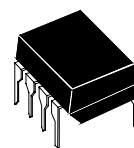


AX3842P / AX3842S

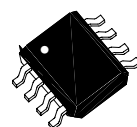
High Performance Current Mode Pwm Controllers

Description

The AX3842 Series is high performance fixed frequency current mode controllers. That is specifically designed for Off-Line and DC To DC converter applications offering the designer a costeffective solution with minimal external components. These integrated circuits feature a trimmed oscillator for precise duty cycle control. A temperature compensated reference, high gain error amplifier, current sensing compara-tor, and a high current totem pole output ideally suited for driving a power MOSFET. Also included are protective features consisting of input and reference undervoltage lockouts each with hysteresis, cycle-by-cycle current limiting, programmable output deadtime, and a latch for single pulse metering.



8-Lead Plastic **DIP-8**
Package Code: P



8-Lead Plastic **SO-8**
Package Code: S

Features

- Trimmed Oscillator for Precise Frequency Control
- Oscillator Frequency Guaranteed at 250 kHz
- Current Mode Operation to 500 kHz
- 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

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_i	Supply Voltage (low impedance source)	30	V
V_i	Supply Voltage ($I_i < 30\text{mA}$)	Self Limiting	
I_o	Output Current	± 1	A
E_o	Output Energy (capacitive load)	5	uJ
	Analog Inputs (pin 2, 3)	-0.3 to 5.5	V
	Error Amplifier Output Sink Current	10	mA
P_{tot}	Power Dissipation at $T_{amb} \leq 25^\circ\text{C}$	800	mW
T_{stg}	Storage Temperature Range	-65 to 150	$^\circ\text{C}$
T_j	Junction Operating Temperature	-40 to 150	$^\circ\text{C}$
T_L	Lead Temperature (soldering 10s)	300	$^\circ\text{C}$

Thermal Data

Symbol	Description	DIP-8	SO-8	Units
$R_{th\ j-amb}$	Thermal Resistance Junction-ambient	100	150	$^\circ\text{C/W}$

Package	Function	Description
<p>DIP-8</p> <p>SO-8</p>	Pin1: Compensation	This pin is the Error Amplifier output and is made available for loop compensation.
	Pin2: Voltage Feedback	This is the inverting input of the Error Amplifier. It's normally connected to the switching power supply output through a resistor divider.
	Pin3: Current Sense	A voltage proportional to inductor current is connected to this input. The PWM uses this information to terminate the output switch conduction.
	Pin4: RT/CT	The oscillator frequency and maximum output duty cycle are programmed by connecting resistor RT to Vref and capacitor CT to ground. Operation to 500kHz is possible.
	Pin5: Ground	This pin is the combined control circuitry and power ground.
	Pin6: Output	This output directly drives the gate of a power MOSFET. Peak currents up to 1A are sourced and sunk by this pin.
	Pin7: Vcc	This pin is the positive supply of the control IC.
	Pin8: Vref	This is the reference output. It provides charging current for capacitor CT through resistor RT.

Electrical Characteristics

Unless otherwise stated, specifications apply for $0 \leq T_{amb} \leq 70^{\circ}\text{C}$ $V_{CC}=15\text{V}$ (Note 1);

$R_T=680\Omega$, $C_T=0.022\mu\text{F}$ for triangular mode, $R_T=10\text{k}$, $C_T=3.3\text{nF}$ for sawtooth mode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Reference Section						
V _{REF}	Reference Output Voltage	T _J =25°C,I _o =1mA	4.90	5	5.1	V
ΔV _{REF}	Line Regulation	12V≤V _{in} ≤25V	-	2.0	20	mV
ΔV _{REF}	Load Regulation	1mA≤I _o ≤20mA	-	3.0	25	mV
ΔV _{REF} /ΔT	Temperature Stability	(Note 2)	-	0.2	-	mV/°C
	Total Output Variation	Line, Load, Temp (Note 2)	4.82	-	5.18	V
e _N	Output Noise Voltage	10Hz≤f≤10kHz,T _J =25°C (Note 2)	-	50	-	uV
	Long Term Stability	T _a =125°C,1000Hrs (Note 2)	-	5	-	mV
I _{SC}	Output Short Current	T _a =25°C	-30	-100	-180	mA
Oscillator Section						
f _{OSC}	Frequency	T _J =25°C	47	52	57	KHz
		T _{low} ≤T _A ≤T _{high}	46	52	60	KHz
Δf _{OSC} /ΔV	Frequency Change with Volt.	12V≤V _{CC} ≤25V	-	0.2	1	%
Δf _{OSC} /ΔT	Frequency Change with Temp.	T _{low} ≤T _A ≤T _{high} (Note 2)	-	5	-	%
		T _J =25°C	-	0.5	-	%
V _{OSC}	Oscillator Voltage Swing	Peak to Peak	-	1.7	-	V
I _{dischg}	Discharge Current (V _{OSC} =2V)	T _J =25°C	7.8	8.3	9.3	mA
		T _{low} ≤T _A ≤T _{high}	7.2	-	9.5	mA
Error Amplifier Section						
V ₂	Voltage Feedback Input	V _O =2.5V	2.42	2.50	2.58	V
I _b	Input Bias Current	V _{FB} =5.0V	-	-0.1	-2.0	uA
A _{VOL}	Open Loop Voltage Gain	2≤V _o ≤4 V	65	90	-	dB
BW	Unity Gain Bandwidth	T _J =25°C (Note 2)	0.7	1.0	-	MHz
PSRR	Power Supply Rejection Ratio	12V≤V _{CC} ≤25V	60	70	-	dB
I _o	Output Current	Sink (V _O =1.1V, V _{FB} =2.7V)	2.0	12	-	mA
		Source (V _O =5.0V, V _{FB} =2.3V)	-0.5	-1.0	-	mA
V _{OUT-High}	Output Voltage Swing High State	V _{FB} =2.3V, R _L =15K to ground	5	6	-	V
V _{OUT-Low}	Output Voltage Swing Low State	V _{FB} =2.7V, R _L =15K to V _{REF}	-	0.7	1.1	V
Current Sense Section						
G _V	Current Sense Input Voltage Gain	(Notes 3 & 4)	2.85	3.0	3.15	V/V
V ₃	Maximum Input Signal	V _{PIN1} =5V (Note 3)	0.9	1.0	1.1	V
SVR	Supply Voltage Rejection Ratio	12V≤V _{CC} ≤25V (Note 3)	-	70	-	dB
I _b	Input Bias Current		-	-2.0	-10	uA
	Propagation Delay	T _J =25°C (Note 2)	-	150	300	nS

