



Intro to high speed comparators

With LVDS output stage

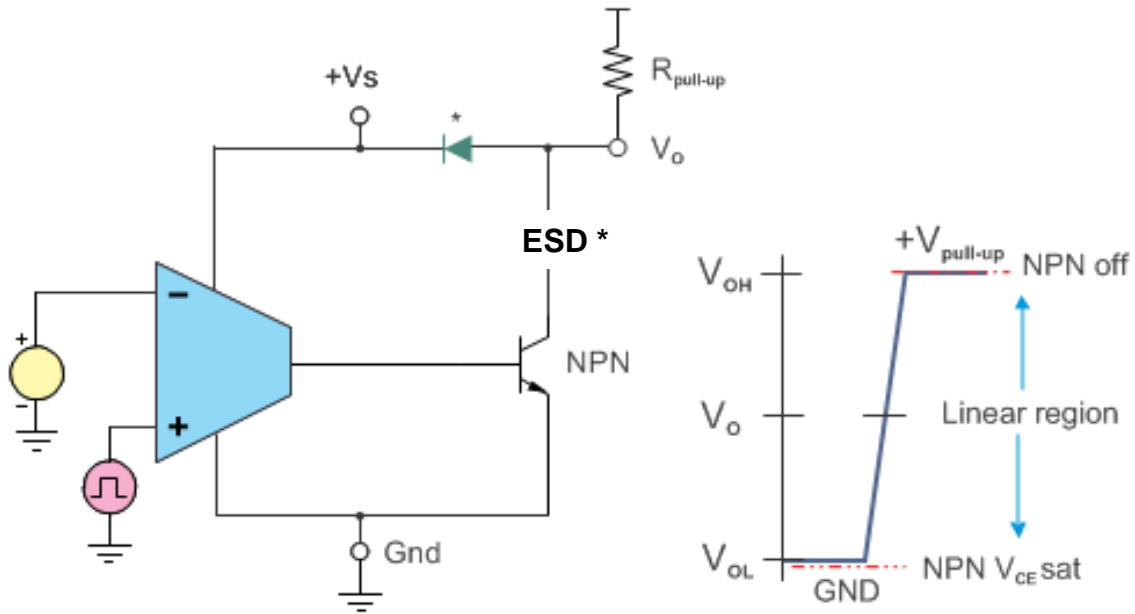
Agenda

- Overview on comparator output types
- What is LVDS and why is it needed?
- Typical high speed applications for comparators

Comparator output types

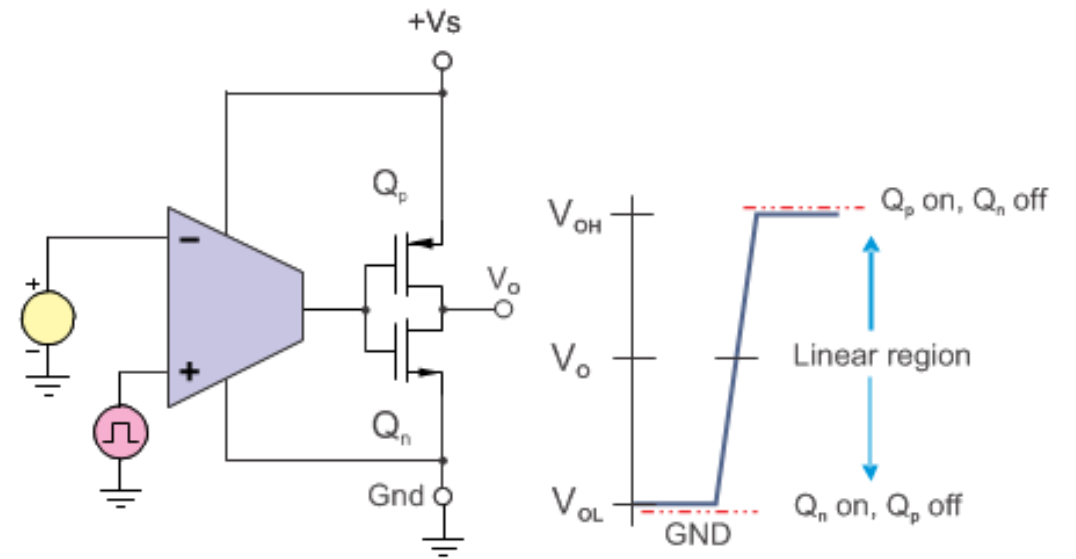
Open-drain/open-collector output (most common)

