

## General Description

The AAT3526/7/8 PowerManager products are members of AnalogicTech's Total Power Management IC™ (TPMIC™) product family. These micro-processor reset circuits are ideal for monitoring voltage supplies in portable systems, where extended battery life is critical. They provide a reliable, low-cost solution by eliminating external components. The AAT3526/7/8 products operate by monitoring the system power supply voltage. When the input voltage drops below a fixed threshold, the device asserts a reset signal for a minimum of 150ms after  $V_{CC}$  has risen back above the fixed threshold. They are guaranteed to operate down to 1.2V and designed to ignore fast line transients appearing on  $V_{CC}$ . The AAT3526/7/8 series is available with three output stage versions: AAT3526 push-pull active low output; AAT3527 push-pull active high output; and AAT3528 open drain active low output. The quiescent supply current is extremely low, typically 1 $\mu$ A, making this device ideal for portable battery-operated equipment.

AAT3526/7/8 devices are available in a Pb-free, 4-pin SOT143 package and are specified over the -40°C to +85°C operating temperature range.

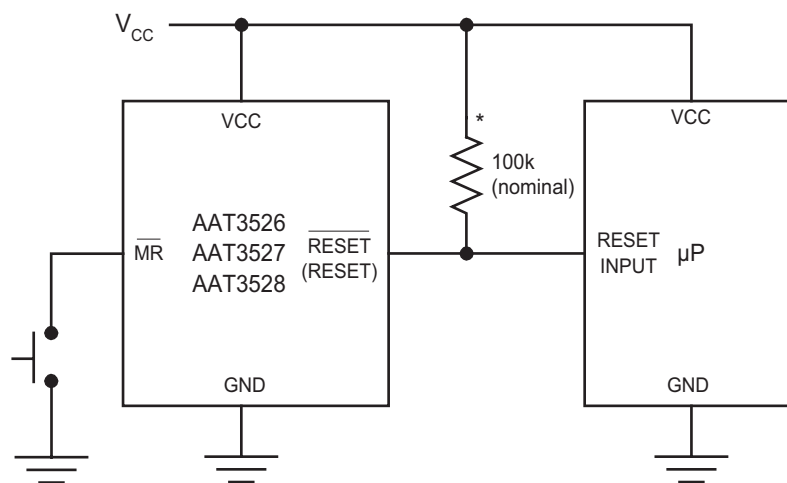
## Features

- Input Voltage Range: 1.2V to 5.5V
- Operation Down to 1.2V
- Extremely Low Quiescent Current: Less Than 2 $\mu$ A
- High Accuracy Detection Threshold:  $\pm 1.5\%$
- Monitor Power Supply Voltages
- Fixed Thresholds From 2.2V to 4.6V
- Minimum 150ms Reset Pulse Width With Fast Delay Time <20 $\mu$ s
- Debounced Manual Reset Input
- Available Output Configurations:
  - Open-Drain Output
  - CMOS Active High Output
  - CMOS Active Low Output
- Temperature Range: -40°C to +85°C
- 4-Pin SOT143 Package
- 4kV ESD Rating

## Applications

- Cell Phones
- Embedded Systems
- Intelligent Instruments
- Notebook Computers
- Portable Electronics

## Typical Application



\*AAT3528 Only

## Pin Descriptions

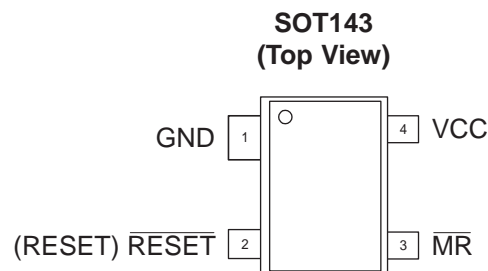
### AAT3526, 3527, 3528 (SOT143)

Pin #	Symbol	Function
1	GND	Ground connection.
2	RESET (AAT3527)	RESET output remains high while $V_{CC}$ is below the reset threshold and remains so for a minimum of 150ms after $V_{CC}$ raises above the reset threshold.
	$\overline{\text{RESET}}$ (AAT3526, AAT3528)	$\overline{\text{RESET}}$ output remains low while $V_{CC}$ is below the reset threshold and remains so for a minimum of 150ms after $V_{CC}$ raises above the reset threshold.
3	$\overline{\text{MR}}$	Manual reset active low input. A logic low signal on $\overline{\text{MR}}$ asserts a reset condition. Asserted reset continues as long as $\overline{\text{MR}}$ is low and for a minimum of 150ms after $\overline{\text{MR}}$ returns high.
4	VCC	Supply voltage (+1.2V to +5.5V). Due to extremely low operating current, it is recommended to place a 10nF capacitor between $V_{CC}$ and GND.

