

## 64-Channel Serial To Parallel Converter With Open Drain Outputs

### Ordering Information

Device	Recommended Operating $V_{PP}$ Max	Package Options				
		80-Lead Quad Cerpak Gullwing	80-Lead Quad Plastic Gullwing	80-Lead 35mm TAB Tape	Die	80-Lead Quad Cerpak Gullwing (MIL-STD-883 Processed*)
HV03	220V	HV0322DG	HV0322PG	HV0322T	HV0322X	RBHV0322DG
	300V	HV0330DG	HV0330PG	HV0330T	HV0330X	—
HV05	220V	HV0522DG	HV0522PG	HV0522T	HV0522X	RBHV0522DG
	300V	HV0530DG	HV0530PG	HV0530T	HV0530X	—

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

### Features

- HVCMOS<sup>®</sup> technology
- Output voltages up to 300V using a ramped supply
- Sink current minimum 100 mA
- Shift register speed 8 MHz
- Latched outputs
- Output polarity and blanking
- CMOS compatible inputs
- Forward and reverse shifting options

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

Supply voltage, $V_{DD}$	-0.5V to +15V
Supply voltage, $V_{PP}$ <sup>2</sup>	-0.5V to +315V
Logic input levels	-0.5V to $V_{DD}$ +0.5V
Ground current <sup>3</sup>	6.0A
Continuous total power dissipation <sup>4</sup>	Ceramic 1900mW
	Plastic 1200mW
Operating temperature range	Commercial -40°C to +85°C
	Military -55°C to +125°C
Storage temperature range	-65°C to +150°C

#### Notes:

1. All voltages are referenced to GND.
2. These devices have been designed to be used in applications which either switch the  $V_{PP}$  supply to ground before changing the state of the high voltage outputs or limit the current through each output.
3. Connection to all power and ground pads is required. Duty cycle is limited by the total power dissipated in the package.
4. For operation above 25°C ambient derate linearly to 85°C at 15mW/°C.

### General Description

The HV03 and HV05 are low voltage serial to high voltage parallel converters with open drain 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 sinking capabilities such as driving inkjet and electrostatic printheads, plasma panels, vacuum fluorescent, or large matrix LCD displays.

These devices consist of a 64-bit shift register, 64 latches, and control logic to perform the polarity select and blanking of the outputs. Data is shifted through the shift register on the high to low transition of the clock. The HV03 shifts in the counterclockwise direction when viewed from the top of the package and the HV05 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. Operation of the shift register is not affected by the LE (latch enable), BL (blanking), or the POL (polarity) inputs. Transfer of data from the shift register to the latch occurs when the LE (latch enable) input is high. The data in the latch is stored when LE is low.

The HV03 and HV05 have been designed to be used in systems which either switch off the high voltage supply before changing the state of the high voltage outputs or limit the current through each output.

## Electrical Characteristics (over recommended operating conditions unless noted)

### DC Characteristics

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$I_{DD}$	$V_{DD}$ Supply Current			25	mA	$f_{CLK} = 8\text{MHz}$ , $f_{DATA} = 4\text{MHz}$ $\overline{LE} = \text{LOW}$
$I_{DDQ}$	Quiescent $V_{DD}$ Supply Current			0.25	mA	All $V_{IN} = 0\text{V}$
$I_{O(OFF)}$	Off State Output Current			100	$\mu\text{A}$	All outputs high, All SWS parallel
$I_{IH}$	High-Level Logic Input Current			10	$\mu\text{A}$	$V_{IH} = V_{DD}$
$I_{IL}$	Low-Level Logic Input Current			-10	$\mu\text{A}$	$V_I = 0\text{V}$
$V_{OH}$	High-Level Output Data Out	$V_{DD} - 1\text{V}$			V	$I_{DOUT} = -100\mu\text{A}$
$V_{OL}$	Low-Level Output	$HV_{OUT}$		15	V	$I_{HVOUT} = +100\text{mA}$
		Data Out		1	V	$I_{DOUT} = +100\mu\text{A}$
$V_{OC}$	$HV_{OUT}$ Clamp Voltage			-1.5	V	$I_{OL} = -100\text{mA}$

