HV852

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 5.3 nF Load (approximately 1.5 in ^{2} Lamp)
- Output Voltage Regulation
- Enable Function
- EL Lamp Dimming

Applications

- Cellular Phone Keypad
- Watches
- Small Handheld Wireless Devices
- MP3 Players

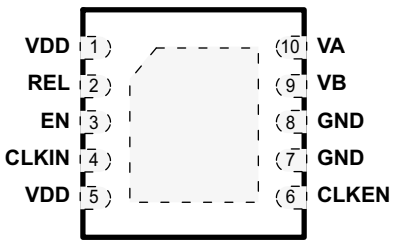
General Description

The HV852 is a high-voltage low-noise, inductorless EL lamp driver. It is designed to drive EL lamps of up to 1.5 in^2, with capacitive values of up to 5.3 nF over an input voltage range of 2.4V to 5V. The HV852 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 an external inductor, diode, and high-voltage capacitor commonly found in conventional topologies.

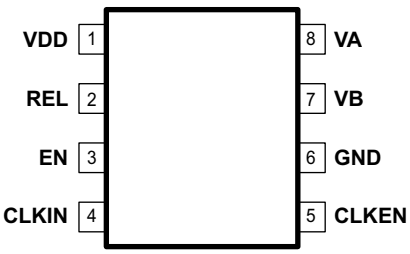
The charge pump circuit discharges its energy into an EL lamp through a high-voltage H-bridge. Once the voltage reaches its regulated limit, it is turned off to conserve power. The EL lamp is then discharged to ground, and the H-bridge changes state to allow the charge pump to charge the EL lamp in the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

Package Types

10-lead WDFN
(Top view)

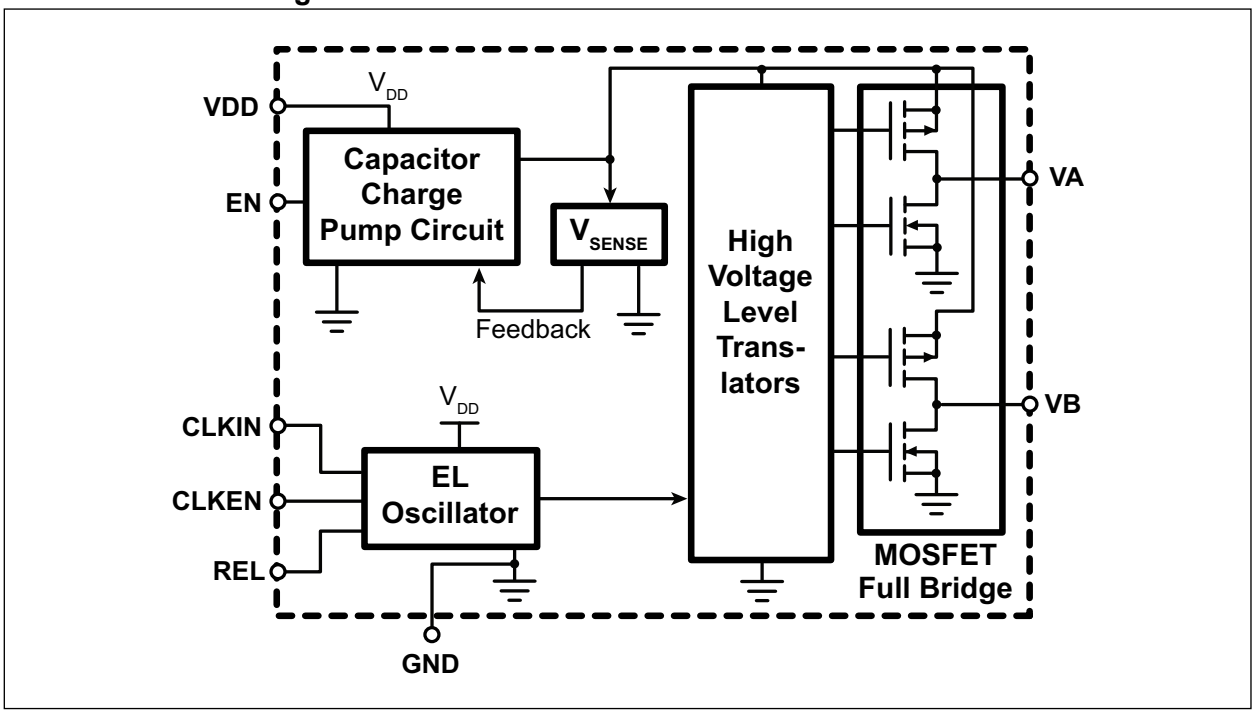


8-lead MSOP
(Top view)

