AAC142/ 143

Current Mode PWM Contoller

PRELIMINARY DATA

DESCRIPTION

The AAC142 and AAC143 are part of AAI's new family of specialty products for Power Management applications. The AAC142 and AAC143 are high performance integrated circuits designed for Off-line or DC to DC converters using peak current mode control.

In offline Ac designs the startup is improved by the low start-up current of the family. The integrated soft-start function adds to the easy of using the AAC14X parts in offline applications.

The AAC142 and AAC143 are identical except for the Under Voltage Lockout. The AAC142 has $UVLO_{on}$ threshold of 16V and off of 10V making it easy to use in offline supplies where startup requirements for energy storage is necessary. For applications using lower supply voltages the AAC143 has $UVLO_{on}$ of 8.4V and $UVLO_{off}$ of 7.6V.

The AAC14X family is offered in DIP and SMD packages. The packages are industry standards and are ROHS compliant. Extended temperature is standard with the AAC14X family.

The greater than 1A output driver is ideal for driving MOSFETs and low power IGBTs. Rise and fall times are typically less that 30ns with a 1000pF load. The improvements in switching speed can provide improvements in efficiency, higher operating frequency and over current protection.

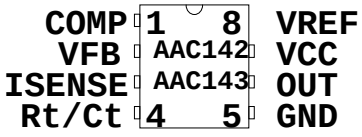
The AAC14X family has a minimum pulse width of 0.4% allowing operation at very low power without pulse skipping or erratic operation. The narrower pulse width capibilities enhances operation at higher frequencies and voltages.

FEATURES

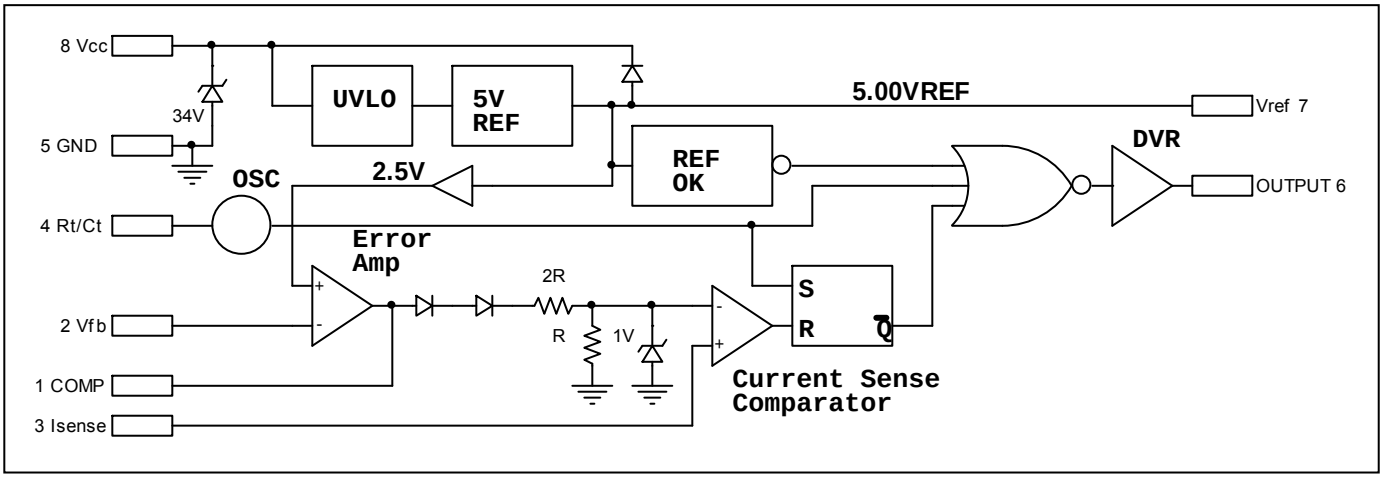
- Low Start-up current
- Pulse by pulse current limiting
- On board voltage reference
- Under Voltage Lockout with hysteresis
- Simple oscillator circuit
- Over Voltage protection zener
- High current output driver
- Less than 30ns rise and fall times
- Operation to over 1MHz
- Peak Current Mode control
- Integrated Soft-Start Function (~330 Clock Cycles)
- 100ns leading edge current blanking for reduced filtering

