

# THERMAL PRINT HEAD

## 3TBX81

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Rev	Description	Date	Approved	Drawn	<i>Zhao Guojian</i>
A	-----	07-1-24	S.Hosokawa	Jianghua	
B	B1 Life expectancy of Run length changed, was 100km(P3)	07-3-21	S.Hosokawa	JM.Liu	
C	C1 Electrical characteristics for driver IC changed.	09-7-06	J.Katagiri	JL.WANG	Checked
D	D1 Add "DATA OUT" pin assignment. (P8)	09-7-31	GJ.ZHAO	JL.WANG	<i>Xu Haifeng</i>
	D2 Electrical characteristics for driver IC changed.				
					Drawn
					<i>Wang Junlei</i>

### 1. Description

This specification is applied to 3TBX81 thermal print head.

### 2. Scope

The 3TBX81 is a thermal print head which has heat elements which produce 960 dots with 300 dots/inch by means of a high density thick film process. It also includes C-MOS ICs; Which operate as 960 bits shift-registers, latches and switching transistors to drive heat elements.

### 3. Outline

Item	Specification	Note
Dimension	Fig.5	
Schematic diagram	Fig.3	
Pin assignment	Table.3	
Print width	81.2 mm	
Number of heaters	960 dots	
Heater resolution	300 dots/inch	
Heater pitch	0.0846mm	
Printed dot dimension	0.08mm×0.1 mm	Nominal
Heater resistance	$\bar{R}=800\Omega \pm 3\%$	
Specifications for driver ICs	Table.2	
Number of driver ICs	96bits × 10	
Number of data inputs	1 serial input	
Number of strobes	4	
Logic power supply	3.3 V × 10mA	at 20 MHz
Specification for Thermistor	$R_{25}=30K\Omega \pm 5\%, B=3,950K \pm 3\%$	Table. 1

### 4. Maximum ratings

Parameter	Symbol	Specification	Note
Heater energy consumption	Eomax	0.17 mJ/dot	0.83 ms/line
		0.15 mJ/dot	0.5 ms/line
Head voltage	VH	25.2 V	Between Connectors
Logic voltage	Vdd	5.5V	
Environment temperature	Ta	+5 ° C ~ +50 ° C	Operating
		- 40 ° C ~ +80 ° C	Non-operating
Environment humidity		10 ~ 90%RH	Non-condensing
Maximum operating temperature	Ts	65 ° C 30min. MAX	
		Detected temperature of Thermistor shall not exceed 65 ° C.	Head temperature shall not exceed 70 ° C.

**5. Standard printing conditions**

Parameter	Symbol	Recommended operating conditions		Note
Speed		0.5 ms/line	0.83 ms/line	
Heater power consumption	Po	0.58 W/dot		$\bar{R} = 800 \Omega$
Heat voltage	VH	24 V		Connectors
Heater energy consumption	Eo (ts)	5°C	0.12mJ/dot (0.21 ms)	0.14mJ/dot (0.24 ms)
		25°C	0.11mJ/dot (0.19 ms)	0.13mJ/dot (0.22ms)
		40°C	0.10mJ/dot (0.17 ms)	0.12mJ/dot (0.21 ms)
Supply current	Io	27mA/dot		$\bar{R} = 800 \Omega$
Timing chart		Fig. 2		
Platen pressure		11.5 ~ 15.3 N / TPH		
Platen hardness		30~40deg		
Platen diameter		Φ20 Max.		
Scanning resolution		300 line/inch		
Thermal paper		F230AA MITSUBISHI PAPER MILL CO., LTD.		
Optical density		1.1 OD Min.		(Note 2)

(Note 1) Supply energy is defined by the following formula.

$$E_o = I_o^2 \bar{R} t_s = \frac{(VH - V_{com})^2 \cdot \bar{R} \cdot t_s}{(\bar{R} + R_{ic})^2}$$

- $R_{ic} = 24 \Omega$  : Driver IC "ON" resistance
- $t_s$  : Strobe printing pulse width
- $VH$  : Heat voltage
- $\bar{R}$  : Heater average resistance
- $V_{com} = 0.5V$  : Common electrode voltage drop

(Note 2) Printed optical density is measured at 10mm intervals after the starting point. Printed optical density is measured by a RD-914 reflector optical density meter or equivalent .

