Enigmas, etc.

RF Input Current

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Figure 1 shows the rectifier circuit of this "Enigmas, etc." column series. The RF voltage source has a purely sinusoidal waveform. However, the current $i_s(t)$ flowing into the circuit is distorted from a sinusoid because of the diode nonlinearity. We can decompose $i_s(t)$ into its Fourier series:

$$i_s(t) = I_o + [I_P \;\; I_Q]\begin{bmatrix}\sin \omega t \\ \cos \omega t\end{bmatrix} + \cdots$$

where I_o signifies the zeroth-order or dc term, I_P and I_Q stand for the orthogonal first-order components, and … denotes the second-order and higher order harmonics that follow. Assuming a nominal 50% duty operation, we can infer I_P and I_Q backward from I_o. Which among the following is equal to I_P?

(a) I_o (b) $\frac{1}{2}I_o$ (c) $\frac{\pi}{2}I_o$ (d) $\frac{2}{\pi}I_o$

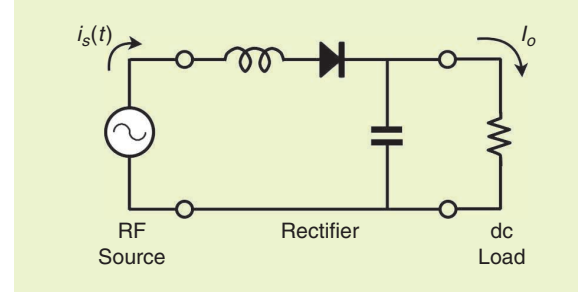

Figure 1. *Single-series diode rectifier. Given the dc output current, can we calculate the RF input current?*

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