

General Description

The AAT351x PowerManager™ products are members of AnalogicTech™'s Total Power Management IC™ product family. This family of Microprocessor Reset Circuits provides the ultimate in versatility, allowing system designers full customization of the μ P monitor and Reset function without any additional components. The AAT351x family offers several combinations of threshold voltage, watchdog timeout period, reset active period and output drive configurations, which are all factory programmed options. All devices are available in 32 reset threshold voltages from 2.6V up to 5V, with three watchdog timeout periods from 6.3ms to 1600ms and three reset timeouts from 1ms up to 140ms. Available output configurations are active low push-pull, active low open drain, active low bi-directional and active high push-pull

The AAT351x family is designed to ignore fast negative transients on V_{DD} and to ensure that Reset outputs remain valid down to 1V.

The AAT351x family is available in the space saving 5-pin SOT23 surface mount package and is specified over the -40 to +85°C temperature range.

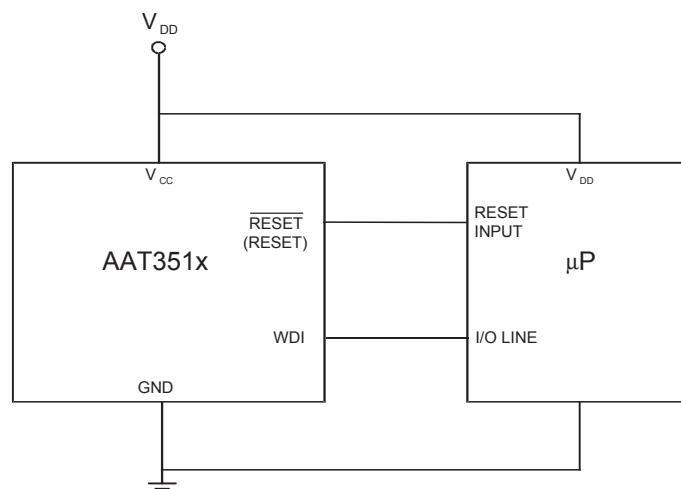
Features

- Tight voltage tolerance: $\pm 1.5\%$
- Low quiescent current: 5 μ A
- Guaranteed Reset Valid down to 1V
- 32 voltage options from 2.6V to 5.0V
- 3 Reset active period options
 - 1ms, 20ms, 140ms
- 3 Watchdog timeout period options
 - 6.3ms, 102ms, 1600ms
- 4 output options:
 - Open drain
 - Inverting
 - Non-inverting
 - Bi-directional
- Low Tempco: 100ppm/°C
- 5-pin SOT23 package

Applications

- Notebook Computers
- Portable Electronics
- Industrial Controllers
- Intelligent Instruments
- Critical μ P and μ C Supply Monitoring
- Power-On reset circuits
- Embedded Control Systems

