Erratum to "Comparison of Wide-Band-Gap Technologies for Soft-Switching Losses at High Frequencies"

Armin Jafari, Mohammad Samizadeh Nikoo, *Member, IEEE*, Nirmana Perera, *Student Member, IEEE*, Halil Kerim Yildirim, Furkan Karakaya, Reza Soleimanzadeh, and Elison Matioli, *Member, IEEE*

In the above mentioned paper [1], the following figures were originally published with low resolution. Please find here the corrected figures.

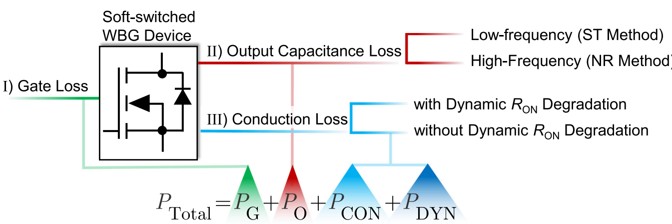

Fig. 1. Major sources of losses in a soft-switched WBG device. Various WBG technologies exhibit significantly different loss behaviors, which are comprehensively analyzed in [1].

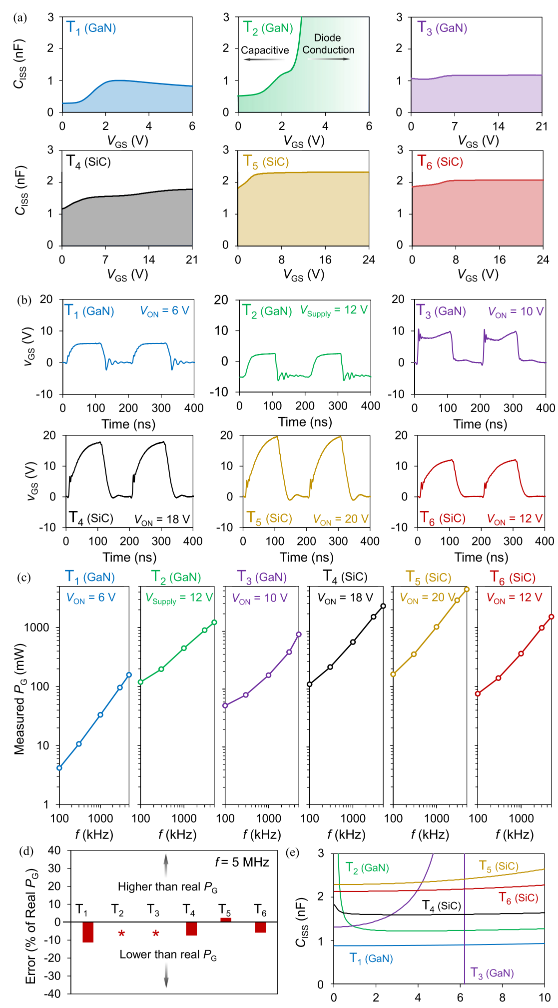

Fig. 2. Gate loss evaluation method using small-signal C_{ISS} measurement. (a) Small-signal C_{ISS} versus V_{GS} for T_1–T_6 measured at 1 MHz. The gate in most of the transistors can be regarded as an *RC* circuit. Device T_2 exhibits a capacitive behavior for low drive voltages, and as the voltage increases, it performs similarly to a diode with an ON-state current, as indicated by the gradient shading under its C_{ISS}-versus-V_{GS} curve. (b) Time-domain gate-to-source voltages for T_1–T_6, driven at 5 MHz with nominal gate conditions. (c) Measurement of real P_G versus f from 100 kHz to 5 MHz at nominal gate driver conditions. (d) Error of using the small-signal Q_G from (2) for P_G evaluation at 5 MHz. The recommended method shows a consistent error of less than 10%. Symbol "$*$" indicates that the recommended method is not applicable to T_2 and T_3 as their gates cannot be modeled with *RC* circuits. (e) Frequency dependence of C_{ISS}. T_2 and T_3 devices exhibit a strong variation in C_{ISS}, suggesting that their gate cannot be modeled as *RC* circuits. T_3 shows a resonance at about 6.5 MHz.

