Messrs.:

Specification No. KU****

(Customer Company name)

Product Specification

Issued date: YYYY MMM. DD

Part Description : Cylindrical Lithium-ion Battery US18650VTC6M

Customer's parts name :

Customer's parts number :

Murata's parts name :

Murata's parts number :

Acknowledgement of receipt
We have received the attached specification)

Date: YYYY MMM. DD

Customer's company name

Dept.

Representative:	Received by:
(Name)	(Name)
(Signature with date)	(Signature with date)

Murata Manufacturing Co., Ltd/ Energy Device Division

Department name :

Product Engineering Department

Representative:

(Name) (Signature with date)

Design department

Representative:

(Name) (Signature with date)

Sales department

Representative:

(Name) (Signature with date)

⚠DANGER

THESE PRODUCT (S) MAY ONLY BE USED WITH ASSEMBLY OF BATTERY PACK (S).
THESE PRODUCT (S) ARE NOT INTENDED FOR INDIVIDUAL SALE OR USE.
THE USE OF THE PRODUCT INDIVIDUALLY POSES A SERIOUS RISK OF PERSONAL INJURY OR DEATH.

Revision history

Date	Revision No.	Revision Item	Revised contents and reason	Rep. (Mgr.)
19 Nov. 2024	Ed 0.1		Issue of Pre-1st Edition	—

Detailed Specification

1. Scope

The product listed in this product specification (hereinafter the product(s) is called as the “Product(s)”) is(are) designed and manufactured for applications specified below in this product specification. (Hereinafter called as the “Specific Application”).

Specific applications: Lithium-ion Battery Pack used for power tools.
Non-specific Application: Applications listed in “8.8 Limitation of applications” in this product specification.

Please contact the Murata representative when intended to use of the product for any other applications than described above in the Specific Application.

1.1 Cell Designation based on IEC61960
INR19/66

1.2 Acquired Safety Standard（Registration name ： US18650VTC6）
UL1642: File No.MH12566
UL62133-2: File No.MH61426
IEC62133 2nd Edition
IEC62133-2 2017/AMD1:2021
Taiwan Commodity Inspection Act (CNS 15364)
Indian Compulsory Registration Order, IS 16046:2018

1.3 Applicable Safety Standard
United Nations, Recommendations on the Transport of Dangerous Goods (UN38.3)
Japan, Electrical Appliances and Materials Safety Act Appendix12 (J62133-2(2021))

Reference
In case of the energy density more than 400Wh/l (refer to 4.1.7 Energy Density), there is a possibility that it is subjected to the regulation by the target country (Japan). It is recommended to check and confirm the contents of the regulation promptly.
Japan, Electrical Appliances and Materials Safety Act
“https://www.meti.go.jp/policy/consumer/seian/denan/index.htm” (Japanese)
“https://www.meti.go.jp/english/policy/economy/consumer/pse” (English)
When using this cell in a battery pack which is subject to Japan, Electrical Appliances and Materials Safety Act, the nominal voltage of the cell shall be indicated in the battery pack itself or in the instruction manual of the battery pack or in specification sheet.

1.4 Category of Type

Item	Type
1.4.1 Shape of secondary cell	Cylindrical
1.4.2 Type of electrolyte in secondary cell	Liquid state
1.4.3 Upper Limited Charging Voltage of secondary cell	4.25V or less

2. Name and Type

2.1 Product name: Cylindrical Lithium-ion Battery (or “cell”)
2.2 Customer’s Parts name: e.g.) xxxx
2.3 Murata’s Product name: US18650VTC6M
2.4 Murata’s Product number: 49945004

3. Shape, Dimension and Structure

3.1 Appearance
It shall be free from defects such as remarkable scratch, breakage, crack, discoloration, leakage, deformation which may affect the product(s) performance and(or) as mentioned in the agreed contract between customer and Murata.

