GP1A35RV

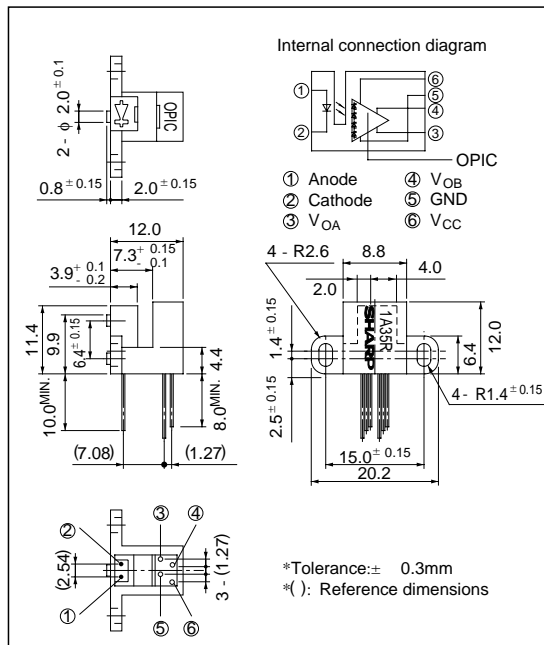## High Sensing Accuracy OPIC Photointerrupter with Encoder Functions

■ Features

1. 2-phase（A, B）digital output
2. High sensing accuracy
   （Disk slit pitch: 0.22mm, Moire stripe application）
3. TTL compatible output
4. Compact and light

■ Applications

1. Copiers
2. Electronic typewriters, printers
3. Numerical control machines

■ Outline Dimensions　　（Unit : mm）

Internal connection diagram

OPIC

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

*Tolerance:± 0.3mm
*( ): Reference dimensions

*"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.

■ Absolute Maximum Ratings　　（Ta= 25°C）

	Parameter	Symbol	Rating	Unit
Input	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	V_{CC}	7	V
	Low level output current	I_{OL}	20	mA
	Power dissipation	P_O	250	mW
Operating temperature		T_{opr}	0 to + 70	°C
Storage temperature		T_{stg}	- 40 to + 80	°C
*2 Soldering temperature		T_{sol}	260	°C

*1 Pulse width<=100µ s, Duty ratio= 0.01　　　　*2 For 5 seconds

■ Electro-optical Characteristics

(Ta= 25˚C)

| 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	Output voltage	Phase A	High level	V_{AH}	V_{CC}= 5V, I_F= 30mA	2.4	4.9	-	V
			Low level	V_{AL}	I_{OL} = 8mA, I_F = 30mA, V_{CC}= 5V	-	0.1	0.4	
		Phase B	High level	V_{BH}	V_{CC}= 5V, I_F = 30mA	2.4	4.9	-	
			Low level	V_{BL}	I_{OL}= 8mA, I_F = 30mA, V_{CC}= 5V	-	0.1	0.4	
	Dissipation current			I_{CC}	*3V_{CC} = 5V, I_F = 30mA	-	5	20	mA
Transfer charac- teristics	Duty ratio			*4 Δ_A	I_F= 30mA	30	50	70	%
				*4 Δ_B	*6 f= 12kHz				
	Phase difference			*5 θ_{AB1}	V_{CC}= 5V	50	90	130	deg.
	Response speed			t_r	I_F= 30mA, V_{CC}= 5V	-	1.0	2.0	μs
				t_f	*6 f= 12kHz	-	1.0	2.0	

*3 In the condition that output A and B are low level.

*4 $\Delta_A = \dfrac{t_{AH}}{t_{AP}}$ x 100, $\Delta_B = \dfrac{t_{BH}}{t_{BP}}$ x 100

*5 $\theta_{AB1} = \dfrac{t_{AB1}}{t_{AP}}$ x 360˚

*6 Measured under the condition shown in Measurement Conditions.

