# 128-Channel Serial to Parallel Converter with Push-Pull Outputs

## Features

- Processed with HVCMOS technology
- 128 Channels
- 4 Separate shift registers
- 5V CMOS logic
- Output voltages up to 80V
- ±30mA output current capability
- Low power level shifting
- 40MHz data shifting
- Latched data outputs
- Forward and reverse shifting option via DIR pin
- Output diode to ground and $V_{PP}$ for efficient power recovery
- Outputs can be hot switched

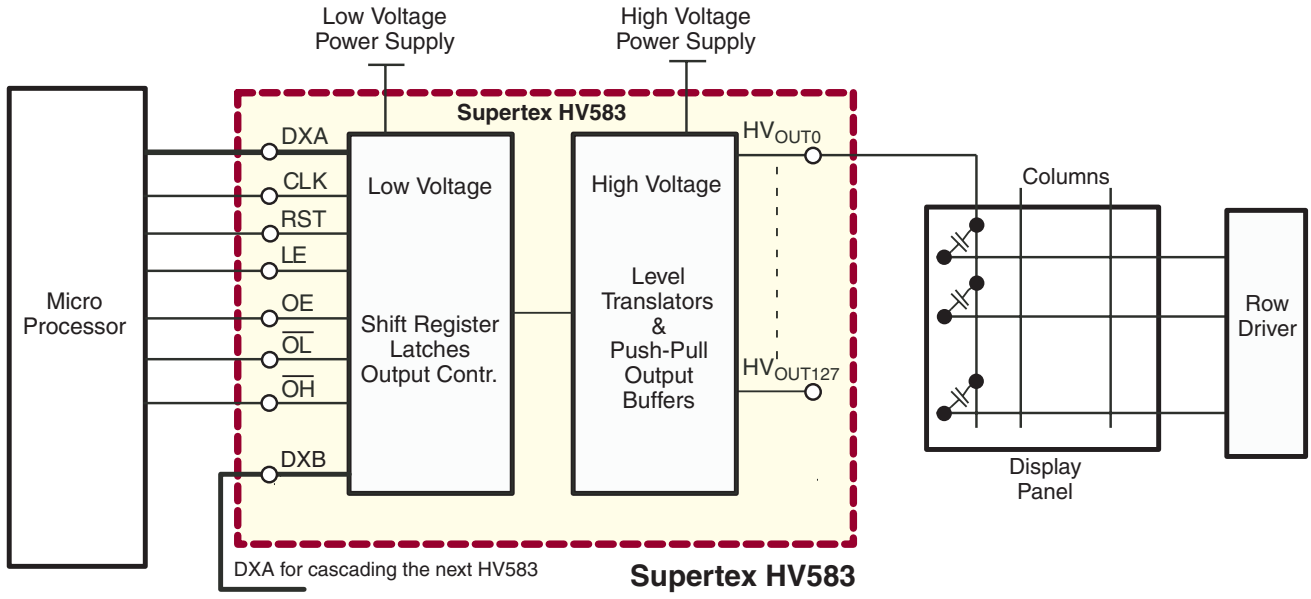
## General Description

The Supertex HV583 is a 128-channel low voltage serial to high voltage parallel converter with push-pull outputs. This device has been designed for use as a display driver. It can also be used in any application requiring multiple output, high voltage current sourcing and sinking capability such as plasma displays and inkjet printers. The device has 4 parallel 32-bit shift registers, permitting data rates 4X the speed of one. The data are shifted in during the low to high clock transition. There are also 128 latches and control logic to shift clockwise or counterclockwise. High at RST input pin clears contents of both: the shift register and the latch. The outputs can be in a high impedance state via the output enable logic pin.

## Applications

- Plasma Displays
- Inkjet Printers

## Typical Application



## Ordering Information

| Device | Recommended Operating $V_{PP}$ Max | Package Options |
|---|---|---|
| | | Die |
| HV583 | 80V | HV583X |

## Absolute Maximum Ratings*

| | |
|---|---|
| $V_{PP}$, High voltage supply | -0.5V to +90V |
| $V_{DD}$, Logic supply voltage | -0.5V to +7.0V |
| $I_{OUT}$, Output source and sink current | -65mA to +40mA |
| $I_{DIODE}$, Output body diode current | -65mA to +65mA |
| Logic input voltages | -0.5V to $V_{DD}$+0.5V |
| Tj, Junction temperature | -25°C to +150°C |
| Storage temperature | -40°C to +150°C |

