

# 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

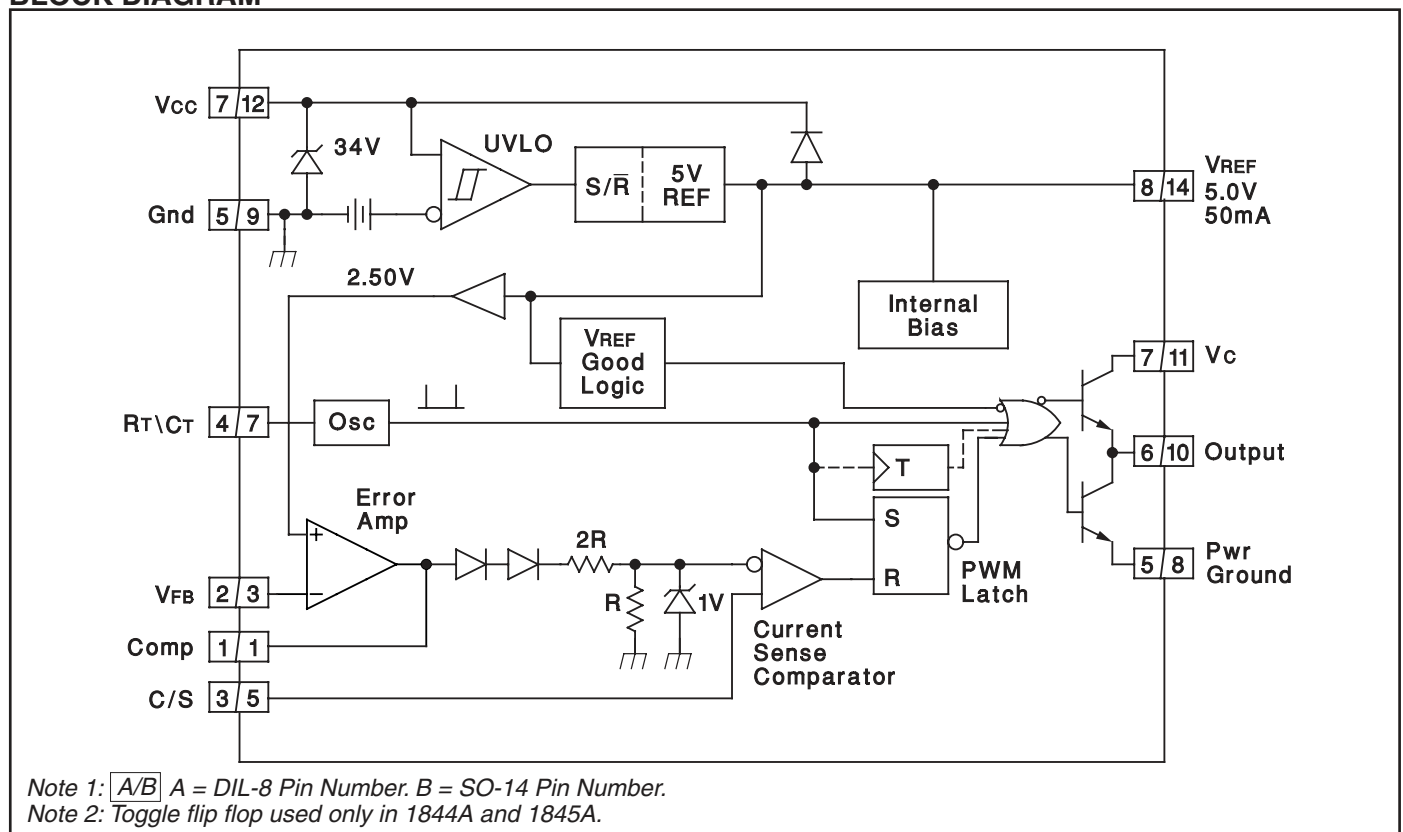
## DESCRIPTION

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

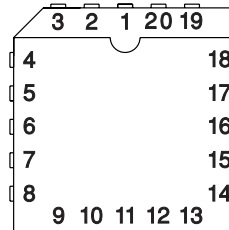
**UC1842A/3A/4A/5A**  
**UC2842A/3A/4A/5A**  
**UC3842A/3A/4A/5A**

