

## 20-Channel Serial-Input Vacuum Fluorescent Display Driver for Anode or Grid

### Features

- HVCMOS<sup>®</sup> Technology for High Performance
- Operating Voltage of up to 80V
- High-speed Source Driver
- 5V CMOS Logic Circuitry
- Up to 5 MHz Data Input Rate
- Excellent Noise Immunity
- Flexible High-voltage Supplies

### Applications

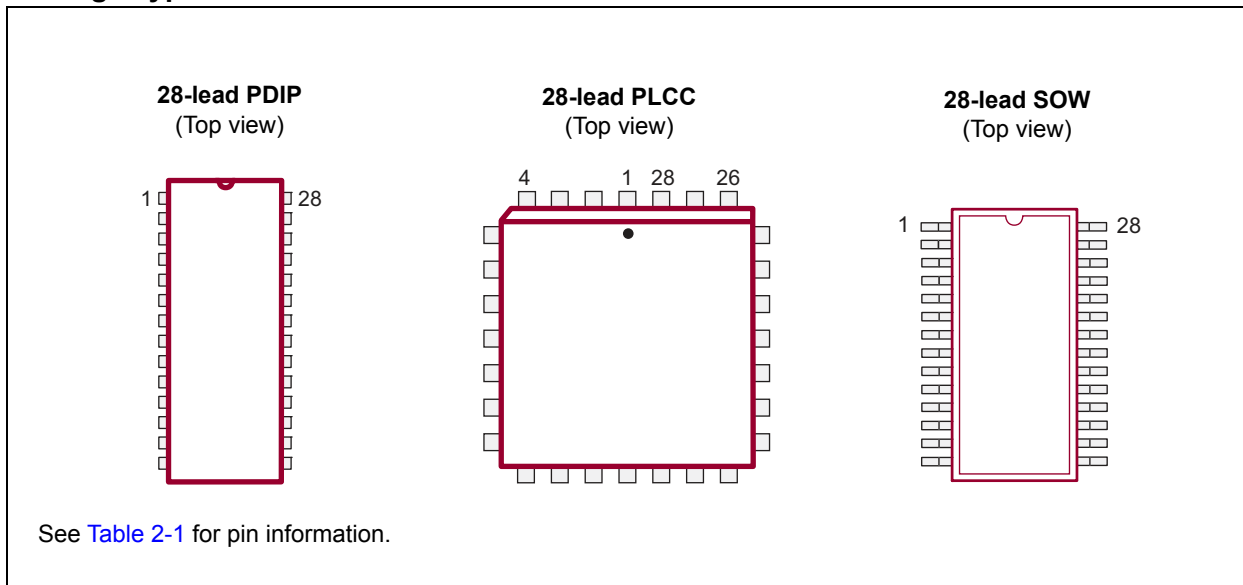
- Display Driver

### General Description

The HV5812 is a 20-channel serial-input vacuum fluorescent display driver. It combines a 20-bit CMOS shift register, data latches and control circuitry with high-voltage MOSFET outputs. The HV5812 is primarily designed for vacuum fluorescent displays.

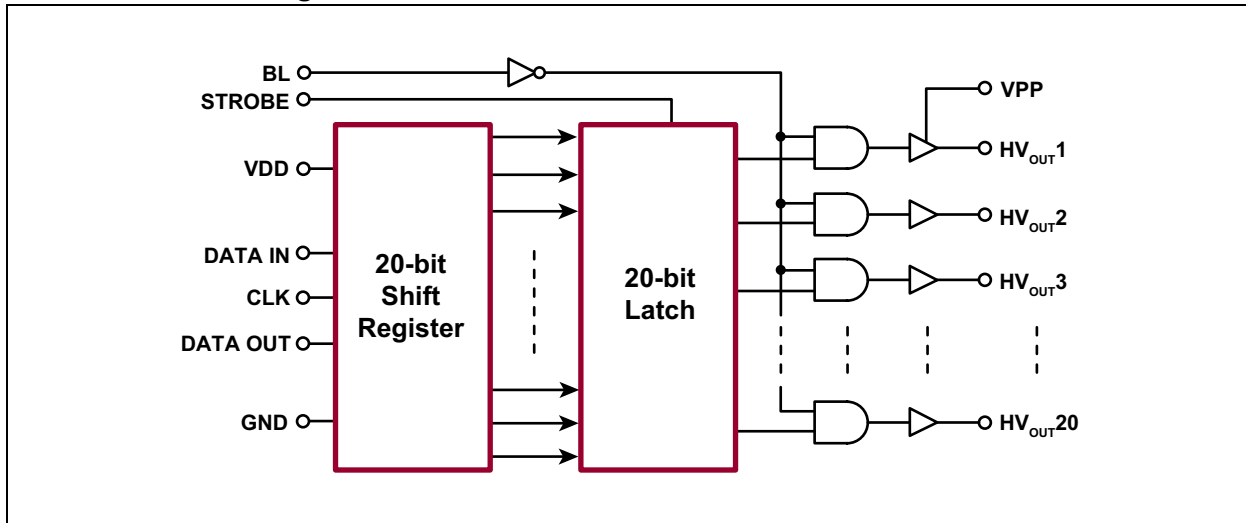
The CMOS shift register and latches allow direct interfacing with microprocessor-based systems. Data input rates are typically over 5 MHz with 5V logic supply. Especially useful for interdigit blanking, the blanking input disables the output source drives and turns on the sink drivers. Using with TTL may require external pull-up resistors to ensure an input logic high.

