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THERMAL PRINTER

FTP-628MCL353#01/#02

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PRODUCT SPECIFICATIONS

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					PRODUCT SPECIFICATIONS			
					DRAW No.		CUST	
					A1NA02265-0353/6			
02	011130	Y.Yada	Y.Mori	01A→03A(Refer to 27 pages for details) K.Maeda				
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DESIGN	00.03.15	Y.Yada	CHECK	Y.Mori	APPRY	K.Maeda	FUJITSU TAKAMISAWA COMPONENT LIMITED	
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1. Guideline for product recycling

- Fujitsu Takamisawa Component Co., Ltd. is making an effort to promote the environmental management per ISO 14001 with a policy **“Better corporate activities while valuing the environment”**
- The below lists the components and their materials used in this printer. Refer this list when the printer is to be recycled.

[FTP-628MCL353#01/#02](#) List of materials

No.	Name of components	Material
1	Printer frame (gear side)	Zinc alloy
2	Printer frame (center)	Zinc alloy
3	Printer frame (switch side)	Zinc alloy
4	Gear cover	POM resin
5	Rubber roller	Silicone rubber + SUS
6	Platen gear, middle gears 1, 2 and 3	POM resin
7	Pulse motor	SPCC + iron + copper wire
8	Paper guide	PC resin
9	Thermal head	Aluminum + ceramic substrate
10	Head pressuring spring	SUS
11	Bearing	Sintered alloy
12	FPC	PI, copper leaf, solder plating
13	Knob	ABS resin
14	Spring	SUS
15	Pinch roller	POM resin
16	Guide film	PET resin
17	Cutter attachment flame	SECC+SUS
18	Auto cutter	*1

“Abbreviations for the materials used”

- SUS: Stainless steel
- POM: Polyacetal resin
- PET: Poly(ethylene terephthalate)
- PC: Polycarbonate
- SPCC: Rolled steel plate
- PI: Polyimide

*1: Please refer to specifications of FTP-628CT001#01/#02.

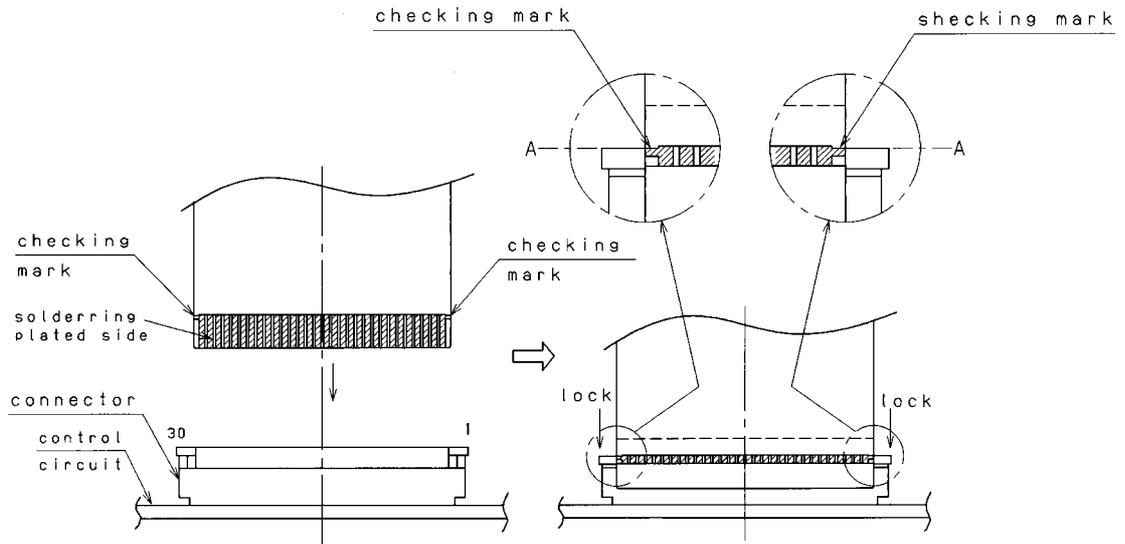
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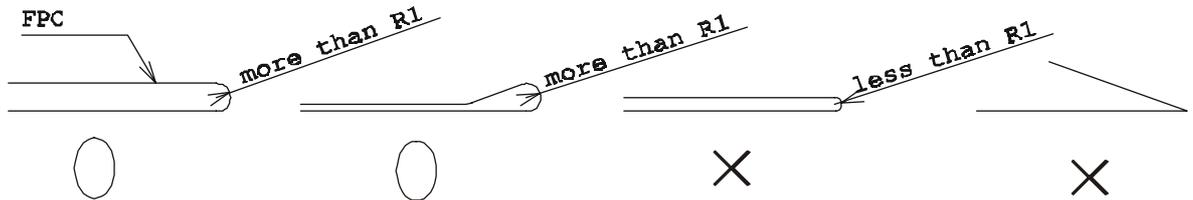
2.Product design, warnings and cautions for using the product

2-1. Handling the printer

- (1) When handling this printer, be sure to take any preventive measure against static electricity such as **Disposable Wrist Strap** in order to prevent damages of inner parts of the printer caused by the static electricity.
- (2) Never attempt to touch the thermal head surface with bare hands. Attaching any oil or grease such as oils from palms on the heating element part may 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. (Section 2-4 describes the cleaning.) In addition, pay attention not to hit it with something hard such as a driver.
- (3) 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. Using the printer with the part is deviated may destroy the head. If it is deviated or disconnected, contact us.
In addition, for the connection of FPC and the control circuit side, as shown in the figure below, the checking mark for attachment is seen on FPC; therefore, follow the mark and make sure not to deviate when attaching.



- (4) Never attempt to touch FPC and the probe part of the signal line of FPC (parts which are soldering-plated) and not to hit them with something hard.
- (5) Do not perform the **contact bending** of FPC because it may cause the disconnection. If FPC requires to be bent, the bending should be more than R1. Once it is bent, do not rework (straighten or bend backward).



- (6) If any paper ejected from this printer is pulled away with an unnecessarily strong force when the platen is released, 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.

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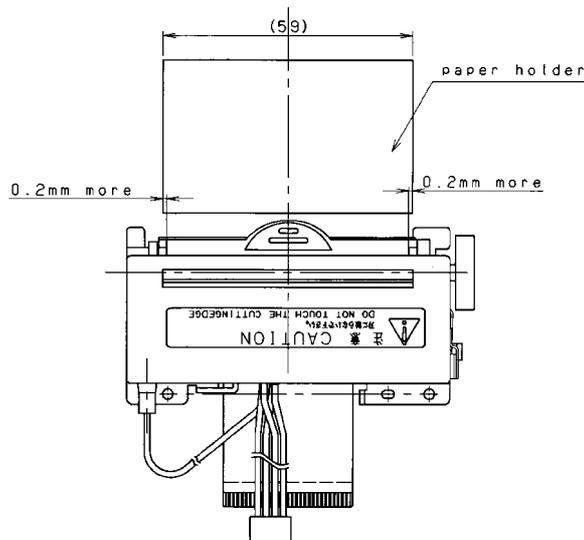
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- (7) If any voltage is applied to the thermal head when the head or paper is wet due to condensation, it may be damaged by electrolytic corrosion; therefore, when using the printer, pay attention to the following items.
- * Do not apply any electric 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.
- (8) When any paper is not set at the printer, be sure to lift up the platen-release lever. 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 trouble of the printer.
- (9) 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.
- (10) Never attempt to any back feeding action of the paper.

2-2 Notice on installation and settings

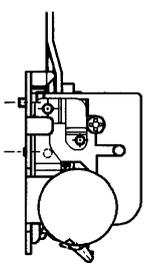
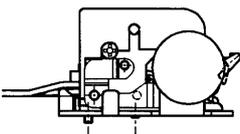
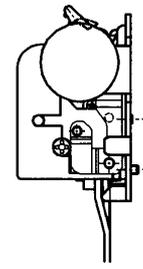
- (1) When installing the printer, fix the edge part with hooks at two places and fix the rear part with screws of M2 at two places. Flatness of the installing surface of the printer should be within equal or less than 0.1mm. It is recommended that the printer is connected to the main body FG with screws of M2 at two places (refer to the figure of the installation dimension). Pay attention not to apply any extra force to the printer main body, FPC since any of such force will give unfavorable effects to the printing quality, paper traveling property (meandering, running short of the paper, and the paper jam), and life time.
- (2) When installing the printer, install it so that the printer and the rolled paper should be parallel as much as possible. When designing the casing, it should be designed so that the printer and the holder part of the roller paper are located at the place shown in the bellow figure. The roller paper should be ejected smoothly so that the paper does not hit anything such as the cover. If the above is not conformed, troubles such as meandering of the printing paper, the running short of the paper, and the paper jam may occur.



