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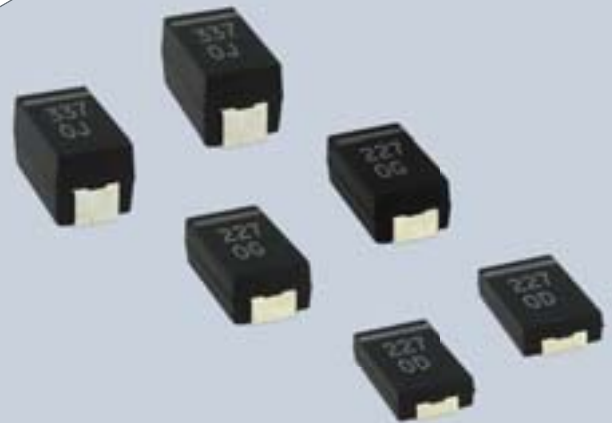
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Polymer Aluminum Electrolytic Capacitors

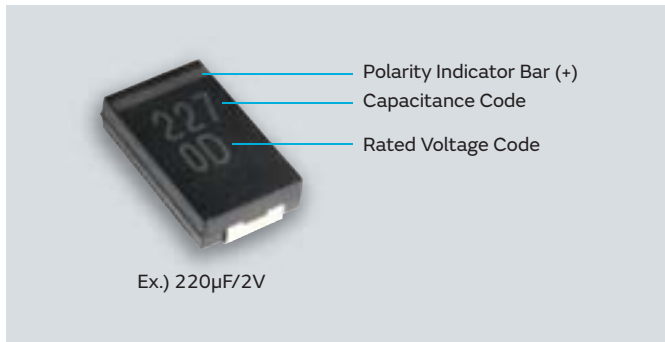


Description

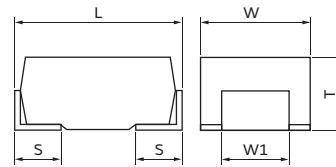
Murata Manufacturing Co., Ltd.'s ECAS series of polymer aluminum electrolytic capacitors realize low ESR, low impedance and high capacitance by means of multilayered aluminum foil for anode, solid conductive polymer for cathode. With no bias characteristics and stable temperature characteristics, ECAS series have excellent performance in ripple absorption, smoothing and transient response suitable for numerous applications. Therefore, it is suitable for smoothing of input-output current of various power supply circuits, and the backup use over the load change of the CPU circumference.

This contributes to reduction of the number of parts, or reduction of substrate area.

Appearance



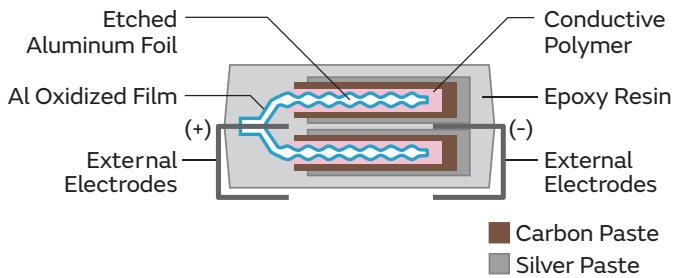
External Dimensions



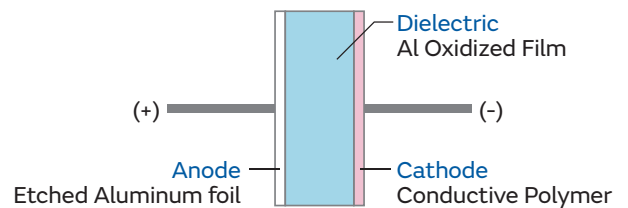
| Case Size | EIA Metric | L | W | T | W1 | S |
|-----------|------------|---------|---------|---------|---------|---------|
| D3 | 7343 | 7.3±0.3 | 4.3±0.2 | 1.4±0.1 | 2.4±0.2 | 1.3±0.2 |
| D4 | 7343 | 7.3±0.3 | 4.3±0.2 | 1.9±0.1 | 2.4±0.2 | 1.3±0.2 |
| D6 | 7343 | 7.3±0.3 | 4.3±0.2 | 2.8±0.3 | 2.4±0.2 | 1.3±0.2 |
| D9 | 7343 | 7.3±0.3 | 4.3±0.3 | 4.2±0.3 | 2.4±0.2 | 1.3±0.2 |

(in mm)

