



# eSTS Product Family Reference Manual

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## Abstract

The LAVA eSTS Product Family permit the charging of select Samsung tablets while simultaneously interacting with USB accessories. The eSTS extended features include battery modulation, screen brightness management, and improved network operation.

This document describes the features of the eSTS products in detail.

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## Introduction

The LAVA eSTS products allow select Samsung tablets to operate as a USB Host while simultaneously being charged. LAVA calls this feature SimulCharge, for simultaneous charging of a tablet while working with USB accessories.

In addition to the features of the classic STS Product Family, the eSTS products provide extended features such as battery modulation, screen brightness management, and improved network operation.

The eSTS features use a combination of hardware and software. The tablet runs the LAVA Tablet Manager (LTM) application to support an eSTS product.

The eSTS products use features specific to a group of Samsung Tablets.

The System Requirements section documents the tablets tested with the eSTS products.

eSTS Product Family Overview				
Product	USB Ports	Ethernet Adapter	Power over Ethernet	Description
eSTS-PE	-	YES	YES	Ethernet Adapter with PoE
eSTS-E	-	YES	-	Ethernet Adapter
eSTS-P2UE	2	YES	YES	2-port USB Hub & Ethernet Adapter with PoE
eSTS-2UE	2	YES	-	2-port USB Hub & Ethernet Adapter
eSTS-3U	3	-	-	3-port USB Hub
eSTS-1U-OEM	1	-	-	1-port USB OEM Adapter (single board)
eSTS-BM-OEM	-	-	-	Charging-Board Adapter (single board)

## System Requirements

The eSTS Product Family is designed to use features specific to a group of Samsung tablets.

The Samsung Tablet requires the installation of the LAVA Tablet Manager (LTM) application, which is provided to the eSTS product integrator. The "eSTS Installation Manual" describes the setup procedure for the eSTS product and LTM application. The LTM installation requires a brief WiFi connection for a one-time activation of the Samsung KNOX license. The KNOX license does not have an additional fee.

The tablet must include the Samsung Knox Standard SDK version 5.1 or newer. The SDK version information is available in the tablet's "About device" information.

The eSTS products work with unrooted Samsung tablets.

The eSTS products and LTM application have been tested with the following Samsung tablets:

Test Summary - Samsung Tablet and eSTS Products					
Model Number	Device Name	Screen Size	Android Version	Build Number	Note(s)
SM-T580	Galaxy Tab A 10.1"	10.1	6.0.1	MMB29K.T580UEU1APG1	1, 6, 7
			7.0	NRD90M.T580UEU2BQL1	1, 6, 7, 9
SM-T560NU	Galaxy Tab E 9.6"	9.6	5.1.1	LMY47X.T560NUUEU1AOK1 MMB29M.T560NUUES1BPL1 MMB29M.T560NUUEU1BQF1	1, 2
			6.0.1	MMB29M.T560NUUEU1BQF1	
			7.1.1	NMF26X.T560NUUEU1CQJ3	
SM-T377A	Galaxy Tab E 8.0"	8.0	6.0.1	MMB29K.T377AUCU2APJ2	1, 10
SM-T377P	Galaxy Tab E 8.0"	8.0	7.1.1	NMF26X.T377PVPU2CQG2	8
SM-T377T	Galaxy Tab E 8.0"	8.0	7.1.1	NMF26X.T377TUVU1BQI5	1, 11
SM-T377V	Galaxy Tab E 8.0"	8.0	6.0.1	MMB29K.T377VVRU1BPD6	1, 5
			7.1.1	NMF26X.T377VVRU1CQH9	
SM-T377W	Galaxy Tab E 8.0"	8.0	6.0.1	MMB29K.T377WVLU0APC3 MMB29K.T377WVLU2API2	1, 4
			7.1.1	NMF26X.T377WVLU2BQI6	
			7.1.1	NMF26X.T377VVRU1CQH9	
SM-T810	Galaxy Tab S2 9.7"	9.7	5.1.1	LMY47X.T810XXU2BOJ1 MMB29K.T810XXU2CPK1	1, 12
			6.0.1	MMB29K.T810XXU2CPK1	
SM-P550	Galaxy Tab A 9.7"	9.7	6.0.1	MMB29M.P550XXU1BPF3 MMB29M.P550XXS1BPK1	1, 3
			7.1.1	NMF26X.P550XXU1CQI8	
SM-T350	Galaxy Tab A 8.0"	8.0	6.0.1	MMB29M.T350XXU1BPE3	1
			7.1.1	NMF26X.T350XXU1CQJ1	

*The LTM Service has been verified in devices in the test summary with the STS-RBM, STS-\*\* and eSTS products as of January 2018. LAVA only has access to models from the Canadian market and some U.S. models for internal testing. A tablet integrator must perform a verification of the tablet model and build targeted for their application. LAVA will assist in the testing of other tablets provided a sample tablet is made available. The sample tablet must be delivered with the intended build already installed.*

*The tablet features used by the LAVA products are not universal across the Samsung Tablet line. Samsung tailors the tablet firmware to a world region or country. Tablet versions created by Samsung for mobile*

*carriers do not behave the same as the standard products. You must verify the behavior of the model of tablet and firmware build to be used before committing to any deployment.*

The eSTS Power-over-Ethernet (PoE) models 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 an eSTS PoE device. A PoE Power Injector is a standard add-on available from many Network Switch vendors.

The eSTS models without PoE require a USB Power Supply with a Micro USB-B receptacle. The Wall/USB Charger provided with the tablet is an ideal choice. Any USB Power Supply, with sufficient power for the combined requirements of the tablet and USB accessories, can be used. The original Samsung USB Charger is preferred as it incorporates voltage drop (sometimes referred to as "droop") compensation for the range of currents required by the tablet and attached accessories.

The eSTS product is connected to a tablet using the custom Micro USB-B to Micro USB-B 39" (100 cm) cable provided with the eSTS. This cable must not be extended, as the additional power loss in the wires will result in unreliable tablet charging and operation.

The eSTS-1U-OEM and eSTS-BM-OEM products are connected to a tablet using the custom Micro USB-B to Micro USB-B 8" (20 cm) cable provided with the board. This cable must not be extended, as the additional power loss in the wires will result in unreliable tablet charging and operation.

Description of Notes from the Test Summary	
Note	Description
1	The tablets issue a beep when the battery modulation changes from the discharging to charging state on most tablets. The newer tablets allow the "Charging sound" to be disabled within the Sound menu. Older tablets can lower the system volume if sound support is not required.
2	The North American versions of the Tab E 9.6" tablet have been tested.. Problems have been using reported with U.K. Android 4.x.x versions of the tablet used with STS-** devices. The U.K. Android builds have not been tested with eSTS and STS-RBM products.
3	Requires tablet connection cable be no longer than 19" (50 cm).
4	The SM-T377W was tested with build MMB29K.T377WVLU0APC3. The unit tested was a Canadian model, not tied to a carrier.
5	The SM-T377V was tested with build MMB29K.T377VVRU1BPD6. Earlier builds do not work with the STS-RBM, eSTS devices, or any STS-** device. The unit tested was a U.S.Verison model.
6	The Tab A 10.1" tablet briefly disconnects attached USB accessories each time the battery modulation changes from charging to discharging. This side effect has the benefit of periodically refreshing the internal resources used by the device. Using a wider set of modulation thresholds will minimize the impact of this behavior on the user.
7	The Tab A 10.1" measure in December of 2016 could require approximately 1.5 amperes during SimulCharge operation. After allowing for the power requirements of the LAVA hardware, about 0.15 to 0.2 amperes is available for user-provided USB accessories.
8	The SM-T377P was tested with a special pre-release build of the firmware tested in August 2017. Earlier versions charged at a very slow rate.
9	The initial release of Android 7.0 for the Tab A 10.1" (SM-T580) was not compatible with the enhanced features of the eSTS product due to problems in the Samsung KNOX Standard SDK. The tablet received the update to Android 7.0 in early-2017. The bug was fixed only for select markets in the final weeks of 2017. The North American models are known to be fixed. Only select countries in Europe received the update. Please contact LAVA for additional details. All versions of the tablet tested, work with nSTS-** and original STS-** products.
10	The Tab E 8.0" AT&T (SM-T377A) model has been tested with Android 6.0.1. As of December 2017 the most recent version of firmware for the tablet is based on Android 6.0.1. The firmware build MMB29K.T377AUCU2APJ2 was fully compatible with the STS-RBM and eSTS product family.

11	The Tab E 8.0" T-Mobile (SM-T377T) model has been tested with Android 7.1.1. The Android 7.1.1 (build NMF26X.T377TUVU1BQI5) is fully compatible with the eSTS, nSTS, and original STS-** product family. The tablet comes with Android 6.0.1 (build MMB29K.T377TUVS1APL1) out of the box. The Android 6.0.1 firmware is not compatible with the eSTS, nSTS, or STS-** product family and must be updated to Android 7.1.1.
12	The Tab S2 (SM-T810) and related models received an update to Android 7.0 in the spring of 2017. The Android 7.0 update introduced a bug in the Samsung KNOX Standard SDK which resulted in the tablet no longer being compatible with the enhanced features of the STS-RBM and eSTS product family. The bug is known to have been fixed in at least one 8.0" version of the Tab S2 family (using build NRD90M.T710XXU2DQI6); however the majority of the models never received the update. All known versions of the tablet continue to work with nSTS-** and original STS-** products.

## Product Features

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### Overview

The eSTS products support a variety of features that include:

- ❑ USB Host operation with simultaneous tablet charging
- ❑ Battery modulation for tablet longevity
- ❑ Enhanced Network Management for reliable network operation
- ❑ Screen brightness control for reduced heat generation
- ❑ Interaction with USB accessories
- ❑ Up to three USB-2.0 receptacles
- ❑ Wired networking (10/100 Ethernet) support
- ❑ Power over Ethernet (PoE) support
- ❑ Option to operate using standard power brick
- ❑ Support for installations running 24/7
- ❑ Maintenance resets of tablet and module hardware
- ❑ USB permission handling using the Samsung KNOX Standard SDK
- ❑ USB permission handling for up to two user peripherals

The eSTS features rely on the hardware working with the LAVA Tablet Manager (LTM) application. Installation of the LAVA Tablet Manger is mandatory before using an eSTS product.

