

# 2A H-Bridge Driver

## Description

The CS3720 is high current (2A typ) bidirectional DC motor driver. The H-bridge output stage consists of two pairs of power NPN transistors, each with a  $V_{SAT}=2.3V$  at  $I_{OUT}=2A$  (typ).

The three TTL compatible inputs, ENABLE1, ENABLE2, and DIRECTION control the output stage. When ENABLE1 is low and

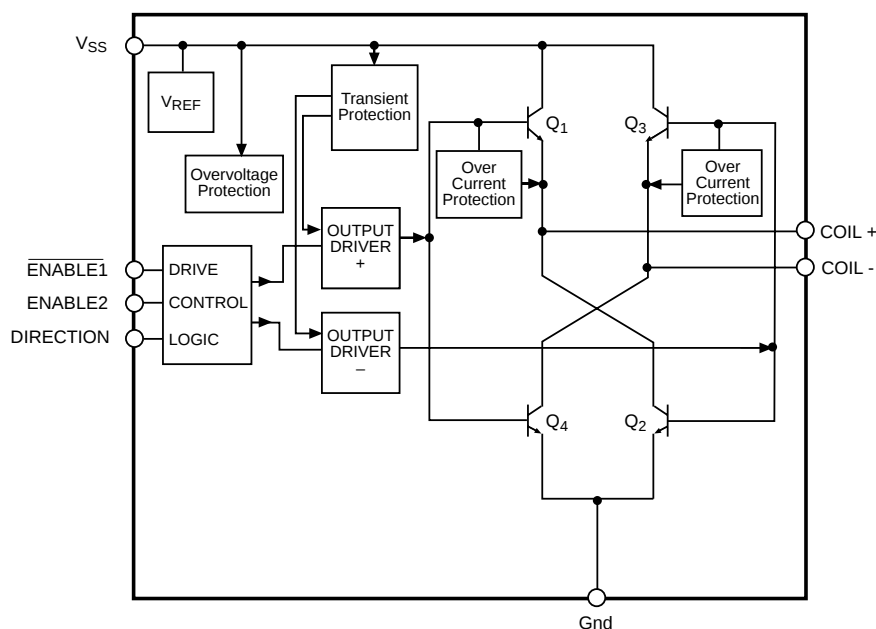
ENABLE2 is high, DIRECTION determines which way current flows through the motor coil. Any other combination of ENABLE settings disables the outputs.

The CS3720 is protected against overvoltage fault conditions. If a fault condition is detected, the IC shuts down.

## Absolute Maximum Ratings

|                                                  |                                     |
|--------------------------------------------------|-------------------------------------|
| DC Input Voltage .....                           | -0.3 to 28V                         |
| Transient Input Voltage .....                    | -0.3 to 74V                         |
| Internal Power Dissipation .....                 | Internally limited                  |
| Junction Temperature Range .....                 | -40°C to +150°C                     |
| Storage Temperature Range .....                  | -65°C to +150°C                     |
| Lead Temperature Soldering                       |                                     |
| Wave Solder (through hole styles only) .....     | 10 sec. max, 260°C peak             |
| Reflow (SMD styles only) .....                   | 60 sec. max above 183°C, 230°C peak |
| Electrostatic Discharge (Human Body Model) ..... | 2kV                                 |

## Block Diagram

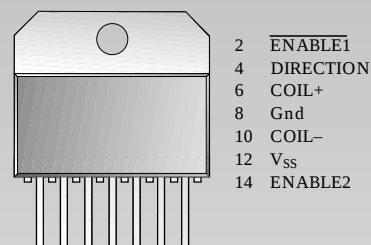


## Features

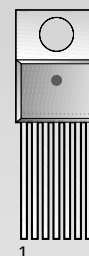
- **High Current (2A typ) Output**
- **TTL compatible DIRECTION Control**
- **Fault Protection**  
**Overvoltage**  
**Load Dump Protection to 74V**

## Package Options

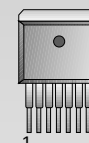
### 7 Lead Power SIP



### 7 Lead TO-220



### 7 Lead D<sup>2</sup>PAK



**Electrical Characteristics:**  $5.5V \leq V_{CC} \leq 17V$ ;  $-40^{\circ}C \leq T_J \leq +150^{\circ}C$ ;  $-40^{\circ}C \leq T_C \leq +105^{\circ}C$ ;  $-40^{\circ}C \leq T_A \leq 105^{\circ}C$ ; unless otherwise specified.

