

IS1685

OPIC Light Detector for DVD Player (X6 Speed)

Features

- OPIC light detector with built-in RF amplifier
(Integrates 6-division PIN photodiode and Amp. IC onto a single chip)
- High speed response
(Response frequency : MIN. 57.4MHz)
- Can read various discs such as DVD, DVD-ROM, DVD-R, CD-ROM, CD-R
- High sensitivity
- Compact and thin package
(Package dimensions : 5.0x4.0x1.5mm)
- Possible to supply custom-made detecting patterns
- Pair use with SHARP's laser diode is recommended.
Laser diode : 650nm band **GH06510A2A/B**

Applications

- DVD drives
- CD-ROM drives

Absolute Maximum Ratings (Ta=25°C)

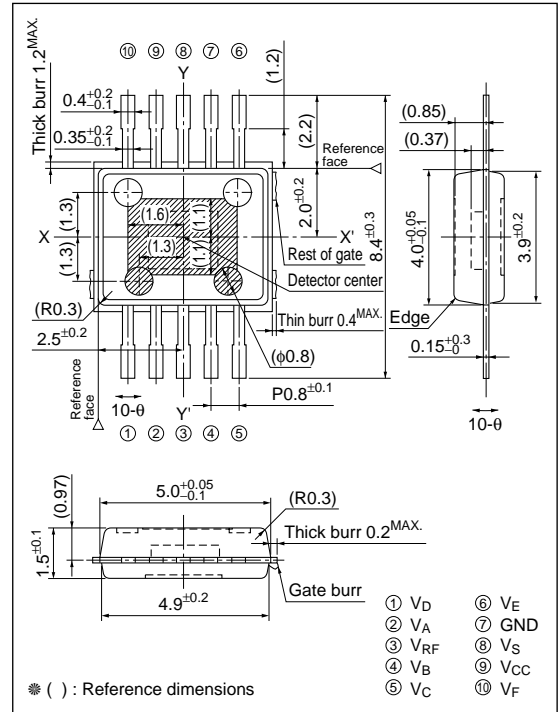
Parameter	Symbol	Rating	Unit
Supply voltage	V _{CC}	6.0	V
*1 Output voltage	V _O	V _{CC}	V
Operating temperature	T _{opr}	-30 to +80	°C
Storage temperature	T _{stg}	-40 to +100	°C
*2 Soldering temperature	T _{sol}	+260	°C

*1 Applies to V_A to V_F terminal.

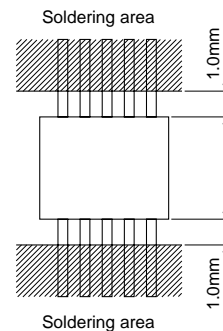
*2 For MAX. 3s at the position of 1.0mm from the bottom face of resin package.

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, V_{cc}=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	V _{cc}
Output off-set voltage 1	V _{od1}	Specified by voltage difference from V _s	–25	0	+25	mV	V _A to V _D
Output off-set voltage 2	V _{od2}	Specified by voltage difference from V _s	–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 λ_p=650nm(Ta=25°C, V_{cc}=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	tg _{d1}	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	tg _{d2}	f=1 to 23.1MHz	–	2.5	5.5	ns	V _{RF}

■ Electro-optical Characteristics 3

Input light source wavelength $\lambda_p=780\text{nm}$

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

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Application
*3*4 Sensitivity 4	R_{p4}	—	18.0	24.6	31.2	$\text{mV}/\mu\text{W}$	V_A to V_D
*3 *4 Sensitivity 5	R_{p5}	—	31.2	44.7	58.1	$\text{mV}/\mu\text{W}$	V_E , V_F
*3 *4 Sensitivity 6	R_{p6}	—	21.3	30.5	39.7	$\text{mV}/\mu\text{W}$	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*7 Response frequency 5	f_{c5}	-3dB	34	57	—	MHz	V_A to V_D
*4*6*7 Response frequency 6	f_{c6}	-3dB	43	68	—	MHz	V_{RF}
*4*6*7 Response frequency 7	f_{c7}	-3dB	1	5	—	MHz	V_E , V_F
*4*6*8 Response 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 $5\mu\text{W}$, $\phi 30\mu\text{m}$ of DC light is applied to the center of each photodiode.

