

Please read this notice before using the TAIYO YUDEN products.

## REMINDERS

- Product information in this catalog is as of October 2017. All of the contents specified herein are subject to change without notice due to technical improvements, etc. Therefore, please check for the latest information carefully before practical application or use of our products.

Please note that TAIYO YUDEN shall not be in any way responsible for any damages and defects in products or equipment incorporating our products, which are caused under the conditions other than those specified in this catalog or individual product specification sheets.

- Please contact TAIYO YUDEN for further details of product specifications as the individual product specification sheets are available.
- Please conduct validation and verification of our products in actual condition of mounting and operating environment before using our products.
- The products listed in this catalog are intended for use in general electronic equipment (e.g., AV equipment, OA equipment, home electric appliances, office equipment, information and communication equipment including, without limitation, mobile phone, and PC) and medical equipment classified as Class I or II by IMDRF. Please be sure to contact TAIYO YUDEN for further information before using the products for any equipment which may directly cause loss of human life or bodily injury (e.g., transportation equipment including, without limitation, automotive powertrain control system, train control system, and ship control system, traffic signal equipment, disaster prevention equipment, medical equipment classified as Class III by IMDRF, highly public information network equipment including, without limitation, telephone exchange, and base station).

Please do not incorporate our products into any equipment requiring high levels of safety and/or reliability (e.g., aerospace equipment, aviation equipment\*, medical equipment classified as Class IV by IMDRF, nuclear control equipment, undersea equipment, military equipment).

\*Note: There is a possibility that our products can be used only for aviation equipment that does not directly affect the safe operation of aircraft (e.g., in-flight entertainment, cabin light, electric seat, cooking equipment) if such use meets requirements specified separately by TAIYO YUDEN. Please be sure to contact TAIYO YUDEN for further information before using our products for such aviation equipment.

When our products are used even for high safety and/or reliability-required devices or circuits of general electronic equipment, it is strongly recommended to perform a thorough safety evaluation prior to use of our products and to install a protection circuit as necessary.

Please note that unless you obtain prior written consent of TAIYO YUDEN, TAIYO YUDEN shall not be in any way responsible for any damages incurred by you or third parties arising from use of the products listed in this catalog for any equipment requiring inquiry to TAIYO YUDEN or prohibited for use by TAIYO YUDEN as described above.

- Information contained in this catalog is intended to convey examples of typical performances and/or applications of our products and is not intended to make any warranty with respect to the intellectual property rights or any other related rights of TAIYO YUDEN or any third parties nor grant any license under such rights.
- Please note that the scope of warranty for our products is limited to the delivered our products themselves and TAIYO YUDEN shall not be in any way responsible for any damages resulting from a fault or defect in our products. Notwithstanding the foregoing, if there is a written agreement (e.g., supply and purchase agreement, quality assurance agreement) signed by TAIYO YUDEN and your company, TAIYO YUDEN will warrant our products in accordance with such agreement.
- The contents of this catalog are applicable to our products which are purchased from our sales offices or authorized distributors (hereinafter "TAIYO YUDEN's official sales channel"). Please note that the contents of this catalog are not applicable to our products purchased from any seller other than TAIYO YUDEN's official sales channel.
- Caution for Export  
Some of our products listed in this catalog may require specific procedures for export according to "U.S. Export Administration Regulations", "Foreign Exchange and Foreign Trade Control Law" of Japan, and other applicable regulations. Should you have any questions on this matter, please contact our sales staff.

# LEADED COMMON MODE CHOKE COILS FOR AC LINES



WAVE

## PARTS NUMBER

\*Operating Temp. : -25~+105°C (Including self-generated heat)

T	L	F	△	9	U	A	△	1	0	2	△	0	R	8	K	1
①	②	③	④	⑤	⑥	⑦										

△=Blank space

### ① Series name

Code	Series name
TLF	Common mode choke
TLH	Hybrid choke

### ② Dimensions of core

Code	Dimensions of core [mm]
△9	9
10	10

### ③ Shape

Code	Shape
UA△	U core, vertical type
UAH	U core, horizontal type
UB△	U core, vertically split wound
CB△	Square type core vertically split wound
CBH	Square type core horizontally split wound
HB△	Double-square type core vertically split wound
HBH	Double-square type core horizontally split wound

