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The technical content of this austriamicrosystems datasheet is still valid.

**Contact information:**

**Headquarters:**

ams AG
Tobelbaderstrasse 30
8141 Unterpremstaetten, Austria
Tel: +43 (0) 3136 500 0
e-Mail: ams_sales@ams.com

Please visit our website at **www.ams.com**

# AS1500/AS1501/AS1502/AS1503
## Digital Potentiometer

**Data Sheet**

## 1 General Description

The AS1500 is a digital potentiometer with 256 programmable steps. The values of the resistor can be controlled via 3 wire serial interface capable to handle programming rates up to 10MHz.

The AS1500 is available in four different resistor values. The AS1500 incorporates a 10kΩ, the AS1501 a 20kΩ, the AS1502 a 50kΩ and the AS1503 a 100kΩ fixed resistor. The wiper contact taps the fixed resistor at points determined by the 8-bit digital code word. The resistance between the wiper and the endpoint of the resistor is linear. The switching action is performed in a way that no glitches occur.

The AS150x is available in an 8-pin SOIC package. All parts are guaranteed to operate over the extended industrial temperature range of –40º to +125º.

## 2 Key Features

- 256 - Taps
- Available in four Resistance values
  - AS1500 resistance 10kΩ
  - AS1501 resistance 20kΩ
  - AS1502 resistance 50kΩ
  - AS1503 resistance 100kΩ
- Standby current - Less than 1 μA
- 3-Wire Serial Data Interface
- 10 MHz Update Data Loading Rate
- 2.7 V to 5.5 V Single-Supply Operation
- Temperature Range –40º to +125º
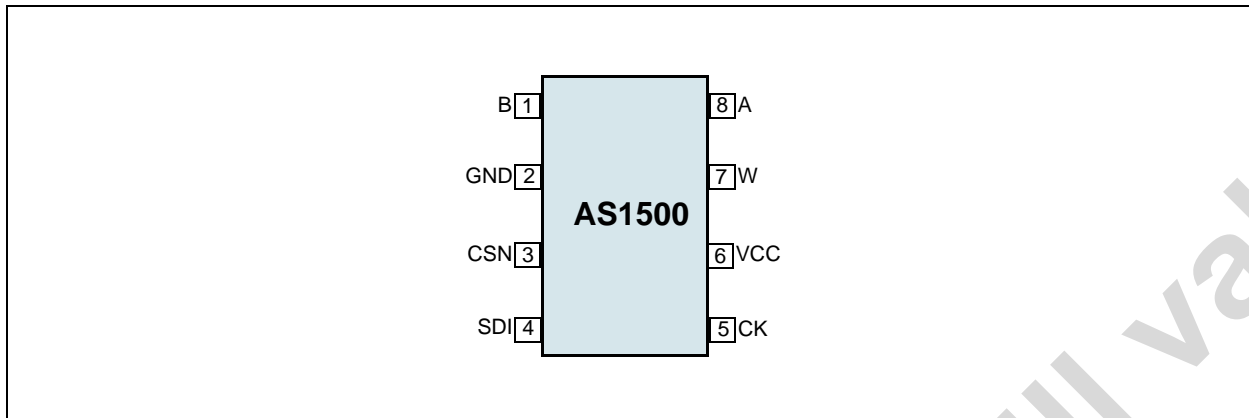- 8-pin SOIC Package

## 3 Applications

The AS1500 is ideal for volume controls in TV sets and audio systems, and applications that require line impedance matching, programmable filters or power supply adjustment. The AS1500 can also be designed in as a replacement for mechanical potentiometers.

*Figure 1.  Application Diagram*
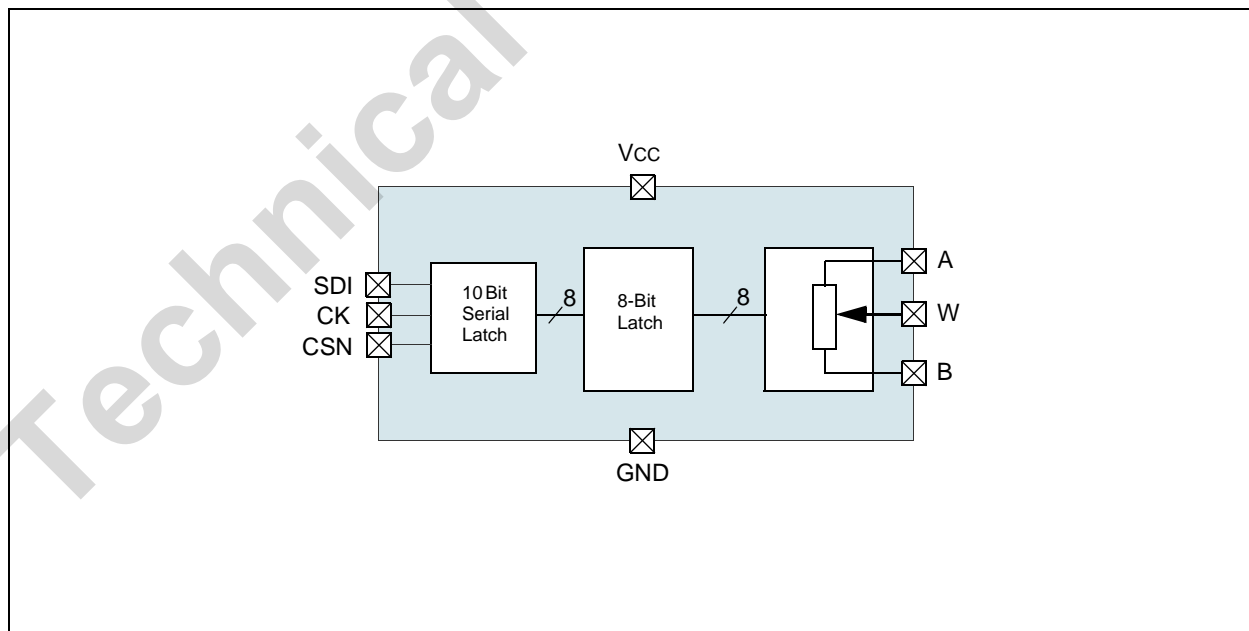
# 4 Pin Assignments

