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Document	Product specifications	Mark-number : 151－ GT－059	
Product	EPL1601T2	31－2	Revision-number:0

1. Cautions

1-1. Safe operation

In case of operating this printer, keep following items for safety.

1-1-1. The thermal head

(1). The temperature of the thermal head becomes high, so don't touch thermal head or the thermal head supporting part(heat spreader) while printing or just after operation. Pay attention at maintenance or replacing the recording paper, too.

(2). When the thermal head falls into continuous ON state for some trouble, it may cause smoke or catch fire from the paper by thermal head heating. Or the power supply may be influenced by deformed or shorten FFC because of high temperature. To avoid above situation, turn off the power immediately when the thermal head falls into continuous ON state.

①The thermal head has a thermistor to detect temperature. Design a protecting circuit not to be operated at out of specified temperature range.

②Design the circuit to cut off the power when the thermistor is SHORT or OPEN.

1-1-2. The motor

(1). The temperature of the motor becomes high, so don't touch the motor while printing or just after operation.

(2). When the motor falls into continuous ON state for some trouble, it may cause smoke or catch fire. To avoid above situation , the temperature of motor surface should be less than 90°C. This printer doesn't have the function to detect motor temperature. Design the function at HOST(CUSTOMER) SIDE. (THERMISTOR, THERMO-FUSE, etc.)

(3). Design the protection circuit to avoid continuous ON state because of CPU trouble.

(4). Design the circuit to cut off the power by detecting the temperature with thermistor or THERMO-FUSE, when the motor is locked by PAPER JAMMING or being put foreign substances to gears.

1-1-3. OTHERS

(1). Don't put in liquid like water or conductive material like metal. It may cause that thermal head will be broken or power supply will be shorten and occur smoke or catch fire.

(2). Don't put finger and so on into rotating gears. Finger may be injured.

(3). Be careful not to touch the edges(especially heat spreader of the head). The sharp cut edges can scratch person's finger.

(4). If it happens trouble for the worst, TURN OFF the power.

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1-2. Precautions in use

1-2-1. The thermal head

(1). The life of the thermal head may become shorter, if oil of finger etc. sticks to the head. In case oils or foreign substances stick to the head, clean up the thermal head immediately. SEE 1-2-8. Maintain

(2). To protect the thermal head or thermal head driver, detect the temperature by the thermistor, located on the head and don't operate the thermal head at 70°C or higher temperature.

(3). Don't apply the energy to head, when thermistor is opened.

(4). The thermal head may be corroded, by following condition.
①Much ions included in the recording paper
②High humidity or dew condensed condition
③Power applied to the thermal head
Therefore keep followings.
•Cut off the power to the thermal head when printer isn't operated.
•Use dry recording paper, because wet paper makes poor printing quality and it causes corrosion of thermal head.

(5). Use the thermal head at the specified voltage and pulse width, or deterioration in the printing quality or damage to the head may be caused.

1-2-2. The motor

(1). Temperature of the motor becomes high. Pay attention to design the case of system around the motor radiation, distance between motor and case, case material, etc.

(2). The surface temperature of the motor should be under 90°C.
This printer doesn't have the function to detect temperature. Take measures for it by system side.

(3). Stop the operation when the motor is locked mechanically because of paper jamming etc. The lock may cause abnormal high temperature of the motor or broken gears.

(4). Design the circuit to cut off the power if it happen that motor is locked electrically.

(5). To avoid the abnormal high temperature of the motor, don't supply the power to the motor except printing or feeding operation.

1-2-3. The recording paper

(1). This printer's specification is guaranteed under recommended paper.
Use the recommended paper.
Un-recommended paper may cause the poor printing and get worse the reliability of the printer.
To use un-recommended paper, evaluate sufficiently before mass-production.

(2). Pay attention that the recommended paper has restriction of operating environment or depend on each paper's characteristics.

(3). Evaluate the paper sufficiency before mass-production to use perforation or the roll paper cored side in.
Printing quality and output level of paper end sensor will be influenced by direction of the flash, or stiffness of perforation.

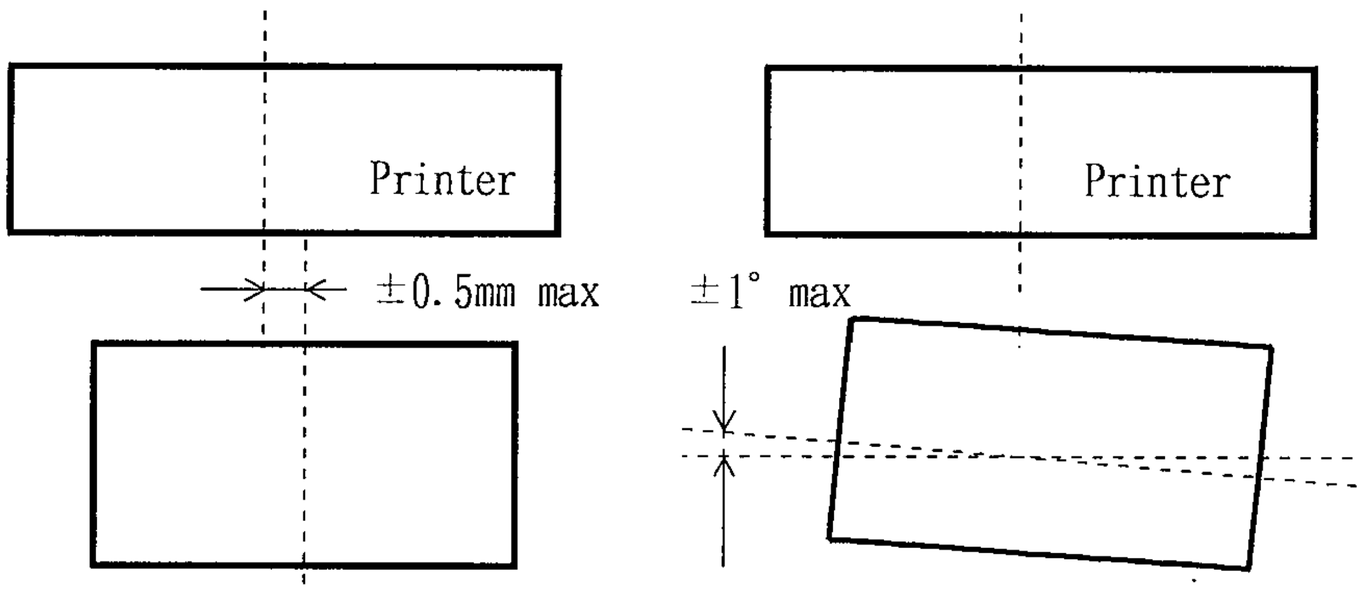
(4). In case of using roll paper, design that the core of the roll paper may be paralleled to the printer. See 1-2-4 (4)

(5). Pay attention as following to use the label converting paper.
- The excess adhesive out of paper edge may cause insufficient operation, soils of printing result and poor printing quality.
- In the case of using PRE-PRINTING PAPER, dry the ink sufficiently.
If the ink isn't dry enough, it may not cause good printing quality.
- Don't feed the label converting paper backward, because label paper may come off from base paper and the adhesive or label paper sticks to the thermal head.

(6). Be careful of the stock and treating of recording paper.
- Don' t store the paper at high temperature & humidity, because it may be colored itself at over 60°C.
- Store the paper at cool & dark place. Don't store long time in direct sunlight condition.
- Discoloring may be caused by ESTER ERASER, TAPE ADHESIVE, PLASTIC FILM include PLASTICIZER.
- Coloring may be caused by facing to ORGANIC SOLVENT or diazo-copy, nail scratching.

1-2-4. Printer installation, Case design

(1). Secure a gap of 5mm(MINIMUM) between the printer base and the case surfaces except the mounting spot of the printer base. (Don't give stress to thermal head, FFC, FPC, HEAD UP/DOWN detecting switch.)
(2). Mounting the FFC, FPC in stretch condition, causes poor printing quality.
Design the connector position to give the slack to the FFC, FPC.
(3). At fixing wire spring for grounding, design the wire not to press the FFC, or the wire damage FFC. See 11 (Printer Appearance Draw)
(4). Take measures in designing so as to minimize the lateral position deviation of the paper holder from the paper inlet of the printer. In case of using roll paper, hold the paper so that the roll core(BAR) of the paper is parallel to the printer, or causes paper skew or jamming.



(5). At fixing, be careful not to apply the excessive force or torsion to the printer main body.
Deformation or torsion may cause the poor printing quality, paper skew, paper jamming.
Design the flatness of the printer mounting spot less than 0. 3mm.
(6). Using of cushion rubber on the printer installing position reduces the running noise label.
(7). Design the case not to re-enter the paper to the printer(PLATEN).
(8). If static electricity is applied to the printer, the thermal head may be damaged.
To avoid this, connect the head earth spring to the frame ground of the case.
(9). This printer doesn't have the special structure of guard against dust or water.
Design the case suitably.
(10). Metal Parts(ESPECIALLY CUT EDGES) may gather rust.
Design the case not to spoil the beauty of the design.

1-2-5. The FFC, FPC and CONNECTOR

(1). When the FFC, FPC is put on to a connector or pulled out from a connector, cut off the power.

(2). Pay attention to the contact face direction and put the FFC, FPC completely.

(3). Use the recommended connector.
Evaluate the specifications(POWER RATING, CONTACT RESISTANCE, WITHDRAWING FORCES etc.), when using un-recommended connector.

(4). Don't bend FFC, FPC because FFC, FPC may be broken.

1-2-6. The power supply

(1). Power ON/OFF order
If an abnormal pulse is applied to the thermal head at power ON/OFF, the head may be destroyed.
To avoid this, the special attention shown below shall be paid to the circuit so that no abnormal pulses are applied to the thermal head.

AT POWER ON :LOGIC (Vdd) ON → THERMAL HEAD (VH) ON
AT POWER OFF:THERMAL HEAD (VH) OFF → LOGIC (Vdd) OFF

(2). Use the power supply which has enough capacity.
The power supply which doesn't have enough capacity may cause poor printing quality.
The maximum current value can be defined by the following formula.

【MAXIMUM CURRENT CONSUMPTION】 = 【MAXIMUM HEAD CURRENT】 + 【MAXIMUM MOTOR CURRENT】

•MAXIMUM HEAD CURRENT = (MAXIMUM SUPPLY VOLTAGE / MINIMUM HEAD RESISTANCE) × MAXIMUM COLORING HEAD NUMBER

•MAXIMUM MOTOR CURRENT = (MAXIMUM SUPPLY VOLTAGE / MINIMUM MOTOR RESISTANCE) × 2(PHASE)

(3). To operate by BATTERY, pay attention to voltage drop by internal resistance of BATTERY and upper/lower limit of BATTERY.

1-2-7. Environment and printing condition

(1). Avoid a dusty place.

(2). Avoid the place near the machine that occurs large radiation noise.
EXAMPLE : HIGH VOLTAGE EQUIPMENT, LARGE SIZED MOTOR

(3). Operate the printer with the paper and head down condition.
Operating it without paper may cause poor printing quality and trouble of gear parts etc.

(4). Operating it with head up condition may cause breakdown of the thermal head.
To avoid this, the UP/ DOWN state of the head is detected with mechanical contact switch.

1-2-8. Storage, Maintain

(1). How to clean up the thermal head

①Up the head up lever, and make the printer head up state.
Remove the paper.

