Although RTL power macromodeling is a mature research topic, it is not yet broadly accepted in the industrial environment. One of the main reasons impairing its widespread use as a power estimation paradigm is that each macromodeling technique makes some assumptions that lead to some sort of intrinsic limitation, thereby affecting its accuracy. This paper discusses the limitations that can lead to unacceptably high estimation errors. First, a qualitative analysis uncovers the implicit assumptions and their resulting limitations. Then, a consistent set of experiments, performed on a same implementation framework, quantitatively compares three well-known macromodeling techniques. Experimental results show that each macromodel is more suitable for a specific region of the input space. Therefore, this work not only identifies the lack of robustness of each macromodel, but also provides proper grounds on how they should be safely combined towards a wider acceptance of the macromodel paradigm.