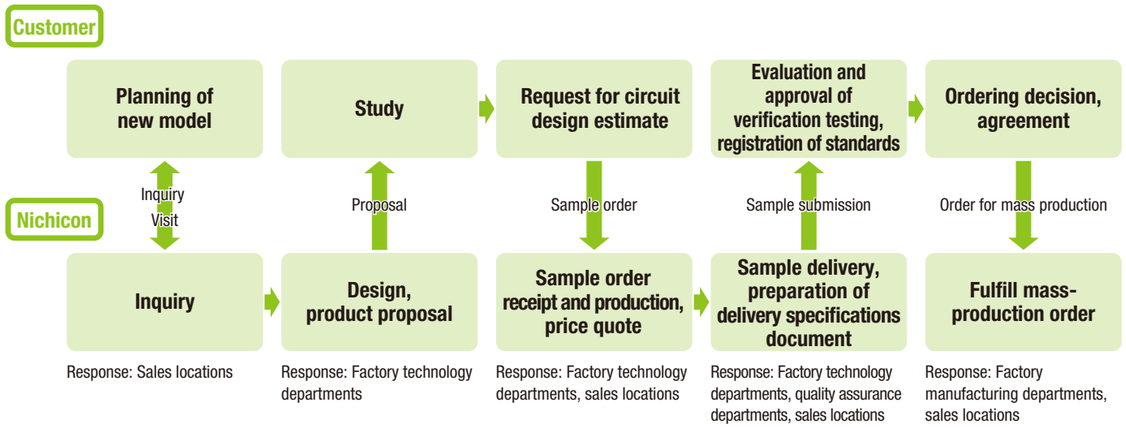
Standard Process for Developing Custom Products

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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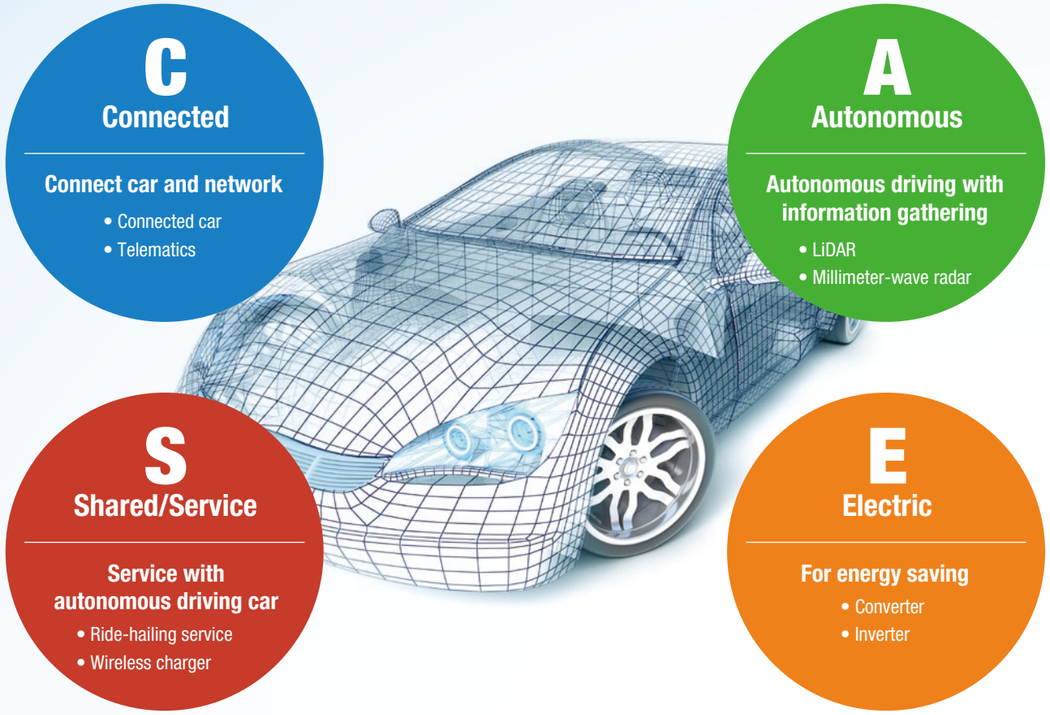
Automotive Application Catalog

January 2023

Automotive Application



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.

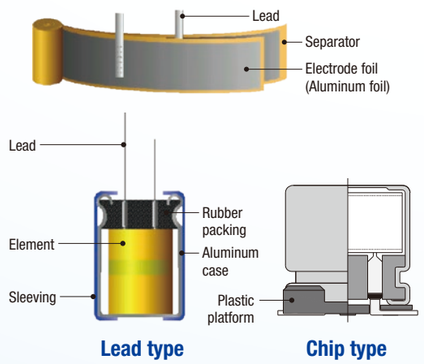
Key Technologies

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

Key Technologies / Market needs	NICHICON development			Joint development			structure
	Anode foil	Cathode foil	Electrolyte	Conductive polymer	Separator	Rubber packing	
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.”

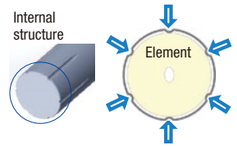
In recent years, following “C.A.S.E.”, various in-vehicle devices have tended to be further miniaturized and lightened in order to pursue higher performance and lower fuel consumption of automobiles.

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

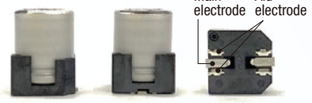
UXY series
40G vibration resistance
135°C guaranteed

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



UUE series
30G vibration resistance (10 to 2,000Hz)
100G impact resistance (pendulum type impact)
Size: φ8 x 10L to φ18x21.5L
Rated voltage: 10 to 50V
Capacitance: 33 to 4,700μF

■φ8×10L, φ10×10L



■Other sizes

Miniaturization・Large capacitance

UCZ series (Φ8x10L, 35V, 100μF)
Aluminum electrolytic capacitors: **6 pcs**
Ripple current: 1,620mArms

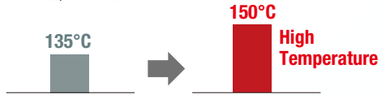
GYA series (Φ8x10L, 35V150μF)
Hybrid aluminum electrolytic capacitors: **1 pcs**
Ripple current: 1,600mArms

UCM series x 3 pcs
25V, 220μF
φ6.3x7.7L

UCV series x 2 pcs
25V, 330μF
φ6.3x7.7L

High heat resistance

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

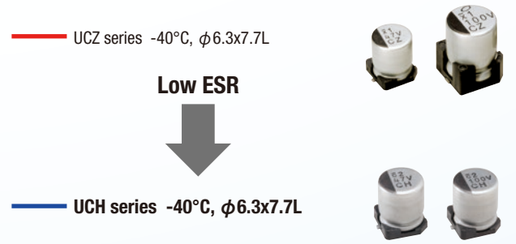


150°C High Temperature

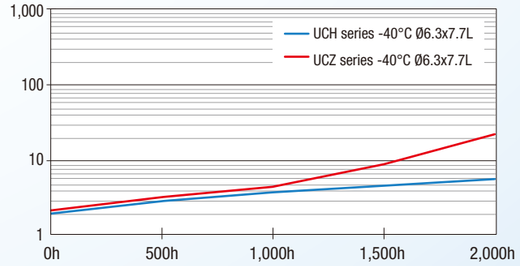
GYD series
Hybrid aluminum electrolytic capacitors
150°C 1,000 hours

