

4-CH Linear Constant Current Sink With Matching**AP2502****General Description**

The AP2502 is a 4-channel independent linear current sink with low dropout voltage and perfect match between each channel. Each channel can provide 20mA continuous constant current.

In application, there is only one 0.1 μ F ceramic capacitor required, and there is no any EMI and switching noise issue. It is perfect choice for hand-hold portable system especially based on Li-ion/Polymer battery powered display module.

The brightness can be controlled and/or adjustable via simple PWM signal applied to EN pin.

The AP2502 is available with SOT-23-6 and TSOT-23-6 packages.

Features

- Current Matching Between Each Channel: $\pm 1\%$
- Low Dropout Voltage: 65mV (Typ.) @ $I_{LED}=20\text{mA}$
- Maximum Output Current on Each Channel: 20mA
- Ultra-low Quiescent Current: 125 μ A (Typ.)
- Ultra-low Shutdown Current: 1 μ A (Max.)
- None EMI and Switching Noise Issue
- Permitted PWM Dimming Frequency up to 150kHz
- OTSD Protection

Applications

- Mobile Phone, Smart Phone, PDA
- MP3, MP4, PMP
- Small Size Backlight Module

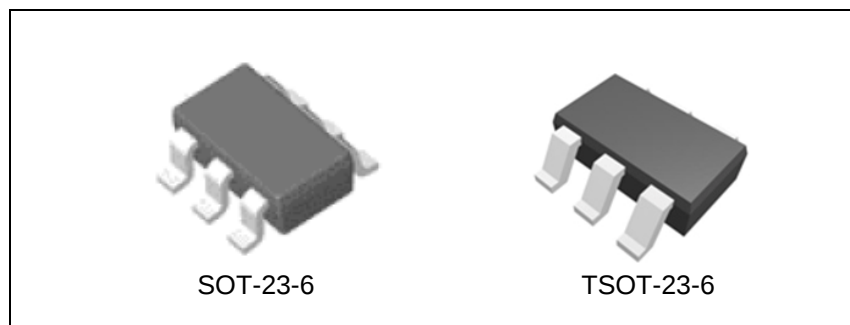


Figure 1. Package Types of AP2502

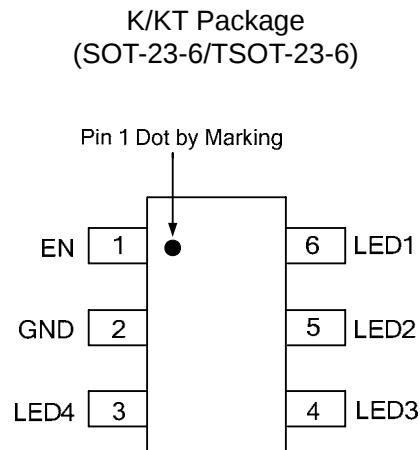
4-CH Linear Constant Current Sink With Matching**AP2502****Pin Configuration**

Figure 2. Pin Configuration of AP2502 (Top View)

Pin Descriptions

P in Number	Pin Name	Description
1	EN	Chip enable pin, active high to permit PWM signal input for brightness control by changing duty cycle
2	GND	GND
3, 4, 5, 6	LED4 to LED1	LED cathode terminal for channel number