②Hooking the finger to the head heat spreader, and up the thermal head.
Pay attention not to scratch the surface of the thermal head and platen by nails.

③Clean up the thermal head by cotton bar with METHANOL or IPA.

④Insert the paper after drying up the thermal head completely.

(2). Keep the head in up state during transportation or long term storage.
If the platen is being pressed by the head for a long time,
It may be deformed, and printing quality may be uneven.

(3). When handling the printer, don't touch the connector terminal,
because the LSI is used in the head. Wear the earthband while handling.

(4). Avoid to storage at the place where are much dust or occur the condensed dew.

(5). The SERVICE PARTS aren't provided for this product.

1-2-9 The product and the specification

(1). The design and the specifications of the document may be changed for improvement without prior notification. However, we shall in advance notify you of the changes that may affect the specifications of your products.

(2). Any parts or whole of this document shall not be reproduced or copied without prior consent of us.

(3). In case of any troubles, both parties shall discuss them based on the items mentioned in this document. The warranty relating to these troubles shall be limited only to the printer.

(4). In the event of troubles attributable to the defects of our product, the remedies of us shall be limited to the cost of those specified product.

(5). Applicability of rule or standard to this printer shall be concerned by customer side.
If you can not accept, please inform us.

(6). This product is compliant RoHS directive.

1-2-10 Intellectual property rights

When a conflict rerating to the intellectual property right of the Goods occurs or likely to occur with a third party, either customer or MATSUSHITA ELECTRONIC COMPONENTS Co.,LTD ("MACO") shall notify immediately in writing the other Party to that effect.

The customer if the aforesaid conflict is for the reason attributable to it or MACO if the conflict is for the reason attributable to it shall settle the conflict with the third party at its own responsibility and expense. MACO is exempt, however, from settling the conflict in case the conflict results from at least one of the following:

(a) the design, specifications and others instructed by customer or the use of the exclusive production equipment and others lent by the customer or the materials supplied by MACO;
(b) the alteration, modification or attachment made to the Goods by a third party other than MACO;
(c) the mention in such manuals as data books and instruction books the customer supplied to MACO;
(d) the combination of the Goods with other parts, circuits, equipment, software and others;
(e) the use of the Goods for other applications than that agreed by both parties.

In case in settling the conflict referred to in the first paragraph of this article, the said third party chooses the customer as the party with whom it wants to negotiate for the settlement, both Parties shall confer as to how to respond to it including payment of money required to settle the conflict.
The amount of money that MACO pays based on the second paragraph of this article out of the total compensation to be paid to said third party shall not exceed the amount that is calculated by multiplying the unit selling price of the Goods from MACO to the customer by the normal royalty rate of the Goods.

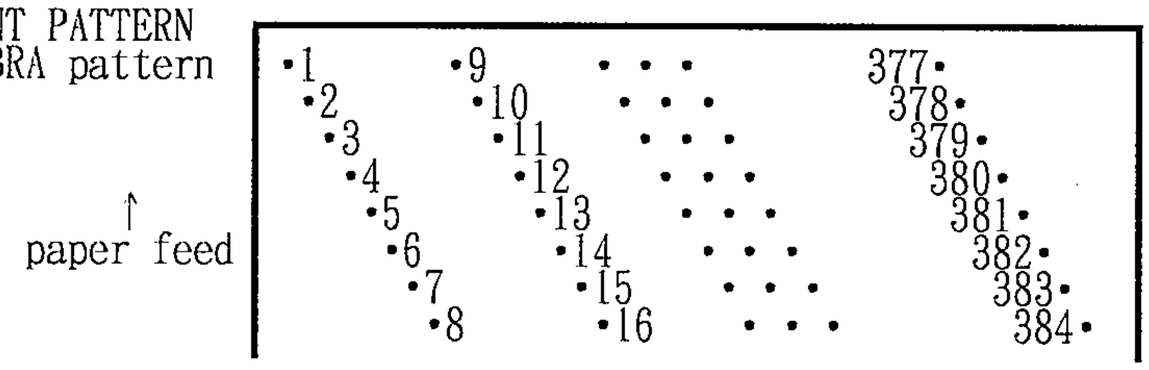
2. General specifications

(At normal temperature and normal humidity:25±5℃, 60±15%RH)

Item		Specification	Remark
Printing method		Thermal line dot method	
Paper width		58^{+0}_{-1} mm	
Effective printing width		48 mm	
Total number of dots		384 dots/line	
Head density		8 dots/mm	
Maximum printing speed		450 dots-line/s max.	at 7.2V, 20℃, 64 dots coloring (standard thermal paper)
Number of printable columns		16 digits columns	For the 24-dot configuration + No space
Number of dots colored at the same time		64 dots max.	For 64 dots or more, divide printing is needed
Horizontal dot pitch		0.125 mm	
Vertical dot pitch		0.125 mm	One dot paper-feed pitch(2 steps of the motor)
Vertical dot pitch accuracy		±0.1 mm/line max.	At. 25℃, 65%RH with definite speed feeding. (7.2V, 900pps)
Cumulative paper-feed accuracy		± 2 %	
Minimum paper-feed pitch		0.0625 mm	For one step of the motor
Detecting function	Head temperature	Detect by thermistor installed in the head	
	Paper absence	Detect by reflection type photo interrupter	
	Head up	Detect by mechanical switch	

Operating voltage	V_H system	DC 4.2V - 8.5V not to exceed 7.2V at continuos operation	Ni-Cd, Ni-MH batteries :5～6 cells
	V_{dd} system	DC 5V±5%	The head driver corresponds to it.
Paper feeding force		0.98 N{100 gf} min	Value at normal temperature and normal humidity, and normal operation of pulse motor. Vp=7.2V, f=900pps
Paper holding force		1.96 N{200 gf} min	
Running noise		50 dB max.	Measured at 1 meter, A curve, slow Vp=7.2V, f=900pps
Weight		85±5g	
External dimensions		78.5 × 51.2 × 20 mm	Excluding the paper feeding knob, release lever, FFC and FPC.
*1 Life		Pulse resistance: MCTF 5×10⁷ pulses Wear resistance: 50 km (Printing rate: 12.5%) (Definition) Rate of resistance change: 15% max. Dot lack: 0.5% max	At normal temperature and normal humidity, rated energy(7.2V). recommended recording paper.
Current consumption	Head	3.4 A max. (When 64 dots are coloring at the same time:)	At 7.2V and minimum resistance
		Average 1.1 A (When 64 dots are coloring at the same time:)	At 7.2V and 142Ω,
	Motor	2.4 A max.	When held at 7.2V 2 phase excitation
		Average 0.45A	Vp=7.2V, f=900PPS

*1 TEST PRINT PATTERN
12.5% ZEBRA pattern



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Mechanical characteristics	Release lever operating force	5.88 N {600 gf} max.	normal temperature normal humidity
	Number of release lever operations	10000 times min.	normal temperature normal humidity
	Paper inserting method	Inserting by hand	label paper is not capable for automatic insertion
		automatic insertion	
	Paper feed direction	forward/reverse	at reverse feed limit to 300mm max
	Continuous operation time	It depends on operating condition. (Limitation;Head temp. 70°Cmax. Motor surface temp. 90°C max.)	

3. Recording paper

Type	Recommended paper (paper width: 58^{+0}_{-1} mm)
Standard thermal paper	Mitsubishi Seishi :F200U9W6 Nippon paper(Jujo Seishi) :TF50KS-E2
Label type thermal paper	Nippon paper(Jujo Seishi) :HG56S Nippon paper(Jujo Seishi) :HG76
High preservation type thermal paper	Mitsubishi Seishi :AFP235B Shin Ouji Seishi :PD300N-R

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4. Reliability characteristics

Item	Conditions	Remarks
Operating environment	Temperature: -5℃ to +50℃ Humidity: 35 to 85% RH	After 3 hours of storage under these conditions, no malfunction shall occur. (Printing quality is reliable from 5℃ to 35℃.)
Storage environment	Temperature: -25℃ to +70℃ Humidity: 5 to 90% RH	After the printer is stored for 72 hours under these conditions and is allowed to stand for 2 hours at normal temperature and humidity, no malfunction shall occur during operation. The storage test shall be conducted with the head kept up. There shall be no condensation. The recording paper shall be excluded.
Vibration resistance	At operation: 3.92m/s^2, 5 to 100 Hz in frequency, 3 directions perpendicular to one another, 15 minutes for each direction At non-operation: 9.8m/s^2, 5 to 100 Hz in frequency, 3 directions perpendicular to one another, 1 hour for each direction	After testing under these conditions, no malfunction shall occur.
Impact resistance	588m/s^2, 11 ms 6 directions, 1 time for each direction	After testing under these conditions, no malfunction shall occur.

5. Quality of printing

Item	Specification	Remarks
Printing	•Recording paper standard thermal paper label type thermal paper high preservation type thermal paper OD value ≧ 0.8 at 100% coloring	[Recording paper] standard thermal :F2000U9W6 TF50KS-E2 label type thermal:HG56S HG76 high preservation :AFP235B type thermal PD300N-R •Measured by Macbeth reflection densitometer at the position which is 10mm away from position of starting printing. •Rated energy printing.(7.2V) •The power capacity shall shall conform to the number of coloring dots. •Ambient atmosphere:25°C 65%RH

6. Thermal head specifications

This thermal head has a built-in thermistor. The thermistor should be used to keep the printing quality good by detecting the thermal head temperature.

6-1 General specifications

Item	Specifications
Printing width	48±0.2 mm
Number of dots	384 dots/line
Dot density	8 dots/mm
Dot pitch	0.125 mm
Resistance	142 Ω ± 4%
Number of strobes	6 strobes (in units of 64 dots)
DATA transfer system	1 DATA input system
Driver setup	6 drivers (in units of 64 dots)
Applied voltage	4.2V to 8.5V not to exceed 7.2 V at continuos operation
Applied pulse width	*1 1.0 ms (Typ)
Applied pulse period	2.2 ms (min)

*1 standard thermal paper, at 7.2V, at 20℃, 64 dots coloring
See 6-5 Applied pulse width control

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Item	Specifications
Applied power	0.2 W/dot (Typ)
Number of dots printable at the same time	64 dots max.
Thermistor characteristics	B constant: 3950k ± 2% $R_{25^\circ C}$: 30 kΩ ± 5% $T = \{(2.308/B) \cdot \mathrm{Log}(R/R_{25}) + (1/298)\}^{-1} - 273^\circ C$
Head life	Pulse resistance: 5×10^7 pulses MCTF (printing rate: 12.5%) Wear resistance : 50 km min. Life definition : Rate of resistance change 15% max. Dot lack 0.5% max. At normal temperature and humidity, rated energy(7.2V)
Operating temperature	The head substrate temperature shall not exceed 70°C. (Thermistor resistance value: 5.29 kΩ)
Remark	$\text{Applied power} = Io^2 \cdot Rav = \frac{VH^2 \times Rav}{(N \cdot Rcom + Rav + Ric + Rl)^2}$ (W/dot) where Rav: Average resistance value 142Ω N : Number of printing dots at same time 64dots max. Rcom: Common resistance value 0.4Ω Ric: Driver IC resistance 15Ω Rl : Lead resistance value 10Ω