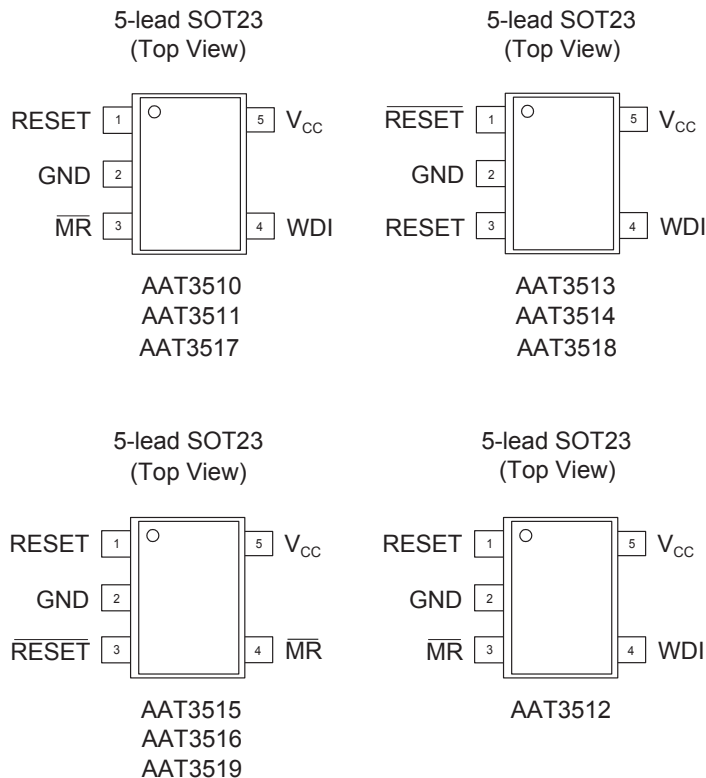
Typical Application



Pin Descriptions

| Pin # | | | | Symbol | Function |
|-------------------------------|---------|-------------------------------|-------------------------------|----------|---|
| AAT3510 AAT3511 AAT3517 | AAT3512 | AAT3513 AAT3514 AAT3518 | AAT3515 AAT3516 AAT3519 | | |
| 1 | N/A | 1 | 1 | RESET | AAT3510/13/15: RESET output goes low whenever V_{DD} falls below the reset threshold. CMOS push-pull Output AAT3511/14/16: RESET output goes low whenever V_{DD} falls below the reset threshold. Bidirectional CMOS push-pull Output intended to interface directly to microprocessors with bi-directional resets AAT3517/18/19: RESET output goes low whenever V_{DD} falls below the reset threshold. Open drain output. Connect a pull-up resistor to any supply voltage up to 5.5V |
| 2 | 2 | 2 | 2 | GND | Ground connection pin |
| | 1 | 3 | 3 | RESET | RESET active-high output. This CMOS push-pull signal is the logical inverse of RESET. |
| 3 | 3 | N/A | 4 | MR | Manual reset input pin. Active low. Pull low to force a reset. |
| 4 | 4 | 4 | N/A | WDI | Watchdog input pin. Triggers a reset if it remains in a steady state for the duration of the watchdog timer period. |
| 5 | 5 | 5 | 5 | V_{CC} | Input voltage pin |

Pin Configuration



Absolute Maximum Ratings ($T_A=25^\circ\text{C}$ unless otherwise noted)

| Symbol | Description | Max | Units |
|----------------------------|--|----------------------|------------|
| V_{CC} | V_{CC} to GND | -0.3 to 6 | V |
| V_{MR}, V_{WDI} | MR, WDI to GND | -0.3 to $V_{CC}+0.3$ | V |
| V_{RESET} | RESET to GND (Push-Pull or Bidirectional Output) | -0.3 to $V_{CC}+0.3$ | V |
| | RESET to GND (Open Drain Output) | -0.3 to 6 | |
| I_{VCC}, I_{MR}, I_{WDI} | Maximum Continuous Input Current | 20 | mA |
| I_{RESET} | RESET/RESET Output Current | 20 | mA |
| dV_{CC}/dt | Rate of rise of V_{CC} | 100 | V/ μ s |
| T_J | Operating Junction Temperature Range (-40° to 150°C) | 150 | °C |

Note: 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.

Thermal Information

| Symbol | Description | Value | Units |
|---------------|---|-------|-------|
| Θ_{JA} | Maximum Thermal Resistance ¹ | 190 | °C/W |
| P_D | Maximum Power Dissipation ¹ | 526 | mW |

Note 1: Mounted on FR4 board

Electrical Characteristics ($V_{CC} = 2.5\text{V}$ to 5.5V , $T_A = -40$ to $+85^\circ\text{C}$ ¹ unless otherwise noted.

Typical values are at $T_A=25^\circ\text{C}$)

| Symbol | Description | Conditions | Min | Typ | Max | Units |
|----------|------------------------------|--|------------------------|----------|-------------------|---------------|
| V_{CC} | Operating Voltage Range | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 1 | | 5.5 | V |
| I_{CC} | Supply Current | AAT3510/1/2/3/4/7/8: MR & WDI unconnected | $V_{CC} = 3.6\text{V}$ | 5 | 15 | μA |
| | | | $V_{CC} = 5.5\text{V}$ | 6 | 18 | |
| | | AAT3515/6/9: MR unconnected | $V_{CC} = 3.6\text{V}$ | | 15 | |
| | | | $V_{CC} = 5.5\text{V}$ | | 18 | |
| V_{TH} | Reset Threshold Voltage | $T_A = 25^\circ\text{C}$ | $V_{THNOM}-1.5\%$ | V_{TH} | $V_{THNOM}+1.5\%$ | V |
| | | $T_A = -40$ to $+85^\circ\text{C}$ | $V_{THNOM}-2.5\%$ | V_{TH} | $V_{THNOM}+2.5\%$ | |
| T_C | Reference Voltage Temp Coeff | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$ | | ± 40 | | ppm/°C |
| t_{RP} | Reset Active Timeout Period | AAT351xIGV-xx-A-x-T1 | 1 | 1.4 | 2 | ms |
| | | AAT351xIGV-xx-B-x-T1 | 20 | 28 | 40 | |
| | | AAT351xIGV-xx-C-x-T1 | 140 | 200 | 280 | |
| T_{RD} | V_{CC} to RESET Delay | V_{CC} falling at $1\text{mV}/\mu\text{s}$ | | 40 | | μs |

