



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:  
3 $\mu$ A Supply Current (Typical)  
0.1 $\mu$ A Shutdown Current
- 3-Level Over Current Detection:  
Over-Current Level 1 /Over Current Level 2 / Short Circuit
- Wide Operating Temperature Range:  
– 40°C to 85°C
- Small SOT25 Package

### GENERAL DESCRIPTION

The AAT8640 series are designed to protect 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 and low current consumption.

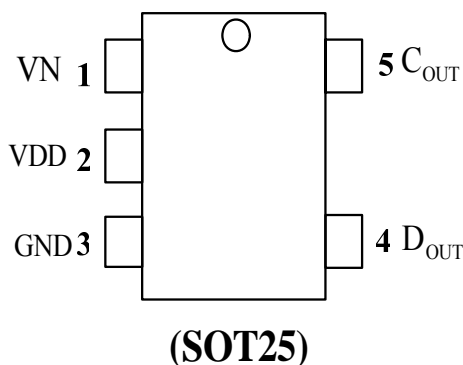
Each of the AAT8640 devices incorporates voltage comparators, bandgap reference voltage generator, signal delay circuit, short circuit detector, and digital control circuit.

In the charge process, when the battery voltage is charged to a value greater than  $V_{C1}$  (Over-Charge Threshold Voltage), the output of  $C_{out}$  pin switches to the low level, i.e., the  $V_N$  pin level. The output of  $C_{out}$  pin will switch to high level when the battery voltage falls lower than  $V_{C2}$  (Over-Charge Release Voltage), or when the charger is disconnected from the battery pack and the battery voltage level ranges 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).

### PIN CONFIGURATION

#### TOP VIEW



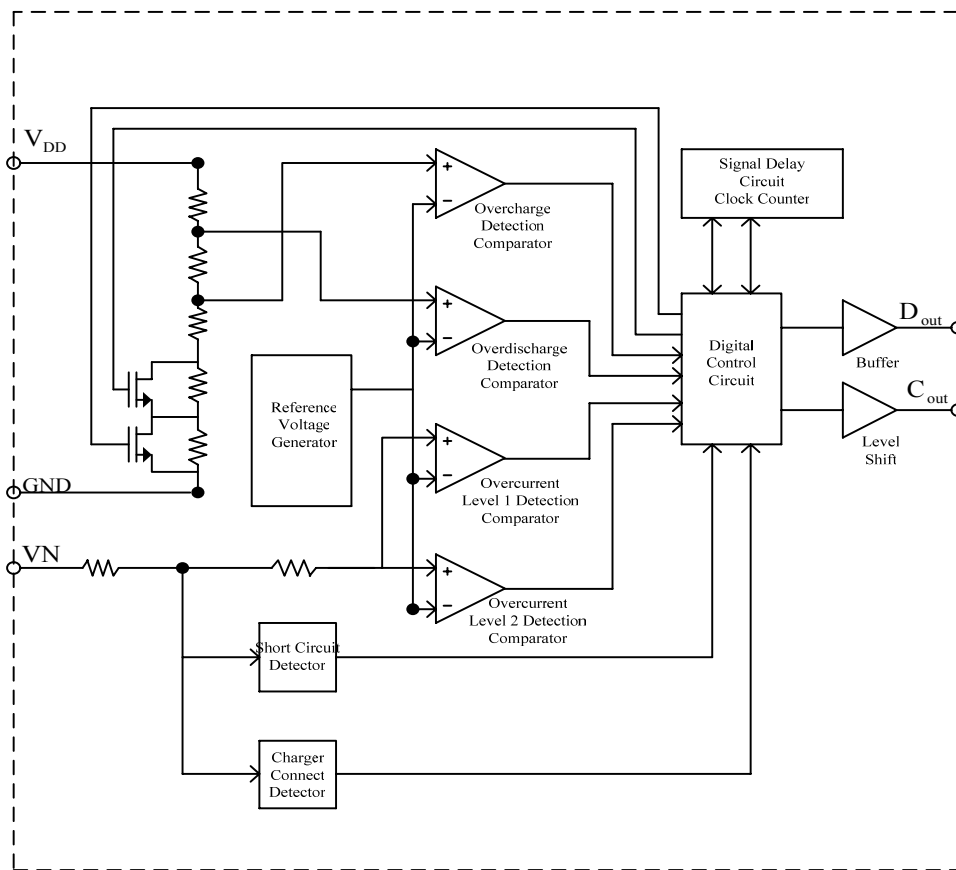


Over current level 1 voltage ( $V_{OC1}$ ) is used to monitor the amount of discharge current. If the discharge current is high enough to cause VN pin voltage increase to a value greater than  $V_{OC1}$ , the output of  $D_{out}$  pin will switch to a low level after a delay time  $t_{OC1}$ . If the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

The mechanism of short circuit protection is

identical to a discharge current. If the short circuit current is high enough to cause VN pin voltage increase to greater than  $V_{short}$ , the output of  $D_{out}$  pin will move to the 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:**



**PIN DESCRIPTION**

PIN NO.	NAME	I/O	DESCRIPTION
1	VN	I	Voltage Detection Pin Between VN and GND
2	VDD	I	Power Supply Input Pin
3	GND		Ground
4	D <sub>out</sub>	O	Discharge Control Pin which Connects to External MOSFET Gate
5	C <sub>out</sub>	O	Charge Control Pin which Connects to External MOSFET Gate.

