

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER****AP4306****General Description**

The AP4306 is a highly integrated solution for a constant voltage/constant current mode SMPS application.

The AP4306 contains one 1.21V voltage reference, one low voltage reference used in current sensing circuit and two operational amplifiers. The 1.21V voltage reference, combined with one operational amplifier, makes of an ideal voltage controller for use in adapters and battery chargers. The low voltage reference, combined with another operational amplifier, makes of an ideal current limiter for output low side current sensing.

The AP4306 is fully compatible with AP4305 in functionality and electrical characteristics except its lower reference voltage for current control loop, thus higher power efficiency in SMPS applications such as low power charger can be realized with AP4306 compared to AP4305.

The AP4306 is available in SOT-23-6 package.

**Features**

- Constant Voltage and Constant Current Control
- Precision Internal Voltage Reference
- Low External Component Count
- Easy Compensation
- Low Supply Current: 0.5mA
- Current Control Loop Reference
  - A Version: 70mV
  - B Version: 100mV
  - C Version: 150mV
- Operating Temperature Range: -40 to 105°C
- Operating Supply Voltage: 2.5V to 18V

**Applications**

- Adapters
- Battery Chargers

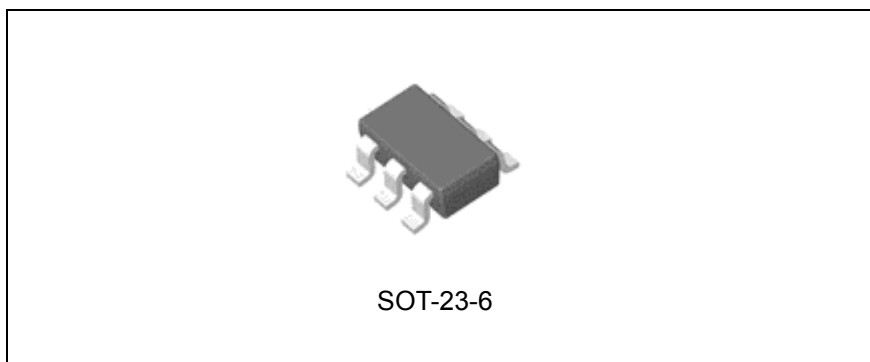


Figure 1. Package Type of AP4306

## Pin Configuration

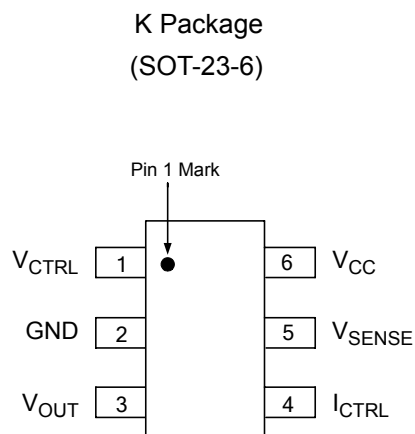


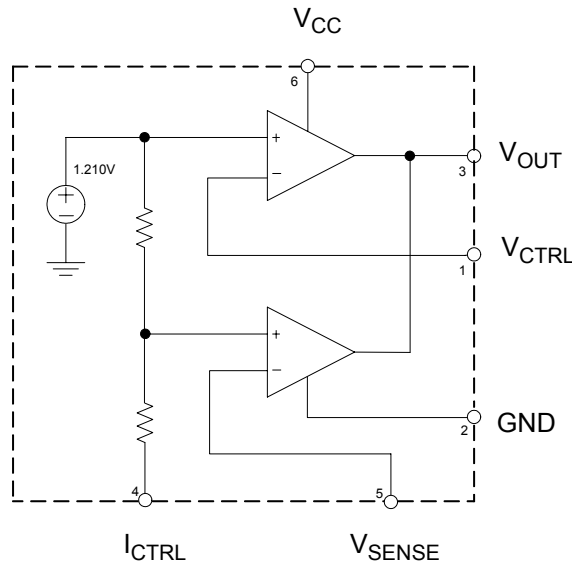
Figure 2. Pin Configuration of AP4306 (Top View)

