



spacestation

2014

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mophie Inc. Proprietary

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CHANGES/REVISION HISTORY

Rev	Date	Author	Page(s)	Change Description
0.1	06/10/2014	Steven Chou		First draft
0.2	06/23/2014	Charles Kim	7, 8	Updated ME section and added Figure 3.1 Mechanical Design Control (DC)
0.3	06/23/2014	Steven Chou	9, 10, 11	Updated Battery Cell spec
0.4	06/27/2014	Steven Chou	All	Incorporated comments from CN team

APPROVALS

Date	Title	Name	Signature
	Product Development Manager	Tyson Mackjust	
	Director of Product Development	Charlie Quong	
	Director of Hardware Engineering	Vannin Gale	
	VP of Marketing	Ross Howe	
	SVP of Sales and Business Development	Darren Shimkus	
	Principle	Shawn Dougherty or Daniel Huang	

1.0 PURPOSE AND SCOPE

1.1 Product Marketing Requirements – An Overview

Concept:

The mophie spacestation combines the functionality of a mophie space pack and a mophie powerstation. The two major features are power and storage with the added benefits of the powerstation form factor (portability and universal compatibility). The product will ship with a 6000 mAH battery @ 2.4A output in variants of 32, 64, and 128GB of additional storage. As a premium product the design will be similar, yet, more premium than the powerstation w/cables 2014 line. The product will ship with BLE as well accompanying free iOS and Android apps. The current iOS “Space” app will be redesigned to work with the spacestation and a new “Space” android app will be ready at launch.

Use cases

The mophie spacestation has the following use cases:

- Supplies up to an additional 60% battery capacity for the iPad Air, 85% battery capacity for the iPad mini retina and 300% battery capacity for iPhone 5/5s
- Supplies additional memory capacities of 32, 64 and 128GB for tablets and smartphones
- Pass-through charging with priority for the connected device
- File transfer from the spacestation to the connected device and vice versa
- File management via included Application – allows for content management between devices (space pack, tablet/smartphone, PC/Macs, iOS/third party apps, cloud solutions via API)
- Compatible with iOS and Android tablets and smartphones

Features:

The following list of key features defines the basic functions of the product:

Housing:

- Color/finish: Metal top and bottom plates/PMS Process Black Pantone Black C.
- mophie logo lasered
- Single Female USB port
- Single female Lightning or microUSB port (depends on SKU)
- LED indicator light button (to double as data on button a la space pack)
- May use 2x64GB microSD cards to achieve 128GB capacity (multiple slots for higher capacity) to save cost.

Battery:

- 6,000 mAh Li-ion polymer battery delivers 100% additional battery (5000 mAh is stated battery size; will actually be closer to 6000)
- Charge indicator button
- 4 white LED indicators and the charge button will function as described below:
 - When the battery button is pressed, the white LEDs will show charge level of the device.
 - 4 LEDs light up: 100% ~ 76%
 - 3 LEDs light up: 75% ~ 51%
 - 2 LEDs light up: 50% ~ 26%
 - 1 LED: 25% ~ 11%
 - 0 LED: 10% ~ 0%
 - When Unit is charged via charging port and included cable, the White LEDs will indicate level of charge. The LED duty cycle is 50% @ 1S (500mS ON and 500mS off)
 - 4 LEDs light up: 100% ~ 76%
 - 3 LEDs light up: 75% ~ 51%
 - 2 LEDs light up: 50% ~ 26%
 - 1 LED: 25% ~ 11%
 - 0 LED: 10% ~ 0%

Firmware:

- Approximately 10% of battery reserved for the spacestation for data only
- Over the air (OTA) firmware updates available (on the App)
- Data transfer – must be able to play HD video and audio
- Auto-notification to download App when spacestation is initially attached to a tablet/smartphone
- Files able to be viewed on tablet/smartphone directly from space station without transferring or saving of files from the space station to the tablet/smartphone
- When connected to a computer, it must be automatically recognized as a removable drive. If passcode feature is turned ON in the space pack firmware, when connecting to a computer, SS will not automatically recognized as a removable drive unless the user has entered the correct password.
- Auto-charge and auto-data connection. When a device is connected to the space station via female USB port, charging and data to be activated. Data to have 3 minute timeout period if not accessed via iOS or Android app
- Charging to be controllable from app. Charging can be turned on or off via the app.
- Pairing BLE to tablet/smartphone via app
- Auto-reconnect of BLE when back in range of previously connected device

