

Current Mode PWM Controller

◆ Description

The KA384x are fixed frequency current mode PWM controller. They are specially designed for off-line and DC to DC converter applications with a minimal external components.

Internally implemented circuits include 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. Protection circuitry includes built under voltage lockout and current limiting.

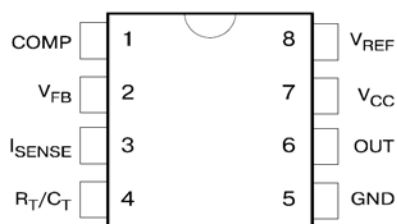
◆ Features

- Low Star-up and Operating Current
- High Current Totem Pole Output
- Under Voltage Lockout With Hysteresis
- Operating Frequency Up to 500KHz

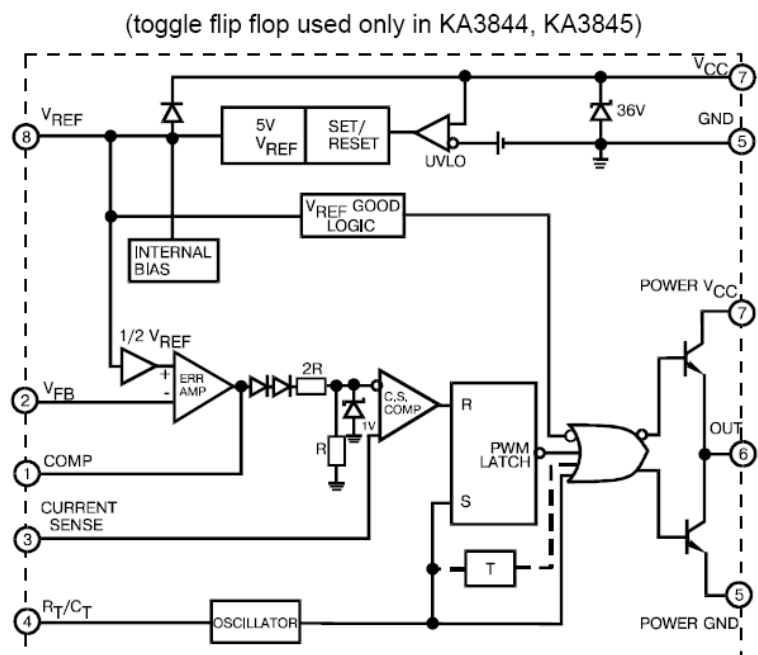
◆ Applications

- Switching Mode Power Supplies
- Power Converters

◆ Pin Description



Block Diagram



◆ Ordering Information

Part Number	Operating Temperature Range	Package	Packing
KA3842KI	-40 °C ~ +85 °C	SOP-8	Tape & Reel
KA3843KI		SOP-8	Tape & Reel
KA3844KI		SOP-8	Tape & Reel
KA3845KI		SOP-8	Tape & Reel
KA3842JI	-40 °C ~ +85 °C	DIP-8	Tube
KA3843JI		DIP-8	Tube
KA3844JI		DIP-8	Tube
KA3845JI		DIP-8	Tube

◆ Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage (Low Impedance Source)	30	V
I _{OUT}	Output Current	±1	A
V _{IN}	Input Voltage (Analog Input pins 2,3)	-0.3 ~ 5.5	V
I _{SINK(E.A)}	Error Amp Output Sink Current	10	mA
P _D	Power Dissipation (T _A =25°C)	1.0	W
T _{STG}	Storage Temperature Range	-65 ~ 150	°C
T _{LEAD}	Lead Temperature (Soldering 5 Sec.)	260	°C

◆ Thermal Characteristics

Symbol	Parameter	Package	Typical Value	Unit
θ _{JA}	Thermal Resistance From Junction to Ambient in Free Air. (Measured with the component mounted on a high effective thermal conductivity test board in free air.)	SOP-8	160	°C/W
		DIP-8	100	

