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Figure 1. Functional Block Diagram

Table 3. PIN ASSIGNMENT

Pin No.	Mnemonic	Description		
1	V _{DD}	Positive Supply, 3.0 V to 5.5 V.		
2	D+	Positive Connection to Remote Temperature Sensor.		
3	Dï	Negative Connection to Remote Temperature Sensor.		
4	THERM	Open-Drain output that can be used to turn a fan on/off or throttle a CPU clock in the event of an overtemperature condition. Requires pullup to V_{DD} .		
5	GND	Supply Ground Connection.		
6	ALERT/THERM2	Open-Drain Logic Output Used as Interrupt or SMBus Alert. This may also be configured as a sec- ond THERM output. Requires pullup resistor.		
7	SDATA	Logic Input/Output, SMBus Serial Data. Open-Drain output. Requires pullup resistor.		
8	SCLK	Logic Input, SMBus Serial Clock. Requires pullup resistor.		

Table 4. SMBus TIMING SPECIFICATIONS (Note 1)

Parameter	Limit at T $_{\rm MIN}$ and T $_{\rm MAX}$	Unit	Description	
fsclk	400	kHz max	ï	
t _{LOW}	1.3	s min	Clock low period, between 10% points.	
tніgн	0.6	s min	Clock high period, between 90% points.	
t _R	300	ns max	Clock/data rise time.	
t _F 300 ns max Clock/data fall time.		Clock/data fall time.		
tsu; sta	600	ns min	Start condition setup time.	
t _{HD; STA} (Note 2)	600	ns min	Start condition hold time.	
t _{SU; DAT} (Note 3)	100	ns min	Data setup time.	
^t HD; DAT	300	ns min	Data hold time.	
t _{SU; STO} (Note 4)	600	ns min	Stop condition setup time.	
t _{BUF}				

TYPICAL PERFORMANCE CHARACTERISTICS

Figure 3. Temperature Error vs. Leakage Resistance

Figure 4. Temperature Error vs. Actual Temperature Using 2N3906

Figure 5. Temperature Error vs. Differential Mode

Functional Description

The ADT7461 is a local and remote temperature sensor and over/under temperature alarm, with the added ability to automatically cancel the effect of $3 k\Omega$ (typical) of resistance in series with the temperature monitoring diode. When the ADT7461 is operating normally, the on-board ADC operates in a 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. The ADC digitizes these signals and the results are stored in the local and remote temperature value registers.

The local and remote measurement results are compared with the corresponding high, low, and THERM temperature limits, stored in eight on-chip registers. Out-of-limit comparisons generate flags that are stored in the status register. A result that exceeds the high temperature limit, the low temperature limit, or an external diode fault causes the ALERT output to assert low. Exceeding THERM temperature limits causes the THERM output to assert low. The ALERT output can be reprogrammed as a second THERM output.

The limit registers can be programmed and the device controlled and configured via the serial SMBus. The contents of



Figure 15. Input Signal Conditioning

Temperature	Binary	Offset Binary (Note 1)
–55°C	0 000 0000 (Note 2)	0 000 1001
0°C	0 000 0000	0 100 0000
+1°C	0 000 0001	0 100 0001
+10°C	0 000 1010	0 100 1010
+25°C	0 001 1001	0 101 1001
+50°C	0 011 0010	0 111 0010
+75°C	0 100 1011	1 000 1011
+100°C	0 110 0100	1 010 0100
+125°C	0 111 1101	1 011 1101
+127°C	0 111 1111	1 011 1111
+150°C	0 111 1111 (Note 3)	1 101 0110

Table 7. TEMPERATURE DATA FORMAT(LOCAL AND REMOTE TEMPERATURE HIGH BYTE)

1. Offset binary scale temperature values are offset by 64°C.

 Binary scale temperature measurement returns 0°C for all temperatures < 0°C.

