

# *LVDS Differential SCSI*

## Common-Mode Specifications

### SPI-2



# *Common-Mode Issues*

- **Ground Offset**
- **Present Proposed Specs**
- **Driver**
- **Receiver**
- **Three Cases of Ground Offset**
- **New Proposed Specs**



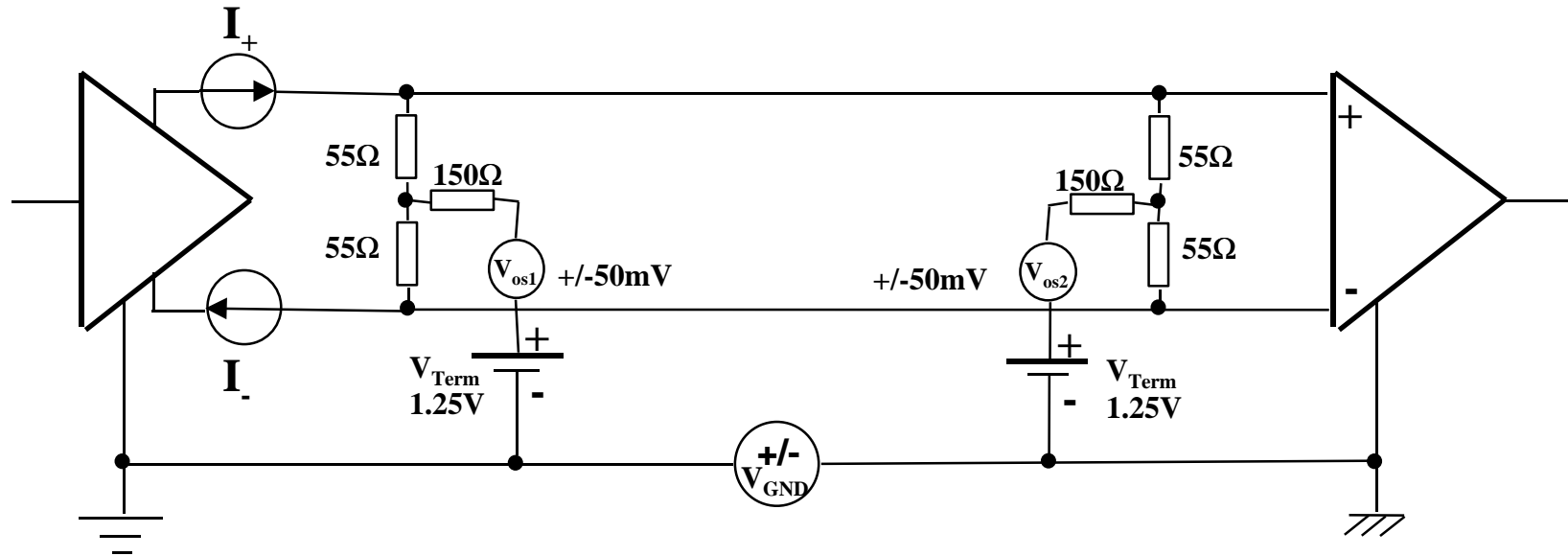
# *Present CM Specs*

*(Sept. 11, 1995)*

	<b>Max</b>	<b>Min</b>	<b>Unit</b>
• <b>Driver</b>	<b>2.175</b>	<b>0.225</b>	<b>[V]</b>
• <b>Receiver</b>	<b>2.350</b>	<b>0.050</b>	<b>[V]</b>

