

2012

Product Catalog

ROHM
SEMICONDUCTOR

Passive Components

Conductive Polymer Capacitors



ROHM Co.,Ltd.

Conductive Polymer Capacitors

Conductive polymer tantalum capacitors are characterized by their use of conductive polymer at the cathode. Conductive polymer features better conductivity than manganese dioxide (used in tantalum capacitors, for example) for significantly lower ESR. ROHM offers conductive polymer capacitors in both the standard package type as well as the newer bottom electrode configuration featuring larger capacitance in a smaller, thinner form factor.

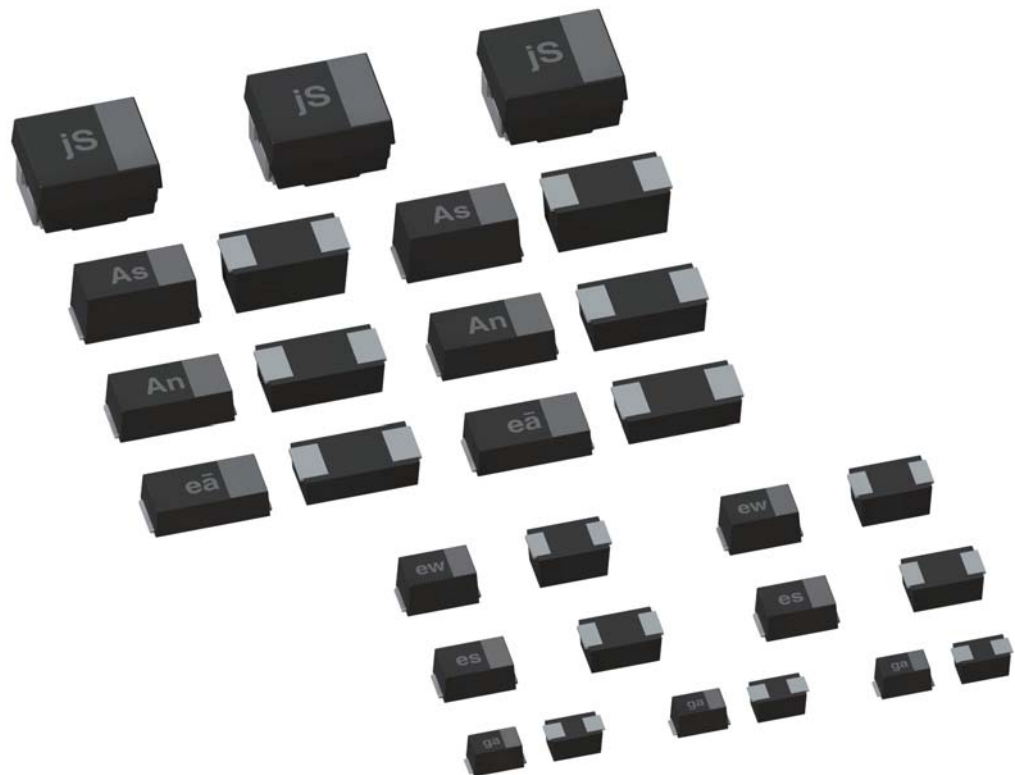


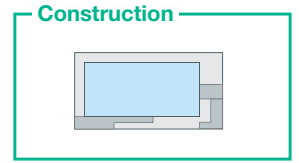
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Conductive Polymer new bottom surface electrode Type (Extra Large Capacitance)



TCSO Series



Summary

These ultra-low ESR conductive polymer capacitors utilize a new efficient package design featuring larger capacitance in a smaller, thinner form factor.

Features

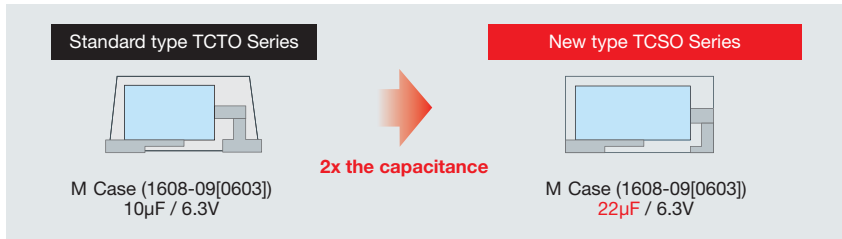
- Compact, Thin
- Extra large capacitance
- Safe
- Excellent temperature characteristics (-55°C to +105°C)

Applications

- Mobile phones
- Digital cameras /camcorders
- Portable music players
- Portable gaming systems and other thin, compact electronic devices

New package construction features smaller, thinner form factor with larger capacitance