## 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 AP4306**

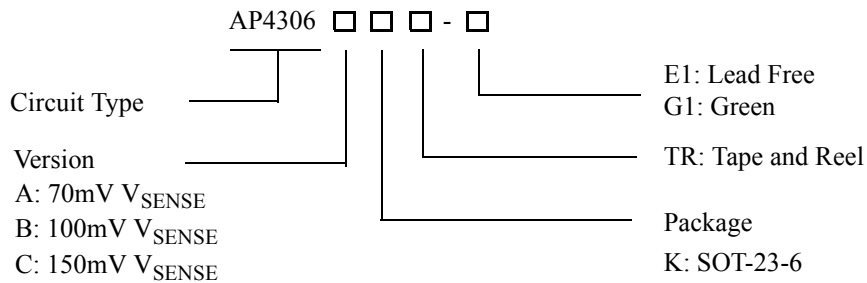
**Functional Block Diagram**



For A, B, C Versions

Figure 3. Functional Block Diagram of AP4306

**Ordering Information**



Package	Version	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
SOT-23-6	70mV $V_{SENSE}$	AP4306AKTR-E1	AP4306AKTR-G1	E7L	G7L	Tape & Reel
	100mV $V_{SENSE}$	AP4306BKTR-E1	AP4306BKTR-G1	E7M	G7M	Tape & Reel
	150mV $V_{SENSE}$	AP4306CKTR-E1	AP4306CKTR-G1	E7N	G7N	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green package.

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4306****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
Thermal Resistance (Junction to Ambient)	SOT-23-6 $\theta_{JA}$	250	°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 AP4306**

**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 Not Including the Output Sinking	$I_{CC}$	$T_A=25^{\circ}C$		0.5	1	mA
		$-40^{\circ}C < T_A < 105^{\circ}C$		0.6		
<b>VOLTAGE CONTROL LOOP</b>						
Transconductance Gain ( $V_{CTRL}$ ). Sink Current Only	$G_{mv}$	$T_A=25^{\circ}C$	1	3.5		mA/mV
		$-40^{\circ}C < T_A < 105^{\circ}C$			2.5	
Voltage Control Loop Reference	$V_{REF}$	A Version	$T_A=25^{\circ}C$	1.186	1.21	1.234
			$-40^{\circ}C < T_A < 105^{\circ}C$	1.162		1.258
		B, C Versions	$T_A=25^{\circ}C$	1.204	1.21	1.216
			$-40^{\circ}C < T_A < 105^{\circ}C$	1.186		1.234
Input Bias Current ( $V_{CTRL}$ )	$I_{IBV}$	$T_A=25^{\circ}C$		50		nA
		$-40^{\circ}C < T_A < 105^{\circ}C$		100		
<b>CURRENT CONTROL LOOP</b>						
Transconductance Gain ( $I_{CTRL}$ ). Sink Current Only	$G_{mi}$	$T_A=25^{\circ}C$	1.5	7		mA/mV
		$-40^{\circ}C < T_A < 105^{\circ}C$		1.5	7	
Current Control Loop Reference	$V_{SENSE}$	A Version	$T_A=25^{\circ}C$	66.5	70	73.5
			$-40^{\circ}C < T_A < 105^{\circ}C$	63		77
		B Version	$T_A=25^{\circ}C$	97	100	103
			$-40^{\circ}C < T_A < 105^{\circ}C$	94		106
		C Version	$T_A=25^{\circ}C$	147	150	153
			$-40^{\circ}C < T_A < 105^{\circ}C$	143		157
Current Out of Pin $I_{CTRL}$ at $V_{SENSE}$	$I_{IBI}$	A Version	$T_A=25^{\circ}C$		18	$\mu A$
			$-40^{\circ}C < T_A < 105^{\circ}C$		35	
		B Version	$T_A=25^{\circ}C$		25	
			$-40^{\circ}C < T_A < 105^{\circ}C$		50	
		C Version	$T_A=25^{\circ}C$		37.5	
			$-40^{\circ}C < T_A < 105^{\circ}C$		75	
<b>OUTPUT STAGE</b>						
Low Output Voltage at 10mA Sinking Current	$V_{OL}$	$T_A=25^{\circ}C$		100		mV
		$-40^{\circ}C < T_A < 105^{\circ}C$		100		
Output Short Circuit Current. Output to $V_{CC}$ . Sink Current Only	$I_{OS}$	$T_A=25^{\circ}C$		27	50	mA
		$-40^{\circ}C < T_A < 105^{\circ}C$		35		

