

# OKI electronic components

## OPA256C-1

### Self-Scanning Line Sensor

#### GENERAL DESCRIPTION

The OPA256C-1 is a 256-bit, one-dimensional diode array comprised of PN junction photodetector diodes and CCDs (charge coupled devices). By using a two-phase clock pulse, transfer pulse, and reset pulse, the OPA256C-1 can measure incident light.

#### FEATURES

- CCD for high sensitivity
- CCD transfer efficiency greater than 99.995%
- Photodetector configured of PN junction photodetector diodes for good blue sensitivity and good output uniformity.
- Photodiodes highly integrated with 13  $\mu\text{m}$  pitch for high resolution
- High-speed scanning
- Low-voltage operation
- Internal output amplifier and compensating amplifier

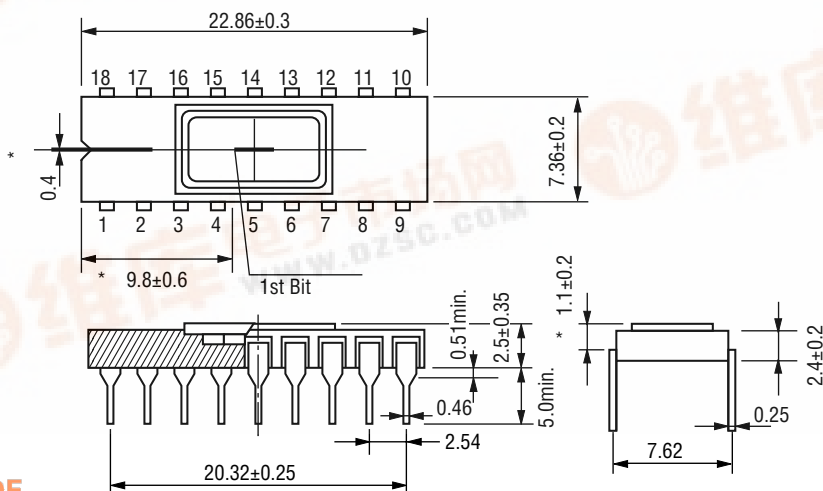
#### APPLICATIONS

- Industrial control
- Pattern recognition
- Control devices
- Object detection

#### PIN CONFIGURATION

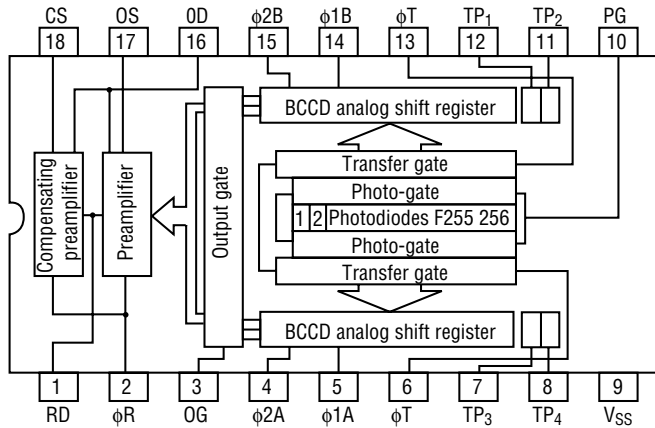
##### • Dimensions

(Unit: mm)



\* : Indicates photodetector location

• Pin Connection Block Diagram



SS

Symbol	Name	Symbol	Name
RD	Reset transistor drain	TP <sub>1</sub>	Test pin (electrical input gate)
φR	Reset transistor gate clock	TP <sub>2</sub>	Test pin (electrical input diode)
OG	Output gate	TP <sub>3</sub>	Test pin (electrical input gate)
φ1A	CCD register clock	TP <sub>4</sub>	Test pin (electrical input diode)
φ1B	CCD register clock	V <sub>SS</sub>	Substrate bias
φ2A	CCD register clock	PG	Photo-gate
φ2B	CCD register clock	OD	Output transistor drain
φT	Phototransfer gate clock	OS	Output transistor source (video output)
		CS	Compensating transistor source (noise output)