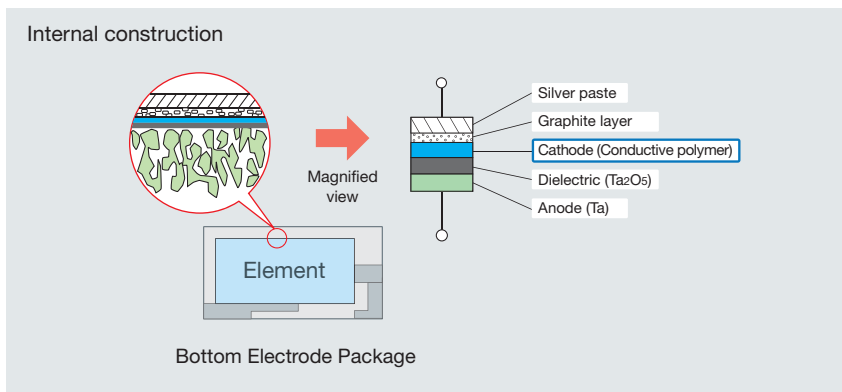
The unique package construction allows for a larger element than conventional bottom electrode types (TCTO Series), resulting in approximately twice the capacitance.



Ultra-low ESR / Self-Repair Function

The TCSO series utilizes conductive polymer at the cathode for ultra-low ESR in a compact, low-profile design.

In addition, conductive polymer has a self-healing function that prevents failure, resulting in safe, high reliability operation.



Lineup

M Case (1608-09 [0603] Size)

Capacitance (μF)	Rated voltage (V, DC)			
	2.5	4	6.3	10
6.8 (685)				☆M
10 (106)				☆M
15 (156)			☆M	
22 (226)		☆M	☆M	
33 (336)	☆M	☆M		
47 (476)	☆M			
68 (686)				

☆Under development

PL Case (Low Profile 2012-10 [0805] Size)

Capacitance (μF)	Rated voltage (V, DC)			
	2.5	4	6.3	10
6.8 (685)				
10 (106)				☆PL
15 (156)				☆PL
22 (226)			☆PL	
33 (336)		☆PL	☆PL	
47 (476)	☆PL	☆PL	☆PL	
68 (686)	☆PL			

☆Under development

P Case (2021-12 [0805] Size)

Capacitance (μF)	Rated voltage (V, DC)			
	2.5	4	6.3	10
15 (156)				☆P
22 (226)				☆P
33 (336)			☆P	
47 (476)		☆P	☆P	
68 (686)	☆P	☆P		
100 (107)	☆P			

☆Under development

Quick Reference

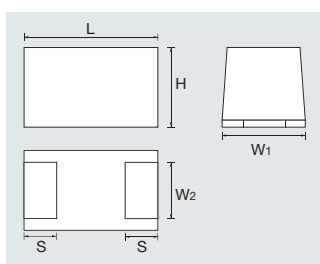
TCSO Series : M Case (1608-09 [0603] Size)

Rated voltage (V)	Capacitance (μF)	tanδ at 120Hz(25°C) (%)	Leakage current (25°C, 5min) (μA)	ESR (at 100kHz) (mΩ)	Part No.
2.5	33	15	8.5	500	TCSOM0E336□
	47	15	11.8	500	TCSOM0E476□
4	22	15	8.8	500	TCSOM0G226□
	33	15	13.2	500	TCSOM0G336□
6.3	15	15	9.5	500	TCSOM0J156□
	22	15	13.9	500	TCSOM0J226□
10	4.7	10	4.7	500	TCSOM1A475□
	6.8	10	6.8	500	TCSOM1A685□
	10	15	10	500	TCSOM1A106□

TCSO Series : PL Case (Low Profile 2021-10 [0805] Size)

Rated voltage (V)	Capacitance (μF)	tanδ at 120Hz(25°C) (%)	Leakage current (25°C, 5min) (μA)	ESR (at 100kHz) (mΩ)	Part No.
2.5	47	15	11.8	500	TCSOPL0E476□
	68	15	17.0	500	TCSOPL0E686□
4	33	15	13.2	500	TCSOPL0G336□
	47	15	18.8	500	TCSOPL0G476□
6.3	22	15	13.9	500	TCSOPL0J226□
	33	15	20.8	500	TCSOPL0J336□
	47	15	29.7	500	TCSOPL0J476□
10	10	15	10.0	500	TCSOPL1A106□
	15	15	15.0	500	TCSOPL1A156□