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- (3) When plugging in and out FPC to the connector of the control side, be sure that all power is turned off before doing that.
- (4) Use our recommended connector as the one of the control side of FPC. If any other connector is used, fully confirm the properties (the contact resistance, drawing strength, and the allowable power supply voltage) before using.
- (5) The back tension of the rolled paper should be equal or less than 0.49N (50g) including the start up. If it exceeds equal or greater than 0.49N, the platen gear may get off the track and causes to damage the gear.
- (6) For the attitude of mounting the cutter, follow the instructions below.

	A	B	C
			
#01 (Full cut)	Applicable	Not applicable	Not applicable
#02 (Partial cut)	Applicable	Applicable (But, pay attention.)	Not applicable

Attitude A: #01, #02 OK

Attitude B: This cutter is of a roller blade type and cuts paper by moving the blade on the paper horizontally (left and right). Therefore, it possibly cuts the paper that has been already cut again when returning to the home position after the paper is cut. For #02, design the case so that a second cutting will not occur. For #01, do not use it because it is more liable to cause a second cutting.

Attitude C: Do not use C because paper chips intrude the cutter.

2-3 Paper to be used

- (1) Regarding the printing quality and lifetime; therefore, carefully confirm the property of the paper before using.
- (2) When using the perforated paper, the punching direction of the perforations should be set to face the thermosensitive side. The height of burrs of the perforations and dusts of them may cause troubles such as deterioration of the printing quality, the paper end sensor, the platen gear's getting off the track, and the lifetime; therefore, carefully check the perforated paper before using.
- (3) To reduce the loads during the paper feeding and to improve the sensitivity of the paper end sensor, when rolling the paper, the thermosensitive side of the paper should be faced outside.
- (4) Use the rolled paper of which inner diameter should be equal or greater than $\phi 8$ (the diameter when there is not core).

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2-4 Storing

- (1) When storing the printer for the long-term (equal or longer than six months at the room temperature), lift up the platen-release lever. If the rubber part of the platen and the head have continued to directly contact for a long term, the rubber part will be deformed and may affect the quality of printing.
- (2) Do not store the printer in damp places and places with drastic temperature variations. Condensation on the printer may cause troubles such as thermal head damages and action failures.
- (3) Do not store the printer in dusty places. Using the printer with dusts adhered on it may cause troubles to the printing and actions.

2-5 Others

- (1) If any trouble occurs, it shall be solved by mutual discussion based on this specification. Only the printer is subject to quality assurance.
- (2) Changes and additions that do not have compatibility of this specification shall be carried out according to the mutual discussion.
However, because this printer is the standard model, changes can be carried out without notices within a range where compatibility exists.
- (3) This thermal printer comes with an 18-month warranty after the date of production (printer serial No.). Any failure caused by the customer side in the warranty period and after expiry of the warranty shall be serviced with charge. The maintenance service can be available in five year after the date of discontinuation of producing this printer.
- (4) This printer does not provide the dust-tight and drip-proof structure. Take measures for the dust-tightness and drip-proof from the main body casing side, as required.
- (5) Surfaces and edge surfaces of metallic parts may change colors; therefore, take measures for discoloration as required, such as covering with a casing.
- (6) Smoke may be generated from parts of the printer; therefore, take measures for preventing any foreign conductive materials from entering the inside as required, such as covering with a casing.

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3 Specifications

3-1 Application

This specification is applies to FTP-628MCL353#01/#02.
 The following standard interface board or drive LSI and reference circuits satisfy the specifications in this manual.

- (1) Standard interface board: FTP-628DSL238
- (2) LSI for driving: FTP-628CU 201

3-2 Overview

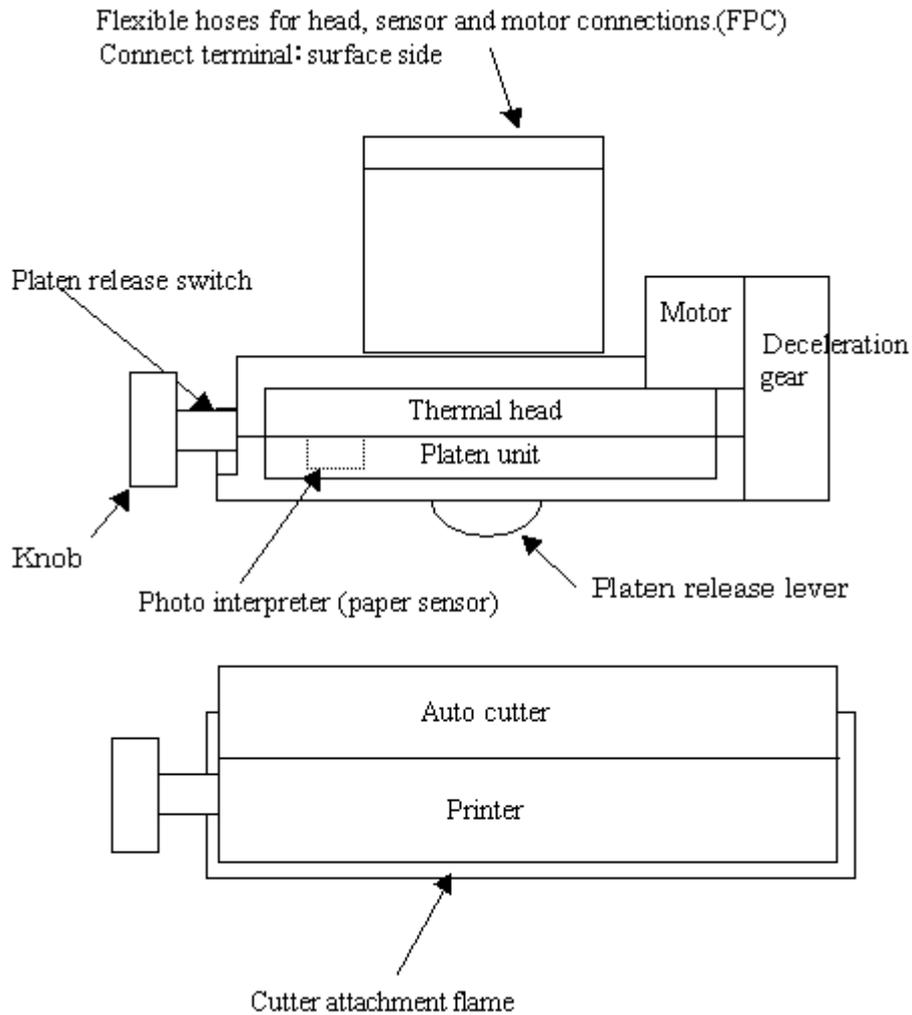
This printer is the small and lightweight printer which build in a line dot thermal head of resolution 8 dots /mm.

This specification applies to only printer unit. Please refer to below specifications for specification of the auto cutter.

Model of printer unit	Model of auto cutter	Specifications
FTP-628MCL353#01	FTP-628CT001#01	Full cutting type
FTP-628MCL353#02	FTP-628CT001#02	Partial cutting type

3-3 Structure

Below is the figure of this printer's structure (the mechanical part).



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3-4 Standard specifications

Item	Specifications	
A Printing specifications	Printing method	Direct thermosensitive method
	Valid printing width	48 mm
	Dot structure	384 dots /line
	Dot pitch(rsolution)	0.125 mm (8 dots/mm)
	Dot size	0.11 0.125mmx0.12mm
	Printing density	OD value greater than 0.8, in use of the specified paper under our standard printing conditions. * Measuring device: Sakura densitometer, PDA-65, by Konika Co., Ltd.
	Printing speed	60 mm/s (At 8.5 V drive, standard paper(PD150R equivalent),Room temperature, 64 dots or less, High speed mode)
B Specified paper for recording *1	Highly sensitive paper	TF50KS-E4 (width: 58.0 ⁺⁰ ₋₁ mm), Nippon Paper
	Standard Paper	TF50KS-E (width: 58.0 ⁺⁰ ₋₁ mm), Nippon Paper
		PD150R (width: 58.0 ⁺⁰ ₋₁ mm), Oji Paper
	Middle-term preservable	TP60KS-F1 (width: 58.0 ⁺⁰ ₋₁ mm), Nippon Paper
		P220VBB-1 (width: 58.0 ⁺⁰ ₋₁ mm), Mitsubishi Paper
		PD170R (width: 58.0 ⁺⁰ ₋₁ mm), Oji Paper
	Long-term preservable	TP50KJ-R (width: 58.0 ⁺⁰ ₋₁ mm), Nippon Paper
		AFP-235 (width: 58.0 ⁺⁰ ₋₁ mm), Mitsubishi Paper
		PD160R-N (width: 58.0 ⁺⁰ ₋₁ mm), Oji Paper
		HA220AA (width: 58.0 ⁺⁰ ₋₁ mm), Mitsubishi Paper
Paper feeding method	Friction feeding (1 dot line/4 pulses, bi-polar 1-2 phase excitation)	
Paper feeding precision	±5% At fixed-speed feed with the back tention of 0.49N or less (±2% at 25°C and RH 60%)	
Line gap in one print line by enable drive	Less than 0.125 mm, the step difference between the right and left printing lines.	
D Detective functions	Thermal head temperature detection	Thermistor
	Paper detection Mark detection	Photo interrupter
	Platen release	Sliding-switch
External dimensions (W x D x H)	83.5±1 mm x 43.0 mm x 26.4±0.5 mm (excluding FPC, cable, and screw) For more information see Figure 1.	
Mass	Approx. 120 g	
Average resistance of the thermal head	176Ω±4%	

*1: If any other paper except for the specified above is used, through the mutual discussion, the paper shall be evaluated, checked and adoption shall be determined.