## Part Number Descriptions

Part Number	Output Type
AAT3526	Reset Output Push Pull Active Low with Delay
AAT3527	Reset Output Push Pull Active High with Delay
AAT3528	Reset Output Open Drain Active Low with Delay

## Pin Configuration



## Absolute Maximum Ratings<sup>1</sup>

$T_A = 25^\circ\text{C}$ , unless otherwise noted.

Symbol	Description	Value	Units
$V_{CC}$	$V_{CC}$ to GND	-0.3 to 5.5	V
$V_{MR}$	MR to GND	-0.3 to $V_{CC} + 0.3$	V
$V_{RESET}$	RESET to GND (Push-Pull Output)	-0.3 to $V_{CC} + 0.3$	V
	$\overline{RESET}$ to GND (Open Drain Output)	-0.3 to 5.5	
$I_{VCC}, I_{MR}$	Maximum Continuous Input Current	20	mA
$I_{RESET}$	RESET/ $\overline{RESET}$ Current	20	mA
$dV_{CC}/dt$	Rate of Rise of $V_{CC}$	100	V/ $\mu\text{s}$
$T_J$	Operating Junction Temperature Range	-40 to 150	$^\circ\text{C}$
$T_{LEAD}$	Maximum Soldering Temperature (at Leads) for 10s	300	$^\circ\text{C}$

## Thermal Information<sup>2</sup>

Symbol	Description	Value	Units
$\Theta_{JA}$	Maximum Thermal Resistance	200	$^\circ\text{C}/\text{W}$
$P_D$	Maximum Power Dissipation	320	mW

1. Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one Absolute Maximum Rating should be applied at any one time.  
 2. Mounted on an FR4 board.

### Electrical Characteristics

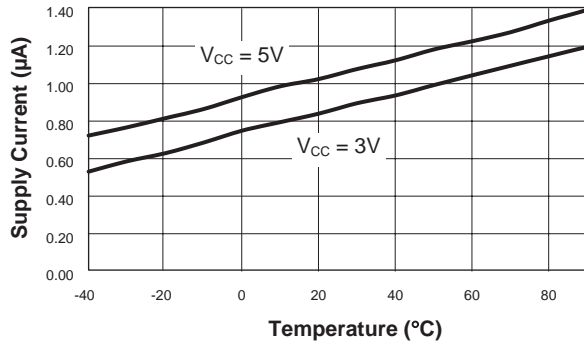
$V_{IN} = 5V$ ,  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , unless otherwise noted. Typical values are  $T_A = 25^{\circ}C$ ,  $V_{CC} = 5V$  for 4.63/4.38V versions,  $V_{CC} = 3.3V$  for 3.08/2.93V versions,  $V_{CC} = 3.0V$  for 2.63V versions, and  $V_{CC} = 2.5V$  for 2.32/2.2V versions.