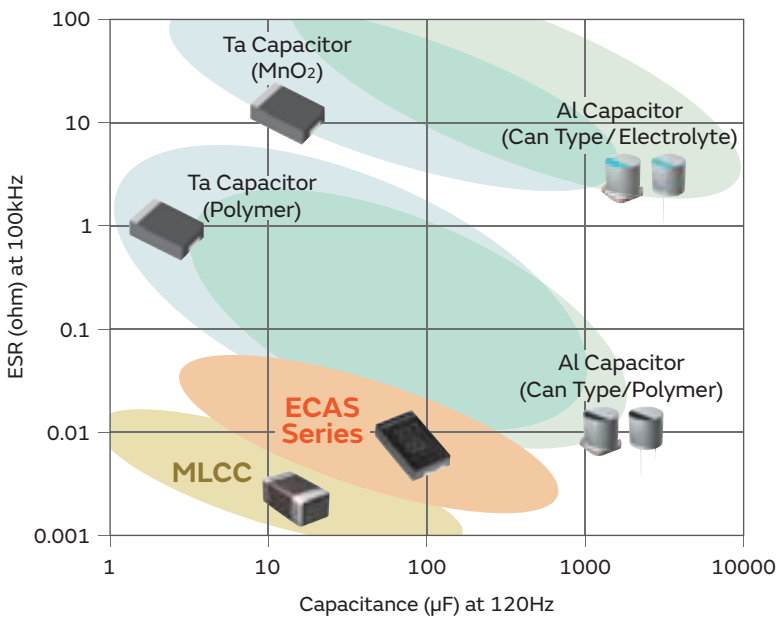
Example of Structure



Capacitor Model



Capacitor Map (Cap & ESR)



Specifications

- Capacitance Range : 6.8 to 560µF
- Operating Temperature: -40°C to +105°C
- Rated Voltage : 2 to 25Vdc
- ESR : 4.5 to 70mΩ

Features

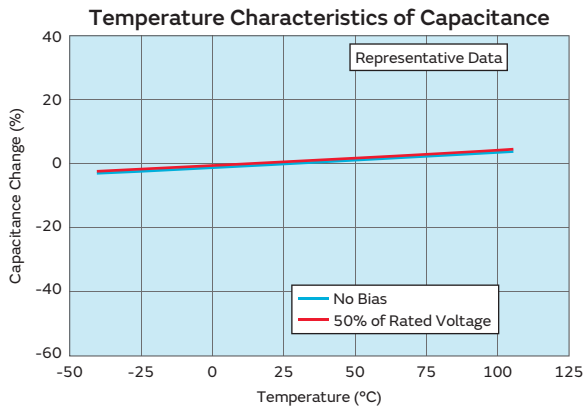
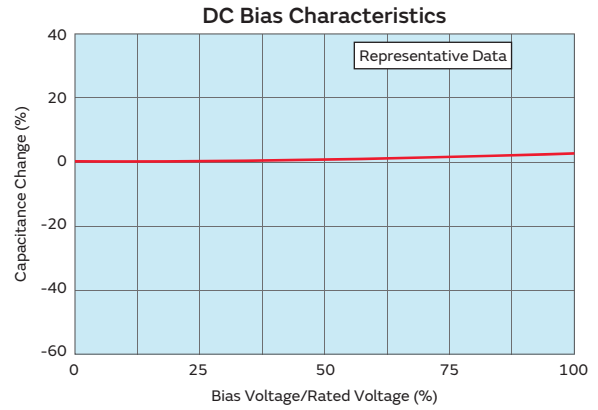
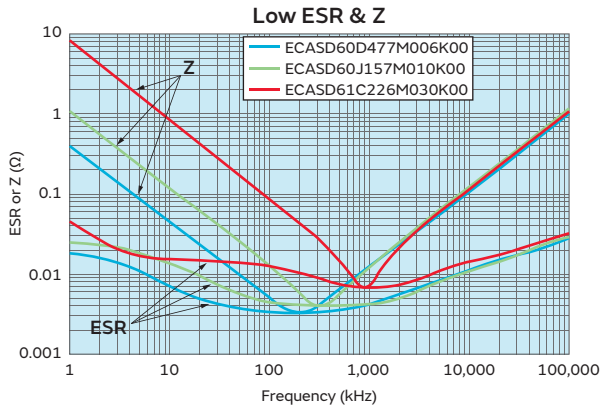
- High capacitance and Low ESR
- Stable capacitance with applied DC voltage/temperature/high frequencies
- Excellent Ripple absorption, Smoothing, Transient response
- No voltage derating required
- Polarity bar (positive) noted on product
- Surface mount construction
- RoHS compliant
- Halogen free
- MSL 3 packaging