### Package Types



# HV5812

## Functional Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings†

Supply Voltage, $V_{DD}$ .....	-0.5V to +7.5V
Supply Voltage, $V_{PP}$ .....	-0.5V to +90V
Logic Input Levels.....	-0.3V to $V_{DD} + 0.3V$
Maximum Operating Junction Temperature.....	+125°C
Storage Temperature.....	-55°C to +150°C
Power Dissipation:	
28-lead PDIP.....	2000 mW
28-lead PLCC.....	1900 mW
28-Lead SOW.....	1700 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.

### RECOMMENDED OPERATING CONDITIONS

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Supply Voltage	$V_{DD}$	4.5	—	5.5	V	
Supply Voltage	$V_{PP}$	20	—	80	V	
Operating Junction Temperature	$T_J$	-40	—	+125	°C	

### DC ELECTRICAL CHARACTERISTICS

**Electrical Specifications:** Over recommended operating conditions;  $T_A = 25^\circ\text{C}$  unless otherwise indicated.

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions	
Output Leakage Current	$I_{DSS}$	—	-5	-15	$\mu\text{A}$	$V_{OUT} = 0V, T_A = +70^\circ\text{C}$	
High-level Output	$V_{OH}$	$HV_{OUT}$	78	78.5	—	V	$I_{OUT} = -25\text{ mA}, V_{PP} = 80V, T_J = +25^\circ\text{C}$
		$HV_{OUT}$	77	78	—	V	$I_{OUT} = -25\text{ mA}, V_{PP} = 80V, T_J = +125^\circ\text{C}$
		DATA OUT	4.5	4.7	—	V	$I_{OUT} = -200\ \mu\text{A}, V_{DD} = 5V$
Low-level Output	$V_{OL}$	$HV_{OUT}$	—	1.5	3	V	$I_{OUT} = 1\text{ mA}, T_J = +25^\circ\text{C}, V_{DD} = 5V$
		$HV_{OUT}$	—	2.3	4	V	$I_{OUT} = 1\text{ mA}, T_J = +125^\circ\text{C}, V_{DD} = 5V$
		DATA OUT	—	200	250	V	$I_{OUT} = +200\ \mu\text{A}, V_{DD} = 5V$
Output Pull-down Current	$I_{SINK}$	2	3.5	—	mA	$V_{OUT} = 5V\text{ to }V_{PP}, V_{DD} = 5V$	
High-level Logic Input Voltage	$V_{IH}$	3.5	—	5.3	V	$V_{DD} = 5V$	
Low-level Logic Input Voltage	$V_{IL}$	-0.3	—	0.8	V		
High-level Logic Input Current	$I_{IH}$	—	0.05	0.5	$\mu\text{A}$	$V_{IN} = V_{DD}, V_{DD} = 5V$	
Low-level Logic Input Current	$I_{IL}$	—	-0.05	-0.5	$\mu\text{A}$	$V_{IN} = 0.8V, V_{DD} = 5V$	
Quiescent $V_{DD}$ Supply Current	$I_{DDQ}$	—	100	300	$\mu\text{A}$	All outputs high, $V_{DD} = 5V$	
		—	100	300	$\mu\text{A}$	All outputs low, $V_{DD} = 5V$	
Quiescent $V_{PP}$ Supply Current	$I_{PPQ}$	—	10	100	$\mu\text{A}$	All outputs high, no load	
		—	10	100	$\mu\text{A}$	All outputs low, no load	

