

Description

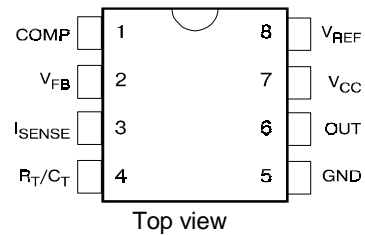
The 3842/43/44/45 are fixed frequency current mode PWM controller. They are specially designed for OFF-Line and DC to DC converter applications with a minimal external components. Internally implemented circuits include a trimmed oscillator for precise duty cycle control, a temperature compensated reference, 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 undervoltage lockout and current limiting. The 3842 and 3844 have UVLO thresholds of 16 V (on) and 10 V (off). The corresponding thresholds for the 3843/45 are 8.4V (on) and 7.6V (off). The 3842) and 3843 can operate within 100% duty cycle. The 3844 and 3845 can operate within 50% duty cycle.

The 384X has Start-Up Current 0.17mA (typ).

Features

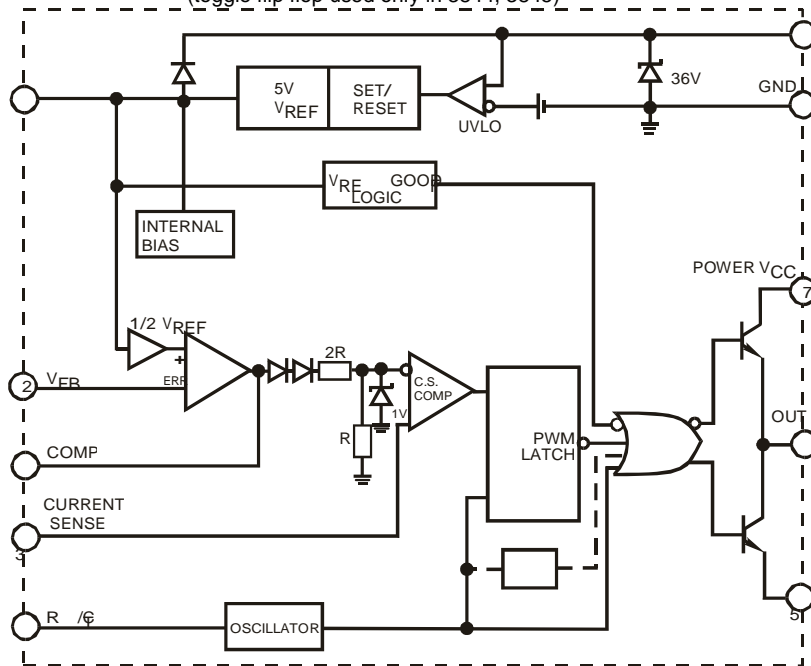
- Low Start-Up and Operating Current
- High Current Totem Pole Output
- Undervoltage Lockout With Hysteresis
- Operating Frequency Up To 300KHz (384X)
500KHz (384X)

Pin Connection



Block diagram

(toggle flip flop used only in 3844, 3845)



Absolute Maximum Ratings

| Symbol | Parameter | Maximum | Units |
|-----------------|---|-------------|-------------|
| V_{CC} | Supply Voltage (low impedance source) | 30 | V |
| I_o | Output Current | ± 1 | A |
| V_i | Input Voltage (Analog Inputs pins 2,3) | -0.3 to 5.5 | V |
| $I_{SINK(E.A)}$ | Error Amp Output Sink Current | 10 | mA |
| P_o | Power Dissipation ($T_A=25^{\circ}C$) | 1 | W |
| Tstg | Storage Temperature Range | -65 to 150 | $^{\circ}C$ |
| T_L | Lead Temperature (soldering 5 sec.) | 260 | $^{\circ}C$ |

Electrical characteristics

(*V_{CC}=15V, R_T=10kΩ, C_T=3.3nF, T_A=0°C to +70°C, unless otherwise specified)

| Characteristics | Symbol | Test Conditions | Min | Typ | Max | Units | |
|---|-----------------------|--|------|------|------|-------|-----|
| Reference Section | | | | | | | |
| Reference Output Voltage | V _{REF} | T _J = 25°C, I _{REF} = 1 mA | 4.9 | 5.0 | 5.1 | V | |
| Line Regulation | ΔV _{REF} | 12V ≤ V _{CC} ≤ 25 V | | 6.0 | 20 | mV | |
| Load Regulation | ΔV _{REF} | 1 mA ≤ I _{REF} ≤ 20mA | | 6.0 | 25 | | |
| Short Circuit Output Current | I _{SC} | T _A = 25°C | | -100 | -180 | mA | |
| Oscillator Section | | | | | | | |
| Oscillation Frequency | f | T _J = 25°C | 384X | 47 | 50 | 57 | KHz |
| | | | 384X | 47 | 52 | 57 | |
| Frequency Change with Voltage | Δf/ΔV _{CC} | 12V ≤ V _{CC} ≤ 25 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 ≤ V _o ≤ 4V | 65 | 90 | | dB | |
| Power Supply Rejection Ratio | PSRR | 12V ≤ V _{CC} ≤ 25 V | 60 | 70 | | | |
| 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 = 15KΩ to GND | 5.0 | 6.0 | | V | |
| Low Output Voltage | V _{OL} | V _{pin2} = 2.7V, R _L = 15KΩ 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 ≤ V _{CC} ≤ 25 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 mA | | 0.08 | 0.4 | V | |
| | | I _{SINK} = 200 mA | | 1.4 | 2.2 | | |
| High Output Voltage | V _{OH} | I _{SINK} = 20 mA | 13 | 13.5 | | | |
| | | I _{SINK} = 200 mA | 12 | 13.0 | | | |
| Rise Time | t _r | T _J = 25°C, C _L = 1nF (Note 3) | | 45 | 150 | nS | |
| Fall Time | t _f | T _J = 25°C, C _L = 1nF (Note 3) | | 35 | 150 | | |
| Undervoltage Lockout Section | | | | | | | |
| Start Theshold | V _{TH(ST)} | 3842/44 | 14.5 | 16.0 | 17.5 | V | |
| | | 3843/45 | 7.8 | 8.4 | 9.0 | | |
| Min. Operating Voltage (After Turn On) | V _{OPR(min)} | 3842/44 | 8.5 | 10 | 11.5 | V | |
| | | 3843/45 | 7.0 | 7.6 | 8.2 | | |
| PWM Section | | | | | | | |
| Max. Duty Cycle | D _(MAX) | 3842/43 | 95 | 97 | 100 | % | |
| | | 3844/45 | 47 | 48 | 50 | | |
| Min. Duty Cycle | D _(MAX) | | | | 0 | | |
| Total Standby Current | | | | | | | |
| Start-Up Current | I _{ST} | 384X | | 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 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=ΔV_{pin1}/ΔV_{pin3} ; 0 ≤ V_{pin3} ≤ 0.8V.

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

Pin functions

| 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 . |

Application information

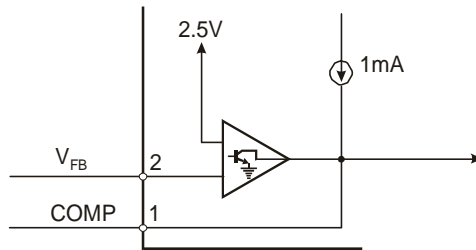


Figure 1. Error Amp Configuration

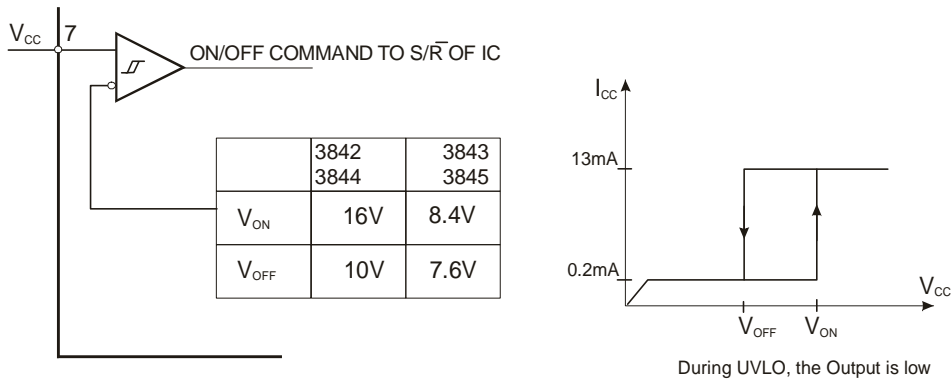


Figure 2. Undervoltage Lockout

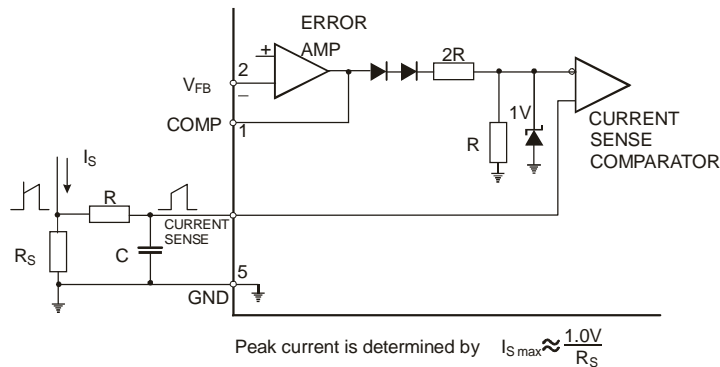


Figure 3. Current Sense Circuit

Typical Performance Characteristics

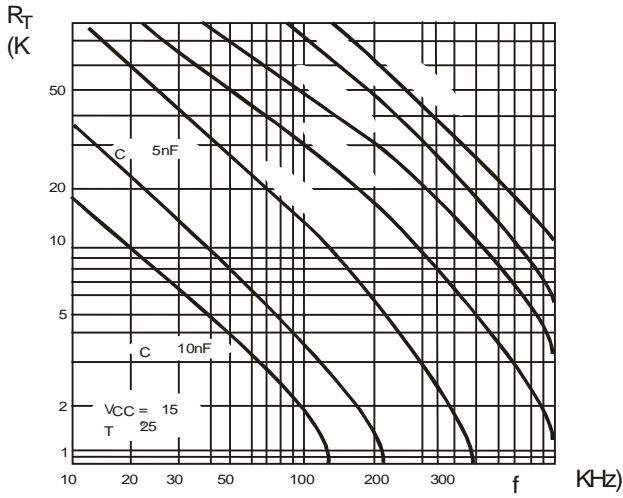


Figure 1. Timing Resistor vs. Oscillator Frequency.

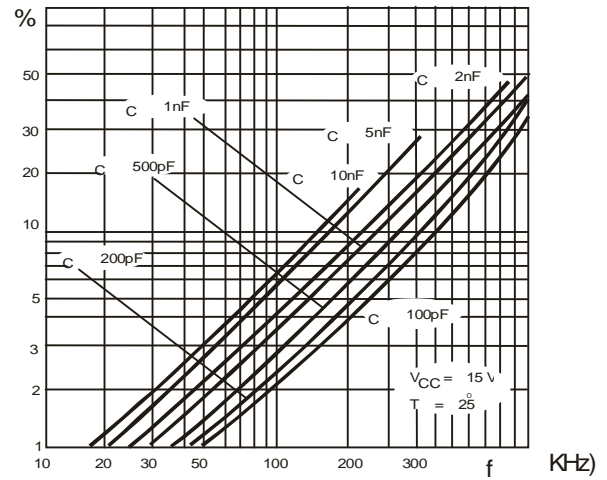


Figure 2. Output Dead-Time vs. Oscillator Frequency.

