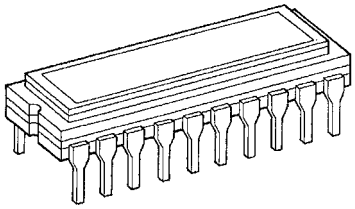
TOSHIBA CCD LINEAR IMAGE SENSOR CCD(Charge Coupled Device)

TCD132DG

The TCD132DG 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 posible to get easy drive by applying simple pulses (φM, φCCD and SH).
The signal processing circuit which consists of the clamp circuit and S / H circuit and pre−amplifier.



WDIP20-G-400-2.54

Weight: (3.1g (Typ.))

FEATURES

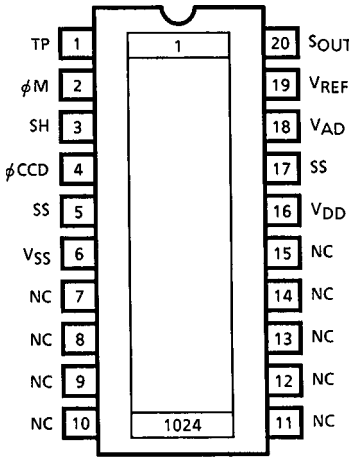
- Number of Image Sensing Elements : 1024
- Image Sensing Element Size : 14μm by 14μm on 14μm centers
- Photo Sensing Region : Low dark current pn photodiode
- Clock : 3 Input pulses 5V
- Internal Circuit : Clamp circuit (for optical black level reference)
  Sample & hold circuit
  Pre−amplifier
- Package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

MAXIMUM RATINGS (Note 1)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Master Clock Voltage	$V_{\varphi M}$	−0.3~15	V
CCD Clock Voltage	$V_{\varphi CCD}$		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 CONNECTION



(TOP VIEW)

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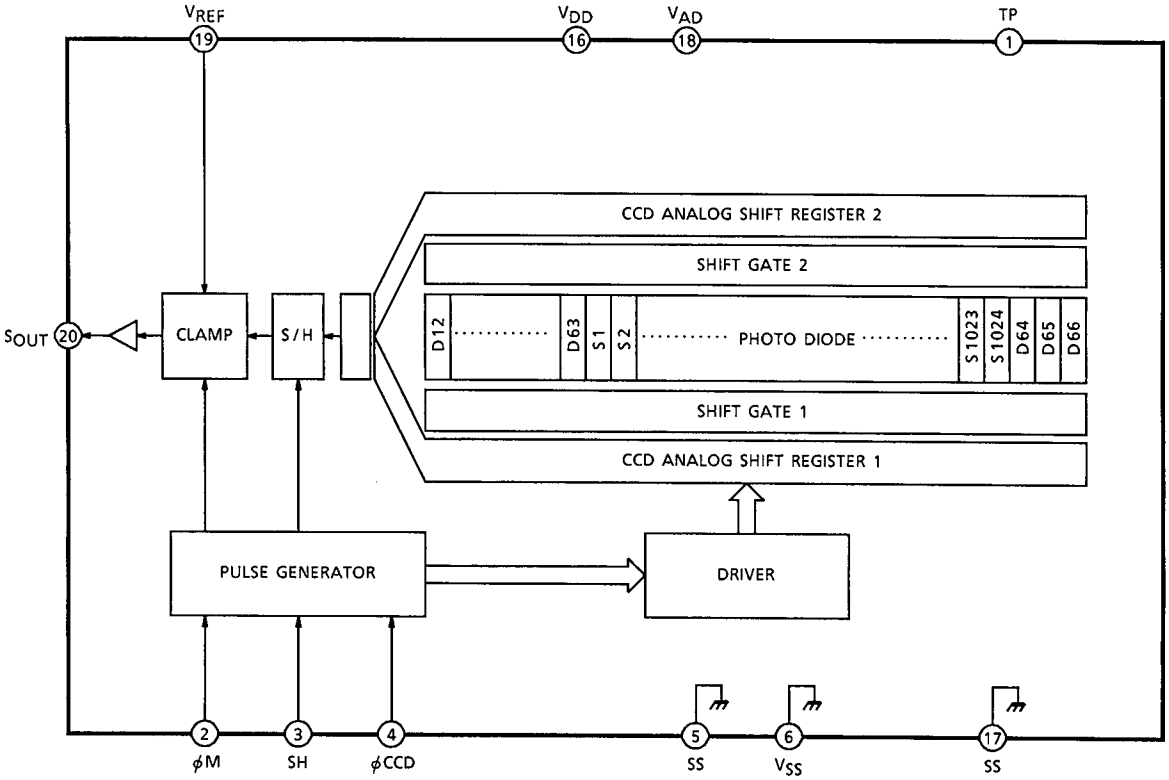
CIRCUIT DIAGRAM



