

## 10-Channel Serial-Input Latched Display Driver

### Features

- High Output Voltage 80V
- High-speed 5 MHz at 5 V<sub>DD</sub>
- Low-power I<sub>BB</sub> ≤ 0.1 mA (All High)
- Active Pull-down 100 µA Minimum at 25°C
- Output Source Current 25 mA at 60V V<sub>BB</sub>
- 10-channel Display Driver
- High-speed Serially-shifted Data Input
- 5V CMOS-compatible Inputs
- Latches on all Driver Outputs
- Pin-compatible Replacement for UCN5810A, TL4810A and TL4810B

### Applications

- High-speed Dot Matrix Print Head Driver
- Vacuum Fluorescent Display (VFD) Driver

### General Description

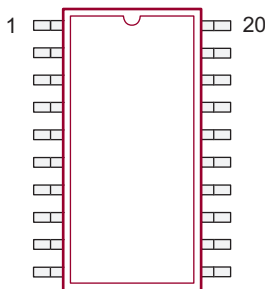
The HV6810 is a monolithic integrated circuit designed to drive a dot matrix or segmented VFD. These devices feature a serial data output to cascade additional devices for large displays.

A 10-bit data word is serially loaded into the shift register on the positive-going transition of the clock. Parallel data are transferred to the output buffers through a 10-bit D-type latch while the latch enable input is high. The data are latched when the latch enable is low. When the blanking input is high, all of the outputs are low.

Outputs are structures formed by double-diffused MOS (DMOS) transistors with output voltage ratings of 80V and 25 mA source-current capability. All inputs are compatible with CMOS levels.

### Package Type

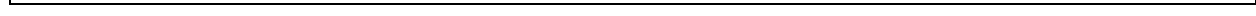
**20-lead SOW**  
(Top view)



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

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## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings† (Note 1)

|                                                                  |                          |
|------------------------------------------------------------------|--------------------------|
| Logic Supply Voltage, $V_{DD}$ (Note 2)                          | 7.5V                     |
| Driver Supply Voltage, $V_{BB}$ (Note 2)                         | 90V                      |
| Output Voltage (Note 2)                                          | 90V                      |
| Input Voltage (Note 2)                                           | -0.3V to $V_{DD} + 0.3V$ |
| Operating Ambient Temperature, $T_A$                             | -45°C to +85°C           |
| Continuous Total Power Dissipation at 25°C Free-air Temperature: |                          |
| 20-lead SOW (Note 3)                                             | 1500 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:** Over operating free-air temperature  
**2:** All voltages are referenced to  $V_{SS}$ .  
**3:** For operations above 25°C ambient, derate linearly to 85°C at 15 mW/°C.

### RECOMMENDED OPERATING CONDITIONS

| Parameter                                        | Sym.      | Min. | Typ. | Max. | Unit | Conditions |
|--------------------------------------------------|-----------|------|------|------|------|------------|
| Logic Supply Voltage                             | $V_{DD}$  | 4.5  | —    | 5.5  | V    |            |
| High Supply Voltage                              | $V_{BB}$  | 20   | —    | 80   | V    |            |
| Supply Voltage                                   | $V_{SS}$  | —    | 0    | —    | V    |            |
| High-level Input Voltage<br>(for $V_{DD} = 5V$ ) | $V_{IH}$  | 3.5  | —    | 5.3  | V    |            |
| Low-level Input Voltage                          | $V_{IL}$  | -0.3 | —    | 0.8  | V    |            |
| Continuous High-level Q Output<br>Current        | $I_{OH}$  | 25   | —    | —    | mA   |            |
| Clock Frequency                                  | $f_{CLK}$ | —    | —    | 5    | MHz  |            |
| Operating Ambient Temperature                    | $T_A$     | -40  | —    | +85  | °C   |            |

