

7.2 Power Distribution

This section describes the USB power distribution specification.

7.2.1 Classes of Devices

The power source and sink requirements of different device classes can be simplified with the introduction of the concept of a unit load. A unit load is defined to be 100 mA. The number of unit loads a device can draw is an absolute maximum, not an average over time. A device may be either low-power at one unit load or high-power, consuming up to five unit loads. All devices default to low-power. The transition to high-power is under software control. It is the responsibility of software to ensure adequate power is available before allowing devices to consume high-power.

The USB supports a range of power sourcing and power consuming agents; these include the following:

- **Root port hubs:** Are directly attached to the USB Host Controller. Hub power is derived from the same source as the Host Controller. Systems that obtain operating power externally, either AC or DC, must supply at least five unit loads to each port. Such ports are called high-power ports. Battery-powered systems may supply either one or five unit loads. Ports that can supply only one unit load are termed low-power ports.
- **Bus-powered hubs:** Draw all of their power for any internal functions and downstream facing ports from VBUS on the hub's upstream facing port. Bus-powered hubs may only draw up to one unit load upon power-up and five unit loads after configuration. The configuration power is split between allocations to the hub, any non-removable functions and the external ports. External ports in a bus-powered hub can supply only one unit load per port regardless of the current draw on the other ports of that hub. The hub must be able to supply this port current when the hub is in the Active or Suspend state.
- **Self-powered hubs:** Power for the internal functions and downstream facing ports does not come from VBUS. However, the USB interface of the hub may draw up to one unit load from VBUS on its upstream facing port to allow the interface to function when the remainder of the hub is powered down. Hubs that obtain operating power externally (from the USB) must supply five unit loads to each port. Battery-powered hubs may supply either one or five unit loads per port.
- **Low-power bus-powered functions:** All power to these devices comes from VBUS. They may draw no more than one unit load at any time.
- **High-power bus-powered functions:** All power to these devices comes from VBUS. They must draw no more than one unit load upon power-up and may draw up to five unit loads after being configured.
- **Self-powered functions:** May draw up to one unit load from VBUS to allow the USB interface to function when the remainder of the function is powered down. All other power comes from an external (to the USB) source.

No device shall supply (source) current on VBUS at its upstream facing port at any time. From VBUS on its upstream facing port, a device may only draw (sink) current. They may not provide power to the pull-up resistor on D+/D- unless VBUS is present (see Section 7.1.5). When VBUS is removed, the device must remove power from the D+/D- pull-up resistor within 10 seconds. On power-up, a device needs to ensure that its upstream facing port is not driving the bus, so that the device is able to receive the reset signaling. Devices must also ensure that the maximum operating current drawn by a device is one unit load, until configured. Any device that draws power from the bus must be able to detect lack of activity on the bus, enter the Suspend state, and reduce its current consumption from VBUS (refer to Section 7.2.3 and Section 9.2.5.1).