# HV5812

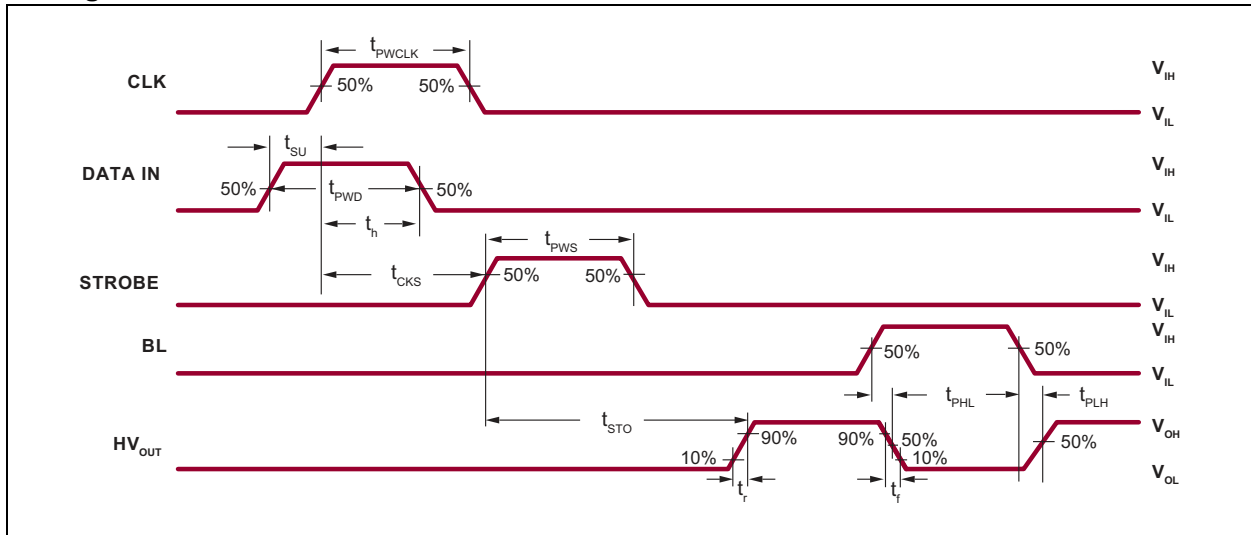
## AC ELECTRICAL CHARACTERISTICS

Electrical Specifications: Over recommended operating conditions; $T_A = 25^\circ\text{C}$ unless otherwise indicated.						
Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Blanking to Output Delay	$t_{\text{PHL}}$	—	2000	—	ns	$C_L = 30\text{ pF}$ , 50% to 50%, $V_{\text{DD}}=5\text{V}$
	$t_{\text{PLH}}$	—	1000	—		
Output Fall Time	$t_f$	—	1450	—	ns	$C_L = 30\text{ pF}$ , 90% to 10%, $V_{\text{DD}} = 5\text{V}$
Output Rise Time	$t_r$	—	650	—	ns	$C_L = 30\text{ pF}$ , 10% to 90%, $V_{\text{DD}} = 5\text{V}$
Data Set-up Time	$t_{\text{SU}}$	75	—	—	ns	See <a href="#">Timing Waveforms</a> .
Data Hold Time	$t_{\text{H}}$	75	—	—	ns	See <a href="#">Timing Waveforms</a> .
Minimum Data Pulse Width	$t_{\text{PWD}}$	150	—	—	ns	See <a href="#">Timing Waveforms</a> .
Minimum Clock Pulse Width	$t_{\text{PWCLK}}$	150	—	—	ns	See <a href="#">Timing Waveforms</a> .
Minimum Time between Clock Activation and Strobe	$t_{\text{CKS}}$	300	—	—	ns	See <a href="#">Timing Waveforms</a> .
Minimum Strobe Pulse Width	$t_{\text{PWS}}$	100	—	—	ns	See <a href="#">Timing Waveforms</a> .
Typical Time between Strobe Activation and Output Transition	$t_{\text{STO}}$	—	500	—	ns	See <a href="#">Timing Waveforms</a> .
Maximum Clock Frequency	$f_{\text{CLK}}$	—	8	—	MHz	$T_J = +25^\circ\text{C}$ , $V_{\text{DD}} = 5\text{V}$
		—	5	—		$T_J = +125^\circ\text{C}$ , $V_{\text{DD}} = 5\text{V}$

