

## Current Mode PWM Controller

### FEATURES

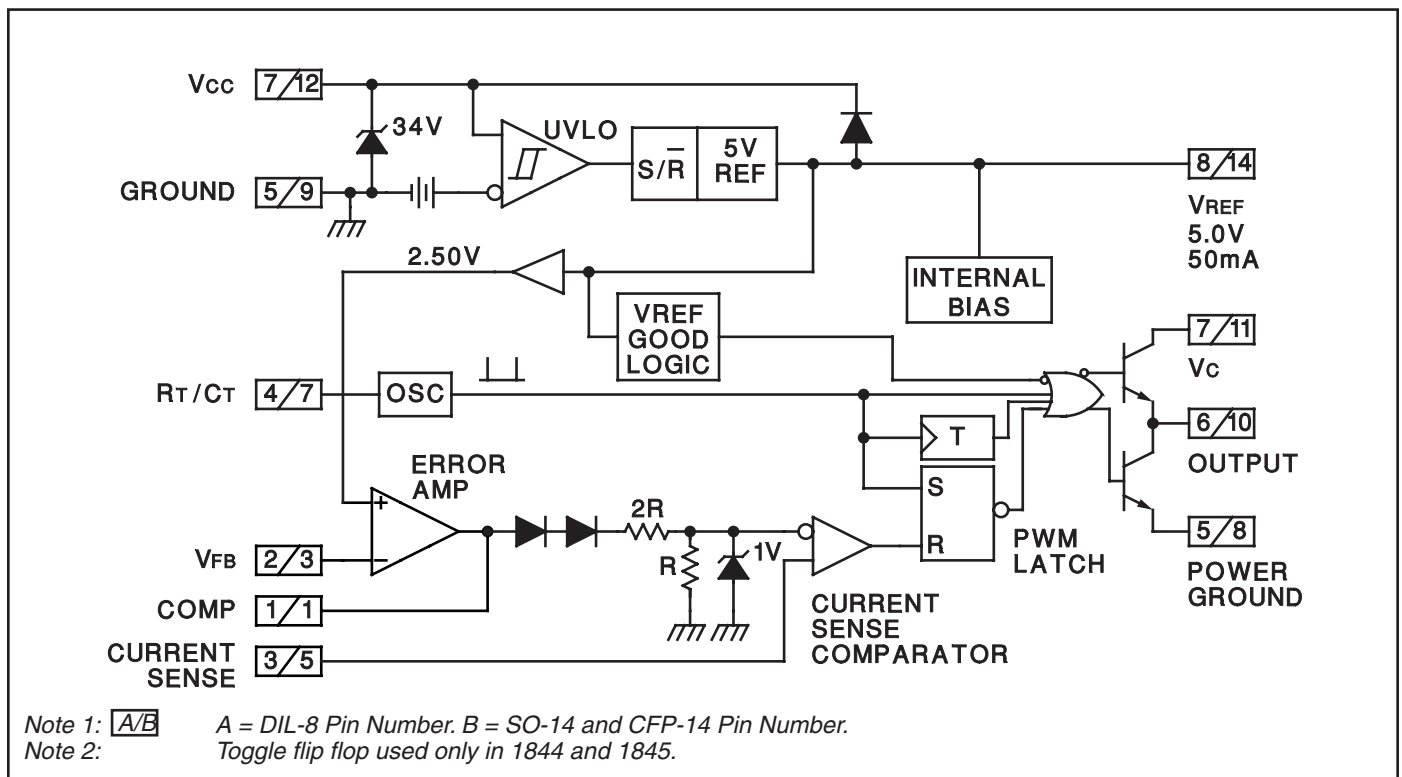
- Optimized For Off-line And DC To DC Converters
- Low Start Up Current (<1mA)
- Automatic Feed Forward Compensation
- Pulse-by-pulse Current Limiting
- Enhanced Load Response Characteristics
- Under-voltage Lockout With Hysteresis
- Double Pulse Suppression
- High Current Totem Pole Output
- Internally Trimmed Bandgap Reference
- 500khz Operation
- Low Ro Error Amp

### DESCRIPTION

The UC1842/3/4/5 family of control ICs provides the necessary features to implement off-line or DC to DC fixed frequency current mode control schemes with a minimal external parts count. Internally implemented circuits include under-voltage lockout featuring start up current less than 1mA, a precision reference trimmed for accuracy at the error amp input, logic to insure latched operation, a PWM comparator which also provides current limit control, and a totem pole output stage designed to source or sink high peak current. The output stage, suitable for driving N Channel MOSFETs, is low in the off state.

