

# PAS

P ⊕ LYACENE CAPACITORS  
2007-2008 Coin type



Shoei Electronics Co., Ltd.

# PAS

## What is PAS ...?

PAS(Polyacenic Semiconductor), which has been originally developed by Shoen Electronics is a kind of conductive polymers synthesized through pyrolytic treatment of phenolic resin. PAS capacitors, in which PAS is employed for both positive and negative electrodes, show extremely high performance.

## Features of PAS capacitor

### ● High capacity / High reliability

PAS can store a large number of ions into its amorphous structure (doping), therefore PAS capacitor has much larger capacity than conventional electric double layer capacitor. In addition, PAS is extremely stable material and PAS capacitor shows excellent performance of cycle life and durability to overcharge and overdischarge.

### ● RoHS / WEEE compliance

PAS capacitors are RoHS and WEEE compliant products and have no recycling and collection duty that is required in lithium ion battery's case.

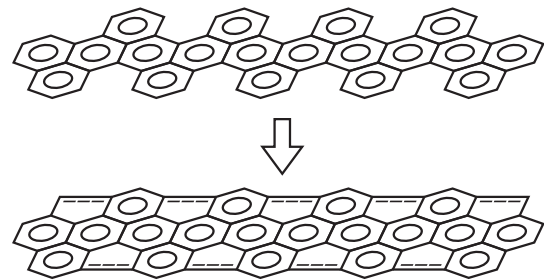
### ● The world's smallest capacitor

"PAS409 series" is the world's smallest coin shaped capacitors, which size is diameter 4.8mm × height 0.9mm. This thinnest and smallest product was carried out by developing electrode materials, sealing technology and introducing special processed heat resistance gasket. Shoen Electronics will continue our development to achieve further downsizing.

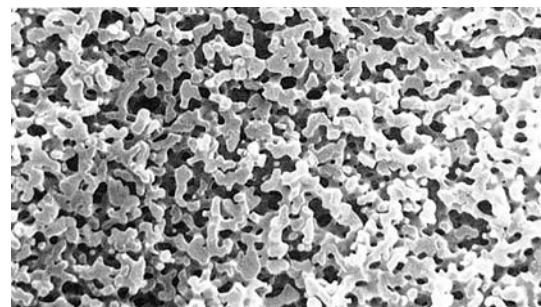
### ● Low voltage compliance

Shoen Electronics developed PAS414TR, which has high performance in charging/discharging characteristics with lower than 2.0V setting, in response to low voltage trend for multifunctional mobile phone and PDAs. PAS414TR achieved 20% increase of capacity compared with our conventional lineup by improving electrode. We have various types of products suitable for various internal circuit voltages.

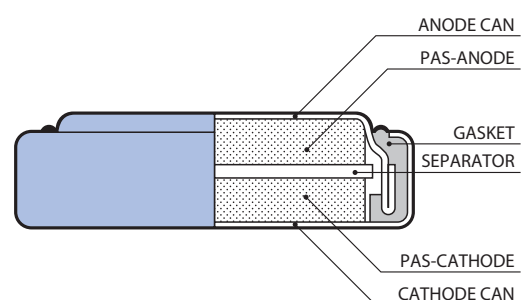
### Molecular structure of PAS



### SEM image of PAS



### Coin type



PAS capacitors have been used all over the world for RTC (Real Time Clock) back-up power source in mobile devices such as cellular phone, digital camera and so on.

## Reflow soldering with lead-free condition type (Peak temperature: 260°C)

**NEW**

TR type	Max. usable voltage (V)	Capacitance (F)	Capacity *1 (μAh)	Cell diameter (mm)	Cell height (mm)	page
PAS414TR	2.0	0.08	22	4.8	1.4	3

SR type	Max. usable voltage (V)	Capacitance (F)	Capacity *2 (μAh)	Cell diameter (mm)	Cell height (mm)	page
PAS409SR	2.5	0.04	10	4.8	0.9	4
PAS414SR		0.07	18	4.8	1.4	

HR type	Max. usable voltage (V)	Capacitance (F)	Capacity *3 (μAh)	Cell diameter (mm)	Cell height (mm)	page
PAS409HR	3.3	0.03	12	4.8	0.9	5
PAS414HR		0.06	20	4.8	1.4	

## Reflow soldering type (Peak temperature: 230°C)

R type	Max. usable voltage (V)	Capacitance (F)	Capacity *2 (μAh)	Cell diameter (mm)	Cell height (mm)	page
PAS414R	2.5	0.07	18	4.8	1.4	6

## Manual soldering type

L type	Max. usable voltage (V)	Capacitance (F)	Capacity *3 (μAh)	Cell diameter (mm)	Cell height (mm)	page
PAS614L	3.3	0.25	90	6.8	1.4	9

\*1) Capacity is measured from 2.0V to 1.0V

\*2) Capacity is measured from 2.5V to 1.5V

\*3) Capacity is measured from 3.3V to 2.0V (approximately doubled capacity can be obtained from 3.3V to 1.0V)

### Applications

Memory and RTC back-up power source used for cellular phone, PDA, digital camera, portable radio and so on.

