

Wire-wound Metal Power Inductors MCOIL™ LSEN series for General Electronic Equipment for Consumer  
 Wire-wound Metal Power Inductors MCOIL™ LSEP series for General Electronic Equipment for Consumer  
 Wire-wound Metal Power Inductors MCOIL™ LLEN series  
 for Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)  
 Wire-wound Metal Power Inductors MCOIL™ LLEP series  
 for Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)

■ RELIABILITY DATA

1. Operating Temperature Range	
Specified Value	-40~+125°C
Test Methods and Remarks	Including self-generated heat

2. Storage Temperature Range	
Specified Value	-40~+85°C
Test Methods and Remarks	0 to 40°C for the product with taping.

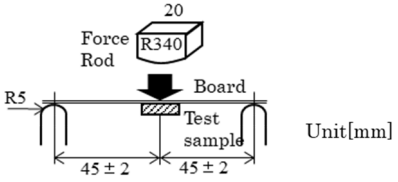
3. Rated current	
Specified Value	Within the specified tolerance

4. Inductance	
Specified Value	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : LCR Meter (HP 4294A or equivalent) Measuring frequency : 1MHz, 0.5V

5. DC Resistance	
Specified Value	Within the specified tolerance
Test Methods and Remarks	Measuring equipment : DC ohmmeter (HIOKI 3227 or equivalent)

6. Self resonance frequency	
Specified Value	—

7. Temperature characteristic	
Specified Value	Inductance change : Within $\pm 15\%$
Test Methods and Remarks	Measurement of inductance shall be taken at temperature range within -40°C~+125°C. With reference to inductance value at +20°C., change rate shall be calculated.

8. Resistance to flexure of substrate	
Specified Value	No damage
Test Methods and Remarks	<p>The test samples shall be soldered to the test board by the reflow. As illustrated below, apply force in the direction of the arrow indicating until deflection of the test board reaches to 2 mm.</p> <p>Test board size : 100×40×1.0 mm                      Test board material : Glass epoxy-resin                      Solder cream thickness : 0.10 mm</p> 

9. Insulation resistance : between wires	
Specified Value	—

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 For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

**10. Insulation resistance : between wire and over-coating**

Specified Value	—
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**11. Withstanding voltage : between wire and over-coating**

Specified Value	—
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**12. Adhesion of terminal electrode**

Specified Value	No abnormality.
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. Applied force : 10N to X and Y directions. Duration : 5s. Solder cream thickness : 0.10mm

**13. Resistance to vibration**

Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.														
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. Then it shall be submitted to below test conditions. <table border="1" style="margin-left: 20px;"> <tr> <td>Frequency Range</td> <td colspan="2">10~55Hz</td> </tr> <tr> <td>Total Amplitude</td> <td colspan="2">1.5mm (May not exceed acceleration 196m/s<sup>2</sup>)</td> </tr> <tr> <td>Sweeping Method</td> <td colspan="2">10Hz to 55Hz to 10Hz for 1min.</td> </tr> <tr> <td rowspan="3">Time</td> <td>X</td> <td rowspan="3">For 2 hours on ach X, Y, and Z axis.</td> </tr> <tr> <td>Y</td> </tr> <tr> <td>Z</td> </tr> </table> <p>Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.</p>	Frequency Range	10~55Hz		Total Amplitude	1.5mm (May not exceed acceleration 196m/s <sup>2</sup> )		Sweeping Method	10Hz to 55Hz to 10Hz for 1min.		Time	X	For 2 hours on ach X, Y, and Z axis.	Y	Z
Frequency Range	10~55Hz														
Total Amplitude	1.5mm (May not exceed acceleration 196m/s <sup>2</sup> )														
Sweeping Method	10Hz to 55Hz to 10Hz for 1min.														
Time	X	For 2 hours on ach X, Y, and Z axis.													
	Y														
	Z														

**14. Solderability**

Specified Value	At least 90% of surface of terminal electrode is covered by new solder.				
Test Methods and Remarks	The test samples shall be dipped in flux, and then immersed in molten solder as shown in below table. Flux : Ethanol solution containing rosin 25%. <table border="1" style="margin-left: 20px;"> <tr> <td>Solder Temperature</td> <td>245<math>\pm</math>5<math>^{\circ}</math>C</td> </tr> <tr> <td>Time</td> <td>5<math>\pm</math>0.5 sec.</td> </tr> </table> <p>※Immersion depth : All sides of mounting terminal shall be immersed.</p>	Solder Temperature	245 $\pm$ 5 $^{\circ}$ C	Time	5 $\pm$ 0.5 sec.
Solder Temperature	245 $\pm$ 5 $^{\circ}$ C				
Time	5 $\pm$ 0.5 sec.				

