



HY2212-BB3A

Data Sheet

1-Cell LiFePO4
Battery Packs Charge Balance IC

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Attention :

1. HYCON Technology Corp. reserves the right to change the content of this datasheet without further notice. For most up-to-date information, please constantly visit our website:
<http://www.hycontek.com> .
2. HYCON Technology Corp. is not responsible for problems caused by figures or application circuits narrated herein whose related industrial properties belong to third parties.
3. Specifications of any HYCON Technology Corp. products detailed or contained herein stipulate the performance, characteristics, and functions of the specified products in the independent state. We does not guarantee of the performance, characteristics, and functions of the specified products as placed in the customer's products or equipment. Constant and sufficient verification and evaluation is highly advised.
4. Please note the operating conditions of input voltage, output voltage and load current and ensure the IC internal power consumption does not exceed that of package tolerance. HYCON Technology Corp. assumes no responsibility for equipment failures that resulted from using products at values that exceed, even momentarily, rated values listed in products specifications of HYCON products specified herein.
5. Notwithstanding this product has built-in ESD protection circuit, please do not exert excessive static electricity to protection circuit.

1. General Description

HY2212-BB3A is best created for multi-cell battery packs to single-cell lithium-ion battery Charge balance control, electrical level monitoring ICs and it also comprises high-accuracy voltage detection circuit and delay circuit. This IC is suitable for multi-cell battery packs to a single-cell lithium-ion battery charge balance control.

2. Features

(1) High-accuracy voltage detection circuit.

- | | | |
|--------------------------------|--------|-----------------------------|
| ● Overcharge detection voltage | 3.600V | Accuracy: $\pm 25\text{mV}$ |
| ● Overcharge release voltage | 3.590V | Accuracy: $\pm 35\text{mV}$ |
| ● Standby detection voltage | 2.70V | Accuracy: $\pm 15\%$ |
| ● Standby release voltage | 2.70V | Accuracy: $\pm 15\%$ |

(2) Delay times are generated by an internal circuit (external capacitors are unnecessary).

(3) Low current consumption (Standby Status).

- | | |
|------------------|--|
| ● Operation mode | Typical 2.5 μA , Max 3.5 μA (VDD=3.2V) |
| ● Standby mode | Max 0.5 μA (VDD=2.0V) |

