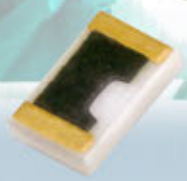
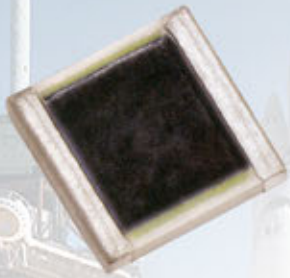
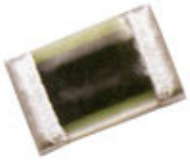
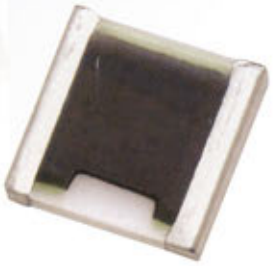
Best Quality and
Delivery since 1968

RESPONSIVE DELIVERY

EXTRAORDINARY RELIABILITY

HAND-CRAFTED QUALITY


MINI-SYSTEMS, INC

Thick Film Division

MINI-SYSTEMS
Precision Components & Services

History of Mini-Systems, Inc. (MSI)

Mini-Systems, Inc. is a leading manufacturer of precision thick and thin film chip resistors, capacitors, metal/glass sidewall packages, custom thick film hybrid circuits, and multi-chip modules. Since 1968, our commitment to total quality and responsive customer service has helped us maintain this leadership status.

MSI is consistently called upon when high reliability and high performance are required in a broad range of applications including satellite, medical, spacecraft, and military. Our parts have been supplied for programs such as:

- F-18
- MX
- Trident
- Patriot
- Space Shuttle
- Voyager
- Mariner
- Heart Pacers

Since our inception, we have known that understanding customer service and fast response is the key to building long-lasting customer relationships. We look forward to giving you a personal introduction to our company in the near future.

Quality

- Uncompromising Product Specifications
- Process Integrated Quality Assurance
- Advanced Testing Equipment and Facilities

Reliability

- Established Reliability of QPL Products to MIL-PRF-55342
- Innovative Design Criteria for Maximum Product Performance
- SPC Process Control and Monitoring

Delivery

- Consistently the Shortest Available Lead Times
- Expedited Delivery Available for Your Critical Needs
- Many Standard Products Maintained in Stock

Service

- Knowledgeable Sales and Engineering Support
- Rapid Response to All Your Questions and Inquiries
- Committed to Total Customer Satisfaction

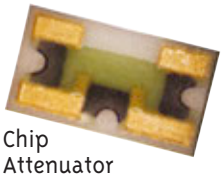
Expertise

- Highly Trained, Dedicated Staff
- Extensive Microelectronics Background in Materials, Assembly, Design, and Testing
- Customized Solutions to Your Hybrid Microelectronics Requirements

Thick Film

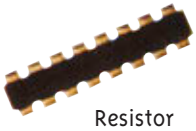
ISO 9001 Certified

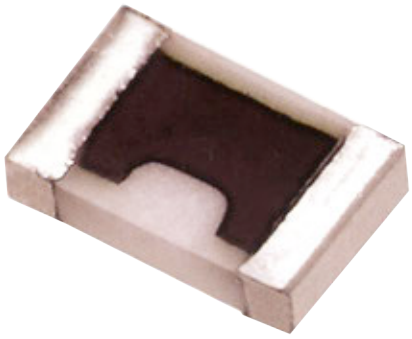
- The WORLD'S FIRST Supplier of QPL/ 1 & 13, 0502 & 0302 Style Resistors
- High Reliability, Precision, Thick Film Chip Resistors and Networks
- QPL Approved to MIL-PRF-55342, "T" Space Level Qualified
- Surface Mount, Wire Bondable, and Flip Chip Configurations
- T and Pi, Low Loss, Chip Attenuators
- Standard and Custom, Gold on Ceramic, Jumpers and Standoffs


Chip Attenuator


Wire Bondable Resitor


Mounting Pad


Resistor Network


Wraparound Resistor

MADE IN AMERICA
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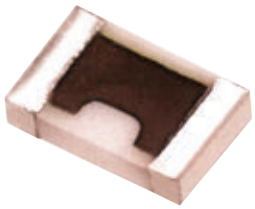
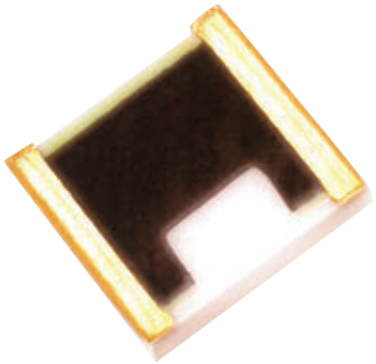
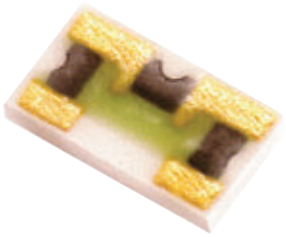
MINI-SYSTEMS, INC.

What's ahead...







Ordering MSI Thick Film Parts

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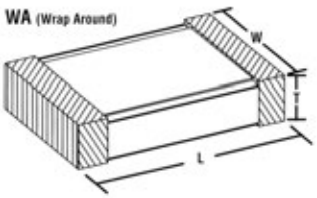
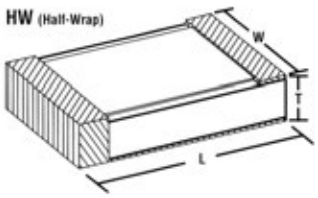
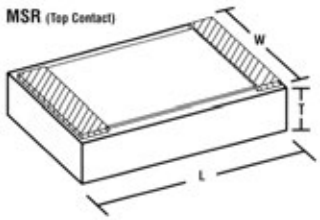
Ordering MSI Thick Film Parts

MINI-SYSTEMS, INC.







PART NUMBER DESIGNATION

EXAMPLE: WA81PG -1001F-NS62TR

Wrap Around, 0502 case size, Platinum Gold base metal, 1kΩ 1% tol., Nickel Barrier, Sn62 Solder, Tape & Reel, Std TCR

Style: WA
WA = Wrap Around
MWA = Mini Wrap Around
HW = Half Wrap
MHW = Mini Half Wrap
MSR = Top Contact

Prefix G = RoHS
(Ex.GWA=RoHS Wrap Around)

Type: 81
See Table to right

Termination: PG Material
Base Metal
G = Gold *for wire bonding (MSR only)*
PG = Platinum Gold
PS = Palladium Silver
SM = Surface Mount*
**Base metal determined by value And TCR (Nickel Barrier required)*

Value: 1001
Resistance Value
Four digits (xxxx) with provisions for five digits (xxxxx) if necessary. The first three digits represent significant figures. The last digit represents the number of zeros to follow. When fractional values of an ohm are required, the letter "R" is used as a decimal point.

Tolerance: F

B = 0.10%	H = 3%	P = 25%
C = 0.25%	J = 5%	N = 30%
E = 0.50%	K = 10%	Y = Max
F = 1%	L = 15%	Z = Special
G = 2%	M = 20%	

Metal Options: N
B = Back Metal *(MSR only)*
N = Nickel Barrier
Blank = No Metal Options

Termination: S62 Finish
Metal option N termination untinned finish= nickel, gold plated.

S60 = Sn60	*Lead Free Options*
S62 = Sn62	S96 = Sn96
S63 = Sn63	S305=Sn305

U = Untinned *No solder*

Options: TR
TR = Tape and Reel *(Heat seal std)*
Pressure seal & Paper tape available

Packaged in chip trays if not specified
TL = *Trimless*
P = *Optimum TCR otherwise std.*
4 Digit # = *Special Requirement Identifier*

Style	Type	Case Size	Power (Watts)	Voltage (Volts DC)
MWA MHW MSR	96	0201	0.015	20
	84	0202	0.020	25
	66	0203	0.040	30
	98	0302	0.040	30
	91	0303	0.040	40
	10	0404	0.050	45

Style	Type	Case Size	Power (Watts)	Voltage (Volts DC)
WA HW MSR	20	0402	0.050	40
	81	0502	0.100	50
	56	0503	0.125	80
	19	0504	0.100	70
	82	0505	0.125	80
	93	0603	0.100	90
	61	0604	0.125	65
	86	0805	0.200	125
	5	1002	0.100	175
	83	1005	0.250	180
	90	1010	0.500	160
	87	1206	0.250	190
	94	1210	0.550	230
	97	1218	1.500	185
	80	1505	0.300	300
	88	2010	0.800	350
	85	2307	0.500	380
	89	2512	2.000	475
	68	3939	5.000	750
	30	5024	4.000	1000
	28	6632	8.000	1400
	26	6645	8.000	1400

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MINI-SYSTEMS, INC.

TCR's for MSI Resitors

RESISTANCE RANGE IN OHMS

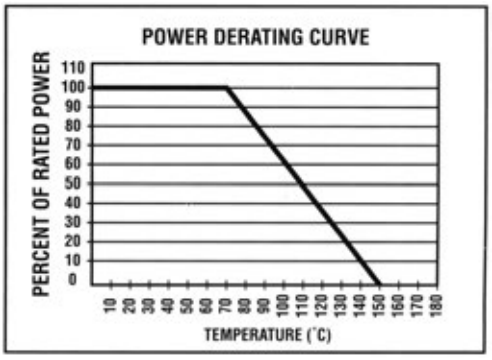
Type	0.1 to < 1	1 to < 5	5 to < 10	10 to < 1M	1M to < 10M	10M to < 100M	100M to < 250M	250M to < 500M	500M to < 750M	750M to < 1G
96	400	300	200	100	200	200	300	300	400	400
84	300	100	100	100	200	200	300	300	400	400
66	300	100	100	100	200	200	300	300	400	400
98	300	100	100	100	100	200	300	300	400	400
91	100	100	100	100	100	100	150	200	300	300
10	100	100	100	100	100	200	200	200	300	300
20	300	100	100	100	100	100	300	300	400	400
81	100	100	100	100	100	100	200	200	300	300
56	100	100	100	100	100	100	200	200	300	300
19	100	100	100	100	100	100	150	200	300	300
82	100	100	100	100	100	100	150	200	300	300
93	100	100	100	100	100	100	150	200	300	300
61	100	100	100	100	100	100	150	200	300	300
86	100	100	100	100	100	100	300	200	300	300
5	500	200	200	100	100	200	200	200	200	200
83	100	100	100	100	100	100	150	200	300	300
90	100	100	100	100	100	100	200	300	400	400
87	100	100	100	100	100	100	150	200	300	300
94	100	100	100	100	100	100	200	300	400	400
97	200	100	100	100	100	200	200	300	400	400
80	500	300	100	100	100	100	100	100	200	200
88	100	100	100	100	100	100	150	200	300	300
85	500	300	100	100	100	100	100	100	200	200
89	100	100	100	100	100	100	150	200	300	300
68	100	100	100	100	100	100	200	300	400	400
30	200	100	100	100	100	100	150	200	300	300
28	200	100	100	100	100	100	150	200	300	300
26	200	100	100	100	100	100	150	200	300	300

1. Table list optimal TCR's, add 200 standard TCR's 2. Optimal TCR's valid for SM termination, may not be available for all other terminations.