PIN CONFIGURATION: 8-Lead DIP and SOIC8

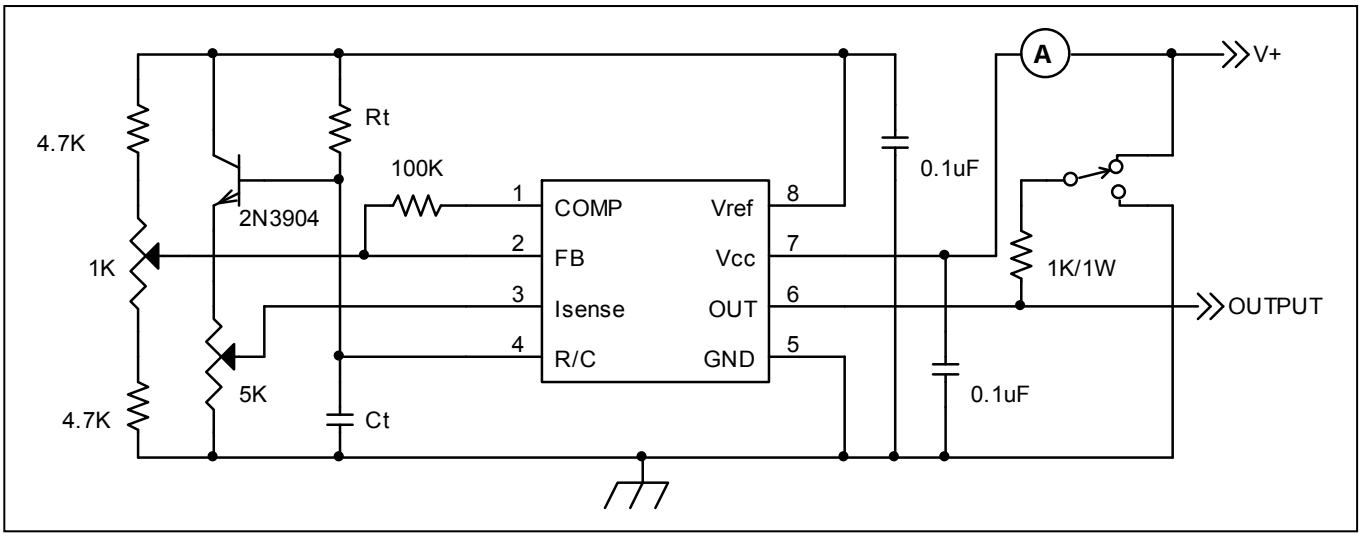
View of the AAC14X shown from the top.



BLOCK DIAGRAM



Open Loop Test Circuit



MAXIMUM RATINGS

PARAMETER	PARAMETERS			UNITS	CONDITIONS
	MIN.		MAX.		
Supply Voltage (V_{cc} – Ground)	0		30	V	Low impedance source
V_{fb} and I_{sense} Amp Inputs	-0.3		5.5	V	
Output Current			±1	A	
Power Dissipation			1200	mW	DIP
			1000	mW	SOIC8
Operating Junction Temperature			150	°C	
Operating Ambient Temperature	-40		105	°C	Extended industrial temp. rated devices
Operating Ambient Temperature	-40		125	°C	Automotive temp. rated devices
Storage Temperature Range	-65		150	°C	
Lead Temperature (10 Second)			300	°C	Soldering

ELECTRICAL CHARACTERISTICS

Unless otherwise stated, T=25C, Vcc=15V, R_T = 10KΩ, C_T = 3300pF.

