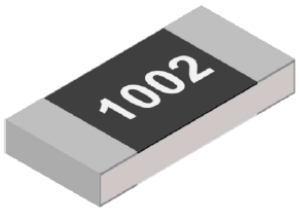
Thin Film Technology Corp.

Product Family: Automotive Thin Film Chip Resistor

Part Number Series: KN_A Series

RoHS COMPLIANT 2011/65/EU

HF HALOGEN-FREE



Construction:

- High purity alumina substrate
- Ni alloy thin film resistive element
- Wrap around electrodes
- 100% matte tin over Ni terminations
- Halogen free
- RoHS compliant and Pb free
- ASTM B809-95 sulfur resistance

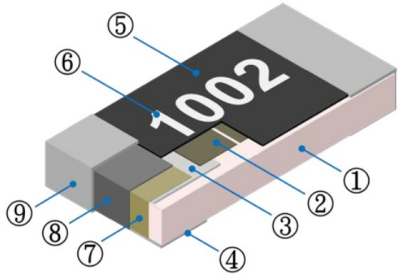
Features:

- 0402, 0603, 0805, and 1206 English case sizes
- Power up to 1/4W (0.25W)
- Resistance from 4.7Ω to 1.5MΩ
- Tolerance down to ±0.05%
- TCR down to ±10ppm/°C
- AEC-Q200 qualified

Description:

These thin film chip resistors are automotive grade AEC-Q200 qualified. They offer great performance in tolerance and TCR and are excellent in applications such as automotive, consumer electronics, computer, telecom, measuring instruments, printing equipment, and converters. High volume production provides excellent pricing and is suitable for commercial and special applications.

Product Construction:

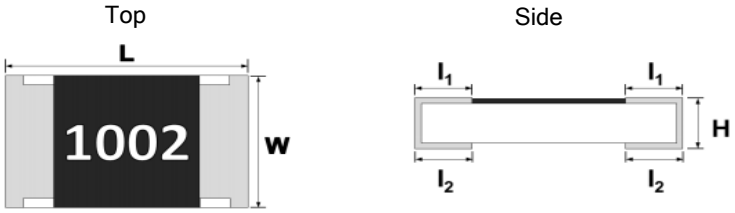


Number	Description
1	Alumina substrate
2	Resistive layer
3	Top inner electrode
4	Bottom inner electrode
5	Protective overcoat
6	Marking
7	Side inner electrode
8	Nickel barrier
9	Solder coating (Sn)

Part Numbering: Ex: KN0402AE10R0FA-T10

Series Name	English Size (Metric Size)	Internal Code	Temp. Coefficient of Resistance (TCR)	Resistance Value	Resistance Tolerance	Automotive	T&R Packaging Quantity
KN	**0402** (1005) **0603** (1608) **0805** (2012) **1206** (3216)	A	**Y** = ±10ppm/°C **X** = ±15ppm/°C **E** = ±25ppm/°C **Q** = ±50ppm/°C	For all sizes, use 4 digit code for all values. "R" denotes decimal position as necessary. i.e. **10R0** = 10.0 **1001** = 1000	**A** = ±0.05% **B** = ±0.10% **C** = ±0.25% **D** = ±0.50% **F** = ±1.00%	**A** = AEC-Q200	**-T5** = 5,000 **-T10** = 10,000 (Refer to electrical tables)

Product Dimensions:



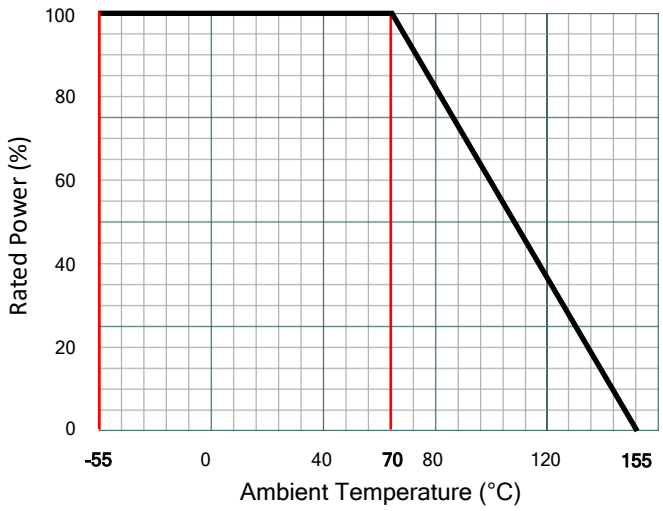
All dimensions are in inches, mm in parentheses.