Electrical Performance Characteristics

MIL-PRF-55342	MIL-PRF-55342 Requirement	MSI Typical
Short Term Overload	±0.25%	±0.03%
High Temperature Exposure	±0.50%	±0.05%
Thermal Shock	±0.50%	±0.07%
Low Temperature Operation	±0.25%	±0.05%
Resistance to Bonding Exposure / Soldering Heat	±0.25%	±0.09%
Moisture Resistance	±0.50%	±0.06%
Stability (Life 70°C 2,000Hrs)	±0.50%	±0.04%
Stability (Life 70°C 10,000Hrs)	±2.00%	±0.07%

Operating temperature range from 55°C to +150°C



Power rating at 70° C derated linearly to 0% power at 150°C ($P=E^2/R$).

Mini WA Series Resistors

MINI-SYSTEMS, INC.

Style	Type	Case Size	Length Inches (mm)	Width Inches (mm)	Thickness[1] Inches (mm)	Pad Width Inches (mm)
MWA	96	0201	0.024 ±0.002 (0.610 ±0.051)	0.012 ±0.002 (0.305 ±0.051)	0.008 ±0.002 (0.203 ±0.051)	0.006 ±0.002 (0.152 ±0.051)
	84	0202	0.024 ±0.002 (0.610 ±0.051)	0.021 ±0.002 (0.533 ±0.051)	0.008 ±0.002 (0.203 ±0.051)	0.007 ±0.002 (0.178 ±0.051)
	66	0203	0.027 ±0.002 (0.686 ±0.051)	0.031 ±0.002 (0.787 ±0.051)	0.012 ±0.003 (0.305 ±0.076)	0.008 ±0.002 (0.203 ±0.051)
	98	0302	0.032 ±0.003 (0.813 ±0.076)	0.020 ±0.003 (0.508 ±0.076)	0.012 ±0.003 (0.305 ±0.076)	0.008 ±0.003* (0.203 ±0.076)
	91	0303	0.030 ±0.003 (0.762 ±0.076)	0.030 ±0.003 (0.762 ±0.076)	0.012 ±0.003 (0.305 ±0.076)	0.008 ±0.003* (0.203 ±0.076)
	10	0404	0.037 ±0.003 (0.940 ±0.076)	0.035 ±0.003 (0.889 ±0.076)	0.012 ±0.003 (0.305 ±0.076)	0.012 ±0.004 (0.305 ±0.102)

* Dimensions are for back termination only.

1 Solder may add an additional 0.004" in thickness.

WA Series Resistors

Style	Type	Case Size	Length Inches (mm)	Width Inches (mm)	Thickness[1] Inches (mm)	Pad Width Inches (mm)
WA	20	0402	0.044 ±0.004 (1.118 ±0.102)	0.022 ±0.003 (0.559 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.011 ±0.004 (0.279 ±0.102)
	81	0502	0.054 ±0.005 (1.372 ±0.127)	0.025 ±0.003 (0.635 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.015 ±0.005[1] (0.381 ±0.127)
	56	0503	0.050 ±0.005 (1.270 ±0.127)	0.032 ±0.003 (0.813 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.015 ±0.005 (0.381 ±0.127)
	19	0504	0.055 ±0.005 (1.397 ±0.127)	0.042 ±0.003 (1.067 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.015 ±0.005* (0.381 ±0.127)
	82	0505	0.054 ±0.005 (1.372 ±0.127)	0.050 ±0.003 (1.270 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.015 ±0.005[1]* (0.381 ±0.127)
	93	0603	0.065 ±0.005 (1.651 ±0.127)	0.032 ±0.003 (0.813 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.015 ±0.005[1]* (0.381 ±0.127)
	61	0604	0.065 ±0.005 (1.651 ±0.127)	0.042 ±0.003 (1.067 ±0.076)	0.018 ±0.003 (0.457 ±0.102.)	0.017 ±0.005 (0.432 ±0.127)

* Dimensions are for back termination only.

1 Solder may add an additional 0.004" in thickness.

E-mail: msithick@mini-systemsinc.com Web site: http://www.Mini-Systemsinc.com

MINI-SYSTEMS, INC.

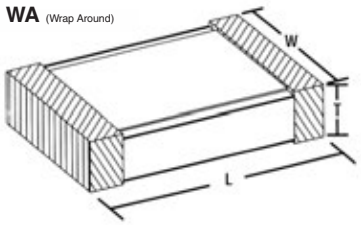
WA Series Resistors

Style	Type	Case Size	Length Inches (mm)	Width Inches (mm)	Thickness[1] Inches (mm)	Pad Width Inches (mm)
WA	86	0805	0.080 ±0.006 (2.032 ±0.152)	0.050 ±0.003 (1.270 ±0.076)	0.018 ±0.003 (0.457 ±0.076)	0.015 ±0.005 (0.381 ±0.127)
	5	1002	0.105 ±0.005 (2.667 ±0.127)	0.027 ±0.003 (0.686 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.020 ±0.005 (0.508 ±0.127)
	83	1005	0.104 ±0.006 (2.642 ±0.152)	0.050 ±0.003 (1.270 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.015 ±0.005 (0.381 ±0.127)
	90	1010	0.104 ±0.006 (2.642 ±0.152)	0.100 ±0.003 (2.540 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.015 ±0.005 (0.381 ±0.127)
	87	1206	0.127 ±0.006 (3.226 ±0.152)	0.063 ±0.003 (1.600 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.019 ±0.005* (0.483 ±0.127)
	94	1210	0.125 ±0.005 (3.175 ±0.127)	0.100 ±0.003 (2.540 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.019 ±0.005 (0.483 ±0.127)
	97	1218	0.120 ±0.005 (3.048 ±0.127)	0.180 ±0.003 (4.572 ±0.076)	0.030 ±0.005 (0.762 ±0.127)	0.025 ±0.005 (0.635 ±0.127)
	80	1505	0.155 ±0.005 (3.937 ±0.127)	0.050 ±0.003 (1.270 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.015 ±0.005 (0.381 ±0.127)
	88	2010	0.210 ±0.006 (5.334 ±0.152)	0.098 ±0.003 (2.489 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.020 ±0.005 (0.508 ±0.127)
	85	2307	0.228 ±0.005 (5.791 ±0.127)	0.075 ±0.003 (1.905 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.020 ±0.005 (0.508 ±0.127)
	89	2512	0.256 ±0.006 (6.502 ±0.152)	0.124 ±0.003 (3.150 ±0.076)	0.030 ±0.005 (0.762 ±0.127)	0.020 ±0.005 (0.508 ±0.127)
	68	3939	0.394 ±0.008 (10.008 ±0.203)	0.390 ±0.005 (9.906 ±0.127)	0.030 ±0.005 (0.762 ±0.127)	0.043 ±0.005 (1.092 ±0.127)
	30	5024	0.501 ±0.008 (12.725 ±0.203)	0.246 ±0.004 (6.248 ±0.102)	0.030 ±0.005 (0.762 ±0.127)	0.058 ±0.005 (1.473 ±0.127)
	28	6632	0.674 ±0.008 (17.120 ±0.203)	0.332 ±0.005 (8.443 ±0.102)	0.030 ±0.005 (0.762 ±0.127)	0.067 ±0.006* (1.702 ±0.152)
	26	6645	0.675 ±0.009 (17.145 ±0.229)	0.499 ±0.005 (12.675 ±0.127)	0.030 ±0.005 (0.762 ±0.127)	0.067 ±0.006* (1.702 ±0.152)

* Dimensions are for back termination only.

1 Solder may add an additional 0.004" in thickness.

WA (Wrap Around)



Mini HW Series Resistors

MINI-SYSTEMS, INC.

Style	Type	Case Size	Length Inches (mm)	Width Inches (mm)	Thickness[1] Inches (mm)	Top Contact Pad Width Inches (mm)
MHW	96	0201	0.023 ±0.002 (0.584 ±0.051)	0.012 ±0.002 (0.305 ±0.051)	0.008 ±0.002 (0.203 ±0.051)	0.005 ±0.002 (0.127 ±0.051)
	84	0202	0.023 ±0.002 (0.584 ±0.051)	0.021 ±0.002 (0.533 ±0.051)	0.008 ±0.002 (0.203 ±0.051)	0.005 ±0.002 (0.127 ±0.051)
	66	0203	0.026 ±0.002 (0.660 ±0.051)	0.031 ±0.002 (0.787 ±0.051)	0.013 ±0.003 (0.330 ±0.076)	0.006 ±0.002 (0.152 ±0.051)
	98	0302	0.031 ±0.003 (0.787 ±0.076)	0.020 ±0.003 (0.508 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.006 ±0.002 (0.152 ±0.051)
	91	0303	0.029 ±0.003 (0.736 ±0.076)	0.030 ±0.003 (0.762 ±0.076)	0.0130 ±0.003 (0.330 ±0.076)	0.006 ±0.002 (0.152 ±0.051)
	10	0404	0.036 ±0.003 (0.914 ±0.076)	0.035 ±0.003 (0.889 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.009 ±0.002 (0.229 ±0.051)

1 Solder may add up to an additional 0.004" in thickness.

HW Series Resistors

Style	Type	Case Size	Length Inches (mm)	Width Inches (mm)	Thickness[1] Inches (mm)	Top Contact Pad Width Inches (mm)
HW	20	0402	0.043 ±0.004 (1.092 ±0.102)	0.022 ±0.003 (0.559 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.009 ±0.002 (0.229 ±0.051)
	81	0502	0.051 ±0.004 (1.295 ±0.102)	0.025 ±0.003 (0.635 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.010 ±0.002 (0.254 ±0.051)
	56	0503	0.048 ±0.004 (1.219 ±0.102)	0.032 ±0.003 (0.813 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.011 ±0.002 (0.279 ±0.051)
	19	0504	0.053 ±0.004 (1.346 ±0.102)	0.042 ±0.003 (1.067 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.011 ±0.002 (0.279 ±0.051)
	82	0505	0.051 ±0.004 (1.295 ±0.102)	0.050 ±0.003 (1.270 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.009 ±0.002 (0.229 ±0.051)
	93	0603	0.063 ±0.004 (1.600 ±0.102)	0.032 ±0.003 (0.813 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.010 ±0.002 (0.254 ±0.051)
	61	0604	0.063 ±0.004 (1.600 ±0.102)	0.042 ±0.003 (1.067 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.013 ±0.002 (0.330 ±0.051)

1 Solder may add up to an additional 0.004" in thickness.

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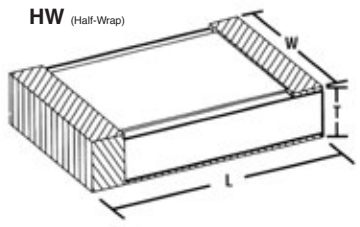
MINI-SYSTEMS, INC.

