

Hysteretic Current-Mode Controller

Description

The CS-322/4 is designed for operating switching voltage regulators using hysteretic current-mode control. The difference between the CS-322 and the CS-324 is in the Start/Stop Voltages. The CS-322 is intended for off-line applications while the CS-324 is intended for battery input or DC to DC converters

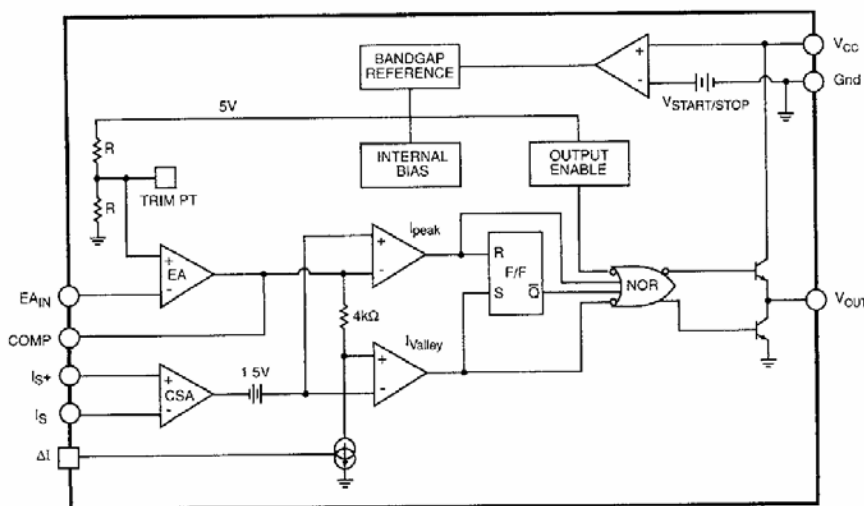
This IC allows the user to select the current hysteresis level required

with a minimum of 10% of full load. A differential current sense amplifier (CSA) permits accurate inductor current measurements. The error amplifier (EA) has its non-inverting input connected to the IC's internal reference voltage. Trimming of the bandgap reference is done at the inverting input of the Error Amplifier to achieve a $\pm 1\%$ tolerance. The output stage provides 1A peak current capability.

Absolute Maximum Ratings

Supply voltage	20V
Output current	$\pm 1A$ (peak)
.....	$\pm 200mA$ (steady state)
Operating Temperature	
Industrial	-25° to $+85^{\circ}C$
Commercial.....	0° to $70^{\circ}C$

Block Diagram

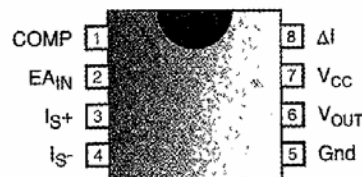


Features

- Provides Hysteretic Current-Mode Control.
- Inherent Short Circuit Protection for the Power Supply.
- High Current Totem Pole Output.
- Eliminates Right-Half Plane Zero in Continuous Conduction Flyback and Boost Converter topologies.
- Feedforward Load Regulation

