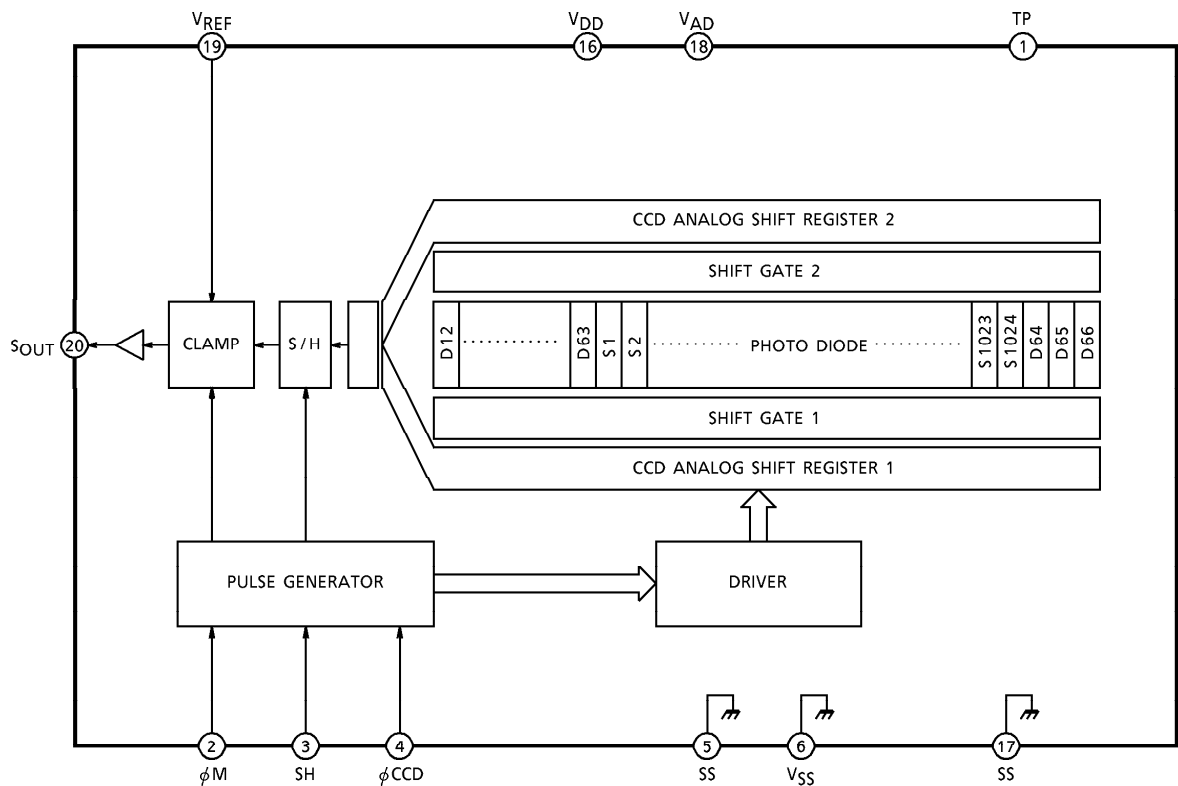


(TOP VIEW)

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**CIRCUIT DIAGRAM**



**PIN NAMES**

$\phi M$	Master Clock
$\phi CCD$	CCD Clock
SH	Shift Pulse
VREF	Reference Voltage Input
SOUT	Signal Output
VAD	Power (Analog)
VDD	Power (Digital)
SS	Ground (Analog)
VSS	Ground (Digital)
TP	Test Input
NC	Non Connection

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**OPTICAL / ELECTRICAL CHARACTERISTICS**

