

**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 $\mu$ 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 $\mu$ A (Typ.)
- Ultra-low Shutdown Current: 1 $\mu$ 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

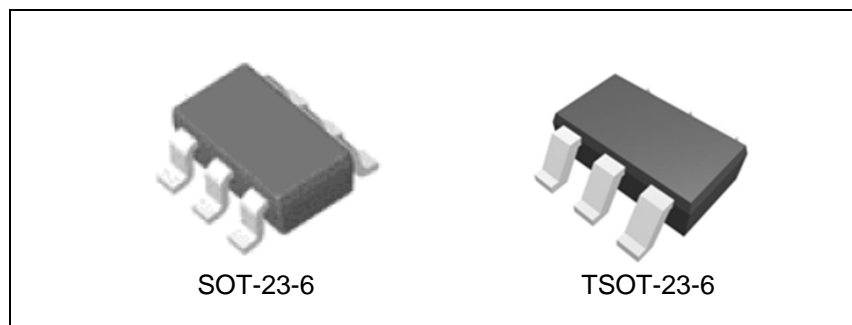


Figure 1. Package Types of AP2502

### Pin Configuration

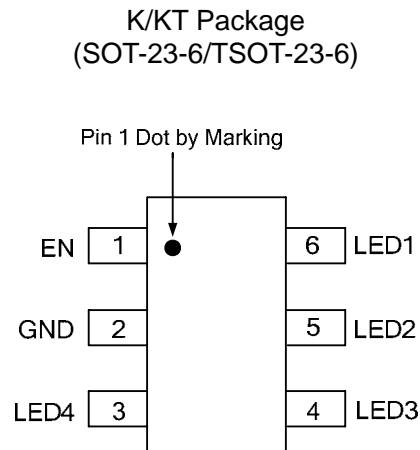


Figure 2. Pin Configuration of AP2502 (Top View)

