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.



Number of Image Sensing Elements: 7500 elements

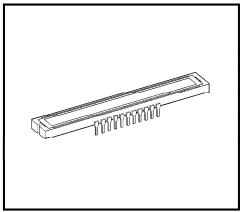
Image Sensing Element Size

: $7\mu \text{m}$ by $7\mu \text{m}$ on $7\mu \text{m}$ centers

Photo Sensing Region : High sensitive and low voltage

dark signal pn photodiode

Clock : 2 phase (5V)Package : 22pin DIP



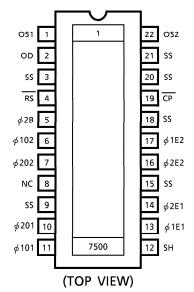
Weight: 6.6g (Typ.)

MAXIMUM RATINGS (Note 1)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Clock Pulse Voltage	Vφ		V
Shift Pulse Voltage	V _{SH}	-0.3~8	
Reset Pulse Voltage	VRS	0.5 0	
Clamp Pulse Voltage	VCP		
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).

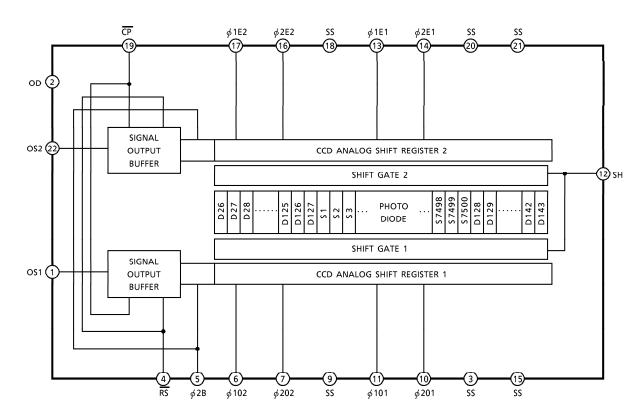
PIN CONNECTIONS



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CIRCUIT DIAGRAM



PIN NAME

φ1E, O	Clock (Phase 1)
φ2E, O	Clock (Phase 2)
φ 2 Β	Final Stage Clock (Phase 2)
SH	Shift Gate
RS	Reset Gate
<u>CP</u>	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_{OD} = 12V, V_{ϕ} = V_{SH} = $V_{\overline{RS}}$ = $V_{\overline{CP}}$ = 5V, f_{ϕ} = 1MHz, t_{INT} (INTEGRATION TIME) = 10ms, LIGHT SOURCE = DAYLIGHT FLUORESCENT LAMP LOAD RESISTANCE = 100k Ω)

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	<u> </u>	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	PD	_	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	VOS1-VOS2	_	_	300	mV	

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

Definition of PRNU : PRNU = $-\frac{\Delta \chi}{\overline{\chi}}$ × 100 (%)

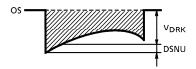
Where $\overline{\chi}$ is average of total signal outputs and $\Delta\chi$ is maximum deviation from $\overline{\chi}$ under uniform illumination. (Channel 1)

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.

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

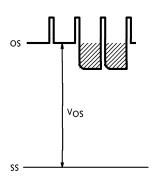
(Note 5) V_{DRK} is defined as average dark signal voltage of all effective pixels. DSNU is defined as different voltage between V_{DRK} and V_{MDK} when V_{MDK} is maximum dark signal voltage.



(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.

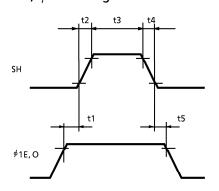
(Note 7) DC signal output voltage and DC compensation output voltage are defined as follows:



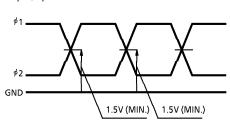
(Note 8) PRNU (3) is defined as maximum voltage with next pixel, where measured 5% of SE (Typ.)

