

# THERMAL PRINT HEAD

## ZX108

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### 1. Description

This specification is applied to ZX108 thermal print head.

### 2. Scope

The ZX108 is a thermal print head which has heat elements which produce 864 dots with 8 dots/mm by means of a high density thick film process. It also includes C-MOS ICs; Which operate as 864 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	108 mm	
Number of heaters	864 dots	
Heater resolution	8 dots/mm	
Heater pitch	0.125 mm	
Printed dot dimension	0.11mm×0.13 mm	Nominal
Heater resistance	$\bar{R} = 700 \Omega \pm 3 \%$	
Specifications for driver ICs	Table.2	
Number of driver ICs	96bits ×9	
Number of data inputs	9 serial input	
Number of strobes	2	
Logic power supply	3.3 V ×90 mA	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	0.16 mJ/dot	0.41ms/line
		0.11 mJ/dot	0.25ms/line
Head voltage	VH	25.2 V	Between Connectors
Logic voltage	Vdd	5.5V	
Environment temperature	Ta	0 ° 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		0.41 ms/line	0.25ms/line		
		12 inch/sec	20 inch/sec		
Heater power consumption	Po	0.74W/dot		$\bar{R} = 700 \Omega$	
Heat voltage	VH	24 V		Connectors	
Heater energy consumption	Eo (ts)	5°C	0.13 mJ/dot (0.18 ms)	0.10 mJ/dot (0.14 ms)	$\bar{R} = 700 \Omega$ (Note 1)
		25°C	0.11 mJ/dot (0.15 ms)	0.08 mJ/dot (0.11 ms)	
		40°C	0.09 mJ/dot (0.12 ms)	0.06 mJ/dot (0.08 ms)	
Supply current	Io	32.4 mA/dot		$\bar{R} = 700 \Omega$	
Timing chart		Fig. 2			
Platen pressure		14.7~ 19.7 N / TPH			
Platen hardness		30~40deg			
Platen diameter		Φ14 Max.			
Scanning resolution		8 line/mm			
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**

**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	

## 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 -0V ~ 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.

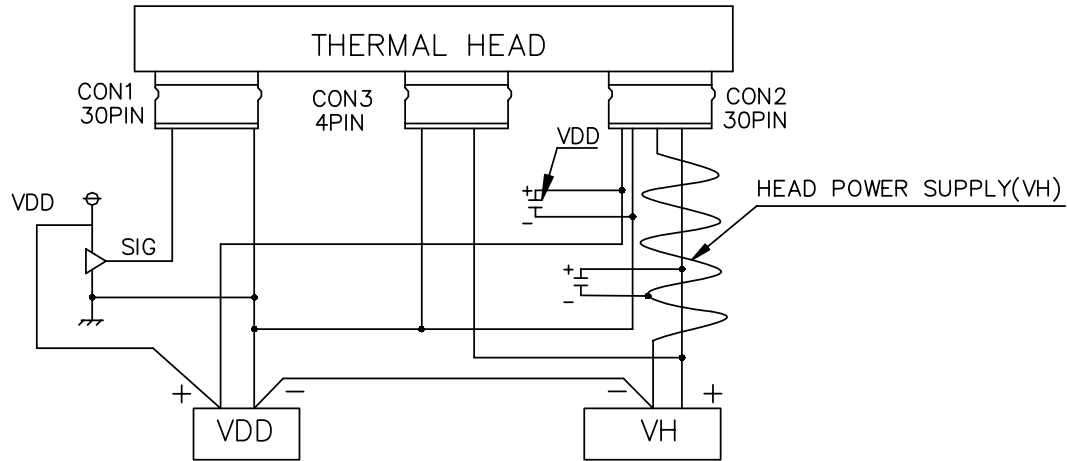
**7.5** Ink dregs adhered to the heater should be wiped off softly with a soft cloth dipped alcohol or detergent. Do not use sandpaper or equivalent.