*Figure 2.  Pin Assignments (Top View)*

```
        B ⊏1⊐          ⊏8⊐ A

     GND ⊏2⊐          ⊏7⊐ W
                AS1500
     CSN ⊏3⊐          ⊏6⊐ VCC

     SDI ⊏4⊐          ⊏5⊐ CK
```

## Pin Descriptions

*Table 1.  Pin Description*

| Pin Name | Pin Number | Description |
|----------|------------|-------------|
| B | 1 | **Terminal B** RDAC |
| GND | 2 | **Ground** |
| CSN | 3 | **Chip Select Input**, Active Low. When CSN returns high, data in the serial input register is loaded into the DAC register. |
| SDI | 4 | **Serial Data Input** |
| CK | 5 | **Serial Clock Input**, Positive Edge Triggered. |
| VCC | 6 | **Positive power supply**, specified for operation at both 3V and 5V. |
| W | 7 | **Wiper RDAC** |
| A | 8 | **Terminal A RDAC** |

# 5 Absolute Maximum Ratings

(TA = 25º C, unless otherwise noted)

*Table 2.  Absolute Maximum Ratings*

| Parameter | Min | Max | Units | Notes |
|---|---|---|---|---|
| Vcc to GND | -0.3 | +7 | V | |
| VA, VB, VW to GND | 0 | Vcc | V | |
| AX – BX, AX – WX, BX – WX | ±20 | | mA | |
| Digital Input and Output Voltage to GND | 0 | +7 | V | |
| Operating Temperature Range | -40 | +125 | ºC | |
| Maximum Junction Temperature (TJ max) | | +150 | ºC | |
| Storage Temperature | -65 | +150 | ºC | |
| Package body temperature | | +260 | ºC | The reflow peak soldering temperature (body temperature) specified is in accordance with *IPC/JEDEC J-STD-020C "Moisture/Reflow Sensitivity Classification for Non-Hermetic Solid State Surface Mount Devices"*. The lead finish for Pb-free leaded packages is matte tin (100% Sn). |
| Package Power Dissipation | | | | (TJ max - TA) / $\theta$JA |
| ESD | | 1 | kV | HBM MIL-Std883E 3015.7methods. |

# 6 Electrical Characteristics

## AS1500 / AS1501 – SPECIFICATIONS

$V_{CC}$ = 3V±10% or 5V±10%, $V_A$ = $V_{CC}$, $V_B$ = 0V, –40ºC $\leq T_A \leq$ +125ºC unless otherwise noted.

*Table 3. Electrical Characteristics – 10k and 20k Versions*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Units |
|---|---|---|---|---|---|---|
| **DC Characteristics Rheostat Mode** | | | | | | |
| $R_{AB}$ | Nominal Resistance[2] | $T_A$ = 25ºC, $V_{CC}$ = 5V, AS1500, Version: 50kΩ | 8 | 10 | 12 | kΩ |
| | | $T_A$ = 25ºC, $V_{CC}$ = 5V, AS1501, Version: 100kΩ | 16 | 20 | 24 | kΩ |
| $\Delta R_{AB}/\Delta T$ | Resistance Tempco[3] | $V_{AB}$ = $V_{CC}$, Wiper = No Connect | | 500 | | ppm/ºC |
| $R_W$ | Wiper Resistance | $V_{CC}$ = 5V | 20 | 100 | 200 | Ω |
| R-DNL | Resistor Differential NL[4] | $R_{WB}$, $V_{CC}$ = 5V, $V_A$ = No Connect | -1 | ±1/4 | +1 | LSB |
| R-INL | Resistor Integral NL | $R_{WB}$, $V_{CC}$ = 5V, $V_A$ = No Connect | -2 | ±1/2 | +2 | LSB |
| **DC Characteristics Potentiometer Divider** | | | | | | |
| N | Resolution | | | 8 | | Bits |
| INL | Integral Nonlinearity | $V_{CC}$ = 5.5V $T_A$ = 25ºC | -2 | ±1/2 | +2 | LSB |
| | | $V_{CC}$ = 2.7V $T_A$ = 25ºC | -2 | ±1/2 | +2 | LSB |
| DNL | Differential Nonlinearity | $V_{CC}$ = 5.5V $T_A$ = 25ºC | -1 | ±1/4 | +1 | LSB |
| | | $V_{CC}$ = 2.7V $T_A$ = 25ºC | -1 | ±1/4 | +1 | LSB |
| $\Delta V_W /\Delta T$ | Voltage Divider Tempco | Code = $80_H$ | | 15 | | ppm/ºC |
| $V_{WFSE}$ | Full-Scale Error | Code = $FF_H$, $V_{CC}$ = 5.5V | -4 | -2.8 | 0 | LSB |
| $V_{WFSE}$ | Zero-Scale Error | Code = $00_H$, $V_{CC}$ = 5.5V | 0 | 1.3 | 2 | LSB |
| **Resistor Terminals** | | | | | | |
| $V_{A, B, W}$ | Voltage Range[5] | | 0 | | $V_{CC}$ | V |
| $C_{A, B}$ | Capacitance[6] Ax, Bx | f =1MHz, Measured to GND, Code = $80_H$ | | 75 | | pF |
| $C_W$ | Capacitance Wx | f =1MHz, Measured to GND, Code = $80_H$ | | 120 | | pF |
| **Digital Inputs and Outputs** | | | | | | |
| $V_{IH}$ | Input Logic High | $V_{CC}$ = 5V | 2.4 | | | V |
| $V_{IL}$ | Input Logic Low | $V_{CC}$ = 5V | | | 0.8 | V |
| $V_{IH}$ | Input Logic High | $V_{CC}$ = 3V | 2.1 | | | V |
| $V_{IL}$ | Input Logic Low | $V_{CC}$ = 3V | | | 0.6 | V |
| $I_{IH}$, $I_{IL}$ | Input Current | $V_{IN}$ = 5V or 0V, $V_{CC}$ = 5V | | | ±1 | µA |
| $C_{IL}$ | Input Capacitance | | | 5 | | pF |
| **Power Supplies** | | | | | | |
| $V_{CC}$ | Power Supply Range | | 2.7 | | 5.5 | V |
| $I_{DD}$ | Supply Current (CMOS) | $V_{IH}$ = $V_{CC}$ or $V_{IL}$ = 0V, $V_{CC}$ = 5.5V | | 0.1 | 1 | µA |
| $I_{DD}$ | Supply Current (TTL)[7] | $V_{IH}$ = 2.4V or 0.8V, $V_{CC}$ = 5.5V | | 0.9 | 4 | mA |