TIMING REQUIREMENTS

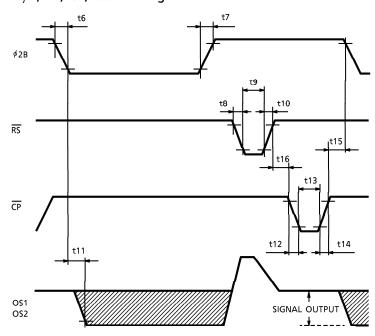
SH, $\phi 1$ Timing



 ϕ 1, ϕ 2 Cross Point



 ϕ 2, \overline{RS} , \overline{CP} , OS Timing



CHARACTERISTIC	SYMBOL	MIN.	TYP. (Note 9)	MAX.	UNIT
Pulse Timing of SH and ϕ 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
φ2 Pulse Rise Time, Fall Time	t6, t7	0	100	_	ns
RS Pulse Rise Time, Fall Time	t8, t10	0	20	_	ns
RS Pulse Width	t9	20	250	_	ns
Video Data Delay Time (Note 10)	t11	_	20	_	ns
CP Pulse Rise Time, Fall Time	t12, t14	0	20	_	ns
CP Pulse Width	t13	20	_	_	ns
Pulse Timing of ϕ 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 fRS = 1.0MHz (Note 10) Load Resistance is 100k Ω

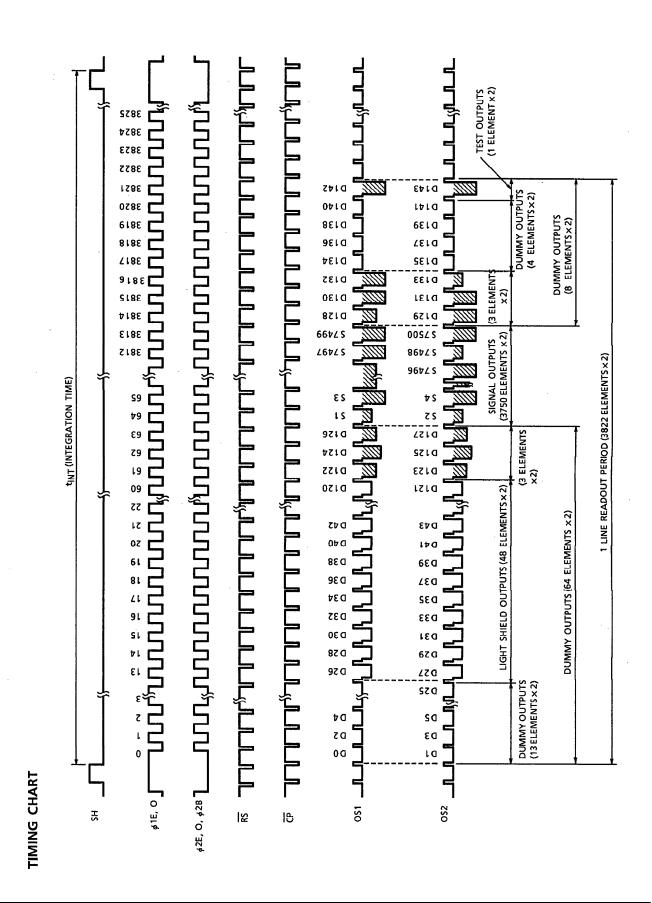
OPERATING CONDITION

CHARACTERISTIC		SYMBOL	MIN.	TYP.	MAX.	UNIT	
Clask Pulsa Valtaga	"H" Level	V¢1E, O	4.5	5	5.5	V	
Clock Pulse Voltage	"L" Level	Vφ2E, Ο	0	_	0.5	V	
Final Stage Clark Valtage	"H" Level	V//2B	4.5	5	5.5	V	
Final Stage Clock Voltage	"L" Level	V∳2B	0	_	0.5		
Shift Pulse Voltage	"H" Level	(Note)	V ∕ E, 0"H" − 0.5	V ø E, 0"H"	V ø E, 0"H"	V	
	"L" Level	VsH	0	_	0.5	V	
Poset Bulse Voltage	"H" Level	\/ = =	4.5	5	5.5	V	
Reset Pulse Voltage	"L" Level	VRS	0	_	0.5		
Clamp Pulse Voltage	"H" Level	\/==	4.5	5	5.5	V	
	"L" Level	VCP	0	_	0.5	V	
Power Supply Voltage		V _{OD}	11.4	12	13	V	

