

CURRENT MODE PWM CONTROLLER

DESCRIPTION

The UC284x and UC384x are fixed frequency current mode PWM controller. They are specially designed for OFF-Line and DC to DC converter applications with a minimal external components. Internally implemented circuits include a trimmed oscillator for precise duty cycle control, a temperature compensated reference, high gain error amplifier, current sensing comparator, and a high current totem pole output ideally suited for driving a power MOSFET. Protection circuitry includes built under voltage lockout and current limiting.

The UC2842/44, UC3842/44 have UVLO thresholds of 16 V (on) and 10 V (off). The corresponding thresholds for the UC2843/45, UC3843/45 are 8.4V (on) and 7.6V (off). The UC2842/43, UC3842/43 can operate within 100% duty cycle. The UC2844/45, UC3844/45 can operate within 50% duty cycle.

The UC2842/44/44/45 is characterized for operation from $T_A = -40^{\circ}\text{C}$ to 85°C . The UC3842/43/44/45 is characterized for operation from $T_A = 0^{\circ}\text{C}$ to 70°C .

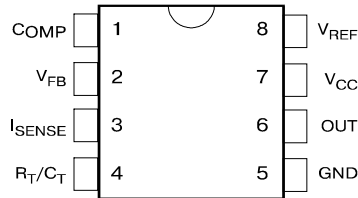
FEATURES

- Low Start-Up and Operating Current
- High Current Totem Pole Output
- Under voltage Lockout With Hysteresis
- Operating Frequency Up To 500KHz

ORDERING INFORMATION

| DEVICE | Package Type | MARKING | Packing | Packing Qty |
|------------|--------------|---------|---------|-------------|
| UC2842N | DIP8 | UC2842 | TUBE | 2000/box |
| UC2843N | DIP8 | UC2843 | TUBE | 2000/box |
| UC2844N | DIP8 | UC2844 | TUBE | 2000/box |
| UC2845N | DIP8 | UC2845 | TUBE | 2000/box |
| UC2842M/TR | SOP8 | UC2842 | REEL | 2500/reel |
| UC2843M/TR | SOP8 | UC2843 | REEL | 2500/reel |
| UC2844M/TR | SOP8 | UC2844 | REEL | 2500/reel |
| UC2845M/TR | SOP8 | UC2845 | REEL | 2500/reel |
| UC3842N | DIP8 | UC3842 | TUBE | 2000/box |
| UC3843N | DIP8 | UC3843 | TUBE | 2000/box |
| UC3844N | DIP8 | UC3844 | TUBE | 2000/box |
| UC3845N | DIP8 | UC3845 | TUBE | 2000/box |
| UC3842M/TR | SOP8 | UC3842 | REEL | 2500/reel |
| UC3843M/TR | SOP8 | UC3843 | REEL | 2500/reel |
| UC3844M/TR | SOP8 | UC3844 | REEL | 2500/reel |
| UC3845M/TR | SOP8 | UC3845 | REEL | 2500/reel |

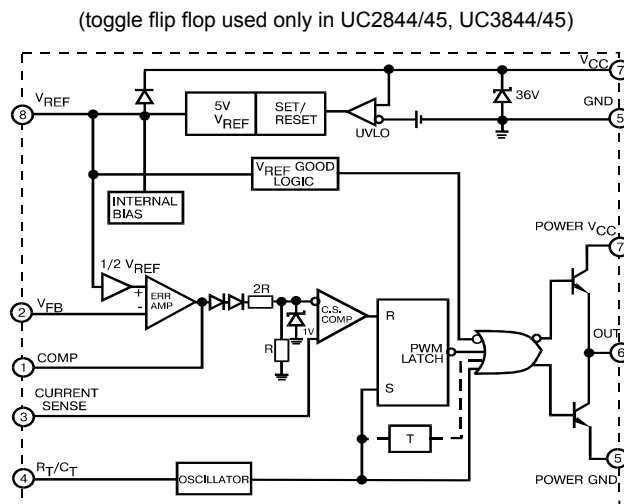
PIN CONNECTION
(TOP VIEW)



PIN FUNCTION

| N | FUNCTION | DESCRIPTION |
|---|--------------------------------|---|
| 1 | COMP | This pin is the Error Amplifier output and is made for loop compensation. |
| 2 | V _{FB} | This is the inverting input of the Error Amplifier. It is normally connected to the switching power supply output through a resistor divider. |
| 3 | I _{SENSE} | A voltage proportional to inductor current is connected to this input. The PWM uses this information to terminate the output switch conduction. |
| 4 | R _T /C _T | The oscillator frequency and maximum Output duty cycle are programmed by connecting resistor R _T to V _{ref} and capacitor C _T to ground. |
| 5 | GROUND | This pin is the combined control circuitry and power ground. |
| 6 | OUTPUT | This output directly drives the gate of a power MOSFET. Peak currents up to 1A are sourced and sink by this pin. |
| 7 | V _{CC} | This pin is the positive supply of the integrated circuit. |
| 8 | V _{ref} | This is the reference output. It provides charging current for capacitor C _T through resistor R _T . |

