HV850

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^2 Lamp)
- Output Voltage Regulation
- Enable Function
- EL Lamp Dimming

Applications

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

General Description

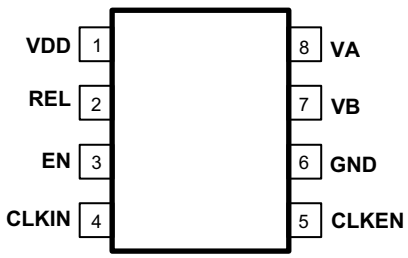
The HV850 is a high-voltage EL Lamp Driver IC. It is designed to drive EL lamps of up to 1.5 in^2 with capacitive values of up to 5 nF. The HV850 converts a low-voltage DC input to a high-voltage AC output across an EL lamp. It uses a charge pump scheme to boost the input voltage, eliminating the need 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.

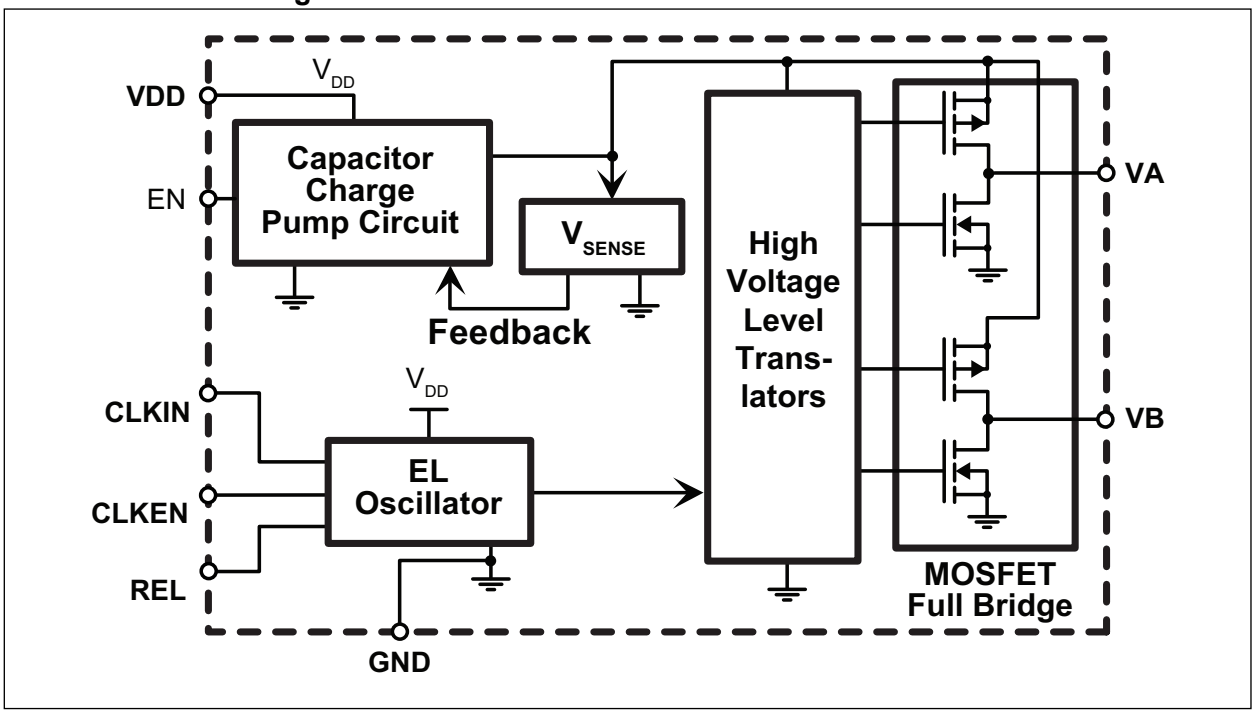
Package Type

8-lead MSOP
(Top view)

