Messrs.:

Specification No. KU*****

Product Specification

Issued Date : Dec. 2018

Part Description : Cylindrical Lithium-ion Battery US18650VTC5D

Customer Part No. :

MURATA Part No. : US18650VTC5D

Acknowledgement of receipt

We have accepted and received the attached specification

Date:

Company:

Dept.:

Representative	Received by
(Signature)	(Signature)
(Type)	(Type)

Person responsible

(Signature)
(Type)

Product Engineering Sect.
Product Dept.2, Energy Device Div.
Tohoku Murata Manufacturing Co., Ltd
(Company name/Dept.)
(Type)

Technical Dept.

Prepared by

(Signature)
(Type)

Representative

(Signature)
(Type)

Product Design Sect.5
Product Dept.2, Energy Device Div.
Tohoku Murata Manufacturing Co., Ltd
(Company name/Dept.)
(Type)

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⚠DANGER

THESE CELLS ARE NOT INTENDED FOR INDIVIDUAL SALE OR USE.
THESE CELLS MAY ONLY BE USED WITH ASSEMBLY OF BATTERY OF BATTERY PACKS.
USE OF THESE CELLS INDIVIDUALLY PRESENTS A SERIOUS RISK OF PERSONAL INJURY OR DEATH.

Revised List

Number	Page
KU*****	2

Date	Revision No.	Revision Item	Revised contents and reason	Rep. (Mgr.)
Oct. 2018	0.1		1st Edition Issue	
Dec. 2018	0.2	7.2.5 Cell Configuration	Change of maximum cell configuration for the battery pack.	

Lithium-Ion Battery Specifications

1 General

1.1 Scope

This product specification is applied to “Lithium-Ion Rechargeable Batteries” used for “ xxxxxxxxxx ”.
Please contact us when using this product for any other applications than described in the above.

1.2 Product Category

Lithium-Ion Rechargeable Battery

1.3 Cell Type

US18650VTC5D

1.4 Cell Designation based on IEC61960.

INR19/66

1.5 Acquired Safety Standard（Registration name ： US18650VTC5D）

UL1642 : File No.MH12566
UL62133 : File No.MH61426
IEC62133 2nd Edition
Taiwan Commodity Inspection Act (CNS 15364)
Indian Compulsory Registration Order, IS 16046:2015
(Murata Energy Device Singapore Pte. Ltd. Product Only)

1.6 Applicable Safety Standard

United Nations, Recommendations on the Transport of Dangerous Goods (UN38.3)
Japan, Electrical Appliance and Material Safety Law

Reference
In case of the energy density is more than 400Wh/l (see 3.4 Energy Density), it is possibility to be subject to regulation by object country. It is recommend to confirm the contents of regulation.
As of April 2018 Japan, Electrical Appliance and Material Safety Law
“http://www.meti.go.jp/policy/consumer/seian/denan/index.htm” (Japanese)
“http://www.meti.go.jp/english/policy/economy/consumer/pse/index.html” (English)

2 Cell Rating

Item		Rating	Note
2.1 Rated Capacity		2700mAh	Discharge at 0.2ItA, 2.0V cut-off 23±2deg.C, after Standard Charging.
2.2 Maximum Charging Voltage		4.25V	
2.3 Discharging Cut-off Voltage		2.5V	Recommended Voltage
		2.0V	Lower limited Voltage
2.4 Continuous Maximum Charging Current		6.0A	
2.5 Continuous Maximum Discharging Current		35A	(With 90deg.C temperature cut)
2.6 Allowable Environment Temperature	Charging	0～+60deg.C	Refer to the cell temperature spec of 2.8 for cell surface temperature.
	Discharging	-20～+60deg.C	
2.7 Weight		46.7 ±1.5g	With tube

※ Cell condition at shipment SOC (State Of Charge) not exceed 30% of rated capacity.

※ In the case of air transportation, it corresponds to dangerous goods according to IATA's Dangerous Goods Regulations.Depending on the rated value of the products (pack) set by the customer, there would be possibility to interfere with the Air Transport Prohibited items in case of SOC≧30%.

