

## 32-Channel Vacuum-Fluorescent Display Driver

### Ordering Information

Device	Package Options		
	40 Pin Dip	44 Plastic Chip Carrier	Die
HV518	HV518P	HV518PJ	HV518X

### Features

- 32 output lines
- 90V output swing
- Active pull-down
- Latches on all outputs
- Up to 6MHz @  $V_{DD} = 5V$
- 40°C to +85°C operation

### General Description

The HV518 is designed for vacuum fluorescent or DC plasma applications, where it can serve as a segment, digit or matrix display driver. Each device has 32 outputs, 32 latches and a 32 bit cascable shift register.

Serial data enters the shift register on the LOW-to-HIGH transition of the clock input. With latch enable ( $\overline{LE}$ ) HIGH, parallel data is transferred to the output buffers through a 32-bit latch. When  $\overline{LE}$  is low the data is stored in the latch. When STROBE is LOW, all outputs are enabled; if STROBE is HIGH, all outputs are LOW.

### Absolute Maximum Ratings

Supply voltage, $V_{DD}$ <sup>1</sup>	-0.5V to +6.0V
Supply voltage, $V_{PP}$ <sup>1</sup>	-0.5V to +90V
Logic input levels <sup>1</sup>	-0.5V to $V_{DD} + 0.5V$
Continuous total power dissipation <sup>2,3</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. All voltages referenced to GND.
2. Duty cycle is limited by the total power dissipated in the package.
3. For operation above 25°C ambient, derate linearly to 85°C at 20mW/°C.

## Electrical Characteristics

(over recommended ranges of operating free-air temperature and  $V_{DD}$ . Unless otherwise noted,  $V_{PP} = 80V$ )

Symbol	Parameter	Min	Typ	Max	Units	Conditions	
$I_{DD}$	Supply current			10	mA	$V_{DD} = 5V$ , $f_{CH} = 6.0$ MHz	
$I_{DDQ}$	Quiescent supply current			0.5	mA	$V_{DD} = 5.5V$ , $V_{IN} = 0V$	
$I_{PP}$	Supply current			12	mA	Output high, $T_A = -40^\circ C$	
			7	10	mA	Output high, $T_A = 0$ to $+85^\circ C$	
				500	$\mu A$	Outputs low	
$V_{OH}$	High-level output voltage	HVoutput	70.0		V	$I_{OH} = -25mA$	
		Serial output	4.5	4.9	5	V	$V_{DD} = 5V$ , $I_{OH} = -20\mu A$
$V_{OL}$	Low-level output	HVoutput			5	V	$I_{OL} = 1mA$
		Serial output		0.06	0.8	V	$I_{OL} = 20\mu A$
$I_{IH}$	High-level logic input current		0.1	1	$\mu A$	$V_{IH} = V_{DD}$	
$I_{IL}$	Low-level logic input current		-0.1	-1	$\mu A$	$V_{IL} = 0V$	

**Note:** The total number of ON outputs times the duty cycle must not exceed the allowable package power dissipation.

## Switching Characteristics ( $V_{PP} = 80V$ , $C_L = 50$ pF, $T_A = 25^\circ C$ , unless otherwise noted)

Symbol	Parameter	Min	Max	Unit	Conditions	
$t_d$	Delay time, Clock to data output	$V_{DD} = 4.5V$	600	ns	$C_L = 15$ pF See Figure 4	
$t_{DHL}$	Delay time, high-to-low-level, HVoutput	from latch enable	$V_{DD} = 4.5V$	1.5	$\mu s$	See Figure 5
		from strobe		1		See Figure 6
$t_{DLH}$	Delay time, low-to-high-level HVoutput	from latch enable	$V_{DD} = 4.5V$	1.5	$\mu s$	See Figure 5
		from strobe		1		See Figure 6
$t_{THL}$	Transition time, high-to-low-level, HVoutput	$V_{DD} = 4.5V$	3	$\mu s$	See Figure 6	
$t_{TLH}$	Transition time, low-to-high-level, HVoutput	$V_{DD} = 4.5V$	2.5	$\mu s$	See Figure 6	

