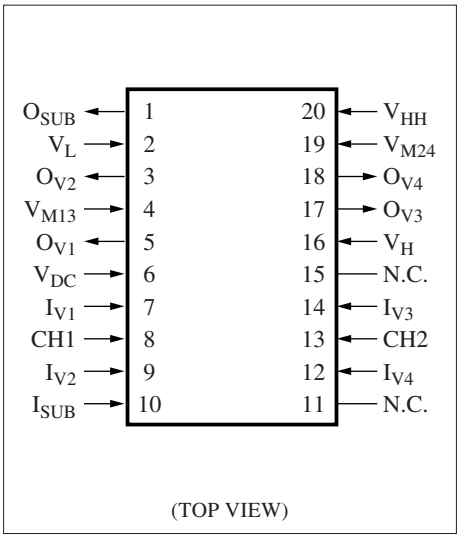
MN31121SA

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.



(TOP VIEW)

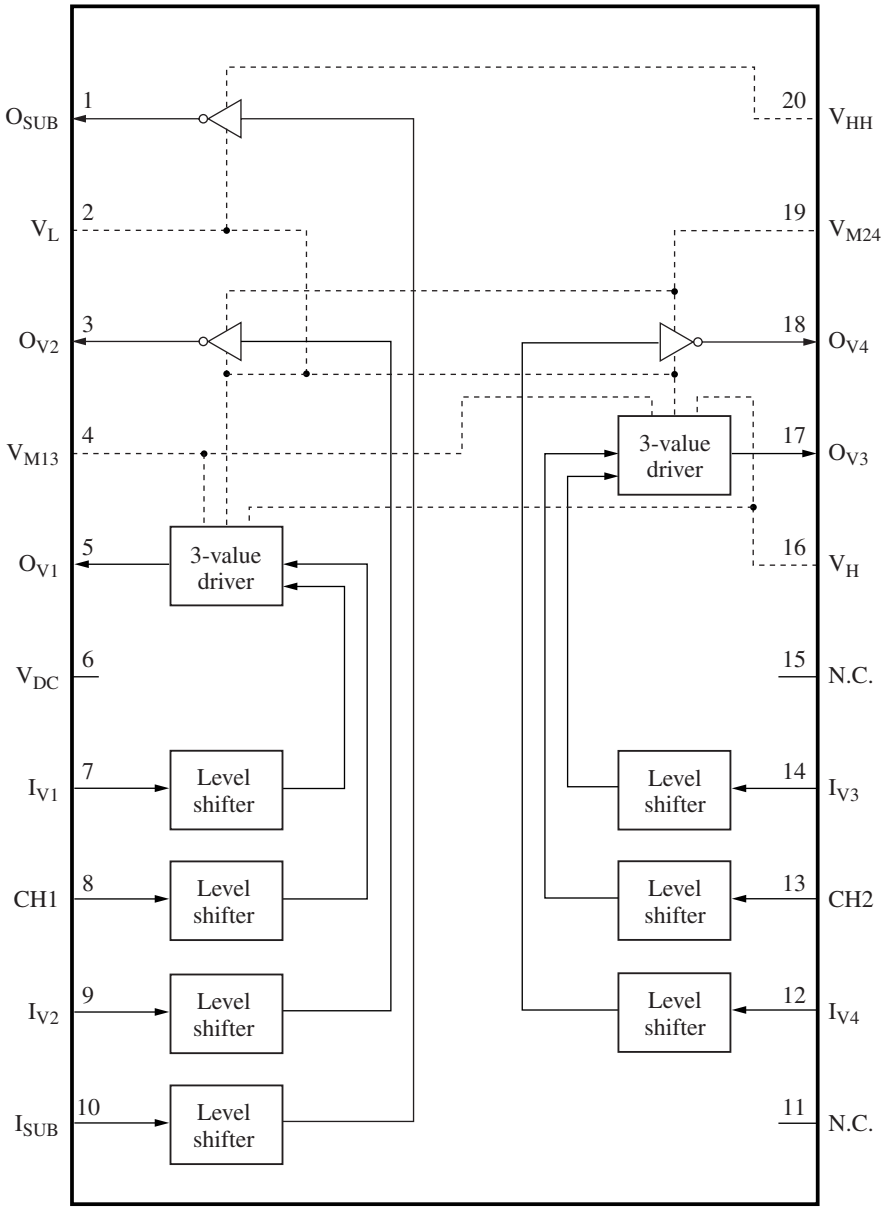
■ Features

- 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}	O	SUB pulse output
2	V_L	I	Low-level power supply
3	O_{V2}	O	2-value transfer pulse output
4	V_{M13}	I	Mid-level power supply
5	O_{V1}	O	3-value transfer pulse output
6	V_{DC}	I	Input block high-level power supply
7	I_{V1}	I	Transfer pulse input
8	CH1	I	Charge pulse input
9	I_{V2}	I	Transfer pulse input
10	I_{SUB}	I	SUB pulse input
11	N.C.	—	Unused
12	I_{V4}	I	Transfer pulse input
13	CH2	I	Charge pulse input
14	I_{V3}	I	Transfer pulse input
15	N.C.	—	Unused
16	V_H	I	High-level power supply of vertical driver block
17	O_{V3}	O	3-value transfer pulse output
18	O_{V4}	O	2-value transfer pulse output
19	V_{M24}	I	Mid-level power supply
20	V_{HH}	I	High-level power supply of SUB driver block

■ Electrical Characteristics

1. Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage 1	V_{HH}-V_L	32	V
Supply voltage 2	V_H-V_L	30	V
Supply voltage 3	V_{M13} , V_{M24}	V_L to 6	V
Supply voltage 4	V_{DC}	0 to 7	V
Negative supply voltage	V_L	−12 to 0	V
Input voltage	V_I	V_L− 0.3 to V_{DC}+0.3	V
Input and output clamp diode currents	I_{IC} , I_{OC}	±10	mA
Maximum DC load current	I_{ODC}	±3	mA
Maximum load capacitance	C_L	5 500	pF/PIN
Power dissipation	P_D	180	mW
Operating temperature	T_{opr}	−10 to +70	°C
Storage temperature	T_{stg}	−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°C to +70°C

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

