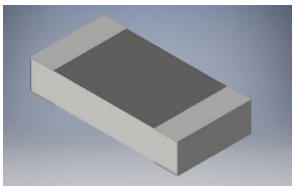
RMEF Series

General Purpose Thick Film Chip Resistor
100% RoHS Compliant Without Exemption

Stackpole Electronics, Inc.
Resistive Product Solutions

Features:

- Nickel barrier terminations standard
- Power derating from 100% at 70ºC to zero at +155ºC
- AEC-Q200 compliant
- 100% RoHS compliant and lead free without exemption
- Halogen free
- REACH compliant



Electrical Specifications

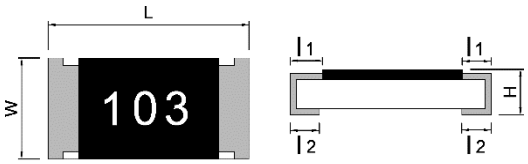
Type/Code	Power Rating (W) @ 70ºC	Max. Working Voltage (V)	Max. Overload Voltage (V)	Max. Jumper Current (A)	TCR (ppm/ºC)	Ohmic Range (Ω) and Tolerance (1)	
						1%	5%
RMEF0402	0.063	50	100	1	± 400	1 - 9.76	
					± 100	10 - 10M	
RMEF0603	0.1	75	150	1	± 100	1 - 10M	
RMEF0805	0.125	150	300	2	± 100	1 - 10M	
RMEF1206	0.25	200	400	2	± 100	1 - 10M	
RMEF1210	0.5			3	± 100	1 - 10M	
RMEF1812	0.75			3	± 100	1 - 10M	
RMEF2010	0.75			3	± 100	1 - 10M	
RMEF2512	1			3	± 100	1 - 10M	

(1) Tighter tolerances available. Contact Stackpole Electronics.
Operating temperature range is -55ºC to +155ºC

Electrical Specifications - Jumper

Type/Code	Max Overload Current (A) <1 second and 1 time	Jumper Resistance Value (Ω)
RMEF0402	3	0.05 Max.
RMEF0603		
RMEF0805		
RMEF1206	10	
RMEF1210		
RMEF2010		
RMEF2512		

Mechanical Specifications

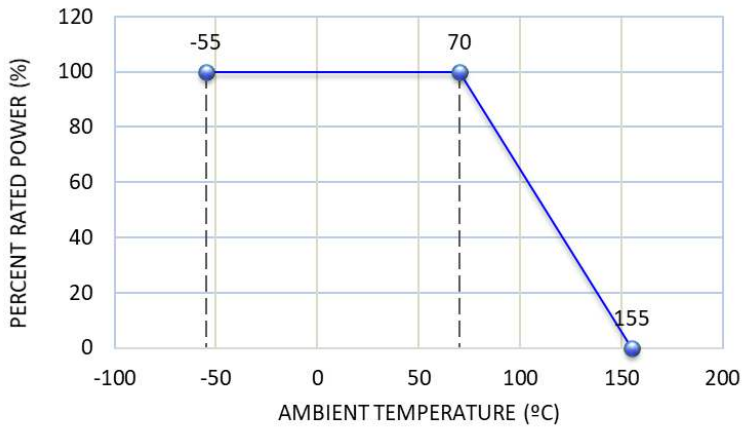


Type/Code	L	W	H	I_1	I_2	Unit
RMEF0402	0.039 ± 0.0039 1.00 ± 0.10	0.020 ± 0.0020 0.50 ± 0.05	0.012 ± 0.0020 0.30 ± 0.05	0.006 ± 0.004 0.15 ± 0.10	0.008 ± 0.004 0.20 ± 0.10	inches mm
RMEF0603	0.063 ± 0.008 1.60 ± 0.20	0.031 ± 0.006 0.80 ± 0.15	0.016 ± 0.004 0.40 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.012 ± 0.004 0.30 ± 0.10	inches mm
RMEF0805	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.006 1.25 ± 0.15	0.020 ± 0.006 0.50 ± 0.15	0.012 ± 0.006 0.30 ± 0.15	0.016 ± 0.006 0.40 ± 0.15	inches mm