Requires pull-up resistor - Useful for wired-OR output applications!



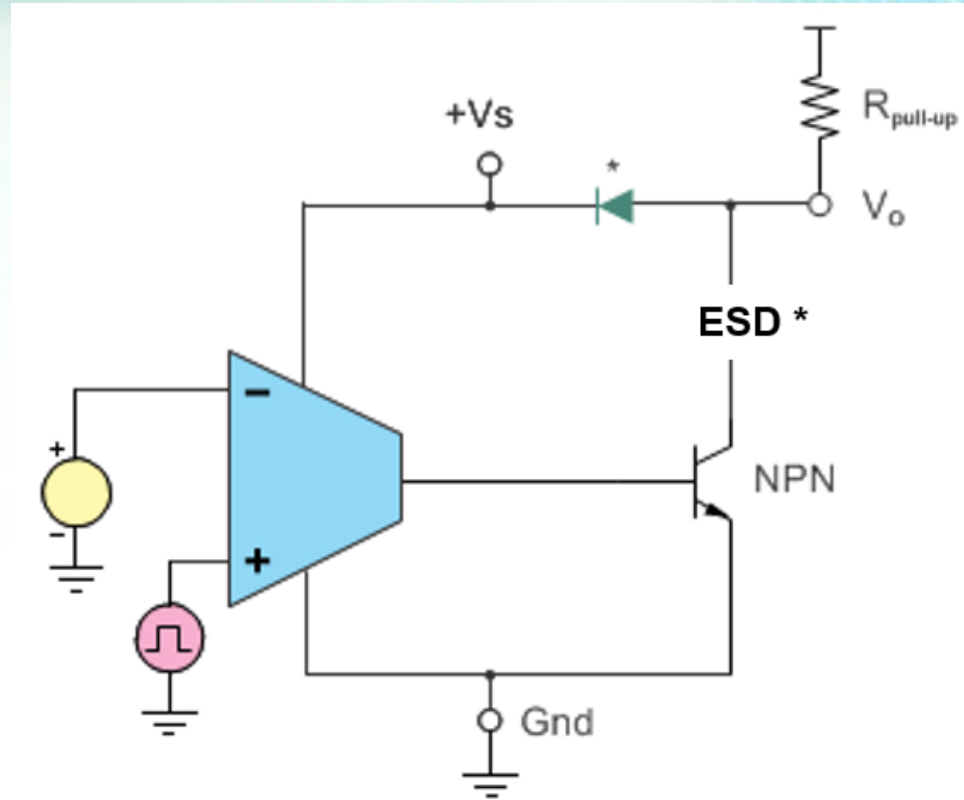
Push-pull (also called R-R or Totem Pole) output

No pull-up resistor required - Cannot tie outputs together!