■ Output Waveforms
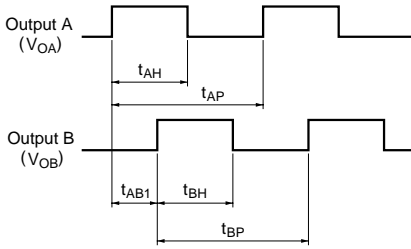
Rotational direction: Counterclockwise when seen from OPIC light detector
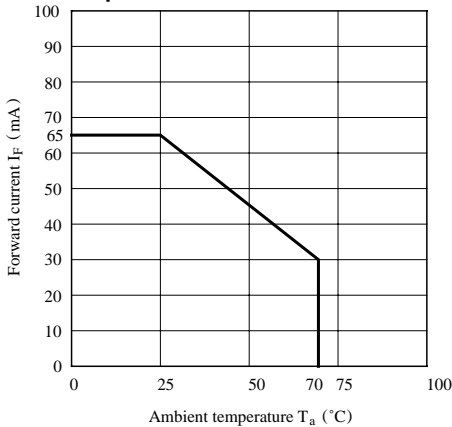
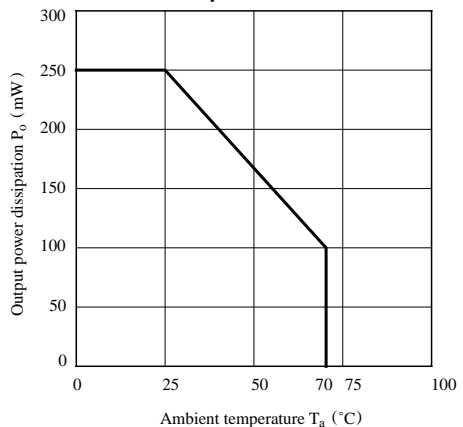### Fig. 1 Forward Current vs. Ambient Temperature

Ambient temperature T_a (˚C)

Fig. 2 Output Power Dissipation vs. Ambient Temperature

Ambient temperature T_a (˚C)

Fig. 3 Duty Ratio vs. Frequency

$\frac{t_{AH}}{t_{AP}}$ (Output A)

$\frac{t_{BH}}{t_{BP}}$ (Output B)

$V_{CC}= 5V$
$I_F= 30mA$
$T_a= 25°C$

Duty ratio
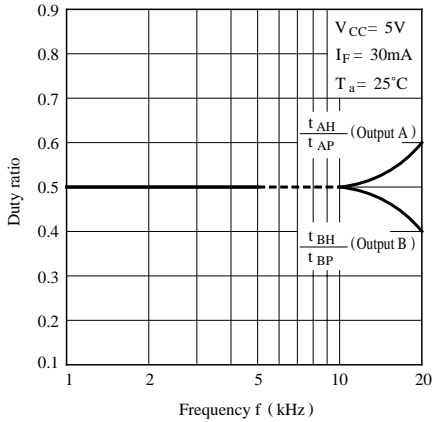
Frequency f (kHz)

Fig. 4 Phase Difference vs. Frequency

$V_{CC}= 5V$
$I_F= 30mA$
$T_a= 25°C$

$\theta_{AB1}= \frac{t_{AB1}}{t_{AP}} \times 360°$

Phase difference θ_{AB1} (deg.)

Frequency f (kHz)
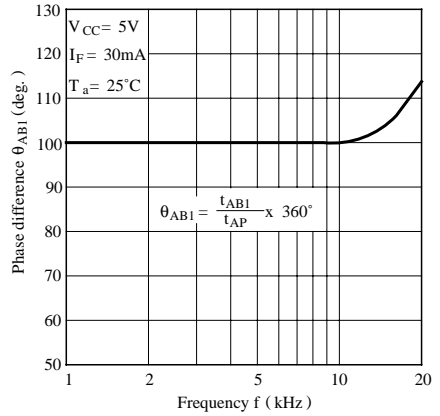
Fig. 5 Duty Ratio vs. Ambient Temperature

$\frac{t_{AH}}{t_{AP}}$ (Output A)

$\frac{t_{BH}}{t_{BP}}$ (Output B)

$V_{CC}= 5V$
$I_F= 30mA$
$f= 12kHz$

Duty ratio

Ambient temperature T_a (°C)
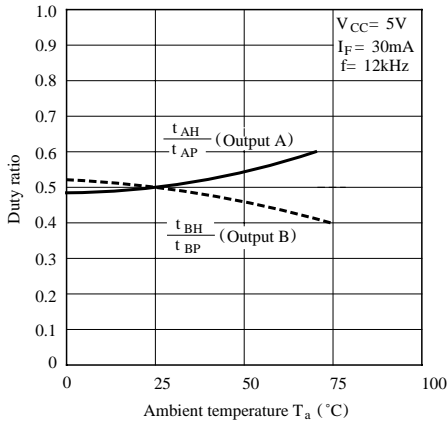
Fig. 6 Phase Difference vs. Ambient Temperature

$V_{CC}= 5V$
$I_F= 30mA$
$f= 12kHz$

$\theta_{AB1}= \frac{t_{AB1}}{t_{AP}} \times 360°$

Phase difference θ_{AB1} (deg.)

