

## High-Voltage Low-Noise Inductorless EL Lamp Driver

### Features

- No External Components required when using an External Electroluminescent (EL) Clock Frequency
- EL Frequency can be set by an External Resistor
- Low Noise
- DC to AC Converter
- Drives up to 5 nF Load (Approximately 1.5 in<sup>2</sup> Lamp)
- Output Voltage Regulation
- Enable Function
- EL Lamp Dimming

### Applications

- Cellphone Keypads and Displays
- Transceivers
- MP3 Players
- Watches
- Pagers
- Measuring Instruments/Gauge

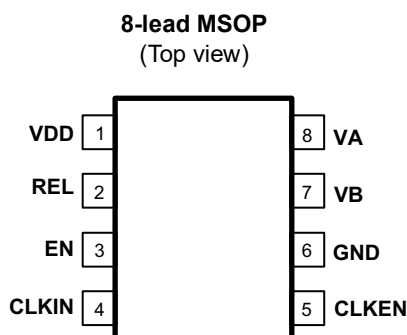
### General Description

The HV850 is a high-voltage EL Lamp Driver IC. It is designed to drive EL lamps of up to 1.5 in<sup>2</sup> with capacitive values of up to 5 nF. The HV850 converts a low-voltage DC input to a high-voltage AC output across an EL lamp. It uses a charge pump scheme to boost the input voltage, eliminating the need for external inductors, diodes, and high-voltage capacitors, components commonly found in conventional topologies.

The charge pump circuit discharges its energy into an EL lamp through a high-voltage H-bridge. Once the voltage reaches its regulated limit, it is turned off to conserve power. The EL lamp is then discharged to ground and the H-bridge changes state to allow the charge pump to charge the EL lamp in the opposite direction.

The EL lamp frequency can be set either by an external resistor,  $R_{EL}$ , or by applying an external clock where the clock frequency is divided by 128 to set the EL lamp frequency.

