

# THERMAL PRINT HEAD

## C80

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| REVISION |  |          |            |         | <u>Approved</u> |
|----------|--|----------|------------|---------|-----------------|
| Rev      | Description  | Date     | Approved   | Drawn   |                 |
| A        | -----  | 98-9-20  | J.Katagiri | Z.Wang  | <u>Checked</u>  |
| B        | <b>B1</b> Pin assignment revise  | 98-11-21 | J.Katagiri | Z.Wang  |                 |
| C        | <b>C1</b> Changed maximum ratings and standard printing conditions. Sections 7.7,7.8.                                | 99-4-13  | J.Katagiri | Z.Wang  |                 |
| D        | <b>D1</b> Changed name plate.  | 99-4-16  | J.Katagiri | Z.Wang  |                 |
| E        | <b>E1</b> Change the location of resistor<br>Origin : 2.0±0.1 ( Fig. 4 & 5)<br><b>E2</b> Add the dimension ( Fig. 5) | 99-5-10  | J.Katagiri | HX.Cong |                 |
| F        | <b>F1</b> Change the label   | 01-12-3  | T.Endo     | HX.Cong |                 |
|          |  |          |            |         | <u>Drawn</u>    |
|          |  |          |            |         |                 |
|          |  |          |            |         |                 |
|          |  |          |            |         |                 |

### 1. Description

This specification is applied to C80 thermal print head.

### 2. Scope

The C80 is a thermal print head which has heat elements which produce 640 dots with 8 dots/mm by means of a high density thick film process. It also includes C-MOS ICs; Which operate as 640 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                   | 80 mm   |          |
| Number of heaters             | 640 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          | 64bits × 10                                       |          |
| Number of data inputs         | 1 serial input                                    |          |
| Number of strobos             | 4   |          |
| Logic power supply            | 5 V × 45 mA                                       | at 2 MHz |
| Specification for Thermistor  | $R_{25} = 30K \Omega \pm 5\%, B = 3,950K \pm 2\%$ | Table. 1 |

### 4. Maximum ratings

| Parameter                     | Symbol | Specification   | Note                                      |
|-------------------------------|--------|---|---|
| Heater energy consumption     | Eomax  | 0.27 mJ/dot   | 2.5 ms/line                               |
|                               |        | 0.18 mJ/dot   | 1.25 ms/line                              |
|                               |        | 0.15 mJ/dot   | 0.625 ms/line                             |
| Head voltage                  | VH     | 25.2 V  | Between Connectors                        |
| Logic voltage                 | Vdd    | Vdd=+5V±0.25V   |   |
| 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                     |         | 0.625 ms/line                                       | 1.25 ms/line         |                                 |
|                           |         | 8 inch/sec  | 4 inch/sec           |                                 |
| Heater power consumption  | Po      | 0.74 W/dot  |                      | $\bar{R} = 700 \Omega$          |
| Heat voltage              | VH      | 24 V  |                      | Connectors                      |
| Heater energy consumption | Eo (ts) | 0.15mJ/dot (0.20 ms)                                | 0.18mJ/dot (0.24 ms) | $\bar{R} = 700 \Omega$ (Note 1) |
|                           |         | 0.14mJ/dot (0.19 ms)                                | 0.15mJ/dot (0.20 ms) |                                 |
|                           |         | 0.13mJ/dot (0.18 ms)                                | 0.14mJ/dot (0.19 ms) |                                 |
| Supply current            | Io      | 31.0 mA/dot   |                      | $\bar{R} = 700 \Omega$          |
| Timing chart              |         | Fig. 2  |                      |                                 |
| Platen pressure           |         | 10.8 ~ 14.7 N / TPH                                 |                      |                                 |
| Platen hardness           |         | 30~40deg  |                      |                                 |
| Platen diameter           |         | $\Phi 14$ Max.                                      |                      |                                 |
| Scanning resolution       |         | 8 line/mm   |                      |                                 |
| Thermal paper             |         | F24OAC / F220-VP<br>MITSUBISHI PAPER MILL CO., LTD. |                      |                                 |
| Optical density           |         | 1.1 OD Min.   |                      | (Note 2)                        |

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

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

- $R_{ic} = 23 \Omega$  : 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       | 50 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 -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.

