High Voltage Dual EL Lamp Driver

Features

- Independent input control for lamp selection
- Split supply capability
- Patented output timing
- One miniature inductor to power both lamps
- Low shutdown current
- Wide input voltage range 2.0V to 5.0V
- Output voltage regulation
- No SCR output
- Available in 10-Lead MSOP package

Applications

- Mobile cellular phones, dual display
- Keypad and LCD backlighting
- Portable instrumentation
- Dual segment lamps
- Hand held wireless communication devices

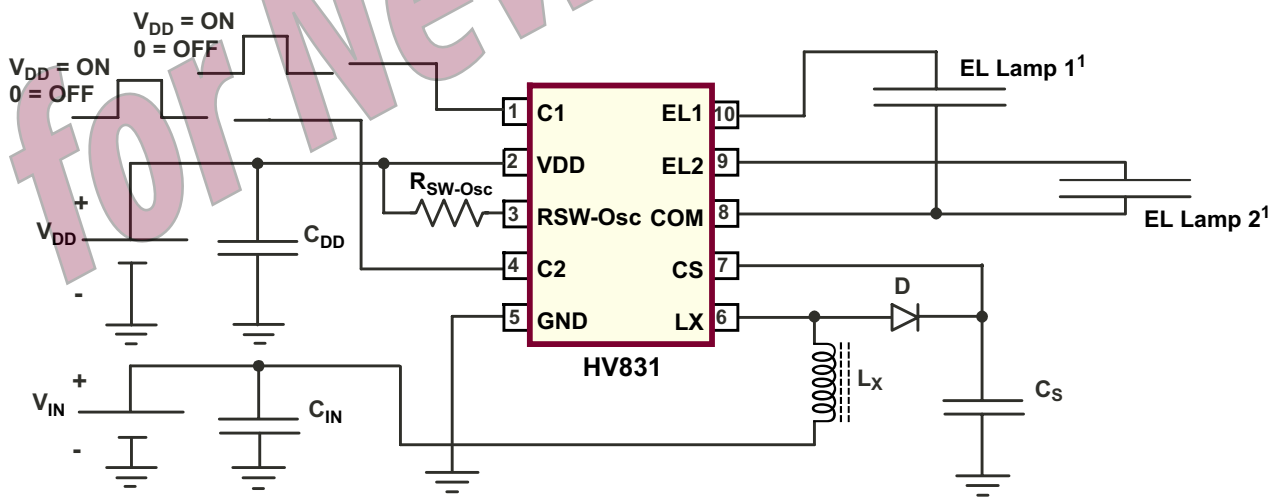
General Description

The Supertex HV831 is a high voltage driver designed for driving two EL lamps with a combined area of 3.5 square inches. The input supply voltage range is from 2.0 to 5.0V. The device is designed to reduce the amount of audible noise emitted by the lamp. This device uses a single inductor and minimum number of passive components to drive two EL lamps. The nominal regulated output voltage of ±80V is applied to the EL lamps. The two EL lamps can be turned on and off by the two logic input control pins, C1 and C2. The device is disabled when both C1 and C2 (pins 1 and 4) are at logic low.

The HV831 has an internal oscillator, a switching MOSFET, and two high voltage EL lamp drivers. An external resistor connected between the RSW-OSC and the voltage supply pin VDD sets the frequency for the switching MOSFET. The EL lamp driver frequency is set by dividing the MOSFET switching frequency by 128. An external inductor is connected between the LX and the VDD pins. Depending on the EL lamp size, a 1.0 to 10.0nF, 100V capacitor is connected between CS and Ground. The two EL lamps are connected between EL1 to Com and EL2 to Com.

The switching MOSFET charges the external inductor and discharges it into the capacitor at CS. The voltage at CS increases. Once the voltage at CS reaches a nominal value of 80V, the switching MOSFET is turned off to conserve power. The outputs EL1 to Com and EL2 to Com are configured as H bridges and switch in opposite states to achieve 160V across the EL lamp.