### ABSOLUTE MAXIMUM RATINGS (Note 1)

|  |                 |
|--|-----------------|
| Supply Voltage (Low Impedance Source) . . . . .              | 30V             |
| Supply Voltage (I <sub>cc</sub> 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 <sub>A</sub> ≤ 25°C (DIL-8) . . . . . | 1W              |
| Storage Temperature Range . . . . .                          | -65°C to +150°C |
| Lead Temperature (Soldering, 10 Seconds) . . . . .           | 300°C           |

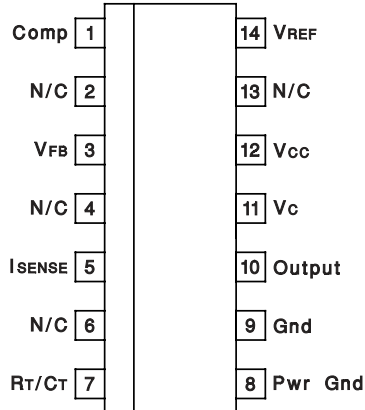
*Note 1. All voltages are with respect to Ground, Pin 5. Currents are positive into, negative out of the specified terminal. Consult Packaging Section of Databook for thermal limitations and considerations of packages. Pin numbers refer to DIL package only.*

### PLCC-20, LCC-20 (TOP VIEW) Q, L Packages

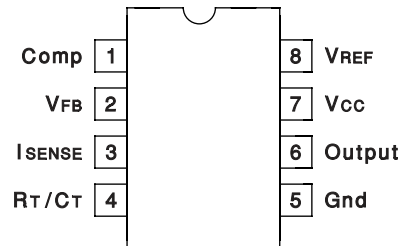


| PACKAGE PIN FUNCTION           |     |
|--------------------------------|-----|
| FUNCTION                       | PIN |
| N/C                            | 1   |
| Comp                           | 2   |
| N/C                            | 3-4 |
| VFB                            | 5   |
| N/C                            | 6   |
| I <sub>SENSE</sub>             | 7   |
| N/C                            | 8-9 |
| R <sub>T</sub> /C <sub>T</sub> | 10  |
| N/C                            | 11  |
| Pwr Gnd                        | 12  |
| Gnd                            | 13  |
| N/C                            | 14  |
| Output                         | 15  |
| N/C                            | 16  |
| V <sub>c</sub>                 | 17  |
| V <sub>cc</sub>                | 18  |
| N/C                            | 19  |
| VREF                           | 20  |