## TEMPERATURE SPECIFICATIONS

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
<b>TEMPERATURE RANGE</b>						
Operating Junction Temperature	$T_J$	-40	—	+125	$^\circ\text{C}$	
Storage Temperature	$T_S$	-55	—	+150	$^\circ\text{C}$	
<b>PACKAGE THERMAL RESISTANCE</b>						
28-lead PDIP	$\theta_{\text{JA}}$	—	43	—	$^\circ\text{C/W}$	
28-lead PLCC	$\theta_{\text{JA}}$	—	48	—	$^\circ\text{C/W}$	
28-lead SOW	$\theta_{\text{JA}}$	—	55	—	$^\circ\text{C/W}$	

## Timing Waveforms



# HV5812

## 2.0 PIN DESCRIPTION

The details on the pins of HV5812 28-lead PDIP, 28-lead PLCC and 28-lead SOW are listed on [Table 2-1](#). Refer to [Package Types](#) for the location of pins.

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

Pin Number	Pin Name	Description
1	VPP	High-voltage power rail
2	Data Out	Serial data output. Data output for cascading to the data input of the next device.
3	HV <sub>OUT</sub> 20	High-voltage output
4	HV <sub>OUT</sub> 19	High-voltage output
5	HV <sub>OUT</sub> 18	High-voltage output
6	HV <sub>OUT</sub> 17	High-voltage output
7	HV <sub>OUT</sub> 16	High-voltage output
8	HV <sub>OUT</sub> 15	High-voltage output
9	HV <sub>OUT</sub> 14	High-voltage output
10	HV <sub>OUT</sub> 13	High-voltage output
11	HV <sub>OUT</sub> 12	High-voltage output
12	HV <sub>OUT</sub> 11	High-voltage output
13	BLANKING	Blank
14	GND	Logic and high-voltage ground
15	CLOCK	Data shift register clock
16	STROBE	Strobe
17	HV <sub>OUT</sub> 10	High-voltage output
18	HV <sub>OUT</sub> 9	High-voltage output
19	HV <sub>OUT</sub> 8	High-voltage output
20	HV <sub>OUT</sub> 7	High-voltage output
21	HV <sub>OUT</sub> 6	High-voltage output
22	HV <sub>OUT</sub> 5	High-voltage output
23	HV <sub>OUT</sub> 4	High-voltage output
24	HV <sub>OUT</sub> 3	High-voltage output
25	HV <sub>OUT</sub> 2	High-voltage output
26	HV <sub>OUT</sub> 1	High-voltage output
27	Data In	Serial data input
28	VDD	Low-voltage logic power rail

## 3.0 FUNCTIONAL DESCRIPTION

Follow the steps below to power up and power down the HV5812:

### POWER-UP AND POWER-DOWN SEQUENCE

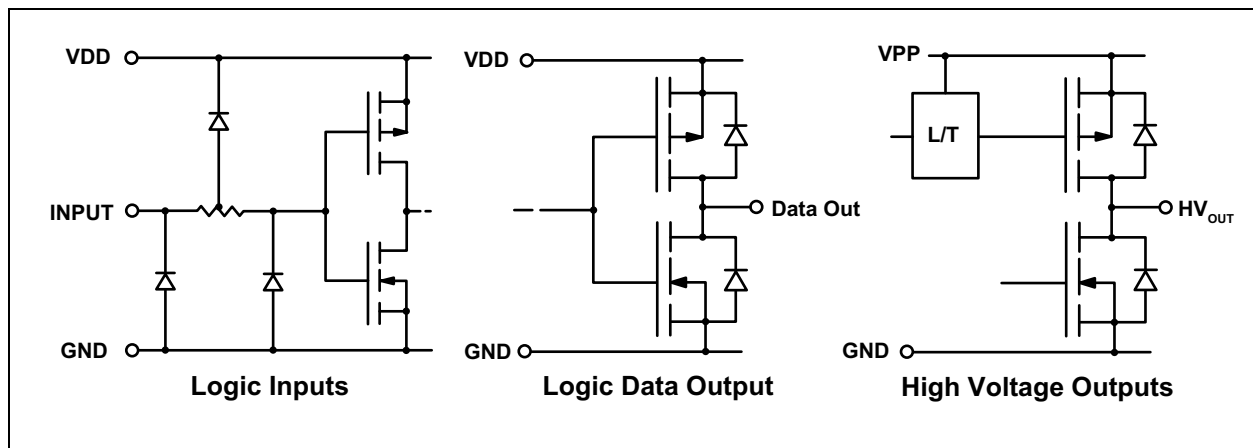
Power-up		Power-down	
Step	Description	Step	Description
1	Connect ground.	1	Remove $V_{PP}$ .
2	Apply $V_{DD}$ .	2	Remove all inputs.
3	Set all inputs (Data, CLK, etc.) to a known state	3	Remove $V_{DD}$ .
4	Apply $V_{PP}$ ( <b>Note 1</b> )	4	Disconnect ground.