Dimensions



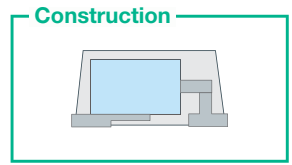
(Unit : mm)

Case (mm[inch])	L	W1	W2	H	S
M (1608-09 [0603])	1.6 ^{+0.2} ₋₀	0.85±0.1	0.55±0.1	0.8±0.2	0.5±0.1
PL (Low Profile 2012-10 [0805])	2.0±0.2	1.25±0.2	0.85±0.2	0.9±0.1	0.5±0.2
P (2021-12 [0805])	2.0±0.2	1.25±0.2	0.85±0.2	1.2Max	0.5±0.1

Conductive Polymer bottom surface electrode Type (Large Capacitance)



TCTO Series



Summary

This ultra-high performance low-ESR series features a bottom electrode configuration for greater compactness, a lower profile, and larger capacitance.

Features

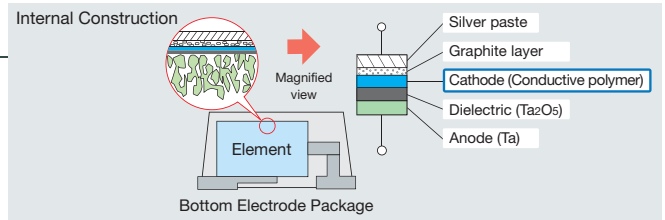
- Thin, compact, large capacitance
- Wide package lineup : M Case (1608) to A Case (3216)
- Ultra-low ESR ideal for noise removal
- Excellent temperature characteristics (-55°C to +105°C)

Applications

- Notebook PCs, peripheral devices
- Digital cameras / camcorders
- Car audio
- Portable gaming systems
- Projectors
- Consumer electronics

Ultra-low ESR / Low Profile / Large Capacitance

The market-tested TCO series of safe, ultra-low ESR conductive polymer capacitors were configured with a bottom electrode structure, resulting in greater capacitance in a smaller, thinner form factor.



Lineup

M Case (1608-09 [0603] Size) (ESR unit : mΩ)

Capacitance (μF)	Rated voltage (V, DC)			
	2.5	4	6.3	10
2.2 (225)				800
3.3 (335)				800
4.7 (475)				☆800
6.8 (685)			☆800	
10 (106)		☆800	☆800	
15 (156)	☆800	☆800		
22 (226)	☆800			
33 (336)				
47 (476)				
68 (686)				
100 (107)				

☆:Under development

P Case (2012-12 [0805] Size) (ESR unit : mΩ)

Capacitance (μF)	Rated voltage (V, DC)			
	2.5	4	6.3	10
2.2 (225)				
3.3 (335)				☆500
4.7 (475)				☆500
6.8 (685)				☆500
10 (106)				☆500
15 (156)				☆500
22 (226)			☆500	
33 (336)		☆500	☆500	
47 (476)	☆500	☆500		
68 (686)	☆500			
100 (107)				

☆:Under development

AS Case (Ultra-Low Profile 3216-10 [1206] Size) (ESR unit : mΩ)

Capacitance (μF)	Rated voltage (V, DC)			
	2.5	4	6.3	10
2.2 (225)				
3.3 (335)				☆300
4.7 (475)				☆300
6.8 (685)				☆300
10 (106)				☆300
15 (156)				☆200
22 (226)				☆200
33 (336)			☆200	
47 (476)		☆200	200	
68 (686)	☆200	☆200		
100 (107)	☆200			

☆:Under development

AL Case (Low Profile 3216-12 [1206] Size) (ESR unit : mΩ)

Capacitance (μF)	Rated voltage (V, DC)			
	2.5	4	6.3	10
4.7 (475)				
6.8 (685)				
10 (106)				
15 (156)				
22 (226)				200
33 (336)				200
47 (476)			200	
68 (686)		200	☆200	
100 (107)	200	200		
150 (157)	☆200			
220 (227)				
330 (337)				

☆:Under development

A Case (3216-18 [1206] Size) (ESR unit : mΩ)

Capacitance (μF)	Rated voltage (V, DC)							
	2.5	4	6.3	10	16	20	25	
4.7 (475)							☆100	
6.8 (685)						☆100		
10 (106)					☆100			
15 (156)								
22 (226)								
33 (336)								
47 (476)								
68 (686)								
100 (107)								
150 (157)								
220 (227)								
330 (337)								

☆:Under development

Quick Reference

TCTO Series: M Case (1608-09 [0603] Size)

