

CCD Vertical ClockDriver

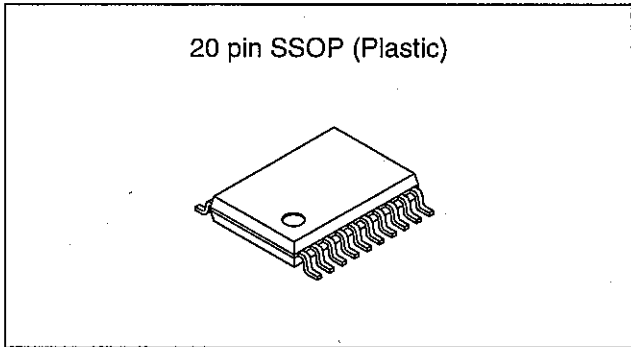
Description

The CXD1267AN is a vertical clock driver for CCD image sensors. This IC is the successor of the CXD1250N with attractive features.

Power consumption is reduced approximately 30% for the CXD1267AN version.

Features

- 1) Substrate voltage (V_{sub}) generator is built-in.
 - Variable V_{sub} in the range of 4.0V to 18.5V.
 - Reduction of peripheral parts saves space.
- 2) Only two power supplies (+15V and -8.5V) are needed.
- 3) 3.3V clock interface is acceptable.
- 4) 20-pin SSOP package is used.
- 5) Low power consumption
 - 90mW (CXD1267N)
 - 62mW (CXD1267AN)
 - approximately 30% reduction



Applications

CCD cameras

Structure

CMOS

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

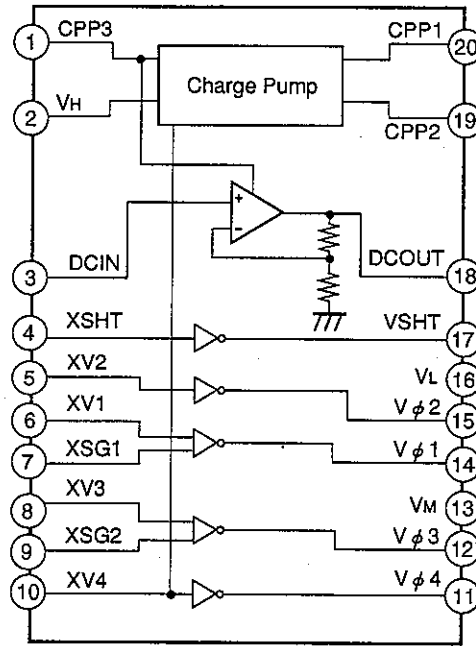
• Supply voltage	V_L	0 to -10	V
• Supply voltage	V_H	$V_L - 0.3$ to $2V_L + 35$	V
• Supply voltage	V_M	$V_L - 0.3$ to 3.0	V
• Input voltage	V_i	$V_L - 0.3$ to $V_H + 0.3$	V
• Output voltage (V_2, V_4)	$MV \phi$	$V_L - 0.3$ to $V_M + 0.3$	V
• Output voltage (V_1, V_3)	$HV \phi$	$V_L - 0.3$ to $V_H + 0.3$	V
• Output voltage (V_{SHT})	$HHV \phi$	$V_L - 0.3$ to $V_H + 0.3$	V
• Operational amplifier output current	I_{bcour}	± 5	mA
• Operating temperature	T_{opr}	-25 to +85	$^\circ\text{C}$
• Storage temperature	T_{stg}	-40 to +125	$^\circ\text{C}$

Recommended Operating Conditions

• Supply voltage	V_H	11.5 to 15.5	V
• Supply voltage	V_M	0	V
• Supply voltage	V_L	-4.5 to -9.0	V
• Input voltage (except for pin 3)	V_i	0 to 6.0	V
• Operational amplifier input voltage	V_{iOP}	1.0 to 4.5	V
• Operating temperature	T_{opr}	-20 to +75	$^\circ\text{C}$

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Block Diagram and Pin Configuration (Top View)



