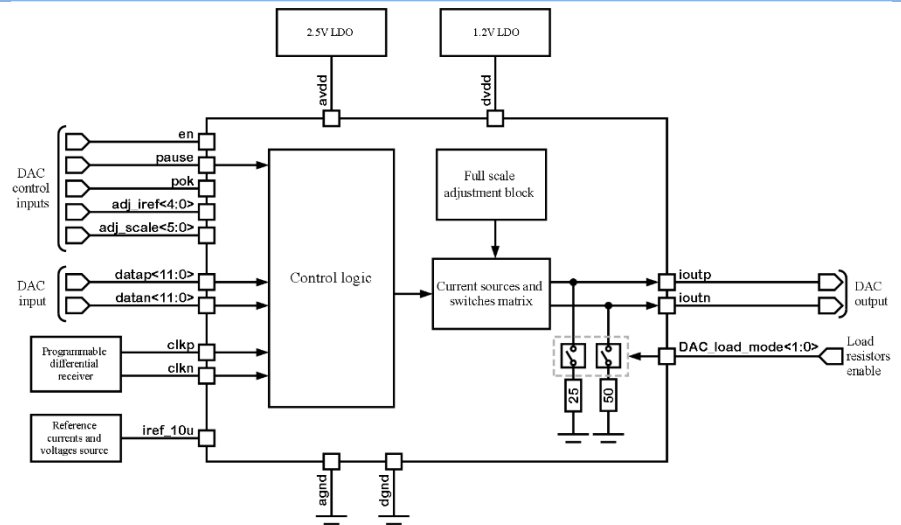


12-bit 1-channel 10-150 MSPS current steering DAC

OVERVIEW

055TSMC_DAC_03 is a 12-bit 1-channel DAC that uses a high-performance current control architecture and provides optional differential current output or differential voltage output. The bandgap and current source are included to provide a complete DAC. The DAC can be configured to adjust full-scale output range by `adj_scale<5:0>` and `adj_iref<4:0>`. The DAC uses segmentation architecture combined



with Q2 random walk algorithm to achieve excellent dynamic and static performance, wide output bandwidth. An internal resistive load (25 or 50 Ohms) together with current source is used to set differential voltage output, which independent from process, supply and temperature.

IP technology: TSMC CMOS 55nm technology.

IP status: silicon proven.

Silicon area: 0.187 mm².

ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Conditions | Value | | | Units | |
|--|-----------------------|---|-------|------|------|-------|----|
| | | | min | typ. | max | | |
| Supply voltage | AVDD | - | 2.25 | 2.5 | 2.75 | V | |
| | DVDD | - | 1.18 | 1.2 | 1.32 | | |
| Operating temperature range | T _j | - | -40 | +27 | +85 | °C | |
| Current consumption | IDD | @ Fs = 50 MSPS | AVDD | - | 20 | - | mA |
| | | | DVDD | - | 193 | - | uA |
| | | @ Fs = 100 MSPS | AVDD | - | 20 | - | mA |
| | | | DVDD | - | 282 | - | uA |
| | | @ Fs = 150 MSPS | AVDD | - | 20 | - | mA |
| | | | DVDD | - | 385 | - | uA |
| Resolution | N | - | - | 12 | - | bit | |
| Differential nonlinearity | DNL | - | - | - | 1.19 | LSB | |
| Integral nonlinearity | INL | - | - | - | 1.57 | LSB | |
| Offset error | OE | - | - | 0.1 | - | LSB | |
| Gain error | GE | - | - | 0.3 | - | LSB | |
| Sampling rate | Fs | Minimal | - | 10 | - | MSPS | |
| | | Maximal | - | 150 | - | | |
| Differential full-scale output current range | I _{OUT(p-p)} | DAC_load_modex<1:0> = "0x" DAC_iref<4:0> = "00000" | - | 0.1 | - | mA | |
| | | DAC_load_modex<1:0> = "0x" DAC_iref<4:0> = "11111" | - | 16.2 | - | | |
| | | DAC_load_mode<1:0> = "0x" DAC_iref<4:0> = "10001" | - | 0.5 | - | | |
| | | DAC_load_mode<1:0> = "0x" DAC_iref<4:0> = "00101" | - | 4.16 | - | | |
| Output resistance | R _{OUT} | - | - | 200 | - | kOhm | |
| Internal resistive load | R _{INT} | DAC_load_mode<1:0> = "10" | - | 50 | - | Ohm | |
| | | DAC_load_mode<1:0> = "11" | - | 25 | - | | |

| Parameter | Symbol | Conditions | Value | | | Units | |
|--|----------------|---|------------------------------|------|------------------|-------|----|
| | | | min | typ. | max | | |
| Differential full-scale output voltage range | $V_{OUT(p-p)}$ | DAC_load_mode<1:0> = "10", DAC_iref<4:0> = "00000" | - | 0.1 | - | V | |
| | | DAC_load_mode<1:0> = "10", DAC_iref<4:0> = "11111" | - | 1.6 | - | | |
| | | DAC_load_modex<1:0> = "11", DAC_iref<4:0> = "00000" | - | 0.1 | - | | |
| | | DAC_load_mode<1:0> = "11", DAC_iref<4:0> = "10001" | - | 0.5 | - | | |
| | | DAC_load_mode<1:0> = "00", DAC_iref<4:0> = "00101", $R_{EXT} = 250 \text{ Ohm}$ | - | 2 | - | | |
| Spurious-free dynamic range | SFDR | $F_s = 50 \text{ MSPS}$, $R_{EXT} = 250 \text{ Ohm}$ | $F_{OUT} = 500 \text{ kHz}$ | 70.1 | 75.2 | 83.1 | dB |
| | | | $F_{OUT} = 2 \text{ MHz}$ | 71.4 | 75.6 | 79.7 | |
| | | | $F_{OUT} = 6.5 \text{ MHz}$ | 69.2 | 74.7 | 80.4 | |
| | | | $F_{OUT} = 16 \text{ MHz}$ | 66.0 | 67.7 | 70.4 | |
| | | $F_s = 100 \text{ MSPS}$, $R_{EXT} = 250 \text{ Ohm}$ | $F_{OUT} = 1 \text{ MHz}$ | 71.0 | 76.0 | 83.6 | |
| | | | $F_{OUT} = 4 \text{ MHz}$ | 71.3 | 74.6 | 77.3 | |
| | | | $F_{OUT} = 13 \text{ MHz}$ | 68.5 | 71.8 | 76.0 | |
| | | $F_s = 150 \text{ MSPS}$, $R_{EXT} = 250 \text{ Ohm}$ | $F_{OUT} = 32 \text{ MHz}$ | 62.7 | 64.3 | 67.3 | |
| | | | $F_{OUT} = 1.5 \text{ MHz}$ | 71.5 | 76.2 | 80.7 | |
| | | | $F_{OUT} = 6 \text{ MHz}$ | 68.7 | 72.4 | 74.8 | |
| | | | $F_{OUT} = 19.5 \text{ MHz}$ | 66.1 | 69.0 | 73.3 | |
| | | | $F_{OUT} = 48 \text{ MHz}$ | 60.0 | 63.0 | 64.7 | |
| Input logic-high level | V_{IL} | For digital inputs | 0 | - | $0.2 \cdot DVDD$ | V | |
| Input logic-low level | V_{IH} | | $0.8 \cdot DVDD$ | - | DVDD | | |
| Output logic-high level | V_{OL} | For digital outputs | 0 | - | 0.4 | V | |
| Output logic-low level | V_{OH} | | $DVDD - 0.4$ | - | DVDD | | |