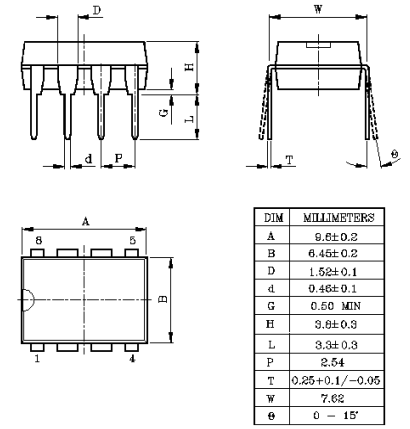
KIA3842/3/4/5AP/AF

BIPOLAR LINEAR INTEGRATED CIRCUIT

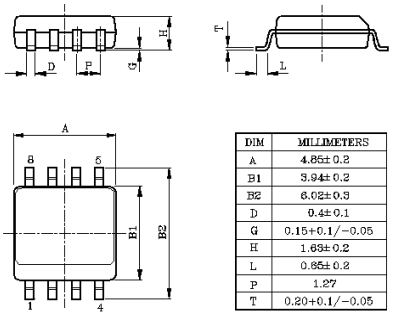
HIGH PERFORMANCE CURRENT MODE CONTROLLER

The KIA3842/3/4/5AP/AF are high performance fixed frequency current mode controller. This is 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 feature a trimmed oscillator for precise duty cycle control, a temperature compensated reference, high gain error amplifier, current sensing comparator, and a high current totempole 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. Differences between members of this family are the under-voltage lockout thresholds and maximum duty cycle ranges. The KIA3842A and KIA3844A have UVLO thresholds of 16V(on) and 10V(off), ideally suited off-line applications The corresponding thresholds for the KIA3843A and KIA3845A are 8.5V and 7.9V. The KIA3842A and KIA3843A can operate to duty cycles approaching 100%. A range of the zero to <50% is obtainedby the KIA3844A and KIA3845A by the addition of an internal toggle flip flop which balanks the output off every other clock cycle.



DIM	MILLIMETERS
A	9.6±0.2
B	6.45±0.2
D	1.52±0.1
d	0.46±0.1
G	0.50 MIN
H	3.6±0.3
L	3.3±0.3
P	2.54
T	0.25+0.1/−0.05
W	7.62
θ	0 ~ 15°

DIP-8



DIM	MILLIMETERS
A	4.85±0.2
B1	3.94±0.2
B2	6.02±0.3
D	0.4±0.1
G	0.15+0.1/−0.05
H	1.65±0.2
L	0.85±0.2
P	1.27
T	0.20+0.1/−0.05

FLP-8

FEATURES

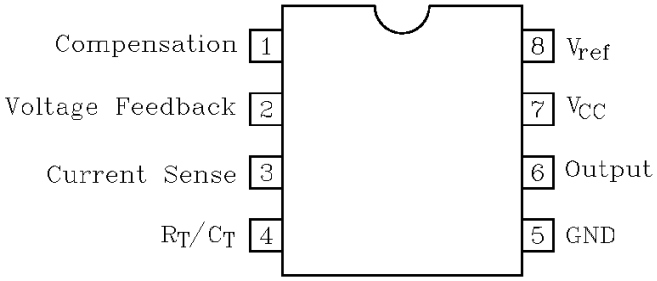
- Trimmed Oscillator Discharge Current for Precise Duty Cycle Control.
- Current Mode Operation to 500kHz.
- Automatic Feed Forward Compensation.
- Latching PWM for Cycle-By-Cycle Current Limiting.
- Internally Trimmed Reference with Undervoltage Lockout.
- High Current TotemPole Output.
- Undervoltage Lockout with Hysteresis.
- Low Start-up and Operating Current 0.2mA(Typ.)

