



# KTY81 series

## Silicon temperature sensors

Rev. 05 — 25 April 2008

Product data sheet

## 1. Product profile

### 1.1 General description

The temperature sensors in the KTY81 series have a positive temperature coefficient of resistance and are suitable for use in measurement and control systems. The sensors are encapsulated in the SOD70 2 in-line leads plastic package.

Other special selections are available on request.

#### CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

### 1.2 Features

- High accuracy and reliability
- Positive temperature coefficient; fail-safe behavior
- Long-term stability
- Virtually linear characteristics

### 1.3 Quick reference data

Table 1. Quick reference data

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ; in liquid; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{25}$	sensor resistance	$I_{sen(cont)} = 1\text{ mA}$				
		KTY81/110	990	-	1010	$\Omega$
		KTY81/120	980	-	1020	$\Omega$
		KTY81/121	980	-	1000	$\Omega$
		KTY81/122	1000	-	1020	$\Omega$
		KTY81/150	950	-	1050	$\Omega$
		KTY81/210	1980	-	2020	$\Omega$
		KTY81/220	1960	-	2040	$\Omega$
		KTY81/221	1960	-	2000	$\Omega$
		KTY81/222	2000	-	2040	$\Omega$
		KTY81/250	1900	-	2100	$\Omega$

## 2. Pinning information

**Table 2. Pinning**

Pin	Description	Simplified outline
1	electrical contact	
2	electrical contact	

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
KTY81/110	-	plastic near cylindrical single-ended package; 2 in-line leads	SOD70
KTY81/120			
KTY81/121			
KTY81/122			
KTY81/150			
KTY81/210			
KTY81/220			
KTY81/221			
KTY81/222			
KTY81/250			

## 4. Marking

**Table 4. Marking codes**

Type number	Marking code
KTY81/110	110
KTY81/120	120
KTY81/121	121
KTY81/122	122
KTY81/150	150
KTY81/210	210
KTY81/220	220
KTY81/221	221
KTY81/222	222
KTY81/250	250

## 5. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$I_{\text{sen(cont)}}$	continuous sensor current	in free air; $T_{\text{amb}} = 25\text{ °C}$	-	10	mA
		in free air; $T_{\text{amb}} = 150\text{ °C}$	-	2	mA
$T_{\text{amb}}$	ambient temperature		-55	+150	°C

## 6. Characteristics

**Table 6. Characteristics**

$T_{\text{amb}} = 25\text{ °C}$ ; in liquid; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{25}$	sensor resistance	$I_{\text{sen(cont)}} = 1\text{ mA}$				
		KTY81/110	990	-	1010	$\Omega$
		KTY81/120	980	-	1020	$\Omega$
		KTY81/121	980	-	1000	$\Omega$
		KTY81/122	1000	-	1020	$\Omega$
		KTY81/150	950	-	1050	$\Omega$
		KTY81/210	1980	-	2020	$\Omega$
		KTY81/220	1960	-	2040	$\Omega$
		KTY81/221	1960	-	2000	$\Omega$
		KTY81/222	2000	-	2040	$\Omega$
TC	temperature coefficient		-	0.79	-	%/K
$R_{100}/R_{25}$	resistance ratio	$T_{\text{amb}} = 100\text{ °C}$ and $25\text{ °C}$	1.676	1.696	1.716	
$R_{-55}/R_{25}$	resistance ratio	$T_{\text{amb}} = -55\text{ °C}$ and $25\text{ °C}$	0.480	0.490	0.500	
$\Delta R_{25}$	drift of sensor resistance at $25\text{ °C}$	10000 h continuous operation; $T_{\text{amb}} = 150\text{ °C}$				
		KTY81/1 series	-	1.6	-	$\Omega$
		KTY81/2 series	-	3.2	-	$\Omega$
$\tau_{\text{th}}$	thermal time constant	in still air	[1] -	30	-	s
		in still liquid	[1] -	5	-	s
		in flowing liquid	[1] -	3	-	s

- [1] The thermal time constant is the time taken for the sensor to reach 63.2 % of the total temperature difference. For example, if a sensor with a temperature of  $25\text{ °C}$  is moved to an environment with an ambient temperature of  $100\text{ °C}$ , the time for the sensor to reach a temperature of  $72.4\text{ °C}$  is the thermal time constant.

