

**Supertex inc.**

**HV8051  
HV8053**

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## High-Voltage EL Lamp Driver

### Ordering Information

Device	Input Voltage	Package Options	
		8-Lead SO	Die
HV8051	1.0V to 1.6V	HV8051LG	HV8051X
HV8053	2.4V to 3.5V	HV8053LG	HV8053X

### Features

- Processed with HVCMOS® technology
- 1.0V to 3.5V operating supply voltage
- DC to AC conversion
- Adjustable output lamp frequency to control lamp color, lamp life, and power consumption
- Adjustable converter frequency to eliminate harmonics and optimize power consumption

### Applications

- Pagers
- Portable transceiver
- Cellular phones
- Remote control units
- Calculators

### Absolute Maximum Ratings\*

Supply voltage, $V_{DD}$	-0.5V to +4.5V
Operating temperature range	-25°C to +85°C
Storage temperature range	-65°C to +150°C
SO-8 power dissipation	400mW

Note:  
\*All voltages are referenced to GND.

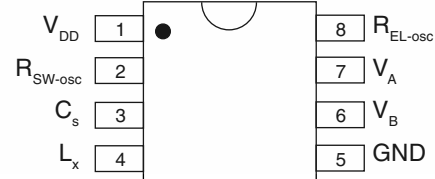
### General Description

The Supertex HV8051 and HV8053 are high-voltage drivers designed for driving EL lamps of typically 4nF and 12nF for a 1V and 3V operation. The input supply voltage range is from 1.0V to 1.6V for HV8051 and 2.4V to 3.5V for HV8053. The device uses a single inductor and a minimum number of passive components. Typical output voltage that can be applied to the EL lamp is  $\pm 50V$  for HV8051 and  $\pm 70V$  for HV8053.

The HV8051/HV8053 has two internal oscillators, a switching bipolar junction transistor (BJT), and a high-voltage EL lamp driver. The frequency for the switching BJT is set by an external resistor connected between the  $R_{SW-osc}$  pin and the supply pin  $V_{DD}$ . The EL lamp driver frequency is set by an external resistor connected between  $R_{EL-osc}$  pin and the  $V_{DD}$  pin. An external inductor is connected between the  $L_x$  and  $V_{DD}$  pins. A  $0.1\mu F$  capacitor is connected between  $C_s$  and GND pins. The EL lamp is connected between  $V_A$  and  $V_B$  pins.

The switching BJT charges the external inductor and discharges it into the  $0.1\mu F$  capacitor at  $C_s$ . The voltage at  $C_s$  will start to increase. The outputs  $V_A$  and  $V_B$  are configured as an H bridge and are switching in opposite states to achieve a peak-to-peak voltage of two times the  $V_{CS}$  voltage across the EL lamp.

### Pin Configuration



top view  
SO-8

## Electrical Characteristics

**DC Characteristics** (Over recommended operating conditions unless otherwise specified,  $T_A = 25^\circ\text{C}$ )

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$R_{DS(on)}$	On-resistance of switching transistor			15	$\Omega$	$I = 50\text{mA}$
$I_{IN}$	$V_{DD}$ supply current (including inductor current)	HV8051	8.0	15	mA	$V_{DD} = 1.0\text{V}$ to $1.6\text{V}$ . See Figure 1.
		HV8053	40	65		$V_{DD} = 2.4\text{V}$ to $3.5\text{V}$ . See Figure 2.
$V_{CS}$	Output voltage on $V_{CS}$	HV8051	41		V	$V_{DD} = 1.0\text{V}$ to $1.3\text{V}$ . See Figure 1.
			52			$V_{DD} = 1.3\text{V}$ to $1.6\text{V}$ . See Figure 1.
		HV8053	43			$V_{DD} = 2.4\text{V}$ to $3.0\text{V}$ . See Figure 2.
			52			$V_{DD} = 3.0\text{V}$ to $3.5\text{V}$ . See Figure 2.
$f_{EL}$	$V_{A-B}$ output drive frequency	HV8051	60	160	Hz	$V_{DD} = 1.0\text{V}$ . See Figure 1.
			70	220		$V_{DD} = 1.6\text{V}$ . See Figure 1.
		HV8053	200	350		$V_{DD} = 2.4\text{V}$ to $3.5\text{V}$ . See Figure 2.
$f_{sw}$	Switching transistor frequency	HV8051	50		KHz	$V_{DD} = 1.0\text{V}$ to $1.6\text{V}$ . See Figure 1.
		HV8053	50			$V_{DD} = 2.4\text{V}$ to $3.5\text{V}$ . See Figure 2.
D	Switching transistor duty cycle		85		%	See Figures 1 and 2.