Electrical Characteristics (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Output Section						
V_{OL}	Output Voltage (Low State)	$I_{sink}=20mA$	-	0.1	0.4	V
		$I_{sink}=200mA$	-	1.5	2.2	V
V_{OH}	Output Voltage (High State)	$I_{source}=20mA$	13	13.5	-	V
		$I_{source}=200mA$	12	13.4	-	V
V_{OLS}	Output Voltage with UVLO Activated	$V_{CC}=6V, I_{sink}=1mA$	-	-0.1	-1.1	V
t_r	Output Voltage Rise Time	$T_J=25^{\circ}C, C_L=1.0nF$ (Note 2)	-	50	150	nS
t_f	Output Voltage Fall Time	$T_J=25^{\circ}C, C_L=1.0nF$ (Note 2)	-	50	150	nS
Under-Voltage Lockout Section						
	Start Threshold		14.5	16	17.5	V
	Min. Operating Voltage	After Turn On	8.5	10	11.5	V
PWM Section						
DC_{max}	Maximum Duty Cycle		94	96	-	%
DC_{min}	Minimum Duty Cycle		-	-	0	%
Total Device						
I_{st}	Start-Up Current		-	0.1	0.5	mA
I_i	Operating Supply Current	$V_{pin2}=V_{pin3}=0, R_T=10K, C_T=3.3nF$	-	11	17	mA
V_{iz}	Vcc Zener Voltage	$I_{CC}=25 mA$	-	34	-	V

