

# AAC242/243

## Current Mode PWM Contoller

PRELIMINARY DATA

### DESCRIPTION

The AAC242 and AAC243 are part of AAI's new family of specialty products for Power Management applications. The AAC242 and AAC243 are high performance integrated circuits designed for Off-line or DC to DC converters using peak current mode control. The AAC24X has a current sense of 250mV in comparison to 1V for AAC14X parts.

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 AAC24X parts in offline applications.

The AAC242 and AAC243 are identical except for the Under Voltage Lockout. The AAC242 has UVLO<sub>on</sub> 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 AAC243 has UVLO<sub>on</sub> of 8.4V and UVLO<sub>off</sub> of 7.6V.

The AAC24X family is offered in DIP and SMD packages. The packages are industry standards and are ROHS compliant. Extended temperature is standard with the AAC24X family.

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

The AAC24X 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 capabilities enhances operation at higher frequencies and voltages.



### FEATURES

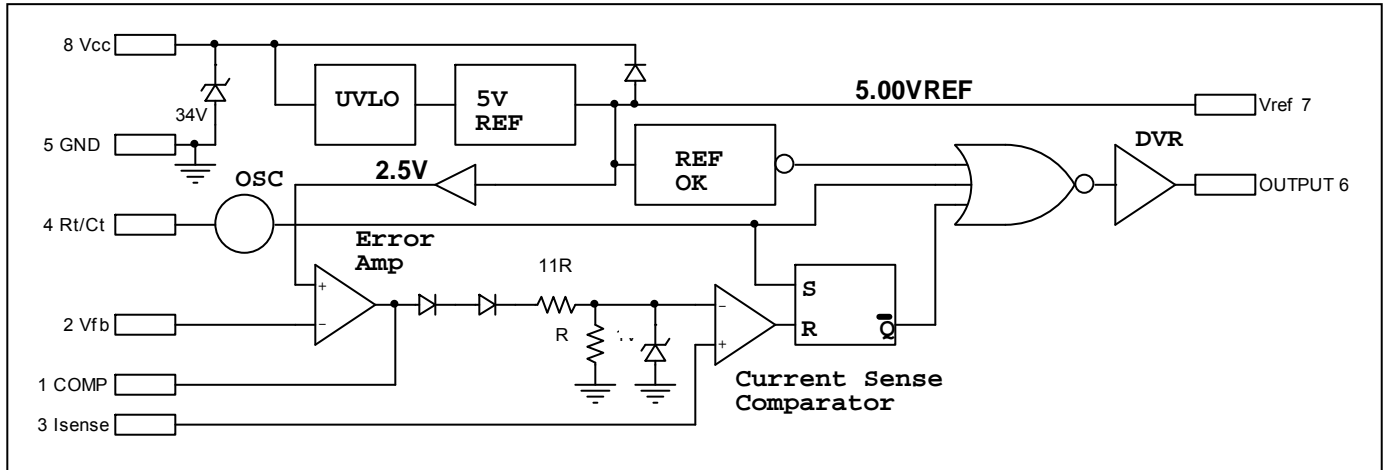
- Low Start-up current
- Pulse by pulse current limiting
- On board voltage reference
- Under Voltage Lockout with hysteresis
- Simple oscillator circuit
- Over Voltage protection zener
- High current output driver
- Less than 30ns rise and fall times
- Operation to over 1MHz
- Peak Current Mode control
- Integrated Soft-Start Function (~330 Clock Cycles)
- 100ns leading edge current blanking for reduced filtering
- 250mV current sense