Symbol	Description	Conditions	Min	Typ	Max	Units
$V_{CC}$	Operation Voltage	$T_A = 0^{\circ}C$ to $+70^{\circ}C$	1.0		5.5	V
		$T_A = -40^{\circ}C$ to $+85^{\circ}C$	1.2		5.5	
$I_Q$	Quiescent Current	$V_{CC} = 5.5V$		1.05	3	$\mu A$
		$V_{CC} = 3V$		0.85	2	
$V_{TH}$	RESET Threshold <sup>1</sup>	$T_A = 25^{\circ}C$	$V_{TH} - 1.5\%$	$V_{TH}$	$V_{TH} + 1.5\%$	V
		$T_A = -40^{\circ}C$ to $+85^{\circ}C$	$V_{TH} - 2.5\%$	$V_{TH}$	$V_{TH} + 2.5\%$	
$\Delta V_{TH}/^{\circ}C$	RESET Threshold Tempco			40		ppm/ $^{\circ}C$
$t_P$	RESET Propagation Delay	$V_{CC} = V_{TH}$ to $(V_{TH} - 100mV)$		15		$\mu s$
$t_{RDY}$	RESET Active Timeout Period		150	250	400	ms
$t_{MR}$	MR Minimum Pulse Width		10			$\mu s$
MRGI	MR Glitch Immunity			100		ns
$t_{MD}$	MR to Reset Propagation Delay			0.5		$\mu s$
$V_{IH}$	MR Input Threshold (High)	$V_{CC} = V_{TH(MAX)}$ , $V_{TH} \geq 4.38V$	2.3			V
		$V_{CC} = V_{TH(MAX)}$ , $V_{TH} < 4.38V$	$0.7 \times V_{CC}$			
$V_{IL}$	MR Input Threshold (Low)	$V_{CC} = V_{TH(MAX)}$ , $V_{TH} \geq 4.38V$			0.8	V
		$V_{CC} = V_{TH(MAX)}$ , $V_{TH} < 4.38V$			$0.25 \times V_{CC}$	
$R_{MR}$	MR Pull-Up Resistance		30	65	90	k $\Omega$
$V_{OL}$	RESET Low Output Voltage AAT3526, AAT3528	$I_{SINK} = 1.2mA$ , $V_{CC} = V_{TH(min)}$ , $V_{TH} \leq 3.08V$ , RESET Asserted			0.3	V
		$I_{SINK} = 3.2mA$ , $V_{CC} = V_{TH(min)}$ , $V_{TH} > 3.08V$ , RESET Asserted			0.4	
$V_{OH}$	RESET High Output Voltage AAT3526	$I_{SOURCE} = 800\mu A$ , $V_{TH} > 3.08V$ , $V_{CC} > V_{TH(max)}$	$V_{CC} - 1.5$			V
		$I_{SOURCE} = 500\mu A$ , $V_{TH} \leq 3.08V$ , $V_{CC} > V_{TH(max)}$	$0.8 V_{CC}$			
$V_{OL}$	RESET Low Output Voltage AAT3527	$I_{SINK} = 1.2mA$ , $V_{CC} > V_{TH(max)}$ , $V_{TH} \leq 3.08V$ , RESET Not Asserted			0.3	V
		$I_{SINK} = 3.2mA$ , $V_{CC} > V_{TH(max)}$ , $V_{TH} > 3.08V$ , RESET Not Asserted			0.4	
$V_{OH}$	RESET High Output Voltage AAT3527	$I_{SOURCE} = 500\mu A$ , $V_{CC} > 2.1V$ , RESET Asserted	$0.8V_{CC}$			V
		$I_{SOURCE} = 50\mu A$ , $V_{CC} > 1.2V$ , RESET Asserted	$0.8V_{CC}$			
$I_{DOFF}$	RESET Leakage Current, AAT3528	$V_{CC} > V_{TH}$			1	$\mu A$

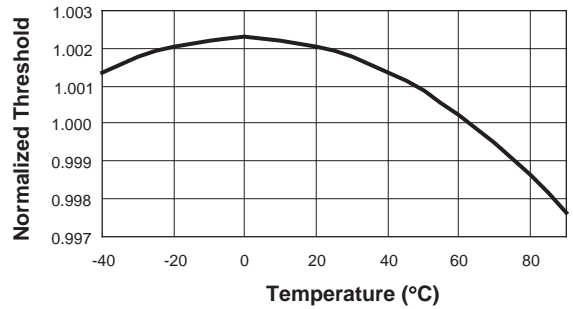
1. See Ordering Information for factory-trimmed reset thresholds.

