Line Thermal Printer Mechanism
Model:HM-080C

HWASUNG
ticket·kiosk printer

No.	Date	Remark	Page
1	06-03-14	Cutter IC changes as recommended.	14

TABLE OF CONTENTS

1. General Specification

1-1) Printing Specification
1) Printing Method   : Direct Line Thermal
2) Resolution：8dot/mm, 203dpi, 1dot=0.125mm
3) Total Dot   : 640dot/line
4) Printing Speed   : 160mm/sec (under 24V, 25℃)
5) Paper Width   : 80mm (Max.)   * Thickness : 65~110㎛
6) Printing Width   : 80mm
7) Average Resistance of Heating element : 800Ω±3%

1-2) Power Supply Voltage

Drive	24V±10%	Motor,TPH
Circuit	5V±5%	TPH Control, sensor

1-3) Paper Load
Below 180gf

1-4) Dimension (Please contact us about the dimension.)

1-5) Weight
xxxg(Without Auto- cutter)
xxxg(With Auto- cutter)

1-6) Options
1) Auto cutter (With Bracket)
2) Paper sensor (Curl Type)
3) Head cable

1-7) Environmental Conditions/Humidity
1) Operating temperature: 0～40℃
2) Operating humidity: 40～90%RH(non-condensing)
※ According to the operating condition the quality could be changed.

1-8) Environmental Conditions for Storage
1) Storage temperature : -25～40℃
2) Staorage humidity : 40～90%RH
※ within 12 months under the above conditions.

2. Detailed Specifications

2-1) Motor Specification

No.	Item	Rating
1	Phase	4phase
2	Phase output	2-2phase
3	Operating frequency	Max. 1600 PPS
4	Step angle	7.5°/Step
5	Rated Voltage	DC26.4V(STD. 24V)
6	Drive method	Bipolar or Unipolar constant current(chopper) drive
7	Drive current	460mA/phase
8	Drive circuit	Refer to Fig2-1 for suggested one
9	Coil Type	E type
10	Coil resistance	10.4Ω(Bipolar), 5.2Ω(Unipolar)

1) Drive sequence

	Drive IC input sequence		Drive IC output sequence				Direction	
Step	PH1	PH2	A	B	/A	/B	CW	CCW
1	H	H	H	H	L	L		
2	L	H	L	H	H	L		
3	L	L	L	L	H	H		
4	H	L	H	L	L	H		

※ **Note: To avoid the damage by motor heating, please drive by constant current (chopper).**
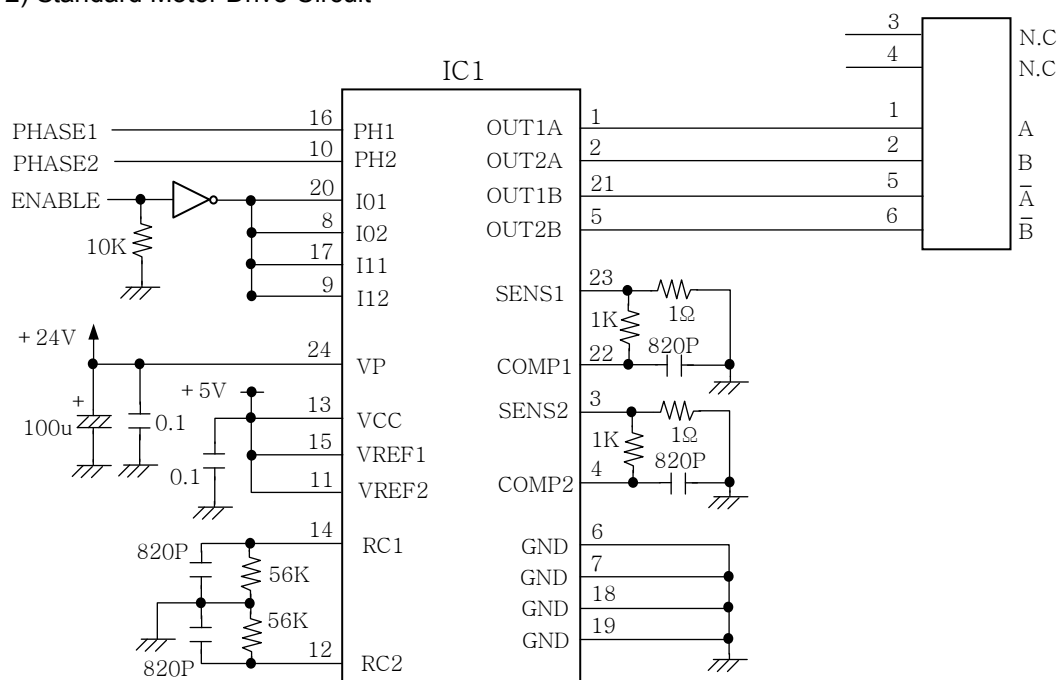
2) Standard Motor Drive Circuit

Fig2-1 Motor Drive Reference Value

(2-2 phase, Bipolar drive)

No.	Item	Part	Maker
IC1	Motor Driver	L6219DS	ST Micro
Axial Resister	1Ω, 1W		
Connector	for Motor	53014-0610	MOLEX

Table2-1 Reference (Drive Circuit)

3) Drive Method

First, Please drive 1STEP (rush step) with the last phase, when it stops.
Please drive constant time after motor accelerate gradually,
according to table 2-2 as shown.

