

Current Mode PWM Controller

FEATURES

- Optimized for Off-line and DC to DC Converters
- Low Start Up Current (<0.5mA)
- Trimmed Oscillator Discharge Current
- 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

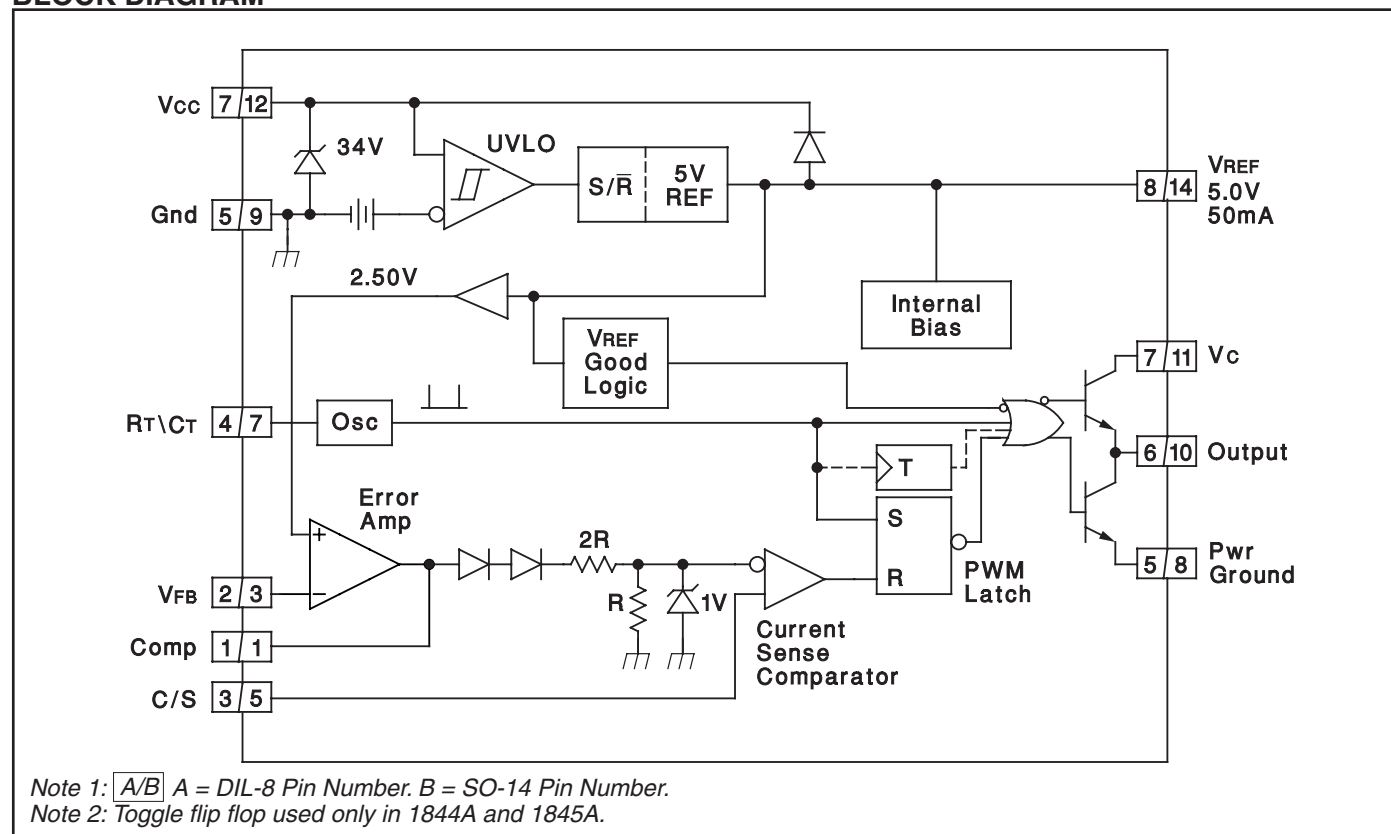
DESCRIPTION

The UC1842A/3A/4A/5A family of control ICs is a pin for pin compatible improved version of the UC3842/3/4/5 family. Providing the necessary features to control current mode switched mode power supplies, this family has the following improved features. Start up current is guaranteed to be less than 0.5mA. Oscillator discharge is trimmed to 8.3mA. During under voltage lockout, the output stage can sink at least 10mA at less than 1.2V for VCC over 5V.

