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HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR

AP2120

General Description

The AP2120 series are positive voltage regulator ICs fabricated 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.

The AP2120 series feature high supply voltage 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 AP2120 series have 1.2V, 1.3V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.2V, 3.3V, 3.6V, 4.0V and 5.0V versions.

The AP2120 are available in standard SOT-23, SOT-89 and TO-92 packages.

Features

- Low Dropout Voltage at $I_{OUT}=100mA$: 200mV Typical (Except 1.2V, 1.3V and 1.5V Versions)
- Low Quiescent Current: 25 μA Typical
- High Ripple Rejection: 65dB Typical ($f=1kHz$)
- Output Current: More Than 150mA (250mA Limit)
- Extremely Low Noise: 15 μV_{rms} @ $V_{OUT}=1.2V, 1.3V, 1.5V$ (10Hz to 100kHz)
- Excellent Line Regulation: 4mV Typical
- Excellent Load Regulation: 12mV Typical
- High Output Voltage Accuracy: $\pm 2\%$
- Excellent Line Transient Response and Load Transient Response
- Compatible with Low ESR Ceramic Capacitor (as Low as 1 μF)

Applications

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

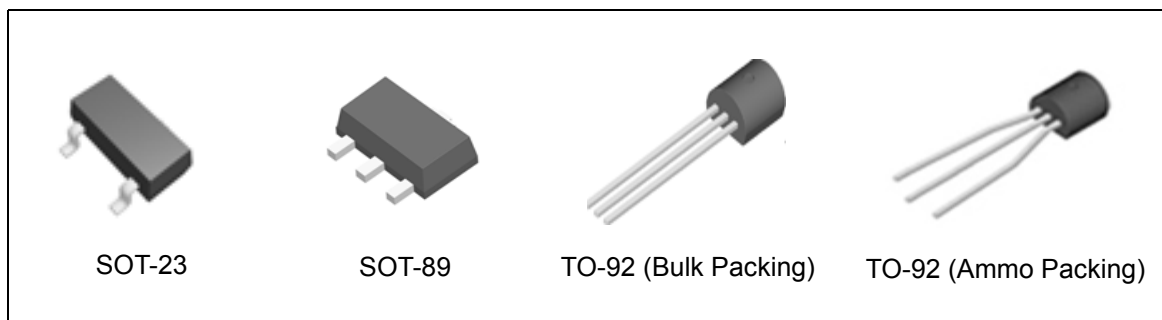


Figure 1. Package Types of AP2120

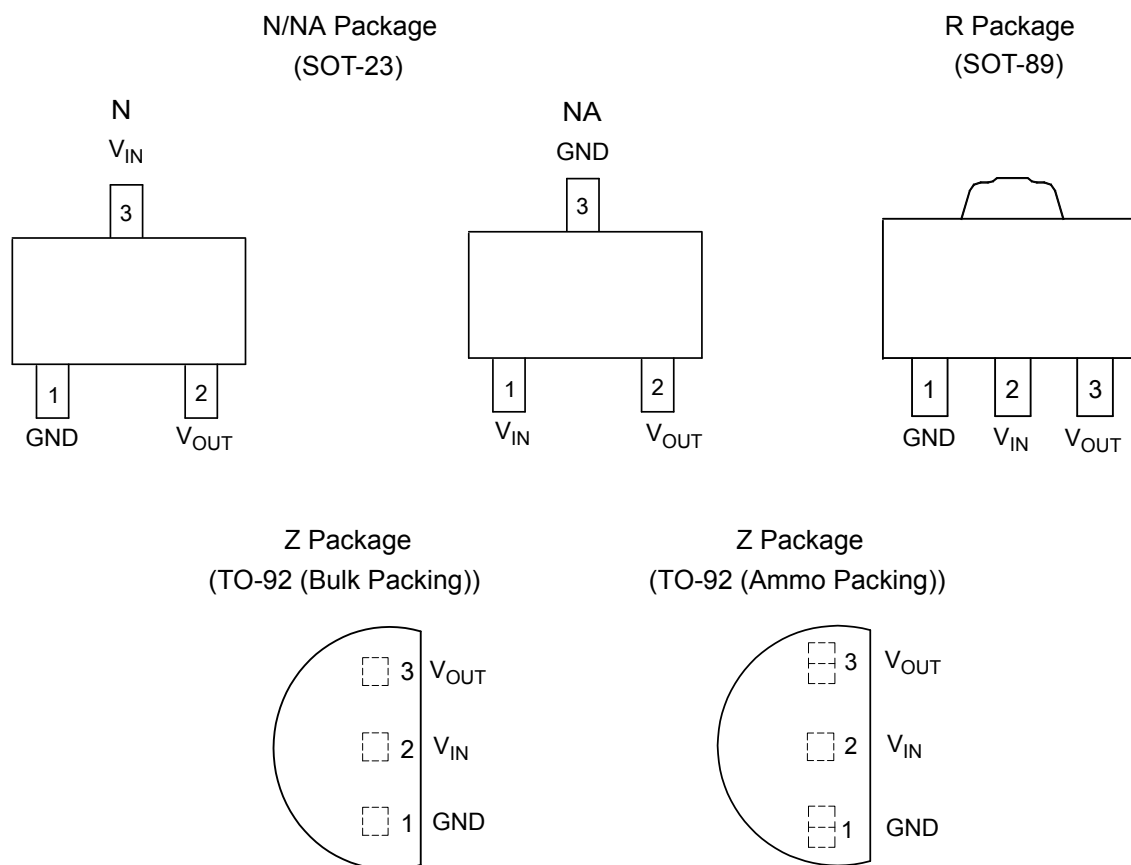
Pin Configuration


Figure 2. Pin Configuration of AP2120 (Top View)

Pin Description

| Pin Number | | | Pin Name | Function |
|------------|-------------|------------------|-----------|--------------------------|
| SOT-23 (N) | SOT-23 (NA) | SOT-89/ TO-92 | | |
| 1 | 3 | 1 | GND | Ground |
| 2 | 2 | 3 | V_{OUT} | Regulated Output Voltage |
| 3 | 1 | 2 | V_{IN} | Input Voltage |

Functional Block Diagram

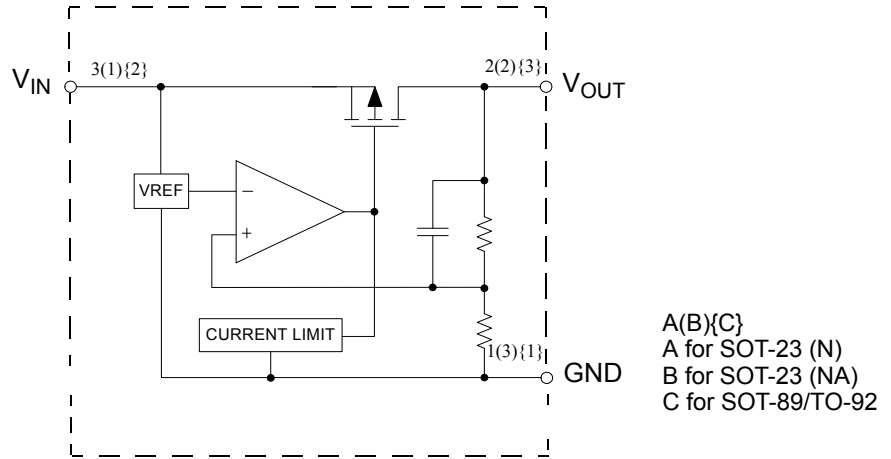
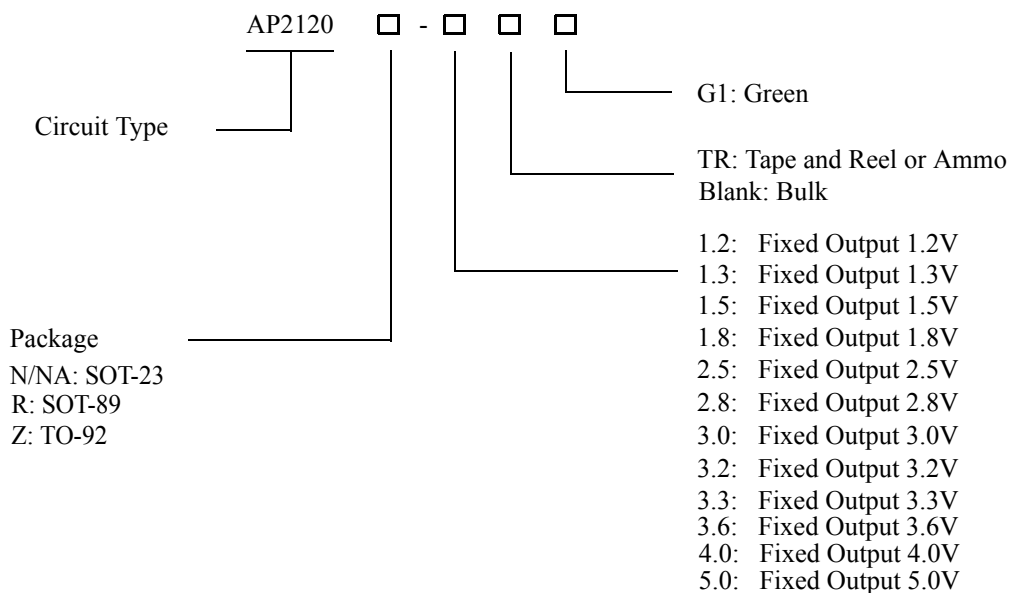


