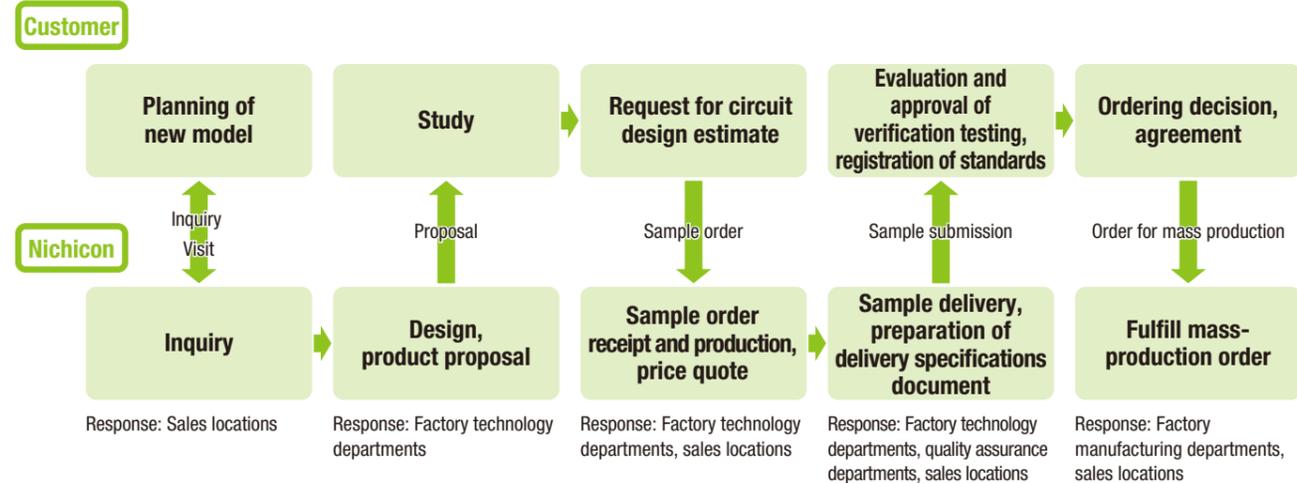


## Standard Process for Developing Custom Products

We propose the best products for our customers, based on application, size and a variety of other design needs.



## Please contact your local Nichicon sales office if you require qualification data based on AEC-Q200.

Note: Please confirm product development details with your dealer.

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**nichicon**

Automotive Application Catalog

January 2021

# Automotive Application



**C**  
Connected

Connect car and network

- Connected car
- Telematics

**A**  
Autonomous

Autonomous driving with information gathering

- LiDAR
- Millimeter-wave radar

**S**  
Shared/Service

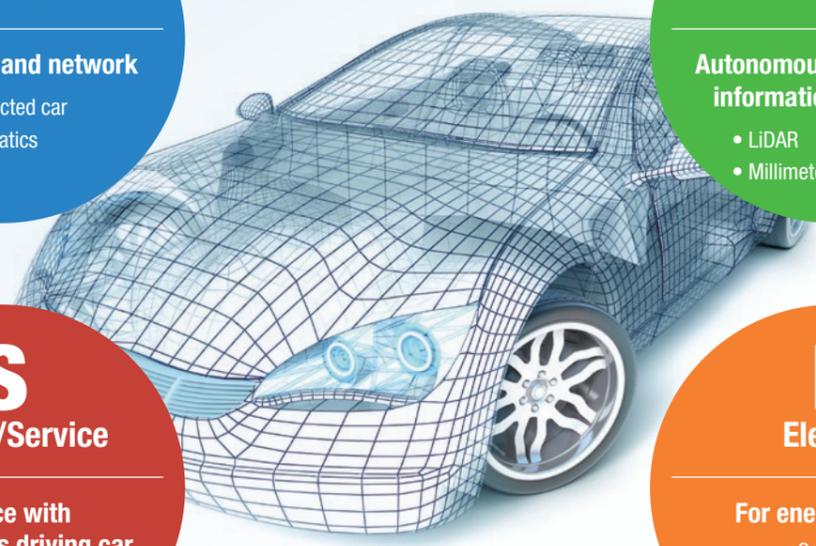
Service with autonomous driving car

- Ride-hailing service
- Wireless charger

**E**  
Electric

For energy saving

- Converter
- Inverter



# Proposal of the best products for vehicle

As an acronym created by Mercedes-Benz in 2016, "C.A.S.E." indicates the trends of the next-generation transportation industry and indicates the future changes in the hardware of the automobile industry and the transformation of automobile services that mix different industries. Specifically, "C.A.S.E." is an acronym for Connected, Autonomous, Shared/Service, and Electric. The transportation industry and the electrical components that support it are both required to meet these market requirements.

NICHICON is committed to offering components with high performance through advanced technologies and strict quality control measures.

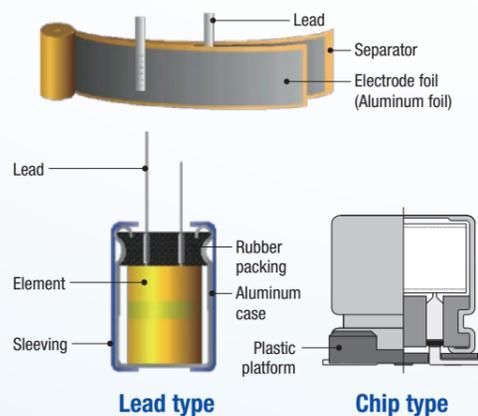
## Key Technologies

NICHICON applies new materials and new structures through in-house and joint development in order to satisfy customers.

Key Technologies	NICHICON development			Joint development			
	Anode foil	Cathode foil	Electrolyte	Conductive polymer	Separator	Rubber packing	structure
Market needs							
Miniaturization / Large capacitance	◎	○		○	○		○
Low ESR / High Ripple	○	○	◎	◎	◎		
High temp. / Humidity resistance	◎	○	◎	◎		○	○
Long life	○	○	◎	◎	○	◎	○
High temp. reflow			◎	◎	○	○	◎
Vibration resistance					○	○	◎

◎: Great influence ○: Influence

## Configuration of the Element



## Market needs regarding "C.A.S.E."

In recent years, following "C.A.S.E.", various in-vehicle devices have tended to be further miniaturized and lightened in order to pursue higher performance and lower fuel consumption of automobiles. In response to the market trends, it is essential for capacitors that are assembled in the vehicles to have characteristics such as vibration resistance, miniaturization, large capacitance, high heat resistance and low ESR.

### Vibration resistance

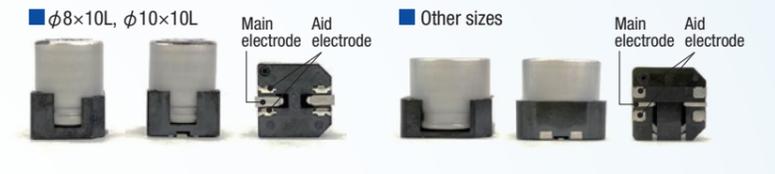
#### UXY series

40G vibration resistance  
135°C guaranteed

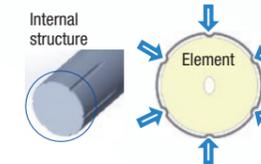


#### UUE series

30G vibration resistance (10 to 2,000Hz)  
100G impact resistance (pendulum type impact)  
Size:  $\phi 8 \times 10L$  to  $\phi 18 \times 21.5L$   
Rated voltage: 10 to 50V  
Capacitance: 33 to 4,700 $\mu F$



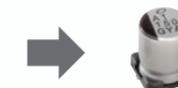
• Slits (groove) are formed on the case side (convex inside).  
⇒ Suppress the element shake under vibration by reducing the gap between element and case.



### Miniaturization • Large capacitance



**UCZ series** ( $\phi 8 \times 10L$ , 35V, 100 $\mu F$ )  
Aluminum electrolytic capacitors: 6 pcs  
Ripple current: 1,620mA rms



**GYA series** ( $\phi 8 \times 10L$ , 35V, 150 $\mu F$ )  
Hybrid aluminum electrolytic capacitors: 1 pcs  
Ripple current: 1,600mA rms



**UCM series** x 3 pcs  
25V, 220 $\mu F$   
 $\phi 6.3 \times 7.7L$



**UCV series** x 2 pcs  
25V, 330 $\mu F$   
 $\phi 6.3 \times 7.7L$

### High heat resistance

#### PCZ series

Conductive polymer aluminum solid electrolytic capacitors  
150°C 2,000 hours



#### GYD series

Hybrid aluminum electrolytic capacitors  
150°C 1,000 hours



#### UBC series

Aluminum electrolytic capacitors  
150°C 1,000 hours



135°C

150°C

High Temperature

150°C High Temperature

### Low ESR

UCZ series -40°C,  $\phi 6.3 \times 7.7L$

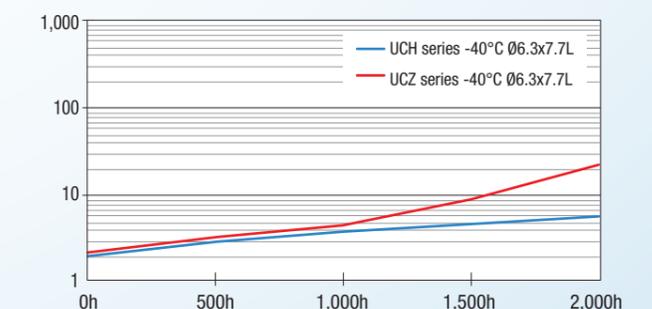


Low ESR

UCH series -40°C,  $\phi 6.3 \times 7.7L$

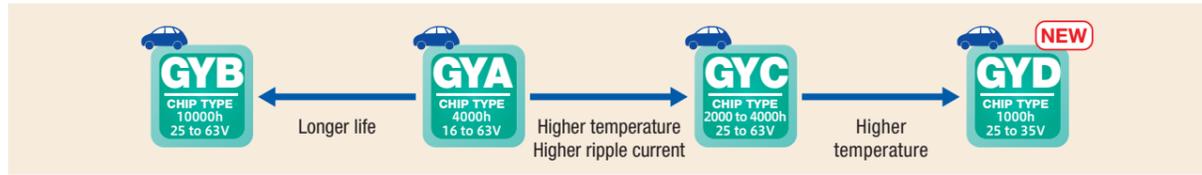


ESR deterioration over time (125°C endurance test)

