# HV5812

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

### Features

- HVCMOS® 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

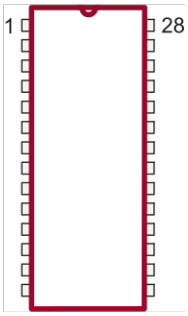
### General Description

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.

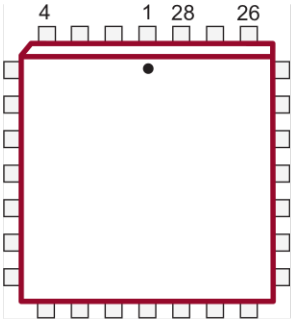
The CMOS shift register and latches allow direct interfacing with microprocessor-based systems. Data input rates are typically over 5 MHz with 5V logic supply. Especially useful for interdigit blanking, the blanking input disables the output source drives and turns on the sink drivers. Using with TTL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

### Package Types

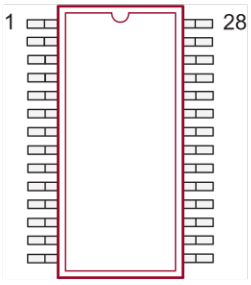
**28-lead PDIP**
(Top view)




**28-lead PLCC**
(Top view)

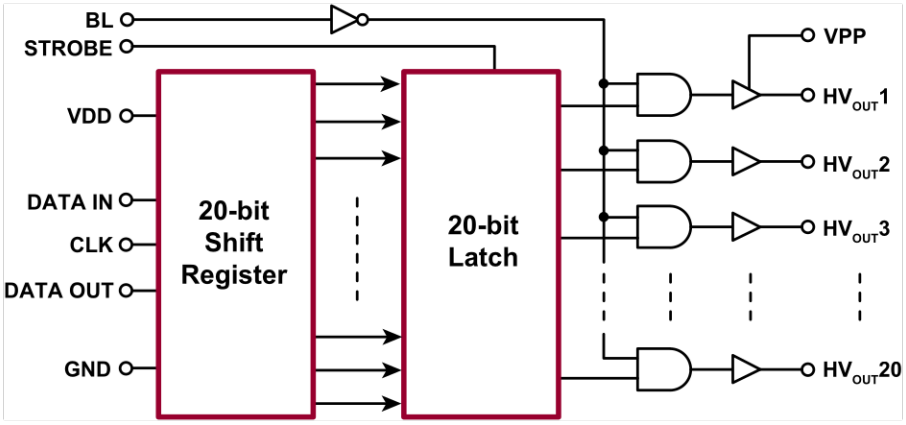



**28-lead SOW**
(Top view)




See Table 2-1 for pin information.