(Ta = 25°C, VAD = VDD = 12V, VφM = VφCCD = VSH = 5V (PULSE), VREF = 5.0V, fφCCD = 0.5MHz, tINT (INTEGRATION TIME) = 10ms, LIGHT SOURCE = DAYLIGHT FLUORESCENT LAMP, LOAD RESISTANCE = 100kΩ)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Sensitivity	R	9	12	15	V / lx·s	(Note 2)
Photo Response Non Uniformity	PRNU	—	—	10	%	(Note 3)
Saturation Output Voltage	V <sub>SAT</sub>	2	3	—	V	(Note 4)
Saturation Exposure	SE	0.13	0.25	—	lx·s	(Note 5)
Dark Signal Non Uniformity	DSNU	—	—	15	mV	(Note 6)
Analog Current Dissipation	I <sub>AD</sub>	—	12	20	mA	
Digital Current Dissipation	I <sub>DD</sub>	—	4	10	mA	
Input Current of VREF	I <sub>REF</sub>	—	0.1	1	mA	
Total Transfer Efficiency	TTE	92	—	—	%	
Output Impedance	Z <sub>O</sub>	—	1	2	kΩ	
Clamp Error Voltage	V <sub>ERR</sub>	—	100	200	V	(Note 7)

(Note 2) Sensitivity for 2856K W-lamp is 25V / lx·s (Typ.)

(Note 3) 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.

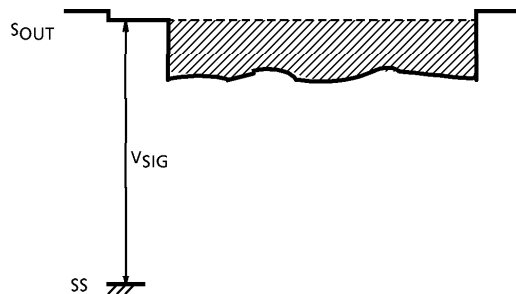
(Note 4) V<sub>SAT</sub> is defined as minimum saturation output voltage of all effective pixels.

$$\text{(Note 5) Definition of SE : SE} = \frac{V_{SAT}}{R} \text{ (lx·s)}$$

(Note 6) Definition of DSNU : DSNU = MAX – MIN (mV)



(Note 7) Definition of  $V_{ERR}$  :  $V_{ERR} = |V_{REF} - V_{SIG}|$   
Where  $V_{SIG}$  is defined below.



