KTP-300S User Manual

Product Name：3inch Thermal Printer Mechanism

Model：KTP-300S

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3inch Thermal Printer Mechanism with cutter

KTP300S

Revision Record

Item	Date	Description	Edited page	Desing	Review
1	20180403	The first draft		Zhu Chunyan	HuRiYu
2	20180606	Modify pin definition	23	Zhu Chunyan	HuRiYu

Contents

Chapter I product features and precautions for use

1. Feature

1.1 Large motor design

Large step motor design, paper cutting thickness up to 0.2mm, support 150mm diameter super large paper roll, reduce the number of consumables replacement

1.2 Narrow and flat design of paper path

The paper path is narrow and flat, which can print consumables with a thickness of 0.2mm

1.3 High Definition Printing

High density print head, 8 dots / mm, can print more accurate and clear effects than needle printing

1.4 Fast printing speed

According to different driving energy and thermal sensitivity of the thermal paper used, different printing speeds can be set according to user requirements Degree, up to 250mm/S printing speed

1.5 Paper structure

Unique design scheme of rubber roller sliding away from the print head, easy to clean the print head and remove faults

1.6 Penetrating photoelectric detection

Penetrating photoelectric detection can be used for label seam detection

1.7 Low noise

Compared with needle printing, thermal printing is more suitable for environments with noise requirements

2. Precautions for use of the mechanism

2.1. The TPH and photoelectric sensor on the movement are electrostatic sensitive devices. Please take protective measures when using the movement

(for example, electrostatic ring, to ensure the humidity of the workshop, etc.) to prevent electrostatic damage to the internal components of the movement.

2.2. When installing the rubber stick components on the bracket, please pay attention not to damage the rubber part of the rubber stick, the rubber stick gear and other bearing components (especially, do not apply any oil or other foreign matters on the rubber part).

2.3. Do not touch the thermal head by hand. When palm oil is adhered to the thermal head, the service life of the thermal head will be greatly shortened.

If any oil or foreign matters stick to the thermal head, please clean it immediately. In addition, please do not hit the thermal head with hard objects.

2.4. When installing the rubber stick on the bracket of the easy to install paper movement, please confirm that the rubber roller and gear should be installed at one end of the gear box.

2.5. The connecting pin end of the FFC of the movement shall not be directly contacted by the operator. During the structural design of the whole machine, it shall be in a relatively relaxed state in space, and shall not be tensioned or subject to additional force; During assembly, the operator shall not pull the FFC forcefully. When unplugging the FFC of the movement, the power supply of the drive board of the movement must be reliably turned off; The number of unplugging and plugging of FFC connected to the drive board shall not exceed 10 times. Please ensure that it is parallel to the socket when unplugging and plugging.

2.6. Do not bend the FFC because it may cause damage and disconnection of the FFC. If the FFC is to be bent, if the curvature exceeds the radius R1, the FFC may be broken once it is bent.

2.7. If the paper is compressed or jammed during use, it may be caused by the damp of the paper. Therefore, please pay attention to the following terms when using the movement:

1) The circuit design of the whole machine. If the movement does not work, please cut off the power.

2) Please do not use damp paper

3) If there is water condensation caused by humidity, please do not power on. If it happens, please power off immediately. At the same time, let the thermal head dry before use. In addition, the use of the movement is related to the environment (low temperature / humidity), and the condensed water may be evaporated from the paper used during the high-speed printing of the movement. Therefore, please carefully consider the environment in which the movement is placed.

2.8. If the movement is short of paper, please separate the thermal head from the rubber stick. If there is no paper in the printing process, stop the printing of the movement. If you print continuously without paper, the thermal head will be damaged.

2.9. During continuous printing, the temperature of the protection plate of the thermal head of the movement (detected by the thermistor radiation calorimeter) shall not exceed 75 ° C, because the temperature of the IC protection plate and the motor surface inside the movement shall not exceed 90 ° C, which is also for better protection of the motor coil.

2.10. Keep the paper feeding smooth.

2.11. Please use high-quality thermal printing paper, because the thermal sensitivity of the paper has a great impact on the printing effect, and the rough paper has serious wear on the printing head, which will shorten the life of the printing head.

Chapter II specification

2.1 general specification

Model		KTP300S
Print	Printing method	Thermal line dot printing
	Printing speed	Max:250mm/s
	Resolution	8dots/mm
	Effective print width	72/80mm
	Print resolution	203dpi
Paper roll specification	Paper type	Thermal paper roll
	Paper width	58-82mm
	Paper thickness	55-200μm
detection	Temperature detection of heating head	Thermistor
	Out of paper detection	Photoelectric detection
	Black mark detection	Photoelectric detection
	Seam mark detection	Photoelectric detection
	Shaft position detection	Mechanical switch
reliability	Print life	100Km
	Cutter life	>1000000cuts
Cutter	Automatic cutter	Full cut / half cut
Power Supply	input	DC24V±10%，≥2A
environment	working temperature	0°C~50°C
	Working humidity	20%RH ~85% RH
	Storage temperature	-20°C~60°C
	Storage humidity	5% ~90%RH
physical characteristics	weight	≈380g
	dimension (W × D× H)	112.2mm×48.4mm×52.5mm