Dimension (Metric)	KN0402 (1005)	KN0603 (1608)	KN0805 (2012)	KN1206 (3216)
L	0.039 ±0.004 (1.00 ±0.10)	0.063 ±0.006 (1.60 ±0.15)	0.079 ±0.006 (2.00 ±0.15)	0.122 ±0.006 (3.10 ±0.15)
W	0.020 ±0.002 (0.50 ±0.05)	0.031 ±0.004 (0.80 ±0.10)	0.049 ±0.006 (1.25 ±0.15)	0.063 ±0.006 (1.60 ±0.15)
H	0.012 ±0.002 (0.30 ±0.05)	0.018 ±0.004 (0.45 ±0.10)	0.022 ±0.004 (0.55 ±0.10)	0.022 ±0.004 (0.55 ±0.10)
I_1	0.008 ±0.004 (0.20 ±0.10)	0.012 ±0.008 (0.30 ±0.20)	0.014 ±0.008 (0.35 ±0.20)	0.018 ±0.008 (0.45 ±0.20)
I_2	0.008 ±0.004 (0.20 ±0.10)	0.012 ±0.008 (0.30 ±0.20)	0.016 ±0.008 (0.40 ±0.20)	0.020 ±0.008 (0.50 ±0.20)

Electrical Specifications:

Type		KN0402		KN0603		KN0805		KN1206	
Metric Size		1005		1608		2012		3216	
Power Rating		1/16W		1/10W		1/8W		1/4W	
Max Operating Voltage		50V		75V		150V		200V	
Max Overload Voltage		100V		150V		300V		400V	
TCR ppm/°C (code)		±10(Y) ±15(X)	±25(E) ±50(Q)	±10(Y) ±15(X)	±25(E) ±50(Q)	±10(Y) ±15(X)	±25(E) ±50(Q)	±10(Y) ±15(X)	±25(E) ±50(Q)
Resistance by Tolerance % (code)	±0.05(A)	49.9Ω ~ 12KΩ		49.9Ω ~ 30KΩ		49.9Ω ~ 50KΩ		49.9Ω ~ 100KΩ	
	±0.10(B) ±0.25(C) ±0.50(D) ±1.00(F)	10Ω~68KΩ	4.7Ω~220KΩ	10Ω~332KΩ	4.7Ω~680KΩ	10Ω~680KΩ	4.7Ω~1MΩ	10Ω~1MΩ	4.7Ω~1.5MΩ
Operating Temp. Range		-55°C ~ +155°C							
Packaging (code)		10,000pcs/reel (-T10)		5,000pcs/reel (-T5)					

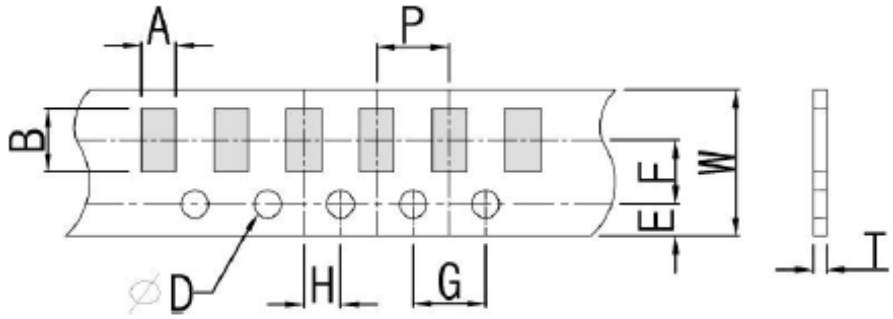
Power Derating Curve:



Reliability Specifications:

Test	Procedure	Specification
Temperature Coefficient of Resistance (TCR) JIS-C 5201-1 4.8 IEC-60115-1 4.8	At 25/-55°C and 25°C/+155°C, 25°C is the reference temperature	Refer to Electrical Specifications
Short Time Overload JIS-C 5201-1 4.13 IEC-60115-1 4.13	2.5 times RCWV or Max. Operating voltage, whichever is less for 5 seconds	±(0.3%+0.05Ω) No visual damage
Leaching JIS-C 5201-1 4.18 IEC-60068-2-58 8.2.1	260 ±5°C for 30 seconds	The covered area >95% No visual damage
High Temp. Exposure (Storage) MIL-STD-202 Method 108	Test Temperature: 155°C Test period: 1,000 hours, unpowered Measurement at 24 ±4 hours after test conclusion	±(0.5%+0.05Ω)
Temperature Cycling JESD22 Method JA-104	Repeat 1,000 cycles: -55 ±3°C for 30 minutes 1+25 ±3°C for 30 minutes	±(0.3%+0.05Ω) No visual damage
Biased Humidity MIL-STD-202 Method 103	1000 hours; 85°C/85% RH, 10% of operating power. Measurement at 24 ±4 hours after test conclusion	±(0.3%+0.05Ω)
Operational Life MIL-STD-202 Method 108	Condition D Steady State TA=125°C at derated power Measurement at 24 ±4 hours after test conclusion	±(0.3%+0.05Ω)
Resistance to Solvents MIL-STD-202 Method 215	Add aqueous wash chemical–OKEM Clean or equivalent : 3 minute soak 2-3 ounce force 10 strokes/repetition	±(0.3%+0.05Ω) No visual damage
Mechanical Shock MIL-STD-202 Method 213	Test 1/2 Since Pulse, Peak Value: 100G Normal Duration: 6ms Velocity Change: 12.3 ft/sec 10 shocks in each direction, total of 30 shocks	±(0.3%+0.05Ω)
Vibration MIL-STD-202 Method 204	Frequency: 10 - 2,000Hz Acceleration: 5G Test Duration: 20 mins / 12 Cycles each of 3 orientations	±(0.3%+0.05Ω)
Resistance to Soldering Heat JIS-C 5201-1 4.8 IEC-60115-1 4.8	260°C ±5°C for 10 seconds	±(0.3%+0.05Ω) No visual damage
ESD AEC-Q200-002	HBM, 100pF, 1.5kΩ 0402: 400V / 0603: 1000V 0805: 1500V / 1206: 2000V	±(0.3%+0.05Ω)
Solderability J-STD-002	(1) 4 hours 155°C dry heat (2) 245 ±5°C, 3 seconds	±(0.3%+0.05Ω)
Insulation Resistance JJIS-C-5201 4.6 IEC-60115-1 4.6	Apply 100VDC for 1 minute	≧10GΩ
Board Flex AEC Q200-005	Bending once for 60 seconds, 3mm	±(0.3%+0.05Ω)
Sulfur Test (FoS) ASTM B809-95 ANSI/EIA-977	60 ±2°C, no power rating for 1000 hours	±(1.0%+0.05Ω)
	105 ±2°C, no power rating for 1000 hours	±(4.0%+0.05Ω)
Terminal Strength (SMD) AEC Q200-006	Pressurizing force for 60 seconds 0402/0603: 8N 0805/1206: 17.7N	Not broken

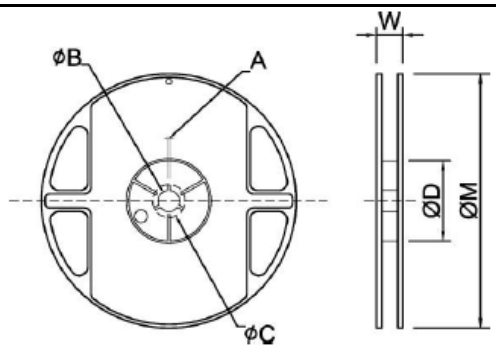
Paper Tape Dimensions:



All dimensions in mm.

Type	A	B	W	E	F	G	H	T	ΦD	P
KN0402	0.70 ±0.10	1.20 ±0.10	8.00 ±0.20	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	2.00 ±0.05	0.45 ±0.10	1.50 +0.10/-0	2.00 ±0.10
KN0603	1.05 ±0.20	1.80 ±0.20	8.00 ±0.20	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	2.00 ±0.05	0.60 ±0.10	1.50 +0.10/-0	4.00 ±0.10
KN0805	1.55 ±0.20	2.30 ±0.20	8.00 ±0.20	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	2.00 ±0.05	0.75 ±0.10	1.50 +0.10/-0	4.00 ±0.10
KN1206	1.90 ±0.20	3.50 ±0.20	8.00 ±0.20	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	2.00 ±0.05	0.75 ±0.10	1.50 +0.10/-0	4.00 ±0.10

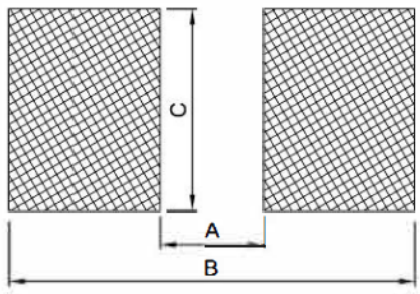
Reel Dimensions:



All dimensions in mm.

