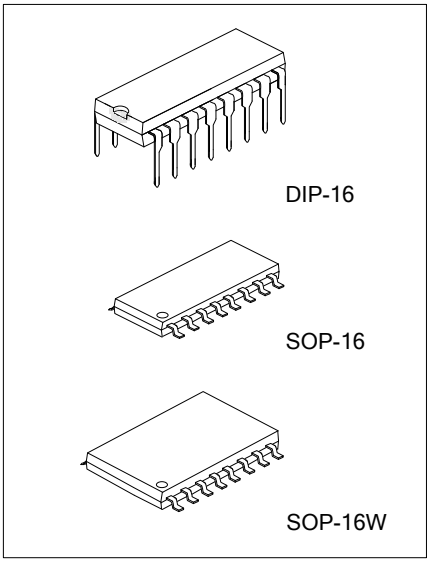
UC3846

LINEAR INTEGRATED CIRCUIT

CURRENT MODE PWM CONTROLLER



■ DESCRIPTION

The UTC **UC3846** control IC offers all necessary features for accomplishment of fixed frequency, current mode control functions, however it contains the least external parts. The performance of this technique is superior to the others in better line regulation, enhanced load response characteristics while designing a simpler and easier control loop for design. It owns topological advantages of inherent pulse-by-pulse current limiting, automatic symmetry correction for push-pull converters, and the ability to parallel “power modules" for equal current sharing.

Protection loop includes soft start, built-in under-voltage lockout and programmable current limit. The shutdown circuitry can provide either a complete shutdown with automatic restart or the supply off-latch.

In addition, many other features can also be available, including fully latched operation, double pulse suppression, deadline adjust, and a ±1% trimmed bandgap reference.

The UTC **UC3846** features low outputs in the OFF state.

■ FEATURES

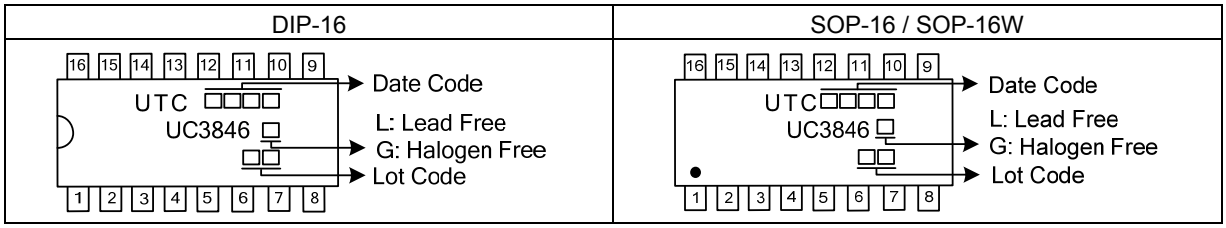
* Built-in under-voltage lockout
* Soft start
* Shutdown function
* 500kHZ operation
* Feed forward compensation
* ±1% bandgap reference
* Programmable pulse-by-pulse current limiting
* Improved load response characteristics
* Parallel operation capability for modular power systems
* Differential current sense amplifier with wide common mode range
* Double pulse suppression
* 500mA (Peak) totem-pole outputs
* Automatic symmetry correction in push-pull configuration

■ ORDERING INFORMATION

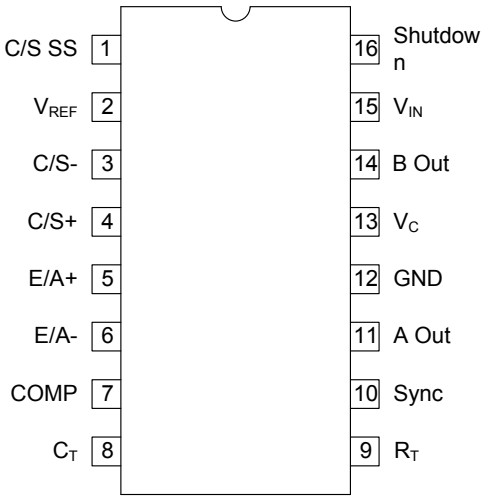
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UC3846L-D16-T	UC3846G-D16-T	DIP-16	Tube
UC3846L-S16-T	UC3846G-S16-T	SOP-16	Tube
UC3846L-S16-R	UC3846G-S16-R	SOP-16	Tape Reel
UC3846L-S16W-T	UC3846G-S16W-T	SOP-16W	Tube
UC3846L-S16W-R	UC3846G-S16W-R	SOP-16W	Tape Reel