**ABSOLUTE MAXIMUM RATINGS**

CHARACTERISTICS	SYMBOL	VALUE	UNIT
Supply Voltage	V <sub>DD</sub>	-0.3 to 8.0	V
VN Pin Input Voltage	V <sub>VN</sub>	V <sub>DD</sub> - 20 to V <sub>DD</sub> + 0.3	V
D <sub>out</sub> Pin Output Voltage	V <sub>Dout</sub>	-0.3 to V <sub>DD</sub> + 0.3	V
C <sub>out</sub> Pin Output Voltage	V <sub>Cout</sub>	V <sub>VN</sub> - 0.3 to V <sub>DD</sub> + 0.3	V
Power Dissipation	P <sub>d</sub>	150	mW
Operating Temperature Range	T <sub>C</sub>	-40 to +85	°C
Storage Temperature Range	T <sub>storage</sub>	-40 to +125	°C

**RECOMMENDED OPERATING CONDITIONS**

	TEST CONDITION	MIN	MAX	UNIT
Supply Voltage, V <sub>DD</sub>	Voltage Defined as V <sub>DD</sub> to GND	1.5	7.0	V
D <sub>out</sub> Output Voltage		GND	V <sub>DD</sub>	V
C <sub>out</sub> Output Voltage		VN	V <sub>DD</sub>	V

**OPERATION VOLTAGE AND OPERATION CURRENT**

PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
Supply Current at Normal Operation Mode	V <sub>DD</sub> =3.3V; VN=0V; GND=0V		3.0	6.0	μA
Standby Current at Power Down Mode		-	-	0.1	μA
Operation Voltage between V <sub>DD</sub> and VN		1.5		20.0	V



**AAT8640A DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.275	4.325	4.375	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.35$	$V_{C1}-0.25$	$V_{C1}-0.15$	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	$\mu$ s
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	k $\Omega$
$C_{out}$ Low Level Resistance	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ; $VN = 0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Level Resistance	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN = 0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Level Resistance	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN = 1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN = 0V$	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN = 3.5V$	50	150	300	k $\Omega$



**AAT8640B DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.300	4.350	4.400	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.20$	$V_{C1}-0.10$	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. $\Rightarrow$ 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	$\mu$ s
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	k $\Omega$
$C_{out}$ Low Level Resistance	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{OUT} = 0.5V$ ; $VN = 0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Level Resistance	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN = 0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Level Resistance	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN = 1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN = 0V$	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN = 3.5V$	50	150	300	k $\Omega$



**AAT8640C DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.250	4.300	4.350	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.20$	$V_{C1}-0.10$	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	$\mu$ S
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	k $\Omega$
$C_{out}$ Low Level Resistance	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ; $VN = 0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Level Resistance	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN = 0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Level Resistance	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN = 1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN = 0V$	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN = 3.5V$	50	150	300	k $\Omega$



**AAT8640D DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.230	4.280	4.330	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.20$	$V_{C1}-0.10$	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	$\mu$ s
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	k $\Omega$
$C_{out}$ Low Level Resistance	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ; $VN = 0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Level Resistance	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN = 0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Level Resistance	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN = 1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN=0V$	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN = 3.5V$	50	150	300	k $\Omega$



**AAT8640E DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.230	4.280	4.330	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.20$	$V_{C1}-0.10$	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	$\mu$ s
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	k $\Omega$
$C_{out}$ Low Level Resistance	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ; $VN = 0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Level Resistance	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN = 0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Level Resistance	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN = 1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN = 0V$	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN = 3.5V$	50	150	300	k $\Omega$





**AAT8640F DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.275	4.325	4.375	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.35$	$V_{C1}-0.25$	$V_{C1}-0.15$	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	$\mu$ s
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	k $\Omega$
$C_{out}$ Low Level Resistance	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ; $VN = 0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Level Resistance	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN=0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Level Resistance	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN=1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN = 0V$	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN=3.5V$	50	150	300	k $\Omega$



**AAT8640G DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.300	4.350	4.400	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.20$	$V_{C1}-0.10$	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	5.2	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	$\mu$ s
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 Resistance Level	$R_{COH}$	$V_{DD} = 3.5V$ ; $C_{out} = 3.0V$ ; $VN=0V$	1	2	10	k $\Omega$
$C_{out}$ Low Resistance Level	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ; $VN=0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Resistance Level	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN=0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Resistance Level	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN=1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN=0V$	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN=3.5V$	50	150	300	k $\Omega$