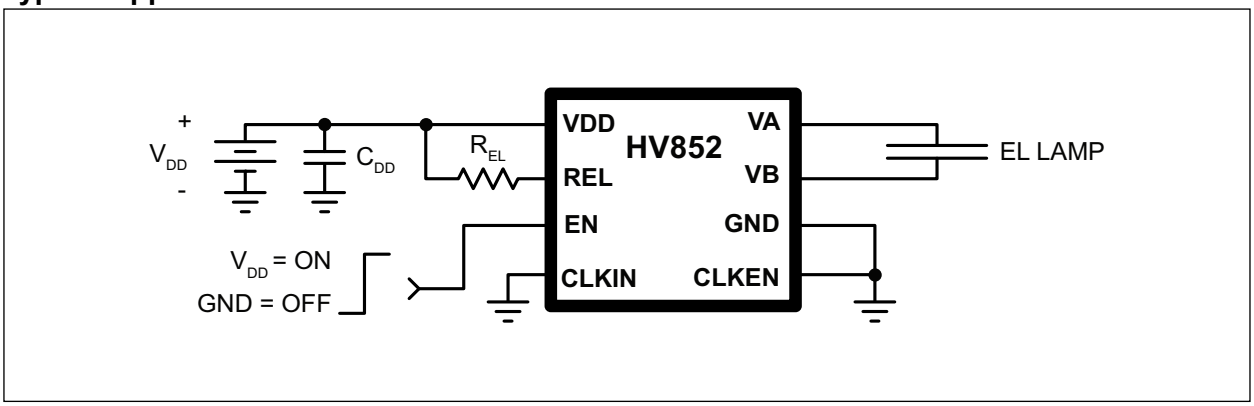


WDFN pads are at the bottom of the package. Center heat slug is at ground potential.
See Table 2-1 for pin information.

Functional Block Diagram



Typical Application Circuit



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings(†)

Supply Voltage, V_{DD} ..... –0.5V to 6.5V
Operating Temperature Range, T_A ..... –25°C to +85°C
Storage Temperature, T_S ..... –65°C to +150°C
Power Dissipation:
10-lead WDFN 1.6W
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}	2.4	—	5	V	
EL Lamp Frequency	f_{EL}	50	—	500	Hz	
EL Lamp Capacitance	C_{LOAD}	0	—	5.3	nF	
Operating Temperature	T_A	–25	—	+85	°C	

ELECTRICAL CHARACTERISTICS

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

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Quiescent Current	I_{DDQ}	—	—	200	nA	EN = 0V
Peak Output Voltage	V_A or V_B	72	82	92	V	No load
Peak-to-Peak Output Voltage	V_A–V_B	144	164	184	V	
Operating Current	I_{DD}	—	15.2	30	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	72	82	92	V	
Peak-to-Peak Output Voltage	V_A–V_B	144	164	184	V	
EL Lamp Frequency	f_{EL}	210	250	300	Hz	
Output Voltage Rise Time	t_{rout}	—	640	—	µs	1 in^2 lamp, 10% to 90% of final value

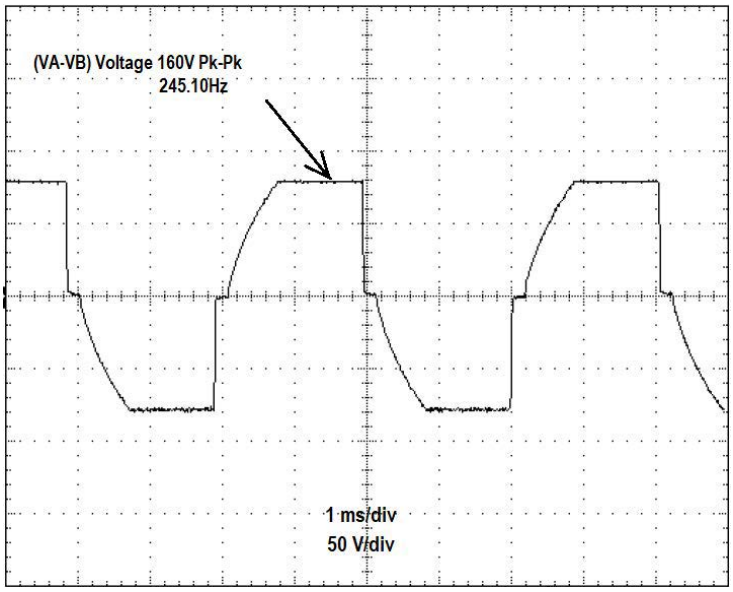
TEMPERATURE SPECIFICATIONS

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
TEMPERATURE RANGE						
Operating Temperature	T_A	–25	—	+85	°C	
Storage Temperature	T_S	–65	—	+150	°C	
PACKAGE THERMAL RESISTANCE						
8-lead MSOP	θ_{JA}	—	216	—	°C/W	
10-lead WDFN	θ_{JA}	—	41	—	°C/W	