UC3846G-D16-T (1)Packing Type (2)Package Type (3)Green Package	(1) T: Tube, R: Tape Reel (2) D16: DIP-16, S16: SOP-16, S16W: SOP-16W (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



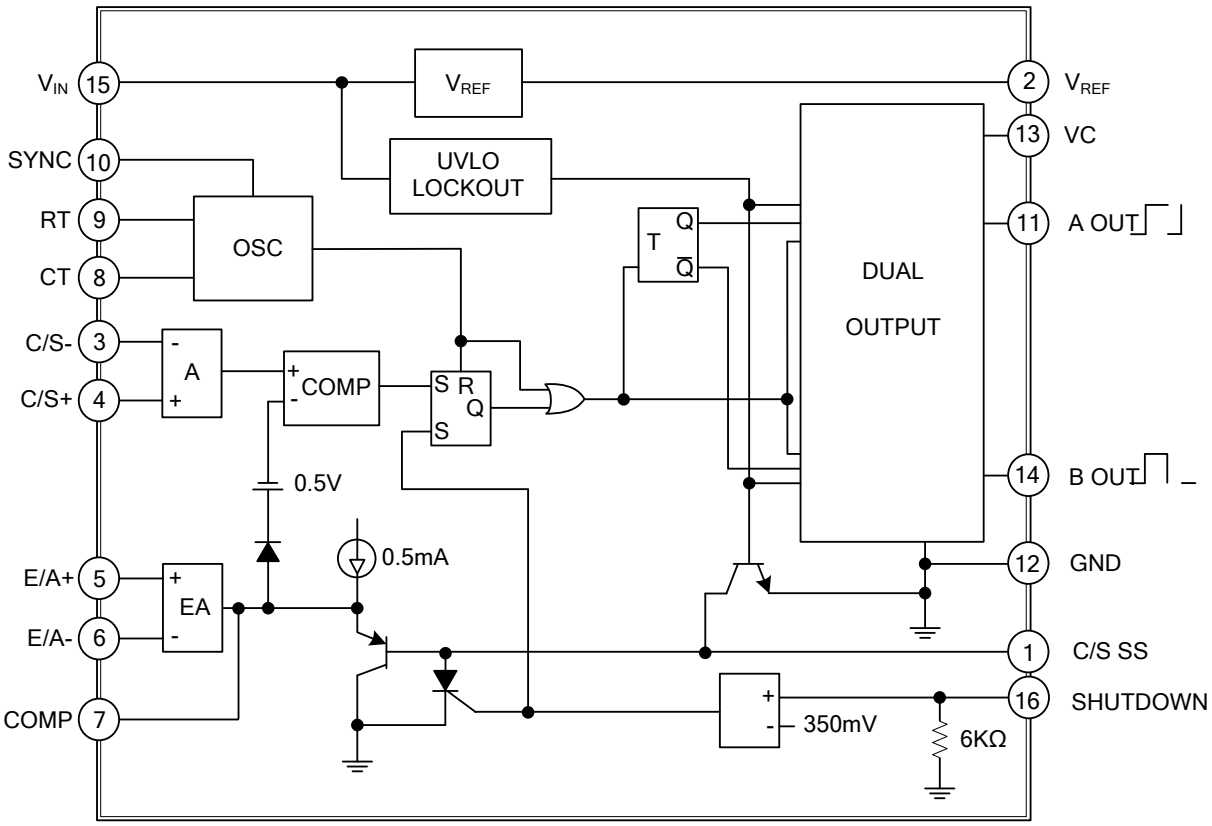
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	C/S SS	Adjustment of Current Limiting
2	V_{REF}	Internal Reference Voltage
3	C/S-	Forward Input of Current Limiting
4	C/S+	Backward Input of Current Limiting
5	E/A+	Forward Input of Error Amplifier
6	E/A-	Backward Input of Error Amplifier
7	COMP	Output of Error Amplifier
8	C_T	External Capacity for Frequency
9	R_T	External Resistor for Frequency
10	SYNC	Synchronization for Frequency of Oscillator
11	A OUT	Dual Output A
12	GND	Ground
13	V_C	Power Supply of the Collector
14	B OUT	Dual Output B
15	V_{IN}	DC Power Supply Input
16	SHUTDOWN	Shutdown Controller

