



## UC3842B/3843B

## LINEAR INTEGRATED CIRCUIT

### HIGH PERFORMANCE CURRENT MODE CONTROLLERS

#### DESCRIPTION

The UTC **UC3842B/3843B** are specifically designed for off-line and dc-to-dc converter applications offering the designer a cost-effective solution with minimal external components.

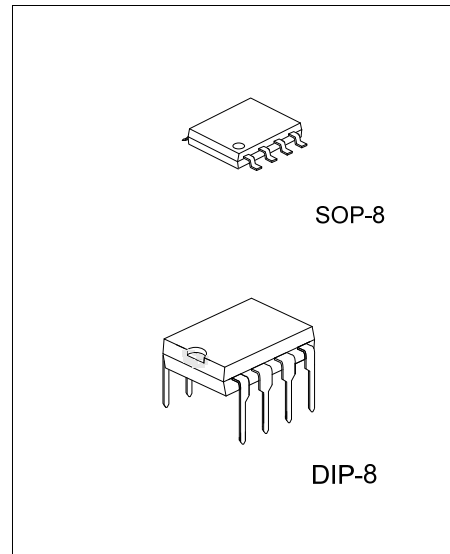
The **UC3842B** has UVLO thresholds 16V (on) and 10V(off), ideally suited for off-line converters. The **UC3843B** is tailored for lower voltage applications having UVLO thresholds of 8.4V(on) and 7.6V(off).

#### FEATURES

- \* Trimmed oscillator for precise frequency control
- \* Oscillator frequency guaranteed at 250kHz
- \* 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 totem pole output
- \* Undervoltage lockout with hysteresis
- \* Low startup and operating current

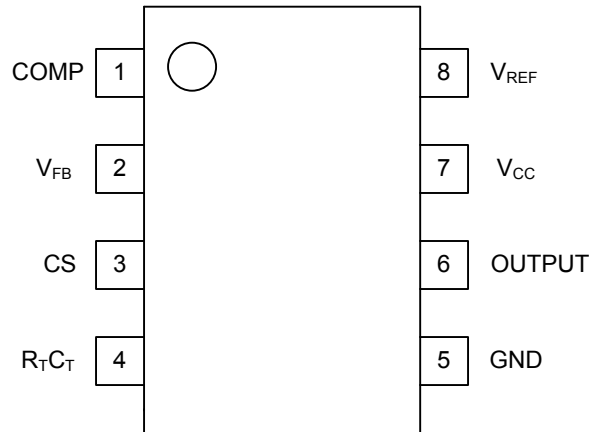
#### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
UC3842BL-D08-T	UC3842BP-D08-T	DIP-8	Tube
UC3842BL-S08-R	UC3842BP-S08-R	SOP-8	Tape Reel
UC3842BL-S08-T	UC3842BP-S08-T	SOP-8	Tube
UC3843BL-D08-T	UC3843BP-D08-T	DIP-8	Tube
UC3843BL-S08-R	UC3843BP-S08-R	SOP-8	Tape Reel
UC3843BL-S08-T	UC3843BP-S08-T	SOP-8	Tube



<p>UC3842BL-D08-T</p> <p>(1)Packing Type (2)Package Type (3)Lead Free</p>	<p>(1) T: Tube, R: Tape Reel (2) D08: DIP-8, S08: SOP-8 (3) P: Halogen Free, L: Lead Free</p>
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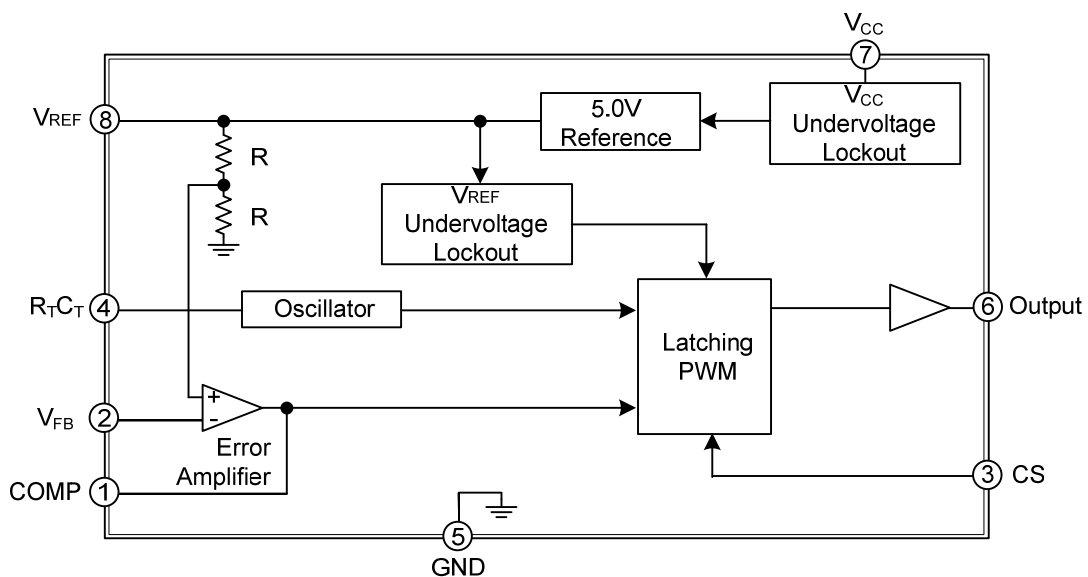
### ■ PIN CONFIGURATION



