

THICK FILM AUTOMOTIVE CHIP RESISTORS

(RMF/RPF SERIES)

Automotive Grade

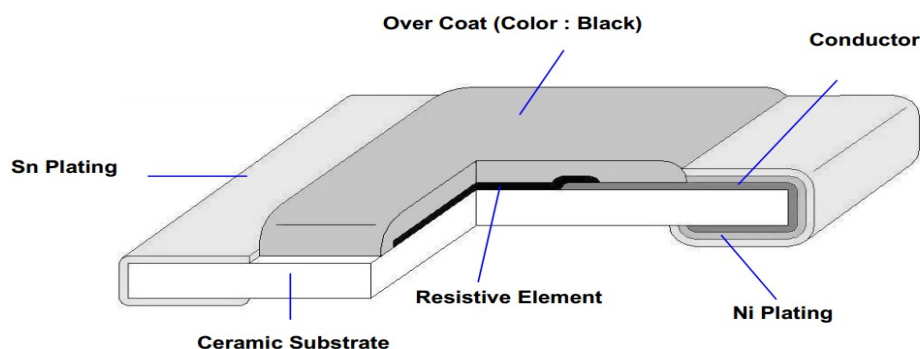
Features:

This specification applies for the RMF series of Automotive Grade thick film chip resistors, all Halogen-Free and AEC-Q200 Compliance

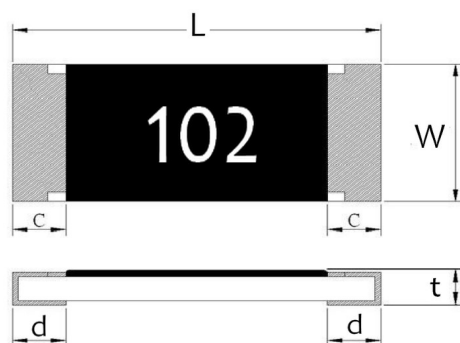
Applications:

- Automotive Industry
- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments

Construction:



Dimensional Specifications



Style		Dimensions : mm				
		L	W	c	d	t
RMF-04 0402	RPF-04 0402	1.00 ±0.05	0.50 ±0.05	0.15 ±0.10	0.20 ±0.10	0.30 ±0.05
RMF-06 0603	RPF-06 0603	1.60 ±0.10	0.80 ±0.10	0.30 ±0.20	0.30 ±0.10	0.40 ±0.10
RMF -10 0805	RPF-10 0805	2.00 ±0.10	1.25 ±0.10	0.30 ±0.15	0.40 ±0.15	0.50 ±0.15
RMF -18 1206	RPF-18 1206	3.05 ±0.10	1.60±0.10	0.40 ±0.25	0.50 ±0.20	0.55 ±0.15
RMF-20 1210	RPF-20 1210	3.05 ±0.10	2.50 ±0.15	0.50 ±0.20	0.50 ±0.20	0.55 ±0.15
RMF-26 1812	RPF-26 1812	4.50 ±0.10	3.10 ±0.15	0.55 ±0.20	0.70 ±0.20	0.55 ±0.05
RMF-22 2010	RPF-22 2010	5.00 ±0.20	2.50 ±0.15	0.60±0.20	0.60 ±0.20	0.55 ±0.10
RMF-24 2512	RPF-24 2512	6.30 ±0.20	3.20 ±0.15	0.60±0.20	0.60 ±0.20	0.60 ±0.20



General Specification

Standard Electrical Specification

Type	Power Rating at 70 °C	Max. Working Voltage	Max. Overload Voltage	T.C.R (PPM/°C)	Resistance Range(Ω)	
					F (±1%) E-96 & E-24	J (±5%) E-24
RMF-04 0402	1/16W	50V	100V	±400 ±100	1Ω - 10Ω 10Ω ~ 10MΩ	
RMF-06 0603	1/10W	75V	150V	±400 ±100	1Ω - 10Ω 10Ω ~ 10MΩ	
RMF-10 0805	1/8W	150V	300V	±400 ±100	1Ω - 10Ω 10Ω ~ 10MΩ	
RMF-18 1206	1/4W	200V	400V	±400 ±100	1Ω - 10Ω 10Ω ~ 10MΩ	
RMF-20 1210	1/2W			±400 ±100	1Ω - 10Ω 10Ω ~ 10MΩ	
RMF-22 2010	3/4W			±400 ±100	1Ω - 10Ω 10Ω ~ 10MΩ	
RMF-26 1812	3/4W			±400 ±100	1Ω - 10Ω 10Ω ~ 10MΩ	
RMF-24 2512	1W			±400 ±100	1Ω - 10Ω 10Ω ~ 10MΩ	

