

# Thermal Monitor

## FEATURES

- On-Chip Temperature Transducer
- Temperature Comparator Gives Threshold Temperature Alarm
- Power Reference Permits Airflow Diagnostics
- Precision 2.5V Power Reference Permits Airflow Diagnostics
- Transducer Output is Easily Scaled for Increased Sensitivity
- Low 2.5mA Quiescent Current

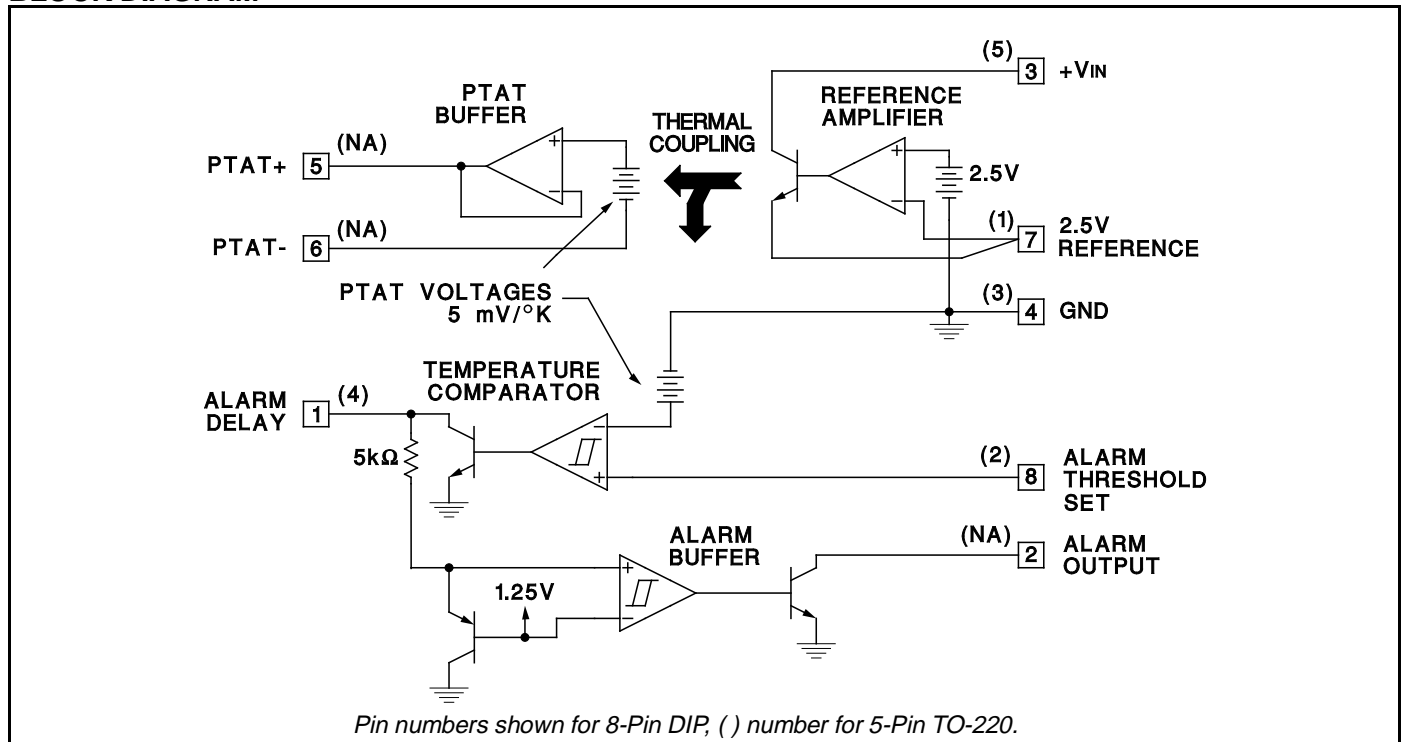
## DESCRIPTION

The UC1730 family of integrated circuit devices are designed to be used in a number of thermal monitoring applications. Each IC combines a temperature transducer, precision reference, and temperature comparator allowing the device to respond with a logic output if temperatures exceed a user programmed level. The reference on these devices is capable of supplying in excess of 250mA of output current – by setting a level of power dissipation the rise in die temperature will vary with airflow past the package, allowing the IC to respond to airflow conditions