Package Options

8 Lead PDIP & SO



Electrical Characteristics: $-25 \leq T_A \leq 85^\circ\text{C}$ for the CS322/4 I, $0 \leq T_A \leq 70^\circ\text{C}$ for the CS322/4 C. $V_{CC}=20\text{V}$,
Voltage on ΔI pin = 0.5V, Unless otherwise stated.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
■ Output Section					
Output Low Level	$I_{SINK}=20\text{mA}$		0.25	0.40	V
	$I_{SINK}=200\text{mA}$		1.5	2.2	V
Output High Level	$I_{SINK}=20\text{mA}$	18.0	18.5		V
	$I_{SINK}=200\text{mA}$	17.5	18.0		V
Rise Time	$T_J=25^\circ\text{C}$, $C=1\text{nF}$ (Note 1)		30	60	ns
Fall Time	$T_J=25^\circ\text{C}$, $C=1\text{nF}$ (Note 1)		30	60	ns
Output Resistance	$7\text{V} < V_{CC} < V_{ULVO}$ (Stop Threshold)		50	65	k Ω
■ Undervoltage Lockout Section					
Start-Up Current			0.8	1.5	mA
Operating Supply Current			14	20	mA
Start Threshold	CS-322	13.5	14.5	15.5	V
	CS-324	8.5	9.0	9.5	V
Stop Threshold	CS-322	9.5	10.5	11.5	V
	CS-324	7.4	7.8	8.2	V
■ Error Amplifier Section					
Input Bias Current	$EA_{IN} = 2.5\text{V}$		-0.3	-1.0	μA
A_{VOL}	$1 < V_{COMP} < 3.5\text{V}$	65	90		dB
Unity Gain Bandwidth	(Note 1)	1	2		MHz
$V_{OUT HI}$		3.8	4.0		V
$V_{OUT LO}$			0.7	1.1	V
Reference Input Voltage	$COMP=EA_{IN}$	2.45	2.50	2.55	V
■ Current Sense Amplifier					
Gain	$V_{Sense^+}=1.4\text{V}$, $V_{Sense^-}=1\text{V}$	4.35	5.00	5.65	V/V
Maximum Differential Input Signal	$V_{Sense^+} = V_{Sense^-} = 1\text{V}$		0.50		V
Internal Offset Voltage			1.5		V
PSRR			70		dB
Input Bias Current			-40	-65	μA
Com-Mode Voltage Range		-0.25		$V_{CC}-5.00$	V
CMRR			60		dB
■ Hysteresis Level					
Hysteresis Level	$V_{\Delta I}=0.25\text{V}$ (Note 2)		50		mV
Hysteresis Voltage Dynamic Range	$V_{\Delta I HI}$		5		V
	$V_{\Delta I LO}$		0		V

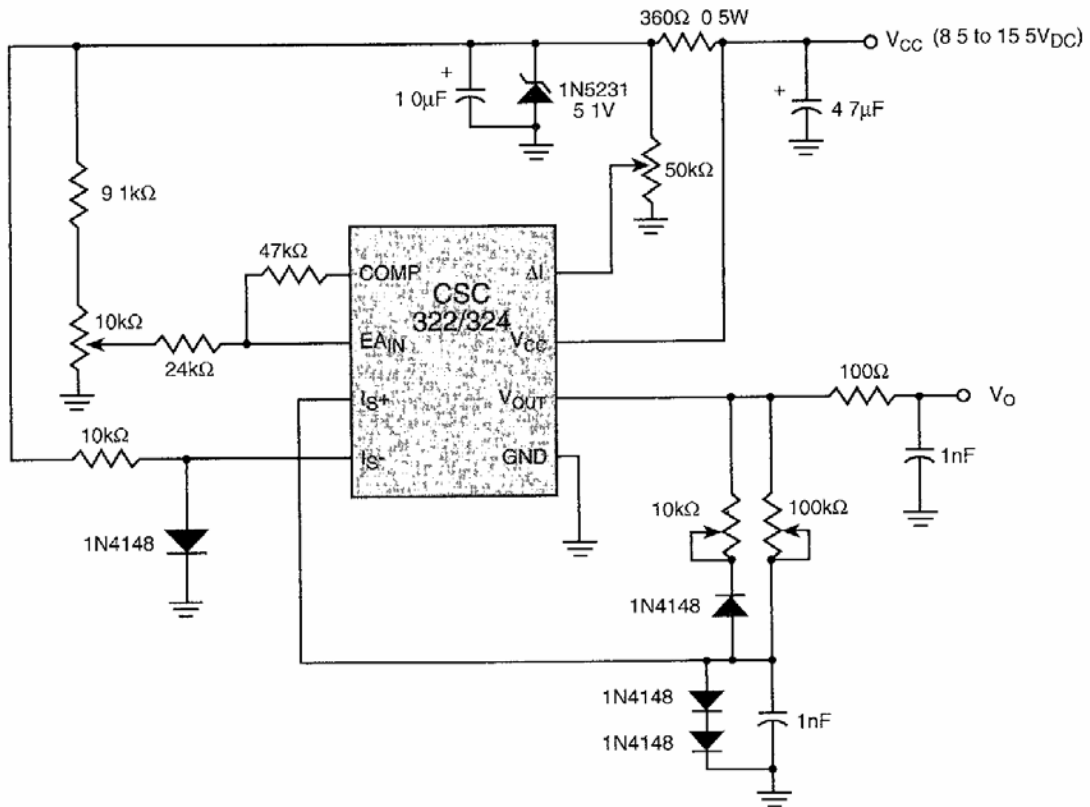
Note: 1. Although guaranteed, these parameters are not 100% tested in production.

