

# MN31121SA

## CCD Image Sensor Vertical Driver IC

### ■ Overview

The MN31121SA is a 2D interline CCD image sensor vertical driver IC that integrates four vertical driver channels and one SUB drive channel on a single chip. This IC can reduce power consumption and the number of external parts.

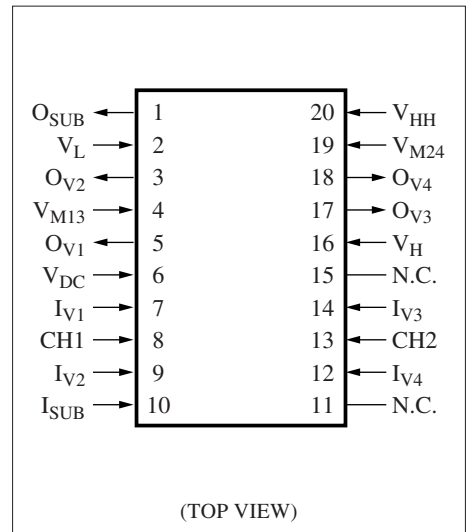
The MN31121SA consists of a vertical driver block that includes both level shifter circuits and 2-value and 3-value output driver circuits, and a SUB driver block that includes level shifter and 2-value output driver circuits.

### ■ Features

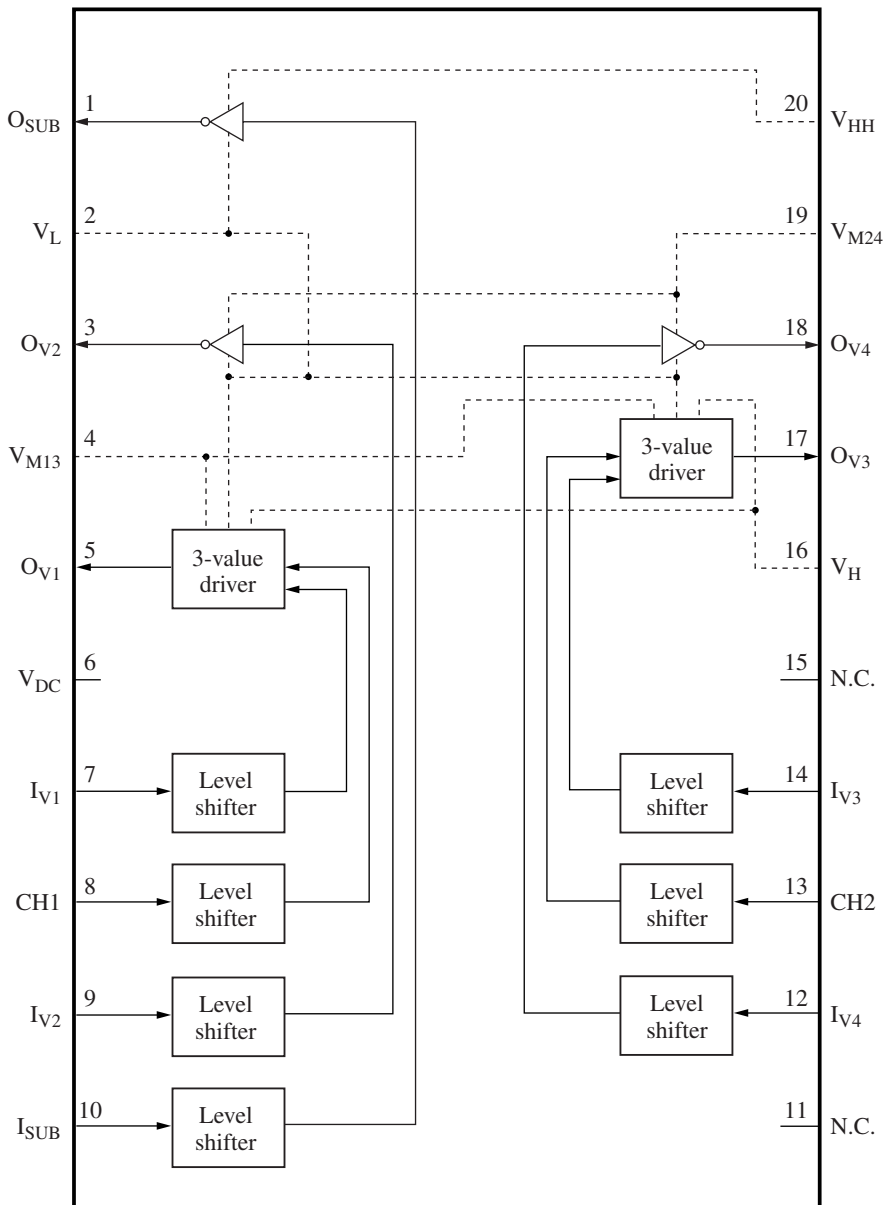
- Level shifter circuits  
Input ( $V_{DC}$ , ground) → output ( $V_{HH}$ ,  $V_L$ )
- 2-value output driver circuits (vertical driver block)  
Outputs:  $V_{M24}$  and  $V_L$
- 3-value output driver circuits (vertical driver block)  
Outputs:  $V_H$ ,  $V_{M13}$ , and  $V_L$
- 2-value output driver circuits (SUB driver block)  
Outputs:  $V_{HH}$  and  $V_L$