Pin Description

Pin No.	Symbol	I/O	Description
1	CPP3	O	Charge pump
2	VH	—	Power supply (15V)
3	DCIN	I	Operational amplifier input
4	XSHT	I	Output control (VSHT)
5	XV2	I	Output control (Vφ2)
6	XV1	I	Output control (Vφ1)
7	XSG1	I	Output control (Vφ1)
8	XV3	I	Output control (Vφ3)
9	XSG2	I	Output control (Vφ3)
10	XV4	I	Output control (Vφ4)
11	Vφ4	O	High-voltage output (2 levels: VM, VL)
12	Vφ3	O	High-voltage output (3 levels: VH, VM, VL)
13	VM	—	GND
14	Vφ1	O	High-voltage output (3 levels: VH, VM, VL)
15	Vφ2	O	High-voltage output (2 levels: VM, VL)
16	VL	—	Power supply (-8.5V)
17	VSHT	O	High-voltage output (2 levels: VH, VL)
18	DCOUT	O	Operational amplifier output
19	CPP2	—	Charge pump
20	CPP1	—	Charge pump

Truth Table

Input				Output		
XV1, 3	XSG1, 2	XV2, 4	XSHT	V ϕ 1, 3	V ϕ 2, 4	VSHT
L	L	X	X	V _H	X	X
H	L	X	X	Z	X	X
L	H	X	X	V _M	X	X
H	H	X	X	V _L	X	X
X	X	L	X	X	V _M	X
X	X	H	X	X	V _L	X
X	X	X	L	X	X	V _H
X	X	X	H	X	X	V _L

X: Don't care
Z: High impedance

Electrical Characteristics

DC Characteristics

(Unless otherwise specified, Ta = 25°C, V_H = 15V, V_M = GND, V_L = -8.5V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
High level input voltage	V _{IH}		2.3	—	—	V
Low level input voltage	V _{IL}		—	—	1.3	V
High level output voltage	V _{OH}	I _O = -20 μ A	14.9	15.0	—	V
Middle level output voltage	V _{OM1}	I _O = 20 μ A	—	0.0	0.1	V
Middle level output voltage	V _{OM2}	I _O = -20 μ A	-0.1	0.0	—	V
Low level output voltage	V _{OL}	I _O = 20 μ A	—	-8.5	-8.4	V
Charge pump output voltage	V _{CPP3}	-1 \leq I _{CPP3} \leq 0mA I _{DCOUT} = 0mA, Ta = -20 to 75°C V _{IOP} = 4.5V	20	—	—	V
Input current	I _I	V _I = V _L to 5V	-1.0	0.0	1.0	μ A
Operating supply current	I _H	*1	—	1.4	2.0	mA
Operating supply current	I _L	*1	-6.0	-5.0	—	mA
Output current	I _{OL}	V ϕ 1 to 4 = -8.0V	25	—	—	mA
Output current	I _{OM1}	V ϕ 1 to 4 = -0.5V	—	—	-10	mA
Output current	I _{OM2}	V ϕ 1, 3 = 0.5V	9	—	—	mA
Output current	I _{OH}	V ϕ 1, 3 = 14.5V	—	—	-12	mA
Output current	I _{OSL}	VSHT = -8.0V	12	—	—	mA
Output current	I _{OSH}	VSHT = 14.5V	—	—	-7	mA
Operational amplifier gain	G	I _{DCOUT} = -200/+100 μ A	—	x4.40	—	
Gain error	Δ G	Ta = -20 to 75°C*2 I _{DCOUT} = -200/+100 μ A V _{IOP} = 1.0 to 4.5V	-3	—	+3	%

*1 See Measurement Circuit. Shutter speed: 1/10000.

*2 See Operational Amplifier Gain Characteristic.

Note) Current directions: + indicates the direction flowing to IC; - indicates the direction flowing from IC

Switching Characteristics

(V_I = 5V, V_H = 15V, V_M = GND, V_L = -8.5V)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Propagation delay time	T _{PLM}	*1	30	50	75	ns
Propagation delay time	T _{PMH}	*1	30	50	75	ns
Propagation delay time	T _{PLH}	*1	30	50	75	ns
Propagation delay time	T _{PML}	*1	50	80	120	ns
Propagation delay time	T _{PHM}	*1	50	80	120	ns
Propagation delay time	T _{PHL}	*1	50	80	120	ns
Rise time	T _{TLM}	V _L →V _M *1	360	600	900	ns
Rise time	T _{TMH}	V _M →V _H *1	330	550	770	ns
Rise time	T _{TLH}	V _L →V _H *1	30	50	75	ns
Fall time	T _{TML}	V _M →V _L *1	180	300	500	ns
Fall time	T _{THM}	V _H →V _M *1	330	550	770	ns
Fall time	T _{THL}	V _H →V _L *1	24	40	60	ns
Charge pump boosting time	T _c	*2	—	—	10	ms
Output noise voltage	V _{CLH}	*3	—	—	0.5	V
Output noise voltage	V _{CLL}	*3	—	—	0.5	V
Output noise voltage	V _{CMH}	*3	—	—	0.5	V
Output noise voltage	V _{CML}	*3	—	—	0.5	V

