

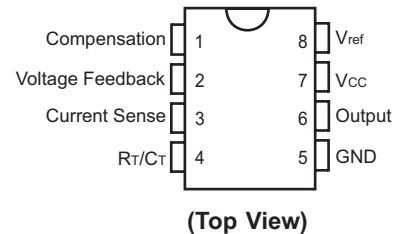
## Fixed Frequency Current Mode PWM Controller

### DESCRIPTION

UC3843 is a fixed frequency current-mode PWM controller. It is specially designed for Off Line and DC-to-DC converter applications with minimal external component. This integrated circuit features a trimmed oscillator for precise duty cycle control, a temperature compensated reference, a high gain error amplifier, a current sensing comparator, and a high current totem pole output ideally suited for driving a power MOSFET.

The device is protective features consisting of input and reference under-voltage lockouts each with hysteresis, cycle-by-cycle current limiting.

### PIN CONFIGURATION



### FEATURES

- Automatic Feed Forward Compensation
- High Current Totem Pole Output
- Internally Trimmed Bandgap Reference
- Undervoltage Lockout with Hysteresis
- Low Start Up Current
- Optimized for offline converter
- Double pulse suppression
- Current mode operation to 500kHz

### APPLICATION

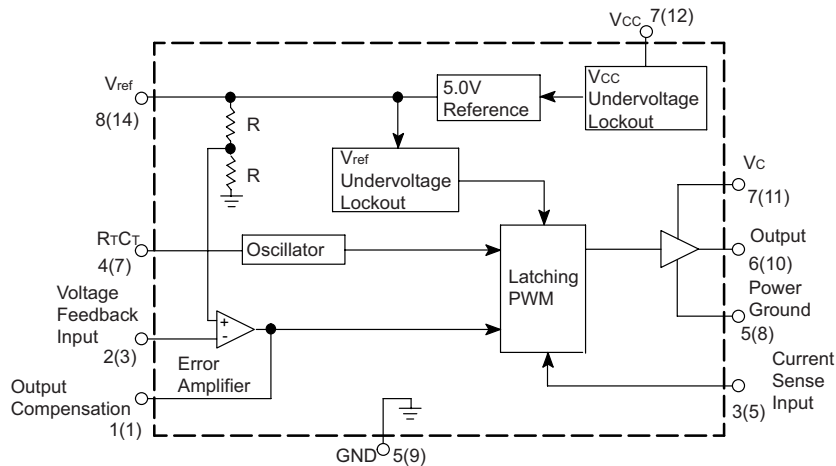
- Wireless Base Station Power
- Telecom and Datacom Power
- Industrial Power Systems
- PC Power Supplies

### ORDERING INFORMATION

Temperature Range	Package		Orderable Device	Package Qty
0°C to +70°C	DIP8L	Pb-Free	UC3843D	75Units/Tube
	SOP8L		UC3843P	50Units/Tube



## SCHEMATIC DIAGRAM



Pin numbers in parenthesis are for the D suffix SOIC-14 package.

**Figure 1. Simplified Block Diagram**

## PIN DESCRIPTION

No.	Name	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 <sub>T</sub> /C <sub>T</sub>	The Oscillator frequency and maximum Output duty cycle are programmed by connecting resistor R <sub>T</sub> to V <sub>REF</sub> and capacitor C <sub>T</sub> to ground. Operation to 500kHz is possible.
5	GND	This pin is the combined control circuitry and power ground.
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 <sub>CC</sub>	This pin is the positive supply of the control IC.
8	V <sub>REF</sub>	This is the reference output. It provides charging current for capacitor C <sub>T</sub> through resistor R <sub>T</sub> .