BLOCK DIAGRAM



Absolute Maximum Ratings

| Characteristic | Symbol | Value | Unit |
|--|--------------------------|-------------|------|
| Supply Voltage (low impedance source) | V _{CC} | 30 | V |
| Output Current | I _O | ±1 | A |
| Input Voltage (Analog Inputs pins 2,3) | V _I | -0.3 to 5.5 | V |
| Error Amp Output Sink Current | I _{SINK (E.A.)} | 10 | mA |
| Power Dissipation (T _A =25°C) | P _O | 1 | W |
| Storage Temperature Range | T _{stg} | -65 to 150 | °C |
| Lead Temperature (soldering 5 sec.) | T _L | 260 | °C |

Electrical characteristics (* $V_{CC}=15V$, $R_T=10k\Omega$, $C_T=3.3nF$, $T_A=0^\circ C$ to $+70^\circ C$, unless otherwise specified)

| Characteristics | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|--------------------------|---|------|------|------|---------|
| Reference Section | | | | | | |
| Reference Output Voltage | V_{REF} | $T_J = 25^\circ C$, $I_{REF} = 1\text{ mA}$ | 4.9 | 5.0 | 5.1 | V |
| Line Regulation | ΔV_{REF} | $12V \leq V_{CC} \leq 25\text{ V}$ | | 6.0 | 20 | mV |
| Load Regulation | ΔV_{REF} | $1\text{ mA} \leq I_{REF} \leq 20\text{ mA}$ | | 6.0 | 25 | |
| Short Circuit Output Current | I_{SC} | $T_A = 25^\circ C$ | | -100 | -180 | mA |
| Oscillator Section | | | | | | |
| Oscillation Frequency | f | $T_J = 25^\circ C$ | 47 | 52 | 57 | KHz |
| Frequency Change with Voltage | $\Delta f/\Delta V_{CC}$ | $12V \leq V_{CC} \leq 25\text{ V}$ | | 0.05 | 1.0 | % |
| Oscillator Amplitude | $V_{(OSC)}$ | (peak to peak) | | 1.6 | | V |
| Error Amplifier Section | | | | | | |
| Input Bias Current | I_{BIAS} | $V_{FB}=3V$ | | -0.1 | -2 | μA |
| Input Voltage | $V_{I(E.A)}$ | $V_{pin1} = 2.5V$ | 2.42 | 2.5 | 2.58 | V |
| Open Loop Voltage Gain | A_{VOL} | $2V \leq V_0 \leq 4V$ | 65 | 90 | | dB |
| Unity Gain Bandwidth | UGBW | $T_J=25^\circ C$, Note 3 | 0.5 | 0.6 | | MHz |
| Power Supply Rejection Ratio | PSRR | $12V \leq V_{CC} \leq 25\text{ V}$ | 60 | 70 | | dB |
| Output Sink Current | I_{SINK} | $V_{pin2} = 2.7V$, $V_{pin1} = 1.1V$ | 2 | 7 | | mA |
| Output Source Current | I_{SOURCE} | $V_{pin2} = 2.3V$, $V_{pin1} = 5V$ | -0.5 | -1.0 | | mA |
| High Output Voltage | V_{OH} | $V_{pin2} = 2.3V$, $R_L = 15K\Omega$ to GND | 5.0 | 6.0 | | V |
| Low Output Voltage | V_{OL} | $V_{pin2} = 2.7V$, $R_L = 15K\Omega$ to PIN 8 | | 0.8 | 1.1 | |
| Current Sense Section | | | | | | |
| Gain | G_V | (Note 1 & 2) | 2.85 | 3.0 | 3.15 | V/V |
| Maximum Input Signal | $V_{I(MAX)}$ | $V_{pin1} = 5V$ (Note1) | 0.9 | 1.0 | 1.1 | V |
| Supply Voltage Rejection | SVR | $12V \leq V_{CC} \leq 25\text{ V}$ (Note 1) | | 70 | | dB |
| Input Bias Current | I_{BIAS} | $V_{pin3} = 3V$ | | -3.0 | -10 | μA |
| Output Section | | | | | | |
| Low Output Voltage | V_{OL} | $I_{SINK} = 20\text{ mA}$ | | 0.08 | 0.4 | V |
| | | $I_{SINK} = 200\text{ mA}$ | | 1.4 | 2.2 | |
| High Output Voltage | V_{OH} | $I_{SINK} = 20\text{ mA}$ | 13 | 13.5 | | |
| | | $I_{SINK} = 200\text{ mA}$ | 12 | 13.0 | | |
| Rise Time | t_R | $T_J = 25^\circ C$, $C_L = 1\text{ nF}$ (Note 3) | | 45 | 150 | nS |
| Fall Time | t_F | $T_J = 25^\circ C$, $C_L = 1\text{ nF}$ (Note 3) | | 35 | 150 | |
| Undervoltage Lockout Section | | | | | | |
| Start Threshold | $V_{TH(ST)}$ | UC2842/44,UC3842/44 | 14.5 | 16.0 | 17.5 | V |
| | | UC2843/45,UC3843/45 | 7.8 | 8.4 | 9.0 | |
| Min. Operating Voltage (After Turn On) | $V_{OPR(min)}$ | UC2842/44,UC3842/44 | 8.5 | 10 | 11.5 | V |
| | | UC2843/45,UC3843/45 | 7.0 | 7.6 | 8.2 | |
| PWM Section | | | | | | |
| Max. Duty Cycle | $D_{(MAX)}$ | UC2842/43,UC3842/43 | 95 | 97 | 100 | % |
| | | UC2844/45,UC3844/45 | 47 | 48 | 50 | |
| Min. Duty Cycle | $D_{(MAX)}$ | | | 0 | | |
| Total Standby Current | | | | | | |
| Start-Up Current | I_{ST} | UC3842/43/44/45 | | 0.17 | 0.3 | mA |
| Operating Supply Current | $I_{CC(OPR)}$ | $V_{pin3} = V_{pin2} = 0V$ | | 13 | 17 | |
| Zener Voltage | V_Z | $I_{CC}=25\text{ mA}$ | 30 | 38 | | V |