* Zero Ohm Jumper < 0.05Ω

* Operating Temperature Range: -55°C ~ +155°C

Type	0402	0603	0805	1206	1210	1812	2010	2512
Jumper Resistance Value	50mΩ Max							
Juice Rated Current	1A				2A			

High Power Rating Electrical Specification

Type	Power Rating at 70 °C	Max. Working Voltage	Max. Overload Voltage	T.C.R (PPM/°C)	Resistance Range(Ω)	
					F (±1%) E-96 & E-24	J (±5%) E-24
RPF-04 0402	1/8W	50V	100V	±100 ±200	10Ω ~ 10MΩ 1Ω - 10Ω	
RPF-06 0603	1/4W	75V	150V	±100 ±200	10Ω ~ 10MΩ 1Ω - 10Ω	
RPF-10 0805	1/3W	150V	300V	±100 ±200	10Ω ~ 10MΩ 1Ω - 10Ω	
RPF-18 1206	1/2W	200V	400V	±100 ±200	10Ω ~ 10MΩ 1Ω - 10Ω	
RPF-20 1210	2/3W			±100 ±400	10Ω ~ 10MΩ 1Ω - 10Ω	
RPF-22 2010	1W			±100 ±400	10Ω ~ 10MΩ 1Ω - 10Ω	
RPF-26 1812	1W			±100 ±400	10Ω ~ 10MΩ 1Ω - 10Ω	
RPF-24 2512	2W			±100 ±400	10Ω ~ 10MΩ 1Ω - 10Ω	

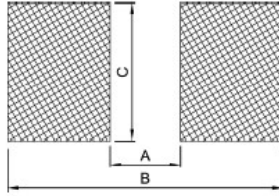
* Zero Ohm Jumper < 0.05Ω

* Operating Temperature Range: -55°C ~ +155°C



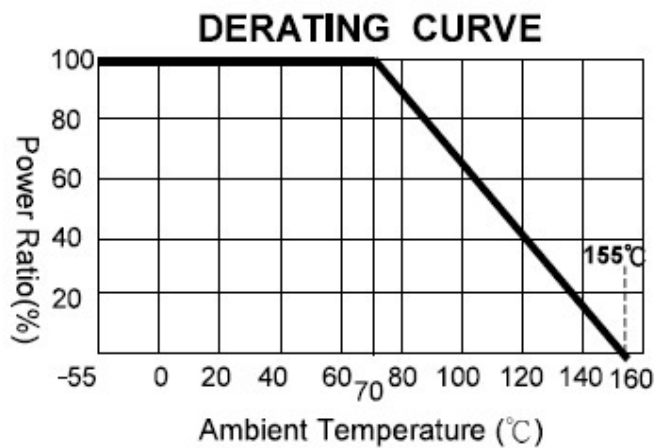
General information

* Recommend Land Pattern Design



Type	RMF/RPF-04 0402	RMFRPF-06 0603	RMF/RPF-10 0805	RMF/RPF-18 1206	RMF/RPF-20 1210	RMF/RPF-26 1812	RMF/RPF-22 2010	RMF/RPF-24 2512
A	0.50	0.95	1.20	2.00	2.00	3.11	3.80	4.90
B	1.40	2.10	2.60	3.80	4.40	5.91	6.68	8.10
C	0.60	0.90	1.30	1.60	2.70	3.00	2.70	3.40

Derating Curve



Powerr Rating or current rating is in the case based on continuous full-load at ambient temperature of 70°C. For operaton at ambient temperature in excess of 70°C, the load should be derated in accordance with figure of derating curve.

* Rate voltage

Resistance range: $\geq 1\Omega$

Rated voltaget: The resistor shall have a DC continuous working voltaget of a AC(ms) continuous working voltage at commercial - line frequency and wave form corresponding to the power rating, as determined formula as following:

$$E(RCWV) = \sqrt{P \times R}$$

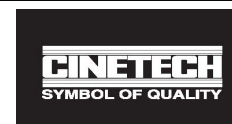
E=Rated voltage(V)

P=Power rating(W)

R=Nominal resistance(Ω)