HW Series Resistors

Style	Type	Case Size	Length Inches (mm)	Width Inches (mm)	Thickness[1] Inches (mm)	Top Contact Pad Width Inches (mm)
HW	86	0805	0.078 ±0.004 (1.981 ±0.102)	0.050 ±0.003 (1.270 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.013 ±0.002 (0.330 ±0.051)
	5	1002	0.103 ±0.004 (2.616 ±0.102)	0.027 ±0.003 (0.686 ±0.076)	0.013 ±0.003 (0.330 ±0.076)	0.016 ±0.002 (0.406 ±0.051)
	83	1005	0.101 ±0.004 (2.565 ±0.102)	0.050 ±0.003 (1.270 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.013 ±0.002 (0.330 ±0.051)
	90	1010	0.101 ±0.004 (2.565 ±0.102)	0.100 ±0.003 (2.540 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.012 ±0.002 (0.305 ±0.051)
	87	1206	0.123 ±0.004 (3.124 ±0.102)	0.063 ±0.003 (1.600 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.015 ±0.002 (0.381 ±0.051)
	94	1210	0.123 ±0.004 (3.124 ±0.102)	0.100 ±0.003 (2.540 ±0.076)	0.018 ±0.004 (0.483 ±0.102)	0.015 ±0.002 (0.381 ±0.051)
	97	1218	0.118 ±0.004 (2.997 ±0.102)	0.180 ±0.003 (4.572 ±0.076)	0.030 ±0.005 (0.762 ±0.127)	0.022 ±0.002 (0.559 ±0.051)
	80	1505	0.153 ±0.004 (3.886 ±0.102)	0.050 ±0.003 (1.270 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.012 ±0.002 (0.305 ±0.051)
	88	2010	0.207 ±0.004 (5.258 ±0.102)	0.098 ±0.003 (2.489 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.017 ±0.002 (0.432 ±0.051)
	85	2307	0.226 ±0.004 (5.740 ±0.102)	0.075 ±0.003 (1.905 ±0.076)	0.018 ±0.004 (0.457 ±0.102)	0.016 ±0.002 (0.406 ±0.051)
	89	2512	0.253 ±0.004 (6.426 ±0.102)	0.124 ±0.003 (3.150 ±0.076)	0.030 ±0.005 (0.762 ±0.127)	0.017 ±0.002 (0.432 ±0.051)
	68	3939	0.390 ±0.006 (9.906 ±0.152)	0.390 ±0.005 (9.906 ±0.127)	0.030 ±0.005 (0.762 ±0.127)	0.040 ±0.002 (1.016 ±0.051)
	30	5024	0.497 ±0.006 (12.624 ±0.152)	0.246 ±0.005 (6.248 ±0.127)	0.030 ±0.005 (0.762 ±0.127)	0.053 ±0.002 (1.346 ±0.051)
	28	6632	0.669 ±0.006 (16.993 ±0.152)	0.332 ±0.005 (8.443 ±0.127)	0.030 ±0.005 (0.762 ±0.127)	0.063 ±0.002 (1.600 ±0.051)
	26	6645	0.669 ±0.006 (16.993 ±0.152)	0.499 ±0.005 (12.675 ±0.127)	0.030 ±0.005 (0.762 ±0.127)	0.063 ±0.002 (1.600 ±0.051)

1 Solder may add up to an additional 0.004" in thickness.



Mini MSR Series Resistors

MINI-SYSTEMS, INC.

Style	Type	Case Size	Length Inches (mm)	Width Inches (mm)	Thickness[1] Inches (mm)	Pad Width Inches (mm)
MSR	96	0201	0.022 ±0.002 (0.559 ±0.051)	0.012 ±0.002 (0.305 ±0.051)	0.007 ±0.002 (0.178 ±0.051)	0.005 ±0.002 (0.127 ±0.051)
	84	0202	0.022 ±0.002 (0.559 ±0.051)	0.020 ±0.002 (0.508 ±0.051)	0.007 ±0.002 (0.178 ±0.051)	0.005 ±0.002 (0.127 ±0.051)
	66	0203	0.025 ±0.002 (0.635 ±0.051)	0.030 ±0.002 (0.762 ±0.051)	0.012 ±0.003 (0.305 ±0.076)	0.006 ±0.002 (0.152 ±0.051)
	98	0302	0.030 ±0.002 (0.762 ±0.051)	0.020 ±0.002 (0.508 ±0.051)	0.012 ±0.003 (0.305 ±0.076)	0.006 ±0.002 (0.152 ±0.051)
	91	0303	0.028 ±0.002 (0.711 ±0.051)	0.030 ±0.002 (0.762 ±0.051)	0.012 ±0.003 (0.305 ±0.076)	0.006 ±0.002 (0.152 ±0.051)
	10	0404	0.035 ±0.002 (0.889 ±0.051)	0.035 ±0.002 (0.889 ±0.051)	0.012 ±0.003 (0.305 ±0.076)	0.009 ±0.002 (0.229 ±0.051)

1 Solder may add up to an additional 0.004" in thickness.

MSR Series Resistors

Style	Type	Case Size	Length Inches (mm)	Width Inches (mm)	Thickness[1] Inches (mm)	Pad Width Inches (mm)
MSR	20	0402	0.040 ±0.002 (1.016 ±0.051)	0.020 ±0.002 (0.508 ±0.051)	0.013 ±0.003 (0.330 ±0.076)	0.009 ±0.002 (0.229 ±0.051)
	81	0502	0.048 ±0.002 (1.219 ±0 .051)	0.023 ±0.002 (0.584 ±0.051)	0.013 ±0.003 (0.330 ±0.076)	0.010 ±0.002 (0.254 ±0.051)
	56	0503	0.045 ±0.002 (1.143 ±0.051)	0.030 ±0.002 (0.762 ±0.051)	0.013 ±0.003 (0.330 ±0.076)	0.011 ±0.002 (0.279 ±0.051)
	19	0504	0.050 ±0.002 (1.270 ±0.051)	0.040 ±0.002 (1.016 ±0.051)	0.013 ±0.003 (0.330 ±0.076)	0.011 ±0.002 (0.279 ±0.051)
	82	0505	0.048 ±0.002 (1.219 ±0.051)	0.048 ±0.002 (1.219 ±0.051)	0.013 ±0.003 (0.330 ±0.076)	0.009 ±0.002 (0.229 ±0.051)
	93	0603	0.060 ±0.002 (1.524 ±0.051)	0.030 ±0.002 (0.762 ±0.051)	0.013 ±0.003 (0.330 ±0.076)	0.010 ±0.002 (0.254 ±0.051)
	61	0604	0.060 ±0.002 (1.524 ±0.051)	0.040 ±0.002 (1.016 ±0.051)	0.018 ±0.004 (0.457 ±0.076)	0.013 ±0.002 (0.330 ±0.051)

1 Solder may add up to an additional 0.004" in thickness.

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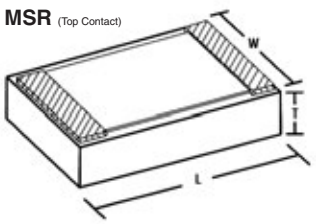
MINI-SYSTEMS, INC.

MSR Series Resistors

Style	Type	Case Size	Length Inches (mm)	Width Inches (mm)	Thickness[1] Inches (mm)	Pad Width Inches (mm)
MSR	86	0805	0.075 ±0.002 (1.905 ±0.051)	0.048 ±0.002 (1.219 ±0.051)	0.018 ±0.003 (0.457 ±0.076)	0.013 ±0.002 (0.330 ±0.051)
	5	1002	0.100 ±0.002 (2.540 ±0.051)	0.025 ±0.002 (0.635 ±0.051)	0.013 ±0.003 (0.330 ±0.076)	0.016 ±0.002 (0.406 ±0.051)
	83	1005	0.098 ±0.002 (2.489 ±0.051)	0.048 ±0.002 (1.219 ±0.051)	0.018 ±0.003 (0.457 ±0.076)	0.013 ±0.002 (0.330 ±0.051)
	90	1010	0.098 ±0.002 (2.489 ±0.051)	0.098 ±0.002 (2.489 ±0.051)	0.018 ±0.003 (0.457 ±0.076)	0.012 ±0.002 (0.305 ±0.051)
	87	1206	0.121 ±0.002 (3.073 ±0.051)	0.061 ±0.002 (1.549 ±0.051)	0.018 ±0.003 (0.457 ±0.076)	0.015 ±0.002 (0.381 ±0.051)
	94	1210	0.120 ±0.002 (3.048 ±0.051)	0.098 ±0.002 (2.489 ±0.051)	0.018 ±0.003 (0.457 ±0.076)	0.015 ±0.002 (0.381 ±0.051)
	97	1218	0.115 ±0.002 (2.921 ±0.051)	0.179 ±0.002 (4.547 ±0.051)	0.030 ±0.005 (0.762 ±0.127)	0.022 ±0.002 (0.559 ±0.051)
	80	1505	0.150 ±0.002 (3.810 ±0.051)	0.048 ±0.002 (1.219 ±0.051)	0.018 ±0.003 (0.457 ±0.076)	0.012 ±0.002 (0.305 ±0.051)
	88	2010	0.204 ±0.002 (5.182 ±0.051)	0.096 ±0.002 (2.438 ±0.051)	0.018 ±0.003 (0.457 ±0.076)	0.017 ±0.002 (0.432 ±0.051)
	85	2307	0.223 ±0.002 (5.664 ±0.051)	0.073 ±0.002 (1.854 ±0.051)	0.018 ±0.003 (0.457 ±0.076)	0.016 ±0.002 (0.406 ±0.051)
	89	2512	0.250 ±0.002 (6.350 ±0.051)	0.122 ±0.002 (3.099 ±0.051)	0.027 ±0.003 (0.686 ±0.076)	0.017 ±0.002 (0.432 ±0.051)
	68	3939	0.386 ±0.002 (9.804 ±0.051)	0.386 ±0.002 (9.804 ±0.051)	0.030 ±0.005 (0.762 ±0.127)	0.040 ±0.002 (1.016 ±0.051)
	30	5024	0.494 ±0.002 (12.548 ±0.051)	0.243 ±0.002 (6.172 ±0.051)	0.030 ±0.005 (0.762 ±0.127)	0.053 ±0.002 (1.346 ±0.051)
	28	6632	0.666 ±0.002 (16.916 ±0.051)	0.328 ±0.002 (8.331 ±0.051)	0.030 ±0.005 (0.762 ±0.127)	0.063 ±0.002 (1.600 ±0.051)
	26	6645	0.666 ±0.002 (16.916 ±0.051)	0.495 ±0.002 (12.573 ±0.051)	0.030 ±0.005 (0.762 ±0.127)	0.063 ±0.002 (01.600 ±0.051)

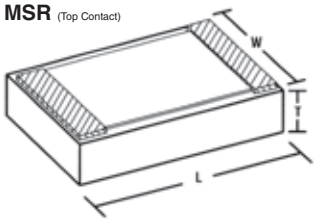
1 Solder may add up to an additional 0.004" in thickness.



