



# Conductive polymer chip capacitors (Bottom surface electrode type : Large capacitance)

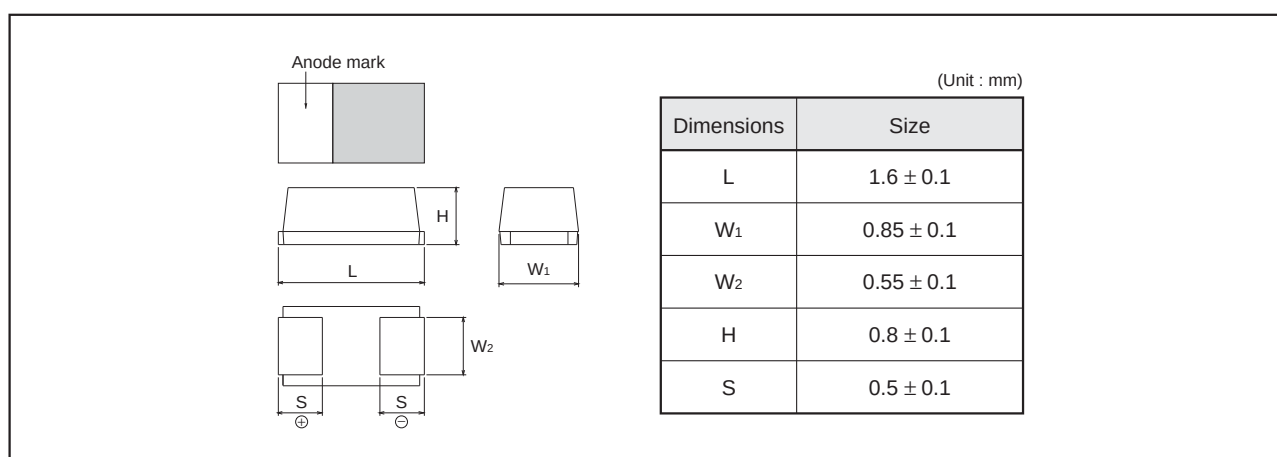
TCTO Series M Case

Datasheet

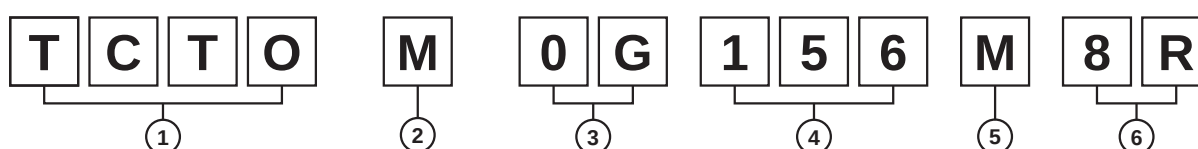
## ●Features

- 1) Conductive polymer used at the cathode for ultra-low ESR.
- 2) Bottom electrode configuration results in the largest capacitance.
- 3) Compact, low profile, ultra-high capacitance contribute to smaller, thinner sets with greater functionality.
- 4) Conductive polymer has a self-healing function that prevents failure, resulting in safe, high reliability operation.

## ●Dimensions



## ●Part No. Explanation



① Series name

TCTO

② Case style

M : 1608-09 (0603) size

③ Rated voltage

|                   |     |    |     |    |
|-------------------|-----|----|-----|----|
| Rated voltage (V) | 2.5 | 4  | 6.3 | 10 |
| CODE              | 0E  | 0G | 0J  | 1A |

