CSC™ CHERRY SEMICONDUCTOR

CS-320
CS-321

ONE MEGAHERTZ CURRENT-MODE CONTROL

DESCRIPTION

The CS-320/1 family of integrated circuits is designed for use with the most preferred types of current-mode control: Hysteretic, Constant-OFF Time, and Constant-Frequency. Careful consideration was given to each of the circuit blocks to allow operation at switching frequencies up to one megahertz.

Several protection features are included to ensure "bullet-proof" operation under severe operating conditions. When used in the Constant-OFF Time mode, a unique circuit (patent-pending) continually monitors the inductor current and extends the OFF time to prevent a current-runaway situation during overload conditions.

The precision timer circuit gives the power supply designer complete freedom in selecting the maximum ON/OFF time of the output drivers.

A programable UVLO is optimized for either OFF-line Boot-Strap or low voltage/battery operation.

The high-bandwidth voltage-type error amplifier has a novel bidirectional interface port that allows paralleling power modules without the need to assign "master/slave" status.

In the CS-320 the output is ACTIVE-HIGH, while the CS-321 is ACTIVE-LOW.

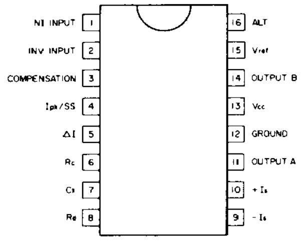
ABSOLUTE MAXIMUM RATINGS

Supply voltage 20V
Output current .... ±1A
Analog Inputs .... −0.25 to V_{CC} −4V

FEATURES:

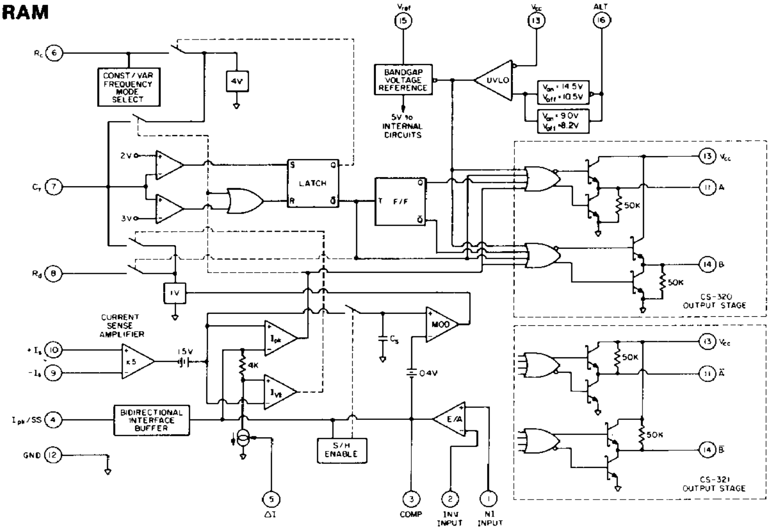
- One Megahertz Operation
- Programmable Under-Voltage Lockout
- Inherent protection against Current Runaway During Short Circuit Conditions
- Operates in Hysteretic, Constant-OFF time and Constant Frequency Modes
- Allows Parallel Operation of Power Modules without "Master/Slave" Status
- Optimized for interfacing with Current-Sensing MOSFETs

PIN CONNECTIONS



TOP VIEW

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS Unless otherwise stated, specifications apply at $-25 \leq Ta \leq 85°C$ for the CS320/1 I, $0 \leq Ta \leq 70°C$ for the CS320/1 C. V_{cc}=20V

