GP1S036HEZ

Phototransistor Output, Transmissive Photointerrupter with Tilt Direction (4-direction) Detecting



■ Description

GP1S36J0000F is a compact-package, phototransistor output, transmissive photointerrupter, with opposing emitter and detector in a molding that provides a ball built-in case sensing. The compact package series is a result of unique technology combing transfer and injection molding.

This is a 2-phase output device, suitable for detection of the position (4 direction).

■ Features

1. Transmissive with phototransistor output
2. Highlights :
   - Built-in a ball (2 phase output)
   - Compact
   - PWB mounting type
   - 4-direction detection
3. Lead free and RoHS directive compliant

■ Agency approvals/Compliance

1. Compliant with RoHS directive

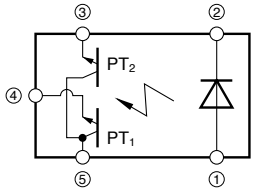
■ Applications

1. General purpose detection of device direction.
2. Example : Camera, DSC, Camcorder, Robot

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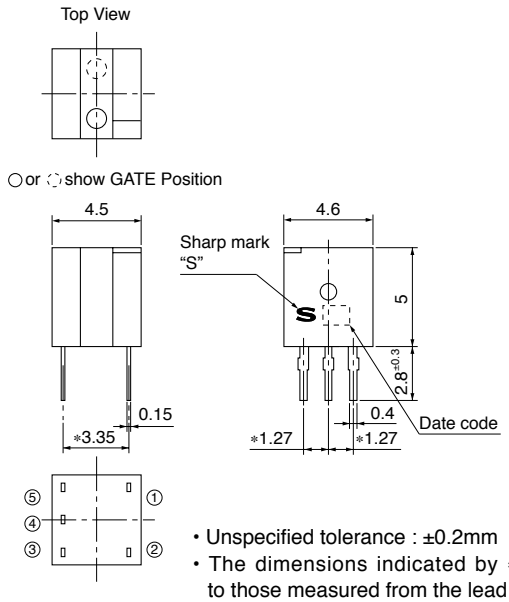
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Date Oct. 3. 2005
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■ Internal Connection Diagram



① Anode
② Cathode
③ Emitter 2
④ Emitter 1
⑤ Collector

■ Outline Dimensions (Unit : mm)



- Unspecified tolerance : ±0.2mm
- The dimensions indicated by ∗ refer to those measured from the lead base.
- Burr is not included in the dimensions. Burr's dimensions : 0.15MAX.

Product mass : approx. 0.2g

Plating material : SnCu (Cu : TYP. 2%)

Date code (2 digit)

1st digit		2nd digit	
Year of production		Month of production	
A.D.	Mark	Month	Mark
2000	0	1	1
2001	1	2	2
2002	2	3	3
2003	3	4	4
2004	4	5	5
2005	5	6	6
2006	6	7	7
2007	7	8	8
2008	8	9	9
2009	9	10	X
2010	0	11	Y
:	:	12	Z

repeats in a 10 year cycle

Country of origin

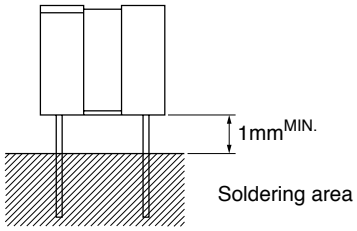
Japan, China

■ Absolute Maximum Ratings

(T_a=25°C)

Parameter		Symbol	Rating	Unit
Input	Forward current	I_F	50	mA
	Reverse voltage	V_R	6	V
	Power dissipation	P	75	mW
Output	Collector-emitter voltage	V_{CE1O} V_{CE2O}	35	V
	Emitter-collector voltage	V_{E1CO} V_{E2CO}	6	V
	Collector current	I_C	20	mA
	Collector power dissipation	P_C	75	mW
Total power dissipation		P_{tot}	100	mW
Operating temperature		T_{opr}	–25 to +85	°C
Storage temperature		T_{stg}	–40 to +100	°C
*1Soldering temperature		T_{sol}	260	°C

*1 For MAX. 5s



■ Electro-optical Characteristics

(T_a=25°C)

