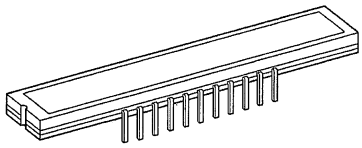
TOSHIBA CCD LINEAR IMAGE SENSOR CCD(Charge Coupled Device)

Preliminary

TCD1201DG

The TCD1201DG is a high sensitive and low dark current 2048−elements linear image sensor. The sensor can be used for POS handscanner.
The device is operated by only 5V power supply, and mounted in 22−pin cerdip package with hermetic sealed optical glass window



WDIP22-G-400-2.54A (A)

Weight: (3.5g (Typ.))

FEATURES

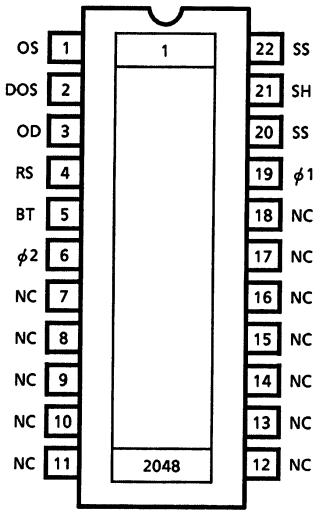
- Number of Image Sensing Elements : 2048
- Image Sensing Element Size : 14μm by 200μm on 14μm centers
- Photo Sensing Region : High sensitive and low dark current pn photodiode
- Clock : 2 phase (5V)
- Package : 22 pin cerdip

MAXIMUM RATINGS (Note 1)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Clock Pulse Voltage	V_{φ}	−0.3~8	V
Shift Pulse Voltage	V_{SH}		V
Reset, Boost Pulse Voltage	V_{RS}, V_{BT}		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 terminals (Ground).

PIN CONNECTION



(TOP VIEW)

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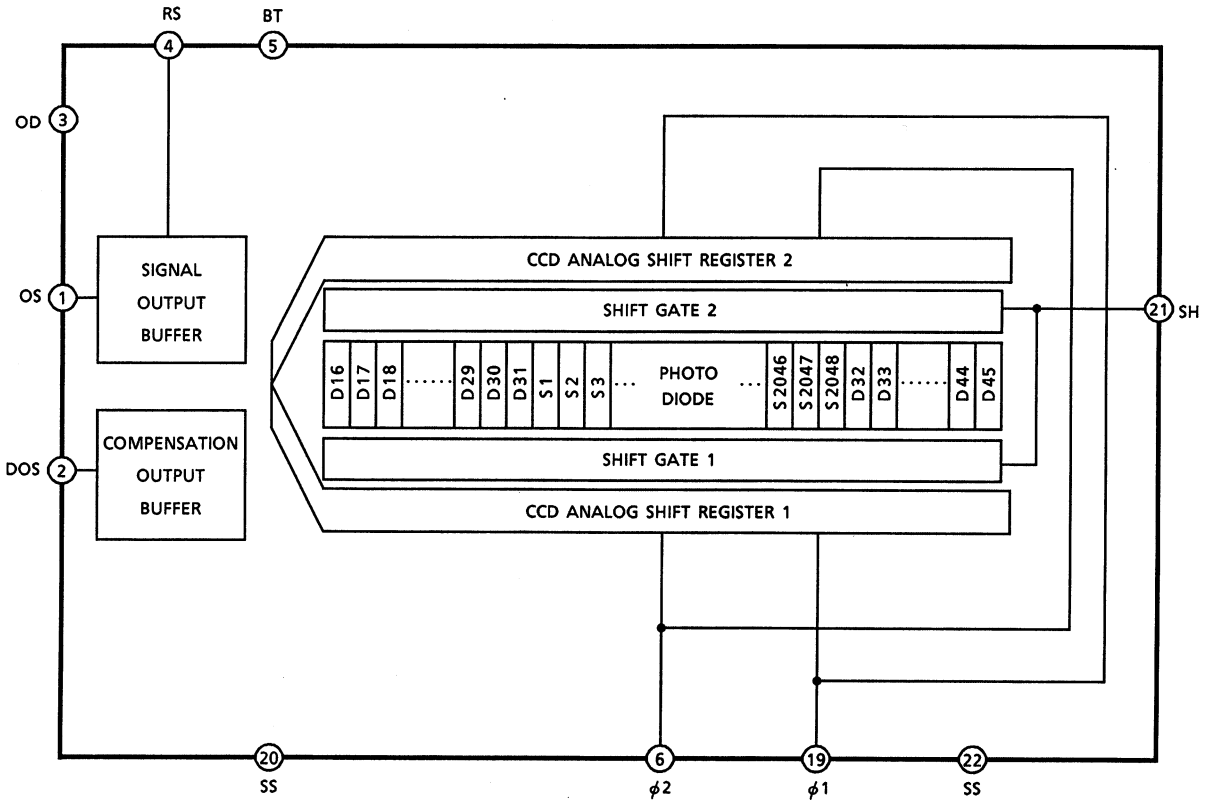
CIRCUIT DIAGRAM



