The S-4622A is a CMOS thermal print head driver containing a 64-bit shift register and a latch. It can be used for general purpose because “H” or “L” can be selected for the latch and the driver enable. It is ideal for the bar-code printer and the thermal print head of high-speed printing because of its large driver output current of 70 mA.

## ■ Features

- Low current consumption : 0.4 mA typ.
  ($f_{CLK}$=5 MHz, SI: fixed)
- High speed operation : 7 MHz (chip)
  5 MHz (cascade connection)
- Driver output voltage : 10 V max.
- Driver output current : 70 mA max.
- 64-bit shift register and latch are built in
- Driver enable
- Selectable “H/L” for latch and driver enable

## ■ Block Diagram

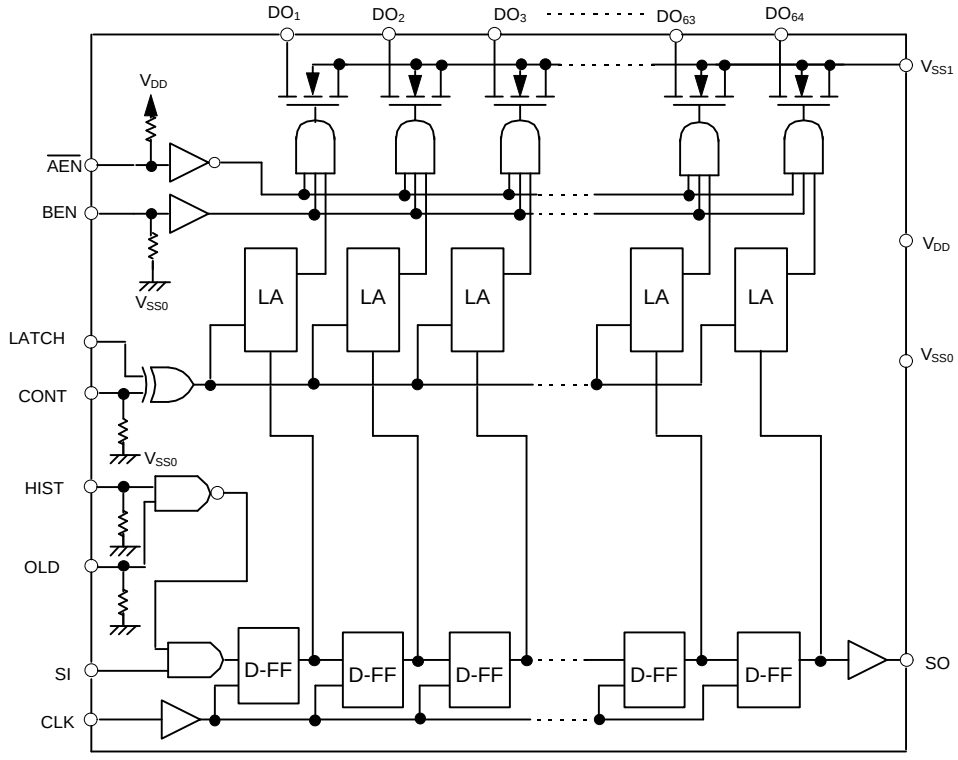



**Figure 1**

## ■ Operation

(1) Fundamental Operation

The 64-bit shift register reads the data input to SI at the rising edge of the CLOCK input. Please use HIST in low or OPEN.

The latch circuit operates depending on the levels of CONT and LATCH ; it reads the data of the shift register when their levels are the same, and it holds the data of the shift register when they differ.

The latch data is output to the respective drivers when $\overline{AEN}$ is low and BEN is high. The driver output transistor turns ON when the latch data is high and turns OFF when low. Turning $\overline{AEN}$ high or BEN low makes all driver output transistors go off.

(2) Operation of Generating Historical Data

When HIST is high, OLD turns active. The data input to SI and the data input to OLD at the rising edge of the CLOCK input are read at the shift resister as historical data by using logical circuit.