**Table 7. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/110 and KTY81/120** $I_{sen(cont)} = 1 \text{ mA}$ .

Ambient temperature		Temperature coefficient (%/K)	KTY81/110				KTY81/120			
(°C)	(°F)		Resistance (Ω)			Temperature error (K)	Resistance (Ω)			Temperature error (K)
			Min	Typ	Max		Min	Typ	Max	
-55	-67	0.99	475	490	505	±3.02	470	490	510	±4.02
-50	-58	0.98	500	515	530	±2.92	495	515	535	±3.94
-40	-40	0.96	552	567	582	±2.74	547	567	588	±3.78
-30	-22	0.93	609	624	638	±2.55	603	624	645	±3.62
-20	-4	0.91	669	684	698	±2.35	662	684	705	±3.45
-10	14	0.88	733	747	761	±2.14	726	747	769	±3.27
0	32	0.85	802	815	828	±1.91	793	815	836	±3.08
10	50	0.83	874	886	898	±1.67	865	886	907	±2.88
20	68	0.80	950	961	972	±1.41	941	961	982	±2.66
25	77	0.79	990	1000	1010	±1.27	980	1000	1020	±2.54
30	86	0.78	1029	1040	1051	±1.39	1018	1040	1061	±2.68
40	104	0.75	1108	1122	1136	±1.64	1097	1122	1147	±2.97
50	122	0.73	1192	1209	1225	±1.91	1180	1209	1237	±3.28
60	140	0.71	1278	1299	1319	±2.19	1265	1299	1332	±3.61
70	158	0.69	1369	1392	1416	±2.49	1355	1392	1430	±3.94
80	176	0.67	1462	1490	1518	±2.8	1447	1490	1532	±4.3
90	194	0.65	1559	1591	1623	±3.12	1543	1591	1639	±4.66
100	212	0.63	1659	1696	1733	±3.46	1642	1696	1750	±5.05
110	230	0.61	1762	1805	1847	±3.83	1744	1805	1865	±5.48
120	248	0.58	1867	1915	1963	±4.33	1848	1915	1982	±6.07
125	257	0.55	1919	1970	2020	±4.66	1899	1970	2040	±6.47
130	266	0.52	1970	2023	2077	±5.07	1950	2023	2097	±6.98
140	284	0.45	2065	2124	2184	±6.28	2043	2124	2205	±8.51
150	302	0.35	2145	2211	2277	±8.55	2123	2211	2299	±11.43

**Table 8. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/121 and KTY81/122** $I_{sen(cont)} = 1 \text{ mA}$ .

Ambient temperature		Temperature coefficient (%/K)	KTY81/121				KTY81/122			
(°C)	(°F)		Resistance (Ω)			Temperature error (K)	Resistance (Ω)			Temperature error (K)
			Min	Typ	Max		Min	Typ	Max	
-55	-67	0.99	471	485	500	±3.02	480	495	510	±3.02
-50	-58	0.98	495	510	524	±2.92	505	520	535	±2.92
-40	-40	0.96	547	562	576	±2.74	558	573	588	±2.74
-30	-22	0.93	603	617	632	±2.55	615	630	645	±2.55
-20	-4	0.91	662	677	691	±2.35	676	690	705	±2.35
-10	14	0.88	726	740	754	±2.14	741	755	769	±2.14
0	32	0.85	794	807	820	±1.91	810	823	836	±1.91
10	50	0.83	865	877	889	±1.67	883	895	907	±1.67
20	68	0.80	941	951	962	±1.41	960	971	982	±1.41
25	77	0.79	980	990	1000	±1.27	1000	1010	1020	±1.27
30	86	0.78	1018	1029	1041	±1.39	1039	1050	1062	±1.39
40	104	0.75	1097	1111	1125	±1.64	1120	1134	1148	±1.64
50	122	0.73	1180	1196	1213	±1.91	1204	1221	1238	±1.91
60	140	0.71	1266	1286	1305	±2.19	1291	1312	1332	±2.19
70	158	0.69	1355	1378	1402	±2.49	1382	1406	1430	±2.49
80	176	0.67	1447	1475	1502	±2.8	1477	1505	1533	±2.8
90	194	0.65	1543	1575	1607	±3.12	1574	1607	1639	±3.12
100	212	0.63	1642	1679	1716	±3.46	1676	1713	1750	±3.46
110	230	0.61	1745	1786	1828	±3.83	1780	1823	1865	±3.83
120	248	0.58	1849	1896	1943	±4.33	1886	1934	1982	±4.33
125	257	0.55	1900	1950	2000	±4.66	1938	1989	2041	±4.66
130	266	0.52	1950	2003	2056	±5.07	1989	2044	2098	±5.07
140	284	0.45	2044	2103	2162	±6.28	2085	2146	2206	±6.28
150	302	0.35	2124	2189	2254	±8.55	2167	2233	2299	±8.55