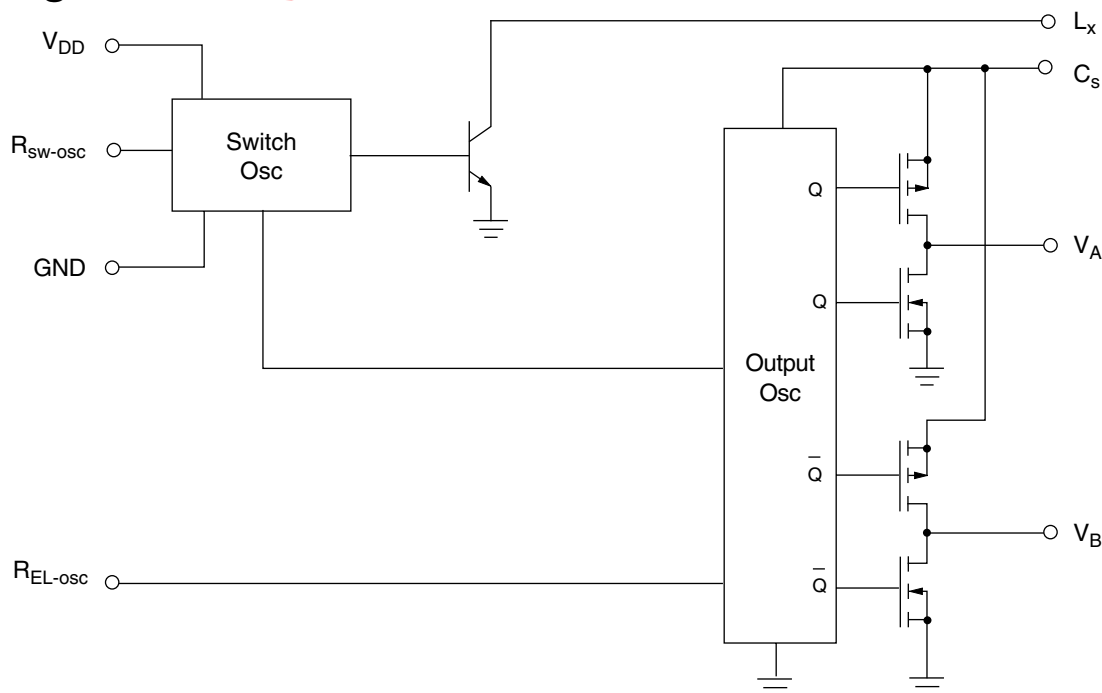
## Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$V_{DD}$	Supply voltage	HV8051	1.0	1.6	V	@ $V_{DD} = 1.0\text{V}$ to $1.6\text{V}$
		HV8053	2.4	3.5	V	@ $V_{DD} = 2.4\text{V}$ to $3.5\text{V}$ .
$C_L$	Load capacitance*	HV8051	0	4.0	nF	@ $V_{DD} = 1.0\text{V}$ to $1.6\text{V}$
		HV8053	0	12	nF	@ $V_{DD} = 2.4\text{V}$ to $3.5\text{V}$
$T_A$	Operating temperature	-25		85	$^\circ\text{C}$	

