Messrs. ALMAR ENTERPRISES CO.,LTD.

ALUMINUM ELECTROLYTIC CAPACITORS SPECIFICATION SHEET

RoHS Compliance

CUSTOMER PART No.		
RUBYCON PART No.	MXE Series	
DRAWING No.	REE-050162	ISSUE No.1
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Rubycon Aluminum electrolytic capacitors Specification Sheet
MXE Series

Drawing No. : REE-050162
Issue No. : 1

1. Scope

This specification shall apply to MXE Series , polarized aluminum electrolytic capacitors with non-solid electrolyte which we deliver to you for use in electronic equipments.

2. Reference Standard

JIS C 5101-1 Fixed capacitors for use in electronic equipment - Part 1 : Generic specification

JIS C 5101-4 Fixed capacitors for use in electronic equipment - Part 4 : Sectional specification: Aluminum electrolytic capacitors with solid (MnO_2) and non-solid electrolyte

3. Style and Numbering System

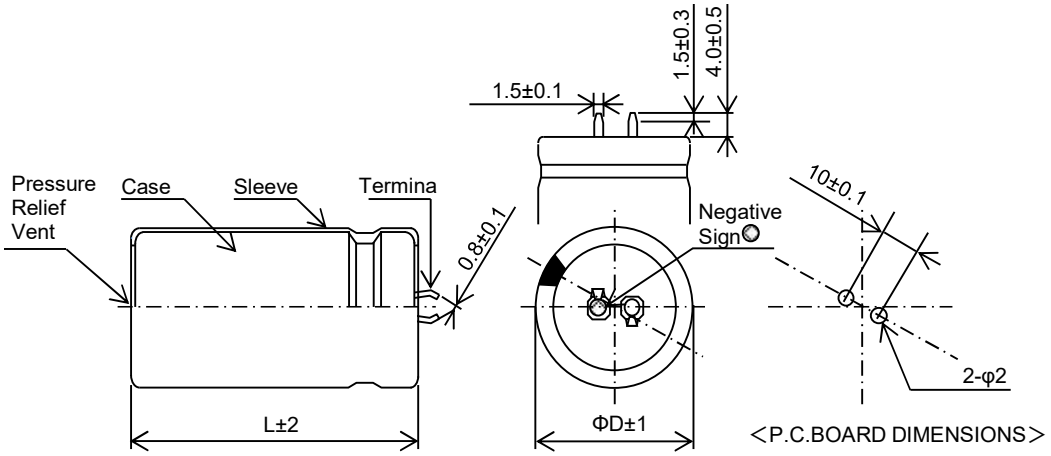
(1) Capacitor type CE

(2) Capacitor Style 69

(3) Numbering System

Rated Voltage	Series	Capacitance	Capacitance Tolerance	Option	Terminal Code	Case Size
□□□	MXE	□□□□	M	EFC	SN	ΦD X L

4. Diagram of dimensions (Unit : mm)



5. Electrical Performance

Category Temperature Range	400 ～ 450 Vdc	-25 ～ 105	(℃)
Nominal Capacitance	20℃/120Hz	See Table-2	(μF)
Capacitance Tolerance	20℃/120Hz	See Table-2	(%)
Rated Voltage		See Table-2	(V.DC)
Surge Voltage		See Table-2	(V.DC)
Leakage Current	20℃,5min	See Table-2	(μA max.)
Dissipation Factor (tanδ)	20℃/120Hz	See Table-2	(max)
Rated Ripple Current	105℃/120Hz	See Table-2	(Ar.m.s.)
Impedance Ratio 120Hz		See Table-1-6	(max)

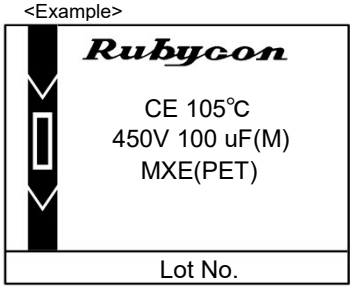
6. Marking

Unless otherwise specified, capacitor shall be clearly marked the following items on its body.

