AAT3510/1/2/3/4/5/6/7/8/9

Micropower µP Reset with Watchdog Timer

PowerManager™

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 µP 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.

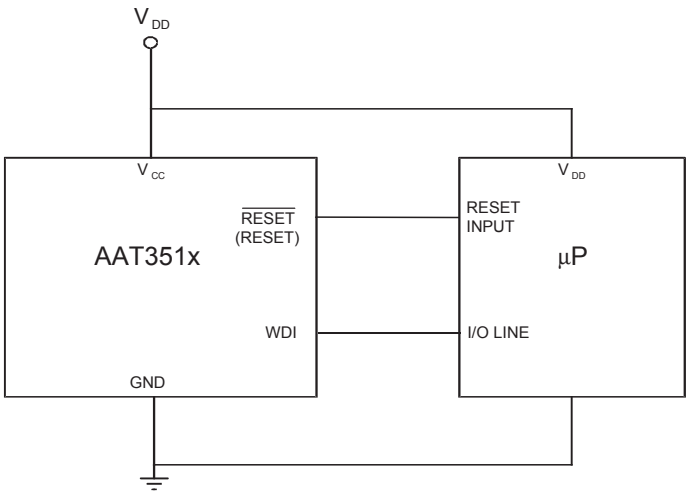
Features

- Tight voltage tolerance: ±1.5%
- Low quiescent current: 5µA
- 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 µP and µC Supply Monitoring
- Power-On reset circuits
- Embedded Control Systems

Typical Application

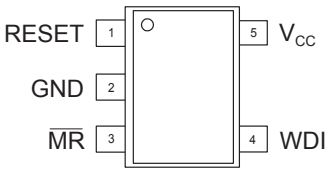


Pin Descriptions

Pin #				Symbol	Function
AAT3510 AAT3511 AAT3517	AAT3512	AAT3513 AAT3514 AAT3518	AAT3515 AAT3516 AAT3519		
1	N/A	1	1	$\overline{\text{RESET}}$	AAT3510/13/15: $\overline{\text{RESET}}$ output goes low whenever V_{DD} falls below the reset threshold. CMOS push-pull Output
					AAT3511/14/16: $\overline{\text{RESET}}$ 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: $\overline{\text{RESET}}$ 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 $\overline{\text{RESET}}$.
3	3	N/A	4	$\overline{\text{MR}}$	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

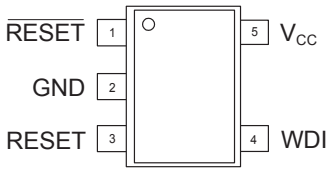
Pin Configuration

5-lead SOT23
(Top View)



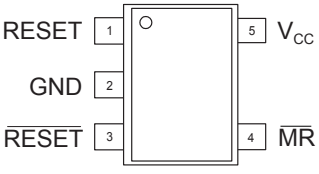
AAT3510
AAT3511
AAT3517

5-lead SOT23
(Top View)



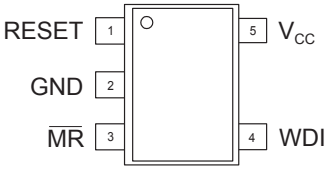
AAT3513
AAT3514
AAT3518

5-lead SOT23
(Top View)



AAT3515
AAT3516
AAT3519

5-lead SOT23
(Top View)



AAT3512

Absolute Maximum Ratings (T_A=25°C unless otherwise noted)

Symbol	Description	Max	Units
V_{CC}	V_{CC} to GND	-0.3 to 6	V
V_{MR}, V_{WDI}	$\overline{MR}$, WDI to GND	-0.3 to V_{CC}+0.3	V
V_{RESET}	$\overline{RESET}$ 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/$\overline{RESET}$ Output Current	20	mA
dV_{CC}/dt	Rate of rise of V_{CC}	100	V/µs
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} = 2.5V to 5.5V, T_A = -40 to +85°C [1] unless otherwise noted. Typical values are at T_A=25°C)

