

## 80-Channel 100 MHz Serial-to-Parallel Converter with Push-Pull Outputs

### Features

- 5V CMOS Logic
- 80V Maximum Output Voltage
- Low-power Level Shifting
- 100 MHz Equivalent Data Rate using Four Dynamic Shift Registers
- Latched Data Outputs
- Forward and Reverse Shifting Options (DIR Pin)
- Diode to  $V_{PP}$  allows Efficient Power Recovery
- Outputs may be Hot Switched

### Applications

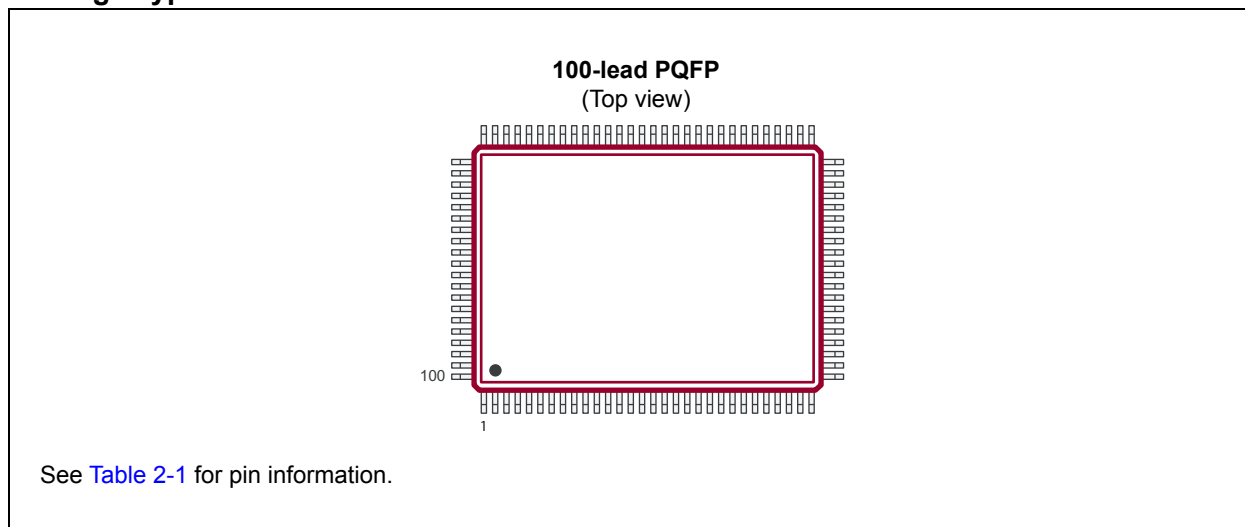
- Display Driver
- Inkjet Driver
- Microelectromechanical Systems Applications

### General Description

The HV574 is a low-voltage to high-voltage serial-to-parallel converter with push-pull outputs. This device is designed as a driver for printer applications. It can also be used in any application requiring multiple-output high-voltage current sourcing-and-sinking capability such as driving plasma panels, vacuum fluorescent displays and large matrix LCD displays.

