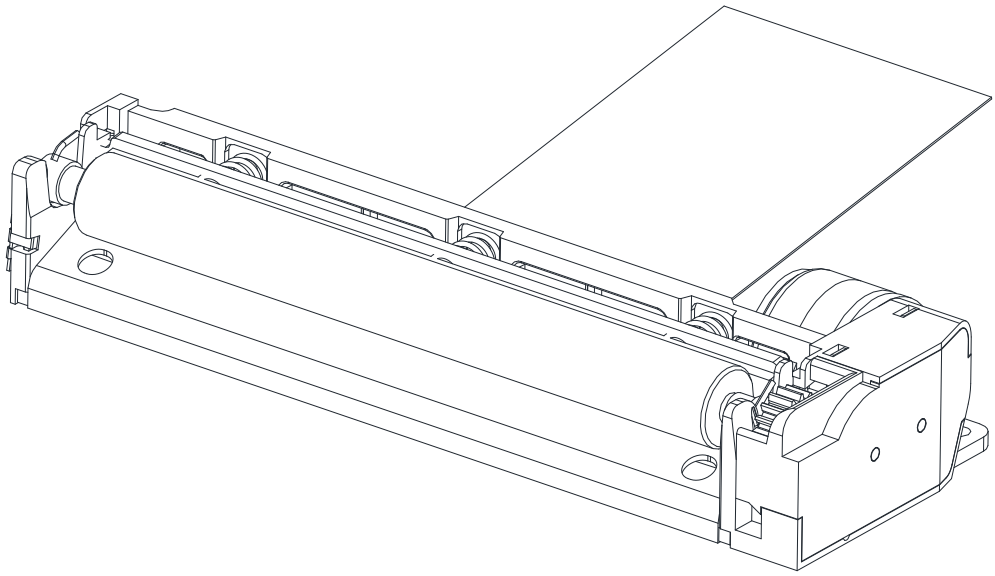
RONGTA

Mini thermal printer mechanism

RT638



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1. Introduction

1.1 RT638 thermal printer mechanism

The RT638 thermal printer mechanism has the characteristics of small size, wide operating voltage, and high efficiency. With unique printer mechanism design, RT638 has the characteristics of easy paper loading, high reliability, etc.

1.2 Characteristics of RT638

- Easy paper loading
- Small size
- Light weight
- High print speed (maximum speed: 60mm/s)
- wide operating voltage
- High print accuracy (8 dots/mm)
- Long service life (50 km or 10^8pulses)
- Low noise

1.3 Description

This Manual describes the electrical and mechanical characteristics of RT638, and may serve as reference for designers.

The Company reserves the right to change this Manual. Please contact us directly for the latest version.

2. Specifications

Project	Specifications
Printing method	thermal
Printing dot	576 dot/line
Dot density (dot/mm)	8
Print width (mm)	72
Paper width (mm)	80
Paper feed accuracy (mm)	0.0625
Width x depth x height (mm)	92.3x33x15.2
Weight (g)	52
Temperature detection of heating head	Thermistor
Paper Shortage Detection	Photocoupler Detection
Working voltage of heating head	4.2~8.5
Logic working power	3.0~5.25
Working temperature	-0°C~50°C
Working humidity	10%~90%
Storage temperature	-25°C~70°C
Storage temperature	10%~90%

3.Parameters of heating head

3.1 Rated parameters

Project	Specifications
heating dots	576 dot
Dot pitch	0.125 mm
Feed accuracy	0.0625 mm
Printable width	72 mm
Average resistance	176Ω±4%
Working power	4.2V~8.5V
Pulse service life	10^8pulses
Mechanical service life	50 km

Service life test condition: temperature 25°C, heating time ratio ≤ 12.5%, thermal paper Mitsubishi F230AA

3.2 Maximum allowable parameters

parameters	Code	Specifications	Description
Heating energy	Eomax	0.2mJ/dot	S.L.T=1.25msec
Heating voltage	V_H	8.5V	Voltage at both ends of connection line
Logic voltage	Vdd	7V	
Working temperature	Ta	0°C~50°C	Recommended temperature: ＞5°C
Ambient humidity		10%~90%RH	No condensation fog
Maximum working temperature	Ts	Last for 30 minutes at 65°C	When the temperature reaches 80°C, stop printing until the temperature drops to 60°C
		max 80°C	

3.3 Calculation formula

The heating energy can be calculated via the following formula:

$$P_0 = I_0^{\,2} \times R_{ave} = \frac{V_H^{\,2} \times R_{ave}}{(R_{com} \times N + R_{ave} + R_{ic})^2}$$

$$T_{on} = E_0 \div P_0$$

or

$$P_0 = E_0 \div T_{on}$$

$$V_H = \sqrt{(P_0 \div R_{ave})} \times (R_{com} \times N + R_{ave} + R_{ic})$$

R_{ave}= R_{res}+ R_{lead} *3:	Average resistance	(Ex.)	176	(Ω)
N :	Number of dots firing at same time	(Ex.)	64	(dots)
R_{com} :	Common resistance	(Ex.)	0.075	(Ω)
R_{ic} :	Driver saturated resistance	(Ex.)	9	(Ω)

