

# Approval Specification

Customer:

Product: SMD Thick Film Resistor

CR-01 / CR-02 / CR-03 / CR-05

CR-06 / CR-10 / CR-0A / CR-12

$\pm 1\%$  &  $\pm 5\%$

Sizes : 0201 / 0402 / 0603 / 0805

1206 / 1210 / 2010 / 2512

Approval Date: \_\_\_\_\_

Customer Approval:

(please sign & return)



**TMTEC CO., LTD.**

**Headquarters**

Tel: +886 7 8217999  
Fax: +886 7 8228229  
No.248-3, Sin-Sheng Rd.,  
Cian-Jhen Dist., Kaohsiung, Taiwan, 806

**Taipei Sales Office**

Tel: +886 2 2501-1358  
Fax: +886 2 2501-1216  
7F, No.33, Sec.2, Jianguo N. Rd.,  
Jhongshan District, Taipei 10479, Taiwan

## 1. Features

- Small and light weight
- Excellent heat resistance and moisture resistance
- Lead free products for RoHS compliance
- ISO 9001, ISO 14001, ISO/TS 16949 Certified

## 2. Applications

- For all electronic products
- Miniaturization products

## 3. Description

The resistors are constructed on the alumina substrate. Top electrodes are added to each end and connected with resistive paste that is applied to top surface of the alumina substrate. The resistive layer is made by resistive paste that is prepared to approach the nominal value. Laser trimming process makes the resistance value to meet the nominal value and within the tolerance.

The resistive layer is protected by primary overcoat and secondary overcoat. Marking on secondary overcoat let user to know the resistance value directly. The barrier layer is added to edge electrodes for plating with external electrode that is the main role makes the resistor mounted on PCB.

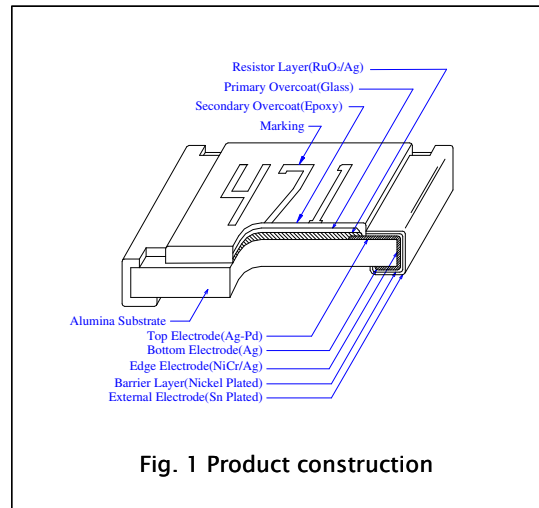


Fig. 1 Product construction

## 4. Quick Reference Data

Type name	CR-01	CR-02	CR-03	CR-05	CR-06	CR-10	CR-0A	CR-12
Size code	0201	0402	0603	0805	1206	1210	2010	2512
Resistance tolerance	±1%(E24, E96 series) ; ±5%(E24 series)							
Resistance range	±1%、±5%: 1Ω~10MΩ, Jumper (<50mΩ)							
Temperature Coefficient of Resistance (ppm/°C)	±1%	±5%			±1%	±5%		
	±200				±200			
	1Ω ≤ R ≤ 9.76Ω				±100			
	10Ω ≤ R ≤ 1MΩ				±200			
1.02MΩ ≤ R ≤ 10MΩ								
Power rating (at 70°C)	1/20W	1/16W	1/10W	1/8W	1/4W	1/3W	3/4W	1W
Max. operation voltage (DC or RMS)	25V	50V	50V	150V	200V	200V	200V	250V
Max. overload voltage	50V	100V	100V	300V	400V	400V	400V	500V
Jumper Rated current	1A	1A	1A	2A	2A	2.5A	3.5A	4A
Climatic category (IEC 60068)	55/125/42	55/155/42						



