HV833

High-Voltage EL Lamp Driver IC

Features

- 1.8V to 6.5V Operating Supply Voltage
- DC to AC Conversion
- Separately Adjustable Lamp and Converter Frequency
- Output Voltage Regulation
- Enable/Disable Function
- Patented Output Timing for High Efficiency
- <100 nA Shutdown Current
- Split Supply Capability
- LCD Backlighting

Applications

- Portable Transceivers
- Remote Control Units
- Calculators
- PDAs
- Global Positioning Systems (GPS)

General Description

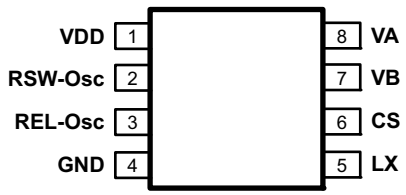
The HV833 is a high-voltage driver designed for driving EL lamps of up to 35 nF (10 in^2 to 12 in^2). The input supply voltage range is from 1.8V to 6.5V. The device uses a single inductor and a minimum number of passive components. The nominal regulated output voltage that is applied to the EL lamp is ±90V. The chip can be enabled/disabled by connecting a resistor between the RSW-Osc pin and the V_{DD}/GND pins.

The HV833 has two internal oscillators, a switching MOSFET and a high-voltage EL lamp driver. The frequency for the switching MOSFET is set by an external resistor connected between the RSW-Osc pin and the VDD supply pin. The EL lamp driver frequency is set by an external resistor connected between the REL-Osc pin and the VDD pin. An external inductor is connected between the LX pin and V_{DD} or V_{IN} pin. A 0.003 µF to 0.1 µF capacitor is connected between the CS pin and the GND pin. The EL lamp is connected between the VA pin and the VB pin.

The switching MOSFET charges the external inductor and discharges it into the capacitor at CS. The voltage at CS will start to increase. Once the voltage at CS reaches a nominal value of 90V, the switching MOSFET is turned off to conserve power. The outputs VA and VB are configured as an H bridge and are switching in opposite states to achieve 180V peak-to-peak across the EL lamp.

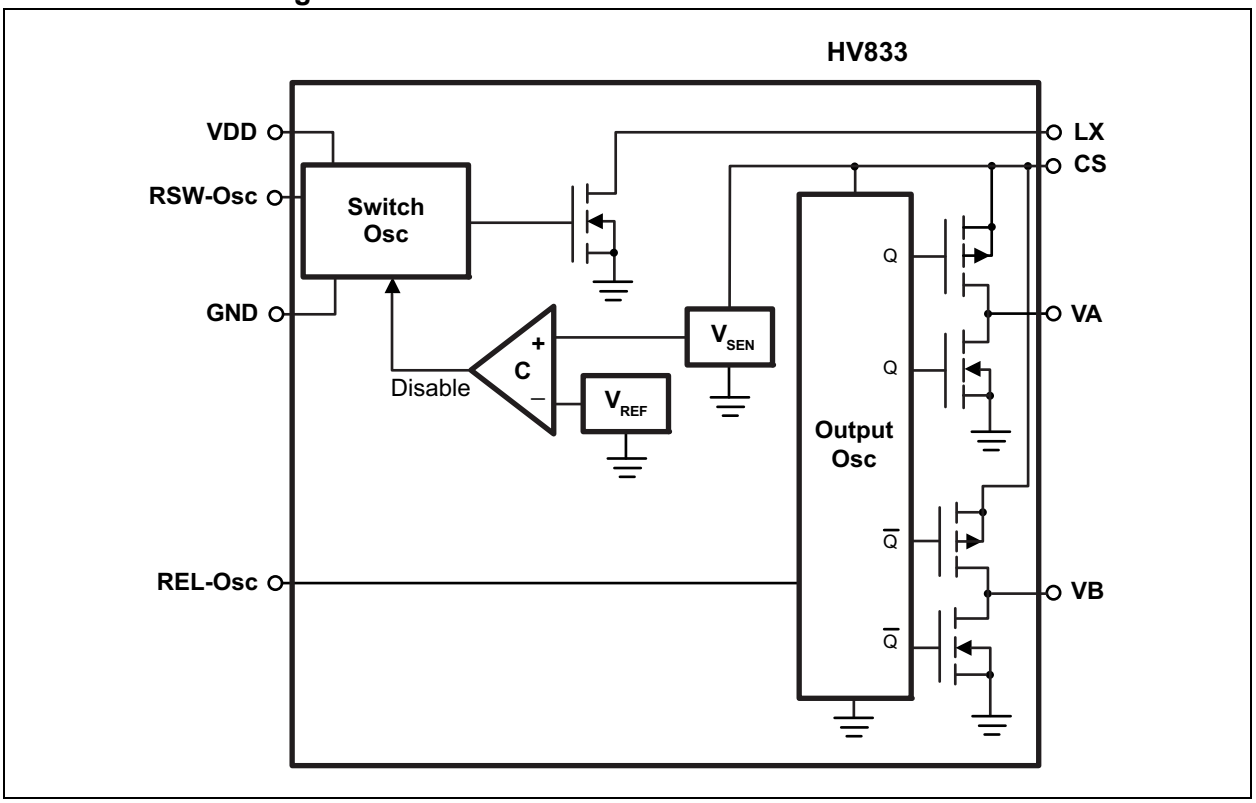
Package Type

8-lead MSOP
(Top view)