**NEW**

# TR type

Reflow soldering with lead-free Condition type

## Features

- Reflowable with lead-free condition (Refer to Page 8 for recommendable reflow pattern).
- Voltage can be set free below 2.0V.
- Achieved 20% capacity increase compared with conventional types.

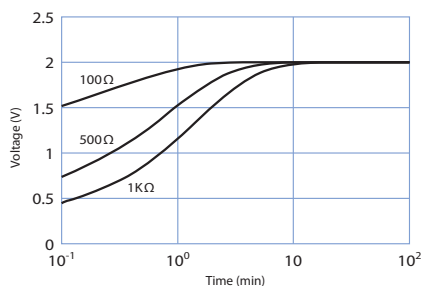
## Specification

Part Number	PAS414TR
Max. operating voltage (V)	2.0
Capacitance (F)	0.08
Capacity (μAh) *	22
Internal resistance (Ω)	80
Operating temperature range (°C)	-25 ~ +70
Temperature characteristics	Highest temperature (70°C) Capacity: Over 90% of initial spec. Lowest temperature (-25°C) Capacity: Over 70% of initial spec.
High temperature load characteristics	Maintain over 70% of initial spec. capacity after keeping with 2.0V of applied voltage at 70°C for 500 hours.
Cycle characteristics	Maintain over 50% of initial spec. capacity after 10,000 cycles (Charging: 2.0V for 5 min with constant resistance / Discharging: For 1 min with constant resistance).
Dimension (diameter φ × cell height mm)	4.8×1.4
Weight (g)	0.07

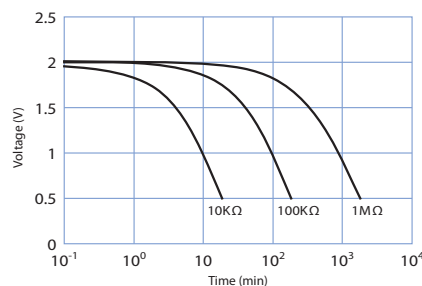
\* Capacity is measured from 2.0V to 1.0V

## Characteristics (PAS414TR)

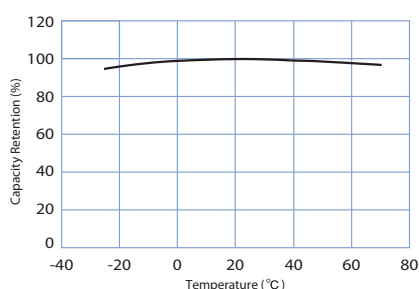
Charging characteristics (Constant R)



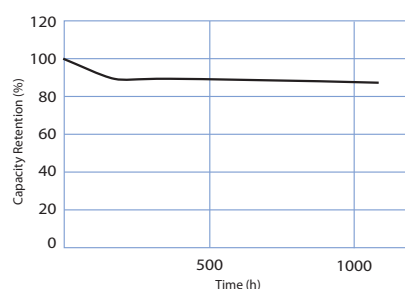
Discharging characteristics (Constant R)



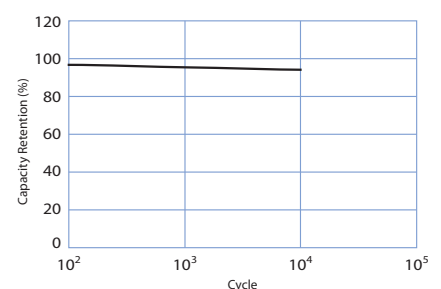
Temperature characteristics



High temperature load characteristics



Cycle characteristics





Reflow soldering with lead-free condition type

## Features

- Reflowable with lead-free condition (Refer to Page 8 for recommendable reflow pattern).
- Voltage can be set free below 2.5V.
- PAS409SR is world's smallest size.

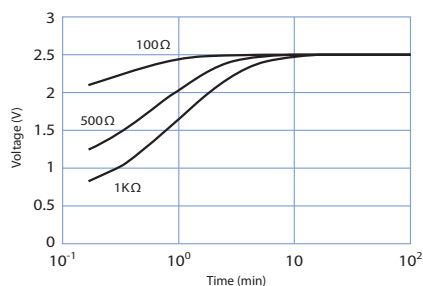
## Specification

Part Number	PAS409SR	PAS414SR
Max. operating voltage (V)	2.5	
Capacitance (F)	0.04	0.07
Capacity (μAh) *	10	18
Internal resistance (Ω)	50	50
Operating temperature range (°C)	-25 ~ +70	
Temperature characteristics	Highest temperature (70°C) Lowest temperature (-25°C)	Capacity: Satisfy initial spec. Capacity: Over 70% of initial spec.
High temperature load characteristics	Maintain over 70% of initial spec. capacity after keeping with 2.5V of applied voltage at 70°C for 500 hours.	
Cycle characteristics	Maintain over 50% of initial spec. capacity after 10,000 cycles (Charging: 2.5V for 9 min with constant resistance / Discharging: For 1 min with constant resistance).	
Dimension (diameter φ × cell height mm)	4.8×0.9	4.8×1.4
Weight (g)	0.05	0.07

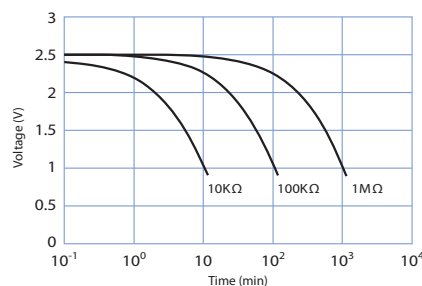
\* Capacity is measured from 2.5V to 1.5V

## Characteristics (Typical of PAS414SR)

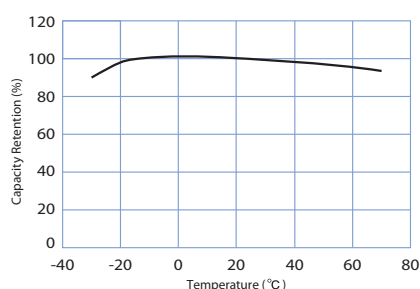
Charging characteristics (Constant R)



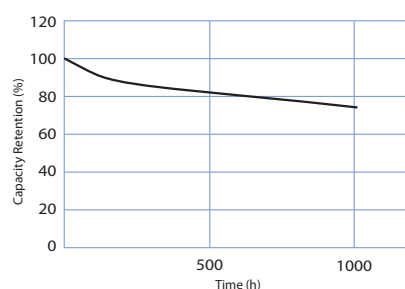
Discharging characteristics (Constant R)



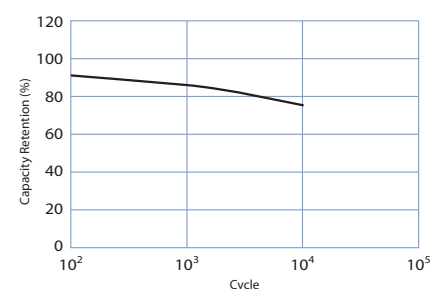
Temperature characteristics



High temperature load characteristics



Cycle characteristics



# HR type

Reflow soldering with lead-free condition type

## Features

- Reflowable with lead-free condition (Refer to Page 8 for recommendable reflow pattern).
- Voltage can be set free below 3.3V.
- PAS409HR is world's smallest size.

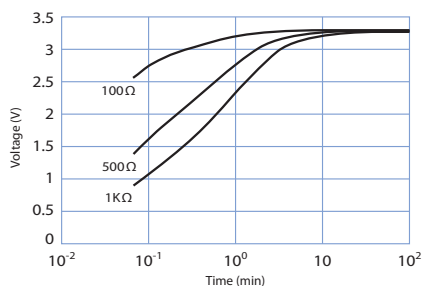
## Specification

Part Number	PAS409HR	PAS414HR
Max. operating voltage (V)	3.3	
Capacitance (F)	0.03	0.06
Capacity ( $\mu\text{Ah}$ ) *	12	20
Internal resistance ( $\Omega$ )	100	80
Operating temperature range ( $^{\circ}\text{C}$ )	-20 ~ +60	
Temperature characteristics	Highest temperature (60 $^{\circ}\text{C}$ ) Lowest temperature (-20 $^{\circ}\text{C}$ )	Over 90% of initial spec. Capacity: Over 50% of initial spec.
High temperature load characteristics	Maintain over 70% of initial spec. capacity after keeping with 3.3V of applied voltage at 60 $^{\circ}\text{C}$ for 500 hours.	
Cycle characteristics	Maintain over 50% of initial spec. capacity after 10,000 cycles (Charging: 3.3V for 24 min with constant resistance / Discharging: For 6 min with constant resistance).	
Dimension (diameter $\phi$ × cell height mm)	4.8×0.9	4.8×1.4
Weight (g)	0.05	0.07

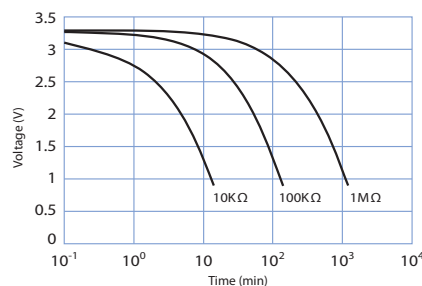
\* Capacity is measured from 3.3V to 2.0V (approximately doubled capacity can be obtained from 3.3V to 1.0V)