UBH series
Aluminum electrolytic capacitors
150°C 2,000 hours

Low ESR

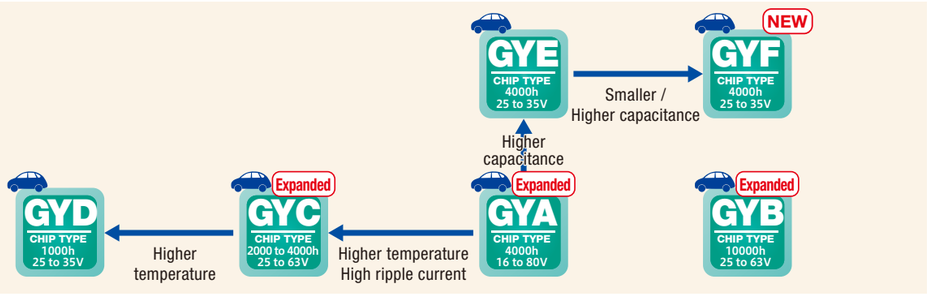


ESR deterioration over time (125°C endurance test)

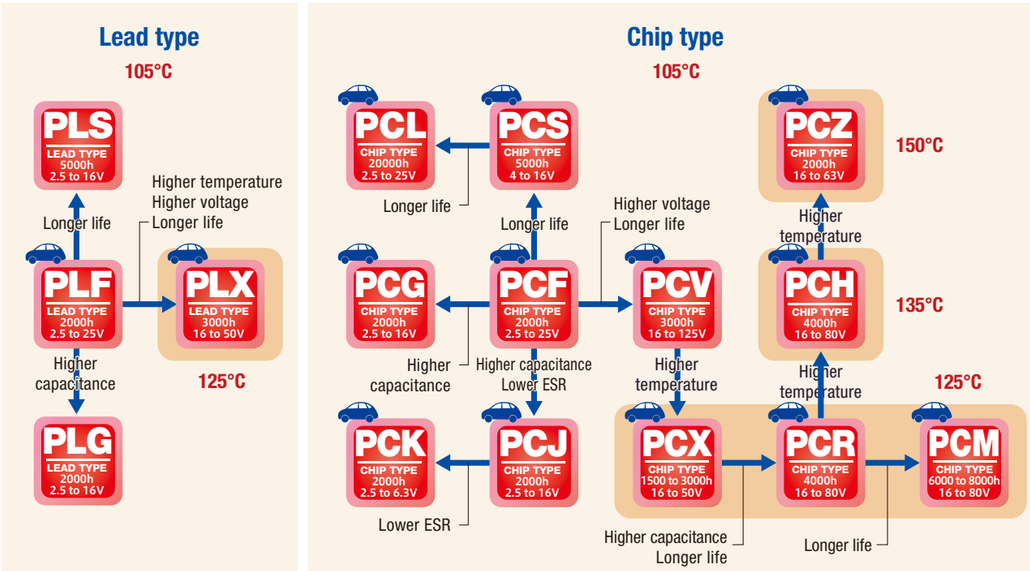


System Diagram for Nichicon Automotive Application

Series of Automotive Conductive Polymer Hybrid Aluminum Electrolytic Capacitors



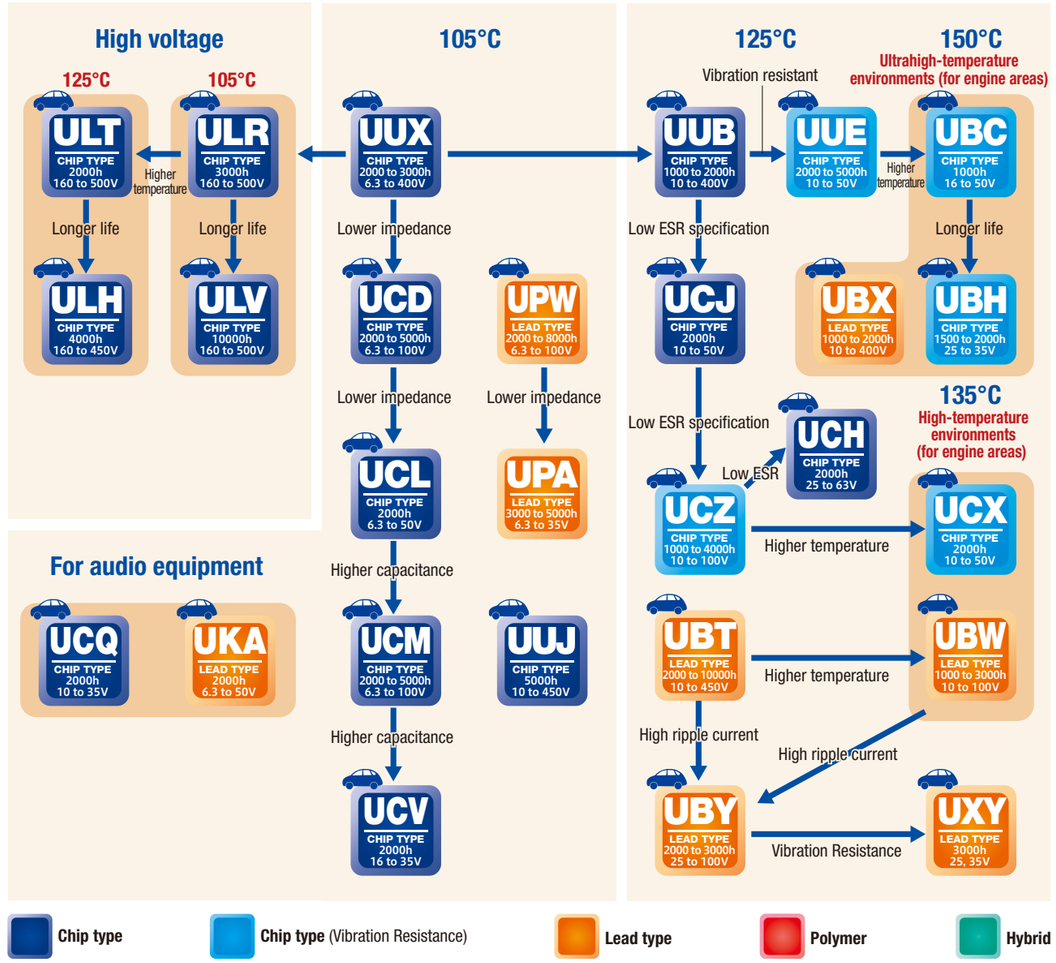
Series of Automotive Conductive Polymer Aluminum Solid Electrolytic Capacitors



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
NICHICON (OHNO) CORPORATION Site II	JQA-AU0031-2	February 2010	The design and manufacture of conductive polymer aluminum solid electrolytic capacitors	
NICHICON (OHNO) CORPORATION Site III	JQA-AU0013	January 2004	The design and manufacture of aluminum electrolytic capacitors	
NICHICON (IWATE) CORPORATION	JQA-AU0037	May 2004	The design and manufacture of aluminum electrolytic capacitors	JQA
NICHICON (KUSATSU) CORPORATION	JQA-AU0406	February 2021	The design and manufacture of plastic film capacitors	JQA
NICHICON (MALAYSIA) SDN. BHD.	AR3641 (updated) QMS-AUT000121	May 2005 (updated) May 2021	The design and manufacture of aluminum electrolytic capacitors	SIRIM
NICHICON ELECTRONICS (WUXI) CO., LTD	No.161012148/1 (updated) No.161012148/3	October 2012 (updated) September 2021	The design and manufacture of aluminum electrolytic capacitors	DEKRA
NICHICON ELECTRONICS (SUQIAN) CO., LTD	No.160817103 (updated) Letter of Conformity	August 2017 (updated) November 2021	The design and manufacture of conductive polymer aluminum solid electrolytic capacitors	DEKRA (updated) SGS

Series of Automotive Aluminum Electrolytic Capacitors



Chip type | Chip type (Vibration Resistance) | Lead type | Polymer | Hybrid

About AEC-Q200

AEC-Q200 compliant.

