

## 32-Channel Serial To Parallel Converter With High Voltage Push-Pull Outputs

### Ordering Information

Device	Recommended Operating $V_{PP}$ max	Package Options	
		44 J-Lead Quad Plastic Chip Carrier	Dice in Waffle Pack Chip Carrier
HV9308	80V	HV9308PJ	HV9308X
HV9408	80V	HV9408PJ	HV9408X

### Features

- Processed with HVCMOS<sup>®</sup> technology
- Low power level shifting
- Shift register speed 8MHz
- Latched data outputs
- 5V CMOS compatible inputs
- Forward and reverse shifting options
- Diode to  $V_{PP}$  allows efficient power recovery
- 44-lead ceramic surface mount package
- Hi-Rel processing available

### Absolute Maximum Ratings<sup>1</sup>

Supply voltage, $V_{DD}$ <sup>2</sup>	-0.5V to +7V
Supply voltage, $V_{PP}$ <sup>2</sup>	-0.5V to +90V
Logic input levels <sup>2</sup>	-0.5 to $V_{DD} + 0.5V$
Ground current <sup>3</sup>	1.5A
Continuous total power dissipation <sup>4</sup>	1200mW
Operating temperature range	-40°C to 85°C
Storage temperature range	-65°C to +150°C
Lead temperature 1.6mm (1/16 inch) from case for 10 seconds	260°C

**Notes:**

1. Device will survive (but operation may not be specified or guaranteed) at these extremes.
2. All voltages are referenced to GND<sub>1</sub>.
3. Duty cycle is limited by the total power dissipated in the package.
4. For operation above 25°C ambient derate linearly to maximum operating temperature at 20mW/°C.

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### General Description

The HV93 and HV94 are low voltage serial to high voltage parallel converters with push-pull outputs. These devices have been designed for use as drivers for AC-electroluminescent displays. They can also be used in any application requiring multiple output high voltage current sourcing and sinking capabilities such as driving plasma panels, vacuum fluorescent, or large matrix LCD displays.

These devices consist of a 32-bit shift register, 32 latches, and control logic to enable outputs. HV<sub>OUT1</sub> is connected to the first stage of the shift register through the Output Enable logic. Data is shifted through the shift register on the low to high transition of the clock. The HV94 shifts in the counterclockwise direction when viewed from the top of the package and the HV93 shifts in the clockwise direction. A data output buffer is provided for cascading devices. This output reflects the current status of the last bit of the shift register (32). Operation of the shift register is not affected by the LE (latch enable) or the OE (output enable) inputs. Transfer of data from the shift register to the latch occurs when the LE input is high. The data in the latch is retained when LE is low.

## Electrical Characteristics ( $V_{PP} = 60V$ , $V_{DD} = 5V$ , $T_A = 25^\circ C$ )

### DC Characteristics

Symbol	Parameter	Min	Max	Units	Conditions
$I_{PP}$	$V_{PP}$ Supply Current		100	$\mu A$	HV <sub>OUT</sub> outputs HIGH to LOW
$I_{DDQ}$	$I_{DD}$ Supply Current (Quiescent)		100	$\mu A$	All inputs = $V_{DD}$ or GND
$I_{DD}$	$I_{DD}$ Supply Current (Operating)		15	mA	$V_{DD} = V_{DD} \text{ max}$ , $f_{CLK} = 8 \text{ MHz}$
$V_{OH} \text{ (Data)}$	Shift Register Output Voltage	$V_{DD}-0.5$		V	$I_O = -100\mu A$
$V_{OL} \text{ (Data)}$	Shift Register Output Voltage		0.5	V	$I_O = 100\mu A$
$I_{IH}$	Current Leakage, any input		1.0	$\mu A$	Input = $V_{DD}$
$I_{IL}$	Current Leakage, any input		-1.0	$\mu A$	Input = GND
$V_{OC}$	HV <sub>OUT</sub> Output Clamp Diode Voltage		-1.5	V	$I_{OC} = -5mA$
$V_{OH}$	HV <sub>OUT</sub> Output when Sourcing	52		V	$I_{OH} = -20mA$ , 0 to $70^\circ C$
$V_{OL}$	HV <sub>OUT</sub> Output when Sinking		4.0	V	$I_{OL} = 5mA$ , 0 to $70^\circ C$