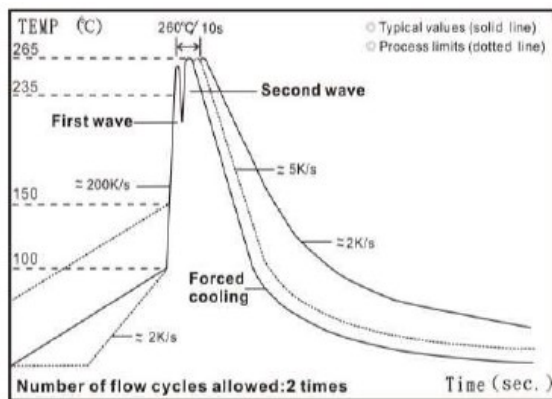
Reliability tests

test Items	Reference standard	Condition of Test	Test Limits ΔR
Temperature Coefficient of Resistance	IEC 60115-1 4.8	-AT +25/-55°C and +25/+125°C	Refer to chart
Short Time Overload	IEC 60115-1 4.13	2.5 X rated voltage for 5 sec	$\pm(1\% + 0.05\Omega)$ Remarks : 0402 : $\pm(2\% + 0.1\Omega)$ 0Ω : 50mΩ or less
High Temperature Exposure(Storage)	AEC-Q200-REV C-Test 3 MIL-STD-202 Method 108	1000hrs. @ T=125°C Unpowered. Measurement at 24± 2 hours after test conclusion.	0.5%, 1%: $\pm(1.0\% + 0.05\Omega)$ 5%: $\pm(2.0\% + 0.1\Omega)$ 0Ω : 50mΩ or less
Moisture Resistance	AEC-Q200-REV C-Test 6 MIL-STD-202 Method 106	T=24 hours / Cycle ,10Cycle . Notes: Steps 7a& 7b not required. Unpowered.	0.5%, 1%: $\pm(1.0\% + 0.05\Omega)$ 5%: $\pm(2.0\% + 0.1\Omega)$ 0Ω : 50mΩ or less
Biased Humidity	AEC-Q200-REV C-Test 7 MIL-STD-202 Method 103	1000 hours 85°C/85%RH. Note: Specified conditions: 10% of operating power (not exceeding max working voltage). Measurement at 24±2 hours after test conclusion.	$\pm(3\% + 0.1\Omega)$ 0Ω : 100mΩ or less
Operational Life	AEC-Q200-REV C-Test 8 MIL-STD-202 Method 108	1000 hours TA=70°C at rated power. Measurement at 24±2 hours after test conclusion.	0.5%, 1%: $\pm(1\% + 0.1\Omega)$ 5%: $\pm(2.0\% + 0.1\Omega)$ 0Ω : 100mΩ or less
External Visual	AEC-Q200-REV C-Test 9 MIL-STD-883 Method 2009	Electrical test not required. Inspect device construction. Marking and workmanship.	
Physical Dimension	AEC-Q200-REV C-Test 10 MIL-STD-202 Method JB-10	Verify physical dimensions to the applicable device detail specification. Note: User(S) and Suppliers spec. Electrical test not required.	
Resistance to Solvents	AEC-Q200-REV C-Test 12 MIL-STD-202 Method 215	a: Isopropyl Alcohol : Mineral Spirits= 1 : 3 b: Terpene Defluxer (Bioact EC-7R) c: Deionized water : Propylene Glycol Monomethyl Ether : monoethanolamine = 42 : 1 : 1	Marking and protective layer can not be detached
Mechanical Shock	AEC-Q200-REV C-Test 13 MIL-STD-202 Method 213	Wave Form: Tolerance for half sine shock Pluse. Peak value is 100g's. Normal duration(D) is 6(ms)	$\pm(1\% + 0.1\Omega)$ 0Ω : 50mΩ or less
Vibration	AEC-Q200-REV C-Test 14 MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations. Note: Test from 10-2000Hz.	$\pm(1\% + 0.1\Omega)$ 0Ω : 50mΩ or less
Resistance to Soldering Heat	AEC-Q200-REV C-Test 15 MIL-STD-202 Method 210	Condition B : Immerse the specimens in and eutectic solder at 260±5°C for 10±1S .	0.5%, 1% : $\pm(0.5\% + 0.05\Omega)$ 5% : $\pm(1\% + 0.1\Omega)$ 0Ω : 50mΩ or less
Thermal Shock	AEC-Q200-REV C-Test 16 MIL-STD-202 Method 107	-55°C/+155°C. Note: Number of cycles required-300, Maximum transfer time-20 seconds, Dwell time -15 minutes. Air-Air.	$\pm(1\% + 0.1\Omega)$ 0Ω : 50mΩ or less
ESD	AEC-Q200-REV C-Test 17	verify the voltage setting at 500V	$\pm(1\% + 0.1\Omega)$
Solderability	AEC-Q200-REV C-Test 18 J-STD-002	Method B, aging 4 hours at 155°C dry heat Lead-free solder bath at 245±3°C Dipping time: 3±0.5 seconds	> 95% area covered with tin
Flammability	AEC-Q200-REV C-Test 17 UL-94	V- 0 or V-1 are acceptable. Electrical test not required.	V-0 or 0-1
Board Flex (Bending)	AEC-Q200-REV C-Test 21	3mm deflection(RMF04~RMF20) 2mm deflection(RMF22~RMF24)	0.5%,1% : $\pm(0.5\% + 0.05\Omega)$ 5% : $\pm(1\% + 0.1\Omega)$ 0Ω : 50mΩ or less
Terminal Strength (SMD)	IEC 60115-1 4.32	Force of 1.02kg for 10±1 seconds. Remarks : RMF-04: 0.51kgs Sulfur(saturated vapor)	$\pm(0.5\% + 0.05\Omega)$ 0Ω : 50mΩ or less
Sulfuration Test	ASTM-B-809-95	360 hours, 105±2°C unpowered	0.5%,1% : $\pm(1\% + 0.05\Omega)$ 5% : $\pm(2\% + 0.05\Omega)$ 0Ω : 100mΩ or less

