Thermal printer mechanism

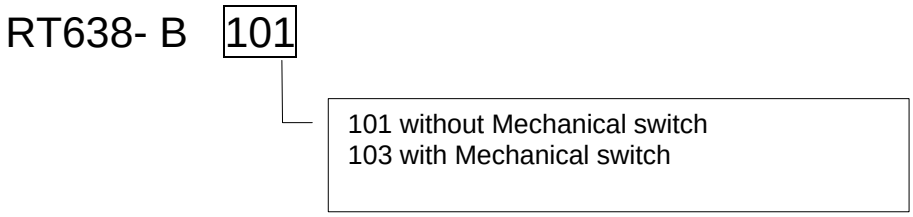
RT638

Content

Characters and operating precautions

1. Characters

Model definition



1. Low voltage supply

The voltage used to drive the thermal printer head is equal to the logic voltage, or is driven by a 5 V single power line, the range of operating voltage is 4.2V-8.5V, so four to six NI-Cd battries or Ni-MH batteries can also be used. Two li-ion battery can be used.

2. Low volume Compact and light

The mechanism is compact and light, dimensions: 92mm(width) * 33.5 mm(depth) * 15mm (height)

3. Printing with High resolution

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

4. High speed printing

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

5. Easy paper loading

Detachable rubber roller structure make the paper loading easier

6. Low noise

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

2. Operation precautions

1.1 When handling this printer , for TPH and photo interpreter is sensitive to static electricity, please take any preventive measures against static electricity, such as disposable static wrist strap, in order to prevent damages of inner parts of the printer caused by the static electricity.

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 .

1.3 Never attempt to touch the thermal printer head surface with bear hands . Attaching any oil or grease such as oils from palms on the heating element part of may be shorten 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.

1.4 When assemble the platen to the platen retainer of the casing , make sure that the orientation is correct.

1.5 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 it sure under condition 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.

1.6 Do not make FPC bend because it may cause FPC disconnection or broken. If FPC requires to be bent,. it will be rework if the bending more than R1.

1.7 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.

1.8 Wet paper can be make it jammed, pay attention to the following items when using the printer :

1.8.1. Turn off the power please when it is not used
1.8.2 Do not load any wet paper please.
1.8.3 Turn off the power to the head immediately when condensation occurs. Use the head only after the heads 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. Therefore, the environment should be considerably evaluated.

1.0 To separate the head and the platen after the paper run off, If the paper is run out during the printing, stop all actions of the printer in order to prevent the printing without the paper fed. If the printing is continued without any paper fed, it may cause the troubles of the printer.

1.10 When using this printer for the continuous actions, the temperature of the head printer board (the detected temperature with the thermistor) should be equal or less than 65 degrees centigrade for the temperature protection of IC inside of the printer as well as the surface temperature of the motor should be equal or less than 90 degrees centigrade for the temperature protection of the motor coil.

1.11 Make sure paper load smooth please.

1.12 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	
	RT638-B101	RT638-B103
Print method	Thermal dot line printing	
Dots per line	576 dots	
Resolution	8 dots/mm	
Print width	72 mm	
Papert width	76~80mm	
W x D x H（mm）	92×33.5×15	
Maximum printing speed	200 dot lines/s (25.0 mm/s) (at 5 V) 1 450 dot lines/s (56.25 mm/s) (at 7.2 V) 1 500 dot lines/s (62.5 mm/s) (at 8.0 V) 1	
Paper feed pitch	0.125mm	
Head temperature detection	Via thermistor	
Out-of-paper detection	Via photo interrupter	
Head-up detection	no	yes（Mechanical switch）
Life span (at 25°C and rated energy) Activation pulse resistance Abrasion resistance	100 million pulses or more (print ratio=12.5%) 4 50 km or more	
Operating temperature range (℃)	0~40℃	
Operating humidity (RH)	20%－80%	
Storage temperature range (℃)	-25-70	
Storage humidity（RH）	10%-%90	

2.2 Heat element dimensions

PT723 contains a thermal head with 576 heat elements (dot–size)

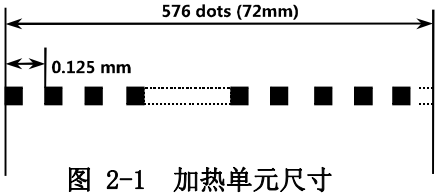
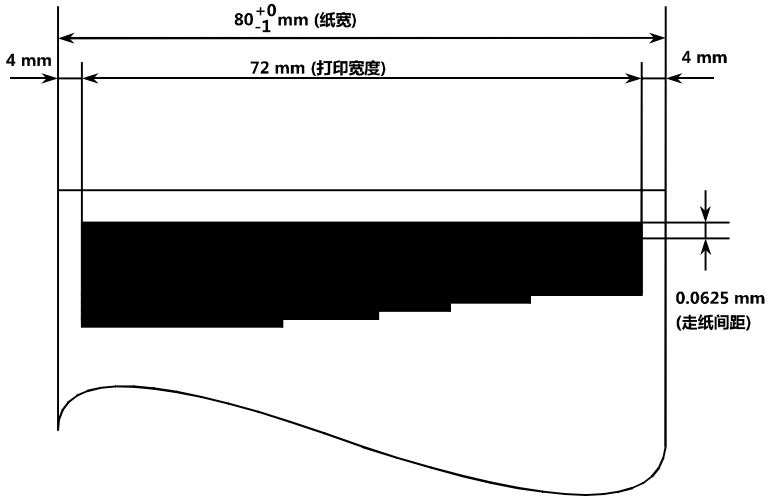