## Recommended Operating Conditions ( $T_A = 25^\circ C$ , unless otherwise noted)

Symbol	Parameter	Min	Max	Units
$V_{DD}$	Logic voltage supply	4.5	5.5	V
$V_{PP}$	High voltage supply	8	80	V
$V_{IH}$	High-level input voltage (See Fig.3.)	$V_{DD} = 4.5V$	3.5	V
$V_{IL}$	Low-level input voltage (See Fig. 3.)	$V_{DD} = 4.5V$	1	V
$I_{OH}$	High-level output current	-25		mA
$I_{OL}$	Low-level output current		2	mA
$f_{CLK}$	Clock frequency (see Figure 3)	$V_{DD} = 4.5V$	6.0	MHz
$t_{w(CKH)}$	Pulse duration, clock high	$V_{DD} = 4.5V$	83	ns
$t_{w(CKL)}$	Pulse duration, clock low	$V_{DD} = 4.5V$	83	ns
$t_{su}$	Setup time, data before clock	$V_{DD} = 4.5V$	75	ns
$t_h$	Hold time, data after clock	$V_{DD} = 4.5V$	75	ns
$T_A$	Operating free-air temperature	-40	85	$^\circ C$

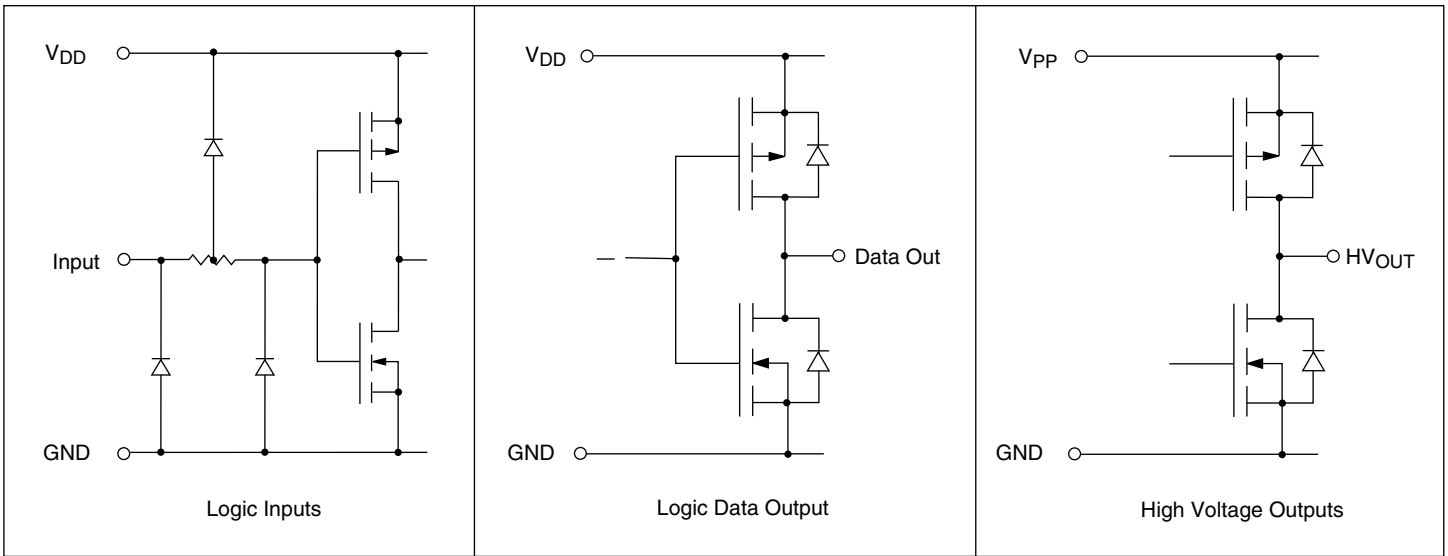
**Note:**

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  $V_{PP}$ .
5. The  $V_{PP}$  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