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (Note)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage (Pin 15)		V_{IN}	+40	V
Collector Supply Voltage (Pin 13)		V_C	+40	V
Output Current, Source or Sink (Pins 11, 14)		I_O	500	mA
Analog Inputs (Pins 3, 4, 5, 6, 16)		V_A	-0.3 ~ +V_{IN}	V
Reference Output Current (Pin 2)		I_{REF}	-30	mA
Sync Output Current (Pin 10)		$I_{SYNC-OUT}$	-5	mA
Error Amplifier Output Current (Pin 7)		I_{O-EA}	-5	mA
Soft Start Sink Current (Pin 1)		I_{SINK}	50	mA
Oscillator Charging Current (Pin 9)		I_{OSC}	5	mA
Power Dissipation	T_A=25°C	P_D	1000	mW
	T_C=25°C		2000	mW
Storage Temperature		T_{STG}	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS

(T_J=T_A=0°C~+70°C, V_{IN}=15V, R_T=10k, C_T=4.7nF, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
REFERENCE SECTION						
Output Voltage	V_{REF}	T_J=25°C, I_O=1mA	5.0	5.1	5.2	V
Line Regulation	ΔV_1	V_{IN}=8V~40V		5	20	mV
Load Regulation	ΔV_2	I_L=1mA~10mA		3	15	mV
Temperature Stability	V_S	Over Operating Range, (Note 2)		0.4		mV/°C
Total Output Variation	V_{REF-O}	Line, Load, and Temperature (Note 2)	4.95		5.25	V
Output Noise Voltage	V_N	10Hz≤f≤10kHz, T_J=25°C (Note 2)		100		μV
Long Term Stability	ΔV_3	T_J=125°C, 1000 Hrs. (Note 2)		5		mV
Short Circuit Output Current	I_S	V_{REF}=0V	-10	-45		mA
OSCILLATOR SECTION						
Initial Accuracy	F_{OSC}	T_J=25°C	39	43	47	kHz
Voltage Stability	ΔV	V_{IN}=8V~40V		-1	2	%
Temperature Stability	ΔT_S	Over Operating Range (Note 2)		-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	$V_{IH(SYNC)}$	Pin 8=0V	3.9			V
Sync Input Low Level	$V_{IL(SYNC)}$	Pin 8=0V			2.5	V
Sync Input Current	I_{SYNC}	Sync Voltage=3.9V, Pin 8=0V		1.3	1.5	mA
ERROR AMP SECTION						
Input Offset Voltage	V_{IO}			0.5	10	mV
Input Bias Current	I_{BIAS}			-0.6	-2	μA
Input Offset Current	I_{IO}			40	250	nA
Common Mode Range	V_{CM}	V_{IN}=8V~40V	0		V_{IN}-2V	V
Open Loop Voltage Gain	G_{VO}	ΔV_O=1.2~3V, V_{CM}=2V	80	105		dB
Unity Gain Bandwidth	B	T_J=25°C (Note 2)	0.7	1.0		MHz
CMRR	$CMRR_A$	V_{CM}=0V~38V, V_{IN}=40V	75	100		dB
PSRR	$PSRR_A$	V_{IN}=8V~40V	80	105		dB
Output Sink Current	I_{SINK}	V_{ID}=-15mV~-5V, $V_{PIN\ 7}$=1.2V	2	6		mA
Output Source Current	I_{SOURCE}	V_{ID}=15mV~5V, $V_{PIN\ 7}$=2.5V	-0.2	-0.5		mA
High Level Output Voltage	V_{OH}	R_L=(Pin 7) 15kΩ	4.3	4.6		V
Low Level Output Voltage	V_{OL}			0.7	1	V