**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 864.

**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	700
-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
	$V_H$	Surge	0 ~ 28	V
Input voltage for logic	$V_{IN}$		0 ~ $V_{dd} + 0.5$	V

Recommended operating conditions

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

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

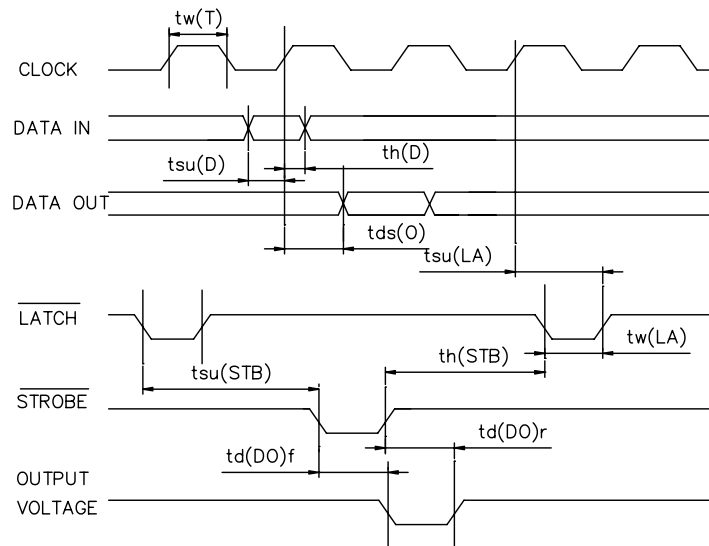
**Table 2.2** Electrical characteristics for driver IC.

Parameter	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Input current	$\overline{LATCH}$	(Note 1) $V_{dd} = 3.3V$ $V_{IH} = 3.3V$			9.0	$\mu A$
	$\overline{STROBE}$				5.0	$\mu A$
	CLOCK				9.0	$\mu A$
	DATA IN				9.0	$\mu A$
	$\overline{LATCH}$	$I_{IL}$ $V_{dd} = 3.3V$ $V_{IL} = 0V$		-540		$\mu A$
	$\overline{STROBE}$			-300		$\mu A$
	CLOCK			-9.0		$\mu A$
	DATA IN			-1.0		$\mu A$
“L” Output voltage of drivers	$V_{DOL}$	$V_{dd} = 3.3V$ $I_{DOL} = 40mA$		0.96	1.92	V
Leak current of drivers	$I_{LEAK}$	$V_{OH} = 24V$			5.0	$\mu A/dot$
Logic supply current	$I_{dd}$	$f_{CLK} = 20MHz$			90	mA
“H” Level output	$I_{OH}$	SO, $V_{OH} = V_{dd} - 0.4V$			-0.5	mA
“L” Level output	$V_{OL}$	SO, $V_{OL} = 0.4V$	0.5			mA

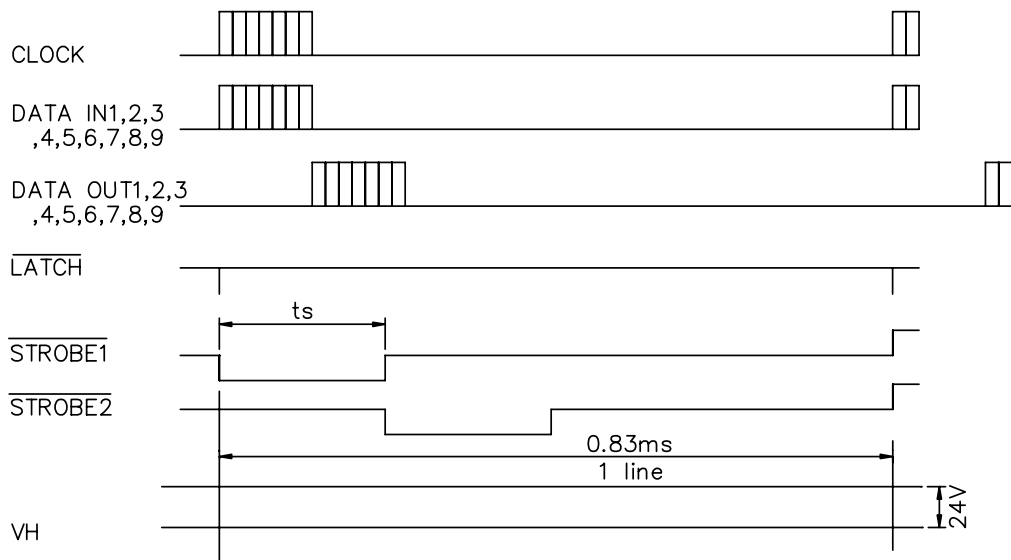
(Note 1) Each  $\overline{STROBE}$  includes pull-up resistance of  $300K\Omega \pm 50\%$  per IC.