Rated voltage (V)	Capacitance (μF)	tanδ at 120Hz(25°C) (%)	Leakage current (25°C, 5min) (μA)	ESR (at 100kHz) (mΩ)	Part No.
2.5	15	8	3.8	800	TCTOM0E156□
	22	8	5.5	800	TCTOM0E226□
4	10	8	4.0	800	TCTOM0G106□
	15	8	6.0	800	TCTOM0G156□
6.3	6.8	6	4.3	800	TCTOM0J685□
	10	8	6.3	800	TCTOM0J106□
10	2.2	6	2.2	800	TCTOM1A225□
	3.3	6	3.3	800	TCTOM1A335□
	4.7	6	4.7	800	TCTOM1A475□

□=Capacitance tolerance (M:±20%)

TCTO Series: AL Case (Low Profile 3216-12 [1206] Size)

Rated voltage (V)	Capacitance (μF)	tanδ at 120Hz(25°C) (%)	Leakage current (25°C, 5min) (μA)	ESR (at 100kHz) (mΩ)	Part No.
2.5	100	10	25.0	200	TCTOAL0E107□
	150	10	37.5	200	TCTOAL0E157□
4	68	10	27.2	200	TCTOAL0G686□
	100	10	40.0	200	TCTOAL0G107□
6.3	47	10	29.7	200	TCTOAL0J476□
	68	10	42.9	200	TCTOAL0J686□
	100	15	63.0	200	TCTOAL0J107□
10	22	6	22.0	200	TCTOAL1A226□
	33	10	33.0	200	TCTOAL1A336□

□=Capacitance tolerance (M:±20%)

TCTO Series: P Case (2012-12 [0805] Size)

Rated voltage (V)	Capacitance (μF)	tanδ at 120Hz(25°C) (%)	Leakage current (25°C, 5min) (μA)	ESR (at 100kHz) (mΩ)	Part No.
2.5	47	15	11.8	500	TCTOP0E476□
	68	15	17.0	500	TCTOP0E686□
4	33	15	13.2	500	TCTOP0G336□
	47	15	18.8	500	TCTOP0G476□
6.3	22	15	13.9	500	TCTOP0J226□
	33	15	20.8	500	TCTOP0J336□
10	3.3	10	3.3	500	TCTOP1A335□
	4.7	10	4.7	500	TCTOP1A475□
	6.8	10	6.8	500	TCTOP1A685□
	10	15	10.0	500	TCTOP1A106□
	15	15	15.0	500	TCTOP1A156□

□=Capacitance tolerance (M:±20%)

TCTO Series: A Case (3216-18 [1206] Size)

Rated voltage (V)	Capacitance (μF)	tanδ at 120Hz(25°C) (%)	Leakage current (25°C, 5min) (μA)	ESR * (at 100kHz) (mΩ)	Part No.
2.5	220	15	55.0	35	TCTOA0E227□
	330	15	82.5	35	TCTOA0E337□
4	150	15	60.0	35	TCTOA0G157□
	220	15	88.0	35	TCTOA0G227□
6.3	100	15	63.0	35	TCTOA0J107□
	150	15	94.5	35	TCTOA0J157□
10	47	10	47.0	70	TCTOA1A476□
	68	15	68.0	70	TCTOA1A686□

□=Capacitance tolerance (M:±20%)

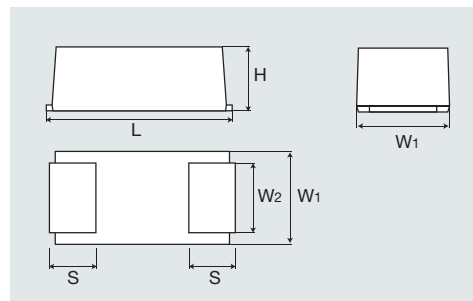
*70mΩ/100mΩ ESR lineup available. Please inquire for additional details.

TCTO Series: AS Case (Ultra-Low Profile 3216-10 [1206] Size)

Rated voltage (V)	Capacitance (μF)	tanδ at 120Hz(25°C) (%)	Leakage current (25°C, 5min) (μA)	ESR (at 100kHz) (mΩ)	Part No.
2.5	68	10	17.0	200	TCTOAS0E686□
	100	10	25.0	200	TCTOAS0E107□
4	47	10	18.8	200	TCTOAS0G476□
	68	10	27.2	200	TCTOAS0G686□
6.3	33	10	20.8	200	TCTOAS0J336□
	47	10	29.7	200	TCTOAS0J476□
10	3.3	6	3.3	300	TCTOAS1A335□
	4.7	6	4.7	300	TCTOAS1A475□
	6.8	6	6.8	300	TCTOAS1A685□
	10	6	10.0	200	TCTOAS1A106□
	15	6	15.0	200	TCTOAS1A156□
22	6	22.0	200	TCTOAS1A226□	