3. DC Characteristics at V_{HH} = 18.0 V, V_H = 13.0 V, V_{M13} = V_{M24} = 1.0 V, V_L = –7.0 V, V_{DC} = 3.00 V, T_a = –10°C to +70°C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Quiescent supply current	I_{DDST}	V_I = GND, V_{DC} = 2.6 V	—	—	2	mA
		V_I = GND, V_{DC} = 3.0 V	—	—	5	
Operating supply current	I_{DDDYN}	Refer to test conditions (Input pulse timing, output load circuit) V_I = GND, V_{DC}	—	—	7	mA
Input Pins	I_{V1} , I_{V2} , I_{V3} , I_{V4} , CH1, CH2, I_{SUB}					
High-level voltage	V_{IH}	V_{DC} = 2.6 V	1.75	—	V_{DC}	V
Low-level voltage	V_{IL}		0.0	—	0.15	V
High-level voltage	V_{IH}	V_{DC} = 3.0 V	2.5	—	V_{DC}	V
Low-level voltage	V_{IL}		0.0	—	0.3	V
Input leakage current	I_{ILK}	V_I = 0 V to V_{DC}	–1.0	—	+1.0	µA
Output Pins 1 (2-value outputs)	O_{V2} , O_{V4}					
Mid-level output voltage	V_{OM1}	I_{OM1} = –1 mA	0.9	—	V_{M24}	V
Low-level output voltage	V_{OL1}	I_{OL1} = 1 mA	V_L	—	–6.9	V
Output on resistance (mid level)	R_{ONM1}	I_{OM1} = –50 mA	—	—	60	Ω
Output on resistance (low level)	R_{ONL1}	I_{OL1} = 50 mA	—	—	40	Ω
Output Pins 2 (3-value outputs)	O_{V1} , O_{V3}					
High-level output voltage	V_{OH2}	I_{OH2} = –1 mA	12.9	—	V_H	V
Mid-level output voltage	V_{OM2}	I_{OM2} = –1 mA	0.9	—	V_{M13}	V
Low-level output voltage	V_{OL2}	I_{OL2} = 1 mA	V_L	—	–6.9	V
Output on resistance (high level)	R_{ONH2}	I_{OH2} = –50 mA	—	—	70	Ω
Output on resistance (mid level)	R_{ONM2}	I_{OM2} = ±50 mA	—	—	60	Ω
Output on resistance (low level)	R_{ONL2}	I_{OL2} = 50 mA	—	—	60	Ω
Output Pins 3 (SUB outputs)	O_{SUB}					
High-level output voltage	V_{OHH3}	I_{OHH3} = –1 mA	17.9	—	V_{HH}	V
Low-level output voltage	V_{OL3}	I_{OL3} = 1 mA	V_L	—	–6.9	V

