

## 34-Channel Symmetric Row Driver

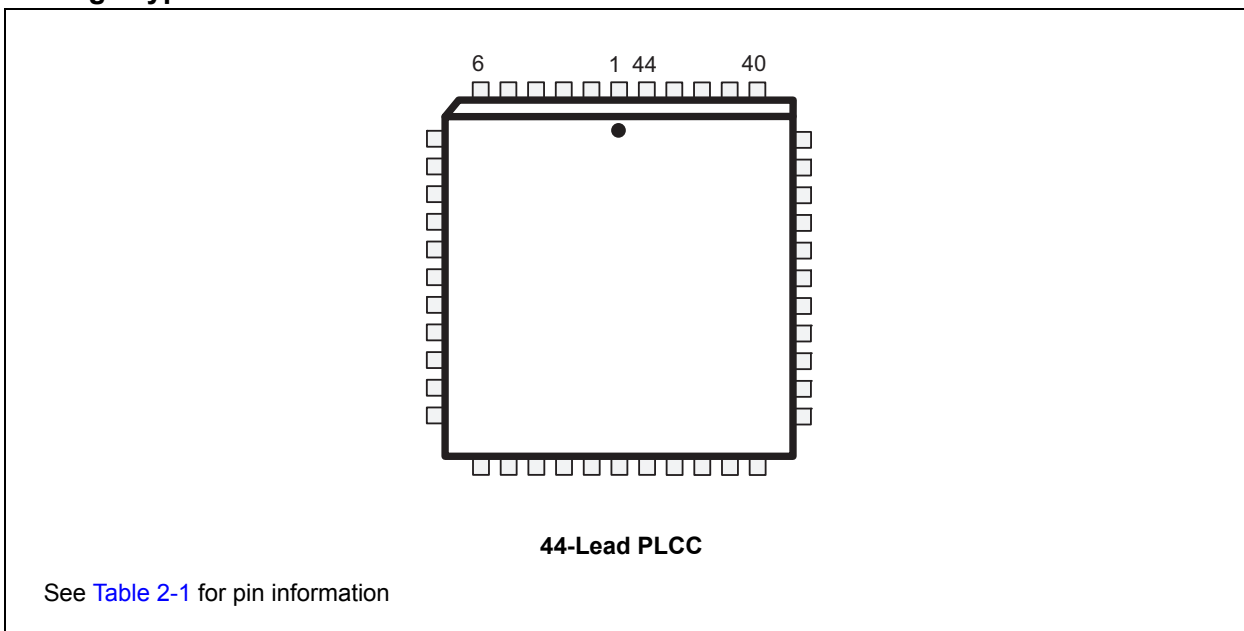
### Features

- High-Voltage CMOS technology
- Symmetric row drive (reduces latent imaging in ACTFEL displays)
- Output voltage up to +230V
- Low power level shifting
- Source/sink current minimum 70 mA
- Shift register speed 4.0 MHz
- Pin-programmable shift direction