### USB Host Operation with Simultaneous Tablet Charging

The primary feature of all LAVA eSTS and STS-\*\* products is to allow the charging of select Samsung tablets while interacting with USB accessories.

Unlike many other Android tablets on the market, the Samsung tablets can operate as a USB HOST and be charged. Lava calls this feature SimulCharge, for simultaneous charging while working with USB accessories. The System Requirements section states which tablets have been tested.

Power to an eSTS product is applied after the tablet is attached and powered. The eSTS product applies power and data to the tablet in a sequence that ensures proper battery charging and USB Host operation.

### USB 2.0 Ports for User Accessories

The eSTS products include an internal USB Hub, which is used to connect integrated and user-supplied USB accessories. Up to three user-accessible USB2.0 ports are available depending on which eSTS 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 for the system must have sufficient capacity for the tablet, eSTS hardware, and attached USB accessories.

An eSTS product must be powered for a USB-A receptacle to function. The eSTS devices have a dedicated power input and are not intended to draw power from the tablet.

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.

## LAVA Tablet Manager (LTM) Application

The LAVA Tablet Manager (LTM) is an Android application provided by LAVA for use with the eSTS products. This application must be installed on the tablet to manage each eSTS product. The "eSTS Installation Manual" describes the installation procedure. This application runs as a background service on the tablet. This application has no displayable component.

The LTM Service and related features are configured using a simple configuration file placed in the tablet's Internal Storage \ Download or \Contents folder. The file name is LTM.INI. The LTM.INI file can be modified on any PC using a standard text editor. Updating the LTM.INI file on the tablet can be performed at any time. The LTM.INI file commands are described in a dedicated section later in this document.

**Note:** *The LAVA Tablet Manager is not a standalone product and requires an eSTS device to function.*

**Note:** *The \Contents folder is created by the Samsung's KNOX Configure service and is not present as a default definition.*

## Battery Modulation

The Battery Modulation feature helps reduce stress on the tablet battery. Battery Modulation is a feature in which the battery is charged up to an upper set point, and then allowed to discharge to a low set point. This feature electronically mimics the process of charging a battery and then disconnecting the charger. This behavior follows the expected use-case for a tablet. After a set number of user-defined charge/discharge cycles, a "full" cycle is performed to reset the tablet battery calibration.

Battery Modulation ensures the tablet battery never remains at the 100% level for more than a few minutes over a month, which prevents overcharging. This behavior makes the eSTS products ideal for enclosures that run 24 hours a day, 7 days a week. All parameters associated with the modulation feature are customized in the LTM.INI configuration file.

The eSTS supports several battery modulation schemes. Setting the correct "board-type" is critical for battery modulation to work. The eSTS Setup will identify which option to use for a given tablet. The sample LTM.INI sets following parameters and represents a typical battery modulation configuration:

```
board-type=2
bty-upper-threshold=70
bty-lower-threshold=45
bty-cycle-upper-threshold=100
bty-cycle-lower-threshold=45
bty-cycle-limit-on-start=2
bty-cycle-limit=50
encourage-night-charging=60
```

The above sample sets the upper and lower battery charge thresholds at 70% and 45% respectively. Every 50 charge cycles the upper threshold is taken as 100%. Within a minute of reaching the 100% level, the tablet starts discharging down to the 45% level. In this example, 45% is used for both low thresholds.

The "bty-cycle-limit-on-start=2" results in a full cycle being run two cycles after the LTM Service is started. The "bty-cycle-limit-on-start" command allows for an early battery calibration for situations where the tablet might have been turned off for some time. Using "bty-cycle-limit-on-start" is optional.

The "encourage-night-charging" is another optional feature used to help reduce heat generation. Please see the INI File description for more information.



## Wired Network Operation

Many eSTS products provide a 10/100 Fast Ethernet wired interface. This feature relies on standard support from the tablet. 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 tablet setup menu.

The tablet setup and status for the Ethernet port 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 tablet 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 tablet attempts to fetch the network addressing information from a DHCP server. If the addressing information is not located within the timeout period, the tablet 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. The eSTS Network Recovery automates the network restart, which is critical for embedding a tablet in an enclosure or kiosk.

When the user disables the Ethernet adapter via the Connections > More networks > Ethernet menu, the adapter remains disabled until enabled again by the user.

In some cases, an installation may choose to use WiFi for network access rather than the wired Ethernet support of the eSTS product. The eSTS product's Ethernet interface can be disabled when WiFi is enabled using the LTM.INI command "wifi-overrides-ethernet=1".

The "permit-ethernet=0" command disables the Ethernet interface. Ethernet is permitted by default.

## Network Recovery Operation

The eSTS products and the LTM application help a tablet recover from failures to establish a network connection when using a wired network connection. The typical failure is due to the inability to establish a network address from a DHCP server.

When a DHCP lookup fails, or the lease renewal fails, the tablet turns off the Ethernet interface and makes no further attempts. In a normal situation, the user would go to the configuration menu and enable Ethernet to restart the connection. The alternative is to unplug the network cable and plug it in again to restart the connection. Until the process is restarted, the tablet has lost the wired network connection. The DHCP behavior is a serious issue for an enclosure-based system. There is no software-only solution for a non-rooted tablet.

The LTM application monitors the wired network connection and if the connection is lost, and then LTM automatically restarts the Ethernet hardware to establish a connection.

When a reset takes place the Android Toast message "LTM – RESET ETHERNET" is reported.

The initial restart takes place if no network connection is seen for about 1 minute. If the connection is not restored, the repeated attempts are made until a connection is restored. There are two options for the handling of subsequent attempts. Option 1 gradually backs off the time-out used. The timeouts are 2, 3, 5, and 8 minutes. After the first three reset attempts, subsequent attempts are made every 8 minutes. Option 2 repeats subsequent attempts every 2 minutes.

If the Network Recovery feature is not desired, it can be disabled using the "dhcp-recovery=0" command in the LTM.INI file.

## Screen Brightness Management

The LTM application has a configurable option to manage the screen brightness. The tablet screen is a major power consumer and heat generator within the tablet. If the screen is too bright, the tablet may not be able to charge the battery in SimulCharge Mode.

For a given application the optimal screen brightness must be established by the system designer. The LTM application can then ensure this maximum is never exceeded.

The Brightness Management feature has two windows for day and night operation. The "time 1" is assumed to be the start of the nighttime operation. The "time 2" is assumed to be the start of the daytime operation. A brightness level can be configured for each of these time windows.

During the daytime window, selecting the lowest possible screen brightness reduces heat generation and improves the ability to charge the battery. In many instances, a tablet screen level of 85% to 90% has a minimal change to the apparent brightness compared to a level of 100%, yet significantly reduces heat generation.

During the nighttime window, selecting a very low screen level reduces heat generation dramatically. Setting a level of 15%, allows the screen to be seen. Turning the screen off during nighttime is preferred.

Reducing heat generation over the life of the tablet helps improve the longevity of the tablet battery and other internal components.

Using this feature is recommended but remains optional.

Using this feature requires the time to be correct on the tablet.

Using this feature requires that auto-brightness of a tablet is turned off.

The sample LTM.INI file located later in this document has the following settings included:

```
brightness-level1-time=1:00  
brightness-level2-time=6:00  
brightness-level1=15  
brightness-level2=85
```

Using these settings, at 1:00 AM the tablet brightness is set to 15%, and at 6 AM the brightness is set to 85%. From 1:00 AM to 5:59, the level 1 brightness is enforced. From 6:00 AM to 00:59 AM, the level 2 brightness is enforced. If the screen brightness is manually changed, the LTM.INI values are restored within a minute.

## Permission Handling for USB Devices

Standard Android USB peripherals include keyboards, mice, memory sticks, and hard drives. These peripherals require no special permission from the user to add them to a system.

Any USB peripheral which is a non-standard peripheral results in an Android permission pop-up window when accessed by an application. The pop-up window asks the user if they grant permission for a given application to work with the specified USB peripheral. The permission must be granted every time the peripheral connects to the tablet. This permission window cannot be bypassed on a system which is not rooted, unless it supports the Samsung KNOX Standard SDK.

### Typical USB Permission Pop-Up Window



The LAVA Tablet Manager (LTM) suppresses the USB permission pop-up window for peripherals, using the Samsung KNOX Standard SDK.

The USB devices built into a LAVA product are handled by LTM with no user setup required.

Up to two user peripherals can also be handled by LTM. Each user peripheral requires the setup of three parameters in the LTM configuration file.

To allow LTM to handle permission for a user's USB peripheral, the following information is required:

- The USB Vendor Identifier (as a decimal integer)
- The USB Product Identifier (as a decimal integer)
- The Android Package Name of the application to be used

The USB vendor identifier and product identifier can be quickly determined for a peripheral using an application such as "USB Device Info", which is available on GooglePlay. The application package name can be provided by your application developer.

The LTM configuration file must be setup with the above information using the USB Permission Handling commands, which are "uph-package-N", "uph-vid-N", and "uph-pid-N", where "N" is either a "1" or a "2". The LTM v2.00 supports two sets of parameters for user permissions.

An example below shows the LTM configuration commands for an NFC reader with Vendor Identifier 1027, Product Identifier 24577, and an application with a package name of "com.lava.util.acr122u":

#### Using command set 1 ('N' = 1):

```
uph-package-1=com.lava.util.acr122u
uph-vid-1=1839
uph-pid-1=8704
```

#### Using command set 2 ('N' = 2):

```
uph-package-2=com.lava.util.acr122u
uph-vid-2=1839
uph-pid-2=8704
```

NOTE 1: Handling USB permissions for user peripherals is present in LAVA Tablet Manager v2.00 and later.

NOTE 2: There are special rules for using a USB Serial Port Adapter (aka UART). Please contact LAVA if you plan to use one or more USB Serial Port Adapters.

## Power Options (PoE or USB Power Supply)

All eSTS products can be powered using a standard USB Power supply, such as the one provided with the tablet. The typical power supply provided with a Samsung tablet is rated at 5 volts nominal output voltage with a 2-ampere capacity. The Samsung Power Supplies have "droop" compensation to ensure that 5 volts or more reach the end of the charging cable.

Any 5 volt regulated power supply is permitted, provided at least 5 volts is present at the input to the eSTS. The preferred voltage is 5.1 to 5.25 volts. The input voltage must never exceed 5.25 volts. Exceeding the maximum input voltage violates LAVA's Manufacturer Warranty.