LOGIC INPUTS

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Input Logic Low Voltage	V_{IL}	0	—	0.5	V	
Input Logic High Voltage	V_{IH}	1.75	—	V_{DD}	V	V_{DD} = 2.4V to 4.3V, T_A = –25 to 85°C
		2	—	V_{DD}	V	4.3 < V_{DD} ≤ 5V, T_A = –25 to 85 °C
Input Logic Low Current	I_{IL}	—	—	1	µA	V_{IL} = 0V, V_{DD} = 2.4V–5V
Input Logic High Current	I_{IH}	—	—	1	µA	V_{IH} = V_{DD} = 2.4V–5V
Enable Input Rise Time (For Delay Turn-on)	t_{rEN}	0.01	—	10	ms	Using External R-C Circuit (See Figure 3-2.)
Enable Input Fall Time (For Delay Turn-off)	t_{fEN}	0.01	—	500	ms	
Logic Input Capacitance	C_{in}	—	—	10	pF	

Typical Output Waveform



Note 1: Refer to Figure 3-1.

2: Test Conditions: HV852 driving a 1.0 in^2 EL lamp VDD = 3.6V and REL = 1.5 MΩ, VA–VB waveform

TYPICAL PERFORMANCE

LOAD	R_{EL} (MΩ)	V_{DD} (V)	I_{DD} (mA)	V_A–V_B (V)	f_{EL} (Hz)
3.3 nF + 1 kΩ	1.5	2.4	17.56	154	245
		3	17.53	158	
		3.6	17.44	158	
		4.2	17.65	158	
		5	18.35	158	

Note: This table specifies observed performance when driving a 1.0 in^2 green lamp.

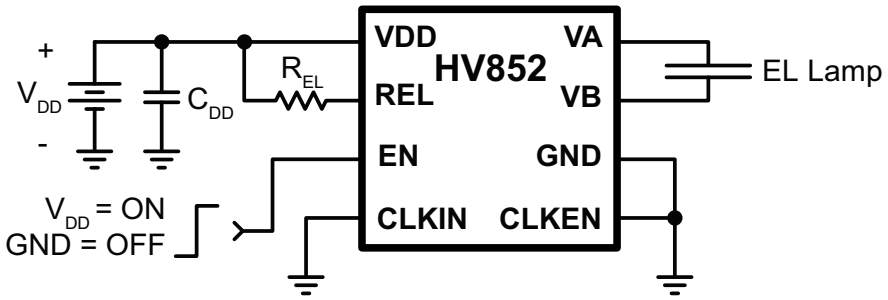
2.0 PIN DESCRIPTION

The details on the pins of HV852 are listed in Table 2-1.
See location of pins in **Package Types**.

TABLE 2-1: PIN FUNCTION TABLE

10-lead WDFN Pin Number	8-lead MSOP Pin Number	Pin Name	Description
1,5	1	VDD	Input supply voltage pin
2	2	REL	An external resistor to VDD will set the EL lamp frequency. The EL frequency is inversely proportional to the R_{EL} resistor value. A 1.5 MΩ resistor would provide a nominal lamp frequency of 250 Hz. $$f_{EL} = \frac{1.5M\Omega \times 250Hz}{R_{EL}}$$ When using an external clock to set the EL lamp frequency, the REL pin should be connected to ground.
3	3	EN	Enable input pin. Logic high will turn the device on. An external R-C circuit can be added for a delayed turn off.
4	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.) The EL lamp frequency is the external clock frequency divided by 128. This is useful for applications requiring the EL lamp to be synchronized to a system clock. Connect to ground when not in use.
6	5	CLKEN	Logic input pin. Logic high will cause the EL lamp frequency to be set by the CLKN input. Logic low will cause the EL lamp frequency to be set by the external R_{EL} resistor.
7,8	6	GND	IC ground pin
9	7	VB	EL lamp driver output pin. The EL lamp is connected across V_A and V_B terminals.
10	8	VA	EL lamp driver output pin. The EL lamp is connected across V_A and V_B terminals.

