# 10-Channel Serial-Input Latched Display Driver

## Ordering Information

| Device | Package Options | | | |
|---|---|---|---|---|
| | 18-Pin Plastic DIP | 20-Pin Small Outline Package | 20-Pin Plastic Chip Carrier | Die |
| HV6810 | HV6810P | HV6810WG | HV6810PJ | HV6810X |

*For Hi-Rel process flow, refer to page 5-3 of the Databook.

## Features

- ❏ High output voltage 80V
- ❏ High speed 5MHz @ $5V_{DD}$
- ❏ Low power $I_{BB} \leq 0.1$mA (All high)
- ❏ Active pull down 100μA min
- ❏ Output source current 100mA at 60V $V_{PP}$
- ❏ Each device drives 10 lines
- ❏ High-speed serially-shifted data input
- ❏ 5V CMOS-compatible inputs
- ❏ Latches on all driver outputs
- ❏ Pin-compatible improved replacement for UCN5810A and TL4810A, TL4810B

## General Description

The HV6810 is a monolithic integrated circuit designed to drive a dot matrix or segmented vacuum fluorescent display (VFD). These devices feature a serial data output to cascade additional devices for large displays.

A 10-bit data word is serially loaded into the shift register on the positive-going transition of the clock. Parallel data is transferred to the output buffers through a 10-bit D-type latch while the latch enable input is high and is latched when the latch enable is low. When the blanking input is high, all outputs are low.

Outputs are structures formed by double-diffused MOS (DMOS) transistors with output voltage ratings of 80 volts and 25 milliampere source-current capability. All inputs are compatible with CMOS levels.

## Absolute Maximum Ratings[1]

| | | |
|---|---|---|
| Logic supply voltage, $V_{DD}$[2] | | 7.5V |
| Driver supply voltage, $V_{BB}$[2] | | 90V |
| Output voltage[2] | | 90V |
| Input voltage[2] | | -0.3V to $V_{DD}$ + 0.3V |
| Continuous total power dissipation at 25°C free-air temperature [3] | 18-Pin P-DIP[3] | 900mW |
| | 20-Pin SOIC[4] | 1000mW |
| | 20-Pin PLCC[4] | 1000mW |
| Operating Temperature Range | | -40° to +85*C |

**Notes:**
1. Over operating free-air temperature.
2. All voltages are referenced to $V_{SS}$.
3. For operation above 25°C ambient derate linearly to 85°C at 15mW/°C.
4. For operation above 25°C ambient derate linearly to 85°C at 16.7mW/°C.

01/06/03

# Electrical Characteristics

## DC Characteristics ($V_{DD}$ = 5V ±10%, $V_{BB}$ = 60V, $V_{SS}$ = 0, $T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|---|
| $V_{OH}$ | High-level output voltage | Q outputs | 57.5 | 58 | | V | $I_{OH}$ = 25mA |
| | | Serial output | 4 | 4.5 | | V | $V_{DD}$ = 4.5V, $I_{OH}$ = -100μA |
| $V_{OL}$ | Low-level output voltage | Q outputs | | 0.15 | 1 | V | $I_{OH}$ = 100μA, Blanking input at $V_{DD}$ |
| | | Serial output | | 0.05 | 0.1 | V | $V_{DD}$ = 4.5V, $I_{OL}$ = 100μA |
| $I_{OL}$ | Low-level Q output current (pull-down current) | | 60 | 80 | | μA | $T_A$ = Max, $V_{OL}$ = 0.7V |
| $I_{O(OFF)}$ | Off-state output current | | | -1 | -15 | μA | $V_O$ = 0, Blanking input<br>$T_A$ = Max at $V_{DD}$ |
| $I_H$ | High-level input current | | | | 1 | μA | $V_I$ = $V_{DD}$ |
| $I_{DD}$ | Supply current from $V_{DD}$ (standby) | | | 10 | 50 | μA | All inputs at 0V, one Q output high |
| | | | | 10 | 50 | μA | All inputs at 0V, all Q outputs low |
| $I_{BB}$ | Supply current from $V_{BB}$ | | | 0.05 | 0.1 | mA | All outputs low, all Q outputs open |
| | | | | 0.05 | 0.1 | mA | All outputs high, all Q outputs open |

* All typical values are at $T_A$ = 25°C, except for $I_O$.