*3 R_{res}: Heater resistance, R_{lead}: Lead resistance

3.4 Recommended parameters

parameters		Code	Recommended working parameters	Description
Heating power		Po	0. 25W/dot	$\overline{R}$ =176Ω
Heating voltage		VH	7.2V	Voltage at both ends of connection line
Recommended speed			1.25msec	
Heating energy	5°C	Eo (ts)	0.16mJ/dot(0.63ms)	Simultaneous heating of 64dots
	25°C		0.13mJ/dot(0.51ms)	
	45°C		0.11mJ/dot(0.43ms)	
current		Io	2.4A	$\overline{R}$ =176Ω

3.5 Electrical parameters

Electrical Characteristics of Circuit (V_{DD} = 4.75～5.25V)

Ta=25±10℃

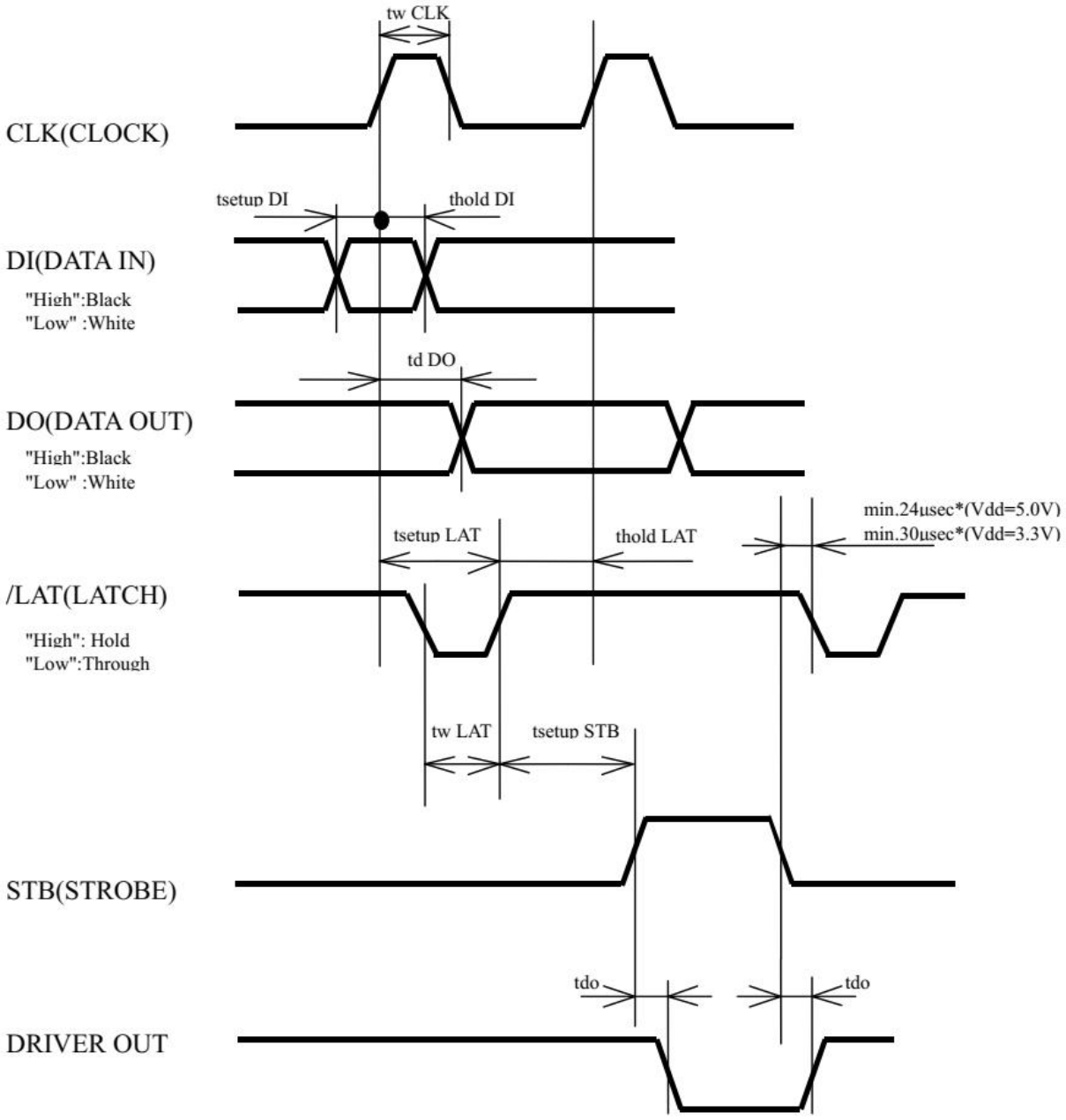
ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	SIGNAL
PRINT VOLTAGE		V_H	-	7.2	8.5	V	
LOGIC VOLTAGE		V_{DD}	4.75	5.00	5.25	V	
LOGIC CURRENT		I_{DD}	-	-	72	mA	fDI= fCLK/2 fCLK=8MHz
INPUT VOLTAGE	H	V_{IH}	$0.8V_{DD}$	-	V_{DD}	V	STB, DI, LAT, CLK
	L	V_{IL}	0	-	$0.2V_{DD}$	V	
DATA INPUT CURRENT (DI)	H	I_{IH} DI	-	-	0.5	μA	V_{IH}=5V V_{IL}=0V
	L	I_{IL} DI	-	-	-0.5	μA	
STB INPUT CURRENT (HIGH ACTIVE)	H	I_{IH} STB	-	-	90	μA	
	L	I_{IL} STB	-	-	-1.0	μA	
CLOCK INPUT CURRENT (CLK)	H	I_{IH} CLK	-	-	4.5	μA	
	L	I_{IL} CLK	-	-	-4.5	μA	
LATCH INPUT CURRENT (LAT)	H	I_{IH} LAT	-	-	4.5	μA	
	L	I_{IL} LAT	-	-	-4.5	μA	
DO VOLTAGE (DO)	H	V_{DOH}	V_{DD}-0.4	-	-	V	I_{OH}= -0.4mA
	L	V_{DOL}	-	-	0.4	V	I_{OL}= 0.4mA
CLOCK FREQUENCY		f CLK	-	-	16	MHz	See title 3.6
CLOCK WIDTH		tw CLK	20	-	-	Ns	
DATA SET-UP TIME		tsetup DI	15	-	-	ns	
DATA HOLD TIME		thold DI	15	-	-	ns	
DATA OUT DELAY TIME		td DO	-	-	25	ns	
LAT WIDTH		tw LAT	40	-	-	ns	
LAT SET-UP TIME		tsetup LAT	60	-	-	ns	
LAT HOLD TIME		thold LAT	20	-	-	ns	
STB SET-UP TIME		tsetup STB	300	-	-	ns	
DRIVER OUT DELAY TIME		Tdo	-	-	24	μ s	