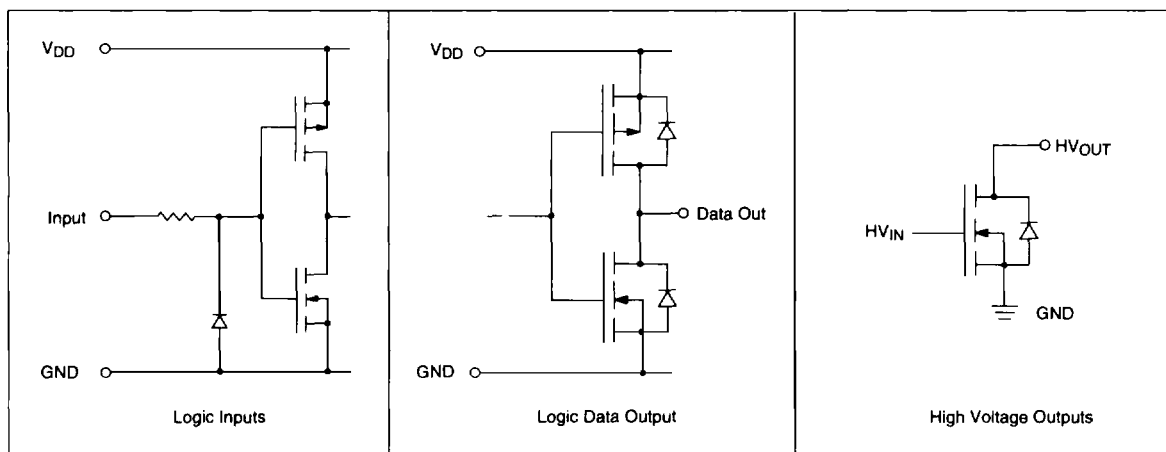
### AC Characteristics

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$f_{CLK}$	Clock Frequency			8	MHz	
$t_W$	Clock Width High or Low	62			ns	
$t_{SU}$	Data Setup Time Before Clock Falls	25			ns	
$t_H$	Data Hold Time After Clock Falls	10			ns	
$t_{WLE}$	Width of Latch Enable Pulse	62			ns	
$t_{DLE}$	$\overline{LE}$ Delay Time Falling Edge of Clock	25			ns	
$t_{SLE}$	$\overline{LE}$ Setup Time Before Falling Edge of Clock	30			ns	
$t_D$	Delay Time from $V_{PP}$ Low Until Change in $\overline{LE}$ , $POL$ , $\overline{BL}$ Is Allowed	100			ns	
$t_{SL}$	Setup Time from Falling Edge $\overline{LE}$ to $V_{PP}$ Rise	200			ns	
$t_{SB}$	Setup Time from $\overline{BL}$ Selected to $V_{PP}$ Rise	150			ns	
$t_{SP}$	Setup Time from $POL$ Selected to $V_{PP}$ Rise	100			ns	
$t_{DHL}$	Delay Time Clock to Data High to Low			100	ns	
$t_{DLK}$	Delay Time Clock to Data Low to High			100	ns	