MAXIMUM RATING (Ta=25℃)

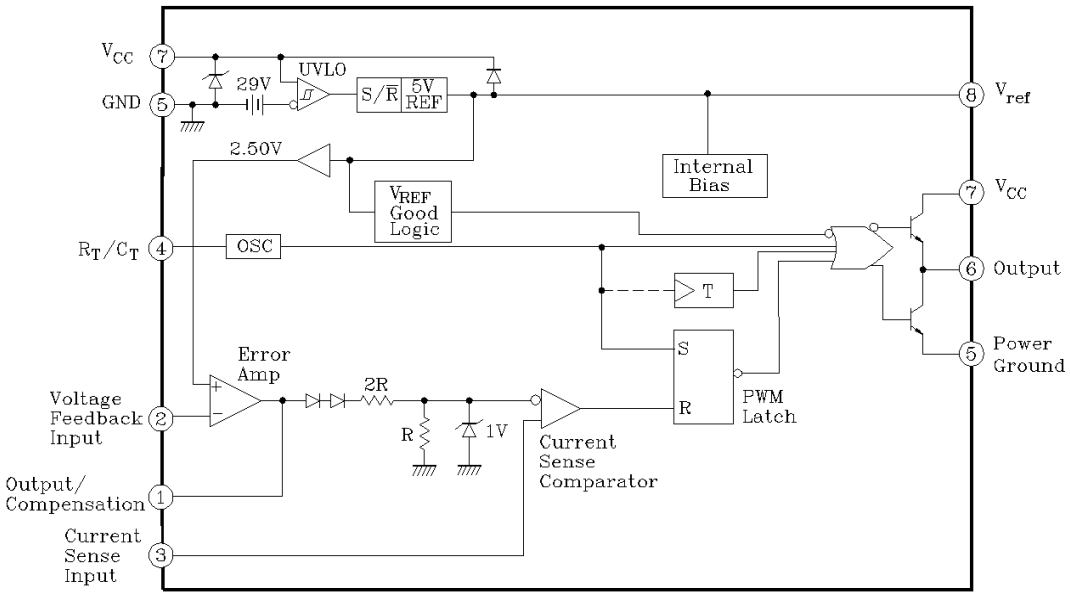
CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V_{CC}	30	V
Output Current, Source of Sink (Note 1)		I_O	1.0	A
Output Energy (Capacitive Load Per Cycle)		W	5.0	μJ
Analog Inputs (Pin ②, ③)		V_{IN}	-0.3 to + 6.3	V
Error Amp Output Sink Current		I_O	10	mA
Power Dissipation	KIA384XAP	P_D	1.25	W
	KIA384XAF		800	mW
Operating Temperature		Ta	0 to + 70	℃
Storage Temperature		T_{stg}	-65 to + 150	℃

NOTE : 1. Maximum package power dissipation limits must be observed.

PIN CONNECTIONS (TOP VIEW)



BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS (Vcc=15V (Note 2), R_T=10kΩ, C_T=3.3nF, Ta=25℃)

REFERENCE SECTION

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Output Voltage	V_{ref}	I_O=1.0mA, Ta=25℃	4.9	5.0	5.1	V
Line Regulation	Reg_{line}	12V≤V_{IN}≤25V	-	2.0	20	mV
Load Regulation	Reg_{load}	1mA≤I_O≤20mA	-	3.0	25	mV
Temperature Stability	T_S	-	-	0.2	-	mV/℃
Total Output Variation over Line, Load, and Temperature	V_{ref}	-	4.82	-	5.18	V
Output Noise Voltage	V_{no}	10Hz≤f≤10kHz, Ta=25℃	-	50	-	μV
Long Term Stability	S	Ta=125℃, 1000Hrs	-	5.0	-	mV
Output Short Circuit Current	I_{SC}	-	-30	-85	-180	mA

OSCILLATOR SECTION

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Frequency	f_{osc}	Ta=25℃	47	52	57	kHz
Frequency Change With Voltage	$\Delta f_{osc}/\Delta V$	12V≤V_{CC}≤25V	-	0.2	1.0	%
Frequency Change With Temperature	$\Delta f_{osc}/\Delta T$	0≤Ta≤70℃	-	5.0	-	%
Oscillator Voltage Swing	V_{OSC}	4 PIN Peak to Peak	-	1.7	-	V
Discharge Current	I_{dischg}	V_{PIN4}=2V	7.8	8.3	8.8	mA

ERROR AMPLIFIER SECTION

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Voltage Feedback Input	V_{FB}	V_{PIN1}=2.5V	2.42	2.5	2.58	V
Input Bias Current	I_{IB}	-	-	-0.3	-2.0	μA
Open-Loop Voltage Gain	A_{VOL}	2V≤V_O≤4V	65	90	-	μA
Unity Gain Bandwidth	BW	Ta=25℃	0.7	1.0	-	MHz
Power Supply Rejection Ratio	PSRR	12V≤V_{CC}≤25V	60	70	-	dB
Output Sink Current	I_{sink}	V_{PIN2}=2.7V, V_{PIN1}=1.1V	2.0	12	-	mA
Output Source Current	I_{source}	V_{PIN2}=2.3V, V_{PIN1}=5V	-0.5	-0.8	-	
Vout High	V_{OH}	R_L=15k to GND, V_{PIN2}=2.3V	5.0	6.0	-	V
Vout Low	V_{OL}	R_L=15k to Ref, V_{PIN2}=2.7V	-	0.7	1.1	