The difference between members of this family are shown in the table below.

Part #	UVLO On	UVLO Off	Maximum Duty Cycle
UC1842A	16.0V	10.0V	<100%
UC1843A	8.5V	7.9V	<100%
UC1844A	16.0V	10.0V	<50%
UC1845A	8.5V	7.9V	<50%

BLOCK DIAGRAM



CONNECTION DIAGRAMS

UC1842A/3A/4A/5A

UC2842A/3A/4A/5A

UC3842A/3A/4A/5A

ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage (Low Impedance Source) 30V

Supply Voltage (I_{CC} mA) Self Limiting

Output Current. ±1A

Output Energy (Capacitive Load). 5μJ

Analog Inputs (Pins 2, 3). -0.3V to +6.3V

Error Amp Output Sink Current 10mA

Power Dissipation at T_A ≤ 25°C (DIL-8) 1W

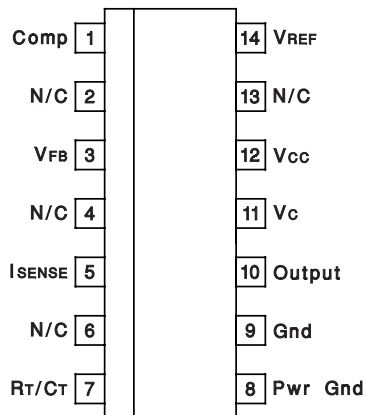
Storage Temperature Range. -65°C to +150°C

Lead Temperature (Soldering, 10 Seconds) 300°C

Note 1. All voltages are with respect to Ground, Pin 5. Currents are positive into, negative out of the specified terminal. Consult Packaging Section of Databook for thermal limitations and considerations of packages. Pin numbers refer to DIL package only.

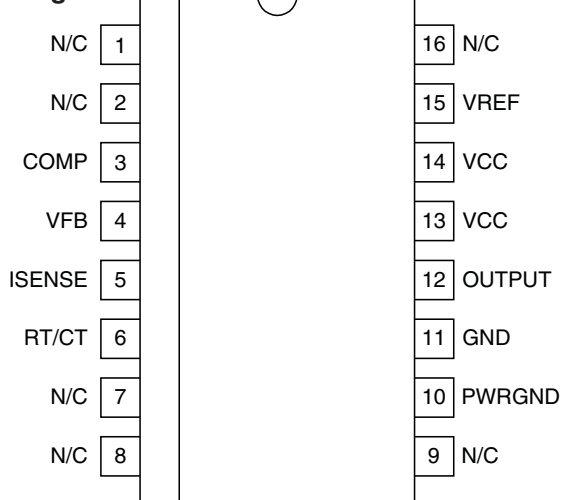
SOIC-14 (TOP VIEW)

D Package



SOIC-WIDE16 (TOP VIEW)

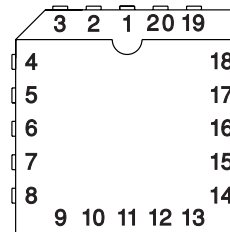
DW Package



PLCC-20, LCC-20

(TOP VIEW)

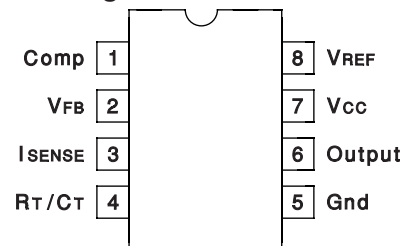
Q, L Packages



PACKAGE PIN FUNCTION	
FUNCTION	PIN
N/C	1
Comp	2
N/C	3-4
VFB	5
N/C	6
I _{SENSE}	7
N/C	8-9
R _T /C _T	10
N/C	11
Pwr Gnd	12
Gnd	13
N/C	14
Output	15
N/C	16
V _C	17
V _{CC}	18
N/C	19
V _{REF}	20

DIL-8, SOIC-8 (TOP VIEW)

J or N, D8 Package



ELECTRICAL CHARACTERISTICS Unless otherwise stated, these specifications apply for $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$ for the UC184xA; $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ for the UC284xA; $0 \leq T_A \leq 70^{\circ}\text{C}$ for the UC384xA; $V_{CC} = 15\text{V}$ (Note 5); $R_T = 10\text{k}$; $C_T = 3.3\text{nF}$; $T_A = T_J$; Pin numbers refer to DIL-8.

