

**150mA EXTREMELY LOW NOISE LDO REGULATOR****AP2121****General Description**

The AP2121 series are positive voltage regulator ICs designed by CMOS process. Each of these ICs consists of a voltage reference, an error amplifier, a resistor network for setting output voltage, a current limit circuit for current protection and a chip enable circuit (5-pin products only).

The AP2121 series have features of high ripple rejection, low dropout voltage, low noise, high output voltage accuracy, and low current consumption which make them ideal for use in various battery-powered devices.

The AP2121 series have 1.5V, 2.5V and 3.2V versions.

The AP2121 are available in standard SOT-23-3 and SOT-23-5 packages.

**Features**

- Low Dropout Voltage at  $I_{OUT}=100mA$ : 150mV Typical (Except 1.5V Version)
- Low Standby Current: 0.1 $\mu A$  Typical (Except 1.5V Version)
- Low Quiescent Current: 25 $\mu A$  Typical
- High Ripple Rejection: 70dB Typical ( $f=10kHz$ )
- Excellent Line Regulation: 4mV Typical
- Excellent Load Regulation: 12mV Typical
- High Output Voltage Accuracy:  $\pm 2\%$
- Excellent Line Transient Response and Load Transient Response
- Low ESR Ceramic Capacitor Available
- ESD (Human Body Model): 2kV

**Applications**

- Mobile Phones, Cordless Phones
- Wireless Communication Equipment
- Portable Games
- Cameras, Video Recorders
- Sub-board Power Supplies for Telecom Equipment
- Battery Powered Equipment

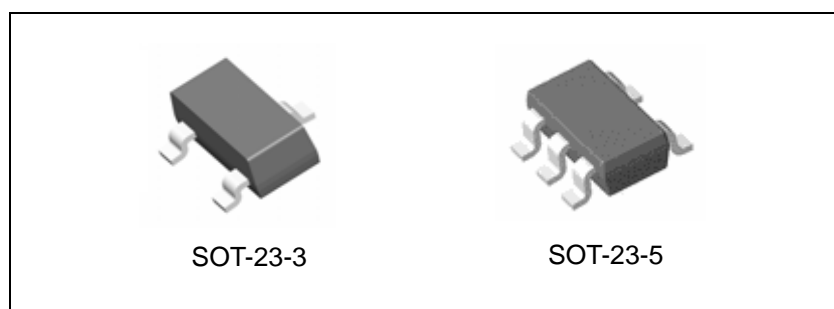


Figure 1. Package Types of AP2121

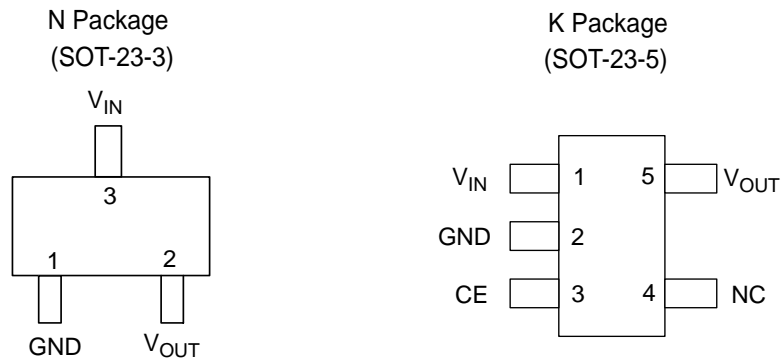
**150mA EXTREMELY LOW NOISE LDO REGULATOR****AP2121****Pin Configuration**

Figure 2. Pin Configuration of AP2121 (Top View)

