

Multilayer Ceramic Inductors

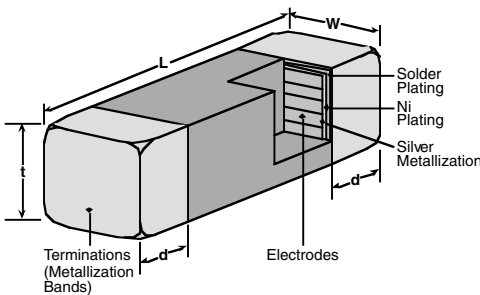
Type MHL

ISO 9001:2000
TS-16949

1. General

- Monolithic structure provides high reliability in a wide temperature and humidity range
- High quality ceramic material and unique manufacturing process provides high Q at high frequency
- Standard EIA packages: 1E, 1J
- Nickel barrier with solder overcoat for excellent solderability
- Marking: Brown body color with no marking (1E)
White body color with with black stripe and no marking (1J)

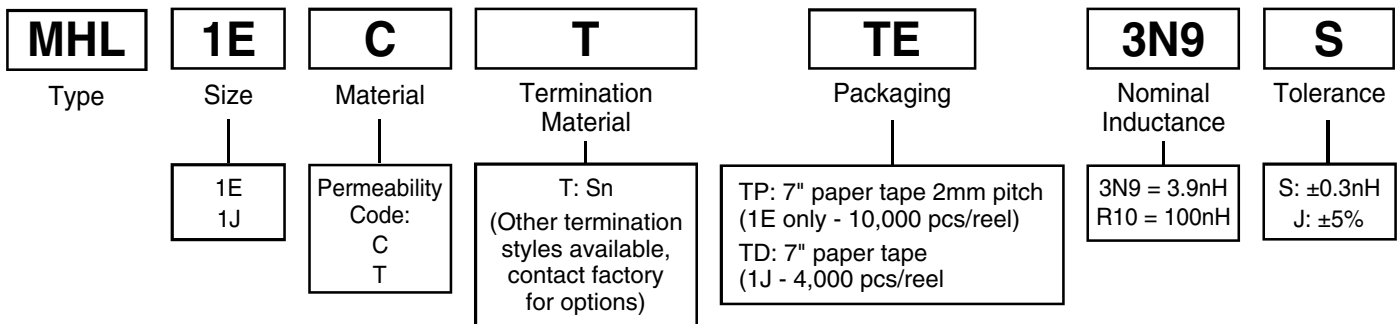
2. Dimensions



Size Code	Dimensions inches (mm)			
	L	W	t	d
1E (0402)	.039±.004 (1.0±0.1)	.02±.004 (0.5±0.1)	.02±.004 (0.5±0.1)	.01±.004 (0.25±0.1)
1J (0603)	.063±.006 (1.6±0.15)	.031±.006 (0.8±0.15)	.031±.006 (0.8±0.15)	.012±.008 (0.30±0.2)

3. Type Designation

The type designation shall be in the following form:



4. Standard Applications

Part Designation	Inductance L (nH)	Inductance Tolerance	Q			Self Resonant Frequency Typical (MHz)	DC Resistance Maximum (Ω)	Allowable DC Current Maximum (mA)	Operating Temperature Range								
			Minimum (100MHz)	Typical (100MHz)	Typical (800MHz)												
MHL1ECTTP1N0*	1.0	S: ±0.3nH	8	11	37	10000	0.12	300	-55°C to +125°C								
MHL1ECTTP1N2*	1.2				36												
MHL1ECTTP1N5*	1.5				34	6000	0.13										
MHL1ECTTP1N8*	1.8									0.14							
MHL1ECTTP2N2*	2.2										0.16						
MHL1ECTTP2N7*	2.7											0.17					
MHL1ECTTP3N3*	3.3												0.19				
MHL1ECTTP3N9*	3.9													0.22			
MHL1ECTTP4N7*	4.7														0.24		
MHL1ECTTP5N6*	5.6															0.27	
MHL1ECTTP6N8*	6.8	J: ±5%	8	11	32	4000	0.27	200	-55°C to +125°C								
MHL1ECTTP8N2*	8.2				3900					0.32							
MHL1ECTTP10N*	10				3500	0.37											
MHL1ECTTP12N*	12				31	3200	0.42										
MHL1ECTTP15N*	15					2600	0.50										
MHL1ECTTP18N*	18				30	2300	0.55										
MHL1ECTTP22N*	22					2000	0.65										
MHL1ECTTP27N*	27					1600	0.8										
MHL1ECTTP33N*	33				28	10	750			1.4	180						
MHL1ECTTP39N*	39											1400	0.9				
MHL1ECTTP47N*	47	1200	1.0														
MHL1ECTTP56N*	56	1100	1.2														
MHL1ECTTP68N*	68	900	1.3														
MHL1ECTTP82N*	82	24	1.6														
MHL1ECTTPR10*	100	23	1.3														
MHL1ECTTPR12*	120	21	1.4														
MHL1ECTTPR12*	120	19	1.4														
MHL1ECTTPR12*	120	16	1.6														
MHL1ECTTPR12*	120	—	100														
MHL1ECTTPR12*	120	—	100														
MHL1JCTTD1N5*	1.5	S: ±0.3nH	8	14	46	6000	0.10	100	-55°C to +125°C								
MHL1JCTTD1N8*	1.8									0.13							
MHL1JCTTD2N2*	2.2										0.15						
MHL1JCTTD2N7*	2.7											0.20					
MHL1JCTTD3N3*	3.3												0.23				
MHL1JCTTD3N9*	3.9													0.20			
MHL1JCTTD4N7*	4.7														0.28		
MHL1JCTTD5N6*	5.6	J: ±5%	8	14	46	4000	0.20	600	-55°C to +125°C								
MHL1JCTTD6N8*	6.8									5800							
MHL1JCTTD8N2*	8.2										3200						
MHL1JCTTD10N*	10											2600					
MHL1JCTTD12N*	12												0.35				
MHL1JCTTD15N*	15													2300			
MHL1JCTTD18N*	18														2000		
MHL1JCTTD22N*	22															1600	
MHL1JCTTD27N*	27																1400
MHL1JCTTD27N*	27																
MHL1JCTTD33N*	33	18	1.4														
MHL1JCTTD33N*	33	15	1.2														
MHL1JCTTD33N*	33	15	1.2														

*Add tolerance character (S, J)

4. Standard Applications (continued)

Part Designation	Inductance L (nH)	Inductance Tolerance	Q			Self Resonant Frequency Typical (MHz)	DC Resistance Maximum (Ω)	Allowable DC Current Maximum (mA)	Operating Temperature Range
			Minimum (100MHz)	Typical (100MHz)	Typical (800MHz)				
MHL1JCTTD39N*	39	J: ±5%	12	15	46	1100	0.65	500	-55°C to +125°C
MHL1JTSTD39N*	39			17					
MHL1JCTTD47N*	47			15	39	900	0.70		
MHL1JCTTD56N*	56				37		0.75		
MHL1JCTTD68N*	68			36	700	0.80	400		
MHL1JCTTD82N*	82			29	600	0.85	300		
MHL1JCTTDR10*	100		8	16	500	0.90			
MHL1JCTTDR12*	120					1.0			
MHL1JCTTDR15*	150		13	—	400	1.2			
MHL1JCTTDR18*	180					1.3			
MHL1JCTTDR22*	220					1.5			

*Add tolerance character (S, J)

