

# Temperature sensor

## SPECIFICATION

### 1 FEATURES

- TSMC CMOS 65 nm
- Operating temperature range  $-40\dots+125\text{ }^{\circ}\text{C}$
- Built-in 10 bit R-2R DAC
- Low current consumption 95  $\mu\text{A}$
- Small area
- No external components required
- Portable to other technologies (upon request)

### 2 APPLICATIONS

- On chip temperature measurement
- Pseudostatic analog digitization
- Sensitive analog circuit
- Navigation receiver
- High clock digital VLSI

### 3 OVERVIEW

Temperature sensor consists of built-in 10-bit R-2R DAC, diode and own reference voltage former. When requested, controller performs conversion of diode voltage level, which depends on temperature linearly. After conversion is done it sets “ready” flag to “1” and outputs 10-bit code. The sensor can operate in two modes: single measurement and continuous measurement. With small size, usability and low current consumption, this device is ideal for use in controlling of the die temperature.

The block is designed on TSMC CMOS 65 nm technology.

### 4 STRUCTURE

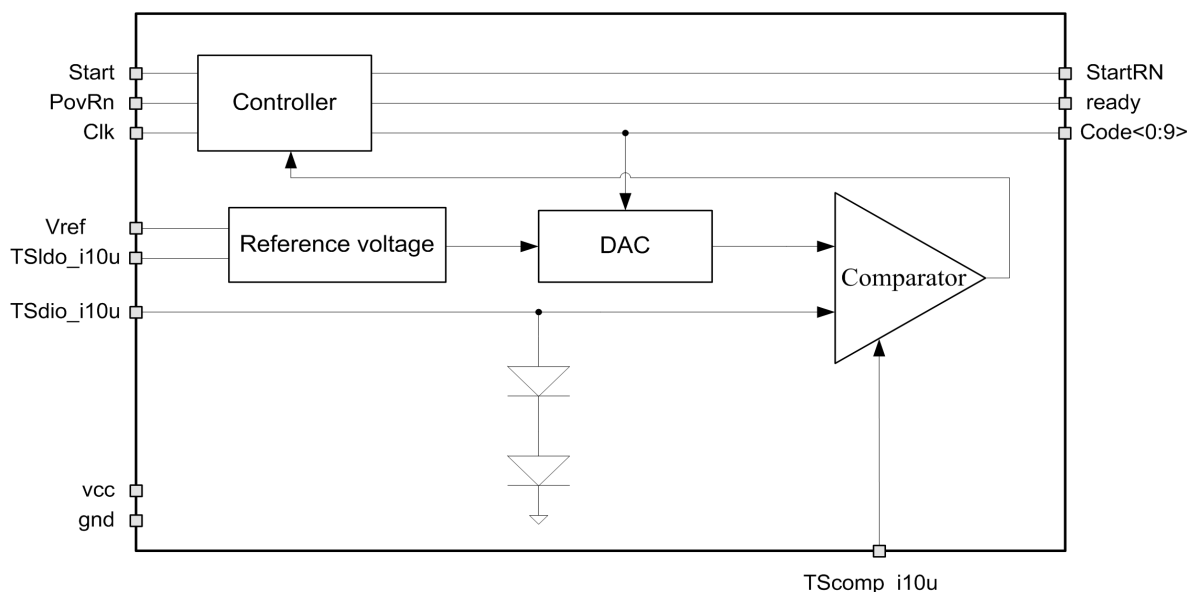


Figure 1: Temperature sensor structure

## 5 PIN DESCRIPTION

Name	Direction	Description
TSdio_i10u	IO	Diode reference current (10 $\mu$ A)
TScomp_i10u	IO	Comparator reference current (10 $\mu$ A)
TSldo_i10u	I	Voltage source reference current (10 $\mu$ A)
vref	I	Reference voltage
code<9:0>	O	Temperature code
PowRn	I	Supply voltage reset
Start	I	Start measure
clk	I	Clock frequency
StartRN	O	Automatic reset mode
ready	O	Ready status
vcc	IO	Supply voltage 2.5 V
gnd	IO	Ground

## 6 LAYOUT DESCRIPTION

The block dimensions are given in the table 1.

Table 1: Block dimensions.

