

**150mA, Low Noise, High PSRR Low-dropout Regulator****AUR9503**

## General Description

AUR9503 is a low-noise and high-PSRR LDO linear voltage regulator which operates from 2.5V to 5.5V and provides up to 150mA output current.

AUR9503 achieves ultra low quiescent current to be ideally used with green operational portable products. Fixed output voltage options are provided with an internal built-in feedback circuit and optimized for stable operations with small 1 $\mu$ F ceramic output capacitors for excellent transient performance. EN pin enables the main chip operation and enables the output to be turned off to allow reduced power consumption in shutdown mode with a smaller than 0.1 $\mu$ A shutdown current. The low dropout voltage is 100mV at a load current of 150mA for system power efficiency. An internal current limit circuit is designed and operated as a short circuit protection for the regulator output pin.

The AUR9503 is available in tiny DFN-1.6 $\times$ 1.6-6 package for a small footprint solution to satisfy the portable design needs.

## Features

- Low Noise for RF Application
- Low Dropout Voltage: 100mV @ 150mA
- Standby Current: 55 $\mu$ A
- < 0.1 $\mu$ A Standby Current When Shutdown
- Thermal Shutdown Protection
- Current Limiting Protection
- Only 1 $\mu$ F Output Capacitor Required for Stability
- Wide Operating Voltage Range: 2.5V to 5.5V

## Applications

- Battery-powered Device or Equipment
- Mobile Phone, Digital Camera and MP3 Player
- Radios, Other Hand-held Games and Instruments
- Post DC-DC Voltage Regulation
- Mini PCI & PCI-E Card
- WiFi Card

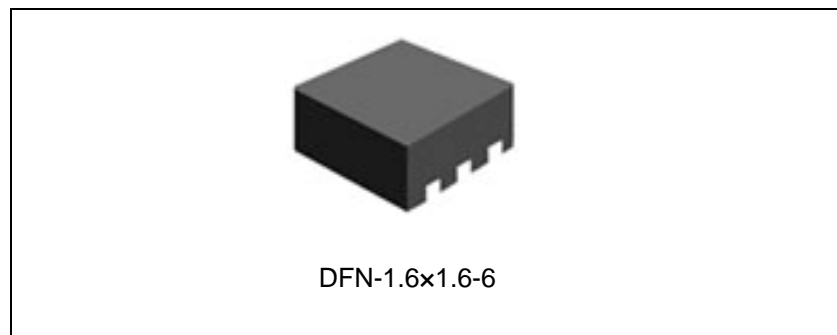


Figure 1. Package Type of AUR9503

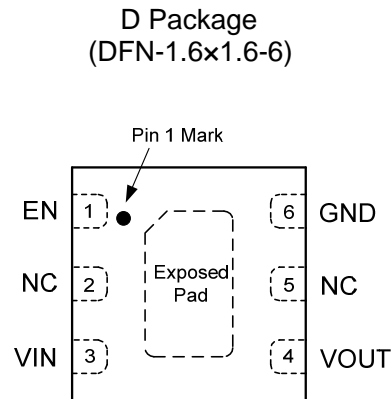
**150mA, Low Noise, High PSRR Low-dropout Regulator**
**AUR9503**
**Pin Configuration**


Figure 2. Pin Configuration of AUR9503 (Top View)

**Pin Description**

| Pin Number | Pin Name | Function  |
|------------|----------|---|
| 1          | EN       | Enable input signal, a 100k $\Omega$ pull-down resistor is needed when there is no digital signal connected |
| 2, 5       | NC       | No internal connection  |
| 3          | VIN      | Regulator input supply voltage with 1 $\mu$ F or greater capacitor  |
| 4          | VOUT     | Regulator voltage output pin, 1 $\mu$ F or greater capacitor is needed                                      |
| 6          | GND      | Ground connection   |

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**Functional Block Diagram**