*1 See Response of Voltage Pulse. Maximum and minimum values depend on variation of process and temperature, etc. at the mentioned drive voltage.

*2 CP1 = 0.1μF, CP2 = 0.1μF, V_{CPP3} = 20V; boosting time after all power supplies rose.

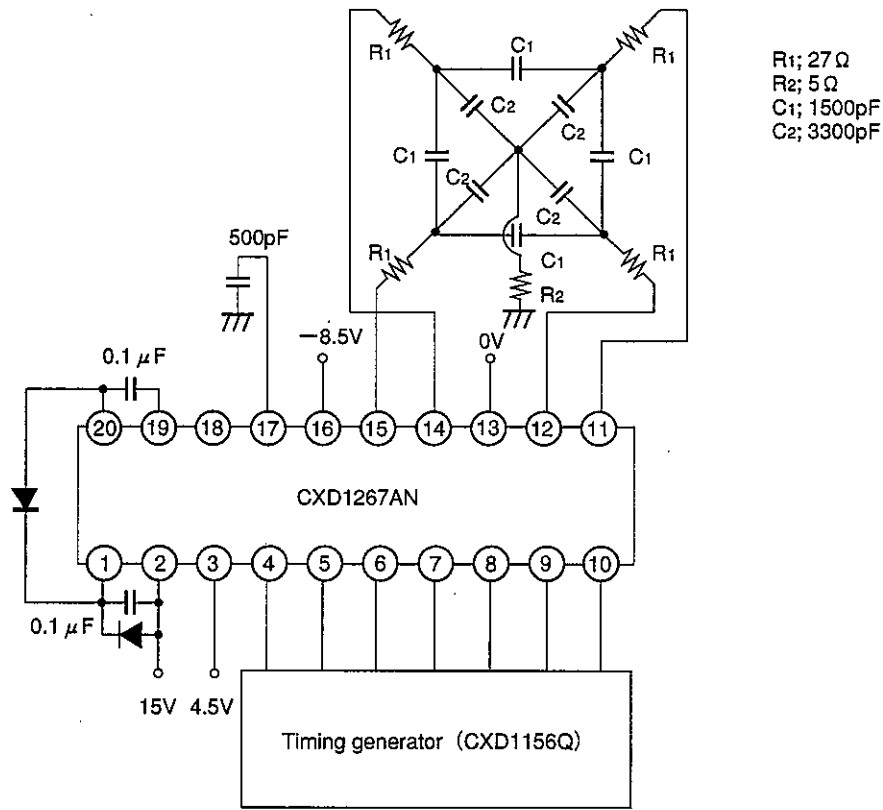
*3 See Noise on a Waveform.

Note) Each item is evaluated by Measurement Circuit.

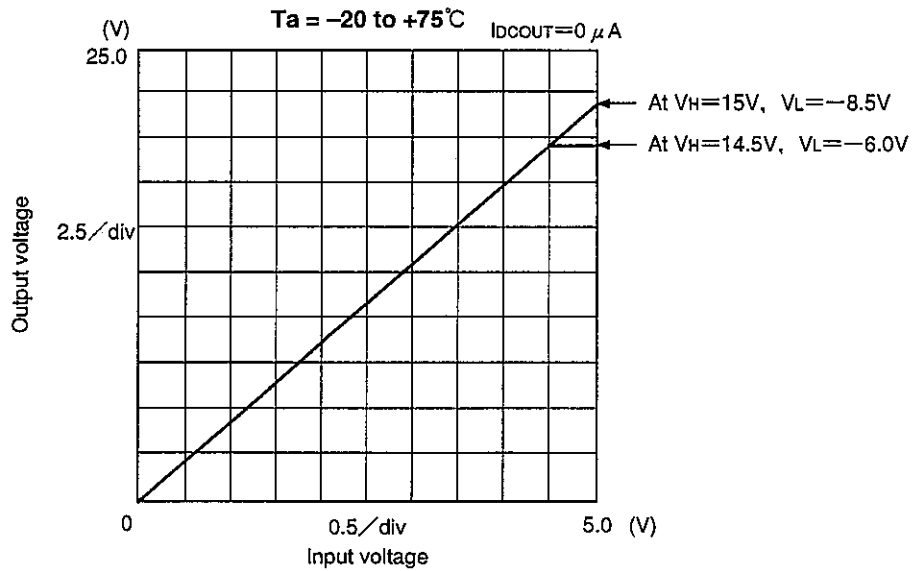
Notes on Operation (See Application Circuit.)