Under that condition, sensitivity R_p is shown by following formula.

$$R_p = (V_p - V_{oi}) / 5\mu\text{W}$$

*4 Light source : laser diode of $\lambda=650\text{nm}$ or 780nm .

*5 Extreme of sensitivity is shown by following formula.

$$2 \times (R_{p1\text{max}} - R_{p1\text{min}}) / (R_{p1\text{max}} + R_{p1\text{min}}) \times 100$$

$$2 \times (R_{p2\text{max}} - R_{p2\text{min}}) / (R_{p2\text{max}} + R_{p2\text{min}}) \times 100$$

$$2 \times (R_{p3\text{max}} - R_{p3\text{min}}) / (R_{p3\text{max}} + R_{p3\text{min}}) \times 100$$

$$2 \times (R_{p5\text{max}} - R_{p5\text{min}}) / (R_{p5\text{max}} + R_{p5\text{min}}) \times 100$$

*6 Frequency sensitivity is -3dB. (reference sensitivity : value at $f=1\text{MHz}$)

*7 Refer to Fig.1

*8 Refer to Fig.1

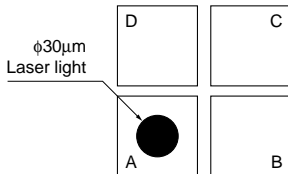
*9 For Frequency Characteristics refer to Fig.2

*10 As the temperature characteristics of the peaking rate A, the peaking rate at $T_a=65^\circ\text{C}$ against the peaking rate at $T_a=25^\circ\text{C}$ shall be satisfied with the following.
(Application terminal : V_A to V_D , V_{RF})

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

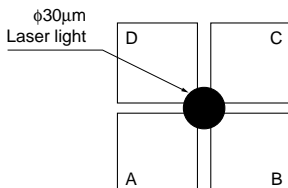
Fig.1 Response Frequency

*7 In addition to $10\mu\text{W}$, $\phi 30\mu\text{m}$ DC light, $4\mu\text{W}$ p-p AC light is applied to the center of each photodiode. $BW=10\text{kHz}$



Application : Response frequency except f_{c4} with $\lambda=650\text{nm}$, peaking rate, bottom rate, change rate, group delay deviation
Response frequency except f_{c8} with $\lambda=780\text{nm}$ peaking rate, bottom rate, change rate, group delay deviation

*8 In addition to $10\mu\text{W}$, $\phi 30\mu\text{m}$ DC light, $4\mu\text{W}$ p-p of AC light is applied to the center of the divided portion of photodiode A, B, C and D. $BW=10\text{kHz}$



Application : f_{c4} with $\lambda=650\text{nm}$ and f_{c8} with $\lambda=780\text{nm}$

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

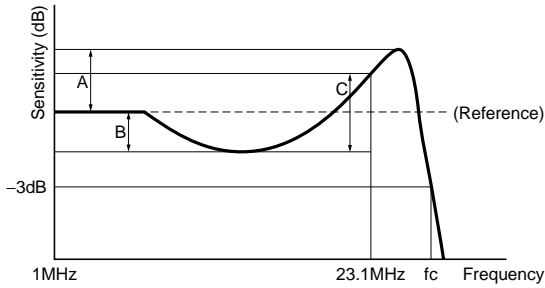


Fig.3 Detecting Pattern of Photodiode

(Unit : μm)