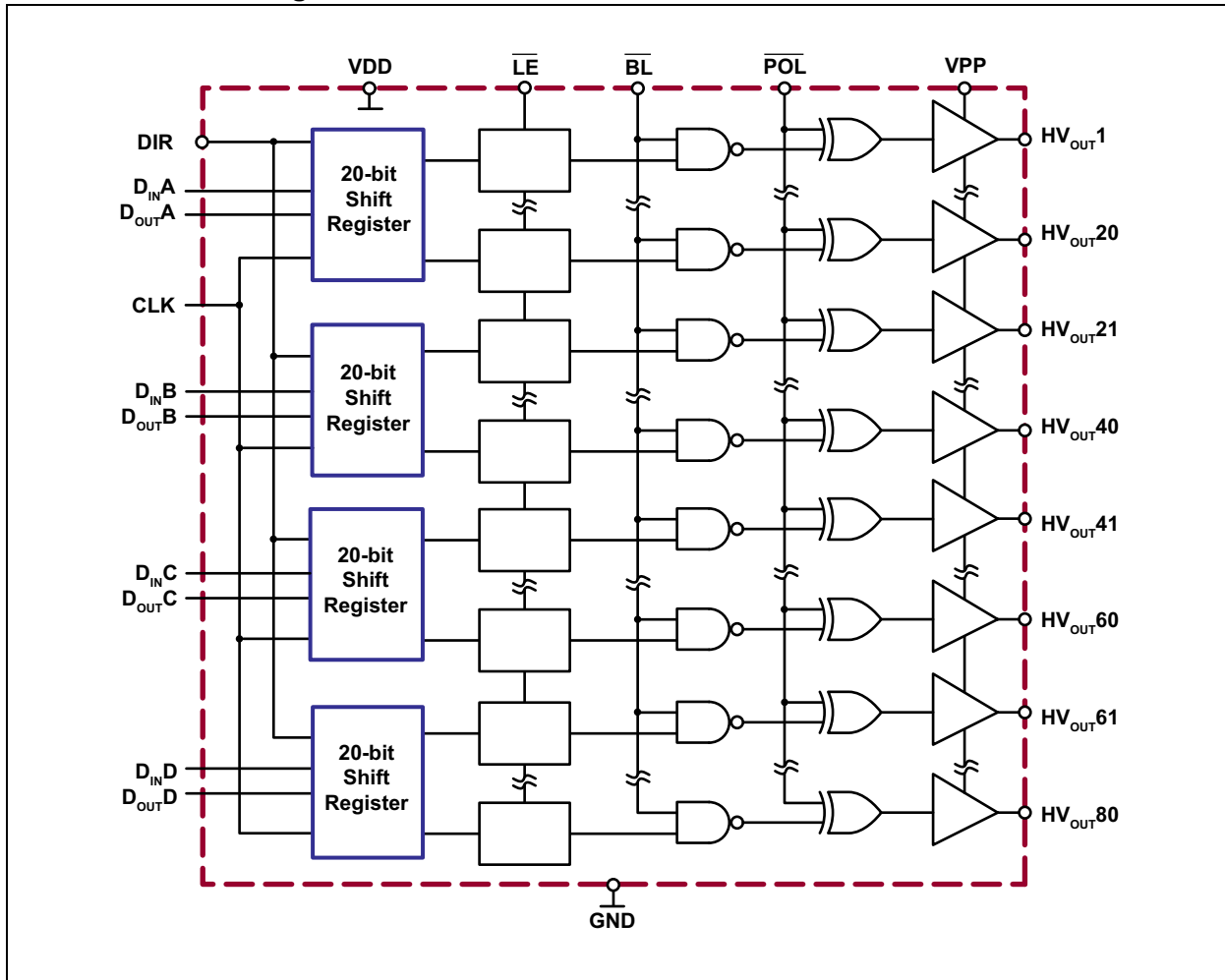
The device has four parallel 20-bit dynamic Shift registers, permitting data rates four times the speed of one in a single clock cycle. There are 80 static latches and control logic to perform the polarity select and blanking of the outputs.  $HV_{OUT1}$  is connected to the first stage of the first Shift register through the polarity and blanking logic. Data is shifted through the Shift registers on the logic low-to-high transition of the clock. The DIR pin causes counter-clockwise shifting when connected to GND and clockwise shifting when connected to  $V_{DD}$ . A data output buffer is provided for cascading devices. This output reflects the current status of the last bit of the Shift register,  $HV_{OUT80}$ . The operation of the Shift register is not affected by the latch enable ( $\overline{LE}$ ), blanking ( $\overline{BL}$ ) and polarity ( $\overline{POL}$ ) inputs. Transfer of data from the Shift registers to the latches occurs when the  $\overline{LE}$  input is high. The data in the latches is stored when  $\overline{LE}$  is low.