Sleeve color: Black, Lettering color: White

(1)Trade mark
(2)Mark Indicating Electrolytic Capacitor
(3)Upper Operating Temperature
(4)Rated Voltage
(5)Nominal Capacitance (Tolerance)
(6)Series (Sleeve material)
(7)Polarity
(8)Lot No.

<Example>



7. PERFORMANCE

<Table-1>

〔Standard Test Conditions〕

Standard conditions: In the absence of provision, test and measurement shall be conducted in the following standard condition.

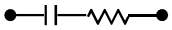
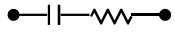
Temperature：15℃～35℃
Relative Humidity：25%～75%
Atmospheric Pressure：86kPa～106kPa

〔Post Processing〕

As a post processing after the test, please leave the capacitor in the measurement temperature(20℃±2℃) for enough time until whole of it reaches the measurement temperature.

If there are no provision, please leave the capacitor in the standard conditions for 1~2 hours.

<table>
<tr><td>1</td><td>Leakage Current</td><td>＜Condition＞
D.C. voltage applied to capacitors to measure leakage current shall be controlled so that the voltage reaches the rated voltage within one minute. Leakage current shall be measured for 5 minutes after the D.C.voltage applied has reached the rated voltage across a 1000 ±10 ohm series protection resistor.(20±2℃)

<Criteria>
Not more than the value of Table-2</td></tr>
<tr><td>2</td><td>Nominal Capacitance
(Capacitance Tolerance)</td><td>＜Condition＞
Measuring Frequency：120Hz±20%
Measuring Voltage：Not more than 0.5Vrms
Measuring Temperature：20±2℃
Measuring Circuit：Series circuit 
<Criteria>
The value of Table-2
(-20 ~ +20 %)</td></tr>
<tr><td>3</td><td>Dissipation Factor
(tanδ)</td><td>＜Condition＞
Measuring Frequency：120Hz±20%
Measuring Voltage：Not more than 0.5Vrms
Measuring Temperature：20±2℃
Measuring Circuit：Series circuit 
＜Criteria＞
Not more than the value of Table-2</td></tr>
<tr><td>4</td><td>Rated Ripple Current</td><td>＜Definition＞
The rated ripple current is the maximum A.C.current at 120Hz which can be applied at maximum operating temperature.The combined value of the D.C.voltage and the peak A.C.voltage shall not exceed the rated voltage.

＜Criteria＞
The value of Table-2
〔Frequency Coefficient〕
<table>
<tr><td>Frequency (Hz)</td><td>60(50)</td><td>120(100)</td><td>300</td><td>500</td><td>1k</td><td>10k≤</td></tr>
<tr><td>Coefficient</td><td>0.80</td><td>1.00</td><td>1.15</td><td>1.20</td><td>1.25</td><td>1.40</td></tr>
</table>
〔Temperature Coefficient〕
<table>
<tr><td>Ambient Temperature (℃)</td><td>105</td><td>85</td><td>65≥</td></tr>
<tr><td>Coefficient</td><td>1.00</td><td>1.88</td><td>2.26</td></tr>
</table>
Temperature coefficient shows the limit that can pass the ripple current exceeding the rated ripple current (table 1) at each temperature when the life expectancy of the capacitor becomes nearly equal.</td></tr>
</table>

5 Variation of Characteristics by Temperature

＜Condition＞

STEP	Testing Temperature (℃)	Time
1	20±2	Time to reach thermal equilibrium
2	-25±3	〃
3	105±2	〃

Capacitance, D.F. and Impedance shall be measured at 120Hz.

＜Criteria＞

STEP2	Impedance Ratio	The ratio of STEP 1 and STEP 2 shall be less than value of Table-1-6
STEP3	Capacitance Change	Within ±20% of the value of STEP 1
	Dissipation Factor	Not more than the value of Table-2
	Leakage Current	Not more than 8 times the value of Table-2

6 Low Temperature Stability Impedance Ratio(MAX)

＜Condition＞

Impedance shall be measured at -25℃, 20℃ and 120Hz.