### ④ Nominal Inductance

Code (example)	Nominal Inductance [μH]
102	1000
103	10000

### ⑤ Inductance tolerance

Code	Inductance tolerance
△	Nominal Values or higher
W	+100/-10%

### ⑥ Rated current

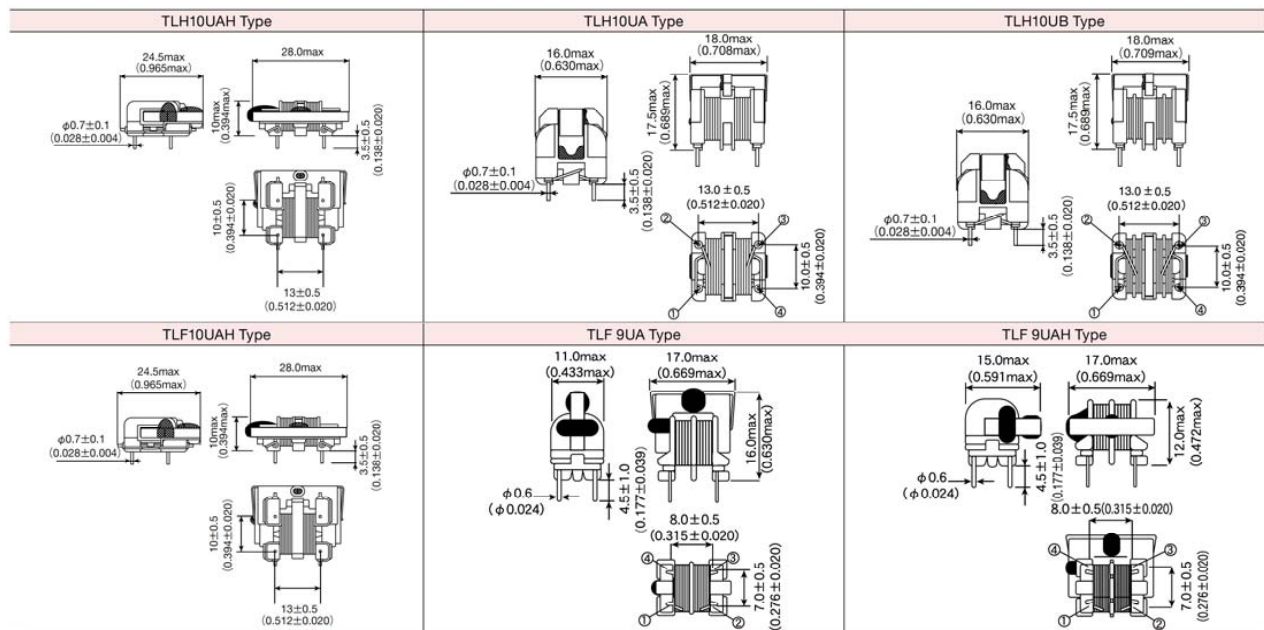
Code	Rated current [A]
R54	0.54
0R8	0.8

※R=Decimal point

### ⑦ Internal code

Code	Internal code
K1	Adhesive fixation

## STANDARD EXTERNAL DIMENSIONS / MINIMUM QUANTITY



Type	Minimum quantity (pcs.) Box
TLH type	500
TLF type	

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PARTS NUMBER

TLH10UAH type (Hybrid choke)

Parts number	EHS	Common mode inductance [mH]	Inductance tolerance	Normal mode inductance [mH] (typ.)	DC Resistance [ $\Omega$ ] (max.)	Rated current [A] (max.)	Rated voltage AC [V] (max.)
TLH10UAH872 0R7	RoHS	8.7	min.	0.70	1.00	0.7	250
TLH10UAH992 0R6	RoHS	9.9	min.	0.85	1.35	0.6	250
TLH10UAH123 0R5	RoHS	12	min.	1.06	1.60	0.5	250

TLH10UA type (Hybrid choke)

Parts number	EHS	Common mode inductance [mH]	Inductance tolerance	Normal mode inductance [mH] (typ.)	DC Resistance [ $\Omega$ ] (max.)	Rated current [A] (max.)	Rated voltage AC [V] (max.)
TLH10UA 901 2R0	RoHS	0.9	min.	0.067	0.089	2.0	250
TLH10UA 112 1R8	RoHS	1.1	min.	0.087	0.126	1.8	250
TLH10UA 152 1R6	RoHS	1.5	min.	0.126	0.171	1.6	250
TLH10UA 212 1R4	RoHS	2.1	min.	0.160	0.222	1.4	250
TLH10UA 282 1R2	RoHS	2.8	min.	0.215	0.272	1.2	250
TLH10UA 432 1R0	RoHS	4.3	min.	0.330	0.398	1.0	250
TLH10UA 622 0R8	RoHS	6.2	min.	0.430	0.578	0.8	250
TLH10UA 872 0R7	RoHS	8.7	min.	0.644	0.878	0.7	250
TLH10UA 992 0R6	RoHS	9.9	min.	0.836	1.138	0.6	250
TLH10UA 143 0R5	RoHS	14	min.	1.256	1.567	0.5	250

