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SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOINTERRUPTER

MODEL No.

GP1A78RB

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2. When using this product, please observe the absolute maximum ratings and the instructions for use outlined in these specification sheets, as well as the precautions mentioned below. Sharp assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets, and the precautions mentioned below.

   (Precautions)

   (1) This product is designed for use in the following application areas ;

   [• OA equipment • Audio visual equipment • Home appliances
   • Telecommunication equipment (Terminal) • Measuring equipment
   • Tooling machines • Computers]

   If the use of the product in the above application areas is for equipment listed in paragraphs (2) or (3), please be sure to observe the precautions given in those respective paragraphs.

   (2) Appropriate measures, such as fail-safe design and redundant design considering the safety design of the overall system and equipment, should be taken to ensure reliability and safety when this product is used for equipment which demands high reliability and safety in function and precision, such as ;

   [• Transportation control and safety equipment (aircraft, train, automobile etc.)
   • Traffic signals • Gas leakage sensor breakers • Rescue and security equipment
   • Other safety equipment]

   (3) Please do not use this product for equipment which require extremely high reliability and safety in function and precision, such as ;

   [• Space equipment • Telecommunication equipment (for trunk lines)
   • Nuclear power control equipment • Medical equipment]

   (4) Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above three paragraphs.

3. Please contact and consult with a Sharp sales representative for any questions about this product.

CUSTOMER'S APPROVAL

DATE

BY

DATE PRESENTED Apr. 17, 1997

BY K. Ebina

K. Ebina,
Chief Manager of
Opto-System Project Team
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1. Application

This specification applies to the outline and characteristics of transmissive type photointerrupter, Model No. GP1A78RB.

2. Outline

Refer to the attached drawing No. CY9152i02.

3. Ratings and characteristics

- Refer to the attached sheet, Page 3 to 7.
- Resolution : 150DPI
- Output form : Digital 2-phase (Phase A and Phase B)

4. Reliability

Refer to the attached sheet, Page 8.

5. Incoming inspection

Refer to the attached sheet, Page 9.

6. Supplements

- Parts

Refer to the attached sheet, Page 10.