2.2 Heating unit size

The number of heating points provided by KTP-300s thermal head is 640 (print point size)

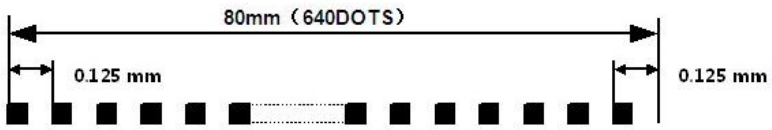


Figure 2-1 size of heating unit

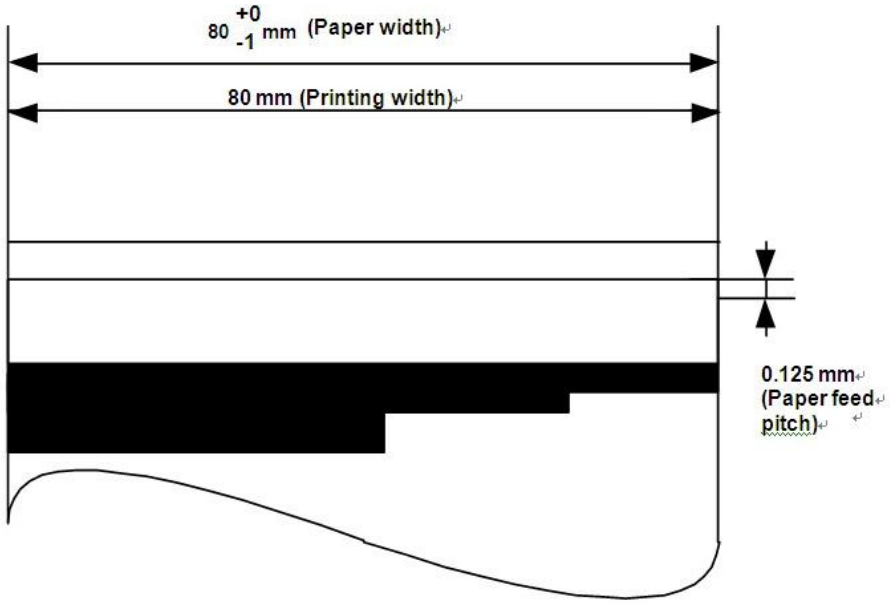


Figure 2-2 print size

2.3 Characteristics of stepper motor

2.3.1 Specification of stepper motor

Item	Specifications
type	PM
Phase number	2 phase
excitation	2-2 phase
Drive current	400mA
Resistance value of each phase	16 Ω / phase ± 10%
driving voltage	24V±10%
Maximum pull in frequency	600Hz Min
Maximum pull out frequency	800Hz Min

2.3.2 Incentive sequence

Signal name	sequence			
	STEP1	STEP2	STEP3	STEP4
PB	low	high	high	low
PA	low	low	high	high
PNB	high	low	low	high
PNA	high	high	low	low

2.3.3 Stepper motor drive

The stepping motor has two driving modes: constant current drive and constant voltage drive.

Advantages and disadvantages of constant current drive and constant voltage drive:

	Constant current drive	Constant voltage drive
Advantages	1. The overall driving current is relatively small, and the motor heat generation is small 2. Driving noise is quite low 3. Power saving	1. The driving force of the motor is relatively large 2. Simple and cheap circuit
disadvantages	1. The driving force of the motor is relatively small 2. Complicated circuit and slightly high cost	1. Large driving current and large motor heat generation 2. Loud noise 3. Power consumption

After the movement is used for a period of time, the transmission resistance of the movement will increase due to wear, so the driving force of the motor should have a certain margin to prevent the movement from shrinking and transmission failure. It is recommended to test the paper pulling force of the movement after the product design is completed.

At the highest driving frequency, it is recommended that the drag force should not be less than 100g.

The common driving methods of the motor include full step driving 2-2 phase (full step) and half step driving 1-2 phase (half step).

Full step driving: the stepping driver charges the two coils of the two-phase stepping motor to the set current according to the pulse / direction command. Each pulse of this driving mode will move the motor by a basic step angle. The driving circuit of this driving mode can be relatively simple, and the program code is relatively easy to realize. However, when the stepping motor is driven in this way, the motor will shake at low speed and the noise will be relatively large.

The half step driving mode is more complicated than the full step driving mode. For example, when the phase A is charged, the motor shaft stops at the full step position. After the driver receives the next pulse, if the phase B coil is charged and the phase A is kept in the charging state, the motor shaft will move by half a step angle and stop in the middle of two adjacent full step positions. This can double the step angle resolution of the motor without changing the motor. In this driving mode, both phases may need to be powered on at the same time. In cooperation with the motor driving IC, the current ratio of each phase in each step state can be controlled to make the motor run more quietly. But this also increases the complexity of the control software to a certain extent.

The motor driving timing table is shown in table 2-2.

