



# HV5122 / HV5222

---

## 32-Channel, Serial-to-Parallel Converter with Open-Drain Outputs

---

### Features

- Processed with High Voltage CMOS technology
- Output voltages to 225V using a ramped supply voltage
- SINK current minimum 100mA
- Shift register speed 8.0MHz
- Strobe and enable inputs
- CMOS compatible inputs
- Forward and reverse shifting options

### Description

HV5122 / HV5222 are low-voltage serial to high-voltage parallel converters with open-drain outputs. These devices are primarily designed for use as a driver for AC electroluminescent displays. HV5122 / HV5222 can also be used in any application requiring multiple high-voltage, current-sinking output capabilities such as driving inkjet and electrostatic print heads, plasma panels, vacuum fluorescent, or large matrix LCD displays.

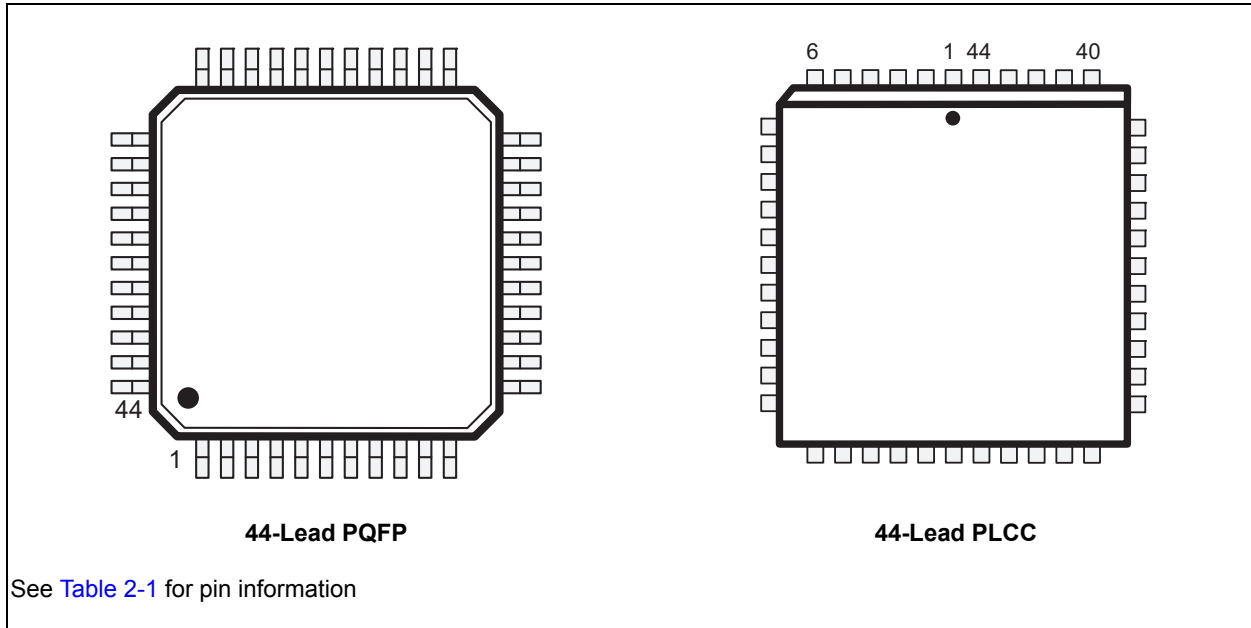
These devices consist of a 32-bit shift register and control logic to perform the Output Enable and all-on functions. Data is shifted through the shift register on the high-to-low transition of the clock. HV5122 shifts in the counter-clockwise direction when viewed from the top of the package and HV5222 shifts in the clockwise direction.

For cascading devices, HV5122 / HV5222 provides a data output buffer that reflects the current status of the last bit of the shift register. Operation of the shift register is not affected by the OE (Output Enable) or the STR (Strobe) inputs.