Product Lineup

| | | Capacitance Value (μF) | | | | | | | | | | | | | | |
|---------------------|------|------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------|-----------|
| | | 6.8 | 10 | 15 | 22 | 33 | 47 | 56 | 68 | 100 | 150 | 220 | 330 | 470 | 560 | |
| Rated Voltage (Vdc) | 2 | | | | | | | | | D4 16 | D4 9 | D4 9 | D6 7 | D6 4.5 | D6 6 | D9 4.5 |
| | 2.5 | | | | | | | | | | | | | D6 4.5 | D6 6 | D6 9 |
| | 4 | | | | | | | | D4 20 | D4 16 | D4 16 | D4 9 | D6 10 | D9 8 | | |
| | 6.3 | | D4 55 | | D4 45 | D4 25 | D4 25 | | D4 15 | D4 15 | D6 10 | D6 10 | D9 9 | | | |
| | 10 | | D4 55 | | D4 28 | D4 25 | D4 25 | | D6 15 | D9 10 | D9 10 | | | | | |
| | 12.5 | | D4 55 | D4 45 | D4 30 | D4 25 | D6 20 | D6 20 | | D9 12 | | | | | | |
| | 16 | D4 70 | D4 60 | D4 40 | D6 30 | D4 40 | D3 40 | D4 40 | | D4 40 | | | | | | |
| | 25 | | D4 40 | D4 40 | D4 40 | | | | | | | | | | | |

D4 — Case Size Code
55 — ESR (mΩ)

Characteristics




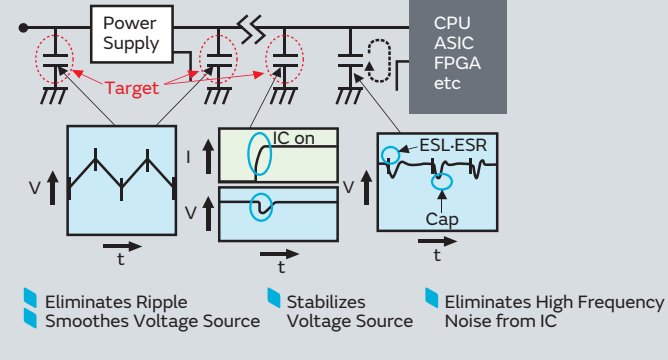



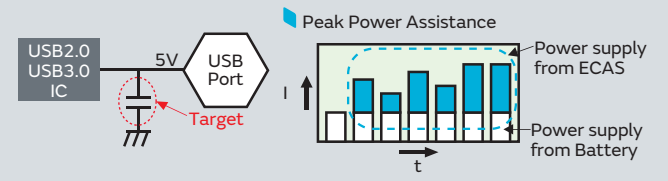
Design Support Tool - SimSurfing



<https://www.murata.com/simsurfing/>

- Frequency responses (Z, ESR, ESL) of ECAS Series are available.
- Netlist and S-parameter can be downloaded.
- The software "SimSurfing" is also available for your simulation on the go where no internet connection is available.

Applications

| Market | Set/Application | Overall Power Management |
|--|-----------------------------|---|
| Consumer  | Notebook/Ultrabook | Ex.1) Power Supply line around IC etc...  <p>Eliminates Ripple Smooths Voltage Source</p> <p>Stabilizes Voltage Source</p> <p>Eliminates High Frequency Noise from IC</p> |
| | Digital TV (LCD/OLED) | |
| | Audio/Projector | |
| | Set Top Box | |
| | Game Console | |
| | Drone | |
| | VR | |
| Enterprise  | Server | |
| | Multi Function Printer | |
| | Enterprise Display (LCD) | |
| | Smart Meter | |
| | Security (Camera/Home) | |
| | Amusement | |
| | POS/Handy Terminal | |
| Industrial  | Robotics | |
| | PLC | |
| | Industrial PC | |
| Network  | Production Equipment/Module | |
| | Base Station (Wireless) | Ex.2) USB bus power line  <p>Peak Power Assistance</p> <p>Power supply from ECAS</p> <p>Power supply from Battery</p> |
| | G-PON (Optical) | |
| Switch/Router | | |

Part Numbering

(Part Number)

| | | | | | | | |
|------|----|----|-----|---|-----|---|----|
| ECAS | D4 | OD | 227 | M | 009 | K | 00 |
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ |

① Series

| Product ID | |
|------------|-----------------------------------|
| ECAS | Polymer Al Electrolytic Capacitor |

② Dimension (LxWxT) (mm)

| Code | L | W | T |
|------|---------|---------|---------|
| D3 | 7.3±0.3 | 4.3±0.2 | 1.4±0.1 |
| D4 | 7.3±0.3 | 4.3±0.2 | 1.9±0.1 |
| D6 | 7.3±0.3 | 4.3±0.2 | 2.8±0.3 |
| D9 | 7.3±0.3 | 4.3±0.3 | 4.2±0.3 |

③ Rated Voltage

| Code | Rated Voltage |
|------|---------------|
| OD | DC 2V |
| OE | DC 2.5V |
| OG | DC 4V |
| OJ | DC 6.3V |
| OK | DC 8V |
| 1A | DC 10V |
| 1B | DC 12.5V |
| 1C | DC 16V |
| 1E | DC 25V |

④ Capacitance

Expressed by three-digit numeric code. The unit is pico-farad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two numbers.

