UC3842/43(B)

High Performance Current Mode Controller

Description

The UC3842B/43B series are high performance fixed frequency current mode controllers. They are specifically designed for Off-Line and DC-to-DC converter applications offering the designer a cost effective solution with minimal external components. These integrated circuits feature 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.

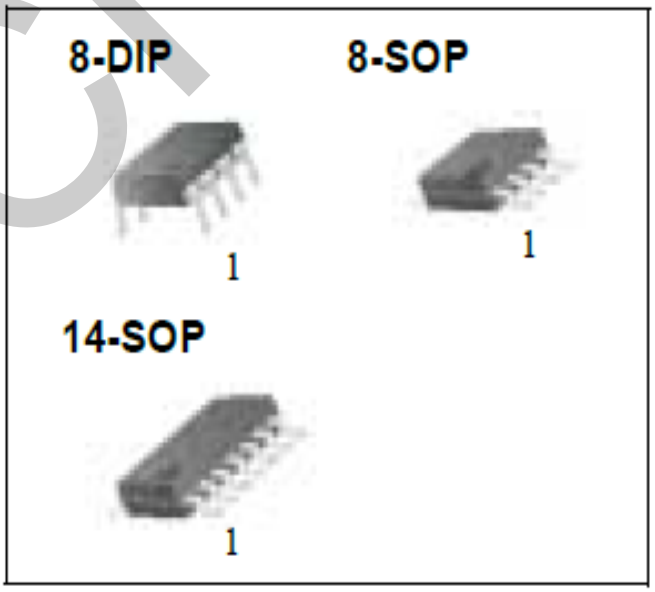
Also included are protective features consisting of input and reference under voltage lockouts each with hysteresis, cycle-by-cycle current limiting, programmable output dead time, and a latch for single pulse metering.

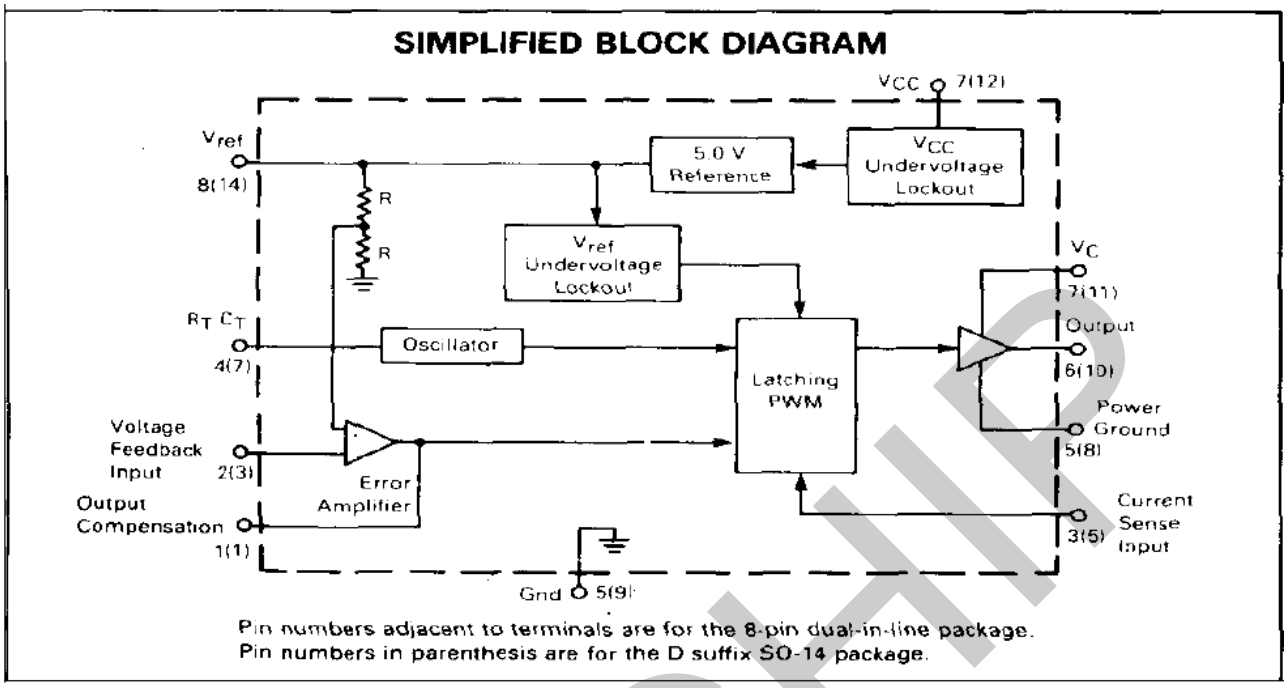
These devices are available in 8-pin dual-in-line ceramic and plastic packages as well as the 8-pin plastic surface mount (SO-8). And 14-pin plastic surface mount (SO-14). SO-14 package Figure Teng column output stage has a separate power and ground pins.

Difference between members of this series is the under-voltage lockout thresholds. The UC3842B has UVLO thresholds of 16 V (on) and 10 V (off), ideally suited for off-line converters. The corresponding thresholds for the UC3843B are 8.5 V and 7.9 V.

Feature

- Trimmed Oscillator Discharge Current for Precise Duty Cycle Control
- Current Mode Operation to 500 kHz
- Automatic Feed Forward Compensation
- Latching PWM for Cycle-By-Cycle Current Limiting
- Internally Trimmed Reference with Under voltage Lockout
- High Current Totem Pole Output
- Under voltage Lockout with hysteresis
- Low Start-Up and Operating Current





Absolute Maximum Ratings

Rating	Symbol	Value	Unit
Total Power Supply and Zenger Current	(I_{CC}+I_Z)	30	mA
Output Current, Source or Sink (Note 1)	I_O	1	A
Output Energy (Capacitive Load per Cycle)	w	5	uJ
Current Sense and Voltage Feedback Inputs	V_{in}	-0.3 to +5.5	V
Error Amp Output Sink Current	I_O	10	mA
Power Dissipation and Thermal Characteristics NF Suffix, Plastic Package Maximum Power Dissipation @ T_A=25℃ Thermal Resistance Junction to Air N Suffix, Plastic Package Maximum Power Dissipation @ T_A=25℃ Thermal Resistance Junction to Air	 P_D $R_{\theta JA}$ P_D $R_{\theta JA}$	 862 145 1.25 100	 mW ℃/W W ℃/W
Operating Junction Temperature	T_J	+150	℃
Operating Ambient Temperature	T_A	0 to +70	℃
Storage Temperature Range	T_{stg}	-65 to + 150	℃

Electrical Characteristics (VCC=15 V [Note 2], RT=10 k, CT=3.3 nF, TA=TLOW to THIGH [Note 3] unless otherwise noted)

Characteristic	UC3842B/43B				
	Symbol	Min	Typ	Max	Unit
Reference Section					
Reference Output Voltage (I_O=1.0 mA, T_J=25℃)	V_{ref}	4.9	5.0	5.1	V
Line Regulation (V_{CC}=12 V to 25 V)	Reg_{line}	—	2.0	20	mV
Load Regulation (I_O=1 mA to 20 mA)	Reg_{load}	—	3.0	25	mV
Temperature Stability	T_S	—	0.2	—	mV/℃
Total Output Variation over Line, Load, and	V_{ref}	4.82	—	5.18	V
Temperature Output Noise Voltage (f=10 Hz to 10 kHz,	V_n	—	50	—	μV
T =25℃) Long Term Stability (T_A=125℃ for 1000 Hours)	S	—	5.0	—	mV
Output Short Circuit Current	I_{SC}	-30	-85	-180	mA
Oscillator Section					
Oscillation Frequency					
T_J=25℃	f_{OSC}	47	52	57	kHz
TA=TLOW to THIGH		46	—	60	
Frequency Change with Voltage (V_{CC}=12 V to 25V)	$\Delta f_{OSC/\Delta V}$	—	0.2	1	%
Frequency Change with Temperature T_A=T_{LOW} to T_{HIGH}	$\Delta_{fOSC/\Delta V}$	—	0.5	—	%
Oscillator Voltage Swing (Peak-to-Peak)	V_{OSC}	—	1.6	—	V
Discharge Current (V_{OSC}=2.0 V) T_J=25℃ T_A=T_{LOW} to T_{HIGH}	I_{dischg}	 7.5 7.2	 8.4 —	 9.3 9.5	mA

Notes: 1. Maximum Package power dissipation limits must be observed.