### Recommended Operating Conditions

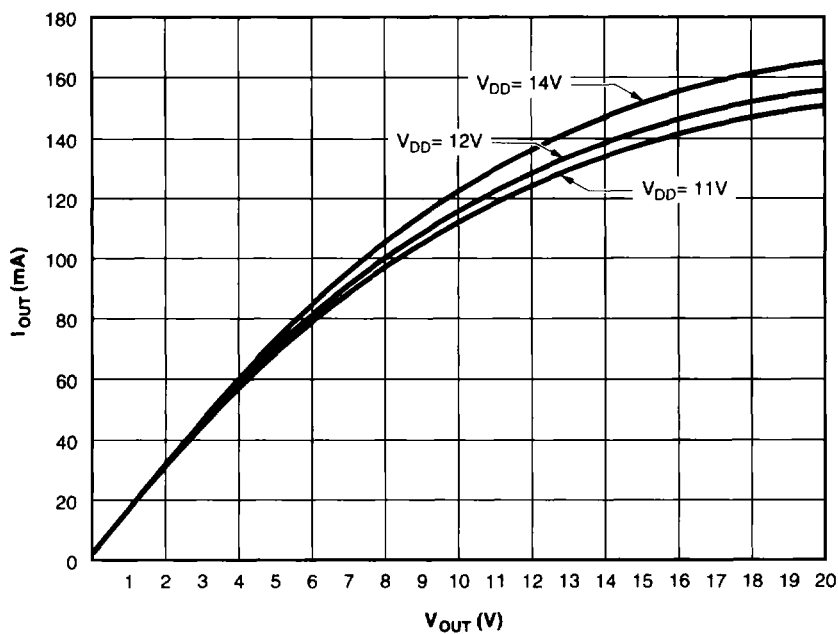
Symbol	Parameter	Min	Typ	Max	Units	
$V_{DD}$	Logic supply voltage	10.8	12	13.2	V	
$V_{PP}$	High voltage supply	HV0322/HV0522		-0.3	220	V
		HV0330/HV0530		-0.3	300	V
$V_{IH}$	High-level input voltage		$V_{DD} - 2\text{V}$	$V_{DD}$	V	
$V_{IL}$	Low-level input voltage		0	2.0	V	
dV/dt	$V_{PP}$ ramp rate			80	V/ $\mu\text{s}$	
$T_A$	Operating free-air temperature	-40		+85	$^{\circ}\text{C}$	