◆ Electrical Characteristics

($T_A=25\text{ }^\circ\text{C}$, $V_{CC}=15\text{V}$, $R_T=10\text{K}\Omega$, $C_T=3.3\text{nF}$, $T_A=0^\circ\text{C}$ to $+70^\circ\text{C}$, unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Reference Section						
V_{REF}	Reference Output Voltage	$T_J=25^\circ\text{C}$, $I_{REF}=1\text{mA}$	4.9	5.0	5.1	V
Reg_{line}	Line Regulation	$12\text{V}\leq V_{CC}\leq 25\text{V}$	-	6.0	20	mV
Reg_{load}	Load Regulation	$1\text{mA}\leq I_{REF}\leq 20\text{mA}$	-	6.0	25	mV
I_{SC}	Short Circuit Output Current	$T_A=25^\circ\text{C}$	-	-100	-180	mA
Oscillator Section						
f	Oscillator Frequency	$T_J=25^\circ\text{C}$	47	52	57	KHz
$\Delta f/\Delta V_{CC}$	Frequency Change with Voltage	$12\text{V}\leq V_{CC}\leq 25\text{V}$	-	0.05	1.0	%
$V_{(OSC)}$	Oscillator Amplitude	(peak to peak)	-	1.6	-	V
Error Amplifier Section						
I_{BIAS}	Input Bias Current	$V_{FB}=3\text{V}$	-	-0.1	-2.0	μA
$V_{IN(E.A)}$	Input Voltage	$V_{pin1}=2.5\text{V}$	2.42	2.5	2.58	V
A_{VOL}	Open Loop Voltage Gain	$2\text{V}\leq V_o\leq 4\text{V}$	65	90	-	dB
UGBW	Unity Gain Bandwidth	$T_J=25^\circ\text{C}$, Note 3	0.5	0.6	-	MHz
PSRR	Power Supply Rejection Ratio	$12\text{V}\leq V_{CC}\leq 25\text{V}$	60	70	-	dB
I_{SINK}	Output Sink Current	$V_{pin2}=2.7\text{V}$, $V_{pin1}=1.1\text{V}$	2.0	7.0	-	mA
I_{SOURCE}	Output Source Current	$V_{pin2}=2.3\text{V}$, $V_{pin1}=5.0\text{V}$	-0.5	-1.0	-	mA
V_{OH}	High Output Voltage	$V_{pin2}=2.3\text{V}$, $R_L=15\text{K}\Omega$ to GND	5.0	6.0	-	V
V_{OL}	Low Output Voltage	$V_{pin2}=2.3\text{V}$, $R_L=15\text{K}\Omega$ to pin 8	-	0.8	1.1	V
Current Sense Section						
G_V	Gain	(Note 1 & 2)	2.85	3.0	3.15	V/V
$V_{IN(MAX)}$	Maximum Input Signal	$V_{pin1}=5\text{V}$ (Note 1)	0.9	1.0	1.1	V
SVR	Supply Voltage	$12\text{V}\leq V_{CC}\leq 25\text{V}$	-	70	-	dB
I_{BIAS}	Input Bias Current	$V_{pin3}=3\text{V}$	-	-3.0	-10	μA
Output Section						
V_{OL}	Low Output Voltage	$I_{SINK}=20\text{mA}$	-	0.08	0.4	V
		$I_{SINK}=200\text{mA}$	-	1.4	2.2	
V_{OH}	High Output Voltage	$I_{SINK}=20\text{mA}$	13	13.5	-	
		$I_{SINK}=200\text{mA}$	12	13.0		
t_R	Rise Time	$T_J=25^\circ\text{C}$, $C_L=1\text{nF}$ (Note 3)	-	45	150	nS
t_F	Fall Time	$T_J=25^\circ\text{C}$, $C_L=1\text{nF}$ (Note 3)	-	35	150	
Under-voltage Lockout Section						
$V_{TH(ST)}$	Start Threshold	KA3842 / KA3844	14.5	16.0	17.5	V
		KA3843 / KA3845	7.8	8.4	9.0	
$V_{OPR(min)}$	Min. Operating Voltage (After Turn On)	KA3842 / KA3844	8.5	10	11.5	V
		KA3843 / KA3845	7.0	7.6	8.2	

◆ Electrical Characteristics (Con.)

($T_A=25\text{ }^\circ\text{C}$, $V_{CC}=15\text{V}$, $R_T=10\text{K}\Omega$, $C_T=3.3\text{nF}$, $T_A=0^\circ\text{C}$ to $+70^\circ\text{C}$, unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
PWM Section						
$D_{(\text{Max.})}$	Max. Duty Cycle	KA3842 / KA3843	95	97	100	%
		KA3844 / KA3845	47	48	50	
$D_{(\text{Min.})}$	Min. Duty Cycle		-	-	0	
Total Standby Current						
I_{ST}	Start-Up Current	KA3843 / KA3845	-	0.13	0.3	mA
		KA3842 / KA3844	-	0.2	0.3	
$I_{CC(\text{OPR})}$	Operating Supply Current	$V_{\text{pin}3}=V_{\text{pin}2}=0\text{V}$	-	13	17	
V_Z	Zener Voltage	$I_{CC}=25\text{mA}$	30	38	-	V

* Adjust V_{CC} above the start threshold before setting it to 15V.

Notes:

Note 1: Parameter measured at trip point of latch with $V_{\text{pin}2}=0$.

Note 2: Gain defined as $A=\Delta V_{\text{pin}1}/\Delta V_{\text{pin}3}$; $0\leq V_{\text{pin}3}\leq 0.8\text{V}$

Note 3: These parameters, although guaranteed, are not 100% tested in production.

◆ Pin Function

Pin	Function	Description
1	COMP	This pin is the Error Amplifier output and is made for loop compensation.
2	V_{FB}	This is the inverting input of the Error Amplifier. It is normally connected to the switching power supply output through a resistor divider.
3	I_{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.
5	GND	This pin is the combined control circuitry and power ground.
6	OUT	This output directly drives the gate of a power MOSFET. Peak currents up to 1A are sourced and sink by this pin.
7	V_{CC}	This pin is the positive supply of the integrated circuit.
8	V_{REF}	This is the reference output. It provides charging current for capacitor C_T through resistor R_T .