Mechanical Specifications (cont.)						
Type/Code	L	W	H	I_1	I_2	Unit
RMEF1206	0.120 ± 0.004 3.05 ± 0.10	0.063 ± 0.008 1.60 ± 0.20	0.022 ± 0.006 0.55 ± 0.15	0.016 ± 0.008 0.40 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm
RMEF1210	0.120 ± 0.004 3.05 ± 0.10	0.098 ± 0.008 2.50 ± 0.20	0.022 ± 0.006 0.55 ± 0.15	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm
RMEF1812	0.177 ± 0.004 4.50 ± 0.10	0.122 ± 0.008 3.10 ± 0.20	0.022 ± 0.002 0.55 ± 0.05	0.022 ± 0.008 0.55 ± 0.20	0.028 ± 0.008 0.70 ± 0.20	inches mm
RMEF2010	0.197 ± 0.008 5.00 ± 0.20	0.098 ± 0.008 2.50 ± 0.20	0.022 ± 0.004 0.55 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm
RMEF2512	0.248 ± 0.008 6.30 ± 0.20	0.126 ± 0.008 3.20 ± 0.20	0.022 ± 0.004 0.55 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm

Performance Characteristics			
Test	Test Method	Procedure	Requirements
Temperature Coefficient of Resistance (TCR)	JIS-C-5201-1 4.8 IEC-60115-1 4.8	At 25/-55ºC and 25ºC/+155ºC, 25ºC is the reference temperature	As per specification
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. Jumper: Overload current for 5 seconds 0402/0603/0805 = 2.5A 1206/1210/1812/2010/2512 = 5A	1%: ± (1 + 0.05 Ω) 5%: ± (2% + 0.1 Ω) Jumper: Max 0.05 Ω after test
Leaching	JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1	260 ± 5ºC for 30 seconds	Individual leaching area ≤ 5% Total leaching area ≤ 10%
Resistance to Soldering Heat	JIS-C-5201-1 4.18 IEC-60115-1 4.18	260 ± 5ºC for seconds	1%: ± (0.5% + 0.05 Ω) 5%: ± (1% + 0.05 Ω)
Rapid Change of Temperature	JIS-C-5201-1 4.19 IEC-60115-1 4.19	-55ºC to +155ºC, 5 cycles	1%: ± (0.5% + 0.05 Ω) 5%: ± (1% + 0.05 Ω)
Resistance to Solvent	JIS-C-5201-1 4.29	The tested resistor is immersed into isopropyl alcohol of 20~25ºC for 60 seconds. Then the resistor is left in the room for 48 hours.	1%: ± (0.5% + 0.05 Ω) 5%: ± (0.5% + 0.05 Ω) Jumper: Max. 0.05 Ω after test
Damp Heat with Load	JIS-C-5201-1 4.24 IEC-60115-1 4.24	40 ± 2ºC, 90~95% R.H. RCWV or Max working voltage whichever is less for 1000 hours with 1.5 hours "ON" and 0.5 hour "OFF".	1%: ± (1% + 0.05 Ω) 5%: ± (2% + 0.05 Ω) Jumper: Max. 0.1 Ω after test
Load Life (Endurance)	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1	70 ± 2ºC, RCWV or Max working voltage whichever is less for 1000 hours with 1.5 hours "ON" and 0.5 hour "OFF"	1%: ± (1% + 0.05 Ω) 5%: ± (3% + 0.1 Ω) Jumper: Max. 0.1 Ω after test
Insulation Resistance	JIS-C-5201-1 4.6 IEC-60115-1 4.6	Apply 100VDC for 1 minute.	≥ 10G Ω
Bending Strength	JIS-C-5201-1 4.33 IEC-60115-1 4.33	Bending once for 5 seconds D: 0402, 0603, 0805 = 5 mm 1206, 1210, 1812 = 3 mm 2010, 2512 = 2 mm	1%: ± (1% + 0.05 Ω) 5%: ± (1% + 0.05 Ω)

Power Derating Curve:

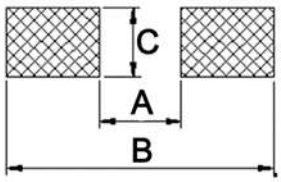


Power rating or current rating is in the case based on continuous full-load at ambient temperature of 70ºC. For operation at ambient temperature in excess of 70ºC, the load should be derated in accordance with figure of derating curve.