Electrical Characteristics ($V_{CC} = 2.5V$ to $5.5V$, $T_A = -40$ to $+85^\circ C$ ¹ unless otherwise noted.)

Typical values are at $T_A = 25^\circ C$)

| Symbol | Description | Conditions | Min | Typ | Max | Units |
|---|--|---|---------------------|------|---------------------|------------|
| Push/Pull RESET Output (AAT3510, 3512, 3513, 3514, 3515, 3516, 3518, 3519) | | | | | | |
| V_{OL} | \overline{RESET} Low Output Voltage | $V_{CC} \geq 1.0V$, $I_{SINK} = 50\mu A$ | | | 0.3 | V |
| | | $V_{CC} \geq 1.2V$, $I_{SINK} = 100\mu A$ | | | 0.3 | |
| | | $V_{CC} \geq 2.7V$, $I_{SINK} = 1.2mA$ | | | 0.3 | |
| | | $V_{CC} \geq 4.5V$, $I_{SINK} = 3.2mA$ | | | 0.4 | |
| V_{OH} | \overline{RESET} High Output Voltage | $V_{CC} \geq 2.7V$, $I_{SOURCE} = 500\mu A$ | $0.8 \times V_{CC}$ | | | V |
| | | $V_{CC} \geq 4.5V$, $I_{SOURCE} = 800\mu A$ | $V_{CC} - 1.5$ | | | |
| V_{OH} | RESET Low Output Voltage | $V_{CC} \geq 2.7V$, $I_{SINK} = 1.2mA$ | | | 0.3 | V |
| | | $V_{CC} \geq 4.5V$, $I_{SINK} = 3.2mA$ | | | 0.4 | |
| | RESET High Output Voltage | $V_{CC} \geq 1.8V$, $I_{SOURCE} = 150\mu A$ | $0.8 \times V_{CC}$ | | | |
| | | $V_{CC} \geq 2.7V$, $I_{SOURCE} = 500\mu A$ | $0.8 \times V_{CC}$ | | | |
| | | $V_{CC} \geq 4.5V$, $I_{SOURCE} = 800\mu A$ | $V_{CC} - 1.5$ | | | |
| Bidirectional RESET Output (AAT3511, 3514, 3516) | | | | | | |
| t_s | Transition Flip-Flop Setup Time ² | | | 400 | | ns |
| t_R | \overline{RESET} Output Rise Time ³ | $V_{CC} = 3.0V$, $C_L = 120pF$ | | | 333 | ns |
| | | $V_{CC} = 5.0V$, $C_L = 200pF$ | | | 333 | |
| | | $V_{CC} = 3.0V$, $C_L = 250pF$ | | | 666 | |
| | | $V_{CC} = 5.0V$, $C_L = 400pF$ | | | 666 | |
| V_{PTH} | Active Pullup Enable Threshold | $V_{CC} = 5.0V$ | 0.4 | 0.65 | | V |
| | \overline{RESET} Active Pullup Current | $V_{CC} = 5.0V$ | | 20 | | mA |
| | \overline{RESET} Pullup Resistance | | 4.2 | 4.7 | 5.2 | k Ω |
| Open-Drain RESET Output (AAT3517, 3518, 3519) | | | | | | |
| V_{OL} | \overline{RESET} Low Output Voltage | $V_{CC} \geq 1.0V$, $I_{SINK} = 50\mu A$ | | | 0.3 | V |
| | | $V_{CC} \geq 1.2V$, $I_{SINK} = 100\mu A$ | | | 0.3 | |
| | | $V_{CC} \geq 2.7V$, $I_{SINK} = 1.2mA$ | | | 0.3 | |
| | | $V_{CC} \geq 4.5V$, $I_{SINK} = 3.2mA$ | | | 0.4 | |
| $I_{D(OFF)}$ | Reset Leakage Current | | | | 1.0 | μA |
| Watchdog Input (AAT3510, 3511, 3512, 3513, 3514, 3517, 3518) | | | | | | |
| t_{WD} | Watchdog Timeout Period | AAT351xIGV-xx-x-A-T1 | 4.3 | 6.3 | 9.3 | ms |
| | | AAT351xIGV-xx-x-B-T1 | 71 | 102 | 153 | |
| | | AAT351xIGV-xx-x-C-T1 ⁴ | 1.12 | 1.6 | 2.4 | s |
| t_{WDI} | WDI Minimum Pulse Width | $V_{IL} = 0.3 \times V_{CC}$, $V_{IH} = 0.7 \times V_{CC}$ | | 50 | | ns |
| V_{IL} | WDI Input Threshold ⁵ | | $0.3 \times V_{CC}$ | | | |
| V_{IH} | WDI Input Threshold ⁵ | | | | $0.8 \times V_{CC}$ | V |
| I_{WDI} | WDI Input Current ⁶ | WDI = V_{CC} , time average | | 120 | 160 | μA |
| | | $V_{WDI} = 0$, time average | -20 | -15 | | |

