

High-Voltage EL Lamp Driver

Ordering Information

Device	Input Voltage	Package Options	
		8-Lead SO	Die
HV803	2.4V to 9.5V	HV803LG	HV803X

Features

- Processed with HVCMOS® technology
- 2.4V to 9.5V operating supply voltage
- DC to AC conversion
- 180V peak-to-peak typical output voltage
- Large output load capability typically 30nF
- Short circuit protection on outputs
- Adjustable output lamp frequency to control lamp color, lamp life, and power consumption
- Adjustable converter frequency to eliminate harmonics and optimize power consumption
- Enable/disable function
- Low current draw under no load condition

Applications

- Pagers
- Cellular phones
- Electronic personal organizers
- GPS units
- Handheld personal computers
- Portable instrumentation

Absolute Maximum Ratings*

Supply Voltage, V_{DD}	-0.5V to +10V
Output Voltage, V_{CS}	-0.5V to +120V
Operating Temperature Range	-25°C to +85°C
Storage Temperature Range	-65°C to +150°C
Power Dissipation	400mW

Note:
*All voltages are referenced to GND.

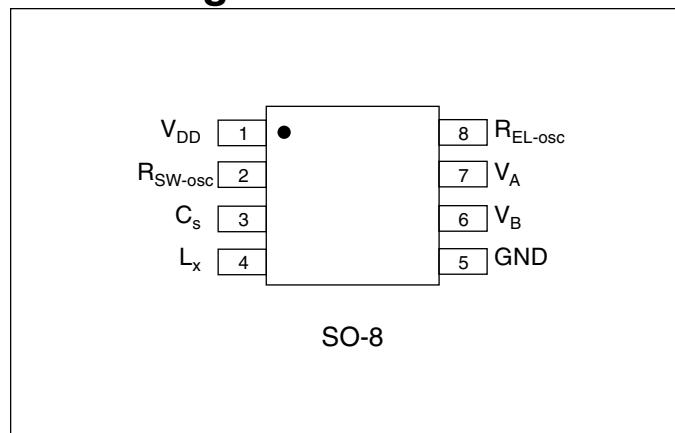
General Description

The Supertex HV803 is a high-voltage driver designed for driving EL lamps of up to 30nF. EL lamps greater than 30nF can be driven for applications not requiring high brightness. The input supply voltage range is from 2.4 to 9.5V. 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 $\pm 90V$. The chip can be enabled by connecting the resistors on R_{SW-osc} and R_{EL-osc} to V_{DD} and disabled when connected to GND.

The HV803 has two internal oscillators, a switching MOSFET, and a high-voltage EL lamp driver. The frequency for the switching converter MOSFET 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 0.01 μF to 0.1 μF capacitor is connected between C_s and GND pins. The EL lamp is connected between V_A and V_B pins.

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

Pin Configuration



Electrical Characteristics

DC Characteristics ($V_{IN} = 3.0V$, $R_{SW} = 750K\Omega$, $R_{EL} = 2.0M\Omega$, $T_A = 25^\circ C$ unless otherwise specified)

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$R_{DS(on)}$	On-resistance of switching transistor		3.5	8.0	Ω	$I = 100mA$
V_{CS}	Output voltage V_{CS} Regulation	80	90	100	V	$V_{IN} = 2.4$ to $9.5V$
$V_A - V_B$	Output peak to peak voltage	160	180	200	V	$V_{IN} = 2.4V$ to $9.5V$
I_{DDQ}	Quiescent V_{DD} supply current, disabled			2.0	μA	$R_{SW-osc} = GND$
I_{DD}	Input current going into the V_{DD} pin			100	μA	$V_{IN} = 3.0V \pm 5\%$. See Figure 1.
				300	μA	$V_{IN} = 5.0V \pm 5\%$. See Figure 2.
				500	μA	$V_{IN} = 9.0V \pm 5\%$. See Figure 3.
I_{IN}	Input current including inductor current			35	mA	$V_{IN} = 3.0V$. See Figure 1.
V_{CS}	Output voltage on V_{CS}	45		70	V	$V_{IN} = 3.0V$. See Figure 1.
f_{EL}	V_{A-B} output drive frequency	300		430	Hz	$V_{IN} = 3.0V$. See Figure 1.
f_{SW}	Switching transistor frequency	50		90	KHz	$V_{IN} = 3.0V$. See Figure 1.
D	Switching transistor duty cycle		88		%	