PIN NAMES

φM	Master Clock
φCCD	CCD Clock
SH	Shift Pulse
V_{REF}	Reference Voltage Input
S_{OUT}	Signal Output
V_{AD}	Power (Analog)
V_{DD}	Power (Digital)
SS	Ground (Analog)
V_{SS}	Ground (Digital)
TP	Test Input
NC	Non Connection

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OPTICAL / ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{AD} = V_{DD} = 12V, $V_{\varphi M}$ = $V_{\varphi CCD}$ = V_{SH} = 5V (PULSE), V_{REF} = 5.0V, $f_{\varphi CCD}$ = 0.5MHz, t_{INT} (INTEGRATION TIME) = 10ms, LIGHT SOURCE = DAYLGIHT 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_{SAT}	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_{AD}	—	12	20	mA	
Digital Current Dissipation	I_{DD}	—	4	10	mA	
Input Current of V_{REF}	I_{REF}	—	0.1	1	mA	
Total Transfer Efficiency	TTE	92	—	—	%	
Output Impedance	Z_O	—	1	2	kΩ	
Clamp Error Voltage	V_{ERR}	—	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.)

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

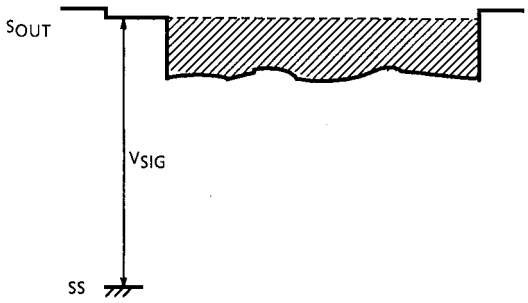
Where $\bar{X}$ is average of total signal outputs and ΔX is the maximum deviation from $\bar{X}$ under uniform illumination.

Note 4: V_{SAT} is defined as minimum saturation output voltage of all effective pixels.

Note 5: Definition of SE : SE = $\frac{V_{SAT}}{R}$ (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..