### ■ Applications

- Video cameras, surveillance cameras, digital still cameras, CCD camera systems



■ Block Diagram



Note)  $V_{DC}$ ,  $V_L$ : Common power supply  
 $V_{M13}$ ,  $V_{M24}$ : Vertical driver block 2-value and 3-value independent power supply  
 $V_{HH}$ ,  $V_H$ : SUB driver block and vertical driver block 3-value independent power supply

## ■ Pin Descriptions

Pin No.	Pin name	I/O	Description
1	O <sub>SUB</sub>	O	SUB pulse output
2	V <sub>L</sub>	I	Low-level power supply
3	O <sub>V2</sub>	O	2-value transfer pulse output
4	V <sub>M13</sub>	I	Mid-level power supply
5	O <sub>V1</sub>	O	3-value transfer pulse output
6	V <sub>DC</sub>	I	Input block high-level power supply
7	I <sub>V1</sub>	I	Transfer pulse input
8	CH1	I	Charge pulse input
9	I <sub>V2</sub>	I	Transfer pulse input
10	I <sub>SUB</sub>	I	SUB pulse input
11	N.C.	—	Unused
12	I <sub>V4</sub>	I	Transfer pulse input
13	CH2	I	Charge pulse input
14	I <sub>V3</sub>	I	Transfer pulse input
15	N.C.	—	Unused
16	V <sub>H</sub>	I	High-level power supply of vertical driver block
17	O <sub>V3</sub>	O	3-value transfer pulse output
18	O <sub>V4</sub>	O	2-value transfer pulse output
19	V <sub>M24</sub>	I	Mid-level power supply
20	V <sub>HH</sub>	I	High-level power supply of SUB driver block

## ■ Electrical Characteristics

### 1. Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage 1	V <sub>HH</sub> -V <sub>L</sub>	32	V
Supply voltage 2	V <sub>H</sub> -V <sub>L</sub>	30	V
Supply voltage 3	V <sub>M13</sub> , V <sub>M24</sub>	V <sub>L</sub> to 6	V
Supply voltage 4	V <sub>DC</sub>	0 to 7	V
Negative supply voltage	V <sub>L</sub>	-12 to 0	V
Input voltage	V <sub>I</sub>	V <sub>L</sub> -0.3 to V <sub>DC</sub> +0.3	V
Input and output clamp diode currents	I <sub>IC</sub> , I <sub>OC</sub>	±10	mA
Maximum DC load current	I <sub>ODC</sub>	±3	mA
Maximum load capacitance	C <sub>L</sub>	5 500	pF/PIN
Power dissipation	P <sub>D</sub>	180	mW
Operating temperature	T <sub>opr</sub>	-10 to +70	°C
Storage temperature	T <sub>stg</sub>	-50 to +125	°C

Note) The absolute maximum ratings are stress ratings only, and do not guarantee operation. Stress in excess of the maximum rating may destroy the device.

