

Xiamen liyin electronic technology CO.,LTD

SAMPLE SPECIFICATIONFOR APPROVAL

Customer Name : _____

Standard Model: _____ MTP02-I _____

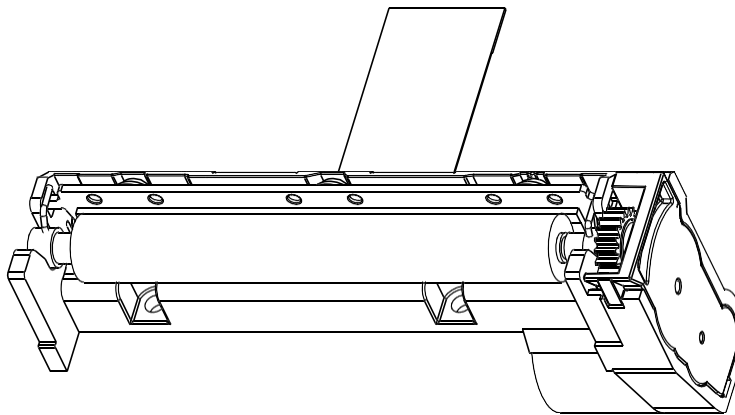
Delivery Date : _____

Sign Date : _____

CUSTOMER			SUPPLIER		
APPROVAL			APPROVAL		
CONFIRMER	CHECKER	APPROVER	FICTION	CHECKER	APPROVER
DATE:			DATE:		

Thermal Printer Mechanism

MTP02-I



LY will execute the PCN procedure before change any specifications or materials related to this mechanism. There will be no changes before the acknowledge and confirmation of our client.

The latest version of the specification will be sent to the client for confirmation if any change has been agreed.

LY continuously promotes new products and we also provide ODM service, if there is any need, please contact us at anytime.

REVISION RECORDS

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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CHAPTER 1 CHARACTERS AND OPERATING PRECAUTIONS

1.1 Characters

- **Operating voltage range**

The range of TPH operating voltage is 3.3V~5.2V and the range of logic voltage is 2.7V~3.5V.

- **High resolution printing**

A high-density printer head of 8 dots/mm make the printing clear and precise.

- **Compact and light**

The mechanism is compact and light,
dimensions: 67.3mm (width) * 18.25mm(depth) * 31.9mm (high).

- **Printing speed adjustable***

According to driving power and sensitivity of thermal paper, set different printing speed required.The max speed is 70mm/s.

- **Easy paper loading**

Detachable rubber roller structure makes the paper loading easier.

- **Low noise**

Thermal line dot printing is used to guarantee low-noise printing.

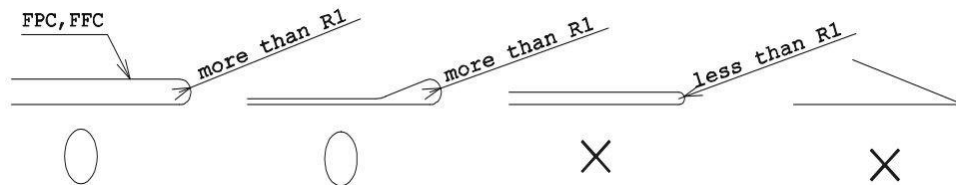
*Remark: Print speed differs depending on working conditions.

1.2 Operation Precautions

- 1) TPH and photo interrupter is sensitive to static electricity,in order to prevent damages of inner parts of the printer caused by the static electricity,when handling this printer,please take any preventive measures against static electricity, such as disposable static wrist strap.
- 2) When attaching the platen part to the platen retainer, pay attention not to flaw or damage or smear the rubber part of the platen, the platen gear, and the bearing part (particularly, don't attach any oil or grease and foreign materials on the rubber part.)
- 3) Never attempt to touch the thermal printer head surface with bare hands. Attaching any oil or

grease such as oils from palms on the heating element part may be shortening the lifetime of the thermal head. In case that any oil and grease or foreign materials are attached on it, perform the cleaning immediately. In addition, pay attention not to hit it with something hard such as driver.

- 4) When assemble the platen to the platen retainer of the casing, make sure that the orientation is correct.
- 5) The thermal head and FPC are shipped as they are connected. When installing the printer, do not pull or apply any extra force in order to avoid the connected part of the thermal head and FPC from being disconnected or deviated. When connecting FPC, please make sure that the power of control circuit is off. Plug in / out FPC to control board should less than 10 times, meanwhile make FPC parallel to connector socket.
- 6) Do not make FPC bend because it may cause FPC disconnection or broken. If FPC requires to be bent, the bending should be more than R1, and do not rework (straighten or bend backward).