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 :  $\pm 20\%$ 

⑥ Taping

8 : Tape width

R : Positive electrode on the side opposite to sprocket hole

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

## ●Rated table

(ESR : mΩ)

| Capacitance<br>(μF) | Rated voltage (V.DC) |      |      |     |
|---------------------|----------------------|------|------|-----|
|                     | 2.5                  | 4    | 6.3  | 10  |
| 2.2 (225)           |                      |      |      | 500 |
| 3.3 (335)           |                      |      |      | 500 |
| 4.7 (475)           |                      |      |      | 500 |
| 6.8 (685)           |                      |      | ☆500 |     |
| 10 (106)            |                      | ☆500 | ☆500 |     |
| 15 (156)            | ☆500                 | ☆500 |      |     |
| 22 (226)            | ☆500                 |      |      |     |

☆ Under development

## ●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                  |
| g            | 4                    |
| j            | 6.3                  |
| A            | 10                   |

| Capacitance Code | Nominal Capacitance (μF) |
|------------------|--------------------------|
| J                | 2.2                      |
| N                | 3.3                      |
| S                | 4.7                      |
| W                | 6.8                      |
| a                | 10                       |
| j                | 22                       |

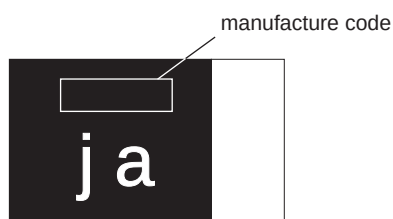
Visual typical example

voltage code and capacitance code are variable with parts number.

[M case]

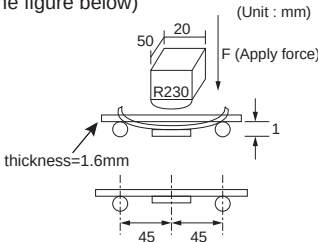
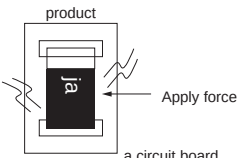
EX.)  $\frac{j}{(1)}$   $\frac{a}{(2)}$

