

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER****AP4313****General Description**

The AP4313 is a highly integrated solution for a constant voltage/constant current mode SMPS application.

The AP4313 contains one 1.21V voltage reference with  $\pm 1\%$  accuracy, one current sensing circuit and two operational amplifiers. Combining the voltage reference with one operational amplifier makes AP4313 an ideal voltage controller for use in adapters and battery chargers. The other low voltage reference combined with the other operational amplifier makes it an ideal current limiter for output low side current sensing.

The AP4313 is available in SOT-23-6 package.

**Features**

- Constant Voltage and Constant Current Control
- Precision Internal Voltage Reference
- Few External Components
- Easy Compensation
- Low Supply Current: 0.5mA
- Operating Temperature Range: -40 to 105°C

**Applications**

- Adapters
- Battery Chargers

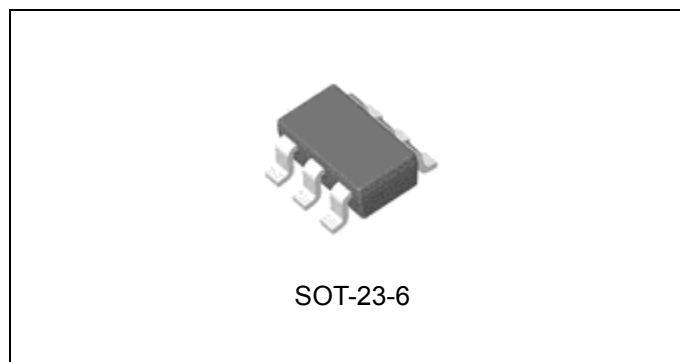


Figure 1. Package Type of AP4313

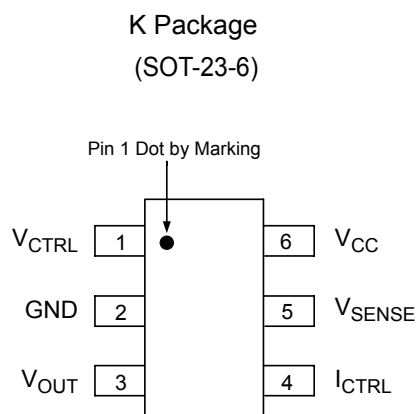
**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**
**Pin Configuration**


Figure 2. Pin Configuration of AP4313 (Top View)

**Pin Description**

| Pin Number | Pin Name    | Function                              |
|------------|-------------|---------------------------------------|
| 1          | $V_{CTRL}$  | Input pin of the voltage control loop |
| 2          | GND         | Ground                                |
| 3          | $V_{OUT}$   | Output pin. Sinking current only      |
| 4          | $I_{CTRL}$  | Input pin of the current control loop |
| 5          | $V_{SENSE}$ | Input pin of the current control loop |
| 6          | $V_{CC}$    | Power supply                          |

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Functional Block Diagram**

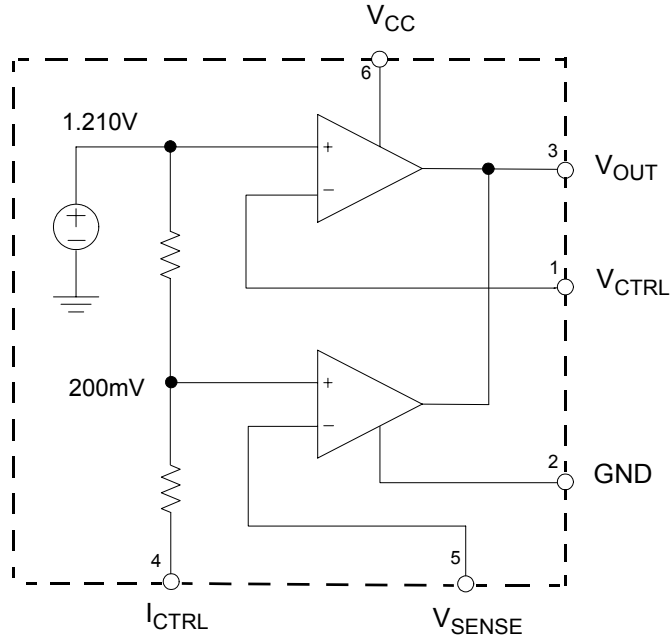
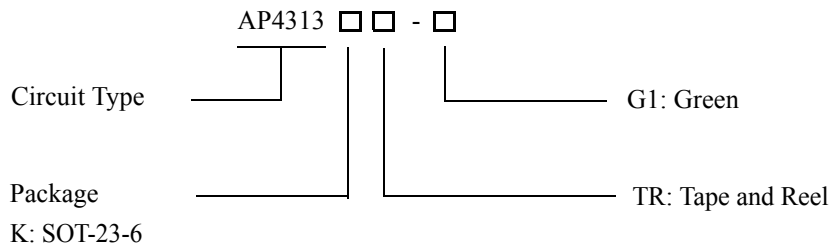