- 7) The printer has a structure such that the platen part is removed from the printer cabinet. Therefore, if any paper ejected from this printer is pulled away with an unnecessarily strong force, it may cause the platen gear to get off the track and damage the gear. Do not attempt to pull any paper ejected from the printer.
- 8) If any voltage is applied to the thermal head when the head or paper is wet due to condensation, it may be damaged by electrolytic corrosion; therefore, when using the printer, pay attention to the following items.
 - ❖ Do not apply any electric power to the printer when it is not used.
 - ❖ Do not perform the printing with any wet paper.
 - ❖ Do not apply any electric power to the printer under any environment where any dew condensation is possible to occur.
 - ❖ Turn off all electric power to the head immediately when condensation occurs. Use the head only after the head is completely dried.
 - ❖ Depending on the environment where the printer is used (the low temperature or high humidity), condensation may be caused by water vapor generated from the used paper when performing the printing of the high printing rate (solid fills, zigzag printing); therefore, the environment should be considerably evaluated.
- 9) When using this mechanism for the continuous actions, the temperature of the head (the temperature detected with the thermistor) should be equal or less than 75 degrees.
- 10) Keep the paper conveyance unobstructed.
- 11) Use the high quality thermal paper, for the property of the paper have big effect on printing quality. The perforated paper may cause the damage to the thermal heads and even shorten lifetime.

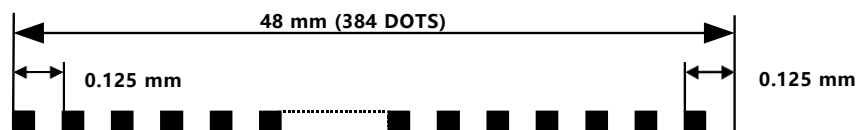
CHAPTER 2 SPECIFICATIONS

2.1 General Specifications

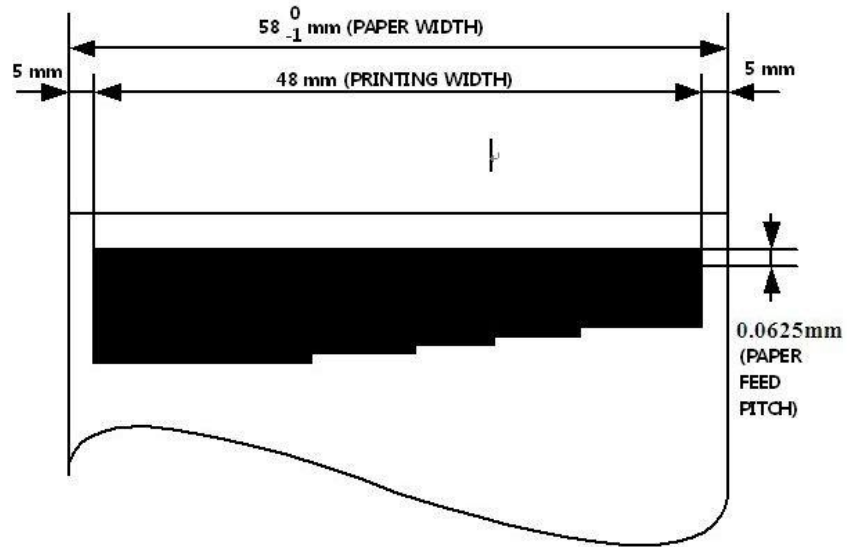
Item	Specifications
	MTP02-I
Print method	Thermal dot line printing
Dots per line	384 dots
Resolution	8 dots/mm
Print width	48 mm
Paper width	58 ± 0.5 mm
W*D*H(mm)	67.3 mm * 18.25 mm * 31.9 mm
Weight	28 g
Printing speed	70 mm/s(MAX.)
Paper feed pitch	0.0625 mm
Head temperature detection	Via thermistor
Out-of-paper detection	Via photo interrupter
Life span (at 25°C and rated energy)	100 million pulses or more (print ratio=12.5%)
Activation pulse resistance	50km or more
Abrasion resistance	
Operating temperature range (°C)	-5 ~ +50
Operating humidity (RH)	10% ~ 90%
Storage temperature range (°C)	-40 ~ +80
Storage humidity (RH)	5% ~ 90%

2.2 Heat Element Dimensions

MTP02-I contains a thermal head with 384 heat elements .