- Hard button use of Power indicator light button to put spacestation in pairing mode

Other:

- BLE to turn on spacestation data access when the app is opened up
- Pass-through charging with priority for tablet/smartphone

Input Charging Rating:

- Voltage: 5V +/- 5% with Current: 1.8A

Output Charging Rating:

- During Pass through: Voltage: 5V +/- 5% with Current: 1A
- During regular charging: Voltage: 5V +/- 5% with Current: 2.4A

Kit contents:

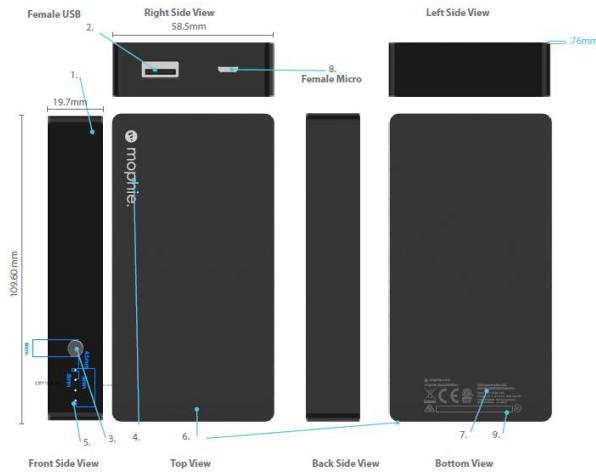
- Gift box style packaging with window and flap with hero shot
- USB to Micro USB 2.0 cable
- Quick start guide with legal info and online link for full user manual (user manual not included in box. To be online only)
- spacestation
- One global packaging SKU for Apple and ROC (See Appendix A for languages supported)

2.0 INDUSTRIAL DESIGN REQUIREMENTS

2.1 Design Requirements

Description	Requirement
Detailed CMF (Color/Material/Finishes)	See Figure 1
Multiple CMF Options or SKU's?	TBD
Secondary Process Required?	Yes a) Process Black Pantone Black C." b) Anodize
Mophie LOGO (size)	Laser mark on Aluminum
Device label and marking size	Laser etching on bottom plate
Power button	Stainless polish
LED indicator	4 white

Figure1:



#	Part Description	Color	Material	Finish	Notes
1.	Body	PMS Process Black Pantone Black C	PC/ABS	PMS Process Black glossy paint	
2.	Female USB	Match PMS blk on the connector tip			flangeless
3.	Power button	silver	stainless steel	polished	reference spacepack button texture
4.	mophie Logo		Aluminum	Laser etched	
5.	LED	white			pinhole .8mm
6.	Top and bottom	Black Anodized	Aluminum	satin finish	chamfer (.2mm refer to CAD) Satin finish and silver color to match Mac Book
7.	Legal info			laser etched	
8.	Female Micro				
9.	Serial number		Aluminum	laser etched	