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

### FUNCTION TABLE (**Note 1**)

Serial Data Input	Clock Input	Shift Register Contents				Serial Data Output	Strobe Input	Latch Contents				Blanking	Output Contents					
		$I_1$	$I_2$	$I_3...I_{N-1}$	$I_N$			$I_1$	$I_2$	$I_3...I_{N-1}$	$I_N$		$O_1$	$O_2$	$O_3...O_{N-1}$	$O_N$		
H	L to H	H	$R_1$	$R_2...R_{N-2}$	$R_{N-1}$	$R_{N-1}$	—	—	—	—	—	—	—	—	—	—	—	—
L	L to H	L	$R_1$	$R_2...R_{N-2}$	$R_{N-1}$	$R_{N-1}$	—	—	—	—	—	—	—	—	—	—	—	—
X	H to L	$R_1$	$R_2$	$R_3...R_{N-1}$	$R_N$	$R_N$	—	—	—	—	—	—	—	—	—	—	—	—
—	—	X	X	$X...X$	X	X	L	$R_1$	$R_2$	$R_3...R_{N-1}$	$R_N$	—	—	—	—	—	—	—
—	—	$P_1$	$P_2$	$P_3...P_{N-1}$	$P_N$	$P_N$	H	$P_1$	$P_2$	$P_3...P_{N-1}$	$P_N$	L	$P_1$	$P_2$	$P_3...P_{N-1}$	$P_N$	—	—
—	—	—	—	—	—	—	—	X	X	$X...X$	X	H	L	L	$L...L$	L	—	—

**Note 1:** L = Low logic level  
 H = High logic level  
 X = Irrelevant  
 P = Present state  
 R = Previous state



**FIGURE 3-1:** IO Circuits.

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## 4.0 PACKAGE MARKING INFORMATION