2. Adjust VCC above the Start-Up threshold before setting to 15 V.

3. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible. TLOW = 0℃ THIGH = +70℃

4. This parameter is measured at the latch trip point with VFB = 0 V

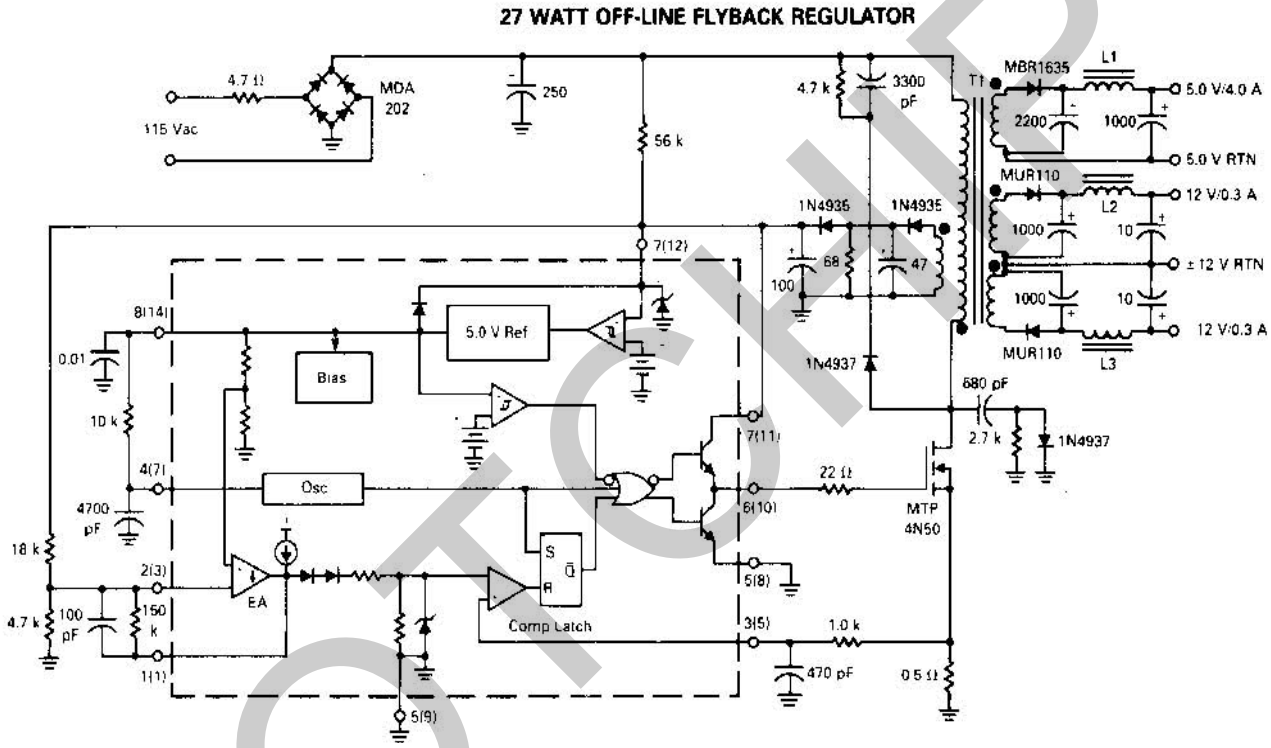
5. Comparator gain is defined as: $A_V = \Delta V_{OUTPUT/COMP} / \Delta V_{CURRENTSENSE}$

Electrical Characteristics (VCC=15 V [Note 2], RT=10 k, CT=3.3 nF, TA=TLOW to THIGH [Note 3] unless otherwise noted)

