HV518

32-Channel Vacuum Fluorescent Display Driver

Features

- Thirty-two Output Lines
- 90V Output Swing
- Active Pull-down
- Latches on all Outputs
- Up to 6 MHz at V_{DD} = 5V
- –40°C to +85°C Operation

Applications

- Vacuum Fluorescent Displays
- DC Plasma Displays

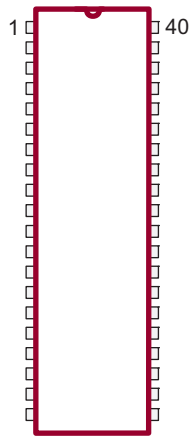
General Description

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 cascadable Shift register.

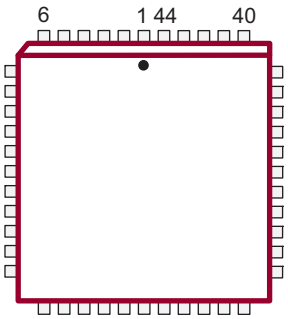
Serial data enters the Shift register on the low-to-high transition of the clock input. With latch enable ($\overline{LE}$) high, parallel data is transferred to the output buffers through a 32-bit latch. When $\overline{LE}$ is low, the data is stored in the latch. When strobe (STR) is low, all outputs are enabled. If the strobe is high, all outputs are low.

Package Types

40-lead PDIP
(Top view)

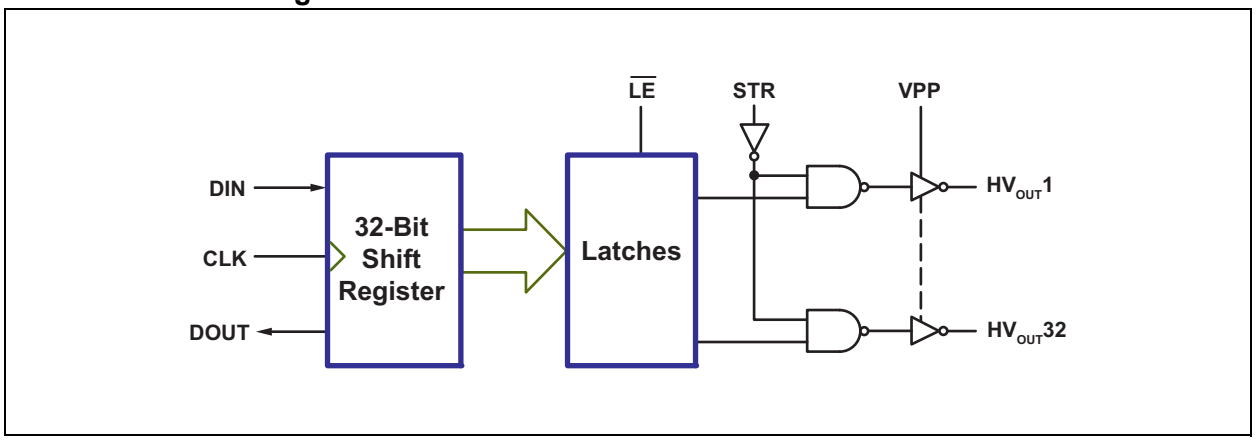


44-lead PLCC
(Top view)

