

34-Channel Symmetric Row Driver

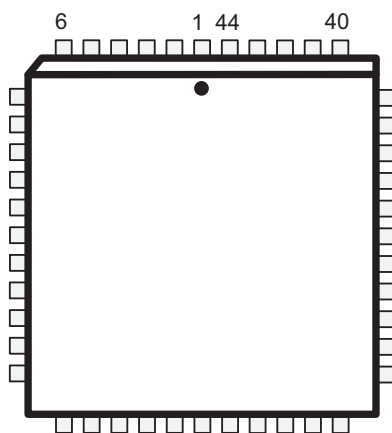
Features

- 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

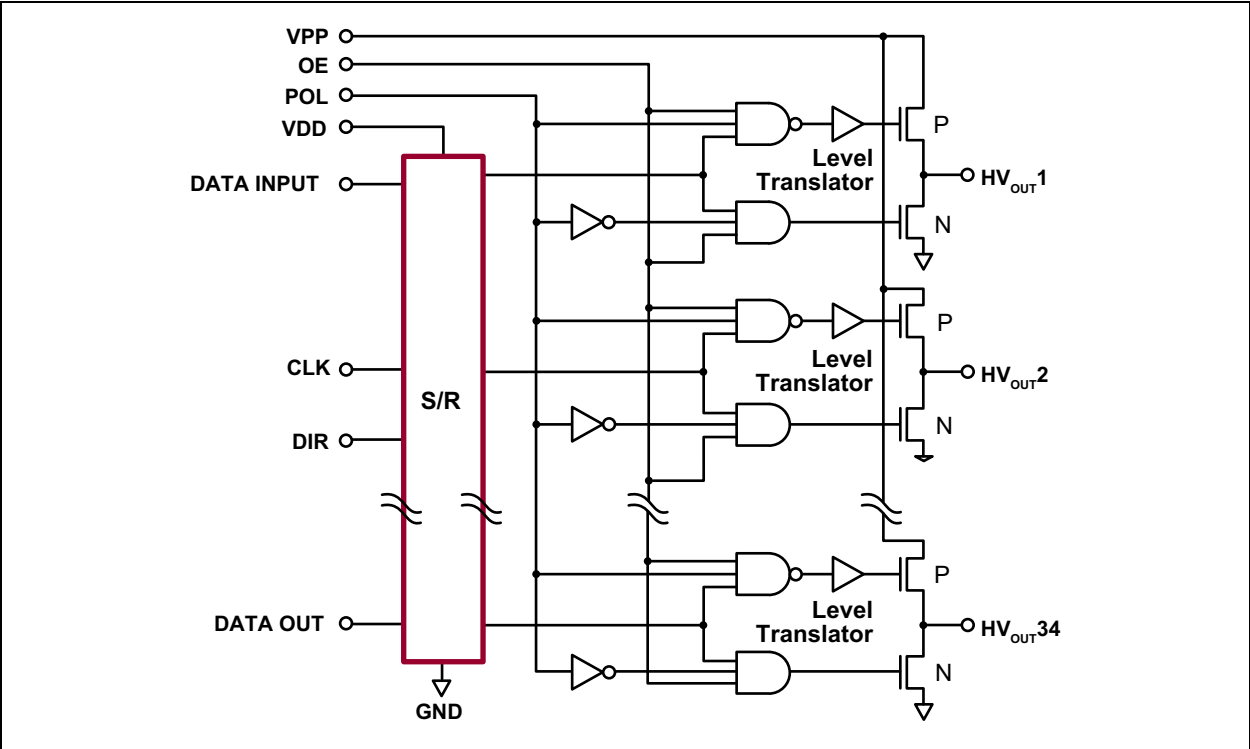


44-Lead PLCC

See [Table 2-1](#) for pin information

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 ¹	1.5A
Continuous total power dissipation ²	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	
DC Characteristics						
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 (Note 1)	
		-	100	μA	All outputs low or High-Z	
		-	750			All outputs low or High-Z (125°C)
I_{DDQ}	Quiescent V_{DD} supply current	-	100	μA	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	μA	$V_{IH} = 12V$	
I_{IL}	Low-level logic input current	-	-1.0	μA	$V_{IL} = 0V$	
AC Characteristics						
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/ μs	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
Temperature Ranges						
Operating Temperature	-	-40	-	85	$^\circ C$	-
Storage Temperature	-	-65	-	150	$^\circ C$	-
Package Thermal Resistances						
Thermal Resistance, 44-Lead PLCC	θ_{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 _{OUT} 18/17	High voltage outputs.
2	HV _{OUT} 17/18	
3	HV _{OUT} 16/19	
4	HV _{OUT} 15/20	
5	HV _{OUT} 14/21	
6	HV _{OUT} 13/22	
7	HV _{OUT} 12/23	
8	HV _{OUT} 11/24	
9	HV _{OUT} 10/25	
10	HV _{OUT} 9/26	
11	HV _{OUT} 8/27	
12	HV _{OUT} 7/28	
13	HV _{OUT} 6/29	
14	HV _{OUT} 5/30	
15	HV _{OUT} 4/31	
16	HV _{OUT} 3/32	
17	HV _{OUT} 2/33	
18	HV _{OUT} 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 _{OUT} 34/1	High voltage outputs
30	HV _{OUT} 33/2	
31	HV _{OUT} 32/3	
32	HV _{OUT} 31/4	
33	HV _{OUT} 30/5	
34	HV _{OUT} 29/6	

TABLE 2-1: PIN DESCRIPTION

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

Note 1: Pin designation for DIR H/L
Example: for DIR = H, pin 1 is HV_{OUT}18
for DIR = L, pin 1 is HV_{OUT}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 _{OUT}	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 _n →Q _{n+1}	*	Q ₃₄
	↓	H	X	X	X	Q _n →Q _{n-1}	*	Q ₁
	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

Q₁ = HV_{OUT1}, Q_n = HV_{OUTn}, etc.