These devices come in an 8-Pin DIP, plastic or ceramic, a 5-Pin TO-220 or a PLCC-20 version. In the 8-Pin version, a PTAT (proportional to absolute temperature) output reports die temperature directly. This output is configured such that its output level can be easily scaled up with two external gain resistors. A second PTAT source is internally referenced to the temperature comparator. The other input to this comparator can then be externally programmed to set a temperature threshold. When this temperature threshold is exceeded an alarm delay output is activated. Following the activation of the delay output, a separate open collector output is turned on. The delay pin can be programmed with an external RC to provide a time separation between activation of the delay pin and the alarm pin, permitting shutdown diagnostics in applications where the open collector outputs of multiple parts are wire OR'ed together.

The 5-Pin version in the TO-220 package is well suited for monitoring heatsink temperatures. Enhanced airflow sensitivities can be obtained with this package by mounting the device to a small heatsink in the airstream. This version of the device does not include the PTAT output or the open collector alarm output.

## BLOCK DIAGRAM

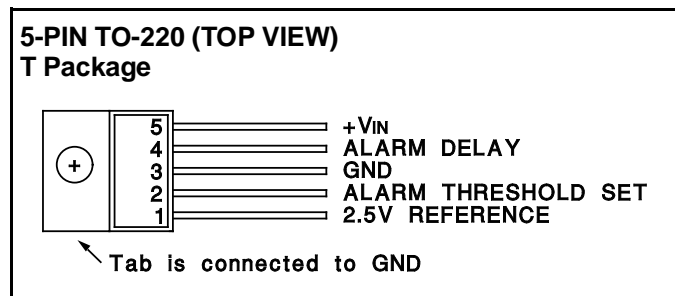
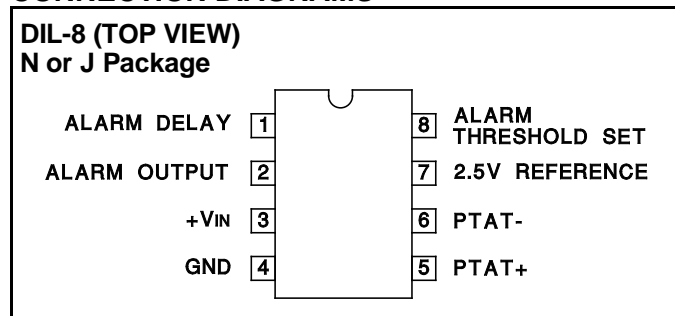
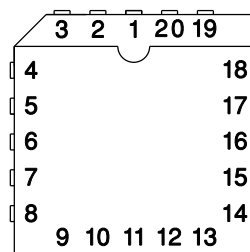


**ABSOLUTE MAXIMUM RATINGS**

Input Supply Voltage, (+VIN)	40V
Alarm Output Voltage (8-Pin Version Only)	40V
Alarm Delay Voltage	10V
Alarm Threshold Set Voltage	10V
2.5V Reference Output Current	-400 mA
Alarm Output Current (8-Pin Version Only)	0 mA
Power Dissipation at TA = 25°C (Note 2)	1000 mW
Power Dissipation at Tc = 25°C (Note 2)	2000 mW
Thermal Resistance Junction to Ambient	
N, 8-Pin Plastic DIP	110°C/W
J, 8-Pin Ceramic DIP	110°C/W

T, 5-Pin Plastic DIP TO-220	65°C/W
Thermal Resistance Junction to Case	
N, 8-Pin Plastic DIP	60°C/W
J, 8-Pin Ceramic DIP	40°C/W
T, 5-Pin Plastic TO-220	5°C/W
Operating Junction Temperature	-55°C to +150°C
Storage Temperature	-65°C to +150°C
Lead Temperature (Soldering, 10 Seconds)	300°C

*Note 1: Voltages are referenced to ground. Currents are positive into, negative out of, the specified terminals.*  
*Note 2: Consult Packaging section of Databook for thermal limitations and considerations of package.*