Characteristic		UC3842B/43B				
		Symbol	Min	TYP	Max	Unit
Error Amplifier Section						
Voltage Feedback Input (V_O=2.5 V)		V_{FB}	2.42	2.5	2.58	V
Input Bias Current (V_{FB}=5.0V)		I_{IB}	—	-0.1	-2	μA
Open-Loop Voltage Gain (V_O=2.0 V to 4.0 V)		A_{VOL}	65	90	—	dB
Unity Gain Bandwidth (T_J=25℃)		BW	0.7	1	—	MHz
Power Supply Rejection Ratio (V_{CC}=12 V to 25 V)		PSRR	60	70	—	dB
V		I_{Sink} I_{Source}	2 -0.5	12 -1	— —	mA
Output Voltage Swing High State (R_L=15 k to ground, V_{FB}=2.3 V) Low State (R_L=15 k to V_{ref}, V_{FB}=2.7 V)		V_{OH} V_{OL}	5 —	6.2 0.8	— 1.1	V
Current Sense Section						
Current Sense Input Voltage Gain (Notes 4 & 5)		A_V	2.85	3	3.15	V/V
Maximum Current Sense Input Threshold (Note 4)		V_{th}	0.9	1	1.1	V
Power Supply Rejection Ratio（V_{CC}=12 V to 25V, Note 4）		PSRR	—	70	—	dB
Input Bias Current		I_{IB}	—	-2	-10	μA
Propagation Delay (Current Sense Input to Output)		$t_{PLH(IN/OUT)}$	—	150	300	ns
Output Section						
Output Voltage Low State (I_{Sink}=20 mA) (I_{Sink}=200 mA) High State (I_{Source}=20 mA) (I_{Source}=200 mA)		V_{OL} V_{OH}	— — 13 12	0.1 1.6 13.5 13.4	0.4 2.2 — —	V
Output Voltage with UVLO Activated V_{CC}=6.0 V, I_{Sink}=1.0 mA		$V_{OL(UVLO)}$	—	0.1	1.1	V
Output Voltage Rise Time (C_L=1.0 nF, T_J=25℃)		tr	—	50	150	ns
Output Voltage Fall Time (C_L=1.0 nF, T_J=25℃)		tf	—	50	150	ns
Under Voltage Lockout Section						
Start-Up Threshold （UC3842B/43B）		V_{th}	14.5/7.8	16/8.4	17.5/9.0	V
Minimum Operating Voltage After Turn-On UC3842B UC3843B		$V_{CC(min)}$	8.5 7.0	10 7.6	11.5 8.2	
PWM Section						
Duty Cycle	Maximum	Dmax	94	96	—	%
	Minimum	D_{min}	—	—	0	
Total Device						

Power Supply Current Start-Up (V_{CC}=14 V for UC3842B V_{CC}=6.5 V for UC3843B)	$I_{CC}+I_c$	—	0.15	0.3	mA
Power Operating Supply Current (Note 2)	$I_{CC}+I_c$	—	12	17	mA
Power Supply Zener Voltage (I_{CC}=25 mA)	V_Z	30	36	—	V

TYPICAL APPLICATION



T1-Primary :45 Turns#26 AWGL1-15μh at 5.0A, Coil craft Z7256

Secondary ±12V:9 Turns #30 AWG (2 strands) Bifilar Wound L2,L3-25μh at 1.0A, Coil craft Z7257Secondary 5.0V:4 Turns (six strands)#26 Hexfiliar Wound

