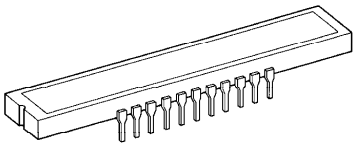
TENTATIVE TOSHIBA CCD LINEAR IMAGE SENSOR CCD(Charge Coupled Device)

TCD141ARC

The TCD141ARC is a high sensitive and low dark current 5000-elements linear image sensor.
The sensor can be used for facsimile, imagescanner and OCR.
The device is contains a row of 5000 photodiodes, which provide a 16 lines / mm (400 DPI) across a A3 size paper.



WDIP22-C-400-2.54B

Weight : 5.4g (Typ.)

FEATURES

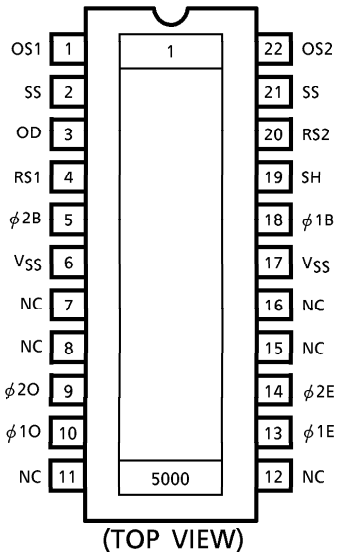
- Number of Image Sensing Elements : 5000
- Image Sensing Element Size : 7μm by 7μm on 7μm centers
- Photo Sensing Region : High sensitive and low dark current pn photodiode
- Clock : 2 phase (12V)
- Package : 22 pin DIP
- Window Glass : Antireflected coating

MAXIMUM RATINGS (Note 1)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Clock Pulse Voltage	V_ϕ	−0.3~15	V
Shift Pulse Voltage	V_{SH}		V
Reset Pulse Voltage	V_{RS}		V
Power Supply Voltage	V_{OD}		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).