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The authors are with the Power and Wide-Band-Gap Electronics Research Laboratory (POWERlab), École Polytechnique Fédérale de Lausanne (EPFL), CH-1015 Lausanne, Switzerland (e-mail: armin.jafari@epfl.ch; mohammad.samizadeh@epfl.ch; nirmana.perera@epfl.ch; halil.yildirim@epfl.ch; furkan.karakaya@metu.edu.tr; reza.soleimanzadehardebili@epfl.ch; elison.matioli@epfl.ch).

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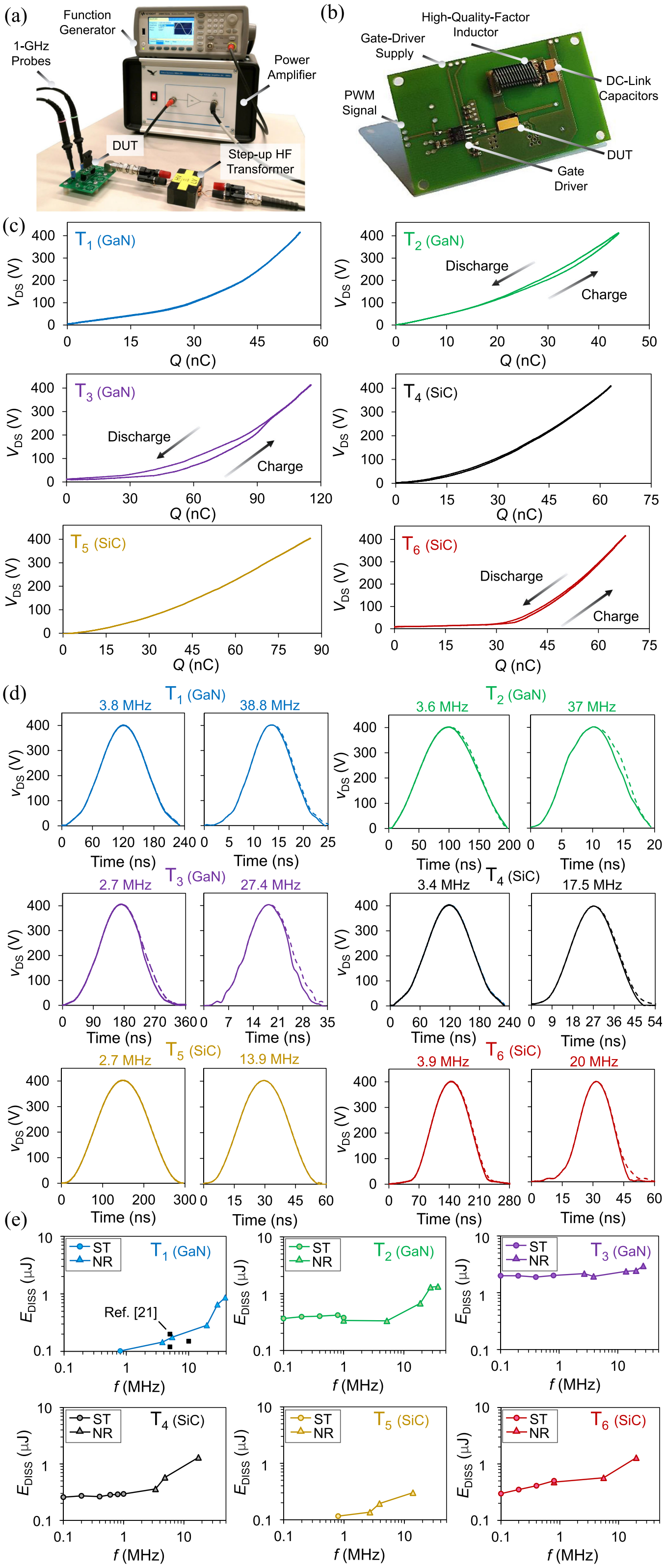

Fig. 3. Evaluation of large-signal C_{OSS} losses. (a) Test setup for ST experiment composed of a DUT, a high-frequency step-up transformer, a WMA-300 power amplifier and a Keysight 33600A function generator. (b) NR test board including a gate drive and a high-quality-factor inductor in series with the DUT. (c) V_{DS}-versus-Q results based on ST measurement for T_1–T_6 at 100 kHz and 400 V. (d) Time-domain v_{DS} for T_1–T_6 using the NR method at two distant frequencies. The dashed curves are the mirrored ones of the rising half of the generated pulse. A higher deviation from the solid-lined curve indicates higher E_{DISS}. (e) E_{DISS} versus frequency for T_1–T_6 measured using ST ($f < 1$ MHz) and NR ($f > 1$ MHz) methods.