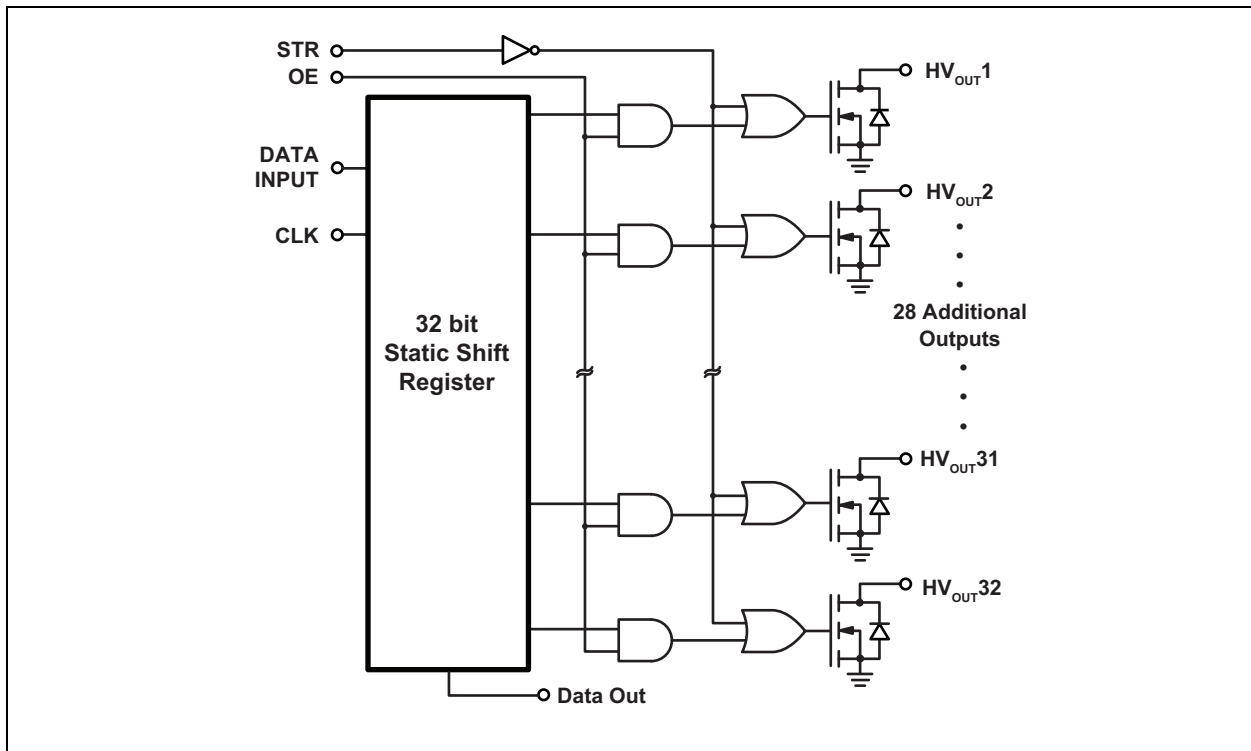
HV5122 / HV5222 are designed to be used in systems which either switch off the high voltage supply before changing the state of the high voltage outputs or which limit the current through each output.

# HV5122 / HV5222

## Package Type



## Functional Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### ABSOLUTE MAXIMUM RATINGS†

Supply voltage, $V_{DD}$ .....	-0.5V to +15V
Supply voltage, $V_{PP}$ .....	-0.5V to +250V
Logic input levels .....	-0.5V to $V_{DD}+0.5V$
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 20mW/°C.

**TABLE 1-1: ELECTRICAL CHARACTERISTICS**

Electrical Specifications: Over recommended conditions unless otherwise specified						
Symbol	Parameter	Min	Max	Units	Conditions	
<b>DC Characteristics</b>						
$I_{DD}$	$V_{DD}$ supply current	-	15	mA	$f_{CLK}= 8.0MHz, f_{DATA}= 4.0MHz$	
$I_{DDQ}$	Quiescent $V_{DD}$ supply current	-	100	$\mu A$	$D_{IN}= 0V$ , all input logic pins = 0V, all outputs off	
$I_{O(OFF)}$	Off-state output current	-	10	$\mu A$	All outputs high, all switches parallel	
$I_{IH}$	High level logic input current	-	1.0	$\mu A$	$V_{IN}= V_{DD}$	
$I_{IL}$	Low level logic input current	-	-1.0	$\mu A$	$V_{IL}= 0$	
$V_{OH}$	High level output data out	$V_{DD}-1.0V$	-	V	$I_{DOUT}= -100\mu A$	
$V_{OL}$	Low level output voltage	HV <sub>OUT</sub>	-	15	V	$I_{HVOUT}= +100mA$
		Data out	-	1.0		$I_{DOUT}= +100\mu A$
$V_{OC}$	HV <sub>OUT</sub> clamp voltage	-	-1.5	V	$I_{OL}= -100mA$	
<b>AC Characteristics</b> ( $V_{DD} = 12V, T_A=25^\circ C$ )						
$f_{CLK}$	Clock frequency	-	8.0	MHz		
$t_W$	Clock width, high or low	62	-	ns		
$t_{SU}$	Data setup time before CLK falls	25	-	ns		
$t_H$	Data hold time after CLK falls	10	-	ns		
$t_{ON}$	Turn-on time, HV <sub>OUT</sub> from strobe	-	500	ns	$R_L = 2.0k\Omega$ to 200V	
$t_{DHL}$	Data output delay after H to L CLK	-	100	ns	$C_L = 15pF$	
$t_{DLH}$	Data output delay after L to H CLK	-	100	ns	$C_L = 15pF$	

