

9097248 TOSHIBA (LOGIC/MEMORY)

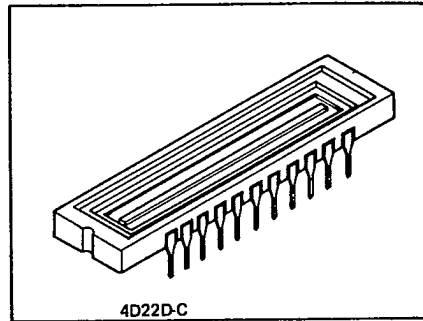
CCD LINEAR IMAGE SENSOR  
 CCD (Charge Coupled Device)

**TCD102C-1**

67C 09521 D T-41-55

The TDS102C-1 is a high resolution and high sensitivity 2048 element linear image sensor.

The sensor is designed for Facsimile readers, optical Character Recognition and other optical applications. The device contains a row of 2048 photodiodes which provide a 8-line/mm resolution across a B4 size paper with well blue response. The TCD102C-1 is capable of high speed operation up to a 10 MHz data rate, and incorporate on-chip sample-and-hold circuitry.



**FEATURES:**

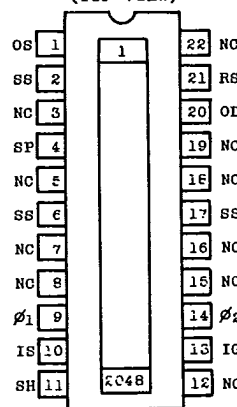
- Number of Image Sensing Elements: 2048
- Image Sensing Element Size: 14µm by 14µm on 14µm centers.
- Photo Sensor Structure: High sensitive P-n photo diode.
- Clock: 2-phase.
- On-chip Circuitry: Sample-and-hold circuitry.
- Dynamic Range: 600(Typ.).
- Package: 22 pin DIP with Hermetic sealed optical glass window.

**MAXIMUM RATINGS**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Clock Pulse Voltage	$V_{\phi}$	-0.3~15	V
Shift Pulse Voltage	$V_{SH}$		
Reset Pulse Voltage	$V_{RS}$		
Sample-and-Hold Pulse Voltage	$V_{SP}$		
Output Transistor Drain Voltage	$V_{OD}$		
Input Gate Voltage	$V_{IG}$		
Input Source Voltage	$V_{IS}$		
Operating Temperature	$T_{opr}$		
Storage Temperature	$T_{stg}$	-40~100	°C

Note: All Voltages are with respect to SS terminal.

**PIN CONNECTIONS  
 (TOP VIEW)**

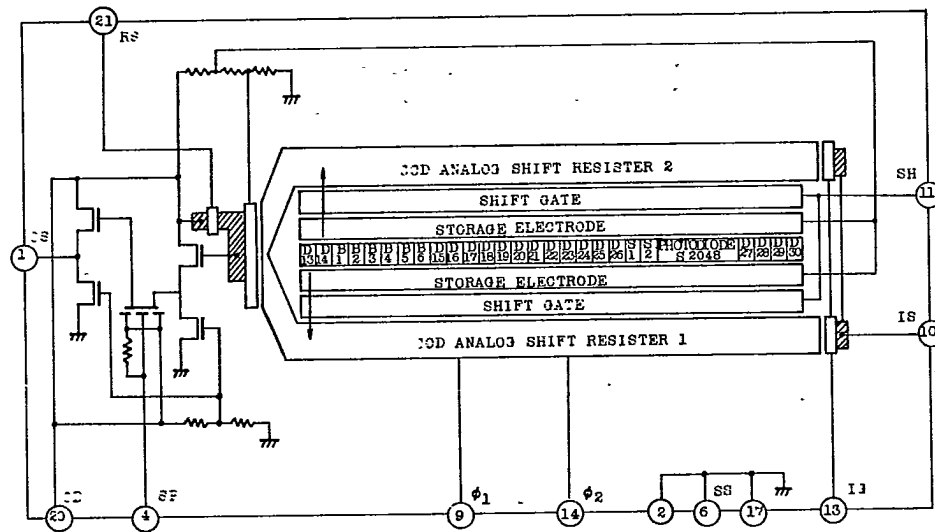


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**TCD102C-1**

CIRCUIT DIAGRAM



## PIN NAMES

φ1	Clock (Phase 1)
φ2	Clock (Phase 2)
SH	Shift Gate
RS	Reset Gate
OS	Output Transistor Source
SP	Sample-and-hold Gate
OD	Output Transistor Drain
SS	Substrate (Ground)
IS	Input Source (Test Point)
IG	Input Gate (Test Point)
NC	Non Connection