lectrical Characteristics of Circuit (V_{DD} = 3.13～3.47V)

Ta=25±10℃

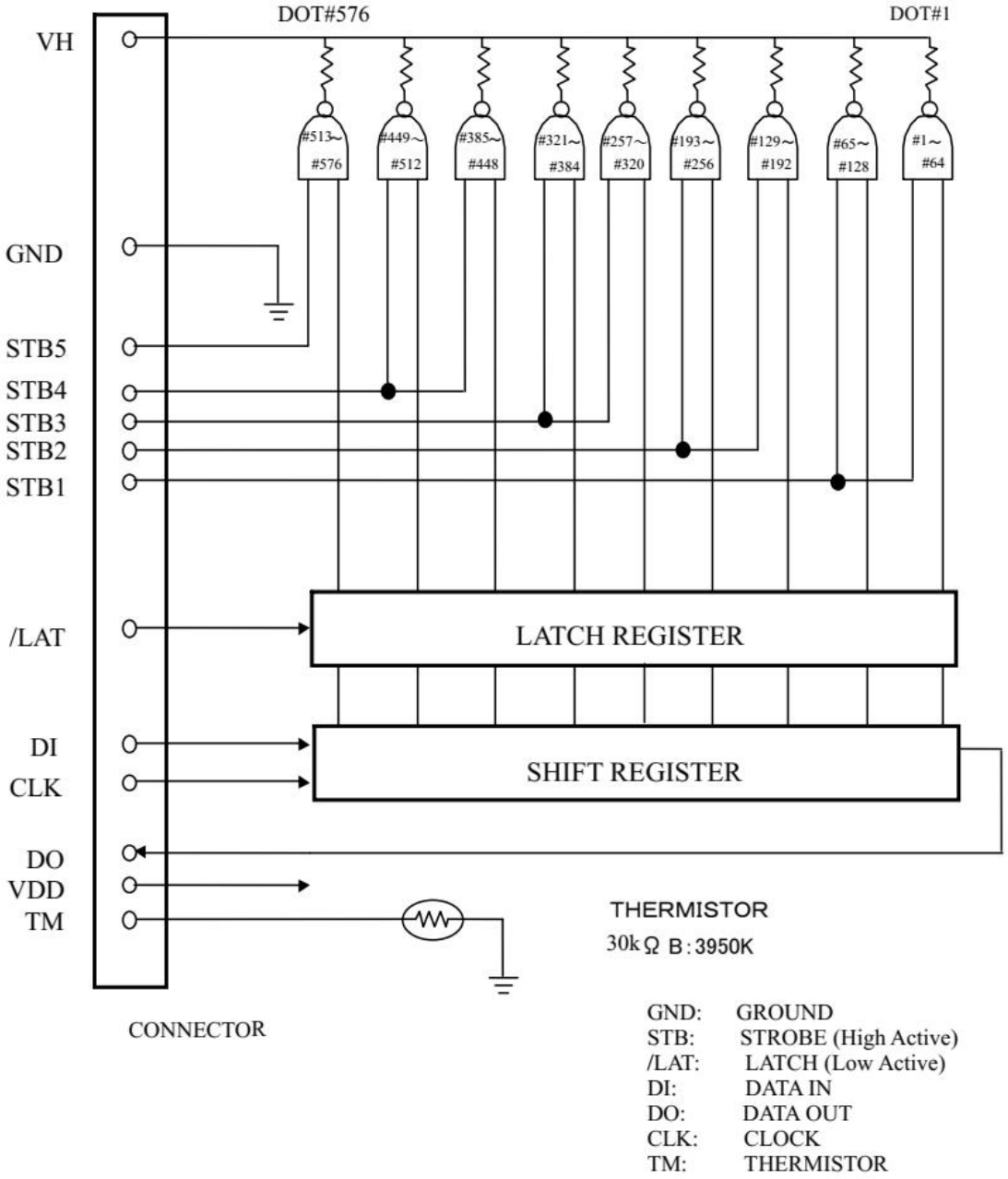
ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	SIGNAL
PRINT VOLTAGE		V_H	-	7.2	8.5	V	
LOGIC VOLTAGE		V_{DD}	3.13	3.3	3.47	V	
LOGIC CURRENT		I_{DD}	-	-	32.4	mA	fDI=fCLK/2 fCLK=6MHz
INPUT VOLTAGE	H	V_{IH}	$0.8V_{DD}$	-	V_{DD}	V	STB, DI, LAT, CLK
	L	V_{IL}	0	-	$0.2V_{DD}$	V	
DATA INPUT CURRENT (DI)	H	I_{IH} DI	-	-	0.5	μA	V_{IH}=3.3V V_{IL}=0V
	L	I_{IL} DI	-	-	-0.5	μA	
STB INPUT CURRENT (HIGH ACTIVE)	H	I_{IH} STB	-	-	30	μA	
	L	I_{IL} STB	-	-	-1.0	μA	
CLOCK INPUT CURRENT (CLK)	H	I_{IH} CLK	-	-	4.5	μA	
	L	I_{IL} CLK	-	-	-4.5	μA	
LATCH INPUT CURRENT (LAT)	H	I_{IH} LAT	-	-	4.5	μA	
	L	I_{IL} LAT	-	-	-4.5	μA	
DO VOLTAGE (DO)	H	V_{DOH}	V_{DD}-0.4	-	-	V	I_{OH}= -0.4mA
	L	V_{DOL}	-	-	0.4	V	I_{OL}= 0.4mA
CLOCK FREQUENCY		f CLK	-	-	10	MHz	See title 3.6
CLOCK WIDTH		tw CLK	32	-	-	ns	
DATA SET-UP TIME		tsetup DI	25	-	-	ns	
DATA HOLD TIME		thold DI	25	-	-	ns	
DATA OUT DELAY TIME		td DO	-	-	35	ns	
LAT WIDTH		tw LAT	100	-	-	ns	
LAT SET-UP TIME		tsetup LAT	100	-	-	ns	
LAT HOLD TIME		thold LAT	40	-	-	ns	
STB SET-UP TIME		tsetup STB	300	-	-	ns	
DRIVER OUT DELAY TIME		Tdo	-	-	30	μ s	

