
# LVDS (Tx/Rx) Design
# With 5V Devices in Sky130nm Process

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Revision 0.0

PO Box 9276
San Jose, CA 95157
www.lewiz.com
Email: support@lewiz.com

# LVDS Receiver Simulation Netlist

```
** sch_path: /home/saumeek/xschem_test/Reciever_SimNet.sch

**.subckt Reciever_SimNet Vout VCC INP INN

*.opin Vout

*.iopin VCC

*.opin INP

*.opin INN

XM1 OP B Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=30 nf=2
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM2 B B Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=30 nf=2
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM3 ON B Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=30 nf=2
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM9 OP A VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=10 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1
```

```
XM10 A A VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=10 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM11 ON A VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=10 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

x1 Vss newVss

I0 net4 net1 500u

I1 net5 net2 500u

R3 C B 0.5k m=1

R4 A C 0.5k m=1

R5 OP INP 0.5k m=1

R6 ON INN 0.5k m=1

XM7 C C Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=2.5 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM4 Vss OP net1 VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=40 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1
```

```
XM5 C net3 net1 VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=40 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM6 C net3 net2 VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=40 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM8 Vss ON net2 VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=40 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

V1 net3 Vss 2.5

.save i(v1)

R1 net4 VCC 10 m=1

R2 net5 VCC 10 m=1

XM12 BGR BGR Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=5 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM13 net6 BGR Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=10
nf=1 ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1
```

```
XM14 F F Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=67 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM15 net9 F Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=67 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM16 N1 net10 Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=67
nf=1 ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM17 net10 net10 Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=67
nf=1 ad='int((nf+1)/2) * W/nf * 0.29'

+ as='int((nf+2)/2) * W/nf * 0.29' pd='2*int((nf+1)/2) * (W/nf +
0.29)' ps='2*int((nf+2)/2) * (W/nf + 0.29)'

+ nrd='0.29 / W' nrs='0.29 / W' sa=0 sb=0 sd=0 mult=1 m=1

XM18 net6 net6 VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=40
nf=1 ad='int((nf+1)/2) * W/nf * 0.29'

+ as='int((nf+2)/2) * W/nf * 0.29' pd='2*int((nf+1)/2) * (W/nf +
0.29)' ps='2*int((nf+2)/2) * (W/nf + 0.29)'

+ nrd='0.29 / W' nrs='0.29 / W' sa=0 sb=0 sd=0 mult=1 m=1

XM19 net8 net6 VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=50
nf=2 ad='int((nf+1)/2) * W/nf * 0.29'

+ as='int((nf+2)/2) * W/nf * 0.29' pd='2*int((nf+1)/2) * (W/nf +
0.29)' ps='2*int((nf+2)/2) * (W/nf + 0.29)'

+ nrd='0.29 / W' nrs='0.29 / W' sa=0 sb=0 sd=0 mult=1 m=1
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```
XM20 net9 net9 VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=67
nf=1 ad='int((nf+1)/2) * W/nf * 0.29'

+ as='int((nf+2)/2) * W/nf * 0.29' pd='2*int((nf+1)/2) * (W/nf +
0.29)' ps='2*int((nf+2)/2) * (W/nf + 0.29)'

+ nrd='0.29 / W' nrs='0.29 / W' sa=0 sb=0 sd=0 mult=1 m=1

XM21 N1 net9 VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=67
nf=1 ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM22 H net7 VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=67 nf=2
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM23 net7 net7 VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=67