# Input and Output Equivalent Circuit

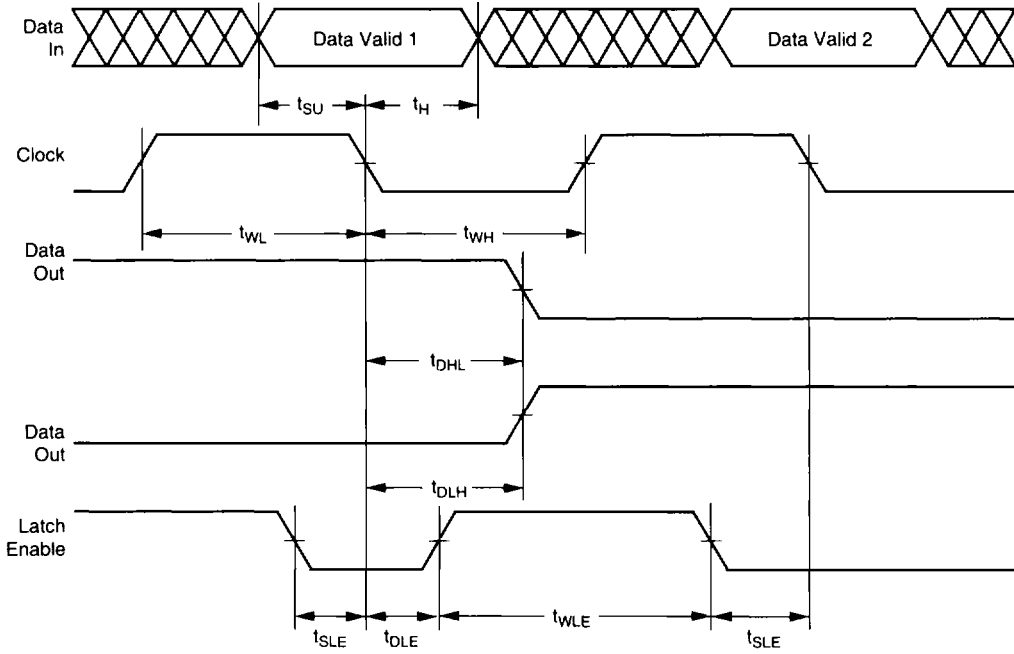


# Typical Operating Conditions

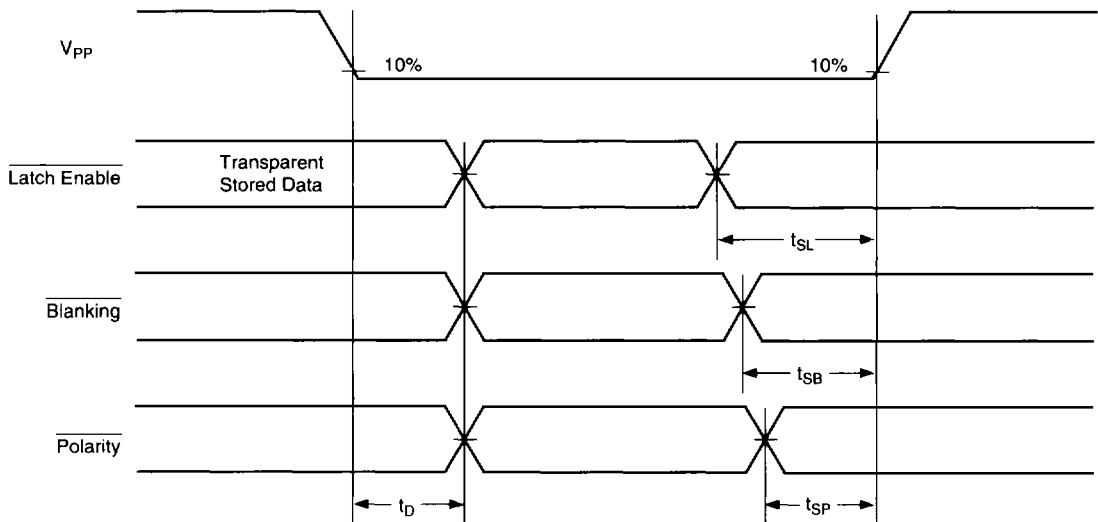
Sink Current @ 25°C



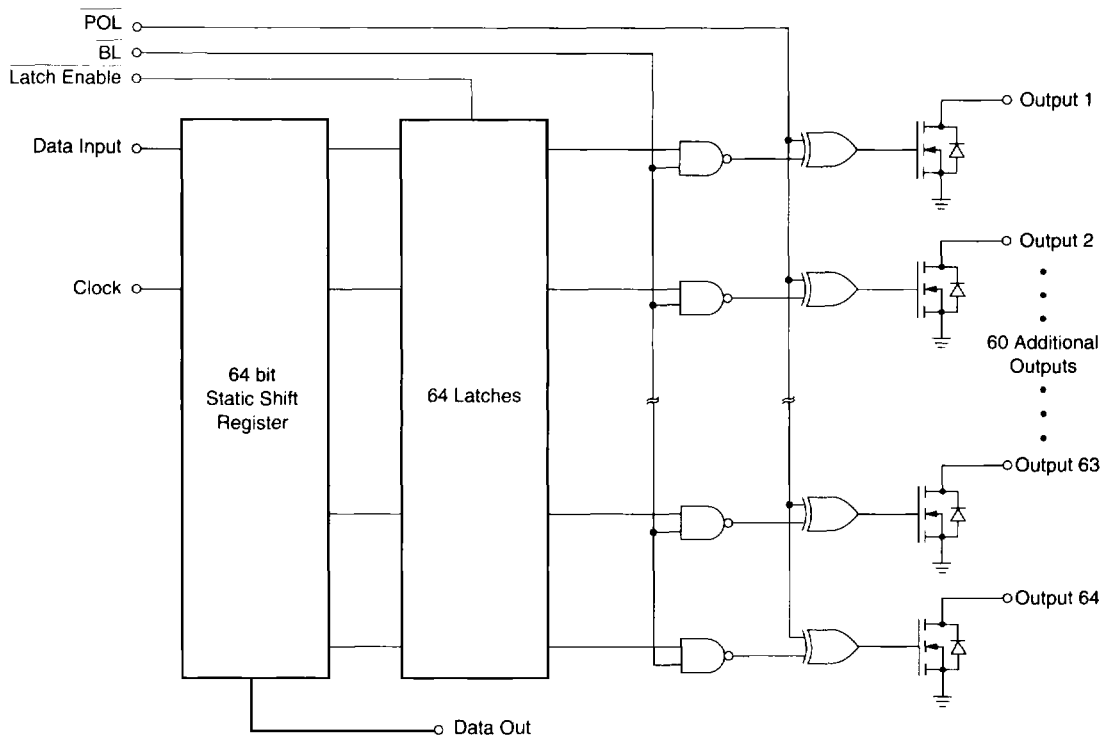
## Switching Waveforms



## Output Control Waveforms



# Functional Block Diagram



# Function Table

Function	Inputs					Outputs		
	Data	CLK	$\overline{LE}$	$\overline{BL}$	$\overline{POL}$	Shift Reg 1 2...64	HV Outputs 1 2...64	Data Out *
All on	X	X	X	L	L	* *...*	L L...L	*
All off	X	X	X	L	H	* *...*	H H...H	*
Invert mode	X	X	L	H	L	* *...*	$\overline{*} \overline{*}...$	*
Load S/R	H or L	↓	L	H	H	H or L *...*	* *...*	*
Load Latches	X	X	H	X	X	* *...*	* *...*	*
Transparent Latch mode	L	↓	H	H	H	L *...*	H *...*	*
	H	↓	H	H	H	H *...*	L *...*	*

**Notes:**

H = high level, L = low level, X = irrelevant, ↓ = high-to-low transition.

\* = dependent on previous stage's state before the last CLK or last LE high.



## Pin Configurations

### PG and DG Packages

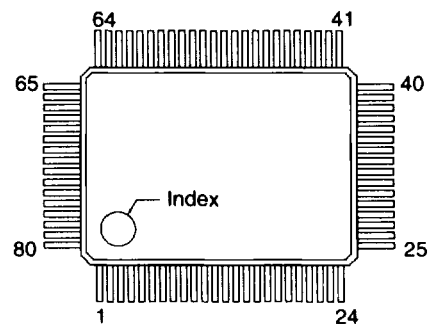
#### HV03

Pin	Function	Pin	Function
1	GND	41	GND
2	GND	42	GND
3	HV <sub>OUT</sub> 59	43	HV <sub>OUT</sub> 23
4	HV <sub>OUT</sub> 60	44	HV <sub>OUT</sub> 24
5	HV <sub>OUT</sub> 61	45	HV <sub>OUT</sub> 25
6	HV <sub>OUT</sub> 62	46	HV <sub>OUT</sub> 26
7	HV <sub>OUT</sub> 63	47	HV <sub>OUT</sub> 27
8	HV <sub>OUT</sub> 64	48	HV <sub>OUT</sub> 28
