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# 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.

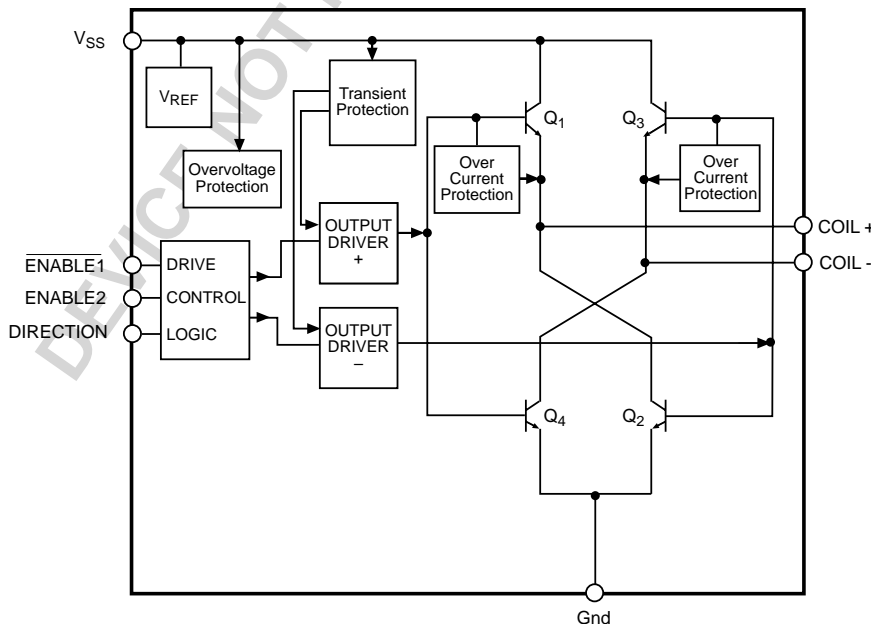
## Features

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

## Absolute Maximum Ratings

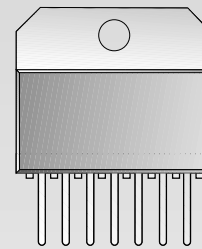
DC Input Voltage .....	-0.3 to 28V
Transient Input Voltage .....	-0.3 to 74V
Internal Power Dissipation.....	Internally limited
Junction Temperature Range .....	-40°C to +150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature Soldering	
Wave Solder (through hole styles only) .....	10 sec. 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



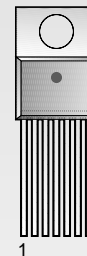
## Package Options

### 7 Lead Power SIP

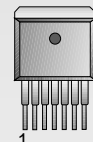


- 2 ENABLE1
- 4 DIRECTION
- 6 COIL+
- 8 Gnd
- 10 COIL-
- 12 V<sub>SS</sub>
- 14 ENABLE2

### 7 Lead TO-220



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



- 1 ENABLE1
- 2 DIRECTION
- 3 COIL+
- 4 Gnd
- 5 V<sub>SS</sub>
- 6 COIL-
- 7 ENABLE2



**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	$I_{OUT} = 0mA$ ; $\overline{ENABLE1} = DIRECTION = High$ $ENABLE2 = Low$			10	mA
Output Saturation Voltage	$I_{OUT} = 2A$ $I_{OUT} = 500mA$			3.2	V
				2.6	V
Output Leakage Current	$I_{OUT} = 0mA$			20	$\mu A$
Current Limit			3.0		A
<b>■ Logic Control Functions</b>					
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 Guaranteed by design	$R_{LOAD} = 30\Omega$ ; Coil = 5mH; $C_{LOAD} = 15pF$		5	50	$\mu s$
Turn off Delay Guaranteed by design	$R_{LOAD} = 30\Omega$ ; Coil = 5mH; $C_{LOAD} = 15pF$		5	50	$\mu s$
<b>■ Fault Protection Functions</b>					
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 $ENABLE2 = High$
4	2	2	DIRECTION	Determines the direction of current flow through COIL+ and COIL- as long as $\overline{ENABLE1} = Low$ and $ENABLE2 = High$
6	3	3	COIL+	Positive Output of H bridge to coil
8	4	4	Gnd	Ground connection
12	5	5	$V_{SS}$	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 $\overline{ENABLE1} = Low$