### PIN CONFIGURATION: 8-Lead DIP and SOIC8

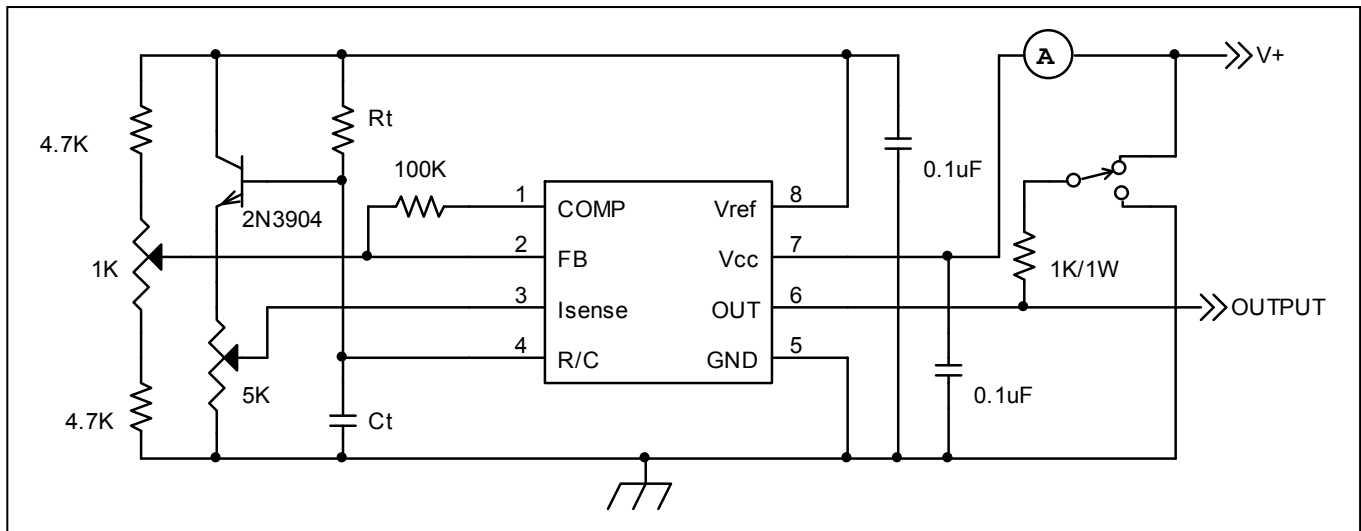
View of the AAC24X shown from the top.

|        |        |   |      |
|--------|--------|---|------|
| COMP   | 1      | 8 | VREF |
| VFB    | AAC242 |   | VCC  |
| ISENSE | AAC243 |   | OUT  |
| Rt/Ct  | 4      | 5 | GND  |

**BLOCK DIAGRAM**



**Open Loop Test Circuit**



**MAXIMUM RATINGS**

| PARAMETER   | PARAMETERS |      | UNITS | CONDITIONS                              |
|---|------------|------|-------|---|
|   | MIN.       | MAX. |       |   |
| Supply Voltage (V <sub>CC</sub> – Ground)         | 0          | 30   | V     | Low impedance source                    |
| V <sub>fb</sub> and I <sub>sense</sub> 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=25°C, V<sub>cc</sub>=15V, R<sub>T</sub> = 10KΩ, C<sub>T</sub> = 3300pF.