PIN NAMES

φ1	Clock (Phase 1)
φ2	Clock (Phase 2)
BT	Boost Pulse
SH	Shift Gate
RS	Reset Gate
OS	Signal Output
DOS	Compensation Output
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_{RS} = V_{BT} = 5V (PULSE), f_{φ} = 0.5MHz, f_{RS} = 1MHz, Load Resistance = 100kΩ, t_{INT} (Integration Time) = 10ms, Light Source = Daylight Fluorescent Lamp)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX	UNIT	NOTE
Sensitivity	R	64	80	96	V / lx·s	(Note 2)
Photo Response Non Uniformity	PRNU	—	—	10	%	(Note 3)
Saturation Output Voltage	V_{SAT}	0.6	0.8	—	V	(Note 4)
Saturation Exposure	SE	0.006	0.01	—	lx·s	(Note 5)
Dark Signal Voltage	V_{MDK}	—	2	5	mV	(Note 6)
Analog Current Dissipation	I_{OD}	—	3	5	mA	V_{OD} = 5V
Total Transfer Efficiency	TTE	92	95	—	%	
Output Impedance	Z_O	—	0.5	1	kΩ	
Dynamic Range	DR	—	400	—		(Note 7)
DC Signal Output Voltage	V_{OS}	1.5	3.0	4.5	V	(Note 8)
DC Compensation Output Voltage	V_{DOS}	1.5	3.0	4.5	V	(Note 8)
DC Mismatch Voltage	$\lvert V_{OS}-V_{DOS}\rvert$	—	—	100	mV	

Note 2: Sensitivity for LED (660nm) is 600V / lx·s (Typ.)

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

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

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

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

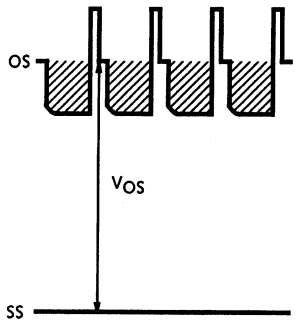
Note 5: Definition of SE : SE = $\frac{V_{SAT}}{R}(lx \cdot s)$

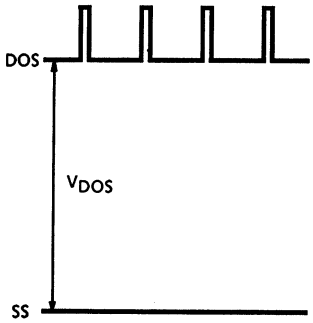
Note 6: V_{MDK} is defined as maximum dark signal voltage of all effective pixels.

Note 7: Definition of DR : DR = $\frac{V_{SAT}}{V_{MDK}}$

V_{MDK} is proportional to t_{INT} (Integration Time).
So the shorter t_{INT} condition makes wider DR value.