3.0 APPLICATION INFORMATION



Note: C_{DD} = 2.2 µF, 6.3V ceramic capacitor.

FIGURE 3-1: *Typical Application Circuit.*

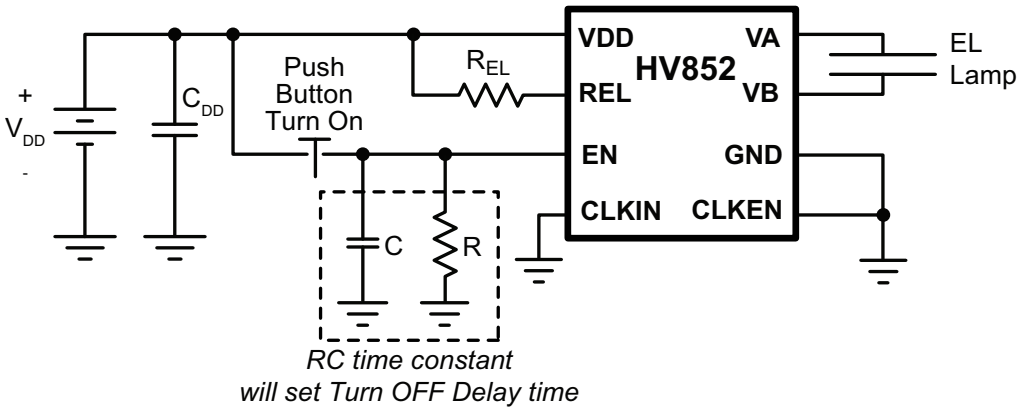
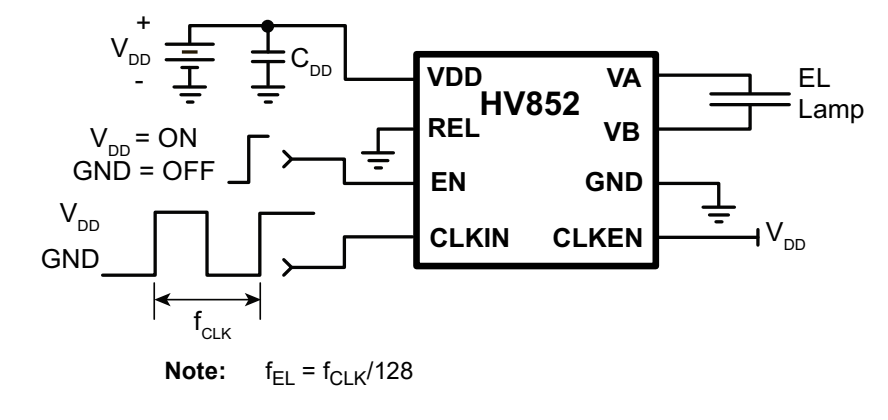


FIGURE 3-2: *Push Button Turn-on with Delay Turn-off.*



Note: $f_{EL} = f_{CLK}/128$

FIGURE 3-3: *Independent Programmable Output Frequency (f_{EL}).*

3.1 EL Lamp Dimming Using PWM

EL lamp dimming can be achieved by applying a PWM signal to the Enable pin. EL Lamp brightness is proportional to the PWM signal duty cycle. 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. Refer to Figure 3-4.

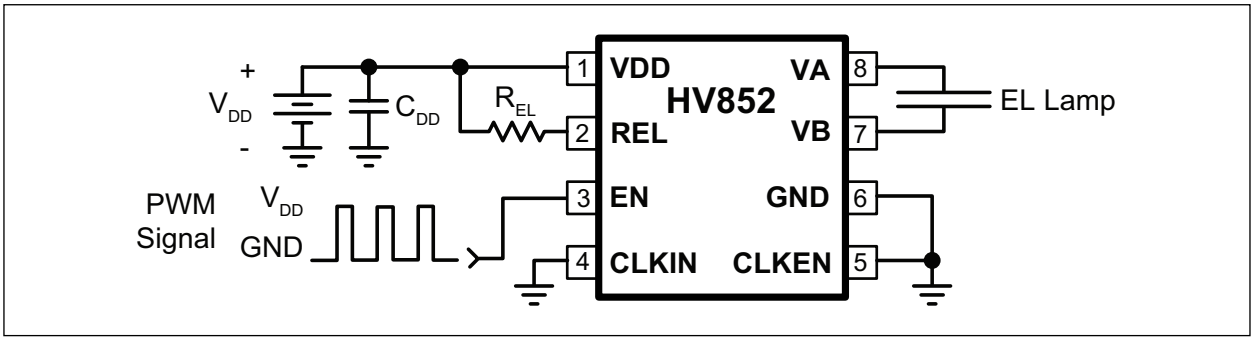
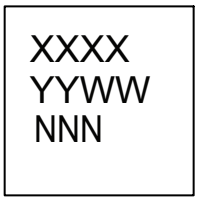


