# IS1623

## OPIC Light Detector for Playback/Recording MD player

### ■ Features

1. OPIC light detector for RF signal detection
   (Integrates 6-division PIN photodiode and amplifier IC onto a single chip)
2. Low operating voltage design (Operating voltage : 2.7 to 5.5V)
3. Sensitivity switching between playback mode and recording mode
4. Compact and thin transparent package
   (Package dimensions : 3.06 x 4.5 x 1.06 mm)

### ■ Applications

1. Optical pickup for playback/recording MD players

### ■ Absolute Maximum Ratings

(Ta=25°C)

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | −0.5 to +6.0 | V |
| Mode switching terminal voltage | $V_M$ | −0.5 to $V_{CC}$ | V |
| *1 Output voltage | $V_O$ | −0.5 to $V_{CC}$ | V |
| *2 Power dissipation | P | 150 | mW |
| Operating temperature | $T_{opr}$ | −20 to +70 | °C |
| Storage temperature | $T_{stg}$ | −40 to +85 | °C |
| *3 Soldering temperature | $T_{sol}$ | +260 | °C |

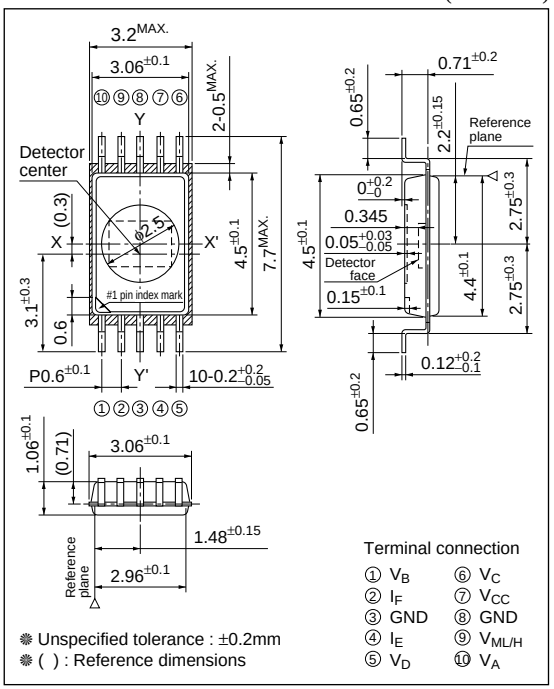
*1 Applies to individual terminals of $V_A$, $V_B$, $V_C$, $V_D$, $I_E$ and $I_F$.

*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 (Vcc=3.0V, Ta=−10°C+65˚C)

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|
| Supply voltage | $V_{cc1}$ | 2.7 | 3.0 | 5.5 | V |
| *4 "H" gain mode incident light quantity range 1 | ϕH1 | 1.58 | 6.84 | 22.9 | μW |
| *5 "H" gain mode incident light quantity range 2 | ϕH2 | 1.1 | 2.77 | 5.93 | μW |
| *4 "L" gain mode incident light quantity range 1 | ϕL1 | 6.99 | 28.8 | 78.3 | μW |
| *5 "L" gain mode incident light quantity range 2 | ϕL2 | 5.07 | 12.3 | 21.3 | μW |
| *4 "L" gain mode incident light quantity range 3 | ϕL3 | 11.1 | 54.9 | 196 | μW |
| *5 "L" gain mode incident light quantity range 4 | ϕL4 | 7.19 | 18.3 | 47.8 | 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.

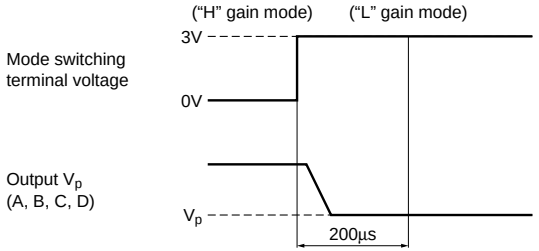
## ■ Electro-optical Characteristics (Current flowing into the device : +, Current flowing out of the device : −) (Ta=25°C, Vcc=3.0V)