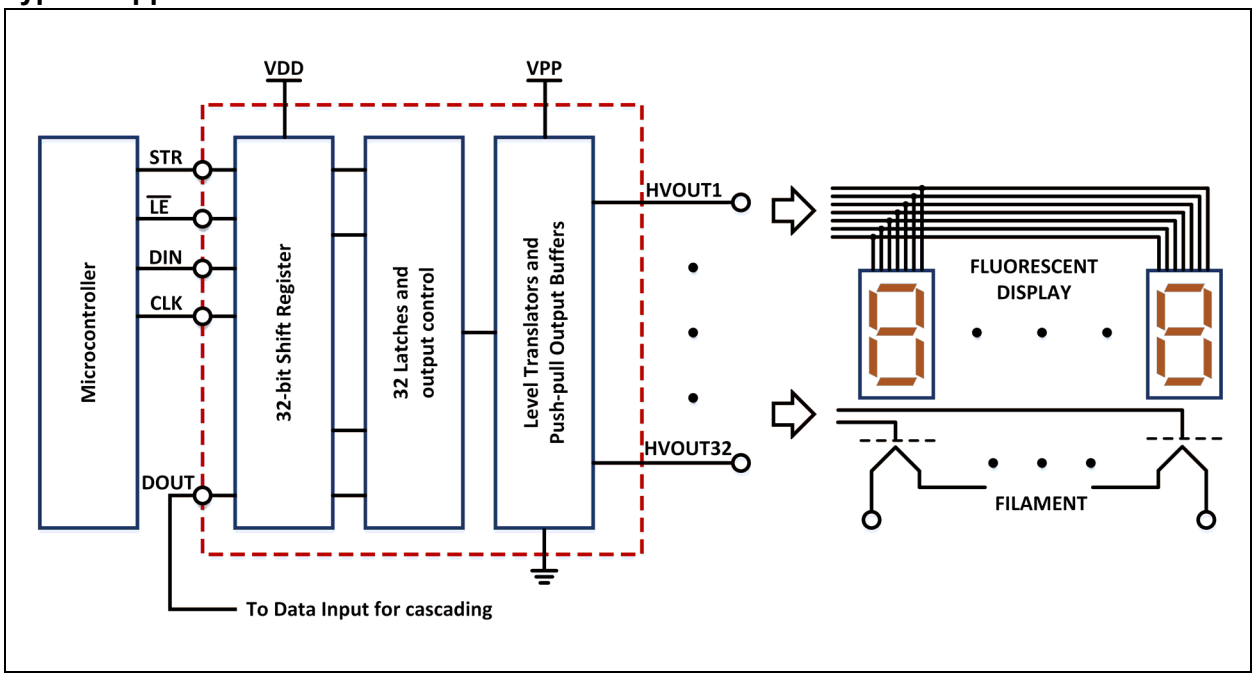


See Table 2-1 and Table 2-2 for pin information.

Functional Block Diagram



Typical Application Circuit



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

Low-voltage Supply Voltage, V_{DD} ..... –0.5V to +6V
High-voltage Supply Voltage, V_{PP} ..... –0.5V to +90V
Logic Input Levels ..... –0.5V to V_{DD}+0.5V
Operating Ambient Temperature, T_A ..... –40°C to +85°C
Storage Temperature, T_S ..... –65°C to +150°C
Continuous Total Power Dissipation:
40-lead PDIP (**Note 1**, **Note 2**) ..... 1200 mW
44-lead PLCC (**Note 1**, **Note 2**) ..... 1200 mW

† Notice: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

Note 1: Duty cycle is limited by the total power dissipated in the package.
2: For operations above 25°C ambient, derate linearly to 85°C at 20 mW/°C.

RECOMMENDED OPERATING CONDITIONS

Electrical Specifications: T_A = 25°C unless otherwise indicated.

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Logic Supply Voltage	V_{DD}	4.5	—	5.5	V	
High-voltage Supply Voltage	V_{PP}	8	—	80	V	
High-level Input Voltage	V_{IH}	3.5	—	—	V	V_{DD} = 4.5V (See Figure 3-1.)
Low-level Input Voltage	V_{IL}	—	—	1	V	V_{DD} = 4.5V (See Figure 3-1.)
High-level Output Current	I_{OH}	–25	—	—	mA	
Low-level Output Current	I_{OL}	—	—	2	mA	
Clock Frequency	f_{CLK}	—	—	6	MHz	V_{DD} = 4.5V (See Figure 3-1.)
Pulse Duration, Clock High	$t_{W(CKH)}$	83	—	—	ns	V_{DD} = 4.5V
Pulse Duration, Clock Low	$t_{W(CKL)}$	83	—	—	ns	V_{DD} = 4.5V
Setup Time, Data before Clock	t_{SU}	75	—	—	ns	V_{DD} = 4.5V
Hold Time, Data after Clock	t_H	75	—	—	ns	V_{DD} = 4.5V
Operating Ambient Temperature	T_A	–40	—	+85	°C	

