

## Low Noise Dual EL Lamp Driver

### Features

- ▶ Low audible noise
- ▶ Independent input control for lamp selection
- ▶ 180V<sub>pp</sub> output voltage
- ▶ Split supply capability
- ▶ Patented output timing
- ▶ One miniature inductor to power both lamps
- ▶ Low shutdown current
- ▶ Wide input voltage range 2.0V to 5.8V
- ▶ Output voltage regulation
- ▶ No SCR output
- ▶ Available in 12-Lead QFN/MLP package

### Applications

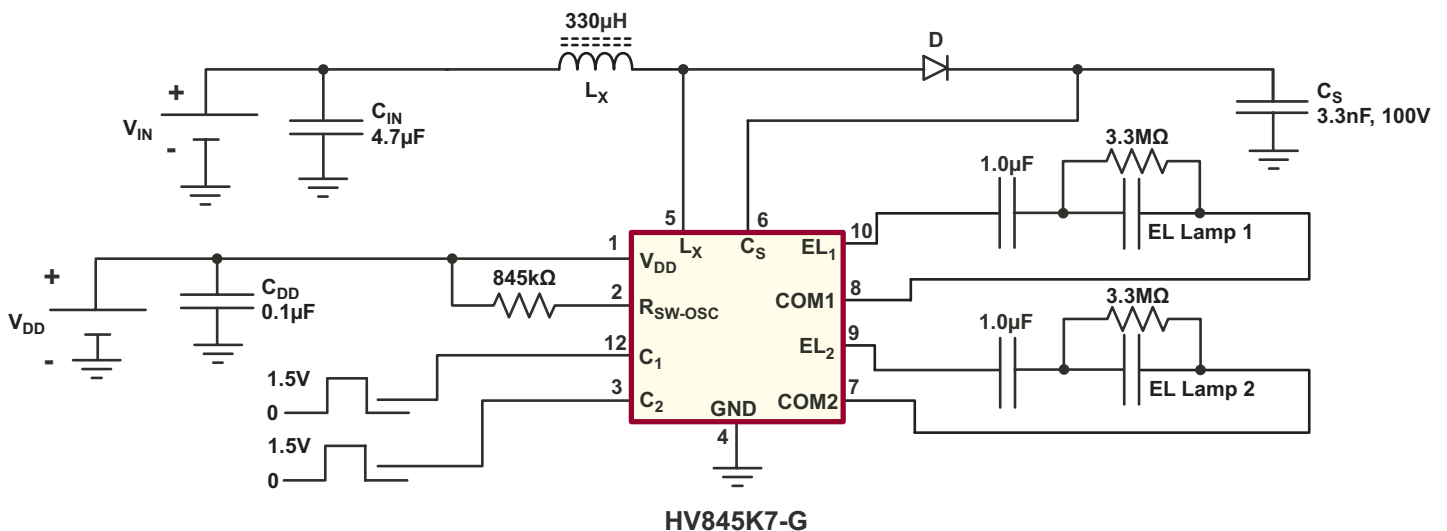
- ▶ Dual display cellular phones
- ▶ Keypad and LCD backlighting
- ▶ Portable instrumentation
- ▶ Dual segment lamps
- ▶ Hand held wireless communication devices

### General Description

The Supertex HV845 is a low noise, 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 2.0V to 5.8V. 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 ±90V is applied to the EL lamps. The two EL lamps can be turned ON and OFF by the two logic input control pins, C<sub>1</sub> and C<sub>2</sub>. The device is disabled when both C<sub>1</sub> and C<sub>2</sub> (pins 12 and 3) are at logic low.

The HV845 has an internal oscillator, a switching MOSFET, and two high voltage EL lamp drivers. Each driver has its own half bridge common output COM1 and COM2, which significantly minimizes the DC offset seen by the EL lamp. An external resistor connected between the R<sub>SW-OSC</sub> pin and the voltage supply pin, V<sub>DD</sub>, sets the frequency for the switching MOSFET. The EL lamp driver frequency is set by dividing the MOSFET switching frequency by 512. An external inductor is connected between the L<sub>x</sub> and the V<sub>DD</sub> pins. Depending on the EL lamp size, a 1.0 to 10.0nF, 100V capacitor is connected between C<sub>s</sub> and Ground. The switching MOSFET charges the external inductor and discharges it into the capacitor at C<sub>s</sub>. The voltage at C<sub>s</sub> increases. Once the voltage at C<sub>s</sub> reaches a nominal value of 90V, the switching MOSFET is turned OFF to conserve power.