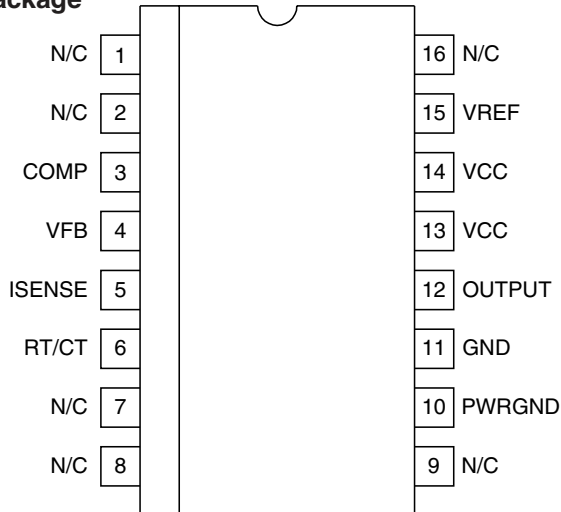
### SOIC-14 (TOP VIEW) D Package



### DIL-8, SOIC-8 (TOP VIEW) J or N, D8 Package



### SOIC-WIDE16 (TOP VIEW) DW 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;  $-40^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$  for the UC284xAQ;  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$  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. |                        |
| <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.   | 4.9             |      | 5.1  | 4.82    |      | 5.18 | V                      |
| Output Noise Voltage         | $10\text{Hz} \leq f \leq 10\text{kHz}$<br>$T_J = 25^{\circ}\text{C}$ (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                      |
| Discharge Current            | $T_J = 25^{\circ}\text{C}$ , $V_{PIN 4} = 2\text{V}$ (Note 8)                 | 7.8             | 8.3  | 8.8  | 7.8     | 8.3  | 8.8  | mA                     |
|                              | $V_{PIN 4} = 2\text{V}$ (Note 8)  | 7.5             |      | 8.8  | 7.6     |      | 8.8  | mA                     |
| <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         | $T_J = 25^{\circ}\text{C}$ (Note 2)   | 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                         | (Note 3, Note 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)                                     |                 | 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                     |
| <b>Output Section</b>        |   |                 |      |      |         |      |      |                        |
| Output Low Level             | $I_{SINK} = 20\text{mA}$  |                 | 0.1  | 0.4  |         | 0.1  | 0.4  | V                      |
|                              | $I_{SINK} = 200\text{mA}$   |                 | 15   | 2.2  |         | 15   | 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                     |
| UVLO Saturation              | $V_{CC} = 5\text{V}$ , $I_{SINK} = 10\text{mA}$                               |                 | 0.7  | 1.2  |         | 0.7  | 1.2  | V                      |

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| PARAMETER                            | TEST CONDITIONS                   | UC184xA\UC284xA |      |      | UC384xA |      |      | UNITS |
|--------------------------------------|-----------------------------------|-----------------|------|------|---------|------|------|-------|
|                                      |                                   | MIN.            | TYP. | MAX. | MIN.    | TYP. | MAX. |       |
| <b>Under-Voltage Lockout Section</b> |                                   |                 |      |      |         |      |      |       |
| 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     |
| <b>PWM Section</b>                   |                                   |                 |      |      |         |      |      |       |
| Maximum Duty Cycle                   | x842A/3A                          | 94              | 96   | 100  | 94      | 96   | 100  | %     |
|                                      | x844A/5A                          | 47              | 48   | 50   | 47      | 48   | 50   | %     |
| Minimum Duty Cycle                   |                                   |                 |      | 0    |         |      | 0    | %     |
| <b>Total Standby Current</b>         |                                   |                 |      |      |         |      |      |       |
| Start-Up Current                     |                                   |                 | 0.3  | 0.5  |         | 0.3  | 0.5  | mA    |
| Operating Supply Current             | $V_{PIN2} = V_{PIN3} = 0\text{V}$ |                 | 11   | 17   |         | 11   | 17   | mA    |
| Vcc Zener Voltage                    | $I_{CC} = 25\text{mA}$            | 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 Vcc 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.

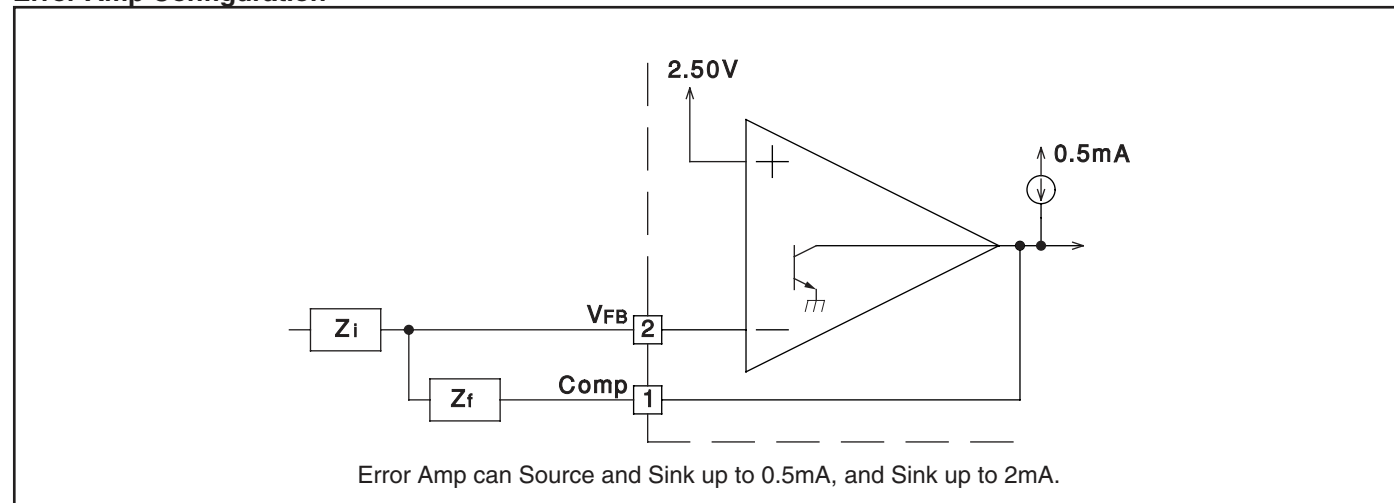
**Note 7:** "Temperature stability, sometimes referred to as average temperature coefficient, is described by the equation:

$$\text{Temp Stability} = \frac{V_{REF}(\text{max}) - V_{REF}(\text{min})}{T_J(\text{max}) - T_J(\text{min})}. V_{REF}(\text{max}) \text{ and } V_{REF}(\text{min}) \text{ are the maximum \& minimum reference volt-}$$

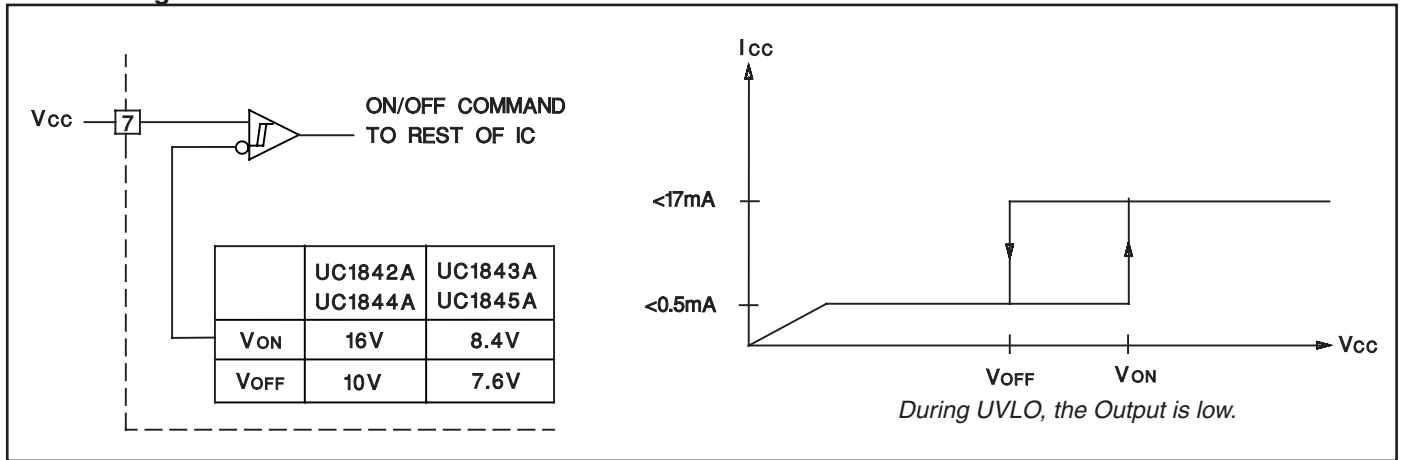
age measured over the appropriate temperature range. Note that the extremes in voltage do not necessarily occur at the extremes in temperature."