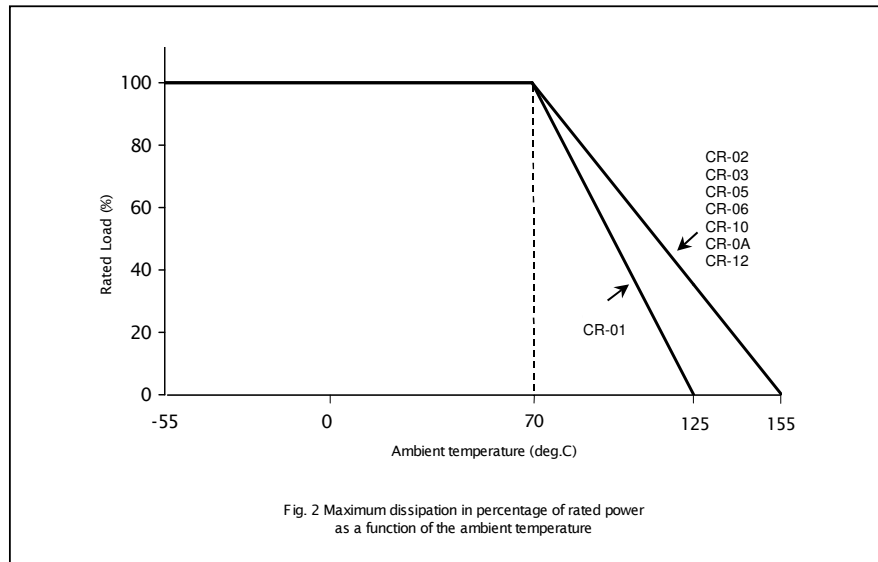
## 5. Order Information

Digits	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Order Code	C	R	-	0	3	F	L	7	-	-	-	1	0	K
	<b>Type Name</b>					<b>Tolerance</b>	<b>Function code</b>	<b>Packaging</b>	<b>Resistance Value</b>					
	CR-01: 0201 CR-02: 0402 CR-03: 0603 CR-05: 0805 CR-06: 1206 CR-10: 1210 CR-0A: 2010 CR-12: 2512					F : ±1% J : ±5%	L: Lead Free (LF)	4: 7" reel, Embossed tape, 4000 pcs/reel 6: 7" reel, paper tape, 10000 pcs/reel 7 : 7" reel, paper tape, 5000 pcs/reel 9 : 10" reel, Embossed tape, 8000 pcs/reel A : 10" reel, paper tape, 10000 pcs/reel B : 10" reel, paper tape, 20000 pcs/reel C : 13" reel, paper tape, 40000 pcs/reel D : 13" reel, paper tape, 20000 pcs/reel - : Not Applicable	---0R : Jumper ----1R : 1Ω ---1R2 : 1.2Ω --3K32 : 3.32KΩ --10K2 : 10.2KΩ --100K : 100KΩ --1M2 : 1.2MΩ					

## 6. Functional description

### Derating curve

For resistors operate in the ambient temperature over 70°C, loading power ratio will derate in accordance with following curve.