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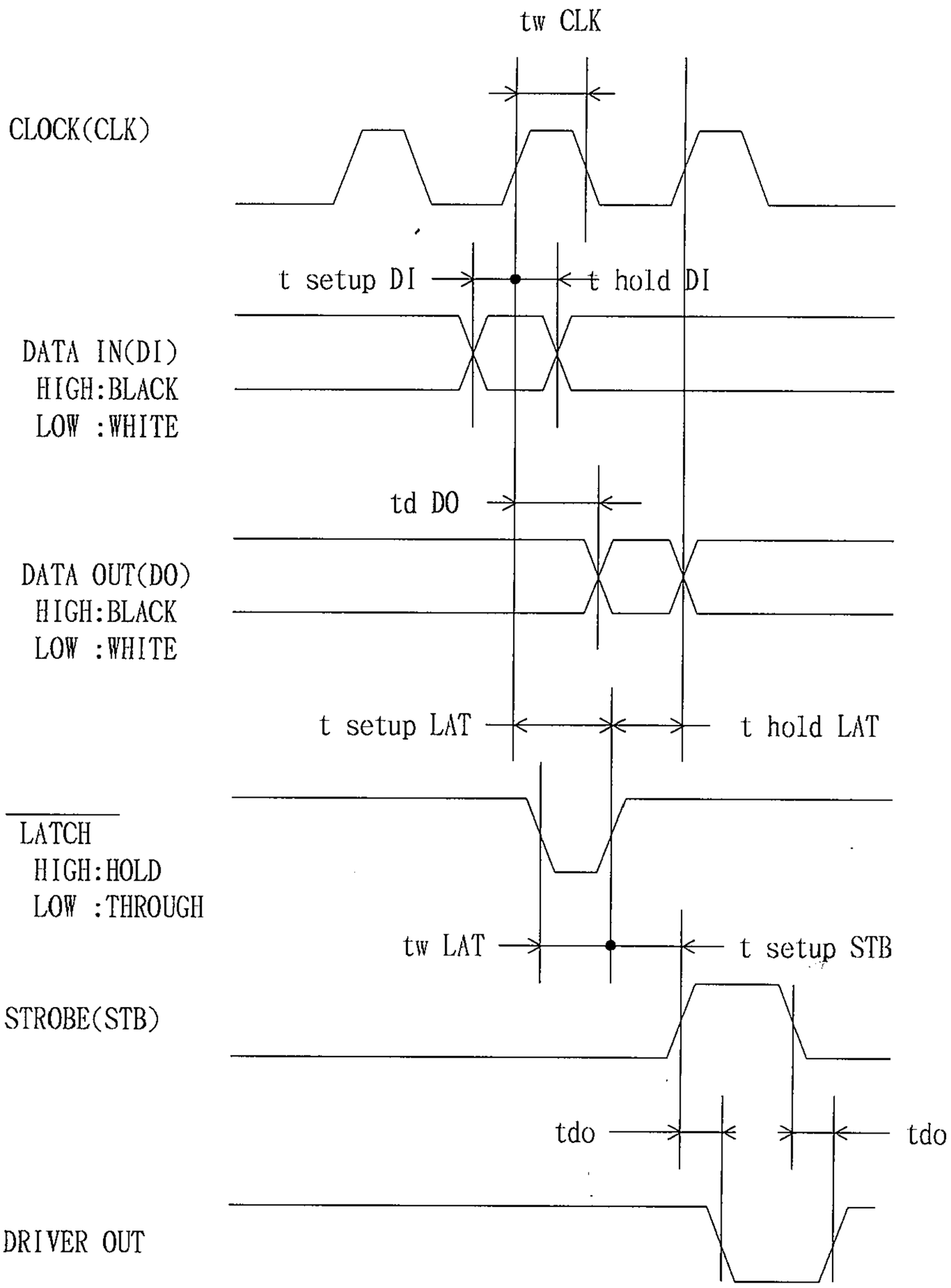
6-2 Electrical characteristics

1) Electrical characteristics (Temperature 5°C～45°C, Humidity 35～85 %RH)

Item		Symbol	Recommended values			Unit	Conditions
			Min.	TYP	Max.		
Power source voltage		VH	-	-	8.5	V	
Power source voltage		Vdd	4.75	5.00	5.25	V	
Power source current		Idd	-	-	36	mA	fDI=fCLK/2
Input voltage	H	VIH	0.8Vdd	-	Vdd	V	STB, DI, LAT, CLK
	L	VIL	0	-	0.2Vdd	V	"
Data input current (DI)	H	IIH DI	-	-	0.5	μA	VIH=5V
	L	IIL DI	-	-	-0.5	μA	VIL=0V
STB input current	H	IIH STB	-	-	30.0	μA	
	L	IIL STB	-	-	-0.5	μA	
CLK input current	H	IIH CLK	-	-	3	μA	
	L	IIL CLK	-	-	-3	μA	
LAT input current	H	IIH LAT	-	-	3	μA	
	L	IIL LAT	-	-	-3	μA	
DO output voltage	H	VDOH	4.45	-	-	V	OPEN (Vdd=4.5V)
	L	VDOL	-	-	0.05	V	
Driver output voltage		VOL	-	(1.0)	-	V	(reference)
Clock frequency		fCLK	-	-	4	MHz	
Clock pulse width		tw CLK	70	-	-	ns	
Data setup time		tsetup DI	50	-	-	ns	
Data hold time		thold DI	10	-	-	ns	
DO delay time		td DO	-	-	120	ns	
LAT pulse width		tw LAt	100	-	-	ns	
LAT setup time		tsetup LAT	200	-	-	ns	
LAt hold time		thold LAT	50	-	-	ns	
STB setup time		tsetup STB	300	-	-	ns	
Output delay time		tdo	-	-	5	μs	

2)Timing chart



6-3 Divided printing of the head

The division printing shall be made by one strobe unit (in units of 64 bits). However, the number of dots possible to be colored at the same time is 64 dots maximum.
If 64 dots or more are colored at the same time, a large voltage drop will result, thinning the printed characters.

384 dots

1 (64)	2 (64)	3 (64)	4 (64)	5 (64)	6 (64)
STB1	STB2	STB3	STB4	STB5	STB6

(1) Continuous divided printing
Division numbers of printing are constant , whenever printing patterns are changed.
Printing speed is constant .

(2) Variable divided printing
Division numbers of printing are variable . It depends on printing patterns.
Printing speed is variable , depends on printing patterns .

→ See 9-1 Variable divide printing

6-4. Applied pulse width control

To obtain a good-printing quality, correct the applied width to the thermal head according to head-driving voltage, temperature of the thermal head, and number of dots at the same time.
The following is the method how to calculate the pulse width.

(1)Pulse width formula

$$t = \frac{E_0}{W} \times \{1 + \frac{\alpha}{100} \times (20 - T)\} \quad (ms)$$

t : applied pulse width (ms)
E_0 : applied energy (mj) → Refer to the value written in the following table.
W : applied wattage $= \frac{V_H^2 \times Rav}{(N \times 0.4 + Rav + 25)^2}$ (W/dot)
V_H :Supplied Voltage (V)
N :Number of dots colored at the same time. (Dots) → 64dots max.
Rav :Thermal HEAD resistance (Ω) → 142Ω
α :Temperature compensating ratio 1.1 (% / deg)
T :Temperature of thermal HEAD (°C)

(2) Printing mode for thermal paper

Printing mode	Thermal paper (vender, type)
Standard thermal paper mode	Mitsubishi Seishi :F200U9W6 Nippon paper(Jujo Seishi) :TF50KS-E2 Nippon paper(Jujo Seishi) :HG56S (label)
High preservation type thermal paper mode	Mitsubishi Seishi :AFP235B Shin Ouji Seishi :PD300N-R Nippon paper(Jujo Seishi) :HG76 (label)

(3)Caution in classification table (driving frequency of stepping motor)

①This printer motor feeds 2 step every one dot pitch printing(0.125mm).
Driving frequency ={ Printing speed}×2 (pps)
Printing speed is written in the following table.

②If the pulse width is longer than driving frequency of stepping motor, extend first step of the motor.

→ See 9-1 Variable divide printing

(4)Classification Table

①Standard thermal paper mode (F200U9W6, TF50KS-E2, HG56S)

Temperature		Head-driving voltage (V)					
		4.2～ 4.5 (excl.)	4.5～ 5.0 (excl.)	5.0～ 5.5 (excl.)	5.5～ 6.0 (excl.)	6.0 ～ 7.0 (excl.)	7.0～ 8.5 (excl.)
-5°C ～	E_o(mj)	0.343	0.328	0.292	0.274	0.245	0.220
10°C(excl.	print speed (dl/s)	77	92	128	165	220	334
10°C ～	E_o(mj)	0.323	0.309	0.275	0.257	0.230	0.207
20°C(excl.	print speed (dl/s)	93	111	155	200	266	403
20°C ～	E_o(mj)	0.312	0.298	0.265	0.248	0.222	0.200
70°C(excl.	print speed (dl/s)	105	127	176	228	304	450

②High preservation type thermal paper mode (AFP235B, PD300N-R, HG76)

Temperature		Head-driving voltage (V)					
		4.2～ 4.5 (excl.)	4.5～ 5.0 (excl.)	5.0～ 5.5 (excl.)	5.5～ 6.0 (excl.)	6.0 ～ 7.0 (excl.)	7.0～ 8.5 (excl.)
-5°C ～	E_o(mj)	0.505	0.486	0.435	0.410	0.368	0.330
10°C(excl.	print speed (dl/s)	52	62	86	110	146	222
10°C ～	E_o(mj)	0.480	0.460	0.411	0.385	0.345	0.310
20°C(excl.	print speed (dl/s)	62	75	103	134	177	269
20°C ～	E_o(mj)	0.465	0.446	0.397	0.372	0.333	0.299
70°C(excl.	print speed (dl/s)	71	85	118	152	202	307

6-5. Pin layout for FFC and FPC

HEAD FFC

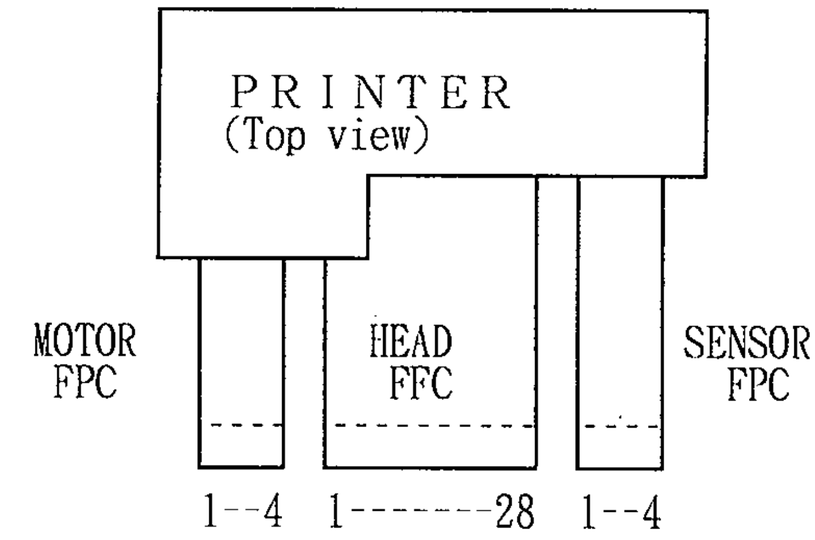
No.	Signal name
1	VH
2	VH
3	VH
4	DATA OUT
5	LATCH
6	CLOCK
7	Vdd
8	STROBE 1
9	STROBE 2
10	STROBE 3
11	THERMISTOR
12	THERMISTOR
13	GND_H
14	GND_H
15	GND_H
16	GND_H
17	GND_H
18	GND_L
19	NC(NON CONNECTION)
20	NC(NON CONNECTION)
21	STROBE 4
22	STROBE 5
23	STROBE 6
24	NC(NON CONNECTION)
25	DATA IN
26	VH
27	VH
28	VH

