



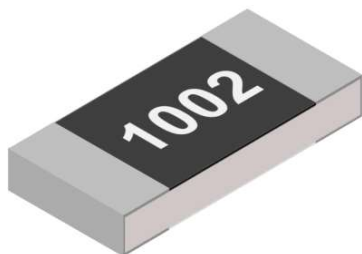
TQ Series AEC-Q200 Compliant Thin Film Chip Resistor Product Specifications

Document No. S-10-12-65-02

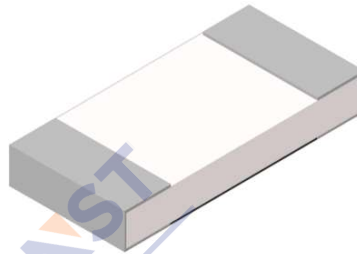
Released Date 2021/05/13

Page No. 1/9

AEC-Q200 Compliant Thin Film Chip Resistor — TQ Series



Top view



Bottom view

Applications

- Industrial electronics
- Communication devices
- Measuring instrument
- Converters

Features

- Tolerance to $\pm 0.05\%$
- Low TCR to $\pm 10 \text{ ppm}/^\circ\text{C}$
- AEC-Q200 qualified
- Halogen free and lead free
- RoHS compliant

Parts Number Explanation

Example:

TQ	1206	B	10K0	P	05	25	Z
Product Type	Size (Inch)	Tolerance	Resistance	Package	Quantity (PCS)	TCR (ppm/ $^\circ\text{C}$)	Optional
TQ Series AEC-Q200 Compliant Thin Film Chip Resistor	0402 0603 0805 1206	A : $\pm 0.05\%$ B : $\pm 0.1\%$ C : $\pm 0.25\%$ D : $\pm 0.5\%$ F : $\pm 1\%$	4 digits EX. 10R0 = 10Ω 100R = 100Ω 2K20 = $2.2 \text{ K}\Omega$ 332K = $332 \text{ K}\Omega$ 1M00 = $1 \text{ M}\Omega$	P : Paper Taping (0603~1206) Q : Paper Taping (0402) E : Embossed Taping	05 : 5000 10 : 10000	10 : ± 10 15 : ± 15 25 : ± 25 50 : ± 50	Z : Default Code



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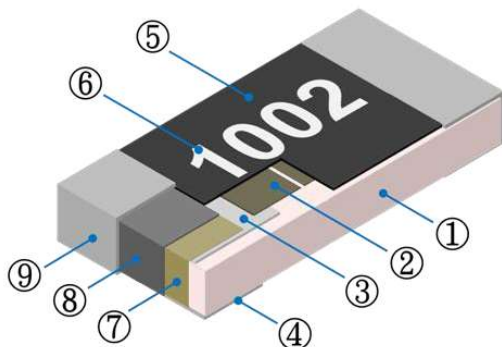
Page No. 2/9

Standard Electrical Specifications

項目 Item 型別 Type	額定功率 Rated Power at 70°C	最大 工作電壓 Max Working Voltage	最大 過負載電壓 Max Overload Voltage	溫度係數 T.C.R. (PPM/°C)	阻值範圍 Resistance Range				
					A ±0.05%	B ±0.1%	C ±0.25%	D ±0.5%	F ±1.0%
TQ0402	0.063W	50V	100V	±10, ±15	49.9 Ω ~ 12 KΩ	10 Ω ~ 68 KΩ			
				±25, ±50		4.7 Ω ~ 220 KΩ			
TQ0603	0.1W	75V	150V	±10, ±15	49.9 Ω ~ 30 KΩ	10 Ω ~ 332 KΩ			
				±25, ±50		4.7 Ω ~ 680 KΩ			
TQ0805	0.125W	150V	300V	±10, ±15	49.9 Ω ~ 50 KΩ	10 Ω ~ 680 KΩ			
				±25, ±50		4.7 Ω ~ 1 MΩ			
TQ1206	0.25W	200V	400V	±10, ±15	49.9 Ω ~ 100 KΩ	10 Ω ~ 1 MΩ			
				±25, ±50		4.7 Ω ~ 1.5 MΩ			

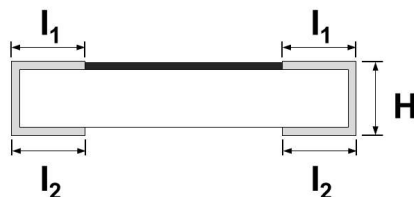
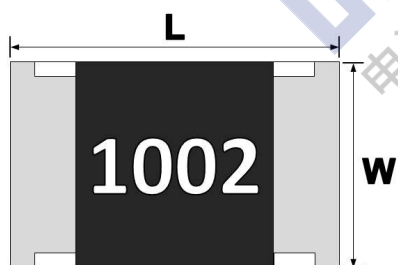
- Operating Temperature Range : -55°C ~ +155°C.
- For non-standard parts, please contact our sales department.