### Description

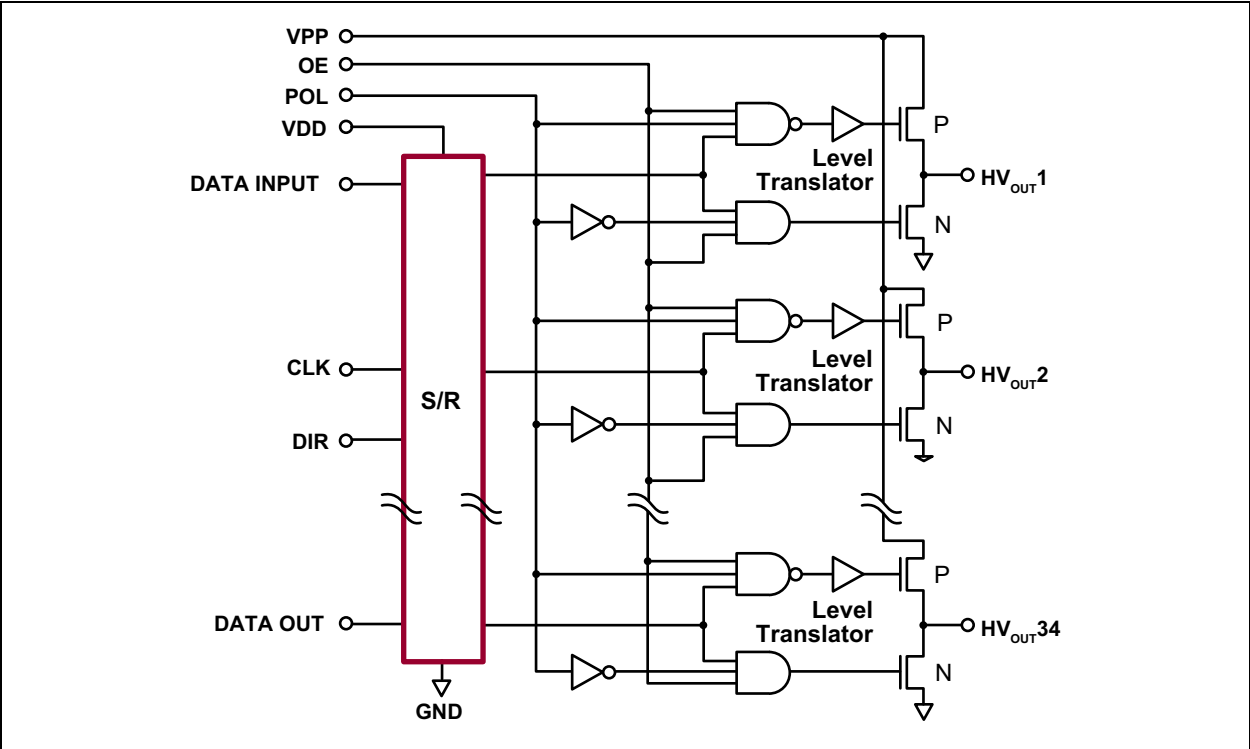
HV7022 is a low-voltage serial to high-voltage parallel converter with push-pull outputs. It is especially suited for use as a symmetric row driver in AC thin-film electroluminescent (ACTFEL) displays. HV7022 offers 34 output lines, a direction (DIR) pin to give CW or CCW shift register loading, output enable (OE), and polarity (POL) control. After data is entered on the falling edge of CLK, a logic high will cause the output to swing to  $V_{PP}$  if POL is high, or to GND if POL is low.

### Package Type



# HV7022

## Functional Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### ABSOLUTE MAXIMUM RATINGS†

Supply voltage, $V_{DD}$	-0.3V to +15V
Supply voltage, $V_{PP}$	-0.3V to +250V
Logic input levels	-0.3V to $V_{DD}+0.3V$
Ground current <sup>1</sup>	1.5A
Continuous total power dissipation <sup>2</sup>	1200mW
Operating temperature range	-40°C to +85°C
Storage temperature range	-65°C to +150°C

† **Notice:** Stresses above those listed under “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 listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

- 1: Duty cycle is limited by the total power dissipated in the package.  
 2: For operation above 25°C ambient derate linearly to maximum operating temperature at 25 mW/°C.

### ELECTRICAL CHARACTERISTICS

Recommended Operating Conditions: $V_{PP} = 230V$ , $V_{DD} = 12V$ , $T_A = 25^\circ C$ , unless otherwise noted						
Symbol	Parameter	Min	Max	Units	Conditions	
<b>DC Characteristics</b>						
$I_{DD}$	$V_{DD}$ supply current	-	10	mA	$f_{CLK} = 4.0MHz$ , $V_{DD} = 13.2V$	
$I_{PP}$	$V_{PP}$ supply current	-	4.0	mA	One output high ( <b>Note 1</b> )	
		-	100	$\mu A$	All outputs low or High-Z	
		-	750			All outputs low or High-Z (125°C)
$I_{DDQ}$	Quiescent $V_{DD}$ supply current	-	100	$\mu A$	All $V_{IN} = GND$ or $V_{DD}$	
$V_{OH}$	High-level output	$HV_{OUT}$	195	-	V	$I_O = -70mA$
		DATA OUT	11	-	V	$I_O = -500\mu A$
$V_{OL}$	Low-level output	$HV_{OUT}$	-	30	V	$I_O = +70mA$
		DATA OUT	-	1.0	V	$I_O = +500\mu A$
$I_{IH}$	High-level logic input current	-	1.0	$\mu A$	$V_{IH} = 12V$	
$I_{IL}$	Low-level logic input current	-	-1.0	$\mu A$	$V_{IL} = 0V$	
<b>AC Characteristics</b>						
$f_{CLK}$	Clock frequency	-	4.0	MHz	-	
$t_{WH}, t_{WL}$	Pulse duration clock width high or low	125	-	ns	-	
$t_{SUD}$	Data set-up time before falling clock	100	-	ns	-	
$t_{HD}$	Data hold time after falling clock	100	-	ns	-	
$t_{SUC}$	Setup time clock low before $V_{PP}\uparrow$ or $GND\downarrow$	300	-	ns	-	
$t_{SUE}$	Setup time enable high before $V_{PP}\uparrow$ or $GND\downarrow$	300	-	ns	-	
$t_{SUP}$	Setup time polarity high or low before $V_{PP}\uparrow$ or $GND\downarrow$	300	-	ns	-	
$t_{HC}$	Hold time clock high after $V_{PP}\uparrow$ or $GND\downarrow$	500	-	ns	-	
$t_{HE}$	Hold time enable high after $V_{PP}\uparrow$ or $GND\downarrow$	300	-	ns	-	
$t_{HP}$	Hold time polarity high or low after $V_{PP}\uparrow$ or $GND\downarrow$	300	-	ns	-	

