Low Noise, High Voltage
EL Lamp Driver IC

Features

► Audible noise reduction
► 190 V_{PP} output voltage for higher brightness
► Single cell lithium ion compatible
► 150nA shutdown current
► Wide input voltage range 1.8V to 5.0V
► Separately adjustable lamp and converter frequencies
► Output voltage regulation
► Split supply capability
► Available in 8-Lead DFN and 8-Lead MSOP-packages

Applications

► Mobile cellular phones
► Keypad backlighting
► LCD backlighting
► PDAs
► Handheld wireless communication products
► Global Positioning Systems (GPS)

General Description

The Supertex HV857L is a low noise, high voltage driver designed for driving Electroluminescent (EL) lamps of up to five square inches. It is the low noise version of the EL lamp driver HV857. The input supply voltage range is from 1.8V to 5.0V. 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 ±95V. The chip can be enabled/disabled by connecting the resistor on RSW-Osc to VDD/ground.

The HV857L 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 supply pin, VDD. The EL lamp driver frequency is set by an external resistor connected between the REL-Osc and VDD pins. An external inductor is connected between the LX and VDD pins, or VIN for split supply applications. A 0.003-0.1μF capacitor is connected between CS and ground. The EL lamp is connected between the VA and VB pins.

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 95V, 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 ±95V across the EL lamp.

Typical Application Circuit
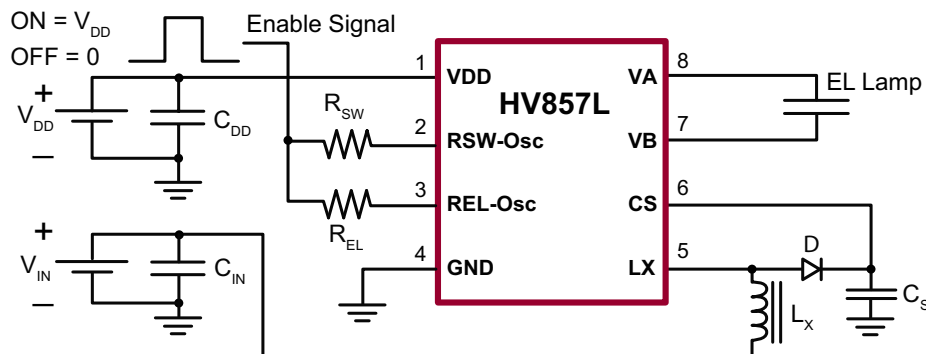
Ordering Information

Part Number	Package	Packing
HV857LK7-G	8-Lead DFN	3000/Reel
HV857LMG-G	8-Lead MSOP	2500/Reel

-G denotes a lead (Pb)-free / RoHS compliant package

Absolute Maximum Ratings

| Parameter	Value
Supply voltage, V_{DD}	-0.5V to 6.5V
Operating temperature	-40°C to +85°C
Storage temperature	-65°C to +150°C
8-Lead DFN power dissipation	1.6W
8-Lead MSOP power dissipation	300mW
Output voltage, V_{CS}	-0.5 to +120V

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.

Typical Thermal Resistance

Package	θ_{ja}
8-Lead DFN	37°C/W
8-Lead MSOP	171°C/W

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

Pin Configurations

8-Lead DFN
(top view)

8-Lead MSOP
(top view)
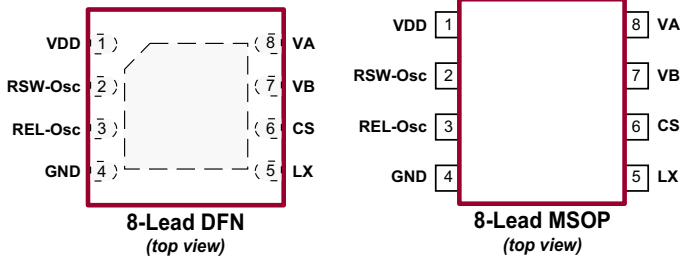
Pads are at the bottom of the package.
Exposed center pad is at ground potential.