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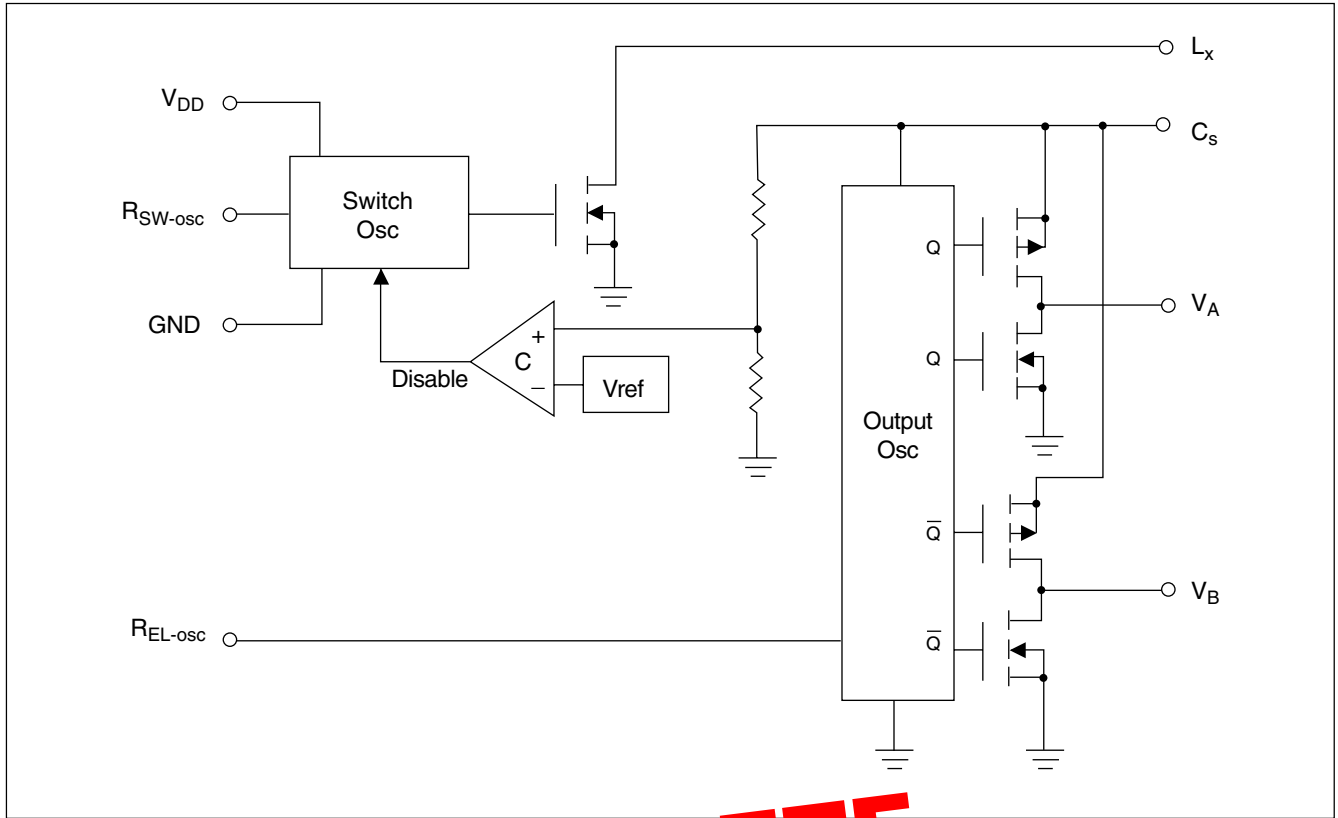
Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units	Conditions
V_{DD}	Supply voltage	2.4		9.5	V	
T_A	Operating temperature	-25		85	$^\circ C$	

Enable/Disable Table (See Figure 4)