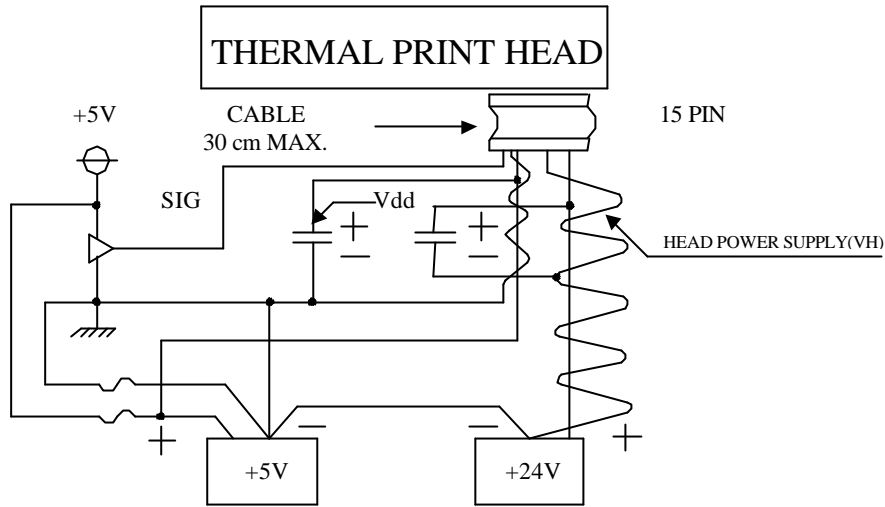
**7.5** Ink dregs adhered to the heater should be wiped off softly with a soft cloth dipped alcohol or detergent. Do not use sandpaper or equivalent.

**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 320.

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

**Fig. 1 Recommend Connection**



**Table. 1 Thermistor**

$$R_{25} = 30K\Omega \pm 5\%, B_{CONST} = 3950\text{kelvin} \pm 2\%, R = R_{25}e^{B(1/T - 1/T_{25})}$$

| Temperature ( ° C ) | Thermistor Resistance (R) |           |           |
|---------------------|---------------------------|-----------|-----------|
|                     | Min .(KΩ)                 | Typ. (KΩ) | Max. (KΩ) |
| -40.0               | 924.3                     | 1048      | 1184      |
| -35.0               | 667.4                     | 751.1     | 843.1     |
| -30.0               | 487.6                     | 545.0     | 607.6     |
| -25.0               | 360.0                     | 399.9     | 442.9     |
| -20.0               | 268.8                     | 296.6     | 326.5     |
| -15.0               | 202.7                     | 222.3     | 243.2     |
| -10.0               | 154.2                     | 168.2     | 182.9     |
| -5.0                | 118.4                     | 128.4     | 138.9     |
| 0.0                 | 91.70                     | 98.90     | 106.4     |
| 5.0                 | 71.65                     | 76.71     | 82.10     |
| 10.0                | 56.20                     | 59.99     | 63.88     |
| 15.0                | 44.50                     | 47.27     | 50.10     |
| 20.0                | 35.49                     | 37.53     | 39.58     |
| 25.0                | 28.50                     | 30.00     | 31.50     |
| 30.0                | 22.84                     | 24.14     | 25.46     |
| 35.0                | 18.42                     | 19.55     | 20.71     |
| 40.0                | 14.95                     | 15.93     | 16.94     |
| 45.0                | 12.20                     | 13.06     | 13.94     |
| 50.0                | 10.02                     | 10.76     | 11.54     |
| 55.0                | 8.271                     | 8.920     | 9.596     |
| 60.0                | 6.864                     | 7.430     | 8.021     |
| 65.0                | 5.726                     | 6.219     | 6.738     |
| 70.0                | 4.799                     | 5.230     | 5.686     |
| 75.0                | 4.041                     | 4.418     | 4.819     |
| 80.0                | 3.418                     | 3.749     | 4.102     |

**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          | $V_{dd}$  |                       | 4.75                | 5.0  | 5.25                | V    |
|                         | $VH$      | Supply voltage for VH | 23.5                | 24.0 | 24.5                | V    |
| Input voltage for logic | $V_{IH}$  | (Note 1)              | $0.8 \times V_{dd}$ |      | $V_{dd}$            | V    |
|                         | $V_{IL}$  |                       | 0                   |      | $0.2 \times V_{dd}$ | V    |
| Clock frequency         | $f_{CLK}$ | duty 50%              | 0.1                 | 1.0  | 3.5                 | MHz  |

