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

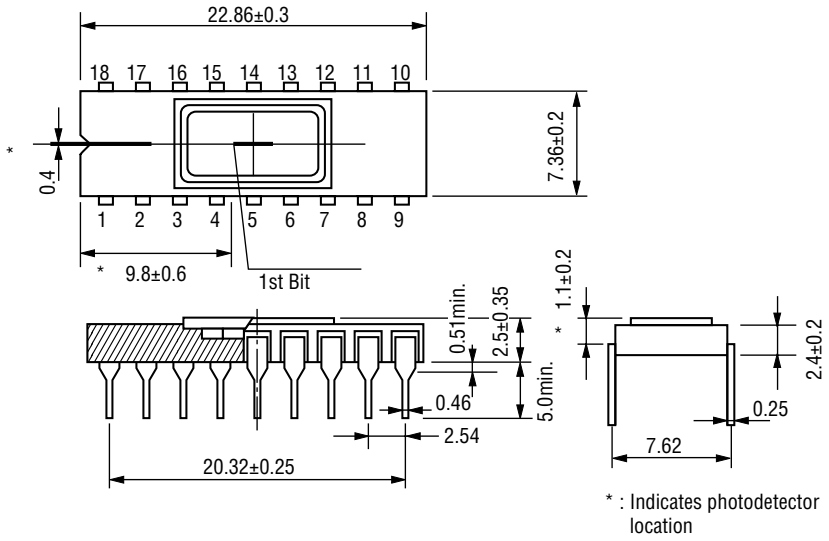
- CCD for high sensitivity
- CCD transfer efficiency greater than 99.995%
- Photodetector configured of PN junction photodetector diodes for good blue sensitivity and good output uniformity.
- Photodiodes highly integrated with 13 µm pitch for high resolution
- High-speed scanning
- Low-voltage operation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

APPLICATIONS

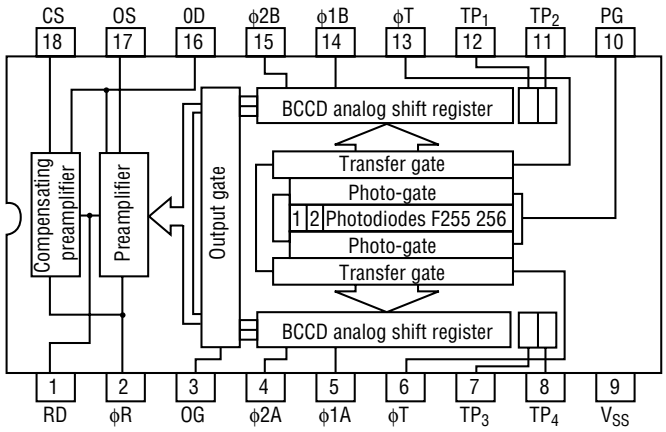
- Industrial control
- Pattern recognition
- Control devices
- Object detection

PIN CONFIGURATION

- **Dimensions** **(Unit: mm)**



- **Pin Connection Block Diagram**



SS

Symbol	Name	Symbol	Name
RD	Reset transistor drain	TP_1	Test pin (electrical input gate)
ϕR	Reset transistor gate clock	TP_2	Test pin (electrical input diode)
OG	Output gate	TP_3	Test pin (electrical input gate)
ϕ1A	CCD register clock	TP_4	Test pin (electrical input diode)
ϕ1B	CCD register clock	V_{SS}	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_{stg}	,—	–40	+125	°C
Operating Temperature	T_{op}	—	–20	+85	°C
Clock Voltage	$V\phi$	Ta=25°C	–0.3	+18	V
Applied Voltage	V_{DD}		–0.3	+18	V

ELECTRICAL CHARACTERISTICS

(Ambient Temperature Ta=25°C)