**Thermal Impedance**

Parameter	Symbol	Value	Unit
Thermal Resistance (Junction to Case)	$\theta_{JC}$	84	$^{\circ}C/W$



**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4306**

**Typical Performance Characteristics**

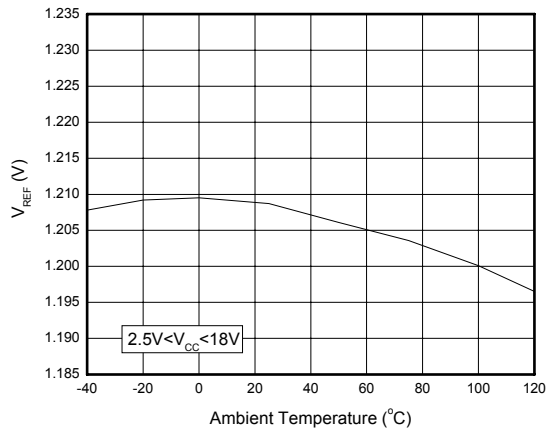


Figure 4. AP4306  $V_{REF}$  vs. Ambient Temperature

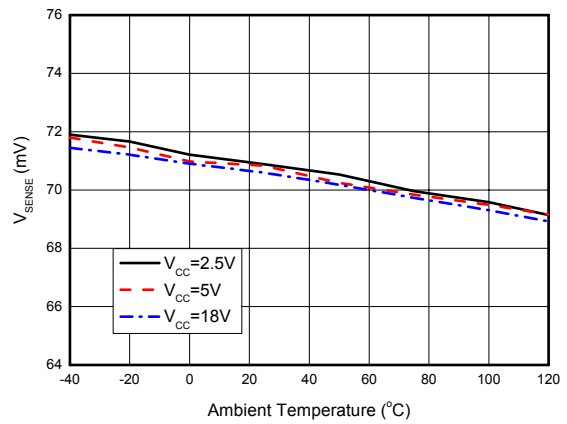