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## OPTICAL AND ELECTRICAL CHARACTERISTICS

$T_a=25^\circ\text{C}$ ,  $V_{OD}=V_{IS}=12\text{V}$ ,  $V_{IG}=0\text{V}$ ,  $V_\phi=V_{RS}=V_{SH}=12\text{V}$  (PULSE)

$f_\phi=0.5$ ,  $f_{RS}=1\text{MHz}$ ,  $t_{INT}$  (INTEGRATION TIME)=10 msec,

LIGHT SOURCE=DAYLIGHT FLUORESCENT LAMP

CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Responsivity	R		0.86	1.08	1.30	V/lx·sec
Photo Response Non Uniformity	PRNU	(Note 1)	-	-	+10	%
Saturation Output Voltage	VSAT	VOD=11.4V	0.8	1.0	-	V
Saturation Exposure	SE	VSAT/R	0.62	1.0	-	lx·sec
Dark Signal Voltage	VDRK	VOD=13V	-	1.8	10	mV
DC Power Dissipation	P <sub>D</sub>	VOD=13V	-	30	60	mW
Total Transfer Efficiency	TTE		92	95	-	%
Output Impedance	Z <sub>O</sub>		-	900	2500	Ω
Dynamic Range	DR	V <sub>SAT</sub> /V <sub>DRK</sub>	-	600	-	

Note: (1) Measured at 50% of SE

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

where  $\bar{X}$  is average of total photodiode outputs and  $\Delta X$  is deviation of photodiode output under uniform illumination.

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**TCD102C-1**

OPERATING CONDITION (Ta=25°C)

CHARACTERISTIC		SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARKS
Clock Pulse Voltage	H-LEVEL	$V_{\phi}$	11	12	13	V	
	L-LEVEL		0.0	0.5	0.8	V	
Shift Pulse Voltage	H-LEVEL	$V_{SH}$	11	12	13	V	
	L-LEVEL		0.0	0.5	0.8	V	
Reset Pulse Voltage	H-LEVEL	$V_{RS}$	11	12	13	V	
	L-LEVEL		0.0	0.5	0.8	V	
Sample-and-hold Pulse Voltage	H-LEVEL	$V_{SP}$	11	12	13	V	(1)
	L-LEVEL		0.0	0.5	0.8	V	
Output Transistor Drain Voltage		$V_{OD}$	11.4	12	13	V	
Input Gate Voltage		$V_{IG}$	0	0	1	V	
Input Source Voltage		$V_{IS}$	11	12	13	V	

Note: (1) Supply DC12V to SP terminal when sample-and-hold circuitry is not used.

CLOCK CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARKS
Clock Pulse Frequency	$f_{\phi}$	-	0.5	-	MHz	
Reset Pulse Frequency	$f_{RS}$	-	1	-	MHz	
Clock Input Terminal Capacitance	$C_{\phi}$	-	900	-	pF	
Shift Gate Capacitance	$C_{SH}$	-	250	-	pF	
Reset Gate Capacitance	$C_{RS}$	-	10	-	pF	
Sample-and-hold Gate Capacitance	$C_{SP}$	-	10	-	pF	

Note: Insert load resistor (1k $\Omega$ ) between OS and SS in case that  $f_{RS} \geq 5\text{MHz}$