# HV7022

## ELECTRICAL CHARACTERISTICS (CONTINUED)

Recommended Operating Conditions: $V_{PP} = 230V$ , $V_{DD} = 12V$ , $T_A = 25^\circ C$ , unless otherwise noted					
Symbol	Parameter	Min	Max	Units	Conditions
$t_{DHL}$	Delay time high to low-level output from clock	-	150	ns	$C_L = 10pF$
$t_{DLH}$	Delay time low to high-level output from clock	-	200	ns	$C_L = 10pF$
$t_{THL}$	Transition time high to low-level serial output	-	200	ns	$C_L = 15pF$
$t_{TLH}$	Transition time low to high-level serial output	-	100	ns	$C_L = 15pF$
$t_{ONH}$	High-level turn-on time $HV_{OUT}$ from enable	-	500	ns	$V_{OH} = 195V$ , $R_L = 2.0k\Omega$ to 95V
$t_{ONL}$	Low-level turn-on time $HV_{OUT}$ from enable	-	500	ns	$V_{OH} = 130V$ , $R_L = 2.0k\Omega$ to 30V
$t_{OFFH}$	High-level turn-off time $HV_{OUT}$ from enable	-	1000	ns	$V_{OH} = 195V$ , $R_L = 2.0k\Omega$ to 95V
$t_{OFFL}$	Low-level turn-off time $HV_{OUT}$ from enable	-	500	ns	$V_{OH} = 130V$ , $R_L = 2.0k\Omega$ to 30V
SR	Slew rate, $V_{PP}$ or GND	-	45	$V/\mu s$	One active output driving 4.7nF load to $V_{PP}$ or GND

**Note 1:** The total number of ON outputs times the duty cycle must not exceed the allowable package power dissipation.

## TEMPERATURE SPECIFICATIONS

Parameter	Symbol	Min	Typ	Max	Units	Conditions
<b>Temperature Ranges</b>						
Operating Temperature	-	-40	-	85	$^\circ C$	-
Storage Temperature	-	-65	-	150	$^\circ C$	-
<b>Package Thermal Resistances</b>						
Thermal Resistance, 44-Lead PLCC	$\theta_{ja}$	-	37	-	$^\circ C/W$	-

## 1.1 Power up and Recommended Operating Conditions

To power-up HV7022, perform the following power-up sequence:

1. Connect ground
2. Apply  $V_{DD}$
3. Set all inputs (Data, CLK, Enable, etc) to a known state.
4. Apply  $V_{PP}$  ( $V_{PP}$  should not drop below  $V_{DD}$  or float during operation).

To power-down the device, reverse the steps above.

### RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Units	
$V_{DD}$	Logic supply voltage	10.8	13.2	V	
$V_{PP}$	High voltage supply	-	230	V	
$V_{IH}$	High-level input voltage	$V_{DD} = 10.8$	8.1	-	V
		$V_{DD} = 13.2$	9.9	-	
$V_{IL}$	Low-level input voltage	$V_{DD} = 10.8$	-	2.7	V
		$V_{DD} = 13.2$	-	3.3	
$f_{CLK}$	Clock frequency	-	4.0	MHz	
$T_A$	Operating free-air temperature	-40	+85	°C	
$I_{OD}$	Allowable pulsed current through output diode.	-	±300	mA	

# HV7022

## 2.0 PIN DESCRIPTION

The locations of the pins are listed in [Package Type](#).