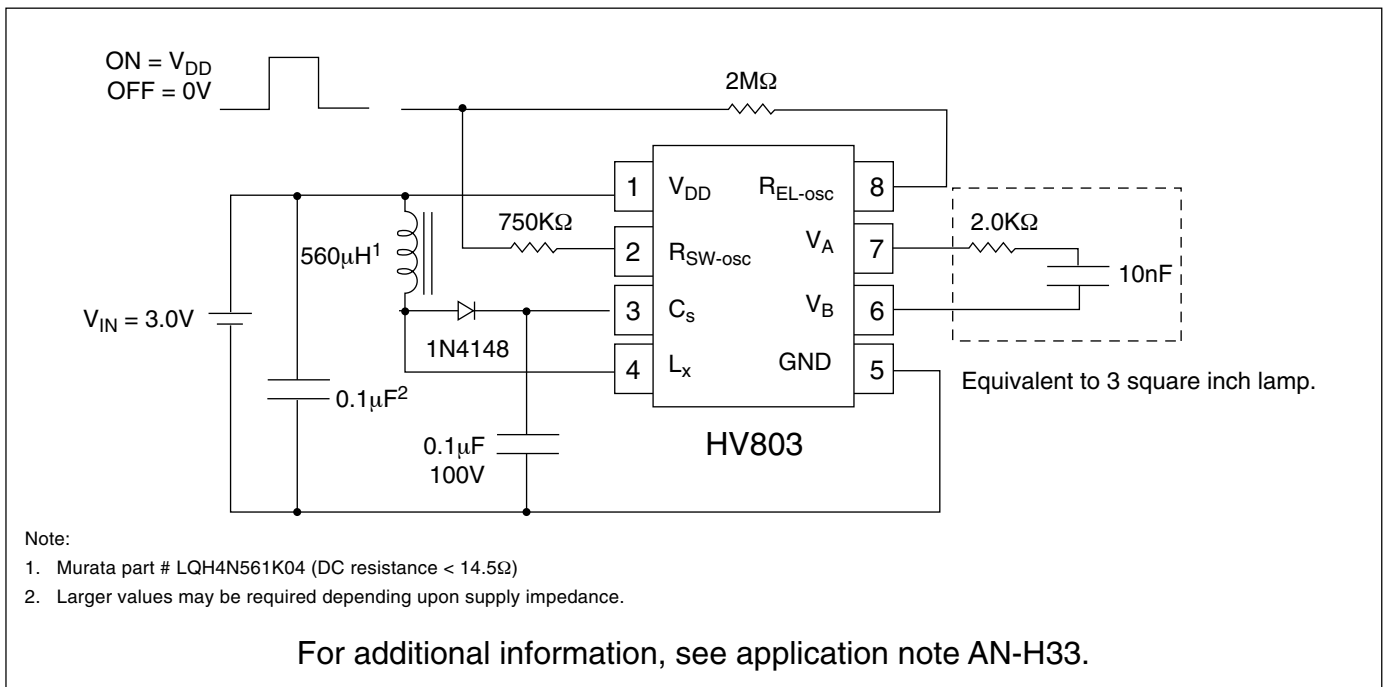
R_{SW} resistor	HV803
V_{DD}	Enabled
GND	Disabled

Block Diagram

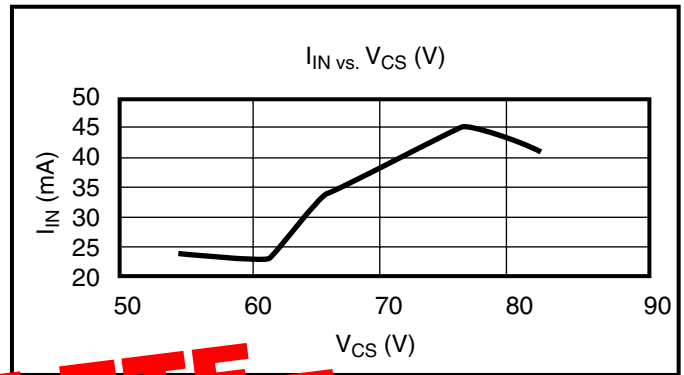