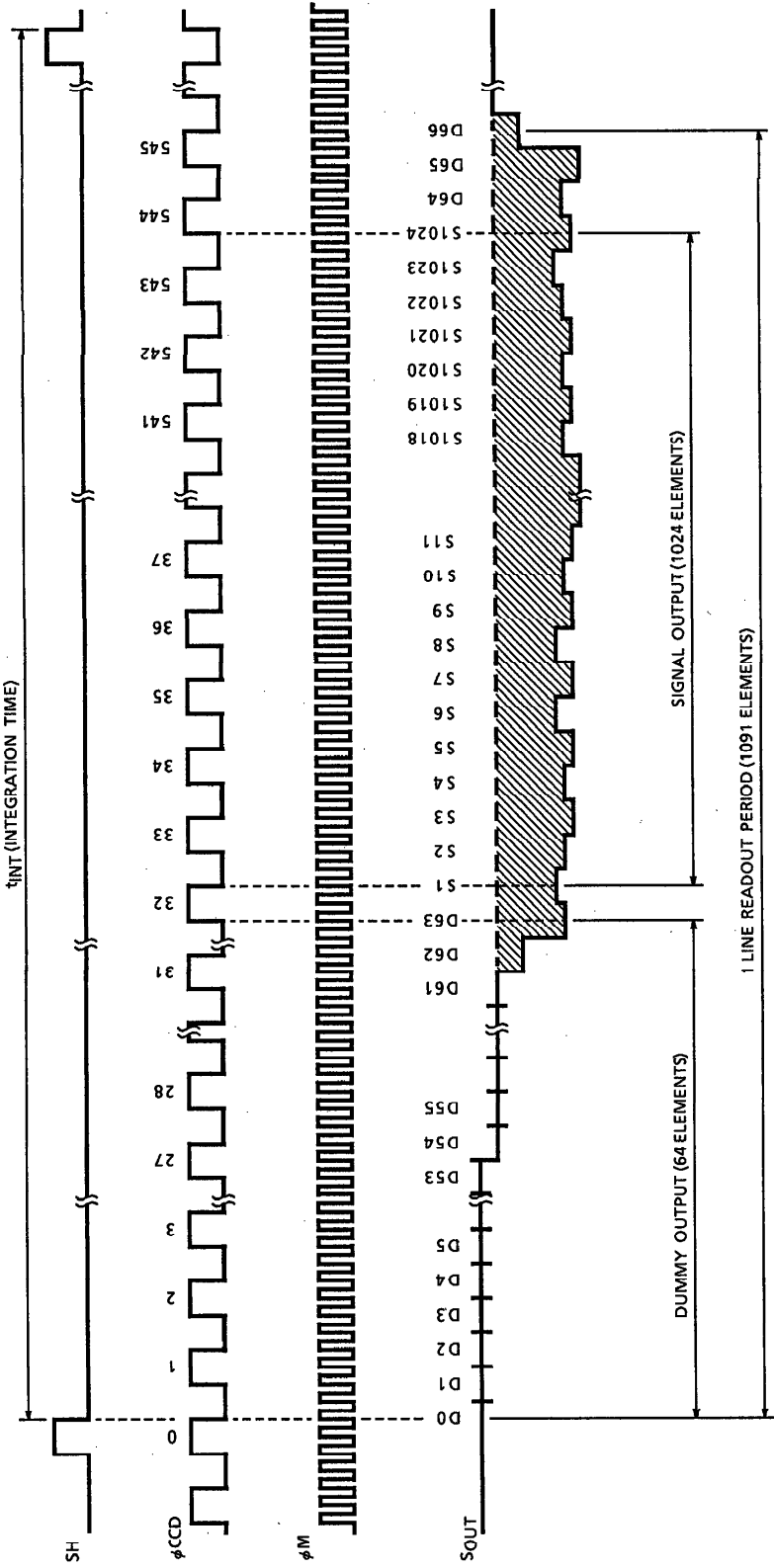
## OPERATING CONDITION

CHARACTERISTIC		SYMBOL	MIN.	TYP.	MAX.	UNIT
Master Clock Voltage	"H" Level	$V_{\phi M}$	4.5	5.0	5.5	V
	"L" Level		0	0.5	0.8	
CCD Clock Voltage	"H" Level	$V_{\phi CCD}$	4.5	5.0	5.5	V
	"L" Level		0	0.5	0.8	
Shift Pulse Voltage	"H" Level	$V_{SH}$	4.5	5.0	5.5	V
	"L" Level		0	0.5	0.8	
Reference Voltage		$V_{REF}$	4.5	5.0	5.5	V
Power Supply Voltage (Analog)		$V_{AD}$	11	12	13	V
Power Supply Voltage ((Driver)		$V_{DD}$	11	12	13	V
Test Input Voltage		$V_{TP}$	0	0	0.8	V