**TABLE 2-1: PIN DESCRIPTION**

Pin #	HV7022	Description
1	HV <sub>OUT</sub> 18/17	High voltage outputs.
2	HV <sub>OUT</sub> 17/18	
3	HV <sub>OUT</sub> 16/19	
4	HV <sub>OUT</sub> 15/20	
5	HV <sub>OUT</sub> 14/21	
6	HV <sub>OUT</sub> 13/22	
7	HV <sub>OUT</sub> 12/23	
8	HV <sub>OUT</sub> 11/24	
9	HV <sub>OUT</sub> 10/25	
10	HV <sub>OUT</sub> 9/26	
11	HV <sub>OUT</sub> 8/27	
12	HV <sub>OUT</sub> 7/28	
13	HV <sub>OUT</sub> 6/29	
14	HV <sub>OUT</sub> 5/30	
15	HV <sub>OUT</sub> 4/31	
16	HV <sub>OUT</sub> 3/32	
17	HV <sub>OUT</sub> 2/33	
18	HV <sub>OUT</sub> 1/34	
19	Data OUT	Serial data output. Data output for cascading to the data input of the next device.
20	OE	Output enable input. When OE is Low, all HV outputs are forced into a High-Z state, regardless of data in each channel. When OE is High, all HV outputs reflect data latched.
21	CLK	Data shift register clock Input are shifted into the shift register on the negative edge of the clock.
22	GND	Logic and high voltage ground.
23	DIR	Direction.
24	VDD	Low voltage logic power rail.
25	POL	Polarity.
26	DATA INPUT	Serial data input. Data needs to be present before each falling edge of the clock.
27	VPP	High voltage power rail.
28	NC	No Connect.
29	HV <sub>OUT</sub> 34/1	High voltage outputs
30	HV <sub>OUT</sub> 33/2	
31	HV <sub>OUT</sub> 32/3	
32	HV <sub>OUT</sub> 31/4	
33	HV <sub>OUT</sub> 30/5	
34	HV <sub>OUT</sub> 29/6	

**TABLE 2-1: PIN DESCRIPTION**

Pin #	HV7022	Description
35	HV <sub>OUT</sub> 28/7	High voltage outputs.
36	HV <sub>OUT</sub> 27/8	
37	HV <sub>OUT</sub> 26/9	
38	HV <sub>OUT</sub> 25/10	
39	HV <sub>OUT</sub> 24/11	
40	HV <sub>OUT</sub> 23/12	
41	HV <sub>OUT</sub> 22/13	
42	HV <sub>OUT</sub> 21/14	
43	HV <sub>OUT</sub> 20/15	
44	HV <sub>OUT</sub> 19/16	

**Note 1:** Pin designation for DIR H/L  
Example: for DIR = H, pin 1 is HV<sub>OUT</sub>18  
for DIR = L, pin 1 is HV<sub>OUT</sub>17

# HV7022

## 3.0 FUNCTIONAL DESCRIPTION

Table 3-1 provides functional information about HV7022.

TABLE 3-1: FUNCTIONAL TABLE CLK

I/O Relations	Inputs					Outputs		
	CLK	DIR	DATA	POL	OE	Shift Reg	HV <sub>OUT</sub>	DATA OUT
O/P HIGH	X	X	H	H	H	*	H	*
O/P OFF	X	X	L	H	H	*	HIGH-Z	*
O/P LOW	X	X	H	L	H	*	L	*
O/P OFF	X	X	L	L	H	*	HIGH-Z	*
O/P OFF	X	X	X	X	L	*	All O/P HIGH-Z	*
Load S/R, set DIR	↓	L	X	X	X	Q <sub>n</sub> →Q <sub>n+1</sub>	*	Q <sub>34</sub>
	↓	H	X	X	X	Q <sub>n</sub> →Q <sub>n-1</sub>	*	Q <sub>1</sub>
	No ↓	X	X	X	X	*	No Change	No Change

**Note 1:** H = logic high level, L = logic low level, X = irrelevant, ↓ = high-to-low transition

Q<sub>1</sub> = HV<sub>OUT1</sub>, Q<sub>n</sub> = HV<sub>OUTn</sub>, etc.

\* = dependent on previous state and whether an O/P or S/R command occurred.