## Characteristics (Typical of PAS414HR)

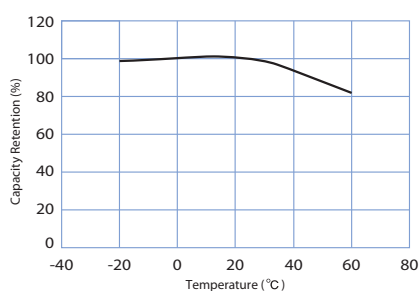
Charging characteristics (Constant R)



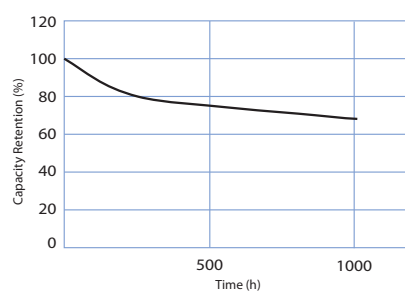
Discharging characteristics (Constant R)



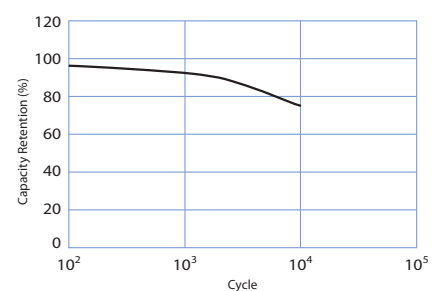
Temperature characteristics



High temperature load characteristics



Cycle characteristics





## Features

- Reflowable (Refer to Page 8 for recommendable reflow pattern).
- Voltage can be set free below 2.5V.
- Durability: more than 100,000 cycles.

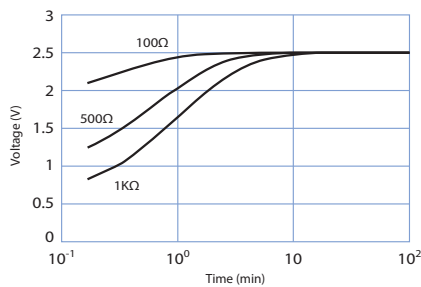
## Specification

Part Number	PAS414R
Max. operating voltage (V)	2.5
Capacitance (F)	0.07
Capacity (μAh) *	18
Internal resistance (Ω)	50
Operating temperature range (°C)	-25 ~ +70
Temperature characteristics	Highest temperature (70°C) Capacity: Satisfy initial spec. Lowest temperature (-25°C) Capacity: Over Over 70% of initial spec.
High temperature load characteristics	Maintain over 70% of initial spec. capacity after keeping with 2.5V of applied voltage at 70°C for 500 hours.
Cycle characteristics	Maintain over 50% of initial spec. capacity after 10,000 cycles (Charging: 2.5V for 9 min with constant resistance / Discharging: For 1 min with constant resistance).
Dimension (diameter φ × cell height mm)	4.8×1.4
Weight (g)	0.07

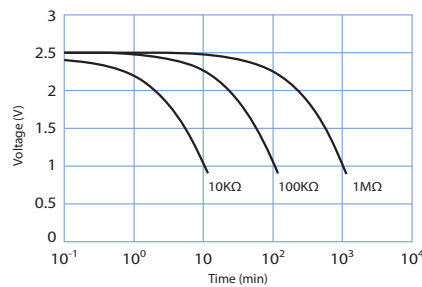
\* Capacity is measured from 2.5V to 1.5V

## Characteristics (PAS414R)

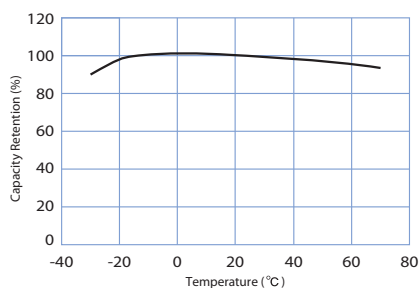
Charging characteristics (Constant R)



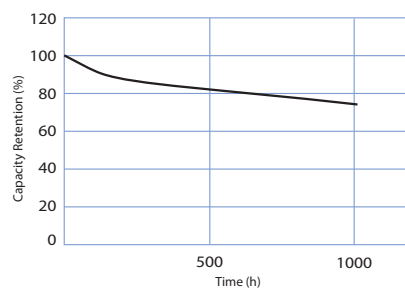
Discharging characteristics (Constant R)