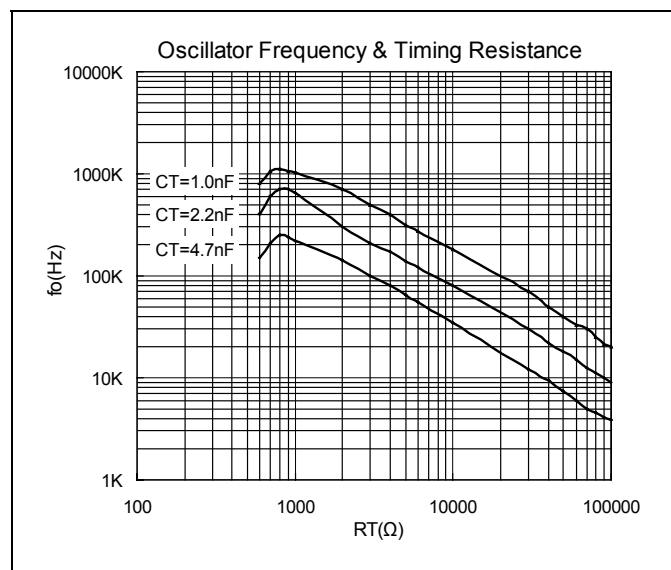
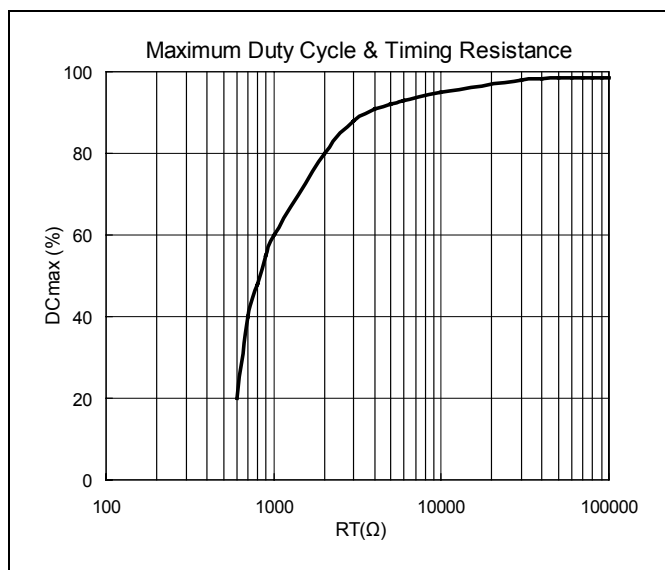
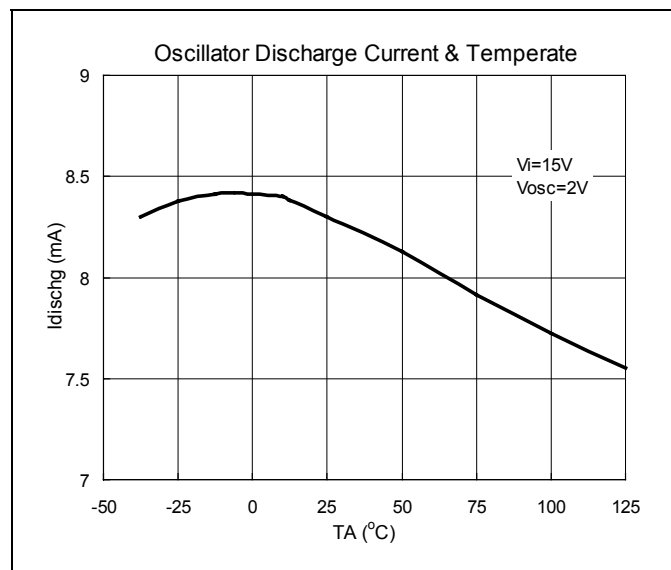
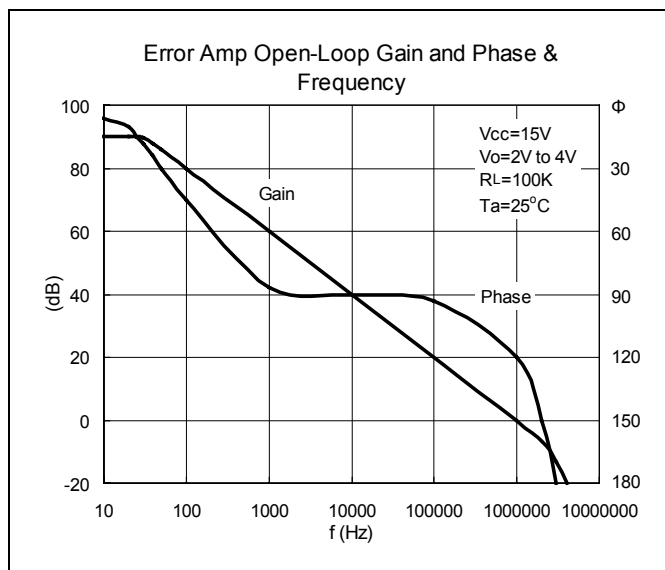
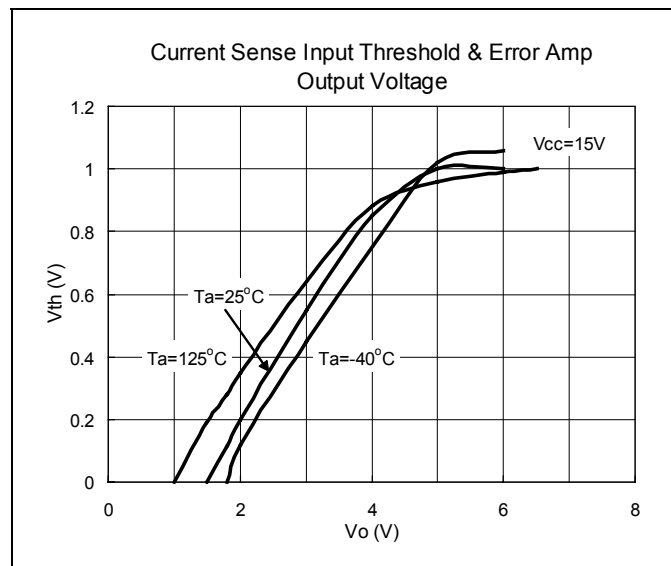
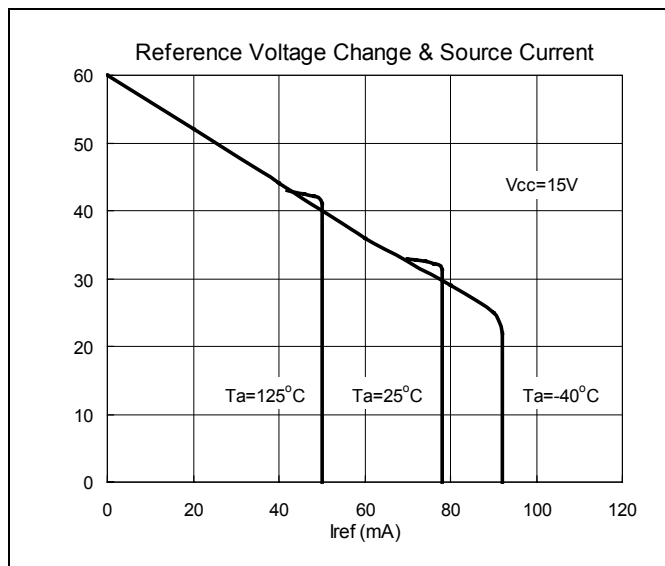
Note 1: Adjust V_{CC} above the start threshold before setting at 15V.

Note 2: These parameters, although guaranteed are not 100% tested in production.

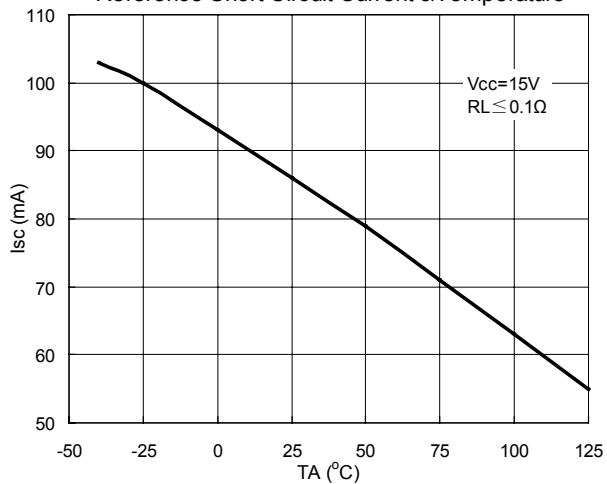
Note 3: Parameter measured at trip point of latch with $V_{pin2}=0$.

