

# SPECIFICATION

Cylindrical nickel-metal hydride (Ni-MH) battery

Type : TNH-03GAE

Receipt stamp

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**TOSHIBA LIFESTYLE PRODUCTS & SERVICES CORPORATION**

Checked by	Inspected by	Prepared by

## PRODUCT SPECIFICATION

### 1. Scope of application

This specification is applicable to the following product.

Product : Cylindrical nickel-metal hydride (Ni-MH) battery **TNH-03GME**

Country of origin : China

Related Standard : JIS C 8708 / IEC 61951-2

### 2. Rating

2.1 Battery type: **TNH-03GME** (Corresponding JIS name: HR03)

2.2 Nominal voltage: 1.2 V

2.3 Rated capacity: 950 mAh (Standard Charge/ Discharge)

Description	Unit	Criteria	Test Conditions (Method)
Standard Charge	mA	95(0.1C)	Ta= 0~45°C
	h	16	(see Note 1)
Fast Charge	mA	475(0.5C) ~ 950(1C)	DT/dt=0.8/min(0.5 to 0.9C)
	h	1.05 approx. (1C) 2.1 approx. (0.5C)	0.8~1°C/min(1C) -ΔV = 0~5 mV/cell Timer cut off = 105% input capacity Temp. cut off = 45~50°C Ta = 10~45°C (see Note 2)
Trickle Charge	mA	47.5(0.05C) ~ 95(0.1C)	Ta = 0~45°C
Discharge Cut-off Voltage	V	1.0	Unit cell
Maximum Discharging Current	A	2.85 (3C)	Ta = -20~50°C
Storage Temperature	°C	-20~35	
Typical Weight	g	15.2(Approx)	Measure weight with a scale.

\* Rated capacity shall be based on the battery cell capacity.

\* A battery cell shall be charged before shipped.

\* In case a battery is stored for 6 months or more, the battery should be charged/discharged or only discharged once a year at least (once in 6 months recommended). \*Consultation is required as for any condition not listed above.

3. Dimensions                      The dimensions shall follow (Fig-1) Product dimensional drawing.
4. External appearance            The cell / battery shall be free from cracks, scars, breakage, rust, Discoloration, leakage and deformation.
5. Shape and structure            A battery cell consists of a positive plate, a negative plate, a separator, an electrolyte, a metal case, and a sealing plate. The positive plate and negative plate are separated by the separator and inserted into the case. The sealing plate is crimped onto the case and sealed. The sealing plate consists of insulators with a positive terminal, a gas exhaust valve, and a negative terminal. The case functions as a negative terminal. In addition, the outside of the case is covered with a shrinkable tube.
6. Test
- 6.1 Sample :                      Use the battery which has been delivered 1 month or less before the test.
- 6.2 Test environment :            Recommended test environment is a temperature of  $20\pm 2^{\circ}\text{C}$  and a relative humidity of  $(60\pm 20)\%$ , if not specified.
- 6.3 Test method :                The test method and criteria should follow (Table-1) Test Method and Criteria.
7. Marking                         Marking should follow (Fig-2) Product Label.
8. Changes and revisions        In case any change or revision of the specification is required, both parties shall in good faith enter into a discussion and make decisions.
9. Warranty information
- (1) Toshiba Life style warrants the battery specified in this specification is covered by a full 12 months from the date of delivery and conforms to this specification. For this period, we will immediately replace the battery at our cost for any failure that apparently occurred due to our negligence.
- (2) With respect to confirmation such as matching to equipment by product assembling and life expectancy, you (manufacture of assembled products) are kindly requested to conduct them and confirm quality assurance.
- (3) This warranty is void and of no effect if you fail to handle the battery properly, operate, install, test, care and check, or fail to follow the instructions, cautions, warnings, information stated in this specification and other reasonable instruction and advice given by us.
- (4) We will regard that you received and agreed to the content of this specification if this specification were not returned by the first delivery of the product from the date of issue.

