MIC5830
MIC5830A
MIC5831

3dB QUADRATURE COUPLERS

MINIATURE 3 dB UHF QUADRATURE COUPLERS

. . . designed for use in applications such as power combining and dividing circuits, phase shifters, phase comparators, modulators and attenuators.

- Small Size – 1.25 x 1.25 x 0.140
- Low Insertion Loss – 0.25 dB (Max) to 0.35 dB (Max)
- High Isolation – 20 dB (Min)
- Small Coupling Variation

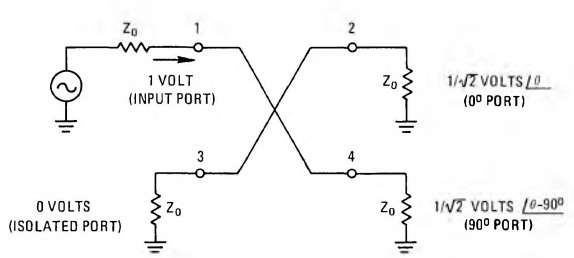
MINIATURE
3 dB UHF
QUADRATURE COUPLERS

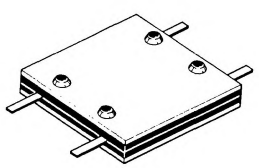
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Model No.	Frequency Range (MHz)	Impedance (Ohms)	Isolation (dB) Min	Amplitude Balance (dB) Max	Phase Balance (°) Max	Insertion Loss (dB)	VSWR Input Max
MIC5830	225-400	50	20	±0.5	±1.5	0.25	1.2:1
MIC5830A	225-400	50	20	±0.7	±3.0	0.30	1.2:1
MIC5831	450-512	50	20	±0.5	±2.5	0.35	1.2:1

Maximum Input Power: 100 W Average
Operating Temperature: -55 to +100°C

SIGNAL RELATIONSHIPS IN A PROPERLY TERMINATED COUPLER





CASE 230

See Packaging Information Section for outline dimensions.

3 dB UHF QUADRATURE COUPLER PARAMETER DEFINITIONS

1. Insertion Loss - Coupler insertion loss is defined as losses in dB of one way transmission through the coupler with all ports terminated in 50 ohms.

   Insertion Loss in

$$dB = 10 \log_{10} \frac{\text{(Input Power)}}{\text{(Power out of } 0^{o} \text{ port) + (Power out of } 90^{o} \text{ port).}}$$

2. Isolation - Coupler isolation is defined as signal level difference in dB between input port and isolated port when the two output ports (0^{o} port and 90^{o} port) are terminated in 50 ohm loads.
3. Phase Balance - Coupler phase balance is defined as the phase difference between the two output signals minus 90^{o}, with all ports terminated in 50 ohms.
4. Amplitude Balance - Amplitude balance is defined as the signal level difference (in dB) of the 0^{o} port output and/or 90^{o} port output referenced to the average output level.

   0^{o} port Amplitude Balance in dB

$$dB = 10 \log_{10} \frac{\text{(Power out of } 0^{o} \text{ port)}}{\frac{\text{(Power out of } 0^{o} \text{ port) + (Power out of } 90^{o} \text{ port).}}{2}}$$

   90^{o} port Amplitude Balance in dB

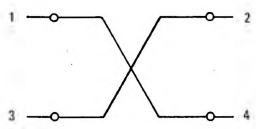
$$dB = 10 \log_{10} \frac{\text{(Power out of } 90^{o} \text{ port)}}{\frac{\text{(Power out of } 0^{o} \text{ port) + (Power out of } 90^{o} \text{ port).}}{2}}$$

APPLICATIONS INFORMATION

Motorola's 3 dB UHF couplers are stripline broadside couplers that are constructed from teflon fiberglass board and are sealed with a low loss, low dielectric compound. Small size is achieved by meandering the coupled lines.

