The recent financial crisis, responsible for massive accumulations of credit events, emphasizes the urgent need for adequate portfolio default models. Due to the high dimensionality of real credit portfolios, balancing flexibility and numerical tractability is of utmost importance. To acknowledge this, a multivariate default model with interesting stylized properties is introduced in the following way: a non-decreasing shot-noise process serves as common stochastic clock. Individual default times are defined as the first-passage times of the common clock across independent exponentially distributed threshold levels. We obtain a default model which has a dynamic stochastic representation, contagion effects, a positive probability for joint defaults, the ability to separate univariate marginal laws from the dependence structure, and the option for efficient pricing routines under a "large homogeneous groups" assumption. Besides this, the model is well-suited for insurance portfolios which are subject to catastrophe risks and the pricing of catastrophe derivatives.