Parameter			Symbol		Min.	Typ.	Max.	Unit
Reset Drain Voltage			V_{DD}	V_{OD}	11.4	12	12.6	V
Output Transistor Drain Voltage				V_{RD}	11.4	12	12.6	V
Output Gate Voltage			V_{OG}		4.75	5	5.25	V
Photo Gate Voltage			V_{PG}		4.75	5	5.25	V
Substrate Bias			V_{SS}		–1.5	–2.0	–2.5	V
Electrical Input Diode Voltage ($TP_{2,4}$)			V_{IS}		11.4	12	12.6	V
Electrical Input Gate Voltage ($TP_{1,3}$)			V_{IG}		–0.1	0	0.2	V
Clock Pulse Voltage	CCD register	"H"	$V\phi^{AB}_{1,2}H$		7	V_{DD}	V_{DD}	V
		"L"	$V\phi^{AB}_{1,2}L$		0	0.4	0.8	V
	Photo-transfer	"H"	$V\phi^{AB}_{1,2}$		7	V_{DD}	V_{DD}	V
		"L"	$V\phi TL$		0	0.4	0.8	V
	Reset	"H"	$V\phi RH$		7	V_{DD}	V_{DD}	V
		"L"	$V\phi RL$		0	0.4	0.8	V
Video Frequency			f_V		0.1	—	4	MH_Z
Clock Input Capacitance	CCD register		$C\phi^{AB}_{1,2}$		—	80	—	pF
	Photo-transfer		$C\phi_T$		—	10	—	pF
	Reset		$C\phi_R$		—	4	—	pF
Power Dissipation			P_D		—	80	—	mW
Output Load Resistance			R_L		—	1	—	kΩ

POTOELECTRIC CHARACTERISTICS

(Ambient Temperature Ta=25°C)

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

*1 2856K tungsten lamp

*2 V_{RD}, V_{DD}=12 V, V_{SS}=2.0 V, R_L=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.

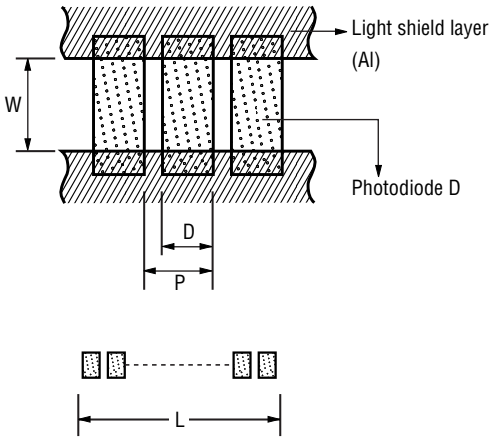
PIXEL CONFIGURATION

(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.

Pixcel Configration Diagram

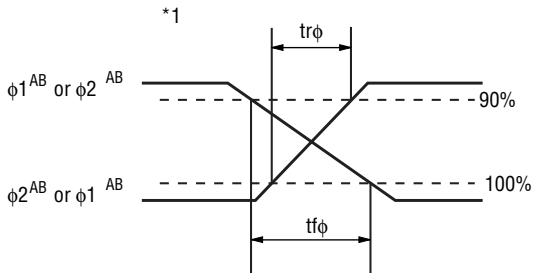


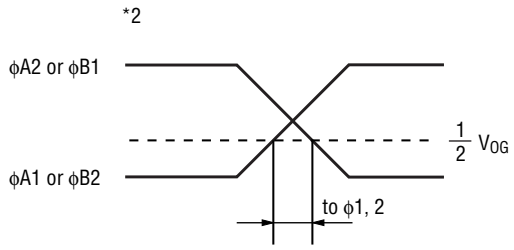
CLOCK INPUT TIMING CHARACTERISTICS

(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	µs	
	Setup time	$t_S\phi T$	0	1	10	µs	
	Hold time	$t_H\phi T$	0	1	10	µs	
Reset	Rise time	$t_r\phi R$	—	30	100	ns	*5
	Fall time	$t_r\phi R$	—	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	