FIGURE 3-4: *PWM Dimming Circuit.*

4.0 PACKAGING INFORMATION

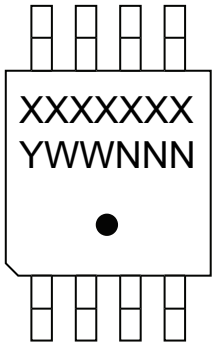
4.1 Package Marking Information

10-lead WDFN

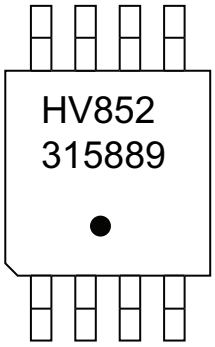


Example

8-lead MSOP



Example

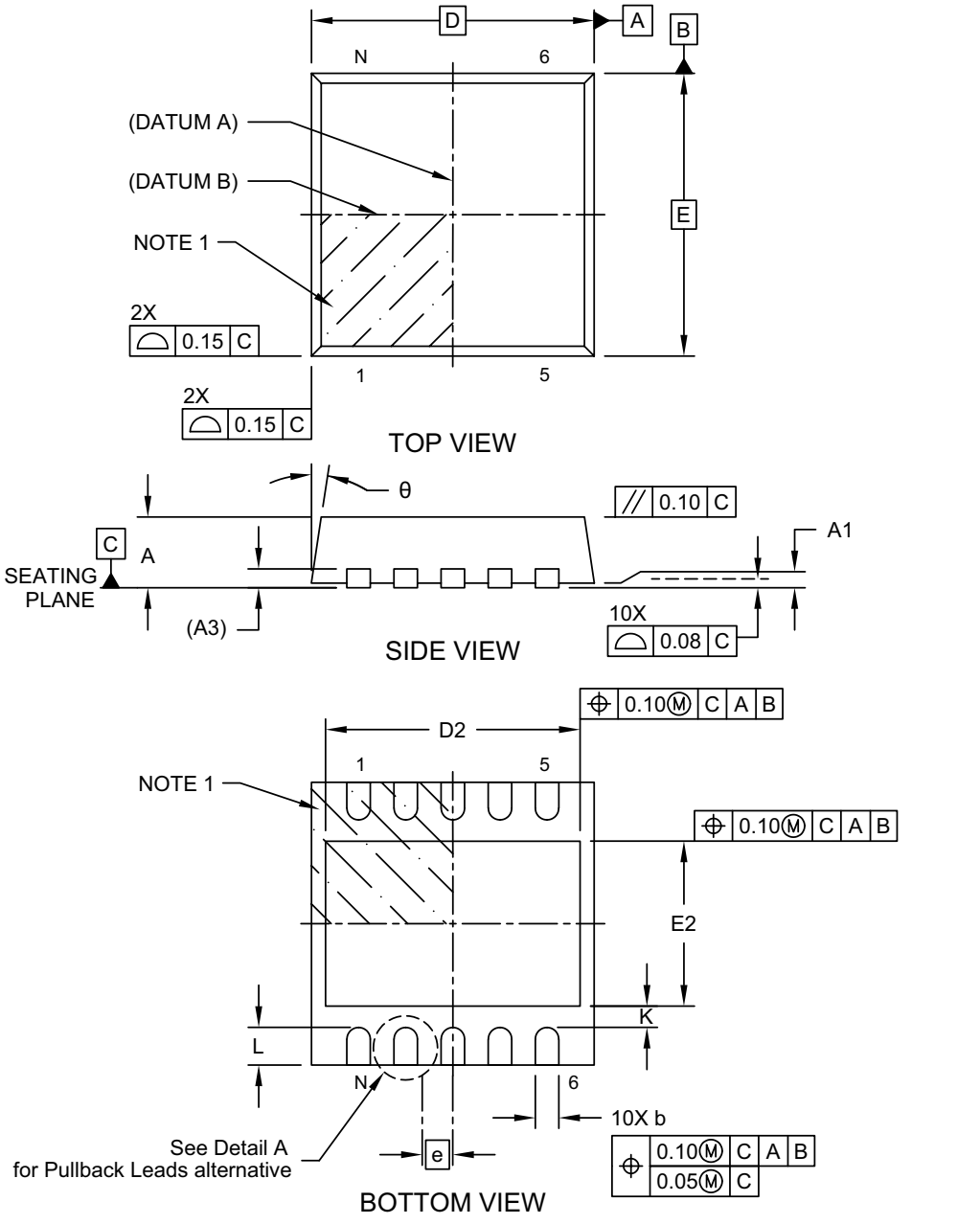


Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package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

10-Lead Very, Very Thin Plastic Dual Flat, No Lead Package (UR) - 3x3 mm Body [WDFN]; Supertex Legacy Package

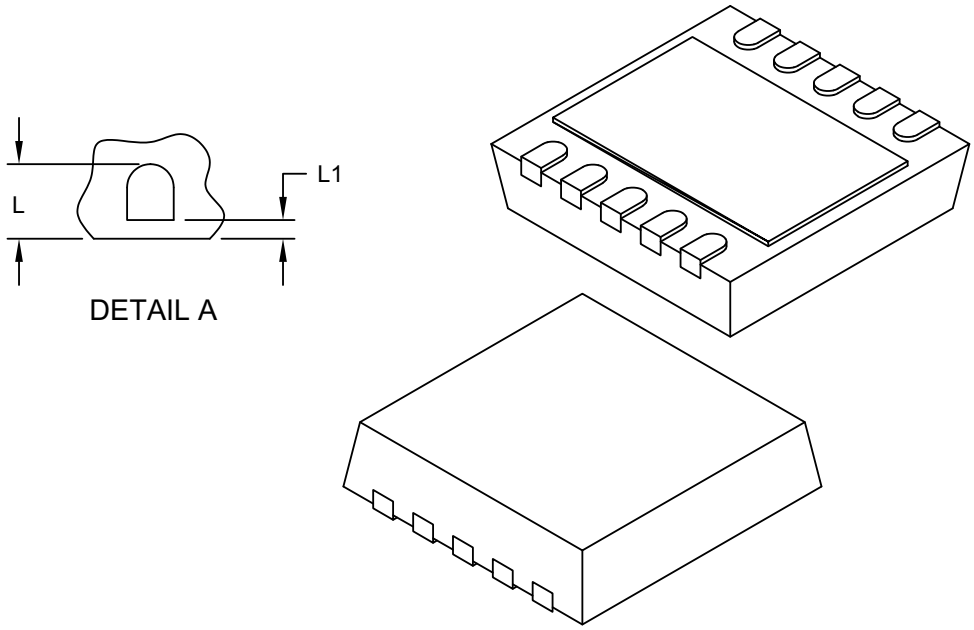
Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-292 Rev A Sheet 1 of 2

10-Lead Very, Very Thin Plastic Dual Flat, No Lead Package (UR) - 3x3 mm Body [WDFN]; Supertex Legacy Package

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		10	
Pitch	e		0.50 BSC	
Overall Height	A	0.70	0.75	0.80
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3		0.20 REF	
Overall Length	D		3.00 BSC	
Exposed Pad Length	D2	2.20	-	2.70
Overall Width	E		3.00 BSC	
Exposed Pad Width	E2	1.40	-	1.75
Terminal Width	b	0.18	0.25	0.30
Terminal Length	L	0.30	0.40	0.50
Pullback	L1	-	-	0.15
Mold Angle	θ	0°	7°	14°
Terminal-to-Exposed-Pad	K	**0.20**	**-**	**-**

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated
3. Dimensioning and tolerancing per ASME Y14.5M