7. Notes

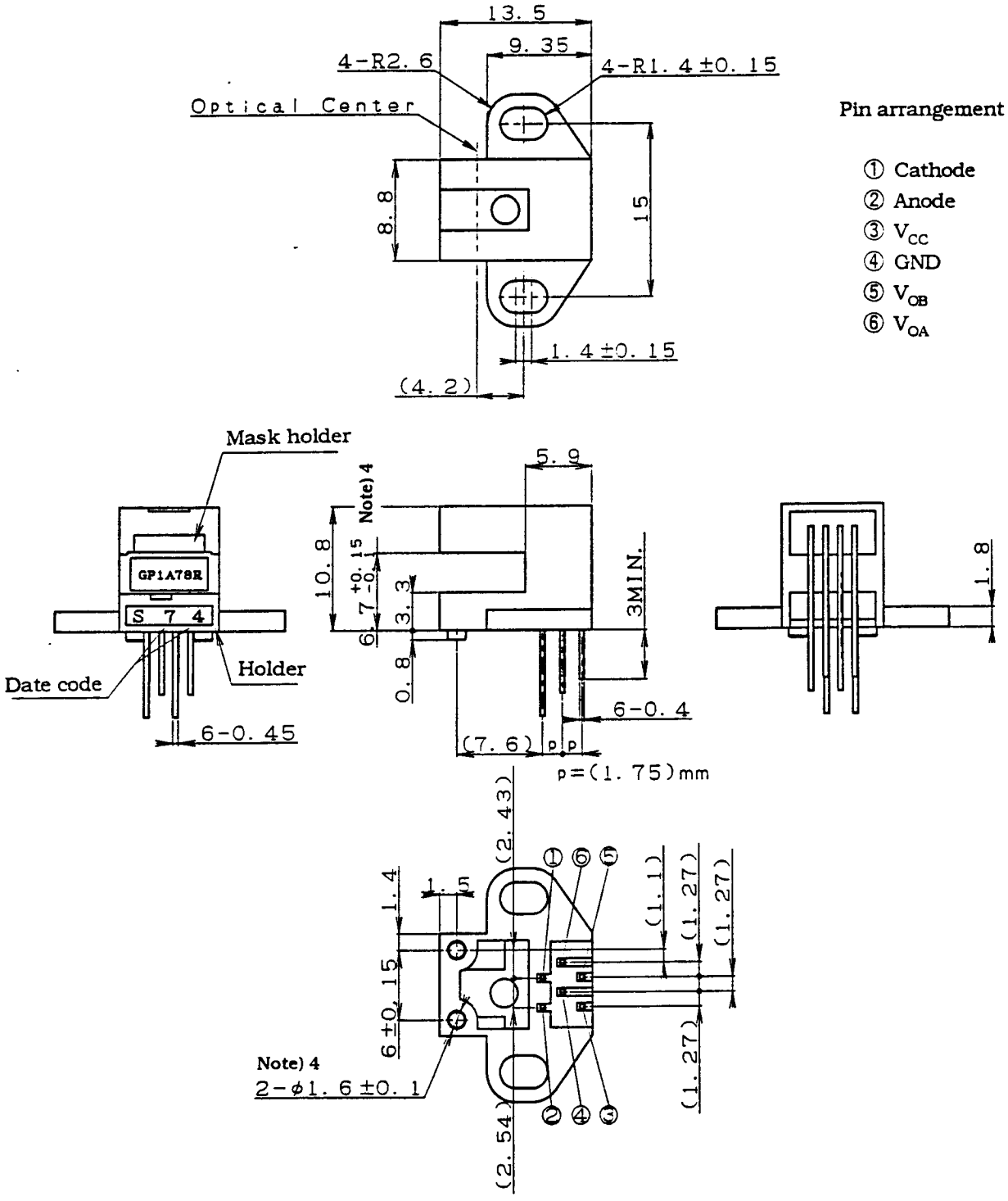
7-1 In order to stabilize power supply line, connect a by-pass capacitor of more than 0.01 μF between Vcc and GND near the device.

7-2 Please don't carry out cleaning GP1A78RB in order to be fixed mask for a moire stripe in GP1A78RB.
(Dust and stain shall clean by air blow.)

7-3 If you use in combination with linear scale, should be mounted that this device don't contact with scale face.

7-4 To solder onto lead pins, solder at 260℃ for 5 s or less.
Please take care not to let any external force exert on lead pins when soldering or just after soldering. Please don't do soldering with preheating, and please don't do soldering by reflow.

