IS1685

OPIC Light Detector for DVD Player (X6 Speed)

■ Features

1. OPIC light detector with built-in RF amplifier
   (Integrates 6-division PIN photodiode and Amp. IC onto a single chip)
2. High speed response
   (Response frequency : MIN. 57.4MHz)
3. Can read various discs such as DVD, DVD-ROM, DVD-R, CD-ROM, CD-R
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)

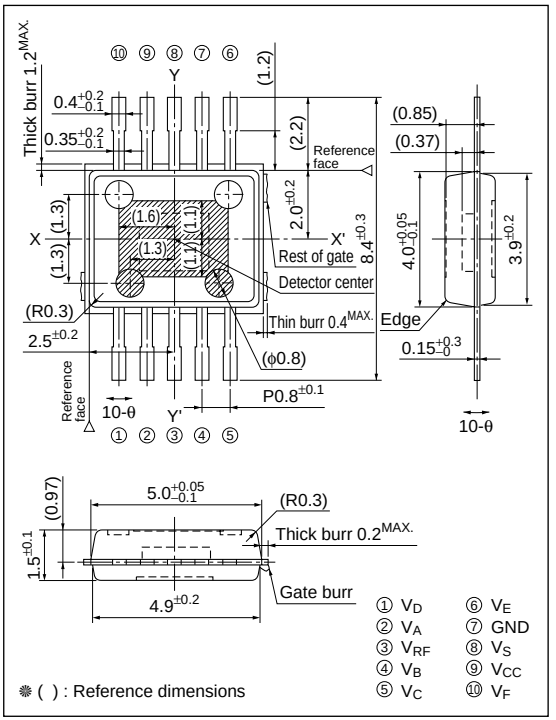
Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	6.0	V
*1 Output voltage	V_O	V_{CC}	V
Operating temperature	T_{opr}	−30 to +80	°C
Storage temperature	T_{stg}	−40 to +100	°C
*2 Soldering temperature	T_{sol}	+260	°C

*1 Applies to V_A to V_F terminal.

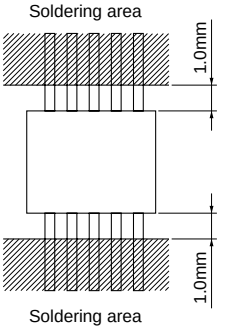
*2 For MAX. 3s at the position of 1.0mm from the bottom face of resin package.

■ 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, Vcc=5V, V_S=2.1V, R_L=10kΩ [V_{RF} : Open], C_L=5pF)

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_E, V_F
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
		E–F	–15	0	+15		V_E, V_F
		A+B+C+D	–100	0	+100		V_A to V_D
Output noise level 1	V_{n1}	f=23.1MHz, BW=30kHz	–	–81	–76	dBm	V_A to V_D
Output noise level 2	V_{n2}	f=23.1MHz, BW=30kHz	–	–70	–65	dBm	V_{RF}

■ Electro-optical Characteristics 2

Input light source wavelength λp=650nm

(Ta=25°C, Vcc=5V, V_S=2.1V, R_L=10kΩ [V_{RF} : Open], C_L=5pF)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Application
*3*4 Sensitivity 1	R_{p1}	–	14.7	20.0	25.4	mV/μW	V_A to V_D
*3*4 Sensitivity 2	R_{p2}	–	25.4	36.4	47.4	mV/μW	V_E, V_F
*3*4 Sensitivity 3	R_{p3}	–	17.4	24.9	32.4	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}	–	1.17	1.24	1.30	–	–
*4*6*7 Response frequency 1	f_{c1}	–3dB	36	60	–	MHz	V_A to V_D
*4*6*7 Response frequency 2	f_{c2}	–3dB	45	70	–	MHz	V_{RF}
*4*6*7 Response frequency 3	f_{c3}	–3dB	1	5	–	MHz	V_E, V_F
*4*6*8 Response frequency 4	f_{c4}	–3dB Applied to the center of the divided portion	57.4	77	–	MHz	V_{RF}
*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	5.5	ns	V_A to V_D
*4, *7 Group delay deviation 2	tgd2	f=1 to 23.1MHz	–	2.5	5.5	ns	V_{RF}

