Abstracts

Design of Composite Magnetic Circuits for Temperature Stabilization of Microwave Ferrite Devices

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The magnetic flux density of unsaturated microwave ferrites can be made almost constant although microwave ferrite saturation magnetization, coercive force, and hysteresis loop shapes change substantially. Temperature stabilization of flux is achieved by a composite series magnetic circuit consisting of microwave, driver, and flux-limiter ferrites, and a control coil. The flux limiter constrains the circuit flux to an almost constant level throughout the operating temperature range, despite large changes in the size and shape of the microwave ferrite hysteresis loop. The driver ferrite supplies the MMF necessary to sustain the flux. Current impulses in the control coil energize and switch the circuit flux. Estimates of the required lengths and cross-sectional areas of the circuit elements, and of the required switching field and energy for a waveguide remanence phase shifter are given, along with the effects of leakage and fringing fluxes. Composite circuit techniques have been applied to an experimental remanence phase shifter. Unstabilized, a 16 percent loss of phase shift was incurred as a result of an 80°C rise in temperature. By applying composite circuit techniques, this value was reduced to less than 2½ percent for the same temperature range.

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