### Pin Descriptions

Pin 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

Functional Block Diagram

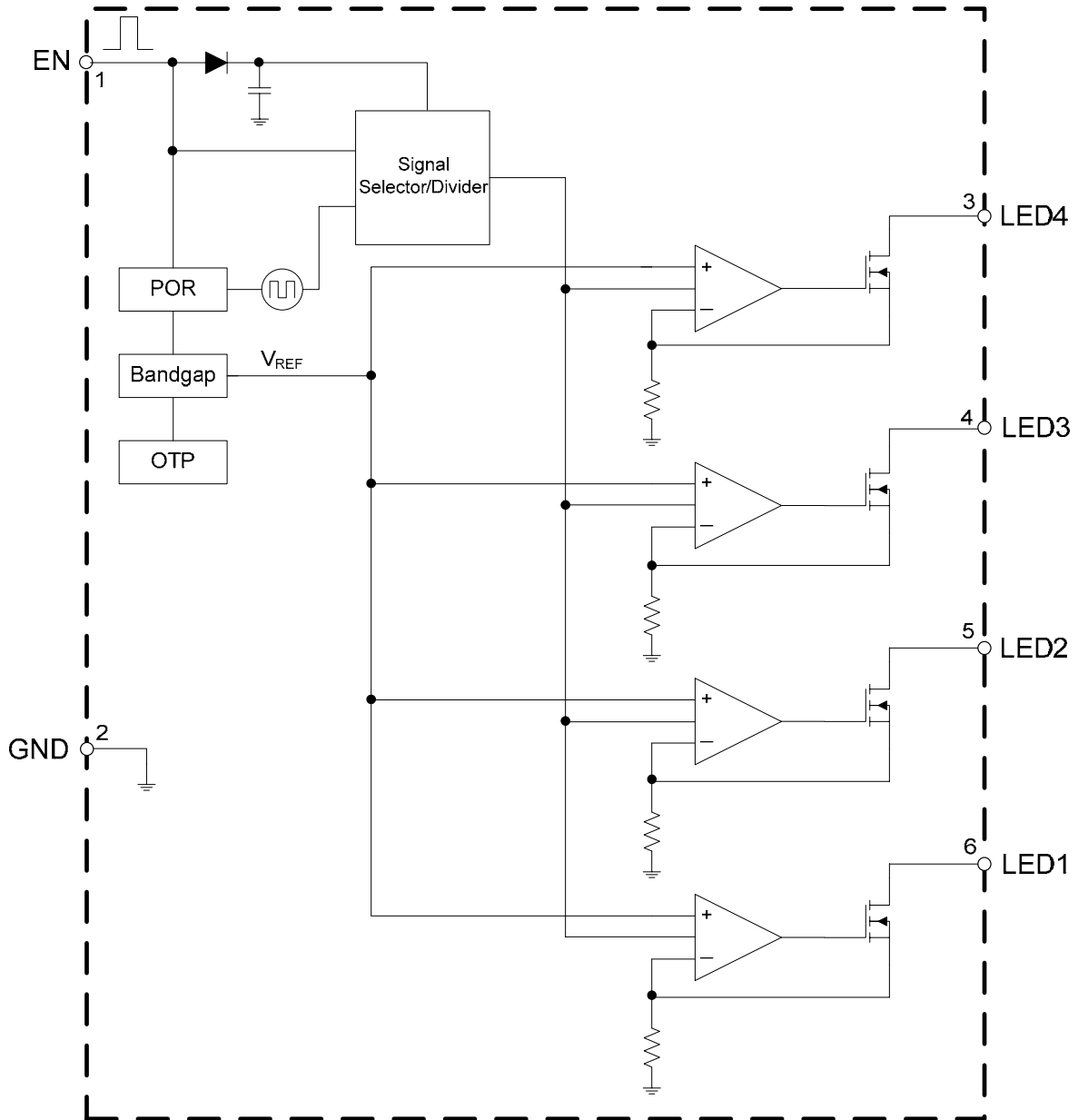
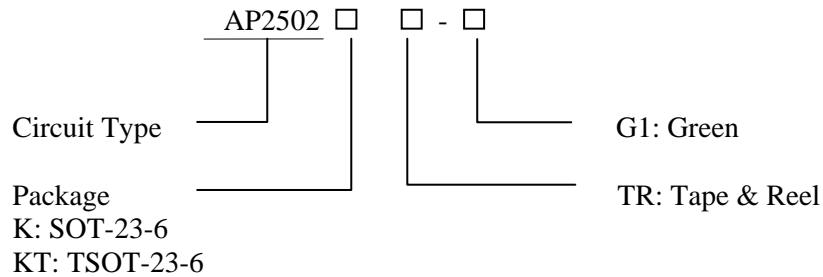


Figure 3. Functional Block Diagram of AP2502

**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)	$\theta_{JA}$	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	$\mu A$
Shutdown Current	$I_{SHUTDOWN}$	Set EN Pin Low		0.1	1	$\mu A$
Thermal Resistance (Junction to Case)	$\theta_{JC}$			80		°C/W
PWM Frequency to Adjust Brightness	$f_{PWM}$				150	kHz
EN Pin Pulse High Time	$T_{HIGH}$		1			$\mu s$
EN Pin Pulse Low Time	$T_{LOW}$		100			ns
Thermal Shutdown Temperature	$T_{OTS D}$			150		°C
Thermal Shutdown Hysteresis	$T_{HYOTS D}$			25		