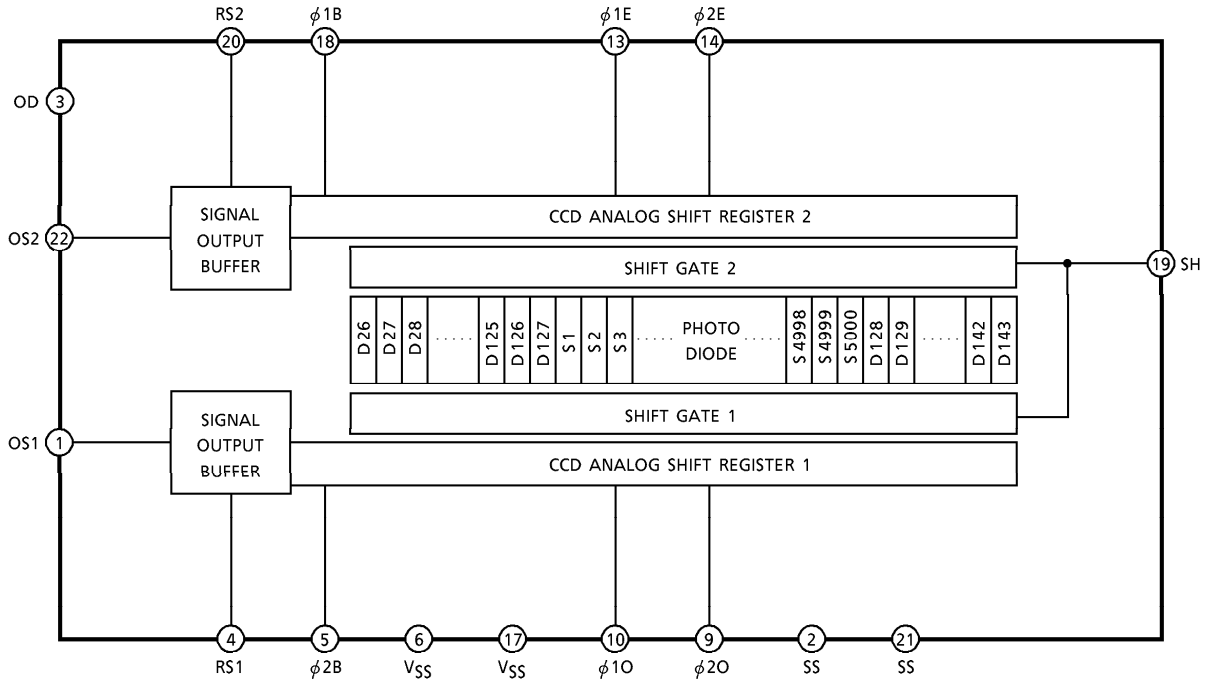
PIN CONNECTIONS



(TOP VIEW)

961001EBA2

CIRCUIT DIAGRAM



PIN NAMES

φ1E, O	Clock (Phase 1)
φ2E, O	Clock (Phase 2)
φ1B	Final Stage Clock (Phase 1)
φ2B	Final Stage Clock (Phase 2)
SH	Shift Gate
RS	Reset Gate
OS1	Signal Output 1
OS2	Signal Output 2
OD	Power
SS	Ground (Analog)
V_{SS}	Ground (Digital)
NC	Non Connection

OPTICAL / ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V_{OD} = 12V, $V_\phi = V_{RS} = V_{SH}$ = 12V (PULSE), f_ϕ = 1.0MHz, t_{INT} (INTEGRATION TIME) = 10ms, LIGHT SOURCE = DAYLGIHT FLUORESCENT LAMP, LOAD RESISTANCE = 100kΩ)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Sensitivity	R	2.0	2.5	3.0	V / lx·s	(Note 2)
Photo Response Non Uniformity	PRNU (1)	—	—	10	%	(Note 3)
	PRNU (3)	—	—	10	mV	(Note 4)
Saturation Output Voltage	V_{SAT}	1.0	1.5	—	V	(Note 5)
Saturation Exposure	SE	0.33	0.6	—	lx·s	(Note 6)
Dark Signal Voltage	V_{DRK}	—	—	5	mV	(Note 7)
Dark Signal Non Uniformity	DSNU	—	—	5	mV	(Note 7)
DC Power Dissipation	P_D	—	100	325	mW	
Total Transfer Efficiency	TTE	92	95	—	%	
Output Impedance	Z_O	—	0.5	1.0	kΩ	
Dynamic Range	DR	—	300	—		(Note 8)
DC Signal Output Voltage	V_{OS1}	3.0	4.0	5.5	V	(Note 9)
	V_{OS2}	3.0	4.0	5.5	V	(Note 9)
DC Mismatch Voltage	$\lvert V_{OS1}-V_{OS2}\rvert$	—	—	300	mV	

(Note 2) Sensitivity for 2856K W-lamp is 7.5V / lx·s (Typ.)

(Note 3) Measured at 50% of SE (Typ.)

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

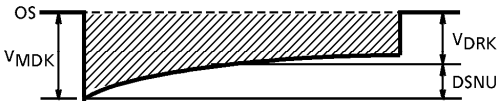
Where $\overline{\chi}$ is average of total signal outputs and $\Delta\chi$ is the maximum deviation from $\overline{\chi}$ under uniform illumination. (Channel 1)
In the case of 2500 elements (Channel 2), the condition is the same as above too.

(Note 4) PRNU (3) is defined as maximum voltage with next pixel.
Where measured 5% of SE (Typ.)

(Note 5) V_{SAT} is defined as minimum saturation output voltage of all effective pixels.

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

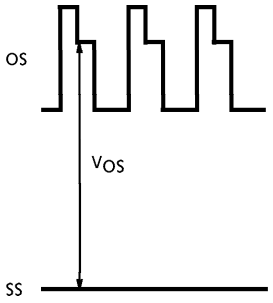
(Note 7) V_{DRK} is defined as average dark signal voltage of all effective pixels.
DSNU is defined as different voltage between V_{DRK} and V_{MDK} when V_{MDK} is maximum dark signal voltage.