PARAMETER	PARAMETERS			UNITS	CONDITIONS
	MIN.	TYP.	MAX.		
REFERENCE SECTION					
Output Voltage	4.95	5.00	5.05	V	
Line Regulation		6	15	mV	12V<V_{cc}<25V
Load Regulation		3	25	mV	
Temperature Stability		0.2		mV/°C	
Total Output Variation	4.9		5.1	V	Line, Load, and Temperature
Long Term Stability		5		mV	T_a=125°C for 1000 hours
Output Short Circuit Current	-30	-50	-60	mA	
OSCILLATOR SECTION					
Frequency Initial Accuracy	47	52	57	KHz	Ta=25°C
Frequency Change with Voltage		0.2	1	%	12<Vcc<25V
Frequency Change with Temp.		1		%	T_{low}<T_a<T_{high}
Oscillator Voltage Swing		1.65		V_{pp}	
ERROR AMPLIFIER SECTION					
Voltage Feedback Input	2.45	2.5	2.55	V	V_{out}=2.5V
Input Bias Current			-1	μA	
Open Loop Voltage Gain		90		dB	
Unity Gain Bandwidth		10		MHz	T_j=25°C
Power Supply Rejection Ratio		70		dB	12V<V_{cc}<25V
Output Current Sink		12		mA	
Output Current Source		-1		mA	
Output Voltage Swing High		6		V	
Output Voltage Swing Low		0.8		V	
PULSE WIDTH MODULATION SECTION					
Maximum Duty Cycle		97		%	
Minimum Duty Cycle		0.4		%	Before drop out
CURRENT SENSE SECTION					
Voltage Gain	2.85	3.0	3.15	V	
Maximum Input Signal	0.97	1.0	1.03	V	
Power Supply Rejection Ratio		70		dB	
Input Bias Current		-10		μA	
Time Delay to Output		300		nS	

PARAMETER	PARAMETERS			UNITS	CONDITIONS
	MIN.	TYP.	MAX.		
OUTPUT SECTION					
Voltage Out Low			0.4	V	Isink = 20mA
Voltage Out Low			2.2	V	Isink = 200mA
Voltage Out High	13.5	14		V	Isink = 20mA
Voltage Out High	12.5	13.5		V	Isink = 200mA
Voltage Out UVLO			1.1	V	Vcc=6V, Isink = 1mA
Voltage Output Rise Time		30	50	ns	C_L=1000pF
Voltage Output Fall Time		30	50	ns	C_L=1000pF
UNDER-VOLTAGE LOCKOUT SECTION					
Voltage Start Threshold (142)	15	16	17	V	
Voltage Start Threshold (143)	7.8	8.4	9	V	
Voltage Turnoff Threshold (142)	9	10	11	V	
Voltage Turnoff Threshold (143)	7	7.6	8.2	V	
Zener Clamp Voltage	30	34		V	I_{cc}≤25mA
TOTAL DEVICE SECTION					
Start-up Supply Current		0.4	0.6	mA	
Operating Supply Current			11	mA	

The improved switching performance increases the high peak current associated with internal and external capacitances and will require careful grounding and PCB trace routing. Bypass and timing capacitors should be of high quality and located carefully with short traces. The reference capacitor must be located very close to the IC with minimum trace lengths. A single point ground should be located at pin 5 ground. The use of a good ground plane is recommended. Under certain conditions of high peak currents it may be advisable to isolate the Vref pin from the bypass capacitor with a resistor to prevent interaction of the high current with the internal oscillator operation.

