INTEGRATED CIRCUITS
UNITRODE

UC1832/3
UC2832/3
UC3832/3

Precision Low Dropout Linear Controllers

FEATURES

- Precision 1% Reference
- Over-Current Sense Threshold Accurate to 5%
- Programmable Duty-Ratio Over-Current Protection
- 4.5V to 36V Operation
- 100mA Output Drive, Source or Sink
- Under-Voltage Lockout

Additional Features of the UC1832 series:

- Adjustable Current Limit to Current Sense Ratio
- Separate +V_{IN} terminal
- Programmable Driver Current Limit
- Access to V_{REF} and E/A(+)
- Logic-Level Disable Input

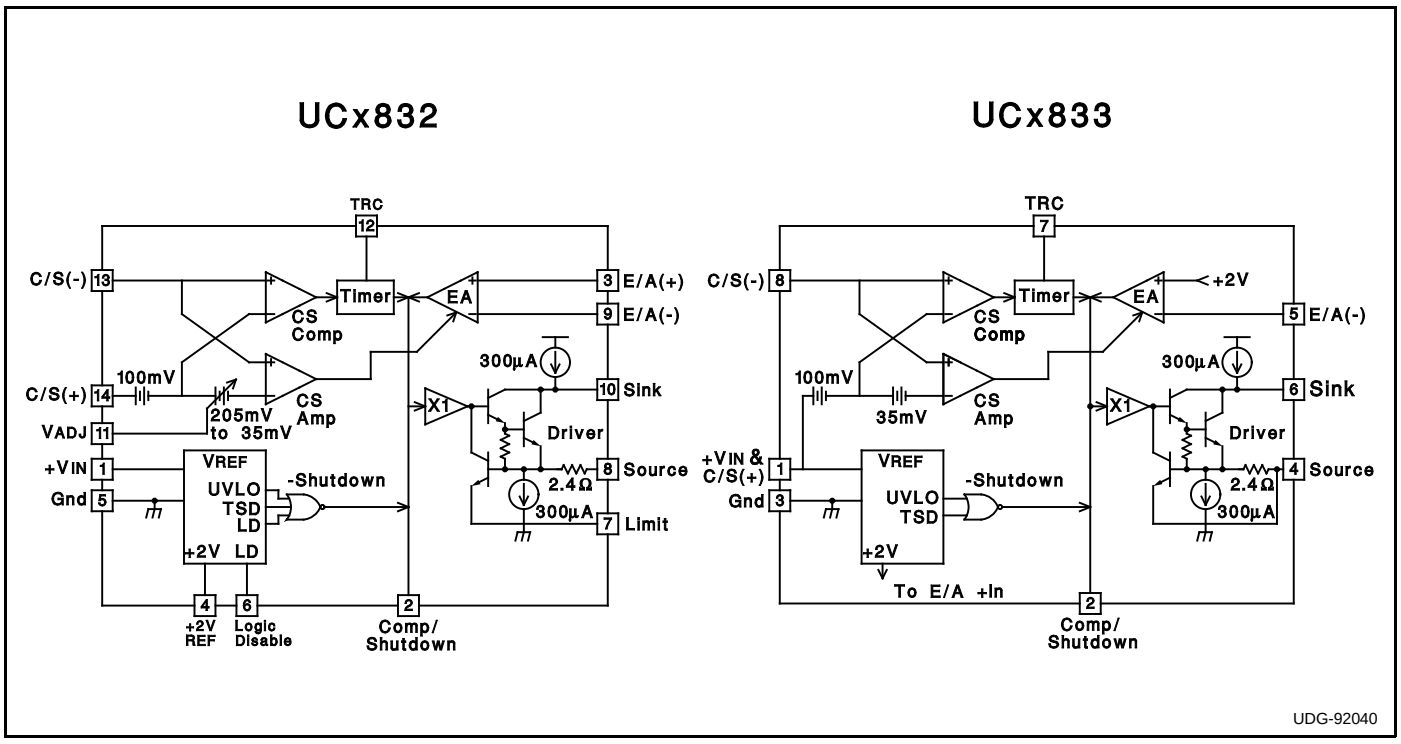
DESCRIPTION

The UC1832 and UC1833 series of precision linear regulators include all the control functions required in the design of very low dropout linear regulators. Additionally, they feature an innovative duty-ratio current limiting technique which provides peak load capability while limiting the average power dissipation of the external pass transistor during fault conditions. When the load current reaches an accurately programmed threshold, a gated-astable timer is enabled, which switches the regulator's pass device off and on at an externally programmable duty-ratio. During the on-time of the pass element, the output current is limited to a value slightly higher than the trip threshold of the duty-ratio timer. The constant-current-limit is programmable on the UCx832 to allow higher peak current during the on-time of the pass device. With duty-ratio control, high initial load demands and short circuit protection may both be accommodated without extra heat sinking or foldback current limiting. Additionally, if the timer pin is grounded, the duty-ratio timer is disabled, and the IC operates in constant-voltage/constant-current regulating mode.

