

# IS1660

## OPIC Light Detector for X8 to X10 Speed DVD-ROM

### ■ Features

- OPIC light detector with built-in RF amplifier  
(Integrates 12-division PIN photodiode and Amp. IC onto a single chip)
- High speed response  
(Response frequency : MIN. 60MHz)
- Can read various discs such as DVD, DVD-ROM, DVD-RAM, DVD-R, CD-ROM, CD-R, CD-RW
- High sensitivity
- Compact and thin package  
(Package dimensions : 5.0×4.0×1.5mm)
- Possible to supply custom-made detecting patterns
- Pair use with SHARP's laser diode is recommended.  
Laser diode : 650nm band **GH06510B2A/B**

### ■ Applications

- DVD-ROM drives
- DVD players

### ■ Absolute Maximum Ratings (Ta=25°C)

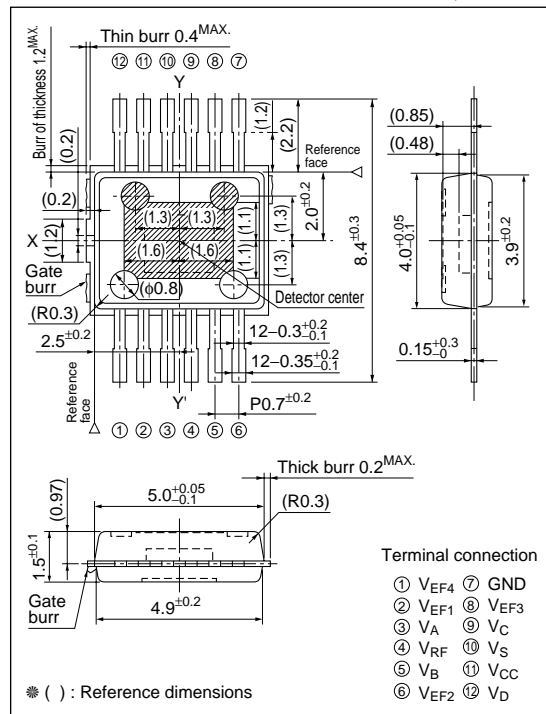
Parameter	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	6.0	V
<sup>*1</sup> Output voltage	V <sub>O</sub>	V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	-30 to +80	°C
Storage temperature	T <sub>stg</sub>	-40 to +100	°C
<sup>*2</sup> Soldering temperature	T <sub>sol</sub>	260	°C

<sup>\*1</sup> Applies to individual terminals of V<sub>A</sub>, V<sub>B</sub>, V<sub>C</sub>, V<sub>D</sub>, V<sub>EF1</sub>, V<sub>EF2</sub>, V<sub>EF3</sub>, V<sub>EF4</sub>, and V<sub>RF</sub>

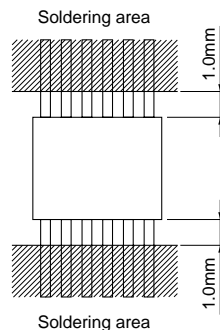
<sup>\*2</sup> For MAX. 3s at the position of 1.0mm from the resin edge

### ■ 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 single chip.



## ■ Recommended Operating Conditions

(Ta=25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Operating supply voltage 1	V <sub>CC</sub>	4.75	5	5.25	V
Operating supply voltage 2	V <sub>S</sub>	2.2	2.3	2.4	V