■ Electro-optical Characteristics 3

Input light source wavelength λp=780nm (Ta=25°C, Vcc=5V, V_S=2.1V, R_L=10kΩ [V_{RF} : Open], C_L=5pF)

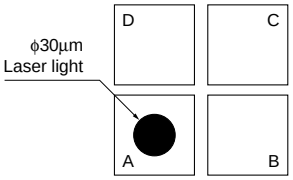
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Application
*3*4 Sensitivity 4	R_{p4}	–	18.0	24.6	31.2	mV/μW	V_A to V_D
*3 *4 Sensitivity 5	R_{p5}	–	31.2	44.7	58.1	mV/μW	V_E, V_F
*3 *4 Sensitivity 6	R_{p6}	–	21.3	30.5	39.7	mV/μW	V_{RF}
*5 Extreme of sensitivity 2	ΔR_{p2}	–	–	–	10	%	–
Sensitivity ratio 3	R_{p5}/R_{p4}	–	–	1.81	–	–	–
Sensitivity ratio 4	R_{p6}/R_{p4}	–	1.17	1.24	1.30	–	–
*4*6*7Response frequency 5	f_{c5}	–3dB	34	57	–	MHz	V_A to V_D
*4*6*7Response frequency 6	f_{c6}	–3dB	43	68	–	MHz	V_{RF}
*4*6*7Response frequency 7	f_{c7}	–3dB	1	5	–	MHz	V_E, V_F
*4*6*8Response frequency 8	f_{c8}	–3dB Applied to the center of the divided portion	50	68	–	MHz	V_{RF}
*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	–	2.5	5.5	ns	V_A to V_D
*4, *7 Group delay deviation 4	t_{gd4}	f=1 to 23.1MHz	–	2.5	5.5	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.
$R_p=(V_P-V_{od})5\mu W$
*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 Refer to Fig.1
*8 Refer to Fig.1
*9 For Frequency Charactoristics refer to Fig.2
*10 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 following.
(Application terminal : V_A to V_D, V_{RF})

780nm	650nm
MAX. 2.5dB	MAX. 3.5dB

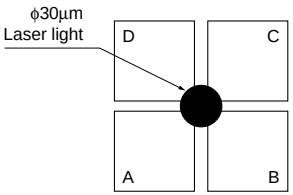
Fig.1 Response Frequency

*7 In addition to 10μW, ϕ30μm DC light, 4μWp-p AC light is applied to the center of each photodiode. BW=10kHz



Application : Response frequency except fc4 with λ=650nm, peaking rate, bottom rate, change rate, group delay deviation
Response frequency except fc8 with λ=780nm peaking rate, bottom rate, change rate, group delay deviation

*8 In addition to 10μW, ϕ30mm DC light, 4μ Wp-p of AC light is applied to the center of the divided portion of photodiode A, B, C and D. BW=10kHz



Application : fc4 with λ=650nm and fc8 with λ=780nm

Fig.2 Frequency Characteristics

The following 3 points shall be satisfied as frequency characteristics.
(Application : fc1, fc2, fc5, fc6)
(Ta=25°C, V_{CC}=5V, V_S=2.1V, R_L=10kΩ [V_{RF} : Open], C_L=5pF)
(Reference frequency 1MHz)

	780nm	650nm
Peaking rate A	MAX. 2.5dB	MAX. 3.5dB
Bottom rate B	MAX. 1.0dB	MAX. 1.0dB
Change rate C	MAX. 3.0dB	MAX. 4.0dB

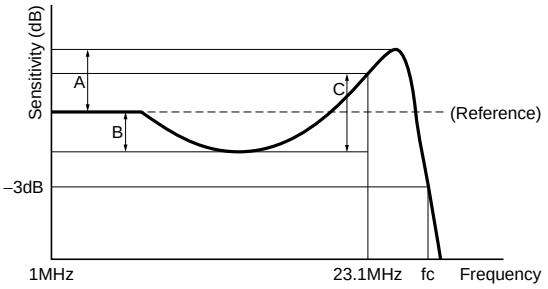


Fig.3 Detecting Pattern of Photodiode

(Unit : μm)

