DESIGN OF HIGH SPEED 1:4 DEMULTIPLEXER FOR OPTICAL COMMUNICATION STYSTEMS

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SYMMARY

A 2.5 Gbps 1:4 Demultiplexer (DEMUX) realized using standard 0.18-µm CMOS technology and a 10 Gbps 1:4 DEMUX realized in 0.25-µm SiGe:C BiCMOS technology have been presented in this report.

The 2.5 Gbps DEMUX is designed for SONET OC-48 systems. To meet the speed requirement with minimal power consumption, MOS current mode circuits are used in the first-stage 2.5 Gbps 1:2 DEMUX, while the two second-stage 1:2 DEMUXs working at the 1.25 Gbps is implemented in differential cascade voltage switch logic (DCVSL). Measurement results show that the designed DEMUX is able to operate in the frequency range from 1 – 2.5 GHz with a large phase margin, and consumes 137 mA from a 2.08V power supply. The layout area is 945µm * 1185µm.

The 10 Gbps DEMUX's is developed for the SONET OC-192 system. A two-level series gating differential emitter-coupled logic (ECL) is used in the design of the high-speed D-flip-flops. The circuit operates from a single 2.5-V supply and consumes 110 mA (including 50Ω buffers). The active area is 838µm * 830µm.

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Symbols

μ_n	Electron mobility constant
μ_p	Hole mobility constant
C_{ox}	Oxide capacitance
g_m	Transconductance
L	Length of transistor
V_{TH}	Threshold voltage
V_{GS}	Gate source voltage
V_{DS}	Drain source voltage
W	Width of transistor
k_n'	Process transconductance parameter of NMOS transistor
k_p'	Process transconductance parameter of PMOS transistor
k_n	Gain factor of NMOS transistor
k_p	Gain factor of PMOS transistor

Abbreviations

CDR	Clock and Data Recovery
CML	Current-Mode Logic
CMOS	Complementary Metal Oxide Semiconductor
DCVSL	Differential Cascode Voltage Switch Logic
DEMUX	Demultiplexer
DFF	D Flip-Flop
ECL	Emitter-coupled Logic
E^2CL	Emitter-emitter-coupled Logic
LA	Limiting Amplifier
MCML	MOS Current-Mode Logic
MOS	Metal Oxide Semiconductor
PLL	Phase-Locked Loop
SDH	Synchronous Digital Hierarchy
SONET	Synchronous Optical Network
TIA	Transimpediance Amplifier
TTL	Transistor-Transistor Logic
TSPC	True Single-Phase Clock
VCO	Voltage-Controlled Oscillator