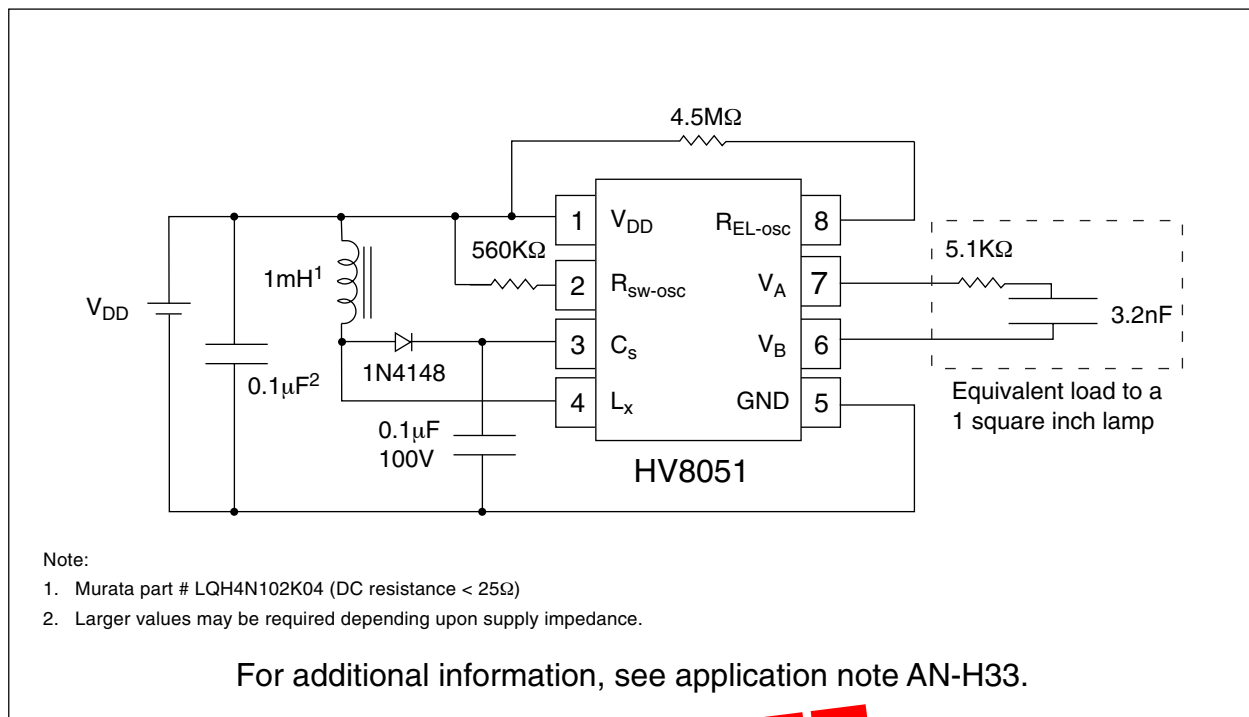
\*Larger panels can be driven with HV8051/HV8053. See application note AN-H33.

## Block Diagram

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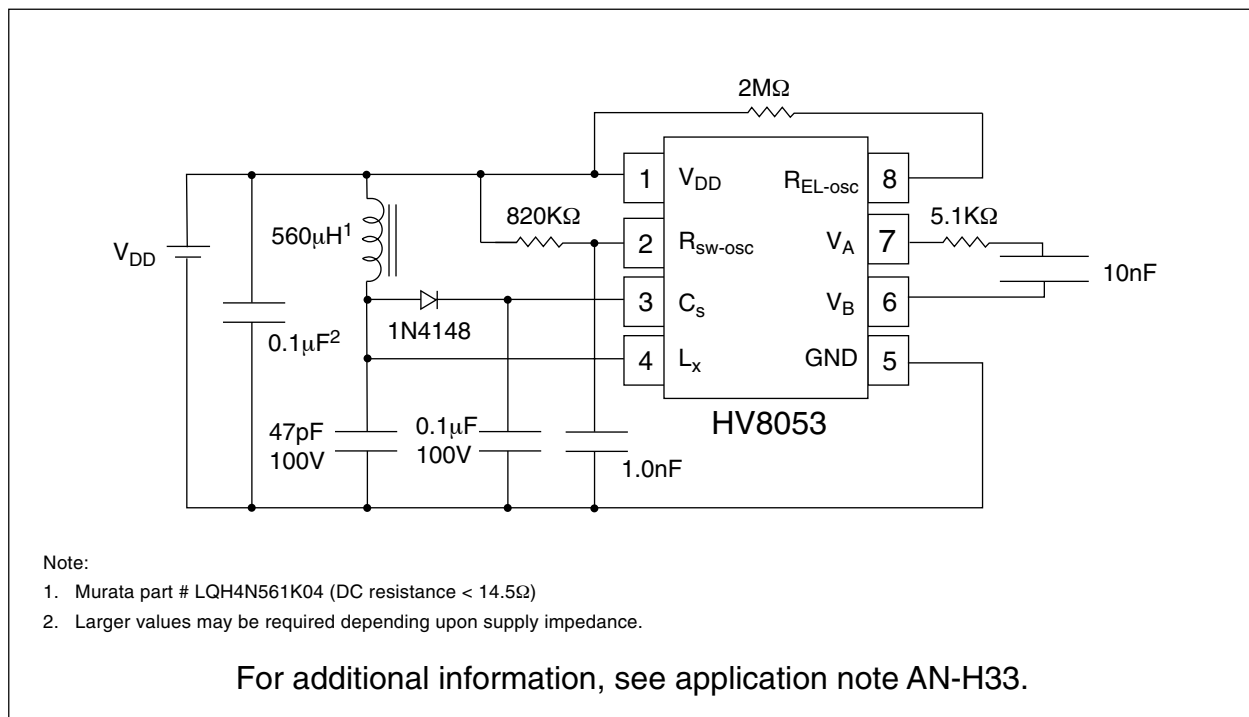