9	POL	49	HV <sub>OUT</sub> 29
10	Data Out	50	HV <sub>OUT</sub> 30
11	CLK	51	HV <sub>OUT</sub> 31
12	GND	52	HV <sub>OUT</sub> 32
13	V <sub>DD</sub>	53	HV <sub>OUT</sub> 33
14	LE	54	HV <sub>OUT</sub> 34
15	Data In	55	HV <sub>OUT</sub> 35
16	BL	56	HV <sub>OUT</sub> 36
17	HV <sub>OUT</sub> 1	57	HV <sub>OUT</sub> 37
18	HV <sub>OUT</sub> 2	58	HV <sub>OUT</sub> 38
19	HV <sub>OUT</sub> 3	59	HV <sub>OUT</sub> 39
20	HV <sub>OUT</sub> 4	60	HV <sub>OUT</sub> 40
21	HV <sub>OUT</sub> 5	61	HV <sub>OUT</sub> 41
22	HV <sub>OUT</sub> 6	62	HV <sub>OUT</sub> 42
23	GND	63	GND
24	GND	64	GND
25	HV <sub>OUT</sub> 7	65	HV <sub>OUT</sub> 43
26	HV <sub>OUT</sub> 8	66	HV <sub>OUT</sub> 44
27	HV <sub>OUT</sub> 9	67	HV <sub>OUT</sub> 45
28	HV <sub>OUT</sub> 10	68	HV <sub>OUT</sub> 46
29	HV <sub>OUT</sub> 11	69	HV <sub>OUT</sub> 47
30	HV <sub>OUT</sub> 12	70	HV <sub>OUT</sub> 48
31	HV <sub>OUT</sub> 13	71	HV <sub>OUT</sub> 49
32	HV <sub>OUT</sub> 14	72	HV <sub>OUT</sub> 50
33	HV <sub>OUT</sub> 15	73	HV <sub>OUT</sub> 51
34	HV <sub>OUT</sub> 16	74	HV <sub>OUT</sub> 52
35	HV <sub>OUT</sub> 17	75	HV <sub>OUT</sub> 53
36	HV <sub>OUT</sub> 18	76	HV <sub>OUT</sub> 54
37	HV <sub>OUT</sub> 19	77	HV <sub>OUT</sub> 55
38	HV <sub>OUT</sub> 20	78	HV <sub>OUT</sub> 56
39	HV <sub>OUT</sub> 21	79	HV <sub>OUT</sub> 57
40	HV <sub>OUT</sub> 22	80	HV <sub>OUT</sub> 58