2-1 Heat Element Dimensions



2-2 Print Area

2.3 Step Motor Characteristics

2.3.1 Step Motor Specification

Item	Specification
Type	PM
Number of phases	2-phase
Excitation	2-2 phase
Winding resistance per phase	5.5Ω±7%
Rated voltage	3.3~5.0V
Step angle	18°/step
Drive frequency	Max.2240pps

2.3.2 Excitation Sequence

Signal Name	Sequence			
	STEP1	STEP2	STEP3	STEP4
PB	Low	Low	High	High
PNB	High	High	Low	Low
PNA	Low	High	High	Low
PA	High	Low	Low	High

2.3.3 Accelerate Time Table

STEP	Time (ms)	STEP	Time (ms)	STEP	Time (ms)	STEP	Time (ms)	STEP	Time (ms)
1	5.579	32	1.102	63	0.796	94	0.654	125	0.558
2	4.308	33	1.086	64	0.789	95	0.651	126	0.548
3	2.614	34	1.071	65	0.784	96	0.647	127	0.538
4	2.500	35	1.056	66	0.778	97	0.644	128	0.529
5	2.426	36	1.042	67	0.772	98	0.641	129	0.520
6	2.272	37	1.029	68	0.766	99	0.637	130	0.512
7	2.144	38	1.016	69	0.761	100	0.634	131	0.504
8	2.035	39	1.003	70	0.756	101	0.631	132	0.497
9	1.941	40	0.991	71	0.750	102	0.628	133	0.489
10	1.859	41	0.979	72	0.745	103	0.625	134	0.482
11	1.786	42	0.968	73	0.740	104	0.622	135	0.476
12	1.721	43	0.957	74	0.735	105	0.619	136	0.469
13	1.663	44	0.947	75	0.731	106	0.616	137	0.463
14	1.610	45	0.936	76	0.726	107	0.614	138	0.457
15	1.561	46	0.927	77	0.721	108	0.611	139	0.452
16	1.517	47	0.917	78	0.717	109	0.608	140	0.446
17	1.477	48	0.908	79	0.712	110	0.605	--	--
18	1.439	49	0.899	80	0.708	111	0.603	--	--
19	1.404	50	0.890	81	0.704	112	0.600	--	--
20	1.372	51	0.882	82	0.699	113	0.597	--	--
21	1.342	52	0.873	83	0.695	114	0.595	--	--
22	1.313	53	0.865	84	0.691	115	0.592	--	--
23	1.287	54	0.857	85	0.687	116	0.590	--	--
24	1.261	55	0.850	86	0.683	117	0.587	--	--
25	1.238	56	0.842	87	0.679	118	0.585	--	--
26	1.215	57	0.835	88	0.675	119	0.582	--	--
27	1.194	58	0.828	89	0.672	120	0.580	--	--
28	1.174	59	0.821	90	0.668	121	0.577	--	--
29	1.155	60	0.815	91	0.664	122	0.573	--	--
30	1.136	61	0.808	92	0.661	123	0.570	--	--
31	1.119	62	0.802	93	0.657	124	0.568	--	--

2.4 Thermal Head Specifications

2.4.1 General Characteristics

Item	Specification	Note
Print width	48mm	
Number of heater elements	384 dots	
Heater resolution	8 dots/mm	203dpi
Heater elements pitch	0.125 mm	
Heater resistance	$\bar{R} = 80 \Omega \pm 10 \%$	
Number of data inputs	1 serial input	Data In
Logic signals	6 STROBE	
Specification for Thermistor	$R_{25}=30K\Omega\pm 5\%, B=3,950K\pm 3\%$	See 2.4.8

2.4.2 Maximum Parameter

Parameter	Symbol	Specification	Note
Head voltage	VH max	5.5 V	IC breakdown voltage
Heater energy consumption	Eo max	0.24mJ(max)	P=0.161W/dot Tcy=2.5ms Ton=1.49ms
Number of heating dots simultaneously ON	Ndot max	96 dots	With common voltage drop compensation
Operating temperature*	Ta	-20 °C ~70 °C	Thermistor temp. 65°C max.
Operating humidity*		20~90%RH	Non-condensing
Storage temperature		-40 °C ~+80 °C	Non-condensing
Storage humidity		5~90 %RH	Non-condensing

NOTE: On the above conditions,TPH can't ensure the printing quality and life.

2.4.3 Characteristics Recommended

Item		Symbol	Recommended conditions	Note
Printing speed			2.5 ms/line	
Heater power consumption		Po	0.125 W/dot	$\bar{R} = 80\Omega$
Heat voltage		VH	3.7V	
Heater energy	5°C	Eo (Ts)	0.18mJ/dot(1.44 ms)	$\bar{R} = 80\Omega$
	25°C		0.16mJ/dot(1.28 ms)	
	40°C		0.14mJ/dot(1.12 ms)	

2.4.4 Electrical Characteristics

1) Limited parameter

Item	Symbol	Text condition	Min.	Typ.	Max.	Unit
Supply voltage	VDD	Surge	-0.3	—	6.0	V
Input voltage	VIN		-0.3	—	VDD+0.3	V
Surge voltage	VHS	Element off	—	—	10.5	V

