Advanced Analog Technology, Inc.

Product information presented is current as of publication date. Details are subject to change without notice

ONE-CELL LI-ION BATTERY PROTECTION IC

FEATURES

- Ideal for One-Cell Rechargeable Li-Ion Battery Packs

- High Accuracy Voltage Detection

- Low Current Consumption:

  3μA Supply Current (Typical)

  0.1μA Shutdown Current

- 3-Level Over Current Detection:
  Over-Current Level 1 /Over Current Level 2 / Short Circuit

- Wide Operating Temperature Range:

  -40 ^{o}C to +85 ^{o}C

- Small SOT25 Package

PIN CONFIGURATION

TOP VIEW

VN **1**   **5** C_{OUT}

V_{DD} **2**

GND **3**   **4** D_{OUT}

SOT25

GENERAL DESCRIPTION

The AAT8641 series are designed for the protection of one-cell rechargeable Li-Ion battery pack against over charge, over discharge, over current and short circuit. They use CMOS process to provide high accuracy voltage detection while consuming relatively low amount of current.

Each of the AAT8641 devices incorporates voltage comparators, bandgap reference voltage generator, signal delay circuit, short circuit detector, and digital control circuit.

During the charge process, when the battery voltage is charged to a value higher than V_{C1} (Over Charge Threshold Voltage), the output of C_{out} pin switches to low level, i.e., the VN pin level. The output of C_{out} pin will switch to high level when the battery voltage is at a level lower than V_{C2} (Over Charge Release Voltage), or when the charger is disconnected from the battery pack and the battery voltage level is in between V_{C1} and V_{C2}.

During the discharge process, when the battery voltage drops to a value lower than V_{D1} (Over Discharge Threshold Voltage), the output of D_{out} pin switches to low level immediately after the internal delay time elapses. The output of D_{out} pin will switch to high level when the battery voltage is at a level higher than V_{D2}

(Over-Discharge Release Voltage).

Over Current Level 1 Voltage (V_{OC1}) is used to monitor the amount of discharge current. If the discharge current is high enough to cause VN pin voltage to be greater than V_{OC1}, the output of D_{out} pin will switch to low level after a delay time t_{OC1}. If the load is removed from battery pack, the output of D_{out} will change to high again.

The mechanism of short circuit protection is exactly the same as discharge current. If the short circuit current is high enough to cause VN pin voltage to be greater than V_{short}, the output of D_{out} pin would fall to low level after a delay time t_{short}, and the output of D_{out} level will change to high when the load is removed from battery pack.

BLOCK DIAGRAM:

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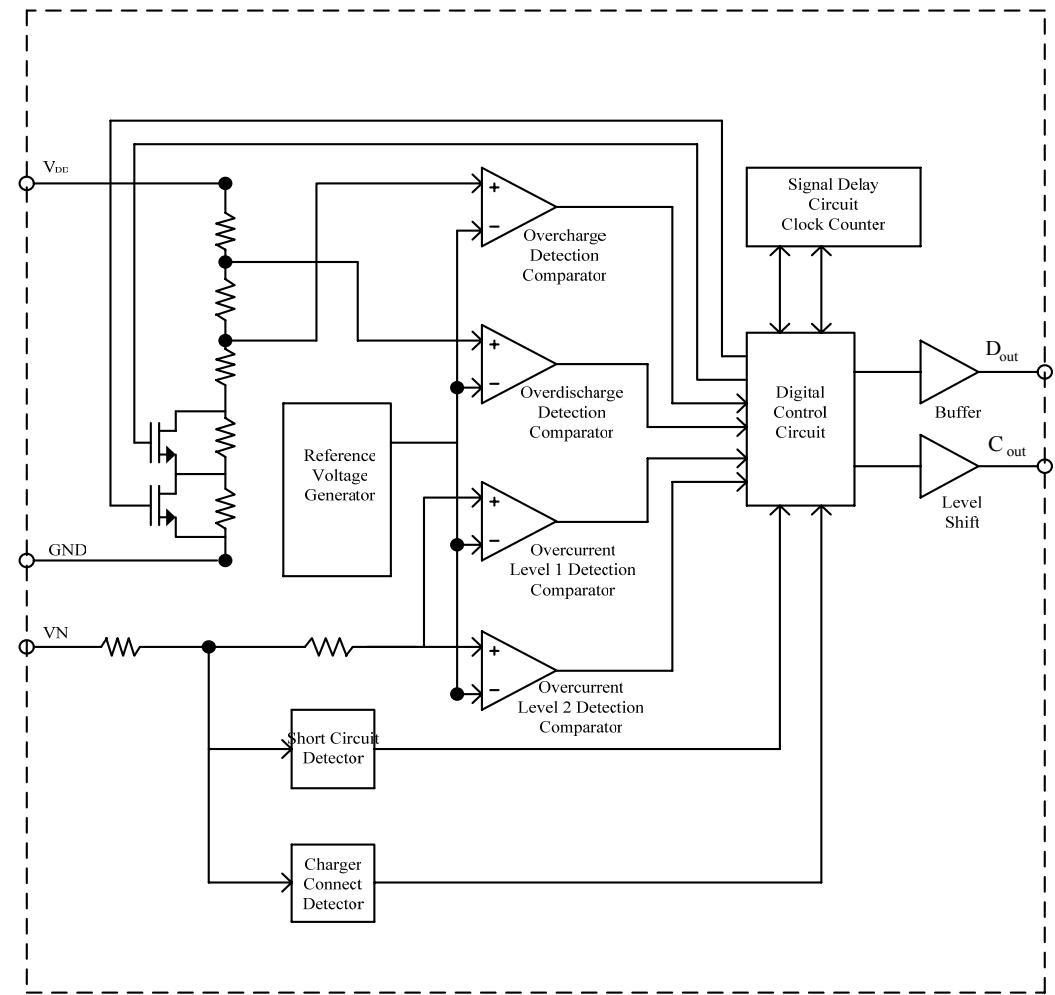
PIN DESCRIPTION

PIN NO	NAME	I/O	DESCRIPTION
1	VN	I	Voltage Detection Pin Between VN and GND
2	V_{DD}	I	Power Supply Input Pin
3	GND		Ground
4	D_{out}	O	Discharge Control Pin which Connects to External MOSFET Gate
5	C_{out}	O	Charge Control Pin which Connects to External MOSFET Gate.