Voltage Rating or Current Rating
Resistance range ≥ 1 Ω
Rated Voltage: The resistor shall have a DC continuous working voltage of a RMS AC continuous working voltage at commercial line frequency and have form corresponding to the power rating, as determined formula as following:

$E(RCWV) = \sqrt{PxR}$ E=Rated voltage (V)
P=Power rating (W)
R=Nominal resistance (Ω)

Recommended Pad Layout



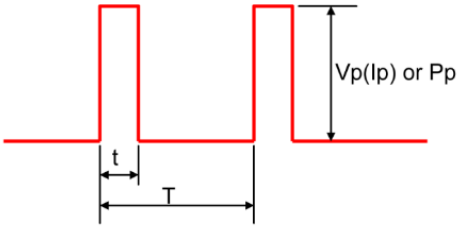
Size	A	B	C	Unit
RMEF0402	0.024 0.60	0.063 1.60	0.028 0.70	inches mm
RMEF0603	0.031 0.80	0.094 2.40	0.039 1.00	inches mm
RMEF0805	0.051 1.30	0.114 2.90	0.055 1.40	inches mm
RMEF1206	0.087 2.20	0.165 4.20	0.067 1.70	inches mm
RMEF1210	0.079 2.00	0.173 4.40	0.106 2.70	inches mm
RMEF1812	0.122 3.11	0.233 5.91	0.118 3.00	inches mm
RMEF2010	0.150 3.80	0.260 6.60	0.106 2.70	inches mm
RMEF2512	0.193 4.90	0.319 8.10	0.134 3.40	inches mm

Repetitive Pulse Information

(This information is for reference only and is not guaranteed performance.)

If repetitive pulses are applied to resistors, pulse wave form must be less than “Pulse limiting voltage”, “Pulse limiting current” or “Pulse limiting wattage” calculated by the formula below.

$$Vp = K\sqrt{P \times R \times T/t}$$
$$Ip = K\sqrt{P/R \times T/t}$$
$$Pp = K^2 \times P \times T/t$$



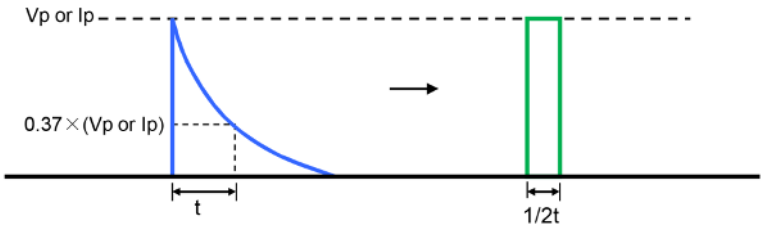
Where: Vp: Pulse limiting voltage (V)
Ip: Pulse limiting current (A)
Pp: Pulse limiting wattage (W)
P: Power rating (W)
R: Nominal resistance (ohm)
T: Repetitive period (sec)
t: Pulse duration (sec)
K: Coefficient by resistors type (refer to below matrix)
[Vr: Rated Voltage (V), Ir: Rated Current (A)]

Note 1: If T > 10 → T = 10 (sec), T / t > 1000 → T / t = 1000
Note 2: If T > 10 and T / t > 1000, “Pulse Limiting power (Single pulse) is applied
Note 3: If Vp < Vr (Ip < Ir or Pp < P), Vr (Ir, P) is Vp (Ip, Pp)
Note 4: Pulse limiting voltage (current, wattage) is applied at less than rated ambient temperature. If ambient temperature is more than the rated temperature (70°C), please decrease power rating according to “Power Derating Curve”
Note 5: Please assure sufficient margin for use period and conditions for “Pulse limiting voltage”
Note 6: If the pulse waveform is not square wave, please judge after transform the waveform into square wave according to the “Waveform Transformation to Square Wave”.