*Table 3. Electrical Characteristics – 10k and 20k Versions*

| Symbol | Parameter | Conditions | | Min | Typ[1] | Max | Units |
|---|---|---|---|---|---|---|---|
| $P_{DISS}$ | Power Dissipation (CMOS)[8] | $V_{IH} = V_{CC}$ or $V_{IL} = 0V$, $V_{CC} = 5.5V$ | | | | 27.5 | µW |
| PSSR | Power Supply Suppression Ratio | $V_{CC} = 5V+0.5V_P$ sine wave @ 1kHz | AS1500, Version: 10kΩ | | -54 | -25 | dB |
| | | | AS1501, Version: 20kΩ | | -52 | -25 | dB |
| **Dynamic Characteristics**[9] | | | | | | | |
| BW_10k | Bandwidth –3dB | $R_{WB} = 10kΩ$, $V_{CC} = 5V$ | | | 1000 | | kHz |
| BW_20k | Bandwidth –3dB | $R_{WB} = 20kΩ$, $V_{CC} = 5V$ | | | 500 | | kHz |
| $THD_W$ | Total Harmonic Distortion | $V_A = 1V_{RMS} + 2V_{DC}$, $V_B = 2V_{DC}$, $f = 1kHz$ | | | 0.003 | | % |
| $t_S$_10k | VW Settling Time | $R_{WB} = 5kΩ$, $V_A = V_{CC}$, $V_B = 0V$, ±1% Error Band | | | 2 | | µs |
| $t_S$_20k | | $R_{WB} = 10kΩ$, $V_A = V_{CC}$, $V_B = 0V$, ±1% Error Band | | | 4 | | µs |
| $e_{NWB}$_10k | Resistor Noise Voltage | $R_{WB} = 5kΩ$, $f = 1kHz$ | | | 9 | | nV/ √ Hz |
| $e_{NWB}$_20k | | $R_{WB} = 10kΩ$, $f = 1kHz$ | | | 13 | | nV/ √ Hz |

1. Typicals represent average readings at 25ºC and $V_{CC}$ = 5V.
2. Wiper is not connected. $I_{AB}$ = 350µA for the 10kΩ version and 175µA for the 20kΩ version.
3. All Tempcos are guaranteed by design and not subject to production test.
4. Terminal A is not connected. $I_W$ = 350µA for the 10kΩ version and 175µA for the 20kΩ version.
5. Resistor terminals A, B, W have no limitations on polarity with respect to each other.
6. All capacitances are guaranteed by design and not subject to production test. Resistor-terminal capacitance tests are measured with 2.5V bias on the measured terminal. The remaining resistor terminals are left open circuit.
7. Worst-case supply current consumed when input logic level at 2.4V, standard characteristic of CMOS logic.
8. $P_{DISS}$ is calculated from ($I_{DD}$×$V_{CC}$). CMOS logic level inputs result in minimum power dissipation.
9. All dynamic characteristics are guaranteed by design and not subject to production test. All dynamic characteristics use $V_{CC}$=5V.

# AS1502 / AS1503 – SPECIFICATIONS

$V_{CC}$ = 3V±10% or 5V±10%, $V_A = V_{CC}$, $V_B = 0V$, –40ºC ≤ $T_A$ ≤ +125ºC unless otherwise noted.

*Table 4. Electrical Characteristics – 50k and 100k Versions*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Units |
|---|---|---|---|---|---|---|
| **DC Characteristics Rheostat Mode** | | | | | | |
| $R_{AB}$ | Nominal Resistance[2] | $T_A = 25ºC$, $V_{CC} = 5V$, AS1502, Version: 50kΩ | 40 | 50 | 60 | kΩ |
| | | $T_A = 25ºC$, $V_{CC} = 5V$, AS1503, Version: 100kΩ | 80 | 100 | 120 | kΩ |
| $\Delta R_{AB}/\Delta T$ | Resistance Tempco[3] | $V_{AB} = V_{CC}$, Wiper = No Connect | | 500 | | ppm/ºC |
| $R_W$ | Wiper Resistance | $V_{CC} = 5V$ | 20 | 100 | 200 | Ω |
| R-DNL | Resistor Differential NL[4] | $R_{WB}$, $V_{CC} = 5V$, $V_A$ = No Connect | -1 | ±1/4 | +1 | LSB |
| R-INL | Resistor Integral NL | $R_{WB}$, $V_{CC} = 5V$, $V_A$ = No Connect | -2 | ±1/2 | +2 | LSB |

