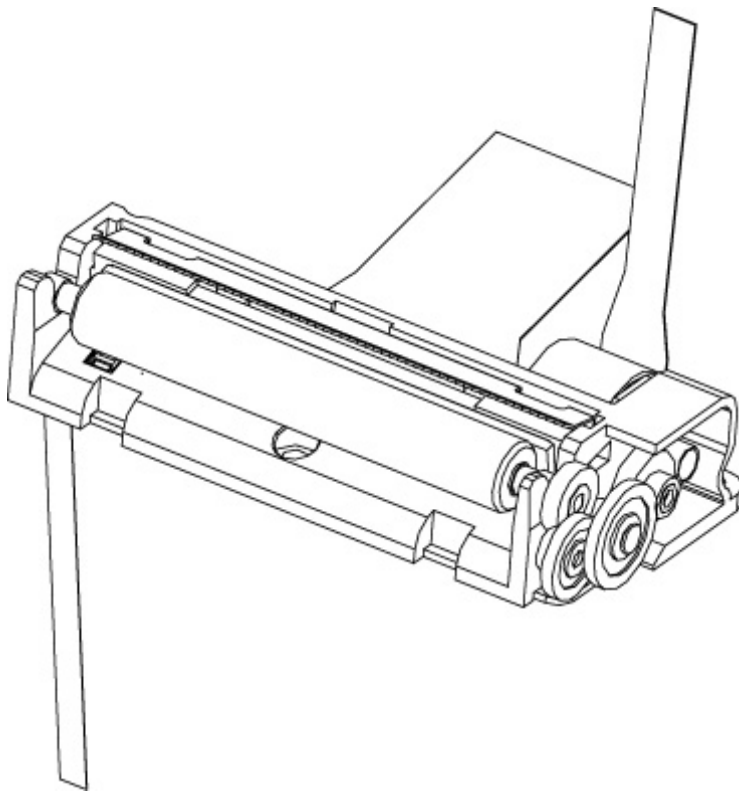


Thermal Printing Mechanism

Porti-M200HN

Operator's Manual



WOOSIM SYSTEM Inc.

Porti-M200H.

Copyright

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DESCRIPTION OF THE MECHANISM

The main characteristics of the Porti-M200HN thermal printing mechanism are definitely the reliability, the quality and the long lasting performance, making it the suitable product for industrial environments such as weighting, control, safety systems, as well as medical and portable applications.

MAIN FEATURES

- High speed up 50mm/sec (MAX)
- High resolution 8dots/mm, 203dpi
- Paper detection photo-sensor
- Life 50 km Printed paper