Note 8: DC signal output voltage and DC compensation output voltage are defined as follows:





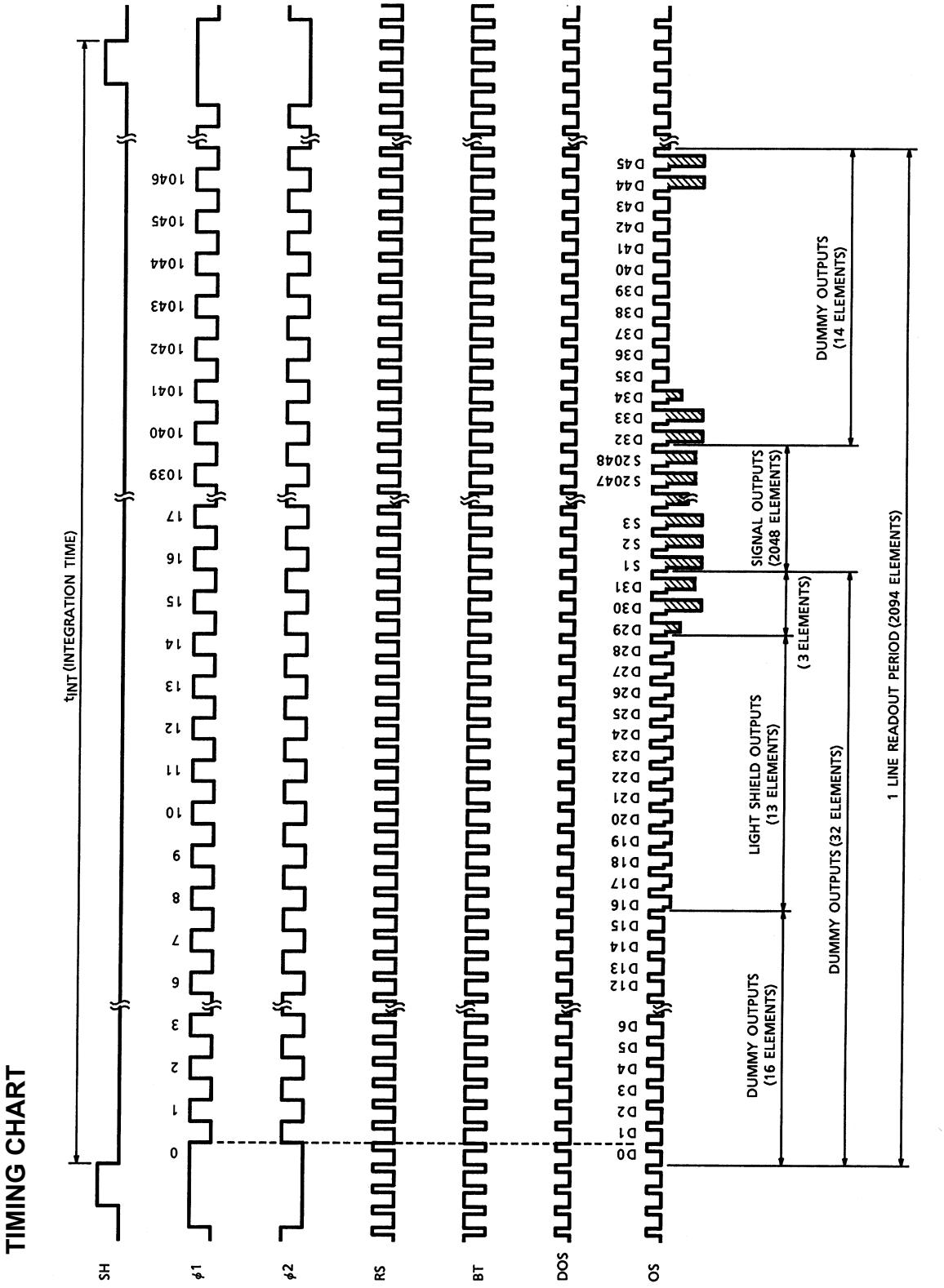
OPERATING CONDITION

CHARACTERISTIC		SYMBOL	MIN	TYP.	MAX	UNIT
Clock Pulse Voltage	"H" Level	V_{φ}	4.5	5.0	5.5	V
	"L" Level		0	0.2	0.5	
Shift Pulse Voltage	"H" Level	V_{SH}	4.5	5.0	5.5	V
	"L" Level		0	0.2	0.5	
Reset Boost Pulse Voltage	"H" Level	V_{RS}	4.5	5.0	5.5	V
	"L" Level	V_{BT}	0	0.2	0.5	
Power Supply Voltage		V_{OD}	4.5	5.0	5.5	V