**AAT8640H DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.250	4.300	4.350	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.20$	$V_{C1}-0.10$	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	$\mu$ s
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 Resistance Level	$R_{COH}$	$V_{DD} = 3.5V$ ; $C_{out} = 3.0V$ ; $VN=0V$	1	2	10	k $\Omega$
$C_{out}$ Low Resistance Level	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ; $VN=0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Resistance Level	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN=0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Resistance Level	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN=1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN=0V$	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN=3.5V$	50	150	300	k $\Omega$



**AAT8640I DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.250	4.300	4.350	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.20$	$V_{C1}-0.10$	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	$\mu$ s
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 Resistance Level	$R_{COH}$	$V_{DD} = 3.5V$ ; $C_{out} = 3.0V$ ; $VN=0V$	1	2	10	k $\Omega$
$C_{out}$ Low Resistance Level	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ; $VN=0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Resistance Level	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN=0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Resistance Level	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN=1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN=0V$	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN=3.5V$	50	150	300	k $\Omega$



**AAT8640J DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect Rising Edge of Supply Voltage	4.230	4.280	4.330	V
Over Charge Release Voltage	$V_{C2}$	Detect Falling Edge of Supply Voltage	$V_{C1}-0.30$	$V_{C1}-0.20$	$V_{C1}-0.10$	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	$\mu$ s
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	k $\Omega$
$C_{out}$ Low Level Resistance	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ;VN=0V	150	602	2,380	k $\Omega$
$D_{out}$ High Level Resistance	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ;VN=0V	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Level Resistance	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ;VN=1.8V	2.5	5.0	10.0	k $\Omega$
Internal Resistance between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; VN=0V	100	300	900	k $\Omega$
Internal Resistance between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; VN=3.5V	50	150	300	k $\Omega$



**AAT8640K DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	Detect rising edge of supply voltage	4.20	4.25	4.30	V
Over Charge Release Voltage	$V_{C2}$	Detect falling edge of supply voltage	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	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	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	$\mu s$
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	k $\Omega$
$C_{out}$ Low Level Resistance	$R_{COL}$	$V_{DD} = 4.5V$ ; $C_{out} = 0.5V$ ; $VN=0V$	150	602	2,380	k $\Omega$
$D_{out}$ High Level Resistance	$R_{DOH}$	$V_{DD} = 3.5V$ ; $D_{out} = 3.0V$ ; $VN=0V$	2.5	5.0	10.0	k $\Omega$
$D_{out}$ Low Level Resistance	$R_{DOL}$	$V_{DD} = 1.8V$ ; $D_{out} = 0.5V$ ; $VN=1.8V$	2.5	5.0	10.0	k $\Omega$
Internal Resistance Between VN and $V_{DD}$	$R_{VND}$	$V_{DD} = 1.8V$ ; $VN=0V$	100	300	900	k $\Omega$
Internal Resistance Between VN and GND	$R_{VNG}$	$V_{DD} = 3.5V$ ; $VN=3.5V$	50	150	300	k $\Omega$



**SUMMARY OF AAT8640 DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	DEVICE	MIN	TYP	MAX	UNIT
Over Charge Threshold Voltage	$V_{C1}$	AAT8640A	4.275	4.325	4.375	V
		AAT8640B	4.30	4.35	4.40	V
		AAT8640C	4.25	4.3	4.35	V
		AAT8640D	4.23	4.28	4.33	V
		AAT8640E	4.23	4.28	4.33	V
		AAT8640F	4.275	4.325	4.375	V
		AAT8640G	4.3	4.35	4.4	V
		AAT8640H	4.25	4.3	4.35	V
		AAT8640I	4.25	4.3	4.35	V
		AAT8640J	4.23	4.28	4.33	V
		AAT8640K	4.20	4.25	4.30	V
Over Charge Release Voltage	$V_{C2}$	AAT8640A	$V_{C1}-0.35$	$V_{C1}-0.25$	$V_{C1}-0.15$	V
		AAT8640B	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	V
		AAT8640C	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	V
		AAT8640D	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	V
		AAT8640E	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	V
		AAT8640F	$V_{C1}-0.35$	$V_{C1}-0.25$	$V_{C1}-0.15$	V
		AAT8640G	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	V
		AAT8640H	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	V
		AAT8640I	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	V
		AAT8640J	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	V
		AAT8640K	$V_{C1}-0.3$	$V_{C1}-0.2$	$V_{C1}-0.1$	V
Over Discharge Threshold Voltage	$V_{D1}$	AAT8640A	2.420	2.5	2.580	V
		AAT8640B	2.220	2.3	2.380	V
		AAT8640C	2.220	2.3	2.380	V
		AAT8640D	2.201	2.281	2.361	V
		AAT8640E	2.201	2.281	2.361	V
		AAT8640F	2.420	2.5	2.580	V
		AAT8640G	2.220	2.3	2.380	V
		AAT8640H	2.220	2.3	2.380	V
		AAT8640I	2.220	2.3	2.380	V
		AAT8640J	2.201	2.281	2.361	V
		AAT8640K	2.201	2.281	2.361	V