## ■ Electrical Characteristics (continued)

### 2. Operating Conditions at $T_a = -10^\circ\text{C}$ to $+70^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply voltage 1	$V_{\text{HH}}-V_{\text{L}}$		$V_{\text{H}}-V_{\text{L}}$	—	30.5	V
Supply voltage 2	$V_{\text{H}}-V_{\text{L}}$		17	—	28	V
Supply voltage 3	$V_{\text{M13}}, V_{\text{M24}}$		-1	—	4	V
Supply voltage 4	$V_{\text{HH}}-V_{\text{M13}}$ $V_{\text{HH}}-V_{\text{M24}}$		12	—	—	V
Supply voltage 5	$V_{\text{DC}}$		2.5	—	3.6	V
Negative supply voltage	$V_{\text{L}}$		-10	—	-4	V
Input frequency	$f_{\text{IN}}$		—	—	20	kHz

### 3. DC Characteristics at $V_{\text{HH}} = 18.0\text{ V}$ , $V_{\text{H}} = 13.0\text{ V}$ , $V_{\text{M13}} = V_{\text{M24}} = 1.0\text{ V}$ , $V_{\text{L}} = -7.0\text{ V}$ , $V_{\text{DC}} = 3.00\text{ V}$ , $T_a = -10^\circ\text{C}$ to $+70^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Quiescent supply current	$I_{\text{DDST}}$	$V_{\text{I}} = \text{GND}, V_{\text{DC}} = 2.6\text{ V}$	—	—	2	mA
		$V_{\text{I}} = \text{GND}, V_{\text{DC}} = 3.0\text{ V}$	—	—	5	
Operating supply current	$I_{\text{DDYN}}$	Refer to test conditions (Input pulse timing, output load circuit) $V_{\text{I}} = \text{GND}, V_{\text{DC}}$	—	—	7	mA

#### Input Pins $I_{\text{V1}}, I_{\text{V2}}, I_{\text{V3}}, I_{\text{V4}}, \text{CH1}, \text{CH2}, I_{\text{SUB}}$

High-level voltage	$V_{\text{IH}}$	$V_{\text{DC}} = 2.6\text{ V}$	1.75	—	$V_{\text{DC}}$	V
Low-level voltage	$V_{\text{IL}}$		0.0	—	0.15	V
High-level voltage	$V_{\text{IH}}$	$V_{\text{DC}} = 3.0\text{ V}$	2.5	—	$V_{\text{DC}}$	V
Low-level voltage	$V_{\text{IL}}$		0.0	—	0.3	V
Input leakage current	$I_{\text{ILK}}$	$V_{\text{I}} = 0\text{ V}$ to $V_{\text{DC}}$	-1.0	—	+1.0	$\mu\text{A}$

#### Output Pins 1 (2-value outputs) $O_{\text{V2}}, O_{\text{V4}}$

Mid-level output voltage	$V_{\text{OM1}}$	$I_{\text{OM1}} = -1\text{ mA}$	0.9	—	$V_{\text{M24}}$	V
Low-level output voltage	$V_{\text{OL1}}$	$I_{\text{OL1}} = 1\text{ mA}$	$V_{\text{L}}$	—	-6.9	V
Output on resistance (mid level)	$R_{\text{ONM1}}$	$I_{\text{OM1}} = -50\text{ mA}$	—	—	60	$\Omega$
Output on resistance (low level)	$R_{\text{ONL1}}$	$I_{\text{OL1}} = 50\text{ mA}$	—	—	40	$\Omega$

#### Output Pins 2 (3-value outputs) $O_{\text{V1}}, O_{\text{V3}}$

High-level output voltage	$V_{\text{OH2}}$	$I_{\text{OH2}} = -1\text{ mA}$	12.9	—	$V_{\text{H}}$	V
Mid-level output voltage	$V_{\text{OM2}}$	$I_{\text{OM2}} = -1\text{ mA}$	0.9	—	$V_{\text{M13}}$	V
Low-level output voltage	$V_{\text{OL2}}$	$I_{\text{OL2}} = 1\text{ mA}$	$V_{\text{L}}$	—	-6.9	V
Output on resistance (high level)	$R_{\text{ONH2}}$	$I_{\text{OH2}} = -50\text{ mA}$	—	—	70	$\Omega$
Output on resistance (mid level)	$R_{\text{ONM2}}$	$I_{\text{OM2}} = \pm 50\text{ mA}$	—	—	60	$\Omega$
Output on resistance (low level)	$R_{\text{ONL2}}$	$I_{\text{OL2}} = 50\text{ mA}$	—	—	60	$\Omega$

#### Output Pins 3 (SUB outputs) $O_{\text{SUB}}$

High-level output voltage	$V_{\text{OHH3}}$	$I_{\text{OHH3}} = -1\text{ mA}$	17.9	—	$V_{\text{HH}}$	V
Low-level output voltage	$V_{\text{OL3}}$	$I_{\text{OL3}} = 1\text{ mA}$	$V_{\text{L}}$	—	-6.9	V