3.6 Sequence characteristics



*If delay time for Driver Out can not be secured enough, there is a possibility that VH would fluctuate greatly. Please design the circuit so that VH does not exceed peak voltage (Vp).

3.7 Structure diagram



STB No.	Dot No.	Dots/STB
STB 1	1 ~ 128	128
STB 2	129 ~ 256	128
STB 3	257 ~ 384	128
STB 4	385 ~ 512	128
STB 5	513 ~ 576	64

3.8 Thermistor

Electrical requirements;

1) Resistance R_{25} : 30kΩ ± 5% at 25ºC
2) B value : 3950K ± 2%
3) Resistance vs. Temperature : See below Fig.

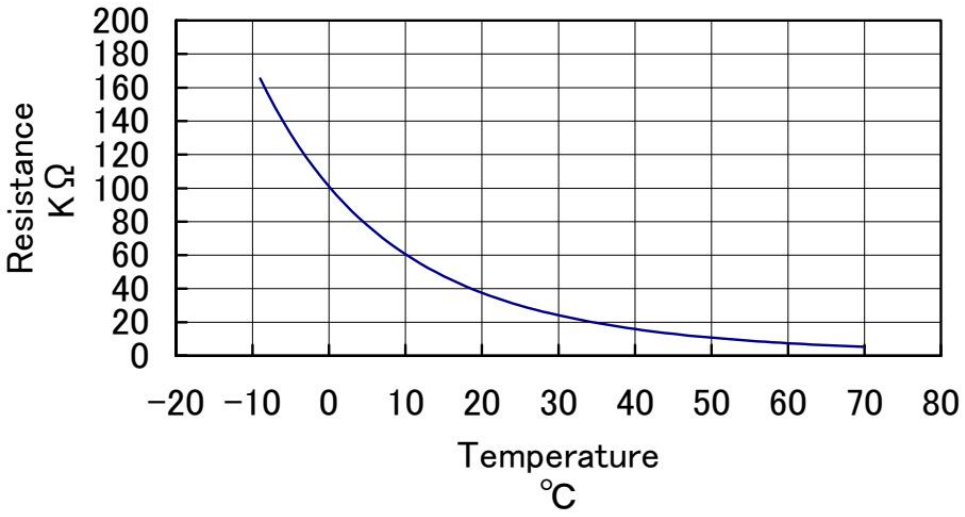
Rating;

1) Operating temperature : -20 ～ +80ºC
2) Time constant: Max. 30sec (in the air)

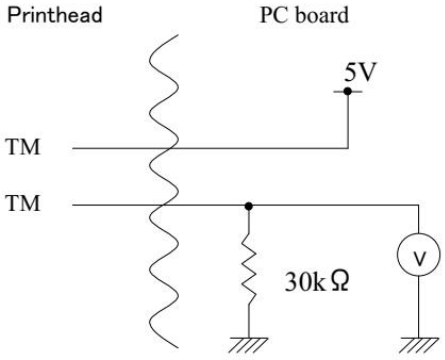
Temperature charact eristic of Thermistor

$$R_X=R_{25}*EXP\{B*(1/T_X-1/T_{25})\}$$

(T; Absolute temperature)



Recommended Circuit



3.9 Matters needing attention

3.9.1 The TPH and photoelectric sensors on the printer mechanism are electrostatic sensitive components.When using the printer mechanism, please take protective measures (for example, wearing an electrostatic ring, ensuring appropriate humidity in the workshop, etc.) to prevent static damage of the internal components and parts of the printer mechanism.