**SUMMARY OF AAT8640 DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	DEVICE	MIN	TYP	MAX	UNIT
Over Discharge Release Voltage	$V_{D2}$	AAT8640A	$V_{D1}+0.3$	$V_{D1}+0.4$	$V_{D1}+0.5$	V
		AAT8640B	$V_{D1}+0.6$	$V_{D1}+0.7$	$V_{D1}+0.8$	V
		AAT8640C	$V_{D1}-0.08$	$V_{D1}$	$V_{D1}+0.08$	V
		AAT8640D	$V_{D1}-0.08$	$V_{D1}$	$V_{D1}+0.08$	V
		AAT8640E	$V_{D1}+0.5$	$V_{D1}+0.6$	$V_{D1}+0.7$	V
		AAT8640F	$V_{D1}+0.3$	$V_{D1}+0.4$	$V_{D1}+0.5$	V
		AAT8640G	$V_{D1}+0.6$	$V_{D1}+0.7$	$V_{D1}+0.8$	V
		AAT8640H	$V_{D1}-0.08$	$V_{D1}$	$V_{D1}+0.08$	V
		AAT8640I	$V_{D1}-0.08$	$V_{D1}$	$V_{D1}+0.08$	V
		AAT8640J	$V_{D1}-0.08$	$V_{D1}$	$V_{D1}+0.08$	V
	AAT8640K	$V_{D1}+0.5$	$V_{D1}+0.6$	$V_{D1}+0.7$	V	
Over Charge Delay Time	$t_{C1}$	AAT8640A	0.700	1	1.300	s
		AAT8640B	0.088	0.125	0.163	s
		AAT8640C	0.700	1	1.300	s
		AAT8640D	0.700	1	1.300	s
		AAT8640E	0.700	1	1.300	s
		AAT8640F	0.700	1	1.300	s
		AAT8640G	0.088	0.125	0.163	s
		AAT8640H	0.700	1	1.300	s
		AAT8640I	0.700	1	1.300	s
		AAT8640J	0.700	1	1.300	s
	AAT8640K	0.700	1	1.300	s	
Over Discharge Delay Time	$t_{D1}$	AAT8640A	87.5	125	162.5	ms
		AAT8640B	22.4	32	41.6	ms
		AAT8640C	87.5	125	162.5	ms
		AAT8640D	87.5	125	162.5	ms
		AAT8640E	87.5	125	162.5	ms
		AAT8640F	87.5	125	162.5	ms
		AAT8640G	22.4	32	41.6	ms
		AAT8640H	87.5	125	162.5	ms
		AAT8640I	87.5	125	162.5	ms
		AAT8640J	87.5	125	162.5	ms
	AAT8640K	87.5	125	162.5	ms	



