

<b>SANYO</b>	NO.3046B	<b>LB8904M</b>
		CCD Clock Driver

**Overview**

- The LB8904M is a monolithic IC designed to drive clock gates of a CCD image sensor (LC9943, etc.) at high speed.

**Features**

- Capable of driving capacitive gates of a CCD, etc.
- On-chip eight-block vertical driver, one of which is capable of providing drive on the three-value level, and on-chip two-block horizontal driver. No more than one chip is required to drive clock gates of the LC9943, etc.
- Placed in a 30-pin miniflat package, facilitating miniaturization of equipment.
- Capable of being driven direct with CMOS, etc.

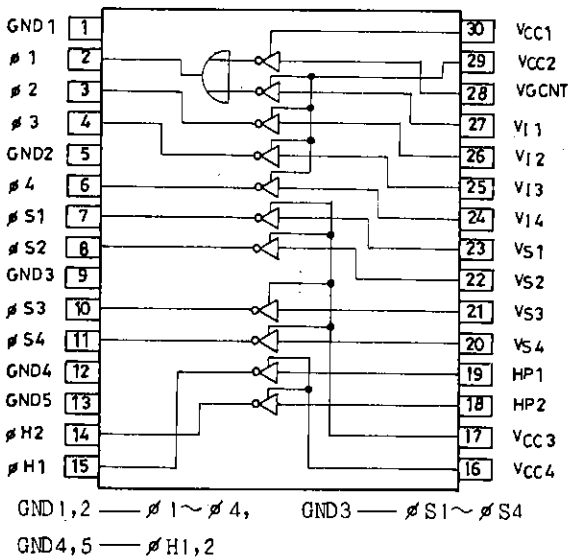
**Absolute Maximum Ratings at Ta = 25°C**

Parameter	Symbol	Condition	Value	unit
Maximum Supply Voltage	V <sub>CC</sub> max	V <sub>CC1</sub> to 4	-0.3 to +16.0	V
Input Supply Voltage	V <sub>IN</sub>	Each input pin	-0.3 to +6.0	V
Maximum Output Current	I <sub>OUT</sub>	Each output pin	150	mA
Allowable Power Dissipation	P <sub>d</sub> max		665	mW
Operating Temperature	T <sub>opr</sub>		-10 to +70	°C
Storage Temperature	T <sub>stg</sub>		-40 to +125	°C

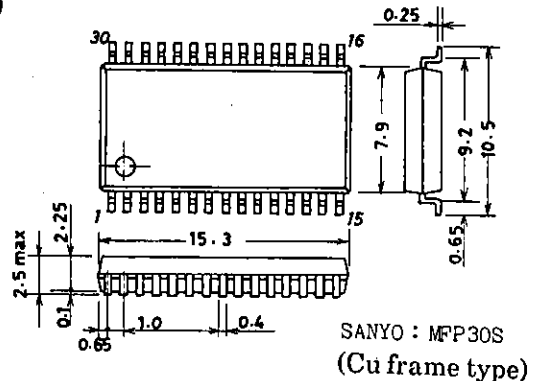
**Allowable Operating Conditions at Ta = 25°C**

Parameter	Symbol	Condition	Value	unit
Supply Voltage	V <sub>CC</sub>	Each V <sub>CC</sub> pin	5 to 16	V
	V <sub>CC1</sub> - V <sub>CC2</sub>	Voltage difference (V <sub>CC1</sub> ≤ V <sub>CC2</sub> to 4)	0 to 6.0	V
Input 'H'-Level Voltage	V <sub>IH</sub>	Each input pin	3.5 to 6.0	V
Input 'L'-Level Voltage	V <sub>IL</sub>	Each input pin	-0.3 to +0.3	V