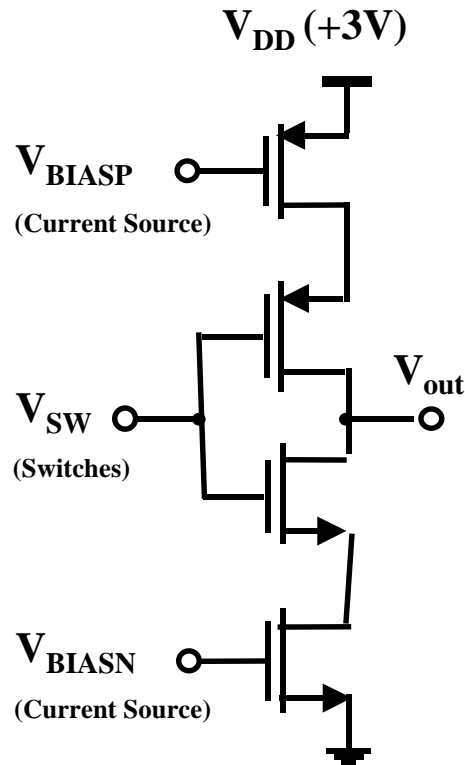


# Ground Offset



# LVDS Driver

Present Common-Mode Specs

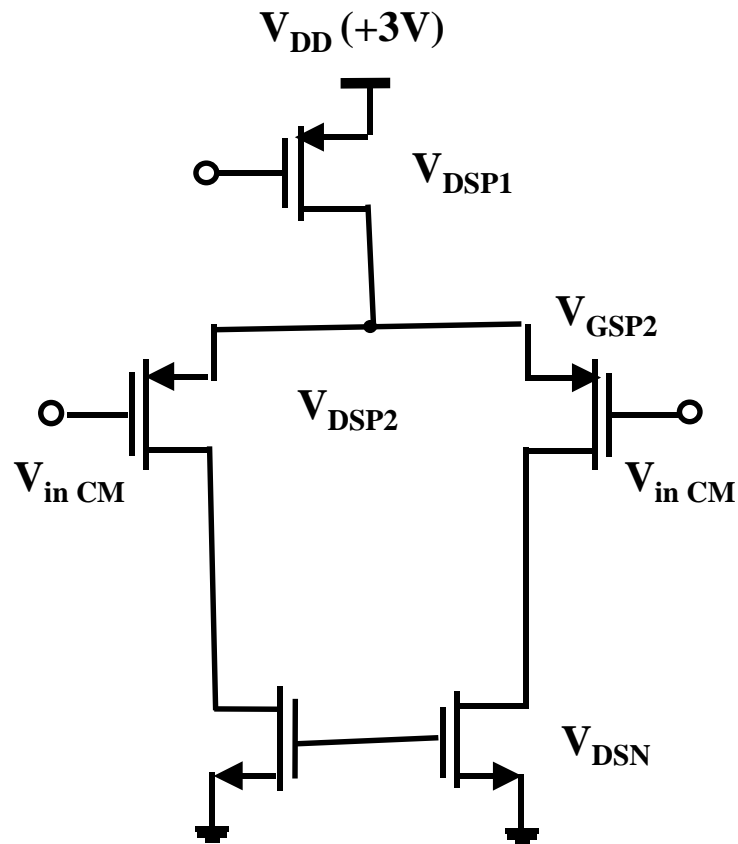


	Nom	+ $V_{CM}$	- $V_{CM}$
$V_{DSP}$	1.55	0.625	
$V_{onP}$	0.20	0.200	
$V_{out}$	1.25	2.175	0.225
$V_{onN}$	0.15		0.150
$V_{DSN}$	1.10		0.075