PARAMETER	TEST CONDITIONS	UC184xA\UC284xA			UC384xA			UNITS
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Reference Section								
Output Voltage	T _J = 25°C, I _O = 1mA	4.95	5.00	5.05	4.90	5.00	5.10	V
Line Regulation	12 ≤ V _{IN} 25V		6	20		6	20	mV
Load Regulation	1 ≤ I _O ≤ 20mA		6	25		6	25	mV
Temp. Stability	(Note 2, Note 7)		0.2	0.4		0.2	0.4	mV/°C
Total Output Variation	Line, Load, Temp.	4.9		5.1	4.82		5.18	V
Output Noise Voltage	10Hz ≤ f ≤ 10kHz T _J = 25°C (Note 2)		50			50		μV
Long Term Stability	T _A = 125°C, 1000Hrs. (Note 2)		5	25		5	25	mV
Output Short Circuit		-30	-100	-180	-30	-100	-180	mA
Oscillator Section								
Initial Accuracy	T _J = 25°C (Note 6)	47	52	57	47	52	57	kHz
Voltage Stability	12 ≤ V _{CC} ≤ 25V		0.2	1		0.2	1	%
Temp. Stability	T _{MIN} ≤ T _A ≤ T _{MAX} (Note 2)		5			5		%
Amplitude	V _{PIN 4} peak to peak (Note 2)		1.7			1.7		V
Discharge Current	T _J = 25°C, V _{PIN 4} = 2V (Note 8)	7.8	8.3	8.8	7.8	8.3	8.8	mA
	V _{PIN 4} = 2V (Note 8)	7.5		8.8	7.6		8.8	mA
Error Amp Section								
Input Voltage	V _{PIN 1} = 2.5V	2.45	2.50	2.55	2.42	2.50	2.58	V
Input Bias Current			-0.3	-1		-0.3	-2	μA
AVOL	2 ≤ V _O ≤ 4V	65	90		65	90		dB
Unity Gain Bandwidth	T _J = 25°C (Note 2)	0.7	1		0.7	1		MHz
PSRR	12 ≤ V _{CC} ≤ 25V	60	70		60	70		dB
Output Sink Current	V _{PIN 2} = 2.7V, V _{PIN 1} = 1.1V	2	6		2	6		mA
Output Source Current	V _{PIN 2} = 2.3V, V _{PIN 1} = 5V	-0.5	-0.8		-0.5	-0.8		mA
V _{OUT} High	V _{PIN 2} = 2.3V, R _L = 15k to ground	5	6		5	6		V
V _{OUT} Low	V _{PIN 2} = 2.7V, R _L = 15k to Pin 8		0.7	1.1		0.7	1.1	V
Current Sense Section								
Gain	(Note 3, Note 4)	2.85	3	3.15	2.85	3	3.15	V/V
Maximum Input Signal	V _{PIN 1} = 5V (Note 3)	0.9	1	1.1	0.9	1	1.1	V
PSRR	12 ≤ V _{CC} ≤ 25V (Note 3)		70			70		dB
Input Bias Current			-2	-10		-2	-10	μA
Delay to Output	V _{PIN 3} = 0 to 2V (Note 2)		150	300		150	300	ns
Output Section								
Output Low Level	I _{SINK} = 20mA		0.1	0.4		0.1	0.4	V
	I _{SINK} = 200mA		15	2.2		15	2.2	V
Output High Level	I _{SOURCE} = 20mA	13	13.5		13	13.5		V
	I _{SOURCE} = 200mA	12	13.5		12	13.5		V
Rise Time	T _J = 25°C, C _L = 1nF (Note 2)		50	150		50	150	ns
Fall Time	T _J = 25°C, C _L = 1nF (Note 2)		50	150		50	150	ns
UVLO Saturation	V _{CC} = 5V, I _{SINK} = 10mA		0.7	1.2		0.7	1.2	V

ELECTRICAL CHARACTERISTICS Unless otherwise stated, these specifications apply for $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$ for the UC184xA; $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ for the UC284xA; $0 \leq T_A \leq 70^{\circ}\text{C}$ for the UC384xA; $V_{CC} = 15\text{V}$ (Note 5); $R_T = 10\text{k}\Omega$; $C_T = 3.3\text{nF}$; $T_A = T_J$; Pin numbers refer to DIL-8.