TLH10UB type (Hybrid choke)

Parts number	EHS	Common mode inductance [mH]	Inductance tolerance	Normal mode inductance [mH] (typ.)	DC Resistance [ $\Omega$ ] (max.)	Rated current [A] (max.)	Rated voltage AC [V] (max.)
TLH10UB 701 2R0	RoHS	0.7	min.	0.056	0.097	2.0	250
TLH10UB 112 1R7	RoHS	1.1	min.	0.068	0.133	1.7	250
TLH10UB 142 1R4	RoHS	1.4	min.	0.113	0.214	1.4	250
TLH10UB 232 1R2	RoHS	2.3	min.	0.150	0.274	1.2	250
TLH10UB 352 1R0	RoHS	3.5	min.	0.232	0.422	1.0	250
TLH10UB 442 0R8	RoHS	4.4	min.	0.328	0.624	0.8	250
TLH10UB 872 0R7	RoHS	8.7	min.	0.580	0.982	0.7	250
TLH10UB 972 0R6	RoHS	9.7	min.	0.735	1.314	0.6	250
TLH10UB 113 0R5	RoHS	11	min.	0.877	1.577	0.5	250

TLF10UAH type

Parts number	EHS	Common mode inductance [mH]	Inductance tolerance	DC Resistance [ $\Omega$ ] (max.)	Rated current [A] (max.)	Rated voltage AC [V] (max.)
TLF10UAH872 0R7	RoHS	8.7	min.	1.00	0.7	250
TLF10UAH992 0R6	RoHS	9.9	min.	1.35	0.6	250
TLF10UAH123 0R5	RoHS	12	min.	1.60	0.5	250

TLF 9UA type

Parts number	EHS	Common mode inductance [mH]	Inductance tolerance	DC Resistance [ $\Omega$ ] (max.)	Rated current [A] (max.)	Rated voltage AC [V] (max.)
TLF 9UA 102W0R8K1	RoHS	1.0	+100/-10%	0.5	0.80	250
TLF 9UA 202WR54K1	RoHS	2.0	+100/-10%	1.0	0.54	250
TLF 9UA 302WR42K1	RoHS	3.0	+100/-10%	1.5	0.42	250
TLF 9UA 502WR32K1	RoHS	5.0	+100/-10%	2.5	0.32	250
TLF 9UA 802WR25K1	RoHS	8.0	+100/-10%	4.0	0.25	250
TLF 9UA 103WR23K1	RoHS	10	+100/-10%	4.5	0.23	250

TLF 9UAH type

Parts number	EHS	Common mode inductance [mH]	Inductance tolerance	DC Resistance [ $\Omega$ ] (max.)	Rated current [A] (max.)	Rated voltage AC [V] (max.)
TLF 9UAH102W0R8K1	RoHS	1.0	+100/-10%	0.5	0.80	250
TLF 9UAH202WR54K1	RoHS	2.0	+100/-10%	1.0	0.54	250
TLF 9UAH302WR42K1	RoHS	3.0	+100/-10%	1.5	0.42	250
TLF 9UAH502WR32K1	RoHS	5.0	+100/-10%	2.5	0.32	250
TLF 9UAH802WR25K1	RoHS	8.0	+100/-10%	4.0	0.25	250
TLF 9UAH103WR23K1	RoHS	10	+100/-10%	4.5	0.23	250

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# LEADED COMMON MODE CHOKE COILS FOR DC AND SIGNAL LINES

## LEADED COMMON MODE CHOKE COILS FOR AC LINES

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### ■ PACKAGING

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#### ① Minimum Quantity

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##### ● TLH/TLF Type

Type	Minimum Quantity [pcs]
	Box
TLH10UA□	1000
TLH10UB	
TLF10UAH	
TLF9UA□	500
TLF9UB□	

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# LEADED COMMON MODE CHOKE COILS FOR DC AND SIGNAL LINES, LEADED COMMON MODE CHOKE COILS FOR AC LINES