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

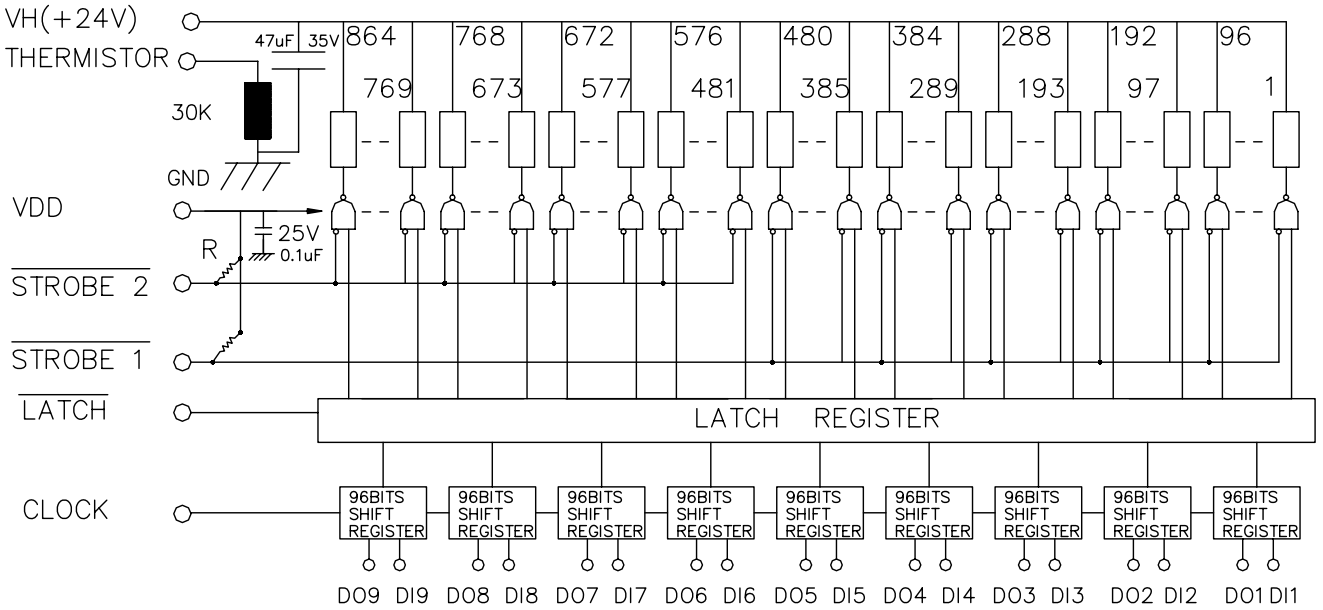
Parameter	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Clock frequency	$f_{MAX}$	cascade			30	MHz
Clock pulse width	$tw(T)$		14			ns
Data setup time	$tsu(D)$		8			ns
Data hold time	$th(D)$		8			ns
Latch setup time	$tsu(LA)$		20			ns
Latch pulse width	$tw(LA)$		100			ns
Latch to Strobe setup 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	$\mu s$