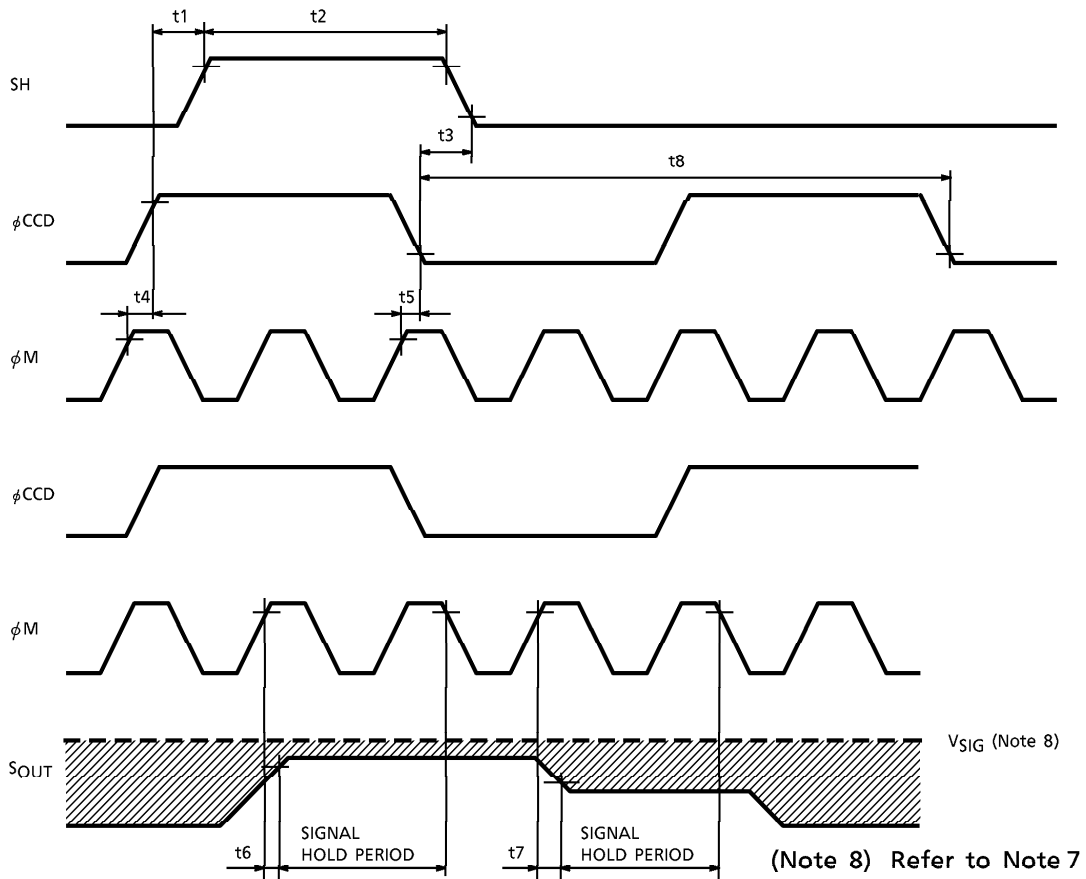
## CLOCK CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Master Clock Frequency	$f_{\phi M}$	0.4	2	4	MHz
Data Rate	$f_{DATA}$	0.2	1	2	MHz
CCD Clock Frequency	$f_{\phi CCD}$	0.1	0.5	1.0	MHz
Master Clock Capacitance	$C_{\phi M}$	—	—	10	pF
CCD Clock Capacitance	$C_{\phi CCD}$	—	—	10	pF
Shift Pulse Capacitance	$C_{SH}$	—	—	10	pF