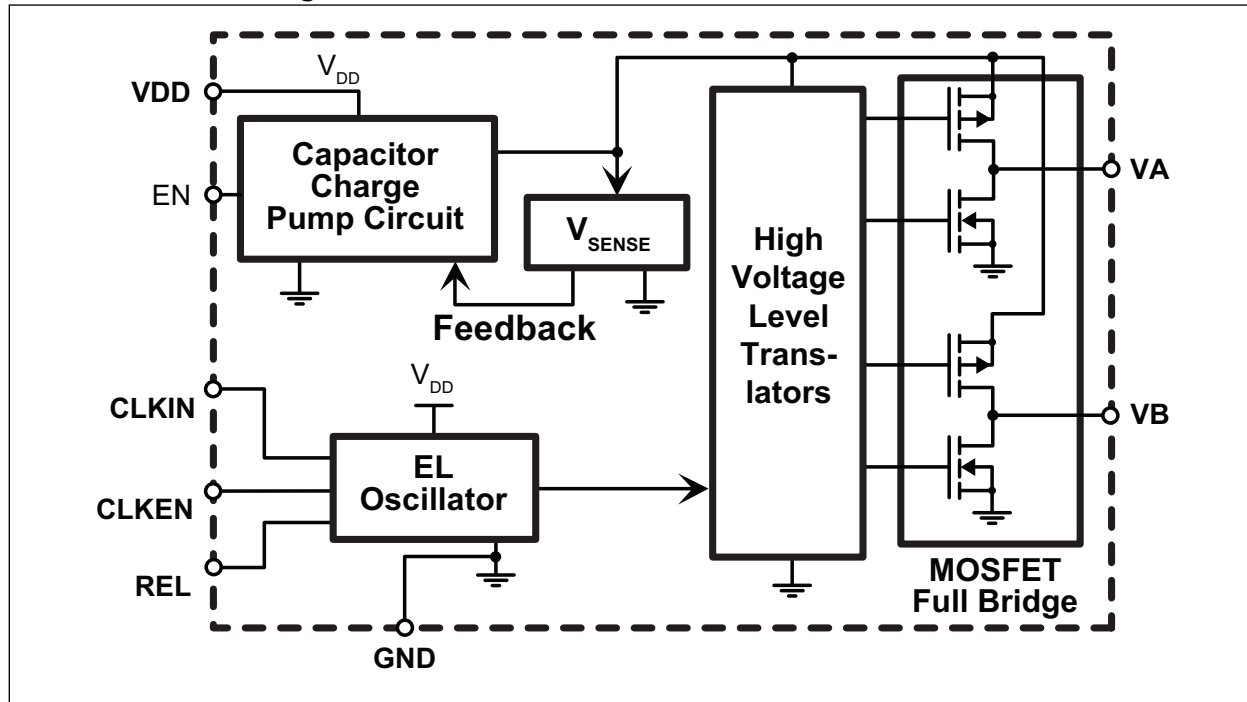
### Package Type



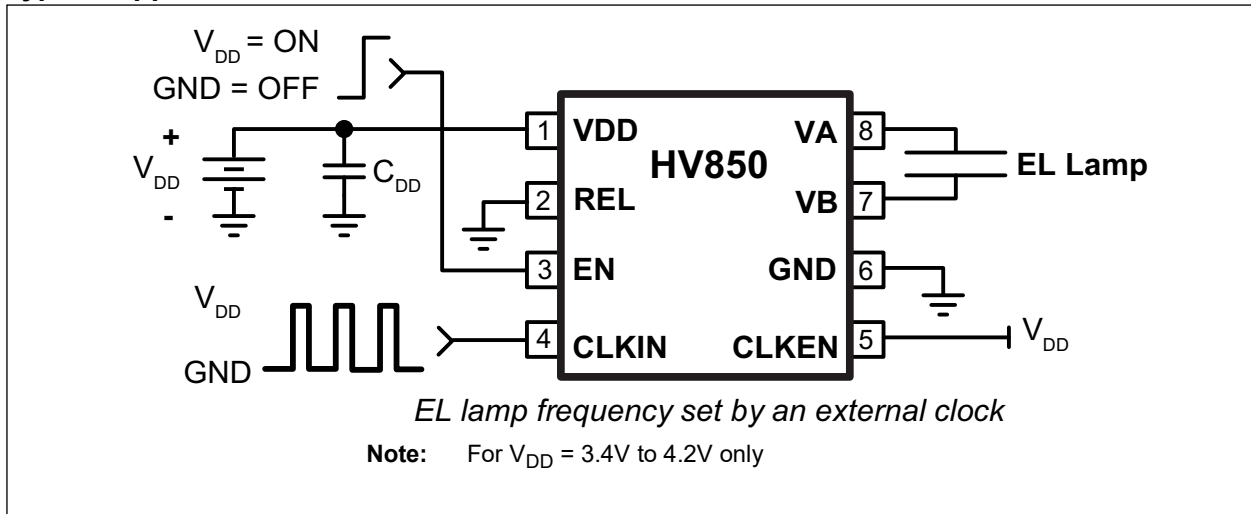
See [Table 2-1](#) for pin information.

# HV850

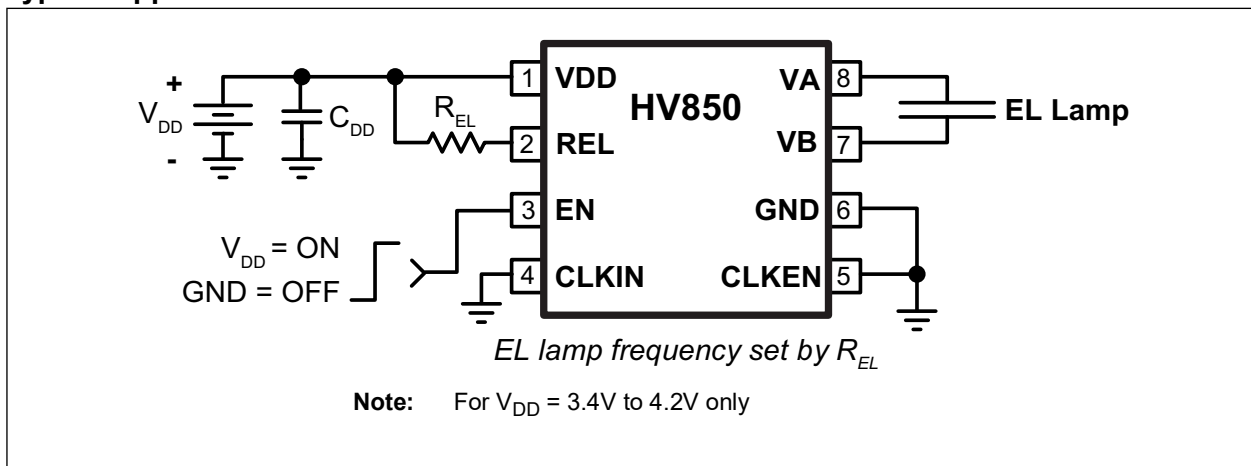
Functional Block Diagram



## Typical Application Circuit 1



## Typical Application Circuit 2



# HV850

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings<sup>(†)</sup>

|                                            |                 |
|--------------------------------------------|-----------------|
| Supply Voltage, $V_{DD}$                   | –0.5V to 4.5V   |
| Operating Ambient Temperature Range, $T_A$ | –25°C to +85°C  |
| Storage Temperature Range, $T_S$           | –65°C to +150°C |
| Power Dissipation:                         |                 |
| 8-lead MSOP                                | 300 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 |
|-------------------------------|------------|------|------|------|------|------------|
| Input Voltage                 | $V_{DD}$   | 3    | —    | 4.2  | V    |            |
| EL Lamp Frequency             | $f_{EL}$   | 50   | —    | 500  | Hz   |            |
| EL Lamp Capacitance           | $C_{LOAD}$ | 0    | —    | 5    | nF   |            |
| Operating Ambient Temperature | $T_A$      | –25  | —    | +85  | °C   |            |