**All voltages are referenced to device ground. Absolute maximum ratings are those values which damage to the device may occur. Functional operation under these conditions is not implied. Continous operation of the device at the absolute rating level may affect device reliability.*

***Notes:***

*Power-up sequence should be the following:*

1. *Connect ground.*
2. *Apply $V_{DD}$.*
3. *Set all inputs (Data, CLK, etc.) to a known state.*
4. *Apply $V_{PP}$.*

*Power-down sequence should be the reverse of the above.*

## Operating Conditions

| Symbol | Parameter | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{PP}$ | High voltage supply | 15 | | 80 | V | Cload = 300pF |
| $V_{DD}$ | Low voltage supply | 4.5 | 5.0 | 5.5 | V | |
| $I_{OUT}$ | HVout peak output current | -30 | | 30 | mA | |
| SR | $V_{PP}$ power supply slew rate | | | 8.0 | V/µs | |
| $f_{CLK}$ | Clock frequency | | | 40 | MHz | Data read |
| | | | | 25 | MHz | Cascade connection |
| Tj | Operating junction temperature | -25 | | +125 | °C | |

## Electrical Characteristics

### DC Characteristics *(Tj = 25°C, $V_{DD}$ = 5V, $V_{PP}$ = 80V)*

| Symbol | Parameter | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_{PPQ}$ | $V_{PP}$ quiescent supply current | | | 10 | µA | |
| $I_{DDQ}$ | $V_{DD}$ quiescent supply current | | | 10 | µA | |
| $HV_{OH}$ | High level output voltage | 73 | 76 | | V | $I_{OUT}$ = 30mA, $V_{PP}$ = 80V |
| | | 10 | | | | $I_{OUT}$ = 10mA, $V_{PP}$ = 20V |
| $HV_{OHD}$ | Output p-channel body diode | | | 81.5 | V | $I_{OUT}$ = -30mA, $V_{PP}$ =80V |
| $HV_{OL}$ | Low level output voltage | | 3.0 | 6.0 | V | $I_{OUT}$ = -30mA |
| $HV_{OLD}$ | Output n-channel body diode | -1.5 | | | V | $I_{OUT}$ = +30mA |
| $V_{IH}$ | Logic input high voltage | 2.0 | | $V_{DD}$ | V | $V_{DD}$ = 4.5V to 5.5V |
| $V_{IL}$ | Logic input low voltage | 0 | | 0.8 | V | $V_{DD}$ = 4.5V to 5.5V |
| $I_{IH}$ | Logic input high current | | | 1.0 | µA | $V_{IH}$ = 5.3V, $V_{DD}$ = 5.0V |
| | | 10 | 30 | 50 | µA | $V_{IH}$ = 5.0V, For DIR only |
| $I_{IL}$ | Logic input low current | -1.0 | | | µA | $V_{IL}$ = -0.3V |
| $V_{OH}$ | Logic output high | 4.5V | | | V | $I_{OUT}$ = 1.0mA |
| $V_{OL}$ | Logic output low | | | 0.5V | V | $I_{OUT}$ = -1.0mA |

## AC Electrical Characteristics *(Tj = 25°C, $V_{DD}$ = 5V, $V_{PP}$ = 80V)*

| Symbol | Parameter | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|
| twCLK | Clock pulse width, high and low | 10 | | | ns | $V_{DD}$ =4.5V to 5.5V, Tj=-25°C to 125°C |
| twLE | LE pulse width, high and low | 10 | | | ns | |
| tsu1 | Setup time, DXAs, DXBs to CLK | 5 | | | ns | |
| tsu2 | Setup time, CLK to LE | 10 | | | ns | |
| tsu3 | Setup time, LE to $\overline{OL}$, $\overline{OH}$ | 25 | | | ns | |
| th1 | Hold time, CLK to DXAs, DXBs | 5 | | | ns | |
| th2 | Hold time, LE to CLK | 10 | | | ns | |
| tpdHL | CLK to DXAs, DXBs | | | 25 | ns | C=15pF |
| tpdLH | CLK to DXAs, DXBs | | | 25 | ns | C=15pF |
| tpHL | LE, $\overline{OH}$, $\overline{OL}$ to $HV_{OUT}$ | | | 150 | ns | C=50pF |
| tpLH | LE, $\overline{OH}$, $\overline{OL}$ to $HV_{OUT}$ | Typ -20 | tpHL+tf | Typ +40 | ns | C=80pF |
| tpHZL | OE to $HV_{OUT}$ | | | 150 | ns | C=50pF |
| tpLZH | OE to $HV_{OUT}$ | Typ -20 | tpHL+tf | Typ +40 | ns | C=80pF |
| tpHZ | OE to $HV_{OUT}$ | | | 300 | ns | Rl=10K, C=50pF |
| tpLZ | OE to $HV_{OUT}$ | | | 300 | ns | Rl=10K, C=50pF |
| tr | $HV_{OUT}$ | | | 120 | ns | C=50pF |
| tf | $HV_{OUT}$ | | | 120 | ns | C=50pF |