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
CURRENT SENSE AMPLIFIER SECTION						
Amplifier Gain	G_A	$V_{PIN\ 3}$=0V, Pin 1 Open (Note 3, 4)	2.5	2.75	3.0	V
Maximum Differential Input Signal ($V_{PIN\ 4}$-$V_{PIN\ 3}$)	$V_{IN(MAX)}$	Pin 1 Open (Note 3), R_L (Pin 7)=15kW	1.1	1.2		V
Input Offset Voltage	V_{IO}	$V_{PIN\ 1}$=0.5V, Pin 7 Open (Note 3)		5	25	mV
CMRR	$CMRR_A$	V_{CM}=1V~12V	60	83		dB
PSRR	$PSRR_A$	V_{IN}=8V~40V	60	84		dB
Input Bias Current	I_{BIAS}	$V_{PIN\ 1}$=0.5V, Pin 7 Open (Note 3)		-2.5	-10	μA
Input Offset Current	I_{IO}	$V_{PIN\ 1}$=0.5V, Pin 7 Open (Note 3)		0.08	1	μA
Input Common Mode Range	ΔV_R		0		V_{IN}-3	V
Delay to Outputs	t_D	T_J=25°C, (Note 2)		200	500	ns
CURRENT LIMIT ADJUST SECTION						
Current Limit Offset	V_L	$V_{PIN\ 3}$=0V, $V_{PIN\ 4}$=0V, Pin 7 Open (Note 3)	0.45	0.5	0.55	V
Input Bias Current	I_B	$V_{PIN\ 5}$=VREF,$V_{PIN\ 6}$=0V		-10	-30	μA
SHUTDOWN TERMINAL SECTION						
Threshold Voltage	V_{TH}		250	350	550	mV
Input Voltage Range	ΔV_{SHUT}		0		V_{IN}	V
Minimum Latching Current (I_{PIN} 1)	I_{LATCH}	(Note 6)	3.0	1.5		mA
Maximum Non-Latching Current (I_{PIN} 1)	$I_{NONLATCH}$	(Note 7)		1.5	0.8	mA
Delay to Outputs	$t_{D\text{-}SHUT}$	T_J=25°C (Note 2)		300	600	ns
OUTPUT SECTION						
Collector-Emitter Voltage	V_T		40			V
Collector Leakage Current	I_L	V_C=40V (Note 5)			200	μA
Output Low Level	V_{OL1}	I_{SINK}=20mA		0.1	0.4	V
	V_{OL2}	I_{SINK}=100mA		0.4	2.1	V
Output High Level	V_{OH1}	I_{SOURCE}=20mA	13	13.5		V
	V_{OH2}	I_{SOURCE}=100mA	12	13.2		V
Rise Time	t_R	C_L=1nF, T_J=25°C (Note 2)		50	300	ns
Fall Time	t_F	C_L=1nF, T_J=25°C (Note 2)		50	300	ns
UNDER-VOLTAGE LOCKOUT SECTION						
Start-Up Threshold	V_{START}			7.7	8.0	V
Threshold Hysteresis	V_H			0.75		V
TOTAL STANDBY CURRENT						
Supply Current	I_T			17	21	mA

Notes: 1. All voltages are with respect to Ground, Pin 13. Currents are positive into, negative out of the speficied terminal.

2. These parameters are not 100% tested in production, although guaranteed over the recommended operating conditions

3. Parameter measured at trip point of latch with $V_{PIN\ 5}$=V_{REF}, $V_{PIN\ 6}$=0V.

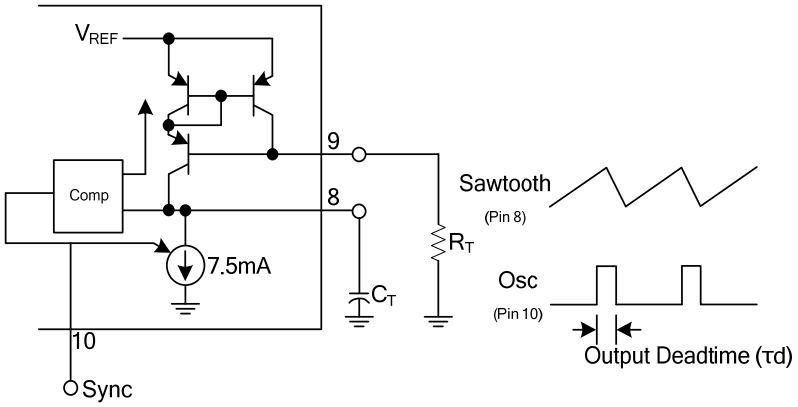
4. Amplifier gain defined as: $G=\frac{\Delta V_{PIN7}}{\Delta V_{PIN4}}$, V_{PIN4}=0~1.0V