(Note 8) 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 value.

(Note 9) DC signal output voltage (Channel 1, 2).



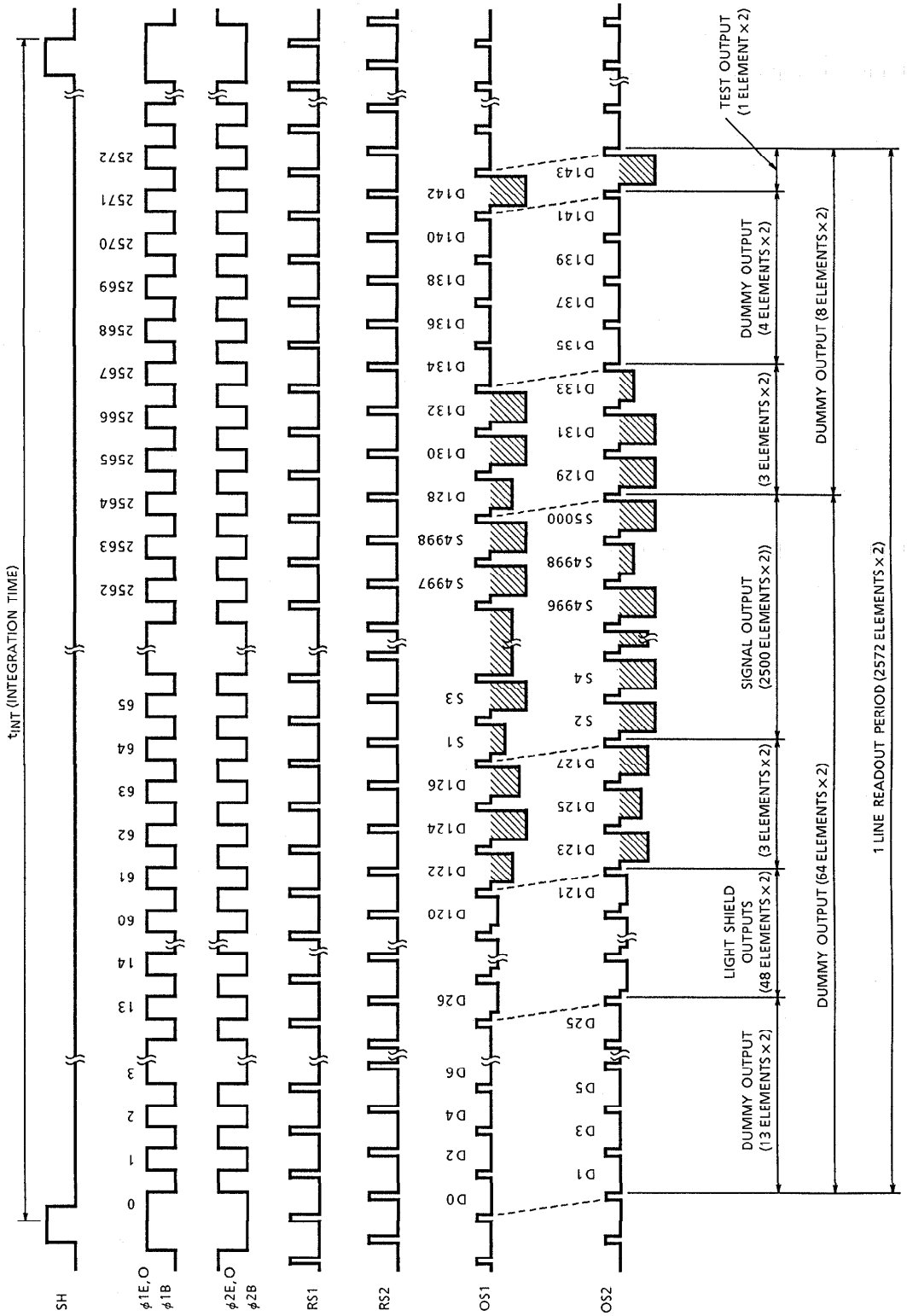
OPERATING CONDITION

CHARACTERISTIC		SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock Pulse Voltage	"H" Level	$V_{\phi 1E, O}$	$V_{OD}-1$	V_{OD}	V_{OD}	V
	"L" Level	$V_{\phi 2E, O}$	0	0.5	0.8	
Final Stage Clock Pulse Voltage	"H" Level	$V_{\phi 1B}$	$V_{OD}-1$	V_{OD}	V_{OD}	V
	"L" Level	$V_{\phi 2B}$	0	0.5	0.8	
Shift Pulse Voltage	"H" Level	V_{SH}	$V_{OD}-1$	V_{OD}	V_{OD}	V