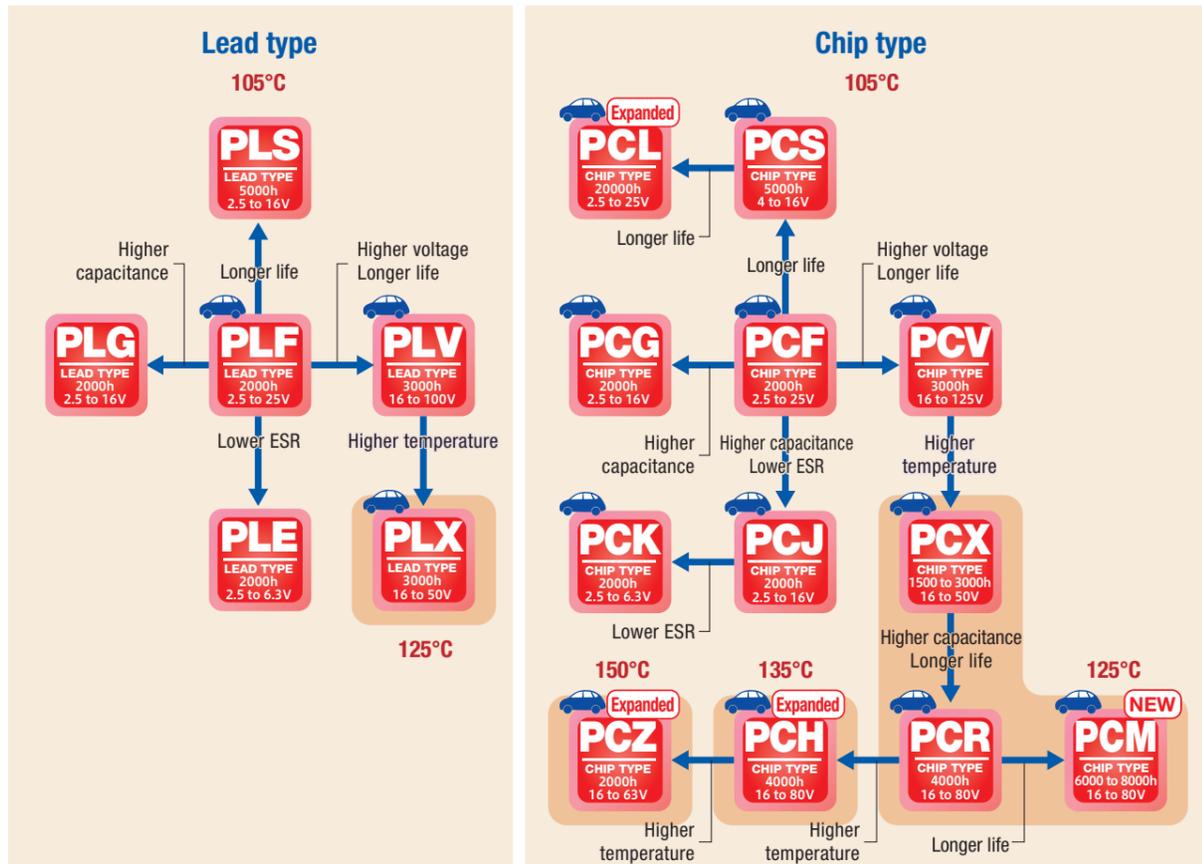


# System Diagram for Nichicon Automotive Application

## Series of Automotive Conductive Polymer Hybrid Aluminum Electrolytic Capacitors



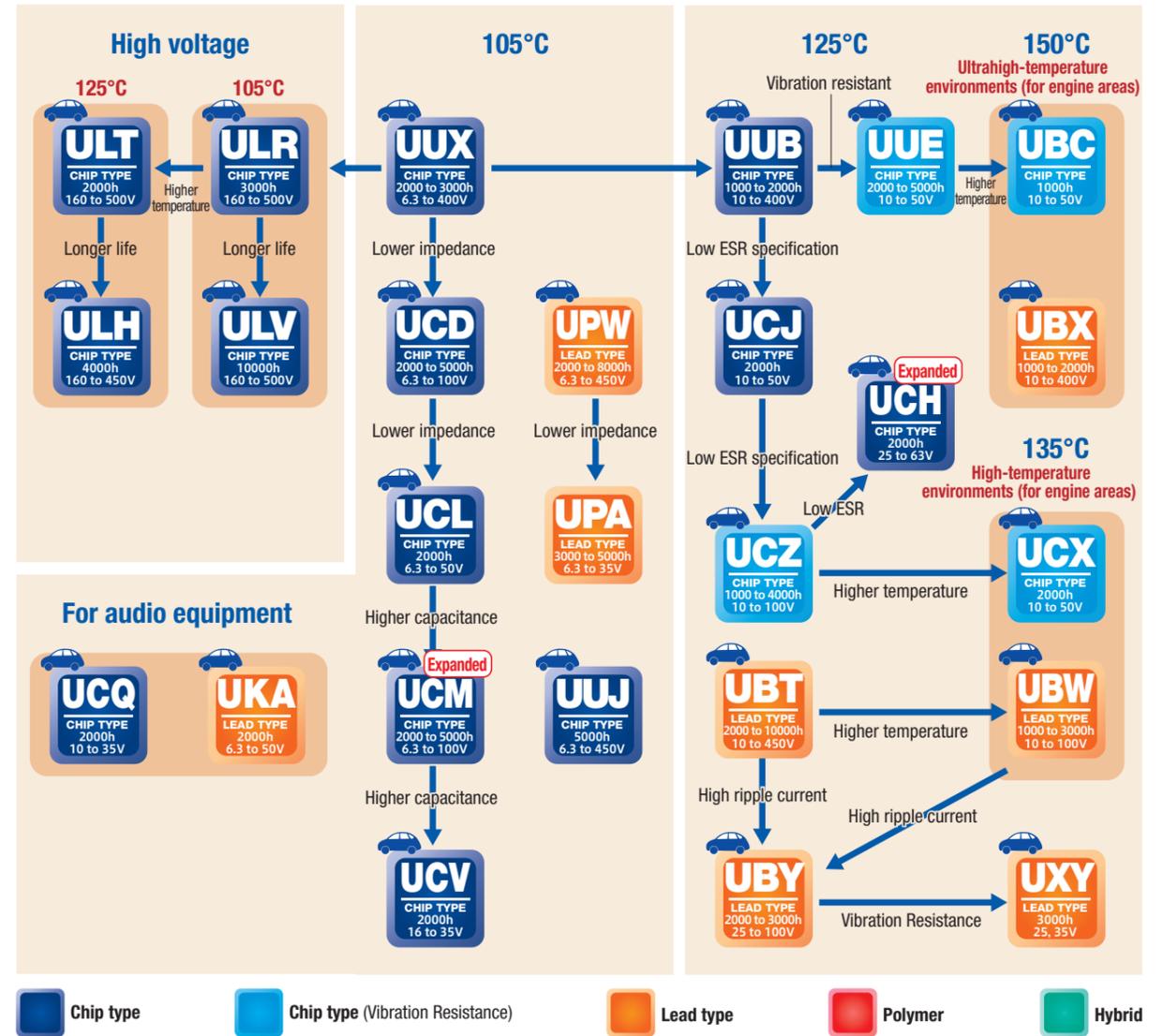
## Series of Automotive Conductive Polymer Aluminum Solid Electrolytic Capacitors



## IATF16949 Certification Numbers

Factory Name	Certification number	Date	Scope of Registration	Auditing Organization
NICHICON (OHNO) CORPORATION	JQA-AU0031-1	April 2004	The design and manufacture of aluminum electrolytic capacitors	JQA
	JQA-AU0031-2	February 2013	The design and manufacture of conductive polymer aluminum solid electrolytic capacitors (Site II)	
	JQA-AU0013	January 2004	The design and manufacture of aluminum electrolytic capacitors (Site III)	
NICHICON (IWATE) CORPORATION	JQA-AU0037	May 2004	The design and manufacture of aluminum electrolytic capacitors	JQA
NICHICON (MALAYSIA) SDN. BHD.	AR3641 (updated) QMS-AUTO00121	May 2005 (updated) May 2018	The design and manufacture of aluminum electrolytic capacitors	SIRIM
NICHICON ELECTRONICS (WUXI) CO., LTD	No.161012148/1 (updated) No.161012148/2	October 2012 (updated) September 2018	The design and manufacture of aluminum electrolytic capacitors	DEKRA
NICHICON ELECTRONICS (SUQIAN) CO., LTD	Letter of Conformity	November 2020	The design and manufacture of conductive polymer aluminum solid electrolytic capacitors	SGS

## Series of Automotive Aluminum Electrolytic Capacitors



## About AEC-Q200



### AEC-Q200

The Automotive Electronics Council (AEC) is an organization created by U.S. automakers and electronic component manufacturers for the standardization of reliability and certification criteria for automotive electronic components. AEC-Q200 is a certification reliability test standard for passive components widely adopted as the standard for electronic components for automotive use in Europe and the United States.

**Nichicon has the industry's largest number of series\* suited for automotive**



\* As of January, 2021

# Powertrain Solution

- Chip type
- Polymer
- Chip type (Vibration Resistance)
- Film capacitors
- Lead type
- Hybrid

## Engine control unit

- |     |     |     |     |     |
|-----|-----|-----|-----|-----|
| UCH | UCV | UCZ | UCX | UBC |
| UBT | UXY | UBY | UBW | UBX |
| PCV | PLV | PCX | PLX | PCR |
| PCH | PCM | PCZ | GYA | GYB |
| GYC | GYD |     |     |     |

## Engine cooling fan

- |     |     |
|-----|-----|
| UUX | UUB |
| UBT | PCR |
| PCM | PCH |
| PCZ | GYD |

## Pump control unit

- |     |     |     |     |     |
|-----|-----|-----|-----|-----|
| UUB | UUE | UCZ | UCX | UBC |
| PCX | PCR | PCM | PCH | PCZ |
| GYA | GYC | GYD |     |     |

## Hybrid electric vehicle

- |     |     |     |     |
|-----|-----|-----|-----|
| UUX | ULR | ULV | ULT |
| ULH | EM  | PCR | PCM |
| PCH |     |     |     |

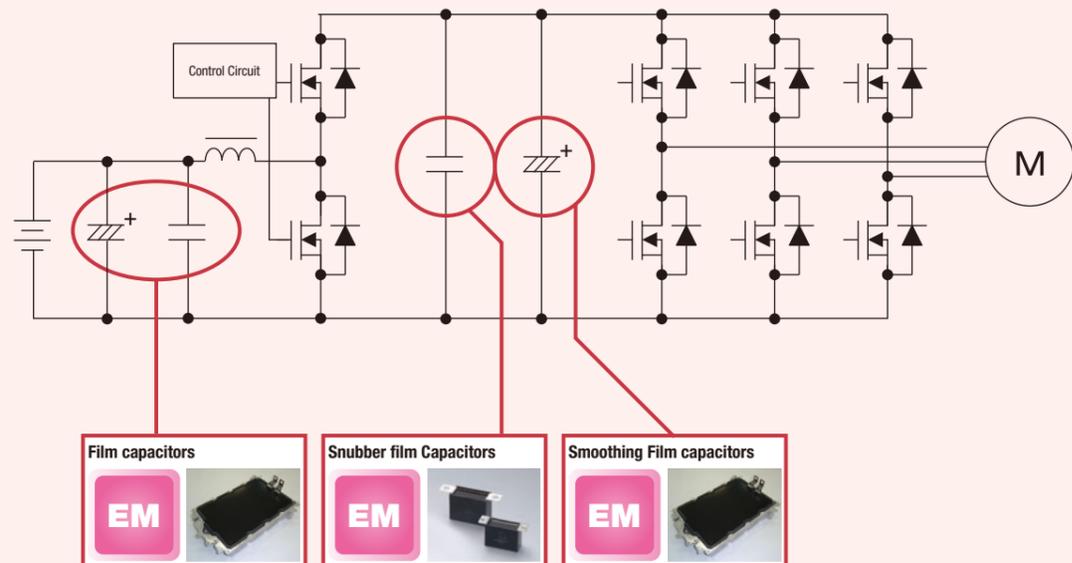
## DC/DC-converter

- |     |     |     |     |
|-----|-----|-----|-----|
| UCZ | UCX | PCV | PCX |
| PCR | PCM | PCH | PCZ |
| GYD |     |     |     |