Second, Please adjust adjust the motor speed slowly according to the user's system,
for the paper setting,

Third, The movement distance of motor 1 STEP is 0.125mm.

Vp = 24V

Step		Drive Cycle(mSec)
Rush	a	4.00
1	b1	2.76
2	b2	2.12
3	b3	1.79
4	b4	1.57
5	b5	1.42
6	b6	1.31
7	b7	1.22
8	b8	1.14
9	b9	1.08
10	b10	1.03
11	b11	0.98
12	b12	0.93
13	b13	0.88
14	b14	0.84
15	b15	0.81
16	b16	0.78
17	b17	0.75
18	b18	0.72
19	b19	0.69
20	b20	0.66
21	b21	0.63
Constant	c	0.62
Stop	OFF	-

Table2-2 For Motor Accelerating

2-2) Thermal Head

1) Reliabilty : 100Km(1 x 100,000,000 Pulse)

2) Maximum Conditions

Item	Symbol	Rated Value				Unit	Condition	
Scanning Line Time	SLT	0.63	0.69	0.83	1.25	ms/line		
Supply Energy	E0max1	0.19	0.20	0.25	0.33	mJ/dot	*1	T=25℃
	E0max2	0.15	0.16	0.18	0.23	mJ/dot	*2	
On Time	ton max	430				uSec		
Supply Voltage	Vmax	26.4				V		
Supply Power	P0max	0.79				W/dot		
Supply Current	I0max	10.1				A	320 dots are pulsed	
Number of Strove	STBmax	2				-		
Number of Heating Dots at Same Time	Ndotmax	320				dots		
Substrate Temperature	Tmax	70				℃		

Table 2-3

Thermal Head Rating

*1 : The adjacenting dot at the same time is once 2dot pulsed.
*2 : The adjacenting dot at the same time is once 3dot pulsed.

3) Standard Drive Values

Item	Symbol	Reference				Unit	Conditions
Supply Voltage	Vset	24				V	Rave=800Ω
Supply Power	P0	0.65				W/dot	Ndot=320
Scanning Line Time	SLT	0.63	0.69	0.83	1.25	ms/line	
ON TIME (ton)	E0	0.12	0.13	0.15	0.16	mJ/dot	
	(ton)	0.18	0.20	0.23	0.25	ms	T=25℃
Supply Current	I0	9.2				A	

Table 2-4 std. drive value

Please refer to the below formula for ON TIME(ton) calculating.

$$P_0 = I_0^2 \times Rave = \frac{Vset^2}{(Ndot \times Rcom + Rave + Ric)^2} \times Rave$$

$$E_0 = ton \times P_0$$

> Rave = 800Ω (Average Resistance)
> Rcom = 0.05Ω (Common Resistance)
> Ric = 20Ω (On Resistance of Driving IC)

4) Electrical Characteristic

Item	Symbol	Reference			Unit	Conditions
		MIN	TYP	MAX		
Average Resistance Value	Rave	776	800	824	Ω	Standard printing conditions
Output Supply Voltage	Vset	-	-	26.4	V	
Circuit Supply Voltage	VDD	4.75	5.0	5.25	V	
Supply Current	IDD	-	-	70	mA	ALL HIGH
H Level Input Voltage	VIH	0.7×VDD	-	VDD	V	
L Level Input Voltage	VIL	0	-	0.3×VDD	V	
H Input Current	IIH	-	-	0.5	µA	VDD=5V,VIH=5V
L Input Current	IIL	-	-	0.5	µA	VDD=5V,VIL=0V
DO Leakage Current	ILEAK	-	-	6.4	mA	ALL LOW
Clock Frequence	t1	-	-	8	MHz	Fig2-2 reference
Clock Pulse Width	t2	70	-	-	ns	
Clock SI setup time	t3	50	-	-	ns	
Clock SI hold time	t4	10	-	-	ns	
Latch Pulse Width	t5	100	-	-	ns	
Clock Latch setup time	t6	100	-	-	ns	
Clock Latch Hold time	t7	50	-	-	ns	
STROBE Delay time	t8	-	0.5	2.0	µs	
DO Fall time	t9	-	0.2	0.5	µs	
DO Rise time	t10	-	1.0	2.0	µs	

