The theory of spontaneous four-wave mixing in a microring resonator is developed. The rate of photon pair emission is calculated analytically for both the monochromatic-pump and pulsed-pump regimes taking into account group velocity dispersion. In doing so, we consider rising exponential pulses which are optimal for exciting single cavity modes. The group velocity dispersion is studied as a function of the waveguide width and height for a particular case of a silicon-nitride racetrack resonator. The results of numerical simulations are in good agreement with the experimental data. The microring resonators are fabricated using both ridge waveguides (full etched) and rib ones (half etched). It is found that the latter allows better control of parameters during the fabrication process thereby making it more robust.