# CAVITY AND AMPLIFIER DESIGN FOR A SOLID-STATE MICROWAVE OVEN

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This paper presents the design of a resonant cavity, probes and amplifiers for a solid-state microwave oven operating in the 2.45GHz unlicensed heating and industrial band. The solid-state power amplifier (PA) is presented with a variable and generally unknown load when food is placed and cooked in the resonator. In other approaches, circulators are used at the output of an LDMOS PA, resulting in relatively poor efficiency *(Farhat and Gajadharsing, NXP Semiconductors 2012)*. In this work, in order to increase the efficiency we eliminate the circulator by using a load-modulated PA architecture.

The PA consists of two saturated high-efficiency class-E amplifiers that are power-combined with a non-isolated combiner. The output of the combiner is connected to a variable load presented by the oven cavity. In order to minimize the reflected power, the relative phases at the input of the high-efficiency PAs are controlled (*Sanchez et al, IEEE IMS 2012*). The phase control is calibrated by pre-measuring and simulating a range of possible loads and entering them into a look-up table. In this outphasing-like configuration, the amplifiers are always operated around peak efficiency. LDMOS (Infineon) and GaN (Qorvo) transistors are compared for this configuration in terms of efficiency and power, and two such power-combined amplifiers are coupled to the cavity fields on two sides of the resonator. Driver amplifiers and oscillators are also considered as a part of the design.

Several probe types are investigated using full-wave simulations (Ansys HFSS), and their geometry and position are varied with two goals in mind: impedance matching to the PA and field uniformity inside a food phantom model. The cavity size is varied as well, and the SAR measured inside the phantom for maximized and uniform heating. Frequency modulation is studied as a means to increase the field uniformity.