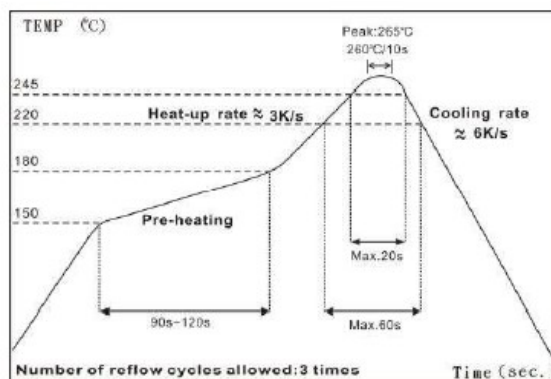


Recommended Customer Soldering Parameters

* Wave solder Temperature condition



* Solder reflow Temperature condition



* Rework temperature (hot air equipment): 350°C, 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.

Parts Number System

RMF -

Type

RMF / RPF
Series
Thick Film
Automotive
Chip Resistor

18 -

Size

04=0402
06=0603
10=0805
18=1206
20=1210
22=2010
24=2512
26=1812

1004

Resistance

0R = 0000
1R = 1R00
9R7 = 9R70
10R = 10R0
100R = 1000
1KR = 1001
1MR = 1004

F

Tolerance

J = ±5%
F = ±1%

R

Standard Packing

R=Paper tape reel
10Kpcs/Reel
size: 0402
5Kpcs/Reel
size: 0603~1210
K=Embossed
plastic tape reel
4Kpcs/Reel
size: 2010~2512



Marking

* 5%: marking code: 3 digits, please refer to E24 data form as below:

- First two digits are significant figure,
- Third digit is number of zeros.
- Letter R is decimal point.

EX: 120K, the marking code is 124 in E24



Value=10KΩ

RMF/RPF-06(0603)
RMF/RPF-10(0805)
RMF/RPF-18(1206)
RMF/RPF-20(1210)

RMF/RPF-26(1812)
RMF/RPF-22(2010)
RMF/RPF-24(2512)

* 1%: Marking code: 4 digits, Please refer to E96 and E24 data form as below:

- First three digits are significant figure,
- Forth digit is number of zeros.
- Letter R is decimal point.

EX: 120K, the marking code is 1203 in E24

121K, The marking code is 1213 in E96



Value=10KΩ

RMF/RPF-10(0805)
RMF/RPF-18(1206)
RMF/RPF-20(1210)

RMF/RPF-26(1812)
RMF/RPF-22(2010)
RMF/RPF-24(2512)

* 0402 no marking



RMF/RPF-04(0402)

* 0603 1%: EIA-96 Marking. Please refer to data form as below:



RMF/RPF-06(0603)

1%marking --> Value=12.4KΩ

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-digit EIA-96 part marking scheme. The third character is a letter multiplier:

⁻² Y=10 ⁻¹ X=10 ⁰ A=10 ¹ B=10 ² C=10 ³ D=10 ⁴ E=10 ⁵ F=10

* E24 & E96 data form

E24		E96							
10	33	100	178	316	562	133	237	422	750
11	36	102	182	324	576	137	243	432	768
12	39	105	187	332	590	140	249	442	787
13	43	107	191	340	604	143	255	453	806
15	47	110	196	348	619	147	261	464	825
16	51	113	200	357	634	150	267	475	845
18	56	115	205	365	649	154	274	487	866
20	62	118	210	374	665	158	280	499	887
22	68	121	215	383	681	162	287	511	909
24	75	124	221	392	698	165	294	523	931
27	82	127	226	402	715	169	301	536	953
30	91	130	232	412	732	174	309	549	976