■ Electrical Characteristics (continued)

3. DC Characteristics (continued) at V_{HH} = 18.0 V, V_H = 13.0 V, V_{M13} = V_{M24} = 1.0 V, V_L = −7.0 V, V_{DC} = 3.00 V, T_a = −10°C to +70°C

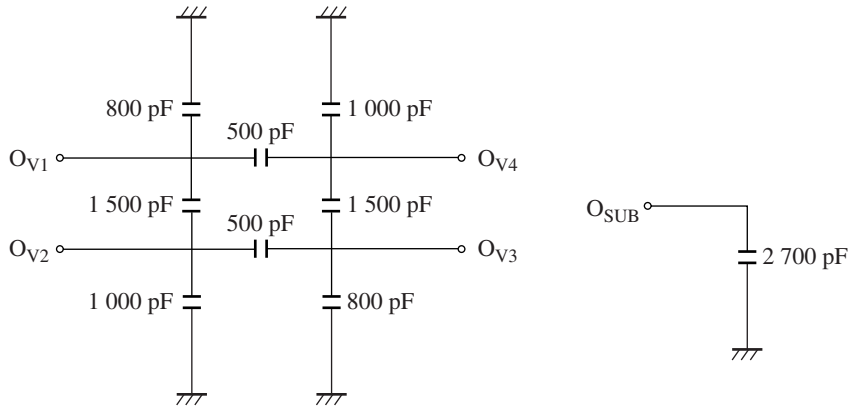
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Pins 3 (SUB outputs) (continued)	O_{SUB}					
Output on resistance (high level)	R_{ONHH3}	I_{ONHH3} = −50 mA	—	—	60	Ω
Output on resistance (low level)	R_{ONL3}	I_{ONL3} = 50 mA	—	—	50	Ω

4. AC Characteristics at V_{HH} = 18.0 V, V_H = 13.0 V, V_{M13} = V_{M24} = 1.0 V, V_L = −7.0 V, V_{DC} = 3.00 V, T_a = −10°C to +70°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

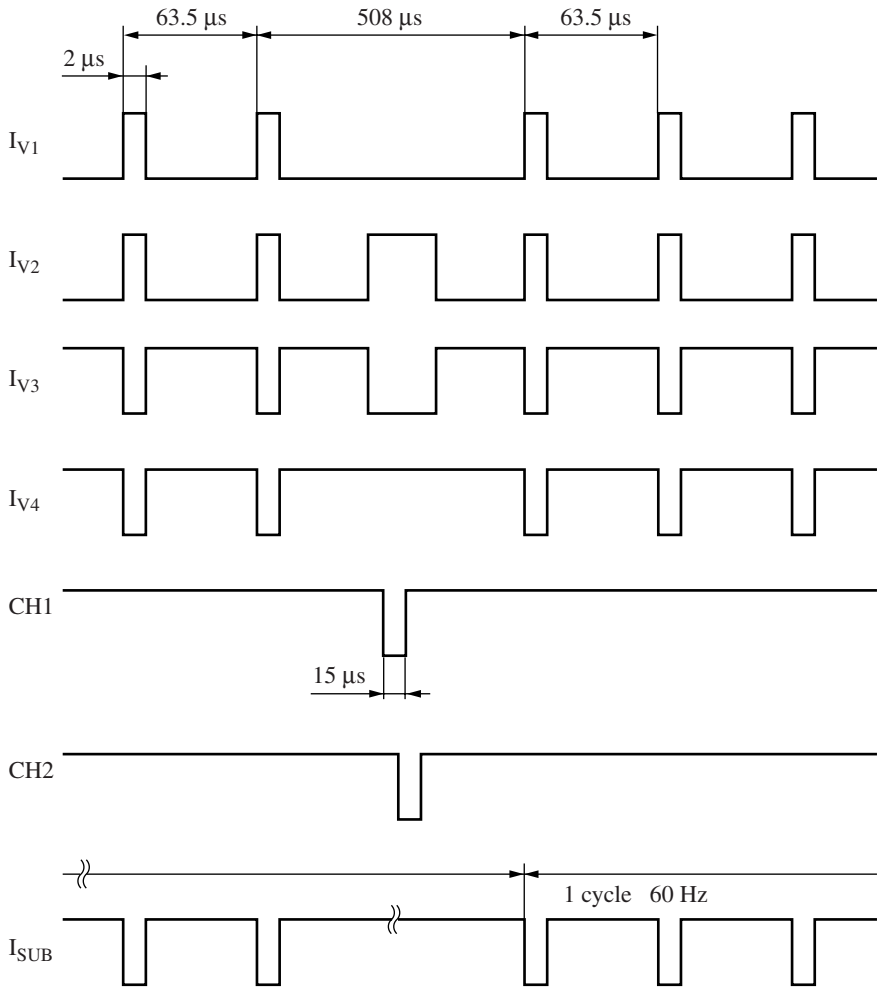
■ Test Conditions

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)

