UC3843

Current-Mode Pulse Width Modulator

Description

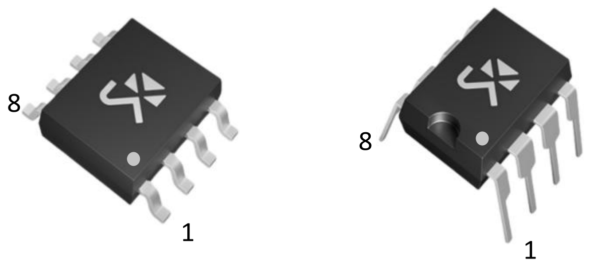
UC3843 is a constant-frequency current-mode PWM controller specifically designed for offline and DC-DC switching power supply applications. It internally integrates a temperature-compensated precision reference, an adjustable oscillator for precise duty cycle regulation, a high-gain error amplifier, a current-sensing comparator, a high-current push-pull output stage suitable for driving power MOSFETs, as well as protection circuits including single-cycle hysteretic current limiting, undervoltage lockout (UVLO) with adjustable dead time, and single-pulse count latch.

UC3843 is available in SOP-8 and DIP-8 packages.

Features

- Low start-up current(<0.5mA)
- Automatic feed forward compensation
- Undervoltage lockout with hysteresis
- Maximum duty cycle clamping
- Operating frequency up to 500kHz

