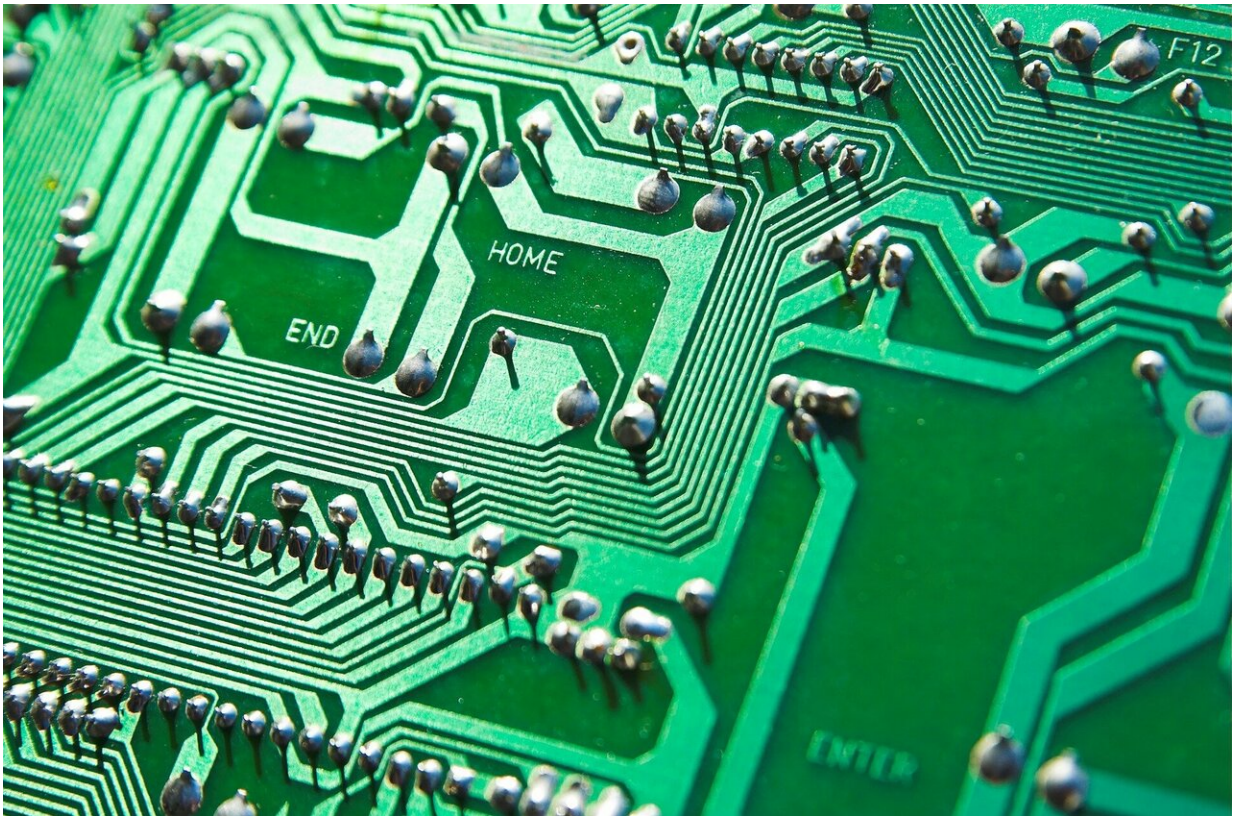


# A gate driver for circuit bipolar transistor electronic switches

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Many homes have electronic timers for automatically turning lights on or off automatically the same time each day. However, the precise control of larger electrical devices requires more sophisticated electronics.

Scientists from the Institute of Industrial Science at The University of Tokyo have successfully developed a programmable gate driver for solid-state electronic transistor switches, and using empirical tests, show that their device showed reduced switching loss even under changes in input current and temperature fluctuations.

Insulated-gate bipolar transistors (IGBTs) are semiconductor electronic elements that can be used in rapid electronic switches of high-powered devices. Because they can control electric loads up to hundreds of kilowatts, IGBTs are suitable for operating of power supplies, traction motors, or induction heaters. In addition, owing to their ability to [switch](#) on and off quickly, IGBTs can also be used for [control systems](#) in industrial applications. However, these switches can experience switching loss based on variations in the input current or temperature. Creating a device with automatic timing would help improve the reliability of these systems.

Now, the team of researchers at The University of Tokyo has developed the first active digital gate driver integrated circuit (IC) with a fully integrated automatic timing control function that achieves both single-chip integration and real-time control. "Our IC includes the world's first 6-bit programmable gate with closed-loop active gate drivers," first author Dibo Zhang says.

An important feature of the IC was the inclusion of real-time automatic control functions on a single chip. This is done by detecting the rate of change of the current as a function of time by sensing the voltage of the parasitic inductance, which is an unavoidable effect present in [electronic devices](#). The research team tested the performance of the new device over a wide range of temperatures. Their [single-chip](#) integration of a timing mechanism allowed for lower cost while maintaining [precise control](#). The fact that it remained stable under fluctuating operating conditions allowed a single programmable device to replace a collection

of different products optimized for different situations.

"Being able to provide programmable, real-time control at low cost should hasten adoption of this type of device," says Makoto Takamiya, senior author. This work may lead to more flexible and reliable control of large electrical currents, and future designs may be extended to include more complex programming features.

The article, "Digital Gate Driver IC with Fully Integrated Automatic Timing Control Function in Stop-and-Go Gate Drive for IGBTs," was presented at the [IEEE Applied Power Electronics Conference and Exposition](#) (APEC), March 19–23.

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