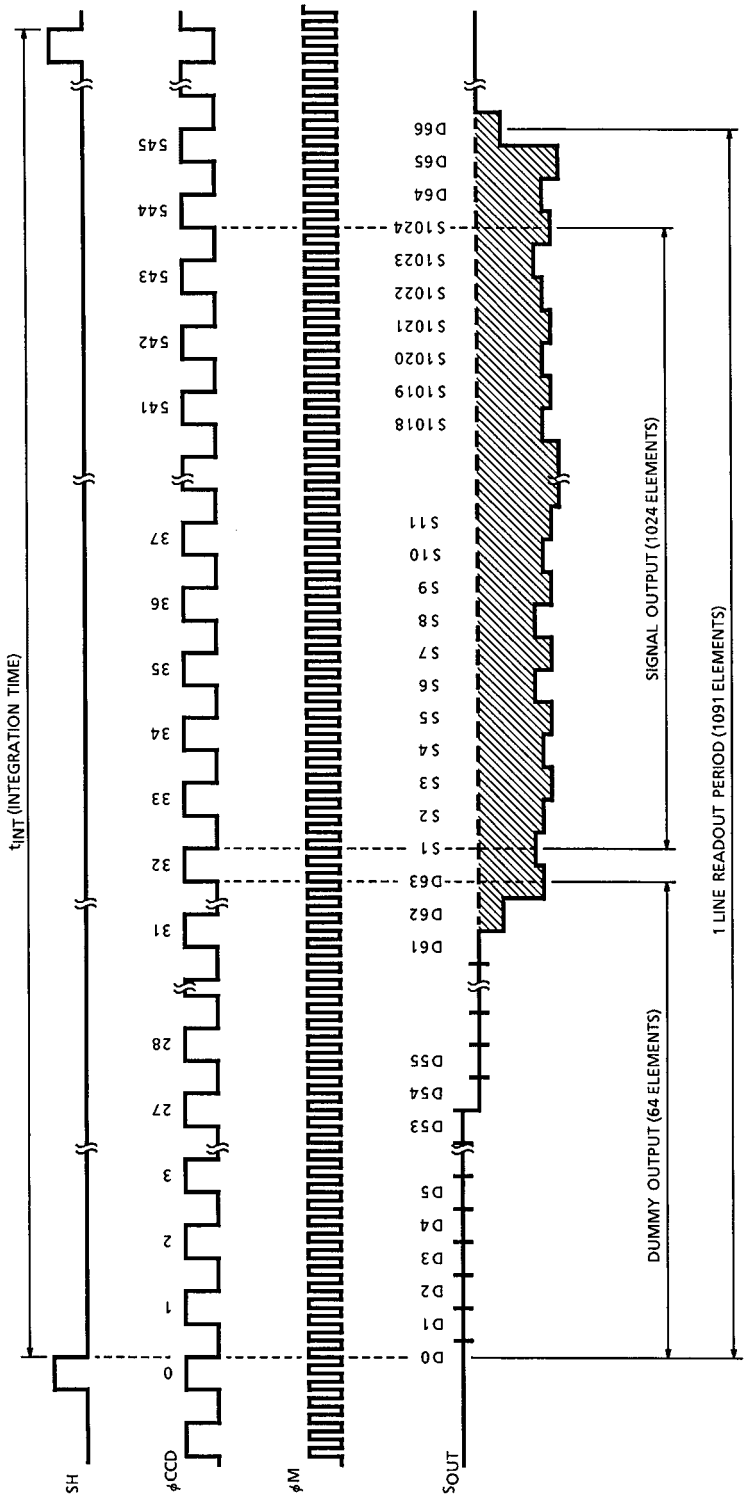
OPERATING CONDITION

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

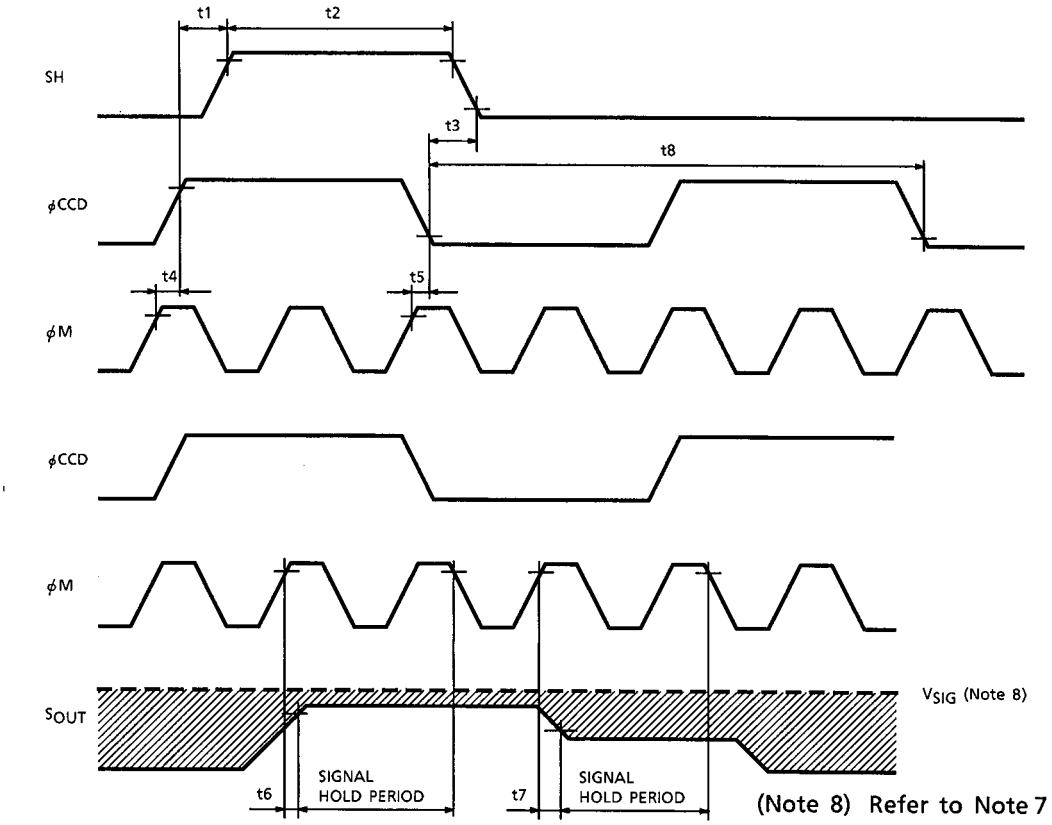
CLOCK CHARACTERISTICS (Ta = 25°C)