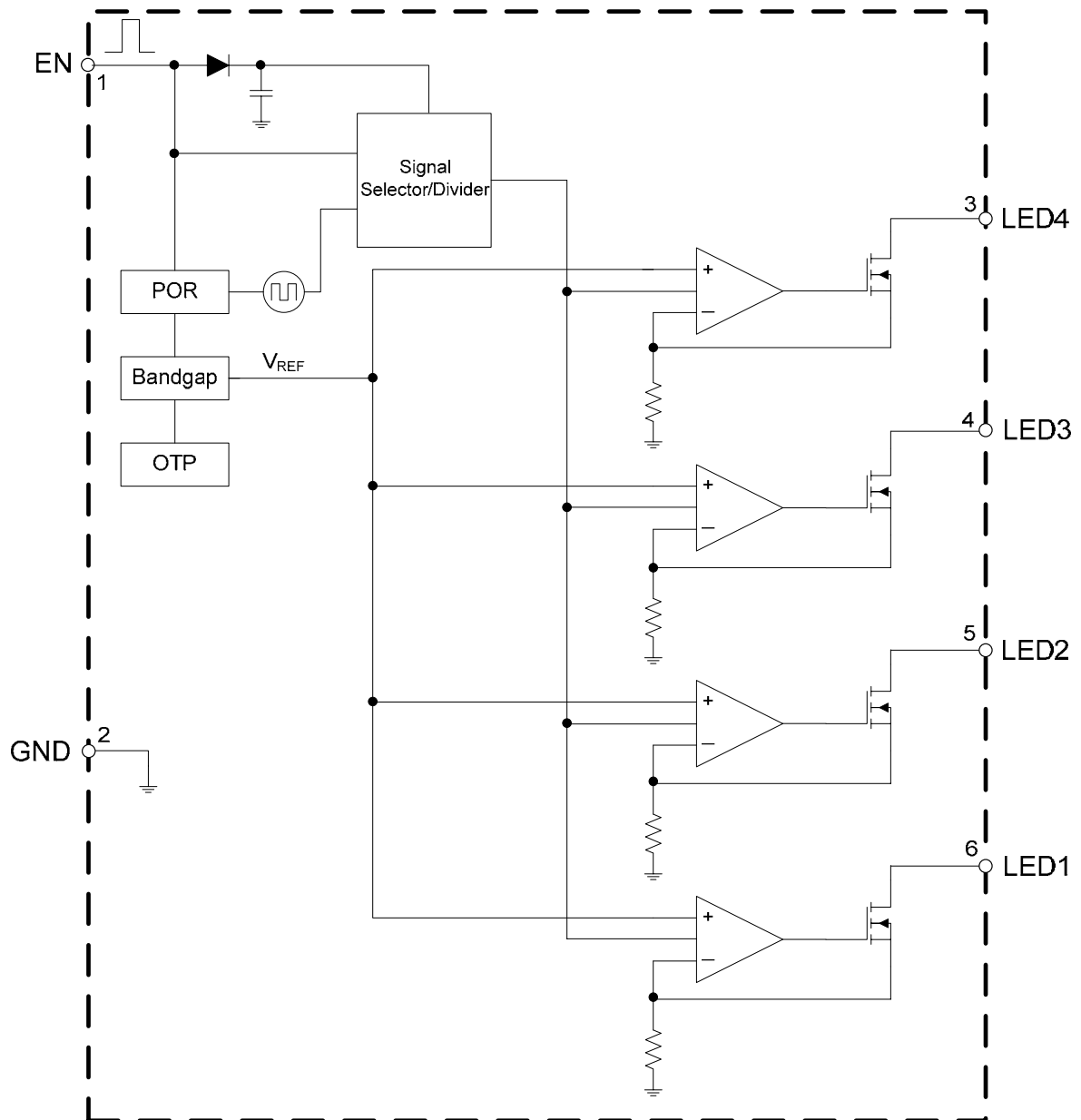
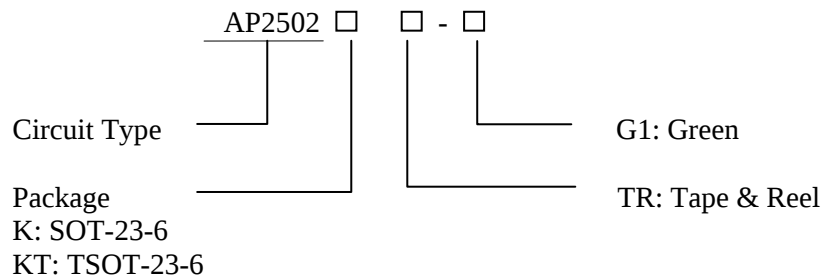
4-CH Linear Constant Current Sink With Matching**AP2502****Functional Block Diagram**