Figure 3. Functional Block Diagram of AP4313

**Ordering Information**



| Package  | Temperature Range | Part Number  | Marking ID | Packing Type |
|----------|-------------------|--------------|------------|--------------|
| SOT-23-6 | -40 to 105°C      | AP4313KTR-G1 | G6G        | Tape & Reel  |

BCD Semiconductor's products, as designated with "G1" suffix in the part number, are RoHS compliant and Green.

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313****Absolute Maximum Ratings (Note 1)**

| Parameter                                     | Symbol        | Value            | Unit |
|---|---------------|------------------|------|
| Power Supply Voltage                          | $V_{CC}$      | 20               | V    |
| Input Voltage                                 | $V_{IN}$      | -0.3 to $V_{CC}$ | V    |
| Junction Temperature                          | $T_J$         | 150              | °C   |
| Storage Temperature                           | $T_{STG}$     | -65 to 150       | °C   |
| Lead Temperature (Soldering, 5sec)            | $T_{LEAD}$    | 260              | °C   |
| Package Thermal Resistance (Junction to Case) | $\theta_{JC}$ | 92               | °C/W |

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

**Recommended Operating Conditions**

| Parameter                   | Symbol   | Min | Max | Unit |
|-----------------------------|----------|-----|-----|------|
| Power Supply Voltage        | $V_{CC}$ | 2.5 | 18  | V    |
| Operating Temperature Range | $T_A$    | -40 | 105 | °C   |

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313****Electrical Characteristics**

( $V_{CC}=5V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.)

| Parameter   | Symbol      | Conditions      | Min   | Typ  | Max   | Unit    |
|---|-------------|-----------------|-------|------|-------|---------|
| <b>TOTAL CURRENT CONSUMPTION</b>  |             |                 |       |      |       |         |
| Total Supply Current<br>Not Including the Output Sinking<br>Current     | $I_{CC}$    |                 |       | 0.6  | 1.2   | mA      |
| <b>VOLTAGE CONTROL LOOP</b>   |             |                 |       |      |       |         |
| Transduction Gain ( $V_{CTRL}$ ).<br>Sink Current Only                  | $G_{mv}$    |                 | 1     | 3.5  |       | mA/mV   |
| Voltage Control Loop Reference  | $V_{REF}$   |                 | 1.198 | 1.21 | 1.222 | V       |
| Input Bias Current ( $V_{CTRL}$ )                                       | $I_{IBV}$   |                 |       | 50   |       | nA      |
| <b>CURRENT CONTROL LOOP</b>   |             |                 |       |      |       |         |
| Transduction Gain ( $I_{CTRL}$ ).                                       | $G_{mi}$    |                 | 1.5   | 7    |       | mA/mV   |
| Current Control Loop Reference  | $V_{SENSE}$ | $I_{OUT}=2.5mA$ | 196   | 200  | 204   | mV      |
| Current Out of Pin $I_{CTRL}$ at<br>-200mV                              | $I_{IBI}$   |                 |       | 25   |       | $\mu A$ |
| <b>OUTPUT STAGE</b>   |             |                 |       |      |       |         |
| Low Output Voltage at 10mA<br>Sinking Current                           | $V_{OL}$    |                 |       | 200  |       | mV      |
| Output Short Circuit Current.<br>Output to $V_{CC}$ . Sink Current Only | $I_{OS}$    |                 |       | 27   | 50    | mA      |



