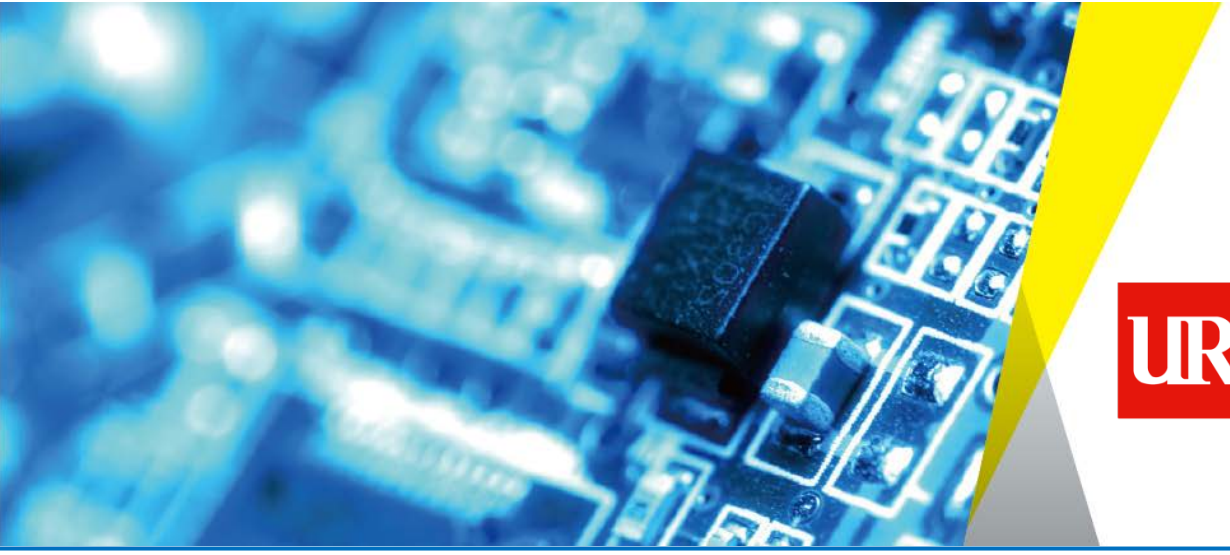

DATA SHEET

Product Name	**Non-magnetic Thick Film Chip Resistors**
Part Name	**NM Series**
File No.	**SMD-SP-012**

Uniroyal Electronics Global Co., Ltd.

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Manufacture Plant	Uniroyal Electronics Industry Co., Ltd.
	Aeon Technology Corporation
	Royal Electronic Factory (Thailand) Co., Ltd.
	Royal Technology (Thailand) Co., Ltd.

1. Scope

1.1 This datasheet is the characteristics of Non-magnetic Thick Film Chip Resistors manufactured by UNI-ROYAL.
1.2 Non-magnetic
1.3Suitable for reflow & wave soldering
1.4Application Mobile phone， PDA,Setbox， Meter

2. Part No. System

Part No. includes 14 codes shown as below:
2.1 1st~4th codes: Part name. E.g.: NM02,NM03,NM05,NM06,NM12
2.2 5th~6th codes: Power rating.