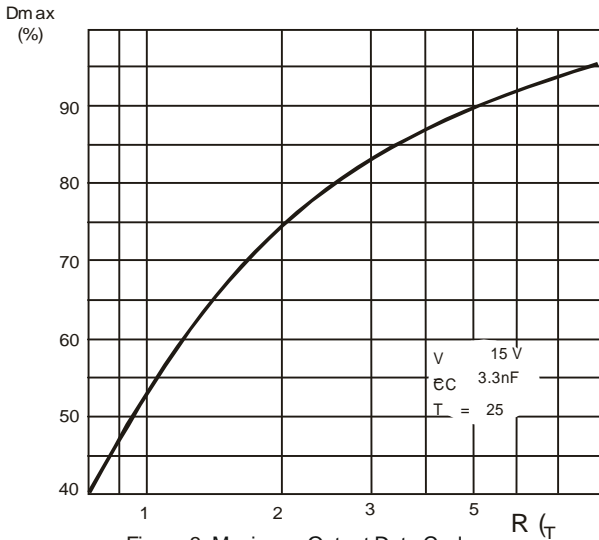


Figure 3. Maximum Output Duty Cycle vs. Timing Resistor (3842/43).

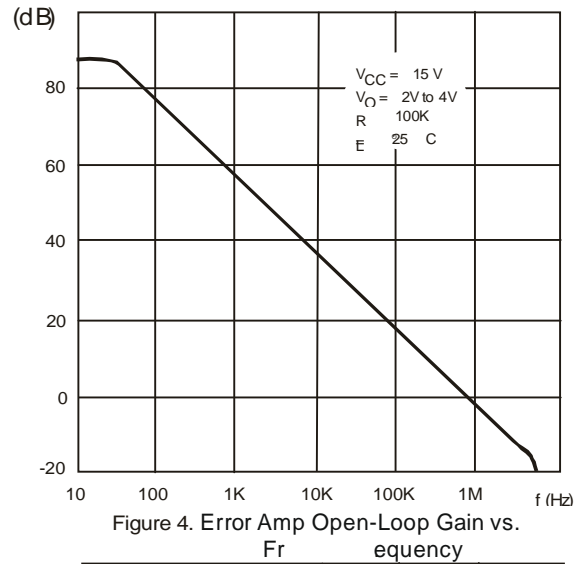


Figure 4. Error Amp Open-Loop Gain vs. Frequency.

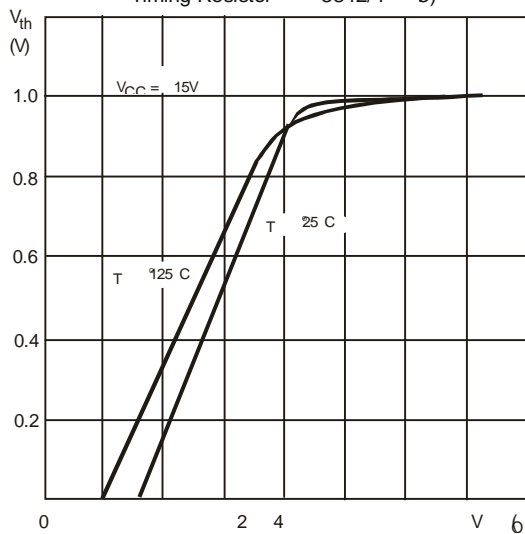


Figure 5. Current Sense Input Threshold vs. Error Amp Output Voltage.

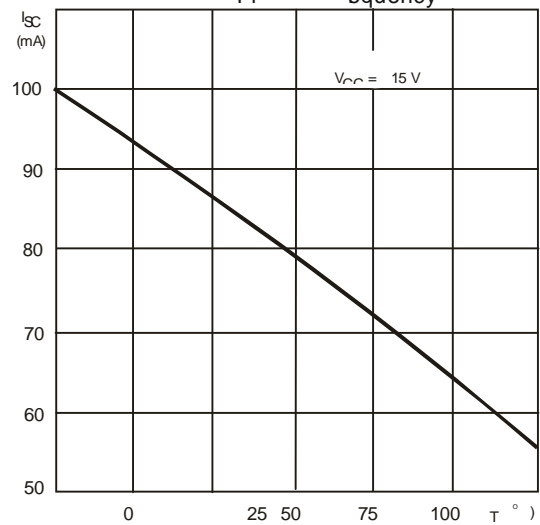


Figure 6. Reference Short Circuit Current vs. Temperature.

