

# IS1622

## OPIC Light Detector for Playback/Recording MD player

### ■ Features

- OPIC light detector for RF signal detection  
(Integrates 6-division PIN photodiode and amplifier IC onto a single chip)
- Low operating voltage design (Operating voltage : 2.7 to 5.5V)
- Sensitivity switching between playback mode and recording mode
- Compact and thin transparent package  
(Package dimensions : 3.7 x 6.1 x 1.5 mm)

### ■ Applications

- Optical pickup for playback/recording MD players

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

| Parameter                       | Symbol            | Rating                  | Unit |
|---------------------------------|-------------------|-------------------------|------|
| Supply voltage                  | V <sub>CC</sub>   | -0.5 to +6.0            | V    |
| Cathode terminal voltage        | V <sub>K</sub>    | -0.5 to +6.0            | V    |
| Mode switching terminal voltage | V <sub>MP/R</sub> | -0.5 to V <sub>CC</sub> | V    |
| *1 Output voltage               | V <sub>O</sub>    | -0.5 to V <sub>CC</sub> | V    |
| *2 Power dissipation            | P                 | 150                     | mW   |
| Operating temperature           | T <sub>opr</sub>  | -20 to +70              | °C   |
| Storage temperature             | T <sub>stg</sub>  | -40 to +85              | °C   |
| *3 Soldering temperature        | T <sub>sol</sub>  | +260                    | °C   |

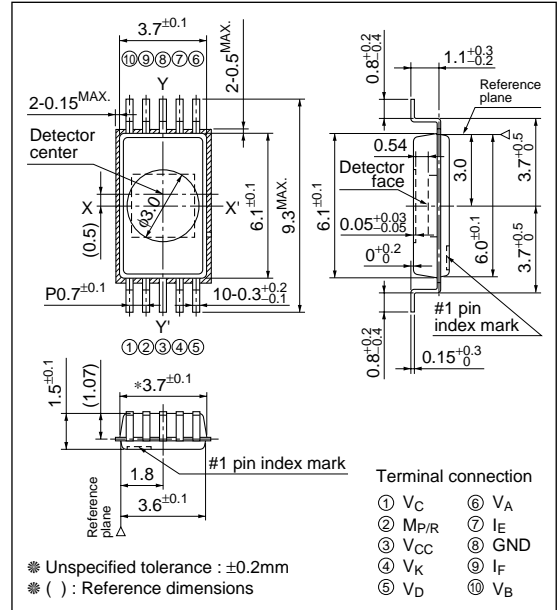
\*1 Applies to individual terminals of V<sub>A</sub>, V<sub>B</sub>, V<sub>C</sub>, V<sub>D</sub>, I<sub>E</sub> and I<sub>F</sub>.

\*2 To decrease at the rate of 2mW/°C at Ta >= 25°C

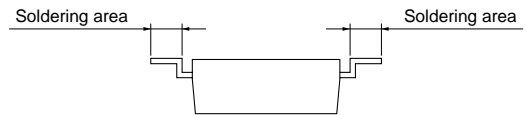
\*3 For MAX. 3 seconds in the soldering area

### ■ 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

| Parameter  | Symbol           | MIN. | TYP. | MAX. | Unit |
|--|------------------|------|------|------|------|
| Supply voltage                                   | V <sub>cc1</sub> | 2.7  | 3.0  | 5.5  | V    |
| Cathode terminal voltage                         | V <sub>K</sub>   | 2.7  | 3.0  | 5.5  | V    |
| *4 "H" gain mode incident light quantity range 1 | ΦP1              | 1    | 6    | 17   | μW   |
| *5 "H" gain mode incident light quantity range 2 | ΦP2              | 0.5  | 3    | 6    | μW   |
| *4 "L" gain mode incident light quantity range 1 | ΦR1              | 15   | 50   | 130  | μW   |
| *5 "L" gain mode incident light quantity range 2 | ΦR2              | 7    | 17   | 36   | μW   |

\*4 The incident light quantity range applies to individual photodiodes of A, B, C and D and is specified in the incident light quantity per single photodiode.

\*5 The incident light quantity range applies to individual photodiodes of E and F and is specified in the incident light quantity per single photodiode.