**Table 9. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/150** $I_{sen(cont)} = 1\text{ mA}$ .

Ambient temperature		Temperature coefficient (%/K)	KTY81/150			Temperature error (K)
(°C)	(°F)		Resistance ( $\Omega$ )			
			Min	Typ	Max	
-55	-67	0.99	456	490	524	$\pm 7.04$
-50	-58	0.98	479	515	550	$\pm 6.99$
-40	-40	0.96	530	567	605	$\pm 6.91$
-30	-22	0.93	584	624	663	$\pm 6.84$
-20	-4	0.91	642	684	725	$\pm 6.77$
-10	14	0.88	703	747	791	$\pm 6.69$
0	32	0.85	769	815	861	$\pm 6.61$
10	50	0.83	838	886	934	$\pm 6.51$
20	68	0.80	912	961	1010	$\pm 6.41$
25	77	0.79	950	1000	1050	$\pm 6.35$
30	86	0.78	987	1040	1093	$\pm 6.55$
40	104	0.75	1064	1122	1181	$\pm 6.97$
50	122	0.73	1143	1209	1274	$\pm 7.4$
60	140	0.71	1226	1299	1371	$\pm 7.85$
70	158	0.69	1313	1392	1472	$\pm 8.31$
80	176	0.67	1402	1490	1577	$\pm 8.79$
90	194	0.65	1495	1591	1687	$\pm 9.29$
100	212	0.63	1591	1696	1801	$\pm 9.81$
110	230	0.61	1690	1805	1919	$\pm 10.4$
120	248	0.58	1791	1915	2039	$\pm 11.28$
125	257	0.55	1840	1970	2099	$\pm 11.91$
130	266	0.52	1889	2023	2158	$\pm 12.72$
140	284	0.45	1980	2124	2269	$\pm 15.21$
150	302	0.35	2057	2211	2365	$\pm 20.09$

**Table 10. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/210 and KTY81/220** $I_{sen(cont)} = 1 \text{ mA}$ .

Ambient temperature		Temperature coefficient (%/K)	KTY81/210				KTY81/220			
(°C)	(°F)		Resistance (Ω)			Temperature error (K)	Resistance (Ω)			Temperature error (K)
			Min	Typ	Max		Min	Typ	Max	
-55	-67	0.99	951	980	1009	±3.02	941	980	1019	±4.02
-50	-58	0.98	1000	1030	1059	±2.92	990	1030	1070	±3.94
-40	-40	0.96	1105	1135	1165	±2.74	1094	1135	1176	±3.78
-30	-22	0.93	1218	1247	1277	±2.55	1205	1247	1289	±3.62
-20	-4	0.91	1338	1367	1396	±2.35	1325	1367	1410	±3.45
-10	14	0.88	1467	1495	1523	±2.14	1452	1495	1538	±3.27
0	32	0.85	1603	1630	1656	±1.91	1587	1630	1673	±3.08
10	50	0.83	1748	1772	1797	±1.67	1730	1772	1814	±2.88
20	68	0.80	1901	1922	1944	±1.41	1881	1922	1963	±2.66
25	77	0.79	1980	2000	2020	±1.27	1960	2000	2040	±2.54
30	86	0.78	2057	2080	2102	±1.39	2036	2080	2123	±2.68
40	104	0.75	2217	2245	2272	±1.64	2194	2245	2295	±2.97
50	122	0.73	2383	2417	2451	±1.91	2359	2417	2475	±3.28
60	140	0.71	2557	2597	2637	±2.19	2531	2597	2663	±3.61
70	158	0.69	2737	2785	2832	±2.49	2709	2785	2860	±3.94
80	176	0.67	2924	2980	3035	±2.8	2894	2980	3065	±4.3
90	194	0.65	3118	3182	3246	±3.12	3086	3182	3278	±4.66
100	212	0.63	3318	3392	3466	±3.46	3284	3392	3500	±5.05
110	230	0.59	3523	3607	3691	±3.93	3487	3607	3728	±5.61
120	248	0.53	3722	3817	3912	±4.7	3683	3817	3950	±6.59
125	257	0.49	3815	3915	4016	±5.26	3775	3915	4055	±7.31
130	266	0.44	3901	4008	4114	±6	3861	4008	4154	±8.27
140	284	0.33	4049	4166	4283	±8.45	4008	4166	4325	±11.46
150	302	0.20	4153	4280	4407	±14.63	4110	4280	4450	±19.56