ELECTRICAL CHARACTERISTICS

Electrical Specifications: Over recommended operating conditions unless otherwise indicated							
Parameter		**Sym.**	**Min.**	**Typ.**	**Max.**	**Unit**	**Conditions**
Supply Current		I_{DD}	—	—	10	mA	V_{DD} = 5V, f_{CH} = 6 MHz
Quiescent Supply Current		I_{DDQ}	—	—	0.5	mA	V_{DD} = 5.5V, V_{IN} = 0V
Supply Current		I_{PP}	—	—	12	mA	Outputs high, T_A = –40°C
			—	7	10	mA	Outputs high, T_A = 0°C to +85°C
			—	—	500	µA	Outputs low
HV_{IN} Operating Current	HV Output	V_{OH}	70	—	—	V	I_{OH} = –25mA
	Serial Output		4.5	4.9	5	V	V_{DD} = 5V, I_{OH} = –20 µA
LV_{IN} Operating Current	HV Output	V_{OL}	—	—	5	V	I_{OL} = 1 mA
	Serial Output		—	0.06	0.8	V	I_{OL} = 20 µA
Logic Input Current High		I_{IH}	—	0.1	1	µA	V_{IH} = V_{DD}
Logic Input Current Low		I_{IL}	—	–0.1	–1	µA	V_{IL} = 0V

Note 1: The power dissipation is determined by the number of output at ON state and their duty cycles. The total power must not exceed the allowable package power dissipation.