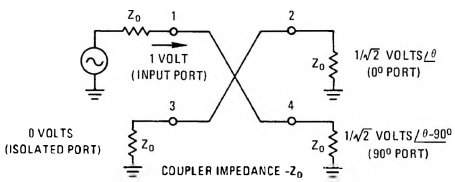
A 3dB UHF quadrature coupler is a four port network which can be depicted as shown in Figure 1. Application of a signal at

FIGURE 1 – 3 dB UHF Quadrature Coupler



any of the 4 ports (with all ports terminated in Z_o) results in equal signals at opposite port pairs with the adjacent port remaining isolated. For example, if a signal strength of one volt is applied to port 1 (see Figure 2), ideally the signals appearing at ports 2 and 4 will be $1/\sqrt{2}$ volts with a phase difference of 90^{o}, none of the voltage will appear at port 3. Thus port 3 is called the isolated port.

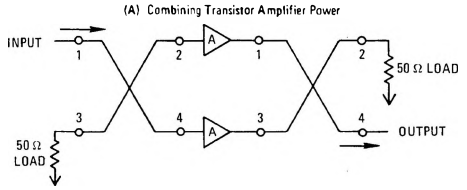
FIGURE 2 – Coupler driven by a signal source and terminated properly.



However if ports 2 and 4 are terminated in equal impedances other than Z_o (examples would be open or short circuits) all of the reflected signal will appear at port 3 (isolated port). Thus the drive source would see a constant impedance of Z_o.

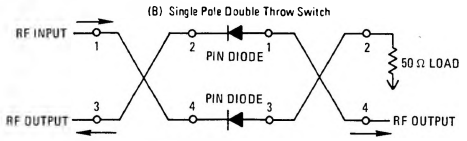
Applications - 3 dB UHF quadrature coupler applications are many, a few are given below.

(A) Combining Transistor Amplifier Power



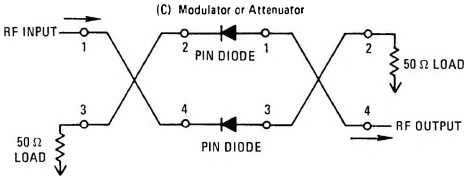
If the input impedances of the amplifiers are equal, reflected power will appear at port 3 resulting in a very low input VSWR. Output power at port 4 will be twice that of a single amplifier minus the coupler losses.

(B) Single Pole Double Throw Switch



By forward biasing the PIN diodes (low impedance mode) RF power can be switched to port 4. Reverse biasing the diodes (high impedance mode) results in power being switched to port 3 of the input coupler.

(C) Modulator or Attenuator



By changing the bias on the PIN diodes the level of RF appearing at port 4 of the output coupler can be controlled. For example, pulse modulation would result by switching the diodes off and on. An electrically controlled attenuator would be the result of varying the diodes between the off and on position.