**TABLE 1-2: TYPICAL THERMAL RESISTANCE**

Package	$\theta_{ja}$
44-Lead PQFP	51°C/W
44-Lead PLCC	37°C/W

# HV5122 / HV5222

## 2.0 PIN DESCRIPTION

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

**TABLE 2-1: PIN DESCRIPTION PQFP**

Pin #	HV5122	HV5222	Description
1	HV <sub>OUT</sub> 11	HV <sub>OUT</sub> 22	High voltage outputs.
2	HV <sub>OUT</sub> 12	HV <sub>OUT</sub> 21	
3	HV <sub>OUT</sub> 13	HV <sub>OUT</sub> 20	
4	HV <sub>OUT</sub> 14	HV <sub>OUT</sub> 19	
5	HV <sub>OUT</sub> 15	HV <sub>OUT</sub> 18	
6	HV <sub>OUT</sub> 16	HV <sub>OUT</sub> 17	
7	HV <sub>OUT</sub> 17	HV <sub>OUT</sub> 16	
8	HV <sub>OUT</sub> 18	HV <sub>OUT</sub> 15	
9	HV <sub>OUT</sub> 19	HV <sub>OUT</sub> 14	
10	HV <sub>OUT</sub> 20	HV <sub>OUT</sub> 13	
11	HV <sub>OUT</sub> 21	HV <sub>OUT</sub> 12	
12	HV <sub>OUT</sub> 22	HV <sub>OUT</sub> 11	
13	HV <sub>OUT</sub> 23	HV <sub>OUT</sub> 10	
14	HV <sub>OUT</sub> 24	HV <sub>OUT</sub> 9	
15	HV <sub>OUT</sub> 25	HV <sub>OUT</sub> 8	
16	HV <sub>OUT</sub> 26	HV <sub>OUT</sub> 7	
17	HV <sub>OUT</sub> 27	HV <sub>OUT</sub> 6	
18	HV <sub>OUT</sub> 28	HV <sub>OUT</sub> 5	
19	HV <sub>OUT</sub> 29	HV <sub>OUT</sub> 4	
20	HV <sub>OUT</sub> 30	HV <sub>OUT</sub> 3	
21	HV <sub>OUT</sub> 31	HV <sub>OUT</sub> 2	
22	HV <sub>OUT</sub> 32	HV <sub>OUT</sub> 1	
23	DATA OUT	DATA OUT	Data output for cascading to the data input of the next device.
24	N/C	N/C	No connect.
25			
26			
27			
28	OE	OE	Output enable input. When OE is LOW, all HV outputs are forced into a LOW state, regardless of data in each channel. When OE is HIGH, all HV outputs reflect data latched.
29	CLK	CLK	Data shift register clock. Input are shifted into the shift register on the positive edge of the clock.
30	GND	GND	Logic and high voltage ground.
31	VDD	VDD	Low voltage logic power rail.
32	STR	STR	Strobe.
33	DATA IN	DATA IN	Serial data input. Data needs to be present before each rising edge of the clock.
34	N/C	N/C	No connect.