**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.

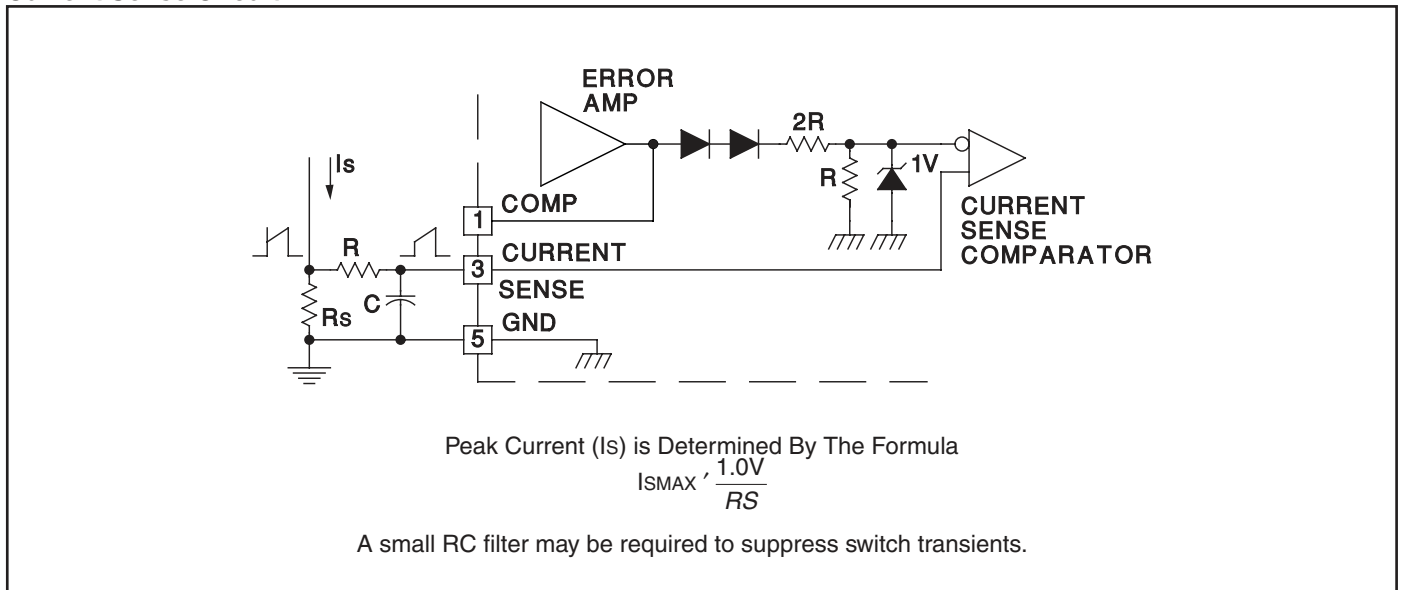
### Error Amp Configuration



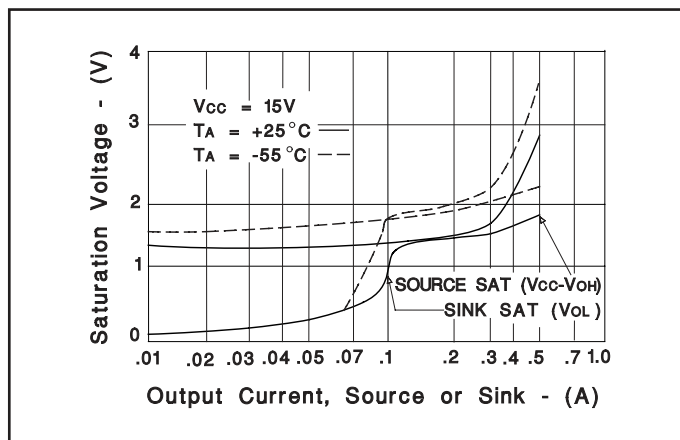