### Package Type

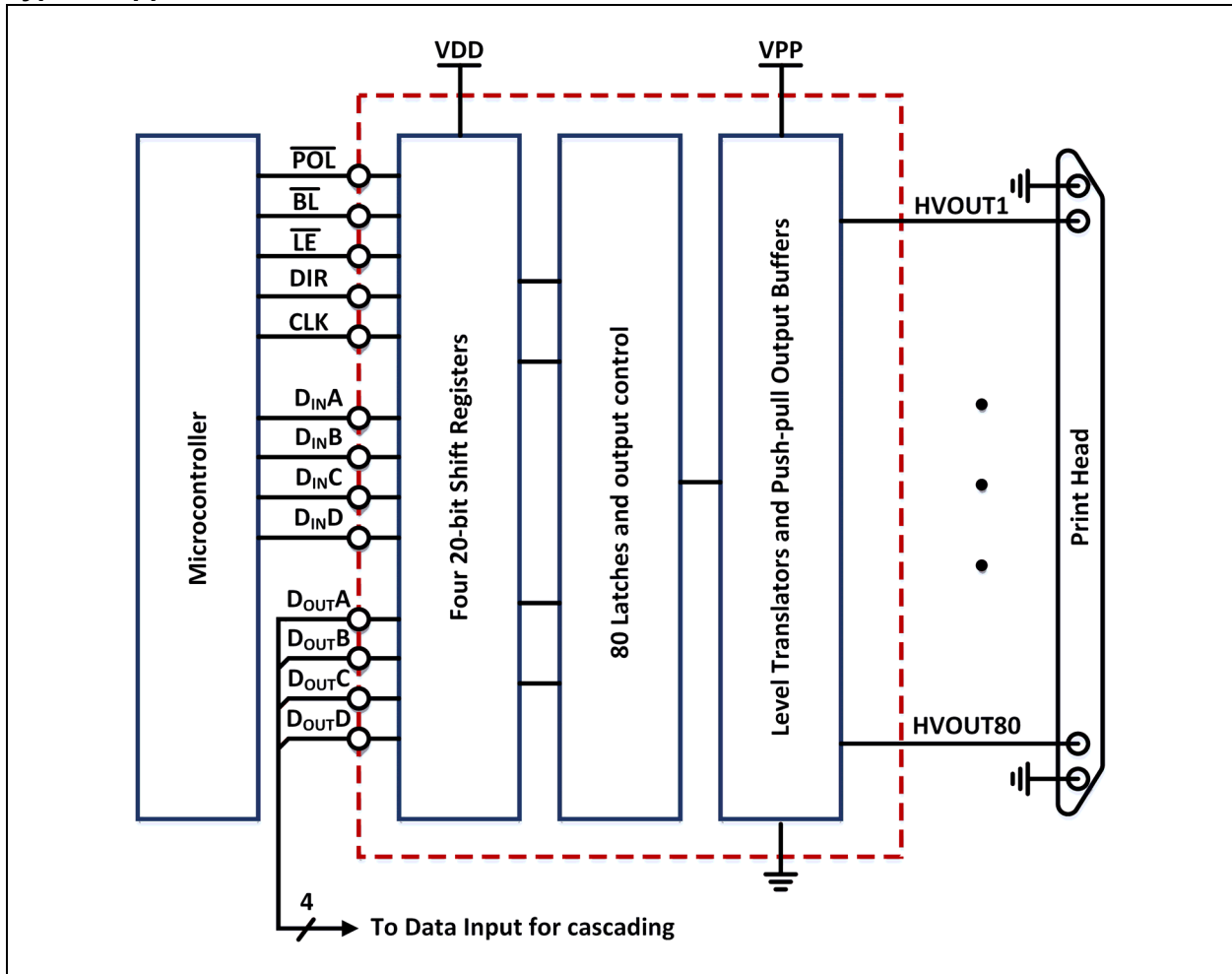


# HV574

## Functional Block Diagram



## Typical Application Circuit



# HV574

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings†

Low-voltage Supply Voltage, $V_{DD}$ .....	-0.5V to +7.5V
High-voltage Supply Voltage, $V_{PP}$ .....	-0.5V to +90V
Logic Input Levels .....	-0.3V to $V_{DD} + 0.3V$
Ground Current (Note 1) .....	1.5A
Maximum Junction Temperature, $T_{J(MAX)}$ .....	+125°C
Storage Temperature, $T_S$ .....	-65°C to +150°C
Continuous Total Power Dissipation:	
100-lead PQFP (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:** 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

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Logic Supply Voltage	$V_{DD}$	4.5	—	5.5	V	
Output Voltage	$V_{PP}$	12	—	80	V	
High-level Input Voltage	$V_{IH}$	$V_{DD} - 0.5V$	—	—	V	
Low-level Input Voltage	$V_{IL}$	0	—	0.5	V	
Clock Frequency per Register	$f_{CLK}$	0.001	—	25	MHz	
Operating Ambient Temperature	$T_A$	-40	—	+85	°C	

## DC ELECTRICAL CHARACTERISTICS

Electrical Specifications: Over recommended operating conditions unless otherwise noted							
Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions	
V <sub>DD</sub> Supply Current	I <sub>DD</sub>	—	—	30	mA	V <sub>DD</sub> = V <sub>DD</sub> maximum f <sub>CLK</sub> = 25 MHz	
Quiescent V <sub>PP</sub> Supply Current	I <sub>PP</sub>	—	—	100	μA	Outputs high	
		—	—	100	μA	Outputs low	
Quiescent V <sub>DD</sub> Supply Current	I <sub>DDQ</sub>	—	—	100	μA	All V <sub>IN</sub> = V <sub>DD</sub>	
High-level Output	HV <sub>OUT</sub>	V <sub>OH</sub>	V <sub>PP</sub> -9	—	—	V	I <sub>O</sub> = -30 mA, V <sub>PP</sub> = +80V
	Data Out		V <sub>DD</sub> -0.5	—	—	—	V
Low-level Output	HV <sub>OUT</sub>	V <sub>OL</sub>	—	—	3.75	V	I <sub>O</sub> = +15 mA, V <sub>DD</sub> = +5V
	Data Out		—	—	0.5	V	I <sub>O</sub> = +100 μA
High-level Logic Input Current	I <sub>IH</sub>	—	—	1	μA	V <sub>IH</sub> = V <sub>DD</sub>	
Low-level Logic Input Current	I <sub>IL</sub>	—	—	-1	μA	V <sub>IL</sub> = 0V	