**6. Life expectancy B1**

**6.1** The life expectancy under 12.5% printing duty of less at 25° C is defined by the following whichever earlier comes.

Item	Specification	Note
Number of pulses	$1 \times 10^8$ pulses	
Run length	150 Km	

**6.2** Under 10% humidity, the platen roller which is protected by a rubber insulator, will operate under test conditions with no paper for a maximum of 3Km, before the heat element fails.

## 7. Warning during use

### 7.1 Strobe signal

During head power supply ON/OFF sequence strobes should be kept "disable".

### 7.2 Stability of IC operation

Care should be taken for stable operation of driver ICs as indicated bellow. (Fig.1)

(1) If the voltage including surge exceeds maximum rating of driver IC, the TPH may burn out by latch-up. Care should be taken especially when head current changes by strobes or at the ON/OFF sequence. The voltage shall be kept within the following voltage.

VH : 0V ~ +28V

Vdd : 0V ~ +6.5V

Other signals : GND -0.3V ~ Vdd+0.3V

**7.3** The heater and driver ICs are electrostatically sensitive. Care should be taken not to touch connectors with hands or an electrostatically charged object. It is recommended that brushes near the head be provided to discharge electrostatic build up.

**7.4** On the surface near the heater, do not apply any hard material. The abrasion resistant layer is fragile to mechanical impact.

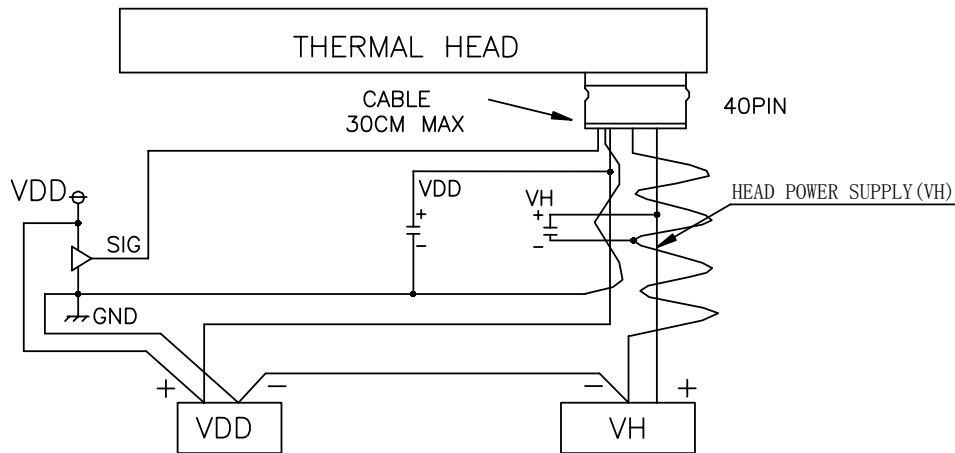
**7.5** Ink dregs adhered to the heater should be wiped off softly with a soft cloth dipped alcohol or detergent. Do not use sandpaper or equivalent.

**7.6** Keep hard particles out of the heater surface. Hard particles may scratch the abrasion resistant layer.

**7.7** Maximum number of heaters for simultaneous is 480.

**7.8** When the printer is on standby, the thermal head (VH) must be switched off.

**Fig. 1 Recommend Connection**



**Table. 1 Thermistor**

$$R_{25} = 30K\Omega \pm 5\%, B_{CONST} = 3950\text{kelvin} \pm 3\%, R = R_{25}e^{B(1/T - 1/T_{25})}$$