2) Recommended parameter

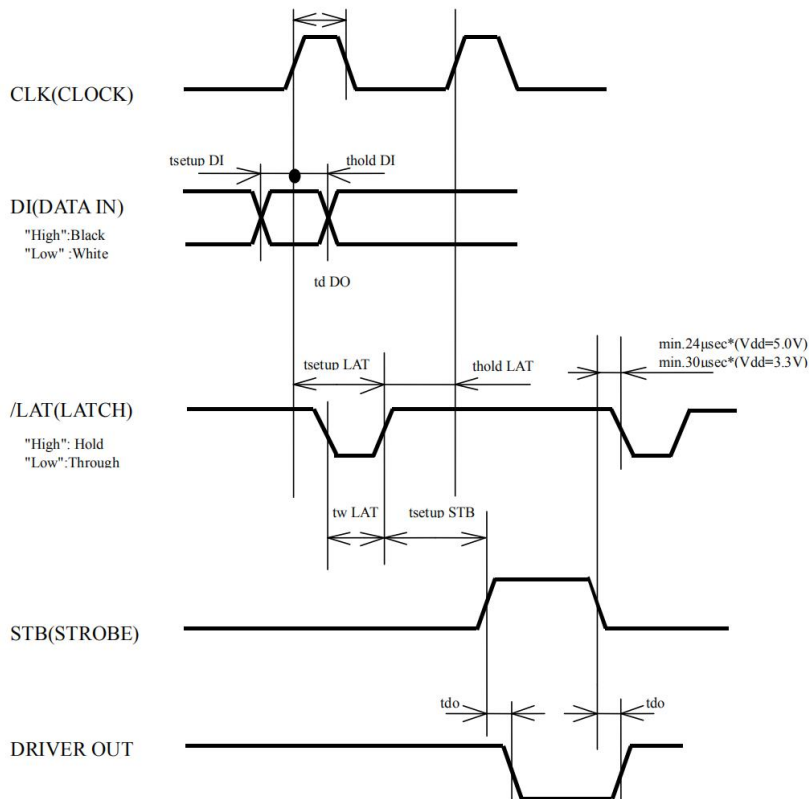
Item	Symbol	Text condition	Reference			Unit
			Min.	Typ.	Max.	
Supply voltage	VDD		2.7	3.3	4.5	V
	VH		—	3.3	5.5	V
Logic input Itage	V _{IH}		0.7×VDD	—	VDD	V
	V _{IL}		0	—	0.3×VDD	V
Clock frequency	f _{clk}	Duty 50%	—	—	10	MHz

3) Electrical parameters

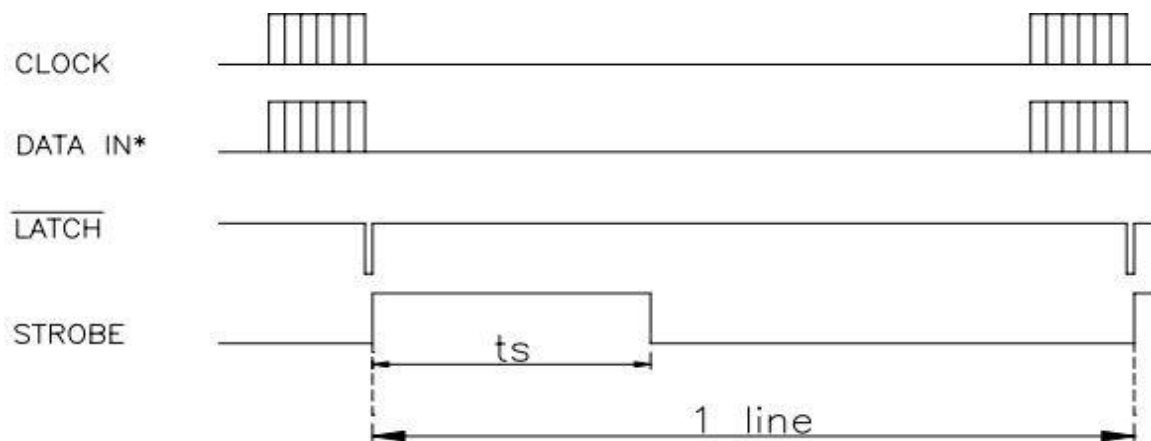
Item		Symbol	Text condition	Reference			Unit
				Min.	Typ.	Max.	
Logic input voltage	latch	I _{IH}	V _{IH} =3.0V VDD=3.0V	—	—	4.0	μA
	Heat the gate			—	—	300	μA
	Clock			—	—	3.0	μA
	Data input			—	—	0.5	μA
	latch	I _{IL}	V _{IL} =0V VDD=3.0V	-300	—	—	μA
	Heat the gate			-3.0	—	—	μA
	Clock			-3.0	—	—	μA
	Data input			-0.5	—	—	μA
"L" level output voltage		V _{DOL}	VDD=3V I _{DOL} =50mA	—	0.3	0.6	V
Drive output leakage current		I _{LEAK}	V _{OH} =10V	—	—	1.0	μA /dot
Current consumption		I _{dd}	f _{CLK} =2MHz DI=1/2f _{CLK}	—	20	40	mA
"H" voltage output		I _{OH}	So, V _{OH} =VDD-0.4V	—	—	-0.5	mA
"L" voltage output		I _{OL}	So, V _{OL} =0.4V	0.5	—	—	mA