*Example for illustration only*



# LVDS Receiver



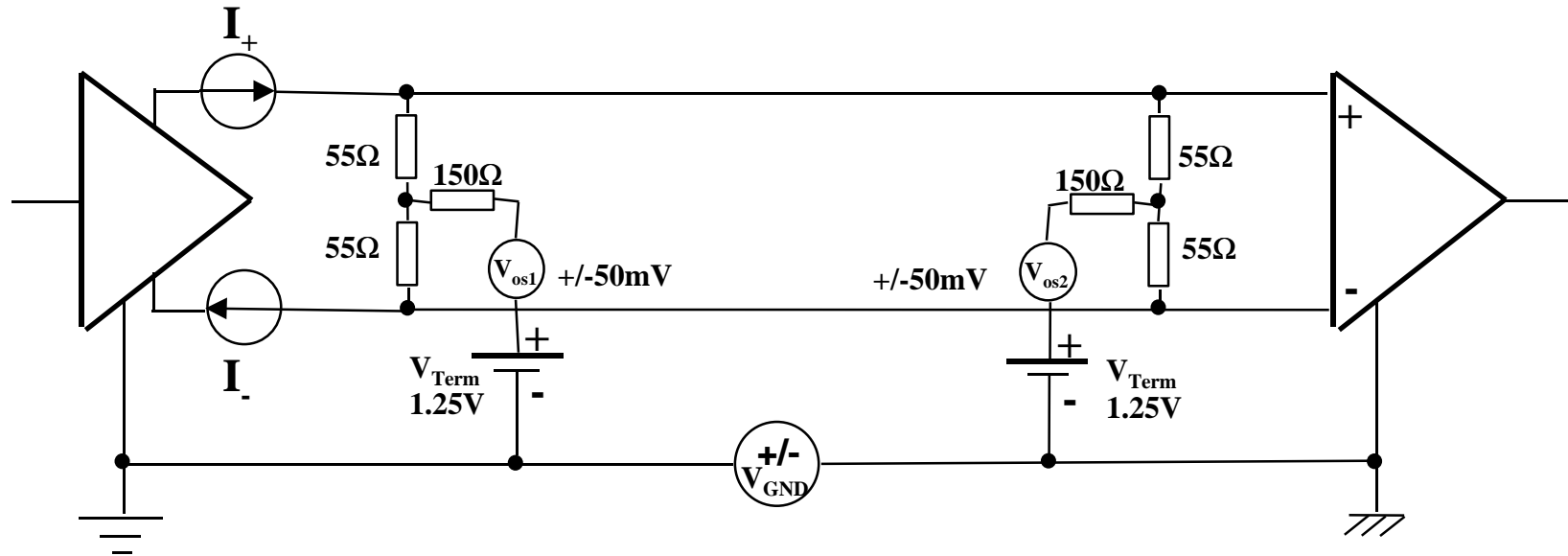
Present Common-Mode Specs

	Nom	+ $V_{CM}$	- $V_{CM}$
$V_{DSP1}$	1.05	-0.05	
$V_{GSP2}$	0.70	0.70	
$V_{inCM}$	1.25	2.35	0.05
$V_{DSP2}$	1.00		0.40
$V_{DSN}$	0.95		0.35

*Example for illustration only*



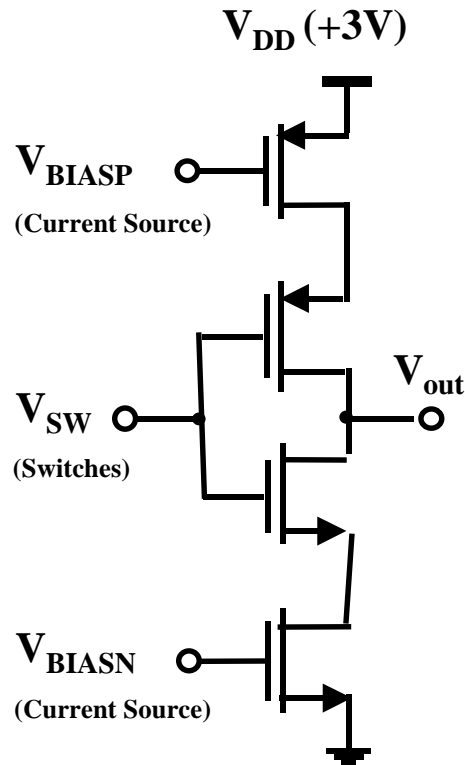
# Ground Offset Case 1



# LVDS Driver

## Case 1

$V_{GND} = +/- 0.5V$



	Nom	+ $V_{CM}$	- $V_{CM}$
$V_{DD}$	3.00	3.50	2.50
$V_{DSP}$	1.55	1.75	1.35
$V_{onP}$	0.20	0.20	0.20
$V_{out}$	1.25	1.55	0.95
$V_{onN}$	0.15	0.15	0.15
$V_{DSN}$	1.10	0.90	1.30
$V_{SS}$	0	+0.50	-0.50

Example for illustration only

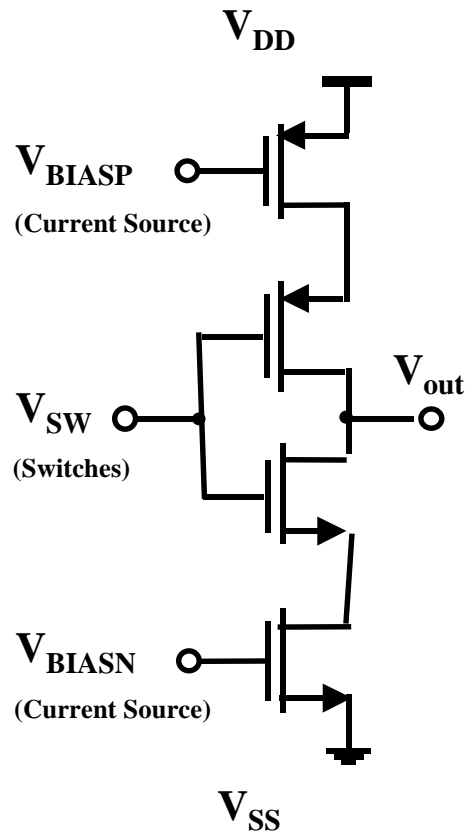




# LVDS Driver

## Case 1

$$V_{GND} = +/- 1V$$



	Nom	+V <sub>CM</sub>	-V <sub>CM</sub>
V <sub>DD</sub>	3.00	4.00	2.00
V <sub>DSP</sub>	1.55	1.96	1.14
V <sub>onP</sub>	0.20	0.20	0.20
V <sub>out</sub>	1.25	1.84	0.66
V <sub>onN</sub>	0.15	0.15	0.15
V <sub>DSN</sub>	1.10	0.69	1.51
V <sub>SS</sub>	0	+1.00	-1.00