## AC ELECTRICAL CHARACTERISTICS

**Electrical Specifications:** T<sub>A</sub> = 85°C maximum. Logic signal inputs and data inputs have t<sub>r</sub>, t<sub>f</sub> ≤ 5 ns (10% and 90% points).

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Clock Frequency	f <sub>CLK</sub>	0.001	—	25	MHz	V <sub>DD</sub> = 4.5V, T <sub>J</sub> = 25°C
		0.001	—	20	MHz	V <sub>DD</sub> = 4.5V, T <sub>J</sub> = 125°C
Clock Width High or Low	t <sub>WL</sub> , t <sub>WH</sub>	20	—	—	ns	
Data Set-up Time before Clock Rises	t <sub>SU</sub>	0	—	—	ns	
Data Hold Time after Clock Rises	t <sub>H</sub>	15	—	—	ns	
Time from Latch Enable to HV <sub>OUT</sub>	t <sub>ON</sub> , t <sub>OFF</sub>	—	—	500	ns	C <sub>L</sub> = 15 pF
Latch Enable Pulse Width	t <sub>WLE</sub>	25	—	—	ns	
Delay Time Clock to Latch Enable Low to High	t <sub>DLE</sub>	25	—	—	ns	<b>Note 1</b>
Latch Enable Set-up Time before Clock Rises	t <sub>SLE</sub>	0	—	—	ns	
Delay Time Clock to Data Low to High	t <sub>DLH</sub>	—	—	38	ns	C <sub>L</sub> = 15 pF, V <sub>DD</sub> = 5V
Delay Time Clock to Data High to Low	t <sub>DHL</sub>	—	—	38	ns	C <sub>L</sub> = 15 pF, V <sub>DD</sub> = 5V
Output Rise and Fall Time	t <sub>r</sub> , t <sub>f</sub>	—	—	1	ns	C <sub>L</sub> = 600 pF, HV <sub>OUT</sub> from 0V-60V

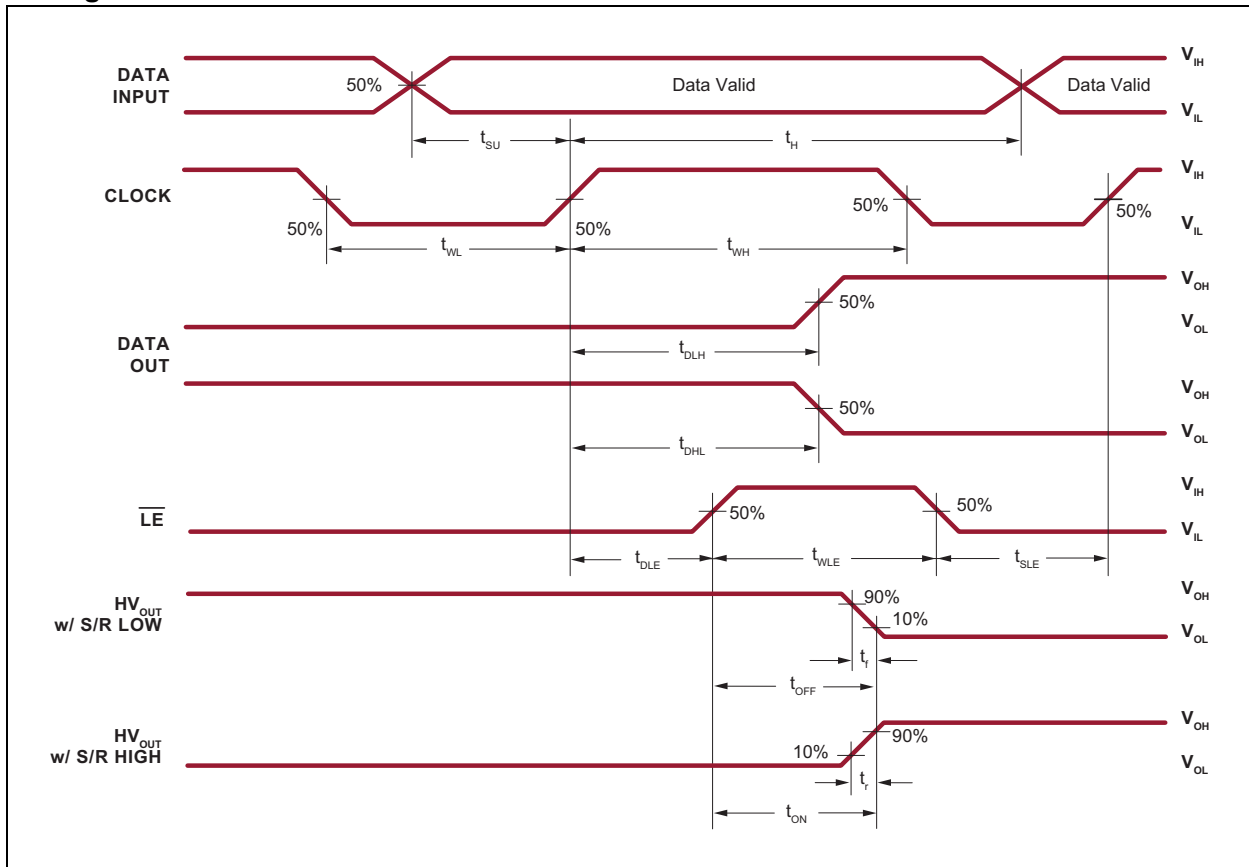
**Note 1:** t<sub>DLE</sub> is not required but is recommended to produce stable HV outputs and minimize power dissipation and current spikes. t<sub>DLE</sub> allows the internal SR output to stabilize.