(4) Wide operating temperature range -40°C to $+85^{\circ}\text{C}$

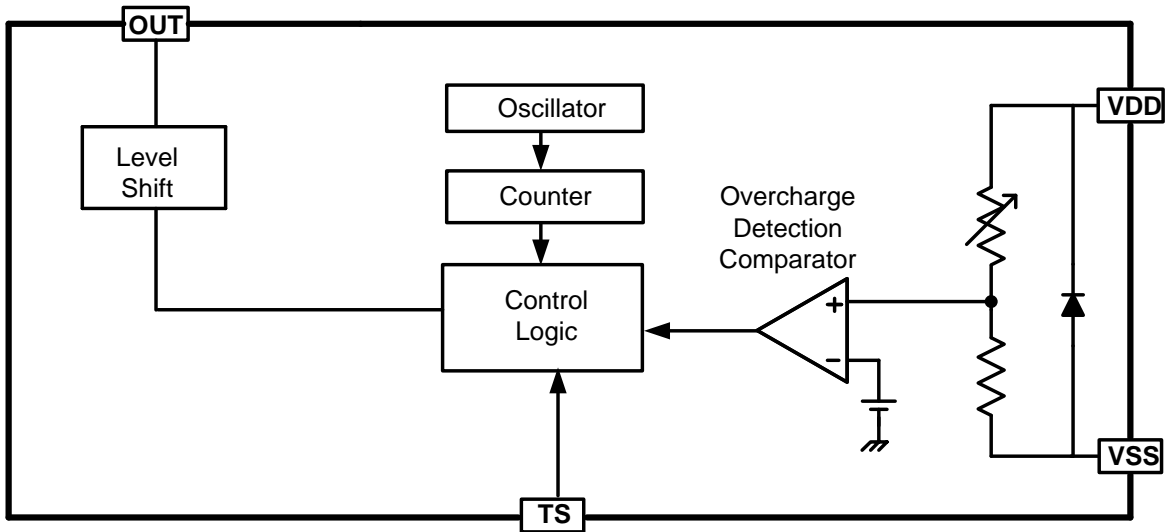
(5) Small Package: SOT-23-6

(6) The HY2212-BB3A is Halogen-free, green package

3. Applications

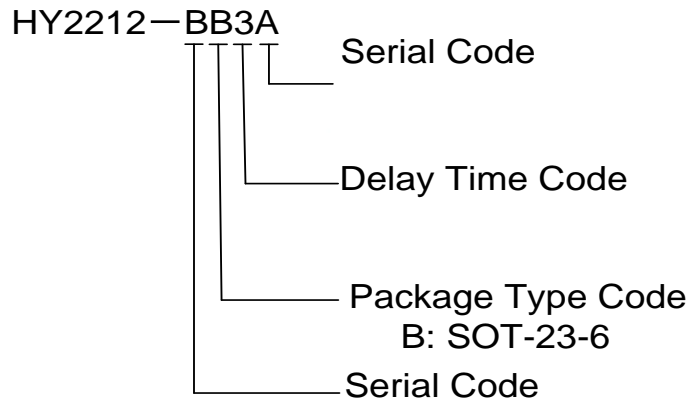
- Multi Cells LiFePO4 Rechargeable Battery Packs.

4. Block Diagram



5. Ordering Information

- Product Name define

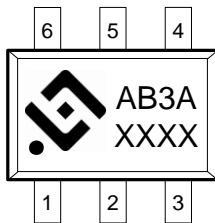


6. Pin Configuration and Package Marking Information

- SOT-23-6 Package

Table 4 SOT-23-6 Package

| PIN | Symbol | Description |
|-----|--------|--|
| 1 | NC | No connection |
| 2 | VDD | Power supply pin |
| 3 | VSS | Ground pin |
| 4 | NC | No connection |
| 5 | NC | No connection |
| 6 | OUT | Charge balance, Control MOSFET gate connection pin |



- A: Product Name Code.
- B: Serial Code.
- 3: Delay Time code.
- A: Characteristics Code.
- XXXX: Traceability Code.

7. Electrical Characteristics

7.1. Absolute Maximum Ratings

Table 5 Absolute Maximum Ratings (VSS=0V, Ta=25°C, unless otherwise specified)

| Item | Symbol | Specification | Unit |
|---------------------------------------|-----------------|-----------------|------|
| Input voltage between VDD and VSS pin | V _{DD} | VSS-0.3~VSS+10 | V |
| OUT Output pin voltage | V _{OC} | VSS-0.3~VDD+0.3 | V |
| Operating Temperature Range | T _{OP} | -40~+85 | °C |
| Storage Temperature Range | T _{ST} | -40~+125 | °C |
| Power dissipation | P _D | 250 | mW |