5. Applies to UTC UC3846 only due to polarity of outputs.

6. Current into Pin 1 guaranteed to latch circuit in shutdown state.

7. Current into Pin 1 guaranteed not to latch circuit in shutdown state.

■ TEST CIRCUIT



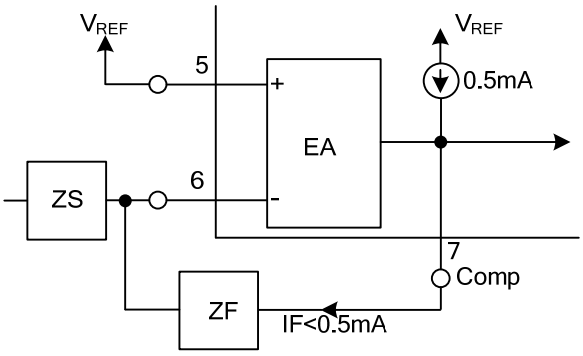
Output deadtime is determined by the external capacitor, C_T, according to the formula: $\tau d\ (\mu s) = 145 C_T\ (\mu f) \frac{ID}{ID - \frac{3.6}{R_T(k\Omega)}}$

I_D = Oscillator discharge current at 25°C is typically 7.5.

For large values of RT: $\tau d\ (\mu s) \approx 145 C_T (\mu f)$

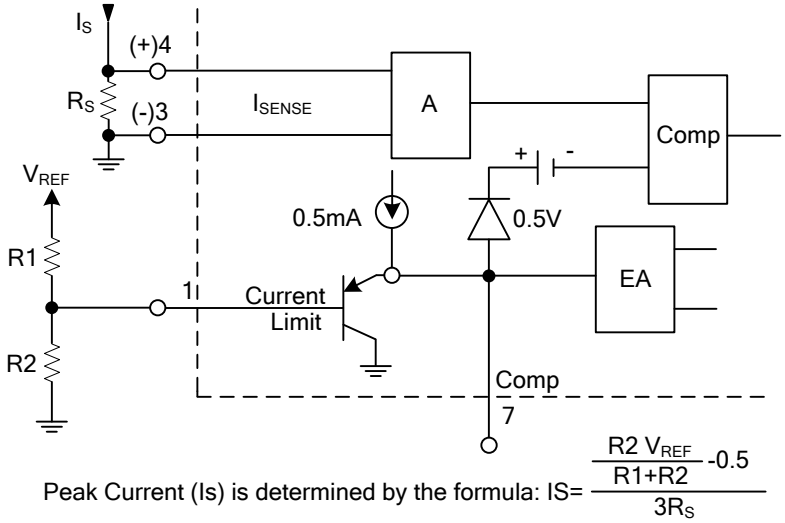
Oscillator frequency is approximated by the formula: $fT\ (kHz) \approx \frac{2.2}{R_T(k\Omega) \cdot C_T(\mu f)}$

Figure 1. Oscillator Circuit



Error Amplifier can source up to 0.5mA

Figure 2. Error Amp Output Configuration



Peak Current (Is) is determined by the formula: $IS = \frac{\frac{R2\ V_{REF}}{R1+R2} - 0.5}{3R_S}$

Figure 3. Pulse by Pulse Current Limiting

■ TEST CIRCUIT(Cont.)