3. Binary scale temperature measurement returns 127°C for all temperatures > 127°C.

The user can switch between measurement ranges at any time. Switching the range also switches the data format. The next temperature result following the switching is reported back to the register in the new format. However, the

contents of the limit registers are not changed. The user must

-1.9.59 63.6.59Tw.3961 369.2m0 Tc(+125(changint. Theion/TT6 1 Tf12 0 9 63.6043 507.2349.1-.0014 Tc0-.000461)TjE Rers are (T6 1

Conversion Rate Register

When Pin 6 is configured as THERM2, only the high temperature limits are relevant. If Flag 6 and/or Flag 4 are set, the THERM2 output goes low to indicate the temperature measurements are outside the programmed limits. Flag 5 and Flag 3 have no effect on THERM2. The behavior of THERM2 is otherwise the same as THERM.

Table 10. STATUS REGISTER BIT ASSIGNMENTS

Bit	Name	Function		
7	BUSY (Note 1)	1 when ADC is converting		
6	LHIGH (Note 2)	1 when local high temperature limit is tripped		
5	LLOW (Note 2)	1 when local low temperature limit is tripped		
4	RHIGH (Note 2)	1 when remote high temperature limit is tripped		
3	RLOW (Note 2)	1 when remote low temperature limit is tripped		
2	OPEN (Note 2)	1 when remote sensor is an open circuit		

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Table 13. LIST OF REGISTERS

Read Address (Hex) Write Address (Hex)		Name	Power-On Default	
Not Applicable	Not Applicable	Address Pointer		

of the clock signal and remain stable during the high period, since a low-to-high transition when the clock is high may be interpreted as a stop signal. The number of data bytes that can be transmitted over the serial bus in a single read or write operation is limited only by what the master and slave devices can handle.

3. When all data bytes have been read or written, stop conditions are established. In write mode, the master pulls the data line high during the tenth clock pulse to assert a stop condition. In read mode, the master device overrides the acknowledge bit by pulling the data line high during the low period before the ninth clock pulse. This is known as a no acknowledge. The master then takes the data line low during the low period before the tenth clock pulse, then high during the tenth clock pulse to assert a stop condition.

Sensor Fault Detection

At its D+ input, the ADT7461 contains internal sensor fault detection circuitry. This circuit can detect situations

Transistors, such as the 2N3904, 2N3906, or equivalents in SOT-23 packages are suitable devices to use.

Thermal Inertia and Self-Heating

Accuracy depends on the temperature of the remote sensing diode and/or the internal temperature sensor being at the same temperature as the environment being measured; many factors can affect this. Ideally, the sensor should be in good thermal contact with the part of the system being measured. If it is not, the thermal inertia caused by the sensor's mass causes a lag in the response of the sensor to a temperature change. With a remote sensor, this should not be a problem since it will be either a substrate transistor in the processor or a small package device, such as the SOT-23, placed in close proximity to it.

The on-chip sensor, however, is often remote from the processor and only monitors the general ambient temperature around the package. The thermal time constant of the SOIC-8 package in still air is about 140 seconds, and if the ambient air temperature quickly changed by 100 degrees, it would take about 12 minutes (5 time constants) for the junction temperature of the ADT7461 to settle within 1 degree of this. In practice, the ADT7461 package is in electrical, and hence thermal, contact with a PCB and may also be in a forced airflow. How accurately the temperature of the board and/or the forced airflow reflects the temperature to be measured also affects the accuracy. Self-heating due to the power dissipated in the ADT7461 or the remote sensor causes the chip temperature of the device or remote sensor to rise above ambient. However, the current forced through the remote sensor is so small that self-heating is negligible. With the ADT7461, the worst-case condition occurs when the device is converting at 64 conversions per second while sinking the maximum current of 1 mA at the ALERT and THERM output. In this case, the total power dissipation in the device is about 4.5 mW. The thermal resistance,



Figure 24. Typical Application Circuit

PACKAGE DIMENSIONS

SOIC-8 NB CASE 751-07 ISSUE AK



PACKAGE DIMENSIONS



	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
Α			1.10			0.043
A1	0.05	0.08	0.15	0.002	0.003	0.006
b	0.25	0.33	0.40	0.010	0.013	0.016
С	0.13	0.18	0.23	0.005	0.007	0.009
D	2.90	3.00	3.10	0.114	0.118	0.122
Е	2.90	3.00	3.10	0.114	0.118	0.122
е	0.65 BSC		0.026 BSC			
L	0.40	0.55	0.70	0.016	0.021	0.028