7.2. Electrical Parameters(Except Delay time)

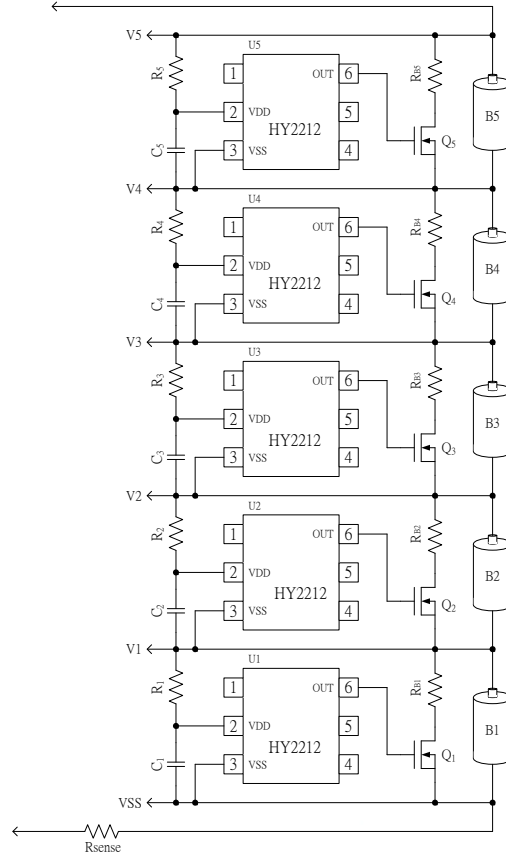
Table 6 Electrical Parameters (Except Delay time. VSS=0V, Ta=25°C, unless otherwise specified)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|--------------|--------------------------------|---------|----------|-------|---------|
| INPUT VOLTAGE/ Current Consumption. | | | | | | |
| Operating voltage between VDD pin and VSS pin | V_{DSOP1} | - | 1.5 | - | 8 | V |
| Supply Current | I_{DD} | $V_{DD}=3.2V$ | - | 2.5 | 3.5 | μA |
| Standby Current | I_{SB} | $V_{DD}=2.0V$ | - | 0.15 | 0.5 | μA |
| DETECTION VOLTAGE | | | | | | |
| Overcharge Detection Voltage | V_{CU} | | 3.575 | 3.600 | 3.625 | V |
| | | -5°C~55°C (*1) | 3.565 | 3.600 | 3.635 | V |
| Overcharge Release Voltage | V_{CR} | | 3.555 | 3.590 | 3.625 | V |
| Standby Detection Voltage | V_{SB} | | 2.30 | 2.70 | 3.10 | V |
| DELAY TIME | | | | | | |
| Overcharge Delay Time | T_{OC} | $V_{DD}=3.2V \rightarrow 4.5V$ | 200 | 250 | 300 | ms |
| CONTROL PIN OUTPUT VOLTAGE | | | | | | |
| OUT PIN output High voltage | V_{OUT_H} | | VDD-0.1 | VDD-0.02 | - | V |
| OUT PIN output Low voltage | V_{OUT_L} | | - | 0.1 | 0.5 | V |

Description: (*1) Since product are not screened by high or low temperature, the specification for this temperature is guaranteed by design. Not test in product.

8. Example of Battery Protection IC Connection

Example of HY2212-BB3A using N-MOSFET charge balance Application



| Symbol | Device Name | Purpose | Min. | Typ. | Max. | Remark |
|-------------------|-------------|--|--------|-------|-------|--------|
| R1-5 | Resistor | Limit current, stabilize VDD and strengthen ESD protection | 100Ω | 100Ω | 200Ω | *1 |
| R _{B1-5} | Resistor | Charge balance release load | | | | *2 |
| C1-5 | Capacitor | Filtering, stable VDD | 0.01μF | 0.1μF | 1.0μF | *3 |
| Q1-5 | N-MOSFET | Charge balance control | - | - | - | *4 |

- *1. If R1-5 connects with an over-spec resistor, battery accuracy may be influenced due to current consumption cause R1 voltage drops. When a charger is connected in reversed, the current flows from the charger to the IC. At this time, if R1 is too high, the voltage between VDD pin and VSS pin may exceed the absolute maximum rating.
- *2. R_{B1-5} connects with an under-spec resistor, when battery voltage exceed Overcharge Detection Voltage(V_{CU}) will let charge current suddenly become large, which may result in charge overcurrent phenomenon which allows circuit system be protected and can not be charged.
- *3. C1-5 can stabilize the supply voltage of VDD, Do not connect capacitor that under 0.01μF.
- *4. To select N-MOSFET.

Caution:

1. The above constants may be changed without notice, please download the most up-to-date datasheet

on our website. <http://www.hycontek.com>

2. It is advised to perform thorough evaluation and test if peripheral devices need to be amended.

9. Description of Operation

9.1. Normal Status

This IC continuously monitors the voltage of the battery connected between the VDD and VSS, to control charge and discharge. When battery voltage exceed overcharge detection voltage (V_{CU}), OUT pin electrical level change from low to high to control N-MOSFET; or the voltage of the battery cell lower than the overcharge release voltage (V_{CR}), OUT pin output electrical level change from high to low to control N-MOSFET to turn off. This status is called “Normal status” Which also can freely operate while charging.