nf=2 ad='int((nf+1)/2) * W/nf * 0.29'

+ as='int((nf+2)/2) * W/nf * 0.29' pd='2*int((nf+1)/2) * (W/nf +
0.29)' ps='2*int((nf+2)/2) * (W/nf + 0.29)'

+ nrd='0.29 / W' nrs='0.29 / W' sa=0 sb=0 sd=0 mult=1 m=1

XM24 E E VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=67 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM25 N1 E VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=67 nf=2
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1
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```
XM26 net10 OP net8 VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=50
nf=4 ad='int((nf+1)/2) * W/nf * 0.29'

+ as='int((nf+2)/2) * W/nf * 0.29' pd='2*int((nf+1)/2) * (W/nf +
0.29)' ps='2*int((nf+2)/2) * (W/nf + 0.29)'

+ nrd='0.29 / W' nrs='0.29 / W' sa=0 sb=0 sd=0 mult=1 m=1

XM27 F ON net8 VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=50 nf=4
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM28 net7 ON D Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=67 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM29 E OP D Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=67 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM30 Vinv N1 VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=30
nf=1 ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM31 Vinv N1 Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=35
nf=2 ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'
```

```
+ sa=0 sb=0 sd=0 mult=1 m=1

XM32 Vout Vinv VCC VCC sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=50
nf=2 ad='int((nf+1)/2) * W/nf * 0.29'

+ as='int((nf+2)/2) * W/nf * 0.29' pd='2*int((nf+1)/2) * (W/nf +
0.29)' ps='2*int((nf+2)/2) * (W/nf + 0.29)'

+ nrd='0.29 / W' nrs='0.29 / W' sa=0 sb=0 sd=0 mult=1 m=1

XM33 Vout Vinv Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=67
nf=1 ad='int((nf+1)/2) * W/nf * 0.29'

+ as='int((nf+2)/2) * W/nf * 0.29' pd='2*int((nf+1)/2) * (W/nf +
0.29)' ps='2*int((nf+2)/2) * (W/nf + 0.29)'

+ nrd='0.29 / W' nrs='0.29 / W' sa=0 sb=0 sd=0 mult=1 m=1

XM34 D BGR Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=83 nf=2
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM35 H H Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=83 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM36 N1 H Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=83 nf=1
ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

x3 net14 newVcc_5

x4 Vss newVss

I2 net11 net12 500u

R9 BGR net12 1k m=1
```

```
V4 net11 Vss 3.3
.save i(v4)
x9 net13 net15 VCC Vss inv_0_5_3v3
R8 net13 Vout 10 m=1
Vmeas net14 VCC 0
.save i(vmeas)
V2 INP Vss pulse(3.06 3.395 0ns 0.1ns 0.1ns 0.4ns 1ns)
.save i(v2)
V3 INN Vss pulse(3.395 3.06 0ns 0.1ns 0.1ns 0.4ns 1ns)
.save i(v3)
**.ends

* expanding   symbol:
/home/saumeek/simulation_library/newVss.sym # of pins=1
** sym_path: /home/saumeek/simulation_library/newVss.sym
** sch_path: /home/saumeek/simulation_library/newVss.sch
.subckt newVss VSS
*.iopin VSS
R2 net1 GND 5 m=1
L1 VSS net1 2n m=1
C1 VSS GND 20p m=1
.ends


* expanding   symbol:
/home/saumeek/simulation_library/newVcc_5.sym # of pins=1
** sym_path: /home/saumeek/simulation_library/newVcc_5.sym
** sch_path: /home/saumeek/simulation_library/newVcc_5.sch
.subckt newVcc_5 Vcc
```

```
*.iopin Vcc

V1 net1 GND 5

.save i(v1)

R1 net2 net1 0.1 m=1

L1 Vcc net2 2n m=1

C1 Vcc GND 20p m=1

.ends



* expanding   symbol:
/home/saumeek/simulation_library/inv_0_5_3v3.sym # of pins=4

** sym_path: /home/saumeek/simulation_library/inv_0_5_3v3.sym

** sch_path: /home/saumeek/simulation_library/inv_0_5_3v3.sch

.subckt inv_0_5_3v3 Vin Vout Vcc Vss

*.ipin Vin

*.opin Vout

*.iopin Vcc

*.iopin Vss

XM3 Vout Vin Vss Vss sky130_fd_pr__nfet_g5v0d10v5 L=0.5 W=10
nf=1 ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

XM1 Vout Vin Vcc Vcc sky130_fd_pr__pfet_g5v0d10v5 L=0.5 W=20
nf=1 ad='int((nf+1)/2) * W/nf * 0.29' as='int((nf+2)/2) * W/nf *
0.29'

+ pd='2*int((nf+1)/2) * (W/nf + 0.29)' ps='2*int((nf+2)/2) *
(W/nf + 0.29)' nrd='0.29 / W' nrs='0.29 / W'

+ sa=0 sb=0 sd=0 mult=1 m=1

.ends
```

```
.GLOBAL GND
.end
```