**Pin Description**

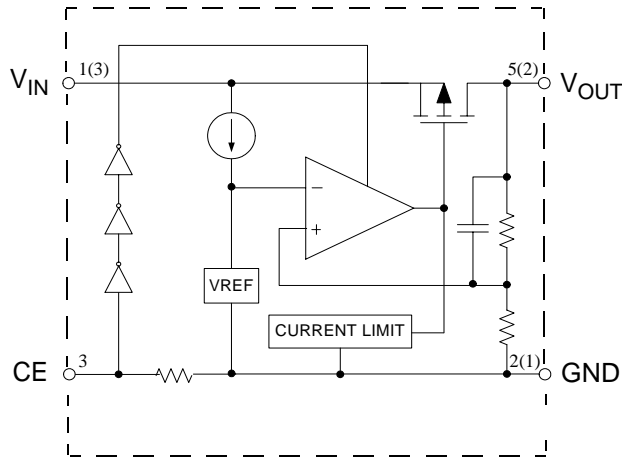
Pin Number		Pin Name	Function
SOT-23-3	SOT-23-5		
3	1	$V_{IN}$	Input voltage
1	2	GND	Ground
	3	CE	Active high enable input pin. Logic high=enable, logic low=shutdown
	4	NC	No connection
2	5	$V_{OUT}$	Regulated output voltage



**150mA EXTREMELY LOW NOISE LDO REGULATOR**

**AP2121**

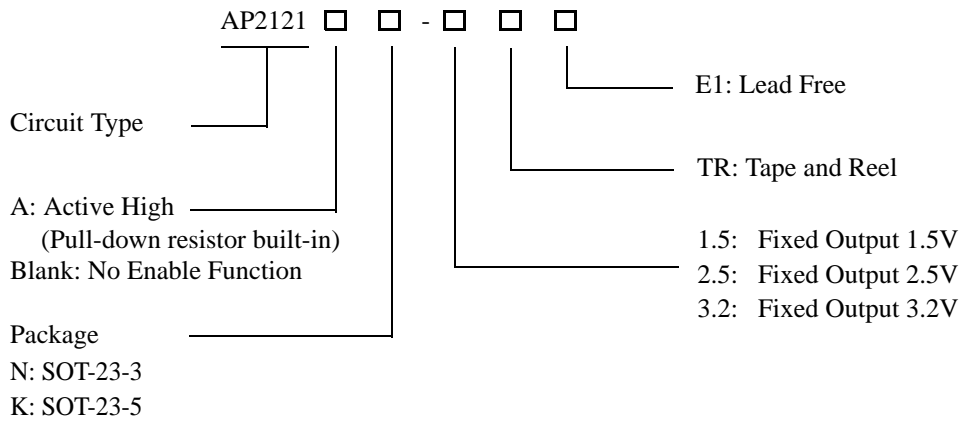
**Functional Block Diagram**



SOT-23-5 (SOT-23-3)

Figure 3. Functional Block Diagram of AP2121

**Ordering Information**



**150mA EXTREMELY LOW NOISE LDO REGULATOR****AP2121****Ordering Information (Continued)**

Package	Temperature Range	Condition	Part Number		Marking ID		Packing Type
			Tin Lead	Lead Free	Tin Lead	Lead Free	
SOT-23-3	-40 to 125°C			AP2121N-1.5TRE1		EF1	Tape & Reel
SOT-23-5		Active High (Pull-down resistor built-in)		AP2121AK-2.5TRE1		E1V	Tape & Reel
		Active High (Pull-down resistor built-in)		AP2121AK-3.2TRE1		E3Z	Tape & Reel

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

**Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit
Input Voltage	$V_{IN}$	6.5	V
Output Current	$I_{OUT}$	300	mA
Storage Temperature Range	$T_{STG}$	-65 to 150	°C
Lead Temperature (Soldering, 10sec)	$T_{LEAD}$	260	°C
ESD (Human Body Model)		2000	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.

**Recommended Operating Conditions**

Parameter	Symbol	Min	Max	Unit
Input Voltage	$V_{IN}$		6	V
Operating Junction Temperature Range	$T_J$	-40	125	°C