### Typical Characteristics

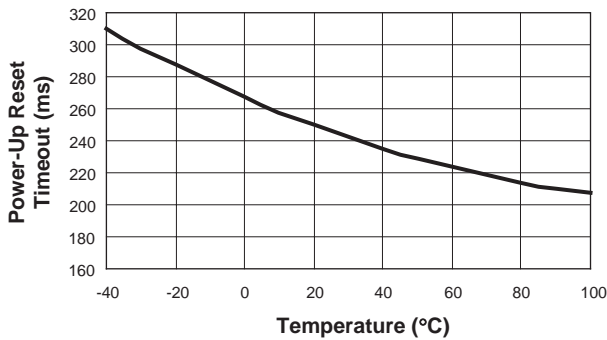
Supply Current vs. Temperature



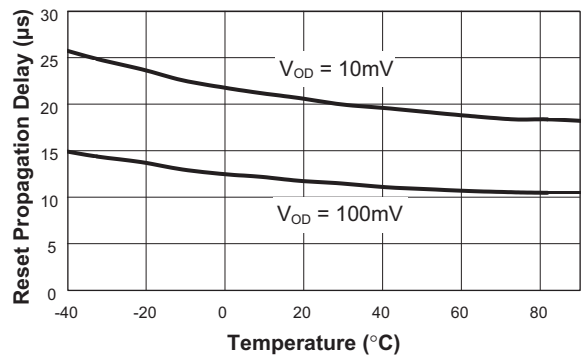
Normalized Reset Threshold vs. Temperature



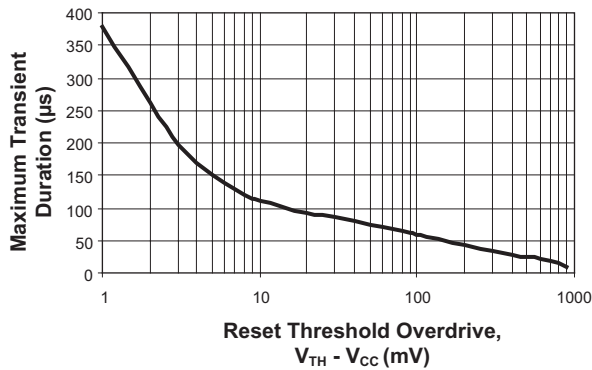
Power-Up Reset Timeout vs. Temperature



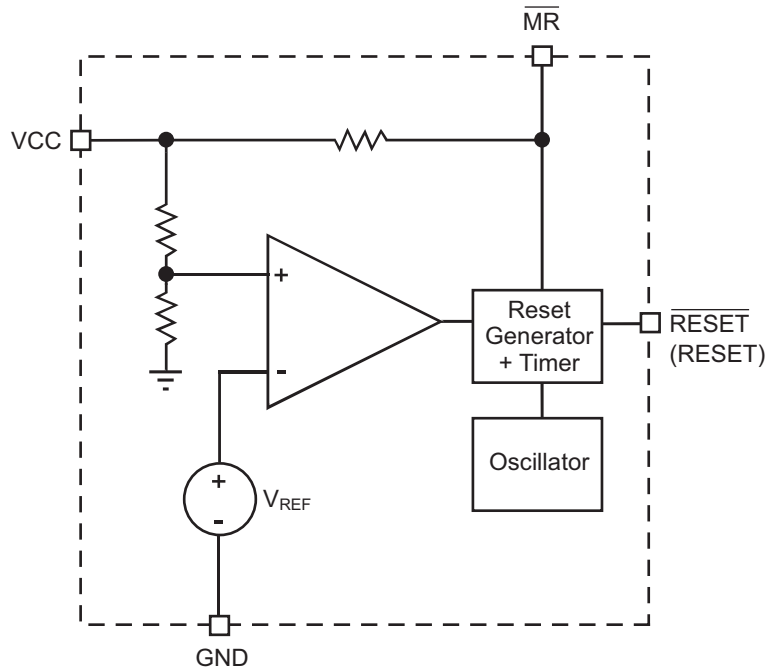
Power-Down Reset Propagation Delay vs. Temperature