Package Outline Drawing

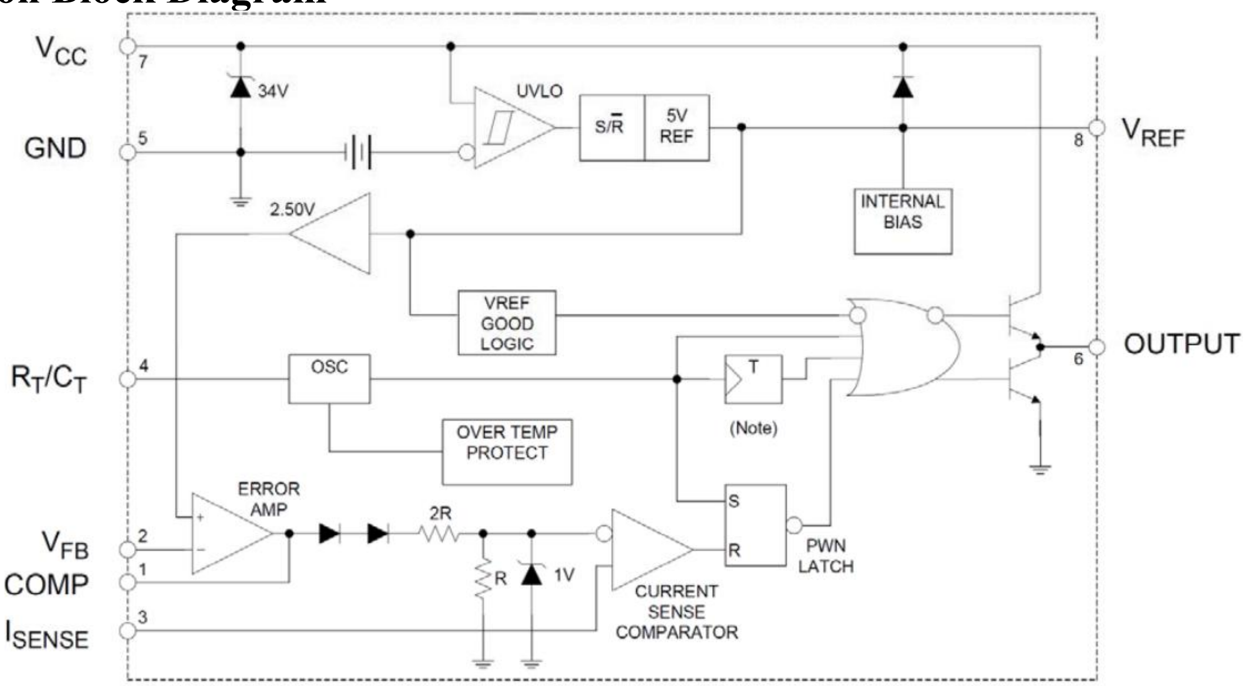


SOP-8 DIP-8

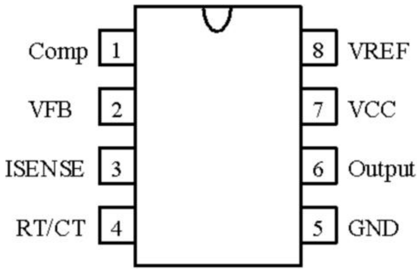
Ordering Information

Type	Marking	Package
UC3843-D8	UC3843	DIP-8
UC3843-P8	UC3843	SOP-8

Function Block Diagram



Pin Description



No.	Pin Name	Symbol	Description
1	Compensation	COMP	Error amplifier compensation pin. Connect external compensation components to this pin to modify the error amplifier output.
2	Voltage Feedback	V_{FB}	Inverting input to the internal error amplifier. V_{FB} is used to control the power converter voltage-feedback loop for stability
3	Current Sense	SENSE	Primary-side current sense pin. Connect to current sensing resistor. The PWM uses this signal to terminate the OUTPUT switch conduction.
4	Oscillator	R_T/C_T	Connect timing resistor, R_T, to V_{REF} and timing capacitor, C_T, to Ground from this pin to set the switching frequency and maximum output ratio. Maximum frequency can up to 500kHz.
5	Ground	GND	Ground
6	Output	OUTPUT	OUTPUT is the gate drive for the external MOSFET. Peak currents of up to 1A are sourced and sunk by this pin
7	Power Supply	V_{CC}	Provides power to the device
8	Reference Voltage	V_{REF}	V_{REF} is used to provide charging current to the oscillator timing capacitor through the timing resistor

Absolute Maximum Ratings

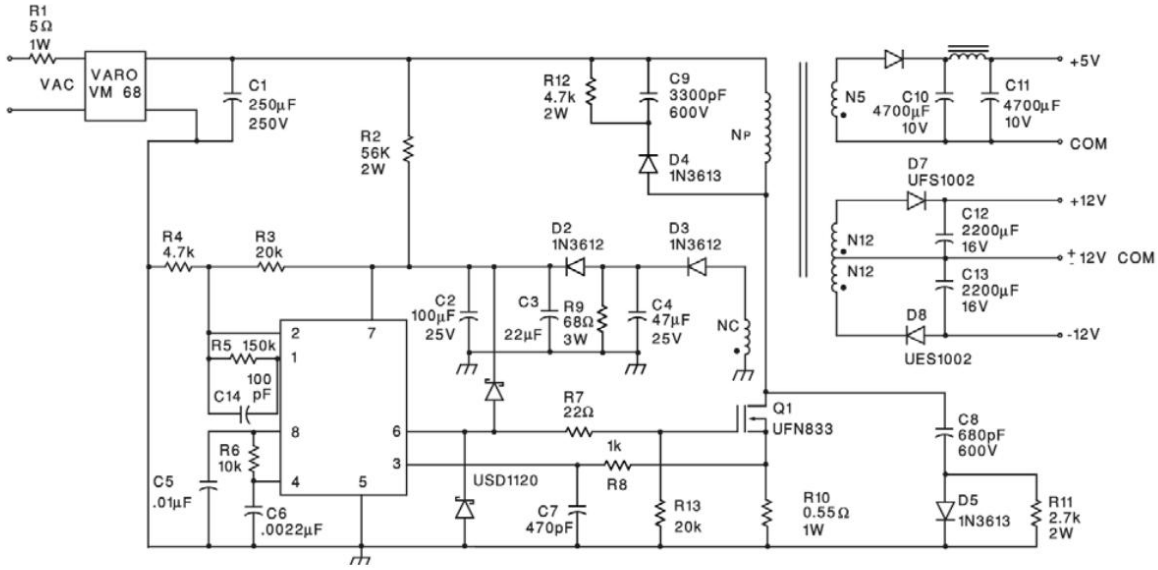
Parameter	Symbol	Min	Max	Unit
Power Voltage	V_{CC}		30	V
Output Current	I_O	-1	1	A
Output Energy	W		5.0	J
Error Amp Output Sink Current	I_O		10	mA
Current Sense and Voltage Feedback Inputs	V_{IN}	-0.3	5.5	V
Operating Junction Temperature	T_J		150	℃
Power Dissipation	P_D		1	W
Operating Ambient Temperature	T_{amb}	0	70	℃
Storage Temperature Range	T_{stg}	-55	150	℃

