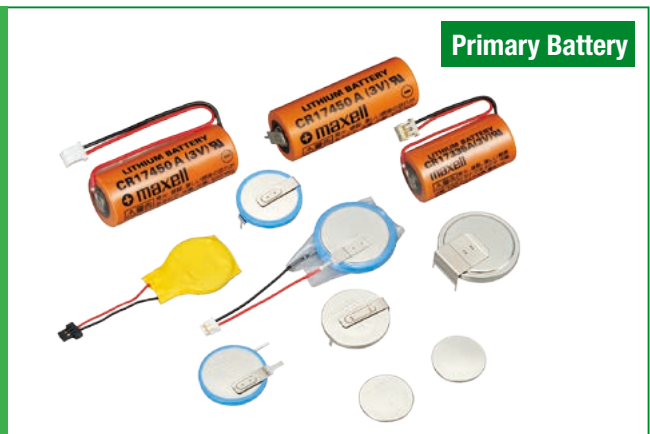


# CR

## Lithium Manganese Dioxide Battery (Li/MnO<sub>2</sub>)



## LITHIUM MANGANESE DIOXIDE BATTERY

### Safety Instructions

This battery contains lithium, organic solvents, and other combustible materials. For this reason, improper handling of the battery could lead to distortion, leakage\*, overheating, explosion, or fire, causing bodily injury or equipment trouble. Please observe the following instructions to prevent accidents.

(\* Leakage is defined as the unintentional escape of a liquid from a battery.)

### ⚠ Warnings — Handling

#### ■ Never swallow.

Always keep the battery out of the reach of infants and young children to prevent it from being swallowed. If swallowed, consult a physician immediately.

#### ■ Never charge.

The battery is not designed to be charged by any other electrical source. Charging could generate gas and internal short-circuiting, leading to distortion, leakage, overheating, explosion, or fire.

#### ■ Never heat.

Heating the battery to more than 100 deg. C\* could increase the internal pressure, causing distortion, leakage, overheating, explosion, or fire. (\* Consult Maxell regarding heat resistant coin type lithium manganese dioxide batteries.)

#### ■ Never expose to open flames.

Exposing to flames could cause the lithium metal to melt, causing the battery to catch on fire and explode.

#### ■ Never disassemble the battery.

Do not disassemble the battery, because the separator or gasket could be damaged, leading to distortion, leakage, overheating, explosion, or fire.

#### ■ Never reverse the positive and negative terminals when mounting.

Improper mounting of the battery could lead to short-circuiting, charging or forced-discharging. This could cause distortion, leakage, overheating, explosion, or fire.

#### ■ Never short-circuit the battery.

Do not allow the positive and negative terminals to short-circuit. Never carry or store the battery with metal objects such as a necklace or a hairpin. Do not take multiple batteries out of the package and pile or mix them when storing. Otherwise, this could lead to distortion, leakage, overheating, explosion, or fire.

#### ■ Never weld the terminals or weld a wire to the body of the battery directly.

The heat of welding or soldering could cause the lithium to melt, or cause damage to the insulating material in the battery. This could cause distortion, leakage, overheating, explosion, or fire. When soldering the battery directly to equipment, solder only the tabs or leads. Even then, the temperature of the soldering iron must be below 350 deg. C and the soldering time less than 5 seconds. Do not use a soldering bath, because the circuit board with battery attached could stop moving or the battery could drop into the bath. Moreover do not use excessive solder, because the solder could flow to unwanted portions of the board, leading to a short-circuit or charging of the battery.

#### ■ Never use different batteries together.

Using different batteries together, i.e. different type or used and new or different manufacturer could cause distortion, leakage, overheating, explosion, or fire because of the differences in battery property. If using two or more batteries connected in series or in parallel even same batteries, please consult with Maxell before using.

#### ■ Never allow liquid leaking from the battery to get in your eyes or mouth.

Because this liquid could cause serious damage, if it does come in contact with your eyes, flush them immediately with plenty of water and consult a physician. Likewise, if the liquid gets in your mouth, rinse immediately with plenty of water and consult a physician.

#### ■ Keep leaking batteries away from fire.

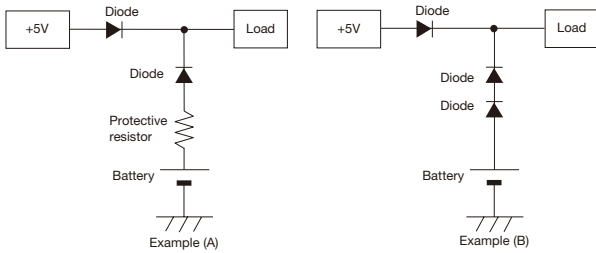
If leakage is suspected or you detect a strong odor, keep the battery away from fire, because the leaked liquid could catch on fire.

#### ■ Never touch the battery electrodes.

Do not allow the battery electrodes to come in contact with your skin or fingers. Otherwise, the moisture from your skin could cause a discharge of the battery, which could produce certain chemical substances causing you to receive a chemical burns.

**Warnings — Circuit Design for Back-up Use**

This is a primary battery and cannot be charged. If used in memory or RTC back-up applications, be sure to use diodes to prevent charging from the main power source or other batteries, and a protective resistor to regulate the current as shown in the figure below. Note that the points described below should be taken into careful consideration when selecting diodes and protective resistors.



**Supplied voltage to load**

Because a diode and a resistor generate the voltage drop on operating, please take into consideration these voltage drops for supplied voltage to load.

**Using diodes to prevent charging**

Please choose diodes with leak current as small as possible. Please keep the charged capacity due to leak current to within 1% of nominal capacity.

**Using and setting protective resistors**

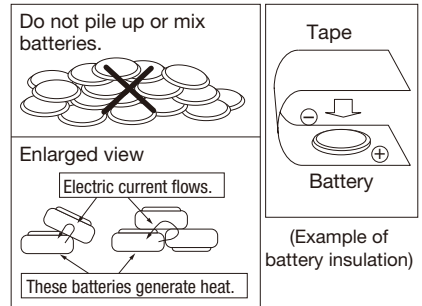
A protective resistor is used to prevent the battery from being charged by large surges of current during diode failure. Please set the resistor so that the maximum current shown in the right table is not exceeded. For example, say a CR2032 battery is used in sample circuit (A) in combination with a main power source 5 volt. Since the permitted charge current is 10mA and this battery's voltage is 3V, let the resistor be  $R \geq (5V-3V)/10mA=0.2k \text{ ohm}$ , meaning that at least 0.2k ohm is required.

Type	Maximum Current
CR2450HR	15mA
CR2450HR-Ex	15mA
CR2050HR	10mA
CR2450	15mA
CR2430	15mA
CR2032H	10mA
CR2032	10mA
CR2025	10mA
CR2016	10mA
CR1632	4.0mA
CR1620	4.0mA
CR1616	2.5mA
CR1220	3.0mA
CR1216	2.5mA
CR17450 A	20mA
CR17335 A	20mA

Note: If the diodes broke down, it is necessary for safety to replace them as soon as possible even though using a protective resistor. Considering the trouble of diodes and resistors, other safety measures should be incorporated in the circuit design.

**Warnings — Disposal**

The battery may be regulated by national or local regulation. Please follow the instructions of proper regulation. As electric capacity is left in a discarded battery and it comes into contact with other metals, it could lead to distortion, leakage, overheating, or explosion, so make sure to cover the (+) and (-) terminals with friction tape or some other insulator before disposal.



**Caution — Handling/Storage**

**Never expose the battery to ultrasonic sound.**

Exposing the battery to ultrasonic sound may cause short-circuiting because the inside material is broken into pieces, leading to distortion, leakage, overheating, explosion, or fire.

**Never subject the battery to severe shock.**

Dropping, throwing or stomping on the battery may cause distortion, leakage, overheating, explosion, or fire.

**Never short-circuit the battery while installing into equipment.**

Please be careful when installing the battery not to short-circuit it with metal portions of the equipment.

**Use the correct battery suitable for the equipment.**

The battery may not be suitable for the specific equipment due to the using conditions or type of equipment. Please select the suitable battery according to the handling instructions of the equipment.

**Never use or leave the battery in a hot place such as under the direct rays of the sun or in a car in hot weather.**

If you do, this may cause distortion, leakage, overheating, explosion, or fire.

**Never allow the battery to come in contact with water.**

If it does, this may cause the battery to rust or lead to distortion, leakage, overheating, explosion, or fire.

**Never store the battery in a hot and highly humid environment.**

Doing so may cause the performance of the battery to deteriorate. In certain environments, this may lead to distortion, leakage, overheating, explosion, or fire.

**Keep contact pressure more than 2N.**

The battery voltage may be lower than intended value because of poor contact condition, please keep contact pressure more than 2N for suitable contact resistance.

CR



### Overview

Maxell's cylindrical type lithium manganese dioxide battery realizes stable discharge characteristics with its original sealing structure, improved electrical-conductivity structure, and negative electrode material. This battery's high reliability makes it ideal for use as a power source in industrial applications such as security devices and electronic meters. Assembled batteries can also be produced to meet special customer requirements. For details, please contact your nearest Maxell dealer or distributor.

### Features

**Long-term reliability of 10 years\***

The employment of a heat-resistant gasket and a laser-seal structure prevents water intrusion and electrolyte evaporation, ensuring a long-term reliability of 10 years. The self-discharge rate is about 0.5% per year.

**Stable discharge characteristics**

The original negative electrode material maintains low internal resistance even at high depths of discharge and ensures stable discharge.

**Superior low-temperature characteristics**

**High safety due to internal short-circuit prevention structure**

\* Designed lifetime at 20 deg. C when not yet used.  
Actual lifetime will vary depending on conditions such as discharge current and temperature.

### UL Recognized Components

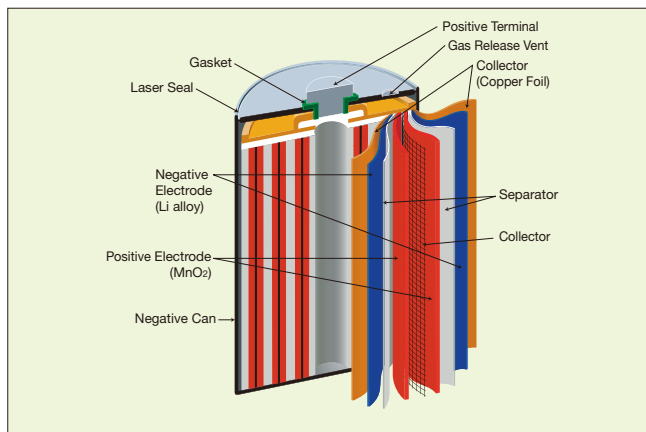
The cylindrical type lithium manganese dioxide battery is a UL (Underwriters Laboratories Inc.) recognized component. (Technician Replaceable)

Recognized models: CR17450 A, CR17335 A  
Certification Number: MH12568

### Applications

- Security Devices
- Communication Tags
- ETC (Electronic Toll Collection System)
- Home Fire/Smoke Alarms
- Electronic Meters (Water, Gas, Electricity)
- Memory Backup Power

### Construction



### Products

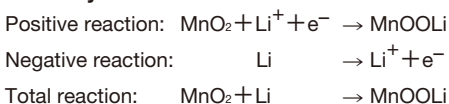
Model	CR17450 A	CR17335 A
Nominal Voltage (V)	3	3
Nominal Capacity (mAh)**	2500	1650
Nominal Discharge Current (mA)	5	5
Operating Temperature Range (deg. C)	-40 to +85	-40 to +85
Dimensions* Diameter (mm) X Height (mm)	17 x 45	17 x 33.5
Weight (g)*	22	17

\* Dimensions and weight are for the battery itself, but may vary depending on terminal specifications and other factors.  
\*\* Nominal capacity indicates duration until the voltage drops down to 2.0V when discharged at a nominal discharge current at 20 deg. C.  
• Data and dimensions are just reference values. For further details, please contact your nearest Maxell dealer or distributor.

### Principle and Reactions

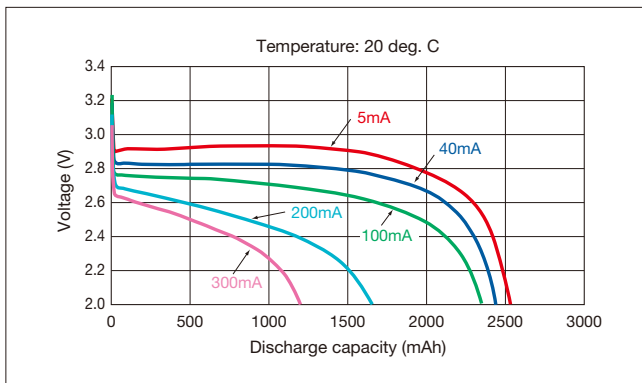
The cylindrical type lithium manganese dioxide battery uses manganese dioxide (MnO<sub>2</sub>) as its positive active material, and lithium (Li) as its negative active material.

**Battery reactions**

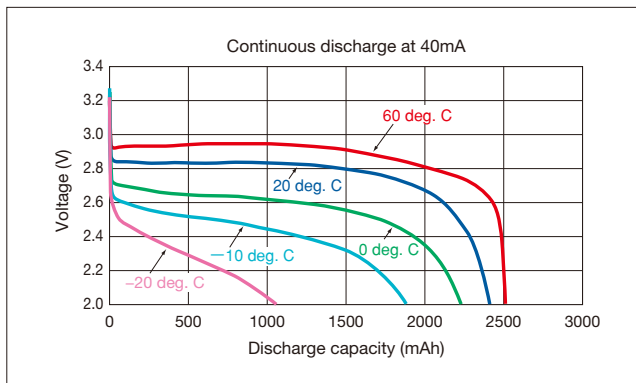


## Characteristics (CR17450 A)

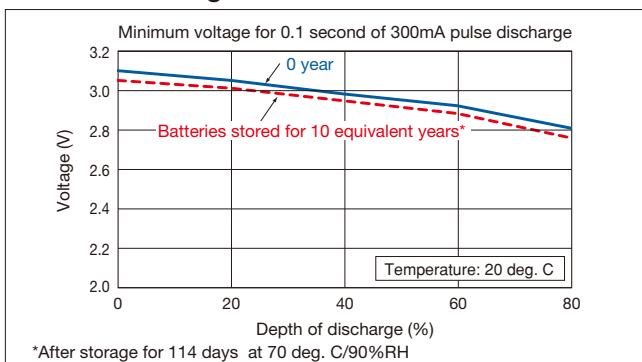
### Discharge characteristics



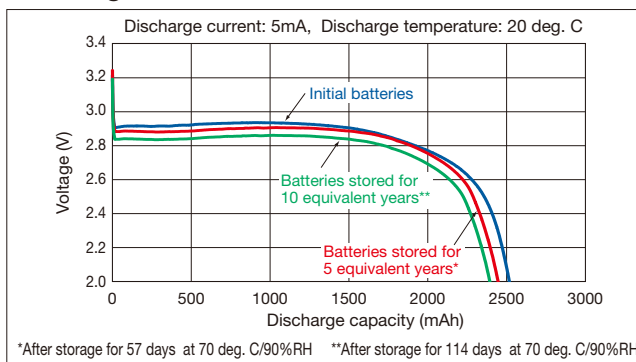
### Temperature characteristics



### Pulse discharge characteristics



### Storage characteristics



## External Dimensions with Terminals and Wire Connectors (unit : mm)

CR17450 A VO-T3	CR17450 A WK 41	CR17450 A 2WK 35	CR17335 A VO-T3	CR17335 A WK 11
	<p>Housing: PHR-2 (JST) Contact: SPH-002T-P0.5S (JST) Lead Wire: AWG26 UL1007</p>	<p>Housing: PHR-2 (JST) Contact: SPH-002T-P0.5S (JST) Lead Wire: AWG26 UL1007</p>		<p>Housing: PHR-2 (JST) Contact: SPH-002T-P0.5S (JST) Lead Wire: AWG26 UL1007</p>

The above are examples. Processing to meet customer requests is possible.

: Horizontal & Through hole Type

: Wire connector Type

: Tin plating

Visit our website for more information

<http://biz.maxell.com/en/>

Go to: Products > Primary Batteries > CR (Cylindrical Type Lithium Manganese Dioxide Battery)

## Dangerous Goods Transportation Regulations for Lithium Cells and Batteries

Some transportation regulations have been recently revised and will come into effect after Jan. 1, 2015. The summary is shown in the following table. Please use updated Dangerous Goods Regulations listed in Normative Reference to confirm details.








### ■ The major revisions for air transport of lithium cells and batteries

(1) Lithium metal cells and batteries transported as cargo will be restricted to cargo aircraft only.

Note. The prohibition does not apply to lithium metal batteries packed with equipment (PI 969) or contained in equipment (PI 970).

(2) Gross mass will change to net quantity for both lithium ion cells and batteries (PI 965 Section IB) and lithium metal cells and batteries (PI 968 Section IB)

### Technical instructions for lithium metal batteries (PI 968)

Section	Section II		Section IB	Section IA	
Lithium Metal Content	Cell: ≤ 0.3 g Battery: ≤ 0.3 g	Cell: ≤ 1.0 g Battery: ≤ 2.0 g	Cell: ≤ 1.0 g Battery: ≤ 2.0 g	Cell: > 1.0 g Battery: > 2.0 g	
Package Limits	Quantity	N/A	≤ 2 batteries or ≤ 8 cells	> 2 batteries or > 8 cells	N/A
	Net Weight	Cargo aircraft only 2.5 kg	Cargo aircraft only N/A	Cargo aircraft only 2.5 kg	Cargo aircraft only 35 kg
Classification	Exempted		<b>Class 9</b>		
Packaging	Strong outer packaging 1.2 M drop test			UN performance packaging	
Labels	 Note 1)	 Note 2)	 Note 3)	   	
Documents	Invoice (air waybill)* Additional documents***		Declaration for DG Air waybill** Additional documents***	Declaration for DG Air waybill**	
Training	Adequate instructions		<b>DG training</b>		

Note 1): Handling label    Note 2): Cargo aircraft only label (necessary for lithium metal cells and batteries)

Note 3): Class 9 hazardous label

\* The words "lithium metal batteries, in compliance with Section II of PI 968" and "Cargo Aircraft Only" or "CAO" must appear on the air waybill, when an air waybill is used. This description should appear in the "Nature and Quantity of Goods" box.





\*\* The words "Dangerous Goods as per attached Shipper's Declaration" and "Cargo Aircraft Only" or "CAO" must appear in the air waybill's "Handling Information" column.

\*\*\* Additional documents must indicate:

- The package contains lithium metal cells or batteries;
- The package must be handled with care and that a flammability hazard exists if the package is damaged;
- Special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
- A telephone number for additional information.

This information can be written in the Declaration for DG's "Additional Handling Information" column or on the air waybill.

### Technical instructions for lithium-ion batteries (PI 965)

Section		Section II		Section IB	Section IA
Watt hour		Cell: ≤ 2.7 Wh Battery: ≤ 2.7 Wh	Cell: ≤ 20 Wh Battery: ≤ 100 Wh	Cell: ≤ 20 Wh Battery: ≤ 100 Wh	Cell: > 20 Wh Battery: > 100 Wh
Package Limits	Quantity	N/A	≤ 2 batteries or ≤ 8 cells	> 2 batteries or > 8 cells	N/A
	Net Weight	2.5 kg	N/A	10 kg Passenger and cargo aircraft	5 kg: Passenger aircraft 35 kg: Cargo aircraft
Classification		Exempted		<b>Class 9</b>	
Packaging		Strong outer packaging 1.2 M drop test			UN performance packaging
Labels					
Documents		Invoice (air waybill)* Additional documents***		Declaration for DG Air waybill** Additional documents***	Declaration for DG Air waybill**
Training		Adequate instructions		<b>DG training</b>	

\* The words "Lithium ion batteries in compliance with section II of PI 965" must appear in the air waybill's "Nature and Quantity of Goods" box, when an air waybill is used. The words "Cargo Aircraft Only" or "CAO" must appear on the air waybill, when transported by cargo.

\*\* The words "Dangerous Goods as per attached Shipper's Declaration" must appear in the air waybill's "Handling Information" column. The words "Cargo Aircraft Only" or "CAO" must appear on the air waybill, when transported by cargo.

\*\*\* Additional documents must indicate:

- The package contains lithium ion cells or batteries;
- The package must be handled with care and that a flammability hazard exists if the package is damaged;
- Special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
- A telephone number for additional information.

This information can be written in the Declaration for DG's "Additional Handling Information" column or on the air waybill.

## ■ The major revisions for UN Model Regulations 18th Revised Edition

- (1) Damaged or defective cells or batteries shall be transported as "Class 9" hazardous goods according to Special Provision 376 and Packing Instruction P908 or LP904.
- (2) Cells and batteries transported for disposal or recycling shall be transported as "Class 9" hazardous goods according to Special Provision 377 and Packing Instruction P909.

The IMDG Code 2014 edition will contain the descriptions of these UN recommendations. The voluntary compliance date is Jan. 1, 2015. Compliance becomes mandatory on Jan. 1, 2016.

Although these revisions will be reflected in each country's regulations, some districts, countries or airlines may establish their own special requirements. Therefore the shipper shall confirm with the forwarder in advance.

## Reference

Except for air transportation, the necessary requirements to transport lithium metal batteries or lithium-ion batteries as exempted from regulation (non-restricted goods) are as follows;

### 1. The minimum requirements to transport lithium metal batteries as non-restricted goods are as follows;

- a) Cells and batteries shall be manufactured under a quality management program.
- b) For a lithium metal or a lithium alloy cell, the lithium content must not be more than 1 g.  
For a lithium metal or lithium alloy battery, the aggregate lithium content must not be more than 2 g.
- c) Each cell or battery must be of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, 5th revised edition, Part III, sub-section 38.3.
- d) A battery handling label must be displayed on each package. A telephone number must be printed on the label for additional information.
- e) Each consignment must be accompanied by a document for transport with an indication that:
  - the package contains lithium metal cells or batteries;
  - the package must be handled with care and that a flammability hazard exists if the package is damaged;
  - special procedures should be followed in the event that the package is damaged, to include inspection and repackaging if necessary; and
  - a telephone number for additional information.
- f) Each package must be capable of withstanding a 1.2 m drop test.
- g) Except when batteries are installed in or packed with equipment, packages shall not exceed 30 kg gross mass.

### 2. The minimum requirements to transport the lithium-ion batteries as non-restricted goods are as follows;

- a) Cells and batteries shall be manufactured under a quality management program.
- b) For lithium-ion cells, the Watt-hour rating is not more than 20 Wh. For lithium-ion batteries, the Watt-hour rating is not more than 100 Wh. The Watt-hour rating must be marked on the outside of the battery case except for those manufactured before Jan. 1, 2009.
- c) Each cell or battery is of the type proven to meet the requirement of each test in the UN Manual of Tests and Criteria, 5th revised edition, Part III, sub-section 38.3.
- d) A battery handling label must be displayed on each package. A telephone number must be printed on the label for additional information.
- e) Each consignment must be accompanied by a document for transport with an indication that:
  - the package contains lithium-ion cells or batteries;
  - the package must be handled with care and that a flammability hazard exists if the package is damaged;
  - special procedures should be followed in the event the package is damaged, to include inspection and repackaging if necessary; and
  - a telephone number for additional information.
- f) Each package must be capable of withstanding a 1.2 m drop test.
- g) Except when batteries are installed in or packed with equipment, packages shall not exceed 30 kg gross mass.

Maxell will provide certificates for b) and c) as the need arises. Documentation for d) and e) needs to be prepared by the customer. If our package is used for transport, Maxell will provide the certificate for f) as the need arises. However, if the customer's package is used, the customer must confirm the package can withstand a 1.2 m drop test. Furthermore, even if our package is used for transport, the telephone number printed on the label must be changed to that of the sender (customer).

## Major Normative Reference

### UN (United Nations) Recommendations (Air, Marine, Overland transportation)

- UN (United Nations) Recommendations on the Transport of Dangerous Goods: Model Regulations 18th revised edition
- UN (United Nations) Recommendations on the Transport of Dangerous Goods: Manual of Test and Criteria 5th revised edition, Amendment 2

### Air Transportation

- International Civil Aviation Organization (ICAO): Technical Instructions for Safety Transport of Dangerous Goods by Air, 2015-2016 edition
- International Air Transport Association (IATA): Dangerous Goods Regulations, 56th edition 2015

### Marine Transportation

- International Maritime Organization (IMO): International Maritime Dangerous Goods (IMDG) Code, 2012 edition (This is applicable until Dec. 31, 2015)
- International Maritime Organization (IMO): International Maritime Dangerous Goods (IMDG) Code, 2014 edition (This is applicable on and after Jan. 1, 2015 and will be mandatory on and after Jan. 1, 2016)

## NORTH AMERICA / SOUTH AMERICA

### Maxell Corporation of America

**Main Office:**

3 Garret Mountain Plaza, 3rd Floor,  
Suite #300, Woodland Park, NJ  
07424, U.S.A.  
Tel: (+1) 973-653-2400  
Fax: (+1) 973-653-2450  
Web Site:  
<http://www.maxell-usa.com/>

**Canada Branch:**

237 Romina Drive, Suite 200  
Concord, Ontario L4K 4V3, Canada  
Tel: (+1) 905-669-8107  
Fax: (+1) 905-669-8108  
Web Site:  
<http://www.maxellcanada.com/>

### Maxell Latin America

Oceania Business Plaza, Tower 2000,  
19th Floor, Office 19-D, Punta Pacifica,  
Panama City, Rep. of Panama  
Tel: (+507) 269-6291  
Fax: (+507) 263-4413  
Web Site:  
<http://www.maxellpan.com/>

## EUROPE

### Maxell Europe Ltd.

**European Headquarters &  
UK Sales Office:**

Whitebrook Park, Lower Cookham  
Road, Maidenhead, Berkshire  
SL6 8YA, UK  
Tel: (+44) 1628-41-2012  
Fax: (+44) 1628-41-2010  
E-mail: [hq@maxell.eu.com](mailto:hq@maxell.eu.com)  
(European Headquarters)  
[sales@maxell.eu.com](mailto:sales@maxell.eu.com)  
(UK Sales Office)  
Web Site:  
<http://www.maxell.eu.com>

**German Branch:**

Mollsfeld 2 40670 Meerbusch,  
Germany  
Tel: (+49) 2159-913-0  
Fax: (+49) 2159-913-150  
E-mail: [mdg@maxell.eu.com](mailto:mdg@maxell.eu.com)