Note 4: Gain defined as: $A=V_{pin1}/V_{pin3}, 0 \leq V_{pin3} \leq 0.8V$

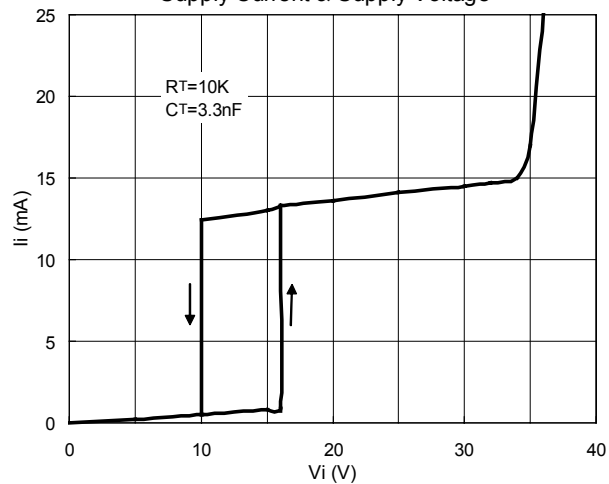
Characteristics Curve



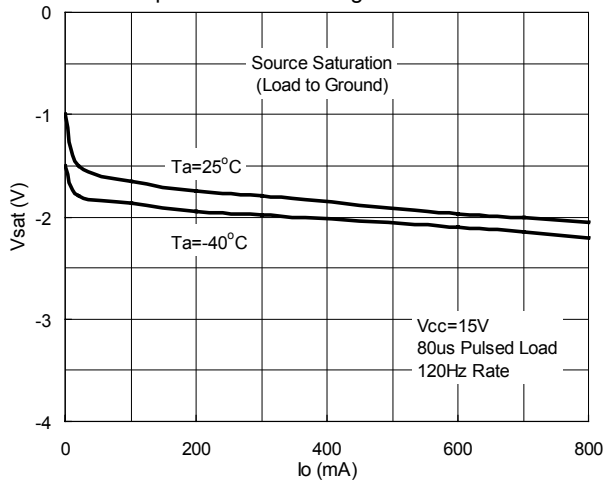
Reference Short Circuit Current & Temperature



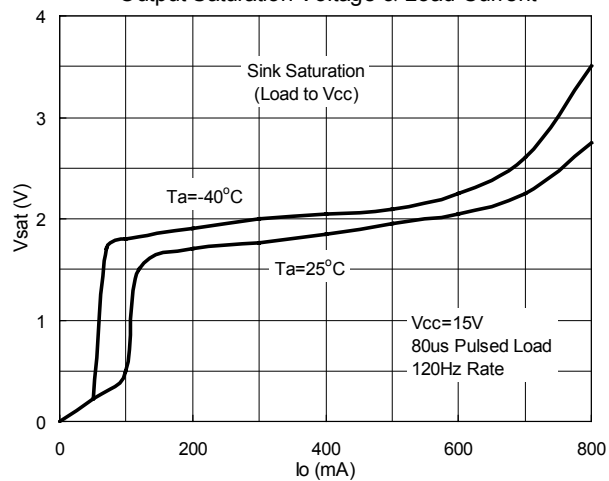
Supply Current & Supply Voltage



Output Saturation Voltage & Load Current

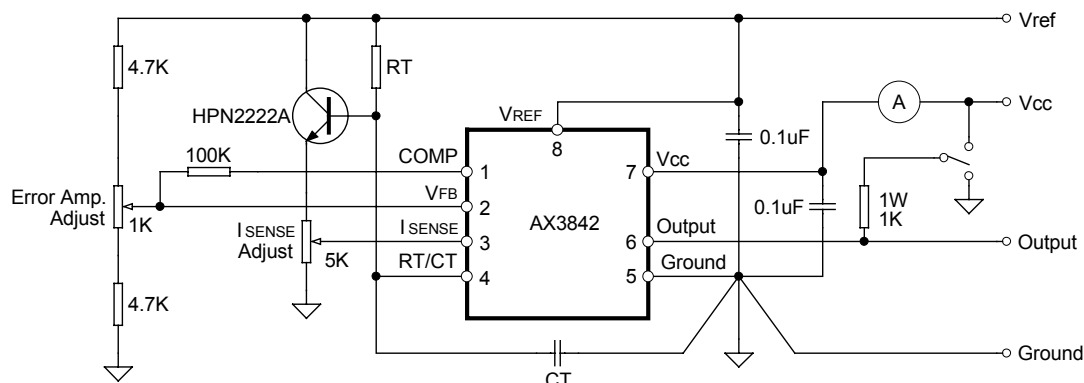


Output Saturation Voltage & Load Current



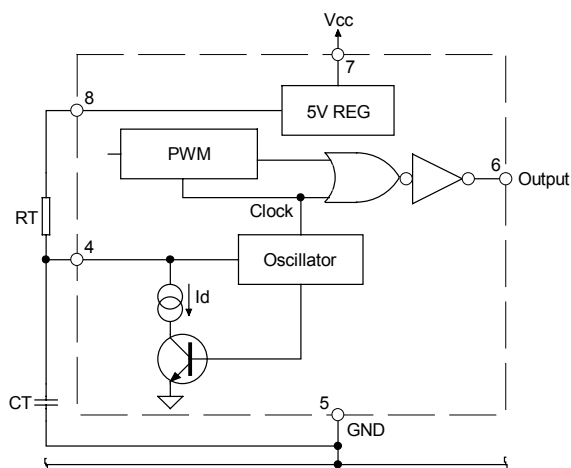
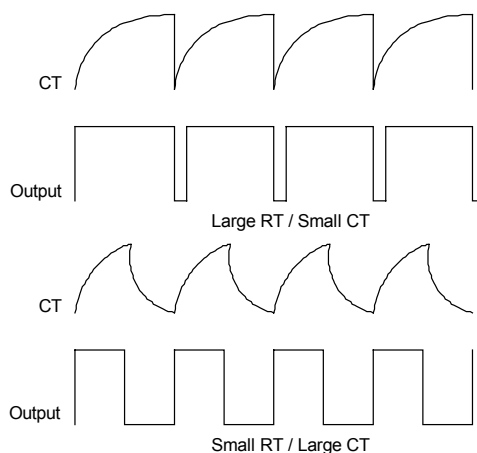
Application Information

Open Loop Test Circuit

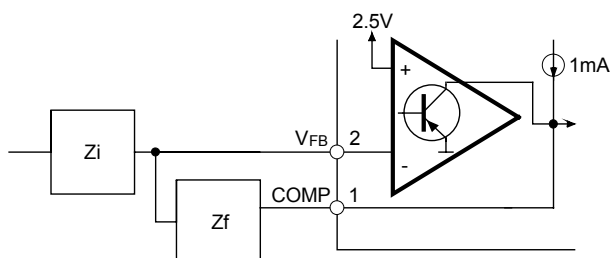


High peak currents associated with capacitive loads necessitate careful grounding techniques. Timing and bypass capacitors should be connected close to pin5 in a single point ground. The transistor and 5K Ω potentiometer are used to sample the oscillator waveform and apply an adjustable ramp to pin3.