**CONNECTION DIAGRAMS****PLCC-20 (TOP VIEW)**  
Q Package

PACKAGE PIN FUNCTION	
FUNCTION	PIN
N/C	1-3
ALARM DELAY	4
ALARM OUTPUT	5
+VIN	6
GND	7
N/C	8-13
PTAT+	14
PTAT-	15
2.5V REFERENCE	16
2.5V REFERENCE	17
ALARM THRESHOLD SET	18
N/C	19-20

**ELECTRICAL CHARACTERISTICS:** Unless otherwise stated, these specifications apply for TJ = 0°C to +100°C for the UC3730, -25°C to +100°C for the UC2730 and -55°C to +125°C for the UC1730, +VIN = +5V, and PTAT- = 0V. TA = TJ.

PARAMETERS	TEST CONDITIONS	MIN	TYP	MAX	UNITS
<b>INPUT SUPPLY</b>					
Supply Current	+VIN = 35V		2.8	4.0	mA
	+VIN = 5V		2.3	3.5	mA
<b>REFERENCE</b>					
Output Voltage	TJ = 25°C	2.475	2.5	2.525	V
	Over Temperature	2.46		2.54	V
Load Regulation	IOUT = 0 to 250mA		8.0	25	mV
Line Regulation	+VIN = 5 to 25V		1.0	5.0	mV
<b>TEMPERATURE COMPARATOR</b>					
Temperature Comparator Threshold	at 300°K (26.85°C), Nominally 5mV/°K, VINUT High to Low	1.475	1.50	1.525	V
Temperature Error		-10		10	°C
Threshold Line Regulation	+VIN = 5 to 25V		0.005	0.02	%/V
Temperature Linearity	Note 2		2.0	5.0	°C
Threshold Hysteresis		3.0	8.0	15	mV
Input Bias Current	VINPUT at 1.5V	-0.5	-0.1		μA
Max Output Current	VOUT = 1V	1.2	3.0		mA
Output Sat Voltage	IOUT = 100μA		0.05	0.25	V

**ELECTRICAL CHARACTERISTICS (cont):**

Unless otherwise stated, these specifications apply for T<sub>J</sub> = 0°C to +100°C for the UC3730, -25°C to + 100°C for the UC2730 and -55°C to +125°C for the UC1730, +V<sub>IN</sub> = + 5V, and PTAT<sub>-</sub> = 0V. T<sub>A</sub> = T<sub>J</sub>.

PARAMETERS	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>TEMPERATURE COMPARATOR (cont.)</b>					
Output Leakage Current	V <sub>OUT</sub> = 1V		0.01	1.0	μA
<b>PTAT BUFFER (8-Pin N, or J Version Only)</b>					
Output Voltage	at 300°K (26.85°C), Nominally 5mV/°K	1.460	1.50	1.54	V
	In 10X Config. + V <sub>IN</sub> = 25V	14.6	15	15.4	V
Temperature Error		-12		12	°C
Temperature Linearity (Note 2)			2.0	5.0	°C
Line Regulation	+V <sub>IN</sub> = 5 to 25V		0.02	0.04	%/V
Load Regulation	I <sub>OUT</sub> = 0 to 2mA		1.0	3.0	mV
Dropout Voltage	PTAT + TO +V <sub>IN</sub>		1.9	2.5	V
Input Bias Current at PTAT <sub>-</sub> Input		-3.0	-1.0		μA
<b>ALARM BUFFER COMPARATOR (8-Pin N, or J Version Only)</b>					
Threshold Voltage (V <sub>TH</sub> )	Alarm Delay Input Low to High	1.1	1.2	1.3	V
Threshold Hysteresis Voltage	Alarm Delay Voltage > V <sub>TH</sub>		100	250	mV
Input Bias Current	Alarm Delay Voltage < V <sub>TH</sub>		0.1	0.5	μA
Max Output Current	V <sub>OUT</sub> = 1V	7.0	15		mA
Output Sat Voltage	I <sub>OUT</sub> = 3mA		0.25	0.45	V
Output Leakage	V <sub>OUT</sub> = 35V		0.1	2.0	μA