图 2-1 加热单元尺寸



2.3 Paper feed characteristics

Paper is fed in a forward direction when the motor shaft is rotating in the normal direction (clockwise) when seen from the motor gear side.

The motor is driven by a 2-2 phase excitation, constant current chopper and method and feeds paper by 0.125mm (equivalent to a single dot pitch) every two steps of the motor drive signal.

To prevent deteriorateon in printing quality due to backlash of the paper feed system, the motor should be driven 40 steps in a reverse direction then 40 steps in the normal direction during initializeation or following backward feeding .During paper feeding, the motor should be driven lower than lower than the value obtained by equation (1).

Equation(1)

At -5℃ or higher

Vp×165-220(pps)(max.1200 (pps))

Under -5℃

300 (pps)

During printing, motor drive frequency should be adjusted according to working conditions such as voltage, temperature, number of activated dots, etc.

Drive the motor at 200 pcs when automatically loading paper, regardless of the voltage. As for the motor current value, to keep the motor torque, activate the motor by only the first setting current value (i.e one current) for the entire motor drive step time.

2.4 Step motor characteristics

2.4.1 Step motor specifications

Item	Specification
Type	PM
Number of phases	4-phase
Excitation	2-2 phase
Winding resistance per phase	10Ω ±10%
Rated voltage	4.2~8.5V
Drive frequency	50-1200pps(Depends driving voltage)

2.4.2 Excitation sequence

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

2.4.3 Step motor driving

Low speed motor driving while printing due to a division drive method, print data, and input data transfer speed may cause noise or print trouble to occur due to over torquing or overheating of the motor. To prevent these from occurring, when using the printer at 5 or higher, be sure to set the motor current as follows and perform two-current control.

In low volatge We recommoned to use 6846 from Rohm and 1836, 1838 from Sanyo

2.5 Thermal head specifications

2.5 1 General characteristics

item	Operating humidity	Note
Print width	72 mm	
Number of heaters	576 dots	
Heater resolution	8 dots/mm	
Heater pitch	0.125 mm	
Printed dot dimension	0.11mm×0.13 mm	
Heater resistance	R =176 Ω ± 4%	
Number of strobes	5	
Logic power supply	3.3 V × 27 mA	at 5 MHz
	5.0 V × 60 mA	
Specification for Thermistor	R25=30K Ω ±5%,B=3,950K±3%	Table. 1

2.5 2 Maximum parameter

Parameter	Symbol	Specification	Note
Heater energy	Eomax	0.26 mJ/dot	2.5 ms/line

consumption		0.20 mJ/dot	1.25 ms/line
Head voltage	VH	10 V	Between Connectors
Logic voltage	Vdd	7 V	
Environment temperature	Ta	-30 ℃ ~ +50 ℃	Above 5℃ as recommended
Environment humidity		10 ~ 90%RH	
Maximum operating temperature	Ts	Continuous:65° C 30min. MAX. Peak:80° C Thermistor temp.	When 80° C was detected, Printing must be stopped, and wait until 60° C

2.5 3 Characteristics recommended

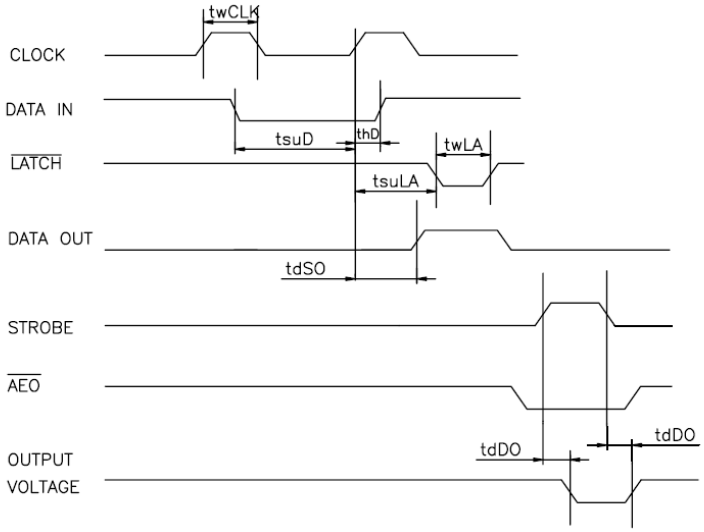
Parameter		**Symbol**	**Recommended operating conditions**		Note
Speed			2.5 ms/line 1 inch/s	1.25 ms/line 2 inc/s	
Heater power consumption		Eo	0.12W/dot	0.25W/dot	R=176Ω
Heat voltage		VH	5.0V	7.2V	connect two ends
Heater energy consumption	5℃	Eo (ts)	0.2mJ/dot(1.6ms)	0.17mJ/dot(0.65ms)	64 dots heated meanwhile
	25℃		0.18mJ/dot(1.4ms)	0.14mJ/dot(0.54ms)	
	40℃		0.16mJ/dot(1.28ms)	0.13mJ/dot(0.50ms)	
Supply current		Io	26.6mA/dot	38.3mA/dot	R=176Ω