### DC ELECTRICAL CHARACTERISTICS

| Electrical Specifications: $V_{DD} = 5V$ , $V_{BB} = 60V$ , $V_{SS} = 0V$ and $T_A = 25^\circ C$ unless otherwise noted. |               |              |      |      |     |         |
|--------------------------------------------------------------------------------------------------------------------------|---------------|--------------|------|------|-----|---------|
| Parameter                                                                                                                |               | Sym.         | Min. | Typ. | Max | Unit    |
| High-level Output<br>Voltage                                                                                             | Q Outputs     | $V_{OH}$     | 57.5 | 58   | —   | V       |
|                                                                                                                          | Serial Output |              | 4    | 4.5  | —   |         |
| Low-level Output<br>Voltage                                                                                              | Q Outputs     | $V_{OL}$     | —    | 0.15 | 1   | V       |
|                                                                                                                          | Serial Output |              | —    | 0.05 | 0.1 |         |
| Low-level Q Output Current<br>(Pull-down Current)                                                                        |               | $I_{OL}$     | 60   | 80   | —   | $\mu A$ |
| Off-state Output Current                                                                                                 |               | $I_{O(OFF)}$ | —    | -1   | -15 | $\mu A$ |
| High-level Input Current                                                                                                 |               | $I_{IH}$     | —    | —    | 1   | $\mu A$ |
| Supply Current from $V_{DD}$ (Standby)                                                                                   |               | $I_{DD}$     | —    | 10   | 50  | $\mu A$ |
|                                                                                                                          |               |              | —    | 10   | 50  |         |

**Note 1:** All typical values are at  $T_A = 25^\circ C$  except for  $I_{OL}$  and  $I_{O(OFF)}$ .

# HV6810

## DC ELECTRICAL CHARACTERISTICS (CONTINUED)

| Electrical Specifications: $V_{DD} = 5V$ , $V_{BB} = 60V$ , $V_{SS} = 0V$ and $T_A = 25^\circ C$ unless otherwise noted. |          |      |      |     |      |                                         |
|--------------------------------------------------------------------------------------------------------------------------|----------|------|------|-----|------|-----------------------------------------|
| Parameter                                                                                                                | Sym.     | Min. | Typ. | Max | Unit | Conditions                              |
| Supply Current from $V_{BB}$                                                                                             | $I_{BB}$ | —    | 0.05 | 0.1 | mA   | All outputs low,<br>all Q outputs open  |
|                                                                                                                          |          | —    | 0.05 | 0.1 |      | All outputs high,<br>all Q outputs open |

**Note 1:** All typical values are at  $T_A = 25^\circ C$  except for  $I_{OL}$  and  $I_{O(OFF)}$ .

## AC ELECTRICAL CHARACTERISTICS

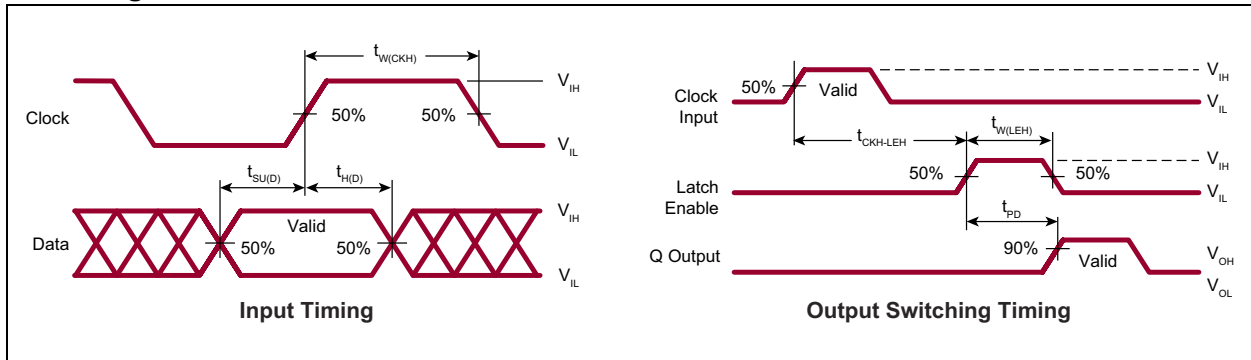
| Electrical Specifications: Timing requirements are over the recommended operating conditions. |               |      |      |     |      |                        |
|-----------------------------------------------------------------------------------------------|---------------|------|------|-----|------|------------------------|
| Parameter                                                                                     | Sym.          | Min. | Typ. | Max | Unit | Conditions             |
| Pulse Duration, Clock High                                                                    | $t_{W(CKH)}$  | 100  | —    | —   | ns   |                        |
| Pulse Duration, Latch Enable High                                                             | $t_{W(LEH)}$  | 100  | —    | —   | ns   |                        |
| Setup Time, Data before Clock                                                                 | $t_{SU(D)}$   | 50   | —    | —   | ns   |                        |
| Hold Time, Data after Clock                                                                   | $t_{H(D)}$    | 50   | —    | —   | ns   |                        |
| Delay Time, Clock to Latch Enable High                                                        | $t_{CKH-LEH}$ | 50   | —    | —   | ns   |                        |
| Propagation Delay Time, Latch Enable to Output                                                | $t_{PD}$      | —    | 300  | —   | ns   | <a href="#">Note 1</a> |