**Equivalent Circuit Block Diagram**



**Package Dimensions 3073A-M30IC  
(unit : mm)**



## LB8904M

Electrical Characteristics at Ta=25°C, V <sub>CC1</sub> to 3=14V, V <sub>CC4</sub> =11V			min	typ	max	unit
Input 'H'-Level Current	I <sub>IH1</sub>	Block1, V <sub>I1</sub> input, V <sub>IN</sub> =5.0V			2	mA
	I <sub>IH2</sub>	Block1, V <sub>GCNT</sub> input, V <sub>IN</sub> =5.0V			2	mA
	I <sub>IH3</sub>	Blocks2 to 8, V <sub>I2</sub> to 4 inputs, V <sub>IN</sub> =5.0V			2	mA
		V <sub>S1</sub> to 4 inputs, V <sub>IN</sub> =5.0V				
Input 'L'-Level Current	I <sub>IH4</sub>	Blocks9,10, HP1,2 inputs, V <sub>IN</sub> =5.0V			2	mA
	I <sub>IL1</sub>	Blocks1 to 10, V <sub>I1</sub> to 4 inputs	-30			μA
		V <sub>S1</sub> to 4 inputs				
		V <sub>IN</sub> =0V				
Supply Current	I <sub>IL2</sub>	Block1, V <sub>GCNT</sub> input, V <sub>IN</sub> =0V	-100	-20		μA
	I <sub>CCH1</sub>	Each input, V <sub>IN</sub> =5.0V			0.5	mA
	I <sub>CCH2</sub>	Each input, V <sub>IN</sub> =5.0V			16	mA
	I <sub>CCH3</sub>	Each input, V <sub>IN</sub> =5.0V			16	mA
	I <sub>CCH4</sub>	Each input, V <sub>IN</sub> =5.0V			8	mA
	I <sub>CCL1</sub>	V <sub>I1</sub> =0V, V <sub>GCNT</sub> =0V			150	μA
	I <sub>CCL2</sub>	V <sub>I2</sub> to 4 inputs, V <sub>IN</sub> =0V,			200	μA
	I <sub>CCL3</sub>	V <sub>S1</sub> to 4 inputs, V <sub>IN</sub> =0V			200	μA
Output Voltage	I <sub>CCL4</sub>	HP1,2 inputs, V <sub>IN</sub> =0V			100	μA
	V <sub>OH1</sub>	V <sub>I1</sub> =0V, V <sub>GCNT</sub> =5V		V <sub>CC2</sub>		V
				-2.0		
	V <sub>OH2</sub>	V <sub>I1</sub> =5V, V <sub>GCNT</sub> =0V		V <sub>CC1</sub>		V
				-2.0		
	V <sub>OH3</sub>	V <sub>I2</sub> to 4=0V		V <sub>CC2</sub>		V
				-2.0		
	V <sub>OH4</sub>	V <sub>S1</sub> to 4=0V		V <sub>CC3</sub>		V
				-2.0		
	V <sub>OH5</sub>	HP1,2=0V		V <sub>CC4</sub>		V
				-2.0		
	V <sub>OL</sub>	Each input, V <sub>IN</sub> =5V			0.5	V

### Switching Characteristics at Ta=25°C, V<sub>CC1</sub> to 3=14V, V<sub>CC4</sub>=11V, V<sub>IN</sub>=5.0V, t<sub>r</sub>, t<sub>f</sub> ≤ 10ns

			min	typ	max	unit
Propagation Time 'L'-Level → 'H'-Level	t <sub>PLH1</sub>	ø1 output, V <sub>GCNT</sub> =5.0V fixed		30		ns
	t <sub>PLH2</sub>	ø1 output, V <sub>I1</sub> =5.0V fixed		2		μs
	t <sub>PLH3</sub>	ø2 to 4, ø <sub>S1</sub> to 4, øH1,2 outputs		30		ns
Propagation Time 'H'-Level → 'L'-Level	t <sub>PHL1</sub>	ø1 output, V <sub>GCNT</sub> =5.0V fixed		30		ns
	t <sub>PHL2</sub>	ø1 output, V <sub>I1</sub> =5.0V fixed		1		μs
	t <sub>PHL3</sub>	ø2 to 4, ø <sub>S1</sub> to 4 outputs, øH1,2 outputs		30		ns
Transient Rise Time	t <sub>r1</sub>	ø1 output, V <sub>GCNT</sub> =5.0V fixed		30		ns
	t <sub>r2</sub>	ø1 output, V <sub>I1</sub> =5.0V fixed		6		μs
	t <sub>r3</sub>	ø2 to 4, ø <sub>S1</sub> to 4 outputs, øH1,2 outputs		30		ns
Transient Fall Time	t <sub>f1</sub>	ø1 output, V <sub>GCNT</sub> =5.0V fixed		30		ns
	t <sub>f2</sub>	ø1 output, V <sub>I1</sub> =5.0V fixed		1		μs
	t <sub>f3</sub>	ø2 to 4, ø <sub>S1</sub> to 4, øH1,2 outputs		30		ns