## Transmission control unit

- |     |     |     |
|-----|-----|-----|
| UUX | UUB | UBT |
| PCR | PCM | PCH |

### Recommended series for motor drive inverter circuits.



# Chassis & Safety Solution

- Chip type
- Polymer
- Chip type (Vibration Resistance)
- Lead type
- EDLCs
- Polymer
- Hybrid

## Camera & radar systems

- |     |     |     |     |
|-----|-----|-----|-----|
| UCD | JUK | JUA | PCR |
| PCM | PCL | GYA |     |

## Telematics

- |     |     |     |     |
|-----|-----|-----|-----|
| UCD | UPW | UPA | PCR |
| PCM | GYA | GYB |     |

## Breaking unit

- |     |     |     |     |
|-----|-----|-----|-----|
| UCD | UCL | UCM | UUB |
| PCR | PCM | PCH | GYA |
| GYB |     |     |     |

## Airbag control

- |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| UCD | UCL | UCM | UCV | UUJ | UPW |
| UPA | PCR | PCM | PCH | GYA | GYB |

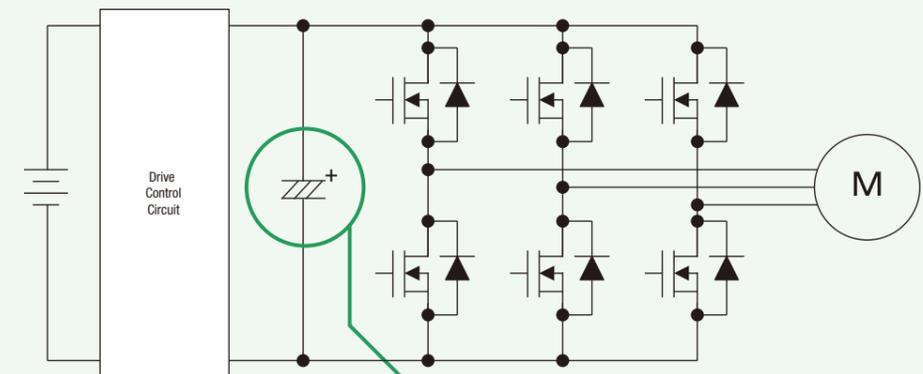
## Power steering

- |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| UCD | UCL | UCM | UUJ | UUE | UPW |
| UPA | UBT | UBY | UXY | PCR | PCM |
| PCH | GYA | GYB | GYC |     |     |

## ABS & traction control

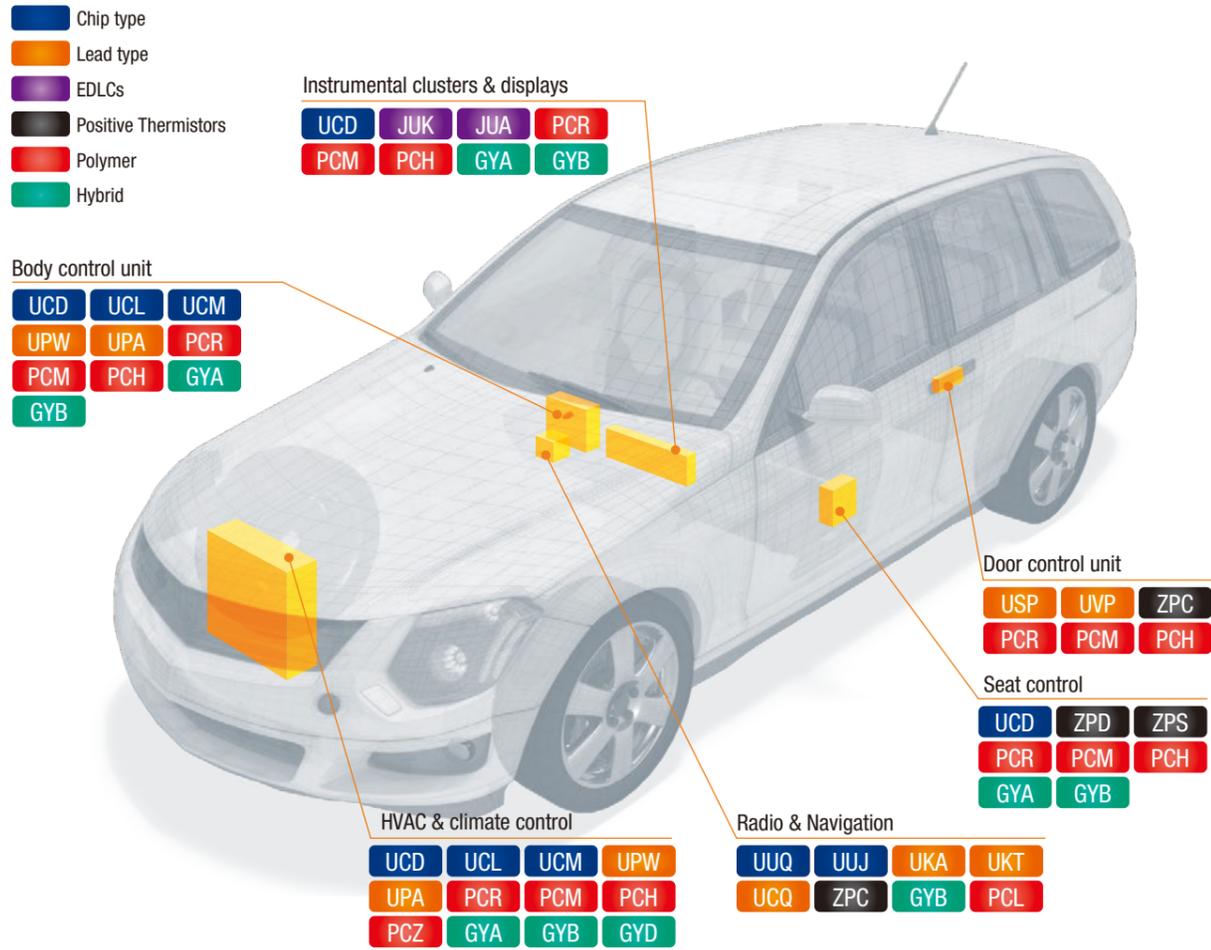
- |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| UCD | UCL | UCM | UUJ | UPW | UPA |
| PCR | PCM | PCH | GYA | GYB |     |

### Recommended series for electric power steering circuits.

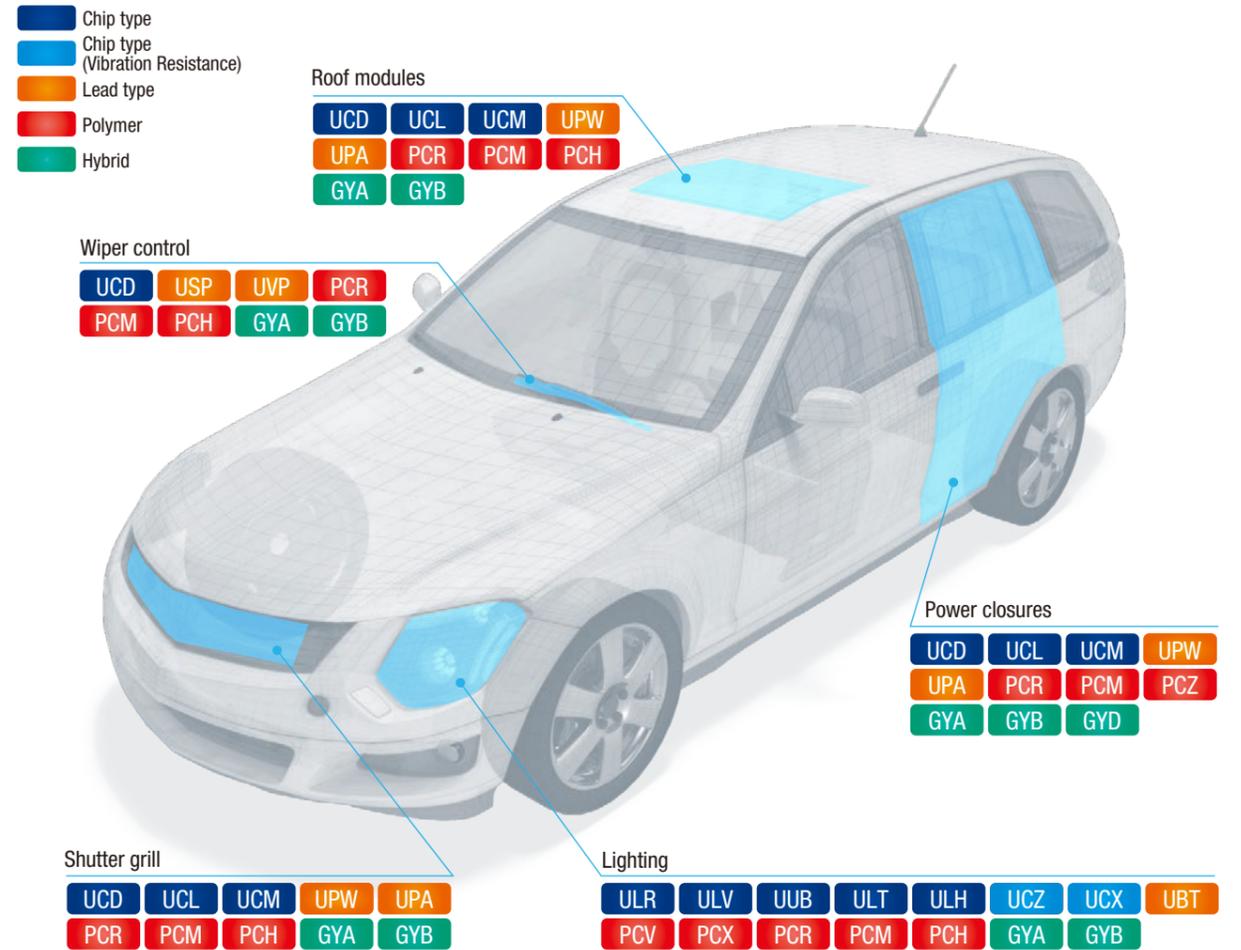


- |            |  |            |  |            |  |            |  |            |  |
|------------|--|------------|--|------------|--|------------|--|------------|--|
| <b>UCL</b> |  | <b>UCM</b> |  | <b>UPA</b> |  | <b>UXY</b> |  | <b>UCV</b> |  |
| <b>UUE</b> |  | <b>UPW</b> |  | <b>UBT</b> |  | <b>PCH</b> |  | <b>GYC</b> |  |