## AC Characteristics (Timing requirements over recommended operating conditions)

| Symbol | Parameter | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|
| $t_{W(CKH)}$ | Pulse duration, clock high | 100 | | | ns | |
| $t_{W(LEH)}$ | Pulse duration, latch enable high | 100 | | | ns | |
| $t_{SU(D)}$ | Setup time, data before clock | 50 | | | ns | |
| $t_{H(D)}$ | Hold time, data after clock | 50 | | | ns | |
| $t_{CKH-LEH}$ | Delay time, clock to latch enable high | 50 | | | ns | |
| $t_{pd}$* | Propagation delay time, latch enable to output | | 0.3 | | μs | |

* Switching characteristics, $V_{BB}$ = 60V, $T_A$ = 25°C.

# Recommended Operating Conditions

| Symbol | Parameter | | Min | Nom | Max | Units |
|---|---|---|---|---|---|---|
| $V_{DD}$ | Supply voltage | | 4.5 | | 5.5 | V |
| $V_{BB}$ | Supply voltage | | 20 | | 80 | V |
| $V_{SS}$ | Supply voltage | | | 0 | | V |
| $V_{IH}$ | High-level input voltage (for $V_{DD}$ = 5V) | | 3.5 | | 5.3 | V |
| $V_{IL}$ | Low-level input voltage | | -0.3 | | 0.8 | V |
| $I_{OH}$ | Continuous high-level Q output current | | -25 | | | mA |
| $f_{CLK}$ | Clock frequency | | | | 5 | MHz |
| $T_A$ | Operating free-air temperature | Plastic | -40 | | +85 | °C |

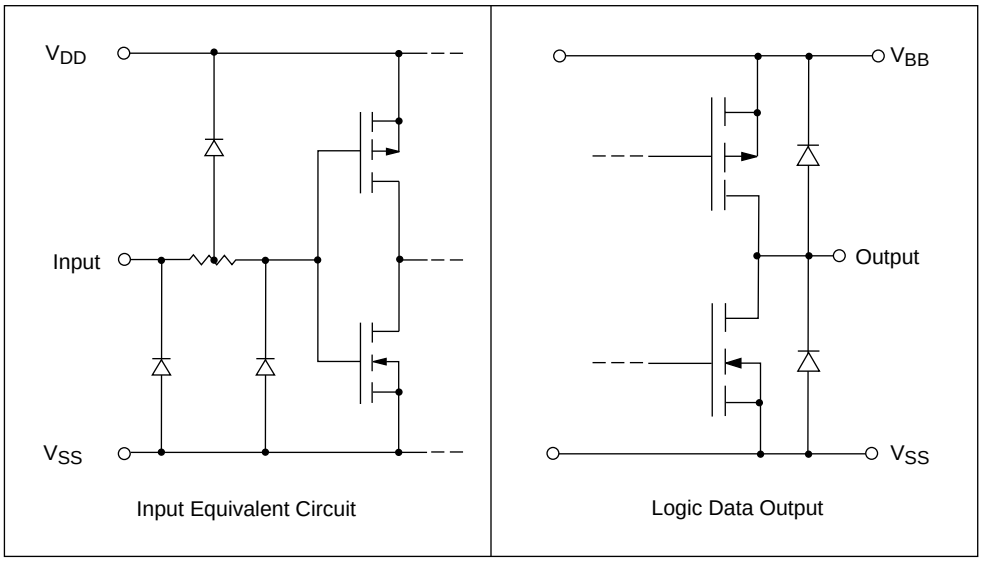
**Note:**

Power-up sequence should be the following:

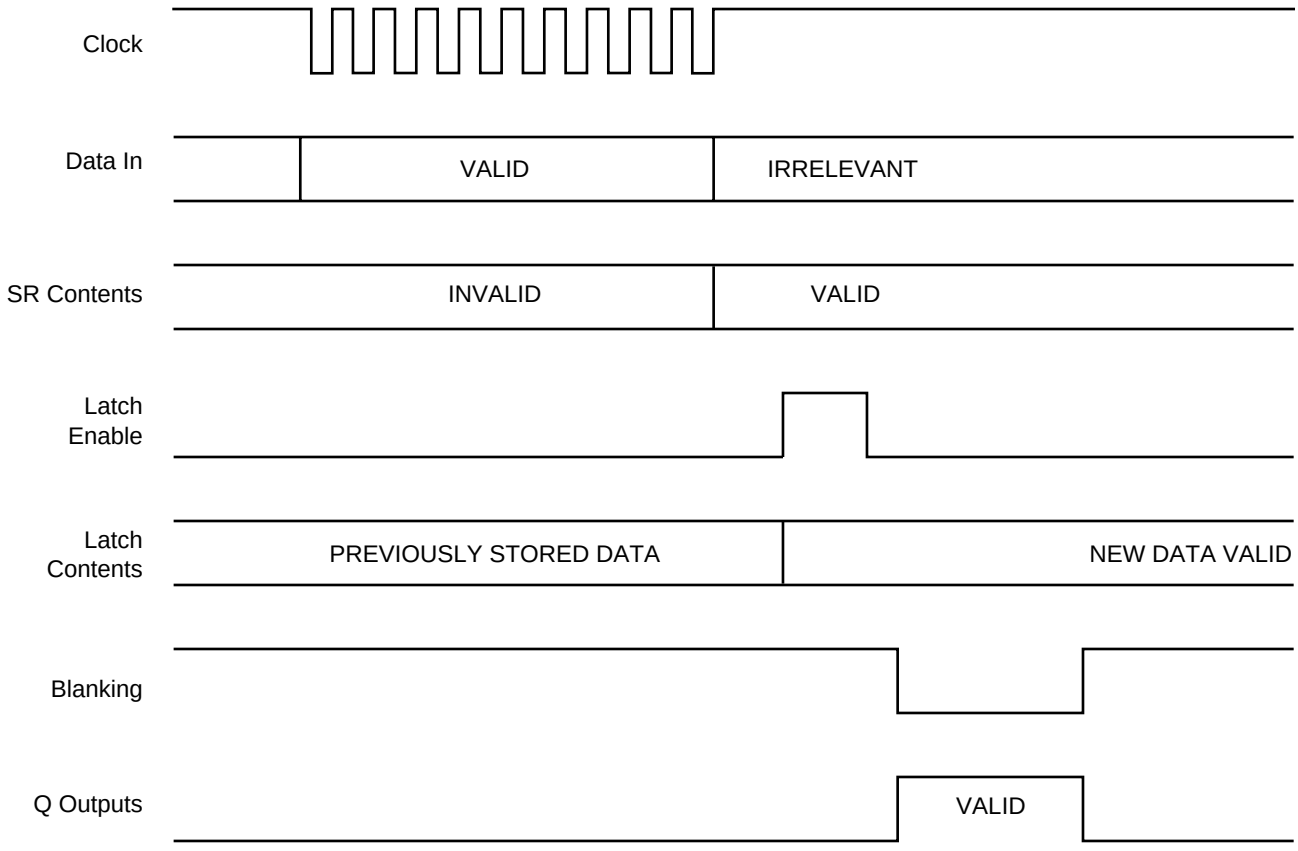
1. Connect ground $V_{SS}$
2. Apply $V_{DD}$.
3. Set all inputs (Data, CLK, Enable, etc.) to a known state.
4. Apply $V_{BB}$.
5. The $V_{BB}$ should not drop below $V_{DD}$ or float during operation.