Type	Quantity	A	ΦB	ΦC	ΦD	W	ΦM
KN0402	10,000 pcs/reel	2.00 ±0.50	13.5 ±1.00	21.0 ±1.00	60.0 ±1.00	11.5 ±2.00	178 ±2.00
KN0603	5,000 pcs/reel	2.00 ±0.50	13.5 ±1.00	21.0 ±1.00	60.0 ±1.00	11.5 ±2.00	178 ±2.00
KN0805							
KN1206							

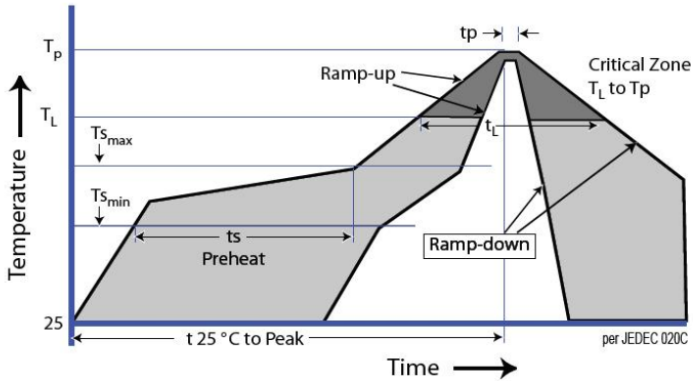
Recommended Land Pattern:



All dimensions in mm.

Type	KN0402	KN0603	KN0805	KN1206
A	0.50	0.80	1.30	2.20
B	1.60	2.40	2.90	4.20
C	0.70	1.00	1.40	1.70

Soldering Profile:



Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (Ts_{max} to Tp)	3 °C/second max.
Preheat	
- Temperature Min (Ts_{min})	150 °C
- Temperature Max (Ts_{max})	200 °C
- Time (ts_{min} to ts_{max})	60-180 seconds
Time maintained above:	
- Temperature (T_L)	217 °C
- Time (t_L)	60-150 seconds
Peak Temperature (T_P)	260 +0 °C
Time within 5 °C of actual Peak Temperature (tp)	20-40 seconds
Ramp-Down Rate	6 °C/second max.
Time 25 °C to Peak Temperature	8 minutes max.

Marking Information:

0402: no marking

0603: 3 digits code

0805 - 1206 : 4 digits

Standard E96 Values and 0603 Resistance Codes																								
R-Value	100	102	105	107	110	113	115	118	121	124	127	130	133	137	140	143	147	150	154	158	162	165	169	174
Code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
R-Value	178	182	187	191	196	200	205	210	215	221	226	232	237	243	249	255	261	267	274	280	287	294	301	309
Code	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
R-Value	316	324	332	340	348	357	365	374	383	392	402	412	422	432	442	453	464	475	487	499	511	523	536	549
Code	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
R-Value	562	576	590	604	619	634	649	665	681	698	715	732	750	768	787	806	825	845	866	887	909	931	953	976
Code	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96

E96 Multiplier Code											
Multiplier	10^0	10^1	10^2	10^3	10^4	10^5	10^6	10^7	10^{-1}	10^{-2}	10^{-3}
Code	A	B	C	D	E	F	G	H	X	Y	Z

Examples of E96 Multiplier Code								
R-Value	10.2KΩ	33.2Ω	7.5Ω	11Ω	130Ω	2KΩ	10KΩ	150KΩ
Code	02C	51X	85Y	05X	12A	30B	01C	18D

Examples of 0603 Resistance Codes for E24 Values						
R-Value	4.7Ω	33Ω	470Ω	5.6KΩ	62KΩ	680KΩ
Code	4R7	330	471	562	623	684

Examples of 4 Digit Resistance Codes for 0805 ~ 1206							
R-Value	5.6Ω	10Ω	22.6Ω	100Ω	1.1KΩ	10KΩ	332KΩ	1MΩ
Code	5R60	10R0	22R6	1000	1101	1002	3323	1004

Storage Conditions:

Environment Conditions:

Products should be stored under the following environmental conditions.

- Temperature: +5 to +35°C
- Humidity: 45 to 85% relative humidity
- Do not keep products in environments where they may be subject to particulate contamination or harmful gases such as sulfuric acid or hydrogen chloride as it may cause oxidization on electrodes, resulting in poor solderability.
- Products should be stored in a space that does not expose it to high temperatures, vibration, or direct sunlight.
- Products should be stored in the original airtight packaging until use.