(1) voltage code (2) capacitance code



## ●Characteristics

| Item                                                   |                    | Performance                                                                  | Test conditions (based on JIS C 5101-1 and JIS C 5101-3)                                                                                                                                                                                                                                 |
|--------------------------------------------------------|--------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating Temperature                                  |                    | -55°C to +105°C                                                              | Voltage reduction when temperature exceeds +85°C                                                                                                                                                                                                                                         |
| Maximum operating temperature with no voltage derating |                    | +85°C                                                                        |                                                                                                                                                                                                                                                                                          |
| Rated voltage (V.DC)                                   |                    | 2.5 4 6.3 10                                                                 | at 85°C                                                                                                                                                                                                                                                                                  |
| Category voltage (V.DC)                                |                    | 2 3.2 5 8                                                                    | at 105°C                                                                                                                                                                                                                                                                                 |
| Surge voltage (V.DC)                                   |                    | 3.2 5.0 8 13                                                                 | at 85°C                                                                                                                                                                                                                                                                                  |
| DC Leakage current                                     |                    | Shall be satisfied the voltage on " Standard list "                          | As per 4.9 JIS C 5101-1<br>As per 4.5.1 JIS C 5101-3<br>Voltage : Rated voltage for 5min                                                                                                                                                                                                 |
| Capacitance tolerance                                  |                    | Shall be satisfied allowance range. $\pm 20\%$                               | As per 4.7 JIS C 5101-1<br>As per 4.5.2 JIS C 5101-3<br>Measuring frequency : 120 $\pm$ 12Hz<br>Measuring voltage : 0.5Vrms +1.5 to 2V.DC<br>Measuring circuit : DC Equivalent series circuit                                                                                            |
| Tangent of loss angle (Df, tan $\delta$ )              |                    | Shall be satisfied the voltage on " Standard list "                          | As per 4.8 JIS C 5101-1<br>As per 4.5.3 JIS C 5101-3<br>Measuring frequency : 120 $\pm$ 12Hz<br>Measuring voltage : 0.5Vrms +1.5 to 2V.DC<br>Measuring circuit : DC Equivalent series circuit                                                                                            |
| ESR                                                    |                    | Shall be satisfied the voltage on " Standard list "                          | As per 4.10 JIS C 5101-1<br>As per 4.5.4 JIS C 5101-3<br>Measuring frequency : 100 $\pm$ 10kHz<br>Measuring voltage : 0.5Vrms or less<br>Measuring circuit : DC Equivalent series circuit                                                                                                |
| Resistance to Soldering heat                           | Appearance         | There should be no significant abnormality. The indications should be clear. | As per 4.14 JIS C 5101-1<br>As per 4.6 JIS C 5101-3<br>Dip in the solder bath<br>Solder temp : 240 $\pm$ 5°C<br>Duration : 10 $\pm$ 0.5s<br>Repetition : 1<br>After the specimens, leave it at room temperature for over 24h and then measure the sample.                                |
|                                                        | L.C.               | Less than 300% of initial limit                                              |                                                                                                                                                                                                                                                                                          |
|                                                        | $\Delta C / C$     | Within $\pm 20\%$ of initial value                                           |                                                                                                                                                                                                                                                                                          |
|                                                        | Df (tan $\delta$ ) | Less than 300% of initial limit                                              |                                                                                                                                                                                                                                                                                          |
| Temperature cycle                                      | Appearance         | There should be no significant abnormality. The indications should be clear. | As per 4.16 JIS C 5101-1<br>As per 4.10 JIS C 5101-3<br>Repetition : 5 cycles<br>(1 cycle : steps 1 to 4) without discontinuation.                                                                                                                                                       |
|                                                        | L.C.               | Less than 1000% of initial limit                                             |                                                                                                                                                                                                                                                                                          |
|                                                        | $\Delta C / C$     | Within $\pm 20\%$ of initial value                                           |                                                                                                                                                                                                                                                                                          |
|                                                        | Df (tan $\delta$ ) | Less than 300% of initial limit                                              |                                                                                                                                                                                                                                                                                          |
| Moisture resistance                                    | Appearance         | There should be no significant abnormality. The indications should be clear. | As per 4.22 JIS C 5101-1<br>As per 4.12 JIS C 5101-3<br>After leaving the sample under such atmospheric condition that the temperature and humidity are 40 $\pm$ 2°C and 90 to 95% RH, respectively, for 500 $\pm$ 12h leave it at room temperature for 24h and then measure the sample. |
|                                                        | L.C.               | Less than 300% of initial limit                                              |                                                                                                                                                                                                                                                                                          |
|                                                        | $\Delta C / C$     | Within +30/-20% of initial value                                             |                                                                                                                                                                                                                                                                                          |
|                                                        | Df (tan $\delta$ ) | Less than 300% of initial limit                                              |                                                                                                                                                                                                                                                                                          |