＜Criteria＞

Rated Voltage (V.DC)	400 ~ 450
Z(-25℃) / Z(20℃)	8

Z(-25℃)：Impedance at -25℃ Z(20℃)：Impedance at 20℃

7 Surge

＜Condition＞

The capacitor shall be applied surge voltage through a (100±50) / CR <KΩ> resistor in series for 30±5 seconds in every 6±0.5 minutes at 15 ～ 35℃. The procedure shall be repeated 1000 times.
Then the capacitors shall be left under the normal temperature and normal humidity for1 to 2 hours before measurement. [CR : Nominal Capacitance (μF)]

＜Criteria＞

Items	Required performance
Capacitance Change	Within ±15% of the initial value
Dissipation Factor	Not more than the value of Table-2
Leakage Current	Not more than the value of Table-2
Appearance	No visible damage and no leakage of electrolyte

This item provides for overvoltage at abnormal situations, and not be hypothesizing that overvoltage is always applied.

8 Resistance to Soldering Heat

＜Condition＞

◇Solder bath method
Terminals of the capacitor shall be immersed into solder bath at 260±3°C for 10±1 seconds up to 2.0 to 2.5mm from the body of capacitor.
Then the capacitor shall be left under the standard conditions for 1 to 2 hours before measurement.
◇Solder iron method
370±10℃(Soldering Iron top) 5±1sec.

＜Criteria＞

Items	Required performance
Capacitance Change	Within ±10% of the initial value
Dissipation Factor	Not more than the value of Table-2
Leakage Current	Not more than the value of Table-2
Appearance	No visible damage and clearly marking

<table>
<tr><td>9</td><td>Resistance to Damp Heat
(Steady State)</td><td>＜Condition＞
The capacitor shall be stored in the ambient of 40±2℃ and relative humidity 90～95% for 240± 8 hours.
After the test, the test sample shall be stored under normal temperature and normal humidity for 1～2 hours before measurement.

＜Criteria＞
<table>
<tr><th>Items</th><th>Required performance</th></tr>
<tr><td>Capacitance Change</td><td>Within ±10%of the initial value</td></tr>
<tr><td>Dissipation Factor</td><td>Not more than the value of Table-2</td></tr>
<tr><td>Leakage Current</td><td>Not more than the value of Table-2</td></tr>
<tr><td>Appearance</td><td>No visible damage and clearly marking, no leakage of electrolyte.</td></tr>
</table></td></tr>
<tr><td>10</td><td>Endurance</td><td>＜Condition＞
D.C.voltage and rated ripple current shall be applied to capacitors for a period of 2000 +72/0 hours at maximum operating temperature ±2℃.
The D.C.voltage and peak A.C.voltage combined must not exceed the rated voltage.
The capacitors under test shall be protected against direct heat radiation from the heat source.
After the test, the capacitor shall meet the following requirements.
＜Criteria＞
<table>
<tr><th>Items</th><th>Required performance</th></tr>
<tr><td>Capacitance Change</td><td>Within ±20% of the initial value</td></tr>
<tr><td>Dissipation Factor</td><td>Not more than 200% of the value of Table-2</td></tr>
<tr><td>Leakage Current</td><td>Not more than the value of Table-2</td></tr>
<tr><td>Appearance</td><td>No visible damage and no leakage of electrolyte.</td></tr>
</table></td></tr>
<tr><td>11</td><td>Shelf Life Test</td><td>＜Condition＞
After capacitors shall be stored at maximum operating temperature ±2℃ for a period of 1000 +48/-0 hours with no voltage applied, then the capacitors shall be left under the normal temperature and normal humidity for 16 hours before measurement.
(If any doubt arises on the judgment, the capacitors shall be subjected to the voltage treatment in JIS C 5101-4,4.1.)