**150mA EXTREMELY LOW NOISE LDO REGULATOR****AP2121****Electrical Characteristics****AP2121-1.5V Electrical Characteristics**(V<sub>IN</sub>=2.5V, T<sub>J</sub>=25°C, C<sub>IN</sub>=1μF, C<sub>OUT</sub>=1μF, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V <sub>OUT</sub>	V <sub>IN</sub> =2.5V, 1mA≤I <sub>OUT</sub> ≤30mA	1.47	1.5	1.53	V
Input Voltage	V <sub>IN</sub>				6	V
Output Current	I <sub>OUT</sub>	V <sub>IN</sub> -V <sub>OUT</sub> =1V	150			mA
Load Regulation	V <sub>RLOAD</sub>	V <sub>IN</sub> =2.5V, 1mA≤I <sub>OUT</sub> ≤80mA		12	40	mV
Line Regulation	V <sub>RLINE</sub>	2.3V≤V <sub>IN</sub> ≤6V, I <sub>OUT</sub> =30mA		4	16	mV
Dropout Voltage	V <sub>DROP</sub>	I <sub>OUT</sub> =100mA		400	600	mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> =2.5V, I <sub>OUT</sub> =0mA		25	50	μA
Power Supply Rejection Ratio	PSRR	Ripple 0.5Vp-p, f=10kHz, V <sub>IN</sub> =2.5V		70		dB
Output Voltage Temperature Coefficient	ΔV <sub>OUT</sub> /ΔT	I <sub>OUT</sub> =30mA, -40°C≤T <sub>J</sub> ≤125°C		±150		μV/°C
	(ΔV <sub>OUT</sub> /V <sub>OUT</sub> )/ΔT	I <sub>OUT</sub> =30mA, -40°C≤T <sub>J</sub> ≤125°C		±100		ppm/°C
Short Current Limit	I <sub>LIMIT</sub>	V <sub>OUT</sub> =0V		50		mA
RMS Output Noise	V <sub>NOISE</sub>	T <sub>A</sub> =25°C, 10Hz ≤f≤100kHz		30		μVrms



**150mA EXTREMELY LOW NOISE LDO REGULATOR**

**AP2121**

**Electrical Characteristics (Continued)**

**AP2121-2.5V Electrical Characteristics**

( $V_{IN}=3.5V$ ,  $T_J=25^{\circ}C$ ,  $C_{IN}=1\mu F$ ,  $C_{OUT}=1\mu F$ , unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$	$V_{IN}=3.5V$ , $1mA \leq I_{OUT} \leq 30mA$	2.45	2.5	2.55	V
Input Voltage	$V_{IN}$				6	V
Output Current	$I_{OUT}$	$V_{IN}-V_{OUT}=1V$	150			mA
Load Regulation	$V_{RLOAD}$	$V_{IN}=3.5V$ , $1mA \leq I_{OUT} \leq 80mA$		12	40	mV
Line Regulation	$V_{RLINE}$	$3V \leq V_{IN} \leq 6V$ , $I_{OUT}=30mA$		4	16	mV
Dropout Voltage	$V_{DROP}$	$I_{OUT}=100mA$		150	300	mV
Quiescent Current	$I_Q$	$V_{IN}=3.5V$ , $I_{OUT}=0mA$		25	50	$\mu A$
Standby Current	$I_{STD}$	$V_{IN}=3.5V$ , $V_{CE}$ in OFF mode		0.1	1	$\mu A$
Power Supply Rejection Ratio	PSRR	Ripple 0.5Vp-p, $f=10kHz$ , $V_{IN}=3.5V$		70		dB
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=30mA$ , $-40^{\circ}C \leq T_J \leq 125^{\circ}C$		$\pm 250$		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$	$I_{OUT}=30mA$ , $-40^{\circ}C \leq T_J \leq 125^{\circ}C$		$\pm 100$		ppm/ $^{\circ}C$
Short Current Limit	$I_{LIMIT}$	$V_{OUT}=0V$		50		mA
RMS Output Noise	$V_{NOISE}$	$T_A=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$		30		$\mu V_{rms}$
CE "High" Voltage		CE input voltage "High"	1.5		$V_{IN}$	V
CE "Low" Voltage		CE input voltage "Low"	0		0.25	V
CE pull-down resistance	$R_{PD}$		2.5	5	10	$M\Omega$