Construction



①	Alumina Substrate	④	Bottom Inner Electrode	⑦	Side Inner Electrode
②	Resistive Layer	⑤	Protective Overcoat	⑧	Nickel Barrier
③	Top Inner Electrode	⑥	Marking	⑨	Solder coating (Sn)

Dimensions



Unit : mm

TYPE	L	W	H	l ₁	l ₂
TQ0402	1.00 ± 0.10	0.50 ± 0.05	0.30 ± 0.05	0.20 ± 0.10	0.20 ± 0.10
TQ0603	1.60 ± 0.15	0.80 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20
TQ0805	2.00 ± 0.15	1.25 ± 0.15	0.55 ± 0.10	0.35 ± 0.20	0.40 ± 0.20
TQ1206	3.10 ± 0.15	1.60 ± 0.15	0.55 ± 0.10	0.45 ± 0.20	0.50 ± 0.20



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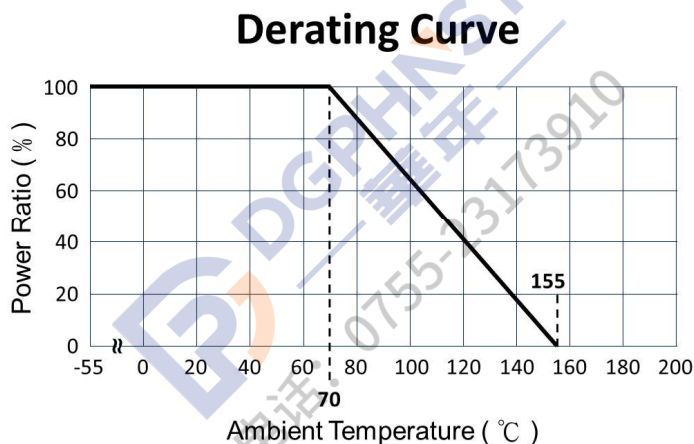
Page No. 4/9

■ Performance Characteristics

■ Power Derating Curve

The Operating Temperature Range: -55°C ~+155°C.

Power rating is in the case based on continuous full-load at ambient temperature of 70°C. For operation at ambient temperature in excess of 70°C, the load should be derated in accordance with figure of derating Curve.



■ Rated Voltage

Resistance Range: $\geq 1\Omega$

Rated Voltage: The resistor shall have a DC continuous working voltage or a RMS AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined formula as following:

$$V = \sqrt{P \times R}$$

V = Rated voltage (V)

P = Rated power (W)

R = Nominal resistance (Ω)



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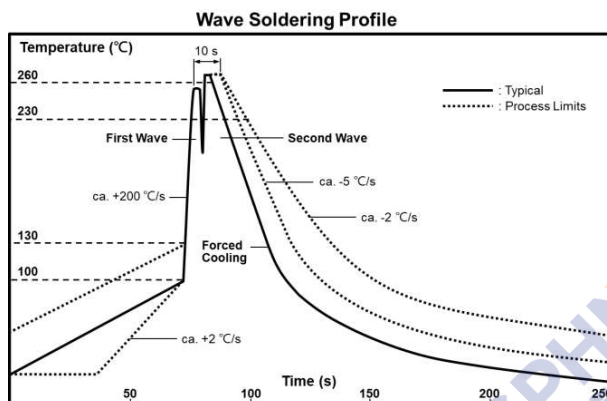
Page No. 5/9

