

CHIP COIL (CHIP INDUCTORS) for Automotive powertrain/safety equipment DFE32CAH□□□R□ Murata Standard Reference Specification [AEC-Q200]

1. Scope

This reference specification applies to DFE32CAH series based on AEC-Q200.

1.1 Specific applications:

- Automotive powertrain/safety equipment: Products that can be used for automotive equipment related to running, turning, stopping, safety devices, etc., or equipment whose structure, equipment, and performance are legally required to meet technical standards for safety assurance or environmental protection.
- Automotive infotainment/comfort equipment: Products that can be used for automotive equipment such as car navigation systems and car audio systems that do not directly relate to human life and whose structure, equipment, and performance are not specifically required by law to meet technical standards for safety assurance or environmental protection.
- Medical equipment (GHTF Class C) *Except for implant/surgery/auto injector: Products that can be used for medical equipment of Class C of the international classification class GHTF and whose malfunction is considered to pose a relatively high risk to the human body.
- Medical equipment (GHTF Class A and B): Products that can be used for medical equipment regulated by Class A and Class B of the international classification class GHTF and whose functions do not directly relate to the protection of human life and property.

1.2 Unsuitable application:

Applications listed in "Limitation of applications" in this reference specification.

2. Part Numbering

(ex)	DF	E	32	CA	H	R47	M	R	0	L
	Product ID	Type	Dimension (L×W)	Applications And Characteristics	Category	Inductance	Tolerance	Dimension (T)	special specification	Packaging

3. Rating

- Operating Temperature Range (product temperature including self-temperature rise) -55 to +150°C
- Storage Temperature Range. -55 to +150°C

Customer Part Number	Murata Part Number	Inductance		DC Resistance (Ω)		*3 Rated Current (mA)				ESD Level (HBM)
						*1 Based on inductance change		*2 Based on Temperature rise		
		Nominal value (uH)	Tolerance (%)	Max.	Typ.	Max.	Typ.	Max.	Typ.	
	DFE32CAHR47MR0L	0.47	±20	0.014	0.008	8700	10800	5900	7600	2
	DFE32CAHR68MR0L	0.68	±20	0.017	0.011	7000	9400	5000	6700	1C
	DFE32CAH1R0MR0L	1.0	±20	0.022	0.015	5900	8100	4100	6200	1C
	DFE32CAH1R5MR0L	1.5	±20	0.030	0.023	4800	6700	3500	5100	1B
	DFE32CAH2R2MR0L	2.2	±20	0.043	0.033	4000	5500	2900	4000	1B
	DFE32CAH3R3MR0L	3.3	±20	0.067	0.050	3300	4600	2300	3400	1A
	DFE32CAH4R7MR0L	4.7	±20	0.101	0.079	2800	3700	1900	2600	1A

*1: The saturation allowable DC current value is specified when the decrease of the initial Inductance value at 30%.

*2: When a rated current (based on Temperature rise) is applied, the temperature rise due to self-heating of the product is 40 °C or less.

*3: Keep the product temperature (ambient temperature + self-heating) below 150 °C. The rated current value is the smaller of the rated current (based on Inductance change) or the rated current (based on Temperature rise).

4. Testing Conditions (Standard atmospheric conditions)

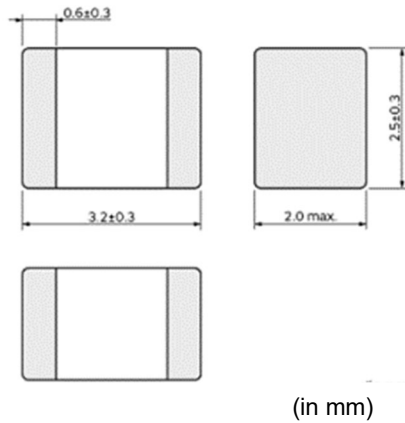
<Unless otherwise specified>

Temperature : Ordinary Temperature (15 to 35°C)
Humidity : Ordinary Humidity (25 to 85 %(RH))

<In case of doubt>

Temperature : 20 ± 2°C
Humidity : 60 to 70 %(RH)
Atmospheric Pressure : 86 to 106 kPa