# HV574

## TEMPERATURE SPECIFICATIONS

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
<b>TEMPERATURE RANGE</b>						
Operating Ambient Temperature	$T_A$	-40	—	+85	°C	
Maximum Junction Temperature	$T_{J(MAX)}$	—	—	+125	°C	
Storage Temperature	$T_S$	-65	—	+150	°C	
<b>PACKAGE THERMAL RESISTANCE</b>						
100-lead PQFP	$\theta_{JA}$	—	39	—	°C/W	

## Timing Waveforms



## 2.0 PIN DESCRIPTION

The details on the pins of HV574 are listed on [Table 2-1](#). Refer to [Package Type](#) for the location of pins.

**TABLE 2-1: PIN FUNCTION TABLE**

Pin Number	Pin Name	Description
1	HVOUT30	High-voltage output
2	HVOUT29	High-voltage output
3	HVOUT28	High-voltage output
4	HVOUT27	High-voltage output
5	HVOUT26	High-voltage output
6	HVOUT25	High-voltage output
7	HVOUT24	High-voltage output
8	HVOUT23	High-voltage output
9	HVOUT22	High-voltage output
10	HVOUT21	High-voltage output
11	HVOUT20	High-voltage output
12	HVOUT19	High-voltage output
13	HVOUT18	High-voltage output
14	HVOUT17	High-voltage output
15	HVOUT16	High-voltage output
16	HVOUT15	High-voltage output
17	HVOUT14	High-voltage output
18	HVOUT13	High-voltage output
19	HVOUT12	High-voltage output
20	HVOUT11	High-voltage output
21	HVOUT10	High-voltage output
22	HVOUT9	High-voltage output
23	HVOUT8	High-voltage output
24	HVOUT7	High-voltage output
25	HVOUT6	High-voltage output
26	HVOUT5	High-voltage output
27	HVOUT4	High-voltage output
28	HVOUT3	High-voltage output
29	HVOUT2	High-voltage output
30	HVOUT1	High-voltage output
31	NC	No connection
32	VPP	High-voltage supply pin
33	HVGND	High-voltage supply ground
34	DINA	Data Input A pin
35	DINB	Data Input B pin
36	DINC	Data Input C pin

# HV574

**TABLE 2-1: PIN FUNCTION TABLE (CONTINUED)**

Pin Number	Pin Name	Description
37	DIND	Data Input D pin
38	VDD	Low-voltage supply pin
39	$\overline{\text{POL}}$	Polarity pin
40	$\overline{\text{LE}}$	Latch Enable pin
41	CLK	Clock pin
42	DIR	Direction pin
43	$\overline{\text{BL}}$	Blanking pin
44	GND	Low-voltage supply ground
45	DOUTD	Data Output D pin
46	DOUTC	Data Output C pin
47	DOUTB	Data Output B pin
48	DOUTA	Data Output A pin
49	HVGND	High-voltage supply ground
50	VPP	High-voltage supply pin
51	HVOUT80	High-voltage output
52	HVOUT79	High-voltage output
53	HVOUT78	High-voltage output
54	HVOUT77	High-voltage output
55	HVOUT76	High-voltage output
56	HVOUT75	High-voltage output
57	HVOUT74	High-voltage output
58	HVOUT73	High-voltage output
59	HVOUT72	High-voltage output
60	HVOUT71	High-voltage output
61	HVOUT70	High-voltage output
62	HVOUT69	High-voltage output
63	HVOUT68	High-voltage output
64	HVOUT67	High-voltage output
65	HVOUT66	High-voltage output
66	HVOUT65	High-voltage output
67	HVOUT64	High-voltage output
68	HVOUT63	High-voltage output
69	HVOUT62	High-voltage output
70	HVOUT61	High-voltage output
71	HVOUT60	High-voltage output
72	HVOUT59	High-voltage output
73	HVOUT58	High-voltage output
74	HVOUT57	High-voltage output
75	HVOUT56	High-voltage output
76	HVOUT55	High-voltage output