**15. Resistance to soldering heat**

Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.
Test Methods and Remarks	The test sample shall be exposed to reflow oven at 230 $^{\circ}$ C for 40 seconds, with peak temperature at 260+0/-5 $^{\circ}$ C for 5 seconds, 2 times. Test board material : Glass epoxy-resin Test board thickness : 1.6mm Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.

**16. Thermal shock**

Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.																		
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. The test samples shall be placed at specified temperature for specified time by step 1 to step 4 as shown in below table in sequence. The temperature cycle shall be repeated 100 cycles. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="3">Conditions of 1 cycle</th> </tr> <tr> <th>Step</th> <th>Temperature (<math>^{\circ}</math>C)</th> <th>Duration (min)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-40<math>\pm</math>3</td> <td>30<math>\pm</math>3</td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td>Within 3</td> </tr> <tr> <td>3</td> <td>+85<math>\pm</math>2</td> <td>30<math>\pm</math>3</td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>Within 3</td> </tr> </tbody> </table> <p>Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.</p>	Conditions of 1 cycle			Step	Temperature ( $^{\circ}$ C)	Duration (min)	1	-40 $\pm$ 3	30 $\pm$ 3	2	Room temperature	Within 3	3	+85 $\pm$ 2	30 $\pm$ 3	4	Room temperature	Within 3
Conditions of 1 cycle																			
Step	Temperature ( $^{\circ}$ C)	Duration (min)																	
1	-40 $\pm$ 3	30 $\pm$ 3																	
2	Room temperature	Within 3																	
3	+85 $\pm$ 2	30 $\pm$ 3																	
4	Room temperature	Within 3																	

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17. Damp heat									
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.								
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. The test samples shall be placed in thermostatic oven set at specified temperature and humidity as shown in below table. <table border="1"> <tr> <td>Temperature</td> <td><math>60 \pm 2^{\circ}\text{C}</math></td> </tr> <tr> <td>Humidity</td> <td>90~95%RH</td> </tr> <tr> <td>Time</td> <td>500+24/-0 hour</td> </tr> </table> Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.	Temperature	$60 \pm 2^{\circ}\text{C}$	Humidity	90~95%RH	Time	500+24/-0 hour		
Temperature	$60 \pm 2^{\circ}\text{C}$								
Humidity	90~95%RH								
Time	500+24/-0 hour								
18. Loading under damp heat									
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.								
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. The test samples shall be placed in thermostatic oven set at specified temperature and humidity and applied the rated current continuously as shown in below table. <table border="1"> <tr> <td>Temperature</td> <td><math>60 \pm 2^{\circ}\text{C}</math></td> </tr> <tr> <td>Humidity</td> <td>90~95%RH</td> </tr> <tr> <td>Applied current</td> <td>Rated current</td> </tr> <tr> <td>Time</td> <td>500+24/-0 hour</td> </tr> </table> Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.	Temperature	$60 \pm 2^{\circ}\text{C}$	Humidity	90~95%RH	Applied current	Rated current	Time	500+24/-0 hour
Temperature	$60 \pm 2^{\circ}\text{C}$								
Humidity	90~95%RH								
Applied current	Rated current								
Time	500+24/-0 hour								
19. Low temperature life test									
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.								
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. After that, the test samples shall be placed at test conditions as shown in below table. <table border="1"> <tr> <td>Temperature</td> <td><math>-40 \pm 2^{\circ}\text{C}</math></td> </tr> <tr> <td>Time</td> <td>500+24/-0 hour</td> </tr> </table> Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.	Temperature	$-40 \pm 2^{\circ}\text{C}$	Time	500+24/-0 hour				
Temperature	$-40 \pm 2^{\circ}\text{C}$								
Time	500+24/-0 hour								
20. High temperature life test									
Specified Value	Inductance change : Within $\pm 10\%$ No significant abnormality in appearance.								
Test Methods and Remarks	The test samples shall be soldered to the test board by the reflow. After that, the test samples shall be placed at test conditions as shown in below table. <table border="1"> <tr> <td>Temperature</td> <td><math>125 \pm 2^{\circ}\text{C}</math></td> </tr> <tr> <td>Time</td> <td>500+24/-0 hour</td> </tr> </table> Recovery : At least 2hrs of recovery under the standard condition after the test, followed by the measurement within 48hrs.	Temperature	$125 \pm 2^{\circ}\text{C}$	Time	500+24/-0 hour				
Temperature	$125 \pm 2^{\circ}\text{C}$								
Time	500+24/-0 hour								
21. Loading at high temperature life test									
Specified Value	—								
22. Standard condition									
Specified Value	Standard test condition : Unless otherwise specified, temperature is $20 \pm 15^{\circ}\text{C}$ and $65 \pm 20\%$ of relative humidity. When there is any question concerning measurement result: In order to provide correlation data, the test shall be condition of $20 \pm 2^{\circ}\text{C}$ of temperature, $65 \pm 5\%$ relative humidity. Inductance is in accordance with our measured value.								