High-Voltage Liquid Crystal Shutter Driver

Features

• Logic-selectable Output Voltage
• 100 nF Drive Capability
• 90 V_{P-P} Maximum Output Voltage
• 25 μs Response Time

Applications

• Liquid Crystal Shutter

General Description

The HV508 is a 45V liquid crystal shutter driver in an 8-lead SOIC surface-mount package. It is composed of two outputs that provide square waves of opposite phases. The liquid crystal shutter is connected between the two outputs. Its equivalent load can be modeled as a minimum of 1 MΩ resistor in parallel with a maximum of 0.1 μF capacitor.

The HV508 has three input supply voltages—HV_{IN}, LV_{IN} and V_{DD}. The output amplitude is either LV_{IN} or HV_{IN}. A logic high on the HV_{EN} input sets the output to operate from the HV_{IN} supply. On the other hand, a logic low on the HV_{EN} input sets the output to operate from the LV_{IN} supply. The output frequency is determined by the logic input frequency applied to the POL input.

Package Type

8-lead SOIC
(Top view)

See Table 2-1 for pin information.
Functional Block Diagram

![Functional Block Diagram of the HV508 chip](image-url)
Typical Application Circuit

Image Controller

HV508

VDD LVIN HVIN

HVOUT1

HVOUT2

LVIN

POL

HVEN

Liquid Crystal Shutter
1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-voltage Input, HVIN</td>
<td>+60V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-voltage Input, LVIN</td>
<td>+7.5V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logic Supply voltage, VDD</td>
<td>+12V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Ambient Temperature, TA</td>
<td>–5°C to +60°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Temperature, TS</td>
<td>–65°C to +150°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Dissipation (Note 1):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>700 mW</td>
<td>8-lead SOIC</td>
</tr>
</tbody>
</table>

† Notice: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

Note 1: For operation above 25°C ambient, derate linearly at 6 mW/°C.

RECOMMENDED OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Supply Voltage</td>
<td>VDD</td>
<td>5</td>
<td>—</td>
<td>10</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Low-output Supply Voltage</td>
<td>LVIN</td>
<td>3</td>
<td>—</td>
<td>6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>High-output Supply Voltage</td>
<td>HVIN</td>
<td>5</td>
<td>—</td>
<td>45</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Logic Input Voltage Low</td>
<td>VIL</td>
<td>0</td>
<td>—</td>
<td>0.7</td>
<td>VDD</td>
<td></td>
</tr>
<tr>
<td>Logic Input Voltage High</td>
<td>VIL</td>
<td>0.7</td>
<td>VDD</td>
<td>—</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>TA</td>
<td>–5</td>
<td>—</td>
<td>+60</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

DC ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVIN Quiescent Current</td>
<td>IVQ</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>µA</td>
<td>POL = 100 Hz, HVEN = high, T_A = 25°C, Load = 1 MΩ in parallel with 0.1 µF between HVOUT1 and HVOUT2</td>
</tr>
<tr>
<td>LVIN Quiescent Current</td>
<td>ILQ</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>µA</td>
<td>POL = 100 Hz, HVEN = low, T_A = 25°C, Load = 1 MΩ in parallel with 0.1 µF between HVOUT1 and HVOUT2</td>
</tr>
<tr>
<td>VDD Quiescent Current</td>
<td>IDDQ</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>HVIN Operating Current</td>
<td>I_HV</td>
<td>—</td>
<td>—</td>
<td>2.8</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>LVIN Operating Current</td>
<td>I_LV</td>
<td>—</td>
<td>—</td>
<td>380</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>Logic Input Current Low</td>
<td>IIL</td>
<td>–5</td>
<td>—</td>
<td>—</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>Logic Input Current High</td>
<td>IIH</td>
<td>—</td>
<td>—</td>
<td>5</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>Output Capacitive Load</td>
<td>CLOAD</td>
<td>0</td>
<td>—</td>
<td>0.25</td>
<td>µF</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: The device can operate continuously in this range without damage. AC limits are not implemented.
**AC ELECTRICAL CHARACTERISTICS**