**TABLE 2-1: PIN FUNCTION TABLE (CONTINUED)**

Pin Number	Pin Name	Description
77	HVOUT54	High-voltage output
78	HVOUT53	High-voltage output
79	HVOUT52	High-voltage output
80	HVOUT51	High-voltage output
81	HVOUT50	High-voltage output
82	HVOUT49	High-voltage output
83	HVOUT48	High-voltage output
84	HVOUT47	High-voltage output
85	HVOUT46	High-voltage output
86	HVOUT45	High-voltage output
87	HVOUT44	High-voltage output
88	HVOUT43	High-voltage output
89	HVOUT42	High-voltage output
90	HVOUT41	High-voltage output
91	HVOUT40	High-voltage output
92	HVOUT39	High-voltage output
93	HVOUT38	High-voltage output
94	HVOUT37	High-voltage output
95	HVOUT36	High-voltage output
96	HVOUT35	High-voltage output
97	HVOUT34	High-voltage output
98	HVOUT33	High-voltage output
99	HVOUT32	High-voltage output
100	HVOUT31	High-voltage output

# HV574

## 3.0 FUNCTIONAL DESCRIPTION

Follow the steps in [Table 3-1](#) to power up and power down the HV574.

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

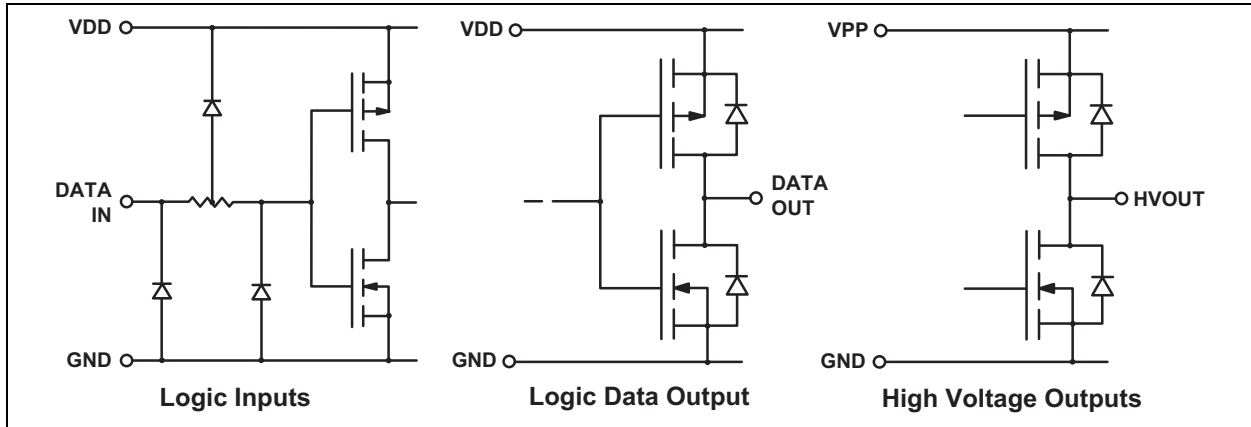
Power-up		Power-down	
Step	Description	Step	Description
1	Connect ground.	1	Remove $V_{PP}$ . ( <a href="#">Note 1</a> )
2	Apply $V_{DD}$ .	2	Remove all inputs.
3	Set all inputs (Data, CLK, Enable, etc.) to a known state.	3	Remove $V_{DD}$ .
4	Apply $V_{PP}$ . ( <a href="#">Note 1</a> )	4	Disconnect ground.

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

**TABLE 3-2: TRUTH FUNCTION TABLE**

Function	Inputs						Outputs		
	Data	CLK	$\overline{LE}$	$\overline{BL}$	$\overline{POL}$	DIR	Shift Register	High-voltage Output	Data Out
All O/P High	X	X	X	L	L	X	—	H	—
All O/P Low	X	X	X	L	H	X	—	L	—
O/P Normal	X	X	X	H	H	X	—	No inversion	—
O/P Inverted	X	X	X	H	L	X	—	Inversion	—
Data Falls through Latches (Latches Transparent)	L	↑	H	H	H	X	L	L	—
	H	↑	H	H	H	X	H	H	—
	L	↑	H	H	L	X	L	H	—
	H	↑	H	H	L	X	H	L	—
Data Stored/Latches Loaded	X	X	L	H	H	X	*	Stored data	—
	X	X	L	H	L	X	*	Inversion of stored data	—
I/O Relation	$D_{IN}X$	↑	H	H	H	H	$Q_n \rightarrow Q_{n+1}$	New H or L	$D_{OUT}X$
	$D_{IN}X$	↑	L	H	H	H	$Q_n \rightarrow Q_{n+1}$	Previous H or L	$D_{OUT}X$
	$D_{OUT}X$	↑	L	H	H	L	$Q_n \rightarrow Q_{n-1}$	Previous H or L	$D_{IN}X$
	$D_{OUT}X$	↑	H	H	H	L	$Q_n \rightarrow Q_{n-1}$	New H or L	$D_{IN}X$

**Note:** H = High-logic level  
 L = Low-logic level  
 X = Irrelevant  
 ↑ = Low-to-high transition  
 \* = Dependent on the previous stage's state. See [Package Type](#) for  $D_{IN}$  and  $D_{OUT}$  pin designation for clockwise and counter-clockwise shifts.



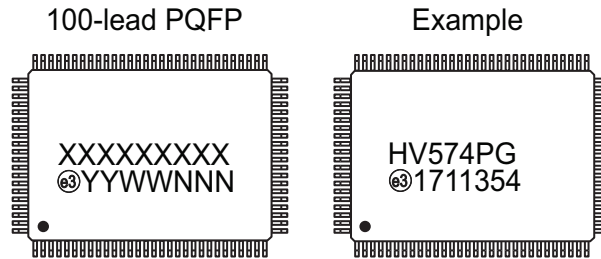
**FIGURE 3-1:** *Input and Output Equivalent Circuits.*

# HV574

---

## 4.0 PACKAGE MARKING INFORMATION

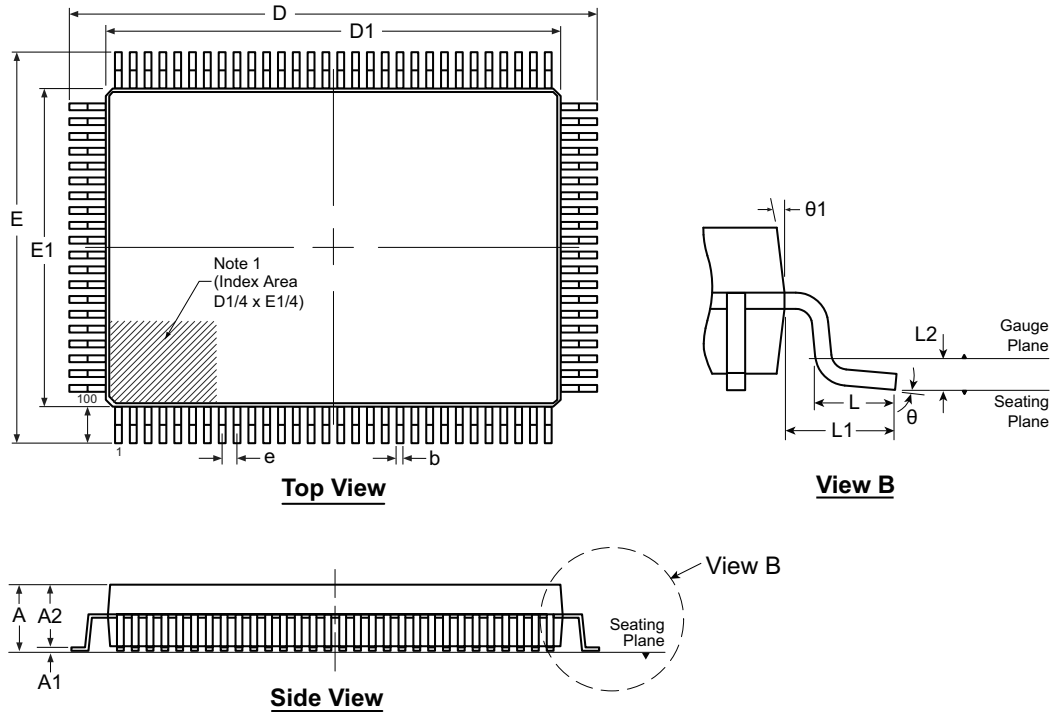
### 4.1 Packaging Information



<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
	ⓔ3	Pb-free JEDEC <sup>®</sup> designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator (ⓔ3) 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.	