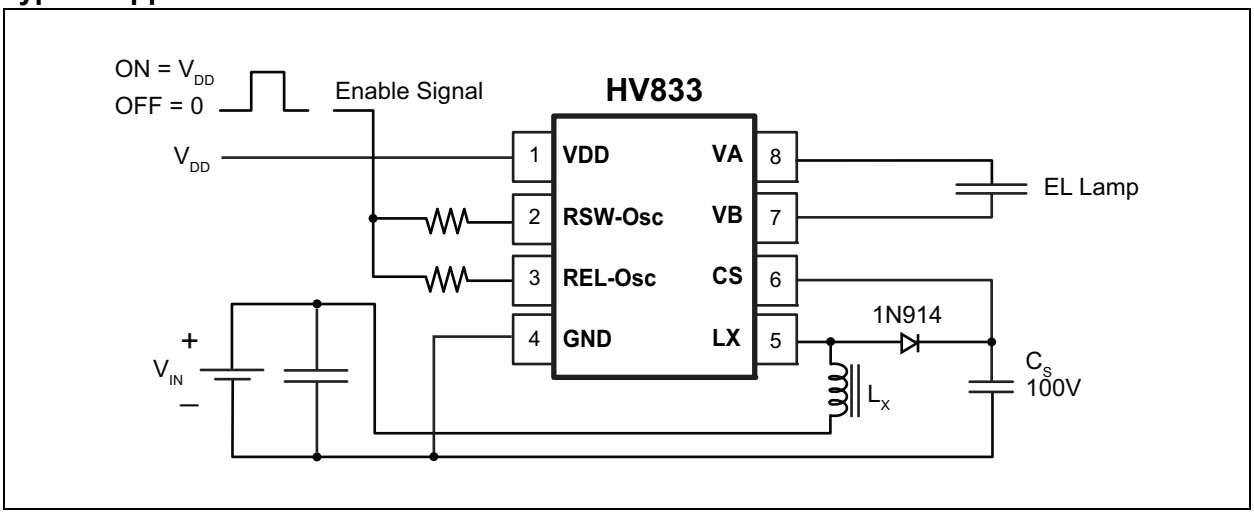


See Table 2-1 for pin information.

Functional Block Diagram



Typical Application Circuit



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings (†)

Supply Voltage, V_{DD} ..... –0.5V to 7.5V
Output Voltage, V_{CS} ..... –0.5V to 125V
Operating Ambient Temperature Range, T_A ..... –40°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
Supply Voltage	V_{DD}	1.8	—	6.5	V	
V_{A-B} Output Drive Frequency	f_{EL}	60	—	1000	Hz	
Operating Ambient Temperature	T_A	–40	—	+85	°C	

DC ELECTRICAL CHARACTERISTICS

Electrical Specifications: Over recommended operating conditions unless otherwise specified, T_A = 25°C.

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
On Resistance of Switching Transistor	$R_{DS(ON)}$	—	—	4	Ω	I = 100 mA
Output Voltage V_{CS} Regulation	V_{CS}	80	90	100	V	V_{DD} = 1.8V to 6.5V
Output Peak-to-Peak Voltage	V_A–V_B	160	180	200	V	V_{DD} = 1.8V to 6.5V
Quiescent V_{DD} Supply Current	I_{DDQ}	—	—	100	nA	R_{SW-Osc} = Low
V_{DD} Supply Current	I_{DD}	—	—	150	µA	V_{DD} = 3.3V (See **Section 3.1 "Typical Application Circuit 1"**.)
Input Current including Inductor Current	I_{IN}	—	56	64	mA	
Output Voltage on V_{CS}	V_{CS}	63	72	81	V	
V_A–V_B Output Drive Frequency	f_{EL}	240	270	300	Hz	
Switching Transistor Frequency	f_{SW}	55	65	75	KHz	
Switching Transistor Duty Cycle	D	—	88	—	%	See Figure 3-1.
ENABLE/DISABLE						
Logic Input Low Voltage	EN-L	0	—	0.5	V	V_{DD} = 1.8V to 6.5V
Logic Input High Voltage	EN-H	V_{DD}–0.5	—	V_{DD}	V	V_{DD} = 1.8V to 6.5V

TEMPERATURE SPECIFICATIONS

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
TEMPERATURE RANGE						
Operating Ambient Temperature Range	T_A	–40	—	+85	°C	
Storage Temperature Range	T_S	–65	—	+150	°C	
PACKAGE THERMAL RESISTANCE						
8-lead MSOP	θ_{JA}	—	216	—	°C/W	

2.0 PIN DESCRIPTION

The details on the pins of HV833 are listed in Table 2-1.
See location of pins in **Package Type**.

TABLE 2-1: PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	VDD	Voltage supply pin
2	RSW-Osc	The switching frequency of the converter is controlled via an external resistor, R_{SW}, between the RSW-Osc and VDD pins of the device. The switching frequency increases as R_{SW} decreases. With a given inductor, as the switching frequency increases, the amount of current drawn from the battery decreases and the output voltage, V_{CS}, also decreases.
3	REL-Osc	The EL lamp frequency is controlled through an external R_{EL} resistor connected between REL-Osc and VDD pins of the device. The lamp frequency increases as R_{EL} decreases. As the EL lamp frequency increases, the amount of current drawn from the battery increases and the output voltage V_{CS} decreases. The color of the EL lamp is dependent upon its frequency.
4	GND	Ground
5	LX	The LX pin is where the inductor L_X is connected. The inductor L_X is used to boost the low-input voltage by inductive flyback. When the internal switch is on, the inductor is being charged. When the internal switch is off, the charge stored in the inductor is transferred to the high-voltage capacitor C_S. The energy stored in the capacitor is connected to the internal H-bridge, and therefore to the EL lamp. In general, smaller value inductors, which can handle more current, are more suitable to drive larger size lamps. As the inductor value decreases, the switching frequency of the inductor (controlled by R_{SW}) should be increased to avoid saturation. A 220 µH inductor with 5.4Ω series DC resistance is typically recommended. For inductors with the same inductance value but with lower series DC resistance, a lower R_{SW} value is needed to prevent high current draw and inductor saturation.
6	CS	A fast recovery diode (1N914 or equivalent) should be used here, and a 0.01 µF to 0.1 µF 100V capacitor to GND needs to be used to store the energy transferred from the inductor as indicated in Figure 3-1.
7,8	VA,VB	The EL lamp terminals are connected to the VA and VB pins. Polarity is irrelevant. As the EL lamp size increases, more current will be drawn from the battery to maintain high voltage across the EL lamp. The input power, (V_{IN} x I_{IN}), will also increase. If the input power is greater than the power dissipation of the package (300 mW), an external resistor in series with one side of the lamp is recommended to help reduce the package power dissipation.

