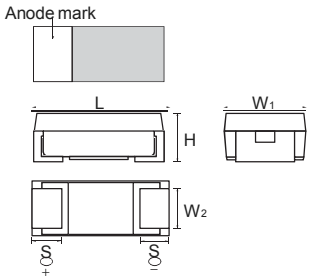
●Features

1) Conductive polymer used at the cathode for ultra-low ESR.
2) Conductive polymer has a self-healing function that prevents failure, resulting in safe, high reliability operating.
3) Screening by thermal shock.

●Dimensions



(Unit: mm)

Dimensions	Size
L	3.5 ± 0.2
W1	2.8 ± 0.2
W2	1.9 ± 0.2
H	1.9 ± 0.2
S	0.8 ± 0.3

●Part No. Explanation

T	C	O	B	0	J	4	7	6	M	8	R	-		
①			②	③		④			⑤	⑥			⑦	

① Series name
TCO

② Case style
B : 3528-21 (1411) size

③ Rated voltage

Rated voltage (V)	2.5	6.3	10	16	25
CODE	0E	0J	1A	1C	1E

④ Nominal capacitance
Nominal capacitance in pF in 3 digits:
2 significant figures followed by the figure representing the number of 0's.

⑤ Capacitance tolerance
M : ±20%

⑥ Taping
8: Tape width
R: Positive electrode on the side opposite to sprocket hole

⑦ Discrimination code

*This specification has possibility of charge, due to underdevelopment product.
Please ask for latest specification to our sales.

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●Rated table

(ESR : mΩ)

Capacitance (μF)	Rated voltage (V.DC)				
	2.5	6.3	10	16	25
15 (156)					100
33 (336)			150	100	
47 (476)		70	150		
100 (107)		35 / 45			
150 (157)		35 / 45			
220 (227)	35	35 / 45			
330 (337)	35 / 45				

●Marking

The indications listed below should be given on the surface of a capacitor.

(1) Polarity: The polarity should be shown by bar. (on the anode side)

(2) Rated DC voltage: A voltage code is shown as below table.

(3) Capacitance: A capacitance code is shown as below table.

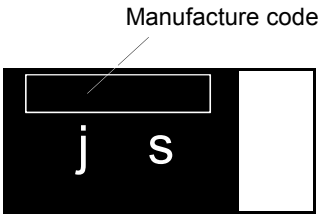
Voltage Code	Rated DC Voltage (V)
e	2.5
j	6.3
A	10
C	16
E	25

Capacitance Code	Nominal Capacitance (μF)
e	15
n	33
s	47
$\overline{a}$	100
$\overline{e}$	150
$\overline{j}$	220
$\overline{n}$	330

[B case]