## ■ Electro-optical Characteristics (Current flowing into the device : +, Current flowing out of the device : -) (Ta=25°C, V<sub>cc</sub>=V<sub>K</sub>=3.0V)

| Parameter                         |                                     | Symbol                            | ** Conditions      | MIN.                 | TYP.  | MAX.            | Unit            | Application   |
|-----------------------------------|-------------------------------------|-----------------------------------|--------------------|----------------------|-------|-----------------|-----------------|---|
| "H" gain mode                     | Supply current                      | I <sub>CCP</sub>                  | —                  | 2.0                  | 5.2   | 9.0             | mA              | V <sub>cc</sub>   |
|                                   | Dark output voltage                 | V <sub>odP</sub>                  | —                  | 1.1                  | 1.4   | 1.6             | V               | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Dark output differential voltage    | V <sub>odPS</sub>                 | —                  | -25                  | 0     | 25              | mV              | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | *6 Sensitivity                      | R <sub>pP</sub>                   | —                  | 13                   | 22.5  | 34              | mV/μW           | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Sensitivity temperature coefficient | R <sub>pPt</sub>                  | Ta=-20 to +70°C    | —                    | +7000 | —               | ppm/°C          | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Response frequency                  | f <sub>CP</sub>                   | -3dB               | 3.0                  | 5.3   | —               | MHz             | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
| "L" gain mode                     | Output noise level                  | V <sub>nP</sub>                   | f=720kHz, BW=10kHz | —                    | -90   | -80             | dBm             | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Supply current                      | I <sub>CCR</sub>                  | —                  | 3.0                  | 5.6   | 10.0            | mA              | V <sub>cc</sub>   |
|                                   | Dark output voltage                 | V <sub>odR</sub>                  | —                  | 1.1                  | 1.35  | 1.6             | V               | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Dark output differential voltage    | V <sub>odRS</sub>                 | —                  | -25                  | 0     | 25              | mV              | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | *7 Sensitivity                      | R <sub>pR</sub>                   | —                  | 1.3                  | 2.8   | 4.9             | mV/μW           | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Sensitivity temperature coefficient | R <sub>pRt</sub>                  | Ta=-20 to +70°C    | —                    | +7000 | —               | ppm/°C          | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
| Common to both modes              | Response frequency                  | f <sub>CR</sub>                   | -3dB               | 2.0                  | 3.8   | —               | MHz             | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Output noise level 1                | V <sub>nR1</sub>                  | f=22kHz, BW=1kHz   | —                    | -100  | -90             | dBm             | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Output noise level 2                | V <sub>nR2</sub>                  | f=720kHz, BW=10kHz | —                    | -90   | -80             | dBm             | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Sensitivity                         | R <sub>pE</sub> , R <sub>pF</sub> | —                  | 0.28                 | 0.37  | 0.52            | μA/μW           | I <sub>E</sub> , I <sub>F</sub>                                   |
|                                   | Output current                      | I <sub>O</sub>                    | —                  | 240                  | 430   | 700             | μA              | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Dark current                        | I <sub>dE</sub> , I <sub>dF</sub> | —                  | —                    | —     | 10              | nA              | I <sub>E</sub> , I <sub>F</sub>                                   |
|                                   | Terminal capacitance                | C <sub>AK</sub>                   | —                  | —                    | (20)  | —               | pF              | I <sub>E</sub> , I <sub>F</sub>                                   |
|                                   | Mode switching terminal voltage 1   | V <sub>MR</sub>                   | —                  | V <sub>cc</sub> -0.5 | —     | V <sub>cc</sub> | V               | M <sub>PR</sub>   |
|                                   | Mode switching terminal voltage 2   | V <sub>MP</sub>                   | —                  | 0                    | —     | 0.4             | V               | M <sub>PR</sub>   |
|                                   | Mode switching terminal current 1   | I <sub>MR</sub>                   | —                  | —                    | —     | 230             | μA              | M <sub>PR</sub>   |
| Mode switching terminal current 2 | I <sub>MP</sub>                     | —                                 | —                  | —                    | -0.5  | μA              | M <sub>PR</sub> |   |
| Mode switching characteristics    | Sensitivity response                | R <sub>pRP</sub>                  | *10                | 11.7                 | 22.5  | 35.7            | mV/μW           | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |
|                                   | Sensitivity response                | R <sub>pPR</sub>                  | *10                | 1.2                  | 2.8   | 5.2             | mV/μW           | V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>D</sub> |

\*6 Specified by sampling test

\*7 6μW, φ50μm of DC light is applied to the center of each photodiode.