| PARAMETER                             | PARAMETERS |      |      | UNITS           | CONDITIONS  |
|---------------------------------------|------------|------|------|-----------------|---|
|                                       | MIN.       | TYP. | MAX. |                 |   |
| <b>REFERENCE SECTION</b>              |            |      |      |                 |   |
| Output Voltage                        | 4.95       | 5.00 | 5.05 | V               |   |
| Line Regulation                       |            | 6    | 15   | mV              | 12V<V <sub>cc</sub> <25V                            |
| Load Regulation                       |            | 3    | 25   | mV              |   |
| Temperature Stability                 |            | 0.2  |      | mV/°C           | 0°C to 130°C  |
| Total Output Variation                | 4.9        |      | 5.1  | V               | Line, Load, and Temperature                         |
| Long Term Stability                   |            | 5    |      | mV              | T <sub>a</sub> =125°C for 1000 hours                |
| Output Short Circuit Current          | -30        | -50  | -60  | mA              |   |
| <b>OSCILLATOR SECTION</b>             |            |      |      |                 |   |
| Frequency Initial Accuracy            | 47         | 52   | 57   | KHz             | T <sub>a</sub> =25°C                                |
| Frequency Change with Voltage         |            | 0.2  | 1    | %               | 12<V <sub>cc</sub> <25V                             |
| Frequency Change with Temp.           |            | 1    |      | %               | T <sub>low</sub> <T <sub>a</sub> <T <sub>high</sub> |
| Oscillator Voltage Swing              |            | 1.65 |      | V <sub>pp</sub> |   |
| <b>ERROR AMPLIFIER SECTION</b>        |            |      |      |                 |   |
| Voltage Feedback Input                | 2.45       | 2.5  | 2.55 | V               | V <sub>out</sub> =2.5V                              |
| Input Bias Current                    |            |      | -1   | μA              |   |
| Open Loop Voltage Gain                |            | 90   |      | dB              |   |
| Unity Gain Bandwidth                  |            | 10   |      | MHz             | T <sub>j</sub> =25°C                                |
| Power Supply Rejection Ratio          |            | 70   |      | dB              | 12V<V <sub>cc</sub> <25V                            |
| Output Current Sink                   |            | 12   |      | mA              |   |
| Output Current Source                 |            | -1   |      | mA              |   |
| Output Voltage Swing High             |            | 6    |      | V               |   |
| Output Voltage Swing Low              |            | 0.8  |      | V               |   |
| <b>PULSE WIDTH MODULATION SECTION</b> |            |      |      |                 |   |
| Maximum Duty Cycle                    |            | 97   |      | %               |   |
| Minimum Duty Cycle                    |            | 0.4  |      | %               | Before drop out                                     |
| <b>CURRENT SENSE SECTION</b>          |            |      |      |                 |   |
| Voltage Gain                          | 11.4       | 12.0 | 12.6 | V               |   |
| Maximum Input Signal                  | 242        | 250  | 258  | mV              |   |
| Power Supply Rejection Ratio          |            | 70   |      | dB              |   |
| Input Bias Current                    |            | -10  |      | μA              |   |
| Time Delay to Output                  |            | 300  |      | nS              |   |

| PARAMETER                            | PARAMETERS |      |      | UNITS | CONDITIONS          |
|--------------------------------------|------------|------|------|-------|---------------------|
|                                      | MIN.       | TYP. | MAX. |       |                     |
| <b>OUTPUT SECTION</b>                |            |      |      |       |                     |
| 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    | CL=1000pF           |
| Voltage Output Fall Time             |            | 30   | 50   | ns    | CL=1000pF           |
| Current Output Source Peak           |            | 1.2  |      | A     |                     |
| Current Output Sink Peak             |            | 0.7  |      | A     |                     |
| <b>UNDER-VOLTAGE LOCKOUT SECTION</b> |            |      |      |       |                     |
| 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     | Icc≤25mA            |
| <b>TOTAL DEVICE SECTION</b>          |            |      |      |       |                     |
| Start-up Supply Current              |            | 0.4  | 0.6  | mA    |                     |
| Operating Supply Current             |            |      | 11   | mA    |                     |

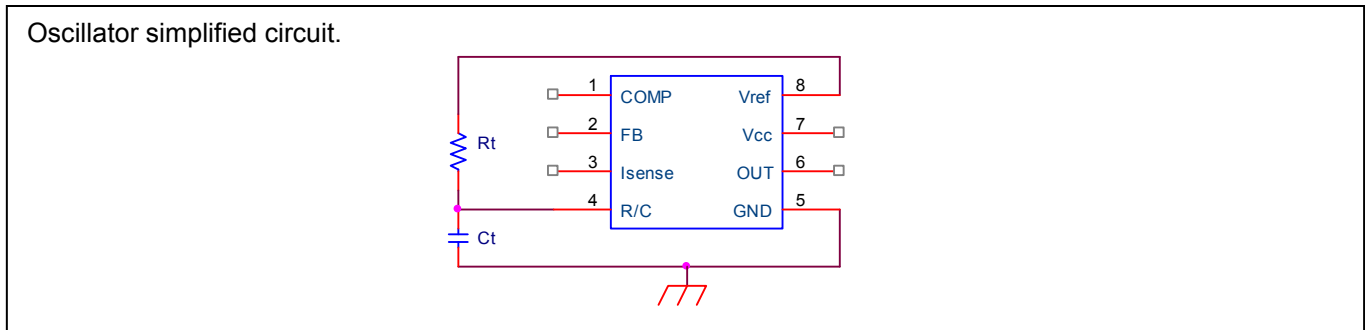
The improved switching performance increases the high peak current associated with internal and external capacitances and will require careful grounding and PCB trace routing. Bypass and timing capacitors should be of high quality and located carefully with short traces. The reference capacitor must 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.

