

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

### Ordering Information

Device	Package Options			
	44 J-Lead Quad Ceramic Chip Carrier	44 J-Lead Quad Plastic Chip Carrier	Die in waffle pack	44 J-Lead Quad Ceramic Chip Carrier (MIL-STD-883 Processed*)
HV97	HV9708DJ	HV9708PJ	HV9708X	RBHV9708DJ
HV98	HV9808DJ	HV9808PJ	HV9808X	RBHV9808DJ

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

### Features

- Processed with HVCMOS<sup>®</sup> technology
- Output voltages up to 80V
- Low power level shifting
- Shift register speed 8MHz
- Latched data outputs
- Forward and reverse shifting options
- Diode to  $V_{PP}$  allows efficient power recovery
- 5V CMOS compatible inputs
- Hi-Rel processing available

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

Supply voltage, $V_{DD}$ <sup>2</sup>	-0.5V to +7V	
Output voltage, $V_{PP}$ <sup>2</sup>	$V_{DD}$ to +90V	
Logic input levels <sup>2</sup>	-0.5V to $V_{DD} + 0.5V$	
Ground current <sup>3</sup>	1.5A	
Continuous total power dissipation <sup>4</sup>	Ceramic	1500mW
	Plastic	1200mW
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.
3. Duty cycle is limited by the total power dissipated in the package.
4. For operation above 25°C ambient, derate linearly to 70°C at 12mW/°C.

### General Description

The HV97 and HV98 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 displays, or large matrix LCD displays. The inputs are fully CMOS compatible.

These devices consist of a 32-bit shift register, 32 latches, and control logic to perform the polarity select and blanking of the outputs.  $HV_{OUT1}$  is connected to the first stage of the shift register through the polarity and blanking logic. Data is shifted through the shift register on the logic low to high transition of the clock. The HV97 shifts data in the clockwise direction when viewed from the top of the package and the HV98 shifts in the counterclockwise direction. A data output buffer is provided for cascading devices. This output reflects the current status of the last bit of the shift register ( $HV_{OUT32}$ ). Operation of the shift register is not affected by the  $\overline{LE}$  (latch enable),  $\overline{BL}$  (blanking), or the  $\overline{POL}$  (polarity) inputs. Transfer of data from the shift register to the latch occurs when the  $\overline{LE}$  (latch enable) input is high. The data in the latch is stored when  $\overline{LE}$  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	$\mu A$	Input = $V_{DD}$
$I_{IL}$	Current Leakage, any input		-1	$\mu A$	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°C
$V_{OL}$	HV <sub>OUT</sub> Output when Sinking		4	V	$I_{OL} = 5mA$ , 0 to 70°C

### AC Characteristics

Symbol	Parameter	Min	Max	Units	Conditions
$f_{CLK}$	Clock Frequency		8	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

(over 0 to 70°C for commercial temperature range and -55°C to 125°C for military)

Symbol	Parameter	Min	Max	Units	Comments
$V_{DD}$	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	MHz	

#### Note:

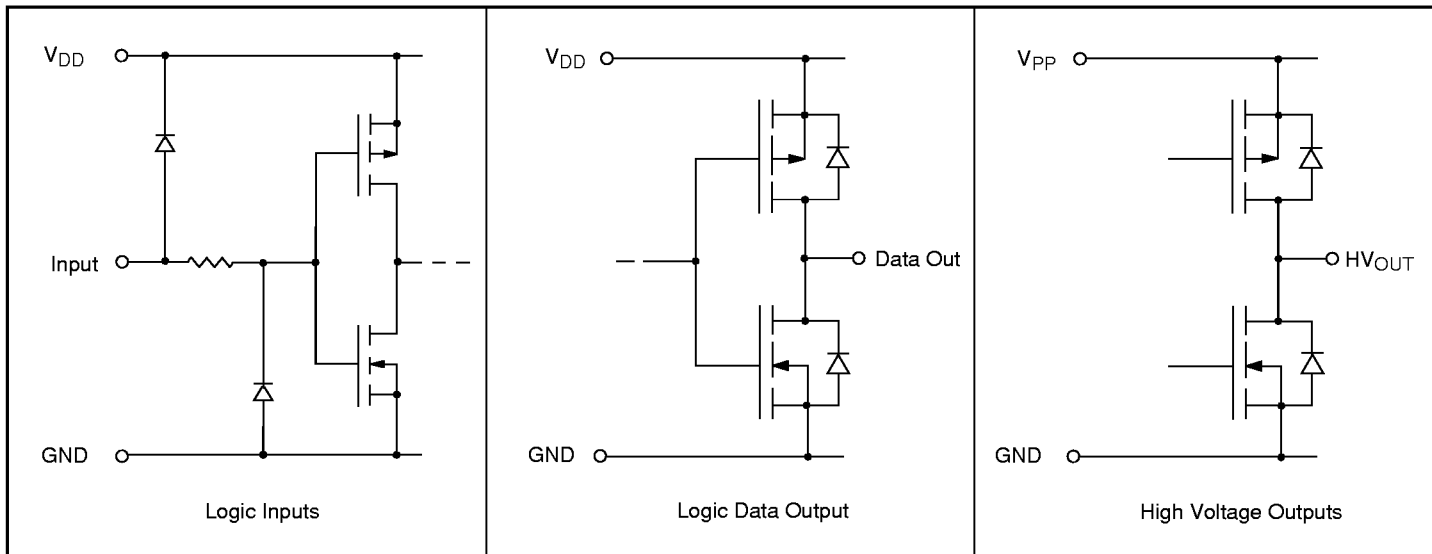
Power-up sequence should be the following:

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

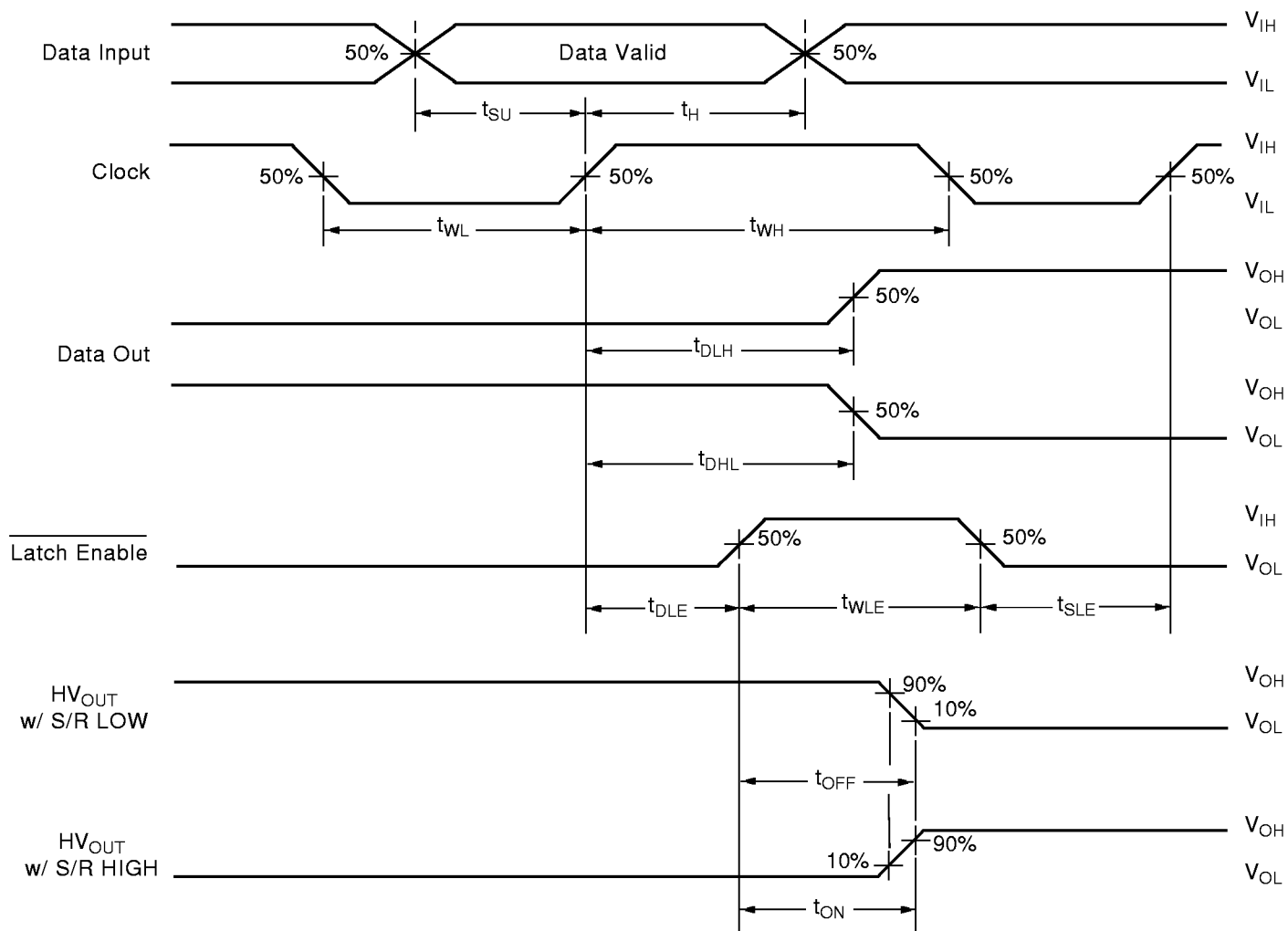
Power-down sequence should be the reverse of the above.