CURRENT SENSE SECTION

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Current Sense Input Voltage Gain	A_V	V_{FB}=0, V_{IN}=0~0.8V $A_V=\frac{\Delta V \text{ output Compensation}}{\Delta V \text{ Current Sense Input}}$	2.85	3.0	3.15	V/V
Maximum Current Sense Input Threshold	V_{th}	V_{PIN1}=5V, V_{PIN2}=0V	0.9	1.0	1.1	V
Power Supply Rejection Ratio	PSRR	12V≤V_{CC}≤25V, V_{PIN2}=0V	-	70	-	dB
Input Bias Current	I_{IB}	-	-	-2.0	-10	μA
Propagation Delay	$t_{PLH(IN/OUT)}$	Current Sense Input to Output, V_{PIN3}=0 to 2V	-	100	200	nS

OUTPUT SECTION

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Low State Output Voltage	V_{OL}	I_{sink}=20mA	-	0.1	0.4	V
		I_{sink}=200mA	-	1.5	2.2	
High State Output Voltage	V_{OH}	I_{source}=20mA	13	13.5	-	V
		I_{source}=200mA	12	13.5	-	
Rise Time	t_r	C_L=1.0nF, V_{FB}=0	-	40	100	nS
Fall Time	t_f	C_L=1.0nF, V_{FB}=0	-	40	100	nS
UVLO Saturation	V_{OLS}	V_{CC}=6V, I_{SINK}=1mA	-	0.7	1.2	V
Output Voltage Swing Limit	V_{OLIM}	V_{CC}=27V, C_1=1nF	-	22	-	V

UNDER VOLTAGE LOCKOUT SECTION

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Start-up Threshold Voltage	V_{TH}		KIA3842/4A	14.5	16	17.5	V
			KIA3843/5A	7.8	8.4	9.0	
Minimum Operating Voltage	$V_{CC(min.)}$	After Turn ON	KIA3842/4A	8.5	10	11.5	V
			KIA3843/5A	7.0	7.6	8.2	