5. Appearance and Dimensions



■ Unit mass (typical value): 0.0913 g

6. Marking

No marking

7. Electrical Performance

No.	Item.	Specification	Test Method
7.1	Inductance	Meet item 3.	Measuring Equipment: Keysight 4284A or equivalent Measurement signal level : 0.5V Measuring Frequency: 1MHz
7.2	DC Resistance		Measuring Equipment: Digital multimeter
7.3	Rated Current (based on Inductance change)	The saturation allowable DC current value is specified when the decrease of the initial Inductance value at 30%.	The rated current specified in Chapter 3 is applied.
7.4	Rated Current (based on Temperature rise)	The temperature rise due to self-heating due to rated current application based on temperature rise is 40 °C or less.	The rated current specified in Chapter 3 is applied.
7.5	withstand voltage	Inductance shall meet item 3.	Testing Equipment: Impulse tester Applied voltage: 60~70V (by item)

8. Q200 Requirement

Performance(based on Table 5 for Magnetics Inductors/Transformer)

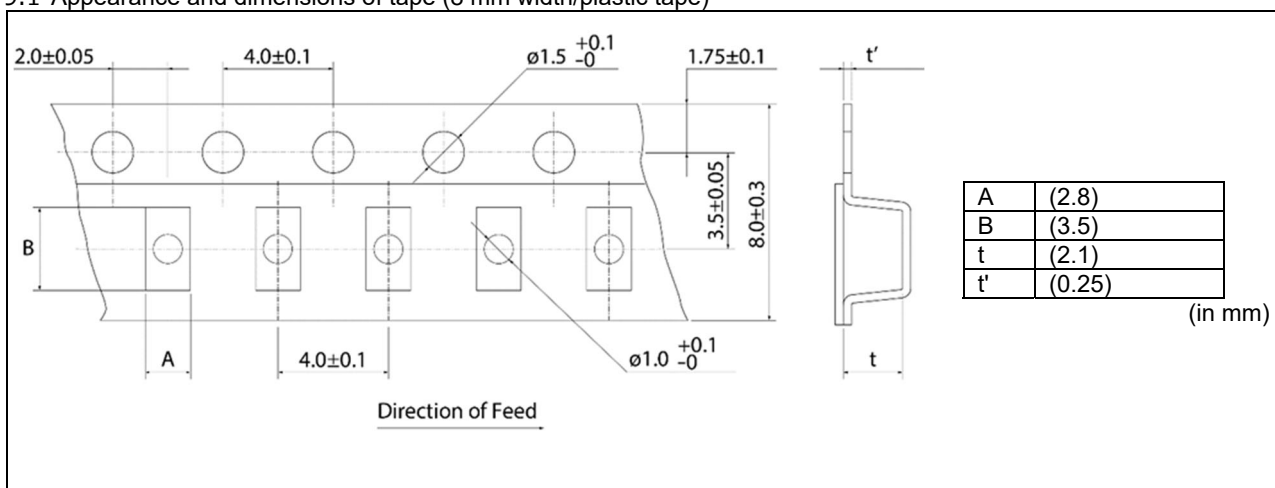
AEC-Q200 Rev.D issued June 1. 2010

AEC-Q200			Murata Specification / Deviation
No.	Stress	Test Method	
3	High temperature exposure	1000 h at 150°C Set for 24 h at room condition, then measured.	Appearance: No damage Inductance change rate: within ±10%
4	Temperature cycling	1000 cycles -55°C to +150°C Set for 24 h at room condition, then measured.	Appearance: No damage Inductance change rate: within ±10%
7	Biased humidity	1000 h at 85°C, 85% (RH). Unpowered. Set for 24 h at room condition, then measured.	Appearance: No damage Inductance change rate: within ±10%
8	Operational life	Apply 110°C 1000 h Set for 24 h at room condition, then measured.	Appearance: No damage Inductance change rate: within ±10%
9	External visual	Visual inspection	No abnormalities
10	Physical dimension	Meet chapter 5, "Appearance and Dimensions".	No defects
13	Mechanical shock	Per MIL-STD-202 Method 213 Condition C: 100 g's/6 ms/half sine	Appearance: No damage Inductance change rate: within ±10%
14	Vibration	5 g's for 20 min, 12 cycles each of 3 orientations Test from 10 Hz to 2000 Hz	Appearance: No damage Inductance change rate: within ±10%