**150mA EXTREMELY LOW NOISE LDO REGULATOR AP2121**

**Electrical Characteristics (Continued)**

**AP2121-3.2V Electrical Characteristics**

( $V_{IN}=4.2V$ ,  $T_J=25^{\circ}C$ ,  $C_{IN}=1\mu F$ ,  $C_{OUT}=1\mu F$ , unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$	$V_{IN}=4.2V$ , $1mA \leq I_{OUT} \leq 30mA$	3.136	3.2	3.264	V
Input Voltage	$V_{IN}$				6	V
Output Current	$I_{OUT}$	$V_{IN}-V_{OUT}=1V$	150			mA
Load Regulation	$V_{RLOAD}$	$V_{IN}=4.2V$ , $1mA \leq I_{OUT} \leq 80mA$		12	40	mV
Line Regulation	$V_{RLINE}$	$3.7V \leq V_{IN} \leq 6V$ , $I_{OUT}=30mA$		4	16	mV
Dropout Voltage	$V_{DROP}$	$I_{OUT}=100mA$		150	300	mV
Quiescent Current	$I_Q$	$V_{IN}=4.2V$ , $I_{OUT}=0mA$		25	50	$\mu A$
Standby Current	$I_{STD}$	$V_{IN}=4.2V$ , $V_{CE}$ in OFF mode		0.1	1	$\mu A$
Power Supply Rejection Ratio	PSRR	Ripple 0.5Vp-p, $f=10kHz$ , $V_{IN}=4.2V$		70		dB
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=30mA$ , $-40^{\circ}C \leq T_J \leq 125^{\circ}C$		$\pm 320$		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$	$I_{OUT}=30mA$ , $-40^{\circ}C \leq T_J \leq 125^{\circ}C$		$\pm 100$		ppm/ $^{\circ}C$
Short Current Limit	$I_{LIMIT}$	$V_{OUT}=0V$		50		mA
RMS Output Noise	$V_{NOISE}$	$T_A=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$		30		$\mu V_{rms}$
CE "High" Voltage		CE input voltage "High"	1.5		$V_{IN}$	V
CE "Low" Voltage		CE input voltage "Low"	0		0.25	V
CE pull-down resistance	$R_{PD}$		2.5	5	10	$M\Omega$