Table 2-2 motor driving timing

STEP	Time(ms)	STEP	Time(ms)	STEP	Time(ms)	STEP	Time(ms)
1	5.653	25	0.790	49	0.563	73	0.464
2	3.494	26	0.775	50	0.557	74	0.461
3	2.698	27	0.761	51	0.552	75	0.458
4	2.265	28	0.748	52	0.547	76	0.455
5	1.986	29	0.735	53	0.542	77	0.452
6	1.787	30	0.723	54	0.537	78	0.449
7	1.637	31	0.712	55	0.532	79	0.446
8	1.519	32	0.701	56	0.528	80	0.443
9	1.423	33	0.690	57	0.523	81	0.441
10	1.343	34	0.680	58	0.519	82	0.438
11	1.274	35	0.671	59	0.514	83	0.435
12	1.250	36	0.662	60	0.510	84	0.433
13	1.164	37	0.653	61	0.506	85	0.430
14	1.118	38	0.644	62	0.502	86	0.428
15	1.078	39	0.636	63	0.498	87	0.425
16	1.041	40	0.628	64	0.494	88	0.423
17	0.978	41	0.621	65	0.491	89	0.421
18	0.950	42	0.613	66	0.487	90	0.418
19	0.925	43	0.606	67	0.483	91	0.416
20	0.880	44	0.599	68	0.480	92	0.414
21	0.859	45	0.593	69	0.477	93	0.411
22	0.840	46	0.580	70	0.473	94	0.408
23	0.822	47	0.574	71	0.470	——	——
24	0.806	48	0.569	72	0.467	——	——

2.4 Thermal head parameters

2.4.1 Rated parameters

Model	KTP300S
Print width	80 mm ±0.2mm
Heating points	640dots
Point density	8 dots/mm
Point distance	0.125 mm
Resistance value	$\overline{R}$ =650Ω±3%
Strobe signal	2 serial inputs
Logic signal	2 heating strobe + 1 latch
Logic voltage	3.3V
Point size	0.11mm×0.13 mm
Thermistor	R_{25}=30KΩ±5%,B=3,950K±2%

2.4.2 Maximum

parameter	code name	Specification	instruction
Heating energy	Eomax	0.167 mJ/dot	0.5ms/line
		0.215 mJ/dot	0.82ms/line
Heating voltage	VH max	26.4V	
Logic voltage	Vdd max	7.5V	
ambient temperature	Ta	-10℃ ～ +50 ℃	operation
		-30℃ ～ +80 ℃	No operation
ambient humidity		10～80%RH	No condensation
Maximum operating temperature	Ts	65° C 30min MAX	
		The detection temperature of the thermistor shall: Not more than 65 ℃	The temperature of the print head shall not exceed 70 ℃

2.4.3 Recommended parameters

parameter		code name	Recommended operating parameters			illustration
Printing speed			0.625ms/line	0.5 ms/line	0.41 ms/line	
			8 inch/sec	10 inch/sec	12 inch/sec	
heating power		Po	0.75W/dot			$\overline{R}$ =650Ω
Heating voltage		VH	24V			Both ends of connecting wire
Heating energy	5℃	Eo (ts)	0.16mJ/dot (0.22ms)	0.20mJ/dot (0.27ms)		
	25℃		0.15mJ/dot (0.20ms)	0.19mJ/dot (0.26ms)		
	45℃		0.14mJ/dot (0.19ms)	0.18mJ/dot (0.24ms)		$\overline{R}$ =650Ω See 2.4.7 for details
Current consumption		Io	21.7 (*2)			$\overline{R}$ =650Ω

2.4.4 Electrical parameters of drive circuit

1）Limit parameters

parameter	code name	Test conditions	Rated value	unit
Supply voltage	V_{dd}	Surge	0～6.5	V
	VH	Surge	0～28	V
Logic input voltage	V_{IN}		0～V_{dd}+0.3	V

2）Recommended parameters

parameter	code name	Test conditions	Recommended value			unit
			minimum	type	maximum	
Supply voltage	V_{dd}		3		5.5	V
	VH	Heating voltage	23.5	24.0	25.2	V
Logic input voltage	V_{IH}		0.8×V_{dd}	—	V_{dd}	V
	V_{IL}		0	—	0.2×V_{dd}	V
clock frequency	f_{CLK}	cascade	—	—	16	MHz