### Typical Application Circuit



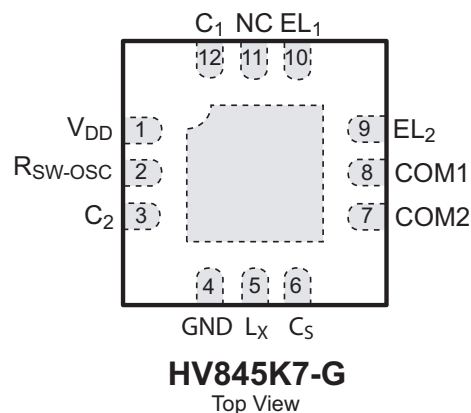
## Ordering Information

| Device | Package Options |
|--------|-----------------|
|        | QFN/MLP - 12    |
| HV845  | HV845K7-G       |

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



## Pin Configuration



Note: Pads are on the bottom of the package.  
Back-side heat slug is at ground potential.

## Absolute Maximum Ratings

| Parameter                   | Value          |
|-----------------------------|----------------|
| Supply Voltage, $V_{DD}$    | -0.5V to 7.5V  |
| Output Voltage, $V_{CS}$    | -0.5V to 120V  |
| Operating Temperature Range | -40°C to 85°C  |
| Storage temperature         | -65°C to 150°C |

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.

## Thermal Resistance

| Package      | $\theta_{ja}$ |
|--------------|---------------|
| QFN/MLP - 12 | 60°C/W        |

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

## Recommended Operating Conditions

| Symbol   | Parameter             | Min | Typ | Max | Units | Conditions |
|----------|-----------------------|-----|-----|-----|-------|------------|
| $V_{DD}$ | Supply voltage        | 2.0 | -   | 5.8 | V     | ---        |
| $T_A$    | Operating temperature | -40 | -   | +85 | °C    | ---        |

## Electrical Characteristics

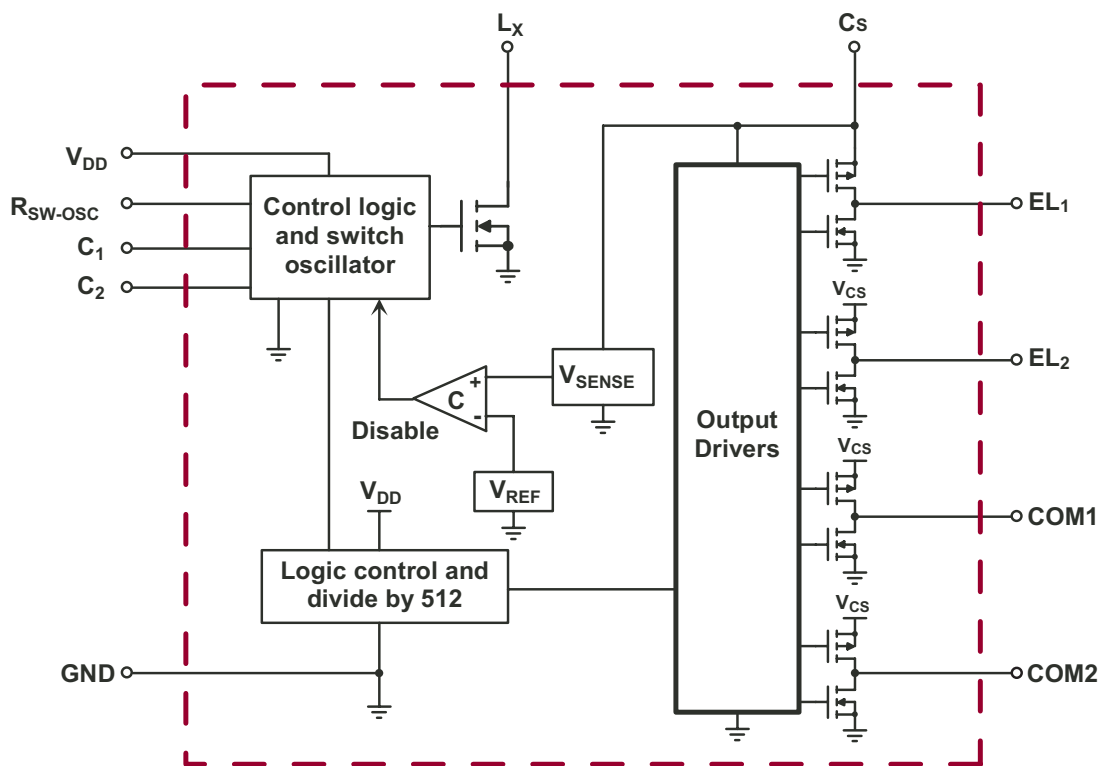
(Over recommended operating conditions unless otherwise specified -  $V_{IN} = V_{DD} = 3.3V$ ,  $T_A = 25^\circ C$ )