Figure 3. Functional Block Diagram of AP2120



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Ordering Information



| Package | Temperature Range | Output Voltage | Part Number | Marking ID | Packing Type |
|---------|-------------------|----------------|------------------|------------|--------------|
| SOT-23 | -40 to 85°C | 1.2V(N) | AP2120N-1.2TRG1 | GR4 | Tape & Reel |
| | | 1.3V(N) | AP2120N-1.3TRG1 | GR5 | Tape & Reel |
| | | 1.5V(N) | AP2120N-1.5TRG1 | GR6 | Tape & Reel |
| | | 1.8V(N) | AP2120N-1.8TRG1 | GR7 | Tape & Reel |
| | | 2.5V(N) | AP2120N-2.5TRG1 | GR8 | Tape & Reel |
| | | 2.8V(N) | AP2120N-2.8TRG1 | GR9 | Tape & Reel |
| | | 3.0V(N) | AP2120N-3.0TRG1 | GS2 | Tape & Reel |
| | | 3.2V(N) | AP2120N-3.2TRG1 | GS3 | Tape & Reel |
| | | 3.3V(N) | AP2120N-3.3TRG1 | GS4 | Tape & Reel |
| | | 3.6V(N) | AP2120N-3.6TRG1 | GZ8 | Tape & Reel |
| | | 4.0V(N) | AP2120N-4.0TRG1 | GZ9 | Tape & Reel |
| SOT-23 | -40 to 85°C | 3.3V(NA) | AP2120NA-3.3TRG1 | GZ1 | Tape & Reel |
| | | 3.6V(NA) | AP2120NA-3.6TRG1 | GAA | Tape & Reel |
| | | 4.0V(NA) | AP2120NA-4.0TRG1 | GBA | Tape & Reel |
| SOT-89 | -40 to 85°C | 1.2V | AP2120R-1.2TRG1 | G13Q | Tape & Reel |
| | | 1.3V | AP2120R-1.3TRG1 | G17Q | Tape & Reel |
| | | 1.5V | AP2120R-1.5TRG1 | G22Q | Tape & Reel |
| | | 1.8V | AP2120R-1.8TRG1 | G27Q | Tape & Reel |

**HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR****AP2120****Ordering Information (Continued)**

| Package | Temperature Range | Output Voltage | Part Number | Marking ID | Packing Type |
|---------|-------------------|----------------|-----------------|-------------|--------------|
| SOT-89 | -40 to 85°C | 2.5V | AP2120R-2.5TRG1 | G28Q | Tape & Reel |
| | | 2.8V | AP2120R-2.8TRG1 | G31Q | Tape & Reel |
| | | 3.0V | AP2120R-3.0TRG1 | G33Q | Tape & Reel |
| | | 3.2V | AP2120R-3.2TRG1 | G37Q | Tape & Reel |
| | | 3.3V | AP2120R-3.3TRG1 | G41Q | Tape & Reel |
| | | 3.6V | AP2120R-3.6TRG1 | G42Q | Tape & Reel |
| | | 4.0V | AP2120R-4.0TRG1 | G43Q | Tape & Reel |
| | | 5.0V | AP2120R-5.0TRG1 | G70Q | Tape & Reel |
| TO-92 | -40 to 85°C | 1.2V | AP2120Z-1.2G1 | 2120Z-1.2G1 | Bulk |
| | | 1.2V | AP2120Z-1.2TRG1 | 2120Z-1.2G1 | Ammo |
| | | 1.3V | AP2120Z-1.3G1 | 2120Z-1.3G1 | Bulk |
| | | 1.3V | AP2120Z-1.3TRG1 | 2120Z-1.3G1 | Ammo |
| | | 1.5V | AP2120Z-1.5G1 | 2120Z-1.5G1 | Bulk |
| | | 1.5V | AP2120Z-1.5TRG1 | 2120Z-1.5G1 | Ammo |
| | | 1.8V | AP2120Z-1.8G1 | 2120Z-1.8G1 | Bulk |
| | | 1.8V | AP2120Z-1.8TRG1 | 2120Z-1.8G1 | Ammo |
| | | 2.5V | AP2120Z-2.5G1 | 2120Z-2.5G1 | Bulk |
| | | 2.5V | AP2120Z-2.5TRG1 | 2120Z-2.5G1 | Ammo |
| | | 2.8V | AP2120Z-2.8G1 | 2120Z-2.8G1 | Bulk |
| | | 2.8V | AP2120Z-2.8TRG1 | 2120Z-2.8G1 | Ammo |
| | | 3.0V | AP2120Z-3.0G1 | 2120Z-3.0G1 | Bulk |
| | | 3.0V | AP2120Z-3.0TRG1 | 2120Z-3.0G1 | Ammo |
| | | 3.2V | AP2120Z-3.2G1 | 2120Z-3.2G1 | Bulk |
| | | 3.2V | AP2120Z-3.2TRG1 | 2120Z-3.2G1 | Ammo |
| | | 3.3V | AP2120Z-3.3G1 | 2120Z-3.3G1 | Bulk |
| | | 3.3V | AP2120Z-3.3TRG1 | 2120Z-3.3G1 | Ammo |
| | | 3.6V | AP2120Z-3.6G1 | 2120Z-3.6G1 | Bulk |
| | | 3.6V | AP2120Z-3.6TRG1 | 2120Z-3.6G1 | Ammo |
| | | 4.0V | AP2120Z-4.0G1 | 2120Z-4.0G1 | Bulk |
| | | 4.0V | AP2120Z-4.0TRG1 | 2120Z-4.0G1 | Ammo |
| | | 5.0V | AP2120Z-5.0G1 | 2120Z-5.0G1 | Bulk |
| | | 5.0V | AP2120Z-5.0TRG1 | 2120Z-5.0G1 | Ammo |