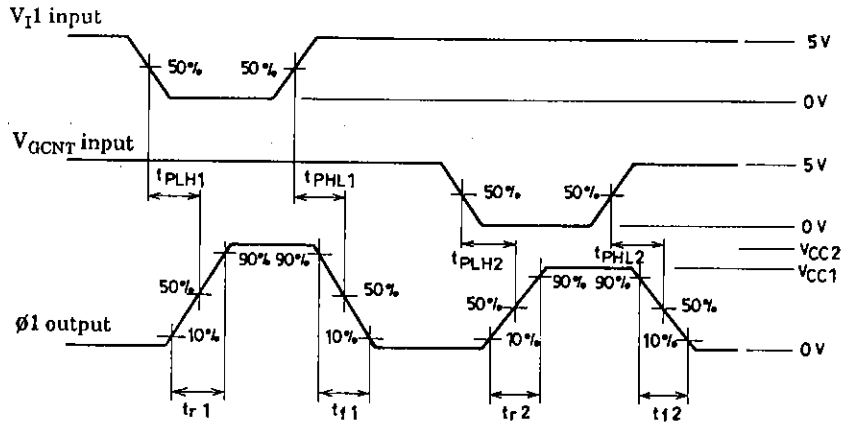
#### Note : Load conditions

- Vertical three-value driver (ø1) ..... R<sub>S</sub>=62Ω, C<sub>L</sub>=140pF
- Vertical two-value driver (ø2 to 3, ø<sub>S1</sub> to 4) ..... R<sub>S</sub>=62Ω, C<sub>L</sub>=140pF
- Horizontal two-value driver (ø H1,2) ..... R<sub>S</sub>=430Ω, C<sub>L</sub>=45pF

# LB8904M

## Switching Waveforms

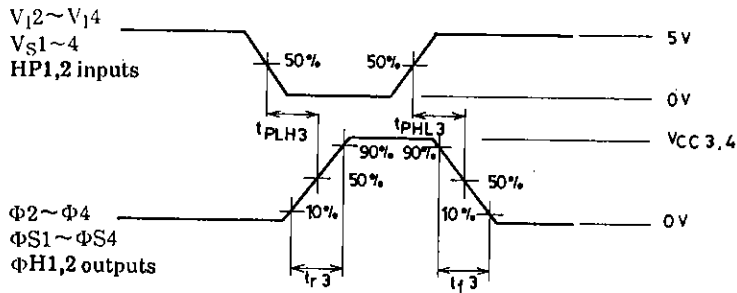
### 1. Block 1



Truth Table

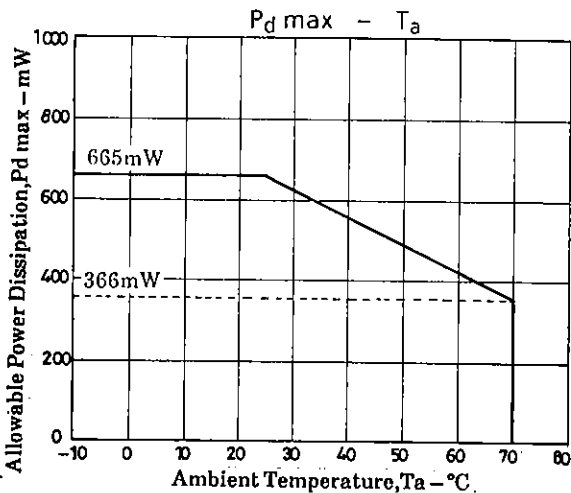
Item		$V_{GCNT}$ inputs	
		H	L
$V_{I1}$ input	H	$V_{OL}$	$V_{OH2}$
	L	$V_{OH1}$	Inhibit

