

**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

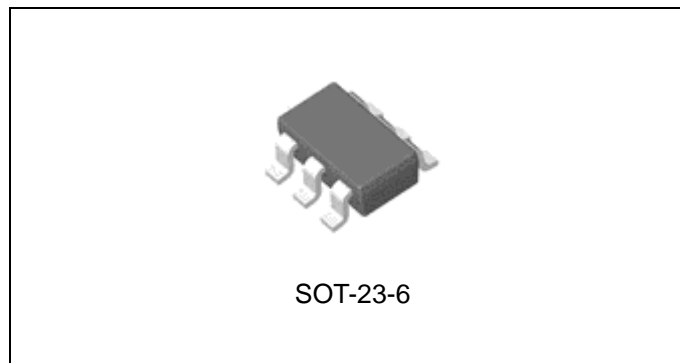


Figure 1. Package Type of AP4313

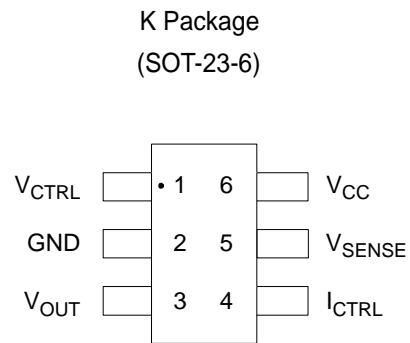
**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**
**Pin Configuration**


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**

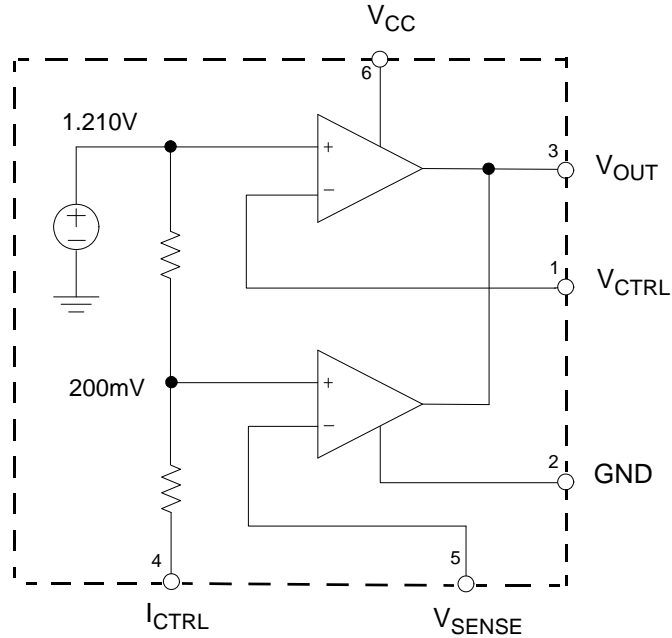
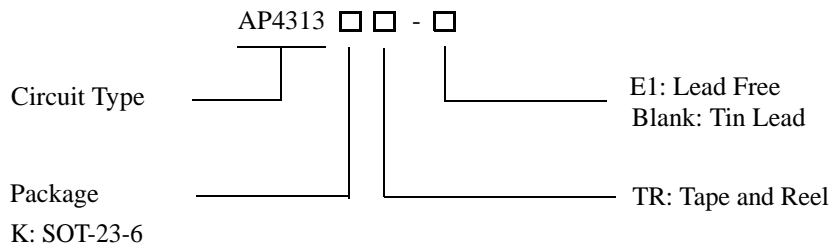


Figure 3. Functional Block Diagram of AP4313

**Ordering Information**



Package	Temperature Range	Part Number		Marking ID		Packing Type
		Tin Lead	Lead Free	Tin Lead	Lead Free	
SOT-23-6	-40 to 105°C	AP4313KTR	AP4313KTR-E1	K6G	E6G	Tape & Reel

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

**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)	$R_{\theta JC}$	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<sub>CC</sub>=5V, T<sub>A</sub>=25°C, unless otherwise specified.)