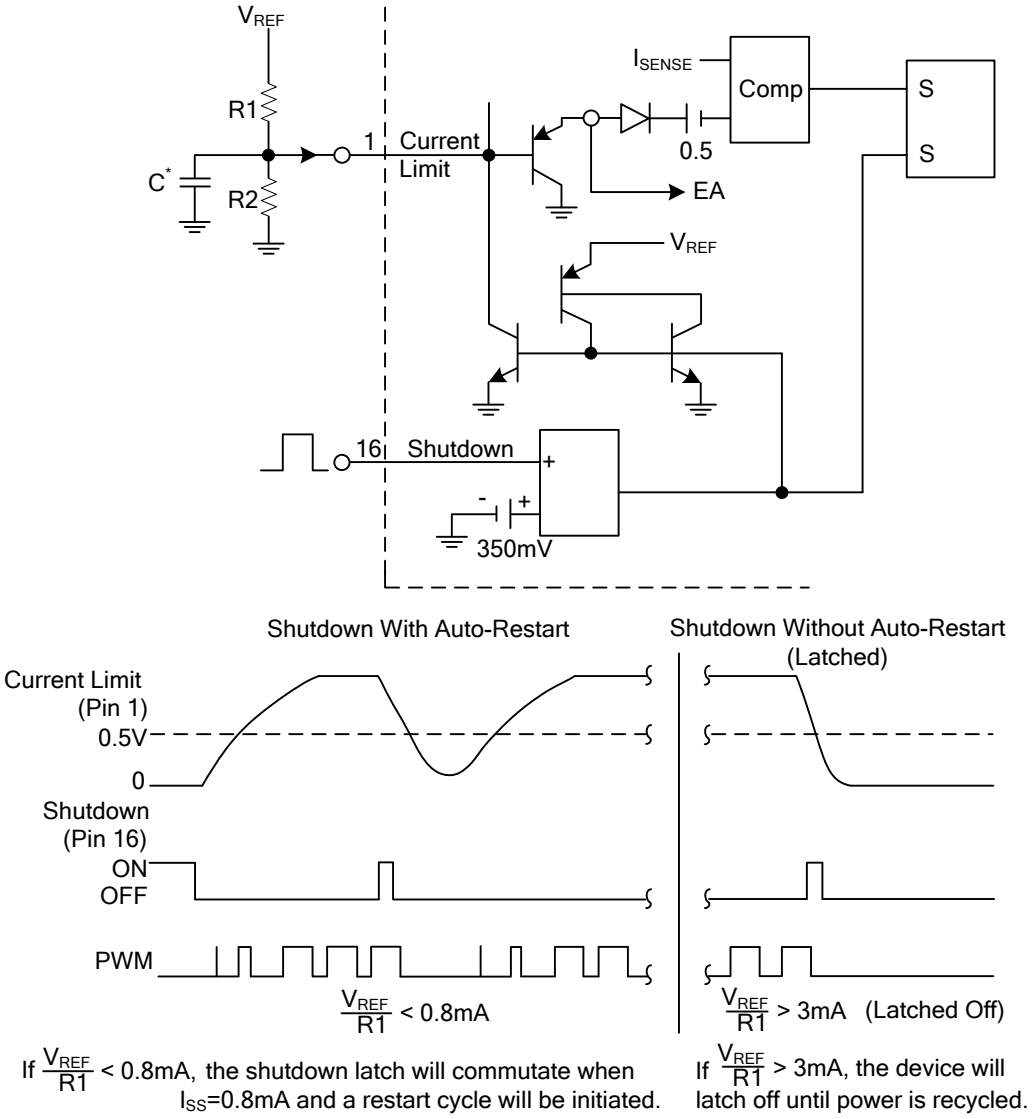
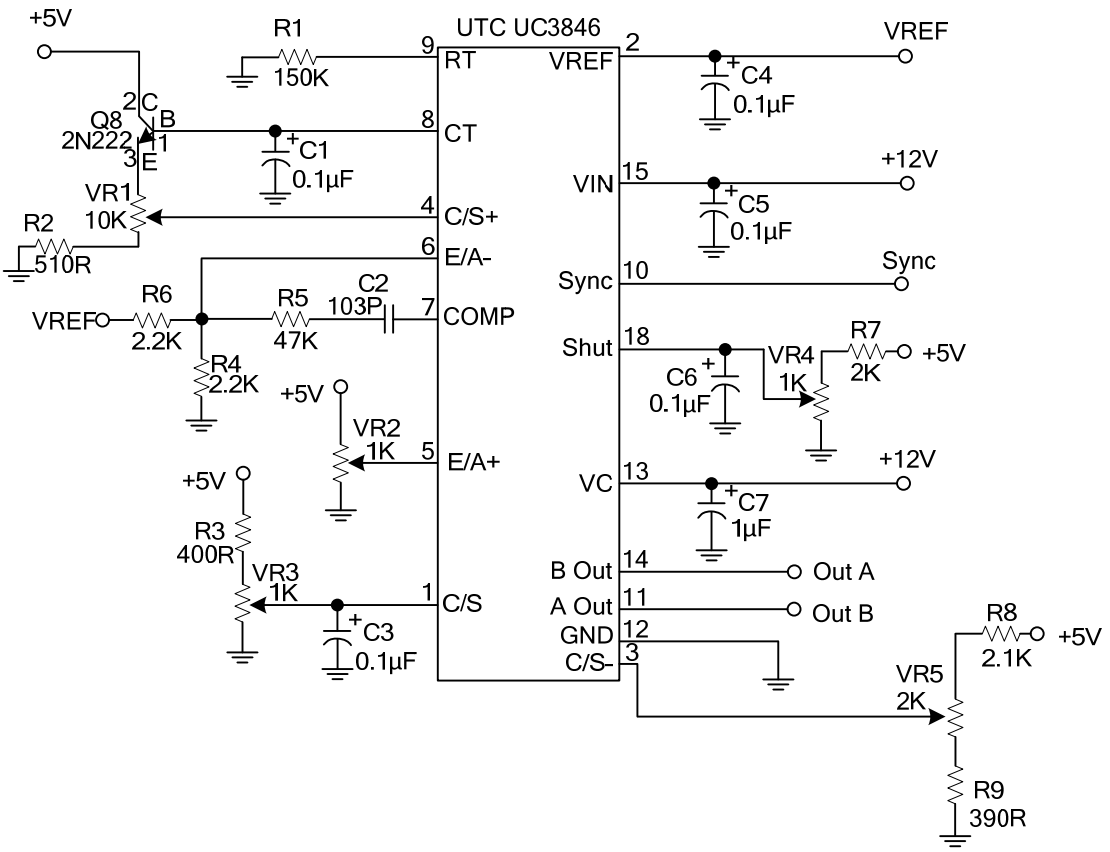