Figure 3. Functional Block Diagram of AP2502

**4-CH Linear Constant Current Sink With Matching****AP2502****Ordering Information**

Package	Temperature Range	Part Number	Marking ID	Packing Type
SOT-23-6	-40 to 85°C	AP2502KTR-G1	GEE	Tape & Reel
TSOT-23-6	-40 to 85°C	AP2502KTTR-G1	L7E	Tape & Reel

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

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Enable Input Voltage	V_{EN}	-0.3 to 6.5	V
Thermal Resistance (Junction to Ambient)	θ_{JA}	250	°C/W
Operating Junction Temperature Range	T_J	150	°C
Storage Temperature Range	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10 seconds)	T_{LEAD}	260	°C
ESD (Machine Model)		600	V
ESD (Human Body Model)		6000	V

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.

**4-CH Linear Constant Current Sink With Matching****AP2502****Recommended Operating Conditions**

Parameter	Symbol	Value		Unit
		Min	Max	
Enable Input Voltage	V_{EN}	2.0	6.0	V
Operating Temperature Range	T_A	-40	85	°C
Sink Current	I_{LED}		20	mA

Electrical Characteristics

$V_{IN}=3.6V$, $V_{F_LED}=3.2V$, $T_A = 25^{\circ}C$, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
LED Dropout Voltage	$V_{DROPOUT}$	$I_{SINK} = 20mA$		65	120	mV
Enable PIN High Voltage	V_{IH}		2		6	V
Enable PIN Low Voltage	V_{IL}		0		0.5	V
LED Maximum Sink Current	$I_{LED(MAX)}$	$V_{CC}=3.3$ to $6.0V$, Enable= V_{CC}	18	20	22	mA
Sink Current Matching Between each Channel	$I_{LED-MATCH}$	$V_{LED}=0.4V$		0.5	1	%
Quiescent Current	I_Q	$I_{LED1}=I_{LED2}=I_{LED3}=I_{LED4}=20mA$		125	180	μA
Shutdown Current	$I_{SHUTDOWN}$	Set EN Pin Low		0.1	1	μA
Thermal Resistance (Junction to Case)	θ_{JC}			80		°C/W
PWM Frequency to Adjust Brightness	f_{PWM}				150	kHz
EN Pin Pulse High Time	T_{HIGH}		1			μs
EN Pin Pulse Low Time	T_{LOW}		100			ns
Thermal Shutdown Temperature	T_{OTSD}			150		°C
Thermal Shutdown Hysteresis	T_{HYOTSD}			25		

