UC3842B High Performance Current Mode Controller

The UC3842B 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.

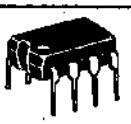
Also included are protective features consisting of input and reference undervoltage lockouts each with hysteresis, cycle-by-cycle current limiting, programmable output deadtime, and a latch for single pulse metering.

This device is available in an 8-pin dual-in-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 UC3842B 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

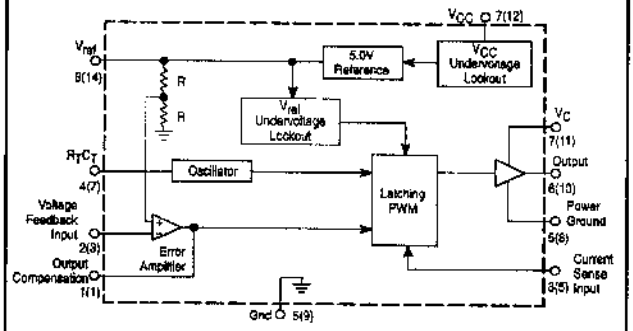
CD SUFFIX
PLASTIC PACKAGE
8 DIP



D8 SUFFIX
PLASTIC PACKAGE
8 SOP

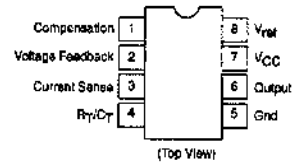
CS SUFFIX
PLASTIC PACKAGE
SOP-14

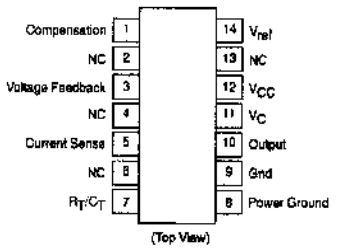
SIMPLIFIED BLOCK DIAGRAM



Pin numbers adjacent to terminals are for the D suffix 8-DIP package.
Pin numbers in parenthesis are for the S suffix SOP-14 package.

PIN CONNECTIONS





NOTES:
1. Maximum Package power dissipation limits must be observed.
2. Adjust V_{CC} 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 $V_{FB} = 0V$.
5. Comparator gain is defined as: $A_V \frac{\text{DV Output Compensation}}{\text{DV Current Sense Input}}$

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	mJ
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			
CS, D8 Suffix, SOP-14, SOP-8 Package			
Maximum Power Dissipation	P_D	862	mW
Thermal Resistance, Junction to Air	$R_{\theta JA}$	145	°C/W
CD Suffix, 8-DIP Package			
Maximum Power Dissipation	P_D	1.25	W
Thermal Resistance, Junction to Air	$R_{\theta JA}$	100	°C/W
Operating Ambient Temperature Range	T_A	0 to 70	°C
Operating Junction Temperature	T_J	150	°C
Storage Temperature Range	T_S	-65 to 150	°C

ELECTRICAL CHARACTERISTICS

V_{CC} = 15V (Note 2), R_T = 10k, CT = 3.3nF, T_A = 0 to 70°C (Note 3) unless otherwise noted.

REFERENCE SECTION

Item	Symbol	Min	Typ	Max	Unit
Reference Output Voltage (I_O = 1.0mA, T_J = 25°C)	V_{REF}	4.9	5.0	5.1	V
Line Regulation (V_{CC} = 12V to 25V)	Reg_{line}	—	2.0	20	mV
Load Regulation (I_O = 1.0mA to 20mA)	Reg_{load}	—	3.0	25	mV
Temperature Stability	T_S	—	0.2	—	mV/°C
Total Output Variation over Line, Load, Temp.	V_{REF}	4.82	—	5.18	V
Output Noise Voltage (f = 10Hz to 10kHz, T_J = 25°C)	V_n	—	50	—	mV
Long Term Stability (T_A = 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°C 4		7	52	57	
T_A = 0 to 70°C		46	—	60	
Frequency Change with Voltage (V_{CC} = 12V to 25V)	Df_{OSC}/DV	—	0.2	1.0	%
Frequency Change with Temperature	Df_{OSC}/DT	—	5.0	—	%
Oscillator Voltage Swing (Peak-to-Peak)	V_{OSC}	—	1.6	—	V
Discharge Current (V_{OSC} = 2.0V)	I_{dischg}				mA
T_J = 25°C		7.5	8.4	9.3	
T_A = 0 to 70°C		7.2	—	9.5	