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

**HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR****AP2120****Absolute Maximum Ratings (Note 1)**

| Parameter | Symbol | Value | | Unit |
|-------------------------------------|---------------|----------------------|-----|------|
| Input Voltage | V_{IN} | 6.5 | | V |
| Enable Input Voltage | V_{CE} | -0.3 to $V_{IN}+0.3$ | | V |
| Output Current | I_{OUT} | 300 | | mA |
| Junction Temperature | T_J | 150 | | °C |
| Storage Temperature Range | T_{STG} | -65 to 150 | | °C |
| Lead Temperature (Soldering, 10sec) | T_{LEAD} | 260 | | °C |
| Thermal Resistance (Note 2) | θ_{JA} | SOT-23 | 250 | °C/W |
| | | SOT-89 | 165 | |
| | | TO-92 | 180 | |
| ESD (Human Body Model) | ESD | 2000 | | V |
| ESD (Machine Model) | ESD | 200 | | 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.

Note 2: Absolute maximum ratings indicate limits beyond which damage to the component may occur. Electrical specifications do not apply when operating the device outside of its operating ratings. The maximum allowable power dissipation is a function of the maximum junction temperature, $T_{J(max)}$, the junction-to-ambient thermal resistance, θ_{JA} , and the ambient temperature, T_A . The maximum allowable power dissipation at any ambient temperature is calculated using: $P_{D(max)} = (T_{J(max)} - T_A) / \theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature.

Recommended Operating Conditions

| Parameter | Symbol | Min | Max | Unit |
|--------------------------------------|----------|-----|-----|------|
| Input Voltage | V_{IN} | 2 | 6 | V |
| Operating Junction Temperature Range | T_J | -40 | 85 | °C |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR

AP2120

Electrical Characteristics

AP2120-1.2 Electrical Characteristics

($V_{IN}=2.2V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|-------|-----------------------------|-------|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=2.2V$ $1mA \leq I_{OUT} \leq 30mA$ | 1.176 | 1.2 | 1.224 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=2.2V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $2.2V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 700 | 900 | mV |
| | | $I_{OUT}=100mA$ | | 700 | 900 | |
| | | $I_{OUT}=150mA$ | | 700 | 900 | |
| | | $I_{OUT}=200mA$ | | 700 | 900 | |
| Quiescent Current | I_Q | $V_{IN}=2.2V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=2.2V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 120 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 100 | | ppm/ $^{\circ}C$ |
| Short Current Limit | I_{LIMIT} | $V_{OUT}=0V$ | | 50 | | mA |
| RMS Output Noise | V_{NOISE} | $T_A=25^{\circ}C$, $I_{OUT}=0$ $10Hz \leq f \leq 100kHz$ | | 15 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Electrical Characteristics (Continued)

AP2120-1.3 Electrical Characteristics

($V_{IN}=2.3V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|-------|-----------------------------|-------|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=2.3V$ $1mA \leq I_{OUT} \leq 30mA$ | 1.274 | 1.3 | 1.326 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=2.3V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $2.3V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 600 | 800 | mV |
| | | $I_{OUT}=100mA$ | | 600 | 800 | |
| | | $I_{OUT}=150mA$ | | 600 | 800 | |
| | | $I_{OUT}=200mA$ | | 600 | 800 | |
| Quiescent Current | I_Q | $V_{IN}=2.3V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=2.3V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 130 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 100 | | ppm/ $^{\circ}C$ |
| Short Current Limit | I_{LIMIT} | $V_{OUT}=0V$ | | 50 | | mA |
| RMS Output Noise | V_{NOISE} | $T_A=25^{\circ}C$, $I_{OUT}=0$ $10Hz \leq f \leq 100kHz$ | | 15 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Electrical Characteristics (Continued)