3.2 Shape・Dimension
Diameter of top： 18.35 +0.15 / -0.20mm (excluding wrinkle on the tube)
Diameter of bottom： 18.35 +0.15 / -0.20mm (excluding wrinkle on the tube)

Total Height: 65.00 ±0.20mm

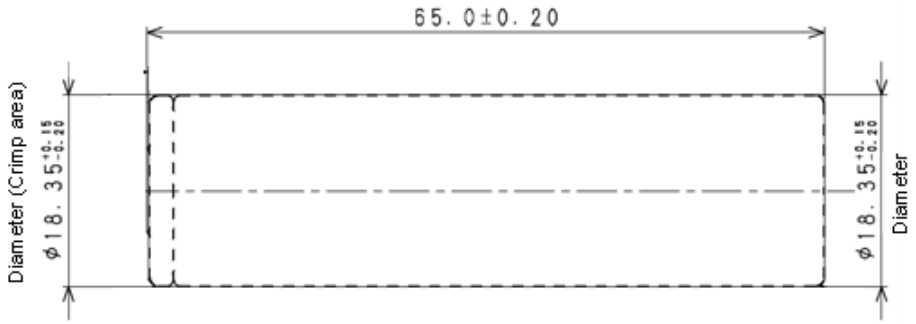

Fig.1 figure explaining the dimension of top, bottom and height.

3.2.1 Prohibited area for tab welding at bottom portion.
As shown in the below figure (fig 2.), do not weld in the following range.
-in the range of Φ3 from the center and in the range of Φ9～Φ12 from the center.

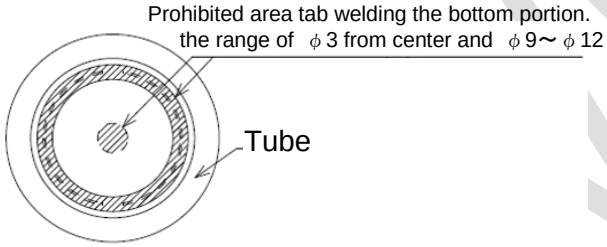

Fig.2 Figure representing the tab welding at bottom portion.

3.3 Identification and Marking (Lot Number definition：Manufacturing Date of Cell)
The code is printed on the surface of the can, beneath the tube, in six lines.

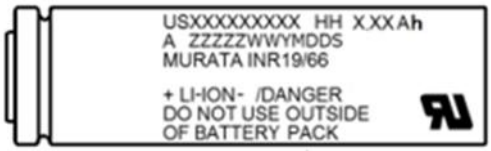

Fig.3 Figure representing the Identification and marking.

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

3.5 Model Name (refer to fig 3.：USXXXXXXXXXX)
US18650VTC6

3.6 Manufacturing Factory code (refer to fig 3.：A for factory code)
SG or G：Murata Electronics Singapore (Pte.) Ltd. Tuas Plant.

3.7 Specification type (refer to fig 3.：HH for Cell Type)
6M：US18650VTC6

3.8 Rated Capacity (refer to fig 3.: X.XX Ah)
3.0 Ah

3.9 Murata Serial No (refer to fig 3.: ZZZZZWW：Murata Serial No)

3.10 Lot Number(refer to fig 3. : YMDDS for Manufacturing Date of Cell)
Y：Year (Represents by “X” for the year 2015, “Y” for the year 2016, “Z” for the year 2017 , “A” for the year 2018, similarly every subsequently increment of alphabets refers to the respective next year) ･･･(Using an Alphabets letter)
M：Month (Represents by “A” for the month January, “B” for February and so on for the next consecutive months ･･･(Using an Alphabet letter)
D：Day 01, 02, ････29, 30, 31 ･･･(Using numbers)
S：Identification Code A, B, C, and so on ･･･(Using an Alphabet letter)

3.11 Warning Message
DANGER DO NOT USE OUTSIDE OF BATTERY PACK

3.12 Cell Designation based on IEC61960
INR19/66

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

3.14 Polarity
＋ , －

3.15 UL Recognition Mark (refer to fig 4.)

Fig.4: UL Recognition Mark

Fig.5: 2Dimensional code

3.16 2Dimensional Code (refer to fig 5.)
The code is printed on the surface of the tube.

3.17 Weight
46.5 ± 1.5g with tube

4. Basic operating conditions (rating) and performance

4.1 Basic operating conditions (rating)

Item		Rating	Note
4.1.1 Rated (Minimum) Capacity		3000mAh	Discharge at 0.2ItA, 2.0V cut-off 23±2deg.C, after Standard Charging.
4.1.2 Maximum Charging Voltage		4.25V	
4.1.3 Discharging Cut-off Voltage		2.5V	Recommended Voltage
		2.0V	Lower limited Voltage
4.1.4 Continuous Maximum Charging Current		5.0A	60deg.C temperature cut required
4.1.5 Continuous Maximum Discharging Current		30A	80deg.C temperature cut required.
4.1.6 Allowable Environment Temperature	Charging	0～+60deg.C	Refer to the cell temperature spec of 2.9 for cell surface temperature.
	Discharging	-20～+60deg.C	
4.1.7 Energy Density		631Wh/l	

※ 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%.