Differences between members of this family are the under-voltage lockout thresholds and maximum duty cycle ranges. The UC1842 and UC1844 have UVLO thresholds of 16V (on) and 10V (off), ideally suited to off-line applications. The corresponding thresholds for the UC1843 and UC1845 are 8.4V and 7.6V. The UC1842 and UC1843 can operate to duty cycles approaching 100%. A range of zero to 50% is obtained by the UC1844 and UC1845 by the addition of an internal toggle flip flop which blanks the output off every other clock cycle.

### BLOCK DIAGRAM

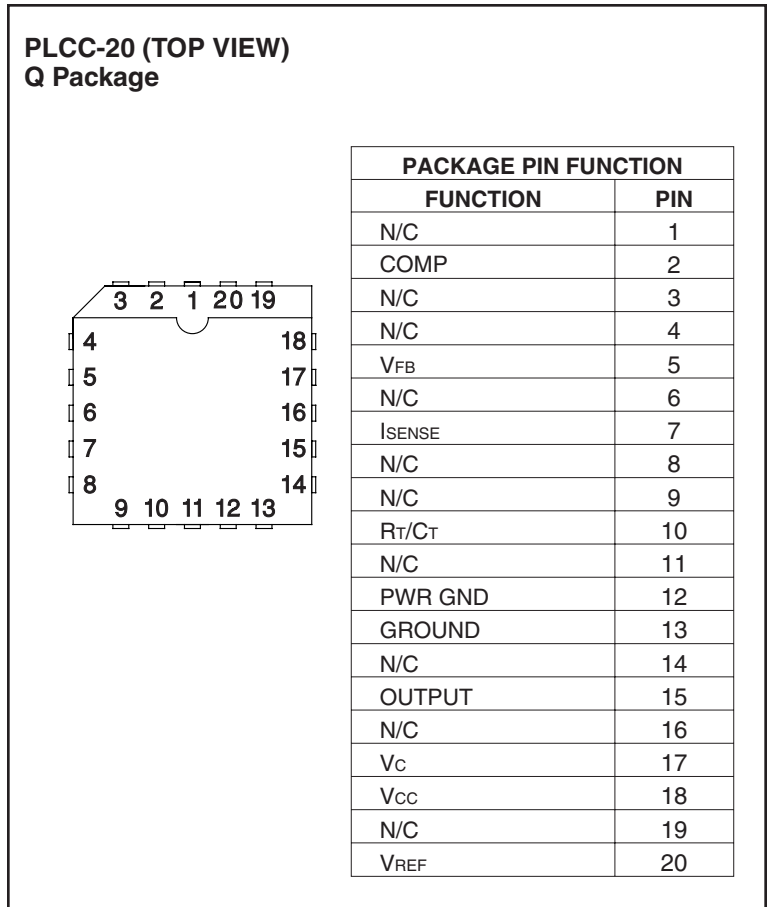
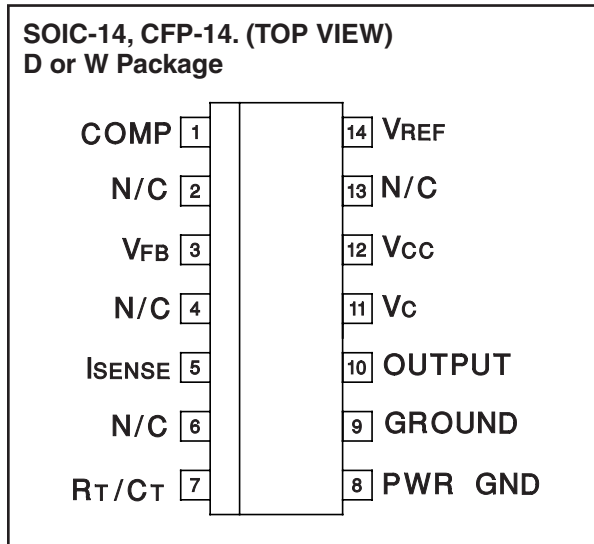
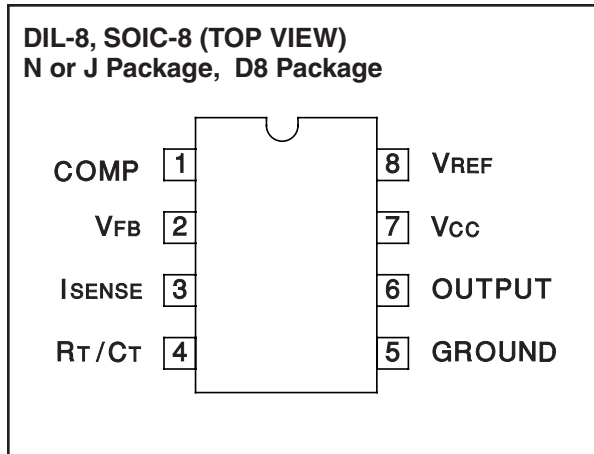