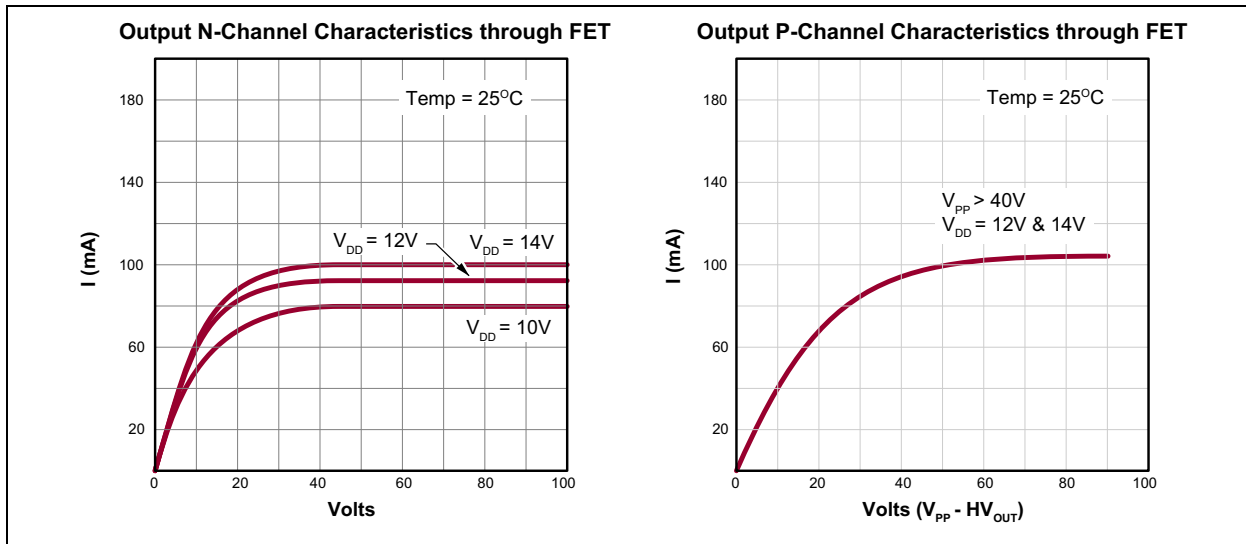


FIGURE 3-1: HV<sub>OUT</sub> Characteristics