### ■ PIN DESCRIPTIONS

PIN NO.	PIN NAME	I/O	DESCRIPTION
1	COMP	O	Error amp output to provide loop compensation maintaing $V_{FB}$ at 2.5V
2	$V_{FB}$	I	Error amp inverting input, The non-inverting input of error amp is 2.5V band gap reference
3	CS	I	Current sense input to PWM control gate drive of output
4	$R_T C_T$	I	To set oscillator frequency and maximum output duty cycle
5	GND		Power ground
6	OUTPUT	O	To direct drive power MOSFET
7	$V_{CC}$		Power supply
8	$V_{REF}$	O	5V regulated output provides charging current for $C_T$ through $R_T$

### ■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS( $T_A=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Total Power Supply and Zener Current	$(I_{CC} + I_Z)$	30	mA
Output Current, Source or Sink (Note 2)	$I_O$	1.0	A
Output Energy (capacitive load per cycle)	W	5.0	$\mu\text{J}$
Current Sense and Voltage Feedback Inputs	$V_{IN}$	-0.3 ~ +5.5	V
Error Amp. Output Sink Current	$I_{O(SINK)}$	10	mA
Power Dissipation	DIP-8	1250	mW
	SOP-8	800	mW
Operating Junction Temperature	$T_J$	+150	$^\circ\text{C}$
Operating Temperature	$T_{OPR}$	0 ~ +70	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-65 ~ +150	$^\circ\text{C}$

Note: 1. 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.

2. Maximum Package power dissipation limits must be observed.

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	DIP-8	100	$^\circ\text{C/W}$
	SOP-8	156	$^\circ\text{C/W}$

■ ELECTRICAL CHARACTERISTICS

( $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ ,  $V_{CC}=15\text{V}$  (Note 1),  $R_T=10\text{k}$ ,  $C_T=3.3\text{nF}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>REFERENCE SECTION</b>						
Output Voltage	$V_{REF}$	$I_O=1.0\text{mA}$ , $T_J=25^\circ\text{C}$	4.9	5.0	5.1	V
Line Regulation	$\Delta V_{LINE}$	$V_{CC}=12\text{V} \sim 25\text{V}$		2.0	20	mV
Load Regulation	$\Delta V_{LOAD}$	$I_O=1.0\text{mA} \sim 20\text{mA}$		3.0	25	mV
Temperature Stability	$T_S$			0.2		$\text{mV}/^\circ\text{C}$
Total Output Variation	$V_{REF}$	Line, Load, Temperature	4.82		5.18	V
Output Noise Voltage	$e_N$	$F=10\text{kHz} \sim 10\text{Hz}$ , $T_J=25^\circ\text{C}$		50		$\mu\text{V}$
Long Term Stability	S	$T_A=125^\circ\text{C}$ , 1000Hrs		5		mV
Output Short Circuit Current	$I_{SC}$		-30	-85	-180	mA
<b>OSCILLATOR SECTION</b>						
Frequency	F	$T_J=25^\circ\text{C}$	49	52	55	kHz
		$T_A=0^\circ\text{C} \sim 70^\circ\text{C}$	48		56	
		$T_J=25^\circ\text{C}$ ( $R_T=6.2\text{k}$ , $C_T=1.0\text{nF}$ )	225	250	275	
Frequency Change with Voltage	$\Delta f_{osc}/\Delta V$	$12 \leq V_{CC} \leq 25\text{V}$		0.2	1.0	%
Frequency Change with Temperature	$\Delta f_{osc}/\Delta T$	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$		0.5		%
Oscillator Voltage Swing (Peak to Peak)	$V_{OSC}$			1.6		V
Discharge Current	$I_{DISCHG}$	$T_J=25^\circ\text{C}$	7.8	8.3	8.8	mA
		$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$	7.6	8.3	8.8	