**Under-Voltage Lockout**



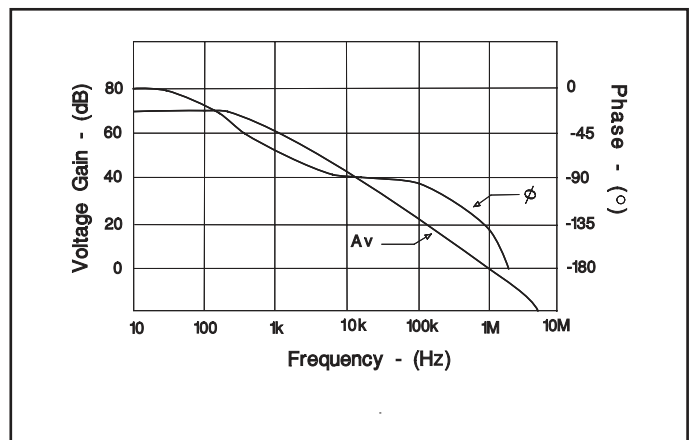
**Current Sense Circuit**



**Output Saturation Characteristics**

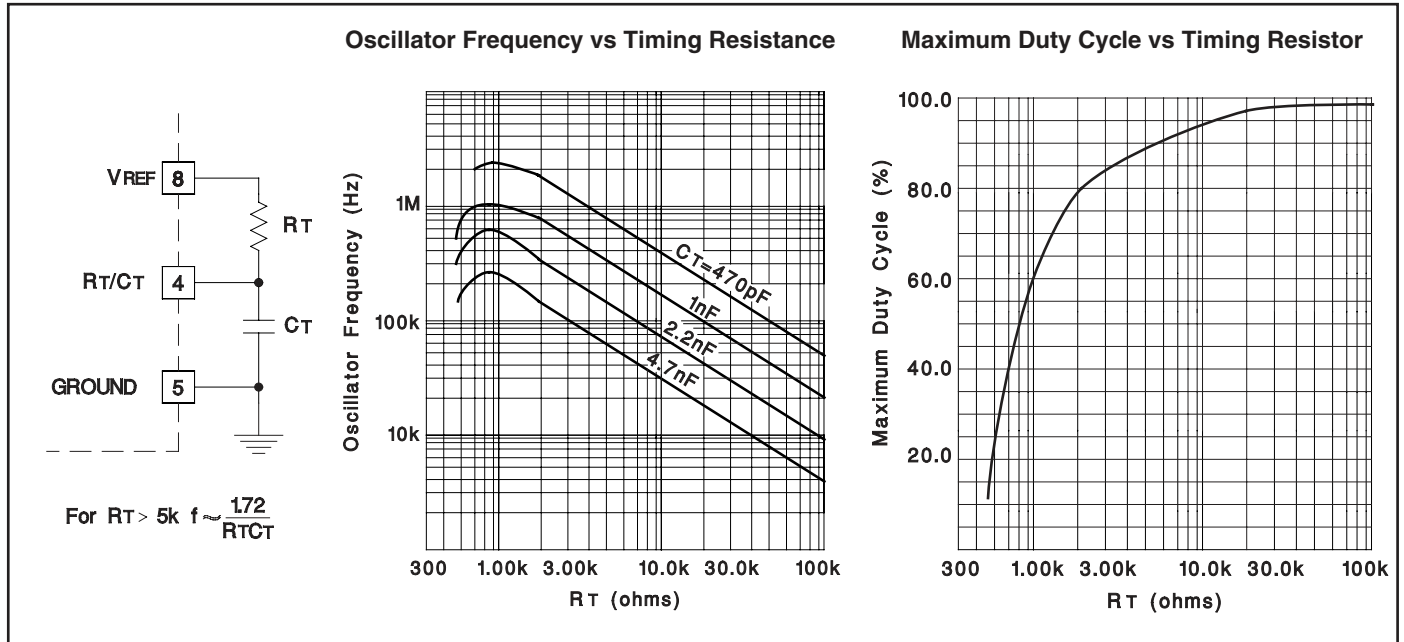


**Error Amplifier Open-Loop Frequency Response**

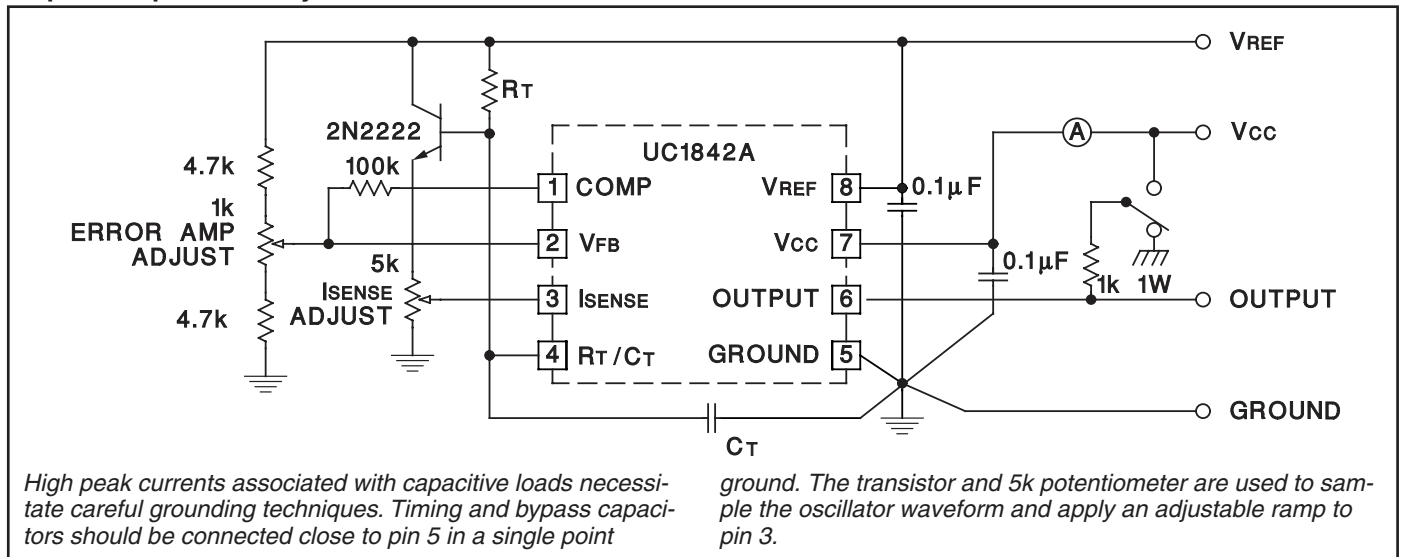


APPLICATIONS DATA (cont.)