These IC's include a 2 Volt (±1%) reference, error amplifier, UVLO, and a high current driver that has both source and sink outputs, allowing the use of either NPN or PNP external pass transistors. Safe operation is assured by the inclusion of under-voltage lockout (UVLO) and thermal shutdown.

The UC1833 family includes the basic functions of this design in a low-cost, 8-pin mini-dip package, while the UC1832 series provides added versatility with the availability of 14 pins. Packaging options include plastic (N suffix), or ceramic (J suffix). Specified operating temperature ranges are: commercial (0°C to 70°C), order UC3832/3 (N or J); industrial (–25°C to 85°C), order UC2832/3 (N or J); and military (–55°C to 125°C), order UC1832/3J. Surface mount packaging is also available.

BLOCK DIAGRAMS



ABSOLUTE MAXIMUM RATINGS

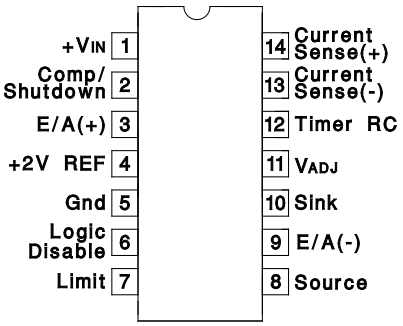
Supply Voltage $+V_{IN}$ 40V
Driver Output Current (Sink or Source) 450mA
Driver Sink to Source Voltage 40V
TRC Pin Voltage . . . . . –0.3V to 3.2V
Other Input Voltages. . . . . –0.3V to $+V_{IN}$
Operating Junction Temperature (note 2) . . . –55°C to +150°C
Storage Temperature . . . . . –65°C to +150°C
Lead Temperature (Soldering, 10 Seconds) . . . . . 300°C

Note 1: Unless otherwise indicated, voltages are referenced to ground and currents are positive into, negative out of, the specified terminals.
Note 2: See Unitrode Integrated Circuits databook for information regarding thermal specifications and limitations of packages.

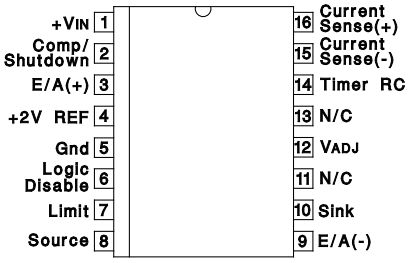
CONNECTION DIAGRAMS

UC1832

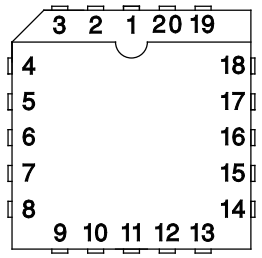
DIL-14 (Top View)
J Or N Package



SOIC-16 (Top View)
DW Package



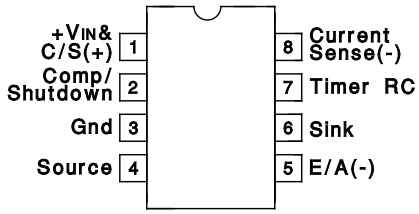
LCC-20 & PLCC-20
L & Q Package
(Top View)



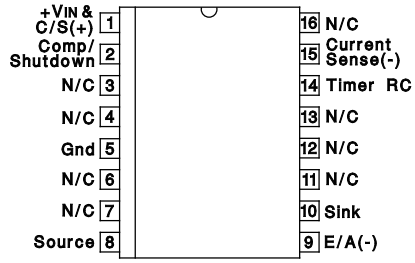
PACKAGE PIN FUNCTION	
FUNCTION	**PIN**
N/C	1
$+V_{IN}$	2
Comp/Shutdown	3
E/A(+)	4
+2V REF	5
N/C	6
Gnd	7
Logic Disable	8
Limit	9
Source	10
N/C	11
E/A(-)	12
Sink	13
V_{ADJ}	14
N/C	15-17
Timer RC	18
Current Sense(-)	19
Current Sense(+)	20

UC1833

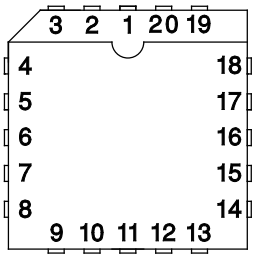
DIL-8 (Top View)
J Or N Package



SOIC-16 (Top View)
DW Package



LCC-20 & PLCC-20
L & Q Package
(Top View)