| Symbol | Description | Conditions | Min | Typ | Max | Units |
|---|--|--------------------------|---------------------|-----|---------------------|------------|
| Manual RESET Input (AAT3510, 3511, 3512, 3515, 3516, 3517, 3519) | | | | | | |
| V_{IL} | \overline{MR} Input Threshold | | $0.3 \times V_{CC}$ | | | V |
| V_{IH} | \overline{MR} Input Threshold | | | | $0.7 \times V_{CC}$ | |
| | \overline{MR} Input Pulse Width | | 1 | | | μ s |
| | \overline{MR} Glitch Rejection | | | 100 | | ns |
| | \overline{MR} Internal Pullup Resistance | $T_A = 25^\circ\text{C}$ | 35 | 52 | 75 | k Ω |
| | \overline{MR} to Reset Delay | $V_{CC} = 5\text{V}$ | | 230 | | ns |

Note 1: Over-temperature limits are guaranteed by design, not production tested.

Note 2: This is the minimum time \overline{RESET} must be held low by an external pulldown source to set the active pullup flip-flop.

Note 3: Measured from $\overline{RESET} V_{OL}$ to $(0.8 \times V_{CC})$, Open Circuit Output.

Note 4: Watchdog timeout period C is not available on AAT3513, AAT3514, and AAT3518.

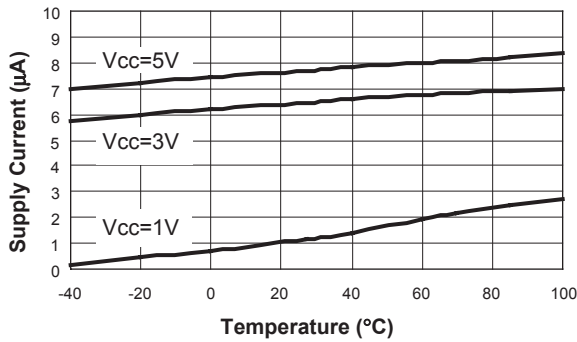
Note 5: WDI is internally serviced within the watchdog period if WDI is left unconnected.

Note 6: The WDI input current is specified as the average input current when the WDI input is driven high or low. The WDI input is designed for a three-stated-output device with a $10\mu\text{A}$ maximum leakage current and capable of driving a maximum capacitive load of 200pF . The three-state device must be able to source and sink at least $200\mu\text{A}$ when active.

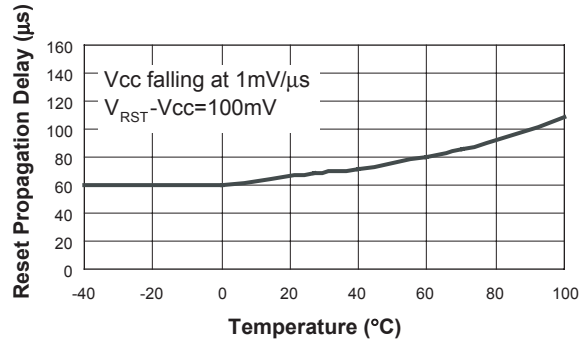
Typical Characteristics

(Unless otherwise noted, $V_{IN} = 3V$, $T_A = 25^\circ C$)