**ABSOLUTE MAXIMUM RATINGS (Note 1)**

Supply Voltage (Low Impedance Source) . . . . . 30V  
 Supply Voltage ( $I_{CC} < 30\text{mA}$ ) . . . . . Self Limiting  
 Output Current . . . . .  $\pm 1\text{A}$   
 Output Energy (Capacitive Load) . . . . .  $5\mu\text{J}$   
 Analog Inputs (Pins 2, 3) . . . . .  $-0.3\text{V}$  to  $+6.3\text{V}$   
 Error Amp Output Sink Current . . . . .  $10\text{mA}$   
 Power Dissipation at  $T_A \leq 25^\circ\text{C}$  (DIL-8) . . . . .  $1\text{W}$   
 Power Dissipation at  $T_A \leq 25^\circ\text{C}$  (SOIC-14) . . . . .  $725\text{mW}$   
 Storage Temperature Range . . . . .  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$   
 Lead Temperature (Soldering, 10 Seconds) . . . . .  $300^\circ\text{C}$

Note 1: All voltages are with respect to Pin 5.  
 All currents are positive into the specified terminal.  
 Consult Packaging Section of Databook for thermal limitations and considerations of packages.

**CONNECTION DIAGRAMS**



**DISSIPATION RATING TABLE**

Package	$T_A \leq 25^\circ\text{C}$ Power Rating	Derating Factor Above $T_A \leq 25^\circ\text{C}$	$T_A \leq 70^\circ\text{C}$ Power Rating	$T_A \leq 85^\circ\text{C}$ Power Rating	$T_A \leq 125^\circ\text{C}$ Power Rating
W	700 mW	5.5 mW/ $^\circ\text{C}$	452 mW	370 mW	150 mW

**ELECTRICAL CHARACTERISTICS:** Unless otherwise stated, these specifications apply for  $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$  for the UC184X;  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$  for the UC284X;  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$  for the 384X;  $V_{CC} = 15\text{V}$  (Note 5);  $R_T = 10\text{k}$ ;  $C_T = 3.3\text{nF}$ ,  $T_A = T_J$ .

PARAMETER	TEST CONDITIONS	UC1842/3/4/5 UC2842/3/4/5			UC3842/3/4/5			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
<b>Reference Section</b>								
Output Voltage	$T_J = 25^{\circ}\text{C}$ , $I_O = 1\text{mA}$	4.95	5.00	5.05	4.90	5.00	5.10	V
Line Regulation	$12 \leq V_{IN} \leq 25\text{V}$		6	20		6	20	mV
Load Regulation	$1 \leq I_O \leq 20\text{mA}$		6	25		6	25	mV
Temp. Stability	(Note 2) (Note 7)		0.2	0.4		0.2	0.4	mV/ $^{\circ}\text{C}$
Total Output Variation	Line, Load, Temp. (Note 2)	4.9		5.1	4.82		5.18	V
Output Noise Voltage	$10\text{Hz} \leq f \leq 10\text{kHz}$ , $T_J = 25^{\circ}\text{C}$ (Note 2)		50			50		$\mu\text{V}$
Long Term Stability	$T_A = 125^{\circ}\text{C}$ , 1000Hrs. (Note 2)		5	25		5	25	mV
Output Short Circuit		-30	-100	-180	-30	-100	-180	mA
<b>Oscillator Section</b>								
Initial Accuracy	$T_J = 25^{\circ}\text{C}$ (Note 6)	47	52	57	47	52	57	kHz
Voltage Stability	$12 \leq V_{CC} \leq 25\text{V}$		0.2	1		0.2	1	%
Temp. Stability	$T_{MIN} \leq T_A \leq T_{MAX}$ (Note 2)		5			5		%
Amplitude	$V_{PIN 4}$ peak to peak (Note 2)		1.7			1.7		V
<b>Error Amp Section</b>								
Input Voltage	$V_{PIN 1} = 2.5\text{V}$	2.45	2.50	2.55	2.42	2.50	2.58	V
Input Bias Current			-0.3	-1		-0.3	-2	$\mu\text{A}$
AVOL	$2 \leq V_O \leq 4\text{V}$	65	90		65	90		dB
Unity Gain Bandwidth	(Note 2) $T_J = 25^{\circ}\text{C}$	0.7	1		0.7	1		MHz
PSRR	$12 \leq V_{CC} \leq 25\text{V}$	60	70		60	70		dB
Output Sink Current	$V_{PIN 2} = 2.7\text{V}$ , $V_{PIN 1} = 1.1\text{V}$	2	6		2	6		mA
Output Source Current	$V_{PIN 2} = 2.3\text{V}$ , $V_{PIN 1} = 5\text{V}$	-0.5	-0.8		-0.5	-0.8		mA
VOUT High	$V_{PIN 2} = 2.3\text{V}$ , $R_L = 15\text{k}$ to ground	5	6		5	6		V
VOUT Low	$V_{PIN 2} = 2.7\text{V}$ , $R_L = 15\text{k}$ to Pin 8		0.7	1.1		0.7	1.1	V
<b>Current Sense Section</b>								
Gain	(Notes 3 and 4)	2.85	3	3.15	2.85	3	3.15	V/V
Maximum Input Signal	$V_{PIN 1} = 5\text{V}$ (Note 3)	0.9	1	1.1	0.9	1	1.1	V
PSRR	$12 \leq V_{CC} \leq 25\text{V}$ (Note 3) (Note 2)		70			70		dB
Input Bias Current			-2	-10		-2	-10	$\mu\text{A}$
Delay to Output	$V_{PIN 3} = 0$ to $2\text{V}$ (Note 2)		150	300		150	300	ns