## 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°C unless otherwise indicated.

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

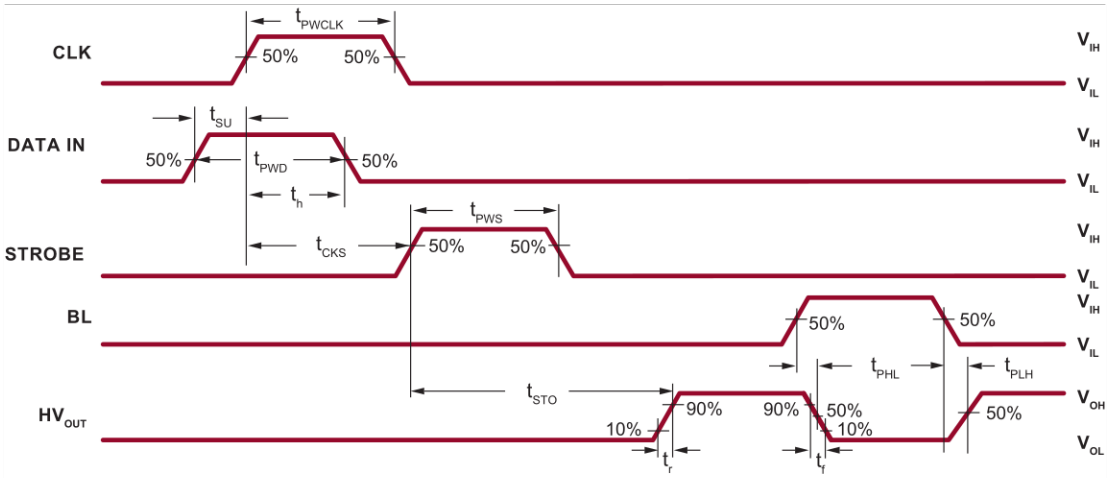
## AC ELECTRICAL CHARACTERISTICS

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

## TEMPERATURE SPECIFICATIONS

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

## Timing Waveforms



## 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 | $HV_{OUT}20$ | High-voltage output |
| 4 | $HV_{OUT}19$ | High-voltage output |
| 5 | $HV_{OUT}18$ | High-voltage output |
| 6 | $HV_{OUT}17$ | High-voltage output |
| 7 | $HV_{OUT}16$ | High-voltage output |
| 8 | $HV_{OUT}15$ | High-voltage output |
| 9 | $HV_{OUT}14$ | High-voltage output |
| 10 | $HV_{OUT}13$ | High-voltage output |
| 11 | $HV_{OUT}12$ | High-voltage output |
| 12 | $HV_{OUT}11$ | High-voltage output |
| 13 | BLANKING | Blank |
| 14 | GND | Logic and high-voltage ground |
| 15 | CLOCK | Data shift register clock |
| 16 | STROBE | Strobe |
| 17 | $HV_{OUT}10$ | High-voltage output |
| 18 | $HV_{OUT}9$ | High-voltage output |
| 19 | $HV_{OUT}8$ | High-voltage output |
| 20 | $HV_{OUT}7$ | High-voltage output |
| 21 | $HV_{OUT}6$ | High-voltage output |
| 22 | $HV_{OUT}5$ | High-voltage output |
| 23 | $HV_{OUT}4$ | High-voltage output |
| 24 | $HV_{OUT}3$ | High-voltage output |
| 25 | $HV_{OUT}2$ | High-voltage output |
| 26 | $HV_{OUT}1$ | 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 $V_{PP}$. (**Note 1**) | 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 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $I_1$ | $I_2$ | $I_3$... $I_{N-1}$ | $I_N$ | | | $I_1$ | $I_2$ | $I_3$... $I_{N-1}$ | $I_N$ | | $I_1$ | $I_2$ | $I_3$... $I_{N-1}$ | $I_N$ |
| 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

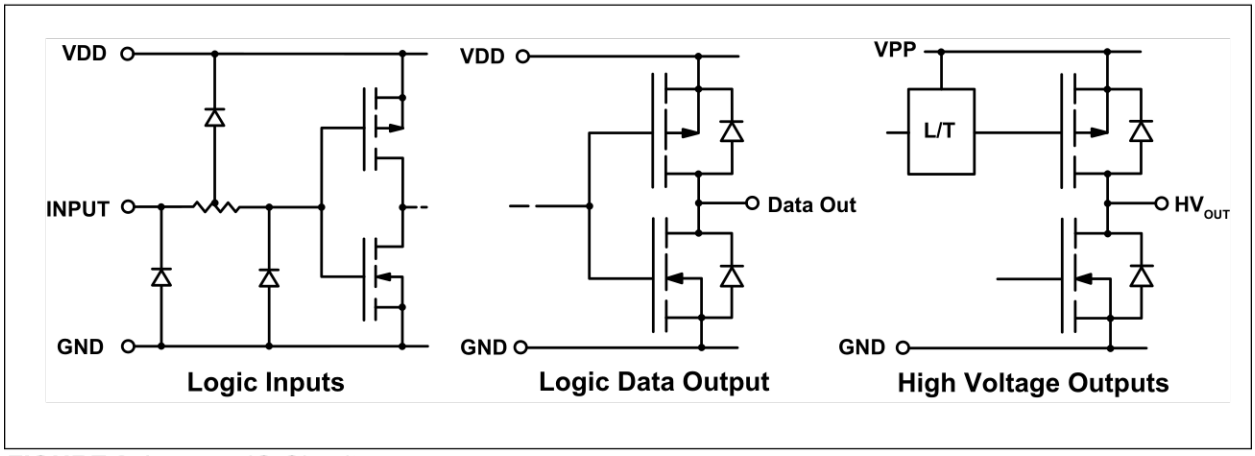
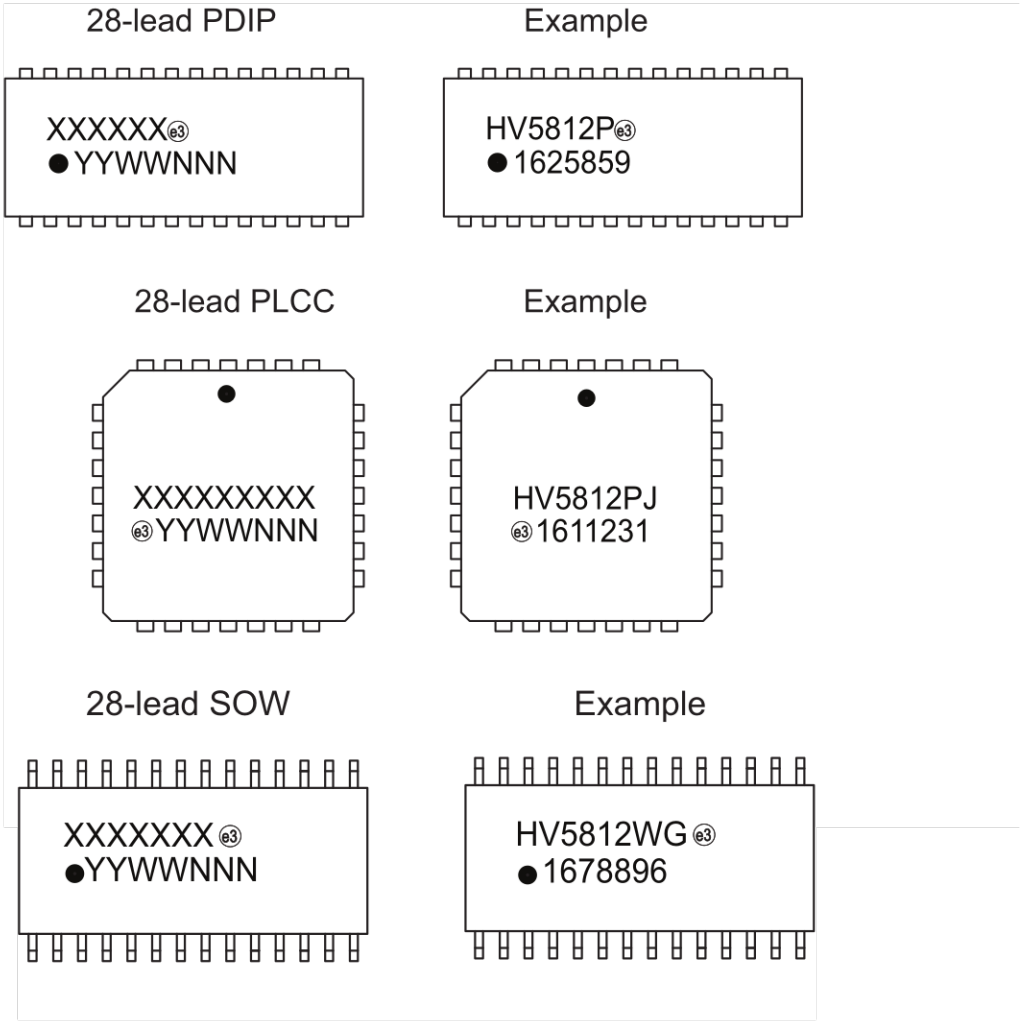