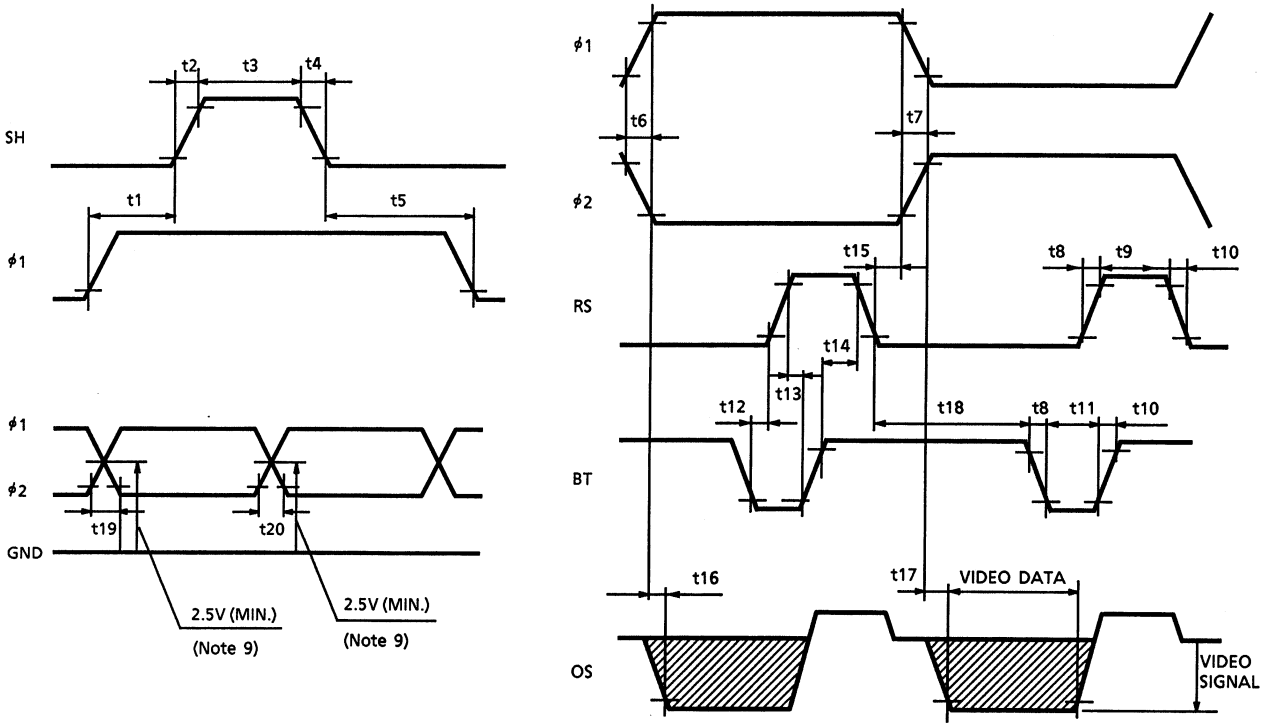
CLOCK CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX	UNIT
Clock Pulse Frequency	f_{φ}	0.01	0.5	1.0	MHz
Reset Pulse Frequency	f_{RS}	0.02	1.0	2.0	MHz
Clock Capacitance	$C_{\varphi A}$	—	400	500	pF
BT Gate Capacitance	C_{BT}	—	10	25	pF
Shift Gate Capacitance	C_{SH}	—	200	250	pF
Reset Gate Capacitance	C_{RS}	—	10	25	pF