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

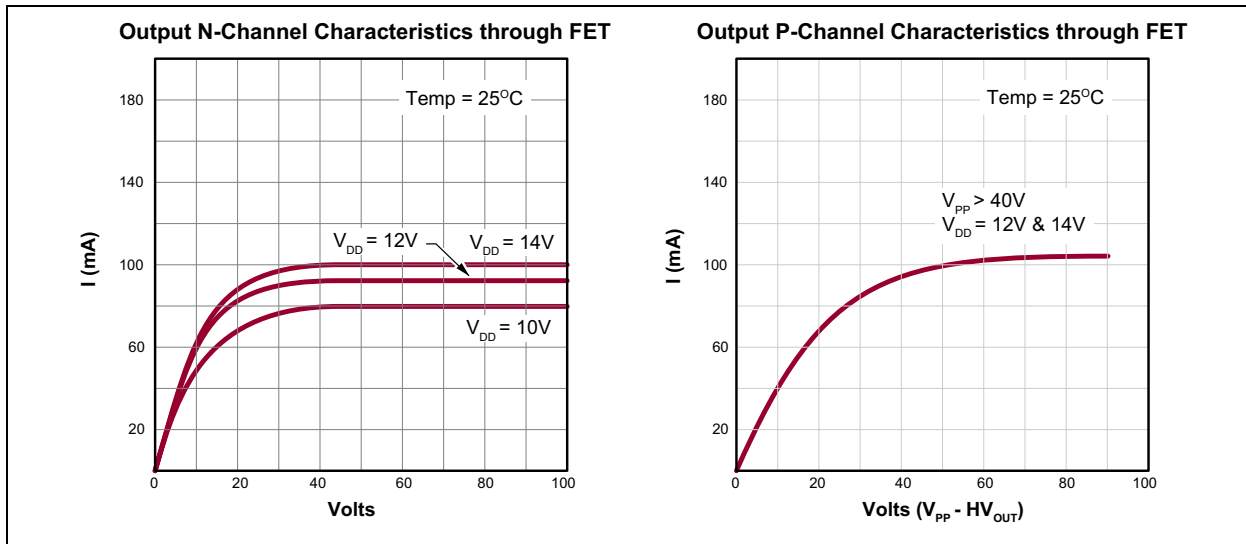


FIGURE 3-1: HV_{OUT} Characteristics

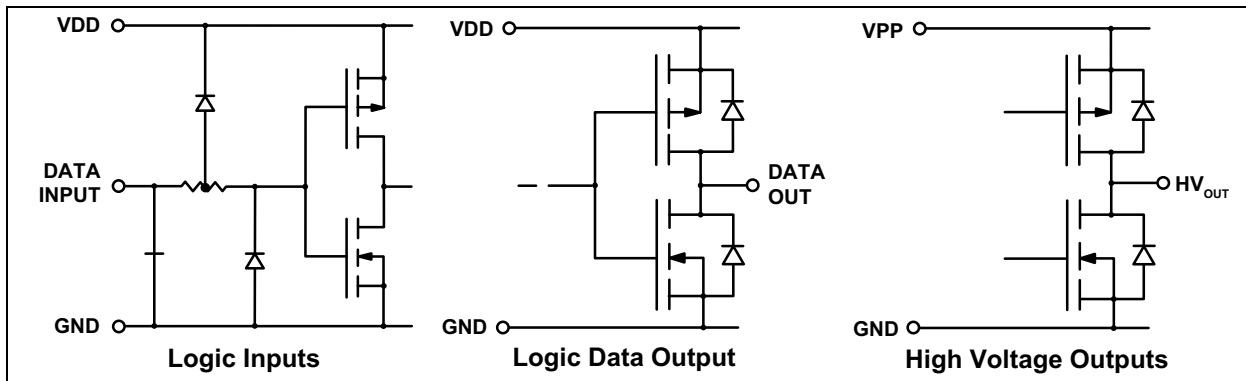


FIGURE 3-2: Input and Output Equivalent Circuits

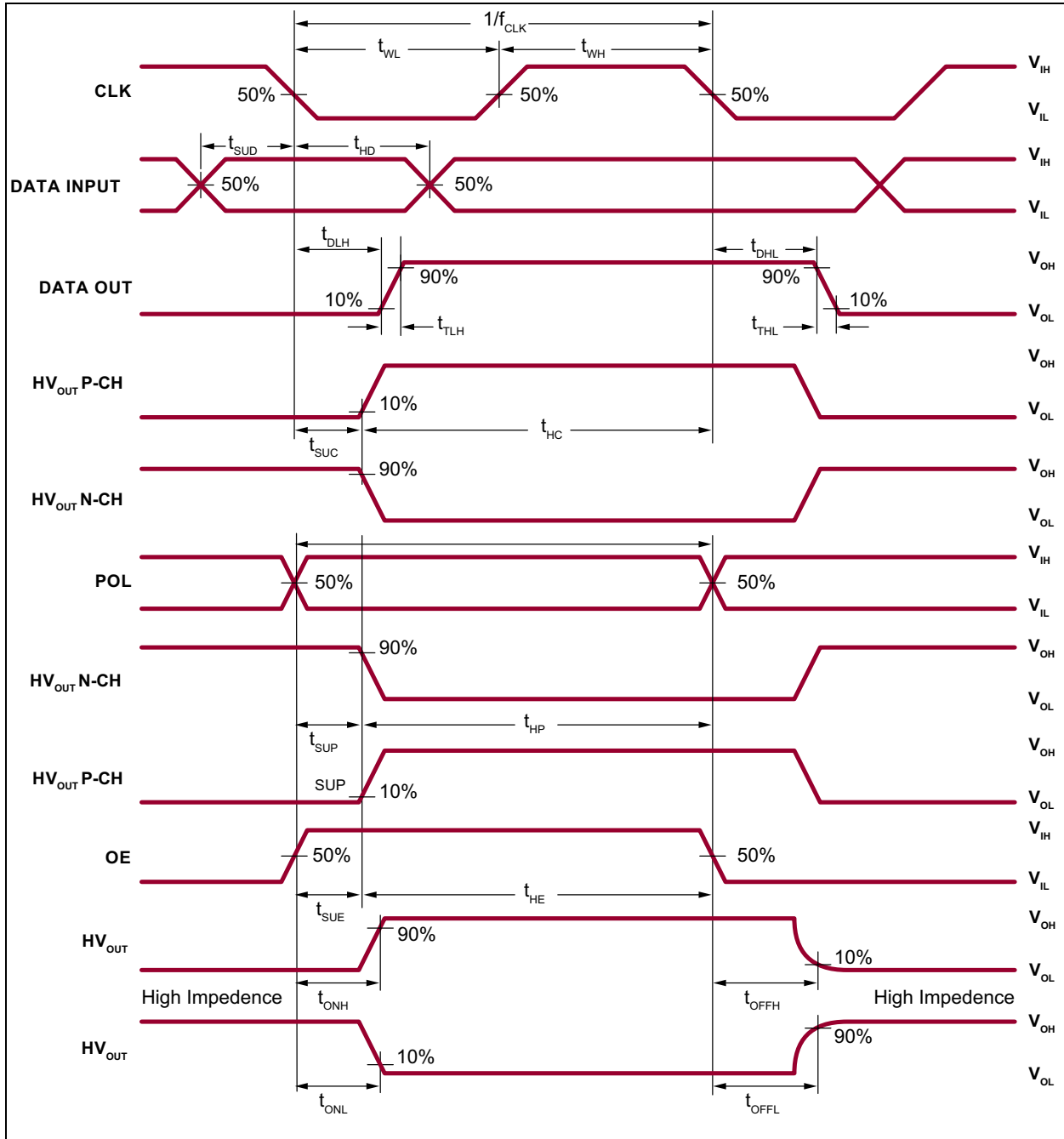


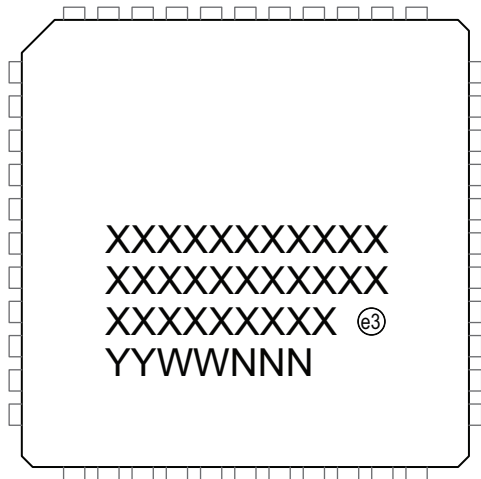
FIGURE 3-3: Switching Waveforms

HV7022

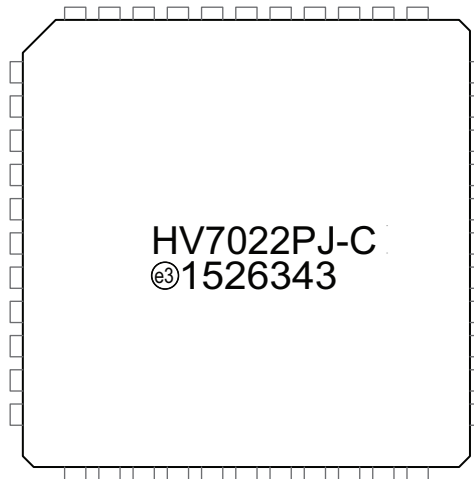
4.0 PACKAGING INFORMATION

4.1 Package Marking Information

44-lead PLCC

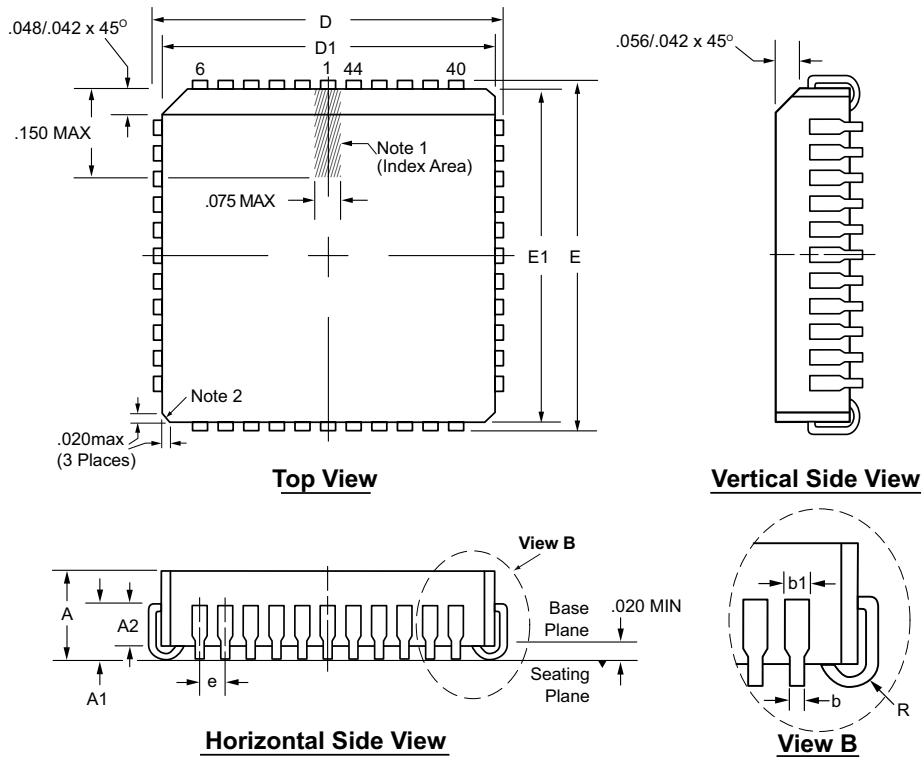


Example



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.	

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	.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

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

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as “unbreakable.”

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

**QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
= ISO/TS 16949 =**

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, dsPIC, FlashFlex, flexPWR, Heldo, JukeBlox, KEELOQ, KEELOQ logo, Klear, LANCheck, LINK MD, MediaLB, MOST, MOST logo, MPLAB, OptoLyzer, PIC, PICSTART, PIC32 logo, RightTouch, SpyNIC, SST, SST Logo, SuperFlash and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, ETHERSYNCH, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and