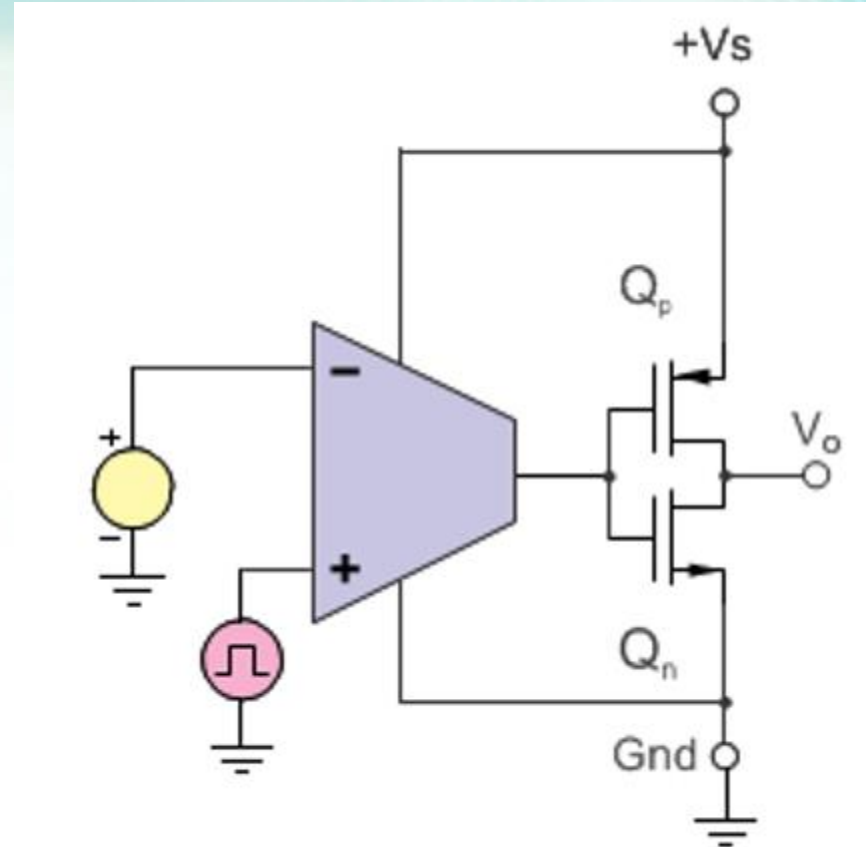
Why open drain cannot be used for high speed applications

- Asymmetrical rise/fall times
 - Due to transition from Hi-Z to sinking current
- RC Time constant from $R_{\text{Pull-up}}$



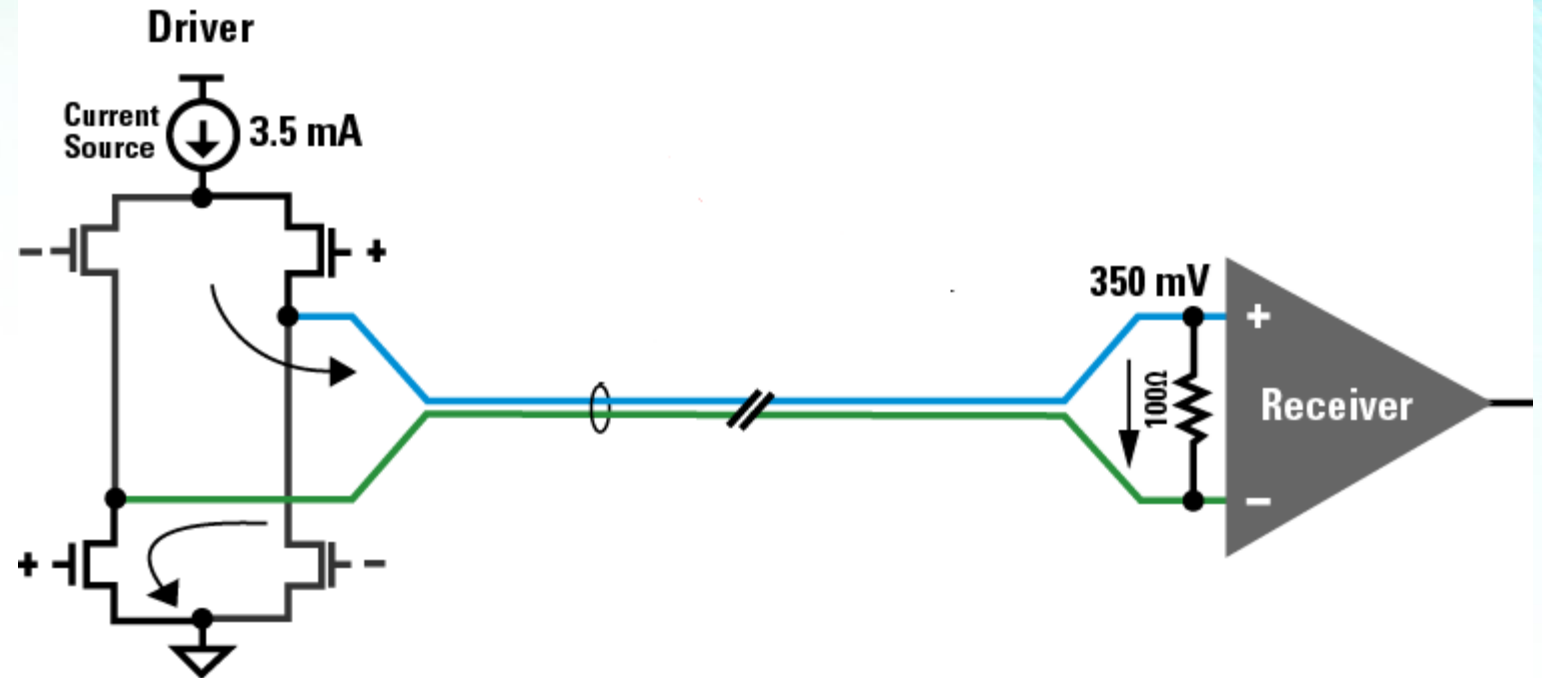
Limitations of push-pull in high speed applications

