On any interval [a,b] in [0,1], there is an irrational number, since the irrationals are dense. So, on any interval, the infimum of f is 0, so all lower sums are 0. In that case, to satisfy the Riemann Criterion, it suffices to show that for all $\varepsilon > 0$ we can find a partition such that $U(f, \mathcal{P}) < \varepsilon$. We know that the max value of f on [0, 1] = 1, since no fraction in lowest terms will have a denominator less than 1, and 1 is a rational number $\frac{1}{1}$. The same argument can be applied to the first interval, $[0,\ t_1]$, since $0 = \frac{0}{1}$. It follows, then, that $M_1 = M_n = 1$. Similarly, on (0, 1), the max value of f is $\frac{1}{2}$.

So, take a partition $\mathcal{P} = 0, \frac{1}{k}, \frac{2}{k}, \ldots \frac{k-1}{k}, 1$. The entries are evenly spaces, with $\frac{1}{k}$ between them, and so $n = k$. Given this, we can write the upper sum.

$$\begin{aligned}
U(f, \mathcal{P}) &= \sum_{i=1}^{n} M_i (T_{i-1} - T_i) \\
&= \sum_{i=1}^{n} M_i \frac{1}{k} \\
&= \frac{1}{k} \sum_{i=1}^{k} M_i \\
&= \frac{1}{k} \left(\left[\sum_{i=1}^{k-1} M_i \right] + 1 \right) \\
&= \frac{1}{k} \left(\left[\sum_{i=2}^{k-1} M_i \right] + 2 \right) \\
&= \frac{1}{k} \sum_{i=2}^{k-1} M_i + \frac{2}{k} \\
&\leq \frac{k-2}{2k} + \frac{4}{2k} \\
&= \frac{k+2}{2k}
\end{aligned}$$

So if we can just find a value of k that makes $\frac{k+2}{2k} < \varepsilon$ we're done. And that's pretty easy.

$$\begin{aligned}
\frac{k+2}{2k} &< \varepsilon \\
k + 2 &< 2k\varepsilon \\
2 &< k(2\varepsilon - 1) \\
\frac{2}{2\varepsilon - 1} &< k
\end{aligned}$$

So given an ε, simply pick $k > \frac{2}{2\varepsilon - 1}$ and you're done.