

# BACK CONTACT CHIP RESISTORS



## SINGLE RESISTOR BACK CONTACT SERIES

CASE SIZE	STYLE EMSBC	DIMENSIONS			RESISTANCE RANGE			POWER RATING <sup>1</sup>
		L (±0.003") [±0.076mm]	W (±0.003") [±0.076mm]	T (±0.002") [±0.051mm]	MIN	MAX OPT TCR ±100ppm/°C	MAX STD TCR ±150ppm/°C	
0201	21	0.020" [0.508]	0.010" [0.254]	0.006" [0.152]	5Ω	60kΩ	300kΩ	50mW
0202	1	0.015" [0.381]	0.015" [0.381]	0.010" [0.254]	5Ω	200kΩ	1MΩ	50mW
0202	122	0.020" [0.508]	0.016" [0.406]	0.010" [0.254]	5Ω	200kΩ	1MΩ	125mW
0202	2	0.020" [0.508]	0.020" [0.508]	0.010" [0.254]	5Ω	320kΩ	1.6MΩ	250mW
0302	32	0.030" [0.762]	0.020" [0.508]	0.010" [0.254]	5Ω	400kΩ	2MΩ	250mW
0303	3	0.030" [0.762]	0.030" [0.762]	0.010" [0.254]	5Ω	800kΩ	4MΩ	250mW
0402	110	0.037" [0.940]	0.017" [0.432]	0.010" [0.254]	5Ω	600kΩ	3MΩ	125mW
0404	35	0.035" [0.889]	0.035" [0.889]	0.010" [0.254]	5Ω	1.3MΩ	6.5MΩ	250mW
0404	4	0.040" [1.060]	0.040" [1.060]	0.010" [0.254]	10Ω	2.4MΩ	11MΩ	350mW
0502	115	0.050" [1.270]	0.025" [0.635]	0.010" [0.254]	5Ω	1.3MΩ	6.5MΩ	250mW
0505	112	0.050" [1.270]	0.050" [1.270]	0.010" [0.254]	5Ω	2.8MΩ	14MΩ	500mW
0603	63	0.060" [1.524]	0.030" [0.762]	0.010" [0.254]	5Ω	2.4MΩ	11MΩ	500mW
0606	6	0.060" [1.524]	0.060" [1.524]	0.010" [0.254]	20Ω	8MΩ	40MΩ	500mW
1005	120	0.100" [2.540]	0.050" [1.270]	0.010" [0.254]	5Ω	9MΩ	45MΩ	500mW
1010	121	0.100" [2.540]	0.100" [2.540]	0.010" [0.254]	10Ω	14MΩ	70MΩ	750mW
1206	126	0.126" [3.200]	0.063" [1.524]	0.010" [0.254]	10Ω	10MΩ	50MΩ	750mW

MSBC2 will continue to be available, size and characteristics match EMSBC2. Available with aluminum bond pads only

<sup>1</sup> Power Rating at 70°C Derated Linearly to 0% at 150°C

<sup>2</sup> Consult Engineering if lower valued resistors are required

## DUAL RESISTOR BACK CONTACT SERIES

Case Size	STYLE DRBC	DIMENSIONS			RESISTANCE RANGE <sup>2</sup> Per Resistor			POWER RATING <sup>1</sup> Per Resistor
		L (±0.003") [±0.076mm]	W (±0.003") [±0.076mm]	T (±0.002") [±0.051mm]	MIN	MAX OPT TCR ±100ppm/°C	MAX STD TCR ±150ppm/°C	
0303	3	0.030" [0.762]	0.030" [0.762]	0.010" [0.254]	5Ω	400kΩ	2MΩ	125mW
0404	4	0.040" [1.060]	0.040" [1.060]	0.010" [0.254]	5Ω	1.2MΩ	6MΩ	125mW

<sup>1</sup> Power Rating at 70°C Derated Linearly to 0% at 150°C

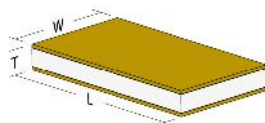
<sup>2</sup> Consult Engineering if lower valued resistors are required

