

1.4A, 180KHz DC-DC CONVERTER STEP-DOWN/STEP-UP/VOLTAGE-INVERTING

A7510

Description

The A7510 is a monolithic switching regulator control circuit containing the primary functions required for DC-DC converters. This device consists of internal temperature compensated reference, voltage comparator, controlled duty cycle oscillator with active current limit circuit, driver and high current output switch. This device was specifically designed to be used in step-down, step-up and voltage-inverting applications with a minimum number of external components.

Features

- Output Switching Current to 1.4A
- Output Voltage Adjustable
- Low Standby Current
- Precision 2% Reference
- Operation from 3.0V to 36V Input
- Operation Frequency Up to 180KHz
- 8Pin SOIC Package

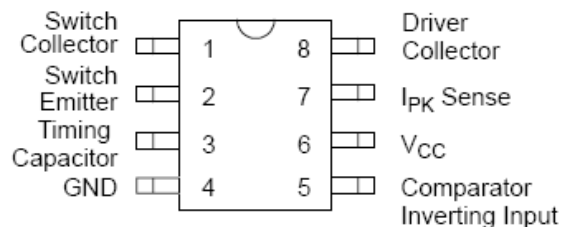
Application

- LCD Backlight Power Supply
- Negative Voltage Power Supply
- ADSL Modem
- Battery Charger

Ordering Information

M8	SOP-8	PN: A7510M8
Note	Provide M8 in T/R, A7510M8R	
	AiT provides all Pb free products	

Pin Assignment



Pin Description

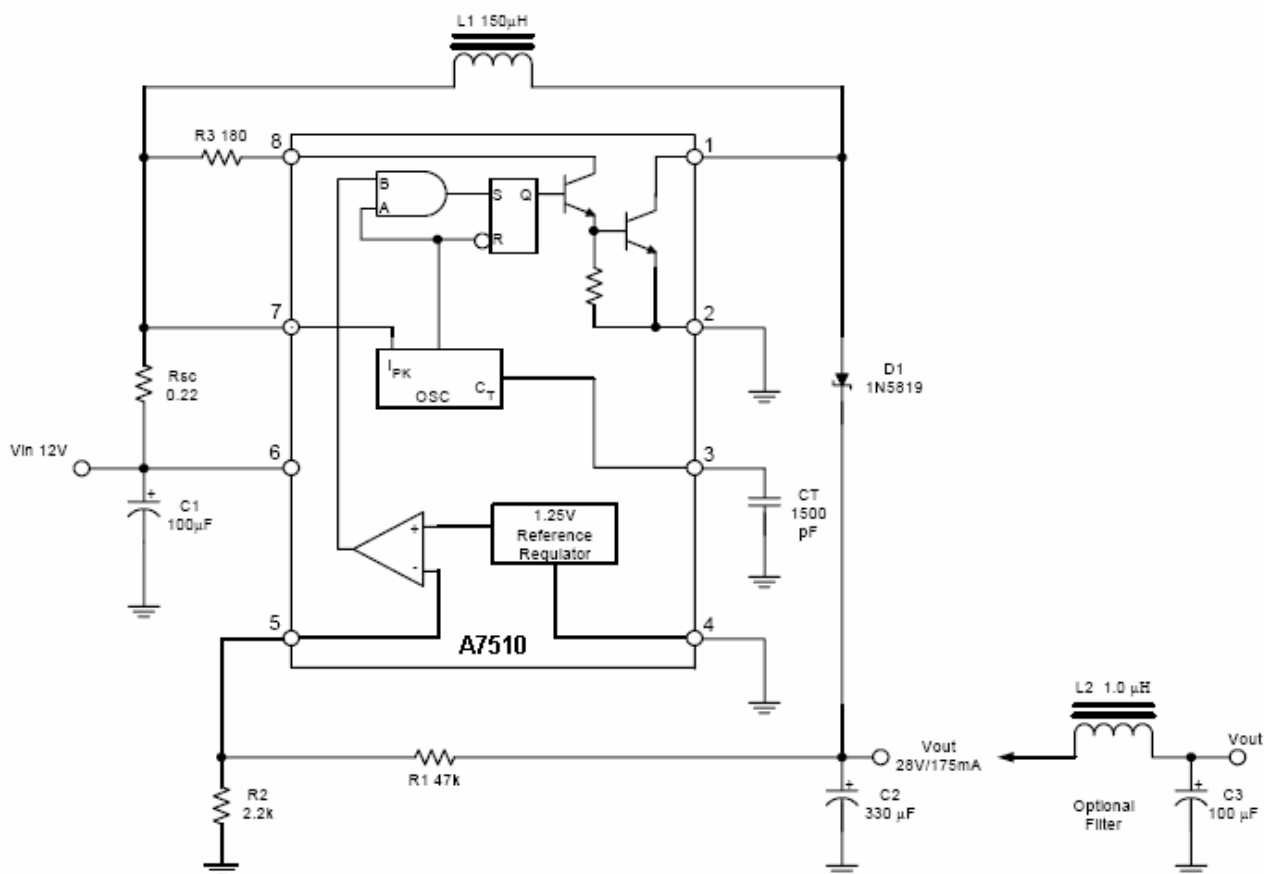
Pin #	Pin Name	Function
1	Switching Collector	Internal Switch Transistor Collector
2	Switch Emitter	Internal Switch Transistor Emitter
3	Timing Capacitor	Timing Capacitor to Control the Switching Frequency
4	GND	Ground Pin for All Internal Circuits
5	Comparator Inverting Input	Inverting Input Pin for Internal Comparator
6	Vcc	Voltage Supply
7	I _{PK} Sense	Peak Current Sense Input by Monitoring the voltage Drop Across an External Isense resistor to limit the peak current through the switch
8	Driver Collector	Voltage Driver Collector

