KA3846

SMPS Controller

Features

- Automatic Feed Forward Compensation
- Programmable Pulse by Pulse Current Limiting
- Automatic Symmetry Correction in Push-Pull Configuration
- Enhanced Load Response Characteristics
- Parallel Operation Capability for Modulator Power Systems
- Differential Current Sense Amplifier with Common Mode Range
- Double Pulse Suppression
- 200mA Totem-Pole Outputs
- ±2% Band gap Reference
- Under-Voltage Lockout
- Soft-Start Capability
- Shutdown Terminal
- 500KHz Operation

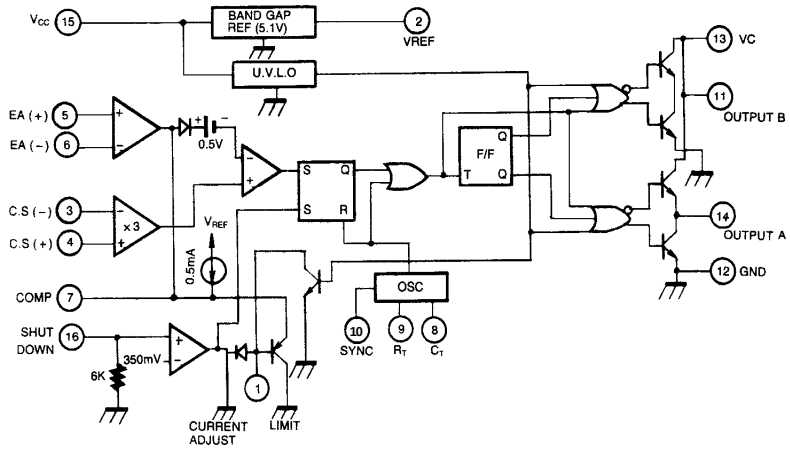
Description

The KA3846 control IC provides all of the necessary features to implement fixed frequency, current mode control schemes while maintaining a minimum external parts count. The superior performance of this technique can be measured in improved line regulation, enhanced load response characteristics, and a simpler, easier-to-design control loop. Topological advantages include inherent pulse-by-pulse current limiting capability, automatic symmetry correction for push-pull converters, and the ability to parallel "power module" while maintaining equal current sharing. Protection circuitry includes built-in-under-voltage lockout and programmable current limit in addition to soft-start capability. A shutdown function is also available which can initiate either a complete shutdown with automatic restart or latch the supply off. Other features include fully latched operation, double pulse suppression, deadtime adjust capability, and ±2% trimmed bandgap reference. The KA3846 features low outputs in the OFF state.

16-DIP

1

Internal Block Diagram



Rev. 5.0

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	40	V
Collector Supply Voltage	V_C	40	V
Output Current, Sink of Source (Peak)	I_O	500	mA
Reference Output Current	I_{REF}	30	mA
Soft Start Sink Current	$I_{SINK(S.S)}$	50	mA
Sync Output Current	I_{SYNC}	5	mA
Error Amplifier Output Current	$I_{O(E.A)}$	5	mA
Oscillator Changing Current	$I_{CHG(OSC)}$	5	mA
Power Dissipation (T_A = 25°C)	P_D	1000	mW
Operating Temperature	T_{OPR}	0 ~ +70	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C
Lead Temperature (Soldering, 10sec)	T_{LEAD}	+300	°C

Electrical Characteristics

(V_{CC}=15V, T_A=0°C to +70°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
REFERENCE SECTION						
Reference Output Voltage	V_{REF}	T_J = 25°C, I_{REF} = 1mA	5.00	5.10	5.20	V
Line Regulation	ΔV_{REF}	V_{CC} = 8 to 40V	-	5	20	mV
Load Regulation	ΔV_{REF}	I_{REF}1 to 10mA	-	3	15	mV
Temperature Stability(Note 6)	ST_T	-	-	0.4	1.0	mV/°C
Output Voltage Range (Note 6)	V_{REF}	Line,Load,Temp	4.95	-	5.25	V
Short Circuit Output Current	I_{SC}	V_{REF} = 0V	-10	-45	-	mA
Output Noise Voltage(Note 6)	V_{NO}	f = 10Hz to 10KHz, T_J = 25°C	-	100	-	uV
Long-Term Stability(Note 6)	S_T	T_J = 125°C, 1KHz	2	5	8	mV