**Note 1:** Switching characteristics,  $V_{BB} = 60V$ ,  $T_A = 25^\circ C$

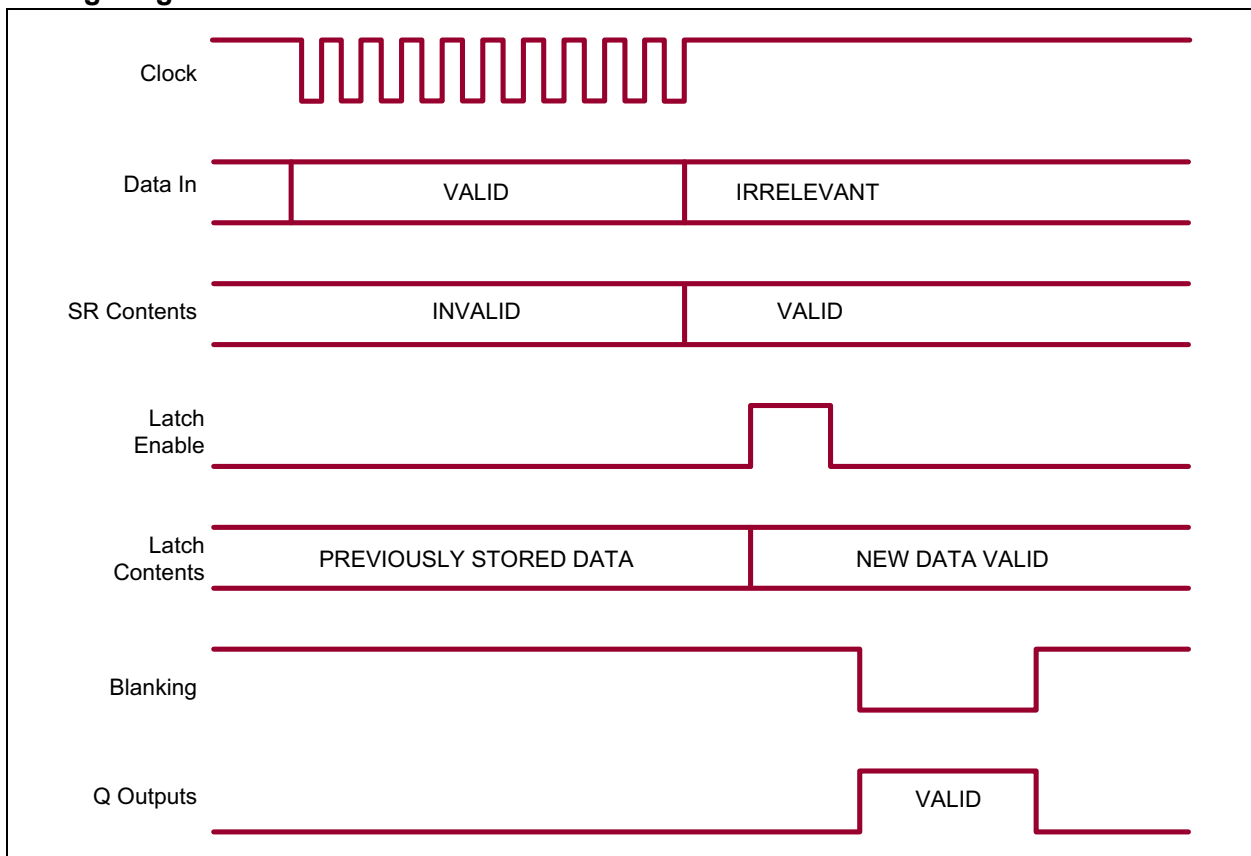
## TEMPERATURE SPECIFICATIONS

| Parameter                         | Sym.          | Min. | Typ. | Max. | Unit         | Conditions |
|-----------------------------------|---------------|------|------|------|--------------|------------|
| <b>TEMPERATURE RANGE</b>          |               |      |      |      |              |            |
| Operating Ambient Temperature     | $T_A$         | -40  | —    | +85  | $^\circ C$   |            |
| <b>PACKAGE THERMAL RESISTANCE</b> |               |      |      |      |              |            |
| 20-lead SOW                       | $\theta_{JA}$ | —    | 66   | —    | $^\circ C/W$ |            |