EX.) $\frac{j}{(1)}$ $\frac{s}{(2)}$

(1) voltage code (2) capacitance code



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●Characteristics

<table>
<tr><th colspan="2">Item</th><th>Performance</th><th>Test conditions (based on JIS C 5101–1 and JIS C 5101–3)</th></tr>
<tr><td colspan="2">Operating Temperature</td><td>–55°C to +105°C</td><td>Voltage reduction when temperature exceeds +85°C</td></tr>
<tr><td colspan="2">Maximum operating temperature with no voltage derating</td><td>+85°C</td><td></td></tr>
<tr><td colspan="2">Rated voltage (V.DC)</td><td>2.5 | 6.3 | 10 | 16 | 25</td><td>at 85°C</td></tr>
<tr><td colspan="2">Category voltage (V.DC)</td><td>2 | 5 | 8 | 12.8 | 20</td><td>at 105°C</td></tr>
<tr><td colspan="2">Surge voltage (V.DC)</td><td>3.2 | 8 | 13 | 20 | 29</td><td>at 85°C</td></tr>
<tr><td colspan="2">DC Leakage current</td><td>Shall be satisfied the value on " Standard list "</td><td>As per 4.9 JIS C 5101-1
As per 4.5.1 JIS C 5101-3
Voltage : Rated voltage for 5min</td></tr>
<tr><td colspan="2">Capacitance tolerance</td><td>Shall be satisfied allowance range. ±20%</td><td>As per 4.7 JIS C 5101-1
As per 4.5.2 JIS C 5101-3
Measuring frequency : 120 ± 12Hz
Measuring voltage : 0.5Vrms + 1.5V.DC
Measuring circuit : DC Equivalent series circuit</td></tr>
<tr><td colspan="2">Tangent of loss angle (Df, tan δ)</td><td>Shall be satisfied the voltage on " Standard list "</td><td>As per 4.8 JIS C 5101-1
As per 4.5.3 JIS C 5101-3
Measuring frequency : 120 ± 12Hz
Measuring voltage : 0.5Vrms + 1.5V.DC
Measuring circuit : DC Equivalent series circuit</td></tr>
<tr><td colspan="2">ESR</td><td>Shall be satisfied the value on " Standard list "</td><td>As per 4.10 JIS C 5101-1
As per 4.5.4 JIS C 5101-3
Measuring frequency : 100 ± 10kHz
Measuring voltage : 0.5Vrms or less
Measuring circuit : DC Equivalent series circuit</td></tr>
<tr><td rowspan="4">Resistance to Soldering heat</td><td>Appearance</td><td>There should be no significant abnormality. The indications should be clear.</td><td rowspan="4">As per 4.14 JIS C 5101-1
As per 4.6 JIS C 5101-3
Dip in the solder bath
Solder temp : 240 ± 5°C
Duration : 10 ± 0.5s
Repetition : 1
After the specimens, leave it at room temperature for over 24h and then measure the sample.</td></tr>
<tr><td>L.C.</td><td>Less than 150% of initial limit</td></tr>
<tr><td>⊿C / C</td><td>Within ±20% of initial value</td></tr>
<tr><td>Df (tan δ)</td><td>Less than 150% of initial limit</td></tr>
<tr><td rowspan="4">Temperature cycle</td><td>Appearance</td><td>There should be no significant abnormality. The indications should be clear.</td><td rowspan="4">As per 4.16 JIS C 5101-1
As per 4.10 JIS C 5101-3
Repetition : 5 cycles
(1 cycle : steps 1 to 4) without discontinuation.
<table><tr><th></th><th>Temp.</th><th>Time</th></tr><tr><td>1</td><td>–55±3°C</td><td>30±3min.</td></tr><tr><td>2</td><td>Room temp.</td><td>3min. or less</td></tr><tr><td>3</td><td>105±2°C</td><td>30±3min.</td></tr><tr><td>4</td><td>Room temp.</td><td>3min. or less</td></tr></table>After the specimens, leave it at room temperature for over 24h and then measure the sample.</td></tr>
<tr><td>L.C.</td><td>Less than 500% of initial limit</td></tr>
<tr><td>⊿C / C</td><td>Within ±20% of initial value</td></tr>
<tr><td>Df (tan δ)</td><td>Less than 150% of initial limit</td></tr>
<tr><td rowspan="4">Moisture resistance</td><td>Appearance</td><td>There should be no significant abnormality. The indications should be clear.</td><td rowspan="4">As per 4.22 JIS C 5101-1
As per 4.12 JIS C 5101-3
After leaving the sample under such atmospheric condition that the temperature and humidity are 40±2°C and 90 to 95% RH, respectively, for 500±12h leave it at room temperature for over 24h and then measure the sample.</td></tr>
<tr><td>L.C.</td><td>Less than 150% of initial limit</td></tr>
<tr><td>⊿C / C</td><td>Within +30/–20% of initial value</td></tr>
<tr><td>Df (tan δ)</td><td>Less than 150% of initial limit</td></tr>
</table>

