

CMOS charge pump

SPECIFICATION

1 FEATURES

- AMS035 BiCMOS 0.35 um technology
- Adjustable output current
- Differential current switches mode
- Single-ended mode with reduced current consumption
- Input frequency up to 100 MHz
- Supported foundries: TSMC, UMC, Global Foundries, SMIC, iHP, AMS, Vanguard, SilTerra

2 APPLICATION

- Phase-locked loop synthesizer

3 OVERVIEW

Charge pump (CP) is a switched current sources controlled by phase-frequency detector which inject or remove some charge to increase or decrease VCO control voltage depended on phase difference between reference frequency and divided VCO frequency.

The block is fabricated on AMS035 BiCMOS 0.35 um technology.

4 STRUCTURE

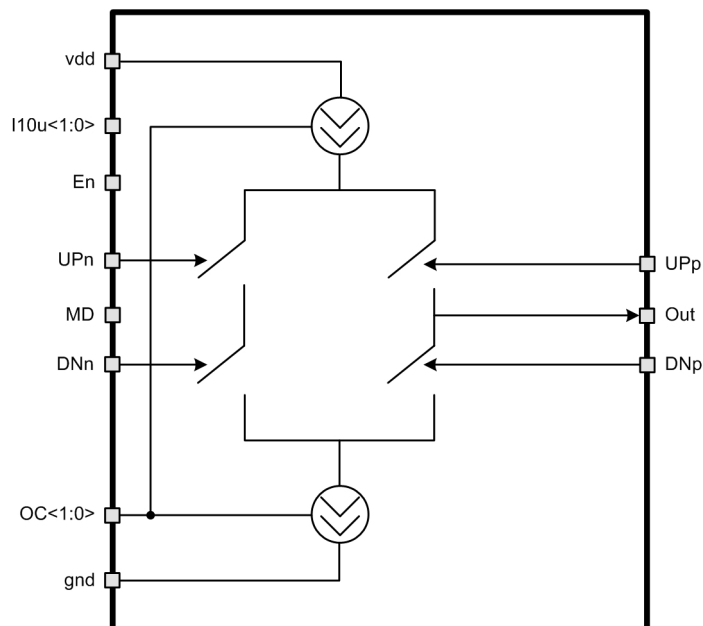


Figure 1: CMOS charge pump structure.

5 PIN DESCRIPTION

| Name | Direction | Description |
|-----------|-----------|--|
| OC<1:0> | I | CP output current selection |
| En | I | Enable/disable charge pump |
| MD | I | Charge pump mode selection |
| UPp | I | Analog differential increase output voltage signal |
| UPn | I | |
| DNp | I | Analog differential decrease output voltage signal |
| DNn | I | |
| I10u<1:0> | I | Reference current (10 uA) |
| Out | O | Charge pump output |
| vdd | IO | Supply voltage |
| gnd | IO | Ground |

6 LAYOUT DESCRIPTION

The block dimensions are given in the table 1.

Table 1: Block dimensions.

| Dimension | Value | Unit |
|-----------|-------|---------------|
| Height | 215 | μm |
| Width | 315 | μm |