Typical Application Circuit



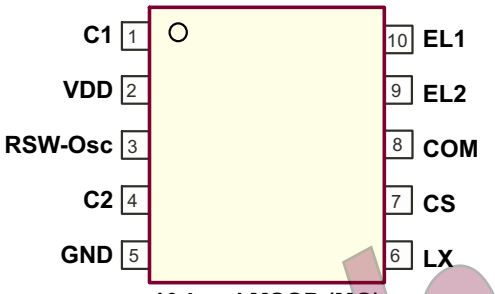
1. *The bigger sized lamp should be tied to EL1 and the smaller sized lamp to EL2 terminals (pins 10 and 9 respectively)*

Ordering Information

Device	Package Option
	10-Lead MSOP *3.00x3.00mm body 1.10mm height (max) 0.50mm pitch*
HV831	HV831MG-G

-G indicates package is RoHS compliant ('Green')

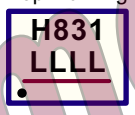
Pin Configuration



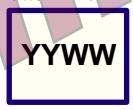
10-Lead MSOP (MG)
(top view)

Product Marking

Top Marking



Bottom Marking



L = Lot Number
YY = Year Sealed
WW = Week Sealed
_____ = "Green" Packaging

Absolute Maximum Ratings

Parameter	Value
Supply voltage, V_{DD}	-0.5 to +7.5V
Supply voltage, V_{CS}	-0.5 to +120V
Operating ambient temperature range	-40°C to +85°C
Storage temperature range	-65° to +150°C
Power dissipation 10-Lead MSOP	250mW

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground, GND

Function Table

C1	C2	EL1	EL2	Com	IC
0	0	Hi Z	Hi Z	Hi Z	OFF
0	1	Hi Z	ON	ON	ON
1	0	ON	Hi Z	ON	ON
1	1	ON	ON	ON	ON

Thermal Resistance

Package	θ_{ja}
MSOP-10	400 °C/W

(Mounted on FR4 board, 25mm x 25mm x 1.57mm)

Recommended Operating Conditions

Sym	Parameter	Min	Typ	Max	Units	Conditions
V_{DD}	Supply voltage	2.0	-	5.0	V	---
T_A	Operating temperature	-40	-	+85	°C	---

Electrical Characteristics

DC Characteristics *(Over operating conditions unless otherwise specified, T_A= 25°C)*

Sym	Parameter	Min	Typ	Max	Units	Conditions
$R_{DS(ON)}$	On-resistance of switching transistor	-	-	6.0	Ω	I = 100mA
V_{DD}	Input voltage range	2.0	-	5.0	V	---
V_{CS}	Output regulation voltage	72	80	88	V	V_{DD} = 2.0V to 5.0V
V_{DIFF}	Differential output peak to peak voltage (EL1 to COM, EL2 to COM)	144	160	176	V	V_{DD} = 2.0V to 5.0V
I_{DDQ}	Quiescent VDD supply current	-	-	150	nA	C_1 = C_2 = 0V
I_{DD}	Input current into the VDD pin	-	-	150	µA	V_{DD} = 2.0V to 5.0V
I_{IN}	Input current including inductor current when driving both lamps	-	-	45	mA	V_{IN} = 3.0V. See Figure 1. T_A= -40 to +85°C
		-	26.5	35		V_{IN} = 3.0V. See Figure 1. T_A= 25°C
V_{CS}	Output voltage on V_{CS} when driving both lamps	-	67.8	-	V	V_{IN} = 3.0V. See Figure 1.
V_{DIFF}	Differential output peak to peak voltage across each lamp. (EL1 to Com, EL2 to Com)	-	135.6	-	V	V_{IN} = 3.0V. See Figure 1.
f_{EL}	V_{DIFF} output drive frequency	214	244	274	Hz	V_{IN} = 3.0V. See Figure 1.
f_{SW}	Switching transistor frequency	27.4	31.2	35	kHz	V_{IN} = 3.0V. See Figure 1.
D	Switching transistor duty cycle	85	-	89	%	---
I_{IL}	Input logic low current going into the control pin	-	-	-0.6	µA	V_{DD} = 2.0V to 5.8V
I_{IH}	Input logic low current going into the control pin	-	-	0.6	µA	V_{DD} = 2.0V to 5.8V
V_{EN-L}	Logic input low voltage	0	-	$0.2V_{DD}$	V	---
V_{EN-H}	Logic input high voltage	$0.8V_{DD}$	-	V_{DD}	V	---

