

ABSTRACT

A storage device including a nonvolatile memory device that includes a nonvolatile memory cell array including a string including first and second memory cells stacked sequentially, and an OTP memory cell array that stores reference count values, the first and second memory cells respectively connected to first and second word lines; a controller including a processor that generates a read command for the first memory cell; a read level generator including a counter that receives the read command and calculates an off-cell count value of memory cells connected to the second word line, and a comparator that receives a first reference count value from the OTP memory cell array, compares the off-cell count value with the first reference count value to determine a threshold voltage shift of the second memory cell, and determines a read level of the first memory cell based on the threshold voltage shift.

FIG. 2