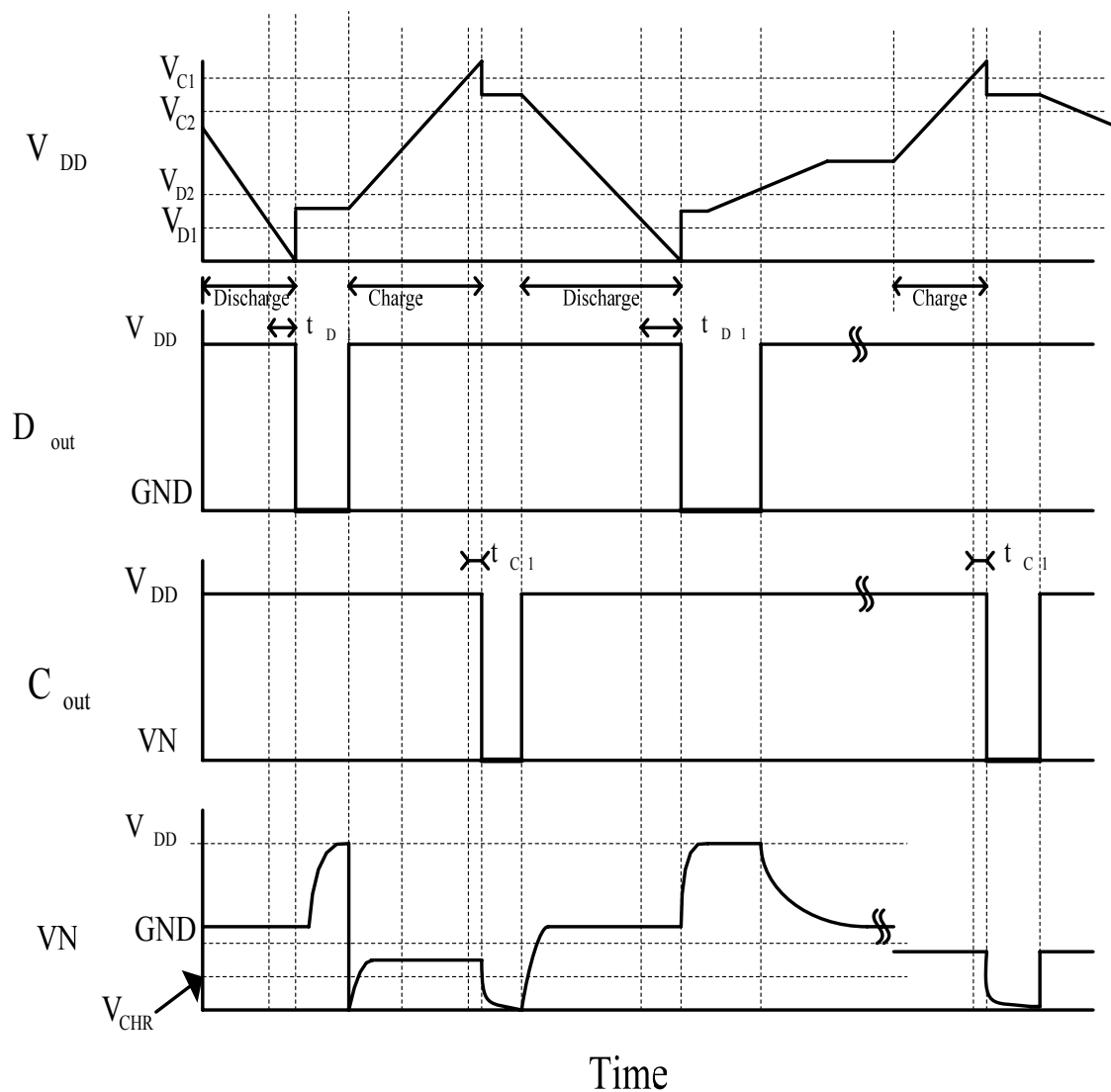


**SUMMARY OF AAT8640 DETECTION VOLTAGE AND DELAY TIME (25°C)**

PARAMETER	SYMBOL	DEVICE	MIN	TYP	MAX	UNIT
Over Current Level 1 Detection Voltage	V <sub>OC1</sub>	AAT8640A	130	150	170	mV
		AAT8640B	130	150	170	mV
		AAT8640C	80	100	120	mV
		AAT8640D	110	130	150	mV
		AAT8640E	80	100	120	mV
		AAT8640F	80	100	120	mV
		AAT8640G	180	200	220	mV
		AAT8640H	130	150	170	mV
		AAT8640I	110	130	150	mV
		AAT8640J	180	200	220	mV
		AAT8640K	80	100	120	mV
Over Current Level 2 Detection Voltage	V <sub>OC2</sub>	AAT8640A	400	500	600	mV
		AAT8640B	400	500	600	mV
		AAT8640C	400	480	600	mV
		AAT8640D	400	490	600	mV
		AAT8640E	400	480	600	mV
		AAT8640F	400	480	600	mV
		AAT8640G	400	510	600	mV
		AAT8640H	400	500	600	mV
		AAT8640I	400	490	600	mV
		AAT8640J	400	510	600	mV
		AAT8640K	400	480	600	mV
Over Current Level 1 Detection Delay Time	t <sub>OC1</sub>	AAT8640A	5.6	8	10.4	ms
		AAT8640B	2.8	4	5.2	ms
		AAT8640C	5.6	8	10.4	ms
		AAT8640D	5.6	8	10.4	ms
		AAT8640E	5.6	8	10.4	ms
		AAT8640F	5.6	8	10.4	ms
		AAT8640G	2.8	4	5.2	ms
		AAT8640H	5.6	8	10.4	ms
		AAT8640I	5.6	8	10.4	ms
		AAT8640J	5.6	8	10.4	ms
		AAT8640K	5.6	8	10.4	ms