***FIGURE 3-1:*** *IO Circuits.*

## 4.0 PACKAGE MARKING INFORMATION

### 4.1 Packaging Information

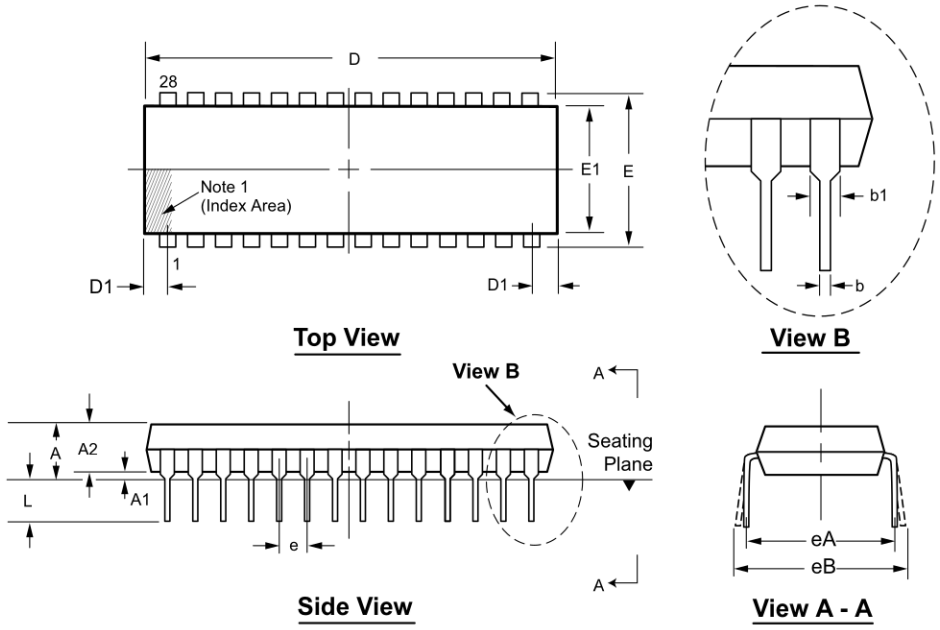



| | | |
|---|---|---|
| **Legend:** | XX...X | Product Code or Customer-specific information |
| | Y | Year code (last digit of calendar year) |
| | YY | Year code (last 2 digits of calendar year) |
| | WW | Week code (week of January 1 is week '01') |
| | NNN | Alphanumeric traceability code |
| | (e3) | 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.