| | Parameter | Symbol | *8 Conditions | MIN. | TYP. | MAX. | Unit | Application |
|---|---|---|---|---|---|---|---|---|
| "H" gain mode | Supply current | $I_{CCH}$ | − | 1.9 | 4.2 | 7.6 | mA | Vcc |
| | Dark output voltage | $V_{odH}$ | − | 0.5 | 0.68 | 0.9 | V | $V_A$, $V_B$, $V_C$, $V_D$ |
| | Dark output differential voltage | $V_{odHS}$ | − | −25 | 0 | 25 | mV | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 *7 Sensitivity | $R_{pH}$ | − | 13.0 | 22.5 | 34.0 | mV/μW | $V_A$, $V_B$, $V_C$, $V_D$ |
| | Sensitivity temperature coefficient | $R_{pHt}$ | Ta=−20 to +70°C | − | +4000 | − | ppm/°C | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 Response frequency | $f_{CH}$ | −3dB | 3.0 | 5.3 | − | MHz | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 Output noise level 1 | $V_{nH1}$ | f=22kHz, BW=1kHz | − | −100 | −90 | dBm | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 Output noise level 2 | $V_{nH2}$ | f=720kHz, BW=10kHz | − | −90 | −80 | dBm | $V_A$, $V_B$, $V_C$, $V_D$ |
| "L" gain mode | Supply current | $I_{CCL}$ | − | 2.1 | 4.6 | 8.3 | mA | Vcc |
| | Dark output voltage | $V_{odL}$ | − | 0.5 | 0.68 | 0.9 | V | $V_A$, $V_B$, $V_C$, $V_D$ |
| | Dark output differential voltage | $V_{odLS}$ | − | −25 | 0 | 25 | mV | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 *7 Sensitivity | $R_{pL}$ | − | 1.3 | 2.8 | 4.9 | mV/μW | $V_A$, $V_B$, $V_C$, $V_D$ |
| | Sensitivity temperature coefficient | $R_{pLt}$ | Ta=−20 to +70°C | − | +4000 | − | ppm/°C | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 Response frequency | $f_{CL}$ | −3dB | 1.8 | 3.8 | − | MHz | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 Output noise level 1 | $V_{nL1}$ | f=22kHz, BW=1kHz | − | −100 | −90 | dBm | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 Output noise level 2 | $V_{nL2}$ | f=720kHz, BW=10kHz | − | −90 | −80 | dBm | $V_A$, $V_B$, $V_C$, $V_D$ |
| Common to both modes | Sensitivity | $R_{pE}$, $R_{pF}$ | − | 0.32 | 0.45 | 0.57 | μA/μW | $I_E$, $I_F$ |
| | Output current | $I_O$ | − | 100 | 250 | 380 | μA | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 Dark current | $I_{dE}$, $I_{dF}$ | − | − | − | 10 | nA | $I_E$, $I_F$ |
| | *6 Terminal capacitance | $C_{AK}$ | − | − | (20) | − | pF | $I_E$, $I_F$ |
| | *6 Mode switching terminal voltage 1 | $V_{ML}$ | − | Vcc−0.5 | − | Vcc | V | $V_M$ |
| | Mode switching terminal voltage 2 | $V_{MH}$ | − | 0 | − | 0.4 | V | $V_M$ |
| | Mode switching terminal current 1 | $I_{ML}$ | − | − | − | 230 | μA | $V_M$ |
| | Mode switching terminal current 2 | $I_{MH}$ | − | − | − | −5 | μA | $V_M$ |
| Mode switching characteristics | *6 Sensitivity response | $R_{pLH}$ | ∗9 | 11.7 | 22.5 | 35.7 | mV/μW | $V_A$, $V_B$, $V_C$, $V_D$ |
| | *6 Sensitivity response | $R_{pHL}$ | ∗9 | 1.2 | 2.2 | 3.8 | mV/μW | $V_A$, $V_B$, $V_C$, $V_D$ |

*6 Specified by sampling test.
*7 6μW, ϕ50μm of DC light is applied to the center of each photodiode.
Under that condition, sensitivity $R_P$ is shown by following formula.
$R_P=(V_P-V_{od})/6\mu W$
$V_P$ : Output voltage when DC light is applied.
$V_{od}$ : Output voltage when DC light is not applied.
*8 "H"gain mode : $V_M$=0V.
"L"gain mode : $V_M=V_{CC}$.
*9 Sensitivity response characteristics after switcing mode is specified in the sensitivity in 200μs after change of the mode switcing voltage.
$R_P=(V_P-V_{od})/20\mu W$