9.2. Overcharge Status

Under the normal status, as soon as the battery voltage becomes higher than the overcharge detection voltage (V_{CU}) during charge and the detection time continues longer than the overcharge detection delay time (TOC) ; or the voltage of the battery voltage lower than the overcharge release voltage (V_{CR}) , HY2212-BB3A will turn the MOSFET (OUT pin) on or off, this condition is called the “Overcharge status” or “Charge balance control” .

Overcharge status has following options turning charge control balance MOSFET on and off :

(1) Selection of HY2212-BB3A , using the N-MOSFET as the charge balance control

(a) During charging process, the battery voltage becomes higher than the overcharge detection voltage (V_{CU}) and the detection time continues longer than the overcharge detection delay time (TOC), OUT pin will produce L→H to turn on N-MOSFET.

(b) During charging process, the battery voltage is lower than the overcharge release voltage (V_{CR}), OUT pin produces H→L to turn off the N-MOSFET.

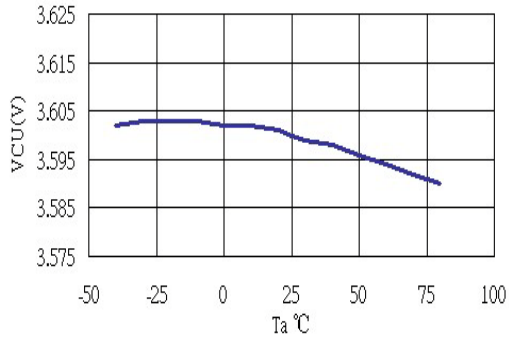
9.3. Standby Status

Under normal status, During discharge process, when battery voltage drops lower than Standby Detection voltage (V_{SB}), IC current consumption minimize to standby status current consumption value, this status is called “Standby Status” .

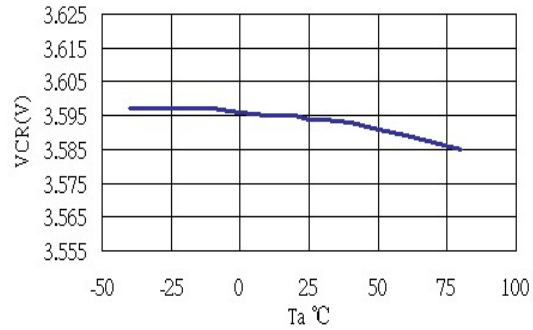
10. Characteristics (Typical Data)