Product Marking

Y = Last Digit of Year Sealed
W = Code for Week Sealed
L = Lot Number
___ = "Green" Packaging

Package may or may not include the following marks: Si or 🔋

8-Lead DFN

Top Marking

Bottom Marking

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

Package may or may not include the following marks: Si or 🔋

8-Lead MSOP

Recommended Operating Conditions

Sym	Parameter	Min	Typ	Max	Units	Conditions
V_{DD}	Supply voltage	1.8	-	5.0	V	---
f_{EL}	Operating drive frequency	-	-	1	kHz	---
T_A	Operating temperature	-40	-	+85	°C	---

Electrical Characteristics

DC Characteristics *(Over recommended 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_{CS}	Max. output regulation voltage	85	95	105	V	V_{DD} = 1.8 to 5.0V
$V_A - V_B$	Peak to peak output voltage	170	190	210	V	V_{DD} = 1.8 to 5.0V
I_{DDQ}	Quiescent V_{DD} supply current	-	-	150	nA	R_{SW-Osc} = Low
I_{DD}	Input current going into the VDD pin	-	-	150	µA	V_{DD} = 1.8 to 5.0V. See Fig. 1
I_{IN}	Input current including inductor current	-	25	40	mA	See Fig. 1*
V_{CS}	Output voltage on VCS	-	92	-	V	See Fig. 1
f_{EL}	EL lamp frequency	175	205	235	Hz	See Fig. 1
f_{SW}	Switching transistor frequency	65	77	89	kHz	See Fig. 1
D	Switching transistor duty cycle	-	88	-	%	See Fig. 1

* The inductor used is a 220µH Murata inductor, max DC resistance of 8.4Ω, part # LQH32CN221K21.

Enable/Disable Function Table

Sym	Parameter	Min	Typ	Max	Units	Conditions
EN-L	Logic input low voltage	0	-	0.2	V	V_{DD} = 1.8 to 5.0V
EN-H	Logic input high voltage	V_{DD} - 0.2	-	V_{DD}	V	V_{DD} = 1.8 to 5.0V