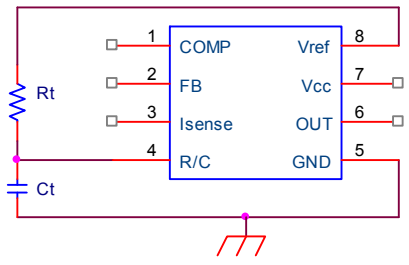
Charge and discharge times are given by the following formulas:

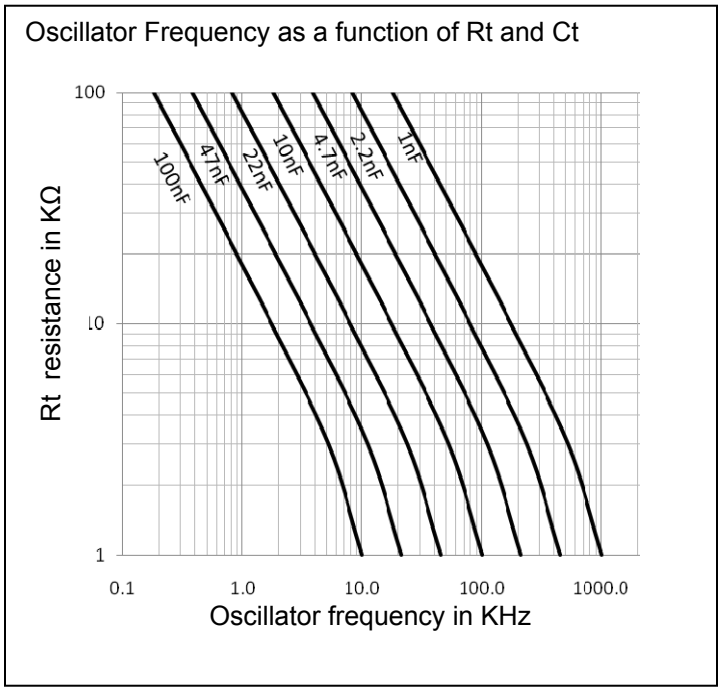
$$T_C=0.55R_tC_t$$

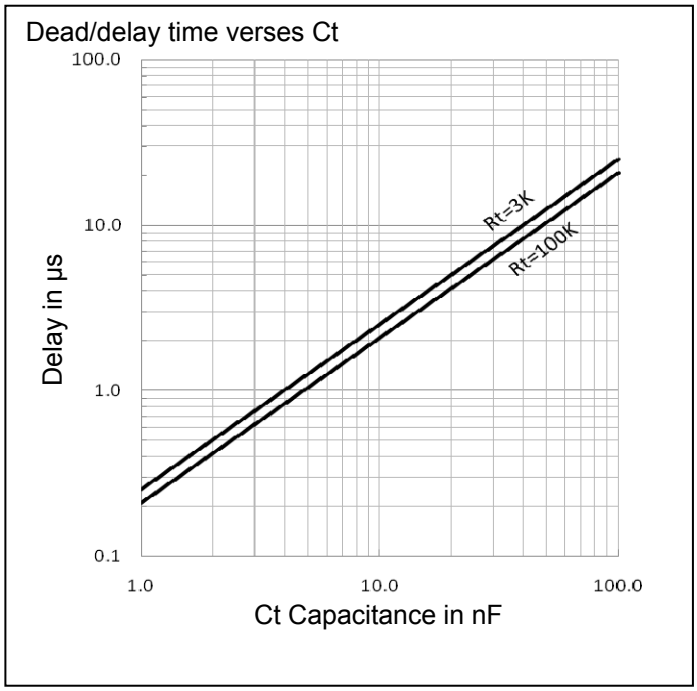
$$T_D=R_tC_tLn[(0.0063R_t-2.7)/(0.0063R_t-4)]$$

$$\text{Frequency} =(T_C+ T_D)^{-1}$$

Oscillator simplified circuit.