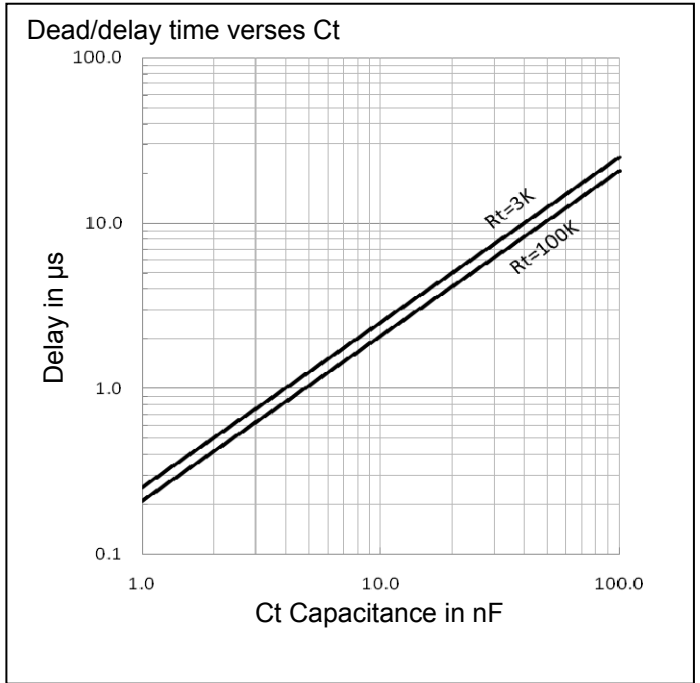
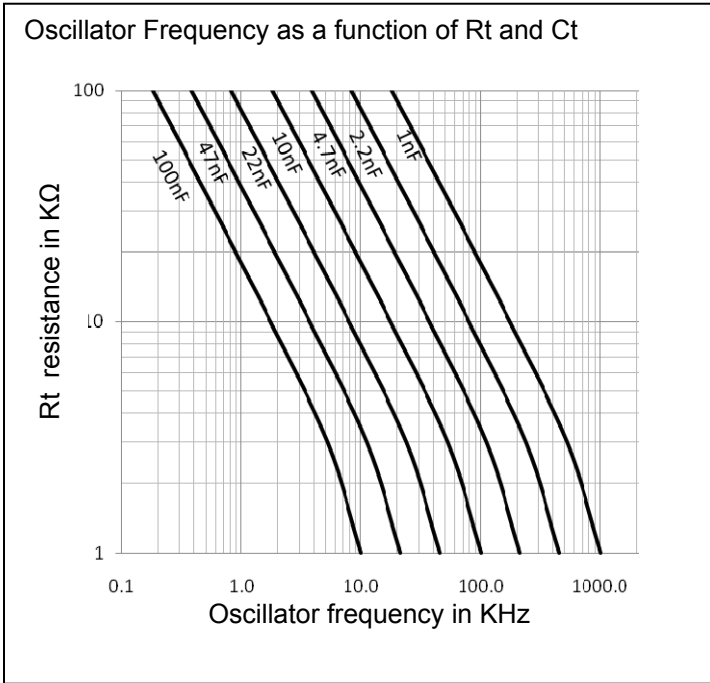
Charge and discharge times are given by the following formulas:

$$T_C = 0.55R_t C_t$$

$$T_D = R_t C_t \ln[(0.0063R_t - 2.7)/(0.0063R_t - 4)]$$

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

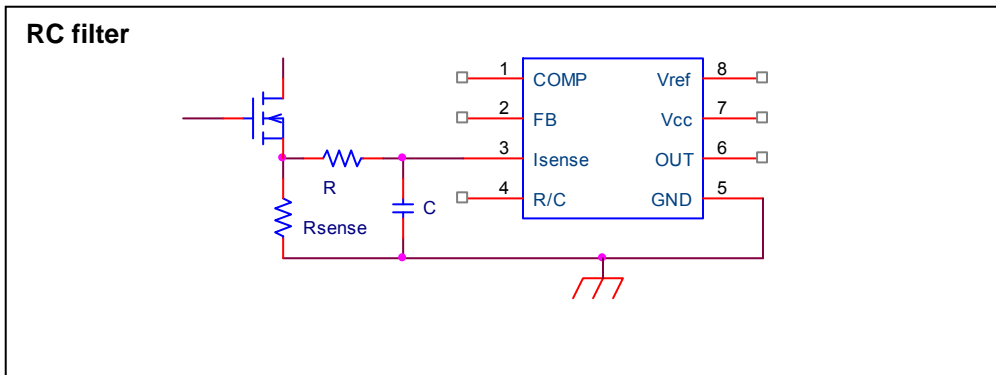




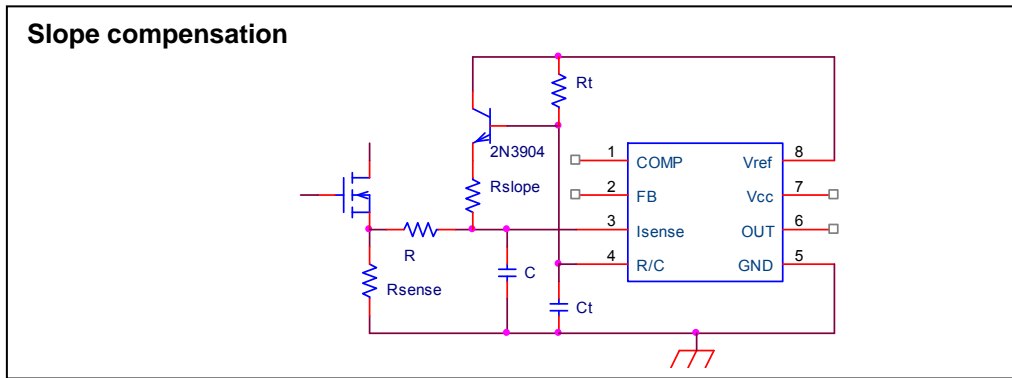
Peak current is set by the internal comparator with a fixed limit of 0.250V. Raising the current sense pin (3) to 0.250V or higher will cause a termination of the output pulse regardless of the error amplifier output. The peak current is normally determined when the current sense pin exceeds the error amplifier conditioned output. Peak current is determined by the formula:

$$I_{SENSE(PK)} = 0.250V/R_s$$

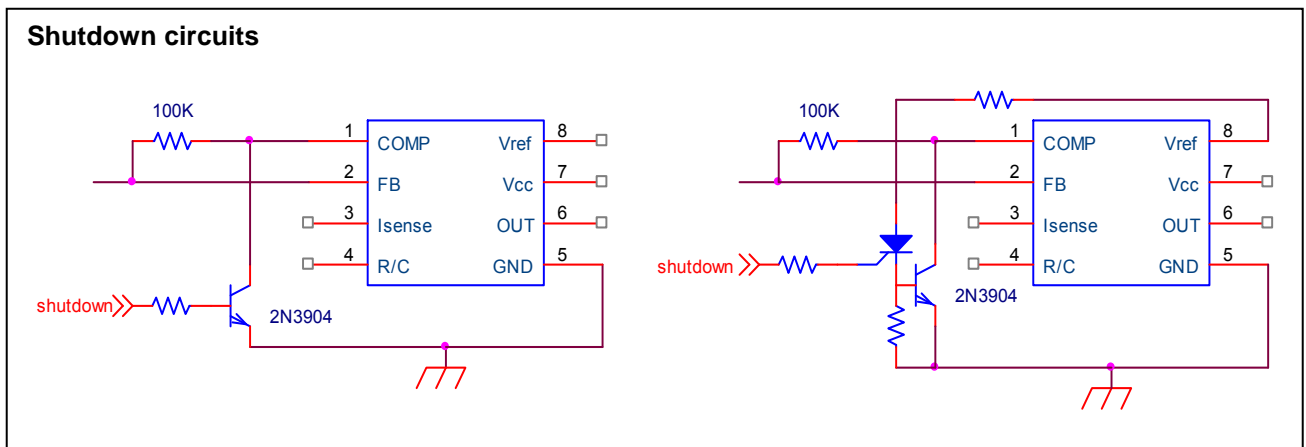
In some cases where leading edge switching transients exceed the 100ns blanking, a small RC filter will be required.