Typical Performance Characteristics

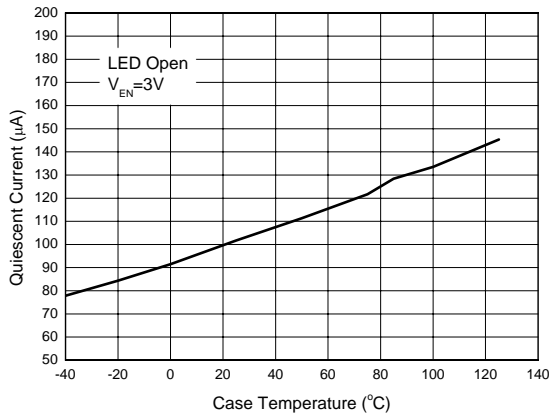


Figure 4. Quiescent Current vs. Case Temperature

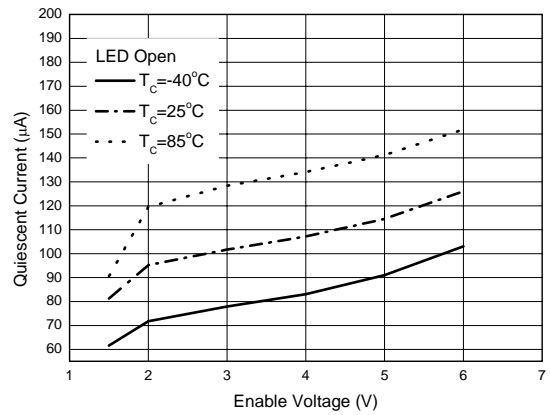


Figure 5. Quiescent Current vs. Enable Voltage

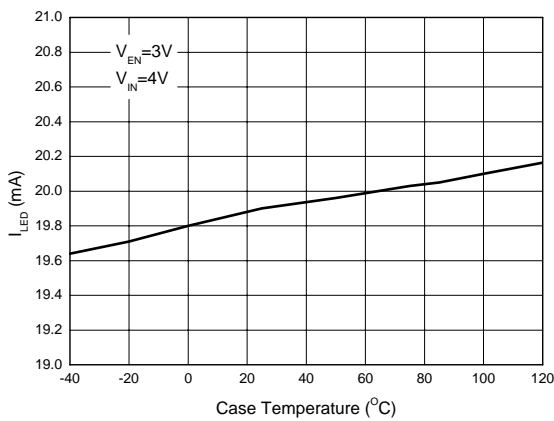


Figure 6. LED Current vs. Case Temperature

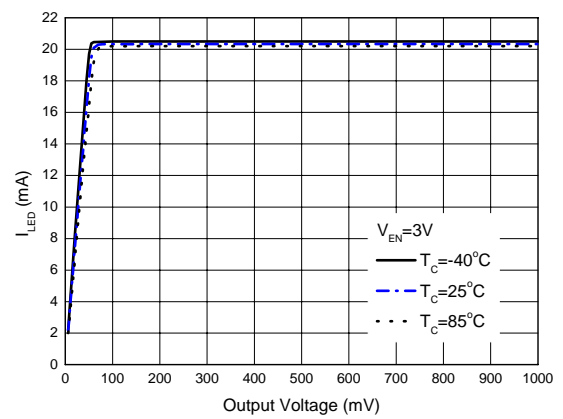


Figure 7. LED Current vs. Output Voltage

**4-CH Linear Constant Current Sink With Matching**

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**Typical Performance Characteristics (Continued)**