AP2120-1.5 Electrical Characteristics

($V_{IN}=2.5V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|------|-----------------------------|------|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=2.5V$ $1mA \leq I_{OUT} \leq 30mA$ | 1.47 | 1.5 | 1.53 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=2.5V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $2.3V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 400 | 600 | mV |
| | | $I_{OUT}=100mA$ | | 400 | 600 | |
| | | $I_{OUT}=150mA$ | | 400 | 600 | |
| | | $I_{OUT}=200mA$ | | 400 | 600 | |
| Quiescent Current | I_Q | $V_{IN}=2.5V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=2.5V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 150 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 100 | | ppm/ $^{\circ}C$ |
| Short Current Limit | I_{LIMIT} | $V_{OUT}=0V$ | | 50 | | mA |
| RMS Output Noise | V_{NOISE} | $T_A=25^{\circ}C$, $I_{OUT}=0$ $10Hz \leq f \leq 100kHz$ | | 15 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR

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Electrical Characteristics (Continued)

AP2120-1.8 Electrical Characteristics

($V_{IN}=2.8V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|-------|-----------------------------|-------|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=2.8V$ $1mA \leq I_{OUT} \leq 30mA$ | 1.764 | 1.8 | 1.836 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=2.8V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $2.3V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 20 | 40 | mV |
| | | $I_{OUT}=100mA$ | | 200 | 300 | |
| | | $I_{OUT}=150mA$ | | 300 | 500 | |
| Quiescent Current | I_Q | $V_{IN}=2.8V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=2.8V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 180 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 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 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Electrical Characteristics (Continued)

AP2120-2.5 Electrical Characteristics

($V_{IN}=3.5V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, 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} | $I_{OUT}=10mA$ | | 20 | 40 | mV |
| | | $I_{OUT}=100mA$ | | 200 | 300 | |
| | | $I_{OUT}=150mA$ | | 300 | 500 | |
| Quiescent Current | I_Q | $V_{IN}=3.5V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=3.5V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 250 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 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 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Electrical Characteristics (Continued)

AP2120-2.8 Electrical Characteristics

($V_{IN}=3.8V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|-------|-----------------------------|-------|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=3.8V$ $1mA \leq I_{OUT} \leq 30mA$ | 2.744 | 2.8 | 2.856 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=3.8V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $3.3V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 20 | 40 | mV |
| | | $I_{OUT}=100mA$ | | 200 | 300 | |
| | | $I_{OUT}=150mA$ | | 300 | 500 | |
| Quiescent Current | I_Q | $V_{IN}=3.8V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=3.8V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 280 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 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 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Electrical Characteristics (Continued)

AP2120-3.0 Electrical Characteristics

($V_{IN}=4V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|------|-----------------------------|------|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=4V$ $1mA \leq I_{OUT} \leq 30mA$ | 2.94 | 3.0 | 3.06 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=4V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $3.5V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 20 | 40 | mV |
| | | $I_{OUT}=100mA$ | | 200 | 300 | |
| | | $I_{OUT}=150mA$ | | 300 | 500 | |
| Quiescent Current | I_Q | $V_{IN}=4V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=4V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 300 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 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 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Electrical Characteristics (Continued)

AP2120-3.2 Electrical Characteristics

($V_{IN}=4.2V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, 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} | $I_{OUT}=10mA$ | | 20 | 40 | mV |
| | | $I_{OUT}=100mA$ | | 200 | 300 | |
| | | $I_{OUT}=150mA$ | | 300 | 500 | |
| Quiescent Current | I_Q | $V_{IN}=4.2V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=4.2V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 320 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 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 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR

AP2120

Electrical Characteristics (Continued)

AP2120-3.3 Electrical Characteristics

($V_{IN}=4.3V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|-------|-----------------------------|-------|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=4.3V$ $1mA \leq I_{OUT} \leq 30mA$ | 3.234 | 3.3 | 3.366 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=4.3V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $3.8V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 20 | 40 | mV |
| | | $I_{OUT}=100mA$ | | 200 | 300 | |
| | | $I_{OUT}=150mA$ | | 300 | 500 | |
| Quiescent Current | I_Q | $V_{IN}=4.3V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=4.3V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 330 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 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 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Electrical Characteristics (Continued)