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

Lead type

10 series

Chip type

43 series

Hybrid

6 series

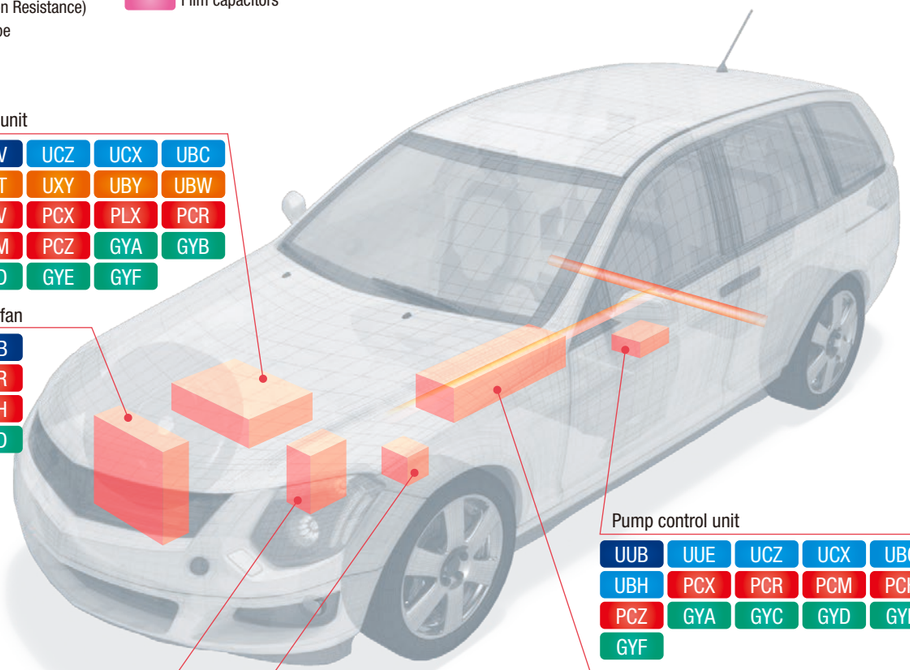
Polymer

15 series

* As of January, 2023

Powertrain Solution

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



Engine control unit

UCH	UCV	UCZ	UCX	UBC
UBH	UBT	UXY	UBY	UBW
UBX	PCV	PCX	PLX	PCR
PCH	PCM	PCZ	GYA	GYB
GYC	GYD	GYE	GYF	

Engine cooling fan

UUX	UUB
UBT	PCR
PCM	PCH
PCZ	GYD

Pump control unit

UUB	UUE	UCZ	UCX	UBC
UBH	PCX	PCR	PCM	PCH
PCZ	GYA	GYC	GYD	GYE
GYF				

Hybrid electric vehicle

UUX	ULR	ULV	ULT
ULH	EM	PCR	PCM
PCH			

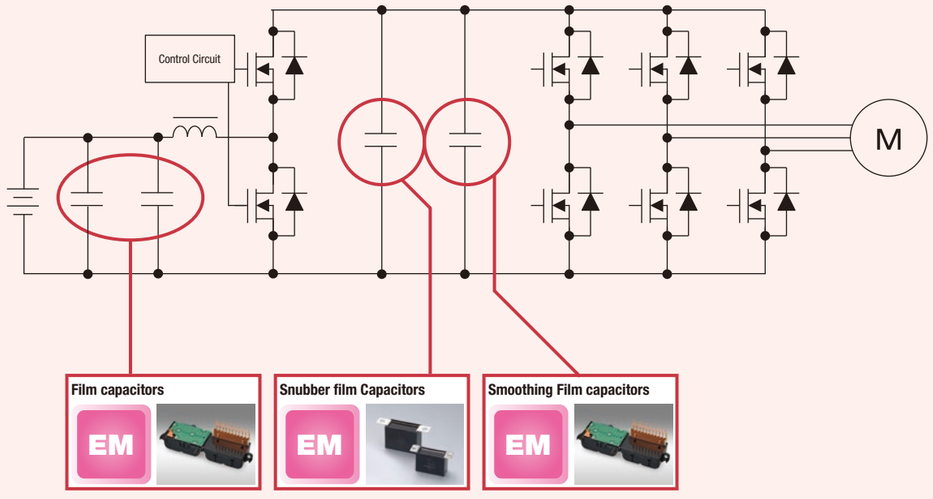
DC/DC-converter

UCZ	UCX	PCV	PCX
PCR	PCM	PCH	PCZ
GYD			

Transmission control unit

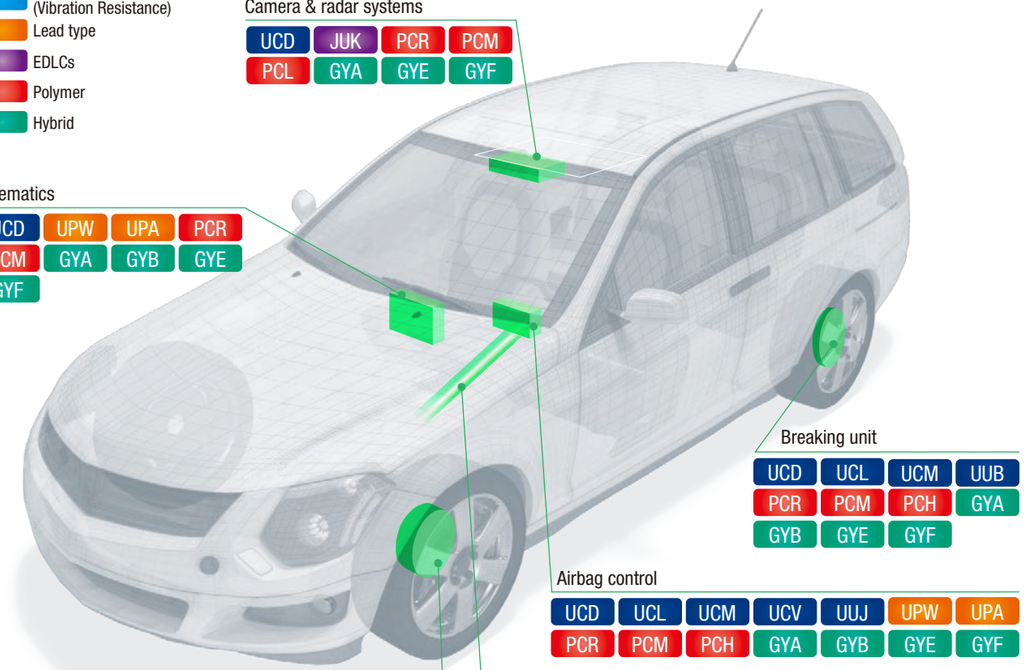
UUX	UUB	UBT
PCR	PCM	PCH

Recommended series for motor drive inverter circuits.



Chassis & Safety Solution

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



Camera & radar systems

UCD	JUK	PCR	PCM
PCL	GYA	GYE	GYF

Telematics

UCD	UPW	UPA	PCR
PCM	GYA	GYB	GYE
GYF			

Breaking unit

UCD	UCL	UCM	UUB
PCR	PCM	PCH	GYA
GYB	GYE	GYF	

Airbag control

UCD	UCL	UCM	UCV	UUJ	UPW	UPA
PCR	PCM	PCH	GYA	GYB	GYE	GYF

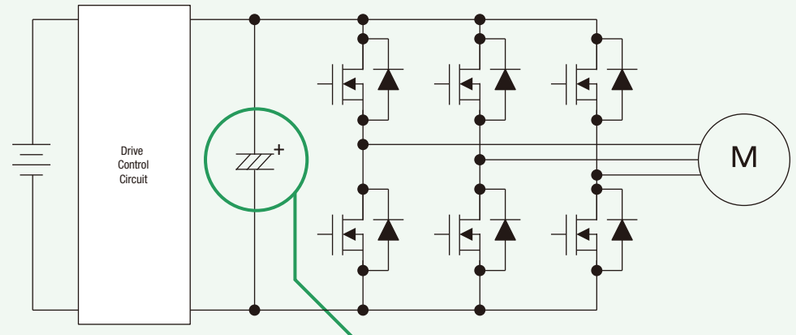
ABS & traction control

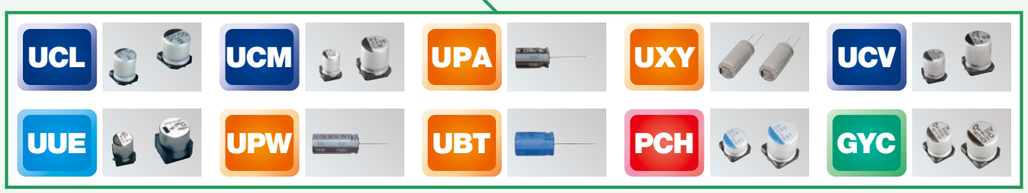
UCD	UCL	UCM	UUJ	UPW	UPA
PCR	PCM	PCH	GYA	GYB	GYE
GYF					

Power steering

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

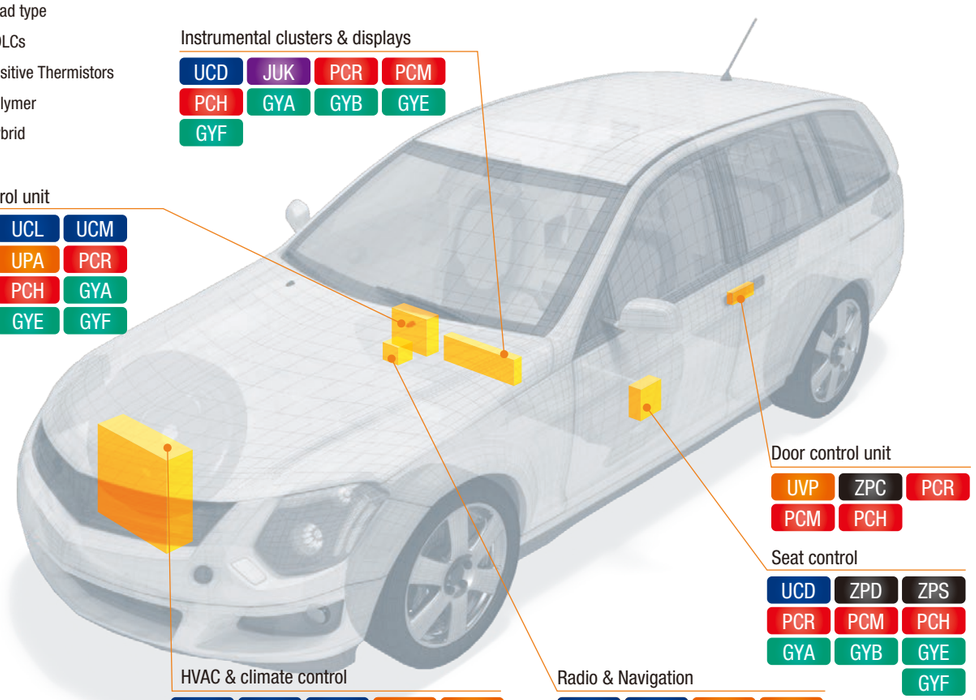
Recommended series for electric power steering circuits.