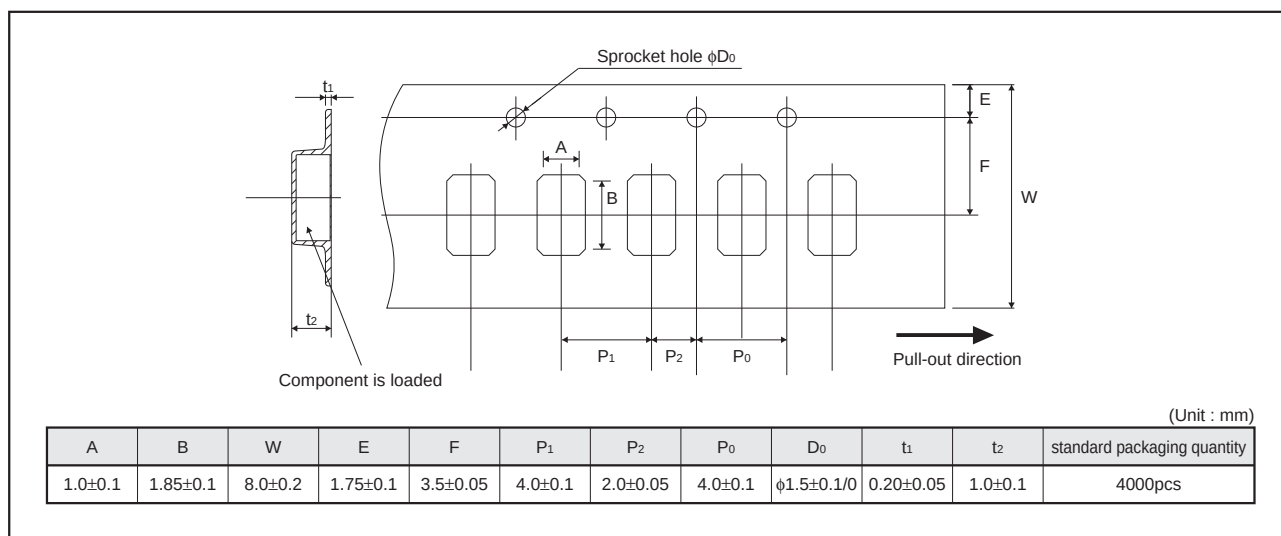
| Item                        |                    | Performance                                                                                                                | Test conditions (based on JIS C 5101-1 and JIS C 5101-3)                                                                                                                                                                                                                                                   |
|-----------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature Stability       | Temp.              | -55°C                                                                                                                      | As per 4.29 JIS C 5101-1<br>As per 4.13 JIS C 5101-3                                                                                                                                                                                                                                                       |
|                             | $\Delta C / C$     | Within 0/-20% of initial value                                                                                             |                                                                                                                                                                                                                                                                                                            |
|                             | Df (tan $\delta$ ) | Shall be satisfied the voltage on " Standard list "                                                                        |                                                                                                                                                                                                                                                                                                            |
|                             | L.C.               | -                                                                                                                          |                                                                                                                                                                                                                                                                                                            |
|                             | Temp.              | +105°C                                                                                                                     |                                                                                                                                                                                                                                                                                                            |
|                             | $\Delta C / C$     | Within +50/0% of initial value                                                                                             |                                                                                                                                                                                                                                                                                                            |
|                             | Df (tan $\delta$ ) | Shall be satisfied the voltage on " Standard list "                                                                        |                                                                                                                                                                                                                                                                                                            |
|                             | L.C.               | Less than 1,000% of initial value                                                                                          |                                                                                                                                                                                                                                                                                                            |
| Surge voltage               | Appearance         | There should be no significant abnormality.                                                                                | As per 4.26 JIS C 5101-1<br>As per 4.14 JIS C 5101-3<br>Apply the specified surge voltage every 5±0.5 min. for 30±5 s. each time in the atmospheric condition of 85±2°C. Repeat this procedure 1,000 times.<br>After the specimens, leave it at room temperature for over 24h and then measure the sample. |
|                             | L.C.               | Less than 200% of initial value                                                                                            |                                                                                                                                                                                                                                                                                                            |
|                             | $\Delta C / C$     | Within ±20% of initial value                                                                                               |                                                                                                                                                                                                                                                                                                            |
|                             | Df (tan $\delta$ ) | Less than 200% of initial limit                                                                                            |                                                                                                                                                                                                                                                                                                            |
| Loading at High temperature | Appearance         | There should be no significant abnormality.                                                                                | As per 4.23 JIS C 5101-1<br>As per 4.15 JIS C 5101-3<br>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 24h and measure the value.                        |
|                             | L.C.               | Less than 400% of initial limit                                                                                            |                                                                                                                                                                                                                                                                                                            |
|                             | $\Delta C / C$     | Within ±20% of initial value                                                                                               |                                                                                                                                                                                                                                                                                                            |
|                             | Df (tan $\delta$ ) | Less than 300% of initial limit                                                                                            |                                                                                                                                                                                                                                                                                                            |
| Terminal strength           | Capacitance        | The measured value should be stable.                                                                                       | As per 4.35 JIS C 5101-1<br>As per 4.9 JIS C 5101-3<br>A force is applied to the terminal until it bends to 1mm and by a prescribed tool maintain the condition for 5s.<br>(See the figure below)                                                                                                          |
|                             | Appearance         | There should be no significant abnormality.                                                                                |                                                                                                                                                                                                                                                                                                            |
|                             |                    |                                                                                                                            |  <p>(Unit : mm)</p> <p>thickness=1.6mm</p>                                                                                                                                                                              |
| Adhesiveness                |                    | The terminal should not come off.                                                                                          | As per 4.34 JIS C 5101-1<br>As per 4.8 JIS C 5101-3<br>Apply force of 5N in the two directions shown in the figure below for 10±1s after mounting the terminal on a circuit board.                                                                                                                         |
|                             |                    |                                                                                                                            |  <p>product</p> <p>Apply force</p> <p>a circuit board</p>                                                                                                                                                             |
| 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<br>As per 4.18 JIS C 5101-3<br>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<br>As per 4.7 JIS C 5101-3<br>Dip speed=25±2.5mm /s<br>Pre-treatment (accelerated aging): Leave the sample on the boiling distilled water for 1 h.<br>Solder temp. : 245±5°C<br>Duration : 3±0.5s<br>Solder : M705<br>Flux : Rosin 25% IPA 75%                                  |
| Vibration                   | Capacitance        | Measure value should not fluctuate during the measurement.                                                                 | As per 4.17 JIS C 5101-1<br>Frequency : 10 to 55 to 10Hz/min.<br>Amplitude : 1.5mm<br>Time : 2h each in X and Y directions<br>Mounting : The terminal is soldered on a print circuit board.                                                                                                                |
|                             | Appearance         | There should be no significant abnormality.                                                                                |                                                                                                                                                                                                                                                                                                            |