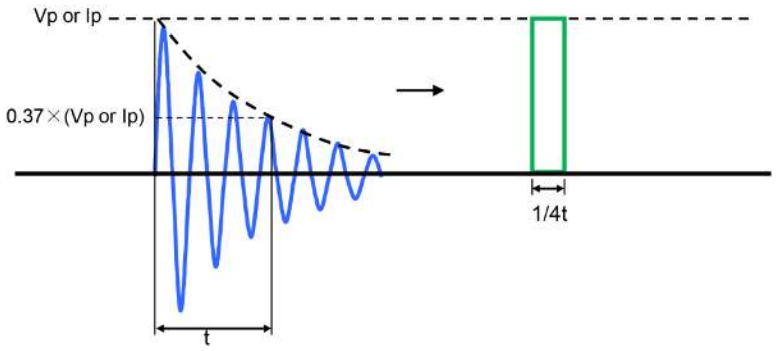
Coefficient (K) Matrix	
Resistor Type	K
R < 10 Ω	0.50
10 Ω ≤ R < 100 Ω	0.45
100 Ω ≤ R < 1K Ω	0.35
1K Ω ≤ R < 10K Ω	0.25
10K Ω ≤ R	0.20

Waveform Transformation to Square Wave

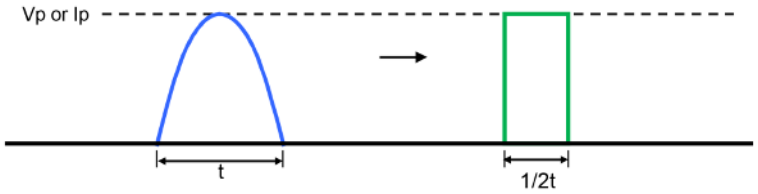
1. Discharge curve wave with time constant "t" → Square wave



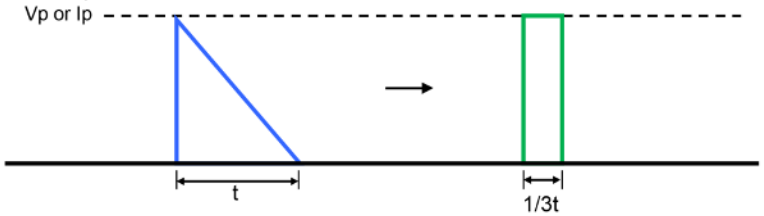
2. Damping oscillation wave with time constant of envelope "t" → Square wave



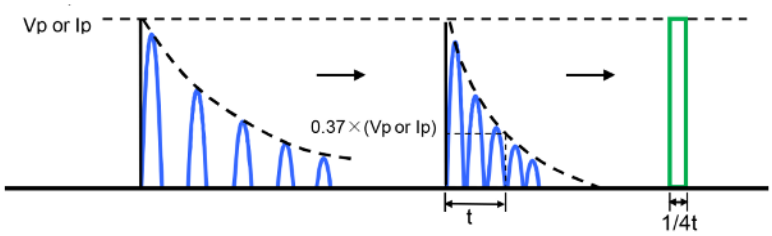
3. Half-wave rectification wave → Square wave