**TABLE 2-1: PIN DESCRIPTION PQFP (CONTINUED)**

Pin #	HV5122	HV5222	Description
35	HV <sub>OUT1</sub>	HV <sub>OUT32</sub>	High voltage outputs.
36	HV <sub>OUT2</sub>	HV <sub>OUT31</sub>	
37	HV <sub>OUT3</sub>	HV <sub>OUT30</sub>	
38	HV <sub>OUT4</sub>	HV <sub>OUT29</sub>	
39	HV <sub>OUT5</sub>	HV <sub>OUT28</sub>	
40	HV <sub>OUT6</sub>	HV <sub>OUT27</sub>	
41	HV <sub>OUT7</sub>	HV <sub>OUT26</sub>	
42	HV <sub>OUT8</sub>	HV <sub>OUT25</sub>	
43	HV <sub>OUT9</sub>	HV <sub>OUT24</sub>	
44	HV <sub>OUT10</sub>	HV <sub>OUT23</sub>	

**TABLE 2-2: PIN DESCRIPTION PLCC**

Pin #	HV5122	HV5222	Description
1	HV <sub>OUT16</sub>	HV <sub>OUT17</sub>	High voltage outputs
2	HV <sub>OUT17</sub>	HV <sub>OUT16</sub>	
3	HV <sub>OUT18</sub>	HV <sub>OUT15</sub>	
4	HV <sub>OUT19</sub>	HV <sub>OUT14</sub>	
5	HV <sub>OUT20</sub>	HV <sub>OUT13</sub>	
6	HV <sub>OUT21</sub>	HV <sub>OUT12</sub>	
7	HV <sub>OUT22</sub>	HV <sub>OUT11</sub>	
8	HV <sub>OUT23</sub>	HV <sub>OUT10</sub>	
9	HV <sub>OUT24</sub>	HV <sub>OUT9</sub>	
10	HV <sub>OUT25</sub>	HV <sub>OUT8</sub>	
11	HV <sub>OUT26</sub>	HV <sub>OUT7</sub>	
12	HV <sub>OUT27</sub>	HV <sub>OUT6</sub>	
13	HV <sub>OUT28</sub>	HV <sub>OUT5</sub>	
14	HV <sub>OUT29</sub>	HV <sub>OUT4</sub>	
15	HV <sub>OUT30</sub>	HV <sub>OUT3</sub>	
16	HV <sub>OUT31</sub>	HV <sub>OUT2</sub>	
17	HV <sub>OUT32</sub>	HV <sub>OUT1</sub>	
18	DATA OUT	DATA OUT	Data output for cascading to the data input of the next device.
19	N/C	N/C	No connect.
20			
21			
22			
23	OE	OE	Output enable input. When OE is LOW, all HV outputs are forced into a LOW state, regardless of data in each channel. When OE is HIGH, all HV outputs reflect data latched.
24	CLK	CLK	Data shift register clock. Input are shifted into the shift register on the positive edge of the clock.
25	GND	GND	Logic and high voltage ground.
26	VDD	VDD	Low voltage logic power rail.
27	STR	STR	Strobe.

# HV5122 / HV5222

**TABLE 2-2: PIN DESCRIPTION PLCC (CONTINUED)**

Pin #	HV5122	HV5222	Description
28	DATA IN	DATA IN	Serial data input. Data needs to be present before each rising edge of the clock.
29	N/C	N/C	No connect.
30	HV <sub>OUT</sub> 1	HV <sub>OUT</sub> 32	High voltage outputs.
31	HV <sub>OUT</sub> 2	HV <sub>OUT</sub> 31	
32	HV <sub>OUT</sub> 3	HV <sub>OUT</sub> 30	
33	HV <sub>OUT</sub> 4	HV <sub>OUT</sub> 29	
34	HV <sub>OUT</sub> 5	HV <sub>OUT</sub> 28	
35	HV <sub>OUT</sub> 6	HV <sub>OUT</sub> 27	
36	HV <sub>OUT</sub> 7	HV <sub>OUT</sub> 26	
37	HV <sub>OUT</sub> 8	HV <sub>OUT</sub> 25	
38	HV <sub>OUT</sub> 9	HV <sub>OUT</sub> 24	
39	HV <sub>OUT</sub> 10	HV <sub>OUT</sub> 23	
40	HV <sub>OUT</sub> 11	HV <sub>OUT</sub> 22	
41	HV <sub>OUT</sub> 12	HV <sub>OUT</sub> 21	
42	HV <sub>OUT</sub> 13	HV <sub>OUT</sub> 20	
43	HV <sub>OUT</sub> 14	HV <sub>OUT</sub> 19	
44	HV <sub>OUT</sub> 15	HV <sub>OUT</sub> 18	

## 3.0 FUNCTIONAL DESCRIPTION

Table 3-1 provides functional information about HV5122 / HV5222.

