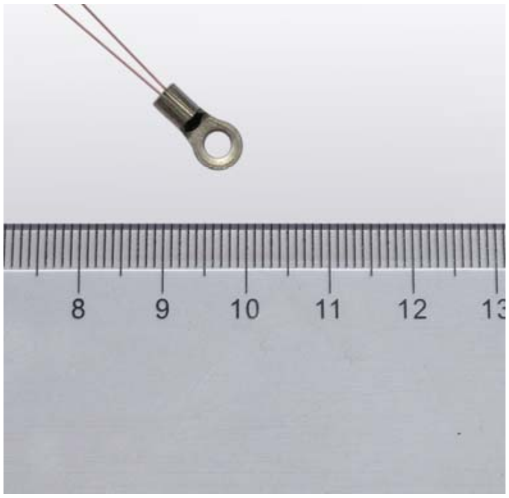

Figure 1.1. The physical photo of ATH100KL2C

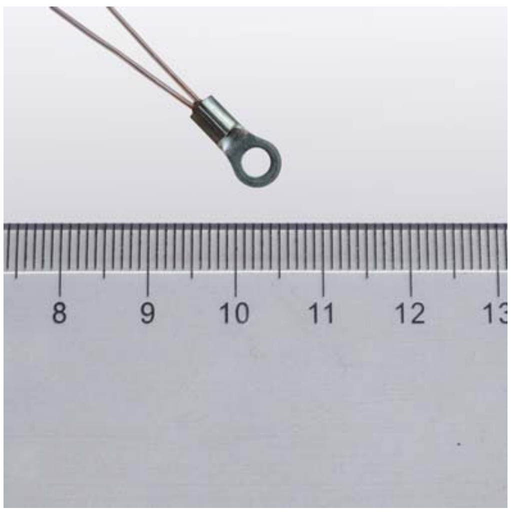

Figure 1.2. The physical photo of ATH100KL2CT70S

MAIN FEATURES

- Glass Encapsulated for Long Term Stability & Reliability
- High Resistance Accuracy: 1%
- Maximum Temp. Range: –40°C to 270°C
- Packaged in Extra Small Ring Lug
- 100 % Lead (Pb)-free and RoHS Compliant

APPLICATION AREAS

Temperature sensing for laser diodes, optical components, etc.

DESCRIPTIONS

The ATH100KL2C is a thermistor assembly with a glass encapsulated thermistor packaged in an extra compact ring lug. The ATH100KL2C series thermistor consists of three versions, ATH100KL2C, ATH100KL2CT70 and ATH100KL2CT70S. The ATH100KL2C has bear leads coated with copper, the ATH100KL2CT70S has the leads covered by high temperature plastic tubing and sealed by epoxy, while the ATH100KL2CT70 is the non-sealed version.

Comparing with conventional assemblies containing epoxy encapsulated thermistors, and ATH100KL2C series thermistor presents higher long term stability, higher reliability and wider temperature range. In addition, it has a small size and short response time.

The ATH100KL2C series thermistor can be used to measure the temperatures of laser diodes, optical components, etc., with high accuracy and long term stability.

There are some differences among ATH100KL2**A**, ATH100KL2**B** and ATH100KL2**C**. First, the ring sizes of them are different. Second, the thermistor head in ATH100KL2**A** is the same as ATH10KR8, while the heads in ATH100KL2**B** and ATH100KL2**C** are the same as ATH100K1R25. Last, the resistance temperature characteristics in ATH100KL2**B** and ATH100KL2**C** are the same, different from ATH100KL2**A**.

SPECIFICATIONS

Parameters	Value
Nominal Resistance @ 25°C	100K ± 1%
B Value @ 25°C /50°C	3950K ± 1%
B Value @ 25°C /85°C	3990K ± 1%
R@25˚C / R@50˚C	2.771
R@25˚C / R@85˚C	9.389
Ring Lug Length	11.2 ± 0.1mm
Ring Lug Width	5.5 ± 0.1mm
Ring Hole Diameter	3.02 ± 0.1mm
Lead Diameter	0.2mm
Lead Length	70 ± 1mm
Insulation Resistance	50MΩ
Time Constant	37.8s (in still air) 1.22s (in water)

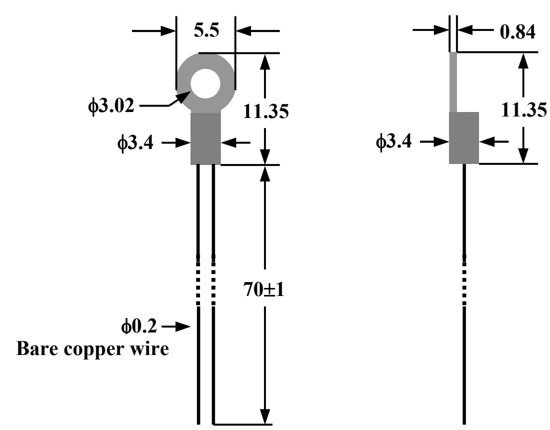

Figure 2. The Front and Side Views of ATH100KL2C

APPLICATIONS

Use #2 imperial or M2.5 metric screw to mount the thermistor assembly onto a smooth metal surface of the object for which the temperature needs to be measured.

The thermistor lead wires are made of plain copper; make sure that they do not touch each other, or any other electrically conductive objects.

For high precision applications, use a cover which is made of thermal isolation material to cover the thermistor area, see Figure 3. In this way, the air flow will not affect the temperature sensing accuracy.

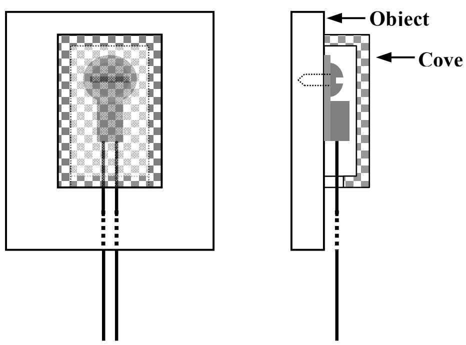

Figure 3. Using an Insulation Cover to Improve Accuracy

CAUTIONS

1. Do not apply a large DC voltage across the thermistor in the temperature sensing circuit. The thermistor self-heating temperature is about 1°C/mW. By injecting a 10μA current into the thermistor, it consumes 1mW and the self-heating temperature is about 1°C if the thermistor is placed in still air. Therefore, the sensing current needs to be much lower than 10μA when the thermistor is placed in the air for high accuracy applications. Injecting short current pulses into the thermistor is one of the ways to reduce the average current level on the thermistor in order to minimize the self-heating effect.
2. Handle the thermistor with care, do not use metal tools to hold the thermistor body with excessive force, otherwise, the glass body may crack, affecting its accuracy and stability.

Thermistor Resistance

Beta Value (β)

A simple approximation for the relationship between the resistance and temperature for ATH100KL2C is to use an exponential approximation. This approximation is based on simple curve fitting to experimental data and uses two points on a curve to determine the value of β. The equation relating resistance to temperature using β is:

$$R = \mathrm{A}e^{\frac{\beta}{\mathrm{T}}};$$

Where:

R = thermistor resistance at temp T,
A = constant of equation,
β = beta, the material constant,
T = thermistor temperature in ˚K(Kelvin),

To calculate β for any given temperature range, the following formula applies:

$$\beta = \ln(R_{T1} / R_{T2}) / (1/T1 - 1/T2);$$

Where β is measured in K, R_{T1} is the resistance at T1, while R_{t2} is the resistance at T2.

β can be used to compare the relative steepness of ATH100KL2C curves. However, the value of β will vary depending on the temperatures used for calculating the value. For example, to calculate β for the temperature range of 25˚C to 50˚C:

T1 = (25 + 273.15)˚K = 298.15˚K,
T2 = (50 + 273.15)˚K = 323.15˚K,
R_{T1} = 100KΩ,
R_{T2}= 35.88KΩ;

This value of β would be referenced as β25˚C/50˚C, and calculated as:

β25˚C/50˚C = ln(100/3.6085) / (1/298.15 – 1/323.15) = 3950K;

By using the same formula, β25˚C/85˚C, will be:

β25˚C/85˚C = ln(100/1.65) / (1/298.15 – 1/358.15) = 3990K.

When using the β value to compare 2 thermistors, make sure that the β values are calculated based on the same 2 temperature points.

Temperature Coefficient of Resistance (α)

Another way to characterize the R-T curve of the ATH100KL2C is to use the slope of the resistance versus temperature (R/T) curve at one temperature. By definition, the resistance slope vs. temperature is given by:

$$\alpha = (1/R) \times (dR/dT);$$

Where T is the temperature in ˚C or ˚K, R is the resistance at temperature T.

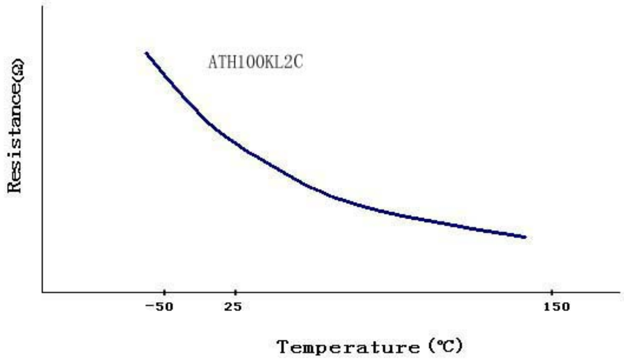

Figure 4. Resistance vs. Temperature for ATH100KL2C

As shown in Figure 4, the steepest position of the ATH100KL2C curve is at colder temperatures.

The temperature coefficient is one method that can be used for comparing the relative steepness of the curves. It is highly recommended to compare the temperature coefficient at the same temperature because α varies widely over the operating temperature range.

Resistance Ratio (Slope)

The resistance ratio, or slope, for thermistors is defined as the ratio of the resistance at one temperature to the resistance at a higher temperature. As with resistance ratios, this method will vary depending on the temperatures used for calculating the value. This method can also be used to compare the relative steepness of two curves. There is no industry standard for the two temperatures that are used to calculate the ratio, we can select two common temperature from the table below, for example, 25˚C and 50˚C, then the result of this calculation: R@25˚C / R@50˚C, will be:

R@25˚C / R@50˚C = 100/35.88 = 2.787;

And this calculation: R@25˚C/R@85˚C, will be:

R@25˚C / R@85˚C = 100/10.65 = 9.389.

Steinhart-Hart Thermistor Equation

The Steinhart-Hart Equation is an empirically derived polynomial formula which does best in describing the relationship between the resistance and the temperature of ATH100KL2C, which is much more accurate than β mathod. To solve for temperature when resistance is known, yields the following equation:

$$1/T = a + b(\ln R) + C(\ln R)^3;$$

Where:

T = temperature in ˚K (Kelvin),
a, b and c are equation constants,
R = resistance in Ω at temp T;

To solve for resistance when the temperature is known, the form of the equation is:

$$R = e^{\left[\left(-\frac{x}{2}+\left(\frac{x^2}{4}+\frac{\psi^3}{27}\right)^{\frac{1}{2}}\right)^{\frac{1}{3}}+\left(-\frac{x}{2}-\left(\frac{x^2}{4}+\frac{\psi^3}{27}\right)^{\frac{1}{2}}\right)^{\frac{1}{3}}\right]};$$

Where:

$$x = \frac{a - 1/T}{c}, \ \psi = \frac{b}{c}.$$

The a, b and c constants can be calculated for either a thermistor material or for individual values of the thermistors within a material type. To solve for the constants, three sets of data must be used. Normally, for a temperature range, the low end, middle end and high end values are used to calculate the constants, resulting in the best fit for the equation over the range. Using the Steinhart-Hart equation allows for accuracy as good as ±0.001˚C over a 100˚C temperature span.

Resistance Temperature Characteristics

Temp	Resistance	Temp	Resistance	Temp	Resistance	Temp	Resistance	Temp	Resistance
˚C	KΩ	˚C	KΩ	˚C	KΩ	˚C	KΩ	˚C	KΩ
-40	3493	7	231.5	54	30.86	101	6.550	148	1.915
-39	3265	8	220.3	55	29.74	102	6.365	149	1.871
-38	3053	9	209.9	56	28.66	103	6.185	150	1.828
-37	2856	10	200.0	57	27.62	104	6.008	151	1.786
-36	2673	11	190.5	58	26.64	105	5.840	152	1.745
-35	2503	12	181.6	59	25.68	106	5.675	153	1.706
-34	2345	13	173.2	60	24.78	107	5.517	154	1.667
-33	2198	14	165.2	61	23.90	108	5.362	155	1.629
-32	2062	15	157.6	62	23.06	109	5.214	156	1.593
-31	1934	16	150.4	63	22.26	110	5.069	157	1.557
-30	1816	17	143.6	64	21.48	111	4.931	158	1.523
-29	1705	18	137.1	65	20.73	112	4.796	159	1.489
-28	1602	19	130.9	66	20.02	113	4.666	160	1.456
-27	1506	20	125.1	67	19.34	114	4.540	161	1.424
-26	1416	21	119.5	68	18.68	115	4.417	162	1.393
-25	1332	22	114.3	69	18.05	116	4.296	163	1.363
-24	1254	23	109.3	70	17.44	117	4.182	164	1.333
-23	1181	24	104.5	71	16.86	118	4.069	165	1.304
-22	1112	25	100.0	72	16.29	119	3.961	166	1.276
-21	1048	26	95.71	73	15.75	120	3.857	167	1.249
-20	988.4	27	91.61	74	15.23	121	3.755	168	1.222
-19	932.3	28	87.72	75	14.74	122	3.657	169	1.196
-18	879.6	29	84.00	76	14.25	123	3.562	170	1.171
-17	830.2	30	80.49	77	13.79	124	3.470	171	1.146
-16	784.1	31	77.11	78	13.35	125	3.381	172	1.122
-15	740.7	32	73.92	79	12.92	126	3.294	173	1.099
-14	699.9	33	70.86	80	12.50	127	3.210	174	1.076
-13	661.7	34	67.96	81	12.10	128	3.129	175	1.054
-12	625.9	35	65.19	82	11.72	129	3.050	176	1.032
-11	592.0	36	62.55	83	11.35	130	2.973	177	1.011
-10	560.4	37	60.01	84	11.00	131	2.898	178	0.9870
-9	55.566	38	57.61	85	10.65	132	2.826	179	0.9671
-8	49.799	39	55.32	86	10.32	133	2.756	180	0.9472
-7	47.208	40	53.12	87	10.00	134	2.688	181	0.9282
-6	44.753	41	51.02	88	9.698	135	2.622	182	0.9093
-5	42.454	42	49.02	89	9.401	136	2.557	183	0.8913
-4	40.273	43	47.12	90	9.115	137	2.495	184	0.8734
-3	38.228	44	45.28	91	8.838	138	2.434	185	0.8564
-2	365.4	45	43.54	92	8.573	139	2.376	186	0.8395
-1	347.1	46	41.88	93	8.317	140	2.318	187	0.8225
0	329.5	47	40.28	94	8.068	141	2.263	188	0.8066
1	313.0	48	38.74	95	7.827	142	2.209	189	0.7906
2	297.5	49	37.28	96	7.597	143	2.157	190	0.7757
3	282.7	50	35.88	97	7.374	144	2.106	191	0.7607
4	268.8	51	34.56	98	7.158	145	2.056	192	0.7458
5	255.6	52	33.26	99	6.949	146	2.008	193	0.7308
6	243.2	53	32.04	100	6.749	147	1.961	194	0.7168

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Temp	Resistance	Temp	Resistance	Temp	Resistance	Temp	Resistance	Temp	Resistance
˚C	KΩ	˚C	KΩ	˚C	KΩ	˚C	KΩ	˚C	KΩ
195	0.7039	211	0.5224	226	0.4004	241	0.3126	256	0.2469
196	0.6899	212	0.5125	227	0.3944	242	0.3076	257	0.2429
197	0.6770	213	0.5035	228	0.3874	243	0.3026	258	0.2398
198	0.6640	214	0.4945	229	0.3805	244	0.2977	259	0.2359
199	0.6520	215	0.4851	230	0.3745	245	0.2927	260	0.2329
200	0.6391	216	0.4771	231	0.3685	246	0.2887	261	0.2290
201	0.6281	217	0.4681	232	0.3625	247	0.2837	262	0.2263
202	0.6161	218	0.4602	233	0.3566	248	0.2787	263	0.2220
203	0.6042	219	0.4522	234	0.3506	249	0.2748	264	0.2190
204	0.5932	220	0.4442	235	0.3446	250	0.2708	265	0.2160
205	0.5822	221	0.4372	236	0.3386	251	0.2668	266	0.2130
206	0.5723	222	0.4293	237	0.3337	252	0.2626	267	0.2091
207	0.5613	223	0.4223	238	0.3277	253	0.2588	268	0.2060
208	0.5513	224	0.4143	239	0.3227	254	0.2548	269	0.2031
209	0.5414	225	0.4074	240	0.3176	255	0.2509	270	0.2001
210	0.5314								

ORDERING INFORMATION

Quantity	1 – 9	10 – 49	50 – 199	200 – 499	≥500
ATH100KL2C	$2.70	$2.40	$2.10	$1.80	$1.50
ATH100KL2CT70	$2.80	$2.50	$2.20	$1.90	$1.60
ATH100KL2CT70S	$2.90	$2.60	$2.30	$1.99	$1.70

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