PARAMETER	TEST CONDITIONS	UC184xA\UC284xA			UC384xA			UNITS
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Under-Voltage Lockout Section								
Start Threshold	x842A/4A	15	16	17	14.5	16	17.5	V
	x843A/5A	7.8	8.4	9.0	7.8	8.4	9.0	V
Min. Operation Voltage After Turn On	x842A/4A	9	10	11	8.5	10	11.5	V
	x843A/5A	7.0	7.6	8.2	7.0	7.6	8.2	V
PWM Section								
Maximum Duty Cycle	x842A/3A	94	96	100	94	96	100	%
	x844A/5A	47	48	50	47	48	50	%
Minimum Duty Cycle				0			0	%
Total Standby Current								
Start-Up Current			0.3	0.5		0.3	0.5	mA
Operating Supply Current	V _{PIN 2} = V _{PIN 3} = 0V		11	17		11	17	mA
V _{CC} Zener Voltage	I _{CC} = 25mA	30	34		30	34		V

Note 2: Ensured by design, but not 100% production tested.

Note 3: Parameter measured at trip point of latch with $V_{PIN2} = 0$.

Note 4: Gain defined as: $A = \frac{\Delta V_{PIN1}}{\Delta V_{PIN3}}$; $0 \leq V_{PIN3} \leq 0.8\text{V}$.

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

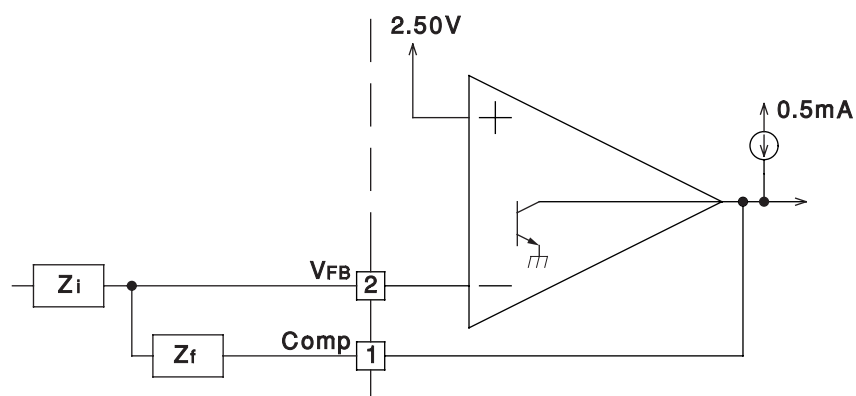
Note 6: Output frequency equals oscillator frequency for the UC1842A and UC1843A. Output frequency is one half oscillator frequency for the UC1844A and UC1845A.

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

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

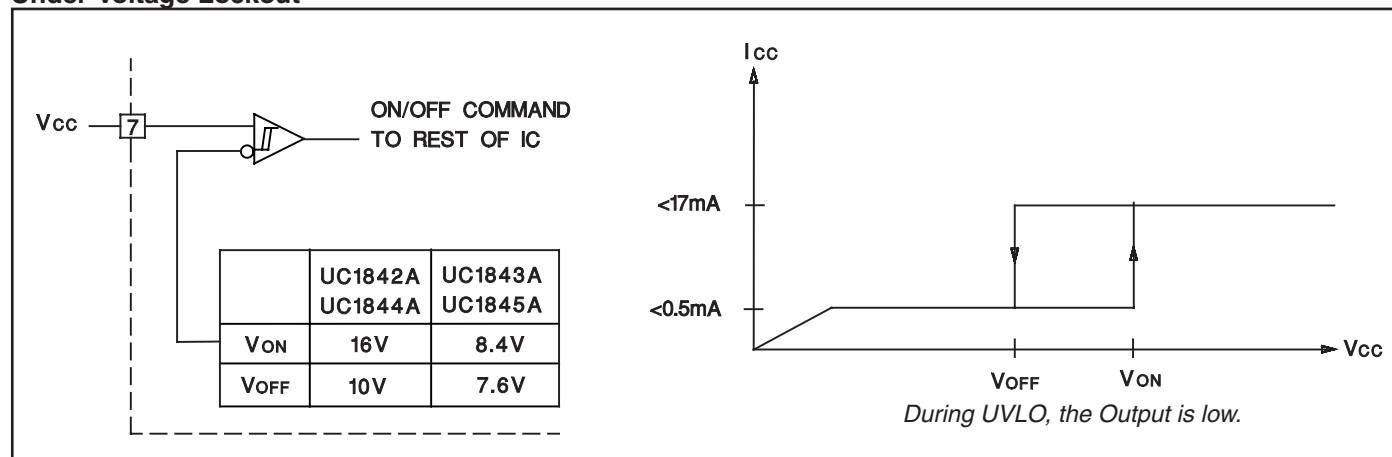
Note 8: This parameter is measured with $R_T = 10\text{k}\Omega$ to V_{REF} . This contributes approximately $300\mu\text{A}$ of current to the measurement. The total current flowing into the R_T/C pin will be approximately $300\mu\text{A}$ higher than the measured value.