* Adjust V_{CC} above the start threshold before setting it to 15V.

Note 1: Parameter measured at trip point of latch with $V_{pin2}=0$.

Note 2: Gain defined as $A=\Delta V_{pin1}/\Delta V_{pin3}$; $0 \leq V_{pin3} \leq 0.8V$.

Note 3: These parameters, although guaranteed, are not 100% tested in production.

APPLICATION INFORMATION

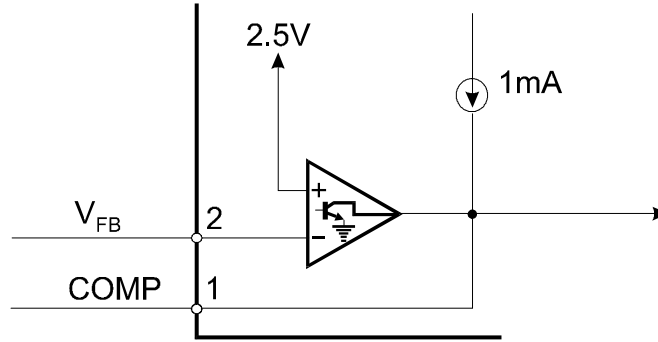
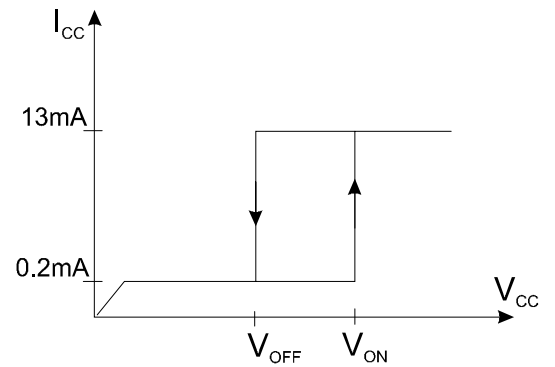
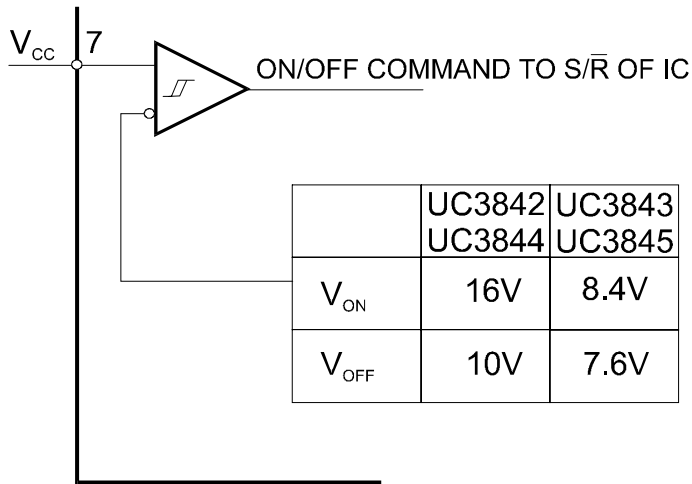
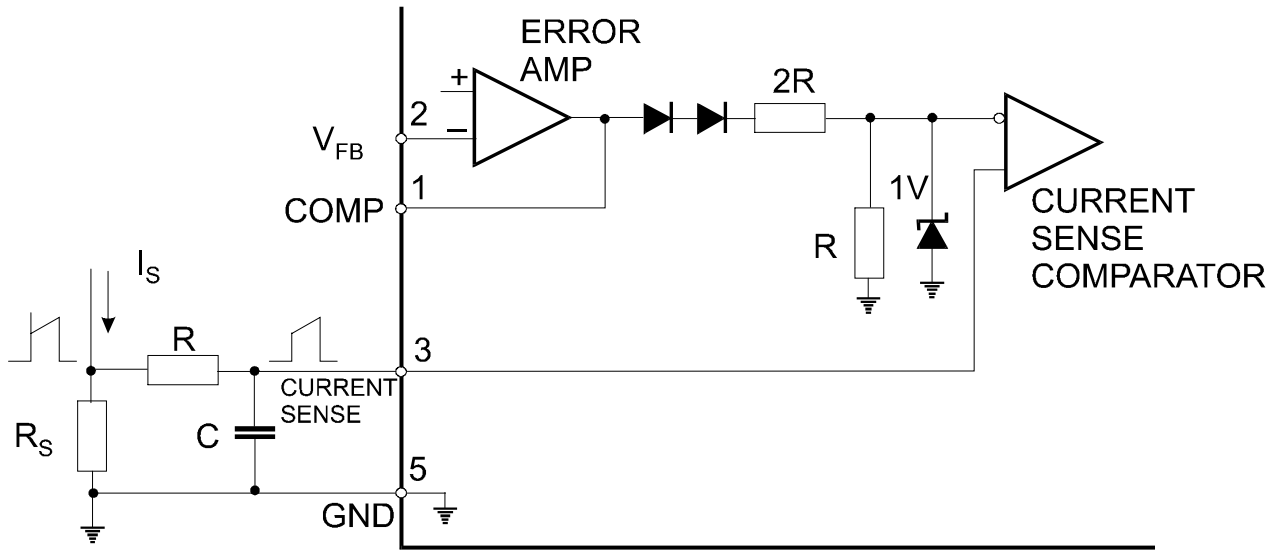