Note 2: These parameters, although guaranteed, are not 100% tested in production.

Note 3: Parameter measured at trip point of latch with  $V_{PIN 2} = 0$ .

Note 4: Gain defined as

$$A = \frac{\Delta V_{PIN 1}}{\Delta V_{PIN 3}}, 0 \leq V_{PIN 3} \leq 0.8\text{V}$$

Note 5: Adjust  $V_{CC}$  above the start threshold before setting at 15V.

Note 6: Output frequency equals oscillator frequency for the UC1842 and UC1843.

Output frequency is one half oscillator frequency for the UC1844 and UC1845.

Note 7: Temperature stability, sometimes referred to as average temperature coefficient, is described by the equation:

$$\text{Temp Stability} = \frac{V_{REF}(\text{max}) - V_{REF}(\text{min})}{T_J(\text{max}) - T_J(\text{min})}$$

$V_{REF}(\text{max})$  and  $V_{REF}(\text{min})$  are the maximum and minimum reference voltages measured over the appropriate temperature range. Note that the extremes in voltage do not necessarily occur at the extremes in temperature.

**ELECTRICAL CHARACTERISTICS:** Unless otherwise stated, these specifications apply for  $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$  for the UC184X;  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$  for the UC284X;  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$  for the 384X;  $V_{CC} = 15\text{V}$  (Note 5);  $R_T = 10\text{k}$ ;  $C_T = 3.3\text{nF}$ ,  $T_A = T_J$ .

PARAMETER	TEST CONDITION	UC1842/3/4/5 UC2842/3/4/5			UC3842/3/4/5			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
<b>Output Section</b>								
Output Low Level	$I_{SINK} = 20\text{mA}$		0.1	0.4		0.1	0.4	V
	$I_{SINK} = 200\text{mA}$		1.5	2.2		1.5	2.2	V
Output High Level	$I_{SOURCE} = 20\text{mA}$	13	13.5		13	13.5		V
	$I_{SOURCE} = 200\text{mA}$	12	13.5		12	13.5		V
Rise Time	$T_J = 25^{\circ}\text{C}$ , $C_L = 1\text{nF}$ (Note 2)		50	150		50	150	ns
Fall Time	$T_J = 25^{\circ}\text{C}$ , $C_L = 1\text{nF}$ (Note 2)		50	150		50	150	ns
<b>Under-voltage Lockout Section</b>								
Start Threshold	X842/4	15	16	17	14.5	16	17.5	V
	X843/5	7.8	8.4	9.0	7.8	8.4	9.0	V
Min. Operating Voltage After Turn On	X842/4	9	10	11	8.5	10	11.5	V
	X843/5	7.0	7.6	8.2	7.0	7.6	8.2	V
<b>PWM Section</b>								
Maximum Duty Cycle	X842/3	95	97	100	95	97	100	%
	X844/5	46	48	50	47	48	50	%
Minimum Duty Cycle				0			0	%
<b>Total Standby Current</b>								
Start-Up Current			0.5	1		0.5	1	mA
Operating Supply Current	$V_{PIN 2} = V_{PIN 3} = 0\text{V}$		11	17		11	17	mA
Vcc Zener Voltage	$I_{CC} = 25\text{mA}$	30	34		30	34		V

Note 2: These parameters, although guaranteed, are not 100% tested in production.