| Symbol       | Parameter   | Min | Typ | Max | Units    | Conditions                     |
|--------------|---|-----|-----|-----|----------|--------------------------------|
| $R_{DS(ON)}$ | On-resistance of switching transistor   | -   | -   | 10  | $\Omega$ | $I = 100mA$                    |
| $V_{DD}$     | Input voltage range   | 2.0 | -   | 5.8 | V        | ---                            |
| $V_{CS}$     | Output regulation voltage   | 80  | 90  | 100 | V        | $V_{DD} = 2.0V$ to 5.8V        |
| $V_{DIFF}$   | Differential output peak to peak voltage (EL <sub>1</sub> to COM1, EL <sub>2</sub> to COM2) | 160 | 180 | 200 | V        | $V_{DD} = 2.0V$ to 5.8V        |
| $I_{DDQ}$    | Quiescent $V_{DD}$ supply current   | -   | -   | 150 | nA       | $C_1 = C_2 = 0.1V$             |
|              |   | -   | -   | 250 | nA       | $C_1 = C_2 = 0.3V$             |
| $I_{DD}$     | Input current into the $V_{DD}$ pin   | -   | -   | 250 | $\mu A$  | $V_{DD} = 5.8V$                |
| $I_{IN}$     | Average input current including inductor current when driving both lamps                    | -   | 20  | 30  | mA       | $V_{IN} = 5.5V$ (See Figure 1) |
| $V_{CS}$     | Output voltage on $V_{CS}$ when driving both lamps  | -   | 87  | -   | V        | $V_{IN} = 5.5V$ (See Figure 1) |

Electrical Characteristics (cont.)

| Symbol         | Parameter  | Min | Typ | Max      | Units   | Conditions                           |
|----------------|--|-----|-----|----------|---------|--------------------------------------|
| $V_{DIF}$      | Differential output peak to peak voltage across each lamp (EL <sub>1</sub> to COM1, EL <sub>2</sub> to COM2) | 160 | 180 | 200      | V       | $V_{IN} = 5.5V$ (See Figure 1)       |
| $f_{EL}$       | $V_{DIFF}$ output drive frequency  | 170 | 200 | 230      | Hz      | $R_{SW} = 845k\Omega$                |
| $f_{SW}$       | Switching transistor frequency   | 87  | 102 | 118      | kHz     | $R_{SW} = 845k\Omega$                |
| $f_{SW\ temp}$ | Switching transistor frequency tempco  | -   | 15  | -        | %       | $T_A = -40^\circ C$ to $+85^\circ C$ |
| D              | Switching transistor duty cycle  | -   | 85  | -        | %       | $T_A = -40^\circ C$ to $+85^\circ C$ |
| $I_{IL}$       | Input logic low current  | -   | -   | 1.0      | $\mu A$ | $V_{DD} = 2.0V$ to $5.8V$            |
| $I_{IH}$       | Input logic high current   | -   | -   | 1.0      | $\mu A$ | $V_{DD} = 2.0V$ to $5.8V$            |
| $V_{IL}$       | Logic input low voltage  | 0   | -   | 0.3      | V       | ---                                  |
| $V_{IH}$       | Logic input high voltage   | 1.5 | -   | $V_{DD}$ | V       | ---                                  |