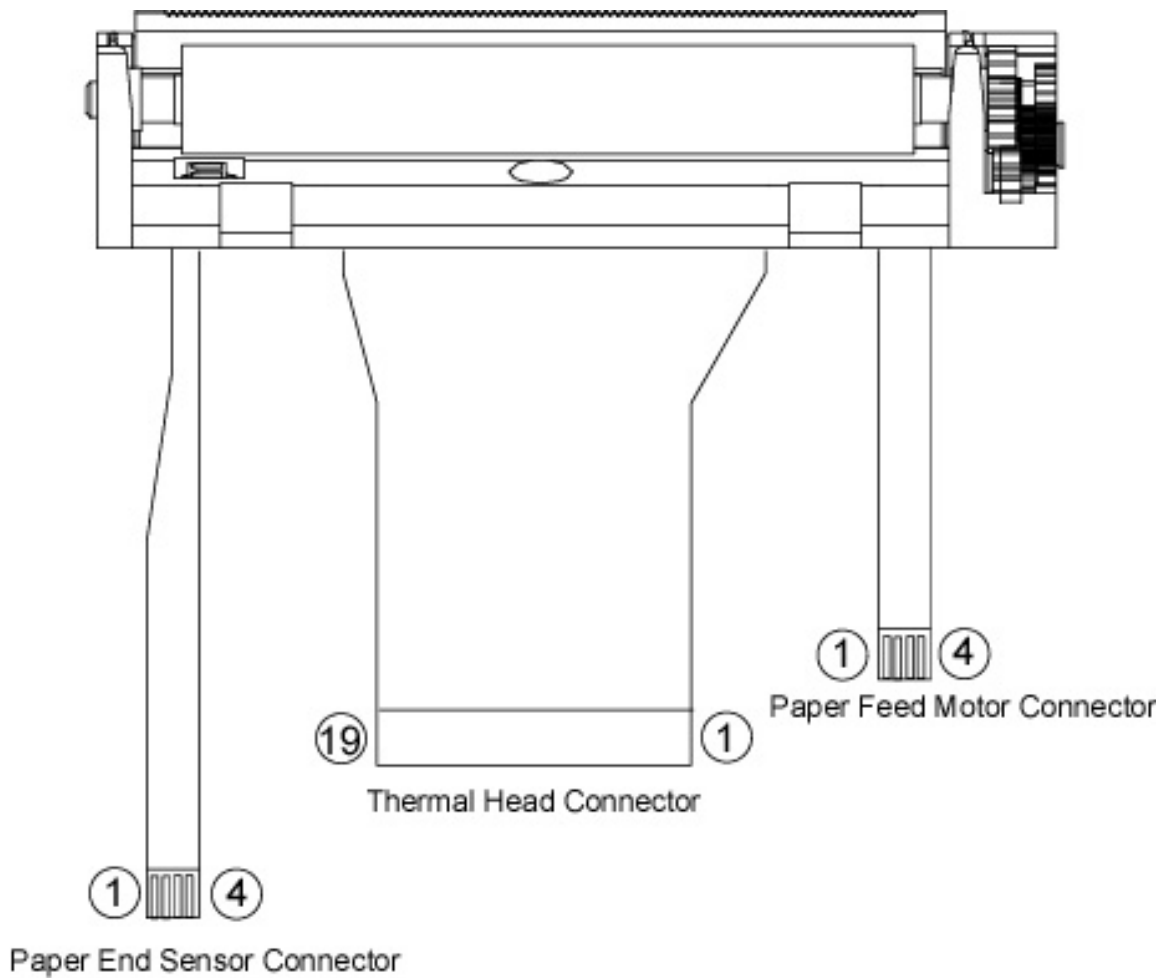
1. CONNECTIONS

The Porti-M200HN mechanism has 3 interface connectors, Print head connector and Paper feed motor control connector, Paper end sensor. In the table below are described the connector specifications and functions:

(Table 1)

No.	Connector	Pin No.	Type
1	Thermal head connector	19	Connector for FPC (pitch 1mm) such as molex connector series 52207-1990
2	Paper feed motor connector	4	Connector for FPC (pitch 1mm) such as molex connector series 52207-0490
3	Paper end sensor connector	4	

(Figure 1)



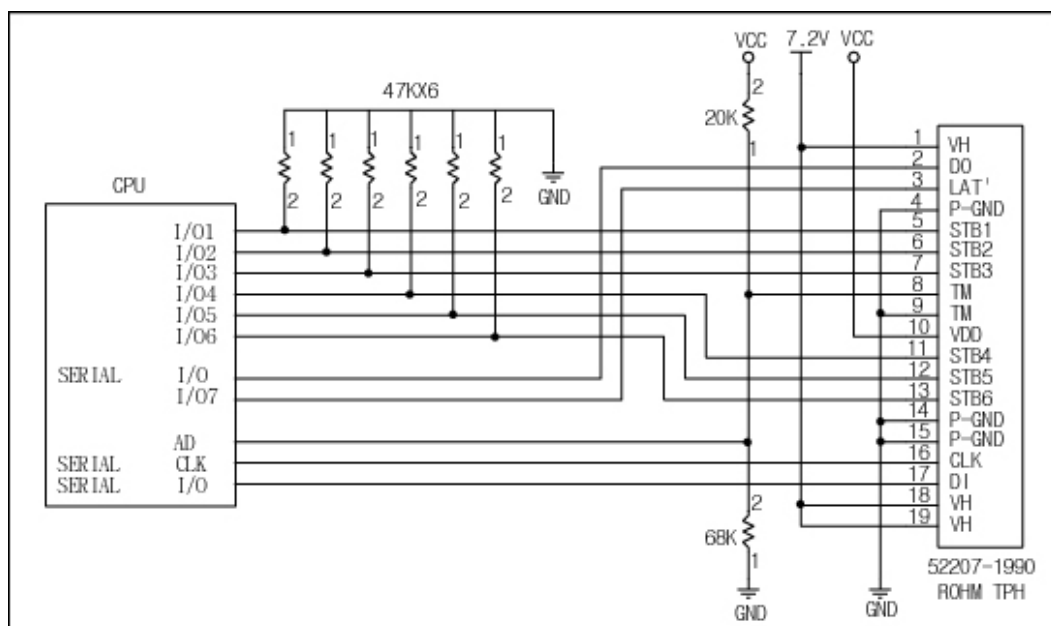
1.1 Thermal print head

1.1.1 Thermal head connectors pin assignments

(TABLE 2)

PIN No.	SIGNAL
1	VH
2	DO
3	/LAT
4	GND
5	STB1
6	STB2
7	STB3
8	TM
9	TM
10	VDD
11	STB4
12	STB5
13	STB6
14	GND
15	GND
16	CLK
17	DI
18	VH
19	VH