■ Electrical Characteristics (continued)

3. DC Characteristics (continued) at  $V_{HH} = 18.0\text{ V}$ ,  $V_H = 13.0\text{ V}$ ,  $V_{M13} = V_{M24} = 1.0\text{ V}$ ,  $V_L = -7.0\text{ V}$ ,  $V_{DC} = 3.00\text{ V}$ ,  $T_a = -10^\circ\text{C}$  to  $+70^\circ\text{C}$

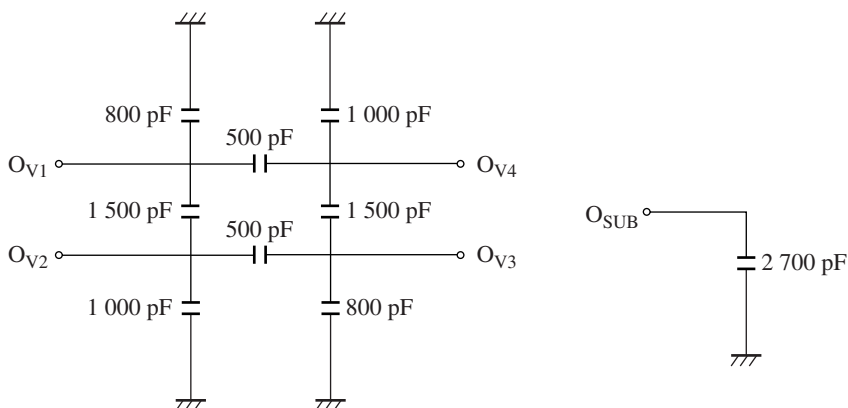
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Pins 3 (SUB outputs) (continued)		$O_{SUB}$				
Output on resistance (high level)	$R_{ONHH3}$	$I_{ONHH3} = -50\text{ mA}$	—	—	60	$\Omega$
Output on resistance (low level)	$R_{ONL3}$	$I_{ONL3} = 50\text{ mA}$	—	—	50	$\Omega$

4. AC Characteristics at  $V_{HH} = 18.0\text{ V}$ ,  $V_H = 13.0\text{ V}$ ,  $V_{M13} = V_{M24} = 1.0\text{ V}$ ,  $V_L = -7.0\text{ V}$ ,  $V_{DC} = 3.00\text{ V}$ ,  $T_a = -10^\circ\text{C}$  to  $+70^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Pins 1 (2-value outputs)		$O_{V2}$ , $O_{V4}$				
Propagation delay time	$T_{PLM}$ $T_{PML}$	No load, Low level to mid level	—	150	250	ns
Rise time Fall time	$T_{TLM}$ $T_{TML}$	Refer to test conditions (Output load circuit)	—	300	400	ns
Output Pins 2 (3-value outputs)		$O_{V1}$ , $O_{V3}$				
Propagation delay time	$T_{PLM}$ $T_{PML}$	No load, Low level to mid level	—	150	250	ns
Propagation delay time	$T_{PMH}$ $T_{PHM}$	No load, Mid level to high level	—	200	400	ns
Rise time Fall time	$T_{TLM}$ $T_{TML}$	Refer to test conditions (Output load circuit)	—	300	400	ns
Rise time Fall time	$T_{TMH}$ $T_{THM}$	Refer to test conditions (Output load circuit)	—	350	550	ns
Output Pins 3 (SUB output)		$O_{SUB}$				
Propagation delay time	$T_{PLHH}$ $T_{PHHL}$	No load, Low level to high level	—	150	250	ns
Rise time Fall time	$T_{TLHH}$ $T_{THHL}$	Refer to test conditions (Output load circuit)	—	300	400	ns