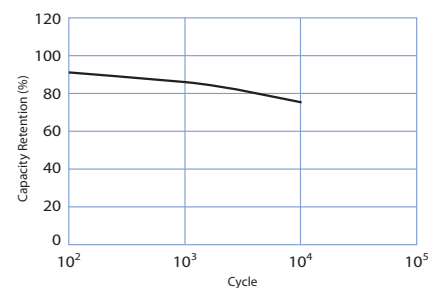
Temperature characteristics




High temperature load characteristics

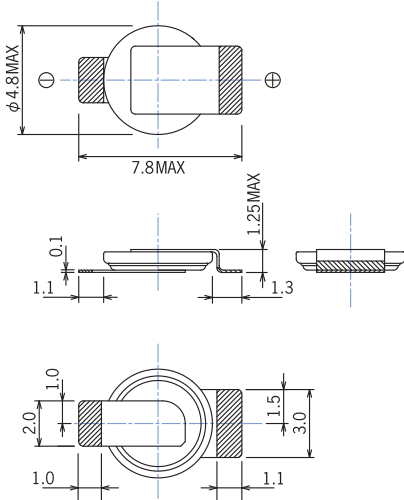


Cycle characteristics

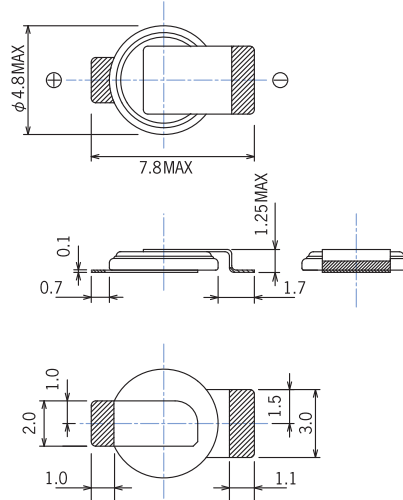


 Solder plating area  
(Measure: mm)