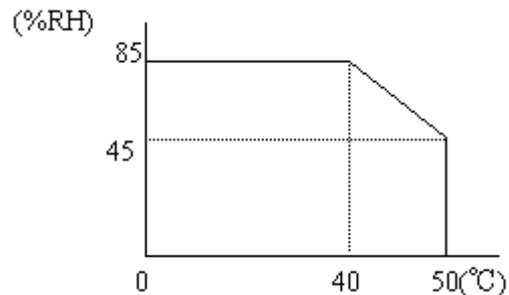
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Item		Specifications	
Drive power	Head	For printing Voltage: DC 4.2 V to 8.5V Current: Approx. 2.4 A (at 25°C, Rav=176Ω, 7.2V, concurrently electrified with 64 dots)	
		For logic Voltage: 2) DC 2.7 to 5.25V DC 5.0 V ±5% Current: 0.1 A Max.	
	Motor drive	Voltage: DC 4.2V to 8.5V Current: 1.0 A Max. (by the F&T standard constant-current drive circuit)	
Environmental characteristics	Operating temperature and humidity *1	+5°C to 40°C, 20 to 85%RH. No dew should be allowed.	
	Temperature and humidity in storage	-20°C to 60°C, 5 to 95%RH. No dew should be allowed. Yet, the paper is not included.	
	Noise	Should not exceed 60dB at a point 1 m above from the printing mechanism position level.	
Reliability characteristics*2	Vibration (non-operation)	10 to 55 to 10Hz. Amplitude is 0.15mm. An 1 octave/min, 1G Max. 20 cycle each to X, Y, and Z directions.	
	Impact (non-operation)	50G, 11m/s, half-sine wave, 5 times each to X, Y and Z direction	
	Package drop	75 cm of 6 faces, 75 cm of corners and ridges as it is packed.	
	Temperature & humidity cycling (non-operation)	2 continuous cycles as a unit cycles: -25°C (2H) to room temp. (2H) to 65°C, 85%RH (2H) to room temp.	
Life	Head	Electric life	1 hundred-million pulses (under our standard printing conditions.)
		Wear life	Paper feed length, 50 km (printing rate 25% max.)
	Platen release life	More than 5000 times (regarding release and close as one time.)	
	Photo interpreter life	1.2x10 ⁴ hours (electrified time) with the recommended circuit.	
Printing start position on the left edge		5±1 mm (by paper width 57.5 mm) from the paper edge to the left printing edge. However, 1) 1PLY, when the specified paper for long-term record storage is used. 2) When no paper jam or no paper empty is present.	

*1: The guaranteed range of the printing concentration. However, its workable temperature range is 0 to +50 degrees centigrade. Refer to the figure below for the relation of the temperature and humidity.



*2: After the test, it shall satisfy the printing specification.

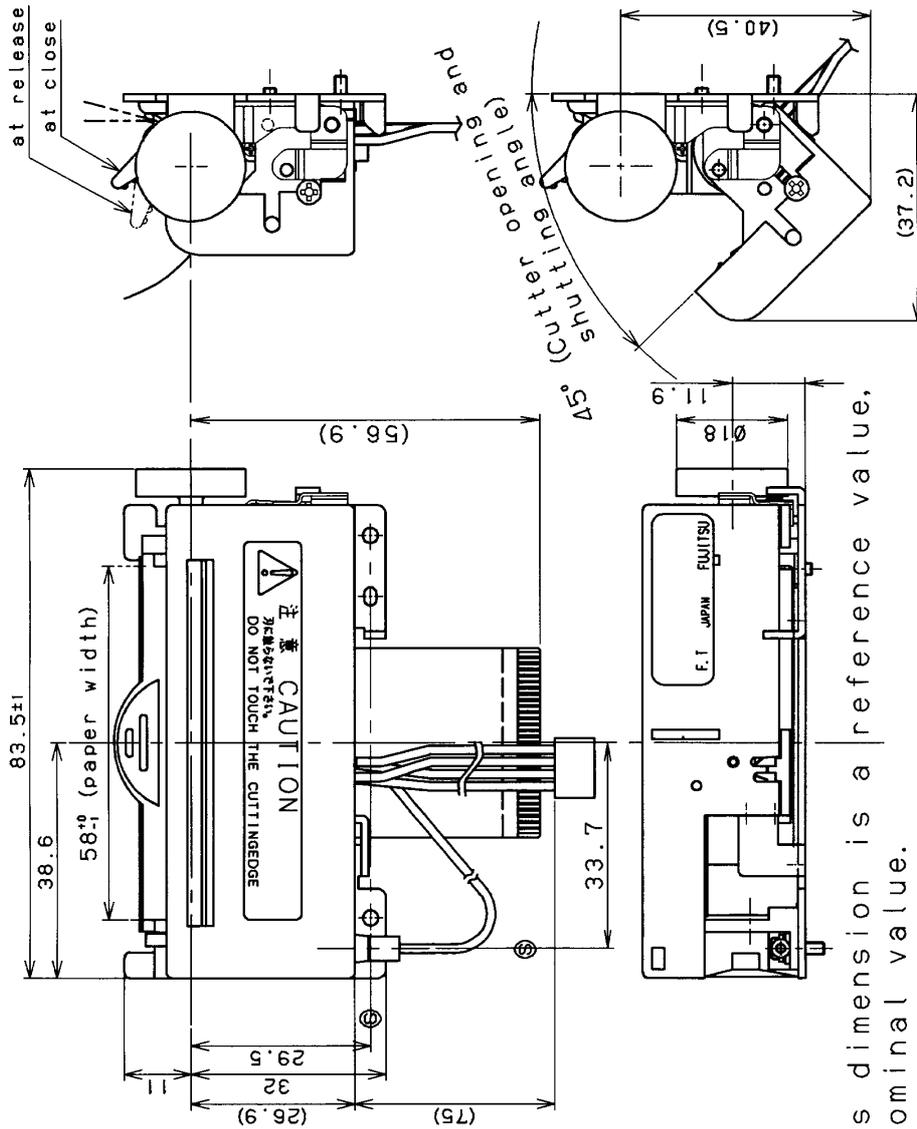
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3-5. External Dimensions and Mounting Positions