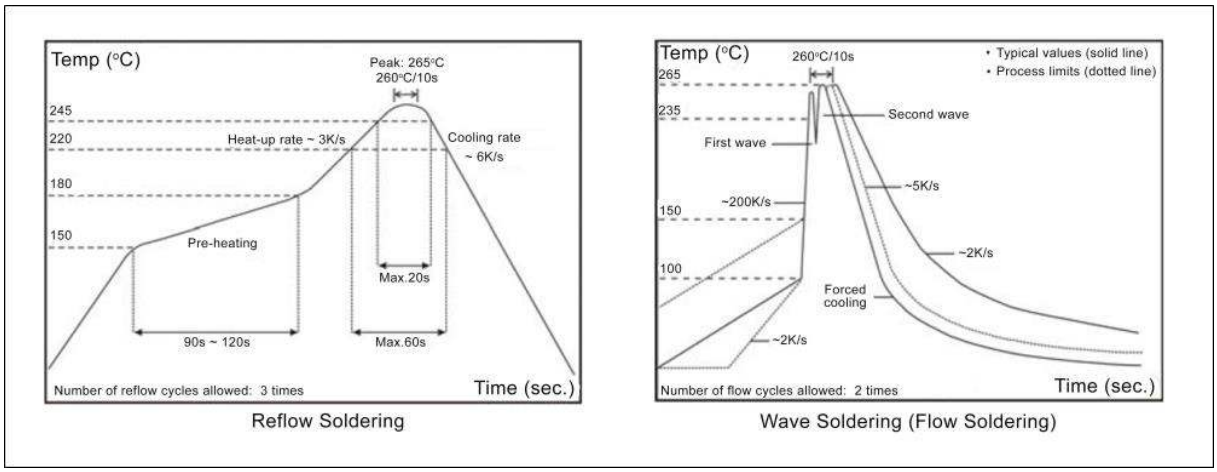
4. Triangular wave → Square wave



5. Special wave → Square wave

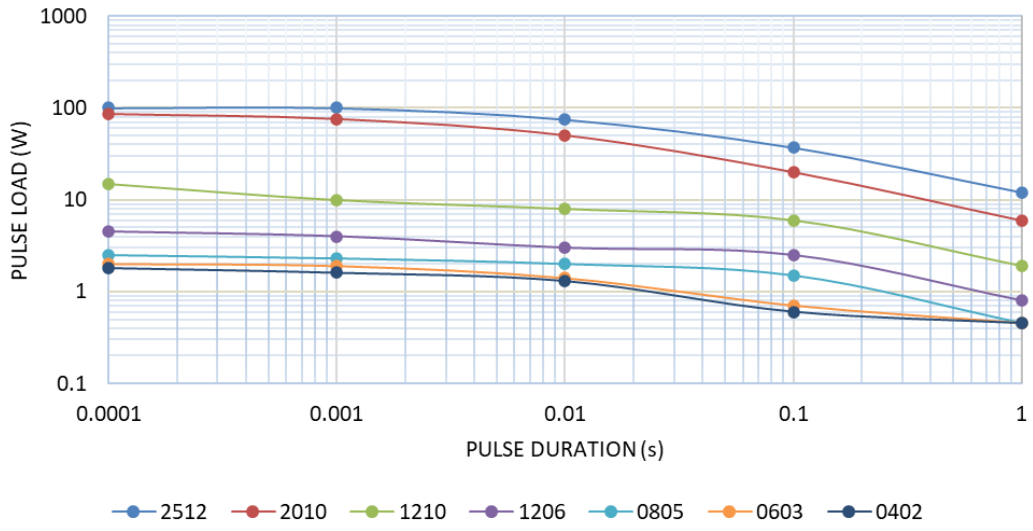


Recommended Solder Profile



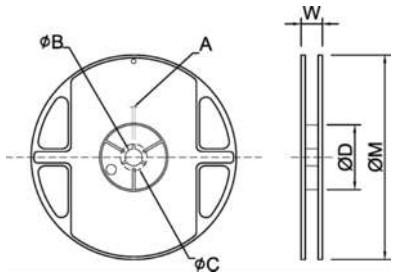
Rework temperature (hot air equipment): 350ºC, 3~5 seconds
Recommended reflow methods: IR, vpor phase oven, hot air oven
If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements

Single Pulse Power



The data provided are for reference only. They are typical performance for this product but are not guaranteed. The actual pulse handling of each individual resistor may vary depending on a variety of factors including resistance tolerance and resistance value. Stackpole Electronics, Inc. assumes no liability for the use of this information. Customers should validate the performance of these products in their applications.
Contact Stackpole marketing to discuss specific pulse application requirements.