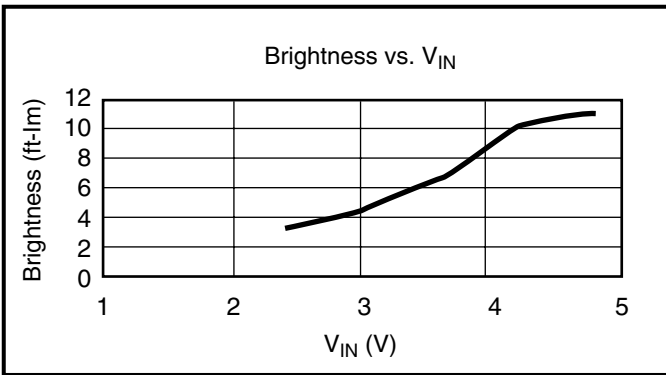
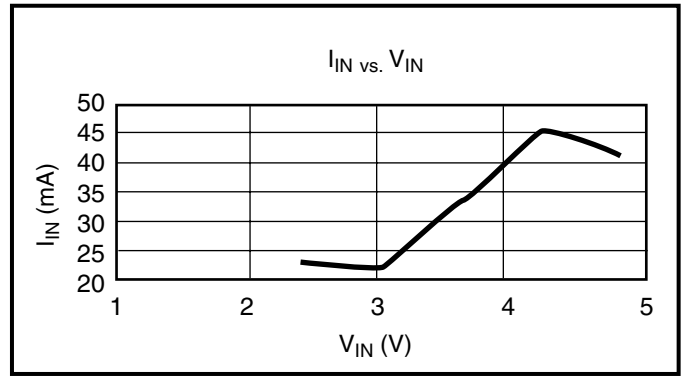
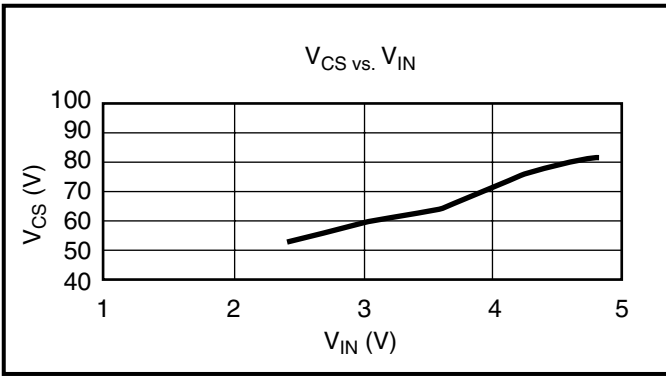