## 100-Lead PQFP Package Outline (PG)

20.00x14.00mm body, 3.40mm height (max), 0.65mm pitch, 3.90mm footprint



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	$\theta$	$\theta_1$	
Dimension (mm)	MIN	2.80*	0.25	2.55	0.22	23.65*	19.80*	17.65*	13.80*	0.65 BSC	0.73	1.95 REF	0.25 BSC	0	5°
	NOM	-	-	2.80	-	23.90	20.00	17.90	14.00		0.88		3.5°	-	
	MAX	3.40	0.50*	3.05	0.38	24.15*	20.20*	18.15*	14.20*		1.03		7°	16°	

JEDEC Registration MO-112, Variation CC-1, Issue B, Sept. 1995.

\* This dimension is not specified in the JEDEC drawing.

Drawings are not to scale.

# HV574

---

NOTES:

## APPENDIX A: REVISION HISTORY

### Revision A (October 2017)

- Converted Supertex Doc # DSFP-HV574 to Microchip DS20005859A
- Removed “HVCMOS<sup>®</sup> Technology” in the Features section
- Changed the package marking format
- Made minor changes throughout the document

# HV574

## PRODUCT IDENTIFICATION SYSTEM

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

<u>PART NO.</u>	<u>XX</u>	-	<u>X</u>	-	<u>X</u>
Device	Package Options		Environmental		Media Type
Device:	HV574	=	80-Channel 100 MHz Serial-to-Parallel Converter with Push-Pull Outputs		
Package:	PG	=	100-lead PQFP		
Environmental:	G	=	Lead (Pb)-free/RoHS-compliant Package		
Media Type:	(blank)	=	66/Tray for a PG Package		

**Example:**

a) HV574PG-G: 80-Channel 100 MHz Serial-to-Parallel Converter with Push-Pull Outputs, 100-lead PQFP, 66/Tray



---

---

**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, AVR, AVR logo, AVR Freaks, BeaconThings, BitCloud, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Heldo, JukeBlox, KEELOQ, KEELOQ logo, Klear, LANCheck, LINK MD, maXStylus, maXTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, RightTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA 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.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, CryptoAuthentication, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KlearNet, KlearNet logo, Mindi, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICKit, PICTail, PureSilicon, QMatrix, RightTouch logo, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, 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 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.

© 2017, Microchip Technology Incorporated, All Rights Reserved.  
ISBN: 978-1-5224-2277-8



# 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](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

**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  
Tel: 317-536-2380

**Los Angeles**  
Mission Viejo, CA  
Tel: 949-462-9523  
Fax: 949-462-9608  
Tel: 951-273-7800

**Raleigh, NC**  
Tel: 919-844-7510

**New York, NY**  
Tel: 631-435-6000

**San Jose, CA**  
Tel: 408-735-9110  
Tel: 408-436-4270

**Canada - Toronto**  
Tel: 905-695-1980  
Fax: 905-695-2078

### 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 - Guangzhou**  
Tel: 86-20-8755-8029

**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: 86-21-3326-8000  
Fax: 86-21-3326-8021

**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: 886-7-213-7830

**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

**Finland - Espoo**  
Tel: 358-9-4520-820

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

**Germany - Garching**  
Tel: 49-8931-9700

**Germany - Haan**  
Tel: 49-2129-3766400

**Germany - Heilbronn**  
Tel: 49-7131-67-3636

**Germany - Karlsruhe**  
Tel: 49-721-625370

**Germany - Munich**  
Tel: 49-89-627-144-0  
Fax: 49-89-627-144-44

**Germany - Rosenheim**  
Tel: 49-8031-354-560

**Israel - Ra'anana**  
Tel: 972-9-744-7705

**Italy - Milan**  
Tel: 39-0331-742611  
Fax: 39-0331-466781

**Italy - Padova**  
Tel: 39-049-7625286

**Netherlands - Drunen**  
Tel: 31-416-690399  
Fax: 31-416-690340

**Norway - Trondheim**  
Tel: 47-7289-7561

**Poland - Warsaw**  
Tel: 48-22-3325737

**Romania - Bucharest**  
Tel: 40-21-407-87-50

**Spain - Madrid**  
Tel: 34-91-708-08-90  
Fax: 34-91-708-08-91

**Sweden - Gothenberg**  
Tel: 46-31-704-60-40

**Sweden - Stockholm**  
Tel: 46-8-5090-4654

**UK - Wokingham**  
Tel: 44-118-921-5800  
Fax: 44-118-921-5820