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The ADM1021A is a two-channel digital thermometer and under/overtemperature alarm, intended for use in personal computers and other systems requiring thermal monitoring and management. The device can measure the temperature of a microprocessor using a diode-connected PNP transistor, which can be provided on-chip with the Pentium[®] III or similar processors, or can be a low cost discrete

ADM1021A

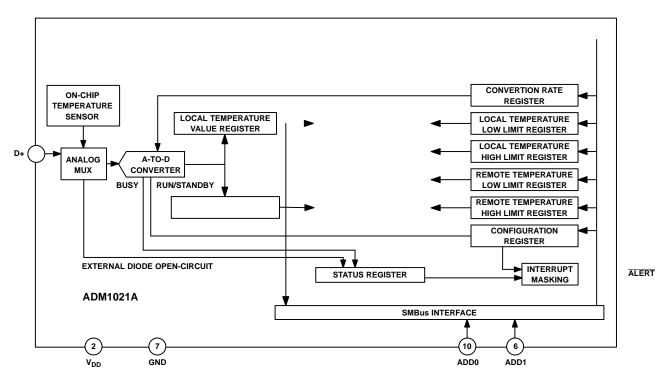


Figure 1. Functional Block Diagram

Table 4. ELECTRICAL CHARACTERISTICS (continued)

 $(T_A$ = T_{MIN} to $T_{MAX},\,V_{DD}$ = 3.0 V to 3.6 V, unless otherwise noted) (Note 1)

Parameter	ions/Comments Mi	Min Typ	Max	Unit
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Functional Description

The ADM1021A contains a two-channel A-to-D converter with special input-signal conditioning to enable operation with remote and on-chip diode temperature sensors. When the ADM1021A is operating normally, the A-to-D converter operates in free-running mode. The analog input multiplexer alternately selects either the on-chip temperature sensor to measure its local temperature or the remote temperature sensor. These signals are digitized by the ADC and the results stored in the local and remote temperature value registers as 8-bit, twos complement

To measure ΔV_{BE} , the sensor is switched between operating currents of I and N × I. The resulting waveform is passed through a 65 kHz low-pass filter to remove noise, and then to a chopper-stabilized amplifier that performs the functions of amplification and rectification of the waveform to produce a dc voltage proportional to ΔV_{BE} . This voltage is measured by the ADC to give a temperature output in 8-bit, twos complement format. To reduce the effects of noise further, digital filtering is performed by averaging the results of 16 measurement cycles.

Signal conditioning and measurement of the internal temperature sensor is performed in a similar manner.

Differences Between the ADM1021 and the ADM1021A

Although the ADM1021A is pin-for-pin compatible with the ADM1021, there are some differences between the two devices. Below is a summary of these differences and reasons for the changes.

- 1. The ADM1021A forces a larger current through the remote temperature sensing diode, typically 205 μ A vs. 90 μ A for the ADM1021. The primary reason for this is to improve the noise immunity of the part.
- 2. As a result of the greater remote sensor source current, the operating current of the ADM1021A is higher than that of the ADM1021, typically $205 \ \mu A \ vs. 160 \ \mu A$.
- 3. The temperature measurement range of the ADM1021A is 0°C to 127°C, compared with –128°C to +127°C for the ADM1021. As a result, the ADM1021 should be used if negative temperature measurement is required.
- 4. The power-on reset values of the remote and local temperature values are –128°C in the ADM1021A as compared to 0°C in the ADM1021. As the part is powered up converting (except when the part is in standby mode, that is, Pin 15 is pulled low), the part measures the actual values of remote and local temperature and writes these to the registers.
- 5. The four MSBs of the revision register can be used to identify the part. The ADM1021 revision register reads 0x0x, and the ADM1021A reads 0x3x.
- 6. The power-on default value of the address pointer register is undefined in the ADM1021A and is equal to 0x00 in the ADM1021. As a result, a value must be written to the address pointer register before a read is performed in the ADM1021A. The ADM1021 is capable of reading back local temperature without writing to the address pointer register, as it defaulted to the local temperature measurement register at powerup.
- 7. Setting the mask bit (Bit 7 Config Reg) on the