## RELIABILITY DATA

1. Operating Temperature Range										
Specified Value	TLH, TLF Type	-25 ~ + 105°C								
Test Method and Remarks	Including temperature rise due to self-generated heat.									
2. Storage temperature range										
Specified Value	TLH, TLF Type	-40 ~ + 85°C								
3. Rated current										
Specified Value	TLH, TLF Type	Within the specified range								
Test Method and Remarks	TLH10U, TLF10UA : The maximum value of AC current within the temperature rise of 60°C TLF9UA, : The maximum value of AC current within the temperature rise of 45°C TLF9UB : The maximum value of DC current within the temperature rise of 45°C									
4. Inductance										
Specified Value	TLH, TLF Type	Within the specified tolerance								
Test Method and Remarks	TLF9U : Measuring equipment : LCR meter 4284A or its equivalent Measuring frequency : 1kHz Measuring voltage : 1Vrms TLH, TLF (except TLF9U) : Measuring equipment : LCR meter 4284A or its equivalent Measuring frequency : 1kHz Measuring voltage : 0.1Vrms									
5. DC resistance										
Specified Value	TLH, TLF Type	Within the specified tolerance								
Test Method and Remarks	Measuring equipment : DC ohmmeter									
6. Terminal strength tensile force										
Specified Value	TLH, TLF Type	No abnormality								
Test Method and Remarks	TLH10UA, TLH10UB, TLF9U : Apply the stated tensile force gradually in the direction to draw terminal. <table border="1"> <thead> <tr> <th>force [N]</th> <th>duration [s]</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>30±5</td> </tr> </tbody> </table> TLH10UAH, TLF (except TLF9U): Apply the stated tensile force gradually in the direction to draw terminal. <table border="1"> <thead> <tr> <th>force [N]</th> <th>duration [s]</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>30±5</td> </tr> </tbody> </table>		force [N]	duration [s]	5	30±5	force [N]	duration [s]	10	30±5
force [N]	duration [s]									
5	30±5									
force [N]	duration [s]									
10	30±5									
7. Insulation resistance between wires										
Specified Value	TLH, TLF Type	100M Ω min.								
Test Method and Remarks	Applied voltage : 500VDC (TLH, TLF (except TLF9UB)) : 250VDC (TLF9UB) Duration : 60sec.									

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8. Insulation resistance between wire and core		
Specified Value	TLH, TLF Type	100M $\Omega$ min. (except TLH, TLF10UAH Type)
Test Method and Remarks	TLF : Applied voltage : 500VDC (TLF (except TLF9UB)) : 250VDC (TLF9UB) Duration : 60 sec.	
9. Withstanding : between wires		
Specified Value	TLH, TLF Type	No abnormality
Test Method and Remarks	Applied voltage : 2000VAC (TLH, TLF (except TLF9UB)) : 500VDC (TLF9UB) Duration : 60sec	
10. Withstanding : between wires and core		
Specified Value	TLH, TLF Type	No abnormality (except TLH, TLF10UAH Type)
Test Method and Remarks	TLF : Applied voltage : 2000VAC (TLF (except TLF9UB)) : 500VDC (TLF9UB) Duration : 60sec.	
11. Rated voltage		
Specified Value	TLH, TLF Type	Within the specified range
Test Method and Remarks	TLH, TLF (except TLF9UB) : 250VAC TLF9UB : 50VDC	
12. Resistance to vibration		
Specified Value	TLH, TLF Type	TLF9U : Inductance change : Within $\pm 5\%$ TLH, TLF (except TLF9U) : Appearance is no abnormality and within the specified range
Test Method and Remarks	TLH, TLF : According to JIS C60068-2-6. Direction : 2hrs each in X, Y and Z direction Total : 6hrs Frequency range : 10 to 55 to 10Hz (1 min.) Amplitude : 1.5mm (shall not exceed acceleration 196m/s <sup>2</sup> ) Mounting method : soldering onto PC board Recovery : At least 1hr of recovery under the standard condition after the removal from test chamber, followed by the measurement within 2hrs.	
13. Solderability		
Specified Value	TLH, TLF Type	At least 90% of terminal electrode is covered by new solder.
Test Method and Remarks	TLH, TLF : Solder temperature : 235 $\pm$ 0.5 $^{\circ}$ C Duration : 2 $\pm$ 0.5sec. Immersion depth : Up to 1.5 to 2.0mm from PBC mounted level.  TLH, TLF : Solder temperature : 245 $\pm$ 5 $^{\circ}$ C Duration : 4 $\pm$ 1sec. Immersion depth : Up to 1.0 to 1.5mm from PBC mounted level.	