Error Amp Configuration

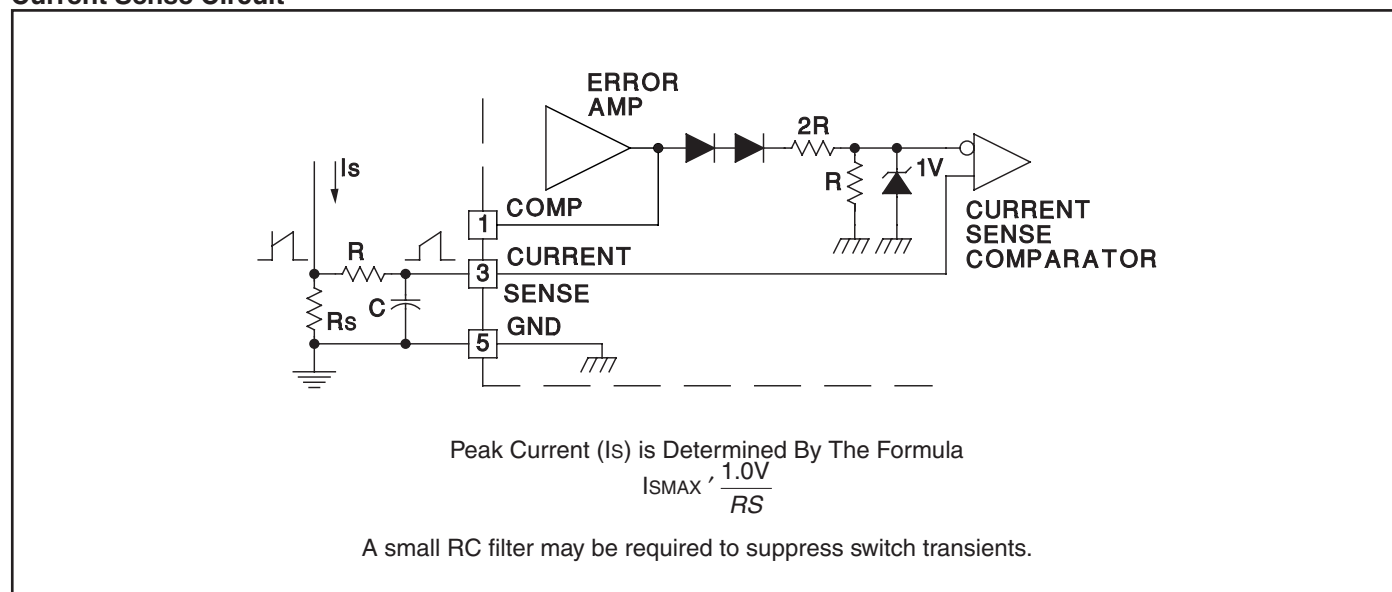


Error Amp can Source and Sink up to 0.5mA, and Sink up to 2mA.