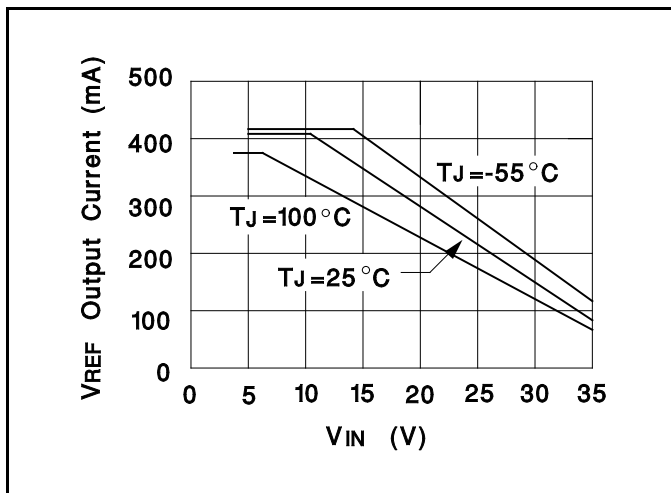
Note 2: This parameter is guaranteed by design and is not tested in production.

**APPLICATIONS AND OPERATION INFORMATION**

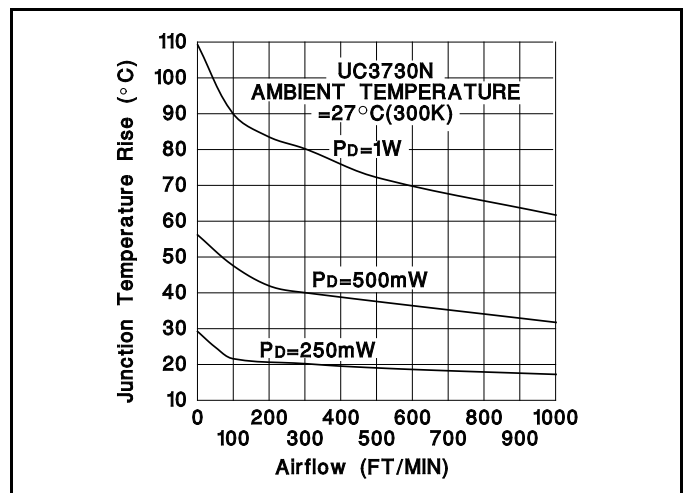
**Scaling the PTAT Output (8 Pin Version Only)**

$$V_{OUT} = 5 \times \left(1 + \frac{R2}{R1}\right) mV/°K$$

(Recommended Range for R1 is 2k to 4k)



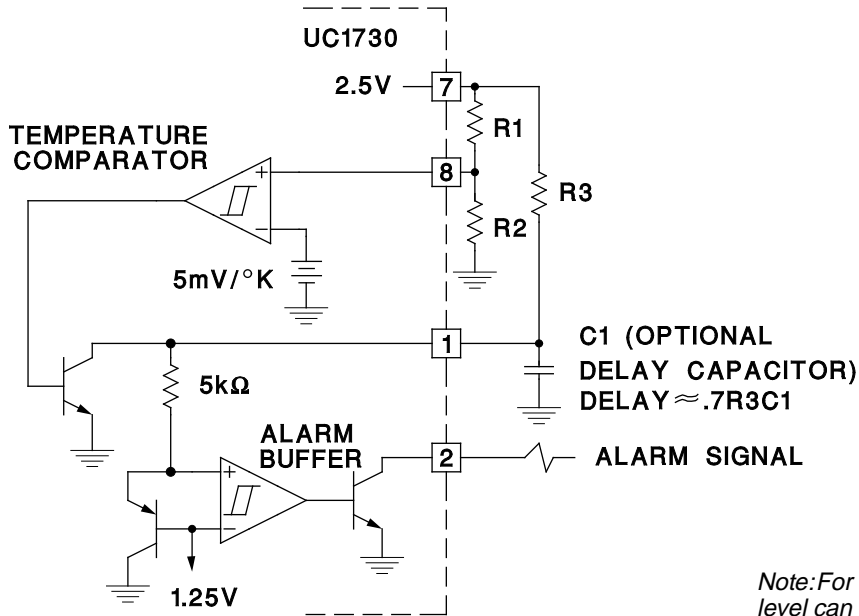
VREF Maximum Output Current vs Input Supply



Junction Temperature Rise vs Airflow UC3730N (8-Pin Plastic Dip)

APPLICATIONS AND OPERATION INFORMATION (Cont.)