## Shift Register Truth Table

| DIR | CLK | State of Shift Register | Shift Direction |
|---|---|---|---|
| L or open | L to H | Shift | $D_{XB}$ to $D_{XA}$ |
| L or open | H to L | Hold | $D_{XB}$ to $D_{XA}$ |
| H | L to H | Shift | $D_{XA}$ to $D_{XB}$ |
| H | H to L | Hold | $D_{XA}$ to $D_{XB}$ |

## Latch Truth Table

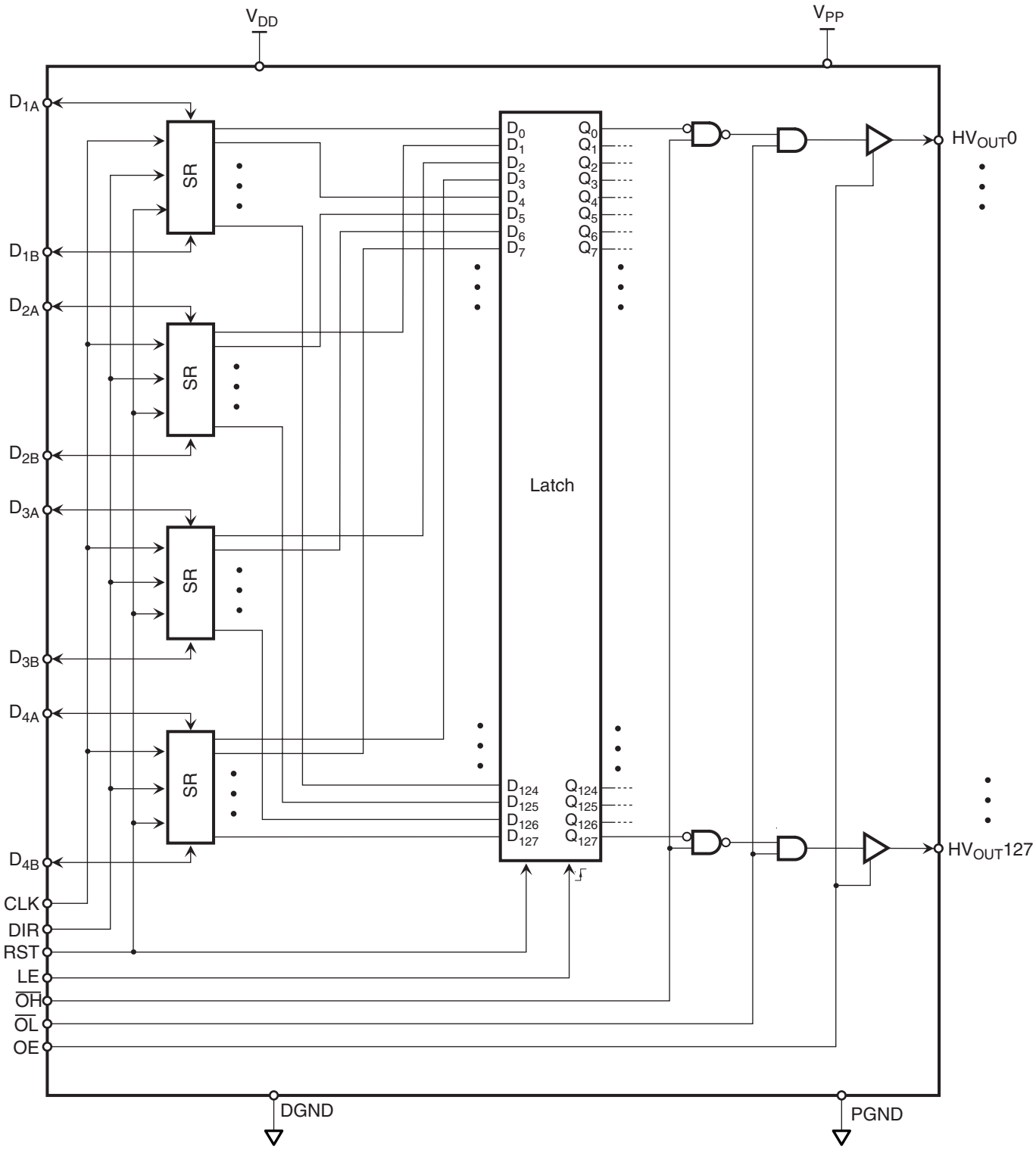
| LE | Output State of Latch |
|---|---|
| L to H | Latch execution |
| H to L | Hold |