◆ Application information

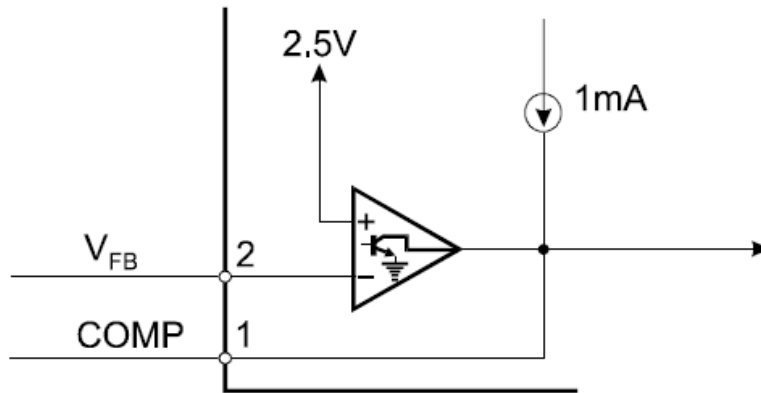


Figure 1. Error Amp Configuration

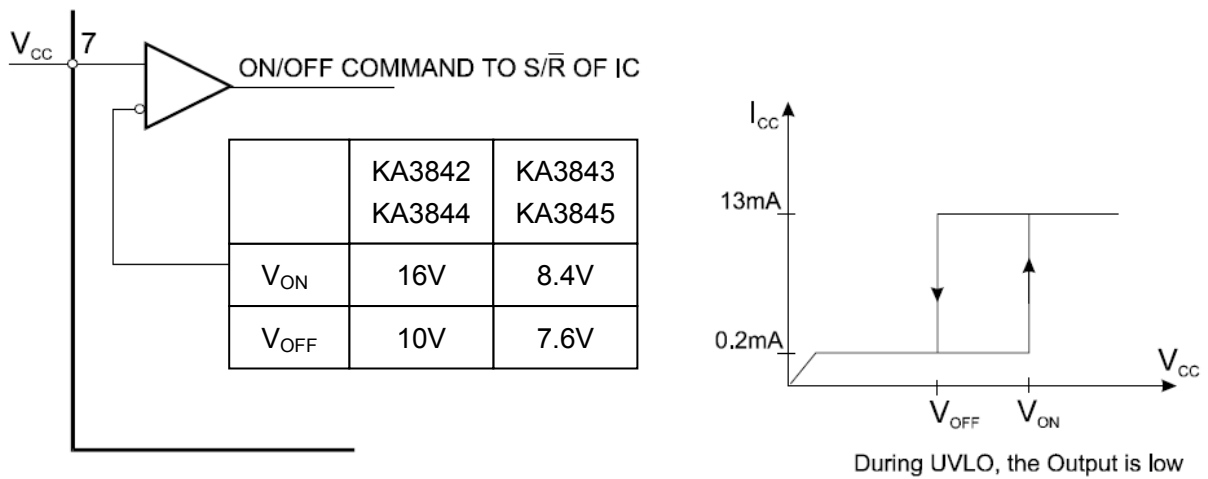


Figure 2. Under voltage Lockout

◆ Application information (Con.)

