IS1650

OPIC Light Detector for DVD Player (X4 to X6 Speed)

■ Features

1. OPIC light detector with built-in RF amplifier
   (Integrates 8-division PIN photodiode and Amp. IC onto a single chip)
2. High speed response
   (Response frequency : MIN. 40MHz)
3. Can read various discs such as DVD, DVD-ROM, DVD-RAM, DVD-R, CD-ROM, CD-R, CD-RW
4. High sensitivity
5. Compact and thin package
   (Package dimensions : 5.0x4.0x1.5mm)
6. Possible to supply custom-made detecting patterns
7. Pair use with SHARP's laser diode is recommended.
   Laser diode : 650nm band **GH06510A2A/B**

■ Applications

1. DVD drives
2. CD-ROM drives

■ Absolute Maximum Ratings (Ta=25°C)

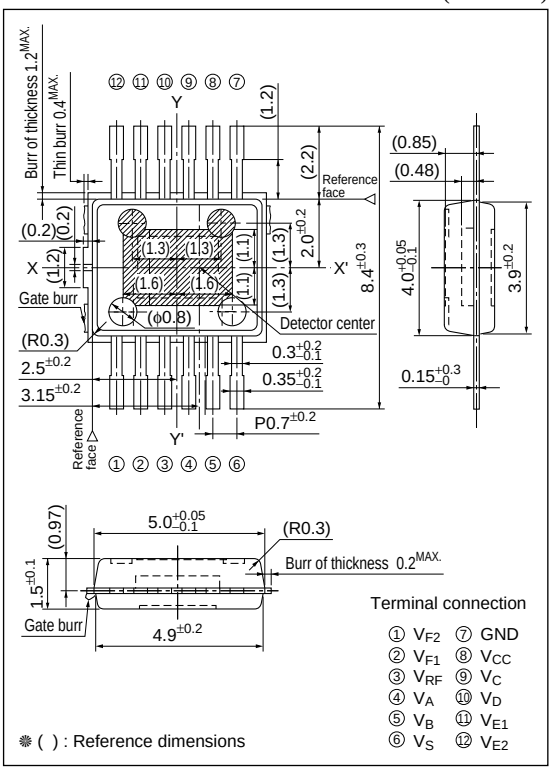
Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	6.0	V
*1 Output voltage	V_O	V_{CC}	V
Operating temperature	T_{opr}	−30 to +80	°C
Storage temperature	T_{stg}	−40 to +100	°C
*2 Soldering temperature	T_{sol}	+260	°C

*1 Applies to V_A to V_{F2} terminal.

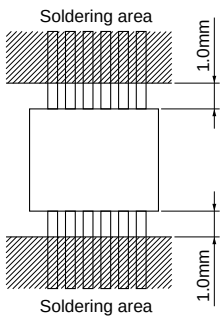
*2 For MAX. 3s at the position of 1.0mm from the bottom face of resin package.

■ Outline Dimensions

(Unit : mm)



∗ "OPIC"(Optical IC) is a trademark of the SHARP Corporation. An OPIC consists of a light-detecting element and signal-processing circuit integrated onto a signal chip.



■ Recommended Operating Conditions

(Ta=25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage 1	V_{CC}	4.75	5.0	5.25	V
Supply voltage 2	V_S	2.0	2.1	2.2	V

■ Electro-optical Characteristics 1

($Ta=25°C$, $V_{CC}=5V$, $V_S=2.1V$, $R_L=10k\Omega$ [V_{RF} : Open], $C_L=10_{pF}$)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Application
Supply current	I_{CC}	–	8.8	14.8	20	mA	Vcc
Output off-set voltage 1	V_{od1}	Specified by voltage difference from Vs	–25	0	+25	mV	V_A to V_D
Output off-set voltage 2	V_{od2}	Specified by voltage difference from Vs	–15	0	+15	mV	V_{E1} to V_{F2}
Output off-set voltage 3	V_{od3}	GND reference	1.25	1.4	1.55	V	V_{RF}
Extremes of off-set voltage	ΔV_{od}	A–B	–20	0	–20	mV	V_A, V_B
		C–D	–20	0	–20		V_C, V_D
		(A+C)–(B+D)	–20	0	–20		V_A to V_D
		(A+D)–(B+C)	–20	0	–20		V_A to V_D
		(A+B)–(C+D)	–20	0	–20		V_A to V_D
		(E1+E2)–(F1+F2)	–15	0	–15		V_{E1} to V_{F2}
		(E1+F2)–(E2+F1)	–15	0	–15		V_{E1} to V_{F2}
		A+B+C+D	–100	0	–100		V_A to V_D
Output noise level 1	V_{n1}	f=23.1MHz, BW=30kHz	–	–81	–72	dBm	V_A to V_D
Output noise level 2	V_{n2}	f=23.1MHz, BW=30kHz	–	–70	–61	dBm	V_{RF}