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

## Input and Output Equivalent Circuits

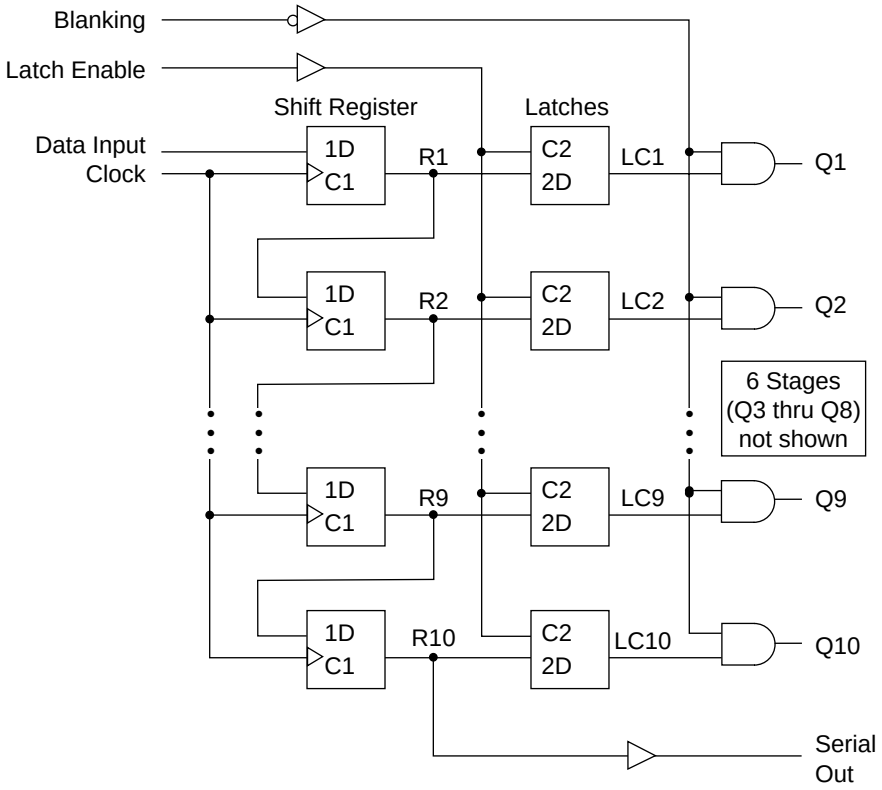



## Timing Diagram



# Functional Block Diagram

Logic Diagram (positive logic)

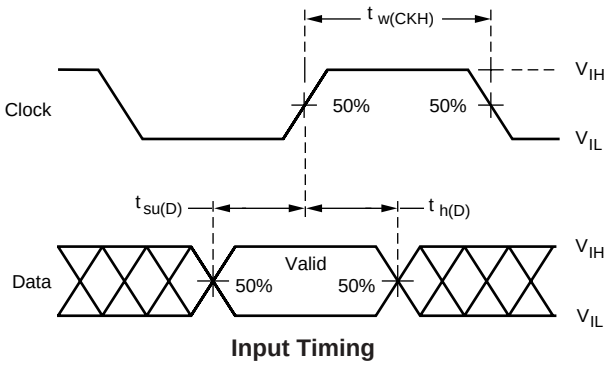



# Function Table

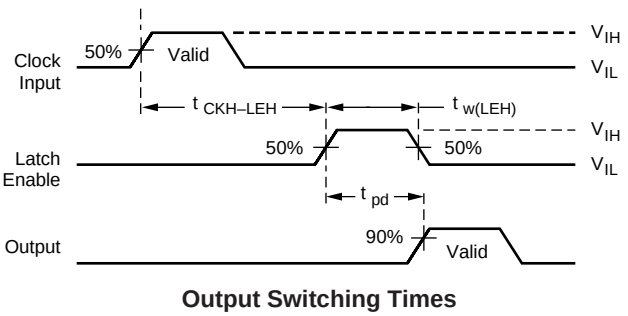
| Serial Data Input | Clock Input | Shift Register Contents $I_1$ $I_2$ $I_3$ … $I_{N-1}$ $I_N$ | Serial Data Output | Strobe Input | Latch Contents $I_1$ $I_2$ $I_3$ … $I_{N-1}$ $I_N$ | Blanking Input | Output Contents $I_1$ $I_2$ $I_3$ … $I_{N-1}$ $I_N$ |
|---|---|---|---|---|---|---|---|
| H | ⎍ | H $R_1$ $R_2$ … $R_{N-2}$ $R_{N-1}$ | $R_{N-1}$ | | | | |
| L | ⎍ | L $R_1$ $R_2$ … $R_{N-2}$ $R_{N-1}$ | $R_{N-1}$ | | | | |
| X | ⎎ | $R_1$ $R_2$ $R_3$ … $R_{N-1}$ $R_N$ | $R_N$ | | | | |
| | | X X X … X X | X | L | $R_1$ $R_2$ $R_3$ … $R_{N-1}$ $R_N$ | | |
| | | $P_1$ $P_2$ $P_3$ … $P_{N-1}$ $P_N$ | $P_N$ | H | $P_1$ $P_2$ $P_3$ … $P_{N-1}$ $P_N$ | L | $P_1$ $P_2$ $P_3$ … $P_{N-1}$ $P_N$ |
| | | | | | X X X … X X | H | L L L … L L |