1. Be sure to protect against static electricity because this IC is MOS structure.
2. A bypass capacitor is connected between each power supply (V_H, V_L) and GND.
3. To prevent latch-up, use a capacitor of 0.1μF (CP1, CP2) for charge pump.
Insert a silicon diode (D2) between CPP3 and CPP1.
4. In order to protect CCD image sensor, pre-clamp is requested prior to clamp by DCOUT.

Measurement Circuit



Operational Amplifier Gain Characteristics

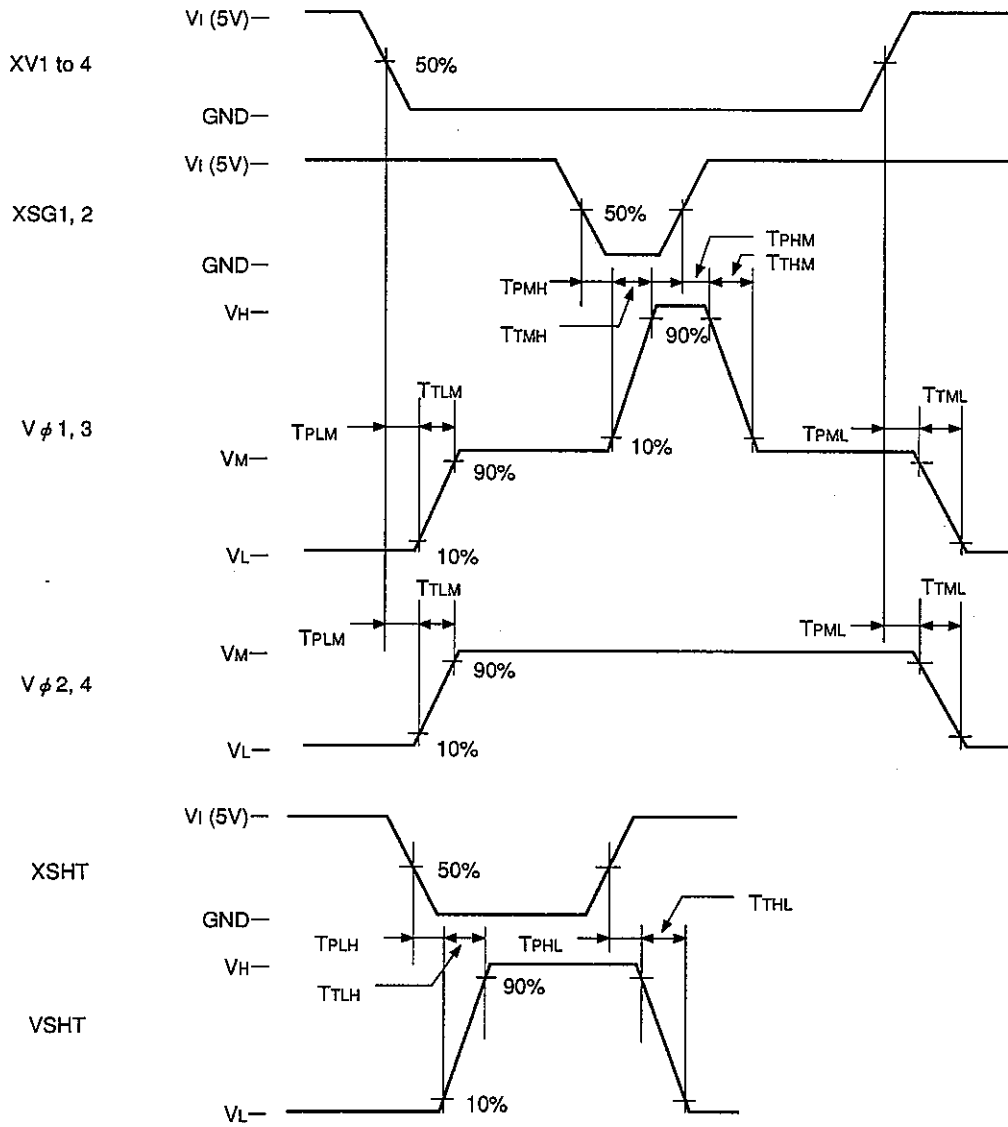


Note) Operating amplifier maximum output voltage is restricted as shown in the formula below depending on supply voltage setting of V_H and V_L .

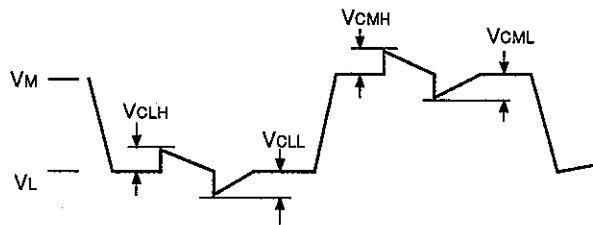
$$\text{Maximum output voltage } V_{DCOUT} (\text{max}) \cong V_H + |V_L| - 0.8V$$

For instance, when $V_H = 14.5V$ and $V_L = -6.0V$, output voltage is saturated at approximately 19.7V as shown above figure.