2. Outline (Drawing No. CY9152i02) Scale : 2/1 Unit : 1/1mm



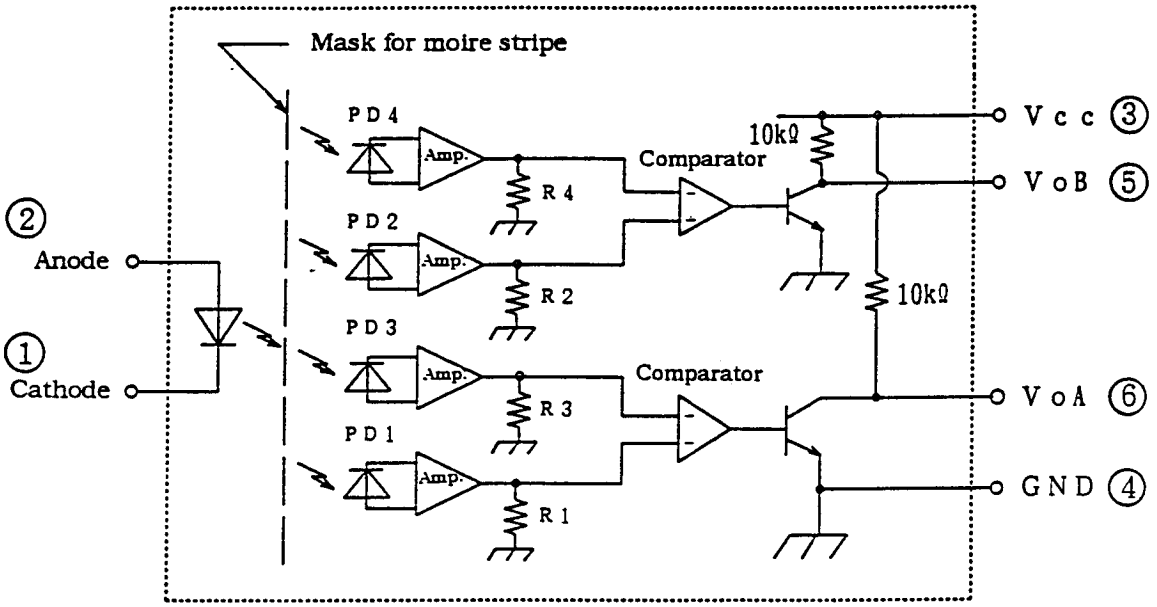
Pin arrangement

① Cathode
② Anode
③ V_{CC}
④ GND
⑤ V_{OB}
⑥ V_{OA}

1) Unspecified tolerances shall be ±0.3.
2) Dimensions in parenthesis are shown for reference.
3) The scale is not included in this encoder module, GP1A78RB.
4) The outline dimensions which affects electrical characteristics in incoming inspection standard.

3. Ratings and characteristics

3.1 GP1A78RB block diagram



Supply voltage V_{CC}=5 ± 10%

3.2 Absolute maximum ratings

Ta=25℃

Parameter		Symbol	Rating	Unit
Input	*2 Forward current	I_F	65	mA
	*1 Peak forward current	I_{FM}	1	A
	Reverse voltage	V_R	6	V
	Power dissipation	P	100	mW
Output	Supply voltage	Vcc	7	V
	Low level output current	I_{OL}	20	mA
	*2 Power dissipation	Po	250	mW
Operating temperature		Topr	0 to +70	℃
Storage temperature		Tstg	-40 to +80	℃
*3 Soldering temperature		Tsol	260	℃

*1 Pulse width≦100 μs, Duty ratio : 0.01

*2 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig. 1, 2.

*3 For 5 s

3.3 Electro-optical characteristics

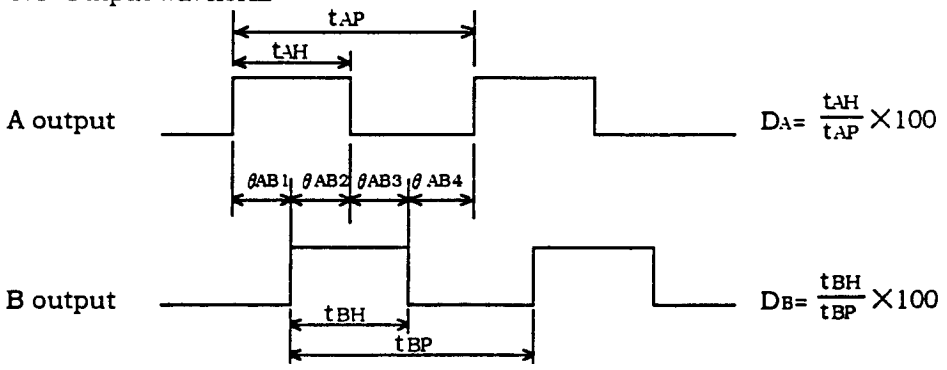
Ta=25℃

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage	V_F	I_F=30mA	-	1.2	1.5	V
	Reverse current	I_R	V_R=3V	-	-	10	μA
Output	Operating supply voltage range	V_{CC}	-	4.5	5.0	5.5	V
	Low level output voltage	V_{OL}	Vcc=5V, I_F=30mA I_{OL}=8mA	-	0.1	0.4	V
	High level output voltage	V_{OH}	Vcc=5V, I_F=30mA	4.0	4.9	-	V
	Supply current	I_{CC}	Vcc=5V, I_F=30mA Phases A and B both at low level	-	5	20	mA
Transfer characteristics ※1	Duty	D_A	V_{CC}=5V I_F=30mA f=100Hz Z=0.3mm $^{\pm 0.2mm}$	30	50	70	%
		D_B					
	Phase difference	$\theta_{AB1\sim4}$		50	90	130	°
	Response speed	tr	V_{CC}=5V, I_F=30mA f=100Hz, Z=0.3mm $^{\pm 0.2mm}$	-	1.0	2.0	μs
		tf		-	1.0	2.0	
	Response frequency	fmax	Vcc=5V, I_F=30mA Z=0.3mm $^{\pm 0.2mm}$	-	-	7	kHz