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Total Power Supply and Zener Current	$I_{CC} + I_Z$	30	mA
DC Supply Voltage	$V_{CC}$	30	V
Output Current	$I_o$	$\pm 1.0$	A
Output Energy (Capacitive Load per Cycle)	W	5.0	$\mu J$
Error Amp Output Sink Current	$I_{oe}$	10	mA
Current Sense and Voltage Feedback Inputs	$V_{IN}$	-0.3 to 5.5	V
Maximum Power Dissipation @ $T_A=25^\circ C$	$P_D$	0.862	W
Thermal Resistance, Junction-to-Air	$R_{BIA}$	145	$^\circ C/W$
Maximum Operating Junction Temperature	$T_J$	+150	$^\circ C$
Storage Temperature Range	$T_{STG}$	-65 to +150	$^\circ C$

## RECOMMENDED OPERATION CONDITIONS

Parameter	Symbol	Min	Max	Unit
DC Supply Voltage	$V_{CC}$	12	25	V
Operating Temperature	$T_A$	0	70	$^\circ C$

## ELECTRICAL CHARACTERISTICS

( $V_{CC} = 15V$  unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Max	Unit
Reference Section					
Reference Out	$V_{REF}$	$I_o = 1.0mA, V_{CC} = 15V,$ $T_A = 25 \pm 10^\circ C$	4.9	5.1	V
		$I_O = 1.0mA, V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	4.865	5.135	
Line Regulation	$Reg_{LINE}$	$V_{CC} = 12V \text{ to } 25V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$		20	mV
Load Regulation	$Reg_{LOAD}$	$I_o = 1.0 \text{ to } 20mA,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$		25	mV
Total Output Variation over Line, Load, Temperature (Note1)	$V_{FINAL}$	$V_{CC} = 12V, I_o = 1.0mA,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	4.82	5.18	V
		$V_{CC} = 25V, I_o = 20mA,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$			
Output Short Circuit Current	$I_{SC}$	$V_{CC} = 15V$	-30	-180	mA



## ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min	Max	Unit	
Oscillator Section						
Frequency	$f_{osc}$	$V_{CC} = 15V, T_J = 25^\circ C$ $R_T = 10K\Omega, C_T = 3.3nF$	47	57	kHz	
		$V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH},$ $R_T = 10K\Omega, C_T = 3.3nF$	46	60		
Frequency Change with Voltage	$\Delta f_{osc}/\Delta V$	$V_{CC} = 12V \text{ to } 25V,$ $T_A = T_{LOW} \text{ to } T_{HIGH},$ $R_T = 10k\Omega, C_T = 3.3nF$		1.0	%	
Discharge Current	$I_{disch}$	$V_{osc} = 2.0V$ $V_{CC} = 15V$	$T_J = 25^\circ C$	7.5	9.3	mA
			$T_A = T_{LOW} \text{ to } T_{HIGH}$	7.2	9.5	
Error Amplifier Section						
Voltage Feedback Input	$V_{FB}$	$V_O = 2.5V, V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	2.42	2.58	V	
Input Bias Current	$I_{IB}$	$V_{FB} = 2.7V, V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$		-2.0	$\mu A$	
Open Loop Voltage Gain	$A_{VOL}$	$V_O = 2.0V \text{ to } 4.0V,$ $V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	65		dB	
Unity Gain Bandwidth	BW	$V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	0.7		MHz	
Power Supply Rejection Ratio	PSRR	$V_{CC} = 12V \text{ to } 25V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	60		dB	
Output Current	Sink	$I_{SINK}$ $V_O = 1.1V, V_{FB} = 2.7V,$ $V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	2.0		mA	
	Source	$I_{SOURCE}$ $V_O = 5.0V, V_{FB} = 2.3V,$ $V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	-0.5			
Output Voltage Swing	High State	$V_{OH}$ $V_{FB} = 2.7V, V_{CC} = 15V$ $R_{L(GND)} = 15K\Omega,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	5.0		V	
	Low State	$V_{OL}$ $V_{FB} = 2.7V, V_{CC} = 15V$ $R_{L(5.0)} = 15K\Omega,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$		1.1		

## ELECTRICAL CHARACTERISTICS(CONTINUE)

Parameter	Symbol	Test Conditions	Min	Max	Unit
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### Current Sense Section

Current Sense Input Voltage Gain	$A_V$	$V_{FB} = 0V, V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	2.85	3.15	
Maximum Current Sense Input Threshold	$V_{TH}$	$V_{FB} = 0V, V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	0.9	1.1	V
Input Bias Current	$I_{IB}$	$V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$		-10	$\mu A$
Propagation Delay (Current Sense Input to Output)	$t_{PLH}$	$V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$		300	ns