TIMING CHART



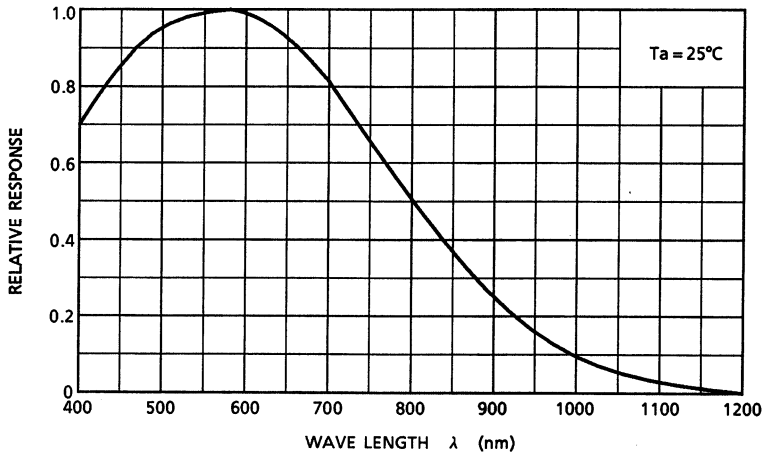
TIMING REQUIREMENTS



CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX	UNIT
Pulse Timing of SH and φ1, φ2	t1	0	100	—	ns
	t5	2000	3000	—	ns
SH Pulse Rise, and Fall Time	t2, t4	0	50	—	ns
SH Pulse Width	t3	1000	2000	—	ns
φ1, φ2 Pulse Rise and Fall Time	t6, t7	0	60	—	ns
RS, BT Pulse Rise and Fall Time	t8, t10	0	20	—	ns
RS Pulse Width	t9	60	250	—	ns
BT Pulse Width	t11	70	250	—	ns
Pulse Timing of RS and BT	t12	50	100	—	ns
	t13	20	—	—	ns
	t14	40	—	—	ns
	t18	200	—	—	ns
Pulse Timing of φ1, φ2, RS	t15	20	—	—	ns
Video Data Delay Time	t16, t17	—	80	—	ns

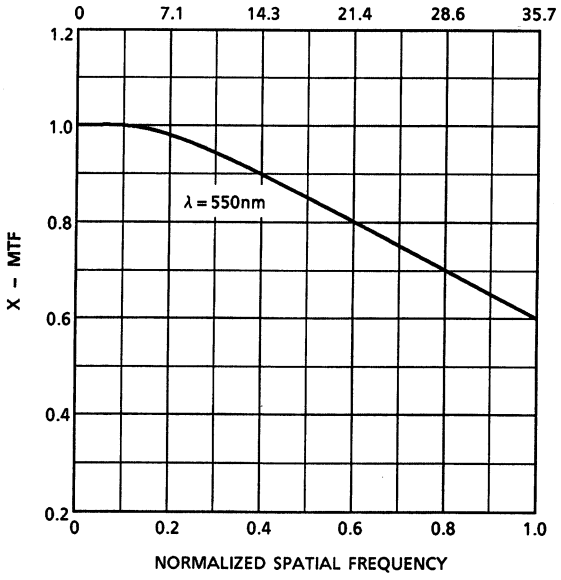
Note 9: If φ1 & φ2 pulse cross point could't be kept over 2.5V, it should be 1.5V and t19 and t20 should be 60ns.

TYPICAL SPECTRAL RESPONSE

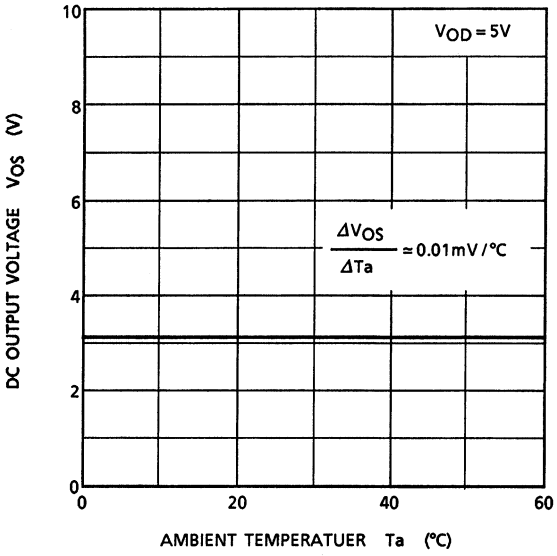


MODULATION TRANSFER FUNCTION
OF X-DIRECTION

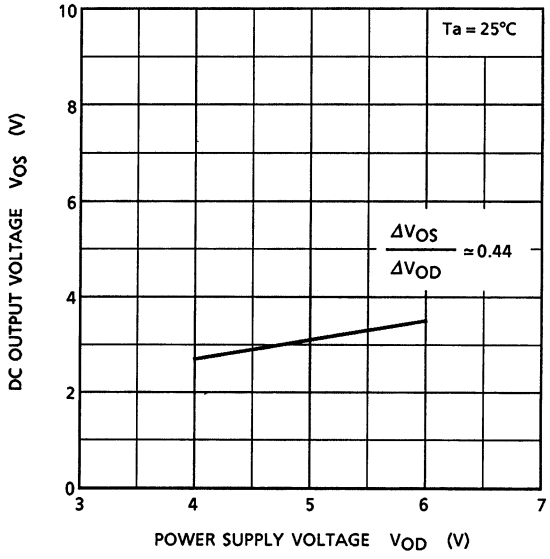
SPATIAL FREQUENCY (Cycles / mm)