AP2120-3.6 Electrical Characteristics

($V_{IN}=4.6V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|-------|-----------------------------|-------|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=4.6V$ $1mA \leq I_{OUT} \leq 30mA$ | 3.528 | 3.6 | 3.672 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=4.6V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $4.6V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 20 | 40 | mV |
| | | $I_{OUT}=100mA$ | | 200 | 300 | |
| | | $I_{OUT}=150mA$ | | 300 | 500 | |
| Quiescent Current | I_Q | $V_{IN}=4.6V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=4.6V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 330 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 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 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Electrical Characteristics (Continued)

AP2120-4.0 Electrical Characteristics

($V_{IN}=5.0V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|------|-----------------------------|------|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=5.0V$ $1mA \leq I_{OUT} \leq 30mA$ | 3.92 | 4.0 | 4.08 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=5.0V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $5V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 20 | 40 | mV |
| | | $I_{OUT}=100mA$ | | 200 | 300 | |
| | | $I_{OUT}=150mA$ | | 300 | 500 | |
| Quiescent Current | I_Q | $V_{IN}=5.0V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=5.0V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 330 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 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 | | μV_{rms} |



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR **AP2120**

Electrical Characteristics (Continued)

AP2120-5.0 Electrical Characteristics

($V_{IN}=6.0V$, $T_J=25^{\circ}C$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|-----|-----------------------------|-----|-------------------|
| Output Voltage | V_{OUT} | $V_{IN}=6.0V$ $1mA \leq I_{OUT} \leq 30mA$ | 4.9 | 5.0 | 5.1 | V |
| Input Voltage | V_{IN} | | | | 6 | V |
| Output Current | I_{OUT} | $V_{IN}-V_{OUT}=1V$ | 150 | | | mA |
| Load Regulation | V_{RLOAD} | $V_{IN}=4.3V$ $1mA \leq I_{OUT} \leq 80mA$ | | 12 | 40 | mV |
| Line Regulation | V_{RLINE} | $5.5V \leq V_{IN} \leq 6V$ $I_{OUT}=30mA$ | | 4 | 16 | mV |
| Dropout Voltage | V_{DROP} | $I_{OUT}=10mA$ | | 20 | 40 | mV |
| | | $I_{OUT}=100mA$ | | 200 | 300 | |
| | | $I_{OUT}=150mA$ | | 300 | 500 | |
| Quiescent Current | I_Q | $V_{IN}=6.0V$, $I_{OUT}=0mA$ | | 25 | 50 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 0.5Vp-p, $f=1kHz$ $V_{IN}=6.0V$ | | 65 | | dB |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | $I_{OUT}=30mA$ | | ± 330 | | $\mu V/^{\circ}C$ |
| | $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | ± 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 | | μV_{rms} |