## ■ Electro-optical Characteristics 1

(Ta=25°C, V<sub>CC</sub>=5V, V<sub>S</sub>=2.3V, R<sub>L</sub>=10kΩ [V<sub>RF</sub>: Open], C<sub>L</sub>=5pF)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Application
Supply current	I <sub>CC</sub>	—	8.8	17.8	25	mA	V <sub>CC</sub>
Output off-set voltage 1	V <sub>od1</sub>	Specified by voltage difference from V <sub>S</sub>	-25	0	+25	mV	V <sub>A</sub> to V <sub>D</sub>
Output off-set voltage 2	V <sub>od2</sub>	Specified by voltage difference from V <sub>S</sub>	-15	0	+15	mV	V <sub>EF1</sub> to V <sub>EF4</sub>
Output off-set voltage 3	V <sub>od3</sub>	GND reference	1.25	1.4	1.55	V	V <sub>RF</sub>
Extremes of off-set voltage	ΔV <sub>od</sub>	A-B	-20	0	+20	mV	V <sub>A</sub> , V <sub>B</sub>
		C-D	-20	0	+20		V <sub>C</sub> , V <sub>D</sub>
		(A+C)-(B+D)	-20	0	+20		V <sub>A</sub> to V <sub>D</sub>
		(A+D)-(B+C)	-20	0	+20		V <sub>A</sub> to V <sub>D</sub>
		(A+B)-(C+D)	-20	0	+20		V <sub>A</sub> to V <sub>D</sub>
		(EF1+EF3)-(EF2+EF4)	-15	0	+15		V <sub>EF1</sub> to V <sub>EF4</sub>
		(EF1+EF4)-(EF2+EF3)	-15	0	+15		V <sub>EF1</sub> to V <sub>EF4</sub>
		(EF1+EF2)-(EF3+EF4)	-15	0	+15		V <sub>EF1</sub> to V <sub>EF4</sub>
		A+B+C+D	-100	0	+100		V <sub>A</sub> to V <sub>D</sub>
High level output voltage 1	V <sub>OH1</sub>	—	3.8	—	—	V	V <sub>A</sub> to V <sub>D</sub>
High level output voltage 2	V <sub>OH2</sub>	—	3.8	—	—	V	V <sub>RF</sub>
Output noise level 1	V <sub>n1</sub>	f=54MHz, BW=30kHz	—	-80	-72	dBm	V <sub>A</sub> to V <sub>D</sub>
Output noise level 2	V <sub>n2</sub>	f=54MHz, BW=30kHz	—	-70	-62	dBm	V <sub>RF</sub>

## ■ Electro-optical Characteristics 2

Input light source wavelength λ<sub>p</sub>=650nm(Ta=25°C, V<sub>CC</sub>=5V, V<sub>S</sub>=2.3V, R<sub>L</sub>=10kΩ [V<sub>RF</sub>: Open], C<sub>L</sub>=5pF)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Application
<sup>*3*4</sup> Sensitivity 1	R <sub>p1</sub>	—	14	20	27.5	mV/μW	V <sub>A</sub> to V <sub>D</sub>
<sup>*3*4</sup> Sensitivity 2	R <sub>p2</sub>	—	23.8	34	46	mV/μW	V <sub>EF1</sub> to V <sub>EF4</sub>
<sup>*3*4</sup> Sensitivity 3	R <sub>p3</sub>	—	17.4	24.8	34	mV/μW	V <sub>RF</sub>
<sup>*5</sup> Extreme of sensitivity 1	ΔR <sub>1</sub>	—	—	—	10	%	—
Sensitivity ratio 1	R <sub>p2</sub> /R <sub>p1</sub>	—	1.52	1.7	1.88	—	—
Sensitivity ratio 2	R <sub>p3</sub> /R <sub>p1</sub>	—	0.95	1.24	1.55	—	—
<sup>*4*6*7</sup> Response frequency 1	f <sub>c1</sub>	-3dB	60	85	—	MHz	V <sub>A</sub> to V <sub>D</sub>
<sup>*4*6*8</sup> Response frequency 2	f <sub>c2</sub>	-3dB	60	85	—	MHz	V <sub>RF</sub>
<sup>*4*6*7</sup> Response frequency 3	f <sub>c3</sub>	-3dB	2	4	—	MHz	V <sub>EF1</sub> to V <sub>EF4</sub>
<sup>*4*7</sup> Sensitivity response 1	ΔR <sub>p1</sub>	f=1 to 54MHz	-3	+2	+5	dB	V <sub>A</sub> to V <sub>D</sub>
<sup>*4*7</sup> Sensitivity response 2	ΔR <sub>p2</sub>	f=1 to 54MHz	-3	+2	+5	dB	V <sub>RF</sub>
<sup>*4*7</sup> Peaking rate 1	ΔR <sub>p3</sub>	1MHz standard	—	—	+4.5	dB	V <sub>A</sub> to V <sub>D</sub>
<sup>*4*7</sup> Peaking rate 2	ΔR <sub>p4</sub>	1MHz standard	—	—	+4.5	dB	V <sub>RF</sub>
<sup>*4*7</sup> Group delay deviation 1	t <sub>gd1</sub>	f=1 to 54.1MHz, Average of V <sub>A</sub> to V <sub>D</sub>	—	2	5	ns	V <sub>A</sub> to V <sub>D</sub>
<sup>*4*7</sup> Group delay deviation 2	t <sub>gd2</sub>	f=1 to 54MHz	—	2	5	ns	V <sub>RF</sub>

