

CHT-NILE-Datasheet

*Version: 1.6
23-Dec-13
(Last Modification Date)*

High-Temperature 8-bit Programmable Threshold Comparator

General Description

The CHT-NILE is a high-temperature, low-power, 8-bit programmable threshold comparator. This device compares an analog input against a 8-bit resolution portion of the 5V reference voltage based on an R-2R network and features a strictly monotonic characteristic from -55°C up to +225°C.

The CHT-NILE is a continuous time device and is able to provide a valid output within 2.6µsec for a 10mV comparator overdrive. Several input ranges are available from -15V up to +10V. It only requires a +5V supply and an external +5V reference.

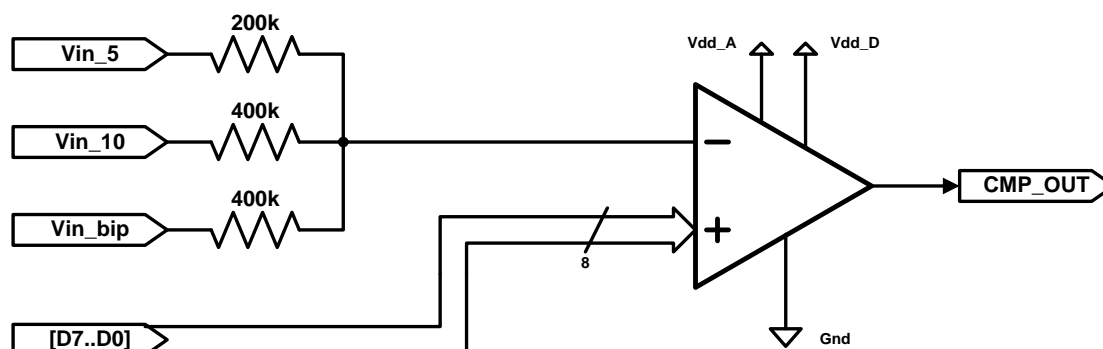
Features

- Continuous time
- 8 bit-resolution
- 2.6µsec typical delay with 10mV overdrive
- +5V power supply only
- Low total supply current (<250 µA)
- Operational from -55 to +225°C with very low drift
- Validated at 225°C for 20000 hours (and still on-going)
- Available in die and CSOIC16

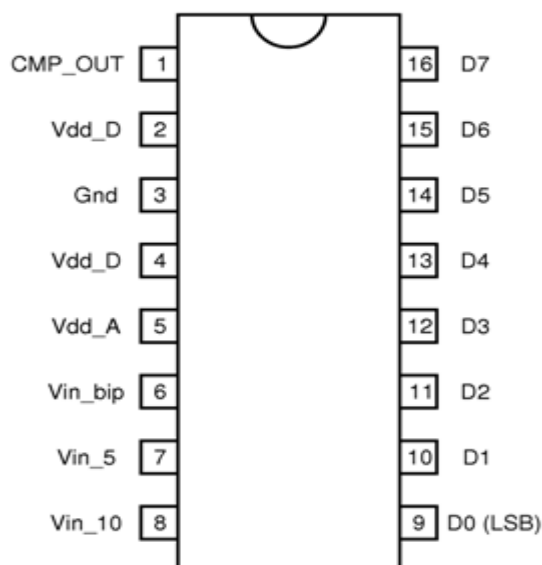
Target Markets & Applications

- Aeronautics & Aerospace, Industrial, Well logging, Automotive,
- Electric Power Conversion

Functional Block Diagram



Package Configurations¹



Pin #	Pin Name ²	Type	Function
1	CMP_OUT	DO	Comparison result.
2	Vdd_D	SD	+5V digital supply (+/- 5%).
3	Gnd	SD	Digital ground.
4	Vdd_D	SD	+5V digital supply (+/- 5%).
5	Vdd_A	SA	Analog supply voltage. It is also used as internal voltage reference. It must be a <u>precise and noiseless</u> 5V supply (current <200µA). The accuracy of this reference directly affects the comparator gain error.
6	Vin_bip	AI	Analog signal input. It is connected to an internal 400kΩ resistor. See Static Characteristics table for possible input ranges.
7	Vin_5	AI	Analog signal input. It is connected to an internal 200kΩ resistor. See Static Characteristics table for possible input ranges.
8	Vin_10	AI	Analog signal input. It is connected to an internal 400kΩ resistor. See Static Characteristics table for possible input ranges.
9	D0 (LSB)	DI	Parallel data input.
10	D1	DI	
11	D2	DI	
12	D3	DI	
13	D4	DI	
14	D5	DI	
15	D6	DI	
16	D7 (MSB)	DI	

Ordering Information

Ordering Reference	Package	Temperature Range	Marking
CHT-PTC8-CSOIC16-T	Ceramic CSOIC16	-55°C to +225°C	CHT-PTC8

¹ Other packages available upon request.