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Figure 1: Test Circuit, $V_{IN} = 3.0V$ (Low input current with moderate output brightness).



Typical Performance Curves for Figure 1 using 3in² EL Lamp.



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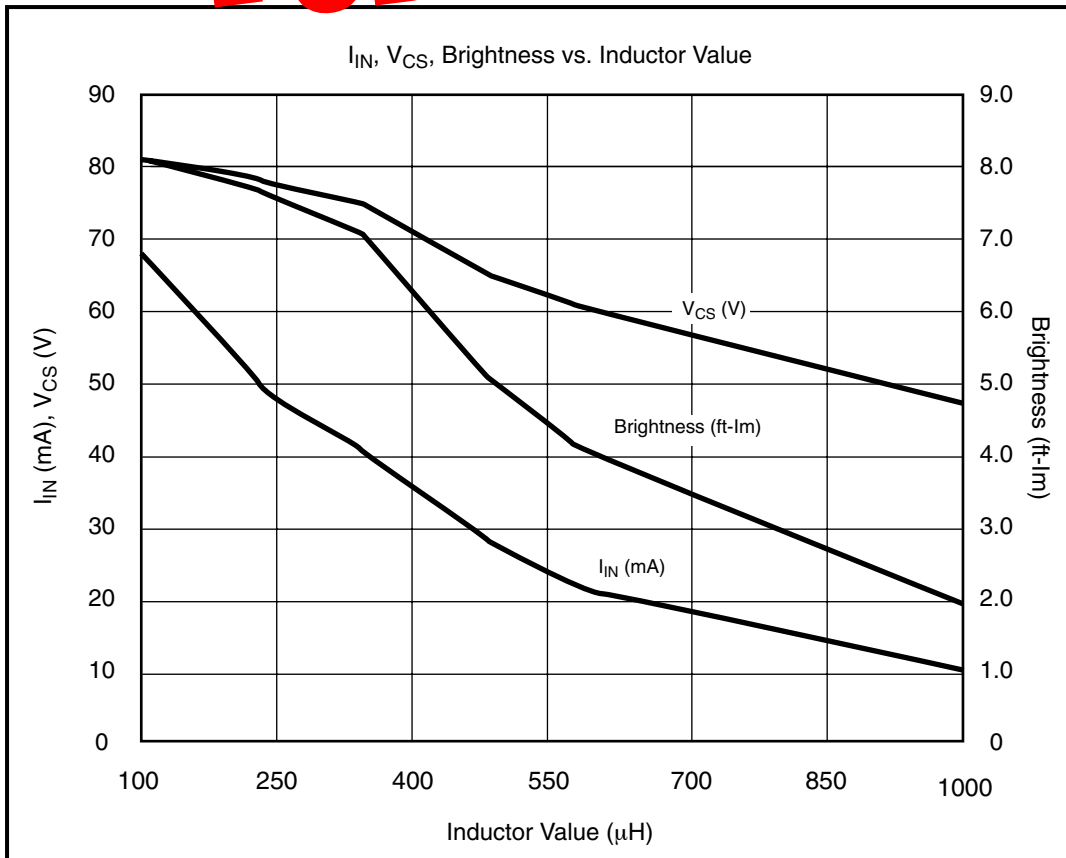
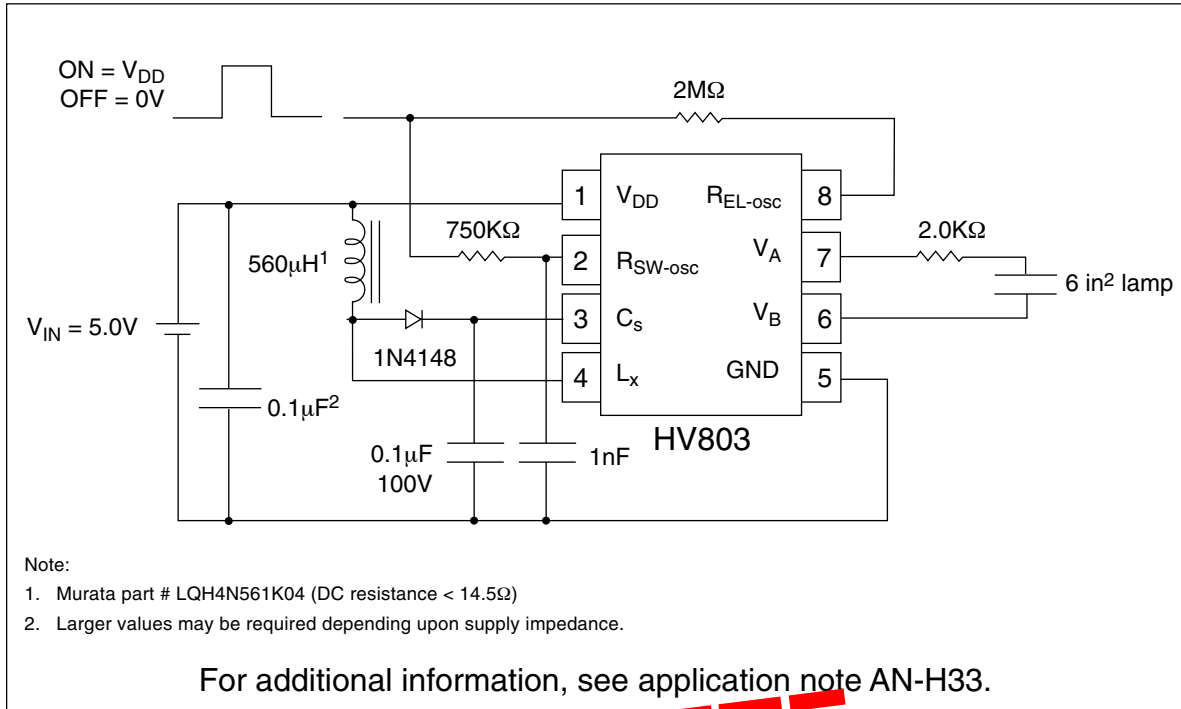


Figure 2: Typical 5.0V Application*



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Typical Performance Curves for Figure 2