- Fastest push-pull comparator
 - TLV3601
 - $T_{pd} = 2.5\text{ns}$
 - Throughput = 500Mbps
- $I = C \frac{dV}{dT}$
 - Outputs generally swing from ground to 3.3V/5V
 - Difficult to sink/source enough current for $< 1\text{ns}$ rise/fall times



LVDS overview

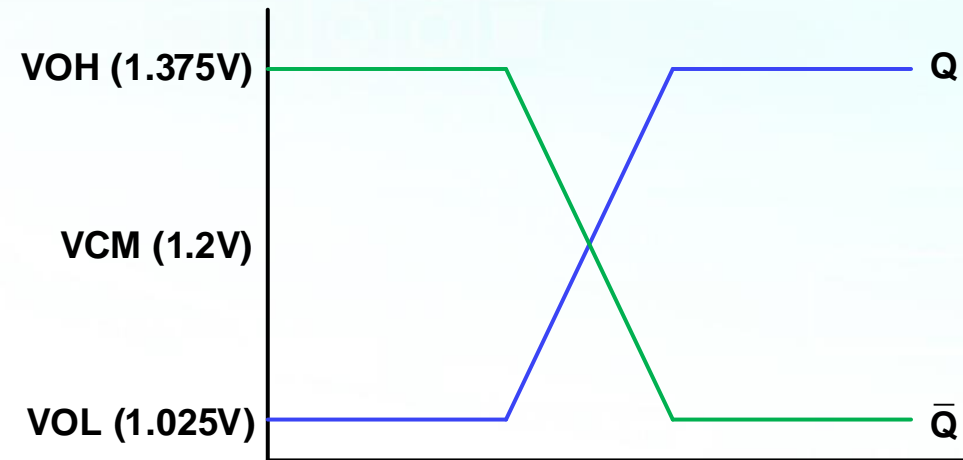
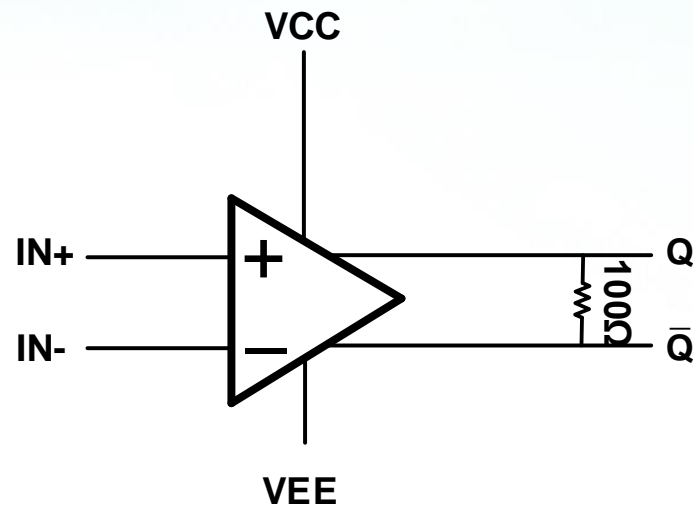
- Up to 4Gbps data throughput
- Low jitter
- Low skew
- High noise immunity
- Reduced EMI due to differential lines