² S=Supply, A=Analog; D=Digital; I=input; O=output

Absolute Maximum Ratings

Supply Voltage V_{DD} to GND -0.5 to 5.5V
 Voltage on pins 6,7,8 -15V to 10V
 Voltage on other pins to GND -0.5 to $V_{DD}+0.5V$

Operating Conditions

Supply Voltage V_{DD} to GND $5V \pm 5\%$
 Junction temperature $-55^{\circ}C$ to $+225^{\circ}C$

ESD Rating (expected)

Human Body Model (expected) >1kV

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Frequent or extended exposure to absolute maximum rating conditions or above may affect device reliability.

DC Electrical Characteristics

Unless otherwise stated: $V_{DD} = 5V \pm 5\%$, $T_j = 25^{\circ}C$. **Bold** figures indicate values over the whole temperature range ($-55^{\circ}C < T_j < 225^{\circ}C$).

Parameter	Condition	Min	Typ	Max	Units
Digital Supply voltage V_{DD}		4.75	5.00	5.25	V
Analog Supply voltage V_{DDA}	Used as internal voltage reference		5.00		V
Current consumption (analog part) I_{DDA}	$T_j = -55^{\circ}C$ $T_j = +225^{\circ}C$		134 164		μA
Current consumption (digital part) I_{DD}			55		μA
Minimum HIGH level output voltage V_{OH}	$I_{OH} < 1mA$ (source)	4.6	4.82		V
Maximum LOW level output voltage V_{OL}	$I_{OL} < 1mA$ (sink)		0.20	0.4	V
Minimum HIGH level input voltage V_{IH}		3.7			V
Maximum LOW level input voltage V_{IL}				2.0	V
Input leakage current (source / sink) $\pm I_I$	$V_I = V_{DD}$ or GND		± 2	± 37	nA

Static characteristics

Unless otherwise stated: $V_{DD}=5V\pm 5\%$, $T_j=25^\circ C$. **Bold** figures indicate values over the whole temperature range ($-55^\circ C < T_j < 225^\circ C$). Selected input range=0 to 5V.

Parameter	Condition	Min	Typ	Max	Units
Resolution		8			Bits
DNL ¹				1	LSB
INL ¹				1	LSB
Missing code			0	1	
Monotonicity			OK		
Offset ²			4		LSB ¹
Gain Error ²			1.5		%
Temperature Drift (d/dT°) - Offset - Gain Error			-0.006 -19		LSB/°C ppm/°C
Selectable Analog Input Ranges	Vin_5	Vin_10	Vin_bip		
	Gnd	in	Gnd	0	10
	in	Gnd	Gnd	0	5
	in	in	Gnd	0	3.33
	in	in	In	0	2.5
	in	in	vddA	-1.67	1.67
	in	Gnd	vddA	-2.5	2.5
	Gnd	In	vddA	-5	5
	in	vddA	vddA	-5	0
	vddA	In	Gnd	-10	0
	vddA	in	vddA	-15	-5
Input Impedance - Sample phase - Hold phase	For [0...5V] range. Can change up to a factor of 2 for other ranges.	144 288	200 400	245 490	kΩ

Timing Characteristics

Unless otherwise stated: $V_{DD}=5V\pm 5\%$, $T_j=25^\circ C$. **Bold** figures indicate values over the whole temperature range ($-55^\circ C < T_j < 225^\circ C$).

Parameter	Condition	Min	Typ	Max	Units
Comparator delay (up or down) t_{DD}	$T_j = +25^\circ C$, [0-5]V input range; peak-to-peak Voltage analog swing around digital threshold= - 20mVpp - 45mVpp - 200mVpp - 5Vpp				μsec
		2.6			
		1.9			
		1.15			
		0.44			

¹ Value extracted with code density method, using 200kHz external clock.

² For [0...5]V range, DAC transfer function is: $D = \text{Offset} + (256/5) * A * (1 - (\text{Gain Error}/100))$

Typical Performance Characteristics

Input voltage set to [0...5]V range, $V_{DD}=5V$. Digital threshold arbitrarily set to $D=[107]$; $T=25^{\circ}C$