ABSOLUTE MAXIMUM RATINGS

CHARACTERISTICS	SYMBOL	VALUE	UNIT
Supply Voltage	V_{DD}	-0.3 to 8.0	V
VN Pin Input Voltage	V_{VN}	$V_{DD} - 20.0$ to $V_{DD} + 0.3$	V
D_{out} Pin Output Voltage	V_{Dout}	-0.3 to $V_{DD} + 0.3$	V
C_{out} Pin Output Voltage	V_{Cout}	$V_{VN} - 0.3$ to $V_{DD} + 0.3$	V
Power Dissipation	P_d	150	mW
Operating Temperature Range	T_C	-40 to $+85$	^{o}C
Storage Temperature Range	$T_{storage}$	-40 to $+125$	^{o}C

RECOMMENDED OPERATING CONDITIONS

	Test condition	Min	Max	Unit
Supply Voltage, V_{DD}	Voltage Defined as V_{DD} to GND	1.5	7.0	V
D_{out} Output Voltage		GND	V_{DD}	V
C_{out} Output Voltage		VN	V_{DD}	V

OPERATION VOLTAGE AND OPERATION CURRENT

Parameter	Test Condition	Min	Typ	Max	Unit
Supply Current at Normal Operation Mode	V_{DD} =3.3V; VN=0V; GND=0V		3.0	5.0	μA
Standby Current at Power Down Mode		-	-	0.1	μA
Operation Voltage between V_{DD} and VN		1.5		20.0	V

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AAT8641A DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	Min	Typ	Max	Unit
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.300	4.325	4.350	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.25$	$V_{C1}-0.20$	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.420	2.500	2.580	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	$V_{D1}+0.3$	$V_{D1}+0.4$	$V_{D1}+0.5$	V
Over Charge Delay Time	t_{C1}	$V_{DD}=3.6V$ to $4.5V$	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	$V_{DD}=3.6V$ to $2.4V$	87.5	125.0	162.5	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	130	150	170	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	500	600	mV
Short Circuit Detection Voltage	V_{short}	$V_{DD}=3.0V$, Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	$V_{DD}-1.7$	$V_{DD}-1.3$	$V_{DD}-0.9$	V
Over Current Level 1 Detection Delay Time	t_{OC1}	$V_{DD}=3.0V$	5.6	8.0	10.4	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. $\Rightarrow$ Low or High Temp. $\Rightarrow$ $V_{DD}=3.0V$	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	$V_{DD}=3.0V$		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of " D_{out} " Pin Voltage (when $V_{D1}<V_{DD}<V_{D2}$)	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	$V_{DD}=3.5V$; $C_{out}=3.0V$;VN=0V	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	$V_{DD}=4.5V$;	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	$V_{DD}=3.5V$; $D_{out}=3.0V$;VN=0V	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	$V_{DD}=1.8V$; $D_{out}=0.5V$;VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	$V_{DD}=1.8V$; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	$V_{DD}=3.5V$; VN=3.5V	50	150	300	kΩ

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AAT8641B DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.325	4.350	4.375	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	V_{C1}-0.25	V_{C1}-0.20	V_{C1}-0.15	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.220	2.300	2.380	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	V_{D1}+0.6	V_{D1}+0.7	V_{D1}+0.8	V
Over Charge Delay Time	t_{C1}	V_{DD} = 3.6V to 4.5V	0.088	0.125	0.163	s
Over Discharge Delay Time	t_{D1}	V_{DD} = 3.6V to 2.2V	22.4	32.0	41.6	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	130	150	170	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	500	600	mV
Short Circuit Detection Voltage	V_{short}	V_{DD} = 3.0V , Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	V_{DD}−1.7	V_{DD}−1.3	V_{DD}−0.9	V
Over Current Level 1 Detection Delay Time	t_{OC1}	V_{DD} = 3.0V	2.8	4.0	5.2	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. ⇒ Low or High Temp. ⇒ V_{DD} = 3.0V	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	V_{DD} = 3.0V		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of " D_{out} " Pin Voltage (when V_{D1}＜V_{DD}＜V_{D2})	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	V_{DD}=3.5V; C_{out}=3.0V;VN=0V	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	V_{DD}=4.5V; C_{out}=0.5V;VN=0V	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	V_{DD} 3.5V; D_{out}=3.0V;VN=0V	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	V_{DD}=1.8V; D_{out}=0.5V;VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	V_{DD}=1.8V; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	V_{DD}=3.5V; VN=3.5V	50	150	300	kΩ

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AAT8641C DETECTION VOLTAGE AND DEALY TIME(25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.275	4.300	4.325	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	V_{C1}-0.25	V_{C1}-0.20	V_{C1}-0.15	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.220	2.300	2.380	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	V_{D1}-0.08	V_{D1}	V_{D1}+0.08	V
Over Charge Delay Time	t_{C1}	V_{DD} = 3.6V to 4.5V	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	V_{DD} = 3.6V to 2.2V	87.5	125.0	162.5	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	80	100	120	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	480	600	mV
Short Circuit Detection Voltage	V_{short}	V_{DD} = 3.0V , Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	V_{DD}−1.7	V_{DD}−1.3	V_{DD}−0.9	V
Over Current Level 1 Detection Delay Time	t_{OC1}	V_{DD} = 3.0V	5.6	8.0	10.4	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. $\Rightarrow$ Low or High Temp. $\Rightarrow$ V_{DD} = 3.0V	1.4 / 1.1	2.0 / 2.0	2.6 / 3.4	ms / ms
Short Circuit Detection Delay Time	t_{short}	V_{DD} = 3.0V		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of " D_{out} " Pin Voltage (when $V_{D1} < V_{DD} < V_{D2}$)	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	V_{DD} =3.5V; C_{out} =3.0V;VN=0V	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	V_{DD} =4.5V; C_{out} =0.5V;VN=0V	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	V_{DD} =3.5V; D_{out} =3.0V;VN=0V	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	V_{DD} =1.8V; D_{out} =0.5V;VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	V_{DD} =1.8V; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	V_{DD} =3.5V; VN=3.5V	50	150	300	kΩ

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AAT8641D DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.255	4.280	4.305	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	V_{C1}-0.25	V_{C1}-0.20	V_{C1}-0.15	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.201	2.281	2.361	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	V_{D1}-0.08	V_{D1}	V_{D1}+0.08	V
Over Charge Delay Time	t_{C1}	$V_{DD} = 3.6V$ to $4.5V$	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	$V_{DD} = 3.6V$ to $2.2V$	87.5	125.0	162.5	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	110	130	150	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	490	600	mV
Short Circuit Detection Voltage	V_{short}	$V_{DD} = 3.0V$, Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	$V_{DD}-1.7$	$V_{DD}-1.3$	$V_{DD}-0.9$	V
Over Current Level 1 Detection Delay Time	t_{OC1}	$V_{DD} = 3.0V$	5.6	8.0	10.4	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. $\Rightarrow$ Low or High Temp. $\Rightarrow$ $V_{DD} = 3.0V$	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	$V_{DD} = 3.0V$		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of " D_{out} " Pin Voltage (when $V_{D1} < V_{DD} < V_{D2}$)	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	$V_{DD} = 3.5V$; $C_{out} = 3.0V$;VN=0V	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	$V_{DD} = 4.5V$; $C_{out} = 0.5V$;VN=0V	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	$V_{DD} = 3.5V$; $D_{out} = 3.0V$;VN=0V	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	$V_{DD} = 1.8V$; $D_{out} = 0.5V$;VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	$V_{DD} = 1.8V$; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	$V_{DD} = 3.5V$; VN=3.5V	50	150	300	kΩ