AEC-Q200			Murata Specification / Deviation
No.	Stress	Test Method	
15	Resistance to Soldering Heat	Pre-heating : 150 to 180°C / 90±30sec Reflow soldering method above 220°C, 60±30 sec Temperature condition above 255°C, above 30sec Peak : above 260°C The specimen shall be subjected to the reflow process under the above condition 3times. Test board shall be 1.6 mm thick. Base material shall be glass epoxy resin. The specimen shall be stored at standard atmospheric conditions for 1 h in prior to the measurement.	Appearance: No damage Inductance change rate: within ±10%
17	ESD	Per AEC-Q200-002	ESD Rank: Refer to chapter 3, "Part Number and Rating". Appearance: No damage
18	Solderability	Per J-STD-002	90% or more of the outer electrode shall be covered with new solder seamlessly. <u>Deviation for AEC-Q200</u> Method b: Not applicable Pre-heating: 150°C/60s
19	Electrical Characterization	Measured: inductance	No defects
20	Flammability	Per UL-94	Not applicable
21	Board Flex	Epoxy-PCB (1.6 mm) Deflection 2 mm (min.) 60 s minimum holding time	Appearance: No damage Inductance change rate: within ±10%
22	Terminal Strength	Per AEC-Q200-006 A force of 17.7 N for 60 s	Appearance: No damage

9. Specification of Packaging

9.1 Appearance and dimensions of tape (8 mm width/plastic tape)



Dimensions A and B are at the bottom of the cavity. The A, B, t, t' dimensions are reference values.

9.2 Taping specification

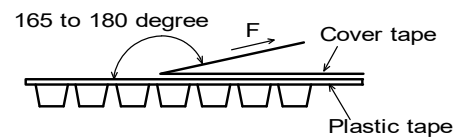
Packing quantity (Standard quantity)	2000 pcs/reel
Packing method	The products are placed in cavities of a carrier tape and sealed by a cover tape.
Feed hole position	The feed holes on the carrier tape are on the right side when the cover tape is pulled toward the user.
Joint	The carrier tape and cover tape are seamless.
Number of missing products	Number of missing products within 0.025% of the number per reel or 1 pc., whichever is greater, and are not continuous. The specified quantity per reel is kept.

9.3 Break down force of tape

Cover tape	10N min.
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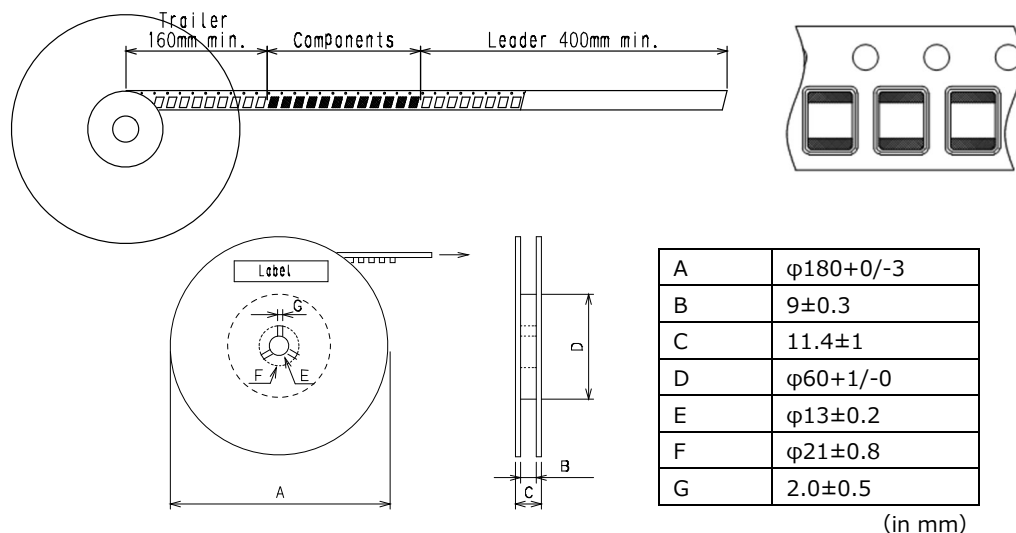
9.4 Peeling off force of cover tape

Speed of Peeling off	300mm/min
Peeling off force	0.1 to 0.7N (The lower limit is for typical value.)