### 4.1 Packaging Information

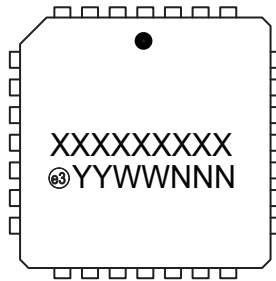
28-lead PDIP



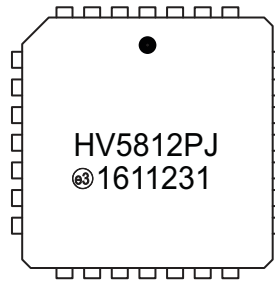
Example



28-lead PLCC



Example



28-lead SOW



Example

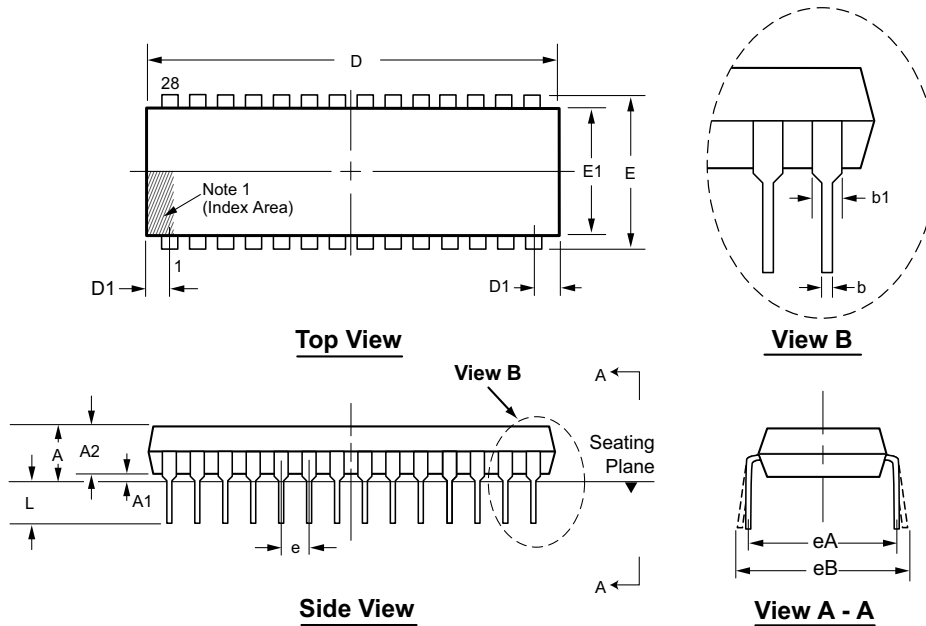


<b>Legend:</b>	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC <sup>®</sup> designator for Matte Tin (Sn)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



## 28-Lead PDIP (.600in Row Spacing) Package Outline (P) 1.565x.580in body, .250in height (max), .100in 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	b1	D	D1	E	E1	e	eA	eB	L	
Dimension (inches)	MIN	.140*	.015	.125	.014	.030	1.380	.065†	.590†	.485	.100 BSC	.600 BSC	.600*	.115
	NOM	-	-	-	-	-	-	-	-	-			-	-
	MAX	.250	.055*	.195	.023†	.070	1.565	.085*	.625	.580			.700	.200

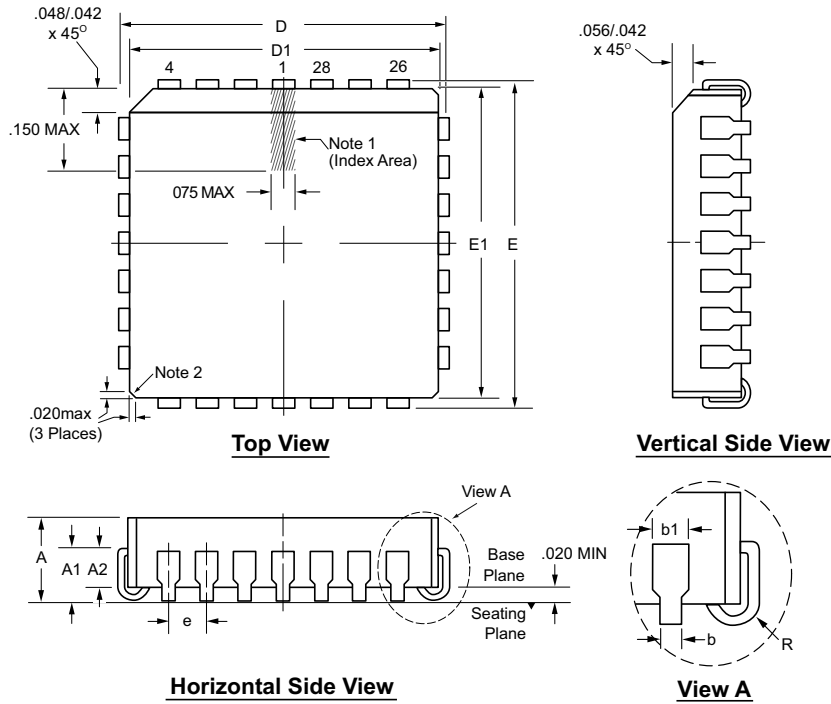
JEDEC Registration MS-011, Variation AB, Issue B, June, 1988.

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

† This dimension differs from the JEDEC drawing.

Drawings not to scale.