Functional Block Diagram

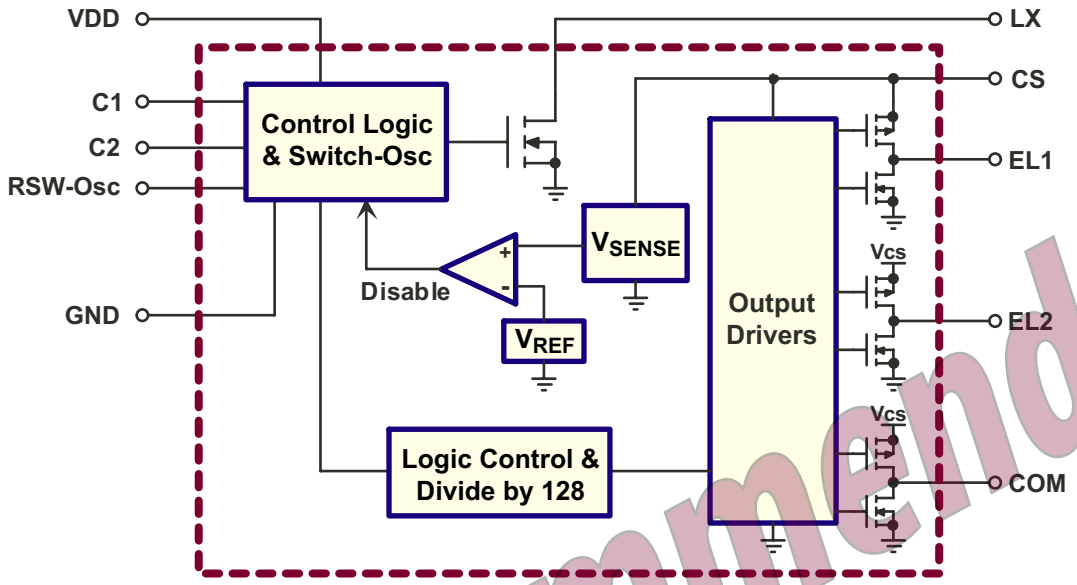
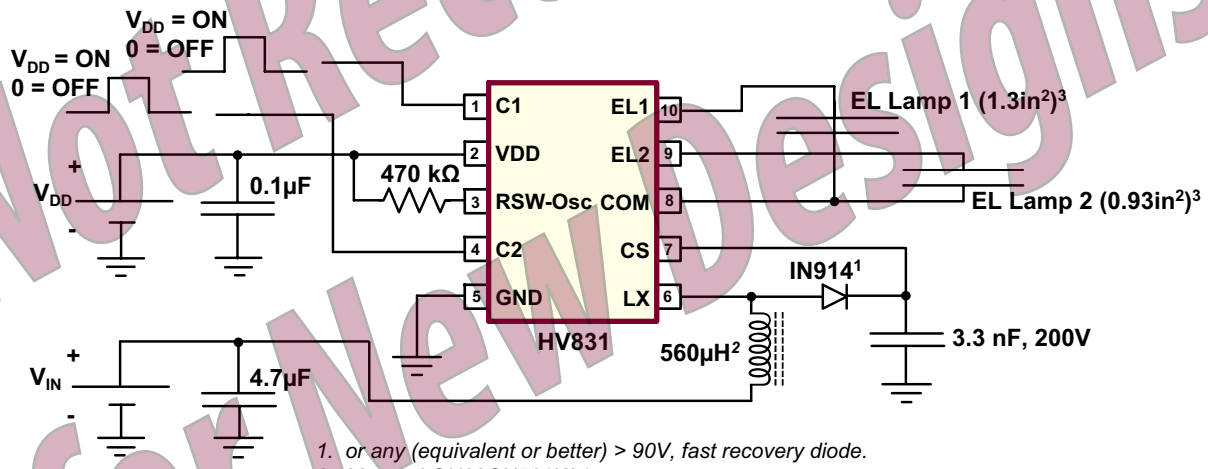