Electrical Characteristics (T_A=0~70℃, V_{CC}=15V, R_T=10kΩ, C_T=3.3nF unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Reference Section						
Reference Output Voltage	V_{REF}	T_J=25℃, I_O=1mA	4.90	5.00	5.10	V
Line Regulation	ΔV_{REF}	12V≤V_I≤25V		6	20	mV
Load Regulation	ΔV_{REF}	1mA≤V_I≤20mA		6	25	mV
Output Noise Voltage	V_N	10Hz≤f≤10kHz		50		µA
Output Short Circuit Current	I_{SC}	T_A=25℃	-30	-100	-180	mA
Oscillator Section						
Frequency	F_{osc}	T_J=25℃	47	52	57	kHz
Frequency Change with Voltage	$\Delta F_{osc}/\Delta V$	VCC=12V to 25V		0.2	1	%
Frequency Change with Temperature	$\Delta F_{osc}/\Delta T$	T_A=T_{low} to T_{high}		5		%
Oscillator Voltage Swing	V_{osc}	peak to peak		1.6		V
Discharge Current	Idischg	T_J=25℃	7.8	8.3	8.8	mA
Error Amplifier Section						
Voltage Feedback Input	V_{fb}	V_{pin1}=2.5V	2.42	2.50	2.58	V
Input Bias Current	I_{bias}	V_{fb}=5V		-0.1	-2	µA
Open Loop Voltage	GVOL	2V≤V_I≤4V	65	90		dB
Unity Gain Bandwidth	BW	T_J=25℃	0.7	1		MHz
Power Supply Rejection Ratio	PSRR	12V≤V_I≤25V	60	70		dB
Output Current-Sink	I_{sink}	V_{pin2}=2.7V, V_{pin1}=1.1V	2	12		mA
Output Current-Source	I_{source}	V_{pin2}=2.3V, V_{pin1}=5V	-0.5	-1		mA
Output Voltage Swing (High State)	V_{OH}	V_{pin2}=2.3V, R1=15kΩ to Ground	5	6.2		V
Output Voltage Swing (Low State)	V_{OL}	V_{pin2}=2.7V, R1=15kΩ to Pin8		0.8	1.1	V

Current Sense Section						
Current Sense Input Voltage Gain(1)(2)	G_V		2.85	3	3.15	V/V
Maximum Current Sense Input Threshold(1)	V3	V_{pin1}=5V	0.9	1.0	1.1	V
Power Supply Rejection Ration(1)	SVR	12V≤V_I≤25V		70		dB
Input Bias Current	I_b			-2	-10	µA
Propagation Delay	T_{PLH}(in/off)	Current sense Input to Output		150	300	ns
Output Section						
Output Voltage Low State	V_{OL}	I_{sink}=20mA		0.1	0.4	V
		I_{sink}=200mA		1.6	2.2	V
Output Voltage High State	V_{OH}	I_{source}=20mA	13	13.5		V
		I_{source}=200mA	12	13.5		V
Output Voltage with UVLO Activated	V_{ols}	V_{CC}=6V,I_{sink}=1mA		0.7	12	V
Output Voltage Rise Time(3)	t_r	T_J=25°C,C1=1nF		50	150	ns
Output Voltage Fall Time(3)	t_f	T_J=25°C,C1=1nF		50	150	ns
Undervoltage Lockout Section						
Startup Threshold	V_{th}		7.8	8.4	9.0	V
Minimum Operating Voltage After Turn On	V_{CC}(min)		7.0	7.6	8.2	V
PWM Section						
Duty Cycle Maximum	D(max)		94	96	100	%
Duty Cycle Minimum	D(min)			0		%
Total Device						
Power Supply Current (Startup)	Ist	V_I=14V		0.12	0.3	mA
Power Supply Current (Operating)	Ii	V_{pin2}=V_{pin3}=0V		12	17	mA
Power Supply Zener Voltage	Viz	I_i=25mA	30	36		V

Application Circuits



Note:

1.Input Voltage: 95Vac~130Vac(50Hz/60Hz)