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



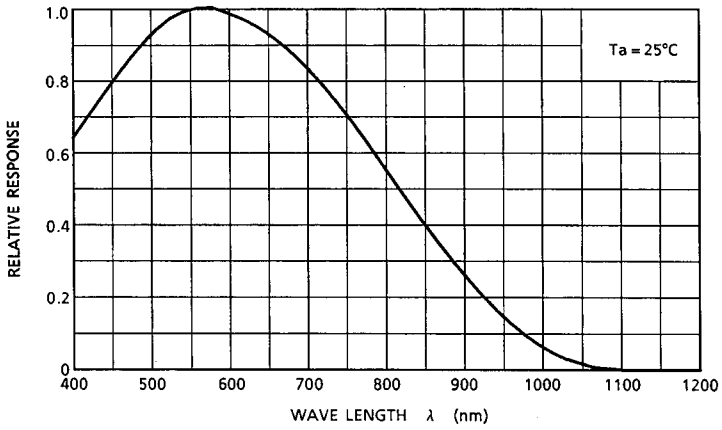
TIMING REQUIREMENTS



CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX	UNIT
Pulse Timing of SH and φ_{CCD}	t1, t3	0	20	60	ns
SH Pulse Width	t2	250	—	t8 / 2	ns
Pulse Timing of φ_M and φ_{CCD}	t4, t5	0	20	60	ns
Aperture Delay	t6, t7	—	80	120	ns
φ_{CCD} Period	t8	1	2	10	μs

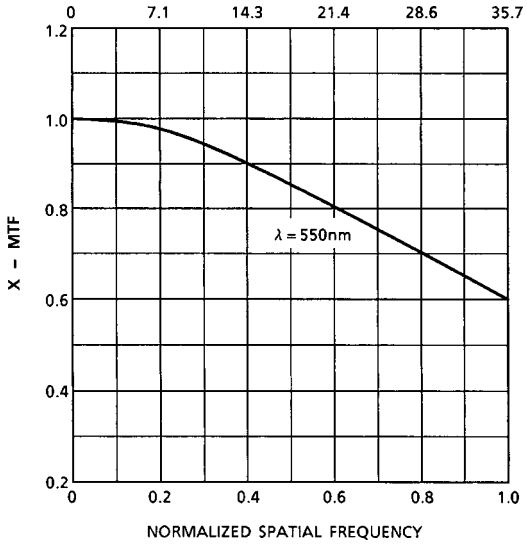
TYPICAL PERFOMANCE CURVES

SPECTRAL RESPONSE



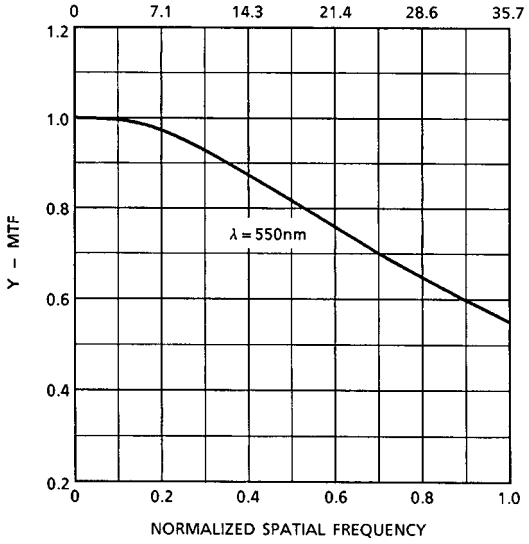
MODULATION TRANSFER FUNCTION OF X-DIRECTION

SPATIAL FREQUENCY (Cycles / mm)



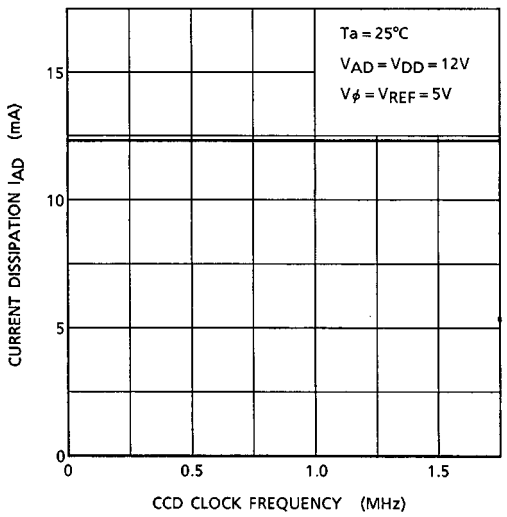
MODULATION TRANSFER FUNCTION OF Y-DIRECTION

SPATIAL FREQUENCY (Cycles / mm)