Ex.)

| Code | Capacitance |
|------|-------------|
| 476 | 47μF |
| 107 | 100μF |
| 227 | 220μF |
| 477 | 470μF |

⑤ Capacitance Tolerance

| Code | Capacitance Tolerance |
|------|-----------------------|
| M | ±20% |

⑥ ESR

Expressed by three-digit alphanumeric. The unit is milli-ohm (mΩ). If there is a decimal point, it is expressed by the capital letter "R".

Ex.)

| Code | ESR |
|------|-------|
| 4R5 | 4.5mΩ |
| 009 | 9mΩ |
| 010 | 10mΩ |

⑦ Packaging

| Code | Packaging |
|------|------------------------|
| K | ø330mm Embossed Taping |

⑧ Individual Specification Code

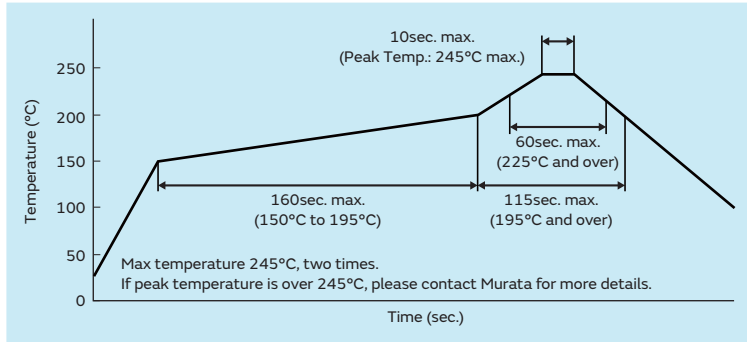
Expressed by two figures.

Specifications and Test Methods

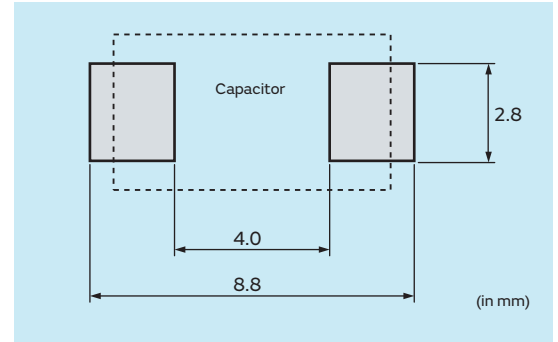
| No. | Item | Characteristics | Test Conditions | |
|-----|-----------------------------------|--|--|---|
| 1 | Operating Temperature Range | -40°C to +105°C | — | |
| 2 | Leakage Current | ≤The value of "Part Number Listing" | Series resistor : 1000 ohm Applied voltage: Rated Voltage Measuring after 2 minutes of application Please conduct pre-conditioning below, if you have a doubt. Pre-conditioning: Apply rated DC voltage for 1 hour at 105°C through 1000 ohm series resistor. Then discharge and keep in the room temperature for 4 to 24 hours. | |
| 3 | Capacitance Tolerance | Please refer to "Part Number Listing" | Measuring frequency : 120Hz ±10% | |
| 4 | Dissipation Factor | ≤0.06 | Measuring circuit : Equivalent series circuit Measuring voltage : +1Vr.m.s. Measuring temperature: 25°C | |
| 5 | ESR | ≤The value of "Part Number Listing" | Measuring frequency : 100kHz ±10% Measuring voltage : no more than +1Vr.m.s. Measuring temperature: 25°C | |
| 6 | Allowable Ripple Current | Please refer to "Part Number Listing" | Measuring frequency: 100kHz ±10% | |
| 7 | Solderability | More than 75% of each terminal face is covered by new solder | Lead Free Solder : Sn/3.0Ag/0.5Cu Flux : Rosin 25%, IPA 75% Solder temperature: 245 ±3°C Immersing time : 3 ±0.3s | |
| 8 | Moisture Resistance Under No Bias | Leakage Current | Test temperature: 60±2°C Relative humidity: 90 to 95%RH Test time : 500+24, -0h | |
| | | Capacitance Change | | ≤750% of initial specified value for 2V to 10V products ≤300% of initial specified value for 12.5V to 25V products |
| | | Dissipation Factor | | -20% and +50% of initial measured value |
| | | Appearance | | ≤0.12 |
| 9 | Moisture Resistance Under Load | Leakage Current | Test temperature: 60±2°C Relative humidity: 90 to 95%RH Test time : 500+24, -0h Applied voltage : Rated Voltage | |
| | | Capacitance Change | | ≤The value of "Part Number Listing" |
| | | Dissipation Factor | | -20% and +50% of initial measured value |
| | | Appearance | | ≤0.12 |
| 10 | Shelf Life | Leakage Current | Test temperature: 105±2°C Test time : 1000+48, -0h | |
| | | Capacitance Change | | ±10% of initial measured value |
| | | Dissipation Factor | | ≤0.06 |
| | | Appearance | | No defects or abnormalities |
| 11 | Endurance | Leakage Current | Test temperature: 105±2°C Test time : 2000+48, -0h Applied voltage : Rated Voltage | |
| | | Capacitance Change | | ≤The value of "Part Number Listing" |
| | | Dissipation Factor | | ±20% of initial measured value |
| | | Appearance | | ≤0.06 |
| 12 | Surge | Leakage Current | Temperature: +85°C for 2V to 10V products Room temp. for 12.5V to 25V products Applied voltage: Rated voltage x1.25 for 2V to 10V products Rated voltage x1.15 for 12.5V to 25V products Current limiting resistance: 33 ohm (in series) for 2V to 10V products 1k ohm (in series) for 12.5V to 25V products Discharge resistance: 33 ohm (in series) for 2V to 10V products 1k ohm (in series) for 12.5V to 25V products Charge on/off: 30 sec. each, 1000 times | |
| | | Capacitance Change | | ≤The value of "Part Number Listing" |
| | | Dissipation Factor | | ±10% of initial measured value |
| | | Appearance | | ≤0.06 |