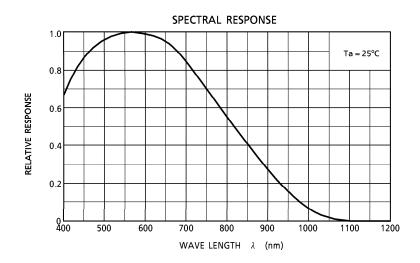
(Note) $V_{\phi}E$, 0"H" means the value of high level voltage at $V_{\phi}E$, 0, when SH pulse is high level.

CLOCK CHARACTERISTICS (Ta = 25°C)

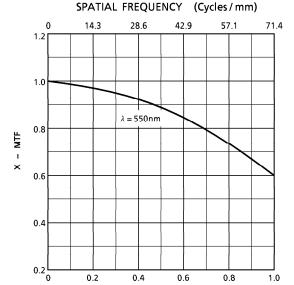
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock Pulse Frequency	fø	_	1	10	MHz
Reset Pulse Frequency	fRS	_	1	10	MHz
Clark Consistence	C∳E	_	350	450	pF
Clock Capacitance	C∮O		350	450	pF
Final Stage Clock Capacitance	C∮B	_	10	20	pF
Shift Gate Capacitance	C _{SH}		350	450	рF
Reset Gate Capacitance	CRS	_	10	20	рF
Clamp Gate Capacitance	CCP	_	10	20	pF



TYPICAL PERFORMANCE CURVES

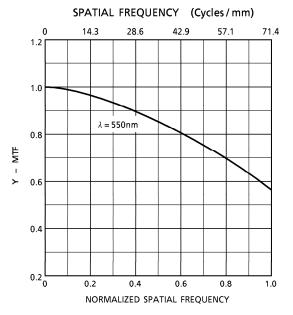


MODULATION TRANSFER FUNCTION OF X-DIRECTION

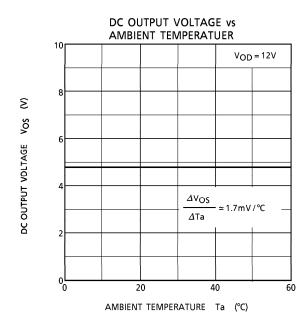


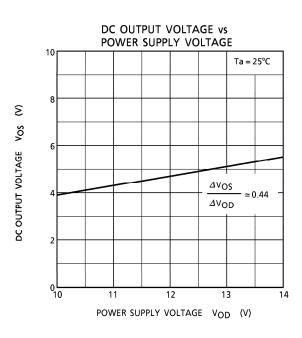
NORMALIZED SPATIAL FREQUENCY

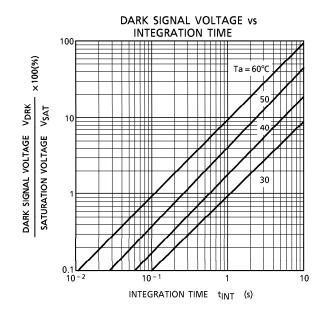
MODULATION TRANSFER FUNCTION OF Y-DIRECTION



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.

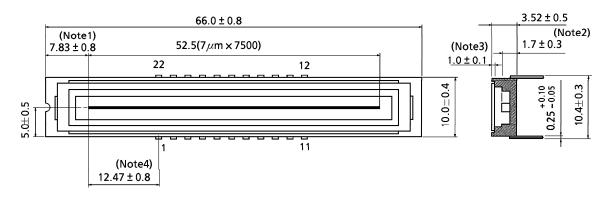
3. Incident Light

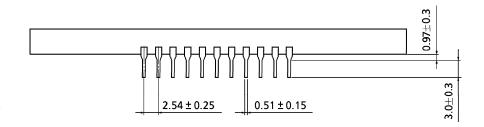
CCD sensor is sensitive to infrared light.

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

OUTLINE DRAWING

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: 6.6g (Typ.)