HYBRID APPLICATION AND DEFINITIONS

By definition, a hybrid is a four-port directional coupler with a -3dB coupling coefficient. It is theoretically matched at all four ports and has two ports where pair members are isolated from each other.

HYBRID OPERATION AS A POWER DIVIDER/COMBINER

Power combiners are devices that are in the simplest case the inverse of a power divider. So logically to produce a power combiner all you need to do is feed a power divider backwards, right? Well almost, for low power applications you can use a standard power divider backwards and in most cases it will work just fine. However when the signals start having some power, consideration must be made for exactly where all that power will be going.

When two or more signals are combined the net resulting signal is the vector sum of the inputs. For coherent signals this means that all of the energy that is put into the combiner will be transmitted to the combined output. On the other hand, for the case of non-coherent signals, this translates into less power being transmitted to the combined output than is being input into the unit. For a typical CDMA signal these combiner losses can approach 3 dB of the total input power. The combiner must absorb this extra energy and dissipate it as heat.

A traditional power divider uses the internal isolation resistors to dissipate this energy. Isolation resistors are designed to balance the node voltages in a power divider to provide output port isolation when the power divider is used in the forward direction. These resistors are typically very low power for two main reasons, they don't need to dissipate any power in their normal operating condition, and secondly larger resistors add unwanted stray capacitance and inductance into the circuit. This nature of the isolation resistor makes it difficult to produce a configuration that is efficient at dissipating large amounts of heat.

Hybrids offer may advantages when used as a power combiner over a traditional power divider. One of the primary advantages occurs when non-coherent signals are being combined. A hybrid does not try to dissipate the differential combining energy as heat, rather it ports the energy to the "Isolated Port", where an external high power termination can easily be added to dissipate the energy. A standard hybrid may be the best solution to a tough power combiner requirement. Understanding the nature of the signals being combined is the key to defining the best configuration of the power combiner for your application. Hybrids are available in many phase and amplitude variations. By using the phase charts of the hybrids, the combined energy path can usually be selected to meet your needs. If you are unsure, contact us and we will be glad to offer assistance.

Isolation: The difference in dB of the signal level measured between output ports with the input port properly terminated.

VSWR: Voltage Standing Wave Ratio is a measure of the deviation of impedance from the characteristic impedance of the power divider.

Phase Balance: The maximum peak-to-peak difference in phase (in degrees) between the outports of the power divider over the specified frequency range.

Input Power: The maximum power that may be supplied to the input port with all outports properly terminated.

Insertion Loss: The net unrecoverable power loss in dB based on one way transmission through the power divider.

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