Figure 5. AP4306A  $V_{SENSE}$  vs. Ambient Temperature

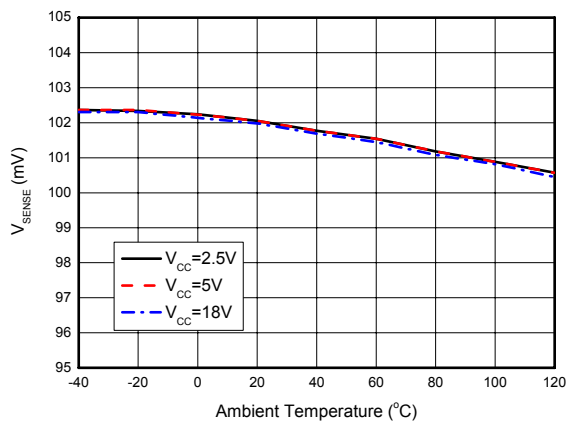


Figure 6. AP4306B  $V_{SENSE}$  vs. Ambient Temperature

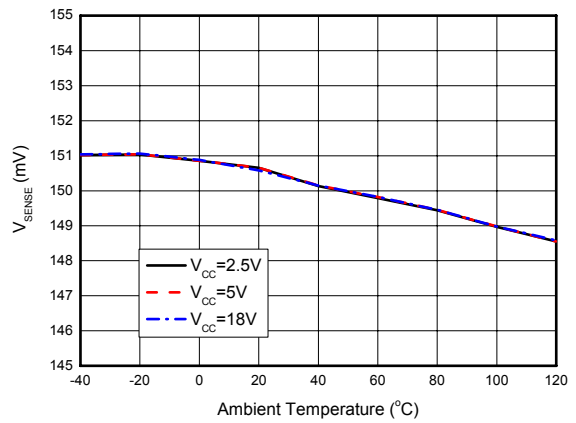


Figure 7. AP4306C  $V_{SENSE}$  vs. Ambient Temperature



**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4306**

**Typical Performance Characteristics (Continued)**

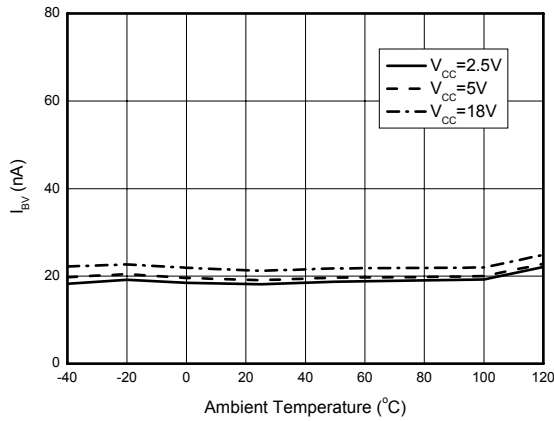


