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**Notes:**

1. The TAP state transitions occur on the rising edge of TCK. The TMS input value, shown on the state transition arcs, determines the next TAP state.

**Figure 1: JTAG TAP Controller State Diagram**

IEEE Std 1149.1 defines behavior of the TAP state machine and its output pins according to specified activities on the TAP input pins. TAP state transitions occur on the rising edge of TCK. The TMS input value determines the next state of a TAP state transition. The TDI input value is sampled at the rising edge of TCK during the Shift-DR and Shift-IR TAP states. The TDO output value is updated on the falling-edge of TCK. The TDO output is driven only when the TAP is shifting data or instructions. The TDO output begins to drive when the TAP transitions into the Shift-DR or Shift-IR state, the TDO output continues to drive while the TAP remains in the Shift-DR or Shift-IR state, and the TAP returns to high-impedance at the falling-edge of TCK when the TAP completes the shift operation in the Exit1-DR or Exit1-IR state. At other times, the TDO output is maintained in a high-impedance condition.

One special TAP state sequence to note is the sequence that guarantees the TAP state machine is put into the Test-Logic-Reset state. From any start state, holding TMS High for at least five TCK cycles (five state transitions) leaves the TAP in the Test-Logic-Reset state. All JTAG operations shift data into or out of JTAG instruction and data registers. The TAP Controller provides direct access to all of these registers. There are two classes of JTAG registers: the Instruction register (only one) and Data registers (many). Access to the Instruction Register is provided through the Shift-IR state, while access to the Data Register is provided through the Shift-DR state.

To shift data through these registers, the TAP Controller of the target device must be moved to the corresponding state. For example, to shift data into the Instruction Register, the TAP Controller must be moved to the Shift-IR state, and the data shifted in, LSB first (Figure 2).