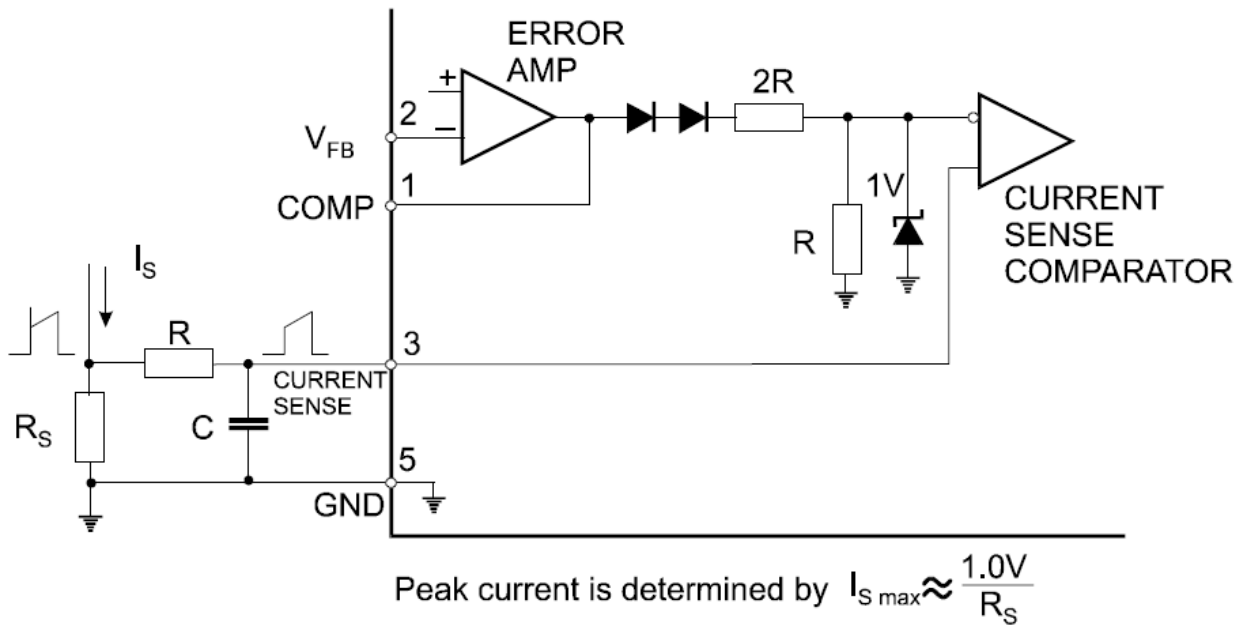


Figure 3. Current Sense Circuit

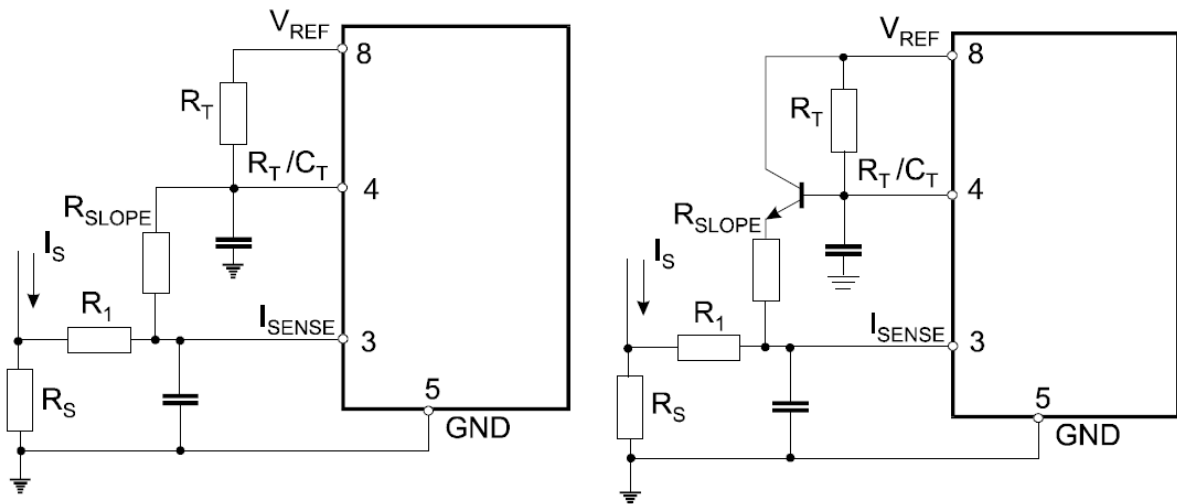
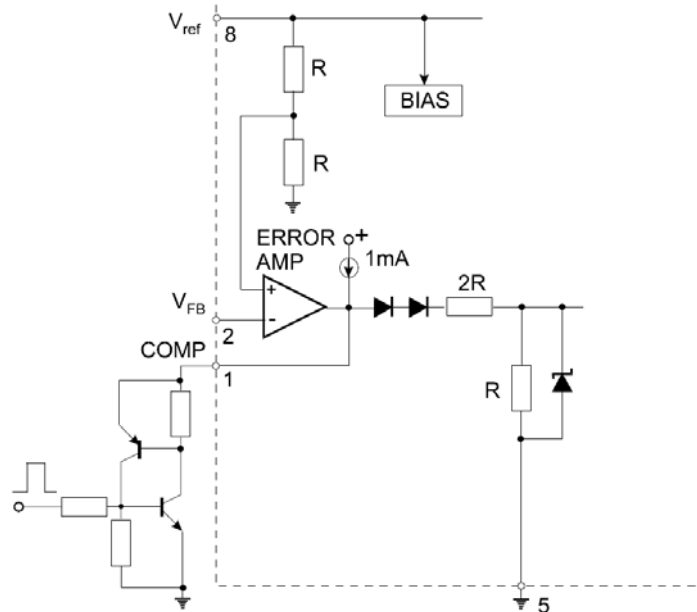
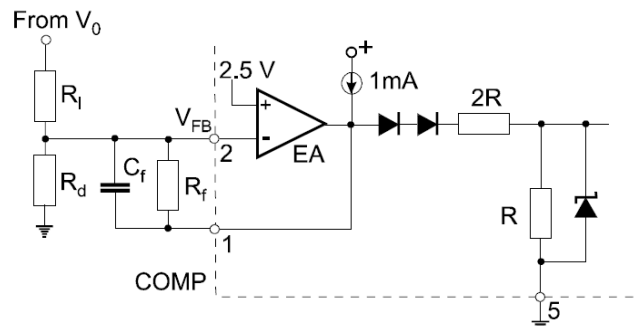


Figure 4. Slope Compensation Techniques

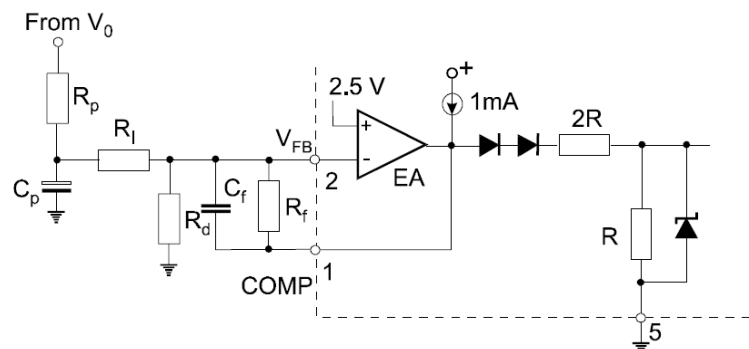
◆ Application information (Con.)