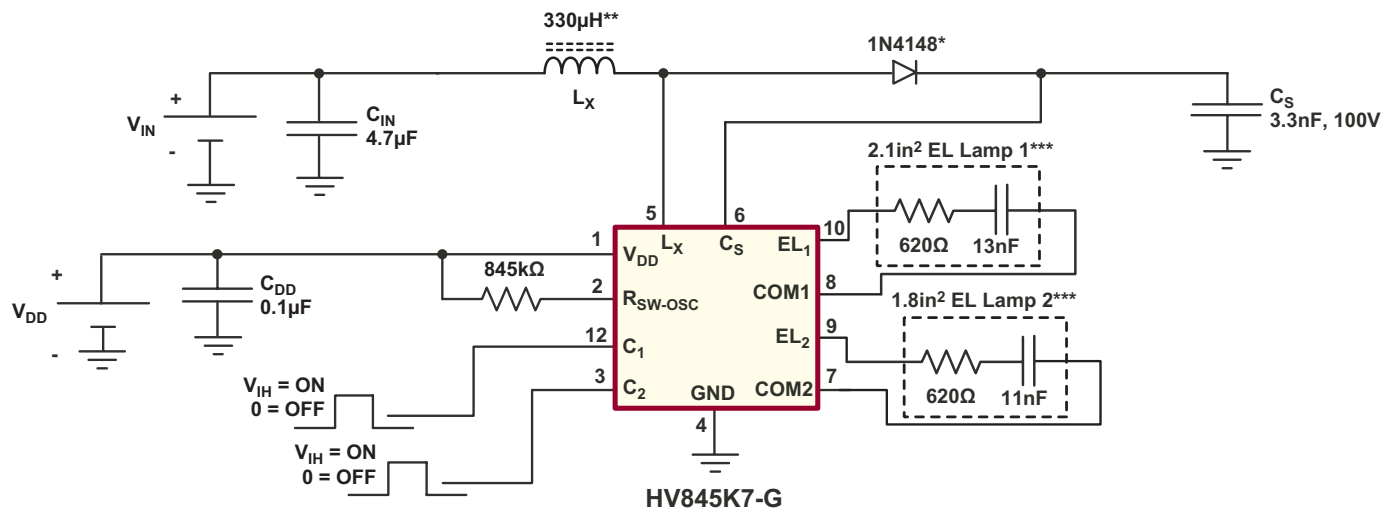
Functional Block Diagram



Function Table

| Logic Inputs   |                | Outputs         |                 |      |      | Device |
|----------------|----------------|-----------------|-----------------|------|------|--------|
| C <sub>1</sub> | C <sub>2</sub> | EL <sub>1</sub> | EL <sub>2</sub> | COM1 | COM2 |        |
| 0              | 0              | Hi Z            | Hi Z            | Hi Z | Hi Z | OFF    |
| 0              | 1              | Hi Z            | ON              | Hi Z | ON   | ON     |
| 1              | 0              | ON              | Hi Z            | ON   | Hi Z | ON     |
| 1              | 1              | ON              | ON              | ON   | ON   | ON     |

## Figure 1 - Test Circuit



\* or any (equivalent or better) > 90V, fast recovery diode

\*\* Cooper LPO6610-334MLB

\*\*\* The bigger sized lamp should be tied to EL<sub>1</sub> and the smaller sized lamp to EL<sub>2</sub> (pins 10 and 9 respectively)