1. V_{CU} / V_{CR} and Delay Time

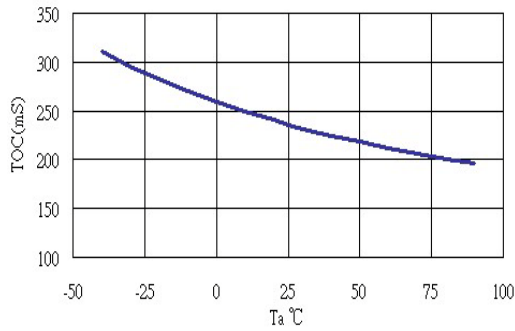
(1) V_{CU} vs. T_a



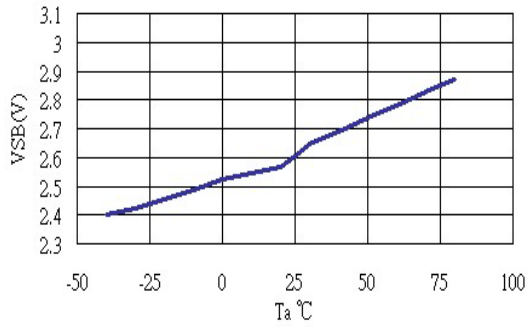
(2) V_{CR} vs. T_a



(3) T_{OC} vs. T_a

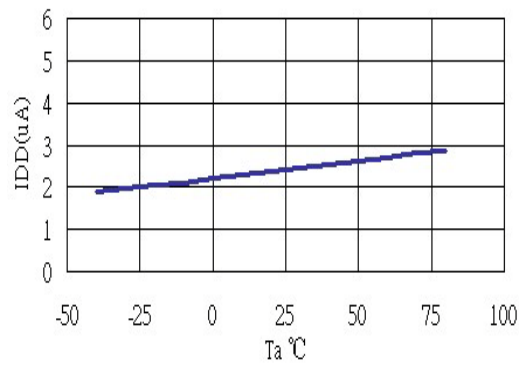


(4) V_{SB} vs. T_a

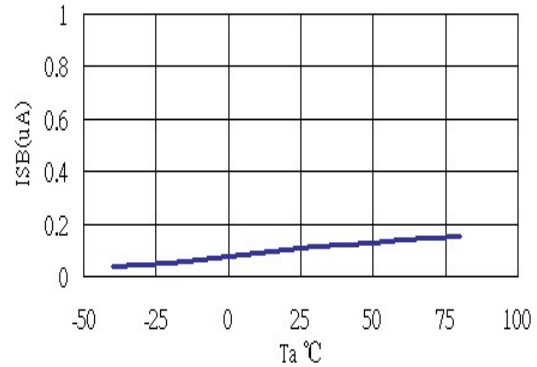


2. Current Consumption

(1) I_{DD} vs. T_a



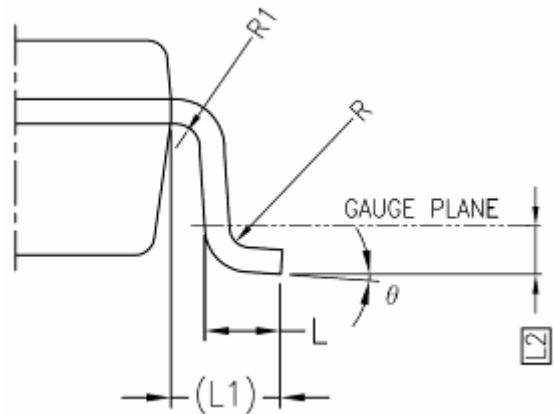
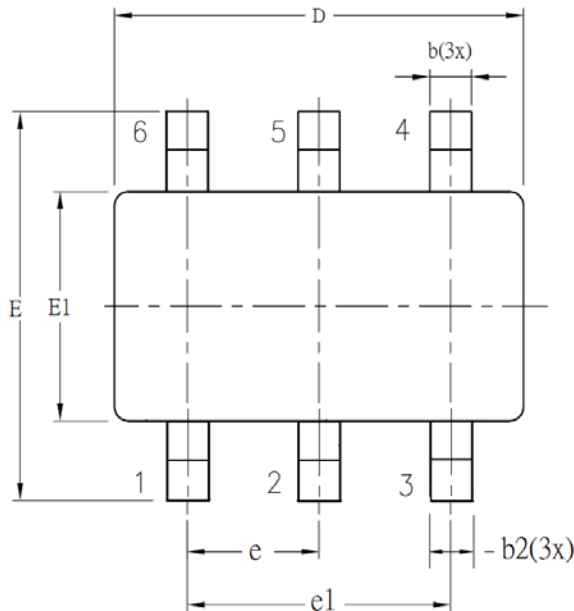
(2) I_{SB} vs. T_a



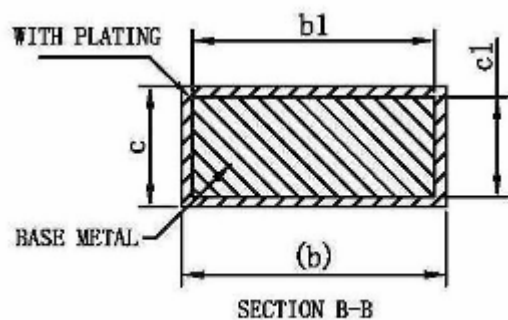
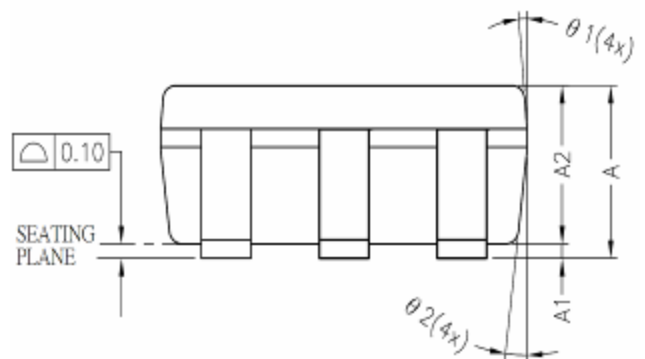
11. Package Information