Table 2-5 Electrical Characteristic
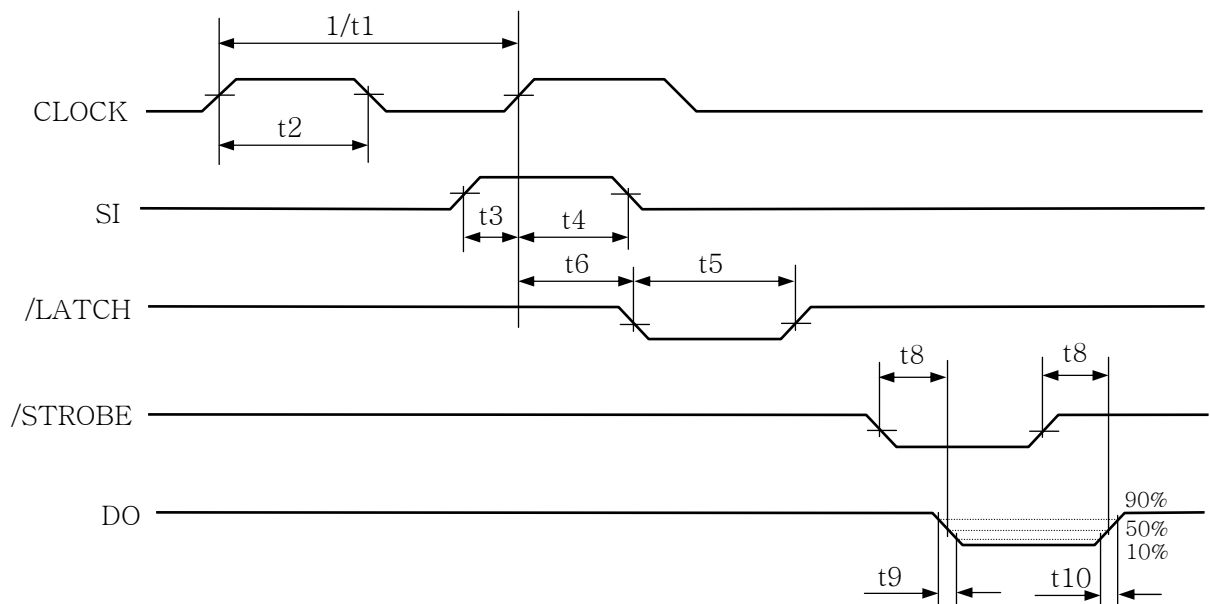
Fig 2-2 Timing chart

5) Thermistor characteristic

①Electrical Characteristic

Item	Reference value	Unit	Contition
Resistance	30K ± 5%	Ω	25℃
B constant	3950 ± 2%	K	

②Range

Item	Reference value	Unit	Condition
Application Temperature	-40 ~ 125℃	℃	
Dissipation Constant	1.5	mW/℃	
Time Constant	5	sec	
Maximum Power	400	mW	25℃

③Thermistor characteristics
  Resistance as a function of temperature can be calculated.

   $Rx = R_{25} \times EXP(B \times (1/(T+273)-1/(25+273)))$

    T : Temperature(℃)
    Rx : : Thermistor resistance of T℃
    R_{25} : Thermistor resistance of 25℃
    B : B constant(3950K)

Temp. (℃)	Res. (KΩ)	Temp. (℃)	Res. (KΩ)	Temp. (℃)	Res. (KΩ)	Temp. (℃)	Res. (KΩ)
-40	1205.579	10	60.524	60	7.458	110	1.587
-35	844.731	15	47.511	65	6.259	115	1.390
-30	600.612	20	37.606	70	5.280	120	1.221
-25	432.951	25	30.000	75	4.475	125	1.077
-20	316.154	30	24.111	80	3.811	130	0.952
-15	233.694	35	19.517	85	3.260	135	0.844
-10	174.737	40	15.904	90	2.801	140	0.751
-5	132.078	45	13.044	95	2.416	145	0.670
0	100.862	50	10.765	100	2.093	150	0.599
5	77.774	55	8.935	105	1.819		