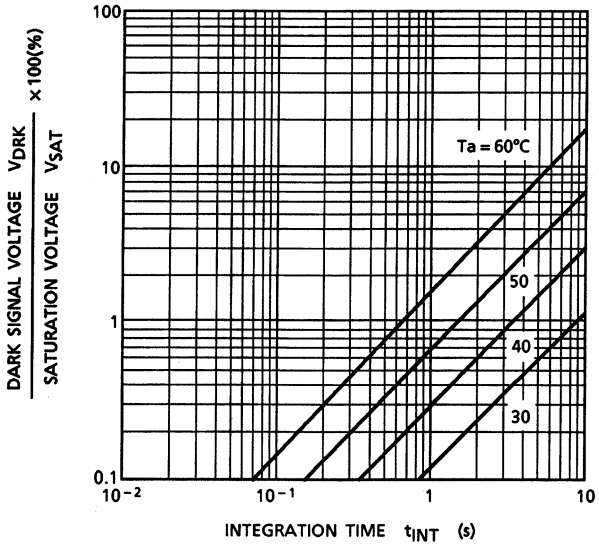
DC OUTPUT VOLTAGE – AMBIENT TEMPERATUER (TYPICAL)



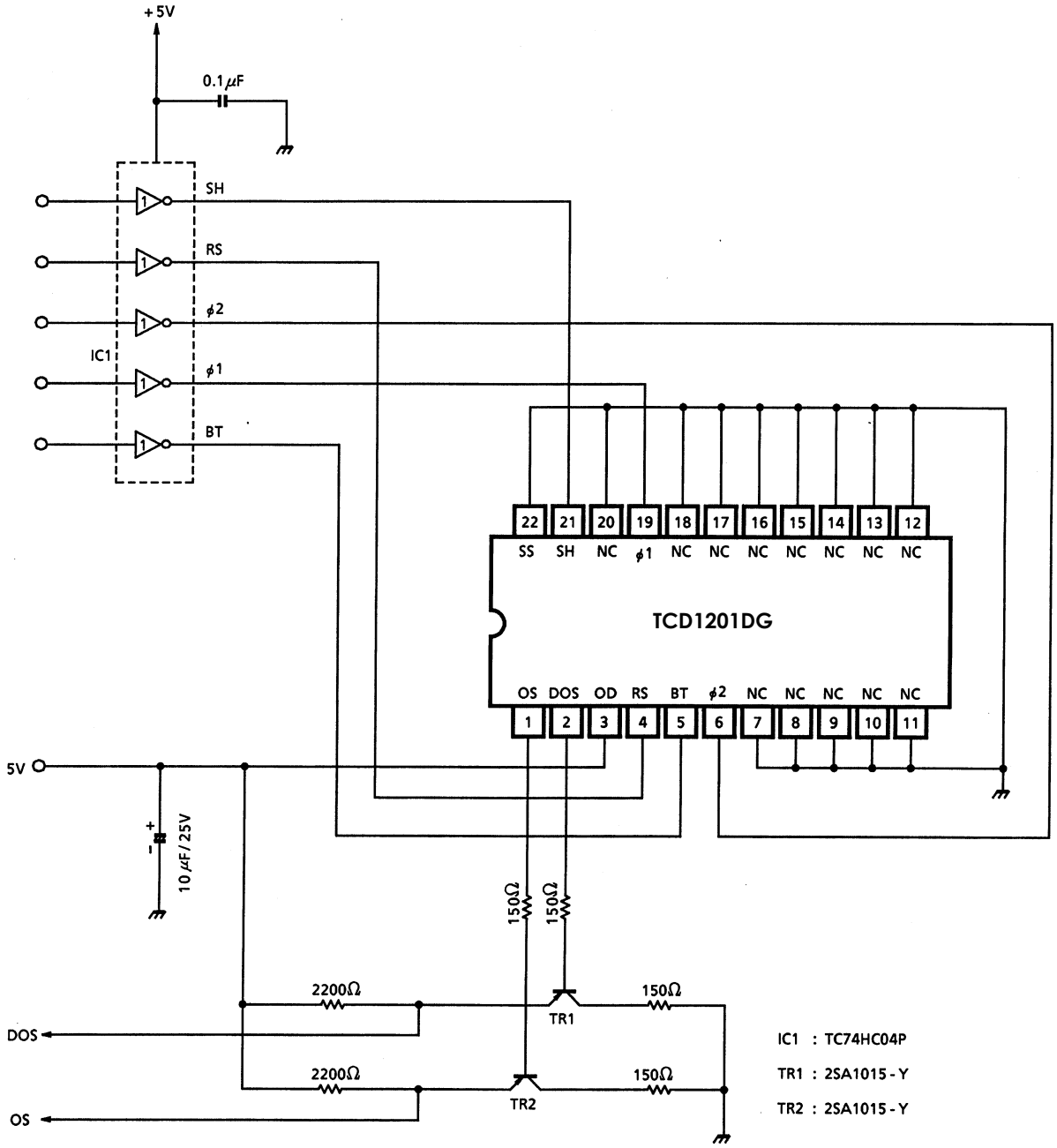
DC OUTPUT VOLTAGE – POWER SUPPLY VOLTAGE (TYPICAL)