PARAMETER	PIN	TEST CONDITIONS	CS-320/1 I MIN.	CS-320/1 I TYP.	CS-320/1 I MAX.	CS-320/1 C MIN.	CS-320/1 C TYP.	CS-320/1 C MAX.	UNIT
Reference Section									
Output Voltage	15	Tj=25 C Io=1mA	4.95	5.00	5.05	4.90	5.00	5.10	V
Line Regulation	15	V16=5V, 9.5<Vin<20V		5	20		5	20	mV
Load Regulation	15	1<Io<10mA		6	25		6	25	mV
Temp Stability	15	(Note 1)		0.2	0.6		0.2	0.6	mV/C
Total Output Variation	15	Line, Load, Temp	4.90		5.10	4.82		5.18	V
Output Noise Voltage	15	10Hz<f<10kHzTj=25C (Note 1)		50			50		uV
Long Term Stability	15	Ta=125 C, 1000 Hrs, (Note 1)		5	25		5	25	mV
Output Short Circuit	15	Ta=25 C V15=0V	25		120	25		125	mA
Timer Section Note: Rc=3.9k, Rd=4.7k, Ct=2000pF unless otherwise noted									
Maximum ON Time	7	Tj=25 C	4.50	5.00	5.50	4.50	5.00	5.50	uS
Maximum OFF Time	7	Tj=25 C	4.50	5.00	5.50	4.50	5.00	5.50	uS
Voltage Stability	7	V16=5V, 9.5<Vin<20V		1			1		%
Temp. Stability	7	Tmin<Ta<Tmax (Note 1)		5			5		%
Vpeak	7			2.9			2.9		V
Vvalley	7			2.0			2.0		V
Vcharge	6	I6=1mA, V7=1.5V		4.0			4.0		V
Vdischarge	8	I8=1mA, V7=3.5V		1.0			1.0		V
Maximum Charge Current	6	V6=2V, V7=1.5V	1.0			1.0			mA
Maximum Discharge Current	8	V8=3V, V7=3.5V	1.0			1.0			mA
Error Amp. Section									
Input Offset Voltage	1,2	V1=2.5V, V2=V3			10			15	mV
Input Bias Current	1,2	V1=V2=2.5V		-0.3	-1		-0.3	-2	uA
Input Offset Current	1,2	V1=V2=2.5V		0.1	1		0.1	1	uA
AVol	3	1<VO<3.5V	65	90		65	90		dB
Unity Gain Bandwidth	3	(Note 1)	3	6		3	6		MHz
Vout High	3		3.8	4		3.8	4		V
Vout Low	3			0.7	1.1		0.7	1.1	V
Common Mode Voltage Range	1,2		1.5		5.5	1.5		5.5	V
Current Sense Section									
Gain	9,10	V9=1V, V3=V2, (Note 2)	4.35	5.0	5.65	4.35	5.0	5.65	V/V
Max. Diff. Input Signal	9,10				400			400	mV
PSRR	9,10			70			70		dB
Input Bias Current	9,10			-40	-65		-40	-65	uA
Delay To Output	11,14	(Note 1)		100	150		100	150	nS
Com.-Mode Voltage Range	9,10		-0.25		Vcc-4	-0.25		Vcc-4	V
CMRR	9,10		60	80		60	80		dB
Current Hysteresis Input									
ΔI Current	5	V_s=0V		0.5	50		0.5	50	uA
Under-Voltage Lockout Section									
Start-Up Current	13			0.8	2		0.8	2	mA
Operating Supply Current	13			26	35		26	35	mA
Start Threshold (Hi)	13	V16=0V	13.5	14.5	15.5	13.5	14.5	15.5	V
Start Threshold (Lo)	13	V16=OPEN	8.5	9.0	9.5	8.5	9.0	9.5	V
Stop Threshold (Hi)	13	V16=0V	9.5	10.5	11.5	9.5	10.5	11.5	V
Stop Threshold (Lo)	13	V16=OPEN	7.4	8.2	8.8	7.4	8.2	8.8	V
Alt. Start Input Current	16	V16=0V	35	60	100	35	60	100	uA
Output Section (Note 3)									
Output Low Level	11,14	Isink=20mA		0.25	0.4		0.25	0.4	V
		Isink=200mA		1.5	2.2		1.5	2.2	V
Output High Level	11,14	Isink=20mA	18	18.5		18	18.5		V
		Isink=200mA	17.5	18		17.5	18		V
Rise Time	11,14	Tj=25 C C1=1nF (Note 1)		60	100		60	100	nS
Fall Time	11,14	Tj=25 C C1=1nF (Note 1)		30	60		30	60	nS
Output Resistance	11,14	Vin<Vin (Start)	35K	50K	65K	35K	50K	65K	Ohm
Ipeak/Soft-Start Section									
S/S Cap. Charge Current	4	V4=0V	40	75	115	40	75	115	uA

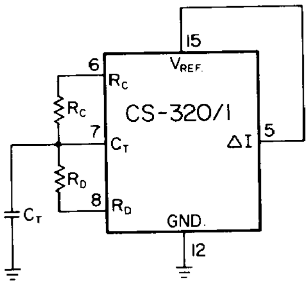
Note 1: Although guaranteed, these parameters are not 100% tested in production.

Note 2: Gain is defined as: $A = \frac{V3_2 - V3_1}{V10_2 - V10_1}$ Where: $V3_1$=2.5V, $V3_2$=3.5V

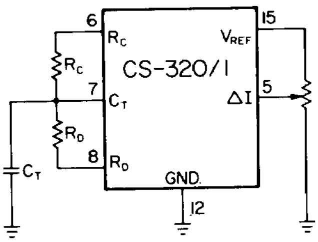
Measure $V10_1$ and $V10_2$ at turn OFF of output.