QUIET-WIRE are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KlearNet, KlearNet logo, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PureSilicon, RightTouch logo, REAL ICE, Ripple Blocker, Serial Quad I/O, SQL, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademarks of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2016, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-0267-1



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office

2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://www.microchip.com/support>

Web Address:

www.microchip.com

Atlanta

Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX

Tel: 512-257-3370

Boston

Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago

Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Cleveland

Independence, OH
Tel: 216-447-0464
Fax: 216-447-0643

Dallas

Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit

Novi, MI
Tel: 248-848-4000

Houston, TX

Tel: 281-894-5983

Indianapolis

Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453

Los Angeles

Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608

New York, NY

Tel: 631-435-6000

San Jose, CA

Tel: 408-735-9110

Canada - Toronto

Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office

Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon

Hong Kong

Tel: 852-2943-5100
Fax: 852-2401-3431

Australia - Sydney

Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing

Tel: 86-10-8569-7000
Fax: 86-10-8528-2104

China - Chengdu

Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing

Tel: 86-23-8980-9588
Fax: 86-23-8980-9500

China - Dongguan

Tel: 86-769-8702-9880

China - Hangzhou

Tel: 86-571-8792-8115
Fax: 86-571-8792-8116

China - Hong Kong SAR

Tel: 852-2943-5100
Fax: 852-2401-3431

China - Nanjing

Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao

Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai

Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

China - Shenyang

Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen

Tel: 86-755-8864-2200
Fax: 86-755-8203-1760

China - Wuhan

Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian

Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

ASIA/PACIFIC

China - Xiamen

Tel: 86-592-2388138
Fax: 86-592-2388130

China - Zhuhai

Tel: 86-756-3210040
Fax: 86-756-3210049

India - Bangalore

Tel: 91-80-3090-4444
Fax: 91-80-3090-4123

India - New Delhi

Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune

Tel: 91-20-3019-1500

Japan - Osaka

Tel: 81-6-6152-7160
Fax: 81-6-6152-9310

Japan - Tokyo

Tel: 81-3-6880-3770
Fax: 81-3-6880-3771

Korea - Daegu

Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul

Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur

Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang

Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila

Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore

Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu

Tel: 886-3-5778-366
Fax: 886-3-5770-955

Taiwan - Kaohsiung

Tel: 886-7-213-7828

Taiwan - Taipei

Tel: 886-2-2508-8600
Fax: 886-2-2508-0102

Thailand - Bangkok

Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels

Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen

Tel: 45-4450-2828
Fax: 45-4485-2829

France - Paris

Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Dusseldorf

Tel: 49-2129-3766400

Germany - Karlsruhe

Tel: 49-721-625370

Germany - Munich

Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Italy - Milan

Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Venice

Tel: 39-049-7625286

Netherlands - Drunen

Tel: 31-416-690399
Fax: 31-416-690340

Poland - Warsaw

Tel: 48-22-3325737

Spain - Madrid

Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Stockholm

Tel: 46-8-5090-4654

UK - Wokingham

Tel: 44-118-921-5800
Fax: 44-118-921-5820

07/14/15