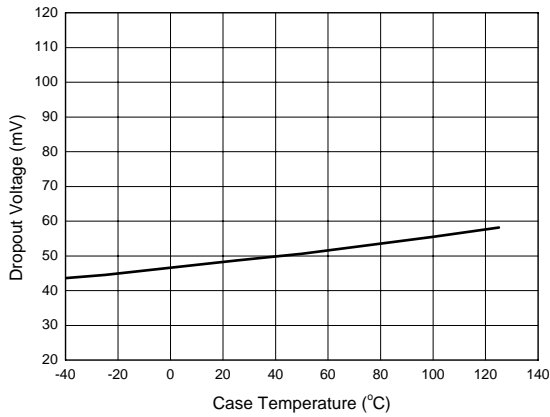


Figure 8. Dropout Voltage vs. Case Temperature

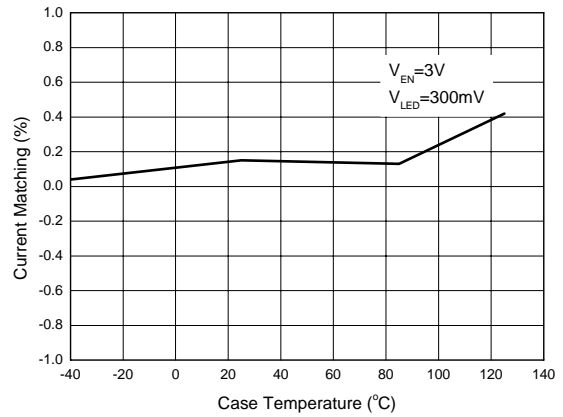


Figure 9. Current Matching vs. Case Temperature

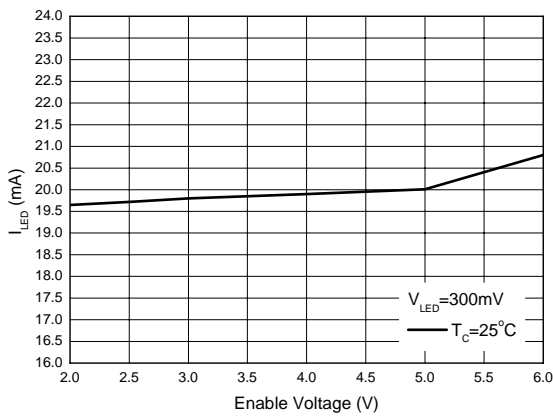


Figure 10. LED Current vs. Enable Voltage

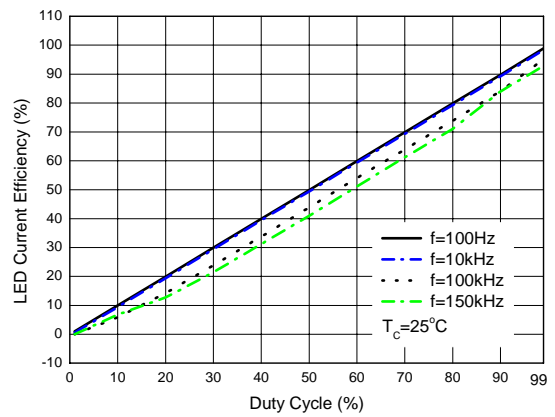


Figure 11. LED Current Efficiency vs. Duty Cycle

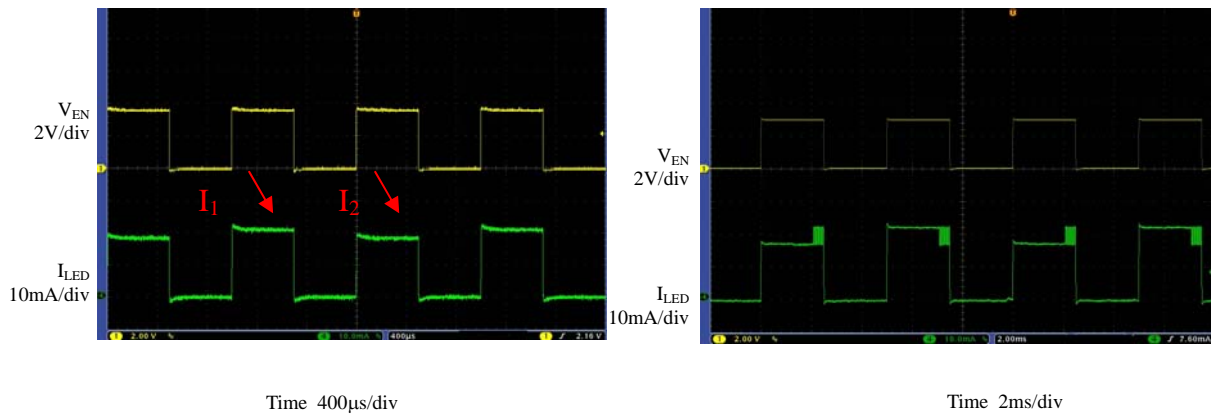
**Typical Performance Characteristics (Continued)**