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.



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.



## Ordering Information

| Ordering PN(1)      | Subgroup   | Description                               | Temp. Range     | Package              | Packing Type | Packing Qty |
|---------------------|------------|---|-----------------|----------------------|--------------|-------------|
| AAC242E-D8A-G-LF    | Controller | Current Mode,<br>Offline Thresholds       | Ext. Industrial | 8-Pin DIP            | Tube         | 50          |
| AAC242A-D8A-G-LF    | Controller | Current Mode,<br>Offline Thresholds       | Automotive      | 8-Pin DIP            | Tube         | 50          |
| AAC242E-S8A-G-LF    | Controller | Current Mode,<br>Offline Thresholds       | Ext. Industrial | 8-Pin SOIC           | Tube         | 98          |
| AAC242E-S8A-G-LF-TR | Controller | Current Mode,<br>Offline Thresholds       | Ext. Industrial | 8-Pin SOIC           | 13" T&R (2)  | 2500        |
| AAC242A-S8A-G-LF    | Controller | Current Mode,<br>Offline Thresholds       | Automotive      | 8-Pin SOIC           | Tube         | 98          |
| AAC242A-S8A-G-LF-TR | Controller | Current Mode,<br>Offline Thresholds       | Automotive      | 8-Pin SOIC           | 13" T&R (2)  | 2500        |
| AAC242E-F8A-G-LF-W  | Controller | Current Mode,<br>Offline Thresholds       | Ext. Industrial | 3mmx3mm<br>8-Pin DFN | Waffle Pack  | TBD         |
| AC242E-F8A-G-LF-TR  | Controller | Current Mode,<br>Offline Thresholds       | Ext. Industrial | 3mmx3mm<br>8-Pin DFN | T&R (2)      | TBD         |
| AAC242A-F8A-G-LF-W  | Controller | Current Mode,<br>Offline Thresholds       | Automotive      | 3mmx3mm<br>8-Pin DFN | Waffle Pack  | TBD         |
| AC242A-F8A-G-LF-TR  | Controller | Current Mode,<br>Offline Thresholds       | Automotive      | 3mmx3mm<br>8-Pin DFN | T&R (2)      | TBD         |
| AAC243E-D8A-G-LF    | Controller | Current Mode,<br>Battery Level Thresholds | Ext. Industrial | 8-Pin DIP            | Tube         | 50          |
| AAC243A-D8A-G-LF    | Controller | Current Mode,<br>Battery Level Thresholds | Automotive      | 8-Pin DIP            | Tube         | 50          |
| AAC243E-S8A-G-LF    | Controller | Current Mode,<br>Battery Level Thresholds | Ext. Industrial | 8-Pin SOIC           | Tube         | 98          |
| AAC243E-S8A-G-LF-TR | Controller | Current Mode,<br>Battery Level Thresholds | Ext. Industrial | 8-Pin SOIC           | 13" T&R (2)  | 2500        |
| AAC243A-S8A-G-LF    | Controller | Current Mode,<br>Battery Level Thresholds | Automotive      | 8-Pin SOIC           | Tube         | 98          |
| AAC243A-S8A-G-LF-TR | Controller | Current Mode,<br>Battery Level Thresholds | Automotive      | 8-Pin SOIC           | 13" T&R (2)  | 2500        |
| AC243E-F8A-G-LF-W   | Controller | Current Mode,<br>Battery Level Thresholds | Ext. Industrial | 3mmx3mm<br>8-Pin DFN | Waffle Pack  | TBD         |
| AAC243E-F8A-G-LF-TR | Controller | Current Mode,<br>Battery Level Thresholds | Ext. Industrial | 3mmx3mm<br>8-Pin DFN | T&R (2)      | TBD         |
| AC243A-F8A-G-LF-W   | Controller | Current Mode,<br>Battery Level Thresholds | Automotive      | 3mmx3mm<br>8-Pin DFN | Waffle Pack  | TBD         |
| AAC243A-F8A-G-LF-TR | Controller | Current Mode,<br>Battery Level Thresholds | Automotive      | 3mmx3mm<br>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 AAC242 and AAC243 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](http://www.asicadvantage.com)) for specific information concerning the package dimensions and package marking.

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