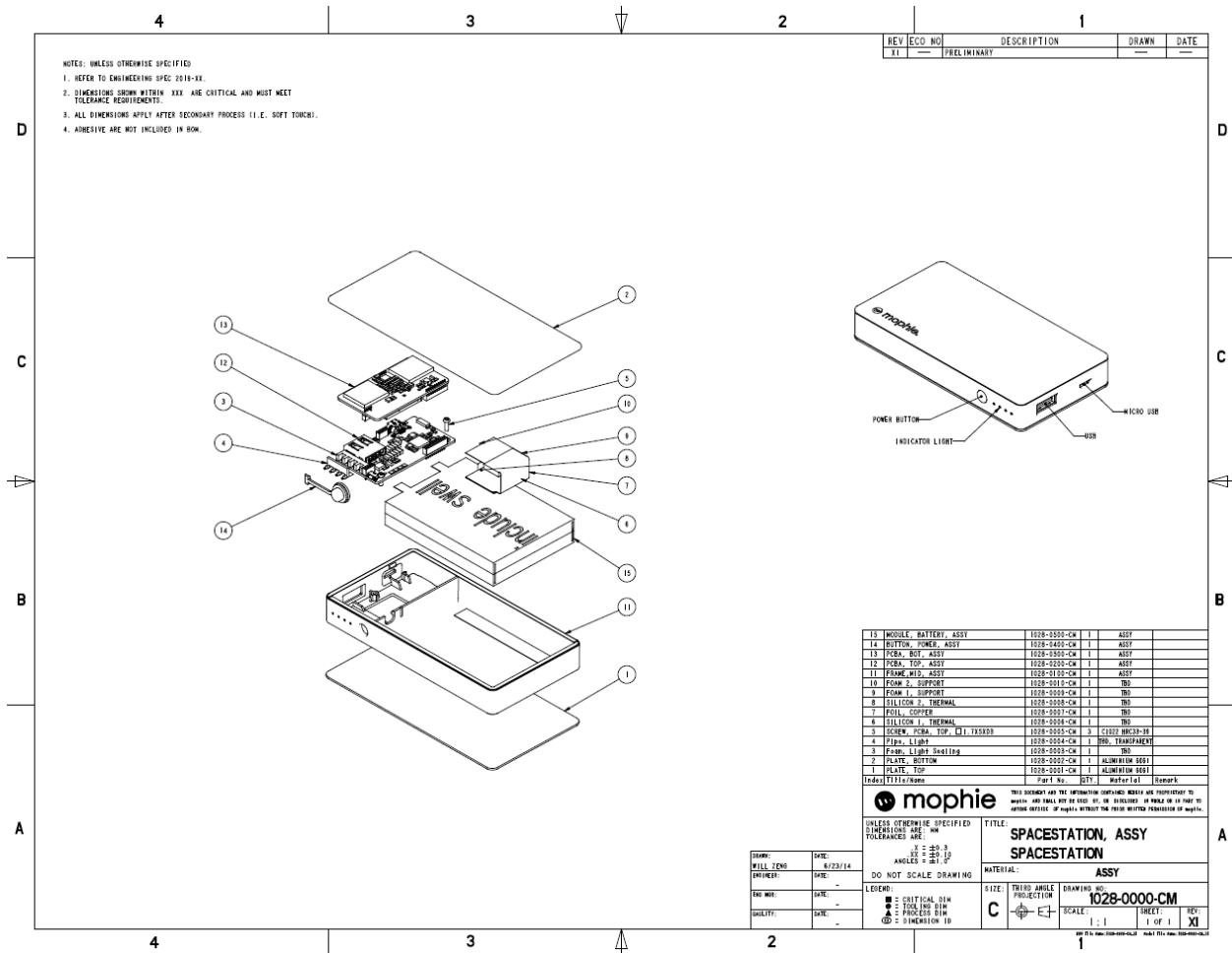
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3.0 MECHANICAL DESIGN REQUIREMENTS

3.1 Hardware System Design

Number	Descriptions
1	Main Body
2	Cover Top & Bottom, Aluminum (1.0mm 6061-T6)
3	Power button
4	VHB tape for adhesion
5	2 X 3000 mAh battery
6	2 PCBA
7	Screws (mount PCBA)
8	Thermal transfer material
9	Conformable thermal conductive pad
NOTE	Refer to 3D CAD for detail

Figure 3.1 Mechanical Design Control (DC)



3.2 Mechanical Design Requirements

Descriptions	Requirement
Power button	TBD. 0.5 to 1 lbf
LED brightness	Cool white at 1000 lux intensity
Light leakage	Must not be seen through nearby opening
Ultra Sonic Weld (USW)	Must pass Drop Test (Refer to test plan)
UV paint	Must pass 2H hardness @500gf and chemical test (Refer to test plan)
Housing construction	Must pass probe test of 20Kg for 1 minute (Refer to test plan)
Housing construction	Must with stand drop test and still functional. Minor crack may occur less than 1mm wide.
Housing Plastic	Must meet Flame retardant 94-V1 minimum (Refer to test spec)
All metal parts and hardware's	Must pass salt spray test (Refer to test spec)