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

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

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



**Typical Application**

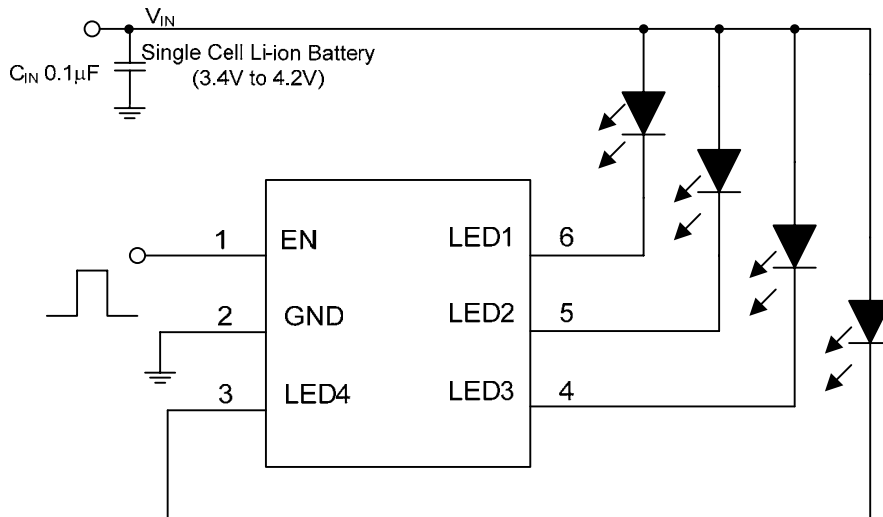


Figure 14. AP2502 Typical Application

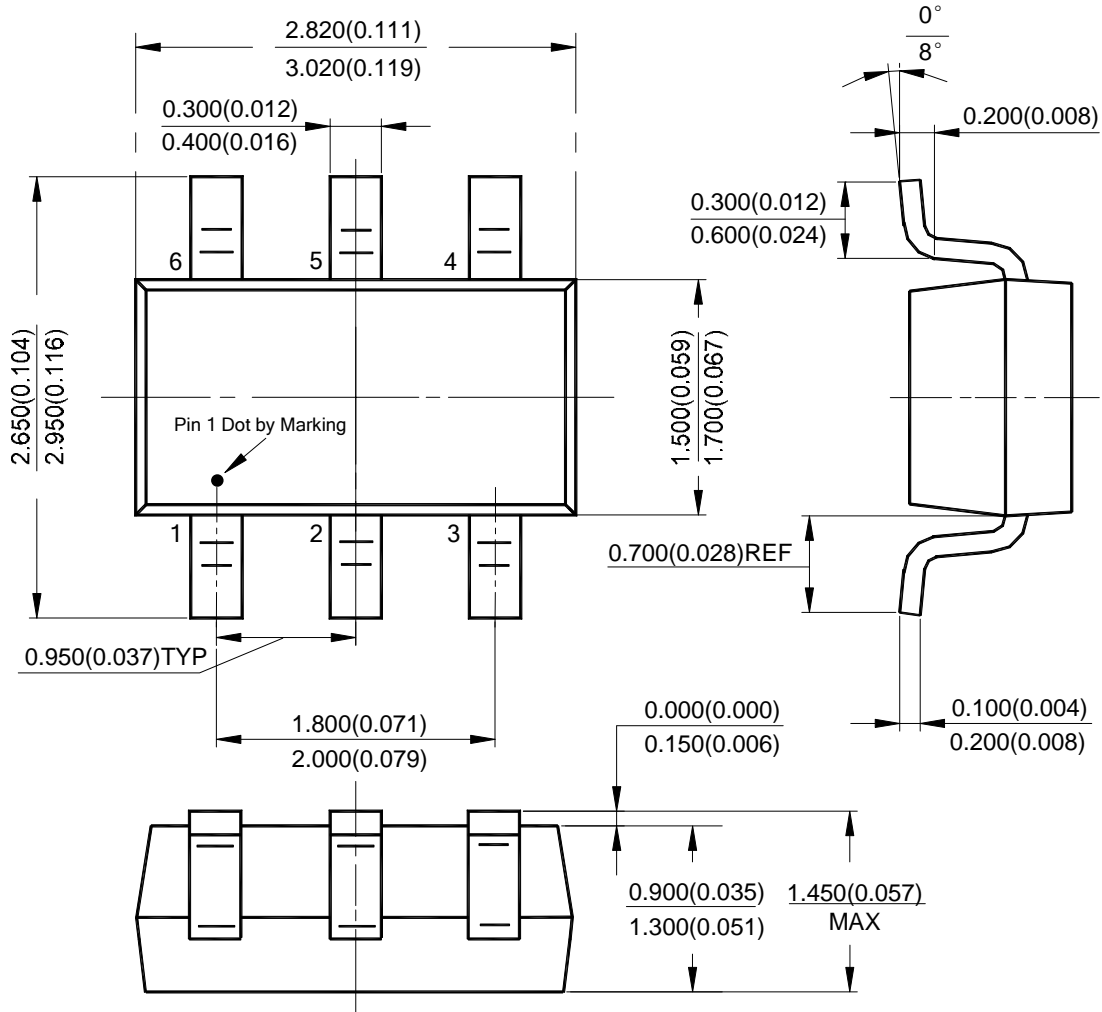
**4-CH Linear Constant Current Sink With Matching**