**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Typical Performance Characteristics**

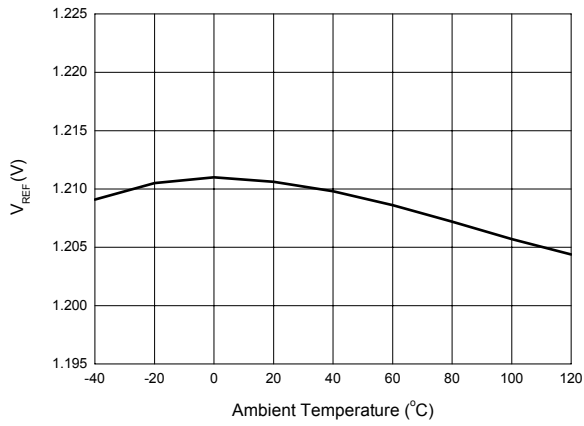


Figure 4.  $V_{REF}$  vs. Ambient Temperature

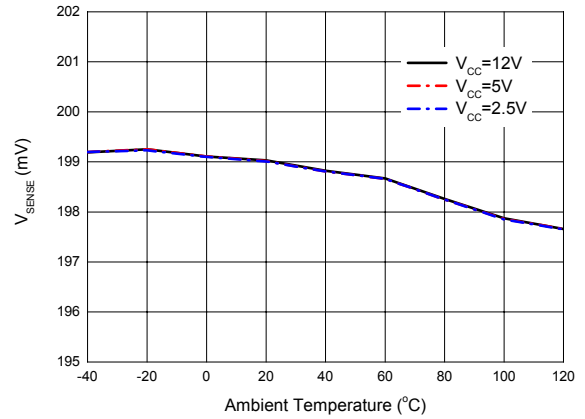


Figure 5.  $V_{SENSE}$  vs. Ambient Temperature

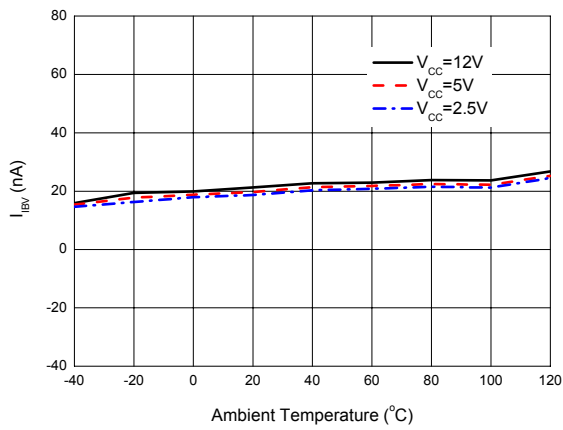


Figure 6.  $V_{CTRL}$  Pin Input Bias Current vs. Ambient Temperature