Secondary Feedback:10 Turns #30 AWG (2 strands) Bifilar Wound

Core: Ferro cube EC35-3C8

Bobbin: Ferro cube EC35PCB1

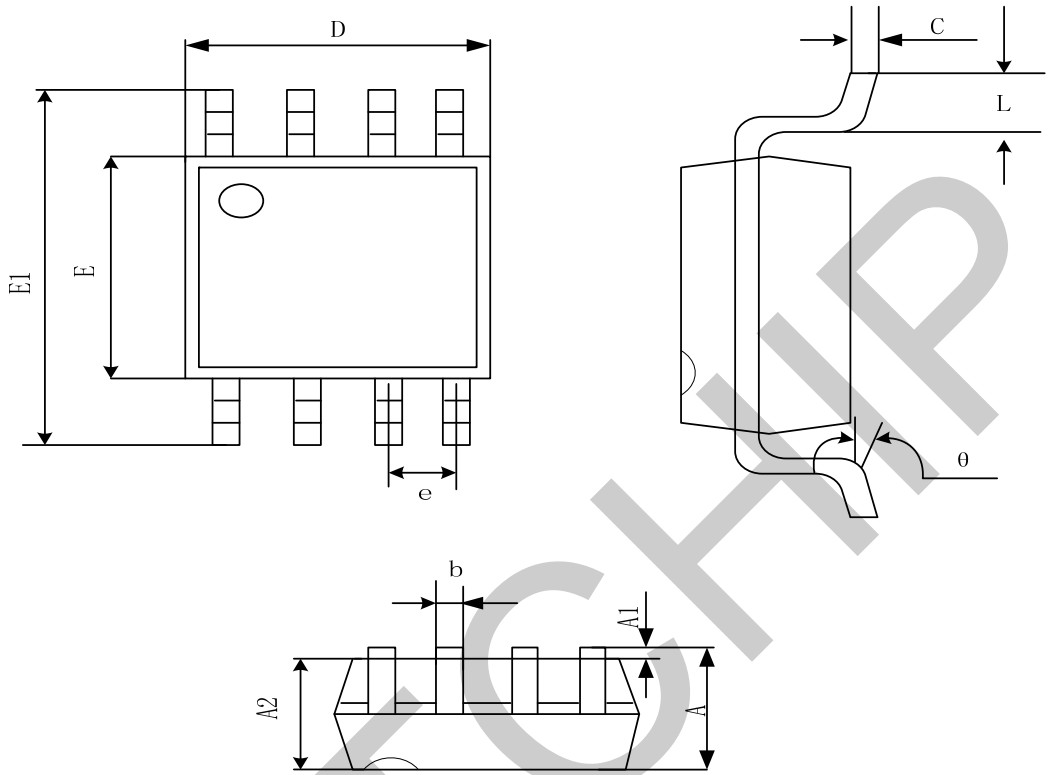
Gap≈0.01” for a primary inductance of 1.0 mH

Test	Conditions	Results
Line Regulation: 5.0 V ±12 V	Vin=95 to 130 Vac	Δ = 50 mV or ±0.5% Δ = 24 mV or ±0.1%
Load Regulation: 5.0V ±12V	Vin=115 Vac, Iout= 1.0 A to 4.0 A Vin=115 Vac, Iout=100 mA to 300 mA	Δ = 300 mV or ±3.0% Δ = 60 mV or ± 0.25%
Output Ripple: 5.0 V ±12V	Vin=115 Vac	40 mVp.p 80 mVp-p
Efficiency	Vin=115 Vac	70%
All outputs are at nominal load currents unless otherwise noted.		

Pin Function Description		
Pin No.	Function	Description
1	Compensation	This pin is the Error Amplifier output and is made available for loop compensation.
2	Voltage Feedback	This is the inverting input of the Error Amplifier. It is normally connected to the switching power supply output through a resistor divider.
3	Current Sense	A voltage proportional to inductor current is connected to this input. The PWM uses this information to terminate the output switch conduction.
4	RT/CT	The Oscillator frequency and maximum Output duty cycle are programmed by connecting resistor RT to Vref and capacitor CT to ground. Operation to 500 kHz is possible.
5	Gnd	This pin is the combined control circuitry and power ground (8-pin package only).
6	Output	This output directly drives the gate of a power MOSFET. Peak currents up to 1.0 A are sourced and sunk by this pin.
7	VCC	This pin is the positive supply of the control IC.
8	Vref	This is the reference output. It provides charging current for capacitor CT through resistor RT.