**AP2502**

**Mechanical Dimensions**

**SOT-23-6**

**Unit: mm(inch)**



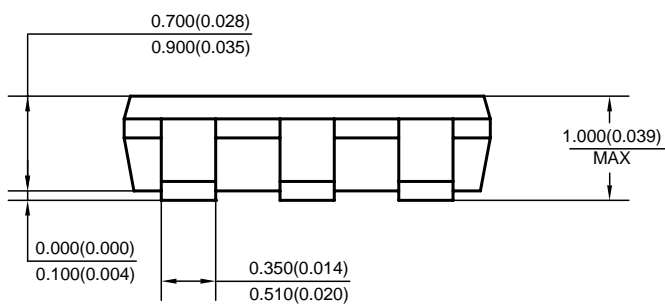
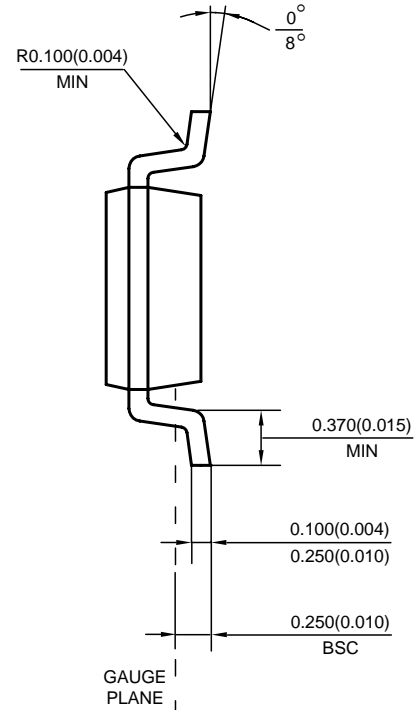
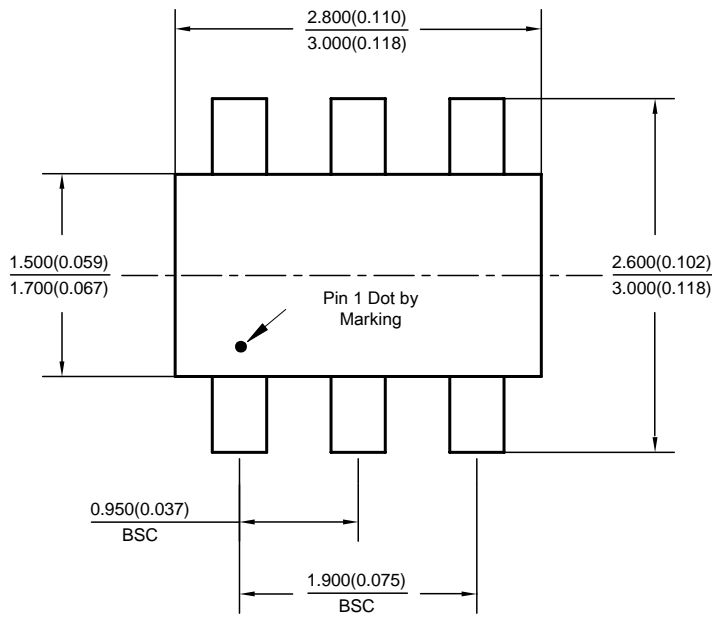
**4-CH Linear Constant Current Sink With Matching**

**AP2502**

**Mechanical Dimensions (Continued)**

**TSOT-23-6**

**Unit: mm(inch)**





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