Parameter			Symbol	Condition	MIN.	TYP.	MAX.	Unit
Input	Forward voltage		V_F	I_F=20mA	–	1.2	1.4	V
	Reverse current		I_R	V_R=3V	–	–	10	μA
*3Output	Dark current		I_{CEO}	V_{CE}=20V	–	–	100	nA
*3Transfer characteristics	Collector current		I_C	V_{CE}=5V, I_F=5mA	55	–	300	μA
	*4Leak current		I_{LEAK}	V_{CE}=5V, I_F=5mA	–	–	17	μA
	Collector-emitter saturation voltage		$V_{CE(sat)}$	I_F=10mA, I_C=55μA	–	–	0.4	V
	Response time	Rise time	t_r	V_{CE}=5V, I_C=100μA, R_L=1kΩ	–	50	150	μs
		Fall time	t_f		–	50	150	μs

*3 Output and coupling characteristics are common to the both phototransistors.
*4 Characteristics except leak current is measured at θ=180°, ϕ=0°.
Leak current is the output current of transistor when θ=+90° or -90°, ϕ=0° and I_C=OFF.

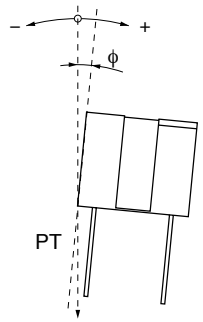
■ Absolute Maximum Ratings (I_F=5mA, V_{CC}=5V, ϕ≤±5)

θ	0°	→	30°	→	60°	→	120°	→	150°	→	210°
I_{C1}	OFF						Indefinite			ON	
I_{C2}	OFF		Indefinite				ON				Indefinite

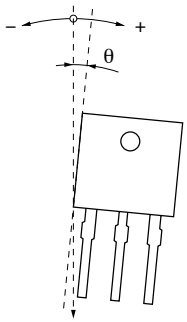
θ	→	240°	→	300°	→	330°	→	360°
I_{C1}	ON			Indefinite			OFF	
I_{C2}	Indefinite		OFF					

I_{C1} : Output current of phototransistors PT_1
I_{C2} : Output current of phototransistors PT_2
θ : Device condition : Refer to the figure
ϕ : Device condition : Refer to the figure
ON :Output current of phototransistors : 55μA or more
OFF : Output current of phototransistors : 17μA or less
∗ Output of ON/OFF is under the condition that the device is in stationary state.

Device state diagram



Gravity direction



Gravity direction
(Viewing from detecting side)

■ Supplement

Principle of Tilt Detection (Viewing from detecting side)