2.Line dissipation: 3850V

3.Switching frequency: 40kHz

4.Efficiency: 70% full load

5.Output voltage: A +5V 5%/-5%: 1A~4A load, pulse voltage: 50mVp-pmax

B +12V 3%/-3%: 0.1A~0.3A load, pulse voltage: 100mVp-pmax

C -12V 3%/-3%: 0.1A~0.3A load, pulse voltage: 100mVp-pmax

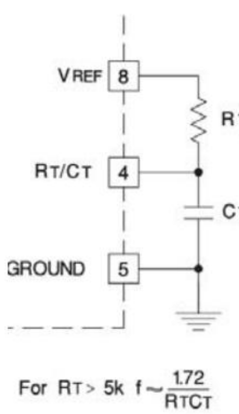
Usage Instruction

1.Buck Converter

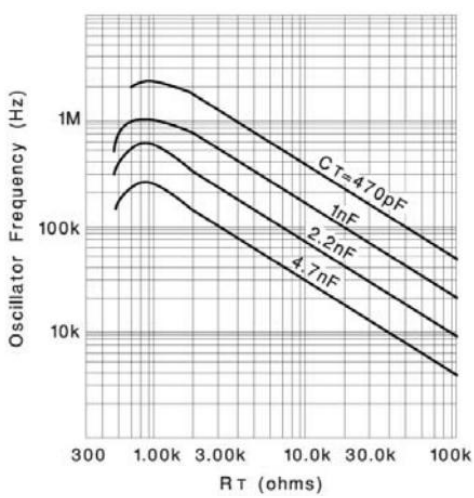
The oscillating frequency and maximum duty cycle is programmed by the timing components RT and CT. The following diagram shows the charging and discharging time.

Charging time: $t_c = 0.55RT*CT$

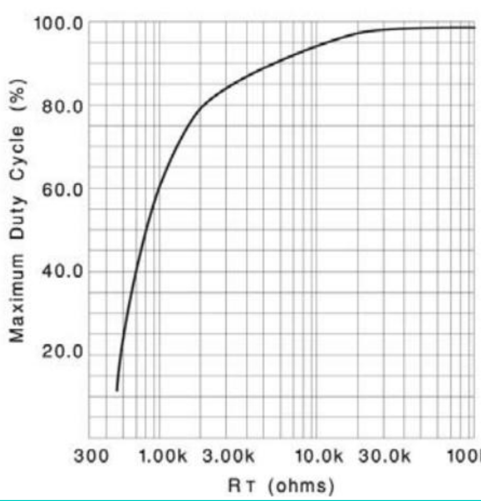
Discharging time: $t_a \approx RT*CT*\ln\{(0.0063RT-2.7)/(0.0063RT-4)\}$