MOTOR FPC

1	$\overline{B}$ (motor)
2	B (motor)
3	A (motor)
4	$\overline{A}$ (motor)

SENSOR FPC

1	Photo interrupter (collector)
2	Photo interrupter (anode)
3	Photo interrupter , SW (emitter & cathode)
4	SW(Head UP)



* Matching connecter

[HEAD FFC]

Molex Co.: 52044－2810 (Horizontal type)
52044－2845 (Horizontal type)
52045－2810 (Vertical type)
52045－2845 (Vertical type)
39－51－3283 (Horizontal lock type)
39－51－3284 (Vertical lock type)

[MOTOR, SENSOR FPC]

Molex Co.: 52044－0410 (Horizontal type)
52044－0445 (Horizontal type)
52045－0410 (Vertical type)
52045－0445 (Vertical type)
39－51－3043 (Horizontal lock type)
39－51－3044 (Vertical lock type)

(FFC, FPC CONTACT SIDE)

Thickness : 0.3 ±0.05 mm
Pitch : 1.25 ±0.1 mm

6-6 Precautions in use

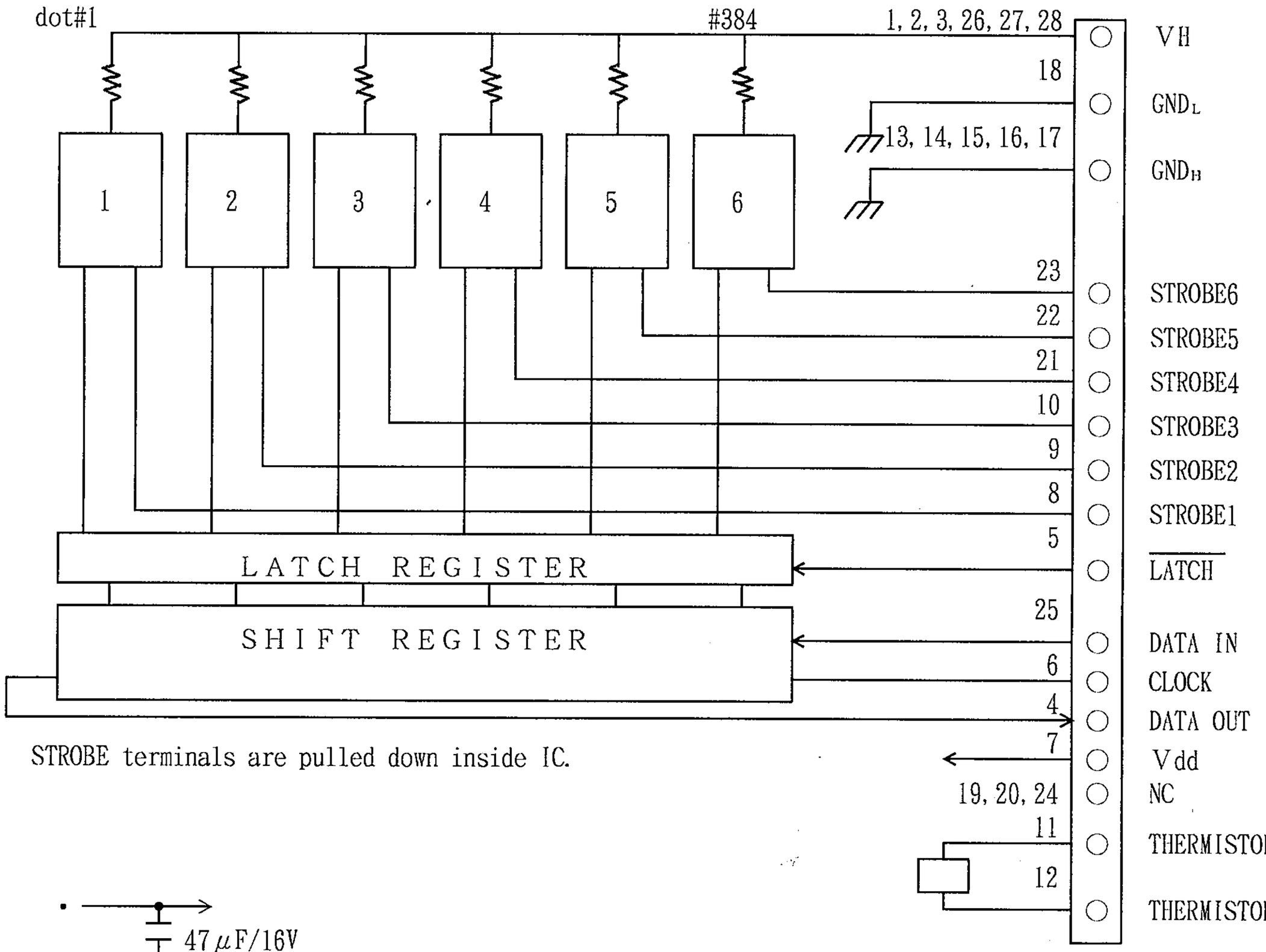
(1) Electrical precautions
  (a) For continuous printing at high printing rate, do not allow the head substrata temperature to exceed the specified value.
  (b) To prevent thermal head destruction by ions, noises, etc., design the circuit so that VH (power to the heating element) turns off (GND_H level) when the equipment stands by.
  (c) Design the circuit so that the thermal head is not heated in case of thermistor wire breakage.
  (d) If the number of dots printed at the same time exceeds the specified number of dots, the net power applied to the heating element decreases due to the internal voltage drop in the thermal head, so that sufficient density cannot be obtained. In addition, because the noise generated from the thermal head increases with increasing current, take full measures against the noise, such as the use of netting wire.

(2) Mechanical precautions
  (a) Wipe off paper residues on the heating element with methanol or IPA.
  (b) Do not touch the heating element or the surface of thermal papers with the hand.
  (c) Use thermal papers which are free from Na+ ion, K+ ion, and Cl- ion, or which is sufficiently evaluated in reliability.
  (d) Allow no condensation on the heating element.

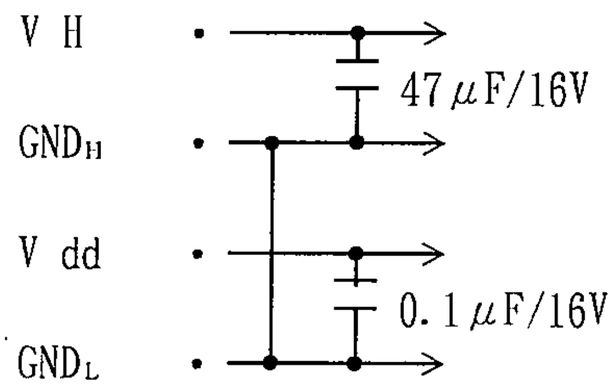
(3) Recommended driving circuit conditions
  (a) At the power turning ON-OFF,
    At power turning ON, Vdd → VH
    At power turning OFF, VH → Vdd

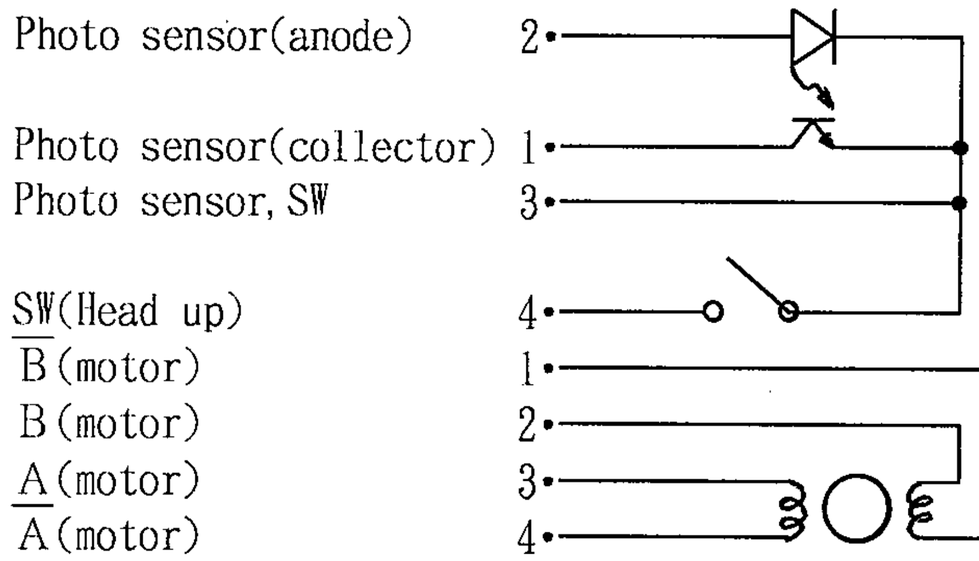
  (b) At the power turning ON-OFF, turn the STROBE to "the disable state" by means of the power ON reset circuit of the CPU or add a system reset IC.
  (c) In order to avoid noise, the length of wires from VH and GND shall be less than 100 mm. And add an aluminum electrolytic capacitor of 47μF capacitance/16V between VH and GNDH, and ceramic capacitor of 0.1μF capacitance between Vdd and GNDL.

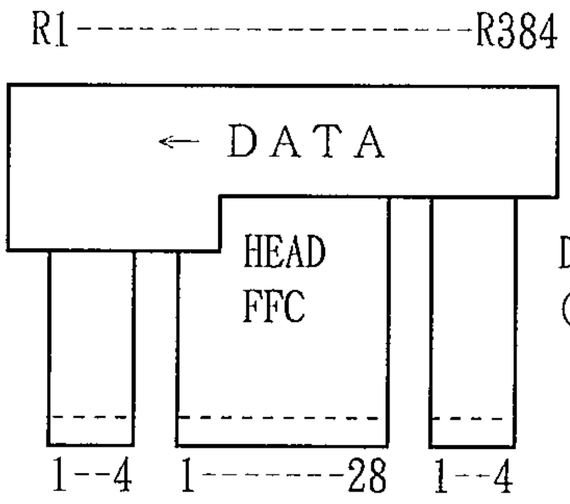
Document	Product specifications	Mark-number : 151－ GT－059	
Product	EPL1601T2	31－23	Revision-number:0



STROBE terminals are pulled down inside IC.