3.0 APPLICATION INFORMATION

3.1 Typical Application Circuit 1

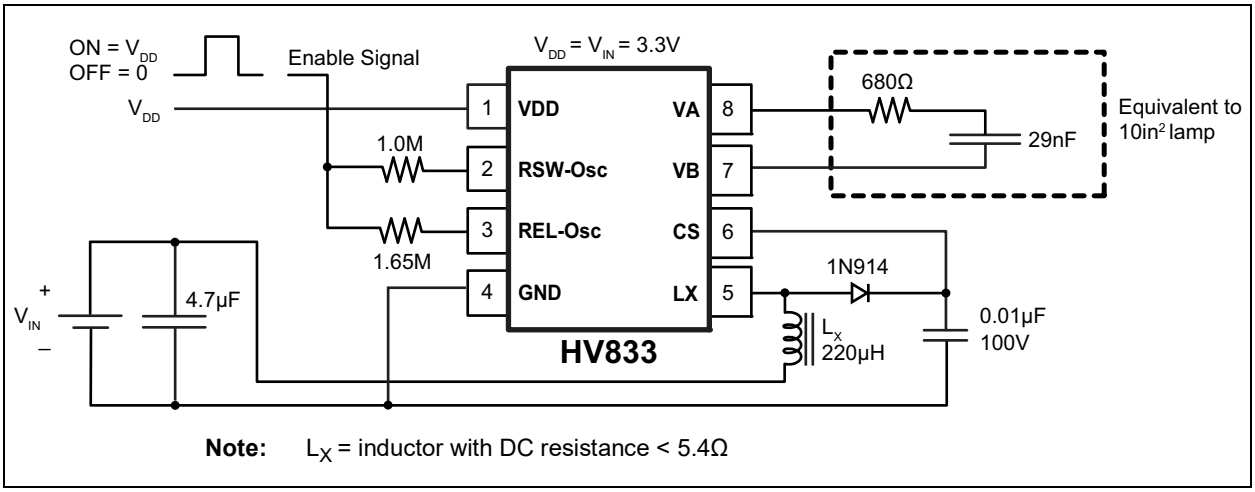


FIGURE 3-1: *Typical Application Circuit 1.*

TABLE 3-1: TYPICAL PERFORMANCE FOR TYPICAL APPLICATION CIRCUIT 1

Device	Lamp Size	V_{IN}	I_{IN}	V_{CS}	f_{EL}	Brightness	T_A
HV833MG	10 in^2	3.3V	56 mA	72V	270 Hz	5 ft-lm	–25°C to +85°C

3.1.1 TYPICAL PERFORMANCE CURVES FOR FOR TYPICAL APPLICATION CIRCUIT 1 (EL LAMP = 10 IN^2, V_{IN} = V_{DD})

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g. outside specified power supply range) and therefore outside the warranted range.