## PERFORMANCE SPECIFICATIONS

PROPERTY	TEST CONDITION	REQUIRED LIMITS	MSI TYPICAL LIMITS
SHORT TERM OVERLOAD	2.5xWVDC(6.25xRATED POWER)MIL-PRF-55342, +25°C, 5 SEC	±0.25 MAX ΔR/R	±0.10 MAX ΔR/R
HIGH TEMP EXPOSURE	+150°C, 100HRS	±0.20 MAX ΔR/R	±0.03 MAX ΔR/R
THERMAL SHOCK	MIL-STD 202, METHOD 107	±0.25 MAX ΔR/R	±0.10 MAX ΔR/R
MOISTURE RESISTANCE	MIL-STD 202, METHOD 106	±0.40 MAX ΔR/R	±0.10 MAX ΔR/R
STABILITY	MIL-STD 202 METHOD 108, 2000 HRS, +70°C, RATED POWER	±0.50 MAX ΔR/R	±0.10 MAX ΔR/R

All EMSBC, DRBC Series parts are produced on the same manufacturing line using the same materials and processes as parts manufactured to MIL-PRF-55342

# THIN FILM JUMPERS



## MSJC SERIES

Mini-Systems, Inc. **MSJC Series Chip Jumpers** are ideal for use as zero ohm jumpers, bonding islands, and stand-offs for specific applications. Available in a variety of standard, as well as custom sizes for your applications.

### MSJC SERIES

CASE SIZE	TYPE	DIMENSIONS			MAX RESISTANCE (mΩ)
		L (±0.003") [±0.076mm]	W (±0.003") [±0.076mm]	T (±0.003") [±0.076mm]	
0101	1	0.010" [0.254]	0.010" [0.254]	0.005" [0.152]	10
0201	21	0.020" [0.508]	0.010" [0.254]	0.005" [0.152]	20
0202	2	0.020" [0.508]	0.020" [0.508]	0.010" [0.254]	10
0303	3	0.030" [0.762]	0.030" [0.762]	0.010" [0.254]	10
0303	35	0.035" [0.889]	0.035" [0.889]	0.010" [0.254]	10
0404	4	0.040" [1.060]	0.040" [1.060]	0.010" [0.254]	10
0505	5	0.050" [1.270]	0.050" [1.270]	0.010" [0.254]	10
0805	75	0.075" [1.905]	0.050" [0.889]	0.010" [0.254]	15
1010	10	0.100" [2.540]	0.100" [2.540]	0.010" [0.254]	10

CUSTOM SIZES AVAILABLE, CONSULT SALES

### GENERAL CHARACTERISTICS

Substrate Materials	99.6% Alumina, other substrate materials available upon request
Metallization	Gold
Available Thickness	0.005" 0.010" 0.015" 0.020" 0.025"
Resistance	10 Milliohms per square, typical

### MSJC PART NUMBER DESIGNATION

MSJC	—	10	—	AT	—	GB10
STYLE		TYPE		MATERIAL		OPTION
MSJC		See Table		AT = Alumina Substrate		G = One Side Gold GB = Gold Back 5 = 0.005" Thick 10 = 0.010" Thick 15 = 0.015" Thick 20 = 0.020" Thick 25 = 0.025" Thick

#### EXAMPLE: MSJC-10-AT-GB10

MSJC-10, 0.100" x 0.100", 0.010" Thick Alumina with Gold Back



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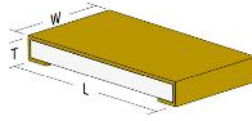
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8041 Rev. A

# THIN FILM JUMPERS



## WAJC SERIES

Mini-Systems, Inc. **WAJC Series Chip Jumpers** with nickel barrier are ideal for use as zero ohm jumpers, bonding islands, and stand-offs for specific applications. Available in a variety of standard, as well as custom sizes for your applications.

### WAJC SERIES

CASE SIZE	TYPE	DIMENSIONS			MAX RESISTANCE (mΩ)
		L (±0.003") [±0.076mm]	W (±0.003") [±0.076mm]	T <sup>1</sup> (±0.003") [±0.076mm]	
0201	21	0.020" [0.508]	0.010" [0.254]	0.005" [0.127]	20
0202	7	0.020" [0.508]	0.020" [0.508]	0.010" [0.254]	10
0402	1	0.040" [1.016]	0.020" [0.508]	0.010" [0.254]	20
0404	2	0.035" [0.889]	0.035" [0.889]	0.010" [0.254]	10
0502	8	0.055" [1.397]	0.025" [0.635]	0.010" [0.254]	20
0505	4	0.050" [1.270]	0.050" [1.270]	0.010" [0.254]	10
0805	3	0.075" [1.905]	0.050" [1.270]	0.010" [0.254]	15
1005	6	0.100" [2.540]	0.050" [1.270]	0.010" [0.254]	20
1206	5	0.126" [3.200]	0.063" [1.600]	0.010" [0.254]	20
1505	9	0.153" [3.886]	0.050" [1.270]	0.010" [0.254]	30