2.8 Cell Temperature Specification

2.8.1 Charging Conditions

Temperature Range / Cell Surface Temperature Range				Upper Limited Charging Voltage	Maximum Charging Current	Recommended Charging Current
1	Low Charging Temperature Range	0deg.C≦T＜10deg.C	A	4.25V	2.00A	1.00A
			B	4.15V	4.00A	2.00A
2	Standard Charging Temperature Range	10deg.C≦T≦45deg.C		4.25V	6.00A	2.70A
3	High Charging Temperature Range	45deg.C＜T≦60deg.C		4.20V	6.00A	2.00A

At Low Charging Temperature range, condition A and B are both available.
Recommended condition is B.

2.8.2 Discharging Conditions

Discharge at cell surface temperature below 90deg.C.

3 Cell Nominal Value

Item	Nominal	Note
3.1 Nominal Capacity	2800mAh	Discharge at 0.2ItA, 2.0V cut-off after Standard Charging.
3.2 Nominal Voltage	3.6V	
3.3 Charging Voltage	4.20V	
3.4 Energy Density	567Wh/l	

4 Performance

4.1 Standard Test Conditions

Test condition shall be at 23 ±2deg.C and (65 ± 20)%RH However, temperature range of 15～30deg.C, humidity 25～85%RH is acceptable as far as the test reliability is assured.

4.2 Testing Instrument or Apparatus

4.2.1 Dimension Measuring Instrument

The dimension measurement shall be implemented by instruments with equal or more precision scale of 0.01mm specified by JIS B 7502(outside micrometer) or JIS B 7503(dial gauge).

4.2.2 Voltmeter and Ammeter

Voltmeters and ammeters shall be equal or more precision instruments specified by JIS C 1102 (Indication Electric Instrument Level 0.5).

4.3 Standard Charging definition

Charge at a constant voltage of 4.2V and a constant current of 2.7A for 2.5 hours in 23±2deg.C atmosphere.

4.4 Standard Discharging definition

Discharge at a constant current of 2.7A down to 2.5V in 23 ±2deg.C atmosphere.

4.5 Electrical Performance

Item		Condition	Specification
4.5.1 Open-Circuit Voltage		Shipping condition Measuring condition Temperature：27 ±3deg.C Accuracy：Within ±1mV	3.250～3.530V and the OCV shall be within 0.100V in the same cell lot.
4.5.2 AC Impedance		After Standard Charging within 3 days.(1kHz)	7mΩ～17mΩ
		Shipping Condition.(1kHz)	7mΩ～17mΩ
4.5.3 Capacity	1	After Standard Charging. Discharge at 0.2ItA(540mA),Cut-off Voltage 2.0V.	2700mAh or more
	2	After Standard Charging, Standard Discharging.	2565mAh or more
	3	After Standard Charging. Discharge at 10A(10000mA), Cut-off Voltage 2.5V.	2430mAh or more
	4	After Standard Charging. Discharge at 20A（20000mA）, Cut-off Voltage 2.5V.	2160mAh or more
4.5.4 Charge/Discharge Cycle		Charge at 4.2V, 4.0A, cut-off current 100mA ⇔Discharge at 10A,2.5V cut-off after 500cycles.	1620mAh or more
4.5.5 Storage Characteristic		After Standard Charging, stored at 23deg.C for 28 days. Discharge at 10A, 2.5V cut-off as Remaining Capacity.	2185mAh or more
		After above measurement, Discharge at 10A, 2.5V cut-off after Standard Charging. Take this value as Recovery Capacity.	2305mAh or more
		After Standard Charging, stored at 45deg.C for 28 days. Discharge at 10A, 2.5V cut-off as Remaining Capacity.	2065mAh or more
		After above measurement, Discharge at 10A, 2.5V cut-off after Standard Charging. Take this value as Recovery Capacity.	2185mAh or more
4.5.6 Long term Storage Characteristic		After Standard Charging, store at 23deg.C, 365days. Discharge at 10A, 2.5V cut-off after Standard Charging. Take this value as Recovery Capacity.	2185mAh or more
4.5.7 Shipping state Storage Characteristic		After store shipping state sample under the following table conditions, Standard Discharge. And then Discharge at 0.2ItA, 2.0V cut-off, 23±2deg.C, after Standard Charging. Take this value as Recovery Capacity. Storage Period / Storage Temperature: 365days: -20deg.C≦T≦25deg.C 90days: -20deg.C≦T≦45deg.C 28days: -20deg.C≦T≦60deg.C T:ambient temperature	2160mAh or more
4.5.7 Discharging Temperature Characteristic		Discharge at 10A, 2.5V cut-off below temperature after Standard Charging. Discharging Temperature / Capacity: -10deg.C: 1700mAh or more 0deg.C: 1940mAh or more 23deg.C: 2430mAh or more 45deg.C: 2430mAh or more	Refer to the left table
4.5.8 Charging Temperature Characteristic		After Standard Discharge, Charge at 4.20V, 2.7A, 2.5h below temperature, and then Standard Discharging. Charging Temperature / Capacity: 0deg.C: 2180mAh or more 23deg.C: 2565mAh or more 45deg.C: 2565mAh or more	Refer to the left table