(1) External Dimensions



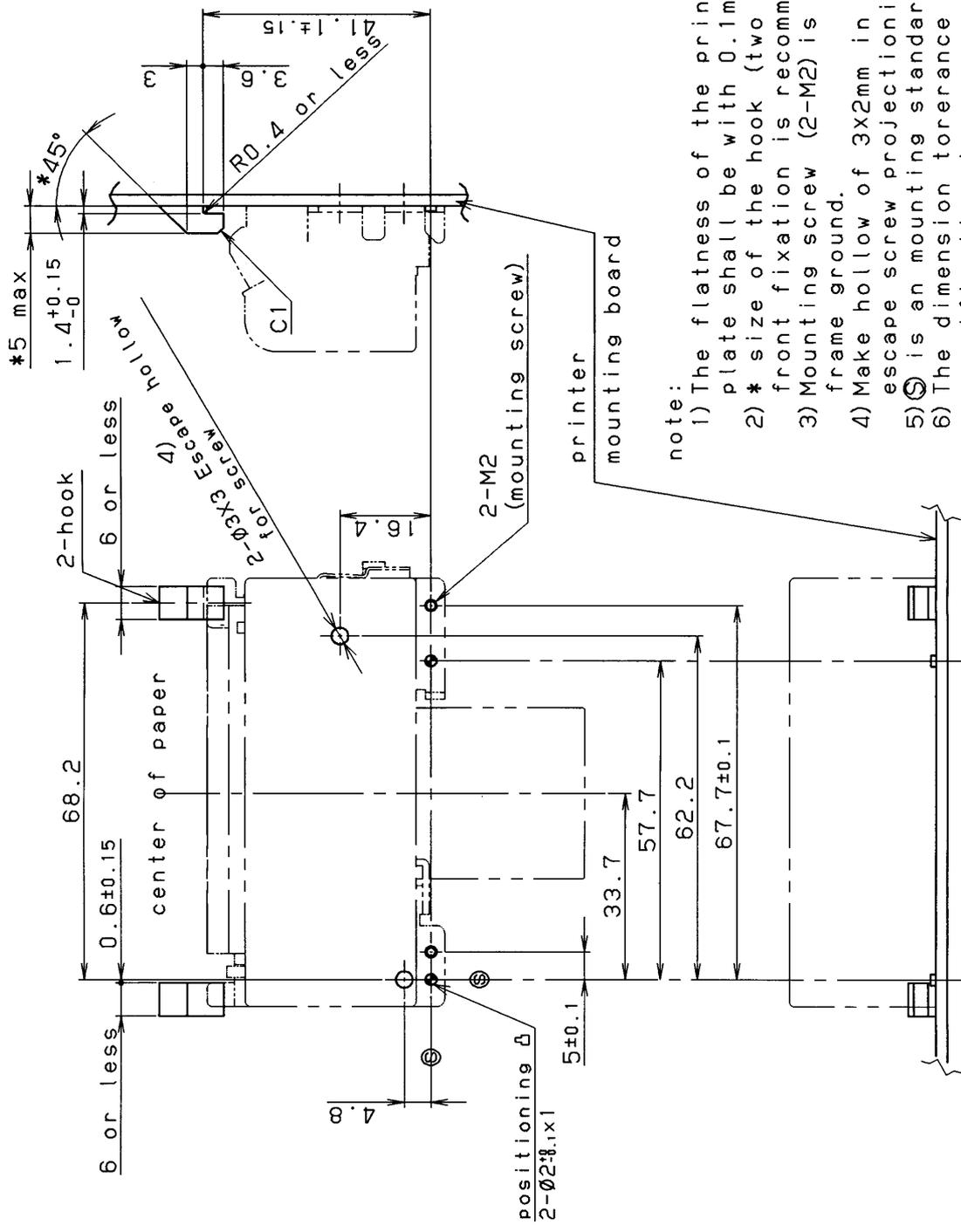
note:
 1). The parentheses dimension is a reference value, and others, a nominal value.
 2). The exhaust of the paper changes by the curl situation of paper.
 3). Ⓢ is an mounting standard line.

Figure 1

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(2) Mounting position



- note:
- 1) The flatness of the printer mounting plate shall be with 0.1mm.
 - 2) * size of the hook (two places) for front fixation is recommended values.
 - 3) Mounting screw (2-M2) is contact the frame ground.
 - 4) Make hollow of 3x2mm in order to escape screw projection in 2 position.
 - 5) Δ is an mounting standard line.
 - 6) The dimension tolerance without specification is a general tolerance.

Figure 2

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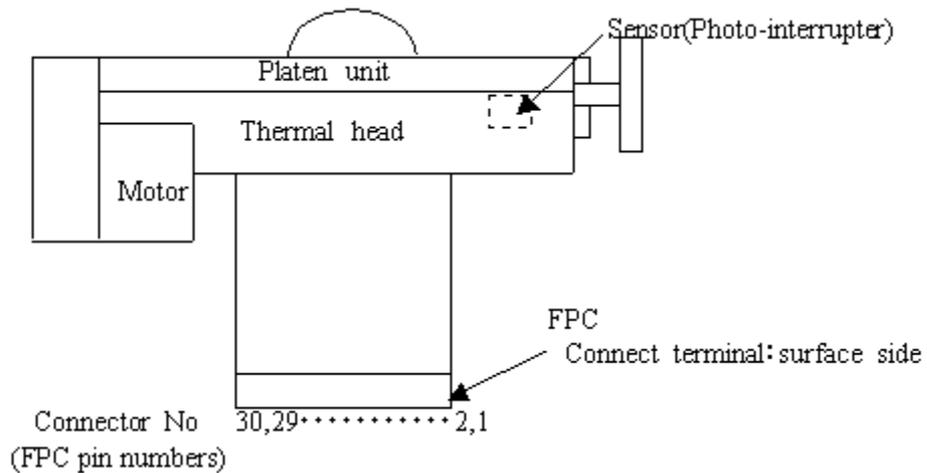
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3-6 Connector (flexible) specifications

- (1) Used connector
 Mechanical unit side: FPC connector
 Remote side (Housing side): ²⁾ ~~52030-3010~~ 52610-3090 (from molex)

- (2) Pin assignment on the mechanical side

No.	Symbol	Signal name
1	PHK	Cathode for photo interrupter
2	VSEN	Photo interrupter power
3	PHE	Emitter for photo interrupter
4	SW1	Platen release switch
5	SW2	Platen release switch
6	VH	Head drive power
7	VH	Head drive power
8	DI	Data in
9	CLK	Clock
10	GND	Head ground
11	GND	Head ground
12	STB 6	Strobe 6
13	STB 5	Strobe 5
14	STB 4	Strobe 4
15	Vdd	Logic power
16	TM	Thermistor
17	TM	Thermistor
18	STB 3	Strobe 3
19	STB 2	Strobe 2
20	STB 1	Strobe 1
21	GND	Head ground
22	GND	Head ground
23	LAT	Data latch
24	DO	Data out
25	VH	Head drive power
26	VH	Head drive power
27	MT /A	Excitation signal A
28	MT /A	Excitation signal A
29	MT /B	Excitation signal B
30	MT /B	Excitation signal B



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(3) Cautions

- 1) Do not plug in and out any flexible connector when the power is being supplied.
- 2) Do not add any unnecessary force to the flexible connector.
- 3) Plugging in and out FPC of the control circuit side shall be equal or less than 10 times. Do not plug in and out FPC of the head side.
- 4) GND of terminal No. 10 and 11 and GND of terminal No. 21 and 22 are separated in the head. Make them common near the flexible connector as close as possible.

3-7 Thermal head specifications

(1) General characteristics

- 1) System: Thermosensitive line dot system
- 2) The total number of dots: 384 dots/line
- 3) Heating resistor dot pitch: 0.125mm
- 4) Heating element structure: 2 heating elements/dot
- 5) Average resistance value of a heating element :176Ω± 4%

(2) Maximum rating (at 25 degrees centigrade of the surrounding temperature)

Item	Max. rated value	Unit	Conditions
Printing cycle (S. L. T.)	1.25	ms/line	Tsub=25°C
Printing energy	0.2	mj/dot	
Printing power voltage: (VH)	8.5	V	Right after the battery charge. Normally, voltage is 7.2 V.
Board temperature	65	°C	Thermistor temperature.
Concurrent printing dot number	64	Dot	²⁾ Note 1
Logic power voltage: (Vdd)	7	V	Including the peak voltage.
Logic input voltage: (Vin)	-0.5 to Vdd+0.5	V	

(3) Electrical characteristics

- 1) Electrical characteristics: Table 1
- 2) Timing chart: Fig. 3-1
- 3) Equivalent circuit: Fig. 3-2
- 4) Driver structure: 64 bitsx6 drivers

(4) Conditions for electrical actions

Item	Symbol	Electric conditions	Unit	Conditions
Power consumption	Po	0.24	W/dot	Rav=176Ω ²⁾ Vdd=5V Concurrent applied dot number. With 64 dots
Supply voltage	VH	7.2	V	
Recording cycle	S.L.T	1.25	ms/line	
Energy consumption (Record pulse width) (Note 2)	Eo (Ton)	0.16	mj/dot	5°C
		(0.67)	ms	
		0.13	mj/dot	25°C
		(0.54)	ms	
		0.11	mj/dot	45°C
		(0.46)	ms	
Current consumption	Io	2.4	A	
Division number		1		

Note 2) The printing interval (SLT) is defined as the time in which strobes are sequentially driven and the printing of one line has all been completed. The relation of the applied voltage and the electric power application time (Ton) is calculated with calculation formula as shown below.