## ●Standard products list

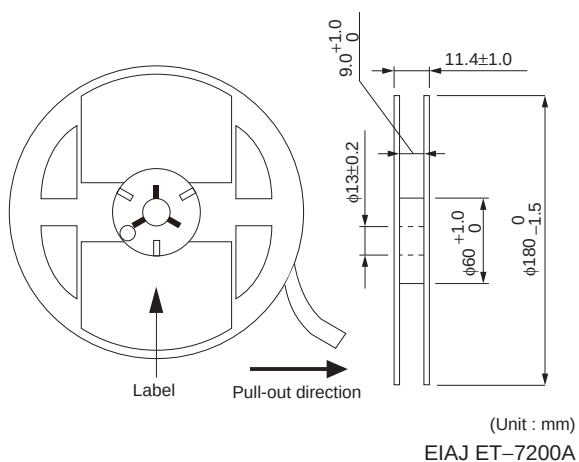
| Part No.            | Rated voltage<br>85°C<br>(V) | Category voltage<br>125°C<br>(V) | Surge voltage<br>85°C<br>(V) | Cap.<br>120Hz<br>(μF) | Tolerance<br>(%) | Leakage current<br>25°C<br>1WV.5min<br>(μA) | Df<br>120Hz<br>(%) |              |       | ESR<br>100kHz<br>(mΩ) |
|---------------------|------------------------------|----------------------------------|------------------------------|-----------------------|------------------|---------------------------------------------|--------------------|--------------|-------|-----------------------|
|                     |                              |                                  |                              |                       |                  |                                             | -55°C              | 25°C<br>85°C | 105°C |                       |
| * TCTO M 0E 156 M8R | 2.5                          | 2                                | 3.2                          | 15                    | ± 20             | 3.8                                         | 8                  | 8            | 12    | 500                   |
| * TCTO M 0E 226 M8R | 2.5                          | 2                                | 3.2                          | 22                    | ± 20             | 5.5                                         | 8                  | 8            | 12    | 500                   |
| * TCTO M 0G 106 M8R | 4                            | 3.2                              | 5                            | 10                    | ± 20             | 4.0                                         | 8                  | 8            | 12    | 500                   |
| * TCTO M 0G 156 M8R | 4                            | 3.2                              | 5                            | 15                    | ± 20             | 6.0                                         | 8                  | 8            | 12    | 500                   |
| * TCTO M 0J 685 M8R | 6.3                          | 5                                | 8                            | 6.8                   | ± 20             | 4.3                                         | 6                  | 6            | 9     | 500                   |
| * TCTO M 0J 106 M8R | 6.3                          | 5                                | 8                            | 10                    | ± 20             | 6.3                                         | 8                  | 8            | 12    | 500                   |
| TCTO M 1A 225 M8R   | 10                           | 8                                | 13                           | 2.2                   | ± 20             | 2.2                                         | 6                  | 6            | 9     | 500                   |
| TCTO M 1A 335 M8R   | 10                           | 8                                | 13                           | 3.3                   | ± 20             | 3.3                                         | 6                  | 6            | 9     | 500                   |
| TCTO M 1A 475 M8R   | 10                           | 8                                | 13                           | 4.7                   | ± 20             | 4.7                                         | 6                  | 6            | 9     | 500                   |