Figure 1. Error Amp Configuration



During UVLO, the Output is low

Figure 2. Under voltage Lockout



Peak current is determined by $I_{S\ max} \approx \frac{1.0V}{R_S}$

Figure 3. Current Sense Circuit

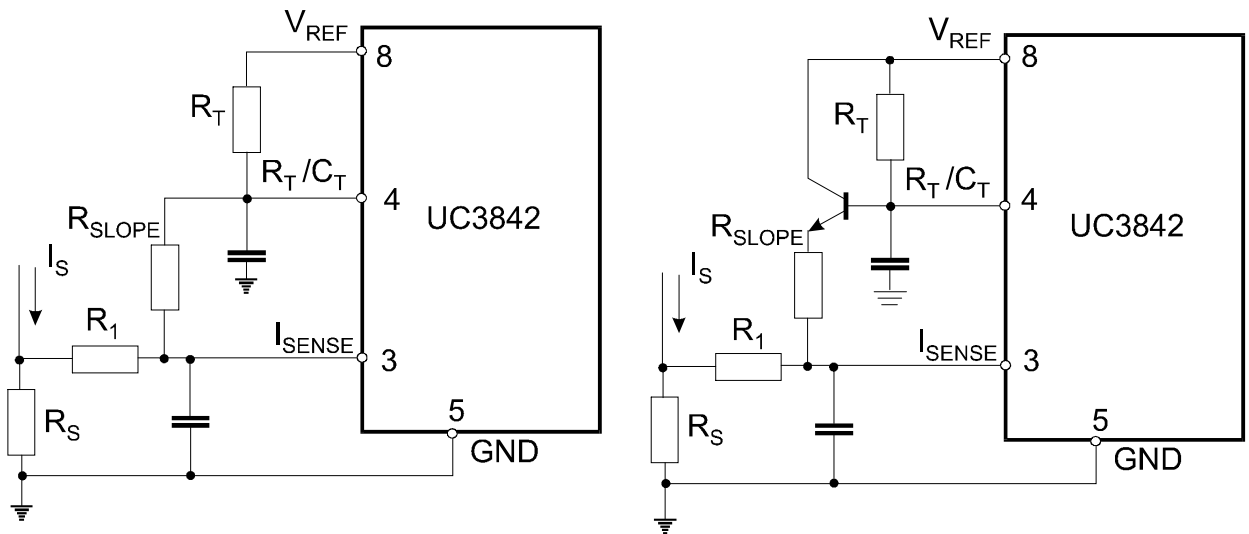
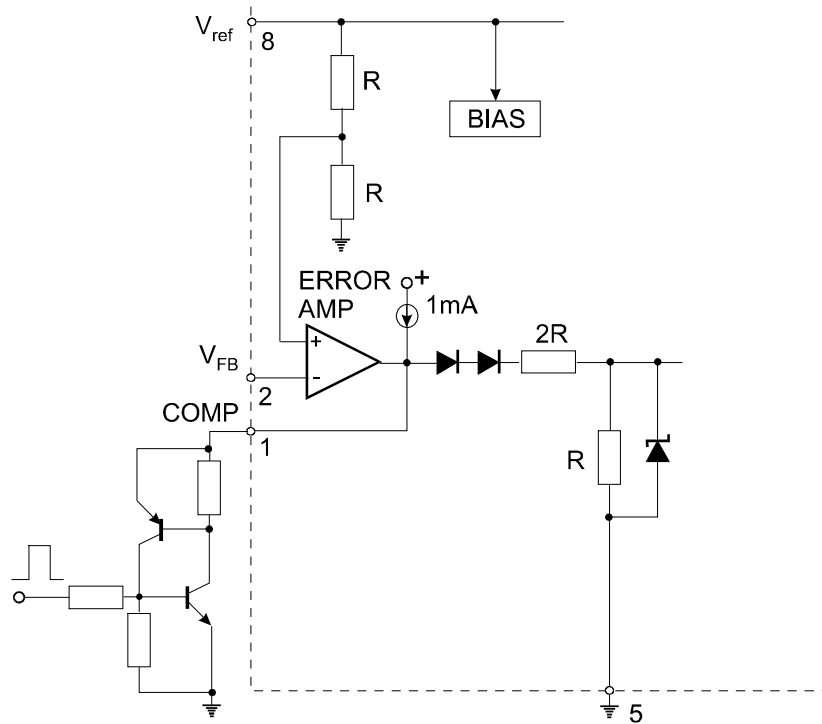
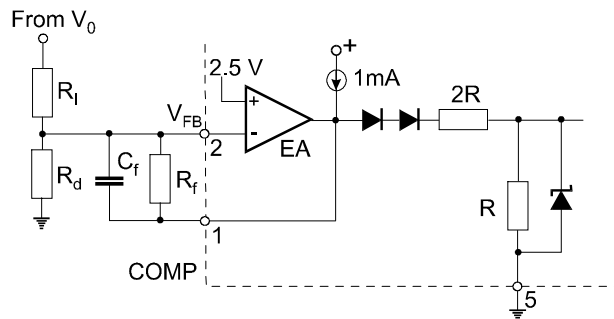


