

CS-7105

5V, 250mA Voice Coil Motor Driver with H-bridge and Programmable Head Retract, Bandwidth and Power Fault Detection

Description

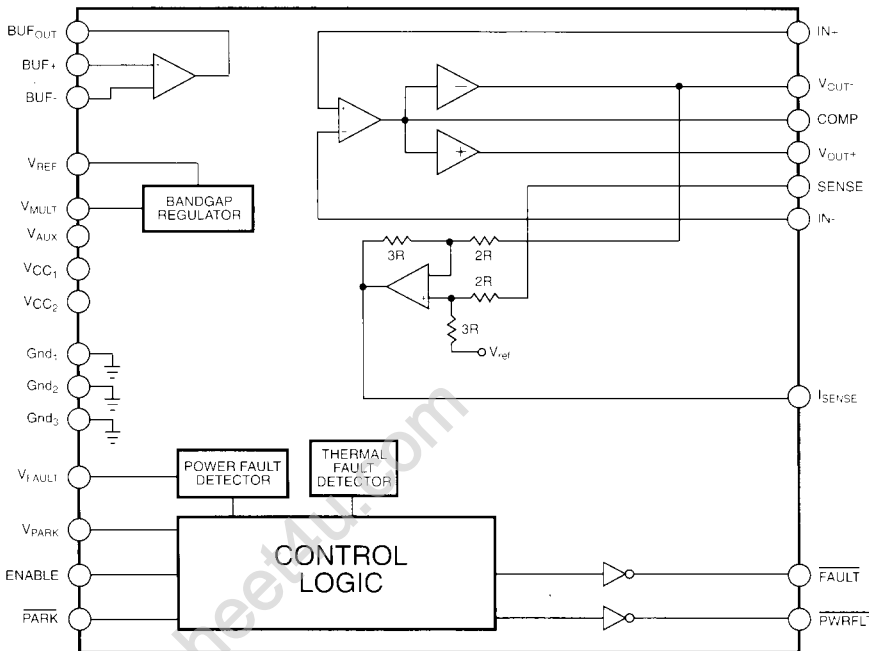
The CS-7105 is a voice coil power driver intended for use in 5V 2.5 inch Hard Disk servo systems. The CS-7105 contains the complete H-Bridge power amplifier, including the 4 power transistors, and all

control functions. Head retraction circuitry is provided to allow for a controlled shutdown of the drive. Power Fault, and Thermal Fault Detection are also included.

Absolute Maximum Ratings

V_{CC1}, V_{CC2}	10V
Auxiliary Supply, V_{AUX}	17V
Logic Input Voltage.....	-0.3V to V_{AUX}
Logic Output Voltage.....	-0.3V to 17V
Maximum Junction Temperature.....	150°C
Maximum Power Dissipation.....	700mW
H-Bridge Output Current.....	350mA
Storage Temperature.....	-65°C to +150°C
Operating Temperature.....	0°C to +70°C

Block Diagram



Features

Single 5 Volt Power Supply

Full 250mA H-Bridge

On Chip Transient Protection

Low System Offset Current (<1mA)

Low Supply Current (6mA)

Low Current Standby Mode

All Amplifiers internally Compensated

No Crossover Distortion

Programmable Functions:

V_{REF}

Retract Voltage

System Bandwidth

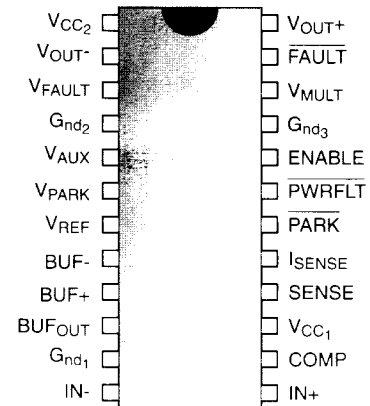
Power Fault Detector

Transconductance

On Chip Thermal Protection

Package Options

24 Lead SO



Electrical Characteristics: $V_{CC} = 4.5V$ to $5.5V$, $T_A = 0$ to $70^\circ C$, Unless otherwise specified