SCR must be selected for a holding current of less than 0.5mA.
The simple two transistor circuit can be used in place of the SCR as shown.

Figure 5. Latched Shutdown



Error Amp compensation circuit for stabilizing any current-mode topology except for boost and flyback converters operating with continuous inductor current.



Error Amp compensation circuit for stabilizing current-mode boost and flyback topologies operating with continuous inductor current.

Figure 6. Error Amplifier Compensation

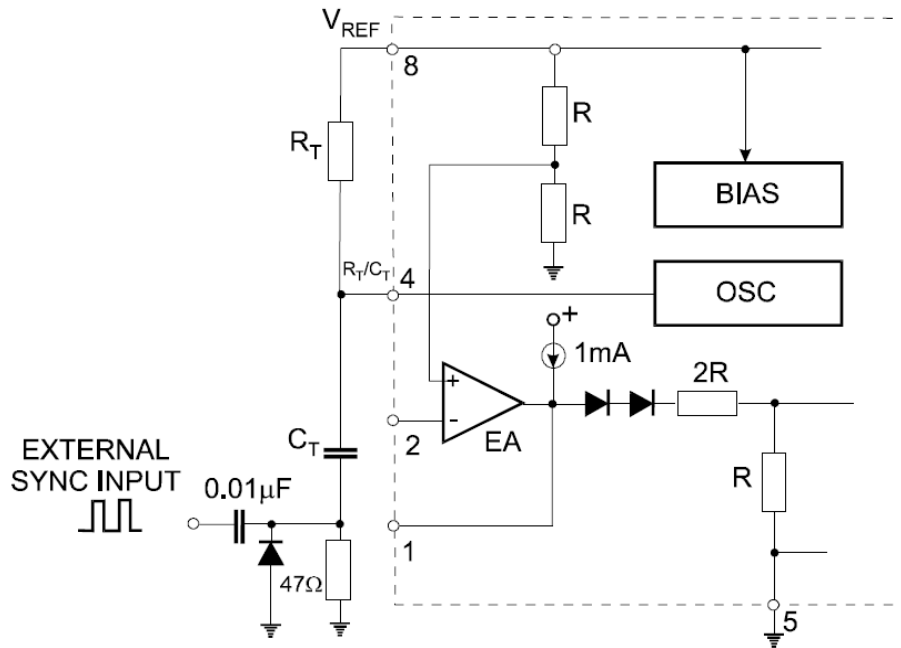
◆ Application information (Con.)