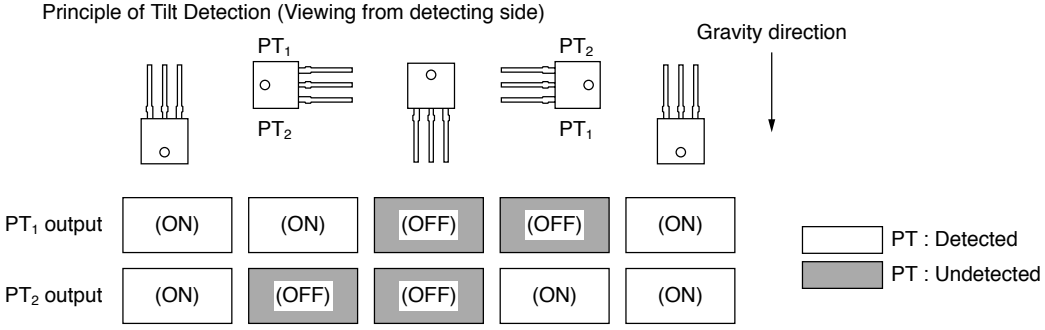


Fig.1 Forward Current vs. Ambient Temperature

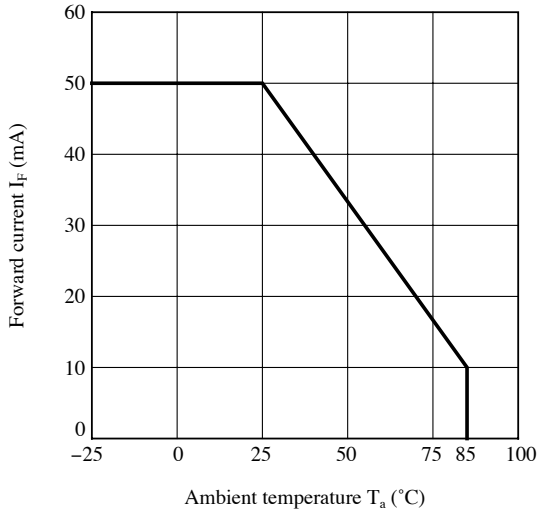


Fig.2 Power Dissipation vs. Ambient Temperature

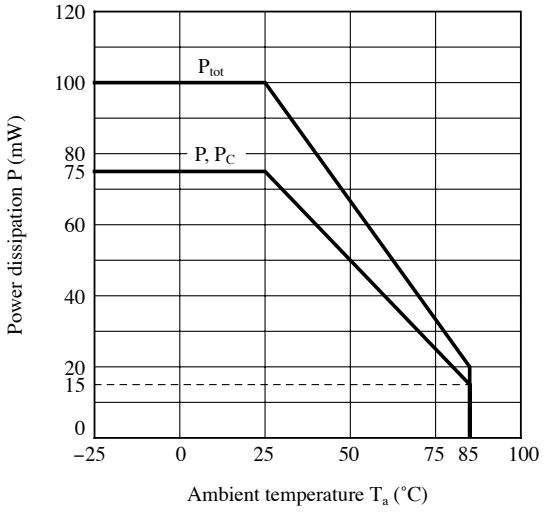


Fig.3 Forward Current vs. Forward Voltage

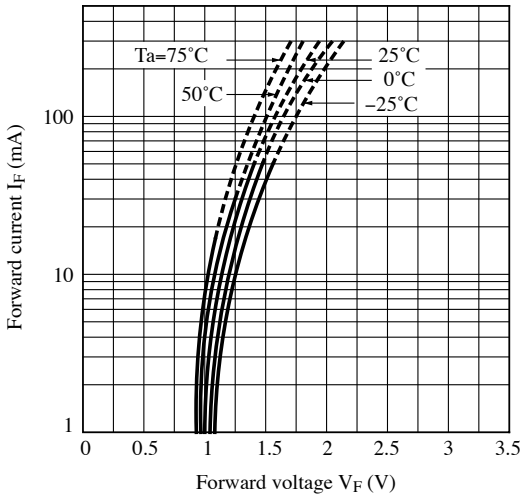


Fig.4 Collector Current vs. Forward Current

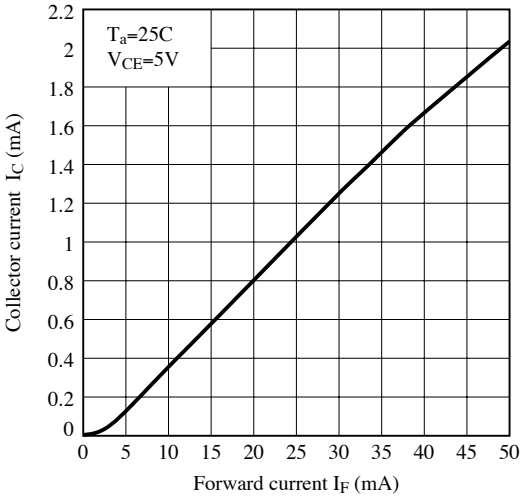


Fig.5 Collector Current vs. Collector-emitter Voltage

