192-bit THERMAL HEAD DRIVER S-4662AWI

The S-4662AWI is a CMOS thermal print head driver containing a 192-bit shift register and a latch. Its latch and driver enable are fixed to negative logic so that it can be used easily.

■ Features

- Low current consumption : 1.0 mA typ.
  (f_{CLK}= 4 MHz, SI: fixed)
- High speed operation :7 MHz (chip)
  :5 MHz (cascade connection)
- Driver output voltage :36 V max.
- Driver output current : 8 mA typ.
- 192-bit shift register and latch are built in
- Driver enable
- Driver-off function when supply voltage falls
- Wafer delivery

■ Block Diagram

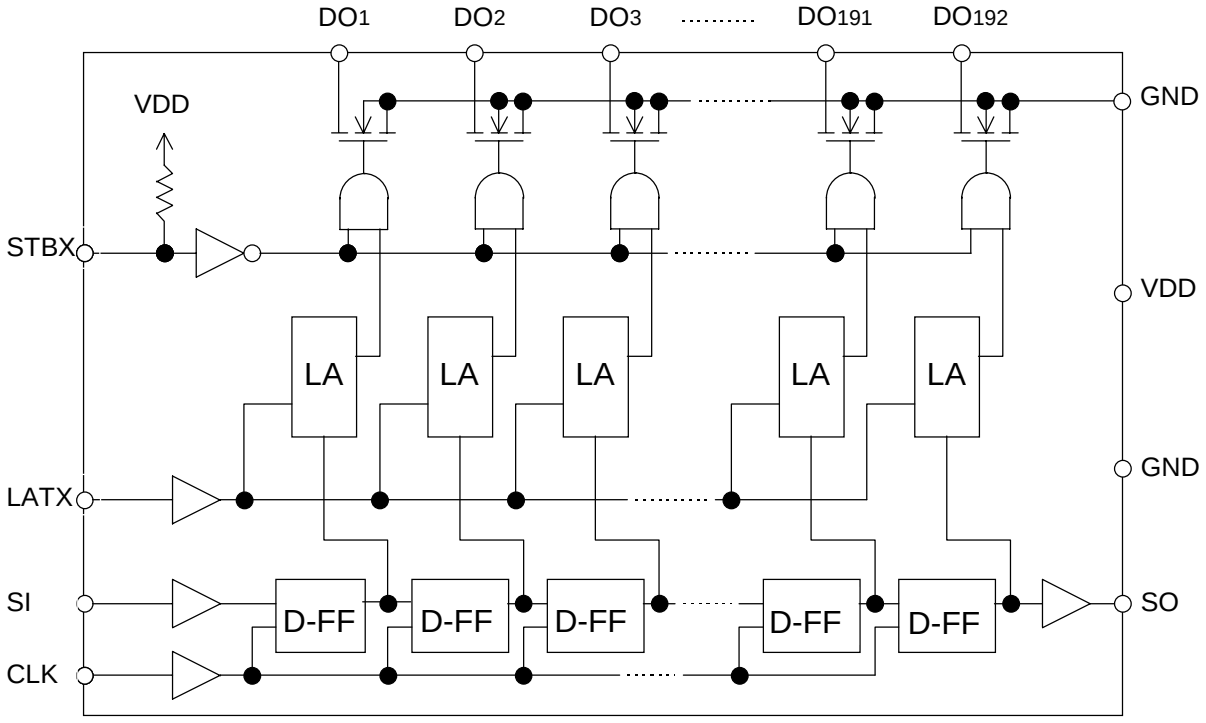


Figure 1

■ Operation

The shift register reads the data input to SI at the rising edge of the CLOCK input.

The latch circuit reads data from the shift register when LATX is low. It holds the immediately preceding data when LATX is high.

Latch data is output to the driver when STBX is low. When latch data is high, the driver output transistor goes on. When it is low, the driver output transistor goes off. Setting STBX high turns off all driver output transistors.

When the supply voltage changes from 0 V to 5 or 5 V to 0, the driver output transister goes off.

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

Table 1

No.	Name	Functions
12 to 203	DO_1 to DO_{192}	Driver output terminals (Nch open-drain)
3	CLK	Clock input terminal for 192-bit shift register
1	SI	Serial data input terminal for 192-bit shift register
2	SO	Serial data output terminal for 192-bit shift register
4	VDD	Power supply terminal for logic (+ 5 V)
7 to 11	GND	Ground terminal (0 V)
5	LATX	Data latch signal input terminal LATX="L": Reads the data of the shift register LATX="H": Holds the preceding data
6	STBX	Driver strobe input terminal Output latch data when STBX is low to the driver. (pull-up resistor R_P = 300 kΩ Typ. is built in.)