## 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.

***Note:***

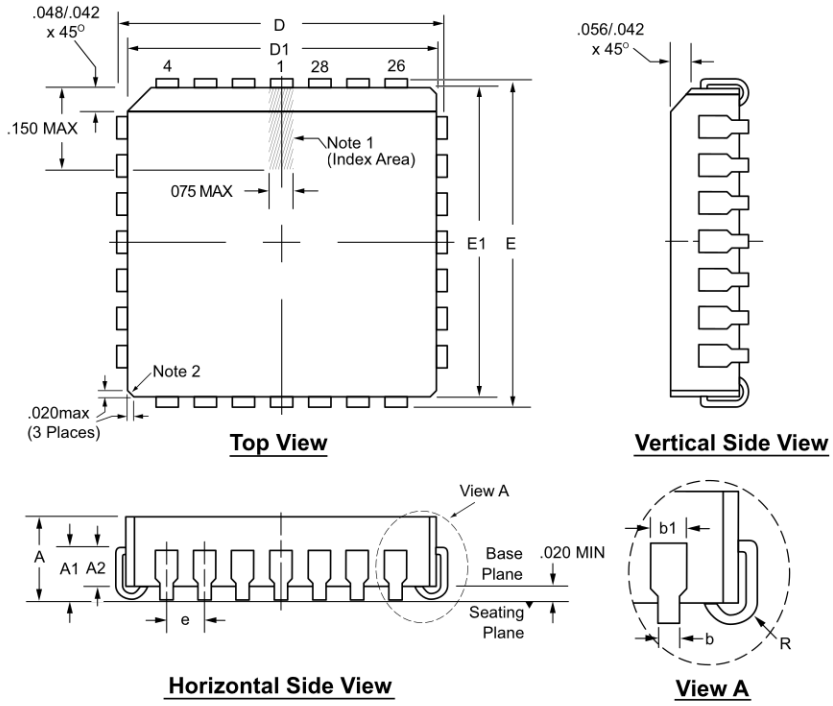
1. *A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.*

| 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.

***Notes:***

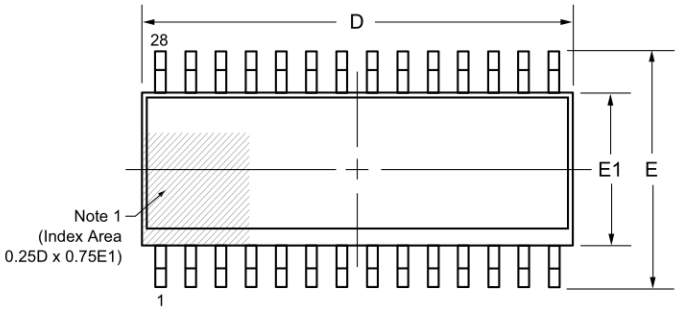
1. *A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.*
2. *Actual shape of this feature may vary.*

| 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 |

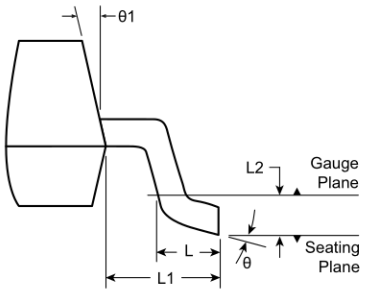
*JEDEC Registration MS-018, Variation AB, Issue A, June, 1993.*
***Drawings not to scale.***

## 28-Lead SOW (Wide Body) Package Outline (WG)

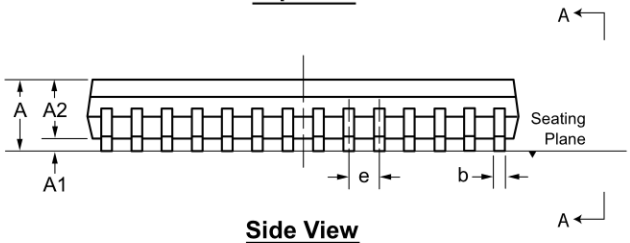
***17.90x7.50mm body, 2.65mm height (max), 1.27mm pitch***



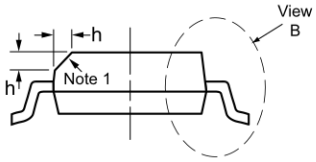

**Top View**




**View B**




**Side View**




**View A - A**

Note: For the most current package drawings, see the Microchip Packaging Specification at 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 | θ | θ1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dimension (mm) | MIN | 2.15* | 0.10 | 2.05 | 0.31 | 17.70* | 9.97* | 7.40* | 1.27 BSC | 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.***

**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

## PRODUCT IDENTIFICATION SYSTEM

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

| PART NO. | XX | - | X | - | X |
|---|---|---|---|---|---|
| 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 f or a WG Package |
| | M904 | = | 750/Reel for a PJ Package |

**Examples:**

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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