TIMING CHART

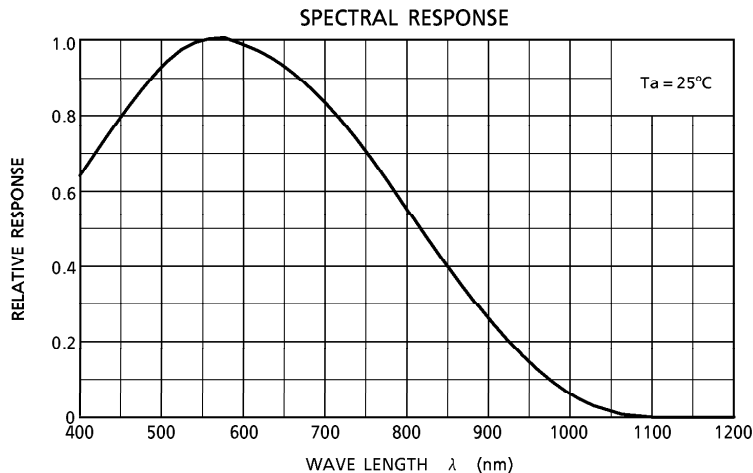


**TIMING REQUIREMENTS**



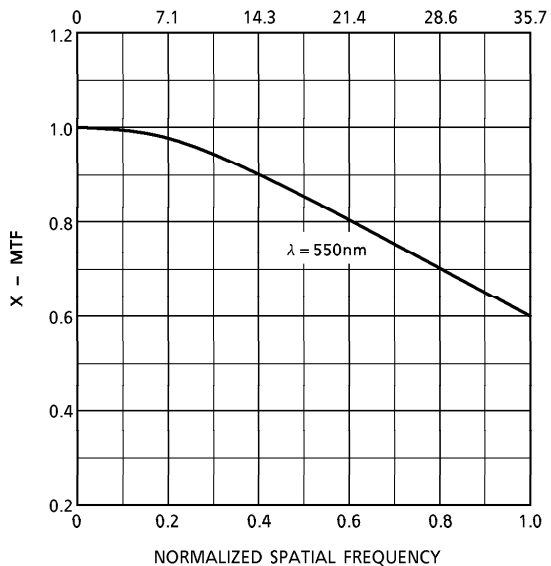
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Pulse Timing of SH and $\phi_{CCD}$	$t_1, t_3$	0	20	60	ns
SH Pulse Width	$t_2$	250	—	$t_8 / 2$	ns
Pulse Timing of $\phi_M$ and $\phi_{CCD}$	$t_4, t_5$	0	20	60	ns
Aperture Delay	$t_6, t_7$	—	80	120	ns
$\phi_{CCD}$ Period	$t_8$	1	2	10	$\mu s$

**TYPICAL PERFORMANCE CURVES**



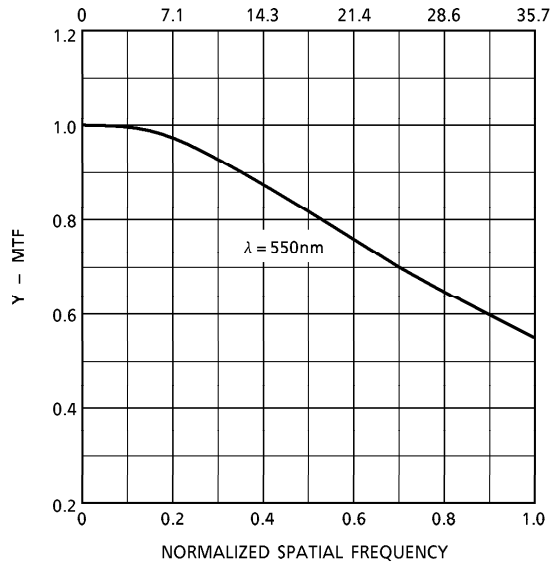
**MODULATION TRANSFER FUNCTION OF X-DIRECTION**

SPATIAL FREQUENCY (Cycles/mm)