4-CH Linear Constant Current Sink With Matching

AP2502

Typical Performance Characteristics

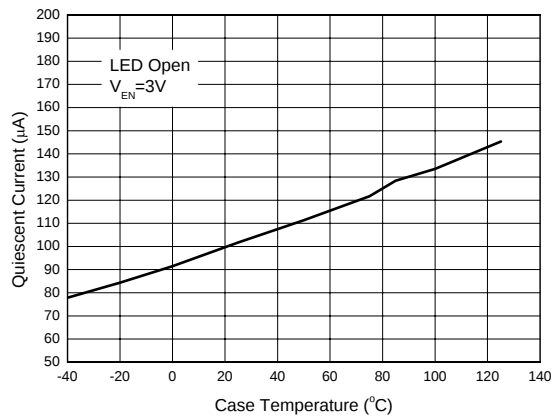


Figure 4. Quiescent Current vs. Case Temperature

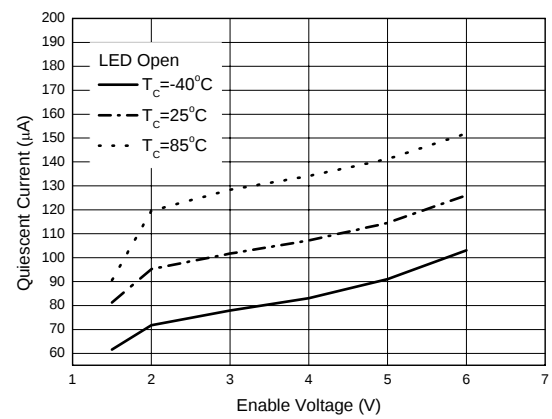


Figure 5. Quiescent Current vs. Enable Voltage

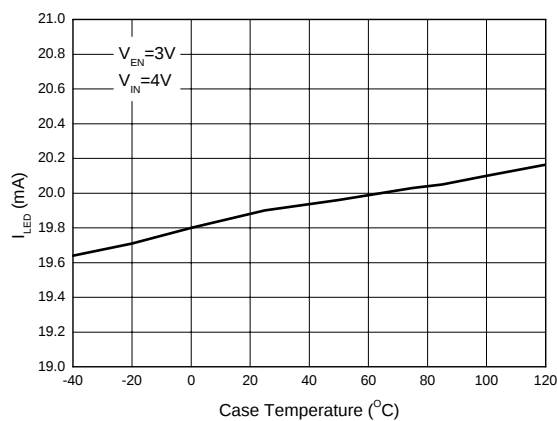


Figure 6. LED Current vs. Case Temperature

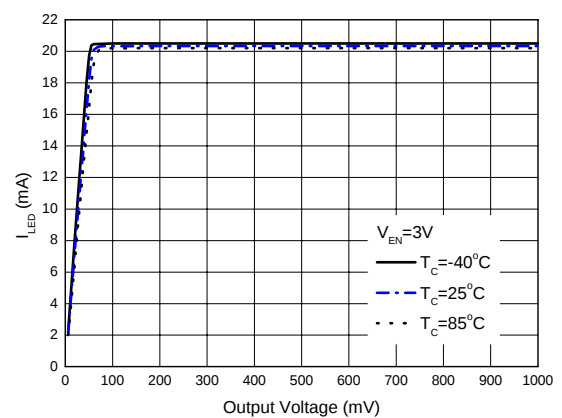


Figure 7. LED Current vs. Output Voltage

4-CH Linear Constant Current Sink With Matching

AP2502

Typical Performance Characteristics (Continued)