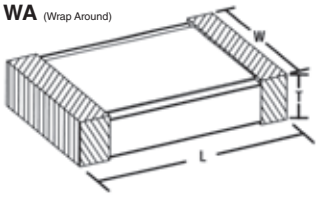
QPL Precision Resistors

MINI-SYSTEMS, INC.

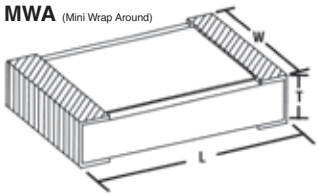
MSR (Top Contact)



WA (Wrap Around)



MWA (Mini Wrap Around)



QPL PART NUMBER DESIGNATION

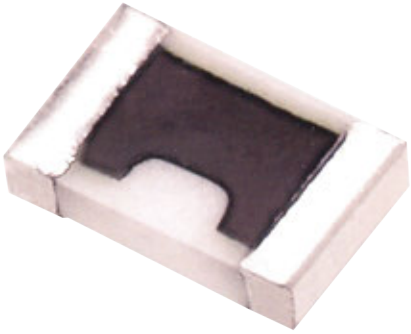
EXAMPLE: M55342M01W10E0S

Per MIL-PRF-55342, TCR ±300ppm, 0502 case size, Top Contact, Gold base metal, 10KΩ, 1% tol., "S" Life Failure Rate

MIL-PRF-55342:	M55342	D = For /07 series only M = all other series Military Spec. Indicating MIL=PRF-55342
Characteristic:	M	K = ±100ppm M = ±300ppm *70 °C Max. ambient temperature at rated wattage*
QPL Size:	01	See Tables on pages 16 & 17
Termination Material: *Base Metal*	W	W = Gold *Top Contact* T = Platinum Gold *Top Contact* D = Palladium Silver *Top Contact* B = Nickel Barrier, Solder Coated *Wrap Around* G = Nickel Barrier, Gold Plated *Wrap Around* C = Palladium Silver *Wrap Around* U = Platinum Gold *Wrap Around*
Value and Tollerance	10E0	10KΩ, 1% *See pgs. 14 & 15 for tables III & IV Of MIL-PRF-55342*
Life Failure Rate *Product Level*	S	C = Non-ER M = 1.0% / 1000 Hrs. P = 0.1% / 1000 Hrs. R = 0.01% / 1999 Hrs. S = 0.001% / 1000 Hrs. T = Space Level

Packaged in chip trays if not specified.

QPL thick film resistors are printed and fired on 96% Alumina. All case sizes are offered to fit a variety of Hi-Rel hybrid microelectronic applications. Advanced processing techniques and, Hi-Rel Construction assure optimum performance where TCR, VCR and operating power are critical factors. All styles meet and exceed the qualification requirements of MIL-PRF-55342.



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MINI-SYSTEMS, INC.

QPL Precision Resistors

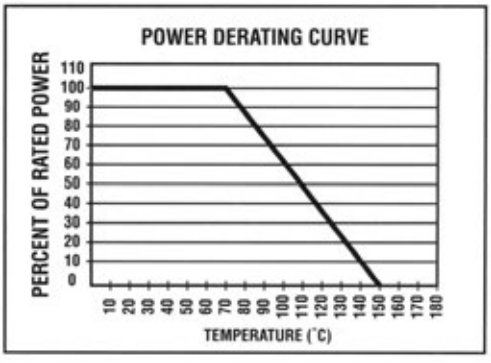
QPL SIZE	QPL STYLE Case Size	TERMINATION	CHAR.	RESISTANCE MIN.	RESISTANCE MAX.	TOLERANCE %	POWER (WATTS)	VOLTAGE (VOLTS DC)	MSI SIMILAR STYLE/ TYPE
01	RM0502	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.050	40	MSR81 WA81
02	RM0505	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.125	40	MSR82 WA82
03	RM1005	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.200	75	MSR83 WA83
04	RM1505	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.150	125	MSR80 WA80
05	RM2208	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.225	175	MSR85 WA85
06	RM0705	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.150	50	MSR86 WA86
07	RM1206	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.250	100	MSR92 WA87
08	RM2010	W, T, D B, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.800[1]	150	MSR88 WA88
09	RM2512	W, T, D B, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	1.000[1]	200	MSR89 WA89
10	RM1010	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.500[1]	75	MSR90 WA90
11	RM0402	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.050	30	MSR20 WA20
12	RM0603	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.100	50	MSR93 WA93
13	RM0302	W, T, D B, G, C, U	K, L, M	1 Ω	22 MΩ	0.1, 0.25, 0.5, 1, 2, 5, 10	0.040	15	MSR 98 MWA98

1. Mounted to a ceramic board.

Electrical Performance Characteristics

MIL-PRF-55342	MIL-PRF-55342 Requirement	MSI Typical
Short Term Overload	±0.25%	±0.03%
High Temperature Exposure	±0.50%	±0.05%
Thermal Shock	±0.50%	±0.07%
Low Temperature Operation	±0.25%	±0.05%
Resistance to Bonding Expopsure / Soldering Heat	±0.25%	±0.09%
Moisture Resistance	±0.50%	±0.06%
Stability (Life 70°C 2,000Hrs)	±0.50%	±0.04%
Stability (Life 70°C 10,000Hrs)	±2.00%	±0.07%

Operating temperature range from -55°C to +150°C



Power rating at 70°C derated linearly to 0% power at 150°C (P=E²/R)

MSI MINI-SYSTEMS, INC.

MIL-PRF-55342

TABLE III. Designator or resistance values for resistance tolerances

	Designator for 1 percent tolerance	Resistance Ohms			
Ohms	1D00 to 9D76 inclusive	1.00	to	9.76	inclusive
	10D0 to 97D6 inclusive	10.0	to	97.6	inclusive
	100D to 976D inclusive	100	to	976	inclusive
Kohms	1E00 to 9E76 inclusive	1,000	to	9,760	inclusive
	10E0 to 97E6 inclusive	10,000	to	97,600	Inclusive
	100E to 976E inclusive	100,000	to	976,000	inclusive
Mohms	1F00 to 9F76 inclusive	1,000,000	to	9,760,000	inclusive
	10F0	10,000,000			
	Designator for 2 percent tolerance	**Resistance Ohms**			
Ohms	1G00 to 9G10 inclusive	1.00	to	9.10	inclusive
	10G0 to 91G0 inclusive	10.0	to	91.0	inclusive
	100G to 910G inclusive	100	to	910	inclusive
Kohms	1H00 to 9H10 inclusive	1,000	to	9,100	inclusive
	10H0 to 91H0 inclusive	10,000	to	91,000	inclusive
	100H to 910H inclusive	100,000	to	910,000	inclusive
Mohms	1T00 to 9T10 inclusive	1,000,000	to	9,100,000	inclusive
	10T0	10,000,000			
	Designator for 5 percent tolerance	**Resistance Ohms**			
Ohms	1J00 to 9J10 inclusive	1.00	to	9.10	inclusive
	10J0 to 91J0 inclusive	10.0	to	91.0	inclusive
	100J to 910J inclusive	100	to	910	inclusive
Kohms	1K00 to 9K10 inclusive	1,000	to	9,100	inclusive
	10K0 to 91K0 inclusive	10,000	to	91,000	inclusive
	100K to 910K inclusive	100,000	to	910,000	inclusive
Mohms	1L00 to 9L10 inclusive	1,000,000	to	9,100,000	inclusive
	10L0	10,000,000			
	Designator for 10 percent tolerance	**Resistance Ohms**			
Ohms	1M00 to 8M20 inclusive	1.00	to	8.20	inclusive
	10M0 to 82M0 inclusive	10.0	to	82.0	inclusive
	100M to 820M inclusive	100	to	820	inclusive
Kohms	1N00 to 8N20 inclusive	1,000	to	8,200	inclusive
	10N0 to 82N0 inclusive	10,000	to	82,000	inclusive
	100N to 820N inclusive	100,000	to	820,000	inclusive
Mohms	1P00 to 8P20 inclusive	1,000,000	to	8,200,000	inclusive
	10P0	10,000,000			

MIL-PRF-55342

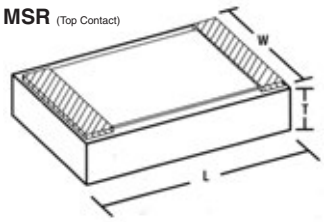
TABLE IV. Standard resistance values for the 10 to 100 decade

1%	2% & 5%	10%	1%	2% & 5%	10%	1%	2% & 5%	10%
10.00	10.00	10.00	21.50	22.00	22.00	46.40	47.00	47.00
10.20			22.10			47.50		
10.50			22.60			48.70		
10.70			23.20			49.90	51.00	51.00
11.00	11.00		23.70	24.00		51.10		
11.30			24.30			52.30		
11.50			24.90			53.60		
11.80	12.00	12.00	25.50			54.90	56.00	56.00
12.10			26.10			56.20		
12.40			26.70	27.00	27.00	57.60		
12.70			27.40			59.00		
13.00	13.00		28.00			60.40		
13.30			28.70			61.90	62.00	
13.70			29.40	30.00		63.40		
14.00			30.10			64.90		
14.30			30.90			66.50		
14.70			31.60			68.10	68.00	68.00
15.00	15.00	15.00	32.40	33.00	33.00	69.80		
15.40			33.20			71.50		
15.80	16.00		34.00			73.20		
16.20			34.80			75.00	75.00	75.00
16.50			35.70	36.00		76.80		
16.90			36.50			78.70		
17.40			37.40			80.60	82.00	82.00
17.80	18.00	18.00	38.30	39.00	39.00	82.50		
18.20			39.20			84.50		
18.70			40.20			86.60		
19.10			41.20			88.70		
19.60			42.20	43.00		90.90	91.00	
20.00	20.00		43.20			93.10		
20.50			44.20			95.30		
21.00			45.30			97.60		

QPL Precision Resistors

MINI-SYSTEMS, INC.