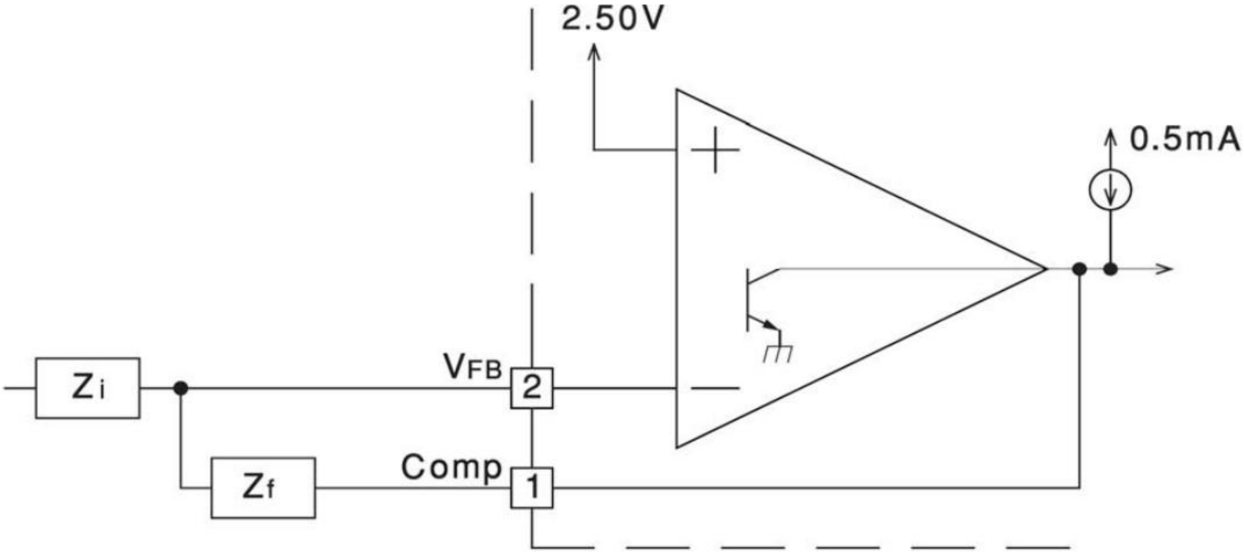
Frequency and Resistance



Maximum duty cycle

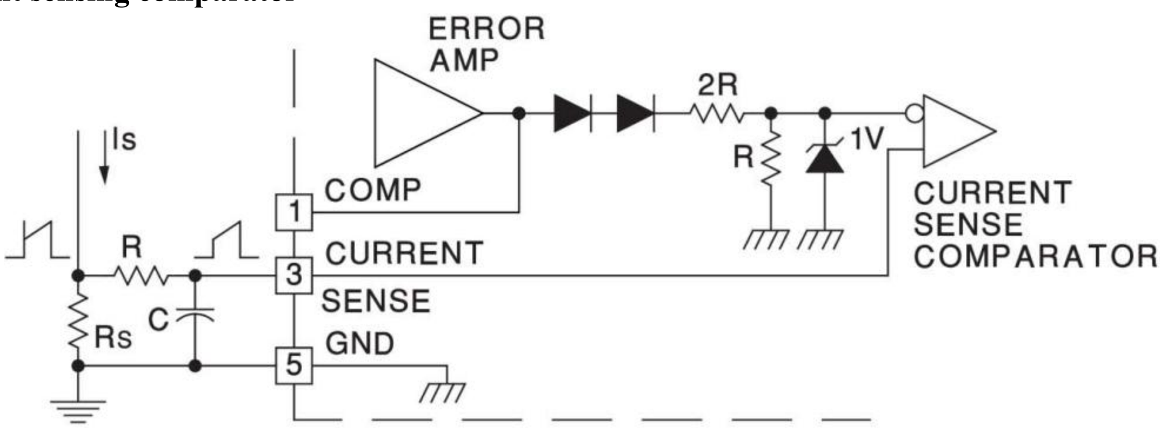


2.Error Amplifier



The open-loop gain of this amp. can reach 80dB. Under open-loop condition, frequency show as upper diagram. It provides 2.5V reference voltage. 2.5V internal reference voltage is added to the positive end of the amplifier. The sample voltage is input into the negative end of the amplifier and divided by the R1 and R2. The closed-loop gain can be adjusted by the negative feedback resistance Rf.