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Test Condition	Min.	Max.	Unit
Storage Temperature	T <sub>stg</sub>	, —	-40	+125	°C
Operating Temperature	T <sub>op</sub>	—	-20	+85	°C
Clock Voltage	V <sub>φ</sub>	Ta=25°C	-0.3	+18	V
Applied Voltage	V <sub>DD</sub>		-0.3	+18	V

**ELECTRICAL CHARACTERISTICS**

(Ambient Temperature Ta=25°C)

Parameter		Symbol	Min.	Typ.	Max.	Unit	
Reset Drain Voltage		V <sub>DD</sub>	V <sub>OD</sub>	11.4	12	12.6	V
Output Transistor Drain Voltage			V <sub>RD</sub>	11.4	12	12.6	V
Output Gate Voltage		V <sub>OG</sub>	4.75	5	5.25	V	
Photo Gate Voltage		V <sub>PG</sub>	4.75	5	5.25	V	
Substrate Bias		V <sub>SS</sub>	-1.5	-2.0	-2.5	V	
Electrical Input Diode Voltage (TP <sub>2, 4</sub> )		V <sub>IS</sub>	11.4	12	12.6	V	
Electrical Input Gate Voltage (TP <sub>1, 3</sub> )		V <sub>IG</sub>	-0.1	0	0.2	V	
Clock Pulse Voltage	CCD register	"H"	V <sub>φ<sub>1,2</sub></sub> <sup>AB</sup> H	7	V <sub>DD</sub>	V <sub>DD</sub>	V
		"L"	V <sub>φ<sub>1,2</sub></sub> <sup>AB</sup> L	0	0.4	0.8	V
	Photo-transfer	"H"	V <sub>φ<sub>1,2</sub></sub> <sup>AB</sup>	7	V <sub>DD</sub>	V <sub>DD</sub>	V
		"L"	V <sub>φTL</sub>	0	0.4	0.8	V
	Reset	"H"	V <sub>φRH</sub>	7	V <sub>DD</sub>	V <sub>DD</sub>	V
		"L"	V <sub>φRL</sub>	0	0.4	0.8	V
Video Frequency		f <sub>V</sub>	0.1	—	4	MHz	
Clock Input Capacitance	CCD register	C <sub>φ<sub>1,2</sub></sub> <sup>AB</sup>	—	80	—	pF	
	Photo-transfer	C <sub>φT</sub>	—	10	—	pF	
	Reset	C <sub>φR</sub>	—	4	—	pF	
Power Dissipation		P <sub>D</sub>	—	80	—	mW	
Output Load Resistance		R <sub>L</sub>	—	1	—	kΩ	

**POTOELECTRIC CHARACTERISTICS**

(Ambient Temperature Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Sensitivity	R <sub>W</sub>	—	1500	—	mV/ℓx • sec	*1
Saturation Output Voltage	V <sub>sat</sub>	180	250	—	mV	*2
Output Uniformity < *007* > (Overall)	U	—	—	±7	%	*3
Output DC Level	V <sub>dc</sub>	—	4.0	—	V	—
Dark Output Voltage	V <sub>d</sub>	—	—	4	mV	*4

\*1 2856K tungsten lamp

\*2 V<sub>RD</sub>, V<sub>DD</sub>=12 V, V<sub>SS</sub>=2.0 V, R<sub>L</sub>=1 kΩ

\*3 When it is 50 percent of the saturation output (2856K tungsten lamp.)

However, this excludes the 1st, 2nd, and 256th bits

\*4 Storage time is assumed to be 10 ms.

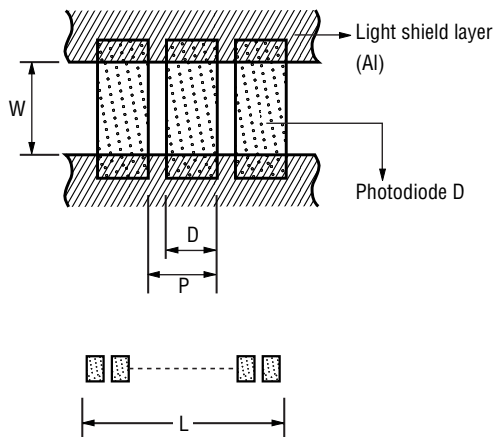
**PIXEL CONFIGURATION**

(Ambient Temperature Ta=25°C)

Parameter	Symbol	Central Value	Accuracy	Unit
Arrangement	—	Straight line	—	—
Number of Pixels	—	256	—	—
Pixels Pitch	P	13	±2.0	μm
Photodiode Width	D	8	±2.0	μm
Aperture Width	W	18	±2.5	μm
Sensor Length	L	3328	±3.0	μm

\* See output timing for information concerning dummy pixels.