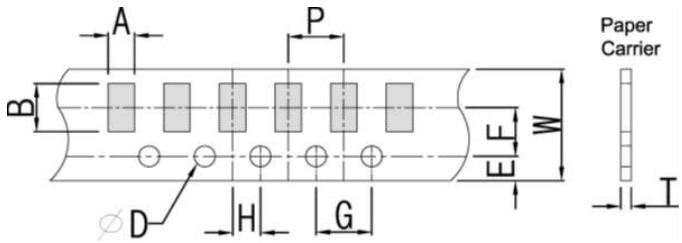
Packaging Specifications



Type	Size(*)		A	ØB	ØC	ØD	W	ØM	Unit
RMEF0402	7"	10 K/Reel	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.453 ± 0.079 11.50 ± 2.00	7.008 ± 0.079 178.00 ± 2.00	inches mm
RMEF0603 RMEF0805 RMEF1206 RMEF1210	7"	5 K/Reel					0.453 ± 0.079 11.50 ± 2.00		inches mm
RMEF2010 RMEF2512 RMEF1812	7"	4 K/Reel					0.630 ± 0.079 16.00 ± 2.00		inches mm

(*) Larger reel sizes may be available. Contact Stackpole Electronics.

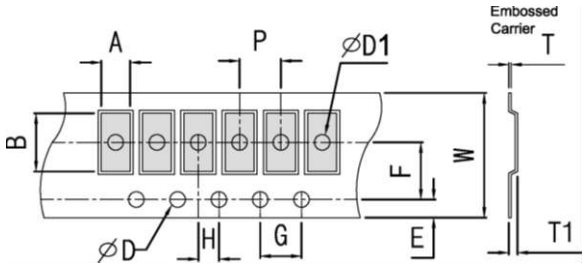
Taping Specifications – Paper Tape



Size	A	B	W	E	F	Unit
RMEF0402	0.028 ± 0.004 0.70 ± 0.10	0.047 ± 0.004 1.20 ± 0.10	0.315 ± 0.008 8.00 ± 0.20	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm
RMEF0603	0.041 ± 0.008 1.05 ± 0.20	0.071 ± 0.008 1.80 ± 0.20				inches mm
RMEF0805	0.061 ± 0.008 1.55 ± 0.20	0.091 ± 0.008 2.30 ± 0.20				inches mm
RMEF1206	0.075 ± 0.008 1.90 ± 0.20	0.138 ± 0.008 3.50 ± 0.20				inches mm
RMEF1210	0.112 ± 0.008 2.85 ± 0.20	0.138 ± 0.008 3.50 ± 0.20				inches mm

Size	G	H	T	ØD	P	Unit
RMEF0402	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.018 ± 0.004 0.45 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.079 ± 0.004 2.00 ± 0.10	inches mm
RMEF0603			0.024 ± 0.004 0.60 ± 0.10		0.157 ± 0.004 4.00 ± 0.10	inches mm
RMEF0805			0.030 ± 0.004 0.75 ± 0.10			inches mm
RMEF1206			0.030 ± 0.004 0.75 ± 0.10			inches mm
RMEF1210			0.030 ± 0.004 0.75 ± 0.10			inches mm

Taping Specifications – Plastic Tape



Size	A	B	W	E	F	G	Unit
RMEF2010	0.110 ± 0.008 2.80 ± 0.20	0.220 ± 0.008 5.60 ± 0.20	0.472 ± 0.004 12.00 ± 0.10	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.002 5.50 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	inches mm
RMEF2512	0.134 ± 0.008 3.40 ± 0.20	0.264 ± 0.008 6.70 ± 0.20					inches mm
RMEF1812	0.130 ± 0.008 3.30 ± 0.20	0.181 ± 0.008 4.60 ± 0.20					inches mm
Size	H	T	ØD	ØD1	T1	P	Unit
RMEF2010	0.079 ± 0.002 2.00 ± 0.05	0.009 ± 0.004 0.23 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.059 ± 0.004 1.50 ± 0.10	0.033 ± 0.006 0.85 ± 0.15	0.157 ± 0.004 4.00 ± 0.10	inches mm
RMEF2512							inches mm
RMEF1812							inches mm

Part Marking Specifications

1% Marking
The nominal resistance is marked on the surface of the overcoating with the use of 4 digit markings.
0201 and 0402 are not marked.

5% Marking
The nominal resistance is marked on the surface of the overcoating with the use of 3 digit markings.
0201 and 0402 are not marked.