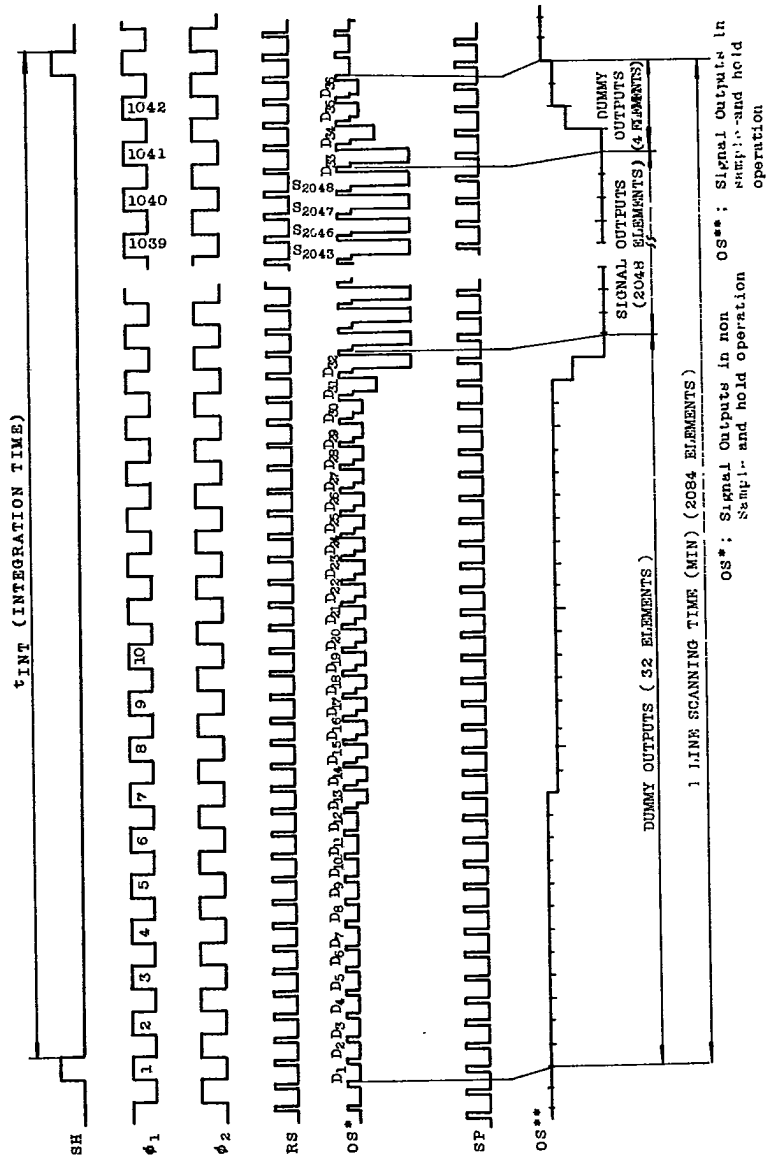
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TIMING CHART



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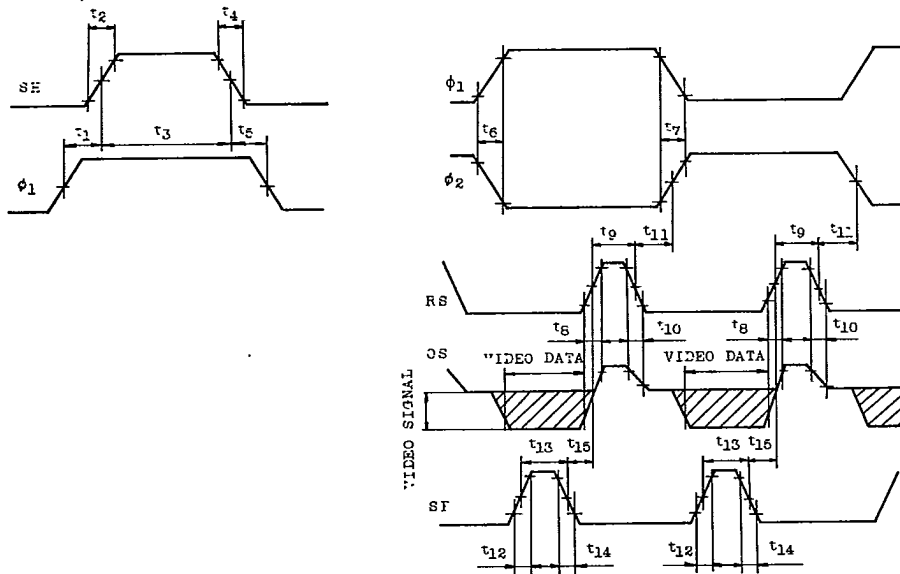
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## TCD102C-1