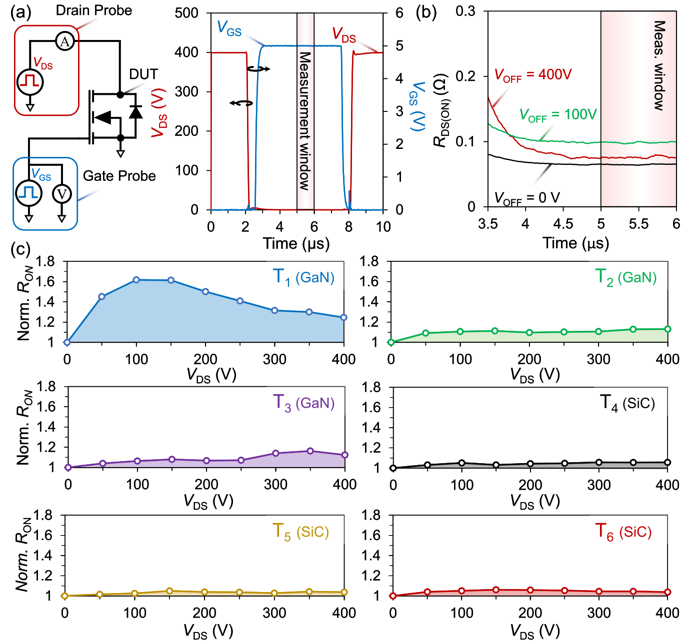

Fig. 4. Dynamic $R_{\mathrm{DS(ON)}}$ measurement using the pulsed-IV method with a 50-kHz pulse repetition rate. (a) DUT was subjected to V_{GS} and V_{DS} pulses and the resistance was measured after the settling time of the setup was reached. (b) $R_{\mathrm{DS(ON)}}$ variation for T_1 at OFF-state V_{DS} of 0 V (no voltage stress), 100 V, and 400 V. (c) Normalized dynamic $R_{\mathrm{DS(ON)}}$ at different V_{DS} values for transistors T_1–T_6. $R_{\mathrm{DS(ON)}}$-versus-V_{DS} pattern varies between GaN devices. SiC transistors exhibit a negligible increase of $R_{\mathrm{DS(ON)}}$. Devices were subjected to 20% of their nominal current. $R_{\mathrm{DS(ON)}}$ was captured 2.5 μs after the DUT turned ON, and was averaged over a 1-μs interval to reject noise.

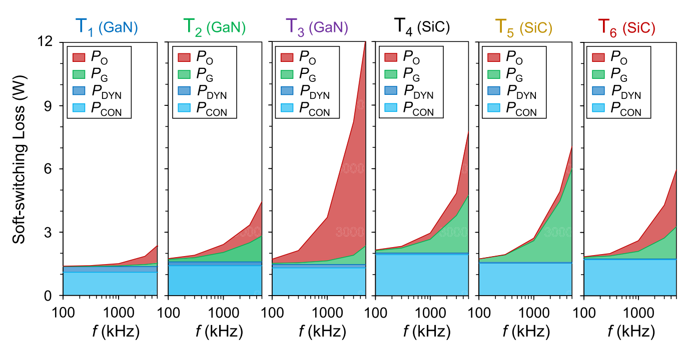

Fig. 5. Soft-switching loss components versus frequency for transistors T_1–T_6 at nominal V_{GS} when transistors are subjected to a V_{DS} of 400 V and 20% of their nominal current. The comparison is of great significance for selection of WBG devices, efficiency optimization, and proper design of cooling systems.

REFERENCE

[1] A. Jafari *et al.*, “Comparison of wide-band-gap technologies for soft-switching losses at high frequencies,” *IEEE Trans. Power Electron.*, vol. 35, no. 12, pp. 12595–12600, Dec. 2020.