### AC Characteristics

Symbol	Parameter	Min	Max	Units	Conditions
$f_{CLK}$	Clock Frequency		8.0	MHz	
$t_{WL}$ or $t_{WH}$	Clock width, HIGH or LOW	62		ns	
$t_{SU}$	Setup time before CLK rises	25		ns	
$t_H$	Hold time after CLK rises	10		ns	
$t_{DLH} \text{ (Data)}$	Data Output Delay after L to H CLK		110	ns	$C_L = 15pF$
$t_{DHL} \text{ (Data)}$	Data Output Delay after H to L CLK		110	ns	$C_L = 15pF$
$t_{DLE}$	LE Delay after L to H CLK	50		ns	
$t_{WLE}$	Width of LE Pulse	50		ns	
$t_{SLE}$	LE Setup Time before L to H CLK	50		ns	
$t_{ON}$	Delay from LE to HV <sub>OUT</sub> , L to H		500	ns	
$t_{OFF}$	Delay from LE to HV <sub>OUT</sub> , H to L		500	ns	

## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Units	
$V_{DD}$	Logic Voltage Supply	4.5	5.5	V	
$V_{PP}$	High Voltage Supply	8.0	80	V	
$V_{IH}$	Input HIGH Voltage	$V_{DD}-0.5$	$V_{DD}$	V	
$V_{IL}$	Input LOW Voltage	0	0.5	V	
$f_{CLK}$	Clock Frequency	0	8.0	MHz	
$T_A$	Operating Free-Air Temperature	Plastic	-40	+85	$^\circ C$
		Ceramic	-55	+125	$^\circ C$

#### Notes:

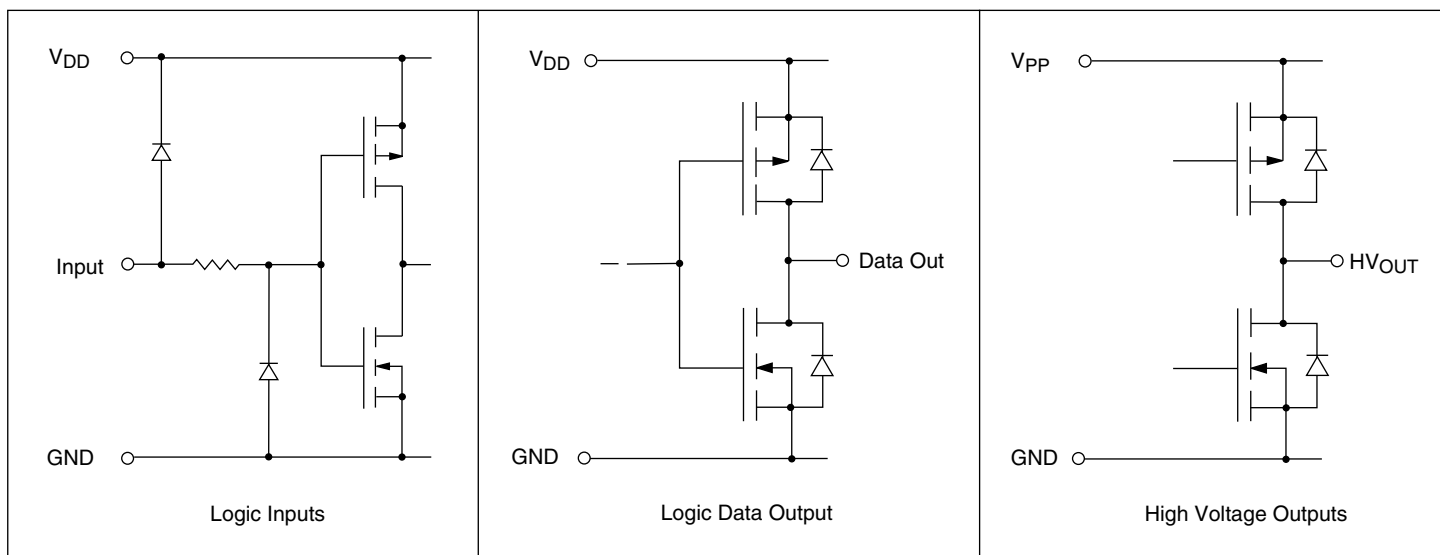
Power-up sequence should be the following:

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

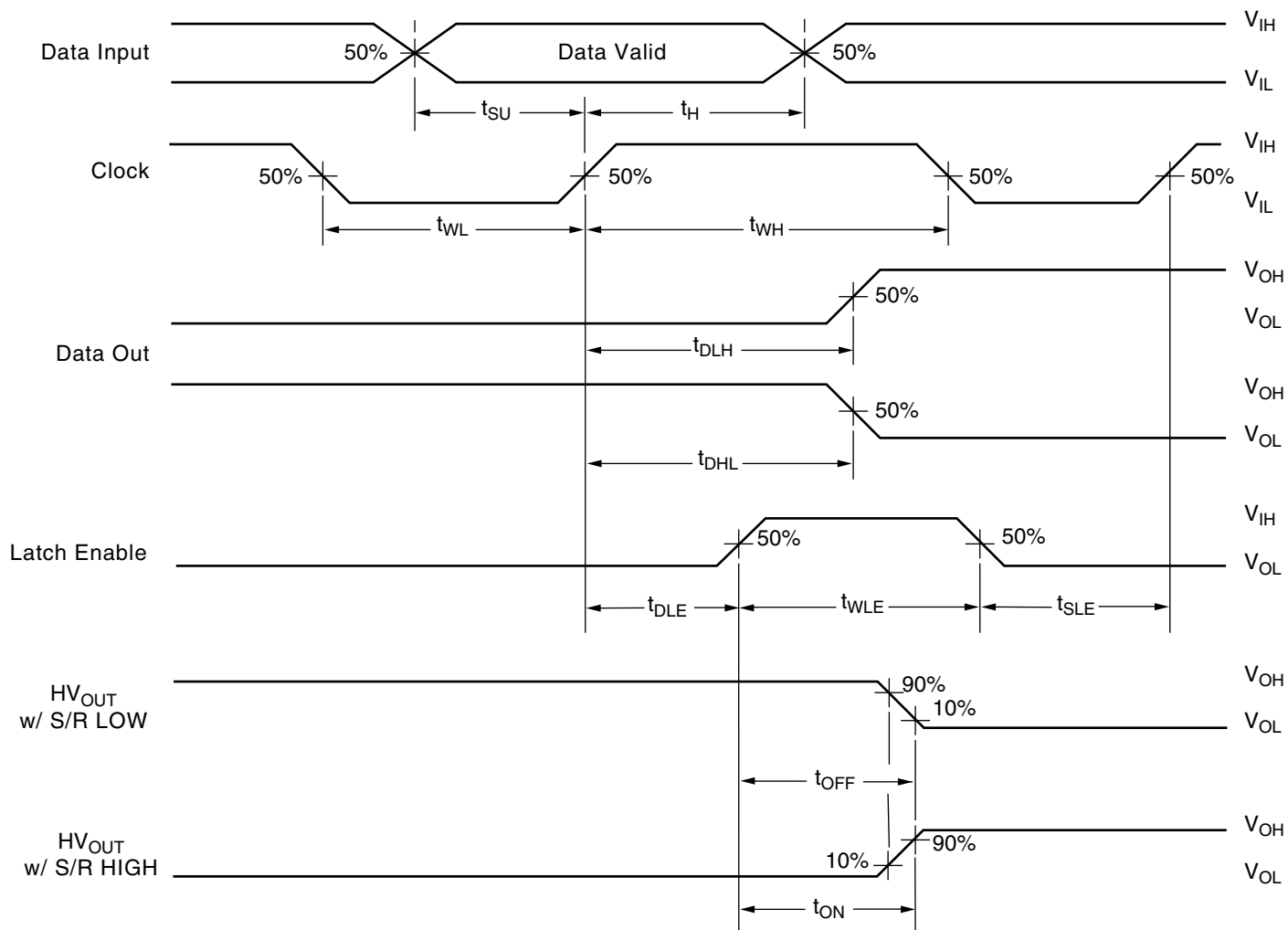
Power-down sequence should be the reverse of the above.