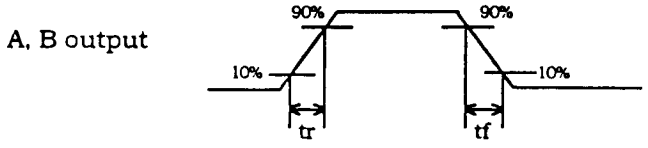
※1 The test condition is according to Fig. 3 (CY9153i06).
Duty ratio and phase difference are average values.
Z stands for distance between scale surface (patterned surface) and detector holder surface.

Note: It is recommended that the GP1A78RB be used under the condition of typical I_F=30mA for which it is designed.

3.4 Output waveform



Refer to note 2 in Fig.3 (CY9153i06) for the moving direction of scale.



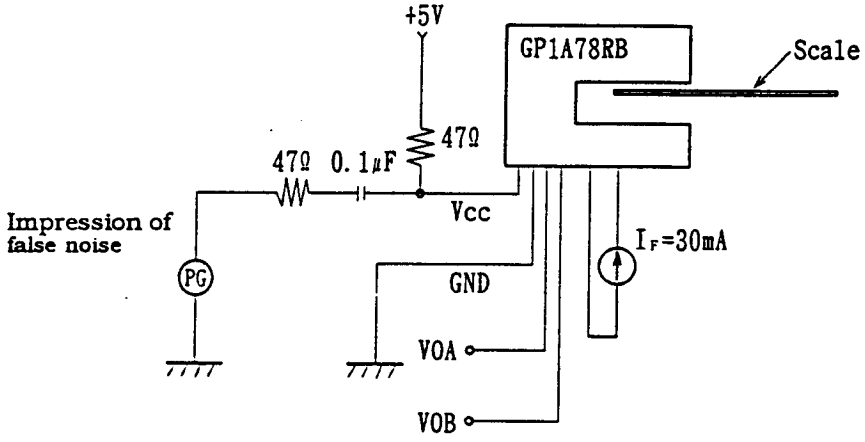
※ Noise resistance

- Specification : No chattering on output waveform of the device with false noise of Vpp=150mV impressed to the power supply of detector side.

- Condition :

Operation voltage		Vcc=5V
False noise	(Peak-to-peak value)	Vpp=150mV
	(Waveform)	Triangle wave
	(Frequency)	f=300kHz
Forward current		I_F=30mA
Photointerrupter output phase frequency		f=100Hz
Operation temperature		Ta=25℃