Dimension	Value	Unit
Height	240	$\mu\text{m}$
Width	295	$\mu\text{m}$

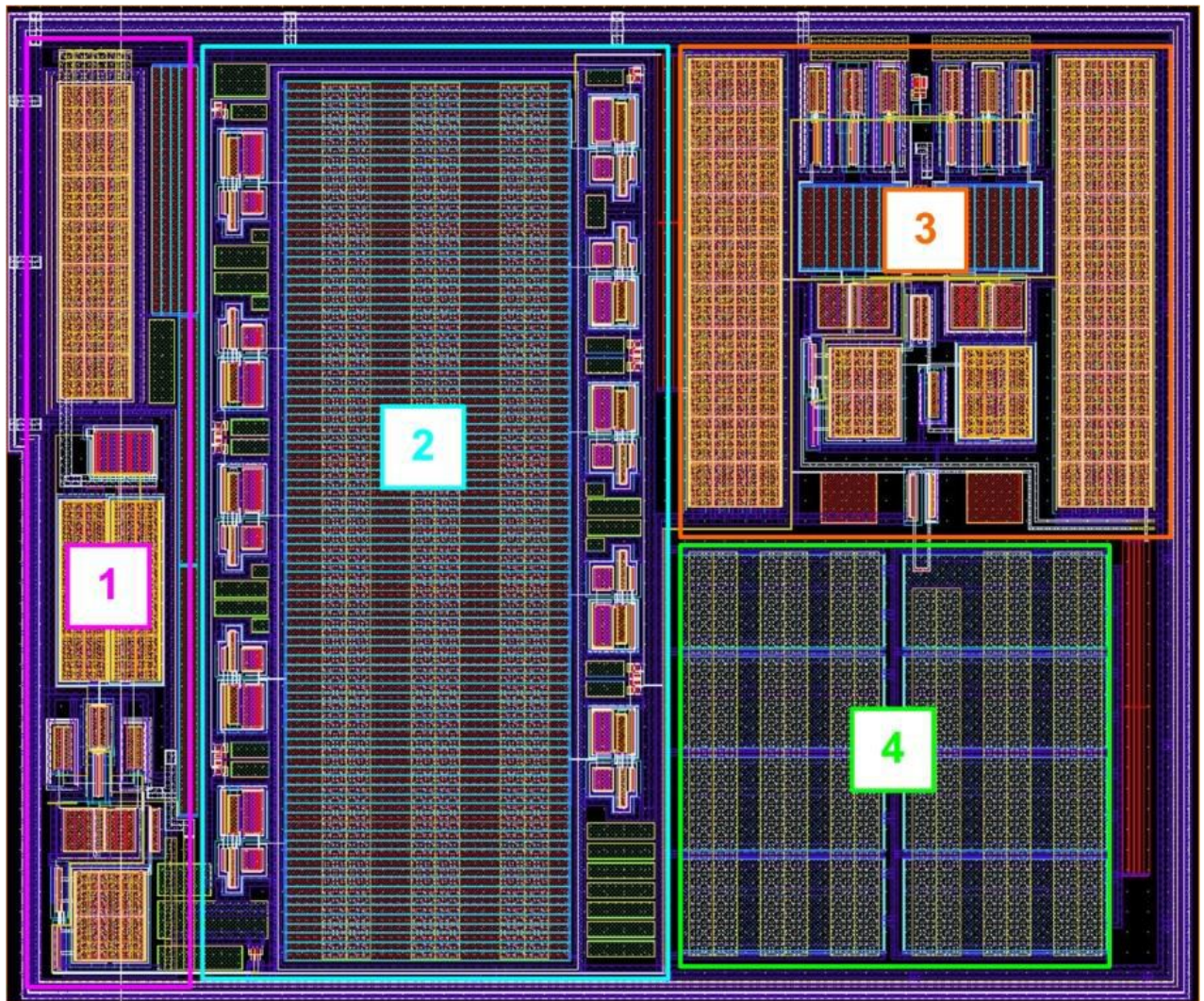


Figure 2: Device layout view

1. Reference voltage source
2. DAC
3. Comparator
4. Diodes

## 7 OPERATION CHARACTERISTICS

### 7.1 TECHNICAL CHARACTERISTICS

Technology \_\_\_\_\_ TSMC CMOS 65 nm  
 Status \_\_\_\_\_ silicon proven  
 Area \_\_\_\_\_ 0.7 mm<sup>2</sup>

### 7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for  $V_{cc} = 2.4 \div 2.6$  V and  $T = -40 \div +125^{\circ}\text{C}$ . Typical values are at  $V_{cc} = 2.5$  V and  $T_a = +85^{\circ}\text{C}$ , unless otherwise specified.

Parameter	Symbol	Conditions	Value			Unit
			min	typ	max	
Supply voltage	$V_{cc}$	-	2.4	2.5	2.6	V
Temperature range	T	-	-40	+85	+125	$^{\circ}\text{C}$
Clock frequency	$F_{clk}$	-	1	50	50	kHz
DAC resolution	K	-	-	10	-	bit
Accuracy step	N	-	-	0.5	-	$\pm^{\circ}\text{C}$
Absolute accuracy	$\delta$	-	-	4.9	-	$\pm^{\circ}\text{C}$
Current consumption	$I_{cc}$	-	-	95	105	$\mu\text{A}$
Stand-by current	$I_{stb}$	-	-	-	0.1	nA
Input logic-high level	$V_{IH}$	For digital inputs	$0.7 V_{cc}$	-	$V_{cc}+0.25$	V
Input logic-low level	$V_{IL}$		-0.25	-	0.3	

## 8 DELIVERABLES

IP contents:

- Schematic or NetList
- Layout or blackbox
- Extracted view (optional)
- GDSII
- DRC, LVS, antenna report
- Test bench with saved configurations (optional)
- Documentation