Note 3: Parameter measured at trip point of latch with  $V_{PIN 2} = 0$

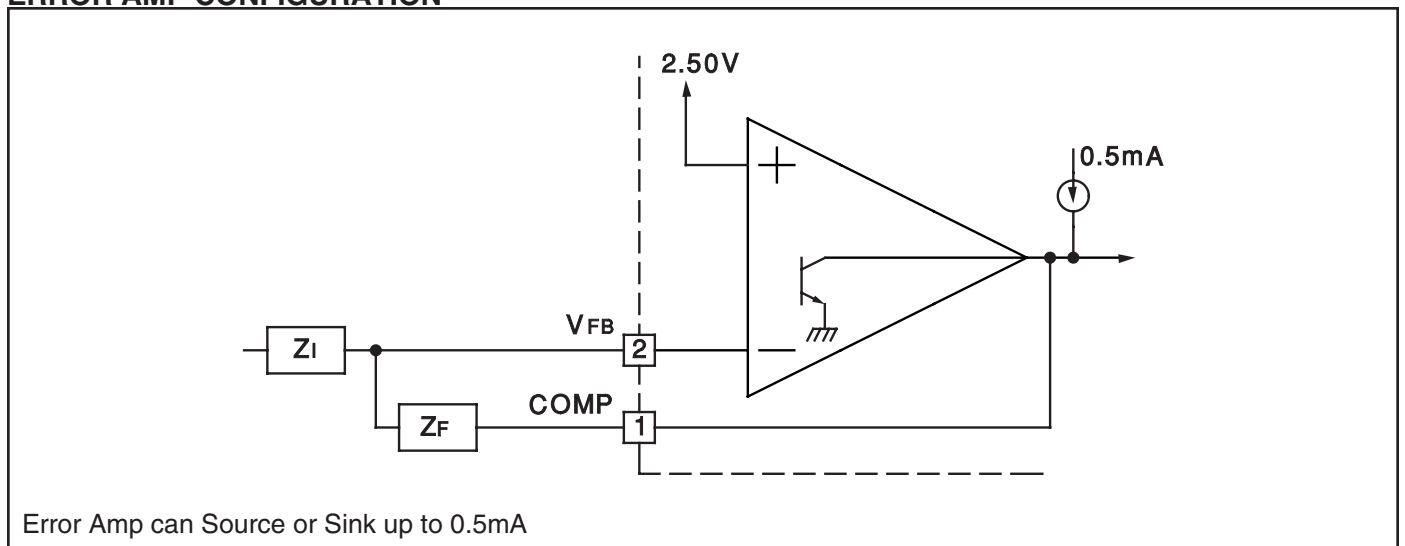
Note 4: Gain defined as:  $A = \frac{\Delta V_{PIN 1}}{\Delta V_{PIN 3}}$ ;  $0 \leq V_{PIN 3} \leq 0.8\text{V}$ .

Note 5: Adjust Vcc above the start threshold before setting at 15V.

Note 6: Output frequency equals oscillator frequency for the UC1842 and UC1843.

Output frequency is one half oscillator frequency for the UC1844 and UC1845.

## ERROR AMP CONFIGURATION



### UNDER-VOLTAGE LOCKOUT

	UC1842	UC1843	UC1844
V <sub>ON</sub>	16V	8.4V	
V <sub>OFF</sub>	10V	7.6V	

During under-voltage lock-out, the output driver is biased to sink minor amounts of current. Pin 6 should be shunted to ground with a bleeder resistor to prevent activating the power switch with extraneous leakage currents.

### CURRENT SENSE CIRCUIT

Peak Current ( $I_s$ ) is Determined By The Formula

$$I_{SMAX} \approx \frac{1.0V}{RS}$$

A small RC filter may be required to suppress switch transients.

