

# 1.8V / 3.3V SWITCHABLE GPIO WITH 3.3V - 5V OPEN-DRAIN CELL IN TSMC 16FF/12FFC TECHNOLOGY



TSMC 16nm & 12nm Flip-Chip IO library with dynamically switchable 1.8V-3.3V GPIO, 3.3V-5V open-drain cell and associated ESD.

## SUMMARY

A key attribute of this library is its ability to detect and dynamically adjust to a VDDIO supply of 1.8V or 3.3V during system operation. The GPIO cell can be configured as input, output, open-source, open-drain with an optional internal 50K ohm pull-up or pull-down resistor. Four selectable drive strengths are offered (25-235MHz @1.8V, 10pF) to optimize across SSO currents & power. The output driver exhibits 50Ω (±20%) termination across PVT to reduce reflections at higher operating frequencies. Supply cells for VDDIO, VREF, and core VDD include necessary built-in ESD circuitry. A 3.3V-5V open-drain (fail-safe) cell with ESD protection is included, compliant across I2C, DDC, CEC & HPD standards. The library includes protection break cells to allow for separate grounds while maintaining ESD robustness. ESD targets are 2KV HBM, 500V CDM and 2KV IEC 61000-4-2 system stress.

## OPERATING CONDITIONS

Parameter	Value
VDDIO	1.8 / 3.3V selectable
VREF	1.8V
Core VDD	0.8V
Tj	-40C to 125C
Max_Load	50pF (10pF at speed)

## CELL SIZE & METAL STACK

Cell size	Metal Stack	Package Type
25x50um	1P8M 1P10M	Flip-Chip

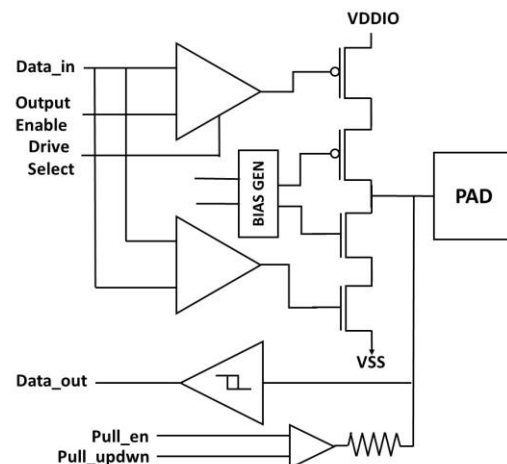
## LIBRARY CELL SUMMARY

Cell Type	Feature
Supply / ESD	1.8-3.3V; 0.8V; GND
GPIO <sup>1</sup>	25-235MHz, selectable
Open-drain <sup>2</sup>	3.3V-5V, fail-safe
Break cells	VSS1 / VSS2

## DRIVE STRENGTH PERFORMANCE @10pF

DS [1:0]	1.8V	3.3V
00	25 MHz	15 MHz
01	140 MHz	75 MHz
10	200 MHz	150 MHz
11	235 MHz	175 MHz

## GPIO BLOCK DIAGRAM



## GPIO FEATURES

- Multi-voltage 1.8V / 3.3V switchable operation
- 4 selectable drive strengths (25-235MHz @1.8V, 10pF)
- Full-speed output enable
- Independent power sequencing
- 50Ω (±20%) source termination across PVT
- Schmitt Trigger receiver
- 50KΩ selectable pull-up or pull-down resistor
- ESD: 2KV HBM, 500V CDM<sup>3</sup>, 2KV IEC 61000-4-2<sup>4</sup>

Certus also supports IO libraries in the following TSMC nodes: 180nm, 130nm, 65nm, 40nm, 28nm, and 22nm. Additional Certus libraries are available across technologies supported by Global Foundries & Samsung. Certus is particularly suited at providing custom variants in a cost-efficient framework. Feel free to inquire for supplementary physical or electrical features to suit your needs.

1. GPIO speeds are load dependent (faster for lighter loads, slower for heavier). Speeds shown are at 10pF. Up to 400MHz (1.8V), & 250MHz (3.3V) at 5pF.
2. Open drain cell is also I2C, DDC, CEC, & HPD compliant.
3. CDM rating is a function of package size. Rating shown is for nominal packages. Certus IOs typically handle 10-20A Peak CDM currents, depending on IO type.
4. Please contact a Certus representative for IEC 62100-4-2 protection levels achievable with your design.