(Table-1) Test method and criteria

Test item	Unit	Criteria	Test Conditions (Method)	Remarks
Capacity	mAh	$\geq 950$ (greater than over equal to)	Standard Charge/Discharge	Up to 3 cycles are allowed
Open Circuit Voltage	V	$\geq 1.25$ (greater than over equal to)	Within 1hr after standard charge	Unit cell
Internal Impedance	m $\Omega$	$\leq 55$ (less than over equal to)	Measure internal resistance within 1 hour after the completion of normal charging. (1kHz AC method)	Unit cell
High Rate Discharge (0.5C)	min	$\geq 108$ (greater than over equal to)	Standard Charge, 1hr rest before discharge	
Overcharge	N/A	There is no deformation or liquid leakage in appearance.	Charge at 95 mA (0.1C) for a year.	
Charge Retention	mAh	$\geq 660$ (greater than over equal to)	Standard Charge, Storage: 6 months at 20°C Standard Discharge	
	mAh	$\geq 470$ (greater than over equal to)	Standard Charge, Storage: 12 months at 20°C Standard Discharge	
IEC Cycles Test	Cycle	330	IEC61951-2(2011) 7.5.1.2	(see Note 3)
Leakage	N/A	No leakage (There is no liquid leakage)	Fully charged at 950 mA (1C), stand for 14 days	(visual check)
External Short Circuit	N/A	No fire and no explosion	After standard charge, short circuit the cell(s) at 20+/-5°C until the cell(s) temperature return to ambient temperature. (The resistance of the inter-connecting circuitry shall not exceed 0.1 $\Omega$ .)	
Vibration Resistance	N/A	$\Delta V < 0.02V/\text{cell}$ $\Delta Ri$ (Internal Impedance) $< 5m\Omega/\text{cell}$	Charge the battery 0.1C 16hrs, and then leave for 24hrs, check battery before/after vibration, Amplitude:1.5mm Vibration: 3000CPM Any direction for 60mins.	Unit cell

Test item	Unit	Criteria	Test Conditions (Method)	Remarks
Impact Resistance	N/A	$\Delta V < 0.02V/\text{cell}$ $\Delta Ri$ (Internal Impedance) $< 5m\Omega/\text{cell}$	Charge the battery 0.1C 16hrs, and then leave for 24hrs, check battery before / after dropped, Height:50cm Wooden board (thickness:30mm) Direction not specified, 3 times.	Unit cell

Notes: 1. Ta: Ambient Temperature

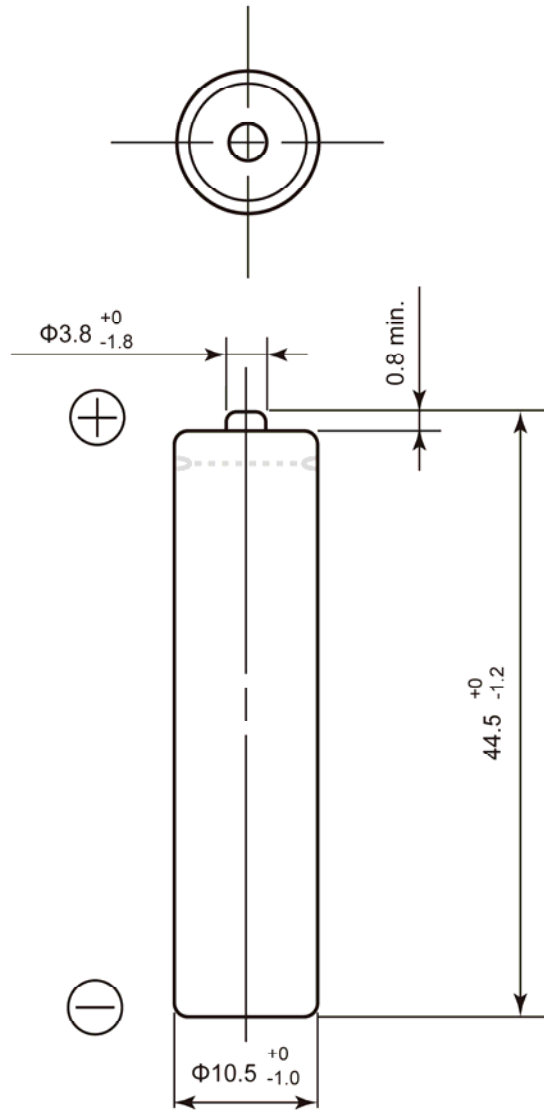
Notes: 2. Approximate charge time from discharged state, for reference only

