

The UC3842A series of high performance fixed frequency current mode controllers are specifically designed for off-line and dc-to-dc converter applications offering the designer a cost effective solution with minimal external components. This integrated circuit features 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.

consisting of input and reference undervoltage lockouts each with hysteresis, cycle-by-cycle current limiting, programmable output deadtime, and a latch for single pulse metering. This device is available in an 8-pin dual-in-

Also included are protective features

line plastic package as well as the 14-pin plastic surface mount (SO-14). The SO-14 package has separate power and ground pins for the totem pole output stage.

The UC3842A has UVLO thresholds of 16V(on) and 10V(off), ideally suited for off-line converters.

- 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 Undervoltage Lockout
- High Current Totem Pole Output
- Undervoltage Lockout with Hysteresis
- Low Startup and Operating Current

# CDSUFFIX PLASTIC PACKAGE 8 DIP

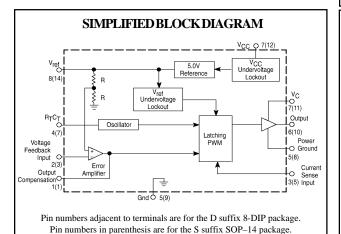


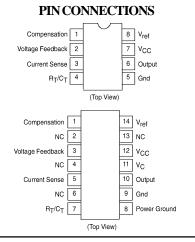
## **D8 SUFFIX** PLASTIC PACKAGE 8SOP



## **CSSUFFIX** PLASTIC PACKAGE SOP-14







- NOTES: 1. Maximum Package power dissipation limits must be observed.
  - 2. Adjust V<sub>CC</sub> above the Startup 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  $T_{low} = 0$ °C,  $T_{high} = +70$ °C.
  - 4. This parameter is measured at the latch trip point with  $V_{_{\mathrm{FB}}} = 0 \text{V}$ .
  - 5. Comparator gain is defined as:  $A_v = \frac{\Delta V \text{ Output Compensation}}{\Delta V \text{ Current Sense Input}}$

# ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Rating	Unit
Total Power Supply and Zener Current	$(I_{CC}\!+\!I_Z)$	30	mA
Output Current, Source or Sink (Note 1)	$I_{O}$	1.0	A
Output Energy (Capacitive Load per Cycle)	W	5.0	μЈ
Current Sense and Voltage Feedback Inputs	$V_{\rm in}$	-0.3 to +5.5	V
Error Amp Output Sink Current	$I_{O}$	10	mA
Power Dissipation and Thermal Characteristics CS, D8 Suffix, SOP-14, SOP-8 Package			
Maximum Power Dissipation	$P_{D}$	862	mW
Thermal Resistance, Junction to Air	$R_{ heta JA}$	145	°C/W
CD Suffix, 8-DIP Package			
Maximum Power Dissipation	$P_{D}$	1.25	W
Thermal Resistance, Junction to Air	$R_{ heta JA}$	100	°C/W
Operating Ambient Temperature Range	$T_A$	0 to 70	°C
Operating Junction Temperature	$T_{\rm J}$	150	℃
Storage Temperature Range	Ts	-65 to 150	℃

## ELECTRICAL CHARACTERISTICS

 $V_{CC} = 15V$  (Note 2),  $R_{T} = 10k$ , CT = 3.3nF,  $T_{A} = 0$  to  $70^{\circ}C$  (Note 3) unless otherwise noted.

### REFERENCESECTION

Item	Symbol	Min	Тур	Max	Unit
Reference Output Voltage ( $I_O = 1.0$ mA, $T_J = 25$ °C)	$V_{ ext{REF}}$	4.9	5.0	5.1	V
Line Regulation ( $V_{CC} = 12V \text{ to } 25V$ )	Reg <sub>line</sub>		2.0	20	mV
Load Regulation (I <sub>O</sub> = 1.0mA to 20mA)	Reg <sub>load</sub>		3.0	25	mV
Temperature Stability	$T_{S}$		0.2		mV/°C
Total Output Variation over Line, Load, Temp.	$V_{\text{REF}}$	4.82		5.18	V
Output Noise Voltage ( $f = 10$ Hz to $10$ kHz, $T_J = 25$ °C)	$V_n$		50		μV
Long Term Stability (T <sub>A</sub> = 125°C for 1000 Hours)	S		5.0		mV
Output Short Circuit Current	ISC	-30	-85	-180	mA