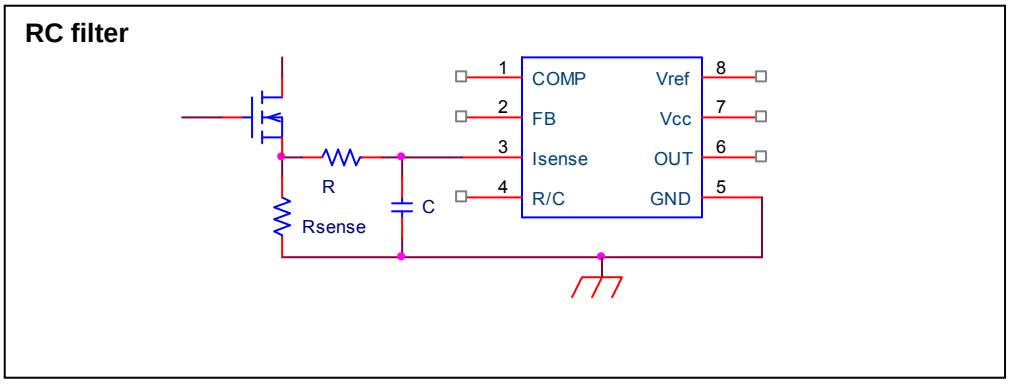




Peak current is set by the internal comparator with a fixed limit of 1V. Raising the current sense pin (3) to 1V or higher will cause a termination of the output pulse regardless of the error amplifier output. The peak current is normally determined when the current sense pin exceeds the error amplifier conditioned output. Peak current is determined by the formula:

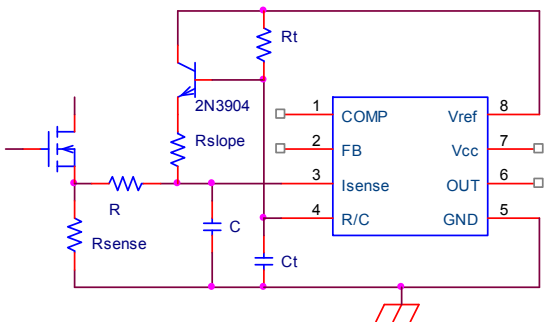
$$I_{SENSE(PK)} = 1.0V/R_S$$

In some cases where leading edge switching transients exceed the 100ns blanking, a small RC filter will be required.



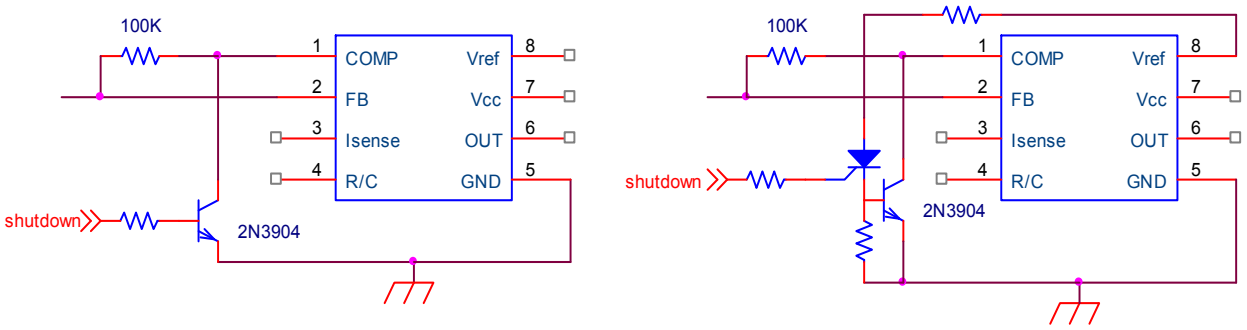
In cases where duty cycle exceeds 50% slope compensation is required. This can be implemented by adding a buffer transistor to the oscillator circuit and using a resistive summing circuit to provide the ramp necessary for slope compensation.

Slope compensation



Shut down circuits depend on the desired function. A transistor can be used to allow control on and off of the PWM or an SCR can be used to latch off the PWM.