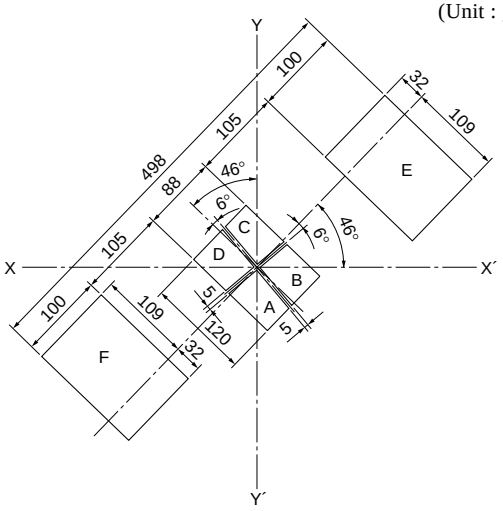


Fig.4 Block Diagram

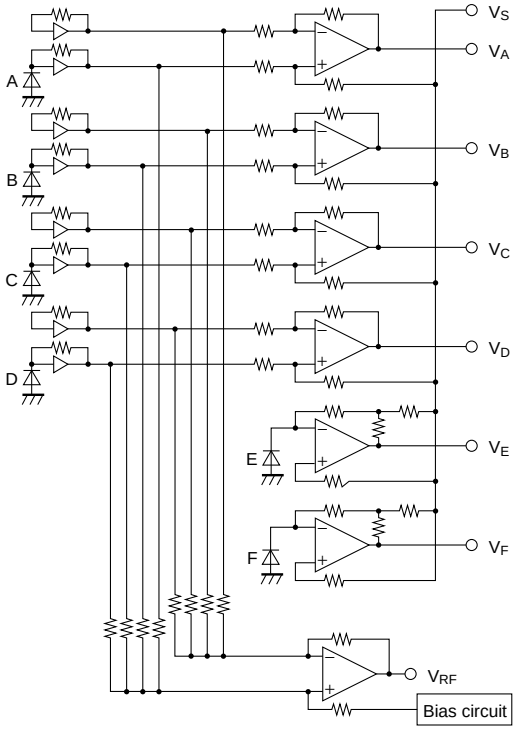


Fig.5 Supply Current vs. Ambient Temperature

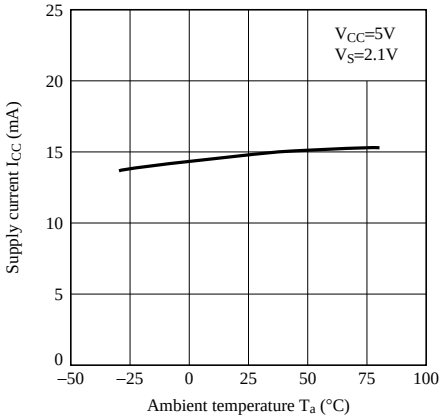


Fig.6 Output Offset Voltage 1 vs. Ambient Temperature (V_A to V_D)

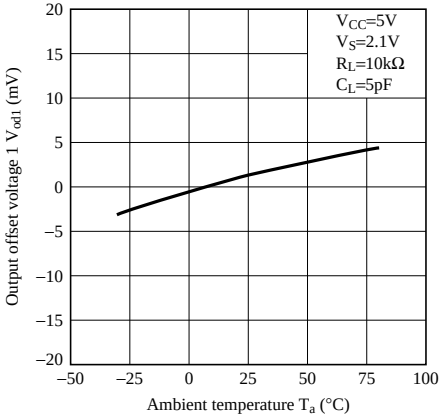


Fig.7 Output Offset Voltage 2 vs. Ambient Temperature (V_E, V_F)

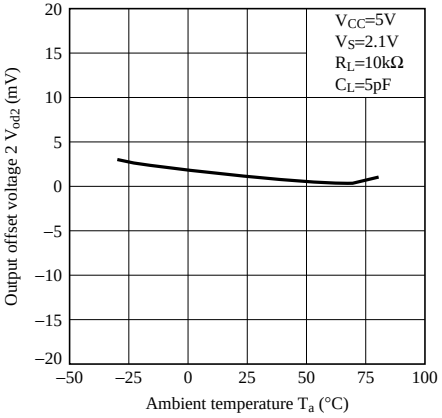


Fig.8 Output Offset Voltage 3 vs. Ambient Temperature (V_{RF})