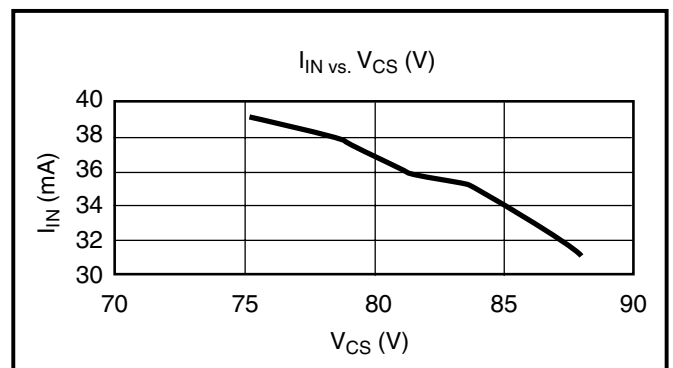
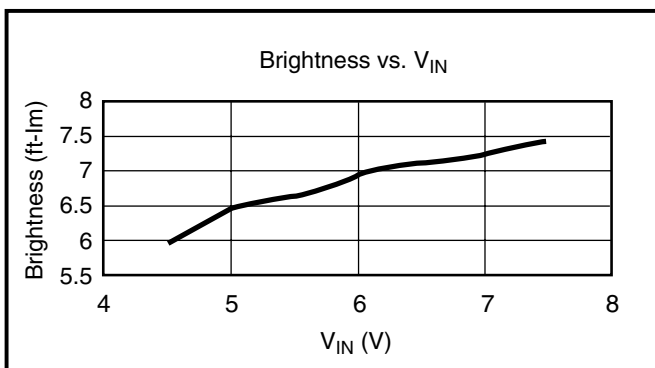
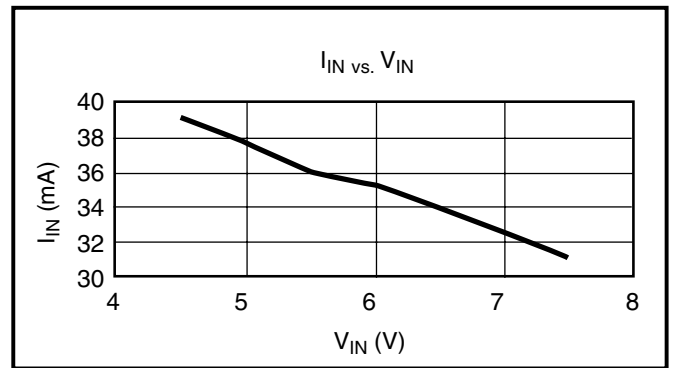
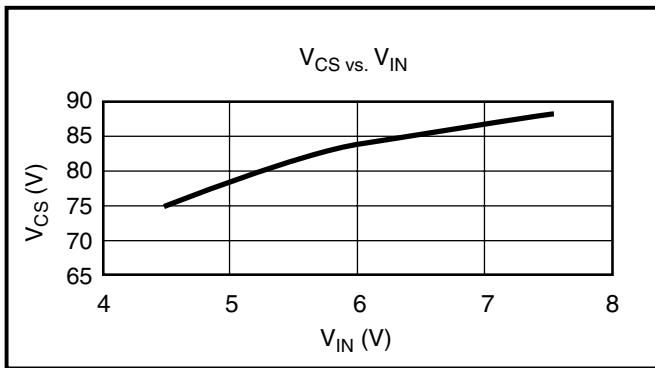
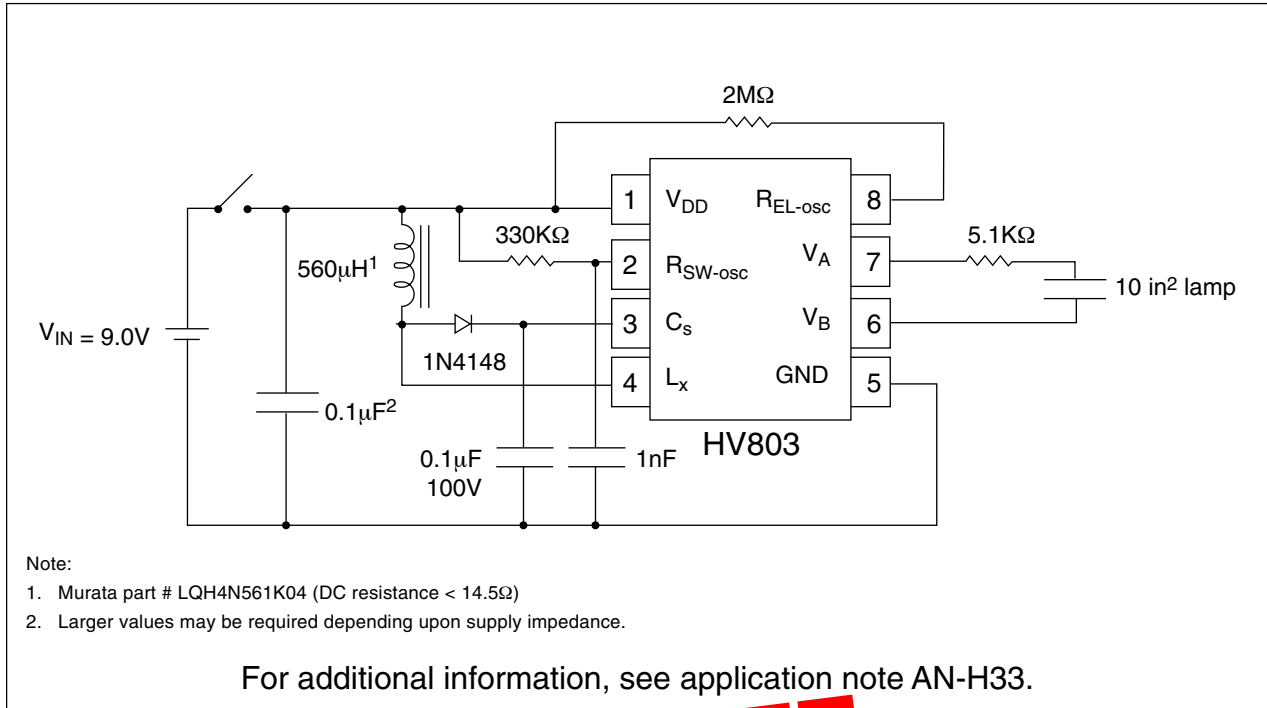