□=Capacitance tolerance (M:±20%)

Dimensions

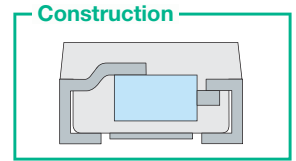
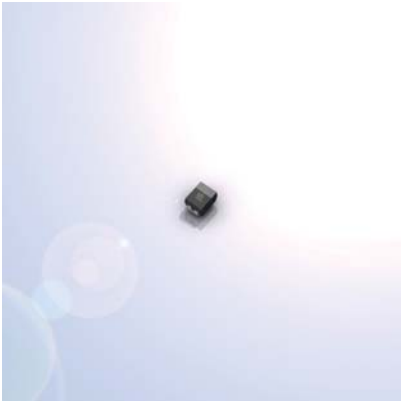


(Unit : mm)

Case (mm[inch])	L	W ₁	W ₂	H	S
M (1608-09 [0603])	1.6±0.1	0.85±0.1	0.55±0.1	0.8±0.1	0.5±0.1
P (2012-12 [0805])	2.0±0.2	1.25±0.2	0.85±0.2	1.2Max	0.5±0.2
AS (Ultra-Low Profile 3216-10 [1206])	3.2±0.2	1.6±0.2	1.2±0.2	0.9±0.1	0.8±0.2
AL (Low Profile 3216-12 [1206])	3.2±0.2	1.6±0.2	1.2±0.2	1.1±0.1	0.8±0.2
A (3216-18 [1206])	3.2±0.2	1.6±0.2	1.2±0.2	1.6±0.2	0.8±0.2

Conductive Polymer Capacitors

TCO Series



Summary

Conductive polymer is utilized at the cathode for significantly lower ESR.

Features

- Ultra-low ESR ideal for noise removal
- Safe
- Excellent temperature characteristics (-55°C to +105°C)

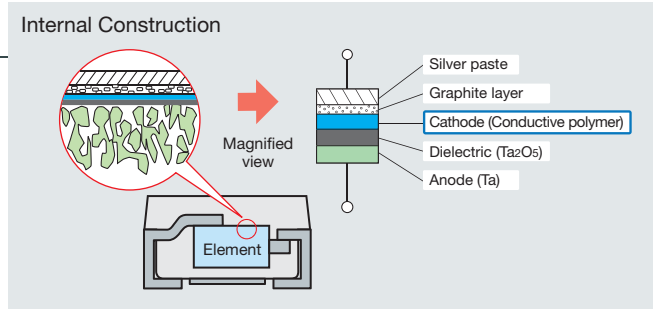
Applications

- Notebook PCs / peripheral equipment
- Digital cameras /camcorders
- Car audio
- Portable gaming systems
- Projectors
- Consumer electronics

Ultra-low ESR • Non-combustible

ESR has been significantly reduced due to utilization of a conductive polymer instead of conventional manganese dioxide.

The unique structural configuration results in much less susceptibility to smoking and combustion than conventional products.



Lineup

B Case (3528-21[1411] Size)		(ESR unit : mΩ)					
Capacitance (μF)	Rated voltage (V, DC)						
	2.5	4	6.3	10	16	20	25
4.7 (475)							☆150
6.8 (685)						☆150	
10 (106)					☆150		
15 (156)							
22 (226)							
33 (336)			☆35/70/150	70/150			
47 (476)			35/70/150	70/150			
68 (686)			35/70/150				
100 (107)			35/70/150				
150 (157)		35/70/150	35/70/150				
220 (227)	35/70/150	☆35/70/150	☆35/70/150				
330 (337)	☆35/70/150						

☆Under development

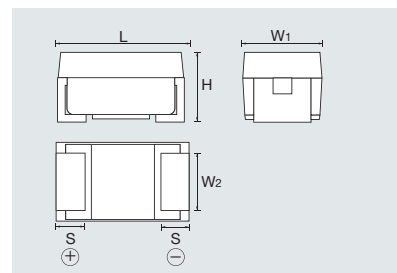
Quick Reference

TCO Series : B Case (3528-21[1411] Size)

Rated voltage (V)	Capacitance (μF)	tanδ at 120Hz(25°C) (%)	Leakage current (25°C, 5min) (μA)	ESR * (at 100kHz) (mΩ)	Part No.
2.5	220	8	55.0	150	TCOB0E227□
	330	15	82.5	150	TCOB0E337□
4	150	8	60.0	150	TCOB0G157□
	220	15	88.0	150	TCOB0G227□
6.3	33	8	21.0	150	TCOB0J336□
	47	8	30.0	150	TCOB0J476□
	68	8	42.9	150	TCOB0J686□
	100	8	63.0	150	TCOB0J107□
	150	15	94.5	150	TCOB0J157□
10	33	8	33.0	150	TCOB1A336□
	47	8	47.0	150	TCOB1A476□

□=Capacitance tolerance (M:±20%) *35mΩ/70mΩ products are currently under development.