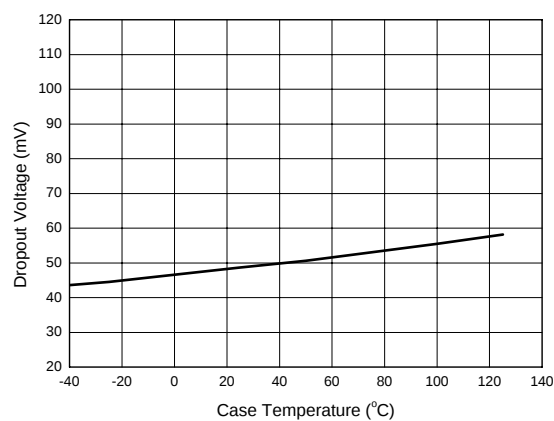


Figure 8. Dropout Voltage vs. Case Temperature

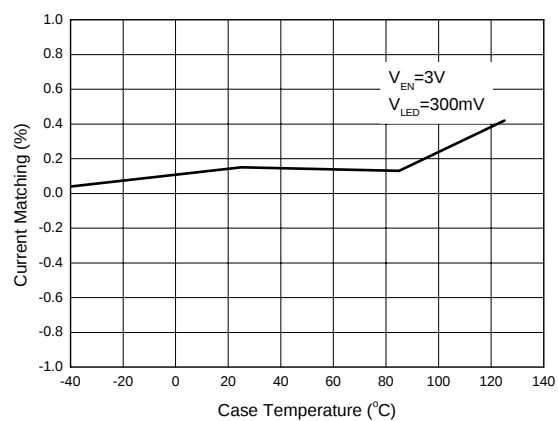


Figure 9. Current Matching vs. Case Temperature

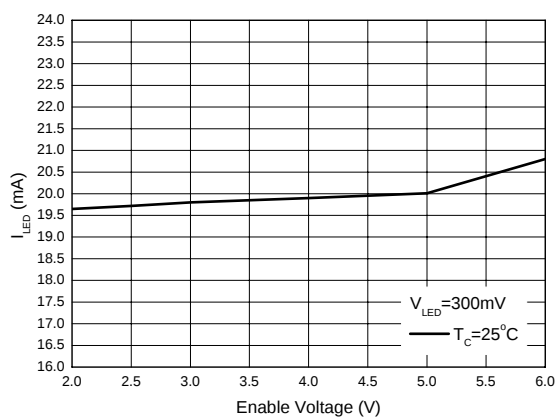


Figure 10. LED Current vs. Enable Voltage

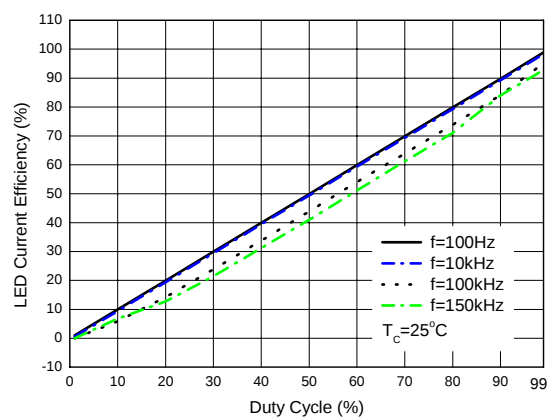
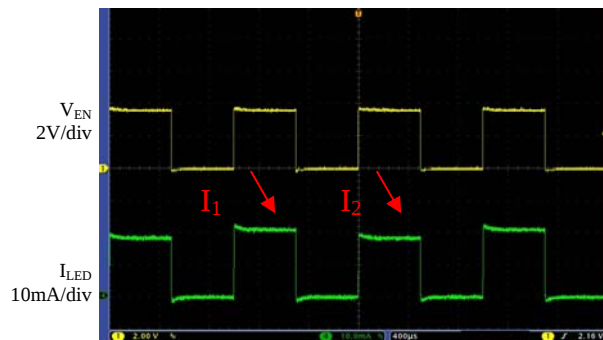
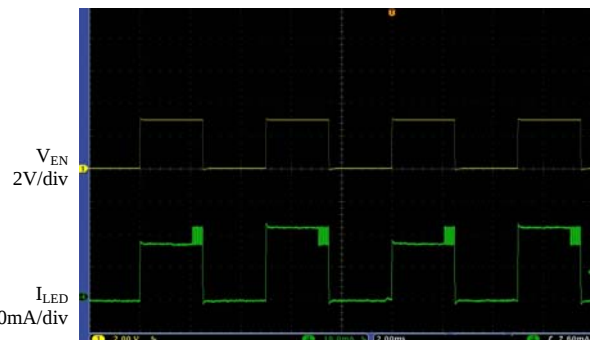


Figure 11. LED Current Efficiency vs. Duty Cycle

4-CH Linear Constant Current Sink With Matching

AP2502

Typical Performance Characteristics (Continued)

Time 400 μ s/div

Time 2ms/div

Figure 12. LED Current (Note 2)
 $(V_{IN}=4V, V_{EN}=0 \text{ to } 3.6V, \text{Duty cycle}=50\%, f_{PWM}=1kHz)$

Figure 13. Internal Oscillator Working at Low Frequency
 $(V_{IN}=4V, V_{EN}=0 \text{ to } 3.6V, \text{Duty cycle}=50\%, f_{PWM}=0.1kHz)$

Note 2: Chopper offset-canceling technology is adopted to get good current matching, $I_{LED}=[(I_1+I_2)/2]*\text{duty}$.

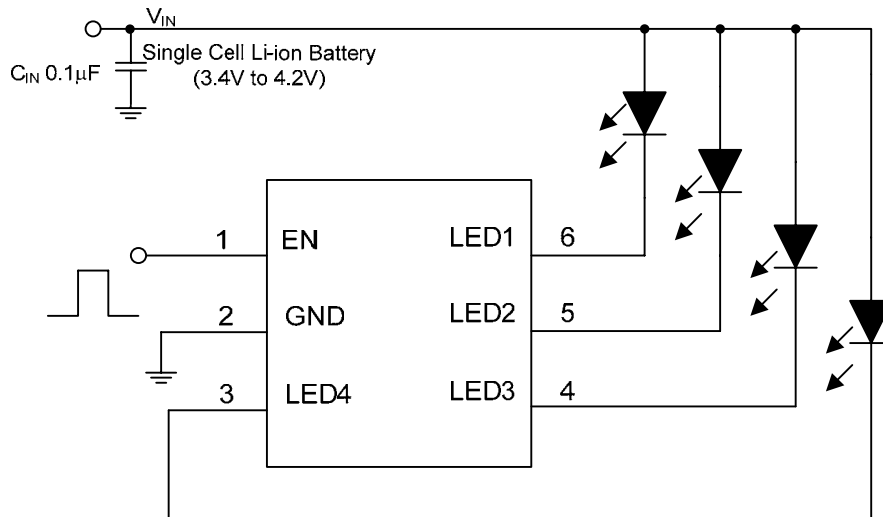
4-CH Linear Constant Current Sink With Matching**AP2502****Typical Application**