PACKAGE PIN FUNCTION	
FUNCTION	**PIN**
$+V_{IN}$ & C/S(+)	1
N/C	2
N/C	3
N/C	4
Comp/Shutdown	5
Gnd	6
N/C	7
N/C	8
N/C	9
Source	10
N/C	11
E/A(-)	12
N/C	13
N/C	14
Sink	15
Timer RC	16
Current Sense(+)	17
N/C	18-20

ELECTRICAL CHARACTERISTICS:

Unless otherwise stated, specifications hold for T_A = 0°C to 70°C for the UC3832/3, –25°C to 85°C for the UC2832/3, and –55°C to 125°C for the UC1832/3, $+V_{IN}$ = 15V, Driver sink = $+V_{IN}$, C/S(+) voltage = $+V_{IN}$. T_A=T_J.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Supply					
Supply Current	$+V_{IN}$ = 6V		6.5	10	mA
	$+V_{IN}$ = 36V		9.5	15	mA
	Logic Disable = 2V (UCx832 only)		3.3		mA
Reference Section					
Output Voltage (Note 3)	T_J = 25°C, I_{DRIVER} = 10mA	1.98	2.00	2.02	V
	over temperature, I_{DRIVER} = 10mA	1.96	2.00	2.04	V
Load Regulation (UCx832 only)	I_{OUT} = 0 to 10mA	-10	-5.0		mV
Line Regulation	$+V_{IN}$ = 4.5 to 36V, I_{DRIVER} = 10mA		0.033	0.5	mV/V
Under-Voltage Lockout Threshold			3.6	4.5	V
Logic Disable Input (UCx832 only)					
Threshold Voltage		1.3	1.4	1.5	V
Input Bias Current	Logic Disable = 0V	-5.0	-1.0		µA
Current Sense Section					
Comparator Offset		95	100	105	mV
	Over Temperature	93	100	107	mV
Amplifier Offset (UCx833 only)		110	135	170	mV
Amplifier Offset (UCx832 only)	V_{ADJ} = Open	110	135	170	mV
	V_{ADJ} = 1V	180	235	290	mV
	V_{ADJ} = 0V	250	305	360	mV
Input Bias Current	V_{CM} = $+V_{IN}$	65	100	135	µA
Input Offset Current (UCx832 only)	V_{CM} = $+V_{IN}$	-10		10	µA
Amplifier CMRR (UCx832 only)	V_{CM} = 4.1V to $+V_{IN}$+0.3V		80		dB
Transconductance	I_{COMP} = ±100µA		65		mS
V_{ADJ} Input Current (UCx832 only)	V_{ADJ} = 0V	-10	-1		µA
Timer					
Inactive Leakage Current	C/S(+) = C/S(-) = $+V_{IN}$; TRC pin = 2V		0.25	1.0	µA
Active Pullup Current	C/S(+) = $+V_{IN}$, C/S(-) = $+V_{IN}$ - 0.4V; TRC pin = 0V	-345	-270	-175	µA
Duty Ratio (note 4)	ontime/period, R_T = 200k, C_T = 0.27µF		4.8		%
Period (notes 4,5)	ontime + offtime, R_T = 200k, C_T = 0.27µF		36		ms
Upper Trip Threshold (Vu)			1.8		V
Lower Trip Threshold (Vl)			0.9		V
Trip Threshold Ratio	Vu/Vl		2.0		V/V
Error Amplifier					
Input Offset Voltage (UCx832 only)	V_{CM} = V_{COMP} = 2V	-8.0		8.0	mV
Input Bias Current	V_{CM} = V_{COMP} = 2V	-4.5	-1.1		µA
Input Offset Current (UCx832 only)	V_{CM} = V_{COMP} = 2V	-1.5		1.5	µA
AVOL	V_{COMP} = 1V to 13V	50	70		dB
CMRR (UCx832 only)	V_{CM} = 0V to $+V_{IN}$ - 3V	60	80		dB
PSRR (UCx832 only)	V_{CM} = 2V, $+V_{IN}$ = 4.5 to 36V		90		dB
Transconductance	I_{COMP} = ±10µA		4.3		mS
VOH	I_{COMP} = 0, Volts below $+V_{IN}$		.95	1.3	V
VOL	I_{COMP} = 0		.45	0.7	V
IOH	V_{COMP} = 2V	-700	-500	-100	µA

ELECTRICAL CHARACTERISTICS (cont.)