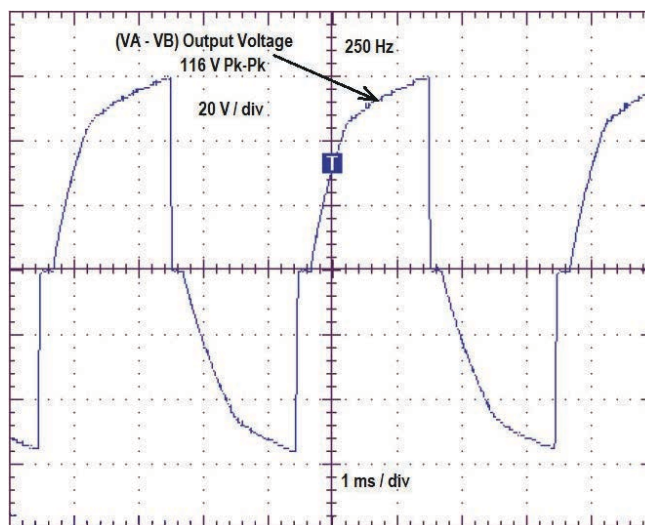
### ELECTRICAL CHARACTERISTICS

| <b>Electrical Specifications:</b> $V_{DD} = 3.5V$ and $T_A = 25^\circ C$ unless otherwise specified. |                    |          |      |          |         |                                                                                                                     |
|------------------------------------------------------------------------------------------------------|--------------------|----------|------|----------|---------|---------------------------------------------------------------------------------------------------------------------|
| Parameter                                                                                            | Sym.               | Min.     | Typ. | Max.     | Unit    | Conditions                                                                                                          |
| Quiescent Current                                                                                    | $I_{DDQ}$          | —        | —    | 150      | nA      | EN = 0V                                                                                                             |
| Peak Output Voltage                                                                                  | $V_A$ or $V_B$     | 63       | 70   | 77       | V       | No load                                                                                                             |
| Peak-to-Peak Output Voltage                                                                          | $V_A - V_B$        | 126      | 140  | 154      | V       |                                                                                                                     |
| EL Lamp Frequency                                                                                    | $f_{EL}$           | 225      | 250  | 275      | Hz      | REL = 1.65 M $\Omega$ or<br>CLK = 32 kHz                                                                            |
| Operating Current                                                                                    | $I_{DD}$           | —        | —    | 16       | mA      | $V_{DD} = 3.5V$ ,<br>$R_{EL} = 1.5 M\Omega$ ,<br>Load = 3.3 nF + 1 k $\Omega$<br>(See <a href="#">Figure 3-1.</a> ) |
| Peak Output Voltage                                                                                  | $V_A$ or $V_B$     | 54       | —    | 74       | V       |                                                                                                                     |
| Peak-to-Peak Output Voltage                                                                          | $V_A - V_B$        | 108      | —    | 148      | V       |                                                                                                                     |
| EL Lamp Frequency                                                                                    | $f_{EL}$           | 250      | 294  | 338      | Hz      |                                                                                                                     |
| Output Voltage Rise Time                                                                             | $t_{rout}$         | 1.5      | —    | —        | ms      | $f_{EL} = 250$ Hz, 1 in <sup>2</sup> lamp,<br>10% to 90% of final value                                             |
| <b>LOGIC INPUTS</b>                                                                                  |                    |          |      |          |         |                                                                                                                     |
| Input Logic Low Voltage                                                                              | $V_{IL}$           | 0        | —    | 0.5      | V       |                                                                                                                     |
| Input Logic High Voltage                                                                             | $V_{IH}$           | 2        | —    | $V_{DD}$ | V       |                                                                                                                     |
| Input Logic Low Current                                                                              | $I_{IL}$           | —        | —    | 1        | $\mu A$ |                                                                                                                     |
| Input Logic High Current                                                                             | $I_{IH}$           | —        | —    | 1        | $\mu A$ |                                                                                                                     |
| Enable Input Rise Time<br>(For Delay Turn-on)                                                        | EN <sub>rise</sub> | 0.01     | —    | 10       | ms      | Using external R-C circuit<br>(See <a href="#">Figure 3-2.</a> )                                                    |
| Enable Input Fall Time<br>(For Delay Turn-off)                                                       | EN <sub>fall</sub> | 10 $\mu$ | —    | 5        | s       |                                                                                                                     |
| Logic Input Capacitance                                                                              | $C_{IN}$           | —        | —    | 10       | pF      |                                                                                                                     |