Figure 7. External Clock Synchronization

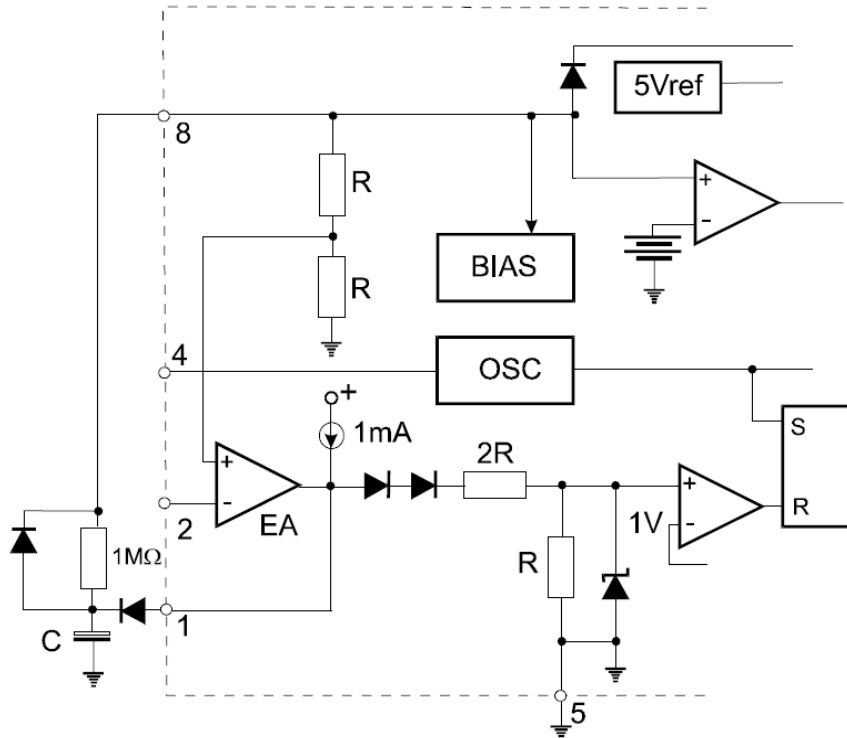


Figure 8. Soft-Start Circuit

◆ Typical Characteristics

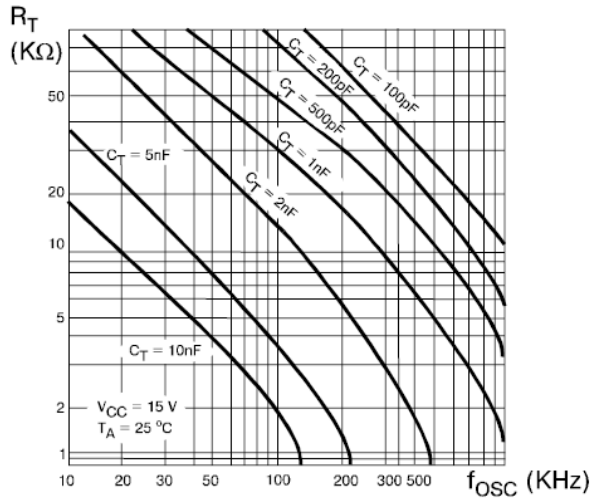


Figure 9. Timing Resistor vs. Oscillator Frequency

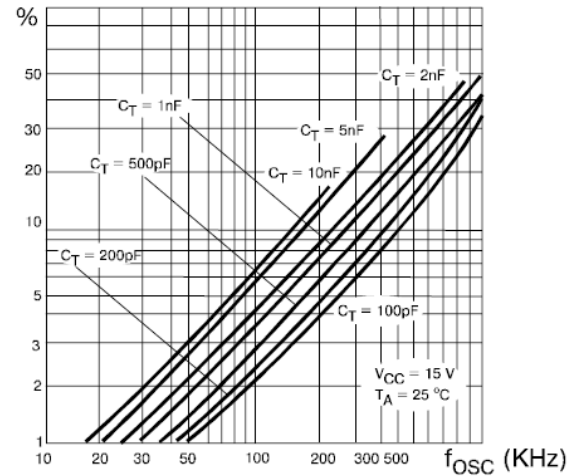


Figure 10. Output Dead-Time vs. Oscillator Frequency

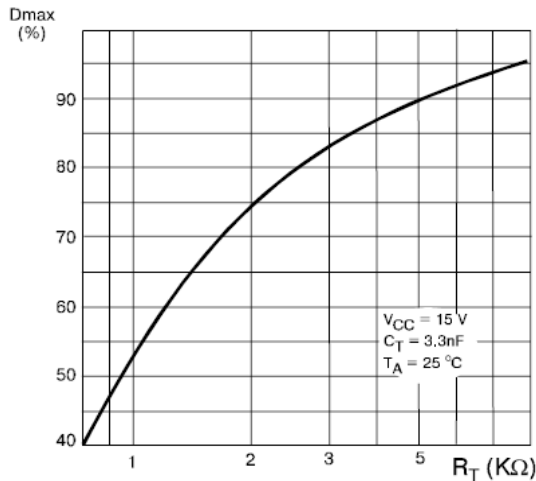


Figure 11. Maximum Output Duty Cycle vs. Timing Resistor (KA3842/43)

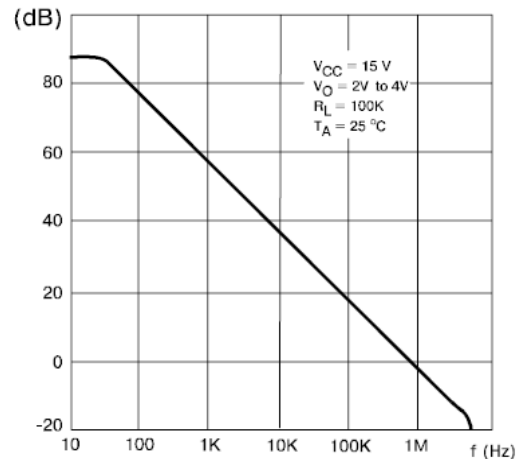


Figure 12. Error Amp Open-Loop Gain vs. Frequency

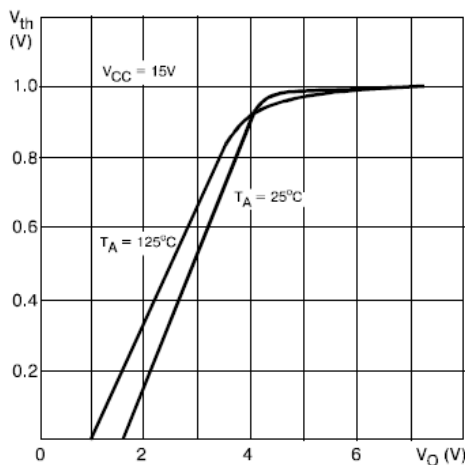


Figure 13. Current Sense Input Threshold vs. Error Amp Output Voltage

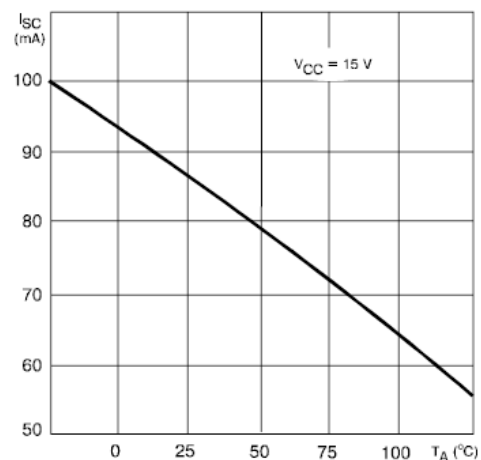


Figure 14. Reference Short Circuit Current vs. Temperature

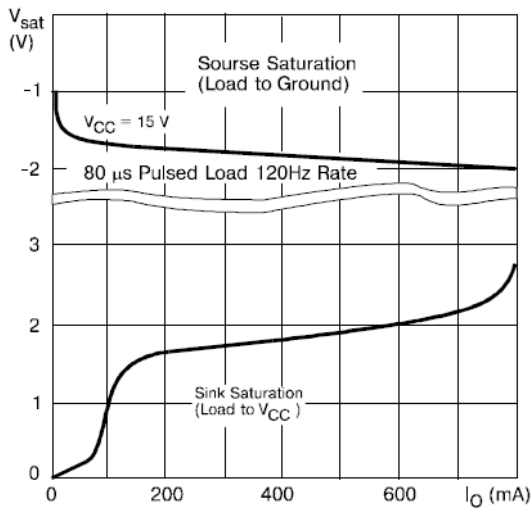
◆ Typical Characteristics (Con.)