2.4.5 Timing Characteristics

Item	Symbol	Specification range			Unit
		Min.	Typ.	Max.	
clock frequency	f_{CLK}	---	---	10	MHZ
Width of the clock	$t_w(T)$	20	---	---	ns
Data set up time	$t_{su}(D)$	20	---	---	ns
Data hold time	$t_h(D)$	20	---	---	ns
LATCH set up time	$t_{su}(LA)$	20	---	---	ns
LATCH pulse width	$t_w(LA)$	20	---	---	ns
clock delay	$t_d(SO)$	---	---	80	ns
Heating drive output delay	$t_d(DO)r$	---	---	36	μs
	$t_d(DO)f$	---	---	36	μs



2.4.6 Timing Chart



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2.4.7 Equation

Calculate the printing energy using this equation:

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

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

or

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

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

$R_{ave} = R_{res} + R_{lead}$ ^{*3}: Average resistance (Ex.) 80 (Ω)

N: Number of dots firing at same time (Ex.) 64 (dots)

R_{com} : Common resistance (Ex.) 0.08 (Ω)

R_{ic} : Driver saturated resistance (Ex.) 9 (Ω)

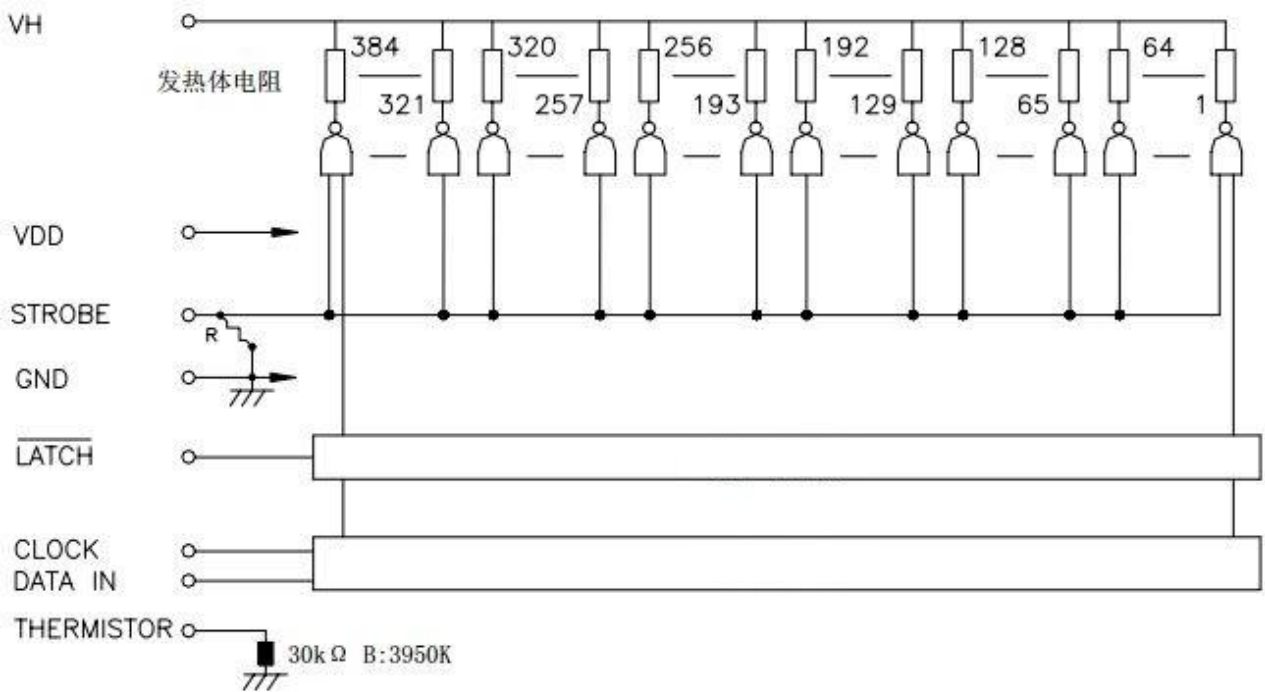
*3 R_{res} : Heater resistance, R_{lead} : Lead resistance

2.4.8 Thermistor Resistance

$$R_{25} = 30k\Omega \pm 5\%, B_{\text{CONST}} = 3950\text{Kelvin} \pm 3\%, R = R_{25} e^{B(1/T - 1/T_{25})}$$