## TEMPERATURE SPECIFICATIONS

| Parameter                         | Sym.          | Min. | Typ. | Max. | Unit | Conditions |
|-----------------------------------|---------------|------|------|------|------|------------|
| <b>TEMPERATURE RANGE</b>          |               |      |      |      |      |            |
| Storage Temperature               | $T_S$         | -65  | —    | +150 | °C   |            |
| Operating Ambient Temperature     | $T_A$         | -25  | —    | +85  | °C   |            |
| <b>PACKAGE THERMAL RESISTANCE</b> |               |      |      |      |      |            |
| 8-lead MSOP                       | $\theta_{JA}$ | —    | 216  | —    | °C/W |            |

## Typical Output Waveform



**Note:** Test conditions,  $V_{DD} = 3.5V$ ,  $F_{EL} = 250.0\text{ Hz}$ ; Load =  $3.3\text{ nF} + 1.0\text{ k}\Omega$ ;  $I_{DD} = 9.19\text{ mA}$

## 2.0 PIN DESCRIPTION

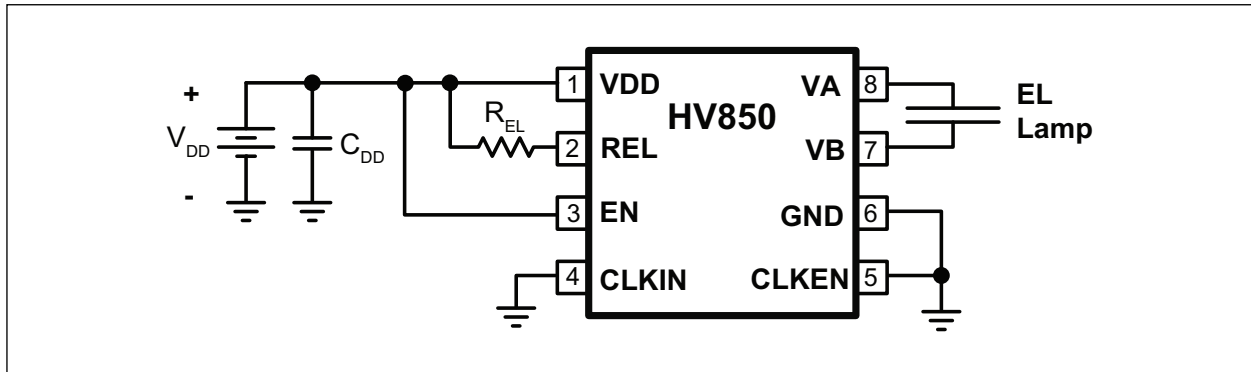
The details on the pins of HV850 are listed in [Table 2-1](#).

Refer to [Package Type](#) for the location of pins.

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

| Pin Number | Pin Name | Description                                                                                                                                                                                                                                                              |
|------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1          | VDD      | Input supply voltage pin                                                                                                                                                                                                                                                 |
| 2          | REL      | An external resistor to VDD will set the EL lamp frequency. The EL lamp frequency is inversely proportional to the resistor value.                                                                                                                                       |
| 3          | EN       | Enable input pin. Logic high will turn on the device. An external R-C circuit can be added for a delayed turn-off. Logic low will turn off the device only for $V_{DD} = 3.4V$ to $4.2V$ . For $V_{DD}$ lower than $3.4V$ , logic low will not turn off the device.      |
| 4          | CLKIN    | Logic input pin. An external logic clock applied to this pin can be used to set the EL lamp frequency. (See <a href="#">Figure 3-3</a> .) This is useful for applications requiring the EL lamp to be synchronized to a system clock. Connect to ground when not in use. |
| 5          | CLKEN    | Logic input pin. Logic high will cause the EL lamp frequency to be set by the CLKIN input. Logic low will cause the EL lamp frequency to be set by the external $R_{EL}$ resistor.                                                                                       |
| 6          | GND      | IC ground pin                                                                                                                                                                                                                                                            |
| 7          | VB       | EL lamp driver output pin. The EL lamp is connected across VA and VB terminals.                                                                                                                                                                                          |
| 8          | VA       | EL lamp driver output pin. The EL lamp is connected across VA and VB terminals.                                                                                                                                                                                          |

