

UNIVERSITI TEKNOLOGI MARA

**COMPACT SINGLE-STAGE INPUT-
POWERED BRIDGE RECTIFIER
WITH BOOST SWITCH WITH HIGH
OUTPUT POWER FOR ENERGY
HARVESTING SYSTEM USING 0.18-
MICRON CMOS TECHNOLOGY**

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ABSTRACT

The demand on microwatt to milliwatts energy harvesting systems has been increasing recently with the increase of the needs for wireless self-powered device applications. With the small output voltage and the AC output from the micro harvesting generators, highly precise specifications, leading to challenging designs, optimizations and realizations of its every component are imposed. Rectifier, which is normally located right after the energy generator in the energy harvesting system, is required to be compact, with high efficiency to produce as high output power as possible. It is in this context that this thesis is focusing, where a new topology of CMOS bridge rectifier is proposed, offering advantages in terms of the compactness and high output power, which is suitable for wireless power devices applications. CMOS technology is seen as a straightforward solution for compactness as it offers possibility to reduce the full wave rectifier circuit size. The proposed rectifier circuit topology is designed such that the threshold voltage, which is a common source of voltage drop in the system, can be reduced, in order to maintain high output voltage. A boost switch is also integrated in the topology, to play the main role in the system voltage doubler, which is much simpler and requires lesser external connections as compared to other recent topologies. Powered by its input AC voltage, the overall circuit will be implemented using 0.18-micron CMOS process technology with low threshold voltage. The analysis of the MOS-based circuits is performed through numerous designs and simulations using simulation tools. Measurement and testing of the prototypes are carried out using DC-DC probes to validate the proposed idea and concept. While providing 1.272 V dc output voltage across a 2 k Ω resistive load from 1.0 V peak AC input voltage at 50 Hz, the proposed bridge rectifier with boost switch achieved the measured output power of 1.65 mW. The proposed rectifier topology implemented on the highly rated CMOS technology is proven to offer compact and efficient solutions to further enhance the energy-harvesting domain of technology. With the overall active surface area of 0.024 mm² and with only six external connections, the proposed rectifier design is found to be more compact than other reported rectifiers to date.