Figure 8. AP4306  $I_{BV}$  vs. Ambient Temperature

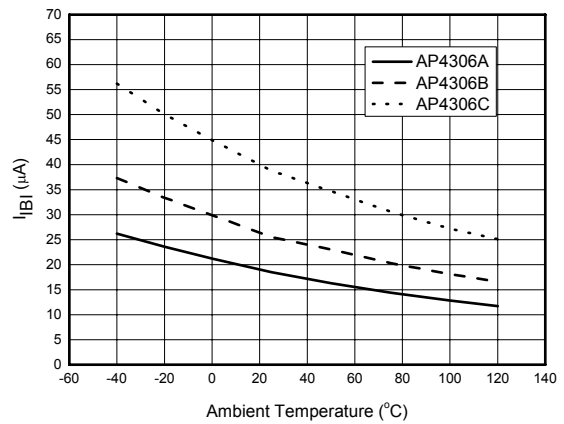


Figure 9. AP4306  $I_{BI}$  vs. Ambient Temperature

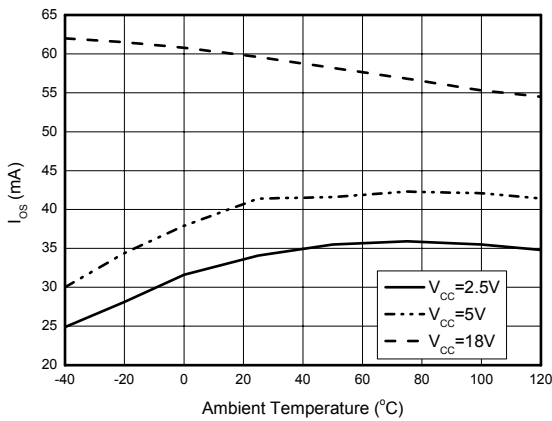


Figure 10. AP4306  $I_{OS}$  vs. Ambient Temperature

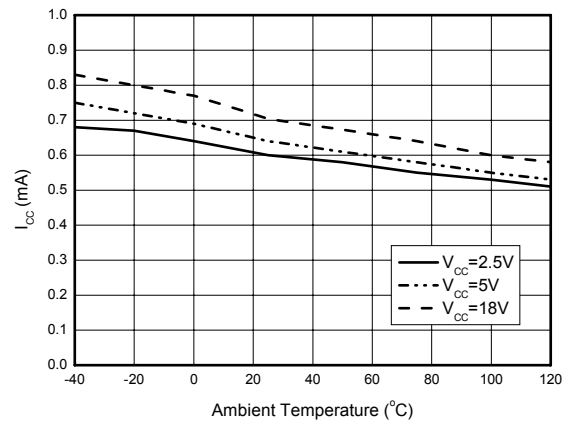
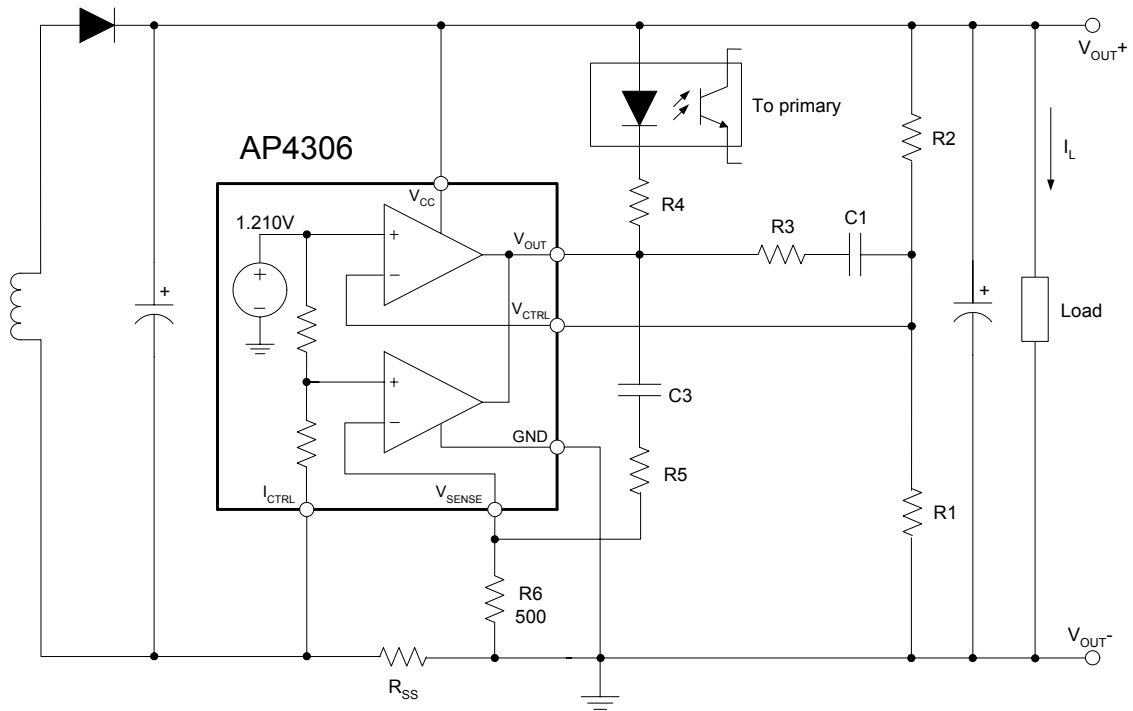