### ■ Electro-optical Characteristics 3

Input light source wavelength  $\lambda_p=780\text{nm}$ (Ta=25°C, Vcc=5V, Vs=2.3V, R<sub>L</sub>=10kΩ [V<sub>RF</sub>: Open], C<sub>L</sub>=5pF)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Application
*3*4 Sensitivity 4	R <sub>p4</sub>	—	18	24.6	31.2	mV/μW	V <sub>A</sub> to V <sub>D</sub>
*3*4 Sensitivity 5	R <sub>p5</sub>	—	28	41.8	54.3	mV/μW	V <sub>EF1</sub> to V <sub>EF4</sub>
*3*4 Sensitivity 6	R <sub>p6</sub>	—	21.3	30.5	39.7	mV/μW	V <sub>RF</sub>
*5 Extreme of sensitivity 2	ΔR <sub>2</sub>	—	—	—	10	%	—
Sensitivity ratio 3	R <sub>p5</sub> /R <sub>p4</sub>	—	1.52	1.7	1.88	—	—
Sensitivity ratio 4	R <sub>p6</sub> /R <sub>p4</sub>	—	0.95	1.24	1.55	—	—
*4*6*7 Response frequency 4	f <sub>c4</sub>	-3dB	50	70	—	MHz	V <sub>A</sub> to V <sub>D</sub>
*4*6*8 Response frequency 5	f <sub>c5</sub>	-3dB	50	70	—	MHz	V <sub>RF</sub>
*4*6*7 Response frequency 6	f <sub>c6</sub>	-3dB	2	4	—	MHz	V <sub>EF1</sub> to V <sub>EF4</sub>
*4*7 Sensitivity response 3	ΔR <sub>p5</sub>	f=1 to 54MHz	-3	+1	+3	dB	V <sub>A</sub> to V <sub>D</sub>
*4*7 Sensitivity response 4	ΔR <sub>p6</sub>	f=1 to 54MHz	-3	+1	+3	dB	V <sub>RF</sub>
*4*7 Peaking rate 3	ΔR <sub>p7</sub>	1MHz standard	—	—	+3.5	dB	V <sub>A</sub> to V <sub>D</sub>
*4*7 Peaking rate 4	ΔR <sub>p8</sub>	1MHz standard	—	—	+3.5	dB	V <sub>RF</sub>
*4*7 Group delay deviation 3	t <sub>gd3</sub>	f=1 to 54MHz, Average of V <sub>A</sub> to V <sub>D</sub>	—	0.5	4	ns	V <sub>A</sub> to V <sub>D</sub>
*4*7 Group delay deviation 4	t <sub>gd4</sub>	f=1 to 54MHz	—	0.5	4	ns	V <sub>RF</sub>

\*3 5μW, φ30μm of DC light is applied to the center of each photodiode.  
Under that condition, sensitivity R<sub>p</sub> 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.

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

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

$$2 \times (R_{p4\text{max}} - R_{p4\text{min}}) / (R_{p4\text{max}} + R_{p4\text{min}}) \times 100$$

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

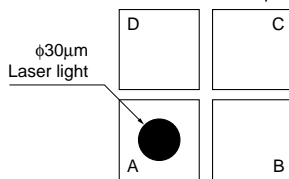
\*6 Frequency sensitivity is -3dB. (reference sensitivity : value at f=1MHz)

\*7 Refer to Fig.1

\*8 Refer to Fig.1

### Fig.1 Response Frequency

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



\*8 In addition to 10μW, φ30μm DC light, 4μW peak-to-peak of AC light is applied to the center of the divided portion of photodiode A, B, C and D. BW=10kHz