Notes: 3. IEC61951-2(2011) 7.5.1.2 Endurance in cycles:

Cycle No.	Charge	Rest	Discharge
1	0.1C × 16hrs	None	0.25C × 2hrs20mins
2-48	0.25C × 3hrs10mins	None	0.25C × 2hrs20mins
49	0.25C × 3hrs10mins	None	0.25C to 1.0V/cell
50	0.1C × 16hrs	1-4hr(s)	0.2C to 1.0V/cell

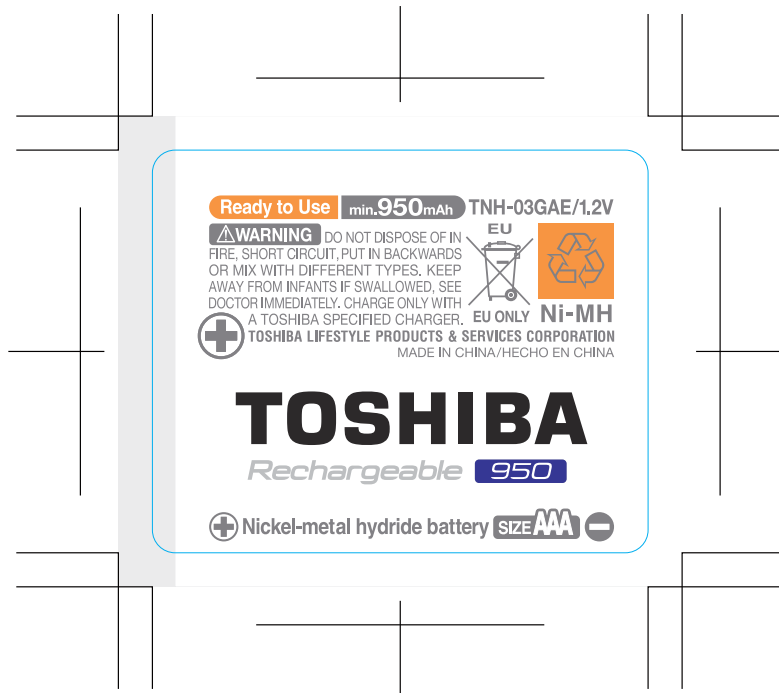
Cycles 1 to 50 shall be repeated until the discharge duration on any 50th cycle becomes less than 3hrs

(Fig-1) Product dimensional drawing



Unit: mm

(Fig-2) Product label



## Precautions when use of NiMH battery

### Cylindrical nickel-metal hydride (NiMH) battery

#### 1. Precautions on battery charging

##### 1-1 Charging temperature

- (1) Rapid charging shall be performed with an ambient temperature range of 10 °C ~ 40 °C.
- (2) Ambient temperature during charging greatly affects charge efficiency. The charge efficiency is best within a temperature range of 10 °C ~ 30 °C. If possible, place the charger in a location within this temperature range.
- (3) At temperatures of 0 °C or less, insufficient gas absorption reaction causes gas pressure inside the battery to rise. It may activate the gas exhaust vent (safety vent) and lead to leakage of gas containing an alkaline electrolyte, which cause deterioration in battery performance.
- (4) Charge efficiency decreases at temperatures of 40 °C or more. This may not only prevent full charge but also lead to deterioration in performance and liquid leakage of the battery.

##### 1-2 Parallel charging

When charging batteries connected in parallel, sufficient care must be taken to design a charger and a temperature of each row. If parallel charging is required, please consult us.

##### 1-3 Reverse charging

Charging with terminals reversed causes gas pressure inside the battery to rise, which activates the gas exhaust vent (safety vent). Never attempt reverse charging since it may lead to rapid deterioration in performance, expansion, and explosion of the battery.

##### 1-4 Overcharging

Avoid overcharging as much as possible.

Repeated overcharging may lead to deterioration in battery performance.

(“Overcharging” means charging a battery when it is already fully charged.)

##### 1-5 Rapid charging

Use a specified charger (or a charging method recommended by us) in a proper way to perform rapid charging,

##### 1-6 Trickle charging (continuous charging)

- (1) Trickle Charging should be performed at a current of  $1/30$  to  $1/20$   $I_t$  mA.
- (2) Apply a current of  $1/30$  to  $1/20$   $I_t$  mA to perform trickle charging as an auxiliary charge after rapid charging.