Figure 11. AP4306  $I_{CC}$  vs. Ambient Temperature

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4306**

**Typical Application**



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

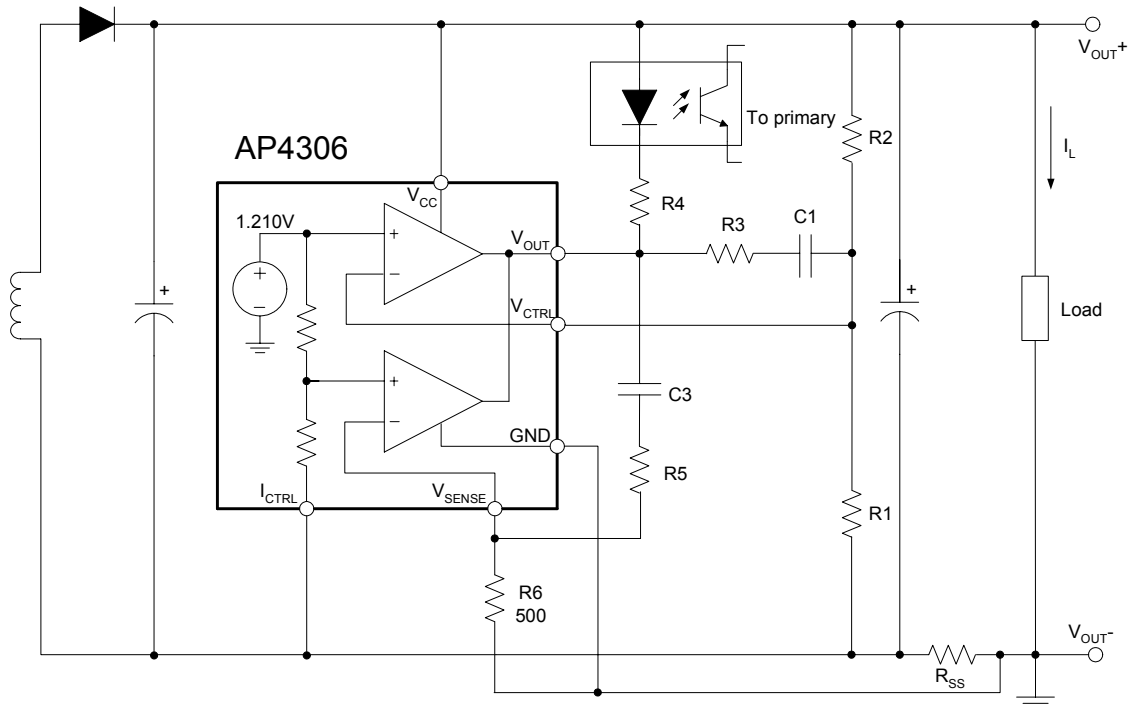
$$CurrentLimit = \frac{V_{SENSE}}{R_{SS}} \quad (A)$$

Figure 12. Typical Application 1 of AP4306



**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4306**

**Typical Application (Continued)**



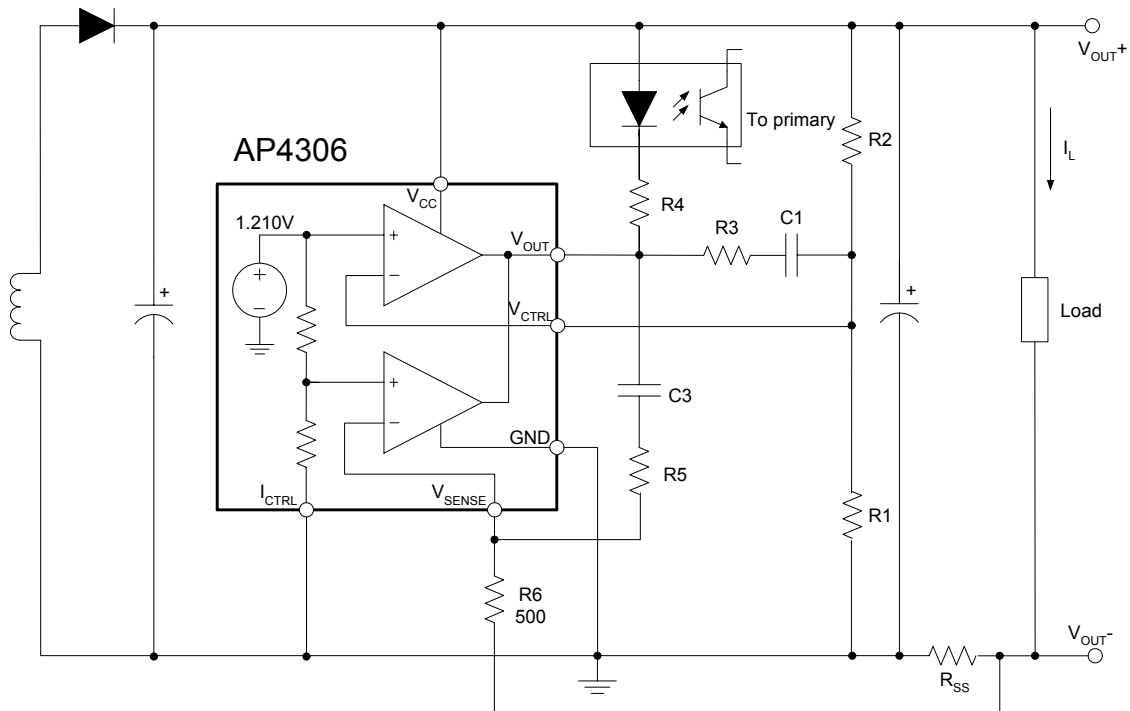
$$V_{OUT} = [V_{REF} + (I_L \times R_{SS})] \times \frac{R1 + R2}{R1} - (I_L \times R_{SS}) \quad (\text{V})$$