Temperature ( ° C )	Thermistor Resistance (R)		
	Min. (KΩ)	Typ. (KΩ)	Max. (KΩ)
-40.0	717	843	989
-35.0	535	623	723
-30.0	405	466	535
-25.0	308	352	400
-20.0	238	269	303
-15.0	185	208	232
-10.0	145	161	178
-5.0	113	124	137
0.0	88.7	96.8	105
5.0	69.9	75.7	81.7
10.0	55.4	59.5	63.8
15.0	44.1	47.1	50.1
20.0	35.4	37.5	39.6
25.0	28.5	30.0	31.5
30.0	22.8	24.2	25.5
35.0	18.3	19.6	20.8
40.0	14.9	15.9	17.1
45.0	12.1	13.1	14.1
50.0	9.92	10.8	11.7
55.0	8.16	8.91	9.7
60.0	6.76	7.41	8.12
65.0	5.62	6.2	6.83
70.0	4.7	5.21	5.77
75.0	3.95	4.4	4.9
80.0	3.34	3.74	4.18

**Table 2 C-MOS Driver IC**

**Table 2.1** Electrical characteristics for driver IC.

Absolute maximum ratings for driver ICs.

Parameter	Symbol	Test conditions	Ratings	Unit
Supply voltage	$V_{dd}$	Surge	0 ~ 6.5	V
	$VH$	Surge	0 ~ 28	V
Input voltage for logic	$V_{IN}$		0 ~ $V_{dd}+0.3$	V

Recommended operating conditions

Parameter	Symbol	Test conditions	Recommendations			Unit
			Min.	Typ.	Max.	
Supply voltage	$V_{dd}$		3.0		5.5	V
	$VH$	Supply voltage for VH	0	24	25.2	V
Input voltage for logic	$V_{IH}$	(Note 1)	$0.7 \times V_{dd}$		$V_{dd}$	V
	$V_{IL}$		-0.3		$0.3 \times V_{dd}$	V
Clock frequency	$f_{CLK}$				30	MHz

(Note 1) Recommended driver IC is 74HC244 or equivalent.

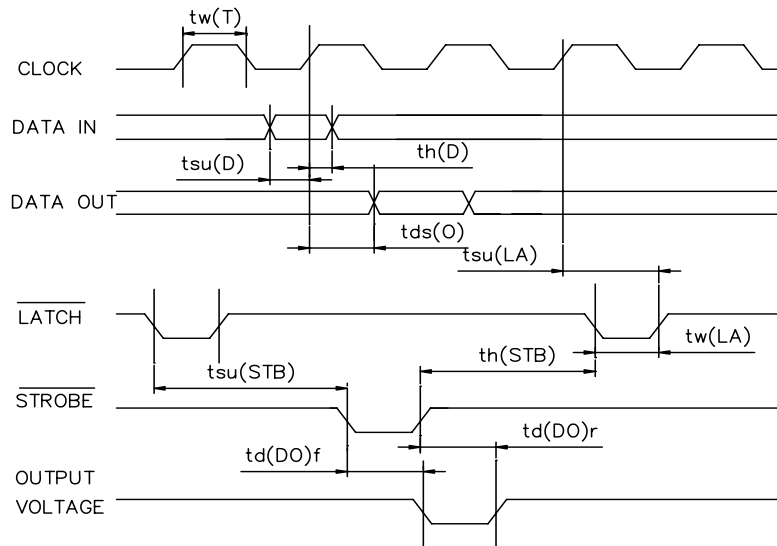
**Table 2.2** Electrical characteristics for driver IC.

Parameter	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Input current	$\overline{LATCH}$	(Note 1) $V_{dd}=3.3V$ $I_{IH}=3.3V$			10.0	$\mu A$
	$\overline{STROBE}$				3.0	$\mu A$
	CLOCK				10.0	$\mu A$
	DATA IN				1.0	$\mu A$
	$\overline{LATCH}$	$I_{IL}$ $V_{dd}=3.3V$ $V_{IL}=0V$	-600			$\mu A$
	$\overline{STROBE}$		-180			$\mu A$
	CLOCK		-10.0			$\mu A$
	DATA IN		-1.0			$\mu A$
Output voltage of drivers (Heater supply voltage)	$V_{OL}$	$V_{dd}=3.3V$ $I_{OL}=40mA$		0.96	1.92	V
Leak current of drivers	$I_{OH}$	$VH=24V$			5.0	$\mu A/dot$
Logic supply current	$I_{dd}$	$f_{CLK}=20MHz$ $DATA\ IN=1/2f_{CLK}$			100.0	mA
“H” Level output	$I_{OH}$	$V_{OH}=V_{dd}-0.4V$			-0.5	mA
“L” Level output	$I_{OL}$	$V_{OL}=0.4V$	0.5			mA