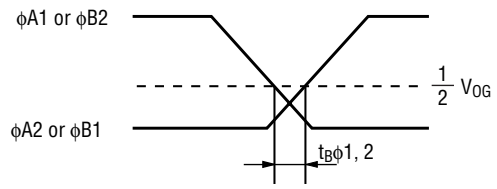
OPA256C–1 Input Timing Diagrams





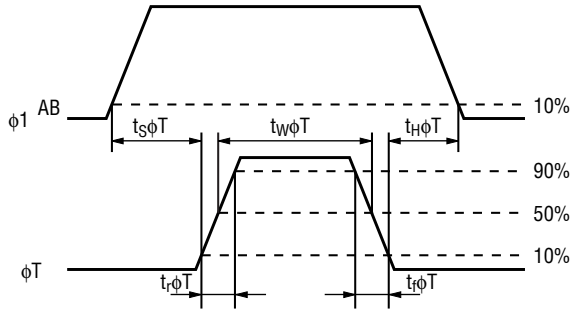
Limited to periods during ϕA1 rise and ϕA2 fall, and ϕB2 rise and ϕB1 fall.

*3

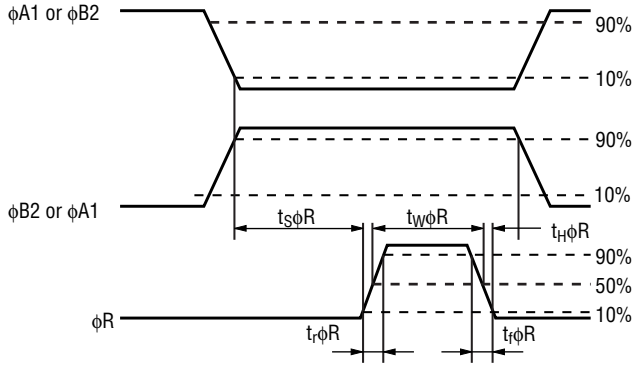


Limited to periods during ϕA2 rise and ϕA1 fall, and ϕB1 rise and ϕB2 fall.

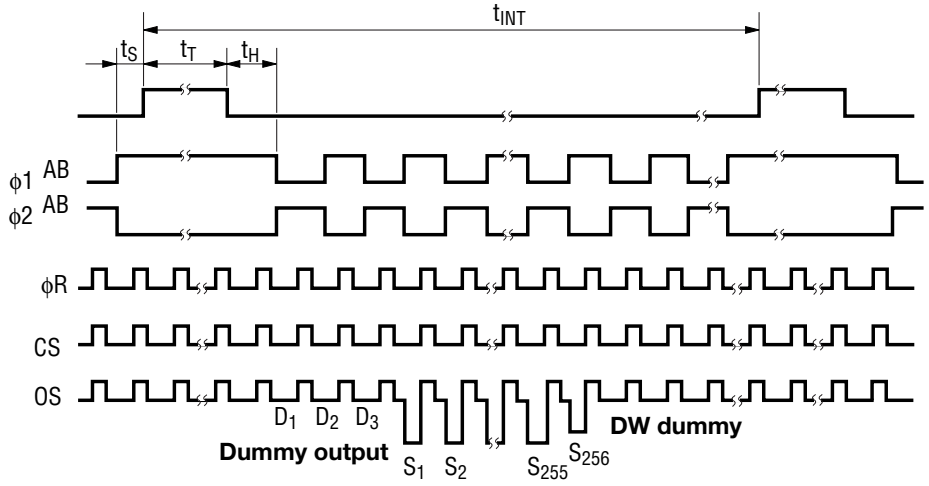
*4



*5



Input Timing Chart



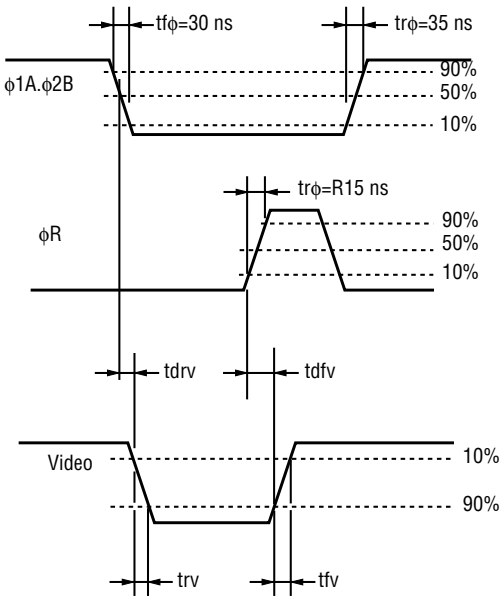
VIDEO OUTPUT TIMING CHARACTERISTICS

(Ambient Temperature Ta=25°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	—