(The measurement condition in No.2 to 4 applies to No.8 to 12.)

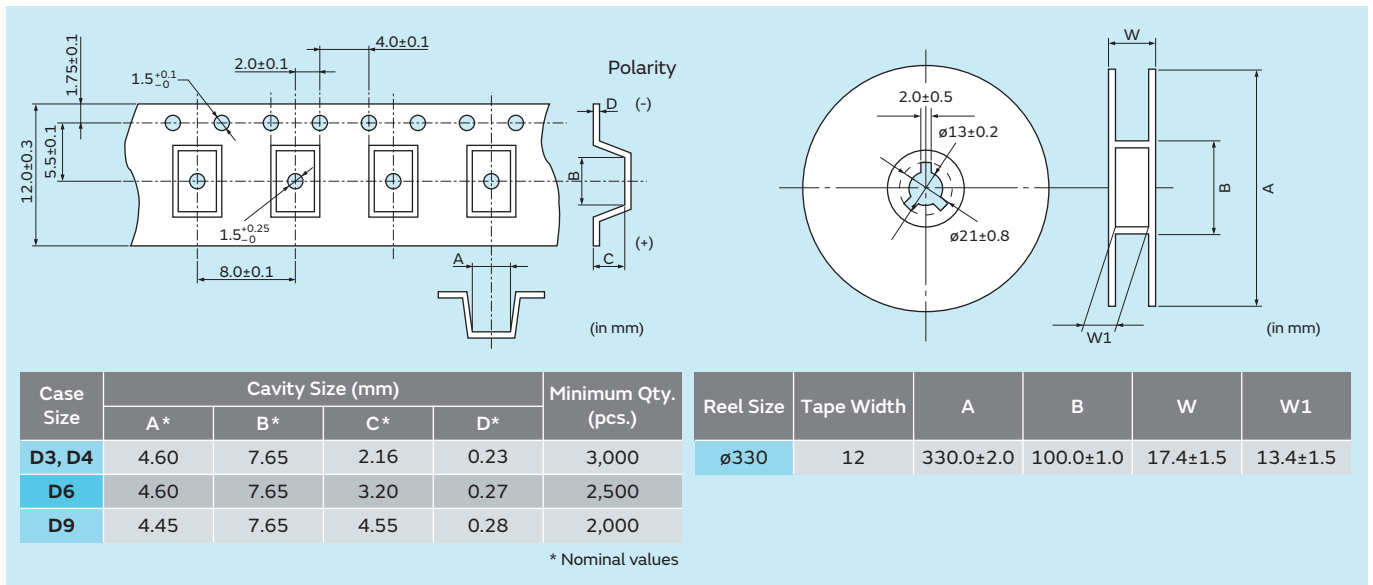
Recommended Reflow Profile



Land Pattern Design



Packaging



Part Number Listing

| Part Number | Rated Voltage (V.DC) | Cap. (µF) | Cap. Tolerance (%) | Case Size | | | ESR Max. (mΩ) 100kHz /+25°C | Leakage Current (µA) | Ripple Current (Arms) 100kHz /+105°C ^(*) | Min. Packaging Quantity (pcs) |
|--------------------|----------------------|-----------|--------------------|-----------|------------|--------|-----------------------------|----------------------|---|-------------------------------|
| | | | | Code | L x W (mm) | T (mm) | | | | |
| ECASD40D107M016K00 | 2 | 100 | ±20 | D4 | 7343 | 1.9 | 16 | 20.0 | 2.0 | 3,000 |
| ECASD40D157M009K00 | 2 | 150 | ±20 | D4 | 7343 | 1.9 | 9 | 30.0 | 3.0 | 3,000 |
| ECASD40D227M009K00 | 2 | 220 | ±20 | D4 | 7343 | 1.9 | 9 | 44.0 | 3.0 | 3,000 |
| ECASD60D337M007K00 | 2 | 330 | ±20 | D6 | 7343 | 2.8 | 7 | 66.0 | 3.5 | 2,500 |
| ECASD60D477M4R5K00 | 2 | 470 | ±20 | D6 | 7343 | 2.8 | 4.5 | 94.0 | 4.0 | 2,500 |
| ECASD60D477M006K00 | 2 | 470 | ±20 | D6 | 7343 | 2.8 | 6 | 94.0 | 3.5 | 2,500 |
| ECASD90D567M4R5K00 | 2 | 560 | ±20 | D9 | 7343 | 4.2 | 4.5 | 112.0 | 4.0 | 2,000 |
| ECASD60E477M4R5K00 | 2.5 | 470 | ±20 | D6 | 7343 | 2.8 | 4.5 | 117.5 | 4.0 | 2,500 |
| ECASD60E477M006K00 | 2.5 | 470 | ±20 | D6 | 7343 | 2.8 | 6 | 117.5 | 3.5 | 2,500 |
| ECASD60E477M009K00 | 2.5 | 470 | ±20 | D6 | 7343 | 2.8 | 9 | 117.5 | 3.0 | 2,500 |
| ECASD40G686M020K00 | 4 | 68 | ±20 | D4 | 7343 | 1.9 | 20 | 27.2 | 1.9 | 3,000 |
| ECASD40G107M016K00 | 4 | 100 | ±20 | D4 | 7343 | 1.9 | 16 | 40.0 | 2.1 | 3,000 |
| ECASD40G157M016K00 | 4 | 150 | ±20 | D4 | 7343 | 1.9 | 16 | 60.0 | 2.1 | 3,000 |
| ECASD40G227M009K00 | 4 | 220 | ±20 | D4 | 7343 | 1.9 | 9 | 88.0 | 3.0 | 3,000 |

(*1) Please refer to Cautions <6>② regarding this temperature.