Temperature (° C)	Thermistor Resistance (R)		
	Min. (K Ω)	Typ. (K Ω)	Max. (K Ω)
-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 Structure Figure



STROBE No.	Dot No.	Number of Dots
1	1 ~ 384	384

2.4.10 Operating Precautions

In order to prevent the printer head heater element overheating or burned up, when we designing products, pay attention to the points as follows:

- In hardware terms:**

- 1) When the power on, the order should be VDD→VH.
- 2) When the power is on or stand by, make sure that the STROBE signal is in invalid state.
- 3) Make sure if program is abnormal (such as system halted), VH voltage should be shut off automatically.
- 4) During the printing, Detecting thermistor temperature, make sure that the thermal printer head (TPH) is not overheated.

- **In firmware terms:**

- 1) STROBE time should not be too long.
- 2) In the following two cases, do not start:
 - ① when paper jammed; ② When the paper is out.
- 3) When the power is on or each printing task completed, it is recommended to send blank data to the mechanism, so it can prevent the printer head from damaged if there are some hardware failure on the control board.
- 4) Over-temperature protection: The printer stops working when heating temperature is greater than 70°C, and start working again when the temperature down to 60°C.

2.5 Pin Assignment

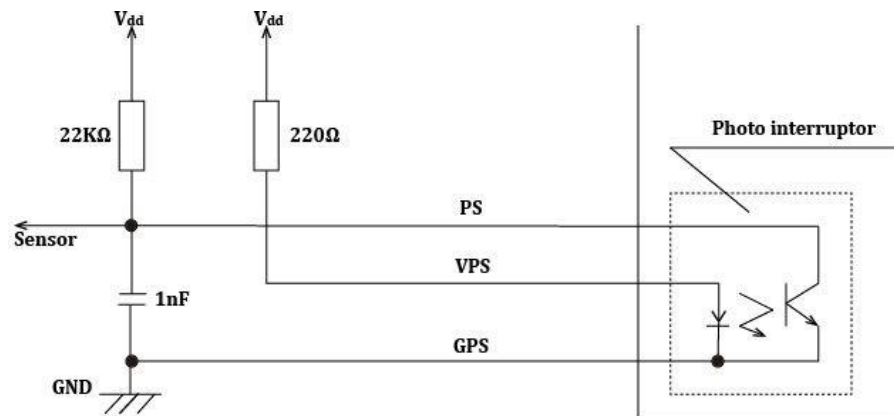
Pin No.	Signal Name	Function
1	\bar{B}	Stepping motor excitation signal
2	B	Stepping motor excitation signal
3	\bar{A}	Stepping motor excitation signal
4	A	Stepping motor excitation signal
5	VH	Head drive power
6	VH	Head drive power
7	\overline{LATCH}	Data latch
8	GND	Ground power supply for thermal head
9	GND	Ground power supply for thermal head
10	GND	Ground power supply for thermal head
11	THERMISTOR	Thermally sensitive resistor input terminal
12	STROBE	Thermal head energizing control signal
13	VDD	Logic power
14	GND	Ground power supply for thermal head
15	GND	Ground power supply for thermal head
16	GND	Ground power supply for thermal head
17	CLOCK	Asynchronous clock for communication
18	DATA IN	Data in
19	VH	Head drive power
20	VH	Head drive power
21	VH	Head drive power
22	VPS	Anode for photo interrupter
23	GPS	Ground
24	PS	Collector for photo interrupter

2.6 Photo Interrupter Specification

MTP02-I has a reflective sensor. As show in the figure below, when the platen released or paper out,no infrared light will be reflected,the output is high.When everything is normal, the sensor will output low level.

In the diagram the VDD is 3.3V 。

When the paper out or platen released, do not start printing.