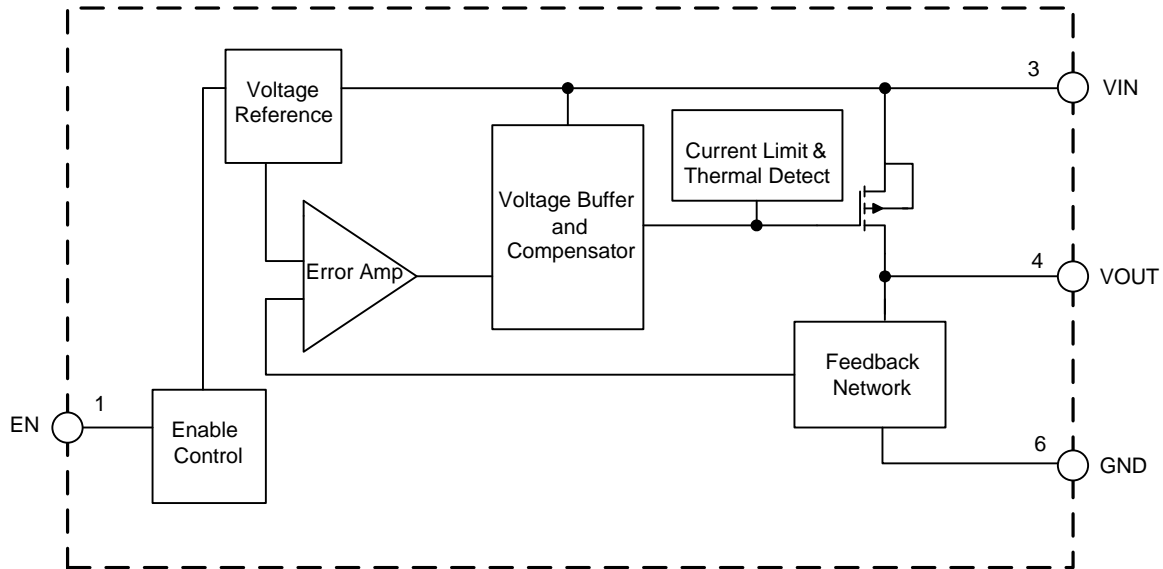
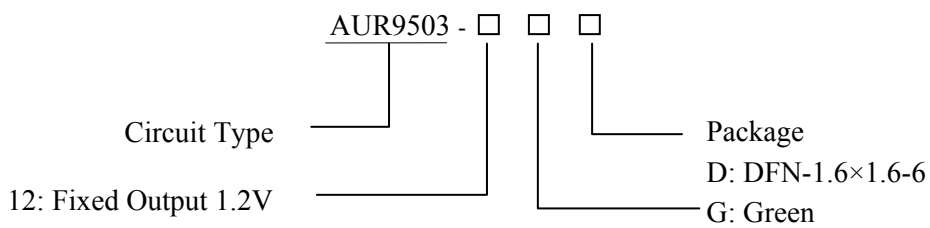


Figure 3. Functional Block Diagram of AUR9503

**Ordering Information**



| Package       | Temperature Range | Part Number  | Marking ID | Packing Type |
|---------------|-------------------|--------------|------------|--------------|
| DFN-1.6x1.6-6 | -40 to 80°C       | AUR9503-12GD | 503        | Tape & Reel  |

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

**150mA, Low Noise, High PSRR Low-dropout Regulator****AUR9503****Absolute Maximum Ratings (Note 1)**

| Parameter  | Symbol        | Value                | Unit                        |
|--|---------------|----------------------|-----------------------------|
| Supply Input Voltage   | $V_{IN}$      | 0 to 6.0             | V                           |
| Enable Input Voltage   | $V_{EN}$      | -0.3 to $V_{IN}+0.3$ | V                           |
| Output Voltage   | $V_{OUT}$     | 0 to $V_{IN}+0.3$    | V                           |
| Power Dissipation (On PCB, $T_A=25^{\circ}\text{C}$ )            | $P_D$         | 0.55                 | W                           |
| Empirical Thermal Resistance (On PCB, $T_A=25^{\circ}\text{C}$ ) | $\theta_{JA}$ | 180                  | $^{\circ}\text{C}/\text{W}$ |
| Operating Junction Temperature                                   | $T_J$         | 160                  | $^{\circ}\text{C}$          |
| Operating Temperature  | $T_{OP}$      | -40 to 85            | $^{\circ}\text{C}$          |
| Storage Temperature  | $T_{STG}$     | -55 to 150           | $^{\circ}\text{C}$          |
| ESD (Human Body Model)   | $V_{HBM}$     | 2000                 | V                           |
| ESD (Machine Model)  | $V_{MM}$      | 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.