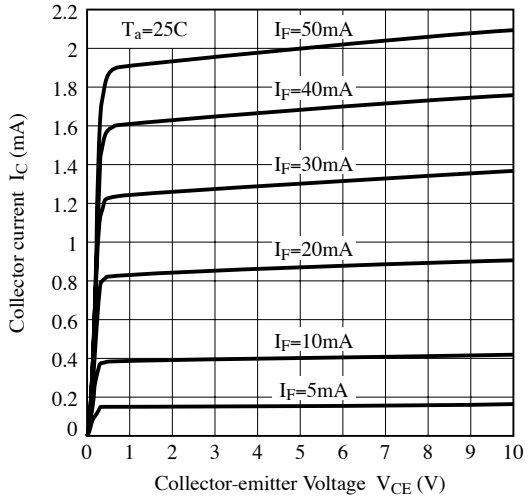


Fig.6 Relative Collector Current vs. Ambient Temperature

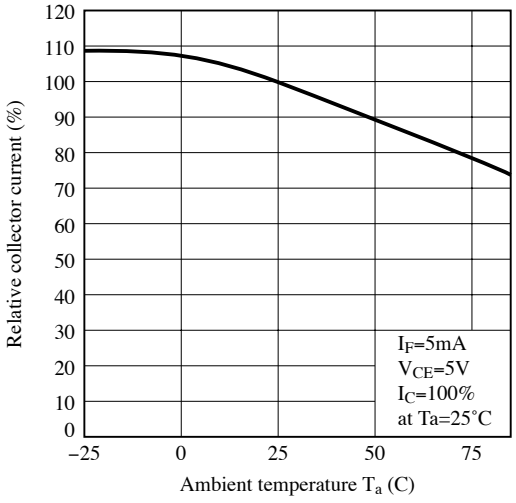


Fig.7 Collector-emitter Saturation Voltage vs. Ambient Temperature

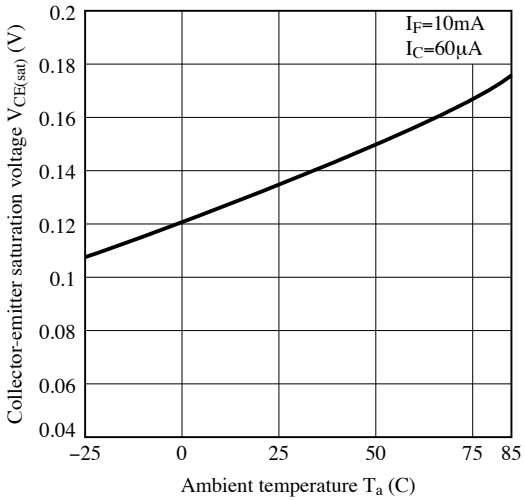


Fig.8 Response Time vs. Load Resistance

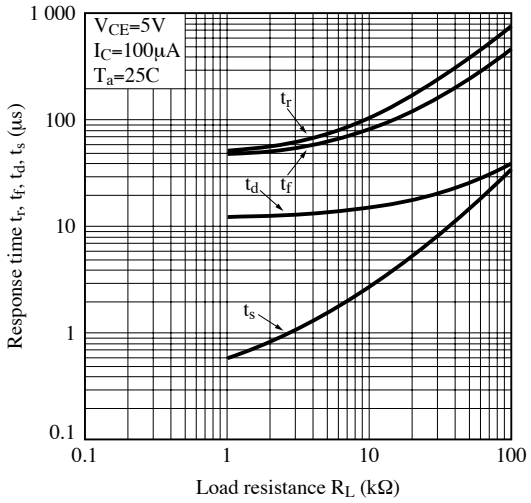


Fig.9 Collector Dark Current vs. Ambient Temperature

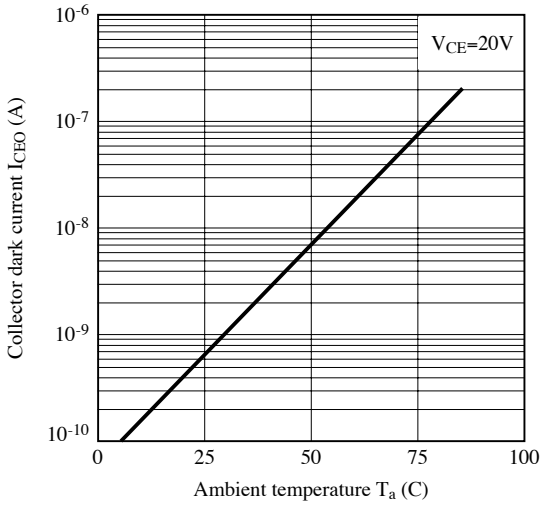
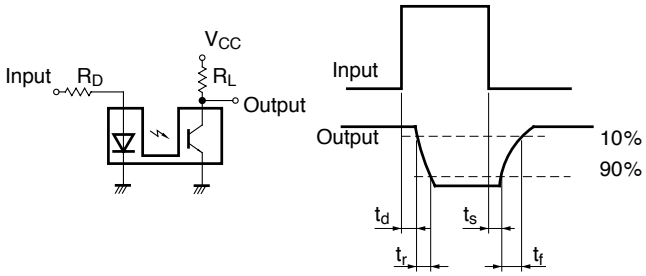