＜Criteria＞
<table>
<tr><th>Items</th><th>Required performance</th></tr>
<tr><td>Capacitance Change</td><td>Within ±20% of the initial value</td></tr>
<tr><td>Dissipation Factor</td><td>Not more than 200% of the value of Table-2</td></tr>
<tr><td>Leakage Current</td><td>Not more than the value of Table-2</td></tr>
<tr><td>Appearance</td><td>No visible damage and no leakage of electrolyte.</td></tr>
</table></td></tr>
<tr><td>12</td><td>Terminal Strength</td><td>＜Condition＞
◇Tensile Strength of Terminals
The body of capacitors shall be fixed and the tensile force of 20N(2.0 kgf) shall be applied to the terminal in the lead out direction of the terminal for 10±1 seconds

◇Bending Strength of Terminals
The body of capacitors shall be fixed.
The weight of 25N(2.5 kgf) shall be applied to the terminal in the perpendicular direction against the lead out direction of the terminal at the part of 1.6mm from the body for 30±5 seconds.
At this time, if permanent change occurs in the terminal , the weight shall be removed, and the terminal shall be made straight to be the original form.
Then the weight shall be applied in the opposite direction with the same way.

＜Criteria＞
No visible damage.</td></tr>
<tr><td>13</td><td>Solderability</td><td>＜Condition＞
Terminals of the capacitor shall be immersed in flux (ethanol solution of the rosin, 25 wt% rosin) and shall be immersed in the solder bath.
＜Criteria＞
At least over 95% of circumferential surface of dipped portion of the terminal shall be covered with new solder.</td></tr>
</table>

14	Resistance to Vibration	＜Condition＞ Testing shall be done out in 3 AXIS for 2 hours each (total 6 hours) as below. Fix it by using mounting device separately. Vibration frequency range : 10 to 55Hz Peak to peak amplitude : 1.5mm Sweep rate : 10 to 55 to 10Hz, In about 1min ＜Criteria＞

Items	Required performance
Capacitance Change	Within ±5% of the initial value
Appearance	No visible damage and clearly marking, no leakage of electrolyte.

15	Vent Test	＜Condition＞ ◇D.C. reverse voltage method Capacitor shall be subjected to D.C. current given in the table below at reverse polarity.

Norminal body diameter of the capacitor	D.C.current (A)
Φ22.4 or less	1
more than Φ22.4	10

＜Criteria＞
The capacitor shall meet the either of the following two requirement.
① When the pressure relief vent operates, a flame shall not be observed or neither some piece of elements nor cases shall disperse, And a capacitor shall not be in a dangerous state.
② The vent shall not operate for 30 minutes and any abnormalities shall not be observed.

8. Factory

Manufacturing Factories	Address
Rubycon Corporation, Main Plant	1938-1,Nishi-minowa,Ina-city,Nagano-pref,JAPAN
Rubycon Corporation, Akita Factory	1-1,Tateai Aza uenodai,Yurihonjyou-city,Akita-pref,JAPAN
P.T. Rubycon Indonesia	Lot 224, Batamindo Industrial park, Mukakuning, Batam, INDONESIA

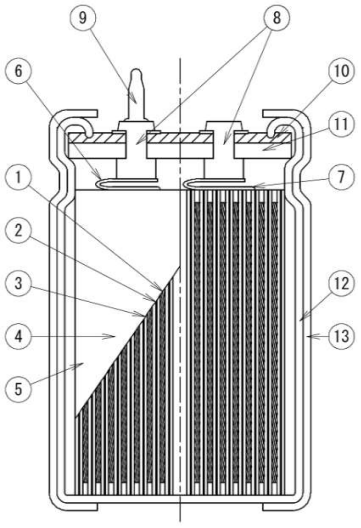
9. Indication of Lot No

□ □ □ □ □

→ Factory code
Blank ･･･Rubycon Corporation, Main Plant　A ･･･Akita Factory.　I ･･･P.T. Rubycon Indonesia
→ Twice of Manufactured day
→ Manufactured month　(Manufactured month : October = O, November = N, December = D)
→ Manufactured year (the last one digit of A.D)