The eSTS-PE and eSTS-2UE support Power over Ethernet (PoE), and therefore can operate using power provided over the network cable. Using PoE can resolve the problem of getting power to the tablet and peripherals when an AC outlet is not accessible.

Using a PoE injector is a method of supplying power to an eSTS-PE or eSTS-P2UE based system, even when wired Ethernet is not required by the customer application.

## Power-over-Ethernet Support

Power over Ethernet (PoE) is a standard for passing electrical power through a network cable along with the data. The eSTS PoE devices always support an Ethernet adapter for wired network communications.

The eSTS products with PoE resolve the problem of getting power to the tablet and peripherals. The PoE specification allows the powered device to be up to 330 feet (100 meters) 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.

The Ethernet RJ-45 provides the input power to the eSTS product. These eSTS products require a suitable Ethernet Switch with PoE support. Deploying network cabling with PoE support can be significantly cheaper than installing dedicated power lines through a facility.

The eSTS PoE Power Supply provides 10.4 watts of power for the tablet, the eSTS, and attached USB accessories. The 10.4 Watt limit allows the device to be treated as a PoE Class 0 device by a PoE switch.

The eSTS PoE Power Supply is capable of supplying 13.5 watts. However, this requires the Network Switch supply more power to the Ethernet cable than is permitted for Class 0 devices. The eSTS **does not** prevent the attached devices from attempting to draw more than 10.4 watts. The accompanying tablet and USB accessories must be designed to work within the design limits.

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

The eSTS PoE devices do not function if power is not available from the PoE-ETHERNET interface or the Aux 5V Input. The eSTS devices are not intended to draw power from the tablet. The Aux 5V Input can only be used if power is not being provided over the Ethernet cable. The Aux 5V Input is intended only for initial testing of an eSTS module. The Aux 5V Input is described in a separate section of this document.

The PoE models include the eSTS-PE and eSTS-P2UE products.

## Maintenance Reset of System

Samsung Tablets are consumer market devices. Running a tablet for an extended period is not the intended use-case. The nature of the application being run may require the tablet be periodically reset to clean up the internal resources of the tablet.

The eSTS system has the option to reset the tablet and eSTS board every ‘n’ hours of operation. After ‘n’ hours of operation, the reset action can be postponed until a time window has been reached that will not interfere with the user experience.

The sample LTM.INI file located later in this document has the following settings included:

```
hardware-reset-frequency=240
hardware-reset-time-1=1:00
hardware-reset-time-2=2:00
hardware-reset-action=0
```

The sample LTM.INI settings result in the tablet and eSTS reset being scheduled every 240 hours, with the action delayed until a window of 1 AM to 2 AM. The hardware-reset-action is set to 0 in the default LTM.INI, which results in no action. If this feature is desirable, then review the potential actions as described in the “eSTS Product Family – Reference Manual”. The sample configuration is arbitrary.

## System Watchdog Handling

The Android system was designed to conserve battery power and memory resources of a mobile device such as a telephone or tablet. The Android System limits how long a user-installed application can run. Samsung Tablets are a consumer market device, and running one for an extended period is not the intended use-case. The standard tablet behavior can result in the LAVA Tablet Manager (LTM) being shut down after a period of time. The eSTS has several safeguards to ensure LTM will continue to function.

The LTM sends information to the eSTS on a regular basis. If the messages stop, the eSTS will attempt to wake up the LTM Service. The first recovery mechanism involves an automatic reset of the port used for the tablet to eSTS messaging. The second level of recovery involves the eSTS automatically shutting down all power and signals to the tablet for 30 seconds and then restoring the signals. This second level of recovery is equivalent to powering down the eSTS board and then restoring power (hence a soft reboot).

The eSTS Mode LED essentially reports that the extended features of the eSTS are operational.

Each eSTS product has an integrated USB Serial Port, which is used by LTM. The eSTS Mode LED reports the serial port enumeration (hence detection) by the tablet. If the LED is not active, the LTM application cannot run. If the LED is not active, the extended features such as Battery Modulation cannot run. The watchdog process within the LAVA hardware monitors the eSTS Mode. If the eSTS Mode is not detected within a reasonable time, the same “USB Reset” described in the above paragraph is performed. The eSTS Mode LED essentially reports that the extended features of the eSTS are operational.

The sample LTM.INI file located later in this document has the following settings included:

```
keep-alive-rate=3
keep-alive-timeout=5
power-watchdog-timeout=7
power-watchdog-action=1
```

There should be no need to change these parameters. These parameters can be removed from the LTM.INI file as they represent the system defaults. The ability to change these parameters has been included to handle custom applications.

Additional "watchdog" features include the Low-Level Detect (LLD), Low Voltage Detect (LVD), and Stuck Level Detect (SLD) mechanisms added in LTM v2.00. These features add an extra level of protection for some rare conditions seen in a few tablet models.

The Low-Level Detect (LLD) monitors the tablet battery level. In some rare cases, the tablet may refuse to start charging. This mechanism prevents the tablet from discharging. The configuration commands use an "lld-" prefix. If the signal drops below the danger threshold ("lld-threshold" - "lld-offset") for three samples, then a recovery operation is started. All signals to the tablet are removed for 3 or 4 seconds, and the tablet is then placed back into Simulcharge. The signal must have been above or at the activation threshold ("lld-threshold") on a previous sample, to enable the detection feature. This feature is active as a default.

The Low Voltage Detect (LVD) monitors the tablet battery voltage. In some rare cases, the tablet may refuse to start charging when using battery modulation. This mechanism prevents the tablet from discharging. The configuration commands use an "lvd-" prefix. If the signal drops below the danger threshold ("lvd-threshold" - "lvd-offset") for three samples, then a recovery operation is started. All signals to the tablet are removed for 3 or 4 seconds, and the tablet is then placed back into Simulcharge. The signal must have been above or at the activation threshold ("lvd-threshold") on a previous sample, to enable the detection feature. This feature is active as a default.

The Stuck Level Detect (SLD) feature monitors the tablet battery level. In some rare cases, the tablet charge level gets stuck. After many hours the tablet recovers. This mechanism ensures the recovery time is controlled. The configuration commands use an "sld-" prefix. If the battery level does not change for 'x' minutes, then a recovery operation is started. All signals to the tablet are removed for 3 or 4 seconds, and the tablet is then placed back into Simulcharge. This feature is active as a default.

## Firmware Update Support

The application firmware of each eSTS board can be updated in the field. The update file is placed in the tablet Download folder. The LTM application detects the update image within a minute and begins the update process. The update takes 1 to 2 minutes. Normal system operation is restored after the update.

Once the update is finished, the update file is automatically removed from the Download folder.

The update process is immune to problems such as a power interruption.

The update file name is always “app\_ltm\_update.bin”.

When the update has completed, the Android Toast message “LTM – controller updated” is reported.

If the update fails, the Android Toast message “LTM – controller update failed” is reported. If the update fails, then removing power from the eSTS and restoring it allows the update to complete. If the update fails, the eSTS is stuck in the Boot Loader. When the Boot Loader is active, the Charge State (green) LED flashes on and off every ½ second. While in the Boot Loader, no battery modulation operations take place, and the tablet is left to charge up to 100%.

The “LTM\_UPD\_LOG.txt” file is generated and placed in the Download folder to indicate success or failure. The file contents are always appended.

The following indicates success:

```
1472658697:
4172658697: START OF UPDATE - 2016-08-31 11:51:37
1472658697: update version = 2.0
1472658697: product type = 2
1472658697: image type = 2
1472658711: UPDATE SUCCESSFUL
1472658711: END OF UPDATE
```

The following indicates failure:

```
1472658639:
1472658532: START OF UPDATE - 2016-08-31 11:48:52
1472658532: update version = 2.0
1472658532: product type = 2
1472658532: image type = 2
1472658537: open connection, status=false
1472658539: open connection, status=false
1472658539: UPDATE FAILED
1472658539: END OF UPDATE
```

The number at the start of each line is a UTC timestamp. The value is the number of seconds since January 1, 1970 (midnight UTC/GMT) not counting leap seconds.

If the product and image type are incorrect in the update file, the update is rejected, and normal operation continues. There is no restriction on the firmware version being newer than the active version. If the LTM Service does not consider an update file valid, the update is aborted before any changes are made to the eSTS product.

## Samsung Knox Configure

The LAVA Tablet Manager (LTM) can be installed using Samsung's "Knox Configure" which is a cloud-based service permitting IT administrators to configure Samsung Galaxy devices in bulk remotely.

The service pushes out customer provided applications and files to a tablet through the \Contents folder created in the Internal Storage folder. The "Knox Configure" service creates the \Contents folder and which is not present on the tablet as a default.

The LAVA Tablet Manager (LTM) searches for it's LTM.ini configuration file in the \Download folder as well as the \Contents folder. Support of the \Contents folder was added in LTM v2.03.

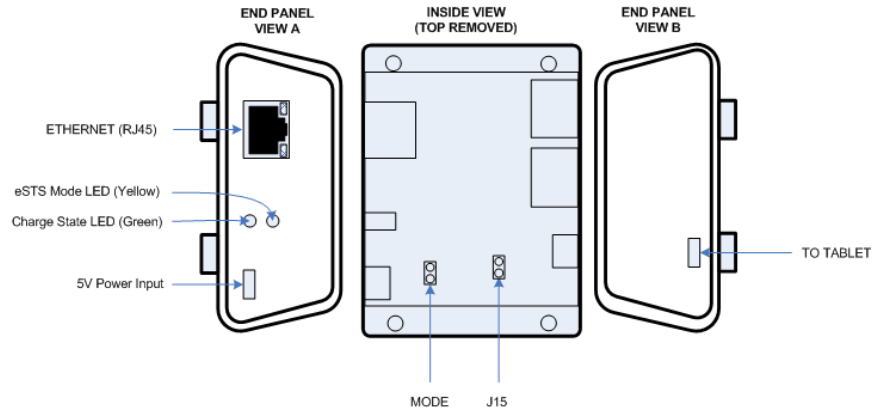
The "Knox Configure" service can remotely handle the Device Administrator permissions required by LTM, eliminating the need for user interaction during this stage of the LTM setup.