■ Absolute Maximum Ratings

Table 2

Parameter	Symbol	Ratings	Unit
Supply voltage	GND to V_{DD}	-0.4 to +7.0	V
Driver output withstand voltage	V_{DOH}	36	V
Driver output current	I_{DOL}	15 *1	mA
Input voltage	VIN	GND -0.5 to V_{DD}+0.5	V
Output voltage	VOUT	GND -0.5 to V_{DD}+0.5	V
Max. junction temperature	Tjmax	125	°C
Operating temperature range	Topr	-10 to +80	°C
Storage temperature range	Tstg	-40 to +125	°C

*1 For one bit of the driver output pins being on.
When 192 bits of the driver output pins are all on, the printing duty is less than 50 percent with IOL being up to 9.0 mA and it is less than 25 percent with IOL being up to 12.0 mA.

■ DC Electrical Characteristics

Table 3
(Unless otherwise specified: V_{DD}=5.0 V±10%, Ta=-10 °C to 80 °C)

Parameter	Sybol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}		4.5	5.0	5.5	V
High level driver output voltage	V_{DOH}	Heat generator resistance: min. 2 kΩ	—	—	28	V
High level input voltage	V_{IH}	CLK : f_{CLK}=fmax duty 50% t_{SUD}=t_{HD}=100nsec SI : f_{SI}=1/2fmax	0.7×V_{DD}	—	V_{DD}	V
Low level input voltage	V_{IL}	LATX: t_{WLA}=100nsec STBX: DC level	GND	—	0.3×V_{DD}	V
High level input current	I_{IH}	V_{IH}=V_{DD}	—	—	0.5	µA
Low level input current	I_{IL}	STBX *1 V_{IL} = GND	-55	-17	—	µA
		Other terminal V_{IL} = GND	-0.5	—	—	µA
High level output voltage	V_{OH}	SO terminal, I_{OH} = -0.5 mA	4.1	—	—	V
Low level output voltage	V_{OL}	SO terminal, I_{OL} = 0.5 mA	—	—	0.4	V
Low level driver output voltage	V_{DOL}	V_{DD}=5.0V, I_{OL}=8.0mA	—	0.9	1.6	V
Driver leakage current	I_{LEAK}	V_{DOH}=28 V	—	—	1.0	µA
Current consumption	I_{DD}	f_{CLK} =4 MHz, SI : fixed	—	1.0	3.3	mA
		f_{CLK} =4 MHz, SI : HLHL	—	2.0	7.0	mA
Static current	I_S	SI, CLK, LATCH = GND Other input terminals = OPEN	—	0.1	0.3	mA
Lower V_{DD} detection voltage	V_{DET}		0.8	—	4.0	V

*1 With built-in pull-up resistor

■ AC Electrical Characteristics

Table 4

(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}	V_{IH}= V_{DD}, V_{IL}= 0V	70	—	—	ns
Data setup time	t_{SUD}	rising,	40	—	—	ns
Data hold time	t_{HD}	faliing 15 nsec or lower	40	—	—	ns
Latch pulse width	t_{WLA}	Output load	100	—	—	ns
Latch setup time	t_{SULA}	R_L =1MΩ	100	—	—	ns
CLK-SO propagation delay time	t_{dSO}	C_L=10 pF	—	—	120	ns
EN-DOn propagation delay time	t_{dDO}	V_{DOH}=24 V, R_L=3000Ω	0.2	—	3.9	µs
DOn rise time	t_{rDO}	V_{DOH}=24 V, R_L=3000Ω	0.2	0.8	2.8	µs
DOn fall time	t_{fDO}	V_{DOH}=24 V, R_L=3000Ω	0.2	0.8	3.0	µs
Clock frequency	f_{CLK}	When cascade connection	—	—	5.0	MHz

