$$
\begin{aligned}
\Psi_{239} &= C_1\left(|22du\rangle + |22ud\rangle - i\,|2du2\rangle - i\,|2ud2\rangle - i\,|d22u\rangle - |du22\rangle - i\,|u22d\rangle - |ud22\rangle\right) \\
&\quad + C_2\left(|2d2u\rangle + |2u2d\rangle - i\,|d2u2\rangle - i\,|u2d2\rangle\right)
\end{aligned}
$$

$$
C_1 = \frac{-\left(\frac{1}{4}\right) - \frac{i}{4}}{\sqrt{2}}
$$

$$
C_2 = \frac{\frac{-i}{2}}{\sqrt{2}}
$$