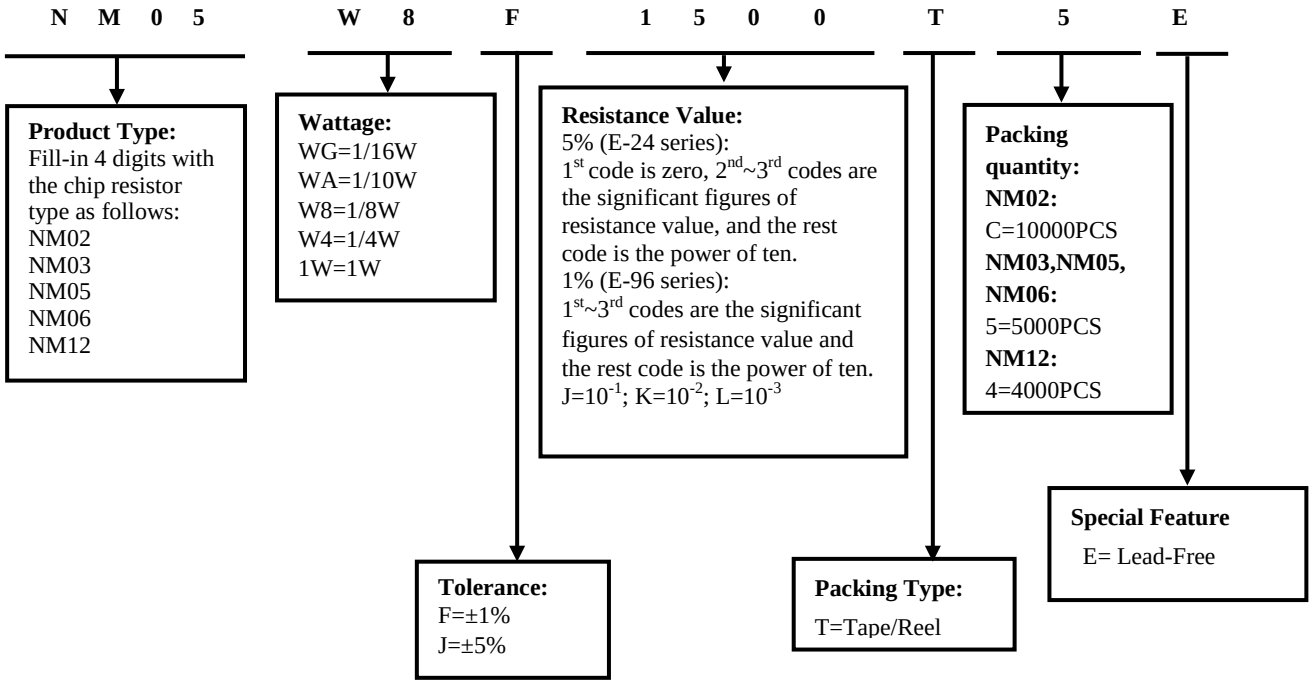
E.g.: W=Normal Size "1~G" = "1~16"

Wattage	1/4	1/8	1/10	1/16	1
Normal Size	W4	W8	WA	WG	1W

If power rating is equal or lower than 1 watt, 5th code would be "W" and 6th code would be a number or letter.
E.g.: WA=1/10W W4=1/4W
2.3 7th code: Tolerance. E.g.: D=±0.5% F=±1% G=±2% J=±5% K= ±10%
2.4 8th~11th codes: Resistance Value.
2.4.1 If value belongs to standard value of E-24 series, the 8th code is zero, 9th~10th codes are the significant figures of resistance value, and the 11th code is the power of ten.
2.4.2 If value belongs to standard value of E-96 series, the 8th~10th codes are the significant figures of resistance value, and the 11th code is the power of ten.
2.4.311th codes listed as following:
0=10^0 1=10^1 2=10^2 3=10^3 4=10^4 5=10^5 6=10^6 J=10^{-1} K=10^{-2} L=10^{-3} M=10^{-4}
2.5 12th~14th codes.
2.5.1 12th code: Packaging Type. E.g.: C=Bulk T=Tape/Reel
2.5.2 13th code: Standard Packing Quantity.
4=4,000pcs 5=5,000pcs C=10,000pcs D=20,000pcs E=15,000pcs
Chip Product: BD=B/B-20000pcs TC=T/R-10000pcs
2.5.3 14th code: Special features.
E = Environmental Protection, Lead Free, or Standard type.

3. Ordering Procedure

(Example: NM05 1/8W ±5% 10KΩ T/R-5000)



4. Marking

4.1 ±5% tolerance products (E-24 series):

3 codes.

1st~2nd codes are the significant figures of resistance value, and the rest code is the power of ten.

333 → 33KΩ

4.2 ±1% tolerance products (E-96 series):

4 codes.

