GaAs IC Switch Power Handling Characteristics

Power handling is defined as the amount of input power that causes the insertion loss to increase by 1 dB ($P_{-1\ dB}$). Skywork's general purpose switches are nominally 0.5–1 W capability that satisfies the receiver market. These products range from single throws to four throws in various package configurations. Skywork's high power, or high linearity switches are nominally 2–7 W capability. They are designed for the hand-held radio market such as T/R, antenna diversity and antenna changeover applications.

General Purpose Switches (<1.0 W)

Control Voltage vs. $P_{-1\ dB}$

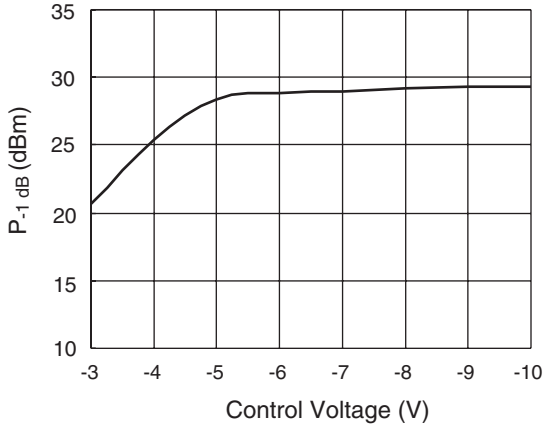
Power handling of a GaAs IC switch is determined primarily by the current handling (IDSS) and voltage breakdown (V_{GS}, V_{GD}) of the MESFET device. For a given design, the user must consider the frequency of operation and the voltage available for biasing the MESFET. Increased power handling occurs up to approximately -10 V. Beyond this voltage, increasing control voltage eventually results in reverse breakdown of the FET junction due to the RF voltage swing at high powers.

GaAs IC switches that operate at -5 V have a "pinch-off" voltage (V_P) of typically -3 to -4 V. As the control voltage becomes more negative the 1 dB compression point increases dramatically as shown in Figure 1.

Frequency of Operation vs. $P_{-1\ dB}$

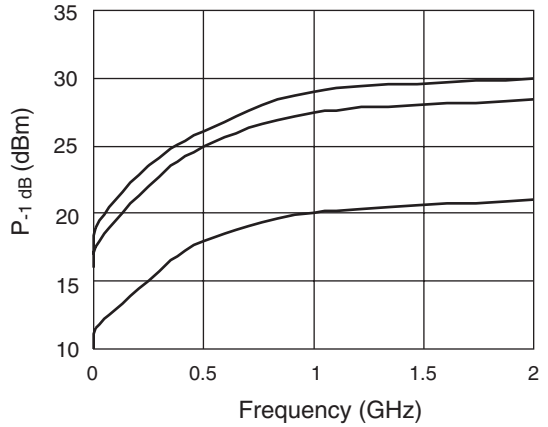
Figure 2 shows the power handling degradation as a function of frequency and control voltage. At a frequency when the gate-to-channel capacitive impedance approximates the gate bias resistance, a significant fall off in power handling occurs in a MESFET switch. At this point the RF voltage in the channel tends to put the device into forward bias or premature saturation. Below 0.5 GHz the $P_{-1\ dB}$ decreases by 2–3 dB and at 0.1 GHz decreases by 5–7 dB at a given control voltage.

As the control voltage is decreased, the "off" path of the switch starts to conduct RF power (turn "on" slightly). This causes non linearities, or distortion to appear in the "on" or T_X path. This must be avoided for proper signal transmission in commercial radios. For these designs high power switches must be used.



Control Voltage vs. $P_{-1\ dB}$ <1.0 W Switches F = 900 MHz

Figure 1. Control Voltage vs. $P_{-1\ dB}$



Frequency vs. $P_{-1\ dB}$ <1.0 W Switches V_{CTL} = -3, -5, -7 V

Figure 2. Frequency vs. $P_{-1\ dB}$

High Power Switches (2–7 W)

By splitting RF voltage across many FETs or using multi-gated FETs RF power handling can be increased up to 7 W. Skyworks offers many switches that combine high power handling, low insertion loss and good isolation. Please refer to the Commercial IC Products Selection Guide for individual datasheets.