*Table 4.  Electrical Characteristics – 50k and 100k Versions*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Units |
|---|---|---|---|---|---|---|
| **DC Characteristics Potentiometer Divider** | | | | | | |
| N | Resolution | | | 8 | | Bits |
| INL | Integral Nonlinearity | $V_{CC} = 5.5V$ $T_A = 25ºC$ | -4 | ±1 | +4 | LSB |
| | | $V_{CC} = 2.7V$ $T_A = 25ºC$ | -4 | ±1 | +4 | LSB |
| DNL | Differential Nonlinearity | $V_{CC} = 5.5V$ $T_A = 25ºC$ | -1 | ±1/4 | +1 | LSB |
| | | $V_{CC} = 2.7V$ $T_A = 25ºC$ | -1 | ±1/4 | +1 | LSB |
| $\Delta V_W /\Delta T$ | Voltage Divider Tempco | Code = $80_H$ | | 15 | | ppm/ºC |
| $V_{WFSE}$ | Full-Scale Error | Code = $FF_H$, $V_{CC}$= 5.5V | -1 | -0.25 | 0 | LSB |
| $V_{WFSE}$ | Zero-Scale Error | Code = $00_H$, $V_{CC}$ = 5.5V | 0 | 0.1 | 1 | LSB |
| **Resistor Terminals** | | | | | | |
| $V_{A, B, W}$ | Voltage Range[5] | | 0 | | $V_{CC}$ | V |
| $C_{A, B}$ | Capacitance[6] Ax, Bx | f =1MHz, Measured to GND, Code = $80_H$ | | 15 | | pF |
| $C_W$ | Capacitance Wx | f =1MHz, Measured to GND, Code = $80_H$ | | 80 | | pF |
| **Digital Inputs and Outputs** | | | | | | |
| $V_{IH}$ | Input Logic High | $V_{CC} = 5V$ | 2.4 | | | V |
| $V_{IL}$ | Input Logic Low | $V_{CC} = 5V$ | | | 0.8 | V |
| $V_{IH}$ | Input Logic High | $V_{CC} = 3V$ | 2.1 | | | V |
| $V_{IL}$ | Input Logic Low | $V_{CC} = 3V$ | | | 0.6 | V |
| $I_{IH}$, $I_{IL}$ | Input Current | $V_{IN}$ = 5V or 0V, $V_{CC}$ = 5V | | | ±1 | µA |
| $C_{IL}$ | Input Capacitance | | | 5 | | pF |
| **Power Supplies** | | | | | | |
| $V_{CC}$ | Power Supply Range | | 2.7 | | 5.5 | V |
| $I_{DD}$ | Supply Current (CMOS) | $V_{IH}$ = $V_{CC}$ or $V_{IL}$ = 0V, $V_{CC}$ = 5.5V | | 0.1 | 1 | µA |
| $I_{DD}$ | Supply Current (TTL)[7] | $V_{IH}$ = 2.4V or 0.8V, $V_{CC}$ = 5.5V | | 0.9 | 4 | mA |
| $P_{DISS}$ | Power Dissipation (CMOS)[8] | $V_{IH}$ = $V_{CC}$ or $V_{IL}$ = 0V, $V_{CC}$ = 5.5V | | | 27.5 | µW |
| PSSR | Power Supply Suppression Ratio | $V_{CC}$ = 5V+0.5$V_P$ sine wave @ 1kHz | AS1502, Version: 50kΩ | | -43 | | dB |
| | | | AS1503, Version: 100kΩ | | -52 | | dB |
| **Dynamic Characteristics[9]** | | | | | | |
| BW_50k | Bandwidth –3dB | $R_{WB}$ = 50kΩ, $V_{CC}$ = 5V | | 220 | | kHz |
| BW_100k | Bandwidth –3dB | $R_{WB}$ = 100kΩ, $V_{CC}$ = 5V | | 110 | | kHz |
| $THD_W$ | Total Harmonic Distortion | $V_A$ = 1$V_{RMS}$ + 2$V_{DC}$, $V_B$ = 2$V_{DC}$, f = 1kHz | | 0.003 | | % |

*Table 4. Electrical Characteristics – 50k and 100k Versions*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Units |
|---|---|---|---|---|---|---|
| $t_{S\_50k}$ | VW Settling Time | $R_{WB}$ = 50k$\Omega$, $V_A$ = Vcc, $V_B$ = 0V, ±1% Error Band | | 9 | | µs |
| $t_{S\_100k}$ | | $R_{WB}$ = 100k$\Omega$, $V_A$ = Vcc, $V_B$ = 0V, ±1% Error Band | | 18 | | µs |
| $e_{NWB\_50k}$ | Resistor Noise Voltage | $R_{WB}$ = 50k$\Omega$, f =1kHz | | 20 | | nV/ $\sqrt{}$ Hz |
| $e_{NWB\_100k}$ | | $R_{WB}$ = 100k$\Omega$, f =1kHz | | 29 | | nV/ $\sqrt{}$ Hz |

1. Typicals represent average readings at 25ºC and Vcc = 5V.
2. Wiper is not connected. $I_{AB}$ = 70µA for the 50k$\Omega$ version and 35µA for the 100k$\Omega$ version.
3. All Tempcos are guaranteed by design and not subject to production test.
4. Terminal A is not connected. $I_W$ = 70µA for the 50k$\Omega$ version and 35µA for the 100k$\Omega$ version.
5. Resistor terminals A, B, W have no limitations on polarity with respect to each other.
6. All capacitances are guaranteed by design and not subject to production test. Resistor-terminal capacitance tests are measured with 2.5V bias on the measured terminal. The remaining resistor terminals are left open circuit.
7. Worst-case supply current consumed when input logic level at 2.4V, standard characteristic of CMOS logic.
8. $P_{DISS}$ is calculated from ($I_{DD} \times V_{CC}$). CMOS logic level inputs result in minimum power dissipation.
9. All dynamic characteristics are guaranteed by design and not subject to production test. All dynamic characteristics use Vcc=5V.