## TIMING REQUIREMENTS



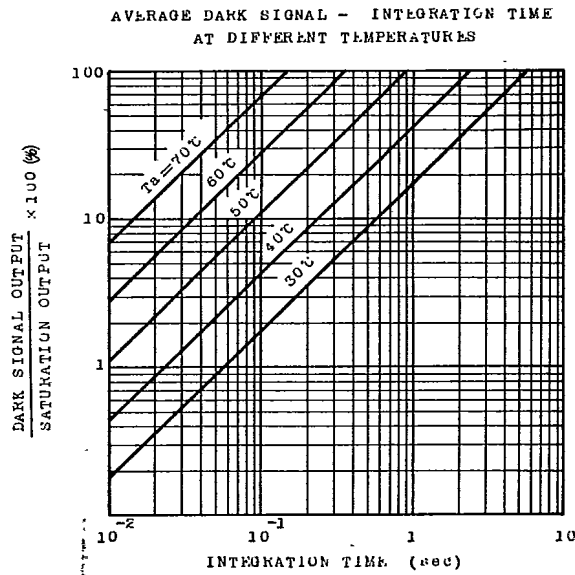
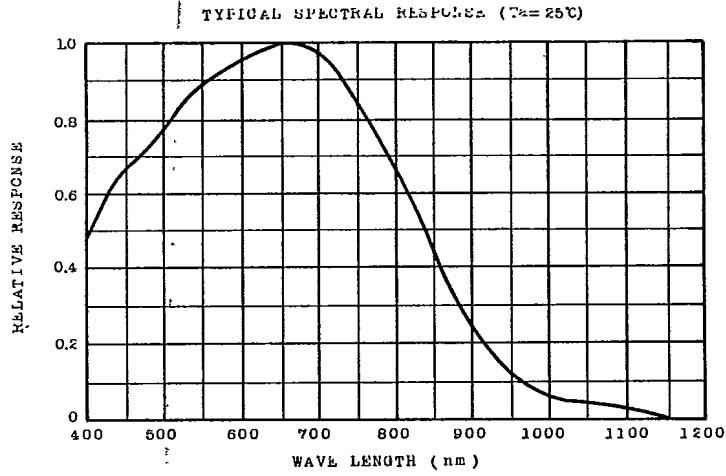
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Pulse Timing of SH and $\phi_1$	$t_1, t_5$	0	100	-	nsec
SH Rise Time, Fall Time	$t_2, t_4$	0	50	-	nsec
SH Pulse Width	$t_3$	60	300	-	nsec
$\phi_1, \phi_2$ Rise Time, Fall Time	$t_6, t_7$	0	100	-	nsec
RS Rise Time, Fall Time	$t_8, t_{10}$	0	20	-	nsec
RS Pulse Width	$t_9$	40	250	-	nsec
Pulse Timing of $\phi_1, \phi_2$ and RS	$t_{11}$	10	250	-	nsec
SP Rise Time, Fall Time	$t_{12}, t_{14}$	10	20	-	nsec
SP Pulse Width	$t_{13}$	60	100	-	nsec
Pulse Timing of SP and RS	$t_{15}$	20	50	-	nsec