**150mA EXTREMELY LOW NOISE LDO REGULATOR**

**AP2121**

**Typical Performance Characteristics**

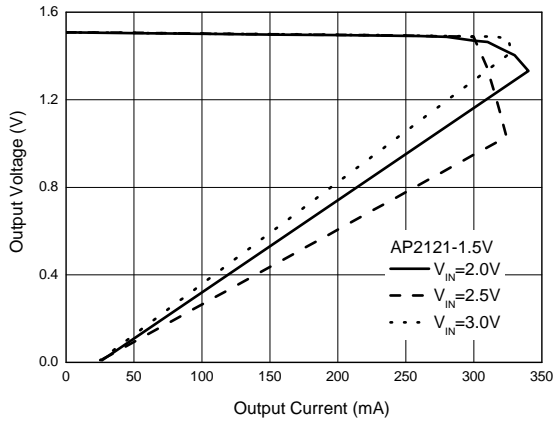


Figure 4. Output Voltage vs. Output Current

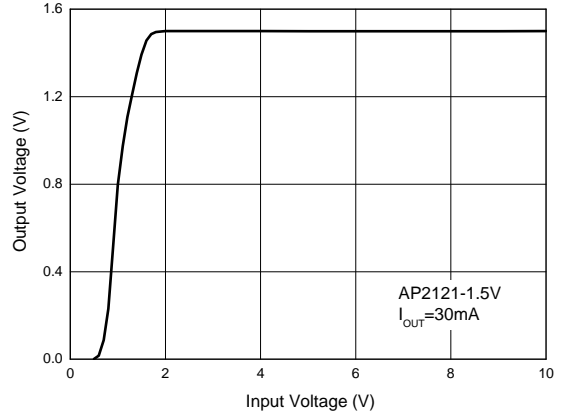


Figure 5. Output Voltage vs. Input Voltage

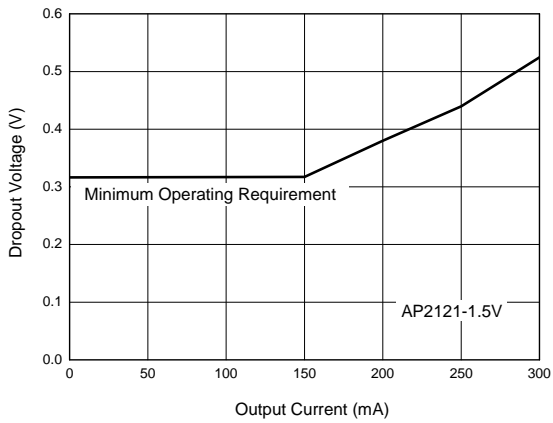


Figure 6. Dropout Voltage vs. Output Current

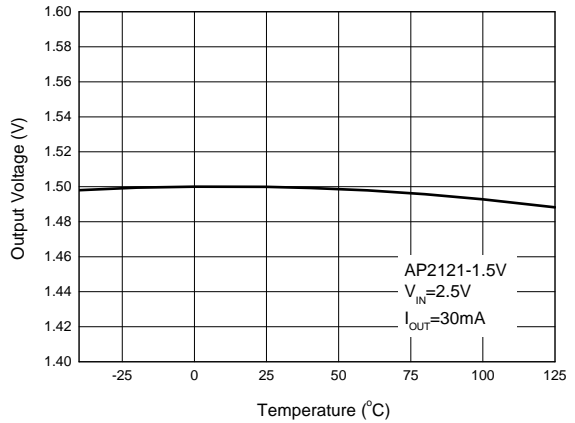


Figure 7. Output Voltage vs. Temperature





**150mA EXTREMELY LOW NOISE LDO REGULATOR**

**AP2121**

**Typical Performance Characteristics (Continued)**

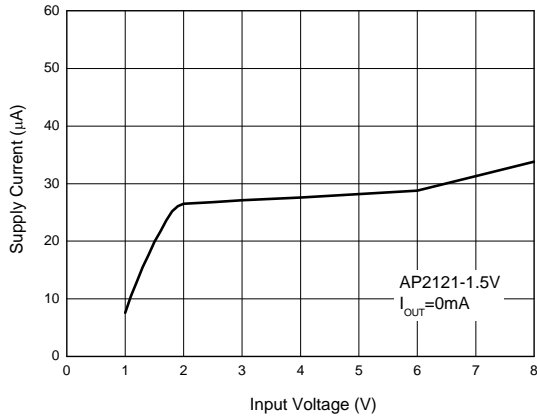


Figure 8. Supply Current vs. Input Voltage

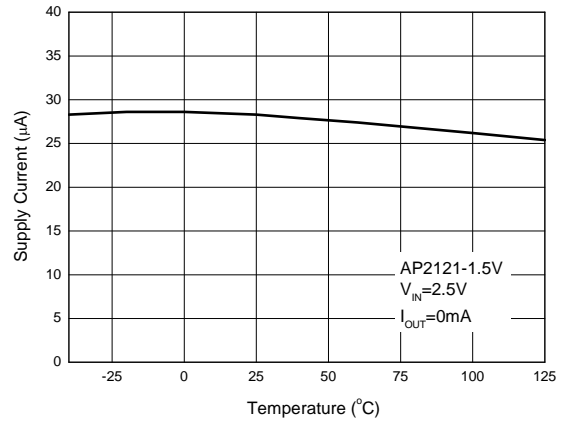


Figure 9. Supply Current vs. Temperature

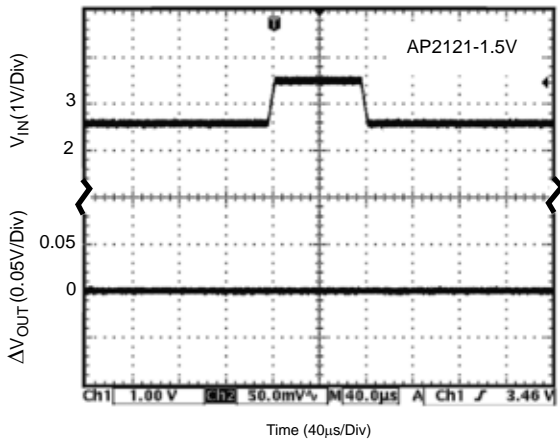


Figure 10. Line Transient  
(Conditions:  $I_{OUT}=30mA$ ,  $C_{IN}=1\mu F$ ,  $C_{OUT}=1\mu F$ )