1.1.2 Thermal head block diagram



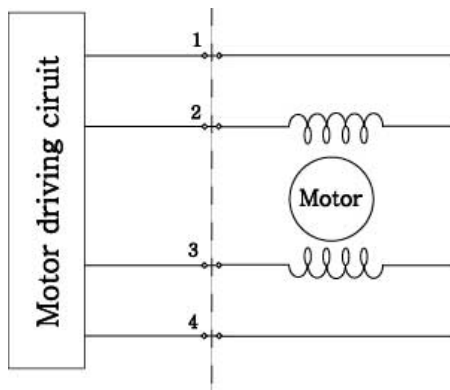
1.2 Paper Feed Motor Connector

1.2.1 Paper feed motor connector's pin assignments

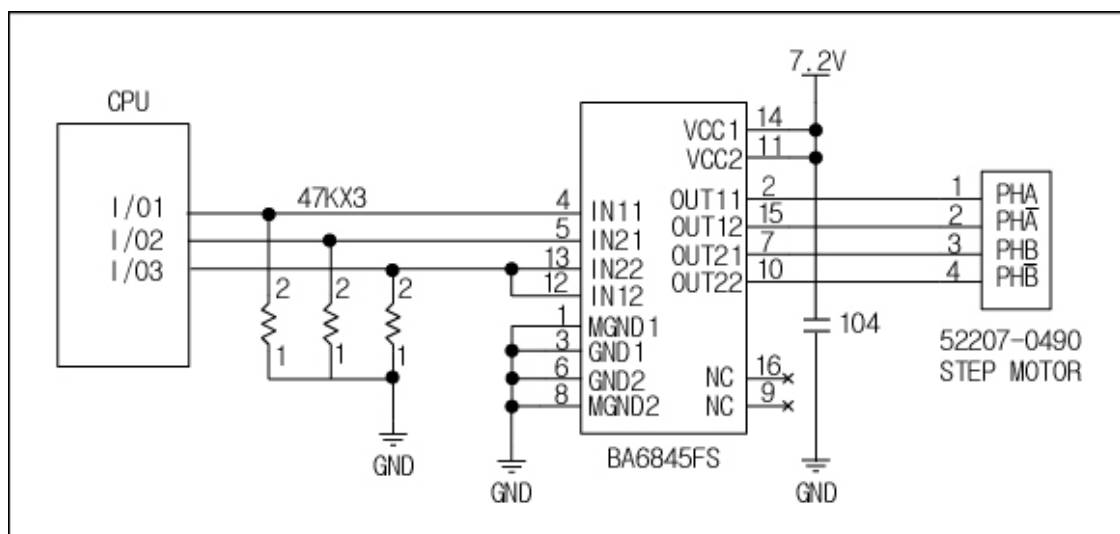
Pin No.	Signal Phase
1	Phase A
2	Phase A
3	Phase B
4	Phase B

(Table 1.2)

1.2.2 Paper feed motor block diagram



(Figure 1.2)



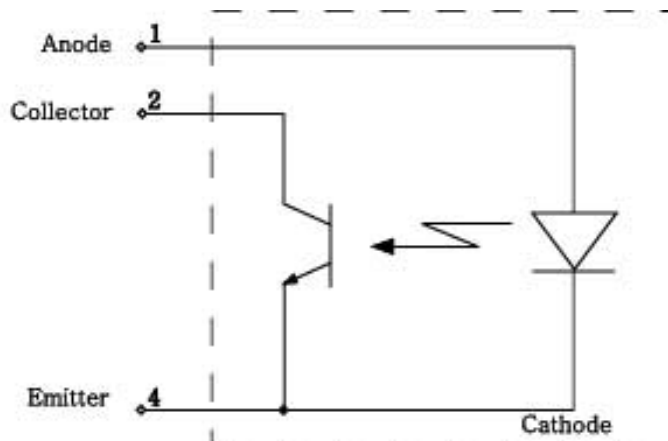
1.3 Paper end Sensor Connector

1.3.1 Paper end sensor connector's pin assignments

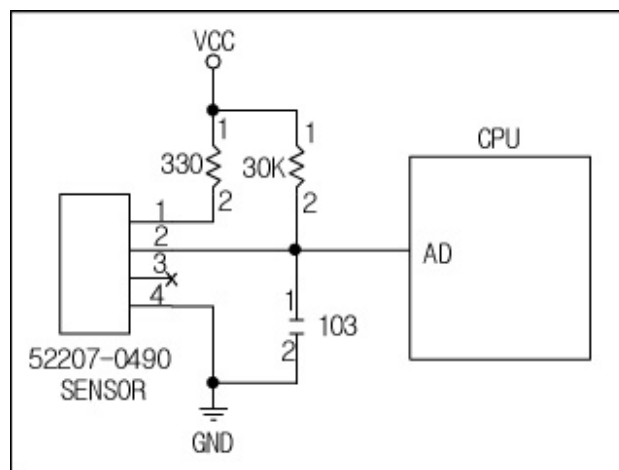
Pin No.	Signal Name
1	Vcc
2	Signal (Open collector)
3	N.C
4	GND

(Table 1.3)

1.3.2 Paper end sensor block diagram



(Figure 1.3)



2. PRINT HEAD

2.1 Outlines

Heat Element Structure	:	2 heaters/dots
Number of Heat Elements	:	384 dots
Heat Element Pitch	:	0.125mm (8 dots/mm)
Pitch Width	:	48mm \pm 0.2mm
Average Resistance Value(R_{ave})	:	176 Ω \pm 4%
Circuit Diagram	:	Fig. 2.8
Pinout Diagram	:	Table 2
Electrical Characteristics of Circuit	:	Table 2.8, Fig. 2.8.3
Thermistor :		Table 2.8.4, Fig. 2.8.4

2.2 Maximum Conditions at 25 °C

(Table 2.2)

Item	Maximum Conditions	Unit	Conditions
Print Cycle (S.L.T.)	1.25	ms/line	$T_{sub} = 25^{\circ}C$
Supply Energy	0.20	mJ/dot	
Supply Voltage	8.5	V	Just after battery charge 7.2V at all time
Substrate Temperature	65	$^{\circ}C$	Thermistor Temperature
Number of Dots to be Energized simultaneously	64	dots	(Note 1)
Logic Supply Voltage(V_{DD})	7	V	Include Peak Voltage of V_{DD}
Logic Input Voltage (V_{in})	-0.5 ~ $V_{DD} + 0.5$	V	

2.3 Typical Printing Conditions at 25 °C

(Table 2.3.1)

* Mechanical Conditions

Item	Mechanical Conditions	Unit or Conditions
Platen Pressure	14.7 \pm 1.96	N/print width
Platen Hardness	40 \pm 5	Shore A
Platen Diameter	Max. 9.0	mm
Scanning Resolution	16.0	line/mm