Typical Performance Characteristics

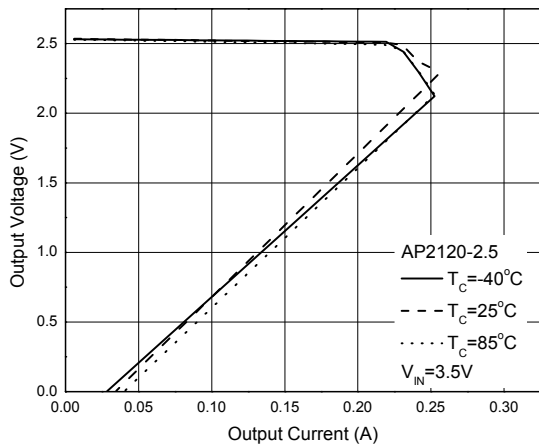


Figure 4. Output Voltage vs. Output Current

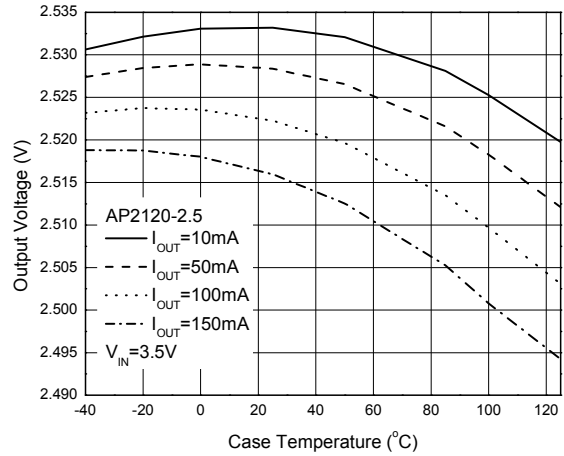


Figure 5. Output Voltage vs. Case Temperature

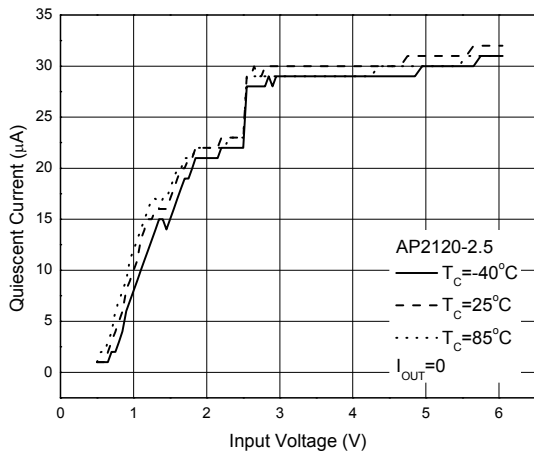


Figure 6. Quiescent Current vs. Input Voltage

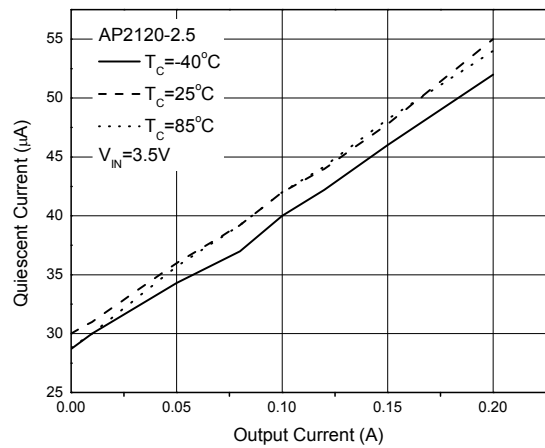


Figure 7. Quiescent Current vs. Output Current



Typical Performance Characteristics (Continued)

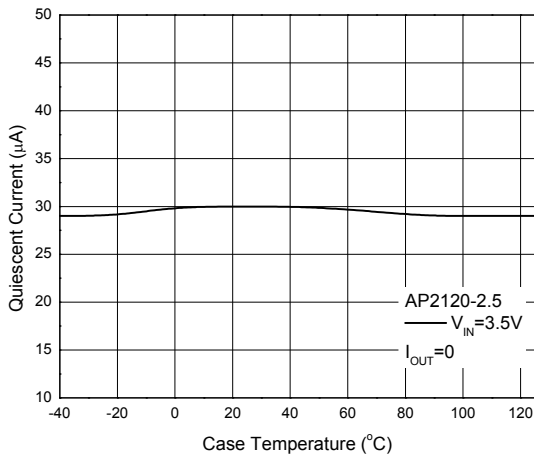


Figure 8. Quiescent Current vs. Case Temperature

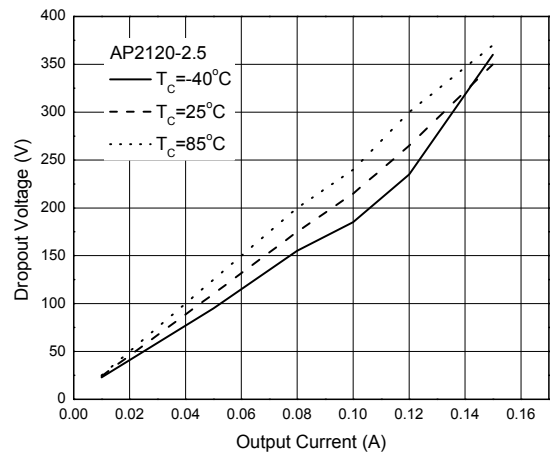


Figure 9. Dropout Voltage vs. Output Current

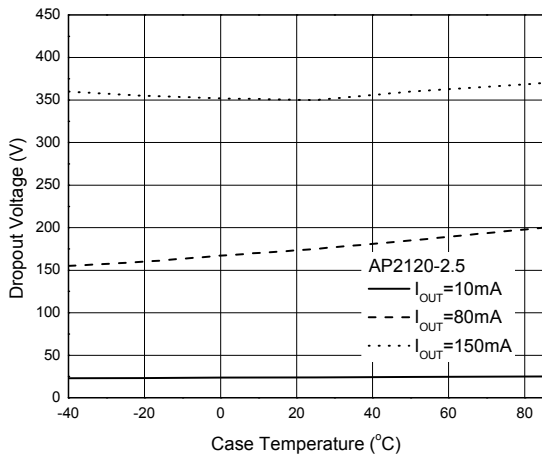


Figure 10. Dropout Voltage vs. Case Temperature

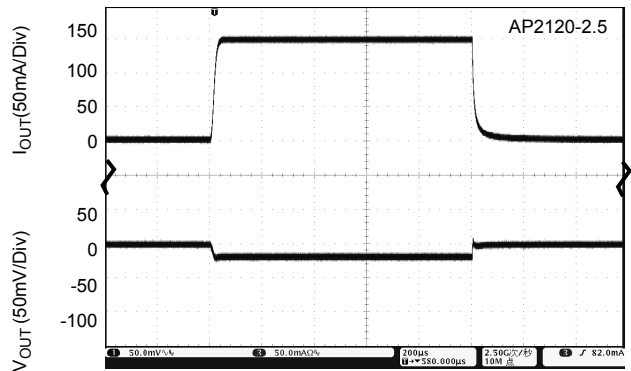


Figure 11. Load Transient ($I_{OUT}=0$ to 150mA)



