Application Notes

Application: Attenuator And Bypass Circuits Using: RF300 / RF303 Series; High Repeatability, Ultra-Miniature, T05, RF Relays

Market:Switching applications up to and beyond 3 GHz.

End Users:

- ATE and desk top measurement equipment users
- Wireless communication companies

OEM Dilemma: Stable, reliable source for switching solutions when faced with the sometimes daunting task of switching high speed signals, regardless of whether it is a frequency domain or a time domain signal.

Competition: Genicom and RF switch manufacturers.

Primary Teledyne Relays Advantage:

- A standard relay with focus on RF applications.
- Significantly less expensive and smaller than RF switches.
- Availability of samples and production level quantities on short notice.

Teledyne Relays' TO-5 style relay has long been known for its excellent Isolation, VSWR and Insertion loss characteristics. However, the constant evolution of customer requirements has obliged Teledyne Relays to develop new solutions to changing problems. Considering increasing system level accuracy requirements, circuit level insertion loss and insertion loss repeatability becomes an ever increasing hurdle for the design engineer. The RF300 and RF303 relays have been designed by Teledyne Relays with emphasis on repeatability of insertion loss. This emphasis addresses the sometimes daunting task of switching high speed signals, regardless of whether it is a frequency domain or a time domain signal.

Applications in the frequency domain include Telecom, Cellular telephone, Attenuators, and antenna amplifier circuits, often called masthead amplifiers. Programmable attenuators and masthead amplifiers have long been an area in which the TO-5 relay has found acceptance.

Attenuators

A programmable attenuator makes use of a series of switching elements that will introduce a resistor network into a circuit. An incoming signal passes through the resistor network reducing the amplitude of the signal to a greater or lesser degree depending on the number of networks selected. Fig 1 is an example of a 0 dB (no attenuation) to 15 dB programmable attenuator in 1 dB step increments:
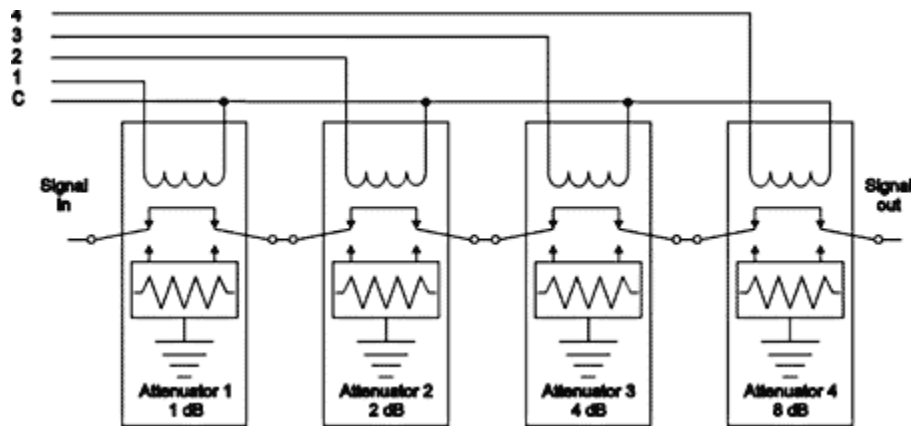

FIG. 1 Typical Programmable Attenuator Circuit

Often, as in the case of Fig. 1, the NC contacts are utilized to provide an unattenuated through path or low loss state when no coil power is applied. As each relay or combination of relays is selected, the attenuation value changes. The resistive elements of the attenuator circuit are the heart of the attenuator. However, if the switching elements' insertion loss varies, the attenuation value will also vary, sometimes beyond acceptable limits. This is what makes the RF300 and RF303 an ideal choice for discrete attenuator circuits.

Attenuation In DB				
Channel	1	2	4	8
0				
1	X			
2		X		
3	X	X		
4			X	
5	X		X	
6		X	X	
7	X	X	X	
8				X
9	X			X
10		X		X
11	X	X		X
12			X	X
13	X>		X	X
14		X	X	X
15	X	X	X	X

table 1 Programmable attenuator matrix

Table 1 is a matrix showing the channel combinations required for each attenuation value from 0 dB to 15 dB.

Masthead Amplifiers For Cellular Networks

In a typical base station, six antennae are mounted on a masthead to provide a 360Á range within a cell. Masthead systems have a common design problem; transmit/received signals share the same antenna. While there is sufficient power to broadcast to some remote, hand held unit, that same hand held unit has very limited power with which to broadcast back to the base station. To increase the receive range of a base station the signal is amplified. There are stages by which the incoming signal will be amplified but if the signal is too weak the amplified results will be essentially useless (signal to noise ratio). To improve signal to noise ratios the amplifier is placed in close proximity to the antenna reducing circuit losses caused by the interconnection medium which is usually coaxial cable.

Should the amplifier malfunction, 1/6th of the receive area will be blacked out until the amplifier can>