**Pixel Configuration Diagram**

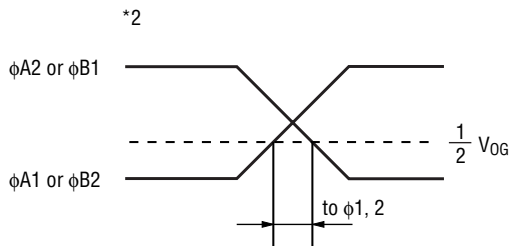
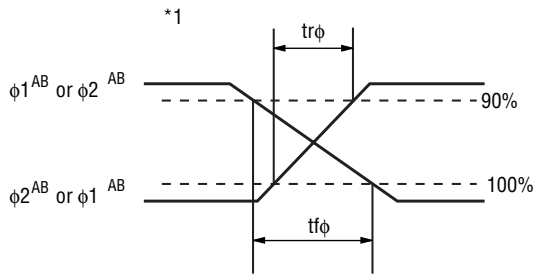


CLOCK INPUT TIMING CHARACTERISTICS

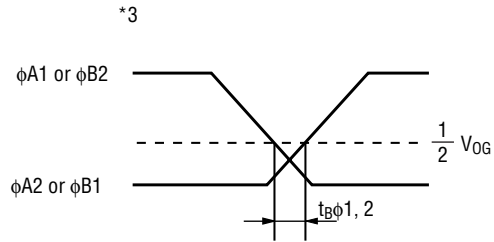
(Ambient Temperature Ta=25°C)

	Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Register	Rise time	$t_{r\phi}$	—	30	100	ns	*1
	Fall time	$t_{f\phi}$	—	20	100	ns	
	Overlap time	$t_{O\phi 1, 2}$	0	20	100	ns	*2
	Blank time	$t_{B\phi 1, 2}$	—	20	100	ns	*3
Phototransfer	Rise time	$t_{r\phi T}$	—	30	100	ns	*4
	Fall time	$t_{f\phi T}$	—	20	100	ns	
	Transfer time duration	$t_{W\phi r}$	5	10	15	$\mu$ s	
	Setup time	$t_{S\phi T}$	0	1	10	$\mu$ s	
	Hold time	$t_{H\phi T}$	0	1	10	$\mu$ s	
Reset	Rise time	$t_{r\phi R}$	—	30	100	ns	*5
	Fall time	$t_{f\phi R}$	—	20	100	ns	
	Duration	$t_{W\phi R}$	80	—	2000	ns	
	Setup time	$t_{S\phi R}$	170	—	2000	ns	
	Hold time	$t_{H\phi R}$	0	—	2000	ns	

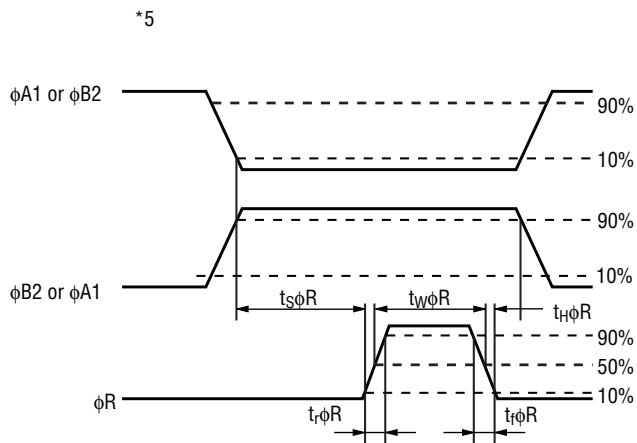
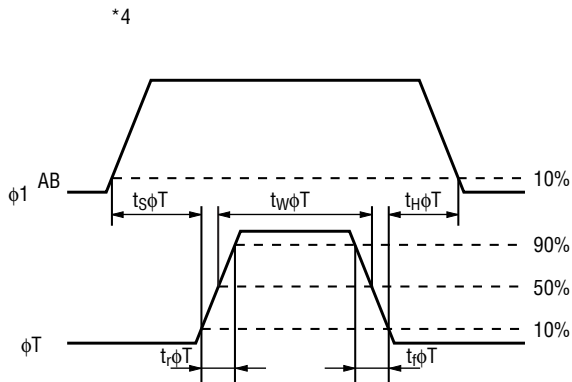
OPA256C-1 Input Timing Diagrams