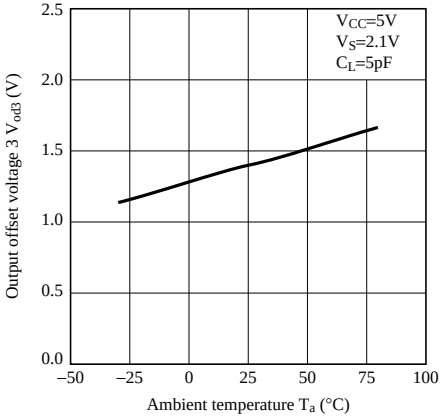


Fig.9 Response Frequency 1 vs. Ambient Temperature (V_A to V_D)

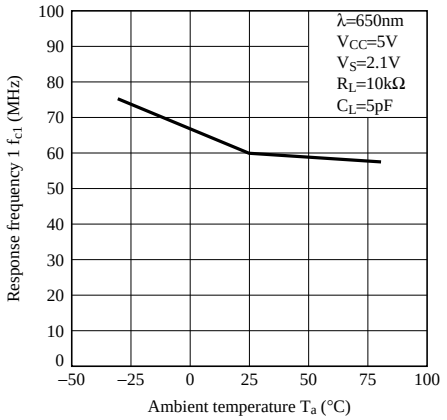


Fig.10 Response Frequency 2 vs. Ambient Temperature (V_{RF})

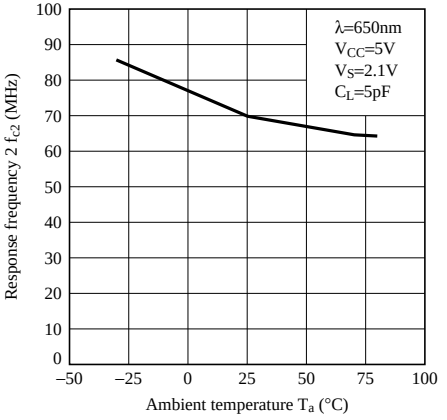


Fig.11 Response Frequency 4 vs. Ambient Temperature (V_{RF} : Applied to The Center of The Divided Portion)

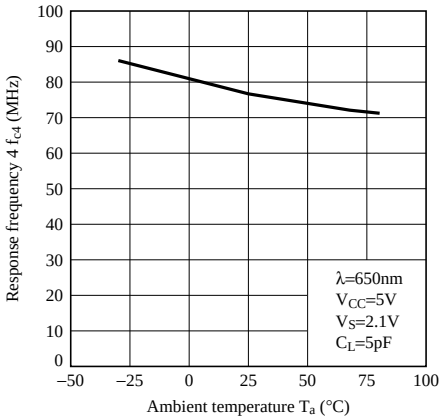


Fig.12 Sensitivity 1 vs. Ambient Temperature (V_A to V_D)

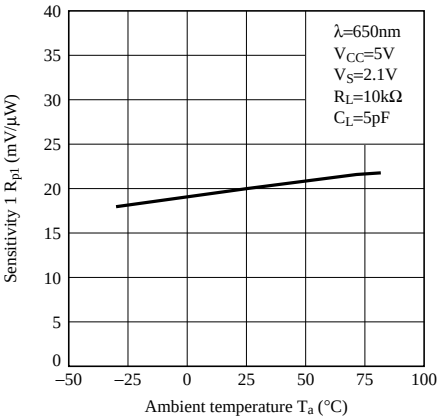
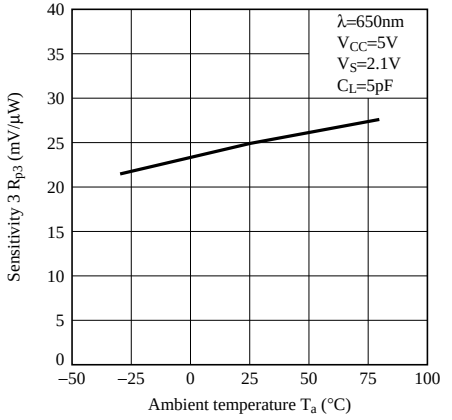


Fig.13 Sensitivity 3 vs. Ambient Temperature (V_{RF})



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— Telecommunication equipment [terminal]
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— Industrial control
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