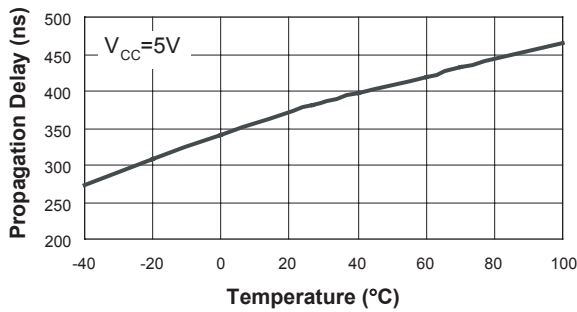
Supply Current vs. Temperature



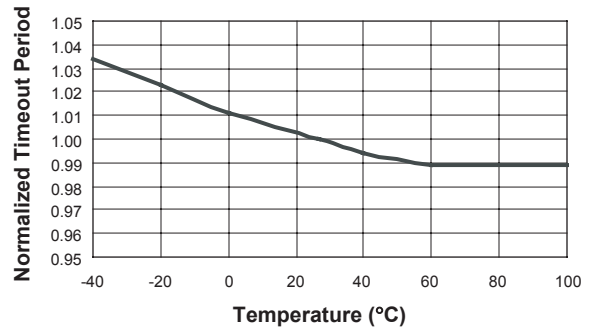
V_{CC} Falling To RESET Propagation Delay vs. Temperature



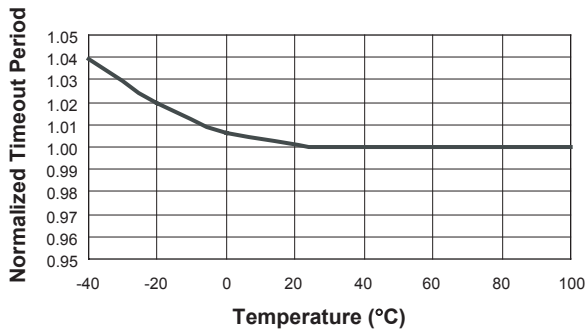
Manual Reset to RESET Propagation Delay vs. Temperature



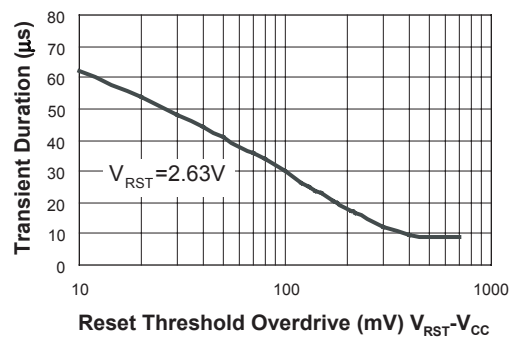
Normalized Reset Timeout Period vs. Temperature



Normalized Watchdog Timeout Period vs. Temperature



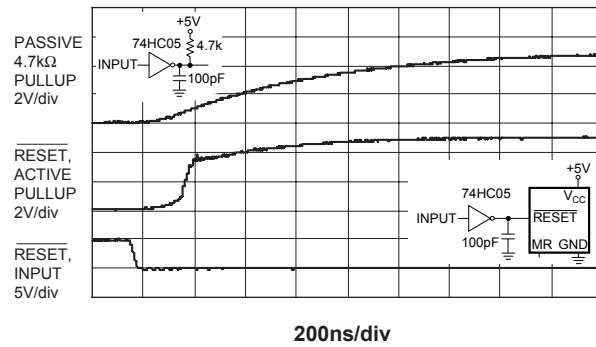
Maximum V_{CC} Transient Duration vs. Reset Threshold Overdrive