Shutdown circuits



Ordering Information

Ordering PN(1)	Subgroup	Description	Temp. Range	Package	Packing Type	Packing Qty
AAC142E-D8A-G-LF	Controller	Current Mode, Offline Thresholds	Ext. Industrial	8-Pin DIP	Tube	50
AAC142AE-D8A-G-LF	Controller	Current Mode, Offline Thresholds	Automotive	8-Pin DIP	Tube	50
AAC142E-S8A-G-LF	Controller	Current Mode, Offline Thresholds	Ext. Industrial	8-Pin SOIC	Tube	98
AAC142E-S8A-G-LF-TR	Controller	Current Mode, Offline Thresholds	Ext. Industrial	8-Pin SOIC	13” T&R (2)	2500
AAC142A-S8A-G-LF	Controller	Current Mode, Offline Thresholds	Automotive	8-Pin SOIC	Tube	98
AAC142A-S8A-G-LF-TR	Controller	Current Mode, Offline Thresholds	Automotive	8-Pin SOIC	13” T&R (2)	2500
AAC142E-F8A-G-LF-W	Controller	Current Mode, Offline Thresholds	Ext. Industrial	3mmx3mm 8-Pin DFN	Waffle Pack	TBD
AAC142E-F8A-G-LF-TR	Controller	Current Mode, Offline Thresholds	Ext. Industrial	3mmx3mm 8-Pin DFN	T&R (2)	TBD
AAC142A-F8A-G-LF-W	Controller	Current Mode, Offline Thresholds	Automotive	3mmx3mm 8-Pin DFN	Waffle Pack	TBD
AAC142A-F8A-G-LF-TR	Controller	Current Mode, Offline Thresholds	Automotive	3mmx3mm 8-Pin DFN	T&R (2)	TBD
AAC143E-D8A-G-LF	Controller	Current Mode, Battery Level Thresholds	Ext. Industrial	8-Pin DIP	Tube	50
AAC143A-D8A-G-LF	Controller	Current Mode, Battery Level Thresholds	Automotive	8-Pin DIP	Tube	50
AAC143E-S8A-G-LF	Controller	Current Mode, Battery Level Thresholds	Ext. Industrial	8-Pin SOIC	Tube	98
AAC143E-S8A-G-LF-TR	Controller	Current Mode, Battery Level Thresholds	Ext. Industrial	8-Pin SOIC	13” T&R (2)	2500
AAC143AE-S8A-G-LF	Controller	Current Mode, Battery Level Thresholds	Automotive	8-Pin SOIC	Tube	98
AAC143A-S8A-G-LF-TR	Controller	Current Mode, Battery Level Thresholds	Automotive	8-Pin SOIC	13” T&R (2)	2500
AAC143E-F8A-G-LF-W	Controller	Current Mode, Battery Level Thresholds	Ext. Industrial	3mmx3mm 8-Pin DFN	Waffle Pack	TBD
AAC143E-F8A-G-LF-TR	Controller	Current Mode, Battery Level Thresholds	Ext. Industrial	3mmx3mm 8-Pin DFN	T&R (2)	TBD
AAC143A-F8A-G-LF-W	Controller	Current Mode, Battery Level Thresholds	Automotive	3mmx3mm 8-Pin DFN	Waffle Pack	TBD
AAC143A-F8A-G-LF-TR	Controller	Current Mode, Battery Level Thresholds	Automotive	3mmx3mm 8-Pin DFN	T&R (2)	TBD

(1) Only RoHS/Lead-Free Packaging is normally offered.

(2) T&R - Tape and Reel

Package Dimensions and Marking

The AAC142 and AAC143 are available in a plastic 8-pin DIP or SOIC package. Refer to the latest version of specification AAPS001 (ASIC Advantage’s “Package Numbering, Marking, and Outline Standard”, available at www.asicadvantage.com) for specific information concerning the package dimensions and package marking.

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- AAI's modified snubber network is patented under the US Patent # 6,233,165

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