### Output Section

Output Voltage	Low State	$V_{OL}$	$I_{SINK} = 20mA, V_{CC} = 15V$		0.4	V
			$I_{SINK} = 200mA, V_{CC} = 15V$		2.2	
	High State	$V_{OH}$	$I_{SINK} = 20mA, V_{CC} = 15V$	13		
			$I_{SINK} = 200mA, V_{CC} = 15V$	12		
Output Voltage with UVLO Activated	$V_{OL(UVLO)}$	$V_{CC} = 6V, I_{SINK} = 1.0mA,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$		1.1	V	
Output Voltage Rise Time	$t_r$	$C_L = 1.0nF, V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$		150	ns	
Output Voltage Fall Time	$t_f$	$C_L = 1.0nF, V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$		150	ns	

### Under Voltage Lockout Section

Startup Threshold	$V_{th}$	$V_{CC} = 0V \text{ to } 25V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	7.8	7.9	V
Minimum Operating Voltage After Turn-On	$V_{CC(MIN)}$	$V_{CC} = 0V \text{ to } 25V,$ $T_A = T_{LOW} \text{ to } T_{HIGH}$	7.0	8.2	V

### PWM Section

Duty Cycle	DC	$V_{CC} = 15V,$ $T_A = T_{LOW} \text{ to } T_{HIGH},$ $R_T = 10K\Omega, C_T = 3.3nF$	0	94	%
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### Total Device

Power Supply Current	$I_{CC}$	Startup: $V_{CC} = 14V$		1.0	mA
		Operating: $V_{CC} = 15V$		17	
Power Supply Zener Voltage	$V_Z$	$I_{CC} = 25mA, V_{CC} = 0 \text{ to } 40V$	30	40	V

**Note 1:**  $V_{FINAL} = V_{REF25}(\text{Reg}_{LINE} + \text{Reg}_{LOAD})/1000 \pm 1V_{REF70}(V_{REF0}) - V_{REF25} | V_{REF25} = V_{REF}@T_A=25^\circ C;$   
 $V_{REF70} = V_{REF}@T_A=70^\circ C; V_{REF0} = V_{REF}@T_A=0^\circ C.$