**Recommended Operating Conditions**

| Parameter                  | Symbol   | Min | Max | Unit               |
|----------------------------|----------|-----|-----|--------------------|
| Supply Input Voltage       | $V_{IN}$ | 2.5 | 5.5 | V                  |
| Junction Temperature Range | $T_J$    | -40 | 125 | $^{\circ}\text{C}$ |
| Ambient Temperature Range  | $T_A$    | -40 | 80  | $^{\circ}\text{C}$ |

**150mA, Low Noise, High PSRR Low-dropout Regulator****AUR9503****Electrical Characteristics (Note 2)** $V_{IN}=V_{OUT}+0.5V$ ,  $C_{IN}=C_{OUT}=1\mu F$  (Ceramic),  $T_A=25^\circ C$ , unless otherwise specified.

| Parameter                               | Symbol                   | Conditions   | Min        | Typ  | Max | Unit          |
|---|--------------------------|--|------------|------|-----|---------------|
| Supply Voltage                          | $V_{IN}$                 |  | 2.5        |      | 5.5 | V             |
| Output Voltage Accuracy                 | $\Delta V_{OUT}/V_{OUT}$ | $I_{OUT}=1mA$  | -2         |      | 2   | %             |
| Shutdown Current                        | $I_{SD}$                 | EN=Low, $I_{OUT}=0mA$                                      |            | 0.1  | 1   | $\mu A$       |
| Quiescent Current                       | $I_Q$                    | EN=High, No Load   |            | 55   |     | $\mu A$       |
| Maximum Output Current                  | $I_{MAX}$                | $R_{LOAD}=1\Omega$   | 180        | 300  | 410 | mA            |
| Enable Input Voltage                    | “H” Level                | $V_{IH}$   | 1.6        |      | 5.5 | V             |
|   | “L” Level                | $V_{IL}$   | 0          |      | 0.3 |               |
| Dropout Voltage (Note 3)                | $V_{DO}$                 | $I_{OUT} = 150mA$  | 50         |      | 200 | mV            |
| Load Regulation                         | $\Delta V_{LOAD}$        | $1mA < I_{OUT} < 150mA$ ,<br>$2.5V < V_{IN} < 5.5V$        |            |      | 1.0 | %             |
| Line Regulation                         | $\Delta V_{LINE}$        | $V_{IN}=(V_{OUT}+0.5V)$ to 5.5V,<br>$I_{OUT}=1mA$ to 150mA |            | 0.01 | 0.2 | %             |
| Power Supply Rejection Ratio            | PSRR                     | $C_{IN}=C_{OUT}=1\mu F$ ,<br>$I_{OUT}=10mA$                | $f=1kHz$   | 70   |     | dB            |
|   |                          |  | $f=10kHz$  | 60   |     |               |
|   |                          |  | $f=100kHz$ | 40   |     |               |
| Output Voltage Noise                    | $V_{NO}$                 | $C_{OUT}=1\mu F$ , $I_{OUT}=0mA$ ,<br>$f=10Hz$ to 100kHz   |            | 30   |     | $\mu V_{RMS}$ |
| Junction Temperature Shutdown Threshold | $T_{SD}$                 |  |            | 160  |     | $^\circ C$    |
| Thermal Shutdown Temperature Hysteresis | $T_{SDH}$                |  |            | 30   |     | $^\circ C$    |

Note 2: Exceeding the absolute maximum rating may cause damage to the device.

Note 3: Dropout voltage is defined as the difference between the input and output voltage when the output voltage drops 0.1V below its nominal value.

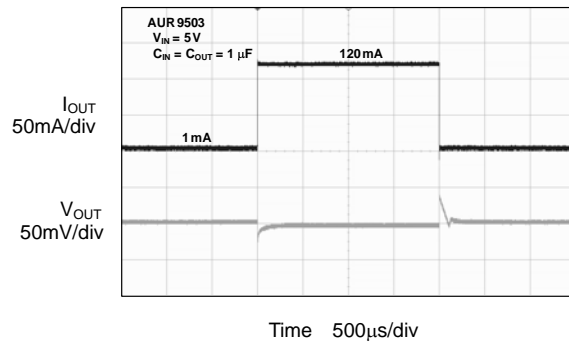
**Typical Performance Characteristics**

Figure 4. Load Transient Response

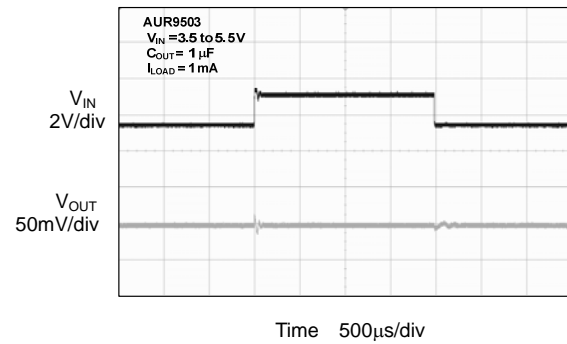


Figure 5. Line Transient Response

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## Application Information

Along with the highly development of portable devices, the LDO linear regulators are applied in many modern digital products like mobile phone, digital camera and MP3 player, etc. Hence, the battery of the hand-held device is widely used and it is important to design a LDO regulator with low quiescent current to extend the battery's life-time. When applied in RF application which is easily affected by noise, low noise supply voltage is also necessary. AUR9503, a low-noise and high-PSRR product, is ideally designed for such portable applications.