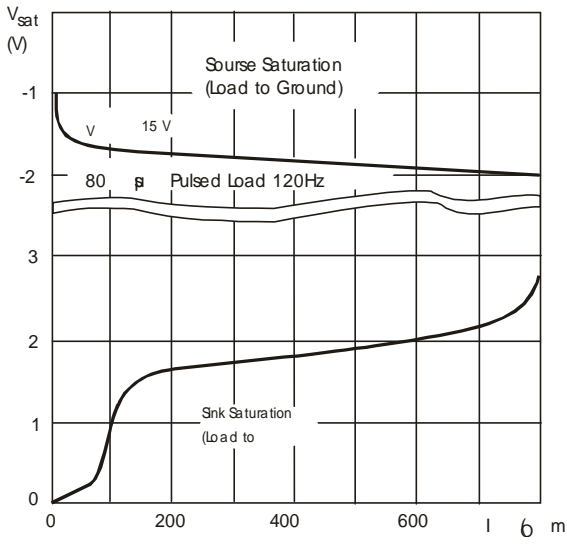


Figure 7 Output Saturation Voltage vs. Load Current

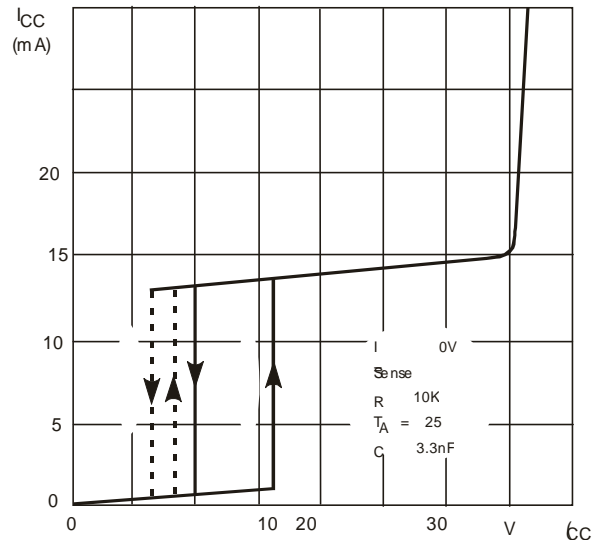


Figure 8 Supply Current vs. Supply Voltage

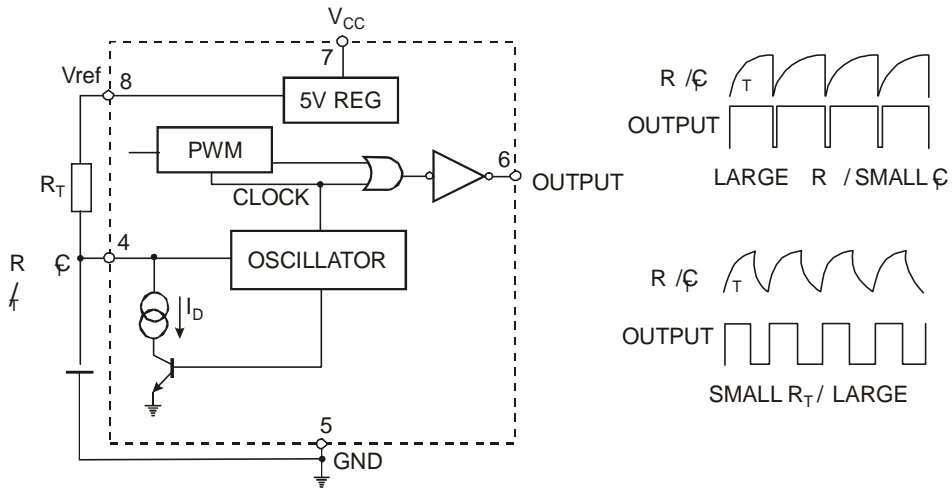


Figure 9. Oscillator and Output Waveforms