L = Low logic level
H = High logic level
X = Irrelevant
P = Present state
R = Previous state

# Switching Waveforms




**Input Timing**




**Output Switching Times**

# Pin Configurations

**HV6810**
**18-Pin DIP**

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | Q8 | 10 | Q3 |
| 2 | Q7 | 11 | Q2 |
| 3 | Q6 | 12 | Q1 |
| 4 | Clock | 13 | Blanking |
| 5 | $V_{SS}$ | 14 | Data in |
| 6 | $V_{DD}$ | 15 | $V_{BB}$ |
| 7 | LE (strobe) | 16 | Serial data out |
| 8 | Q5 | 17 | Q10 |
| 9 | Q4 | 18 | Q9 |

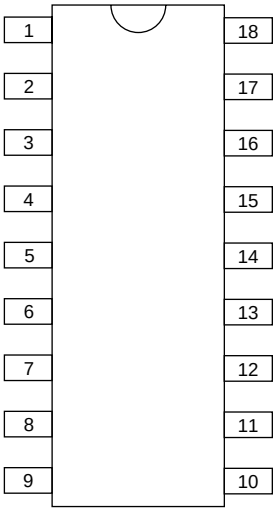
**HV6810**
**20-Pin SOW**

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | Q8 | 11 | Q3 |
| 2 | Q7 | 12 | Q2 |
| 3 | Q6 | 13 | Q1 |
| 4 | Clock | 14 | Blanking |
| 5 | $V_{SS}$ | 15 | Data in |
| 6 | N/C | 16 | $V_{BB}$ |
| 7 | $V_{DD}$ | 17 | Serial data out |
| 8 | LE (strobe) | 18 | N/C |
| 9 | Q5 | 19 | Q10 |
| 10 | Q4 | 20 | Q9 |

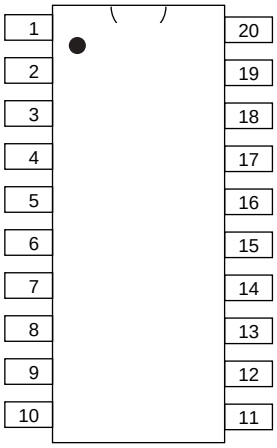
**HV6810**
**20-Pin Plastic PLCC**

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | Q8 | 11 | Q3 |
| 2 | Q7 | 12 | Q2 |
| 3 | Q6 | 13 | Q1 |
| 4 | Clock | 14 | Blanking |
| 5 | N/C | 15 | Data In |
| 6 | $V_{SS}$ | 16 | N/C |
| 7 | $V_{DD}$ | 17 | $V_{BB}$ |
| 8 | LE(Strobe) | 18 | Serial data out |
| 9 | Q5 | 19 | Q10 |
| 10 | Q4 | 20 | Q9 |

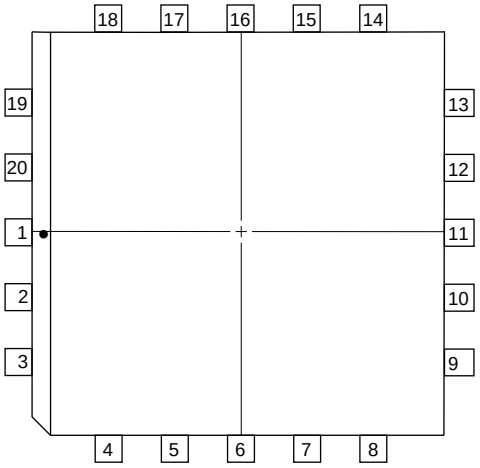
# Package Outlines




top view
18-pin DIP




top view
SOW-20




top view
20-pin PLCC





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