**Figure 1:**  $V_{DD} = 1.0V$  to  $1.6V$



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**Figure 2:**  $V_{DD} = 2.4V$  to  $3.5V$



## External Component Description

External Component	Selection Guide Line
Diode	Fast reverse recovery diode, 1N4148 or equivalent.
C <sub>S</sub> Capacitor	0.01μF to 0.1μF, 100V capacitor to GND is used to store the energy transferred from the inductor.
R <sub>EL-osc</sub>	The EL lamp frequency is controlled via an external R <sub>EL</sub> resistor connected between R <sub>EL-osc</sub> and V <sub>DD</sub> of the device. The lamp frequency increases as R <sub>EL</sub> decreases. As the EL lamp frequency increases, the amount of current drawn from the battery will increase and the output voltage V <sub>CS</sub> will decrease. The color of the EL lamp is dependent upon its frequency.
R <sub>SW-osc</sub>	The switching frequency of the converter is controlled via an external resistor, R <sub>SW</sub> between R <sub>SW-osc</sub> and V <sub>DD</sub> of the device. The switching frequency increases as R <sub>SW</sub> 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 <sub>CS</sub> , will also decrease.
C <sub>SW</sub> Capacitor	A 1nF capacitor is typically recommended on R <sub>SW-osc</sub> to GND for HV8053. As the input voltage of the device increases, a faster switching converter frequency is required to avoid saturating the inductor. With the higher switching frequency, more noise will be introduced. This capacitor is used to shunt any switching noise that may couple into the R <sub>SW-osc</sub> pin.
C <sub>Lx</sub> Capacitor	In order to drive the HV8053 more efficiently when high brightness is required, a 47pF, 100V C <sub>Lx</sub> capacitor needs to be used at the L <sub>x</sub> pin to GND. This capacitor reduces the total amount of current drawn by the circuit by reducing the dv/dt voltage on the internal switch.
Lx Inductor	The inductor L <sub>x</sub> 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 <sub>S</sub> . The energy stored in the capacitor is then available 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 size decreases, the switching frequency of the inductor (controlled by R <sub>SW</sub> ) should be increased to avoid saturation.  560μH Murata inductors with 14.5Ω series DC resistance is typically recommended. For inductors with the same inductance value but with lower series DC resistance, lower R <sub>SW</sub> value is needed to prevent high current draw and inductor saturation.
Lamp Size	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 <sub>IN</sub> x I <sub>IN</sub> ), will also increase. If the input power is greater than the power dissipation of the package (350mW), an external resistor in series with one side of the lamp is recommended to help reduce the package power dissipation.

## Application Hints

Start with a high conversion frequency to avoid inductor saturation. Adjust converter frequency (via R<sub>SW-osc</sub>) and inductor value to obtain desired lamp drive voltage and supply current. Make sure that inductor current does not approach saturation as specified on the inductor data sheet. Higher V<sub>IN</sub>'s and smaller inductors require a higher conversion frequency to avoid saturation.

Adjust the lamp drive frequency via R<sub>EL-osc</sub> to obtain desired lamp brightness and hue.

If the desired V<sub>CS</sub> cannot be obtained, try decreasing lamp drive frequency slightly.

If V<sub>CS</sub> is above 80 volts, insert a 2kΩ resistor in series with the lamp.

Monitor overall power consumption. If above 350mW, insert a resistor in series with the lamp to decrease device power dissipation.

In keeping with good circuit design practice, the supply voltage

should be bypassed with a capacitor located close to the lamp driver. Values can range from 0.1μF to 1μF depending on supply impedance. A supply bypass capacitor elsewhere in the host circuit is sufficient if located close to the driver.

For **lower power consumption**, set a low lamp drive frequency, use a 1mH inductor, and adjust power conversion frequency for minimum current draw.

For **high brightness**, set lamp drive frequency for desired hue, use a 330μH inductor and adjust power conversion frequency until desired brightness is obtained.

For **longer lamp life**, use as low a lamp drive frequency as is acceptable. Adjust converter frequency and inductor value to obtain acceptable brightness.

For **high lamp drive frequencies**, employ a FET follower on the output. See application note AN-H33.

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