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



**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Typical Performance Characteristics**

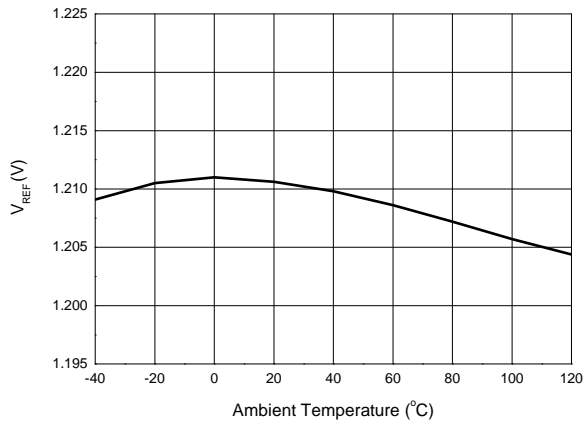


Figure 4. V<sub>REF</sub> vs. Ambient Temperature

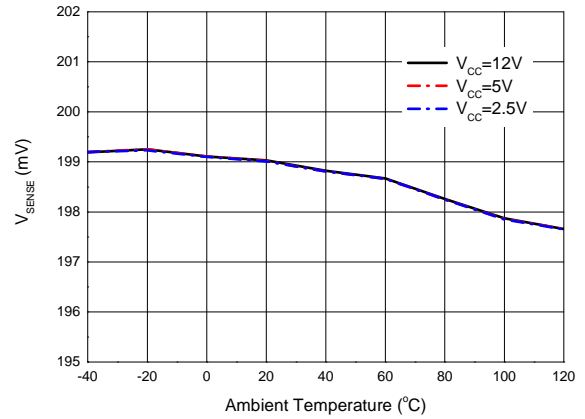


Figure 5. V<sub>SENSE</sub> vs. Ambient Temperature

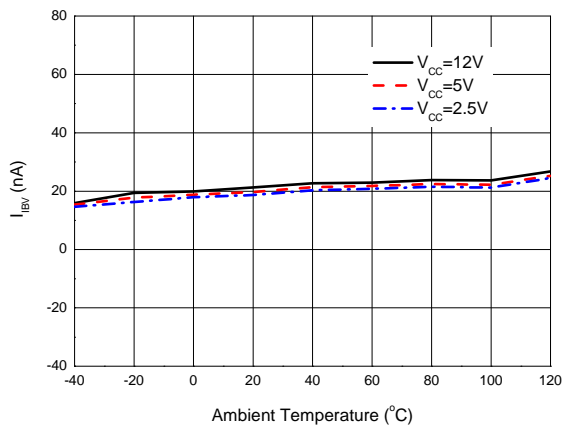


Figure 6. V<sub>CTRL</sub> Pin Input Bias Current vs. Ambient Temperature