	"L" Level		0	0.5	0.8	
Reset Pulse Voltage	"H" Level	V_{RS1}	$V_{OD}-1$	V_{OD}	V_{OD}	V
	"L" Level	V_{RS2}	0	0.5	0.8	
Power Supply Voltage		V_{OD}	11.4	12	13	V

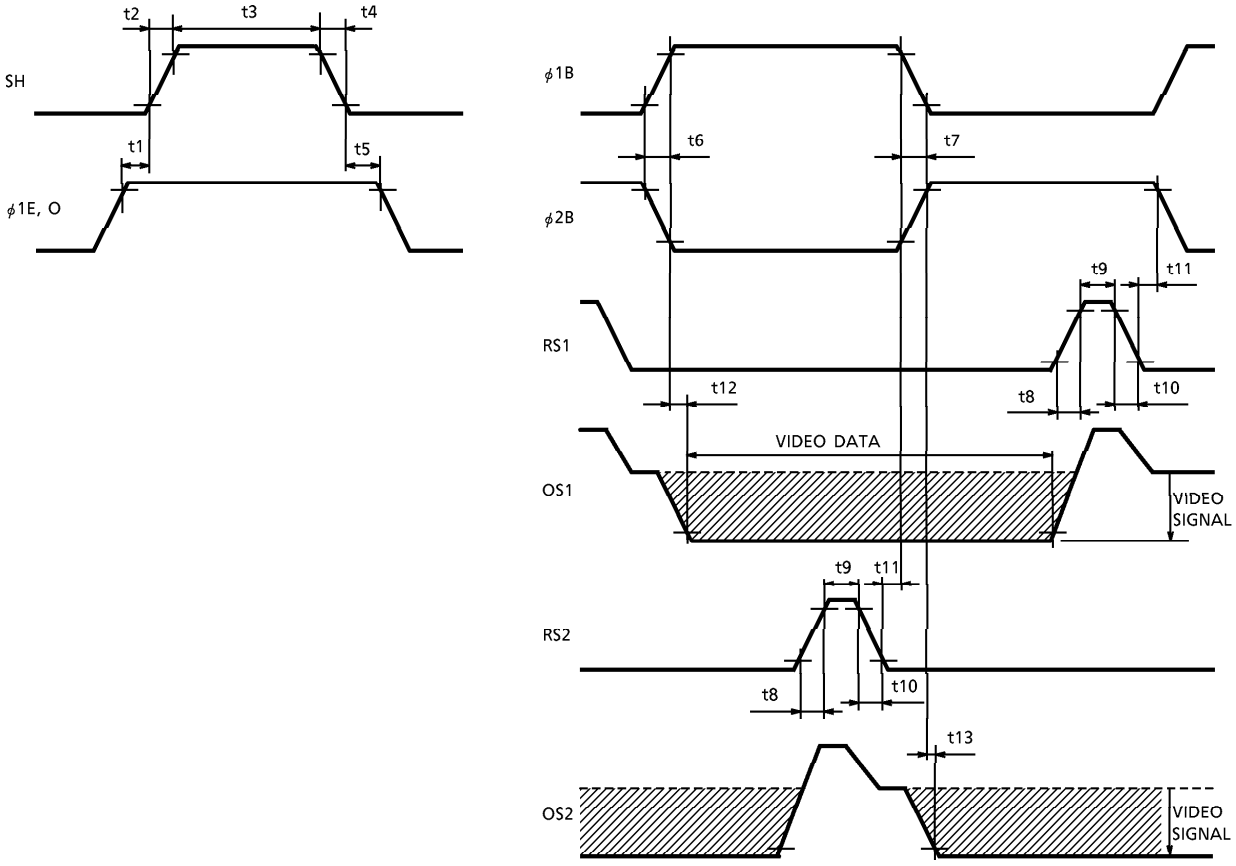
CLOCK CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Clock Pulse Frequency	f_{ϕ}	—	1	10	MHz
Reset Pulse Frequency	f_{RS}	—	1	10	MHz
Clock Capacitance	$C_{\phi E, O}$	—	450	550	pF
Final Stage Clock Capacitance	$C_{\phi B}$	—	10	20	pF
Shift Gate Capacitance	C_{SH}	—	250	350	pF
Reset Gate Capacitance	C_{RS}	—	10	20	pF