| Part Number | Rated Voltage (V.DC) | Cap. (μF) | Cap. Tolerance (%) | Case Size | | | ESR Max. (mΩ) 100kHz /+25°C | Leakage Current (μA) | Ripple Current (Arms) 100kHz /+105°C ^(*) | Min. Packaging Quantity (pcs) |
|--------------------|----------------------|-----------|--------------------|-----------|------------|--------|-----------------------------|----------------------|---|-------------------------------|
| | | | | Code | L x W (mm) | T (mm) | | | | |
| ECASD60G227M010K00 | 4 | 220 | ±20 | D6 | 7343 | 2.8 | 10 | 88.0 | 3.0 | 2,500 |
| ECASD90G337M008K00 | 4 | 330 | ±20 | D9 | 7343 | 4.2 | 8 | 132.0 | 3.3 | 2,000 |
| ECASD40J106M055K00 | 6.3 | 10 | ±20 | D4 | 7343 | 1.9 | 55 | 6.3 | 1.0 | 3,000 |
| ECASD40J226M045K00 | 6.3 | 22 | ±20 | D4 | 7343 | 1.9 | 45 | 13.9 | 1.0 | 3,000 |
| ECASD40J336M025K00 | 6.3 | 33 | ±20 | D4 | 7343 | 1.9 | 25 | 20.8 | 1.8 | 3,000 |
| ECASD40J476M025K00 | 6.3 | 47 | ±20 | D4 | 7343 | 1.9 | 25 | 29.7 | 1.8 | 3,000 |
| ECASD40J686M015K00 | 6.3 | 68 | ±20 | D4 | 7343 | 1.9 | 15 | 42.9 | 2.0 | 3,000 |
| ECASD40J107M015K00 | 6.3 | 100 | ±20 | D4 | 7343 | 1.9 | 15 | 63.0 | 2.0 | 3,000 |
| ECASD60J157M010K00 | 6.3 | 150 | ±20 | D6 | 7343 | 2.8 | 10 | 94.5 | 3.0 | 2,500 |
| ECASD60J227M010K00 | 6.3 | 220 | ±20 | D6 | 7343 | 2.8 | 10 | 138.6 | 3.0 | 2,500 |
| ECASD90J337M009K00 | 6.3 | 330 | ±20 | D9 | 7343 | 4.2 | 9 | 207.9 | 3.4 | 2,000 |
| ECASD41A106M055K00 | 10 | 10 | ±20 | D4 | 7343 | 1.9 | 55 | 10.0 | 1.0 | 3,000 |
| ECASD41A226M028K00 | 10 | 22 | ±20 | D4 | 7343 | 1.9 | 28 | 22.0 | 1.6 | 3,000 |
| ECASD41A336M025K00 | 10 | 33 | ±20 | D4 | 7343 | 1.9 | 25 | 33.0 | 1.8 | 3,000 |
| ECASD41A476M025K00 | 10 | 47 | ±20 | D4 | 7343 | 1.9 | 25 | 47.0 | 1.8 | 3,000 |
| ECASD61A686M015K00 | 10 | 68 | ±20 | D6 | 7343 | 2.8 | 15 | 68.0 | 2.0 | 2,500 |