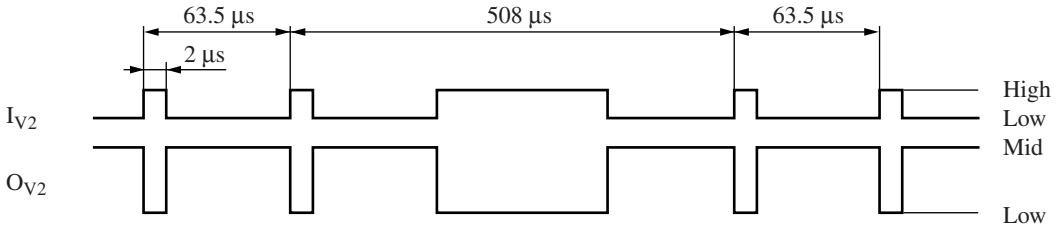
3. Unnecessary Charge Sweep-Out Pulse (SUB driver block)

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

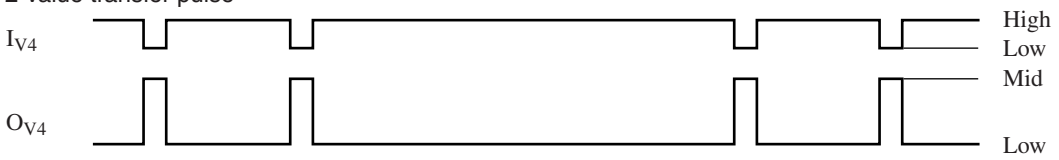
Note) I_{SUB}
High: V_{DC}, Low: Ground
O_{SUB}
High: V_{HH}, Low: V_L