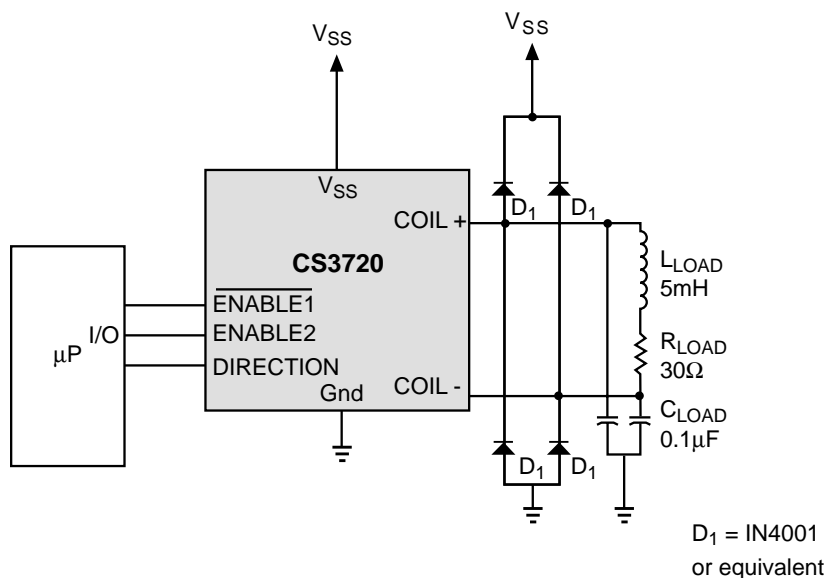
### Application Hints

#### 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.

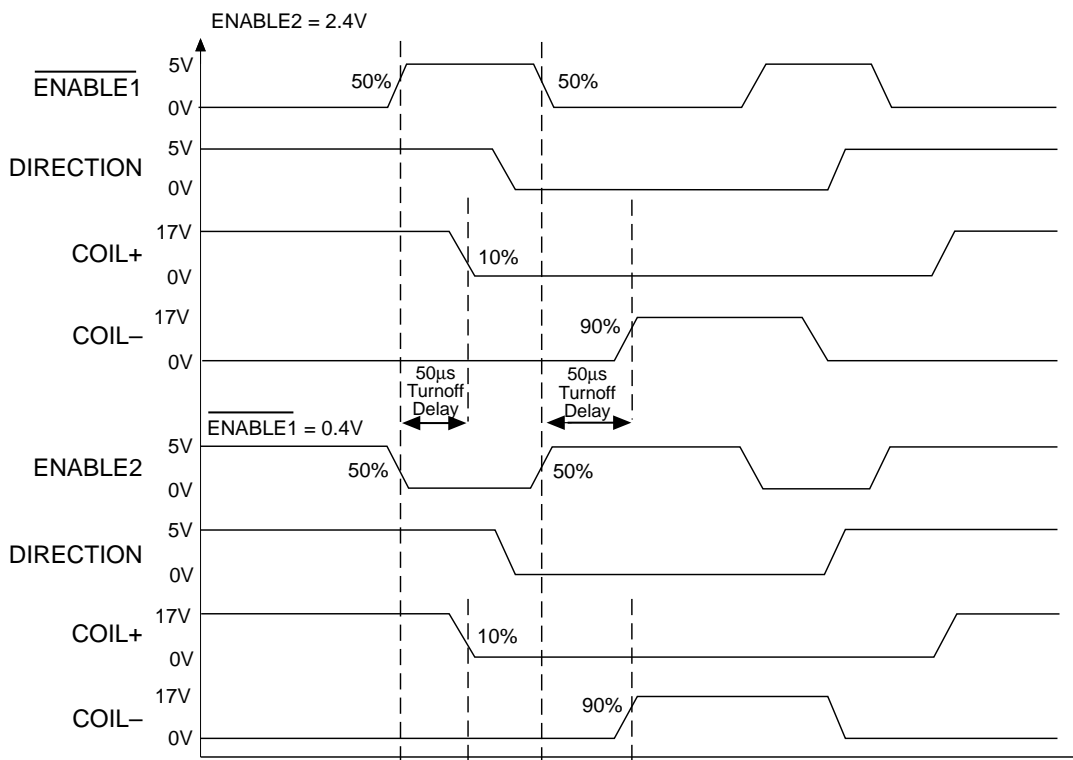
$\overline{ENABLE1}$	ENABLE2	DIRECTION	COIL+	COIL-
Low	High	High	High	Low
Low	High	Low	Low	High
High	X	X	OFF	OFF
X	Low	X	OFF	OFF