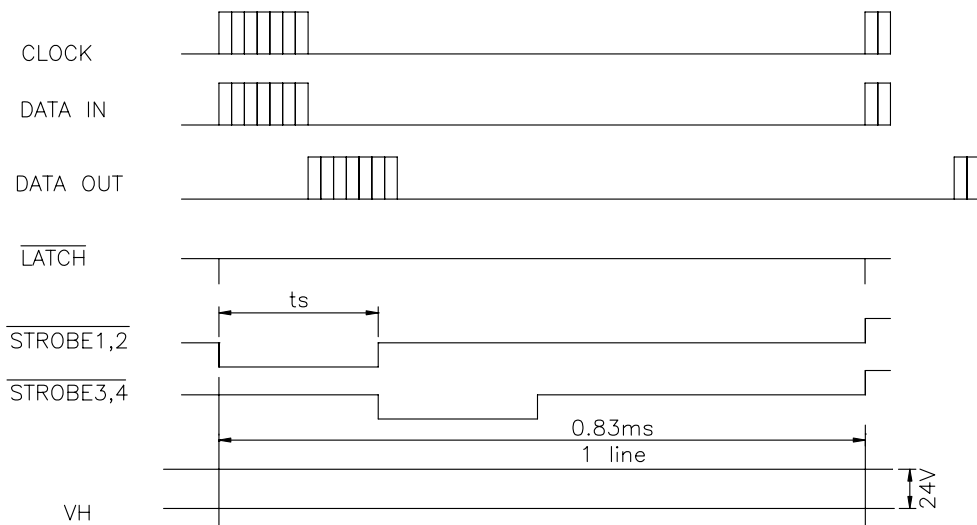
(Note 1) Each  $\overline{STROBE}$  includes pull-up resistance of  $300K\Omega \pm 50\%$  per IC.

**Table 2.3** Switching characteristics for driver ICs.

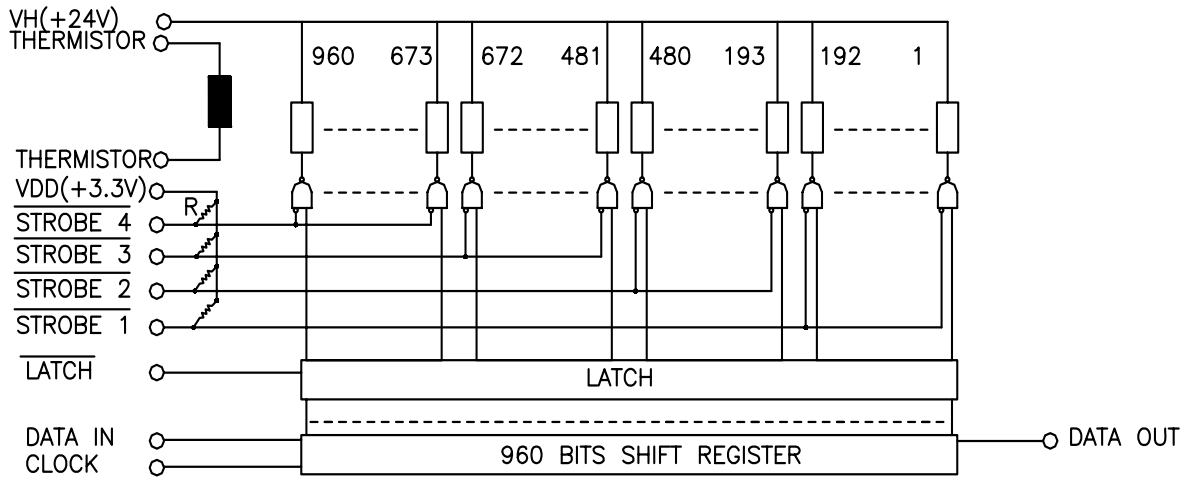
Parameter	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Clock frequency	$f_{MAX}$	cascade			30	MHz
Clock pulse width	$tw(T)$		14.0			ns
Data setup time	$tsu(D)$		8.0			ns
Data hold time	$th(D)$		8.0			ns
Latch setup time	$tsu(LA)$		20.0			ns
Latch pulse width	$tw(LA)$		100			ns
Latch to Strobe setup time	$tsu(STB)$		100			ns
Strobe to Latch setup time	$th(STB)$		100			ns
Clock to So delay time	$tds(O)$				28	$\mu s$
Strobe to driver Output delay time	$td(DO)r$				60	$\mu s$
	$td(DO)f$				15	$\mu s$