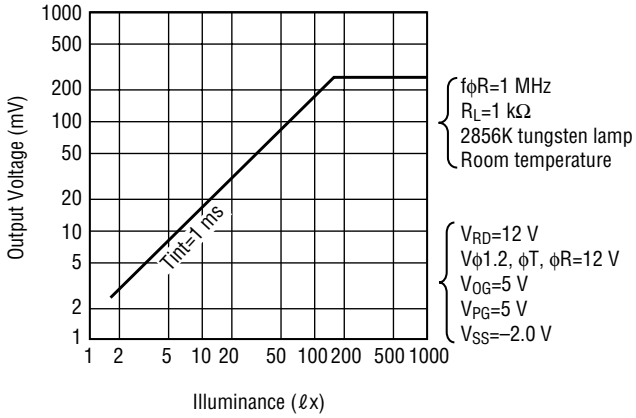
Conditions: $V_{DD}=V_{RD}=V\phi=12$ V; $V_{DG}=V_{PG}=5$ V; $V_{SS}=-2$ V; $R_L=1$ kΩ; $C_L=31$ pF; Ta=25°C; $t_f\phi=30$ ns; $t_r\phi=35$ ns; $t_r\phi R=15$ ns

Output Timing Diagrams

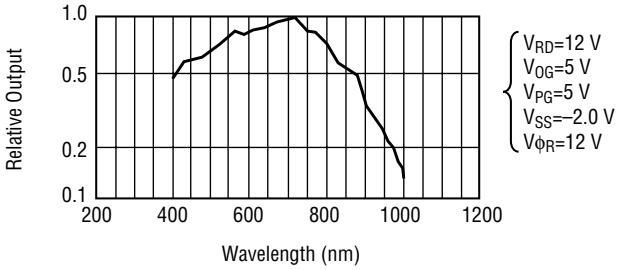


TYPICAL CHARACTERISTICS

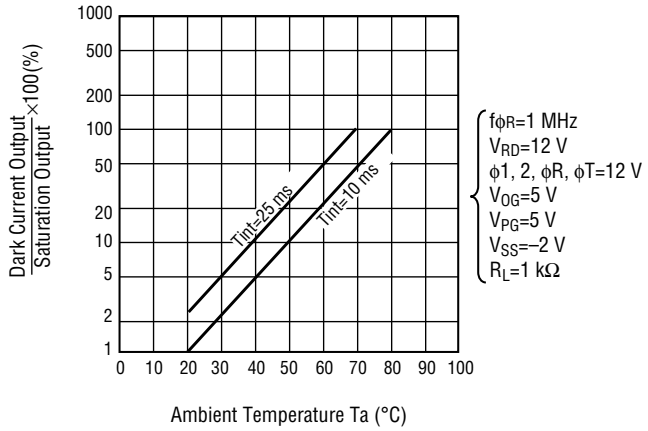
- **Iluminance vs. Output Characteristics**



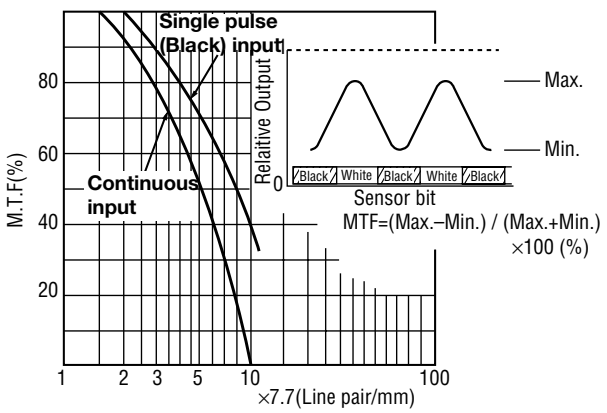
- **Spectral Sensitivity Characteristic**



- **Dark vs. Temperature Characteristics**



- **M.T.F. Characteristics (White Fluorescent Lamp)**



DRIVE CIRCUIT