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

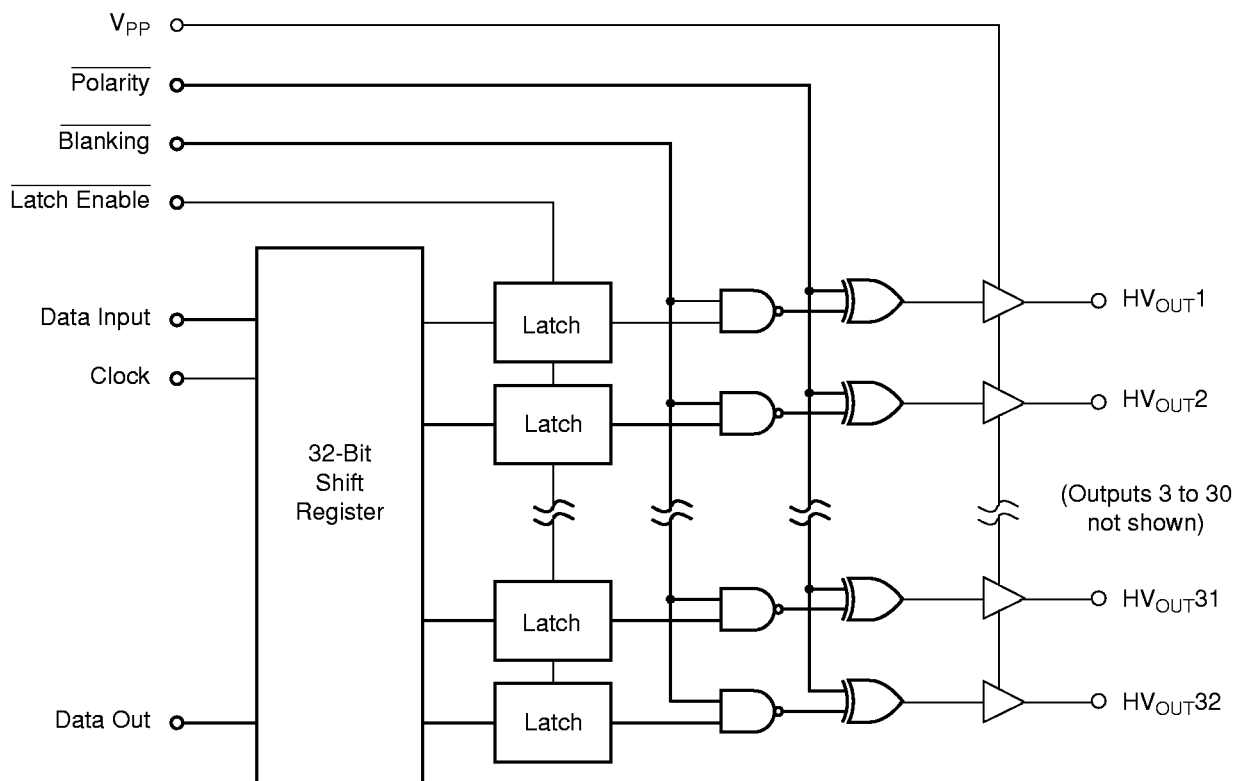
# Input and Output Equivalent Circuits



# Switching Waveforms



# Functional Block Diagram



# Function Table

Function	Inputs					Outputs			
	Data	CLK	LE	BL	POL	Shift Reg 1 2...32	HV Outputs 1 2...32		Data Out *
All on	X	X	X	L	L	* *...*	H	H...H	*
All off	X	X	X	L	H	* *...*	L	L...L	*
Invert mode	X	X	L	H	L	* *...*	$\bar{*}$	$\bar{*}...$	*
Load S/R	H or L	↑	L	H	H	H or L *...*	*	*...*	*
Load latches	X	H or L	↑	H	H	* *...*	*	*...*	*
	X	H or L	↑	H	L	* *...*	$\bar{*}$	$\bar{*}...$	*
Transparent latch mode	L	↑	H	H	H	L *...*	L	*...*	*
	H	↑	H	H	H	H *...*	H	*...*	*

**Notes:**  
 H = high level, L = low level, X = irrelevant, ↑ = low-to-high transition.  
 \* = dependent on previous stage's state before the last CLK or last LE high.

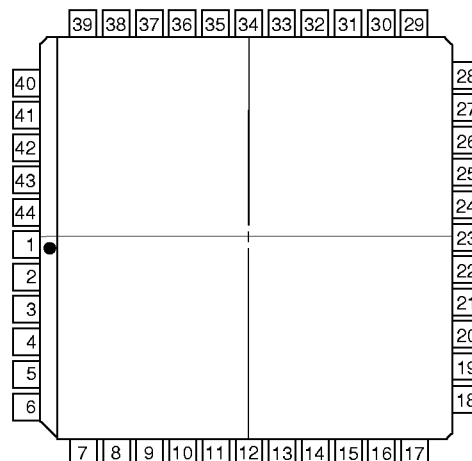
## Pin Configurations

## Package Outline

### HV97

#### 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	Blanking
7	HV <sub>OUT</sub> 11	29	N/C
8	HV <sub>OUT</sub> 10	30	HVout 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	Polarity	43	HV <sub>OUT</sub> 19
22	Clock	44	HV <sub>OUT</sub> 18



top view  
44-pin J-Lead Package

### HV98

#### 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	Blanking
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	Polarity	43	HV <sub>OUT</sub> 14
22	Clock	44	HV <sub>OUT</sub> 15