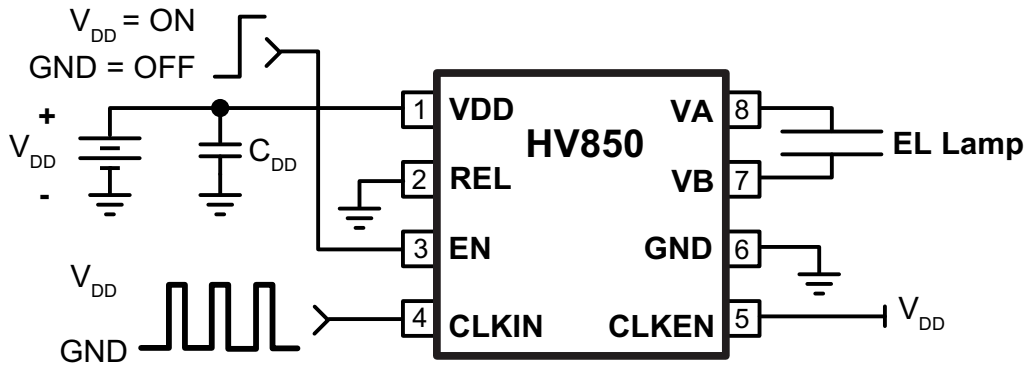


See Table 2-1 for pin information.

Functional Block Diagram



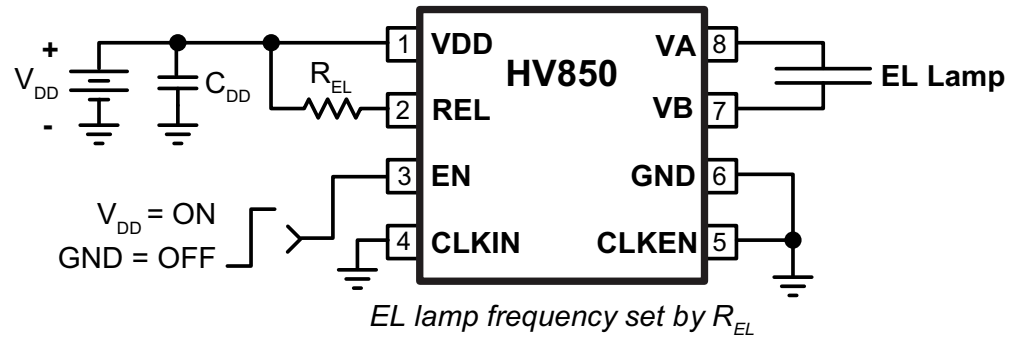
Typical Application Circuit 1



EL lamp frequency set by an external clock

Note: For V_{DD} = 3.4V to 4.2V only

Typical Application Circuit 2



EL lamp frequency set by R_{EL}

Note: For V_{DD} = 3.4V to 4.2V only

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings(†)

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

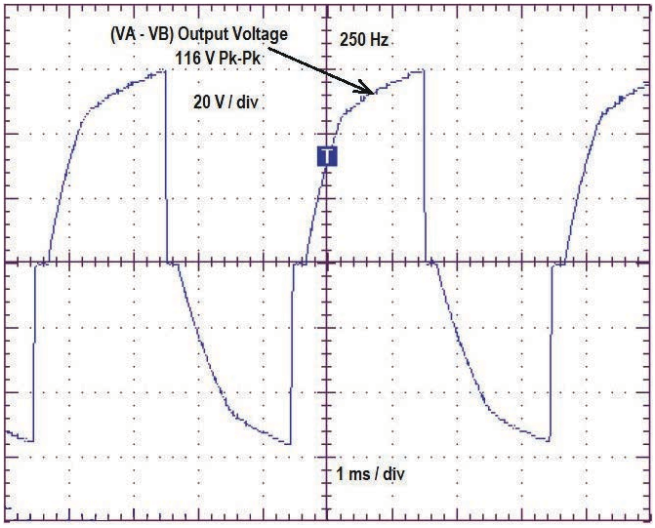
Electrical Specifications: V_{DD} = 3.5V and T_A = 25°C unless otherwise specified.

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 MΩ or CLK = 32 kHz
Operating Current	I_{DD}	—	—	16	mA	V_{DD} = 3.5V, R_{EL} = 1.5 MΩ, Load = 3.3 nF +1 kΩ (See Figure 3-1.)
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^2 lamp, 10% to 90% of final value
LOGIC INPUTS						
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	µA	
Input Logic High Current	I_{IH}	—	—	1	µA	
Enable Input Rise Time (For Delay Turn-on)	EN_{rise}	0.01	—	10	ms	Using external R-C circuit (See Figure 3-2.)
Enable Input Fall Time (For Delay Turn-off)	EN_{fall}	10µ	—	5	s	
Logic Input Capacitance	C_{IN}	—	—	10	pF	

TEMPERATURE SPECIFICATIONS

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

Typical Output Waveform



Note: Test conditions, V_{DD} = 3.5V, F_{EL} = 250.0 Hz; Load = 3.3 nF+1.0 kΩ; I_{DD} = 9.19 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 Figure 3-3.) 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

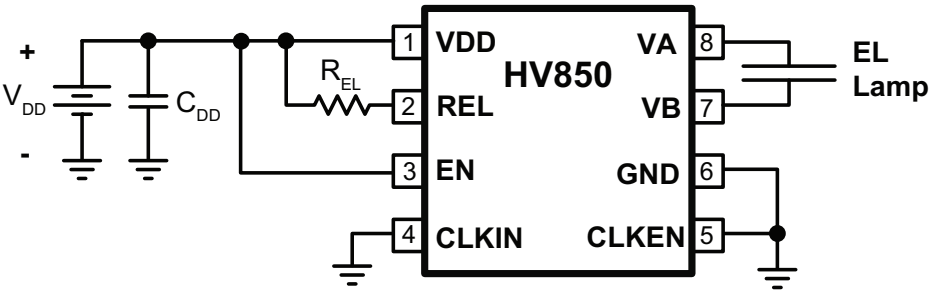


FIGURE 3-1: *Typical Application Circuit (without Enable Function).*

TABLE 3-1: TYPICAL PARAMETERS

Load (Lamp Equivalent)	R_{EL} (MΩ)	V_{DD} (V)	I_{DD} (mA)	Peak V_A (V)	f_{EL} (Hz)
3.3 nF + 1 kΩ	1.5	3	8.9	53	294
		3.5	10.2	61	
		4	10.4	66	

Note 1: C_{DD} = 2.2 µF, 6.3V low ESR

TABLE 3-2: TYPICAL PERFORMANCE

Lamp Size	R_{EL} (MΩ)	V_{DD} (V)	I_{DD} (mA)	Peak V_A (V)	f_{EL} (Hz)	Brightness (cd/m^2)
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

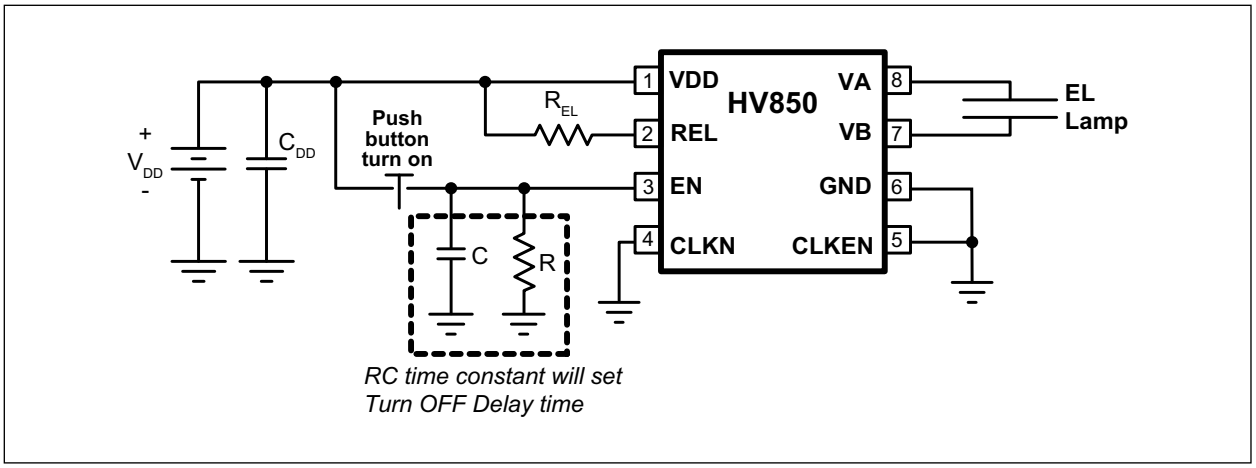


FIGURE 3-2: *Push Button Turn-on with Delay Turn-off (For V_{DD} = 3.4V to 4.2V only).*

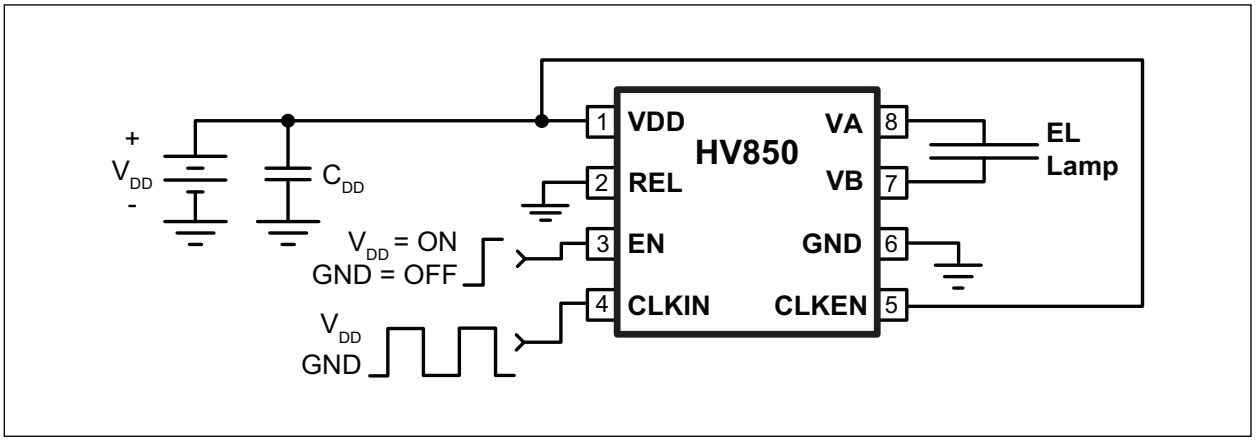


FIGURE 3-3: *Independent Programmable Output Frequency (f_{EL})(For V_{DD} = 3.4V to 4.2V only).*

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.

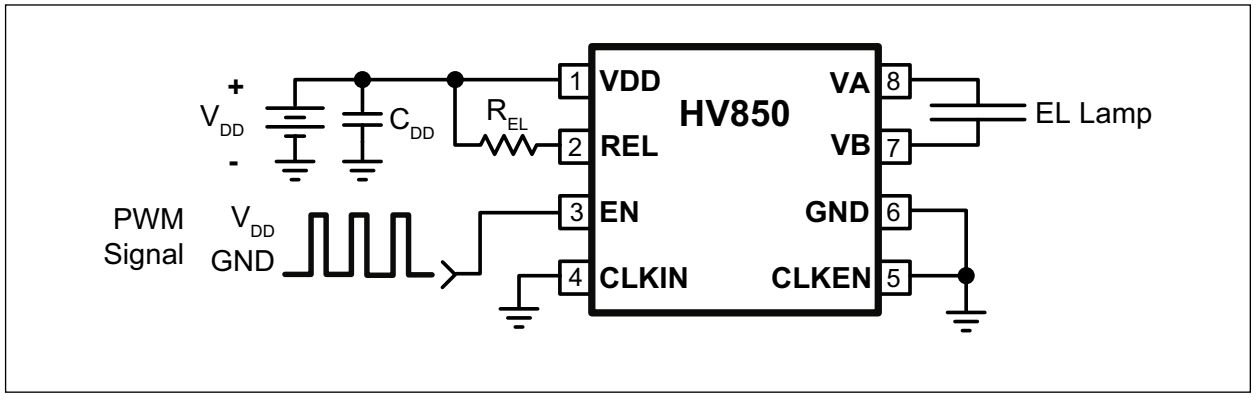
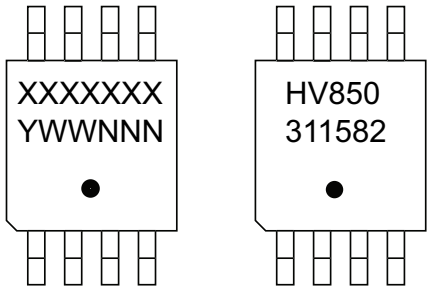