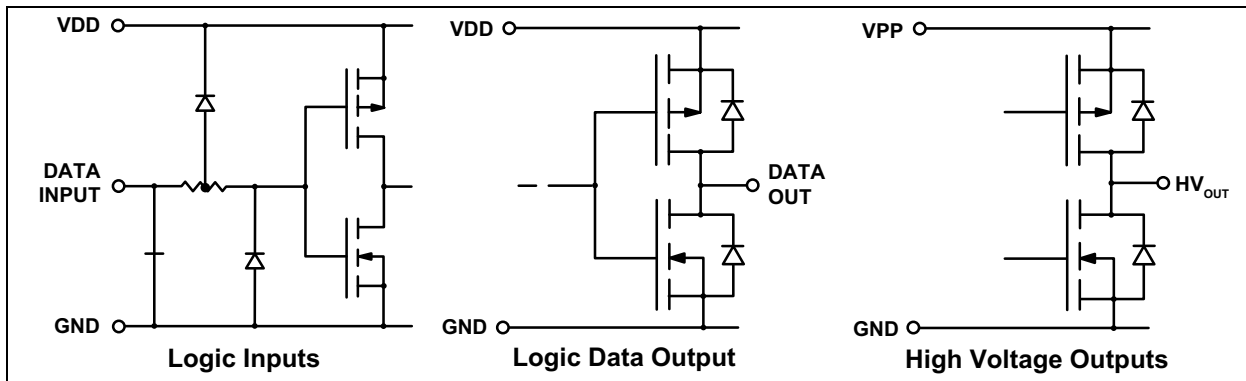
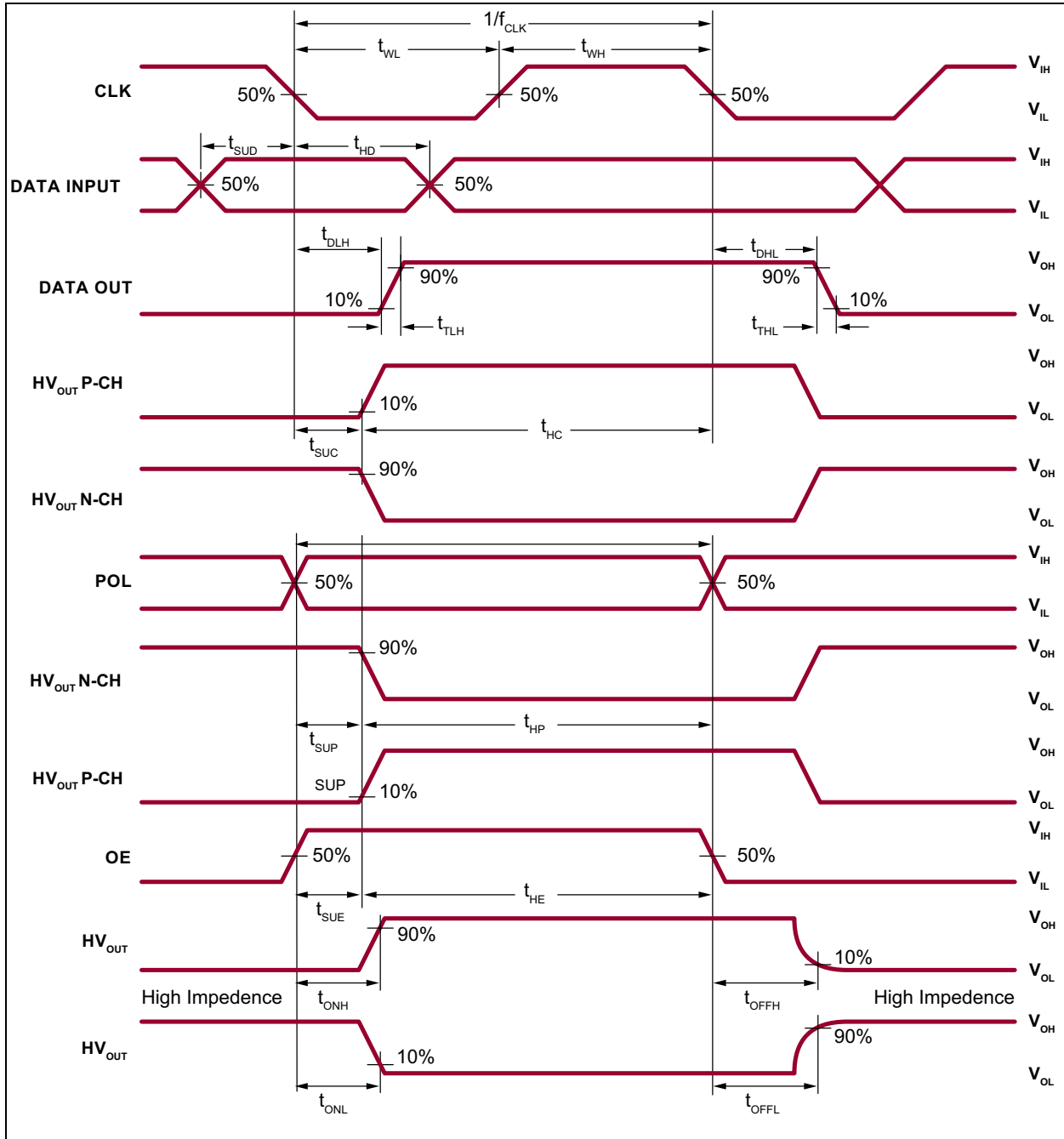