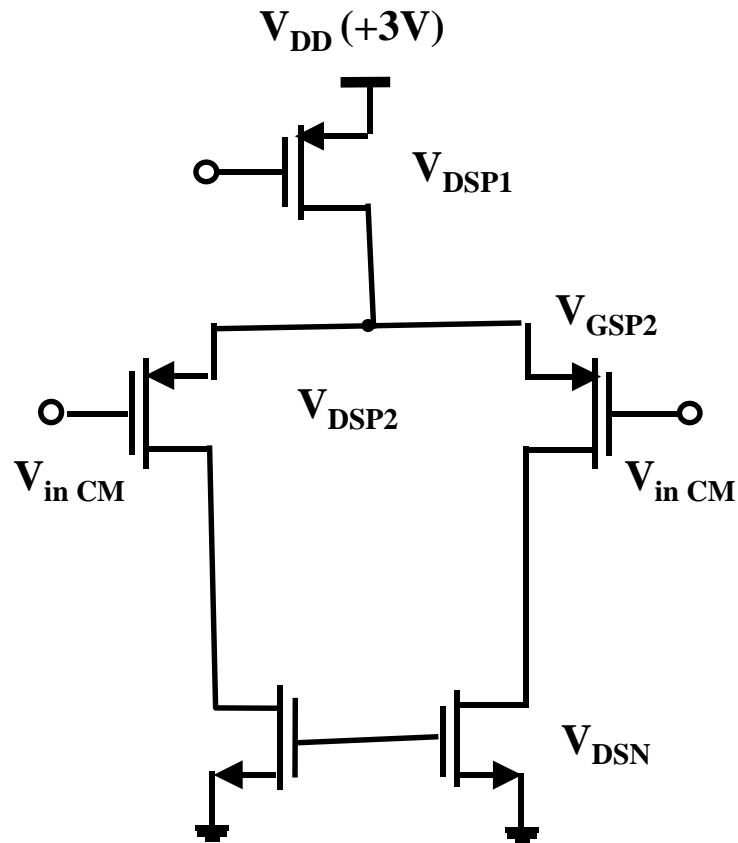
*Example for illustration only*



# LVDS Receiver

## Case 1

$V_{GND} = +/- 0.5V$



	Nom	+ $V_{CM}$	- $V_{CM}$
$V_{DD}$	3.00	3.00	3.00
$V_{DSP1}$	1.00	0.75	1.35
$V_{GSP2}$	0.70	0.70	0.70
$V_{inCM}$	1.25	1.55	0.95
$V_{DSP2}$	1.00	1.13	0.83
$V_{DSN}$	0.95	1.13	0.83
$V_{SS}$	0	0	0