## Typical Performance

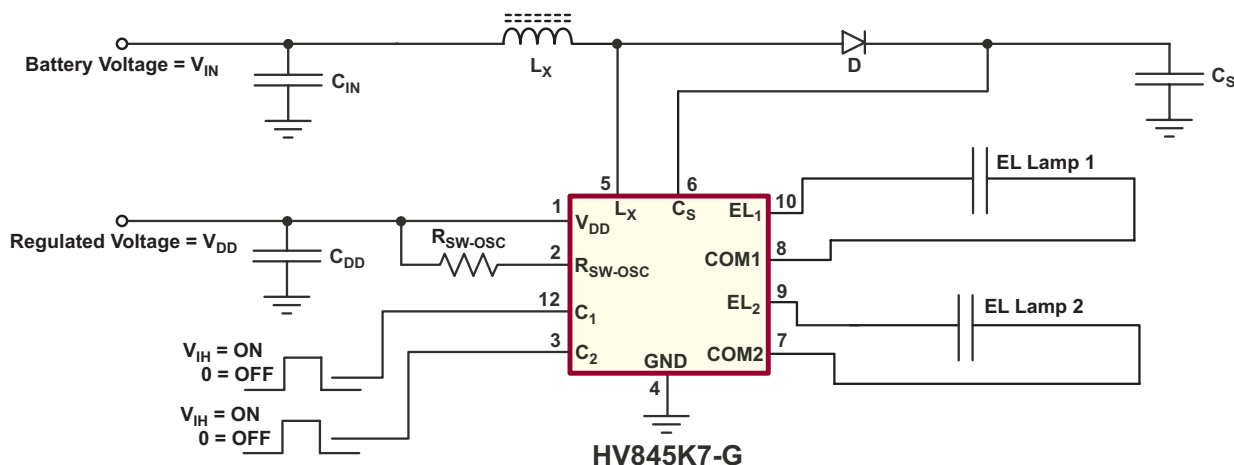
| Lamp  | V <sub>DD</sub> (V) | V <sub>IN</sub> (V) | I <sub>IN</sub> (mA) | V <sub>CS</sub> (V <sub>PEAK</sub> ) | f <sub>EL</sub> (Hz) | Lamp Brightness (cd/in <sup>2</sup> ) |                 |
|---|---------------------|---------------------|----------------------|--------------------------------------|----------------------|---------------------------------------|-----------------|
|   |                     |                     |                      |                                      |                      | EL <sub>1</sub>                       | EL <sub>2</sub> |
| EL <sub>1</sub> ON                          | 3.0V                | 5.2V                | 7.96                 | 88                                   | 195                  | 13.89                                 | -               |
| EL <sub>2</sub> ON                          |                     |                     | 6.91                 |                                      |                      | -                                     | 12.89           |
| Both EL <sub>1</sub> and EL <sub>2</sub> ON |                     |                     | 13.93                |                                      |                      | 13.02                                 | 11.24           |
| EL <sub>1</sub> ON                          |                     | 5.5V                | 7.47                 |                                      |                      | 13.93                                 | -               |
| EL <sub>2</sub> ON                          |                     |                     | 6.42                 |                                      |                      | -                                     | 13.22           |
| Both EL <sub>1</sub> and EL <sub>2</sub> ON |                     |                     | 13.42                |                                      |                      | 13.30                                 | 12.05           |
| EL <sub>1</sub> ON                          |                     | 5.8V                | 7.04                 |                                      |                      | 14.03                                 | -               |
| EL <sub>2</sub> ON                          |                     |                     | 6.01                 |                                      |                      | -                                     | 13.30           |
| Both EL <sub>1</sub> and EL <sub>2</sub> ON |                     |                     | 12.94                |                                      |                      | 13.55                                 | 12.51           |

## Split Supply Configuration

The HV845 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 HV845. The amount of current used to drive

the internal logic is less than 200µA. Therefore, the regulated voltage could easily provide the current without being loaded down.