TIMING CHART



TIMING REQUIREMENTS

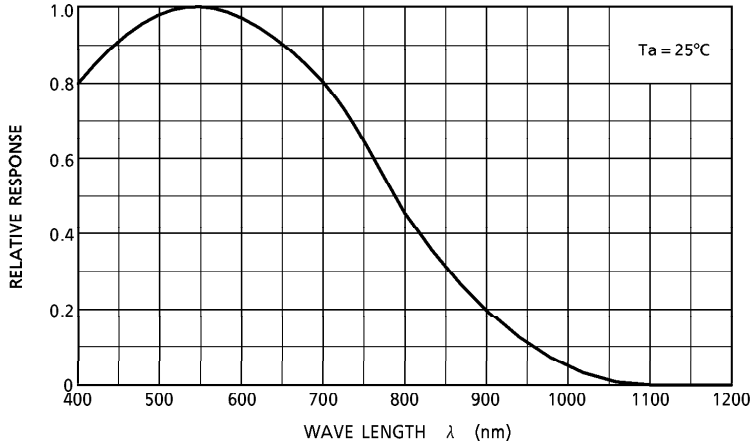


CHARACTERISTIC	SYMBOL	MIN.	TYP. (Note 10)	MAX.	UNIT
Pulse Timing of SH and ϕ1E, O	t1, t5	0	100	—	ns
SH Pulse Rise Time, Fall Time	t2, t4	0	50	—	ns
SH Pulse Width	t3	300	1000	—	ns
ϕ1B, ϕ2B Pulse Rise Time, Fall Time	t6, t7	0	100	—	ns
RS Pulse Rise Time, Fall Time	t8, t10	0	20	—	ns
RS Pulse Width	t9	20	250	—	ns
Pulse Timing of ϕ1B, ϕ2B, RS	t11	0	250	—	ns
Video Data Delay Timing (Note 11)	t12, t13	—	30	—	ns

(Note 10) TYP, is the case of f_{RS} = 1MHz.
(Note 11) Load Resistance is 100kΩ.