## ■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>ERROR AMPLIFIER SECTION</b>						
Voltage Feedback Input	$V_{FB}$	$V_O=2.5V$	2.42	2.50	2.58	V
Input Bias Current	$I_{I(BIAS)}$	$V_{FB}=5.0V$		-0.1	-2.0	$\mu A$
Open Loop Voltage Gain	$G_{VO}$	$2 \leq V_O \leq 4V$	65	90		dB
Unity Gain Bandwidth	$GB_W$	$T_J = 25^\circ C$	0.7	1.0		MHz
Power Supply Rejection Ratio	PSRR	$12V \leq V_{CC} \leq 25V$	60	70		dB
Output Sink Current	$I_{SINK}$	$V_O=1.1V, V_{FB}=2.7V$	2.0	12		mA
Output Source Current	$I_{SOURCE}$	$V_O=5.0V, V_{FB}=2.3V$	-0.5	-1.0		mA
Output Voltage Swing High State	$V_{OH}$	$V_{FB}=2.3V, R_L=15k \text{ to GND}$	5.0	6.2		V
Output Voltage Swing Low State	$V_{OL}$	$V_{FB}=2.7V, R_L=15k \text{ to } V_{REF}$		0.8	1.1	V
<b>CURRENT SENSE SECTION</b>						
Current Sense Input Voltage Gain	$G_V$	(Note 2, 3)	2.85	3.0	3.15	V/V
Maximum Current Sense Input Threshold	$V_{I(THR)}$	(Note 2)	0.9	1.0	1.1	V
Power Supply Rejection Ratio	PSRR	$12 \leq V_{CC} \leq 25V$ (Note 2)		70		dB
Input Bias Current	$I_{I(BIAS)}$			-2	-10	$\mu A$
Propagation Delay	$t_{D(IN/OUT)}$	Current Sense Input to Output		150	300	ns
<b>OUTPUT SECTION</b>						
Output Low Voltage	$V_{OL}$	$I_{SINK}=20mA$		0.1	0.4	V
		$I_{SINK}=200mA$		1.6	2.2	V
Output High Voltage	$V_{OH}$	$I_{SOURCE}=20mA$	13	13.5		V
		$I_{SOURCE}=200mA$	12	13.4		V
Output Voltage with UVLO Activated	$V_{OL(UVLO)}$	$V_{CC}=6.0V, I_{SINK}=1.0mA$		0.1	1.1	V
Output Voltage Rise Time	$t_R$	$T_J = 25^\circ C, C_L=1nF$		50	150	ns
Output Voltage Fall Time	$t_F$	$T_J = 25^\circ C, C_L=1nF$		50	150	ns
<b>UNDER-VOLTAGE LOCKOUT SECTION</b>						
Startup Threshold	$V_{THR}$	<b>UC3842B</b>	14.5	16	17.5	V
		<b>UC3843B</b>	7.8	8.4	9	V
Min. Operating Voltage After Turn-on( $V_{CC}$ )	$V_{CC(MIN)}$	<b>UC3842B</b>	8.5	10	11.5	V
		<b>UC3843B</b>	7.0	7.6	8.2	V
<b>PWM SECTION</b>						
Duty Cycle	MAX	DC	94	96		%
	MIN				0	%
<b>Total DEVICE</b>						
Power Startup Supply Current	$I_{CC}+I_C$	$V_{CC}=6.5V$ for <b>UC3843B</b> $V_{CC}=14V$ for <b>UC3842B</b>		0.3	0.5	mA
Power Operating Supply Current	$I_{CC}+I_C$	Note 1		12	17	mA
Power Supply Zener Voltage	$V_Z$	$I_{CC}=25mA$	30	36		V

Note: 1. Adjust  $V_{CC}$  above the Startup threshold before setting to 15V.

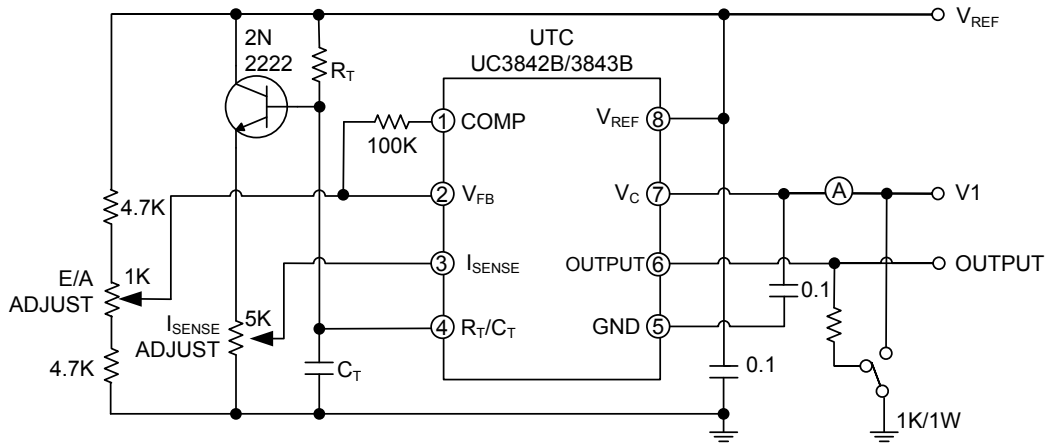
2. This parameter is measured at the latch trip point with  $V_{FB}=0V$ .