2.5 4 Electrical characteristics

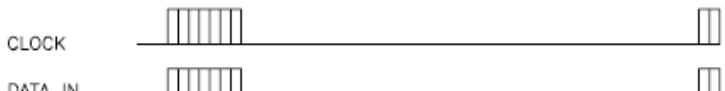
Parameter	Symbol	Test condition	Min	Stanard	Max	Unit
Printing power voltage	VH		4.2	5	8.5	V
Circuit power voltage	V_{dd}		3.0	3.3	5.5	V
Circuit power current	I_{dd}				30	mA
Input voltage (H)	V_{IH}		$0.7V_{dd}$		V_{dd}	V
Input voltage (L)	V_{IL}				$0.3\ V_{dd}$	V
Clock frequency	f_{CLK}	Duty50%			5	MH_Z
Latch input curret (H)	I_{IH}	V_{dd}=5.0V V_{IH}=5.0V			4.5	μA
Strobe input current (H)					110	
AEO					2.5	
Clock input current (H)					4.5	
Data input current (H)					0.5	
Latch input curret (L)	I_{IL}	V_{dd}=5.0V V_{IH}=5.0V	-4.5			μA
Strobe input current (L)			-1.0			
AEO			-275			
Clock input current (L)			-4.5			
Data input current (H) (L)			-0.5			
Output voltage of drivers (Heater supply voltage) (L)	V_{OL}	I_{OL}=60mA		0.7	0.9	V
Leak current of drivers	I_{LEAK}	V_{OH}=7V			1.0	μA/dot
Logic supply current	I_{dd}	f_{CLK}=5MHz,S=1/2		14.4	45	mA
Output voltage (H)	V_{OH}	无负载	4.45			V
Out current (H)	I_{OH}	V_{OH}= V_{dd}-0.4V			-0.5	mA
Output voltage (L)	V_{OL}	无负载			0.05	V
Output current (L)	I_{OL}	V_{OL}= V_{OL}=0.4V	0.5			

2.5 5 Timing characteristics

Parameter	Code	Ratings			
		Min.	Typ.	Max.	unit.
Clock frequency	f_{MAX}			5.0	MHZ
Clock pulse width	$t_w(T)$	70			Ns
Data setup time	$t_{su}(D)$	40			ns
Data hold time	$t_h(D)$	40			ns
Latch setup time	$t_{su}(LA)$	100			ns
Latch pulse width	$t_w(LA)$	100			ns
Clock to So delay time	$t_d(SO)$			120	ns
Strobe to driver Output delay time	$t_d(DO)$			13.0	μs



2.5 6 Timing figure



2.5 7 Equation:

Calculate the printing energy using this equation;