| ECASD91A107M010K00 | 10 | 100 | ±20 | D9 | 7343 | 4.2 | 10 | 100.0 | 3.0 | 2,000 |
| ECASD91A157M010K00 | 10 | 150 | ±20 | D9 | 7343 | 4.2 | 10 | 150.0 | 3.0 | 2,000 |
| ECASD41B106M055K00 | 12.5 | 10 | ±20 | D4 | 7343 | 1.9 | 55 | 12.5 | 1.0 | 3,000 |
| ECASD41B156M045K00 | 12.5 | 15 | ±20 | D4 | 7343 | 1.9 | 45 | 18.8 | 1.0 | 3,000 |
| ECASD41B226M030K00 | 12.5 | 22 | ±20 | D4 | 7343 | 1.9 | 30 | 27.5 | 1.6 | 3,000 |
| ECASD41B336M025K00 | 12.5 | 33 | ±20 | D4 | 7343 | 1.9 | 25 | 41.3 | 1.8 | 3,000 |
| ECASD61B476M020K00 | 12.5 | 47 | ±20 | D6 | 7343 | 2.8 | 20 | 58.8 | 2.0 | 2,500 |
| ECASD61B566M020K00 | 12.5 | 56 | ±20 | D6 | 7343 | 2.8 | 20 | 70.0 | 2.0 | 2,500 |
| ECASD91B107M012K00 | 12.5 | 100 | ±20 | D9 | 7343 | 4.2 | 12 | 125.0 | 2.5 | 2,000 |
| ECASD41C685M070K00 | 16 | 6.8 | ±20 | D4 | 7343 | 1.9 | 70 | 10.9 | 1.0 | 3,000 |
| ECASD41C106M060K00 | 16 | 10 | ±20 | D4 | 7343 | 1.9 | 60 | 16.0 | 1.0 | 3,000 |
| ECASD41C156M040K00 | 16 | 15 | ±20 | D4 | 7343 | 1.9 | 40 | 24.0 | 1.0 | 3,000 |
| ECASD61C226M030K00 | 16 | 22 | ±20 | D6 | 7343 | 2.8 | 30 | 35.2 | 1.6 | 2,500 |
| ECASD41C336M040KA0 | 16 | 33 | ±20 | D4 | 7343 | 1.9 | 40 | 158.4 | 1.6 | 3,000 |
| ECASD31C476M040KA0 | 16 | 47 | ±20 | D3 | 7343 | 1.5 | 40 | 225.6 | 1.6 | 3,000 |
| ECASD41C476M040KA0 | 16 | 47 | ±20 | D4 | 7343 | 1.9 | 40 | 225.6 | 1.6 | 3,000 |
| ECASD41C686M040KA0 | 16 | 68 | ±20 | D4 | 7343 | 1.9 | 40 | 326.4 | 1.6 | 3,000 |
| ECASD41E106M040KA0 | 25 | 10 | ±20 | D4 | 7343 | 1.9 | 40 | 75.0 | 1.6 | 3,000 |
| ECASD41E156M040KA0 | 25 | 15 | ±20 | D4 | 7343 | 1.9 | 40 | 112.5 | 1.6 | 3,000 |
| ECASD41E226M040KA0 | 25 | 22 | ±20 | D4 | 7343 | 1.9 | 40 | 165.0 | 1.6 | 3,000 |

(*1) Please refer to Cautions <6>② regarding this temperature.

Cautions for Use

Cautions

<1> Prohibited Circuits For Use

Do not use the capacitor with the following circuits.