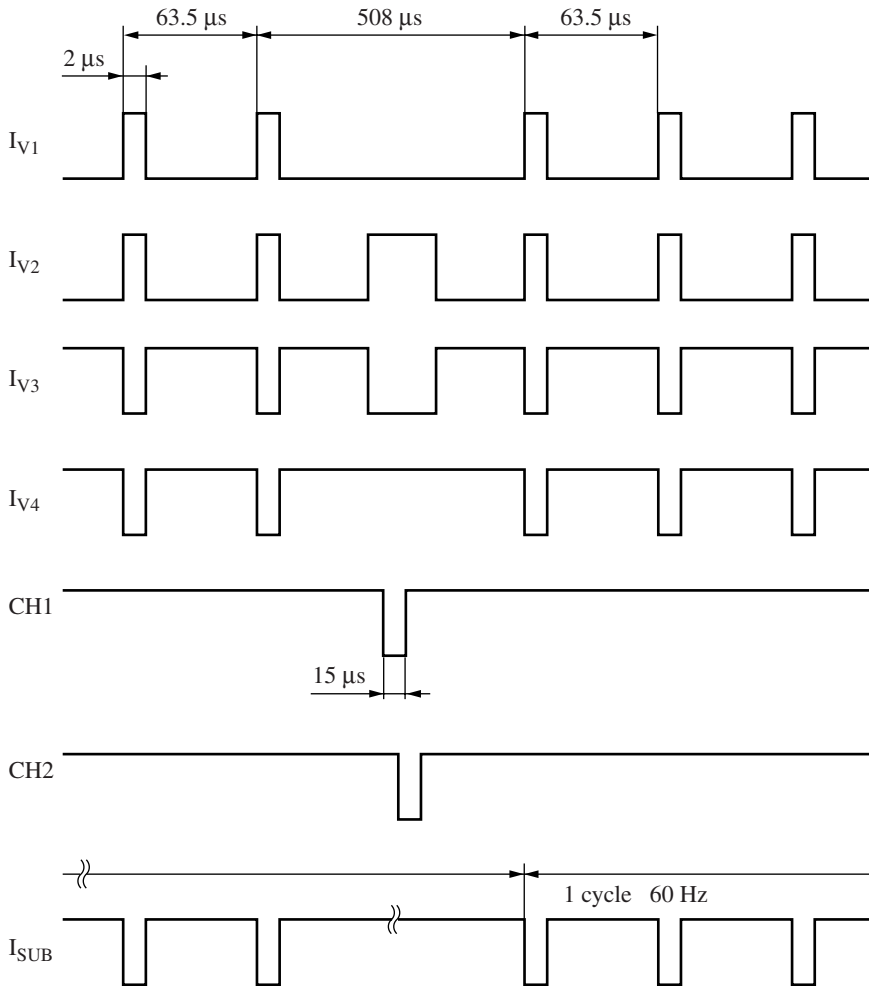
■ Test Conditions

1. Output Load Circuit



■ Test Conditions (continued)

2. Input Pulse Timing Charts (NTSC)



■ Function Tables

1. 2-Value Transfer Pulse (vertical driver block)

$I_{V2}$ $I_{V4}$	$O_{V2}$ $O_{V4}$
High	Low
Low	Mid

2. 3-Value Transfer Pulse

CH1 CH2	$I_{V1}$ $I_{V3}$	$O_{V1}$ $O_{V3}$
High	High	Low
	Low	Mid
Low	High	Low
	Low	High

Note)  $I_{V1}$ ,  $I_{V2}$ ,  $I_{V3}$ ,  $I_{V4}$ , CH1, CH2

High:  $V_{DC}$ , Low: Ground

$O_{V1}$ ,  $O_{V2}$ ,  $O_{V3}$ ,  $O_{V4}$

High:  $V_H$ , Mid:  $V_{M13}$  or  $V_{M24}$ , Low:  $V_L$

■ Function Tables (continued)