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

R_{ic} =12Ω

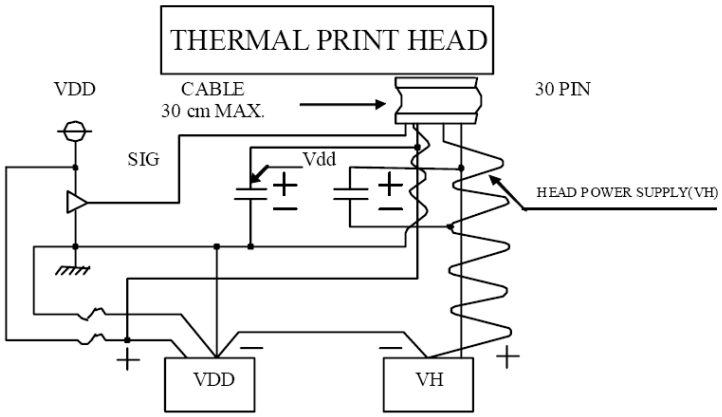
t_s

VH

$\overline{R}$

R_{IC}	12Ω (V_{dd}=5V)，15Ω (V_{dd}=3.3V)
t_s	加热时间
VH	加热电压
$\overline{R}$	平均电阻值

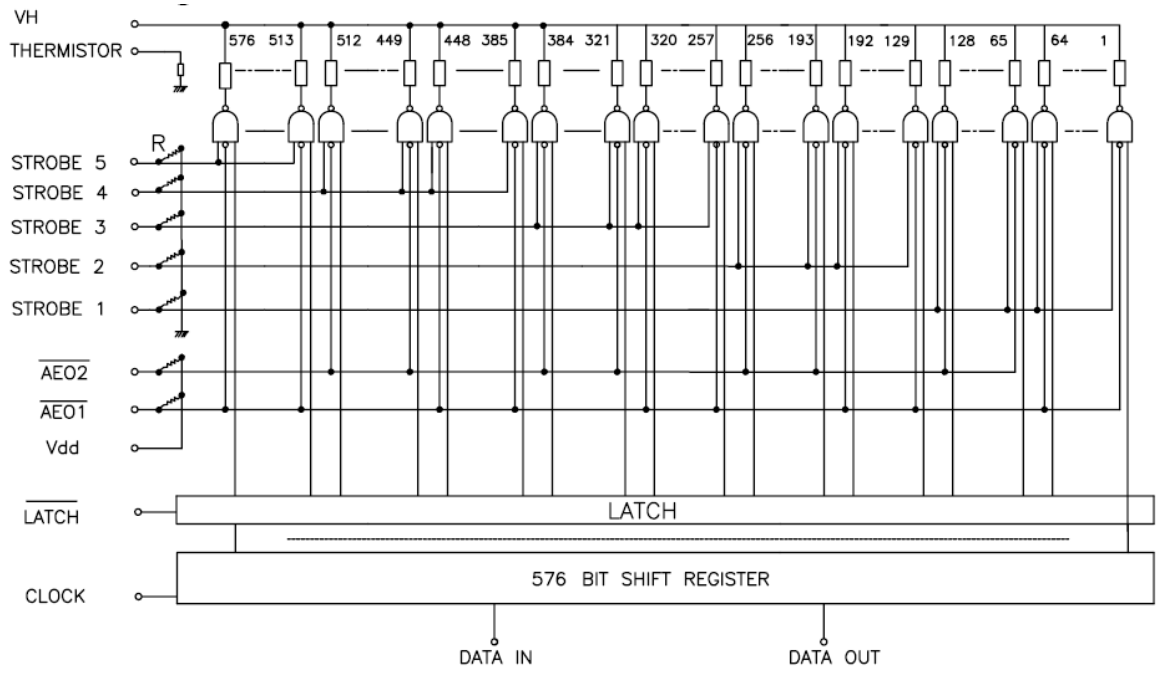
2.5.8 Circuit recommended



2.5.9 Thermistor resistance

Temperature (° C)	Thermistor Resistance (R)		
	Min.(KΩ)	Typ.(KΩ)	Max.(KΩ)
-40	717	843	989
-35	535	623	487
-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

2.5.10 Structure figure



2.5.11Operating precautions

1、When the power on, the order shall be VDD-VH, and make sure strobe is the lowest,. When the power off, it should be VH –VDD .

2、Set time limits on circuit, make strobe low automatically when it is abnormal or system halted.

3. For the waiting time, control (circuit design) the printer so that VH (power supply of the heating element) is turned off (the GND level) in order to prevent thermal printer head damage by ions and noises.

4. When the thermistor is disconnected , control (circuit design) the printer head is not overheated.

5. Do not input any pulse noise of equal or more than 2V， 20ns in each signal.

6.Do not input any pulse noise of equal or more than 2V, 20ns in each signal terminal.

7 Make sure not to condense dews on the head. If condensation occurs on the head, maintain the VH power supply in the off state until condensation has been solved.

2.6 Tables

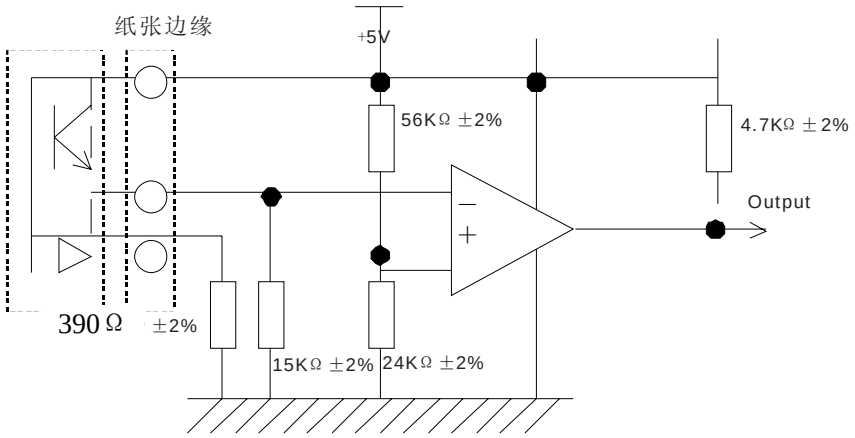
1	PHK	Cathode for photo interruptor	光电管二极管阴极
2	VSEN	Paper sensot power	光电侦测电源
3	PHE	Emittor for photo interruptor	光电管二级管发射
4	N.C(101)SW1(103)	Platen release switch	到位侦测开关
5	N.C(101)SW2(103)	Platen release switch	到位侦测开关
6	VH	Head drive power	打印驱动电压
7	VH	Head drive power	打印驱动电压
8	DI	Data in	数据输入
9	CLK	Aynchronous clock for communication	时钟
10	GND	Ground power supply for thermal head	接地
11	GND	Ground power supply for thermal head	接地
12	STB5	Thermal head energizing control signal	加热控制 5
13	STB4	Thermal head energizing control signal	加热控制 4
14	STB3	Thermal head energizing control signal	加热控制 3
15	VDD	Logic power	逻辑电源
16	TM	Thermally sensitive resistor input terminal	温度侦测 1
17	STB2	Thermal head energizing control signal	加热控制 2
18	STB1	Thermal head energizing control signal	加热控制 1
19	AEO2		
20	AEO1		
21	GND	Ground power supply for thermal head	接地
22	GND	Ground power supply for thermal head	接地
23	/LAT	Data latch	锁存
24	DO	Data out	数据输出
25	VH	Power supply for thermal head	打印驱动电压
26	VH	Power supply for thermal head	打印驱动电压
27	MT/A	Stepping motor excitation signal	马达驱动 A
28	$\overline{\text{MT/A}}$	Stepping motor excitation signal	马达驱动 A
29	MT/B	Stepping motor excitation signal	马达驱动 B
30	$\overline{\text{MT/B}}$	Stepping motor excitation signal	马达驱动 B