Block Diagram
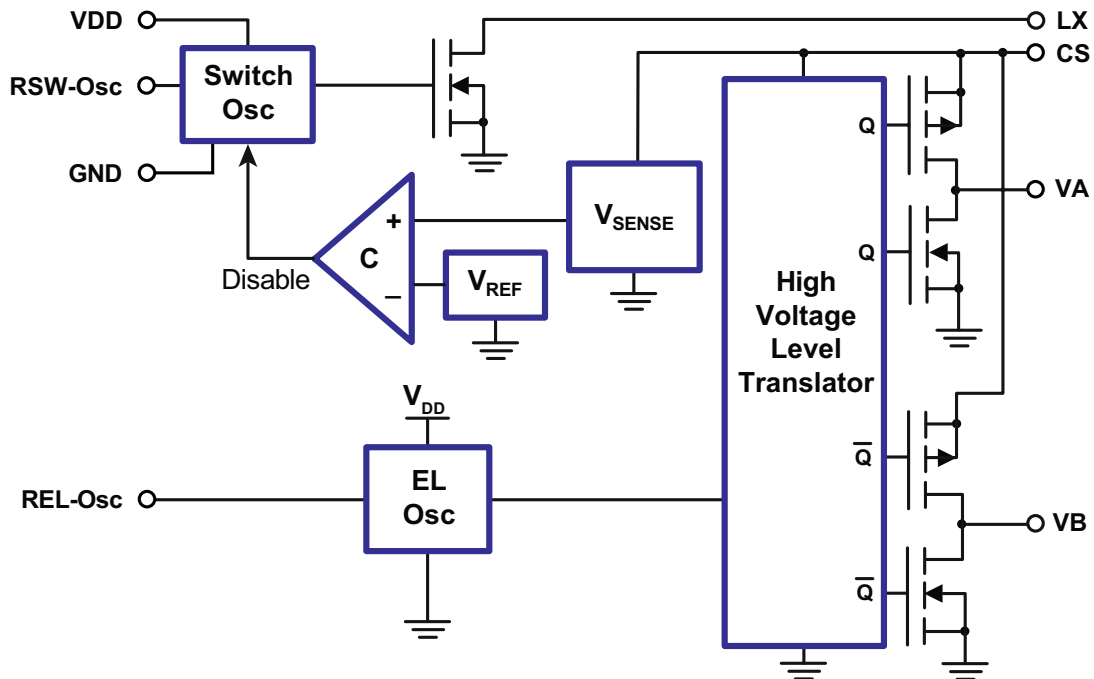
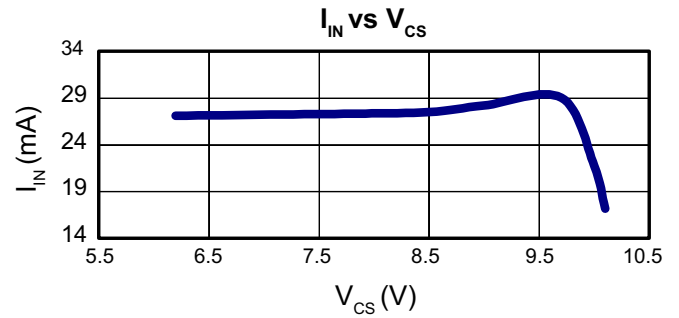## Fig. 1: Typical Application/ Test Circuit
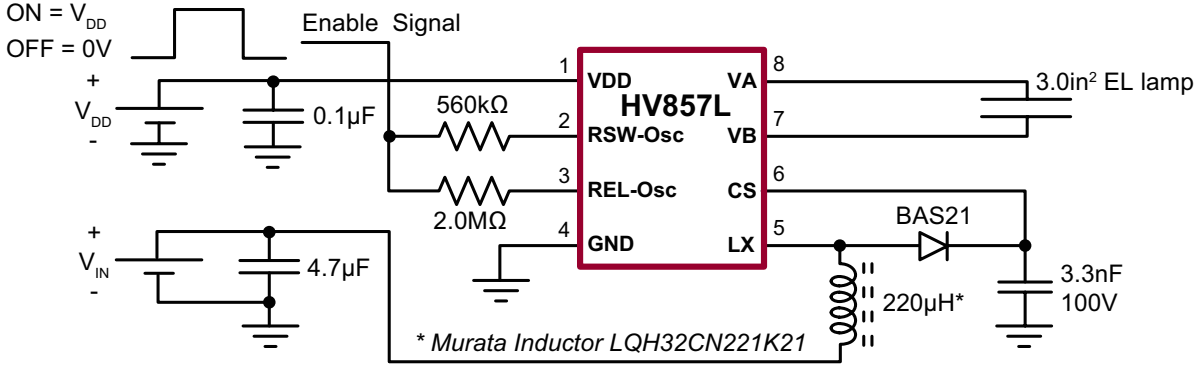
Typical Performance

Device	Lamp Size	$V_{DD} = V_{IN}$	I_{IN}	V_{CS}	f_{EL}	Brightness
HV857LMG-G	$3.0in^2$	3.3V	25.40mA	92V	205Hz	5.70ft-lm

