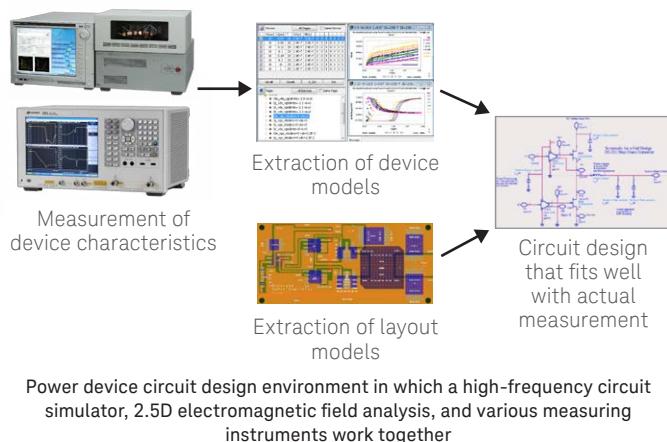


## [Power Device]

# Switching circuit design techniques using power devices such as GaN and SiC



**Are you missing out** on a better design technique, thinking in the following way?

“We can’t do any better because we don’t have a device model.”

“There is a limit to what SPICE can do.”

“It is impossible for circuit designers to create models.”

“I’m sure my competitors also don’t have better solutions.”

Establishing a technique for design that matches the actual measurement as early as possible is what will determine who **wins the competition for the market.**

## Developing a design environment considering the influence of high frequency

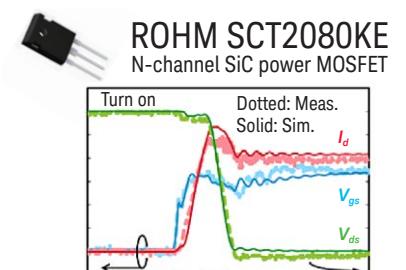
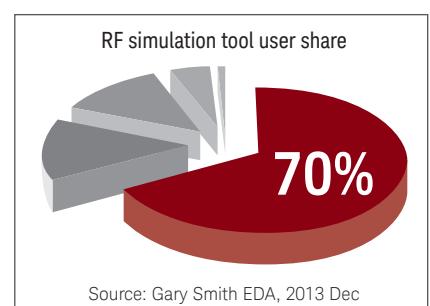
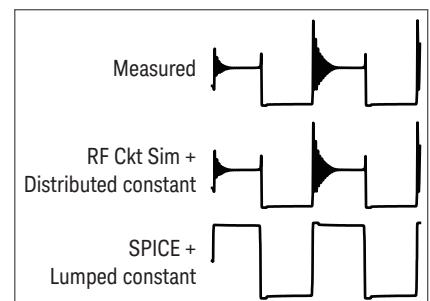
To realize a design that suits the actual measurement with a switching circuit that uses a power device having a rise time as short as 10 nsec (equivalent to a frequency of 100 MHz), the influence of frequency components up to 10 times, or approximately 1 GHz, must be considered. In addition to creating a layout model with frequency characteristics that take into account parasitic components taking advantage of electromagnetic (EM) field analysis instead of SPICE analysis using a lumped parameter model, it is important to move quickly to a design environment that uses high-frequency circuit design tools.

## Selecting the standard of high-frequency circuit design

Leading designers of high-speed switching circuits are moving towards the usage of a de facto standard high-frequency simulation tool. This practice may be unknown in the conventional low-speed switching circuit market. It is important to select an industry-standard tool to avoid failure risks when the design moves into the actual build environment.

## Acquiring an accurate device model

A model that accurately simulates the behavior of a device is important, but the reality is that deviation from the actual operation is still large. While waiting for a better model from the device manufacturers, some pioneering circuit designers are working voluntarily on the creation and verification of a device model that matches actual measurements. Device modeling is a challenging but necessary task in order for circuit designers to gain market share. Some companies have chosen to outsource device modeling.

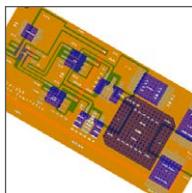


Source: IEICE the 29th Workshop on Circuits and Systems



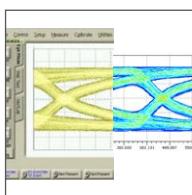
### Curve tracer for circuit designers

With B1506A, even a circuit designer not familiar with device modeling can easily acquire data such as IV, CV, and Qg, that are necessary for modeling just by following the work procedure presented.



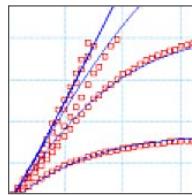
### A high-precision layout model that is readily accessible

Momentum, a 2.5D EM tool, allows you to model a board layout with frequency characteristics. It can be used for various types of board data.



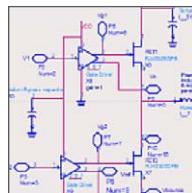
### Verification of simulation probability is also available

Keysight provides a one-stop solution for modeling, simulation and actual measurements. You can also verify the probability and validity of each result.



### Device model extraction service

Once you have measured the device characteristics, leave the rest to us. You will have the device model you want without having to spend time to learn modeling knowledge.



### Achieving simulation that considers high frequency

With its ease of use and powerful capabilities, Keysight's Advanced Design System (ADS) has garnered a global share of over 70% among high frequency circuit designers, enabling design simulations that match actual measurements.



### Together with the major players in the market

Keysight continues to collaborate with major players to drive better design and test solutions based on evolving circuit designs and challenges.

## Recommended configuration

Model Number	Description	Remarks
Measurement of device characteristic data		
B1506A	Power device analyzer for circuit design Curve Tracer	IV, CV, and temperature characteristics
E5061B	ENA Series Network Analyzer	S parameter
Device modeling		
W8500BP	IC-CAP Device Modeling Platform Bundle	Extraction by customer
E4725A	Parameter extraction & modeling service	Extraction by Keysight
circuit design and evaluation		
W2211BP	ADS core, time domain, layout, Momentum bundle	Layout model creation and circuit design
DSOS104A	Infiniium S-Series Oscilloscopes	Switching waveform observation

## Related Documents

Title	Remarks
[Case Study] Application of GaN Power Switches for Power Electronics Has Started: Circuit Design and Layout Facilitated by a Powerful Simulation Tool (Transphorm)	<b>5992-2180ENN</b>
Physical Design Techniques for High Speed GaN Power Converters (Transphorm Japan Inc. co-authored with Keysight, with Japanese & English notes)	To be published in March 2017

The documents can be downloaded from the following webpage.

[www.keysight.com/find/autovehicles](http://www.keysight.com/find/autovehicles)

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