MSR (Top Contact)



QPL SIZE	QPL STYLE Case Size	Length Inches (mm)	Width Inches (mm)	Pad Width Inches (mm)
01	RM0502	0.050 ±0.005 (1.270 ±0.127)	0.025 ±0.005 (0.635 ±0.127)	0.010 ±0.005 (0.254 ±0.127)
02	RM0505	0.050 ±0.005 (1.270 ±0.127)	0.050 ±0.005 (1.270 ±0.127)	0.010 ±0.005 (0.254 ±0.127)
03	RM1005	0.100 ±0.005 (2.540 ±0.127)	0.050 ±0.005 (1.270 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
04	RM1505	0.150 ±0.005 (3.810 ±0.127)	0.050 ±0.005 (1.270 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
05	RM2208	0.225 ±0.005 (5.715 ±0.127)	0.075 ±0.005 (1.905 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
06	RM0705	0.075 ±0.005 (1.905 ±0.127)	0.050 ±0.005 (1.270 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
07	RM1206	0.126 ±0.005 (3.200 ±0.127)	0.063 ±0.005 (1.600 ±0.127)	0.018 ±0.007 (0.457 ±0.178)
08	RM2010	0.206 ±0.005 (5.232 ±0.127)	0.098 ±0.005 (2.489 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
09	RM2512	0.248 ±0.005 (6.299 ±0.127)	0.124 ±0.005 (3.150 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
10	RM1010	0.100 ±0.005 (2.540 ±0.127)	0.100 ±0.005 (2.540 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
11	RM0402	0.041 ±0.006 (1.041 ±0.152)	0.022 ±0.005 (0.559 ±0.127)	0.010 ±0.005 (0.254 ±0.127)
12	RM0603	0.060 ±0.005 (1.524 ±0.127)	0.032 ±0.005 (0.813 ±0.127)	0.010 ±0.005 (0.254 ±0.127)
13	RM0302	0.032 ±0.004 (0.813 ±0.102)	0.022 ±0.005 (0.559 ±0.127)	0.008 ±0.005 (0.203 ±0.127)

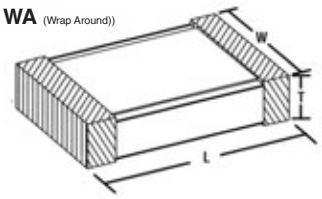
Max Thickness 0.033 in. (0838mm)

E-mail: msithick@mini-systemsinc.com Web site: http://www.Mini-Systemsinc.com

MINI-SYSTEMS, INC.

QPL Precision Resistors

WA (Wrap Around))



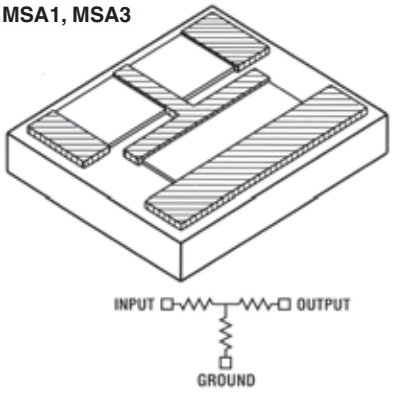
QPL SIZE	QPL STYLE Case Size	Length Inches (mm)	Width Inches (mm)	Pad Width Inches (mm)
01	RM0502	0.055 ±0.006 (1.397 ±0.152)	0.025 ±0.005 (0.635 ±0.127)	0.015 ±0.005[1] (0.381 ±0.127)
02	RM0505	0.055 ±0.006 (1.397 ±0.152)	0.050 ±0.005 (1.270 ±0.127)	0.015 ±0.005[1] (0.381 ±0.127)
03	RM1005	0.105 ±0.007 (2.667 ±0.178)	0.050 ±0.005 (1.270 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
04	RM1505	0.155 ±0.007 (3.937 ±0.178)	0.050 ±0.005 (1.270 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
05	RM2208	0.230 ±0.007 (5.842 ±0.178)	0.075 ±0.005 (1.905 ±0.127)	0.020 ±0.005 (0.508 ±0.127)
06	RM0705	0.080 ±0.006 (2.032 ±0.152)	0.050 ±0.005 (1.270 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
07	RM1206	0.126 ±0.008 (3.200 ±0.203)	0.063 ±0.005 (1.600 ±0.127)	0.018 ±0.007[1] (0.457 ±0.178)
08	RM2010	0.209 ±0.009 (5.309 ±0.229)	0.098 ±0.005 (2.489 ±0.127)	0.020 ±0.005 (0.508 ±0.127)
09	RM2512	0.256 ±0.012 (6.502 ±0.305)	0.124 ±0.005 (3.150 ±0.127)	0.020 ±0.005 (0.508 ±0.127)
10	RM1010	0.105 ±0.007 (2.667 ±0.178)	0.100 ±0.005 (2.540 ±0.127)	0.015 ±0.005 (0.381 ±0.127)
11	RM0402	0.042 ±0.008 (1.067 ±0.203)	0.022 ±0.005 (0.559 ±0.127)	0.010 ±0.005 (0.254 ±0.127)
12	RM0603	0.064 ±0.006 (1.626 ±0.152)	0.032 ±0.005 (0.813 ±0.127)	0.015 ±0.005[1] (0.381 ±0.127)
13	RM0302	0.034 ±0.004 (0.864±0.102)	0.022 ±0.005 (0.559 ±0.127)	0.008 ±0.005[1] (0.203 ±0.127)

Max Thickness 0.033 in. (0838mm)
1. Dimensions are for back terminations only.

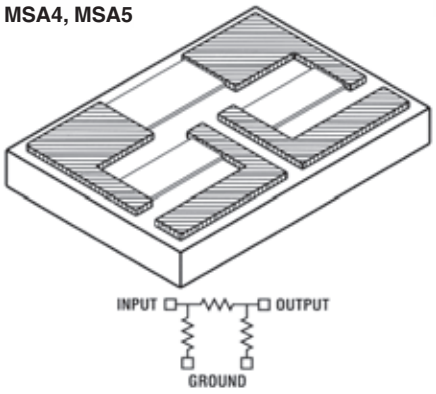
Thick film Chip Attenuators

MINI-SYSTEMS, INC.

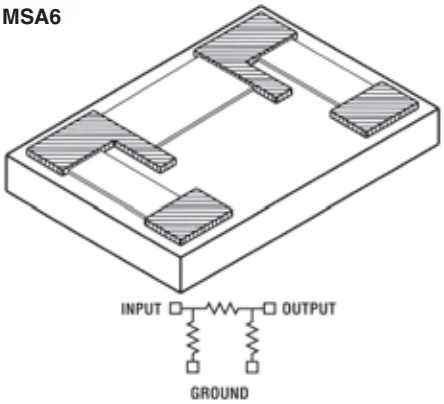
MSA1, MSA3



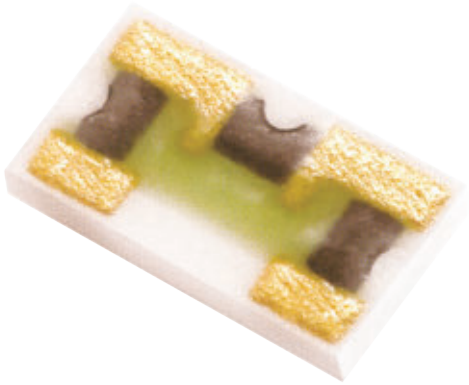
MSA4, MSA5



MSA6



Wire and ribbon bondable and Flipchip thick film chip attenuators, printed and fired on 96% alumina. Provides attenuation accuracy for frequencies through 10 Ghz. Double layer terminations provide additional bonding surface. Abrasive trimming ensures optimum resistor stability. Diamond sawed for dimensional uniformity and accuracy. Advanced processing techniques, and Hi-Rel construction assure optimum performance.



PART NUMBER DESIGNATION

EXAMPLE: MSA3G-01dB-BU

MSA-3 Series, Gold Termination, -1dB, Back Metal, Untinned

Style: MSA	Mini-Systems Attenuator
Type: 3	1, 3, 4, 5, 6
Termination Material: G *Base Metal*	G = Gold *for wire bonding (MSR only)* PG = Platinum Gold PS = Palladium Silver
dB Value: 01dB	
Metal Options: B	B = Back Metal Blank = No Metal Options
Options: U	*U = Untinned No Solder* *S = Soldered* *Packaged in chip trays if not specified*

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MINI-SYSTEMS, INC.

Thick film Chip Attenuators

MSA1, MSA3

Size	MSA1 = 0.320" X 0.240" X 0.030" (±0.005") MSA3 = 0.155" X 0.125" X 0.030" (±0.005")
Substrate	96% Alumina
Bond Pads	Wire Bondable, Ribbon Bondable, or Solderable
Attenuation	-1dB Through -20dB
Ranges	Consult Sales For 0.5dB Steps
Attenuation Accuracy	±0.5dB
Frequency Range	DC Through 10 GHz
Impedance	50Ω
Vswr	1.5:1 Max.
Power Rating	MSA1 = 1W MSA3 = 500mW

MSA4, MSA5

Size	MSA4 = 0.155" X 0.125" X 0.030" (±0.005") MSA5 = 0.320" X 0.240" X 0.030" (±0.005")
Substrate	96% Alumina
Bond Pads	Wire Bondable, Ribbon Bondable, or Solderable
Attenuation	-1dB Through -20dB
Ranges	Consult Sales For 0.5dB Steps
Attenuation Accuracy	±0.5dB
Frequency Range	DC Through 10 GHz
Impedance	50Ω
Vswr	1.5:1 Max.
Power Rating	MSA4 = 500mW MSA5 = 1W

MSA6

Size	MSA6 = 0.090" X 0.050" X 0.011" (±0.002")
Substrate	96% Alumina
Bond Pads	Wire Bondable, Ribbon Bondable, or Solderable
Attenuation	-1dB Through -20dB
Ranges	Consult Sales For 0.5dB Steps
Attenuation Accuracy	±0.5dB
Frequency Range	DC Through 10 GHz
Impedance	50Ω
Vswr	1.5:1 Max.
Power Rating	MSA6 = 125mW Higher power ratings available

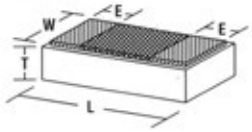
Other configurations and impedances are available

Thick film Jumpers

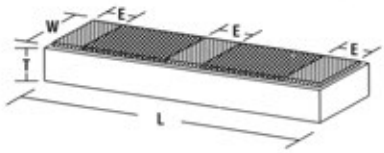
MINI-SYSTEMS, INC.