Typical Performance Curves for Fig. 1 *(EL Lamp = $3.0in^2$, $V_{DD} = 3.0V$)*
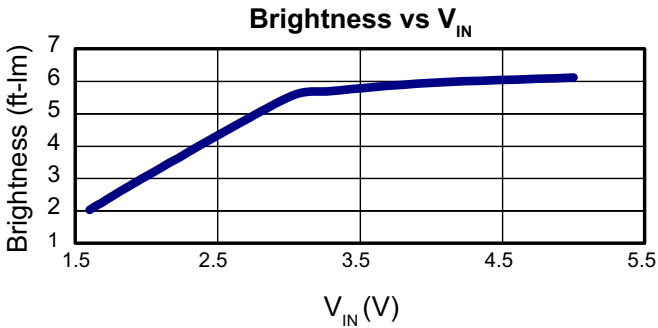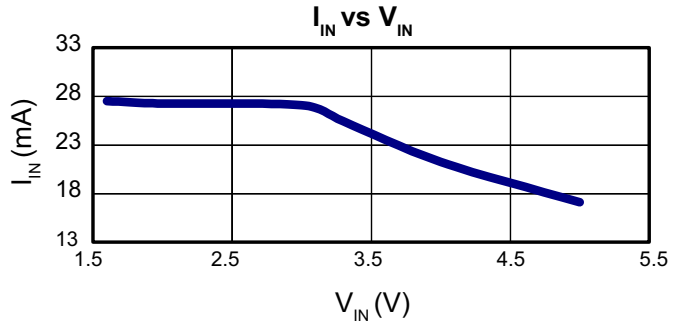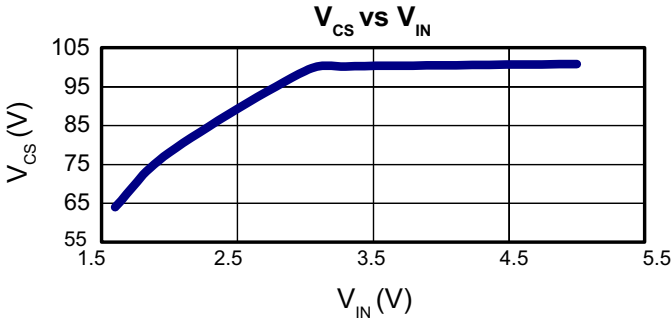
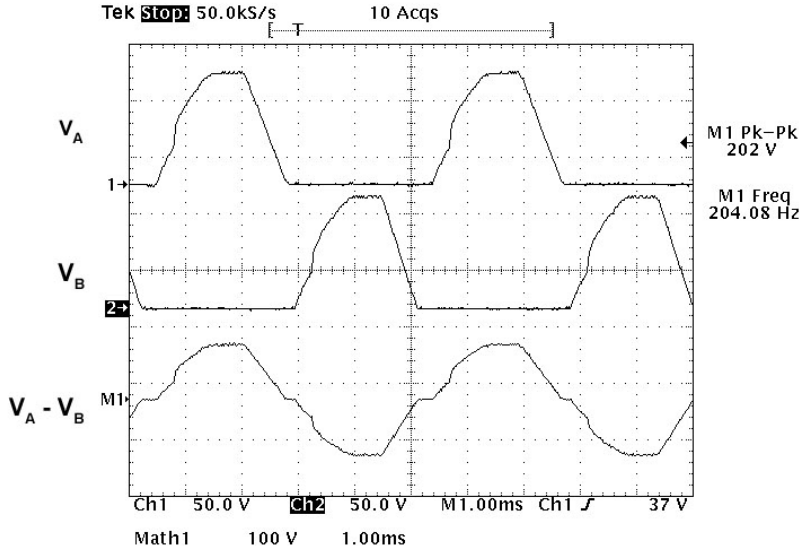# Typical Waveform on V_A, V_B and Differential Waveform V_A - V_B
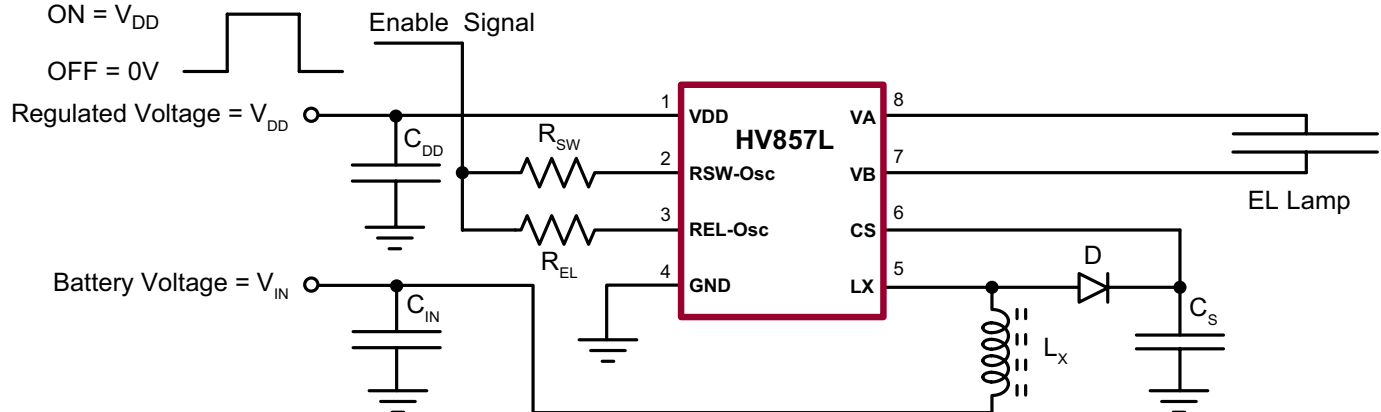