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$$Po = I_o^2 \times R_{av} = \frac{VH^2 \times R_{av}}{(R_{com} \times N + R_{av} + R_{ic} + R_{lead})^2}$$

$$Ton = E_o / Po$$

or

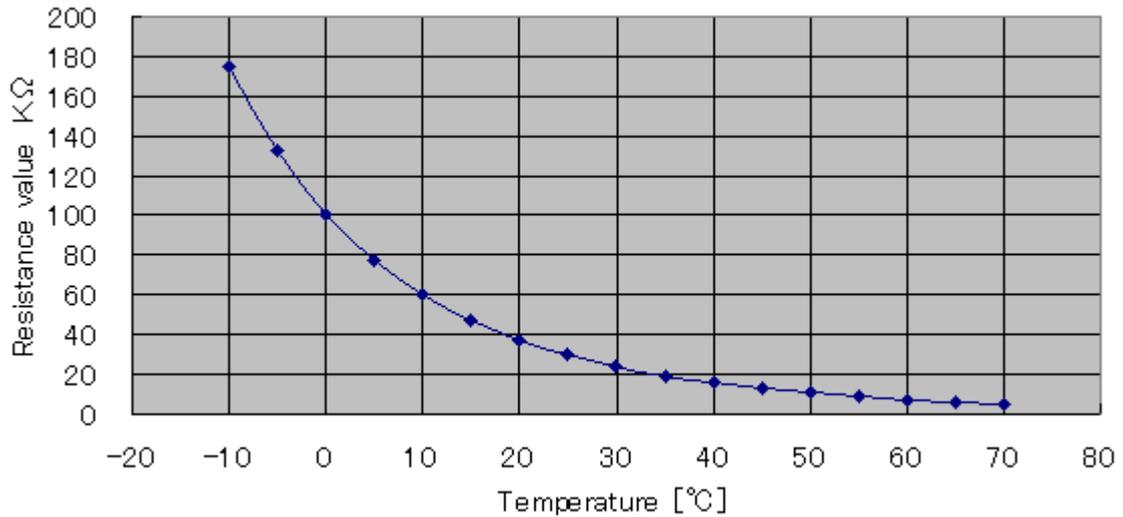
$$Po = E_o / Ton$$

$$VH = \sqrt{(Po / R_{av}) \times (R_{com} \times N + R_{av} + R_{ic} + R_{lead})}$$

Rav:	Average resistance value	(example)	176	[Ω]
N:	The number of simultaneous printing dot	(example)	64	[dot]
Rcom:	Common resistance		0.05	[Ω]
Ric:	Driver-On resistance		6	[Ω]
Rlead:	Lead resistance		10	[Ω]

(5) Thermistor characteristics

B constant:	3950K±2%
Resistance value R25:	30KΩ±5% at 25°C
Thermistor calculation formula:	$RX = R25 \times \text{EXP}\{Bx(1/TX - 1/T25)\}$ T: Absolute temperature
Operating temp. range:	-20 to +80°C
Thermal time constant:	Within 30sec (in the air)



(6) Cautions on operation

- 1) When performing the continuous printing with high printing rate, regulate the head base (thermistor) temperature so that it does not exceed the standard value.
- 2) 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 head damages caused by ions and noises.
- 3) When the thermistor is disconnected, control (circuit design) the printer so that the thermal head is not overheated.
- 4) Do not input any pulse noise of equal or more than 2V, 20ns in each signal terminal.
- 5) Control signals of CLK, LAT, DIN, and STB with C-MOS (equivalent to 74HC240). In addition, when the power supply is on/off and for the non-printing time, maintain the STB signal in the "DISABLE" state.

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6) **Surge noise to prevent**, the cable length of VH and GND shall be equal or shorter than 100mm. Mount an aluminum electrolytic capacitor of 47 μ F between VH and GND of the head side, which should be as close to the head side as possible. In addition, mount a laminating ceramic condenser of 0.1 μ F between VDD and GND.

7) When the power supply is on, the order shall be VDD \rightarrow VH. When the power supply is off, it shall be VH \rightarrow VDD.

8) 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.

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Table-1 Electrical characteristics

(Ta=25±10°C)

Item	Symbol	Min.	Standard	Max.	Unit	Conditions etc.	
Printing power voltage	VH	-	-	8.5	V		
Circuit power voltage	Vdd	²⁾ 2.70 4.75	5.00	5.25	V		
Circuit power current	Idd	-	-	54	mA	fDI=fCLK/2	
Input voltage	H	VIH	0.8Vdd	-	Vdd	V	STB,DI,LAT,CLK
	L	VIL	0	-	0.2Vdd	V	Same as above
Data input current (DI)	H	I _{IH} DI	-	-	0.5	μA	VIH=5V
	L	I _{IL} DI	-	-	-0.5	μA	VIL=0V
STB input current (HIGH-ACTIVE)	H	I _{IH} STB	-	-	30.0	μA	
	L	I _{IL} STB	-	-	-0.5	μA	
Clock input current (CLK)	H	I _{IH} CLK	-	-	3	μA	
	L	I _{IL} CLK	-	-	-3	μA	
Latch input current (LAT)	H	I _{IH} LAT	-	-	3	μA	
	L	I _{IL} LAT	-	-	-3	μA	
Data out (DO)	H	VDOH	4.45	-	-	V	OPEN status, Vdd=4.5V
	L	VDOL	-	-	0.05	V	
Output voltage	VOL	-	(1.0)	-	V	Reference value, Driver output part	
Clock frequency	fCLK	-	-	8	MHz	At 3.0≤Vdd≤5.25	
		-	-	5	MHz	At 2.7≤Vdd<3.0	
Clock pulse width	tw CLK	30	-	-	ns	Refer to the timing chart.	
Data setup time	testup DI	30	-	-	ns		
Data hold time	thold DI	10	-	-	ns		
Data out delay time	td DO	-	-	120	ns	At 3.0≤Vdd≤5.25	
		-	-	150	ns	At 2.7≤Vdd<3.0	
Latch pulse width	tw LAT	100	-	-	ns		
Latch setup time	testup LAT	200	-	-	ns		
Latch hold time	thold LAT	50	-	-	ns		
STB setup time	testup STB	300	-	-	ns		
Output delay time	tdo	-	-	10	μs	At 5.0V(Vdd)	
		-	-	60	μs	At 2.7V(Vdd)	