4.6 Mechanical Performance

Item	Condition	Specification
4.6.1 Shock Test	After Standard Charging, P-tile from height of 1.2m. Dropped in Each X, Y and Z for 3 time, with guide like as tube. Discharging 10A, Cut-off Voltage 2.5V Capacity of the 2nd time.	No leakage 2305mAh or more
4.6.2 Vibration Test	After Standard Charging, vibration is to be applied. Discharging at 10A, Cut-off Voltage 2.5V Capacity of the 2nd time. Sinusoidal Oscillation Freqency(Hz): 10～60 / 60～80 / 80～100 / 100～125 Acceleration(m/s^2): 20.6 / 13.7 / 6.9 / 3.9 5 min. Sweep Each XYZ for 1h.	No leakage 2305mAh or more

5 Identification and Marking (Lot Number Definition：Manufacturing Date of Cells)
The code is printed on a surface of the can, under the tube, at six lines.

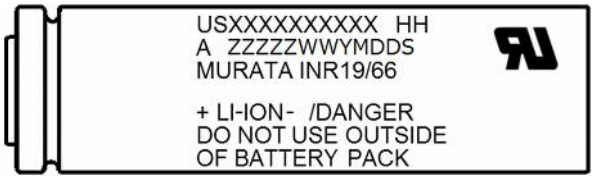


Fig.1

5.1 Manufacturer Name (Trade name for UL standard)
MURATA (Trade name for Tohoku Murata Manufacturing Co., Ltd.)

5.2 Model Name(Fig.1：USXXXXXXXXXX)
US18650VTC5D

5.3 Factory(Fig.1：A for factory code)
SG or G：Murata Energy Device Singapore Pte. Ltd.

5.4 Specification(Fig.1：HH for Cell Type）
5D：US18650VTC5D

5.5 Lot Number(Fig.1: YMDDS for Manufacturing Date of Cells）
ZZZZZ：Serial No.
Y：Year Supposing the year ’15 as X, the year ’16 as Y, the year ’17 as Z, the year ’18 as A, Every next year is counted as B, C,･･･(Using an Alphabet letter)
M：Month January as A, the consecutive month as B, C,･･･(Using an Alphabet letter)
D：Day 01, 02, ･････29, 30, 31 （Using figures）
S：Identification Code A, B, C,･･･(Using an Alphabet letter)