#### OSCILLATOR SECTION

Frequency	$f_{OSC}$				V
$T_J = 25^{\circ}C$		47	52	57	
$T_A = 0$ to $70^{\circ}$ C		46		60	
Frequency Change with Voltage ( $V_{CC} = 12V \text{ to } 25V$ )	$\Delta f_{OSC}/\Delta V$		0.2	1.0	%
Frequency Change with Temperature	$\Delta f_{OSC}/\Delta T$		5.0		%
Oscillator Voltage Swing (Peak-to-Peak)	$V_{OSC}$		1.6		V
Discharge Current ( $V_{OSC} = 2.0V$ )	$I_{ m dischg}$				mA
$T_J = 25^{\circ}C$		7.5	8.4	9.3	
$T_A = 0$ to $70^{\circ}$ C		7.2		9.5	



# ELECTRICAL CHARACTERISTICS

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ERROR AMPLIFIER SECTION							
Item	Symbol	Min	Тур	Max	Unit		
Voltage Feedback Input (V <sub>o</sub> = 2.5V)	$V_{\scriptscriptstyle FB}$	2.42	2.5	2.58	V		
Input Bias Current ( $V_{FB} = 2.7V$ )	$I_{\mathrm{IB}}$		-0.1	-2.0	μΑ		
Open Loop Voltage Gain ( $V_0 = 2.0 \text{V to } 4.0 \text{V}$ )	$A_{VOL}$	65	90		dB		
Unity Gain Bandwidth ( $T_J = 25^{\circ}C$ )	BW	0.7	1.0		MHz		
Power Supply Rejection Ratio ( $V_{CC} = 12V \text{ to } 25V$ )	PSRR	60	70		dB		
Output Current					mA		
Sink $(V_O = 1.1V, V_{FB} = 2.7V)$	$\mathbf{I}_{\mathrm{Sink}}$	2.0	12				
Source ( $V_0 = 5.0V, V_{FB} = 2.3V$ )	$I_{Source}$	-0.5	-1.0				
Output Voltage Swing					V		
High State ( $R_L = 15k$ to GND, $V_{FB} = 2.3V$ )	$V_{OH}$	5.0	6.2				
Low State ( $R_L = 15k$ to $V_{REF}$ , $V_{FB} = 2.3V$ )	$V_{OL}$		0.8	1.1			
CURRENT SENSE SECTION							
Current Sense Input Voltage Gain (Notes 4 & 5)	$A_{V}$	2.85	3.0	3.15	V/V		
Maximum Current Sense Input Threshold (Note 4)	$V_{TH}$	0.9	1.0	1.1	V		
Power Supply Rejection Ratio ( $V_{CC} = 12V \text{ to } 25V$ )	PSRR		70		dB		
Input Bias Current	$I_{\rm IB}$		-2.0	-10	μΑ		
Propagation Delay (Current Sense Input to Output)	t <sub>PLH(in/out)</sub>		150	300	ns		

## OUTPUTSECTION

Output Voltage						V
Low State	$(I_{Sink} = 20mA)$	$V_{OL}$		0.1	0.4	
	$(I_{Sink} = 200mA)$			1.6	2.2	
High State	$(I_{Sink} = 20mA)$	$V_{OH}$	13	13.5		
	$(I_{Sink} = 200mA)$		12	13.4		
Output Voltage with UVLO Activated		V <sub>OL(UVLO)</sub>				V
$(V_{CC} = 6.0V, I_{Si})$	$_{nk}$ = 1.0mA)			0.1	1.1	
Output Voltage Rise Time ( $C_L = 1.0 \text{nF}, T_J = 25 ^{\circ}\text{C}$ )		$t_{\rm r}$		50	150	ns
Output Voltage	Fall Time ( $C_L = 1.0 \text{nF}, T_J = 25 ^{\circ}\text{C}$ )	$t_{\mathrm{f}}$		50	150	ns
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### UNDERVOLTAGE LOCKOUT SECTION

Startup Threshold	$V_{ ext{th}}$	14.5	16	17.5	V
Minimum Operating Voltage After Turn-On	V <sub>CC(min)</sub>	8.5	10	11.5	V

## **PWM SECTION**

Duty Cycle	Max.	$DC_{max}$	94	96		%
	Min.	DC <sub>min</sub>			0	
	_					

### **TOTAL DEVICE**

Power Supply Current ( $V_{CC} = 14V$ ) (Note 2)	$I_{CC}$				mA
Startup			0.17	0.3	
Operating			12	17	
Power Supply Zener Voltage	$V_{\rm Z}$	30	36		V



