Decoupling capacitors placed across the device between V_{cc} and ground reduce voltage spikes by supplying the extra current needed during switching. These capacitors should be placed close to their devices because the inductance of connection lines negates their effect.

When selecting decoupling capacitors, the user should provide 0.01 microfarads for each device and 0.1 microfarads for every 20 gates. Radio-frequency capacitors must be used; they should be distributed evenly over the board to be most effective. In addition, the board should be decoupled from the external supply line with a 2.2 microfarads capacitor.

Chip capacitors (surface-mount) are preferable because they exhibit lower inductance and require less total board space. They should be connected as in Figure 11-3. Leaded capacitors can also be used if the leads are kept as short as possible. Six leaded capacitors are required to match the effectiveness of one chip capacitor, but because only a limited number can fit around the 80386, the configuration in Figure 11-4 results.

11.2 HIGH-FREQUENCY DESIGN CONSIDERATIONS

At high signal frequencies, the transmission line properties of signal paths in a circuit must be considered. Reflections, interference, and noise become significant in comparison to the high-frequency signals. They can cause false signal transitions, data errors, and input voltage level violations. These errors can be transient and therefore difficult to debug. In this section, some high-frequency design issues are discussed; for more information, consult a reference book on high-frequency design.

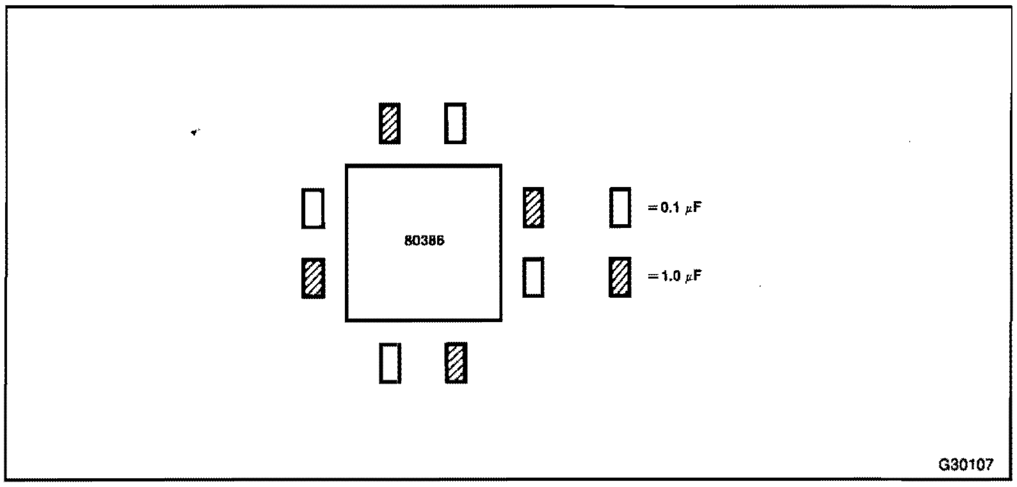

Figure 11-3. Decoupling Chip Capacitors