

Numerical answers 3B2 –2009

1 (a) $V_{OL} = 0.185$ V for inverter A, $V_{OL} = 0$ V for inverter B

$$(c) I_{D1} = 16 \times 10^{-5} \text{ A} \quad t_{sat} = \frac{C_L}{I_{D2}} = \text{s} = 31 \text{ ns} \quad t_{non-sat} = 15.9 \text{ ns}]$$

The total delay, the sum of t_{sat} and $t_{non-sat}$, or $31 + 15.9 = 46.9$ ns

2. (b) $V_{DS} = +3.9$ V; the range of V_{GS} values for saturation is +1.0 to +4.9 V

$$V_{IN} = 0.82 \text{ V}$$

3. (a) Simplified function $T = \overline{B} \overline{C} \overline{E} + A B \overline{E}$

(b) $Z = A'BC + AC'$. The minimal delay in the output when C changes from 0 to 1 for $A=B=1$ can be obtained as 2δ . The total delay = 3δ

4. $D1 = y1^+ = \Sigma (1, 2, 3, 6, 7, 8, 9, 10, 11, 14, 15)$

$$D2 = y2^+ = \Sigma (1, 5, 9, 13)$$

$$D3 = y3^+ = \Sigma (0, 8, 9, 13)$$

$$Z = \Sigma (2, 3, 14, 15)$$