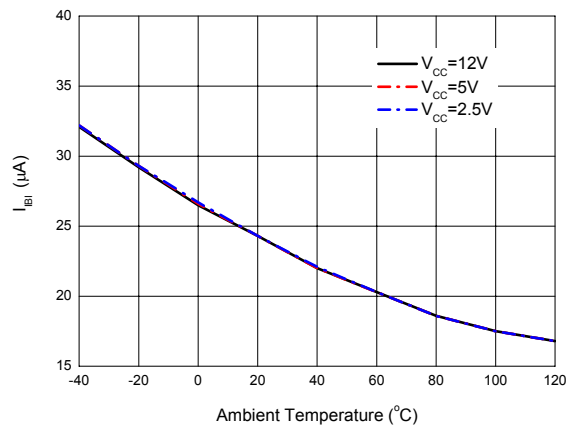


Figure 7.  $I_{CTRL}$  Pin Input Bias Current vs. Ambient Temperature



**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Typical Performance Characteristics (Continued)**

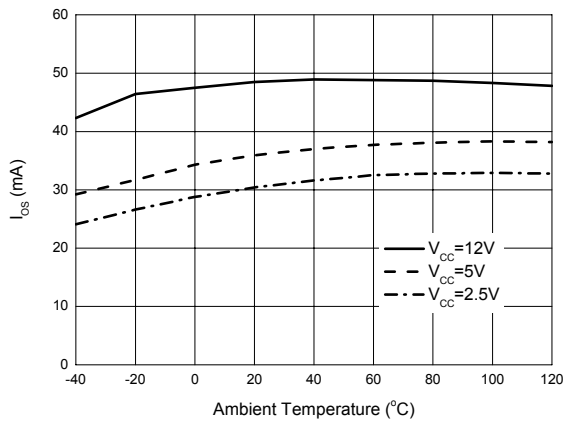


Figure 8. Output Short Circuit Current vs. Ambient Temperature

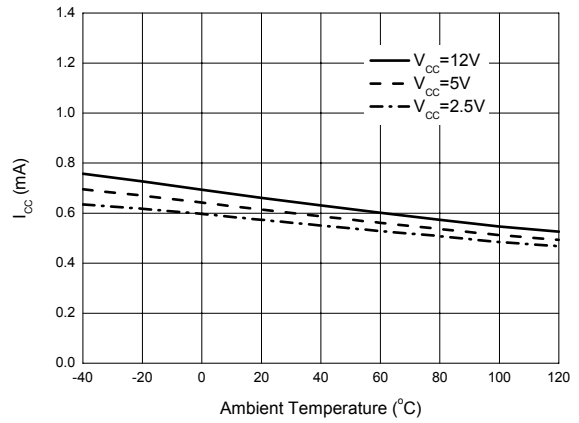
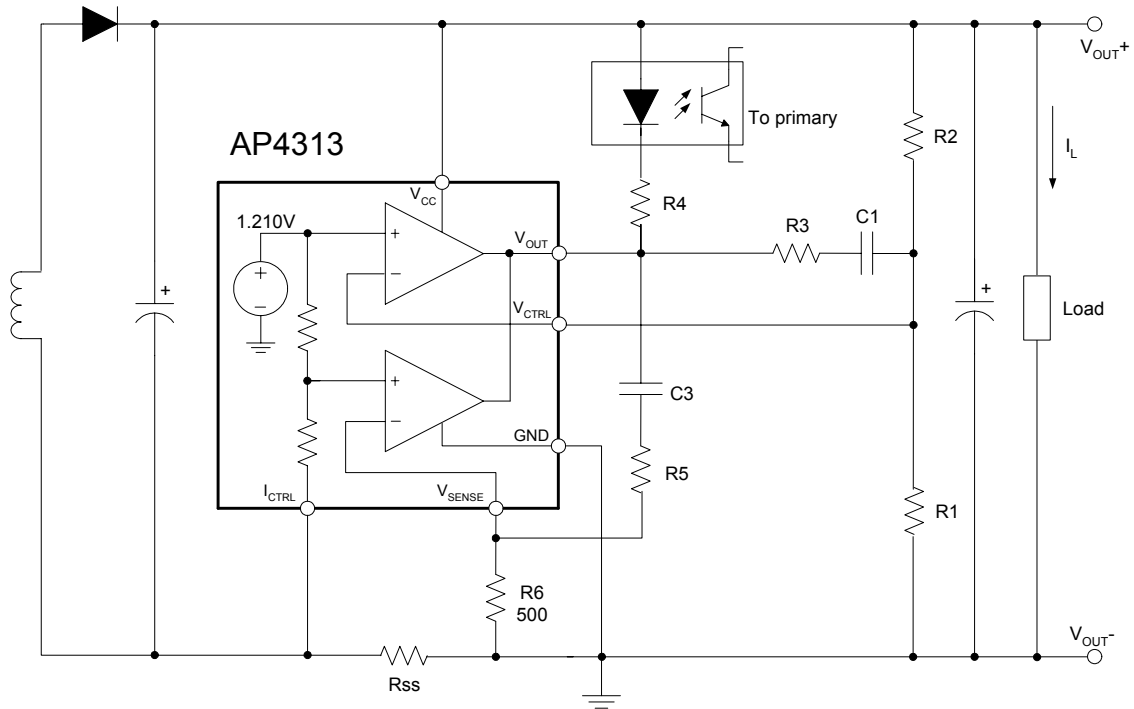