**TABLE 3-1: FUNCTIONAL TABLE**

Function	Inputs				Outputs				
	Data In	CLK	OE	STR	Shift Reg		HV Outputs		Data Out
					1	2...32	1	2...32	
All on	X	X	X	L	•	•...•	ON	ON...ON	•
All off	X	X	L	H	•	•...•	OFF	OFF...OFF	•
Load S/R	H/L	↓	L	H	H/L	Q1...Q31	OFF	OFF...OFF	Q32
Output Enable	X	H/L	H	H	H/L	•...•	ON/OFF	•...•	•

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

**2:** • = dependent on previous stage's state before the last CLK high-to-low transition

### 3.1 Power-Up and Recommended Operating Conditions

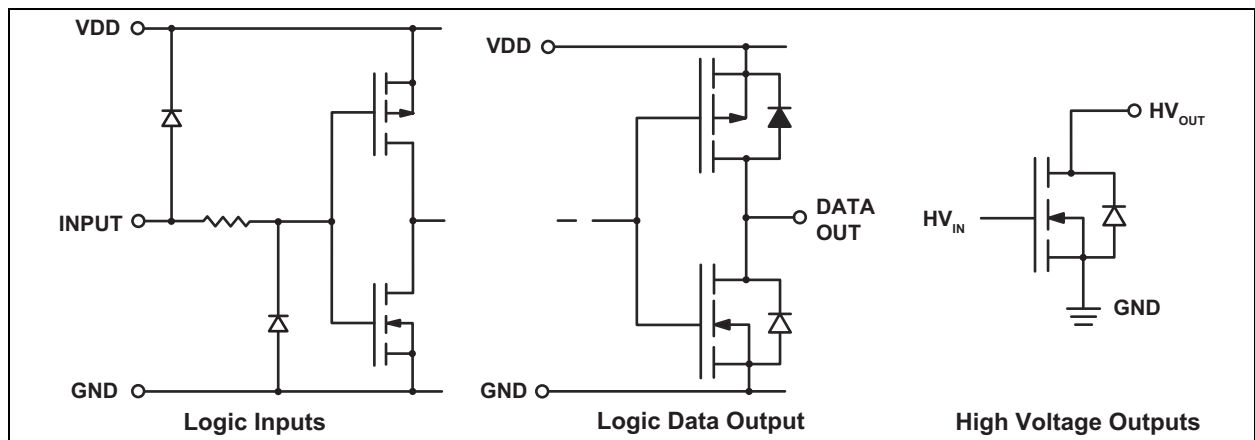
To power-up HV5122 / HV5222, perform the following power-up sequence:

1. Connect ground
2. Apply  $V_{DD}$
3. Set all inputs to a known state

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

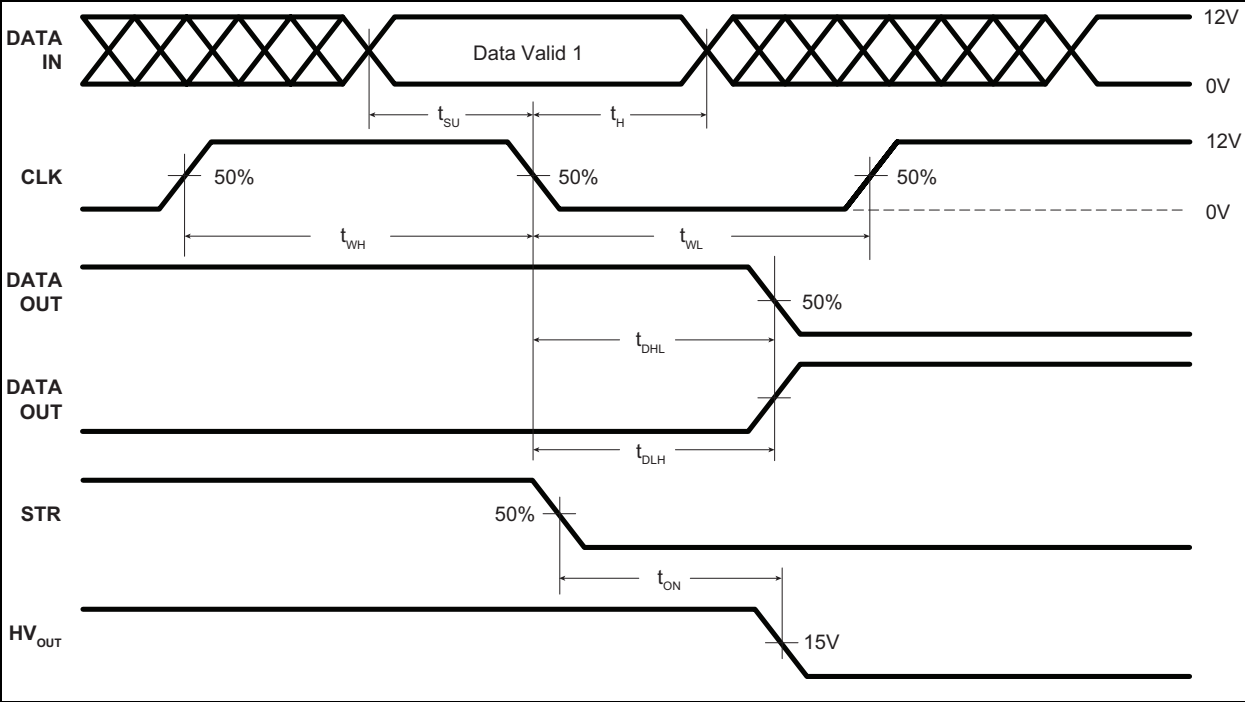
**TABLE 3-2: RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Min	Typ	Max	Units
$V_{DD}$	Logic voltage supply	10.8	12	13.2	V
$HV_{OUT}$	High voltage output	-0.3	-	225	V
$V_{IH}$	High-level input voltage	$V_{DD}-2.0$	-	$V_{DD}$	V
$V_{IL}$	Low-level input voltage	0	-	2.0	V
$f_{CLK}$	Clock frequency	-	-	8.0	MHz
$T_A$	Operating free-air temperature	-40	-	+85	°C



**FIGURE 3-1:** Input and Output Equivalent Circuits

# HV5122 / HV5222



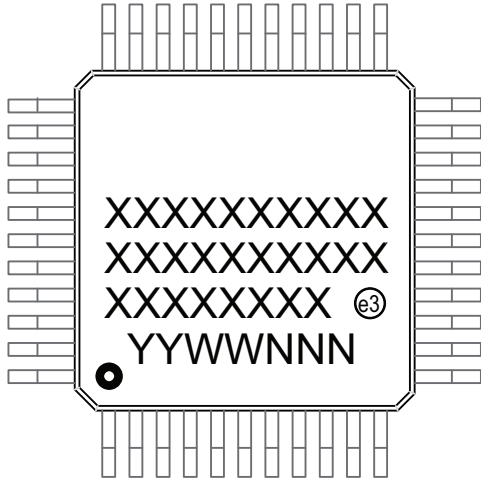
**FIGURE 3-2:** Switching Waveforms



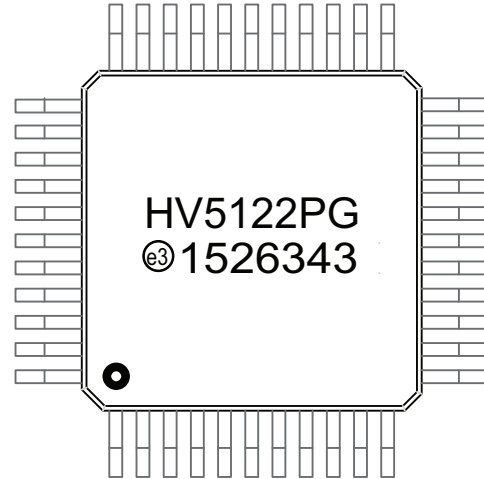
## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