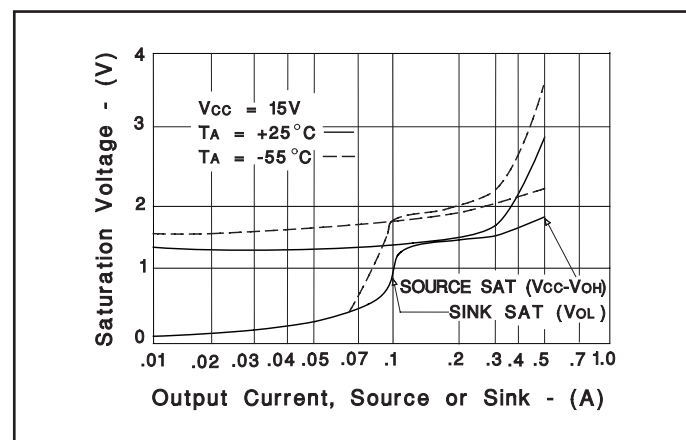
Under-Voltage Lockout



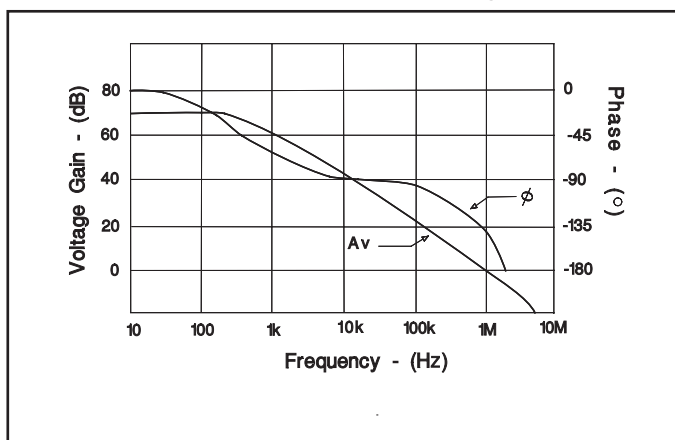
Current Sense Circuit



Output Saturation Characteristics