Data transfer direction
(Top view)

Note	Format No. FORM1062. JBW
Established NOV/21/95	
Enforced MAY/21/96	

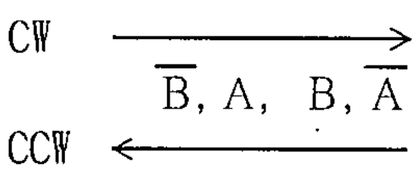
7. Stepping motor specifications

7-1. Basic specifications

Item	Standard
Type	Permanent magnet type
Number of phases	4 phases
Excitation method	2-2 phase bipolar driving
Wound wire resistance/phase	6.5 Ω/phase
Rated voltage	7.2 V
Max. current consumption	2.4 A /2 phases (at 7.2V)
Average current consumption	0.45 A /2 phases (at 7.2V)
Driving frequency	0～ 900 pps

7-2 Excitation method for the stepping motor

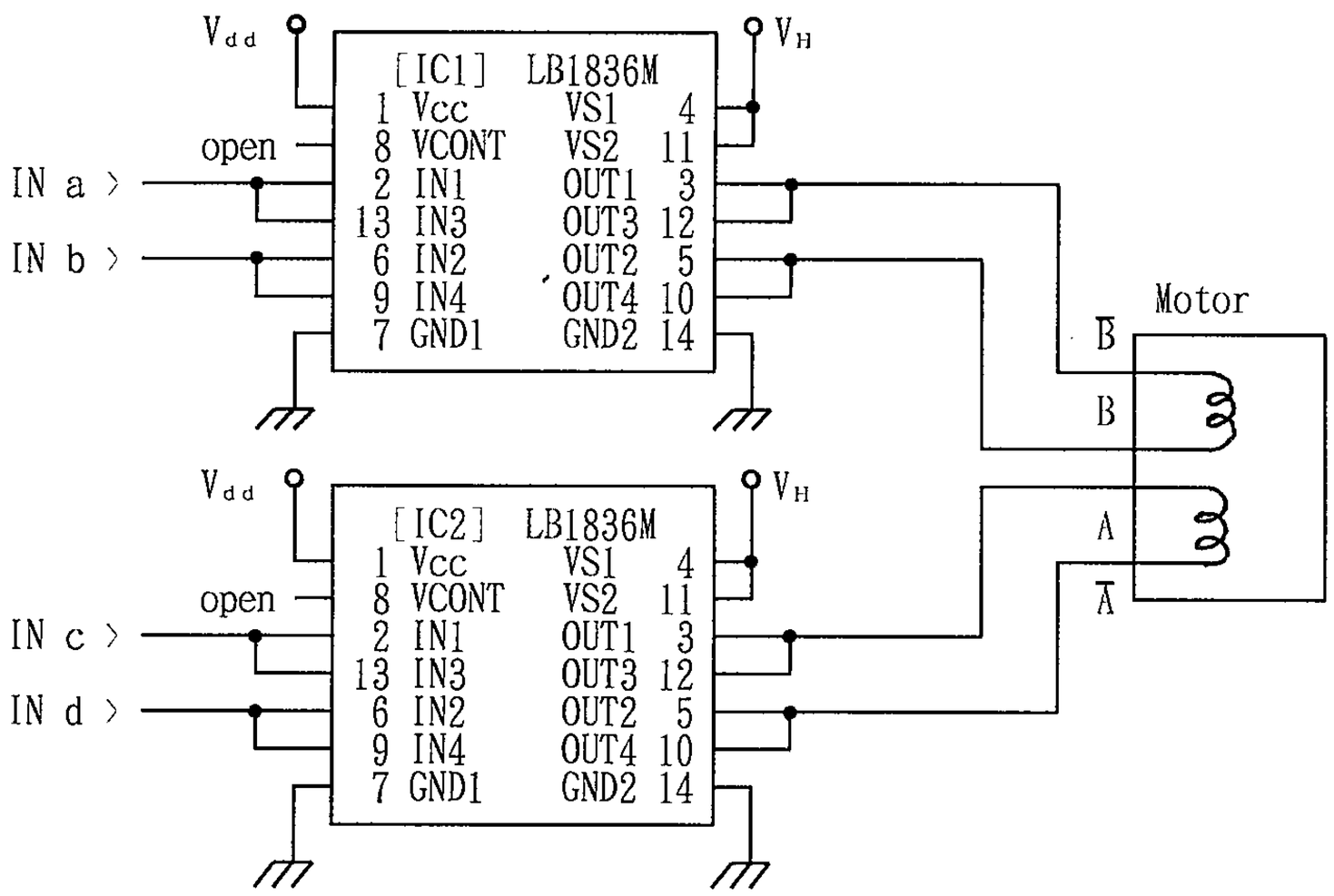
Excitation method	Phase	FPC pinNo.	← 1 dot →
2-2 phase (Bipolar driving)	$\overline{B}$	1	stand by
	A	3	
	B	2	
	$\overline{A}$	4	



1) Two steps of the motor correspond to one dot of paper feed.
2) When starting excitation of motor, the same excitation as the phase just before the stoppage should be performed first for one step time of motor frequency.

7-3 Example of driving circuit

motor driver: Sanyo LB1836M×2



Excitation method		← 1 dot →
2-2 phase (Bipolar driving)	I N a	
	I N b	
	I N c	
	I N d	

1) The IN__ signals in the above table indicate the input signals to the motor driver IC.
2) Switching the exciting phase in the order shown in the table above feeds the paper in the forward direction.

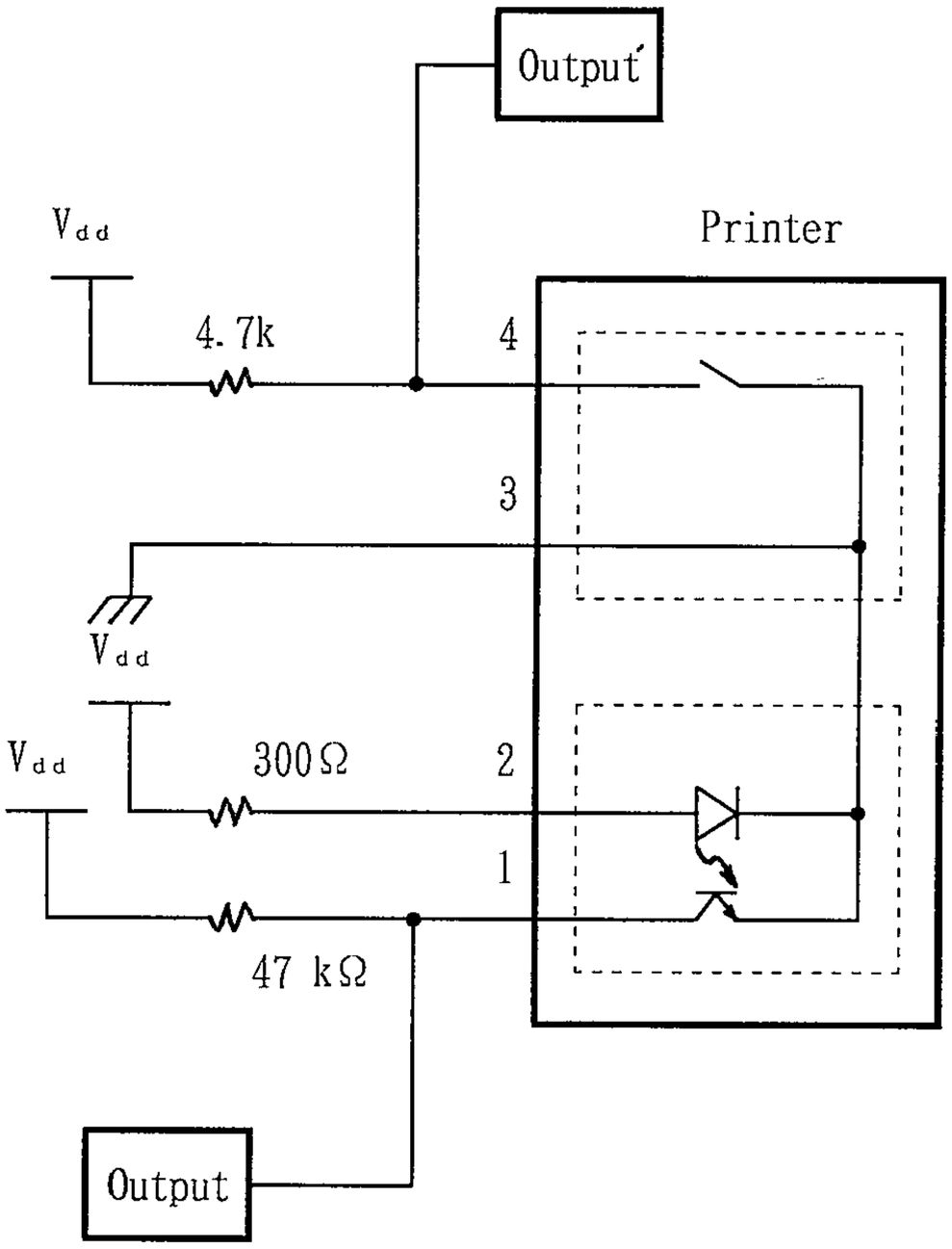
7-4. Cautions in motor driving

1. To prevent abnormal heating of the motor, do not apply power to the motor except when the paper is fed (or printed).
2. In case of restarting after stopping the motor, the stepping motor shall be excited for one step time of that printing speed from the stopping phase, and after that, the data shall be taken in.
3. Paper feeding of about 8 dot lines shall be made at applying the power to the printer.

Note	Format No. FORM1062. JBW
Established NOV/21/95	
Enforced MAY/21/96	

8. Sensors

8-1. Recommended circuit

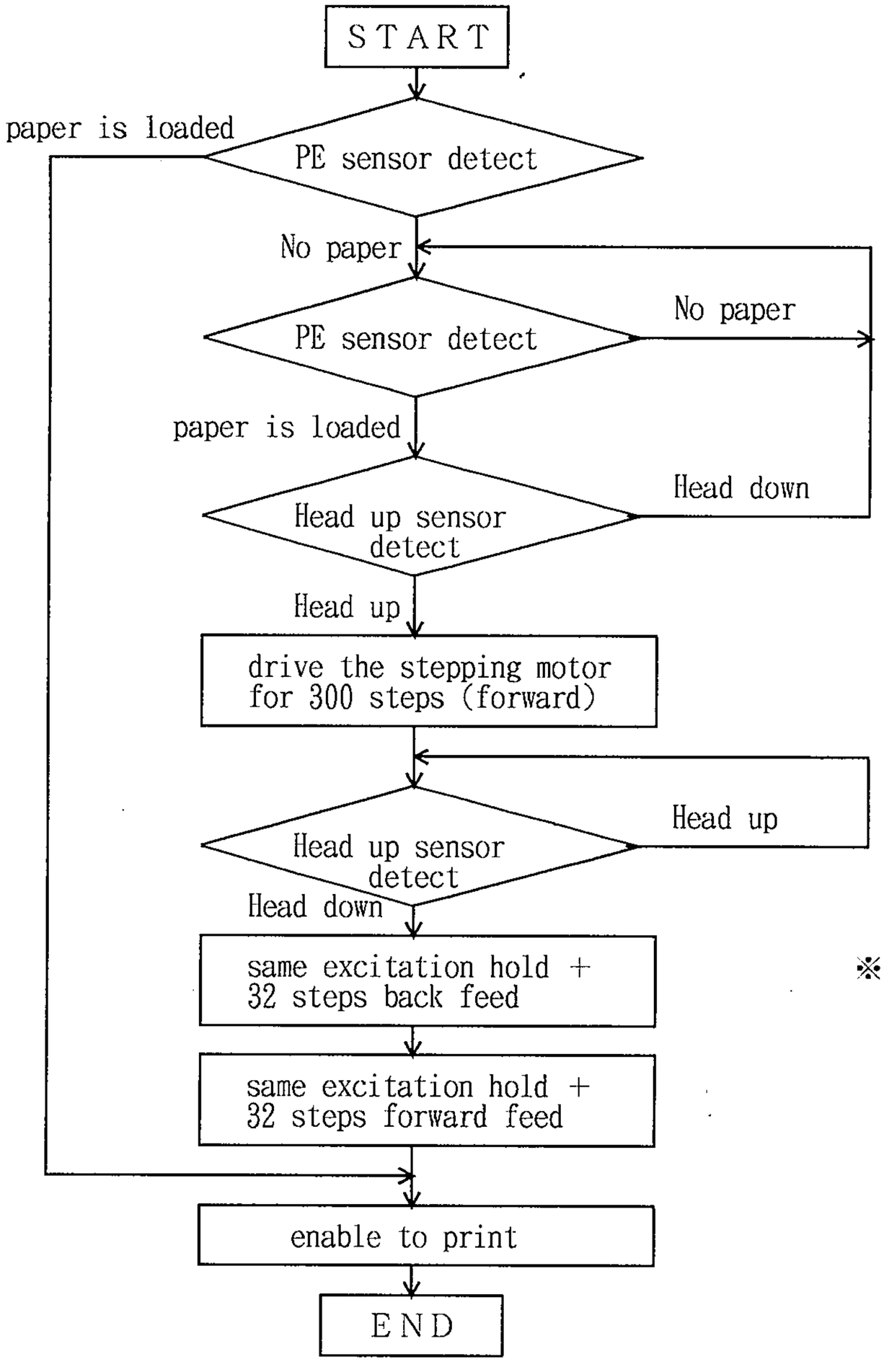


[mechanical contact switch]
(Head UP/DOWN detection)
Head UP :close
Head DOWN :open

[Photo-interrupter]
(No-paper detection)
L (Paper) : 0.8V max.
H (No paper): 3.5V min.

