Rubik 3x3x4

Made by Cube 4 You (C4U), 2009.
(plastic, 2.2 by 2.2 by 3 inches;
white body has opposite sides white / blue, red / orange, green / yellow,
the same as the color scheme as the standard Rubik's 3x3x3;
black body has opposite sides black / white, red / yellow, green / blue)

This extension of the standard Rubik's 3x3x3 cube allows only 180 degree rotations in two of the dimensions. One solution approach is to think of an "outer" Rubik 2x3x3 Domino formed by the top and bottom layers with an "inner" domino in the middle:

1. Solve the outer domino.

2. Solve the inner domino, except if your solution makes use of flips of the front, back, or left sides, replace each such flip by a flip of the right side (that is, rotate the middle layers appropriately, flip the right side, rotate the middle layers back).

3. If Step 2 ended up using an even number of flips, then the puzzle is solved. Otherwise, perform the following transformation, adapted from Jaap's Page for the domino, that does nothing to the middle two layers (by exchanging an upper and lower middle edge) using an odd number of flips:

\[ D2 \ R \ M - (D2 \ R)^3 \ M \ R \ D2 \]

**Notation:** R denotes a flip of the right face, M a 90 degree clockwise rotation of the middle two layers (with respect to looking down from the top), D and D- clockwise and counter clockwise rotations of the lower middle layer (with respect to looking up from the bottom), 2 and 3 mean do it two or three times.

**Further Reading**

*Jaap's Page*, from: http://www.jaapsch.net/puzzles/cube334.htm
(Presents a similar approach with many additional transformations.)