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02	011130	2) change (For Multi-purchase)			
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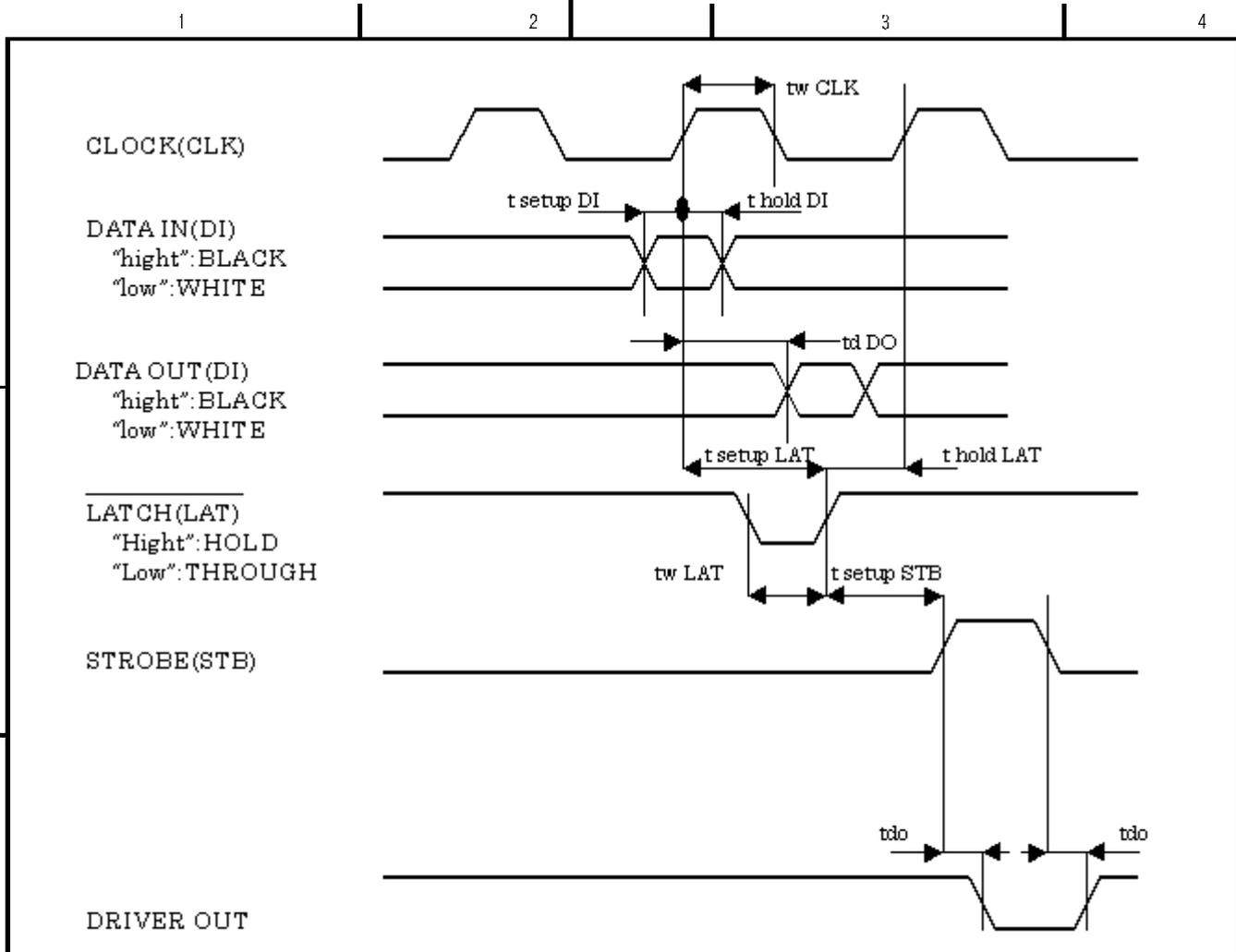
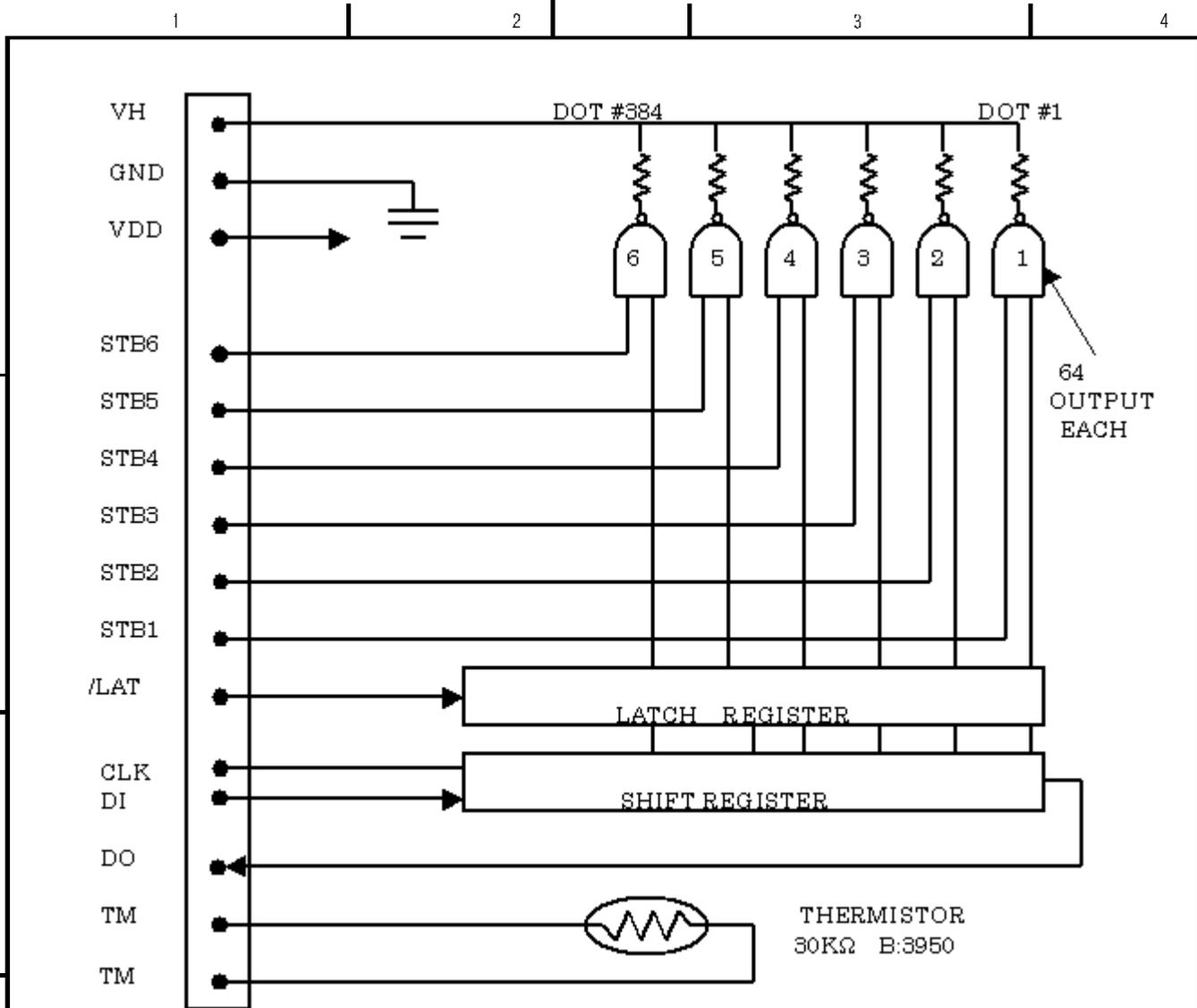


Figure 3-1 Timing chart

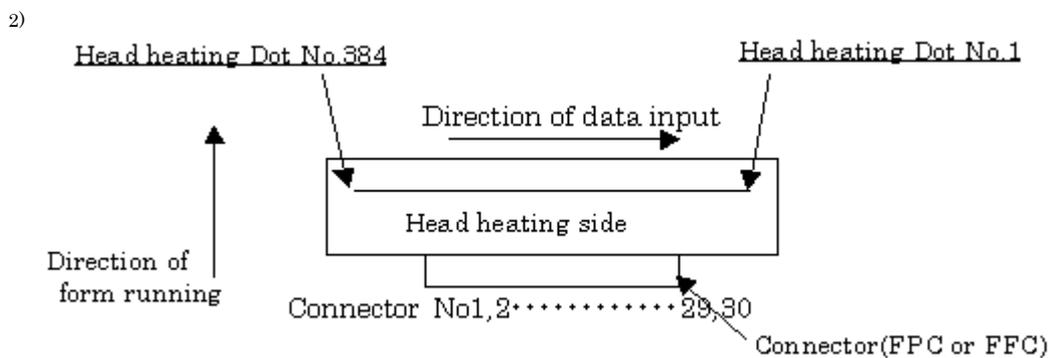
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STB No.	Dot No.	dots/STB
1	1 to 64	64
2	65 to 128	64
3	129 to 192	64
4	193 to 256	64
5	257 to 320	64
6	321 to 384	64

Figure 3-2 Equivalent circuit



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02 011130		Dot No postscript etc.			
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3-8 Stepping motor specifications

(1) General specification (motor only)

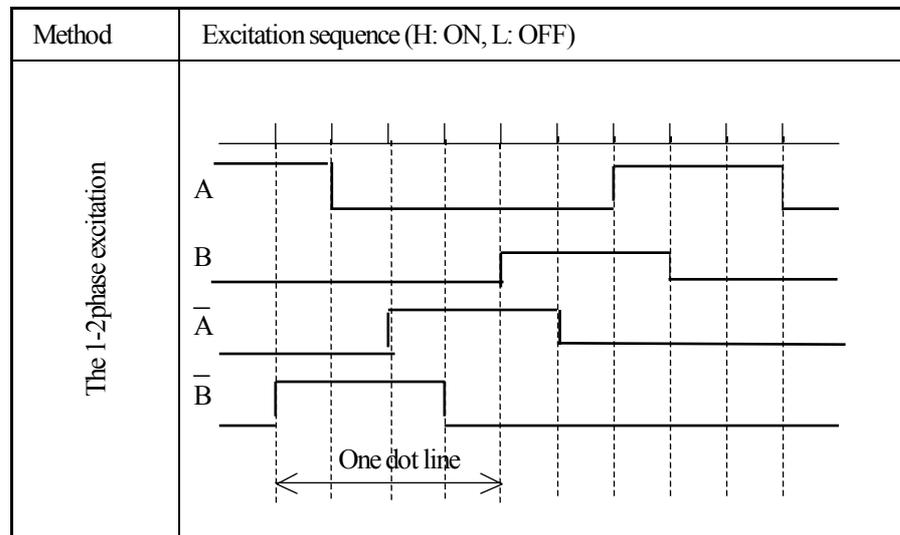
Item	Specifications
Model	Permanent magnet type
Phase	Two phase (bi-polar specification)
Step angle	9 degrees by 1-2 phase excitation
Winding resistance / phase	9.5Ω±8% (at 25°C) 10Ω
Rated voltage	DC4.2 to 8.5 V

(2) Driving procedures of the stepping motor

- 1) Drive the motor with the 1-2 phase excitation of the bipolar.
- 2) The number of steps per dot line of printing

Excitation method	Step No.	Rotation angle
1-2 phase excitation	4	9 degrees /step

3) The reference excitation method is described below.



(3) Driving the bipolar transistor

- 1) Drive the motor by the fixed current control for the output torque stabilization to the applied voltage change. This reference excitation current is 440mA. Applying any excessive electric current will cause the abnormal generation and the excessive torque, which will end in mechanical damages; therefore, do not apply any electric current that exceeds the requirement.
- 2) Determine the motor driving requirements after confirming effects of load variations caused by temperature, the humidity, and types of paper. If the motor is driven by any excessive torque, the gears may be damaged when the paper is locked; therefore, attention should be paid.
- 3) In the low-speed drive (the low driving frequency), abnormal noises and the torque reduction may occur due to resonance of the motor. In the low-speed drive, be sure to perform sufficient evaluation and confirmation.

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4) The reference exciting current when the pressurization power supply is applied is 440mA. Applying any excessive electric current will generate the excessive torque and cause mechanical damages; therefore, do not apply any electric current that exceeds the requirement.