9.5 Dimensions of leader section, trailer section and reel

A vacant section is provided in the leader (start) section and trailer (end) section of the tape for the product. The leader section is further provided with an area consisting only of the cover tape (or top tape). (See the diagram below.)



9.6 Marking for reel

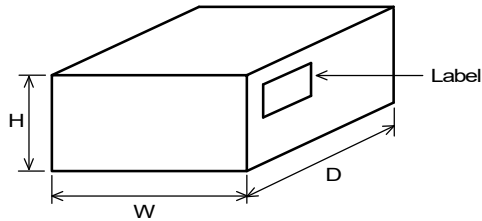
Customer part number, MURATA part number, Inspection number(*1), RoHS marking(*2), Quantity etc ...

*1 Expression of inspection No.: $\square\square$ $\bigcirc\bigcirc\bigcirc\bigcirc$ $\diamond\diamond\diamond$ (1) (2) (3)	(1) Factory code (2) Date First digit: year/last digit of year Second digit: month/Jan. to Sep.→1 to 9, Oct. to Dec.→O, N, D Third, Fourth digit: day (3) Serial No.
*2 Expression of RoHS marking: ROHS- $\frac{Y}{(1)}$ $\frac{(\Delta)}{(2)}$	(1) RoHS regulation conformity (2) Murata classification number

9.7 Marking on outer box (corrugated box)

Customer name, purchasing order number, customer part number, Murata part number, RoHS marking (*2), quantity, etc.

9.8 Specification of Outer box



Outer Case Dimensions (mm)			Standard Reel Quantity in Outer Case (Reel)
W	D	H	
185	195	65	*5
*Above Outer Case size is typical. It depends on a quantity of an order.			

10. **Caution**

10.1 Limitation of applications

The products listed in the product specification (hereinafter the product(s) is called as the "Product(s)") are designed and manufactured for applications specified in the product specification (hereinafter called as the "Specific Application").

We shall not warrant anything in connection with the Products including fitness, performance, adequateness, safety, or quality, in the case of applications listed in from (1) to (11) written at the end of this precautions, which may generally require high performance, function, quality, management of production or safety. Therefore, the Product shall be applied in compliance with the specific application.

WE DISCLAIM ANY LOSS AND DAMAGES ARISING FROM OR IN CONNECTION WITH THE PRODUCTS INCLUDING BUT NOT LIMITED TO THE CASE SUCH LOSS AND DAMAGES CAUSED BY THE UNEXPECTED ACCIDENT, IN EVENT THAT (i) THE PRODUCT IS APPLIED FOR THE PURPOSE WHICH IS NOT SPECIFIED AS THE SPECIFIC APPLICATION FOR THE PRODUCT, AND/OR (ii) THE PRODUCT IS APPLIED FOR ANY FOLLOWING APPLICATION PURPOSES FROM (1) TO (11) (EXCEPT THAT SUCH APPLICATION PURPOSE IS UNAMBIGUOUSLY SPECIFIED AS SPECIFIC APPLICATION FOR THE PRODUCT IN OUR CATALOG SPECIFICATION FORMS, DATASHEETS, OR OTHER DOCUMENTS OFFICIALLY ISSUED BY US*).

- (1) Aircraft equipment
- (2) Aerospace equipment
- (3) Undersea equipment
- (4) Power plant control equipment
- (5) Medical equipment
- (6) Transportation equipment
- (7) Traffic control equipment
- (8) Disaster prevention/security equipment
- (9) Industrial data-processing equipment
- (10) Combustion/explosion control equipment
- (11) Equipment with complexity and/or required reliability equivalent to the applications listed in the above.

For exploring information of the Products which will be compatible with the particular purpose other than those specified in the product specification, please contact our sales offices, distribution agents, or trading companies with which you make a deal, or via our web contact form.

Contact form: <https://www.murata.com/contactform>

* We may design and manufacture particular Products for applications listed in (1) to (11). Provided that, in such case we shall unambiguously specify such Specific Application in the product specification without any exception. Therefore, any other documents and/or performances, whether exist or non-exist, shall not be deemed as the evidence to imply that we accept the applications listed in (1) to (11).

10.2 Precautions on rating

Avoid using in exceeded the rated temperature range, rated voltage, or rated current.