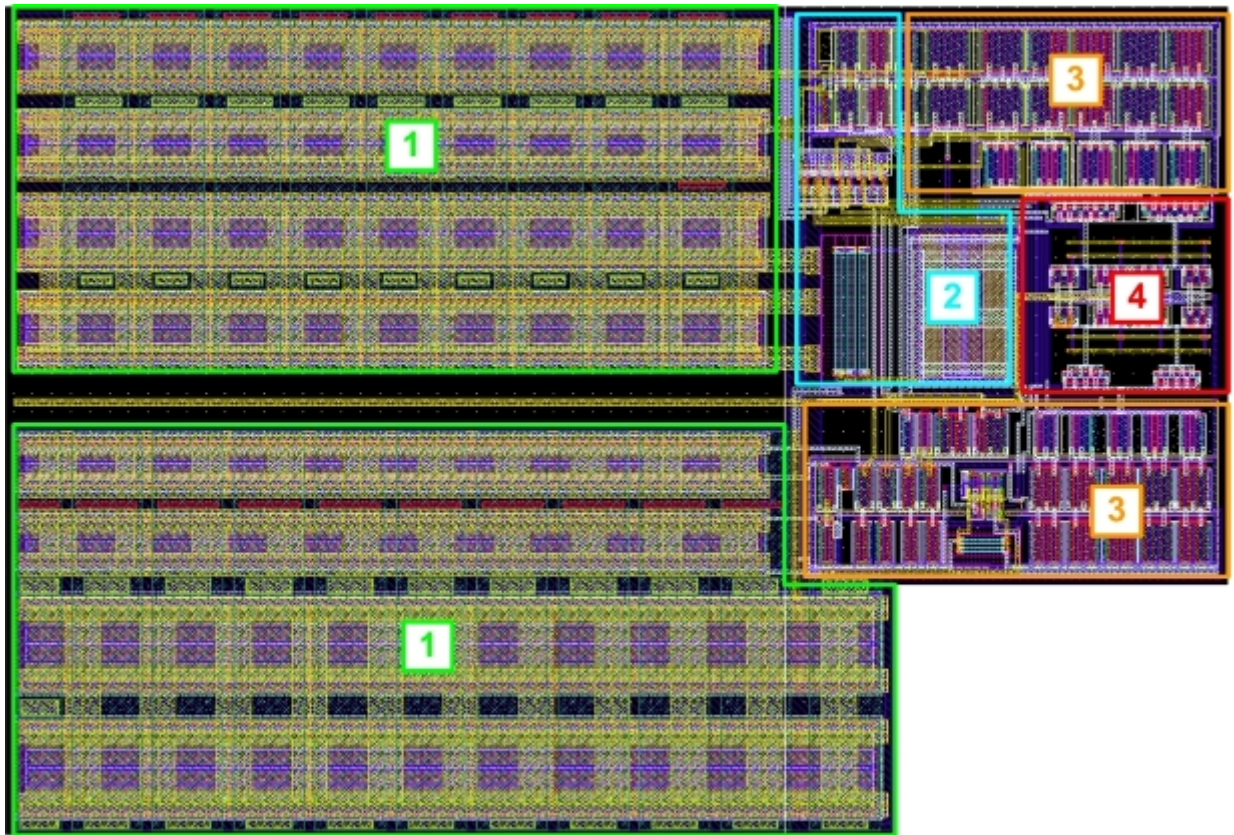


Figure 2: Charge pump layout view.

1. Filter capacitors
2. Voltage repeater
3. Current source
4. Analog switches

7 OPERATING CHARACTERISTICS

7.1 TECHNICAL CHARACTERISTICS

Technology AMS035 BiCMOS 0.35 um
 Status silicon proven
 Area 0.063 mm²

7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for $V_{cc} = 2.6 \div 3.15$ V, $T = -40 \div +85$ °C. Typical values are at $V_{cc} = 2.7$ V and $T = +27$ °C, unless otherwise specified.

| Parameter | Symbol | Condition | Value | | | Unit |
|------------------------------|---------------|----------------------|-------------|------|--------------|------|
| | | | min | typ | max | |
| Supply voltage | V_{cc} | - | 2.6 | 2.7 | 3.15 | V |
| Operating temperature range | T | - | -40 | 27 | 85 | °C |
| Input signal frequency | F_{max} | - | - | - | 100 | MHz |
| Source current | $I_{out\ up}$ | OC<1:0>="00" - 20 uA | 19.2 | 20.4 | 21.1 | uA |
| | | OC<1:0>="01" - 40 uA | 36.6 | 38.7 | 40 | |
| | | OC<1:0>="10" - 80 uA | 71.2 | 75.3 | 77.8 | |
| | | OC<1:0>="11" -100 uA | 88.6 | 93.6 | 96.7 | |
| Sink current | $I_{out\ dn}$ | OC<1:0>="00" - 20 uA | 19.4 | 20 | 20.4 | uA |
| | | OC<1:0>="01" - 40 uA | 38 | 39.1 | 39.9 | |
| | | OC<1:0>="10" - 80 uA | 75.3 | 77.3 | 78.8 | |
| | | OC<1:0>="11" -100 uA | 93.9 | 96.5 | 98.3 | |
| Working output voltage range | V_{out} | - | 0.4 | - | $V_{cc}-0.4$ | V |
| Supply current | I_{dd} | - | - | 0.06 | - | mA |
| Stand-by current | I_{st} | - | - | - | 1 | nA |
| Input logic-level high | V_{OH} | - | $0.9V_{cc}$ | - | V_{cc} | V |
| Input logic-level low | V_{OL} | - | -0.2 | 0 | 0.2 | V |

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

REVISION HISTORY

1. From version 1.0:
 - Section “Technical characteristics” (refer to [page 4](#))