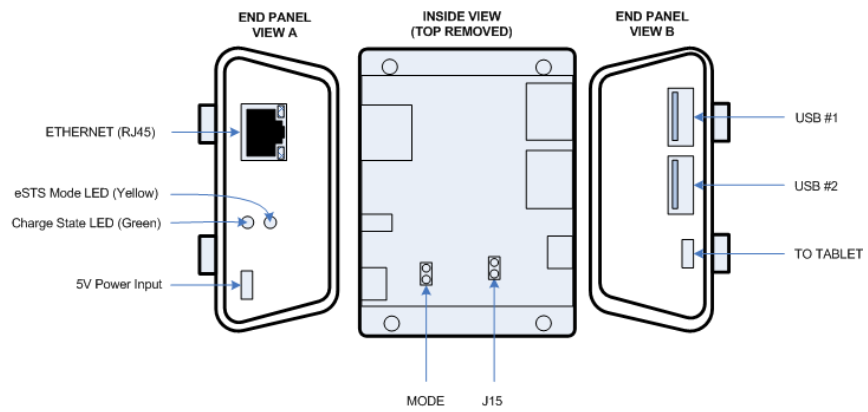
# Connection Descriptions

## Connector Placement

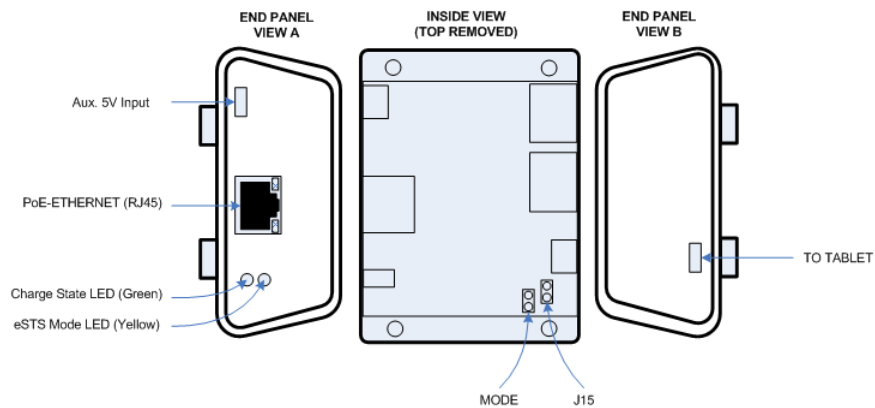
### eSTS-E Connections



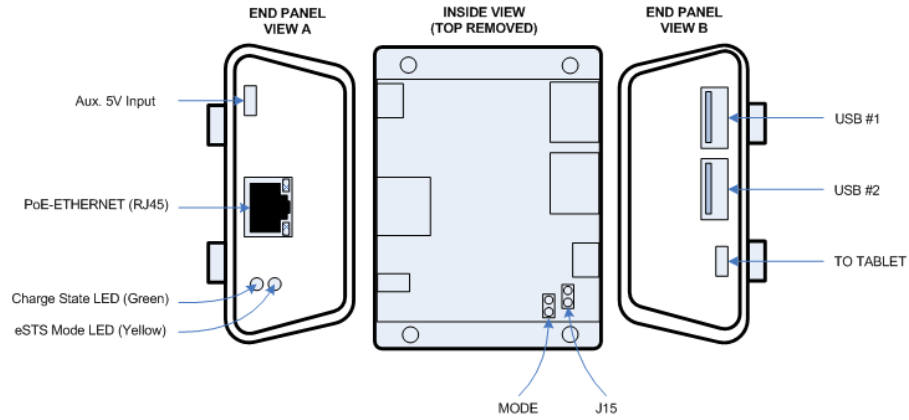
### eSTS-2UE Connections



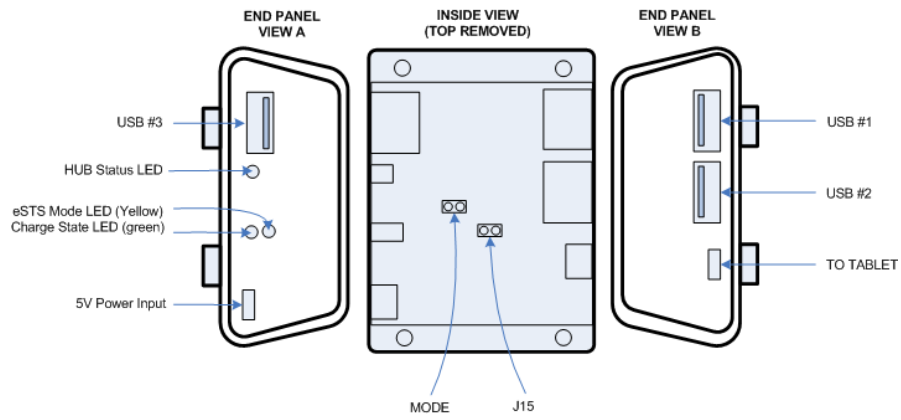
### eSTS-PE Connections



**eSTS-P2UE Connections**



**eSTS-3U Connections**



## Micro-B USB “To Tablet”

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

The custom 39” (100 cm) cable provided with the eSTS product provides the connection between the eSTS and the tablet. The custom cable has a Micro USB-B connector at each end. It does not matter which end of the cable is attached to the tablet or the eSTS product.

The eSTS to Tablet cable must not be extended, as the additional power loss in the wires will result in unreliable tablet charging and operation.

*Note: The eSTS-1U and eSTS-BM boards are supplied with 8” (20 cm cables).*

*Note: All LAVA eSTS/STS cables of any length are interchangeable.*

## Micro-B USB “5V Power Input”

The “5V Power Input” is a Micro USB-B Receptacle on eSTS products without Power over Ethernet.

The 5V Power Input provides power for the eSTS product, the tablet, and for attached USB accessories. The eSTS product will not function if power has not been applied to the 5V Power Input. The eSTS products are not intended to draw power from the tablet.

A standard USB 5V DC Power Supply is attached to the 5V Power Input. The supply need not be a Dedicated Charge Port (DCP) compliant device. A standard USB power supply is rated at 5 volts nominal, with a 5.25 volts maximum. The typical current rating is 2 amperes for a tablet with at least a 10-inch screen. A typical USB Power supply is rated at 10 watts (2 amperes at 5 volts DC).

The USB Power Supply provided with most Samsung tablets are rated at 5.3 volts and 2 amperes. When using the charge cable provided by Samsung, the voltage delivered to the end of the cable will typically be from 5.0 to 5.1 volts. These supplies have some compensation for wire losses.

The voltage at this input should not be much below 5 volts. The preferred level is 5.1 to 5.25 volts.

The 5V Power Input on the eSTS products can be used with an external USB Power Bank (aka. USB Battery Pack). 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 eSTS product **must be** as short as possible. The cable has power loss proportional to the cable length and wire thickness. The voltage present at the eSTS receptacle will be lower than the supply output due to cable power loss. There is power loss in the cable which connects the eSTS to the tablet. If the voltage at the tablet is too low, the tablet will not charge.

The USB specification defines the minimum voltage of 4.75 volts for USB accessories operating at a full unit load. When connecting some accessories to the tablet via an eSTS device, the cable quality and length must be selected to ensure that the voltage reaching each accessory is at least 4.75 volts as a general rule. Many devices such as mice operate at a lower voltage than 4.75. A power budget must be carefully evaluated for the system if reliable operation is to be ensured.

The models with the 5V Power Input include the eSTS-1U-OEM, eSTS-BM-OEM, eSTS-3U, eSTS-E, and eSTS-2UE.

## Micro-B USB “Aux 5V Input”

The ‘Aux 5V Input’ is a Micro USB-B Receptacle on eSTS products with PoE capability.

This input **is only** used for system testing when PoE power **is not** present. The eSTS product will be fully functional, including the 10/100 Ethernet, when this power input is used.

A standard USB 5V DC Power Supply is attached to the Aux 5V Input. A standard USB power supply is rated at 5 volts nominal, with a 5.25 volts maximum. A typical USB Power supply is rated at 10 watts (2 amperes at 5 volts DC).

The eSTS product does not function if power has not been applied either via PoE or the Aux 5V Input.

The PoE models include the eSTS-PE and eSTS-P2UE products.

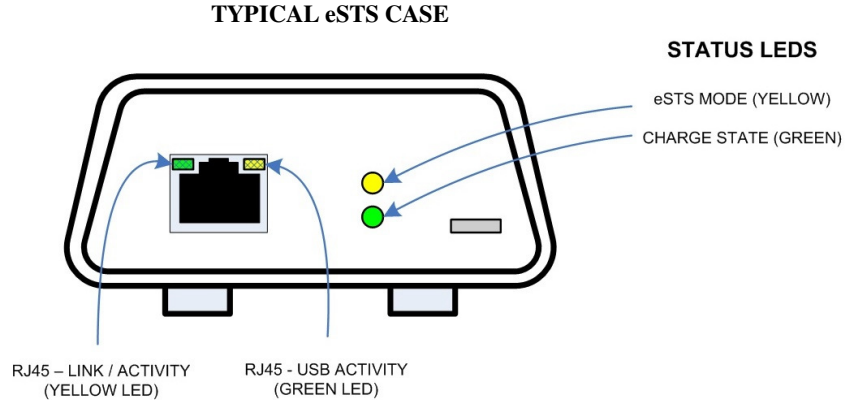
**Warning:** *When supplying power using the “Aux. 5 Volt” input on the eSTS-PE or eSTS-P2UE, you must not use PoE supplied power.*

## USB-A receptacles

Several eSTS 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 tablet. Each receptacle provides power to each USB Accessory up to a maximum of 500 mA, as per the USB specification.

## Status LEDs

Each eSTS has two primary Status LEDs. The mounting location varies between each eSTS product. The eSTS products in a casing always have the two primary Status LEDs mounted one above the other as shown in the following diagram.



Units with Ethernet support have two additional status LEDs mounted in the RJ45 receptacle, which are described in the ETHERNET RJ45 section.

The “Charge State” LED flashes on and off in a unique “flash-flash-pause” pattern during the first 2 to 3 seconds. The chart below explains the various states the “Charge State” LED reports. The “eSTS Mode” LED flashes on and off to report the system is running. A careful examination of the flash pattern can indicate finer details of the system operation such as the battery modulation state (charging or discharging).