## AS150x – SPECIFICATIONS

Vcc = 3V±10% or 5V±10%, $V_A$ = Vcc, $V_B$ = 0V, −40ºC ≤ $T_A$ ≤ +125ºC unless otherwise noted.

*Table 5. Switching Characteristics*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Unit |
|---|---|---|---|---|---|---|
| **Switching Characteristics**[2][3] | | | | | | |
| $t_{CH}$, $t_{CL}$ | Input Clock Pulsewidth | Clock Level High or Low | 50 | | | ns |
| $t_{DS}$ | Data Setup Time | | 5 | | | ns |
| $t_{DH}$ | Data Hold Time | | 5 | | | ns |
| $t_{CSS}$ | CSN Setup Time | | 10 | | | ns |
| $t_{CSWH}$ | CSN High Pulsewidth | | 10 | | | ns |
| $t_{CSWL}$ | CSN Low Pulsewidth | | | | 100 | ms |
| $t_{CSH}$ | CK Fall to CSN Rise Hold Time | | 0 | | | ns |
| $t_{CS1}$ | CSN Rise to Clock Rise Setup | | 10 | | | ns |

1. Typicals represent average readings at 25ºC and Vcc=5V.
2. Guaranteed by design and not subject to production test. Resistor-terminal capacitance tests are measured with 2.5V bias on the measured terminal. The remaining resistor terminals are left open circuit.
3. See timing diagram for location of measured values. All input control voltages are specified with tR = tF = 1ns (10% to 90% of Vcc) and timed from a voltage level of 1.6V. Switching characteristics are measured using Vcc=3V or 5V. To avoid false clocking, a minimum input logic slew rate of 1V/µs should be maintained.

# 7 Detailed Description

## Serial-Programming

Programming of the AS150x is done via the 3 wire serial interface. The three input signals are serial data input (SDI), clock(CK) and chip select (CSN). A programming sequence consists of 10-bit, where the last eight bit contain the code word for the resistor value. The first two bits A1 and A0 have to be low to program the resistor value (see Table 6). Otherwise the resistor value is not affected. The data is shifted into the internal 10 Bit register with the rising edge of the CK signal. With the rising edge of the CSN signal the data become valid and the resistance is updated (see Figure 3). A detailed block diagram is shown in Figure 4.

*Table 6. Serial data format (10 bits)*

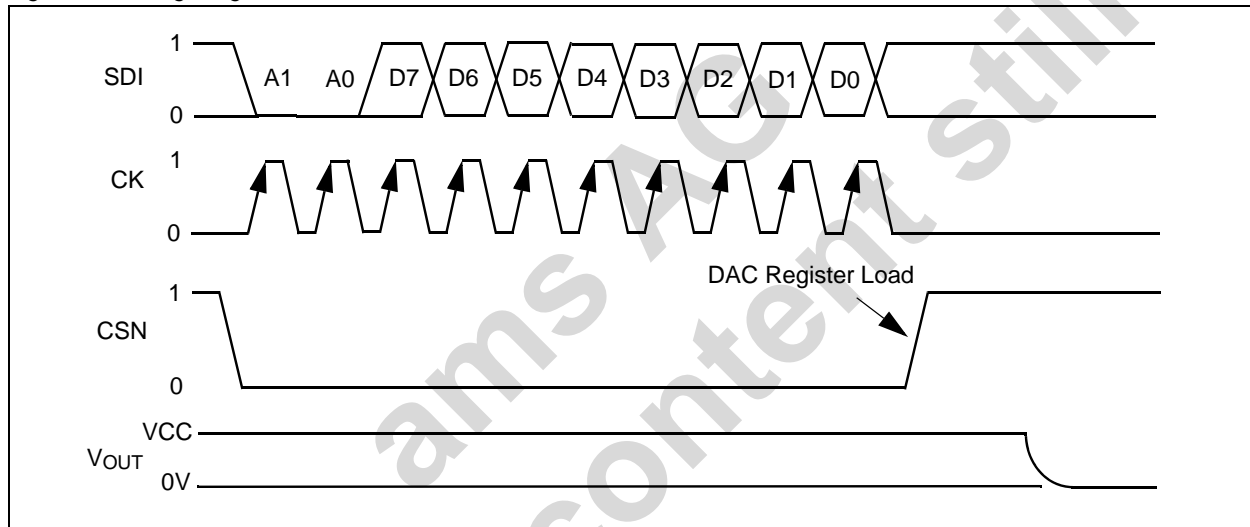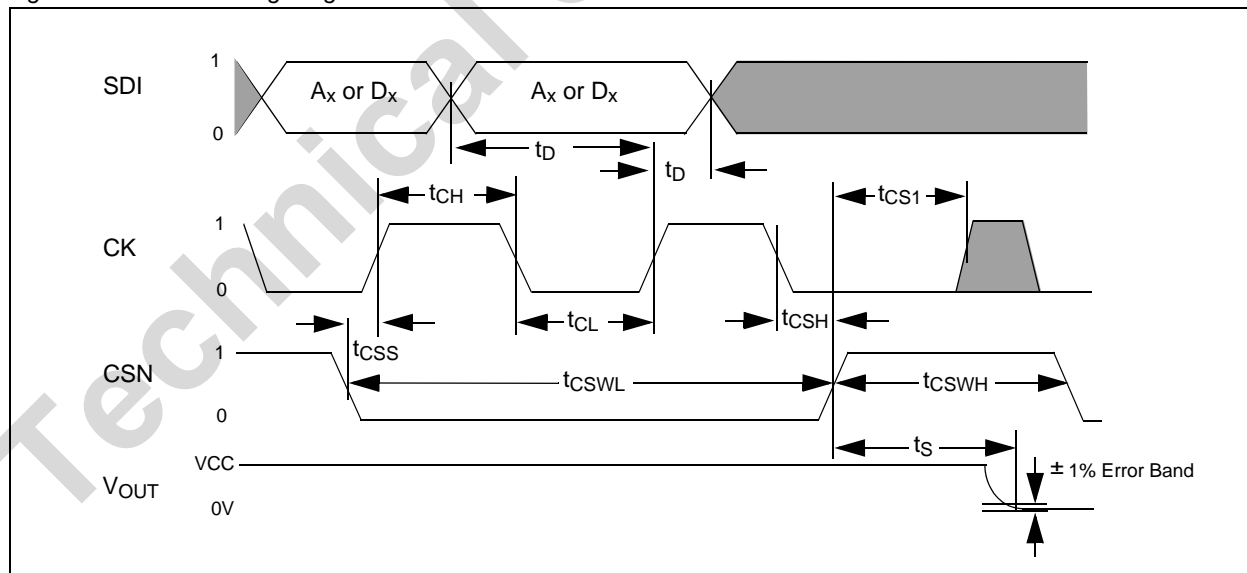| A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|----|----|----|----|----|----|----|----|----|----|
| 0 | 0 | MSB | | | | Data | | | LSB |