Unless otherwise stated, specifications hold for T_A = 0°C to 70°C for the UC3832/3, –25°C to 85°C for the UC2832/3, and –55°C to 125°C for the UC1832/3, $+V_{IN}$ = 15V, Driver sink = $+V_{IN}$, C/S(+) voltage = $+V_{IN}$. T_A=T_J.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Error Amplifier (cont.)					
IOL	V_{COMP} = 2V, C/S(-) = $+V_{IN}$	100	500	700	µA
	V_{COMP} = 2V, C/S(-) = $+V_{IN}$ - 0.4V	2	6		mA
Driver					
Maximum Current	Driver Limit & Source pins common; T_J = 25°C	200	300	400	mA
	Over Temperature	100	300	450	mA
Limiting Voltage (UCx832 only)	Driver Limit to Source voltage at current limit, I_{SOURCE} = -10mA; T_J = 25°C (Note 6)		.72		V
Internal Current Sense Resistance	T_J = 25°C (Note 6)		2.4		Ω
Pull-Up Current at Driver Sink	Compensation/Shutdown = 0.4V; Driver Sink = $+V_{IN}$ - 1V	-800	-300	-100	µA
	Compensation/Shutdown = 0.4V, $+V_{IN}$ = 36V; Driver Sink = 35V	-1000	-300	-75	µA
Pull-Down Current at Driver Source	Compensation/Shutdown = 0.4V; Driver Source = 1V	150	300	700	µA
Saturation Voltage Sink to Source	Driver Source = 0V; Driver Current = 100mA		1.5		V
Maximum Source Voltage	Driver Sink = $+V_{IN}$, Driver Current = 100mA Volts below $+V_{IN}$		3.0		V
UVLO Sink Leakage	$+V_{IN}$ = C/S(+) = C/S(-) = 2.5V, Driver Sink = 15V, Driver Source = 0V, TA = 25°C		25		µA
Maximum Reverse Source Voltage	Compensation/Shutdown = 0V; I_{SOURCE} = 100µA, $+V_{IN}$ = 3V		1.6		V
Thermal Shutdown			160		°C

Note 3: On the UCx833 this voltage is defined as the regulating level at the error amplifier inverting input, with the error amplifier driving V_{SOURCE} to 2V.

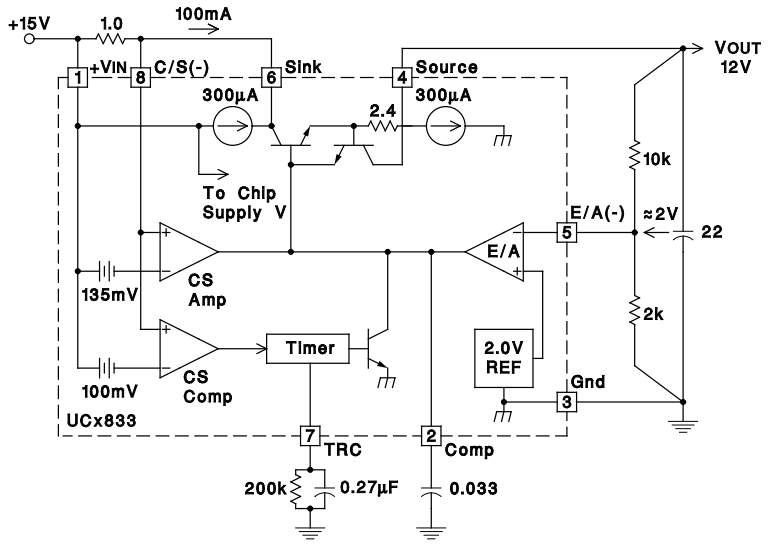
Note 4: These parameters are first-order supply-independent, however both may vary with supply for $+V_{IN}$ less than about 4V. This supply variation will cause a slight change in the timer period and duty cycle, although a high off-time/on-time ratio will be maintained.

Note 5: With recommended R_T value of 200k, $T_{OFF} \approx R_T C_T * ln(Vu/Vl) \pm 10\%$.

Note 6: The internal current limiting voltage has a temperature dependence of approximately -2.0mV/°C, or -2800ppm/°C. The internal 2.4 Ω sense resistor has a temperature dependance of approximately +1500ppm/°C.

APPLICATION AND OPERATION INFORMATION

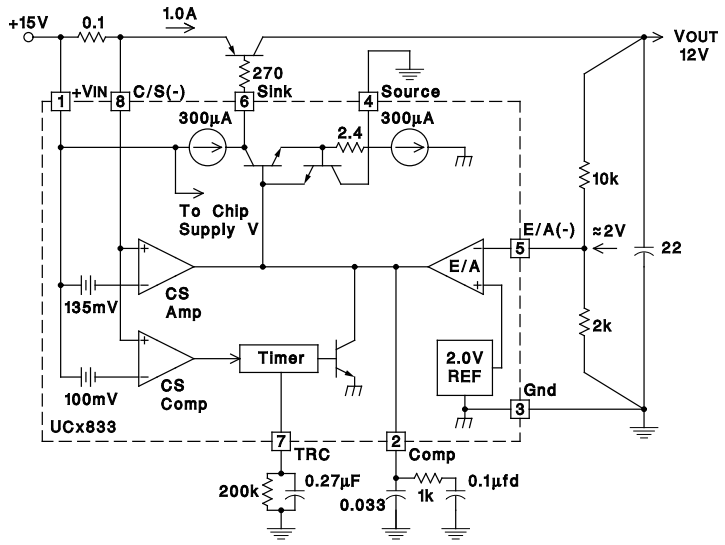
NPN Pass (Local 100mA Regulator) (UCx833)