## 3.0 APPLICATION INFORMATION



**FIGURE 3-1:** Typical Application Circuit (without Enable Function).

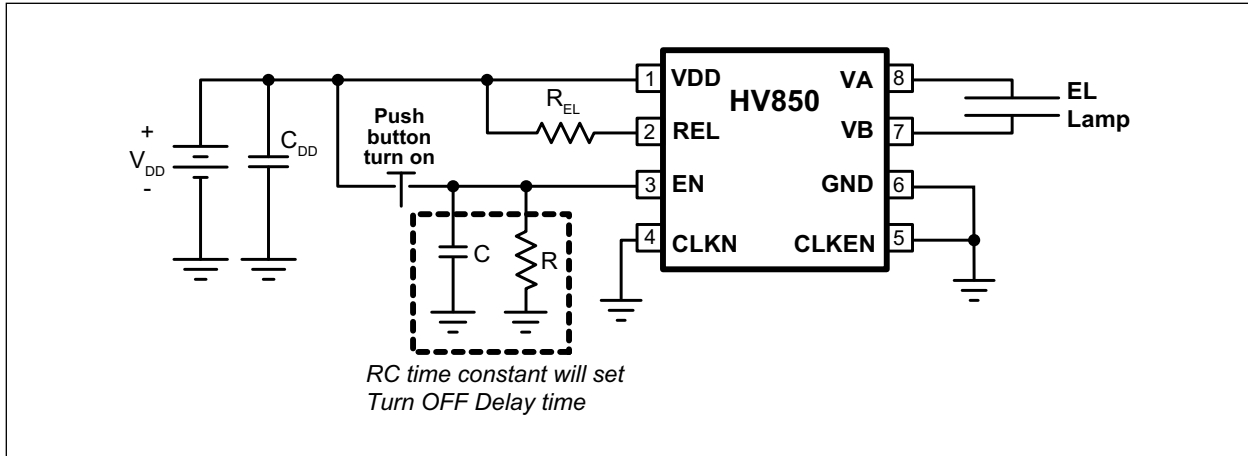
**TABLE 3-1: TYPICAL PARAMETERS**

| Load<br>(Lamp Equivalent) | $R_{EL}$<br>(M $\Omega$ ) | $V_{DD}$<br>(V) | $I_{DD}$<br>(mA) | Peak $V_A$<br>(V) | $f_{EL}$<br>(Hz) |
|---------------------------|---------------------------|-----------------|------------------|-------------------|------------------|
| 3.3 nF + 1 k $\Omega$     | 1.5                       | 3               | 8.9              | 53                | 294              |
|                           |                           | 3.5             | 10.2             | 61                |                  |
|                           |                           | 4               | 10.4             | 66                |                  |

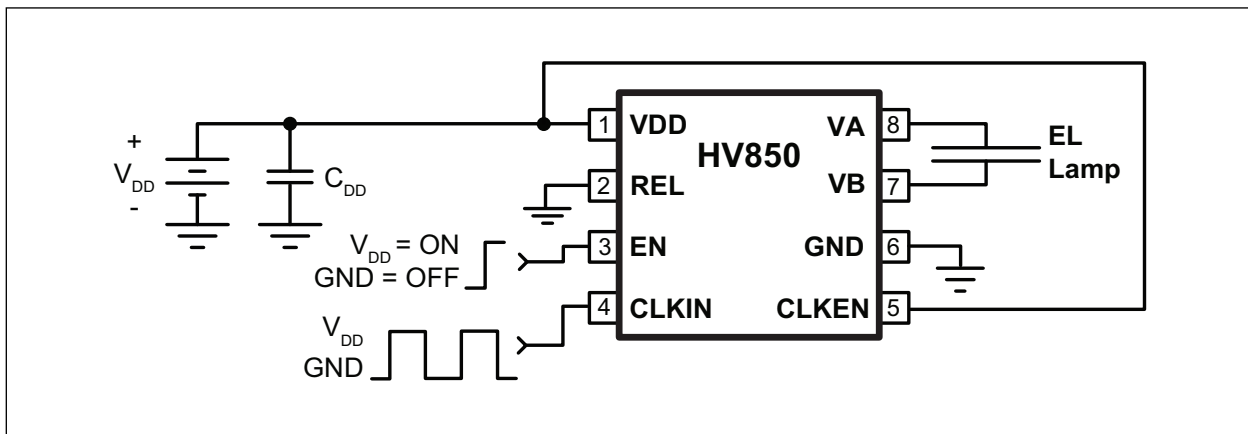
**Note 1:**  $C_{DD}$  = 2.2  $\mu$ F, 6.3V low ESR