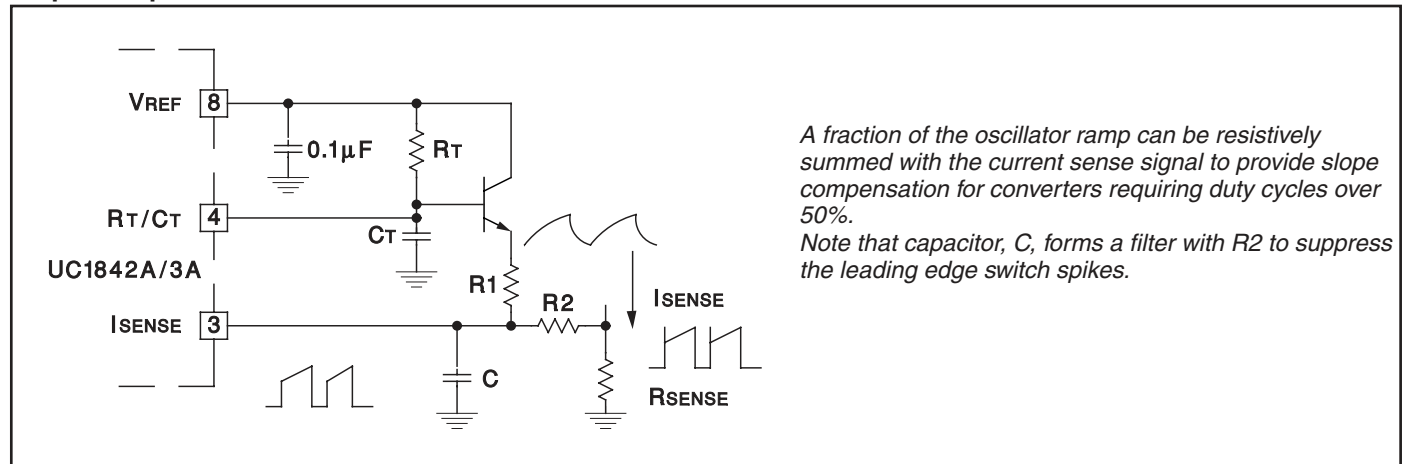
Oscillator Section



Open-Loop Laboratory Test Fixture

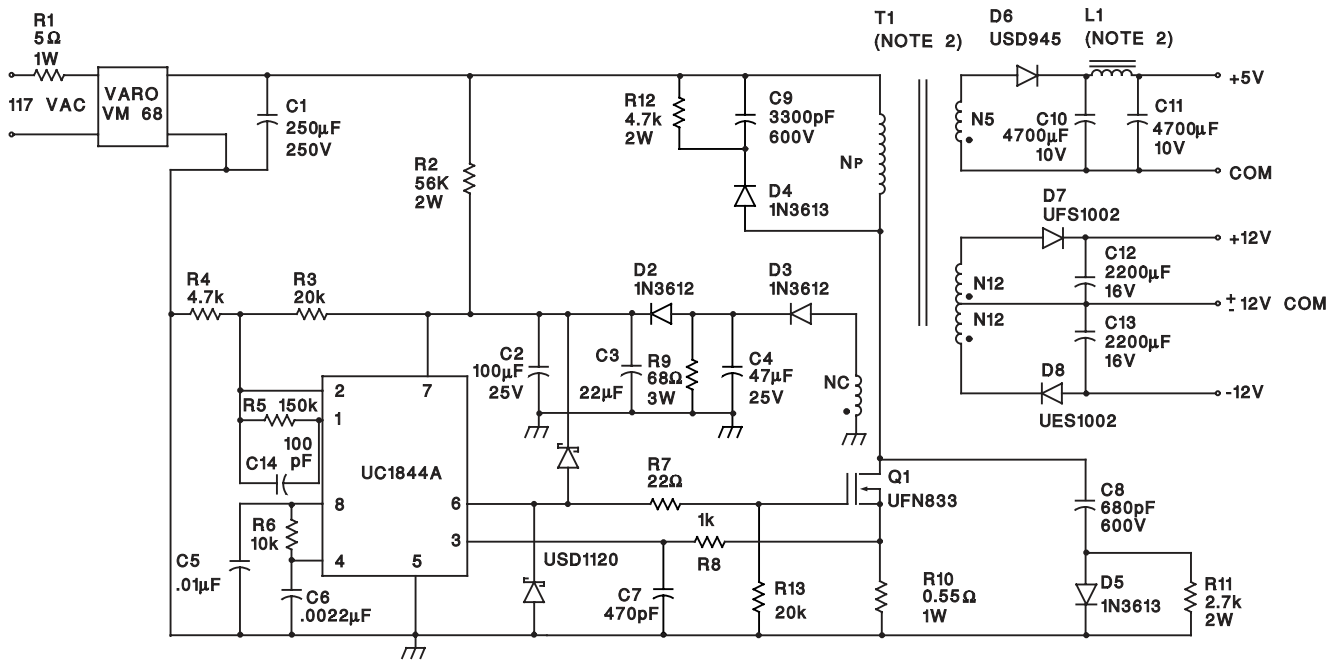


Slope Compensation



APPLICATIONS DATA (cont.)

Off-line Flyback Regulator



Power Supply Specifications

- |                         |                                |                                 |
|-------------------------|--------------------------------|---------------------------------|
| 1. Input Voltage        | 95VAC to 130VA<br>(50 Hz/60Hz) | 5. Output Voltage:              |
| 2. Line Isolation       | 3750V                          | A. +5V, ±5%; 1A to 4A load      |
| 3. Switching Frequency  | 40kHz                          | Ripple voltage: 50mV P-P Max    |
| 4. Efficiency Full Load | 70%                            | 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   |