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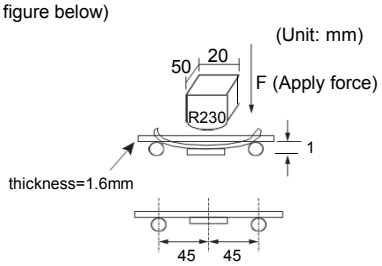
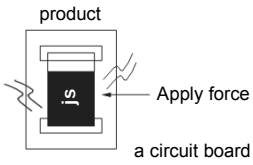
Item		Performance	Test conditions (based on JIS C 5101−1 and JIS C 5101−3)
Temperature Stability	Temp.	−55°C	As per 4.29 JIS C 5101-1 As per 4.13 JIS C 5101-3
	⊿C / C	Within 0/−20% of initial value	
	Df (tan δ)	Shall be satisfied the value on " Standard list "	
	L.C.	−	
	Temp.	+105°C	
	⊿C / C	Within +80/0% of initial value	
	Df (tan δ)	Shall be satisfied the value on " Standard list "	
	L.C.	Less than 1,000% of initial limit	
Surge voltage	Appearance	There should be no significant abnormality.	As per 4.26JIS C 5101-1 As per 4.14JIS C 5101-3 Apply the specified surge voltage via the serial resistance of 1kΩ ever 5±0.5 min. for 30±5 s. each time in the atmospheric condition of 85±2° C. Repeat this procedure 1,000 times. After the specimens, leave it at room temperature for over 24h and then measure the sample.
	L.C.	Less than initial limit	
	⊿C / C	Within ±20% of initial value	
	Df (tan δ)	Less than initial limit	
Loading at High temperature	Appearance	There should be no significant abnormality. The indications should be clear.	As per 4.23 JIS C 5101-1 As per 4.15 JIS C 5101-3 After applying the rated voltage for 1000+72/0 h without discontinuation via the serial resistance of 3Ω or less at a temperature of 85±2°C, leave the sample at room temperature / humidity for over 24h and measure the value.
	L.C.	Less than 200% of initial limit	
	⊿C / C	Within ±20% of initial value	
	Df (tan δ)	Less than 150% of initial limit	
Terminal strength	Capacitance	The measured value should be stable.	As per 4.35 JIS C 5101-1 As per 4.9 JIS C 5101-3 A force is applied to the terminal until it bends to 1mm and by a prescribed tool maintains the condition for 5s. (See the figure below) 
	Appearance	There should be no significant abnormality.	
Adhesiveness		The terminal should not come off.	As per 4.34 JIS C 5101-1 As per 4.8 JIS C 5101-3 Apply force of 5N in the two directions shown in the figure below for 10 ±1s after mounting the terminal on a circuit board. 
Dimensions		Refer to "External dimensions"	Measure using a caliper of JIS B 7507 Class 2 or higher grade.
Resistance to solvents		The indication should be clear.	As per 4.32 JIS C 5101-1 As per 4.18 JIS C 5101-3 Dip in the isopropyl alcohol for 30±5s, at room temperature.
Solderability		3/4 or more surface area of the solder coated terminal dipped in the soldering bath should be covered with the new solder.	As per 4.15.2 JIS C 5101-1 As per 4.7 JIS C 5101-3 Dip speed=25±2.5mm / s Pre-treatment (accelerated aging): Leave the sample on the boiling distilled water for 1h. Solder temp. : 245±5°C Duration : 3±0.5s Solder : M705 Flux : Rosin 25% IPA 75%
Vibration	Capacitance	Measure value should not fluctuate during the measurement.	As per 4.17 JIS C 5101-1 Frequency : 10 to 55 to 10Hz/min. Amplitude : 1.5mm Time : 2h each in X and Y directions Mounting : The terminal is soldered on a print circuit board.
	Appearance	There should be no significant abnormality.	