STATUS LED STATES			
Name	Colour	State	Description
eSTS MODE	Yellow	On	The “eSTS Mode” LED reports that the USB Serial Port used by LTM has been detected by the tablet. The “Extended STS” features are therefore enabled when this LED is “on”.
		Off	The internal USB Serial Port used by LTM has not been detected by the tablet. If this condition persists, verify the cable connecting the eSTS to the tablet. The USB connection is reset every few minutes in an attempt to “wake” up the tablet, which this indicator is “off”.
CHARGE STATE	Green	Mostly “on”, short flash “off”	Tablet is charging (part of the battery modulation process). The pattern repeats every 1.5 seconds.
		Mostly “off”, short flash “on”	Tablet is discharging (part of the battery modulation process). The pattern repeats every 1.5 seconds.
		Slow “on” and “off” four times	A configuration command has been sent to the board. The pattern duration is 1.5 seconds.
		Rapid “on” and “off” eight times	Charging “on” or “off” command sent to the board. The pattern duration is 1.5 seconds.
		Continuous “on”	The “Extended STS” features are disabled. The internal MODE jumper is installed. The LTM application does not run in this state. The LTM application is not required on the tablet.
		Off	No power is applied to the eSTS device. If using the hardware-reset-action which acts on the eSTS, the LED will be off for about 30 seconds and then recover.
		Even pattern of “on” and “off”	When the J15 jumper is installed, the unit remains in the Bootloader after power up. This pattern indicates the Bootloader is running. All extended operations are suspended while the Bootloader is active.

Each eSTS product has an internal USB Serial Port, which is used by the LAVA Tablet Manager (LTM) application. The “eSTS Mode” LED reports if the serial port has been enumerated (hence detected) by the tablet. If the “eSTS Mode” LED is not active, the LTM application cannot run. If the “eSTS Mode” LED is not active, the extended features such as Battery Modulation cannot run.

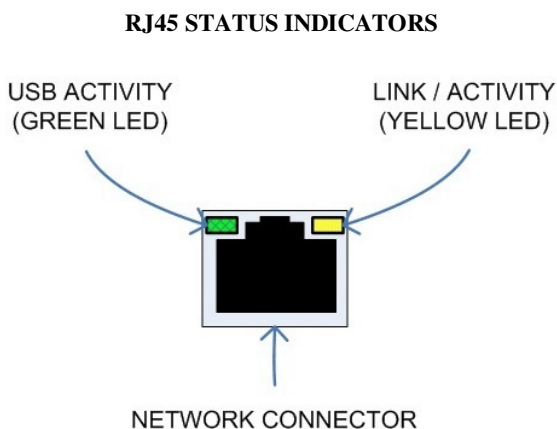
The watchdog process within the LAVA hardware monitors the eSTS Mode. If the “eSTS Mode” LED is not active within a reasonable time, the same "USB Reset" described in the System Watchdog Handling section is applied. The “eSTS Mode” LED indirectly reports that the extended features of the eSTS are operational.

## “ETHERNET” RJ45 Port and Indicators

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 the eSTS-E and eSTS-2UE.

The ETHERNET Port only functions when the eSTS device is powered. The eSTS devices have a dedicated power input and are not intended to draw power from the tablet.

The ETHERNET Port has two status indicators labeled “USB Activity” and “Link/Activity”.



The USB Activity is a yellow indicator. The USB Activity is solid yellow when the eSTS is powered and connected to the tablet. The USB Activity flashes when there is traffic between the tablet and an eSTS product.

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

Both indicators remain off when power has not been applied.

The tablet setup and status for the ETHERNET port 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 tablet options permit the use of static address assignments or dynamic address assignments via DHCP. This menu reports if the Ethernet adapter is active as well as serving as the adapter enable.

When using DHCP, the tablet attempts to fetch the addressing information from a DHCP server. If the addressing information is not located within the timeout period, the tablet 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. The eSTS Network Recovery automates the network restart, which is critical for embedding a tablet in an enclosure

When the user disables the Ethernet adapter via the Connections > More networks > Ethernet menu, the adapter remains disabled until enabled again by the user.

## “PoE-ETHERNET” RJ45 Port and Indicators

The PoE ETHERNET Port has all the features of the ETHERNET Port described in the previous section, as well as the ability to receive power from the Network Cable. All power for the eSTS device, tablet charging, and attached USB accessories are provided by the PoE-ETHERNET Port.

A “PoE-ETHERNET” port is present on the eSTS-PE and eSTS-P2UE products.

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 the eSTS-PE and eSTS-P2UE.

**Warning:** *When supplying power using the “Aux. 5 Volt” input on the eSTS-PE or eSTS-P2UE, you must not use PoE supplied power.*

## Internal Jumpers

Each eSTS product has a pair of internal 2-pin jumpers. The jumpers are not installed as a manufacturing default. These jumpers handle special conditions. In practice, most users will never use these jumpers.

Internal Jumpers	
Label	Description
MODE	<p>This 2-pin jumper is used to disables all the extended features of the eSTS, including Battery Modulation. The “eSTS Mode” LED will always be off. All System Watchdog features are disabled. The LTM application will never run. There is no need to install the LTM application. The SimulCharge feature is always active.</p> <p>No jumper permits all extended features to function, and the LTM application must be activated on the tablet. This is the manufacturing default.</p>
J15	<p>The 2-pin J15 jumper forces the Bootloader to be run on power up and remain active. The installed application is not affected. This jumper is used to recover from an upgrade application image which is not behaving correctly.</p>

## Tablet Charging with USB Host Operation (SimulCharge)

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### Overview

The Samsung tablet was intended as a stand-alone device. When the tablet battery requires charging, it is plugged into a Wall/USB Charger to restore the battery charge. The tablet can continue to be used while being charged. Once the battery is charged, the tablet may use the charger as a supplementary power source if the tablet is left running. It is preferred to charge a tablet 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 tablet charges at a high rate that is tablet 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 tablet 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 tablet and is equivalent to a USB Charger with a Dedicated Charge Port (DCP).

The eSTS products do not support Charge-Only Mode.

### USB Host versus Accessory

A tablet 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 tablet is attached. The PC provides power to the tablet, but the tablet battery is being charged at a low rate. In some cases, the battery may not charge.

To plug a USB Accessory into a tablet, the tablet 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 tablet detects that a USB Accessory has been plugged in and automatically switches to operate as a USB Host Controller. Not all tablets support the USB OTG feature. When operating as an OTG USB Host, the tablet is expected to supply power to the attached accessories, which means power is drained from the tablet battery.

### SimulCharge Mode

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

Samsung tablets 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 tablet and USB accessories. If there is not enough power coming in, the tablet takes the extra from the battery. Hence the battery will not be charging. The screen brightness may have to operate at less than 100% to allow the battery to charge. The application color scheme can be designed to reduce the power required. Application processes requesting too much CPU time increases the power needed for the tablet.



The tablet must be turned on and connected to the eSTS-\*\* product before power is applied to the eSTS-\*\* product, to ensure proper startup. If the eSTS\*\* product is powered before attaching it to the tablet, the tablet may not enter USB Host mode or may not enable battery charging.

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

The eSTS products must always be powered to keep the tablet charged, and allow operation with USB accessories.

## **Additional Notes**

A self-powered USB Hub can be used to offload the power required by the USB accessories from the power supply running the tablet and eSTS device. A self-powered USB Hub should not draw power from the USB Host Controller but from a dedicated supply. A self-powered USB Hub becomes the power source for the attached USB accessories.

## Using USB Serial Ports

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An interface once commonly used to access external hardware is an RS232 Serial Port. This type of interface was once used to connect a variety of devices to a desktop PC such as printers, mice, barcode scanners, and NFC readers. The low hardware and software cost of adding this type of device makes this type of interface still attractive in many devices.

The majority of serial ports use a device referred to as a Universal Asynchronous Receiver Transmitter, or UART for short. This device manages the sending and receiving of data.

There are many standards for serial communications. The RS232 standard defines the most common electrical levels and types of connectors used.

There are several USB UART Adapters available on the market compatible with Android.

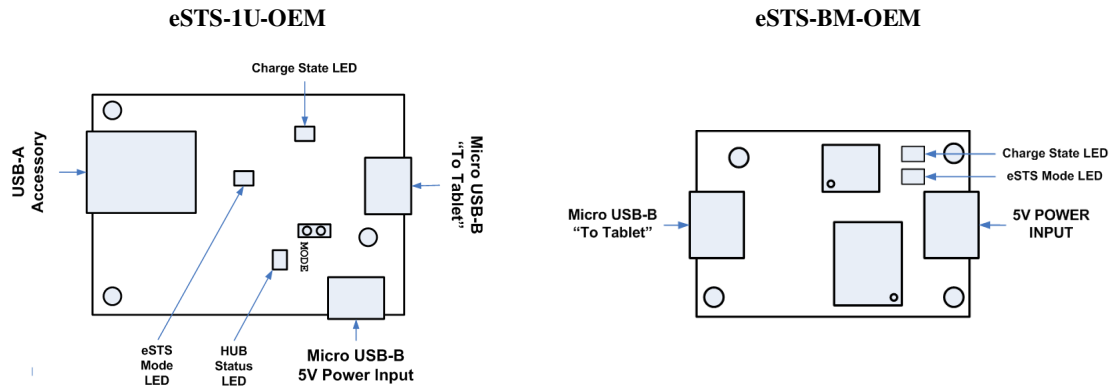
The LAVA Tablet Manager (LTM) v2.00 has added special support for single and multiple user-supplied serial ports. If your system is using a USB Serial Port, please contact LAVA for additional information.

## Modules: eSTS-1U-OEM and eSTS-BM-OEM

The eSTS-1U-OEM and eSTS-BM-OEM are single board OEM devices intended for system integrators. These are board-only products. It is expected that a system integrator will incorporate the board into a casing.

The LAVA eSTS-1U-OEM allows select Samsung Tablets to work with USB accessories while power is being supplied to the tablet. A single USB 2.0 Type A receptacle is available.

The eSTS-BM-OEM is a unique member of the eSTS Family of devices. This board provides the battery modulation features of the eSTS Family of devices at a very low cost. This board does not support USB devices.



The LAVA Tablet Manager application must be installed on the tablet. When combined with the LAVA Tablet Manage application, both products support the extended features of Battery Modulation and Screen Brightness control. The application firmware can also be updated through the LAVA Tablet Manager, just as any other member of the eSTS Family.

Ethernet related features described in this document do not apply to these boards.