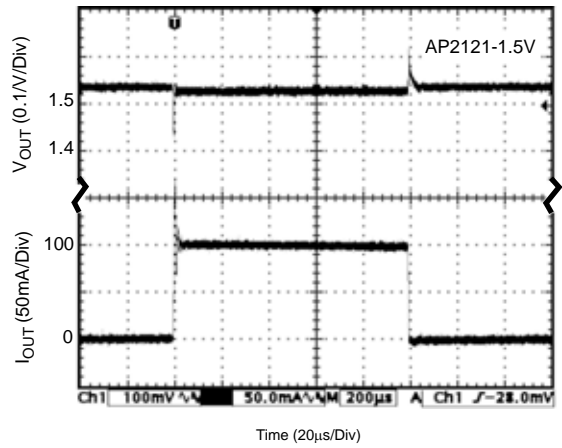


Figure 11. Load Transient  
(Conditions:  $V_{IN}=2.5V$ ,  $C_{IN}=1\mu F$ ,  $C_{OUT}=1\mu F$ )



**150mA EXTREMELY LOW NOISE LDO REGULATOR**

**AP2121**

**Typical Performance Characteristics (Continued)**

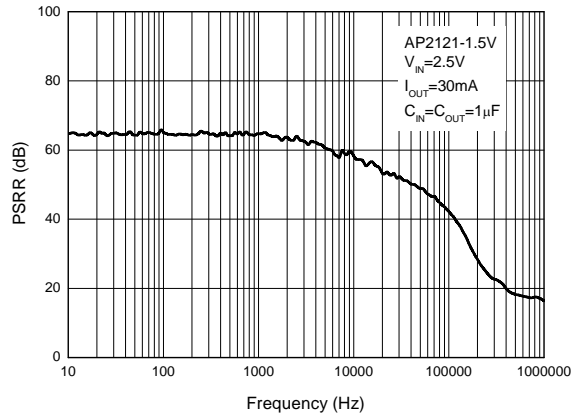


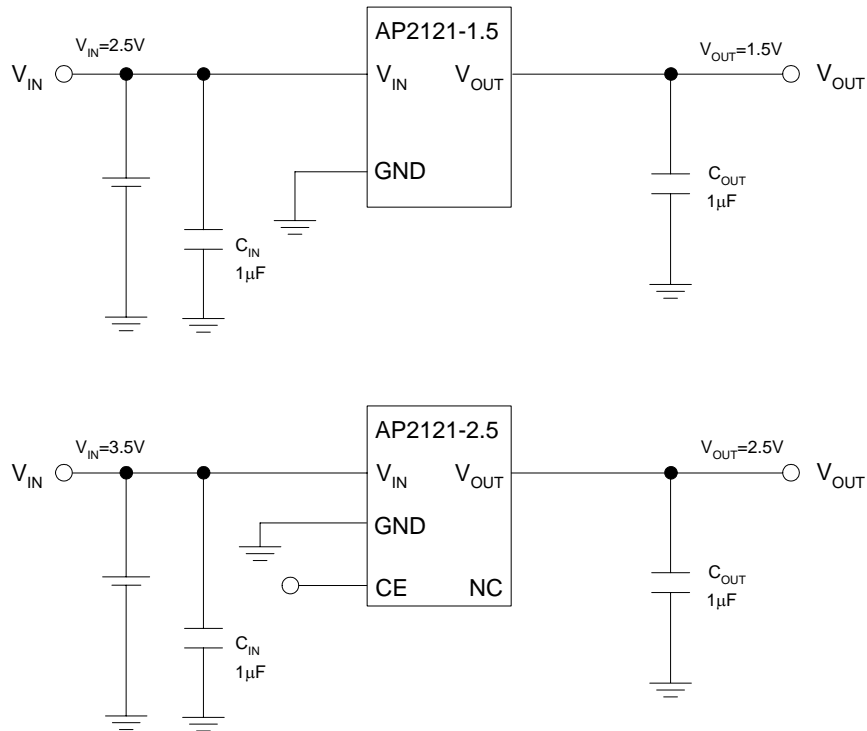
Figure 12. PSRR vs. Frequency



**150mA EXTREMELY LOW NOISE LDO REGULATOR**

**AP2121**

**Typical Application**



Note: Filter capacitors are required at the AP2121's input and output. 1µF capacitor is required at the input. The minimum output capacitance required for stability should be more than 1µF with ESR from 0.1Ω to 10Ω. Ceramic capacitors are recommended.