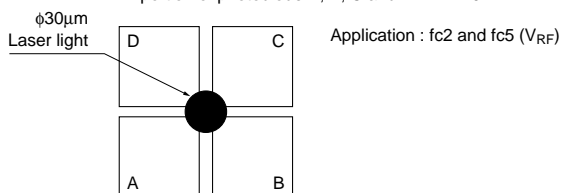


Fig.2 Block Diagram

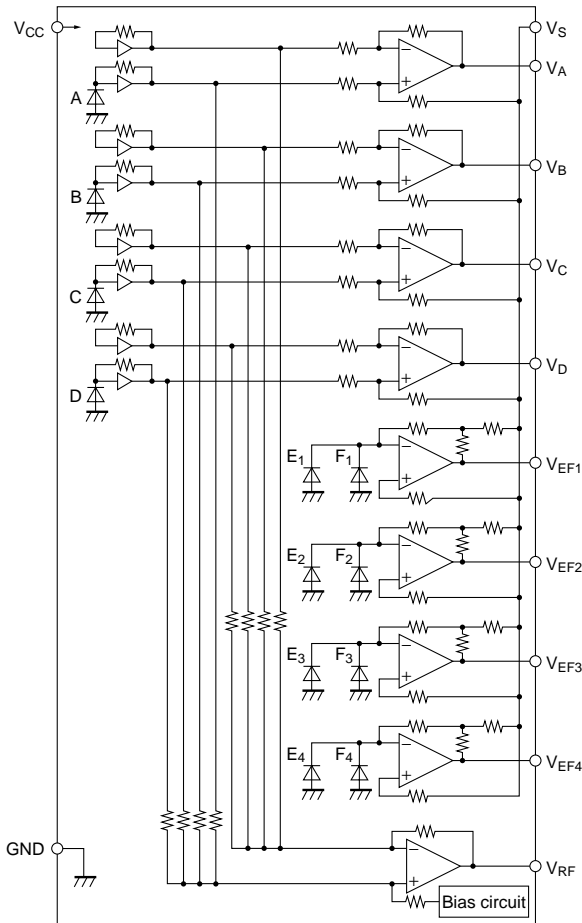


Fig.3 Detecting Pattern of Photodiode

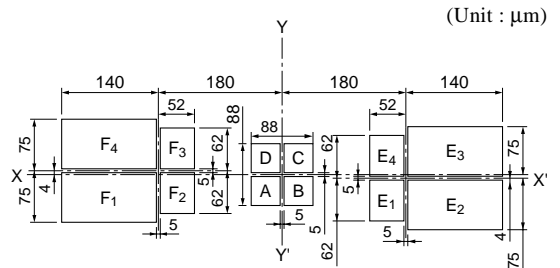


Fig.4 Supply Current vs. Ambient Temperature

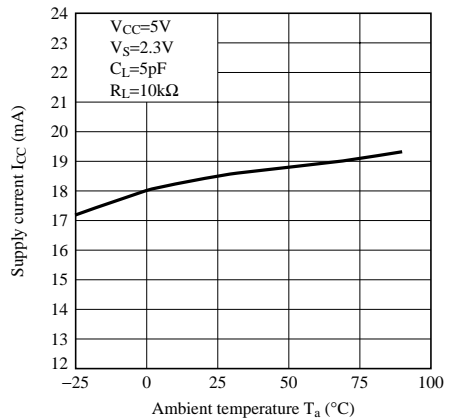


Fig.5 Output Offset Voltage vs. Ambient Temperature (A to D)