The basic application circuit of AUR9503 is shown in Figure 6.

### 1. Thermal Protection

The efficiency of a LDO linear regulator is determined by the difference between input and output voltage. The larger difference may cause overheat problems within the integrated circuit and reduce the efficiency. AUR9503 has a built-in over-temperature and over-current protection circuit. When the junction temperature exceeds 160°C,

thermal shutdown circuit is enabled to prevent heat danger.

### 2. External Capacitors

The AUR9503 is stable using an output capacitor of 1 $\mu$ F. The ceramic capacitors can be used to attain better AC response. Moreover, low ESR can provide smaller undershoot and overshoot when loading current varies. Besides, an input capacitor of 1 $\mu$ F is required to stabilize VIN. All the capacitors' ground is recommended to share the IC's GND pin as direct and short as possible.

### 3. Enable Input

The AUR9503 can be operated or shutdown by the voltage level of EN pin. For continuous ON state, the EN pin is tied to VIN.

### 4. PCB Layout Consideration

The AUR9503 needs 1 $\mu$ F capacitors on VIN and VOUT pin. Place the capacitors as close as possible to the pin.

## Typical Application

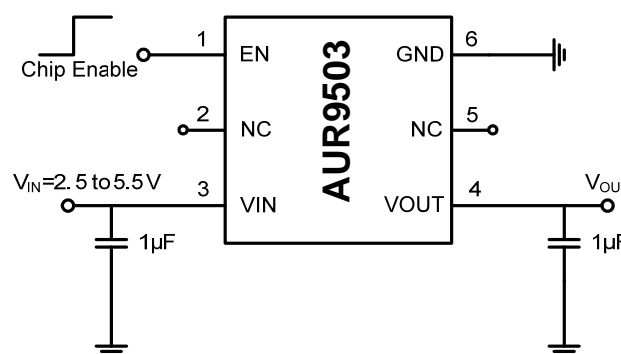


Figure 6. Typical Application Circuit of AUR9503

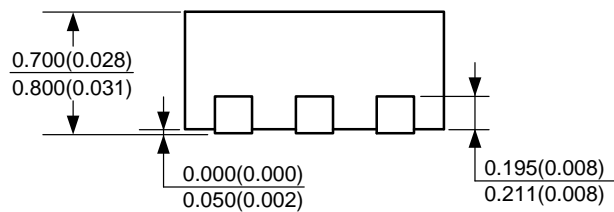
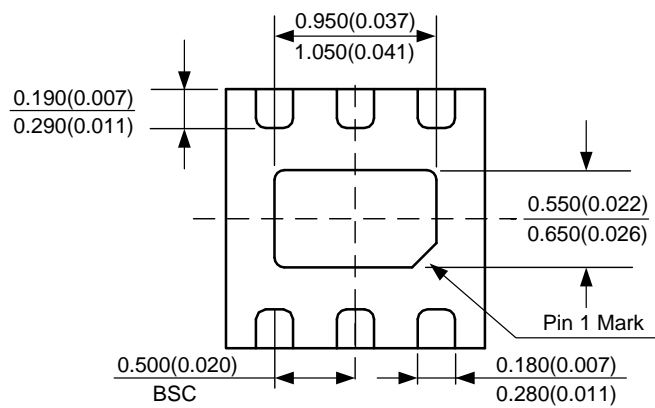
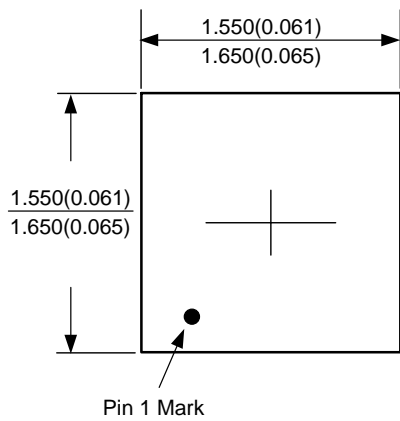
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**AUR9503**

**Mechanical Dimensions**

**DFN-1.6x1.6-6**

**Unit: mm(inch)**







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