5. Characteristics

Item	Requirement	Conditions									
Operating Temperature	-55°C to +125°C										
Storage Temperature	40°C @ 70% Humidity	Sealed plastic bags with desiccant shall be used to reduce the potential of oxidation on the terminations during storage.									
Resistance to Solder Heat	Change in Impedance: Relative to value before test $\pm 20\%$. Appearance: There shall be no cracking Solder Coverage: More than 75% of the terminal electrode shall be covered with solder.	Flux: 5-10 sec dip After Flux: Air dry for 15 sec Preheat: 150°C $\pm 10^\circ\text{C}$ Preheat Time: 60 sec Solder Temp: 260°C $\pm 5^\circ\text{C}$ Dip Time: 10 ± 1 sec									
Solderability	Solder Coverage: More than 95% of the termination shall be covered with solder.	Flux: 5-10 sec dip After Flux: Air dry for 15 sec Solder Temp: 245°C $\pm 5^\circ\text{C}$ Dip Time: 5 ± 0.5 sec									
Leach Resistance	Appearance: There shall be no visible signs of physical or mechanical damage (i.e. no cracks) Terminations: Termination must not be leached away for more than 5%.	The bead shall be subjected to the following 5 steps for the period of time shown below. The 5 steps constitute one (1) rotation. 4 rotations shall be carried out. 1) Flux: 5-10 sec 2) After Flux: Air dry for 15 sec 3) Solder Temp: 230°C $\pm 5^\circ\text{C}$ 4) Dip Time: 5 ± 0.5 sec 5) Cool: Air cool for 60 seconds									
Insulation Resistance	Insulation Resistance: Min 1G ohms										
Solvent Resistance	Change in Impedance: Relative to value before test $\pm 10\%$.	Cleaning by: Washer: Ultrasonic washer (100W) Solvent: Isopropyl alcohol Time: 3 minutes									
Terminal Strength (hanging test)	Appearance: The terminal electrode shall not break off, nor shall there be damage to the body.	<table border="1"> <thead> <tr> <th>Type</th> <th>W(kgf)</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1E</td> <td>—</td> <td>N/A</td> </tr> <tr> <td>1J</td> <td>0.5</td> <td>30 sec ± 2 sec</td> </tr> </tbody> </table>	Type	W(kgf)	Time	1E	—	N/A	1J	0.5	30 sec ± 2 sec
Type	W(kgf)	Time									
1E	—	N/A									
1J	0.5	30 sec ± 2 sec									
Terminal Strength (push test)	Appearance: There shall be no evidence of mechanical degradations to terminals or body.	<table border="1"> <thead> <tr> <th>Type</th> <th>W(kgf)</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1E</td> <td>—</td> <td>N/A</td> </tr> <tr> <td>1J</td> <td>1.4</td> <td>60 sec</td> </tr> </tbody> </table>	Type	W(kgf)	Time	1E	—	N/A	1J	1.4	60 sec
Type	W(kgf)	Time									
1E	—	N/A									
1J	1.4	60 sec									
Bending Strength	Appearance: There shall be no physical or mechanical damage Impedance: Relative to initial value before test $\pm 10\%$	Board: 90x40x1.6mm Bend: 1mm Time: 5 sec									

5. Characteristics (continued)

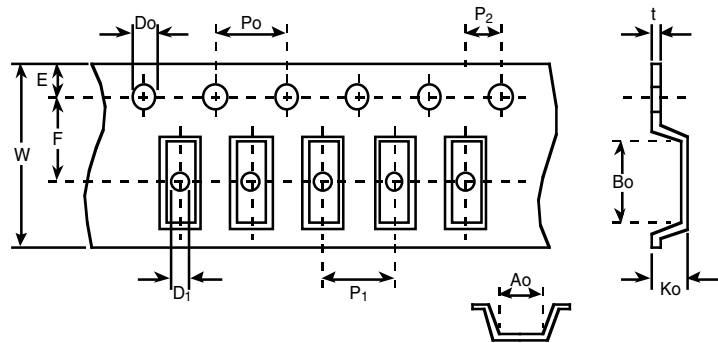
Item	Requirement	Conditions																		
Mechanical Shock	<p>Appearance: There shall be no physical or mechanical damage</p> <p>Impedance: Relative to initial value before test $\pm 10\%$</p>	<p>Force: 50G</p> <p>Time: 11 msec</p> <p>There shall be 3 shocks in each of 6 directions (18 shocks total).</p>																		
Vibration	<p>Impedance: Relative to initial value $\pm 10\%$</p>	<p>Only endurance conditioning by sweeping shall be made. The entire frequency range from 10-2,000 Hz and return to 10 Hz in 20 minutes (this shall constitute one cycle). Amplitude: 15G</p> <p>The test shall have a 15G peak and shall be applied for a period of 4 hours (12 cycles) in each of 3 mutually perpendicular directions (a total of 36 cycles within a total of 12 hours).</p>																		
Thermal Shock	<p>Appearance: There shall be no physical or mechanical damage.</p> <p>Impedance: Relative to initial value $\pm 20\%$.</p> <p>DCR: The DCR shall not exceed initial specified value.</p> <p>Testing of the parts will be made at 0 hours, 250 hours and 500 hours. Before testing the parts shall be allowed to cool to room temperature for 24 hours.</p>	<table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1-start</td> <td>-40°C $\pm 2^\circ\text{C}$</td> <td>_____</td> </tr> <tr> <td>2-hold</td> <td>-40°C $\pm 2^\circ\text{C}$</td> <td>30 min ± 5 min</td> </tr> <tr> <td>3-transfer</td> <td>_____</td> <td>0.5 min max.</td> </tr> <tr> <td>4-hold</td> <td>+105°C $\pm 2^\circ\text{C}$</td> <td>30 min ± 5 min</td> </tr> <tr> <td>5-transfer</td> <td>_____</td> <td>0.5 min max.</td> </tr> </tbody> </table> <p>Steps 1 thru 5 constitute one complete cycle and the test shall consist of a total of 500 cycles.</p>	Step	Temperature	Time	1-start	-40°C $\pm 2^\circ\text{C}$	_____	2-hold	-40°C $\pm 2^\circ\text{C}$	30 min ± 5 min	3-transfer	_____	0.5 min max.	4-hold	+105°C $\pm 2^\circ\text{C}$	30 min ± 5 min	5-transfer	_____	0.5 min max.
Step	Temperature	Time																		
1-start	-40°C $\pm 2^\circ\text{C}$	_____																		
2-hold	-40°C $\pm 2^\circ\text{C}$	30 min ± 5 min																		
3-transfer	_____	0.5 min max.																		
4-hold	+105°C $\pm 2^\circ\text{C}$	30 min ± 5 min																		
5-transfer	_____	0.5 min max.																		
Load Humidity	<p>Appearance: There shall be no physical or mechanical damage</p> <p>Impedance: Relative to initial value $\pm 15\%$</p> <p>Measurements shall be taken at 0 hours, 250 hours, 500 hours and 1,000 hours and shall meet the conditions stated above.</p>	<p>Temperature: 85°C $\pm 2^\circ\text{C}$</p> <p>Relative Humidity: 85%</p> <p>Time: 1,000 hours total</p> <p>Apply: 100% rated current</p>																		
Life Test	<p>Appearance: There shall be no physical or mechanical damage</p> <p>Impedance: Relative to initial value $\pm 15\%$</p> <p>Measurements shall be taken at 0 hours, 250 hours, 500 hours and 1,000 hours and shall meet the conditions stated above.</p>	<p>Temperature: 85°C $\pm 2^\circ\text{C}$</p> <p>Time: 1,000 hours total</p> <p>Apply: 100% rated current</p>																		