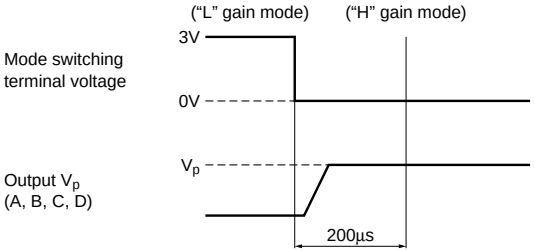
## Fig.1 Response Time

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



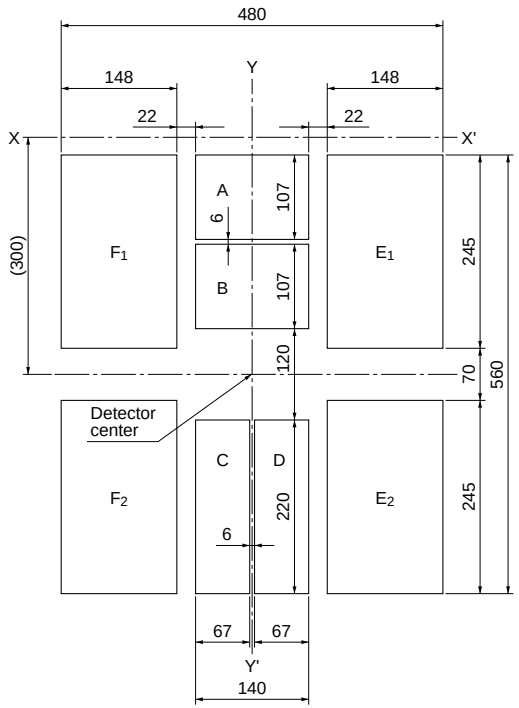

## Fig.2 Response Time

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

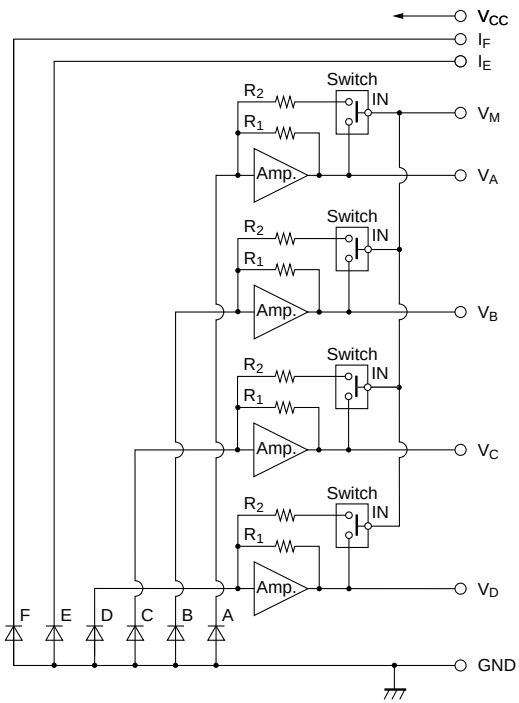



## Fig.3 Detecting Pattern of Photodiode

(Unit : µm)



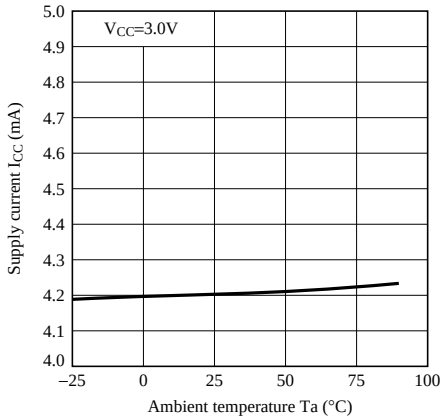

## Fig.4 Block Diagram



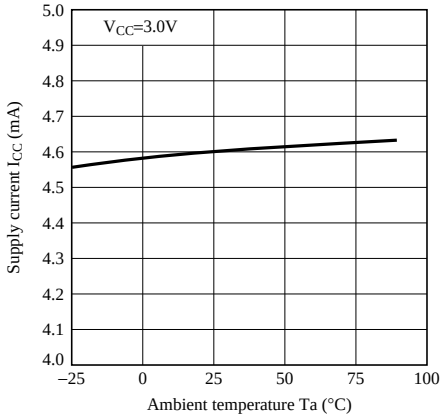

The switching circuit operates according to H and L voltage of the $V_M$ terminals.