These glass insulated, "0-Ohm", gold jumpers are Ideally suited for providing interconnections and wiring crossovers in the fabrication of "chip and wire" type microelectronic modules. These jumpers allow for prototype and small quantity circuitry layouts without the need for special conductor patterns.

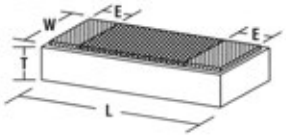
TJ JUMPER



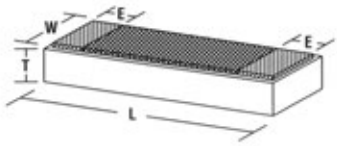
DJ JUMPER



J JUMPER



M JUMPER



Top Contact Series

Supbtrate:	96% Alumina *Other substrate materials available upon request*
Metallization:	Gold; 11 Microns Nominal; *Solder Optional*
Insulation:	Glass, 10 Microns Nominal
Maximum: Current	1.5 Amps

PART NUMBER DESIGNATION

EXAMPLE: TJ-JUMPER

0.045" X 0.017" X 0.011", Jumper, 0.020Ω Max Resistance

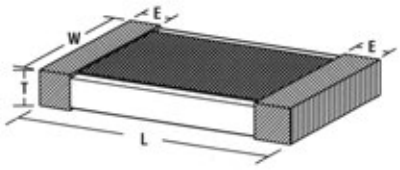
Style: TJ TJ, J, MJ, DJ

JUMPER

Style	Length Inches	Width Inches	Thick Inches	Pad Width Inches	Tolerance Inches	Resistance Max
TJ	0.045	0.017	0.011	0.010	±0.002	0.020 Ω
J	0.065	0.017	0.011	0.010	±0.002	0.025 Ω
MJ	0.100	0.017	0.011	0.015	±0.002	0.040 Ω
DJ	0.130	0.017	0.011	0.015[1]	±0.002	0.050 Ω

Custom sizes available
1. Center pad .010"

WRAP AROUND JUMPER



Wrap Around Series

Substrate:	96% Alumina *Other substrate materials available upon request*
Metallization:	Palladium Silver, Platinum Gold. *Untinned or solder over nickel barrier optinal.*
Insulation:	Glass
Maximum: Current	1.5 Amps
Maximum: Resistance	0.100Ω *Values to 0.01Ω available. Contact sales.* *Values dependant on mounting method*

Custom sizes available

PART NUMBER DESIGNATION

EXAMPLE: WAJ81PG-NS62TR

0.055" x 0.025" x 0.017", Pt Gold Term., Ni Barrier, Sn62 Solder, Tape & Reel

Style:	WAJ	WAJ = Wrap Around Jumper *Please reference WA & MSR Series* *Prefix G=RoHS*
Type:	81	See list below
Termination: Material *Base Metal*	PG	PG = Platinum Gold PS = Palladium Silver
Metal/Solder: Options	NS62	NS62 = Nickel, Sn62 NU = Nickel, Gold Plate S62 = Sn62 S305=Sn305 U = Untinned *No Solder*
Option:	TR	X = Special requirements *Available from sales agent* TR = Tape & Reel *Package in bulk if not specified*

All MSR and WA series resistors are available as jumpers

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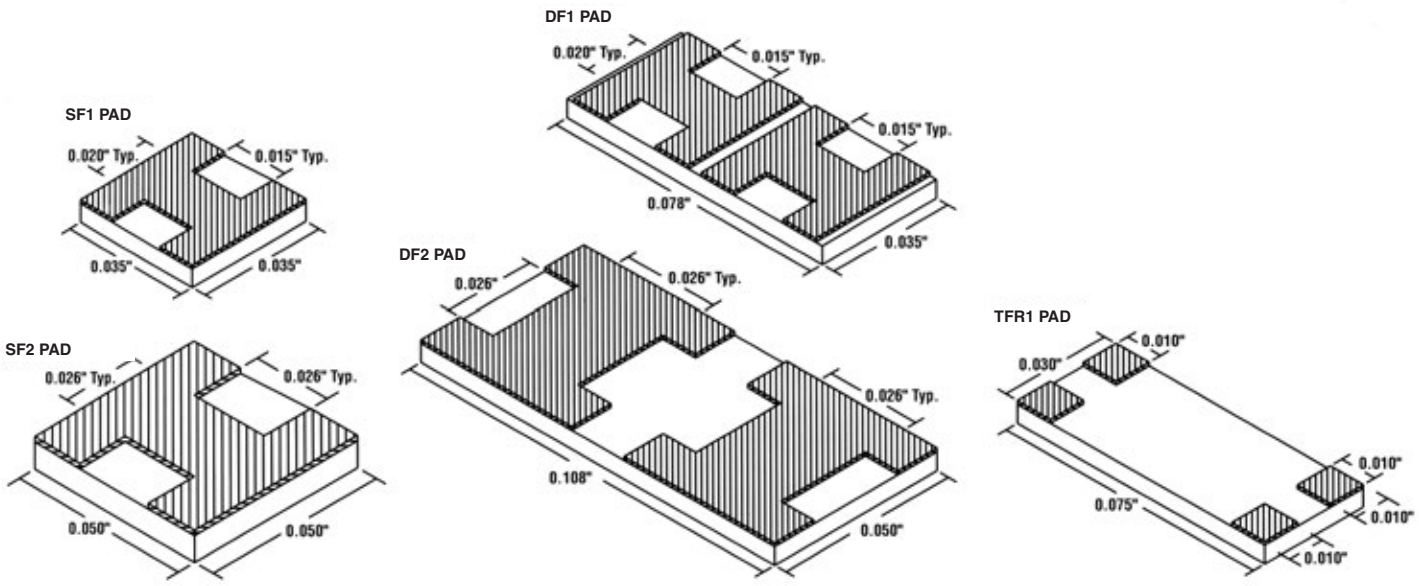
MINI-SYSTEMS, INC.

Mounting Pads and Kits



Gold Mounting Pads

Substrate: 96% Alumina
Tolerance: ±0.003"
On all dimensions

Custom configurations available

PART NUMBER DESIGNATION

EXAMPLE: DF1 PAD
0.078 x 0.035 Mounting Pad

Style: DF
DF = Dual
SF = Single
TFR *Type 1 only*

Type: 1
1 or 2

Option: X
X = Special requirements
Available from sales agent
Chip Trays *optional*
Packaged in bulk if no specified

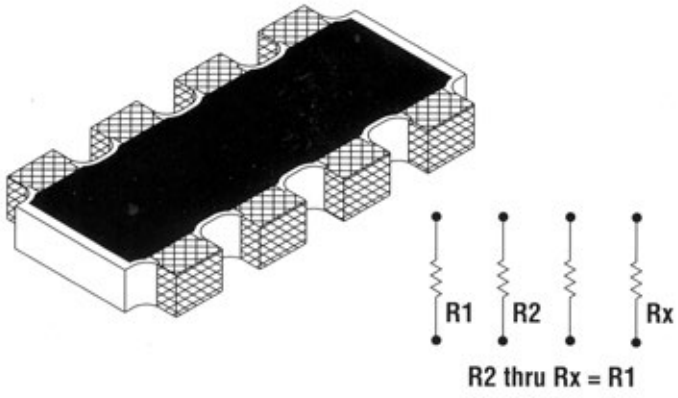
Jumper & Mounting Pad Kits

Jumper Kit: Contents
DJ Jumper = 70 pieces
J Jumper = 100 pieces
MJ Jumper = 100 pieces
TJ Jumper = 100 pieces

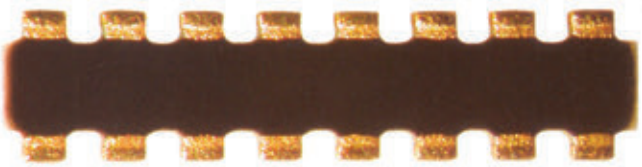
Combo Kit: Contents
DJ Jumper = 20 pieces
J Jumper = 35 pieces
MJ Jumper = 35 pieces
TJ Jumper = 35 pieces
SF1 Pad = 70 Pieces
DF1 Pad = 35 Pieces
DF2 Pad = 35 Pieces
TFR1 Pad = 35 Pieces

Surface Mount Resistor Networks

MINI-SYSTEMS, INC.



SMR Series of precision resistor networks for fine pitch, surface mount applications. These networks feature a lead pitch of (0.031") and are available in 4 to 16 pin-out styles. The standard value range is 2 Ω to 10 MΩ, isolated resistors. Custom configurations are available. Advanced processing techniques, including abrasively trimmed resistors, ensures maximum performance and stability.



PART NUMBER DESIGNATION

EXAMPLE: SMR8S-1001J-NS62TR

SMR Series, (8) 1 kΩ Resistors, ±5% Abs. Tol., Nickel, Sn62 Solder Tape & Reel

Style: SMR	Surface Mount Resistor
Type: 8	4, 6, 8, 10, 12, 14, 16
Termination: Material S *Base Metal*	Silver
Value: 1001 *Resistance Value*	1 KΩ *Four digits (xxxx) with provisions for five digits (xxxxx) if necessary. The first three digits represent significant figures.The last digit represents the number of zeros to follow. When fractional values of an ohm are required, the letter "R" is used as a decimal point.*
Tolerance: J	J = 5% K = 10% M = 20%
Termination: Finish SN62 *All come with Nickel*	NS60 = Nickel Barrier, Sn60 NS62 = Nickel Barrier, Sn62 NS63 = Nickel Barrier, Sn63 NS96 = Nickel barrier, Sn96 NI50 = Nickel Barrier, In50 NI75 = Nickel Barrier, In75 NU = Nickel, Gold Plate
Options: TR	TR = Tape and Reel *(Heat seal std)* *Pressure seal & Paper tape available* *Packaged in chip trays if not specified* X = *Special Requirements Code*

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MINI-SYSTEMS, INC.