**TABLE 3-2: TYPICAL PERFORMANCE**

| Lamp Size | $R_{EL}$<br>(M $\Omega$ ) | $V_{DD}$<br>(V) | $I_{DD}$<br>(mA) | Peak $V_A$<br>(V) | $f_{EL}$<br>(Hz) | Brightness<br>(cd/m <sup>2</sup> ) |
|-----------|---------------------------|-----------------|------------------|-------------------|------------------|------------------------------------|
| 1         | 1.65                      | 3               | 8.4              | 53                | 250              | 7.31                               |
|           |                           | 3.5             | 9.4              | 62                |                  | 10.35                              |
|           |                           | 4               | 9.9              | 66                |                  | 12.62                              |
| 0.5       | 2                         | 3               | 5.5              | 62                | 210              | 11.54                              |
|           |                           | 3.5             | 5.3              | 68                |                  | 14.33                              |
|           |                           | 4               | 4.9              | 68                |                  | 14.9                               |
| 1         | 3.3                       | 3               | 5.6              | 62                | 128              | 8.55                               |
|           |                           | 3.5             | 5.4              | 67                |                  | 10.29                              |
|           |                           | 4               | 5                | 68                |                  | 10.94                              |
| 0.5       | 3.3                       | 3               | 4.6              | 64                | 128              | 8.25                               |
|           |                           | 3.5             | 4.1              | 68                |                  | 9.62                               |
|           |                           | 4               | 3.8              | 68                |                  | 9.95                               |
| 1         | 4.7                       | 3               | 4.8              | 64                | 89               | 6.02                               |
|           |                           | 3.5             | 4.4              | 68                |                  | 7.5                                |
|           |                           | 4               | 5                | 68                |                  | 10.94                              |



**FIGURE 3-2:** Push Button Turn-on with Delay Turn-off (For  $V_{DD} = 3.4V$  to  $4.2V$  only).

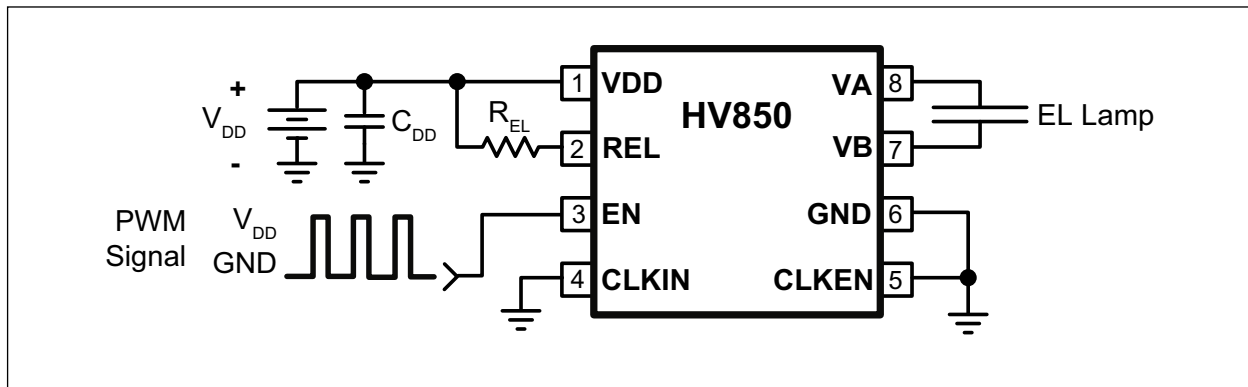


**FIGURE 3-3:** Independent Programmable Output Frequency ( $f_{EL}$ ) (For  $V_{DD} = 3.4V$  to  $4.2V$  only).

### 3.1 EL Lamp Dimming Using PWM

EL lamp dimming can be achieved by applying a PWM signal to the Enable pin. The PWM signal duty cycle is proportional to the lamp brightness. This is done by

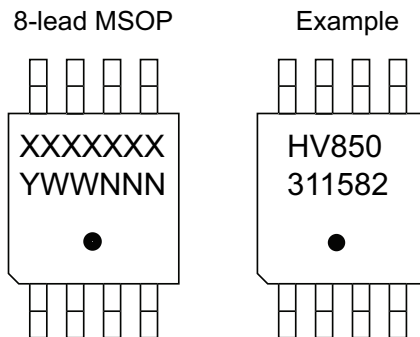
pulse skipping the output pulses. The PWM frequency should be kept below the EL frequency but above 50 Hz to avoid flickering.