UDG-92041-1

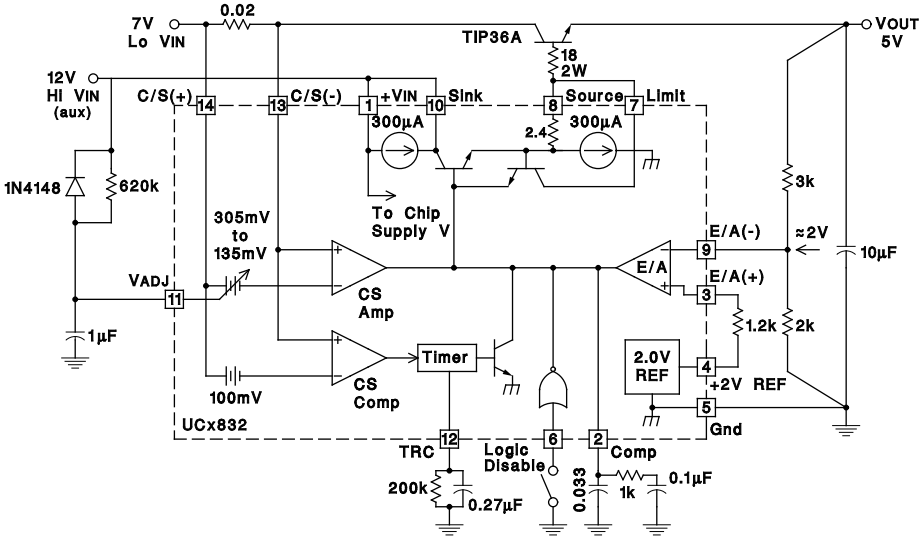
APPLICATION AND OPERATION INFORMATION (cont.)

PNP Pass (Low Drop-Out Regulator) (UCx833)



UDG-92042-1

NPN Pass (Medium Power, Low Drop-Out Regulator) (UCx832)



UDG-92043-1

Estimating Maximum Load Capacitance

For any power supply, the rate at which the total output capacitance can be charged depends on the maximum output current available and on the nature of the load. For a constant-current current-limited power supply, the output will come up if the load asks for less than the maximum available short-circuit limit current.

To guarantee recovery of a duty-ratio current-limited power supply from a short-circuited load condition, there is a maximum total output capacitance which can be charged for a given unit ON time. The design value of ON time can be adjusted by changing the timing capacitor. Nominally, $T_{ON} = 0.693 \times 10k \times C_T$.

Typically, the IC regulates output current to a maximum of $I_{MAX} = K \times I_{TH}$, where I_{TH} is the timer trip-point current,

and $$K = \frac{Current\ Sense\ Amplifier\ Offset\ Voltage}{100mA}$$

≈1.35 for UCx833, and is variable from 1.35 to 3.05 with V_{ADJ} for the UCx832.

For a worst-case constant-current load of value just less than I_{TH}, C_{MAX} can be estimated from:

$$C_{MAX} = ((K-1)I_{TH})\left(\frac{T_{ON}}{V_{OUT}}\right),$$

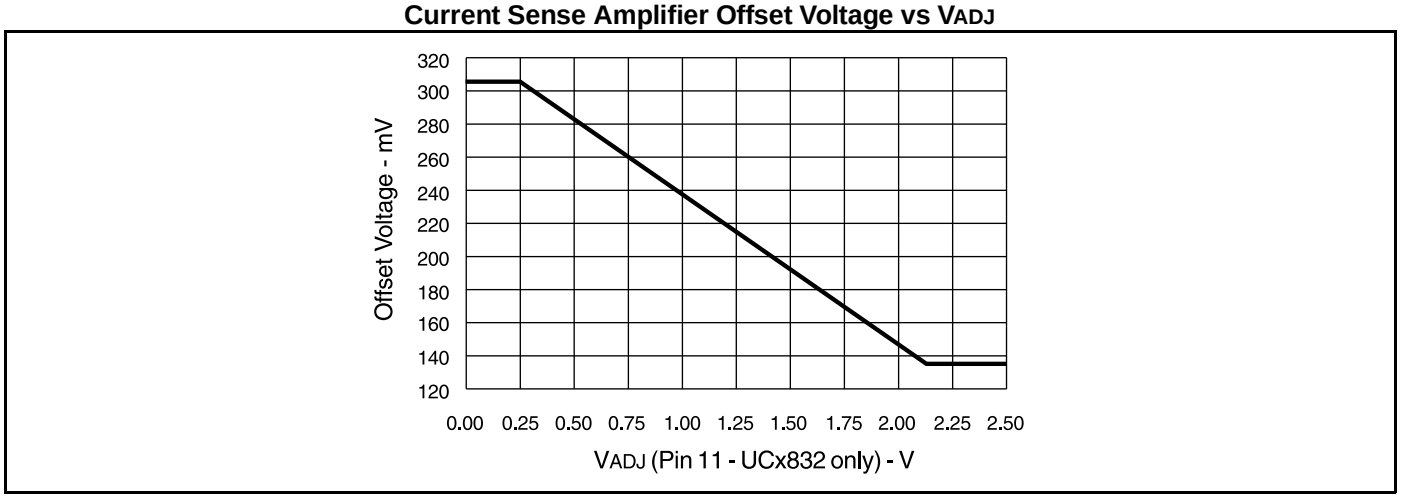
where V_{OUT} is the nominal regulator output voltage.