Note 3: CS-320 Output is active HIGH
CS-321 Output is active LOW

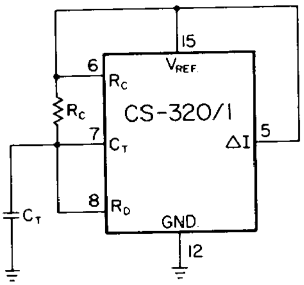
TYPICAL TIMER CONFIGURATIONS FOR THE THREE CURRENT-MODE CONTROLLERS



CONSTANT OFF TIME



HYSTERETIC



CONSTANT FREQUENCY

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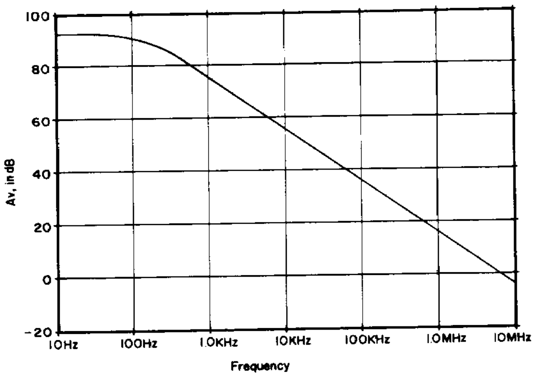
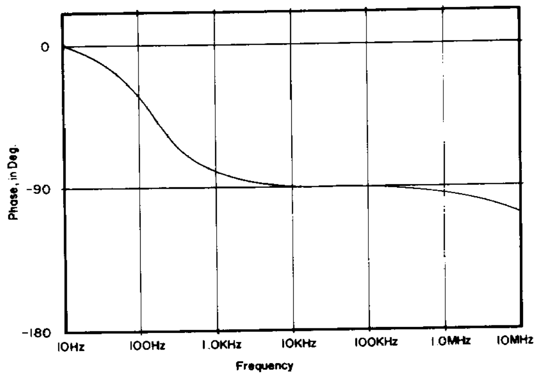
ERROR AMPLIFIER TYPICAL CHARACTERISTICS



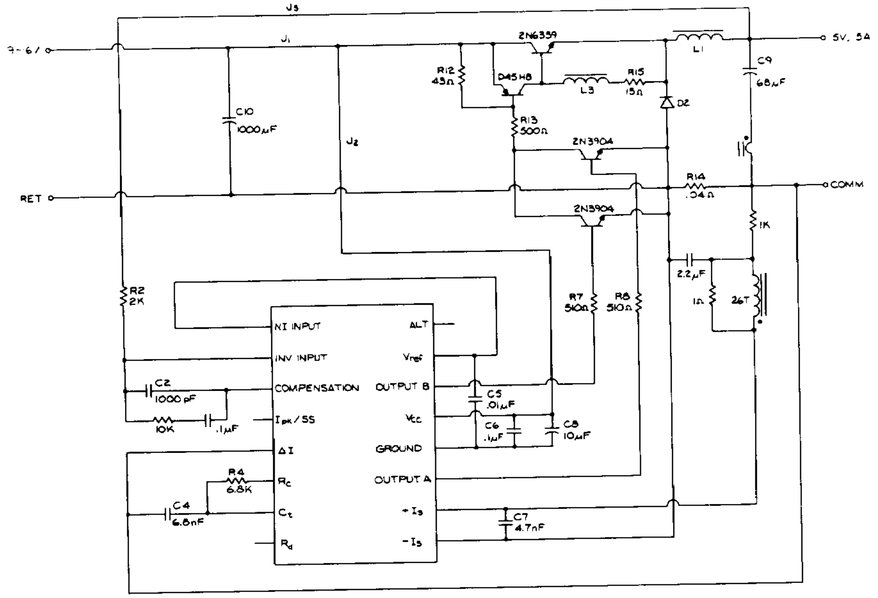
ERROR AMPLIFIER OPEN LOOP GAIN vs FREQUENCY



ERROR AMPLIFIER OPEN LOOP PHASE vs FREQUENCY

MANUFACTURED UNDER U.S. PATENT NO. 4,456,872

TYPICAL APPLICATION



STEP DOWN WITH HYSTERETIC CMC

ORDERING INFORMATION

PART NO.	0°C to 70°C	-25°C to 85°C	PACKAGE
CS-320CJ	*		16L CDIP
CS-320CN	*		16L PDIP
CS-321CJ	*		16L CDIP
CS-321CN	*		16L PDIP
CS-320IJ		*	16L CDIP
CS-320IN		*	16L PDIP
CS-321IJ		*	16L CDIP
CS-321IN		*	16L PDIP

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