10. Structure of Electrolytic Capacitors

№	Name	Material	Note
1	Anode Foil	Aluminum	
2	Cathode Foil	Aluminum	
3	Separator	Electrolytic Capacitor Paper	
4	Electrolyte	Etylene glycol	
5	Winding Tape	PP	
6	Anode Tab	Aluminum	
7	Cathode Tab	Aluminum	
8	Rivet	Aluminum	
9	Terminal	SPCC	Cu over 2μm + Sn over 6μm
10	Terminal Board	Rubber(EPT)	
11	Terminal Board	Bakelite	
12	Case	Aluminum	
13	Sleeve	P.E.T.	Appearance：Black



11. Compliance for RoHS Directive

This capacitor complies with the RoHS Directive. So this product don't use substances regulated by RoHS Directive intentionally.

12. Export Trade Control Ordinance

Products described in this specification are not applicable because they do not meet the regulation values for pulse capacitors and high voltage capacitors described in Appendix 1, Items 1 to 15 of the Export Trade Control Ordinance.

Products described in this specification are applicable to goods under Export Regulation based on Section 16 of Appendix Table 1 in Export Trade Control Ordinalce. In case that there is a certain danger of the products conflicting with the use and activity for the developments of weapons of mass destruction, the procedures based upon the relevant export regulation laws are absolutely needed.

13. Notes on use of aluminum electrolytic capacitors

(1)Charge and discharge

Do not use for the circuit that repeats quick charge or discharge.

(2) External stress

Do not apply excessive force of pushing, pulling bending, and/or twisting to the main body and terminals.

(3) Heat resistance at soldering process

In the soldering process of PC board with Capacitors mounted, secondary shrinkage or crack of sleeve may be observed when soldering temperature is too high and /or soldering time is too long.
If lead wire of other components or pattern of double sided PC board touches the capacitor, the similar failure may be also originated at pre-heating, heating at hardening process of adhesive and soldering process.

(4) Insulation and PC board mounting

Aluminum electrolytic capacitors are covered with P.E.T. sleeve which purpose is mainly indication of necessary items.
The case of capacitor and the cathode terminal are not insulated.

(5) Adhesives and coating materials

Do not use the adhesives and coating materials that contain halogenated organic solvents or chloroprene as polymer.

(6) Storage

Keep at a normal temperature and humidity. During a long storage time, leakage current will be increased. To prevent heat rise or any trouble that high leakage current possibly causes, voltage treatment is recommended for the capacitors that have been stored for a long time.

Storage time after shipment from Rubycon factory is less than 2 years.

<Storage Condition>

* Aluminum electrolytic capacitors should not be stored in high temperatures or where there is a high level of humidity. The suitable storage condition is 5℃-35℃ and less than 75% in relative humidity.
* Aluminum electrolytic capacitors should not be stored in damp conditions such as water, saltwater spray or oil spray.
* Do not store aluminum electrolytic capacitors in an environment full of hazardous gas (hydrogen sulfide, sulfurous acid gas, nitrous acid, chlorine gas, ammonia or bromine gas).
* Aluminum electrolytic capacitors should not be stored under exposure to ozone, ultraviolet rays or radiation.

(7) Fumigation and halogenated flame retardant

It may cause corrosion of internal electrodes, aluminum cases and terminal surface when the following conditions exist.

* Fumigation of wooden pallets before shipment to disinfect vermin.
* Existence of components or parts that contain halogenated flame retardant agent (bromine etc.) together with capacitors.
* When halogenated detergents or antiseptics for preventing intection of epidemic diseases contact directly to capacitors.

(8)PC board cleaning after soldering

Please consult us when cleaning is subjected.

(9)Polarity

Please confirm the polarity before use because this capacitor has polarity.