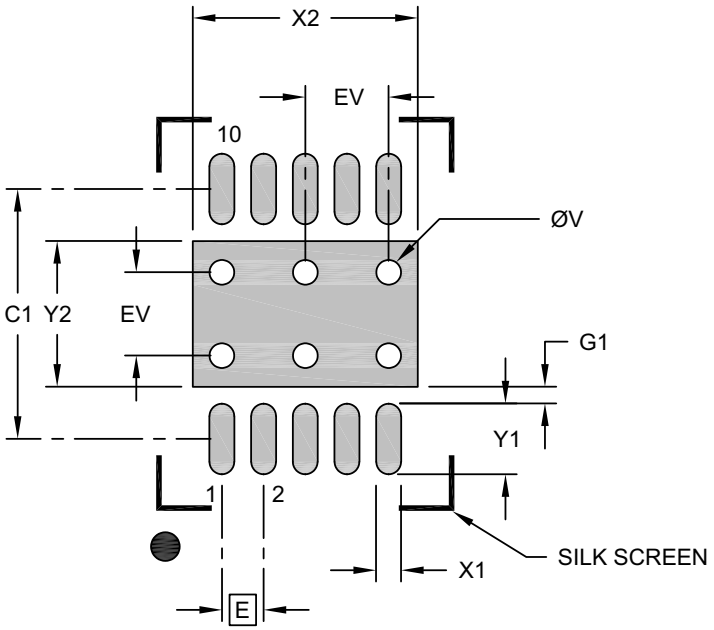
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-292 Rev A Sheet 2 of 2

10-Lead Very, Very Thin Plastic Dual Flat, No Lead Package (UQ) - 3x3 mm Body [WDFN]; Supertex Legacy Package

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		0.50 BSC	
Optional Center Pad Width	X2			2.70
Optional Center Pad Length	Y2			1.75
Contact Pad Spacing	C1		3.00	
Contact Pad Width (X10)	X1			0.30
Contact Pad Length (X10)	Y1			0.85
Contact Pad to Center Pad (X10)	G1	0.20		
Thermal Via Diameter	V		0.30	
Thermal Via Pitch	EV		1.00	

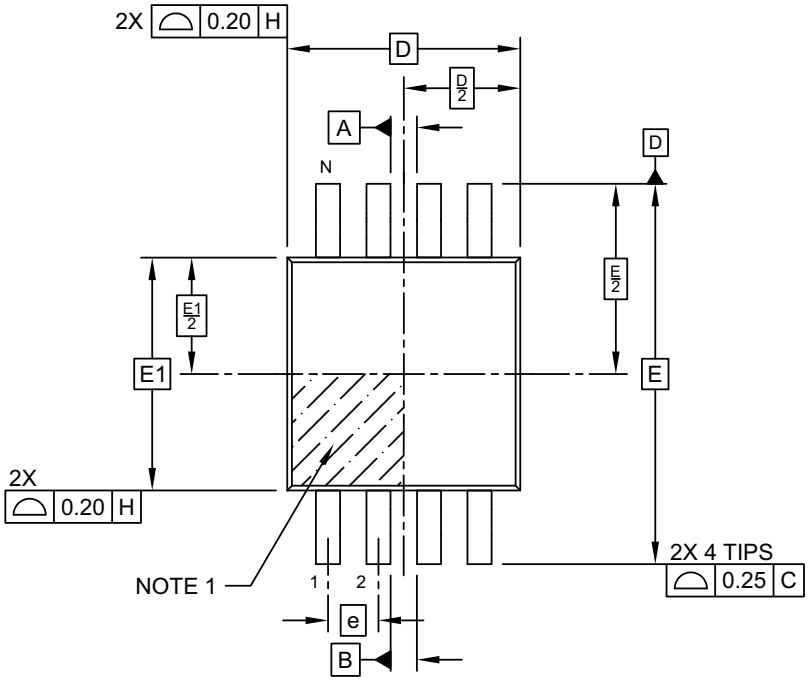
Notes:

1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

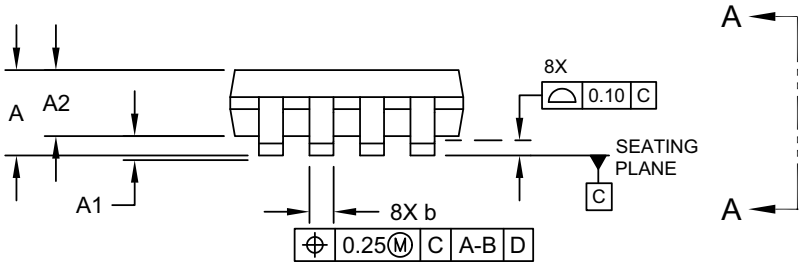
Microchip Technology Drawing C04-2292 Rev A

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

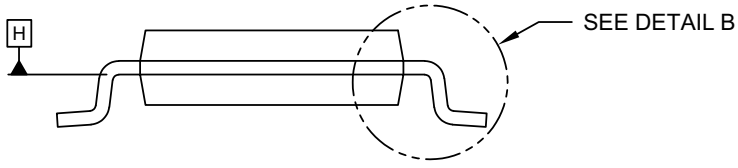
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