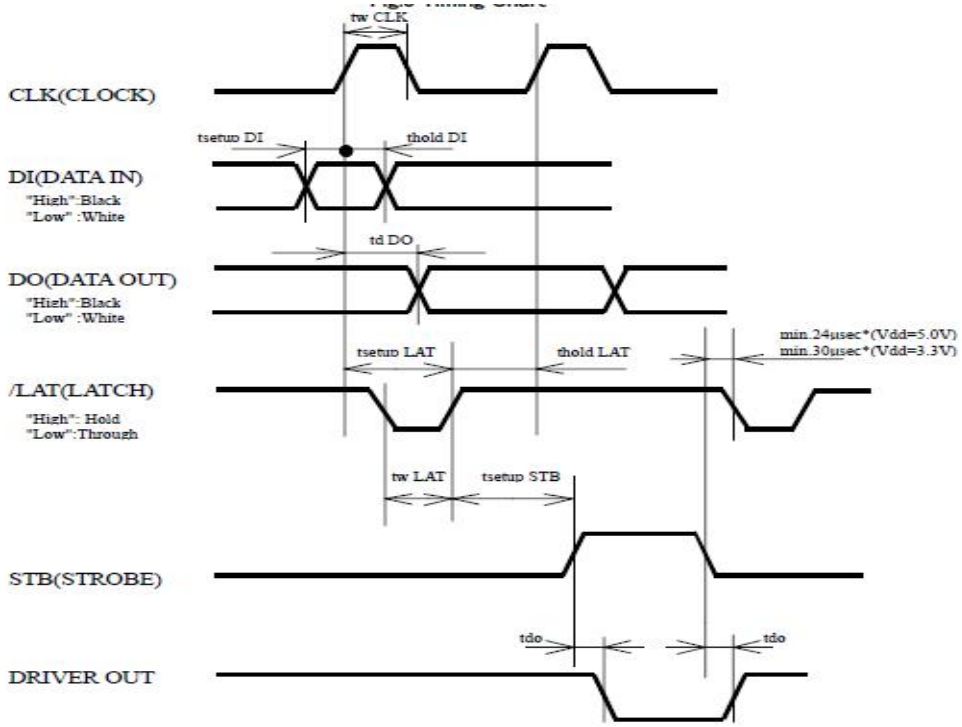
3）Electrical parameters

parameter		Symbol	Test conditions	Rated value			unit
				minimum	type	maximum	
logicInput current	Latch	I_{IH}	V_{IH}= V_{dd}=5V	—	—	5.0	μA
	Heating gating			—	—	270	μA
	Clock			—	—	5.0	μA
	data input			—	—	0.5	μA
	Latch	I_{IL}	V_{dd}=5V V_{IL}=0V	-5.0	—	—	μA
	Heating gating			-2.5	—	—	μA
	Clock			-5.0	—	—	μA
	data input			-0.5	—	—	μA
Drive output voltage (low)		V_{DOL}	I_{DOL}=30mA	—	0.7	1.5	V
Drive output leakage current		I_{LEAK}	V_{OH}=28V	—	—	1.0	μA /dot
Logic supply current		I_{dd}	f_{CLK}=5MHz DI=1/2f_{CLK}	—	16	50	mA
"H" level output		V_{OH}	So， No load	4.45	—	—	V
		I_{OH}	So, V_{OH} = V_{dd} -0.4V			-0.5	mA
"L" level output		V_{OL}	So， No load	—	—	0.05	V
		I_{OL}	So, V_{OL} =0.4V	0.5	—	—	mA

Note: each heating gate includes 30K Ω± 5% pull-down resistance.

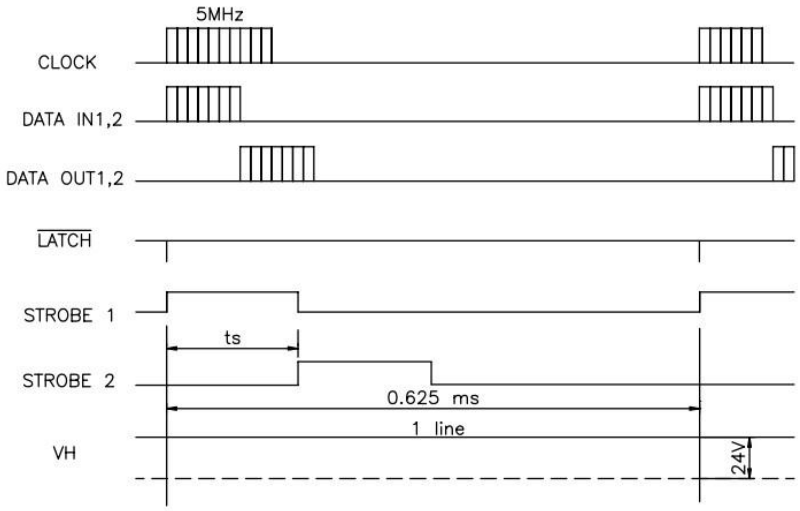
2.4.5 temporal characteristic

parameter	code name	Specification range			Unit
		minimum	Type	maximum	
clock frequency	f_{CLK}			5.0	MHZ
Clock width	t_w(T)	20			ns
data setup time	t_{su}(D)	15			ns
Data retention time	t_h(D)	15			ns
Latch setup time	t_{su}(LA)	100			ns
Latch pulse width	t_w(LA)	100			ns
clock delay	t_d(SO)			120	ns
Heating drive output delay	t_d(DO)			24	μs


tw CLK
CLK(CLOCK)
tsetup DI
thold DI
DI(DATA IN)
"High":Black
"Low" :White
td DO
DO(DATA OUT)
"High":Black
"Low" :White
tsetup LAT
thold LAT
min.24μsec*(Vdd=5.0V)
min.30μsec*(Vdd=3.3V)
/LAT(LATCH)
"High": Hold
"Low":Through
tw LAT
tsetup STB
STB(STROBE)
tdo
tdo
DRIVER OUT

2.4.6 Sequence diagram

For users with large allowable power supply current, it is recommended to adopt the following driving mode.