* Thermal Paper use for Evaluation

- OJI KF50-HAD or Equivalent

* Electrical Conditions

(Table 2.3.2)

Item	Symbol	Electrical Conditions	Unit	Conditions
Power Consumption	P _O	0.24	W/dot	Rave = 176 Ω 64 dots ON
Supply Voltage	V _H	7.2	V	
Print Cycle	S.L.T	1.25	ms/line	
Energy Consumption (On Time)	E _O (T _{on})	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	
Supply Current	I _O	2.4	A	
Print Segment		1		

2.4 Ambient Conditions

(Table 2.4)

Item	Symbol	Ambient Conditions	Unit on Conditions
Storage Temp	T _{sto}	-25 ~ 70	°C
Operation Temp	T _{ope}	0 ~ 50	°C
Humidity	-	10 ~ 90	% RH No Condensation

2.5 Print Quality (at standard Conditions and operation temperature is higher or equal 5 °C)

(1) Optical Density *1 Min.1.0

(2) Variation of Density *1 Max.0.3

*1 with Macbeth Densitometer RD-914

2.6 Printhead Life on Standard Printing Conditions

Life is defined that resistance value of any dots changes more than or equal to 15% from the initial value.

(1) Pulse Life 1×10⁸ pulses

(2) Abrasion Life 50Km

2.7 Operation Precautions

- (1) When continuous printing is performed, the supply energy should be reduced so that the substrate temperature monitored through the thermistor will remain below the maximum temperature show in Section 2.(Maximum Conditions at 25 degrees C)
- (2) Power on and off sequence must be in the following order to prevent the dot element damage;
Turn on - Apply the logic supply voltage (V_{dd}) first and the printhead supply voltage.
Turn off - Switch off the printhead supply voltage first and turn the logic supply voltage off.
- (3) Interface each signal input (CLK, LAT, STB, DI) with CMOS level (ex. 74HC240). Please keep STB signal to "Disable" during ON/OFF and during no printing condition.
- (4) Heat elements and IC's shall be anti-electrostatic in order to prevent the electrostatic destruction. Do not touch the connector pins y naked hands.
- (5) The printhead substrate surface is coated with glass and mechanical stress or shock (including dust scratch damage) should be voided to prevent damage.
- (6) When the printhead operation is finished, print supply voltage. (including the charged operation)
- (7) Platen roller should be composed of non-conductive materials.
- (8) Condensation should be avoided. If condensation occurred, do not switch on the printhead power until condensation disappeared.
- (9) The connectors installed are connected directly to the substrate. Please pay attention to the extra forces to get damages when the connector is plugged in or out. (Plug in-out cycle for this connector shall not be exceeded 20 times.) Do not pick up connector to take printhead.
- (10) Print quality would be degraded if paper or ink residue were sticked on the heat element area. For such a case, please use applicator with alcohol to clean up. Do not use the sandpaper destroying the heat elements.
- (11) If printing sound, for example sticking sound, occurred, please review and adjust the paper feed mechanism and the electrical pulse program to eliminate the sound.
- (12) The change of printhead flatness (warp) is minimized with temperature change in the free body of one unit. Please pay attention to the warp created by fixing the printhead to the printer unit with screws or clamp.
- (13) Please pay attention that the paper used does not include bad factor to affect the printhead life.
- (14) If printhead operation method is changed, Please inform us in advance to change.
- (15) In order to avoid surge, V_H and GND cable length should be less than 100mm, and 47 μ F Aluminum capacitor is required between V_H and GND at controller board side. Evaluation is required when the length of V_H and GND cable is more than 100mm.
- (16) Please design the system in such a way that the printing medium (while in printing) and the paper guide do not contact IC protective coating and pin protective coating, in order to ensure to the good printing quality.
- (17) Thermal head is heat-generating device; it can cause smoking and combustion as a result of abnormal heating if damaged electrically or mechanically.
Therefore, it is recommended to conduct the temperature control by thermistor in order to secure

safely of the system, and design shut-down of power source for the head (V_H , V_{DD}) when anomaly takes place.

(18) If dusts/foreign articles stuck on the surface of thermal head substrate or printed circuit board. It may cause stained print, faded print and also damage of heat element, smoking and combustion. In this case, the head should be cleaned by ethyl-alcohol after power source for head is shut down and please check if the dusts/foreign articles are completely removed.