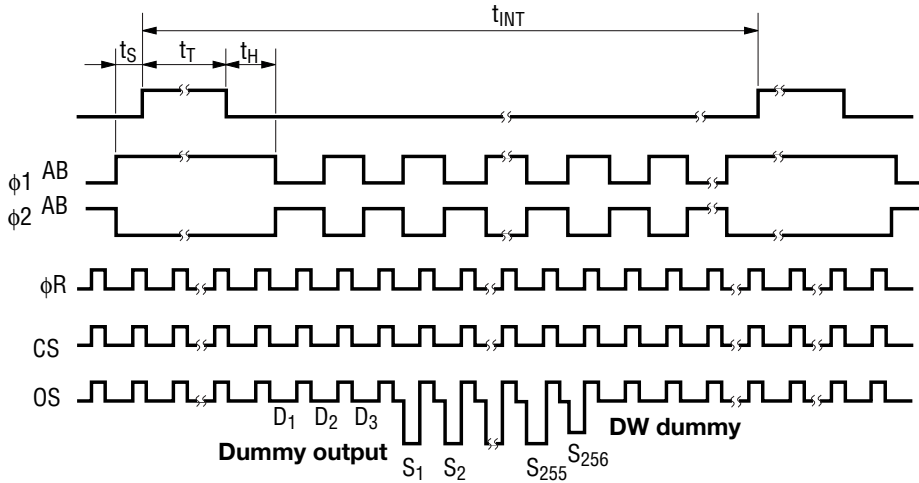
Limited to periods during  $\phi A 1$  rise and  $\phi A 2$  fall, and  $\phi B 2$  rise and  $\phi B 1$  fall.



Limited to periods during  $\phi A2$  rise and  $\phi A1$  fall, and  $\phi B1$  rise and  $\phi B2$  fall.



Input Timing Chart



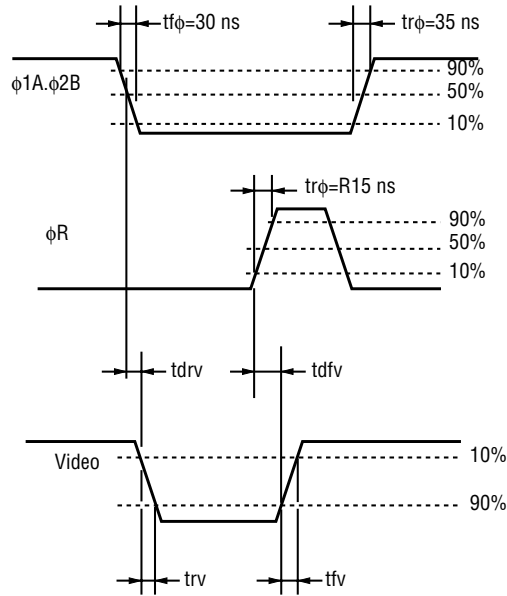
VIDEO OUTPUT TIMING CHARACTERISTICS

(Ambient Temperature  $T_a=25^\circ\text{C}$ )

Parameter	Symbol	Guaranteed Values			Unit	Note
		Min.	Typ.	Max.		
Video Rise Delay Time	tdrv	—	55	—	ns	—
Video Rise Time	trv	—	55	—	ns	—
Video Fall Delay Time	tdfv	—	15	—	ns	—
Video Fall Time	tfv	—	30	—	ns	—