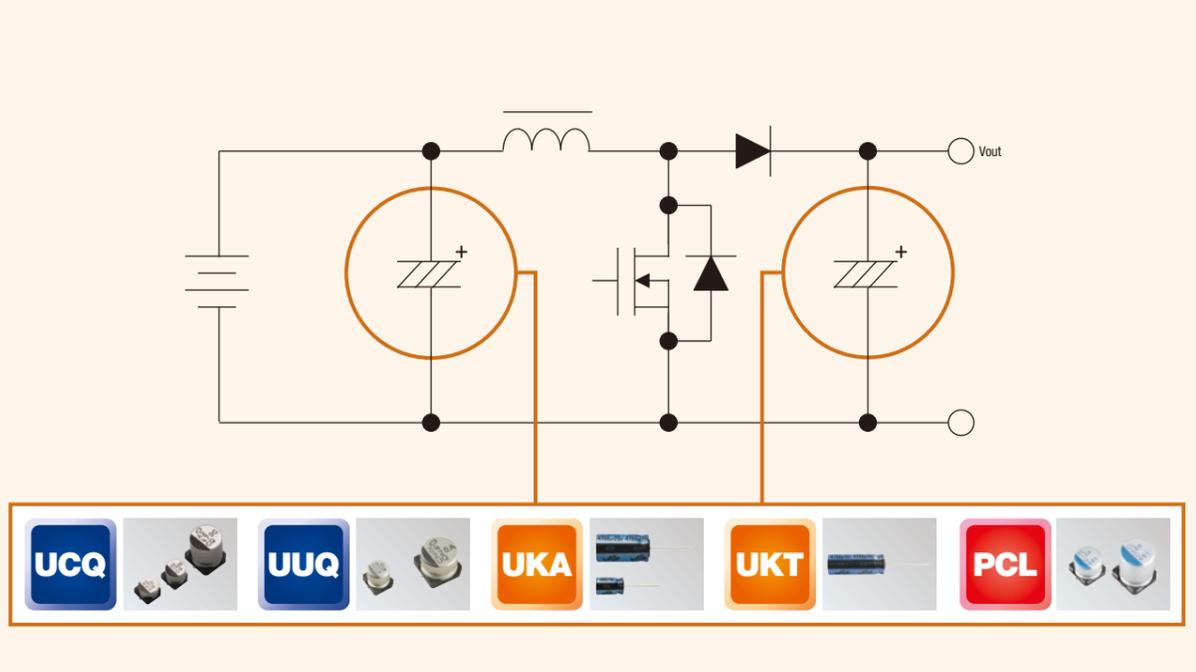
# Interior Solution



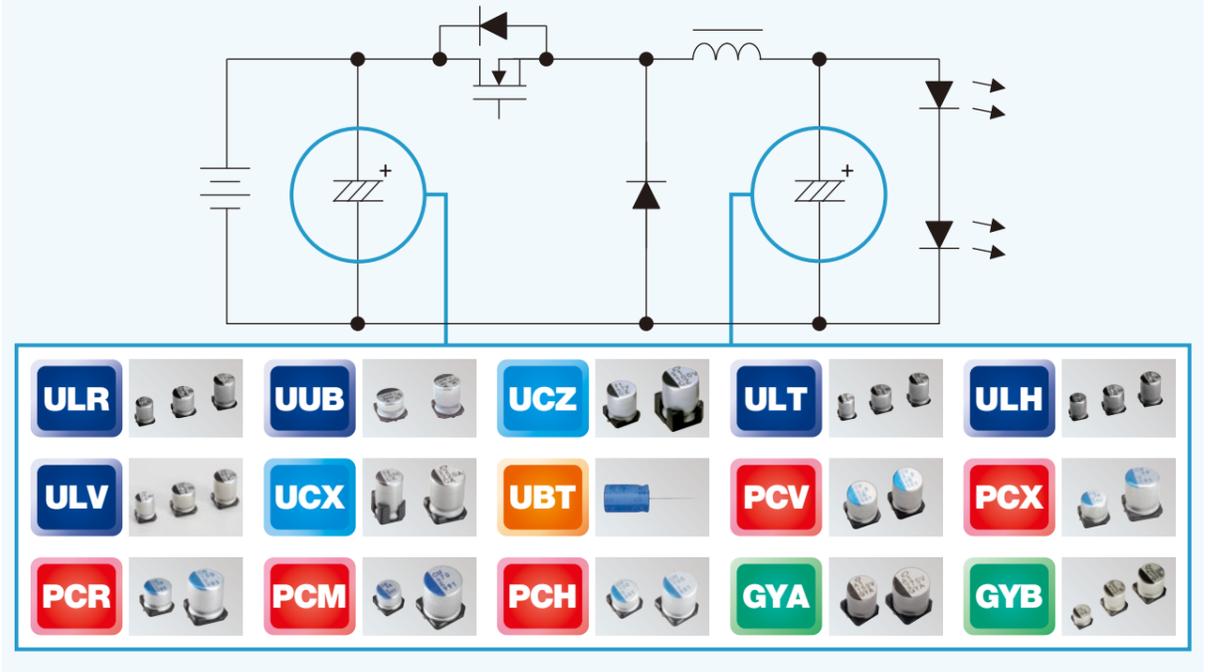
# Exterior Solution



Recommended series for audio DC-DC converters circuits.

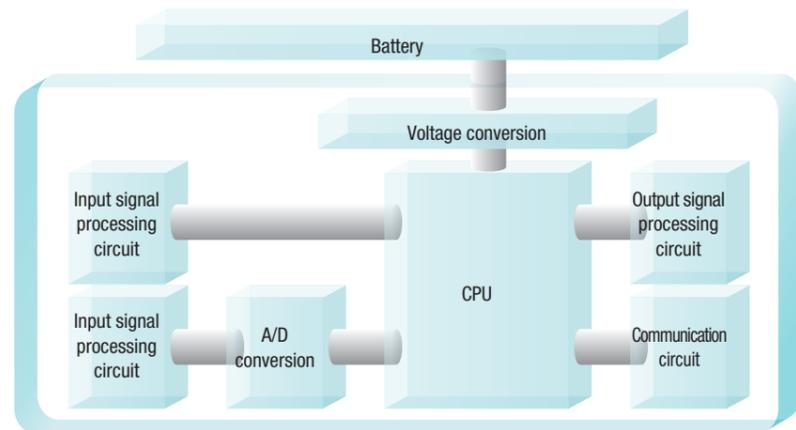


Recommended series for LED headlight circuits.



# Electronic Control Solutions

## Engine ECU Pattern Diagram

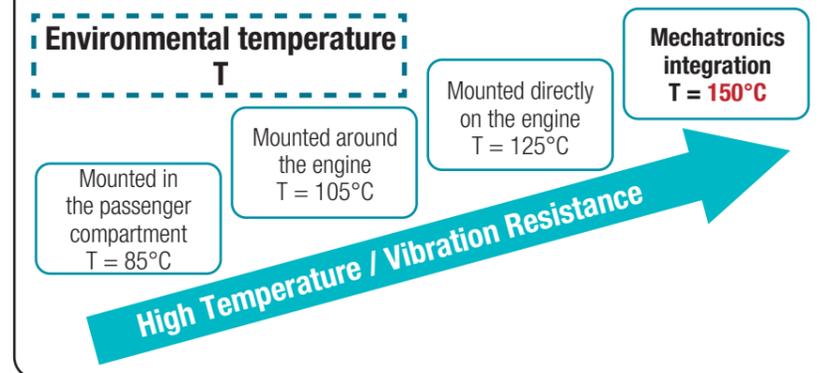


High temperature

Vibration resistance

Low temperature ESR

## Requirements for Capacitors on In-vehicle ECU



## Mechatronics Integration

Heat resistance requirements:  
125°C ⇒ 150°C

Vibration resistance requirements:  
Vibration acceleration: 40G Max.

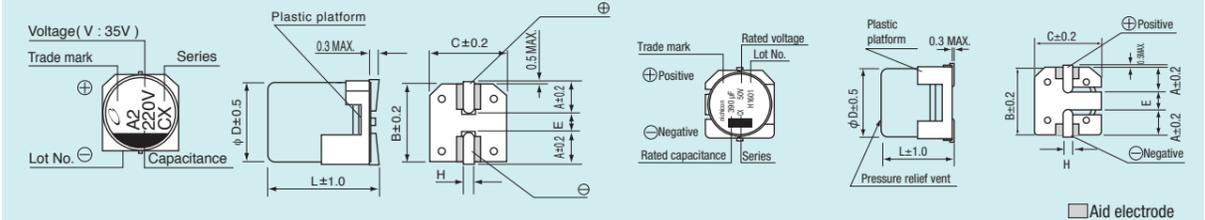
## Chip Type Aluminum Electrolytic Capacitors Suited for Engine Areas (High-Temperature Environments, Vibrations)

Smaller, high reliability : Surface mounting technology, anti-vibration capabilities: 30G (10 to 2,000Hz)

Anti-Vibration Points ● Adjust height of resin seating plate collar, control vibration of capacitor itself ● Improved adhesion of auxiliary electrode to resin seating plate

(φ8×10L, φ10×10L) [vibration resistant]

(φ12.5 to φ18) [vibration resistant]



Dimensions

(mm)

	φ D	8	10	12.5	16	18
A		2.9	3.2	4.8	5.4	6.4
B		8.3	10.3	13.6	17.1	19.1
C		8.3	10.3	13.6	17.1	19.1
E		3.1	4.5	4.0	6.3	6.3
L		10	10	13.5	16.5, 21.5	21.5
H		1.1 to 1.5	1.1 to 1.5	1.0 to 1.4	1.0 to 1.4	1.0 to 1.4

## UBC

Vibration resistance, high temperature



- Highly dependable reliability withstanding load life of 1,000 hours at +150°C
- Suited for automobile electronics where heavy duty services are indispensable
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Product size	φ 8×10L to φ 18×21.5L
Endurance	1,000 hours at 150°C
Rated voltage	10 to 50V
Capacitance	33 to 3,300 μF
Category temperature	-55 (-40) to +150°C

Vibration resistance

Applications ECUs, automotive water pumps, automotive oil pumps

## UUE

Vibration Resistance



- Chip type guaranteed for 2,000 to 5,000 hours at 125°C
- Ideal for automotive electrical components
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Applications Power steering, automotive water pumps, automotive oil pumps

Product size	φ 8×10L to φ 18×21.5L
Endurance	5,000 hours at 125°C (φ 8, φ 10: 2,000 hours)
Rated voltage	10 to 50V
Capacitance	33 to 4,700 μF
Category temperature	-55 to +125°C (φ 12.5 to 18), -40 to +125°C (φ 8, φ 10)

Note: UUE series also applies to control solution specifications.

## Mounting Examples

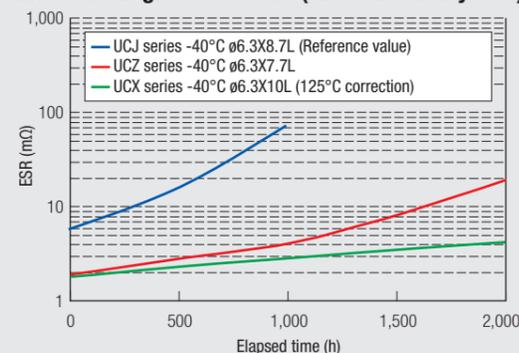
ECUs, hybrid vehicle ECUs, "idling stop," automotive water pumps, electric oil pumps

Note: For detailed specifications, please refer to Nichicon's general catalog of electronics.

The electronic components have been moved from the passenger compartment to the engine room to enable a comfortable and spacious interior area. As a result, capacitors are required to have higher heat resistance and vibration resistance to cope with the engine's heat and vibration.