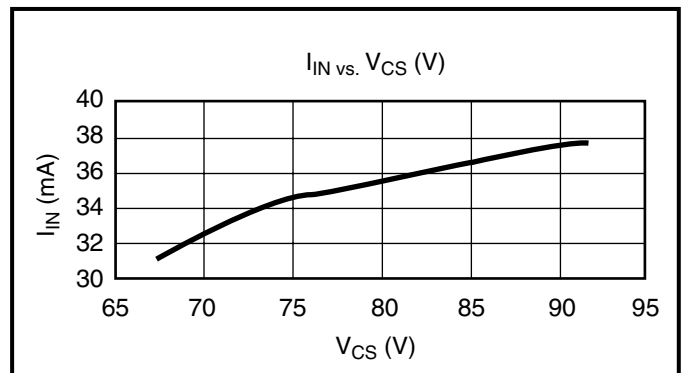
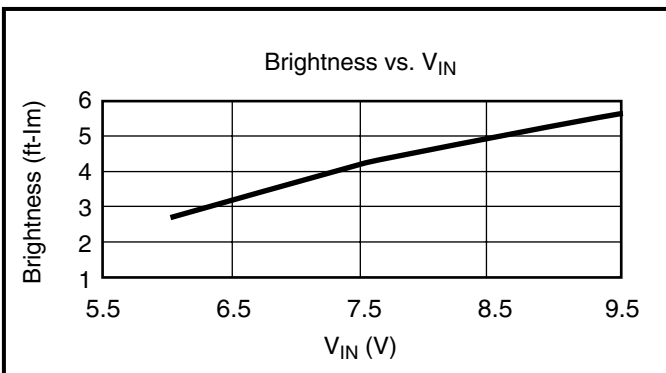
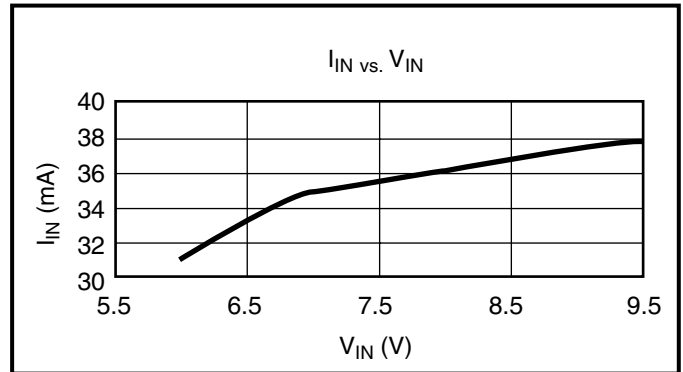
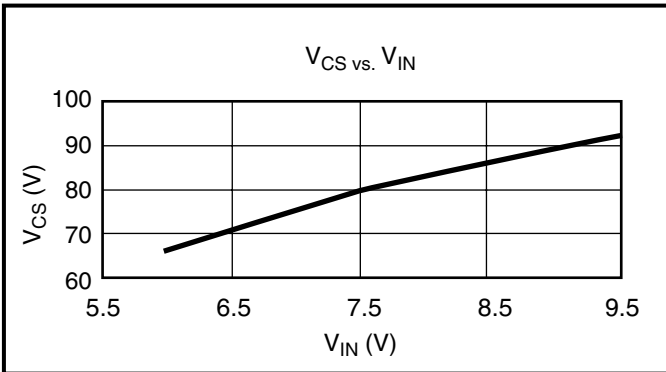