5.6 Warning Message
DANGER DO NOT USE OUTSIDE OF BATTERY PACK

5.7 Cell Designation based on IEC61960
INR19/66

5.8 Battery Type
LI-ION (Lithium-ion Battery)

5.9 Polarity
＋ , -

5.10 UL Recognition Mark (Fig.2)

Fig.2

5.11 2Dimensional Code (Fig.3)
The code is on the surface of the tube


Fig.3

6 Outline

6.1 Shape/Dimension

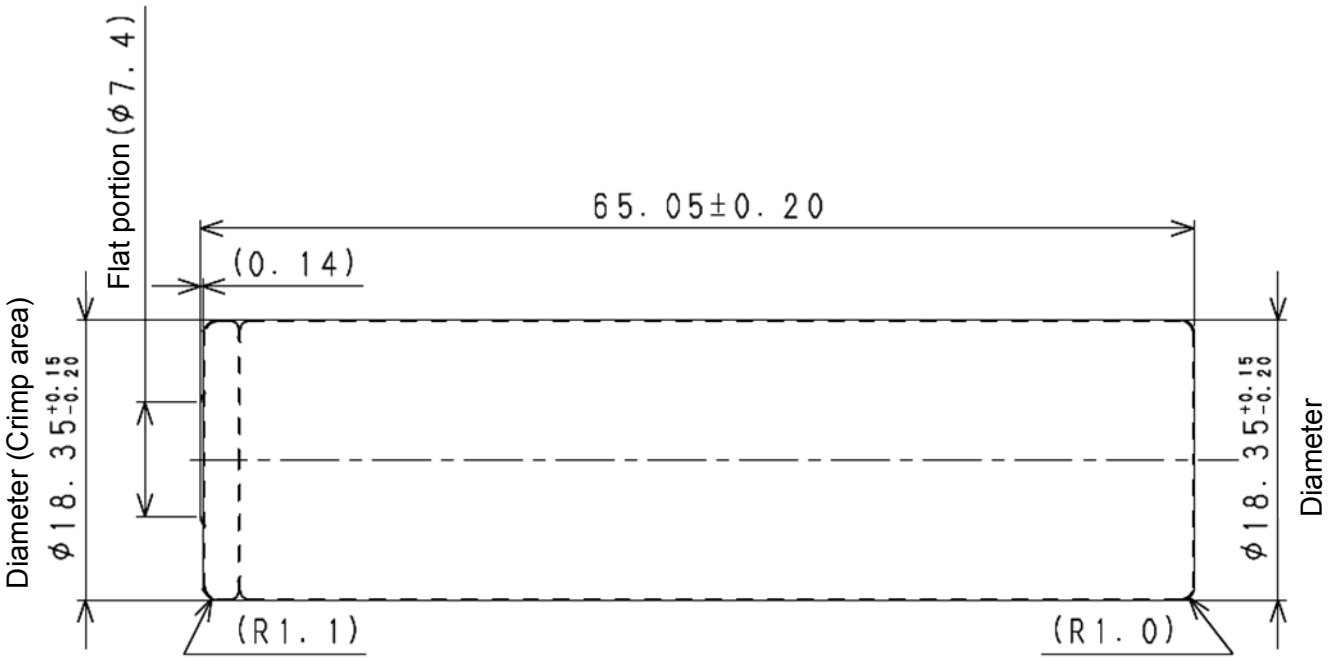
Diameter of crimp : 18.35 +0.15 / -0.20mm (excluding wrinkle on the tube)

Diameter of trunk : 18.35 +0.15 / -0.20mm (excluding wrinkle on the tube)

Total Height : 65.00 ±0.20mm

6.2 Appearance

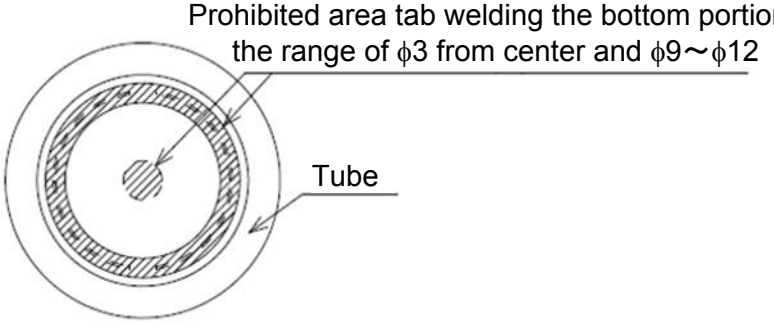
It shall be free from any defects such as remarkable scratches, breaks, cracks, discoloration, leakage, or deformation.



Prohibited area tab welding the bottom portion

As shown in the figure on the right,

Don't weld in the range of ϕ3 from center and the range of ϕ9～ϕ12



7 Caution

Caution on usage of Lithium-Ion Rechargeable Battery

⚠CAUTION

7.1 Caution for installing the battery into the pack

*Do not combine the different Lot Number cell (the Last 5 letters and figure) into the pack.

7.2 Caution for the battery and the pack

7.2.1 Charge

*It should be Constant Current-Constant Voltage (CC-CV) charging method.