Figure 13. Typical Application of AP2121



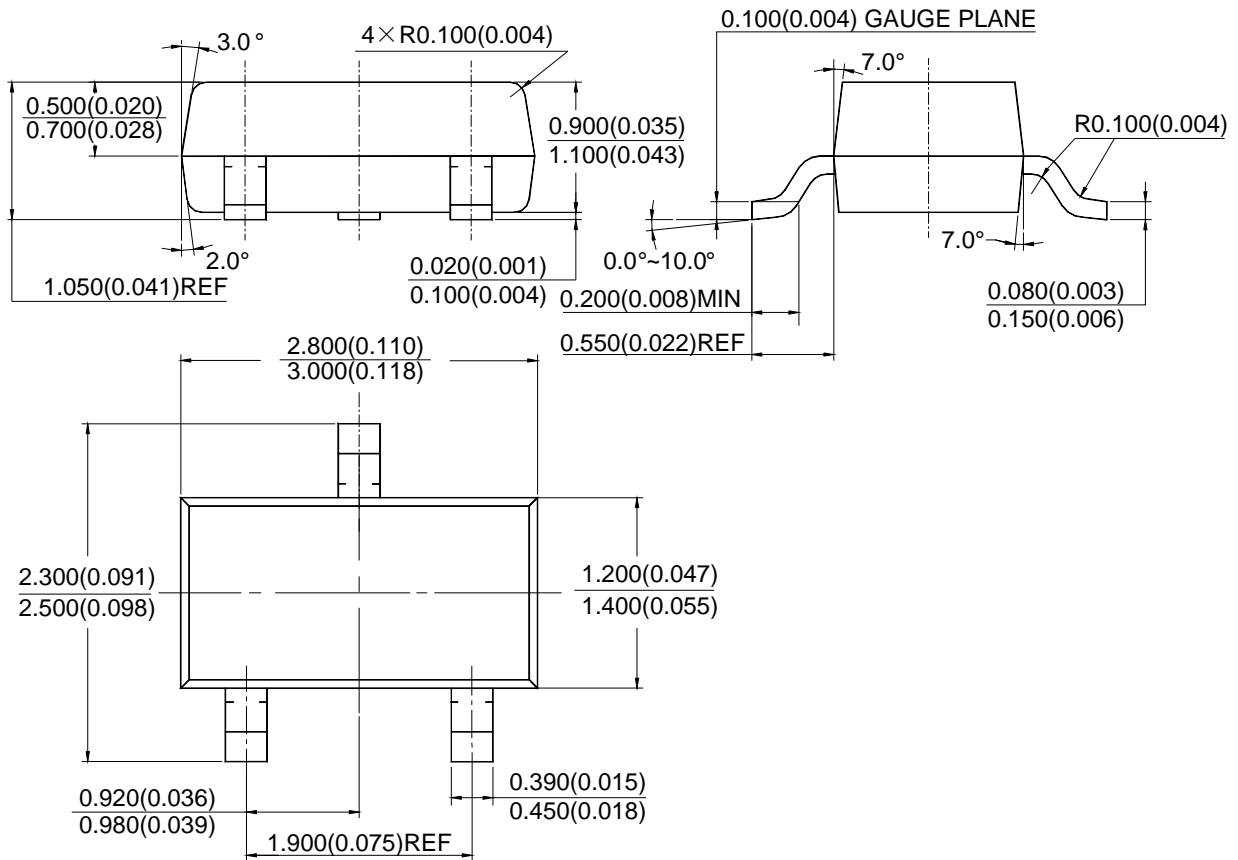
**150mA EXTREMELY LOW NOISE LDO REGULATOR**