Interior Solution

Chip type
Lead type
EDLCs
Positive Thermistors
Polymer
Hybrid



Instrumental clusters & displays
UCD JUK PCR PCM
PCH GYA GYB GYE
GYF

Body control unit
UCD UCL UCM
UPW UPA PCR
PCM PCH GYA
GYB GYE GYF

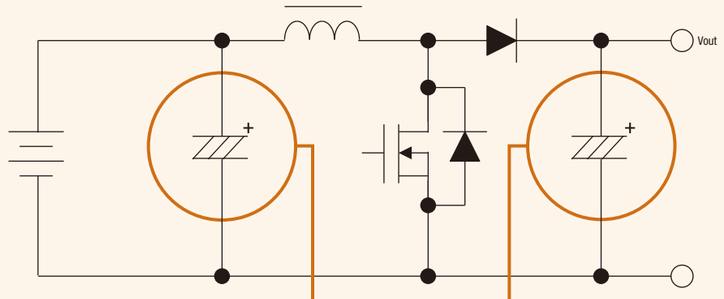
Door control unit
UVP ZPC PCR
PCM PCH

Seat control
UCD ZPD ZPS
PCR PCM PCH
GYA GYB GYE
GYF

HVAC & climate control
UCD UCL UCM UPW UPA
PCR PCM PCH PCZ GYA
GYB GYD GYE GYF

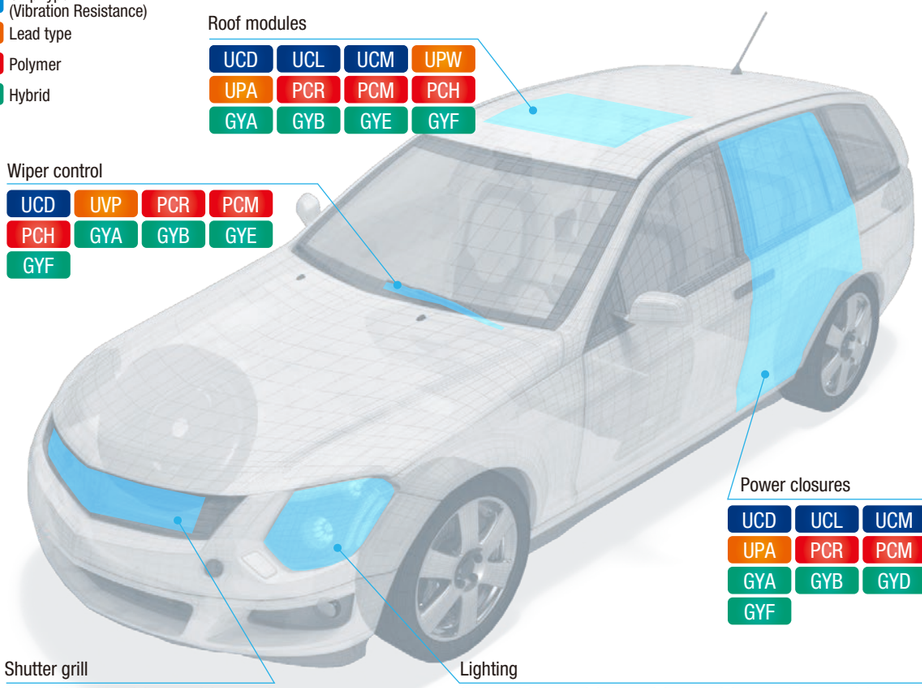
Radio & Navigation
UUQ UUJ UKA UKT
UCQ ZPC GYB PCL

Recommended series for audio DC-DC converters circuits.



Exterior Solution

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



Roof modules
UCD UCL UCM UPW
UPA PCR PCM PCH
GYA GYB GYE GYF

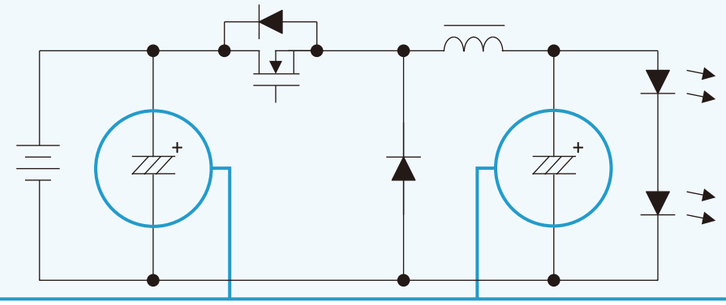
Wiper control
UCD UVP PCR PCM
PCH GYA GYB GYE
GYF

Power closures
UCD UCL UCM UPW
UPA PCR PCM PCZ
GYA GYB GYD GYE
GYF

Shutter grill
UCD UCL UCM UPW
UPA PCR PCM PCH
GYA GYB GYE GYF

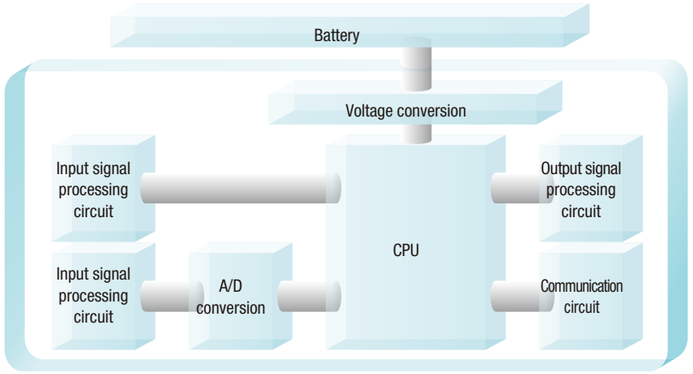
Lighting
ULR ULV UUB ULT ULH UCZ UCX UBT
PCV PCX PCR PCM PCH GYA GYB GYE
GYF

Recommended series for LED headlight circuits.



Electronic Control Solutions

Engine ECU Pattern Diagram

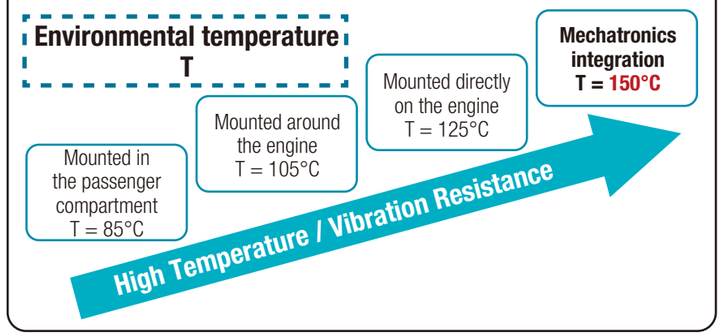


High temperature

Vibration resistance

Low temperature ESR

Requirements for Capacitors on In-vehicle ECU



Mechatronics Integration

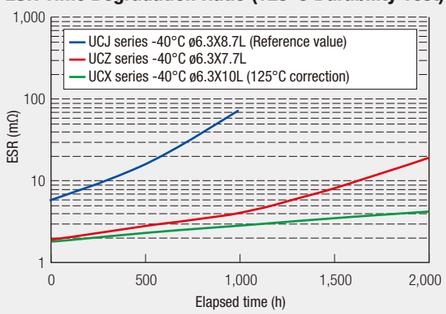
Heat resistance requirements:
125°C ⇒ 150°C

Vibration resistance requirements:
Vibration acceleration: 40G max.

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

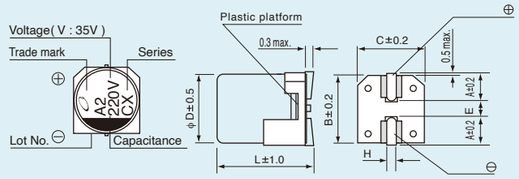
Point 3 Optimization of Product Configuration
- Optimized element configuration
  ⇒Expands facing area and optimizes sealing cuff
- Addition of φ6.3×10L (new size)(UCX series only)
  ⇒Use of a thicker sealing cuff to control degradation over time

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

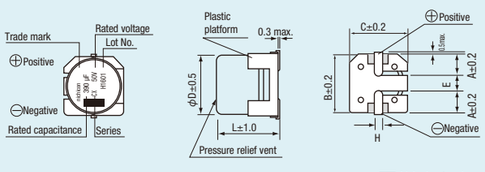
Smaller, high reliability : Surface mounting technology, anti-vibration capabilities: 30G (10 to 2,000Hz)

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]



Aid electrode

Dimensions (mm)

φD	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

UBH

High Temperature Range, Vibration Resistance Low temperature ESR specification

- Highly dependable reliability withstanding load life of 1,500 to 2,000 hours at +150°C
- Compliant to the RoHS directive (2011/65/EU, (EU) 2015/863)
- AEC-Q200 compliant. Please contact us for details.

Vibration resistance **Applications** ECUs, automotive water pumps, automotive oil pumps

Product size	φ8×10L to φ10×10L
Endurance	1,500 to 2,000 hours at 150°C (φ8: 1,500 hours)
Rated voltage	25 to 35V
Capacitance	100 to 270 μF
Category temperature	-40 to +150°C

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.

Vibration resistance **Applications** ECUs, automotive water pumps, automotive oil pumps

Product size	φ8×10L to φ18×21.5L
Endurance	1,000 hours at 150°C
Rated voltage	16 to 50V
Capacitance	33 to 2,200 μF
Category temperature	-55 (–40) to +150°C

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.