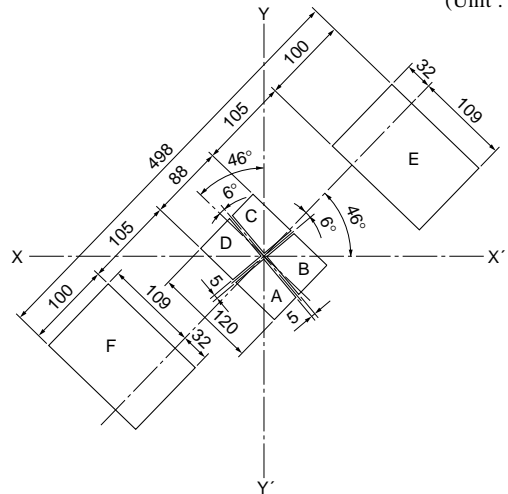


Fig.4 Block Diagram

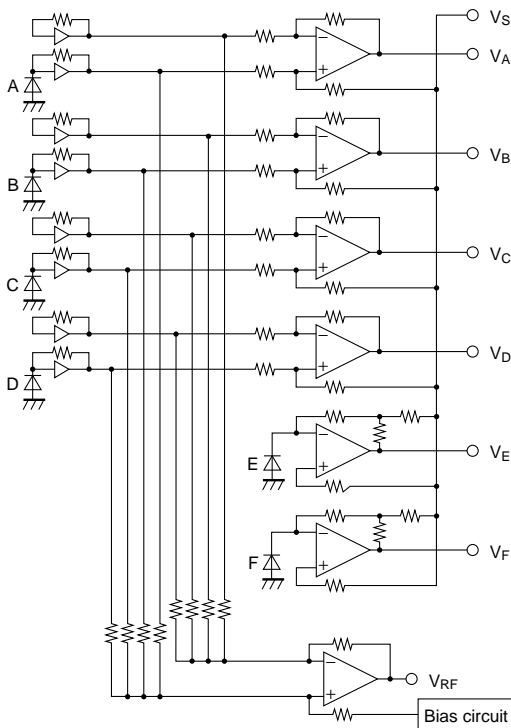


Fig.5 Supply Current vs. Ambient Temperature

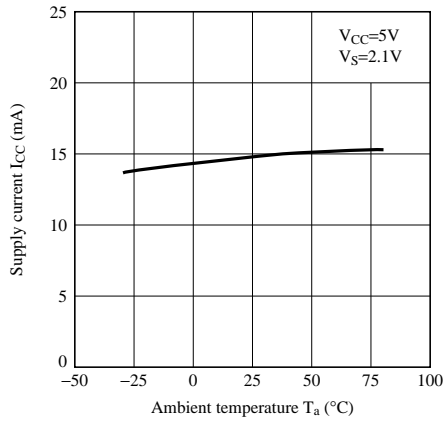


Fig.6 Output Offset Voltage 1 vs. Ambient Temperature (V_A to V_D)

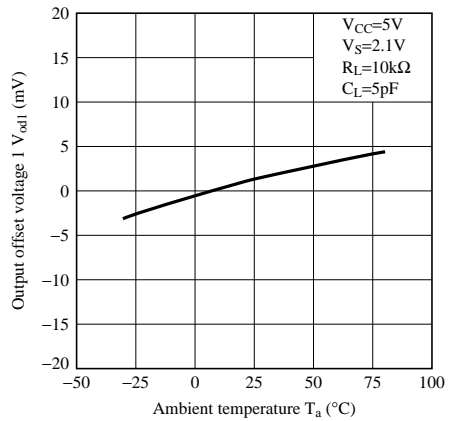


Fig.7 Output Offset Voltage 2 vs. Ambient Temperature (V_E , V_F)

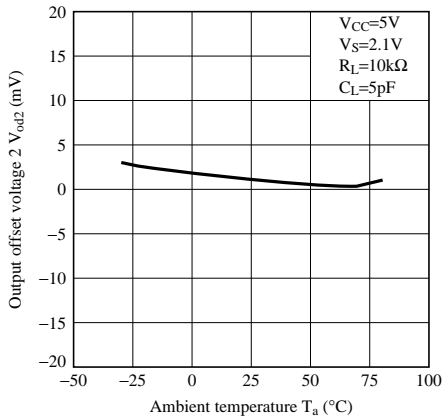


Fig.8 Output Offset Voltage 3 vs. Ambient Temperature (V_{RF})

