used. The great advantage of an inbuilt device for dynamically matched impedances is that when resistors are replaced with digitally dynamically controlled and matched impedances in the devices, there are no line reflections and therefore no missing of bits or bus faults.

5. An I/O device may consist of multiple gigabit (622 Mbps to 3.125 Gbps) transceiver(s) (MGTs). Special support circuitry is needed for this rate. Rocker I/O ^{TM} serial 3.125 Gbps transreceivers are the examples of circuits that provide the support circuitry for this rate.

6. A device for I/O may integrate a SerDes (serialization and De-serialization) subunit. SerDes is a standard subunit in a device where the bytes placed at 'transmit holding buffer' serialize on transmission and once the bits are received these de-serialize and are placed at the 'receiver buffer'. Once the device SerDes subunit is configured, serialization and de-serialization is done automatically without the use of the processor-instructions. The great advantage of the SerDes unit is that these operations are fast when compared to operations without a SerDes. [A device for I/O may integrate a DAA or McBSP subunit when serializing. Refer Sections D.4.4 and D.4.5.]

7. Recently, multiple I/O standards have been developed for I/O devices. A support to the multiple I/O standards may be needed in certain embedded systems. A technology, Flexible Select I/O ^{TM}-Ultra technology supports over 20 single ended and differential I/O signaling standards. Advantages of multiple standard support devices are obvious.

8. An I/O device may integrate a digital Physical Coding Sub layer (PCS). Analog audio and video signals can then be pulse code modulated (PCM) at the sub layer. The PCS sub layer directly provides the codes from the analog inputs within the device itself. The codes are then saved in the device data buffers. The advantage of an in-built PCS at a port device is that there is no need of external PCM coding. Besides, these operations are in the background as well as fast. It improves the system's performance for multimedia inputs at the devices.

9. A device for I/O may integrate an analog Physical Media Attachment (PMA) unit for connecting direct inputs and outputs of voice, music, video and images. The great advantage of an in-built PMA is that the device directly connects to the physical media. PMA is needed for real-time processing of video and audio inputs at the device.

Nowadays, I/O devices have sophisticated features. Schmitt trigger inputs are used for noise elimination. Devices with low voltage gates and devices using power management by preventing unnecessary toggling at the inputs are used for sophisticated applications. Dynamically controlled impedance matching is new technology and it eliminates line reflections when interfacing the devices. SerDes subunit serializes and de-serializes outputs and inputs in the devices. A port may have PCS and PMA subunits for analog inputs for video and audio I/O devices.

3.2 TIMER AND COUNTING DEVICES

Can we think of even a simple system like a TV remote controller or a washing machine without a timer device? *No*. Exactly same is the answer for embedded systems. A timer device is fairly complex. It has a number of states (Table 3.5).