Under that condition, sensitivity R<sub>pP</sub> is shown by following formula.

$$R_{pP} = (V_{pP} - V_{odP}) / 6\mu W$$

V<sub>pP</sub> : Output voltage when DC light is applied.

V<sub>odP</sub> : Output voltage when DC light is not applied.

\*8 50μW φ50μm of DC light is applied to the center of each photodiode.

Under that condition, sensitivity R<sub>pR</sub> is shown by following formula.

$$R_{pR} = (V_{pR} - V_{odR}) / 50\mu W$$

V<sub>pR</sub> : Output voltage when DC light is applied.

V<sub>odR</sub> : Output voltage when DC light is not applied.

\*9 Playback mode : V<sub>M<sub>PR</sub></sub>=0V Recording mode : V<sub>M<sub>PR</sub></sub>=V<sub>cc</sub>.

\*10 Sensitivity response characteristics after switching mode is specified in the sensitivity in 200μs after change of the mode switching voltage. Take measurement with 20μ W DC light radiated to the center of each photodiode at 50μmφ.

$$R_{pP} = (V_{pP} - V_{odP}) / 20\mu W$$

Fig.1 Response Time

"L" gain mode → "H" gain mode switching time

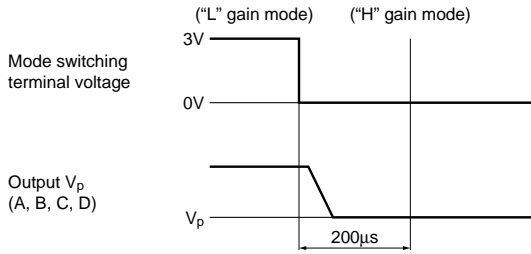


Fig.2 Response Time

"H" gain mode → "L" gain mode switching time

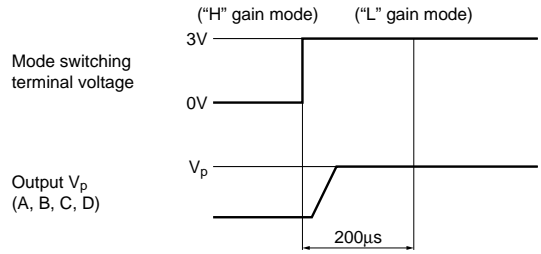


Fig.3 Detecting Pattern of Photodiode

(Unit : µm)

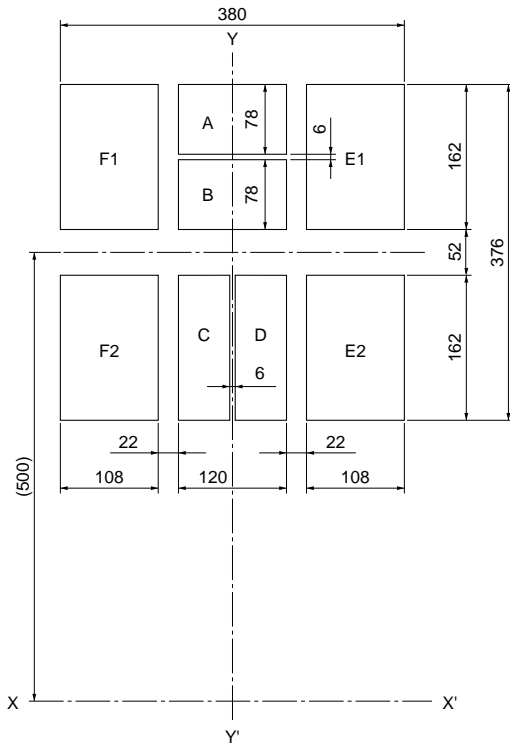
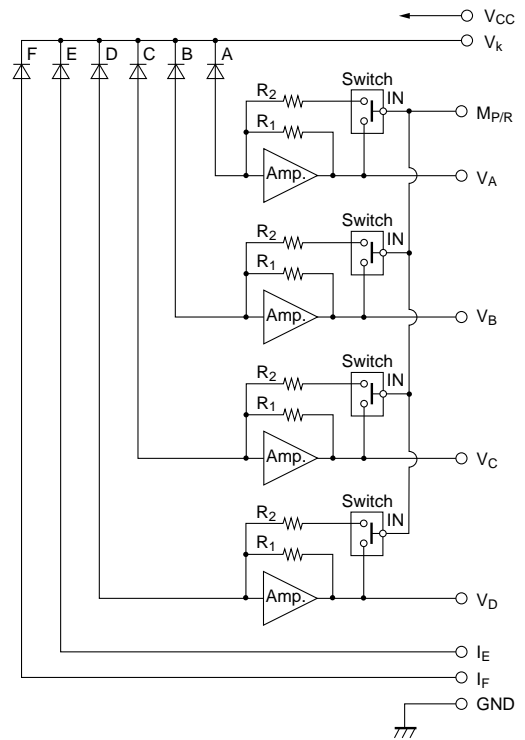