Symbol	Description	Conditions		Min	Typ	Max	Units
V_{CC}	Operating Voltage Range	T_A = -40°C to +85°C		1		5.5	V
I_{CC}	Supply Current	AAT3510/1/2/3/4/7/8:	V_{CC} = 3.6V		5	15	µA
		$\overline{MR}$ & WDI unconnected	V_{CC} = 5.5V		6	18	
		AAT3515/6/9:	V_{CC} = 3.6V			15	
		$\overline{MR}$ unconnected	V_{CC} = 5.5V			18	
V_{TH}	Reset Threshold Voltage	T_A = 25°C		V_{THNOM}-1.5%	V_{TH}	V_{THNOM}+1.5%	V
		T_A = -40 to +85°C		V_{THNOM}-2.5%	V_{TH}	V_{THNOM}+2.5%	
T_C	Reference Voltage Temp Coeff	-40°C < T_A < +85°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 1mV/µs			40		µs

Electrical Characteristics

(V_{CC} = 2.5V to 5.5V, T_A = -40 to +85ºC[1] unless otherwise noted. Typical values are at T_A=25°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} = 50µA			0.3	V
		$V_{CC} \geq 1.2V$, I_{SINK} = 100µA			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} = 500µA	0.8 x V_{CC}			V
		$V_{CC} \geq 4.5V$, I_{SOURCE} = 800µA	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} = 150µA	0.8 x V_{CC}			
		$V_{CC} \geq 2.7V$, I_{SOURCE} = 500µA	0.8 x V_{CC}			
		$V_{CC} \geq 4.5V$, I_{SOURCE} = 800µA	V_{CC} - 1.5			
Bidirectional $\overline{RESET}$ 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	kΩ
Open-Drain $\overline{RESET}$ Output (AAT3517, 3518, 3519)						
V_{OL}	$\overline{RESET}$ Low Output Voltage	$V_{CC} \geq 1.0V$, I_{SINK} = 50µA			0.3	V
		$V_{CC} \geq 1.2V$, I_{SINK} = 100µA			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 x V_{CC}, V_{IH} = 0.7 x V_{CC}		50		ns
V_{IL}	WDI Input Threshold [5]		0.3 x V_{CC}			
V_{IH}	WDI Input Threshold [5]				0.8 x V_{CC}	V
I_{WDI}	WDI Input Current [6]	WDI = V_{CC}, time average		120	160	µA
		V_{WDI} = 0, time average	-20	-15		

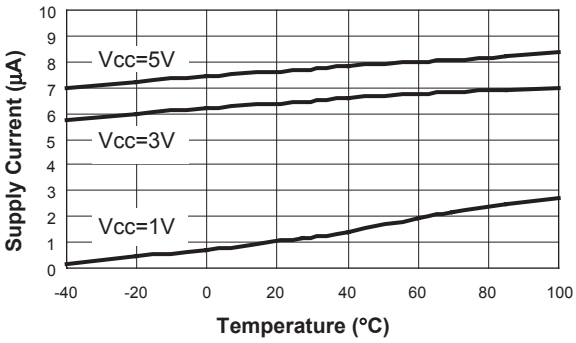
Symbol	Description	Conditions	Min	Typ	Max	Units
Manual RESET Input (AAT3510, 3511, 3512, 3515, 3516, 3517, 3519)						
V_{IL}	$\overline{MR}$ Input Threshold		0.3 x V_{CC}			V
V_{IH}	$\overline{MR}$ Input Threshold				0.7 x V_{CC}	
	$\overline{MR}$ Input Pulse Width		1			µs
	$\overline{MR}$ Glitch Rejection			100		ns
	$\overline{MR}$ Internal Pullup Resistance	T_A = 25°C	35	52	75	kΩ
	$\overline{MR}$ to Reset Delay	V_{CC} = 5V		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 x 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 10µA 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 200µA when active.