**Soldering condition**

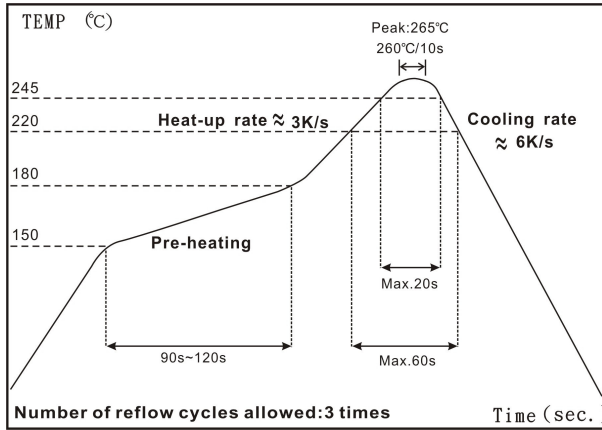


Fig.3 IR Reflow Soldering

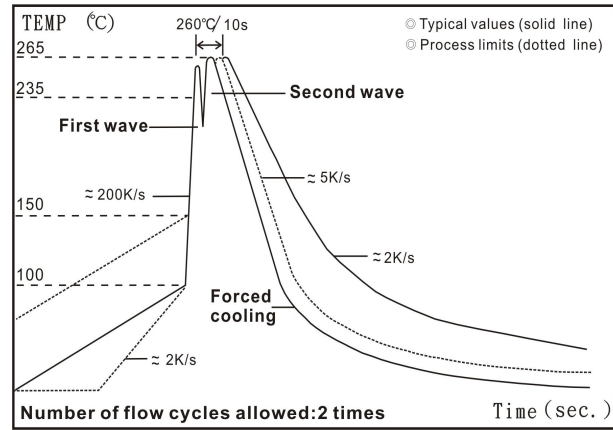


Fig.4 Wave Soldering (Flow Soldering)

- (1) Time of IR reflow soldering at maximum temperature point 260°C : 10s
- (2) Time of wave soldering at maximum temperature point 260°C : 10s
- (3) Time of soldering iron at maximum temperature point 410°C : 5s

**7. Mechanical Data**

**Mass per 1000 pcs**

TYPE NAME	MASS (g)
CR-01	0.150
CR-02	0.620
CR-03	2.042
CR-05	4.368
CR-06	8.947
CR-10	15.959
CR-0A	24.241
CR-12	39.448

**Outline**

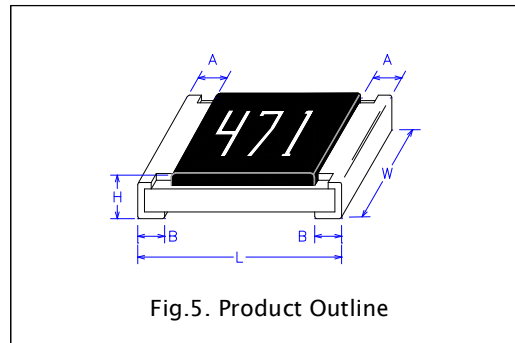


Fig.5. Product Outline

**Dimension**

Type	L (mm)	W (mm)	H (mm)	A (mm)	B (mm)
CR-01	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05
CR-02	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10
CR-03	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
CR-05	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20
CR-06	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20
CR-10	3.20±0.20	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20
CR-0A	5.00±0.20	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20
CR-12	6.35±0.20	3.20±0.15	0.55±0.10	0.60±0.25	0.50±0.20

**Termination**

- (1) Thickness of Tin plating product termination :  $\geq 3\mu\text{m}$
- (2) Thickness of Nickel plating product termination :  $\geq 3\mu\text{m}$



**Marking**

Type A: 5% product with 3 digits marking, the first two digits are significant figures; third digit is number of zeros to follow. Letter “R” is as decimal point. Letter “0” for jumper

Type B: 1% product is with 4 digits, first three digits are significant figures, and fourth digit is number of zeros. Letter “R” is as decimal point. Letter “0” for jumper

Type C: CR-03, ±1 % E-96 marking series as below list. (Table 2)

Type D: CR-01/CR-02 is without marking due the size is too small.

The marking example is as table 1.

**Table 1. Making code example**

Type	Product	Value	Example
A	CR-03, ±5%	68KΩ Jumper	
	CR-05, ±5%		
	CR-06, ±5%		
	CR-10, ±5%		
	CR-0A, ±5%		
	CR-12, ±5%		
B	CR-05, ±1%	68.1KΩ	
	CR-06, ±1%		
	CR-10, ±1%		
	CR-0A, ±1%		
	CR-12, ±1%		
C	CR-03, ±1%	31.6Ω	
D	CR-01, ±1, ±5% CR-02, ±1, ±5%	N/A	

**Table 2. CR-03, ±1% 0603 size, E-96 series marking code**

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

This table shows the first two digits for the three-digits EIA-96 part-marking scheme.