3.Current sensing comparator

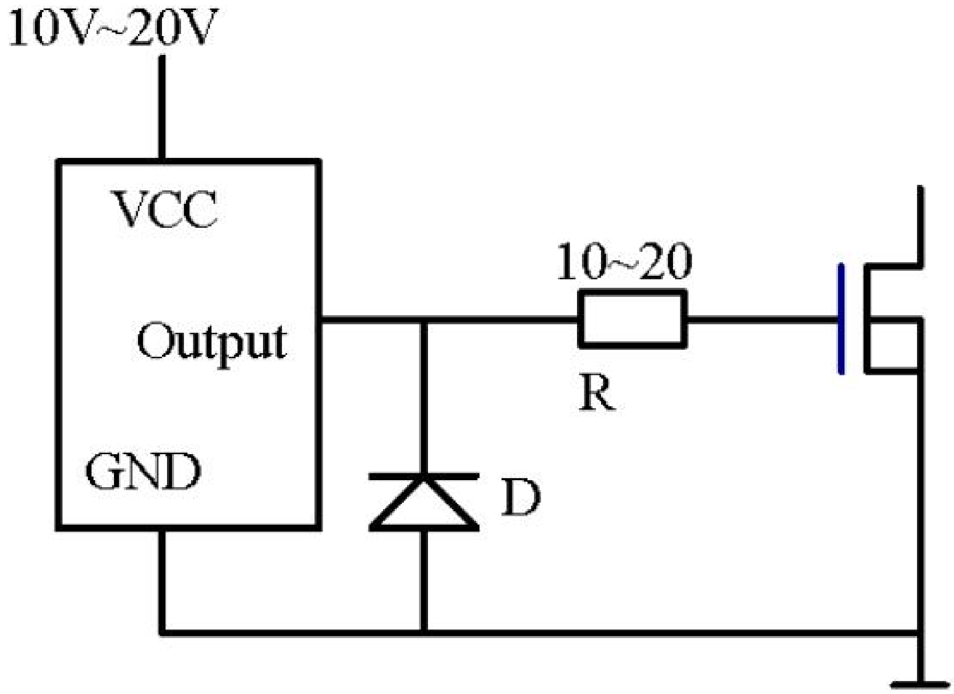


Peak Current (Is) is Determined By The Formula

$$I_{SMAX} \approx \frac{1.0V}{RS}$$

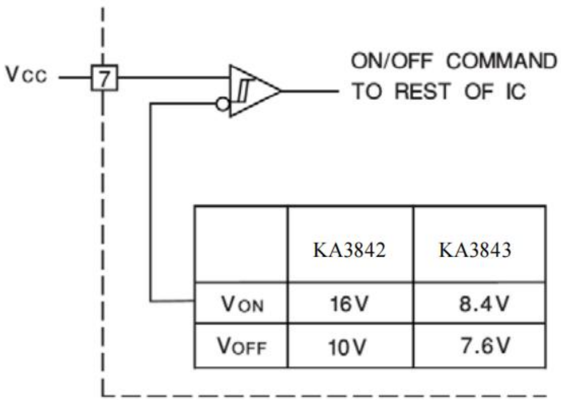
The sampling voltage is amplified by error amplifier and sent to the current sense comparator to convert into current mode to control the pulse-width. In addition, the current sense comparator plays the role of over-current protection. Imax=(N*1V)/Rs, N is the ratio of the primary turns of the transformer.

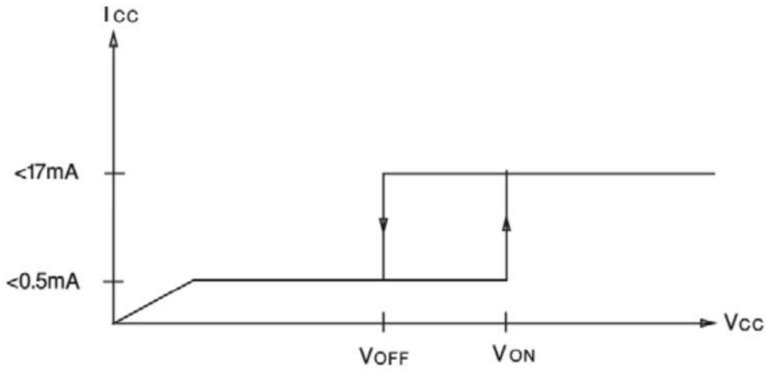
4.Push-pull Output



The UC3843 Pulse square waveform can drive field tube drive field tube directly and has ±1A drive current in peak.