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14. Resistance to soldering heat		
Specified Value	TLH, TLF Type	TLF9UA : Inductance change : Within $\pm 5\%$
Test Method and Remarks	TLH, TLF : Solder temperature : $260 \pm 5^\circ\text{C}$ Duration : $5 \pm 0.5\text{sec.}$ Immersion depth : Up to 1.5 to 2.0mm from PBC mounted level. Recovery : At least 1hr of recovery under the standard condition after the removal from test chamber, followed by the measurement within 2hrs.  TLH, TLF : Solder temperature : $260 \pm 5^\circ\text{C}$ Duration : $10 \pm 1\text{sec.}$ Immersion depth : Up to 1.0 to 1.5mm from PBC mounted level. Recovery : At least 1hr of recovery under the standard condition after the removal from test chamber, followed by the measurement within 2hrs.	

15. Thermal shock		
Specified Value	TLH, TLF Type	TLF9UA : Inductance change : Within $\pm 15\%$ TLH, TLF (except TLF9UA) : Withstanding voltage : No abnormality Insulation resistance : No abnormality
Test Method and Remarks	TLH, TLF : According to JIS C60068-2-14. Conditions for 1 cycle $-25^\circ\text{C} \sim +85^\circ\text{C}$ , keep each 30min  Number of cycles : 10 Recovery : At least 1hr of recovery under the standard condition after the removal from test chamber, followed by the measurement within 2 hrs.	

16. Damp heat		
Specified Value	TLH, TLF Type	TLF9UA : Inductance change : Within $\pm 15\%$ TLH, TLF (except TLF9UA) : Withstanding voltage : No abnormality Insulation resistance : No abnormality
Test Method and Remarks	TLH, TLF : Temperature : $60 \pm 2^\circ\text{C}$ : $40 \pm 2^\circ\text{C}$ (※except TLF9U) Humidity : $90 \sim 95\%RH$ Duration : 500 hrs Recovery : At least 1hr of recovery under the standard removal from test chamber followed by the measurement within 2 hrs.	

17. Loading under damp heat						
Specified Value	TLH, TLF Type	Withstanding voltage : No abnormality Insulation resistance : No abnormality				
Test Method and Remarks	TLH, TLF : Temperature : $60 \pm 2^\circ\text{C}$ : $40 \pm 2^\circ\text{C}$ (※except TLF9U ) Humidity : $90 \sim 95\%RH$ Duration : 100 hrs : 500 hrs Apply rated current across windings (※except TLF9U ) Applied voltage : Apply the following specified voltage between windings. <table border="1" style="margin-left: 40px;"> <tr> <td>TLF9UA</td> <td>250VAC</td> </tr> <tr> <td>TLF9UB</td> <td>50VDC</td> </tr> </table> Recovery : At least 1hr of recovery under the standard removal from test chamber followed by the measurement within 2 hrs.		TLF9UA	250VAC	TLF9UB	50VDC
TLF9UA	250VAC					
TLF9UB	50VDC					

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18. Low temperature life test		
Specified Value	TLH, TLF Type	TLF9U : Inductance change : Within $\pm 15\%$ TLH, TLF (except TLF9U) : Withstanding voltage : No abnormality Insulation resistance : No abnormality
Test Method and Remarks	TLH, TLF : Temperature : $-25 \pm 2^\circ\text{C}$ : $-40 \pm 2^\circ\text{C}$ (※TLF•TLH) Duration : 500 hrs Recovery : At least 1hr of recovery under the standard removal from test chamber followed by the measurement within 2 hrs.	

19. High Temperature life test		
Specified Value	TLH, TLF Type	TLF9U : Inductance change : Within $\pm 15\%$ TLH, TLF (except TLF9U) : Withstanding voltage : No abnormality Insulation resistance : No abnormality
Test Method and Remarks	TLH, TLF : Temperature : $105 \pm 3^\circ\text{C}$ (※ TLF•TLH) Duration : 500 hrs Recovery : At least 1hr of recovery under the standard removal from test chamber followed by the measurement within 2 hrs.	