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

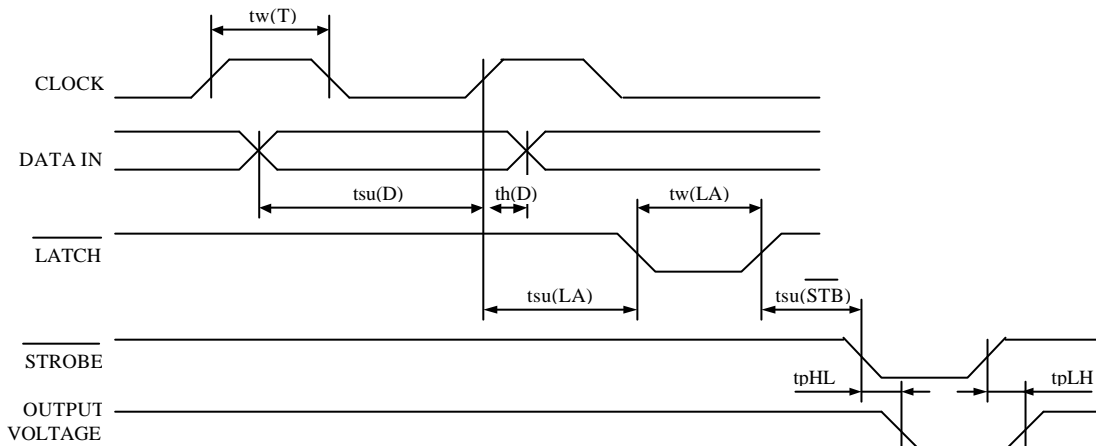
**Table 2.2** Electrical characteristics for driver IC.

| Parameter  | Symbol              | Test conditions                            | Ratings                          |      |      | Unit        |         |
|--|---------------------|--|----------------------------------|------|------|-------------|---------|
|  |                     |  | Min.                             | Typ. | Max. |             |         |
| Input current  | $\overline{LATCH}$  | (Note 1)<br>$I_{IH}$                       | $V_{dd}=5.75V$<br>$V_{IH}=5.75V$ |      |      | 5.0         | $\mu A$ |
|  | $\overline{STROBE}$ |  |                                  |      |      | 1.5         | $\mu A$ |
|  | CLOCK               |  |                                  |      |      | 5.0         | $\mu A$ |
|  | DATA IN             |  |                                  |      |      | 0.5         | $\mu A$ |
|  | $\overline{LATCH}$  | $I_{IL}$                                   | $V_{dd}=5.75V$<br>$V_{IL}=0V$    | -5.0 |      |             | $\mu A$ |
|  | $\overline{STROBE}$ |  |                                  | -165 |      |             | $\mu A$ |
|  | CLOCK               |  |                                  | -5.0 |      |             | $\mu A$ |
|  | DATA IN             |  |                                  | -0.5 |      |             | $\mu A$ |
| Output voltage of drivers<br>(Heater supply voltage) | $V_{OL}$            | $V_{dd}=5V$<br>$I_{OL}=15mA$               | $T_j=0^\circ C$                  | 1.1  | 1.7  | V           |         |
|  |                     |  | $T_j=70^\circ C$                 | 1.5  | 2.3  |             |         |
| Leak current of drivers                              | $I_{OH}$            | $V_{dd}=4.25V$<br>$VH=24V$                 |                                  |      | 1.0  | $\mu A/dot$ |         |
| Logic supply current                                 | $I_{dd}$            | $V_{dd}=5.25V$ ALL WHITE<br>$f_{CLK}=2MHz$ |                                  |      | 45   | mA          |         |

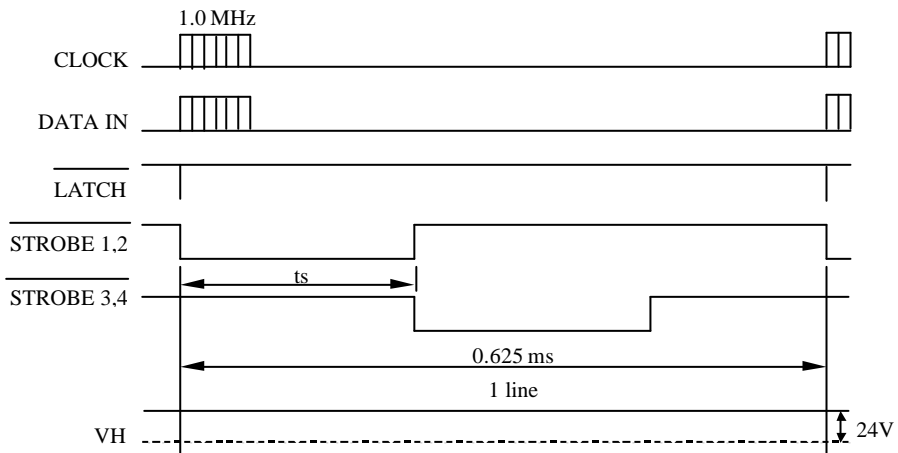
(Note 1) Each  $\overline{STROBE}$  includes pull-up resistance of  $300K\Omega \pm 50\%$  per IC.