The eSTS-1U has an internal USB 2.0 Hub which isolates the tablet from any attached USB accessories. The attached accessories are not permitted to draw more than 500 mA, as per the USB specification.

The board and tablet are powered through a Micro USB-B power input using the same USB power supply provided with the tablet. The standard Samsung USB Power Supply is rated at 5 volts and 2 amperes, which nominally provides 5.0 to 5.1 volts at the eSTS input. Extending the original power supply cable is not wise as the voltage reaching the eSTS may be too low due to cable losses.

The input voltage to the board should be at least 5 volts for proper tablet operation. The preferred voltage at the board input is 5.1 to 5.25 volts. The board input voltage **must not** exceed 5.25 volts.

Due to power loss across the connecting cables, the designer must ensure that the voltage at no point in the system is too low. Power loss is an issue that applies to all USB cables in the system.

The power supply used to run the system is responsible for handling over current conditions.

The power connectors have no protection against over voltage or reversed connections. Application of the wrong voltage can result in **immediate** damage to the board and possibly other components in the system.

Application of the wrong input voltage violates LAVA's Manufacturer Warranty.

## LAVA Tablet Manager INI File

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### Overview

The LAVA Tablet Manager (LTM) Service is configured by the file LTM.ini located in the Internal Storage “root” folder of the tablet. The “root” refers to the folder that contains sub-folders such as Download, Playlists, Music, Movies, and so on.

The LTM.INI file is a simple human-readable UTF-8 (ASCII) file. The file can be modified using a text editor on a PC, as most tablets do not have a suitable editor installed.

A configuration file update can be placed in the \Download or \Contents folder and is then automatically moved to the Internal Storage “root” by the LTM Service. A configuration file update can be placed directly in the “root” folder. The \Contents folder is created by the Samsung’s KNOX Configure service and is not present as a default definition.

The INI file can be copied to the tablet at any time. When the INI file has changed, all but four commands take effect immediately within the LTM Service. The following commands are in a unique category and are only acted on when the service starts:

- ❑ power-watchdog-timeout
- ❑ power-watchdog-action
- ❑ keep-alive-timeout

All lines starting with a ';' character are ignored. Lines starting with a '#' character can be used as comments.

The configuration file tokens are not case sensitive.

The configuration file contains a set of tokens and values with the format of "token=x", where 'x' is a decimal integer.

The LTM Service has default values for all commands. If a given command is missing from the INI or the INI was deleted, the LTM Service will still run.

The command “board-type” defines the only critical parameter in the configuration file. This parameter must be matched to the tablet being used to define the battery modulation scheme.

## Commands and Parameters

INI Command	Description
configuration=x	This command defines an optional message string to identify the INI version. The string is reported via a Toast message when the LTM Service is started. No white space allowed. If the string is not defined, no Toast is displayed. The default is an empty string, therefore no message. Example: The Toast message "LTM – xyz" is reported for "configuration=xyz".
board-type=x	Select the eSTS board type and modulation command set. The supported values are: 0=Prototype board using a unique command set (L180.0 board) 1=Modulation scheme 1 2=Modulation scheme 2 3=Modulation scheme 3 The default is 2.  The Tab A 10.1" tablet uses board-type = 3. The Tab E 9.6", Tab A 9.7", and Tab A 8.0" tablets use board-type = 2. The Tab S2 9.7", S2 8.0" and Tab E 8.0" use board-type = 1.
bttv-upper-threshold=x	The standard upper limit for battery charging as a percentage. The permitted range is 20 to 100. The default is 95.
bttv-lower-threshold=x	The standard lower limit for battery charging as a percentage. The permitted range is 1 to 100. The default is 70.
bttv-cycle-upper-threshold=x	The "full" charge cycle upper limit for battery charging as a percentage. When the battery level reaches this point during a "full" charge cycle, then charging is automatically turned off. It is important to allow the tablet to periodically charge up to 100% to reset the calibration. A "full" charge cycle is performed every 'n' standard cycles, where "bttv-cycle-limit" defines 'n'. This parameter should always be 100. The permitted range is 20 to 100. The default is 100.
bttv-cycle-lower-threshold=x	The "full" charge cycle lower limit for battery charging as a percentage. When the battery level reaches this point during a full charge cycle, then charging is automatically turned off. It is important to allow the tablet to periodically charge up to 100% to reset the calibration. A "full" charge cycle is performed every 'n' standard cycles, where "bttv-cycle-limit" defines 'n'. The parameter is typically set to the same value as "bttv-lower-threshold". The permitted range is 1 to 90. The default is 70.
bttv-cycle-limit-on-start=x	The number of charge cycles after startup before a "full" charge cycle is forced. For a "full" charge cycle the bttv-cycle-lower-threshold and bttv-cycle-upper-threshold are used. The permitted range is 0 to 100. The default is 0.
bttv-cycle-limit=x	The number of charge cycles before a "full" charge cycle is used. For a "full" charge cycle the bttv-cycle-lower-threshold and bttv-cycle-upper-threshold are used. The permitted range is 1 to 9999. The default is 25.
encourage-night-charging=x	The "encourage-night-charging" feature results in the tablet being forced into the charge state 'x' minutes before the start of brightness-level2-time. The "night time" window starts at "brightness-level1-time" and ends at the "brightness-level2-time". During this window, the tablet screen can be set to operate at a low brightness to reduce heat generation. This feature encourages the battery to be charged toward to upper threshold to take advantage of the reduced heat. The permitted range is 0 to 720. The default is 30.

check-btty-current=x	This command is used to enable the checking the battery charge current while waiting for a charge threshold to be reached. If the battery current is not flowing in the expected direction, a reminder command (charge or discharge) is sent to the eSTS board. The permitted range is 0 to 1. The default is 1, which enables the feature.
ignore-btty-current=x	This command behaves the same as "check-btty-current". This command has been kept for backward compatibility with another product. This command sets the same internal variable as "check-btty-current".
no-btty-modulation=x	This command can be used to disable the battery modulation. A "1" results in no battery modulation and all battery thresholds are internally set to 100. A "0" permits battery modulation. Disabling battery modulation is not recommended. The ability is present for internal testing. The permitted range is 0 to 1. The default is 0.
permit-ethernet=x	This command is used to enable the Ethernet related features of LTM. The permitted range is 0 to 1. A 1 permits the Ethernet features. A 0 disables the Ethernet features. The default is 1.
dhcp-recovery=x	A dhcp-recovery value of 1 or 2 enables the Network/DHCP Recovery mechanism. When the network connection is lacking for approximately 1 minute, a network reset is attempted. A value of 0 disables the mechanism. The permitted range is 0 to 2. The default is 1.  A dhcp-recovery value of 1 results in subsequent recovery attempts taking place after 2, 3, 5, and then 8 minutes. After the first 4 recovery attempts, then subsequent attempts are every 8 minutes.  A dhcp-recovery value of 2 results in subsequent recovery attempts taking place every 2 minutes. The dhcp-recovery value of 2 was added in LTM v1.11.
wifi-overrides-ethernet=x	This command allows the wired Ethernet interface to be disabled when WiFi is enabled. The permitted range is 0 to 1. A "1" results in the Ethernet interface being disabled if WiFi is enabled. A "0" results in the Ethernet interface being active if WiFi is enabled, and the Android system determines how messages are routed. The permitted range is 0 to 1. The default is 0.
keep-alive-rate=x	The number of minutes between a charge (on or off) command being sent to the eSTS board as a reminder of the current charging state. The permitted range is 0 to 60. A 0 disables keep-alive messages; charge commands are only sent when an upper or lower threshold is reached. The default is 3.
keep-alive-timeout=x	This command defines the timeout for the reception of any command from the LTM Service. If no command is received within the timeout, the communication port used for the tablet to eSTS messaging is reset. This command is used as a first level recovery mechanism in the event the LTM Service has been shut down by the Android system. This can occur on occasion as the Android system does not want a user launched application to run forever. A value of 0 disables the timeout. Values 1 to 4 are treated as 0 The permitted range is 0 to 60 minutes. The manufacturing default is 5 minutes. This value is stored in non-volatile memory of the board, so if the command is removed from the INI file, the last value presented is remembered by the board. This value is only set when the LTM Service starts.
power-watchdog-timeout=x	This command sets a timeout for the reception of a charge command. The LTM Service is expected to send a charge (on or off) command on a regular basis as a keep alive. If no command is received within the timeout, the LTM Service is assumed to have been halted by the Android system. This can occur on occasion as the Android system does not want a user launched application to run forever. If the timeout does occur, the "power-watchdog-action" defines the action to take place. The units are in minutes. A value of 0 disables the timeout. Values 1 to 4 are treated as 0 The permitted range is 0 to 60 minutes. The default is 7 minutes. This value is stored in non-volatile memory of the board, so if the command is removed from the INI file, the last value presented is remembered by the board. This value is only set when the LTM Service starts.

