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LV0229XA

Monolithic Linear IC

Front Monitor OE-IC for Optical Pickups

Overview

The LV0229XA is a front monitor optoelectronic IC for optical pickups that has a built-in photo diode compatible with three waveforms. LV0229XA is small size and type CSP packages.

Functions

- Pin photodiode compatible with three wavelengths incorporated.
- Gain adjustment (-5dB to +5dB in 256 steps) through serial communication.
- Amplifier to amplify differential output.

Features

- Photodiode compatible with three wavelengths incorporated, high-speed process employed.
- Compact, thin CSP package employed.
- Use AR coated glass for three-wavelength (One side).

Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC}		6	V
Allowable power dissipation	P_d	substrate *1, $T_a = 75^\circ\text{C}$	105	mW
Operating temperature	T_{opr}		-20 to +75	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +100	$^\circ\text{C}$

*1: Glass epoxy both-side substrate 55mm × 45mm × 1mm, Copper foil area (head: about 85% tail: about 70%)

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Operating supply voltage	V _{CC}		4.5	5	5.5	V
Output load capacitance	C _o		12	20	33	pF
Output load resistance	Z _o		3			kΩ

Electrical and Optical Characteristics at Ta = 25°C, V_{CC} = 5V, R_L = 6kΩ, C_L = 20pF

Parameter	Symbol	Conditions	IV Gain	Ratings			Unit	
				min	typ	max		
Current dissipation	I _{CC}			9	14	19	mA	
Sleep current	I _{slp}				0.2	0.5	mA	
Output voltage when shielded	V _c	At shielding		1.85	2	2.15	V	
Output offset voltage	V _{ofs}	At shielding, voltage between VOP-VON		-30	0	30	mV	
Temperature dependence of offset voltage *1	V _{ofs}	Ta = -10 to +75°C		-60	0	60	μV/°C	
Optical output voltage *1 Voltage between VOP-VON	VLC	λ = 780nm, G = 0dB	Low	1.93	2.41	2.90	mV/μW	
	VH1C		Middle	4.58	5.73	6.87		
	VH2C		High	10.86	13.58	16.29		
	VLD	λ = 650nm, G = 0dB	Low	2.03	2.54	3.05		
	VH1D		Middle	4.82	6.02	7.23		
	VH2D		High	11.42	14.28	17.13		
	VLB	λ = 405nm, G = 0dB	Low	1.27	1.59	1.90		
	VH1B		Middle	3.01	3.76	4.52		
VH2B	High		7.14	8.92	10.71			
Light output voltage adjustment range *1	G	G = 0dB reference, absolute value of adjustment width		4.5	5	5.5	dB	
Output saturation voltage *1	V _{oD}	Voltage between VOP-VON		2000			mV	
Frequency characteristics *1, *2	FcC	-3dB (1MHz reference), λ = 780nm Light input = 40μW (DC) + 20μW (AC)		40	60		MHz	
	FcD1	-3dB (1MHz reference), λ = 650nm Light input = 40μW (DC) + 20μW (AC)	Low Middle	60	85			
	FcD2	-3dB (1MHz reference), λ = 650nm Light input = 40μW (DC) + 20μW (AC)	High	50	70			
	FcB1	-3dB (1MHz reference), λ = 405nm Light input = 40μW (DC) + 20μW (AC)	Low Middle	60	85			
	FcB2	-3dB (1MHz reference), λ = 405nm Light input = 40μW (DC) + 20μW (AC)	High	50	70			
Settling time *1	T _{set}				10	15	ns	
Response time *1	T _r , T _f	V _o = 0.9Vp-p, output level 10 to 90% f _c = 10MHz, duty = 50%				4	10	ns
Linearity *1	Lin	At output voltage 0.5V and 1.0V (Between VOP-VON)		-1	0	1	%	
Light-output voltage temperature dependence Voltage between VOP-VON *1, *3	TC	λ = 780nm, 25°C reference		4	7	10	%	
	TD	λ = 650nm, 25°C reference		-3	0	3	%	
	TB	λ = 405nm, 25°C reference		-4	-1	2	%	

Item with *1 mark indicate the design reference value.

Item with *2 mark indicate the frequency characteristics when VOP and VON are applied individually.

The frequency characteristics are for the output voltage adjustment range is -5 to +5dB.