**Note 2:**  $T_{LOW} = 0^\circ C, T_{HIGH} = +70^\circ C$



TYPICAL PERFORMANCE CHARACTERISTICS

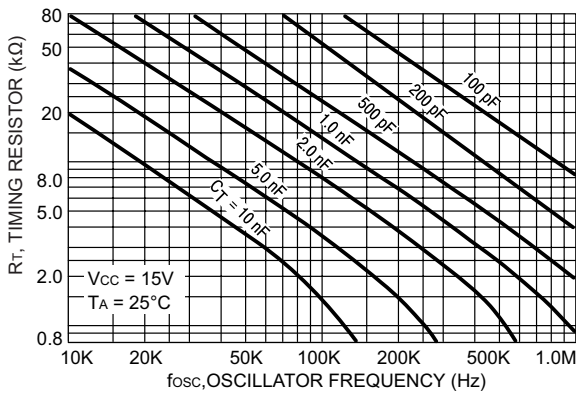


Figure 2. Timing Resistor versus Oscillator Frequency

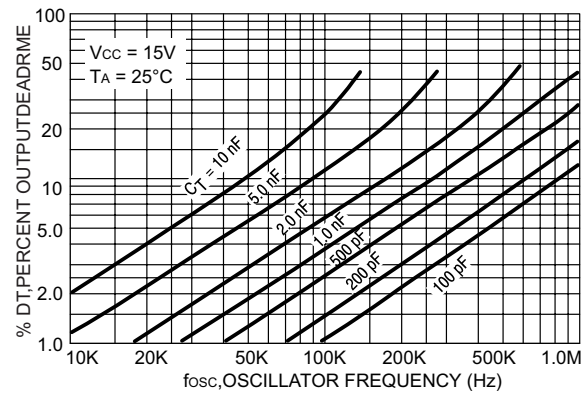


Figure 3. Output Deadtime versus Oscillator Frequency

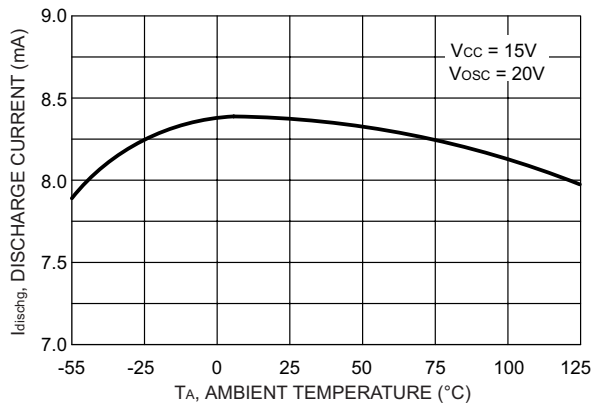


Figure 4. Oscillator Discharge Current versus Temperature

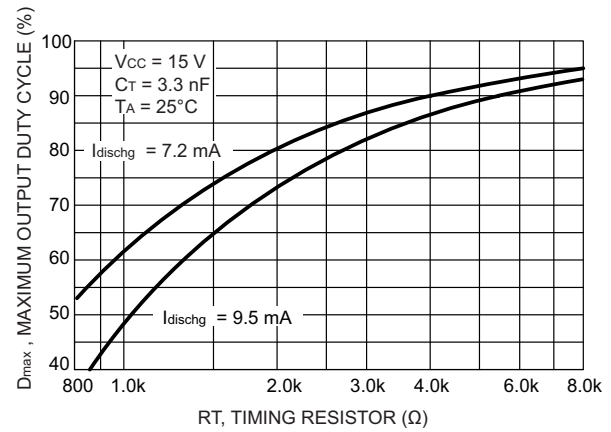


Figure 5. Maximum Output Duty Cycle versus Timing Resistor

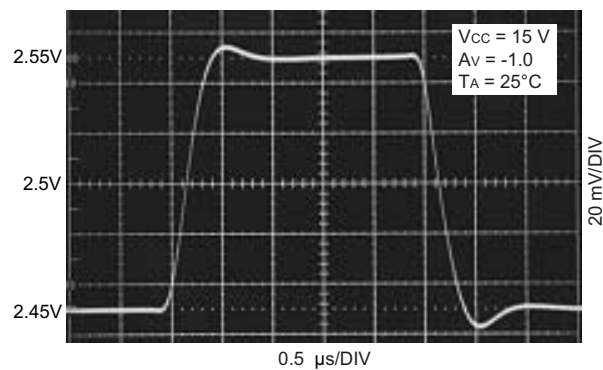


Figure 6. Error Amp Small Signal Transient Response

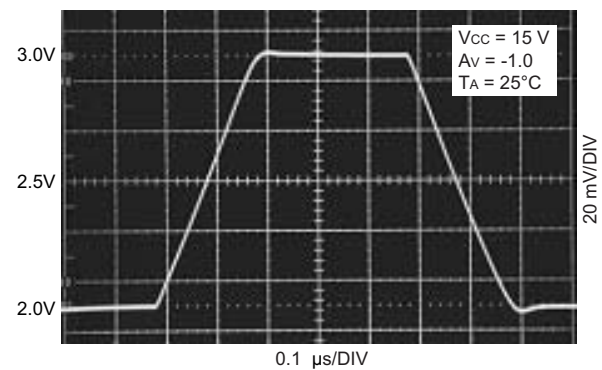
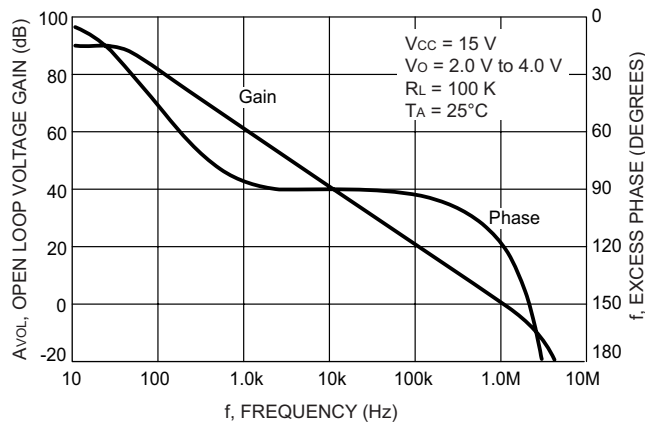