Figure 1: Test Circuit



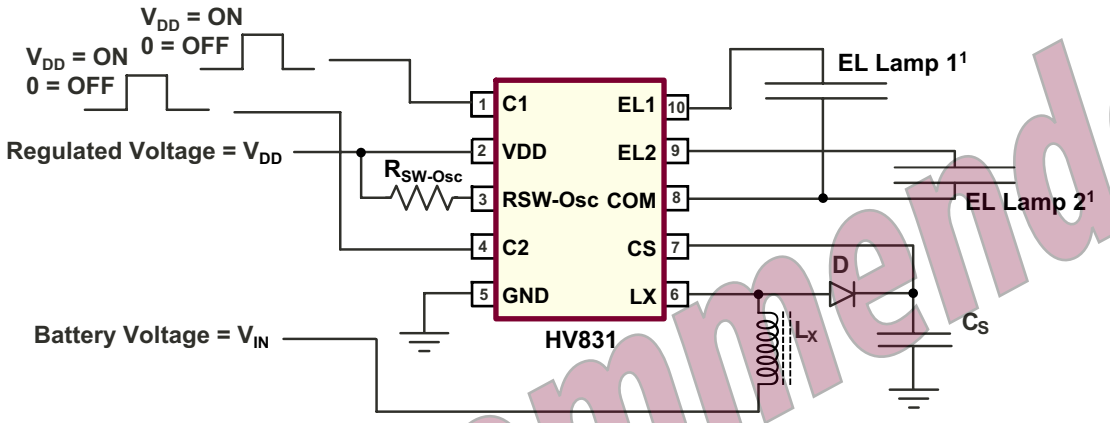
1. *or any (equivalent or better) > 90V, fast recovery diode.*
2. *Murata LQH32CN561K21.*
3. *The bigger sized lamp should be tied to EL1 and the smaller sized lamp to EL2 terminals (pins 10 and 9 respectively).*

Device	Lamp	V_{DD}	I_{DD}	V_{CS}	f_{EL}	Brightness
HV831MG	EL1	3.0V	17.3mA	74.8V	244Hz	5.9ft-lm
	Both EL1 and EL2 ON		26.5mA	67.8V		5.5ft-lm

Split Supply Configuration

The HV831 can be used in applications operating from a battery where a regulated voltage is available. This is shown in Figure 2. The regulated voltage can be used to drive the internal logic of HV831. The amount of current used to drive the internal logic is less than 150µA. Therefore, the regulated voltage could easily provide the current without being loaded down.

Figure 2: Split Supply Configuration



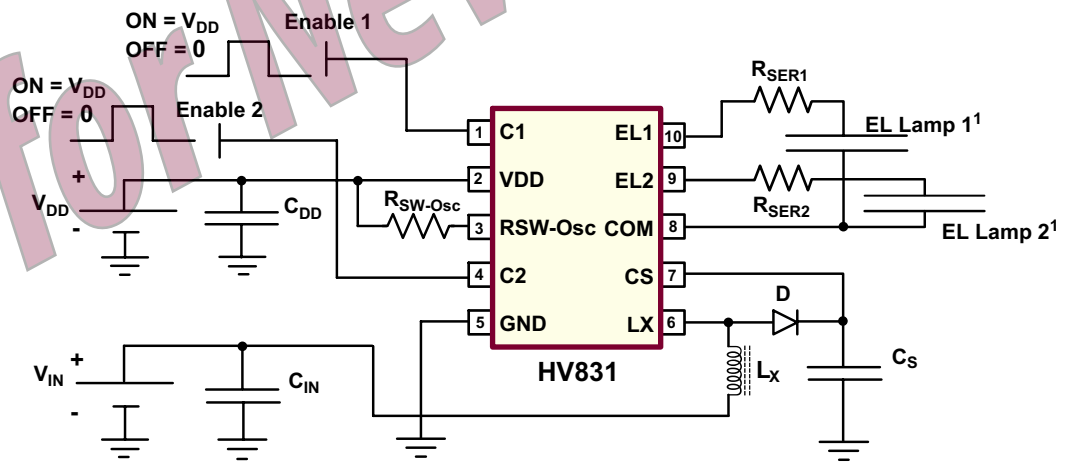
1. *The bigger sized lamp should be tied to EL1 and the smaller sized lamp to EL2 terminals (pins 10 and 9 respectively)*

Audible Noise Reduction

This section describes a method (patented) developed at Supertex to reduce the audible noise emitted by the EL lamps used in application sensitive to audible noise. The waveform takes the shape of approximately 2RC time constants for rising and 2RC time constants for falling, where C is the capacitance of the EL lamp, and R is the external resistor, R_{SER} connected in series with the EL lamp.