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Typical Application

A. Step-Up Converter

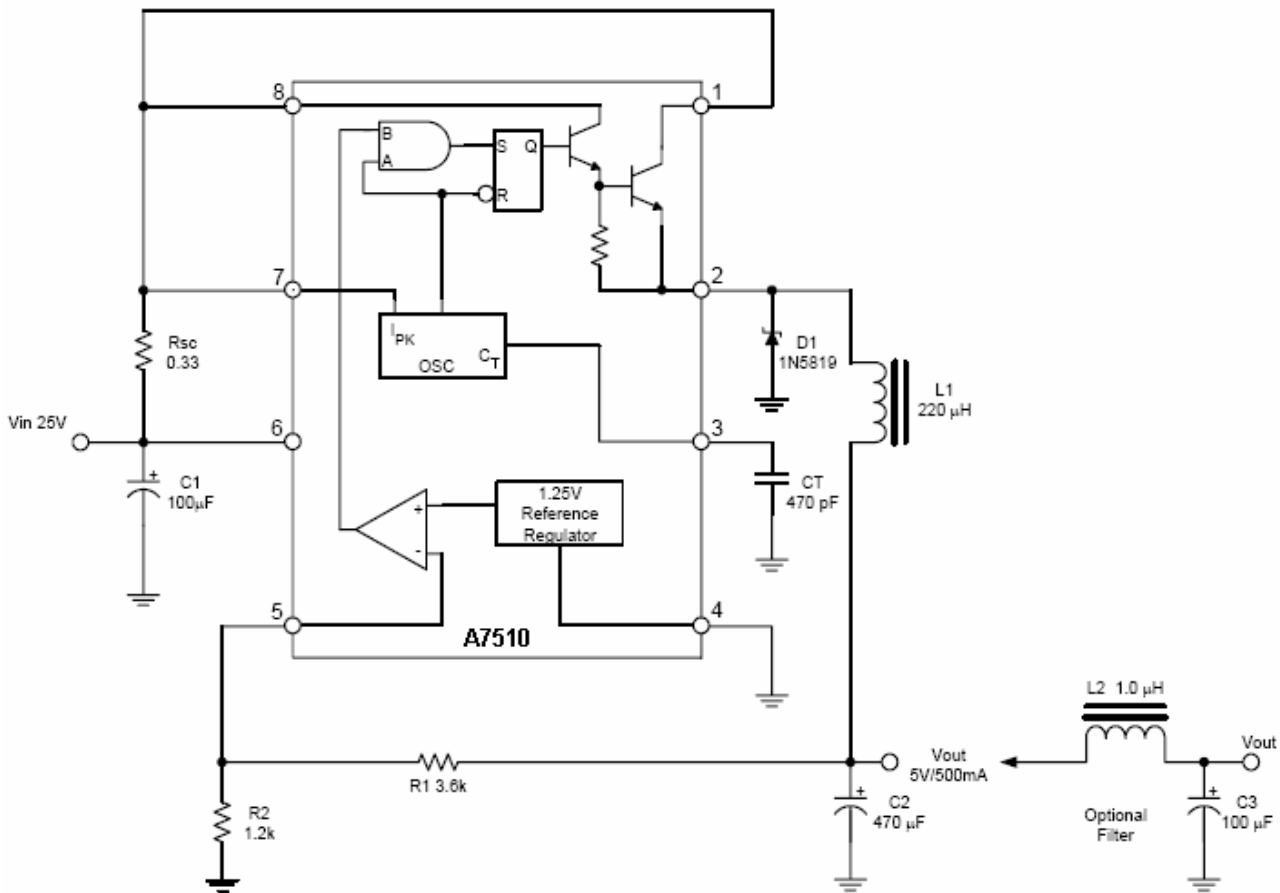


This is a typical step-up converter configuration. In the steady state, if the resistor divider voltage at pin 5 is greater than the voltage in the non-inverting input, which is 1.25V determined by the internal reference, the output of the comparator will go low. At the next switching period, the output switch will not conduct and the output voltage will eventually drop below its nominal voltage until the divider voltage at pin 5 is lower than 1.25V. Then the output of the comparator will go high, the output switch will be allowed to conduct. Since $V_{PIN5} = V_{OUT} * R2 / (R1 + R2) = 1.25(V)$, the output voltage can be decided by $V_{OUT} = 1.25 * (R1 + R2) / R2 (V)$.