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

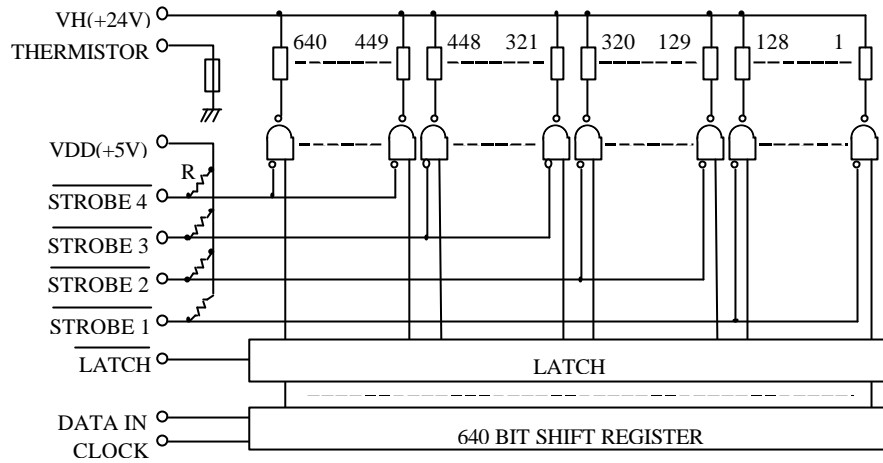
| Parameter                             | Symbol                 | Test conditions | Ratings |      |      | Unit    |
|---------------------------------------|------------------------|-----------------|---------|------|------|---------|
|                                       |                        |                 | Min.    | Typ. | Max. |         |
| Clock frequency                       | $f_{MAX}$              |                 |         |      | 4.0  | MHz     |
| Clock pulse width                     | $tw(T)$                |                 | 70      |      |      | ns      |
| Data setup time                       | $tsu(D)$               |                 | 50      |      |      | ns      |
| Data hold time                        | $th(D)$                |                 | 40      |      |      | ns      |
| Latch setup time                      | $tsu(LA)$              |                 | 100     |      |      | ns      |
| Latch pulse width                     | $tw(LA)$               |                 | 100     |      |      | ns      |
| Strobe setup time                     | $tsu(\overline{STB})$  |                 | 100     |      |      | ns      |
| Strobe to driver<br>Output delay time | $T_{pLH}$<br>$T_{pHL}$ |                 |         |      | 3.5  | $\mu s$ |



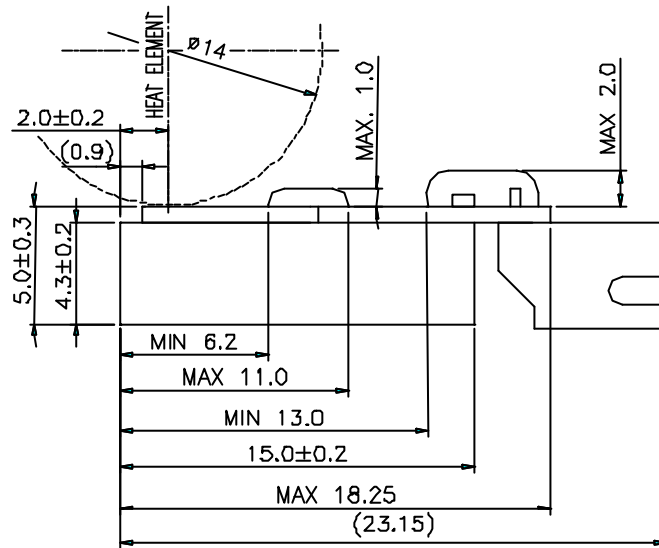
**Fig. 2** Thermal Print Head (C80) Timing Chart