Also, add a timer which controls total charge duration to avoid deterioration of battery performance caused by overcharging (e.g. trickle charging).



\*It mA: It mA indicates the current during charging or discharging, which is expressed as a multiple of rated capacity.  
Make sure to calculate It by assigning the rated capacity of each battery.  
For example, for a battery with 1500 mAh and 1/30 It mA, this value is equal to  $1/30 \times 1500 \text{ mA} = 50 \text{ mA}$ .

## 2. Precautions on battery discharging

### 2-1 Discharging temperature

- (1) Discharging shall be performed at an ambient temperature range of  $-5^{\circ}\text{C} \sim 50^{\circ}\text{C}$ .
- (2) Discharge current on discharging greatly affects discharge efficiency.  
The best charge efficiency is within a range of 1/10 to 1/2 It mA.
- (3) Temperatures at  $-5^{\circ}\text{C}$  or less and  $50^{\circ}\text{C}$  or more may cause deterioration in battery performance.
- (4) At a low temperature, you may not be able to discharge the battery at the maximum discharge current.

### 2-2 Over-discharging

Over-discharging may cause deterioration in characteristics and liquid leakage of the battery. Avoid over-discharging with the battery connected to the device for a long time (e.g. forgetting to switch off the device). Also avoid shipping with the battery inserted into the device.

### 2-3 High-rate discharging

Continuous discharging or pulse discharging with the current of 2 It mA or more may decrease discharge efficiency and heat the battery.

## 3. Precautions on storing battery

### 3-1 Storage temperature and humidity (short-term)

- (1) Store the battery in a dry place with no corrosive gas at an ambient temperature range of  $-10 \sim 40^{\circ}\text{C}$ .
- (2) A place with temperatures at  $-10^{\circ}\text{C}$  or less and  $40^{\circ}\text{C}$  or more, or a place with an extremely high humidity may cause liquid leakage due to expansion and shrinkage of the parts of organic materials in the battery. It may also cause rust in metallic parts. Please avoid storing the battery in an extremely humid place.

### 3-2 Long-term storage (1 year at $-10 \sim 30^{\circ}\text{C}$ )

- (1) Long-term storage may cause various kinds of deterioration in characteristics. To reduce deterioration caused by long-term storage, the battery should be stored at as low temperature as possible. However, sufficient care must be taken to prevent condensation.
- (2) Increase of charging voltage and decrease of capacity may be caused by inactivation of reactants in an initial charge after long-term storage. Repeat charging and discharging several times to recover them.

- (3) In case of long-term storage for 1 year or more, make sure to perform charging and discharging once a year at least, or once in 6 months (recommended) if possible, to prevent deterioration in performance and liquid leakage caused by self-discharge.

#### **4. Battery life**

##### 4-1 Cycle life

The battery can be used 200 times or more under the endurance test condition stipulated in IEC. If the battery usage time is significantly shortened despite proper charging, please consider that it is almost the end of the battery life.

At the end of life, the battery enters a failure mode in which extraordinary increase of internal resistance and internal short-circuits occurs.

##### 4-2 Long-term life

The battery is a chemical product taking advantage of chemical reactions. Its performance will be decreased if it is stored for a long term, as well as it is used. The battery used under proper conditions without being overcharged or over-discharged is normally available for 2 to 3 years (or approx. 200 times). However, if any of charging, discharging, or temperature does not meet proper conditions in actual use, the battery cycle life will decrease, performance will be deteriorated due to liquid leakage, and the battery life (or number of times the battery is used) will be shortened.

#### **5. Precautions on device design**

##### 5-1 Connect battery with device

- (1) Do not solder the battery directly, since it will damage the parts of organic materials such as a gas exhaust valve (safety valve) and a separator in the battery.

To connect the battery with the device by soldering, solder a lead wire to a nickel plate or a steel splice plate (tab) coated with nickel, and spot-weld it to the battery.

- (2) When the terminals of the device and terminals of the battery are connected not by connectors but by contacts, sufficient care must be taken for terminal shapes, contact pressure etc. to prevent a contact failure.