Figure 9. Supply Current vs. Ambient Temperature

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Typical Application**



$$V_{OUT} = V_{REF} \times \frac{R1 + R2}{R1} \quad (V)$$

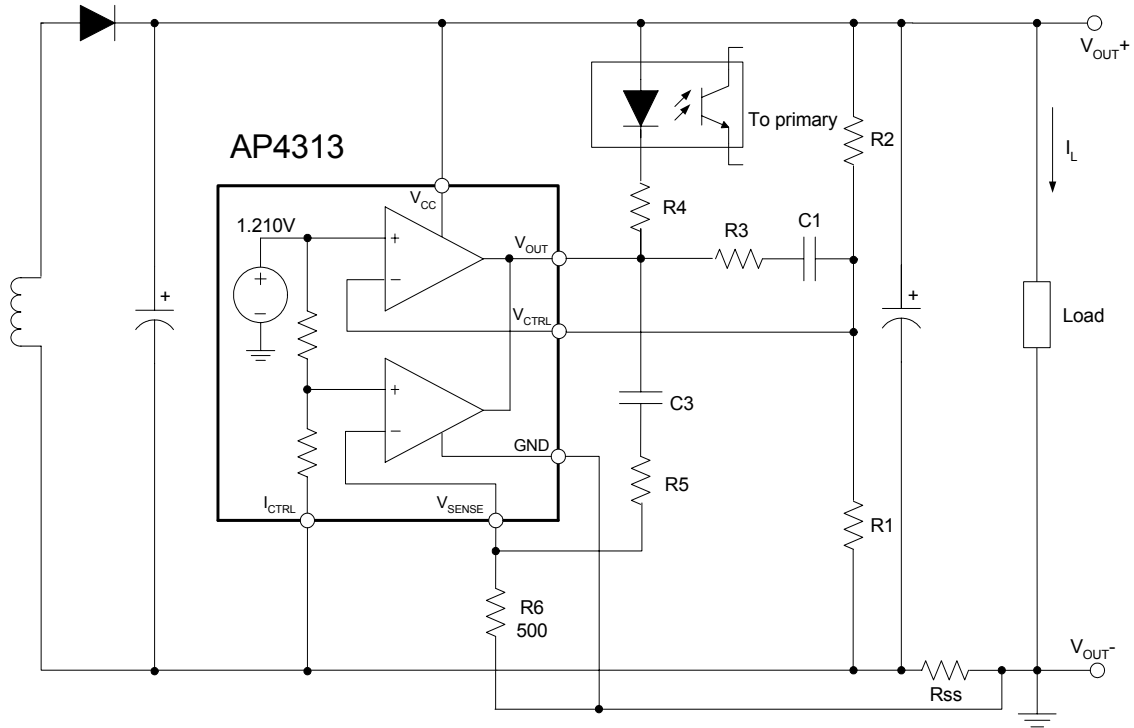
$$CurrentLimit = \frac{V_{SENSE}}{R_{SS}} \quad (A)$$

Figure 10. Typical Application 1 of AP4313



**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Typical Application (Continued)**



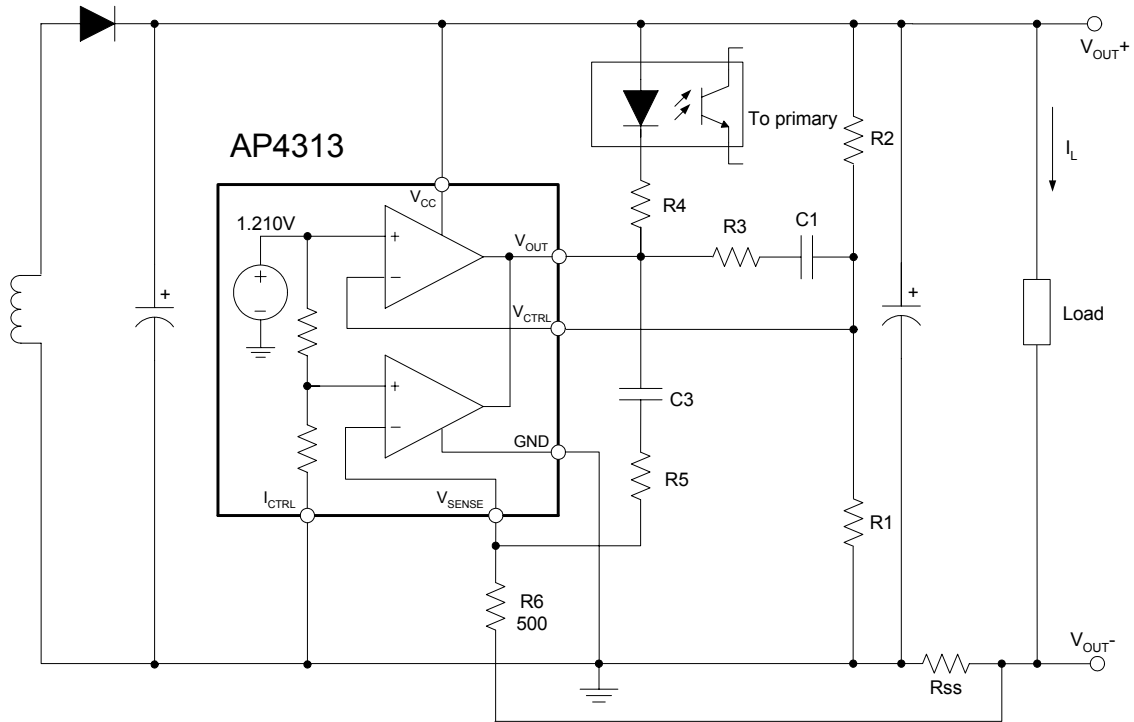
$$V_{OUT} = [V_{REF} + (I_L \times R_{SS})] \times \frac{R1 + R2}{R1} - (I_L \times R_{SS}) \quad (\text{V})$$

