Abstracts

A Ka-band indium-antimonide junction circulator

C.K. Yong, R. Sloan and L.E. Davis. "A Ka-band indium-antimonide junction circulator." 2001 Transactions on Microwave Theory and Techniques 49.6 (Jun. 2001, Part I [T-MTT]): 1101-1106.

Following a brief overview of the underlying theory, experimental results are presented for the first time showing circulator action in a semiconductor junction structure. An axially magnetized indium-antimonide disc fixed in a three-port finline structure and cooled to the temperature of boiling nitrogen, 77 K gives circulation across K/spl alpha/-band. For a dc magnetic bias of 0.73 T, a 15-dB isolation is recorded from 28 to 40 GHz, or a fractional bandwidth of at least 35%. Typical insertion loss is less than 1.5 dB from the WG22 reference plane at the test fixture ports. Continued operation above 40 GHz is predicted, but has not yet been measured. Measurement suggests that circulation is evident even where the effective propagation constant is imaginary, although better theoretical agreement is achieved when this is a real quantity. This new device makes millimeter-wave broad-band circulation a possibility and confirms the current model based upon the Drude-Zener approximation. A theoretical example is then given for a design operating to 140 GHz, yielding a fractional bandwidth of 110%.

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