3. Comparator gain is defined as :  $G_V = \frac{\Delta V \text{ Output Compensation}}{\Delta V \text{ Current Sense Input}}$

## TYPICAL APPLICATION CIRCUIT

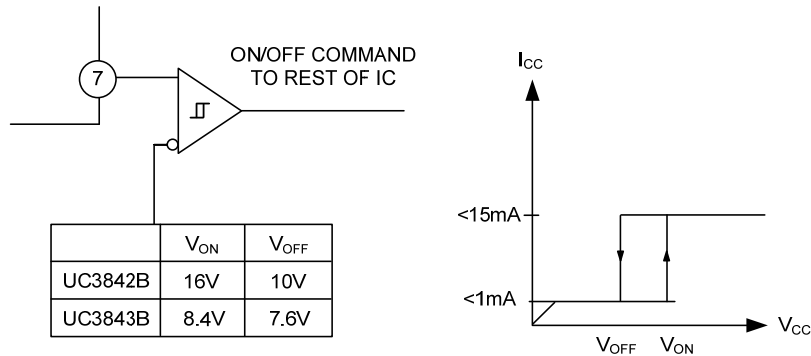
### Open Loop Test Circuit

All of the parameters are not all tested in production, although been guaranteed. The timing and bypass capacitors must be connected to Pin 5 in a single point ground very closely. To sample the oscillator waveform, the transistor and 5kΩ potentiometer are used, and also can apply an adjustable ramp to I<sub>SENSE</sub> Pin.

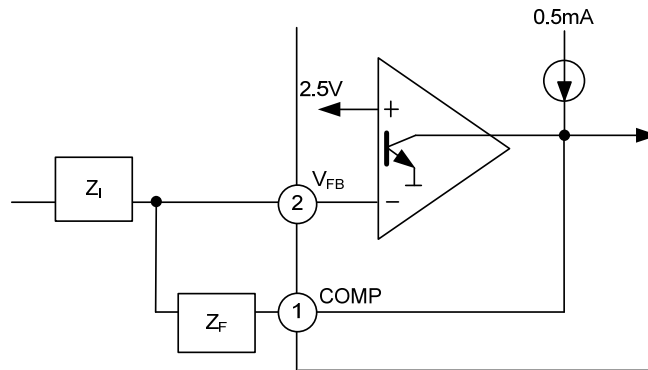


### Under Voltage Lockout

Under-Voltage Lock-Out: the output driver is biased to a high impedance state. To prevent activating the power switch with output leakage current, Pin 6 should be shunted to ground with a bleeder resistor.



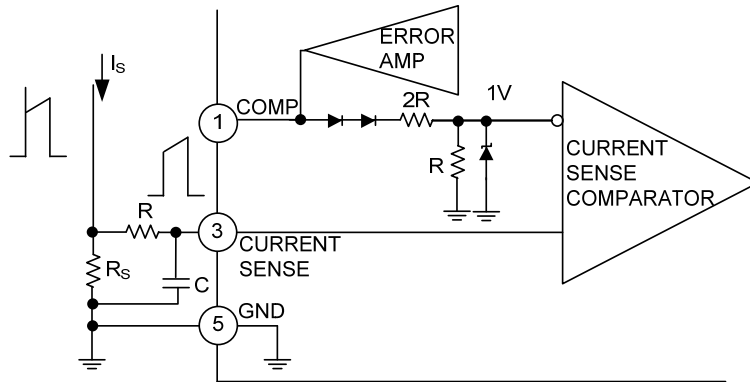
### Error Amp Configuration



Error amp can source sink up to 0.5mA

## APPLICATION INFORMATION(Cont.)

### Current Sense Circuit

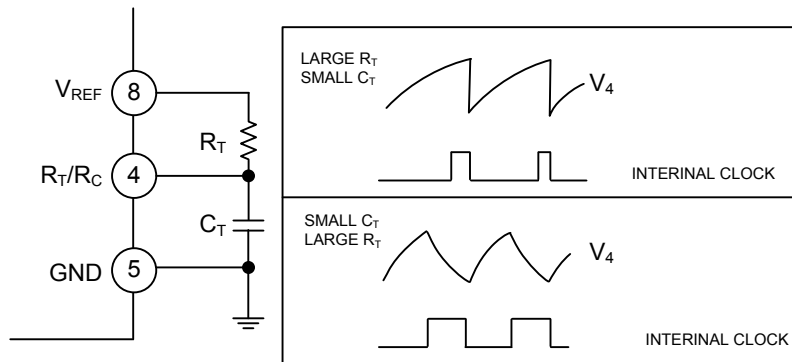


Peak current ( $I_s$ ) is equaled:

$$I_{S(MAX)} = 1.0V/R_s$$

There should be a small RC filter to suppress switch transients.

### Oscillator Waveforms and Maximum Duty Cycle



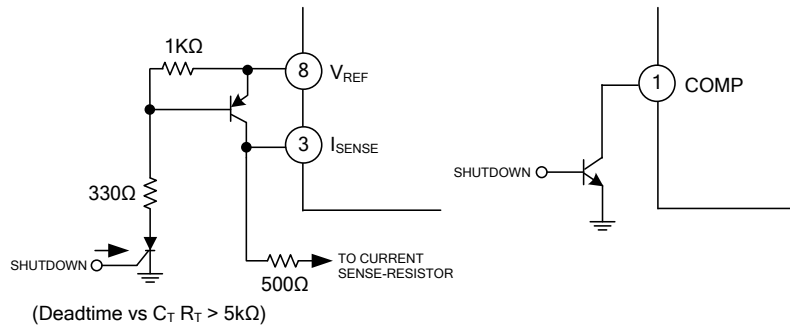
$C_T$  (Oscillator timing capacitor) can be charged by  $V_{REF}$  through  $R_T$  and discharged by an internal current source. At discharge time, the internal clock signal blanks the output to the low. Both oscillator frequency and maximum duty cycle can be determined by Selection of  $R_T$  and  $C_T$ . All charge and discharge times can be calculated by the next formulas:

$$t_C = 0.55 R_T C_T$$

$$t_D = R_T C_T \ln \left( \frac{0.0063 R_T - 2.7}{0.0063 R_T - 4} \right)$$

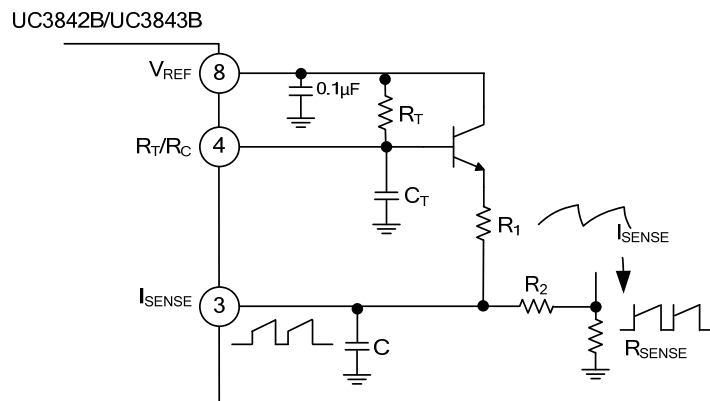
## APPLICATION INFORMATION(Cont.)

### Shutdown Techniques



The UTC **UC3842B**'s shutdown can be accomplished by two ways: raise Pin 3 above 1V; or pull Pin 1 below a voltage two diode drops above ground. Either method can cause the PWM comparator's output to be high. Because the PWM latch is reset dominant, the output will remain low until the next clock cycle after the shutdown condition at Pins 1 and/or 3 is removed.