| PARAMETER                 | TEST CONDITIONS                                                                                      | MIN | TYP | MAX | UNIT    |
|---------------------------|------------------------------------------------------------------------------------------------------|-----|-----|-----|---------|
| <b>■ Output Stage</b>     |                                                                                                      |     |     |     |         |
| Quiescent Current         | $I_{OUT} = 0mA$ ;<br>$\overline{ENABLE1} = \text{DIRECTION} = \text{High}$<br>$ENABLE2 = \text{Low}$ |     |     | 10  | mA      |
| Output Saturation Voltage | $I_{OUT} = 2A$                                                                                       |     |     | 3.2 | V       |
|                           | $I_{OUT} = 500mA$                                                                                    |     |     | 2.6 | V       |
| Output Leakage Current    | $I_{OUT} = 0mA$                                                                                      |     |     | 20  | $\mu A$ |
| Current Limit             |                                                                                                      |     | 3.0 |     | A       |

**■ Logic Control Functions**

|                          |                                     |      |   |     |         |
|--------------------------|-------------------------------------|------|---|-----|---------|
| High Level Input Voltage |                                     | 2.0  |   |     | V       |
| Low Level Input Voltage  |                                     |      |   | 0.8 | V       |
| High Level Input Current |                                     |      |   | 10  | $\mu A$ |
| Low Level Input Current  |                                     | -250 |   |     | $\mu A$ |
| Turn on Delay            | $R_{LOAD} = 30\Omega$ ; Coil = 5mH; |      |   | 50  | $\mu s$ |
| Guaranteed by design     | $C_{LOAD} = 15pF$                   |      | 5 |     |         |
| Turn off Delay           | $R_{LOAD} = 30\Omega$ ; Coil = 5mH; |      |   | 50  | $\mu s$ |
| Guaranteed by design     | $C_{LOAD} = 15pF$                   |      | 5 |     |         |

**■ Fault Protection Functions**

|                      |                   |      |  |      |   |
|----------------------|-------------------|------|--|------|---|
| Overvoltage Shutdown | $I_{OUT} = 500mA$ | 18.0 |  | 21.5 | V |
|----------------------|-------------------|------|--|------|---|

**Package Lead Description**

| PACKAGE LEAD#     |               |                           | LEAD SYMBOL          | FUNCTION                                                                                                                                  |
|-------------------|---------------|---------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 15 Lead Power SIP | 7 Lead TO-220 | 7 Lead D <sup>2</sup> PAK |                      |                                                                                                                                           |
| 2                 | 1             | 1                         | $\overline{ENABLE1}$ | Enables output when held low and $ENABLE2 = \text{High}$                                                                                  |
| 4                 | 2             | 2                         | DIRECTION            | Determines the direction of current flow through COIL+ and COIL- as long as $\overline{ENABLE1} = \text{Low}$ and $ENABLE2 = \text{High}$ |
| 6                 | 3             | 3                         | COIL+                | Positive Output of H bridge to coil                                                                                                       |
| 8                 | 4             | 4                         | Gnd                  | Ground connection                                                                                                                         |
| 12                | 5             | 5                         | V <sub>SS</sub>      | Supply voltage for IC                                                                                                                     |
| 10                | 6             | 6                         | COIL-                | Negative Output of H bridge to coil                                                                                                       |
| 14                | 7             | 7                         | ENABLE2              | Enables output when held high and $\overline{ENABLE1} = \text{Low}$                                                                       |

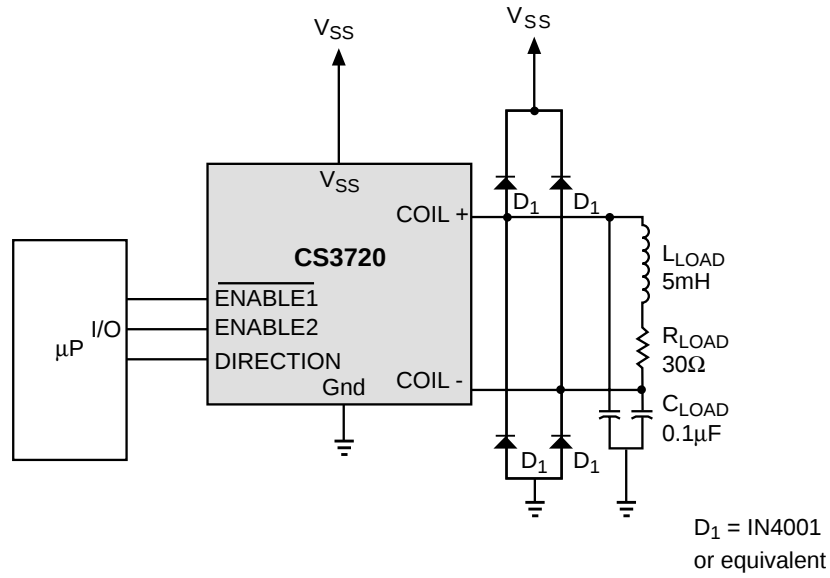
**Application Hints**

**Motor Direction Control**

Current flow through the two outputs COIL+ and COIL- is controlled by the combined settings of  $\overline{ENABLE1}$ ,  $ENABLE2$  and DIRECTION (Table 1). The outputs will be active only when  $\overline{ENABLE1}$  is low and  $ENABLE2$  is high. When DIRECTION is high, current flows out of COIL+ and into COIL-. When DIRECTION is low, current flows out of COIL- and into COIL+. For any other combination of ENABLE settings, the outputs are off.

