Measuring Terminal Capacitance and Its Voltage Dependency for High-Voltage Power Devices

Author(s): Funaki, T (Funaki, Tsuyoshi)[1]; Phankong, N (Phankong, Nathabhat)[2,3]; Kimoto, T (Kimoto, Tsunenobu)[4]; Hikihara, T (Hikihara, Takashi)[2]

Source: IEEE TRANSACTIONS ON POWER ELECTRONICS **Volume:** 24 **Issue:** 5-6 **Pages:** 1486-1493 **DOI:**10.1109/TPEL.2009.2016566 **Published:** MAY-JUN 2009

Abstract: The switching behavior of semiconductor devices responds to charge/discharge phenomenon of terminal capacitance in the device. The differential capacitance in a semiconductor device varies with the applied voltage in accordance with the depleted region thickness. This study develops a C-V characterization system for high-voltage power transistors (e.g., MOSFET, insulated gate bipolar transistor, and JFET), which realizes the selective measurement of a specified capacitance from among several capacitances integrated in one device. Three capacitances between terminals are evaluated to specify device characteristics-the capacitance for gate-source, gate-drain, and drain-source. The input, output, and reverse transfer capacitance are also evaluated to assess the switching behavior of the power transistor in the circuit. Thus, this paper discusses the five specifications of a C-V characterization system and its measurement results. Moreover, the developed C-V characterization system enables measurement of the transistor capacitances from its blocking condition to the conducting condition with a varying gate bias voltage. The measured C-V characteristics show intricate changes in the low-bias-voltage region, which reflect the device structure. The monotonic capacitance change in the high-voltage region is attributable to the expansion of the depletion region in the drift region. These results help to understand the dynamic behavior of high-power devices during switching operation.

Addresses:

1. Osaka Univ, Div Elect Elect & Informat Engn, Grad Sch Engn, Suita, Osaka 5650871, Japan
2. Kyoto Univ, Dept Elect Engn, Grad Sch Engn, Kyoto 6158510, Japan
3. Rajamangala Univ Technol Thanyaburi, Dept Elect Engn, Thanyaburi 12110, Thailand
4. Kyoto Univ, Dept Elect Sci & Engn, Grad Sch Engn, Kyoto 6158510, Japan

แหล่งอ้างอิง Web of Science