In this paper, an asymmetrical space vector pulse-width modulation (SVPWM) fault-tolerant control is proposed for the five-phase permanent-magnet motor under the open-circuit condition of a single phase. The key of this method comes from two parts. First, the voltage vector diagram is rebuilt in the event of an open-circuit fault. Second, the switching signals constructing an asymmetry waveform are selected in one sector. Then, this asymmetrical SVPWM control can reduce the amplitude and total harmonic distribution of currents in healthy phases, though it has limitation for the open-circuit condition of two phases. Additionally, both simulated and experimental results are provided to validate the good performances of the proposed fault-tolerant drive, maintaining average torque, and low torque ripple during fault. Finally, the dynamic responses of open-loop and close-loop condition are measured. The results show that the proposed method can offer comparable dynamic performance of normal SVPWM control that is widely used in healthy five-phase motor drive.