- Test circuit : As shown below



* Vcc waveform

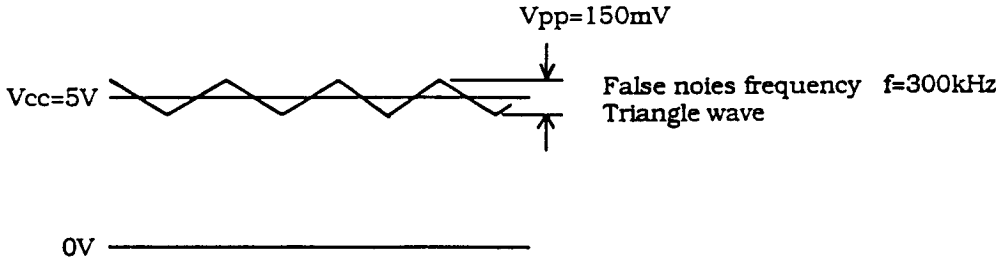


Fig.1 Forward current vs. ambient temperature

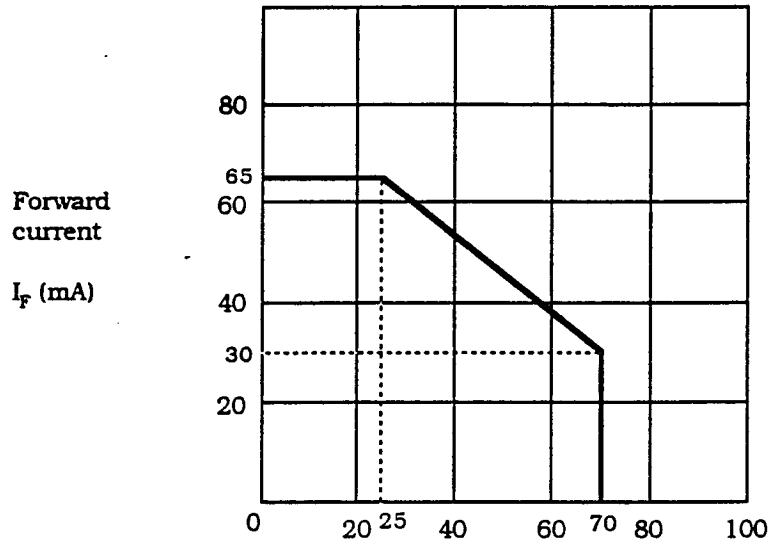


Fig.2 Output power dissipation vs. ambient temperature

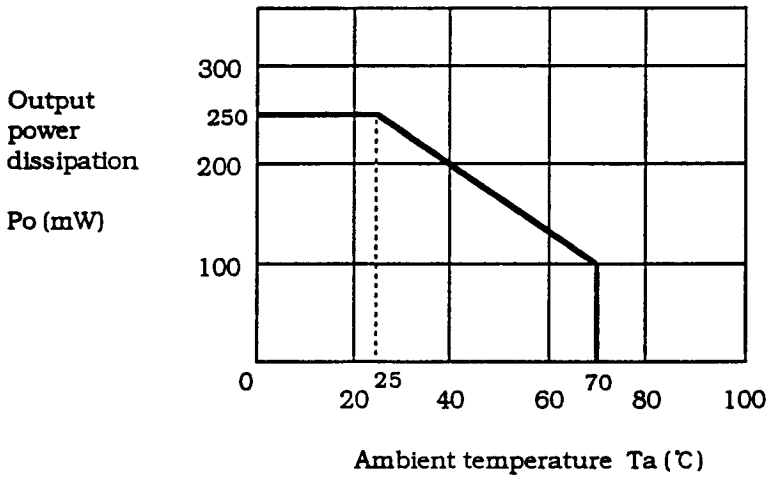
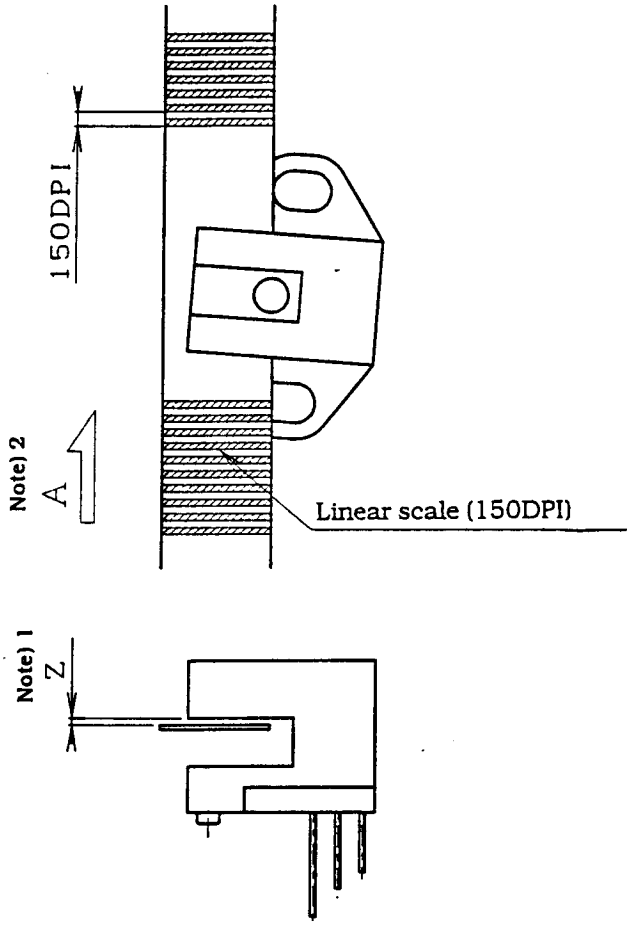