## $HV_{OUT}$ Truth Table

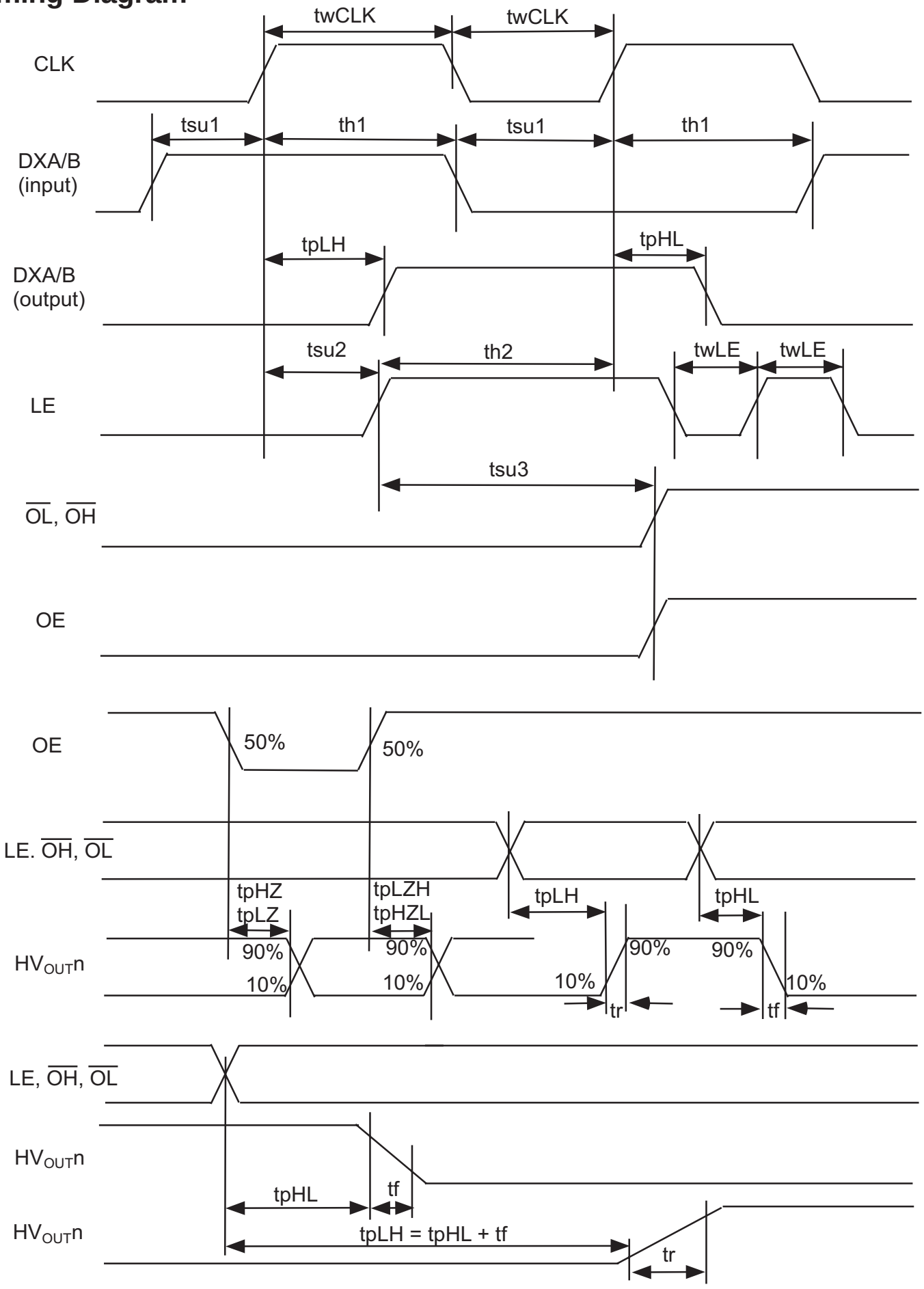
| OE | $\overline{OL}$ | $\overline{OH}$ | DXA/DXB | $HV_{OUT}$ |
|---|---|---|---|---|
| L | X | X | X | Z |
| H | L | X | X | L |
| H | H | L | X | H |
| H | H | H | L | L |
| H | H | H | H | H |