(10)Others

* Do not cover pressure relief vent with sometihing or do not use in the condition which cause a problem of pressure relief vent operation.
* The pressure relief vent bulges right before operation. Please provide the clearance space 3mm or more over the pressure relief vent of a capacitor.
* Do not print coppoer line or circuit patterns under the sealing(terminal) side of capacitors.

* Guide to application except the above are described in our catalog and JEITA RCR-2367D (including any amendments).

JEITA RCR-2367D: "Safety application guide for fixed aluminum electrolytic capacitors for use in electronic equipment."
Published by Japan Electronics and Information Technology Industries Association.

Table - 2 SIZE AND CHARACTERISTICS TABLE

Rubycon Part Number									Rated Voltage (V.DC)	Surge Voltage (V.DC)	Nominal Capacitance (μF)	Cap. Tolerance (%)	tanδ MAX.	MAX. Leakage Current (μA)	Rated Ripple Current (A r.m.s.) 105deg.C /120Hz	Dimension (mm)	
																ΦD	L
400	MXE	120	M	EFC	SN	22	X	25	400	450	120	±20	0.20	657	0.91	22	25
400	MXE	150	M	EFC	SN	22	X	30	400	450	150	±20	0.20	734	1.07	22	30
400	MXE	150	M	EFC	SN	25	X	25	400	450	150	±20	0.20	734	1.04	25	25
400	MXE	180	M	EFC	SN	22	X	35	400	450	180	±20	0.20	804	1.21	22	35
400	MXE	220	M	EFC	SN	22	X	40	400	450	220	±20	0.20	889	1.38	22	40
400	MXE	220	M	EFC	SN	25	X	30	400	450	220	±20	0.20	889	1.29	25	30
400	MXE	270	M	EFC	SN	22	X	45	400	450	270	±20	0.20	985	1.56	22	45
400	MXE	270	M	EFC	SN	25	X	35	400	450	270	±20	0.20	985	1.48	25	35
400	MXE	270	M	EFC	SN	30	X	30	400	450	270	±20	0.20	985	1.44	30	30
400	MXE	330	M	EFC	SN	22	X	55	400	450	330	±20	0.20	1089	1.83	22	55
400	MXE	330	M	EFC	SN	25	X	45	400	450	330	±20	0.20	1089	1.76	25	45
400	MXE	330	M	EFC	SN	30	X	35	400	450	330	±20	0.20	1089	1.64	30	35
400	MXE	390	M	EFC	SN	25	X	50	400	450	390	±20	0.20	1184	1.95	25	50
400	MXE	390	M	EFC	SN	30	X	40	400	450	390	±20	0.20	1184	1.84	30	40
400	MXE	470	M	EFC	SN	25	X	60	400	450	470	±20	0.20	1300	2.24	25	60
400	MXE	470	M	EFC	SN	30	X	45	400	450	470	±20	0.20	1300	2.05	30	45
400	MXE	560	M	EFC	SN	30	X	50	400	450	560	±20	0.20	1419	2.26	30	50
400	MXE	680	M	EFC	SN	30	X	60	400	450	680	±20	0.20	1564	2.60	30	60
420	MXE	100	M	EFC	SN	22	X	25	420	470	100	±20	0.20	614	0.83	22	25
420	MXE	150	M	EFC	SN	22	X	30	420	470	150	±20	0.20	752	1.05	22	30
420	MXE	150	M	EFC	SN	25	X	25	420	470	150	±20	0.20	752	1.02	25	25
420	MXE	180	M	EFC	SN	22	X	35	420	470	180	±20	0.20	824	1.19	22	35
420	MXE	180	M	EFC	SN	25	X	30	420	470	180	±20	0.20	824	1.18	25	30
420	MXE	220	M	EFC	SN	22	X	40	420	470	220	±20	0.20	911	1.36	22	40
420	MXE	220	M	EFC	SN	25	X	35	420	470	220	±20	0.20	911	1.35	25	35
420	MXE	270	M	EFC	SN	22	X	50	420	470	270	±20	0.20	1010	1.59	22	50
420	MXE	270	M	EFC	SN	25	X	40	420	470	270	±20	0.20	1010	1.53	25	40
420	MXE	270	M	EFC	SN	30	X	30	420	470	270	±20	0.20	1010	1.40	30	30
420	MXE	330	M	EFC	SN	22	X	60	420	470	330	±20	0.20	1116	1.84	22	60
420	MXE	330	M	EFC	SN	25	X	45	420	470	330	±20	0.20	1116	1.72	25	45
420	MXE	330	M	EFC	SN	30	X	35	420	470	330	±20	0.20	1116	1.61	30	35
420	MXE	390	M	EFC	SN	25	X	55	420	470	390	±20	0.20	1214	1.98	25	55
420	MXE	390	M	EFC	SN	30	X	40	420	470	390	±20	0.20	1214	1.80	30	40
420	MXE	470	M	EFC	SN	25	X	60	420	470	470	±20	0.20	1332	2.19	25	60
420	MXE	470	M	EFC	SN	30	X	50	420	470	470	±20	0.20	1332	2.12	30	50
420	MXE	560	M	EFC	SN	30	X	55	420	470	560	±20	0.20	1454	2.32	30	55
450	MXE	100	M	EFC	SN	22	X	25	450	500	100	±20	0.20	636	0.84	22	25
450	MXE	120	M	EFC	SN	22	X	30	450	500	120	±20	0.20	697	0.96	22	30
450	MXE	120	M	EFC	SN	25	X	25	450	500	120	±20	0.20	697	0.95	25	25
450	MXE	150	M	EFC	SN	22	X	35	450	500	150	±20	0.20	779	1.12	22	35
450	MXE	150	M	EFC	SN	25	X	30	450	500	150	±20	0.20	779	1.10	25	30
450	MXE	180	M	EFC	SN	22	X	40	450	500	180	±20	0.20	853	1.26	22	40
450	MXE	180	M	EFC	SN	25	X	35	450	500	180	±20	0.20	853	1.25	25	35
450	MXE	220	M	EFC	SN	22	X	45	450	500	220	±20	0.20	943	1.43	22	45
450	MXE	220	M	EFC	SN	25	X	40	450	500	220	±20	0.20	943	1.42	25	40
450	MXE	220	M	EFC	SN	30	X	30	450	500	220	±20	0.20	943	1.32	30	30
450	MXE	270	M	EFC	SN	22	X	55	450	500	270	±20	0.20	1045	1.66	22	55
450	MXE	270	M	EFC	SN	25	X	45	450	500	270	±20	0.20	1045	1.61	25	45