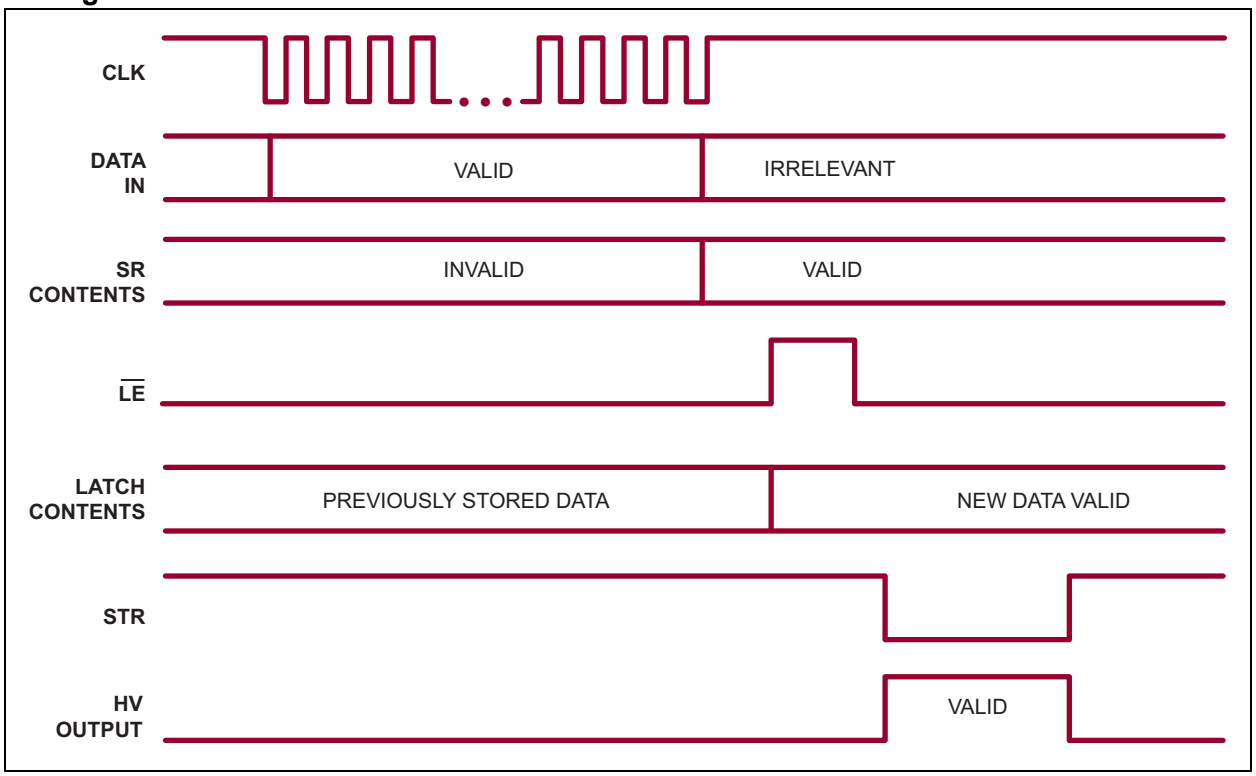
SWITCHING CHARACTERISTICS

Electrical Specifications: V_{PP} = 80V, C_L = 50 pF and T_A = 25°C unless otherwise noted.							
Parameter		**Sym.**	**Min.**	**Typ.**	**Max.**	**Unit**	**Conditions**
Delay Time, Clock-to-data Output		t_d	—	—	600	ns	C_L = 15 pF (See Figure 3-2.)
Delay Time, High-to-low Level, HV Output	From Latch Enable	t_{DHL}	—	—	1.5	µs	V_{DD} = 4.5V (See Figure 3-3.)
	From Strobe		—	—	1	µs	V_{DD} = 4.5V (See Figure 3-4.)
Delay Time, Low-to-high Level, HV Output	From Latch Enable	t_{DLH}	—	—	1.5	µs	V_{DD} = 4.5V (See Figure 3-3.)
	From Strobe		—	—	1	µs	V_{DD} = 4.5V (See Figure 3-4.)
Transition Time, High-to-low Level, HV Output		t_{THL}	—	—	3	µs	V_{DD} = 4.5V (See Figure 3-4.)
Transition Time, Low-to-high Level, HV Output		t_{TLH}	—	—	2.5	µs	V_{DD} = 4.5V (See Figure 3-4.)

TEMPERATURE SPECIFICATIONS

Parameter	**Sym.**	**Min.**	**Typ.**	**Max.**	**Unit**	**Conditions**
TEMPERATURE RANGE						
Operating Ambient Temperature	T_A	–40	—	+85	°C	
Storage Temperature	T_S	–65	—	+150	°C	
PACKAGE THERMAL RESISTANCE						
40-lead PDIP	θ_{JA}	—	39	—	°C/W	
44-lead PLCC	θ_{JA}	—	37	—	°C/W	

Timing Waveforms



2.0 PIN DESCRIPTION

The details on the pins of HV518 40-lead PDIP and 44-lead PLCC are listed on Table 2-1 and Table 2-2, respectively. Refer to **Package Types** for the location of pins.

TABLE 2-1: 40-LEAD PDIP PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	VPP	High-voltage power supply
2	SERIAL OUT	Serial data output
3	HVOUT32	High-voltage output
4	HVOUT31	High-voltage output
5	HVOUT30	High-voltage output
6	HVOUT29	High-voltage output
7	HVOUT28	High-voltage output
8	HVOUT27	High-voltage output
9	HVOUT26	High-voltage output
10	HVOUT25	High-voltage output
11	HVOUT24	High-voltage output
12	HVOUT23	High-voltage output
13	HVOUT22	High-voltage output
14	HVOUT21	High-voltage output
15	HVOUT20	High-voltage output
16	HVOUT19	High-voltage output
17	HVOUT18	High-voltage output
18	HVOUT17	High-voltage output
19	STR	Strobe
20	GND	Ground
21	CLK	Data Shift register clock. Inputs are shifted into the Shift register on the positive edge of the clock.
22	$\overline{LE}$	Latch enable
23	HVOUT16	High-voltage output
24	HVOUT15	High-voltage output
25	HVOUT14	High-voltage output
26	HVOUT13	High-voltage output
27	HVOUT12	High-voltage output
28	HVOUT11	High-voltage output
29	HVOUT10	High-voltage output
30	HVOUT9	High-voltage output
31	HVOUT8	High-voltage output
32	HVOUT7	High-voltage output
33	HVOUT6	High-voltage output

TABLE 2-1: 40-LEAD PDIP PIN FUNCTION TABLE (CONTINUED)