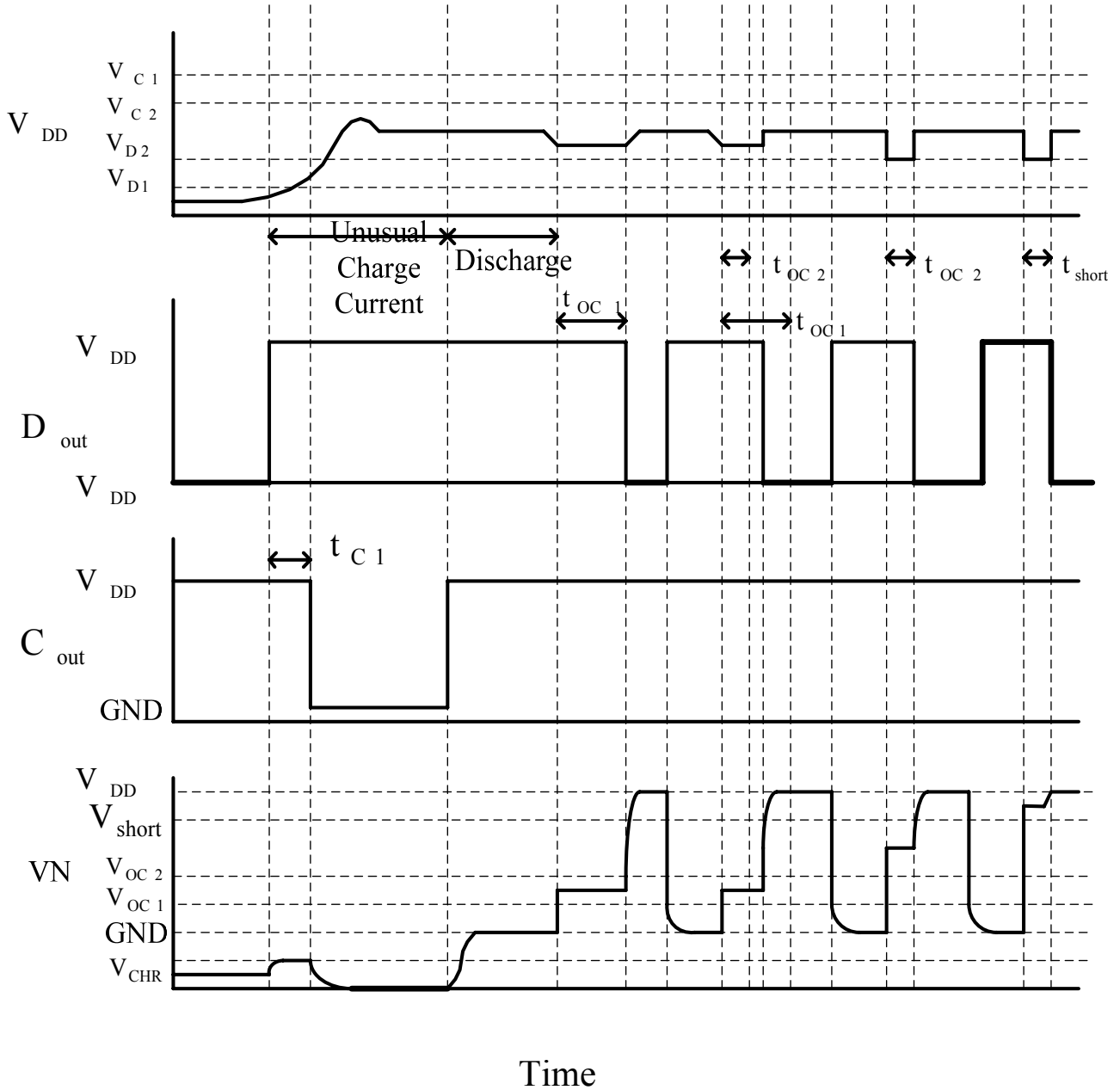
**TIMING CHART**  
**AAT8640 (CHARGE AND DISCHARGE)**