11.1. SOT-23-6 Package

Description : Unit (mm.)



| SYM BOL | ALL DIMENSIONS IN MILLIMETERS | | |
|---------|-------------------------------|---------|---------|
| | MINIMUM | NOMINAL | MAXIMUM |
| A | - | 1.30 | 1.40 |
| A1 | 0 | - | 0.15 |
| A2 | 0.90 | 1.20 | 1.30 |
| b | 0.30 | - | 0.50 |
| b1 | 0.30 | 0.40 | 0.45 |
| b2 | 0.30 | 0.40 | 0.50 |
| c | 0.08 | - | 0.22 |
| c1 | 0.08 | 0.13 | 0.20 |
| D | 2.90 BSC | | |
| E | 2.80 BSC | | |
| E1 | 1.60 BSC | | |
| e | 0.95 BSC | | |
| e1 | 1.90 BSC | | |
| L | 0.30 | 0.45 | 0.60 |
| L1 | 0.60 REF | | |
| L2 | 0.25 BSC | | |
| R | 0.10 | - | - |
| R1 | 0.10 | - | 0.25 |
| θ | 0° | 4° | 8° |
| θ1 | 5° | - | 15° |
| θ2 | 5° | - | 15° |

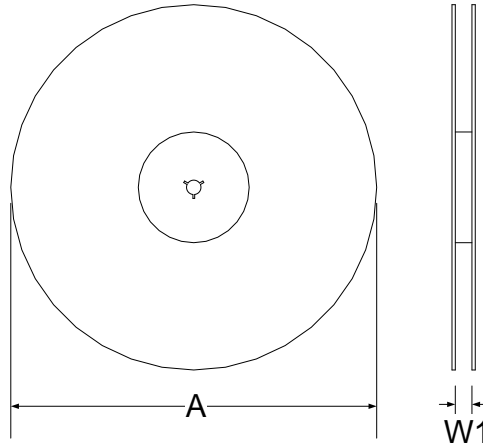


12. Tape & Reel Information

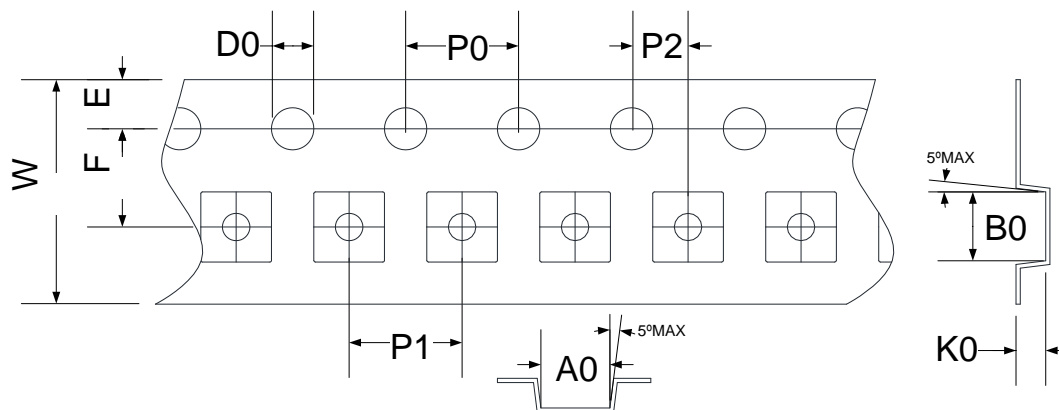
12.1. Tape & Reel Information---SOT-23-6 (Type 1)

Unit : mm.