3.9.2 When installing the rubber roller parts onto the bracket, please be careful not to damage the rubber part of the roller, roller gear and other bearing parts (especially do not apply any oil or stick other foreign matter on the rubber part).

3.9.3 Do not touch the thermal head directly with hands. Any greasy dirt on the thermal head will greatly shorten its service life. If there is any oil or foreign matter on the thermal head, wipe it with cotton cloth moistened with alcohol, and do not use it until the alcohol completely volatilizes.

3.9.4 It is not allowed to directly touch the golden finger end of FPC with hands, or strike or scratch it with any hard object. When designing the whole structure, the device shall be in a relatively relaxed state in the spatial position, without any tension or additional force; during assembly, do not pull FPC forcibly. Insert or remove FPC of the printer mechanism only when the power of the drive board of the printer mechanism is off and keep it parallel to the socket. FPC shall not be inserted into or removed from the drive board more than 10 times.

3.9.5 Do not bend FPC, as this may cause FPC damage or disconnection. If FPC is to be bent, the bending shall be greater than R1.

3.9.6 Since this printer mechanism adopts an easy paper loading structure, slightly pull the rubber roller part, and you can take it out. If paper jam occurs, do not pull the paper too hard, otherwise the rubber roller gear may fall off or be damaged.

3.9.7 Using the printer when the thermal head or printing paper is wet will cause thermal head damage due to electrolytic attack. Please pay attention to the following when using the printer mechanism:

A: Cut off the power of the printer when not in use.
B: Do not use damp paper.

C: In the environment with water condensation due to humidity, please do not switch on the power. If the power is on, please cut off the power immediately. At the same time,allow the thermal head to dry before use. The use of the printer mechanism is related to the environment (low temperature or high humidity). The condensate water may be caused by the moisture evaporation from the paper used when the printer mechanism is printing at high speed. Therefore, please pay attention to the environment where the printer mechanism is placed.

D: Upon condensation, please turn off the printer immediately, and do not use it until it is completely dry.

3.9.8 If the printer mechanism is out of paper or not used for a long time, please separate the thermal head from the rubber roller. If there is no paper during printing, stop printing. Keeping printing with paper shortage will damage the printer mechanism.

3.9.9 During continuous printing, the circuit board temperature (detection temperature of the thermistor) of the thermal head shall not exceed 65°C, in order to protect the internal IC of the thermal head; the surface temperature of the motor shall not exceed 90°C, in order to protect the motor coil.

3.9.10 Keep smooth paper feeding when printing.

3.9.11 Please use thermal paper of good quality. The thermal sensitivity of thermal paper has a great impact on the printing effect and rough paper will seriously wear the print head, which will shorten the service life of the print head.

3.9.12 The maximum number of dots that can be printed simultaneously is 384.

3.9.13 When not printing, the printer power shall be cut off. As for the heating control signal, when the printer mechanism voltage is on/off, ensure that the heating control signal is off. The following voltages shall be guaranteed:

VH	0V ~ 10V
Vdd	0V ~ 7V
Other signals	GND ~ Vdd+0.5V

3.9.14 Turn on/off the printer in the following order:

At power on: 1) Vdd → 2) VH

At power OFF: 1) VH → 2) Vdd

4. Stepping motor

For each step the stepping motor advances, the paper advances by 0.0625 mm.

4.1 Stepping motor phase

The stepping motor of RT638 adopts 2-2 phase driving mode with has 4 positions:

positions	STEP1	STEP2	STEP3	STEP4
PA	-	-	+	+
PB	-	+	+	-
/PA	+	+	-	-
/PB	+	-	-	+

4.2 Stepping motor parameters

Project	**Specifications**	**Condition**
Rated voltage	4.2 ~ 8.5V	
Step distance	0.0625mm	
Phase resistance	10Ω±7%	20°C
Phase current	0.357A	
Life	3000H	

4.3 Stepping motor driv

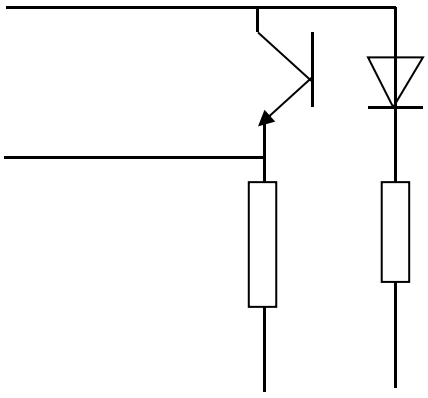
It is recommended to drive the stepping motor with PWM mode, such as L3967 driver chip. Use different drive currents for different motor speeds. It can effectively reduces the heating and noise of the stepping motor during the printing step.For low-voltage operation, it is recommended to use ROHM of 6848, SANYO of 1836,1838.