## Switching Waveforms



## Timing Diagram



# HV6810

## 2.0 PIN DESCRIPTION

The details on the pins of HV6810 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          | Q8              | High-voltage output                                                                                                         |
| 2          | Q7              |                                                                                                                             |
| 3          | Q6              |                                                                                                                             |
| 4          | CLOCK           | Input data are shifted into the data shift register on the positive edge of the clock.                                      |
| 5          | VSS             | Usually $V_{SS} = 0V$ ; ground connection                                                                                   |
| 6          | N/C             | No connection                                                                                                               |
| 7          | VDD             | Low-voltage power supply                                                                                                    |
| 8          | LE (STROBE)     | When LE is high, the shift register output is latched to Q output. When LE stays high, the latches are in Transparent mode. |
| 9          | Q5              | High-voltage output                                                                                                         |
| 10         | Q4              |                                                                                                                             |
| 11         | Q3              |                                                                                                                             |
| 12         | Q2              |                                                                                                                             |
| 13         | Q1              |                                                                                                                             |
| 14         | BLANKING        | When blanking is high, all Q's are forced to a Low state regardless of data in each channel.                                |
| 15         | DATA IN         | Input data for the input shift register                                                                                     |
| 16         | VBB             | High-voltage power supply                                                                                                   |
| 17         | SERIAL DATA OUT | Output data from the shift register                                                                                         |
| 18         | N/C             | No connection                                                                                                               |
| 19         | Q10             | High-voltage output                                                                                                         |
| 20         | Q9              |                                                                                                                             |

## 3.0 FUNCTIONAL DESCRIPTION

Follow the steps below to power up and power down the HV6810.

### POWER-UP AND POWER-DOWN SEQUENCE <sup>1</sup>

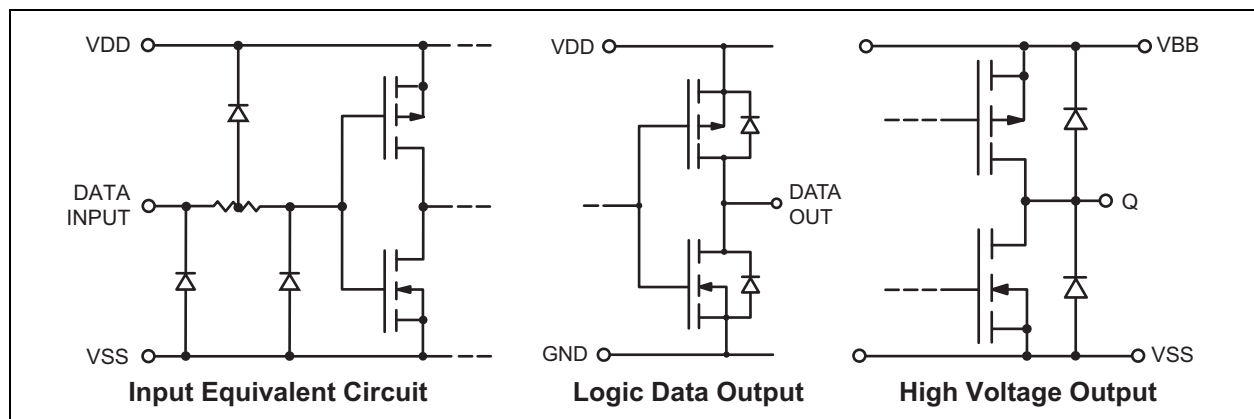
| Power-up |                                                            | Power-down |                              |
|----------|------------------------------------------------------------|------------|------------------------------|
| Step     | Description                                                | Step       | Description                  |
| 1        | Connect ground $V_{SS}$ .                                  | 1          | Remove $V_{BB}$ .            |
| 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 $V_{BB}$ .                                           | 4          | Disconnect ground $V_{SS}$ . |

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

### FUNCTION TABLE <sup>1</sup>

| Serial Data Input | Clock Input | Shift Register Contents |       |                 |           | Serial Data Output | LE Strobe Input | Latch Contents |       |                 |       | Blanking Input | 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     |