The  $V_{PP}$  should not drop below  $V_{DD}$  during operations.

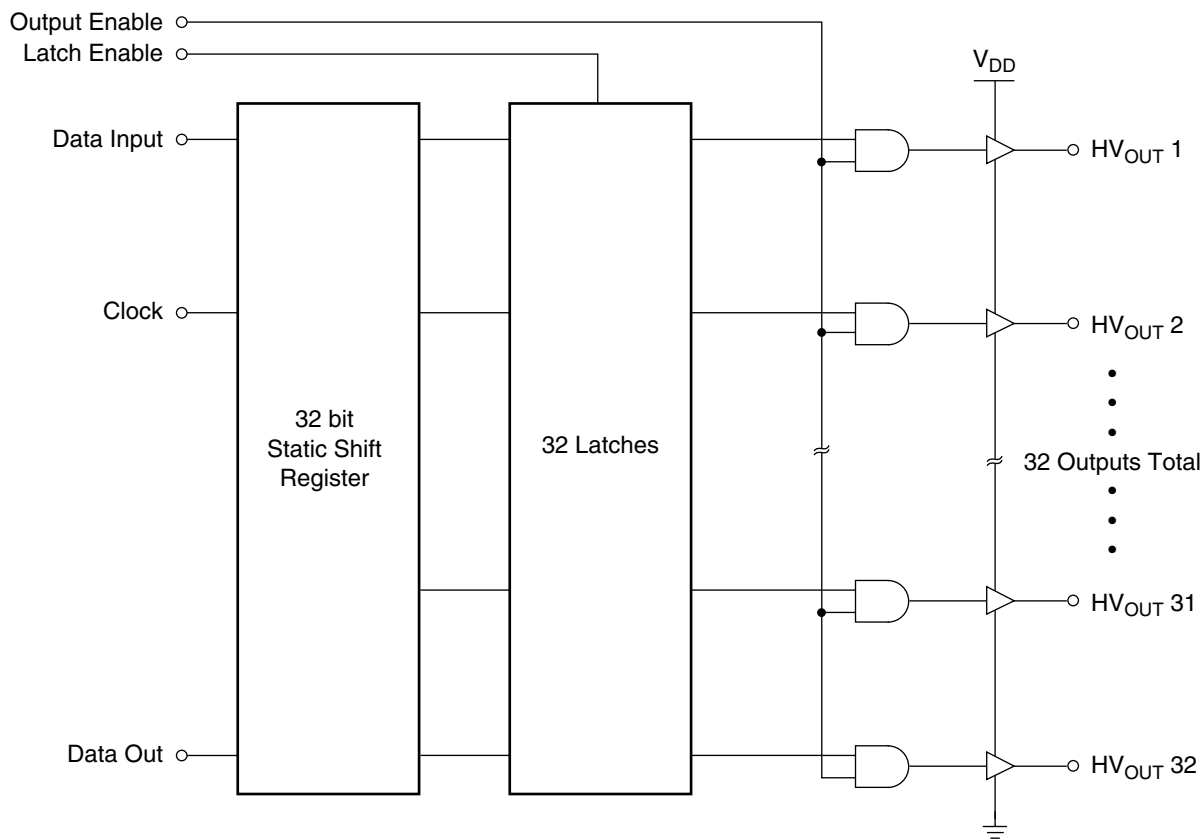
# Input and Output Equivalent Circuits



# Switching Waveforms



# Functional Block Diagram



# Function Tables

Data Input	CLK*	Data Output
H		H
L		L
X	No	No Change

\* = LOW-to-HIGH level transition

Data Input	LE	OE	HV <sub>OUT</sub> Output
X	X	L	All HV <sub>OUT</sub> = LOW
X	L	H	Previous Latched Data
H	H	H	H
L	H	H	L