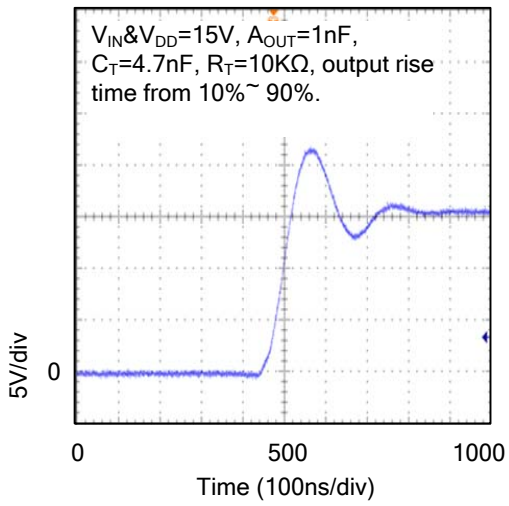
Figure 4. Soft Start and Shutdown /Restart Functions

■ TYPICAL APPLICATION CIRCUIT

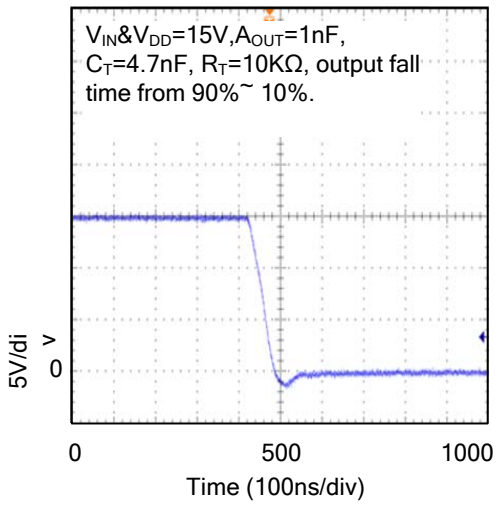


■ TYPICAL CHARACTERISTICS

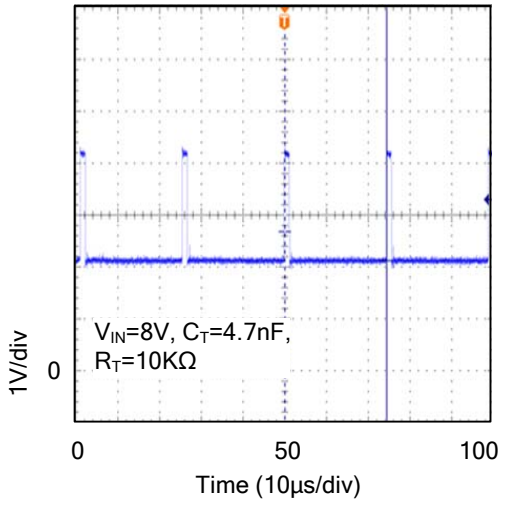
Rising Time



Falling Time



Voltage Stability



Voltage Stability