Usage when the ratings are exceeded could lead to wire breakage, burning, or other serious fault.

10.3 Inrush current

If an inrush current (or pulse current or rush current) that significantly exceeds the rated current is applied to the product, overheating could occur, resulting in wire breakage, burning, or other serious fault.

10.4 Circuit voltage

There is a possibility available for DCDC converters with a maximum voltage of 40V or less.

Be sure to evaluate the actual machine in advance to check the quality of this product.

10.5 Fail-safe

Be sure to provide an appropriate fail-safe function on your product to prevent a second damage that may be caused by the abnormal function or the failure of our product.

10.6 Corrosive gas

Do not use this product when exposed to corrosive gases (Sulfur gases [Hydrogen sulfide, sulfur dioxide, etc.], chlorine, ammonia, etc.) or in contact with oil (Cutting oil, silicone oil, etc.) exposed to corrosive gases. This may cause deterioration or degradation of the product electrode, resulting in opening. our company assumes no responsibility for use in this environment.

11 Precautions for Use

This product is designed to be mounted by soldering. If you want to use other mounting method, for example, using a conductive adhesive, please consult us beforehand.

Also, if repeatedly subjected to temperature cycles or other thermal stress, due to the difference in the coefficient of thermal expansion with the mounting substrate, the solder (solder fillet part) in the mounting part may crack.

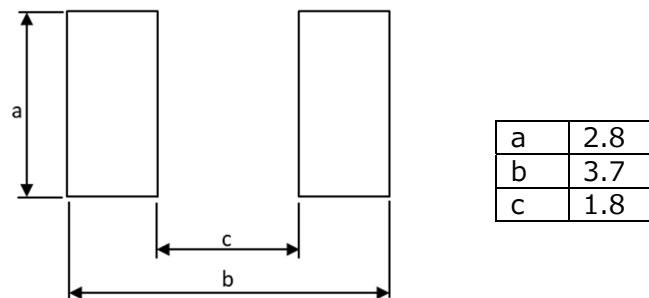
The occurrence of cracks due to thermal stress is affected by the size of the land where mounted, the solder volume, and the heat dissipation of the mounting substrate. Carefully design it when a large change in ambient temperature is assumed.

This product has a lower insulation resistance than conventional ferrite products, so care must be paid to its use.

- Do not make any through holes and copper pattern under the coil except a copper pattern to the electrode.
- Design/mount any components not to contact this product.

11.1 Land dimensions

The following diagram shows the recommended land dimensions for flow and reflow soldering:



(in mm)

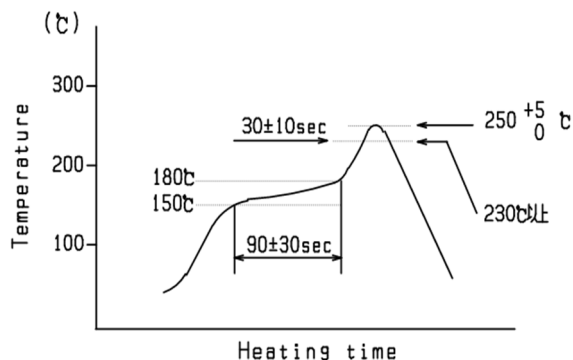
11.2 Flux and solder used

Flux	•Use rosin-based flux. •Don't use highly acidic flux with halide content exceeding 0.2(wt)% (chlorine conversion value). •Don't use water-soluble flux.
Solder	•Use Sn-3.0Ag-0.5Cu solder •Standard thickness of solder paste : 100μm to 150μm

Other flux (except above) Please contact us for details, then use.

11.3 Soldering conditions (Reflow)

- Pre-heating should be in such a way that the temperature difference between solder and product surface is limited to 100°C max. Cooling into solvent after soldering also should be in such a way that the temperature difference is limited to 100°C max. Insufficient pre-heating may cause cracks on the product, resulting in the deterioration of product quality.
- Standard soldering profile is as follows.



	Standard profile
Pre-heating	150~180°C/90 s±30 s
Heating	Above 230°C/30 s±10 s
Peak temperature	250°C +5/-0°C
Number of reflow cycles	2times

11.4 Reworking with soldering iron

The following requirements must be met to rework a soldered product using a soldering iron.