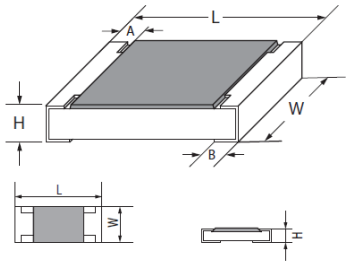
1st~3rd codes are the significant figures of resistance value, and the rest code is the power of ten.

Letter "R" in mark means decimal point.

2701 → 2.7KΩ

5. Dimension

Type	Dimension(mm)				
	L	W	H	A	B
NM02(0402)	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
NM03(0603)	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
NM05(0805)	2.00±0.15	1.25+0.15/-0.10	0.55±0.10	0.40±0.20	0.40±0.20
NM06(1206)	3.10±0.15	1.55+0.15/-0.10	0.55±0.10	0.45±0.20	0.45±0.20
NM12(2512)	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20



6. Resistance Range

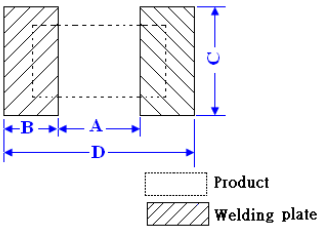
Type	Power Rating	Resistance Range	
		1.0%	5.0%
NM02	1/16W	1Ω-10MΩ	1Ω-10MΩ
NM03	1/10W	1Ω-10MΩ	1Ω-10MΩ
NM05	1/8W	1Ω-10MΩ	1Ω-10MΩ
NM06	1/4W	1Ω-10MΩ	1Ω-10MΩ
NM12	1W	1Ω-10MΩ	1Ω-10MΩ

7. Ratings

Type	Max. Working Voltage	Max. Overload Voltage	Dielectric withstanding Voltage	Resistance Value of Jumper	Rated Current of Jumper	Max. Overload Current of Jumper	Operating Temperature
NM02	50V	100V	100V	<50mΩ	1A	2A	-55℃~155℃
NM03	75V	150V	300V	<50mΩ	1A	2A	-55℃~155℃
NM05	150V	300V	500V	<50mΩ	2A	5A	-55℃~155℃
NM06	200V	400V	500V	<50mΩ	2A	10A	-55℃~155℃
NM12	200V	500V	500V	<50mΩ	2A	10A	-55℃~155℃

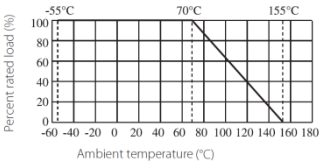
8. Recommend the size of welding plate

Type	Dimension(mm)			
	A	B	C	D
NM02	0.50±0.05	0.45±0.05	0.5±0.05	1.4±0.05
NM03	0.8±0.05	0.65±0.05	0.8±0.05	2.1±0.05
NM05	1.0±0.1	1.0±0.1	1.3±0.1	3.0±0.1
NM06	2.0±0.1	1.1±0.1	1.6±0.1	4.2±0.1
NM12	4.9±0.1	1.6±0.1	3.3±0.1	8.1±0.1



9. Derating Curve

Power rating will change based on continuous load at ambient temperature from -55 to 155℃.
It is constant between -55 to 70℃, and derate to zero when temperature rise from 70 to 155℃.

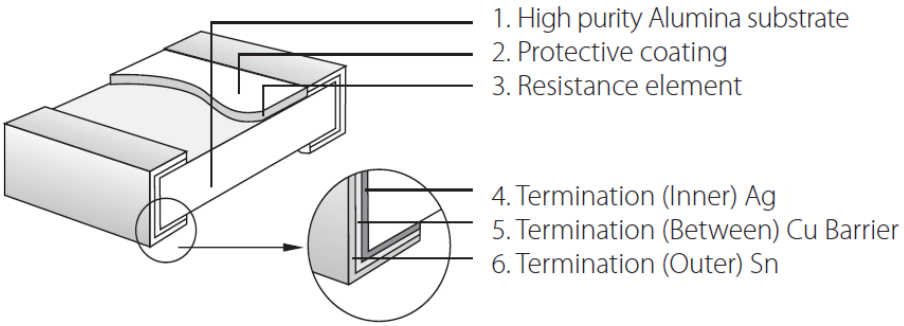


Voltage rating:
Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating, as determined from the following formula:

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

Remark: RCWV: Rating Continuous Working Voltage (Volt.) P: power rating (Watt) R: nominal resistance (Ω)
In no case shall the rated DC or RMS AC continuous working voltage be greater than the applicable maximum value.
The overload voltage is 2.5 times RCWV or Max. Overload voltage whichever is lower.

10. Structure



11. Performance Specification

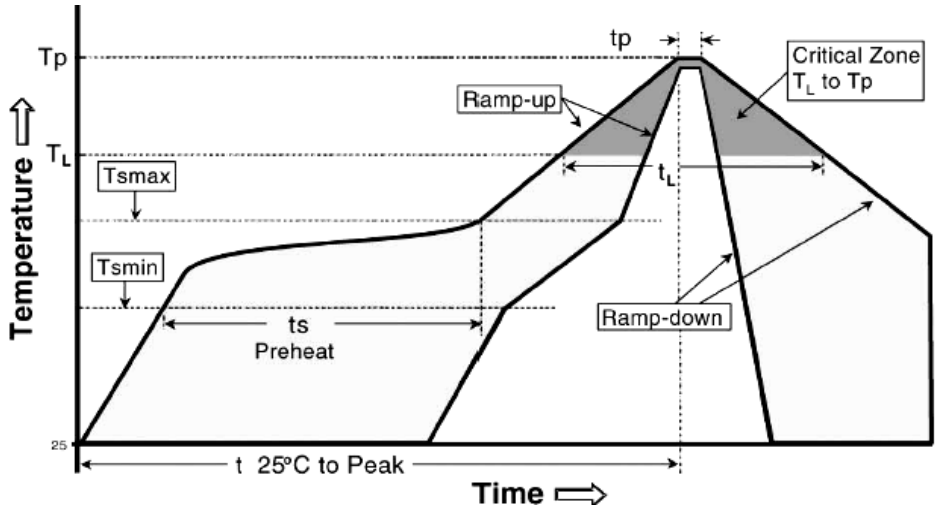
Characteristic	Limits		Test Methods (GB/T5729&JIS-C-5201&IEC60115-1)
Temperature Coefficient	1Ω≤R≤10Ω : ≤ ±400PPM/°C 10Ω＜R≤100Ω : ≤ ±200PPM/°C R＞100Ω: ≤ ±100PPM/°C		4.8 Natural resistance changes per temp. Degree centigrade $\frac{R_2-R_1}{R_1(t_2-t_1)} \times 10^6$ (PPM/℃) R_1: Resistance Value at room temperature （t_1）; R_2: Resistance at test temperature （t_2） t_1: +25°C or specified room temperature t_2: Test temperature（-55℃or 125℃）
Short-time overload	±1%	±(1.0%+0.1Ω)	4.13 Permanent resistance change after the application of 2.5 times RCWV for 5 seconds.
	±5%	±(2.0%+0.1Ω)	
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation breaks down.		4.7 Resistors shall be clamped in the trough of a 90℃metallic v-block and shall be tested at ac potential respectively specified in the given list of each product type for 60-70 seconds.
Solderability	95% coverage Min.		4.17 The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes. Temperature of solder:245±3℃; Dwell time in solder: 2~3 seconds.
Terminal bending	±(1.0%+0.05Ω)		4.33 Twist of test board: Y/X = 3/90 mm for 60Seconds
Rapid change of temperature	±1%	±(0.5%+0.05Ω)	4.19 30 min at lower limit temperature and 30 min at upper limit temperature，100 cycles.
	±5%	±(1.0%+0.05Ω)	
Insulation resistance	≥1,000 MΩ		4.6 The measuring voltage shall be ,measured with a direct voltage of (100±15)V or a voltage equal to the dielectric withstanding voltage., and apply for 1min.