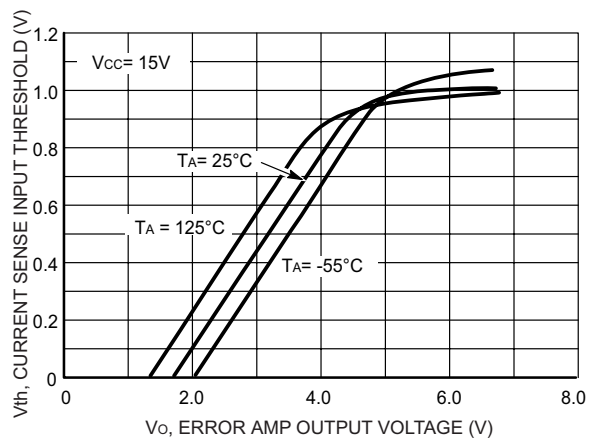
Figure 7. Error Amp Large Signal Transient Response



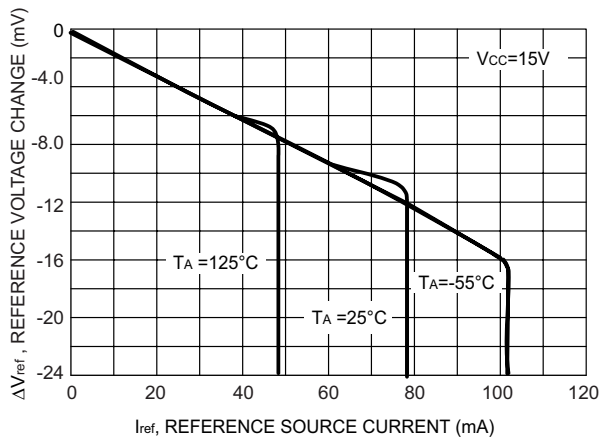
## TYPICAL PERFORMANCE CHARACTERISTICS(CONTINUE)



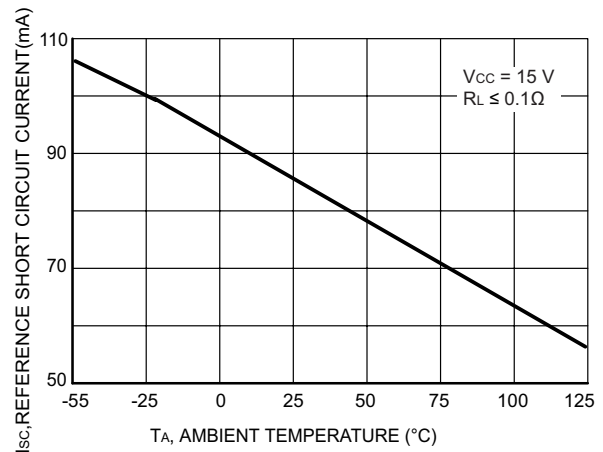
**Figure 8. Error Amp Open Loop Gain and Phase versus Frequency**



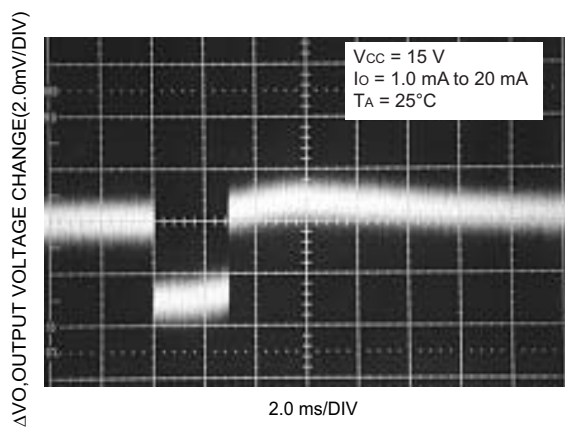
**Figure 9. Current Sense Input Threshold versus Error Amp Output Voltage**



