



# nSTS Product Family Reference Manual

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## Abstract

This document describes the LAVA nSTS product line, designed for select Samsung mobile devices, which use a USB Micro-B receptacle for charging and data.

The nSTS products permit the mobile device to access USB accessories while being charged. This product's mode of operation charges your mobile device battery to 100% as long as external power is attached. This mode of operation supports Docking Detect, which ensures the mobile device enters the correct state during a "hot connect" to the LAVA product.

This document describes the connectors and configuration options for the nSTS product line.

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## Introduction

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The nSTS (Samsung Tablet Simulcharge) product line allows USB 2.0 peripherals to be attached to a mobile device, while permitting simultaneous battery charging.

No software needs to be installed on the mobile device in order to use the LAVA product.

The mobile device's Micro USB-B receptacle is connected to the LAVA product using a custom cable provided by LAVA. An external power supply provides power for both the mobile device and USB peripherals.

The core products are powered using a standard 5V USB power supply, such as the charging brick supplied with the mobile device.

The “vc” products operate from a 9 to 36 VDC unregulated power supply. This power option is ideal in vehicle-based applications or any stand-alone unit running from a storage battery. In a retail or business environment, this option permits the power brick to be placed a considerable distance away from the product while using a thin power cable.

The Power-over-Ethernet (PoE) products require a suitable Network Switch with PoE support. A non-PoE Network Switch can use a PoE Power Injector for each port to operate with a LAVA PoE capable product. A PoE Power Injector is a standard add-on available from many Network Switch vendors.

Each member of the product family uses a green status LED.

The nSTS products only function with select Samsung mobile devices. For a complete list of tested mobile devices please check the LAVA compatibility list. The link for this list is located on each product page.

For mobile devices using a USB-C receptacle for data and power, please contact LAVA Sales or Technical support.

## nSTS Product Family

All members of the nSTS Product Family provide the same core functionality of allowing USB peripherals to be attached to a mobile device while permitting simultaneous battery charging, called SimulCharge.

nSTS Product Family Overview						
Product	USB 2.0 Ports [Type A]	Ethernet Adapter	Power over Ethernet	5 VDC Input [Micro-B]	9/36 VDC Input [Barrel]	Description
nSTS-E	-	YES	-	YES	-	Ethernet Adapter
nSTS-PE	-	YES	YES	Optional	-	Ethernet Adapter with PoE
nSTS-vcE	-	YES	-	Optional	YES	Ethernet Adapter
nSTS-2UE	2	YES	-	YES	-	2-port USB Hub & Ethernet Adapter
nSTS-P2UE	2	YES	YES	Optional	-	2-port USB Hub & Ethernet Adapter with PoE
nSTS-vc2UE	2	YES	-	Optional	YES	2-port USB Hub & Ethernet Adapter
nSTS-1U	1	-	-	YES	-	1-port USB Hub
nSTS-3U	3	-	-	YES	-	3-port USB Hub
nSTS-vc1U	1	-	-	Optional	YES	1-port USB Hub
nSTS-vc3U	3	-	-	Optional	YES	3-port USB Hub
nSTS 1U-OEM	1	-	-	YES	-	1-port OEM Adapter (board only)

The “vc” products operate from a 9 to 36 VDC unregulated power supply via a DC Barrel Jack with a 2 mm positive center pin.

The optional 5 VDC Inputs on the PoE products are labelled “Aux 5V”.

## Product Operation

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### Overview

The nSTS products contain the following core features:

- ❑ USB Host operation with simultaneous device charging
- ❑ Up to three USB-2.0 receptacles
- ❑ Wired networking (10/100 Ethernet) support
- ❑ Option for Power over Ethernet (PoE) support
- ❑ Option to be powered from a standard USB Power Adapters
- ❑ Option to be powered from any regulated 5-volt power supply
- ❑ Option to be powered from a 12 or 24 volt unregulated DC power source

The product's mode of operation charges a mobile device battery to 100% as long as external power is attached. This product supports Docking Detect, which ensures the mobile device enters the correct state during a "hot connect" to the LAVA adapter.

The LAVA nSTS products require no mobile device software or configuration.

