Supertex inc.

– OBSOLETE –

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
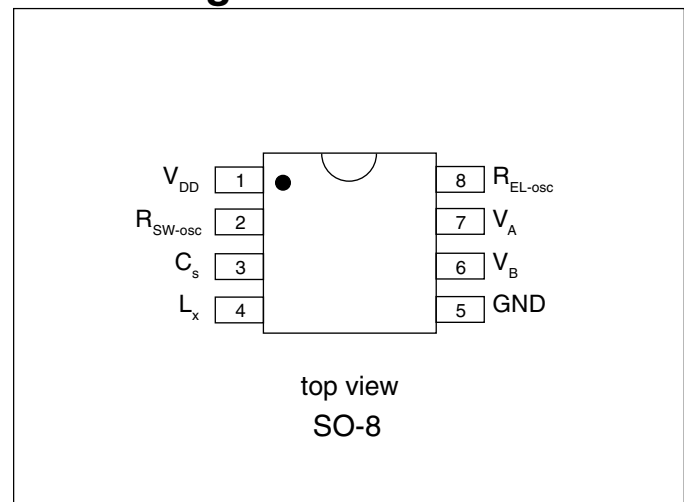
☐ Cellular phones

☐ Remote control units

☐ Calculators

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 ±50V for HV8051 and ±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.

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.