Surface Mount Resistor Networks

Style	Type	Number of Resistors	Number of Pin-outs	Length Inches (mm)	Width Inches (mm)	Thickness Inches (mm)
SMR	4	2	4	0.064 ±0.005 (1.626 ±0.127)	0.063 ±0.005 (1.600 ±0.127)	0.020 ±0.005 (0.508 ±0.127)
	6	3	6	0.094 ±0.005 (2.388 ±0.127)	0.063 ±0.005 (1.600 ±0.127)	0.020 ±0.005 (1.508 ±0.127)
	8	4	8	0.126 ±0.005 (3.200 ±0.127)	0.063 ±0.005 (1.600 ±0.127)	0.020 ±0.005 (1.508 ±0.127)
	10	5	10	0.157 ±0.005 (3.988 ±0.127)	0.063 ±0.005 (1.600 ±0.127)	0.020 ±0.005 (1.508 ±0.127)
	12	6	12	0.189 ±0.005 (4.801 ±0.127)	0.063 ±0.005 (1.600 ±0.127)	0.020 ±0.005 (1.508 ±0.127)
	14	7	14	0.220 ±0.005 (5.588 ±0.127)	0.063 ±0.005 (1.600 ±0.127)	0.020 ±0.005 (1.508 ±0.127)
	16	8	16	0.252 ±0.005 (6.401 ±0.127)	0.063 ±0.005 (1.600 ±0.127)	0.020 ±0.005 (1.508 ±0.127)

Mechanical Data

Substrate: 96% Alumina

Optional marking and custom configurations available

Electrical Performance Characteristics

Test per MIL-PRF-55342	MSI Typical
Short Term Overload	±0.03%
High Temperature Exposure	±0.05%
Thermal Shock	±0.07%
Low Temperature Operation	±0.05%
Resistance to Bonding Exposure / Soldering Heat	±0.09%
Moisture Resistance	±0.06%
Stability (Life 70°C 2,000Hrs)	±0.04%
Stability (Life 70°C 10,000Hrs)	±0.07%

Electrical Data

Power Rating:	0.063 Watts per resister *($P = E^2/R$)*	
Voltage Rating:	40 Volts per Resistor	
TCR:	2 Ω to < 5 Ω:	±300ppm/°C
	5 Ω to < 100 KΩ:	±150ppm/°C
	100 KΩ to < 1 MΩ:	±200ppm/°C
	1 MΩ to < 10 MΩ	±300ppm/°C

MSIRP Reliability Program

MINI-SYSTEMS, INC.

The reliability assurance program will provide customers with real time data on similar resistor chip products. These products will be tested on a continuous basis and data will be accompanied by a certificate of conformance. The data will be displayed in a graphical representation and plotted against military standard criteria.

Samples Being Selected

- Samples are selected at random
- Samples are MSR or WA series parts styles RM0502,
- RM0505, RM1005, RM1505, RM2208, RM0705, RM1206,
- RM2010, RM2512, RM1010, RM0402, RM0603
- Substrate material is 96% Alumina (Al_2O_3)
- Data is also taken from parts that are currently
- being tested and meet the previous requirements

Applicable Military Standards

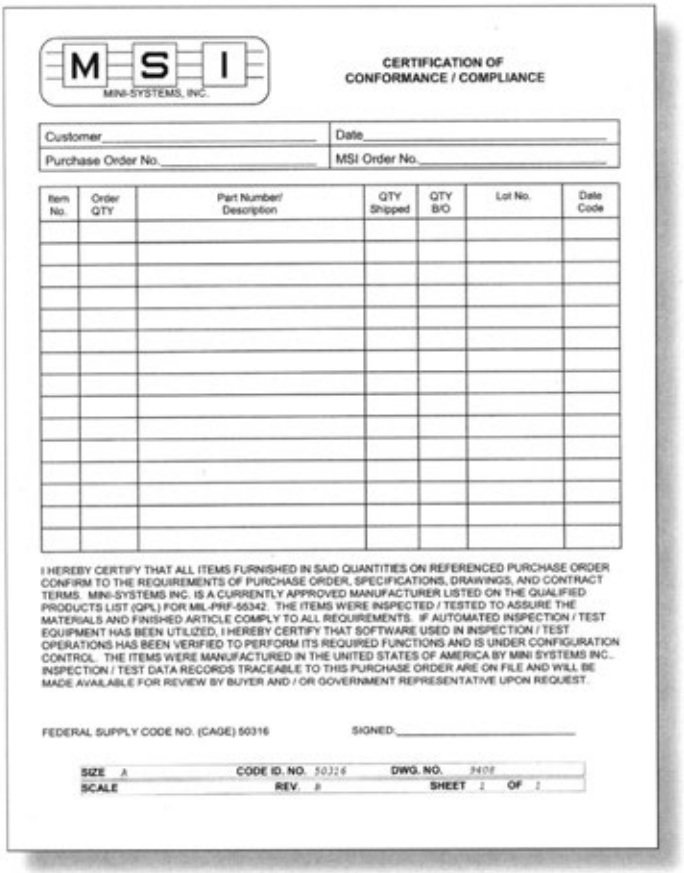
- MIL-PRF-55342, Characteristic "K"
- MIL-STD-202, Method 107 & 108

Tests Being Performed

- Life Test-style RM1005
  2000 Hours +72/-24 Hours@70°C ±5°C, 100mW
  ΔR Requirement ±0.5%
- Life Test-style RM1206
  2000 Hours +72/-24 Hours@70°C ±5°C, 250mW
  ΔR Requirement ±0.5%
- Thermal Shock Test
  5 Cycles 65°C +0/-10°C To 150°C +10/-0°C
  ΔR Requirement ±0.5%
- High Temperature Exposure
  100 Hours ±4 Hours At 150°C ±5°C
  ΔR Requirement ±0.5%

Data

- Data will be supplied with a certificate of conformance for orders that do not require additional quality conformance testing.
- Charts are updated and are available on the web page.



MINI-SYSTEMS, INC.

CERTIFICATION OF CONFORMANCE / COMPLIANCE

Customer _____ Date _____

Purchase Order No. _____ MSI Order No. _____

Item No.	Order QTY	Part Number/ Description	QTY Shipped	QTY B/O	Lot No.	Date Code

I HEREBY CERTIFY THAT ALL ITEMS FURNISHED IN SAID QUANTITIES ON REFERENCED PURCHASE ORDER CONFIRM TO THE REQUIREMENTS OF PURCHASE ORDER, SPECIFICATIONS, DRAWINGS, AND CONTRACT TERMS. MINI-SYSTEMS INC. IS A CURRENTLY APPROVED MANUFACTURER LISTED ON THE QUALIFIED PRODUCTS LIST (QPL) FOR MIL-PRF-55342. THE ITEMS WERE INSPECTED / TESTED TO ASSURE THE MATERIALS AND FINISHED ARTICLE COMPLY TO ALL REQUIREMENTS. IF AUTOMATED INSPECTION / TEST EQUIPMENT HAS BEEN UTILIZED, I HEREBY CERTIFY THAT SOFTWARE USED IN INSPECTION / TEST OPERATIONS HAS BEEN VERIFIED TO PERFORM ITS REQUIRED FUNCTIONS AND IS UNDER CONFIGURATION CONTROL. THE ITEMS WERE MANUFACTURED IN THE UNITED STATES OF AMERICA BY MINI SYSTEMS INC.. INSPECTION / TEST DATA RECORDS TRACEABLE TO THIS PURCHASE ORDER ARE ON FILE AND WILL BE MADE AVAILABLE FOR REVIEW BY BUYER AND / OR GOVERNMENT REPRESENTATIVE UPON REQUEST.

FEDERAL SUPPLY CODE NO. (CAGE) 50316 SIGNED: _____

SIZE A CODE ID. NO. 50316 DWG. NO. 3408

SCALE REV. B SHEET 1 OF 1

Front page of a typical Certificate of Conformance, *Signed by the Q.A. Manager*
Custom layouts available with alternate information available by request

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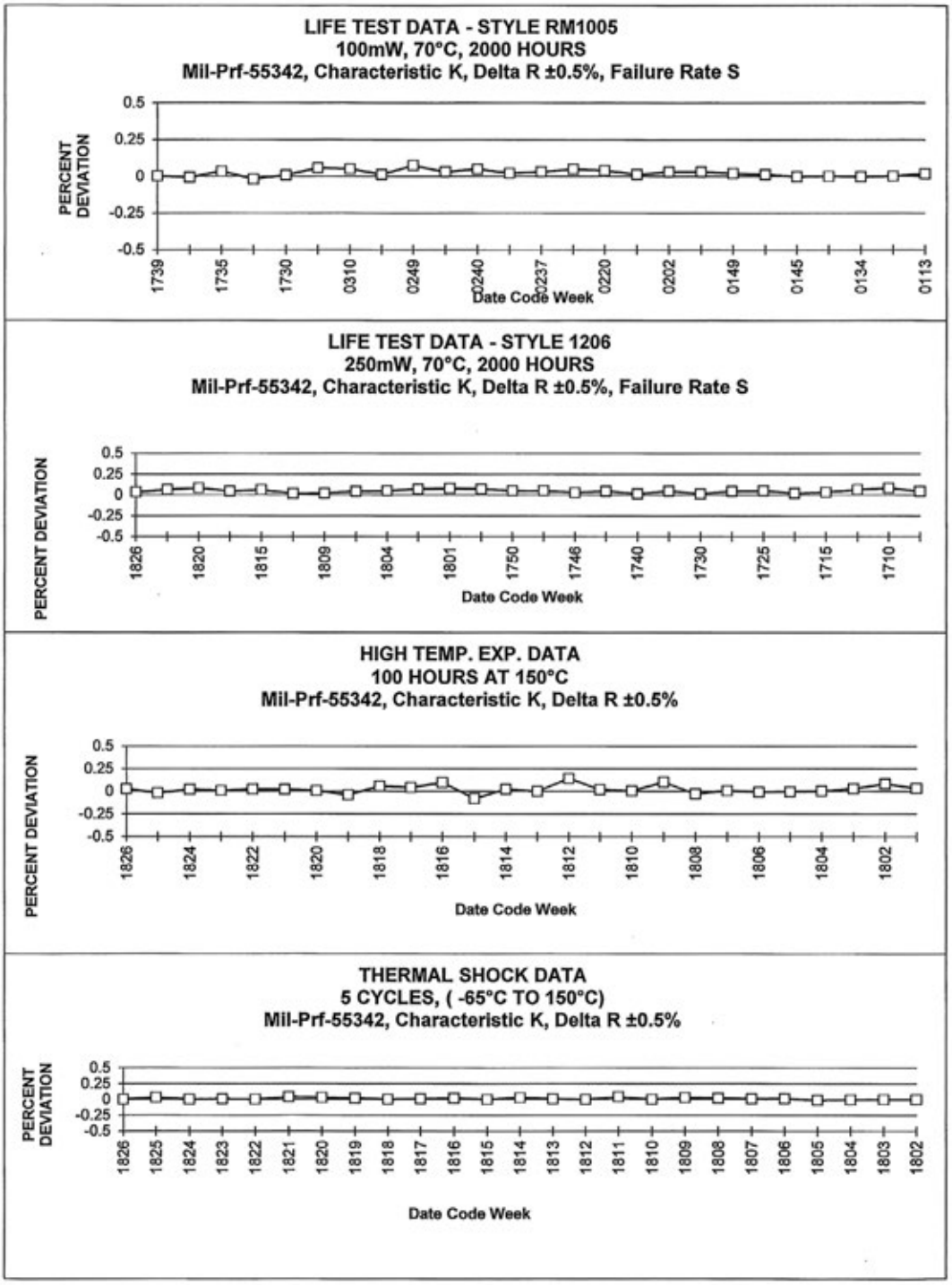
MSIRP Reliablility Program



Back page of a Certificate of Conformance, containing data on Thick Film resistor products.
Data is continuously updated, and referenced by date code, so that the most recent point is placed at the beginning of the graph

For more information contact the
MSI Thick Film Quality Assurance Department

Thick Film Process Capabilities

MINI-SYSTEMS, INC.