<sup>1</sup> Thickness does not include solder  
CUSTOM SIZES AVAILABLE, CONSULT SALES

### GENERAL CHARACTERISTICS

Substrate Material	99.6% Alumina, other substrate materials available upon request
Metallization	(NU) Solderable Au w/ Ni barrier; (NT) Nickel with Solder
Available Thickness <sup>1</sup>	0.005", 0.010", 0.015", 0.020", 0.025"
Resistance	10 Milliohms per square, typical

<sup>1</sup> Thickness does not include solder

### WAJC PART NUMBER DESIGNATION

WAJC	6	AT	NT10
STYLE	TYPE	MATERIAL	OPTION
WAJC	See Table	AT = Alumina Substrate	NU = Solderable Au w/ Ni barrier NT = Nickel with Sn62 Solder NT3 = Nickel with SAC305 Solder 5 = 0.005" Thick 10 = 0.010" Thick 15 = 0.015" Thick 20 = 0.020" Thick 25 = 0.025" Thick

EXAMPLE: WAJC-6-AT-NT10

WAJC-6, 0.100" x 0.100", 0.010" Thick Alumina Wraparound



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# THIN FILM ATTENUATORS

## GENERAL CHARACTERISTICS

Resistor Material	Tantalum Nitride, NiChrome		
Bond Pads	Gold Pads, Wire or Ribbon Bondable		
Backside Surface	Bare Substrate (Standard), Gold (Optional)		
Attenuation Ranges	0dB Through -24dB; (0.5dB Steps Available)		
DC Attenuation Tolerance	±0.1dB (-0.5dB to -6dB), ±0.2dB (-0.5dB to -24dB)		
Impedance	50Ω		
Frequency Range	DC Through 40 GHz		
Current Noise	-20dB Typical		
Operating Temperature	-55°C to +150°C		
Storage Temperature	-65°C to +150°C		
VSWR <sup>1</sup>	DC to 10GHz	10GHz to 20GHz	20GHz to 40GHz
	1.2:1	1.3:1	1.5:1

<sup>1</sup> Achieving operating characteristics is dependent on attachment methods in order to minimize parasitics

## SUBSTRATE CHARACTERISTICS

SUBSTRATE MATERIAL	Dielectric Constant @ 1MHz	Thermal Conductivity W/m•K
99.6% Alumina	9.9	28
Quartz (Fused Silica)	3.75	1.3
Beryllium Oxide	6.7	300
Aluminum Nitride <sup>2</sup>	9.0	140 - 177

<sup>2</sup> Discrete Elements Only

## RESISTOR CHARACTERISTICS

RESISTOR FILM	Passivation	Standard TCR	TCR Optional To
Tantalum Nitride	Ta <sub>2</sub> O <sub>5</sub> (Self Passivating)	±150 ppm/°C	-----
NiChrome	SiO <sub>2</sub>	±25 ppm/°C	±5 ppm/°C

## PART NUMBER DESIGNATION

MSAT	—	21	—	A	—	T	—	5dB	—	G	—	G
STYLE		TYPE		SUBSTRATE		RESISTOR FILM		dB		TOLERANCE		OPTION
MSAT		SEE TABLE		A = Alumina B = BeO N = AlN <sup>3</sup> Q = Quartz		T = Tantalum Nitride N = NiChrome		0dB-24dB		F = ±0.1dB G = ±0.2dB		C = ±10ppm/°C D = ±5ppm/°C G = Wire Bondable Gold GB = Gold Back TR = Tape & Reel