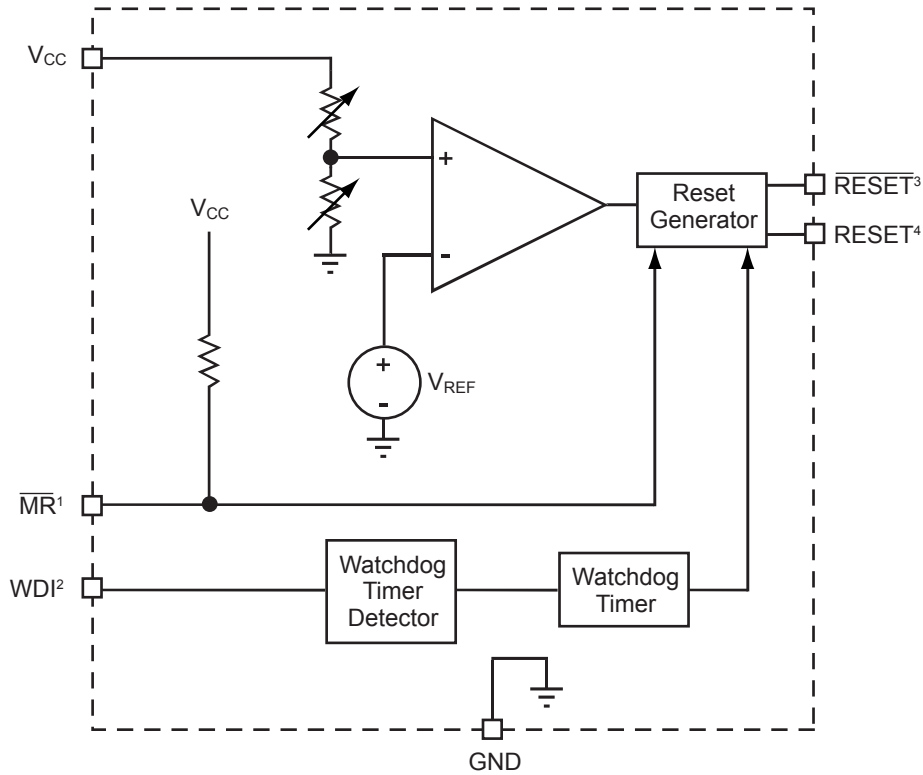
Typical Characteristics

(Unless otherwise noted, $V_{IN} = 3V$, $T_A = 25^\circ C$)

Bidirectional Pullup Characteristic



Functional Block Diagram



Note 1: MR pin available on AAT3510/1/2/5/6/7/9

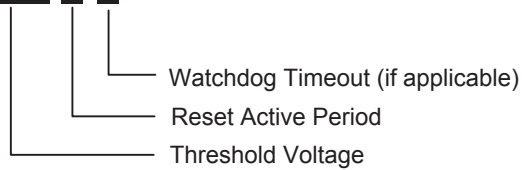
Note 2: WDI pin available on AAT3510/1/2/3/4/7/8

Note 3: $\overline{\text{RESET}}$ pin available on AAT3510/1/3/4/5/6/7/8/9

Note 4: RESET pin available on AAT3512/3/4/5/6/8/9

Factory Trimmed Reset Thresholds* and Ordering Information

AAT351x IGV - X.XX - X-X - X-T1



Reset Active Period

- A: $T_{R(MIN)} = 1\text{ms}$
- B: $T_{R(MIN)} = 20\text{ms}$
- C: $T_{R(MIN)} = 140\text{ms}$

Watchdog Timeout Period

- A: $T_{WD(NOM)} = 6.3\text{ms}$
- B: $T_{WD(NOM)} = 102\text{ms}$
- C: $T_{WD(NOM)} = 1600\text{ms}^*$

VDD Threshold Voltage

| | |
|------------------------------------|------------------------------------|
| 2.63: $V_{TH(NOM)} = 2.63\text{V}$ | 3.90: $V_{TH(NOM)} = 3.9\text{V}$ |
| 2.70: $V_{TH(NOM)} = 2.7\text{V}$ | 4.00: $V_{TH(NOM)} = 4.0\text{V}$ |
| 2.80: $V_{TH(NOM)} = 2.8\text{V}$ | 4.10: $V_{TH(NOM)} = 4.1\text{V}$ |
| 2.93: $V_{TH(NOM)} = 2.93\text{V}$ | 4.20: $V_{TH(NOM)} = 4.2\text{V}$ |
| 3.00: $V_{TH(NOM)} = 3.0\text{V}$ | 4.38: $V_{TH(NOM)} = 4.3\text{V}$ |
| 3.08: $V_{TH(NOM)} = 3.08\text{V}$ | 4.40: $V_{TH(NOM)} = 4.38\text{V}$ |
| 3.20: $V_{TH(NOM)} = 3.2\text{V}$ | 4.50: $V_{TH(NOM)} = 4.5\text{V}$ |
| 3.30: $V_{TH(NOM)} = 3.3\text{V}$ | 4.63: $V_{TH(NOM)} = 4.63\text{V}$ |
| 3.40: $V_{TH(NOM)} = 3.4\text{V}$ | 4.70: $V_{TH(NOM)} = 4.7\text{V}$ |
| 3.50: $V_{TH(NOM)} = 3.5\text{V}$ | 4.80: $V_{TH(NOM)} = 4.8\text{V}$ |
| 3.60: $V_{TH(NOM)} = 3.6\text{V}$ | 4.90: $V_{TH(NOM)} = 4.9\text{V}$ |
| 3.70: $V_{TH(NOM)} = 3.7\text{V}$ | 5.00: $V_{TH(NOM)} = 5.0\text{V}$ |
| 3.80: $V_{TH(NOM)} = 3.8\text{V}$ | |