Ambient temperature T_a (°C)
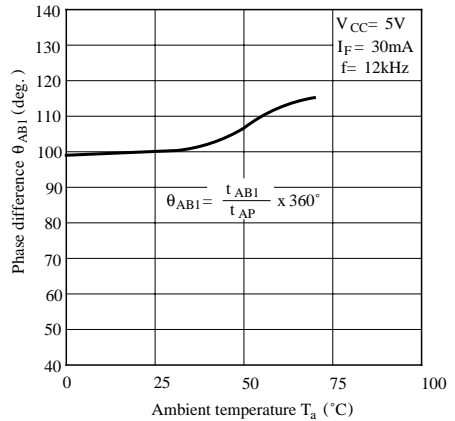
Fig. 7 Duty Ratio vs. Distance （Xdirection）

$\frac{t_{AH}}{t_{AP}}$ (Output A)

$\frac{t_{BH}}{t_{BP}}$ (Output B)

$V_{CC}= 5V$
$I_F= 30mA$
$f= 12kHz$
$T_a= 25°C$

Duty ratio

Distance X (mm) (Shifting encoder)

Fig. 8 Phase Difference vs. Distance （Xdirection）

$V_{CC}= 5V$
$I_F= 30mA$
$f= 12kHz$
$T_a= 25°C$

$\theta_{AB1}= \frac{t_{AB1}}{t_{AP}} \times 360°$

Reference position
(-) ←→ (+)
GP1A35RV

Disk

Phase difference θ_{AB1} (deg.)

Distance X (mm) (Shifting encoder)

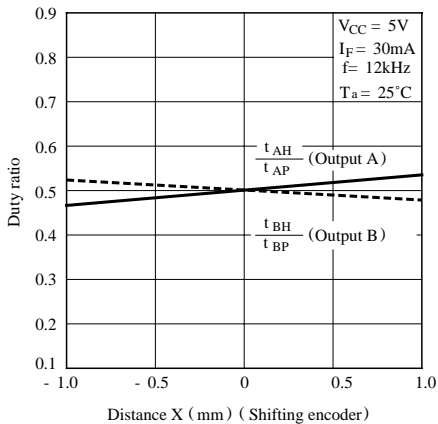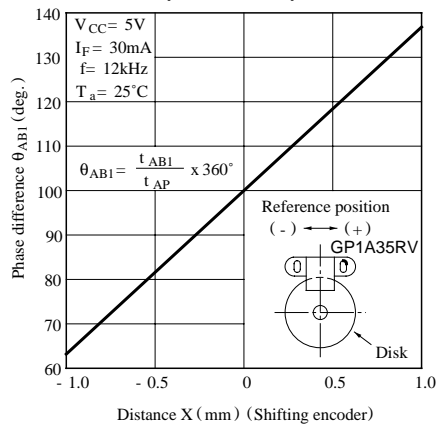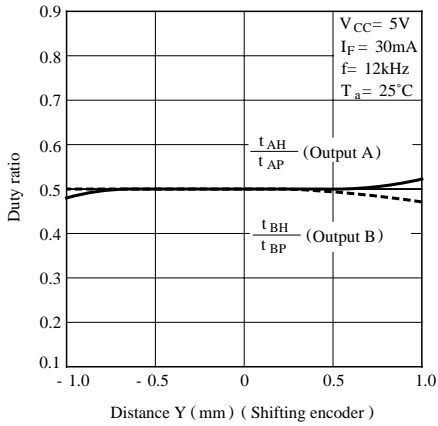**Fig. 9 Duty Ratio vs. Distance（Ydirection）**
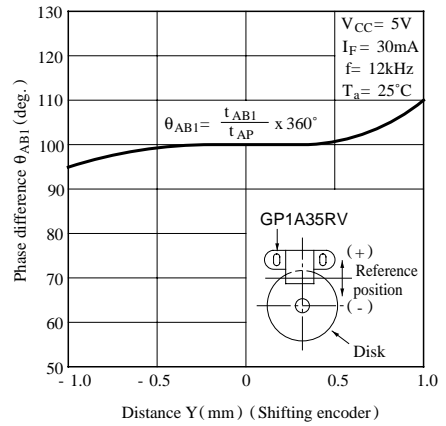

Fig.10 Phase Difference vs. Distance（Ydirection）
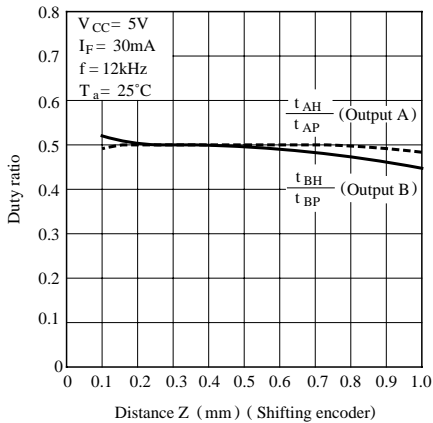