4.2 Cell Temperature Specification

4.2.1 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	5.00A	3.00A
3	High Charging Temperature Range	45deg.C＜T≦60deg.C		4.20V	5.00A	2.00A

4.2.2 Discharging Conditions
Discharge at cell surface temperature below 80deg.C.

4.3 Cell Nominal Value

Item	Nominal	Note
4.3.1 Nominal Capacity	3120mAh	Discharge at 0.2ItA, 2.0V cut-off after Standard Charging.
4.3.2 Nominal Voltage	3.6V	
4.3.3 Charging Voltage	4.20V ± 0.05V	

4.4 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.

4.5 Testing Instrument or Apparatus

4.5.1 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).

4.5.2 Voltmeter and Ammeter

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

4.6 Standard Charging definition

Charge at a constant voltage of 4.20V and a constant current of 3.0A for 2.5 hours in 23±2deg.C atmosphere.

4.7 Standard Discharging definition

Discharge at a constant current of 3.0A down to 2.5V in 23±2deg.C atmosphere.

4.8 Electrical Performance

Item		Condition	Specification
4.8.1 Open-Circuit Voltage		Shipping condition Measuring condition Temperature：27 ±3deg.C Accuracy：Within ±1mV	3.250～3.527V and the OCV shall be within 0.100V in the same cell lot.
4.8.2 AC Impedance		After Standard Charging within 3 days (1kHz)	8mΩ～18mΩ
		Shipping Condition (1kHz)	8mΩ～18mΩ
4.8.3 Capacity	1	After Standard Charging. Discharge at 0.2ItA (600mA), Cut-off Voltage 2.0V.	3000mAh or more
	2	After Standard Charging, Standard Discharging.	2850mAh or more
	3	After Standard Charging. Discharge at 10A (10000mA), Cut-off Voltage 2.5V.	2700mAh or more
	4	After Standard Charging. Discharge at15A (15000mA), Cut-off Voltage 2.5V.	2400mAh or more
4.8.4 Charge/Discharge Cycle		Charge at 4.2V, 4A, Cut-off current 100mA ⇔Discharge at 10A, 2.5V Cut-off After 300cycles.	1600mAh or more

<table>
<tr><td rowspan="4">4.8.5 Storage Characteristic</td><td>After Standard Charging, Stored at 23deg.C for 28 days. Discharge at 10A, 2.5V Cut-off as Remaining Capacity.</td><td>2430mAh or more</td></tr>
<tr><td>After above Measurement, Discharge at 10A, 2.5V Cut-off after Standard Charging. Take this value as Recovery Capacity.</td><td>2565mAh or more</td></tr>
<tr><td>After Standard Charging, Stored at 45deg.C for 28 days. Discharge at 10A, 2.5V Cut-off as Remaining Capacity.</td><td>2295mAh or more</td></tr>
<tr><td>After above Measurement, Discharge at 10A, 2.5V Cut-off after Standard Charging. Take this value as Recovery Capacity.</td><td>2430mAh or more</td></tr>
<tr><td>4.8.6 Long term Storage Characteristic</td><td>After Standard Charging, Store at 23deg.C, 365days. Discharge at 10A, 2.5V Cut-off after Standard Charging. Take this value as Recovery Capacity.</td><td>2430mAh or more</td></tr>
<tr><td>4.8.7 Shipping state Storage Characteristic</td><td>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.
<table><tr><td>Storage Period</td><td>Storage Temperature</td></tr><tr><td>365days</td><td>-20deg.C≦T≦25deg.C</td></tr><tr><td>90days</td><td>-20deg.C≦T≦45deg.C</td></tr><tr><td>28days</td><td>-20deg.C≦T≦60deg.C</td></tr></table>T:ambient temperature</td><td>2400mAh or more</td></tr>
<tr><td>4.8.8 Discharging Temperature Characteristic</td><td>Discharge at 10A, 2.5V Cut-off below Temperature after Standard Charging.
<table><tr><td>Discharging Temperature</td><td>Capacity</td></tr><tr><td>-10deg.C</td><td>1890mAh or more</td></tr><tr><td>0deg.C</td><td>2160mAh or more</td></tr><tr><td>23deg.C</td><td>2700mAh or more</td></tr><tr><td>45deg.C</td><td>2700mAh or more</td></tr></table></td><td>Refer to the left table</td></tr>
<tr><td>4.8.9 Charging Temperature Characteristic</td><td>After Standard Discharge, Charge at 4.20V, 3.0A, 2.5h below Temperature, and then Standard Discharging.
<table><tr><td>Charging Temperature</td><td>Capacity</td></tr><tr><td>0deg.C</td><td>2423mAh or more</td></tr><tr><td>23deg.C</td><td>2850mAh or more</td></tr><tr><td>45deg.C</td><td>2850mAh or more</td></tr></table></td><td>Refer to the left table</td></tr>
</table>