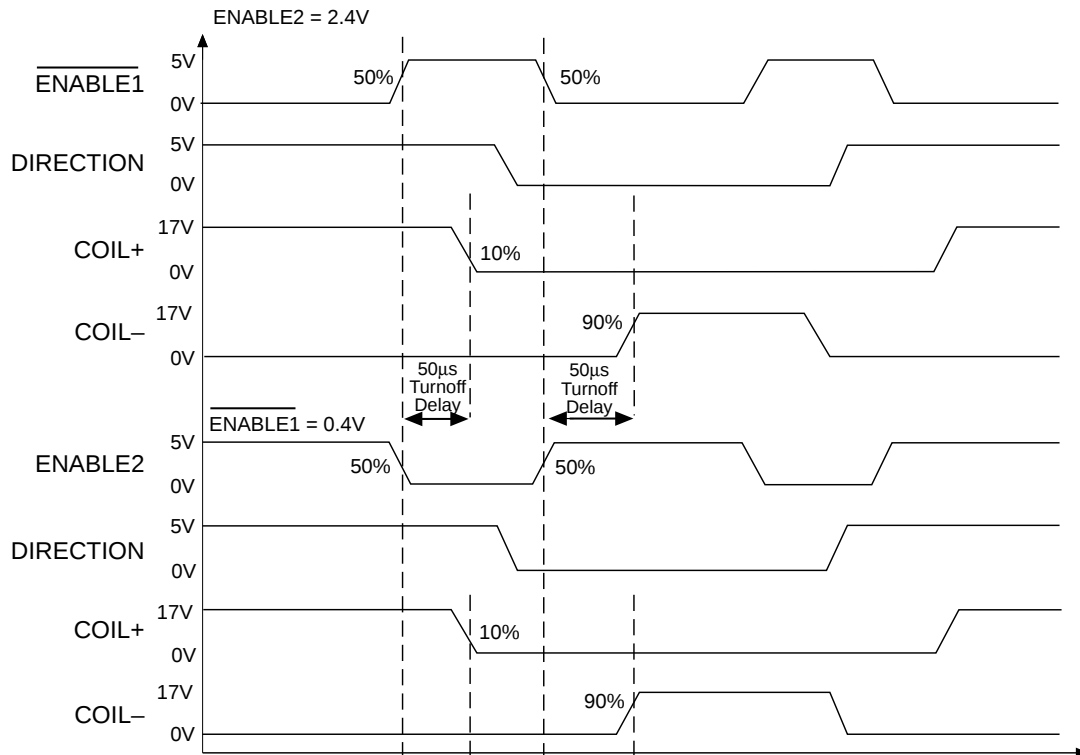
| $\overline{ENABLE1}$ | ENABLE2 | DIRECTION | COIL+ | COIL- |
|----------------------|---------|-----------|-------|-------|
| Low                  | High    | High      | High  | Low   |
| Low                  | High    | Low       | Low   | High  |
| High                 | X       | X         | OFF   | OFF   |
| X                    | Low     | X         | OFF   | OFF   |