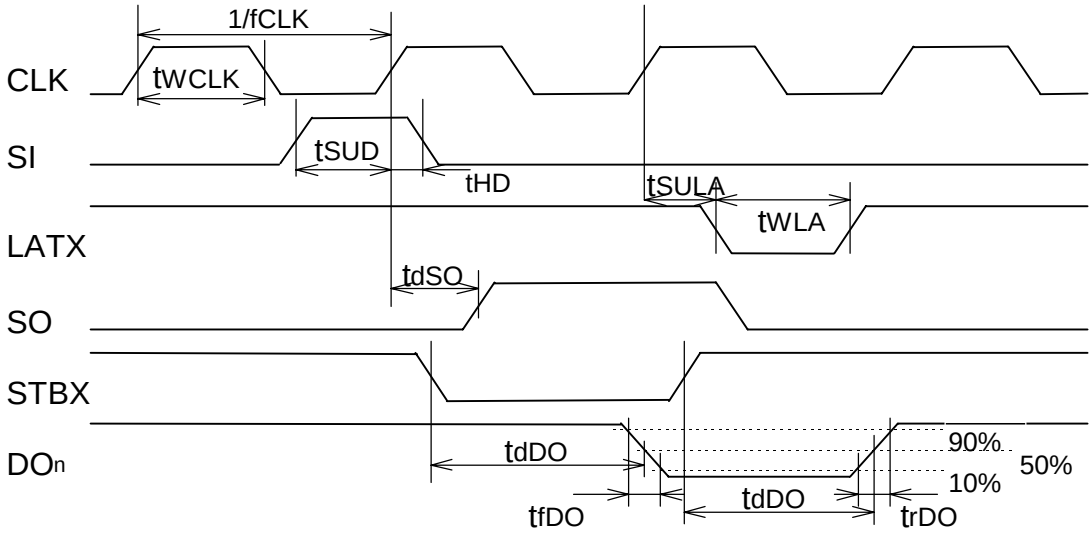
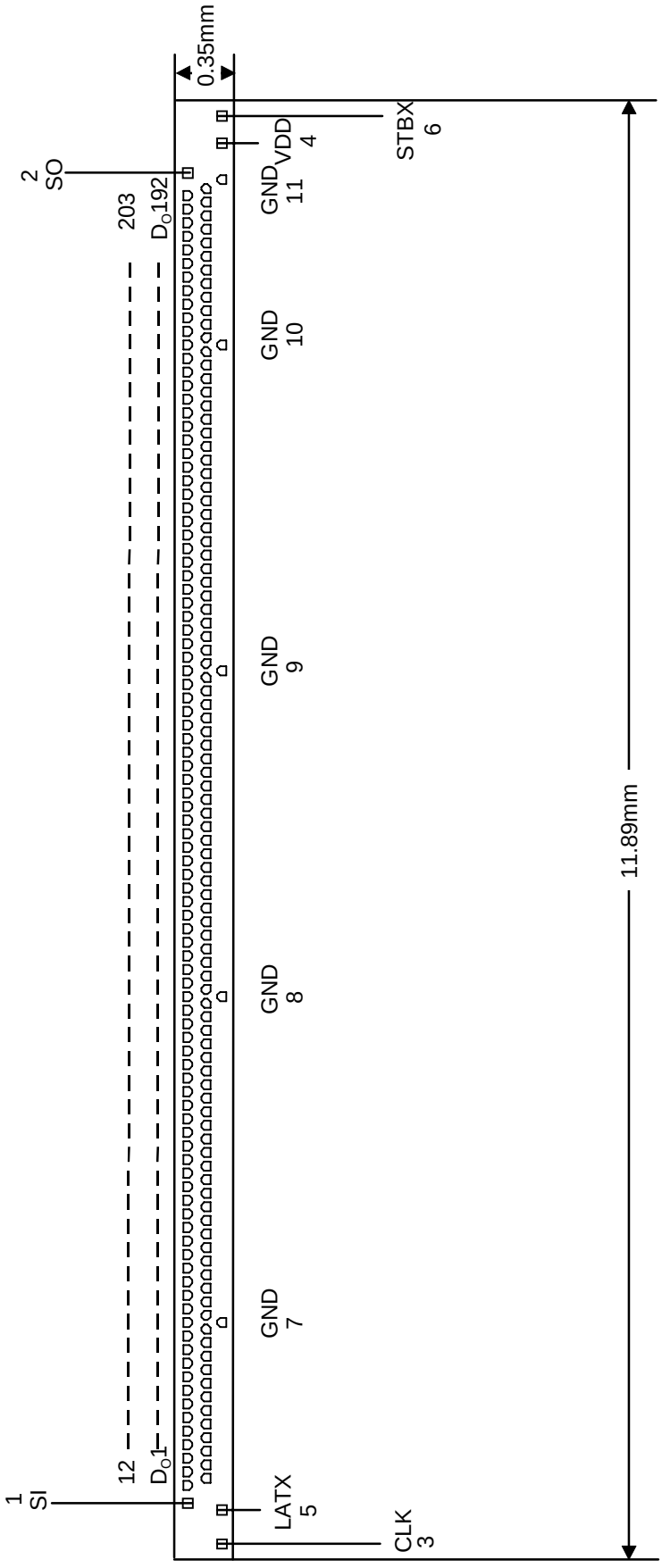