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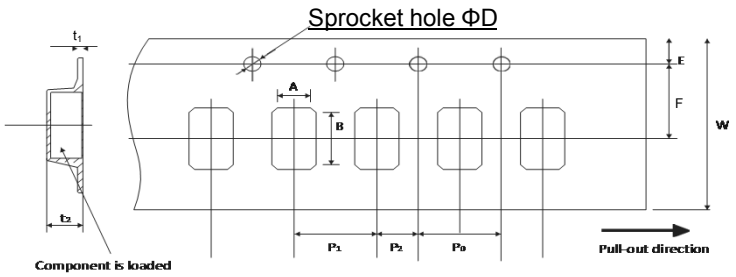
●Standard products list

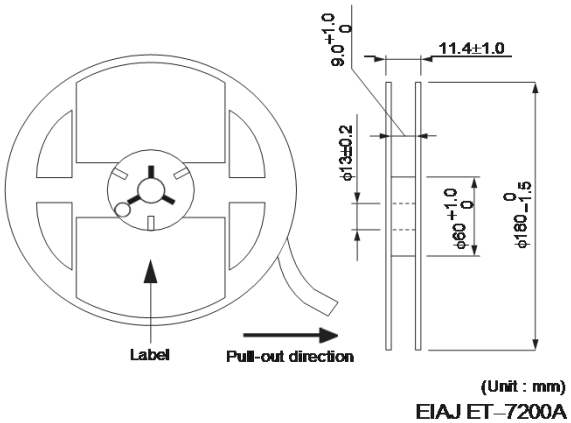
Part No.	Rated voltage 85°C	Category voltage 105°C	Surge voltage 85°C	Cap. 120Hz	Tolerance	Leakage current 25°C 1WV.5min	Df 120Hz (%)			ESR 100kHz
	(V)	(V)	(V)	(μF)	(%)	(μA)	–55°C	25°C	105°C	(mΩ)
TCO B 0E 227 M8R-EN1	2.5	2	3.2	220	±20	55	8	8	12	35
TCO B 0E 337 M8R-EN1	2.5	2	3.2	330	±20	82.5	30	15	20	35
TCO B 0E 337 M8R-ES1	2.5	2	3.2	330	±20	82.5	30	15	20	45
TCO B 0J 476 M8R-EW1	6.3	5	8	47	±20	30	8	8	12	70
TCO B 0J 107 M8R-EN1	6.3	5	8	100	±20	63	8	8	12	35
TCO B 0J 107 M8R-ES1	6.3	5	8	100	±20	63	8	8	12	45
TCO B 0J 157 M8R-EN1	6.3	5	8	150	±20	94.5	30	15	20	35
TCO B 0J 157 M8R-ES1	6.3	5	8	150	±20	94.5	30	15	20	45
TCO B 0J 227 M8R-EN1	6.3	5	8	220	±20	139	30	15	20	35
TCO B 0J 227 M8R-ES1	6.3	5	8	220	±20	139	30	15	20	45
TCO B 1A 336 M8R	10	8	13	33	±20	33	8	8	12	150
TCO B 1A 476 M8R	10	8	13	47	±20	47	8	8	12	150
TCO B 1C 336 M8R	16	12.8	20	33	±20	159	10	10	15	100
TCO B 1E 156 M8R	25	20	29	15	±20	113	10	10	20	100

●Packaging specifications



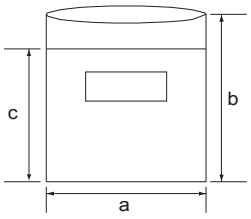
A	B	W	E	F	P1	P2	P0	D0	t1	t2	standard packaging quantity
3.3±0.1	3.8±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	4.0±0.1	φ1.5+ 0.1/0	0.25± 0.05	2.2±0.1	2000pcs

●Reel dimensions



●Damp proof package

①One reel is packed in aluminum bag.
The size of aluminum bag is 240(a) x 250(b)mm.
The size up to 230(c)mm is to zipper.
②A desiccant is packed with a reel.
③The aluminum bag is heat-sealed.
④The label of the same as the label on the reel is placed on the aluminum bag.



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Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipment (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
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   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (Exclude cases where no-clean type fluxes is used. However, recommend sufficiently about the residue.) ; or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse, is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

A two-dimensional barcode printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

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