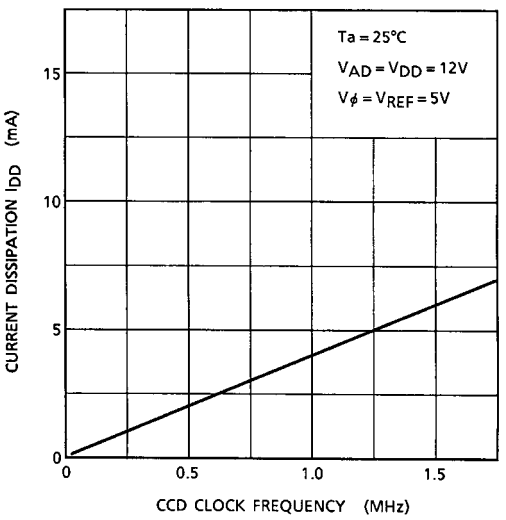


TYPICAL PERFOMANCE CURVES (Con't)

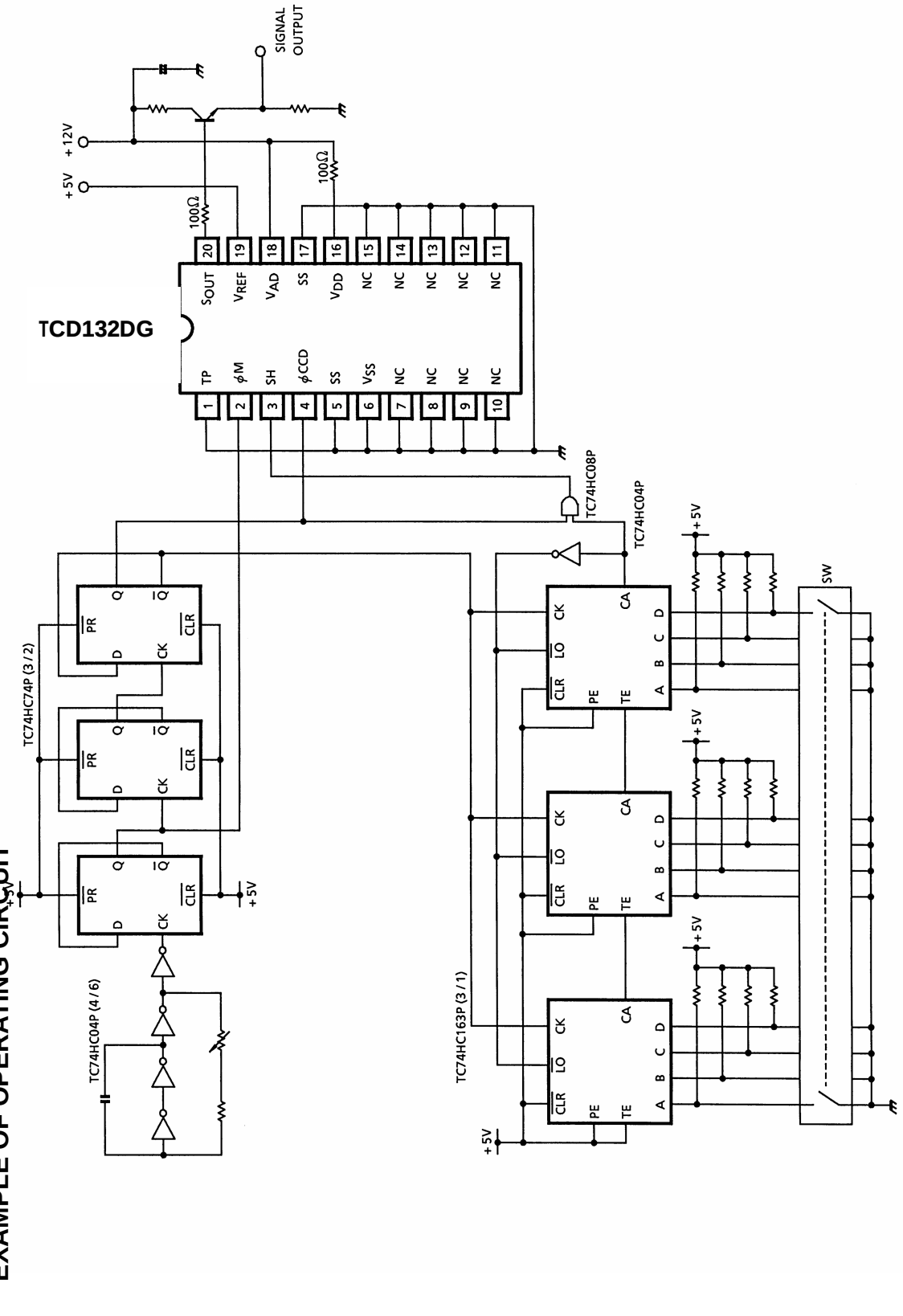
CURRENT DISSIPATION (ANALOG) – OPERATING FREQUENCY



CURRENT DISSIPATION (DIGITAL) – OPERATING FREQUENCY



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 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.

CCD Image Sensor is protected against static electricity, but interior puncture mode device due to static electricity is sometimes detected. In handing the device, it is necessary to execute the following static electricity preventive measures, in order to prevent the trouble rate increase of the manufacturing system due to static electricity.

a. Prevent the generation of static electricity due to friction by making the work with bare hands or by putting on cotton gloves and non-charging working clothes.
b. Discharge the static electricity by providing earth plate or earth wire on the floor, door or stand of the work room.