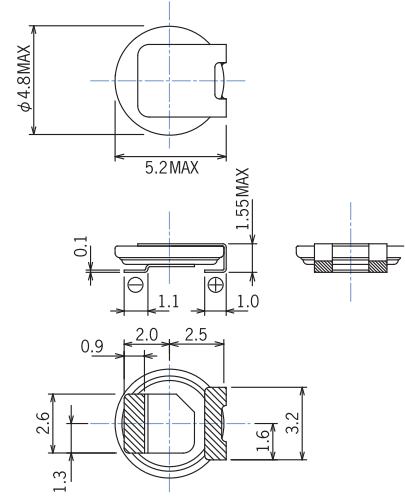
409-VA5 type



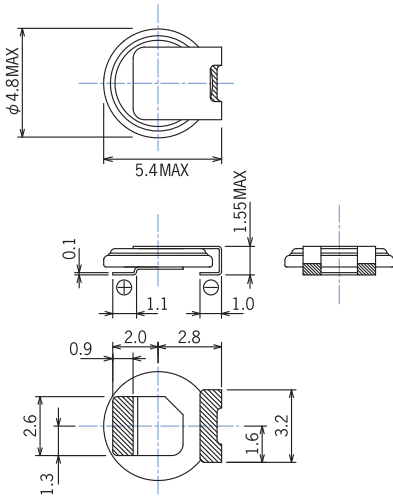
409-VA5R type



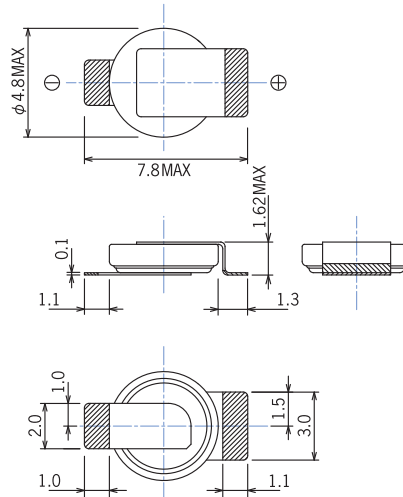
409-VE5 type



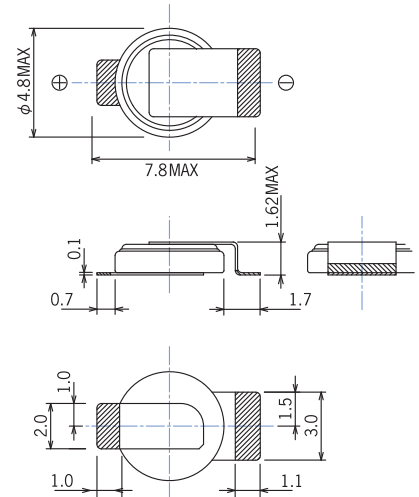
409-VE5R type



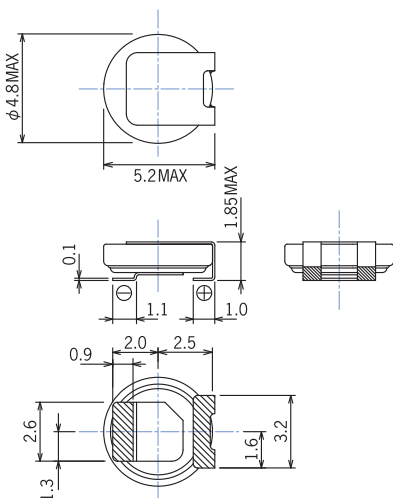
414-VA5 type



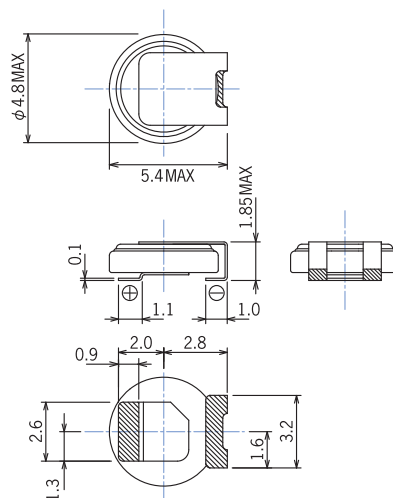
414-VA5R type



414-VE5 type



414-VE5R type



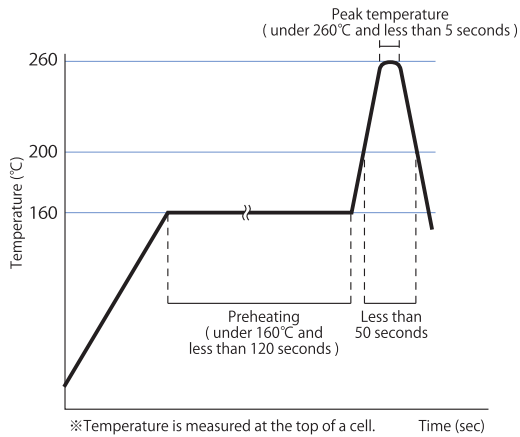
\*Contact us for other terminals.



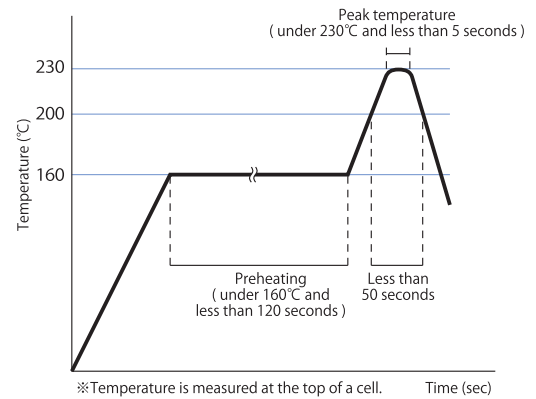
## Cautions

- Do not charge prior to reflow.
- Set reflow condition within the range provided in 'Specifications', which will be published separately.
- Contact us for more details.

Reflow profile with lead free condition (TR/SR/HR)

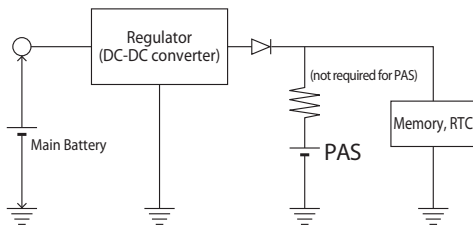


Reflow profile with standard condition ( R )

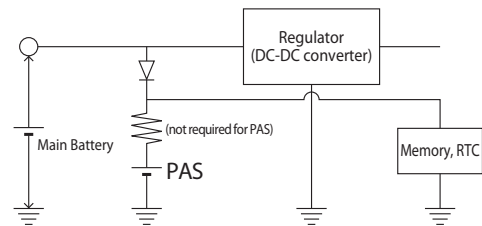


## Circuit applications

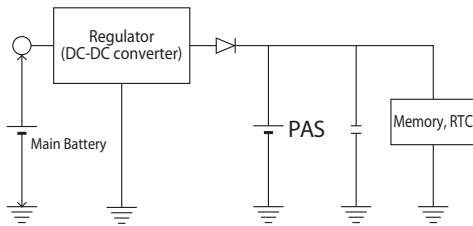
Application 1: Cellular Phone



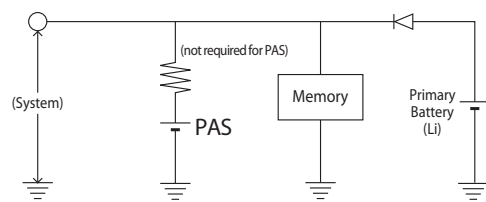
Application 2: Cellular Phone



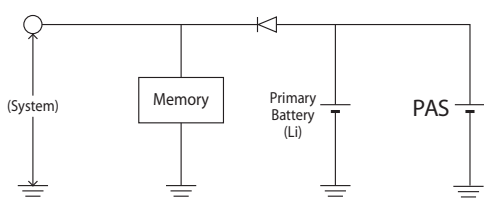
Application 3: Cellular Phone



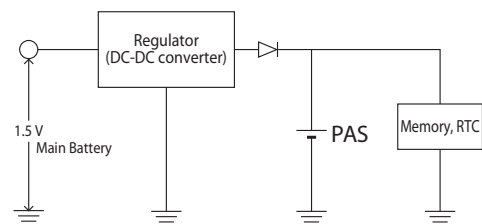
Application 4: Memory card



Application 5: IC Memory card



Application 6: Pager



# L type

Manual soldering type

## Features

- 3.3V type (Voltage can be set free below 3.3V).
- More than 10,000cycles discharging
- Excellent self-discharging characteristics.
- UL certification (File No. MH19429).

