DE-COUPLING NOISE ON POWER RAIL WITH R-C PARALLEL PAIR

When a TTL gate changes state, the amount of current that it draws changes rapidly. These changes in current, called switching transients, appear on the power supply line and can cause false triggering of other devices. For this reason, the power bus should be adequately decoupled. For proper decoupling of TTL circuits, connect a 0.01 to 0.1 µF capacitor from VCC to ground near each device to minimize the transient currents caused by device switching and magnetic coupling. These capacitors must be low-inductance, high frequency RF capacitors (ceramic capacitors are preferred). In addition, a large-value (50 to 100 µF) capacitor should be connected from VCC to ground somewhere on the board to accommodate the continually changing ICC requirements of the total VCC bus line. These are generally low-inductance tantalum capacitors.

By-Pass Caps shunt noise to ground. De-coupling caps smoothe signals.

In a common emitter amplifier, a cap can be added to the R_E to trap noise. The cap should have 1/10 the resistance of the parallel resistor. To shunt a noise, we need to provide a current divider so that the noise signal will be shorted to ground. A resistor and capacitor in parallel will do the job.

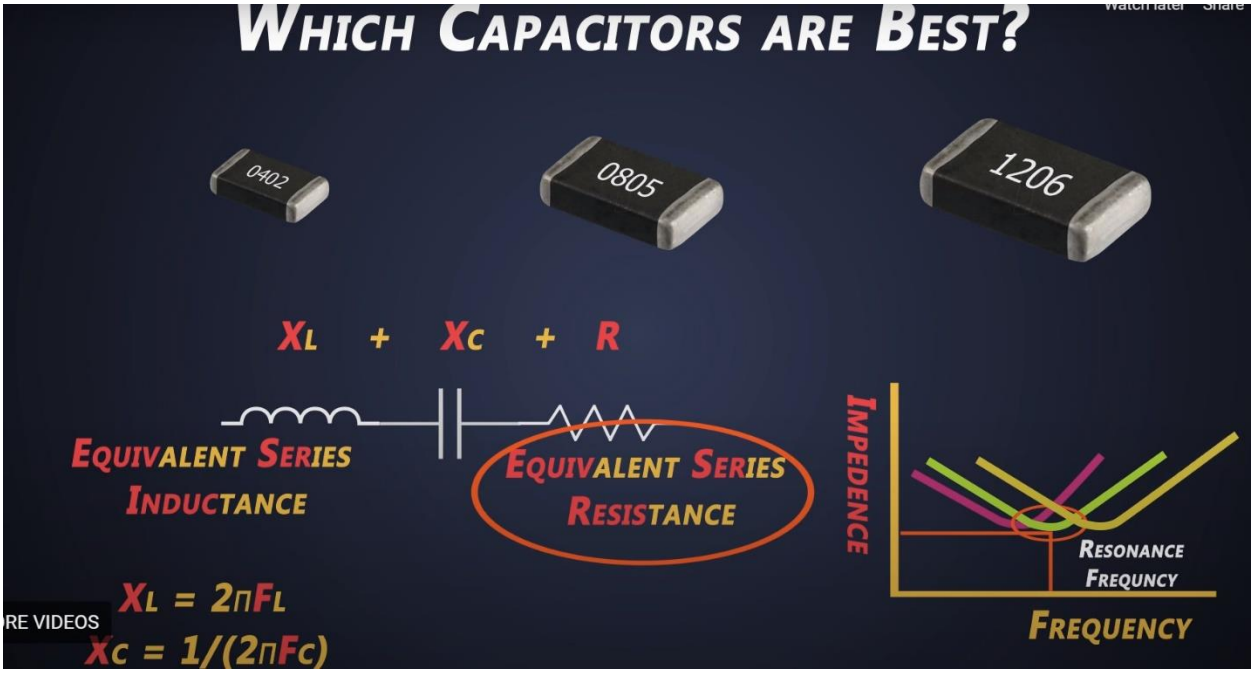
When choosing a capacitor, start with the resistance of the resistor. Let's say it is 2700Ω. The reactance of our cap should be 1/10 the resistance of our resistor so the current will take the easiest path to ground. Therefore, we want our capacitor's reactance to be around 270Ω.

Now use the following equation to find a cap that will have 270Ω reactance at 18kHz.

C = $\frac{1}{2\pi FXc}$ where f= noise frequency (18kHz) and Xc = 270Ω.

Use an online calculator to compute our value. Solving this formula gives us C = 33nF (.03µF).

At <50MHz signals: 1µF and .01µF and .001µF in parallel work best. Keep the smallest value cap closest to the IC Vcc pin.



A partial list of TTL subfamilies includes:

74xx standard TTL

H 74Hxx High-speed

L 74Lxx Low-power

S 74Sxx Schottky

F 74Fxx Fairchild Advanced Schottky

LS 74LSxx Low-power Schottky

AS 74ASxx Advanced Schottky

ALS 74ALSxx Advanced Low-power Schottky