c. Ground the tools such as soldering iron, radio cutting pliers of or pincer.

It is not necessarily required to execute all precaution items for static electricity.

It is all right to mitigate the precautions by confirming that the trouble rate within the prescribed range.

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 strong against mechanical stress, you should not reform the lead frame.

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

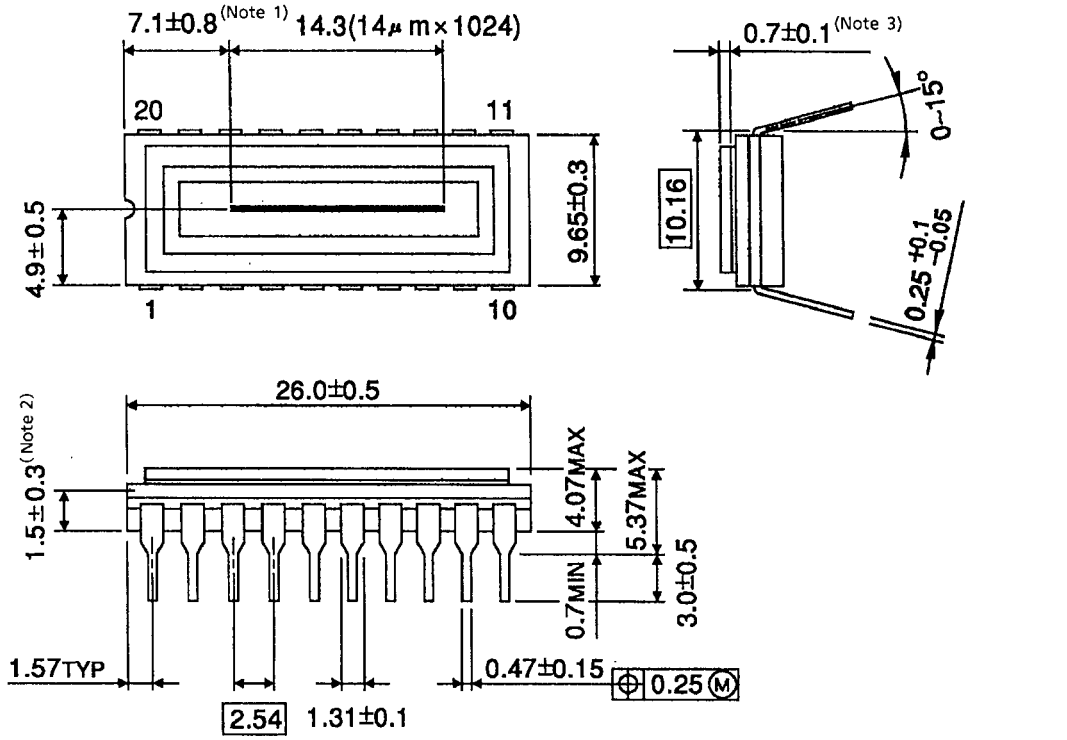
5. Soldering

Soldering by the solder flow method cannot be guaranteed because this method may have deleterious effects on prevention of window glass soiling and heat resistance.

Using a soldering iron, complete soldering within ten seconds for lead temperatures of up to 260°C, or within three seconds for lead temperatures of up to 350°C.

PACKAGE DIMENSIONS

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.))

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