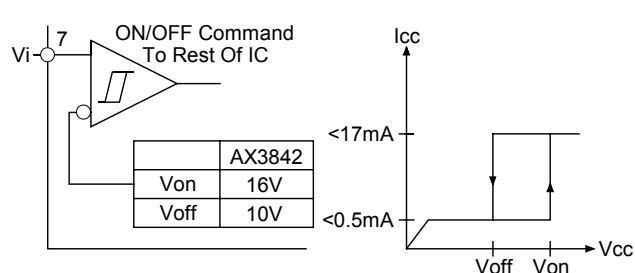
Oscillator and Output Waveforms



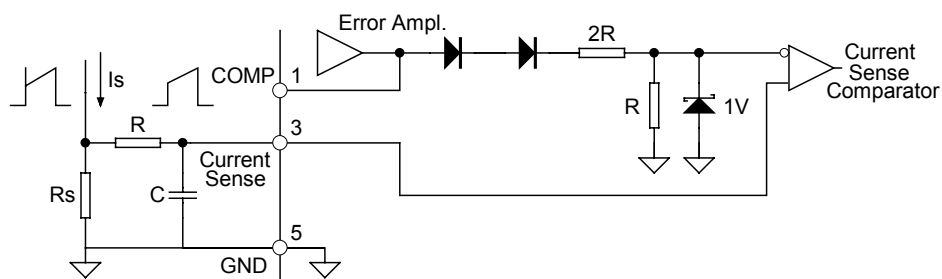
Error Amp Configuration



Under Voltage Lockout



Current Sense Circuit

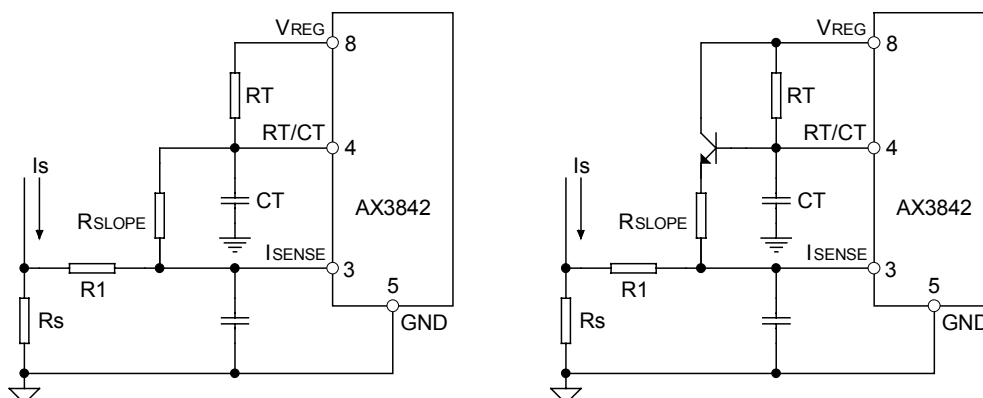


Peak current (I_s) is determined by the formula

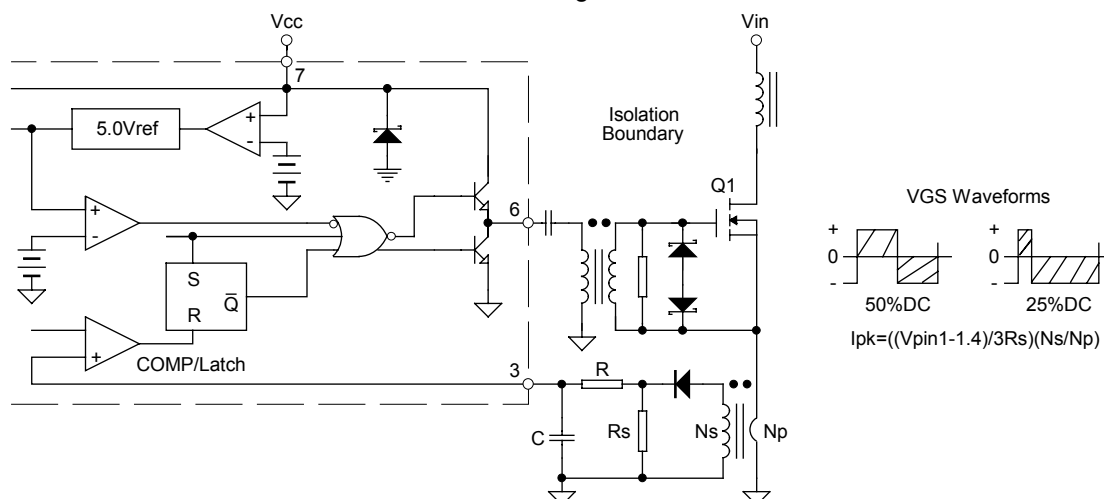
$$I_{s(max.)} \approx 1V/R_s$$

A small RC filter may be required to suppress switch transients.

