

fundamental with an equal amplitude second harmonic present. The improvement is greatest at frequencies below the optimum transit-time frequency and it is possible to obtain power output comparable to and even slightly greater than that attained at the optimum single-frequency point. The second-harmonic tuning curve extends below the avalanche frequency, indicating that it is possible to obtain power from the diode at frequencies below the single-frequency operating range. However, for frequencies above the optimum 11 GHz the power improvement is small, and for frequencies from 12 to 20 GHz better performance is obtained using first-subharmonic tuning.

The first-subharmonic tuning curve shows that there is little improvement below 11 GHz, but that in the frequency range from 11 to

20 GHz some improvement can be obtained. In particular, at 20 GHz the improvement attainable is nearly 100 percent although the power is not as large as at the optimum single-frequency point.

In summary, the improvement attainable with harmonic or subharmonic tuning depends upon the relationship of the frequency at which power is desired to the optimum operating frequency of the diode. If the desired frequency is equal to the optimum, then the improvement attainable with harmonic tuning is in the range of 10 to 20 percent. If the desired frequency is below the optimum then second-harmonic tuning can provide substantial improvement. However, the power output attainable and the efficiency are still comparable to that attainable at the optimum point. For frequencies above the optimum,

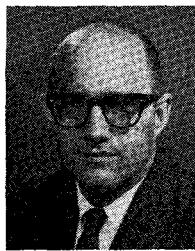
first-subharmonic tuning is preferable to second-harmonic tuning and significant improvement can be obtained. It should be emphasized that in this two-frequency mode attainable efficiency does not greatly exceed that attainable for the single-frequency IMPATT mode.

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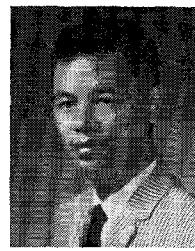
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