##### 5-2 Materials used in terminals of device

When the gas exhaust valve (safety valve) is operated by extraordinary use or during long-term use of the battery, an alkaline electrolyte may be leaked a little from the sealing part of the battery. Therefore, alkali-resistant materials should be applied to the device terminals to prevent corrosion.

### 5-3 Position/Temperature of battery in device

The battery should be placed distant from the heating part of the device. At a high temperature (65 °C or more), liquid leakage of the battery may damage the device, and deterioration of the separator may shorten the battery life. The desirable placement of the battery is to divide the battery room with alkali-resistant materials and block out the circuit part of the device. This can prevent damage to the device caused by liquid leakage of the battery.

### 5-4 Discharge final voltage

The discharge final voltage of the battery is basically calculated by the equation below:

Batteries in serial: 1 to 6 batteries (the number of batteries x 1.0) V

7 to 10 batteries V [(the number of batteries - 1) x 1.2] V

However, the discharge final voltage needs to be set depending on the number of cells and discharge current of a battery pack. Please consult us if you consider a discharge current of 2 It or more, or a battery pack containing 10 or more cells.

### 5-5 Measures to prevent over-discharge

Over-discharging and reverse charging greatly decrease battery performance, which cause troubles such as liquid leakage and performance degradation.

To prevent them, make sure to set up an over-discharging prevention system in the device.

The leakage current flowing from the battery to the device at a time should be less than several  $\mu$ A.

## 6. Precautions on battery handling to ensure security

### 6-1 Do not disassemble battery

Never disassemble the battery. If alkaline fluid of the battery adheres to your skin or clothes, rinse them with a lot of clear water (running water etc.) immediately. It may damage your skin. If alkaline fluid enters your eyes, it may cause loss of eyesight. Do not rub your eyes but rinse them with a lot of clear water (running water etc.) and see a doctor immediately.

### 6-2 Do not short battery

Never short the battery. It may damage the device and cause liquid leakage, heating or explosion of the battery.

Sufficient care must be taken especially for the short of a battery pack. In some cassette-type battery packs, batteries may be inserted with its terminals reversed depending on the device and battery shape. Also note that some battery packs have a structure easily causing short circuits depending on the shape of device terminals etc.

### 6-3 Do not throw battery into fire or water

Throwing the battery into fire may cause battery explosion. Also, never throw it into water since the battery functions may be lost.

#### 6-4 Do not solder battery directly.

Do not solder the battery directly, since it may damage the gas exhaust valve (safety valve) inside the battery which may break the gas exhaust system.

#### 6-5 Do not insert battery with its terminals reversed

Never insert the battery with its (+) (-) terminals reversed, since there is a risk of battery expansion or explosion.

#### 6-6 Do not overcharge or over-discharge battery at a high-rate current

(1) Never overcharge or reverse charge the battery at a high-rate current exceeding a specified value.

It may rapidly generate gas inside the battery and the gas pressure increases, which causes expansion, heating and explosion of the battery.

(2) Never charge the battery with a non-specified charger or a modified charger since it may cause expansion, heating and explosion of the battery.

☆ To ensure security, make sure to describe these prohibitions in the operating manual for each device.

#### 6-7 Do not integrate sealed battery into device

Never provide a sealed structure when integrating the battery into the device, since it may generate gas (hydrogen/oxygen), and ignition sources (sparks emitted by motors, switches, etc.) may lead to battery explosion.

#### 6-8 Do not use battery for other purposes

Never use the battery for other devices or purposes. The difference of specification may damage the battery and the device.

#### 6-9 Do not use new/old batteries or different types of batteries mixed together

Never use different types of batteries together (e.g. primary batteries, NiCad and NiMH), new batteries and old batteries mixed together, or different brands of batteries together. The difference of characteristics may cause liquid leakage, heating, or explosion of the battery.

### 7. Other precautions

#### 7-1 Charge before use

Make sure to charge the battery before use. Also, make sure to charge it in a proper way.

### 8. Request to users

\*Performance and life of the battery are greatly different depending on how it is used.

To ensure security, please ask us for the charging/discharging specifications and device structure etc. when you design a device using the battery.

We shall not take responsibility for any quality issues or troubles caused by the battery use not compliant with "Precautions on the use of NiMH battery" above.