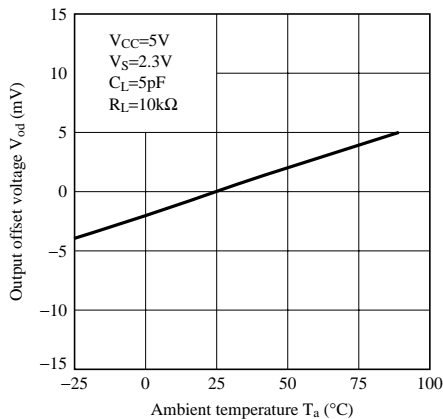
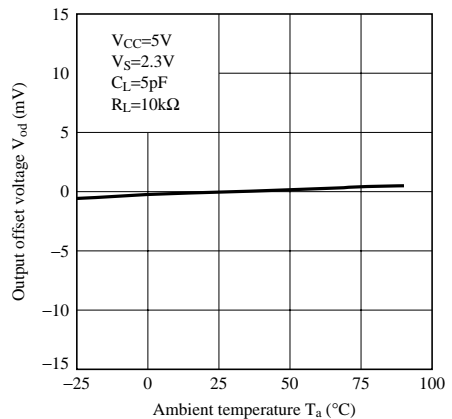
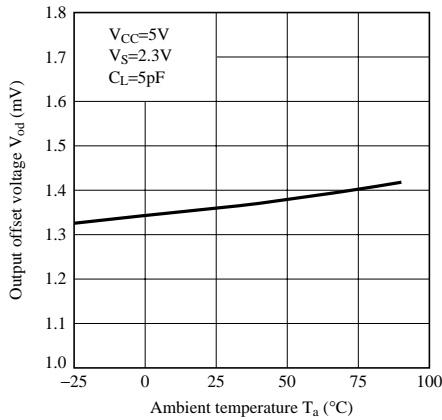


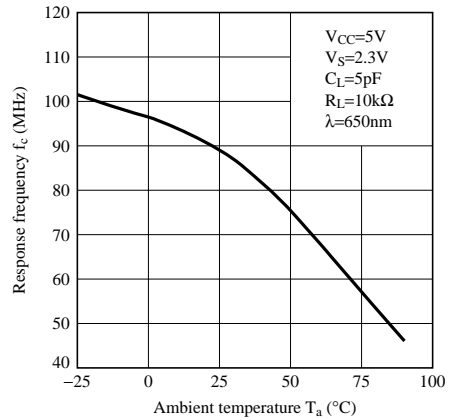
Fig.6 Output Offset Voltage vs. Ambient Temperature (EF1 to EF4)



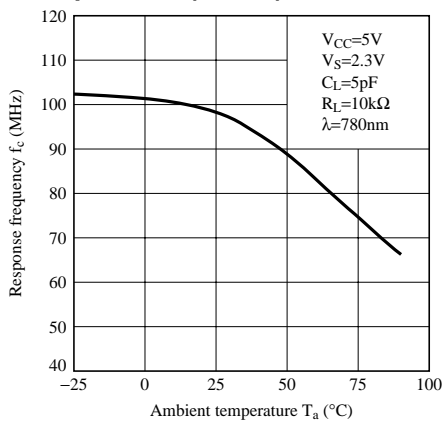
**Fig.7 Output Offset Voltage vs. Ambient Temperature (RF)**



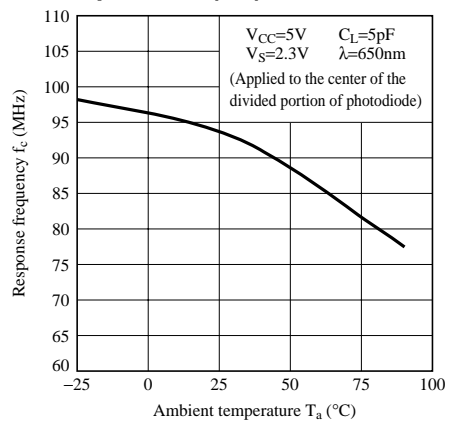
**Fig.8 Response Frequency vs. Ambient Temperature (A to D)**



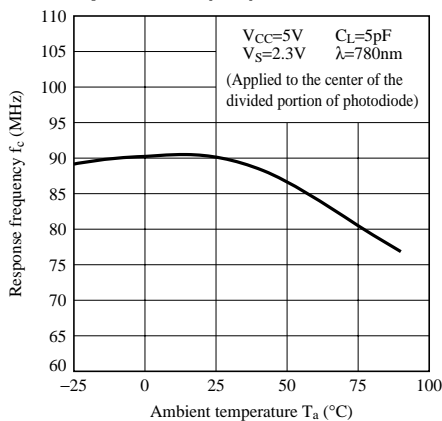
**Fig.9 Response Frequency vs. Ambient Temperature (A to D)**



