ELECTRONIC CIRCUITS

LAB. NO.8

TITLE: ZERO AND NON–ZERO CROSSING DETECTORS AND WAVESHAPING

1. ZERO CROSSING DETECTOR (POSITIVE SLOPE)


1.2 SKETCH THE FOLLOWING WAVEFORMS (VIN = 3V–p)

***LABEL: + VPEAK, −VPEAK, Vp–p. CRO COUPLED

WRT = WITH RESPECT TO (IN PROPER TIME RELATION)

1.2.1 VOUT WRT VIN
1.2.2 V1 WRT VIN
1.2.3 V2 WRT VIN
1.2.4 V2 WRT VOUT
1.2.5 V1 WRT VOUT

CRO TRIGGER:
+ SLOPE, CH1
SWEEP = .5ms/DIV

CH2
CH1
DC COUPLED

**LABEL ALL NUMERICAL VALUES (+Vp, −Vp, Vp–p) ON ALL WAVEFORMS

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2. WAVESHAPING CIRCUIT

![Circuit Diagram]

2.1 SET $V_{IN} = 3V_p-p$. CRO DC COUPLED, SKETCH THE FOLLOWING WAVEFORMS. LABEL $+V_{PEAK}$, $-V_{PEAK}$, AND $V_{p-p}$

2.1.1 $V_1$ WRT $V_{IN}$
2.1.2 $V_1$ WRT $V_{OUT}$

CH2      CH1
DC COUPLED
3. INVERTING NON ZERO-CROSSING DETECTOR OR INVERTING VOLTAGE LEVEL DETECTOR

![Electrical Circuit Diagram](image)

**FIG-3**

3.1 SET \( V_{REF} = +3 \text{VDC} \) AND \( V_{IN} = 10V_p-p \).
   SKETCH VOUT WRT VIN. LABEL \(+V_p\), \(-V_p\), \(V_p-p(s)\)

3.2 SET \( V_{REF} = -3 \text{VDC} \) AND \( V_{IN} = 10V_p-p \).
   SKETCH VOUT WRT VIN. LABEL \(+V_p\), \(-V_p\), \(V_p-p(s)\)

3.3 OBSERVE VOUT WHILE VARYING VREF FROM \(-4.5 \text{ VOLTS} \) TO \(+4.5 \text{ VOLTS}\).
   WHY DOES THE VOUT WAVE FORM DISAPPEAR WHEN VREF >5 VOLTS? AND VREF < -5 VOLTS? WHAT DOES VOUT EQUAL TO FOR THE PREVIOUS TWO CONDITIONS?
4. Noninverting Nonzero-Crossing Detector or Noninverting Voltage Level Detector

NOTE: OPAMP INPUT POLARITIES REVERSED


4.2 Set VREF = -3VDC and VIN = 10Vp-p. Sketch VOUT WRT VIN. Label +Vp, -Vp, Vp-p(s).

4.3 Observe VOUT while varying VREF from -4.5 Volts to +4.5 Volts. Why does the VOUT wave form disappear when VREF > 5 Volts? What does VOUT equal for the previous two conditions?
5. VARIABLE DUTY CYCLE PULSE GENERATOR

MODIFY FIG-4 TO THE FOLLOWING

![Circuit Diagram]

CIRCUIT AS IN FIG-4

DUTY CYCLE = \(D = \frac{t_{on}}{T} \times 100\%\)

COMPLETE THE FOLLOWING TABLE

<table>
<thead>
<tr>
<th>[WIPER OF R2 AT THE TOP]</th>
<th>(V_{DC})</th>
<th>(V_{DC})</th>
</tr>
</thead>
<tbody>
<tr>
<td>VREF (VOLTS)</td>
<td>(t_{on}) (mS)</td>
<td>D%</td>
</tr>
<tr>
<td>+4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>+3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(t_{on}=T)</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

[WIPER OF R2 AT THE BOTTOM]
6. ZERO CROSSING DETECTOR
(POSITIVE AND NEGATIVE SLOPE)

6.1 SET VIN = 5Vp-p, 100HZ LAG 120A OR LAGLAG 120B.
*LM358 IS A DUAL OPAMP CHECK PIN OUT CAREFULLY
V+ = 15VDC, GND = -15VDC. TWO LM741 OPAMPS MAY
BE USED IF DESIRED.

6.2 DEMOstrate CIRCUIT TO YOUR INSTRUCTOR SHOWING
V1, V2 AND VOUT

6.3 SKETCH THE FOLLOWING WAVEFORMS:
6.3.1 VOUT WRT VIN
6.3.2 V1 WRT VIN
6.3.3 V2 WRT VIN
6.3.4 V2 WRT VOUT
6.3.5 V1 WRT VOUT
6.3.6 VOUT WRT VIN