*Figure 3. Timing Diagram*



*Figure 4. Detailed Timing Diagram*

## Rheostat Operation

The digital potentiometer family AS150x offers nominal resistor values of 10kΩ, 20kΩ, 50kΩ and 100kΩ. The resistor has 256 contact points where the wiper can access the resistor. The 8-bit code word determines the position of the wiper and is decoded through an internal logic. The lowest code 00h is related to the terminal B. The resistance is then only determined by the wiper resistance (100Ω). The resistance for the next code 01h is the nominal resistor RAB (10kΩ, 20kΩ, 50kΩ or 100kΩ) divided through 256 plus the wiper resistor. In case of AS1501 (10kΩ) the total resistance is 39Ω+100Ω=139Ω. Accordingly the resistor for code 02h is 78Ω+100Ω=178Ω. The last code 255h does not connect to terminal A directly (see Figure 5). So the maximum value is 10000Ω - 39Ω +100Ω = 10061Ω. The general formula for the calculation of the resistance $R_{WB}$ is:

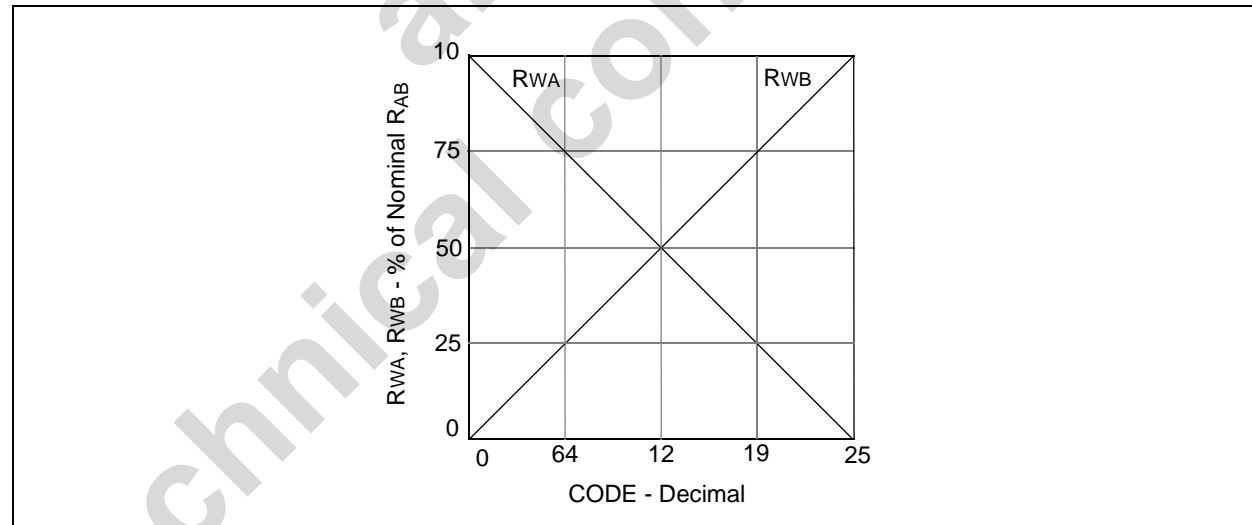$$R_{WB} (Dx)= (Dx)/256 \bullet R_{AB} + R_W \qquad (EQ\ 1)$$

where $R_{AB}$ is the nominal resistance between terminal A and B, $R_W$ is the wiper resistance and $D_X$ is the 8-Bit Code word. In Table 7 the resistor values between the wiper and terminal B for AS1500 are given for specific codes $D_X$. In the zero-scale condition the wiper resistance of 100Ω remains present.