Figure 15. Output Saturation Voltage vs. Load Current
 $T_A = 25^\circ\text{C}$

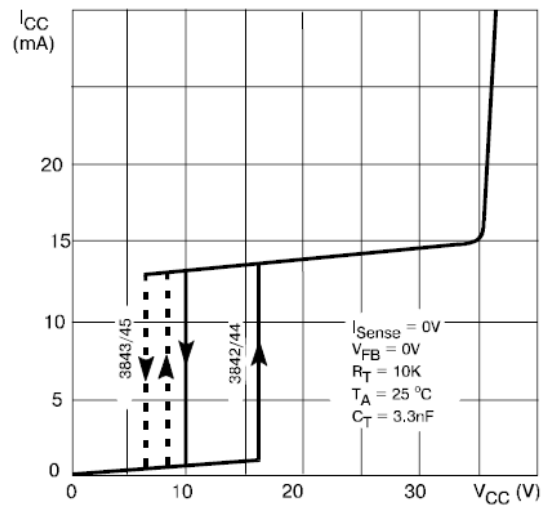


Figure 16. Supply Current vs. Supply Voltage

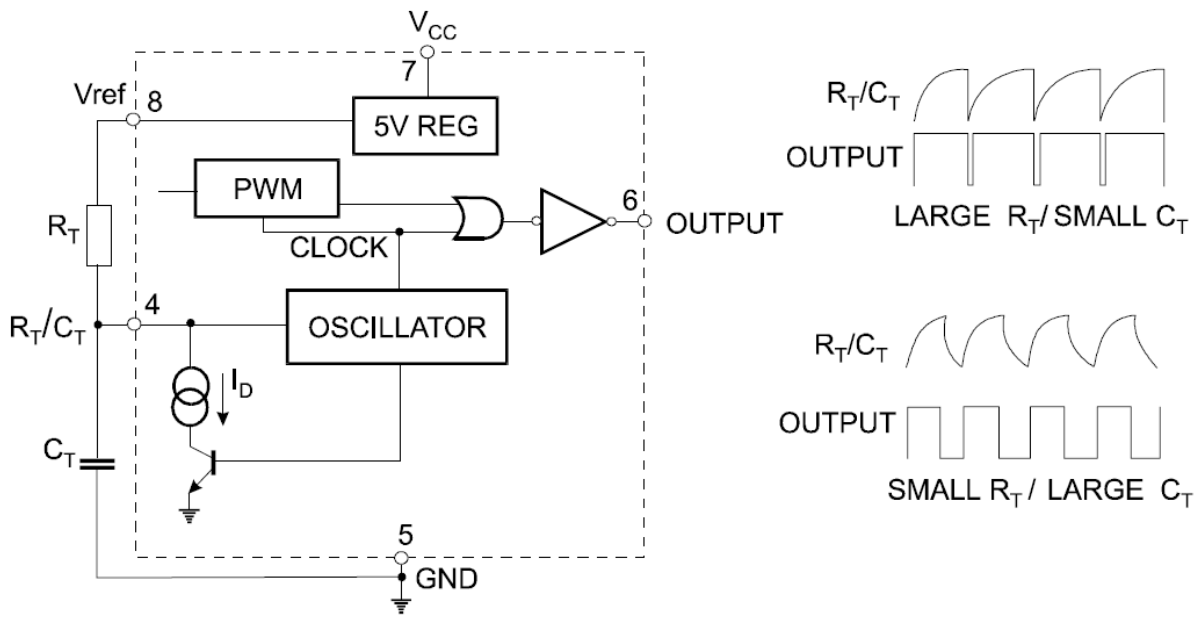
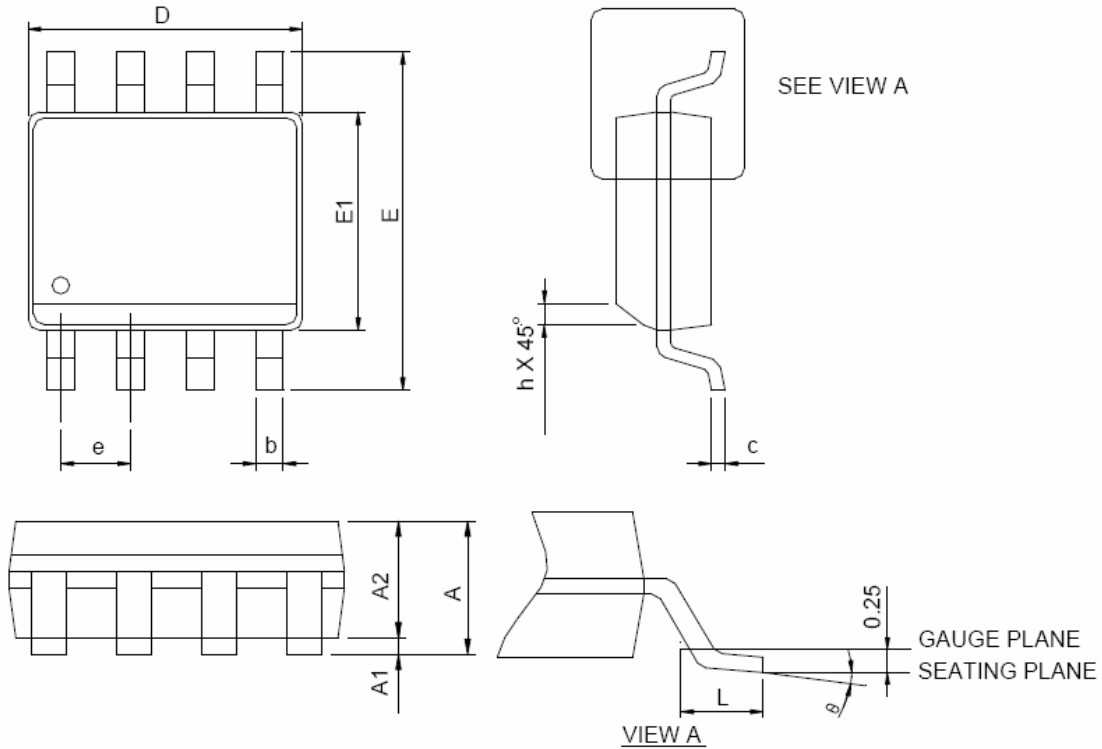