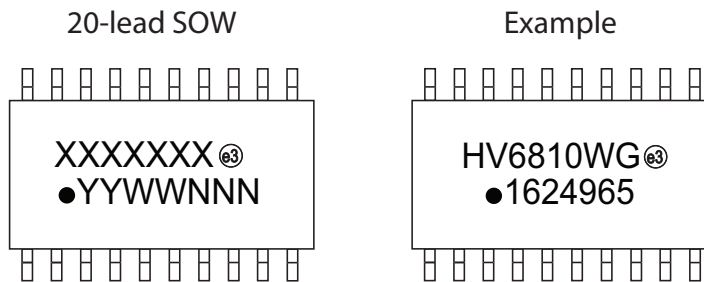
**Note 1:** L = Low logic level  
H = High logic level  
X = Don't care  
P = Present state  
R = Previous state



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

## 4.0 PACKAGE MARKING INFORMATION

### 4.1 Packaging Information

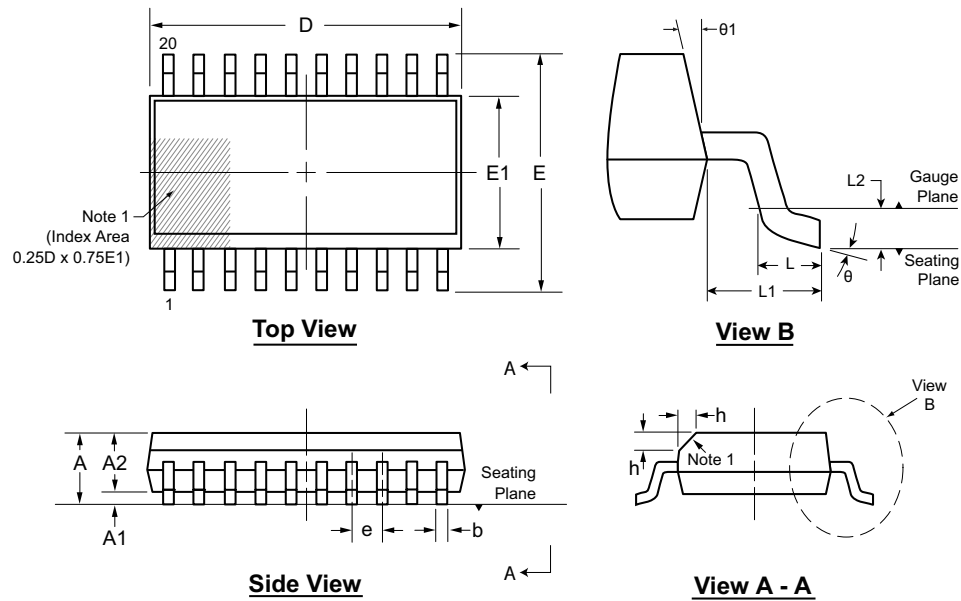


|                |        |                                                                                                                  |
|----------------|--------|------------------------------------------------------------------------------------------------------------------|
| <b>Legend:</b> | 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                                                                                   |
|                | 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.



## 20-Lead SOW (Wide Body) Package Outline (WG) 12.80x7.50mm 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          | θ  | θ1  |
|-------------------|-----|-------|------|-------|------|--------|--------|-------|-------------|------|------|-------------|-------------|----|-----|
| Dimension<br>(mm) | MIN | 2.15* | 0.10 | 2.05  | 0.31 | 12.60* | 9.97*  | 7.40* | 1.27<br>BSC | 0.25 | 0.40 | 1.40<br>REF | 0.25<br>BSC | 0° | 5°  |
|                   | NOM | -     | -    | -     | -    | 12.80  | 10.30  | 7.50  |             | -    | -    |             |             | -  | -   |
|                   | MAX | 2.65  | 0.30 | 2.55* | 0.51 | 13.00* | 10.63* | 7.60* |             | 0.75 | 1.27 |             |             | 8° | 15° |

JEDEC Registration MS-013, Variation AC, 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-HV6810 to Microchip DS20005626A
- Removed the PJ package option
- Changed the quantity of the WG package from 1000/Reel to 1600/Reel
- Made minor text changes throughout the document

# HV6810

## 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:         | HV6810          | = | 10-Channel Serial-Input Latched Display Driver |   |            |
| Package:        | WG              | = | 20-lead SOIC                                   |   |            |
| Environmental:  | G               | = | Lead (Pb)-free/RoHS-compliant Package          |   |            |
| Media Type:     | (blank)         | = | 1600/Reel for a WG Package                     |   |            |

**Example:**  
a) HV6810WG-G: 10-Channel Serial-Input Latched Display Driver, 20-lead SOIC, 1600/Reel for a WG Package

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ISBN: 978-1-5224-1003-4

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