Item	Requirement
Pre-heating	150°C/approx. 1 min
Tip temperature of soldering iron	350°C max.
Power consumption of soldering iron	60 W max.
Tip diameter of soldering iron	ø3 mm max.
Soldering time	3 s (+1 s, -0 s)
Number of reworking operations	2 times max.
* Avoid a direct contact of the tip of the soldering iron with the product. Such a direction contact may cause cracks in the ceramic body due to thermal shock.	

11.5 Solder volume

Solder shall be used not to increase the volume too much.

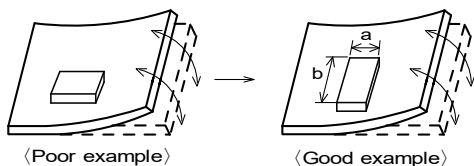
An increased solder volume increases mechanical stress on the product. Exceeding solder volume may cause the failure of mechanical or electrical performance.

11.6 Product's location

The following shall be considered when designing and laying out P.C.B.'s.

- (1) P.C.B. shall be designed so that products are not subject to the mechanical stress due to warping the board.

[Products direction]



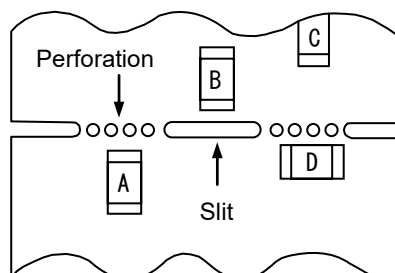
Products shall be located in the sideways direction to the mechanical stress.

- (2) Components location on P.C.B. separation.

It is effective to implement the following measures, to reduce stress in separating the board.

It is best to implement all of the following three measures; however, implement as many measures as possible to reduce stress.

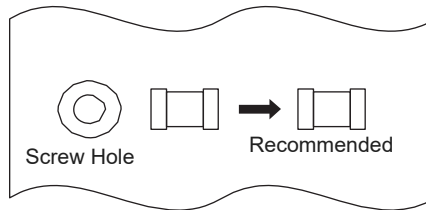
Contents of Measures	Stress Level
(1) Turn the mounting direction of the component parallel to the board separation surface.	$A > D^{*1}$
(2) Add slits in the board separation part.	$A > B$
(3) Keep the mounting position of the component away from the board separation surface.	$A > C$
*1 $A > D$ is valid when stress is added vertically to the perforation as with hand separation. If a cutting disc is used, stress will be diagonal to the PCB, therefore $A > D$ is invalid.	



(3) Mounting components near screw holes

When a component is mounted near a screw hole, it may be affected by the board deflection that occurs during the tightening of the screw.

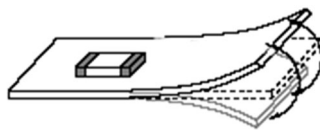
Mount the component in a position as far away from the screw holes as possible.



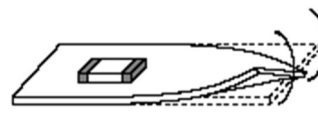
11.7 Handling of substrate

After mounting products on a substrate, do not apply any stress to the product caused by bending or twisting to the substrate when cropping the substrate, inserting and removing a connector from the substrate or tightening screw to the substrate.

Excessive mechanical stress may cause cracking in the product.



Bending



Twisting

11.8 Cleaning

When cleaning this product, observe the following conditions:

(1) The cleaning temperature shall be 60°C max. If isopropyl alcohol (IPA) is used, the cleaning temperature shall be 40°C max.

(2) During ultrasonic cleaning, under some cleaning conditions, the resonation of PCB should be caused by its vibration.

Be sure to do the test cleaning with actual cleaning equipment before production and confirm that product does not be damaged by cleaning.

(3) Cleaner

Alcohol-based cleaner: IPA

(4) There shall be no residual flux or residual cleaner. When using aqueous agent, rinse the product with deionized water adequately and completely dry it so that no cleaner is left.