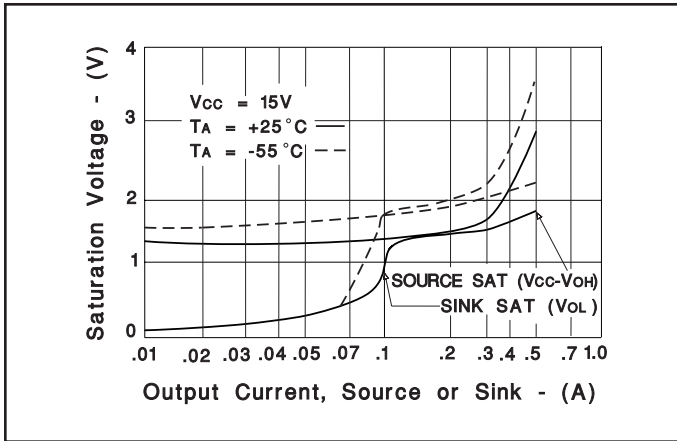
### OSCILLATOR SECTION

For  $RT > 5k$   $f \approx \frac{1.72}{RTCT}$

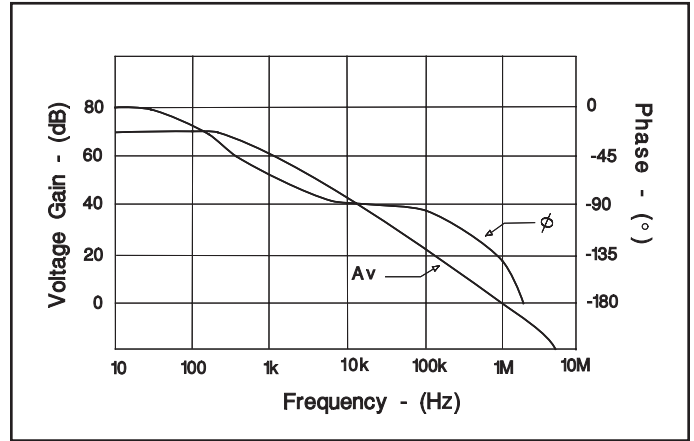
Deadtime vs  $C_T$  ( $RT > 5k$ )