Item with *3 mark indicates the temperature dependence for the case of High / Middle / Low gain and for the case when the temperature is 25 to 75°C for the output voltage adjustment range of -5 to +5dB.

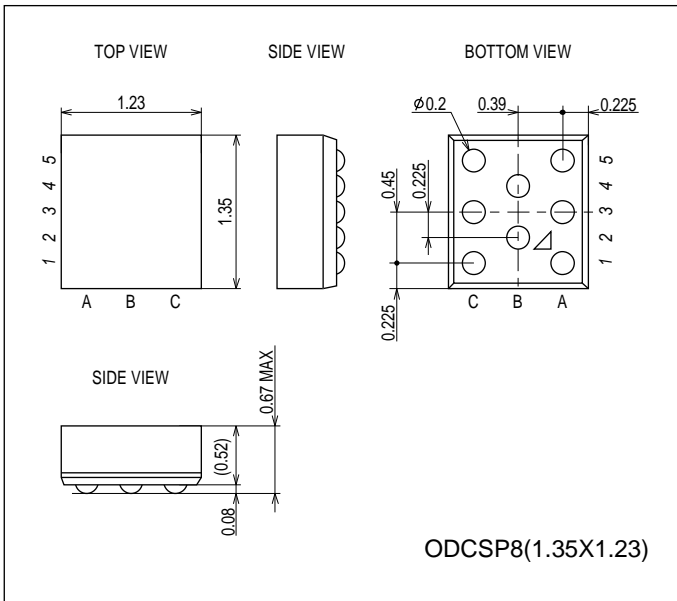
[Expression of output voltage]

$$V_n = (\text{sensitivity} / 1.78) \times 5221 / (5221 - 14 \times \text{GCAstep}) \times \text{light intensity } (\mu\text{W})$$

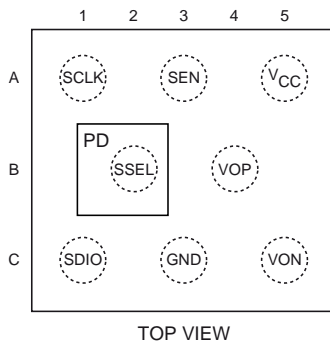
Package Dimensions

unit : mm (typ)