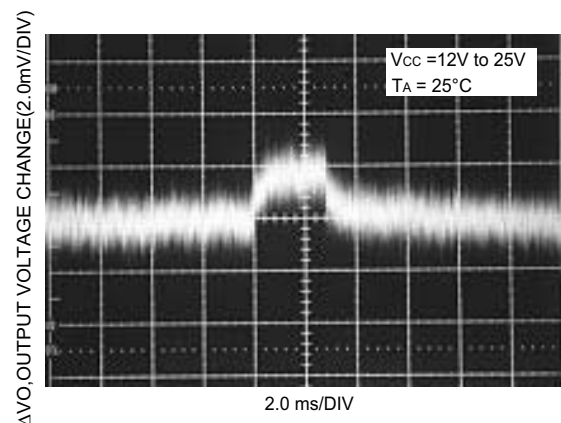
**Figure 10. Reference Voltage Change versus Source Current**



**Figure 11. Reference Short Circuit Current versus Temperature**

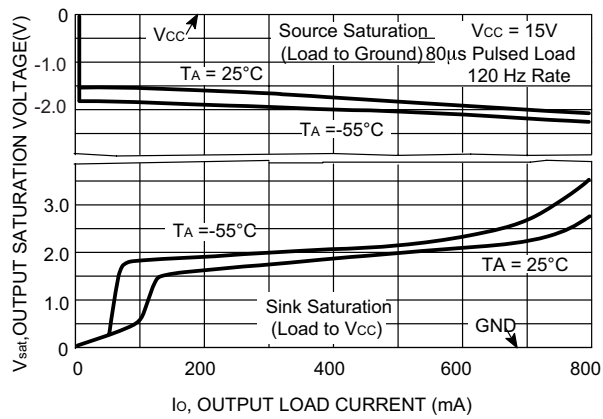


**Figure 12. Reference Load Regulation**

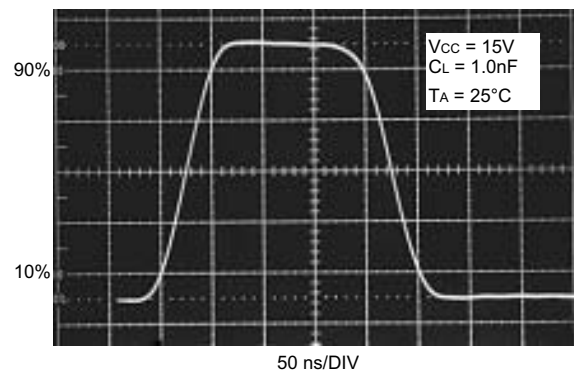


**Figure 13. Reference Line Regulation**

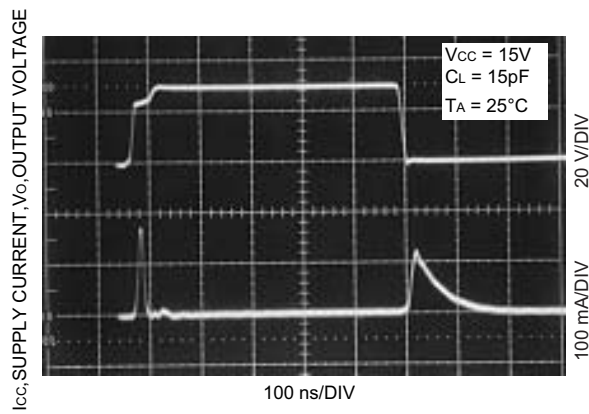
## TYPICAL PERFORMANCE CHARACTERISTICS(CONTINUED)