Timing Resistance vs Frequency

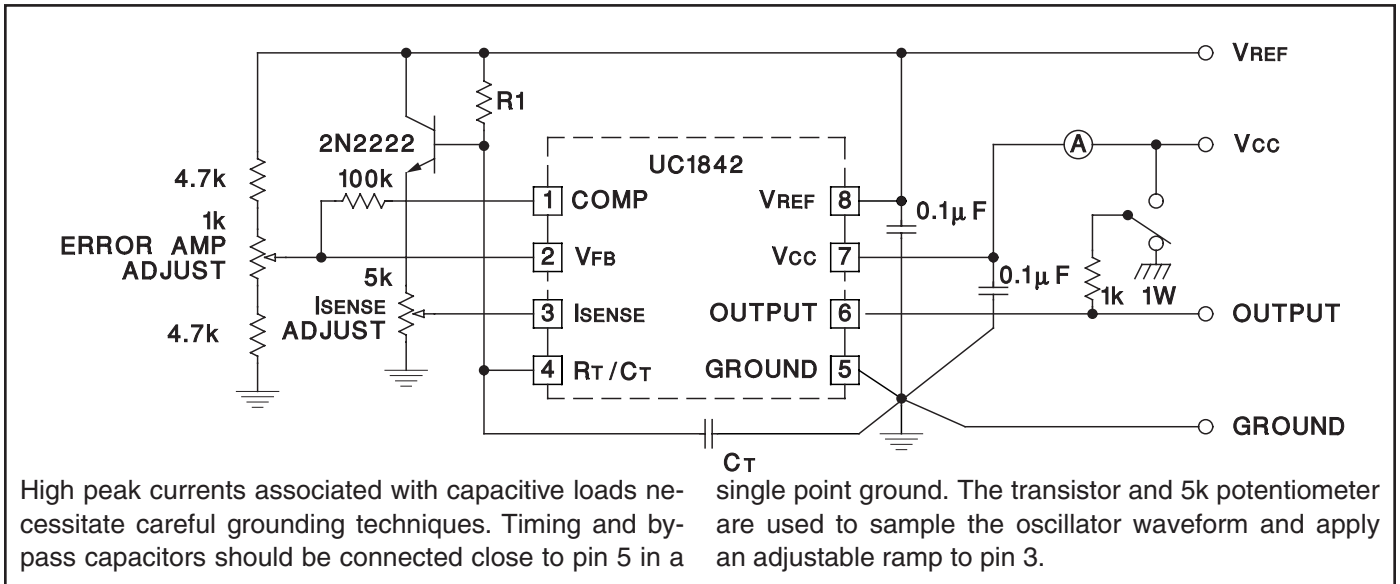
**OUTPUT SATURATION CHARACTERISTICS**



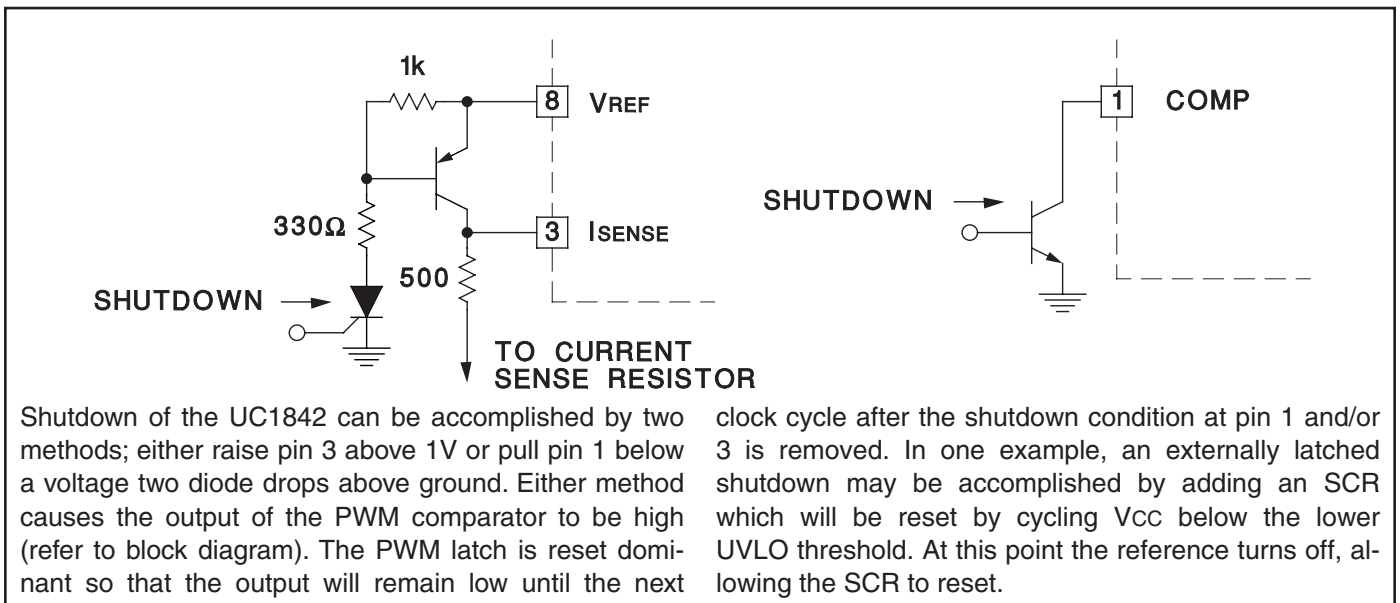
**ERROR AMPLIFIER OPEN-LOOP FREQUENCY RESPONSE**