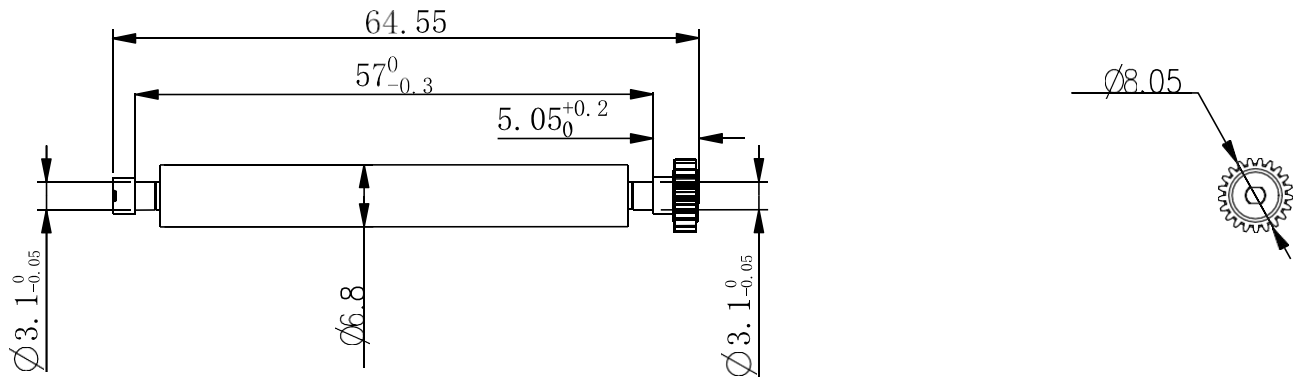


Electro-Optical Characteristics

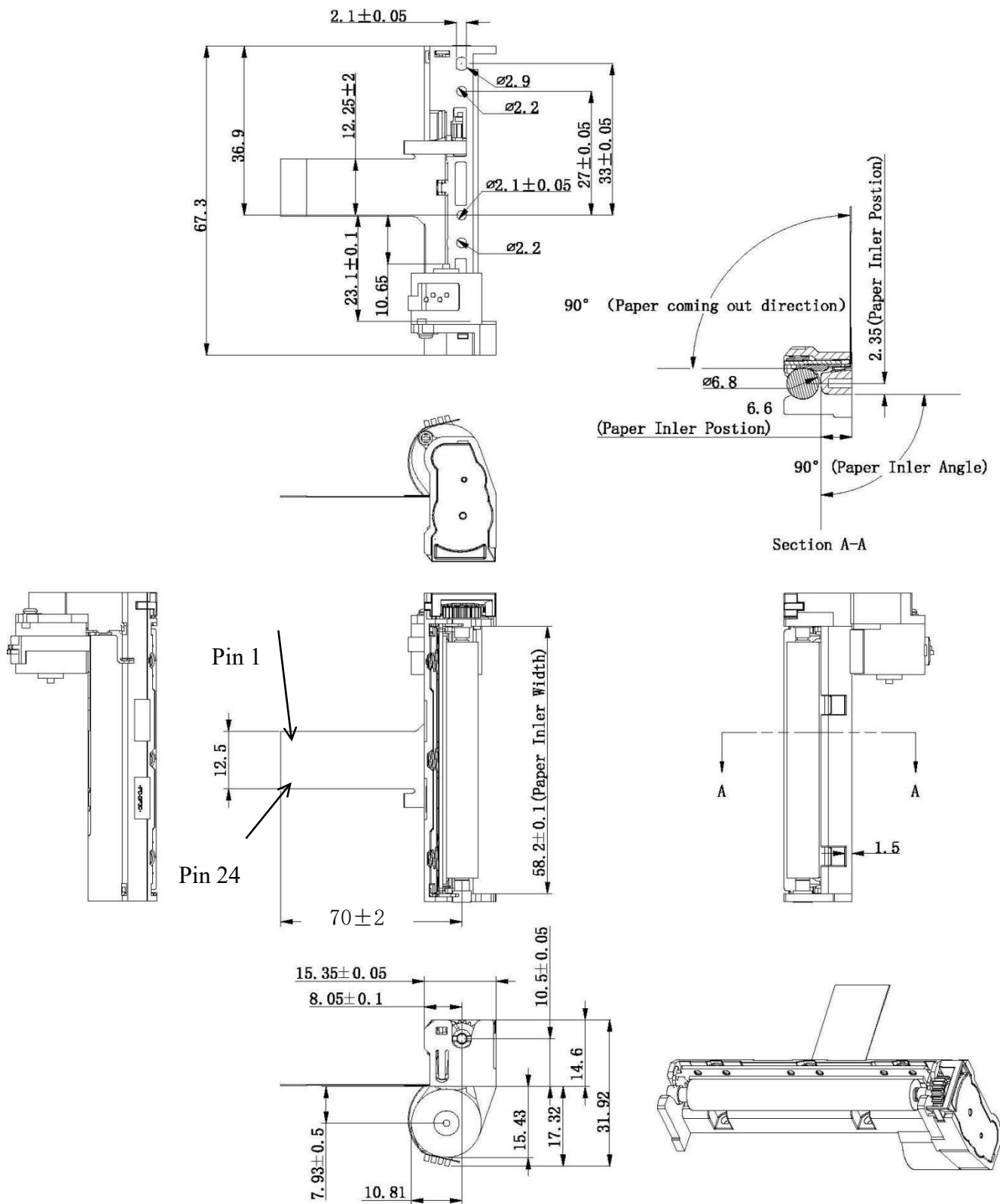
Parameter		Symbol	numerical			Unit	Conditions
			Min.	Typ.	Max.		
Input	Forward Voltage	V_F	---	1.25	1.5	V	$I_F=4mA$
	Reverse Current	I_R	---	---	10	μA	$V_R=6V$
Output		I_{CEO}	---	--	0.1	μA	$V_{CE}=10V$
Transfer Characteristics	Collector Current	$I_C(ON)$	70	--	130	μA	$V_{CE}=2V$ $I_F=4mA$ $d=0.7mm$
	Rise Time	t_r	---	15	--	μs	$V_{CE}=2V$ $I_o=100\mu A$ $R_L=1K\Omega$ $d=0.7mm$
	Fall Time	t_f	---	15	--	μs	