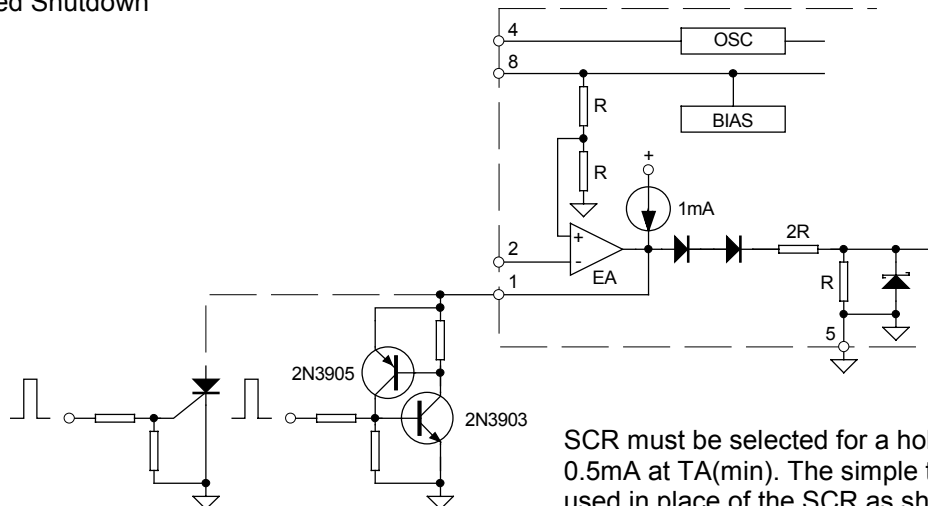
Slope Compensation Techniques



Isolated MOSFET Drive and Current Transformer Sensing

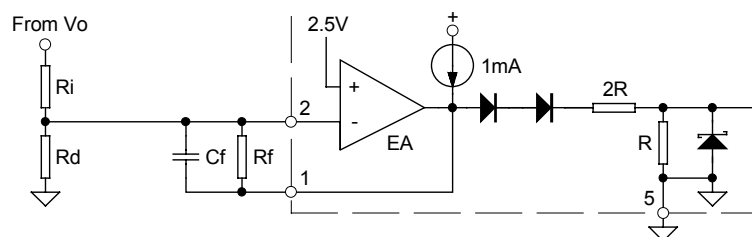


Latched Shutdown

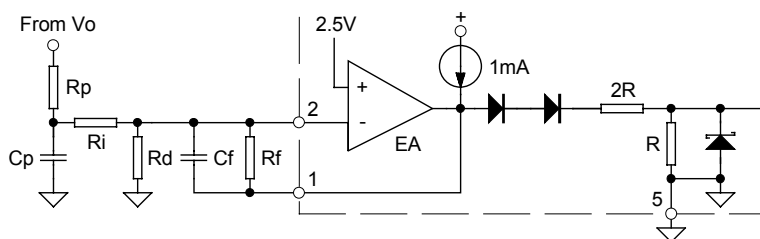


SCR must be selected for a holding current of less than 0.5mA at TA(min). The simple two transistor circuit can be used in place of the SCR as shown. All resistors are 10K.

Error Amplifier Compensation

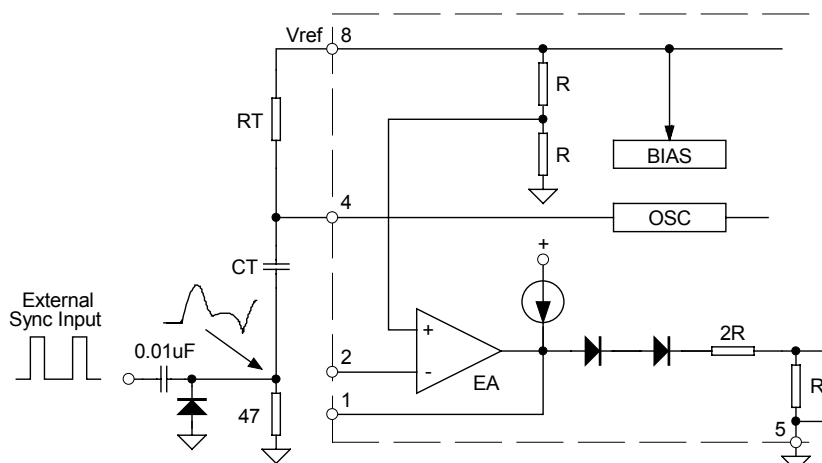


Error Amp compensation circuit for stabilizing any current-mode topology except for boost and flyback converters operating with continuous inductor current



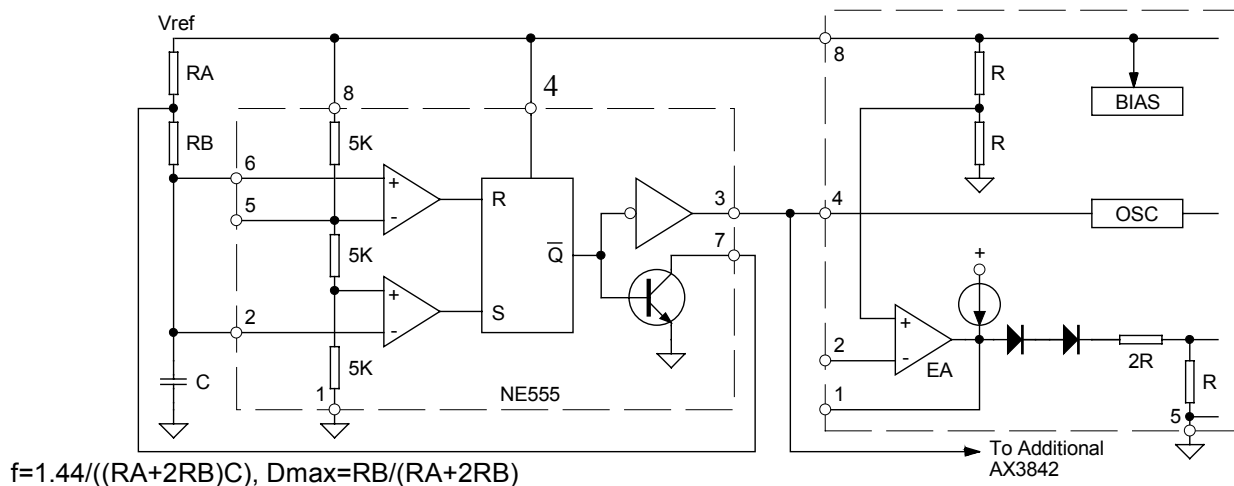
Error Amp compensation circuit for stabilizing current-mode boost and flyback topologies operating with continuous inductor current.