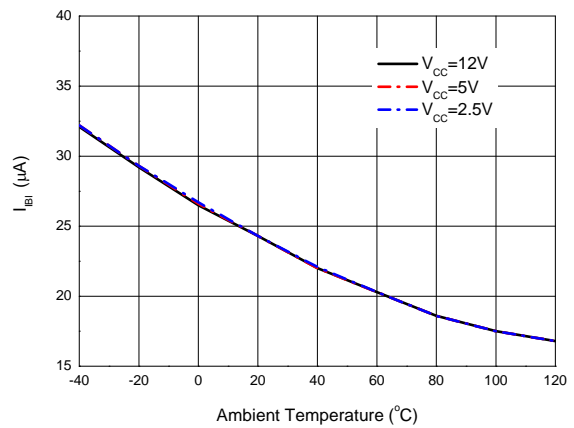


Figure 7. I<sub>CTRL</sub> Pin Input Bias Current vs. Ambient Temperature



**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Typical Performance Characteristics (Continued)**

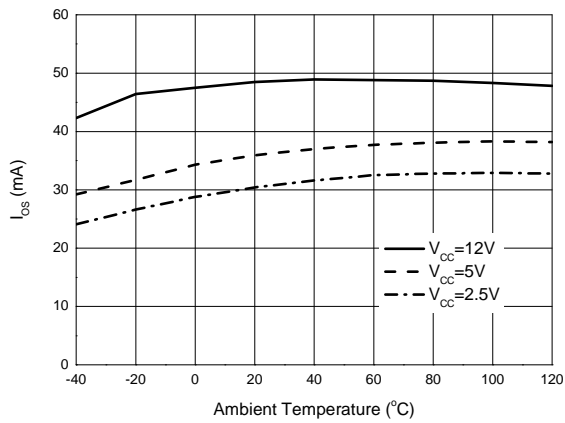


Figure 8. Output Short Circuit Current vs. Ambient Temperature

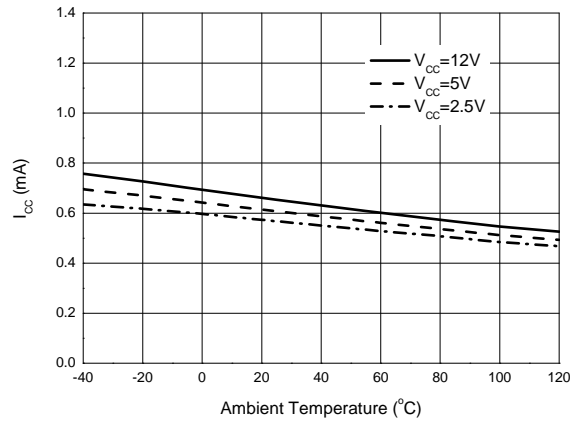
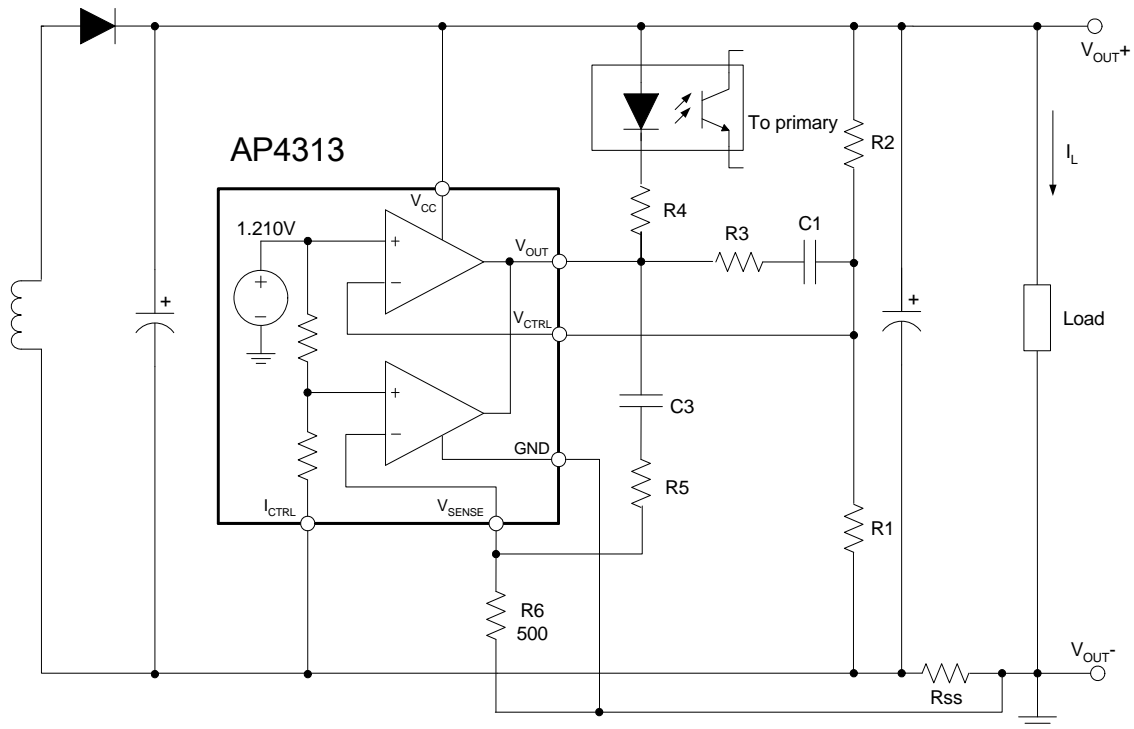