Note :  $f_{RS}=1\text{MHz(Typ.)}$

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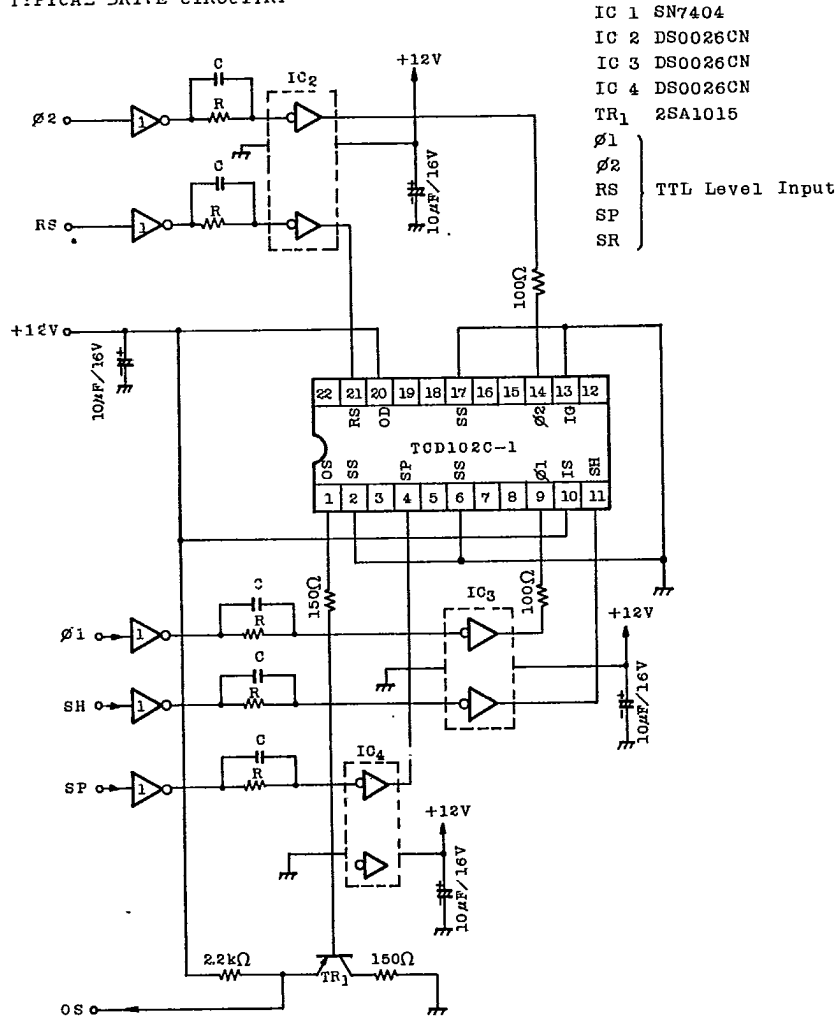


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**TCD102C-1**

TYPICAL DRIVE CIRCUITRY



V<sup>2</sup>



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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> or fleon gas.  
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.

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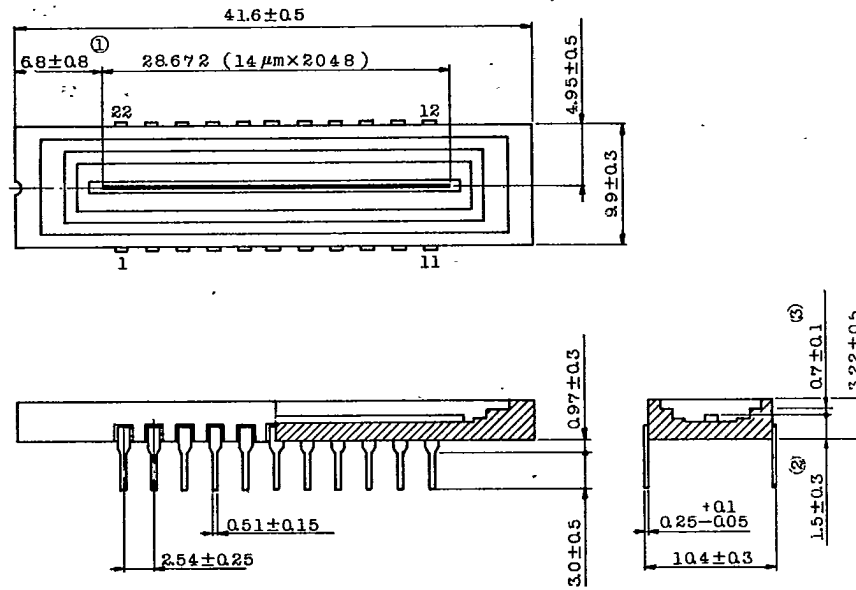
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**TCD102C-1**

PACKAGE OUTLINE (4D22D-C)

Unit in mm



- ① No. 1 SENSOR ELEMENT(S1) TO EDGE OF PACKAGE.
- ② TOP OF CHIP TO BOTTOM OF CERAMIC.
- ③ GALSS THICKNESS (n=1.5)