# Parameter Measurement Information

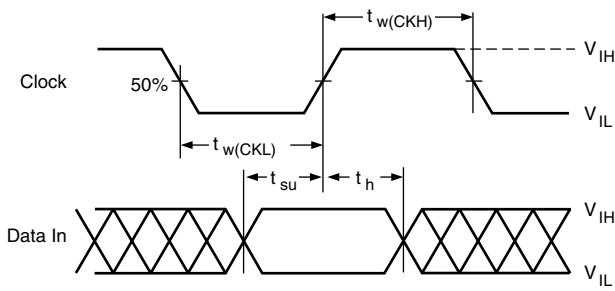


Figure 3: Input Timing Voltage Waveforms

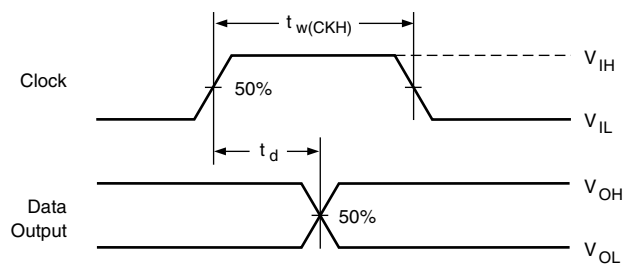


Figure 4

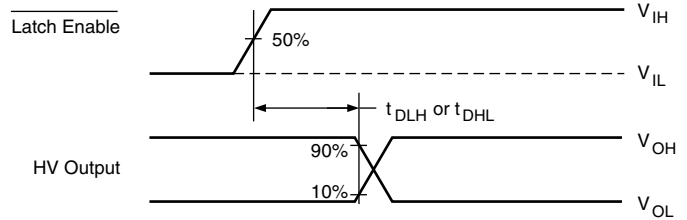


Figure 5

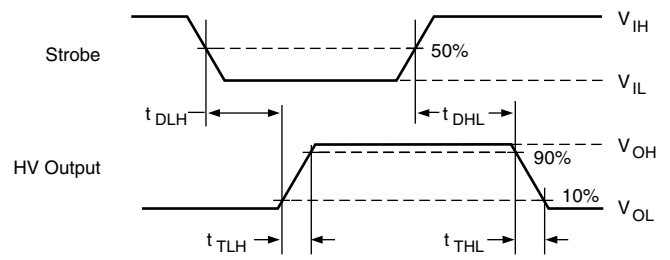
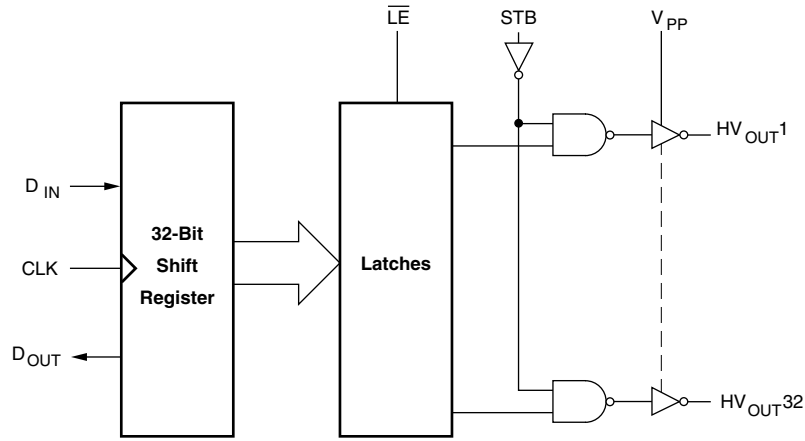