2.7 Photo interpreter specification

RT638 have one opto sensor, it performs dual functions - door open and end of paper detection. The opto sensor is designed in a way that as soon as the door is opened, the distance between the paper and the sensor increases, and this causes the end of paper sensor is to trigger.

Arrange the circuitry so that no energy is applied to the head when there is no paper. If the head is energized when there is no paper and the head is in the down position, then both roller and head may be strongly damaged.。

One possible interface as following:



Absolute Maximum Ratings (Ta=25℃)

Parameter		Symbol	Ratings	Unit
Input	Power Dissipation at(or below) 25℃ Free Air Temperature	Pd	75	mW
		V_R	5	V
	Forward Current	I_F	50	mA
	Peak Forward Current Pulse width ≦100 μs, Duty cycle=1%	I_{FP}	1	A
Output	Collector Power Dissipation	P_C	75	mW
	Collector Current	I_C	50	mA
	Collector-Emitter Voltage	B V_{CEO}	30	V
	Emitter-Collector Voltage	B V_{ECO}	5	V
Operating Temperature		Topr	-25~+85	℃
Storage Temperature		Tstg	-40~+85	℃
Lead Soldering Temperature (1/16 inch from body for 5 seconds)		Tsol	260	℃

(＊1) tw=100 μsec. , T=10 msec. (＊2) t=5 Sec

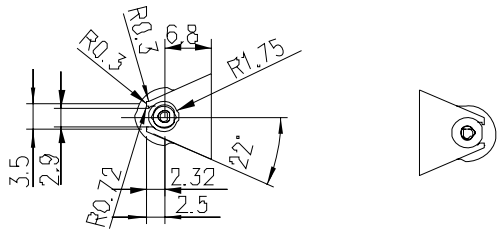
Electro-Optical Characteristics (Ta=25℃)

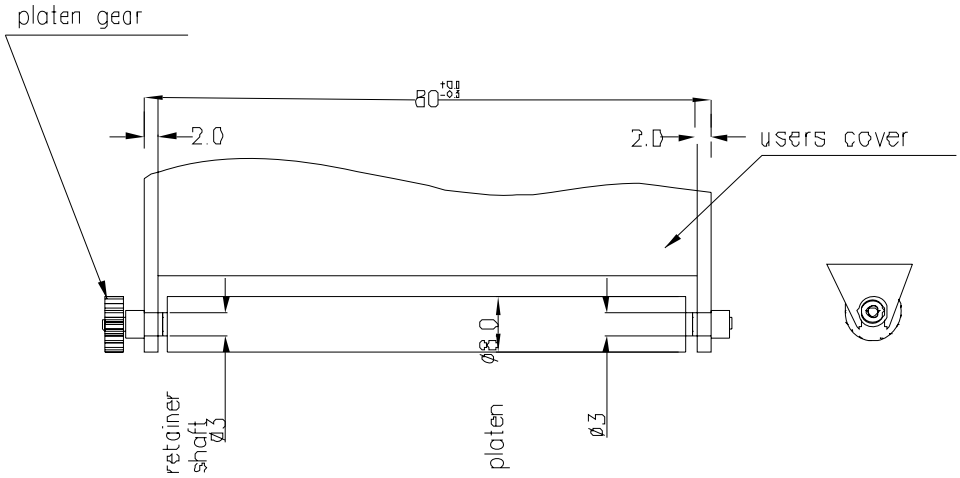
Parameter		Symbol	Min	Typ.	Max.	Unit	Conditions
Input	Forward oltage	V_F		1.2	1.6	V	I_F=20mA
	Reverse Current	I_R			10	μA	V_R=5V
	Peak avelength	λ P		940		nm	
	View Angle	2□1/2		110		Deg	I_F=20mA
Outpu	Dark Current	I_{CEO}			100	nA	V_{CE}=10V
	C-E Saturation Voltage	V_{CE} (sat)			0.4	V	I_C=2mA I_B=0.1mA
Light Current		I_C(ON)	0.1			mA	V_{CE}=5V I_F=20mA
Leakage Current		I_{CEOD}			1	μA	
Speed	Rise time	tr		20		μsec	V_{CE}=2V I_C=100 μA R_L=1K∧
	Fall time	tf		20		μsec	