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
■ Power Supply					
Supply Voltage Range V_{CC1} and V_{CC2}		4.5	5.0	5.5	V
Total Supply Current ($I_{CC} + I_{AUX}$) $V_{ENABLE} = 2.0V$ (Track Following)			6.0	25.0	mA
	$V_{ENABLE} = 0.8V$			2.0	mA
Auxiliary Voltage, V_{AUX}		2.0		15.0	V
Auxiliary Current, I_{AUX} $V_{CC} = 0$, $V_{AUX} = 5.0V$				15.0	mA
■ Logic I/O					
Logic HI Input Current	$V_{IN} = 2.0V$			100	μA
Logic LOW Input Current	$V_{IN} = 0.8V$			-100	μA
Logic HI Input Voltage			1.5	2.0	V
Logic LOW Input Voltage		0.8	1.5		V
\overline{FAULT}	$I_{OUT} = 100\mu A$			0.4	V
\overline{PWRFLT}	$I_{OUT} = 100\mu A$			0.4	V
■ Voltage Reference					
V_{REF}	$R_{MULT} = 20k\Omega$	2.40	2.50	2.60	V
Output Current	$R_{REF} = 20k\Omega$	2.0			mA
PSRR		40			dB
■ Closed Loop System ($R_{SENSE} = 2\Omega$)					
Transconductance (Buffer amplifier set for Gain = 1.0)					
($T_A = 25^\circ C$) $I_{OUT} = 200mA$	$R_n = 50k\Omega$ $R_f = 20k\Omega$	190	200	210	mA/V
($T_A = 0$ to $70^\circ C$) $I_{OUT} = 200mA$		186	200	214	mA/V
Output Offset Current	$T_A = 25^\circ C$			1.00	mA
Output Offset Current	$T_A = 0$ to $70^\circ C$			1.25	mA
Input Voltage Range		0.00		3.50	V
Frequency Response		30			kHz
■ H-Bridge Amplifier					
Voltage Gain			14		V/V
Frequency Response		60			kHz
Bridge Output Current		250			mA
Quiescent Bias Current (per Side)			2		mA
Bridge Saturation Voltage, $I_{OUT} = 100mA$, $T_A = 25^\circ C$				0.25	V
Bridge Saturation Voltage, $I_{OUT} = 200mA$, $T_A = 25^\circ C$				0.50	V

Electrical Characteristics: continued

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
■ H-Bridge Amplifier (continued)					
Bridge Saturation Voltage, $I_{OUT} = 200\text{mA}$, ($T_A = 0$ to 70°C)				0.60	V
Thermal Shutdown Temp.			150		$^\circ\text{C}$
■ Buffer Amplifier					
Open Loop Gain		60			dB
Input Offset Voltage				5	mV
Input Bias Current				5.0	μA
Unity Gain Bandwidth		300	500		kHz
PSRR		50			dB
Input Common Mode Range		0		3.5	V
Output Voltage Range		0.1		3.5	V
■ Current Sensing Amplifier					
Closed Loop Gain	$V_{IN} = (V_{OUT}) - (\text{SENSE})$	1.45	1.50	1.55	V/V
Input Offset Voltage				5	mV
■ Power Fault Level					
V_{FAULT}	$R_{PWRH} = 30\text{k}\Omega$	3.75	4.00	4.25	V
V_{FAULT} Hysteresis	$R_{PWR_L} = 50\text{k}\Omega$		100	200	mV
■ Head Park					
V_{PARK}	$R_{PARK} = 5\text{k}\Omega$	0.4	0.5	0.6	V
Output Current		10			mA