ELECTRICAL CHARACTERISTICS

ERROR AMPLIFIER SECTION

Item	Symbol	Min	Typ	Max	Unit
Voltage Feedback Input (V_O = 2.5V)	V_{FB}	2.42	2.5	2.58	V
Input Bias Current (V_{FB} = 2.7V)	I_{IB}	—	-0.1	-2.0	mA
Open Loop Voltage Gain (V_O = 2.0V to 4.0V)	A_{VOL}	65	90	—	dB
Unity Gain Bandwidth (T_J = 25°C)	BW	0.7	1.0	—	MHz
Power Supply Rejection Ratio (V_{CC} = 12V to 25V)	PSRR	60	70	—	dB
Output Current					mA
Sink (V_O = 1.1V, V_{FB} = 2.7V)	I_{Sink}	2.0	12	—	
Source (V_O = 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 to 25V)	PSRR	—	70	—	dB
Input Bias Current	I_{IB}	—	-2.0	-10	mA
Propagation Delay (Current Sense Input to Output)	$t_{PLH(in/out)}$	—	150	300	ns

OUTPUT SECTION

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_{CC} = 6.0V, I_{Sink} = 1.0mA)	$V_{OL(UVLO)}$	—	0.1	1.1	V
Output Voltage Rise Time (C_L = 1.0nF, T_J = 25°C)	t_r	—	50	150	ns
Output Voltage Fall Time (C_L = 1.0nF, T_J = 25°C)	t_f	—	50	150	ns

UNDERVOLTAGE LOCKOUT SECTION

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

PWM SECTION

Duty Cycle	Max.	DC_{max}	94	96	—	%
	Min.	DC_{min}	—	—	0	

TOTAL DEVICE

Power Supply Current (V_{CC} = 14V) (Note 2)	I_{CC}				mA
Startup		—	0.45	1	
Operating		—	12	17	
Power Supply Zener Voltage	V_Z	30	36	—	V