Electrical Characteristics

(V_{CC}= 15V,T_A=0°C to +70°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OSCILLATOR SECTION (Note 2)						
Initial Accuracy	ACCUR	T_J = 25°C	39	43	47	KHz
Frequency Change with Voltage	$\Delta f/\Delta V_{CC}$	V_{CC} = 8 to 40V	-	1	2	%
Frequency Change with Temperature (Note 6)	$\Delta f/\Delta T$	-	-	1	-	%
Sync Output High Level	$V_{OH(SYNC)}$	-	3.9	4.35	-	V
Sync Output Low Level	$V_{OL(SYNC)}$	-	-	2.3	2.5	V
Sync Input High Level	$V_{IH(SYNC)}$	V_8 = 0V	3.9	-	-	V
Sync Input Low Level	$V_{IL(SYNC)}$	V_8 = 0V	-	-	2.5	V
Sync Input Current	$I_{I(SYNC)}$	Sync Voltage = 3.9V, V_8 = 0V	-	1.3	1.5	mA
ERROR AMPLIFIER SECTION						
Input Offset Voltage	V_{IO}	-	-	0.5	5	mV
Input Bias Current	I_{BIAS}	-	-	-0.6	-1	uA
Input Offset Current	I_{IO}	-	-	40	250	uA
Common-Mode Range	V_{CM}	V_{CC} = 8 to 40V	0	-	V_{CC}2	V
Open Loop Voltage Gain	G_{VO}	V_O = 1.2 to 3V, V_{CM} = 2V	80	105	-	dB
Unity Gain Bandwidth(Note 6)	BW	T_J = 25°C	0.7	1.0	-	MHz
Common Mode Rejection Ratio	CMRR	V_{CM} = 0 to 38V, V_{CC} = 40V	75	100	-	dB
Power Supply Rejection Ratio	PSRR	V_{CC} = 8 to 40V	80	105	-	dB
Output Sink Current	I_{SINK}	V_{IO} = -15mV to 5V, V_7 = 2.5V	2	6	-	mA
Output Source Current	I_{SOURCE}	R_L = 15KΩ	-0.4	-0.5	-	mA
High Output Voltage	V_{OH}	R_L = 15KΩ	4.3	4.6	-	V
Low Output Voltage	V_{OL}	-	-	0.7	1	V
CURRENT SENSE AMPLIFIER SECTION						
Amplifier Gain (Note 1, 3)	G_V	V_3 = 0V, Pin 1 open	2.5	2.75	3.0	V
Maximum Differential Input Signal (V_4 - V_3) (Note 1)	$V_{I(DIFF,MAX)}$	R_L = 15KΩ, Pin 1 open	1.1	1.2	-	V
Input Offset Voltage (Note 1)	V_{IO}	V_1 = 0.5V, Pin 1 open	-	5	25	mV
Common Mode Rejection Ratio	CMRR	V_{CM} = 1 to 12V	60	83	-	dB
Power Supply Rejection Ratio	PSRR	V_{CC} = 8 to 40V	60	84	-	dB
Input Bias Current (Note 1)	I_{BIAS}	V_1 = 0.5V, Pin 7 open	-	-2.5	-10	uA
Input Offset Current (Note 1)	I_{IO}	V_1 = 0.5V, Pin 7 open	-	0.08	1	uA
Delay to Outputs (Note 6)	t_D	T_J = 25°C	-	200	500	ns

Electrical Characteristics

(V_{CC}=15V, T_A=0°C to + 70°C, unless otherwise specified)

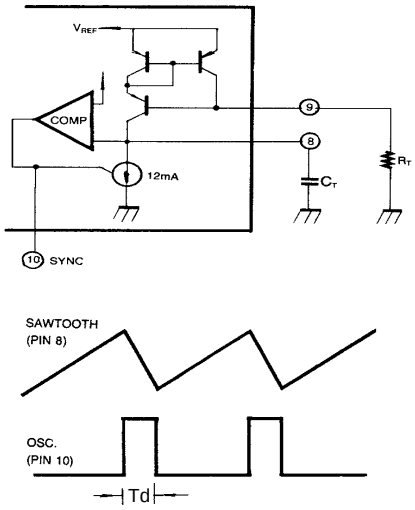
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
CURRENT LIMIT ADJUST SECTION						
Current Limit Offset Voltage (Note 1)	$V_{IO(C.L)}$	V_3 = 0V V_4 = 0V, Pin 7 open	0.45	0.5	0.55	V
Input Bias Current	I_{BIAS}	$V_5 = V_{REF}$, V_6 = 0V	-	- 10	- 30	uA
SHUTDOWN TERMINAL SECTION						
Threshold Voltage	V_{TH}	-	250	350	400	mV
Input Voltage Range	V_I	-	0	-	V_{CC}	V
Minimum Latching Current (Note 4)	$I_{(LATCH,MIN)}$	-	3.0	1.5	-	mA
Maximum Non-Latching Current (Note 5)	$I_{(NONLATCH,MAX)}$	-	-	1.5	0.8	mA
UNDER-VOLTAGE LOCKOUT SECTION						
Start Threshold	$V_{TH(ST)}$	-	7	7.7	8.4	V
Threshold Hysteresis	V_{HYS}	-	0.45	0.75	1.05	V
OUTPUT SECTION						
Collector-Emitter Voltage	V_{CEO}	-	40	-	-	V
Collector Leakage Current	I_{LEAK}	V_C = 40V	-	-	200	uA
Low Output Voltage 1	V_{OL} 1	I_{SINK} = 20mA	-	0.1	0.4	V
Low Output Voltage 2	V_{OL} 2	I_{SINK} = 100mA	-	0.4	2.1	V
High Output Voltage 1	V_{OH} 1	I_{SOURCE} = 20mA	13	13.5	-	V
High Output Voltage 2	V_{OH} 2	I_{SOURCE} = 100mA	12	13.5	-	V
Rise Time (Note 6)	t_R	C_L = 1nF, T_J = 25°C	-	50	300	us
Fall Time (Note 6)	t_F	C_L = 1nF, T_J = 25°C	-	50	300	us
TOTAL STANDBY CURRENT						
Supply Current	I_{CC}	-	-	17	21	mA