FIGURE 3-2: Input and Output Equivalent Circuits





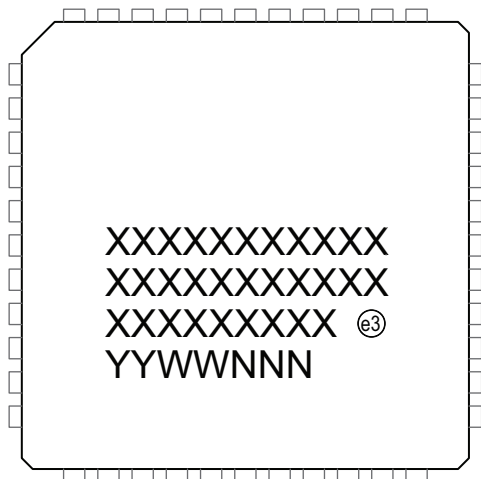
**FIGURE 3-3:** Switching Waveforms

# HV7022

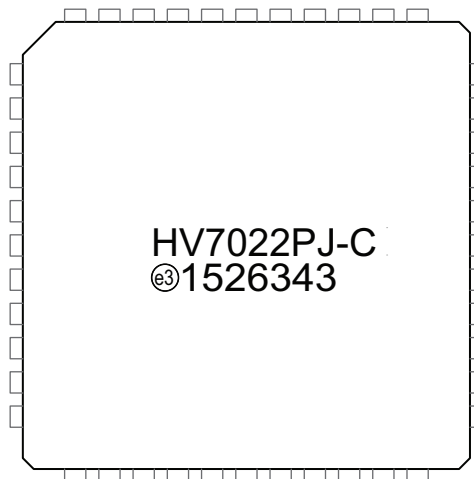
## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

44-lead PLCC

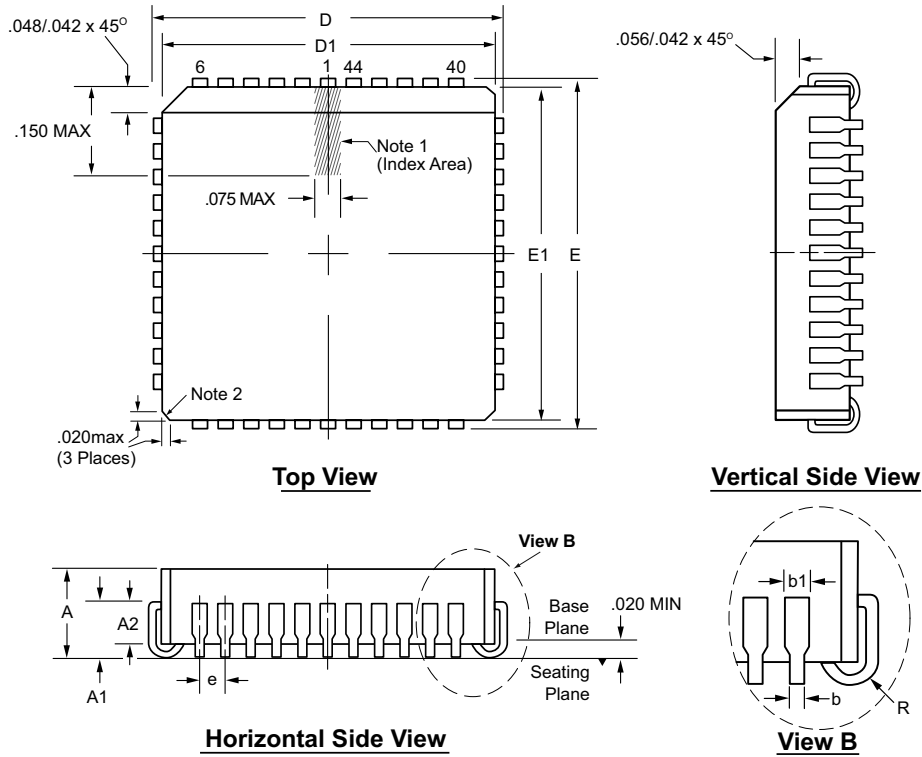


Example



<b>Legend:</b>	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.
<b>Note:</b>	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.	

## 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](http://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	.685	.650	.685	.650	.050 BSC	.025
	NOM	.172	.105	-	-	.690	.653	.690	.653		.035
	MAX	.180	.120	.083	.021	.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.

# HV7022

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## APPENDIX A: REVISION HISTORY

### Revision A (February 2016)

- Updated Supertex Doc.# DSFP-HV7022C to Microchip DS20005428A.
- Changed part number from HV7022C to HV7022.
- Removed 44-Lead Quad Cerpac package.
- Minor text changes throughout.

## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

<u>PART NO.</u>	<u>XX</u> -	<u>X</u>	-	<u>X</u>	-	<u>X</u>
Device	Package Options	Version		Environmental		Media Type
Device:	HV7022	=		34-Channel Symmetric Row Driver		
Package:	PJ	=		44-Lead PLCC		
Version	C	=		Revision C		
Environmental	G	=		Lead (Pb)-free/ROHS-compliant package		
Media Type:	(blank)	=		27/Tube for PJ package		

**Examples:**

a) HV7022PJ-C-G      44-Lead PLCC package, 27/Tube

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