FIGURE 1 - TIMING RESISTOR versus OSCILLATOR FREQUENCY

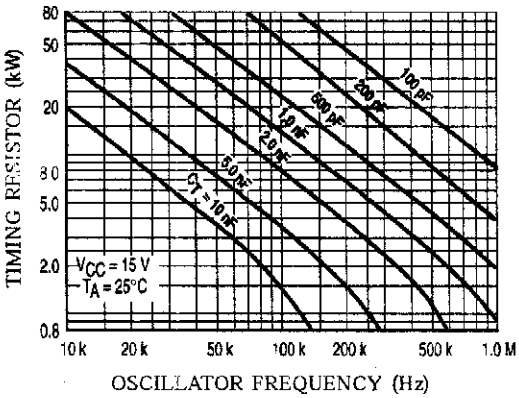


FIGURE 2 - OUTPUT DEADTIME versus OSCILLATOR FREQUENCY

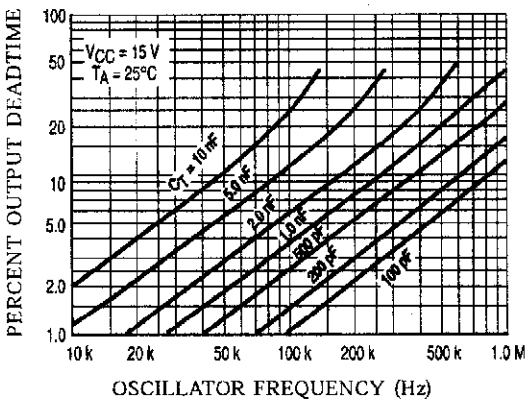


FIGURE 3 - OSCILLATOR DISCHARGE CURRENT versus TEMPERATURE

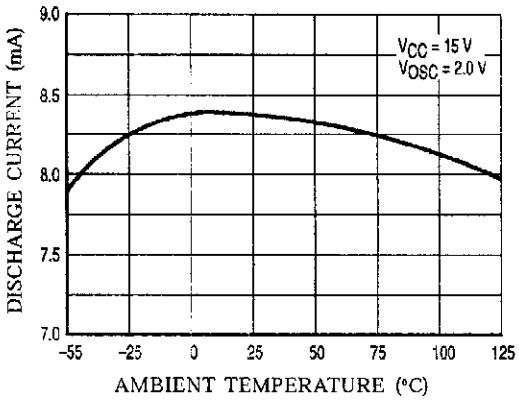


FIGURE 4 - MAXIMUM OUTPUT DUTY CYCLE versus TIMING RESISTOR

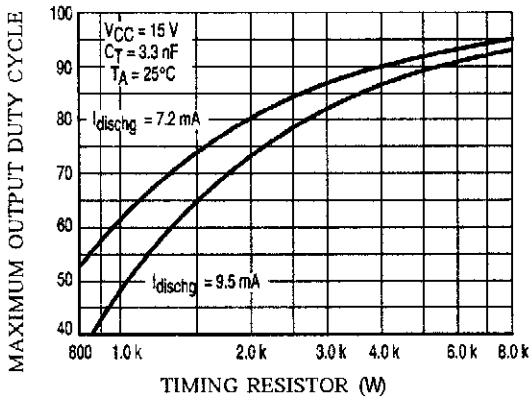


FIGURE 5 - ERROR AMP SMALL SIGNAL TRANSIENT RESPONSE

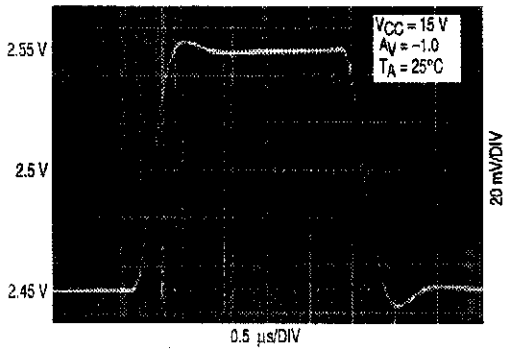


FIGURE 6 - ERROR AMP LARGE SIGNAL TRANSIENT RESPONSE

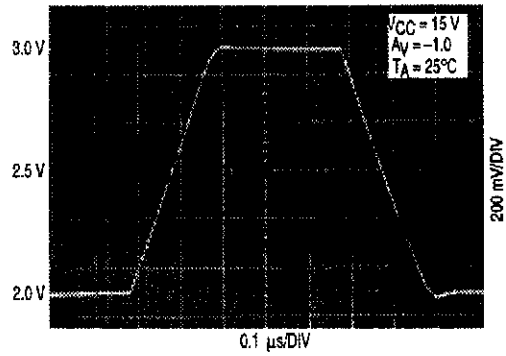


FIGURE 7 - ERROR AMP OPEN-LOOP GAIN AND PHASE versus FREQUENCY

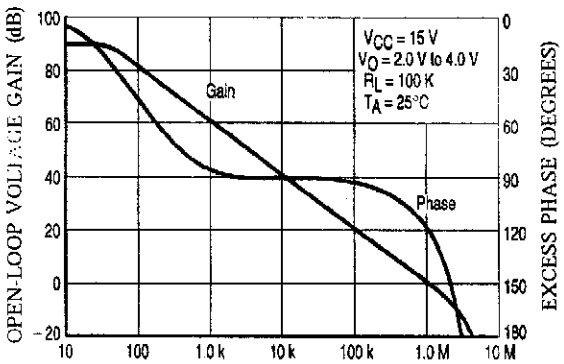


FIGURE 8 - CURRENT SENSE INPUT THRESHOLD versus ERROR AMP OUTPUT VOLTAGE