5. Paper shortage detection and platen shaft ready detection

RT638 printer has a reflective photoelectric detection switch. As shown in the figure below, when it is out of paper or the platen is not pressed properly, the light emitted by the photoelectric detection cannot be reflected, with “high” electrical level output.

When the paper and platen roller are normal, the light emitted by the photoelectric detection is reflected and received by the receiving tube, with “low” electrical level output.The drive circuit of the photoelectric switch is shown in the figure below. The logic voltage can be 3.3V or 5V.

When the printer is out of paper or the platen roller is not ready, do not start the printer heating; when the printer is out of paper, the paper feed speed shall be lowered.

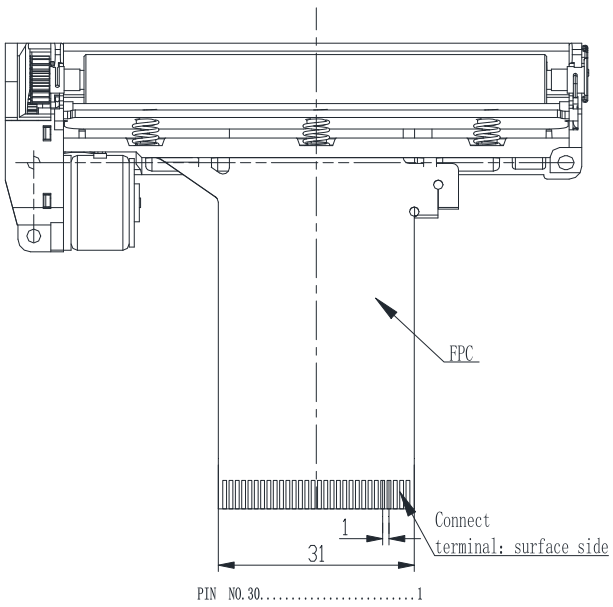


Photoelectric parameters

Project		Code	Condition	Value			unit
Input end	Forward voltage	V_F	I_F=20mA	1.0	1.2	1.5	V
	Reverse current	I_R	V_R=5V			10	μA
Output end	Collector to emitter breakdown voltage	BV_{CEO}	I_C=0.5mA	30			V
	Emitter to collector breakdown voltage	BV_{ECO}	I_E=0.1mA	5			V
	Dark current of collector	I_{CEO}	V_{CE}=10V			100	nA
Coupling characteristics	Collector to emitter saturation voltage drop	$V_{CE(SAT)}$	I_C=2mA E_e=1mW/cm^2			0.4	V
	Detection distance	d					mm
	leakage current	I_{LEAK}	I_F=10mA V_{CE}=5V			50	μA
	Ascending/descending time	t_r/t_f	V_{CE}=5V I_C=1mA R_L=1000Ω			15/15	μs

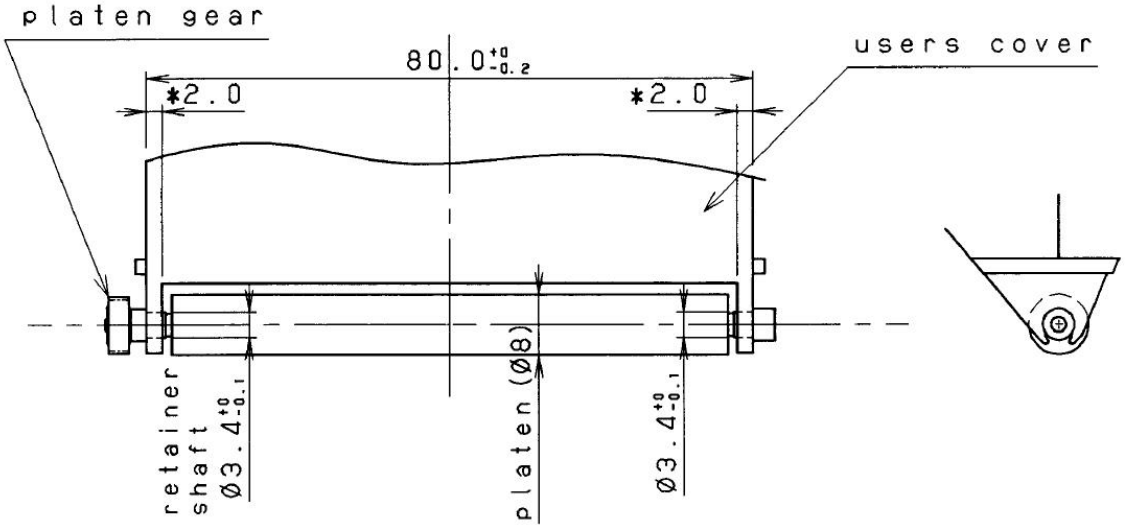
6. Pin definition

PIN	signal	Description
1	PCA	C pole of the transmitting tube
2	PCO	Collector of the photoelectric triode and A pole of the emitter
3	PEM	Emitter of the phototransistor
4~5	SW	Platen roller ready detection switch
6-7	VH	the printer power
8	DI	Print data input
9	CLK	Print clock input
10~11	P_GND	Printing grounding
12	STB5	The fifth heating control pin
13	STB4	The fouth heating control pin
Condition14	STB3	The third heating control pin
15	Vdd	Logic voltag
16	TM	Thermistor terminal (the other terminal is grounded)
17	STB2	The second heating control pin
18	STB1	The first heating control pin
19	NC	No connection
20~22	P_GND	Printing grounding
23	\LAT	Data latch control
24	DO	Print data output
25~26	VH	the printer power
27	PA	Stepping motor winding 1 pin 1
28	\PA	Stepping motor winding 1 pin 2
29	PB	Stepping motor winding 2pin 1
30	\PB	Stepping motor winding 2 pin 2