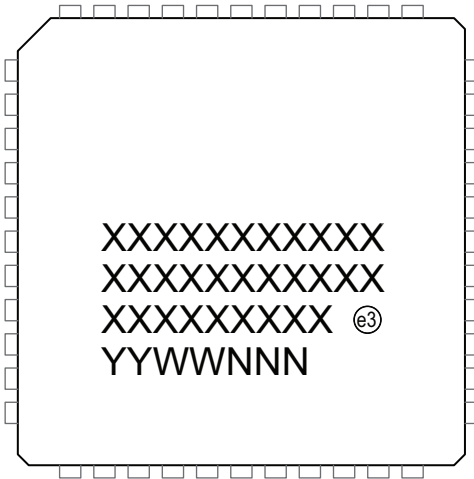
44-lead PQFP



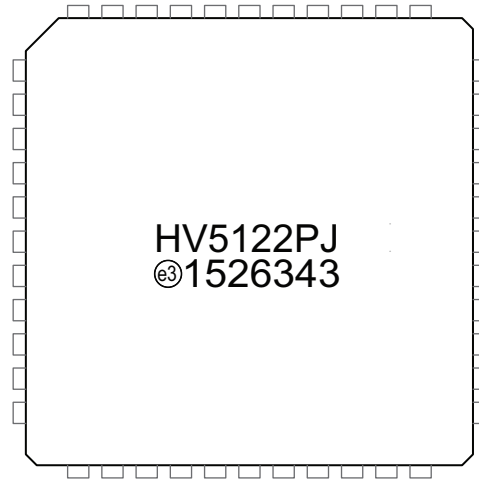
Example



44-lead PLCC



Example



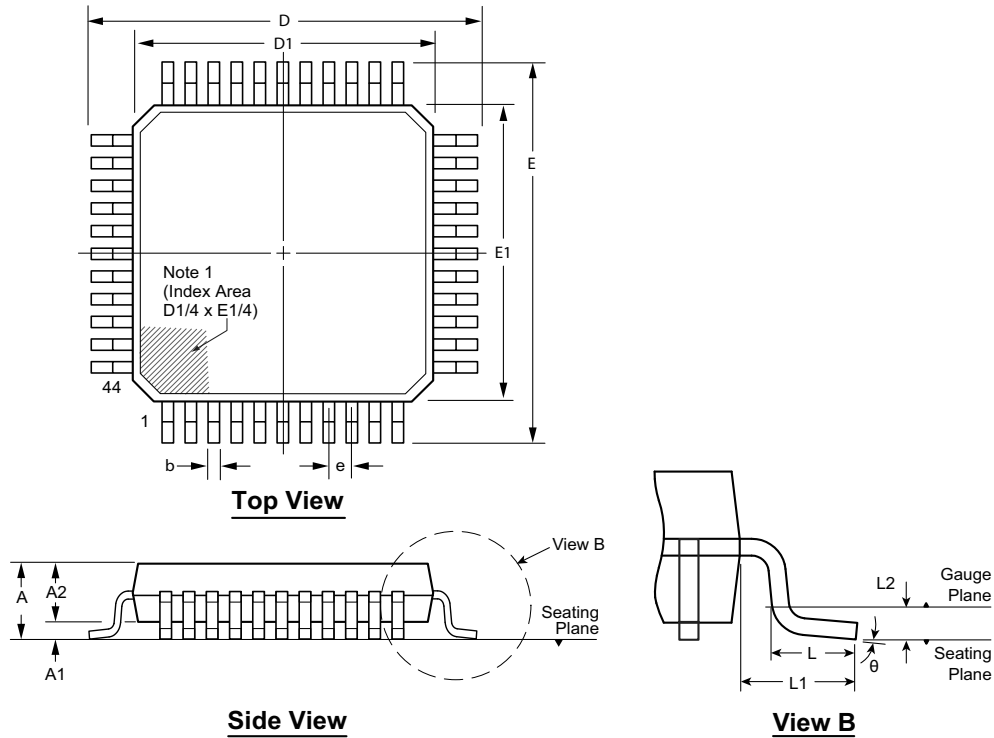
<b>Legend:</b>	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package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