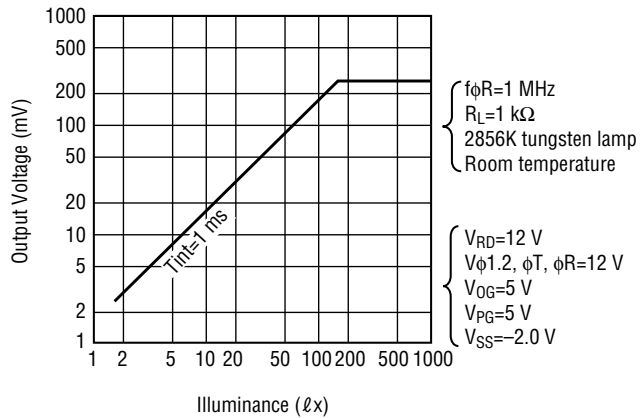
Conditions  $\left\{ \begin{array}{l} V_{DD}=V_{RD}=V_{\phi}=12\text{ V} \\ V_{DG}=V_{PG}=5\text{ V} \\ V_{SS}=-2\text{ V} \end{array} \right. \quad \begin{array}{l} R_L=1\text{ k}\Omega \\ C_L=31\text{ pF} \\ T_a=25^\circ\text{C} \end{array} \quad \begin{array}{l} t_{r\phi}=30\text{ ns} \\ t_{r\phi}=35\text{ ns} \\ t_{r\phi R}=15\text{ ns} \end{array}$

Output Timing Diagrams

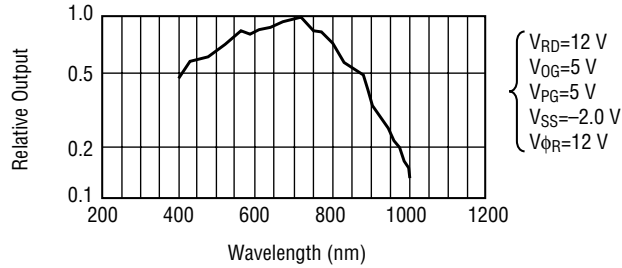


TYPICAL CHARACTERISTICS

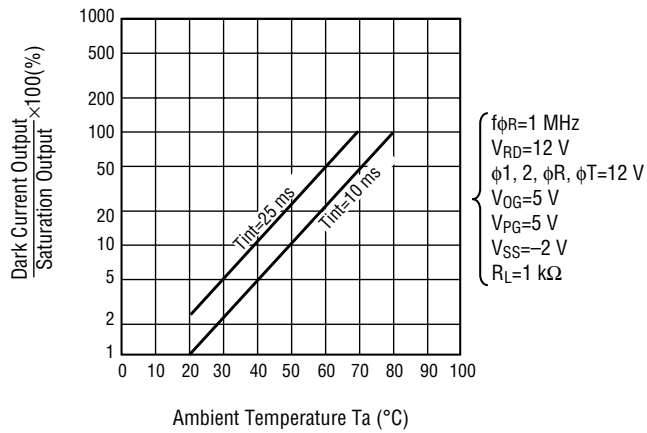
• Illuminance vs. Output Characteristics



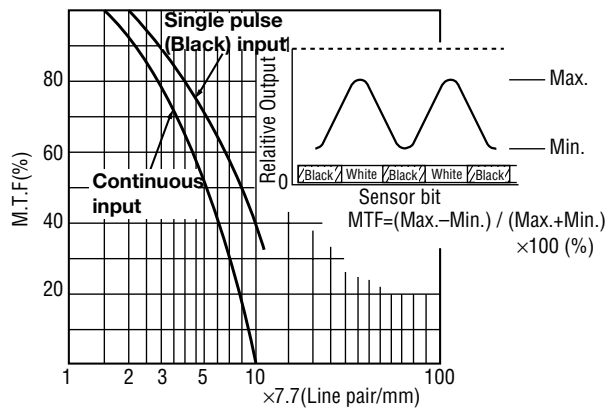
• Spectral Sensitivity Characteristic



• Dark vs. Temperature Characteristics



• M.T.F. Characteristics (White Fluorescent Lamp)



DRIVE CIRCUIT