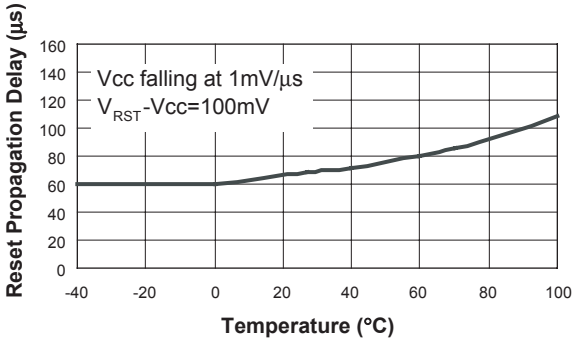
Typical Characteristics

(Unless otherwise noted, V_{IN} = 3V, T_A = 25°C)

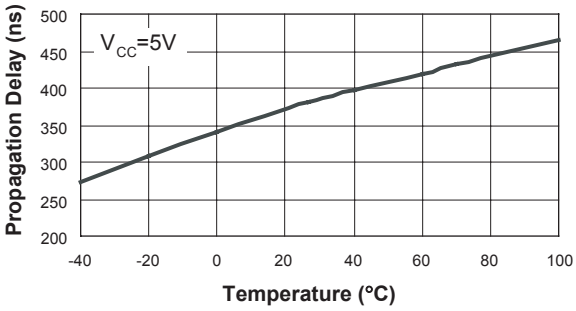
Supply Current vs. Temperature



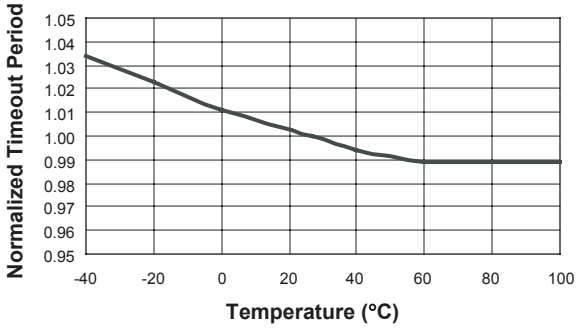
Vcc Falling To RESET Propagation Delay vs. Temperature



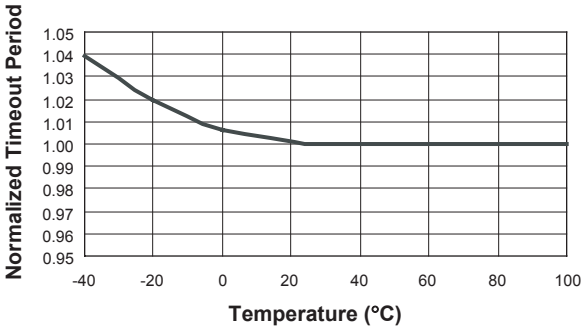
Manual Reset to RESET Propagation Delay vs. Temperature



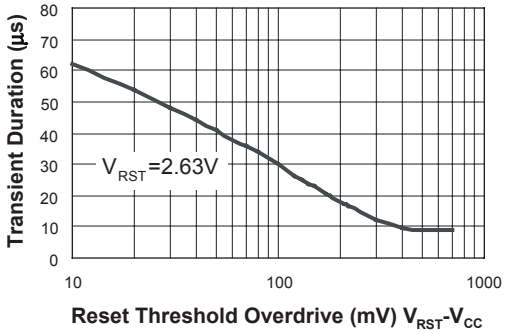
Normalized Reset Timeout Period vs. Temperature



Normalized Watchdog Timeout Period vs. Temperature



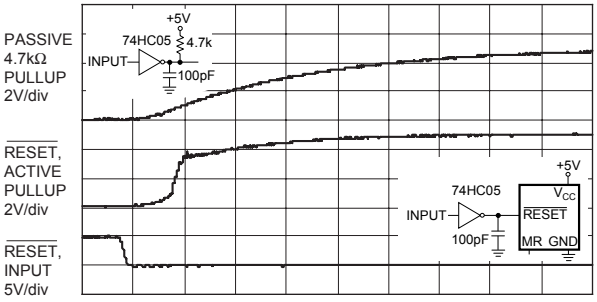
Maximum V_{CC} Transient Duration vs. Reset Threshold Overdrive



