

Innovative Design of an Automotive High Side Smart Switch Based Upon Frugal Engineering Concepts

Vaidya, V.M.

ABSTRACT - Automotive electronics is increasingly playing a vital role in all vehicle subsystems. Since an electronic control system needs to be interfaced with the outside world, an electronic smart switch forms a key output interface with various loads such as solenoids, lamps, motors, relays, fans etc. Although integrated circuit based smart-switch semiconductor solutions are provided by all global semiconductor vendors, they prove more often than not to be overdesigned for majority of situations relevant to low end vehicles. They are also generously loaded with standard high-end features like thermal and overload protection which may not always be required. In addition, external transient protection and on-chip diagnostic features lend further complexity to the entire solution. This paper proposes a novel smart switch design which can be optimally tailored to given output load requirements such as current profile, thermal requirements, protection on one hand and provides optimal pin count by combining diagnostic and command functions into a common terminal pin. Transient protection requirement may be minimized by judicious choice of the active device. The smart switch system design employs system engineering techniques which lists performance requirements and explores alternate system designs to meet the same. All the alternatives are rated on various performance counts to arrive at the rightmost choice fitting a given application. The paper ends with a subsystem design example which covers both hardware philosophy and a state machine based low level command/diagnostic driver. Future directions and opportunities for these solutions are discussed at the end. © 2022 SAE International. All Rights Reserved.

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