**Table 11. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/221 and KTY81/222**

$I_{sen(cont)} = 1\text{ mA}$ .

Ambient temperature		Temperature coefficient (%/K)	KTY81/221				KTY81/222			
(°C)	(°F)		Resistance (Ω)			Temperature error (K)	Resistance (Ω)			Temperature error (K)
			Min	Typ	Max		Min	Typ	Max	
-55	-67	0.99	941	970	999	±3.02	960	990	1020	±3.02
-50	-58	0.98	990	1019	1049	±2.92	1010	1040	1070	±2.92
-40	-40	0.96	1094	1123	1153	±2.74	1116	1146	1176	±2.74
-30	-22	0.93	1205	1235	1264	±2.55	1230	1260	1290	±2.55
-20	-4	0.91	1325	1354	1382	±2.35	1352	1381	1410	±2.35
-10	14	0.88	1452	1480	1508	±2.14	1481	1510	1538	±2.14
0	32	0.85	1587	1613	1640	±1.91	1619	1646	1673	±1.91
10	50	0.83	1730	1754	1779	±1.67	1765	1790	1815	±1.67
20	68	0.80	1882	1903	1924	±1.41	1920	1941	1963	±1.41
25	77	0.79	1960	1980	2000	±1.27	2000	2020	2040	±1.27
30	86	0.78	2037	2059	2081	±1.39	2078	2100	2123	±1.39
40	104	0.75	2195	2222	2250	±1.64	2239	2267	2295	±1.64
50	122	0.73	2360	2393	2426	±1.91	2407	2441	2475	±1.91
60	140	0.71	2531	2571	2611	±2.19	2582	2623	2664	±2.19
70	158	0.69	2710	2757	2804	±2.49	2764	2812	2860	±2.49
80	176	0.67	2895	2950	3005	±2.8	2953	3009	3065	±2.8
90	194	0.65	3086	3150	3214	±3.12	3149	3214	3279	±3.12
100	212	0.63	3285	3358	3431	±3.46	3351	3426	3501	±3.46
110	230	0.59	3488	3571	3655	±3.93	3558	3643	3728	±3.93
120	248	0.53	3684	3779	3873	±4.7	3759	3855	3951	±4.7
125	257	0.49	3776	3876	3976	±5.26	3853	3955	4056	±5.26
130	266	0.44	3862	3967	4073	±6	3940	4048	4155	±6
140	284	0.33	4009	4125	4241	±8.45	4090	4208	4326	±8.45
150	302	0.20	4112	4237	4363	±14.63	4195	4323	4451	±14.63