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B. Step-Down Converter

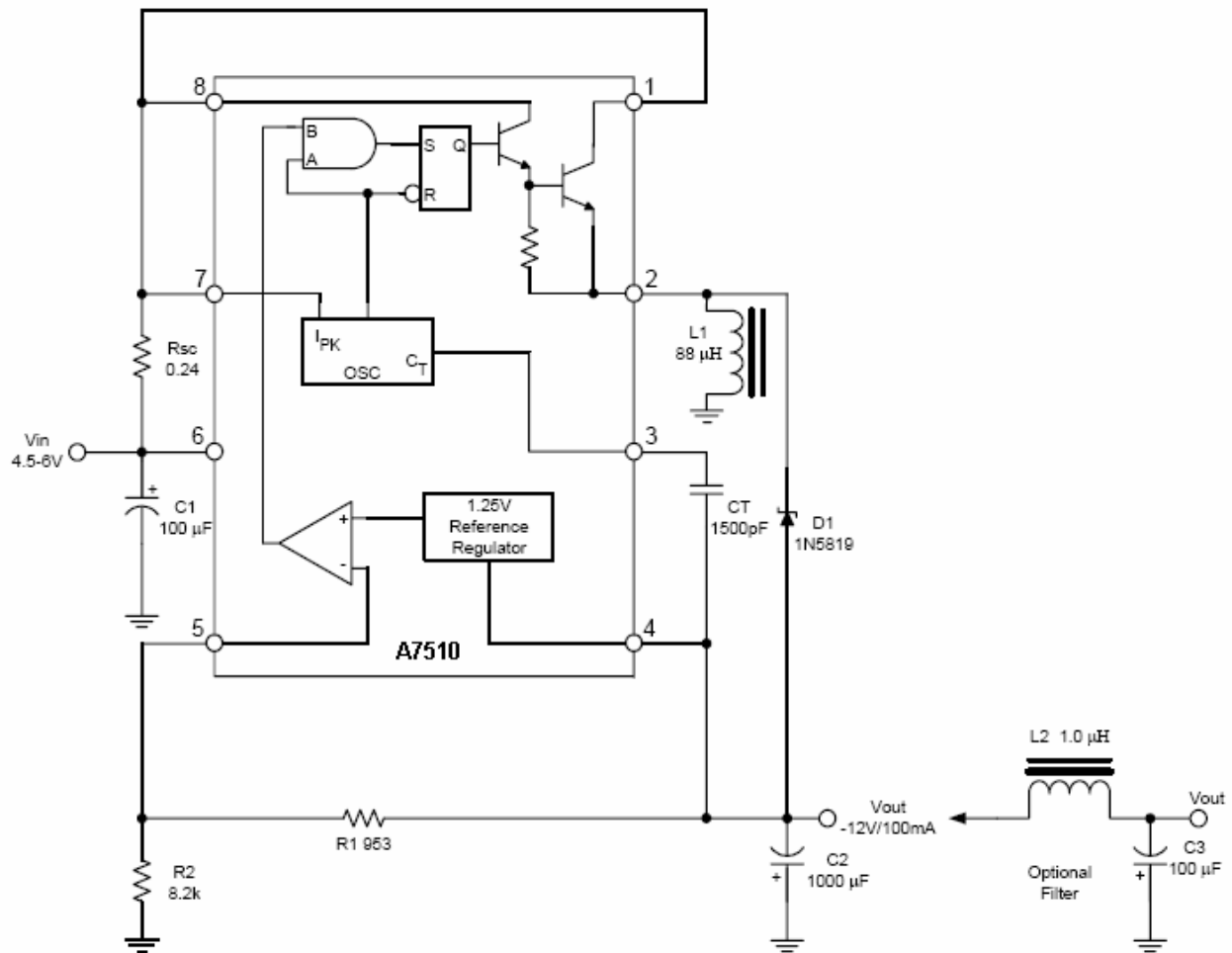


This is a typical step-down converter configuration. The working process in the steady state is similar to step-up converter, $V_{PIN5} = V_{OUT} * R2 / (R1 + R2) = 1.25(V)$, the output voltage can be decided by $V_{OUT} = 1.25 * (R1 + R2) / R2 (V)$

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C. Voltage Inverting Converter



This is a typical inverting converter configuration. The working process in the steady state is similar to step-up converter, the difference in this situation is that the voltage at the non-inverting pin of the comparator is equal to $1.25V + V_{OUT}$, then $V_{PIN5} = V_{OUT} * R2 / (R1 + R2) = 1.25V + V_{OUT}$, so the output voltage can be decided by $V_{OUT} = -1.25 * (R1 + R2) / R1 (V)$.

Absolute Maximum Ratings

Power Supply Voltage (Vcc)	+3.0 ~ 36V
Comparator Input Voltage Range	-0.3 ~ +40V
Switch Collector Voltage	40V
Switch Emitter Voltage (V _{PIN1} =40V)	40V
Driver Collector Current (note1)	100mA
Switch Current	1.3A
Power Dissipation (T _A =25°C)	625mW
Thermal Resistance	+160°C/W
Storage Temperature Range	-65°C ~ +150°C
Operating Junction Temperature	+150°C
ESD (Human Body Model)	2000V

Note1. maximum package power dissipation limits must be observed.