* Watchdog timeout period C is not available on AAT3513, AAT3514 and AAT3518.

Ordering Information

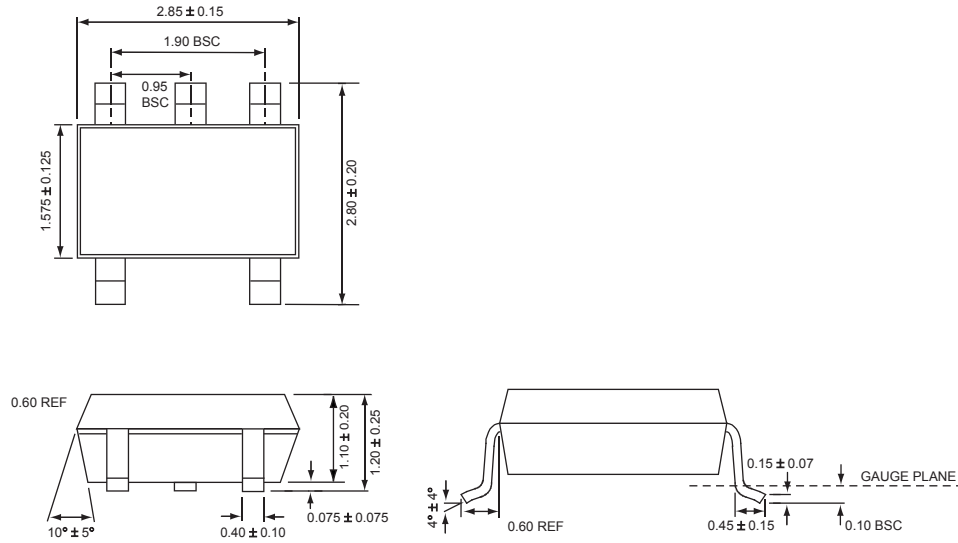
| Package | Marking ¹ | Part Number (Tape and Reel) |
|---------|----------------------|-------------------------------|
| SOT23-5 | HVXYY | AAT3510IGV-2.63-C-C-T1 |
| SOT23-5 | HUXYY | AAT3510IGV-2.93-C-C-T1 |
| SOT23-5 | HGXYY | AAT3510IGV-3.08-C-C-T1 |
| SOT23-5 | HHXYY | AAT3510IGV-4.38-C-C-T1 |
| SOT23-5 | EWXYY | AAT3511IGV-2.63-C-C-T1 |
| SOT23-5 | MYXYY | AAT3512IGV-2.63-A-C-T1 |
| SOT23-5 | JOXYY | AAT3512IGV-2.63-C-C-T1 |
| SOT23-5 | HFXYY | AAT3513IGV-2.63-C-C-T1 |
| SOT23-5 | HEXYY | AAT3515IGV-2.63-C-T1 |
| SOT23-5 | HIXYY | AAT3515IGV-2.93-B-T1 |
| SOT23-5 | KLXYY | AAT3515IGV-2.93-C-T1 |
| SOT23-5 | JNXYY | AAT3515IGV-3.08-C-T1 |
| SOT23-5 | KMXYY | AAT3515IGV-4.38-C-T1 |
| SOT23-5 | MFXY | AAT3515IGV-4.63-C-T1 |
| SOT23-5 | INXYY | AAT3517IGV-2.63-C-C-T1 |
| SOT23-5 | LZXYY | AAT3517IGV-2.8-B-C-T1 |
| SOT23-5 | IQXYY | AAT3517IGV-2.93-C-C-T1 |

Note: Sample stock is held on part numbers listed in **bold**.

Note 1: XYY = date and assembly code.

Package Information

SOT23-5



All dimensions in millimeters.

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