**Table 12. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/250** $I_{sen(cont)} = 1\text{ mA}$ .

Ambient temperature		Temperature coefficient (%/K)	KTY81/250			
(°C)	(°F)		Resistance ( $\Omega$ )			Temperature error (K)
			Min	Typ	Max	
-55	-67	0.99	911	980	1049	$\pm 7.04$
-50	-58	0.98	959	1030	1101	$\pm 6.99$
-40	-40	0.96	1060	1135	1210	$\pm 6.91$
-30	-22	0.93	1168	1247	1327	$\pm 6.84$
-20	-4	0.91	1283	1367	1451	$\pm 6.77$
-10	14	0.88	1407	1495	1583	$\pm 6.69$
0	32	0.85	1538	1630	1721	$\pm 6.61$
10	50	0.83	1677	1772	1867	$\pm 6.51$
20	68	0.80	1824	1922	2021	$\pm 6.41$
25	77	0.79	1900	2000	2100	$\pm 6.35$
30	86	0.78	1974	2080	2185	$\pm 6.55$
40	104	0.75	2127	2245	2362	$\pm 6.97$
50	122	0.73	2287	2417	2547	$\pm 7.4$
60	140	0.71	2453	2597	2741	$\pm 7.85$
70	158	0.69	2626	2785	2943	$\pm 8.31$
80	176	0.67	2805	2980	3154	$\pm 8.79$
90	194	0.65	2990	3182	3374	$\pm 9.29$
100	212	0.63	3182	3392	3602	$\pm 9.81$
110	230	0.59	3379	3607	3836	$\pm 10.65$
120	248	0.53	3569	3817	4065	$\pm 12.25$
125	257	0.49	3658	3915	4173	$\pm 13.45$
130	266	0.44	3741	4008	4274	$\pm 15.06$
140	284	0.33	3883	4166	4450	$\pm 20.49$
150	302	0.20	3982	4280	4578	$\pm 34.35$



To keep the temperature error low, an operating current of  $I_{sen(cont)} = 1 \text{ mA}$  is recommended for temperatures above  $100 \text{ }^\circ\text{C}$

- a. KTY81/1 series
- b. KTY81/2 series

Fig 1. Sensor resistance as a function of operating current



$T_{amb} = 25 \text{ }^\circ\text{C}$

- a. KTY81/1 series

$T_{amb} = 25 \text{ }^\circ\text{C}$

- b. KTY81/2 series

Fig 2. Deviation of sensor resistance as a function of operating current



Fig 3. Maximum operating current for safe operation

## 7. Package outline



Fig 4. Minimized package outline SOD70

8. Packing information



Fig 5. Configuration of bandolier: spread leads

**Note:** Types in bulk packaging have a lead-to-lead distance of 2.54 mm (see [Figure 4](#)). The lead-to-lead distance of types packaged on reel have a lead-to-lead distance of 5.08 mm, spread leads (see [Figure 5](#)).

Table 13. Tape specification

Symbol	Dimension	Specifications					Remarks
		Min	Typ	Max	Tolerance	Unit	
A <sub>1</sub>	body width	4.4	-	4.8	-	mm	
A	body height	5	-	5.2	-	mm	
T	body thickness	3.6	-	4.2	-	mm	
P	pitch of component	-	12.7	-	±1	mm	
P <sub>0</sub>	feed hole pitch	-	12.7	-	±0.3	mm	
	cumulative pitch error	-1	-	+1	-	mm	measured over 20 devices
P <sub>2</sub>	feed hole center to component center	-	6.35	-	±0.4	mm	to be measured at bottom of clinch
F	lead-to-lead distance	-	5.08	-	+0.6/-0.2	mm	spread leads
Δh	component alignment	-	0	1	-	mm	at top of body
W	tape width	-	18	-	±0.5	mm	
W <sub>0</sub>	hold-down tape width	-	6	-	±0.2	mm	
W <sub>1</sub>	hole position	-	9	-	+0.7/-0.5	mm	
W <sub>2</sub>	hold-down tape position	-	0.5	-	±0.2	mm	
H <sub>0</sub>	lead wire clinch height	-	16.5	-	±0.5	mm	
H <sub>1</sub>	component height	-	-	23.25	-	mm	
L	length of snipped leads	-	-	11	-	mm	
D <sub>0</sub>	feed hole diameter	-	4	-	±0.2	mm	
t	total tape thickness	-	-	1.2	-	mm	t <sub>1</sub> = 0.3 mm to 0.6 mm
F <sub>1</sub> , F <sub>2</sub>	lead to snipped lead distance	-	2.54	-	+0.4/-0.2	mm	spread leads
H <sub>2</sub>	clinch height	-	2.5	-	+0.5/0	mm	
(p)	pull-out force	6	-	-	-	N	

## 9. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
KTY81_SER_5	20080425	Product data sheet	-	KTY81-2SERIES_4 KTY81-1SERIES_3
Modifications:				
				<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>
KTY81-2SERIES_4	20000825	Product specification	-	-
KTY81-1SERIES_3	20000825	Product specification	-	-

## 10. Legal information

### 10.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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Тел: +7 (812) 336 43 04 (многоканальный)

Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)