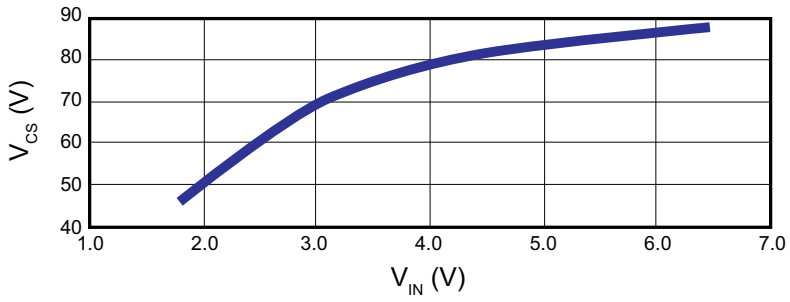


FIGURE 3-2: *V_{CS} vs. V_{IN}*

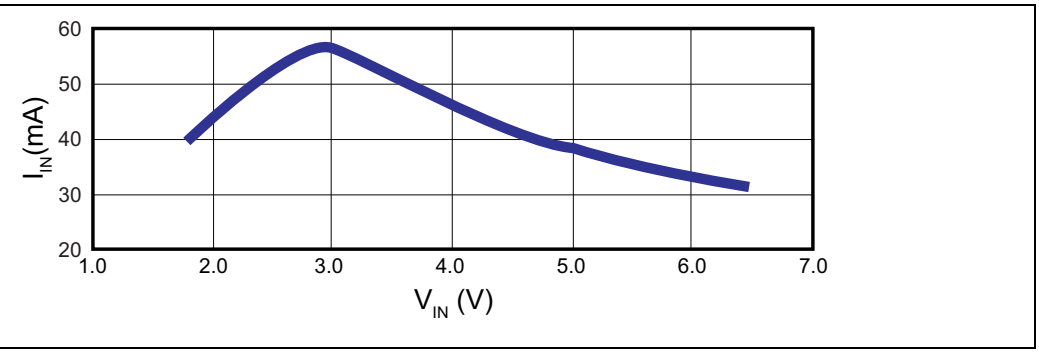


FIGURE 3-3: *I_{IN} vs. V_{IN}.*

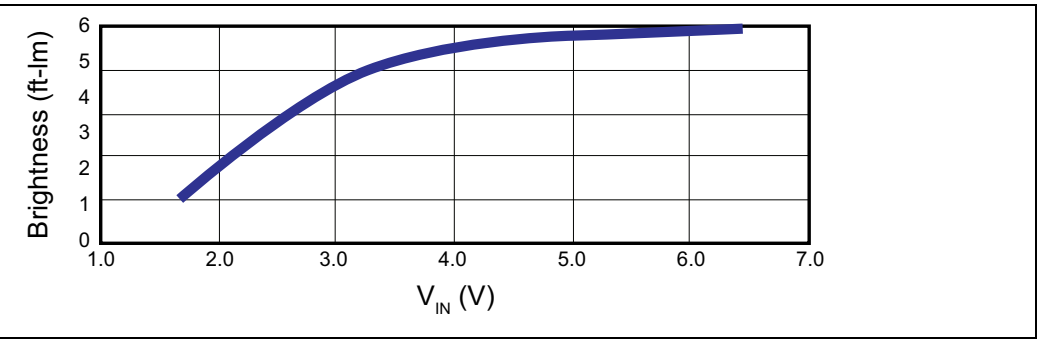


FIGURE 3-4: *Brightness vs. V_{IN}.*

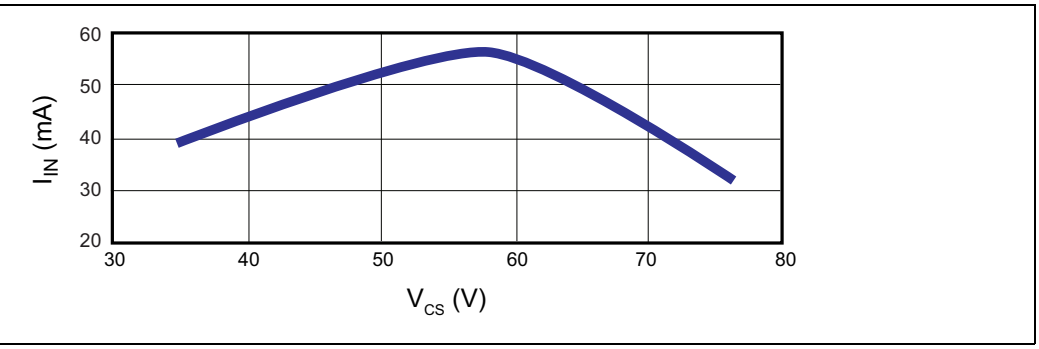


FIGURE 3-5: *I_{IN} vs. V_{CS}.*

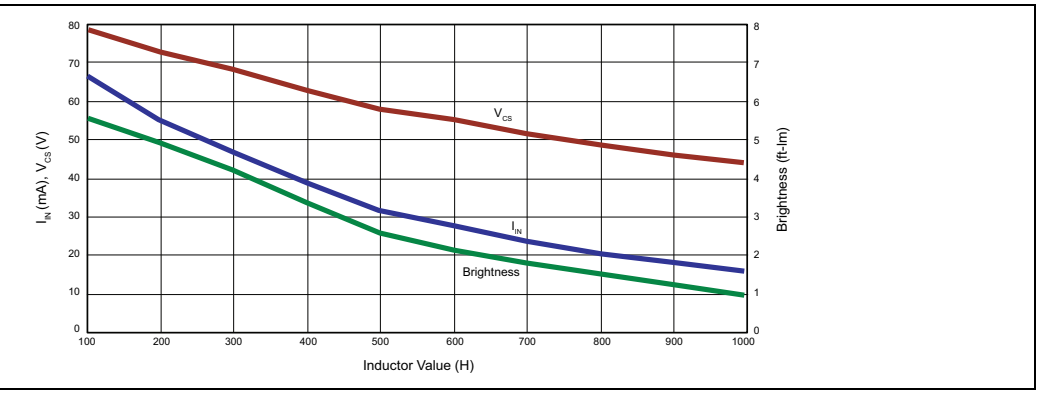


FIGURE 3-6: *I_{IN}, V_{CS} and Brightness vs. Inductor Value.*

3.2 Typical Application Circuit 2

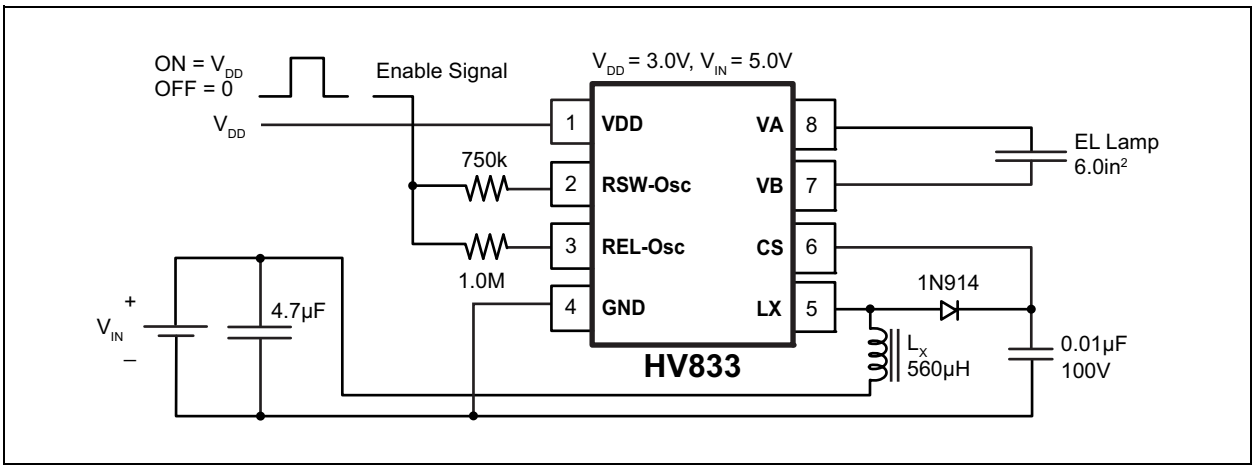


FIGURE 3-7: *Typical Application Circuit 2.*

TABLE 3-2: TYPICAL PERFORMANCE FOR TYPICAL APPLICATION CIRCUIT 2

Device	Lamp Size	V_{IN}	I_{IN}	V_{CS}	f_{EL}	Brightness	T_A
HV833MG	6 in^2	5V	30 mA	70V	440 Hz	6 ft-lm	–25°C to +85°C

3.2.1 TYPICAL PERFORMANCE CURVES FOR TYPICAL APPLICATION CIRCUIT 2

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g. outside specified power supply range) and therefore outside the warranted range.