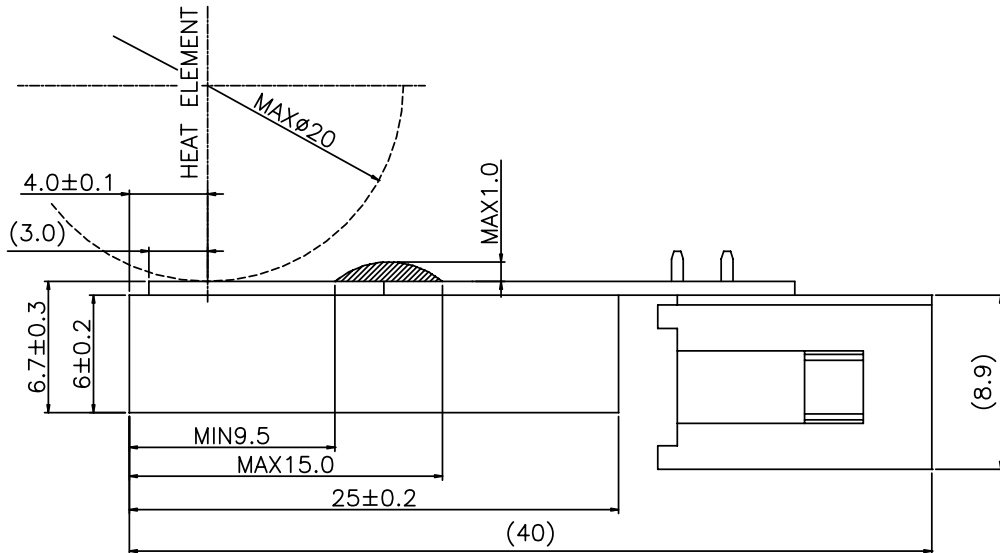
**Fig. 2 Thermal Print Head (3TBX81) Timing Chart**



**Fig. 3 Schematic Diagram**



**Fig. 4 Cross Section**



**Table. 3 Pin assignment** D1

Connector : HIF3F-40PA-2.54DS(71) or EQUIVALENT

PIN	NAME	PIN	NAME	PIN	NAME	PIN	NAME
1	VH	11	VH	21	DATA IN	31	$\overline{STROBE2}$
2	GND	12	GND	22	GND	32	$\overline{STROBE1}$
3	VH	13	VH	23	NC	33	THERMISTOR
4	GND	14	GND	24	GND	34	THERMISTOR
5	VH	15	Vdd	25	NC	35	VH
6	GND	16	GND	26	GND	36	VH
7	VH	17	$\overline{LATCH}$	27	DATA OUT	37	VH
8	GND	18	GND	28	GND	38	VH
9	VH	19	CLOCK	29	$\overline{STROBE4}$	39	VH
10	GND	20	GND	30	$\overline{STROBE3}$	40	VH

**Fig. 5 Dimension**