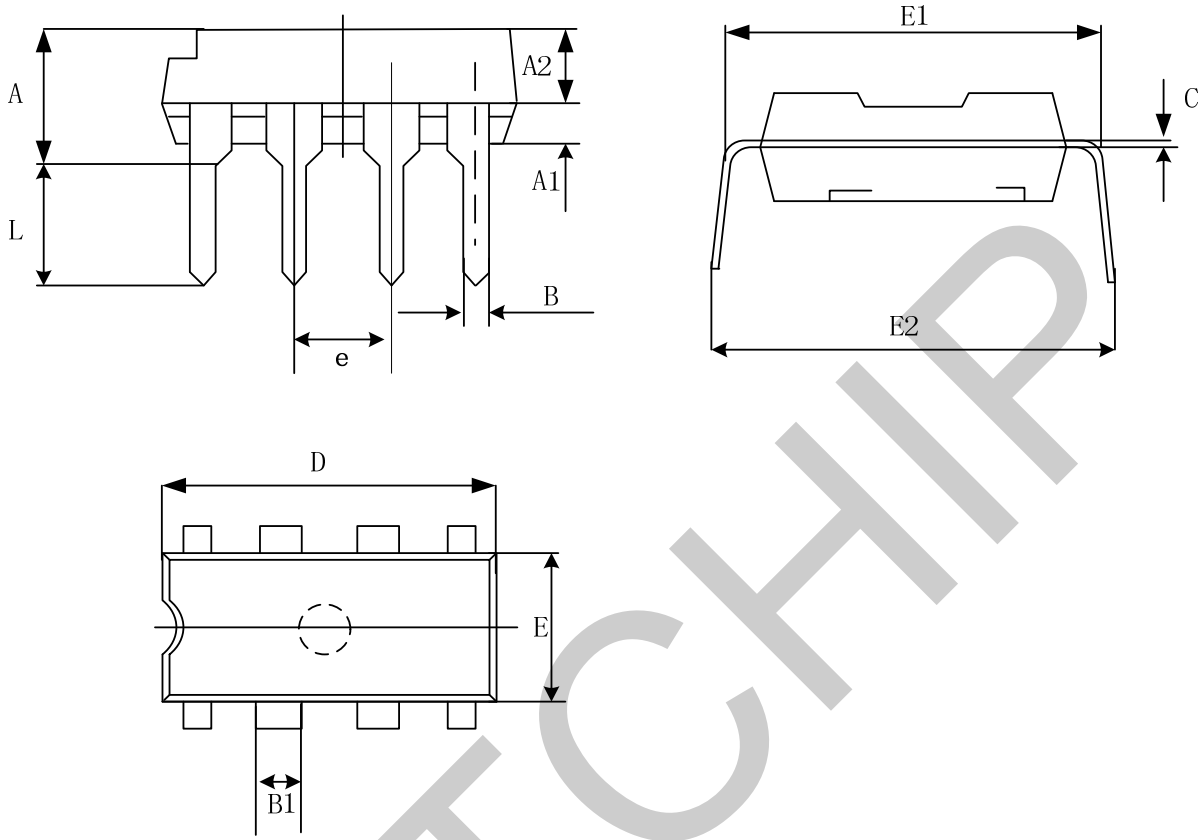
PACKAGE MECHANICAL DATA

SOP- 8



Symbol	Dimensions In Millimeters(mm)	
	Min	Max
A	1.350	1.750
A1	0.100	0.250
A2	1.350	1.550
b	0.330	0.510
C	0.170	0.250
D	4.700	5.100
E	3.800	4.00
E1	5.800	6.2
e	1.270(BSC)	
L	0.400	1.270
θ	0°	8°

DIP-8



Symbol	Dimensions In Millimeters(mm)	
	Min	Max
A	3.710	4.310
A1	0.500	
A2	3.200	3.600
B	0.350	0.620
B1	1.524(BSC)	
C	0.204	0.360
D	9.000	9.500
E	6.200	6.600
E1	7.320	7.920
e	2.540(BSC)	
L	3.000	3.600
E2	8.200	9.000