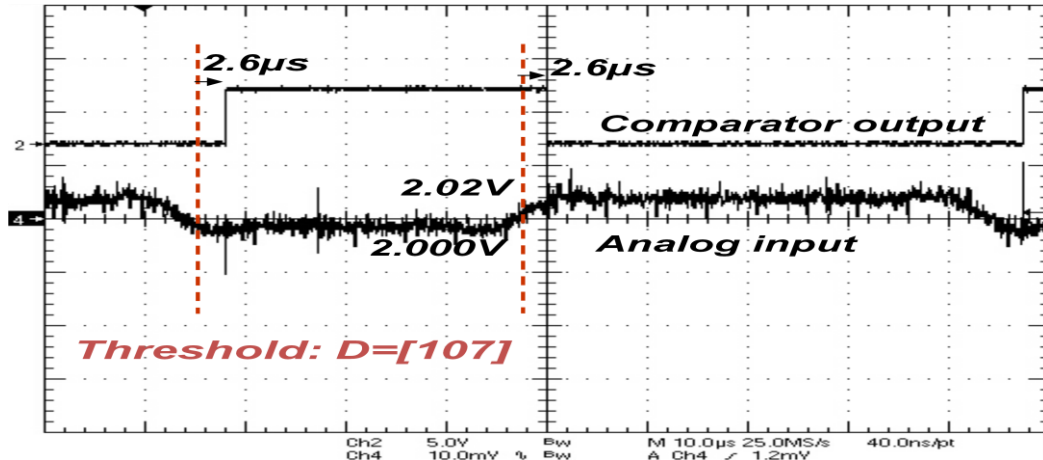


Figure 1: Comparator delay measured with fast analog input transient for fixed D. In this case, peak-to-peak analog value is 20mV, corresponding to 8 bit resolution step in 5V mode range. Measured delay is 2.6µs.

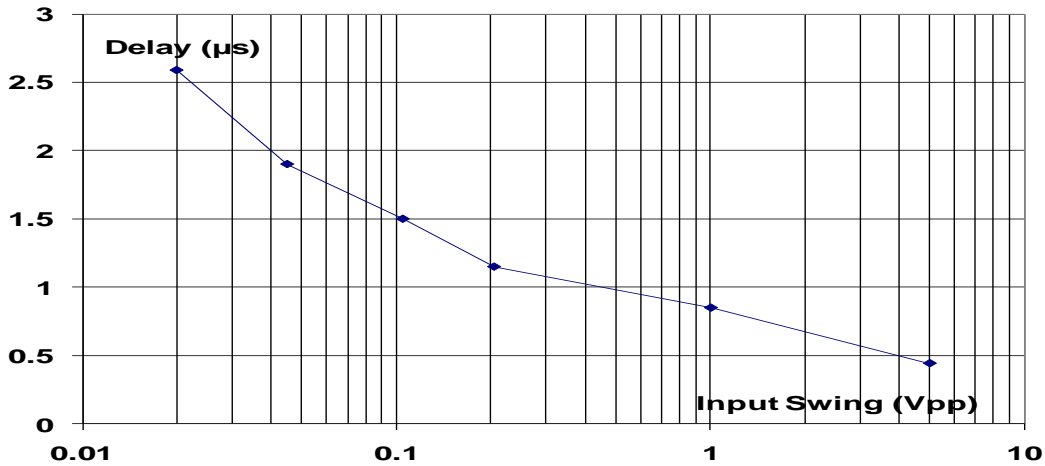


Figure 2: Measured comparator delay ($D=[107]$; Fast Analog input transient (peak-to-peak value) around theoretical analog threshold.

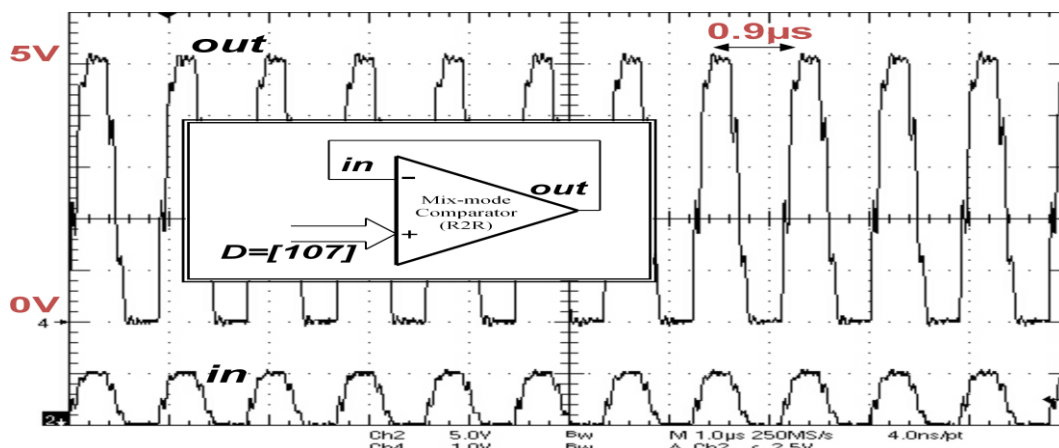


Figure 3: Maximum speed measurement at 25°C ($D=[107]$) in [0-5]V mode range with analog input connected to comparator output. Period is 0.9µs, corresponding to 0.45µs comparator delay.