**FIGURE 3-4:** PWM Dimming Circuit (For  $V_{DD} = 3.4V$  to  $4.2V$  only).

## 4.0 PACKAGING INFORMATION

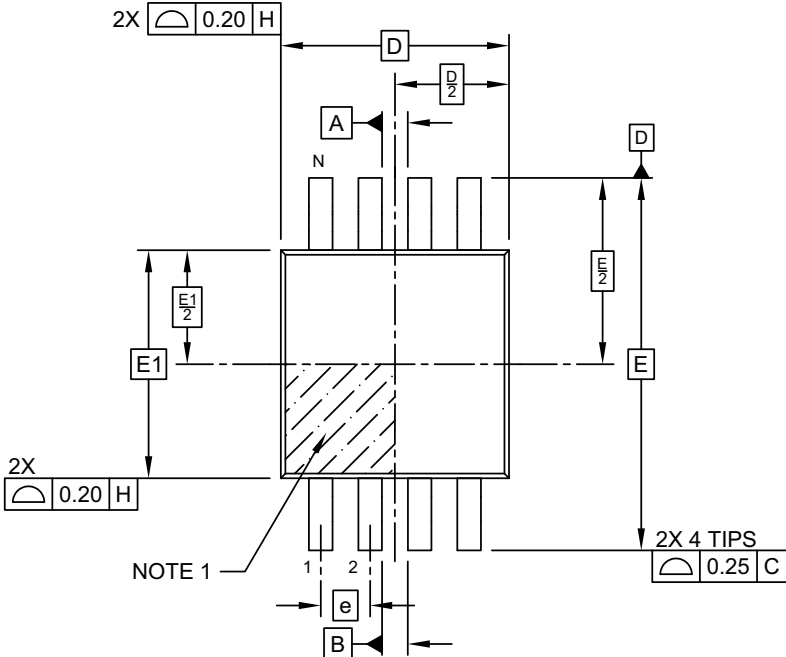
### 4.1 Package Marking Information



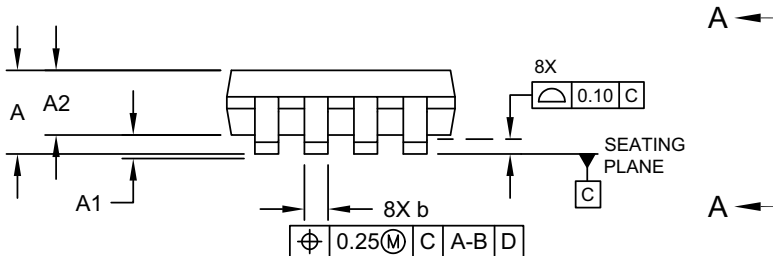
|                |        |                                                                                                                    |
|----------------|--------|--------------------------------------------------------------------------------------------------------------------|
| <b>Legend: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

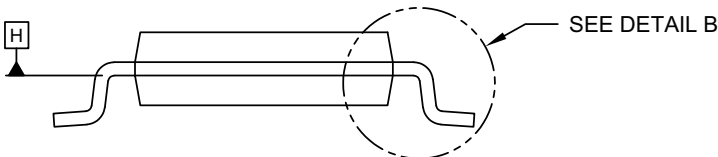
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packageing>



TOP VIEW



### SIDE VIEW

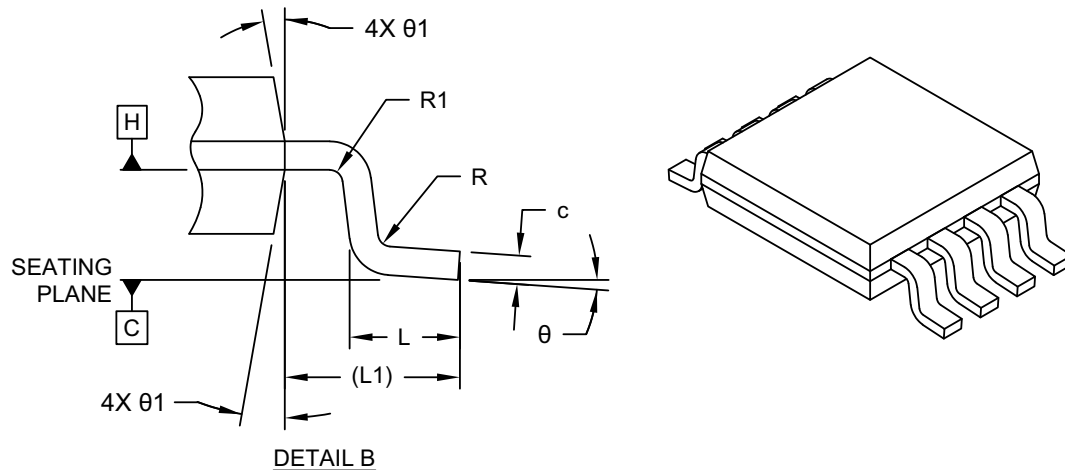


VIEW A-A

Microchip Technology Drawing C04-111-A3X Rev F Sheet 1 of 2

## 8-Lead Plastic Micro Small Outline Package (A3X) - 3x3 mm Body [MSOP]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