8-2. Application of paper end sensor(automatic paper loading)

Automatic paper loading is capable through the paper end sensor.
If recording paper is skew, drive the stepping motor until the paper becomes straight, or settle the paper by hand with the head-up state.



(300 steps shall be re-adjusted according to customer's housing of the terminal. Recommended paper feed speed : 500pps)

※ to cancel mechanical gap (backlash)

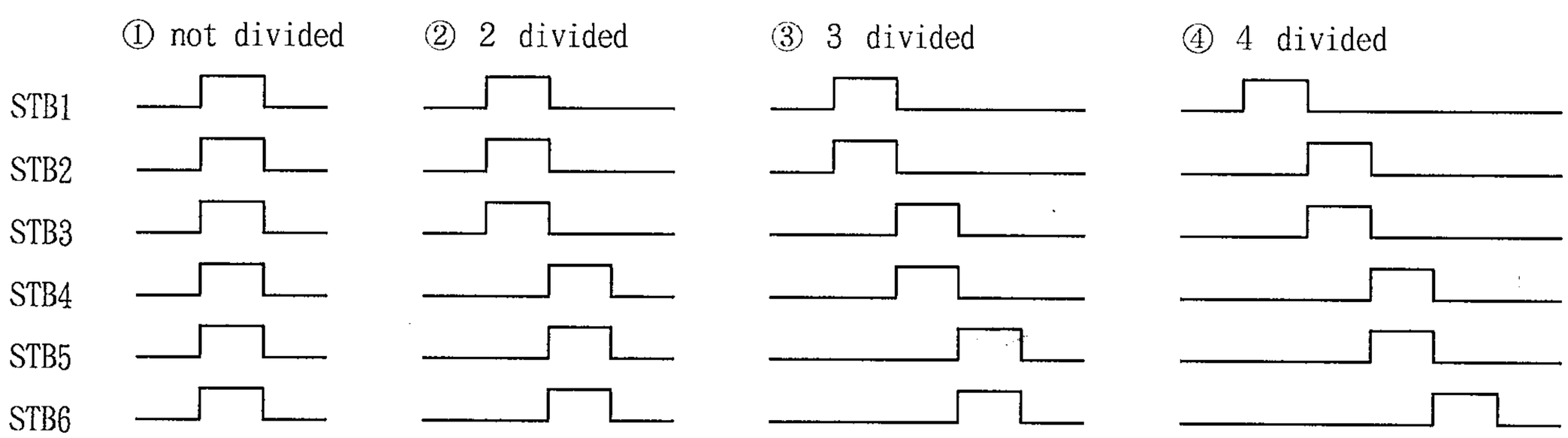
9. Printer control

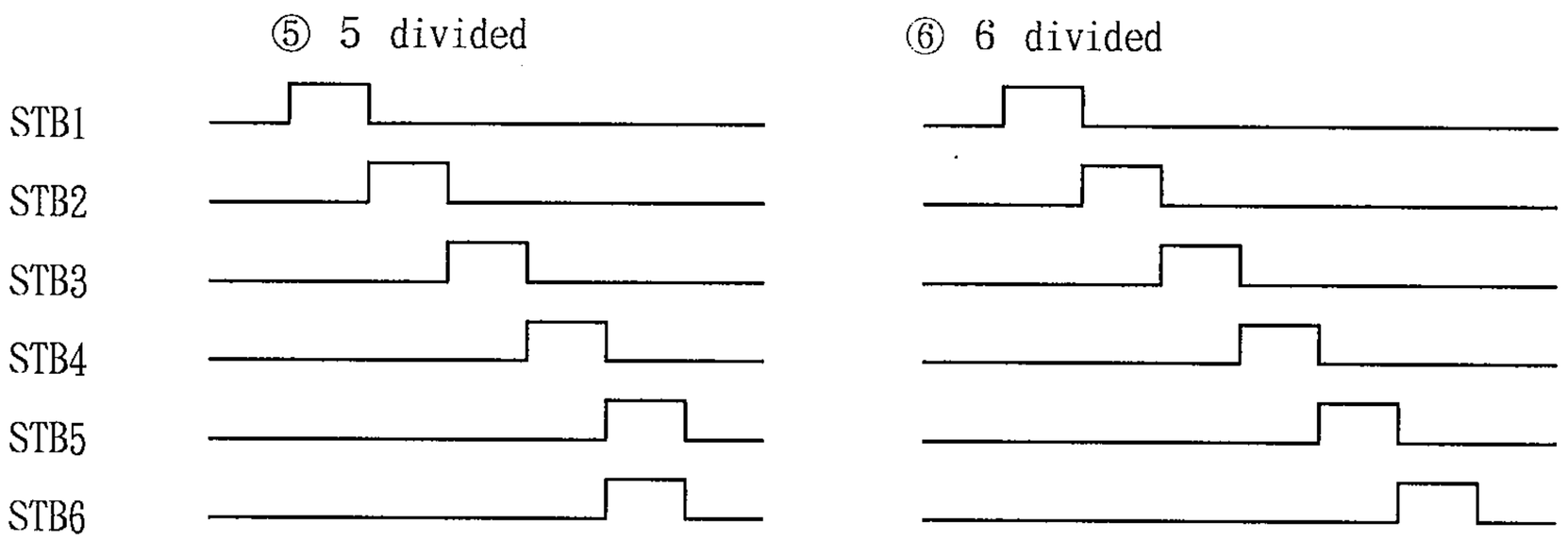
9-1 Variable divide printing

1) As shown in the next page, perform the divide printing up to maximum of 6 divisions according to the number of dots colored in one dot line. Set the number of divisions so that the number of dots colored at the same time does not exceed 64 dots.

2) If the number of divisions increases and the power-applied time to the head becomes long, extend the excitations time for the first step of the motor up to the end edge of the time to be fired off. As a basic rule, the phase switching for the second step of the motor shall be done from the time when the firing is completed. (At the standard voltage and temperature)

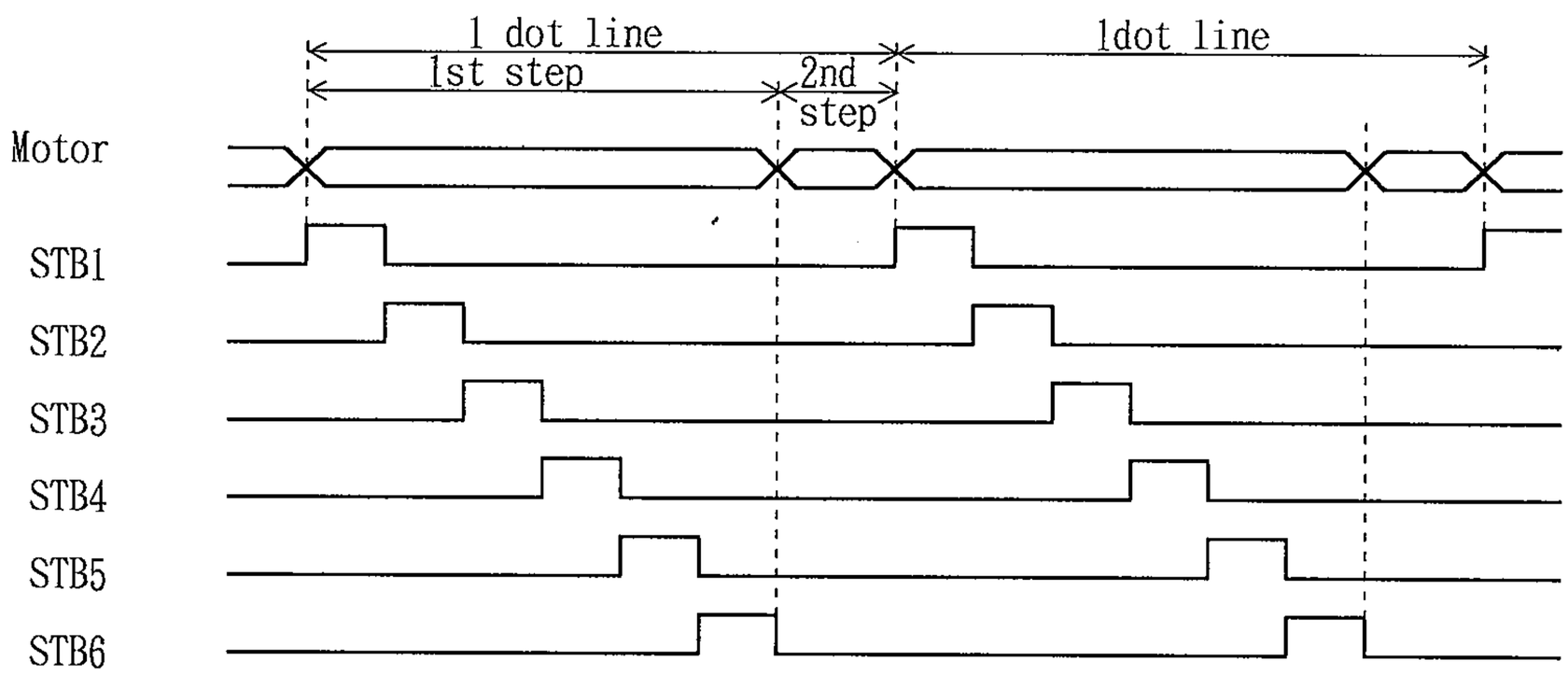
The timing of divided printing is shown as follows.