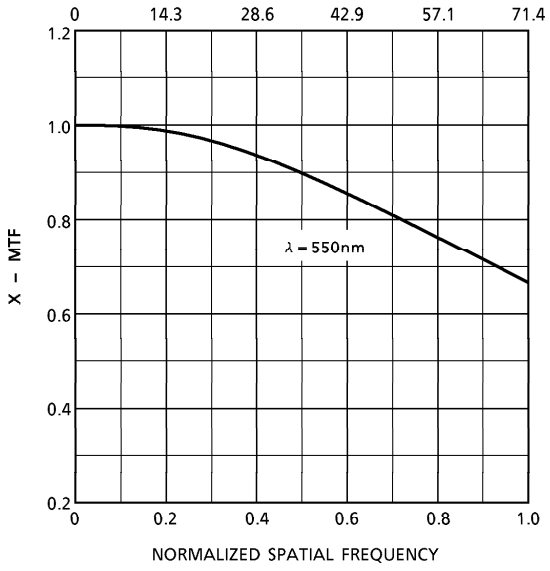
TYPICAL PERFORMANCE CURVES

TYPICAL SPECTRAL RESPONSE



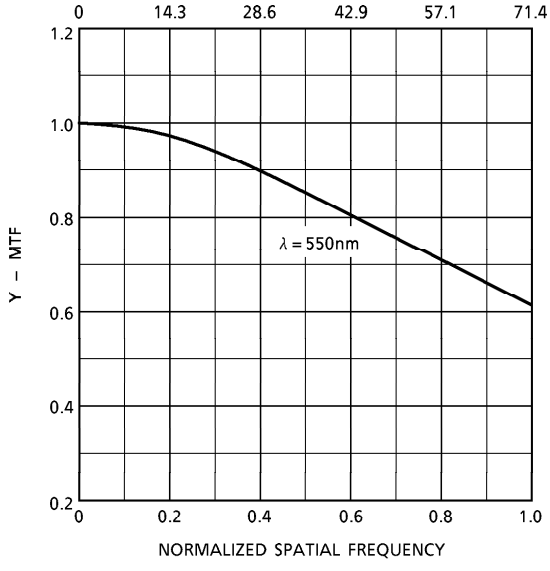
MODULATION TRANSFER FUNCTION
OF X-DIRECTION

SPATIAL FREQUENCY (Cycles / mm)