FIGURE 1 - TIMING RESISTOR versus OSCILLATOR FREQUENCY

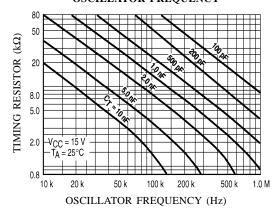


FIGURE 3 - OSCILLATOR DISCHARGE CURRENT versus TEMPERATURE

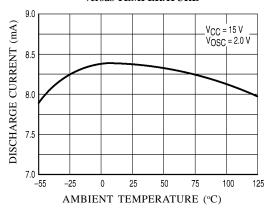


FIGURE 5 - ERROR AMP SMALL SIGNAL TRANSIENT RESPONSE

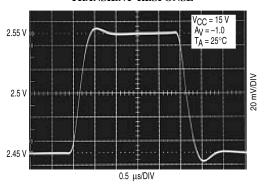


FIGURE 2 - OUTPUT DEADTIME versus OSCILLATOR FREQUENCY

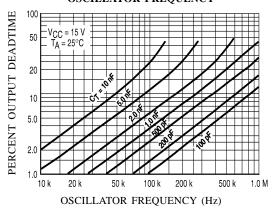


FIGURE 4 - MAXIMUM OUTPUT DUTY CYCLE versus TIMING RESISTOR

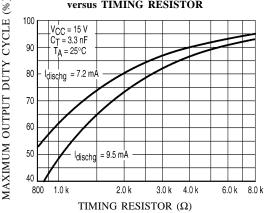
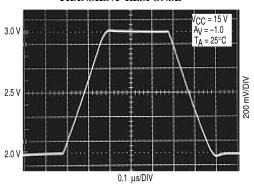
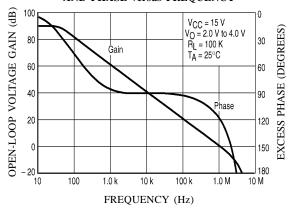


FIGURE 6 - ERROR AMP LARGE SIGNAL TRANSIENT RESPONSE

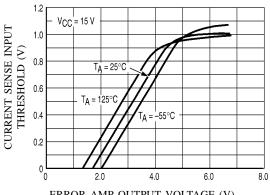




#### FIGURE 7 - ERROR AMP OPEN-LOOP GAIN AND PHASE versus FREQUENCY



#### FIGURE 8 - CURRENT SENSE INPUT THRESHOLD versus ERROR AMP OUTPUT VOLTAGE



ERROR AMP OUTPUT VOLTAGE (V)

FIGURE 9 - REFERENCE VOLTAGE CHANGE versus SOURCE CURRENT

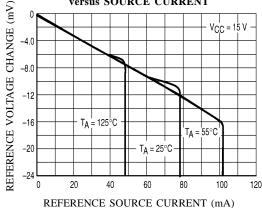
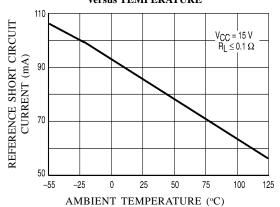
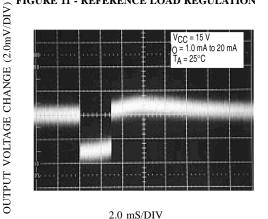


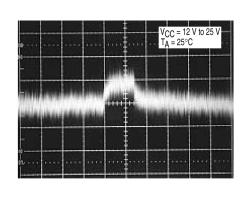
FIGURE 10 - REFERENCE SHORT CIRCUIT CURRENT versus TEMPERATURE



#### FIGURE 11 - REFERENCE LOAD REGULATION



#### FIGURE 12 - REFERENCE LINE REGULATION



OUTPUT VOLTAGE CHANGE (2.0mV/DIV)

2.0 mS/DIV



FIGURE 13 - OUTPUT SATURATION VOLTAGE versus LOAD CURRENT

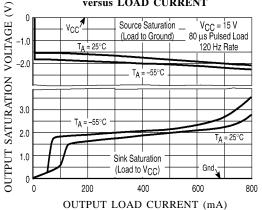


FIGURE 15 - OUTPUT CROSS CONDUCTION

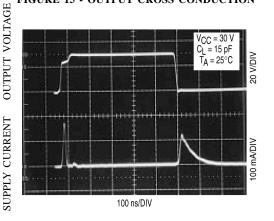


FIGURE 14 - OUTPUT WAVEFORM

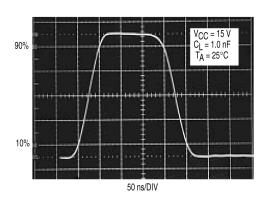


FIGURE 16 - SUPPLY CURRENT versus SUPPLY VOLTAGE