Pin Configuration

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top view
SO-8

Electrical Characteristics

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

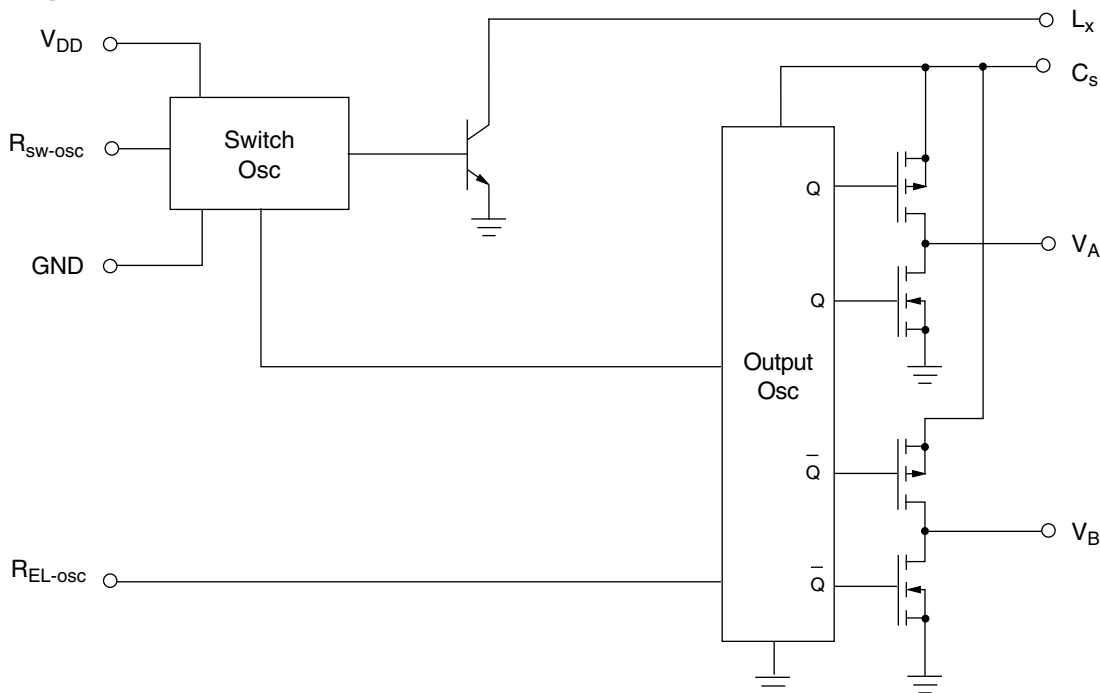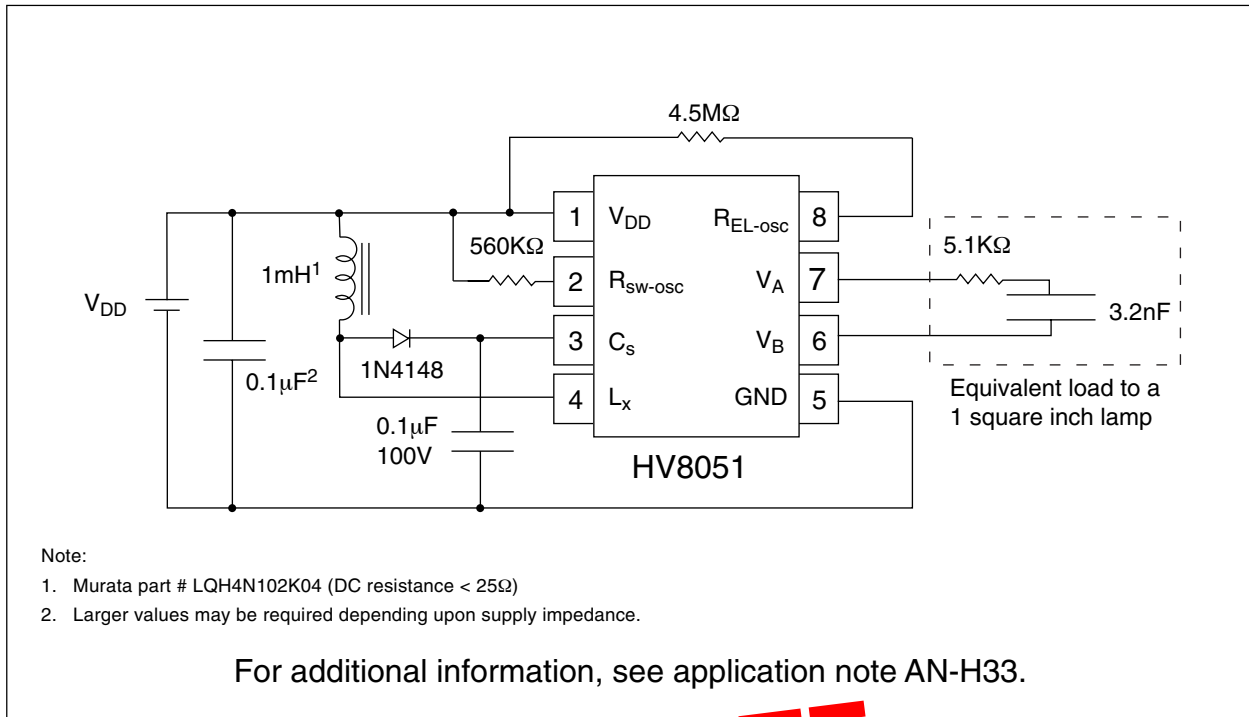| Symbol	Parameter		Min	Typ	Max	Units	Conditions
$R_{DS(on)}$	On-resistance of switching transistor				15	Ω	I = 50mA
I_{IN}	V_{DD} supply current (including inductor current)	HV8051		8.0	15	mA	V_{DD} = 1.0V to 1.6V. See Figure 1.
		HV8053		40	65		V_{DD} = 2.4V to 3.5V. See Figure 2.
V_{CS}	Output voltage on V_{CS}	HV8051	41			V	V_{DD} = 1.0V to 1.3V. See Figure 1.
			52				V_{DD} = 1.3V to 1.6V. See Figure 1.
		HV8053	43				V_{DD} = 2.4V to 3.0V. See Figure 2.
			52				V_{DD} = 3.0V to 3.5V. See Figure 2.
f_{EL}	V_{A-B} output drive frequency	HV8051	60		160		V_{DD} = 1.0V. See Figure 1.
			70		220	Hz	V_{DD} = 1.6V. See Figure 1.
		HV8053	200		350		V_{DD} = 2.4V to 3.5V. See Figure 2.
f_{sw}	Switching transistor frequency	HV8051		50		KHz	V_{DD} = 1.0V to 1.6V. See Figure 1.
		HV8053		50			V_{DD} = 2.4V to 3.5V. 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} = 1.0V to 1.6V
		HV8053	2.4		3.5	V	@ V_{DD} = 2.4V to 3.5V.
C_L	Load capacitance*	HV8051	0	4.0		nF	@ V_{DD} = 1.0V to 1.6V
		HV8053	0	12		nF	@ V_{DD} = 2.4V to 3.5V
T_A	Operating temperature		-25		85	°C	

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

Block Diagram

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

Note:
1. Murata part # LQH4N102K04 (DC resistance < 25Ω)
2. Larger values may be required depending upon supply impedance.

For additional information, see application note AN-H33.