Notes :

1. Parameter measured at trip point at latch with $V_5 = V_{REF}$, V_6 = 0V
2. R_T = 10KΩ, C_T = 4.7nF
3. Amplifier gain definde as:

$$G = \frac{\Delta V7}{\Delta V4}; \Delta V_4 = 0 \text{to} 1.0V$$

4. Current into Pin 1 guaranteed to latch circuit in shutdown state.
5. Current into Pin 1 guaranteed not to latch circuit in shutdown state.
6. These parameters, although guaranteed over the recommended operating conditions, are not 100% tested in production.



OUTPUT DEADTIME(T_d)

Figure 1. KA3846 Oscillator Circuit

Output deadtime is determined by the external capacitor, C_T, according to the formula: $Td(us) = 145C_T(\mu F)\left(\frac{12}{12 - \frac{3.6}{R_T(K\Omega)}}\right)$
For large values of R_T: T_d (us) = l45C_T (uF) Oscillator frequency is approximately

by the formula: $f_T(KHz) = \frac{2.2}{R_T(K\Omega)C_T(\mu F)}$

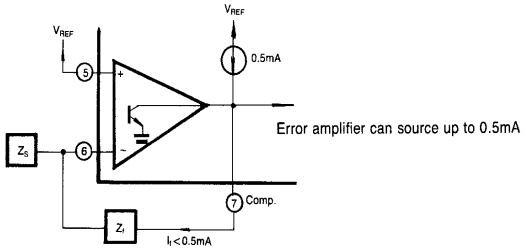


Figure 2. Error Amplifier Output Configuration

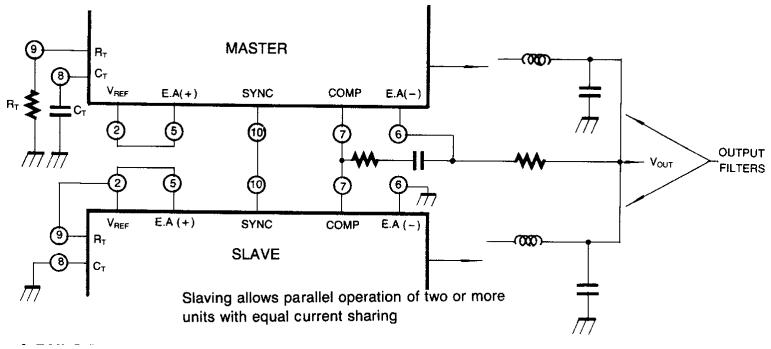


Figure 3. Parallel Operation

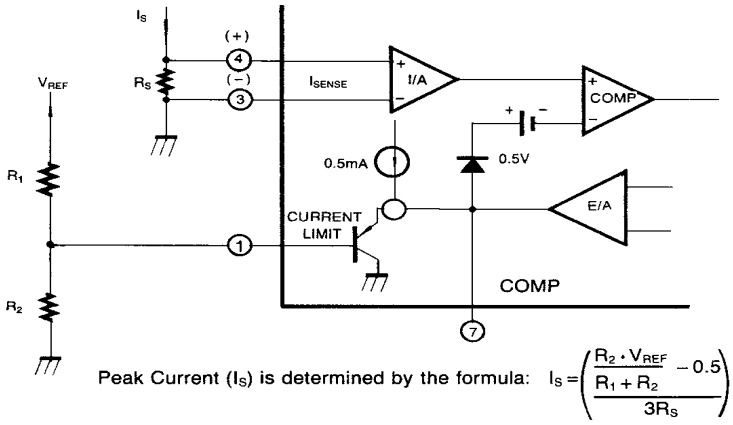


Figure 4. Pulse By Pulse Current Limiting

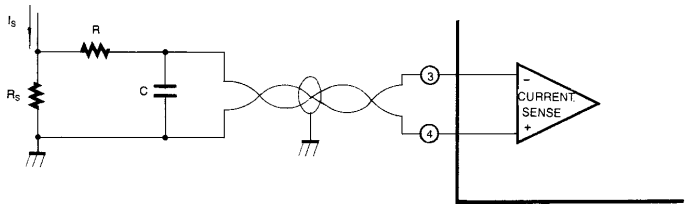


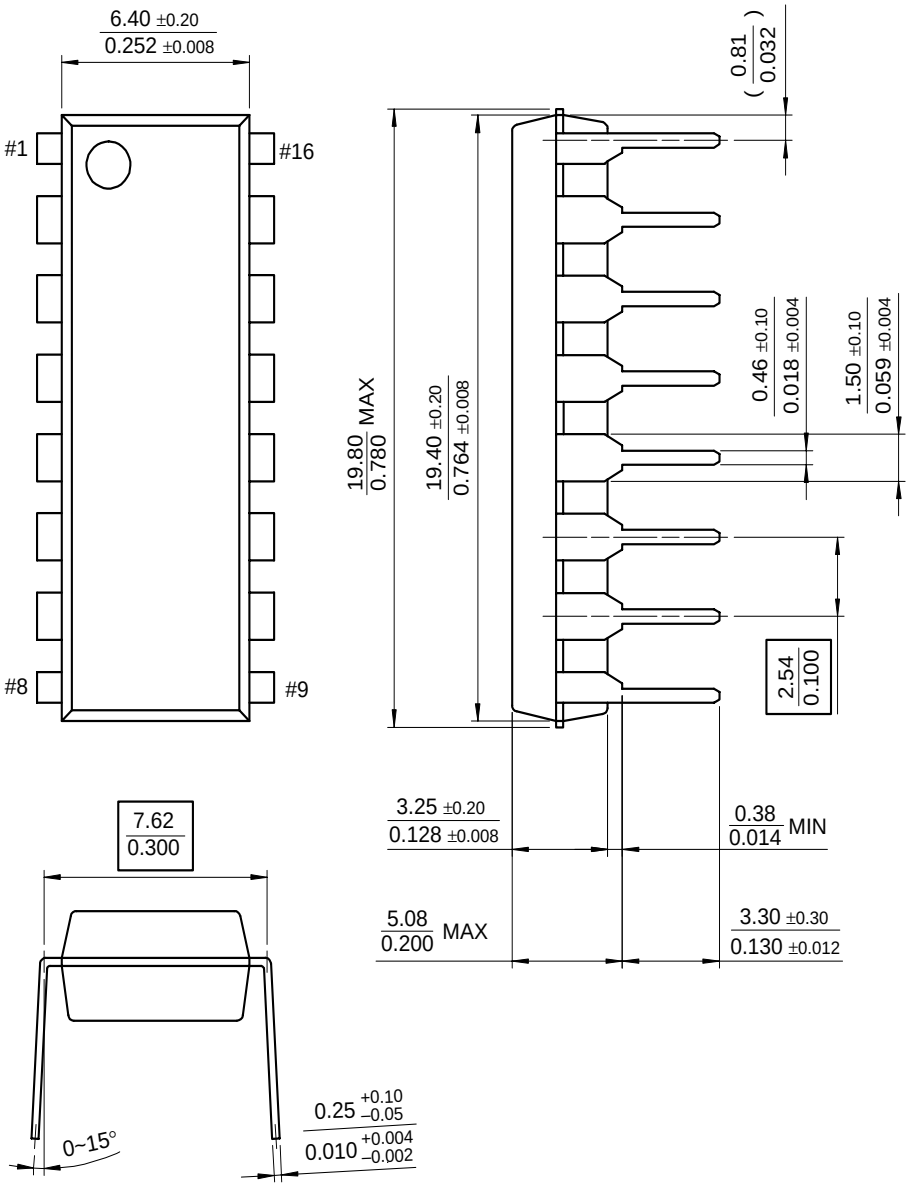
Figure 5. Current Sense Amp Connections

A small PC filter may be required in some applications to reduce switch transients
Differential input allows remote, noise free sensing.

Mechanical Dimensions

Package

16-DIP



Ordering Information

Product Number	Package	Operating Temperature
KA3846	16 DIP	0 ~ + 70°C

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR INTERNATIONAL. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

www.fairchildsemi.com

7/13/00 0.0m 001
Stock#DSxxxxxxxx