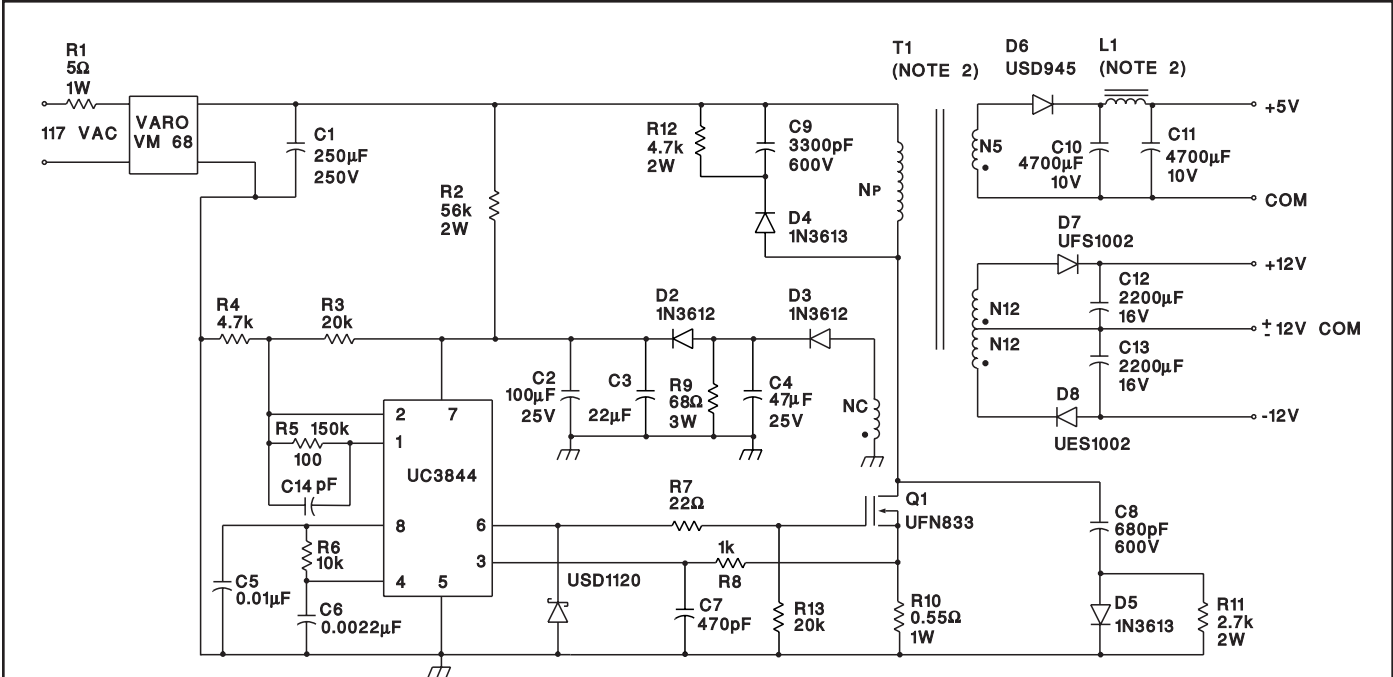
**OPEN-LOOP LABORATORY FIXTURE**



**SHUT DOWN TECHNIQUES**



**OFFLINE FLYBACK REGULATOR**



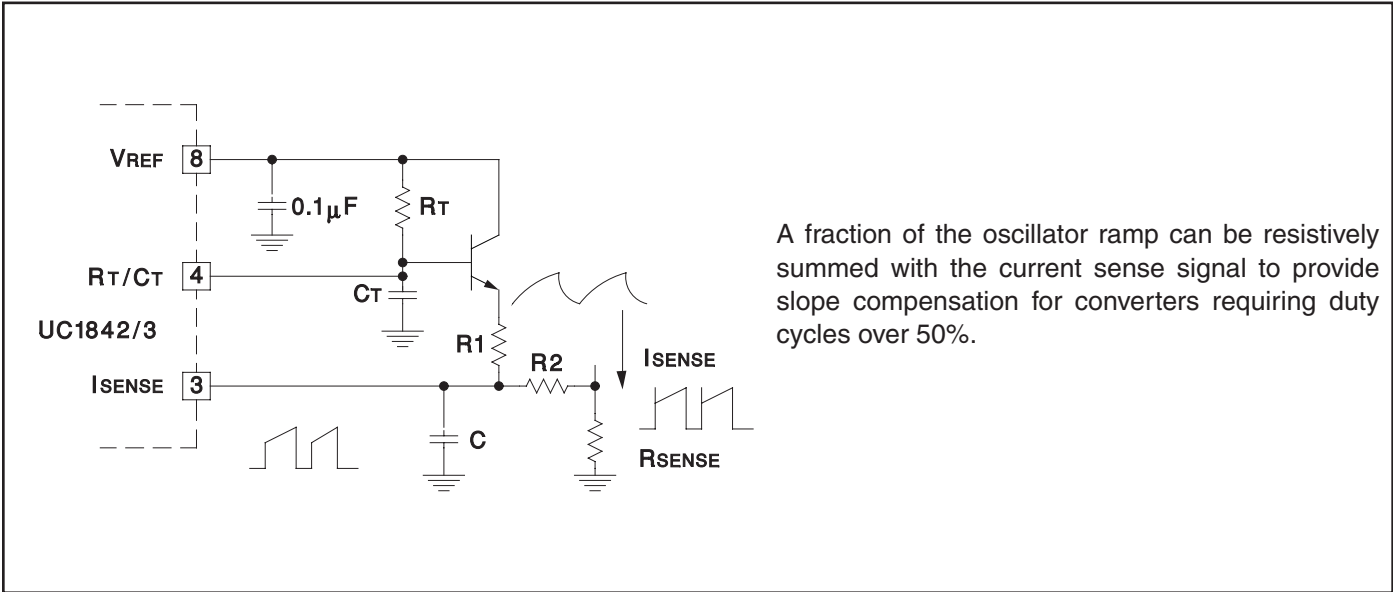
**Power Supply Specifications**

- 1. Input Voltages 5VAC to 130VA  
(50 Hz/60Hz)
- 2. Line Isolation 3750V
- 3. Switching Frequency 40kHz
- 4. Efficiency at Full Load 70%

**5. Output Voltage:**

- A. +5V, ±5%; 1A to 4A load  
Ripple voltage: 50mV P-P Max
- B. +12V, ±3%; 0.1A to 0.3A load  
Ripple voltage: 100mV P-P Max
- C. -12V, ±3%; 0.1A to 0.3A load  
Ripple voltage: 100mV P-P Max

**SLOPE COMPENSATION**



A fraction of the oscillator ramp can be resistively summed with the current sense signal to provide slope compensation for converters requiring duty cycles over 50%.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

### Mailing Address:

Texas Instruments  
Post Office Box 655303  
Dallas, Texas 75265



This datasheet has been download from:

[www.datasheetcatalog.com](http://www.datasheetcatalog.com)

Datasheets for electronics components.