*H = Level High*
*L = Level Low*
*X = Don't care. Can be High or Low*
*Z = High impedance. Open circuit.*

## Block Diagram



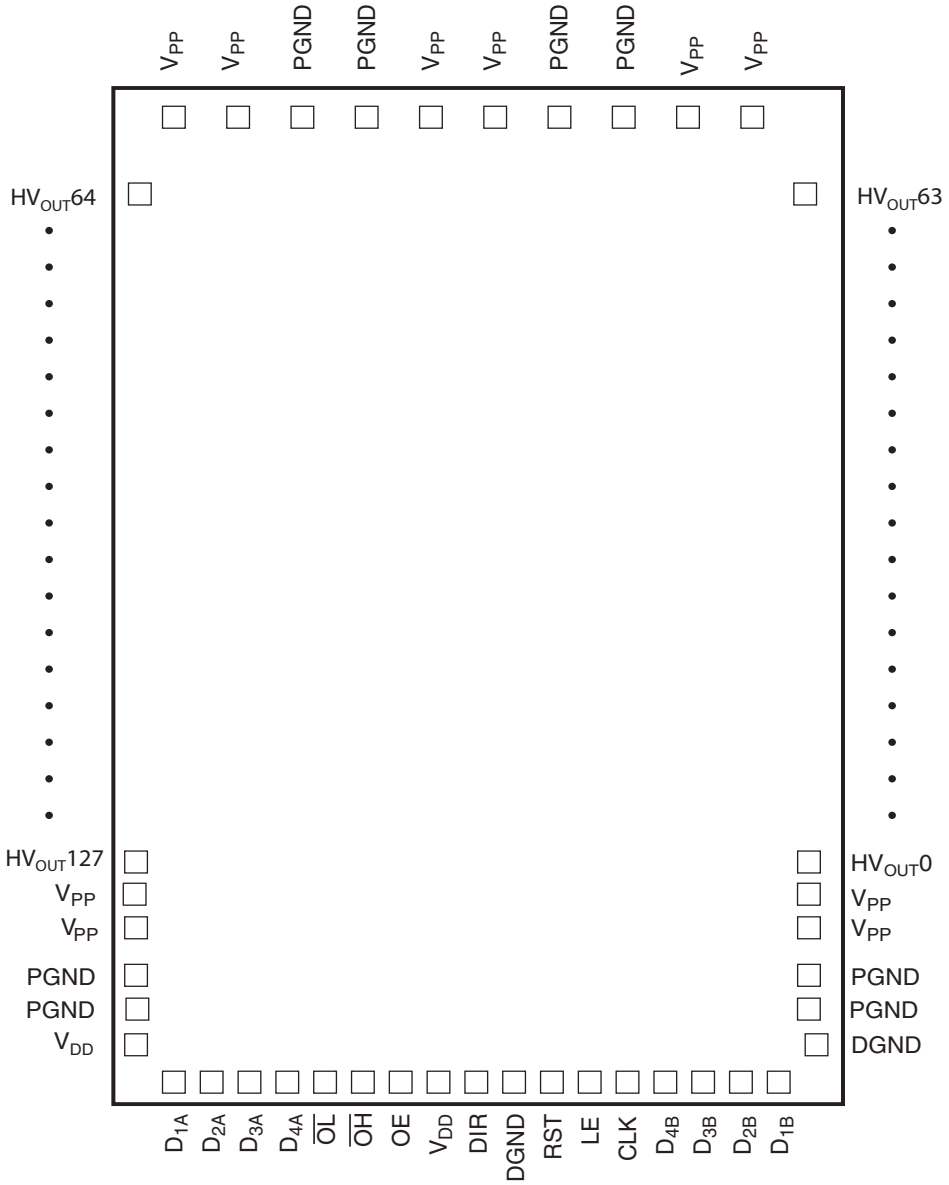
## Timing Diagram



## Pad Description

| | |
|---|---|
| $V_{PP}$ | High voltage supply for outputs. |
| $V_{DD}$ | Low voltage logic supply |
| D1A to D4A | Right data input/output. Input when Dir = H, Output when Dir = L. |
| D1B to D4B | Left data input/output. Input when Dir = L, Output when Dir = H. |
| Dir | Dir = L or open, $D_{XB}$ to $D_{XA}$ shift. Dir = H, $D_{XA}$ to $D_{XB}$ shift. |
| CLK | Clock input. Data shifted from low to high transition. |
| RST | Resets latches. |
| LE | Latch enable. Data latches during rising edge LE. |
| OE | Output enable. $HV_{OUT}$ high impedance control. |
| $\overline{OL}$ | Output low bar. All $HV_{OUT}$ = low when this pin is low. |
| $\overline{OH}$ | OH bar input. All $HV_{OUT}$ = high when this pin is low. |
| DGND | Digital logic ground. |
| PGND | $HV_{OUT}$ output ground. |
| $HV_{OUT}0$ to $HV_{OUT}127$ | High voltage outputs. |

## Pad Location



## Pad Coordinates

| Pad # | Name | X | Y |
|---|---|---|---|
| 1 | $V_{DD}$ | 0 | 0 |
| 2 | PGND | 0 | 150 |
| 3 | PGND | 0 | 260 |
| 4 | $V_{PP}$ | 0 | 410 |
| 5 | $V_{PP}$ | 0 | 520 |
| 6 | $HV_{OUT}127$ | 0 | 670 |
| 7 | $HV_{OUT}126$ | 0 | 780 |
| 8 | $HV_{OUT}125$ | 0 | 890 |
| 9 | $HV_{OUT}124$ | 0 | 1000 |
| 10 | $HV_{OUT}123$ | 0 | 1110 |
| 11 | $HV_{OUT}122$ | 0 | 1220 |
| 12 | $HV_{OUT}121$ | 0 | 1330 |
| 13 | $HV_{OUT}120$ | 0 | 1440 |