■ Timing Charts

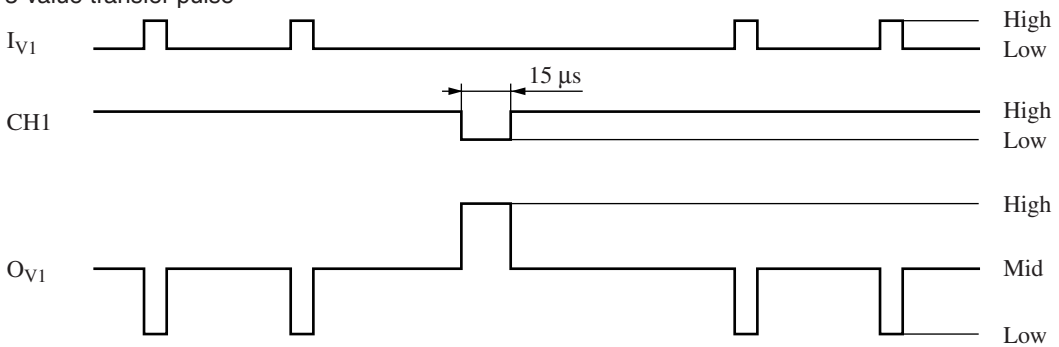
1. 2-value transfer pulse



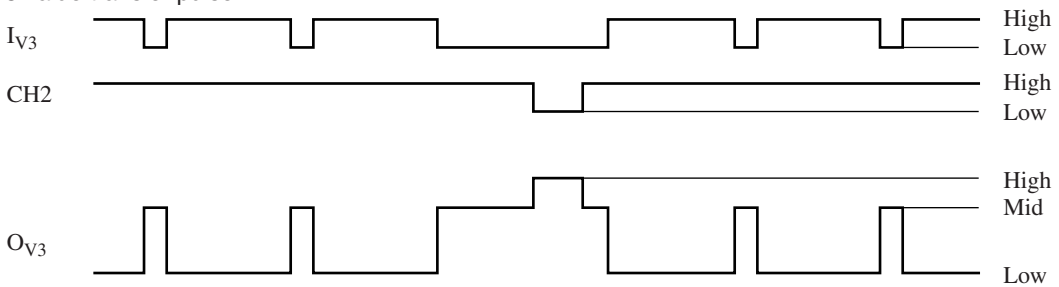
2. 2-value transfer pulse



3. 3-value transfer pulse

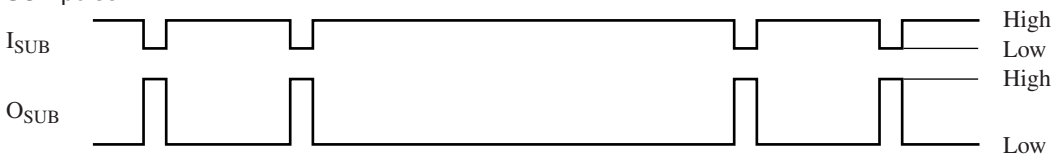


4. 3-value transfer pulse



■ Timing Charts (continued)

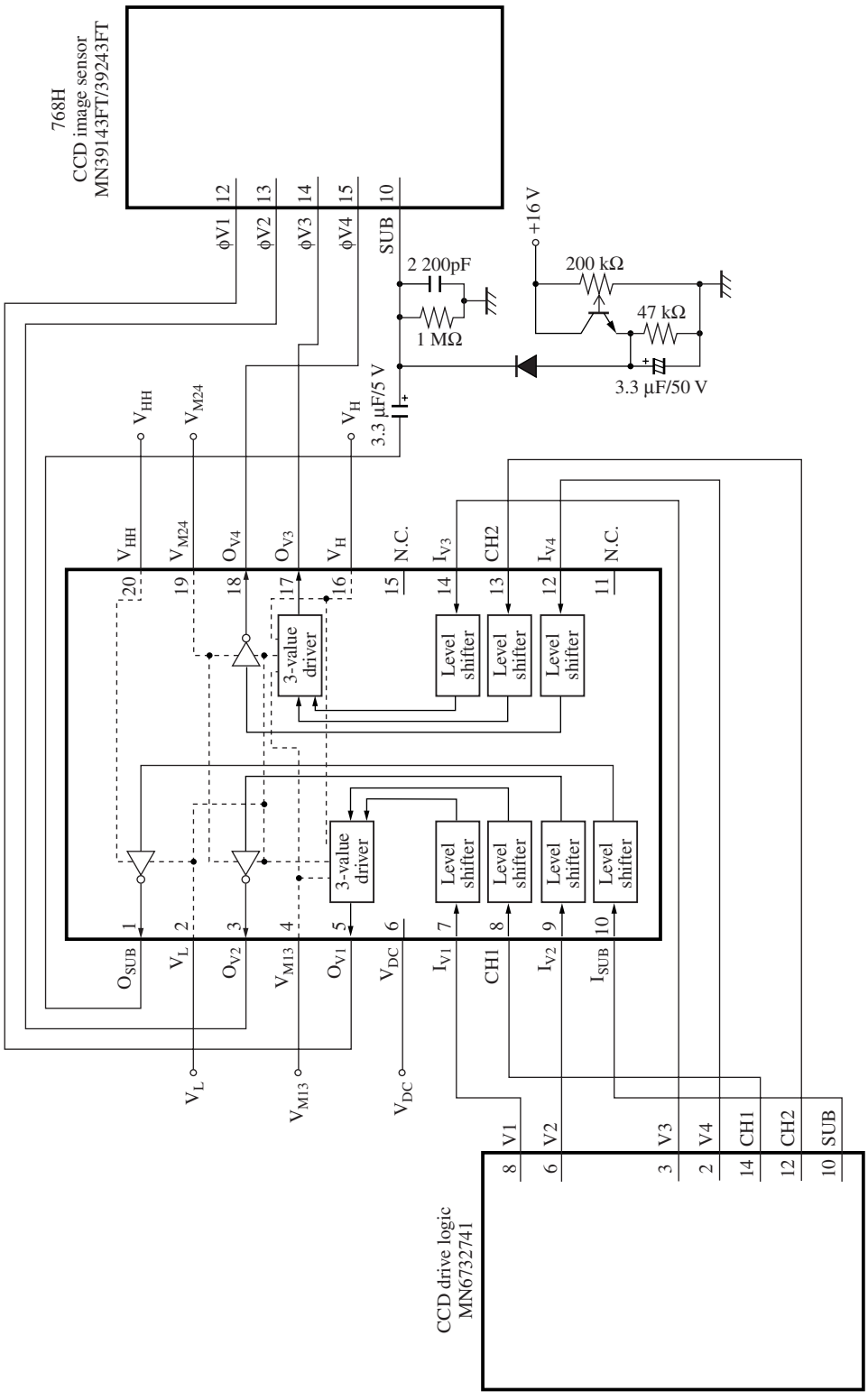
5. SUB pulse



■ 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.