Figure 14. AP2502 Typical Application

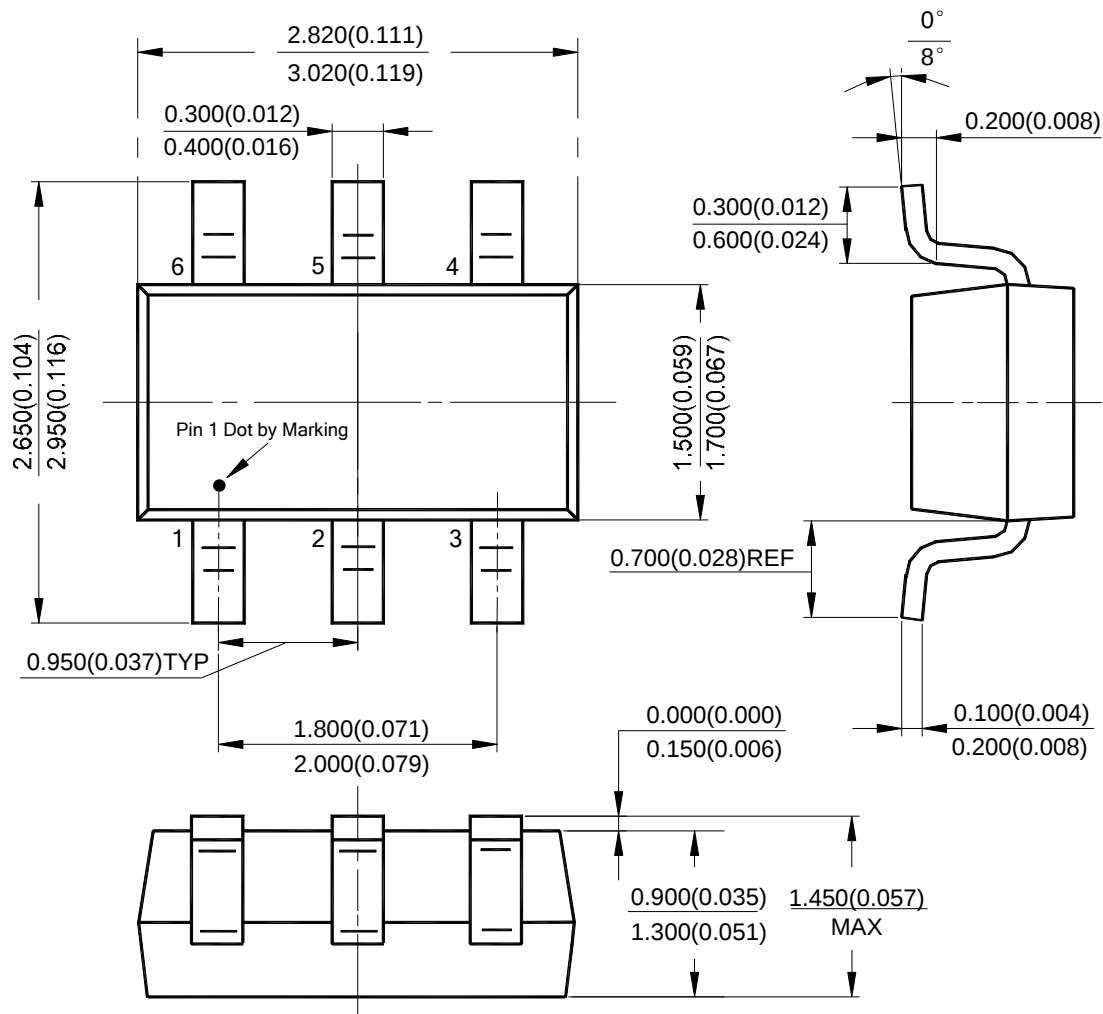
4-CH Linear Constant Current Sink With Matching