| Mode | $V_M$ terminal voltage | SW state | Gain resistance |
|---|---|---|---|
| "H"gain mode | L | OFF | R1 |
| "L"gain mode | H | ON | R1/R2 |

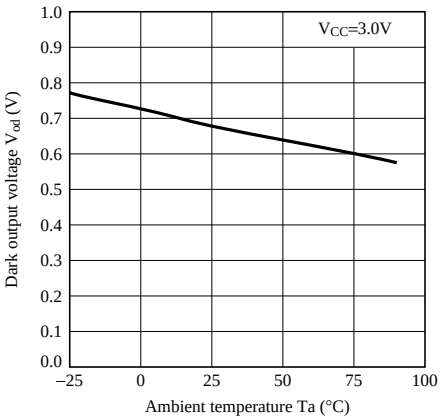
## Fig.5 Supply Current vs. Ambient Temperature (H Gain Mode)



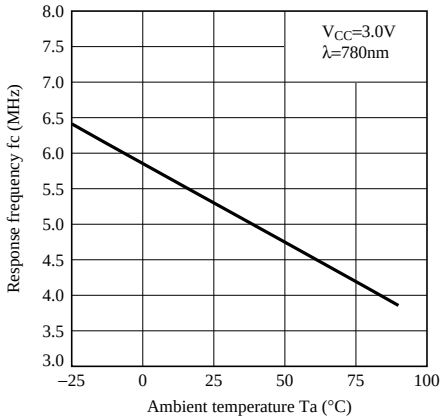

## Fig.6 Supply Current vs. Ambient Temperature (L Gain Mode)



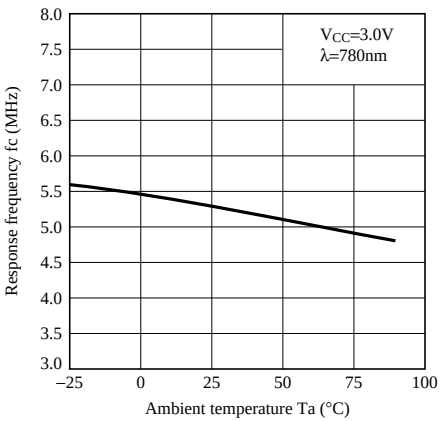

## Fig.7 Dark Output Voltage vs. Ambient Temperature (H/L Gain Mode)



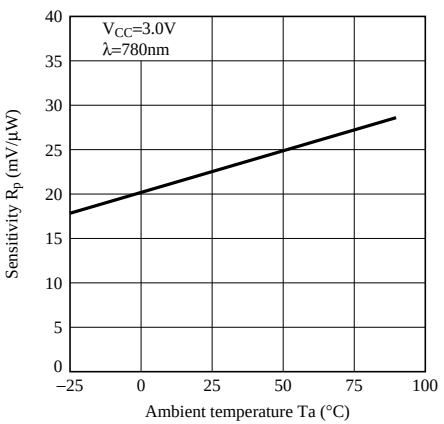

## Fig.8 Response Frequency vs. Ambient Temperature (H Gain Mode)



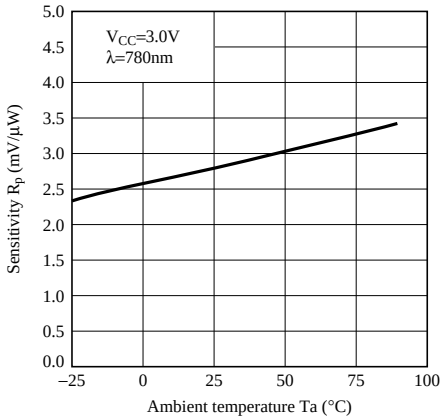

## Fig.9 Response Frequency vs. Ambient Temperature (L Gain Mode)




## Fig.10 Sensitivity vs. Ambient Temperature (H Gain Mode)



## Fig.11 Sensitivity vs. Ambient Temperature (L Gain Mode)



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