Dimensions

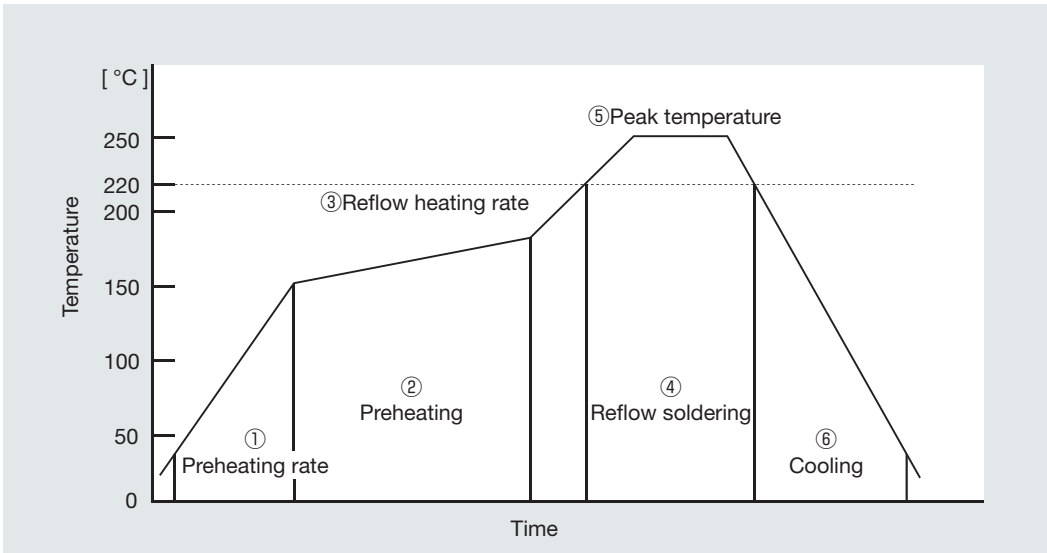


(Unit : mm)

Case (mm[inch])	L	W ₁	W ₂	H	S
B (3528-21[1411])	3.5±0.2	2.8±0.2	1.9±0.2	1.9±0.2	0.8±0.3

Recommended Soldering Conditions

TCSO/TCTO/TCO Series

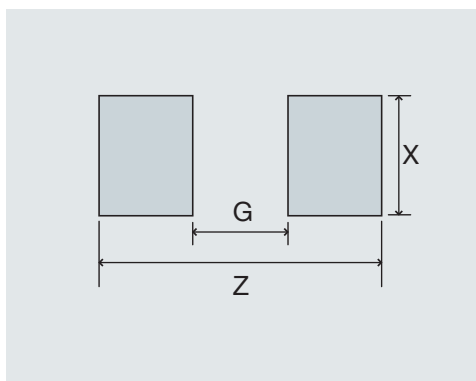


[Recommended reflow soldering conditions]

[Recommended hand soldering conditions]

- | | | | |
|---------------------------------------|----------------------------|--------------------------|-----------------------------------|
| ① Preheating rate | : 2°C/s | ① Solder tip temperature | : 350°C Max. |
| ② Preheating | : 150 to 180°C , 120s Max. | ② Time | : 3s Max. |
| ③ Reflow heating rate | : 1.5°C/s | | |
| ④ Soldering (high temperature period) | : 220°C , 40s | | * Not suitable for flow soldering |
| ⑤ Peak temperature | : 250°C , 5s Max. | | |
| ⑥ Cooling | : 60s Min. | | |
| ⑦ Reflow count | : 2 times Max. | | |

Recommended Land Pattern



(Unit : mm)				
Series	Case size (mm [inch])	X	G	Z
TCSO	MC(1608-09 [0603])	0.65	0.9	2.3
	PL (Low Profile 2012-12 [0805])	0.95	1.2	3.0
	P (2012-12 [0805])			
TCTO	M (1608-09 [0603])	0.65	0.65	2.2
	P (2012-12 [0805])	0.95	1.1	2.9
	AS (Ultra-Low Profile 3216-10 [1206])			
	AL (Low Profile 3216-12 [1206])	1.25	1.7	4.1
	A (3216-18 [1206])			
TCO	B (3528-21 [1411])	2.7	1.4	5.6