For a resistive load of value R_L, the value of C_{MAX} can be estimated from:

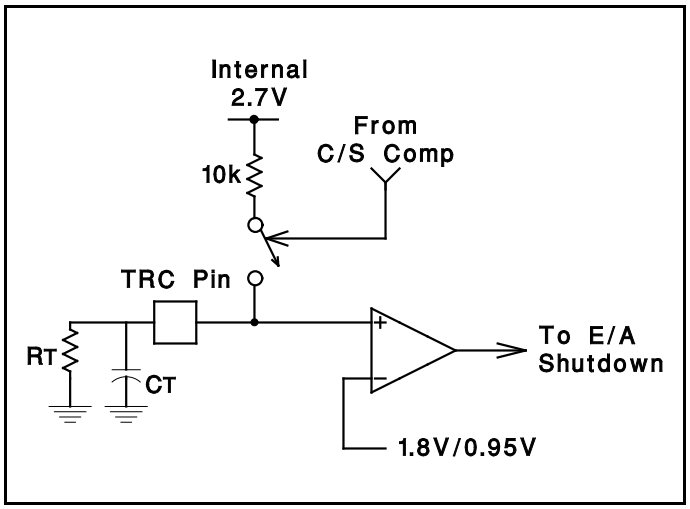
$$C_{MAX} = \frac{T_{ON}}{R_L} \bullet \frac{1}{In\left[\left(1-\frac{V_{OUT}}{K \bullet I_{TH} \bullet R_L}\right)^{-1}\right]}.$$

APPLICATION AND OPERATION INFORMATION (cont.)

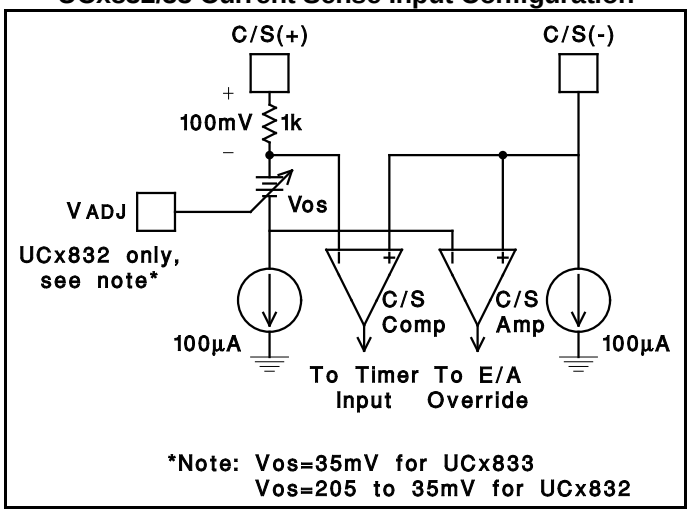
Current Sense Amplifier Offset Voltage vs V_{ADJ}