### 2. Blocks 2 to 10

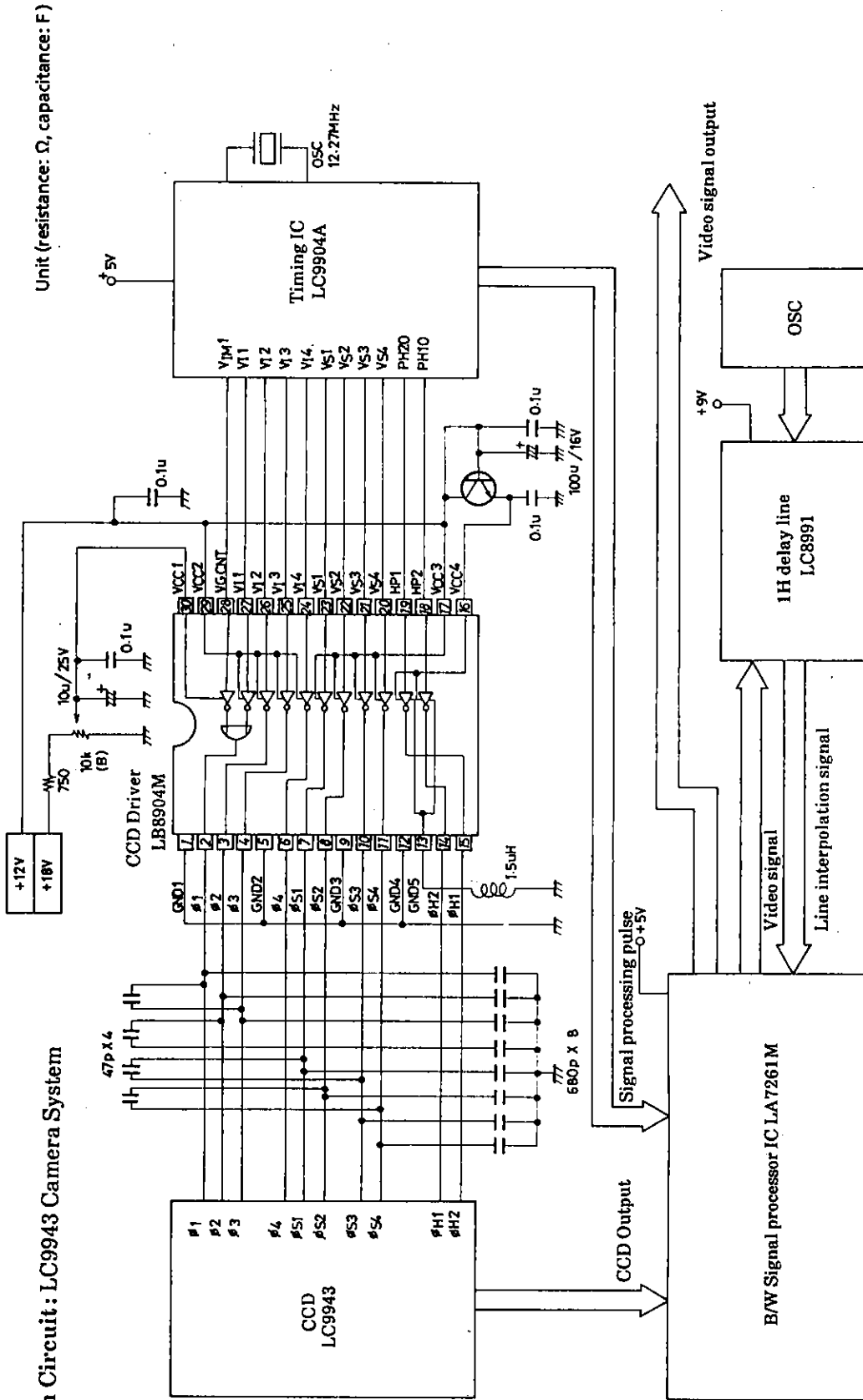


Truth Table

Item		Output
Input	H	$V_{OL}$
	L	$V_{OH3}$ to 7



Sample Application Circuit : LC9943 Camera System



Proper Cares to be Taken in Designing a Printed Circuit Board

When operating the LB8904M at high speed, design the printed circuit board with the following points kept in mind.

- 1) Make the pattern of the power supply, GND lines as large as possible.
- 2) Place the bypass capacitor as close to the IC as possible (less than 1cm).
- 3) Make the wiring of the input signal line as short as possible to minimize the effect of stray capacitance.
- 4) Make the wiring of the output signal line also as short as possible, because the inductance of a long signal line may affect the output waveforms adversely.

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