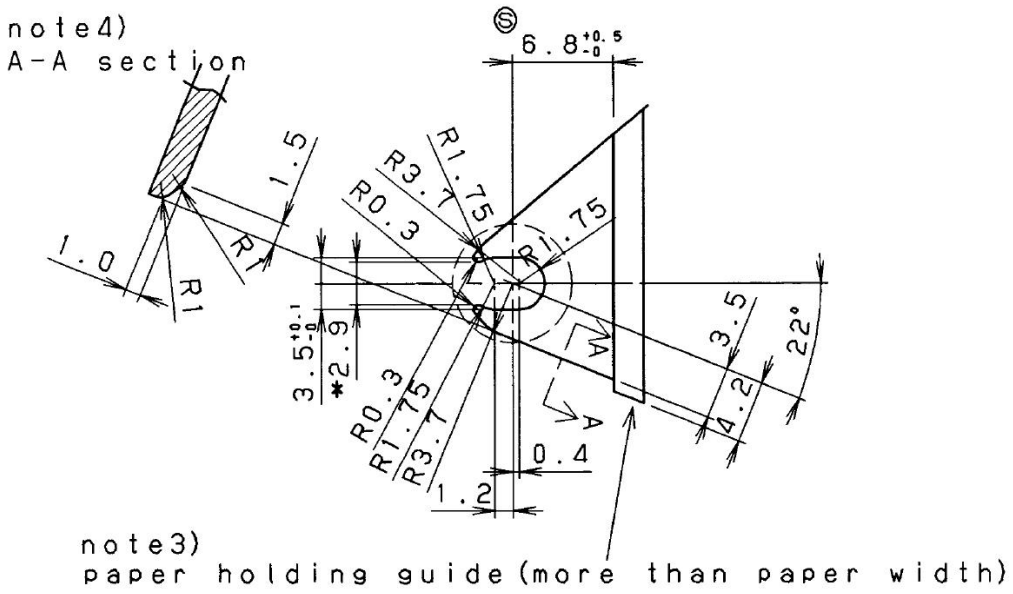
7. Mechanical design reference

7.1 Design reference for easy paper loading structure

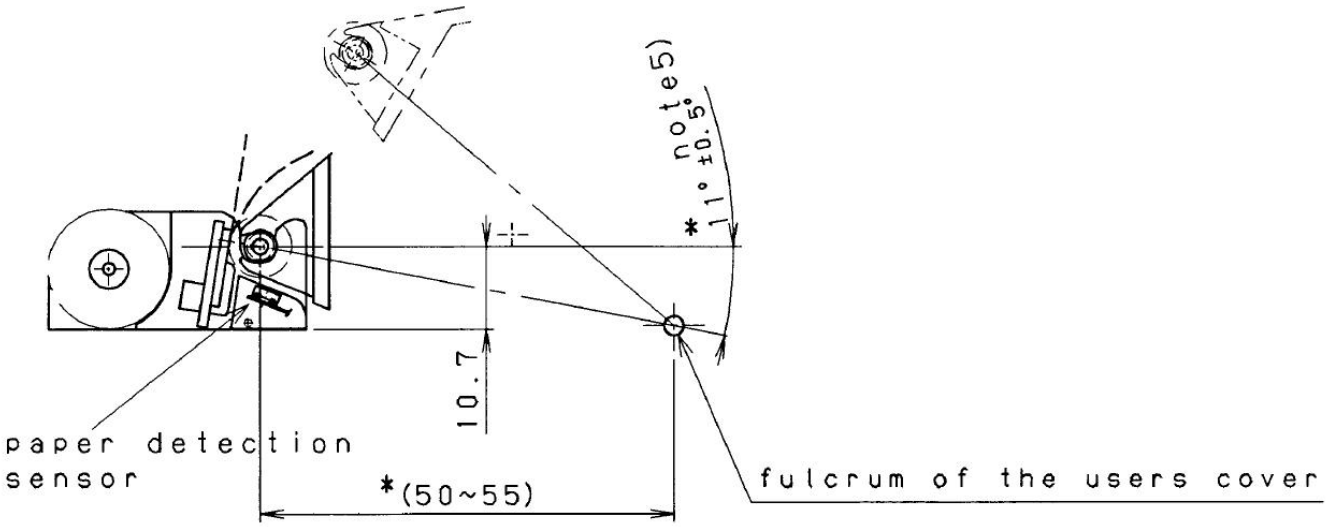


Note:

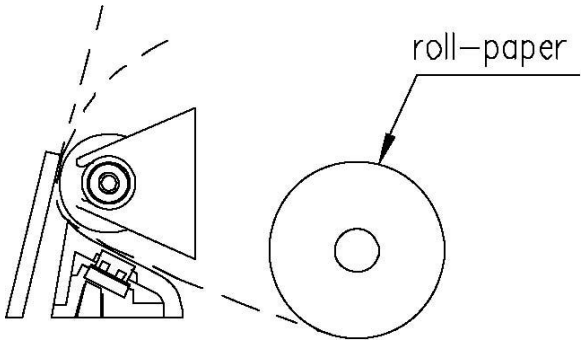
1) The sizes marked with "*" are recommended.
2) Ⓢin the figure below is the center of the printer.
3) A paper guide is required to ensure the stability of the photoelectric detection signal output when feeding paper.
4) Both sides of the easy paper loading structure shall have guide angles (as shown in the A-A section below), so that the rubber roller can be easily removed from and installed on the printer mechanism when loading paper.



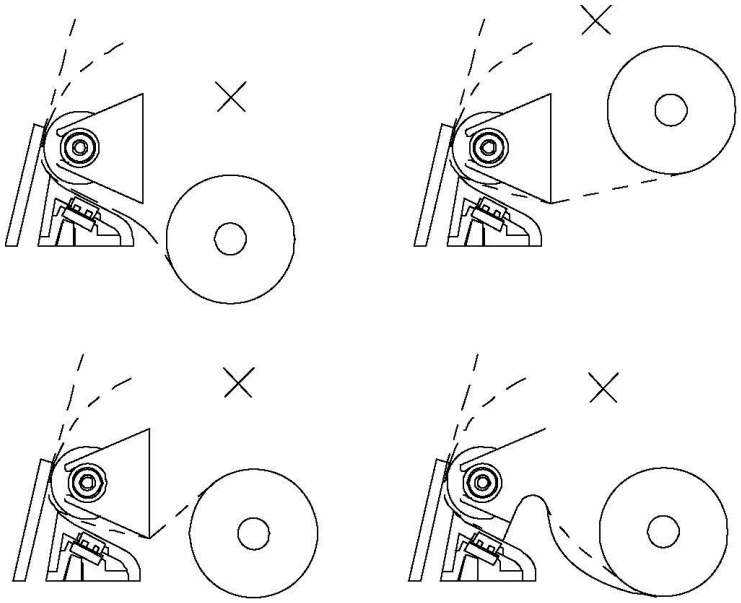
Design reference for the position of the rotating shaft of the easy paper loading device:



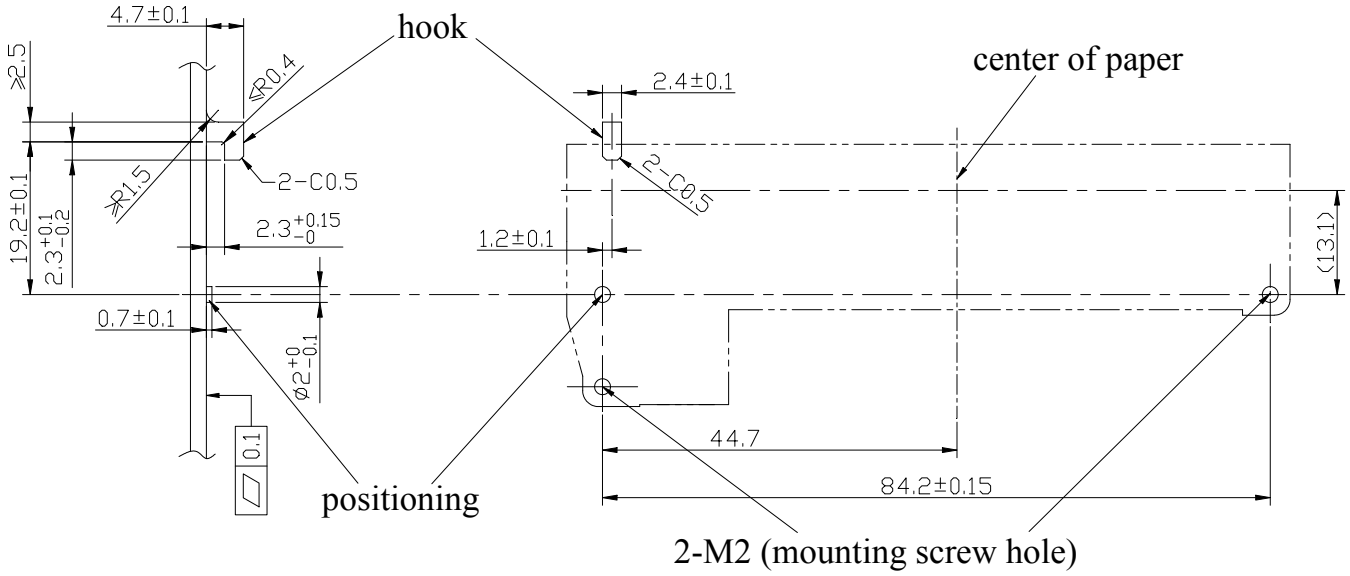
7.2 Paper roll placement location



Wrong installation method:



7.3 Printer mechanism installation size



7.4 Mechanical dimensions diagram