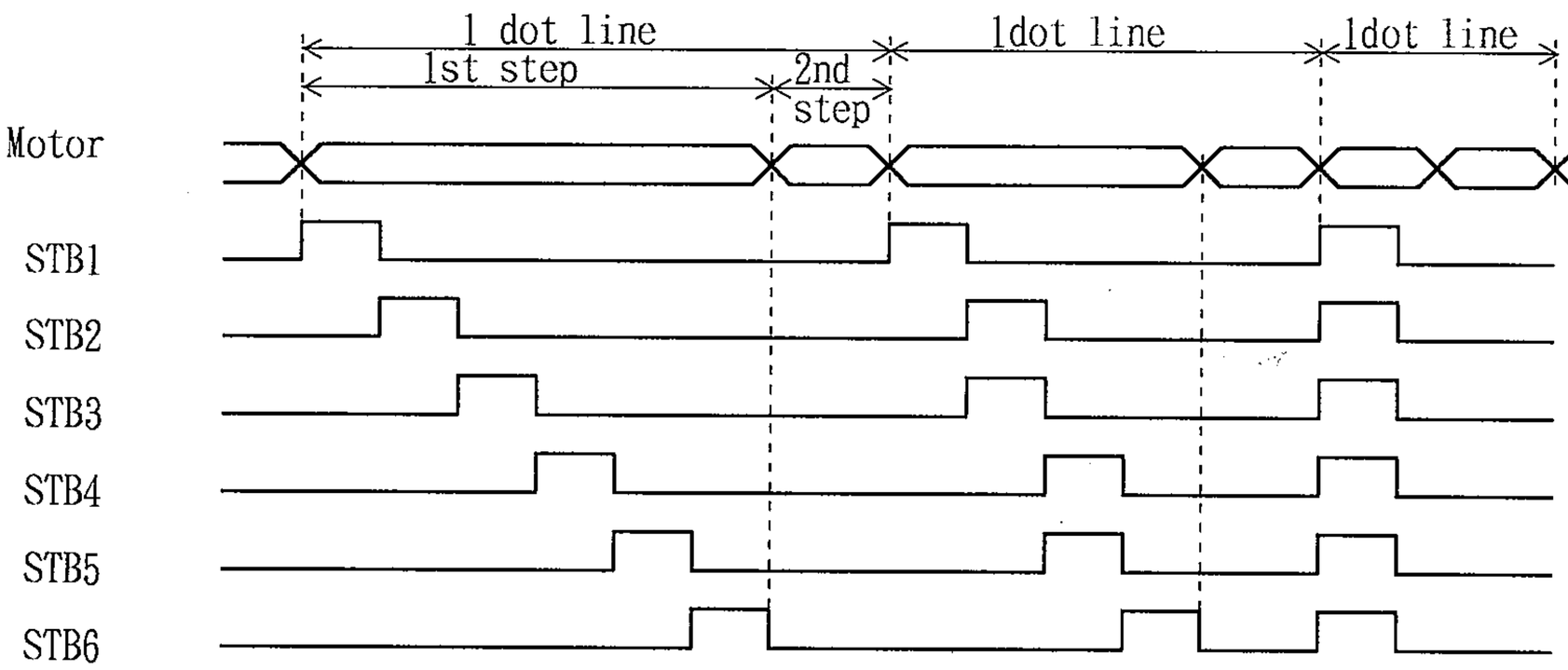


Example timing chart: stepping motor and thermal head

Case 1: Continuous 6 divided printing



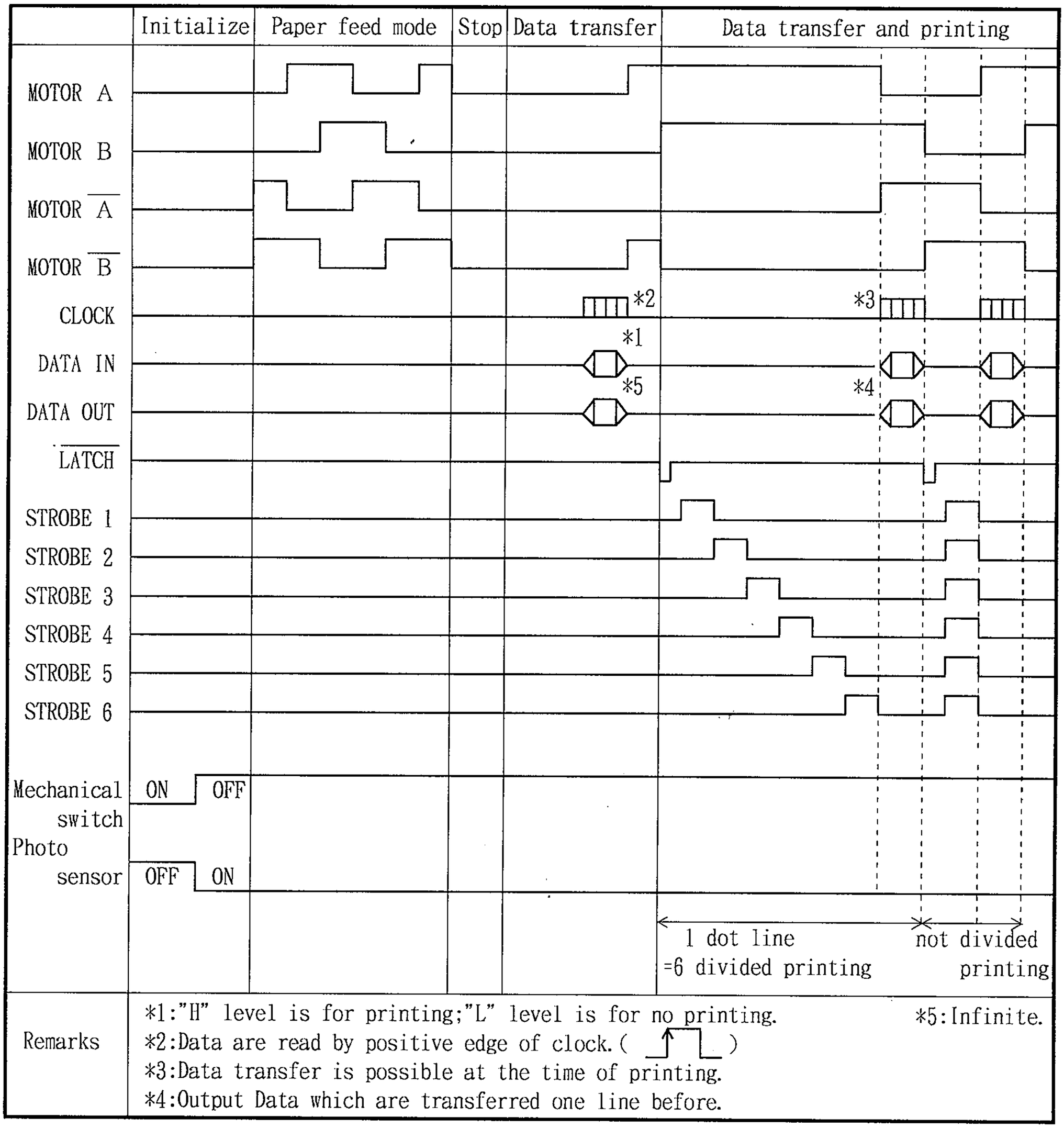
Case 2: Variable divided printing (6 divided →4 divided→not divided)



9-2 Timing chart of entire printer

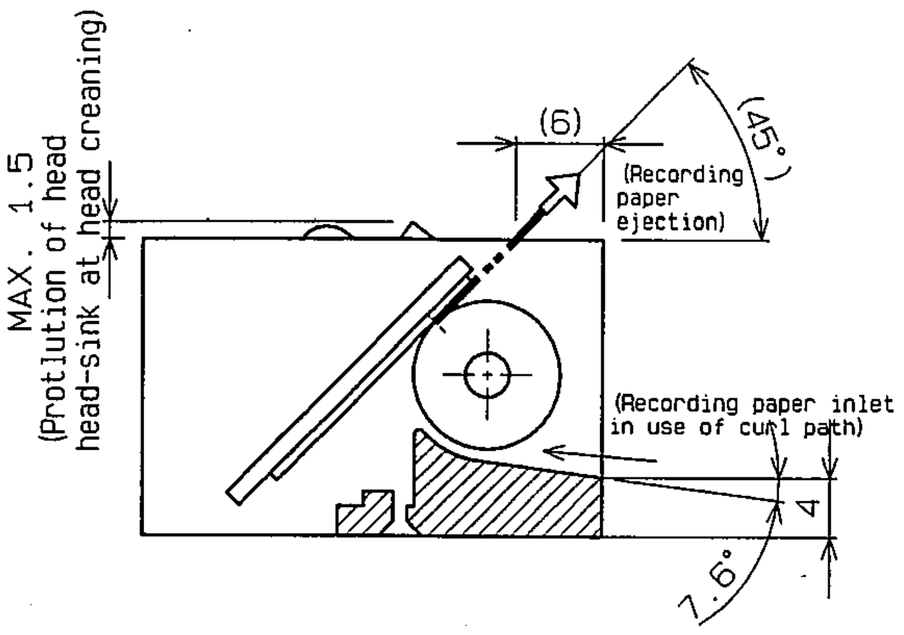
1) The timing of the entire printer is shown in the next page. In case of printing, the serial printing data are input by being synchronized with the CLK signal, and the printing data are stored at the timing of the LATCH signal. The stored printing data applies power to the heating element by the STB signal.
2) When printing, keep the mechanical switch OFF and the photo sensor ON.

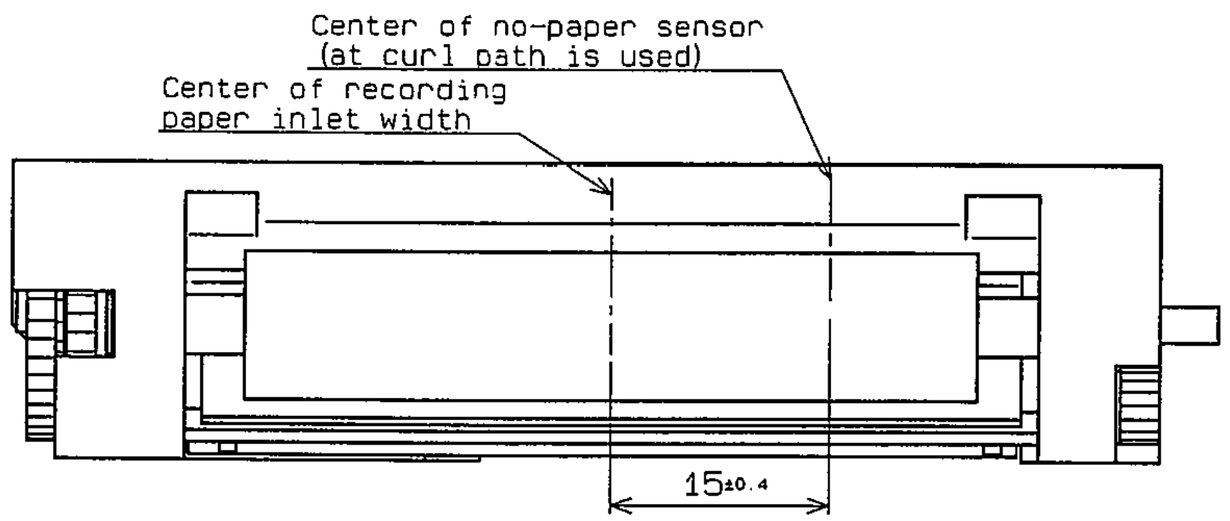
〈Operation sequence〉 Example 1.