## Technologies for Low Temperature ESR

### ESR Time Degradation Ratio (125°C Durability Test)



#### Point 1 Use of a Thin, Low-ESR-Function Separator

- Employs low-ESR-function electrolysis paper
- Increases electrode foil capacitance area through the use of electrolysis paper

#### Point 2 Use of Low-Transpiration Solvent (Optimized Solvent Composition)

- Ensures stable performance in high-temperature environments

#### Point 3 Optimization of Product Configuration

- Optimized element configuration  
⇒ Expands facing area and optimizes sealing cuff
- Addition of φ 6.3×10L (new size)(UCX series only)  
⇒ Use of a thicker sealing cuff to control degradation over time

## Lead Type Aluminum Electrolytic Capacitors Suitable for the Engine Compartment (High-Temperature Environments, Vibrations)

### UBY High reliability



- Application suggestion high temperature, electric power steering.
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Rated voltage	25 to 100V
Capacitance	160 to 12,000 $\mu$ F
Endurance	125°C 3,000 hours / 135°C 2,000 to 3,000 hours
Product size	$\phi$ 12.5×20L to $\phi$ 18×40L
Category temperature	-40 to +135°C

**High temperature** Applications ECUs, power steering

### UBW High temperature, High reliability (135°C)



- Products with high-temperature stability, guaranteed for 1,000 to 3,000 hours at 135°C
- Suited for automobile electronics where heavy duty services are indispensable
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Rated voltage	10 to 100V
Capacitance	4.7 to 4,700 $\mu$ F
Endurance	1,000 to 3,000 hours at 135°C
Product size	$\phi$ 8×11.5L to $\phi$ 16×31.5L
Category temperature	-55 to +135°C

**High temperature** Applications ECUs, power steering

### UBX Ultra-high temperature suited for automotive electronics (150°C)



- Laminated case series
- Products suited for ultra-high temperatures (150°C)
- Suited for automobile electronics where heavy duty services are indispensable
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Rated voltage	10 to 400V
Capacitance	2.2 to 4,700 $\mu$ F
Endurance	150°C 1,000 to 2,000 hours
Product size	$\phi$ 10×12.5L to $\phi$ 18×40L
Category temperature	-55 to +150°C (10 to 100V) -40 to +150°C (160 to 200V) -25 to +150°C (350 to 400V)

**Ultra-high temperature** Applications ECUs

### UBT High reliability (125°C)



- Stable high-temperature products guaranteed for 2,000 to 10,000 hours at 125°C
- Suited for automobile electronics where heavy duty services are indispensable
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Rated voltage	10 to 450V
Capacitance	4.7 to 4,700 $\mu$ F
Endurance	2,000 to 10,000 hours at 125°C (50V or less, $\phi$ 8: 2,000 hours, $\phi$ 10: 5,000 hours, $\phi$ 12.5 above: 10,000 hours), (63 to 100V, $\phi$ 8: 2,000 hours, $\phi$ 10: 3,000 hours, $\phi$ 12.5: 5,000 hours), (160V or more: 2,000 hours)
Product size	$\phi$ 8×11.5L to $\phi$ 18×35.5L
Category temperature	-40 to +125°C (10 to 250V), -25 to +125°C (350 to 450V)

Applications Automotive compressors, HID lights, power steering, EPSs, ECUs

**Mounting Examples** ABS, ECUs, power steering

Note: For detailed specifications, please refer to Nichicon's general catalog of electronics.

### UXY High Vibration Resistance

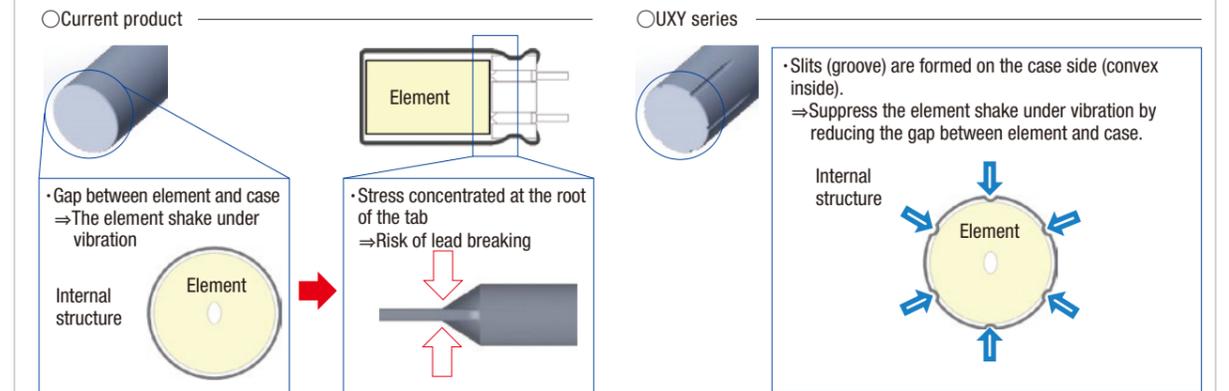


- Smaller and Higher ripple current and Anti-vibration structure
- Suited for automobile electronics where heavy duty services are indispensable.
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

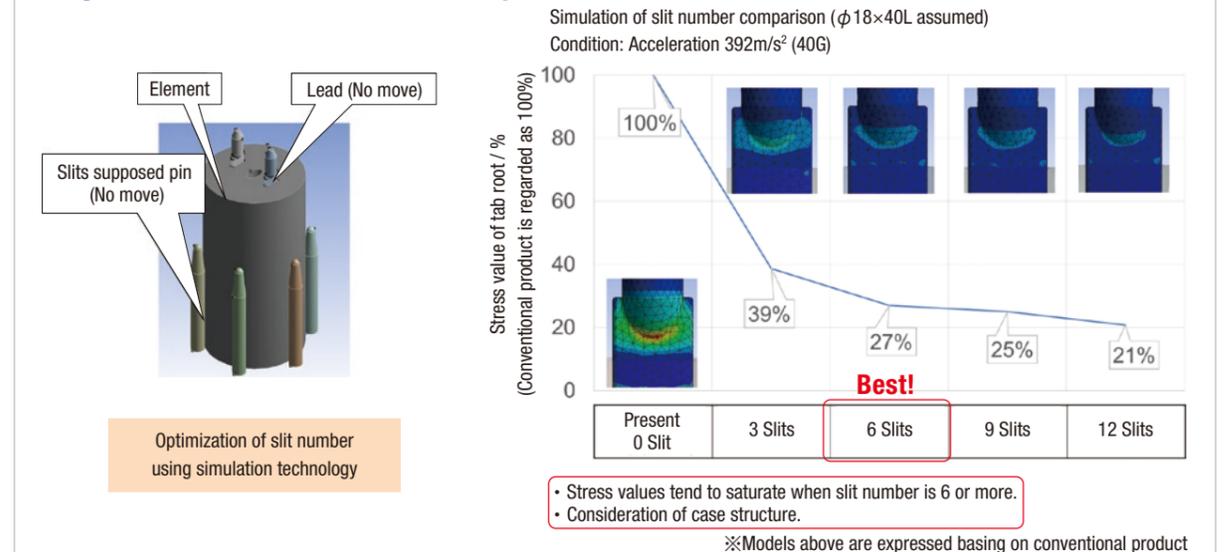
Product size	$\phi$ 18×31.5L to $\phi$ 18×40L
Endurance	3,000 hours at 125°C/135°C
Rated voltage	25, 35V
Capacitance	5,000 to 11,000 $\mu$ F
Category temperature	-40 to +135°C

**40G Resistance** Applications ECUs, power steering

### Points to improve vibration resistance



### Design of vibration resistant structure by simulation



### Vibration test result

○Vibration test conditions

Frequency	10 to 2,000Hz
Amplitude / Acceleration	All amplitude 1.5 mm or 392 m/s <sup>2</sup> (40 G)
Test time	XYZ directions, 2 hours each

	X direction 2 hours	Y direction 2 hours	Z direction 2 hours
Vibration direction			
Current product	NG	—	—
UXY	Clear	Clear	Clear

# Conductive Polymer Hybrid Aluminum Electrolytic Capacitors

## NICHICON's Key Technologies — Improvement of Electrolyte

### Compounding Ratio Optimization

#### 1. Solvent optimization

- Low transpiration



#### 2. Solute optimization

- Restrain polymer deterioration
- Improve moisture resistance

#### Sample Data

Part No. : GYA1V271MCQ1GS  
 Rated: 35V, 270μF  
 Size: φ10 x 10L  
 Life test: 125°C Ripple  
 \*2Arms@100kHz  
 Number of samples: 10 pcs

### Long Life

Suppression of capacitance change during life test (75% DOWN)

### Low ESR

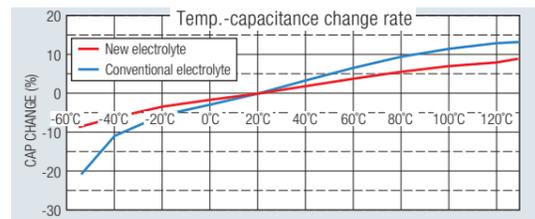
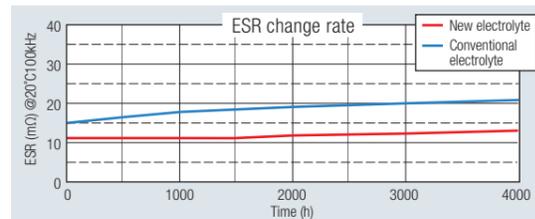
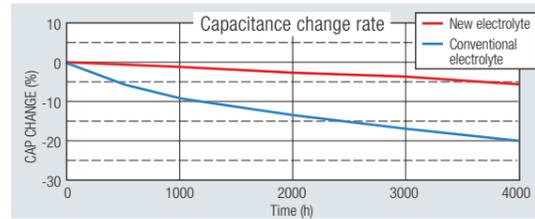
ESR 30% -40% DOWN compared to conventional electrolyte

### Low Temp. Characteristics

Suppression of temperature change rate of capacitance (50% DOWN)

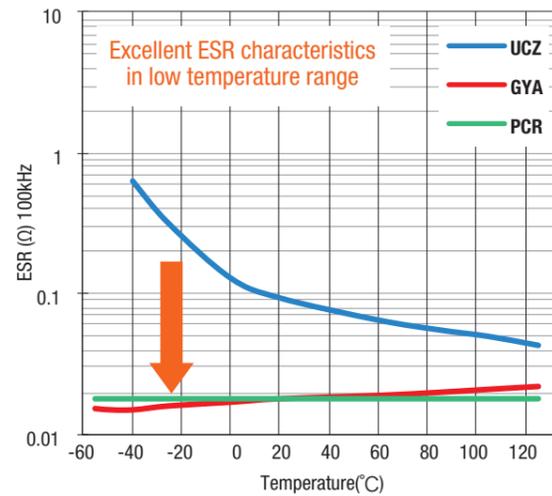
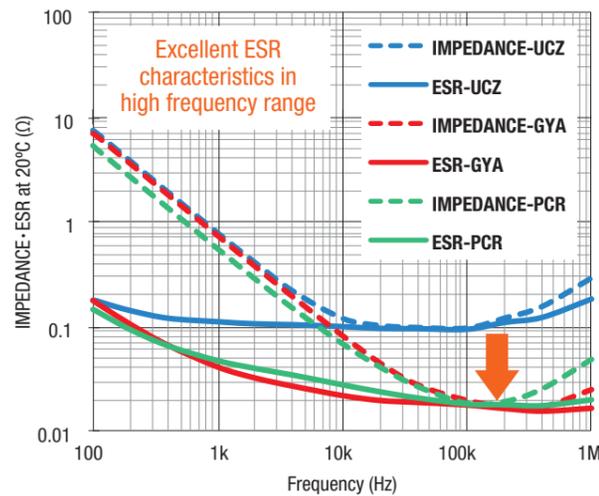
### Moisture Resistance

85°C 85% RH., 2,000 hour standard support



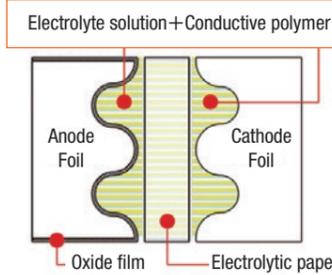
## Excellent ESR · Impedance Characteristics

Type	Specifications	Size	Part number	Temperature
Aluminum Electrolytic Capacitors	35V 220 μF	φ10×10L	UCZ1V221MCL1GS	20°C
Conductive Polymer Hybrid Aluminum Electrolytic Capacitors	35V 270 μF	φ10×10L	GYA1V271MCQ1GS	20°C
Conductive Polymer Aluminum Solid Electrolytic Capacitors	35V 270 μF	φ10×10L	PCR1V271MCL1GS	20°C



The conductive polymer hybrid aluminum electrolytic capacitors have the same frequency characteristics as the conductive polymer aluminum solid electrolytic capacitors, and the ESR values in the high frequency and low temperature regions are considerably reduced compared with the aluminum electrolytic capacitors.