7.2.2 Design of battery pack

*It shall be the shape which cannot be connected easily to any charger other than the dedicated charger.
*It shall have the structure which cannot be connected easily for end user to apply for another purpose.
*It shall have terminals or function which cannot easily cause external short circuit. (such as chain short by necklace).
*It shall not short easily by effect of vibration or drop due to contact of internal wiring materials to battery.
*Mounted PWB which is assembled in battery pack shall perform the smoke and fire protection for the electrolyte adhesion.
*It should have the structure which protect electrolyte to outside of battery pack, in case of the electrolyte leakage from battery cell.

7.2.3 Protection Circuit for Safety

*The protection circuit shall be installed in the battery pack or the charger.
*The battery system must possess the following four types of protective circuits;

7.2.3.1 Over charging protective circuit by each block cell voltage monitoring

By each block cell voltage monitoring, the overcharging protective circuit shall operate at less than 4.250V/cell.

7.2.3.2 Over discharging protective circuit by each block cell voltage monitoring

By each block cell voltage monitoring, the over discharging protective circuit shall operate at 1.5V/cell to 2.5V/cell.

7.2.3.3 Over current protective circuit

The over current protective circuit shall operate charging at less than 6A.
The over current protective circuit or device shall operate discharging at less than 35A.
If the over 35A discharge occur, the allowable time of operating over current protection comply with the below table.

Discharge current	～40A	～50A	～60A	～80A	～100A
Time	<91sec.	<43sec.	<28sec.	<15sec.	<9sec.

～120A	～130A	～150A	～200A
<6sec.	<4sec.	<3sec.	<1sec.

7.2.3.4 Temperature protective circuit

The over temperature protective circuit at high temperature side shall operate discharging until 90deg.C on the cell surface.（Including overshoot）.
The over temperature protective circuit at high temperature side shall operate charging at until 60deg.C on the cell surface.（Including overshoot）.
The over temperature protective circuit at low temperature side shall operate charging below 0degC on the cell surface.

7.2.4 Prohibition of Charging at over discharged state.

*In the situation that the battery becomes over discharged to the point where it becomes less than or equal to 1.0V, it is prohibited to charge such battery.

7.2.5 Cell Configuration

* The maximum cell configuration for the battery pack is shown in below table.

Parallels	Series
1P	Up to 32
2P, 3P	Up to 18
4P, 5P	Up to 14

7.3 Storage

*Keep and Store the same package condition as shipping from Manufacturer.
*The recommendation is SOC 10～50% for long-term storage.
*Recommended condition is temperature 0～25deg.C and Humidity 75%RH or less.
*Do not store the battery near heat sources, nor in a place subject to direct sunlight.

7.4 Prohibition Clause

⚠WARNING

*Do not use the battery for any purpose other than the application and the battery pack specified in the Pack Check Sheet for Li-ion Cell (Category; Power Technology) of such battery.
*Do not resell the battery.

⚠DANGER

*Do not expose the batteries to water or moisture.
*Do not leave the battery in a place of high temperature (60deg.C or more).
*Do not use the battery in a place of high temperature (60deg.C or more).
*Do not throw the battery into fire, nor heat the battery.
*Do not disassemble nor modify the battery.
*Do not add strong shock, nor drop the battery.
*Do not solder leads directly to the battery body.
*Do not short (+) and (-) terminal of the battery with a kind of metal.
*Do not reverse charge the battery.
*Do not penetrate the battery with a nail etc., nor make a hole in the battery.
*Do not put the battery into a microwave oven or high pressure container.

7.5 Note

If any doubt or inconvenience regards this specification arises, modification and revision shall be only made per mutual agreement.

Depending upon circumstances such as E.O.L of raw material for cell component,
we may not be able to keep the supply of the cell. In that case, we will notify you of
this announcement by more than 6 months before production stop (before discontinuation).

When production location of the cell is planned to be changed or added,
we'll inform and provide of necessary evaluation data beforehand to get customer's approval.

8 Packing

8.1 Packing Instruction

LBH, Class9 and CAO marks are printed on the surface on carton.
These marks are compliant with the specified design of ICAO and IATA.

8.2 Parts Name Marking

Part name is marked on the bar code label of master carton.
This bar code label is stuck onto one of the faces of the master carton.

8.3 Packing Instruction for Pallet

LBH, Class9 and CAO labels are affixed on the surface of the stretch film.
These labels are compliant with the specified design of ICAO and IATA.