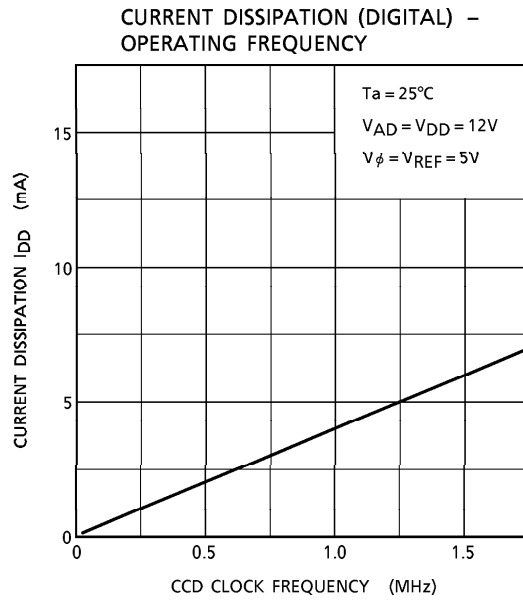
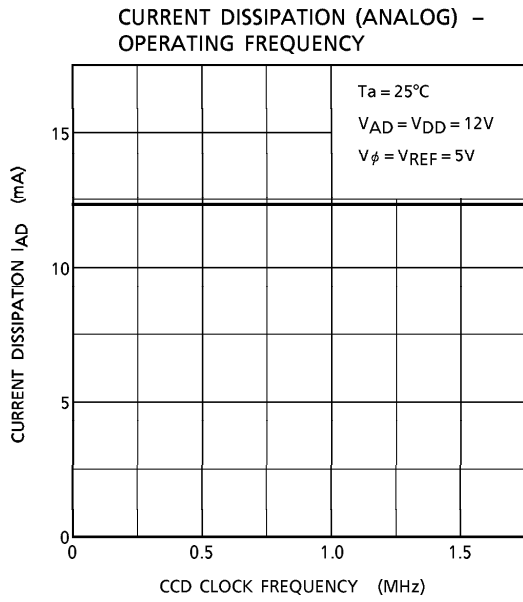
**MODULATION TRANSFER FUNCTION OF Y-DIRECTION**

SPATIAL FREQUENCY (Cycles/mm)