## Structure and Advantages



Aluminum Electrolytic Capacitors (UCZ, UCD etc.)  
 Electrolyte: Electrolyte solution  
 High capacitance · Low leakage current  
 · High oxide film restoration performance

Conductive Polymer Aluminum Solid Electrolytic Capacitors (PCM, PCZ etc.)  
 Electrolyte: Conductive polymer  
 Low ESR · High heat resistance  
 · Long lifetime · High ripple current

- 1,000 hours longer lifetime
- More than 4 times higher ripple
- Leakage current reduced to 1/5
- 4 times higher capacitance

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors  
 Electrolyte: Electrolyte solution + Conductive polymer

## GYA

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors  
 125°C 4,000Hrs. High Reliability



- High Reliability, Low ESR, High ripple current
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** ECUs, automotive electric pump, airbag control instruments lighting systems, power seat, meters

Product size	φ6.3×5.8L to φ10×10L
Endurance	4,000 hours at 125°C
Rated voltage	16 to 63V
Capacitance	10 to 470 μF
Category temperature	-55 to +125°C

## GYB

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors  
 105°C 10,000Hrs. High Reliability



- High Reliability, Low ESR, High ripple current
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** ECUs, automotive electric pump, airbag control instruments lighting systems, power seat, meters

Product size	φ6.3×5.8L to φ10×10L
Endurance	10,000 hours at 105°C
Rated voltage	25 to 63V
Capacitance	10 to 330 μF
Category temperature	-55 to +105°C

## GYC

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors  
 135°C 4,000Hrs. High Reliability



- High Reliability, Low ESR, High ripple current
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** ECUs, automotive electric pump, airbag control instruments lighting systems, power seat, meters

Product size	φ6.3×5.8L to φ10×10L
Endurance	4,000 hours at 135°C (φ6.3: 2,000 hours)
Rated voltage	25 to 63V
Capacitance	10 to 330 μF
Category temperature	-55 to +135°C

## GYD

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors  
 150°C 1,000Hrs. High Reliability

**NEW**



- High Reliability, Low ESR, High ripple current
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** EV · HV converter, motor control, charging circuit

Product size	φ8×10L to φ10×10L
Endurance	1,000 hours at 150°C
Rated voltage	25 to 35V
Capacitance	100 to 270 μF
Category temperature	-55 to +150°C

Note: For detailed specifications, please refer to Nichicon's general catalog of electronics.



# Control Solutions

## Chip Type Aluminum Electrolytic Capacitors with Excellent Low Temperature ESR Characteristic

**UCZ** High reliability, low ESR specification  
Vibration-resistant



- Added ESR specification after the test at -40°C
- Endurance 125°C 1,000 to 4,000 hours
- Capacitance 10 to 3,300μF
- Category temperature -40 to +125°C
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications**

ECUs, DC-DC converters, inverters, headlight ballast secondary, automotive water pumps, automotive oil pumps

ESR (Ω) MAX.at-40°C, 100kHz

Product size φ×L	Rated voltage 10 to 35V			Rated voltage 50V			Rated voltage 63V			Rated voltage 80V			Rated voltage 100V		
	Initial	Guaranteed time 2,000h	3,000h	Initial	Guaranteed time 2,000h	3,000h	Initial	Guaranteed time 2,000h	3,000h	Initial	Guaranteed time 2,000h	3,000h	Initial	Guaranteed time 2,000h	3,000h
6.3×5.8	24	—	—	42	—	—	—	—	—	—	—	—	—	—	—
6.3×7.7	5	40	—	5	40	—	100	—	—	—	—	—	—	—	—
8×10	3	4.5	—	3.5	6	—	35	—	—	50	—	—	50	—	—
10×10	2	3.5	—	2.5	4.5	—	25	—	—	35	—	—	35	—	—
12.5×13.5	0.40	3.0	—	0.44	4.0	—	1.3	14	—	1.9	14	—	1.9	22	—
16×16.5	0.28	1.4	—	0.34	2.6	—	0.9	4.8	—	1.4	4.8	—	1.4	4.8	—
18×16.5	0.23 (35V:0.28)	1.3 (35V:1.4)	—	0.32	2.6	—	0.82	3.9	—	1.1	3.9	—	1.1	3.9	—
16×21.5	0.20	—	0.60	0.22	—	1.5	0.46	—	2.0	0.8	—	2.6	0.8	—	2.6
18×21.5	0.16	—	0.50	0.20	—	1.5	0.44	—	1.8	0.7	—	2.4	0.7	—	2.4

**UCX** 135°C-guaranteed low ESR specification  
Vibration-resistant



- Added ESR specification after the test at -40°C
- Endurance 135°C 2,000 hours
- Capacitance 47 to 3,300μF
- Category temperature -40 to +135°C
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications**

ECUs, DC-DC converters, inverters, headlight ballast secondary, automotive water pumps, automotive oil pumps

ESR (Ω) MAX.at-40°C, 100kHz

Product size φ×L	Rated voltage 10 to 35V		Rated voltage 50V	
	Initial	Guaranteed time 1,000h	Initial	Guaranteed time 1,000h
6.3×10	4	15	—	—
8×10	3	12	3.5	15
10×10	2	10	2.5	12
12.5×13.5	1.0	5.0	1.3	6.5
16×16.5	0.50	2.5	0.70	3.5
18×16.5	0.50	2.5	0.70	3.5
16×21.5	0.32	1.6	0.40	2.0
18×21.5	0.28	1.4	0.32	1.6

**UCH** High reliability, low ESR specification **Expanded**



- Added ESR specification after the test at -40°C 400kHz
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

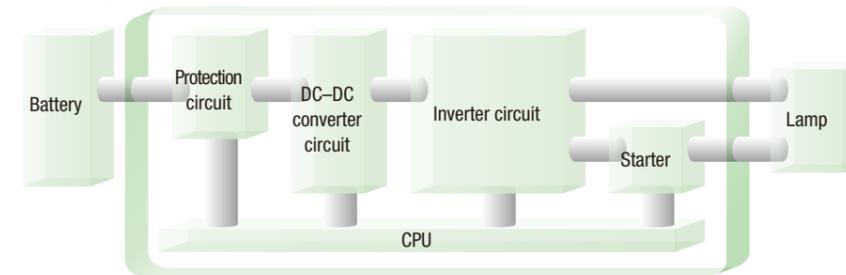
**Applications**

ECUs, DC-DC converters, inverters, headlight ballast secondary, automotive water pumps, automotive oil pumps

Product size	φ 6.3×7.7L to φ 10×10L
Endurance	2,000 hours at 125°C
Rated voltage	25 to 63V
Capacitance	33 to 560μF
Category temperature	-40 to +125°C
ESR (Ω)	φ 6.3×7.7L Initial:3 Guaranteed time 2,000h: 6
	φ 8×10L Initial:2 Guaranteed time 2,000h: 4.5
	φ 10×10L Initial:1.5 Guaranteed time 2,000h: 3.5

Note: For detailed specifications, please refer to Nichicon's general catalog of electronics.

## Headlight Ballast Pattern Diagram



Suited for high temperature

Large-surface mounting

Suited for high voltage

## Automotive Aluminum Electrolytic Capacitors

**UUX** Chip type, larger size



- Chip type, larger size
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications**

[High voltage] Batteries in EVs and HVs/battery unit control/monitoring  
[Low voltage] Electrical systems, measurement systems

Product size	φ 6.3×7.7L to φ 10×10L
Endurance	2,000 hours at 105°C (160 to 400V: 3,000 hours)
Rated voltage	6.3 to 400V
Capacitance	1 to 1,000μF
Category temperature	-55 to +105°C (6.3 to 100V), -40 to +105°C (160 to 400V)

**UUB** High reliability



- Chip type, 125°C
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications**

[High voltage] HLB primary  
[Low voltage] Engine control, automotive electric water pumps (EWPs), electric oil pumps (EOP)

Product size	φ 8×6.2L to φ 10×10L
Endurance	2,000 hours at 125°C (φ 8×6.2L: 1,000 hours)
Rated voltage	10 to 400V
Capacitance	1 to 330μF
Category temperature	-40 to +125°C

**UUJ** Chip Type, Higher Capacitance Range



- Chip Type, higher capacitance in larger case sizes (φ 12.5, φ 16, φ 18)
- Applicable to automatic mounting machine fed with carrier tape.
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications**

ECUs, ABS, airbags, electronic meters, power steering, car navigation

Product size	φ 12.5×13.5L to φ 18×21.5L
Endurance	5,000 hours at 105°C
Rated voltage	6.3 to 450V
Capacitance	3.3 to 680μF
Category temperature	-55 to +105°C (6.3 to 100V), -40 to +105°C (160 to 450V)

**UCQ** For Audio Equipment  
Wide Temperature Range



- Chip type acoustic series within the wide temperature range.
- Applicable to automatic mounting machine fed with carrier tape.
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications**

For automotive audio

Product size	φ 4×4.5L to φ 10×10L
Endurance	2,000 hours at 105°C (4.5L: 1,000hours)
Rated voltage	10 to 35V
Capacitance	4.7 to 680μF
Category temperature	-55 to +105°C

**UKA** Wide temperature range, for audio equipment  
High-grade type



- 105°C high quality capacitors for audio equipment
- Selected materials to create superior acoustic sound
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications**

For automotive audio

Product size	φ 5×11L to φ 18×40L
Endurance	2,000 hours at 105°C
Rated voltage	6.3 to 50V
Capacitance	22 to 22,000μF
Category temperature	-55 to +105°C

Note: For detailed specifications, please refer to Nichicon's general catalog of electronics.