2.4.7 Calculation formula

The heating energy can be calculated by the following formula:

$$E_O = I_o^2 \overline{R} t_s = \frac{(VH - V_{com})^2 \cdot \overline{R} \cdot t_s}{(\overline{R} + R_{ic})^2}$$

R_{ic} =23 Ω

t_s

VH

$\overline{R}$

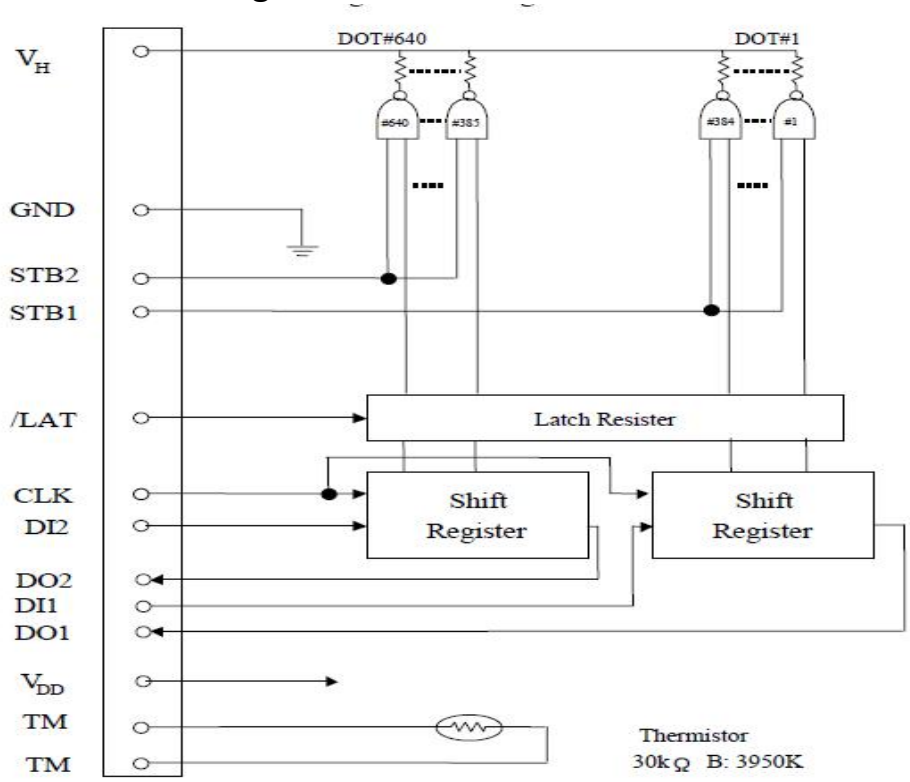
V_{com} =0.5V

Drive IC internal resistance
Gate pulse width (heating time)
Print voltage
Resistance value of heating element
Common electrode voltage drop

2.4.8 Thermistor

temperature (°C)	resistance (R)		
	minimum(KΩ)	type.(KΩ)	Maximum (KΩ)
-40	717	843	989
-35	535	623	723
-30	405	466	535
-25	308	352	400
-20	238	269	303
-15	185	208	232
-10	145	161	178
-5	113	124	137
0	88.7	96.8	105
5	69.9	75.7	81.7
10	55.4	59.5	63.8
15	44.1	47.1	50.1
20	35.4	37.5	39.6
25	28.5	30	31.5
30	22.8	24.2	25.5
35	18.3	19.6	20.8
40	14.9	15.9	17.1
45	12.1	13.1	14.1
50	9.92	10.8	11.7
55	8.16	8.91	9.7
60	6.76	7.41	8.12
65	5.62	6.2	6.83
70	4.7	5.21	5.77
75	3.95	4.4	4.9
80	3.34	3.74	4.18

2.4.9 Structural diagram



2.4.10 Control precautions

In order to prevent the printer core from overheating and burning during use, the following points should be noted during design:

Hardware:

1. Ensure that VH is powered on after VDD.

2. During power on of the system and without printing, ensure that strobe signal is in invalid state.

3. The hardware shall ensure that the VH voltage can be automatically turned off when the program is abnormal (running and crash).

4. Detect the temperature of the thermistor and control the current so as not to overheat the TPH and cause damage to the thermal body of the thermistor.

Software:

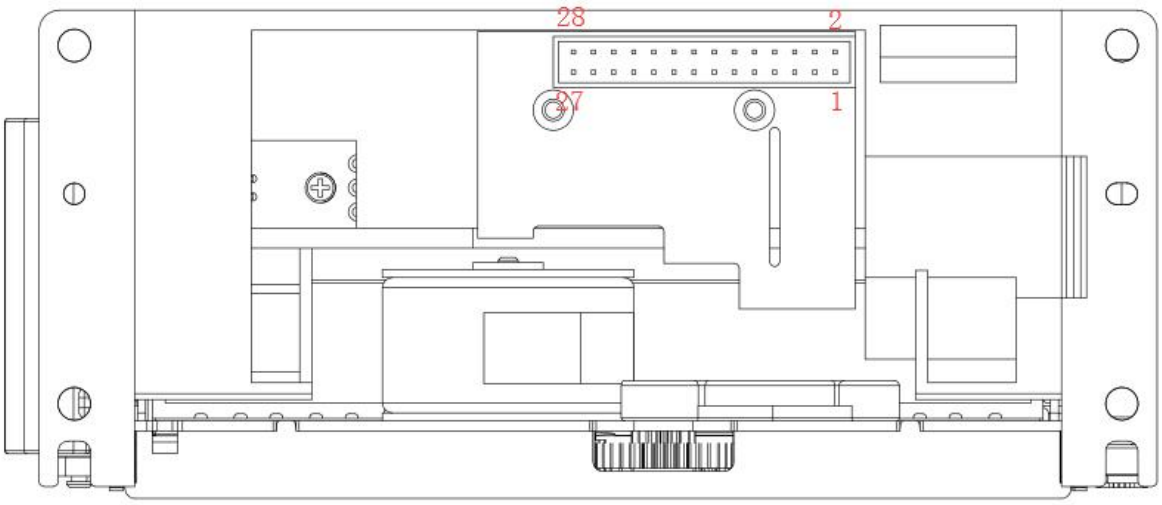
1. The time for each heating shall not be too long (exceeding the maximum energy).

2. Heating cannot be started when there is no paper, and printing cannot be performed when there is no paper.

3. It is recommended to send a blank line of data to the printer core after power on and each printing, so as to protect the printer from damage when other hardware fails.

2.5 Pin definition

Pin number	Signal name	illustration	Pin number	Signal name	illustration
1	VH	Print drive voltage	2	VH	Print drive voltage
3	GND	Grounding	4	GND	Grounding
5	PRN1B	Paper feeding stepper motor phase B	6	CUTB	Phase of cutter stepping motor B
7	PRN1A	Paper feeding stepper motor phase A	8	CUTA	Phase of cutter stepping motor A
9	/PRN1B	Paper feeding stepper motor phase /B	10	/CUTB	Phase of cutter stepping motor /B
11	/PRN1A	Paper feeding stepper motor phase /B	12	/CUTA	Phase of cutter stepping motor /A
13	AXIS	Output signal of shaft in position detector	14	/HOME_Sensor	Cutter in place detection
15	Thermo_Senser	Thermal head temperature detection	16	DI	printing data input
17	Paper-senser	Paper detection sensor output	18	STB	Strobe pulse
19	V_Paper	Positive electrode of the launch tube of the paper out detection sensor	20	CLK	Print clock input
21	V-lable	Positive electrode of slot marker detection emission tube	22	/LAT	Data latch control
23	/Lable-Sensor	Output end of seam mark detection sensor	24	VDD	Logic power terminal（+3.3V）
25	GND	Grounding	26	GND	Grounding
27	VH	Print drive voltage	28	VH	Print drive voltage



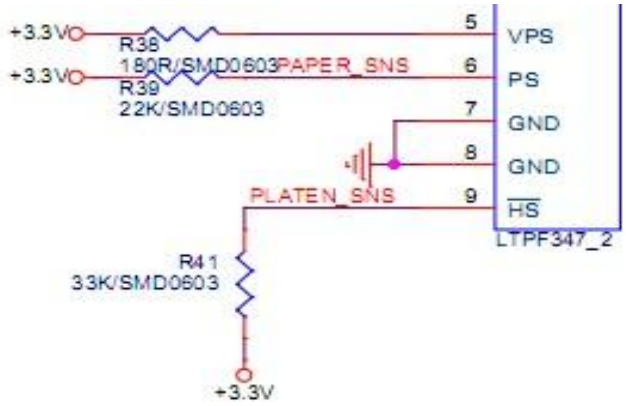
2.6 Photoelectric sensor specification

The micro printer has a reflective photoelectric detection switch. As shown in the figure below, when there is a lack of paper or the paper pressing shaft is not pressed properly, the light emitted by the photoelectric detection cannot be reflected and the high level is output.

When the paper and the platen shaft are normal, the light emitted by the photoelectric detection is reflected, received by the receiving tube, and output low level.

The circuit driving of the photoelectric switch is shown in the figure below. The logic voltage can be 3.3V or 5V.

Do not start the printer heating when the paper is out or the platen is not ready.



VPS	Power thermal head up detector (LED positive electrode)
PS	Paper detector output signal
GND	Common grounding point of thermal head upward and paper detector
GND	Common grounding point of thermal write head upward and axis in place detector
$\overline{HS}$	Output signal of shaft in position detector

Photoelectric sensor parameters

Absolute Maximum Ratings (Ta=25℃)

item		Symbol	Specification range	Unit
input terminal	power dissipation（Ta ≤25℃）	Pd	75	mW
	Reverse voltage	VR	5	V
	Forward current	IF	50	mA
	Forward surge current pulse width ≦100μs	IFP	1	A
output terminal	Collector loss power（Ta ≤25℃）	PC	100	mW
	Collector current	IC	50	mA
	Collector to emitter voltage drop	VCEO	30	V
	Emitter to collector voltage drop	VECO	5	V
working temperature		Topr	-20～+70	℃
Storage temperature		Tstg	-30～+80	℃
welding temperature (the welding time is 5S when the pin is 2mm)		Tsol	260	℃