DARK SIGNAL VOLTAGE – INTEGRATION TIME (TYPICAL)



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 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.

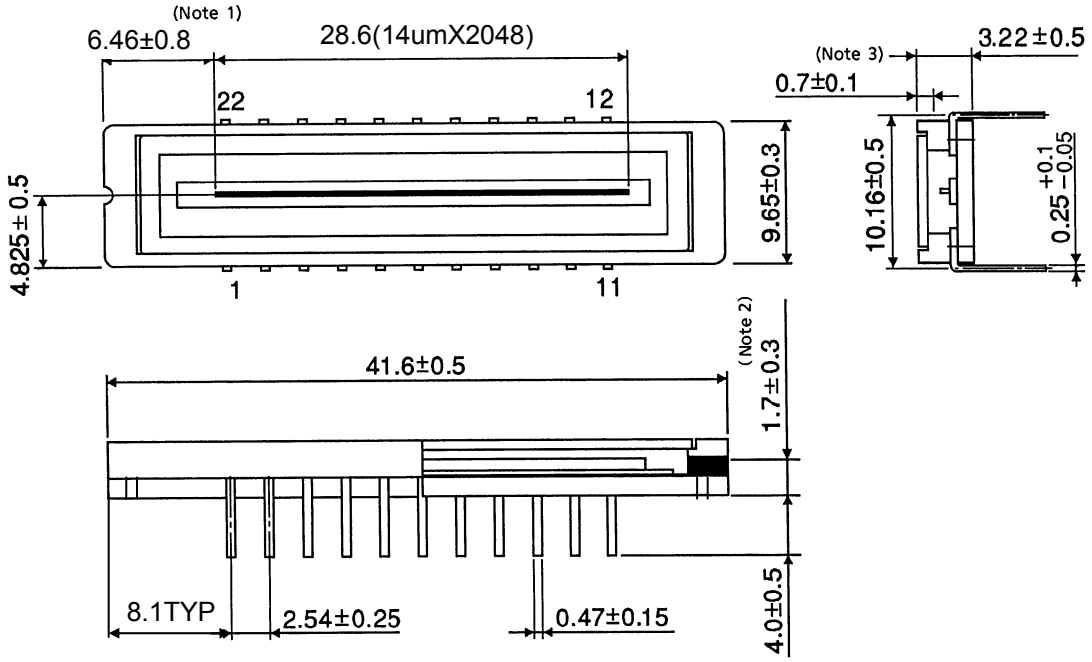
We recommend to use a IC-inserter when you assemble to PCB.

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



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: (3.5g (Typ.))