For shared E24/E96 values, 1% tolerance product may be marked with three digit marking instead of the standard four digit marking for all other E96 values. All E24 values available in 1% tolerance are also marked with three digit marking.

Mark Instructions for 0603 1% Chip Resistors (per EIA-J)

A two-digit number is assigned to each standard R-Value (E96) as shown in the chart below.
This is followed by one alpha character which is used as a multiplier. Each letter "Y" – "F" represents a specific multiplier as follows:

Y = 0.1	X = 1	A = 10	B = 100
C = 1000	D(d) = 10000	E = 100000	F = 1000000

EXAMPLE:

Chip Marking	Explanation	Value
01B	01 means 10.0 and B = 100	10.0 x 100 = 1 K ohm
25C	25 means 17.8 and C = 1,000	17.8 x 1,000 = 17.8 K ohm
93D	93 means 90.9 and D = 10,000	90.9 x 10,000 = 909 K ohm

E96											
1%	#	1%	#	1%	#	1%	#	1%	#	1%	#
10.0	01	14.7	17	21.5	33	31.6	49	46.4	65	68.1	81
10.2	02	15.0	18	22.1	34	32.4	50	47.5	66	69.8	82
10.5	03	15.4	19	22.6	35	33.2	51	48.7	67	71.5	83
10.7	04	15.8	20	23.2	36	34.0	52	49.9	68	73.2	84
11.0	05	16.2	21	23.7	37	34.8	53	51.1	69	75.0	85
11.3	06	16.5	22	24.3	38	35.7	54	52.3	70	76.8	86
11.5	07	16.9	23	24.9	39	36.5	55	53.6	71	78.7	87
11.8	08	17.4	24	25.5	40	37.4	56	54.9	72	80.6	88
12.1	09	17.8	25	26.1	41	38.3	57	56.2	73	82.5	89
12.4	10	18.2	26	26.7	42	39.2	58	57.6	74	84.5	90
12.7	11	18.7	27	27.4	43	40.2	59	59.0	75	86.6	91
13.0	12	19.1	28	28.0	44	41.2	60	60.4	76	88.7	92
13.3	13	19.6	29	28.7	45	42.2	61	61.9	77	90.9	93
13.7	14	20.0	30	29.4	46	43.2	62	63.4	78	93.1	94
14.0	15	20.5	31	30.1	47	44.2	63	64.9	79	95.3	95
14.3	16	21.0	32	30.9	48	45.3	64	66.5	80	97.6	96

RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union's directive regarding "Restrictions on Hazardous Substances" (RoHS 3). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

RoHS Compliance Status						
Standard Product Series	Description	Package / Termination Type	Standard Series RoHS Compliant	Lead-Free Termination Composition	Lead-Free Mfg. Effective Date (Std Product Series)	Lead-Free Effective Date Code (YY/WW)
RMEF	General Purpose Thick Film Surface Mount Chip Resistor 100% Lead Free	SMD	YES	100% Matte Sn over Ni	Always	Always

"Conflict Metals" Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the "conflict region" of the eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

Compliance to "REACH"

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, "The Registration, Evaluation, Authorization and Restriction of Chemicals", otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

Environmental Policy

It is the policy of Stackpole Electronics, Inc. (SEI) to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.

How to Order

R	M	E	F	0	6	0	3	J	T	1	0	R	0

Product Series	
Code	Description
RMEF	Thick Film Chip Resistor

Size	
Size	W
0402	0.063
0603	0.1
0805	0.125
1206	0.25
1210	0.5
1812	0.75
2010	0.75
2512	1

Tolerance		
Code	Tol	Value
F	1%	E96, E24
J	5%	E24
Z	Jumper	

Packaging (*)			
Code	Description	Size	Quantity
T	7" Reel Paper Tape	0402	10000
		0603, 0805 1206, 1210	5000
	7" Reel Plastic Tape	2010, 2512 1812	4000

(*) Larger reel sizes may be available.
Contact Stackpole Electronics.

Resistance Value
Four characters with the multiplier used as the decimal holder.
1 ohm = 1R00 10 ohm = 10R0 100 Kohm = 100K 1 Mohm = 1M00 Zero ohm jumper = 0R00