Fig. 2: Split Supply and Enable/Disable Configuration

Split Supply Configuration

The HV857L can also be used for handheld devices operating from a battery where a regulated voltage is available. This is shown in Fig. 2. The regulated voltage can be used to run the internal logic of the HV857L. The amount of current necessary to run the internal logic is 150µA maximum at a V_{DD} of 5.0V. Therefore, the regulated voltage could easily provide the current without being loaded down.

Enable/Disable Configuration

The HV857L can be easily enabled and disabled via a logic control signal on the R_{SW} and R_{EL} resistors as shown in Fig. 2 below. The control signal, which can be from a micropro-

cessor, has to track the V_{DD} supply. R_{SW} and R_{EL} are typically very high values. Therefore, only 10's 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.

Audible Noise Reduction

The EL lamp, when lit, emits an audible noise. This is due to EL lamp construction and it creates a major problem for applications where the EL lamp can be close to the ear such as cellular phones. The HV857L employs a circuit designed to help minimize the EL lamp's audible noise by slowing down the rise and fall times seen by the EL lamp.

External Component	Description
Diode	Fast reverse recovery diode, BAS21 diode or equivalent.
C_S Capacitor	0.003µF to 0.1µF, 100V capacitor to GND is used to store the energy transferred from the inductor.
R_{EL} Resistor	The EL lamp frequency is controlled via an external R_{EL} resistor connected between REL-Osc and VDD 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 will increase and the output voltage V_{CS} will decrease. The color of the EL lamp is dependent upon its frequency. A 2MΩ resistor would provide lamp frequency of 205Hz. Decreasing the R_{EL} resistor by a factor of 2 will increase the lamp frequency by a factor of 2. $$f_{EL} = \frac{(2M\Omega)(205Hz)}{R_{EL}}$$
R_{SW} Resistor	The switching frequency of the converter is controlled via an external resistor, R_{SW}, between RSW-Osc and VDD 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 will decrease and the output voltage, V_{CS}, will also decrease. $$f_{SW} = \frac{(560k\Omega)(77Hz)}{R_{SW}}$$
L_X Inductor	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 will be 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 220µH Murata (LQH32CN221) inductor with 8.4Ω series DC resistance is typically recommended. For inductors with the same inductance value, but with lower series DC resistance, a lower R_{SW} resistor value is needed to prevent high current draw and inductor saturation.
Lamp	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, an external resistor in series with one side of the lamp is recommended to help reduce the package power dissipation.