**French Branch:**

15 Rue Des Oziers PA Du Vert Galant,  
BP 97091, St Ouen L'Aumone 95 052  
Cergy-Pontoise Cedex, France  
Tel: (+33) 1-3424-8811  
Fax: (+33) 1-3075-5677  
E-mail: [mfrinfo@maxell.eu](mailto:mfrinfo@maxell.eu)

**Italian Branch:**

Via Tommaso Gulli 39, 20147 Milan, Italy  
Tel: (+39) 02-48-7861  
Fax: (+39) 02-3919-0574  
E-mail: [info@maxell.eu](mailto:info@maxell.eu)

**Hungarian Branch:**

Magyarorszagi Fiolkelepe H-1095  
Budapest Mariassy Utca 7, Hungary  
Tel: (+36) 1-464-3800  
Fax: (+36) 1-464-3801  
E-mail: [mhu@maxell.eu](mailto:mhu@maxell.eu)

## ASIA

### Hitachi Maxell Global, Ltd.

**Main Office:**

Unit Nos. 03B-06, 13/F, No. 909 Cheung  
Sha Wan Road, Cheung Sha Wan,  
Kowloon, Hong Kong  
Tel: (+852) 2730-9243  
Fax: (+852) 2735-6250  
E-mail: [maxell@maxell.com.hk](mailto:maxell@maxell.com.hk)  
Web Site:  
<http://www.maxell.com.hk/>

**Vietnam Office:**

Room No. 15, Mezzanine Floor,  
Sun Wah Tower, 115 Nguyen Hue  
Boulevard, District 1, Ho Chi Minh  
City, Vietnam  
Tel: (+84) 8-3821-9183  
Fax: (+84) 8-3821-9181  
E-mail: [maxellvn@saigonnet.vn](mailto:maxellvn@saigonnet.vn)

### Maxell (Shanghai) Trading Co., Ltd.

**Main Office:**

1801, Plaza 336, No.336, Xi Zang  
Middle Road, Shanghai 200001, China  
Tel: (+86) 21-3330-3377  
Fax: (+86) 21-3330-4001  
E-mail: [maxell@maxell.net.cn](mailto:maxell@maxell.net.cn)  
Web Site:  
<http://www.maxell.com.cn/>

**Beijing Office:**

1009 Tower3, Beijing International  
Center, No 38 Dongsanhuan Bei Road,  
Chaoyang District, Beijing 100026,  
China  
Tel: (+86) 10-8587-0215  
Fax: (+86) 10-8587-0238  
E-mail: [maxell@maxell.net.cn](mailto:maxell@maxell.net.cn)

### Maxell (Shenzhen) Trading Co., Ltd.

21B, Building A, Honglong Century  
Plaza, 4002nd East Shennan Road,  
Luohu District, Shenzhen, China  
Tel: (+86) 755-8280-5220  
Fax: (+86) 755-8280-5695

### Maxell Taiwan, Ltd.

14F, No. 111, Sung Chiang Road,  
Taipei 104, Taiwan  
Tel: (+886) 2-2516-5553  
Fax: (+886) 2-2516-4804  
E-mail: [maxell@maxell.com.tw](mailto:maxell@maxell.com.tw)  
Web Site:  
<http://www.maxell.com.tw/>

### Maxell Asia (Singapore) Pte. Ltd.

**Main Office:**

24 Peck Seah Street, #07-03/05, Nehsons Building,  
Singapore 079314  
Tel: (+65) 6220-9291  
Fax: (+65) 6220-6070  
Web Site:  
<http://www.maxell.com.sg/>

**Chennai Office:**

C/o NICHE BUSINESS CENTRE.  
No:10, First Floor, Second Avenue,  
Harrington Road, Chetpet, Chennai-600031, India  
Tel: (+91) 44-2836-5152

**Gurgaon Office**

2nd Floor, Vatika Business Centre No.24,  
First India Place, MG Road,  
Gurgaon 122002 Haryana, India  
Tel: (+91) 124-4028-862

Maxell is accredited with international quality management standard ISO 9001 and international environmental management standard ISO 14001 certifications.