| 14 | $HV_{OUT}119$ | 0 | 1550 |
| 15 | $HV_{OUT}118$ | 0 | 1660 |
| 16 | $HV_{OUT}117$ | 0 | 1770 |
| 17 | $HV_{OUT}116$ | 0 | 1880 |
| 18 | $HV_{OUT}115$ | 0 | 1990 |
| 19 | $HV_{OUT}114$ | 0 | 2100 |
| 20 | $HV_{OUT}113$ | 0 | 2210 |
| 21 | $HV_{OUT}112$ | 0 | 2320 |
| 22 | $HV_{OUT}111$ | 0 | 2430 |
| 23 | $HV_{OUT}110$ | 0 | 2540 |
| 24 | $HV_{OUT}109$ | 0 | 2650 |
| 25 | $HV_{OUT}108$ | 0 | 2760 |
| 26 | $HV_{OUT}107$ | 0 | 2870 |
| 27 | $HV_{OUT}106$ | 0 | 2980 |
| 28 | $HV_{OUT}105$ | 0 | 3090 |
| 29 | $HV_{OUT}104$ | 0 | 3200 |
| 30 | $HV_{OUT}103$ | 0 | 3310 |
| 31 | $HV_{OUT}102$ | 0 | 3420 |
| 32 | $HV_{OUT}101$ | 0 | 3530 |
| 33 | $HV_{OUT}100$ | 0 | 3640 |
| 34 | $HV_{OUT}99$ | 0 | 3750 |
| 35 | $HV_{OUT}98$ | 0 | 3860 |
| 36 | $HV_{OUT}97$ | 0 | 3970 |
| 37 | $HV_{OUT}96$ | 0 | 4080 |
| 38 | $HV_{OUT}95$ | 0 | 4190 |
| 39 | $HV_{OUT}94$ | 0 | 4300 |
| 40 | $HV_{OUT}93$ | 0 | 4410 |
| 41 | $HV_{OUT}92$ | 0 | 4520 |
| 42 | $HV_{OUT}91$ | 0 | 4630 |
| 43 | $HV_{OUT}90$ | 0 | 4740 |
| 44 | $HV_{OUT}89$ | 0 | 4850 |
| 45 | $HV_{OUT}88$ | 0 | 4960 |
| 46 | $HV_{OUT}87$ | 0 | 5070 |
| 47 | $HV_{OUT}86$ | 0 | 5180 |
| 48 | $HV_{OUT}85$ | 0 | 5290 |
| 49 | $HV_{OUT}84$ | 0 | 5400 |
| 50 | $HV_{OUT}83$ | 0 | 5510 |
| 51 | $HV_{OUT}82$ | 0 | 5620 |
| 52 | $HV_{OUT}81$ | 0 | 5730 |
| 53 | $HV_{OUT}80$ | 0 | 5840 |
| 54 | $HV_{OUT}79$ | 0 | 5950 |
| 55 | $HV_{OUT}78$ | 0 | 6060 |
| 56 | $HV_{OUT}77$ | 0 | 6170 |
| 57 | $HV_{OUT}76$ | 0 | 6280 |
| 58 | $HV_{OUT}75$ | 0 | 6390 |
| 59 | $HV_{OUT}74$ | 0 | 6500 |
| 60 | $HV_{OUT}73$ | 0 | 6610 |