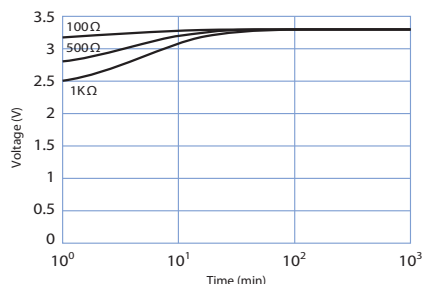
## Specification

Part Number	PAS614L		
Max. operating voltage (V)	3.3	Temperature characteristics	Highest temperature (60°C) Capacity: Satisfy initial spec. Lowest temperature (-20°C) Capacity: Over 50% of initial spec.
Capacitance (F)	0.25	High temperature load characteristics	Maintain over 70% of initial spec. capacity after keeping with 3.3V of applied voltage at 60°C for 500 hours.
Capacity (μAh)	90	Cycle characteristics	Maintain over 50% of initial spec. capacity after 10,000 cycles (Charging: 3.3V for 24 min with constant resistance / Discharging: For 6 min with constant resistance).
Internal resistance (Ω)	160	Dimension (diameterφ × cell height mm)	6.8×1.4
Operating temperature range (°C)	-20 ~ +60	Weight (g)	0.16

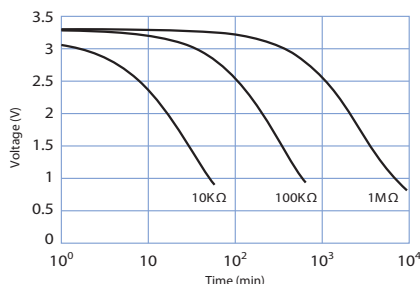
\* Capacity is measured from 3.3V to 2.0V (approximately doubled capacity can be obtained from 3.3V to 1.0V)

## Characteristics (PAS614L)

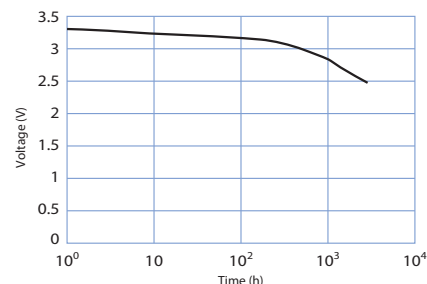
Charging characteristics (Constant R)



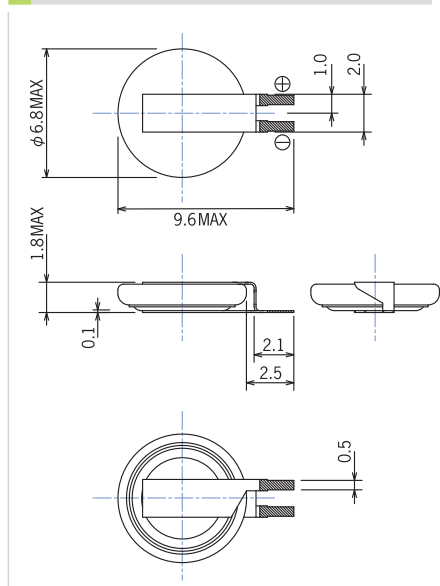
Discharging characteristics (Constant R)