- ①Time-constant circuit ②Coupling circuits ③2 or more capacitors connected serially
- ④Circuit which are greatly affected by leakage current

<2> Polarity

Polymer aluminum electrolytic capacitor is polarized. Please not to reverse the polarity when using.

If reverse voltage is applied even momentary, it may damage the oxide film and the capacitor itself.

<3> Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the Vp-p value of the applied voltage or the Vo-p which contains DC bias within the rated voltage range.

When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

<4> Inrush Current

Extreme inrush current may cause short circuit or leakage current increase. If the inrush current exceeds 20A, adding protection circuit is recommended.

<5> Allowable Ripple Current

Please not to apply ripple current exceeding the allowable value specified in this document. If excessive current is applied, it may generate heat and the heat may damage the capacitor.

The sum of DC voltage and the peak AC voltage shall not exceed the rated voltage. The sum of the DC voltage and the peak AC voltage shall not allow a voltage reversal.

<6> Operating Temperature

The operating temperature limit depends on the capacitor.

①Do not apply temperature exceeding the upper operating temperature. It is necessary to select a capacitor with a suitable rated temperature that will cover the operating temperature range. Also it is necessary to consider the temperature distribution in equipment and the seasonal temperature variable factor.

②Consider the self-heating of the capacitor. The surface temperature of the capacitor shall be the upper operating temperature or less when including the self-heating factors.

<7> Reflow Soldering

Please not to apply excessive force to the capacitor during insertion as well as after soldering. The excessive force may result in damage to electrode terminals and/or degradation of electrical performance.

<8> Conditions for soldering with iron Temperature of iron tip: 350 ±5°C max. (70W max.)

Soldering time: Within 3 sec. for each terminal Times: 1 time only for each terminal

Please do not touch the capacitor body with iron or apply excessive force to the capacitor while soldering.

Do not reuse the capacitor once removed from a printed circuit board.

<9> Operating Environment

Confirm the environment in which the equipment will operate is under the specified conditions. Do not use the equipment under the following environments.

- ①Being splattered with water or oil. ②Being exposed to direct sunlight. ③Being exposed to Ozone, ultraviolet rays or radiation.
- ④Being exposed to toxic gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas, etc.)
- ⑤Being exposed to excessive vibrations or mechanical shocks. ⑥Being exposed to condensable environments.

Storage Conditions

<1> Term of warranty for this product is two years after packaging in a moisture-proof bag, under the conditions below with sealed packaging.

Recommended storage environment Room temperature: 5-30°C Humidity: no more than 60%RH

<2> Polymer aluminum electrolytic capacitors should not be stored in an atmosphere consisting of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas, etc.).

<3> Polymer aluminum electrolytic capacitors should be stored in a dry atmosphere, avoiding direct sunlight and condensation. If capacitors are kept at a higher humidity, the following problems may occur:

①Leakage current will increase at the beginning of use and damage the circuit.

②Moisture absorbed in a resin will evaporate and expand with heat of mounting and damage the mold resin.

<4> Please confirm a dry state with a humidity indicator card after open immediately. If 20% indication was in a pink state after opened, it is recommended to bake under the conditions below.

<5> The capacitors should be kept dry using desiccators or any other methods after unsealing the moisture-proof packaging. If more than one week has passed under the recommended storage environment specified above after unsealing the packaging, it is recommended to bake under the conditions below.

Recommended baking conditions Temperature: 60 (+0, -5) °C Time: 168 hours

<6> This product meets MSL-3.

EU RoHS Compliant

- All the products in this catalog comply with EU RoHS.
- EU RoHS is "the European Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment."
- For more details, please refer to our website 'Murata's Approach for EU RoHS' (<http://www.murata.com/en-us/support/compliance/rohs>).

Global Locations

For details please visit www.murata.com



⚠ Note

1 Export Control

For customers outside Japan:

No Murata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contribution to (1) any weapons (Weapons of Mass Destruction [nuclear, chemical or biological weapons or missiles] or conventional weapons) or (2) goods or systems specially designed or intended for military end-use or utilization by military end-users.

For customers in Japan:

For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

2 Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.

- ① Aircraft equipment
- ② Aerospace equipment
- ③ Undersea equipment
- ④ Power plant equipment
- ⑤ Medical equipment
- ⑥ Transportation equipment (vehicles, trains, ships, etc.)
- ⑦ Traffic signal equipment
- ⑧ Disaster prevention / crime prevention equipment
- ⑨ Data-processing equipment
- ⑩ Application of similar complexity and/or reliability requirements to the applications listed above

3 Product specifications in this catalog are as of March 2018. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.

4 Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.

5 This catalog has only typical specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

6 Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.

7 No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

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