5) At the start of the high-speed printing and the start of the printing after turning off the motor excitation, perform the speedup control.

(5) Cautions

1) If the motor is stopped and its excitation is turned off while the printing is being performed, because of the elasticity of the rubber roller, troubles may occur at the restart of the motor: the order of the printing may be disconnected, the printing may be smudged, white lines may be inserted. When the printing contents are necessary to be continued, complete the printing without interrupting once it is started. In addition, applying the slight electric current in the waiting state can reduce effects such as deformation of the rubber roller, as shown above. In this case, the reference electric current should be 150mA.

2) When leaving the printer for the long term, turn off the excitation. Failure to do so, it may cause heat generation of the motor and the driving elements.

3) The motor side wall temperature shall be equal or less than 90 degrees centigrade. If the temperature exceeds 90 degrees centigrade, the coil inside of the motor may be damaged.

4) When any abnormal state occurs, stop driving the printer as soon as possible.

5) This printer performs one paper feeding operation of one dot line with four steps. Therefore, for power saving and stable actions, when driving the motor with the 1-2 phase excitation, control the motor so that it is stopped in the 1-phase excitation state and started in the 2-phase excitation.

6) Any printing action with the platen closed and no paper fed may wear the rubber roller and damage the head. Do not perform the printing in this state.

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(5) Example of stepping motor driving circuit

Figure 3-3 shows an example of the driving circuit using the bipolar constant current.

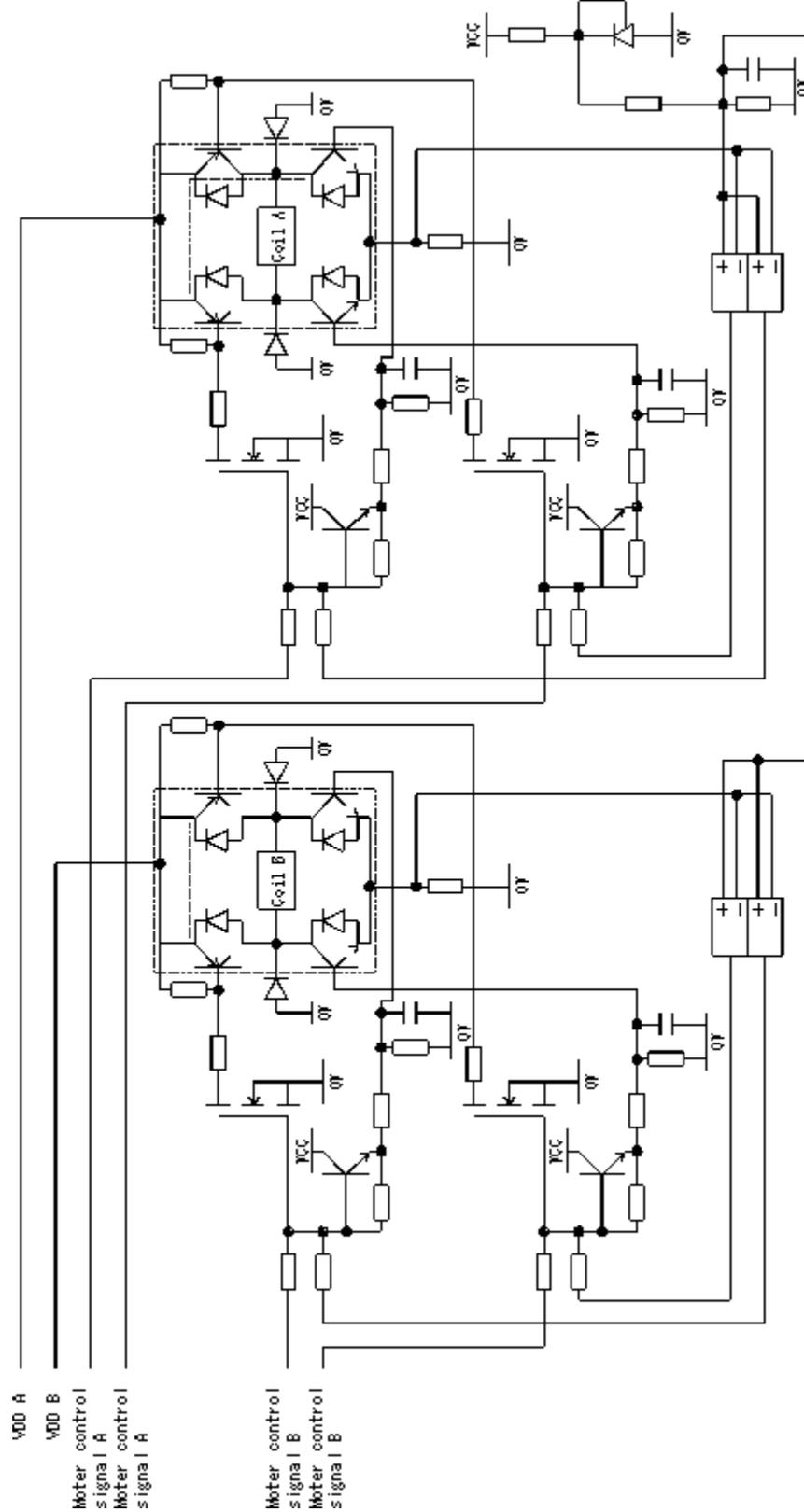


Figure 3-3

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3-9 Photo-interrupter specification

This photo-interrupter is mainly used for detecting whether the paper is set. In addition, it can be used as the paper-positioning tool by seeking the mark.

(1) Absolute maximum rating

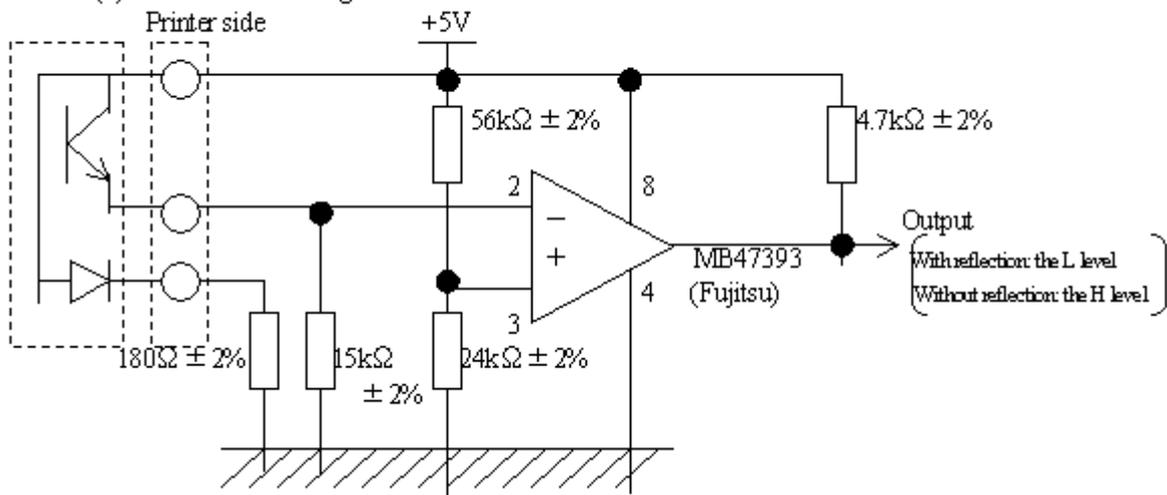
Item		Symbol	Rated value	Unit
Input	Forward current	I_F	50	mA
	Reversed voltage	V_R	5	V
	Loss of capacity	P	70	mW
Output	Voltage between the collector and emitter	V_{CEO}	20	V
	Voltage between the emitter and collector	V_{ECO}	5	V
	Collector current	I_C	20	mA
	Loss of collector	P_C	70	mW

(2) Electric optics characteristics

(25°C)

Item	Mark	Min. value	Ref. value	Max. value	Unit	Requirement	
Input	Forward voltage	V_F	1.0	1.2	1.6	V	$I_F=10\text{mA}$
	Reverse current	I_R	--	--	10	μA	$V_R=5\text{V}$
Output	Dark current	I_{CEO}	--	--	200	nA	$V_{CE}=10\text{V}, I_F=0\text{mA}$
Transfer characteristics	Photocurrent	I_C	150	--	600	μA	$V_{CE}=5\text{V}, I_F=10\text{mA}$
	Leakage current	I_{LEAK}	--	--	1	μA	$V_{CE}=5\text{V}, I_F=10\text{mA}$
	Response time (rising)	t_r	--	5	--	μs	$V_{CE}=5\text{V}, I_F=1\text{mA}$ $R_L=100\Omega$
	Response time (dropping)	t_f	--	5	--	μs	

(3) Connecting circuit



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3-10 Sliding-switch specifications

This printer is built in a sliding switch for detecting whether the platen is released.