Pin Number	Pin Name	Description
34	HVOUT5	High-voltage output
35	HVOUT4	High-voltage output
36	HVOUT3	High-voltage output
37	HVOUT2	High-voltage output
38	HVOUT1	High-voltage output
39	DATA IN	Serial data input
40	VDD	Low-voltage power supply

TABLE 2-2: 44-LEAD PLCC PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	VPP	High-voltage power supply
2	SERIAL OUT	Serial data output
3	HVOUT32	High-voltage output
4	HVOUT31	High-voltage output
5	HVOUT30	High-voltage output
6	NC	No connection
7	HVOUT29	High-voltage output
8	HVOUT28	High-voltage output
9	HVOUT27	High-voltage output
10	HVOUT26	High-voltage output
11	HVOUT25	High-voltage output
12	HVOUT24	High-voltage output
13	HVOUT23	High-voltage output
14	HVOUT22	High-voltage output
15	HVOUT21	High-voltage output
16	HVOUT20	High-voltage output
17	HVOUT19	High-voltage output
18	NC	No connection
19	HVOUT18	High-voltage output
20	HVOUT17	High-voltage output
21	STR	Strobe
22	GND	Ground
23	CLK	Data Shift register clock. Inputs are shifted into the Shift register on the positive edge of the clock.
24	$\overline{LE}$	Latch enable
25	HVOUT16	High-voltage output
26	HVOUT15	High-voltage output
27	HVOUT14	High-voltage output
28	NC	No connection

TABLE 2-2: 44-LEAD PLCC PIN FUNCTION TABLE (CONTINUED)

Pin Number	Pin Name	Description
29	NC	No connection
30	HVOUT13	High-voltage output
31	HVOUT12	High-voltage output
32	HVOUT11	High-voltage output
33	HVOUT10	High-voltage output
34	HVOUT9	High-voltage output
35	HVOUT8	High-voltage output
36	HVOUT7	High-voltage output
37	HVOUT6	High-voltage output
38	HVOUT5	High-voltage output
39	HVOUT4	High-voltage output
40	HVOUT3	High-voltage output
41	HVOUT2	High-voltage output
42	HVOUT1	High-voltage output
43	DATA IN	Serial data input
44	VDD	Low-voltage power supply

3.0 FUNCTIONAL DESCRIPTION

3.1 Parameter Measurement Information

Figure 3-1 to Figure 3-4 show parametric measurement information. For testing purposes, all input pulses have maximum rise and fall times of 30 nanoseconds.