Figure 9. Supply Current vs. Ambient Temperature





**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**
**Typical Application**


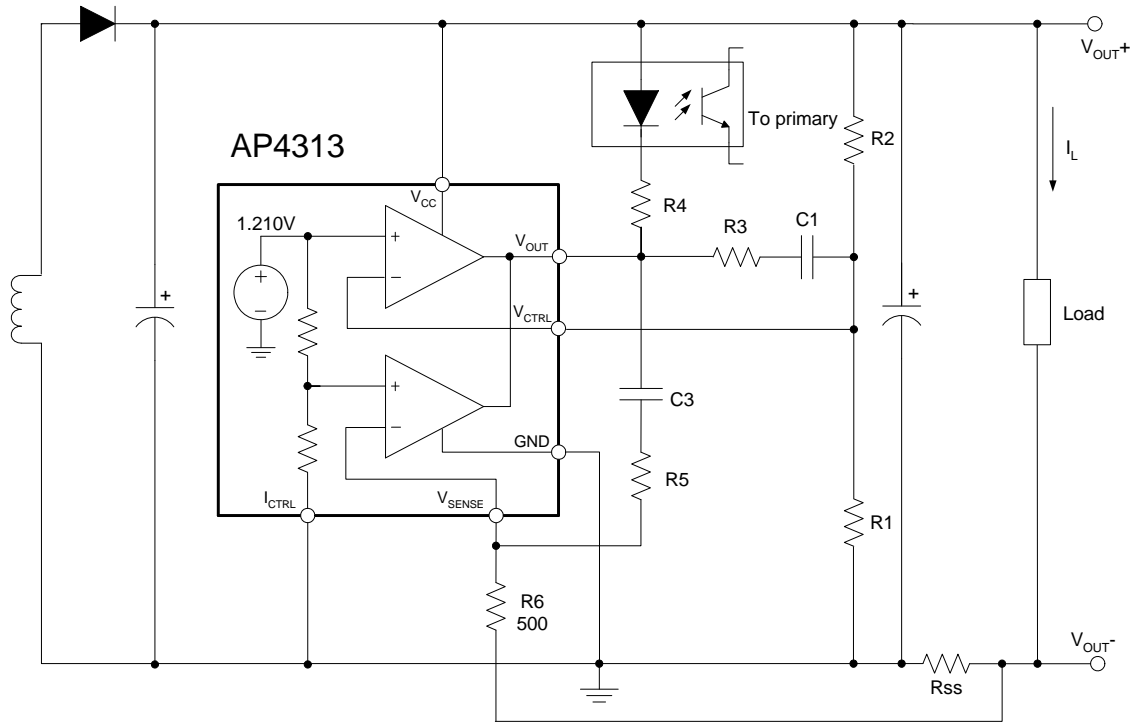
$$V_{OUT} = [V_{REF} + (I_L \times R_{SS})] \times \frac{R1 + R2}{R1} - (I_L \times R_{SS}) \quad (\text{V})$$