3. Unnecessary Charge Sweep-Out Pulse (SUB driver block)

$I_{SUB}$	$O_{SUB}$
High	Low
Low	High

Note)  $I_{SUB}$

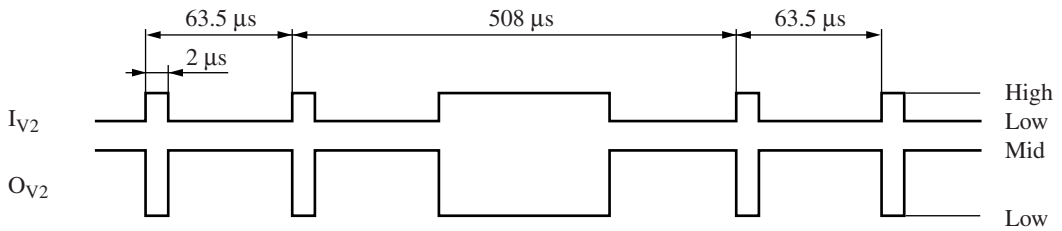
High:  $V_{DC}$ , Low: Ground

$O_{SUB}$

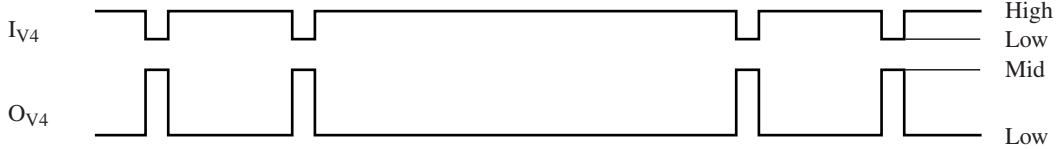
High:  $V_{HH}$ , Low:  $V_L$

■ Timing Charts

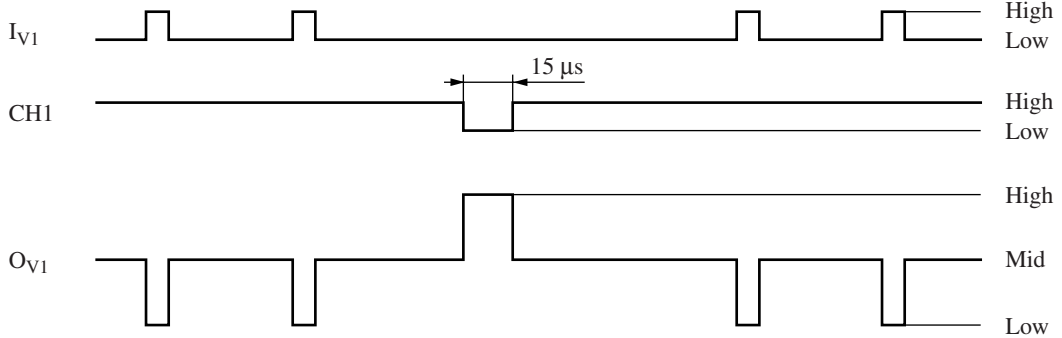
1. 2-value transfer pulse



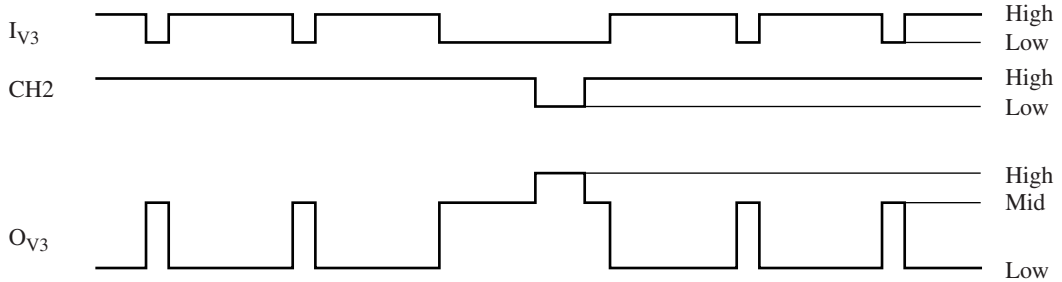
2. 2-value transfer pulse



3. 3-value transfer pulse

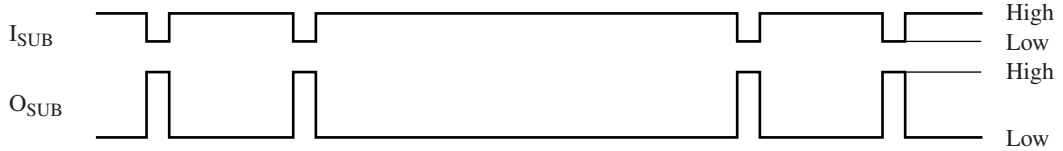


4. 3-value transfer pulse



## ■ Timing Charts (continued)

### 5. SUB pulse

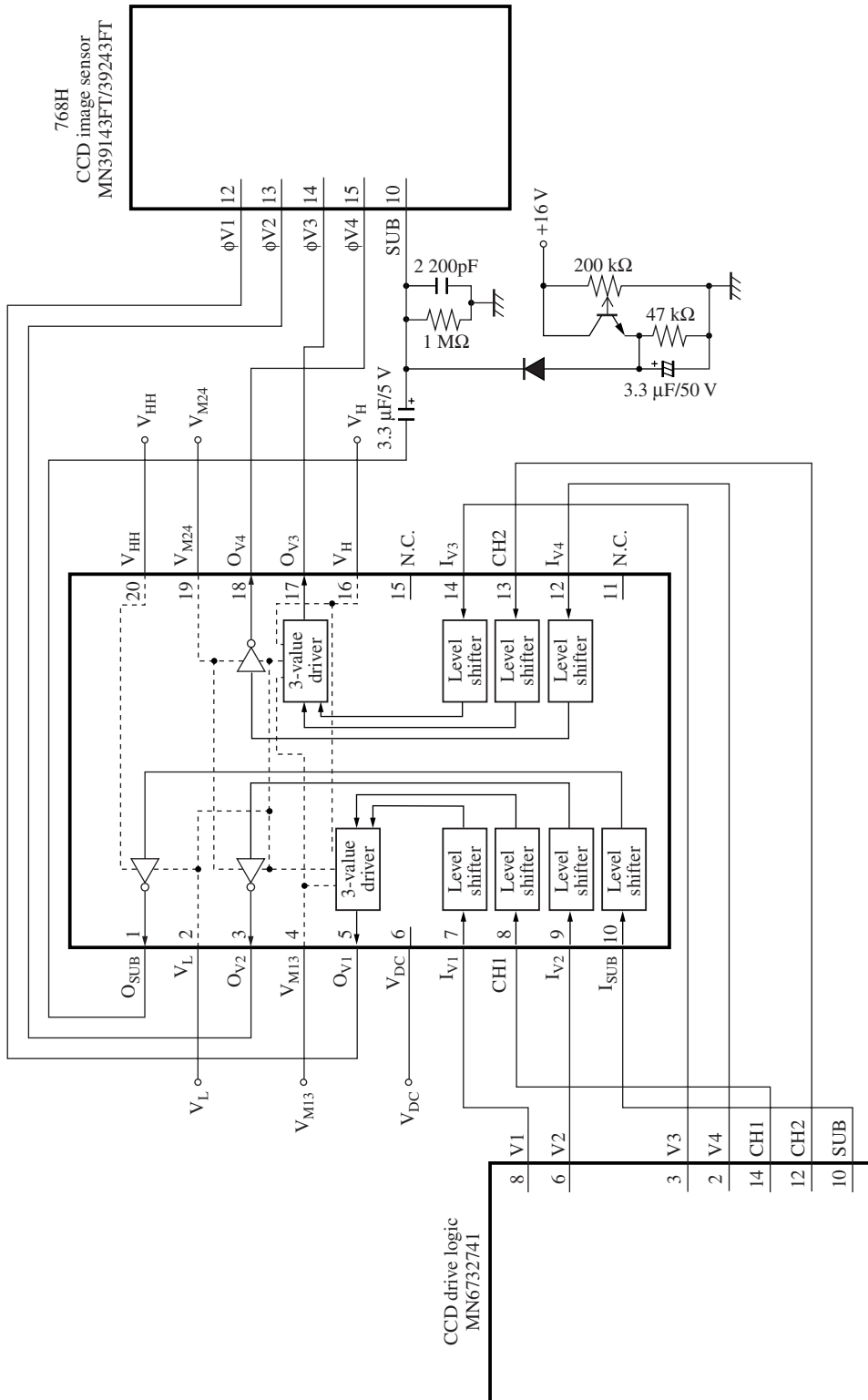


## ■ Usage Notes

1. If the SUB driver is not used:
  - 1) Connect  $V_{HH}$  (pin 20) to  $V_H$  (pin 16).
  - 2) Connect  $I_{SUB}$  (pin 10) to  $V_{DC}$  (pin 6).
  - 3) Leave  $O_{SUB}$  (pin 1) open.
2. Mount the bypass capacitors for power supply pins  $V_{HH}$  (pin 20),  $V_H$  (pin 16),  $V_{M13}$  (pin 4),  $V_{M24}$  (pin 19),  $V_L$  (pin 2), and  $V_{DC}$  (pin 6) as close as possible to the pin itself.
3. If the overcurrents that occur at power on and power off are limited to under 10 ms and under 100 mA, then the MN31121SA is guaranteed for 10,000 power cycle (power on/power off) operations.
4. Guarantee period after packing is opened  
The guarantee period after opening the moisture-proof packing is three weeks under environmental conditions of 30°C and 70% RH.
5. The recommended reflow soldering temperature is 230°C.