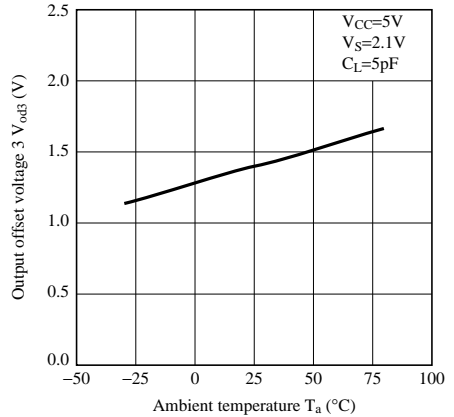


Fig.9 Response Frequency 1 vs. Ambient Temperature (V_A to V_D)

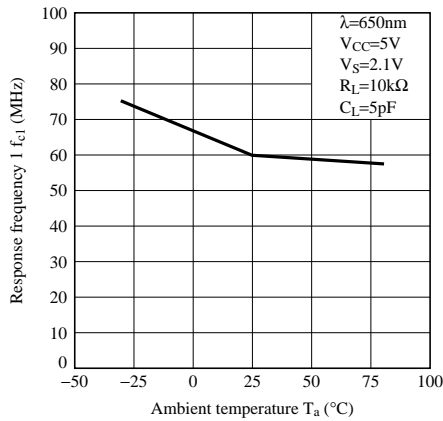


Fig.10 Response Frequency 2 vs. Ambient Temperature (V_{RF})

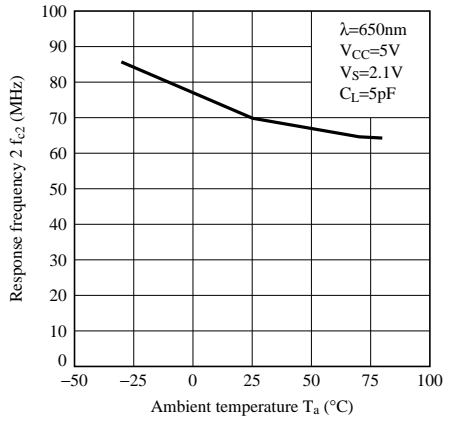


Fig.11 Response Frequency 4 vs. Ambient Temperature (V_{RF} : Applied to The Center of The Divided Portion)

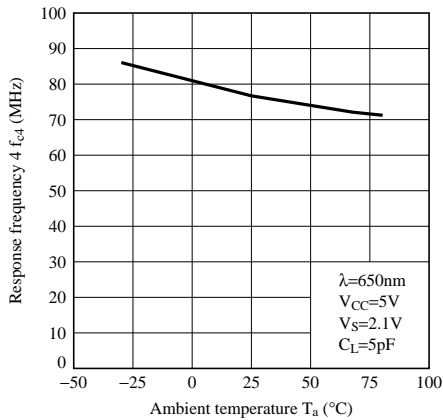


Fig.12 Sensitivity 1 vs. Ambient Temperature (V_A to V_D)

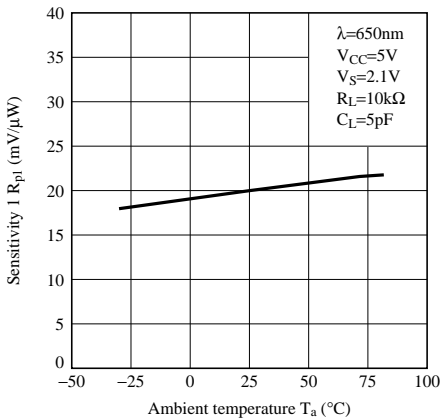
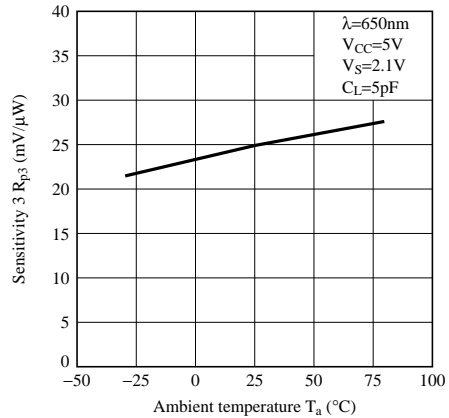


Fig.13 Sensitivity 3 vs. Ambient Temperature (V_{RF})



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