■ Electro-optical Characteristics 2

Input light source wavelength λp=780nm

($Ta=25°C$, $V_{CC}=5V$, $V_S=2.1V$, $R_L=10k\Omega$ [V_{RF} : Open], $C_L=10pF$)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Application
*3, *4 Sensitivity 1	R_{p1}	–	18.6	25.5	32.3	mV/μW	V_A to V_D
*3, *4 Sensitivity 2	R_{p2}	–	31.2	44.7	58.1	mV/μW	V_{E1} to V_{F2}
*3, *4 Sensitivity 3	R_{p3}	–	21.3	30.5	39.7	mV/μW	V_{RF}
*5 Extreme of sensitivity 1	ΔR_{p1}	–	–	–	10	%	–
Sensitivity ratio 1	R_{p2}/R_{p1}	–	–	1.81	–	–	–
Sensitivity ratio 2	R_{p3}/R_{p1}	–	1.05	1.18	1.30	–	–
*4, *6 Response frequency 1	f_{c1}	–3dB	34	50	–	MHz	V_A to V_D
*4, *6 Response frequency 2	f_{c2}	–3dB	36	60	–	MHz	V_{RF}
*4, *6 Response frequency 3	f_{c3}	–3dB	2	4	–	MHz	V_{E1} to V_{F2}
*4 High level output voltage 1	V_{OH1}	–	3.8	–	–	V	V_A to V_D
*4 High level output voltage 2	V_{OH2}	–	3.8	–	–	V	V_{RF}
*4, *7 Group delay deviation 1	tgd1	f=1 to 23.1MHz, Average of V_A to V_D	–	2.5	6	ns	V_A to V_D
*4, *7 Group delay deviation 2	tgd2	f=1 to 23.1MHz	–	2.5	6	ns	V_{RF}

■ Electro-optical Characteristics 3

Input light source wavelength λp=650nm (Ta=25°C, Vcc=5V, V_S=2.1V, R_L=10kΩ [V_{RF} : Open], C_L=10pF)

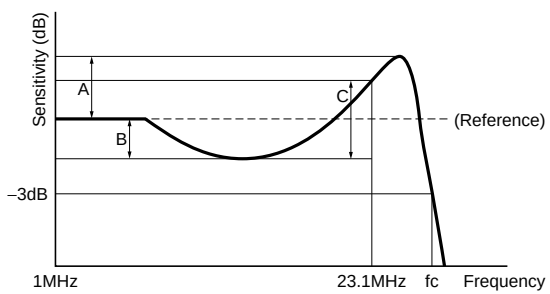
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Application
*3, *4 Sensitivity 4	R_{p4}	–	15.5	21.3	27.0	mV/μW	V_A to V_D
*3, *4 Sensitivity 5	R_{p5}	–	25.4	36.4	47.4	mV/μW	V_{E1} to V_{F2}
*3, *4 Sensitivity 6	R_{p6}	–	20.0	25.0	37.2	mV/μW	V_{RF}
*5 Extreme of sensitivity 2	ΔR_{p2}	–	–	–	10	%	–
Sensitivity ratio 3	R_{p5}/R_{p4}	–	–	1.81	–	–	–
Sensitivity ratio 4	R_{p6}/R_{p4}	–	1.05	1.18	1.30	–	–
*4, *6 Response frequency 4	f_{c4}	–3dB	40	55	–	MHz	V_A to V_D
*4, *6 Response frequency 5	f_{c5}	–3dB	40	65	–	MHz	V_{RF}
*4, *6 Response frequency 6	f_{c6}	–3dB	2	4	–	MHz	V_{E1} to V_{F2}
*4 High level output voltage 3	V_{OH3}	–	3.8	–	–	V	V_A to V_D
*4 High level output voltage 4	V_{OH4}	–	3.8	–	–	V	V_{RF}
*4, *7 Group delay deviation 3	t_{gd3}	f=1 to 23.1MHz, Average of V_A to V_D	–	3	7	ns	V_A to V_D
*4, *7 Group delay deviation 4	t_{gd4}	f=1 to 23.1MHz	–	3	7	ns	V_{RF}