This is proceeded by AND of logical invert data of input data from OLD and input data from SI.

For example, when the last printed-data input to OLD and the up-data printed-data input to SI, historical data in the figure 2 in the below is read to the shift resistor.

Table 1

| | Pattern 1 | Pattern 2 | Pattern 3 | Pattern 4 |
|---|---|---|---|---|
| The last printed-data (OLD) | ● | ● | ○ | ○ |
| The up-data printed-data (SI) | ● | ○ | ● | ○ |
| The historical data to the shift resistor | ○ | ○ | ● | ○ |

● is HIGH.

○ is LOW.

The application example is advantage for the preliminary powering-on electricity data of heating elements since when the last printed-data is ○ and the up-data printer-data is ●, the historical data will be ●.

## ■ Terminal Functions (Refer to the dimensions for the pad arrangement)

**Table 2**

| No. | Name | Functions |
|---|---|---|
| 1 to 64 | $DO_1$ to $DO_{64}$ ( $DO_n$) | Driver output terminals (Nch open-drain) |
| 65, 69, 72, 73, 78, 82 | $V_{SS1}$ | GND for driver (0 V) |
| 80 | $V_{DD}$ | Positive power supply for logic (+5 V) |
| 66, 74 | $V_{SS0}$ | GND for logic (0 V) |
| 76 | CLK | Clock input terminal for 64-bit shift register |
| 81 | SI | Serial data input terminal for 64-bit shift register |
| 67 | SO | Serial data output terminal for 64-bit shift register |
| 68 | LATCH | Data latch signal input terminal<br>When CONT="L" or open<br>LATCH="L": Reads the data of the shift register<br>LATCH="H": Holds the preceding data<br>When CONT="H"<br>LATCH="L": Holds the preceding data<br>LATCH="H": Reads the data of the shift register |
| 71 | CONT | Data latch signal control terminal : Selects "H" or "L" for LATCH (pull-down resistor is built in) |
| 75 | $\overline{AEN}$ | Driver enable terminal : Outputs the latch data to the driver when low (pull-up resistor is built in) |
| 70 | BEN | Driver enable terminal : Outputs the latch data to the driver when high (pull-down resistor is built in) |
| 79 | OLD | Former column serial data input terminal<br>(A pull- down resistor is built in) |
| 77 | HIST | Former column serial data input control terminal (A pull-down resistor is built in)<br>HIST="H" : OLD terminal is active.<br>HIST="L" or open : Input from OLD terminal is not allowed. |

## ■ Absolute Maximum Ratings

**Table 3**

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Supply voltage | $V_{SS0,1}$ - $V_{DD}$ | -0.4 to +7.0 | V |
| Driver output voltage | $V_{DOH}$ | 10 | V |
| Driver output current | $I_{DOL}$ | 70 | mA |
| Input voltage | $V_{IN}$ | $V_{SS0}$-0.5 to $V_{DD}$+0.5 | V |
| Output voltage | $V_{OUT}$ | $V_{SS0}$-0.5 to $V_{DD}$+0.5 | V |
| Max. junction temperature | $T_{jMAX}$ | 125 | °C |
| Operating temperature range | $T_{opr}$ | -10 to +80 | °C |
| Storage temperature range | $T_{stg}$ | -40 to +125 | °C |

## ■ DC Electrical Characteristics

**Table 4**

(Unless otherwise specified: $V_{DD}$=5.0 V±10%, Ta=-10 °C to 80 °C)