Package Pin Description

PACKAGE PIN #	PIN SYMBOL	FUNCTION
24 Lead SO		
15	V _{CC1}	Positive power supply, 4.5V to 5.5V.
11	Gnd ₁	Analog ground.
5	V _{AUX}	Auxiliary power supply for head park during supply line failure.
1	V _{CC2}	Positive power supply for the H-Bridge driver.
4	Gnd ₂	Ground for the H-Bridge driver.
21	Gnd ₃	Ground for the H-Bridge driver.
7	V _{REF}	Internal voltage reference for external DAC.
6	V _{PARK}	Voltage that is programmed by an external resistor and is applied across the VCM during park.
10	BUF _{OUT}	Output of the buffer amplifier and input to the transconductance amplifier.
8	BUF-	Negative input to the buffer amplifier.
9	BUF+	Positive input to the buffer amplifier.
20	ENABLE	Digital input to select standby of full power mode.
23	$\overline{\text{FAULT}}$	A digital output signaling an over velocity, a power fault, or a thermal fault condition. Reset by the ENABLE pin. May also be used for spin brake.
19	$\overline{\text{PWRFLT}}$	Open Collector NPN output. Low indicates power fault.
18	$\overline{\text{PARK}}$	Logic input for park.
17	I _{SENSE}	Output of the amplifier sensing the VCM current.
12	IN-	Negative input of the transconductance amplifier.
13	IN+	Positive input of the transconductance amplifier.
2	V _{OUT-}	Negative output of H-Bridge.
24	V _{OUT+}	Positive output of H-Bridge.
16	SENSE	Current sense input from the current sense resistor.
14	COMP	Compensation node of the transconductance amplifier.
22	V _{MULT}	Programming pin for V _{REF} .
3	V _{FAULT}	Programming pin for power fault.

Circuit Description

Power Supply

Power supply pins V_{CC1} and V_{CC2} must be connected together externally. V_{aux} can be connected to V_{CC} or to a Park voltage source. During normal operation where the Park source is not active, the V_{aux} is internally powered from the V_{CC} line. Gnd_1 , Gnd_2 , and Gnd_3 must all be connected to system ground.

The current sensing amplifier provides a voltage which is 1.5 times the voltage across R_{sense} and is referenced to V_{REF} . The gain of this amplifier is set by internal resistors.

Voltage Reference

A bandgap voltage source is used to provide the reference for the power fault detector and for the transconductance reference voltage. The reference voltage is programmed by external resistors.

Power Fault Detector

The power fault detector monitors the voltage supply line. Should an undervoltage condition occur, the **FAULT** line will switch low and a head park will occur. If the power recovers, the fault condition will be cleared. The power fault level is programmable by external resistors.

Transconductance Loop

The transconductance loop consists of a full H-Bridge output stage, a low offset error amplifier, and an input buffer amplifier. The transconductance is programmed by external resistors.

The buffer amplifier is a low offset operational amplifier which can be configured as a gain stage or as a second order low pass filter.

The error amplifier is a low offset operational amplifier which can be configured as a gain stage or as a second order low pass filter.

The power amplifier is a full H-Bridge with 250mA capability, and built in transient protection diodes. The differential voltage gain is 14. Class AB bias is used to eliminate crossover distortion.

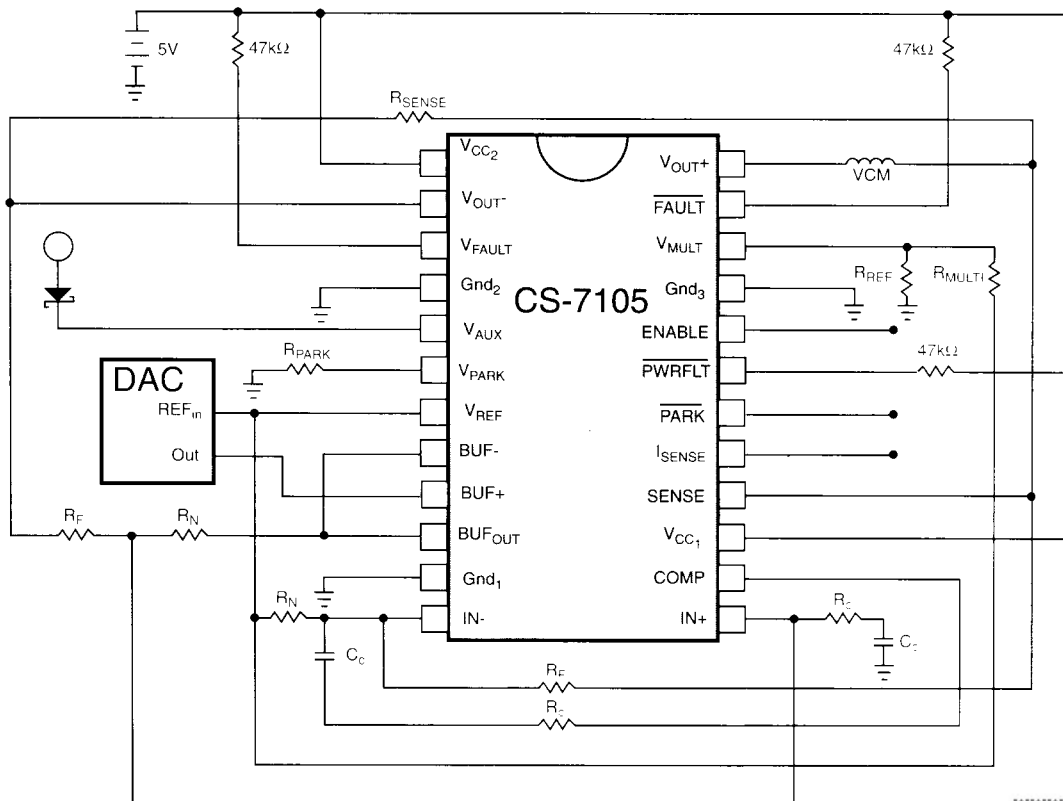
The power amplifier is protected from overload by thermal shutdown circuitry. Should a thermal overload occur, the H-Bridge amplifier will turn off until the **ENABLE** line is toggled low then high.