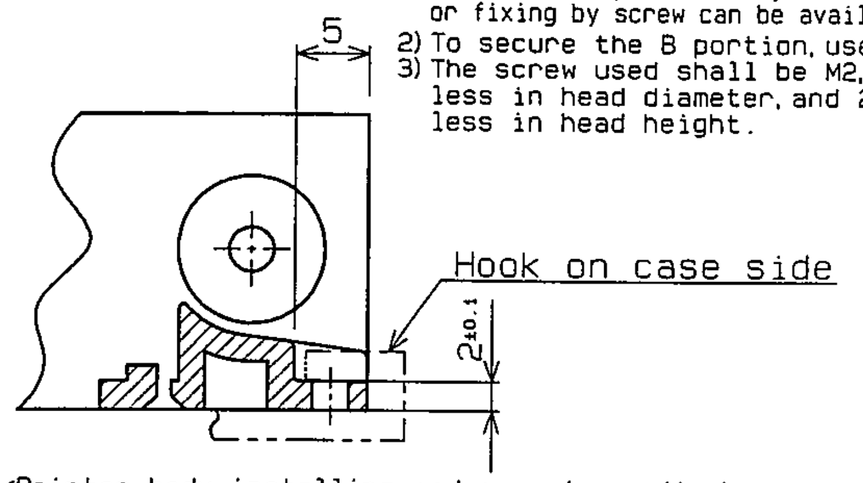
Remarks	*1:"H" level is for printing;"L" level is for no printing. *5:Infinite. *2:Data are read by positive edge of clock.(⌐↑¬) *3:Data transfer is possible at the time of printing. *4:Output Data which are transferred one line before.

10.Printer Appearance Drawing



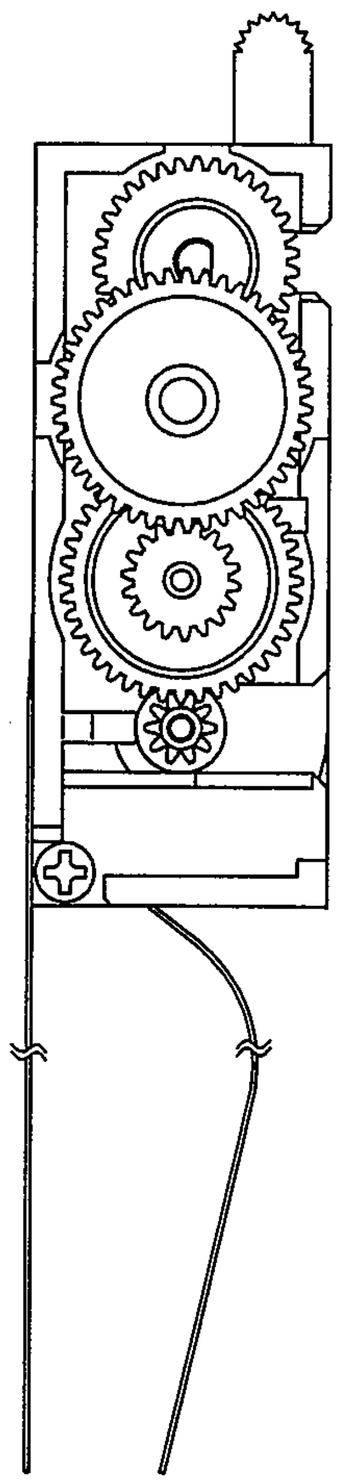


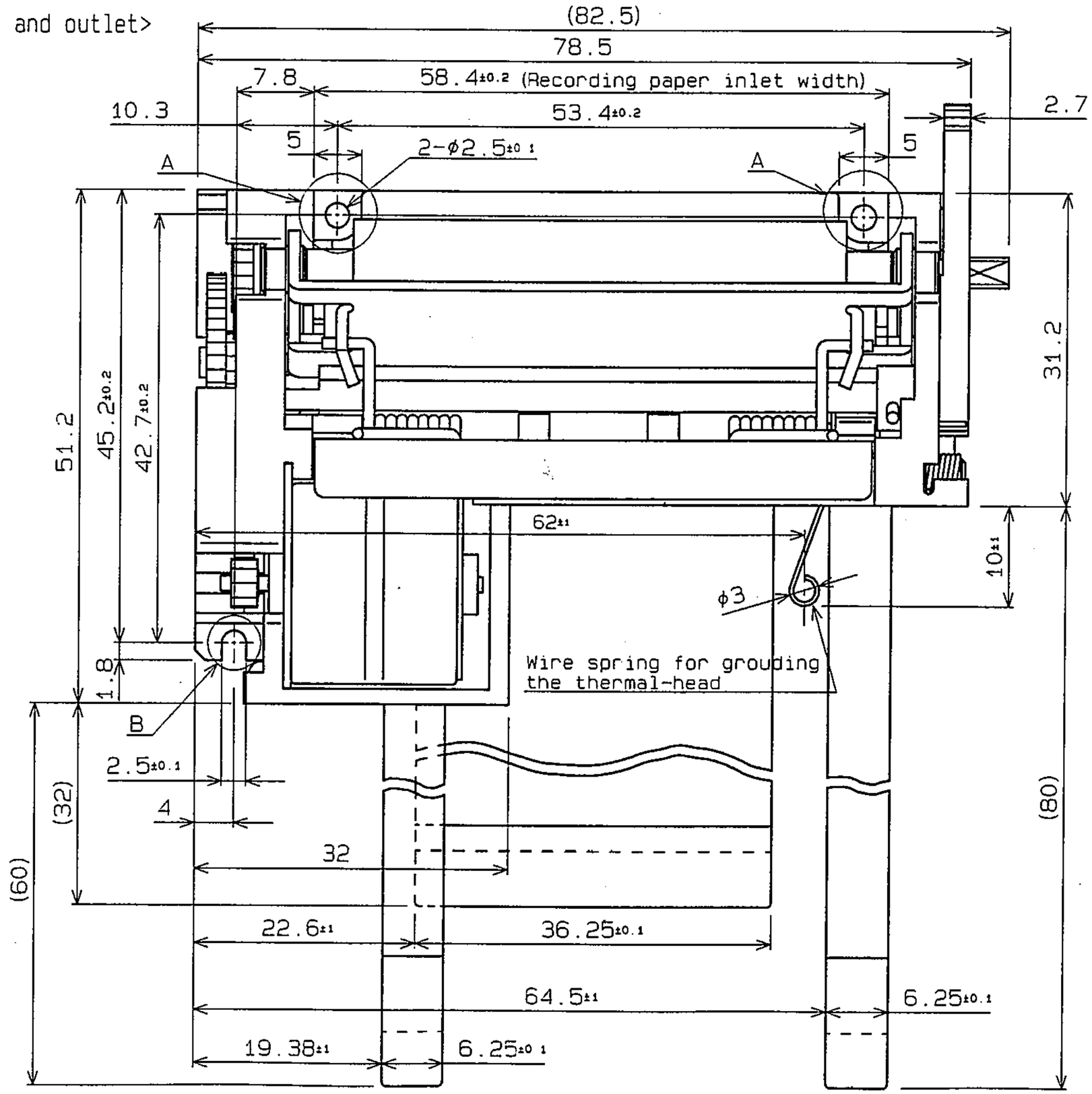
1) To secure the A portions (2 points), provide the case with hooks and then sandwich the printer body between them, or fixing by screw can be available.
2) To secure the B portion, use a screw.
3) The screw used shall be M2, 4mm or less in head diameter, and 2mm or less in head height.

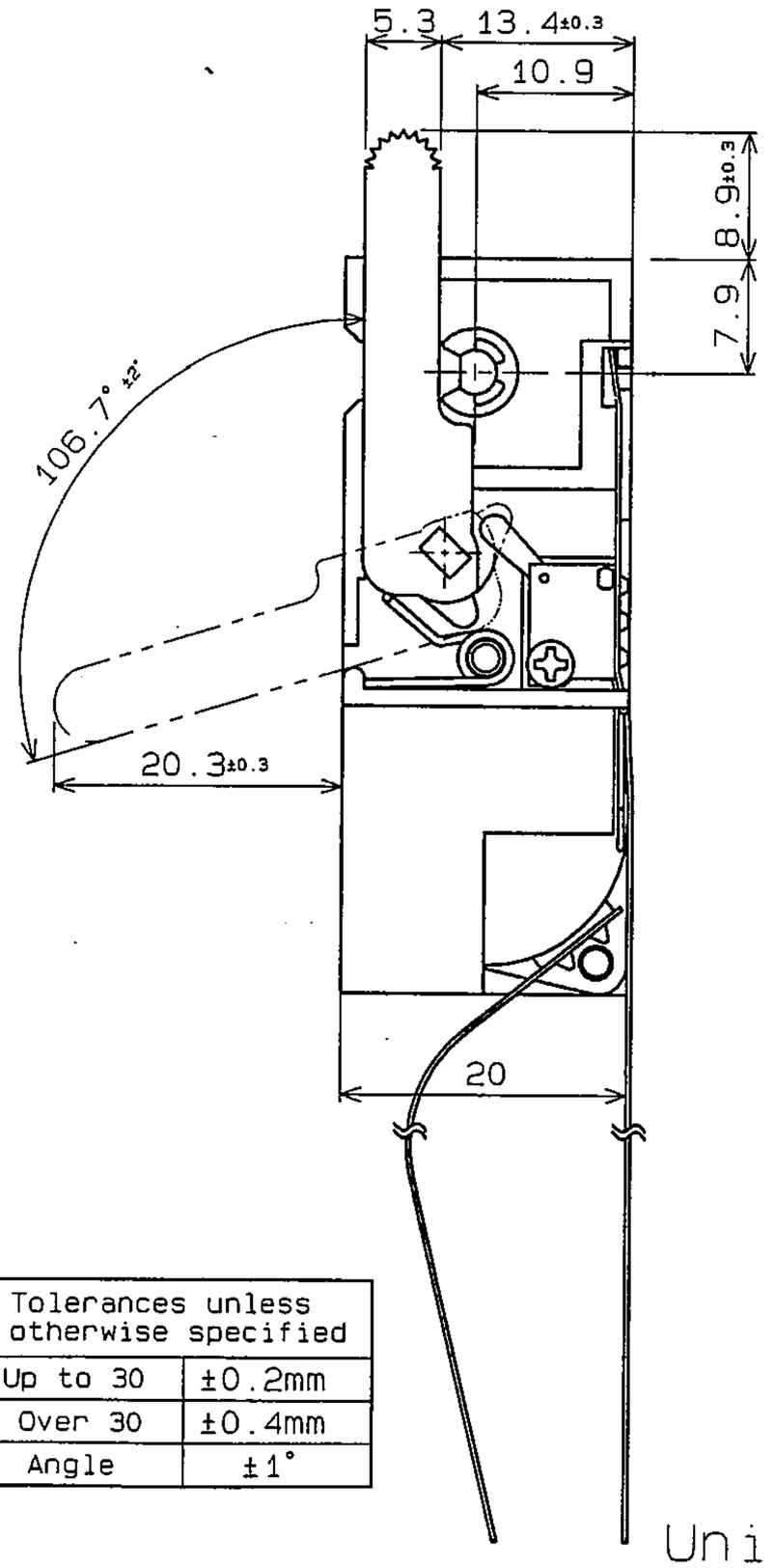


<Printer body installing and securing method>

<Dimensions of recording paper inlet and outlet>







Tolerances unless otherwise specified	
Up to 30	±0.2mm
Over 30	±0.4mm
Angle	±1°

Unit: mm