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AAT8641E DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.255	4.280	4.305	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	V_{C1}-0.25	V_{C1}-0.20	V_{C1}-0.15	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.201	2.281	2.361	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	V_{D1}+0.5	V_{D1}+0.6	V_{D1}+0.7	V
Over Charge Delay Time	t_{C1}	V_{DD} = 3.6V to 4.5V	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	V_{DD} = 3.6V to 2.2V	87.5	125.0	162.5	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	80	100	120	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	480	600	mV
Short Circuit Detection Voltage	V_{short}	V_{DD} = 3.0V , Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	$V_{DD}-1.7$	$V_{DD}-1.3$	$V_{DD}-0.9$	V
Over Current Level 1 Detection Delay Time	t_{OC1}	V_{DD} = 3.0V	5.6	8.0	10.4	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. $\Rightarrow$ Low or High Temp. $\Rightarrow$ V_{DD} = 3.0V	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	V_{DD} = 3.0V		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of " D_{out} " Pin Voltage (when $V_{D1} < V_{DD} < V_{D2}$)	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	V_{DD} =3.5V; C_{out} =3.0V;VN=0V	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	V_{DD} =4.5V; C_{out} =0.5V;VN=0V	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	V_{DD} =3.5V; D_{out} =3.0V;VN=0V	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	V_{DD} =1.8V; D_{out} =0.5V;VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	V_{DD} =1.8V; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	V_{DD} =3.5V; VN=3.5V	50	150	300	kΩ

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AAT8641F DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.300	4.325	4.350	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.25$	$V_{C1}-0.20$	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.420	2.500	2.580	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	$V_{D1}+0.3$	$V_{D1}+0.4$	$V_{D1}+0.5$	V
Over Charge Delay Time	t_{C1}	$V_{DD} = 3.6V$ to $4.5V$	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	$V_{DD} = 3.6V$ to $2.4V$	87.5	125.0	162.5	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	80	100	120	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	480	600	mV
Short Circuit Detection Voltage	V_{short}	$V_{DD} = 3.0V$, Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	$V_{DD}-1.7$	$V_{DD}-1.3$	$V_{DD}-0.9$	V
Over Current Level 1 Detection Delay Time	t_{OC1}	$V_{DD} = 3.0V$	5.6	8.0	10.4	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. $\Rightarrow$ Low or High Temp. $\Rightarrow$ $V_{DD} = 3.0V$	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	$V_{DD} = 3.0V$		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of "D_{out}" Pin Voltage (when $V_{D1} < V_{DD} < V_{D2}$)	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	$V_{DD} = 3.5V$;	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	$V_{DD} = 4.5V$;	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	$V_{DD} = 3.5V$;	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	$V_{DD} = 1.8V$; $D_{out} = 0.5V$; VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	$V_{DD} = 1.8V$; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	$V_{DD} = 3.5V$; VN=3.5V	50	150	300	kΩ

AAT8641G DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.325	4.350	4.375	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	V_{C1}-0.25	V_{C1}-0.20	V_{C1}-0.15	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.220	2.300	2.380	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	V_{D1}+0.6	V_{D1}+0.7	V_{D1}+0.8	V
Over Charge Delay Time	t_{C1}	V_{DD} = 3.6V to 4.5V	0.088	0.125	0.163	s
Over Discharge Delay Time	t_{D1}	V_{DD} = 3.6V to 2.2V	22.4	32.0	41.6	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	180	200	220	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	510	600	mV
Short Circuit Detection Voltage	V_{short}	V_{DD} = 3.0V , Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	V_{DD}−1.7	V_{DD}−1.3	V_{DD}−0.9	V
Over Current Level 1 Detection Delay Time	t_{OC1}	V_{DD} = 3.0V	2.8	4.0	5.2	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp.⇒ Low or High Temp. ⇒ V_{DD} = 3.0V	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	V_{DD} = 3.0V		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of " D_{out} " Pin Voltage (when $V_{D1}<V_{DD}<V_{D2}$)	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	V_{DD} =3.5V; C_{out} =3.0V;VN=0V	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	V_{DD} =4.5V; C_{out} =0.5V;VN=0V	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	V_{DD} =3.5V; D_{out} =3.0V;VN=0V	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	V_{DD} =1.8V; D_{out} =0.5V;VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	V_{DD} =1.8V; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	V_{DD} =3.5V; VN=3.5V	50	150	300	kΩ

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AAT8641H DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.275	4.300	4.325	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	V_{C1}-0.25	V_{C1}-0.20	V_{C1}-0.15	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.220	2.300	2.380	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	V_{D1}-0.08	V_{D1}	V_{D1}+0.08	V
Over Charge Delay Time	t_{C1}	V_{DD} = 3.6V to 4.5V	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	V_{DD} = 3.6V to 2.2V	87.5	125.0	162.5	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	130	150	170	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	500	600	mV
Short Circuit Detection Voltage	V_{short}	V_{DD} = 3.0V , Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	V_{DD}−1.7	V_{DD}−1.3	V_{DD}−0.9	V
Over Current Level 1 Detection Delay Time	t_{OC1}	V_{DD} = 3.0V	5.6	8.0	10.4	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. $\Rightarrow$ Low or High Temp. $\Rightarrow$ V_{DD} = 3.0V	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	V_{DD} = 3.0V		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of " D_{out} " Pin Voltage (when $V_{D1} < V_{DD} < V_{D2}$)	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	V_{DD}=3.5V; C_{out}=3.0V;	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	V_{DD}=4.5V; C_{out}=0.5V;	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	V_{DD}=3.5V; D_{out}=3.0V;	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	V_{DD}=1.8V; D_{out}=0.5V; VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	V_{DD}=1.8V; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	V_{DD}=3.5V; VN=3.5V	50	150	300	kΩ

AAT8641I DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.275	4.300	4.325	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	$V_{C1}-0.25$	$V_{C1}-0.20$	$V_{C1}-0.15$	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.220	2.300	2.380	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	$V_{D1}-0.08$	V_{D1}	$V_{D1}+0.08$	V
Over Charge Delay Time	t_{C1}	$V_{DD}=3.6V$ to $4.5V$	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	$V_{DD}=3.6V$ to $2.2V$	87.5	125.0	162.5	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	110	130	150	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	490	600	mV
Short Circuit Detection Voltage	V_{short}	$V_{DD}=3.0V$, Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	$V_{DD}-1.7$	$V_{DD}-1.3$	$V_{DD}-0.9$	V
Over Current Level 1 Detection Delay Time	t_{OC1}	$V_{DD}=3.0V$	5.6	8.0	10.4	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. $\Rightarrow$ Low or High Temp. $\Rightarrow$ $V_{DD}=3.0V$	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	$V_{DD}=3.0V$		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of "D_{out}" Pin Voltage (when $V_{D1}<V_{DD}<V_{D2}$)	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	$V_{DD}=3.5V$; $C_{out}=3.0V$;VN=0V	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	$V_{DD}=4.5V$; $C_{out}=0.5V$;VN=0V	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	$V_{DD}=3.5V$; $D_{out}=3.0V$;VN=0V	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	$V_{DD}=1.8V$; $D_{out}=0.5V$;VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	$V_{DD}=1.8V$; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	$V_{DD}=3.5V$; VN=3.5V	50	150	300	kΩ