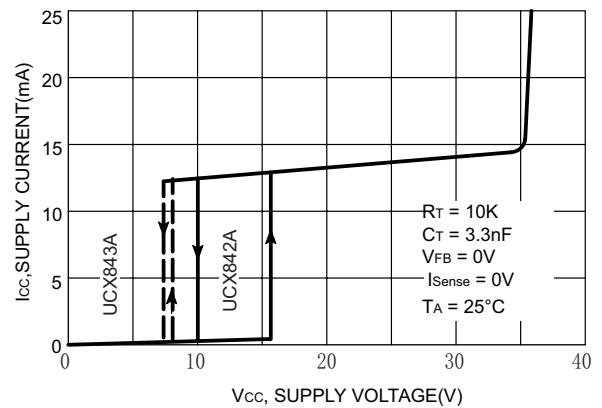
**Figure 14. Output Saturation Voltage versus Load Current**



**Figure 15. Output Waveform**



**Figure 16. Output Cross Conduction**

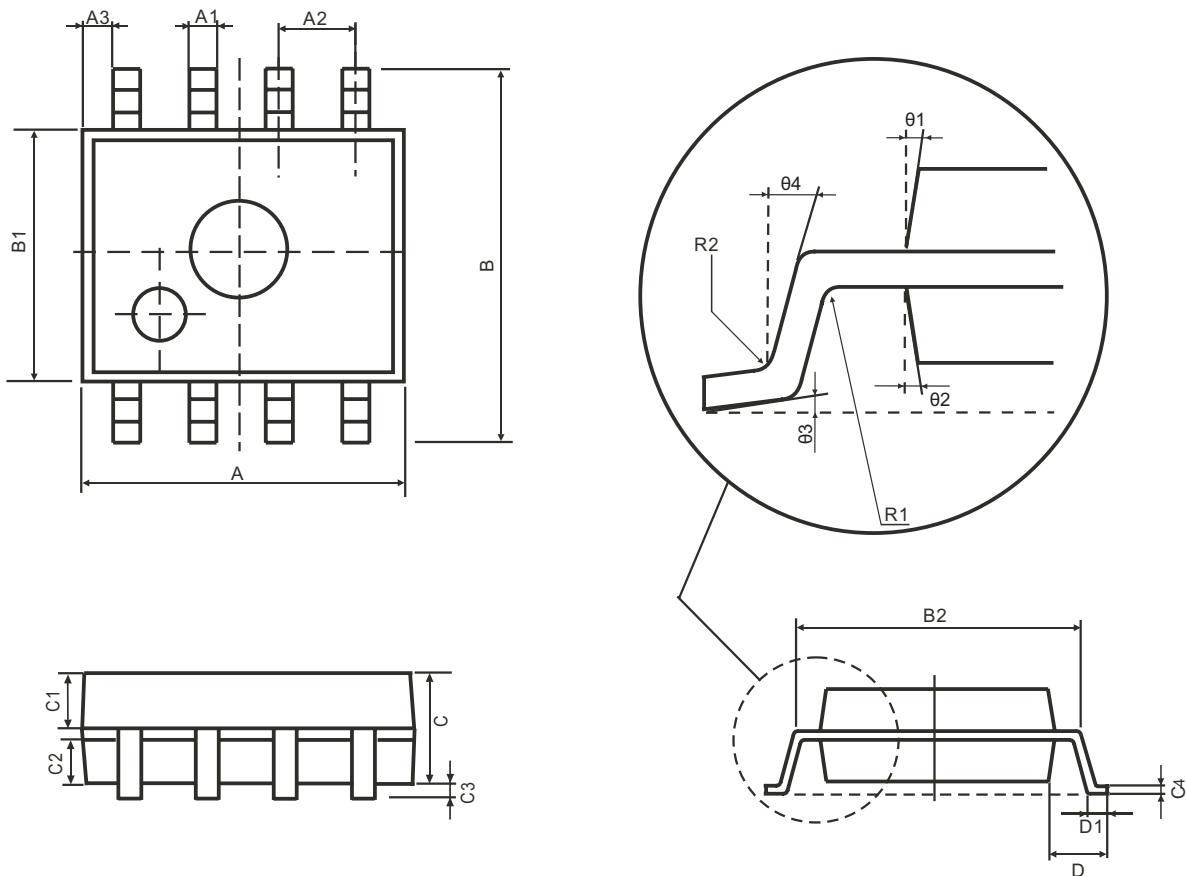


**Figure 17. Supply Current versus Supply Voltage**



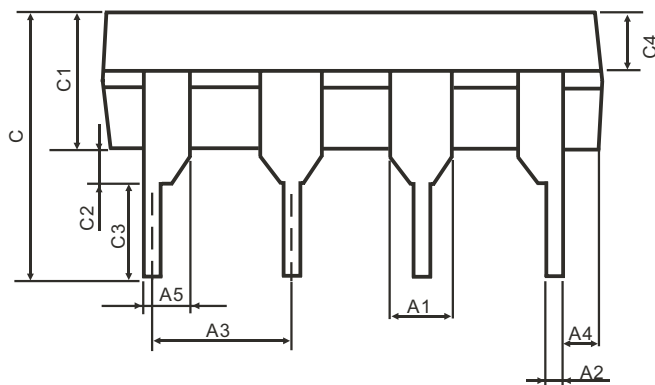
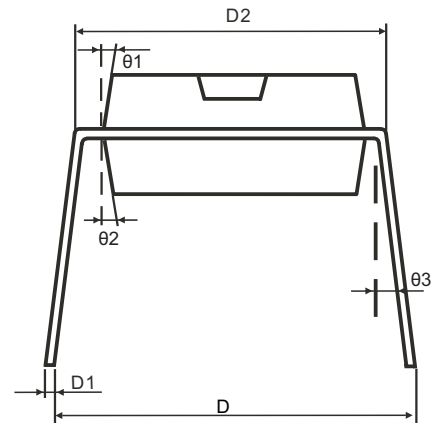
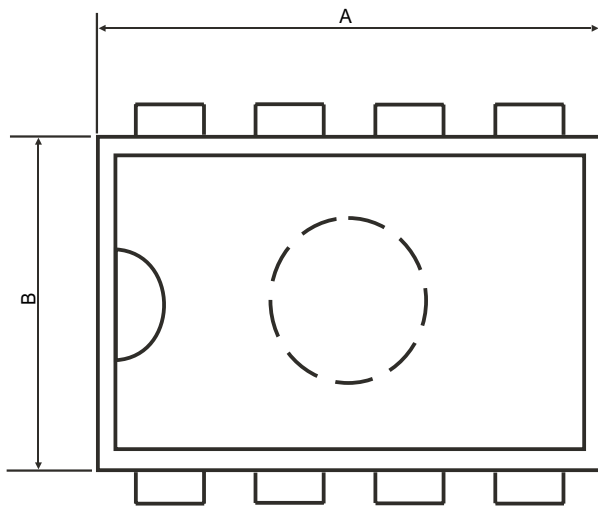


## PHYSICAL DIMENSIONS SOP8L



Symbol	Dimension(mm)		Symbol	Dimension(mm)	
	Min	Max		Min	Max
A	4.95	5.15	C3	0.05	0.20
A1	0.37	0.47	C4	0.20(TYP)	
A2	1.27(TYP)		D	1.05(TYP)	
A3	0.41(TYP)		D1	0.40	0.60
B	5.80	6.20	R1	0.07(TYP)	
B1	3.80	4.00	R2	0.07(TYP)	
B2	5.0(TYP)		θ1	17°(TYP)	
C	1.30	1.50	θ2	13°(TYP)	
C1	0.55	0.65	θ3	4°(TYP)	
C2	0.55	0.65	θ4	12°(TYP)	

## DIP8L



Symbol	Dimension(mm)		Symbol	Dimension(mm)	
	Min	Max		Min	Max
A	9.30	9.50	C2	0.5(TYP)	
A1	1.524(TYP)		C3	3.3(TYP)	
A2	0.39	0.53	C4	1.57(TYP)	
A3	2.54(TYP)		D	8.20	8.80
A4	0.66(TYP)		D1	0.20	0.35
A5	0.99(TYP)		D2	7.62	7.87
B	6.3	6.5	θ1	8°(TYP)	
C	7.20(TYP)		θ2	8°(TYP)	
C1	3.30	3.50	θ3	5°(TYP)	