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(54) **ACTIVE GATE VOLTAGE CONTROL CIRCUIT FOR BURST MODE AND PROTECTION MODE OPERATION OF POWER SWITCHING TRANSISTORS**

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(57) **ABSTRACT**

An active gate voltage control circuit for a gate driver of a power semiconductor switching device comprising a power semiconductor transistor, such as a GaN HEMT, provides active gate voltage control comprising current burst mode operation and protection mode operation. The gate-source turn-on voltage $V_{gs(on)}$ is increased in burst mode operation, to allow for a temporary increase of saturation current. In protection mode operation, a multi-stage turn-off may be implemented, comprising reducing $V_{gs(on)}$ to implement fast soft turn-off, followed by full turn-off to bring $V_{gs(on)}$ below threshold voltage, to reduce switching transients such as V_{ds} spikes. Circuits of example embodiments provide for burst mode operation for enhanced saturation current, to increase robustness of enhancement mode GaN power switching devices, e.g. under overcurrent and short circuit conditions, or to provide active gate voltage control which adjusts dynamically to specific operating conditions or events.