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AAT8641J DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.255	4.280	4.305	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	$V_{C1}-0.25$	$V_{C1}-0.20$	$V_{C1}-0.15$	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.201	2.281	2.361	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	$V_{D1}-0.08$	V_{D1}	$V_{D1}+0.08$	V
Over Charge Delay Time	t_{C1}	$V_{DD}=3.6V$ to $4.5V$	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	$V_{DD}=3.6V$ to $2.2V$	87.5	125.0	162.5	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	180	200	220	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	510	600	mV
Short Circuit Detection Voltage	V_{short}	$V_{DD}=3.0V$, Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	$V_{DD}-1.7$	$V_{DD}-1.3$	$V_{DD}-0.9$	V
Over Current Level 1 Detection Delay Time	t_{OC1}	$V_{DD}=3.0V$	5.6	8.0	10.4	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. $\Rightarrow$ Low or High Temp. $\Rightarrow$ $V_{DD}=3.0V$	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	$V_{DD}=3.0V$		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of "D_{out}" Pin Voltage (when $V_{D1}<V_{DD}<V_{D2}$)	–2.0	–1.3	–0.6	V
C_{out} High Level Resistance	R_{COH}	$V_{DD}=3.5V$; $C_{out}=3.0V$;VN=0V	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	$V_{DD}=4.5V$; $C_{out}=0.5V$;VN=0V	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	$V_{DD}=3.5V$; $D_{out}=3.0V$;VN=0V	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	$V_{DD}=1.8V$; $D_{out}=0.5V$;VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	$V_{DD}=1.8V$; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	$V_{DD}=3.5V$; VN=3.5V	50	150	300	kΩ

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AAT8641K DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	Detect Rising Edge of Supply Voltage	4.225	4.250	4.275	V
Over Charge Release Voltage	V_{C2}	Detect Falling Edge of Supply Voltage	V_{C1}-0.25	V_{C1}-0.20	V_{C1}-0.15	V
Over Discharge Threshold Voltage	V_{D1}	Detect Falling Edge of Supply Voltage	2.201	2.281	2.361	V
Over Discharge Release Voltage	V_{D2}	Detect Rising Edge of Supply Voltage	V_{D1}+0.5	V_{D1}+0.6	V_{D1}+0.7	V
Over Charge Delay Time	t_{C1}	V_{DD} = 3.6V to 4.5V	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	V_{DD} = 2.8V to 2.2V	87.5	125.0	162.5	ms
Over Current Level 1 Detection Voltage	V_{OC1}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC1} Delay Time)	80	100	120	mV
Over Current Level 2 Detection Voltage	V_{OC2}	Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{OC2} Delay Time)	400	480	600	mV
Short Circuit Detection Voltage	V_{short}	V_{DD} = 3.0V , Detect Rising Edge of "VN" Pin Voltage (D_{out} Response with t_{short} Delay Time)	V_{DD}−1.7	V_{DD}−1.3	V_{DD}−0.9	V
Over Current Level 1 Detection Delay Time	t_{OC1}	V_{DD} = 3.0V	5.6	8.0	10.4	ms
Over Current Level 2 Detection Delay Time	t_{OC2}	Room Temp. $\Rightarrow$ Low or High Temp. $\Rightarrow$ V_{DD} = 3.0V	1.4 1.1	2.0 2.0	2.6 3.4	ms ms
Short Circuit Detection Delay Time	t_{short}	V_{DD} = 3.0V		10	50	μs
Charger Detection Voltage	V_{CHR}	Detect Rising Edge of " D_{out} " Pin Voltage (when $V_{D1} < V_{DD} < V_{D2}$)	−2.0	−1.3	−0.6	V
C_{out} High Level Resistance	R_{COH}	V_{DD} =3.5V; C_{out} =3.0V;VN=0V	1	2	10	kΩ
C_{out} Low Level Resistance	R_{COL}	V_{DD} =4.5V; C_{out} =0.5V;VN=0V	150	602	2,380	kΩ
D_{out} High Level Resistance	R_{DOH}	V_{DD} =3.5V; D_{out} =3.0V;VN=0V	2.5	5.0	10.0	kΩ
D_{out} Low Level Resistance	R_{DOL}	V_{DD} =1.8V; D_{out} =0.5V;VN=1.8V	2.5	5.0	10.0	kΩ
Internal Resistance between VN and V_{DD}	R_{VND}	V_{DD} =1.8V; VN=0V	100	300	900	kΩ
Internal Resistance between VN and GND	R_{VNG}	V_{DD} =3.5V; VN=3.5V	50	150	300	kΩ

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SUMARY OF AAT8641 DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	DEVICE	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	V_{C1}	AAT8641A	4.300	4.325	4.350	V
		AAT8641B	4.325	4.350	4.375	V
		AAT8641C	4.275	4.300	4.325	V
		AAT8641D	4.255	4.280	4.305	V
		AAT8641E	4.255	4.280	4.305	V
		AAT8641F	4.300	4.325	4.350	V
		AAT8641G	4.325	4.350	4.375	V
		AAT8641H	4.275	4.30	4.325	V
		AAT8641I	4.275	4.30	4.325	V
		AAT8641J	4.255	4.280	4.305	V
		AAT8641K	4.225	4.250	4.275	V
Over Charge Release Voltage	V_{C2}	AAT8641A	$V_{C1} - 0.30$	$V_{C1} - 0.25$	$V_{C1} - 0.20$	V
		AAT8641B	$V_{C1} - 0.25$	$V_{C1} - 0.20$	$V_{C1} - 0.15$	V
		AAT8641C	$V_{C1} - 0.25$	$V_{C1} - 0.20$	$V_{C1} - 0.15$	V
		AAT8641D	$V_{C1} - 0.25$	$V_{C1} - 0.20$	$V_{C1} - 0.15$	V
		AAT8641E	$V_{C1} - 0.25$	$V_{C1} - 0.20$	$V_{C1} - 0.15$	V
		AAT8641F	$V_{C1} - 0.30$	VC1-0.25	$V_{C1} - 0.20$	V
		AAT8641G	$V_{C1} - 0.25$	$V_{C1} - 0.20$	$V_{C1} - 0.15$	V
		AAT8641H	$V_{C1} - 0.25$	$V_{C1} - 0.20$	$V_{C1} - 0.15$	V
		AAT8641I	$V_{C1} - 0.25$	$V_{C1} - 0.20$	$V_{C1} - 0.15$	V
		AAT8641J	$V_{C1} - 0.25$	$V_{C1} - 0.20$	$V_{C1} - 0.15$	V
		AAT8641K	$V_{C1} - 0.25$	$V_{C1} - 0.20$	$V_{C1} - 0.15$	V
Over Discharge Threshold Voltage	V_{D1}	AAT8641A	2.420	2.500	2.580	V
		AAT8641B	2.220	2.300	2.380	V
		AAT8641C	2.220	2.300	2.380	V
		AAT8641D	2.201	2.281	2.361	V
		AAT8641E	2.201	2.281	2.361	V
		AAT8641F	2.420	2.500	2.580	V
		AAT8641G	2.220	2.300	2.380	V
		AAT8641H	2.220	2.300	2.380	V
		AAT8641I	2.220	2.300	2.380	V
		AAT8641J	2.201	2.281	2.361	V
		AAT8641K	2.201	2.281	2.361	V