Typical Performance Characteristics (Continued)

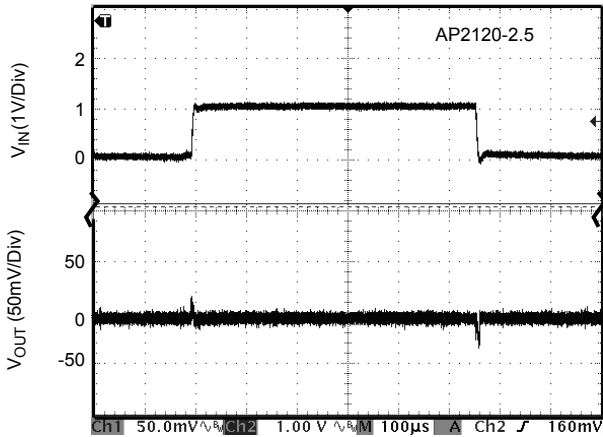


Figure 12. Line Transient
(Condition: $V_{IN}=2.5V$ to $3.5V$, $I_{OUT}=10mA$)

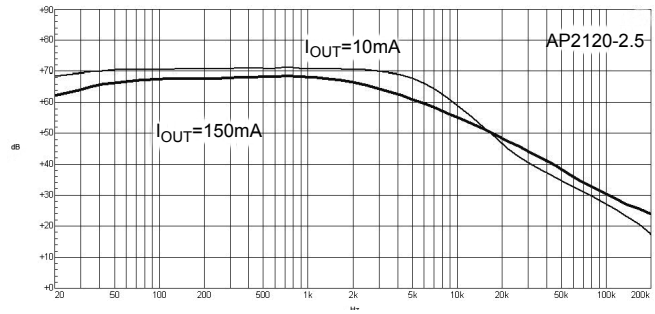


Figure 13. PSRR vs. Frequency

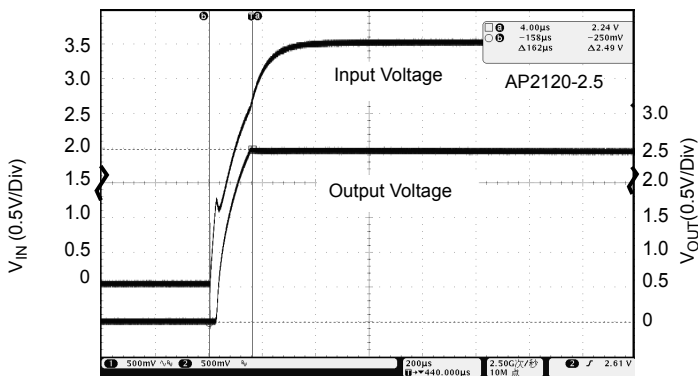
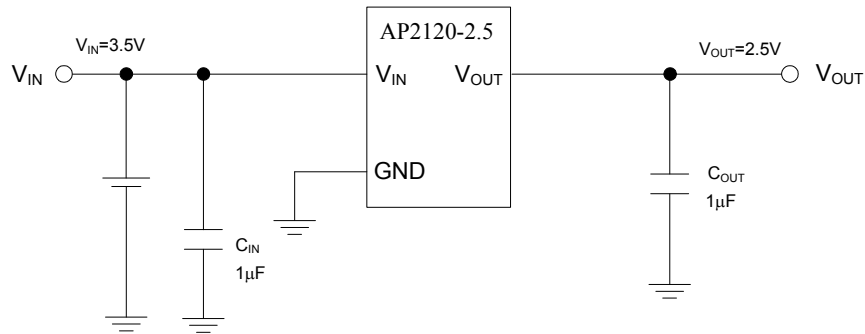


Figure 14. Start-up

Typical Application


Note: Filter capacitors are required at the AP2120'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 0.01Ω to 100Ω. Ceramic capacitors are recommended.

Figure 15. Typical Application of AP2120



HIGH SPEED, EXTREMELY LOW NOISE LDO REGULATOR

AP2120

Mechanical Dimensions (Continued)

TO-92 (Bulk Packing)

Unit: mm(inch)