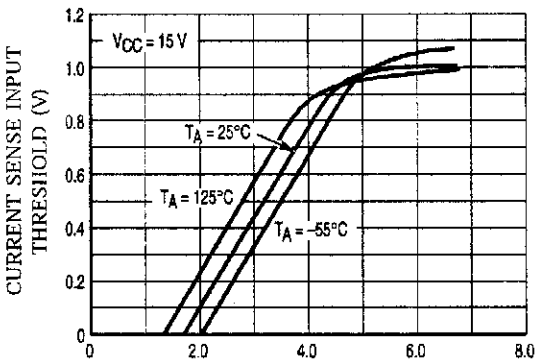


FIGURE 9 - REFERENCE VOLTAGE CHANGE versus SOURCE CURRENT

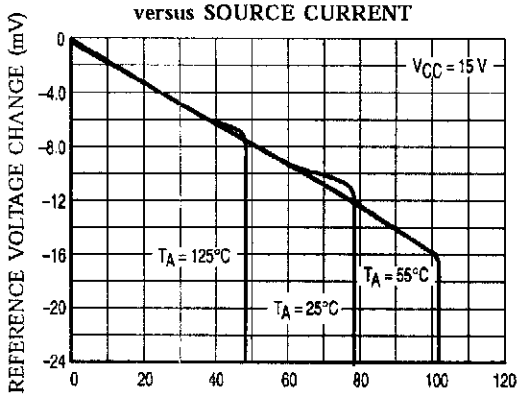


FIGURE 10 - REFERENCE SHORT CIRCUIT CURRENT versus TEMPERATURE

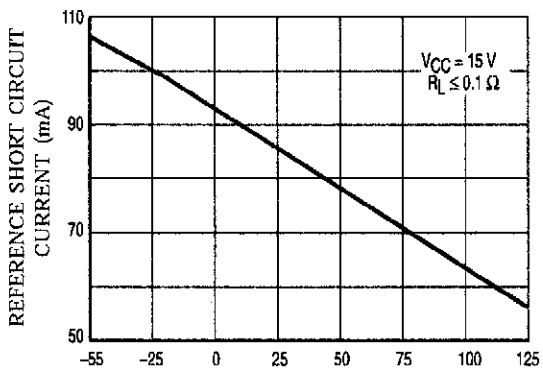


FIGURE 11 - REFERENCE LOAD REGULATION

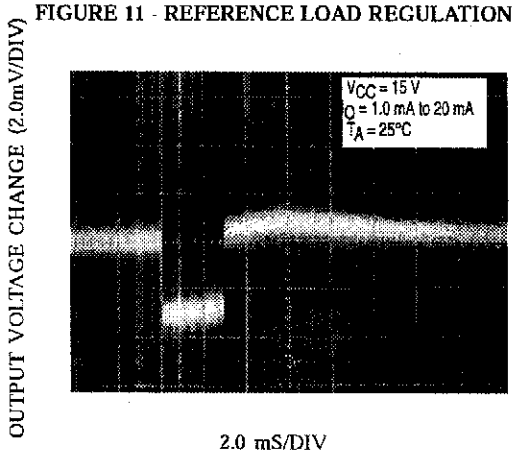


FIGURE 12 - REFERENCE LINE REGULATION

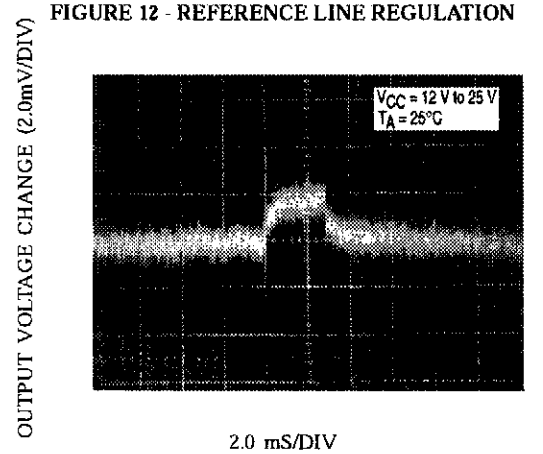


FIGURE 13 - OUTPUT SATURATION VOLTAGE versus LOAD CURRENT

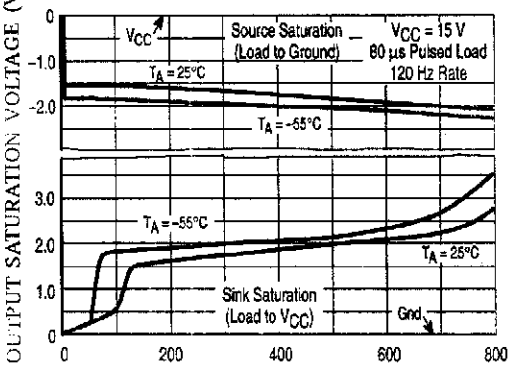


FIGURE 14 - OUTPUT WAVEFORM

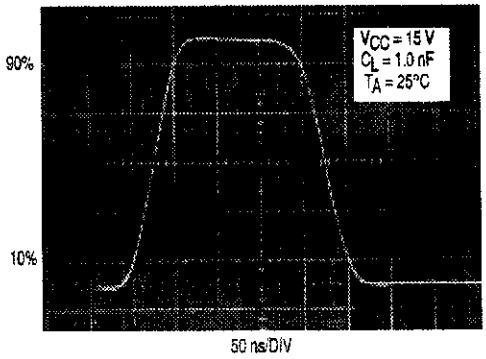


FIGURE 15 - OUTPUT CROSS CONDUCTION

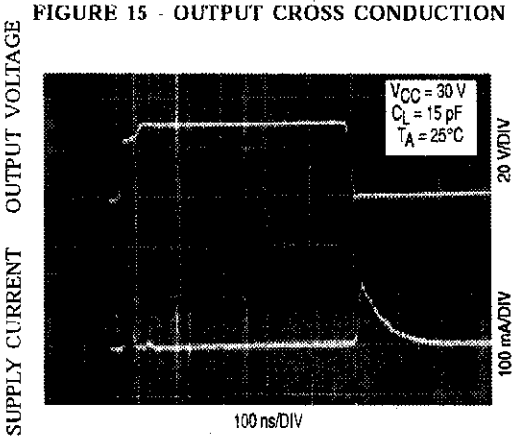


FIGURE 16 - SUPPLY CURRENT versus SUPPLY VOLTAGE