5. Environmental resistance

<table>
<tr><th>Item</th><th>Condition</th><th>Specification</th></tr>
<tr><td>5.1 Shock Test</td><td>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.</td><td>No leakage
2565mAh or more</td></tr>
<tr><td>5.2 Vibration Test</td><td>After Standard Charging, Vibration is to be applied. Discharging at 10A, Cut-off Voltage 2.5V Capacity of the 2nd time.
Sinusoidal Oscillation
<table><tr><td>Frequency (Hz)</td><td>10～60</td><td>60～80</td><td>80～100</td><td>100～125</td></tr><tr><td>Acceleration (m/s^2)</td><td>20.6</td><td>13.7</td><td>6.9</td><td>3.9</td></tr></table>5 min. Sweep Each XYZ for 1h.</td><td>No leakage
2565mAh or more</td></tr>
</table>

6. Packing

6.1 Packing form

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

6.1.1 Boat transport specifications

6.1.2 Air transport specifications

6.1.3 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.
The shape and size of the pallet is for reference.

6.1.4 Boat transport specifications

6.1.5 Air transport specifications

6.2 Packaging label

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.

6.2.1 Boat transport specifications (Singapore - products)

CUSTOMER PARTS CODE		
MODEL NAME		
PARTS CODE	F49945004	
CELL NAME	US18650VTC6M	
SUPPLIER	Murata Manufacturing Co., Ltd.	
CELL LOT No.& QTY		
LOT NO.		
CARTON NO.		
QUANTITY		
REMARKS:		

6.2.2 Air transport specifications (Singapore - products)

CUSTOMER PARTS CODE		
MODEL NAME		
PARTS CODE	F********	
CELL NAME	US18650VTC6M	
SUPPLIER	Murata Manufacturing Co., Ltd.	
CELL LOT No.& QTY		
LOT NO.		
CARTON NO.		
QUANTITY		
REMARKS:		

7. Appendix *in case of any customer requirement

7.1 xxxx Required Cell Performance. Xxxxxxx drawing is attached in the appendix for reference.

8. Caution

Caution on usage of Lithium-Ion Rechargeable Battery

⚠CAUTION

8.1 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.

8.2 Caution for the battery and the pack

8.2.1 Charging method

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

8.2.2 Design of battery pack

*It shall have a specific shape which cannot be connected easily to any other charger than the dedicated charger as specified by battery pack company.

*It shall have a specific structure which cannot be connected easily by end user to use for any another purpose than that is specified by battery pack company.

*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 have the smoke and fire protection for the electrolyte adhesion.

*It should have the structure which should protect electrolyte from leaking outside of battery pack, in case of the electrolyte leakage from battery cell.

8.2.3 Protection circuit for safety

*The protection circuit shall be installed in the battery pack and (or) to the charger.

*The battery system must possess the following four types of protective circuits.

8.2.3.1 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.

8.2.3.2 Over discharging protective circuit by each block cell voltage monitoring

By each block cell voltage monitoring, the over discharging protective circuit shall operate at less than 2.0V/cell.

8.2.3.3 Over current protective circuit

The over current protective circuit shall operate charging at less than 5A.

The over current protective circuit or device shall operate discharging at less than 30A.

If over 30A discharge occur, the allowable time of operating over current protection should comply with the below table.