Typical Characteristics

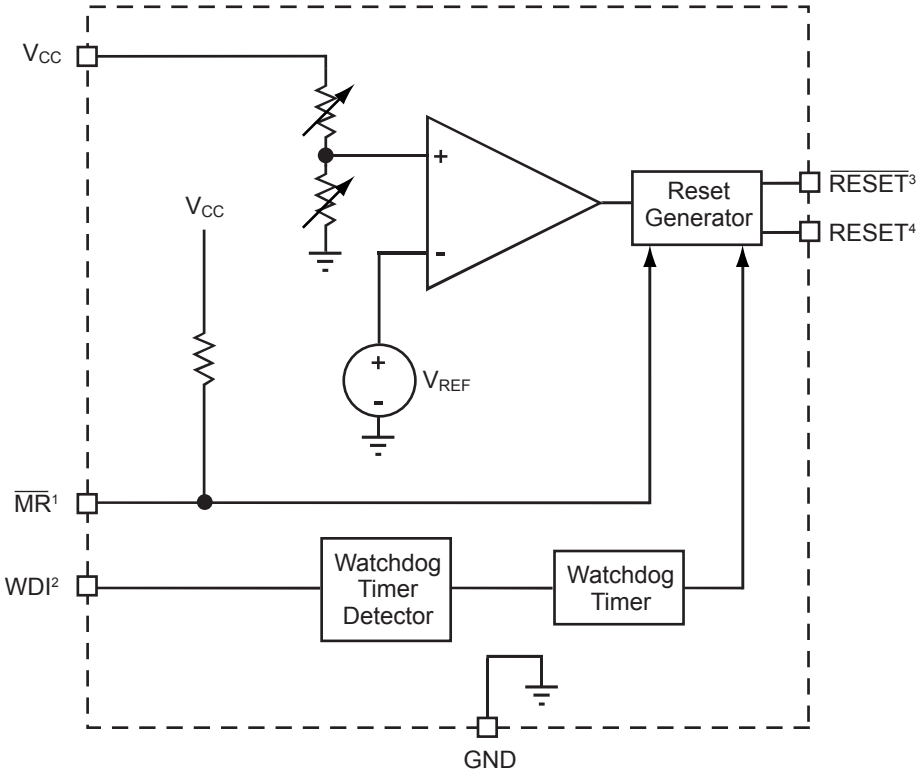
(Unless otherwise noted, V_{IN} = 3V, T_A = 25°C)

Bidirectional Pullup Characteristic



200ns/div

Functional Block Diagram



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

Note 2: WDI pin avaliable 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-T1

- Watchdog Timeout (if applicable)
- Reset Active Period
- Threshold Voltage

Reset Active Period

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

Watchdog Timeout Period

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

VDD Threshold Voltage

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

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

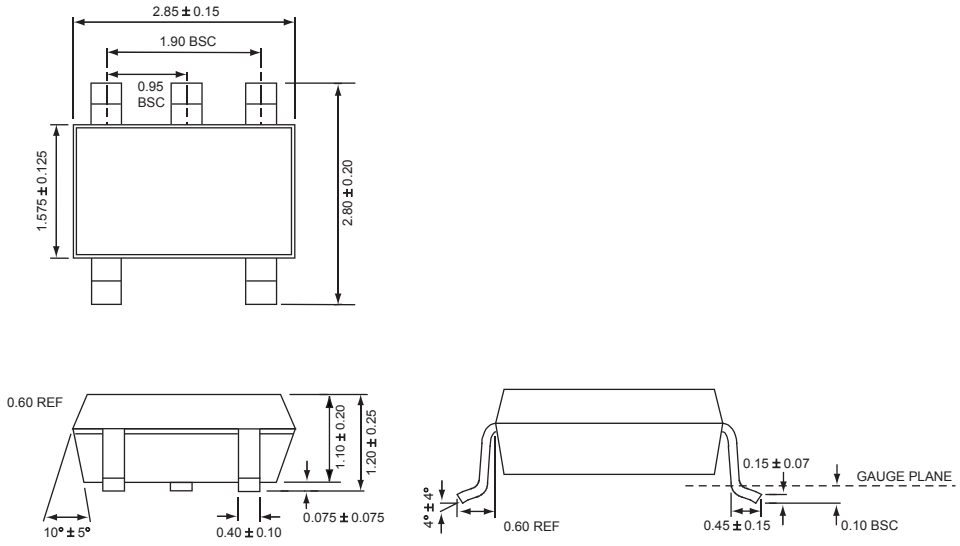
Ordering Information

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	MFXYY	**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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Advanced Analogic Technologies, Inc.
830 E. Arques Avenue, Sunnyvale, CA 94085
Phone (408) 737-4600
Fax (408) 737-4611