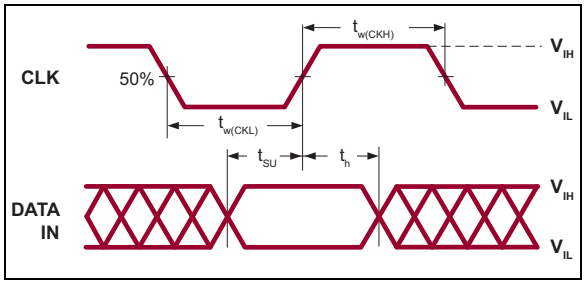


FIGURE 3-1: *Input Timing Voltage Waveforms.*

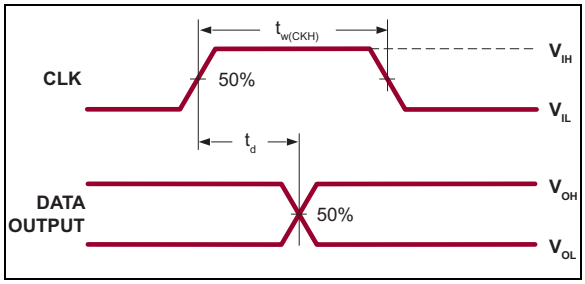


FIGURE 3-2: *Output Timing Voltage Waveforms.*

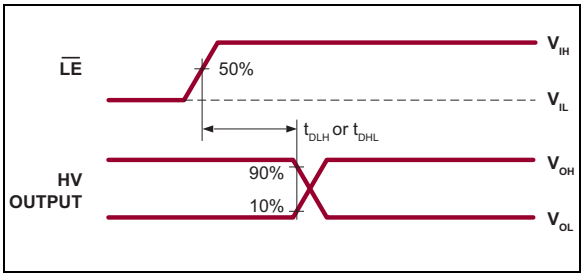


FIGURE 3-3: *Latch Enable Timing Voltage Waveforms.*

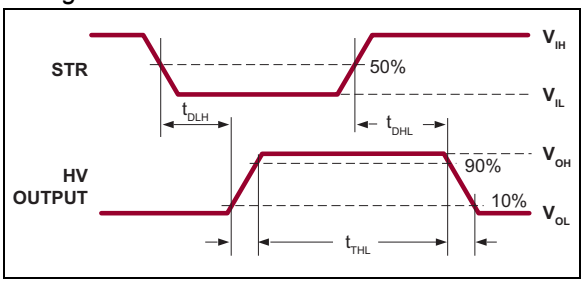


FIGURE 3-4: *Switching-Time Voltage Waveforms.*

3.2 Power-up and Power-down Sequence

Follow the steps below to power up and power down the HV518:

TABLE 3-1: POWER-UP AND POWER-DOWN SEQUENCE

Power-up		Power-down	
Step	**Description**	**Step**	**Description**
1	Connect ground.	1	Remove V_{PP}. (**Note 1**)
2	Apply V_{DD}.	2	Remove all inputs.
3	Set all inputs (Data, CLK, EN, etc.) to a known state.	3	Remove V_{DD}.
4	Apply V_{PP}. (**Note 1**)	4	Disconnect ground.

Note 1: The V_{PP} should not drop below V_{DD} during operation.

TABLE 3-2: TRUTH FUNCTION TABLE

Inputs			Outputs			
Data In	**CLK**	**Data Out**	**Data In**	**$\overline{LE}$**	**STR**	**High-voltage Output**
H	↓	H	X	X	H	All low
L	↓	L	H	H	L	High
X	No change	Previous state	L	H	L	Low
			X	L	L	Previous state

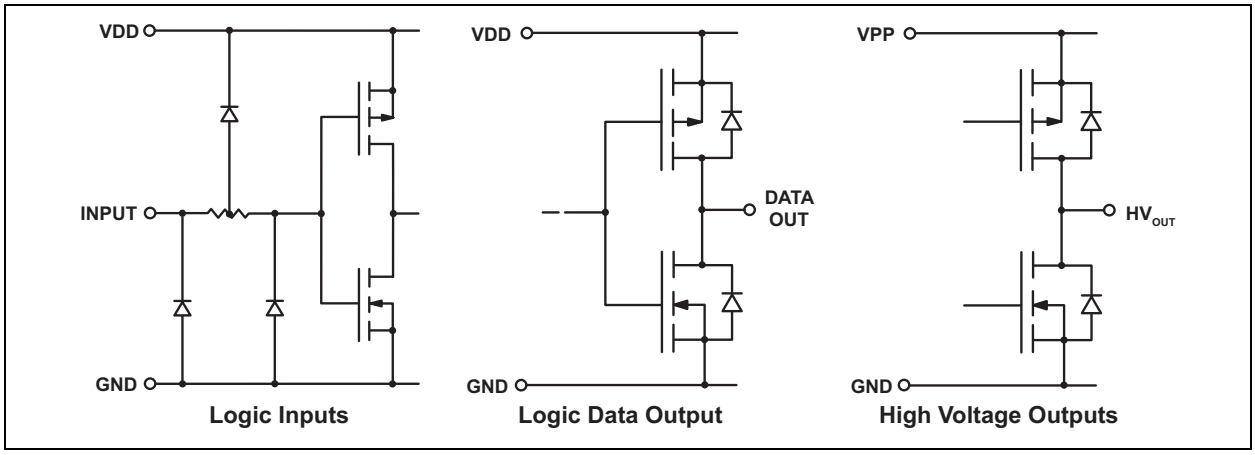
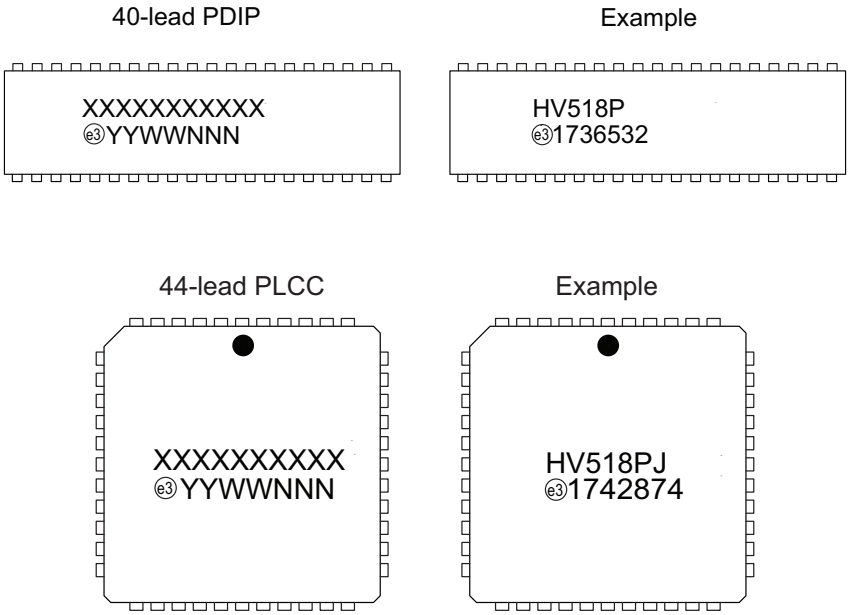