3446

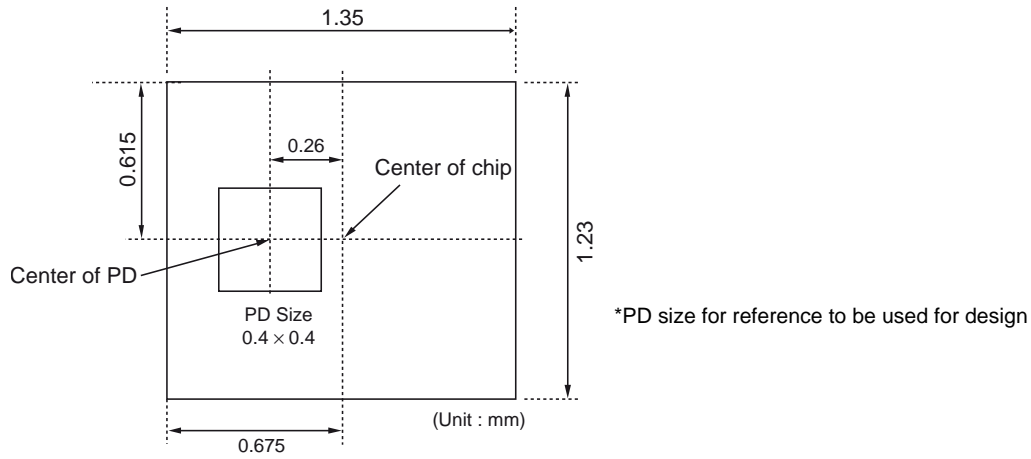


Pin Assignment

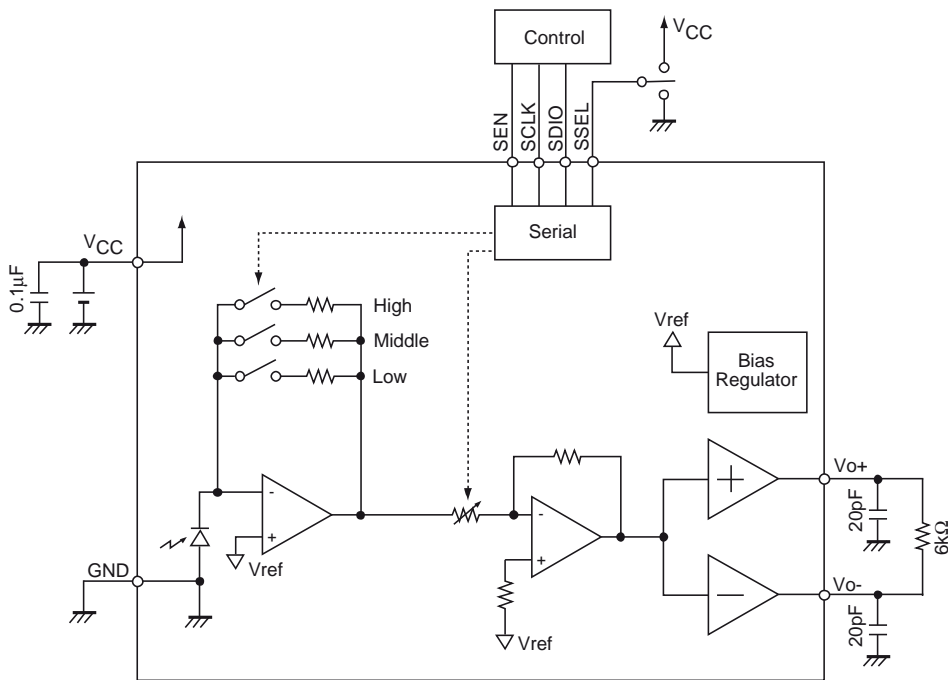


Pin No.	Pin name	Function
A1	SCLK	Serial communication Clock pin
A3	SEN	Serial communication Enable pin
A5	VCC	Power supply voltage pin
B2	SSEL	Register selection pin
		SSEL = Low : Address 00 to 0Fh used
		SSEL = High : Address 10 to 1Fh used
	SSEL = Open : Address 70 to 7Fh used	
B4	VOP	Positive side output pin
C1	SDIO	Serial communication Data pin
C3	GND	GND pin
C5	VON	Negative side output pin

PD assignment



Block diagram and Test circuit diagram



* Please place decoupling capacitors within 3mm from pin

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Resister table

Enable selection of the register group from the SSEL pin.

SSEL = Low

	Address	7	6	5	4	3	2	1	0
Name	00h	POWER		IV GAIN SEL					
Default		00		00		0	0	0	0
Value		11: Power on 00/01/10: Sleep		00/01: High 10: Middle 11: Low					
Name	01h	GAIN							
Default		1	1	1	1	1	1	1	1
Value		00000000 to 11111111							
Name	0Eh	TEST1 (*1)							

SSEL = High

	Address	7	6	5	4	3	2	1	0
Name	10h	POWER		IV GAIN SEL					
Default		00		00		0	0	0	0
Value		11: Power on 00/01/10: Sleep		00/01: High 10: Middle 11: Low					
Name	11h	GAIN							
Default		1	1	1	1	1	1	1	1
Value		00000000 to 11111111							
Name	1Eh	TEST1 (*1)							

SSEL = Open

	Address	7	6	5	4	3	2	1	0
Name	70h	POWER		IV GAIN SEL					
Default		00		00		0	0	0	0
Value		11: Power on 00/01/10: Sleep		00/01: High 10: Middle 11: Low					
Name	71h	GAIN							
Default		1	1	1	1	1	1	1	1
Value		00000000 to 11111111							
Name	7Eh	TEST1 (*1)							

*1 TEST1 are either the time when power is applied or "00000000" is set. Do not attempt to change "00000000" during operation.

"00000000" is returned when reading is made.

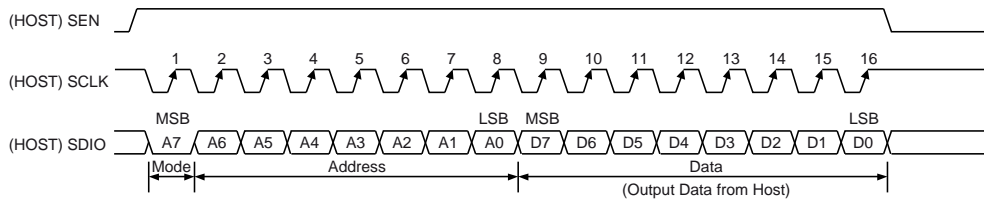
*2 No problem in terms of operation occurs even when writing is made to the address 02h to 0Dh & 0Fh, 12h to 1Dh & 1Fh and 72h to 7Dh & 7Fh.