**EXAMPLE: MSAT-21-AT - 5DBG - G**  
MSAT-21 Series, Alumina, Tantalum Nitride, 5dB, ±0.2dB, Wire Bondable Gold

<sup>3</sup> AlN Substrate is not available on Lumped Element Attenuators



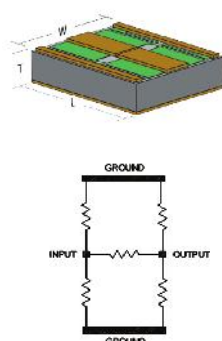
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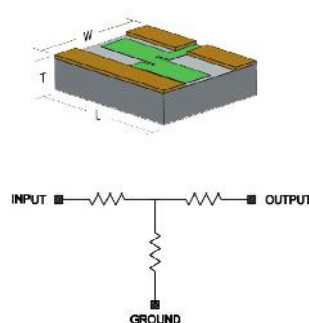
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# TOP CONTACT THIN FILM ATTENUATORS

MSAT 1



MSAT 5, 21



Mini-Systems, Inc. **MSAT** series discrete element Thin Film **chip attenuators** provide the design engineer with attenuators that are very accurate over operating frequencies from **DC through 40 GHz**. They offer the **low noise, low stray capacitance and tight tolerance** of Mini-Systems, Inc. Thin Film materials in compact sizes that make them ideal for applications where small footprints are required. MSAT series is offered in balanced pi or T-type styles.

## MSAT SERIES

CASE SIZE	TYPE	LAYOUT	DIMENSIONS			POWER RATING <sup>1</sup>				ATTENUATOR TYPE	ELEMENT TYPE
			L (±0.003") [±0.076mm]	W (±0.003") [±0.076mm]	T (±0.003") [±0.076mm]	Quartz	Al <sub>2</sub> O <sub>3</sub>	AlN	BeO		
0806	21	Top Contact	0.077" [1.956]	0.061" [1.549]	0.015" [0.381]	50 mW	250 mW	Not Available	2 W	T	Lumped
1008	1	Top Contact	0.100" [2.540]	0.080" [2.032]	0.010" [0.254]	25 mW	125 mW	500 mW	1 W	Pi	Discrete
1512	5	Top Contact	0.148" [3.759]	0.122" [3.099]	0.025" [0.635]	400 mW	2 W	Not Available	8 W	T	Lumped

<sup>1</sup> Power Rating at 70°C Derated Linearly to 0% at 150°C

## PERFORMANCE SPECIFICATIONS

PROPERTY	TEST CONDITION	REQUIRED LIMITS	MSI TYPICAL LIMITS
HIGH TEMP EXPOSURE	+150°C, 100HRS	±0.20 MAX ΔR/R	±0.03 MAX ΔR/R
THERMAL SHOCK	MIL-STD 202, METHOD 107	±0.25 MAX ΔR/R	±0.10 MAX ΔR/R
STABILITY	MIL-STD 202 METHOD 108, 2000 HRS, +70°C, RATED POWER	±0.50 MAX ΔR/R	±0.10 MAX ΔR/R

All MSAT Series parts are produced on the same manufacturing line using the same materials and processes as parts manufactured to MIL-PRF-55342



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# THIN FILM ATTENUATORS

## GENERAL CHARACTERISTICS

Resistor Material	Tantalum Nitride, NiChrome		
Bond Pads	(NU) Solderable Gold with Nickel Barrier, (NT) Nickel with Solder		
Attenuation Ranges	0dB Through -24dB; (0.5dB Steps Available)		
DC Attenuation Accuracy	$\pm 0.1\text{dB}$ (-0.5dB to -6dB), $\pm 0.2\text{dB}$ (-0.5dB to -24dB)		
Impedance	50 $\Omega$		
Frequency Range	DC Through 40 GHz		
Current Noise	-20dB Typical		
Operating Temperature	-55°C to +150°C		
Storage Temperature	-65°C to +150°C		
VSWR <sup>1</sup>	DC to 10GHz	10GHz to 20GHz	20GHz to 40GHz
	1.2:1	1.3:1	1.5:1

<sup>1</sup> Achieving operating characteristics is dependent on attachment methods in order to minimize parasitics

## SUBSTRATE CHARACTERISTICS

SUBSTRATE MATERIAL	Dielectric Constant @ 1MHz	Thermal Conductivity W/m•K
99.6% Alumina	9.9	28
Beryllium Oxide <sup>1</sup>	6.7	300
Aluminum Nitride <sup>2</sup>	9.0	140 - 177

<sup>1</sup> Not Available on MSAT 3, 7, or 23

<sup>2</sup> Discrete Elements Only

## RESISTOR CHARACTERISTICS

RESISTOR FILM	Passivation	Standard TCR	TCR Optional To
Tantalum Nitride	Ta <sub>2</sub> O <sub>5</sub> (Self Passivating)	$\pm 150\text{ ppm}/^\circ\text{C}$	-----
NiChrome	SiO <sub>2</sub>	$\pm 25\text{ ppm}/^\circ\text{C}$	$\pm 5\text{ ppm}/^\circ\text{C}$