# LEADED COMMON MODE CHOKE COILS FOR DC AND SIGNAL LINES, LEADED COMMON MODE CHOKE COILS FOR AC LINES

## ■ PRECAUTIONS

1. Circuit Design	
Precautions	<ul style="list-style-type: none"> <li>◆Operating environment               <ol style="list-style-type: none"> <li>1. The products described in this specification are intended for use in general electronic equipment, (office supply equipment, telecommunications systems, measuring equipment, and household equipment). They are not intended for use in mission-critical equipment or systems requiring special quality and high reliability (traffic systems, safety equipment, aerospace systems, nuclear control systems and medical equipment including life-support systems) where product failure might result in loss of life, injury or damage. For such uses, contact TAIYO YUDEN Sales Department in advance.</li> </ol> </li> </ul>
2. PCB Design	
Precautions	<ul style="list-style-type: none"> <li>◆Design               <ol style="list-style-type: none"> <li>1. Please design insertion pitches as matching to that of leads of the component on PCBs.</li> </ol> </li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆Design               <ol style="list-style-type: none"> <li>1. When Inductors are mounted onto a PC board, hole dimensions on the board should match the lead pitch of the component, if not, it will cause breakage of the terminals or cracking of terminal roots covered with resin as excess stress travels through the terminal legs.</li> </ol> </li> </ul>
3. Soldering	
Precautions	<ul style="list-style-type: none"> <li>◆Wave soldering               <ol style="list-style-type: none"> <li>1. Please refer to the specifications in the catalog for a wave soldering.</li> <li>2. Do not immerse the entire inductor in the flux during the soldering operation.</li> </ol> </li> <li>◆Lead free soldering               <ol style="list-style-type: none"> <li>1. When using products with lead free soldering, we request to use them after confirming of adhesion, temperature of resistance to soldering heat, etc. sufficiently.</li> </ol> </li> <li>◆Recommended conditions for using a soldering iron               <ul style="list-style-type: none"> <li>• Put the soldering iron on the land-pattern.</li> <li>• Soldering iron's temperature – Below 350°C</li> <li>• Duration – 3 seconds or less</li> <li>• The soldering iron should not directly touch the product.</li> </ul> </li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆Lead free soldering               <ol style="list-style-type: none"> <li>1. If products are used beyond the range of the recommended conditions, heat stresses may deform the products, and consequently degrade the reliability of the products.</li> </ol> </li> <li>◆Recommended conditions for using a soldering iron               <p>If products are used beyond the range of the recommended conditions, heat stresses may deform the products, and consequently degrade the reliability of the products.</p> </li> </ul>
4. Cleaning	
Precautions	<ul style="list-style-type: none"> <li>◆Cleaning conditions               <ol style="list-style-type: none"> <li>1. TLF type                   <p>Please contact any of our offices for about a cleaning.</p> </li> </ol> </li> </ul>
5. Handling	
Precautions	<ul style="list-style-type: none"> <li>◆Handling               <ol style="list-style-type: none"> <li>1. Keep the product away from all magnets and magnetic objects.</li> </ol> </li> <li>◆Mechanical considerations               <ol style="list-style-type: none"> <li>1. Please do not give the product any excessive mechanical shocks.</li> <li>2. TLF type                   <p>Please do not add any shock or power to a product in transportation.</p> </li> </ol> </li> <li>◆Packing               <ol style="list-style-type: none"> <li>1. Please do not give the product any excessive mechanical shocks.                   <p>In loading, please pay attention to handling indication mentioned in a packing box (a loading direction / number of maximum loading / fragile item).</p> </li> </ol> </li> </ul>
Technical considerations	<ul style="list-style-type: none"> <li>◆Handling               <ol style="list-style-type: none"> <li>1. There is a case that a characteristic varies with magnetic influence.</li> </ol> </li> <li>◆Mechanical considerations               <ol style="list-style-type: none"> <li>1. There is a case to be damaged by a mechanical shock.</li> <li>2. TLF type                   <p>There is a case to be broken by a fall.</p> </li> </ol> </li> <li>◆Packing               <ol style="list-style-type: none"> <li>1. There is a case that a lead route turns at by a fall or an excessive shock.</li> </ol> </li> </ul>

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## 6. Storage conditions

Precautions	<p>◆Storage</p> <p>1. To maintain the solderability of terminal electrodes and to keep the packing material in good condition, temperature and humidity in the storage area should be controlled.</p> <ul style="list-style-type: none"><li>• Recommended conditions</li></ul> <p>Ambient temperature : 0~40°C Humidity : Below 70% RH</p> <p>The ambient temperature must be kept below 30°C. Even under ideal storage conditions, the solderability of electrodes decreases gradually, so the products should be mounted within one year from the time of delivery.</p> <p>In case of storage over 6 months, solderability shall be checked before actual usage.</p>
Technical considerations	<p>◆Storage</p> <p>1. Under a high temperature and humidity environment, problems such as reduced solderability caused by oxidation of terminal electrodes and deterioration of taping/packaging materials may take place.</p>