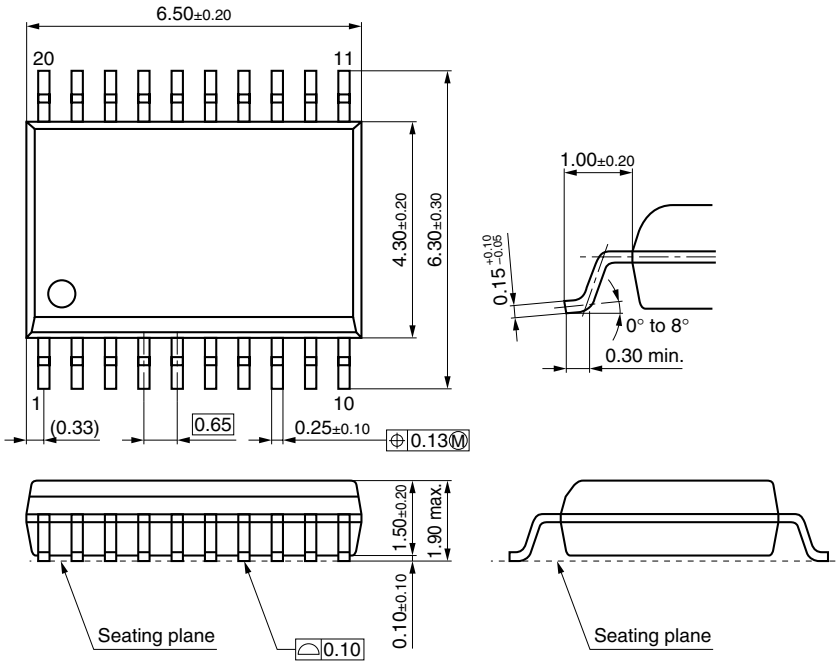
■ Application Circuit Example



Note) Mount the bypass capacitors for the MN31121SA power supply pins (V_{HH}, V_H, V_{M13}, V_{M24}, V_L, and V_{DC}) as close as possible to the pin itself.

■ Package Dimensions (Unit: mm)

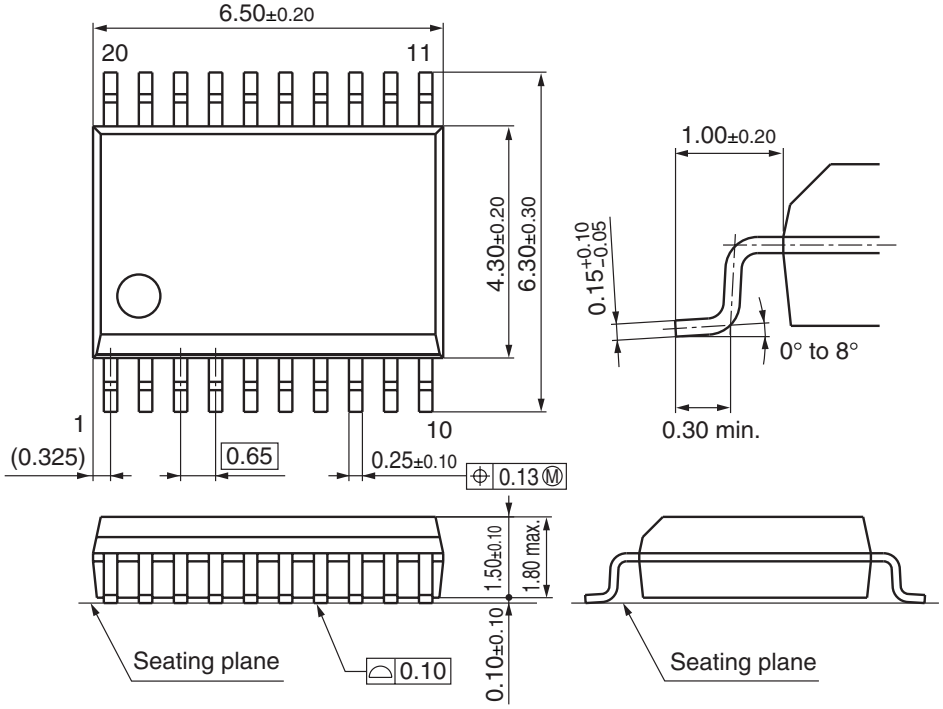
• SSOP020-P-0225



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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