Figure 3 shows a general circuit schematic that uses the series resistors, R_{SER1} and R_{SER2}, for each of the EL lamps. R_{SER1} and R_{SER2} are connected in series with the EL lamp. The audible noise can be set a desirable level by selecting the resistances for R_{SER1} and R_{SER2}. It is important to note

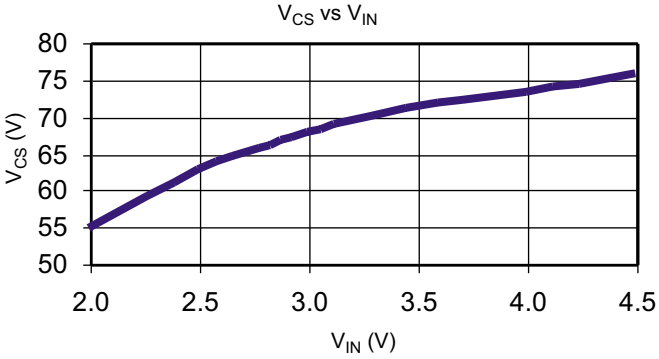
Figure 3: Typical Application Circuit For Audible Noise Reduction

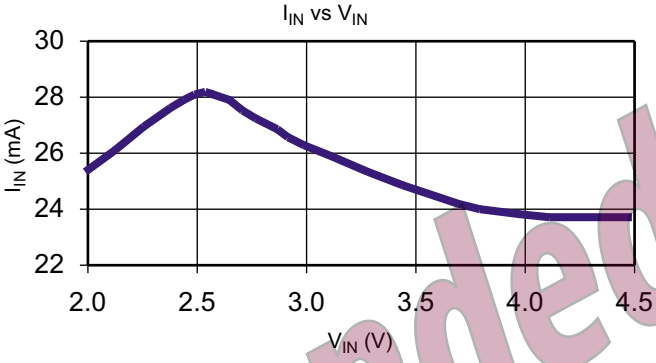


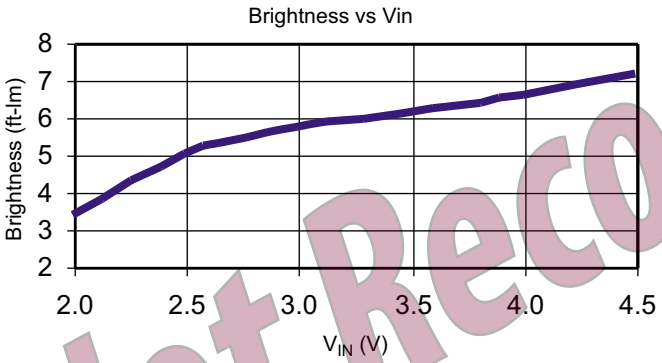
1. *The bigger sized lamp should be tied to EL1 and the smaller sized lamp to EL2 terminals (pins 10 and 9 respectively)*