AP2502

Mechanical Dimensions

SOT-23-6

Unit: mm(inch)



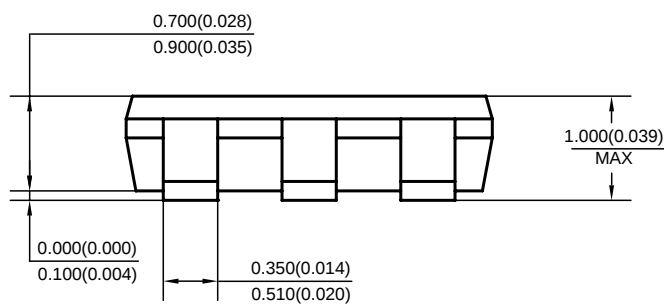
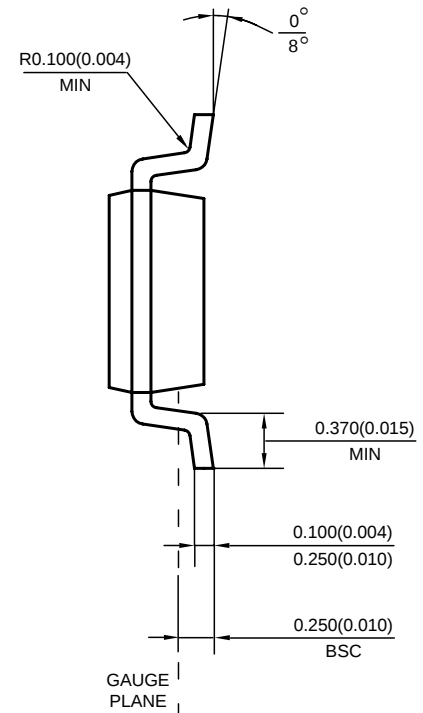
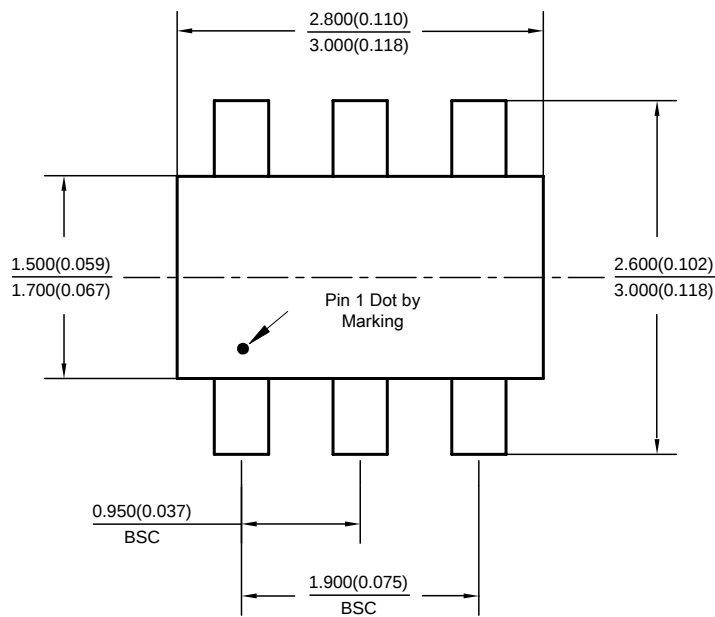
4-CH Linear Constant Current Sink With Matching

AP2502

Mechanical Dimensions (Continued)

TSOT-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

Unit A Room 1203, Skyworth Bldg., Gaoxin Ave. I.S., Nanshan District, Shenzhen, 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