## Automotive Conductive Polymer Aluminum Solid Electrolytic Capacitors

**PCZ** Chip Type, Higher Capacitance, High Temperature Range **Expanded**

- High reliability, low ESR, high ripple current
- Long life of 2,000 hours at 150°C
- Chip type : Lead free reflow soldering condition at 260°C peak correspondence
- ESR after Endurance at -40°C.
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Product size	φ8×7L to φ10×12.7L
Endurance	2,000 hours at 150°C
Rated voltage	16 to 63V
Capacitance	12 to 1,000 μF
Category temperature	-55 to +150°C

**Applications**  
ECUs, DC-DC converters, headlight ballast secondary, automotive water pumps

**PCM** Chip Type, Higher Capacitance, High Temperature Range **NEW**

- High reliability, low ESR, high ripple current
- Long life of 6,000 to 8,000 hours at 125°C
- Chip type : Lead free reflow soldering condition at 260°C peak correspondence
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Product size	φ6.3×6L to φ10×12.7L
Endurance	8,000 hours at 125°C (φ6.3: 6,000 hours)
Rated voltage	16 to 80V
Capacitance	12 to 1,000 μF
Category temperature	-55 to +125°C

**Applications**  
ECUs, DC-DC converters, headlight ballast secondary, automotive water pumps

**PCH** Chip Type, Higher Capacitance, High Temperature Range **Expanded**

- High reliability, High voltage (to 80V), Low ESR, High ripple current
- Long life of 4,000 hours at 135°C
- Chip type : Lead free reflow soldering condition at 260°C peak correspondence
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- ESR after Endurance at -40°C
- AEC-Q200 compliant. Please contact us for details.

Product size	φ6.3×6L to φ10×12.7L
Endurance	4,000 hours at 135°C
Rated voltage	16 to 80V
Rated Capacitance	12 to 1,000 μF
Category temperature	-55 to +135°C

**Applications**  
ECUs, DC-DC converters, headlight ballast secondary, automotive water pumps

**PCL** Chip Type, Higher Capacitance, LongLife Assurance **Expanded**

- Long life of 20,000 hours at 105°C
- High reliability, Low ESR, High ripple current
- Chip type : Lead free reflow soldering condition at 260°C peak correspondence
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Product size	φ5×6L to φ10×12.7L
Endurance	20,000 hours at 105°C
Rated voltage	2.5 to 25V
Rated Capacitance	12 to 3,300 μF
Category temperature	-55 to +105°C

**Applications**  
Navigation systems, e-latches

**PCR** High reliability

- High reliability with high voltage (to 80V), low ESR, high ripple current
- Long life of 4,000 hours at 125°C
- Chip type: Lead free reflow soldering condition at 260°C peak correspondence
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- ESR after endurance at -40°C
- AEC-Q200 compliant. Please contact us for details.

Product size	φ8×7L to φ10×12.7L
Endurance	4,000 hours at 125°C
Rated voltage	16 to 80V
Capacitance	22 to 1,000 μF
Category temperature	-55 to +125°C

**Applications**  
ECUs, electric pumps, power steering, DC-DC converters

**PCX** High reliability

- High reliability, low ESR, high ripple current
- Long life of 1,500 to 3,000 hours at 125°C
- Chip type : Lead free reflow soldering condition at 260°C peak correspondence
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Product size	φ6.3×6L to φ10×12.7L
Endurance	3,000 hours at 125°C (φ6.3: 1,500 hours)
Rated voltage	16 to 50V
Capacitance	5.6 to 390 μF
Category temperature	-55 to +125°C

**Applications**  
DC-DC converters, lights, electric water pumps(EWPs), electric oil pumps(EOPs), inverters for EV motors, ECUs

\*PCZ,PCM,PCH,PCR,PCX series: The vibration structure-resistant product is also available upon request, please ask for details.

## “EverCAP®” Automotive Electric Double-Layer Capacitors

**JUA** Radial Lead Type, Lower Resistance, Long Life

- 2.7V rated voltage
- Lower resistance and long life type of JUM
- Lower temperature range (-40 to +70°C)
- Load life of 2,000hours at 70°C
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)

Product size	φ8×20L, φ10×20L
Endurance	2,000 hours at 70°C
Rated voltage	2.7V
Rated Capacitance	2.5 to 4.7F
Category temperature	-40 to +70°C

**Applications**  
Navigation systems, drive recorders, e-latches

Note: For detailed specifications, please refer to Nichicon's general catalog of electronics.

## Positive Thermistor “Posi-R®”

### Thermistor :

The thermistor is classified into the two types, one is **Positive thermistor** whose resistance increases rapidly along with temperature increasing, and the other one **Negative thermistor** whose resistance decreases along with temperature increasing. Among various Positive thermistors, **Ceramic Positive thermistor (Posi-R®)** is manufactured and sold by our company.

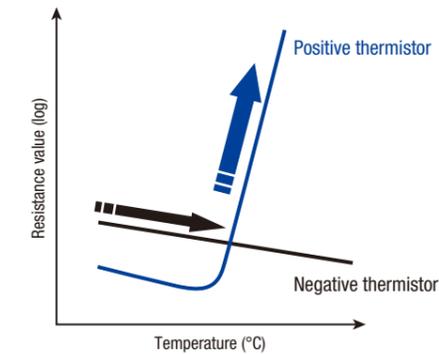
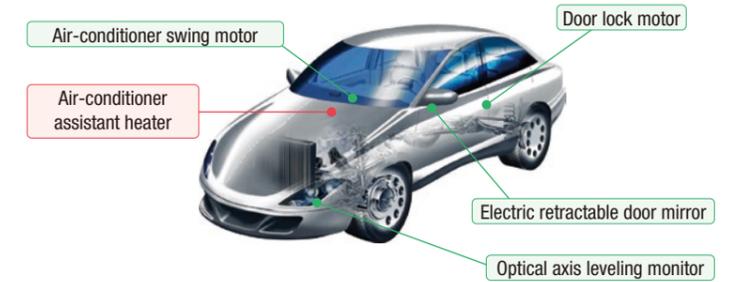


Fig. Resistance-Temperature Characteristic

### Posi-R® used for automotive

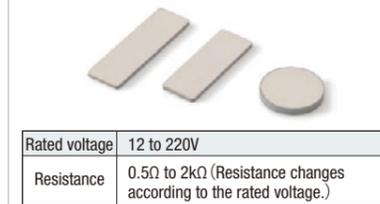
- Over current Protection use
- Automotive heater use



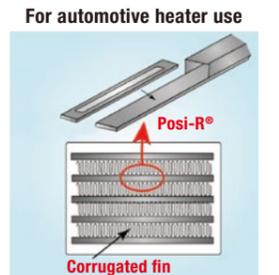
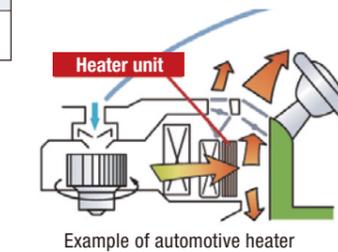
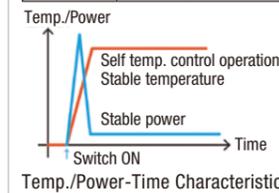
## Posi-R® used for heater “ZPD ZPS Series”

**ZPD/ZPS** Curie temperature 50 to 240°C available

**Applications** Posi-R® is used as a heating element of an auxiliary heating heater unit of an eco car or a hybrid car.



- Warm up rapidly to the target heating temperature.
- Temperature homogeneous, without red heat, always safe.
- Excessive temperature rise is suppressed by self temperature control.
- Power saving by self temperature control.
- The desired temperature can be selected.



In EV and HV, the heat source used for car heating is not enough → Use Posi-R® to compensate.

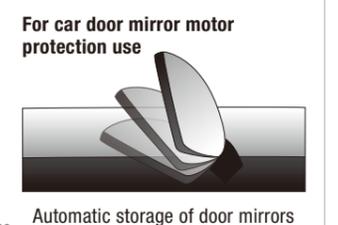
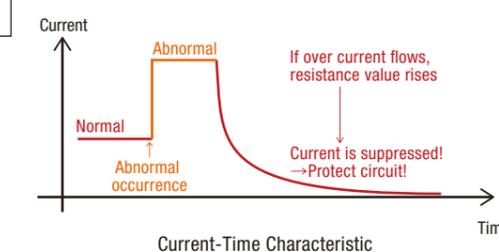
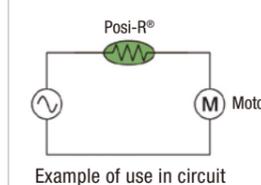
## Posi-R® used for over current Protection “ZPC Series”

**ZPC** Expand the current region by reducing the resistance.

- Because it can be used repeatedly, replacement is unnecessary.
- Excellent repetitive operation due to no contact point.
- Even under repetitive operation, there is no change in operating conditions.
- No malfunction due to noise.

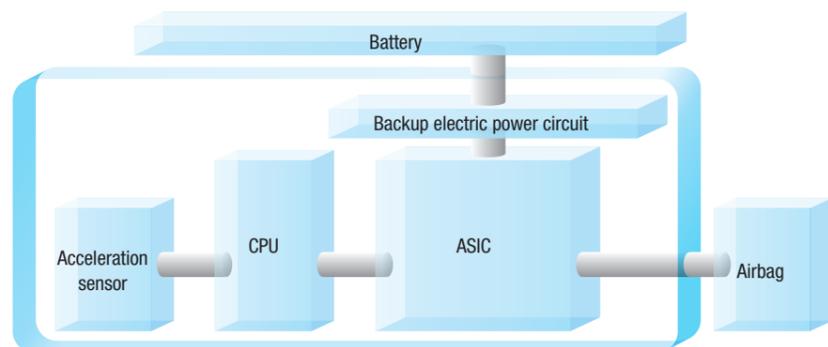
**Applications** It is mainly used for automotive miniature motor protection (door mirrors, etc.) and air conditioner circuit protection (inverter control board etc.).

Rated voltage	12 to 220V
Resistance	0.3Ω to 1kΩ (Resistance changes according to the rated voltage.)



# Safety Solutions

## Airbag ECU Pattern Diagram



High voltage

High reliability

Long life

### UCL Low impedance

- Chip type, low impedance
- Applicable to automatic mounting machine fed with carrier tape
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** ECUs, PSDs, PBDs, collating ECUs, blower motors, gateway ECUs, DCMs, airbag controls

Product size	φ4×5.8L to φ10×13.5L
Endurance	2,000 hours at 105°C
Rated voltage	6.3 to 50V
Capacitance	10 to 2,200 μF
Category temperature	-55 to +105°C

### UCV Low impedance

- Chip type, low impedance
- Applicable to automatic mounting machine fed with carrier tape
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** ECUs, PSDs, PBDs, collating ECUs, blower motors, gateway ECUs, DCMs, airbag controls

Product size	φ6.3×7.7L to φ10×10L
Endurance	2,000 hours at 105°C
Rated voltage	16 to 35V
Capacitance	220 to 1,500 μF
Category temperature	-55 to +105°C

### UCD Low impedance

- Chip type, low impedance
- Applicable to automatic mounting machine fed with carrier tape
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** Navigation, car audio, wipers, airbag controls, electrical leak detection, collating ECUs, gateway ECUs, instruments, EPSs, DCMs, lighting, compact drive trains, power seat meters

Note: The same product number also meets ECU solution specifications.