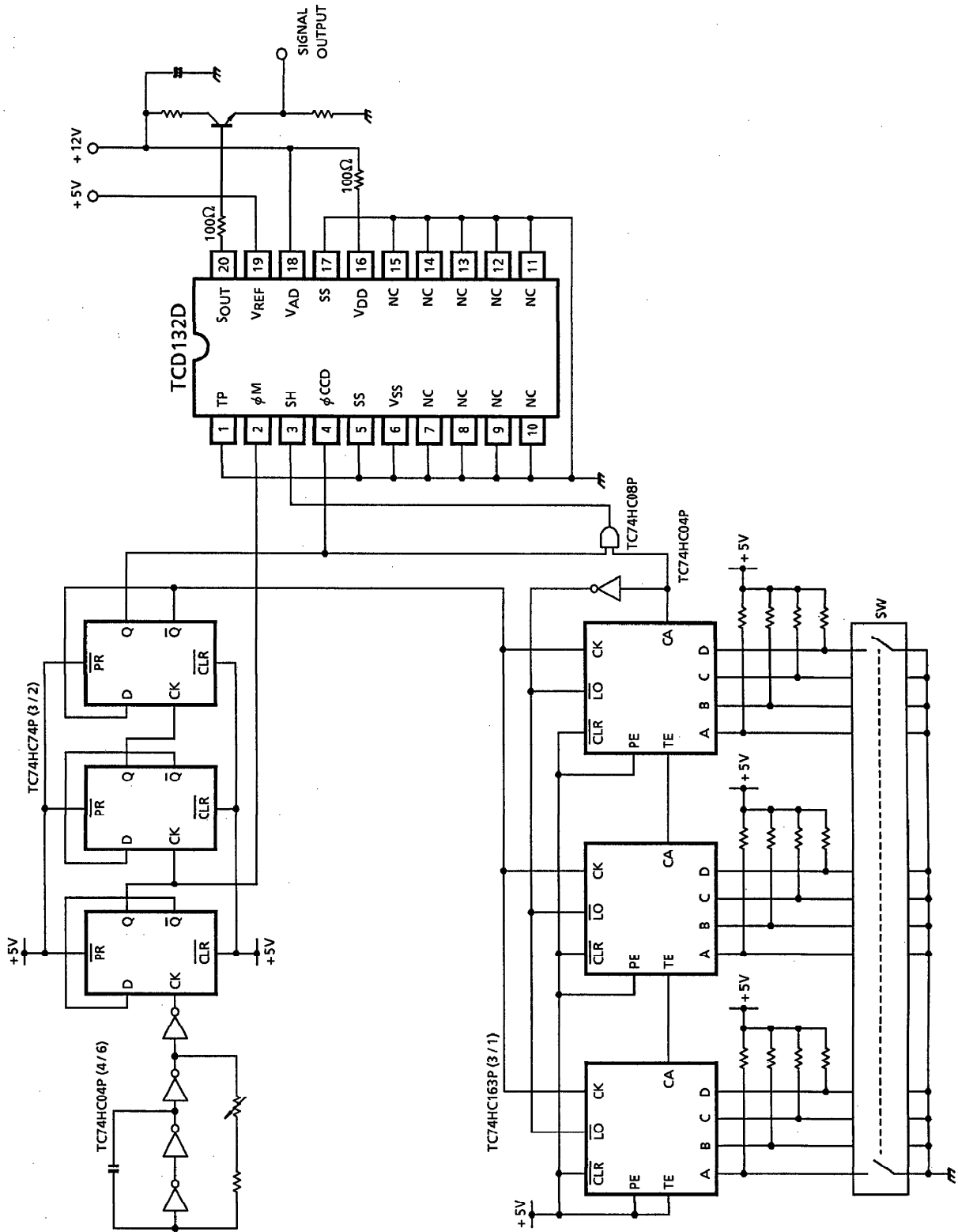




TYPICAL PERFORMANCE CURVES (Cont'd)



EXAMPLE OF OPERATING 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.

**4. Lead Frame Forming**

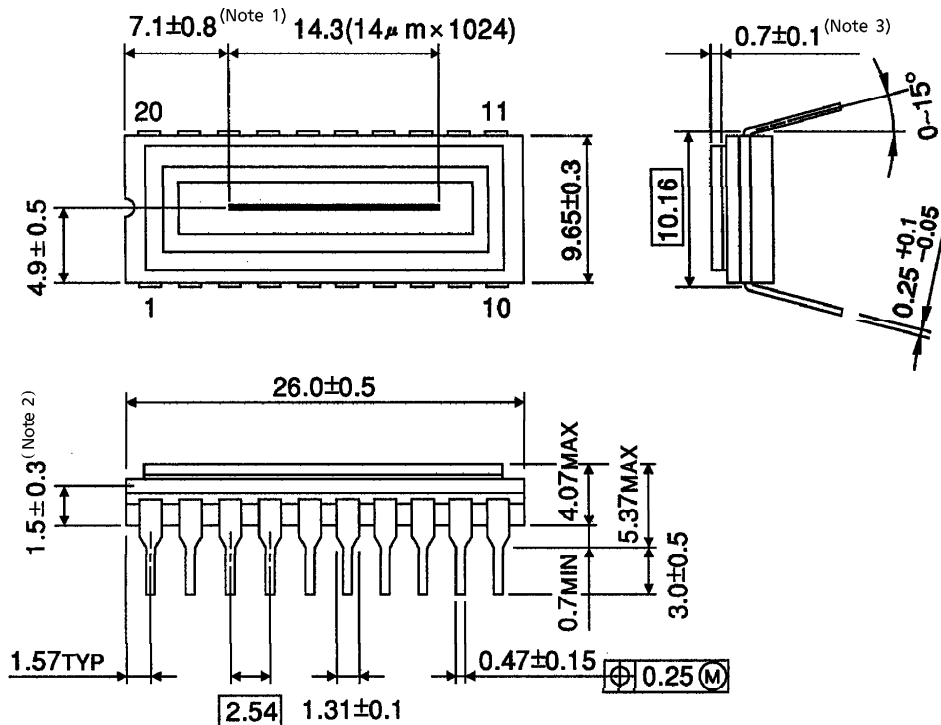
Since this package is not stout against mechanical stress, you should not reform the lead frame.

We recommend to use a IC-inserter when you assemble to PCB.

**OUTLINE DRAWING**

WDIP20-G-400 (B)

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 : 3.1g (Typ.)