Vibration resistance **Applications** Power steering, automotive water pumps, automotive oil pumps

Product size	φ8×10L to φ18×21.5L
Endurance	5,000 hours at 125°C (φ8, φ10: 2,000 hours)
Rated voltage	10 to 50V
Capacitance	33 to 4,700 μF
Category temperature	-55 to +125°C (φ12.5 to 18), -40 to +125°C (φ8, φ10)

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.

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.

High temperature

Applications ECUs, power steering

Rated voltage	25 to 100V
Capacitance	160 to 12,000μF
Endurance	125ºC 3,000 hours / 135ºC 2,000 to 3,000 hours
Product size	φ12.5×20L to φ18×40L
Category temperature	-40 to +135°C

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.

High temperature

Applications ECUs, power steering

Rated voltage	10 to 100V
Capacitance	4.7 to 4,700μF
Endurance	1,000 to 3,000 hours at 135°C
Product size	φ8×11.5L to φ16×31.5L
Category temperature	-55 to +135°C

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.

Ultra-high temperature

Applications ECUs

Rated voltage	10 to 400V
Capacitance	6.8 to 4,700μF
Endurance	150°C 1,000 to 2,000 hours
Product size	φ12.5×20L to φ18×40L
Category temperature	-55 to +150°C (10 to 100V) -40 to +150°C (160 to 200V) -25 to +150°C (350 to 400V)

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.

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

Rated voltage	10 to 450V
Capacitance	4.7 to 4,700μF
Endurance	2,000 to 10,000 hours at 125°C (50V or less, φ8: 2,000 hours, φ10: 5,000 hours, φ12.5 above: 10,000 hours), (63 to 100V, φ8: 2,000 hours, φ10: 3,000 hours, φ12.5: 5,000 hours), (160V or more: 2,000 hours)
Product size	φ8×11.5L to φ18×35.5L
Category temperature	-40 to +125°C (10 to 250V), -25 to +125°C (350 to 450V)

Mounting Examples ABS, ECUs, power steering

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

UXY — High Vibration Resistance

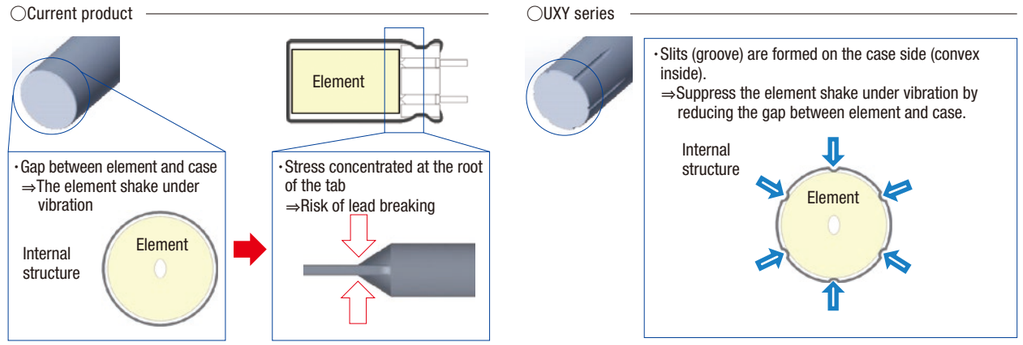
40G Resistance

- 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.

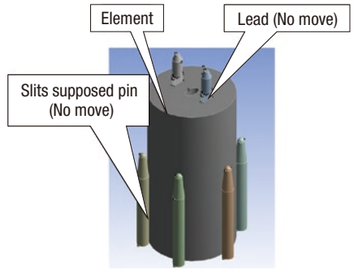
Applications ECUs, power steering

Product size	φ18×31.5L to φ18×40L
Endurance	3,000 hours at 125°C/135°C
Rated voltage	25, 35V
Capacitance	5,000 to 11,000μF
Category temperature	-40 to +135°C

Points to improve vibration resistance

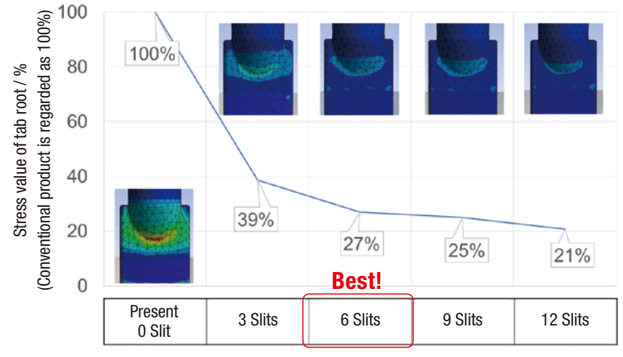


Design of vibration resistant structure by simulation



Optimization of slit number using simulation technology

Simulation of slit number comparison (φ18×40L assumed)
Condition: Acceleration 392m/s² (40G)



- Stress values tend to saturate when slit number is 6 or more.
- Consideration of case structure.

※Models above are expressed basing on conventional product

Vibration test result

○Vibration test conditions

Frequency	10 to 2,000Hz
Amplitude / Acceleration	All amplitude 1.5 mm or 392 m/s² (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

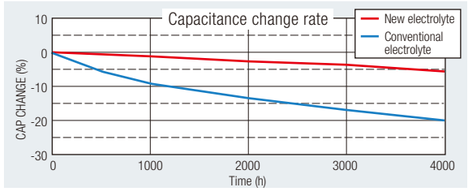
ESR 30% -40% DOWN compared to conventional electrolyte

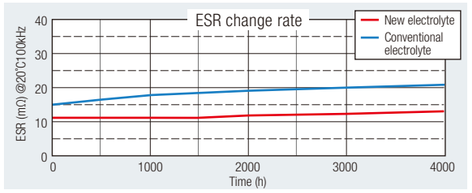
Low Temp. Characteristics

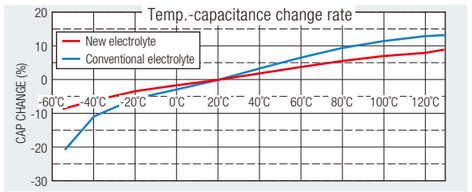
Suppression of temperature change rate of capacitance (50% DOWN)

Moisture Resistance

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

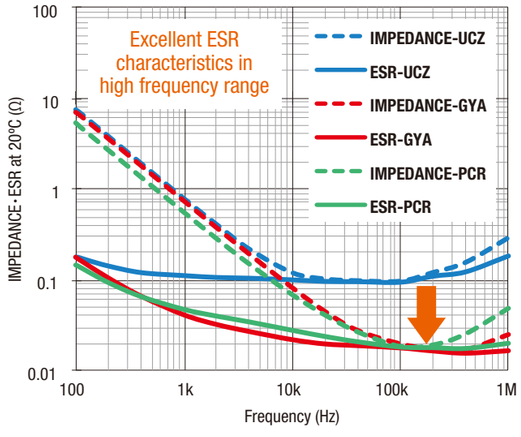


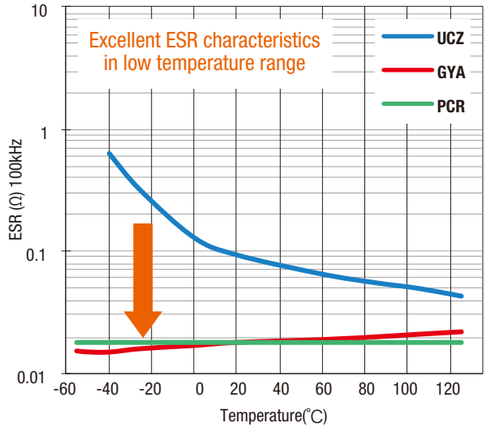




Excellent ESR・Impedance Characteristics

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

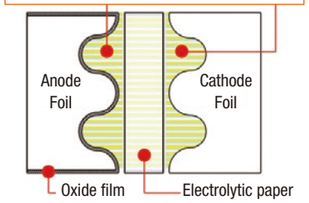




The conductive polymer hybrid aluminum electrolytic capacitors have the same frequency characteristics as the conductive polymer aluminum solid electrolytic capacitors, and the ESR values in the high frequency and low temperature regions are considerably reduced compared with the aluminum electrolytic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