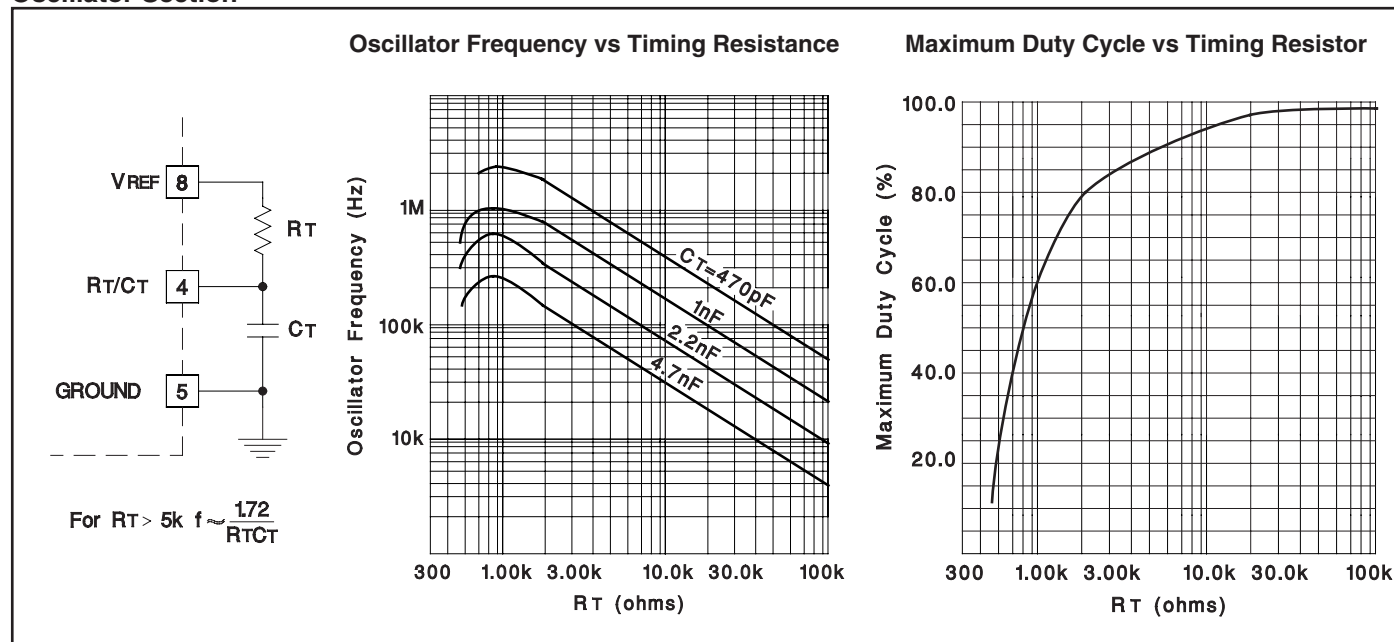


Error Amplifier Open-Loop Frequency Response

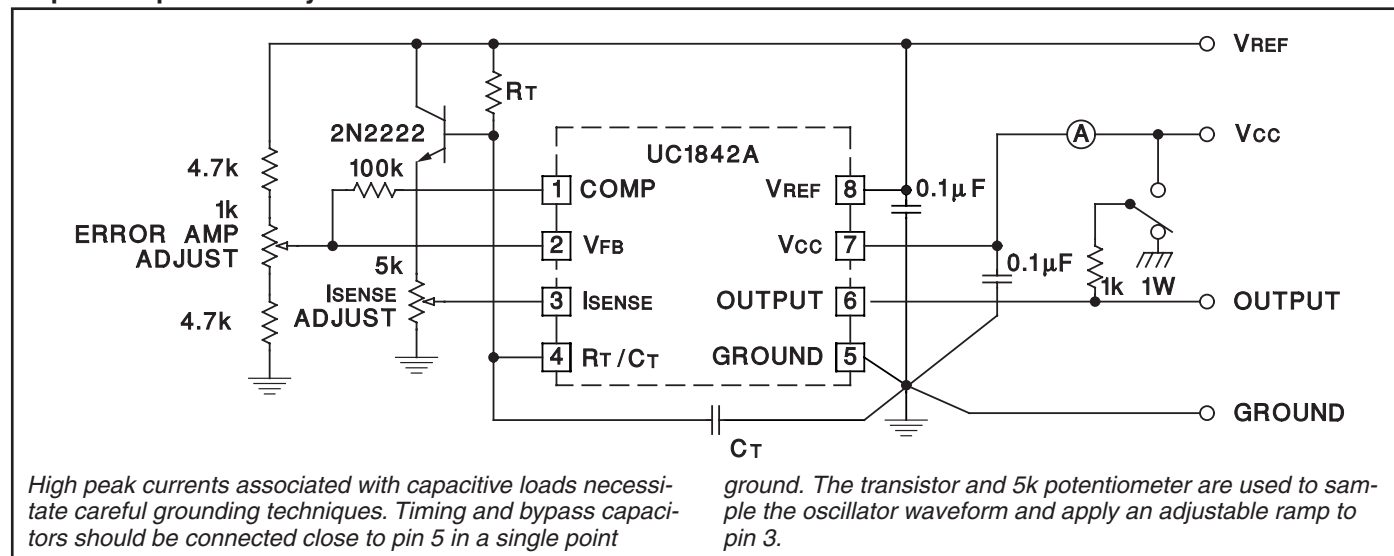


APPLICATIONS DATA (cont.)