*3 5μW, ϕ30μm of DC light is applied to the center of each photodiode.
Under that condition, sensitivity R_p is shown by following formula.
$R_p=(V_p-V_{od})/10\mu W$
V_p : Output voltage when DC light is applid.
V_{od} : Output voltage when DC light is not applied.
*4 Light source : laser diode of λ=650nm or 780nm.
*5 Extreme of sensitivity is shown by following formula.
2 x (R_{p1}max.–R_{p1}min.) / (R_{p1}max.+R_{p1}min.) x 100
2 x (R_{p2}max.–R_{p2}min.) / (R_{p2}max.+R_{p2}min.) x 100
2 x (R_{p4}max.–R_{p4}min.) / (R_{p4}max.+R_{p4}min.) x 100
2 x (R_{p5}max.–R_{p5}min.) / (R_{p5}max.+R_{p5}min.) x 100
*6 Frequency sensitivity is –3dB. (reference sensitivity : value at f=1MHz)
*7 In addition to 10μW, ϕ30μm DC light, 4μWp-p AC light is applied to the center of each photodiode. BW=10kHz
*8 For Frequency Charactoristics refer to Fig.1.
*9 As the temperature characteristics of the peaking rate A, the peaking rate at Ta=65˚C against the peaking rate at Ta=25˚C shall be satisfied with the change rate Max. 2.5dB.
(Application terminal : VA to VD, VRF)

Fig.1 Frequency Characteristics

The following 3 points shall be satisfied as frequency characteristics.
(Application : fc1, fc2, fc4, fc5)
(Ta=25°C, V_{CC}=5V, V_S=2.1V, R_L=10kΩ [V_{RF} : Open], C_L=10pF)
(Reference frequency 1MHz)

	780nm	650nm
Peaking rate A	MAX. 2.5dB	MAX. 4.5dB
Bottom rate B	MAX. 0.5dB	MAX. 0.5dB
Change rate C	MAX. 2.5dB	MAX. 4.5dB



No oscillation at the load condition of R_L=10kΩ, C_L=30pF.

Fig.2 Detecting Pattern of Photodiode

(Unit : μm)

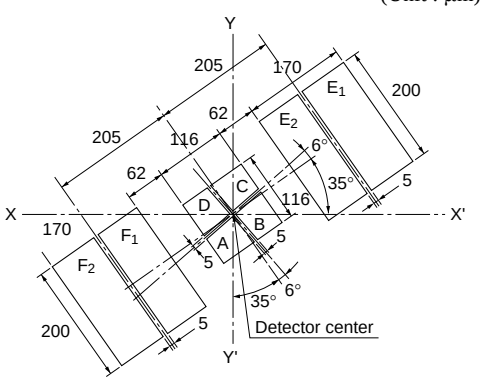


Fig.3 Block Diagram

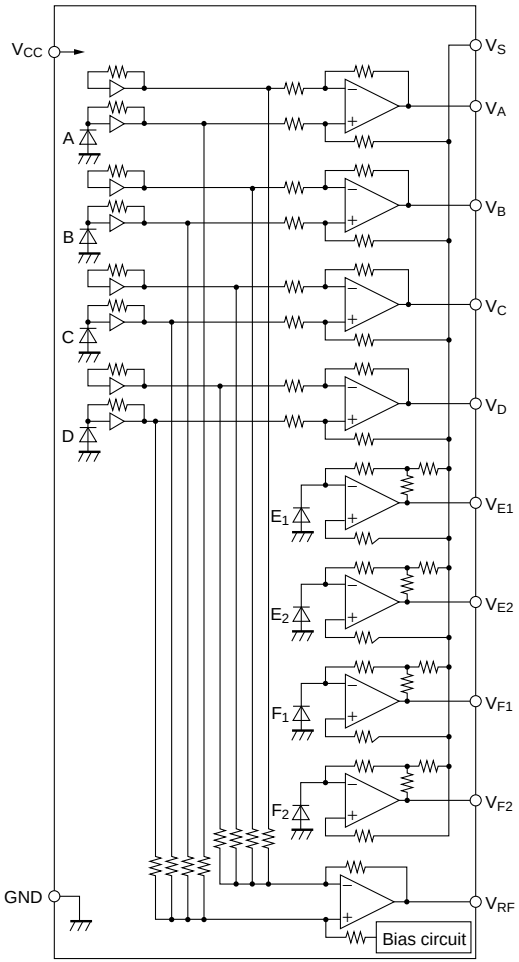


Fig.4 Supply Current vs. Ambient Temperature

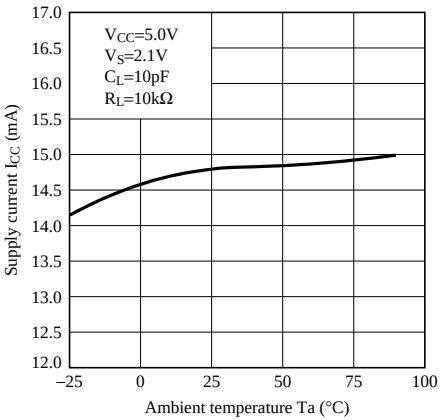


Fig.5 Output Offset Voltage vs. Ambient Temperature (A to D)