| Pad # | Name | X | Y |
|---|---|---|---|
| 61 | $HV_{OUT}72$ | 0 | 6720 |
| 62 | $HV_{OUT}71$ | 0 | 6830 |
| 63 | $HV_{OUT}70$ | 0 | 6940 |
| 64 | $HV_{OUT}69$ | 0 | 7050 |
| 65 | $HV_{OUT}68$ | 0 | 7160 |
| 66 | $HV_{OUT}67$ | 0 | 7270 |
| 67 | $HV_{OUT}66$ | 0 | 7380 |
| 68 | $HV_{OUT}65$ | 0 | 7490 |
| 69 | $HV_{OUT}64$ | 0 | 7600 |
| 70 | $V_{PP}$ | 263.1 | 7963.5 |
| 71 | $V_{PP}$ | 373.1 | 7963.5 |
| 72 | PGND | 607.1 | 7802.5 |
| 73 | PGND | 717.1 | 7802.5 |
| 74 | $V_{PP}$ | 977.1 | 7963.5 |
| 75 | $V_{PP}$ | 1087.1 | 7963.5 |
| 76 | PGND | 1347.1 | 7802.5 |
| 77 | PGND | 1457.1 | 7802.5 |
| 78 | $V_{PP}$ | 1691.1 | 7963.5 |
| 79 | $V_{PP}$ | 1801.1 | 7963.5 |
| 80 | $HV_{OUT}63$ | 2064.2 | 7600 |
| 81 | $HV_{OUT}62$ | 2064.2 | 7490 |
| 82 | $HV_{OUT}61$ | 2064.2 | 7380 |
| 83 | $HV_{OUT}60$ | 2064.2 | 7270 |
| 84 | $HV_{OUT}59$ | 2064.2 | 7160 |
| 85 | $HV_{OUT}58$ | 2064.2 | 7050 |
| 86 | $HV_{OUT}57$ | 2064.2 | 6940 |
| 87 | $HV_{OUT}56$ | 2064.2 | 6830 |
| 88 | $HV_{OUT}55$ | 2064.2 | 6720 |
| 89 | $HV_{OUT}54$ | 2064.2 | 6610 |
| 90 | $HV_{OUT}53$ | 2064.2 | 6500 |
| 91 | $HV_{OUT}52$ | 2064.2 | 6390 |
| 92 | $HV_{OUT}51$ | 2064.2 | 6280 |
| 93 | $HV_{OUT}50$ | 2064.2 | 6170 |
| 94 | $HV_{OUT}49$ | 2064.2 | 6060 |
| 95 | $HV_{OUT}48$ | 2064.2 | 5950 |
| 96 | $HV_{OUT}47$ | 2064.2 | 5840 |
| 97 | $HV_{OUT}46$ | 2064.2 | 5730 |
| 98 | $HV_{OUT}45$ | 2064.2 | 5620 |
| 99 | $HV_{OUT}44$ | 2064.2 | 5510 |
| 100 | $HV_{OUT}43$ | 2064.2 | 5400 |
| 101 | $HV_{OUT}42$ | 2064.2 | 5290 |
| 102 | $HV_{OUT}41$ | 2064.2 | 5180 |
| 103 | $HV_{OUT}40$ | 2064.2 | 5070 |
| 104 | $HV_{OUT}39$ | 2064.2 | 4960 |
| 105 | $HV_{OUT}38$ | 2064.2 | 4850 |
| 106 | $HV_{OUT}37$ | 2064.2 | 4740 |
| 107 | $HV_{OUT}36$ | 2064.2 | 4630 |
| 108 | $HV_{OUT}35$ | 2064.2 | 4520 |
| 109 | $HV_{OUT}34$ | 2064.2 | 4410 |
| 110 | $HV_{OUT}33$ | 2064.2 | 4300 |
| 111 | $HV_{OUT}32$ | 2064.2 | 4190 |
| 112 | $HV_{OUT}31$ | 2064.2 | 4080 |
| 113 | $HV_{OUT}30$ | 2064.2 | 3970 |
| 114 | $HV_{OUT}29$ | 2064.2 | 3860 |
| 115 | $HV_{OUT}28$ | 2064.2 | 3750 |
| 116 | $HV_{OUT}27$ | 2064.2 | 3640 |
| 117 | $HV_{OUT}26$ | 2064.2 | 3530 |
| 118 | $HV_{OUT}25$ | 2064.2 | 3420 |
| 119 | $HV_{OUT}24$ | 2064.2 | 3310 |
| 120 | $HV_{OUT}23$ | 2064.2 | 3200 |