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Electrical Characteristics

(V_{CC}=5.0V, T_A=-40 to 85°C, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OSCILLATOR						
Frequency	F _{OSC}	V _{PIN5} =0V, CT=1.0nF, T _A =25°C	30	38	45	KHz
Charge Current	I _{CHG}	V _{CC} =5.0 to 36V, T _A =25°C	30	38	45	uA
Discharge Current	I _{DISCHG}	V _{CC} =5.0 to 36V, T _A =25°C	180	240	290	uA
Discharge to Charge Current Ratio	I _{DISCHG} / I _{CHG}	Pin#7 to V _{CC} , T _A =25°C	5.2	6.5	7.5	
Current Limit Sense Voltage	V _{IPK} (Sense)	I _{CHG} = I _{DISCHG} , T _A =25°C	250	300	350	mV
OUTPUT SWITCH (Note2)						
Saturation Voltage, Darlington Connection	V _{CE(sat)}	I _{sw} =1.0A, Pin#1& 8 connected		1.0	1.3	V
Saturation Voltage (Note3)	V _{CE(sat)}	I _{sw} =1.0A, R _{Pin#8} =82Ω to V _{CC} , Forced β=20		0.45	0.7	V
DC Current Gain	h _{FE}	I _{sw} =1.0A, V _{CE} =5.0V, T _A =25°C	50	75		
Collector Off-State Current	I _{c(off)}	V _{CE} =36V		0.01	100	uA
COMPARATOR						
Threshold Voltage	V _{TH}	T _A =25°C	1.225	1.250	1.275	V
		T _A =-40 to 85°C	1.210		1.290	
Threshold Voltage Line Regulation	R _{EGLINE}	V _{CC} =3.0V to 36V		1.4	5	mV
Input Bias Current	I _{IB}	V _{IN} =0V		-20	-400	nA
TOTAL DEVICE						
Supply Current	I _{CC}	V _{CC} =5.0V to 36V, CT=1.0nF Pin#7=V _{CC} , V _{Pin#5} >V _{TH}			4	mA

Note2: Low duty cycle pulse technique are used during test to maintain junction temperature as close to ambient temperature as possible.

Note3: If the output switch is driven into hard saturation (non-Darlington configuration) at low switch currents ($\leq 300\text{mA}$) and high driver currents ($\geq 30\text{mA}$), it may take up to 2.0us for it to come out of saturation. This condition will shorten the off time at frequency 30KHz, and is magnified at high temperatures. This condition does not occur with a Darlington configuration, since the output switch cannot saturate. If a non-Darlington configuration is used, the following output drive condition is recommended:

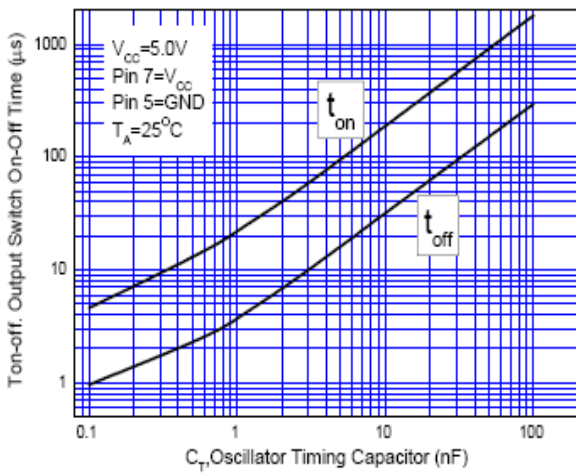
$$\text{Foreced } \beta \text{ of output switch: } \frac{I_{c \text{ output}}}{I_{CDRIVER} - 7.0\text{mA}^*} \geq 10$$

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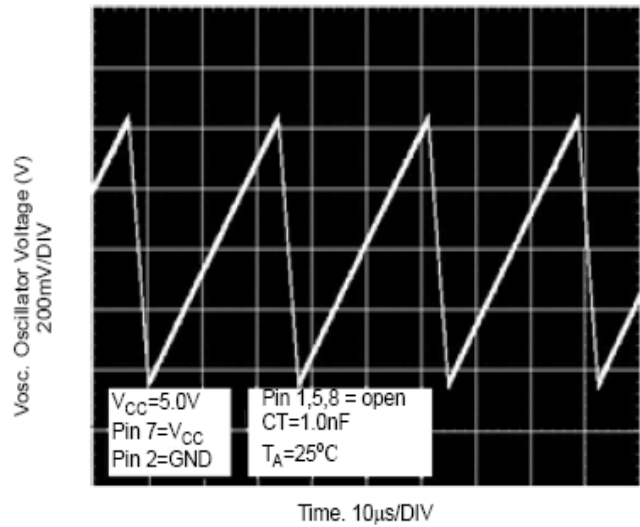
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Typical Characteristics