The third character is the letter of multiplier: Y=10<sup>-2</sup> X=10<sup>-1</sup> A=10<sup>0</sup> B=10<sup>1</sup> C=10<sup>2</sup> D=10<sup>3</sup> E=10<sup>4</sup> F=10<sup>5</sup>



## 8. Test and Requirements

In table 3 the tests and requirements are listed with reference relevant clause of IEC 60115-1. A short description of the test procedure is given. Essentially all tests are carried out refer to the schedule of IEC 60115-8-1. The testing also covers the requirements specified by EIA.

**Table 3 Test procedure and requirements**

Test Item	Test Method	Test Condition	Requirement		
			±1%	±5%	Jumper
Temperature Coefficient of Resistance (T.C.R.)	JIS C 5201 4.8 IEC 60115-1 4.8	-55°C~+125/+155°C, 20°C is the reference temperature	Within the specification		
Short Time Overload	JIS C 5201 4.13 IEC 60115-1 4.13	2.5 times RCWV or Max. Overload voltage for 5 seconds	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ
Insulation Resistance	JIS C 5201 4.6 IEC 60115-1 4.6	Max. overload voltage for 1 minute	≥10G		
Voltage Proof	JIS C 5201 4.7 IEC 60115-1 4.7	1.42 times RCWV (RMS) for 1 minute	no breakdown or flashover		
Substrate Bending Test	JIS C 5201 4.33 IEC 60115-1 4.33	Bending once for 5 seconds 2010, 2512 size: 2mm Other size: 3mm	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ
Resistance to soldering heat	JIS C 5201 4.18 IEC 60115 4.18	260±5°C for 10 seconds	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ
Leaching	JIS C 5201 4.18 IEC 60068-2-58 8.2.1	260±5°C for 30 seconds	Individual leaching area ≤ 5% Total leaching area ≤ 10%		
Solderability	JIS C 5201 4.17 IEC 60115-1 4.17	245±5°C for 3 seconds	>95% coverage		
Endurance at upper category temperature	JIS C 5201 4.23 IEC 60115-1 2.23.2	at +125/+155°C for 1000 hrs	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ
Rapid change of temperature	JIS C 5201 4.19 IEC 60115-1 4.19	-55°C to +125/+155 °C, 5 cycles	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ
Damp heat with load	JIS 5201 4.24	40±2°C, 90~95% R.H. or Max. working voltage for 1000 hrs with 1.5hrs "ON" and 0.5 hr "OFF"	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ
Endurance	JIS C 5201 4.25 IEC 60115-1 4.25.1	70±2°C, or Max. working voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"	±(2.0+0.10Ω)	±(3.0+0.10Ω)	<100mΩ

**Note:**

RCWV : Rated continuous working voltage

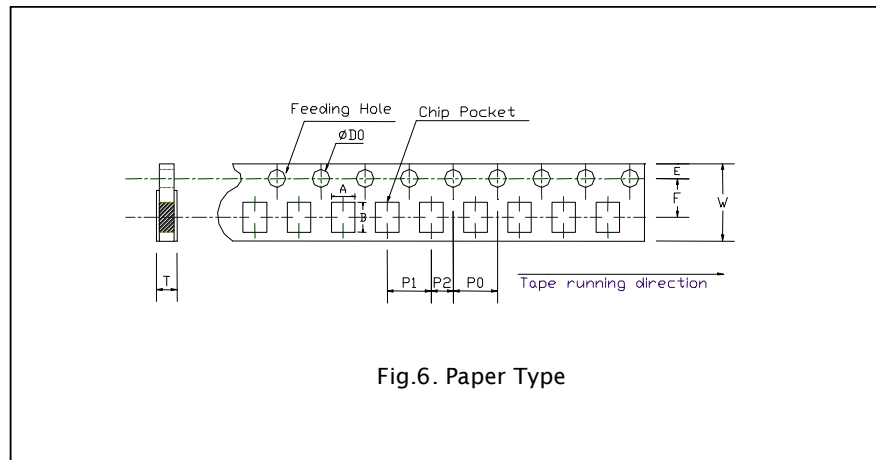
RCWV=Radical of Rated power x Resistance value