Structure and Advantages

Electrolyte solution+Conductive polymer



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

GYB

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

Expanded

- 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 φ10×12.5L
Endurance	10,000 hours at 105°C
Rated voltage	25 to 63V
Capacitance	10 to 470μF
Category temperature	-55 to +105°C

GYC

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

Expanded

- 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 φ10×12.5L
Endurance	4,000 hours at 135°C (φ6.3: 2,000 hours)
Rated voltage	25 to 63V
Capacitance	10 to 470μF
Category temperature	-55 to +135°C

GYD

Conductive Polymer Hybrid Aluminum Electrolytic Capacitors
150°C 1,000Hrs. 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 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 270μF
Category temperature	-55 to +150°C

GYE

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

- High Reliability, Low ESR, High ripple current
- Long life of 4,000 hours at 125°C, High Capacitance
- 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	25 to 35V
Capacitance	56 to 470μF
Category temperature	-55 to +125°C

GYF

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

NEW

- High Reliability, Low ESR, High ripple current
- Long life of 4,000 hours at 125°C, High Capacitance
- 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	25 to 35V
Capacitance	68 to 560μF
Category temperature	-55 to +125°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		Initial	Guaranteed time		Initial	Guaranteed time		Initial	Guaranteed time		Initial	Guaranteed time	
		2,000h	3,000h		2,000h	3,000h		2,000h	3,000h		2,000h	3,000h		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

- 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.

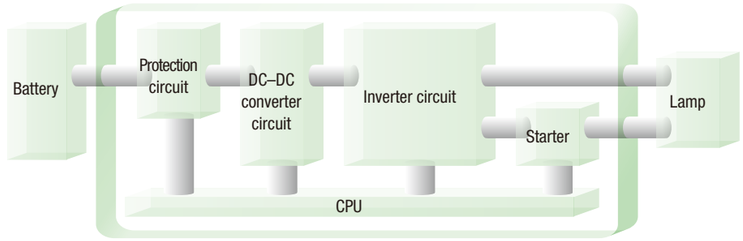
Applications

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

Product size	φ6.3×7.7L to φ10×10L
Endurance	2,000 hours at 125°C
Rated voltage	25 to 63V
Capacitance	33 to 560μF
Category temperature	-40 to +125°C
ESR (Ω)	φ6.3×7.7L Initial:3 Guaranteed time 2,000h: 6 φ8×10L Initial:2 Guaranteed time 2,000h: 4.5 φ10×10L 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	φ6.3×7.7L to φ10×10L
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	φ8×6.2L to φ10×10L
Endurance	2,000 hours at 125°C (φ8×6.2L: 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 (φ12.5, φ16, φ18)
- 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	φ12.5x13.5L to φ18x21.5L
Endurance	5,000 hours at 105°C
Rated voltage	10 to 450V
Capacitance	3.3 to 6800μF
Category temperature	-55 to +105°C (10 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	φ4×4.5L to φ10×10L
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	φ8×11.5L to φ18×40L
Endurance	2,000 hours at 105°C
Rated voltage	6.3 to 50V
Capacitance	100 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

- 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.

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

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

PCM

Chip Type, Higher Capacitance, High Temperature Range

- 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
- 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.

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

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 1,000μF
Category temperature	-55 to +125°C

PCH

Chip Type, Higher Capacitance, High Temperature Range

- 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
- 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.

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

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

PCL

Chip Type, Higher Capacitance, LongLife Assurance

- 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.

Applications Navigation systems, e-latches

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

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
- 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.

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

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

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.

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

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 390μF
Category temperature	-55 to +125°C

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

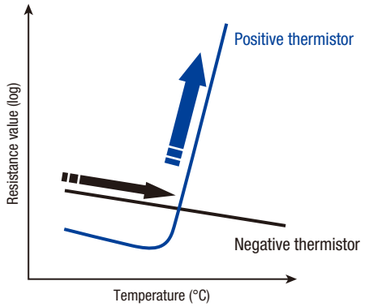
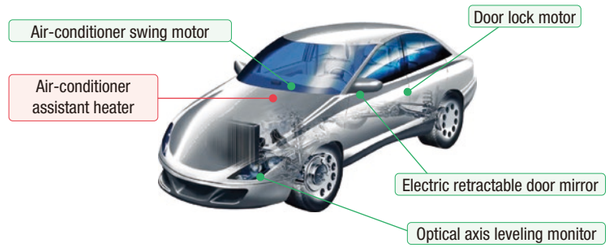


Fig. Resistance-Temperature Characteristic

Posi-R® used for automotive

Over current Protection use
Automotive heater use



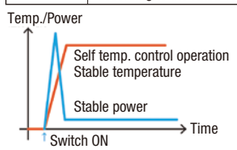
Posi-R® used for heater "ZPD ZPS Series"

ZPD/ZPS

Curie temperature 50 to 240°C available

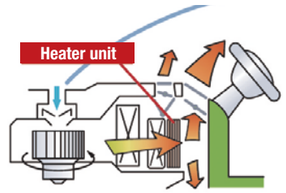
Applications Posi-R® is used as a heating element of an auxiliary heating heater unit of an eco car or a hybrid car.

Rated voltage	12 to 220V
Resistance	0.5Ω to 2kΩ (Resistance changes according to the rated voltage.)



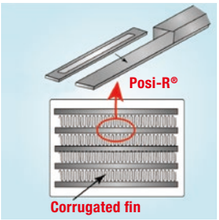
Temp./Power-Time Characteristic

- 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.



Example of automotive heater

For automotive heater use



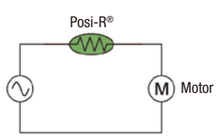
In EV and HV, the heat source used for car heating is not enough → Use Posi-R® to compensate.

Posi-R® used for over current Protection "ZPC Series"

ZPC

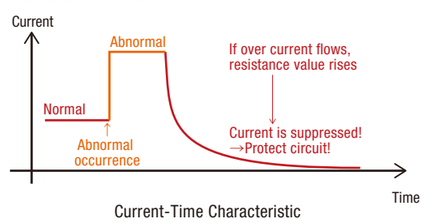
Expand the current region by reducing the resistance.

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



Example of use in circuit

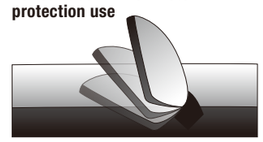
- Because it can be used repeatedly, replacement is unnecessary.
- Excellent repetitive operation due to no contact point.
- Even under repetitive operation, there is no change in operating conditions.
- No malfunction due to noise.