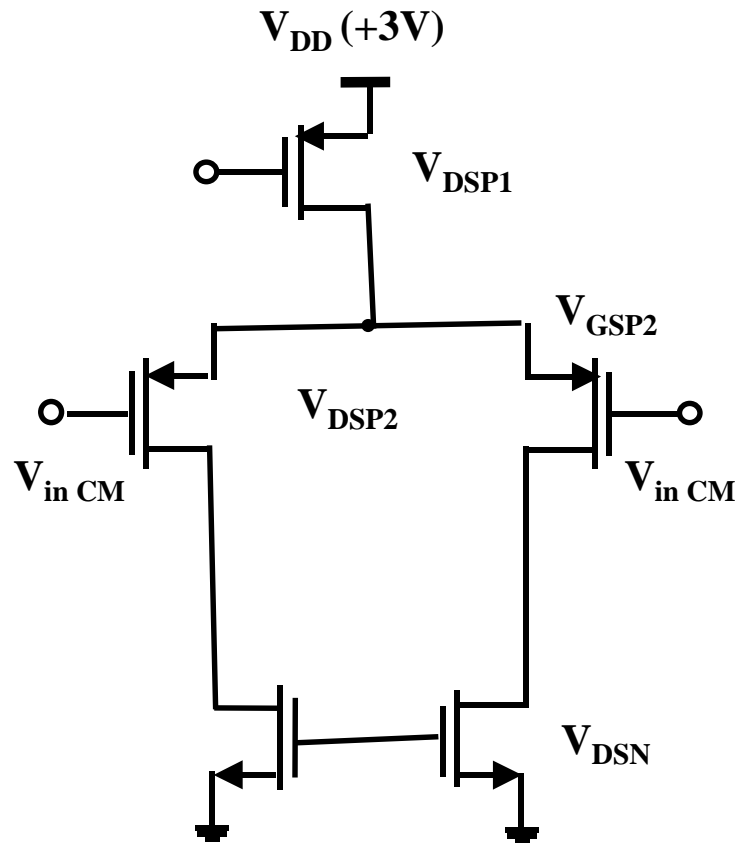
Example for illustration only



# LVDS Receiver

## Case 1

$V_{GND} = +/- 1V$

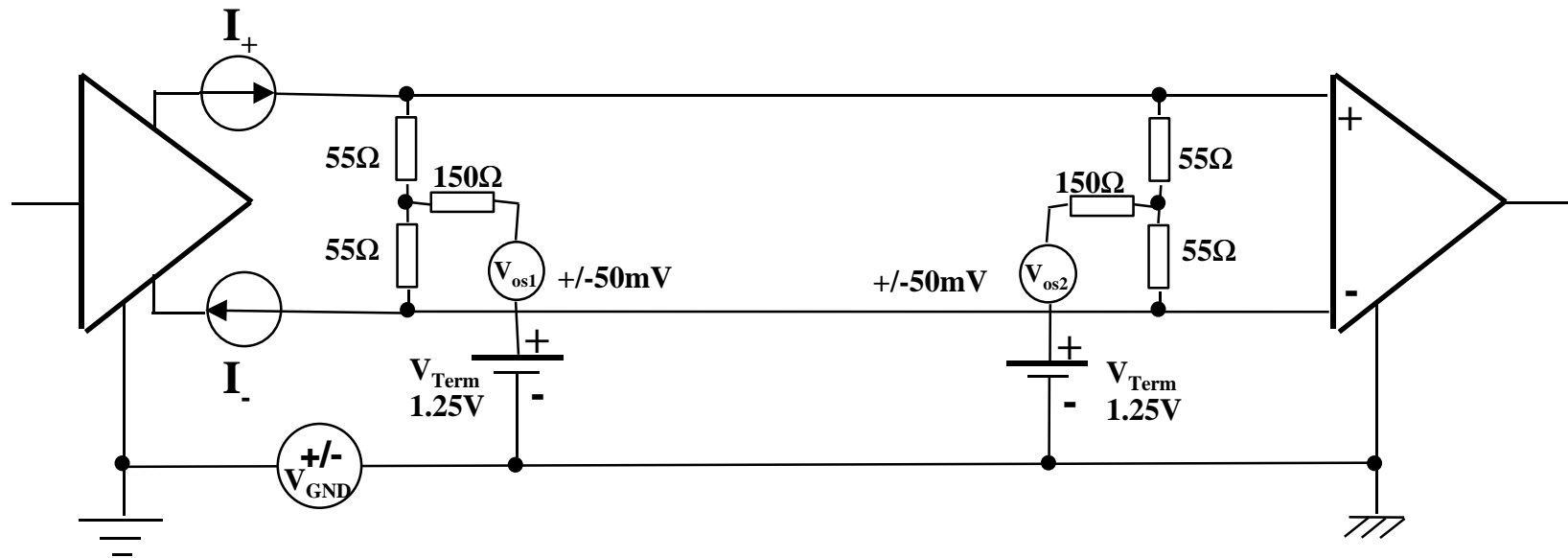


	Nom	+V <sub>CM</sub>	-V <sub>CM</sub>
V <sub>DD</sub>	3.00	3.00	3.00
V <sub>DSP1</sub>	1.00	0.53	1.55
V <sub>GSP2</sub>	0.70	0.70	0.70
V <sub>inCM</sub>	1.25	1.77	0.75
V <sub>DSP2</sub>	1.00	1.24	0.73
V <sub>DSN</sub>	0.95	1.24	0.73
V <sub>SS</sub>	0	0	0