| Pad # | Name | X | Y |
|---|---|---|---|
| 121 | $HV_{OUT}22$ | 2064.2 | 3090 |
| 122 | $HV_{OUT}21$ | 2064.2 | 2980 |
| 123 | $HV_{OUT}20$ | 2064.2 | 2870 |
| 124 | $HV_{OUT}19$ | 2064.2 | 2760 |
| 125 | $HV_{OUT}18$ | 2064.2 | 2650 |
| 126 | $HV_{OUT}17$ | 2064.2 | 2540 |
| 127 | $HV_{OUT}16$ | 2064.2 | 2430 |
| 128 | $HV_{OUT}15$ | 2064.2 | 2320 |
| 129 | $HV_{OUT}14$ | 2064.2 | 2210 |
| 130 | $HV_{OUT}13$ | 2064.2 | 2100 |
| 131 | $HV_{OUT}12$ | 2064.2 | 1990 |
| 132 | $HV_{OUT}11$ | 2064.2 | 1880 |
| 133 | $HV_{OUT}10$ | 2064.2 | 1770 |
| 134 | $HV_{OUT}9$ | 2064.2 | 1660 |
| 135 | $HV_{OUT}8$ | 2064.2 | 1550 |
| 136 | $HV_{OUT}7$ | 2064.2 | 1440 |
| 137 | $HV_{OUT}6$ | 2064.2 | 1330 |
| 138 | $HV_{OUT}5$ | 2064.2 | 1220 |
| 139 | $HV_{OUT}4$ | 2064.2 | 1110 |
| 140 | $HV_{OUT}3$ | 2064.2 | 1000 |
| 141 | $HV_{OUT}2$ | 2064.2 | 890 |
| 142 | $HV_{OUT}1$ | 2064.2 | 780 |
| 143 | $HV_{OUT}0$ | 2064.2 | 670 |
| 144 | $V_{PP}$ | 2064.2 | 520 |
| 145 | $V_{PP}$ | 2064.2 | 410 |
| 146 | PGND | 2064.2 | 260 |
| 147 | PGND | 2064.2 | 150 |
| 148 | DGND | 2064.2 | 0 |
| 149 | $D_{1B}$ | 1940.2 | -210.1 |
| 150 | $D_{2B}$ | 1825.5 | -210.1 |
| 151 | $D_{3B}$ | 1710.8 | -210.1 |
| 152 | $D_{4B}$ | 1596.1 | -210.1 |
| 153 | CLK | 1481.5 | -210.1 |
| 154 | LE | 1366.8 | -210.1 |
| 155 | RST | 1252.1 | -210.1 |
| 156 | DGND | 1142.1 | -210.1 |
| 157 | DIR | 1032.1 | -210.1 |
| 158 | $V_{DD}$ | 922.1 | -210.1 |
| 159 | $\overline{OE}$ | 812.1 | -210.1 |
| 160 | $\overline{OH}$ | 697.4 | -210.1 |
| 161 | $\overline{OL}$ | 582.7 | -210.1 |
| 162 | $D_{4A}$ | 468 | -210.1 |
| 163 | $D_{3A}$ | 355.3 | -210.1 |
| 164 | $D_{2A}$ | 238.6 | -210.1 |
| 165 | $D_{1A}$ | 123.9 | -210.1 |



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