*Table 7. RDAC-Codes WB*

| $D_X$ (Dec) | $R_{WB}$ (Ω) | Output State |
|---|---|---|
| 255 | 10061 | Full Scale |
| 128 | 5100 | Midscale |
| 1 | 139 | 1 LSB |
| 0 | 100 | Zero-Scale (Wiper Contact Resistance) |

The maximum current through the wiper and terminal B is 5mA. If the current exceeds this limit the internal switches can degrade or even be damaged. As a mechanical potentiometer the resistances $R_{WA}$ and $R_{WB}$ are totally symmetrical. The relation between them is shown in Figure 5.

*Figure 5. $R_{WA}$ and $R_{WB}$ versa code*

The resistance $R_{WA}$ is the complimentary resistor to $R_{WB}$ and can be controlled digitally as well. $R_{WA}$ starts at the maximum value of the nominal resistance and is reduced with increasing 8-Bit code words. The formula to calculate $R_{WA}$ is given below:

$$R_{WA} (Dx)= (256 - Dx)/256 \cdot R_{AB} + R_W \qquad (EQ\ 2)$$

where $R_{AB}$ is the nominal resistance between terminal A and B, $R_W$ is the wiper resistance and Dx is the 8-Bit Code word. In Table 8 the resistor values between the wiper and terminal B for AS1500 are given for specific codes Dx.

*Table 8.  RDAC-Codes WA*

| $D_X$ (Dec) | $R_{WA}$ ($\Omega$) | Output State |
|:---:|:---:|:---:|
| 255 | 89 | Full Scale |
| 128 | 5050 | Midscale |
| 1 | 10011 | 1 LSB |
| 0 | 10050 | Zero-Scale |

*Figure 6.  Equivalent RDAC Circuit*
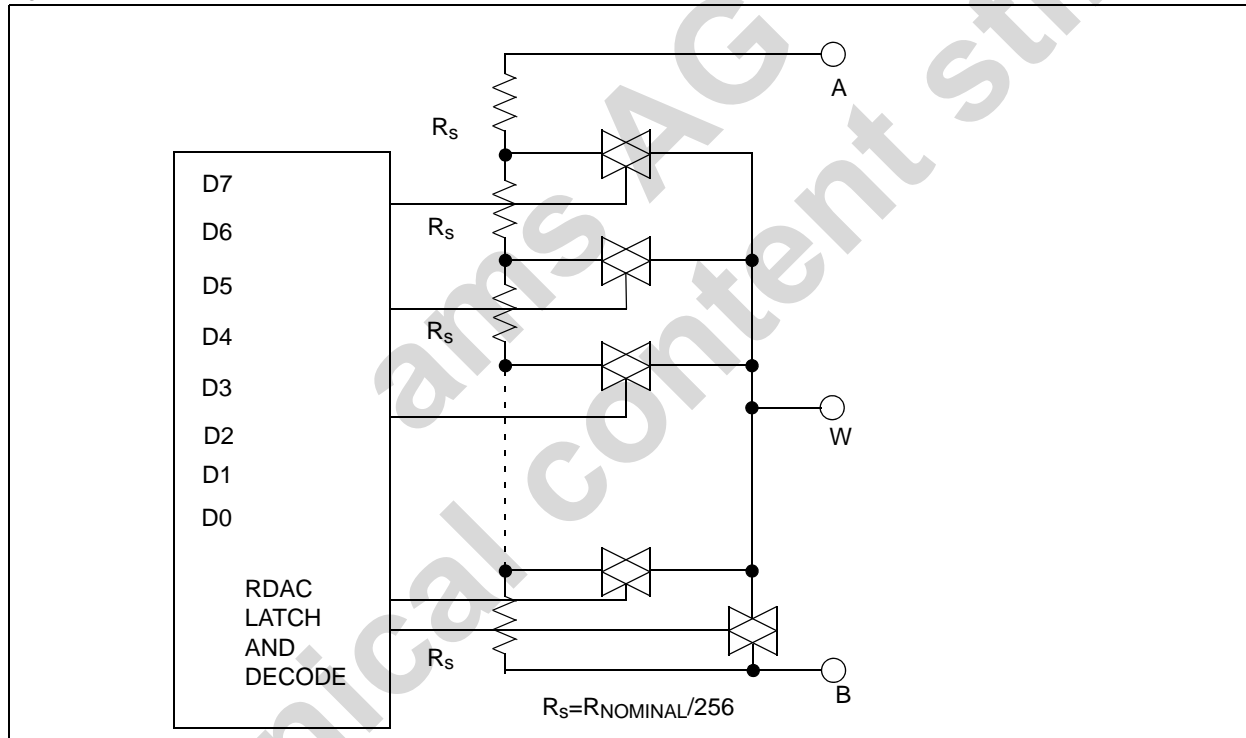


## Voltage Output Operation

The AS150x family can easily used in an voltage output mode, where the output voltage is proportional to an applied voltage to a given terminal. When 5V are applied to terminal A and B is set to ground the ouput voltage at the wiper starts at zero volts up to 1LSB less then 5V. One LSB of voltage corresponds to the voltage applied at terminal AB divided through 256 steps of possible wiper settings. The formula is given by

$$V_W (Dx)= (Dx)/256 \cdot V_{AB} + V_B \qquad (EQ\ 3)$$

where $V_{AB}$ is the voltage applied between terminal A and B, VW is the voltage at the wiper, Dx is the 8-Bit Code word and $V_B$ is the voltage at terminal B. The temperature drift is significant better than in Rheostat mode, since the temperature coefficient is determined by the internal resistor ratio. Therefore the temperature drift is only 15ppm/°C.

