Let Σ be a random variable

$\Sigma: \Omega \to \mathbb{R}$

with ~~PMF~~ PDF $p_\Sigma : \mathbb{R} \to [0, \infty)$:

$$P(\Sigma \in [a,b]) = \int_a^b p_\Sigma(\epsilon)\, d\epsilon$$

Stipulate: $\int_{-\infty}^{\infty} p_\Sigma(\epsilon)\, d\epsilon = 1$ (proper prob)

and $H(\epsilon) \stackrel{\sim}{=} \int_{-\infty}^{\infty} p_\Sigma(\epsilon) \ln p_\Sigma(\epsilon)\, d\epsilon < \infty$ (some entropy fn exists and is $<\infty$)

That is, if we rewrite $H(\epsilon)$ as:

$$H(\epsilon) = \lim_{a \to -\infty} -\int_a^0 p_\Sigma(\epsilon) \ln p_\Sigma(\epsilon)\, d\epsilon - \lim_{b \to \infty} \int_0^b p \ln p\, d\epsilon$$

$< \infty$