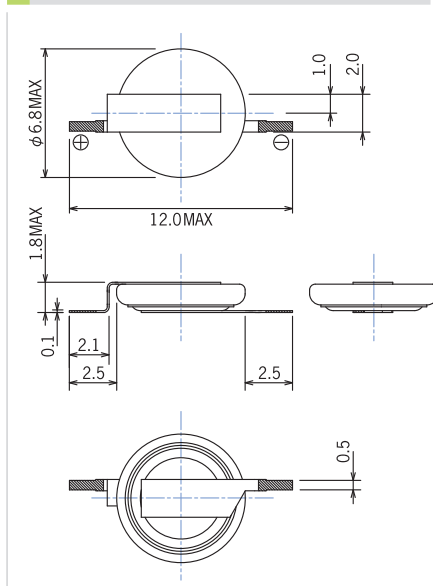
Self-discharging characteristics



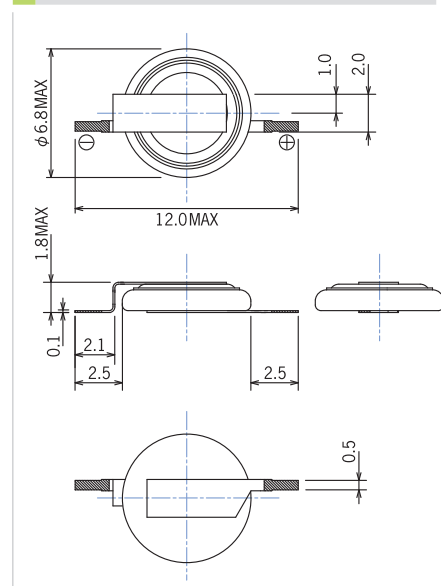
614L-VL3 type




614L-VL5 type



614L-VL5R type



\*Contact us for other terminals.

 Solder plating area (Measure: mm)

# PAS

## Caution

### 1 Use under the maximum usable voltage.

If over maximum usable voltage is applied, it might cause abnormal current flow, which shorten lifetime and sometimes damage PAS capacitor.

### 2 Use under surrounding temperature kept as normal as possible.

Lifetime of PAS capacitor is greatly affected by surrounding temperature. Each 10°C drop in temperature extends its expected lifetime approximately twice as much. Therefore, avoid high temperature and use PAS capacitor under lower temperature than the maximum operating temperature range.

### 3 Mind voltage drop when back-up.

When discharging (back-up) start, voltage drop occurs by actuating current and internal resistance in the cell. Consult us beforehand in case if discharging current of 414/409 type is over 20μA and over 50μA for 614 type.

### 4 Consult us when using PAS capacitors in a series connection.

In case of using PAS capacitors in series connection, the voltage of each capacitor is not always equal and it may be occurred excessive voltage in a part of capacitor, which may lead to shortening lifetime and breakdown.

### 5 Pay sufficient attention to use PAS in circuit with high ripple current.

Since PAS capacitor has higher internal resistance than electric capacitor, ripple current may heat up capacitor body, which might cause the increase of internal resistance and deterioration of capacity.

### 6 Do not expose PAS capacitor into high humidity, alkaline or acid air.

In case PAS capacitor is used in high humidity, alkaline or acid air, lead terminal and container may be damaged. Also, it may cause deteriorating of its performance.

### 7 Do not touch with printed pattern.

If product touch with printed pattern, short-circuit occurs. Additionally, in case of there is a printed pattern under the product, it may occur short-circuit caused by a breakage of resist.

### 8 Mind the polarity of PAS capacitor when soldering on board.

Identify the indication of polarity or terminal shapes when installing. If counter current is applied, it might deteriorate capacity and increase internal resistance. It may turn out to be a breakage of product.

### 9 Caution on soldering

#### 9-1. Reflow soldering type

- Follow the scope of conditions regulated in specifications.
- Do not charge prior to reflowing.
- Consult us for details about reflow condition.

#### 9-2. Manual soldering type

- For use of a soldering iron, it should not touch the cell body. Temperature of the soldering iron should be less than 350°C and soldering time for terminal should be less than 3 seconds.
- Do not reflow soldering.

### 10 Consult us about cleaning condition when cleaning circuit-board after soldering.

Cleaning may affect PAS capacitor. Consult us about cleaning conditions beforehand.

### 11 Avoid excessive vibration.

Excessive vibration may be a cause of breaking soldering part and damaging terminal.

### 12 Storage

#### Keep following cautions for storage:

- Use Shoei Electronics's tray or reel. For moving on to another tray, do not bend terminals.
- Store under normal atmosphere. Sudden change of temperature or high humid condition deteriorates the performance.
- Avoid dust and direct sunlight.

### 13 Other cautions

- Do not heat or throw into fire.
- Do not short-circuit.
- Do not direct soldering to cell body.
- Do not dismantle.
- Do not deform.
- Mind the edge of terminals.

# PAS

## **Shoei Electronics Co., Ltd.**

**Headquarters:**

**587-3 Sumiyoshi, Ueda-shi, Nagano, 386-0002 Japan**

**URL: <http://www.u-shoei.co.jp/>**

**Tokyo Sales Office:**

**Shoei Dai-2 Nishikicho Bldg. 7F 3-15-2, Kanda-Nishikicho,  
Chiyoda-ku, Tokyo, 101-0054 Japan**

**TEL: +81-3-3292-3388 / FAX: +81-3-3292-1070**

**< Inquiries for PAS capacitors >**

**Osaka Sales Office:**

**Kawaramachi KT Bldg. 7F**

**3-3-7, Kawaramachi, Chuo-ku, Osaka, 541-0048 Japan**

**TEL: +81-6-6231-3337 / FAX: +81-6-6231-3339**

**E-mail: [pas@o-shoei.com](mailto:pas@o-shoei.com)**