Setting a Temperature Threshold

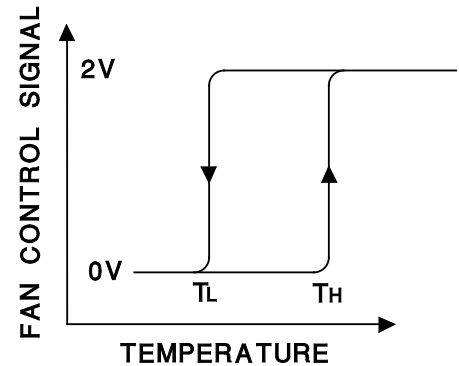
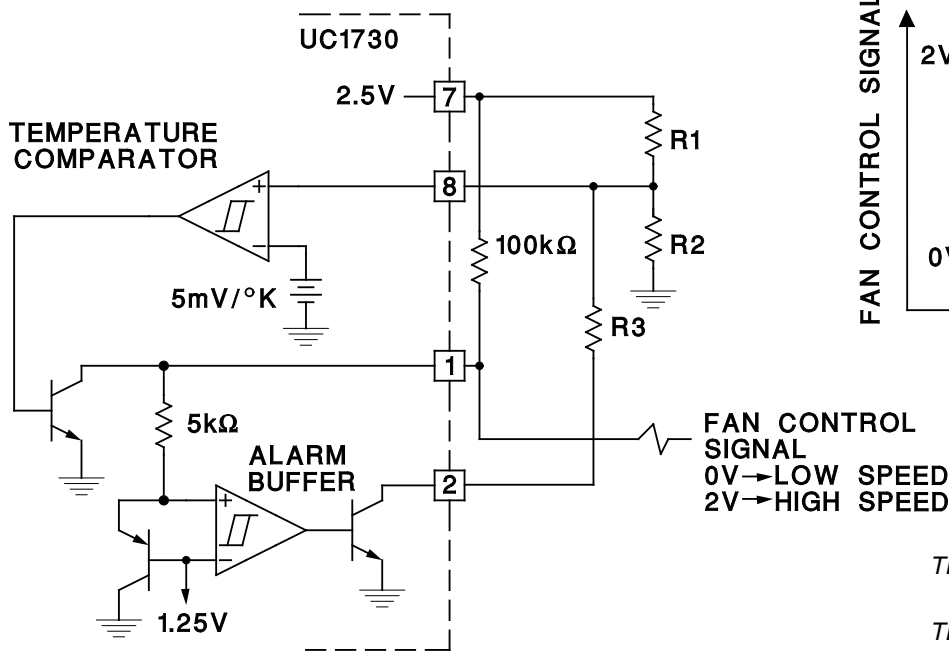


$$\text{Temperature Threshold (}^\circ\text{C)} = \left( \frac{2.5\text{V}}{0.005} \right) \times \frac{R2}{R1+R2} - 273.15$$

C1 (OPTIONAL DELAY CAPACITOR)  
DELAY  $\approx .7R3C1$

Note: For airflow monitoring a power dissipation level can be set with a resistive load,  $R_L$ , on the reference output.  $PD = (+V_{IN} - 2.5\text{V})^2 / R_L$ .

Dual Speed Fan Control



FAN CONTROL SIGNAL  
0V → LOW SPEED  
2V → HIGH SPEED

$$TH(^{\circ}\text{C}) = \frac{2.5\text{V}}{0.005} \times \frac{R2}{R1+R2} - 273.15$$

$$TL(^{\circ}\text{C}) = \frac{2.5\text{V}}{0.005} \times \frac{RX}{R1+RX} - 273.15$$

$$\text{Where: } RX = R2 \times \frac{R3}{R2 + R3}$$

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