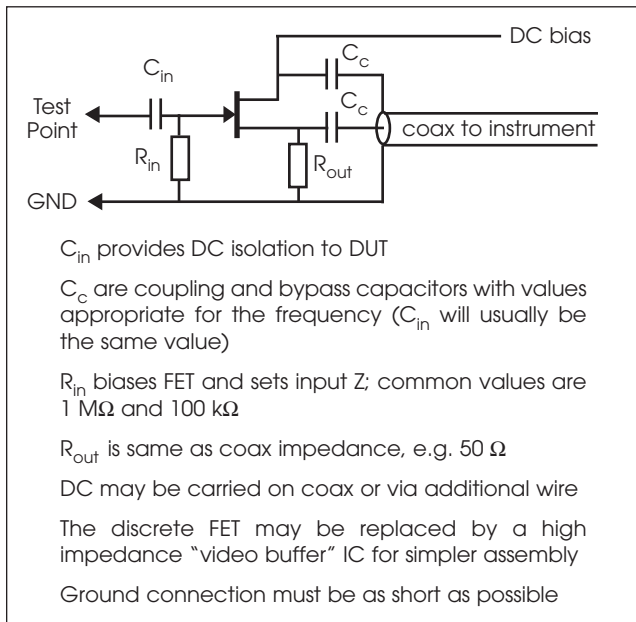


DESIGN NOTES

A Few Notes for the Laboratory

One of the questions we ask when talking with engineers is what things make their lives easier when working in the lab. Here are a few comments and suggestions from our long-time, ongoing, informal “survey” of engineers and technicians.

High frequency FET probe—Some engineers still evaluate a lot of prototypes, mainly at companies that make custom products in small quantities. A few of them have noted that probing a printed circuit board to evaluate circuits *in situ* is the best way to identify problem areas when the performance is below expectations. A few have even fabricated their own probes, perhaps out of economy, but mostly out of haste—when they needed it *now*.



Of course, a lab-built probe will not have accurate calibration, and may not have the bandwidth of a good commercial probe. They are most valuable when approximate measurements are sufficient.

You may want to affix a bright white LED to a probe to get better illumination of densely-packed circuitry. A dab of hot glue will hold the LED in place. Tape the DC power wire to the coax.

SMT tools—Technicians have many tricks for assembly and test, particularly when using the smallest surface-mount devices. Useful tools for working with miniature parts include a *spring-loaded hold-down tool* to keep components in place until they are soldered; a *hot air reflow soldering station* for both initial assembly and re-work; an assortment of *fine-point*

soldering tips used with a high-quality temperature-controlled soldering station; and plenty flux-impregnated copper braid (“solder wick”). It is not unusual for a technician to flow a large amount of solder across multiple pins of a large IC, then absorb the excess with the braid.

Keep a collection of common instrument setups—Today’s instruments, such as signal generators, spectrum and network analyzers, are easily programmable, but their powerful functionality may complicate manual set up. Having an assortment of typical lab-bench setups for frequency, amplitude, bandwidth and other parameters has become essential. The easiest way to develop this collection is to save each important test setup as it is created. Keep a reference sheet or computer notes of saved setups so choosing a starting point for a new measurement is easy. A few of your most common setups might even be programmed as “one-button” commands.

Scientific calculator—While a computer is the tool of choice for most important simulation and analysis tasks, there are a vast number of small calculations that are easier to perform on an “old-fashioned” calculator. A scientific calculator will give you the common trig and math functions that are not included on simple four-function calculators. However, we have met a few engineers who claim that all their “on the fly” calculations can be done with a calculator that has the four functions plus square root.

Keep a great notebook—All larger companies will have specific guidelines on lab notebook procedures, but small companies and consultants may be less rigorous. Proper notebook practice is essential for the documentation of patent-related work, or any work that will be revised in the future. Here a few key recommendations:

- Use a bound book, spiral or glue. Keep them signed, dated, numbered and, when needed, witnessed.
- Include plenty of detail in the entries.
- Always add on to the end. “What’s done is done”—don’t change any past entries.
- Include seemingly unrelated notes about meetings, discussions and ideas for future work.
- Attachments are OK. Staple them to the pages.
- Use typical language. Write so an engineer will understand (legal documents are for lawyers).
- Keep and file them! They are an important record of your work.