"00000000" is returned when this address is read.

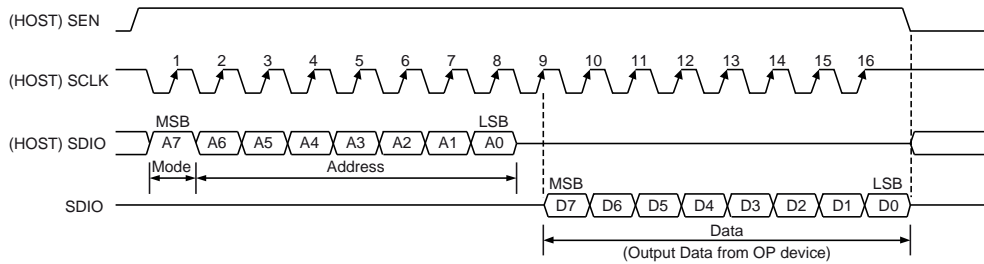
*3 When I performed address reading except the register group set by an SSEL terminal, I keep Hi-Z without paying a value.

Serial protocol

WRITE timing chart



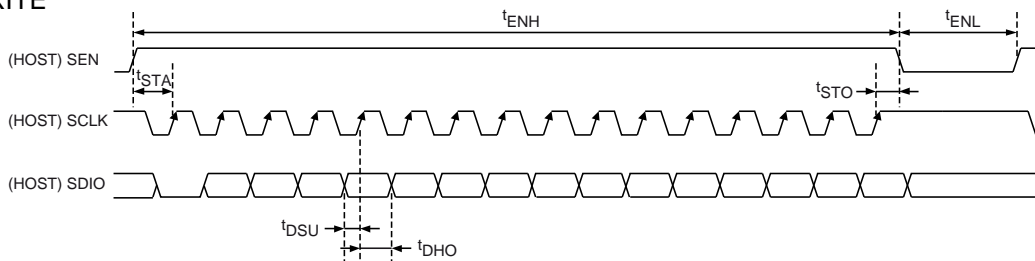
READ timing chart



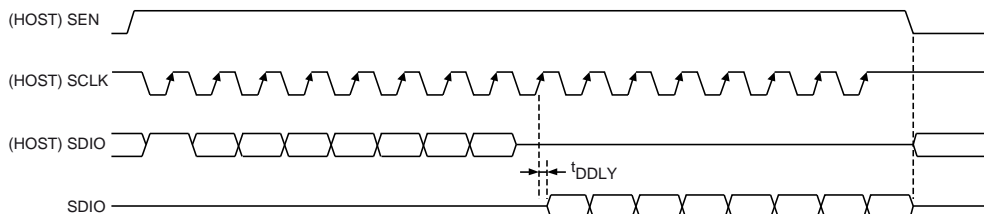
SDIO pin load / $C_L = 20\text{pF}$. The table below shows the design reference value.

Parameter	Symbol	Min.	Typ.	Max.	Unit
SCL clock frequency Write	f _{SCL}	0		10	MHz
SCL clock frequency Read	f _{SCL}	0		4	MHz
SDIO data setup time	t _{DSU}	50			ns
SDIO data hold time	t _{DHO}	50			ns
SDIO output delay	t _{DDL}		10	80	ns
SEN "H" period	t _{ENH}	1.6			μs
SEN "L" period	t _{ENL}	200			ns
SCL rise time after SEN rise	t _{STA}	60			ns
SEN fall time after final SCL rise	t _{STO}	100			ns
Serial input "H" voltage	V _{IH}	2.4		V _{CC}	V
Serial input "L" voltage	V _{IL}			0.6	V
SDIO output "H" voltage	V _{OH}	2.5	2.9	3.3	V
SDIO output "L" voltage	V _{OL}	0	0.3	0.8	V

WRITE



READ



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Pin	Type	Equivalent circuit diagram
SDIO	Input Output	
VOP VON	Output	
SCLK SEN	Input	
SSEL	Input	

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