Example for illustration only



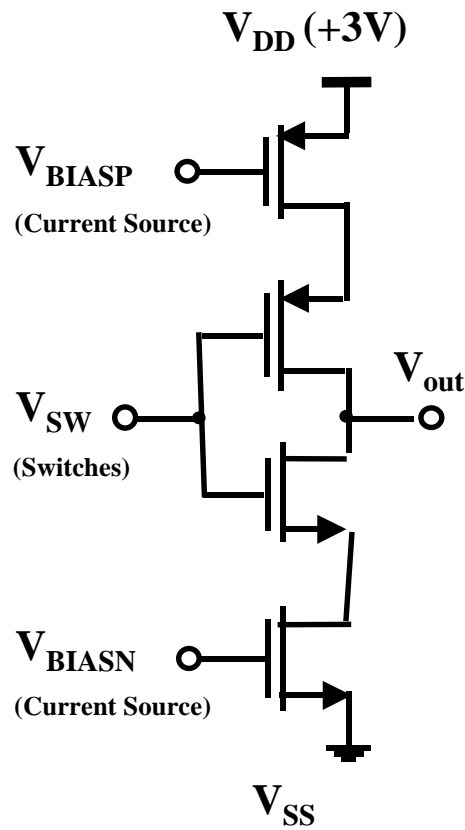
# Ground Offset Case 2



# LVDS Driver

## Case 2

$$V_{GND} = +/- 0.5V$$



	Nom	+V <sub>CM</sub>	-V <sub>CM</sub>
V <sub>DD</sub>	3.00	3.50	2.50
V <sub>DSP</sub>	1.55	2.10	1.00
V <sub>onP</sub>	0.20	0.20	0.20
V <sub>out</sub>	1.25	1.20	1.30
V <sub>onN</sub>	0.15	0.15	0.15
V <sub>DSN</sub>	1.10	0.55	1.65
V <sub>SS</sub>	0	+0.50	-0.50