FIGURE 3-5: *Input and Output Equivalent Circuits.*

4.0 PACKAGE MARKING INFORMATION

4.1 Packaging Information

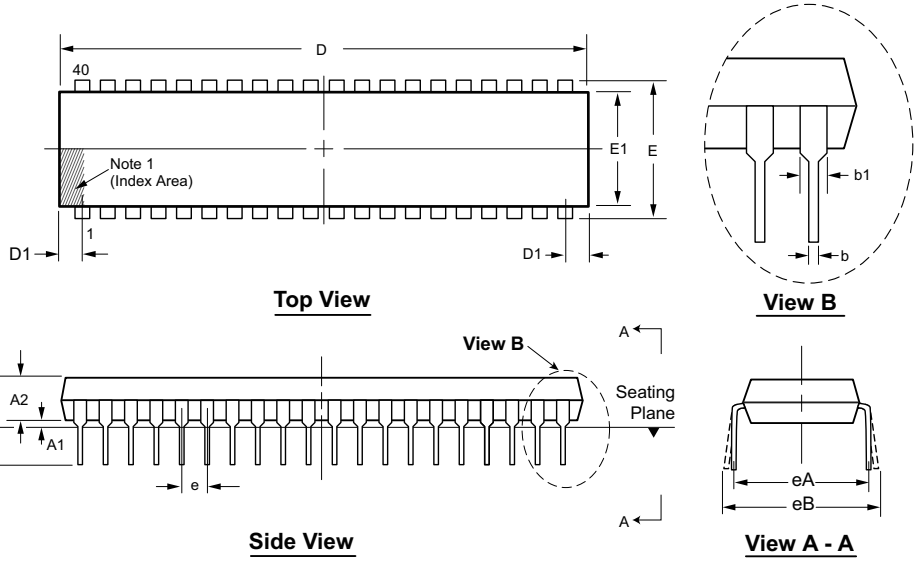


Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.

Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for product code or customer-specific information. Package may or not include the corporate logo.

40-Lead PDIP (.600in Row Spacing) Package Outline (P)

2.095x.580in body (max), .250in height (max), .100in pitch



Note: For the most current package drawings, see the Microchip Packaging Specification at www.microchip.com/packaging.