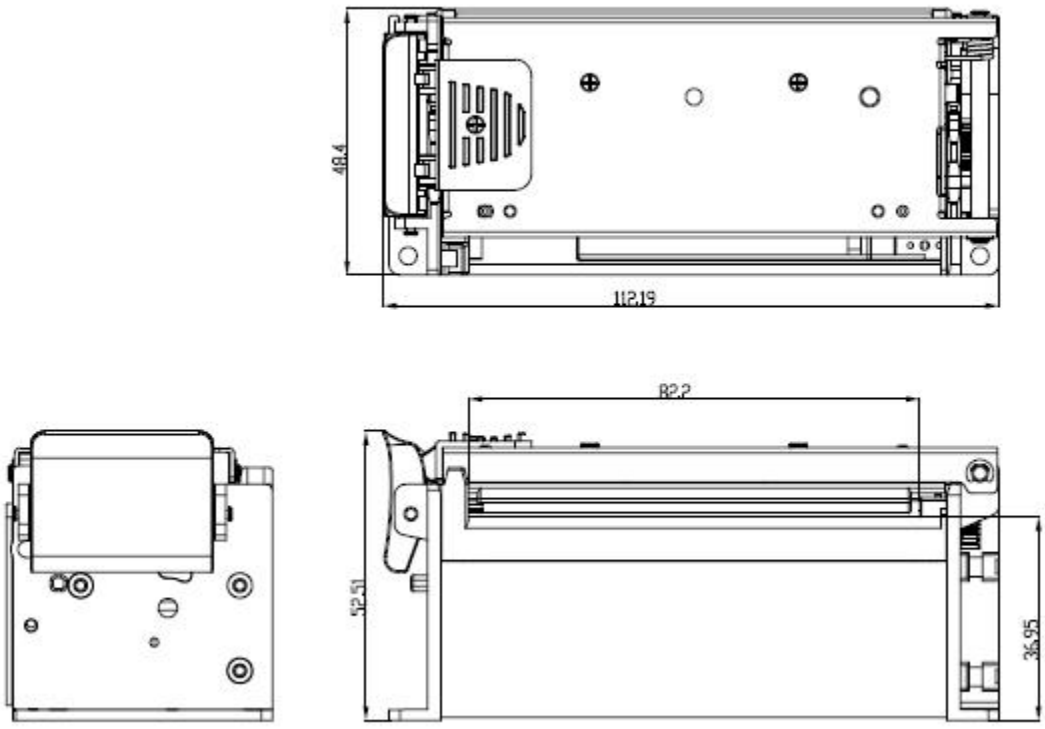
Electrical characteristics（Ta=25℃）

parameter		Symbol	Min	Typ.	Max.	unit	Test conditions
input terminal	Forward voltage	VF		1.2	1.6	V	IF=20mA
	Reverse current	IR			10	μA	VR=5V
output terminal	Collector dark current	ICEO			100	nA	VCE=10V
	Saturation voltage drop from collector to emitter	VCE (sat)			0.4	V	IC=2mA $E_{E=}$1mW/cm^2
Coupling characteristics	sensorelectric current	$I_{C(ON)}$	0.1			mA	VCE=5V IF=20mA
	Leakage current	I_{LEAK}			1	μA	
	rise time	Tr		20		μsec	VCE=2V IC=100μA RL=1KΩ
	Falling time	Tf		20		μsec	