CHAPTER 3 CASING DESIGN GUIDE

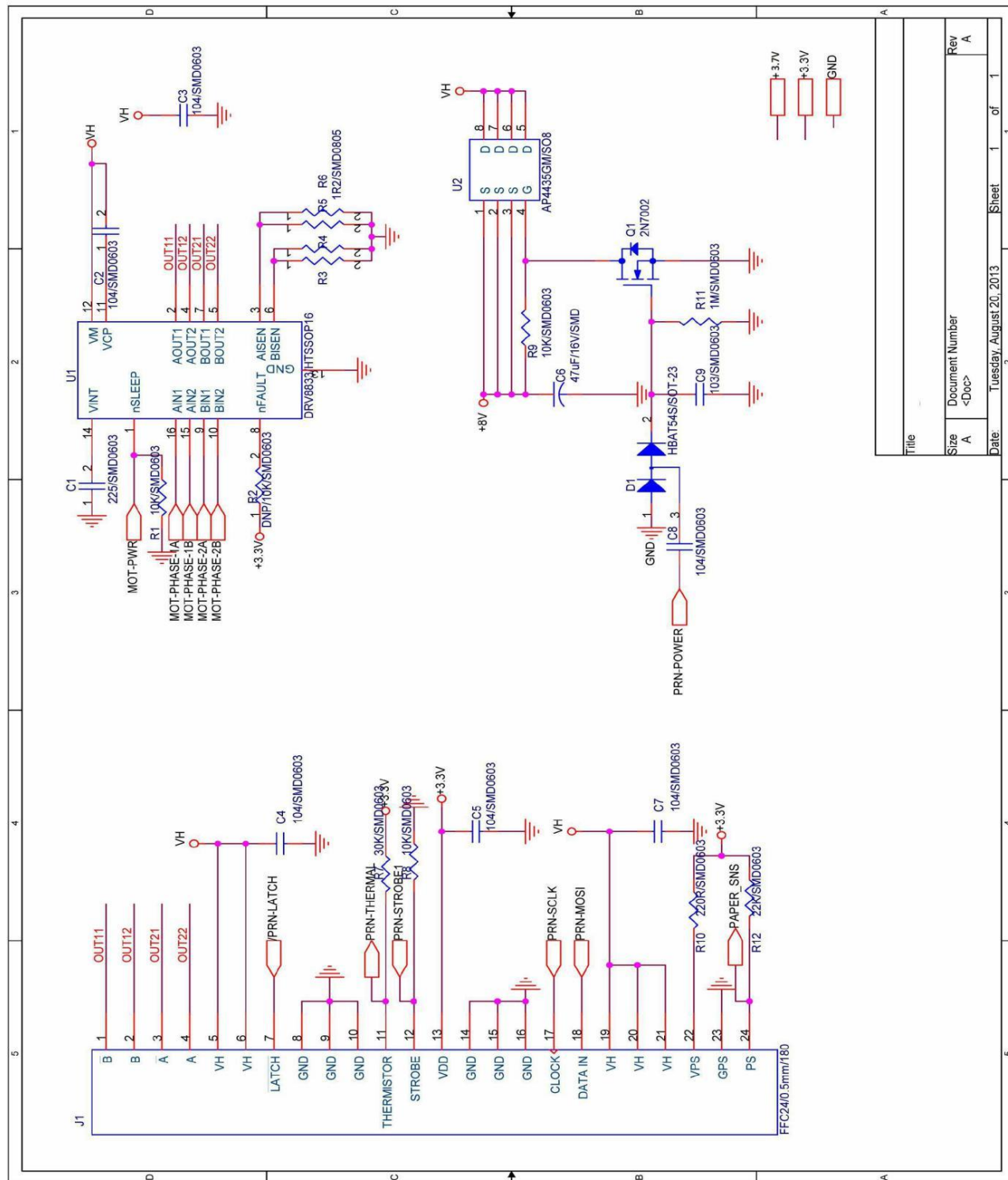
3.1 Platen Structure Dimensions



3.2 Mechanism Structure Dimensions



APPENDIX



Title	
Size	A
Document Number	<Doc>
Rev	A
Date	Tuesday, August 20, 2013
Sheet	1 of 1