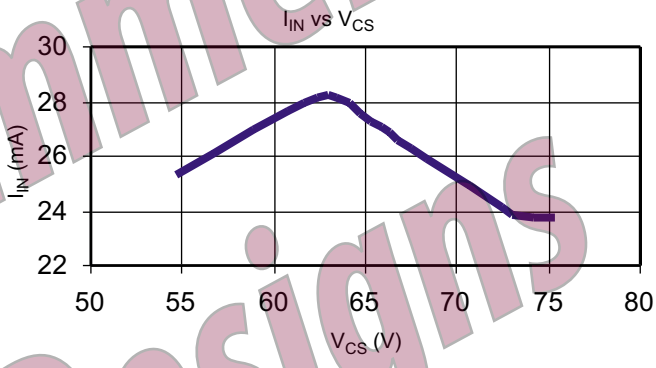
Typical HV831 Performance Curves

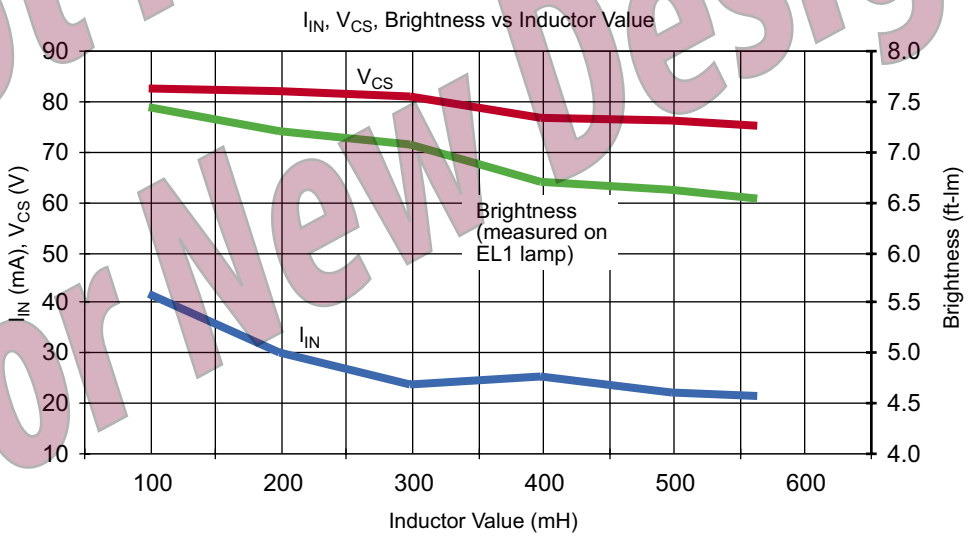
(When driving both EL Lamps, EL_1 Lamp = 1.3in², EL_2 Lamp = 0.93in², V_{DD} = 3.0V)