**Fig. 3 Schematic Diagram**



**Fig. 4 Cross Section**

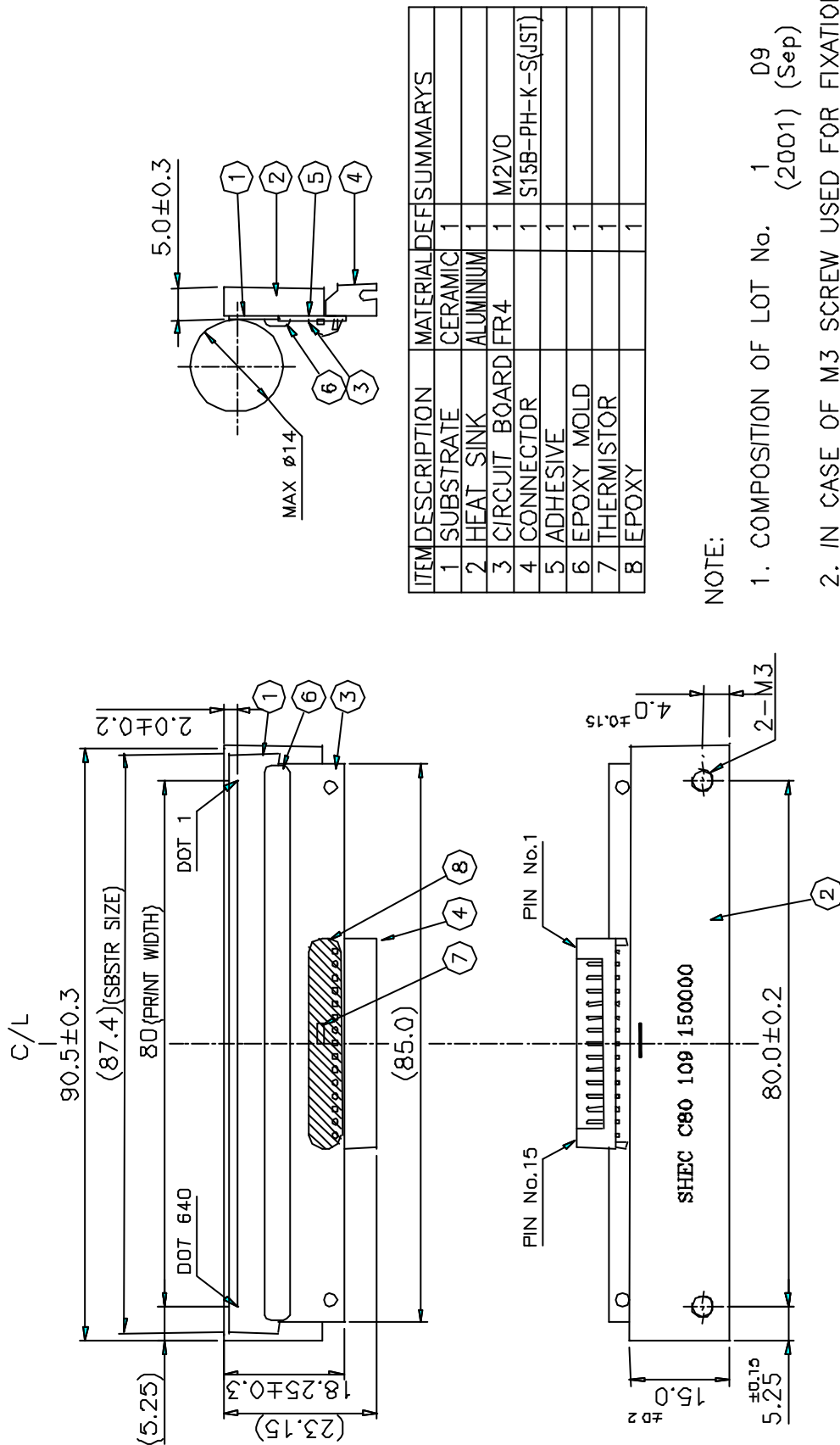


**Table. 3 Pin assignment**

Connector : (S15B-PH-K-S-2.2:JST)

| PIN | NAME       | PIN | NAME            |
|-----|------------|-----|-----------------|
| 1   | VH         | 9   | <u>STROBE 1</u> |
| 2   | VH         | 10  | <u>STROBE 2</u> |
| 3   | VH         | 11  | <u>STROBE 3</u> |
| 4   | GND        | 12  | <u>STROBE 4</u> |
| 5   | GND        | 13  | <u>CLOCK</u>    |
| 6   | GND        | 14  | <u>LATCH</u>    |
| 7   | Vdd        | 15  | DATA IN         |
| 8   | THERMISTOR |     |                 |

**Fig. 5 Dimension**



NOTE:

1. COMPOSITION OF LOT No. 1 D9 (2001) (Sep)
2. IN CASE OF M3 SCREW USED FOR FIXATION. DEPTH IS 3.5 MAX.