MicroNotes

MicroNote #708

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📁 The Advantages of PIN Diode Switches Over MESFET Switches
for IEEE 802.11a High Speed Wireless LAN Applications [1]

In the context of wireless mobile communications equipment, there is a need for the selection of signals from an array of two or more receive antennas to obtain the strongest signal available. This function is achieved by the use of a diversity switch.

The semiconductor devices that constitute the diversity switch should approximate the open- and short-circuit conditions of an ideal switch - nearly no insertion loss in the ON state and nearly infinite isolation in the OFF state. Silicon PIN diodes and MESFETs have different characteristics that must be considered when designing a diversity switch. Important system operating conditions governing the switch design are:

- Availability of one or two bias voltage polarities and amount of bias current for each polarity
- Amount of RF Power to be controlled (switched)
- Thermal conductivity available in the circuit configuration
- Amount of RF Signal Distortion (non-linearity) that can be tolerated to satisfy the BER specification
- Circuit layout space and geometry, and cost

All of these issues affect the choice of a PIN switch or a GaAs MESFET switch.

GaAs MESFET switches are marketed in injection molded lead frame packages and are very low cost. The package parasitics of these packages can vary as much as 20% among switches, even from the same lot. They are adequate for narrow band T/R switch applications, below 2 GHz, where low power is being switched and low distortion are not issues. If lead frame package drawbacks are a concern, the Nanomount circuit is the solution.

The PIN diode switch that is ideally suited for mobile wireless diversity switches, is the Microsemi Silicon Nanomount Switch (available from the Microsemi's Lowell facility)*. The Nanomount family of switches consists of three configurations of 4 MMSM* PIN diodes on a common substrate. These configurations are the MNM 4200 - PIN SPDT Switch, the MNM 4210 - PIN Transfer Switch (Dual Diversity Switch - ring configuration), and the MNM 4220 - PIN Switch Junction (Diversity Switch - star configuration).

The attached table displays the key performance characteristics of a GaAs MESFET SPDT switch and the Microsemi MNM 4200 PIN SPDP Switch, which is considerably smaller that the MESFET switch and it has far superior Isolation, Insertion Loss, and power control capabilities.

The transmitter / receiver switching function is also needed and can be implemented with a T/R switch and channel filters or a duplexer, combined with the diversity switch. The MNM 4200 can be used either as a T/R switch or as a diversity switch.

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|		GaAs MESFET SPDT switch	Microsemi Silicon Nanomount switch
Bandwidth		DC to 2500 MHz	100 to 6000 MHz
Isolation	900 MHz (LMDS) 2400 MHz (PCS) 5600 MHz (WLAN)	23 dB typical Not Specified Not Useable	40 dB typical 30 dB typical 20 dB typical
Insertion loss	900 MHz (LMDS) 2400 MHz (PCS) 5600 MHz (WLAN)	1 dB typical Not Specified Not Useable	0.25 dB typical 0.5 dB typical 1 dB typical
Power Handling		1 Watt	10 Watts
Third order IP		+ 39 dBm Typical	+ 39 dBm Typical
Switching Speed		Not Specified	10 nS typical
Package Construction		SOT-23-5 Plastic injection molded lead frame;	MMSM hermetic-on-microstrip EPSM ceramic;
Overall Footprint		118 X 122 mils maximum	75 X 100 mils maximum
Bias supply		0 to +8 V	+/- 20 mA
Control supply		-1 to +6 V	Reverse bias polarity

MNM 4200: Series/Shunt SPDT Switch
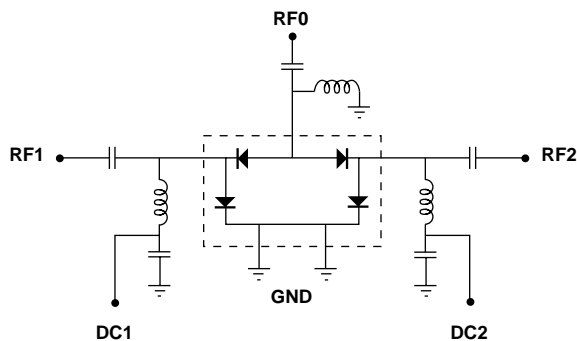
MNM 4210: Transfer/Dual Diversity Switch
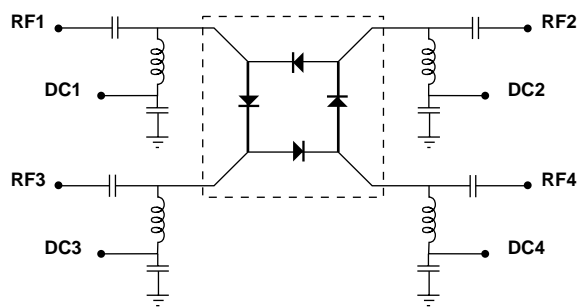
MNM 4220: Junction/Diversity Switch
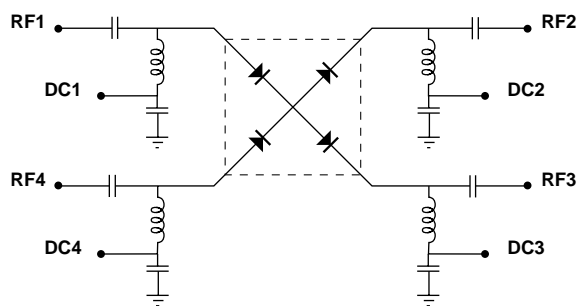
You can obtain additional information on Microsemi's MNM 4200, MNM 42210, and MNM 4220 Nanomount switches, including samples, price and delivery, for use in your switch applications, by visiting Microsemi's website and looking up these part numbers or by visiting the hyperlink, below. You can also reach me at (617) 510-0089 or at bdoherty@microsemi.com to discuss how Microsemi's Nanomount Switches can improve or simplify your detector design. Comments on this series are always welcome.

[1] *"Silicon PIN Diode and GaAs MESFET Switches And Their Effects On Linearity Of Digital Communications Systems", W. E. Doherty, Wireless Technology Conference Digest, Stamford, CT, 1995*
*patent pending