Temperature sensor

SPECIFICATION

1 FEATURES

- TSMC CMOS 65 nm
- Operating temperature range -40…+125 °C
- Built-in 10 bit R-2R DAC
- Low current consumption 95 uA
- Small area
- No external components required
- Supported foundries: TSMC, UMC, Global Foundries, SMIC

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

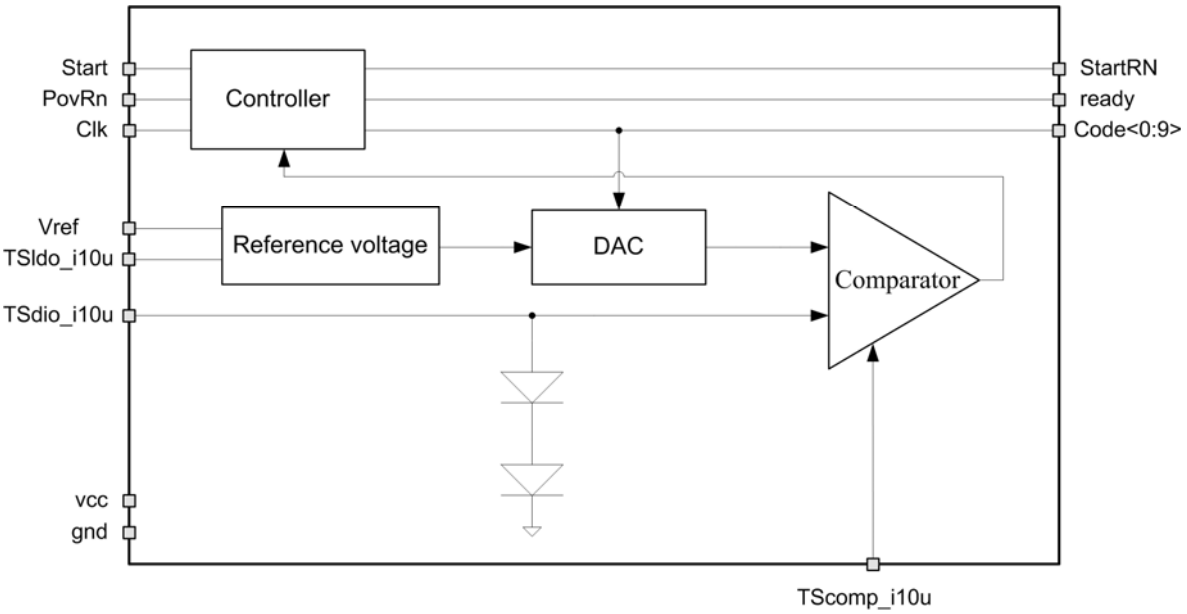

Figure 1: Temperature sensor structure.

5 PIN DESCRIPTION

Name	Direction	Description
TSdio_i10u	IO	Diode reference current (10 µA)
TScomp_i10u	IO	Comparator reference current (10 µA)
TSldo_i10u	I	Voltage source reference current (10 µA)
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	µm
Width	295	µm

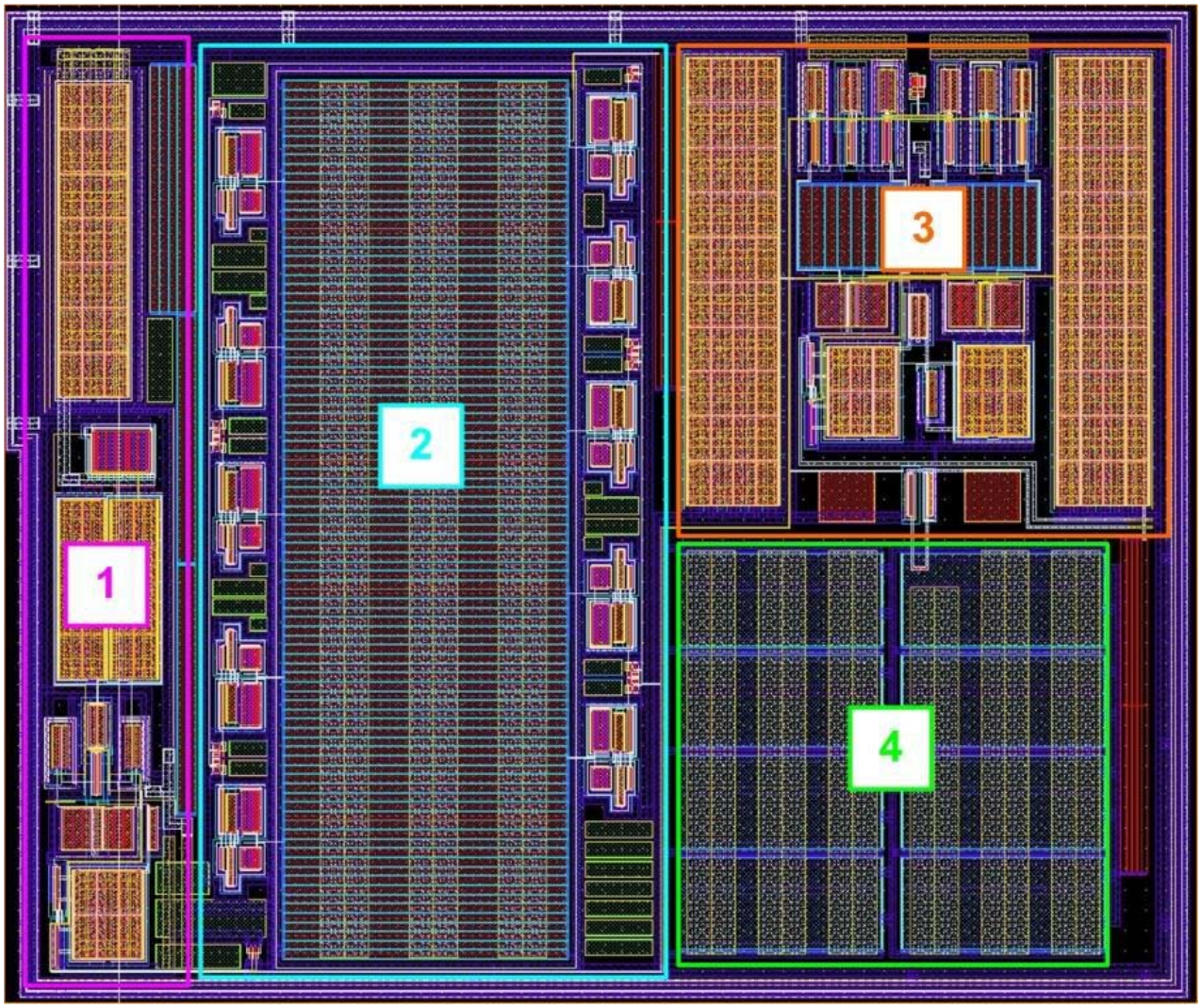

Figure 2:Device layout view.

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^2

7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for V_{cc} = 2.4 ÷ 2.6 V and T = -40 ÷ +125°C. Typical values are at V_{cc} = 2.5 V and Ta = +85° 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	°C
Clock frequency	F_{clk}	-	1	50	50	kHz
DAC resolution	K	-	-	10	-	bit
Accuracy step	N	-	-	0.5	-	±°C
Absolute accuracy	δ	-	-	4.9	-	±°C
Current consumption	I_{cc}	-	-	95	105	uA
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