Figure 3: Typical 9.0V Application*



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Typical Performance Curves for Figure 3



External Component Description

External Component	Selection Guide Line
Diode	Fast reverse recovery diode, 1N4148 or equivalent.
Cs Capacitor	0.01 μ F to 0.1 μ F, 100V capacitor to GND is used to store the energy transferred from the inductor. 0.01 μ F is recommended when driver has large EL lamps.
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.
	A 2M Ω resistor would provide lamp frequency of 300 to 430Hz. Decreasing the R _{EL-osc} by a factor of 2, the lamp frequency will increase by factor of 2.
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 required on R _{SW-osc} pin to GND when the input voltage is equal to or greater than 5V. 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.
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 value decreases, the switching frequency of the inductor (controlled by R _{SW}) should be increased to avoid saturation. 560 μ H Murata inductors with 14.5 Ω 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	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.

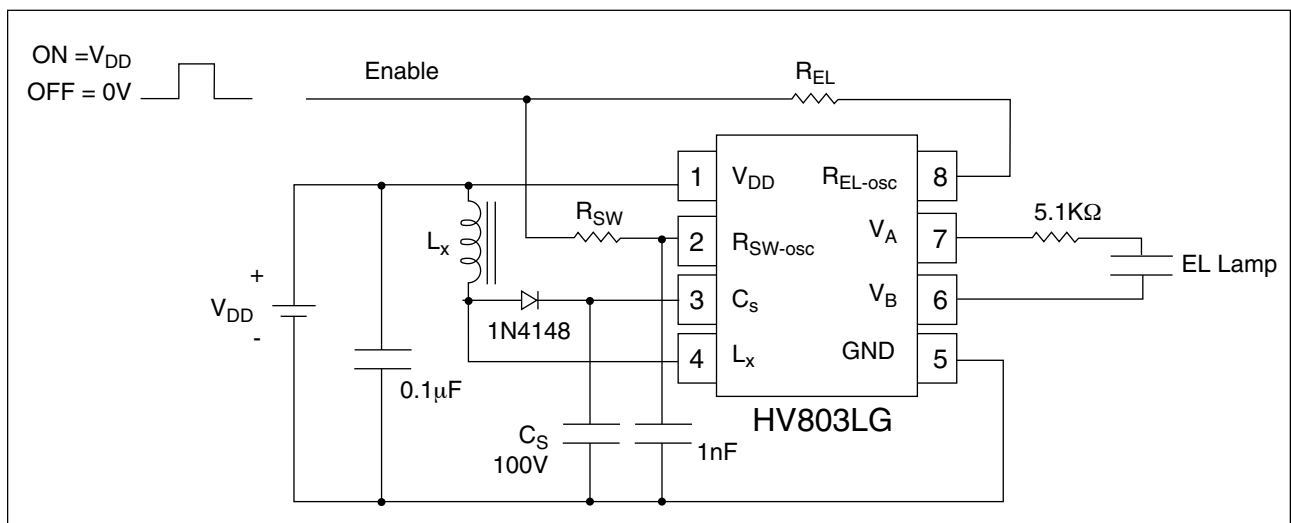
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Enable/Disable Configuration

The HV803 can be easily enabled and disabled via a logic control signal on the R_{SW} and R_{EL} resistors as shown in Figure 4 below. The control signal can be from a microprocessor. R_{SW} and R_{EL} are typically very high values. Therefore, only 10's of microam-

peres 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.

Figure 4: Enable/Disable Configuration



Split Supply Configuration Using a Single Cell (1.5V) Battery

The HV803 can also be used for handheld devices operating from a single cell 1.5V battery where a regulated voltage is available. This is shown in Figure 5. The regulated voltage can be used to run the internal logic of the HV803. The amount of current necessary to run the internal logic is typically 30 to 60µA. Therefore, the regulated voltage could easily provide the current without being loaded down. The HV803 used in this configuration can also be enabled/disabled via logic control signal on the R_{SW} and R_{EL} resistors as shown in Figure 4.

Split Supply Configuration for Battery Voltages of Higher than 9.5V

Figure 5 can also be used with high battery voltages such as 12V as long as the input voltage, V_{DD} , to the HV803 device is within its specifications of 2.4V to 9.5V.

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Figure 5: Split Supply Configuration