Rubycon Aluminum electrolytic capacitors Specification Sheet
MXE Series

DRAWING No. : REE-050162
ISSUE No. : 1

Rubycon Part Number									Rated Voltage (V.DC)	Surge Voltage (V.DC)	Nominal Capaci-tance (μF)	Cap. Toler-ance (%)	tanδ MAX.	MAX. Leakage Current (μA)	Rated Ripple Current (A r.m.s.) 105deg.C /120Hz	Dimen-sion (mm)	
																ΦD	L
450	MXE	270	M	EFC	SN	30	X	35	450	500	270	±20	0.20	1045	1.52	30	35
450	MXE	330	M	EFC	SN	25	X	50	450	500	330	±20	0.20	1156	1.81	25	50
450	MXE	330	M	EFC	SN	30	X	40	450	500	330	±20	0.20	1156	1.72	30	40
450	MXE	390	M	EFC	SN	25	X	60	450	500	390	±20	0.20	1256	2.05	25	60
450	MXE	390	M	EFC	SN	30	X	50	450	500	390	±20	0.20	1256	2.00	30	50
450	MXE	470	M	EFC	SN	30	X	55	450	500	470	±20	0.20	1379	2.21	30	55
450	MXE	560	M	EFC	SN	30	X	60	450	500	560	±20	0.20	1505	2.41	30	60