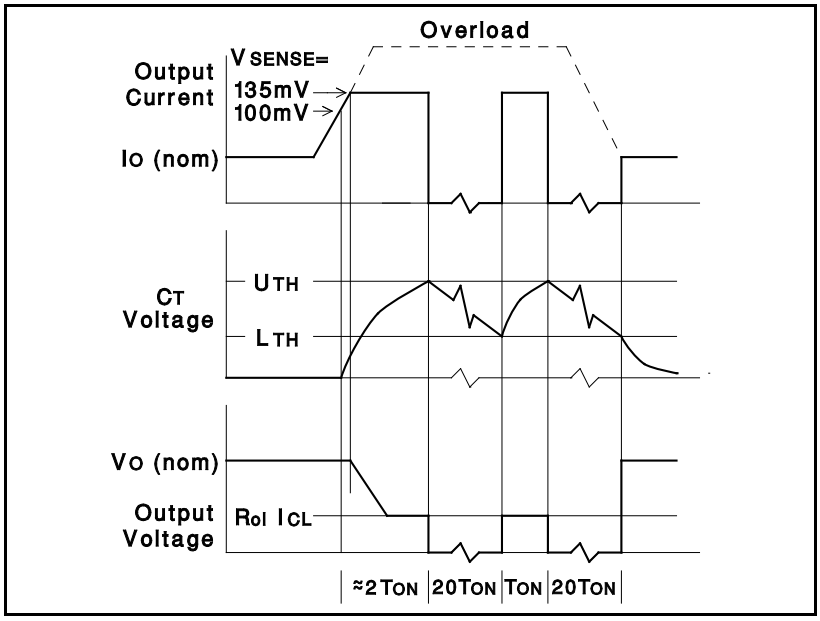
UCx832/33 Timer Function



UCx832/33 Current Sense Input Configuration



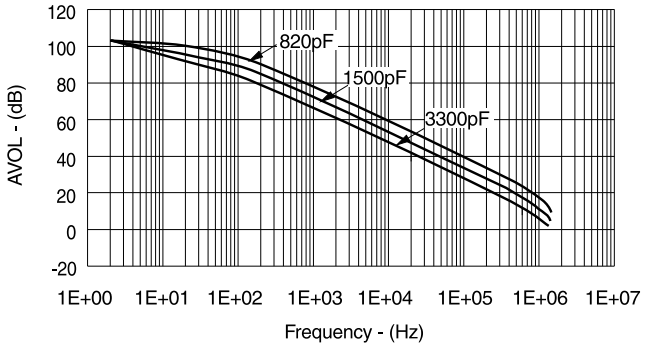
Load current, timing capacitor voltage, and output voltage of the regulator under fault conditions.



APPLICATION AND OPERATION INFORMATION (cont.)

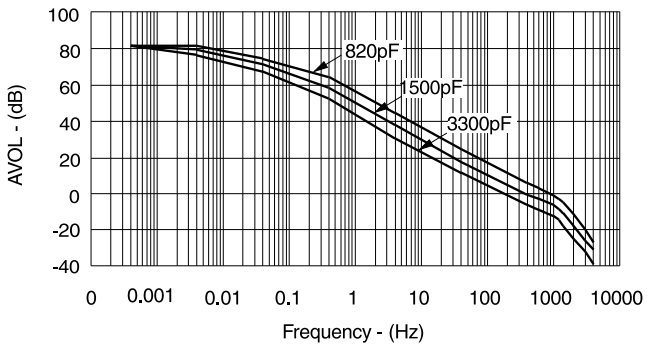
UCx832 Error Amplifier

AVOL vs Frequency and CC



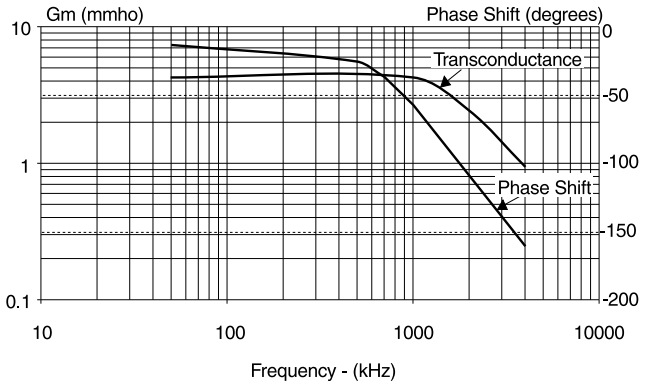
UCx832 Current Sense Amplifier

AVOL vs Frequency and CC



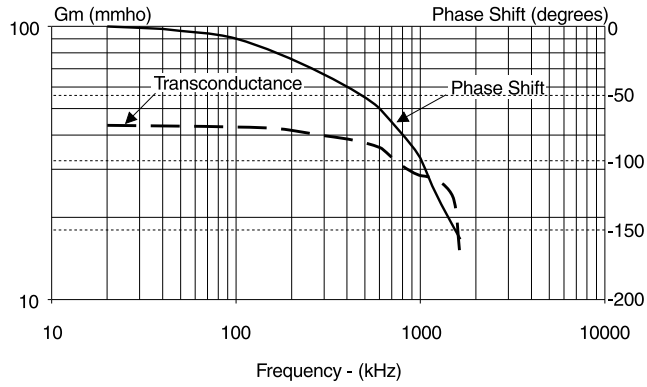
UCx832 Error Amplifier

Transconductance and Phase vs Frequency



UCx832 Current Sense Amplifier

Transconductance and Phase vs Frequency



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UCC3803, LOW-POWER BICMOS CURRENT-MODE PWM

Device Status: Active

Parameter Name	UCC3803
Shutdown	No
Output Type	Single, Totem Pole
Output Current (mA)	+/-1000
Frequency (max) (kHz)	1000
Pulse - by - Pulse Isense	Yes
Reference Voltage (V)	4
Vref tol (%)	1.5
Startup Current (uA)	100
Duty Cycle (max) (%)	100
Operating Supply Current (mA)	0.5
Operating Supply (max) (V)	12
Operating Supply (min) (V)	3.6
PWM Outputs (#)	1
Error Amplifier GBW (mHz)	2

Description

Unitrode Products from Texas Instruments

The UCC1800/1/2/3/4/5 family of high-speed, low-power integrated circuits contain all of the control and drive components required for off-line and DC-to-DC fixed frequency current-mode switching power supplies with minimal parts count.