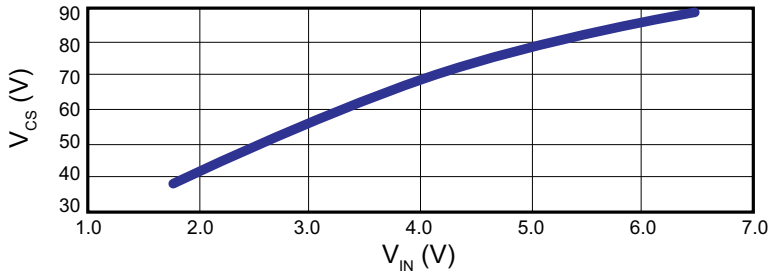


FIGURE 3-8: *V_{CS} vs. V_{IN}.*

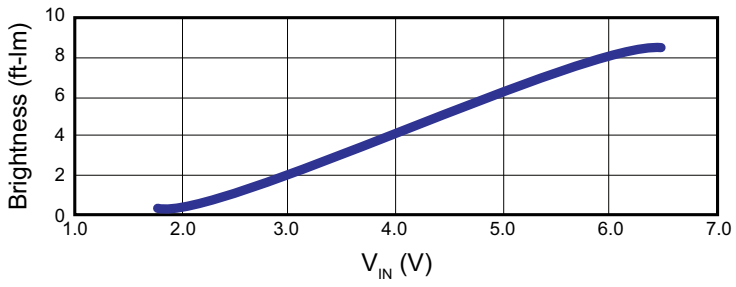


FIGURE 3-9: *Brightness vs. V_{IN}.*

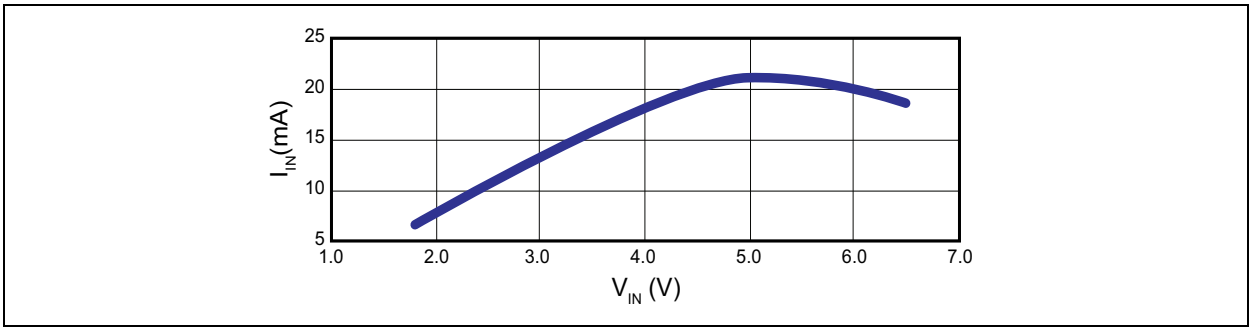


FIGURE 3-10: *I_{IN} vs. V_{IN}.*

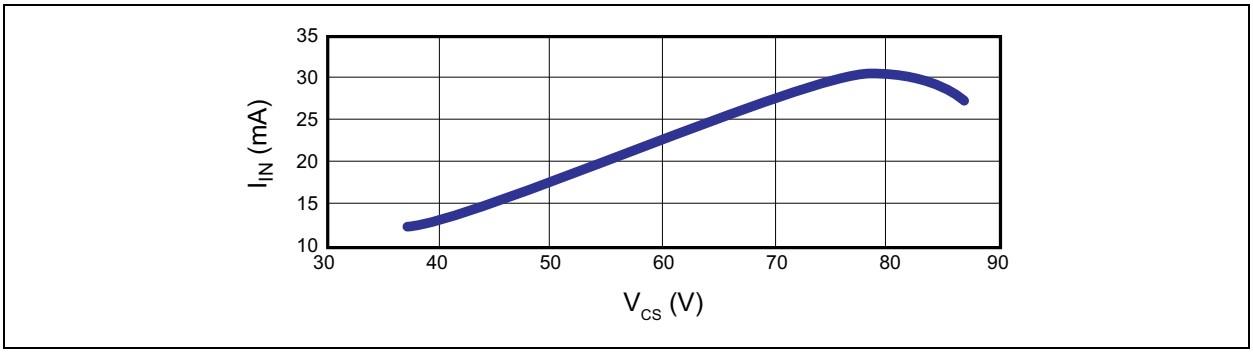


FIGURE 3-11: *I_{IN} vs. V_{CS}.*

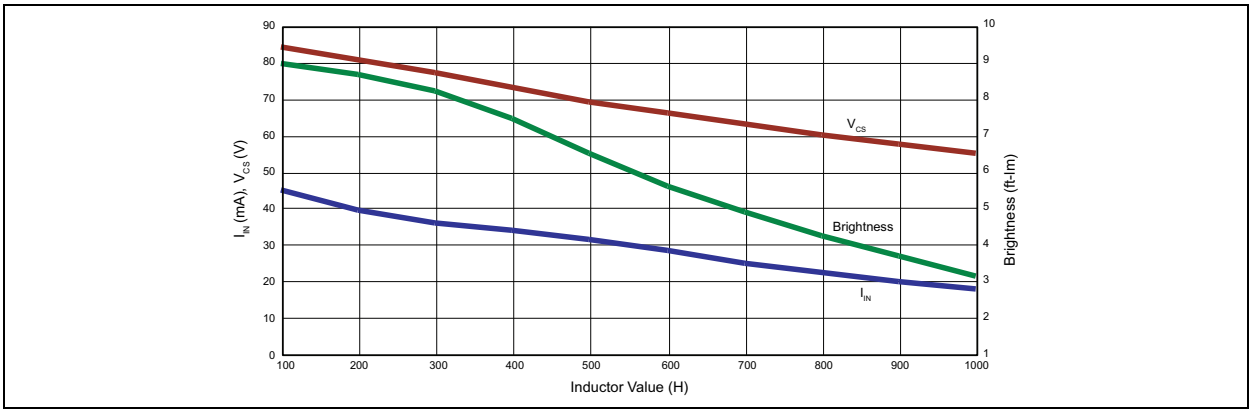


FIGURE 3-12: *I_{IN}, V_{CS}, Brightness vs. Inductor Value.*

3.3 Typical Application Circuit 3

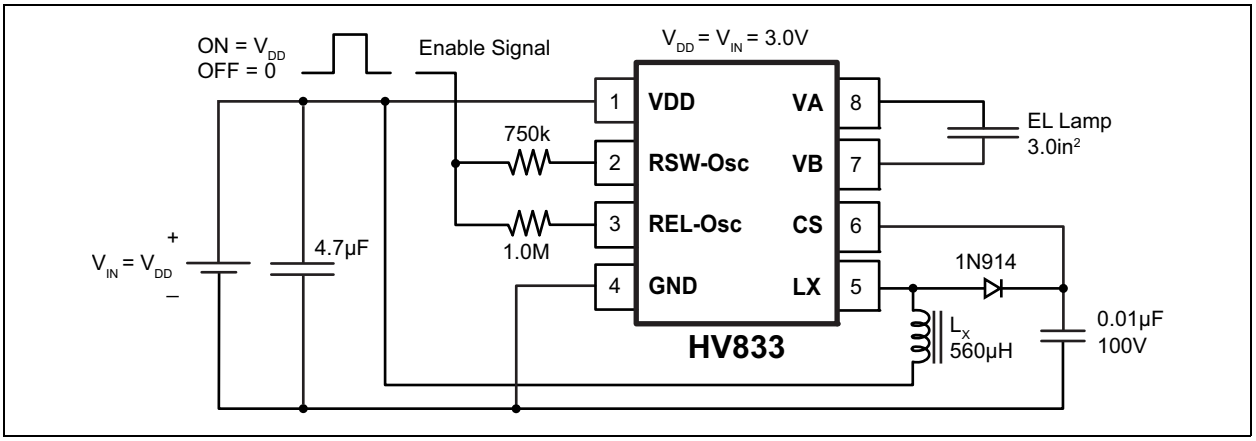


FIGURE 3-13: *Typical Application Circuit 3.*

TABLE 3-3: TYPICAL PERFORMANCE FOR TYPICAL APPLICATION CIRCUIT 3

Device	Lamp Size	V_{IN}	I_{IN}	V_{CS}	f_{EL}	Brightness	T_A
HV833MG	3 in^2	3V	20 mA	60V	440 Hz	4 ft-lm	–25°C to +85°C

3.3.1 TYPICAL PERFORMANCE CURVES FOR TYPICAL APPLICATION CIRCUIT 3

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g. outside specified power supply range) and therefore outside the warranted range.