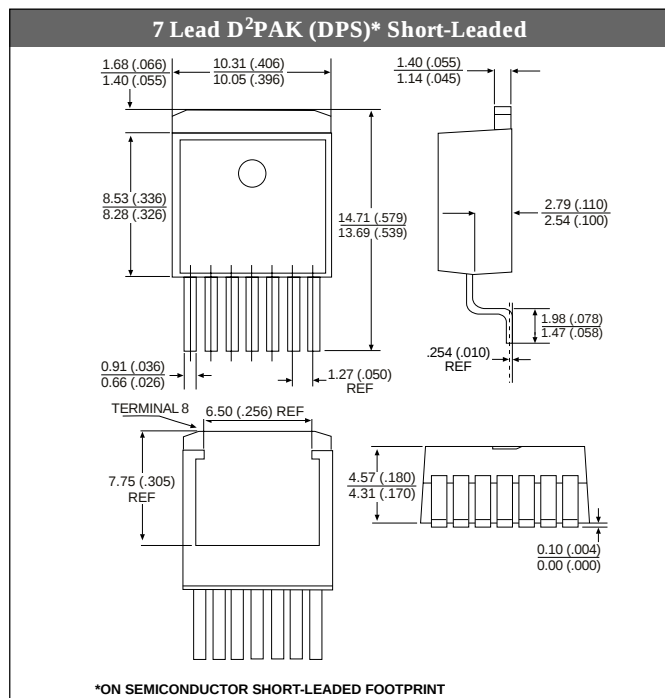
**Table 1. Logical Control Diagram**



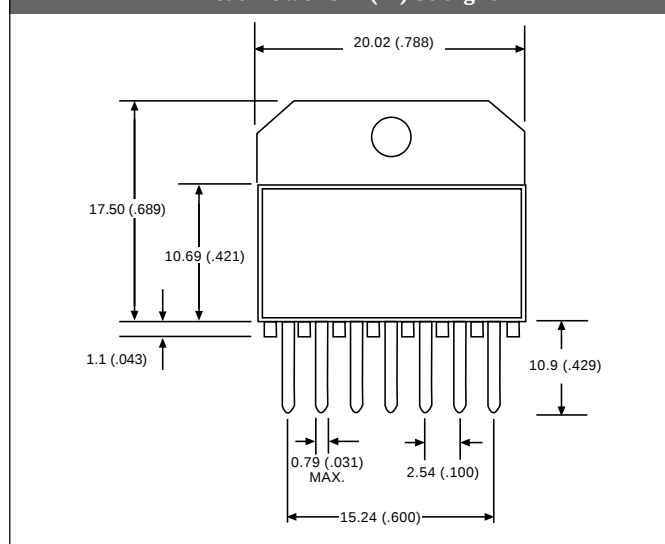
Note: A heatsink is required for 2A operation.

Figure 1. Delay Times for ENABLE and COIL



**PACKAGE DIMENSIONS IN mm (INCHES)**

### 7 Lead Power SIP (M) Straight

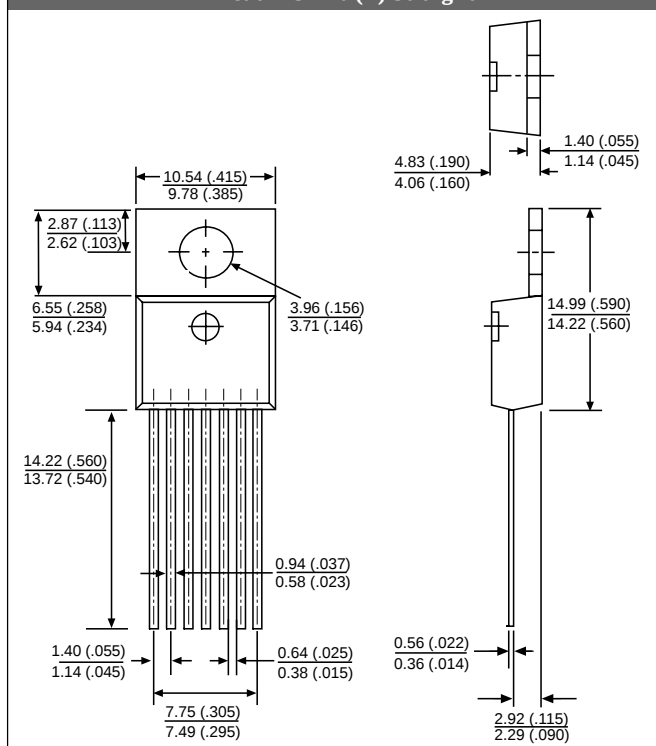


## PACKAGE THERMAL DATA

| Thermal Data     |     | 7L<br>D <sup>2</sup> PAK | 7L<br>TO-220 | 7L<br>Power SIP |        |
|------------------|-----|--------------------------|--------------|-----------------|--------|
| R <sub>ΘJC</sub> | typ | 2.1                      | 2.1          | 2.1             | °C / W |
| R <sub>ΘJA</sub> | typ | 10-50*                   | 50           | 35              | °C / W |

\*Depending on thermal properties of substrate.  $R_{\text{CIA}} = R_{\text{CIC}} + R_{\text{CCA}}$

### 7 Lead TO-220 (T) Straight



## Ordering Information

| Part Number  | Description                                             |
|--------------|---------------------------------------------------------|
| CS3720XT7    | 7 Lead TO-220 Straight                                  |
| CS3720XTVA7  | 7 Lead TO-220 Vertical                                  |
| CS3720XTHA7  | 7 Lead TO-220 Horizontal                                |
| CS3720XM7    | 7 Lead Power SIP Straight                               |
| CS3720XDPS7  | 7 Lead D <sup>2</sup> PAK Short-Leaded                  |
| CS3720XDPSR7 | 7 Lead D <sup>2</sup> PAK Short-Leaded<br>(tape & reel) |

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