Humidity (steady state)	±1%	±(0.5%+0.1Ω)	4.24Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at 40±2℃ and 90-95% relative humidity,
	±5%	±(3.0%+0.1 Ω)	
Load life in humidity	±(1.0%+0.1Ω)		7.9 Resistance change after 1,000 hours (1.5 hours "ON",0.5 hour "OFF") at RCWV in a humidity chamber controlled at 40℃±2℃ and 90 to 95% relative humidity.
Load life	±1%	±(1.0%+0.1Ω)	4.25.1 Permanent resistance change after 1,000 hours operating at RCWV with duty cycle 1.5 hours "ON", 0.5 hour "OFF" at 70℃±2℃ ambient.
	±5%	±(3.0%+0.1 Ω)	
Low Temperature Storage	±1%	±(1.0%+0.1Ω)	IEC 60068-2-1 (Aa) Lower limit temperature，for 2H.
	±5%	±(3.0%+0.1 Ω)	
High Temperature Exposure	±1%	±(1.0%+0.1Ω)	MIL-STD-202 108A Upper limit temperature ，for 1000H.
	±5%	±(3.0%+0.1 Ω)	
Leaching	No visible damage		J-STD-002 Test D Samples completely immersed for 30 sec in solder bath at 260℃

12. Soldering Condition

(This is for recommendation, please customer perform adjustment according to actual application)

12.1 Recommend Reflow Soldering Profile：(solder : Sn96.5 / Ag3 / Cu0.5)

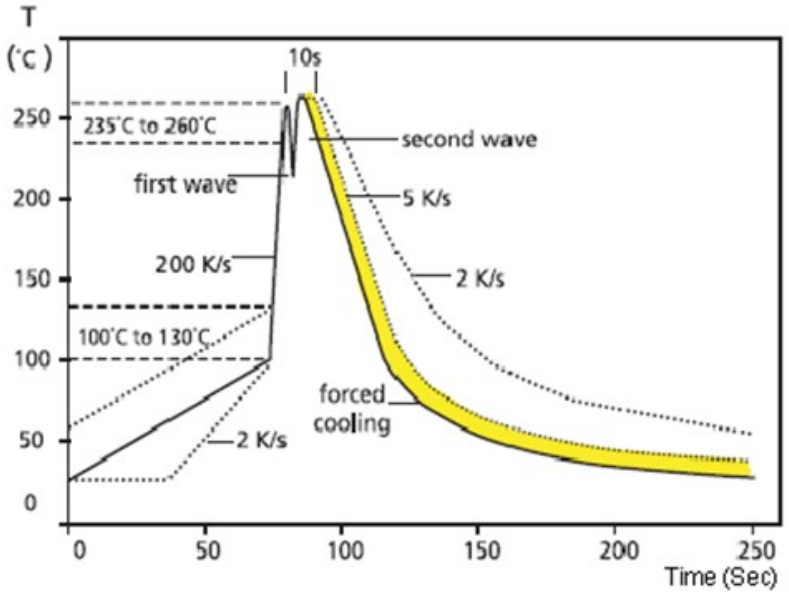


Profile Feature	Lead (Pb)-Free solder
Preheat: Temperature Min (Ts_{min}) Temperature Max (Ts_{max}) Time (Ts_{min} to Ts_{max}) (ts)	 150℃ 200℃ 60 -120seconds
Average ramp-up rate: (Ts max to Tp)	 3℃ / second max.
Time maintained above : Temperature (T_L) Time (t_L)	 217℃ 60-150 seconds
Peak Temperature (Tp)	260℃
Time within $^{+0}_{-5}$℃ of actual peak Temperature (tp)[2]	10 seconds
Ramp-down Rate	6℃/second max.
Time 25℃ to Peak Temperature	8minutes max.

Allowed Re-flow times : 2 times

Remark : To avoid discoloration phenomena of chip on terminal electrodes, please use N2 Re-flow furnace .