12.1.1. Reel Dimensions



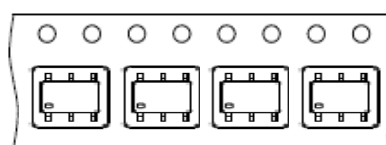
12.1.2. Carrier Tape Dimensions



| SYMBOLS | Reel Dimensions | | Carrier Tape Dimensions | | | | | | | | | |
|-----------|-----------------|----------|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|---------------|
| | A | W1 | A0 | B0 | K0 | P0 | P1 | P2 | E | F | D0 | W |
| Spec. | 178 | 9.0 | 3.30 | 3.20 | 1.50 | 4.00 | 4.00 | 2.00 | 1.75 | 3.50 | 1.50 | 8.00 |
| Tolerance | ±0.50 | +1.50/-0 | ±0.10 | ±0.10 | ±0.10 | ±0.10 | ±0.10 | ±0.10 | ±0.05 | ±0.10 | ±0.05 | +0.1/-0 ±0.20 |

Note: 10 Sprocket hole pitch cumulative tolerance is ±0.20mm.

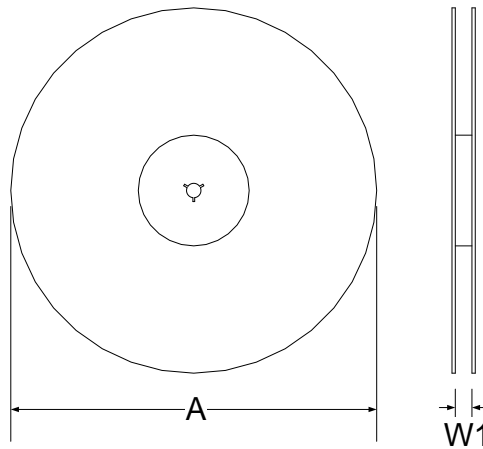
12.1.3. Pin1 direction



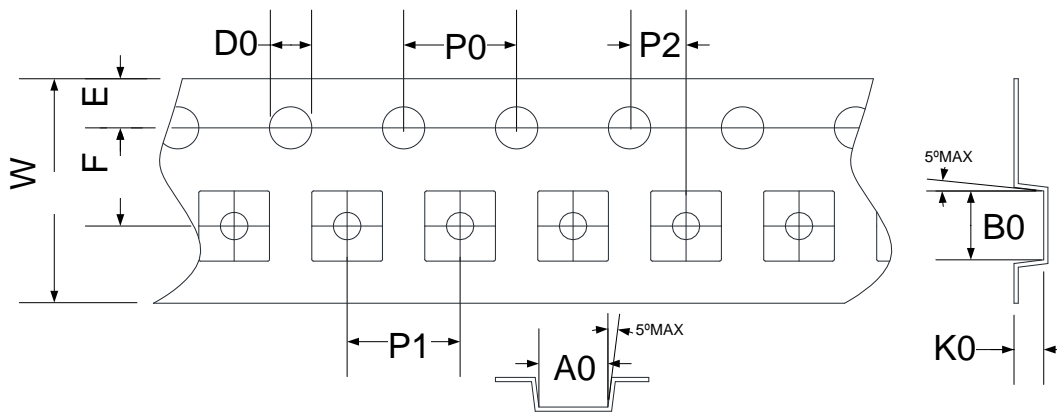
12.2. Tape & Reel Information---SOT-23-6 (Type 2)

Unit : mm.

12.2.1. Reel Dimensions



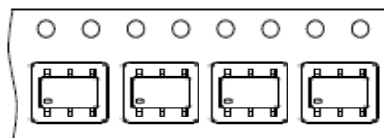
12.2.2. Carrier Tape Dimensions



| SYMBOLS | Reel Dimensions | | Carrier Tape Dimensions | | | | | | | | | |
|-----------|-----------------|-------|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------------|
| | A | W1 | A0 | B0 | K0 | P0 | P1 | P2 | E | F | D0 | W |
| Spec. | 178 | 9.4 | 3.17 | 3.23 | 1.37 | 4.00 | 4.00 | 2.00 | 1.75 | 3.50 | 1.55 | 8.00 |
| Tolerance | ±2.00 | ±1.50 | ±0.10 | ±0.10 | ±0.10 | ±0.10 | ±0.10 | ±0.05 | ±0.10 | ±0.05 | ±0.05 | +0.30/-0.10 |

Note: 10 Sprocket hole pitch cumulative tolerance is ±0.20mm.

12.2.3. Pin1 direction



13. Revision Record

Major differences are thereafter

| Version | Page | Revision Summary |
|---------|------|------------------|
| V01 | - | First Edition. |