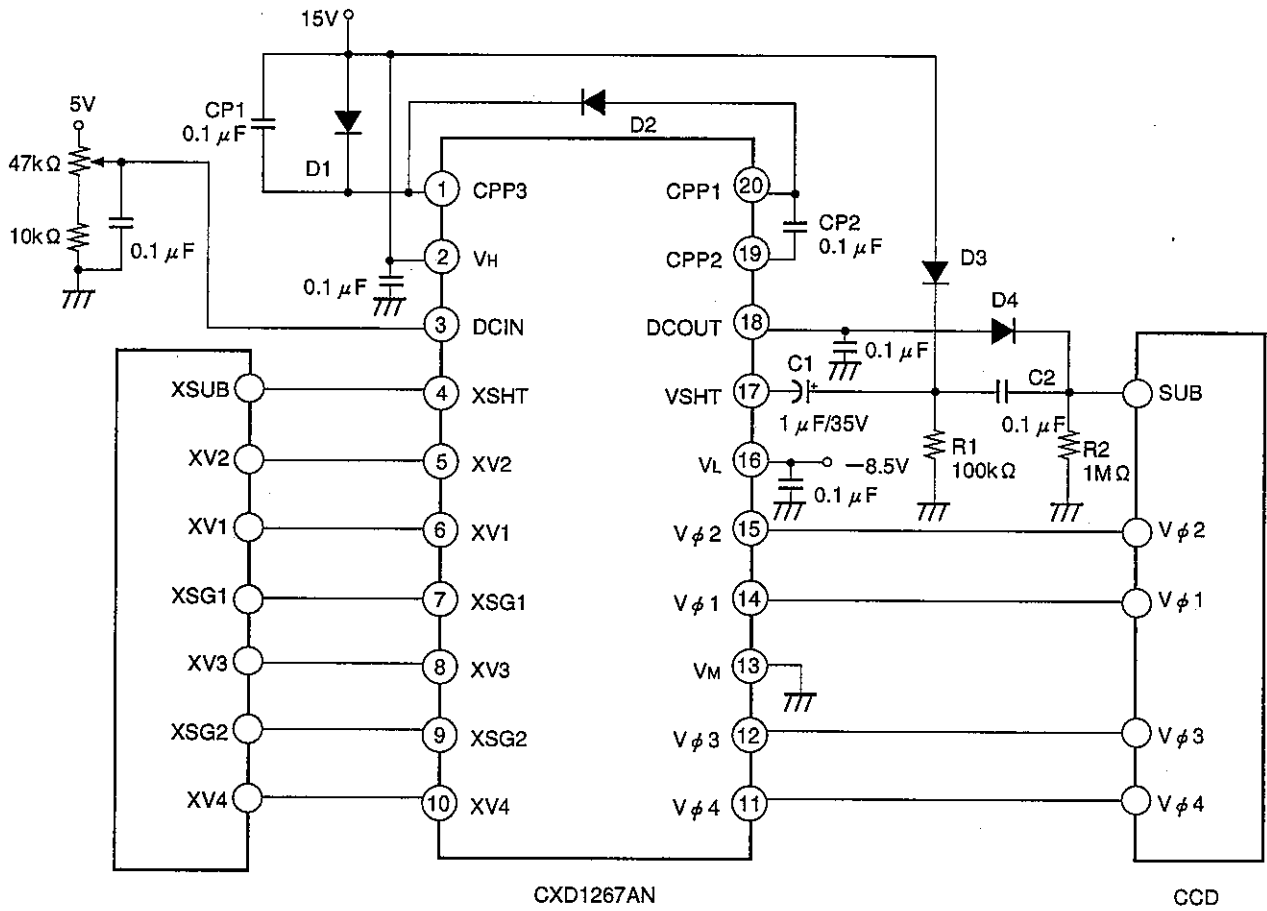
Response of Voltage Pulse



Noise on a Waveform



Application Circuit

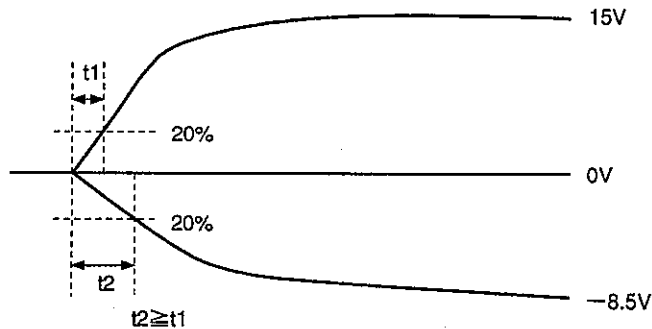


* A peripheral circuit can be simplified by CCD image sensor.

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Note with power-on sequence

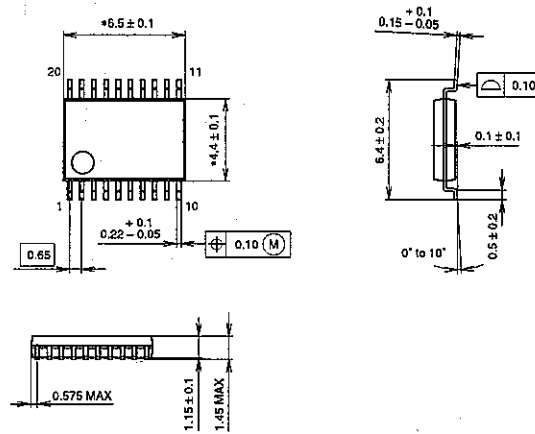
To protect CCD image sensor, rise two power supplies as follows.



Package Outline

Unit : mm

20PIN SSOP (PLASTIC)



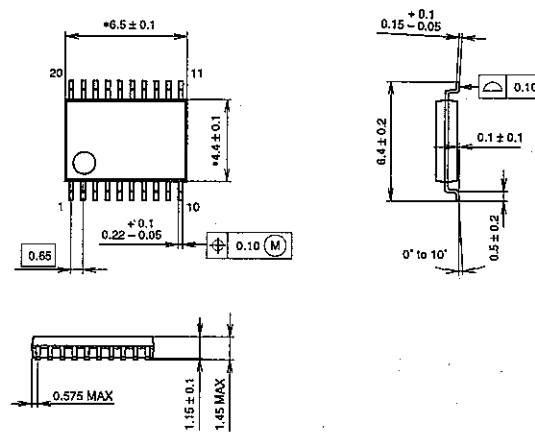
NOTE: Dimension "*" does not include mold protrusion.

PACKAGE STRUCTURE

SONY CODE	SSOP-20P-L071
EIAJ CODE	SSOP020-P-0044
JEDEC CODE	_____

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	COPPER ALLOY
PACKAGE MASS	0.1g

20PIN SSOP (PLASTIC)



NOTE: Dimension "*" does not include mold protrusion.

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LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	COPPER ALLOY
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LEAD PLATING SPECIFICATIONS

ITEM	SPEC.
LEAD MATERIAL	COPPER ALLOY
SOLDER COMPOSITION	Sn-Bi:1-4wt%
PLATING THICKNESS	5-18 μ m