Thick Film Products

Wrap Around Resistors

Our five sided wrap around with a double layer termination hermetically seals in the sensitive resistor/conductor interface. This unique construction allows for easier wire bonding and electrical probing. By coupling this multilayer construction with the superior five sided termination, and abrasive trimming, results in a quality product that has higher chip to board adhesion, higher power dissipation, better stability and longer life.

Half Wrap Resistors

MSR Resistors

Top gold pads for wire bonding or solderable top pads for flip chip applications

QPL Approved Products

Approved to all MIL-PRF-55342 style parts
Qualified to "S" Life Failure Rate
Qualified to "T" Space Level

"T" and "PI" Attenuators

Low loss attenuators

Chip Jumpers (Wrap Around & MSR styles)

Ideally suited for interconnections and wiring crossovers

Mounting Pads

Gold pads on ceramic

Jumper Kits and Combo Kits

Surface Mount Resistor Networks

Applications

- High Reliability Microelectronics
- Military
- Biotelemetry
- Surface Mount
- Navigation
- Hybrid
- Communications
- Cryogenics
- Medical Implantable
- Space
- Microwave
- Sensors
- Research
- Wireless
- MCM's
- Custom

Metallizations

- Platinum Gold
- Platinum Gold with Nickel barrier and Gold plate
- Platinum Gold with Nickel barrier and solder
- Palladium Silver
- Palladium Silver with Nickel barrier and Gold plate
- Palladium Silver with Nickel barrier and solder
- Gold
- Silver

Substrates

- 96% Alumina substrates
- Also available; black ceramic and beo

Testing Short time overload

- Resistance to bonding exposure
- Resistance to soldering heat
- Thermal shock
- Temperature cycling
- Moisture resistance
- Low temperature operation
- High temperature exposure
- Solderability testing
- Die shear
- End cap pull
- Matching and tracking
- Temperature coefficient of resistance (TCR)
- Voltage coefficient of resistance (VCR)
- Life and extended life testing
- Adhesion, solder mounting integrity
- Power burn-in
- Bondability and wire bond integrity testing
- Steam aging
- Constant acceleration
- Cross sectional analysis
- Resistor noise testing
- Data logging of DC resistance

E-mail: msithick@mini-systemsinc.com Web site: http://www.Mini-Systemsinc.com

MINI-SYSTEMS, INC.

Thick Film Process Capabilities

Equipment

Screen printing

Systems

Custom blended pastes

Substrate size – up to 4" x 6"

Line width definition

Resistor element geometry down to 0.007"

Conductor linewidths to 0.005

Screens

Sizes up to 8" x 12"

Firing

- Belt furnaces

Trimming

- Computer controlled abrasive trimmers
- Trim tolerances to 0.1%
- Values from 20 mΩ to 100 GΩ

Separation

- Full automatic dicing saws
- Laser machining available

Die handling and sorting

- Automatic and semiautomatic tape to waffle pack die pickers
- Tape and reel
- Wave soldering system
- Automatic end metallization system

QA Systems

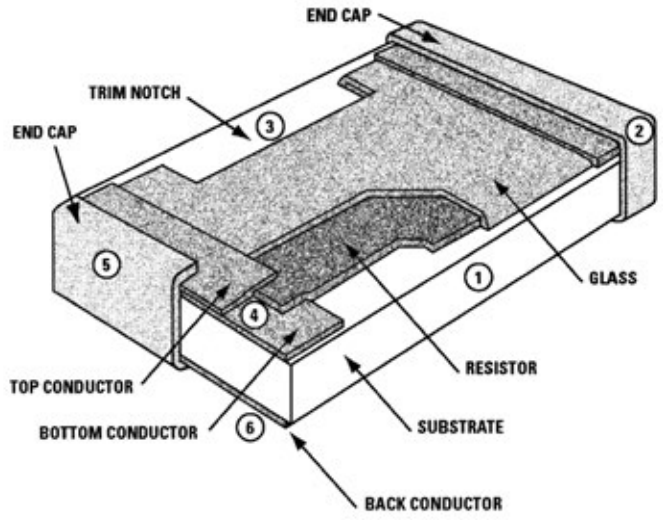
- 100% Visual per MIL-STD-883, Method 2032
- 100% DC resistance per MIL-STD-202
- Complete MIL-PRF-55342 testing capabilities
- Element evaluation per MIL-PRF-38534, class H and K
- Cross sectional analysis
- Surface mount reflow soldering
- Customer selected

Engineering systems

- Autocad design, file formats handled includes DXF, DWG
- Comprehensive design review and testing

Construction of MSI Precision Chip Resistors

MINI-SYSTEMS, INC.



ANATOMY OF A HIGH RELIABILITY THICK FILM CHIP RESISTOR

To illustrate Mini-Systems approach, the following design and fabrication considerations are used for WA, MSR, and QPL series resistors in our thick film processes to maximize the components performance in:

1. Automated Electronic Assembly

Diamond saw die separation tightly controls the resistor's dimensional tolerances, thus improving pick and place assembly by reducing components misplacement and resets.

2. Surface Mount Adhesion

The unique, (5) sided construction of the wrap around termination maximizes component to board solder adhesion in a way that minimizes component tombstoning.

3. Electrical Performance

The fine nozzle, sand blasting method of abrasively trimming resistors results in a component that has lower noise, better short and long term stability, better resistance to voltage pulses, and improved power handling characteristics than a LASER trimmed component.

4. Bondability

All resistors are fabricated with the resistor film sandwiched between a bottom conductor and a top conductor termination. This construction exposes the maximum bond pad area for multiple wire bonds, automated wire bonding and solder coverage. Also inherent to this design is better long term stability, and power handling. Five separate screenings of each part give a consistent and unique advantage.

5. Solderability

Hot solder dip tinning for optimum shelf life and best solder wetting.

6. Chip Attach

Precisely screened-on backside conductors provide a uniform clear space and prevents shorting.

7. Reliability and Testing

Processed materials are continuously tested for mechanical and electrical performance parameters to MIL-PRF55342. Our current DLA failure rating is "S" which represents more than (91) million hours of life testing without a failure.

8. Stray Capacitance

Minimized and consistent by controlled dimensions imparted by (5) precise screenings.

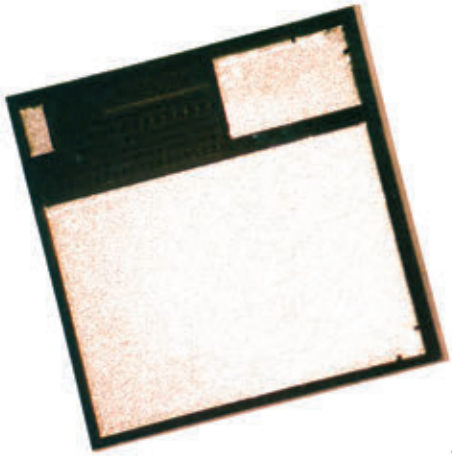
E-mail: msithick@mini-systemsinc.com Web site: http://www.Mini-Systemsinc.com

MINI-SYSTEMS, INC.

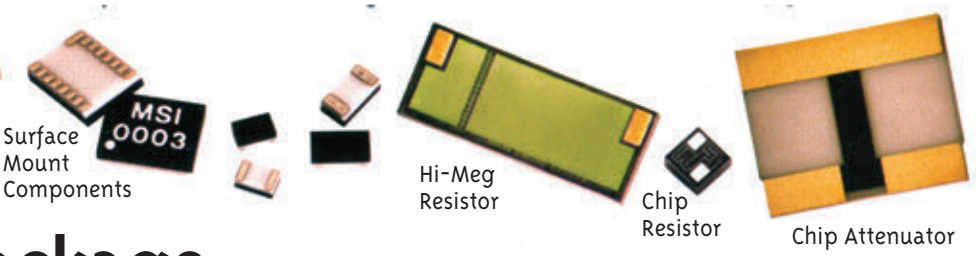
Thin Film

ISO 9001 Certified

- Precision Thin Film Chip Resistors and Networks, TCRs to ±5ppm
- Microwave Resistors, Terminations, Attenuators, and Capacitors
- Single, Binary, RC, and Networks MOS Capacitors
- Surface Mount, Packaged and Wire Bondable Configurations



RC Network



Surface Mount Components

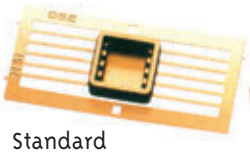
Hi-Meg Resistor

Chip Resistor

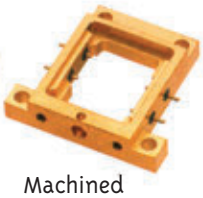
Chip Attenuator

Electronic Package

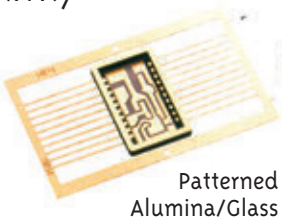
- Hermetic Packages — The "ULTIMATE" Device Protection
- High Performance, Alumina / Glass Walled Flat Packs
- Plug-in Surface Mount Configurations
- Microwave Packages, Precision Machined Metal Package
- Power, Custom, and TO-8 Package
- Superior Thermal Conductivity



Standard Alumina/Glass Flatpack

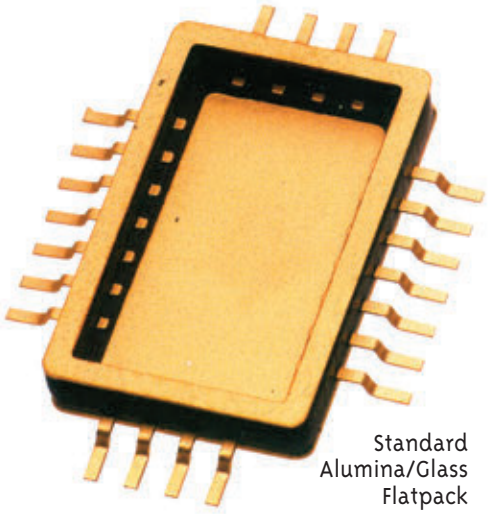


Machined Housing



Patterned Alumina/Glass Flatpack

Metal Plug-In



Standard Alumina/Glass Flatpack

MINI-SYSTEMS, INC.

For more product information
and technival assistance,
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Thick Film Division

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