8-Lead DFN Package Outline (K7)
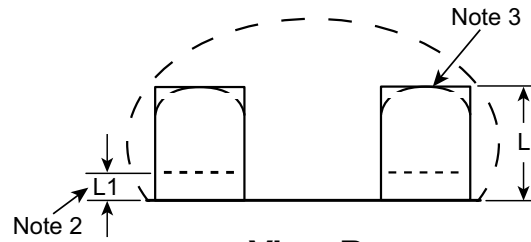## *3.00x3.00mm body, 0.80mm height (max), 0.65mm pitch*
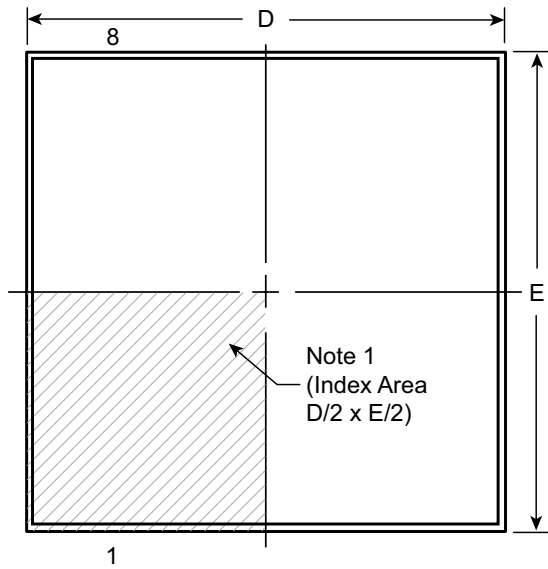
Top View
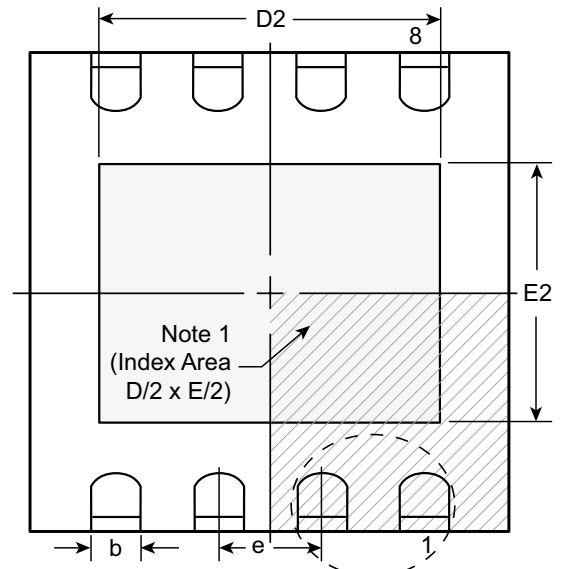
Bottom View

View B

Side View

View B

Note 3

Notes:

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.*
2. *Depending on the method of manufacturing, a maximum of 0.15mm pullback (L1) may be present.*
3. *The inner tip of the lead may be either rounded or square.*

| Symbol		A	A1	A3	b	D	D2	E	E2	e	L	L1	θ
Dimension (mm)	MIN	0.70	0.00	0.20 REF	0.25	2.85*	1.60	2.85*	1.35	0.65 BSC	0.30	0.00*	0º
	NOM	0.75	0.02		0.30	3.00	-	3.00	-		0.40	-	-
	MAX	0.80	0.05		0.35	3.15*	2.50	3.15*	1.75		0.50	0.15	14º

JEDEC Registration MO-229, Variation WEEC-2, Issue C, Aug. 2003.
* This dimension is not specified in the JEDEC drawing.
Drawings not to scale.
***Supertex Doc. #:** DSPD-8DFNK73X3P065, Version C081109.*

8-Lead MSOP Package Outline (MG)
3.00x3.00mm body, 1.10mm height (max), 0.65mm pitch