Advanced Analog Technology, Inc.

SUMMARY OF AAT8641 DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	DEVICE	MIN	TYP	MAX	UNIT
Over Discharge Release Voltage	V_{D2}	AAT8641A	VD1+0.3	VD1+0.4	VD1+0.5	V
		AAT8641B	VD1+0.6	VD1+0.7	VD1+0.8	V
		AAT8641C	$V_{D1}-0.08$	VD1	VD1+0.08	V
		AAT8641D	$V_{D1}-0.08$	VD1	VD1+0.08	V
		AAT8641E	VD1+0.5	VD1+0.6	VD1+0.7	V
		AAT8641F	VD1+0.3	VD1+0.4	VD1+0.5	V
		AAT8641G	VD1+0.6	VD1+0.7	VD1+0.8	V
		AAT8641H	$V_{D1}-0.08$	VD1	VD1+0.08	V
		AAT8641I	$V_{D1}-0.08$	VD1	VD1+0.08	V
		AAT8641J	$V_{D1}-0.08$	VD1	VD1+0.08	V
		AAT8641K	VD1+0.5	VD1+0.6	VD1+0.7	V
Over Charge Delay Time	t_{C1}	AAT8641A	0.700	1.000	1.300	s
		AAT8641B	0.088	0.125	0.163	s
		AAT8641C	0.700	1.000	1.300	s
		AAT8641D	0.700	1.000	1.300	s
		AAT8641E	0.700	1.000	1.300	s
		AAT8641F	0.700	1.000	1.300	s
		AAT8641G	0.088	0.125	0.163	s
		AAT8641H	0.700	1.000	1.300	s
		AAT8641I	0.700	1.000	1.300	s
		AAT8641J	0.700	1.000	1.300	s
		AAT8641K	0.700	1.000	1.300	s
Over Discharge Delay Time	t_{D1}	AAT8641A	87.5	125.0	162.5	ms
		AAT8641B	22.4	32.0	41.6	ms
		AAT8641C	87.5	125.0	162.5	ms
		AAT8641D	87.5	125.0	162.5	ms
		AAT8641E	87.5	125.0	162.5	ms
		AAT8641F	87.5	125.0	162.5	ms
		AAT8641G	22.4	32.0	41.6	ms
		AAT8641H	87.5	125.0	162.5	ms
		AAT8641I	87.5	125.0	162.5	ms
		AAT8641J	87.5	125.0	162.5	ms
		AAT8641K	87.5	125.0	162.5	ms

Advanced Analog Technology, Inc.

SUMMARY OF AAT8641 DETECTION VOLTAGE AND DELAY TIME (25℃)

PARAMETER	SYMBOL	DEVICE	MIN	TYP	MAX	UNIT
Over Current Level 1 Detection Voltage	V_{OC1}	AAT8641A	130	150	170	mV
		AAT8641B	130	150	170	mV
		AAT8641C	80	100	120	mV
		AAT8641D	110	130	150	mV
		AAT8641E	80	100	120	mV
		AAT8641F	80	100	120	mV
		AAT8641G	180	200	220	mV
		AAT8641H	130	150	170	mV
		AAT8641I	110	130	150	mV
		AAT8641J	180	200	220	mV
		AAT8641K	80	100	120	mV
Over Current Level 2 Detection Voltage	V_{OC2}	AAT8641A	400	500	600	mV
		AAT8641B	400	500	600	mV
		AAT8641C	400	480	600	mV
		AAT8641D	400	490	600	mV
		AAT8641E	400	480	600	mV
		AAT8641F	400	480	600	mV
		AAT8641G	400	510	600	mV
		AAT8641H	400	500	600	mV
		AAT8641I	400	490	600	mV
		AAT8641J	400	510	600	mV
		AAT8641K	400	480	600	mV
Over Current Level 1 Detection Delay Time	t_{OC1}	AAT8641A	5.6	8.0	10.4	ms
		AAT8641B	2.8	4.0	5.2	ms
		AAT8641C	5.6	8.0	10.4	ms
		AAT8641D	5.6	8.0	10.4	ms
		AAT8641E	5.6	8.0	10.4	ms
		AAT8641F	5.6	8.0	10.4	ms
		AAT8641G	2.8	4.0	5.2	ms
		AAT8641H	5.6	8.0	10.4	ms
		AAT8641I	5.6	8.0	10.4	ms
		AAT8641J	5.6	8.0	10.4	ms
		AAT8641K	5.6	8.0	10.4	ms