Product size	φ4×5.8L to φ18×16.5L
Endurance	2,000 to 5,000 hours at 105°C (50V or less and less than 10L: 2,000 hours, 63V or more and 10L or less: 2,000 hours)
Rated voltage	6.3 to 100V
Capacitance	1 to 3,300 μF
Category temperature	-55 to +105°C

### UPW Miniature sized, low impedance for switching power supplies

- Miniature sized, low impedance
- Capacitance ranges available based on the numerical values in E-12
- High reliability withstanding 2,000 to 8,000 hours at 105°C
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** Power steering, turn signals, airbag controls

Note: The same product numbers also apply to control solution specifications.

Product size	φ4×7L to φ25×50L
Endurance	2,000 to 8,000 hours at 105°C (φ4, 5, 6.3: 2,000 hours, φ8: 3,000 hours, φ10: 5,000 hours, φ12.5: 7,000 hours, ≧ φ16: 8,000 hours)
Rated voltage	6.3 to 450V
Capacitance	0.47 to 15,000 μF
Category temperature	-55 to +105°C (6.3 to 100V), -40 to +105°C (160 to 400V), -25 to +105°C (450V)

### Mounting Examples

Airbags, automotive cameras, drive recorders, ABS systems

Note: For detailed specifications, please refer to Nichicon's general catalog of electronics.

# Eco-Car Solutions

## Aluminum Electrolytic Capacitors for Battery Management

### ULR High Voltage

- Chip type, high voltage
- Load life of 3,000 hours at 105°C
- Applicable to automatic mounting machine fed with carrier tape
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** EV/HV batteries, battery unit control, and monitoring

### ULV High voltage, long life

- Chip type, high voltage and long life
- Load life of 10,000 hours at 105°C
- Applicable to automatic mounting machine fed with carrier tape
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** EV/HV batteries, battery unit control, monitoring

### ULT Chip type, high voltage, high temperature

- Chip type, high voltage and high temperature
- Load life of 2,000 hours at 125°C
- Applicable to automatic mounting machine fed with carrier tape
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** Headlight ballast primary

### ULH Chip type, high voltage and high reliability

- Chip type, high voltage and high reliability
- Load life of 4,000 hours at 125°C
- Applicable to automatic mounting machine fed with carrier tape
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

**Applications** Headlight ballast primary

**ULR** Surface-mount standard, mid- to high voltage guaranteed for 3,000 hours at 105°C

**ULV** Long life surface-mount mid- to high voltage guaranteed for 10,000 hours at 105°C

**ULT** High-temperature surface-mount mid- to high voltage guaranteed for 2,000 hours at 125°C

**ULH** Highly reliable surface-mount mid- to high voltage guaranteed for 4,000 hours at 125°C

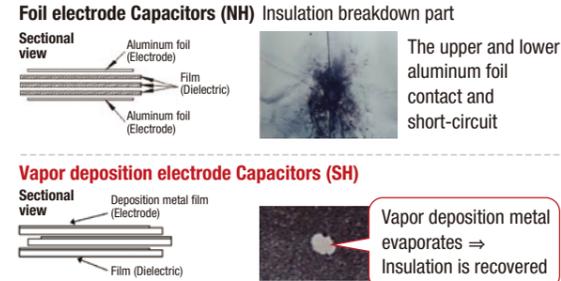
		Lineup (μF)											
		ULR		ULV		ULT		ULH					
Size (mm)	Diameter	8	10	8	10	8	10	8	10	8	10	8	10
	Height	10	10	13.5	10	10	13.5	10	10	13.5	10	10	13.5
Rated voltage	160V	15	27	39	15	22	33	15	22	33	12	18	27
	200V	12	22	33	12	18	27	12	18	27	10	15	22
	250V	10	15	22	8.2	15	18	8.2	15	18	7.5	12	15
	400V	4.7	8.2	12	3.9	6.8	10	3.9	6.8	10	3.3	5.6	7.5
	500V	2.7	3.9	5.6	1.8	3.3	4.7	1.8	3.3	4.7	—	—	—

Note: For detailed specifications, please refer to Nichicon's general catalog of electronics.

## Film Capacitors for EVs/HVs/PHVs

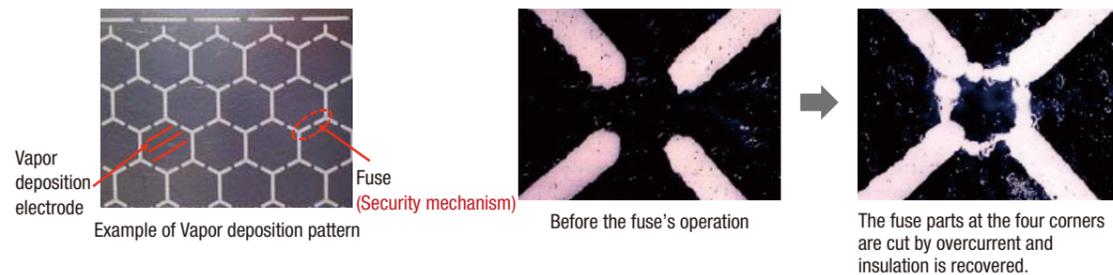
### Deposition electrode (SH) and Foil electrode (NH) Capacitors

	Foil electrode capacitors Non-self Healing (NH)	Vapor deposition electrode capacitors Self Healing (SH)
Electrode	Metal foil (Generally aluminum foil)	Vapor deposition metal film on the surface of film
Dielectric	Insulating Paper, Film, Combination of insulating paper and film	Film
Destruction mode	The broken part is short-circuit, the insulation will never be recovered.	The electrode film in the broken part evaporates and disappears, the insulation is recovered



### Improvement of safety by SH capacitor Pattern vapor deposition

#### Self-healing process of Pattern vapor deposition

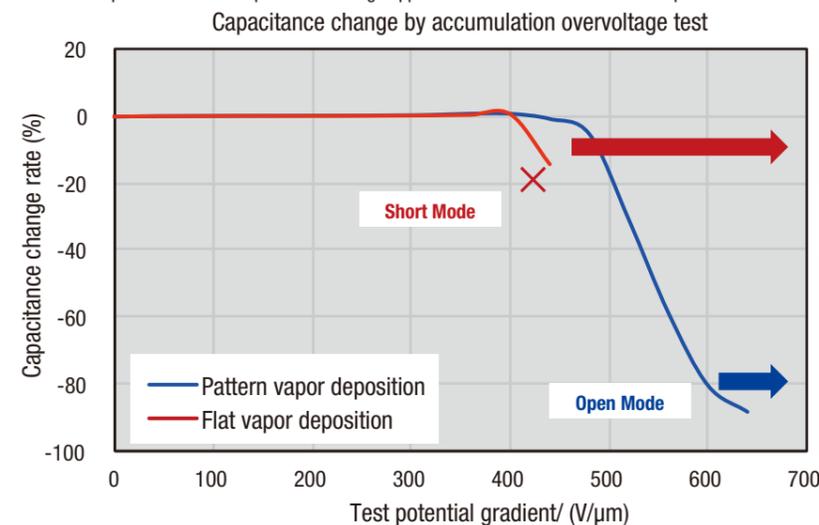


### Improvement of safety by Pattern vapor deposition

#### Comparison of safety between Pattern vapor deposition and Flat vapor deposition.

<Test conditions>

Ambient temperature: room temperature Voltage application time: 1 minute for each step

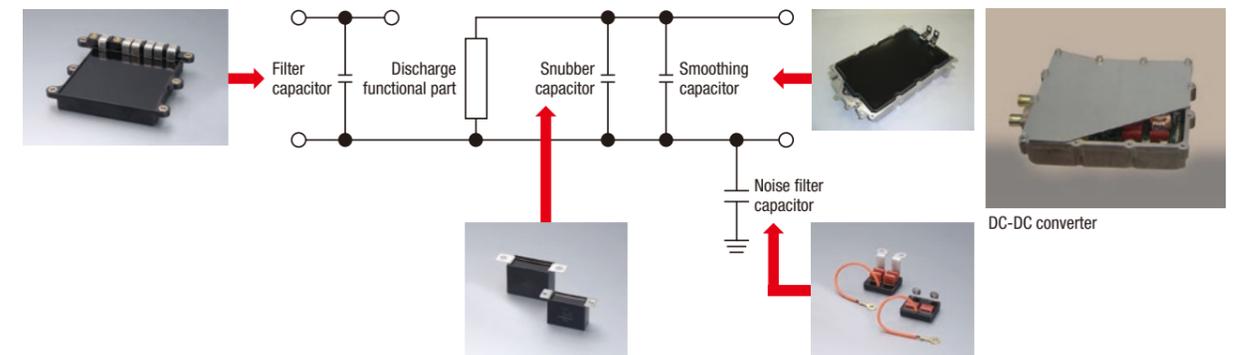


\* In this test, the test power supply is shut off by detecting the short mode with the overcurrent, but there is a possibility of burning or fire if it is not shut off.

**We adopt film with vapor deposition pattern security mechanism to realize safety and long life.**

### Sample Uses for Inverter with Booster Function

#### Capacitor Module Equivalence Circuit

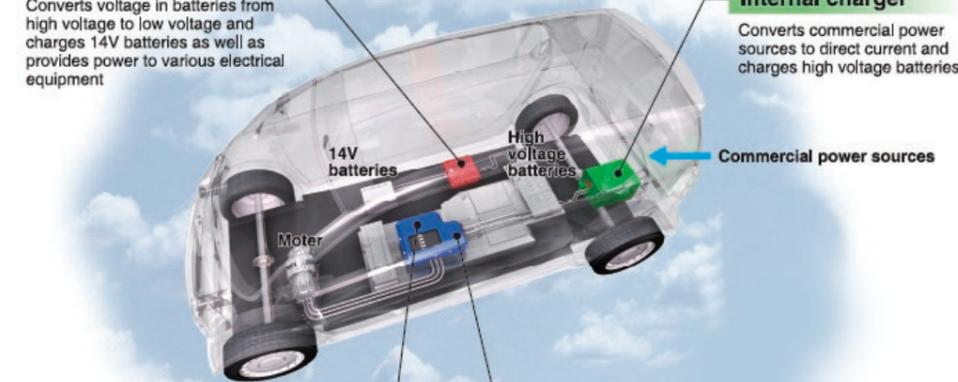


#### DC-DC converter

Converts voltage in batteries from high voltage to low voltage and charges 14V batteries as well as provides power to various electrical equipment

#### Internal charger

Converts commercial power sources to direct current and charges high voltage batteries



#### Plastic Film Capacitor / Aluminum Electrolytic Capacitor

Capacitors that level electric current are indispensable for motor control equipment

#### AC inverter

Converts direct current to alternating current and provides it to the motor

### Film Capacitors

Providing Film Capacitors with Superior Electrical Characteristics and Flexible Exterior and Electrode Configurations for Use in Automobiles, trains and other vehicles

#### High-Frequency Characteristics

- Sharp high-frequency characteristics (excellent filtering effects)
- Lower loss, energy-saving

#### Stable Characteristics

- Steady changes in capacitance in response to temperature variations

#### Withstand Current Characteristics

- High ripple current withstand volume (high current density per unit volume)

#### High Reliability, Safety Performance

- Self-healing type
- With automatic shutoff security mechanism

#### Long Life

- Maintenance-free for 10 years or more even in challenging temperature conditions

#### Shape Freedom

- Flexible exterior shapes (square, cylindrical)
- Flexible terminal shapes

#### Integrated Design

- Integrated design enables use for smoothing and filtering

#### Inverter System Diagram