Maximum Transient Duration vs. Reset Threshold Overdrive



## Functional Block Diagram

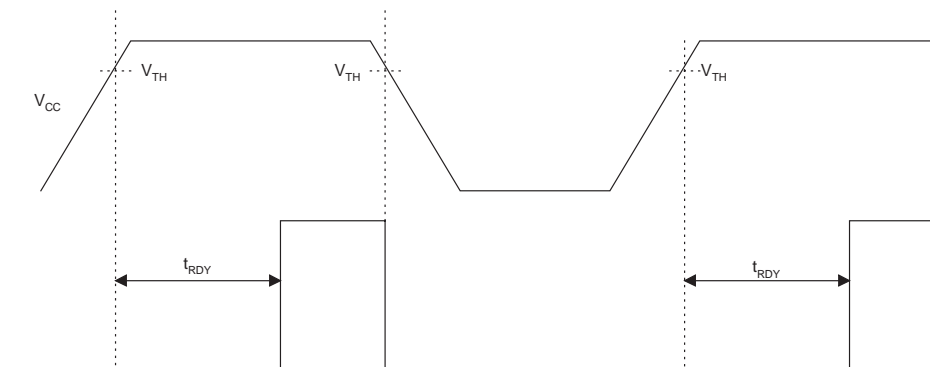


## Functional Description

### General

During start-up, the reset pin on a microprocessor ensures that it is fully reset and starts up in a known condition. The AAT3526/7/8 series of microprocessor reset devices monitor the supply voltage to a

microprocessor and assert a reset signal whenever the  $V_{CC}$  voltage falls below a factory-programmed threshold. This threshold is accurate within  $\pm 1.5\%$  at  $25^\circ\text{C}$  and within  $\pm 2.5\%$  over the entire operating temperature range. The reset signal remains asserted for a minimum of 150ms after  $V_{CC}$  has risen above the threshold, as shown in Figure 1.



**Figure 1: Reset Timing Diagram.**

### Applications Information

#### Reset Output Options

The AAT3528 has an active low open drain output and the AAT3526/7 have a push-pull output. The AAT3528 may be used in multiple voltage systems with an external pull-up resistor. This allows the AAT3528 to interface to microprocessors with higher supply voltages up to 5.5V (Figure 2). In the event of a power-down or brown-out condition, the reset signal remains valid until the  $V_{CC}$  drops below 1.2V. To ensure validity down to ground, an external 100k $\Omega$  resistor should be connected between the RESET output and GND.

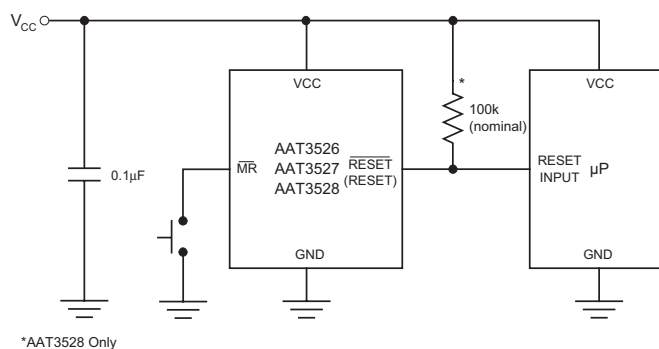
#### Manual Reset Input

A logic low signal on  $\overline{MR}$  asserts a reset condition. Reset continues to be asserted as long as  $\overline{MR}$  is low and for a minimum of 150ms after  $\overline{MR}$  returns high. This input is internally pulled up to  $V_{CC}$  via a 65k $\Omega$  resistor, so leaving the pin unconnected is acceptable if the manual reset function is not needed. The

$\overline{MR}$  input is internally debounced which allows the use of a mechanical switch. It should be a normally-open momentary switch connected from  $\overline{MR}$  to GND. Additionally, the  $\overline{MR}$  pin can be driven from TTL, CMOS, or open drain logic outputs.

#### Supply Voltage Transient Behavior

In some cases, fast negative transients of short duration can appear on the  $V_{CC}$  power supply. The AAT3526/7/8 series devices provide some immunity to line transients which can generate invalid reset pulses. Figure 1 shows typical behavior to short duration pulses versus RESET comparator overdrive. As shown in the Maximum Transient Duration vs. Reset Threshold Overdrive graph, when the transient voltage becomes larger, the time allowed before asserting a reset becomes shorter (e.g., typically a transient of 100mV below the reset threshold would have to present for more than 50 $\mu$ s to cause a reset). Immunity can be increased by the addition of a small bypass capacitor of 0.1 $\mu$ F connected as close to the  $V_{CC}$  pin as possible.