TIMING CHART
AAT8641 (CHARGE AND DISCHARGE)
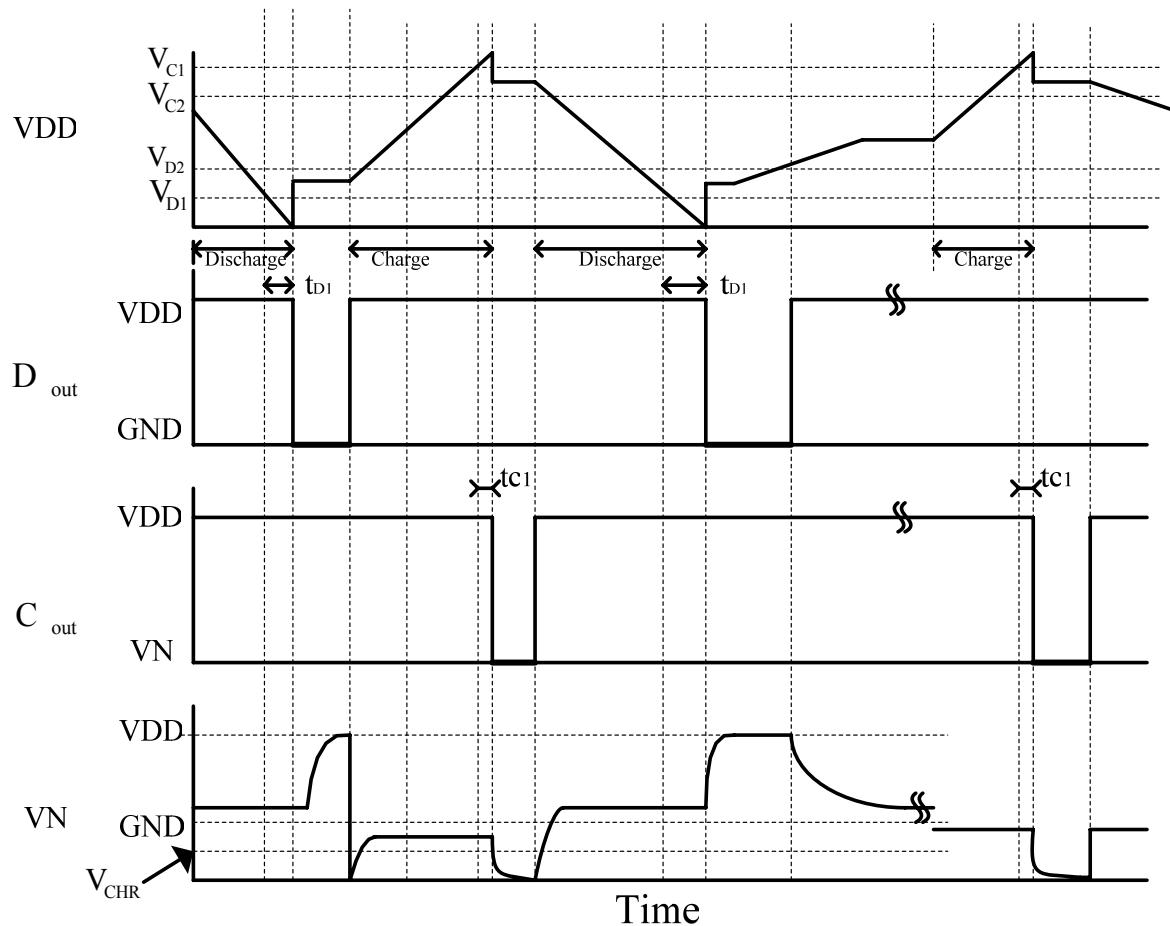
TIMING CHART

**AAT8641 (UNUSUAL CHARGE CURRENT, OVER CURRENT, AND SHORT CIRCUIT)**

Time
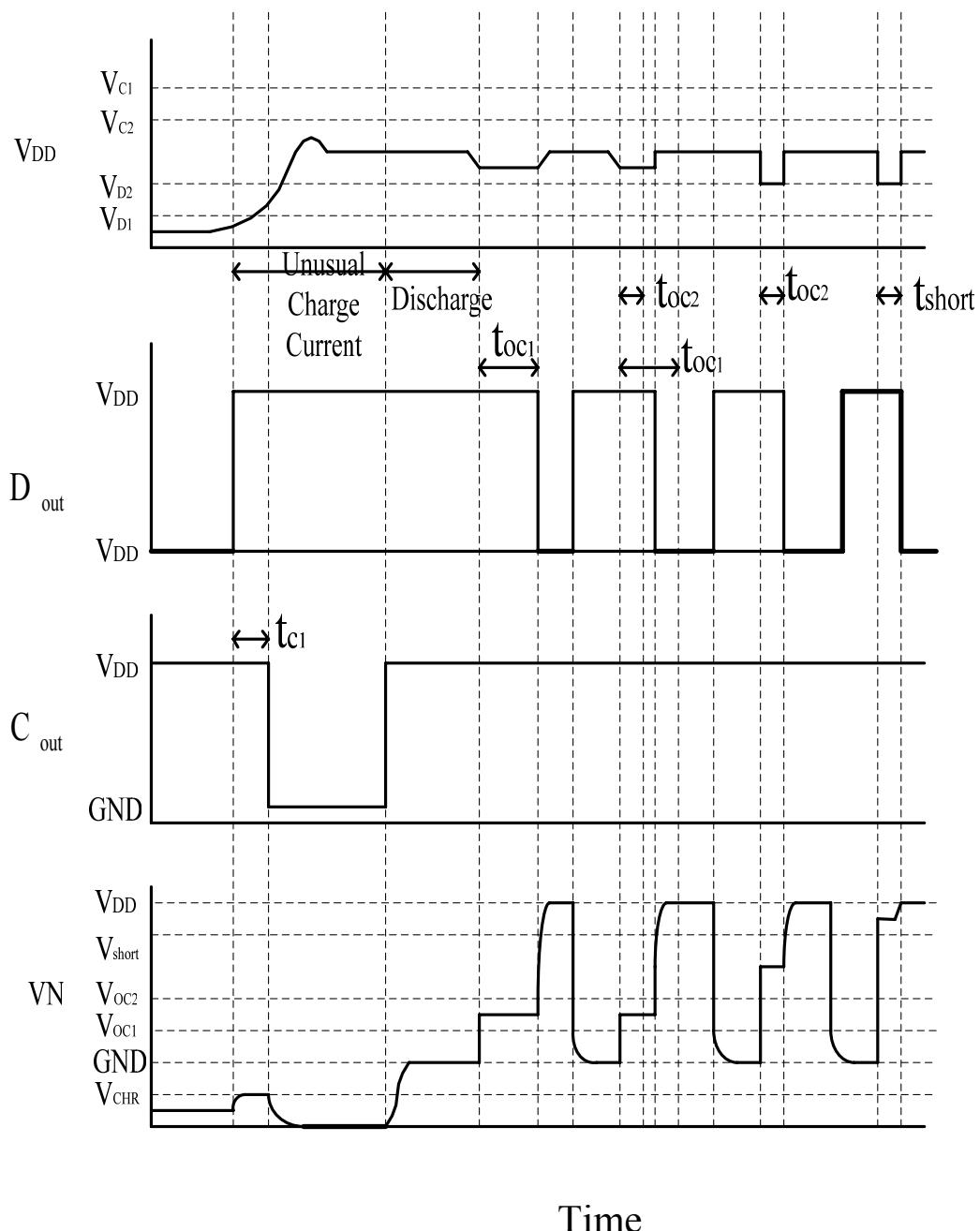
TYPICAL APPLICATION

PACKAGE DIMENSION

WITH PLATING

BASE METAL

SECTION B-B