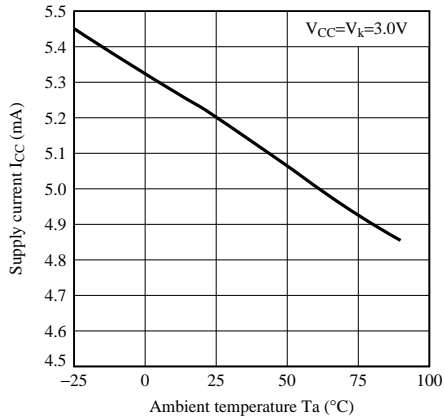
Fig.4 Block Diagram



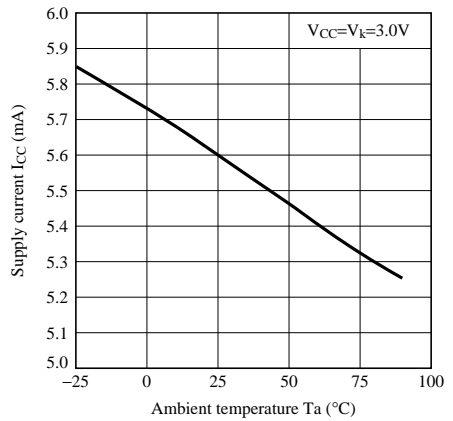
The switching circuit operates according to H and L voltage of the Mp/R terminals.

| Mode          | Mp/R terminal voltage | SW state | Gain resistance                |
|---------------|-----------------------|----------|--------------------------------|
| "H" gain mode | L                     | OFF      | R <sub>1</sub>                 |
| "L" gain mode | H                     | ON       | R <sub>1</sub> /R <sub>2</sub> |

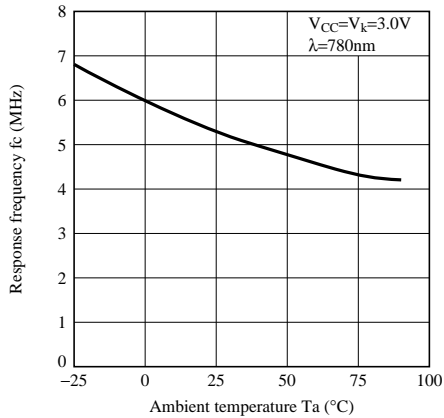
**Fig.5 Supply Current vs. Ambient Temperature (H Gain Mode)**



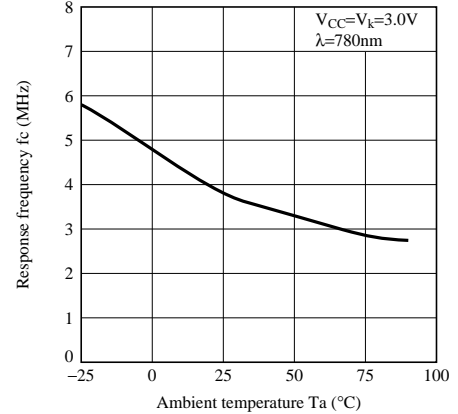
**Fig.6 Supply Current vs. Ambient Temperature (L Gain Mode)**



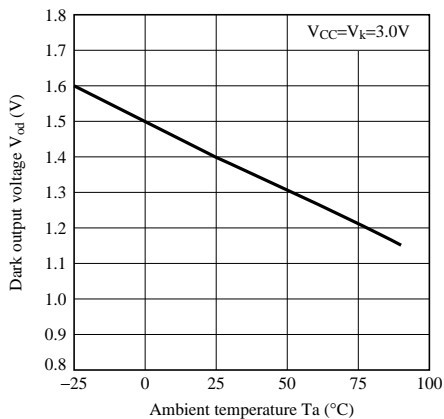
**Fig.7 Response Frequency vs. Ambient Temperature (H Gain Mode)**



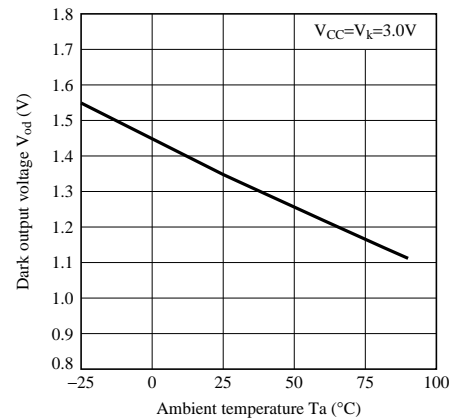
**Fig.8 Response Frequency vs. Ambient Temperature (L Gain Mode)**



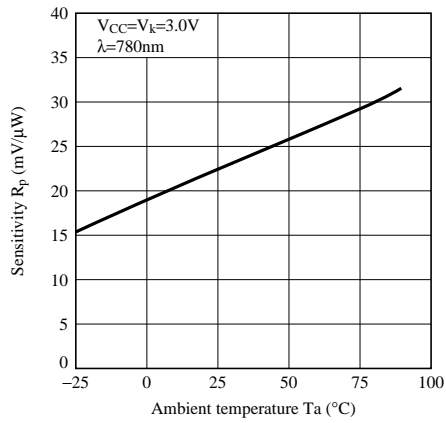
**Fig.9 Dark Output Voltage vs. Ambient Temperature (H Gain Mode)**



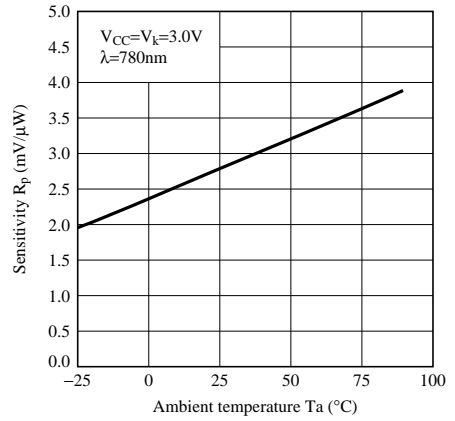
**Fig.10 Dark Output Voltage vs. Ambient Temperature (L Gain Mode)**



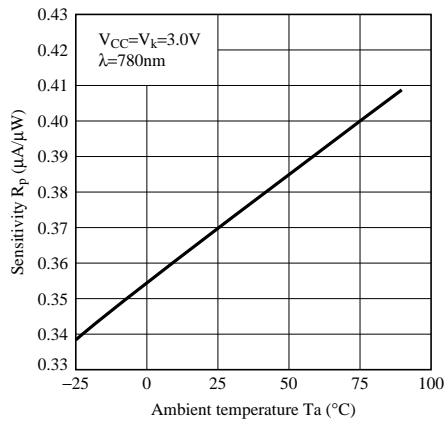
**Fig.11 Sensitivity vs. Ambient Temperature (H Gain Mode)**



**Fig.12 Sensitivity vs. Ambient Temperature (L Gain Mode)**



**Fig.13 Sensitivity vs. Ambient Temperature (H/L Gain Mode)**



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