\*AAT3528 Only

Figure 2: Using Recommended Bypass Capacitor.

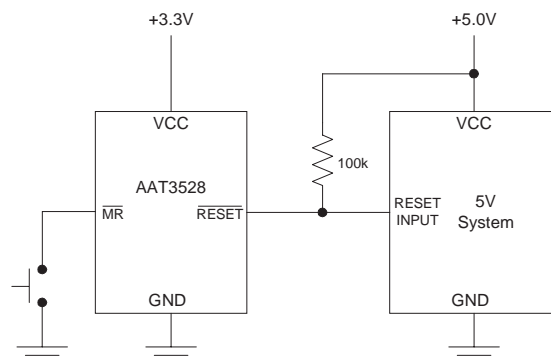


Figure 3: Using AAT3528 Open Drain Output with Multiple Supplies.

### Ordering Information and Factory-Trimmed Reset Thresholds<sup>1</sup>

Ordering Part Number <sup>2</sup>	Marking <sup>3</sup>	Reset Threshold Voltage, $V_{TH}$ (V)				
		$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$	
		Min	Typ	Max	Min	Max
<b>AAT3526ICX-2.32-200-T1</b> AAT3527ICX-2.32-200-T1 AAT3528ICX-2.32-200-T1	<b>NOXYY</b>	2.285	2.320	2.355	2.262	2.378
<b>AAT3526ICX-2.63-200-T1</b> AAT3527ICX-2.63-200-T1 <b>AAT3528ICX-2.63-200-T1</b>	<b>DNXYY</b> <b>DRXYY</b>	2.591	2.630	2.669	2.564	2.696
<b>AAT3526ICX-2.93-200-T1</b> AAT3527ICX-2.93-200-T1 AAT3528ICX-2.93-200-T1	<b>DOXYY</b> <b>DQXYY</b> <b>FQXYY</b>	2.886	2.930	2.974	2.857	3.003
<b>AAT3528ICX-3.00-200-T1</b>	<b>FIXYY</b>	2.955	3.000	3.045	2.925	3.075
<b>AAT3526ICX-3.08-200-T1</b> AAT3527ICX-3.08-200-T1 AAT3528ICX-3.08-200-T1	<b>EQXYY</b> <b>FHXYY</b> <b>FJXYY</b>	3.034	3.080	3.126	3.003	3.157
<b>AAT3526ICX-4.38-200-T1</b> AAT3527ICX-4.38-200-T1 AAT3528ICX-4.38-200-T1	<b>GCXYY</b> <b>HLXYY</b>	4.314	4.380	4.446	4.271	4.490
<b>AAT3526ICX-4.63-200-T1</b> AAT3527ICX-4.63-200-T1 AAT3528ICX-4.63-200-T1	<b>DPXYY</b> <b>HMXYY</b>	4.561	4.630	4.699	4.514	4.746



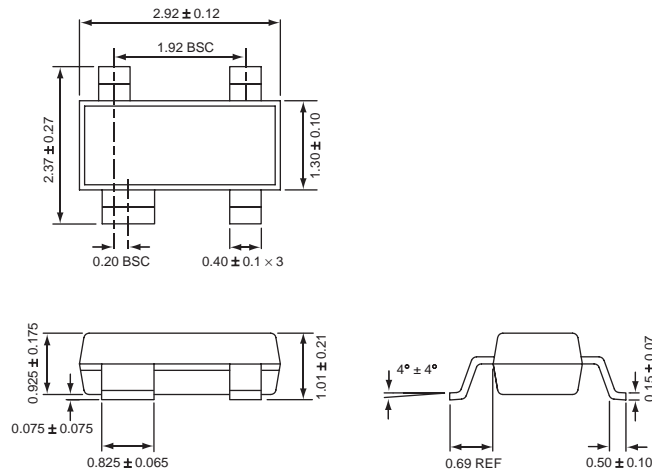
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1. Contact local Sales Office for custom trimmed options.
2. Sample stock is generally held on all part numbers listed in **BOLD**.
3. XYY = assembly and date code.



**Package Information**

**SOT143**



All dimensions in millimeters.

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