| Parameter | Sybl | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Supply voltage | $V_{DD}$ | | | 4.5 | 5.0 | 5.5 | V |
| High level input voltage | $V_{IH}$ | ∗1 | | 0.7×$V_{DD}$ | — | $V_{DD}$ | V |
| Low level input voltage | $V_{IL}$ | | | $V_{SS}$ | — | 0.3×$V_{DD}$ | V |
| High level input current | $I_{IH}$ | $V_{DD}$=5.0V<br>$V_{IH}$=5.0V | BEN,CONT,OLD, HIST | — | — | 55 | µA |
| | | Ta=25°C | | — | — | 0.5 | µA |
| Low level input current | $I_{IL}$ | $V_{DD}$=5.0V<br>$V_{IL}$=0V<br>Ta=25°C | $\overline{AEN}$ | -55 | — | — | µA |
| | | | | -0.5 | — | — | µA |
| High level output voltage | $V_{OH}$ | SO terminal, no load | | 4.45 | — | — | V |
| Low level output voltage | $V_{OL}$ | SO terminal, no load | | — | — | 0.05 | V |
| High level output current | $I_{OH}$ | SO terminal, $V_{OH}$=$V_{DD}$-0.4 V | | — | — | -0.5 | mA |
| Low level output current | $I_{OL}$ | SO terminal, $V_{OL}$=0.4 V | | 0.5 | — | — | mA |
| High level driver output voltage | $V_{DOH}$ | Heat generator resistance:<br>100 Ω min. | | — | 5 | 7 | V |
| Low level driver output voltage | $V_{DOL}$ | $I_{DOL}$=60 mA, Ta=25 °C | | — | 0.7 | 0.9 | V |
| Driver leakage current | $I_{LEAK}$ | $V_{DOH}$=7 V<br>Per 1-bit of driver output | | — | — | 1.0 | µA |
| | | $V_{DOH}$=7 V<br>Per 64-bit of driver output | | — | — | 10 | µA |
| Current consumption | $I_{DD}$ | Ta=<br>25 °C | $f_{CLK}$ =2 MHz,SI : fixed | | 0.2 | 0.6 | mA |
| | | | $f_{CLK}$ =5 MHz,SI : fixed | | 0.4 | 1.2 | mA |
| | | | $f_{CLK}$ =5 MHz, SI=1/2$f_{CLK}$ | | 1.6 | 5.0 | mA |
| Static current | $I_S$ | ∗2 | | — | — | 10 | µA |

∗1 CLK : $f_{CLK}$=fmax duty 50%
$T_{SUD}$=THD=100 nsec
SI, OLD, HIST : 1/2 fmax
LATCH : $T_{WLA}$=100 nsec
Others : DC level

∗2 SI, CLK, LATCH = GND
Other input terminals = OPEN

## ■ AC Electrical Characteristics

**Table 5**
(Unless otherwise specified: $V_{DD}$=5.0 V±10%, Ta=-10 °C to 80 °C)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| CLK pulse width | $t_{WCLK}$ | | 70 | — | — | ns |
| Data setup time | $t_{SUD}$ | $V_{IH}=V_{DD}$, $V_{IL}=V_{SS0}$ | 40 | — | — | ns |
| Data hold time | $t_{HD}$ | $V_{IH}=V_{DD}$, $V_{IL}=V_{SS0}$ | 40 | — | — | ns |
| Latch pulse width | $t_{WLA}$ | | 100 | — | — | ns |
| Latch setup time | $t_{SULA}$ | | 100 | — | — | ns |
| CLK-SO propagation delay time | $t_{dSO}$ | $C_L$=3 pF | — | — | 120 | ns |
| EN-DOn propagation delay time | $t_{dDO}$ | $R_L$=1.0 kΩ, $V_{DOH}$=5 V | — | — | 13.0 | µs |
| DOn rise time | $t_{rDO}$ | $R_L$=1.0 kΩ, $V_{DOH}$=5 V | — | 1.0 | 4.5 | µs |
| DOn fall time | $t_{fDO}$ | $R_L$=1.0 kΩ, $V_{DOH}$=5 V | — | 1.0 | 4.0 | µs |
| Clock frequency | $f_{CLK}$ | When cascade connection | — | — | 5.0 | MHz |