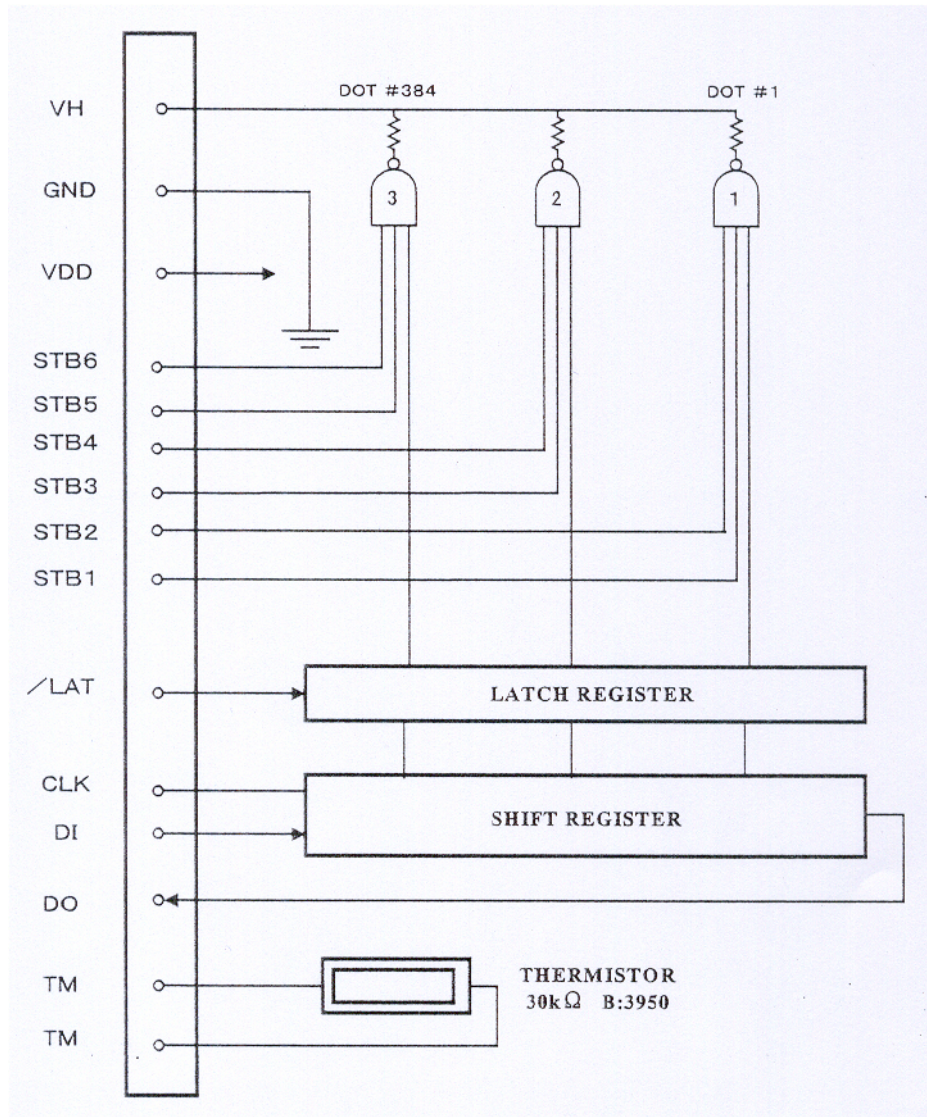
Yet, make sure that ethyl-alcohol is dried up before restarting the operation.

(19) Please design power source for head (V_H , V_{DD}) to be shutdown when the thermal head surpasses the maximum rated wattage while STB is On, or the printing medium does not move like paper jam. Otherwise, heated printing medium bums and sticks to the head and may lead to combustion in the worst case.

2.8

2.8.1 Circuit Diagram

Fig.2.8



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

2.8.2 Electrical characteristics of Circuit

Table2.8
Ta=25 ±10 °C

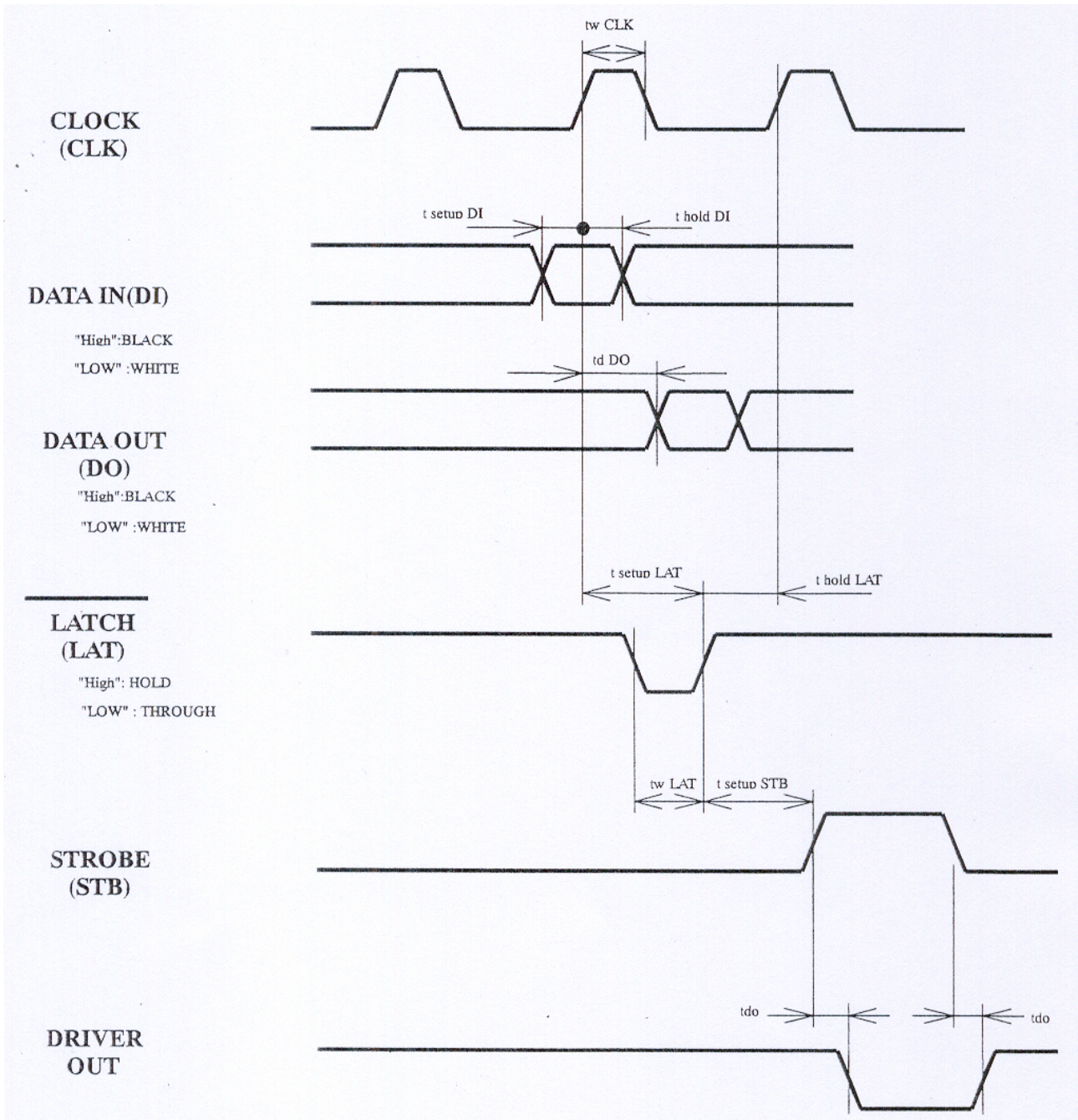
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	SIGNAL	
PRINT VOLTAGE	VH	-	-	8.5	V		
LOGIC VOLTAGE	V _{dd}	3.30	5.00	5.25	V		
LOGIC CURRENT	I _{dd}	-	-	54	mA	f _{DI} =f _{CLK} /2	
INPUT VOLTAGE	H	V _{IH}	0.8V _{DD}	-	V _{DD}	V	STB,DI,LAT,CLK
	L	V _{IL}	0	-	0.2V _{DD}		
DATA INPUT CURRENT (DI)	H	I _{IH} DI	-	-	0.5	μA	V _{IH} =V _{DD} (V)
	L	I _{IL} DI	-	-	-0.5	μA	V _{IL} =0V
STB INPUT CURRENT (HIGH ACTIVE)	H	I _{IH} STB	-	-	30	μA	V _{DD} =5V, V _{IH} =V _{DD} (V)
	L	I _{IL} STB	-	-	-0.5	μA	V _{IL} =0V
CLOCK INPUT CURRENT (CLK)	H	I _{IH} CLK	-	-	3	μA	V _{IH} =V _{DD} (V)
	L	I _{IL} CLK	-	-	-3	μA	V _{IL} =0V
LATCH INPUT CURRENT (LAT)	H	I _{IH} LAT	-	-	3	μA	V _{IH} =V _{DD} (V)
	L	I _{IL} LAT	-	-	-3	μA	V _{IL} =0V
DO VOLTAGE (DO)	H	V _{DOH}	4.45	-	-	V	OPEN, V _{DD} =4.5V
	L	V _{DOL}	-	-	0.05	V	
OUTPUT VOLTAGE	V _{OL}	-	(1.0)	-	V	(NOMINAL) DRIVER-OUT	
CLOCK FREQUENCY	f CLK	-	5	8	MHz	V _{DD} =5V	
		-	3	5	MHz	V _{DD} =3.3V	
CLOCK WIDTH	tw CLK	95(155)	-	-	ns	V _{DD} =5V, f _{CLK} =5MHz*1 (V _{DD} =3.3V, f _{CLK} =3MHz)	
DATA SET-UP TIME	tsetup DI	100(140)	-	-	ns		
DATA HOLD TIME	thold DI	85	-	-	ns		
DATA OUT DELAY TIME	td DO	-	50	-	ns	V _{DD} =5V	
		-	-90	-	ns	V _{DD} =3.3V	
LAT WIDTH	tw LAT	150	-	-	ns		
LAT SET-UP TIME	tsetup LAT	200	-	-	ns		
LAT HOLD TIME	thold LAT	80	-	-	ns		
STB SET-UP TIME	tsetup STB	300	-	-	ns		
DRIVER OUT DELAY TIME	t _{do}	-	-	10(30)	μs	V _{DD} =5V (V _{DD} =3.3V)	

*1 When using over f_{CLK}=5MHz, CLK is used at 50% duty.

Also, The ratio of DATA SET-UP TIME and DATA HOLD TIME is controlled a 1:1 ratio within one cycle of CLK.

2.8.3 Timing chart

Fig. 2.8.3



2.8.4 THERMISTOR SPECIFICATION

Table 2.8.4

ELECTRICAL REQUIREMENTS;

- 1) RESISTANCE R25 : 30k Ω \pm 5% at 25 $^{\circ}$ C
- 2) B VALUE : 3950k Ω \pm 2%
- 3) RESISTANCE vs. TEMPERATURE : Fig.4

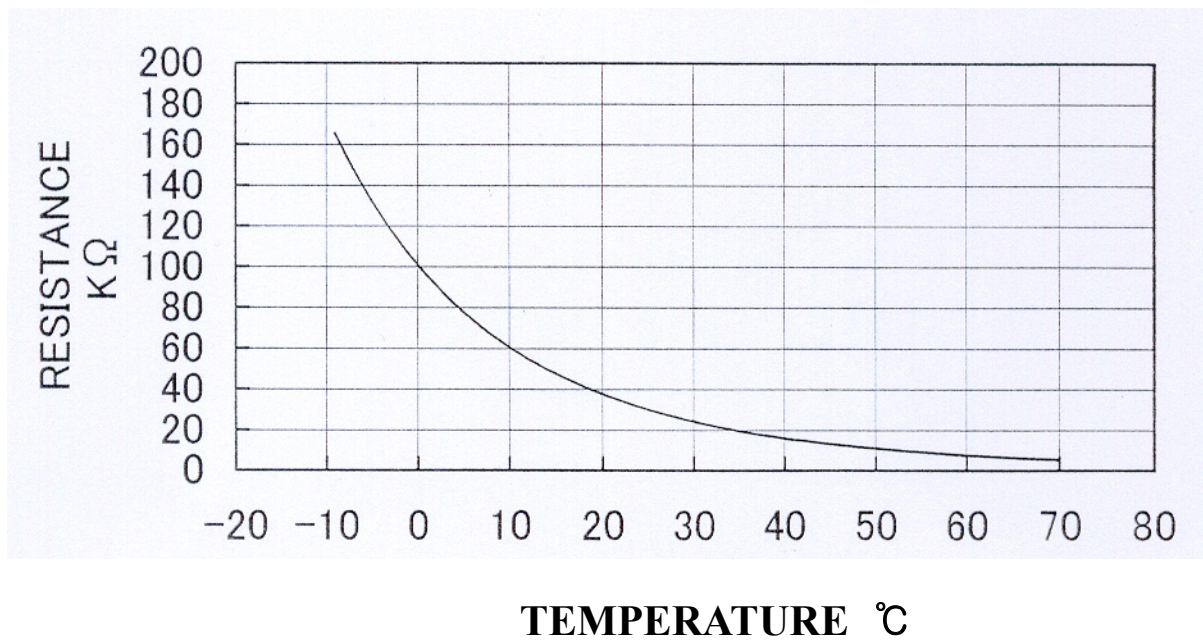
RATING;

- 1) OPERATING TEMPERATURE : -20 ~ +80 $^{\circ}$ C
- 2) TIME CONSTANT : Max. 30sec(in the air)

$$\text{Fig. 2.8.4 } R_X = R_{25} \cdot \text{EXP}\{B \cdot (1/T_X - 1/T_{25})\}$$

(T; ABSOLUTE TEMPERATURE)

Fig.4



3. PAPER FEED MOTOR

The paper feed pitch for stepping motor is 2 steps for one dotline (1dotline = 0.125mm).

3.1 Ratings

(Table 3.1)

No.	Item	Specification			Remark
1	Number of phase	2			
2	Step angle	18°	deg		
3	Voltage	4.5 ~ 8.2	VDC		
4	Excitation	2-phase Bipolar			
5	Direction of rotation	Both-Way (CW / CCW)			
6	Rated current	230mA / phase at 800pps			(7.2V DC)

3.2 Electrical characteristics

- with a terminal voltage of 7.2V DC otherwise specified.
- Under 2-phase excitation.

(Table 3.2)

No.	Item	Specification		Remark
1	Winding resistance	15Ω ± 7% / phase		Equivalent at 25°C
2	Winding Inductance	6mH ± 20%		1kHz , 1Vrms
3	Pull - out Torque	Min	16 gf · cm	f= 800 pps Motor Temperature : 25°C
4	Holding Torque	Min	25 gf · cm	
5	Max. starting rate	920 pps	MIN.	No Load
6	Insulation resistance	50MΩ	MIN	DC500V between winding and case
7	Dielectric strength	2mA (AC 600V 0.5SEC)		between winding and case
8	Temperature rise winding	90 deg. MAX		Motor 7.2VDC , 600PPS
9	Flux leakage	10 Gauss	MAX.	At distance of 20mm from motor surface

3.3 Mechanical properties

(Table 3.3)

No	Item	Performance
1	Rotor Inertia	0.07 g · cm ² (ref) : Calculated value
2	Construction and dimension	Refer to the Outside- Drawing
3	Appearance	Any scratches press burrs or stains on the surface of the motor, the lead screw will not be allowed
4	Weight	9g Approximate
5	Output shaft material	SUS 420J2
6	Noise	No unusual sound

3.4 Excitation (2 phase, Full step)

(Table 3.4)

PIN No.	STEP			
	1	2	3	4
1	+	-	-	+
2	-	+	+	-
3	-	-	+	+
4	+	+	-	-

Switching sequence for cw rotation

3.5 Environmental properties

① Operation temperature / humidity range

Temperature : 10 ~ 55°C

Humidity : 20 ~ 80% (No condensing)

② Storage temperature / humidity range

Temperature : -40 ~ 65°C

Humidity : 8 ~ 90% (No condensing)

4. PAPER END SENSOR

A photo-sensor is used to detect the existence of the thermal paper in the path near the thermal head.

4.1 Maximum rating

(Table 4.1)

ITEM		Symbol	Rating	Unit
INPUT	Power dissipation	P_D	75	mW
	Reverse voltage	V_R	5	V
	Forward current	I_F	50	mA
	Pulse forward current	I_{FP}	1	A
OUTPUT	Collector power dissipation	P_C	50	mW
	Collector current	I_C	20	mA
	C-E voltage	V_{CEO}	30	V
	E-C voltage	V_{ECO}	3	V
Operating temp		Topr.	-25 ~ +85	°C
Storage temp		Tstg	-30 ~ +100	°C
Soldering temp		Tsol.	240	°C

($T_a=25^\circ\text{C}$)

4.2 Electron-optical characteristics

(Table 4.2)

ITEM		Symbol	Conditions	Min	Typ	Max	Unit
INPUT	Forward voltage	V_F	$I_F=4\text{mA}$			1.3	V
	Reverse current	I_R	$V_R=5\text{V}$			10	μA
	Capacitance	C_t	$V=0\text{V}, f=1\text{kHz}$				pF
	Peak wavelength	λ_p			940		nm
OUTPUT	Collector dark current	I_{CEO}	$V_{CE}=10\text{V}$			0.2	μA
Light current		I_L	$V_{CE}=2\text{V}, I_F=4\text{mA}$	90			μA
Leakage current		I_{CEOD}	$V_{EC}=2\text{V}, I_F=4\text{mA}$			0.2	μA
Switching speeds	Rise time	tr	$V_{CC}=2\text{V}$		30		$\mu\text{sec.}$
	Fall time	tf	$I_C=100\mu\text{A}$ $R_L=1\text{K}\Omega$		25		$\mu\text{sec.}$

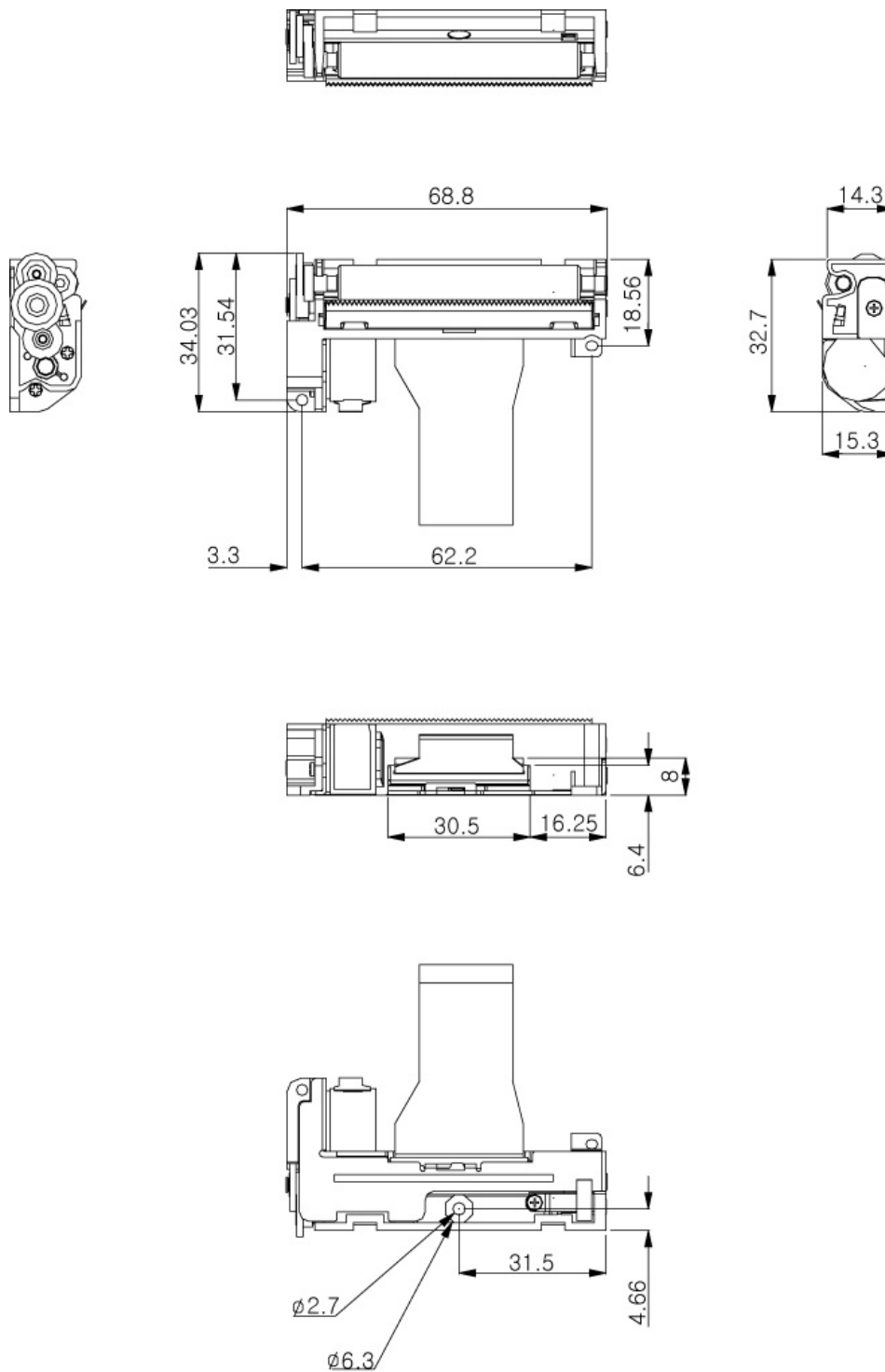
($T_a=25^\circ\text{C}$)

5. DIMENSIONS

The figure 5.1 illustrates the overall dimensions for the Porti-M200HN thermal printing mechanism.

(Dimension in mm)

(Figure 5.1)



6. DISASSEMBLY AND ASSEMBLY

Figure A.1 EXPLODED DIAGRAM OF Porti-M200HN