5.Undervoltage lockout circuit

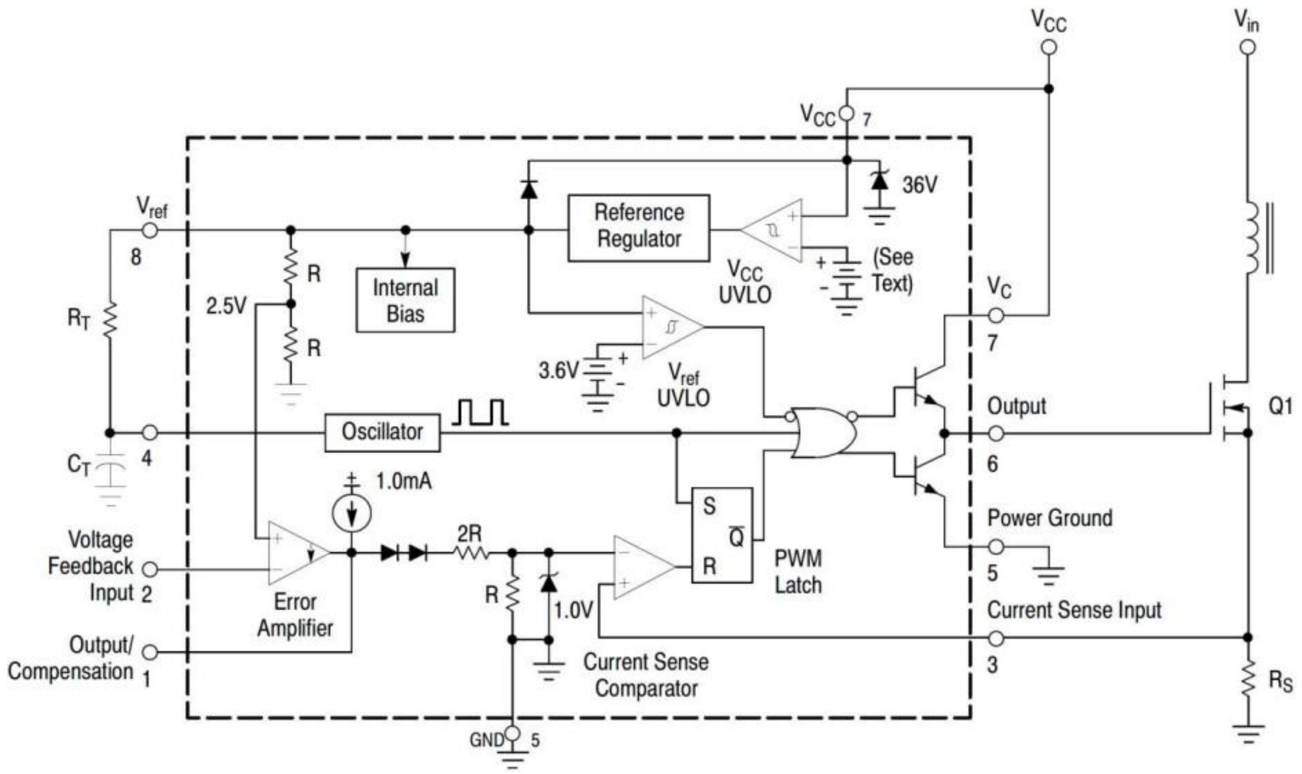




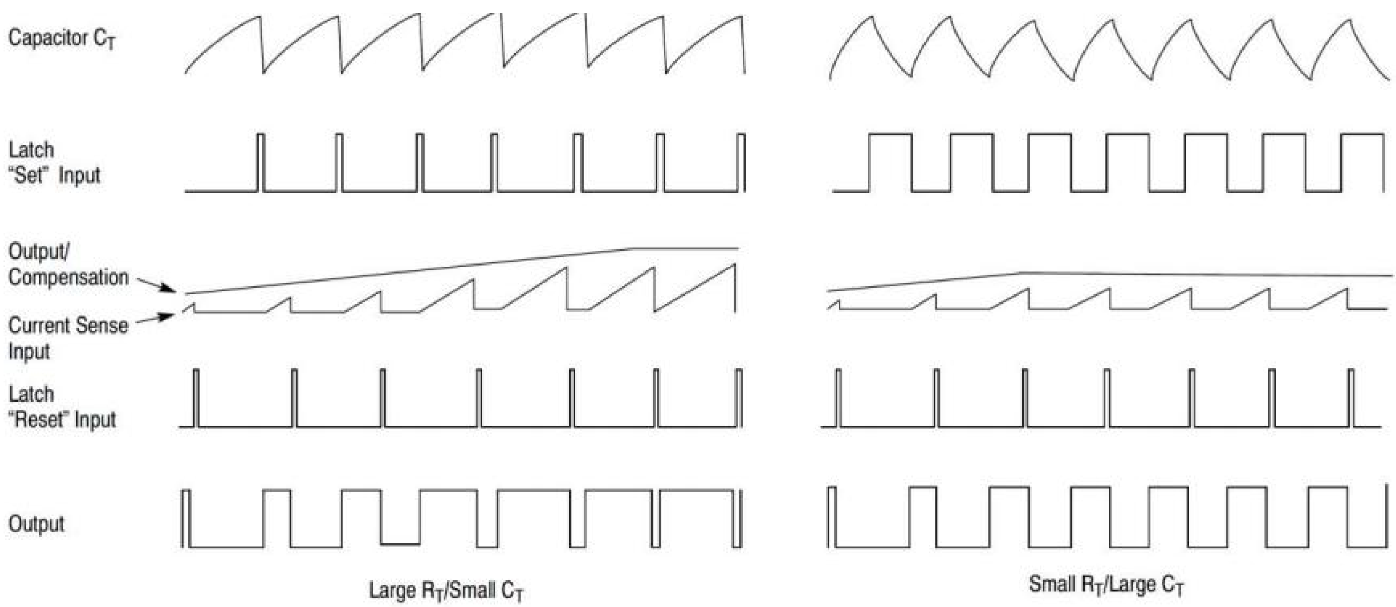
During UVLO, the Output is low.

The UC3843 contains an under-voltage lockout circuit (UVL0). The startup voltage and shutdown voltage are less than 10V. This ensures the stability of the switching power supply and makes it immune to fluctuations in the power grid. Additionally, an internal 5V leakage reference power supply is employed, which is extremely precise and stable.