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

Figure 13. Typical Application 2 of AP4306

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4306**

**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 14. Typical Application 3 of AP4306

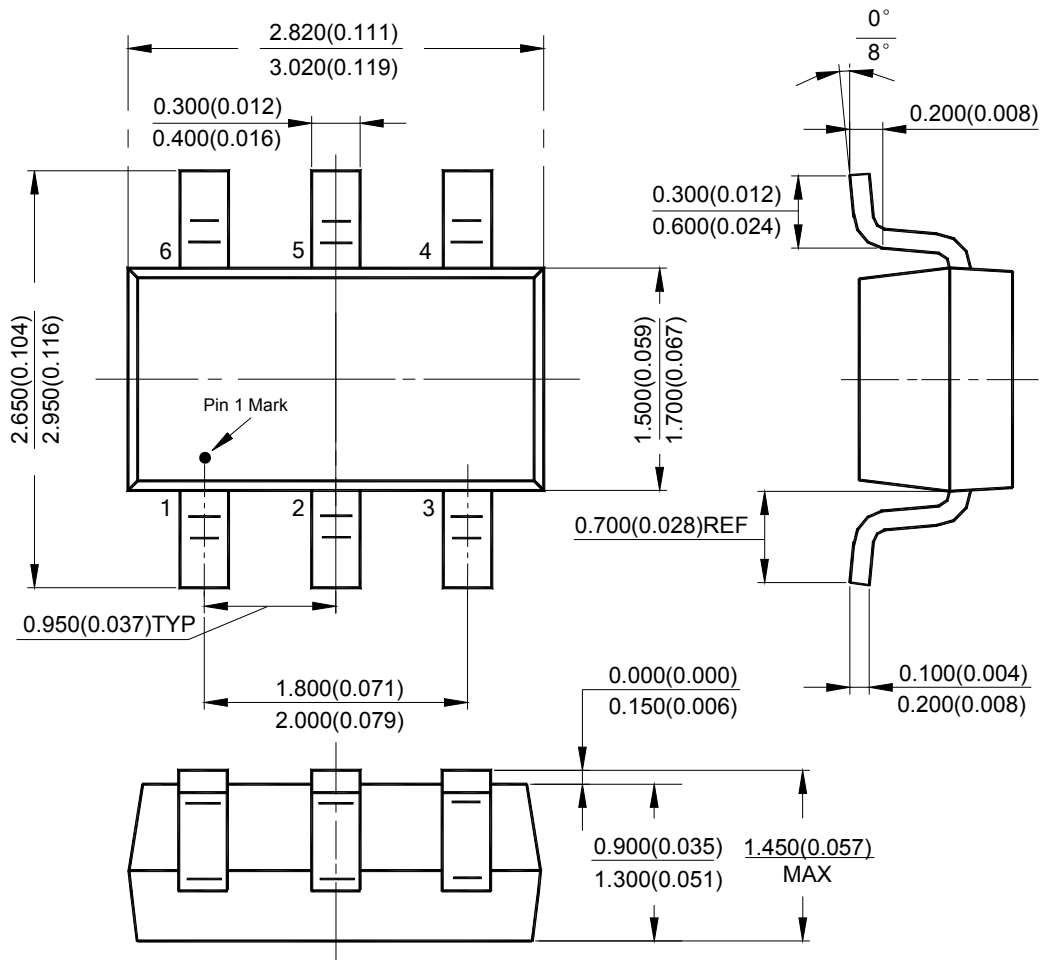


**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4306**

**Mechanical Dimensions**

**SOT-23-6**

**Unit: mm(inch)**





## **BCD Semiconductor Manufacturing Limited**

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