2. $V_{\Delta Sense} = 0.2V_{\Delta I}$ measured across I_{S+} and I_{S-} .

Package Pin Description

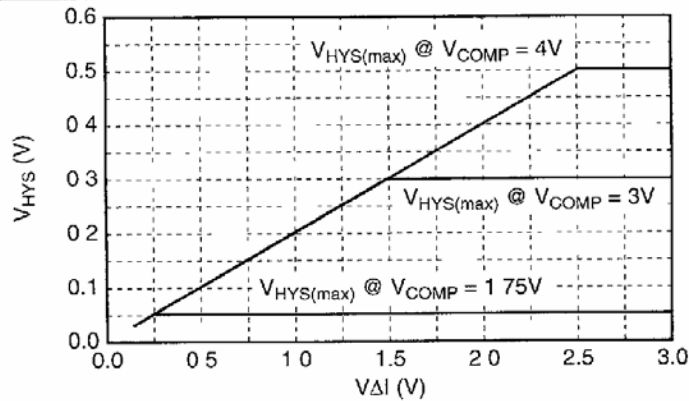
PACKAGE PIN #	PIN SYMBOL	FUNCTION
8L PDIP & 8L SO		
1	COMP	Output of Error Amplifier.
2	EA _{IN}	Inverting input of Error Amplifier.
3	I _S ⁺	Non-inverting input of Current Sense Amplifier.
4	I _S ⁻	Inverting input of Current Sense Amplifier.
5	Gnd	Ground.
6	V _{OUT}	Output driver.
7	V _{CC}	Positive power supply input
8	ΔI	Input voltage that determines the width of the Hysteretic Band.

