

Process/Voltage/Temperature Sensor with Self-calibration (Supply voltage 1.2V)

OVERVIEW

003TSMC_PVT_01 IP library is a unique solution intended to continuously monitor IC status at several on-die locations. It is able to detect manufacturing process deviation, perform voltage, current and die temperature measurement.

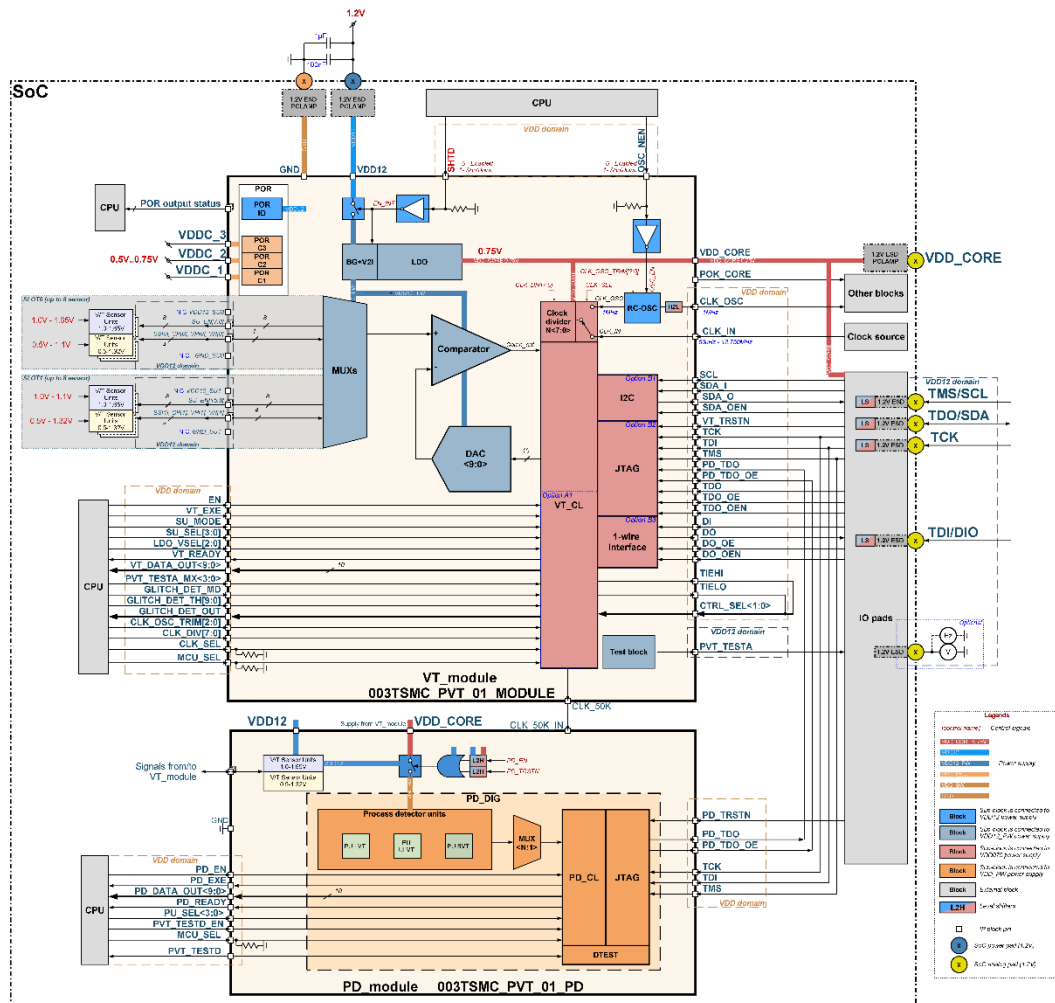
PVT Sensor IP library consists of three main parts:

- VT module as a calculation center for voltage and temperature measurements. It is able to maintain up to 16 on-die voltage/temperature units to be put on over the die. Grape-like connection is intended for easy routing and sensors placement
- Voltage/Temperature sensor of two type: from 0.5V to 1.1V and from 1.0V to 1.65V;
- Process detector module includes process units, dedicated for process variation elicitation of transistors with different threshold voltage types: Ultra Low VT, Low VT, Standard VT and 1.2V IO transistor, and voltage/temperature sensor units. Also Process detector module embeds one VT sensor unit.

Glitch detector mode allows to monitor and detect rapid fluctuations of voltage and temperature.

Stand-alone calibration system together with dedicated interface is embedded to the VT module for ability to calibrate temperature measurements independently from VT module operation.

Power-On-Reset circuit in implemented to monitor core voltage VDD 0.5V to 0.8V to generate resetting signals in SOC during power supply ramp up and ramp-down as well as POR for IO voltage reset signal



IP technology: TSMC 3nm N3P.

IP status: pre-silicon verified.

Silicon area: 0.024mm² for VT module, 0.0017mm² for Process detector unit; 0.0004mm² for sensor units

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	Min	Typ	Max	Units
IO supply voltage	VDD12	-	1.08	1.2	1.32	V
Operating temperature range	T _j	-	-40	27	+125	°C
VT module current consumption during measurements	ICC _{VT}	@VDD_CORE	-	223	401	uA
		@VDD12	-	605	877	
Process detector current consumption during measurements	ICC _{PD}	@VDD_CORE	-	325	-	uA
		@VDD12	-	1	-	
SU08 VT sensor unit current consumption	ICC _{SU08}	-	-	3.7	7.2	uA
SU12 VT sensor unit current consumption	ICC _{SU12}	SU12 VT sensor unit does not switchable.	-	4.7	9.2	uA
Shutdown current	ISHD	VT module EN=0, SHTD=“1”	@VDD_CORE	-	2.4	nA
			@VDD12	-	210	
		Process detector, PD_EN=0	@VDD_CORE	-	20	
			@VDD12	-	5000	
Input-logic level high	VIH	-	0.9V*0.75	-	1.1*0.75	V
Input-logic level low	VIL	-	0	-	0.1*0.75	V
Output-logic level high	VOH	-	0.9*VDD _{CORE}	-	1.1*VDD _{CORE}	V
Output-logic level low	VOL	-	0	-	0.1*VDD _{CORE}	V
Output DATA resolution	K	-	-	10	-	bit
Input clock frequency	f _{CLK_IN}	-	50	-	12750	kHz
Input clock frequency for PD module	f _{CLK_IN_PD}	± 1%	-	50	-	kHz
Voltage measurement range	VMR08	-	0.5	-	1.1	V
	VMR12	-	1	-	1.65	V
Voltage measurement accuracy for SU08 VT sensor unit for voltage range 0.5V to 1.32V	AV08	W/o trimming	-	-	2	%
Voltage measurement accuracy for SU12 VT sensor unit for voltage range 1.0V to 1.65V	AV12	W/o trimming	-	-	2	%
Main temperature measurement range	TMR	-	-40	-	+125	°C
Temperature measurement accuracy	AT	W/o trimming from 0°C to 125°C	-	-	7.3	°C
		W/o trimming from -40°C to 0°C	-	-	2.8	°C
		With trimming method T1	-	-	3	°C
		With trimming method T2.A	-	-	5	°C
		With trimming method T2.B	-	-	1	°C
		With trimming method T3	-40	-	125	°C