## 9. Packaging

### Packaging Methods

Type (unit: piece)	Paper Tape			Embossed Tape	
	7" (178mm)	10" (254mm)	13" (330mm)	7"(178mm)	10"(250mm)
CR-01	10000	20000	40000	-	-
CR-02	10000	20000	40000	-	-
CR-03	5000	10000	20000	-	-
CR-05	5000	10000	20000	-	-
CR-06	5000	10000	20000	-	-
CR-10	5000	10000	20000	-	-
CR-0A / CR-12	-	-	-	4000	8000

### Paper Tape



Type	A	B	W	E	F	P0	P1	P2	$\phi D0$	T
CR-01	0.38±0.05	0.68±0.05	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	2.0±0.05	1.5 <sup>+0.1/-0</sup>	0.42±0.2
CR-02	0.65±0.1	1.15±0.1								0.45±0.1
CR-03	1.10±0.1	1.90±0.1					0.70±0.1			
CR-05	1.60±0.1	2.40±0.2					4.0±0.05			0.85±0.1
CR-06	1.90±0.1	3.50±0.2								0.85±0.1
CR-10	2.80±0.1	3.50±0.2					0.85±0.1			

Unit: mm

**Embossed Plastic Tape**

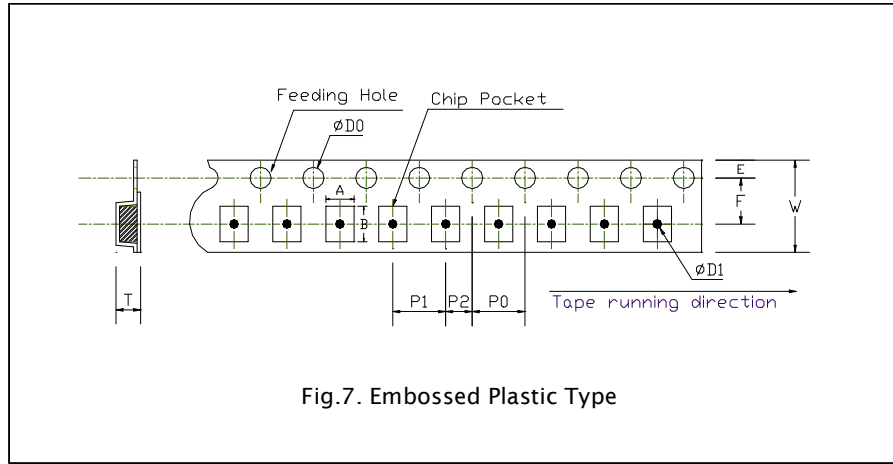
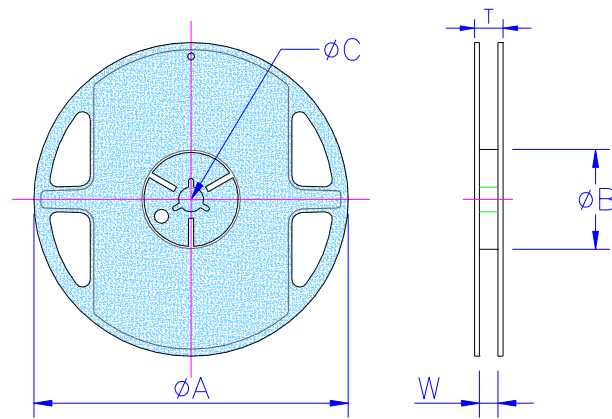


Fig.7. Embossed Plastic Type

Type	A	B	W	E	F	P0	P1	P2	$\phi D0$	$\phi D1$	T
CR-0A	2.8±0.2	5.5±0.2	12±0.3	1.75±0.1	5.5±0.05	4.0±0.1	4.0±0.1	2.0±0.05	1.5 <sup>+0.1/0</sup>	1.5 <sup>+0.25/0</sup>	Max. 1.2
CR-12	3.5±0.2	6.7±0.2	12±0.3	1.75±0.1	5.5±0.05	4.0±0.1	4.0±0.1	2.0±0.05	1.5 <sup>+0.1/0</sup>	1.5 <sup>+0.25/0</sup>	Max. 1.2