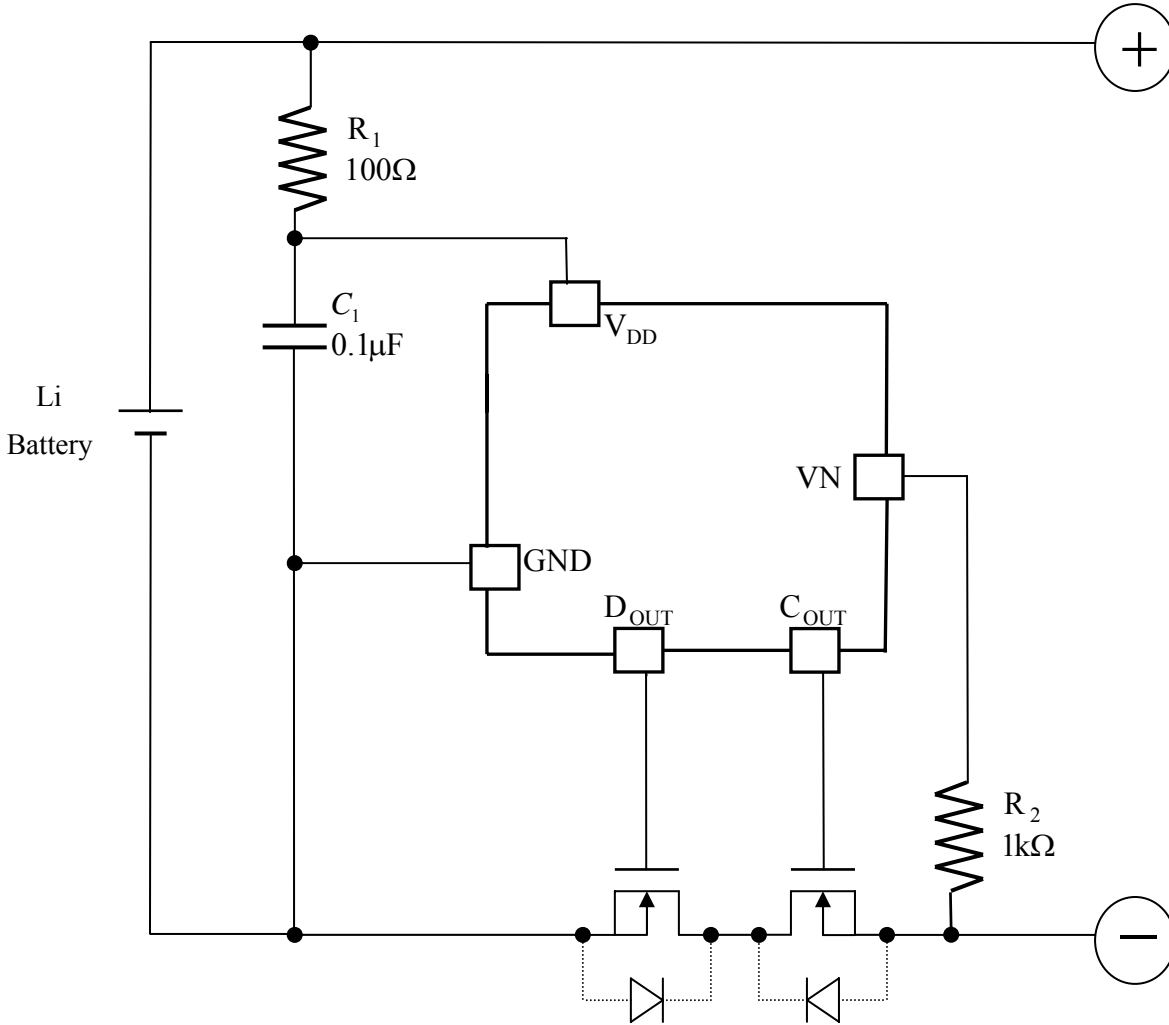
**TIMING CHART**

**AAT8640 (UNUSUAL CHARGE CURRENT, OVER CURRENT, SHORT CIRCUIT)**



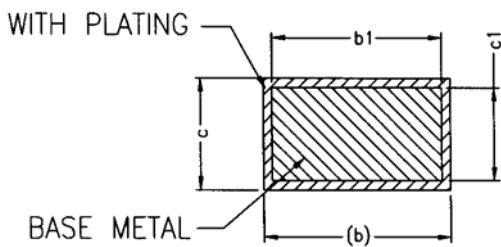
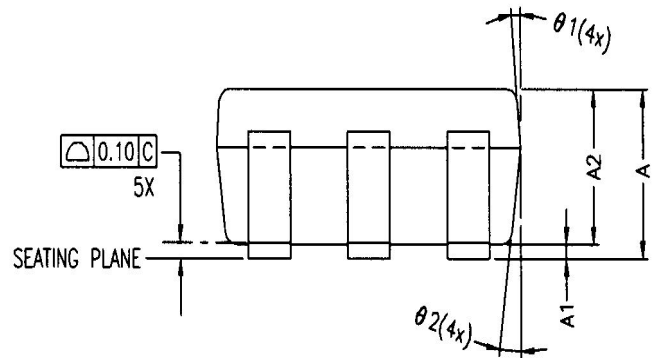
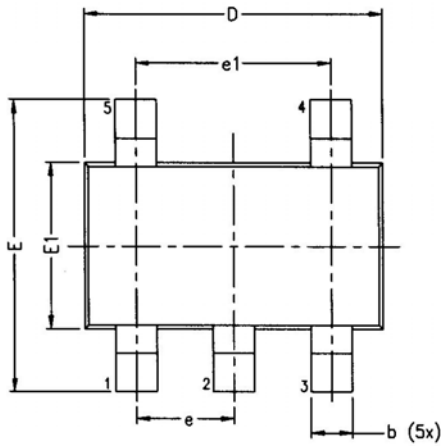