#### HV05

Pin	Function	Pin	Function
1	GND	41	GND
2	GND	42	GND
3	HV <sub>OUT</sub> 6	43	HV <sub>OUT</sub> 42
4	HV <sub>OUT</sub> 5	44	HV <sub>OUT</sub> 41
5	HV <sub>OUT</sub> 4	45	HV <sub>OUT</sub> 40
6	HV <sub>OUT</sub> 3	46	HV <sub>OUT</sub> 39
7	HV <sub>OUT</sub> 2	47	HV <sub>OUT</sub> 38
8	HV <sub>OUT</sub> 1	48	HV <sub>OUT</sub> 37
9	POL	49	HV <sub>OUT</sub> 36
10	Data Out	50	HV <sub>OUT</sub> 35
11	CLK	51	HV <sub>OUT</sub> 34
12	GND	52	HV <sub>OUT</sub> 33
13	V <sub>DD</sub>	53	HV <sub>OUT</sub> 32
14	LE	54	HV <sub>OUT</sub> 31
15	Data In	55	HV <sub>OUT</sub> 30
16	BL	56	HV <sub>OUT</sub> 29
17	HV <sub>OUT</sub> 64	57	HV <sub>OUT</sub> 28
18	HV <sub>OUT</sub> 63	58	HV <sub>OUT</sub> 27
19	HV <sub>OUT</sub> 62	59	HV <sub>OUT</sub> 26
20	HV <sub>OUT</sub> 61	60	HV <sub>OUT</sub> 25
21	HV <sub>OUT</sub> 60	61	HV <sub>OUT</sub> 24
22	HV <sub>OUT</sub> 59	62	HV <sub>OUT</sub> 23
23	GND	63	GND
24	GND	64	GND
25	HV <sub>OUT</sub> 58	65	HV <sub>OUT</sub> 22
26	HV <sub>OUT</sub> 57	66	HV <sub>OUT</sub> 21
27	HV <sub>OUT</sub> 56	67	HV <sub>OUT</sub> 20
28	HV <sub>OUT</sub> 55	68	HV <sub>OUT</sub> 19
29	HV <sub>OUT</sub> 54	69	HV <sub>OUT</sub> 18
30	HV <sub>OUT</sub> 53	70	HV <sub>OUT</sub> 17
31	HV <sub>OUT</sub> 52	71	HV <sub>OUT</sub> 16
32	HV <sub>OUT</sub> 51	72	HV <sub>OUT</sub> 15
33	HV <sub>OUT</sub> 50	73	HV <sub>OUT</sub> 14
34	HV <sub>OUT</sub> 49	74	HV <sub>OUT</sub> 13
35	HV <sub>OUT</sub> 48	75	HV <sub>OUT</sub> 12
36	HV <sub>OUT</sub> 47	76	HV <sub>OUT</sub> 11
37	HV <sub>OUT</sub> 46	77	HV <sub>OUT</sub> 10
38	HV <sub>OUT</sub> 45	78	HV <sub>OUT</sub> 9
39	HV <sub>OUT</sub> 44	79	HV <sub>OUT</sub> 8
40	HV <sub>OUT</sub> 43	80	HV <sub>OUT</sub> 7

## Package Outline



top view

80-pin Gullwing Package