Table 2-6 Thermister Temperature Characteristic

6) Thermal head operation caution

① When the switch is ON , VDD(5V) is ON first, and then Vset(24V) is ON later.
  When the switch is Off, Vset is Off first, and then VDD is Off later.
② To prevent from the corrosion of thermal head, pls remember that the Head Voltage (Vset) should be switched On once printing , turn OFF once non printing.
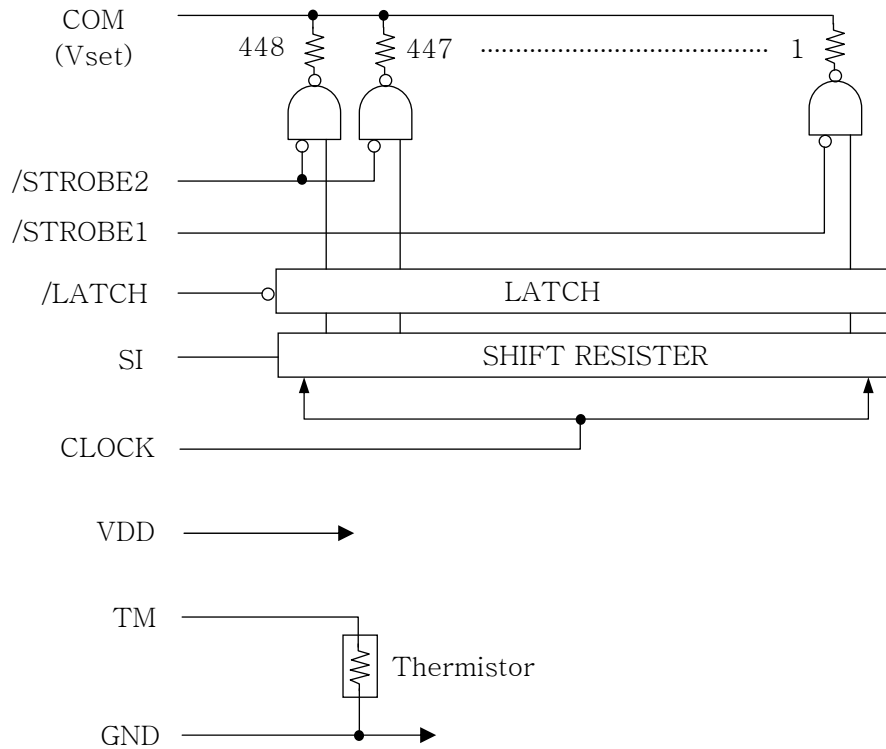 (Pls make sure to use the transistor or to relay for ON/OFF control)

7) TPH Block Diagram

Fig2-3 Thermal Head Block Diagram

STROBE No.	Dot No.	Dot
1	1 ~ 320	320
2	321~ 640	320

2-3) Paper sensor

Photo sensor equips the foto sensor to check if the paper is in or not.

1) Part No : SG-105F(reflection type, Codensi)
2) Rating

	Item	Symbol	Max.	Unit
Input	Forward Current	I_F	50	mA
	Reverse Voltage	V_R	5	V
	Supply Power	P_D	75	mW
Output	C-E Voltage	V_{CEO}	30	V
	E-C Voltage	V_{ECO}	3	V
	Collector Current	I_C	20	mA
	Collector Power Supply	P_C	50	mW

	Title	Rev.	Page
HWASUNG ticket-kiosk printer	HM-080C	Ver1.0	P.9

3) Electrical Characteristic

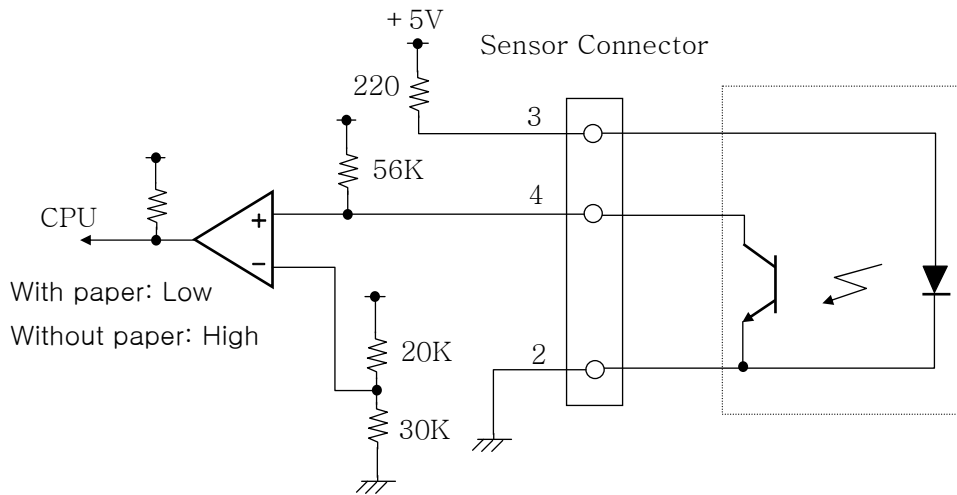| Item		Symbol	Condition	MIN	TYP	MAX	Unit
Input	Forward Current	V_F	I_F=10mA	-	-	1.3	V
	Photo Current	I_R	V_R=5V	-	-	10	µA
Output	Dark Current	I_{CEO}	V_{CE}=10V	-	-	0.2	µA
Trancefer	Photo Current	I_C	I_F=10mA,V_{CE}=5V	90	-	-	µA
Characteristic	Leakage Current	I_{LEAK}	I_F=10mA,V_{CE}=5V	-	-	0.2	µA
	Rise time	tr	V_{CC}=2V,I_C=0.1mA	-	30	-	µs
	Fall time	tf	R_L=1KΩ	-	25	-	µs

Fig2-4 Paper Sensor

2-4) Head up detector switch

It includes the micro switch for Head up detecting.

1) Rating
①Power Votage : DC 5V±5%
②Current : 0.5A
③Rating Voltage : DC 30V

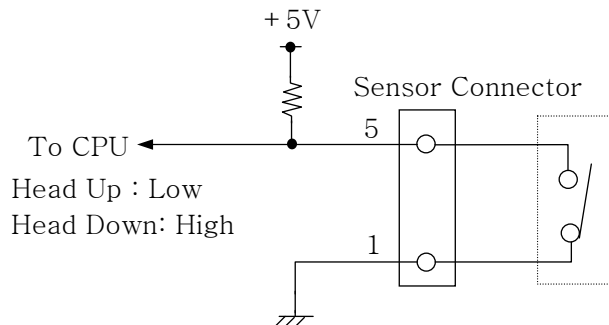Fig2-5 Head Up Detector

2-5) Connector

Please refer to the below 3 type of connector.

1)Connector for Motor

Mechanism : 51004-0600 (MOLEX)

Control B/D : 53014-0610 (MOLEX)

Pin No.	Color	Circuit Name	
1	Black	A	φ1
2	Brown	B	φ2
3	Red	+24V	Only Unipolar drive *1
4	Red	+24V	Only Unipolar drive *2
5	Orange	/A	φ3
6	Yellow	/B	φ4

※ *1,*2 : Don't use when Bipolar drive.

Table 2-7 Motor Pin arrangement

2) Connector for TPH

Mechanism : S15B-PH-K-S(JST)

Control B/D: PHR-15(JST) or GIL-S-15S-S2C2(LG CABLE)

Pin No.	Circuit	
1	COM	+24V
2	COM	+24V
3	GND	
4	GND	
5	V_{DD}	
6	TM	Thermistor
7	/STROBE1	Low Active
8	/STROBE2	Low Active
9	CLOCK	
10	/LATCH	Low Active
11	SI	
12	GND	
13	GND	
14	COM	+24V
15	COM	+24V

Table 2-8 TPH Pin arrangement

3) Connector for Sensor

Mechanism : 51004-0500(MOLEX)

Control B/D : 53014-0510(MOLEX)

Pin No.	Wire Color	Signal	
1	Black	GND	
2	Black	GND	
3	Brown	V_A	Must be connect with current limit resistance.
4	Red	Paper Detection	Full up resistance is needed.
5	Orange	Head Up	Full up resistance is needed.

Table 2-9 Sensor Pin arrangement

3-1) High-Speed mode

1) When start printing, first, outputted phase before stop, should be rushed step with same phase. Second, slow up driving gradually, according to the table 2-2 as shown, and then drive constant time.

2) Print 1 dot line per motor 1step

The high speed mode can be driven 640dots at one time, without STROBE signal split.

3) When stopping, all phase is OFF without the deceleration control.

4) After print one line, if the next editing time is long and the constant time is not valid in motor speed (max.1600pps), pls do the acceleration control again from the beginning ,according to the table 2-2.
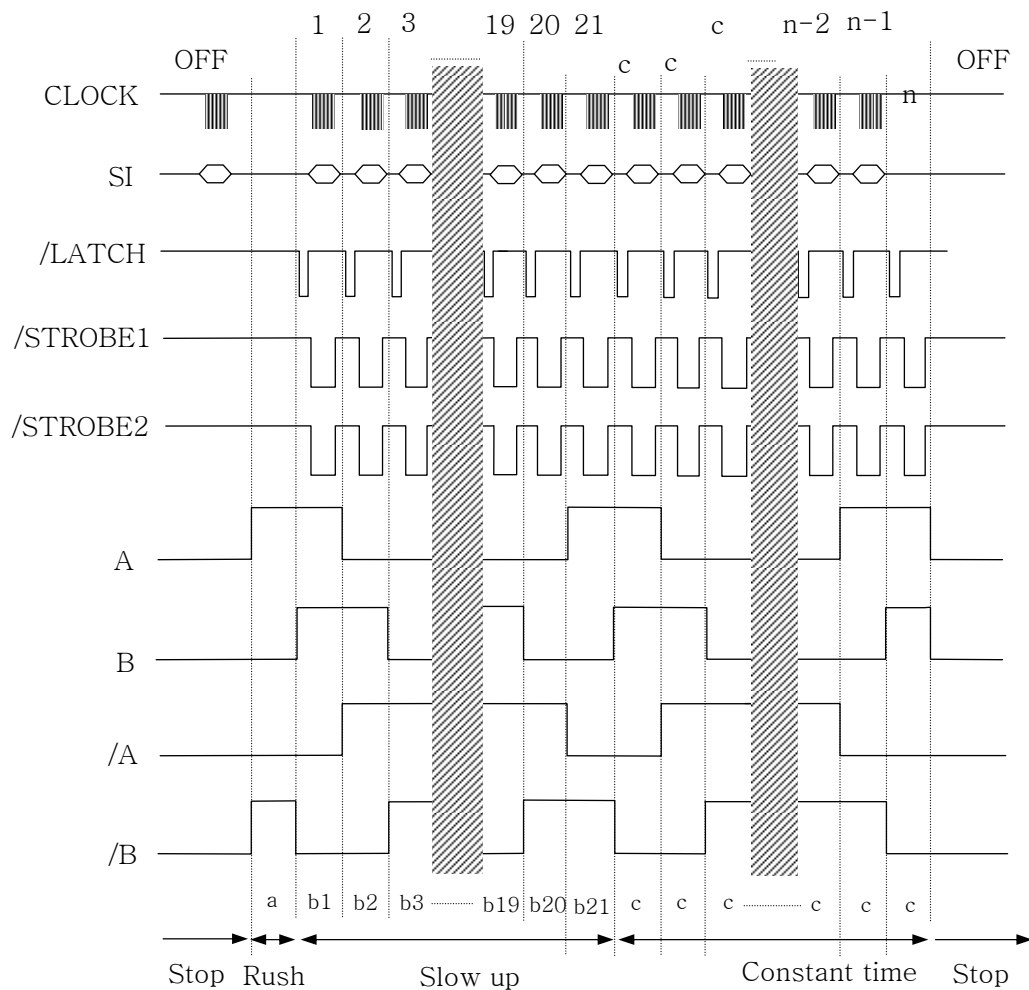

Fig 3-1. Print Timing Chart

HWASUNG ticket-kiosk printer	Title	Rev.	Page
	HM-080C	Ver1.0	P.12

3-2) Low Power Mode / Split Mode

1) Use this mode once the power supply is deficient.
2) As well with high speed mode, first, pls output the rush step with outputted phase before stop, same phase.
   Second, pls drive the constant time gradually according to table 2-2 as shown.

3) Printed 1 dot line per motor 1step.
   In case of the low power mode, the STROBE should be divided in 320 & 320 dot (2-split).

4) Once stop, all phase is OFF without deceleration control.
5) After print one line, if the next editing time is long and the constant time is not valid in motor's speed (max 1600pps), pls do the slow up control again from the beginning according to table 2-2 as shown.
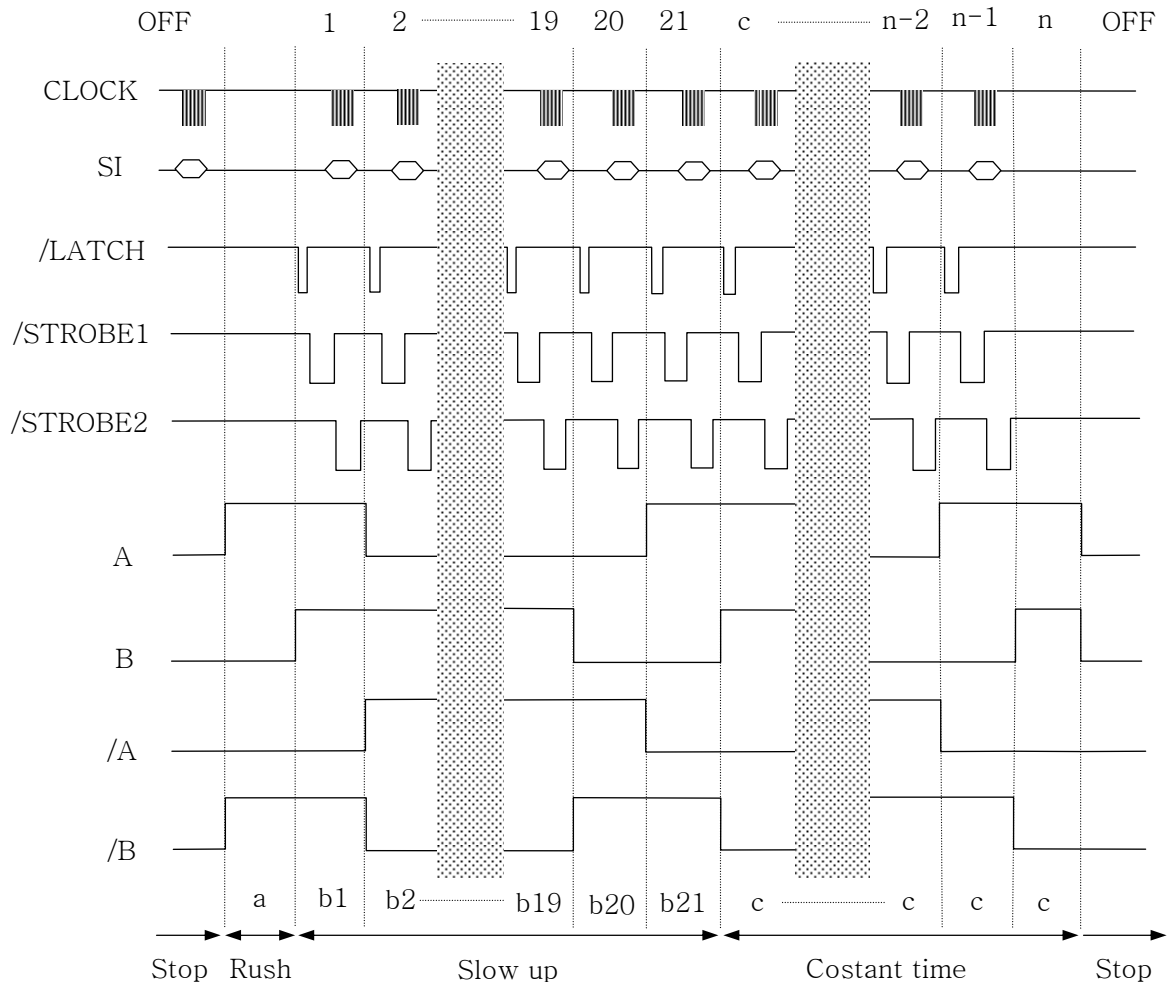

Fig3-2. Print Timing Chart

4.Auto Cutter (option)

4-1) Rating
  1) Motor   : DC24V±5%(MAX. 1A)
  2) Micro S/W   : DC5V±5%(MAX. 5mA)

4-2) Cutting Capability : Paper With 80mm(MAX), Thickness 150μm(MAX)

4-3) Reliability   : 300,000 cut
4-4) Cutting frequency : 0.4sec/cycle
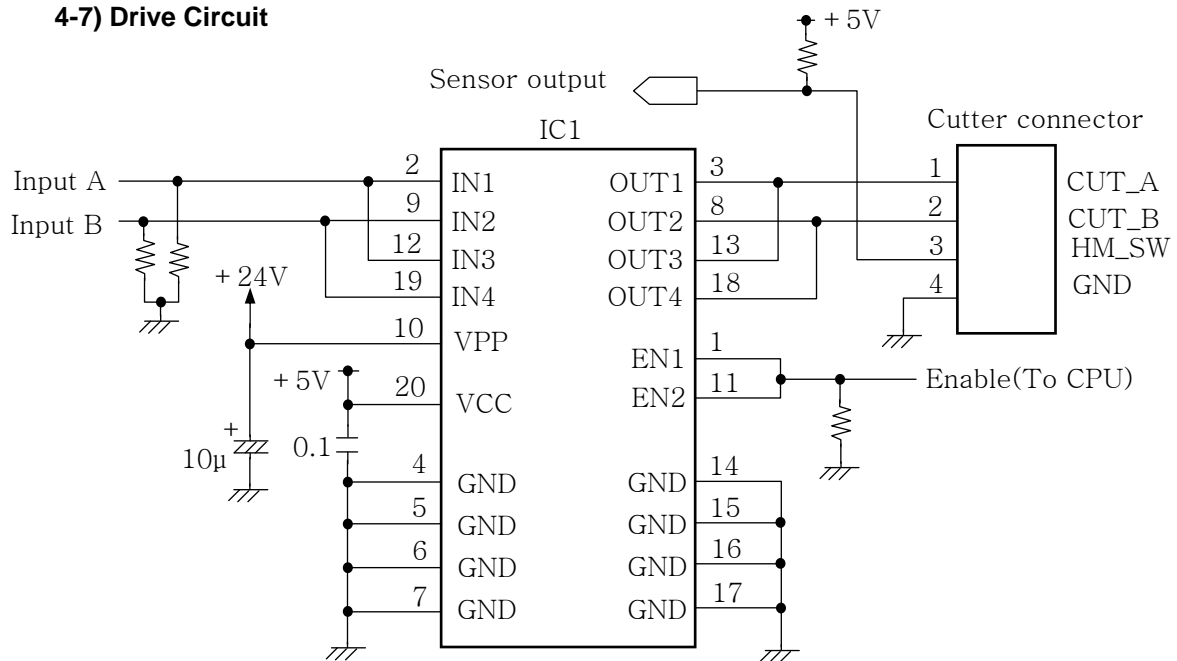
4-5) Maximum Cutting Counts : 30cuts/Min

4-6) Connector
  Cutter : 5264-04 (MOLEX)
  Control B/D : 5267-04A (MOLEX)

Pin No.	Wire Color	Circuit
1	Red	Operate signal (CUT_A)
2	Black	Operate signal (CUT_B)
3	White	Micro S/W (HM_SW)
4	White	Micro S/W (GND)

4-7) Drive Circuit

* Caution : Pls connect the resistance of pull down in Drive Signal A & B,
     to prevent IC damage once powered.

Fig4-1.Example Cutter operating circuit

No.	Item	Part No	Maker
IC1	Motor Driver	L293DD	ST MICRO
Connector	Cutter Connector	5267-04A	MOLEX

4-8) Operating Method
Please refer to the below Timing Chart for drive.

1) Full Cutting
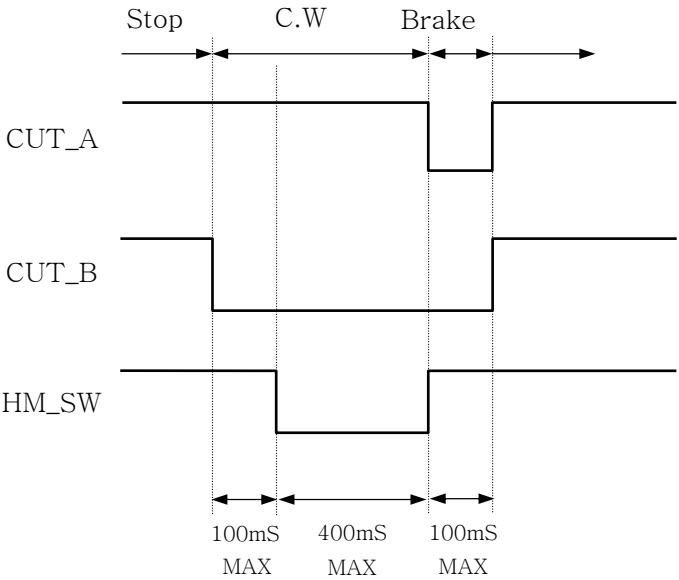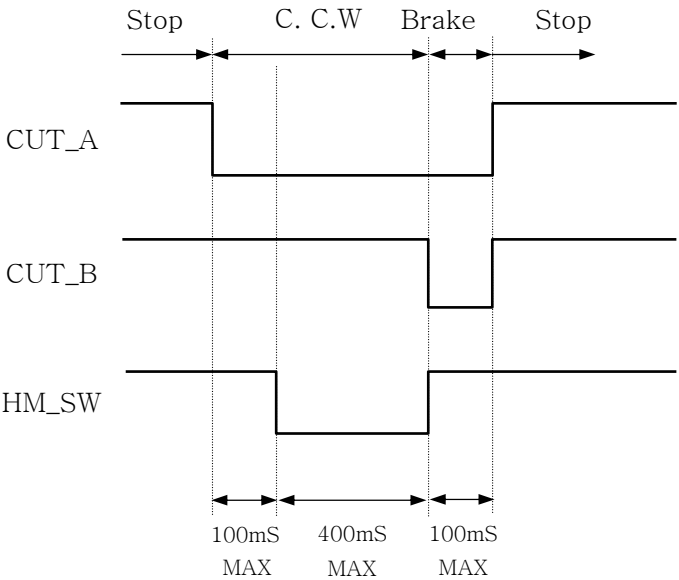

Fig4-2.Full Cutting timing chart

2) Partial Cutting

Fig4-3.Partial Cutting Timing chart

	Title	Rev.	Page
HWASUNG ticket-kiosk printer	HM-080C	Ver1.0	P.15

The thermal paper recommended for Thermal Print Head / Auto cutter.		
Model	**Part**	**Paper recommended**
HMC-060	TPH	MODEL : TF50KS-E2D (NIPPON PAPER)
HM-060C	AUTO CUTTER	CALIPER : 65-180 μm
HMC-080	TPH	MODEL : TF50KS-E (NIPPON PAPER)
HM-080C	AUTO CUTTER	CALIPER : 65-110 μm
HMK-060	TPH	MODEL : TF50KS-E2D (NIPPON PAPER)
	AUTO CUTTER	CALIPER : 65-180 μm
HMK-080	TPH	MODEL : TF50KS-E (NIPPON PAPER)
	AUTO CUTTER	CALIPER : 65-110 μm
HMKP-080	TPH	MODEL : TF50KS-E (NIPPON PAPER)
	AUTO CUTTER	CALIPER : 65-110 μm
HMK-825	TPH	MODEL : TF50KS-E2D (NIPPON PAPER)
	AUTO CUTTER	CALIPER : 65-110 μm
	AUTO CUTTER	CALIPER : 65-110 μm
HMKP-825	TPH	MODEL : TF50KS-E2D (NIPPON PAPER)
	AUTO CUTTER	CALIPER : 65-110 μm
HP-058	TPH	MODEL : TF50KS-E2D (NIPPON PAPER) MODEL : PD190R (OJI PAPER) MODEL : PD160R-N (OJI PAPER) MODEL : PD160R-63 (OJI PAPER)
	AUTO CUTTER	CALIPER : 60-80 μm

* **If it is the thermal paper which does not recommend as those above, the lifes at TPH and Cutter could be changed.**

* **If it is the thermal paper which does not recommend as those above, the printing condition could be changed.**