11.9 Storage and transportation

Storage period	Use the product within 6 months after delivery. If you do not use the product for more than 6 months, check solderability before using it.
Storage conditions	- The products shall be stored in a room not subject to rapid changes in temperature and humidity. The recommended temperature range is -10°C to +40°C. The recommended relative humidity range is 15% to 85%. Keeping the product in corrosive gases, such as sulfur, chlorine gas or acid may cause the poor solderability. - Do not place the products directly on the floor; they should be placed on a palette so that they are not affected by humidity or dust. - Avoid keeping the products in a place exposed to direct sunlight, heat or vibration. - Do not keep products in bulk packaging. Doing so may cause collision between the products or between the products and other products, resulting in chipping or wire breakage. - Avoid storing the product by itself bare (i.e. exposed directly to air).
Transportation	Excessive vibration and impact reduce the reliability of the products. Exercise caution when handling the products.

11.10 Resin coating (including moistureproof coating)

Coating/molding the product with resin may change electrical characteristics.

A wire breakage issue may occur by mechanical stress caused by the resin, amount/cured shape of resin, or operating condition etc. Some resin contains some impurities or chloride possible to generate chlorine by hydrolysis under some operating condition may cause corrosion of conductor, leading to wire breakage.

Prior to use the coating resin, please make sure no reliability issue is observed by evaluating products mounted on your board.

11.11 Mounting Conditions

- Please check the mounting condition before using.
- Using mounting conditions (nozzles, equipment conditions, etc.) that are not suitable for products may lead to pick up errors, misalignment, or damage to the product.

11.12 Operating Environment

Do not use this product under the following environmental conditions as it may cause deterioration of product quality.

- (1) in the corrodible atmosphere such as acidic gases, alkaline gases, chlorine, sulfur gases, organic gases and etc. (the sea breeze, Cl₂, H₂S, NH₃, SO₂, NO₂, etc)
- (2) in the atmosphere where liquid such as organic solvent, may splash on the products.
- (3) in the atmosphere where the temperature / humidity changes rapidly and it is easy to dew.

11.13 Implementation density

When placing this product near parts with heat generation, take sufficient heat radiation countermeasures.

If the heat received from other parts is large, the characteristics of this product may deteriorate, causing circuit operational failure or deterioration of the joints.

Be sure to use this product below the maximum rated operating temperature even when heat received from other parts is applied.

11.14 Handling of product

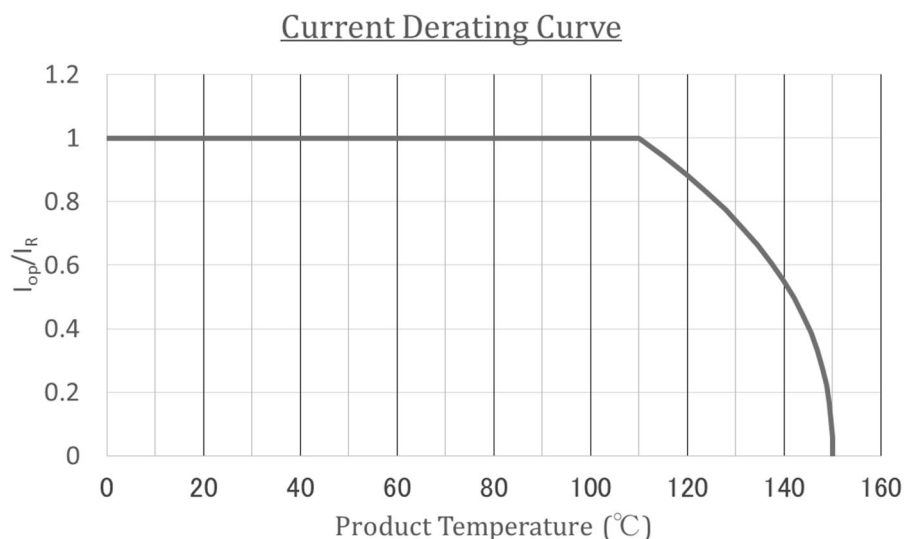
Inductance could change due to the effect of magnetism. Do not use magnetized tweezers, magnets, or other similar tools when handling the product (instead, use tweezers with resin or ceramic tips).

11.15 Derating

Max. current (DC, AC) as function of product temperature (derating curve)

I_{OP} : Loaded Current

I_R : Rated Current



12. Note

- (1) Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
- (2) You are requested not to use our product deviating from the reference specifications.
- (3) The contents of this reference specification are subject to change without advance notice.
Please approve our product specifications or transact the approval sheet for product specifications before ordering.