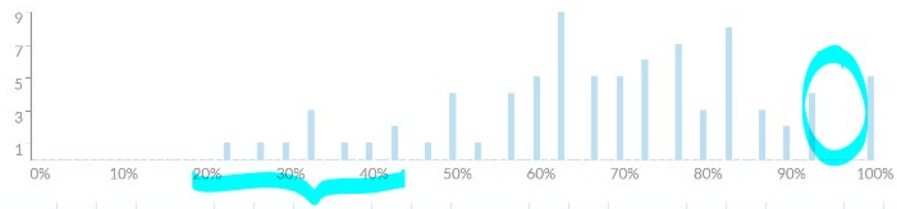
Lec-14

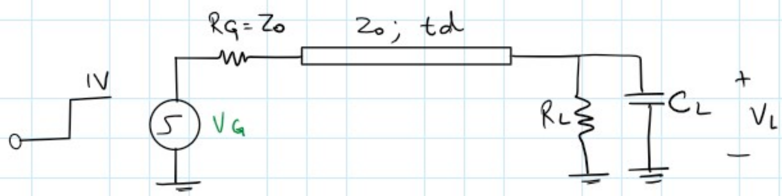
Friday, May 1, 2020 7:52 AM

- HW #3 will be posted today.
- Bonus points – 3

Average Score	High Score	Low Score	Standard Deviation	Average Time
69% 21/30	100%	23%	5.49	48:59



Termination with a lossy capacitor.



Discharged Capacitor acts like a short circuit.
$\Gamma_L = -1$ at the instant of incident wave.

$$\underbrace{V_L(t) = V_1^+(t) + V_1^-(t)}$$

$$V_1^- = -V_1^+ \quad @ \; t = t_d$$

$$I_L(t) = I_1^+(t) + I_1^-(t)$$

$$I_1^- = -\frac{V_1^-}{Z_0}$$

$$I_L(t) = \frac{V_1^+(t)}{Z_0} - \frac{V_1^-(t)}{Z_0}$$

$$I_L(t) = \frac{V_L(t)}{R} + C\frac{dV_L(t)}{dt}$$

$$\frac{V_1^+(t)}{Z_0} - \frac{V_1^-(t)}{Z_0} = \frac{V_1^+(t)}{R_L} + \frac{V_1^-(t)}{R_L} + C_L\frac{dV_1^-(t)}{dt} \quad ; \quad \left\{ \begin{array}{l} C\frac{dV_1^+(t)}{dt} = 0 \\ V_1^+(t) = \frac{V_G}{2} \end{array} \right.$$

$$\frac{dV_1^-(t)}{dt} + \left[\frac{R_L + Z_0}{Z_0 R_L}\right] V_1^-(t) - \left[\frac{R_L - Z_0}{Z_0 R_L}\right] \underbrace{V_1^+(t)}_{V_G/2} = 0$$

$$V_1^-(t) = K_1 + K_2\, e^{-[(R_L + Z_0)/R_L Z_0 C_L](t - t_d)}$$

K_1 & K_2 are integration constants. Can be calculated from the boundary conditions.

1. At $t = t_d$ $\qquad V_1^- = -V_1^+ = -V_G/2$

2. At $t \to \infty$ $\qquad V_1^- = \underbrace{\left(\frac{R_L - Z_0}{R_L + Z_0}\right)}\cdot V_1^+$

$$V_1^-(t) = V_1^+(t)\left[\frac{R_L - Z_0}{R_L + Z_0} - \frac{2R_L}{R_L + Z_0}\, e^{-\left[(R_L+Z_0)/R_L Z_0 C_L\right](t - t_d)}\right]$$

$V_L(t) = V_1^-(t) + V_1^+(t)$

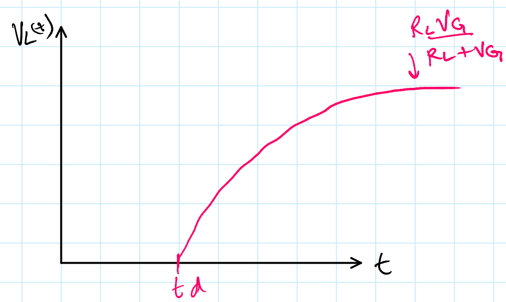
$$\boxed{V_L(t) = \frac{R_L V_G}{R_L + Z_0}\left[1 - e^{-\underbrace{\left[(R_L+Z_0)/R_L Z_0 C_L\right]}(t - t_d)}\right]}$$

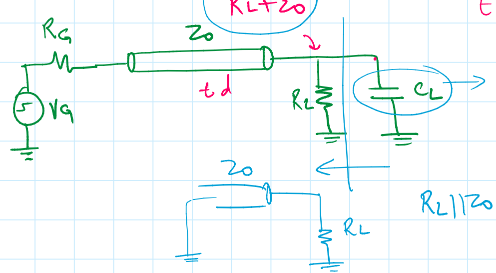
$t \to \infty \quad e^{-\infty} = 0$

$t \to t_d \quad e^0 = 1$

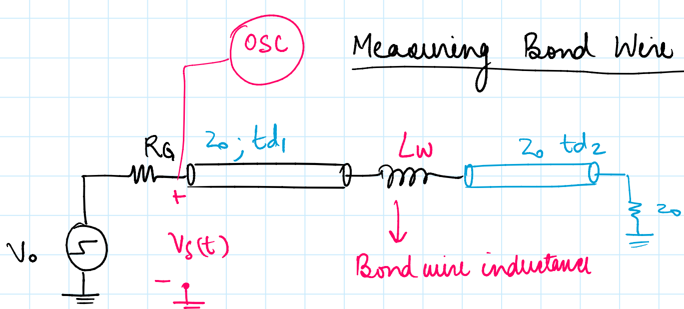
$V_L(t) \to 0$

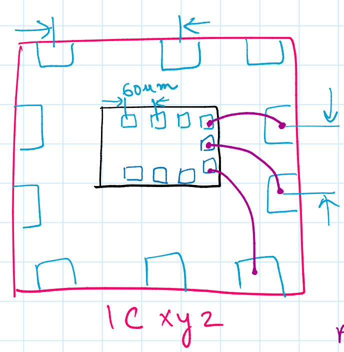
$\tau = \frac{R_L Z_0}{R_L + Z_0} \cdot C_L$





Measuring Bond Wire Inductance.





Bond wire inductance
1nH/mm

Flip chip.
BGA →