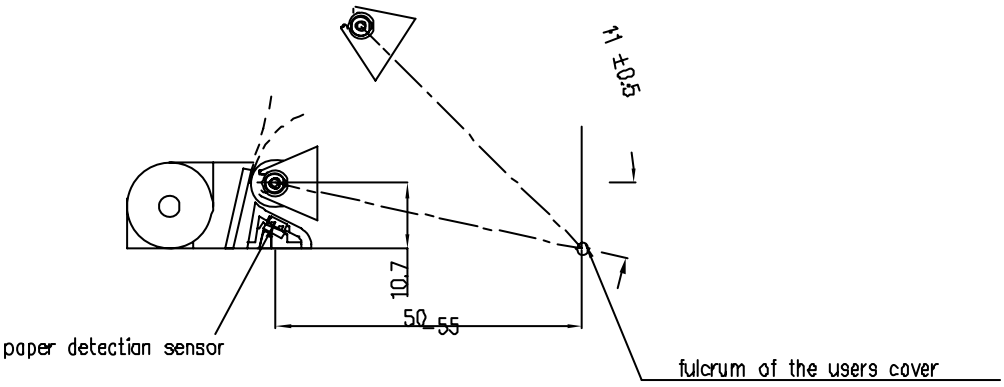
Chapter 3 Casing design guide

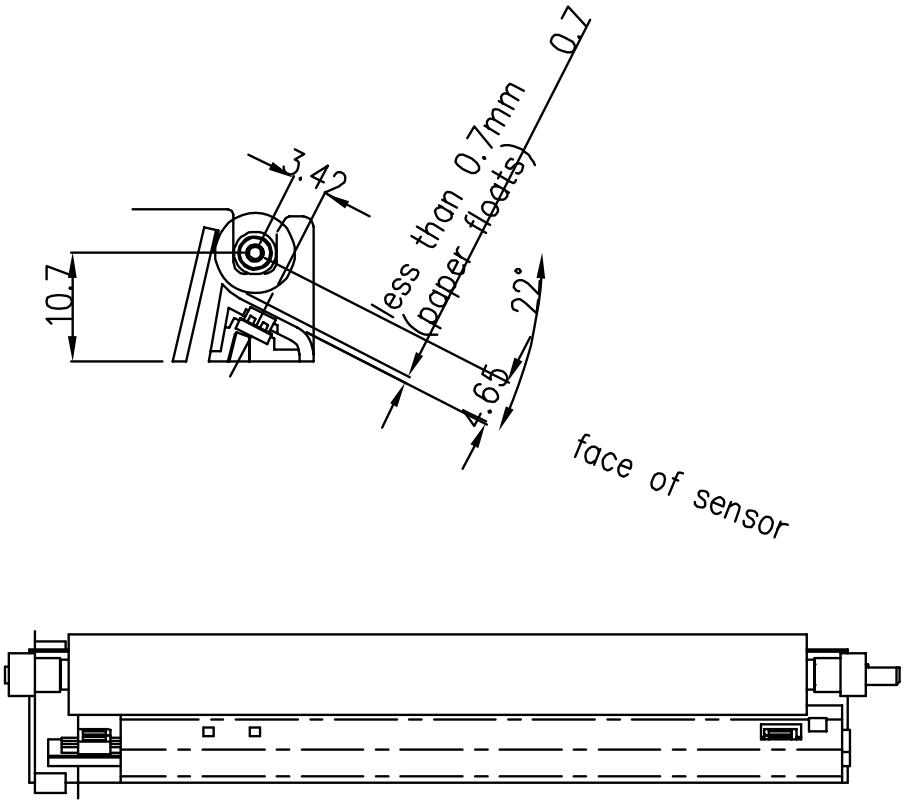
3.1 Thermal printer mechanism structure dimensions