## Applications

The digital potentiometer can replace in many applications the analog trimming potentiometer. The digital potentiometer is not sensitive to vibrations and shocks. It has an extremely small form-factor and can be adjusted very fast (e.g. AS1500 has an update rate of 600kHz). Furthermore the temperature drift, resolution and noise are significant better and cannot be achieved with a mechanical trimming potentiometer. Due to the programmability the resistor settings can be stored in the system memory, so that after a power down the exact settings can be recalled easily.

All analog signals must remain within 0 to Vcc range. For standard potentiometer applications the wiper output can be used directly. In the case of a low impedance load, a buffer shall be used.

# 8 Package Drawings and Markings

*Figure 7.  8-pin SOIC Package*
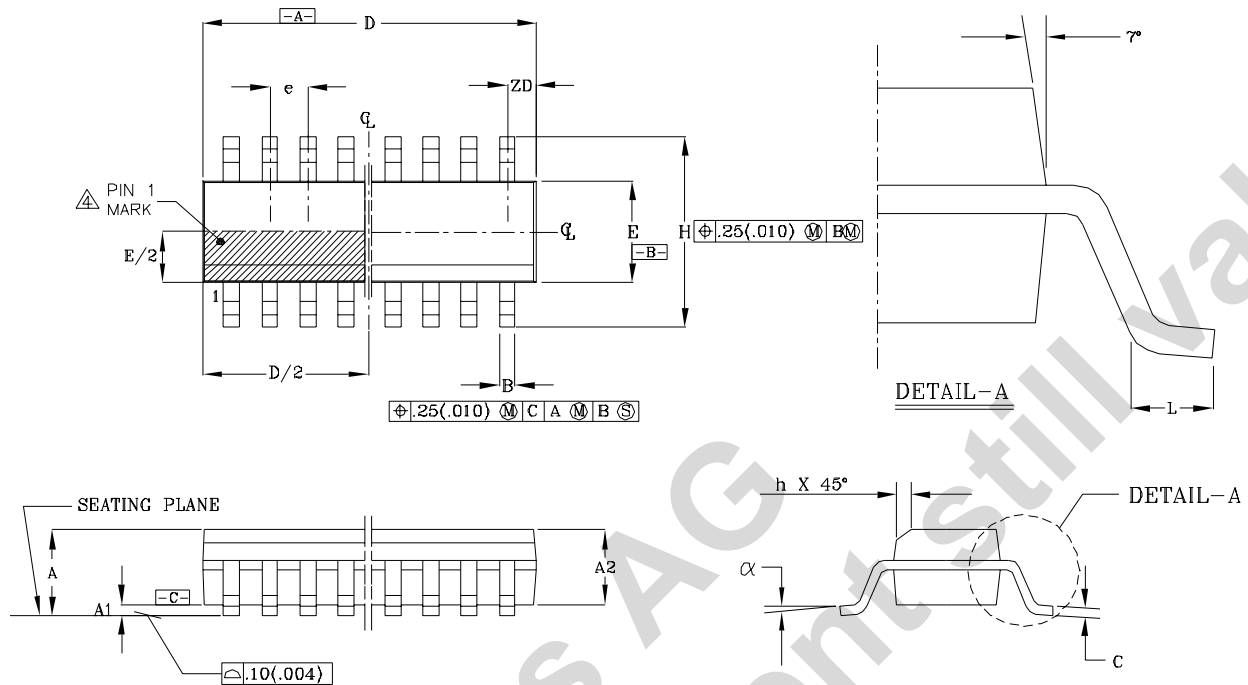


**Notes:**

1. Lead coplanarity should be 0 to 0.10mm (.004") max.
2. Package surface finishing:
   (2.1) Top: matte (charmilles #18-30).
   (2.2) All sides: matte (charmilles #18-30).
   (2.3) Bottom: smooth or matte (charmilles #18-30).
3. All dimensions exclusive of mold flash, and end flash from the package body shall not exceed 0.24mm (0.10") per side (D).
4. Details of pin #1 identifier are optional but must be located within the zone indicated.

| Symbol | Min | Max |
|--------|------|------|
| A1 | 0.10 | 0.25 |
| B | 0.36 | 0.46 |
| C | 0.19 | 0.25 |
| D | 4.80 | 4.98 |
| E | 3.81 | 3.99 |
| e | 1.27BSC | |
| H | 5.80 | 6.20 |
| h | 0.25 | 0.50 |
| L | .041 | 1.27 |
| A | 1.52 | 1.72 |
| | 0º | 8º |
| ZD | 0.53REF | |
| A2 | 1.37 | 1.57 |

# 9 Ordering Information

*Table 9.*

| Model | Resistor | Delivery Form | Package | Description |
|---|---|---|---|---|
| AS1500 | 10kΩ | Tubes | 8-pin SOIC | 8-bit Digital Potentiometer |
| AS1501 | 20kΩ | Tubes | 8-pin SOIC | 8-bit Digital Potentiometer |
| AS1502 | 50kΩ | Tubes | 8-pin SOIC | 8-bit Digital Potentiometer |
| AS1503 | 100kΩ | Tubes | 8-pin SOIC | 8-bit Digital Potentiometer |
| AS1500-T | 10kΩ | T&R | 8-pin SOIC | 8-bit Digital Potentiometer |
| AS1501-T | 20kΩ | T&R | 8-pin SOIC | 8-bit Digital Potentiometer |
| AS1502-T | 50kΩ | T&R | 8-pin SOIC | 8-bit Digital Potentiometer |
| AS1503-T | 100kΩ | T&R | 8-pin SOIC | 8-bit Digital Potentiometer |

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*austria**micro**systems*

## Contact Information

**Headquarters**
austriamicrosystems AG
A-8141 Schloss Premstaetten, Austria

Tel: +43 (0) 3136 500 0
Fax: +43 (0) 3136 525 01

For Sales Offices, Distributors and Representatives, please visit:

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