Electrical Specifications: $HV_IN = 45V$, $LV_IN = 6V$, $V_DD = 5V$, and $T_A = -5°C$ to $+60°C$.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>POL Input Frequency</td>
<td>$f_{POL}$</td>
<td>0</td>
<td>—</td>
<td>100</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>Turn-on Time when High-voltage is Enabled</td>
<td>$t_{HV(ON)}$</td>
<td>—</td>
<td>—</td>
<td>16</td>
<td>µs</td>
<td>Load = 1 MΩ in parallel with 0.1 µF between $HV_{OUT1}$ and $HV_{OUT2}$, $HVEN$ = high, outputs rise to $HV_IN$ (See Fig.1 in Timing Waveforms.)</td>
</tr>
<tr>
<td>Turn-off Time when High-voltage is Enabled</td>
<td>$t_{HV(OFF)}$</td>
<td>—</td>
<td>—</td>
<td>16</td>
<td>µs</td>
<td></td>
</tr>
<tr>
<td>Turn-on time when High-voltage is Disabled</td>
<td>$t_{LV(ON)}$</td>
<td>—</td>
<td>—</td>
<td>40</td>
<td>µs</td>
<td>Load = 1 MΩ in parallel with 0.1 µF between $HV_{OUT1}$ and $HV_{OUT2}$, $HVEN$ = low, outputs rise to $HV_IN$ (See Fig.1 in Timing Waveforms.)</td>
</tr>
<tr>
<td>Turn-off time when High-voltage is Disabled</td>
<td>$t_{LV(OFF)}$</td>
<td>—</td>
<td>—</td>
<td>6</td>
<td>µs</td>
<td></td>
</tr>
<tr>
<td>Turn-on time from $HVEN$ to $HV_{OUT}$</td>
<td>$t_{EN(ON)}$</td>
<td>—</td>
<td>—</td>
<td>25</td>
<td>µs</td>
<td>Load = 1 MΩ in parallel with 0.1 µF between $HV_{OUT1}$ and $HV_{OUT2}$ (See Fig.2 in Timing Waveforms.)</td>
</tr>
</tbody>
</table>

**TEMPERATURE SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sym.</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEMPERATURE RANGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Ambient Temperature</td>
<td>$T_A$</td>
<td>-5</td>
<td>—</td>
<td>+60</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>$T_S$</td>
<td>-65</td>
<td>—</td>
<td>+150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>PACKAGE THERMAL RESISTANCE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-lead SOIC</td>
<td>$\theta_{JA}$</td>
<td>—</td>
<td>101</td>
<td>—</td>
<td>°C/W</td>
<td></td>
</tr>
</tbody>
</table>

**Timing Waveforms**

![Timing Waveforms Diagram](image-url)
2.0 PIN DESCRIPTION

The details on the pins of HV508 are listed on Table 2-1. Refer to Package Type for the location of pins.

### TABLE 2-1: PIN FUNCTION TABLE

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Pin Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LVIN</td>
<td>Low Voltage Supply</td>
</tr>
<tr>
<td>2</td>
<td>POL</td>
<td>Polarity</td>
</tr>
<tr>
<td>3</td>
<td>HVEN</td>
<td>High Voltage Enable</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>HVOUT2</td>
<td>High Voltage Output Channel 2</td>
</tr>
<tr>
<td>6</td>
<td>VDD</td>
<td>Logic Voltage Supply</td>
</tr>
<tr>
<td>7</td>
<td>HVIN</td>
<td>High Voltage Supply</td>
</tr>
<tr>
<td>8</td>
<td>HVOUT1</td>
<td>High Voltage Output Channel 1</td>
</tr>
</tbody>
</table>
3.0 FUNCTIONAL DESCRIPTION

Follow the steps in Table 3-1 to power up and power down the HV508.