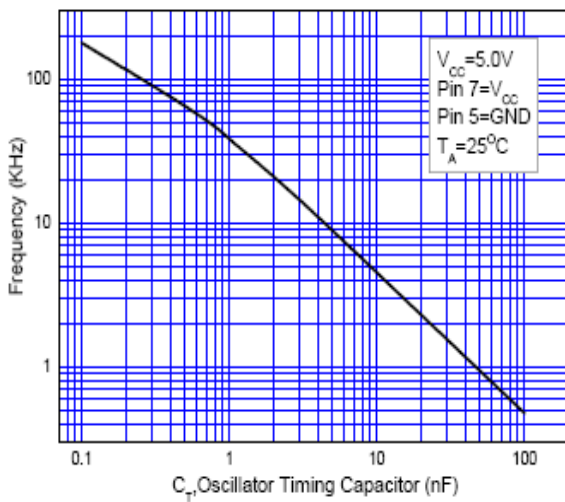
1. Output Switch On-Off Time vs. Oscillator Timing Capacitor



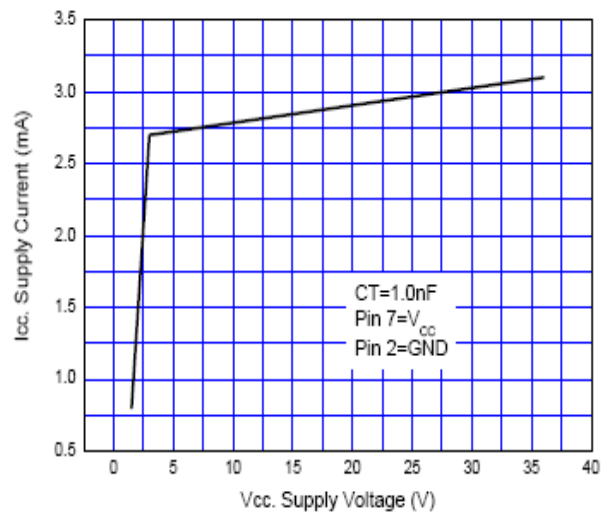
2. Timing Capacitor Waveform



3. Oscillator Frequency vs. Timing Capacitor



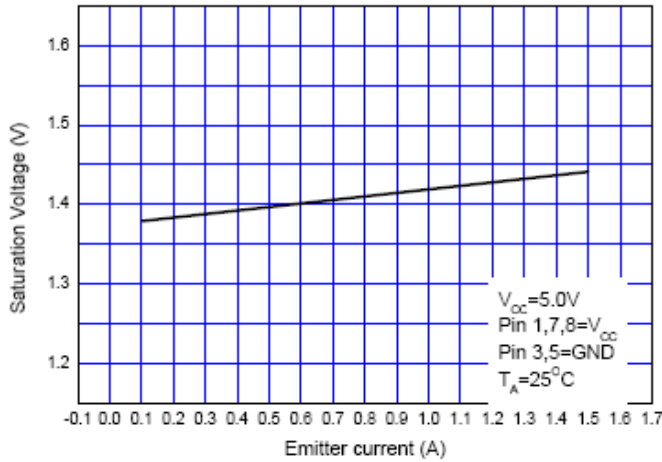
4. Standard Supply Current vs. Supply Voltage