Top View

View B

Side View

View A-A
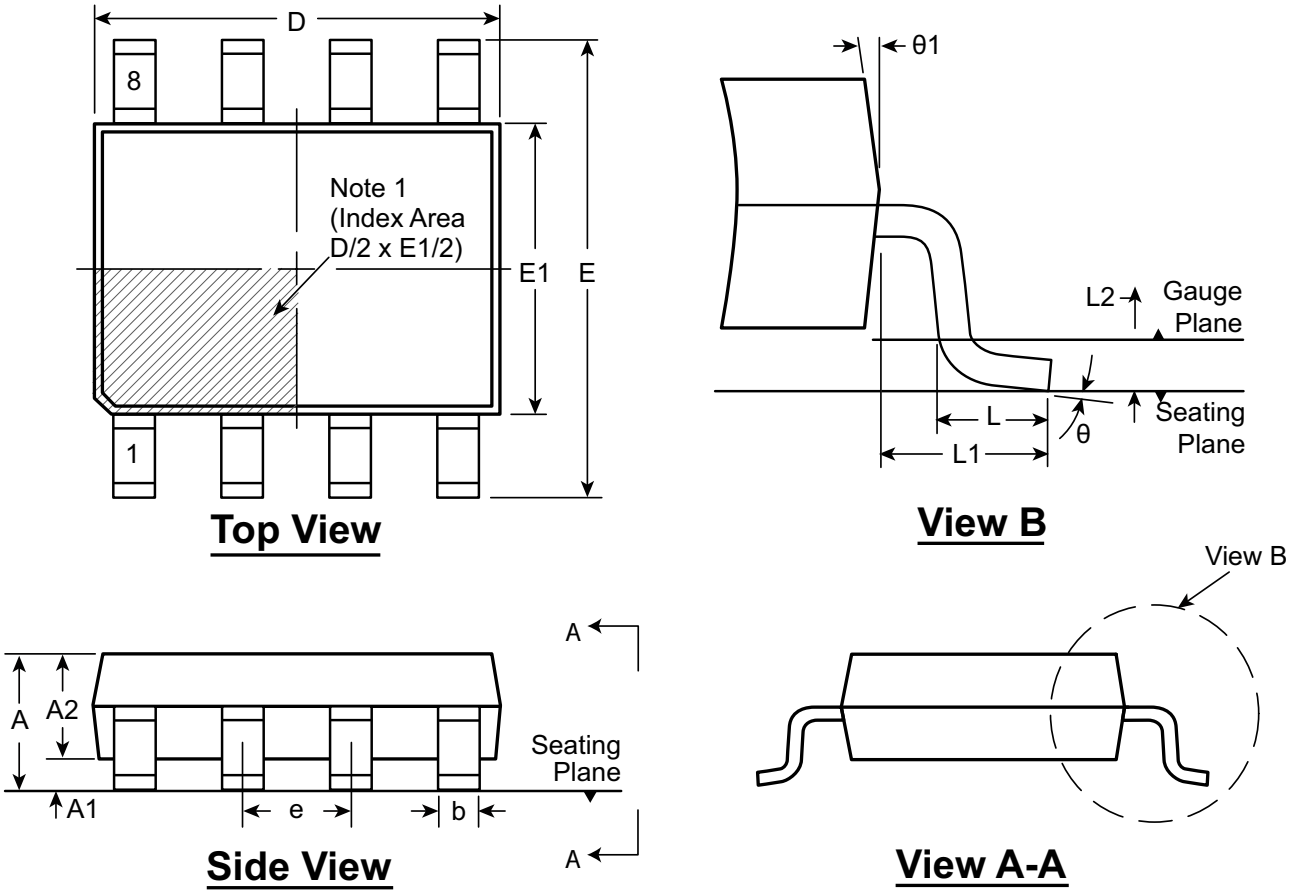
Note:

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	0.22	2.80*	4.65*	2.80*	0.65 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	0.38	3.20*	5.15*	3.20*		0.80			8°	15°

JEDEC Registration MO-187, Variation AA, Issue E, Dec. 2004.
* This dimension is not specified in the JEDEC drawing.
Drawings are not to scale.
Supertex Doc. #: *DSPD-8MSOPMG, Version H041309.*

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to http://www.supertex.com/packaging.html.)

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