All adhesive and glue	Must pass thermal cycle test (Refer to test spec)
Housing Plastic	Must meet Flame retardant 94-V1 minimum (Refer to test plan)
All metal parts and hardware's	Must pass salt spray test (Refer to test plan)
All adhesive and glue	Must pass thermal cycle test (Refer to test plan)

4.0 ELECTRICAL DESIGN REQUIREMENTS

4.1 Electrical Design Requirements

Description	Requirement
Battery Output Voltage	3.8V/cell; 6000mAh Li-ion (polymer) battery
Input Charging	Voltage: 5.1V +/- 0.5% with Current: 1.8A
Output Charging	Voltage: 5.1V +/- 0.1% with Current: 2.4A
Charging (general)	Pass through charging with priority for connected device
Syncing	Yes, data path must be allowed from input to the applicable charging device (ex. phone and tablets)
Compatibility	Compatible with charging outlets: BC1.2, Samsung wall chargers, computer, wall and Car charger (500mA or greater)
Hardware Interface	Input: USB-A connector Output: Lightning or MicroUSB Connector
PCB Type (Single Sided, Double Sided Silver thru hole, Double Sided Plated thru hole, Double Sided Carbon)	Double Sided Silver thru hole; 4-layer
Power Converter Type (Input/output)	Buck/Boost; DC-DC
ESD Protection (e.g. USB Receptacle)	Yes; SMD diode(s)

LED Power indicators	<p>4 White LED indicators and the charge button will function as described below:</p> <ul style="list-style-type: none"> • When the battery button is pressed, the White LEDs will show charge level of the device. <ul style="list-style-type: none"> ○ 4 LEDs light up: 100% ~ 76% ○ 3 LEDs light up: 75% ~ 51% ○ 2 LEDs light up: 50% ~ 26% ○ 1 LED light up: 25% ~ 11% ○ No LED: 10% ~ 0% • When Unit is charged via charging port and included cable, the white LEDs will indicate level of charge. The LED duty cycle is 50% @ 1S (500mS ON and 500mS off) <ul style="list-style-type: none"> ○ 4 LEDs light up: 100% ~ 76% ○ 3 LEDs light up: 75% ~ 51% ○ 2 LEDs light up: 50% ~ 26% ○ 1 LED light up: 25% ~ 11% ○ No LED: 10% ~ 0%
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4.2 Battery Cell Requirements

The table below outlines baseline requirements for the battery cell used in this product:

Description	Requirement
Appearance	The surface is clear and no scratch
Maximum Cell Dimensions	74.35*51.5*11.8 mm
Max Cell Dimensions(after swell)	TBD
Weight	TBD
Nominal Capacity	6000mAh
Marked Capacity(Minimum Rated)	6000mAh (0.5C)
Typical Rated capacity	6000mAh (0.5C)
Charge time	Approx.4 hours from input of 5V at 1.8A
Nominal Cell Charge Voltage	4.35V±0.05V
Nominal Cell Discharge (Operating) Voltage	3.8V
Nominal Cell Discharge Cut-Off Voltage	3.1V
Nominal Cell Charge Current	3A
Nominal Cell Discharge Current	4.6A
Basic Charging Characteristics	Charging shall consist of charging at a constant current rate of 3A until the cell voltage reaches 4.35V. The cell shall then be charged at constant voltage of 4.35V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 250mA. These characteristics should stay consistent when charging the