Fig.11 Duty Ratio vs. Distance（Zdirection）

Fig.12 Phase Difference vs. Distance（Zdirection）
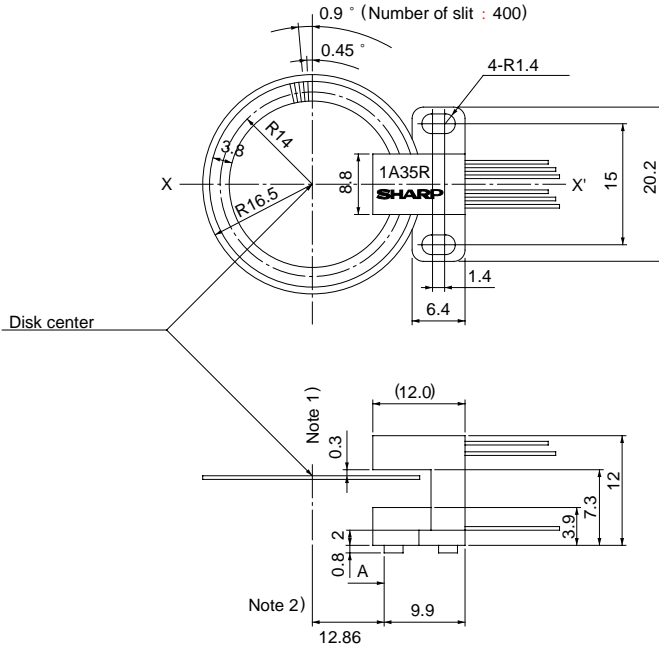
Measurement Conditions

0.9 ° (Number of slit : 400)
0.45 °
4-R1.4
R14
3.8
R16.5
8.8
1A35R
SHARP
X
X'
15
20.2
1.4
6.4

Disk center
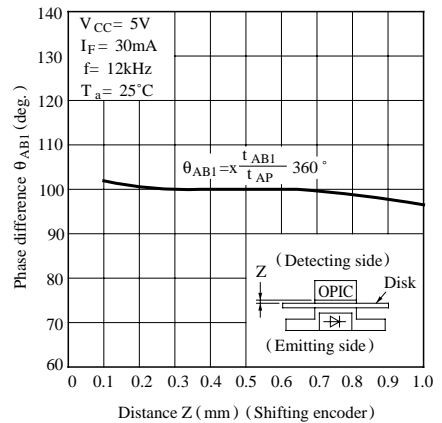
Note 1)
(12.0)
0.3
12
7.3
3.9
2
0.8
A
Note 2)
9.9
12.86
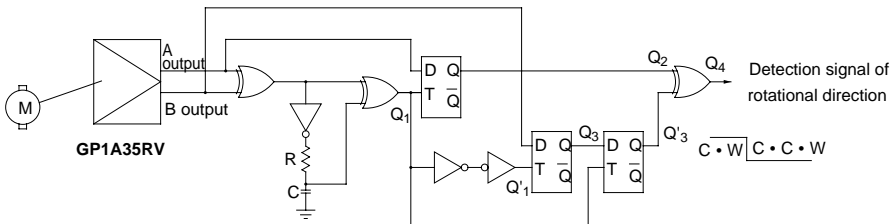
Note 1) Distance between disk surface and case surface in the detector side is 0.3mm.
2) Encoder positioning pin is positioned on X-X' axis.
Distance between center of disk and portion A of positioning pin is 12.86mm.
3) Center of disk slit is R14.0.

■ Precautions for Use

(1) This module is designed to be operated at $I_F = 30mA$ TYP.
(2) Fixing torque : MAX. 0.6N • m
(3) In order to stabilize power supply line, connect a by-pass capacitor of more than $0.01\mu F$
between Vcc and GND near the device.
(4) As for other general cautions, refer to the chapter "Precautions for Use".

■ Application Circuit (Detection of Rotational Direction)

M
GP1A35RV
A output
B output
R
C
D Q
T Q̄
Q₁
D Q
T Q̄
Q'₁
D Q
T Q̄
Q₃
D Q
T Q̄
Q'₃
Q₂
Q₄
Detection signal of
rotational direction
C • W   C • C • W

When gate delay causes pulse noise in Q4 output,
apply the CR filter to remove pulse noise.