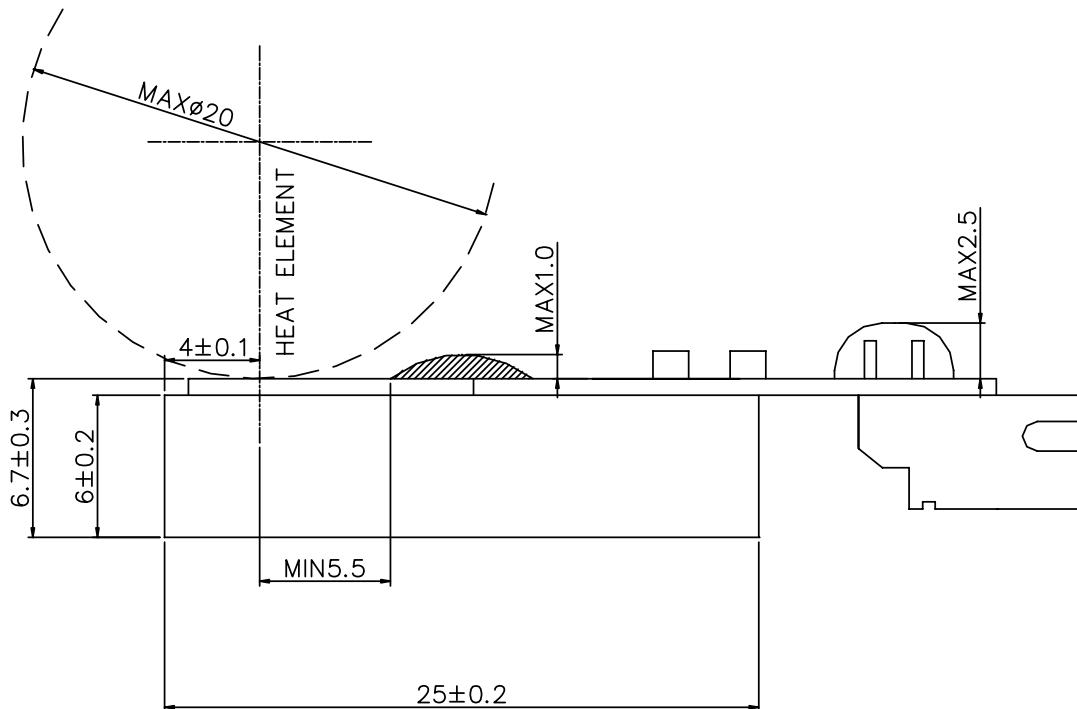
**Fig. 2** Thermal Print Head (ZX108) Timing Chart



**Fig. 3 Schematic Diagram**



**Fig. 4 Cross Section**



**Table. 3 Pin assignment**

Connector : S30B-PHDSS-B(LF)(SN) or EQUIVALENT

CONNECTOR1 ASSIGNMENT

PIN	NAME	PIN	NAME
1	DATA IN1	16	DATA OUT8
2	DATA OUT1	17	DATA IN9
3	DATA IN2	18	DATA OUT9
4	DATA OUT2	19	GND
5	DATA IN3	20	GND
6	DATA OUT3	21	GND
7	DATA IN4	22	GND
8	DATA OUT4	23	GND
9	DATA IN5	24	GND
10	DATA OUT5	25	GND
11	DATA IN6	26	GND
12	DATA OUT6	27	CLOCK
13	DATA IN7	28	LATCH
14	DATA OUT7	29	STROBE1
15	DATA IN8	30	STROBE2

CONNECTOR2 ASSIGNMENT

PIN	NAME	PIN	NAME
1	VH	16	GND
2	VH	17	GND
3	VH	18	GND
4	VH	19	GND
5	VH	20	GND
6	VH	21	GND
7	VH	22	GND
8	VH	23	GND
9	VH	24	GND
10	VH	25	GND
11	VH	26	GND
12	VH	27	GND
13	VH	28	GND
14	VH	29	VDD
15	GND	30	THERMISTOR

**Fig. 5 Dimension**