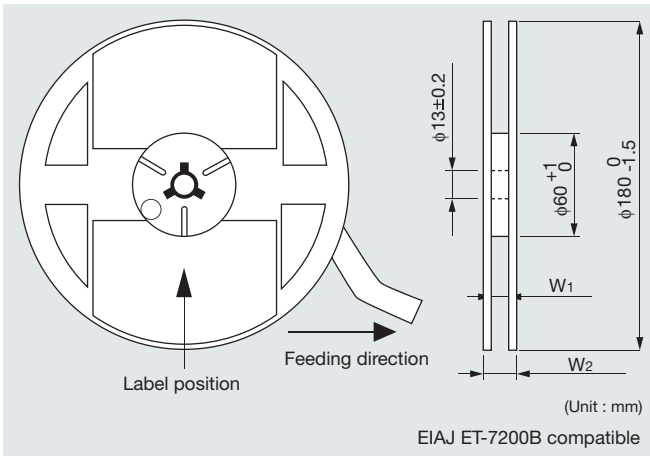
Part Number Explanation

T	C	S	O	M	0	J	2	2	6	M	8	R																																															
Series name			Case style		Rated voltage		Capacitance tolerance			Code		Parts orientation																																															
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Nominal capacitance (in pF) is denoted by 3 digits: 2 significant figures followed by a 3rd digit representing the number of zeroes (i.e. 226 = 22,000,000pF)

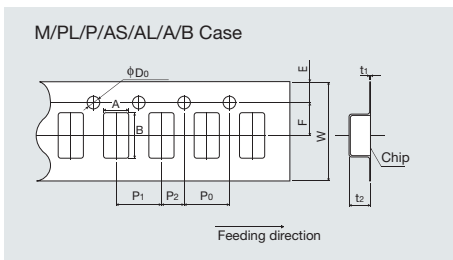
Taping Specifications

Reel Dimensions and Quantity



Case size (mm [inch])	Series	Package quantity (pcs)	Tape width ±0.3(mm)	Reel diameter 0 -1.5 (mm)	W1 +1.0 0 (mm)	W2 ±0.1(mm)
M (1608-09 [0603])	TCTO	4000				
	TCSO	3000				
PL (Low Profile 2012-10 [0805])	TCSO					
P (2012-12 [0805])						
AS (Ultra-Low Profile 3216-10 [1206])	TCTO	3000	8.0	φ180	9.0	11.4
AL (Low Profile 3216-12 [1206])						
A (3216-18 [1206])	TCSO					
B (3528-21 [1411])	TCO	2000				

Embossed Carrier Tape Specifications



(Unit : mm)

Case size (mm [inch])	A±0.1	B±0.1	W±0.2	E±0.1	F±0.05	P1±0.1	P2±0.05	P0±0.1	D0±0.1	t1±0.05	t2±0.1
M (1608-09 [0603])	1.0	1.85							φ1.55	0.2	1.0
PL (Low Profile 2012-10 [0805])	1.6	2.4								0.25	1.05
P (2012-12 [0805])	1.55	2.3									1.5
AS (Ultra-Low Profile 3216-10 [1206])	1.9	3.5	8.0	1.75	3.5	4.0	2.0	4.0	φ1.5		1.1
AL (Low Profile 3216-12 [1206])	1.9	3.5								0.25	1.3
A (3216-18 [1206])	1.9	3.5									1.9
B (3528-21 [1411])	3.3	3.8									2.2

Usage Precautions

- 1 Verification and confirmation of performance characteristics of products, after mounting on board, is strongly advised.
- 2 In particular, if a transient load (a large load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after mounting on board is strongly recommended. Avoid applying power exceeding the normal rated power, since exceeding the power rating under steady state load conditions may negatively affect product performance and reliability.

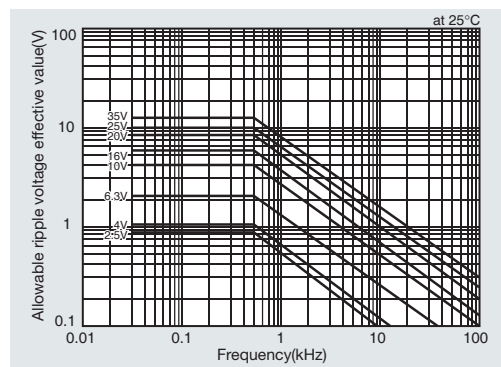
- 3 Allowable ripple voltage
The sum of the peak values of DC and AC voltage should not exceed the rated voltage. The ripple voltage, if applied, should not exceed the maximum allowable value. The allowable ripple voltage at different temperatures is calculated using the formulas below.