Figure 6: Switching-Time Voltage Waveforms

**Note:** For testing purposes, all input pulses have maximum rise and fall times of 30 nsec.

# Block Diagram



# Truth Tables

## Input

Data In	CLK	Data Out
H		H
L		L
X	No Change	*

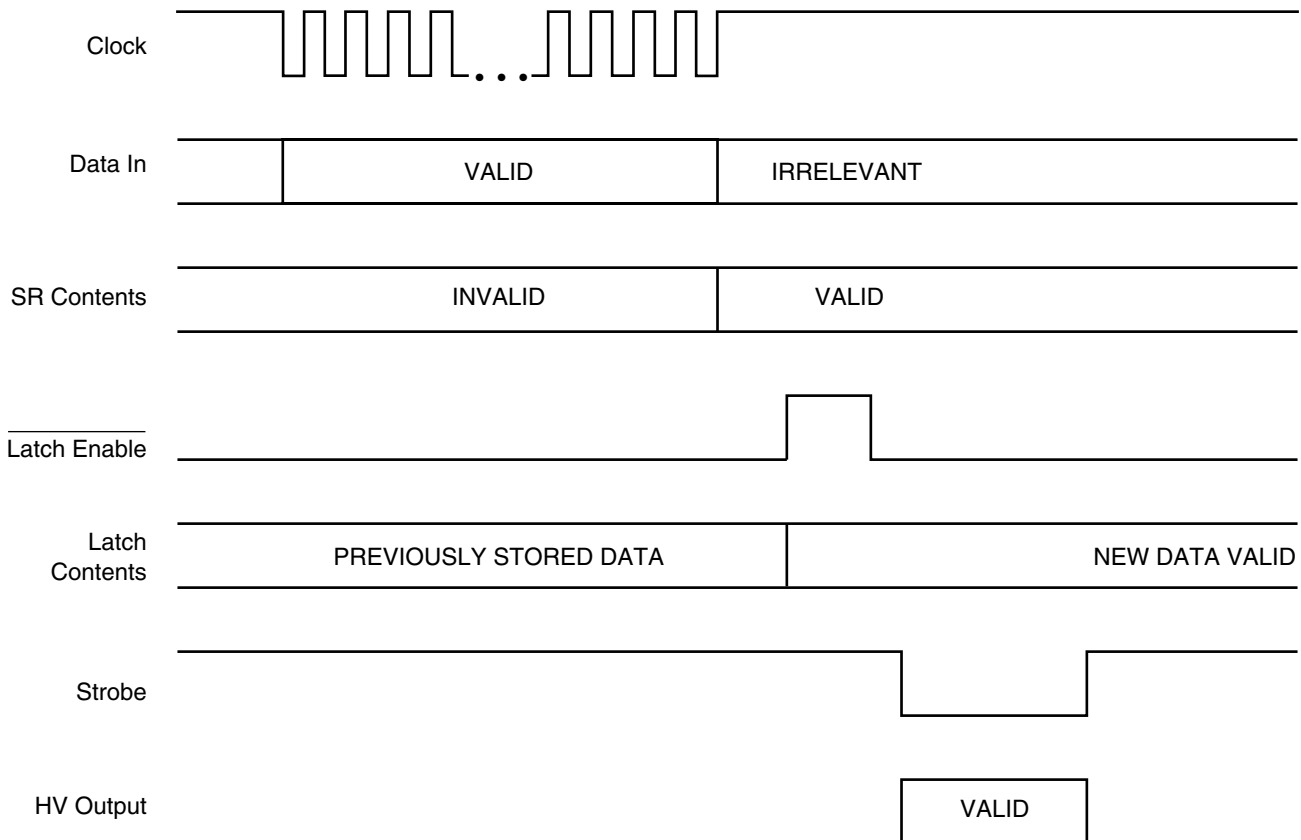
\* Previous state

## Output

Data In	LE	STB	HV Outputs
X	X	H	All Low
H	H	L	High
L	H	L	Low
X	L	L	*

\* Previous state

# Typical Operating Sequence



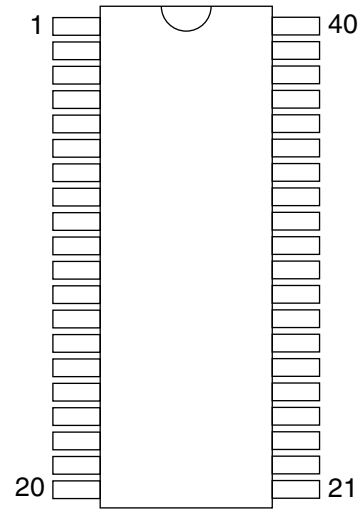
# Pin Configurations

# Package Outline

## HV518

### 40 Pin Dual-In-Line Package

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

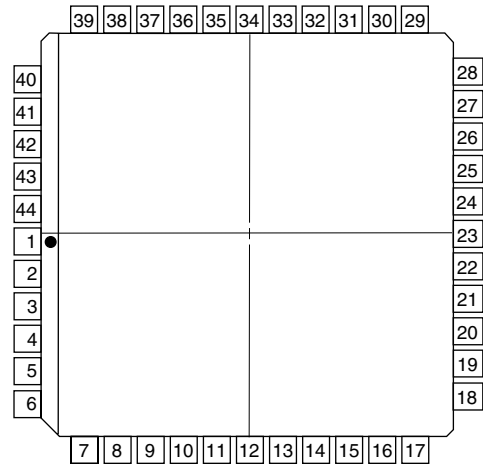


top view  
40-pin DIP

## HV518

### 44 Pin J-Lead Package

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



top view