Fig. 3 GP1A78RB Test Conditions (Drawing No. CY9153i06) Scale : Free Unit : 1/1mm



Note 1) Distance between scale surface and holder surface in the detector side.

2) The moving direction of scale against output waveform (Refer to 3.4) .

3) X-X' axis is a line through center of fixing pin and has an angle of 85.72° with scale slit.

4. Reliability

The reliability of products shall satisfy items listed below.

Confidence level : 90%
LTPD : 10%/20%

Test Items	Test Conditions	Failure Judgement Criteria	Samples (n) / Defective (c)
Temperature cycling	1 cycle -40℃ to +80℃ (30min) (30min) 20 cycles test	$V_F \geqq U \times 1.2$ $I_R \geqq U \times 2$ $V_{OL} \geqq U \times 1.2$ $V_{OH} \leqq L \times 0.8$ $I_{CC} \geqq U \times 1.2$ Duty : Shall be within the specification values. U: Upper specification limit L: Lower specification limit	n=22, c=0
High temp. and high humidity storage	+60℃, 90%RH, 500h		n=22, c=0
High temp. storage	+80℃, 1000h		n=22, c=0
Low temp. storage	-40℃, 1000h		n=22, c=0
Operation life	I_F=30mA, Vcc=5V, Ta=25℃, 1000h		n=22, c=0
Mechanical shock	15000m/s^2, 0.5ms 3 times/ ±X, ±Y, ±Z direction		n=11, c=0
Variable frequency vibration	100 to 2000 to 100Hz/4min 4 times/X, Y, Z direction 200m/s^2		n=11, c=0
Terminal strength (Tension)	Weight: 10N 30s/each terminal		n=11, c=0
Terminal strength (Bending)	Weight: 5N 0° →90° →0° →-90° →0° 1time bending		n=11, c=0
Soldering heat	260℃, 5s		n=11, c=0
Solderability	230℃, 5s	*1	n=11, c=0

* For details, conforms to JIS C 7021.

* Test conditions shall be based upon the specification.

*1 Solder shall adhere at less than 95% area of immersed portion of lead.

5. Incoming inspection

Incoming inspection standard of GP1A78RB is shown below.

A single sampling plan, normal inspection level II based on ISO 2859 is applied.
The AQL according to the inspection items are shown below.

Defect	Inspection item	AQL (%)	Judgement Criteria
Major defect	Electrical characteristics Dimension that may affect electrical characteristics * Unreadable marking	0.25	Depend on the specification
Minor defect	Appearance and outline dimension except shown above.	0.65	

* Refer to Note 4 in drawing CY9152i02 (GP1A78RB outline dimensions).

6. Supplements

6.1 Parts

This product uses the below parts.

6.1.1 Light detector (IS478, Q'ty : 1)

(Using a silicon photodiode as light detecting portion, and a bipolar IC as signal processing circuit.)

Type	Maximum sensitivity wavelength (nm)	Sensitivity wavelength (nm)	Response time (μs)
Photodiode	900	400 to 1200	143

6.1.2 Light emitter (GL4100, Q'ty : 1)

Type	Material	Maximum light emitting wavelength (nm)	I/O Frequency (MHz)
Infrared light emitting diode (Non-coherent)	GaAs	950	0.3

6.1.3 Material

Holder	Mask holder
Polycarbonate resin (UL 94V-2)	Polycarbonate resin (UL 94V-2)

6.1.4 Others

This product shall not be proof against radiation flux.

Laser generator is not used.

Phototriac coupler, GP1A78RB