FIGURE 3-4: *PWM Dimming Circuit (For V_{DD} = 3.4V to 4.2V only).*

4.0 PACKAGING INFORMATION

4.1 Package Marking Information

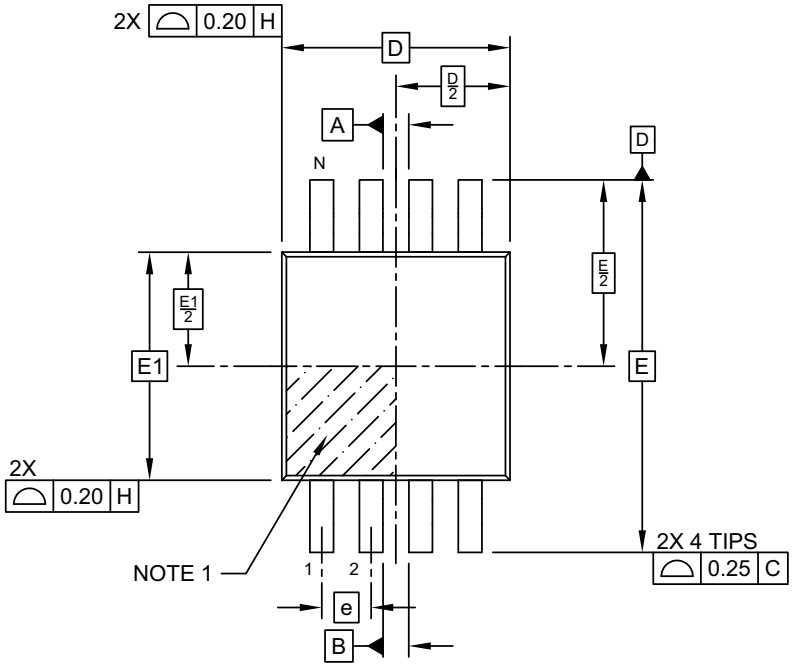


Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.

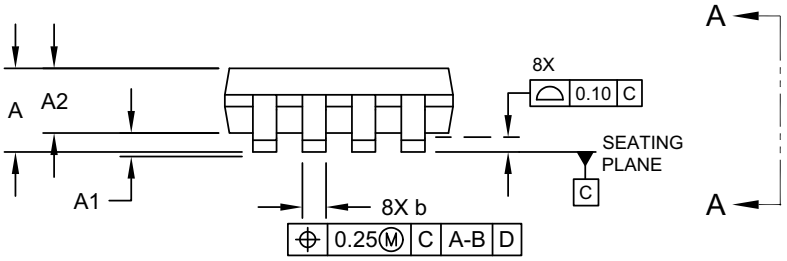
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for product code or customer-specific information. Package may or not include the corporate logo.

