Engineer's newsletter

How to measure the standby power of C-MOS RAMs

The attractively low standby power of complementary-MOS static random-access memories—typically only 40 to 100 μW for a 1,024-bit device—is actually a function of the pattern stored in the RAM, points out Conrad Boisvert, an applications manager at Synertek in Santa Clara, Calif. This power is at its minimum (P_{min}) if you measure it immediately after applying V_{CC} (before any memory-write operations), but at its maximum (P_{max}) if you read the pattern and then store its complement. Indeed, P_{max} is frequently several orders of magnitude greater than P_{min}.

Knowing P_{max} is often necessary, but measuring it directly is very difficult and sometimes impossible. **One way to simplify the measurement yet still determine the absolute worst-case value is to take advantage of the equality: $P_{max} + P_{min} = P0 + P1$,** where P0 is the power with all zeros stored, and P1 the power with all ones stored. This equation may be rewritten as: $P_{max} = P0 + P1 - P_{min}$. The three right-hand terms are all relatively easy to measure on moderately priced test equipment. In your application, if it is unlikely that the worst-case standby-power pattern will occur, then you only need to determine P0 and P1, which are easy to measure even with the simplest equipment. In fact, just with this minimal test, you will be able to detect any severe leakage paths.