If the local and/or remote temperature measurement is above the corresponding high temperature limit or below the corresponding low temperature limit, then one or more of these flags are set. Bit 2 is a flag that is set if the remote temperature sensor is open-circuit. These five flags are NOR'd together so that if any of them are high, the ALERT

Table 8. CONFIGURATION REGISTER BIT ASSIGNMENTS

Bit	Name	Function	Power-on Default
7	MASK1	$0 = \overline{\text{ALERT}} \text{ Enabled}$ 1 = ALERT Masked	0
6	RUN/STOP	0 = Run 1 = Standby	0
5 to 0		Reserved	0

Table 11. DEVICE ADDRESSES (Note 1)

ADD0	ADD1	Device Address
0	0	0011 000
0	NC	0011 001
0	1	0011 010
NC	0	0101 001
NC	NC	0101 010
NC	1	0101 011
1	0	1001 100
1	NC	1001 101
1	1	1001 110

1. ADD0 and ADD1 are sampled at powerup only.

The serial bus protocol operates as follows:

1. The master initiates data transfer by establishing a start condition, defined as a high-to-low transition on the serial data line SDATA, while the serial clock line SCLK remains high. This indicates that an address/data stream will follow. All slave peripherals connected to the serial bus respond to

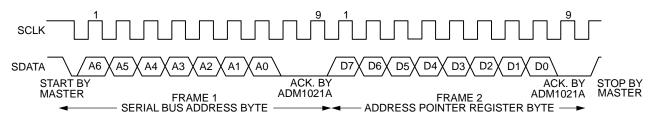


Figure 15. Writing to the Address Pointer Register Only

Layout Considerations

Digital boards can be electrically noisy environments, and because the ADM1021A is measuring very small voltages from the remote sensor, care must be taken to minimize noise induced at the sensor inputs. The following precautions should be taken:

- 1. Place the ADM1021A as close as possible to the remote sensing diode. Provided that the worst noise sources, such as clock generators, data/address buses, and CRTs, are avoided, this distance can be four to eight inches.
- 2. Route the D+ and D- tracks close together, in parallel, with grounded guard tracks on each side. Provide a ground plane under the tracks, if possible.
- 3. Use wide tracks to minimize inductance and reduce noise pickup. 10 mil track minimum width and spacing is recommended.
- 4. Try to minimize the number of copper/solder joints, which can cause thermocouple effects. Where copper/solder joints are used, ensure they are in both the D+ and D- paths and at the same temperature.

Thermocouple effects should not be a major problem as 1°C corresponds to about 240 μ V, and thermocouple voltages are about 3 μ V/°C of temperature difference. Unless there are two thermocouples with a big temperature differential between them, thermocouple voltages should be much less than 240 μ V.

- 5. Place a 0.1 μ F bypass capacitor close to the V_{DD} pin, and 2,200 pF input filter capacitors across D+, D– close to the ADM1021A.
- 6. If the distance to the remote sensor is more than eight inches, the use of twisted pair cable is recommended. This works up to about 6 to 12 feet.

7. For very long distances (up to 100 feet), use shielded twisted pair, such as Belden #8451 microphone cable. Connect the twisted pair to D+ and D- and the shield to GND close to the ADM1021A. Leave the remote end of the shield unconnected to avoid ground loops.



Figure 18. Arrangement of Signal Tracks

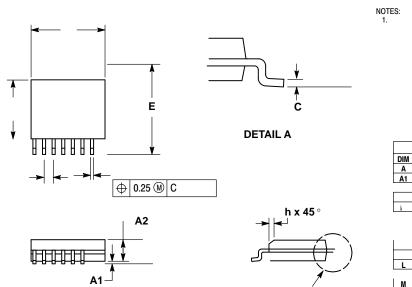
Because the measurement technique uses switched current sources, excessive cable and/or filter capacitance can affect the measurement. When using long cables, the filter capacitor can be reduced or removed.

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3. Use wide tracks to minimize inductance and reduce noise pickup. 10 mil track minimum width possible.

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DETÁIL A

	INCHE		
DIM	MIN	MA	
Α	0.053	0.069	
A1	0.004	0.010	
	0.008	0.012	
1	0.007	0.010	

	0.025 BSC		
	0.009	0.020	
L	0.016	0.050	
М	0	8	

SCALE 2:1

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