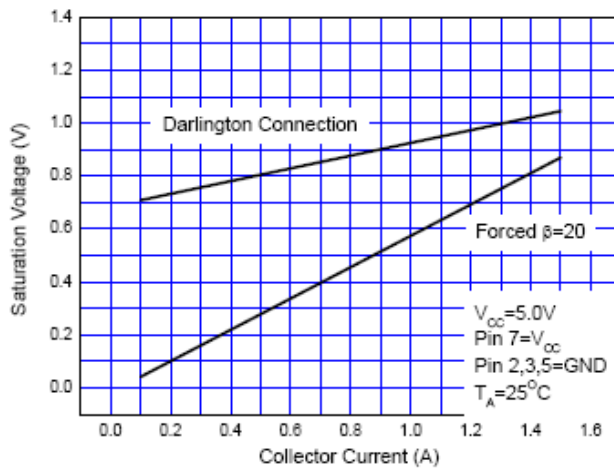
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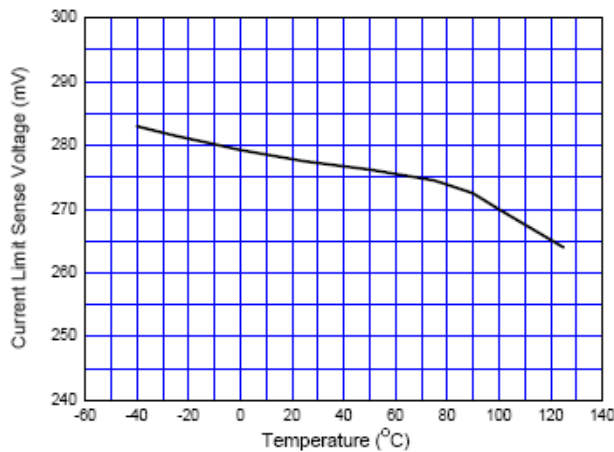
5. Emitter Follower Configuration Output Saturation Voltage vs. Emitter Current



6. Common Emitter Configuration Output Switch Saturation Voltage vs. Collector Current



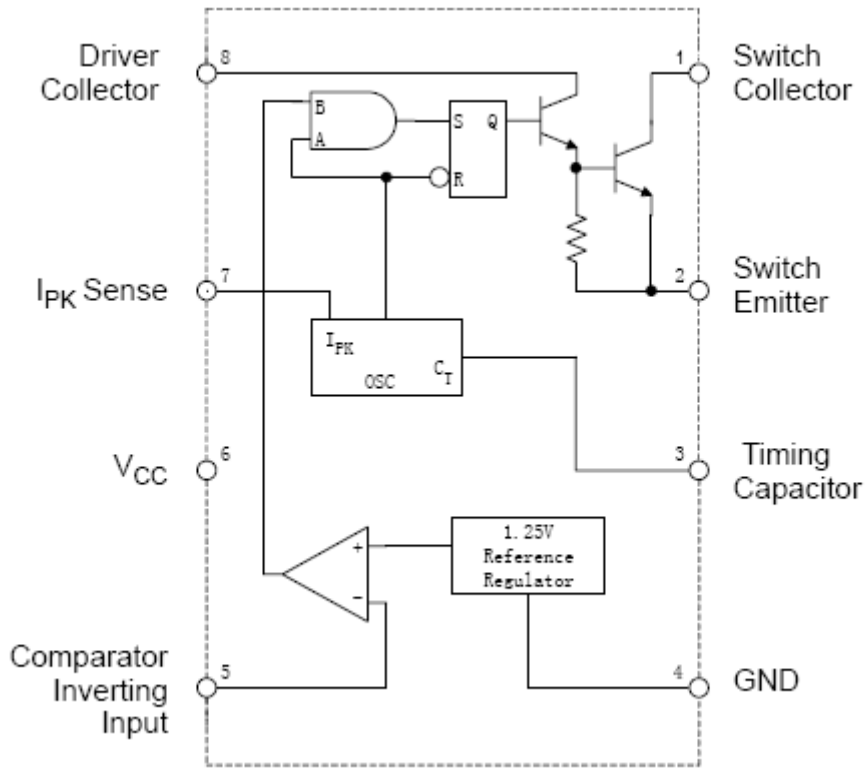
7. Current Limit Sense Voltage vs. Temperature



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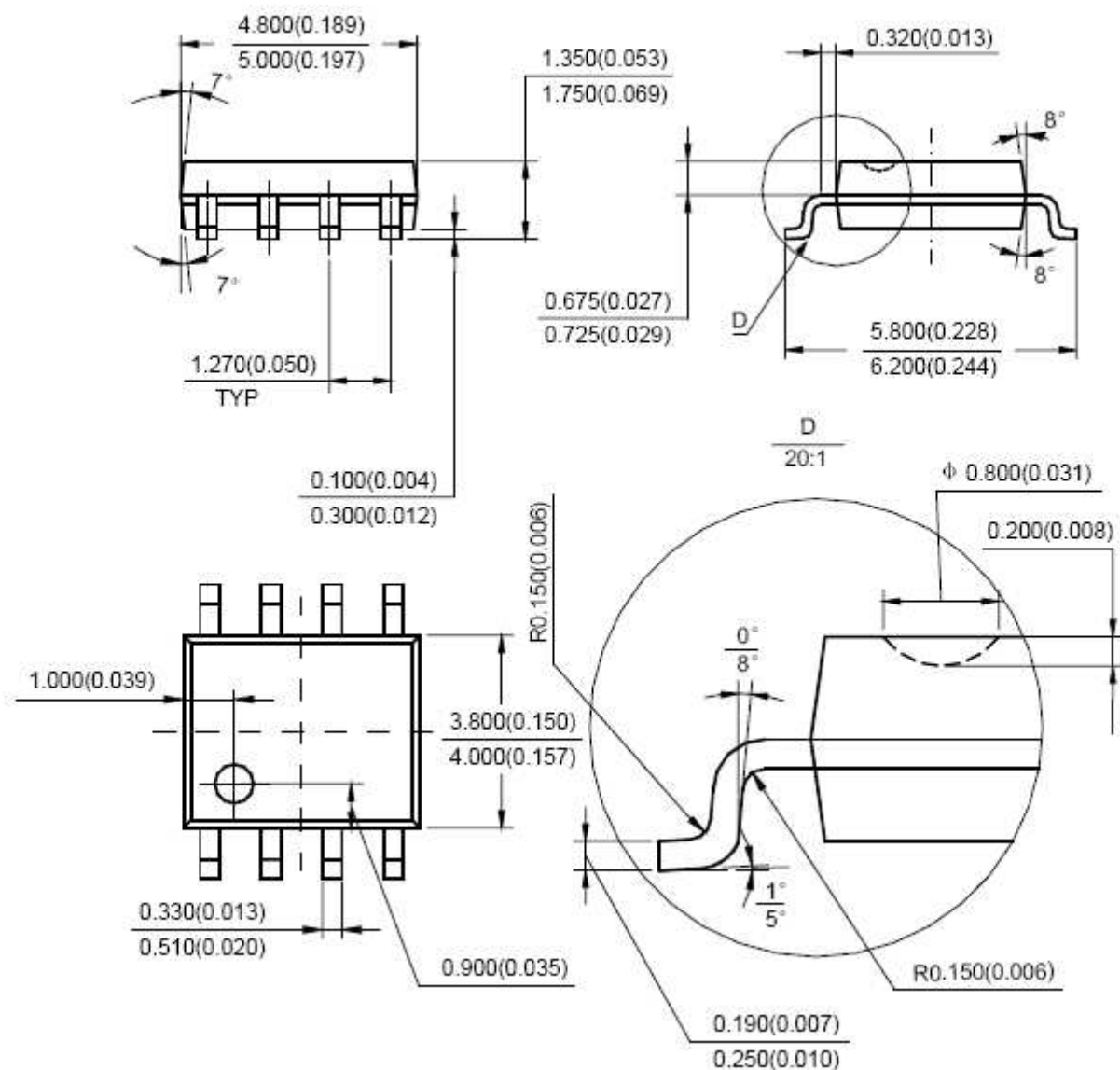
Block Diagram



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Dimension in SO-8 (Unit: mm)



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