Note:

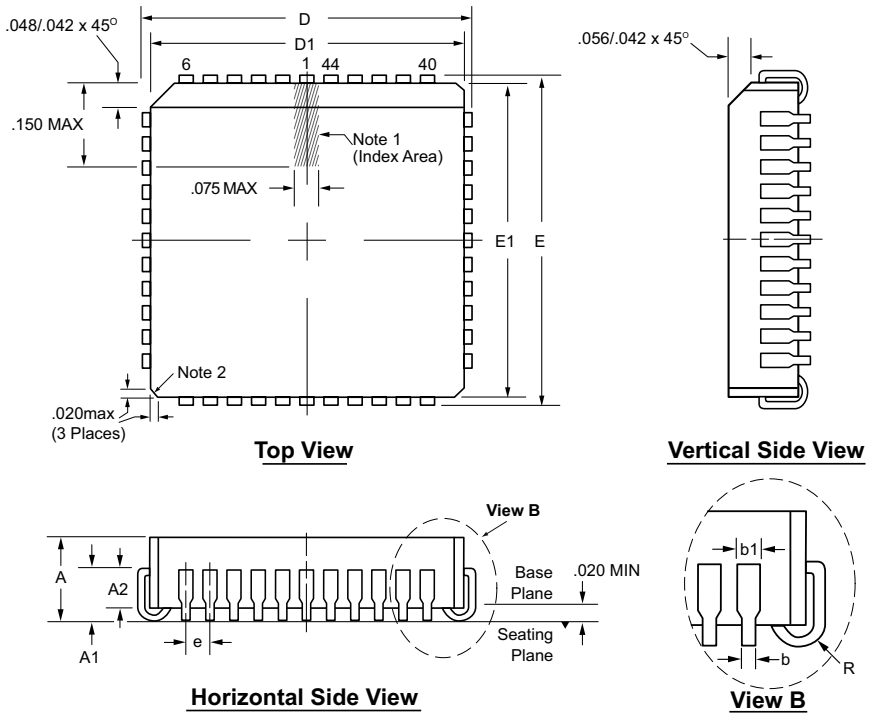
1. *A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.*

Symbol		A	A1	A2	b	b1	D	D1	E	E1	e	eA	eB	L
Dimension (inches)	MIN	.140*	.015	.125	.014	.030	1.980	.065†	.590†	.485	.100 BSC	.600 BSC	.600*	.115
	NOM	-	-	-	-	-	-	-	-	-			-	-
	MAX	.250	.055*	.195	.023†	.070	2.095	.085*	.625	.580			.700	.200

JEDEC Registration MS-011, Variation AC, Issue B, June, 1988.
** This dimension is not specified in the JEDEC drawing.*
† This dimension differs from the JEDEC drawing.
Drawings not to scale.

44-Lead PLCC Package Outline (PJ)

.653x.653in body, .180in height (max), .050in pitch



Note: For the most current package drawings, see the Microchip Packaging Specification at www.microchip.com/packaging.

Notes:

1. *A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.*
2. *Actual shape of this feature may vary.*

Symbol		A	A1	A2	b	b1	D	D1	E	E1	e	R
Dimension (inches)	MIN	.165	.090	.062	.013	.026	.685	.650	.685	.650	.050 BSC	.025
	NOM	.172	.105	-	-	-	.690	.653	.690	.653		.035
	MAX	.180	.120	.083	.021	.036†	.695	.656	.695	.656		.045

JEDEC Registration MS-018, Variation AC, Issue A, June, 1993.
† This dimension differs from the JEDEC drawing.
Drawings not to scale.

APPENDIX A: REVISION HISTORY

Revision A (October 2017)

- Converted Supertex Doc# DSFP-HV518 to Microchip DS20005847A
- Changed the package marking format
- Made minor text changes throughout the document

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

PART NO.	XX	-	X	-	X
Device	Package Options		Environmental		Media Type

Device:	HV518	=	32-Channel Vacuum Fluorescent Display Driver
Packages:	P	=	40-lead PDIP
	PJ	=	44-lead PLCC
Environmental:	G	=	Lead (Pb)-free/RoHS-compliant Package
Media Types:	(blank)	=	9/Tube for a P Package
	(blank)	=	27/Tube for a PJ Package
	M903	=	500/Reel for a PJ Package

Examples:

a) HV518P-G: 32-Channel Vacuum Fluorescent Display Driver, 40-lead PDIP, 9/Tube

b) HV518PJ-G: 32-Channel Vacuum Fluorescent Display Driver, 44-lead PLCC, 27/Tube

c) HV518PJ-G-M903: 32-Channel Vacuum Fluorescent Display Driver, 44-lead PLCC, 500/Reel

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