Circuit Functionality

Operating conditions

The CHT-NILE has been qualified for digital supply voltages from 4.75V to 5.25V and for an accurate and noise-free analog supply voltage of 5V.

The qualification temperature range extends from -55°C to +225°C, though functionality above +250°C is achieved with some derating of the characteristics.

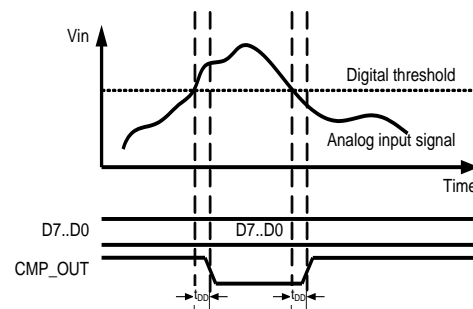
Input scaling

The CHT-NILE allows operating with several possible input voltage ranges by properly connecting its 3 analog inputs (Vin_5; Vin_10; Vin_bip). Connecting them to the analog input voltage, to Gnd or to Vdd_A allows setting different input voltage dynamic ranges. For a standard 0-5V range for example, the analog input is "Vin_5" pin whereas both other pins "Vin_10" and "Vin_bip" must be grounded. For other input ranges, please refer to the **Static Characteristics** table.

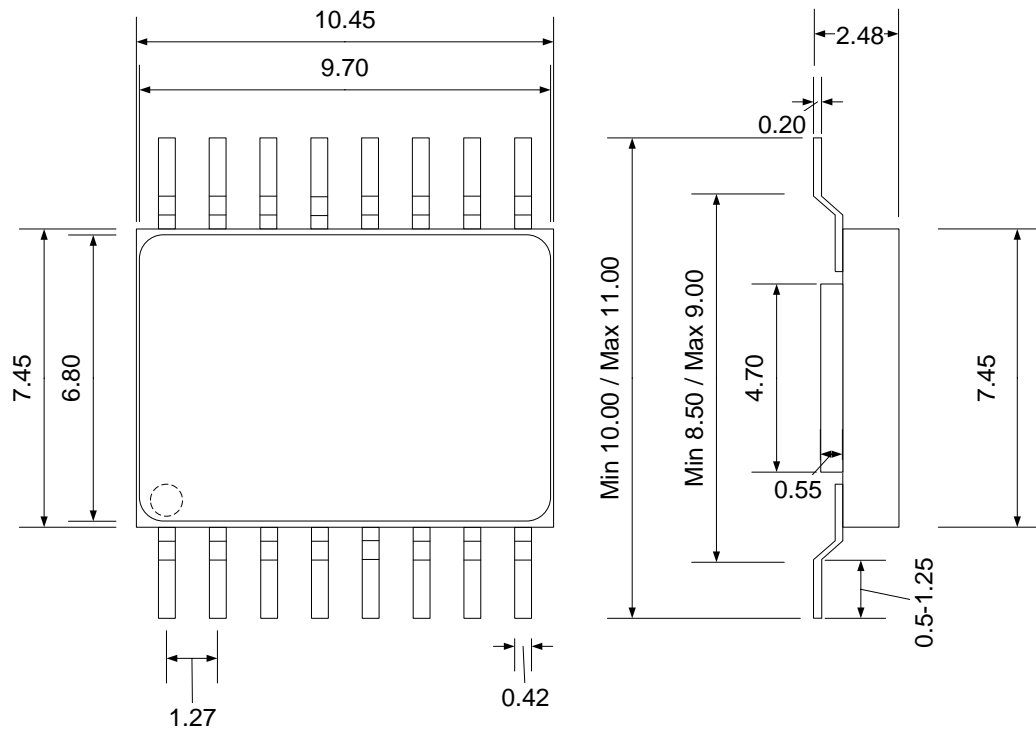
Theory of operation

The CHT-NILE is a continuous time 8-bit digital programmable threshold comparator. The analog input or the digital input can be changed at any time with the appropriate output response.

The analog input corresponds to the inverting input of the comparator. When the analog input signal is above the value given by the digital threshold, the output **CMP_OUT** is LOW.



Package dimensions (CSOIC16)



CSOIC 16 Drawing (mm +/- 10%)

Ordering information

Product Name	Ordering Reference	Package	Marking
CHT-PTC8	CHT-PTC8-CSOIC16-T	CSOIC16	CHT-PTC8

Contact & Ordering

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