Figure 17. Oscillator and Output Waveforms

◆ Package Information

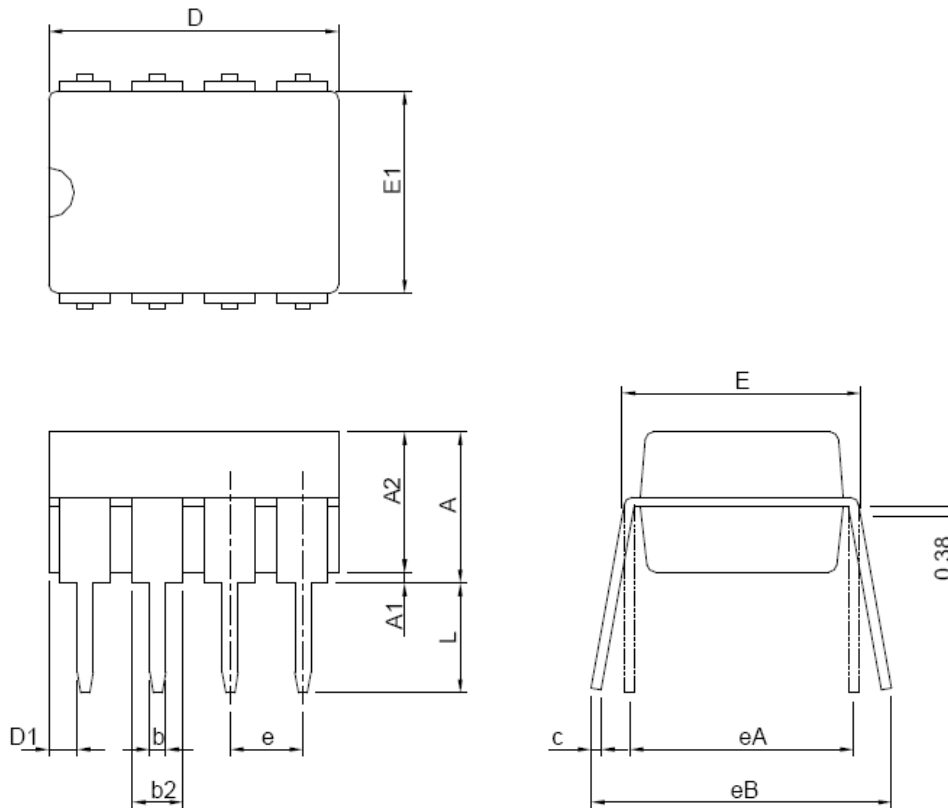
SOP-8



SYMBOL	SOP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.75		0.069
A1	0.10	0.25	0.004	0.010
A2	1.25		0.049	
b	0.31	0.51	0.012	0.020
c	0.17	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

◆ Package Information

DIP-8



DIMENSIONS	DIP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		5.33		0.210
A1	0.38		0.015	
A2	2.92	4.95	0.115	0.195
b	0.36	0.56	0.014	0.022
b2	1.14	1.78	0.045	0.070
c	0.20	0.35	0.008	0.014
D	9.01	10.16	0.355	0.400
D1	0.13		0.005	
E	7.62	8.26	0.300	0.325
E1	6.10	7.11	0.240	0.280
e	2.54 BSC		0.100 BSC	
eA	7.62 BSC		0.300 BSC	
eB		10.92		0.430
L	2.92	3.81	0.115	0.150