The mobile device's Micro USB-B receptacle is connected to the nSTS product with a custom cable provided by LAVA.

The core products are powered using a standard 5V USB power supply, such as the charging brick supplied with the mobile device. The "vc" products operate from a 9 to 36 VDC unregulated power supply, which drives both the mobile device and USB accessories. The PoE capable products derive power from the network cable.

USB accessories can be attached at any time.

LAVA products do not draw power from the mobile device if the external power source is removed. The attached USB accessories do not function when external power is removed.

*Note: If your use-case requires USB accessories to be operated with and without an external power source, please contact LAVA Sales as other LAVA products not described in this document are designed for this situation.*

### USB Host Operation with Simultaneous Mobile Device Charging

LAVA nSTS products allow the charging of select Samsung mobile devices while interacting with USB accessories. The LAVA products do not draw power from the Samsung mobile device and only allow USB accessory operation while being powered by an external power source.

Unlike many other Android mobile devices on the market, Samsung mobile devices can operate as a USB host while being charged. LAVA calls this feature SimulCharge, for simultaneous charging while working with USB accessories. The System Requirements section states which mobile devices have been tested for the ability to employ SimulCharge.

## USB 2.0 Ports for User Accessories

The LAVA products include an internal USB 2.0 Hub, which is used to connect integrated and user-supplied USB accessories. Up to five user-accessible USB 2.0 ports are available depending on which LAVA product is selected.

User accessories are attached to USB 2.0 ports with a standard A-type receptacle. Each receptacle provides power to each USB Accessory up to a maximum of 500 mA, as per the USB specification. The power supply used must have sufficient capacity for the mobile device, LAVA hardware, and USB accessories.

A LAVA product must be powered for a USB-A receptacle to function. The LAVA products have a dedicated power input and are not intended to draw power from the tablet or mobile phone they are connected to.

A power budget must be developed for a system to handle additional USB accessories and the related cables. Power loss in each cable results in lower voltages at each device. Using self-powered USB Hubs may be required in some systems, to offload the power supply responsible for the tablet or mobile phone.

## Wired Network Operation

Many nSTS products provide a 10/100 Fast Ethernet wired interface. This feature relies on standard support from the mobile device. A wired networking solution is more reliable than WiFi and has greater security.

Tablets supporting Wired Ethernet operation provide options for dynamic address setup (DHCP) and static address setup. The choice of address management is a Network system issue. The Ethernet addressing configuration is performed within the mobile device setup menu.

The mobile device setup and Ethernet port status are located in the Connections > More networks > Ethernet menu. The Ethernet menu can only be entered when a powered Ethernet adapter is present. The standard mobile device options permit the use of static address assignments or dynamic address assignments via DHCP. The menu reports if the Ethernet adapter is active as well as serving as the adapter enable.

When using DHCP, the mobile device attempts to fetch the network addressing information from a DHCP server. If the addressing information is not located within the timeout period, the mobile device makes no further attempts. The user must manually retrigger the Ethernet interface to start the DHCP process. The retrigger is a simple matter of pressing the Ethernet "box" again in the "More networks > Ethernet" menu.

## Status LED lights

A green status LED is used to report the state of the unit. When power is applied to the board, the status LED is flashed in unison to confirm the unit is operational and to report the active mode.

The start-up status LED patterns are:

The start-up LED flash duration is approximately ½ second on and ½ second off.

During regular operation the LED patterns will vary depending on the active mode.

Status LED behaviour – after power-up	
LED Behaviour	Description
The green LED pulses once, pauses briefly, then repeats.	The unit is waiting for a mobile device to be attached.
The green LED pulses rapidly for two seconds.	The unit has detected a mobile device and is in the process of attaching to the device. This LED state is a momentary state, after which the device is treated as connected.
The Green LED is on solid.	The mobile device is attached and being charged. USB peripherals are available to the mobile device.

## **Tablet Charging with USB Host Operation (SimulCharge)**

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### **Overview**

The Samsung mobile device was intended as a stand-alone device. When the mobile device battery requires charging, it is plugged into a Wall/USB Charger to restore the battery charge. The mobile device can continue being used while it is charging. Once the battery is charged, the mobile device may use the charger as a supplementary power source if the mobile device is left running. It is preferable to charge a mobile device with the unit off and remove the supply once a full charge has been reached for the longest battery life.