$$E = \text{Allowable ripple voltage}$$

$$E \text{ Max. (at } 50^{\circ}\text{C)} = 0.7 \times E \text{ Max. (at } 25^{\circ}\text{C)}$$

$$E \text{ Max. (at } 85^{\circ}\text{C)} = 0.5 \times E \text{ Max. (at } 25^{\circ}\text{C)}$$

$$E \text{ Max. (at } 125^{\circ}\text{C)} = 0.3 \times E \text{ Max. (at } 25^{\circ}\text{C)}$$



- 4 The voltage should be reduced as much as possible.
In particular, a voltage lower than 1/3 of the rated voltage is recommended when used in a low impedance circuit.
- 5 The tester must not be in contact with a capacitor. If this occurs, an excessive or reverse voltage may be applied to the capacitor.
- 6 Please refer to the derating curve during operation from 85°C to 125°C.
- 7 Apply a series-resistor rated at 3Ω per 1V.
- 8 When a highly active halogenous (i.e. chlorine, bromine) flux is used, the remainder of flux may negatively affect product performance and reliability. Therefore, a halogen-free flux should be used.
- 9 Reflow soldering is recommended. However, if flow soldering will be performed please consult with ROHM in advance.
- 10 This section is concerned with accidental short-mode failures due to thermal, mechanical, and electrical stresses.
Please note that failures can be delayed by reducing the ambient temperature, ripple current, and/or supply voltage.
- 11 Failures often occur in the circuits below. Therefore, their use is strictly prohibited.
 - a) High impedance voltage retention circuits
 - b) Coupling circuits
 - c) Circuits affected by current leakage
 - d) Series connection with loads exceeding the rated voltage
- 12 Bipolar connection is prohibited.
- 13 The products are packaged in an aluminum pack with silica gel.
Please open immediately before mounting. Products should be used one week after opening.
For products opened longer than one week, baking under the following conditions should be performed.

Baking Conditions
Individual Pieces : 105°C for 15±1hrs
Reel : 40°C for 192hrs
- 14 Please note that the electrical characteristics will fluctuate depending on the peripheral circuitry and frequency.
Please take this into consideration during circuit design.

The content specified in this document is correct as of 10th October, 2011.

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The content specified herein is subject to change for improvement without notice.

The content specified herein is for the purpose of introducing ROHM's products (hereinafter "Products"). If you wish to use any such Product, please be sure to refer to the specifications, which can be obtained from ROHM upon request.

Examples of application circuits, circuit constants and any other information contained herein illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.

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Please be sure to implement in your equipment using the Products safety measures to guard against the possibility of physical injury, fire or any other damage caused in the event of the failure of any Product, such as derating, redundancy, fire control and fail-safe designs. ROHM shall bear no responsibility whatsoever for your use of any Product outside of the prescribed scope or not in accordance with the instruction manual.

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If you intend to export or ship overseas any Product or technology specified herein that may be controlled under the Foreign Exchange and the Foreign Trade Law, you will be required to obtain a license or permit under the Law.

ROHM Sales Offices

Contact us for further information about the products.

San Diego	+1-858-625-3600	Mexico	+52-33-3123-2001	Spain	+34-9375-24320	Singapore	+65-6332-2322
Atlanta	+1-770-754-5972	Brazil	+55-11-3539-6320	Hungary	+36 1 950 5859	Philippines	+63-2-807-6872
Boston	+1-978-371-0382	Dusseldorf	+49-2154-921-0	Russia	+74 95 739 4174	Thailand	+66-2-254-4890
Chicago	+1-847-368-1006	Stuttgart	+49-711-7272370	Seoul	+82-2-8182-700	Malaysia	+60-3-7958-8355
Dallas	+1-972-473-3748	France	+33 (0) 1 40 60 87 30	Dalian	+86-411-8230-8549	India	+91-44-4352-0008
Denver	+1-303-708-0908	United Kingdom	+44-1-908-272400	Shanghai	+86-21-6279-2727	Kyoto	+81-75-365-1218
Detroit	+1-248-348-9920	Espoo	+358 400 222 382	Shenzhen	+86-755-8307-3008	Yokohama	+81-45-476-2121
Nashville	+1-615-620-6700	Salo	+358-2-7332234	Hong Kong	+852-2-740-6262		
Sunnyvale	+1-408-720-1900	Oulu	+358-400-726 124	Taiwan	+886-2-2500-6956		

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