



FRAMEWORK IMPLEMENTATION, FIRMWARE DEVELOPMENT AND CHARACTERIZATION OF FLEX-SPI COMMUNICATION PROTOCOL: ENERGY CONSUMPTION ANALYSIS AND COMPARISON WITH I²C STANDARD

P. Visconti¹, G. Giannotta^{2#}, R. Brama^{3#}, P. Primiceri⁴, R. de Fazio⁵, A. Malvasi^{6#}

Department of Innovation Engineering, University of Salento, 73100, Lecce, Italy

[#] CMC Labs -A Division of CMC S.r.l.- C.da Pagliarulo sn – 72012, Carovigno (BR), Italy

Emails: paolo.visconti@unisalento.it¹, gmgianotta@gmail.com², r.brama@cmclabs.com³, patrizio.primiceri@unisalento.it⁴, defazio_roberto@libero.it⁵, a.malvasi@cmclabs.com⁶

Submitted: Aug. 2, 2017

Accepted: Oct. 15, 2017

Published: Dec. 1, 2017

Abstract – *In this paper, we report a detailed description of developed Flex-SPI firmware structure together with experimental tests carried out by using ad-hoc instrumental setups based on TI MSP-EXP430F5438 experimenter boards. Developed framework, aimed to provide a solid base to test the possibility of performing a shared SPI communication with a fixed number of wires without renouncing to push-pull output stage advantages, has been implemented and successfully validated. Also, FlexSPI energy consumption has been evaluated and then compared with the I²C one, by proper experimental setups and related data processing: the two protocols, in fact, share several features, although they rely on a different hardware configuration. The energy/bit metric was chosen so that the two output stages can be compared regardless the effective quantity of exchanged packets; thus, this measure provides an indication of necessary energy amount to move a single bit to guarantee the correct firmware functionality. Despite larger quantity of exchanged data due to channel reservation needs (with a 35% traffic overhead, in the performed tests), the FlexSPI total energy consumption is comparable with the I²C one, at the same communication speed; thus a lower energy/bit requirement is required for FlexSPI protocol, decreasing with the negotiated speed, in this way proving FlexSPI protocol as a suited and valid choice for high-speed low-consumption communications inside embedded systems with a developed architecture capable of great flexibility.*

Index Terms: communication protocol, smart objects, FlexSPI, firmware, energy consumption, PIC, I²C.