LVDS specs for comparators

DC Output Characteristics						
V_{OCM}	Output common mode voltage	$V_{CCI} = V_{CCO} = 2.5 \text{ V and } 5 \text{ V}$ $T_A = -40^\circ\text{C to } +125^\circ\text{C}$	1.125	1.2	1.375	V
ΔV_{OCM}	Output common mode voltage mismatch	$V_{CCI} = V_{CCO} = 2.5 \text{ V and } 5 \text{ V}$ $T_A = -40^\circ\text{C to } +125^\circ\text{C}$			50	mV
V_{OCM_PP}	Peak-to-Peak output common mode voltage			20		mVpp
V_{OD}	Differential output voltage	$V_{CCI} = V_{CCO} = 2.5 \text{ V and } 5 \text{ V}$ $T_A = -40^\circ\text{C to } +125^\circ\text{C}$	250	350	450	mV
ΔV_{OD}	Differential output voltage mismatch	$V_{CCI} = V_{CCO} = 2.5 \text{ V and } 5 \text{ V}$ $T_A = -40^\circ\text{C to } +125^\circ\text{C}$			10	mV

LVDS specs for comparators



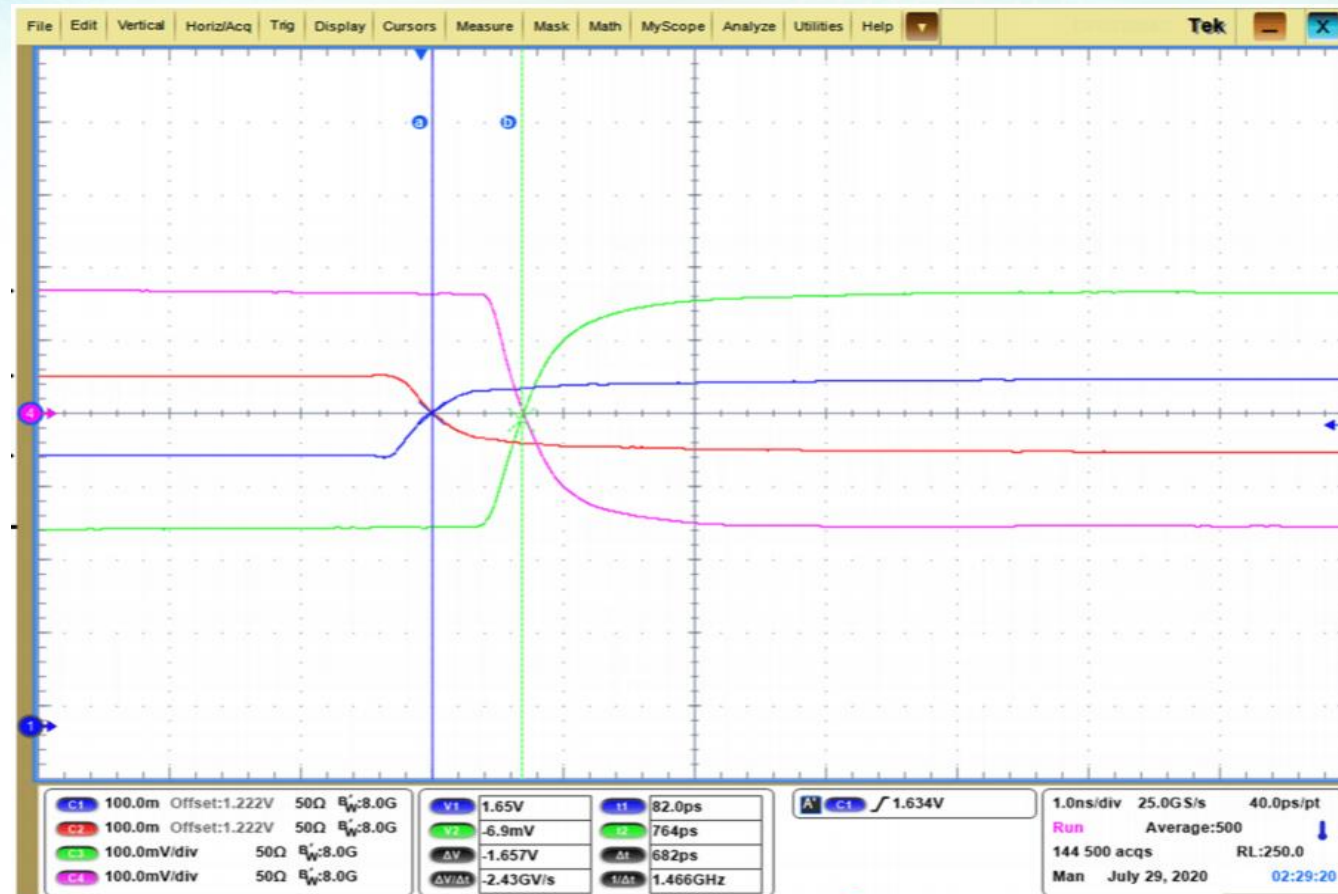
LVDS response for comparator

CH4: OUTN/ \bar{Q}

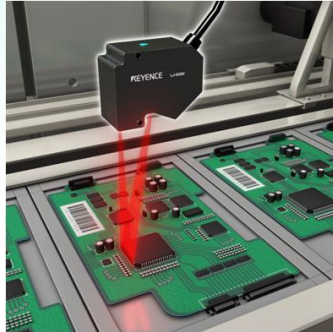
CH2: IN-

CH1: IN+

CH3: OUTP/Q



Typical applications for LVDS comparators



PCB positioner



Factory robot



Vacuum robot



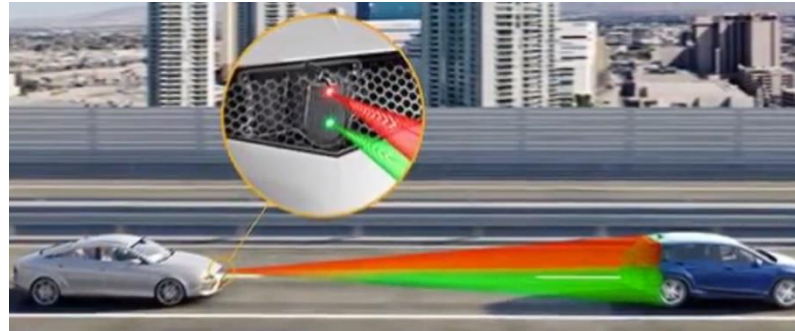
Drone



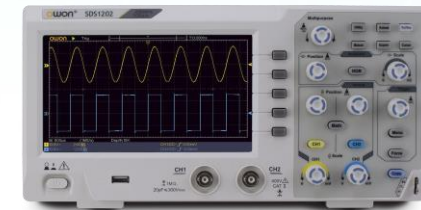
Disc vibration tester



Metal thickness tester



Automotive Lidar



Oscilloscope