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

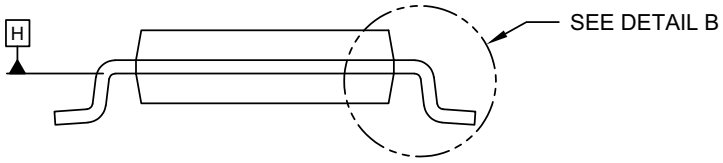
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

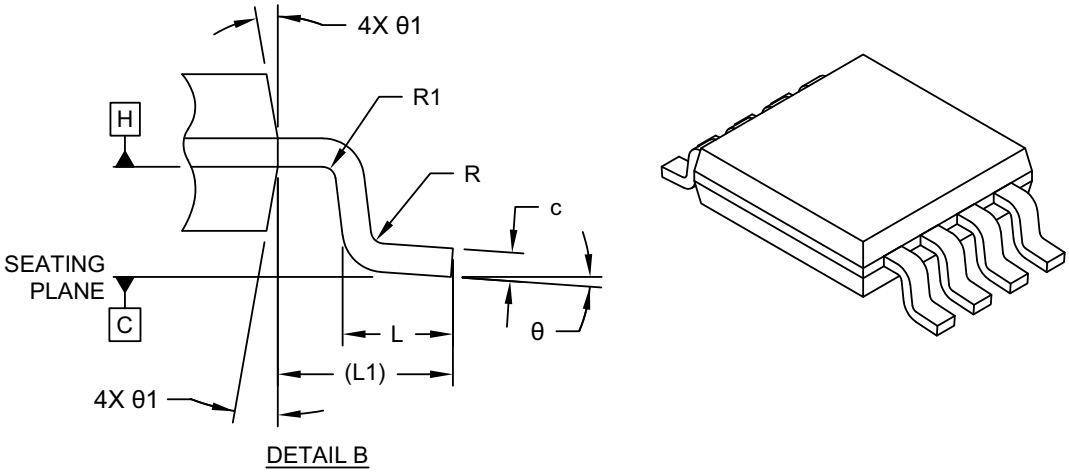


VIEW A–A

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



Units		MILLIMETERS		
Dimension Limits		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°

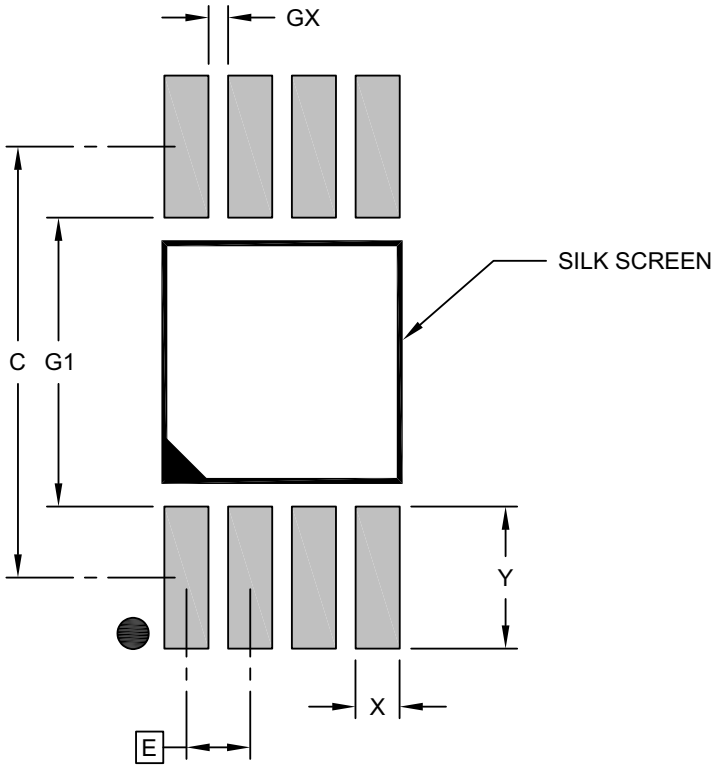
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
3. 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

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

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

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:	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

Example:

a) HV850MG-G: High-Voltage Low-Noise Inductorless EL Lamp Driver, 2500/Reel

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