Logic

The **ENABLE** pin is used to select full power mode or standby mode. When **ENABLE** is high, the circuit is in the full power mode. When **ENABLE** is low, the circuit is in a standby mode with only the logic powered.

The **FAULT** line is an open collector NPN transistor which is intended to provide a system reset. This line will switch low if a power fault or a thermal fault is detected. This line may also be used to drive a spin brake.

Application Diagram



Package Specification

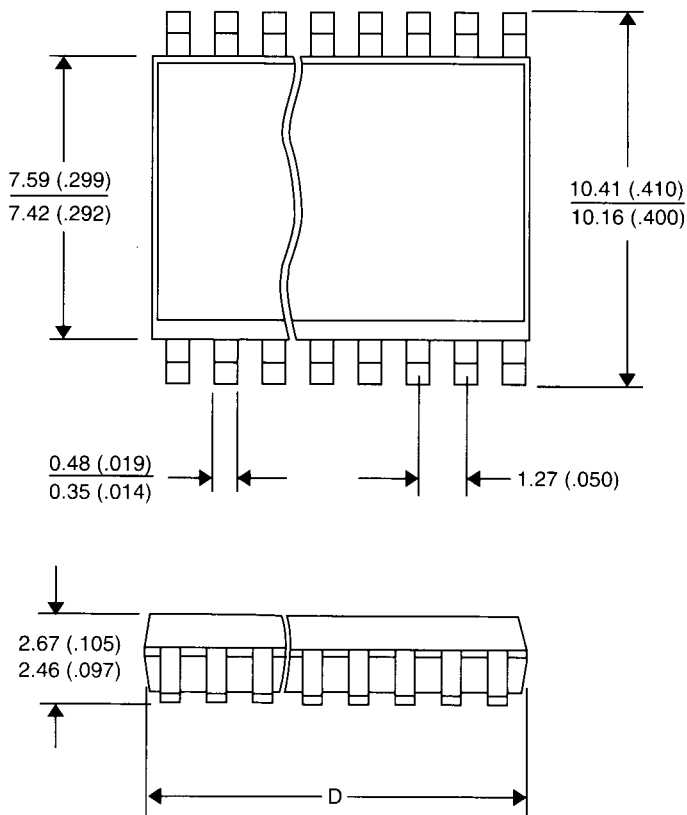
PACKAGE DIMENSIONS IN mm (INCHES)

Lead Count	D			
	Metric		English	
	Max	Min	Max	Min
24 Lead SO	15.54	15.29	.612	.602

PACKAGE THERMAL DATA

Thermal Data		24 Lead SODW	
R θ JC	typ	16	°C/W
R θ JA	typ	80	°C/W

24 Lead SO



Ordering Information

Part Number	Description
CS-7105DW24	SO Wide

Preliminary

This product is in the preproduction stages of the design process. The data sheet contains preliminary data. CSC reserves the right to make changes to the specifications without notice. Please contact CSC for the latest available information.



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