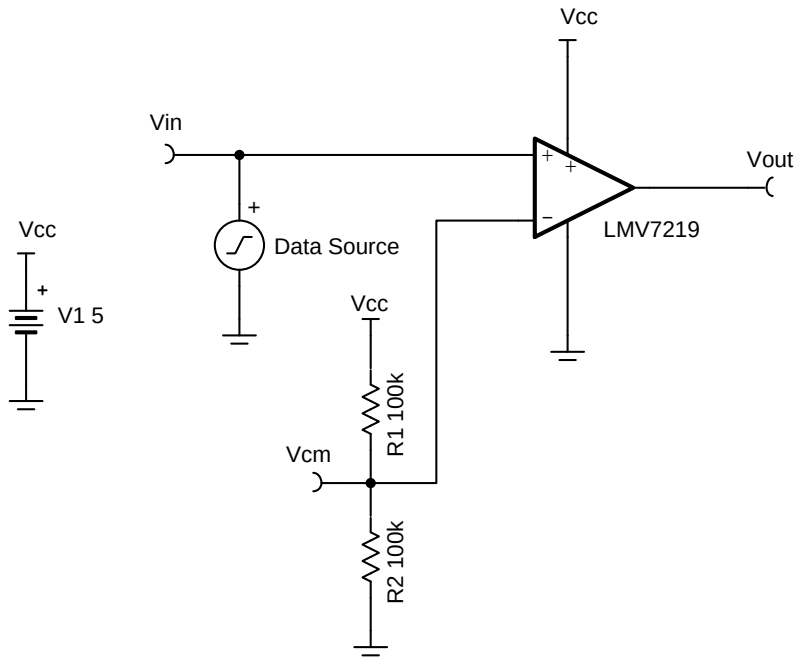
Signal and clock restoration circuit

Design Goals

Supply		Attenuated Input Signal		
V_{cc}	V_{ee}	V_i	V_{cm}	f
5V	0V	200mV_{p-p}	2.5V	20MHz

Design Description

The signal restoration circuit is used in digital systems to retrieve distorted clock or data waveforms. These clock and data signals can be attenuated and distorted on long traces due to stray capacitance, stray inductance, or reflections on transmission lines.The comparator is used to sense the attenuated and distorted input signal and convert it to a full scale digital output signal.



Design Notes

1. Select a comparator with low input offset voltage and fast propagation delay.
2. A comparator with a toggle frequency larger than the input signal frequency should be used in order to properly process the incoming digital signal. A margin of 30% is sufficient.
3. If level translation is also required, use a comparator with seperate input and output supplies.
4. If a differential output is required, use a comparator with a compatible output stage such as the LVDS compatible output on the LMH7220.

Design Steps

1. Calculate the maximum toggle frequency of the comparator to ensure it can process the 20MHz input signal.

   $f_{max} = (t_{rise} + t_{fall} + t_{pd\_hl} + t_{pd\_lh})^{-1}$

   $f_{max} = (1.3ns + 1.25ns + 7ns + 7ns)^{-1} = 35.4\ MHz$

2. Set the inverting input of the comparator to the common mode voltage of 2.5V through the resistor divider R_1, R_2.

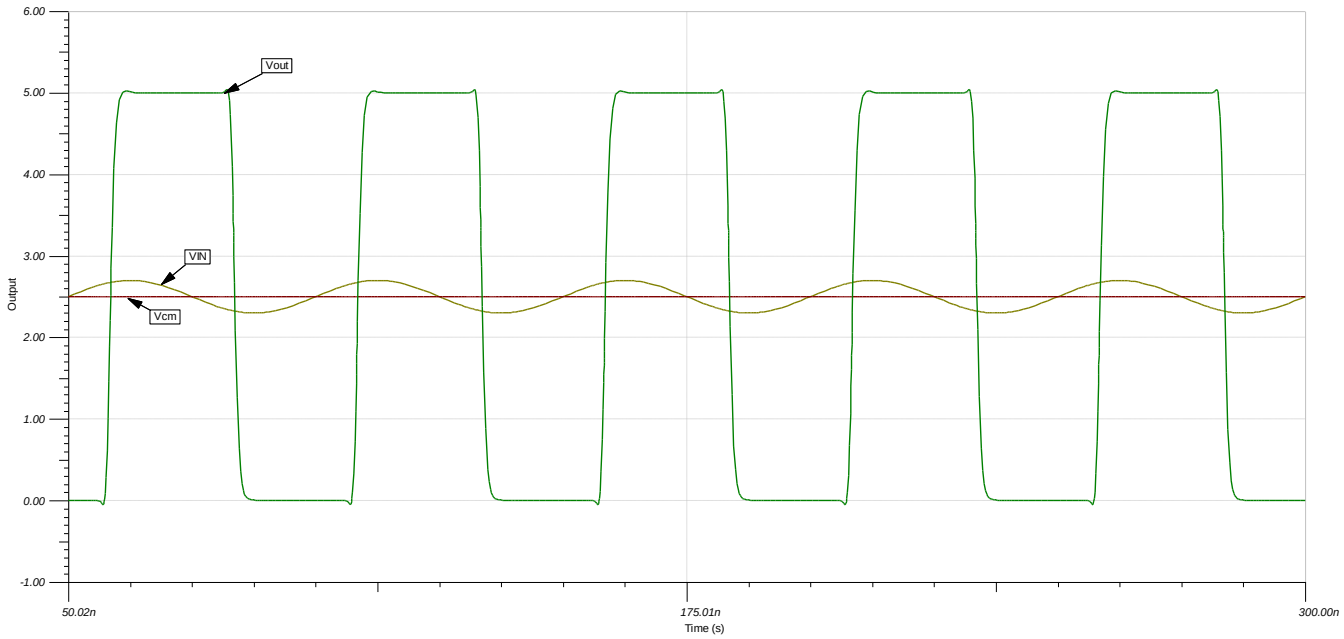
   $V_{cm} = (V_{cc})\ x\ (\frac{R_2}{R_1+R_2}) = 2.5V$

   $(\frac{R_2}{R_1+R_2}) = \frac{1}{2}$

3. Set $R_1 = R_2 = 100k$.
4. Set the noninverting input of the comparator to the input data signal.

Design Simulations

Transient Simulation Results



Design References

See Analog Engineer's Circuit Cookbooks for TI's comprehensive circuit library.

See circuit spice simulation file, SNOM661.

For more information on many comparator topics including hysteresis, propagation delay and input common mode range please see, TI Precision Labs.

Design Featured Comparator

LMV7219	
V_{ss}	2.7V to 5V
V_{inCM}	Rail-to-rai
t_{pd}	7ns
V_{os}	1mV
V_{HYS}	7mV
I_q	0.9mA
Output Type	Push-Pull
#Channels	1
www.ti.com/product/lmv7219	

Design Alternate Comparator

	TLV3501	LMH7220
V_{ss}	2.7 to 5.5V	2.7V to 12V
V_{inCM}	Rail-to-rail	Rail-to-rail
t_{pd}	4.5ns	2.9ns
V_{os}	1mV	9.5mV
V_{HYS}	6mV	na
I_q	3.2mA	6.8
Output Type	Push-Pull	LVDS
#Channels	1	1
	www.ti.com/product/tlv3501	www.ti.com/product/lmh7220