power-watchdog-action=x	<p>This command defines the action to take when the power-watchdog-timeout expires.</p> <p>A "1" results in the tablet being restarted in SimulCharge mode.</p> <p>A "0" results in the tablet power being turned back on.</p> <p>The permitted values are 0 and 1.</p> <p>The manufacturing default is 1</p> <p>This value is stored in non-volatile memory of the board, so if the command is removed from the INI file, the last value presented is remembered by the board.</p> <p>This value is only set when the LTM Service starts.</p>
brightness-level1-time=x	<p>Time of night when the "level 1" brightness is set.</p> <p>The military (aka 24 hour) time format is used.</p> <p>The default is -1, which disables the brightness timers.</p> <p>Examples: 0:00 for midnight, 7:30 for 7:30AM, 23:15 for 11:15PM</p> <p>Note: The format expects an ':' to separate the hour and minutes.</p> <p>Note: If one integer is present, it is treated as hours, with minutes defaulting to 0.</p> <p>Note: If minutes exceed 59, then time is invalid.</p> <p>Note: If hours exceed 23, the time is invalid.</p> <p>Note: A negative time (ex. -1) disables all brightness thresholds</p> <p>Note: If the brightness times are valid and equal, then brightness-level2 is always applied.</p>
brightness-level2-time=x	<p>Time of day when the "level 2" brightness is set.</p> <p>Same format and rules as used by brightness-level1-time</p> <p>The default is -1, which disables the brightness timers.</p>
brightness-level1=x	<p>Screen brightness used by "brightness-level1-time".</p> <p>The permitted range is 0 to 100.</p> <p>The default is 15.</p> <p>Invalid values are replaced with the default.</p>
brightness-level2=x	<p>Screen brightness used by "brightness-level2-time".</p> <p>The permitted range is 0 to 100.</p> <p>The default is 85.</p>
hardware-reset-frequency=x	<p>This command defined the number of hours the LTM Service runs before a hardware reset is performed as defined by the "hardware-reset-action".</p> <p>A tablet was not originally intended to run for an extended period. Depending on the tablet used and the customer application a partial or full reset of the system on a regular interval can prevent unexpected resets during prime operating hours. The time is specified in hours since the LTM Service has been started. The permitted range of values is 0 to 5000 hours (208 days). Once the number of hours has been reached, a time of day window can also be specified. If the hours do not fall in the time of day window, the reset is simply delayed until the next time of day window.</p> <p>The permitted range is 0 to 5000.</p> <p>The default is 0, which disables the feature.</p>
hardware-reset-time-1=x	<p>The "hardware-reset-time-1" and "hardware-reset-time-2" define the start and end of the window in which a hardware reset is permitted as controlled by the "hardware-reset-frequency". See the "hardware-reset-frequency" description for further information.</p> <p>The time used the same format as used by brightness-level1-time.</p> <p>A negative value disables the parameter and the time window.</p> <p>The "hardware-reset-time-1" and "hardware-reset-time-2" must be different valid times to enable the window.</p> <p>The default is -1, which disables the feature.</p>
hardware-reset-time-2=x	<p>The "hardware-reset-time-1" and "hardware-reset-time-2" define the start and end of the window in which a hardware reset is permitted as controlled by the "hardware-reset-frequency". See the "hardware-reset-frequency" description for further information.</p> <p>The time used the same format as used by brightness-level1-time.</p> <p>A negative value disables the parameter and the time window.</p> <p>The "hardware-reset-time-1" and "hardware-reset-time-2" must be different valid times to enable the window.</p> <p>The default is -1, which disables the feature.</p>

hardware-reset-action=x	<p>This command determines the action to take once the "hardware-reset-frequency" limit is reached. The actions included resetting the eSTS hardware and resetting the Tablet. An eSTS hardware reset has the same effect as removing power from the board and then restoring power.</p> <p>The possible values for the command and associated action are:</p> <ul style="list-style-type: none"> <li>0=nothing</li> <li>1=eSTS reset (the default)</li> <li>2=Tablet reset</li> <li>3=eSTS and Tablet reset</li> </ul>
	<p>The <b>USB Permission Handling</b> feature allows the Android USB permissions for an application to be assigned automatically for user peripherals. This eliminates the need for the user to respond to the standard Android pop-up normally presented when a USB peripheral attaches. The mechanism supports two USB devices. The USB vendor identifier and product identifier must be specified, along with the "package name" of the Android application. The feature was added in LTM v2.00.</p> <p>There are special rules for using USB Serial Port. If you are using one or more serial ports, please contact LAVA for additional information.</p>
uph-package-1=x	USB Permission Handling - Package name #1. The minimum length is 5 characters.
uph-vid-1=x	USB Permission Handling - USB vendor identifier #1. Range is 1 to 65535.
uph-pid-1=x	USB Permission Handling - USB product identifier #1. Range is 1 to 65535.
uph-package-2=x	USB Permission Handling - Package name #2. The minimum length is 5 characters.
uph-vid-2=x	USB Permission Handling - USB vendor identifier #2. Range is 1 to 65535.
uph-pid-2=x	USB Permission Handling - USB product identifier #2. Range is 1 to 65535.
lld-permitted=x	<p>The "lld-permitted" command enables the Low-Level Detect (LLD) feature for the tablet battery level. In some rare cases, the tablet may refuse to start charging. This mechanism prevents the tablet from discharging. If the signal drops below the danger threshold ("lld-threshold" - "lld-offset") for three samples, then a recovery operation is started. All signals to the tablet are removed for 3 or 4 seconds, and the tablet is then placed back into Simulcharge. The signal must have been above or at the activation threshold ("lld-threshold") on a previous sample, to enable the detection feature.</p> <p>This mechanism is part of the System Watchdog Handling.</p> <p>The permitted values are 0 (on) and 1 (off), the default is 1.</p> <p>This feature was added in LTM v2.00.</p>
lld-threshold=x	<p>The activation "threshold" for the Low-Level Detect feature. If the lld-threshold is not defined, then the "btty-lower-threshold" default is used. The "lld-threshold" is limited to the modulation lower thresholds, defined by "btty-lower-threshold" and "btty-cycle-lower-threshold".</p> <p>The range is 1 to 99. The default is defined by that of "btty-lower-threshold".</p> <p>This feature was added in LTM v2.00.</p>
lld-offset=x	<p>The "offset" for the Low-Level Detect (LLD) feature.</p> <p>The range is 0 to 99. The default is 10.</p> <p>This feature was added in LTM v2.00.</p>
lvd-permitted=x	<p>The "lvd-permitted" command enables the Low Voltage Detect (LVD) feature for the tablet battery voltage. In some rare cases, the tablet may refuse to start charging. This mechanism prevents the tablet from discharging. If the signal drops below the danger threshold ("lvd-threshold" - "lvd-offset") for three samples, then a recovery operation is started. All signals to the tablet are removed for 3 or 4 seconds, and the tablet is then placed back into Simulcharge. The signal must have been above or at the activation threshold ("lvd-threshold") on a previous sample, to enable the detection feature. This mechanism is part of the System Watchdog Handling.</p> <p>The permitted values are 0 (on) and 1 (off), the default is 1.</p> <p>This feature was added in LTM v2.00.</p>
lvd-threshold=x	<p>The activation "threshold" for the Low Voltage Detect feature</p> <p>The range is 3000 to 4000. The default is 3700.</p> <p>This feature was added in LTM v2.00.</p>



lvd-offset=x	<p>The "offset" for the Low Voltage Detect (LVD) feature. The range is 0 to 1000. The default is 100. This feature was added in LTM v2.00.</p>
sld-permitted=x	<p>The command enables the Stuck Level Detect (SLD) feature. In some rare cases, the tablet charge level gets stuck. After many hours the tablet recovers. This mechanism ensures the recovery time is controlled. A value of 10 to 300 enables the feature. If the battery level does not change for 'x' minutes then a recovery operation is started. All signals to the tablet are removed for 3 or 4 seconds, and the tablet is then placed back into Simulcharge. This mechanism is part of the System Watchdog Handling. The permitted range is 0 to 300 minutes. Values 1..9 are treated as 0. The default is 60. This feature was added in LTM v2.00.</p>
permit-wake-lock=x	<p>This command results in the LTM service being a little more persistent, when the tablet screen saver is being used, or if the tablet screen is manually turned off. The typical use-case for a tablet using an eSTS product is to have the tablet screen always active. A 1 enables the feature. A 0 disabled the features. If the command is not specified, the feature is disabled as the default. This feature was added in LTM v2.03.</p> <p>Note: When the use-case for the tablet includes allowing the screen to turn off, it is best to set "sld-permitted=0" or at least "sld-permitted=300". With the screen turned off, the tablet is in a hibernation state in which the battery discharges very slowly.</p>
permit-ltm-icon=x	<p>This command determines if the LTM Notification Icon is visible or transparent. A 1 enables the LTM icon. This is the default. A 0 disabled the icon, which is made transparent. It is not possible to eliminate the icon. The notification text is always present. This feature was added in LTM v2.03.</p>
log-file-rate=x	<p>The number of minutes between updates of the diagnostic log file. The log file records the battery level and several other relevant statistics. A value of 0 results in updates only for changes in charge direction. The permitted range is 0 to 1440. The default is 0.</p>
log-file-limit=x	<p>The maximum size of the diagnostic log file. The value is in units of 1000000. The permitted range is 0 to 100. A 0 disables logging. The default is 0.</p>

user-debug=x	<p>This command enables a set of Toast based status messages suitable for the user. The messages report the general state of the LTM Service and tablet. The permitted range is 0 to 3. The default is 1.</p> <table border="1" data-bbox="526 289 1385 657"> <thead> <tr> <th>Level</th> <th>Messages</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>0</td> <td></td> <td>No status messages</td> </tr> <tr> <td>1</td> <td>“LTM - controller attached”</td> <td>The tablet has detected the eSTS board.</td> </tr> <tr> <td>1</td> <td>“LTM - controller running”</td> <td>The LTM7 Service has started to operate.</td> </tr> <tr> <td>1</td> <td>“LTM - controller detached”</td> <td>The eSTS has disconnected from the tablet.</td> </tr> <tr> <td>1</td> <td>“LTM - brightness update”</td> <td>The LTM Service has updated the tablet screen brightness.</td> </tr> <tr> <td>2</td> <td>“LTM - charging nn%”</td> <td>The tablet battery is charging. The current battery level is “nn” percent.</td> </tr> <tr> <td>2</td> <td>“LTM - discharging nn%”</td> <td>The tablet battery is discharging. The current battery level is “nn” percent.</td> </tr> <tr> <td>3</td> <td>“LTM - PASS #nn”</td> <td>The pass number “nn” increments each time the LTM Service runs.</td> </tr> </tbody> </table> <p>Note: Each level includes the messages of the lower levels.</p>	Level	Messages	Comments	0		No status messages	1	“LTM - controller attached”	The tablet has detected the eSTS board.	1	“LTM - controller running”	The LTM7 Service has started to operate.	1	“LTM - controller detached”	The eSTS has disconnected from the tablet.	1	“LTM - brightness update”	The LTM Service has updated the tablet screen brightness.	2	“LTM - charging nn%”	The tablet battery is charging. The current battery level is “nn” percent.	2	“LTM - discharging nn%”	The tablet battery is discharging. The current battery level is “nn” percent.	3	“LTM - PASS #nn”	The pass number “nn” increments each time the LTM Service runs.
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ethernet-debug=x	<p>This command enables a set of Toast based messages suitable for the user. The messages report the status of the Ethernet interface. The permitted range is 0 to 3. The default is 1.</p> <table border="1" data-bbox="526 842 1385 1157"> <thead> <tr> <th>Level</th> <th>Messages</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>0</td> <td></td> <td>No status messages</td> </tr> <tr> <td>1</td> <td>“LTM – ethernet connected”</td> <td>Reported when the Ethernet state changes from not connected to connected.</td> </tr> <tr> <td>1</td> <td>“LTM – ethernet not connected”</td> <td>Reported when the Ethernet state changes from connected to not connected.</td> </tr> <tr> <td>2</td> <td>“LTM – ethernet not connected”</td> <td>Reported each pass of the LTM Service if the Ethernet interface is not connected to the network. The message repeats every 30 seconds.</td> </tr> <tr> <td>3</td> <td>“LTM – ethernet remains connected”</td> <td>Reported each pass of the LTM Service if the Ethernet interface is connected to the network.</td> </tr> </tbody> </table> <p>Note: Each level includes the messages of the lower levels.</p>	Level	Messages	Comments	0		No status messages	1	“LTM – ethernet connected”	Reported when the Ethernet state changes from not connected to connected.	1	“LTM – ethernet not connected”	Reported when the Ethernet state changes from connected to not connected.	2	“LTM – ethernet not connected”	Reported each pass of the LTM Service if the Ethernet interface is not connected to the network. The message repeats every 30 seconds.	3	“LTM – ethernet remains connected”	Reported each pass of the LTM Service if the Ethernet interface is connected to the network.									
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## Diagnostic Log File

The LTM Service has the option to write the battery status to a diagnostic log file.