TABLE 3-1: POWER-UP AND POWER-DOWN SEQUENCE

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1    | Connect ground.   | 1    | Remove LV\textsubscript{IN}.
| 2    | Apply V\textsubscript{DD}. | 2    | Remove HV\textsubscript{IN}.
| 3    | Connect logic Inputs. | 2    | Remove all logic inputs.
| 4    | Connect HV\textsubscript{IN}. | 3    | Remove V\textsubscript{DD}.
| 5    | Connect LV\textsubscript{IN}. | 4    | Disconnect ground.  |

TABLE 3-2: TRUTH FUNCTION TABLE

<table>
<thead>
<tr>
<th>HV\textsubscript{EN}</th>
<th>POL</th>
<th>HV\textsubscript{OUT1}</th>
<th>HV\textsubscript{OUT2}</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>H</td>
<td>HV\textsubscript{IN}</td>
<td>GND</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
<td>GND</td>
<td>HV\textsubscript{IN}</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>LV\textsubscript{IN}</td>
<td>GND</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>GND</td>
<td>LV\textsubscript{IN}</td>
</tr>
</tbody>
</table>
4.0 PACKAGE MARKING INFORMATION

4.1 Packaging Information

Legend:

- **XX...X** Product Code or Customer-specific information
- **Y** Year code (last digit of calendar year)
- **YY** Year code (last 2 digits of calendar year)
- **WW** Week code (week of January 1 is week ‘01’)
- **NNN** Alphanumeric traceability code
- **@3** Pb-free JEDEC® designator for Matte Tin (Sn)
- **[*]** This package is Pb-free. The Pb-free JEDEC designator (@3) can be found on the outer packaging for this package.

Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for product code or customer-specific information. Package may or not include the corporate logo.
8-Lead SOIC (Narrow Body) Package Outline (LG/TG)
4.90x3.90mm body, 1.75mm height (max), 1.27mm pitch

Top View

Note: For the most current package drawings, see the Microchip Packaging Specification at www.microchip.com/packaging.

Note:
1. This chamfer feature is optional. 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.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>A</th>
<th>A1</th>
<th>A2</th>
<th>b</th>
<th>D</th>
<th>E</th>
<th>E1</th>
<th>e</th>
<th>h</th>
<th>L</th>
<th>L1</th>
<th>L2</th>
<th>θ</th>
<th>θ1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension (mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIN</td>
<td>1.35</td>
<td>0.10</td>
<td>1.25</td>
<td>0.31</td>
<td>4.80</td>
<td>5.80</td>
<td>3.80</td>
<td>0.25</td>
<td>0.40</td>
<td>1.04</td>
<td>0.25</td>
<td>8°</td>
<td>5°</td>
<td></td>
</tr>
<tr>
<td>NOM</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4.90</td>
<td>6.00</td>
<td>3.90</td>
<td>-</td>
<td>-</td>
<td>1.27</td>
<td>0.25</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>MAX</td>
<td>1.75</td>
<td>0.25</td>
<td>1.65</td>
<td>0.51</td>
<td>5.00</td>
<td>6.20</td>
<td>4.00</td>
<td>0.50</td>
<td>1.27</td>
<td>1.04</td>
<td>0.25</td>
<td>8°</td>
<td>15°</td>
<td></td>
</tr>
</tbody>
</table>

* This dimension is not specified in the JEDEC drawing.

Drawings are not to scale.
APPENDIX A: REVISION HISTORY

Revision A (March 2017)

- Converted Supertex Doc# DSFP-HV508 to Microchip DS20005728A
- Removed “HVCMOS® Technology” throughout the data sheet
- Changed part marking format
- Changed the quantity of the 8-lead SOIC LG package from 2500/Reel to 3300/Reel
- Made minor text changes throughout the document
**PRODUCT IDENTIFICATION SYSTEM**

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>XX</th>
<th>-</th>
<th>X</th>
<th>-</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device</strong></td>
<td><strong>Package Options</strong></td>
<td><strong>Environmental</strong></td>
<td><strong>Media Type</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Device:</th>
<th>Package:</th>
<th>Environmental:</th>
<th>Media Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HV508</td>
<td>LG</td>
<td>G</td>
<td>(blank)</td>
</tr>
</tbody>
</table>

**Example:**

a) HV508LG-G: High-Voltage Liquid Crystal Shutter Driver, 8-lead SOIC, 3300/Reel

Lead (Pb)-free/RoHS-compliant Package for an LG Package.
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Fax: 86-10-8528-2104

China - Changdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing
Tel: 86-23-8960-9588
Fax: 86-23-8980-9500

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115
Fax: 86-571-8792-8116

China - Hong Kong SAR
Tel: 852-2943-5100
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-3326-8000
Fax: 86-21-3326-8021

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
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Fax: 86-755-8203-1760

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