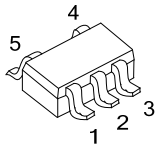
LOW-POWER VOLTAGE OUTPUT TEMPERATURE SENSOR



SOT-353

■ DESCRIPTION

The UTC **UTS2301** low-cost, low-power and tiny temperature sensor family converts temperature to an analog voltage. It provides an accuracy of ±4°C from 0°C to +70°C while consuming 6μA (typ.) of operating current.

The UTC **UTS2301** provides a low-cost solution for applications that require measurement of a relative change of temperature. When measuring relative change in temperature from 25°C, an accuracy of ±1°C (typ.) (V_{DD}=5V) can be realized from 0°C to 70°C. This accuracy can also be achieved by applying system calibration at 25°C.

Unlike resistive sensors such as thermistors, this family does not require a signal conditioning circuit. The voltage output pin can be directly connected to an ADC input of a microcontroller. The UTC **UTS2301** temperature coefficient is scaled to provide a 1° C/bit resolution for an 8-bit ADC with a reference voltage of 2.5V and 5V, respectively.

In addition, It is immune to the effects of parasitic capacitance and can drive large capacitive loads. This provides Printed Circuit Board (PCB) layout design flexibility by enabling the device to be remotely located from the microcontroller. Adding some capacitance at the output also helps the output transient response by reducing overshoots or undershoots. However, capacitive load is not required for sensor output stability.

The UTC **UTS2301** low operating current of 6μA (typ.) makes it ideal for battery-powered applications. However, for applications that require tighter current budget, this device can be powered using a microcontroller Input/Output (I/O) pin. The I/O pin can be toggled to shutdown the device. In such applications, the microcontroller internal digital switching noise is emitted to the UTC **UTS2301** as power supply noise. This switching noise compromises measurement accuracy. Therefore, a decoupling capacitor will be necessary.

■ FEATURES

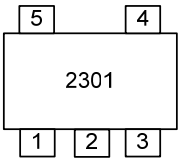
* Tiny Analog Temperature Sensor
* Wide Temperature Measurement Range: -10°C ~ +125°C
* Accuracy: ±4°C (max.), 0°C ~ +70°C
* Optimized for Analog-to-Digital Converters (ADCs): 19.5mV/°C (typ.)
* Wide Operating Voltage Range: V_{DD} = 3.1V~ 5.5V
* Low Operating Current: 6 μA (typ.)
* Optimized to Drive Large Capacitive Loads

■ ORDERING INFORMATION

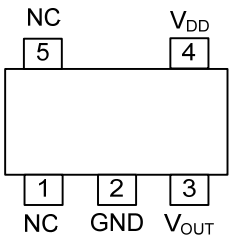
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UTS2301L-AL5-R	UTS2301G-AL5-R	SOT-353	Tape Reel

UTS2301G-AL5-R (1)Packing Type (2)Package Type (3)Green Package	(1) R: Tape Reel (2) AL5: SOT-353 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1, 5	NC	No Connected
2	GND	Ground
3	V_{OUT}	Output Voltage
4	V_{DD}	Power Supply

■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Operating Voltage Range	V_{DD}	6.0	V
Junction Temperature	T_J	+150	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C
Ambient Temp. with Power Applied		-40 ~ +125	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ_{JA}	331	°C/W

■ ELECTRICAL CHARACTERISTICS

(V_{DD} = 3.1V ~ 5.5V, GND = Ground, T_A = -10°C ~ +125°C and No load. unless otherwise specified))

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Supply						
Operating Voltage Range	V_{DD}		3.1		5.5	V
Operating Current	I_{DD}			6	12	μA
Sensor Accuracy (Note1, 2)						
Sensor Accuracy	T_{ACY}	V_{DD} = 5.0V, T_A = +25°C		±1		°C
		V_{DD} = 5.0V, T_A = 0°C ~ +70°C	-4.0		+4.0	°C
		V_{DD} = 5.0V, T_A = -10°C ~ +125°C	-4.0		+6.0	°C
Sensor Output						
Output Voltage, T_A = 0°C	$V_{0°C}$			400		mV
Temperature Coefficient	T_{C1}			19.5		mV/°C
Output Nonlinearity	V_{ONL}	T_A = 0°C ~ +70°C (Note2)		±0.5		°C
Output Current	I_{OUT}				100	μA
Output Impedance	Z_{OUT}	I_{OUT} = 100μA, f = 500Hz		20		Ω
Output Load Regulation	$\triangle V_{OUT}/\triangle I_{OUT}$	T_A = 0°C ~ +70°C, I_{OUT} = 100μA		1		Ω
Turn-On Time	t_{ON}			800		μs
Typical Load Capacitance (Note 3)	C_{LOAD}				1000	pF

Notes: 1. The UTC **UTS2301** accuracy is tested with V_{DD}=5V.

2. The UTC **UTS2301** is characterized using the first-order or linear equation, as shown in Equation 1.

Equation 1: sensor transfer function：$V_{OUT}=T_{C1}\times T_A+ V_0°C$

Where: T_A =Ambient temperature

V_{OUT} =Sensor output voltage

$V_{0°C}$ =Sensor output voltage at 0°C

T_{C1}=Temperature Coefficient

The UTC **UTS2301** temperature sensing element essentially a P-N junction or a diode. The diode electrical characteristics has a temperature coefficient that provides a change in voltage based on the relative in voltage is scaled to a temperature coefficient of 19.5 mV/°C (typ.) for UTC **UTS2301**. The output voltage at 0°C is also scaled to 400 mV (typ.) for UTC **UTS2301**, respectively.

■ TYPICAL APPLICATION CIRCUIT