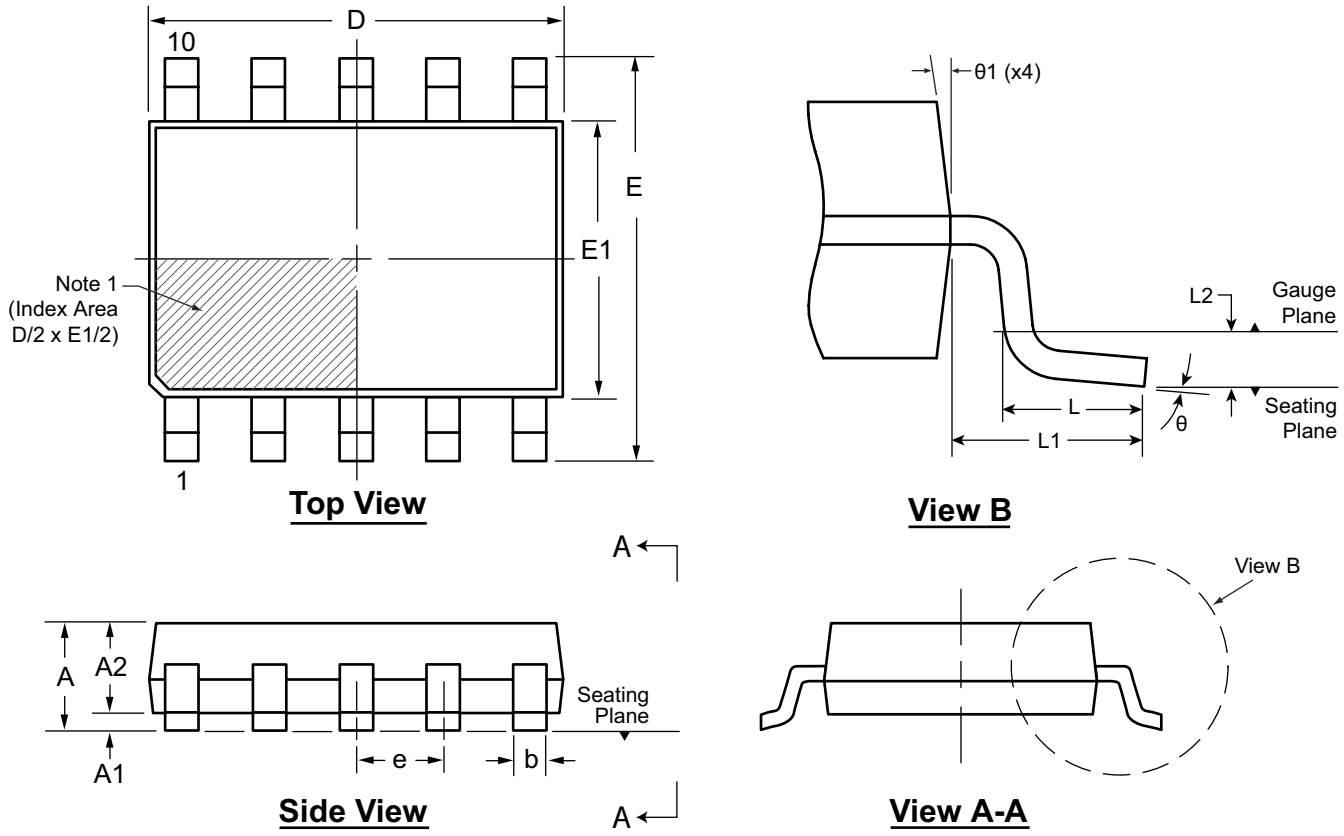


Pin Configuration and Description

Pin #	Name	Function
1	C1	Enable input signal for EL lamp 1. Logic high will turn ON the EL lamp 1 and logic low will turn it OFF. Refer to the Function Table.
2	VDD	Input supply voltage pin.
3	RSW-Osc	External resistor connection to set both the switching MOSFET frequency and EL Lamp frequency. The external resistor should be connected between this pin and the V_{DD} pin. The EL lamp frequency is switching frequency divided by 128. The switching frequency increases as the value of R_{SW-OSC} decreases. A 470kΩ resistor will provide a switching frequency of 31.2 kHz, and an EL lamp frequency of 244 Hz. To change the frequency to f_{SW1}, the value of the resistor $R_{SW-OSC1}$ can be determined as $R_{SW-OSC1}$ = (470 x 244) / f_{EL1}MΩ.
4	C2	Enable input signal for EL lamp 2. Logic high will turn ON the EL lamp 2 and logic low will turn it OFF. Refer to the Function Table.
5	GND	IC Ground Pin.
6	LX	External inductor connection to boost the low input voltage using inductive flyback. Connect an inductor between VIN and this pin. Also connect a high voltage fast recovery diode between this pin and the CS pin. The anode of the diode needs to be connected to the LX pin and the cathode to the CS pin. In general, small valued inductors, which can handle more current, are more suitable for driving large sized lamps. As the inductor value decreases, the switching frequency should be increased to avoid saturation. When the switching MOSFET is turned ON, the inductor is being charged. When the MOSFET is turned OFF, the energy stored in the inductor is transferred to the high voltage capacitor connected at the CS pin.
7	CS	Connect a 100V capacitor between this pin and GND. This capacitor stores the energy transferred from the inductor.
8	COM	Common connection for both EL lamps. Connect one end of both the lamps to this pin.
9	EL2	EL lamp 2 connection. For optimum performance, the smaller of the two lamps should be connected to this pin.
10	EL1	EL lamp 1 connection. For optimum performance, the larger of the two lamps should be connected to this pin.

10-Lead MSOP Package Outline (MG)

3.00x3.00mm body, 1.10mm height (max), 0.50mm pitch



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	L	L1	L2	θ	θ1
Dimension (mm)	MIN	0.75*	0.00	0.75	0.17	2.80*	4.65*	2.80*	0.50 BSC	0.40	0.95 REF	0.25 BSC	0°	5°
	NOM	-	-	0.85	-	3.00	4.90	3.00		0.60			-	-
	MAX	1.10	0.15	0.95	0.33	3.20*	5.15*	3.20*		0.80			8°	15°

JEDEC Registration MO-187, Variation BA, Issue E, Dec. 2004.
** This dimension is not specified in the JEDEC drawing.*
Drawings are not to scale.
Supertex Doc. #: *DSPD-10MSOPMG, Version F041309*

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