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

Figure 11. Typical Application 2 of AP4313

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Typical Application**



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

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

Figure 12. Typical Application 3 of AP4313

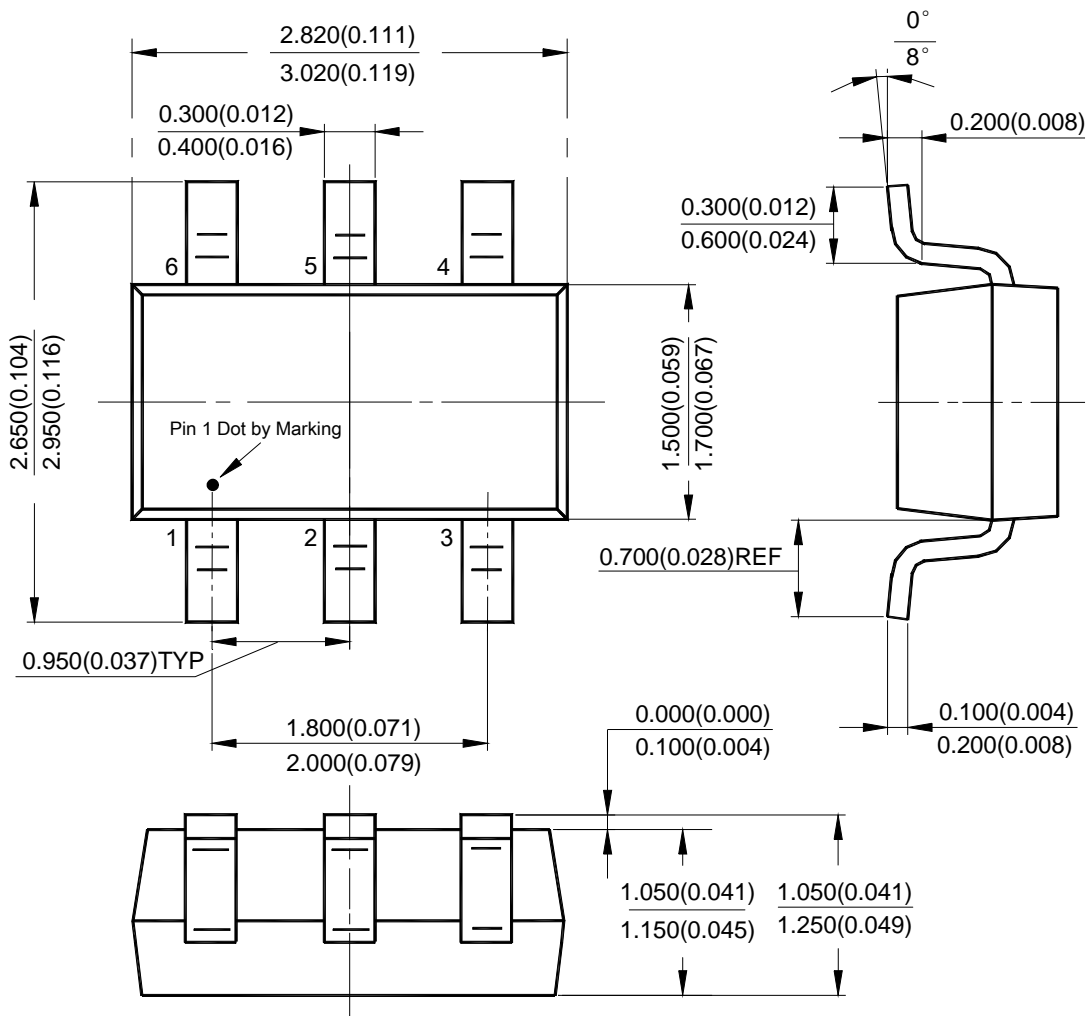


**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER AP4313**

**Mechanical Dimensions**

**SOT-23-6**

**Unit: mm(inch)**





## **BCD Semiconductor Manufacturing Limited**

<http://www.bcdsemi.com>

### **IMPORTANT NOTICE**

BCD Semiconductor Manufacturing Limited reserves the right to make changes without further notice to any products or specifications herein. BCD Semiconductor Manufacturing Limited does not assume any responsibility for use of any its products for any particular purpose, nor does BCD Semiconductor Manufacturing Limited assume any liability arising out of the application or use of any its products or circuits. BCD Semiconductor Manufacturing Limited does not convey any license under its patent rights or other rights nor the rights of others.

---

#### **MAIN SITE**

##### **- Headquarters**

##### **BCD Semiconductor Manufacturing Limited**

No. 1600, Zi Xing Road, Shanghai Zizhu Science-based Industrial Park, 200241, China  
Tel: +86-21-24162266, Fax: +86-21-24162277

##### **- Wafer Fab**

##### **Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd.**

800 Yi Shan Road, Shanghai 200233, China  
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

#### **REGIONAL SALES OFFICE**

##### **Shenzhen Office**

**Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd., Shenzhen Office**  
Room E, 5F, Noble Center, No.1006, 3rd Fuzhong Road, Futian District, Shenzhen,  
518026, China  
Tel: +86-755-8826 7951  
Fax: +86-755-8826 7865

##### **Taiwan Office**

**BCD Semiconductor (Taiwan) Company Limited**  
4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei,  
Taiwan  
Tel: +886-2-2656 2808  
Fax: +886-2-2656 2806

##### **USA Office**

**BCD Semiconductor Corp.**  
30920 Huntwood Ave. Hayward,  
CA 94544, USA  
Tel : +1-510-324-2988  
Fax: +1-510-324-2788