### Slope Compensation



## TYPICAL CHARACTERISTICS

Fig. 1 Timing Resistor vs. Oscillator Frequency

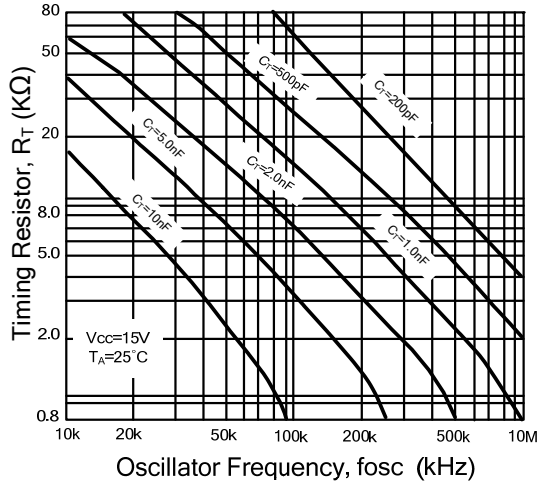


Fig. 2 Output Deadtime vs. Oscillator Frequency

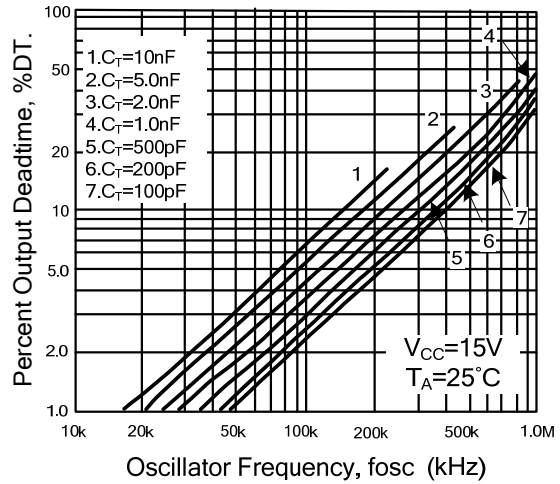


Fig. 3 Oscillator Discharge Current vs. Temperature

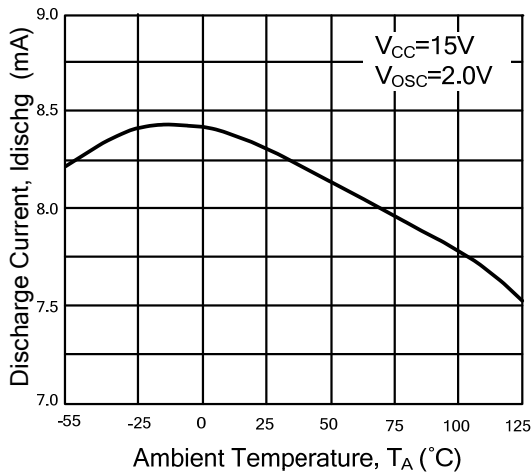


Fig. 4 Maximum Output Duty Cycle vs. Timing Resistor

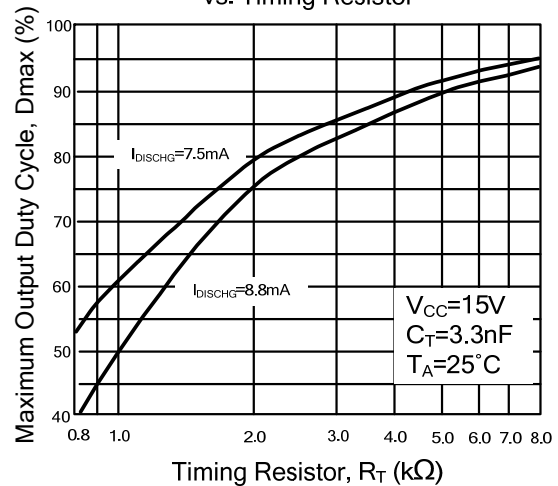


Fig. 5 Error Amp Small Signal Transient Response

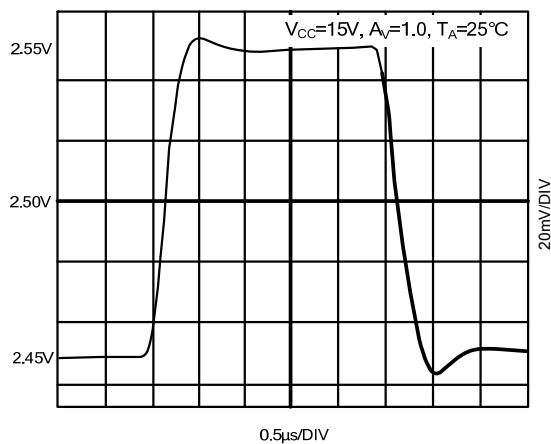
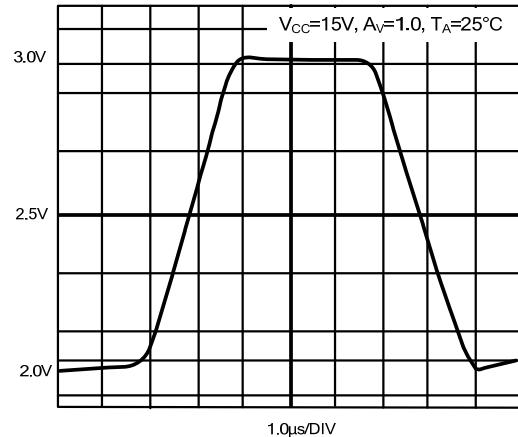


Fig. 6 Error Amp Large Signal Transient Response





■ TYPICAL CHARACTERISTICS(Cont.)

