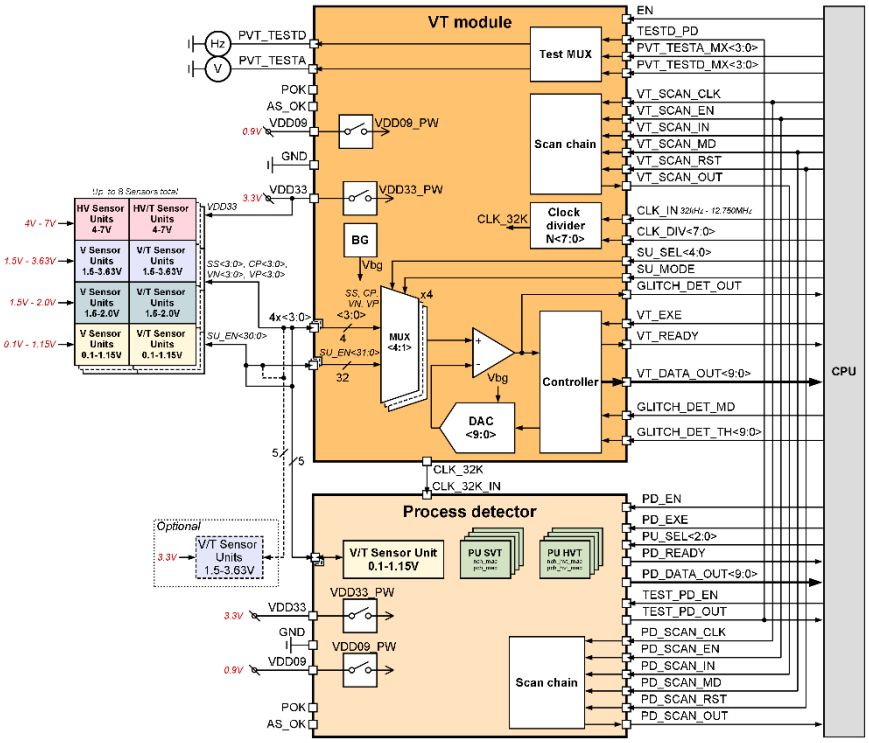
# PVT Detector

## OVERVIEW

028TSMC_PVT_04 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 and die temperature measurement. PVT Detector consists of VT module as a calculation center for voltage and temperature measurements, Process detector with process unit for standard-voltage, low-voltage and high-voltage threshold MOS transistors and IO 2.5V transistor, voltage/temperature sensor units and voltage sensor units. VT module is able to maintain up to 32 external voltage and voltage/temperature sensor units of four types in any variations: for Core voltage measurement range from 0.1V to 1.15V, for IO voltage measurement range from 1.5V÷2.0V, for IO voltage measurement range from 1.5V÷3.63V and additional 4.0V÷7.0V IO voltage measurement range. Process detector embeds VT sensor unit for Core voltage measurement and can be placed on the die in quantity up to 31 cells




IP technology: TSMC 28nm eFlash.

IP status: pre-silicon verification.

Silicon area: VT module – 0.1151mm$^2$; Process detector – 0.005016mm$^2$; Sensor Units for 0.9V/1.8V/3.3V/5V temperature/voltage measurement – 0.001514mm$^2$/ 0.001895mm$^2$/ 0.002795mm$^2$/ 0.003485mm$^2$; Sensor Units for 0.9V/1.8V/3.3V/5V voltage measurement – 0.000648mm$^2$/ 0.001041mm$^2$/ 0.001767mm$^2$/ 0.002571mm$^2$.

## ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Conditions | | Value min | Value typ. | Value max | Units |
|---|---|---|---|---|---|---|---|
| Core supply voltage | $V_{DD09}$ | - | | 0.81 | 0.9 | 0.99 | V |
| IO supply voltage | $V_{DD33}$ | - | | 2.97 | 3.3 | 3.63 | V |
| Operating temperature range | $T_j$ | - | | -40 | 27 | 150 | °C |
| Voltage measurement range | $V_{MR09}$ | For 0.9V VT sensor unit | | 0.1 | - | 1.15 | V |
| | $V_{MR18}$ | For 1.8V VT sensor unit | | 1.5 | - | 2.0 | V |
| | $V_{MR33}$ | For 3.3V VT sensor unit | | 1.5 | - | 3.63 | V |
| | $V_{MR5}$ | For 5.0V VT sensor unit | | 4 | - | 7 | V |
| Output DATA resolution | K | - | | - | 10 | - | bit |
| Clock frequency | $F_{CLK}$ | - | | - | 32 | - | kHz |
| Current consumption | $I_{CCVDD09\_VT}$ | In case of V/T measurement | @AVDD09 | - | 0.2 | 31 | uA |
| | $I_{CCVDD33\_VT}$ | | @AVDD33 | - | 323 | 399 | |
| | $I_{CCVDD09\_P}$ | In case of Process detection | @AVDD09 | - | 200 | 250 | uA |
| | $I_{CCVDD33\_P}$ | | @AVDD33 | - | 5 | 10 | |
| Shutdown current | $I_{CCSTD\_VDD09}$ | @AVDD09 | | - | 0.1 | 2.31 | uA |
| | $I_{STD\_VDD33}$ | @AVDD33 | | - | 0.1 | 0.97 | uA |
| Bandgap voltage | $V_{BG}$ | - | | 796 | 805 | 815 | mV |
| Voltage measurement inaccuracy for 0.9V VT sensor unit | $A_{V\_MR09}$ | Without trimming | δ | - | - | 0.6 | % |
| | | | 3δ | - | - | 2.0 | |
| Voltage measurement inaccuracy for 1.8V VT sensor unit | $A_{V\_MR18}$ | Without trimming | δ | - | - | 0.6 | % |
| | | | 3δ | - | - | 1.9 | |
| Voltage measurement inaccuracy for 3.3V VT sensor unit | $A_{V\_MR33}$ | Without trimming | δ | - | - | 0.9 | % |
| | | | 3δ | - | - | 2.9 | |

| Parameter | Symbol | Conditions | | Value | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | min | typ. | max | |
| Voltage measurement inaccuracy for 5.0V VT sensor | $A_{V\_MR5}$ | Without trimming | δ | - | - | 0.8 | % |
| | | | 3δ | - | - | 2.9 | |
| Temperature measurement range | $T_{MR}$ | - | | -40 | - | 150 | ˚C |
| Temperature measurement accuracy | $A_T$ | Without trimming | δ | - | - | 2.2 | ˚C |
| | | | 3δ | - | - | 6.6 | |
| | | With trimming | δ | - | - | 0.4 | |
| | | | 3δ | - | - | 0.8 | |