Table 1. Logical Control Diagram

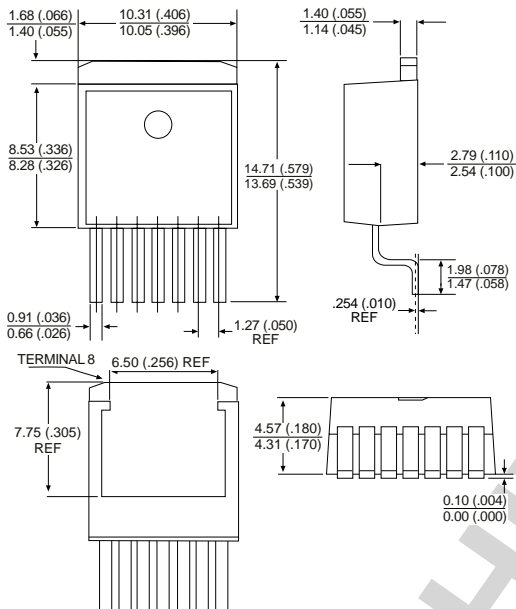


Note: A heatsink is required for 2A operation.

Figure 1. Delay Times for ENABLE and COIL

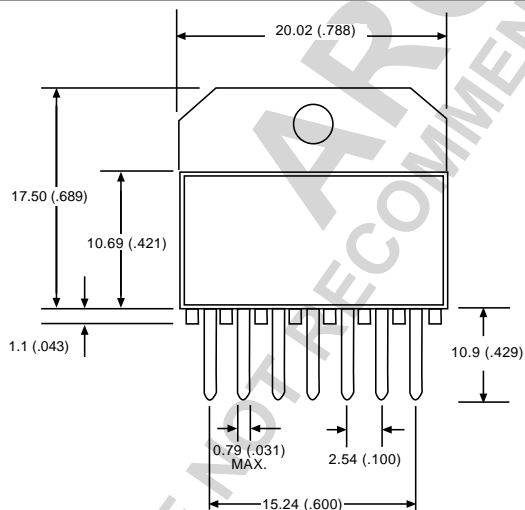


## PACKAGE DIMENSIONS IN mm (INCHES)

7 Lead D<sup>2</sup>PAK (DPS)\* Short-Leaded

\*ON SEMICONDUCTOR SHORT-LEADED FOOTPRINT

## 7 Lead Power SIP (M) Straight

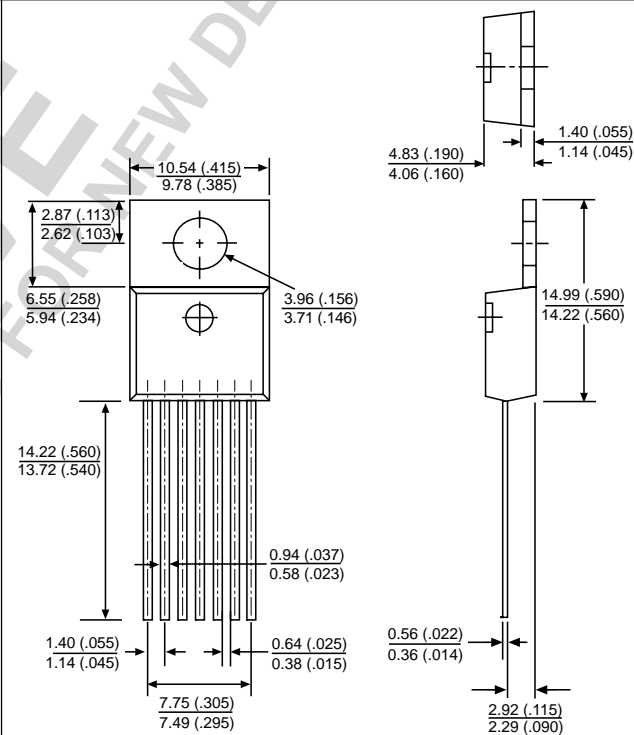


## PACKAGE THERMAL DATA

Thermal Data	7L D <sup>2</sup> PAK	7L TO-220	7L Power SIP	
$R_{\theta JC}$ typ	2.1	2.1	2.1	°C/W
$R_{\theta JA}$ typ	10-50*	50	35	°C/W

\*Depending on thermal properties of substrate.  $R_{\theta JA} = R_{\theta JC} + R_{\theta CA}$ .

## 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 (tape & reel)

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