Figure 4. Slope Compensation Techniques

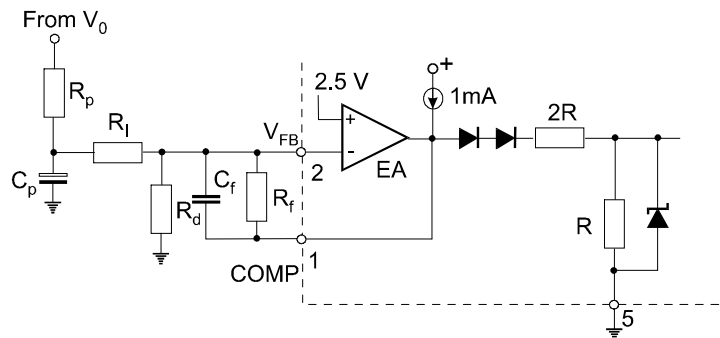


SCR must be selected for a holding current of less than 0.5mA.
The simple two transistor circuit can be used in place of the SCR as shown.

Figure 5. Latched Shutdown



Error Amp compensation circuit for stabilizing any current-mode topology except for boost and flyback converters operating with continuous inductor current.



Error Amp compensation circuit for stabilizing current-mode boost and flyback topologies operating with continuous inductor current.

Figure 6. Error Amplifier Compensation

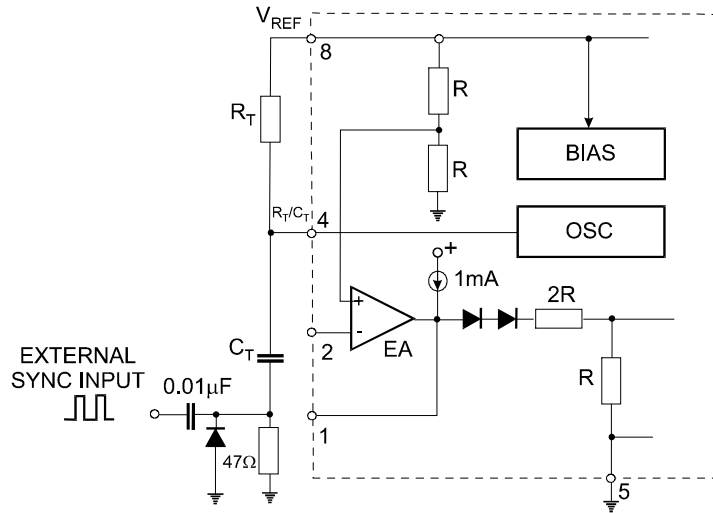


Figure 7. External Clock Synchronization

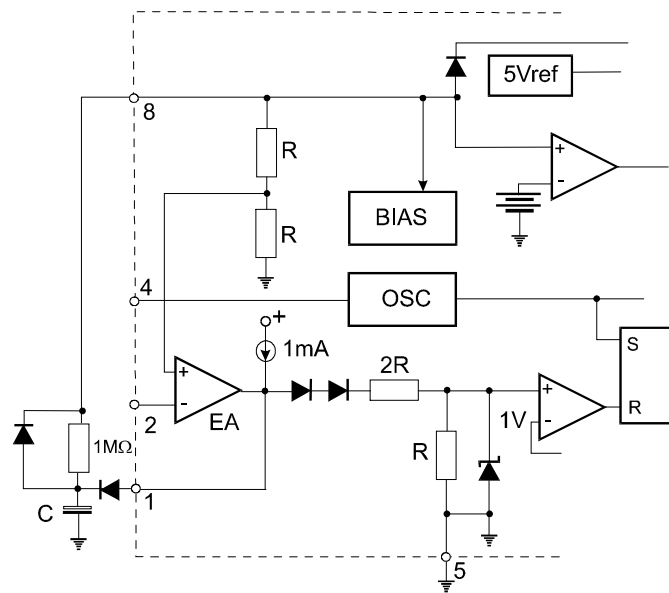


Figure 8. Soft-Start Circuit

TYPICAL PERFORMANCE CHARACTERISTICS

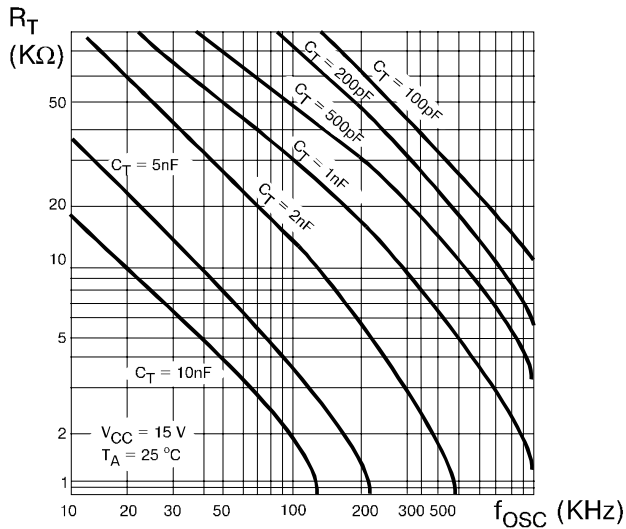


Figure 1. Timing Resistor vs. Oscillator Frequency

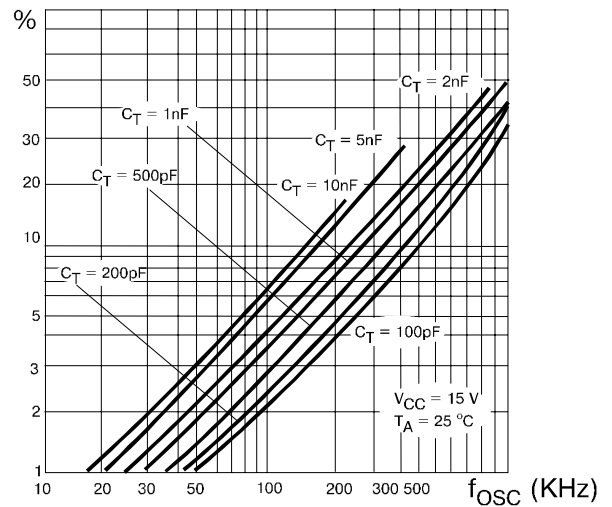


Figure 2. Output Dead-Time vs. Oscillator Frequency

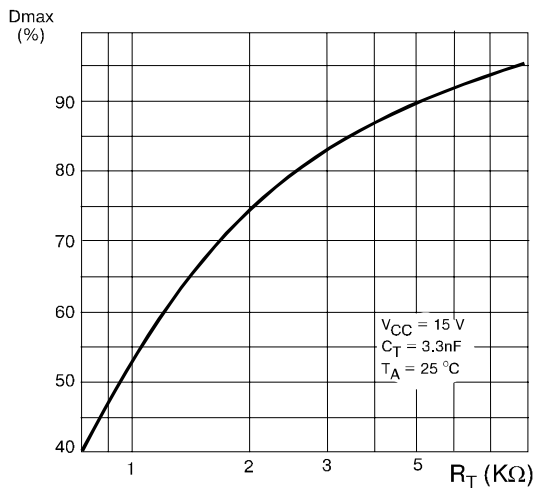


Figure 3. Maximum Output Duty Cycle vs. Timing Resistor (UC3842/43)