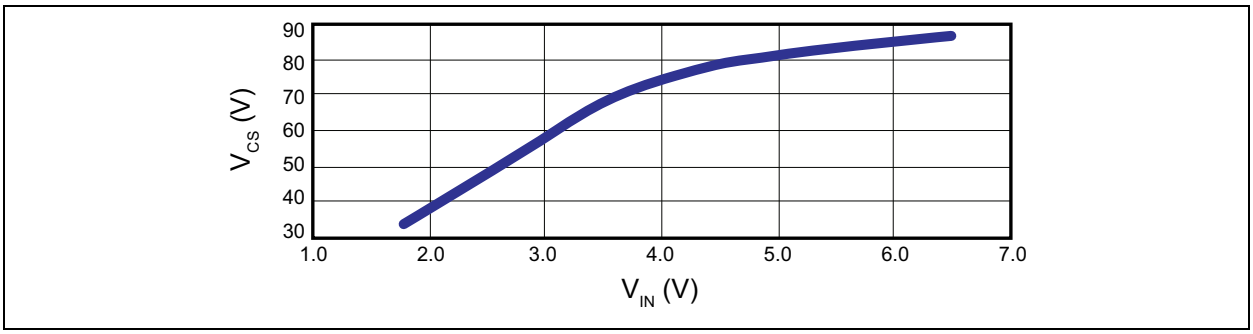


FIGURE 3-14: *V_{CS} vs. V_{IN}.*

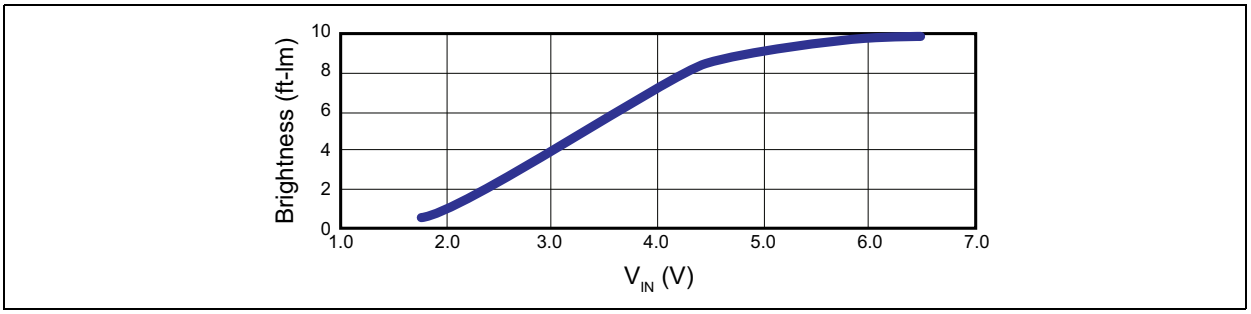


FIGURE 3-15: *Brightness vs. V_{IN}.*

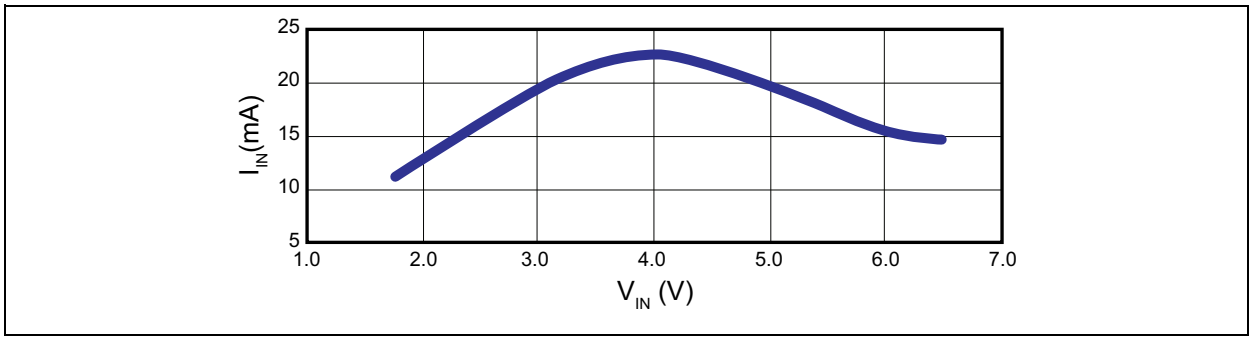


FIGURE 3-16: *I_{IN} vs. V_{IN}.*

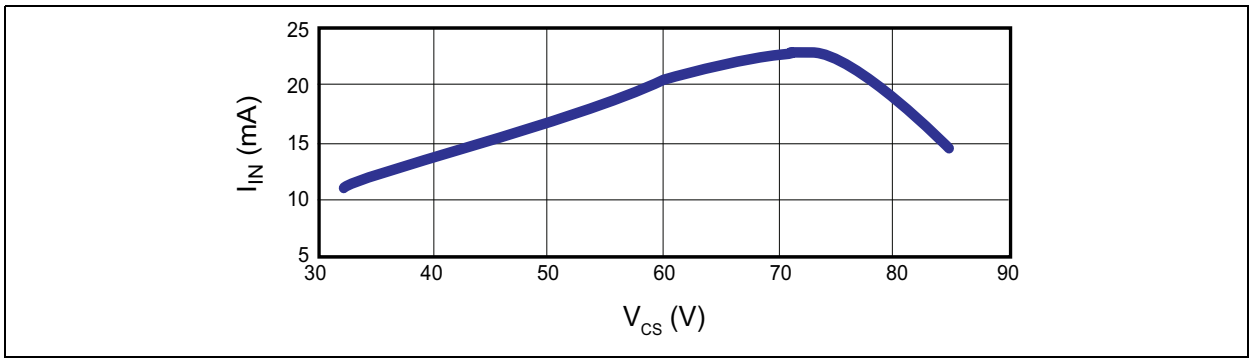


FIGURE 3-17: *I_{IN} vs. V_{CS}.*

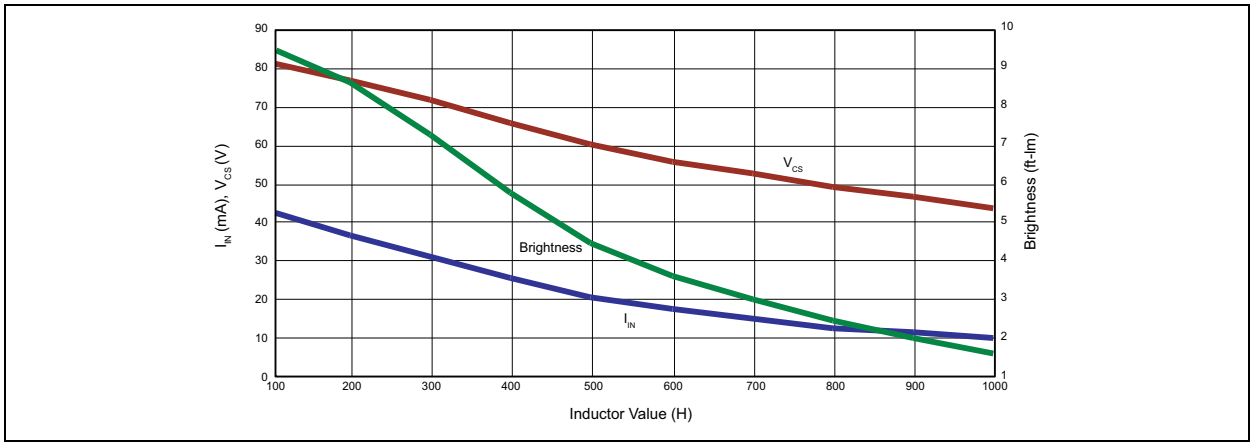


FIGURE 3-18: *I_{IN}, V_{CS}, Brightness vs. Inductor Value.*

3.4 Enable/Disable Configuration

The HV833 can be easily enabled and disabled through a logic control signal on the R_{SW} and R_{EL} resistors as shown in the **Typical Application Circuit**. The control signal can be from a microprocessor. R_{SW} and R_{EL} are typically very high values. Therefore, only 10s of microamperes will be drawn from the logic signal when it is