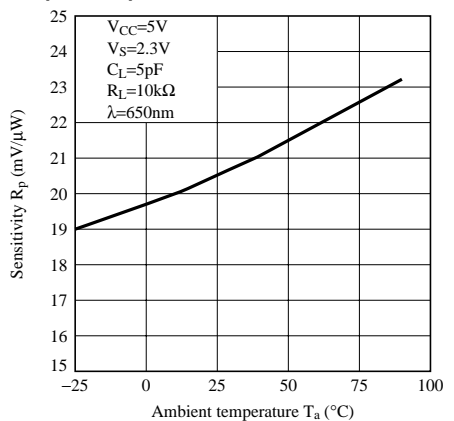
**Fig.10 Response Frequency vs. Ambient Temperature (RF)**



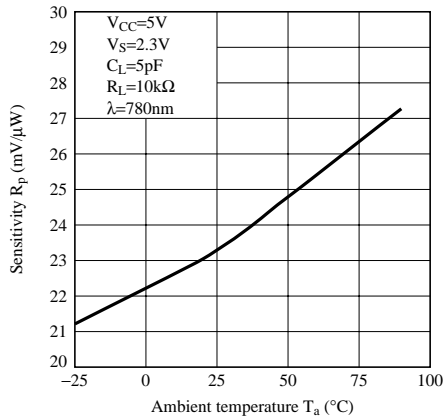
**Fig.11 Response Frequency vs. Ambient Temperature (RF)**



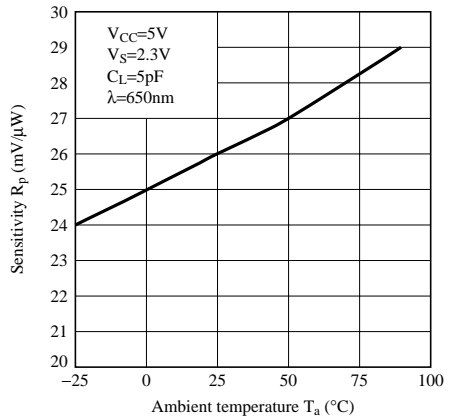
**Fig.12 Sensitivity vs. Ambient Temperature (A to D)**



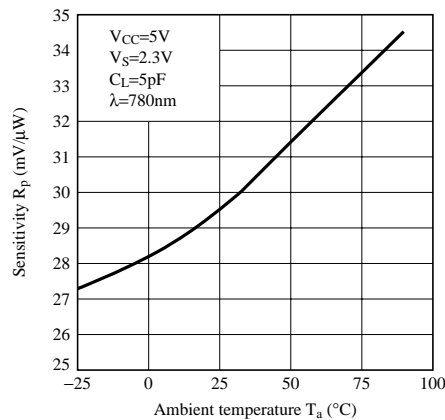
**Fig.13 Sensitivity vs. Ambient Temperature (A to D)**



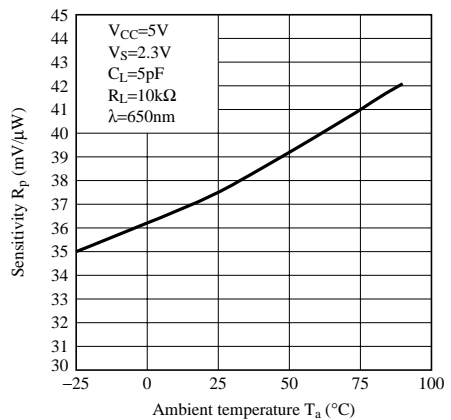
**Fig.14 Sensitivity vs. Ambient Temperature (RF)**



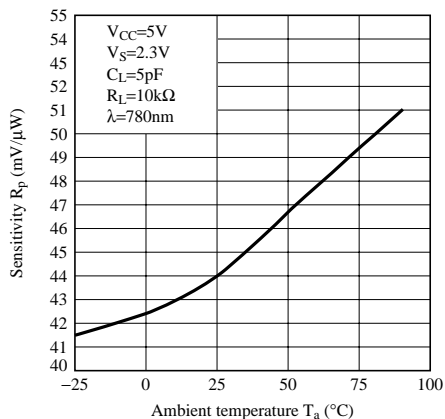
**Fig.15 Sensitivity vs. Ambient Temperature (RF)**



**Fig.16 Sensitivity vs. Ambient Temperature (EF1 to EF4)**



**Fig.17 Sensitivity vs. Ambient Temperature (EF1 to EF4)**



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