When using a Samsung Wall/USB Charger, the mobile device charges at a high rate that is mobile device specific. The charge rate is also limited to the power available from the attached charger. The Samsung Wall/USB Chargers come in several power ratings, each matched to the original mobile device requirements.

### **Charge-Only Mode**

The Samsung Wall/USB Charger is equivalent to a USB Charger with a Dedicated Charge Port (DCP) as defined by the USB Battery Charging Specification R1.2.

The STS\*\* products use the term Charge-Only Mode to indicate the battery is being charged at the highest rate permitted by the mobile device and is equivalent to a USB Charger with a Dedicated Charge Port (DCP).

### **USB Host versus Accessory**

A mobile device plugged into a desktop (or laptop) PC is treated as a USB Accessory (also referred to as a USB Target). The PC operates as a USB Host Controller when the mobile device is attached. The PC provides power to the mobile device, but the mobile device battery is being charged at a low rate. In some cases, the battery may not charge.

To plug a USB Accessory into a mobile device, the mobile device must operate as a USB Host Controller rather than a USB Accessory. The USB Standard has the On-The-Go (OTG) feature, in which the mobile device detects that a USB Accessory has been plugged in and automatically switches to operate as a USB Host Controller. Not all mobile devices support the USB OTG feature. When operating as an OTG USB Host, the mobile device is expected to supply power to the attached accessories, which means power is drained from the mobile device battery.

## SimulCharge Mode

The nSTS products place a Samsung mobile device into the SimulCharge Mode. SimulCharge Mode informs the mobile device to operate as a USB Host controller, but not to provide power for USB accessories. With SimulCharge mode active, the mobile device is expecting power to be provided to it for battery charging and running the mobile device. This allows the mobile device to be run while simultaneously interacting with one or more USB accessories. The SimulCharge charging rates are specific to each mobile device.

Samsung mobile devices operating in SimulCharge mode may limit the amount of power drawn from the external power source. Limiting the power drawn from the external supply allows the supply to be shared between the mobile device and USB accessories. If there is not enough power coming in, the mobile device takes the extra from the battery. Therefore, in this case the battery will not be charging. The screen brightness may have to operate at less than 100% to allow the battery to charge. The color scheme of the device application can be designed to reduce the power required. Application processes requesting too much CPU time increase the power needed for the mobile device.

The nSTS products use features specific to a set of Samsung mobile devices which are identified in the System Requirements section. Simultaneous battery charging and USB Host operation are not universal among Samsung mobile devices. Mobile device models have different features based on country/region.

The nSTS products must always be powered to keep the mobile device charged, and allow operation with USB accessories.



## Connection Descriptions

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### USB Micro-B “To Tablet”

The “To Tablet” receptacle is a standard Micro USB-B receptacle.

The custom 3.3 foot (1 meter) cable that is included with the LAVA product provides the connection between the LAVA product and the mobile device. The custom cable has a male Micro USB-B connector at each end. It does not matter which end of the cable is attached to the mobile device or the LAVA product.

The LAVA product to mobile device cable must **not** be extended, as the additional power loss in the wires will result in unreliable device charging and operation.

The LAVA product to mobile device cable cannot be replaced with a third party cable. The LAVA provided cable is specifically designed to facilitate SimulCharge operation.

### Barrel Jack “9-36 VDC In”

LAVA products equipped with the “vc” option include a power option that uses a DC barrel jack with a 2.1 millimetre positive center pin. The power cable and power supply are supplied by the user.

Many use-cases require up to a 24 watt power supply (12 volts at 2 amperes or 24 volts at 1 ampere). The permitted input range is 9 to 36 volts. Any unregulated power supply can be used. This range of supported voltages permits the power supply to be placed up to 50 feet away from the LAVA product when a suitable wire gauge is used.

The minimum power specification for a use-case requires developing a power budget that is based on the USB peripherals you wish to use and the mobile device. In cases where no external USB peripherals or a few low-power peripherals are used, the power supply requirements can drop down to 12 watts (12 volts at 1 ampere, or 24 volts at 0.5 amperes). The internal power converter within the LAVA product is 80% efficient at full load, therefore 12 watts into the product results in 10 watts for system use.