at a Logic High (Enable) state. When the microprocessor signal is high, the device is enabled, and when the signal is low, it is disabled.

TABLE 3-4: ENABLE/DISABLE TABLE

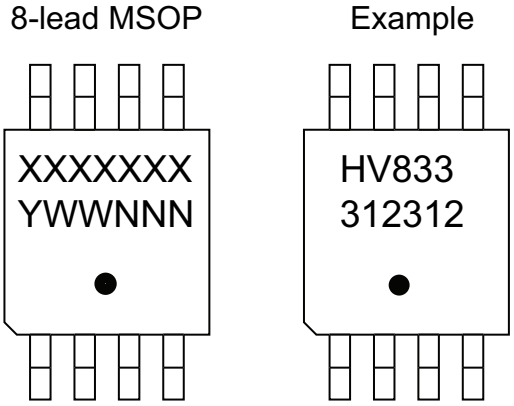
Enable Signal	HV833
V_{DD}	Enable
0V	Disable

3.5 Split Supply Configuration for Battery Voltages of Higher than 6.5V

The **Typical Application Circuit** can also be used with high battery voltages such as 12V as long as the input voltage, V_{DD}, to the HV833 device is within its specifications of 1.8V to 6.5V. Split supply configuration is shown on Figure 3-7.

4.0 PACKAGING INFORMATION

4.1 Package Marking Information

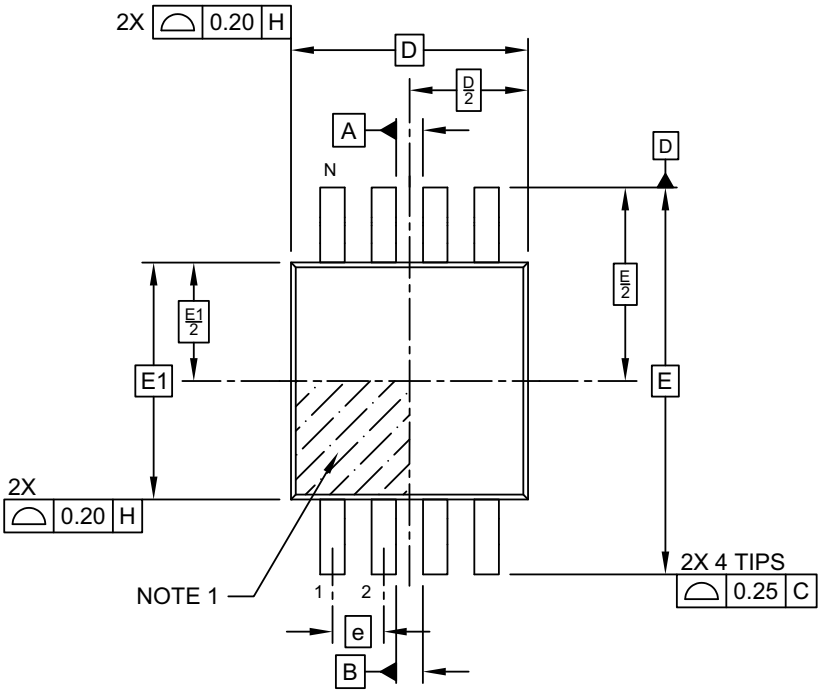


Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package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