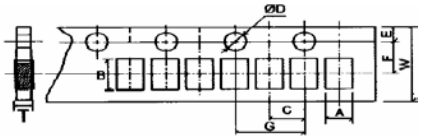
12.2 Recommend Wave Soldering Profile：(Apply to 0603 and above size)



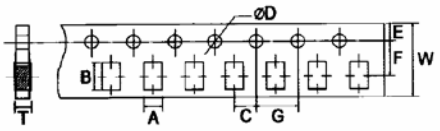
13. Packing of Surface Mount Resistors

13.1 Dimension of Paper Taping :(Unit: mm)

Type	A ±0.1	B ±0.1	C ±0.05	$\Phi D^{+0.1}_{-0}$	E ±0.1	F ±0.05	G ±0.1	W ±0.2	T ±0.05
NM02	0.65	1.2	2.0	1.5	1.75	3.5	4.0	8.0	0.42

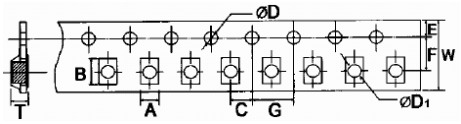


Type	A ±0.2	B ±0.2	C ±0.05	$\Phi D^{+0.1}_{-0}$	E ±0.1	F ±0.05	G ±0.1	W ±0.2	T ±0.1
NM03	1.10	1.90	2.0	1.5	1.75	3.5	4.0	8.0	0.67
NM05	1.65	2.40	2.0	1.5	1.75	3.5	4.0	8.0	0.81
NM06	2.00	3.60	2.0	1.5	1.75	3.5	4.0	8.0	0.81



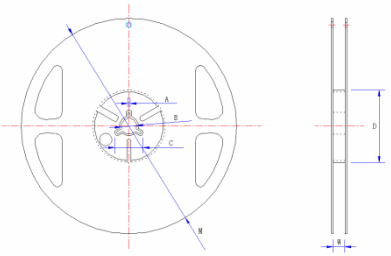
13.2 Dimension of plastic taping：(Unit: mm)

Type	A ±0.2	B ±0.2	C ±0.05	$\Phi D^{+0.}_{-0}$	$\Phi D1^{+0.25}_{-0}$	E ±0.1	F ±0.05	G ±0.1	W ±0.2	T ±0.1
NM12	3.50	6.70	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00



13.3 Dimension of Reel：(Unit: mm)

Type	Taping	Qty/Reel	A±0.5	B±0.5	C±0.5	D±1	M±2	W±1
NM02	Paper	10,000pcs	2.0	13.0	21.0	60.0	178.0	10
NM03	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10
NM05	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10
NM06	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10
NM12	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8



14. Note

14.1. UNI-ROYAL recommend products store in warehouse with temperature between 15 to 35℃ under humidity between 25 to 75%RH. Even under storage conditions recommended above, solder ability of products will be degraded stored over 1 year old.

14.2. Cartons must be placed in correct direction which indicated on carton, otherwise the reel or wire will be deformed.

14.3. Storage conditions as below are inappropriate:

a. Stored in high electrostatic environment

b. Stored in direct sunshine, rain, snow or condensation.

c. Exposed to sea wind or corrosive gases, such as Cl_2, H_2S, NH_3, SO_2, NO_2, Br etc.

15. Record

Version	Description	Page	Date	Amended by	Checked by
1	First version	1~7	Mar.20, 2018	Haiyan Chen	Nana Chen
2	Modify characteristic	5~6	Feb.14, 2019	Haiyan Chen	Yuhua Xu
3	Modify the High Temperature Exposure conditions	6	July.29, 2019	Haiyan Chen	Yuhua Xu
4	Modify the reflow curve and add the wave soldering curve	5~6	Apr.29, 2020	Haiyan Chen	Yuhua Xu
5	Modify the temperature coefficient test conditions	4	Oct.26, 2022	Haiyan Chen	Yuhua Xu