Fig. 7 Error Amp Open Loop Gain Phase vs. Frequency

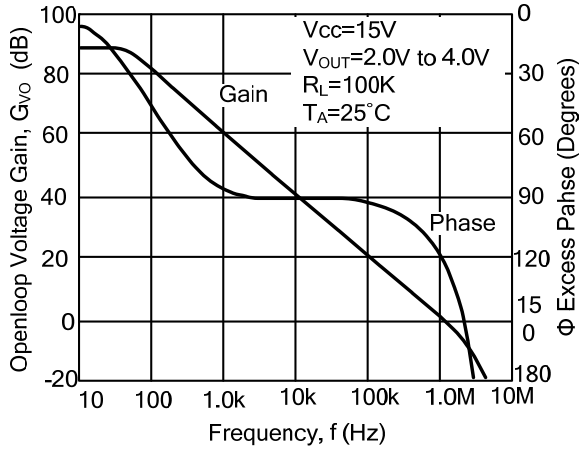


Fig. 8 Current Sense Input Threshold vs. Error Amp Output Voltage

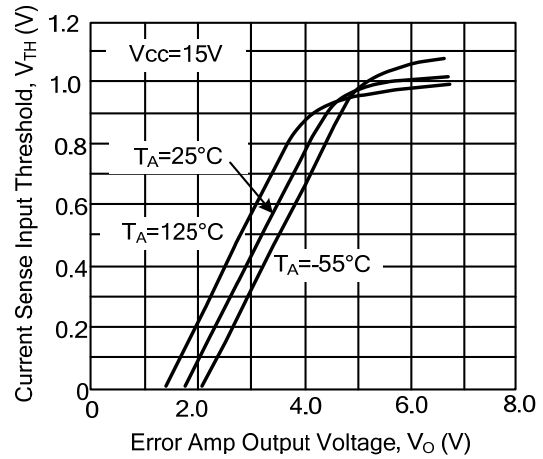


Fig. 9 Reference Voltage Change vs. Source Current

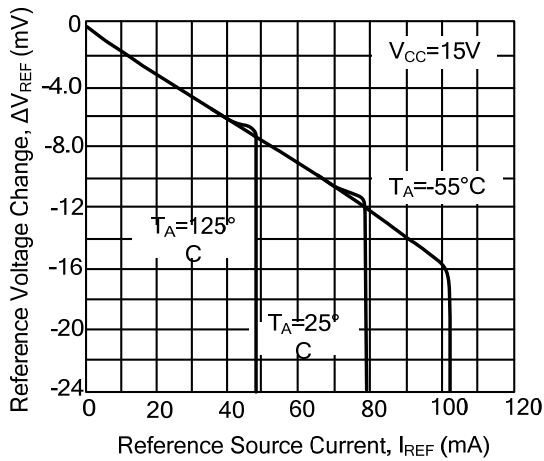


Fig. 10 Reference Short Circuit Current vs. Temperature

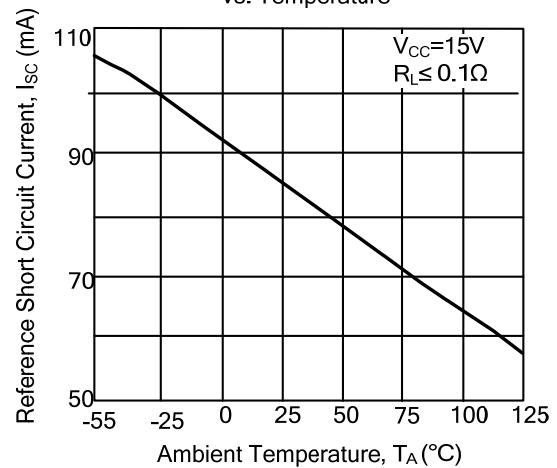


Fig. 11 Reference Load Regulation

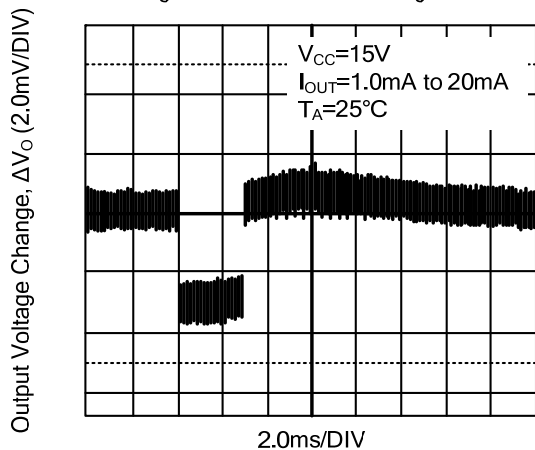
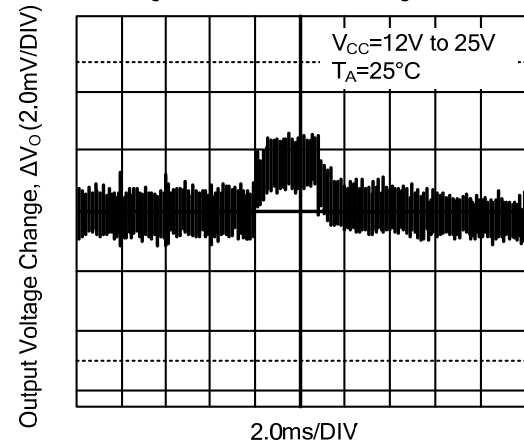