## 28-Lead PLCC Package Outline (PJ) .453x.453in. 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).

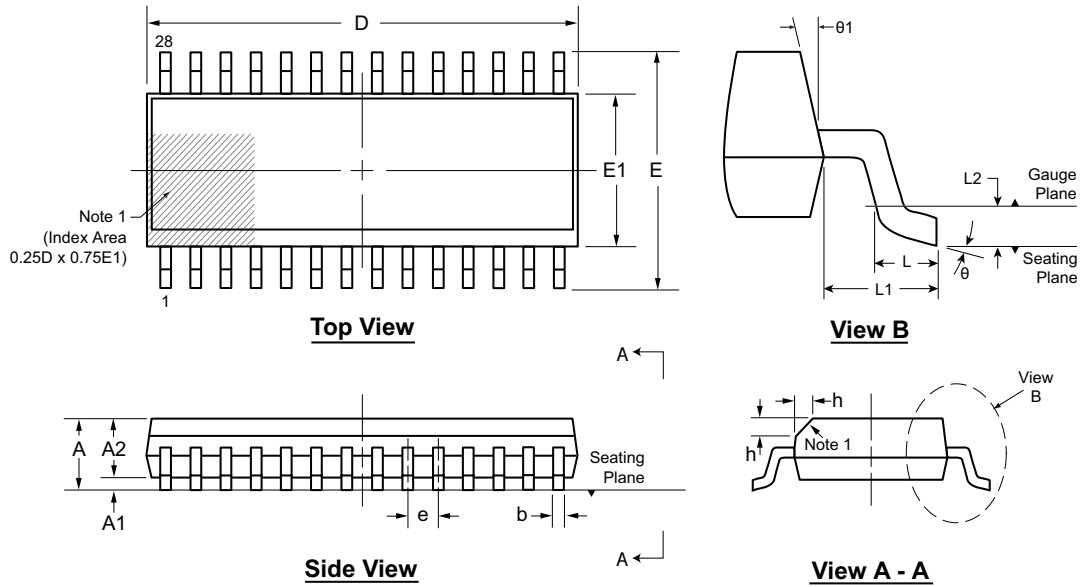
**Notes:**

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	.026	.485	.450	.485	.450	.050 BSC	.025
	NOM	.172	.105	-	-	-	.490	.453	.490	.453		.035
	MAX	.180	.120	.083	.021	.032	.495	.456	.495	.456		.045

JEDEC Registration MS-018, Variation AB, Issue A, June, 1993.  
 Drawings not to scale.

## 28-Lead SOW (Wide Body) Package Outline (WG) 17.90x7.50mm body, 2.65mm height (max), 1.27mm 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	E	E1	e	h	L	L1	L2	$\theta$	$\theta 1$
Dimension (mm)	MIN	2.15*	0.10	2.05	0.31	17.70*	9.97*	7.40*	0.25	0.40	1.40 REF	0.25 BSC	0°	5°
	NOM	-	-	-	-	17.90	10.30	7.50	-	-			-	-
	MAX	2.65	0.30	2.55*	0.51	18.10*	10.63*	7.60*	0.75	1.27			8°	15°

JEDEC Registration MS-013, Variation AE, Issue E, Sep. 2005.

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

Drawings are not to scale.

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NOTES:

## APPENDIX A: REVISION HISTORY

### Revision A (October 2016)

- Converted Supertex Doc# DSFP-HV5812 to Microchip DS20005629A
- Changed the packaging quantity of 28-lead PLCC (PJ M904) from 500/Reel to 750/Reel and 28-lead SOW (WG) from 1000/Reel to 1600/Reel
- Made minor text changes throughout the document

# HV5812

## 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: HV5812 = 20-Channel Serial-Input Vacuum Fluorescent Display Driver for Anode or Grid  Packages: P = 28-lead PDIP PJ = 28-lead PLCC WG = 28-lead SOW  Environmental: G = Lead (Pb)-free/RoHS-compliant Package  Media Types: (blank) = 13/Tube for a P Package = 38/Tube for a PJ Package = 1600/Reel for a WG Package M904 = 750/Reel for a PJ Package	<b>Examples:</b>  a) HV5812P-G: 20-Channel Serial-Input Vacuum Fluorescent Display Driver for Anode or Grid, 28-lead PDIP, 13/Tube  b) HV5812PJ-G: 20-Channel Serial-Input Vacuum Fluorescent Display Driver for Anode or Grid, 28-lead PLCC, 38/Tube  c) HV5812PJ-G-M904: 20-Channel Serial-Input Vacuum Fluorescent Display Driver for Anode or Grid, 28-lead PLCC, 750/Reel  d) HV5812WG-G: 20-Channel Serial-Input Vacuum Fluorescent Display Driver for Anode or Grid, 28-lead SOW, 1600/Reel				

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