SEE VIEW C

GAUGE PLANE

0.25
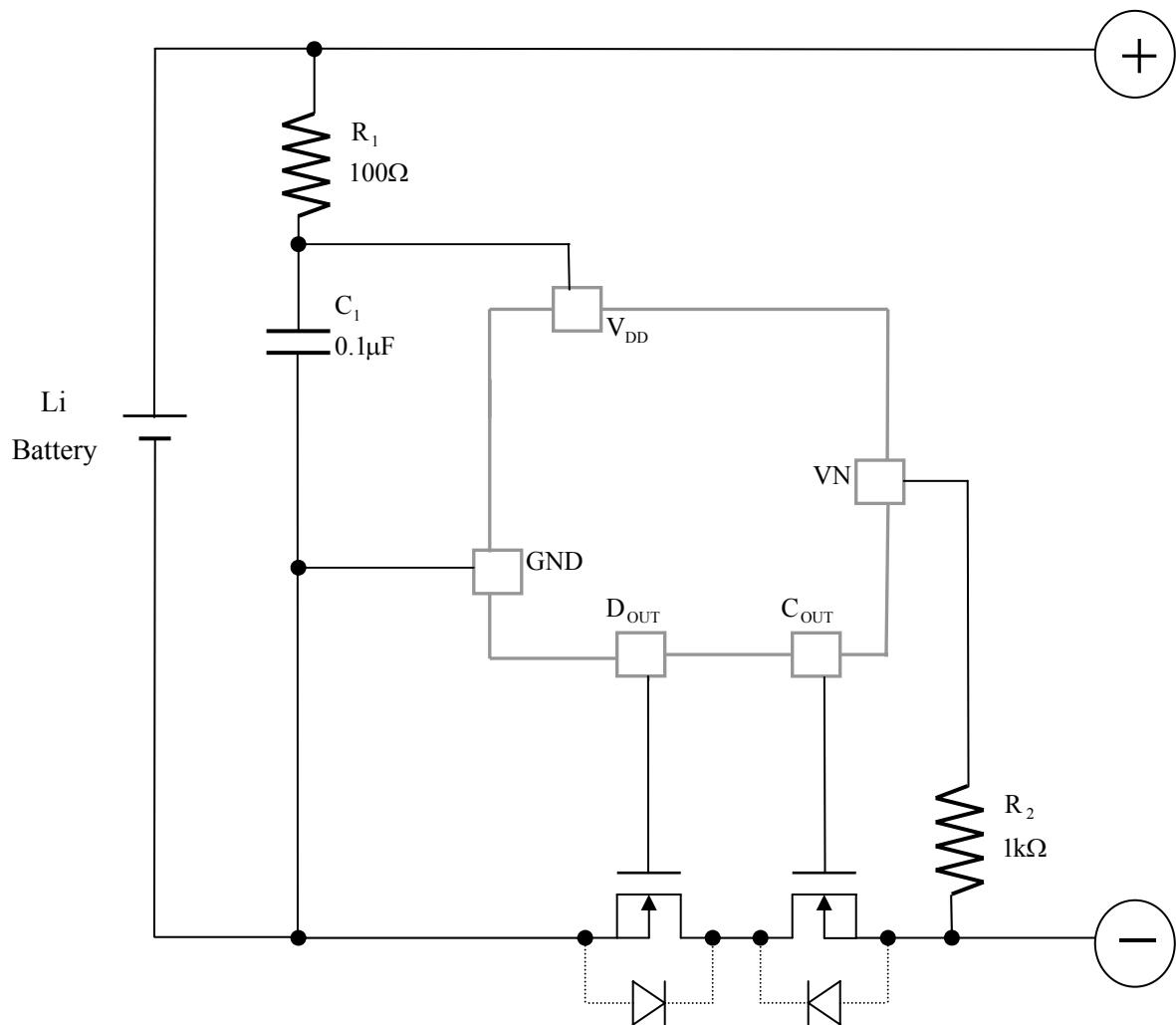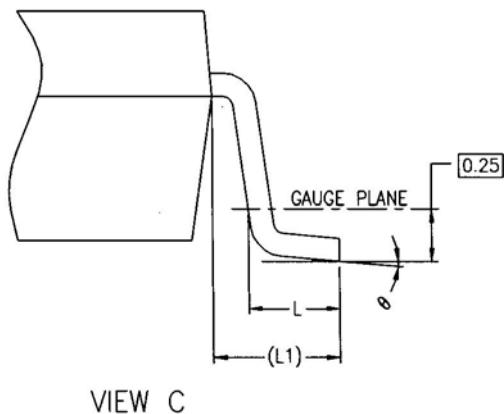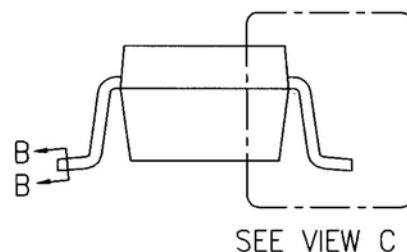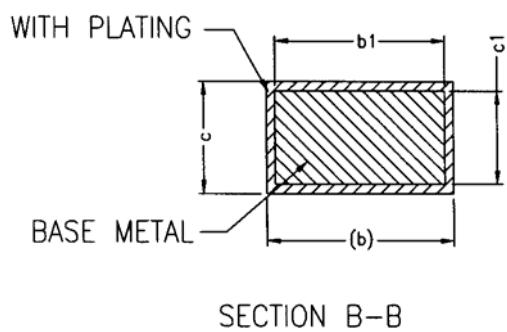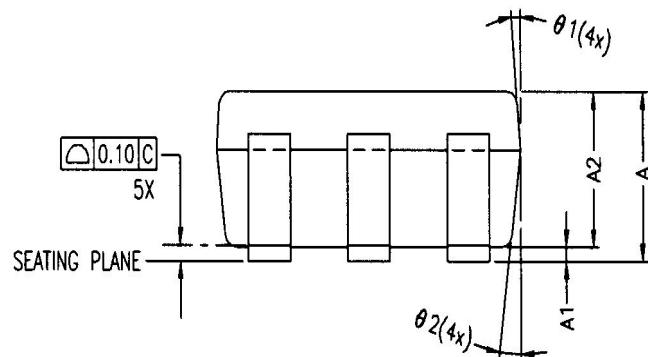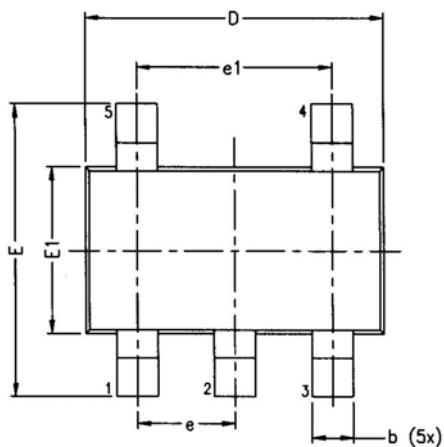
VIEW C

PACKAGE DIMENSION (CONT.)