6.Block Diagram



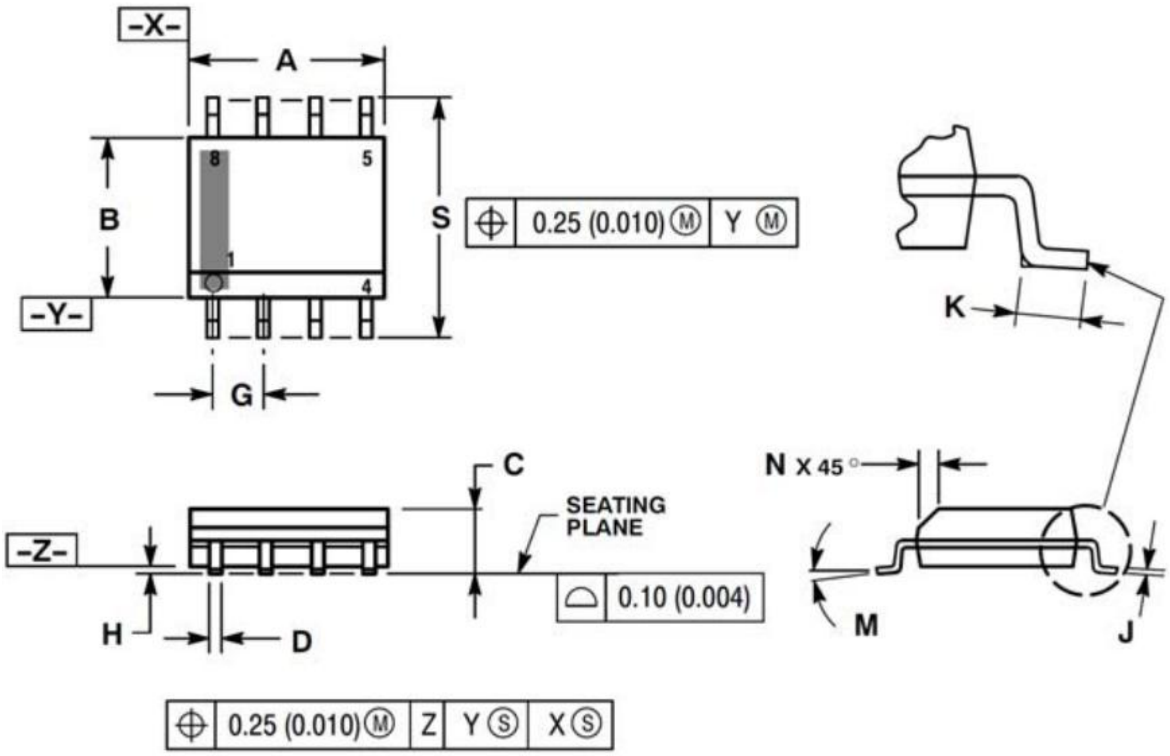
Timing Diagram



Package Information

SOP-8

Dimensions in mm



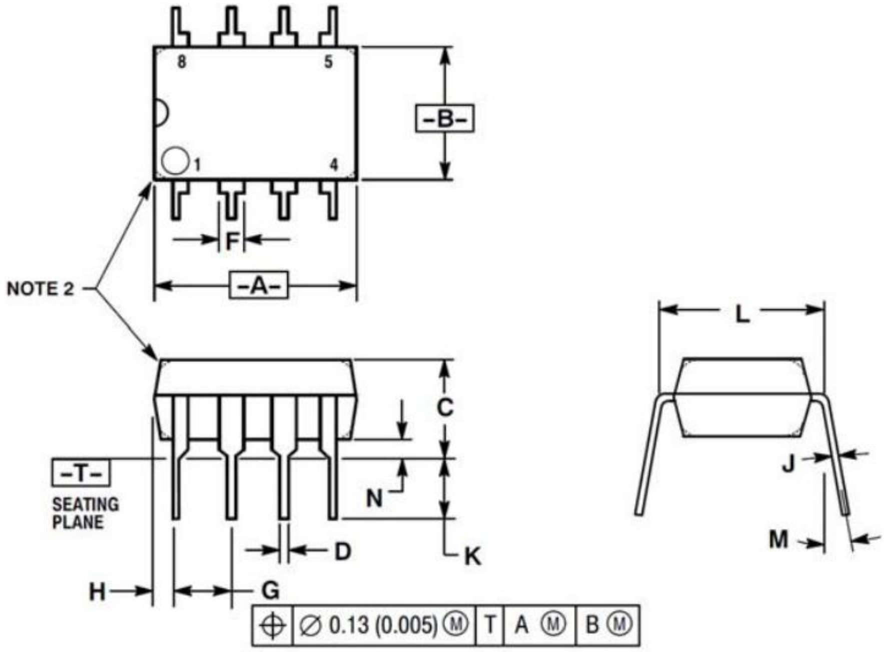
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

Package Information

DIP-8

Dimensions in mm



Note: 1.Dimension to center of lead when formed parallel
2.Package contour optional(Round or square corners)
3.Dimensioning and tolerancing per ANSI Y14.5M, 1982

Symbol	Millimeter		Inches	
	Min	Max	Min	Max
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	-	10°	-	10°
N	0.76	1.01	0.030	0.040

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