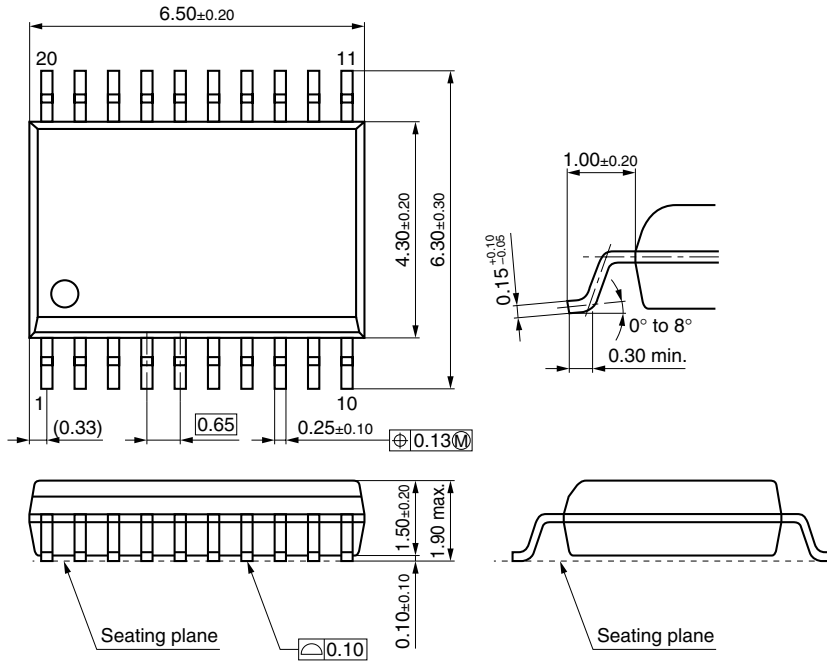
■ Application Circuit Example



Note) Mount the bypass capacitors for the MN31121SA power supply pins (V<sub>HH</sub>, V<sub>H</sub>, V<sub>M13</sub>, V<sub>M24</sub>, V<sub>L</sub>, and V<sub>DC</sub>) as close as possible to the pin itself.

■ Package Dimensions (Unit: mm)

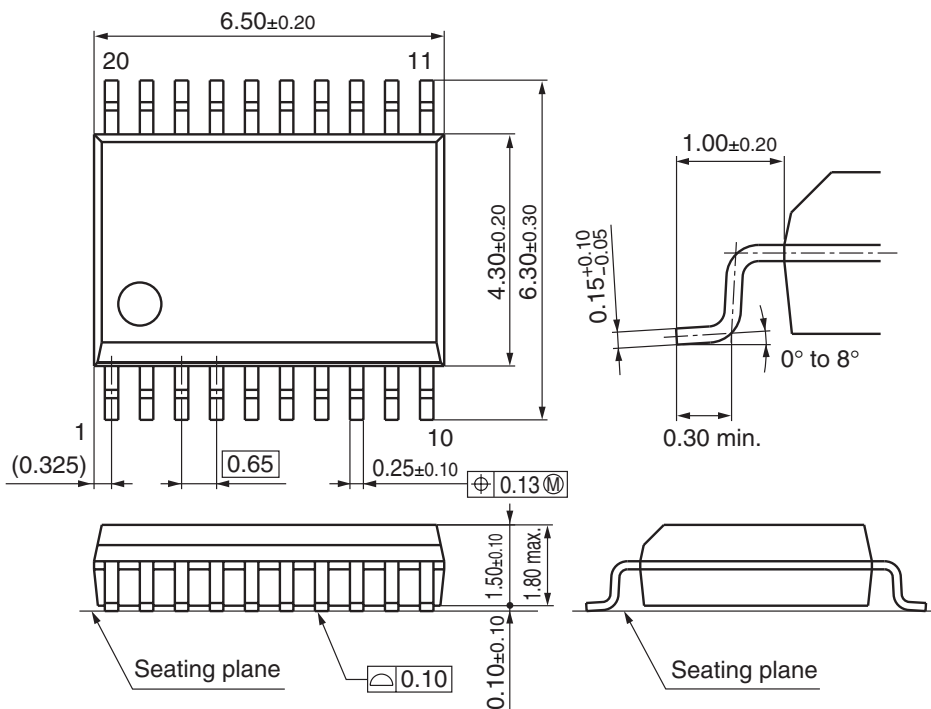
- SSOP020-P-0225



Note) The package of this product will be changed to the following lead-free type (SSOP020-P-0225C).

■ New Package Dimensions (Unit: mm)

- SSOP020-P-0225C (Lead-free package)



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