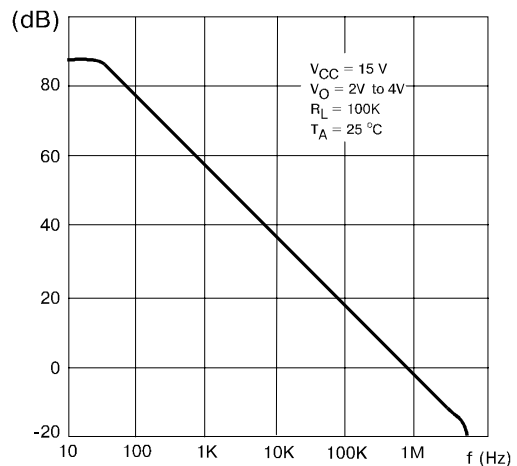


Figure 4. Error Amp Open-Loop Gain vs. Frequency

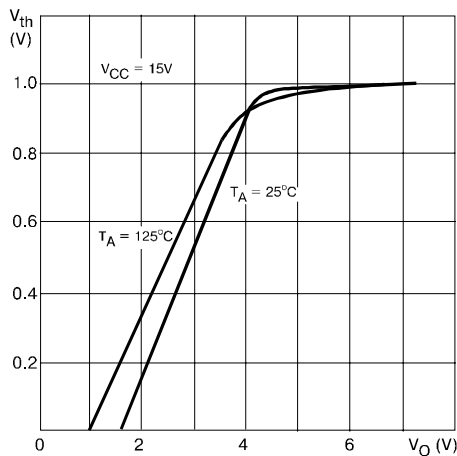


Figure 5. Current Sense Input Threshold vs. Error Amp Output Voltage

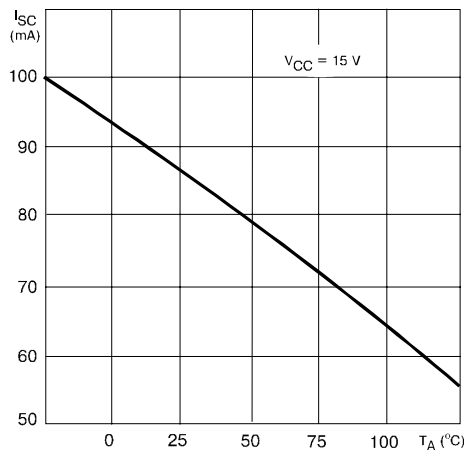


Figure 6. Reference Short Circuit Current vs. Temperature

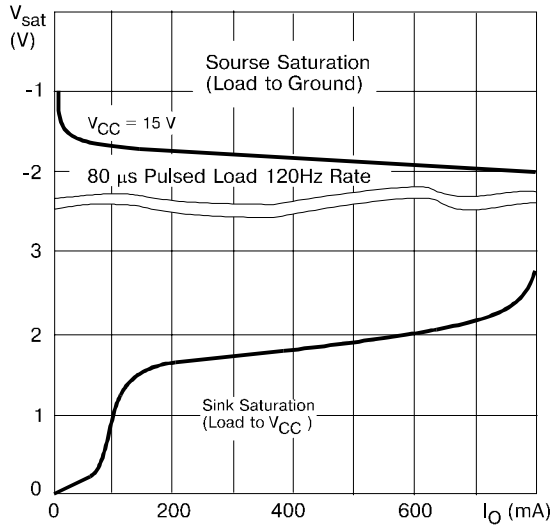


Figure 7. Output Saturation Voltage vs. Load Current
 $T_A = 25^\circ\text{C}$

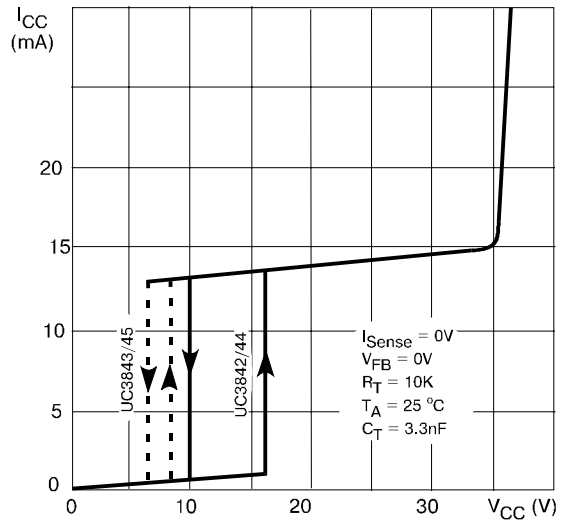


Figure 8. Supply Current vs. Supply Voltage

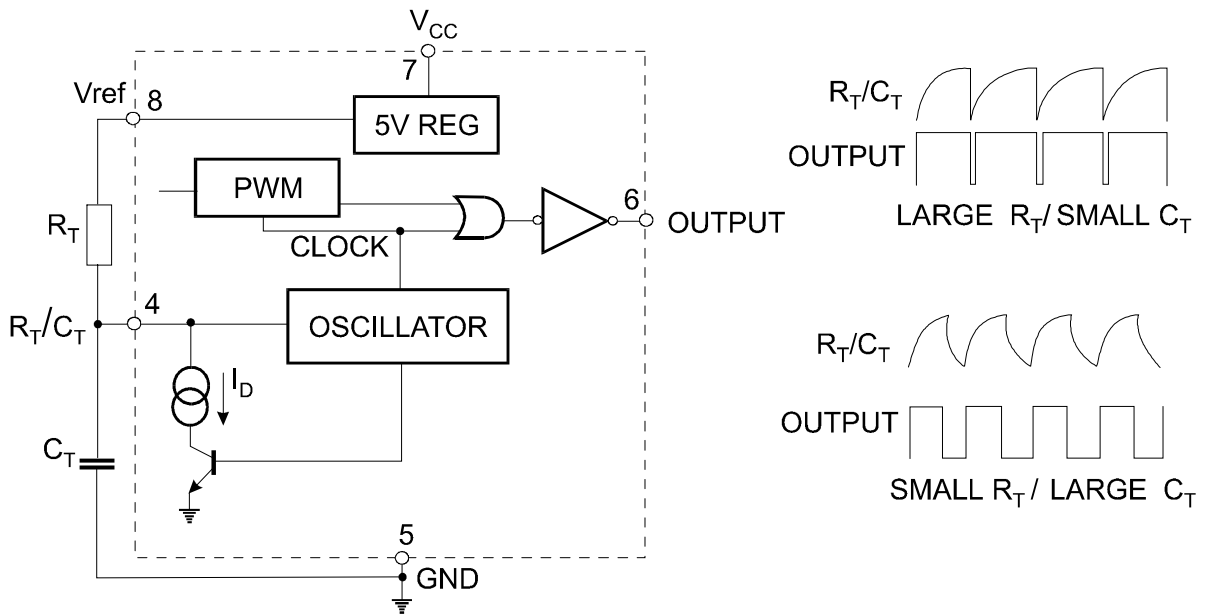
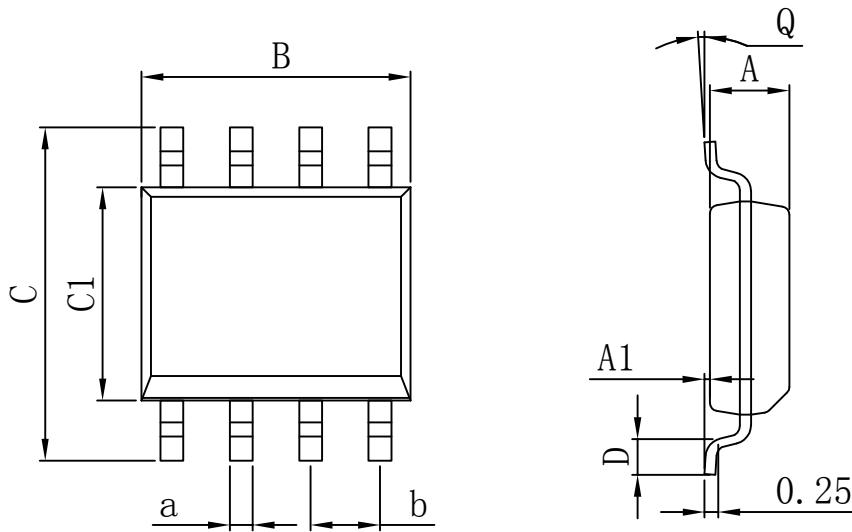


Figure 9. Oscillator and Output Waveforms

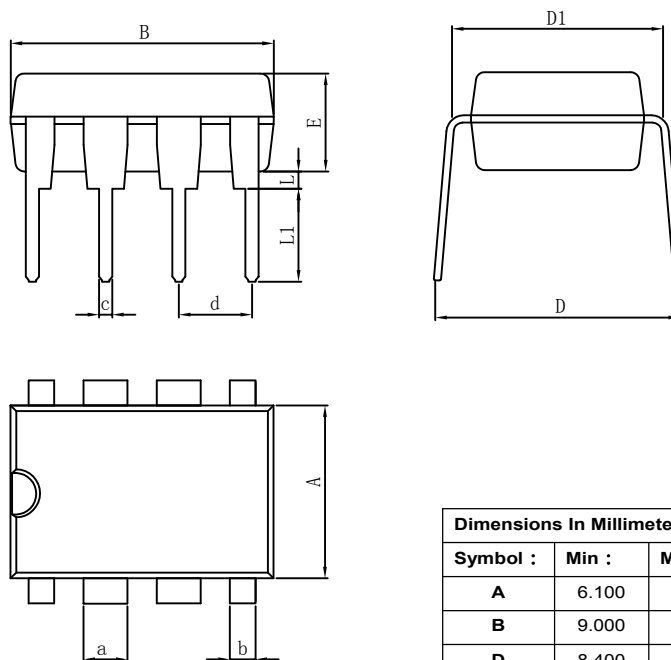
PACKAGE

SOP8



| Dimensions In Millimeters | | | | | |
|---------------------------|-------|-------|----------|-----------|-------|
| Symbol : | Min : | Max : | Symbol : | Min : | Max : |
| A | 1.225 | 1.570 | D | 0.400 | 0.950 |
| A1 | 0.100 | 0.250 | Q | 0° | 8° |
| B | 4.800 | 5.100 | a | 0.420 TYP | |
| C | 5.800 | 6.250 | b | 1.270 TYP | |
| C1 | 3.800 | 4.000 | | | |

DIP8



| Dimensions In Millimeters | | | | | |
|---------------------------|-------|-------|----------|-----------|-------|
| Symbol : | Min : | Max : | Symbol : | Min : | Max : |
| A | 6.100 | 6.680 | L1 | 3.000 | 3.600 |
| B | 9.000 | 9.500 | a | 1.524 TYP | |
| D | 8.400 | 9.000 | b | 0.889 TYP | |
| D1 | 7.420 | 7.820 | c | 0.457 TYP | |
| E | 3.100 | 3.550 | d | 2.540 TYP | |
| L | 0.500 | 0.700 | | | |

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