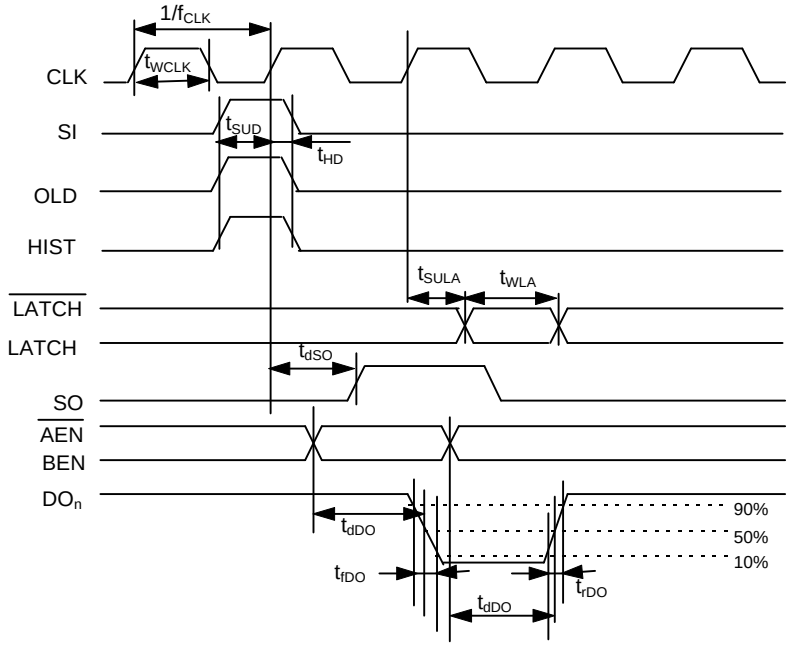
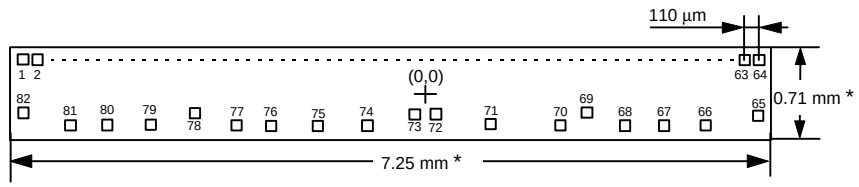



**Figure 2**

## ■ Dimensions




Pad size : 80 μm × 80 μm
(passivation opening)
Pad pitch : 110 μm (driver output pad)
Chip thickness : 350±30 μm