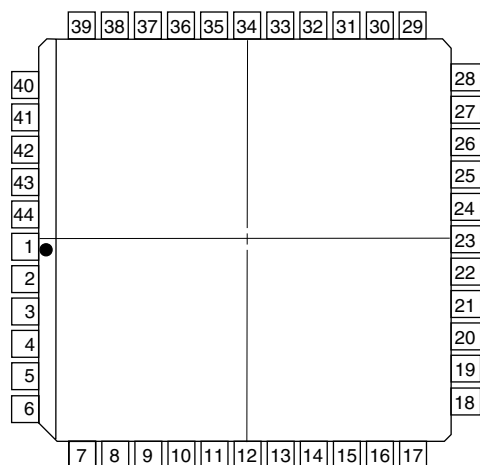
## Pin Configuration

### HV93

#### 44 Pin J-Lead Package

Pin	Function	Pin	Function
1	HV <sub>OUT</sub> 17	23	GND
2	HV <sub>OUT</sub> 16	24	V <sub>PP</sub>
3	HV <sub>OUT</sub> 15	25	V <sub>DD</sub>
4	HV <sub>OUT</sub> 14	26	Latch Enable
5	HV <sub>OUT</sub> 13	27	Data In
6	HV <sub>OUT</sub> 12	28	Output Enable
7	HV <sub>OUT</sub> 11	29	N/C
8	HV <sub>OUT</sub> 10	30	HV <sub>OUT</sub> 32
9	HV <sub>OUT</sub> 9	31	HV <sub>OUT</sub> 31
10	HV <sub>OUT</sub> 8	32	HV <sub>OUT</sub> 30
11	HV <sub>OUT</sub> 7	33	HV <sub>OUT</sub> 29
12	HV <sub>OUT</sub> 6	34	HV <sub>OUT</sub> 28
13	HV <sub>OUT</sub> 5	35	HV <sub>OUT</sub> 27
14	HV <sub>OUT</sub> 4	36	HV <sub>OUT</sub> 26
15	HV <sub>OUT</sub> 3	37	HV <sub>OUT</sub> 25
16	HV <sub>OUT</sub> 2	38	HV <sub>OUT</sub> 24
17	HV <sub>OUT</sub> 1	39	HV <sub>OUT</sub> 23
18	Data Out	40	HV <sub>OUT</sub> 22
19	N/C	41	HV <sub>OUT</sub> 21
20	N/C	42	HV <sub>OUT</sub> 20
21	N/C	43	HV <sub>OUT</sub> 19
22	Clock	44	HV <sub>OUT</sub> 18

## Package Outline



top view

44-pin J-Lead Package

### HV94

#### 44 Pin J-Lead Package

Pin	Function	Pin	Function
1	HV <sub>OUT</sub> 16	23	GND
2	HV <sub>OUT</sub> 17	24	V <sub>PP</sub>
3	HV <sub>OUT</sub> 18	25	V <sub>DD</sub>
4	HV <sub>OUT</sub> 19	26	Latch Enable
5	HV <sub>OUT</sub> 20	27	Data In
6	HV <sub>OUT</sub> 21	28	Output Enable
7	HV <sub>OUT</sub> 22	29	N/C
8	HV <sub>OUT</sub> 23	30	HV <sub>OUT</sub> 1
9	HV <sub>OUT</sub> 24	31	HV <sub>OUT</sub> 2
10	HV <sub>OUT</sub> 25	32	HV <sub>OUT</sub> 3
11	HV <sub>OUT</sub> 26	33	HV <sub>OUT</sub> 4
12	HV <sub>OUT</sub> 27	34	HV <sub>OUT</sub> 5
13	HV <sub>OUT</sub> 28	35	HV <sub>OUT</sub> 6
14	HV <sub>OUT</sub> 29	36	HV <sub>OUT</sub> 7
15	HV <sub>OUT</sub> 30	37	HV <sub>OUT</sub> 8
16	HV <sub>OUT</sub> 31	38	HV <sub>OUT</sub> 9
17	HV <sub>OUT</sub> 32	39	HV <sub>OUT</sub> 10
18	Data Out	40	HV <sub>OUT</sub> 11
19	N/C	41	HV <sub>OUT</sub> 12
20	N/C	42	HV <sub>OUT</sub> 13
21	N/C	43	HV <sub>OUT</sub> 14
22	Clock	44	HV <sub>OUT</sub> 15