| Dimension Limits         | Units | MILLIMETERS |      |      |
|--------------------------|-------|-------------|------|------|
|                          |       | MIN         | NOM  | MAX  |
| Number of Terminals      | N     | 8           |      |      |
| Pitch                    | e     | 0.65 BSC    |      |      |
| Overall Height           | A     | –           | –    | 1.10 |
| Standoff                 | A1    | 0.00        | –    | 0.15 |
| Molded Package Thickness | A2    | 0.75        | 0.85 | 0.95 |
| Overall Length           | D     | 3.00 BSC    |      |      |
| Overall Width            | E     | 4.90 BSC    |      |      |
| Molded Package Width     | E1    | 3.00 BSC    |      |      |
| Terminal Width           | b     | 0.22        | –    | 0.40 |
| Terminal Thickness       | c     | 0.08        | –    | 0.23 |
| Terminal Length          | L     | 0.40        | 0.60 | 0.80 |
| Footprint                | L1    | 0.95 REF    |      |      |
| Lead Bend Radius         | R     | 0.07        | –    | –    |
| Lead Bend Radius         | R1    | 0.07        | –    | –    |
| Foot Angle               | θ     | 0°          | –    | 8°   |
| Mold Draft Angle         | θ1    | 5°          | –    | 15°  |

**Notes:**

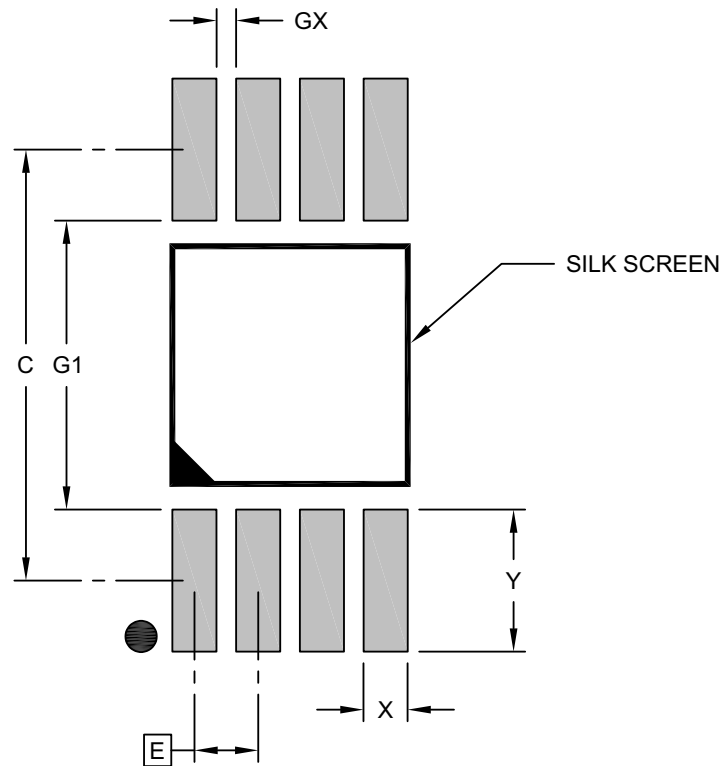
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-111-A3X Rev F Sheet 2 of 2

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## 8-Lead Plastic Micro Small Outline Package (A3X) - 3x3 mm Body [MSOP]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



### RECOMMENDED LAND PATTERN

| Units                           |    | MILLIMETERS |      |      |
|---------------------------------|----|-------------|------|------|
| Dimension Limits                |    | MIN         | NOM  | MAX  |
| Contact Pitch                   | E  | 0.65 BSC    |      |      |
| Contact Pad Spacing             | C  |             | 4.40 |      |
| Contact Pad Width (X8)          | X  |             |      | 0.45 |
| Contact Pad Length (X8)         | Y  |             |      | 1.45 |
| Contact Pad to Contact Pad (X4) | G1 | 2.95        |      |      |
| Contact Pad to Contact Pad (X6) | GX | 0.20        |      |      |

**Notes:**

1. Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-2111-A3X Rev F

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## APPENDIX A: REVISION HISTORY

### Revision A (September 2023)

- Converted Supertex Doc# DSFP-HV850 to Microchip DS20005904A
- Changed the package marking format
- Updated the package outline drawing
- Made minor text changes throughout the document

# HV850

## 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:                                                                     | HV850           | = | High-Voltage Low-Noise Inductorless EL Lamp Driver |   |            |
| Package:                                                                    | MG              | = | 8-lead MSOP                                        |   |            |
| Environmental:                                                              | G               | = | Lead (Pb)-free/RoHS-compliant Package              |   |            |
| Media Type:                                                                 | (blank)         | = | 2500/Reel for an MG Package                        |   |            |
| <b>Example:</b>                                                             |                 |   |                                                    |   |            |
| a) HV850MG-G: High-Voltage Low-Noise Inductorless EL Lamp Driver, 2500/Reel |                 |   |                                                    |   |            |

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