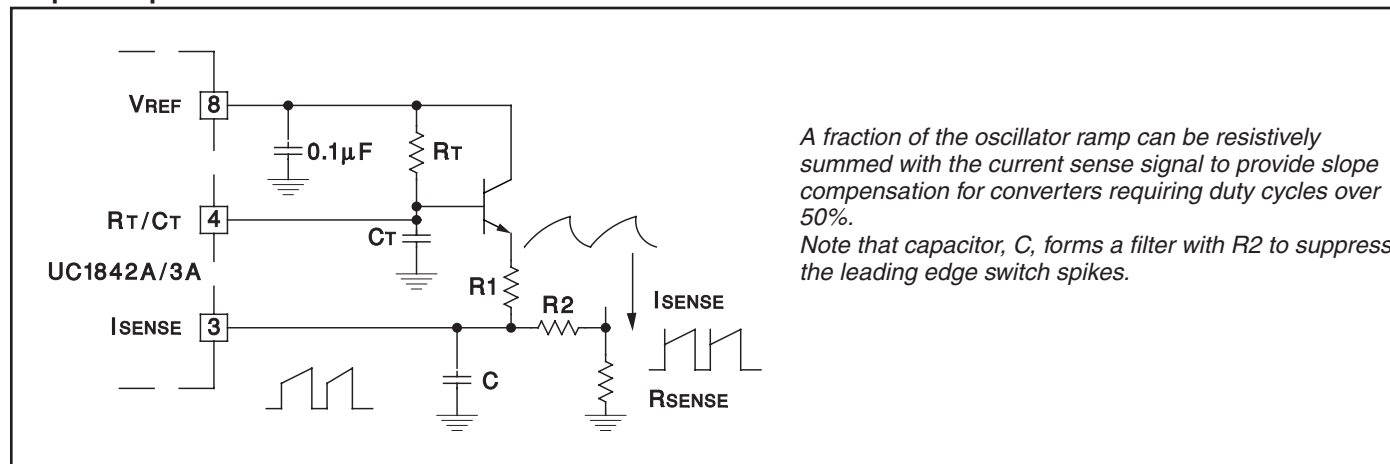
Oscillator Section



Open-Loop Laboratory Test Fixture

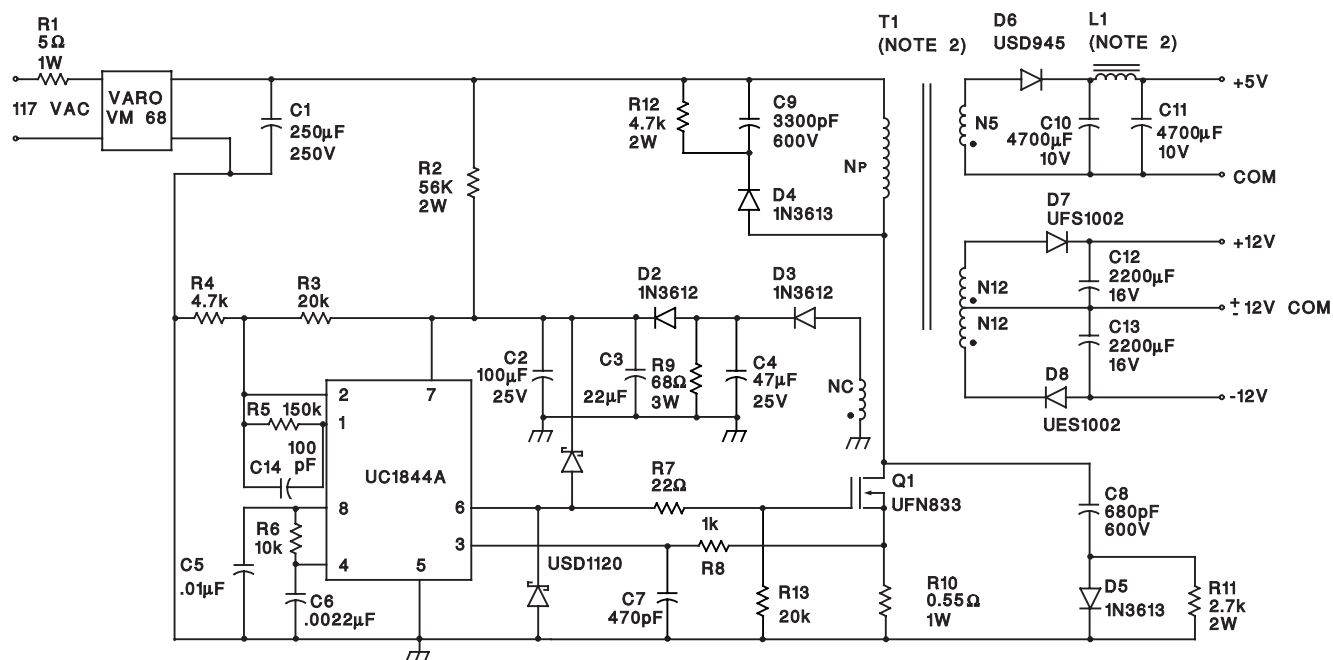


Slope Compensation



APPLICATIONS DATA (cont.)

Off-line Flyback Regulator



Power Supply Specifications

1. Input Voltage 95VAC to 130VA
(50 Hz/60Hz)
2. Line Isolation 3750V
3. Switching Frequency 40kHz
4. Efficiency 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

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