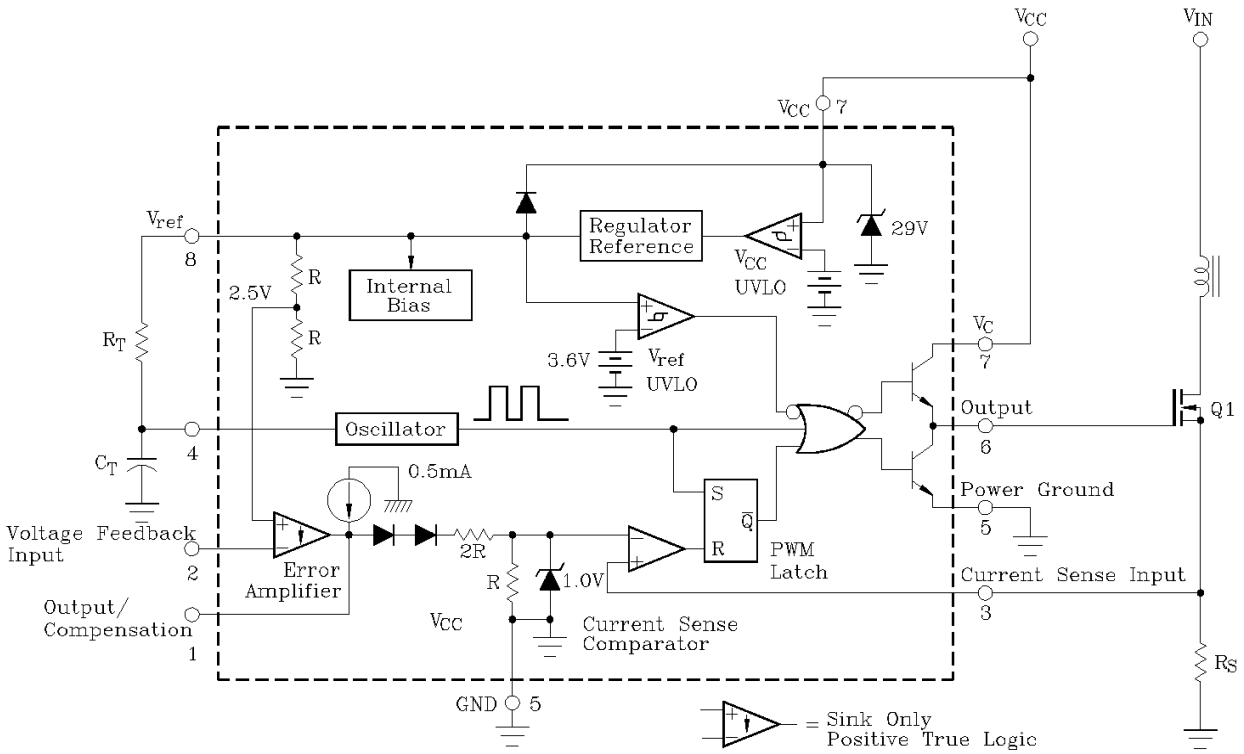
PWM SECTION

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Duty Cycle Max.	$DC_{max.}$		KIA3842/3A	94	96	100	%
			KIA3844/5A	47	48	50	
Duty Cycle Min.	$DC_{min.}$			-	-	0	%

TOTAL DEVICE

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Current	I_{CC}	V_{CC}=14V	-	0.2	0.5	mA
		V_{CC}=15V, after turn ON	-	11	17	
Power Supply Zener Voltage	V_Z	I_{CC}=25mA	-	29	-	V

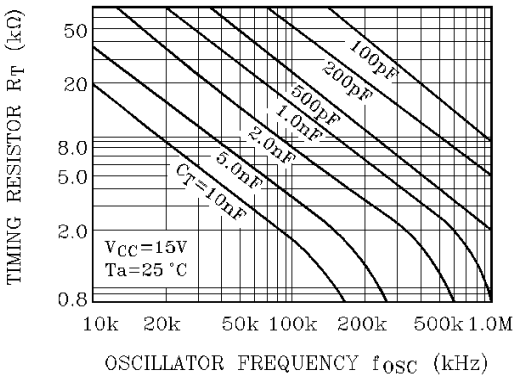
TEST CIRCUIT



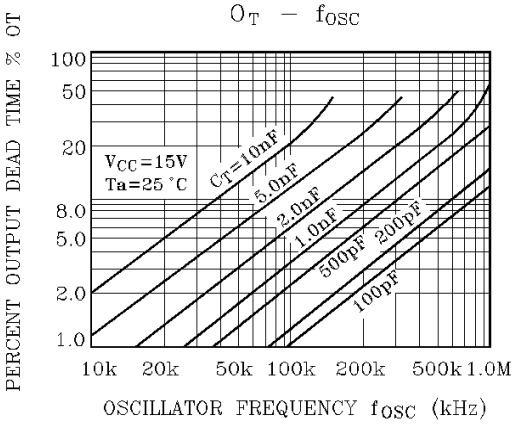
PIN FUNCTION DESCRIPTION

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	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. Operation to 500kHz 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 1.0A are sourced and sunk by this pin.
7	V_{CC}	This pin is the positive supply of the control IC.
8	V_{ref}	This is the reference output. It provides charging current for capacitor C_T through resistor R_T.

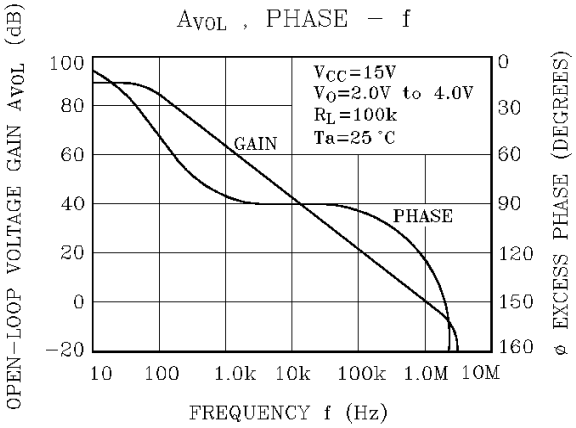
R_T – f_{OSC}



O_T – f_{OSC}



A_{VOL} , PHASE – f



I_{CC} – V_{CC}