Fig. 12 Reference Line Regulation



■ TYPICAL CHARACTERISTICS(Cont.)

Fig. 13 Output Saturation Voltage Versus Load Current

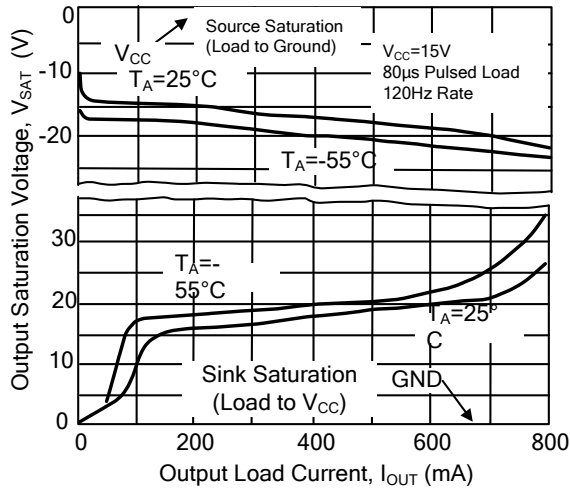


Fig. 14 Output Waveform

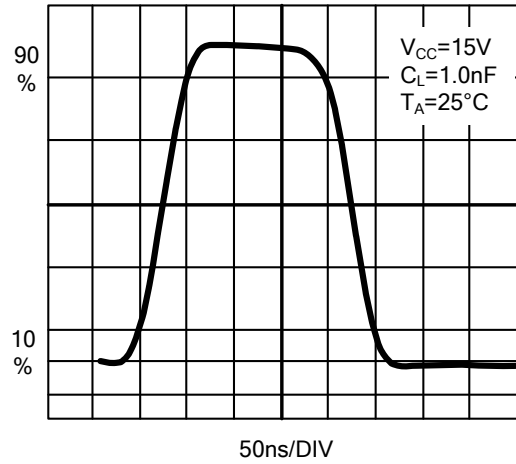


Fig. 15 Output Cross Conduction

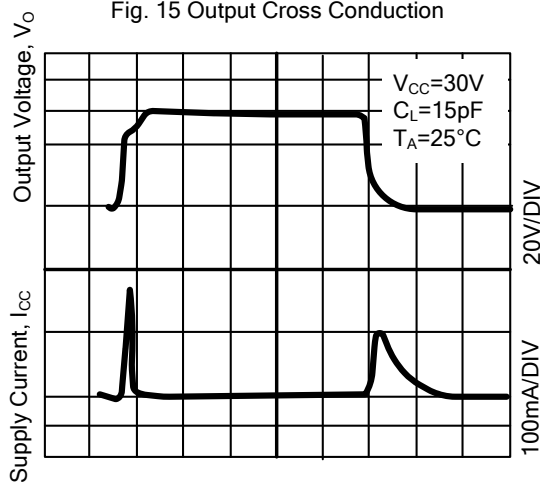
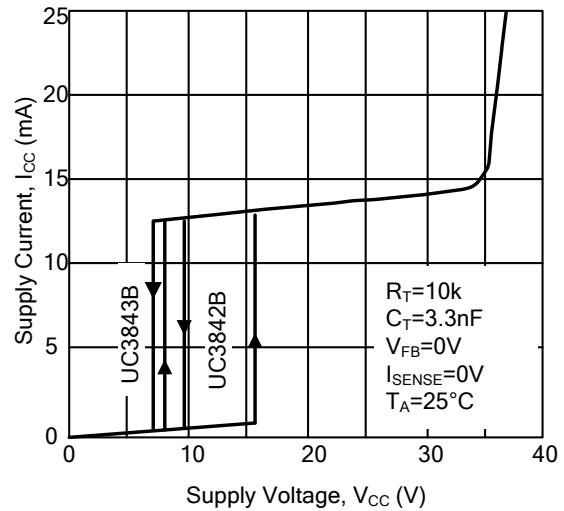


Fig. 16 Supply Current vs. Supply Voltage



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