TYPICAL APPLICATION

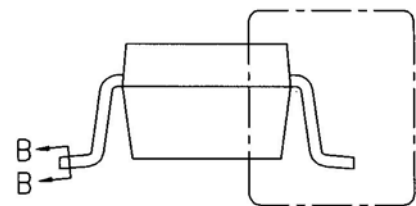




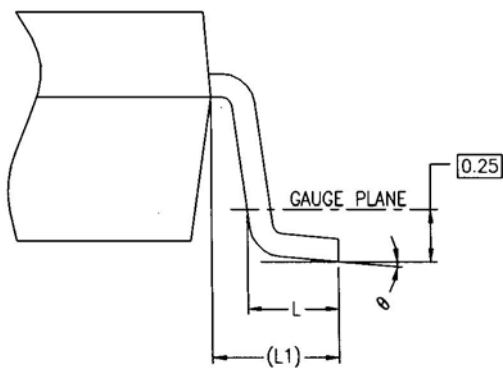
PACKAGE DIMENSION



SECTION B-B



SEE VIEW C



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°

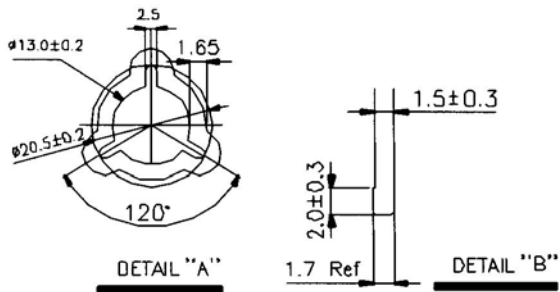
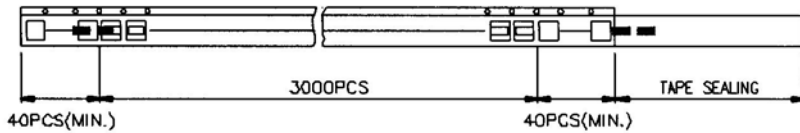
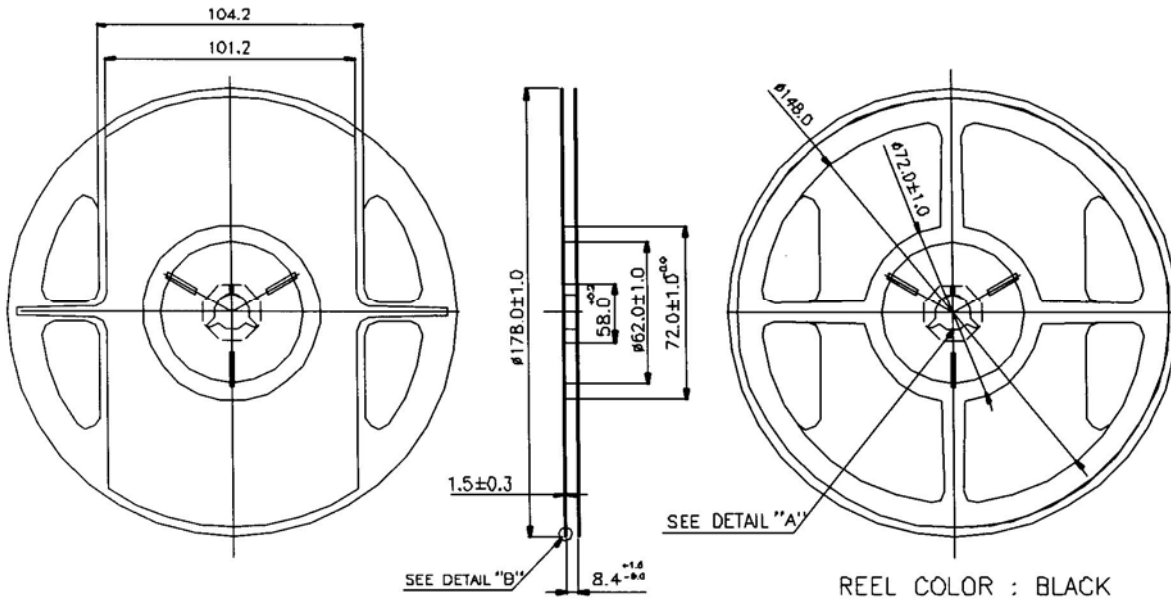
NOTE:

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 SAMLER 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.



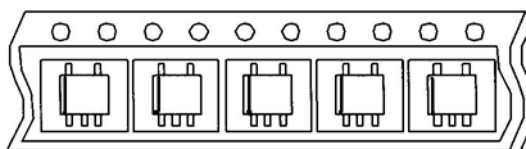
**TAPE AND REEL**

**PACKING METHOD: 3,000PCS/REEL, 5 REELS/BOX**

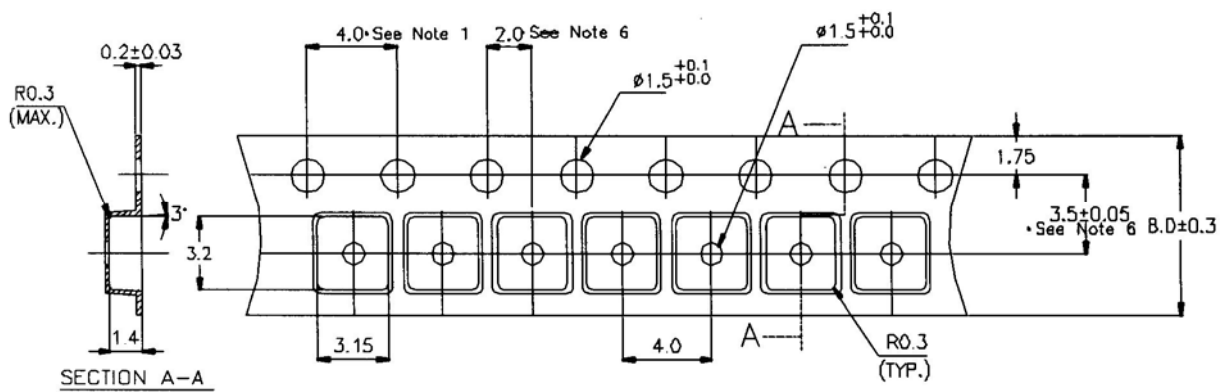




TAPE AND REEL (CONT.)



SOT-25



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**