Figure 2

■ Dimensions



Pad pitch :X = 57 mm,
Y = 87 mm (diver output pad)
Chip thickness : 350 ± 30 mm
Chip size is before dicing

Figure 3

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

Table 5

Unit: μm (1 / 2)

Pad No.	Name	X	Y	Pad No.	Name	X	Y
1	SI	-5574.5	94.0	51	DO40	-3241.5	11.5
2	SO	5531.6	95.0	52	DO41	-3184.5	98.5
3	CLK	-5833.9	-92.0	53	DO42	-3127.5	11.5
4	VDD	5711.6	-92.0	54	DO43	-3070.5	98.5
5	LATX	-5613.1	-92.0	55	DO44	-3013.5	11.5
6	STBX	5834.0	-92.0	56	DO45	-2956.5	98.5
7	GND	-4096.5	-78.8	57	DO46	-2899.5	11.5
8	GND	-1360.5	-78.8	58	DO47	-2842.5	98.5
9	GND	1375.5	-78.8	59	DO48	-2785.5	11.5
10	GND	4111.5	-78.8	60	DO49	-2728.5	98.5
11	GND	5489.4	-78.8	61	DO50	-2671.5	11.5
12	DO1	-5464.5	98.5	62	DO51	-2614.5	98.5
13	DO2	-5407.5	11.5	63	DO52	-2557.5	11.5
14	DO3	-5350.5	98.5	64	DO53	-2500.5	98.5
15	DO4	-5293.5	11.5	65	DO54	-2443.5	11.5
16	DO5	-5236.5	98.5	66	DO55	-2386.5	98.5
17	DO6	-5179.5	11.5	67	DO56	-2329.5	11.5
18	DO7	-5122.5	98.5	68	DO57	-2272.5	98.5
19	DO8	-5065.5	11.5	69	DO58	-2215.5	11.5
20	DO9	-5008.5	98.5	70	DO59	-2158.5	98.5
21	DO10	-4951.5	11.5	71	DO60	-2101.5	11.5
22	DO11	-4894.5	98.5	72	DO61	-2044.5	98.5
23	DO12	-4837.5	11.5	73	DO62	-1987.5	11.5
24	DO13	-4780.5	98.5	74	DO63	-1930.5	98.5
25	DO14	-4723.5	11.5	75	DO64	-1873.5	11.5
26	DO15	-4666.5	98.5	76	DO65	-1816.5	98.5
27	DO16	-4609.5	11.5	77	DO66	-1759.5	11.5
28	DO17	-4552.5	98.5	78	DO67	-1702.5	98.5
29	DO18	-4495.5	11.5	79	DO68	-1645.5	11.5
30	DO19	-4438.5	98.5	80	DO69	-1588.5	98.5
31	DO20	-4381.5	11.5	81	DO70	-1531.5	11.5
32	DO21	-4324.5	98.5	82	DO71	-1474.5	98.5
33	DO22	-4267.5	11.5	83	DO72	-1417.5	11.5
34	DO23	-4210.5	98.5	84	DO73	-1360.5	98.5
35	DO24	-4153.5	11.5	85	DO74	-1303.5	11.5
36	DO25	-4096.5	98.5	86	DO75	-1246.5	98.5
37	DO26	-4039.5	11.5	87	DO76	-1189.5	11.5
38	DO27	-3982.5	98.5	88	DO77	-1132.5	98.5
39	DO28	-3925.5	11.5	89	DO78	-1075.5	11.5
40	DO29	-3868.5	98.5	90	DO79	-1018.5	98.5
41	DO30	-3811.5	11.5	91	DO80	-961.5	11.5
42	DO31	-3754.5	98.5	92	DO81	-904.5	98.5
43	DO32	-3697.5	11.5	93	DO82	-847.5	11.5
44	DO33	-3640.5	98.5	94	DO83	-790.5	98.5
45	DO34	-3583.5	11.5	95	DO84	-733.5	11.5
46	DO35	-3526.5	98.5	96	DO85	-676.5	98.5
47	DO36	-3469.5	11.5	97	DO86	-619.5	11.5
48	DO37	-3412.5	98.5	98	DO87	-562.5	98.5
49	DO38	-3355.5	11.5	99	DO88	-505.5	11.5
50	DO39	-3298.5	98.5	100	DO89	-448.5	98.5