Item	Specifications
Rated voltage	DC5V
Rated current	1mA
contact resistance	Equal or less than 1Ω

2)

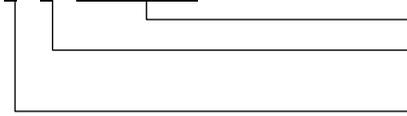
The state of an internal point of contact of this switch is shown in the following.

- : At the print state (platen close) →The switch closes.
- : At platen opens →The switch opens.

4. Product model plate

- | | |
|---------------------------------------|---|
| (1) Contents to be indicated: | The model, manufacturing additional No., and version No. |
| (2) Indicating locations: | Label is plated on the back of auto cutter. |
| (3) Indicating methods: | The model, additional and version numbers are stamped. |
| (4) Indication of the additional No.: | The indicating method is described as follows. It is consisted of a six-digit character string. |

* * * * *



- | | |
|------------------------------------|--|
| (5) Indication of the version No.: | It indicates the version No. of the printer. |
|------------------------------------|--|

5. Packing

- | | |
|-------------------------------------|--|
| (1) Packing state: | It is individually packed in an anti-static bag and contained in an exclusive packing box. |
| (2) Dimensions: | They are conformed to our standard. |
| (3) Number of boxes to be piled up: | If it is placed horizontally, up to three boxes can be piled up in maximum. |
| (4) Indication: | The model and quantity is plated on the outside of the packing box. |

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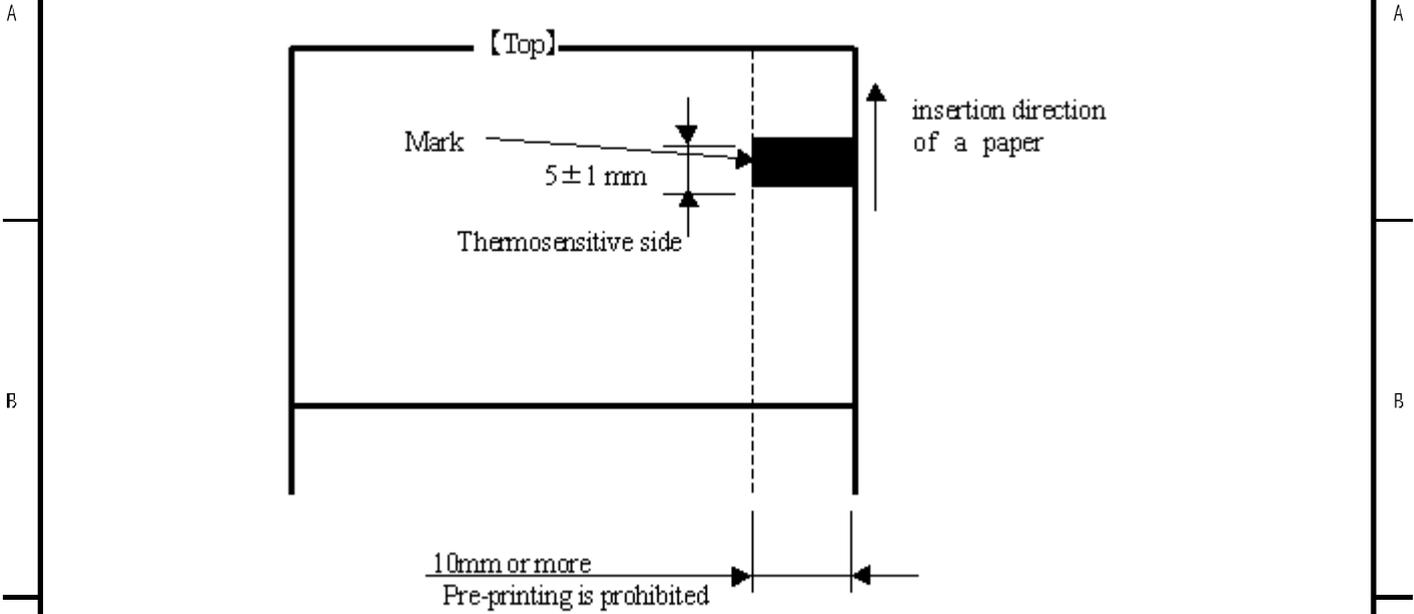
DATE

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				PRODUCT SPECIFICATIONS	
02 011130				DRAW No. A1NA02265-0353/6	
Switch specification postscript				CUST	
EDIT	DATE	DESIGN	CHECK	DESCRIPTION	FILE
DESIGN			CHECK	FUJITSU TAKAMISAWA COMPONENT LIMITED	24/24
				APPRY	

6. Pre-printing specifications

6-1 Position of the detecting mark

When printing, the mark should be the width equal to or more than $5 \pm 1\text{mm}$ x 10mm and printed on the thermosensitive side, as shown below.



6-2 Pre-printing the positioning mark

The positioning mark should be printed as follows: the color is black, the reflection rate is equal or less than 7% and PCS is equal or more than 0.9 for the deepness.

To eliminate the light and shade, use the oil-base ink for printing the mark. To improve the PCS value, overprinting is recommended.

The measuring apparatus and value for deepness are described below.

* PCS measuring apparatus: GretagMacbeth reflection type densitometer PCM-II (Filter used: D-range of 900nm)

6-3 Prohibiting the pre-printing

Pre-printing in the range where the mark is detected (10 mm from the left edge) is prohibited; however, if pre-printing is required for absolute necessity, select the used ink so that the reflection rate is equal or more than 80% within the range where the wavelength band of the photo-interrupter is used (700-1000 nm).

6-4 Cautions on pre-printing

The thermosensitive paper has different characteristics from those of general printed paper and non-carbon paper. In the print process, pay attention to the followings.

- A Printing method
Print the thermosensitive paper by the UV print method because the drying characteristics of the ink is bad.
- B Ink to be used
 - (1) Select the ink that does not give unfavorable effects to the thermal printer, such as adhesion of work-up, wear of the head, and sticking.
 - (2) The quantity of the ions, Na and K in the ink should be respectively equal to or less than 50ppm. In addition, the quantity of ion of Cl should be equal to or less than 100ppm.

Recommended ink: RNC type by F&K TOKAI

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- (3) The surface strength of the thermosensitive layer is weaker than that of the general printed paper; therefore, pay attention to **tacks of the ink**. Set **the tack of the ink** to about 6.0 for the general thermosensitive paper, to the same level as the non-carbon paper for the high saving type thermosensitive paper. However, when reducing the tuck with a reducer, the quantity of addition should be equal to or less than 5%. (Failure to do so, the drying characteristics will be worse.)
- (4) Do not introduce too much quantity of the ink. Excessive amount of the ink may cause defectiveness of the printing color development and sticking of the thermal printer.
- (5) Materials used for the ink should be heat-resistant and have cooling effects. The same ink should be used for the non-thermosensitive paper side.
- (6) After the printing has been completed, confirm if the ink is contacted to the paper. Furthermore, the UV ink is generally weak to the water; therefore, care should be taken for controlling the dampening solution.
- (7) Make sure that transcription and blocking of the ink do not occur.
- (8) Do not remove the pre-printing with water or alcohol.

B

C Dampening solution

- (1) The thermosensitive paper is water-repellent; therefore, care should be taken for controlling the dampening solution.
- (2) Excessive amount of IPA of the dampening solution may cause color development fog; therefore, the amount should be equal to or less than 5% for the general thermosensitive paper, equal to or less than 10% for the high saving type thermosensitive paper, respectively.

C

D Others

- (1) When a large number of UV lamps are used, care should be taken for paper shrinkage due to heat (the flow direction, the width direction) and the color development fog.
- (2) The paper surface is quite smooth; therefore, set the rolling pressure to be strong.
- (3) When increasing in the PCS value of the positioning mark, perform the overprinting.
- (4) Sticking may occur in some pre-printing results; therefore, be sure to perform evaluation and confirmation with the actually operated unit.

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7.Revision history table

MODEL:FTP-628MCL353#01/#02

SPECIFICATION REVISION	PRODUCT REVISION	ITEM/CHANGE-CONTENTS	APPLIED-TIME	A REMARKS COLUMN
REV.0	01A			
REV.02	03A	*Multi-company purchase of the parts. Page9: Error in writing correction Page10: Head logic voltage change (For Multi-purchase) Page13: Error in writing correction Page14: Error in writing correction Page17: Circuit power voltage change (For Multi-purchase) Page19: Dot No postscript etc. Page20: For multi-company purchase Page24: Switch specification postscript		

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				PRODUCT SPECIFICATIONS	
				DRAW No.	CUST
				A1NA02265-0353/6	
EDIT	DATE	DESIGN	CHECK	DESCRIPTION	FILE
DESIGN			CHECK	APPRY	27/27
				FUJITSU TAKAMISAWA COMPONENT LIMITED	