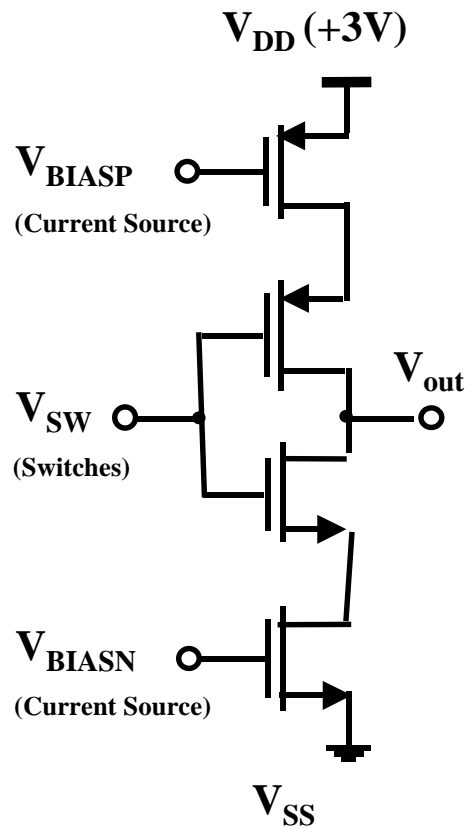
Example for illustration only



# LVDS Driver

## Case 2

$V_{GND} = +/- 1V$

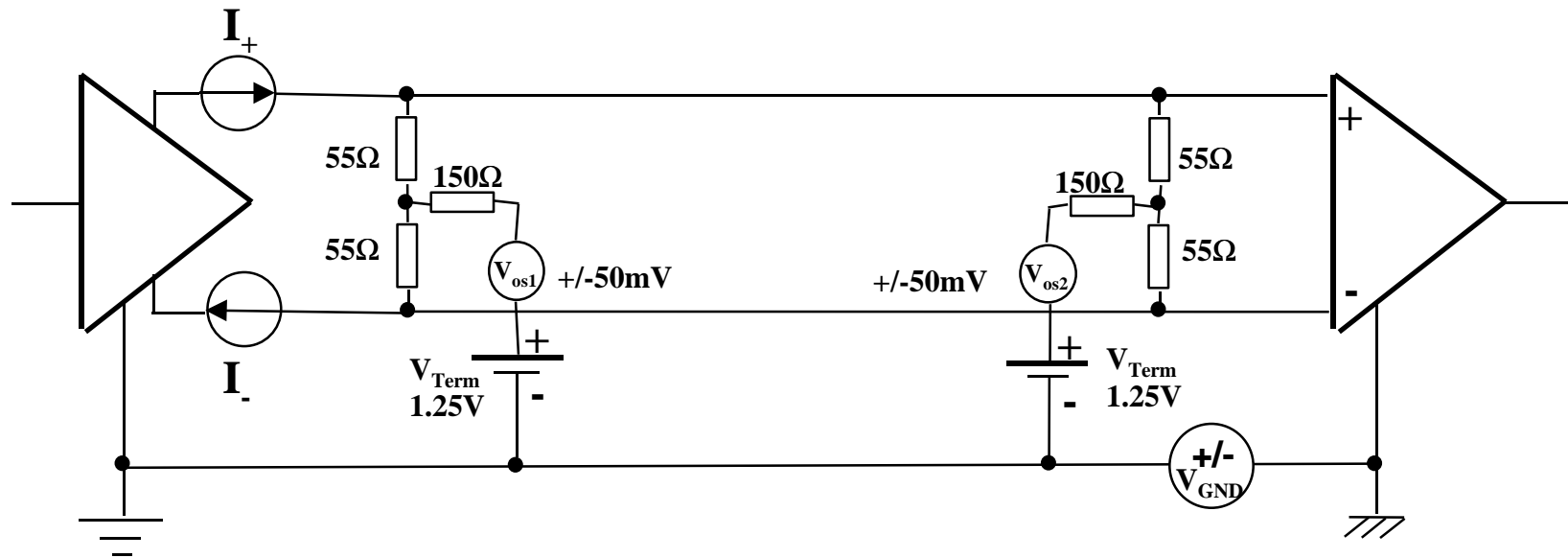


	Nom	+ $V_{CM}$	- $V_{CM}$
$V_{DD}$	3.00	4.00	2.00
$V_{DSP}$	1.55	2.60	0.50
$V_{onP}$	0.20	0.20	0.20
$V_{out}$	1.25	1.20	1.30
$V_{onN}$	0.15	0.15	0.15
$V_{DSN}$	1.10	0.05 !	2.15
$V_{SS}$	0	+1.00	-1.00

*Example for illustration only*



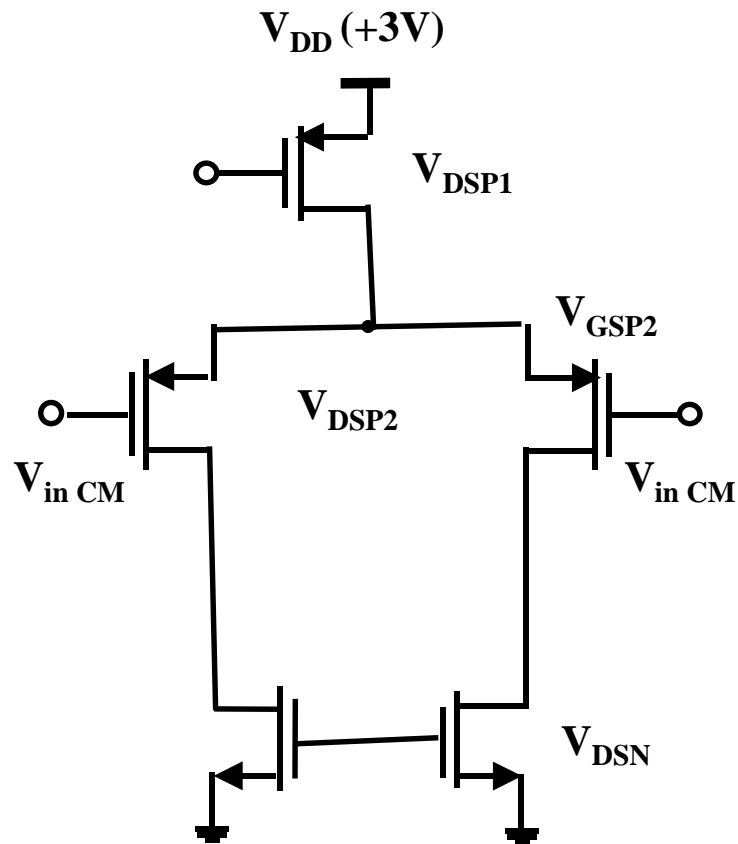
# Ground Offset Case 3



# LVDS Receiver

## Case 3

$V_{DD} = +/- 0.5V$



	Nom	+V <sub>CM</sub>	-V <sub>CM</sub>
V <sub>DD</sub>	3.00	3.50	2.50
V <sub>DSP1</sub>	1.00	1.50	0.60
V <sub>GSP2</sub>	0.70	0.70	0.70
V <sub>inCM</sub>	1.25	1.30	1.20
V <sub>DSP2</sub>	1.00	0.75	1.20
V <sub>DSN</sub>	0.95	0.75	1.20
V <sub>SS</sub>	0	+0.5	-0.5