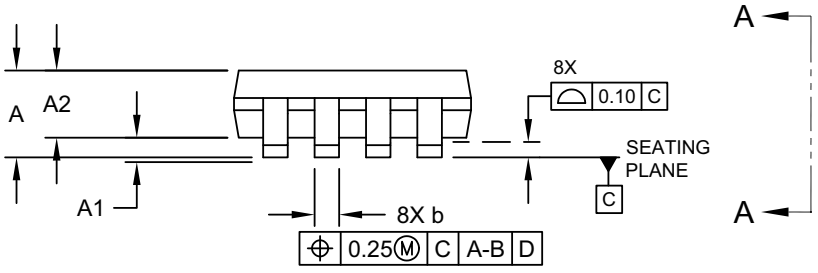
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for product code or customer-specific information. Package may or not include the corporate logo.

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

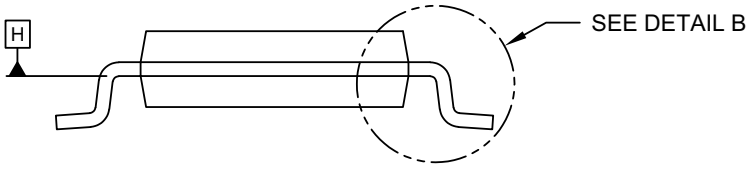
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

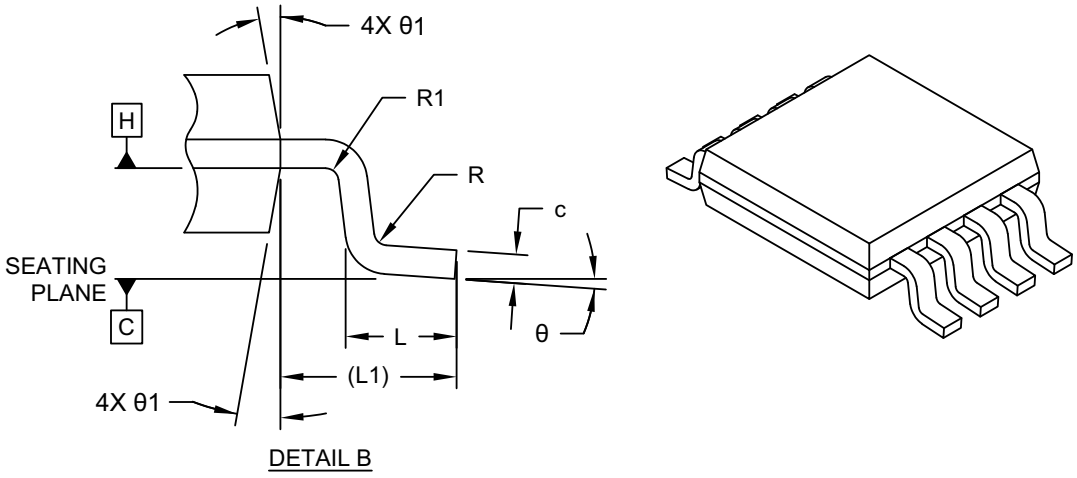


VIEW A–A

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°

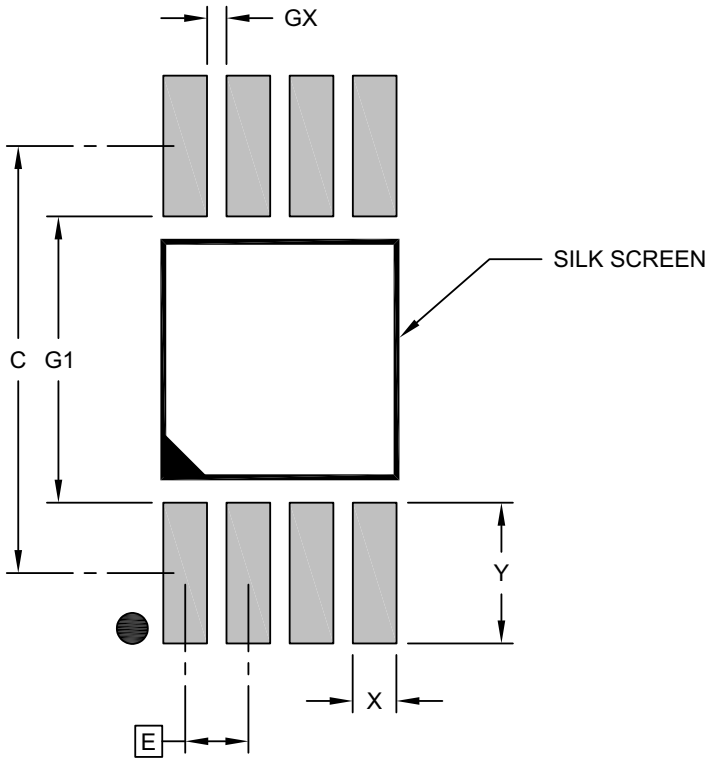
Notes:

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 (July 2023)

- Converted Supertex Doc# DSFP-HV833 to Microchip DS20005903A
- 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:	HV833	=	High-Voltage 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) HV833MG-G: High-Voltage EL Lamp Driver, 8-lead MSOP Package, 2500/Reel

Note the following details of the code protection feature on Microchip products:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
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