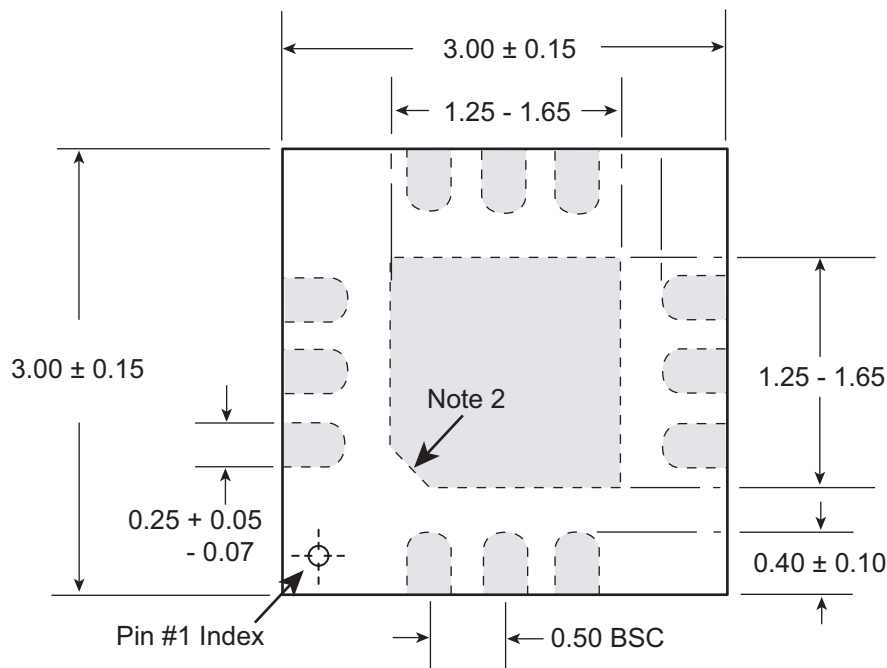
**Figure 2 - Split Supply Configuration**



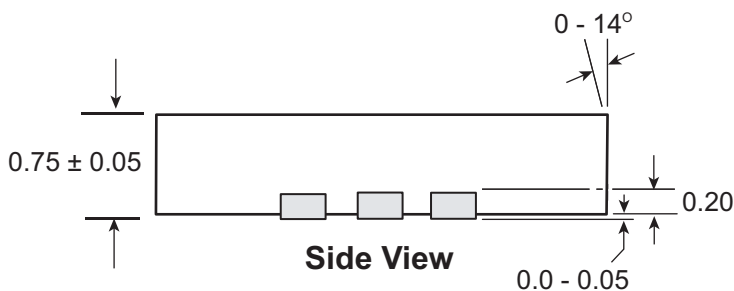
## Pin Configuration and Description

| Pin # | Function            | Description   |
|-------|---------------------|---|
| 1     | V <sub>DD</sub>     | Input voltage supply pin.   |
| 2     | R <sub>SW-OSC</sub> | External resistor connection to set both the switching MOSFET frequency and EL Lamp frequency. The external resistor should be connected between V <sub>DD</sub> and this pin. The EL lamp frequency is the switching frequency divided by 512. The switching frequency is inversely proportional to the resistor value. A 845kΩ resistor will provide a nominal switching frequency of 102kHz and an EL lamp frequency of 200Hz. To change the frequency to f <sub>EL1</sub> , the value of the resistor R <sub>SW-OSC1</sub> can be determined as R <sub>SW-OSC1</sub> = (845 x 200) / f <sub>EL1</sub> kΩ. |
| 3     | C <sub>2</sub>      | 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.   |
| 4     | GND                 | Device ground.  |
| 5     | L <sub>X</sub>      | Drain of internal switching MOSFET. Connection for an external inductor. 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 C <sub>S</sub> pin.  |
| 6     | C <sub>S</sub>      | Connect a 100V capacitor between this pin and GND. This capacitor stores the energy transferred from the inductor.  |
| 7     | COM2                | Common lamp connection for EL <sub>2</sub> .  |
| 8     | COM1                | Common lamp connection for EL <sub>1</sub> .  |
| 9     | EL <sub>2</sub>     | EL lamp 2 connection. For optimum performance, the smaller of the two lamps should be connected to this pin.  |
| 10    | EL <sub>1</sub>     | EL lamp 1 connection. For optimum performance, the larger of the two lamps should be connected to this pin.   |
| 11    | NC                  | No connect.   |
| 12    | C <sub>1</sub>      | 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.   |

12-Lead QFN/MLP (3x3) Package (K7)



Top View



Side View

Note:

1. All dimensions are in millimeters; all angles in degrees
2. Corner shape may differ from drawing

(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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