The file format is UTF-8 (simple ASCII). The file can be read on a PC using any text editor.

The log file is located in the Download folder. The log file name is LTM\_\*\*\*\_LOG.txt. The \*\*\* portion of the file is the Tablet serial number.

If the Tablet is an LTE device, then the IMEI number is used for \*\*\*, for versions of LTM up to v2.02. As of LTM v2.03, the application no longer reads the IMEI information from the tablet.

The “log-file-rate” defines the number of minutes between updates of the diagnostic log file. The permitted range is 0 to 1440, with a default of 0. A value of 0 results in updates only for changes in charge direction.

The “log-file-limit” defines the maximum size of the diagnostic log file in units of 1000000 characters. The permitted range is 0 to 100, with a default of 0. A 0 disables the log file.

The log file can be erased at any time. The LTM Service always appends new information.

When the log file is created, the current configuration settings from the INI file are written to a header in the file. Subsequent changes to the INI file are not written until a new log file has to be created.

Each line of data contains 15 fields. A comma separates each field of data. The first line after the header contains a short “title” for each field, which is useful for some graphing applications.

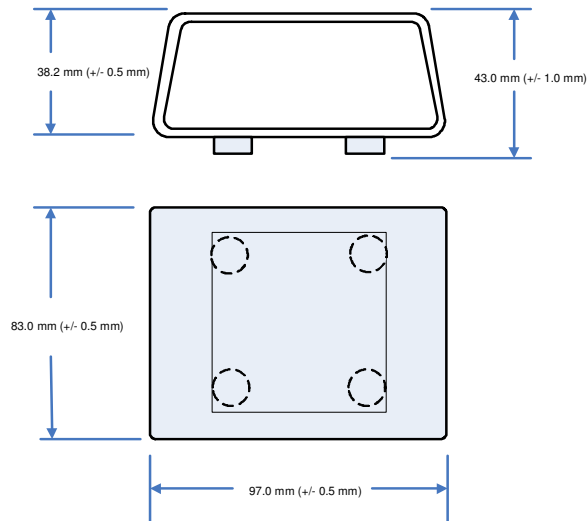
Diagnostic Log File – Field Descriptions														
Field	Title	Description												
1	ID	The ID field contains an ‘L’ followed by an integer indicating the log source.												
		<table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>L1</td> <td>Periodic log entry as selected by "log-file-rate"</td> </tr> <tr> <td>L2</td> <td>Charging state change</td> </tr> <tr> <td>L4</td> <td>LTM Service has started (or possible re-started)</td> </tr> <tr> <td>L8</td> <td>Hardware reset requested. The action was determined by the "hardware-reset-action" command.</td> </tr> <tr> <td>L16</td> <td>Charging enabled due to "encouragement", see the "encourage-night-charging" command.</td> </tr> </tbody> </table>	Value	Description	L1	Periodic log entry as selected by "log-file-rate"	L2	Charging state change	L4	LTM Service has started (or possible re-started)	L8	Hardware reset requested. The action was determined by the "hardware-reset-action" command.	L16	Charging enabled due to "encouragement", see the "encourage-night-charging" command.
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		L8	Hardware reset requested. The action was determined by the "hardware-reset-action" command.											
L16	Charging enabled due to "encouragement", see the "encourage-night-charging" command.													
2	DT	Time stamp as the number of seconds since midnight January 1, 1970, UTC.												
3	UT	Tablet up time in seconds.												
4	AC	The Activity Count is a counter that advances each time the LTM Service runs. The value is reported as “PASS #” when the “user-debug” level is set.												
5	BCI	The Battery Charge Index is an internal counter used to keep track of the charging state of the battery.												
6	BL	The Battery Level is the battery charge level as a percentage.												
7	HLTH	The Android Health parameter is reported here.												
8	BI	The Battery Current is reported in units of mill-amperes.												
9	BV	The Battery Voltage is reported in units of milli-volts.												
10	BT	The Battery Temperature is reported in degrees Celsius * 10.												
11	NR	The Network Reset Count is the number of times a reset of the Ethernet interface was requested since the last log entry.												
12	BN	The Brightness Number ranges from 0 to 2. A value of 2 indicates the “daytime” brightness is active. A value of 1 indicates the “nighttime” brightness is active. A 0 indicates the LTM Service is not controlling the tablet screen brightness.												
13	MR	This field is reserved for future use.												
14	IC	This field is reserved for future use.												
15	AM	This field is reserved for future use.												

## Sample INI File

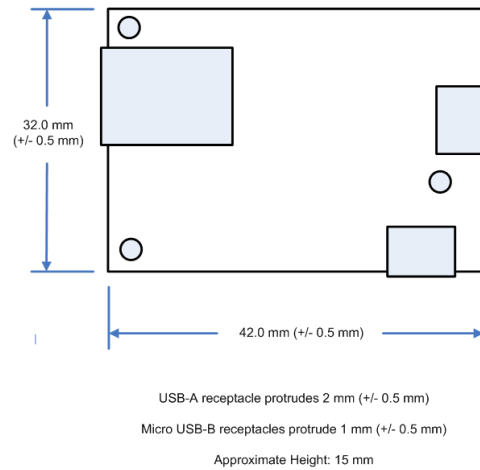
```
;-----  
; LTM7 (LAVA Tablet Manager VII) - Initialization File  
;-----  
; Options for board-type:  
; Type 1 - Tab S2 9.7", Tab S2 8.0", and Tab E 8.0"  
; Type 2 - Tab E 9.6", Tab A 9.7", Tab A 8.0"  
; Type 3 - Tab A 10.1"  
;-----  
[LTM-START]  
configuration=20180130-1200  
;-----  
board-type=2  
;-----  
;permit-wake-lock=1  
;permit-ltm-icon=1  
;-----  
bty-upper-threshold=70  
bty-lower-threshold=45  
bty-cycle-upper-threshold=100  
bty-cycle-lower-threshold=45  
  
bty-cycle-limit-on-start=2  
bty-cycle-limit=50  
;-----  
encourage-night-charging=60  
;-----  
permit-ethernet=1  
dhcp-recovery=2  
wifi-overrides-ethernet=1  
;-----  
keep-alive-rate=3  
;keep-alive-timeout=5  
;power-watchdog-timeout=7  
;power-watchdog-action=1  
;-----  
brightness-level1-time=1:00  
brightness-level2-time=6:00  
brightness-level1=15  
brightness-level2=85  
;-----  
hardware-reset-frequency=240  
hardware-reset-time-1=1:00  
hardware-reset-time-2=2:00  
hardware-reset-action=0  
;-----  
;uph-package-1=  
;uph-vid-1=  
;uph-pid-1=  
;-----  
;uph-package-2=  
;uph-vid-2=  
;uph-pid-2=  
;-----  
log-file-rate=0  
log-file-limit=0  
;-----  
user-debug=0  
ethernet-debug=0  
;-----  
[LTM-END]
```

## Dimensions

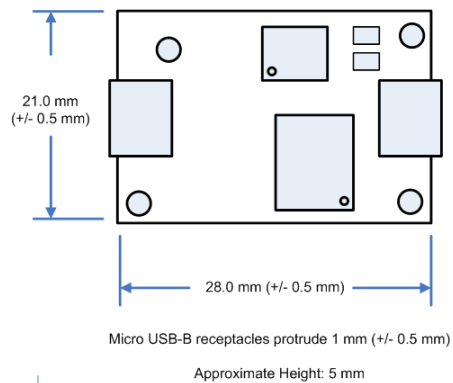
### Case dimensions for the eSTS-3U, eSTS-E, eSTS-PE, eSTS-2UE, and eSTS-P2UE:



### Dimensions of the eSTS-1U-OEM board



### Dimensions of the eSTS-BM-OEM board



## Technical Support

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

<p>Telephone: +1 416 674-5942</p> <p>Fax: +1 416 674-8262</p> <p>Toll-Free (US and Canada): 800 241-5282</p> <p>Internet: <a href="http://www.lavalink.com/helpdesk">www.lavalink.com/helpdesk</a></p>
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## History

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Document Revision	Date	Change
A01	Mar.23, 2017	Initial release.
A02	Apr.28, 2017	Updated the connection diagram for the eSTS-3U. Minor edits in several sections.
A03	May 17, 2017	Updated the Network Recovery description and the “dhcp-recovery” command description to include additional option added in LTMv1.11. Corrected description for INI command “ethernet-debug”. Revised the sample INI file. Changed the dhcp-recovery value to 2.
A04	Sep. 7, 2017	Updated the document for LTM v2.00. Added the “Permission Handling for USB Devices” section. Added the “Using USB Serial Ports” section. Updated the diagrams for the eSTS-BM-OEM. Updated the diagrams for the eSTS-1U-OEM. Expanded the System Watchdog Handling to include the Low-Level Detect (LLD), Low Voltage Detect (LVD), and Stuck Level Detect (SLD). Updated the Tablet Test Summary.
A05	Feb.5, 2018	Updated the Test Summary table. Minor updates to all sections. Clarified the description of the “permit-ethernet” command. Added the “permit-wake-lock” and “permit-ltm-icon” commands. Support for Samsung Knox Configure added.