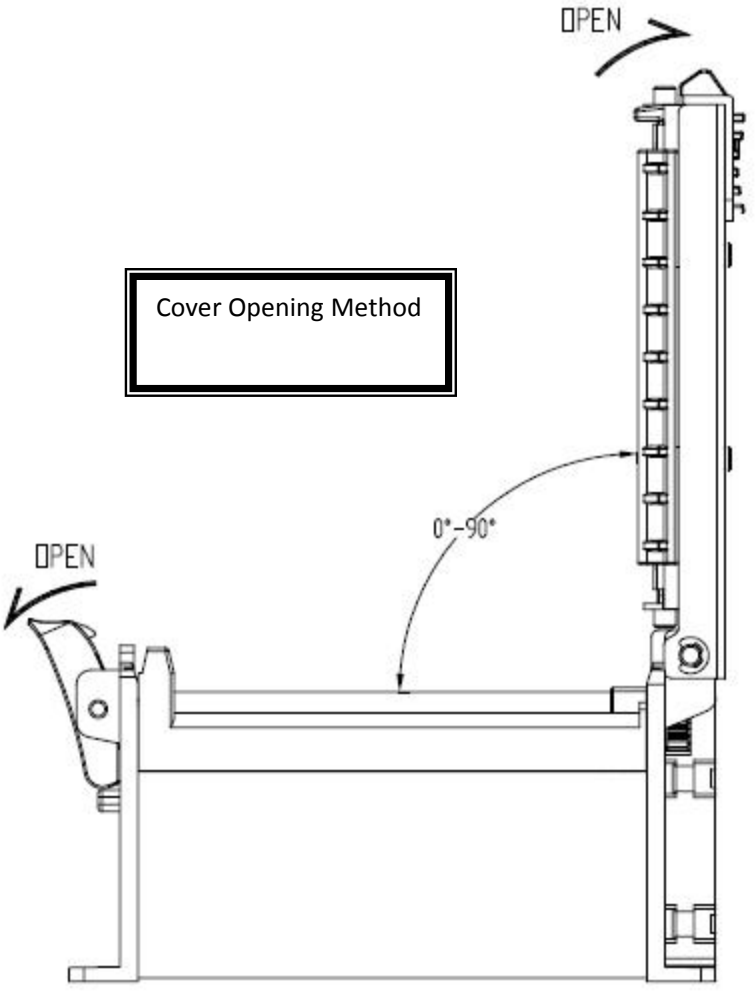
Chapter III Fuselage design guidance

3.1 Structural dimension drawing

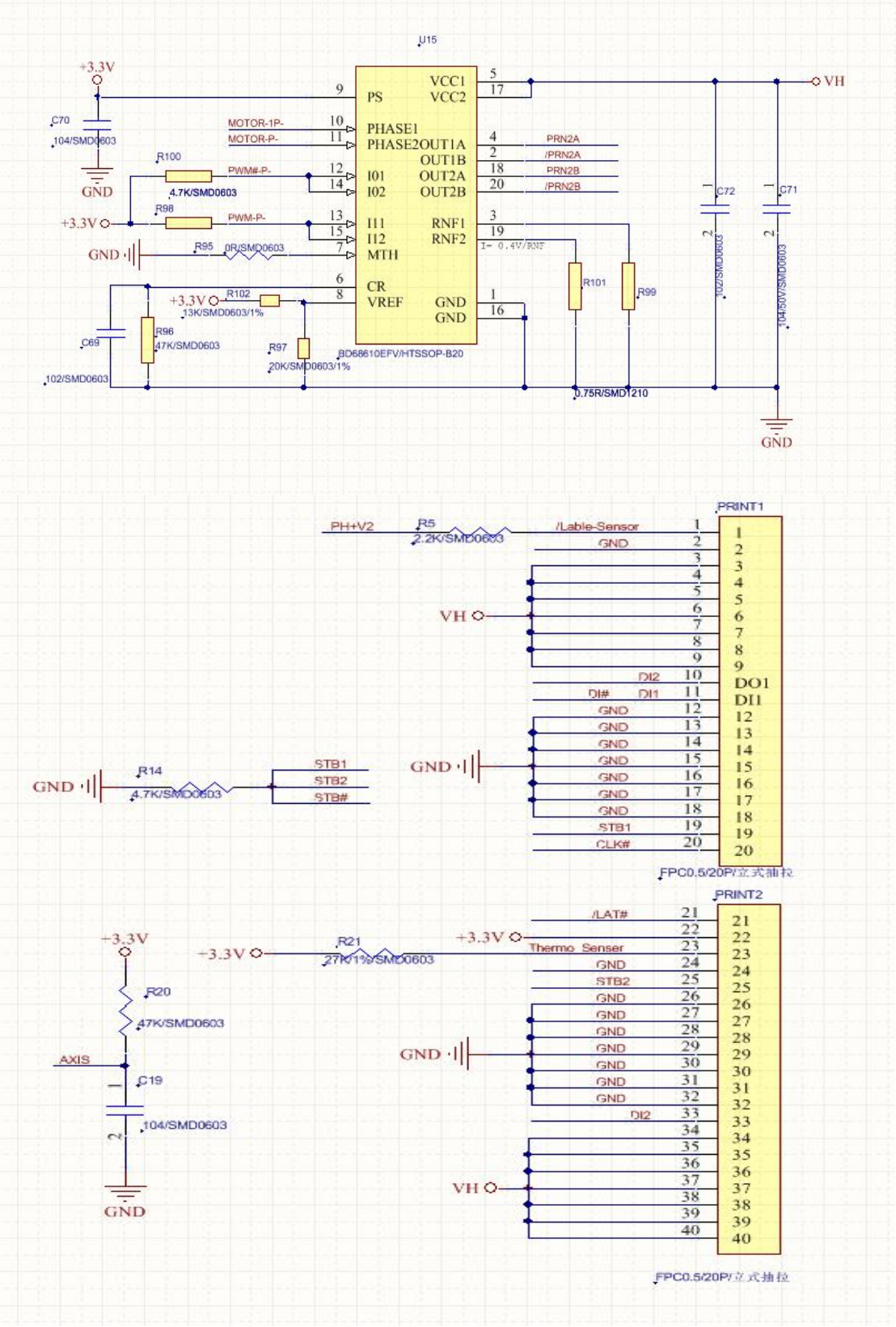
3.1.1 Dimension drawing of KTP-300S Printer Mechanism



3.1.2 Schematic diagram of cover opening



3.2 Demo circuit schematic diagram



Circuit description:

1. When designing the circuit, it must be ensured that VH (+ 24V in the figure) must be powered on later than the system power supply (5V). It is recommended to add a PMOS to control the power on of VH

2. When the program starts printing, the prn-power control line outputs high / low pulses (it is recommended to continuously reverse the control line during the timing interruption of the control motor step, and turn off the pulse if the printing is not driven. This can prevent the printer from being damaged due to system errors (such as program crash)