A power supply with a higher power rating than the required minimum is always permitted. This has the benefit of your hardware system running cooler. As an example, if your system ideally requires a 12 volt 2 ampere power supply, then a 12 volt 2.5 ampere supply is acceptable.

The length and gauge of wire used to connect the power supply to the LAVA product results in a loss of voltage and therefore power reaching the LAVA product. This additional loss must be factored into the power budget as well. A higher power supply voltage is always preferred to minimize the power loss in the wire.

When connecting the LAVA product to the supply, ensure the wiring is such that the center pin is positive. If the polarity is reversed, the damage to the LAVA product is immediate. Application of the wrong input voltage violates LAVA's Manufacturer Warranty.

The attached power supply and wiring are responsible for providing short circuit protection.

## **Micro-B USB “5V Power Input”**

The 5V Power input provides power for the LAVA product, the device, and attached USB accessories. This receptacle is present on units without the “vc” or “PoE” power options.

The LAVA product will not function if external power has not been applied. The LAVA products are not intended to draw power from the mobile device.

The attached USB accessories do not function if external power has not been applied.

A typical USB power supply is rated at 5 volts nominal, with a 5.25 volts maximum. The most common USB Power supply is rated at 10 watts (2 amperes at 5 volts DC). The voltage at this input should not be too far below 5 volts. The preferred level is 5.1 to 5.25 volts. The voltage at this input must never exceed 5.25 volts.

The adaptive fast chargers being shipped with many mobile devices are fully compatible with the LAVA products. The LAVA products automatically use the 5-volt option.

The 5V Power input can be used with an external USB power bank. This ability can be useful in some deployments. The USB power bank must be physically removed for recharging.

The cable length between the power supply and the LAVA product must be as short as possible. The cable will experience power loss proportional to the cable length and wire thickness. The voltage present at the LAVA product receptacle will be lower than the supply output due to cable power loss. If the voltage at the mobile device is too low, the mobile device will not charge. The voltage reaching the LAVA product should be at least 4.9 volts, with a preferred range of 5.1 to 5.25 volts.

The voltage at this input must never exceed 5.25 volts. Application of the wrong input voltage violates LAVA's Manufacturer Warranty.

The attached power supply and wiring are responsible for providing short circuit protection.

## Micro-B USB “Aux 5V”

The Auxiliary Power input is a Micro USB-B receptacle on LAVA “vc” and PoE capable products.

The Auxiliary Power input is intended to be used for system testing when PoE or vc power is not available or present. The receptacle is not intended for use during standard operation of the device (with PoE or vc power)

The same USB power supply described for the “5V POWER” input is used with the Auxiliary Power input.

The LAVA product will be fully functional, including the 10/100 Ethernet, when this power input is used.

This receptacle is **only** for providing power to the LAVA product.

**Warning:**      *When supplying power using the "Aux. 5V Power Input", you must not use PoE supplied power.*

## USB-A Receptacles

Several LAVA products support one or more USB 2.0 ports with a standard A-type receptacle. Each receptacle allows a USB Accessory to be accessed by the mobile device.

Each receptacle provides power to each USB accessory up to a maximum of 500 mA, as per the USB specification. The product power supply must have sufficient capacity to supply power for the mobile device, the LAVA product, and the attached USB accessories combined.

The USB ports can be extended using a compatible USB 2.0 hub. If the external hub is not self-powered, then the LAVA product’s power supply must have sufficient capacity for the hub, the mobile device, the LAVA product, and the attached USB accessories combined. The external hub and accessories are not permitted to draw more than 500 mA from a USB-A port.

## RJ45 “PoE Ethernet Port”

The PoE Ethernet Port has all the features of the Ethernet Port described in the next section and resolves the problem of getting power to a mobile device and peripherals.

This port is attached to a Network Switch, which has been configured for PoE operation.

Use of a PoE Injector allows a non-PoE switch to be used with a PoE enabled product. A PoE Power Injector is a standard add-on available from many Network Switch vendors.