3.1.1 Easy paper loading dimensions

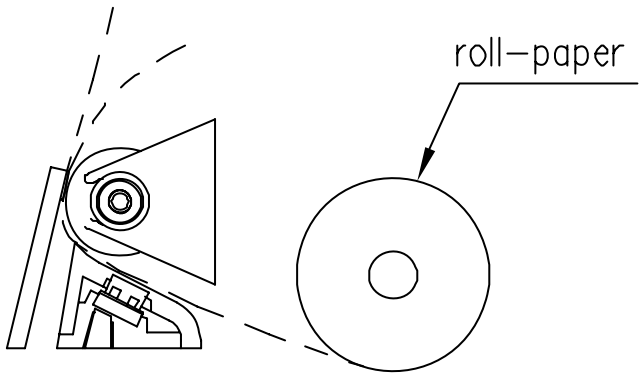




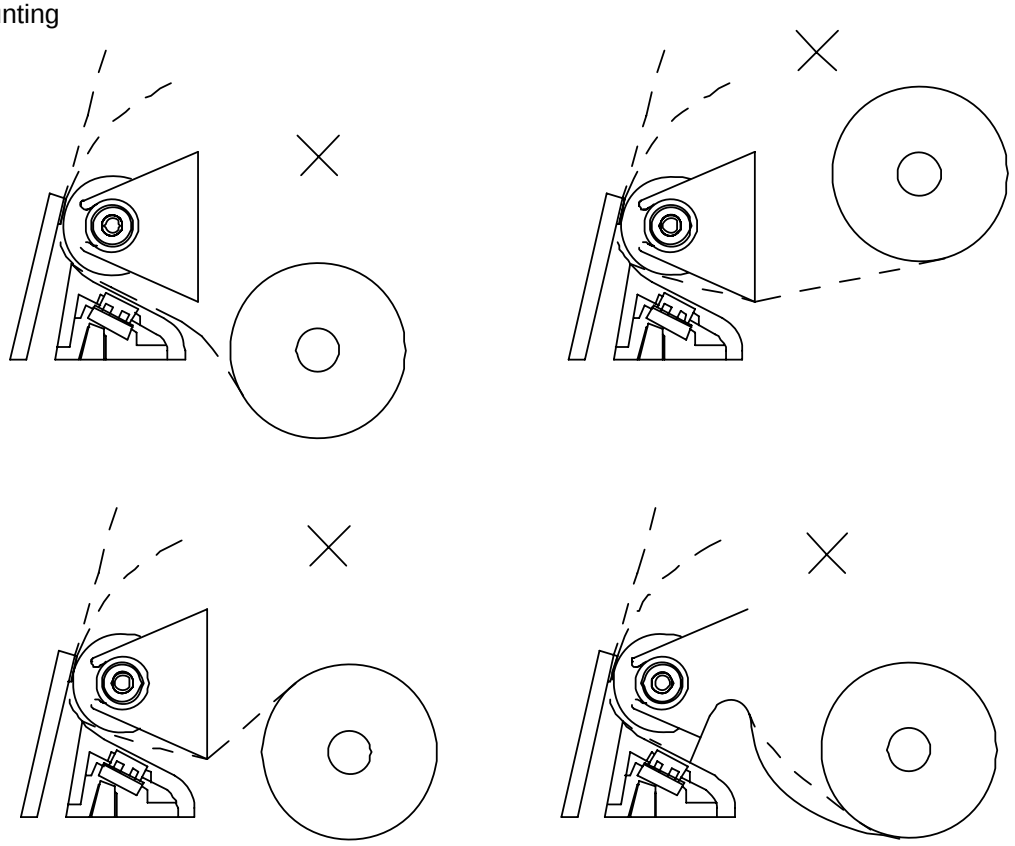



3.42
10.7
less than 0.7mm
(paper floats)
0.7
22°
4.65
face of sensor

3.1.2 Roll-paper mounting position

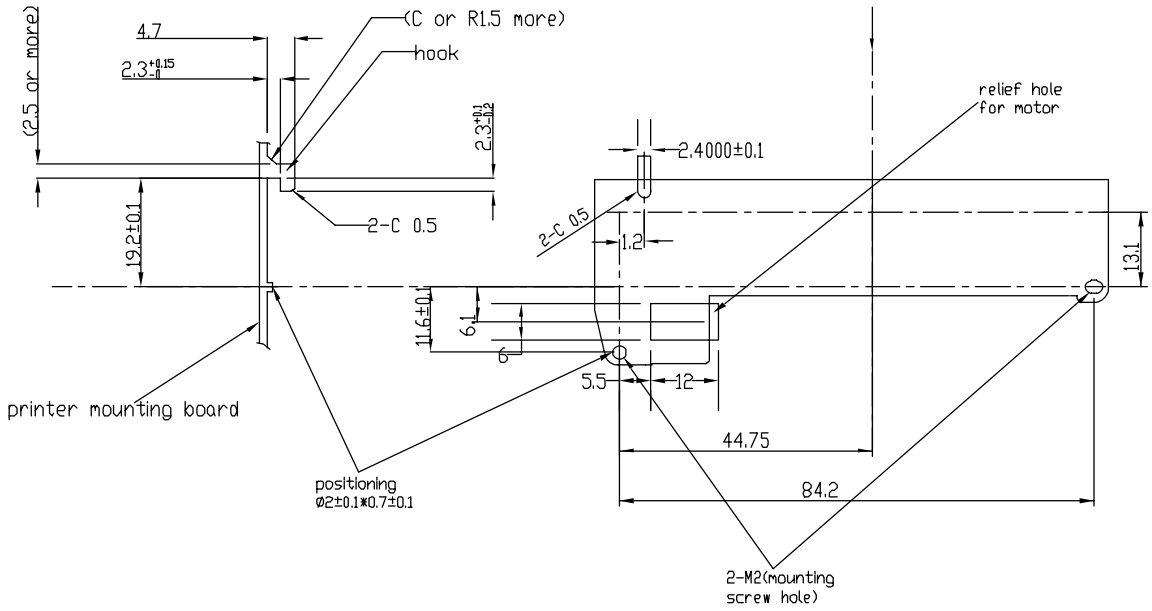


Wrong mounting

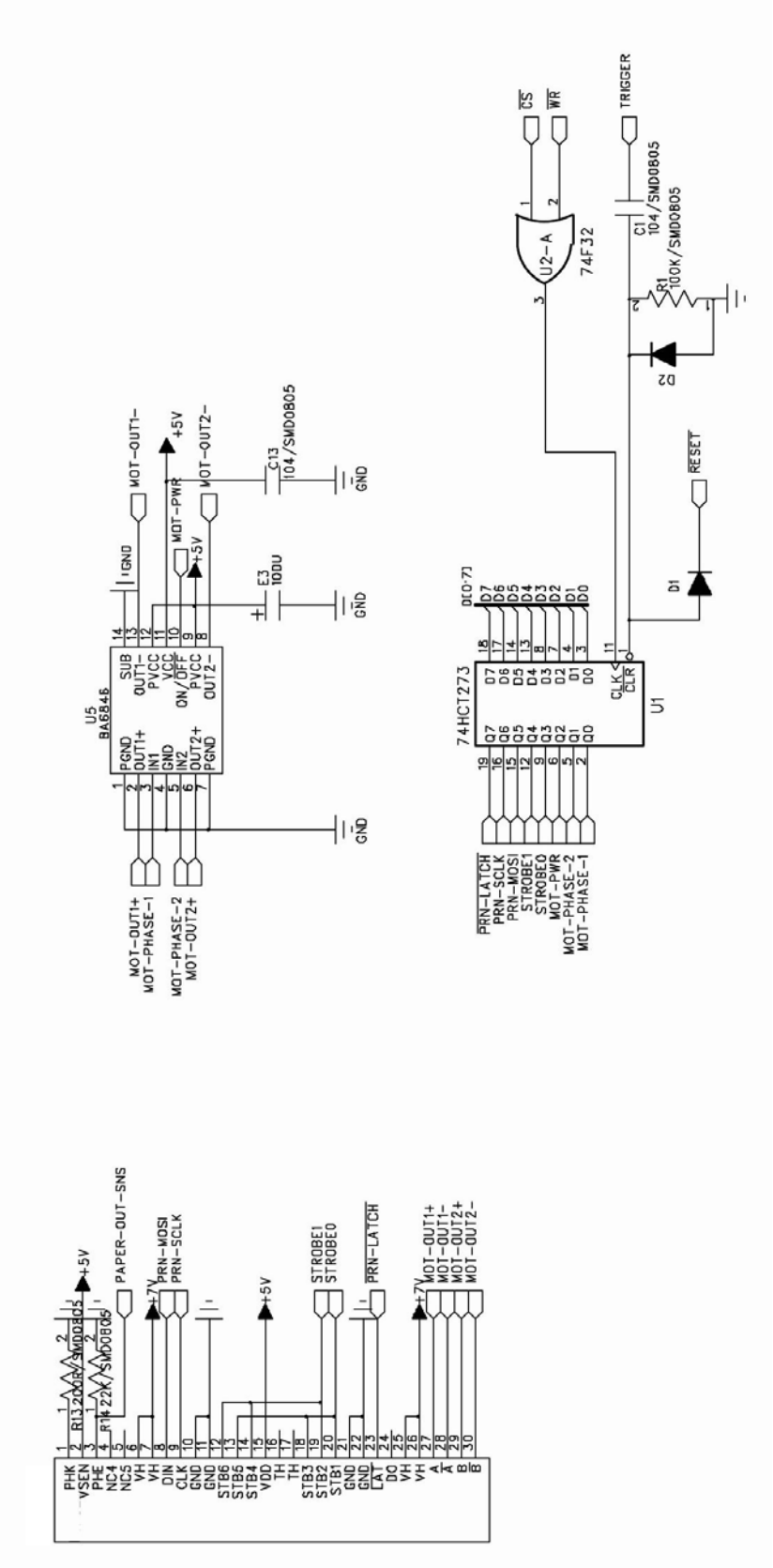


3.1.3 Mounting dimensions

Mounting position



3.2 DEMO circuit figure



Circuit definition

1. This Demo controls printer by bus.
2. Bus supports 3.3V and 3.5V system.
3. When designing circuit, make powering on VH (7V) later than that of the system (5V) and PMOS is recommended to add to VH.
4. In printing, trigger output high/low pulse is recommend to prevent the system mistake and damages to the printer.