External Clock Synchronization

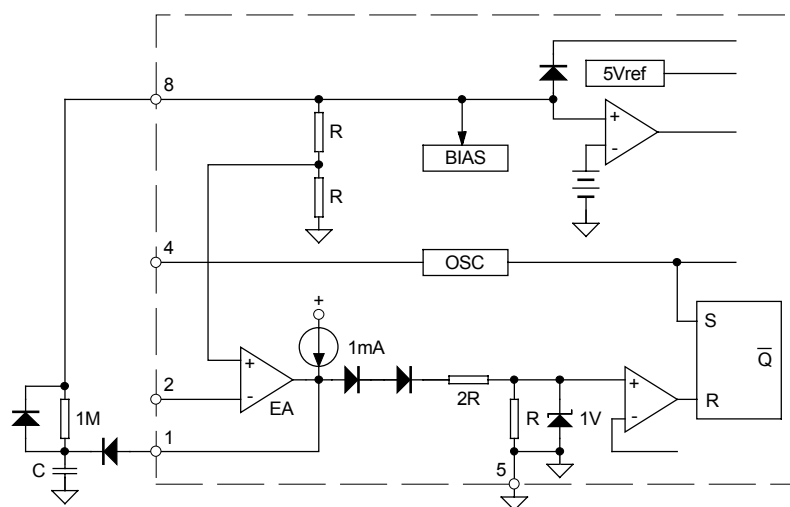


The diode clamp is required if the Sync amplitude is large enough to cause the bottom side of CT to go more than 300mV below ground

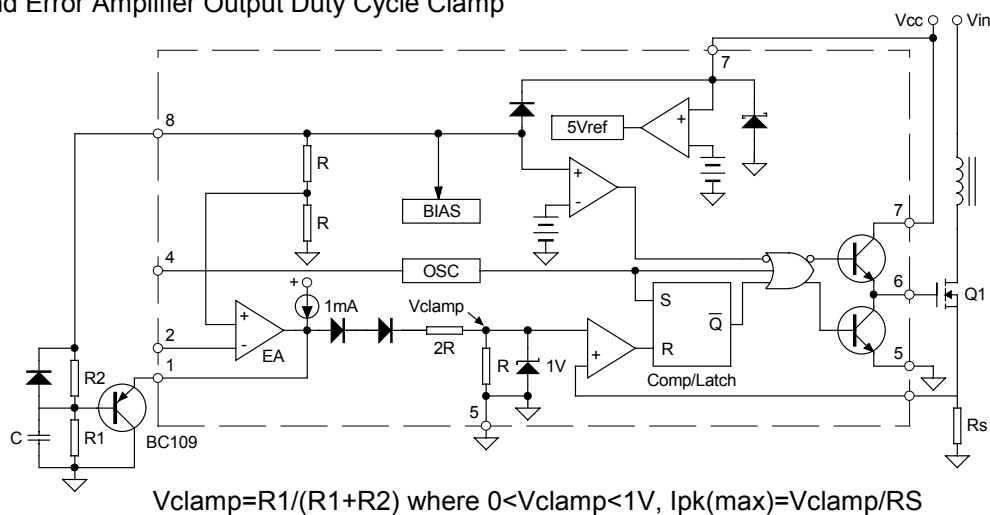
External Duty Cycle Clamp and Multi Unit Synchronization