$$\text{CurrentLimit} = \frac{V_{SENSE}}{R_{SS}} \quad (\text{A})$$

Figure 11. Typical Application 2 of AP4313

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Typical Application (Continued)**



$$V_{OUT} = V_{REF} \times \frac{R1 + R2}{R1} - (I_L \times R_{SS}) \quad (V)$$

$$CurrentLimit = \frac{V_{SENSE} \times V_{REF}}{(V_{SENSE} + V_{REF}) \times R_{SS}} \quad (A)$$

Figure 12. Typical Application 3 of AP4313

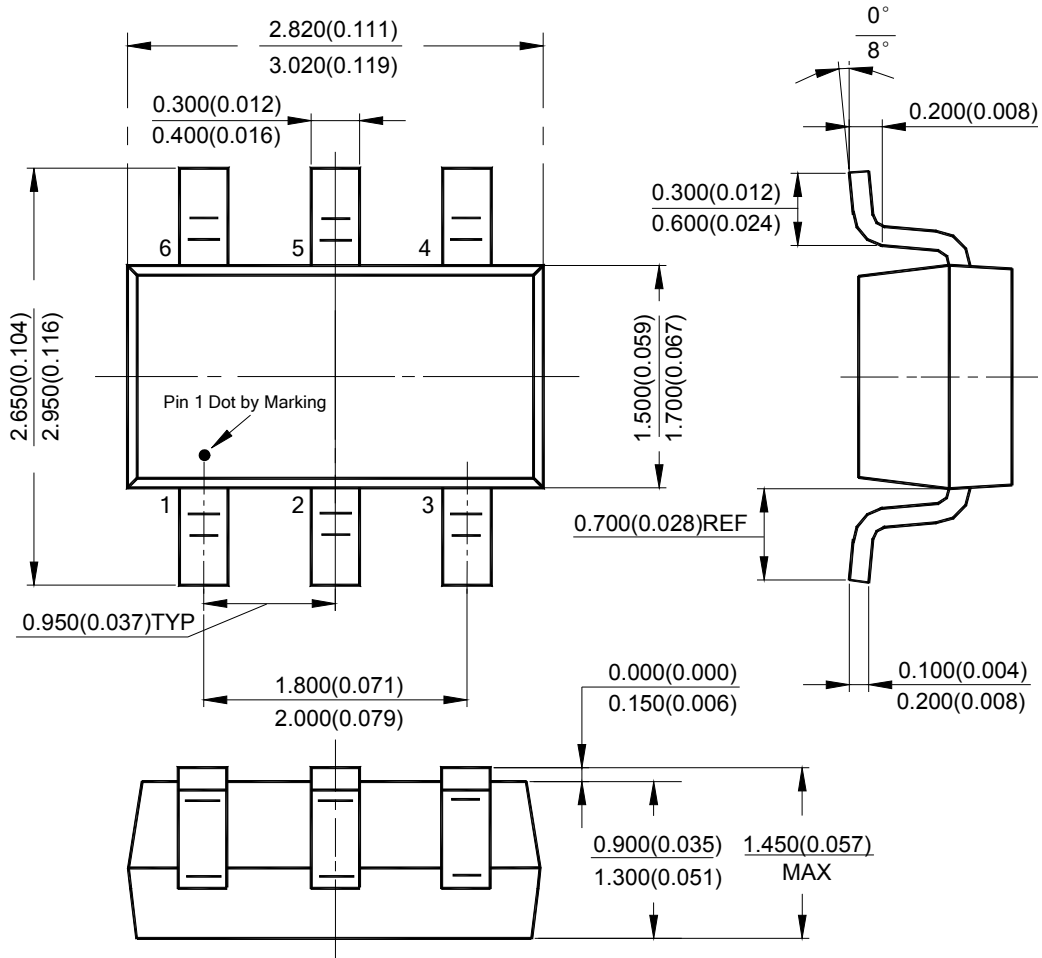


**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Mechanical Dimensions**

**SOT-23-6**

**Unit: mm(inch)**





## **BCD Semiconductor Manufacturing Limited**

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