Fig.10 Test Circuit for Response Time



Remarks : Please be aware that all data in the graph are just for reference and not for guarantee.

■ Design Considerations

● Design guide

1) Prevention of malfunction

To prevent photointerrupter from faulty operation caused by external light, do not set the detecting face to the external light.

Please confirm that there is no mis-operation by magnetic field in use, for prevention of mis-operation by magnetic field.

Please don't let the device put in change of temperature that makes dew for prevention of mis-operation by dew.

If the device is put in the change of temperature which makes dew, please leave the device for enough time in the constant temperature for use.

This product is not designed against irradiation and incorporates non-coherent IRED.

● Degradation

In general, the emission of the IRED used in photointerrupter will degrade over time.

In the case of long term operation, please take the general IRED degradation (50% degradation over 5 years) into the design consideration.

● Parts

This product is assembled using the below parts.

• Photodetector (qty. : 1)

Category	Material	Maximum Sensitivity wavelength (nm)	Sensitivity wavelength (nm)	Response time (μs)
Phototransistor	Silicon (Si)	800	700 to 1 200	12

• Photo emitter (qty. : 1)

Category	Material	Maximum light emitting wavelength (nm)	I/O Frequency (MHz)
Infrared emitting diode (non-coherent)	Gallium arsenide (GaAs)	950	0.3

• Material

Case	Lead frame	Lead frame plating	Packing case	Metal ball
Black polyphenylene sulfide resin (UL94 V-0)	42Alloy	SnCu plating	Polycarbonate	Fe

■ Manufacturing Guidelines

● Soldering Method

Flow Soldering:

Soldering should be completed below 260˚C and within 5 s.
Please solder within one time.
Soldering area is 1mm or more away from the bottom of housing.
Please take care not to let any external force exert on lead pins.
Please don't do soldering with preheating, and please don't do soldering by reflow.

Lead pin

Lead terminals of this product are tin copper alloy plated. Before usage, please evaluate solderability with actual conditions and confirm. And the uniformity in color for the lead terminals are not specified.

Other notice

Please test the soldering method in actual condition and make sure the soldering works fine, since the impact on the junction between the device and PCB varies depending on the tooling and soldering conditions.

● Cleaning instructions

The device shall not be washed with washing material, for there is possibility to remain washing material in internal space of this transmissive type photointerrupter.

● Presence of ODC

This product shall not contain the following materials.
And they are not used in the production process for this product.
Regulation substances : CFCs, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methylchloroform)

Specific brominated flame retardants such as the PBBOs and PBBs are not used in this product at all.

This product shall not contain the following materials banned in the RoHS Directive (2002/95/EC).

- Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE).

■ Package specification

● Sleeve package

Package materials

Sleeve : Polystyrene
Stopper : Styrene-Elastomer

Package method

MAX. 40 pcs. of products shall be packaged in a sleeve. Both ends shall be closed by tabbed and tabless stoppers.
MAX. 50 sleeves in one case.

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--- Personal computers
--- Office automation equipment
--- Telecommunication equipment [terminal]
--- Test and measurement equipment
--- Industrial control
--- Audio visual equipment
--- Consumer electronics

(ii) Measures such as fail-safe function and redundant design should be taken to ensure reliability and safety when SHARP devices are used for or in connection with equipment that requires higher reliability such as:

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--- Traffic signals
--- Gas leakage sensor breakers
--- Alarm equipment
--- Various safety devices, etc.

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--- Telecommunication equipment [trunk lines]
--- Nuclear power control equipment
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