\* = Under development

## ●Packaging specifications

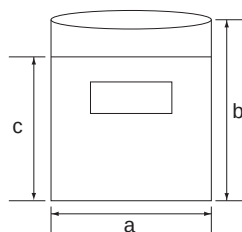


## ●Reel dimensions



## ●Damp proof package

- ① One 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.
- ② A desiccant is packed with a reel.
- ③ The aluminum bag is heat-sealed.
- ④ The label of the same as the label on the reel is placed on the aluminum bag.



## Notes

- 1) The information contained herein is subject to change without notice.
- 2) Before you use our Products, please contact our sales representative and verify the latest specifications :
- 3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.  
Therefore, in order to prevent personal injury or fire arising from failure, please take safety measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. ROHM shall have no responsibility for any damages arising out of the use of our Products beyond the rating specified by ROHM.
- 4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.
- 5) The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM or any other parties. ROHM shall have no responsibility whatsoever for any dispute arising out of the use of such technical information.
- 6) The Products are intended for use in general electronic equipment (i.e. AV/OA devices, communication, consumer systems, gaming/entertainment sets) as well as the applications indicated in this document.
- 7) The Products specified in this document are not designed to be radiation tolerant.
- 8) For use of our Products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a ROHM representative : transportation equipment (i.e. cars, ships, trains), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, servers, solar cells, and power transmission systems.
- 9) Do not use our Products in applications requiring extremely high reliability, such as aerospace equipment, nuclear power control systems, and submarine repeaters.
- 10) ROHM shall have no responsibility for any damages or injury arising from non-compliance with the recommended usage conditions and specifications contained herein.
- 11) ROHM has used reasonable care to ensure the accuracy of the information contained in this document. However, ROHM does not warrant that such information is error-free, and ROHM shall have no responsibility for any damages arising from any inaccuracy or misprint of such information.
- 12) Please use the Products in accordance with any applicable environmental laws and regulations, such as the RoHS Directive. For more details, including RoHS compatibility, please contact a ROHM sales office. ROHM shall have no responsibility for any damages or losses resulting from non-compliance with any applicable laws or regulations.
- 13) When providing our Products and technologies contained in this document to other countries, you must abide by the procedures and provisions stipulated in all applicable export laws and regulations, including without limitation the US Export Administration Regulations and the Foreign Exchange and Foreign Trade Act.
- 14) This document, in part or in whole, may not be reprinted or reproduced without prior consent of ROHM.



Thank you for your accessing to ROHM product informations.  
More detail product informations and catalogs are available, please contact us.

## ROHM Customer Support System

<http://www.rohm.com/contact/>