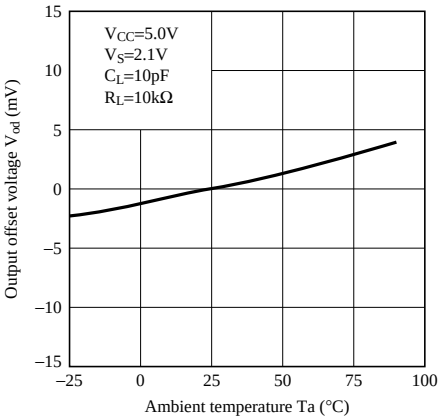


Fig.6 Output Offset Voltage vs. Ambient Temperature (E, F)

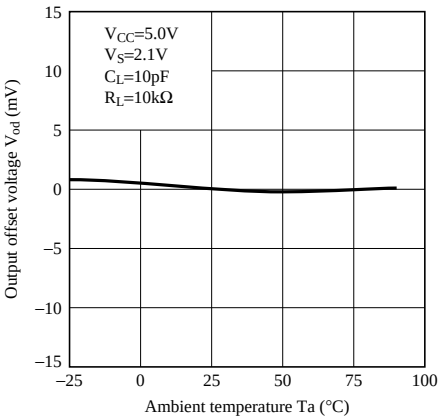


Fig.7 Output Offset Voltage vs. Ambient Temperature (RF)

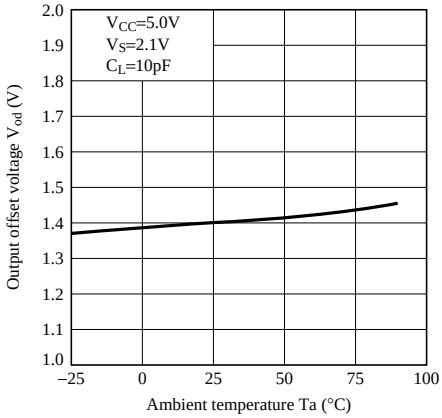


Fig.8 Response Frequency vs. Ambient Temperature (A to D)

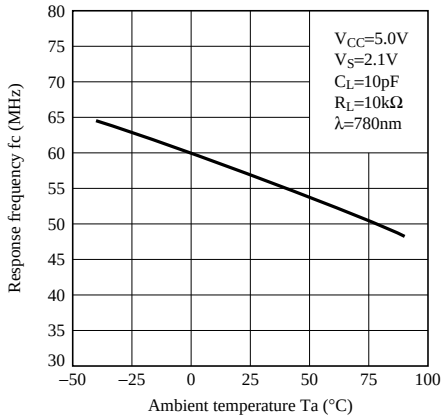


Fig.9 Response Frequency vs. Ambient Temperature (RF)

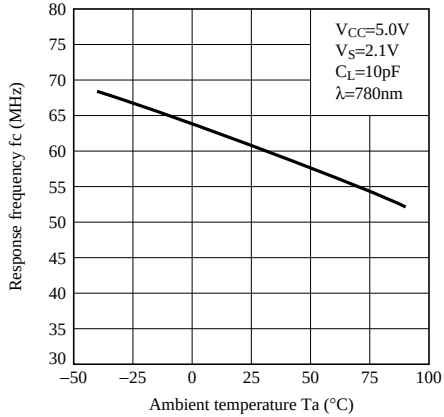


Fig.10 Sensitivity vs. Ambient Temperature (A to D)

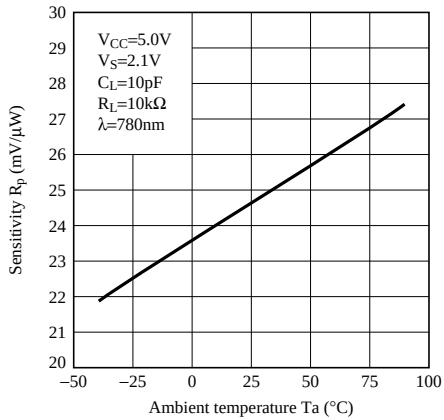
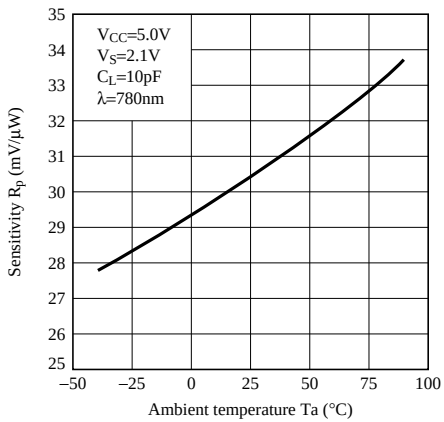


Fig.11 Sensitivity vs. Ambient Temperature (RF)



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— Telecommunication equipment [terminal]
— Test and measurement equipment
— Industrial control
— Audio visual equipment
— Consumer electronics

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— Traffic signals
— Gas leakage sensor breakers
— Alarm equipment
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