Test Circuit



V_{HYS} vs V_{ΔI}

$$V_{HYS} = \frac{(V_{COMP} - 1.5V)}{CSA \text{ Gain}}$$



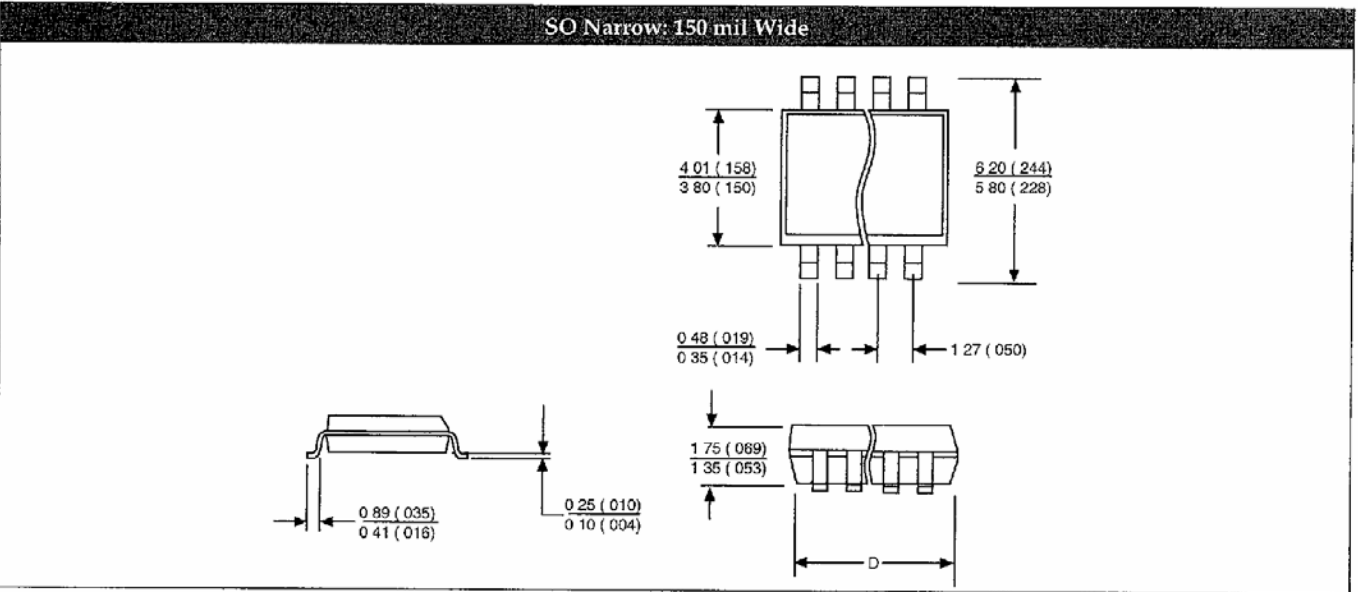
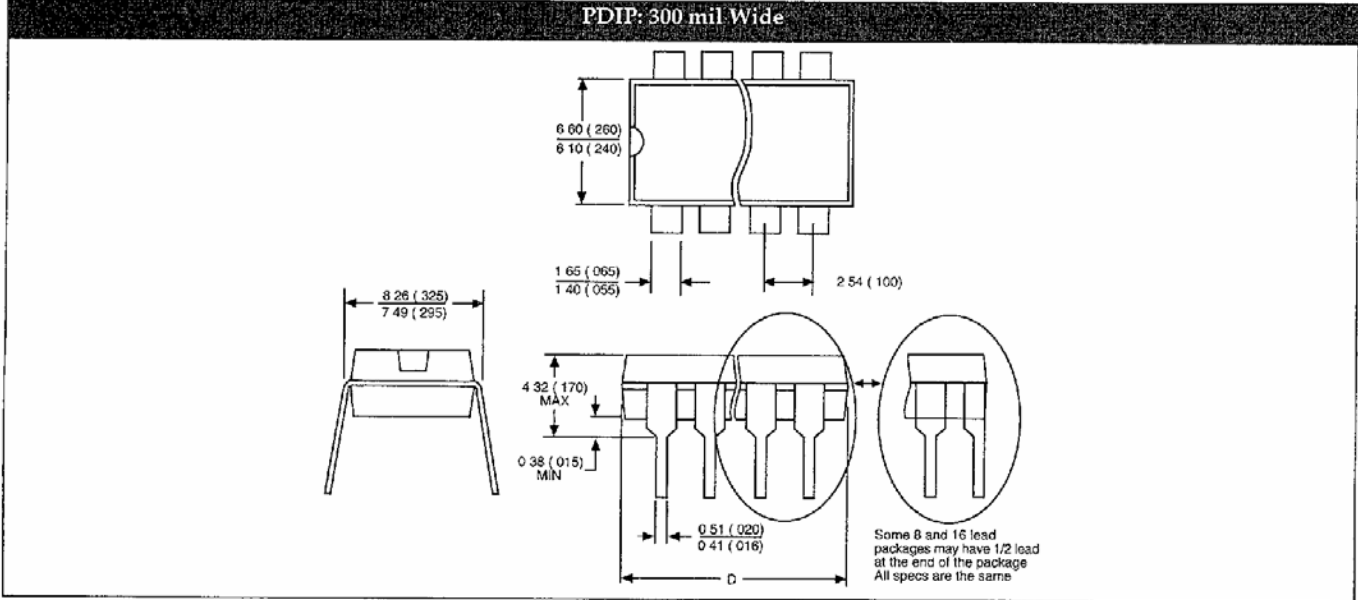
Package Specification

PACKAGE DIMENSIONS IN mm (INCHES)

PACKAGE THERMAL DATA

Lead Count	D			
	Metric		English	
	Max	Min	Max	Min
8L PDIP	9.40	9.14	.370	.360
8L SO	5.00	4.80	.197	.188

Thermal Data		8 L PDIP	8L SO	
$R_{\theta JC}$	typ	52	45	°C/W
$R_{\theta JA}$	typ	100	165	°C/W



Ordering Information

Part Number	0°C to 70°C	-25°C to 85°C	Description
CS-322CN8	•		8L PDIP
CS-322CD8	•		8L SO
CS-324CN8	•		8L PDIP
CS-324CD8	•		8L SO
CS-322IN8		•	8L PDIP
CS-324IN8		•	8L PDIP