	call between 0°C and 40°C
Basic Discharging Characteristics	Cells shall be able to discharge at a constant current of 4600mA, 3.1 V, at 23±2°C and humidity of 65±20%.
Nominal Cell Cycle Life	500 0.5C-discharging cycles (residue ≥ 80% of initial capacity)
Overcharge Protection?	Yes
Overcharge Detection	Yes
Over-Discharge Protection?	Yes
Over-Discharge Detection	Yes
Over-Current Protection?	Yes
Over-Current Detection	Yes
Overcharge Protection Test Criteria	TBD
Over-Discharge Protection Test Criteria	TBD
Short-Circuit Protection Test Criteria	TBD
PCM Input Voltage's Dynamic Range	2.7V – 4.5V
Active Protection Components (<i>Or Equivalent</i>)	Seiko S8211CAM-M5T1S (SOT23-5); Panasonic MTMC8E2A0LBF (WMini8-F1); Panasonic FC8V22040L (WMini8-F1); Analog Power AMCC920NE (DFN3x3-8L).
Ex-Factory Cell Capacity	100%
Minimum Remaining Capacities. Shelf Time	1-month in 20±5°C & 70-80% RH Storage: 90%; 6-monthsin 20±5°C & 70-80% RH Storage: 70%; 12 months in 20±5°C & 70-80% RH Storage: 50%.
Relative Cell Capacity vs. Temperature	-10°C (70%); 0°C (80%); 25°C (100%); 45°C (95%); 60°C (90%)
Leakage Shutdown Capability?	Required
Minimum Required Declarations/Certifications	Directive 2006/66/EC, MSDS, UN38.3

See Battery Pack Specification for more detail.

5.0 QUALITY CONTROL PLAN
5.1 Quality Design Requirements

Must meet mophie General Workmanship Standard

Descriptions	Requirement
Gap between Cap and Main Body	0.2 mm max
Part mismatch	0.1 mm max
Part flash	.05 mm max
Paint scratch / durability	See Test Plan for testing
USW gap	0.1 mm
Sink Mark	See Standard
Color match	Match approved sample
CMF match	Match approved sample

5.2 Environmental Test Requirements

Description	Requirement
Operating temperature range	0°C to + 40°C
Storage (Non-operating) temperature range	-20°C to +60°C
Temperature Shock	will be subjected from 0°C to 50°C for 4 cycles at a rate of 1°C per minute with a dwell time of 1 hour at high and low temperature (as shown below). Functional tests will be randomly performed while unit is inside the chamber
Humidity (operating)	40±3°C, 95% relative humidity, and non-condensing for 96 hours with batteries or power. Functional tests will be randomly performed while unit is inside the chamber.
Altitude	Must withstand a 10,000-feet altitude test (by simulation). Packaged products must withstand a 20,000-feet altitude test (by simulation)
Vibration	Must withstand the vibration/stress test. The test is performed at amplitude of 3.15 mm and frequency of 7-500 Hz, for 10 minutes (per axis)
Unit Drop test (transit drop)	Must withstand multiple free-fall drops on a hardwood floor (e.g. a 1.00" thick oak layer) with the surface(s) or edge(s) without obstruction. See Test Plan for details
Chemical resistance	See Test Plan for list of chemicals and test methods

5.3 Functional Test Requirements

Description	Requirement
Refer to test plan	N/A

5.4 Critical Dimension Requirements

Description	Requirement
2D drawings for plastic parts	See part prints and Incoming Quality Control (IQC)
Finish notes for secondary process	See part prints and IQC

Assembly notes and Checklist	See part prints and IQC
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6.0 STANDARD COMPLIANCE

6.1 Certifications required for this product:

Certification	Requirement
RoHS	Yes
FCC	Yes
CE	Yes
C-Tick	Yes
IEC60950-1	Yes
UL1642	Yes
WEEE	Yes
Prop 65 (CA), KC, PSE, TISI	Yes
UN38.3	Yes

6.2 ESD Protection

Standard products must meet 8kV air discharge. Products that have metal casing must meet 4kV contact discharge, as well as 8kV air. All ESD tests shall be performed using the test systems as specified by the IEC 61000-4-2 2001 standard.

6.3 EMC Compliance

All EMC tests shall be performed by following the IEC 61000-4-2 2001 standard.

6.4 RoHS Compliance (Restriction of Hazardous Substances)

The product should be RoHS compliant. The product shall not contain any of the following six harmful substances:

- ❖ Lead
- ❖ Mercury
- ❖ Hexavalent Chromium
- ❖ Cadmium
- ❖ PBB (Polybrominated Biphenyl)
- ❖ PBDE (Polybrominated Diphenyl Ether)

FCC Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE 1: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

NOTE 2: Any changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.