Current-Time Characteristic

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

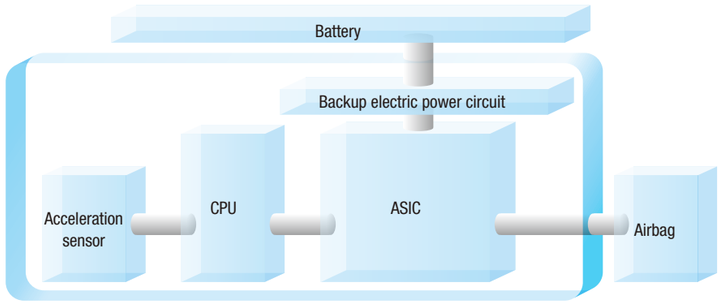
For car door mirror motor protection use



Automatic storage of door mirrors

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 2,200μF
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 1,500μF
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 3,300μF
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	φ8×11.5L to φ18×40L
Endurance	3,000 to 8,000 hours at 105°C (φ8: 3,000 hours, φ10: 5,000 hours, φ12.5: 7,000 hours, ≧φ18: 8,000 hours)
Rated voltage	6.3 to 100V
Capacitance	15 to 15,000μF
Category temperature	-55 to +105°C

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

(μF)

		Lineup											
		ULR			ULV			ULT			ULH		
Size (mm) Diameter		8	10		8	10		8	10		8	10	
Size (mm) 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
	450V	3.9	6.8	10	3.3	5.6	7.5	3.3	5.6	7.5	2.2	3.9	5.6
	500V	2.7	3.9	5.6	1.8	3.3	4.7	1.8	3.3	4.7	—	—	—

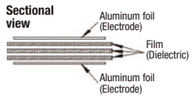
Note: For detailed specifications, please refer to Nichicon's general catalog of electronics.

Film Capacitors for EVs/HVs/PHVs

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

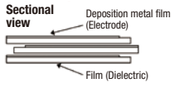
	Foil electrode capacitors Non-self Healing (NH)	Vapor deposition electrode capacitors Self Healing (SH)
Electrode	Metal foil(Generally aluminum foil)	Vapor deposition metal film on the surface of film
Dielectric	Insulating Paper, Film,Combination of insulating paper and film	Film
Destruction mode	The 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

Foil electrode Capacitors (NH) Insulation breakdown part



The upper and lower aluminum foil contact and short-circuit

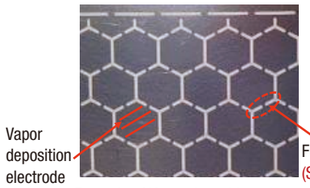
Vapor deposition electrode Capacitors (SH)



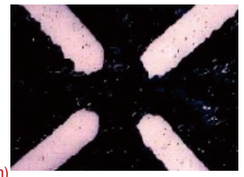
Vapor deposition metal evaporates ⇒ Insulation is recovered

Improvement of safety by SH capacitor Pattern vapor deposition

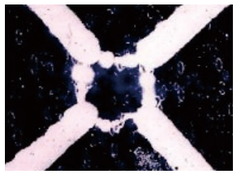
Self-healing process of Pattern vapor deposition



Example of Vapor deposition pattern



Before the fuse's operation

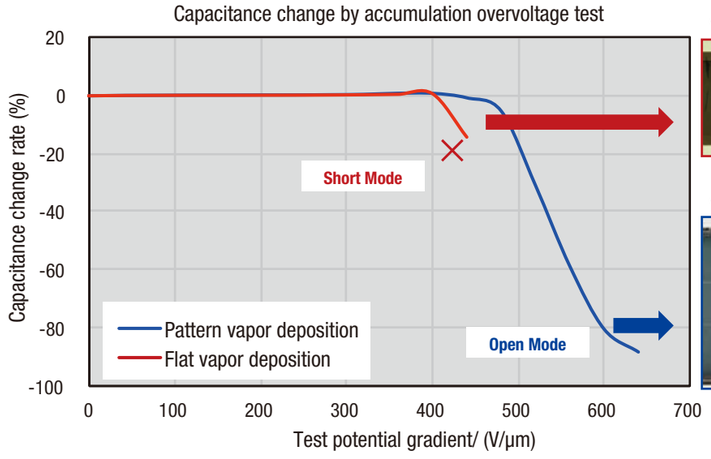


The fuse parts at the four corners are cut by overcurrent and insulation is recovered.

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



Flat vapor deposition product

Flat vapor deposition Appearance after the test: Wrapping breakage, element elution

Pattern vapor deposition product

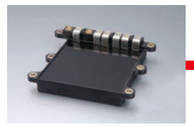
Pattern vapor deposition Appearance after the test: No abnormality

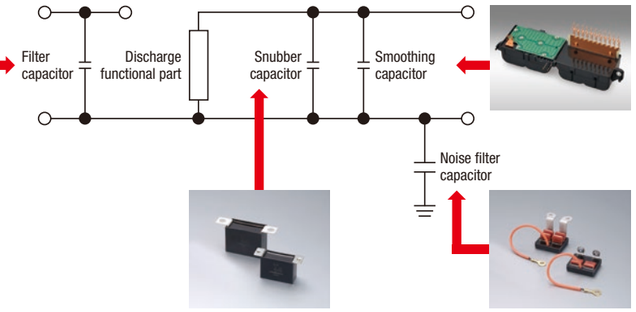
∗ In this test, the test power supply is shut off by detecting the short mode with the overcurrent, but there is a possibility of burning or fire if it is not shut off.

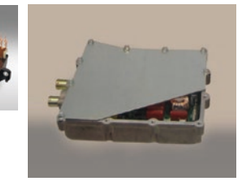
We adopt film with vapor deposition pattern security mechanism to realize safety and long life.

Sample Uses for Inverter with Booster Function

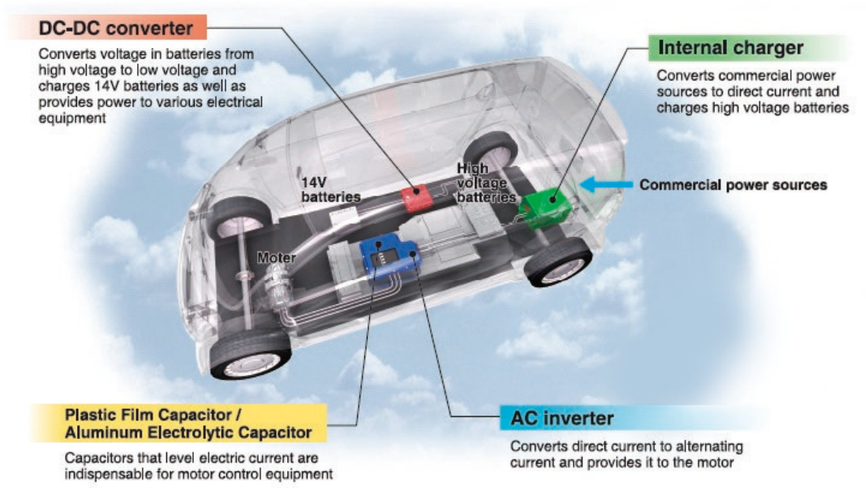
Capacitor Module Equivalence Circuit







DC-DC converter



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