*Before dicing

**Figure 3**

## ■ Pad Coordinates (The origin of the coordinate axes is the center of the chip)

**Table 6**

Unit: μm

| Pad No. | Name | X | Y | Pad No. | Name | X | Y | Pad No. | Name | X | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $DO_1$ | -3465 | 257.5 | 29 | $DO_{29}$ | -385 | 257.5 | 57 | $DO_{57}$ | 2695 | 257.5 |
| 2 | $DO_2$ | -3355 | 257.5 | 30 | $DO_{30}$ | -275 | 257.5 | 58 | $DO_{58}$ | 2805 | 257.5 |
| 3 | $DO_3$ | -3245 | 257.5 | 31 | $DO_{31}$ | -165 | 257.5 | 59 | $DO_{59}$ | 2915 | 257.5 |
| 4 | $DO_4$ | -3135 | 257.5 | 32 | $DO_{32}$ | -55 | 257.5 | 60 | $DO_{60}$ | 3025 | 257.5 |
| 5 | $DO_5$ | -3025 | 257.5 | 33 | $DO_{33}$ | 55 | 257.5 | 61 | $DO_{61}$ | 3135 | 257.5 |
| 6 | $DO_6$ | -2915 | 257.5 | 34 | $DO_{34}$ | 165 | 257.5 | 62 | $DO_{62}$ | 3245 | 257.5 |
| 7 | $DO_7$ | -2805 | 257.5 | 35 | $DO_{35}$ | 275 | 257.5 | 63 | $DO_{63}$ | 3355 | 257.5 |
| 8 | $DO_8$ | -2695 | 257.5 | 36 | $DO_{36}$ | 385 | 257.5 | 64 | $DO_{64}$ | 3465 | 257.5 |
| 9 | $DO_9$ | -2585 | 257.5 | 37 | $DO_{37}$ | 495 | 257.5 | 65 | $V_{SS1}$ | 3455 | -125.0 |
| 10 | $DO_{10}$ | -2475 | 257.5 | 38 | $DO_{38}$ | 605 | 257.5 | 66 | $V_{SS0}$ | 2855 | -257.5 |
| 11 | $DO_{11}$ | -2365 | 257.5 | 39 | $DO_{39}$ | 715 | 257.5 | 67 | SO | 2455 | -257.5 |
| 12 | $DO_{12}$ | -2255 | 257.5 | 40 | $DO_{40}$ | 825 | 257.5 | 68 | LATCH | 2085 | -257.5 |
| 13 | $DO_{13}$ | -2145 | 257.5 | 41 | $DO_{41}$ | 935 | 257.5 | 69 | $V_{SS1}$ | 1760 | -125.0 |
| 14 | $DO_{14}$ | -2035 | 257.5 | 42 | $DO_{42}$ | 1045 | 257.5 | 70 | BEN | 1570 | -257.5 |
| 15 | $DO_{15}$ | -1925 | 257.5 | 43 | $DO_{43}$ | 1155 | 257.5 | 71 | CONT | 685 | -257.5 |
| 16 | $DO_{16}$ | -1815 | 257.5 | 44 | $DO_{44}$ | 1265 | 257.5 | 72 | $V_{SS1}$ | 60 | -125.0 |
| 17 | $DO_{17}$ | -1705 | 257.5 | 45 | $DO_{45}$ | 1375 | 257.5 | 73 | $V_{SS1}$ | -60 | -125.0 |
| 18 | $DO_{18}$ | -1595 | 257.5 | 46 | $DO_{46}$ | 1485 | 257.5 | 74 | $V_{SS0}$ | -390 | -257.5 |
| 19 | $DO_{19}$ | -1485 | 257.5 | 47 | $DO_{47}$ | 1595 | 257.5 | 75 | $\overline{AEN}$ | -860 | -257.5 |
| 20 | $DO_{20}$ | -1375 | 257.5 | 48 | $DO_{48}$ | 1705 | 257.5 | 76 | CLK | -1280 | -257.5 |
| 21 | $DO_{21}$ | -1265 | 257.5 | 49 | $DO_{49}$ | 1815 | 257.5 | 77 | HIS | -1520 | -257.5 |
| 22 | $DO_{22}$ | -1155 | 257.5 | 50 | $DO_{50}$ | 1925 | 257.5 | 78 | $V_{SS1}$ | -1760 | -125.0 |
| 23 | $DO_{23}$ | -1045 | 257.5 | 51 | $DO_{51}$ | 2035 | 257.5 | 79 | OLD | -2103 | -257.5 |
| 24 | $DO_{24}$ | -935 | 257.5 | 52 | $DO_{52}$ | 2145 | 257.5 | 80 | $V_{DD}$ | -2523 | -257.5 |
| 25 | $DO_{25}$ | -825 | 257.5 | 53 | $DO_{53}$ | 2255 | 257.5 | 81 | SI | -2929 | -257.5 |
| 26 | $DO_{26}$ | -715 | 257.5 | 54 | $DO_{54}$ | 2365 | 257.5 | 82 | $V_{SS1}$ | -3455 | -125.0 |
| 27 | $DO_{27}$ | -605 | 257.5 | 55 | $DO_{55}$ | 2475 | 257.5 | | | | |
| 28 | $DO_{28}$ | -495 | 257.5 | 56 | $DO_{56}$ | 2585 | 257.5 | | | | |