Simple nanosecond-width pulse generator provides high performance

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If you need to produce extremely fast pulses in response to an input and trigger, such as for sampling applications, the predictably programmable short-time-interval generator has broad uses. The circuit of Figure 1, built around a quad high-speed comparator and a high-speed gate, has settable 0- to 10 ns output width with 520 ps, 5V transitions. Pulse width varies less than 100 ps with 5V supply variations of 65%. The minimum input-trigger width is 30 ns, and input-output delay is 18 ns.

Comparator IC₁ inverts the input pulse (Figure 2, Trace A) and isolates the 50Ω termination. IC₁’s output drives fixed and variable RC networks. Programming resistor R₉ primarily determines the networks' charge-time difference and, hence, delay at a scale factor of approx 80Ω/ns. Comparators IC₂ and IC₃, arranged as complementary-output-level detectors, represent the networks' delay difference as edge-timing skew. Trace B is IC₃’s fixed-path output, and Trace C is IC₂’s variable output. Gate G₁’s output (Trace D), which is high during IC₂-IC₃ positive overlap, presents the circuit output pulse. Figure 2 shows a 5V, 5ns width, measured at 50% amplitude, output pulse with R=390Ω. The pulse is clean and has well-defined transitions. Post-transition aberrations, within 8%, derive from G₁’s bond-wire inductance and an imperfect coaxial probing path. Figure 3 shows the narrowest full amplitude, 5V pulse available. Width measures 1ns at the 50% amplitude point and 1.7 ns at the base in a 3.9 GHz bandwidth. Shorter widths are available if partial amplitude pulses are acceptable. Figure 4 shows a 3.3V, 700 ps width (50%) with a 1.25 ns base. G₁’s rise time limits minimum achievable pulse width. The partial-amplitude pulse, 3.3V high, measures 700 ps with a 1.25 ns base (Figure 5). Figure 6, taken in a 3.9 GHz sampled bandpass, measures 520 ps rise time. Fall time is similar. The transition of the probe edge is well-defined and free of artifacts.

Also see:

- Stable pulse generator uses matched transistors in a current mirror
- Auto pulse generator senses and responds to a probed load
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