Discharge Current	30～40A	～55A	～80A
Time	< 40 sec	< 19 sec	< 6 sec

8.2.3.4 Temperature protective circuit

The over temperature protective circuit at high temperature side shall operate discharging until 80deg.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.

8.2.4 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.

8.2.5 Cell configuration

The cell configuration in the battery pack is to 4 parallels 16 series at the maximum.

8.3 Storage

*Keep and store at the package condition similar to that of shipping from manufacturer (Murata).
*Recommended SOC of cell is 10～50% for long-term storage.
*Recommended temperature is 0～25deg.C and Humidity 75%RH or less.
*Do not store the battery near to heat sources, nor in a place subjected to direct sunlight.

8.4 Disposal

*The cell should be disposed according to the local government regulations.

8.5 Prohibition clause

⚠WARNING

*Do not use the battery for any purpose other than the mentioned specified application and as mentioned in 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.

8.6 Note

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

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 the necessary evaluation data beforehand to get customer's approval.

8.7 Fail-safe

Be sure to add appropriate fail-safe functions on the battery pack to prevent the second damage in case malfunction occur from this product.

8.8 Limitation of Applications

Murata shall not warrant anything in connection with the Product (s) including fitness, performance, adequateness, safety, or quality, in the case of use in applications listed in the Non-specific application mentioned below, which may generally require different performance, function, quality, management of production or safety than mentioned in this specification.
Therefore, this Product specification shall be applied in compliance with the specific application only.
MURATA DISCLAIM ANY LOSS AND DAMAGES ARISING FROM OR IN CONNECTION WITH THE

PRODUCTS INCLUDING BUT NOT LIMITED TO THE CASE SUCH LOSS AND DAMAGES CAUSED BY THE UNEXPECTED ACCIDENT, IN EVENT THAT (i) THE PRODUCT IS APPLIED FOR THE PURPOSE WHICH IS NOT SPECIFIED AS THE SPECIFIC APPLICATION FOR THE PRODUCT, AND/OR (II) THE PRODUCT IS USED/APPLIED FOR ANY APPLICATION PURPOSES AS MENTIONED IN NON-SPECIFIC APPLICATION (EXCEPT THAT SUCH APPLICATION PURPOSE IS UNAMBIGUOUSLY SPECIFIED AS SPECIFIC APPLICATION FOR THE PRODUCT IN OUR CATALOG SPECIFICATION FORMS, DATASHEETS, OR OTHER DOCUMENTS OFFICIALLY ISSUED BY US*).

Non-specific applications as listed below from (1) to (11):

(1) Aircraft equipment
(2) Aerospace equipment
(3) Undersea equipment
(4) Power plant control equipment
(5) Medical equipment
(6) Transportation equipment (including Automotives)
(7) Traffic control equipment
(8) Disaster prevention/security equipment
(9) Industrial data-processing equipment
(10) Combustion/explosion control equipment
(11) Equipment with complexity and/or required reliability equivalent to the applications listed in the above.

For exploring information of the Products which will be compatible with the particular purpose other than those specified in the specific application, please contact our sales offices, distribution agents, or trading companies with which you make a deal, or via our web contact form.
Contact form: https://www.murata.com/contactform

*Murata may design and manufacture specific Product (s) for applications listed above as non-specific applications. Provided that, in such case we shall unambiguously specify such Specific Application in the product specification without any exception and as agreed by both parties. Therefore, any other documents and/or performances, whether exist or non-exist, shall not be deemed as the evidence to imply that we accept the applications listed non-specific applications mentioned above.

9. Request

1. When using the product, please be sure to evaluate it in the condition of being mounted/assembled on the battery pack.
2. Please do not use this product deviating from the description mentioned in this product specification.
3. We believe that it is not appropriate to include contractual matters related to transactions in specifications, drawings, and other technical documents. Therefore, if the technical documents prepared by your company contain any statement regarding quality assurance, product liability, industrial property rights, export control, etc., such statement shall be deemed invalid. We would like to ask you to agree to these matters in a separate basic transaction agreement. In case of any ambiguity, please contact Murata representative at the earliest.
4. Please affix your company's seal of acceptance to this product specification and return one copy to the Murata representatives. If you do not return it by **MM/DD**, we will assume that you have received and accepted this product specification.

----------End of the document----------