Pad No.	Name	X	Y	Pad No.	Name	X	Y
101	DO90	-391.5	11.5	153	DO142	2572.5	11.5
102	DO91	-334.5	98.5	154	DO143	2629.5	98.5
103	DO92	-277.5	11.5	155	DO144	2686.5	11.5
104	DO93	-220.5	98.5	156	DO145	2743.5	98.5
105	DO94	-163.5	11.5	157	DO146	2800.5	11.5
106	DO95	-106.5	98.5	158	DO147	2857.5	98.5
107	DO96	-49.5	11.5	159	DO148	2914.5	11.5
108	DO97	7.5	98.5	160	DO149	2971.5	98.5
109	DO98	64.5	11.5	161	DO150	3028.5	11.5
110	DO99	121.5	98.5	162	DO151	3085.5	98.5
111	DO100	178.5	11.5	163	DO152	3142.5	11.5
112	DO101	235.5	98.5	164	DO153	3199.5	98.5
113	DO102	292.5	11.5	165	DO154	3256.5	11.5
114	DO103	349.5	98.5	166	DO155	3313.5	98.5
115	DO104	406.5	11.5	167	DO156	3370.5	11.5
116	DO105	463.5	98.5	168	DO157	3427.5	98.5
117	DO106	520.5	11.5	169	DO158	3484.5	11.5
118	DO107	577.5	98.5	170	DO159	3541.5	98.5
119	DO108	634.5	11.5	171	DO160	3598.5	11.5
120	DO109	691.5	98.5	172	DO161	3655.5	98.5
121	DO110	748.5	11.5	173	DO162	3712.5	11.5
122	DO111	805.5	98.5	174	DO163	3769.5	98.5
123	DO112	862.5	11.5	175	DO164	3826.5	11.5
124	DO113	919.5	98.5	176	DO165	3883.5	98.5
125	DO114	976.5	11.5	177	DO166	3940.5	11.5
126	DO115	1033.5	98.5	178	DO167	3997.5	98.5
127	DO116	1090.5	11.5	179	DO168	4054.5	11.5
128	DO117	1147.5	98.5	180	DO169	4111.5	98.5
129	DO118	1204.5	11.5	181	DO170	4168.5	11.5
130	DO119	1261.5	98.5	182	DO171	4225.5	98.5
131	DO120	1318.5	11.5	183	DO172	4282.5	11.5
132	DO121	1375.5	98.5	184	DO173	4339.5	98.5
133	DO122	1432.5	11.5	185	DO174	4396.5	11.5
134	DO123	1489.5	98.5	186	DO175	4453.5	98.5
135	DO124	1546.5	11.5	187	DO176	4510.5	11.5
136	DO125	1603.5	98.5	188	DO177	4567.5	98.5
137	DO126	1660.5	11.5	189	DO178	4624.5	11.5
138	DO127	1717.5	98.5	190	DO179	4681.5	98.5
139	DO128	1774.5	11.5	191	DO180	4738.5	11.5
140	DO129	1831.5	98.5	192	DO181	4795.5	98.5
141	DO130	1888.5	11.5	193	DO182	4852.5	11.5
142	DO131	1945.5	98.5	194	DO183	4909.5	98.5
143	DO132	2002.5	11.5	195	DO184	4966.5	11.5
144	DO133	2059.5	98.5	196	DO185	5023.5	98.5
145	DO134	2116.5	11.5	197	DO186	5080.5	11.5
146	DO135	2173.5	98.5	198	DO187	5137.5	98.5
147	DO136	2230.5	11.5	199	DO188	5194.5	11.5
148	DO137	2287.5	98.5	200	DO189	5251.5	98.5
149	DO138	2344.5	11.5	201	DO190	5308.5	11.5
150	DO139	2401.5	98.5	202	DO191	5365.5	98.5
151	DO140	2458.5	11.5	203	DO192	5422.5	11.5
152	DO141	2515.5	98.5				

■ Quality Standards

Table 6 Reliability Check Test Specifications

No.	Test item	Test condition	Test time	LTFR
1	**Bias at high temperature and high humidity**	Ta=85 °C , RH=85%, Vabs.max[*1] × 0.9	1000H	10%
2	**Bias at high temperature**	Ta=125 °C, Vabs.max[*1] × 0.9	1000H	10%
3	**Operation at high temperature**	Ta=125 °C, Vopr.max[*2]	1000H	10%
4	**Electrostatic voltage resistance**	C=200 pF, V=200 V, Reference positive or negative voltage at V_{SS} (or GND), V_{DD} (or VCC)	One time	—
5	**Latch up**	V=±100V, C=200pF, V=Vopr.max[*2]	One time	—

[*1]: Absolute maximum rating

[*2]: Maximum operating voltage

Note: In testing, the thermal print head driver shall be mounted on a standard ceramic package (resin coating is required for a humidity resistance test).