Reliability Tests and Requirements

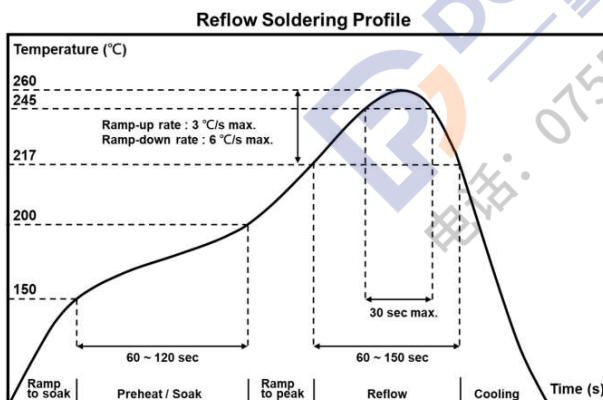
Test Item	Test Method	Procedure	Requirements
Temperature Coefficient of Resistance (T.C.R)	JIS-C-5201-1 4.8 IEC-60115-1 4.8	At 25 / -55°C and 25°C / +125°C, 25°C is the reference temperature.	Refer to Standard Electrical Specifications
Short Time Overload	JIS-C-5201-1 4.13 IEC-60115-1 4.13	2.5 times RCWV or Max. Overload voltage whichever is less for 5 seconds.	±(0.1%+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.	>95% Coverage No Visual damage
Resistance to Soldering Heat	JIS-C-5201-1 4.18 IEC-60115-1 4.18	260±5°C for 10 seconds.	±(0.1%+0.05Ω) No Visual damage
Insulation Resistance	JJIS-C-5201-1 4.6 IEC-60115-1 4.6	Apply 100VDC for 1 minute.	≥ 10GΩ
Temperature Cycling	JESD22 Method JA-104	1000 Cycles (-55°C to +125°C) Measurement at 24±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme.	±(0.3%+0.05Ω) No Visual damage
Resistance to Solvent	MIL-STD-202 Method 215	Add Aqueous wash chemical - OKEM Clean or equivalent.	±(0.1%+0.05Ω) No Visual damage
Biased Humidity	MIL-STD-202 Method 103	1,000 hours; 85°C / 85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion.	±(0.3%+0.05Ω)
High Temperature Exposure (Storage)	MIL-STD-202 Method 108	1000 hrs. @ T=155°C. Unpowered. 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)
External Visual	MIL-STD-883 Method 2009	Electrical test not required. Inspect device construction, marking and workmanship.	No Visual damage
Mechanical Shock	MIL-STD-202 Method 213	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration(D) is 6(ms).	±(0.1%+0.05Ω)
Vibration	MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations. Note: Test from 10-2000 H.	±(0.1%+0.05Ω)
ESD	AEC-Q200- 002 or ISO/DIS 10605	Human body model 0402 : 400 V / 0603 : 1000 V 0805 : 1500 V / 1206 : 2000 V	±(0.5%+0.05Ω)
Solderability	J-STD-002	(1) 4 hrs 155°C dry heat. (2) 245±5°C 3 sec.	>95% Coverage No Visual damage
Terminal Strength (SMD)	AEC Q200-006	Pressurizing force for 60 seconds 0402 / 0603 : 8N ; 0805 / 1206 : 17.7N	No broken
Board Flex	AEC Q200-005	Beading once for 60 seconds 0402 / 0603 / 0805 / 1206 : 3mm	±(0.1%+0.05Ω)
Sulfur Test (FoS)	ASTM B809-95 ANSI/EIA-977	105±2°C, no power rating for 1000 hrs.	±(1.0%+0.05Ω)

■ Recommended Customer Soldering Parameters

■ Wave solder Temperature condition



■ Solder reflow Temperature condition



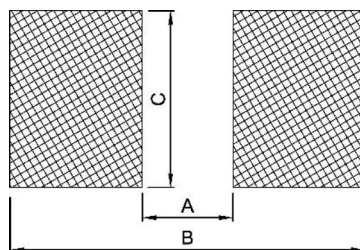
■ Rework temperature (hot air equipment) : 350℃, 3~5seconds

■ Recommended reflow methods

IR, vapor phase oven, hot air oven

If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

■ Recommend Land Pattern Design



Type	0402	0603	0805	1206
Item				
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



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Document No. S-10-12-65-02

Released Date 2021/05/13

Page No. 7/9

Marking



0402 : no marking



0603 : 3 digits code



0805 、 1206 : 4 digits

No marking on 0402 type

3 digits code for 0603 type

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

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

1. 0603 3 digits coding formula for E96 values as following:

CODING FORMULA

$XX \quad X$
 $\uparrow \quad \swarrow$
 Resistance Code Multiplier Code
 Example: $10.2K\Omega = \underline{102} \times \underline{10^2}\Omega = \underline{02C}$
 $33.2\Omega = \underline{332} \times \underline{10^{-1}}\Omega = \underline{51X}$
 $51 \quad X$

EX.: $7.5\Omega = 85Y$; $11\Omega = 05X$; $130\Omega = 12A$; $2K\Omega = 30B$; $10K\Omega = 01C$; $150K\Omega = 18D$

E24	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91
-----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

2. 0603 3 digits for E24 values

Examples:

Resistance	4.7Ω	33Ω	470Ω	$5.6K\Omega$	$62K\Omega$	$680K\Omega$
3 digits code	4R7	330	471	562	623	684

("R"= decimal point)

3. 0603 E192 values have no marking code.