**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.

# HV5122 / HV5222

## 44-Lead PQFP Package Outline (PG)

10.00x10.00mm body, 2.35mm height (max), 0.80mm pitch



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

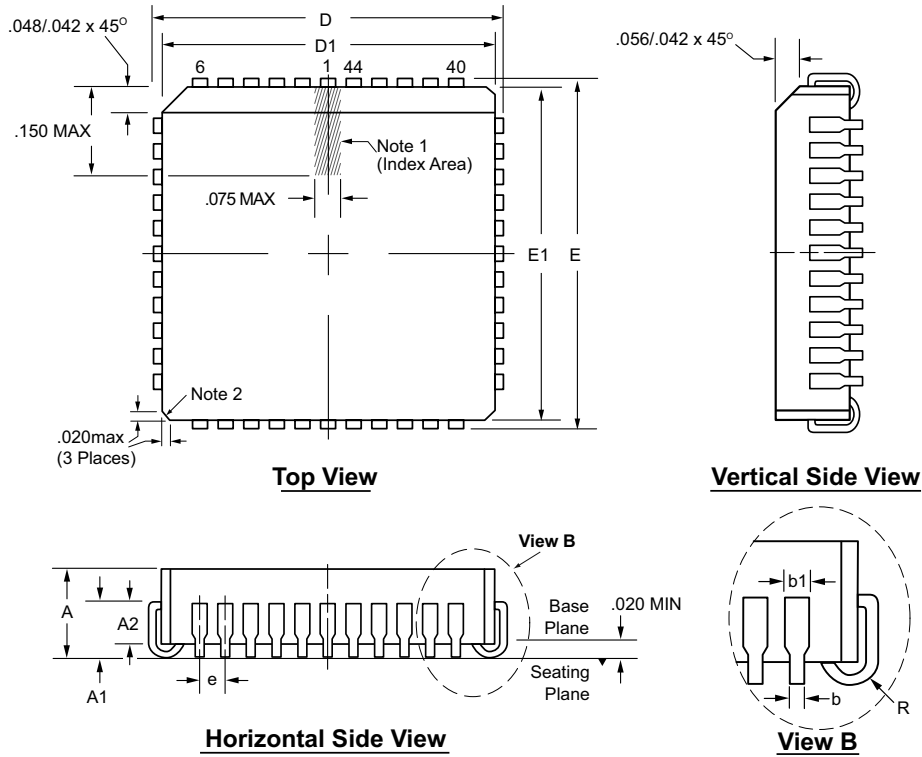
Symbol	A	A1	A2	b	D	D1	E	E1	e	L	L1	L2	$\theta$	
Dimension (mm)	MIN	1.95*	0.00	1.95	0.30	13.65*	9.80*	13.65*	9.80*	0.80 BSC	0.73	1.95 REF	0.25 BSC	0°
	NOM	-	-	2.00	-	13.90	10.00	13.90	10.00		0.88		3.5°	
	MAX	2.35	0.25	2.10	0.45	14.15*	10.20*	14.15*	10.20*		1.03		7°	

JEDEC Registration MO-112, Variation AA-2, Issue B, Sep. 1995.

\* This dimension is not specified in 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](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.

# HV5122 / HV5222

---

## APPENDIX A: REVISION HISTORY

### Revision A (August 2015)

- Update file to new format

### Revision B (October 2015)

- Updated Continuous total power dissipation in Absolute Maximum Ratings on page 3
- Corrected a typo on page 13

## 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>
Device	Package Options		Environmental		Media Type
<p>Device:</p> <p>HV5122 = 32-Channel Serial to Parallel Converter, data shifts in counter-clockwise direction</p> <p>HV5222 = 32-Channel Serial to Parallel Converter, data shifts in clockwise direction</p> <p>Package:</p> <p>PG = 44-Lead PQFP</p> <p>PJ = 44-Lead PLCC</p> <p>Environmental</p> <p>G = Lead (Pb)-free/ROHS-compliant package</p> <p>Media Type:</p> <p>(blank) = 96/Tray for PG package</p> <p>= 27/Tube for PJ package</p>	<p><b>Examples:</b></p> <p>a) HV5122PG-G      Data shifts in counter-clockwise direction, 44-Lead PQFP package, 96/Tray</p> <p>b) HV5222PJ-G      Data shifts in clockwise direction, 44-Lead PLCC package, 27/Tube</p>				

---

---

**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.

#### **Trademarks**

The Microchip name and logo, the Microchip logo, dsPIC, FlashFlex, flexPWR, JukeBlox, KEELOQ, KEELOQ logo, Kleer, LANCheck, MediaLB, MOST, MOST logo, MPLAB, OptoLyzer, PIC, PICSTART, PIC<sup>32</sup> 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.

The Embedded Control Solutions Company and mTouch are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, BodyCom, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, ECAN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, KleerNet, KleerNet logo, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICTail, RightTouch logo, REAL ICE, SQI, Serial Quad I/O, 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 trademark 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.

© 2015, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-63277-882-6

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

*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<sup>®</sup> MCUs and dsPIC<sup>®</sup> DSCs, KEELOQ<sup>®</sup> 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.*



# 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](http://www.microchip.com/support)

Web Address:

[www.microchip.com](http://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