These devices have the same pin configuration as the UC1842/3/4/5 family, and also offer the added features of internal full-cycle soft start and internal leading-edge blanking of the current-sense input.

The UCC1800/1/2/3/4/5 family offers a variety of package options, temperature range

The UCC1800/1/2/3/4/5 family offers a variety of package options, temperature range options, choice of maximum duty cycle, and choice of critical voltage levels. Lower reference parts such as the UCC1803 and UCC1805 fit best into battery operated systems, while the higher reference and the higher UVLO hysteresis of the UCC1802 and UCC1804 make these ideal choices for use in off-line power supplies.

The UCC180x series is specified for operation from –55°C to +125°C, the UCC280x series is specified for operation from –40°C to +85°C, and the UCC380x series is specified for operation from 0°C to +70°C.

Features

- 100uA Typical Starting Supply Current
- 500uA Typical Operating Supply Current
- Operation to 1MHz
- Internal Soft Start
- Internal Fault Soft Start
- Internal Leading-Edge Blanking of the Current Sense Signal
- 1 Amp Totem-Pole Output
- 70ns Typical Response from Current-Sense to Gate Drive Output
- 1.5% Tolerance Voltage Reference
- Same Pinout as UC3842 and UC3842A

To view the following documents, Acrobat Reader 3.x is required.
To download a document to your hard drive, right-click on the link and choose 'Save'.

Datasheets

Full datasheet in Acrobat PDF: slus270.pdf (210 KB)
Full datasheet in Zipped PostScript: slus270.psz (154 KB)

Pricing/Samples/Availability

Orderable Device	Package	Pins	Temp (ºC)	Status	Price/unit USD (100-999)	Pack Qty	Availability / Samples
UCC3803D	D	8	0 TO 70	ACTIVE	1.95	1	Check stock or order
UCC3803DTR	D	8	0 TO 70	ACTIVE	1.77	1	Check stock or order
UCC3803N	P	8	0 TO 70	ACTIVE	1.91	1	Check stock or order
UCC3803PW	PW	8	0 TO 70	ACTIVE	2.14	1	Check stock or order
UCC3803PWTR	PW	8	0 TO 70	ACTIVE	1.92	1	Check stock or order

Application Reports

- CONDITIONING A SWITCH-MODE POWER SUPPLY CURRENT SIGNAL USING TI OP AMPS (SLOA044 - Updated: 03/26/2000)
- DN-42A DESIGN CONSIDERATIONS FOR TRANSITIONING FROM UC3842 TO THE NEW UCC3802 (SLUA084 - Updated: 12/02/1999)
- DN-43 SIMPLE TECHNIQUES TO GENERATE A NEGATIVE VOLTAGE BIAS SUPPLY (SLUA042 - Updated: 12/02/1999)

SUPPLY (SLUA042 - Updated: 12/02/1999)

- DN-46 HIGHLY EFFICIENT LOW POWER DC TO DC INVERTER CONVERTS PLUS5V INPUT TO -3V OUT (SLUA179 - Updated: 11/04/1999)
- DN-48 VERSATILE LOW POWER SEPIC CONVERTER ACCEPTS WIDE INPUT VOLTAGE RANGE (SLUA158 - Updated: 12/02/1999)
- DN-54 INNOVATIVE BUCK REGULATOR USES HIGH SIDE N-CHANNEL SWITCH WITHOUT COMPLEX (SLUA185 - Updated: 12/02/1999)
- DN-56A, SINGLE SWITCH FLYBACK CIRCUIT CONVERTS PLUS 5 V TO PLUS/- 12 V FOR RS-232/422 (SLUA046 - Updated: 12/02/1999)
- DN-65 CONSIDERATIONS IN POWERING BICMOS ICS (SLUA081 - Updated: 12/02/1999)
- ELECTROSTATIC DISCHARGE APPLICATION NOTE (SSYA008 - Updated: 05/05/1999)
- THERMAL CHARACTERISTICS OF LINEAR AND LOGIC PACKAGES USING JEDEC PCB DESIGNS (SZZA017A - Updated: 09/10/1999)
- U-133A UCC3800/1/2/3/4/5 BICMOS CURRENT MODE CONTROL IC'S (SLUA149 - Updated: 11/04/1999)

Table Data Updated on: 8/15/2000