MIC5830 and MIC5830A

FIGURE 3 – COUPLING versus FREQUENCY

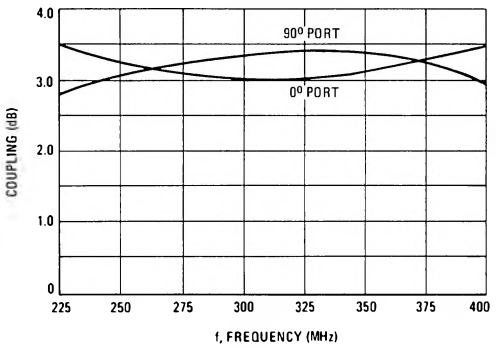


FIGURE 4 – INSERTION LOSS versus FREQUENCY

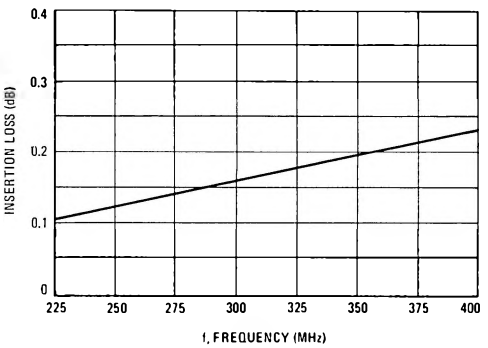


FIGURE 5 – ISOLATION versus FREQUENCY

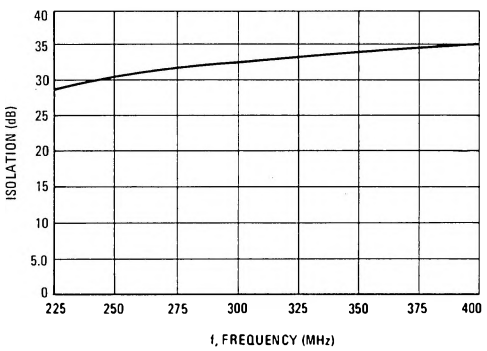


FIGURE 6 – INPUT VSWR versus FREQUENCY

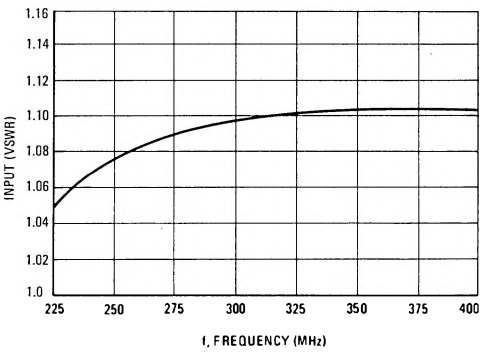
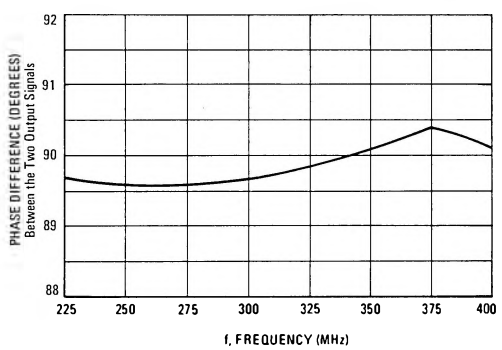


FIGURE 7 – PHASE DIFFERENCE versus FREQUENCY



MIC5831

FIGURE 8 – COUPLING versus FREQUENCY

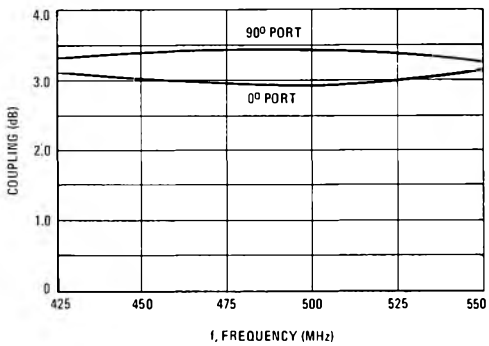


FIGURE 9 – INSERTION LOSS versus FREQUENCY

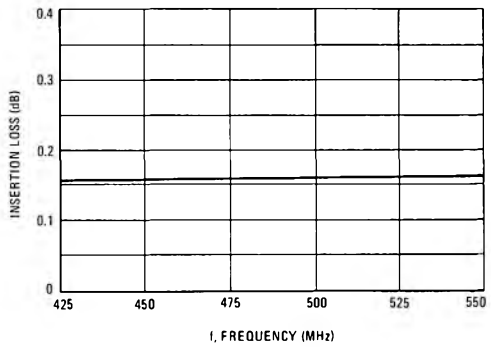


FIGURE 10 – ISOLATION versus FREQUENCY

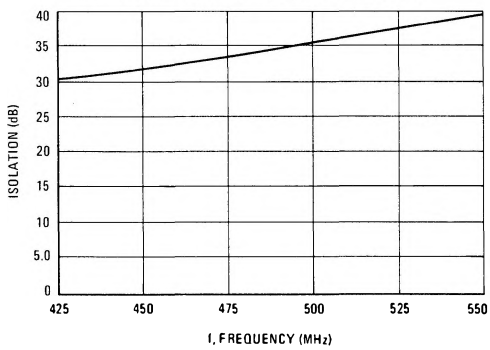


FIGURE 11 – INPUT VSWR versus FREQUENCY

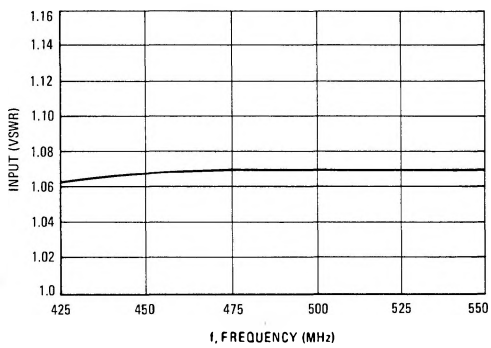


FIGURE 12 – PHASE DIFFERENCE versus FREQUENCY