The PoE (Power-over-Ethernet) specification allows the unit that is being powered to be located up to 330 feet (100 meters) away from the Network Switch or PoE Injector.

Deploying network cabling with PoE support can be significantly cheaper than installing dedicated power lines through a facility. Using PoE to supply power to a unit can be advantageous even when no Ethernet data is required.

The LAVA PoE products provide up to 10.4 watts of power for the device and attached peripherals. The 10.4 Watt limit allows the unit to be treated as a PoE Class 0 device by a PoE switch.

The LAVA product is capable of supplying 13.5 watts to the device and peripherals. However, this requires the Network Switch to provide more power to the Ethernet cable than is permitted for Class 0 devices. The LAVA product does not prevent the attached devices from attempting to draw more than 10.4 watts. The accompanying device and USB accessories must be designed to work within the design limits.

The system designer must budget for the charging requirements of the mobile device and the power required by USB accessories. The LAVA products do not provide diode protection between the module and the peripheral ports.

The LAVA PoE products do not function if power is not available from the PoE-Ethernet interface or the Auxiliary Power input. The LAVA products are not intended to draw power from the mobile device. The Auxiliary Power input is only be used if power is not being provided over the Ethernet cable. The Auxiliary Power input is intended for the initial testing of a LAVA product. The Auxiliary Power input is described in a separate section of this document.

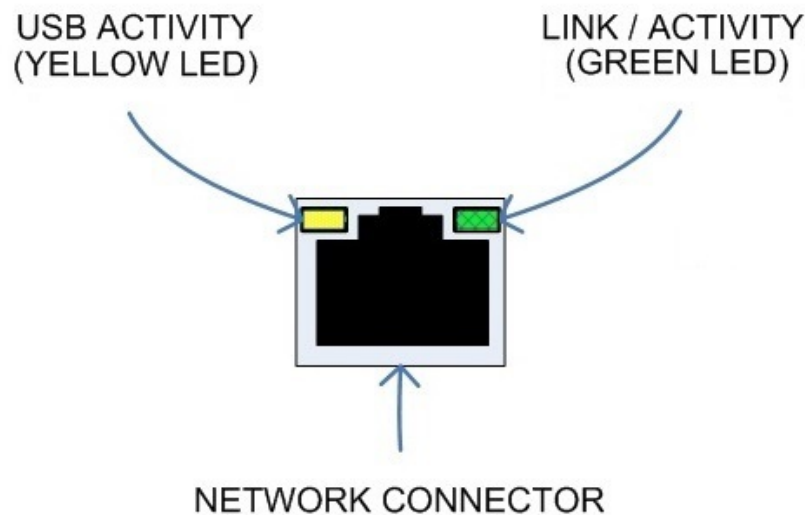
**Warning:**      *When supplying power using the "Aux. 5V Power Input", you must not use PoE supplied power.*

## RJ45 “Ethernet Port”

The Ethernet Port is an IEEE 802.3 10BASE-T / 100BASE-TX compatible Fast Ethernet interface. The Ethernet port accepts a standard RJ45 connector. The ETHERNET port is present on a number of LAVA products.

The Ethernet port only functions when the LAVA product is powered. The LAVA products have a dedicated power input and are not intended to draw power from the mobile device.

The Ethernet port has two status indicator LED lights labelled "USB Activity" and "Link/Activity".



**Figure 1:** RJ45 Status Indicators

The USB Activity indicator is a yellow LED light. The USB Activity LED is solid yellow when the LAVA product is powered and connected to the mobile device. The USB Activity LED flashes when there is traffic between the mobile device and a LAVA product.

The Link/Activity indicator is a green LED light. The Link/Activity LED is solid green when the Ethernet Link has been established. The Link/Activity LED flashes when there is network traffic through the Ethernet interface. The Link/Activity LED remains off when the mobile device is not attached.

The Ethernet peripheral integrated within a LAVA product is subject to support built into the mobile device. Any details related to Ethernet setup and Network configuration are described in the documentation provided by the manufacturer of the mobile device.

## Technical Support

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LAVA Technical support is open from 9:00 am to 5:00 pm Monday through Friday (EST).

Telephone: +1 416 674-5942

Toll-Free (the US and Canada): 800 241-5282

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