4 digits code for 0805 、 1206 type

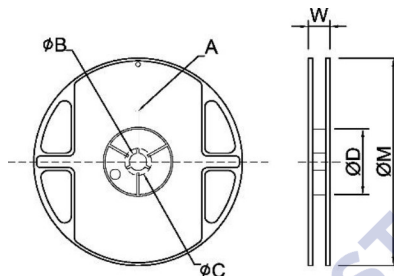
First 3 digits are the significant figures, the 4th digit is the multiplier. "R"= decimal point.

Examples:

Resistance	5.6Ω	10Ω	22.6Ω	100Ω	$1.1K\Omega$	$10K\Omega$	$332K\Omega$	$1M\Omega$
4 digits code	5R60	10R0	22R6	1000	1101	1002	3323	1004

■ Packaging Information

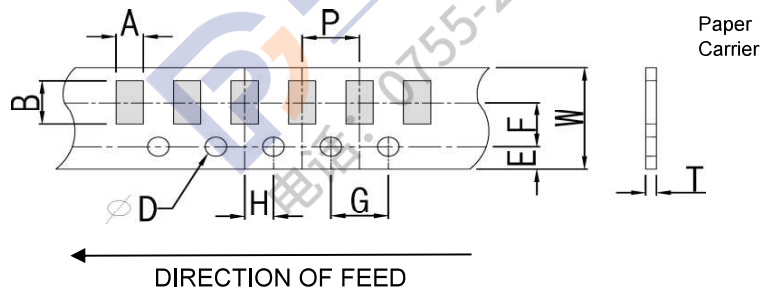
■ Reel Dimensions



Unit: mm t

TYPE	SIZE	A	ΦB	ΦC	ΦD	W	ΦM
0402	7"	10K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0
0603/0805/1206	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0

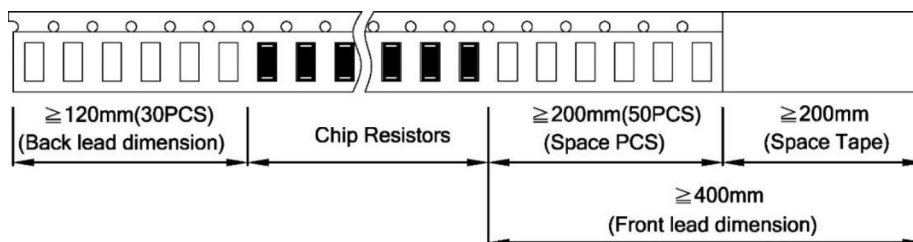
■ Paper Tape Dimensions



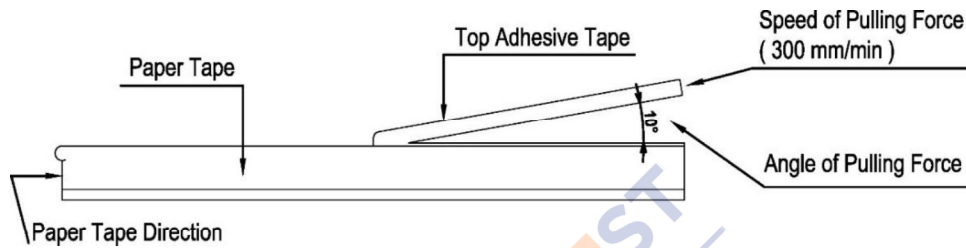
Unit: mm

Type	A	B	W	E	F	G	H	T	ΦD	P
0402	0.70±0.10	1.20±0.10	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.45±0.10	1.50 ^{+0.10} ₋₀	2.0±0.10
0603	1.05±0.20	1.80±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.60±0.10		4.0±0.10
0805	1.55±0.20	2.30±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.75±0.10		
1206	1.90±0.20	3.50±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.75±0.10		

■ Front & Back Lead Dimensions

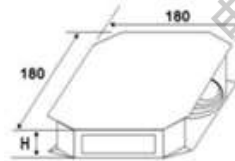


■ **Top Adhesive Peel Off Strength : 10~70g**

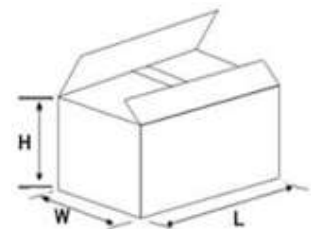


■ **Package**

Inner Box Size	
Reel	Size H(mm)
1	13
2	24
3	36
5	60
10	113



External Box Size			
Contain (Kpcs)	Length (mm)	Width (mm)	Height (mm)
25K	180	180	60
50K	180	180	110
150K	430	200	200
300K	400	400	200



■ **Storage Data :**

Storage time at the environment temp: 25±5°C & humidity: 60±20% is valid for one year from the date of delivery.