**AP2121**

**Mechanical Dimensions**

**SOT-23-3**

**Unit: mm(inch)**





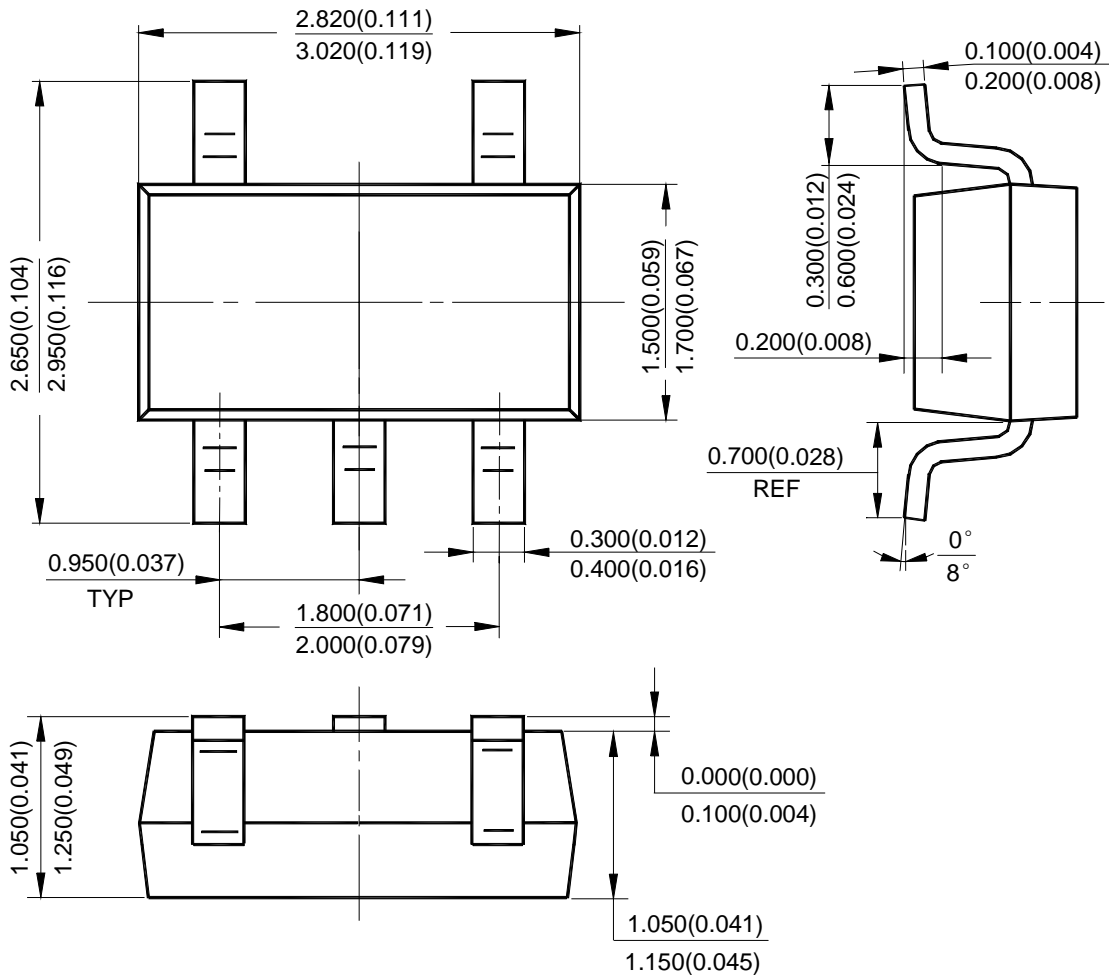
**150mA EXTREMELY LOW NOISE LDO REGULATOR**

**AP2121**

**Mechanical Dimensions (Continued)**

**SOT-23-5**

**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

**BCD Semiconductor Manufacturing Limited**  
- Wafer Fab  
Shanghai SIM-BCD Semiconductor Manufacturing Limited  
800, Yi Shan Road, Shanghai 200233, China  
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

**BCD Semiconductor Manufacturing Limited**  
- IC Design Group  
Advanced Analog Circuits (Shanghai) Corporation  
8F, Zone B, 900, Yi Shan Road, Shanghai 200233, China  
Tel: +86-21-6495 9539, Fax: +86-21-6485 9673

#### REGIONAL SALES OFFICE

**Shenzhen Office**  
Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd. Shenzhen Office  
Advanced Analog Circuits (Shanghai) Corporation Shenzhen Office  
27B, Tower C, 2070, Middle Shen Nan Road, Shenzhen 518031, China  
Tel: +86-755-8368 3987, Fax: +86-755-8368 3166

**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 Corporation  
3170 De La Cruz Blvd., Suite 105, Santa Clara,  
CA 95054-2411, U.S.A  
Tel: +1-408-988 6388, Fax: +1-408-988 6386