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

Note:
1. Murata part # LQH4N561K04 (DC resistance < 14.5Ω)
2. Larger values may be required depending upon supply impedance.

For additional information, see application note AN-H33.

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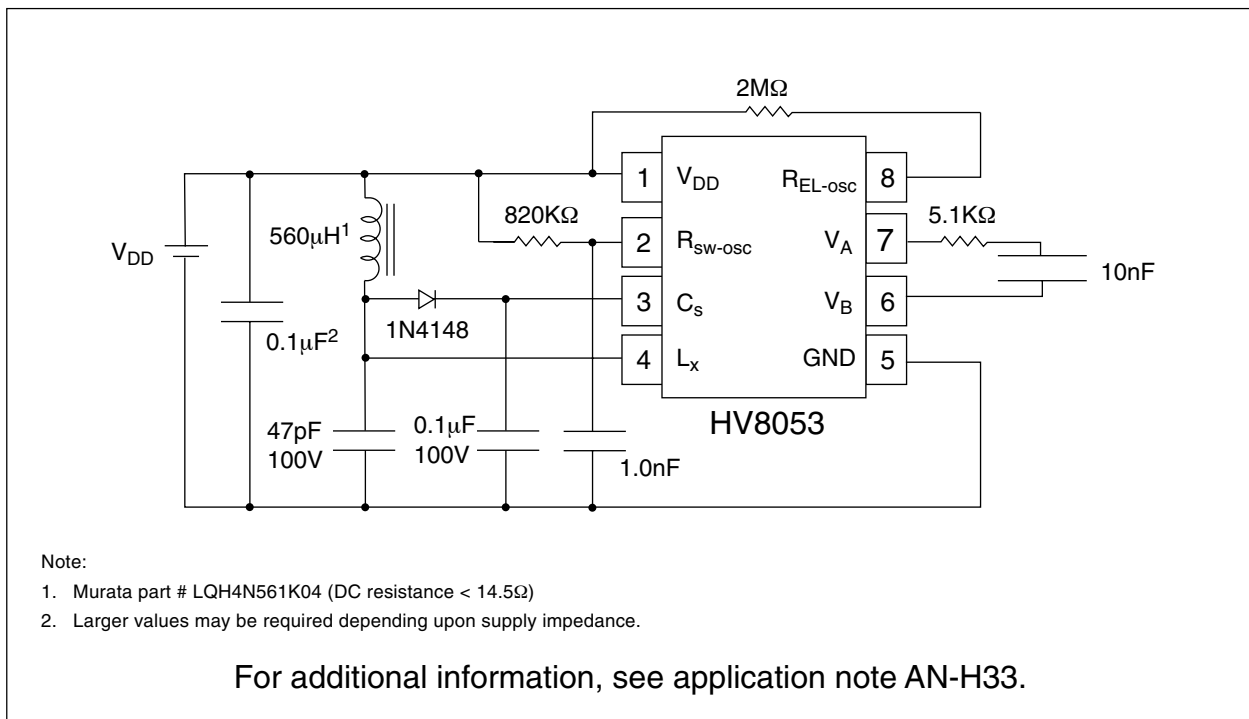
External Component Description

External Component	Selection Guide Line
Diode	Fast reverse recovery diode, 1N4148 or equivalent.
Cs Capacitor	0.01μF to 0.1μF, 100V capacitor to GND is used to store the energy transferred from the inductor.
R_{EL-osc}	The EL lamp frequency is controlled via an external R_{EL} resistor connected between R_{EL-osc} and V_{DD} 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.
R_{SW-osc}	The switching frequency of the converter is controlled via an external resistor, R_{SW} between R_{SW-osc} and V_{DD} 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.
C_{SW} Capacitor	A 1nF capacitor is typically recommended on R_{SW-osc} 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_{SW-osc} pin.
C_{Lx} Capacitor	In order to drive the HV8053 more efficiently when high brightness is required, a 47pF, 100V C_{Lx} capacitor needs to be used at the L_x 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_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 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_{SW}) 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_{SW} 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_{IN} x I_{IN}), 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_{SW-osc}) 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_{IN}'s and smaller inductors require a higher conversion frequency to avoid saturation.

Adjust the lamp drive frequency via R_{EL-osc} to obtain desired lamp brightness and hue.

If the desired V_{CS} cannot be obtained, try decreasing lamp drive frequency slightly.

If V_{CS} 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.