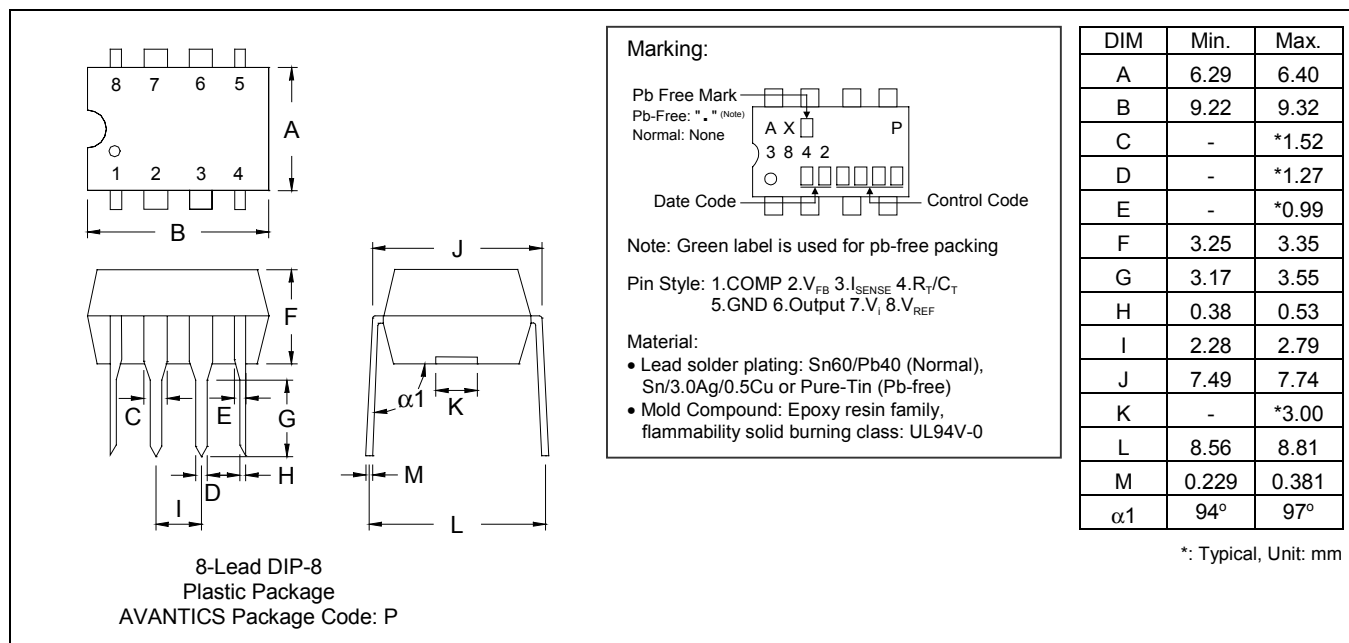
Soft-Start Circuit



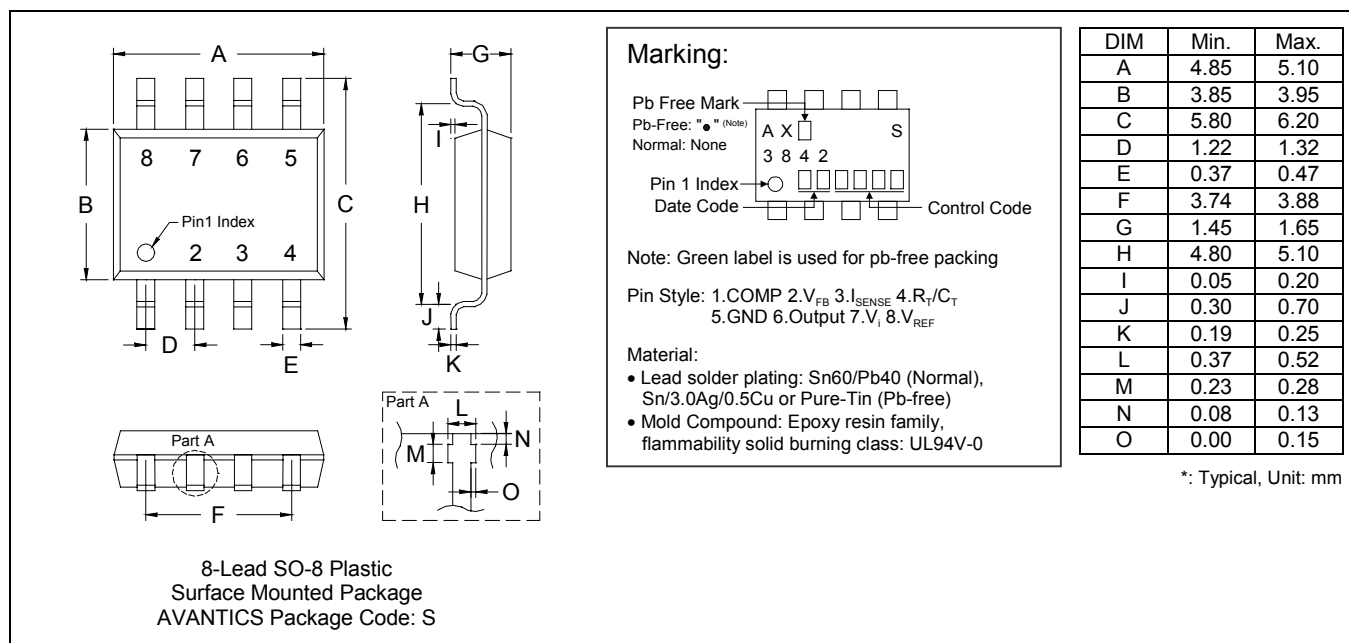
Soft-Start and Error Amplifier Output Duty Cycle Clamp



DIP-8 Dimension



SO-8 Dimension



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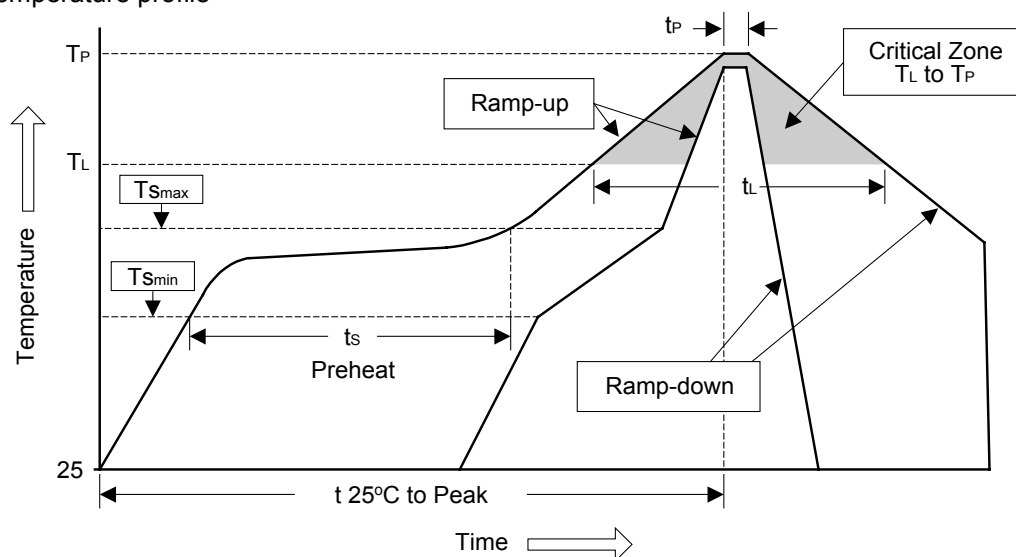
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Soldering Methods for AVANTICS's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min (T_{Smin})	100°C	150°C
- Temperature Max (T_{Smax})	150°C	200°C
- Time (min to max) (t_s)	60~120 sec	60~180 sec
T_{Smax} to T_L		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature (T_L)	183°C	217°C
- Time (t_l)	60~150 sec	60~150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_p)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec