A CMOS Current Mirror / Divider for High Precision Applications

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Abstract **- A current mirror topology is presented that provides very high precision, design insensitive "up" and "down" mirrored current with excellent operation over a wide power supply range, easy and straightforward design, and the possibility of conveniently obtaining a wide range of current divisions. This topology is appropriate for high accuracy A/D and D/A converters, or, more generally, for those applications in which precise current handling is necessary.**

- Current mirror/divider blocks:
  - reference cell
  - up mirror
  - down mirror
  - divider
  - bias circuit

• Transistor-level schematic of CMOS current mirror/divider circuit is shown in Fig. 1.

• Output resistance of the current mirror/divider is

$$R_o = ro_6 \cdot gm_{18} \cdot ro_{18} \cdot gm_{19} \cdot ro_{19} \cdot gm_{20} \cdot ro_{20} \cdot gm_{21} \cdot ro_{21} \quad (1)$$

• Simulation of current mirror/divider using Cadence-Spice and 1.2 μm CMOS technology is shown in Fig. 2.

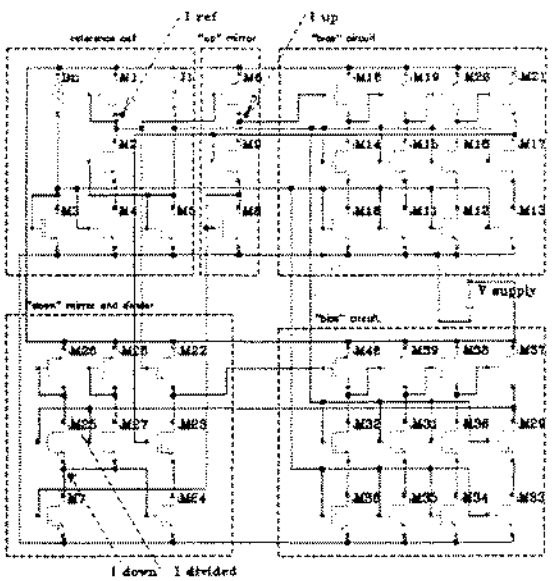

Fig. 1: Transistor-level schematic of CMOS current mirror/divider circuit.

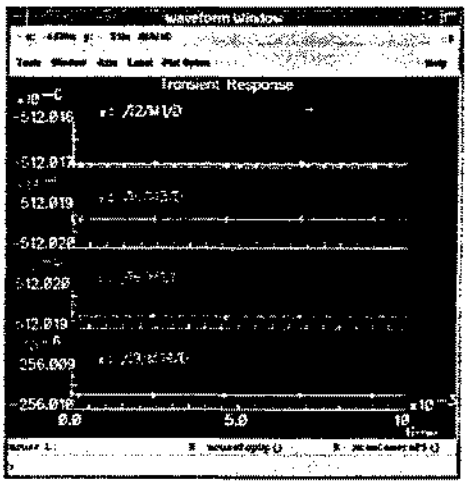

Fig. 2: Transient waveforms for the reference, up, down, and divided currents, respectively.

• Summary of performance of the up mirror compared with a state of the art current mirror [1] is shown in Table 1. Equal precision for the up and down mirror permits indefinite mirroring of the current.

Table 1: Up mirror performance summary and comparison with IAFCCM [1]

Issue	Up Mirror	IAFCCM [1]
Mirroring error	< 0.00022 %	< 0.02 %
Supply voltage dependency	0	0.015 %
Mirroring accuracy dependency on I_{in}	NO	YES
Largest transistor width	19.2 μm	300 μm
Number of transistors	15	8
Total width of all transistors	288 μm	1200 μm
Dissipated power (~ 500 μA current)	~ 30 mW	< 20 mW
R_o (qualitative)	~ $(g_m r_o)^4$	~ $(g_m r_o)^3$

REFERENCES

[1] A. Zeki and H. Kuntman, "Accurate and High Output Impedance Current Mirror Suitable for CMOS Current Output Stages," *Electronics Letters*, Vol. 33, No. 12, pp. 1042-1043, June 1997.