Unit: mm

**Reel Specification**



Unit: mm

Style	Packing	Tape width	Reel Diameter	$\phi A$	$\phi B$	$\phi C$	W	T
CR-01 CR-02 CR-03 CR-05 CR-06 CR-10	Paper	8mm	7 inch	178.5±1.5	60 <sup>+1/0</sup>	13.0±0.2	9.0±0.5	12.5±0.5
			10 inch	254±1	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
			13 inch	330±1	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
CR-0A CR-12	Embossed	12mm	7 inch	178.5±1.5	60 <sup>+1/0</sup>	13.0±0.5	13.0±0.5	15.5±0.5
			10 inch	250±1	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5

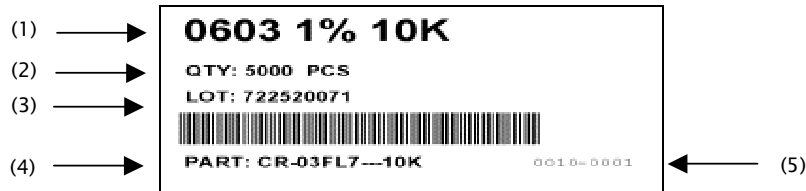




**Label**

The label put on each reel denoted with each products types, tolerance, resistance value, Q'ty, each Lot tracing no and barcode etc.

**Example**



- (1) Type / Tolerance / Resistance value
- (2) Reel packing quantity
- (3) Lot Number
- (4) Part Number
- (5) Labeling control sequence

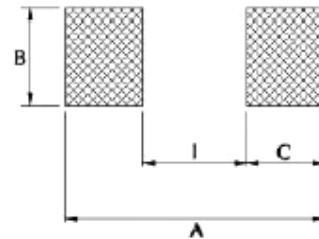
**10. Storage Condition**

- (1) Suggest temperature : 5~40°C
- (2) Suggest humidity : 40% ~80% R.H.

**11. Solder Pad Design**

**Reflow Soldering**

Type	A	B	C	I
CR-01	0.80	0.30	0.25	0.30
CR-02	1.40	0.60	0.45	0.50
CR-03	2.10	0.90	0.60	0.90
CR-05	2.60	1.30	0.70	1.20
CR-06	3.80	1.60	0.90	2.00
CR-10	3.80	2.80	0.90	2.00
CR-0A	5.60	2.80	0.90	3.80
CR-12	7.00	3.50	1.60	3.80



**Wave Soldering**

Type	A	B	C	I
CR-03	2.70	0.80	0.90	0.90
CR-05	3.40	1.30	1.05	1.30
CR-06	4.80	1.70	1.25	2.30
CR-10	4.80	2.50	1.25	2.30
CR-0A	6.30	2.50	1.40	3.50
CR-12	8.50	3.20	2.00	4.50



## 12. Revising History

Revision	Date	Change Notification	Description
Rev.1	2005/2/23	N/A	New issue
Rev.2	2005/8/8	N/A	Revise soldering condition and reel drawing
Rev.3	2005/9/21	N/A	Revise power rating and voltage
Rev.4	2006/4/6	N/A	Revise CR-02 temperature and add storage condition of chip resistor
Rev.5	2006/7/17	N/A	Revise CR-01 resistance range
Rev.6	2007/4/26	N/A	Revise TCR of 0402, soldering temp. and test method & 11.Solder Pad Design
Rev.7	2008/2/20	N/A	Revise Test and Requirements-Leaching
Rev.8	2008/7/3	N/A	Revise CR-01 Dimensions & Working Voltage; Revise Taping Reel; add Embossed 10" taping reel & Packing Methods
Rev.9	2008/8/1	N/A	Revise Features & Applications; Cancel Bulk Cassette; Revise Reel Specification