SYMBOLS	DIMENSIONS IN MILLIMETERS			DEMINSIONS IN INCHES		
	MIN	TYP	MAX	MIN	TYP	MAX
A	1.05	1.20	1.35	0.041	0.047	0.053
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	1.00	1.10	1.20	0.039	0.043	0.047
b	0.25	------	0.50	0.010	------	0.020
b1	0.25	0.40	0.45	0.010	0.016	0.018
c	0.08	------	0.20	0.003	------	0.008
c1	0.08	0.11	0.15	0.003	0.004	0.006
D	2.70	2.90	3.00	0.106	0.114	0.118
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
L	0.35	0.45	0.55	0.014	0.018	0.022
L1	0.60 REF			0.024 REF		
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
θ	0°	5°	10°	0°	5°	10°
θ1	3°	5°	7°	3°	5°	7°
θ2	6°	8°	10°	6°	8°	10°

NOTE:

1. DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
    MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.20 MILLIMETERS PER SIDE.
2. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.
     INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.20MILLIMETERS PER SIDE.
3. THE PACKAGE TOP MAY BE SAMLLER THAN PACKAGE BOTTOM.
    DIMENSION D AND E1 ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY
    EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, INTERLEAD FLASH AND GATE BURRS, BUT
    INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE MOLDED BODY.
4. THE SECTION B-B APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 MILLIMETERES AND
    0.15 MILLIMETERS FROM THE LEAD TIP
5. LEAD FRAME MATERIAL: EFTEC-64T 1/2H OR H.

TAPE AND REEL

REEL COLOR : BLACK

40PCS(MIN.)　3000PCS　40PCS(MIN.)　TAPE SEALING

DETAIL "A"　DETAIL "B"
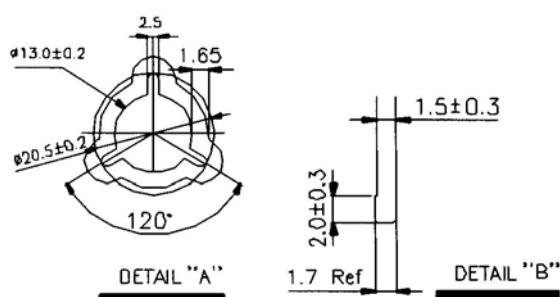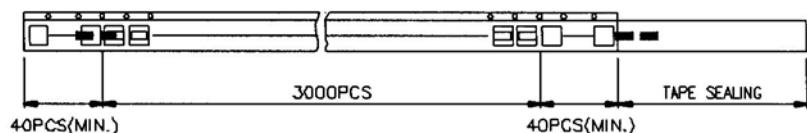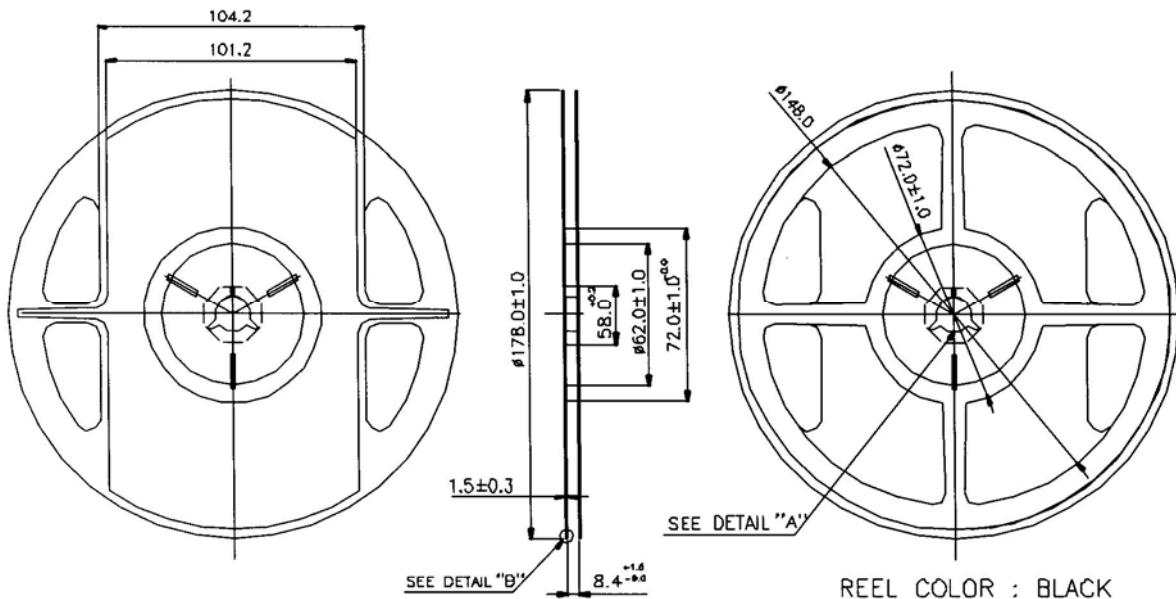
TAPE AND REEL (CONT.)

SOT-25

SECTION A-A
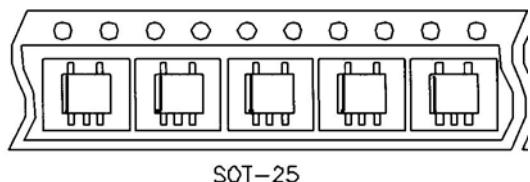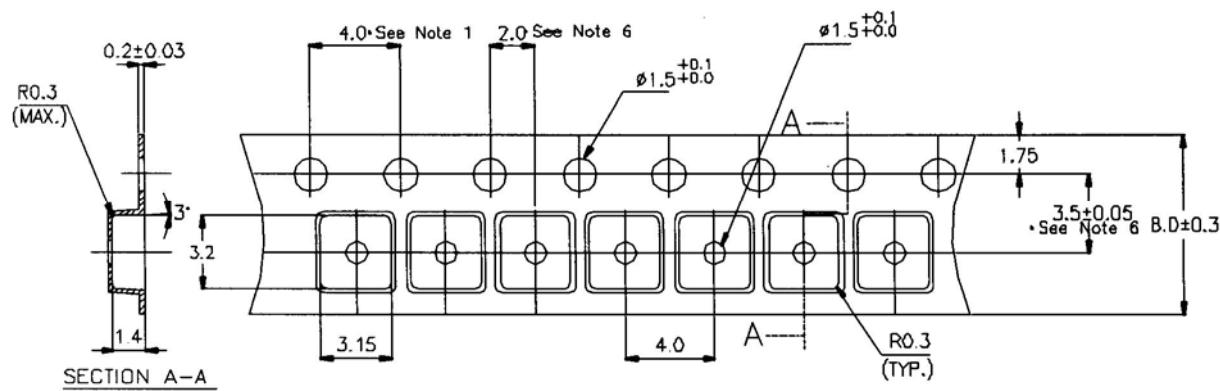
```
X.XXX X      ±  0.0025
X.XXX        ±  0.006
X.XX         ±  0.025
X.X          ±  0.10
X            ±  0.25
```

UNIT: MILLIMETERS

ORDERING INFORMATION

AAT xxxxx-xx-x

AAT Part Number

Package Code 1
Sot25: S5

Package Code 2
T=Taping Reel
Blank=Tube or Tray

Remark:
T=Taping Reel
PS.
Sot25→3,000pcs/reel

Blank=Tube