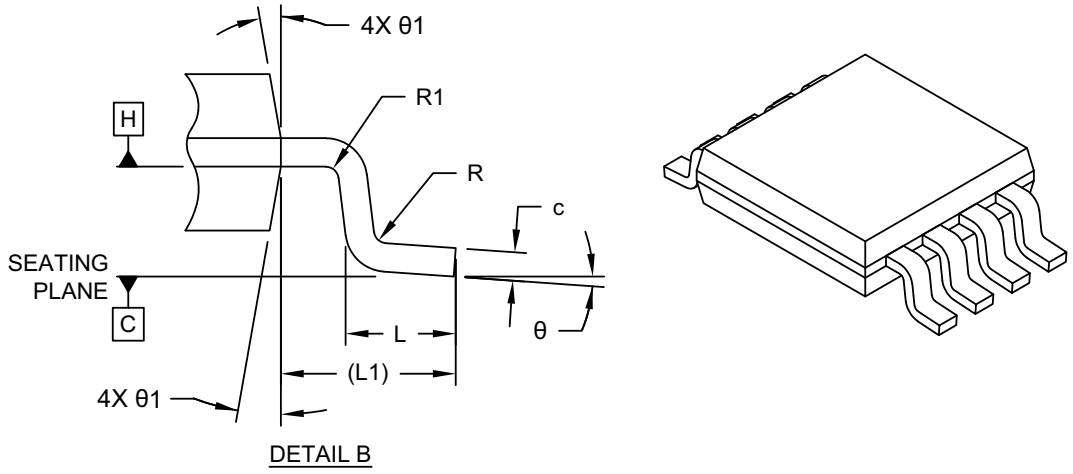


VIEW A–A

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°

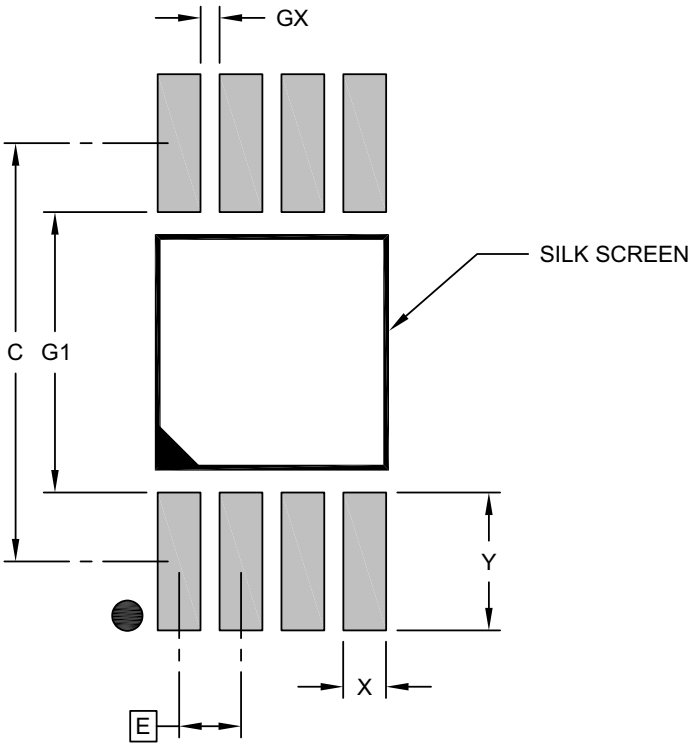
Notes:

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

NOTES:

APPENDIX A: REVISION HISTORY

Revision A (September 2023)

- Converted Supertex Doc# DSFP-HV852 to Microchip DS20005690A
- Changed the quantity of the 10-lead WDFN K7 package from 3000/Reel to 3300/Reel to alight packaging specifications with the actual BQM
- Updated 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:	HV852	=	High-Voltage Low-Noise Inductorless EL Lamp Driver
Packages:	K7	=	10-lead WDFN
	MG	=	8-lead MSOP
Environmental:	G	=	Lead (Pb)-free/RoHS-compliant Package
Media Type:	(blank)	=	3300/Reel for a WDFN Package 2500/Reel for an MSOP Package

Examples:

a) HV852K7-G: High-Voltage EL Lamp Driver IC, 10-lead WDFN Package, 3300/Reel

b) HV852MG-G: High-Voltage EL Lamp Driver IC, 8-lead MSOP Package, 2500/Reel

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