Example for illustration only

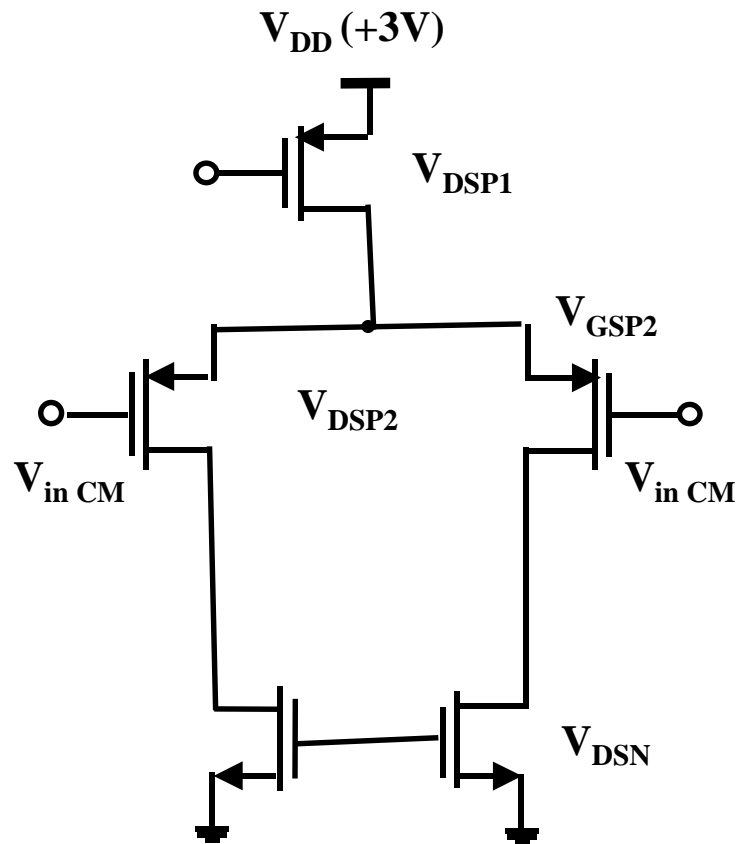




# LVDS Receiver

## Case 3

$V_{DD} = +/- 1V$



	Nom	+V <sub>CM</sub>	-V <sub>CM</sub>
V <sub>DD</sub>	3.00	4.00	2.00
V <sub>DSP1</sub>	1.00	2.00	0.10 !
V <sub>GSP2</sub>	0.70	0.70	0.70
V <sub>inCM</sub>	1.25	1.30	1.20
V <sub>DSP2</sub>	1.00	0.50	1.45
V <sub>DSN</sub>	0.95	0.50	1.45
V <sub>SS</sub>	0	+1.00	-1.00

Example for illustration only



# $V_{CM}$ Calculation Case 1

$$\begin{aligned}
 \text{Example: } V_{+CM \text{ Driver}} &= V_{\text{Term}} + V_{\text{GND}} + V_{\text{os1}} - I_{\text{CM}} R_{\text{CM}} \\
 &= 1.25 + 0.50 + 0.05 - 0.25 = \underline{1.55V} \\
 V_{-CM \text{ Driver}} &= V_{\text{Term}} - V_{\text{GND}} - V_{\text{os1}} + I_{\text{CM}} R_{\text{CM}} \\
 &= 1.25 - 0.50 - 0.05 + 0.25 = \underline{0.95V} \\
 V_{+CM \text{ Rec}} &= V_{\text{Term}} + V_{\text{os2}} + I_{\text{CM}} R_{\text{CM}} \\
 &= 1.25 + 0.05 + 0.25 = \underline{1.55V} \\
 V_{-CM \text{ Rec}} &= V_{\text{Term}} - V_{\text{os2}} - I_{\text{CM}} R_{\text{CM}} \\
 &= 1.25 - 0.05 - 0.25 = \underline{0.95V} \\
 I_{\text{CM}} &= (V_{\text{GND}} + 2V_{\text{OS}}) / (2R_{\text{CM}} + 110 \parallel 110) = \\
 &= (0.5 + 2(0.05)) / (2(150) + 55) = \underline{1.69mA}
 \end{aligned}$$



# *Proposed CM Specs*

*(Nov. 6, 1995)*

	<b>Max</b>	<b>Min</b>	<b>Unit</b>
• <b>Driver</b>	<b>1.55</b>	<b>0.95</b>	<b>[V]</b>
• <b>Receiver</b>	<b>1.55</b>	<b>0.95</b>	<b>[V]</b>

**Assumption:**  $|V_{\text{GND}}| < 0.5\text{V}$