6. Packaging Specifications

KOA's multilayer components are provided on tape-and-reel for use in pick-and-place machines. The reel size is 7 inch.

7. Dimensions - inches (mm)

Tape	Ao	Bo	Ko
1E	.026±.004 (0.67±0.1)	.046±.004 (1.17±0.1)	.025±.004 (0.63±0.1)
1J	.045±.004 (1.15±0.1)	.073±.004 (1.85±0.1)	.043±.004 (1.1±0.1)



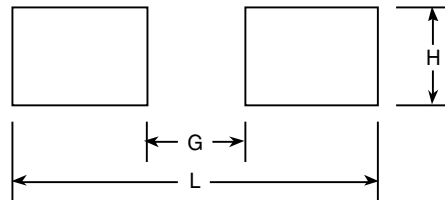
Tape	E	F	W	P ₁	P _o	P ₂	Do	D ₁	t
1E	.069±.004 (1.75±0.10)	.138±.002 (3.5±0.05)	.315±.008 (8.0±0.2)	.079±.009 (2.0±0.23)	.079±.004 (2.0±0.1)	.079±.002 (2.0±0.05)	.059±.004 (1.5+0.1/-0.0)	.039 min. (1.0 min.)	.009±.001 (0.23±0.02)
1J									

8. Chip Quantities Per Reel

Chip Size	Parts on 7 inch (178mm) Reel	Parts on 13 inch (330mm) Reel
0402 (1005)	10,000	—
0603 (1608)	4,000	4,000

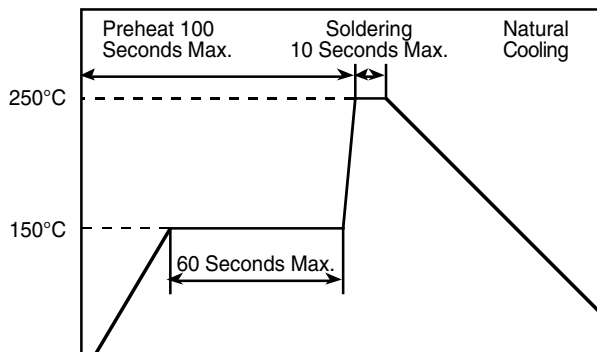
9. Recommended PC Board Land Patterns - inches (mm)

Chip Size	L	G	H
1E (0402)	.05 (1.3)	.015 (0.4)	.019 (0.5)
1J (0603)	.102 (2.6)	.023 (0.6)	.031 (0.8)



10. Recommended Temperature Profiles for Soldering

Recommended Temperature Profile for Wave Soldering



Recommended Temperature Profile for Reflow Soldering