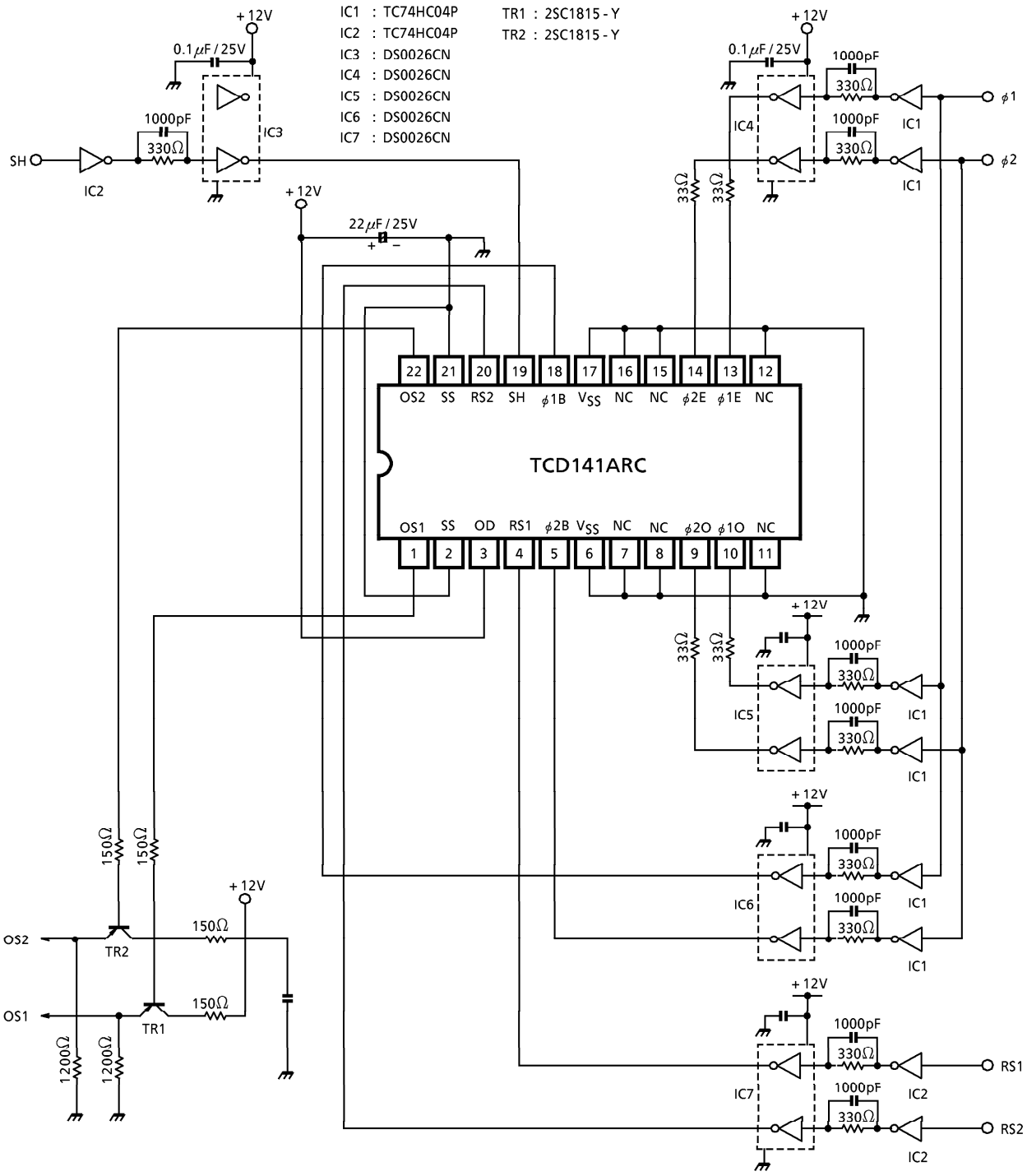


MODULATION TRANSFER FUNCTION
OF Y-DIRECTION

SPATIAL FREQUENCY (Cycles / mm)



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_2.
   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.

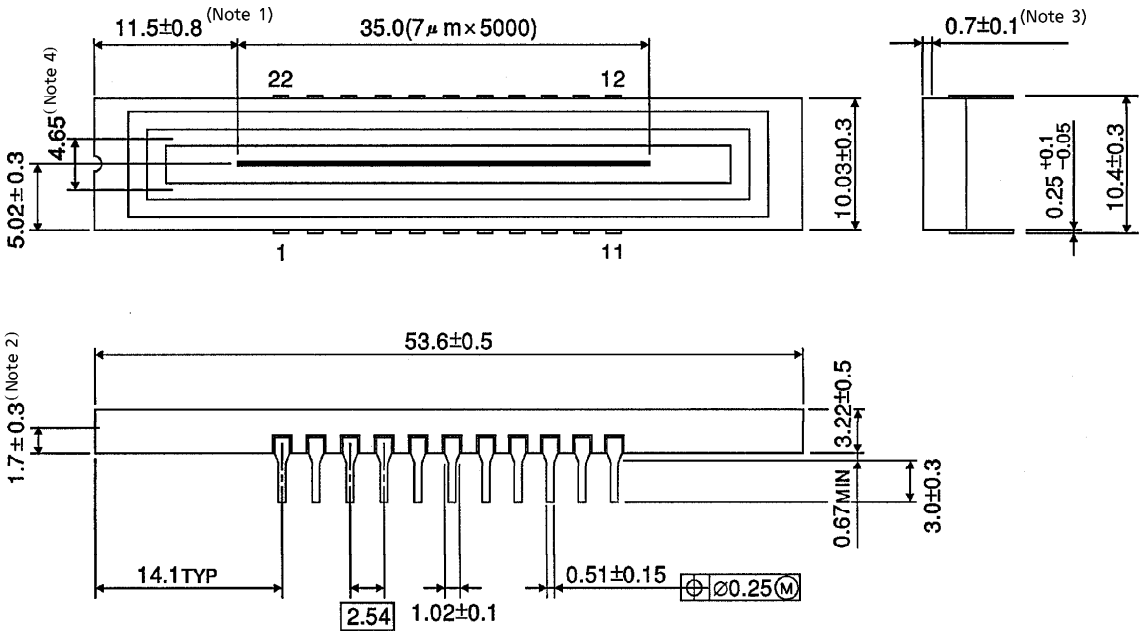
4. Lead Frame Forming

   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.

PACKAGE OUTLINE

WDIP22-C-400-2.54B (B)

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) ANTIREFECTED COATING AREA.

Weight : 5.4g (Typ.)