## PART NUMBER DESIGNATION

MSAT	—	23	—	A	—	T	—	5dB	—	G	—	NT
STYLE		TYPE		SUBSTRATE		RESISTOR FILM		dB		TOLERANCE		OPTION
MSAT		SEE TABLE		A = Alumina B = BeO <sup>3</sup> N = AlN <sup>4</sup>		T = Tantalum Nitride N = NiChrome		0dB-24dB		F = $\pm 0.1\text{dB}$ G = $\pm 0.2\text{dB}$		C = $\pm 10\text{ppm}/^\circ\text{C}$ D = $\pm 5\text{ppm}/^\circ\text{C}$ NU = Solderable Au w/ Ni Barrier NT = Nickel w/Sn62 Solder NT3= Nickel w/SAC305 Solder TR = Tape & Reel

EXAMPLE: MSAT-23-AT - 5DBG - NT

MSAT-23 Series, Alumina, Tantalum Nitride, 5dB,  $\pm 0.2\text{dB}$ , Nickel w/Sn62 Solder

<sup>3</sup> BeO Substrate is not available on MSAT 3, 7, or 23

<sup>4</sup> AlN Substrate is not available on Lumped Element Attenuators



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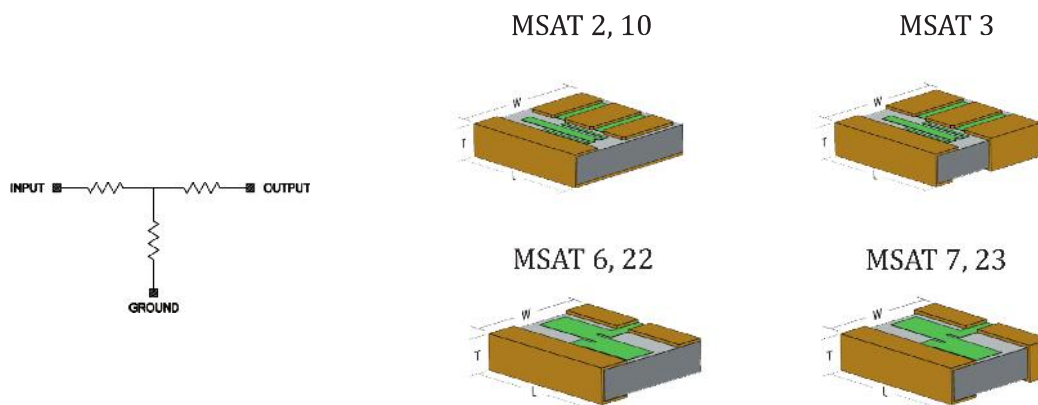
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# SURFACE MOUNT THIN FILM ATTENUATORS



Mini-Systems, Inc. **MSAT** series discrete element Thin Film **chip attenuators** provide the design engineer with attenuators that are very accurate over operating frequencies from **DC through 40 GHz**. They offer the **low noise, low stray capacitance and tight tolerance** of Mini-Systems, Inc. Thin Film materials in compact sizes that make them ideal for applications where small footprints are required.

## MSAT SERIES

CASE SIZE	TYPE	LAYOUT	DIMENSIONS			POWER RATINGS <sup>1</sup>			ATTENUATOR TYPE	ELEMENT TYPE
			L (±0.003") [±0.076mm]	W (±0.003") [±0.076mm]	T <sup>2</sup> (±0.003") [±0.076mm]	Al <sub>2</sub> O <sub>3</sub>	AlN	BeO		
0505	2	Half Wrap	0.050" [1.270]	0.050" [1.270]	0.020" [0.508]	250 mW	1 W	2 W	T	Discrete
0505	3	Surface Mount	0.050" [1.270]	0.050" [1.270]	0.020" [0.508]	250 mW	1 W	Not Available	T	Discrete
0505	10	Half Wrap	0.050" [1.270]	0.050" [1.270]	0.010" [0.254]	250 mW	1 W	2 W	T	Discrete
0806	22	Half Wrap	0.077" [1.956]	0.061" [1.549]	0.015" [0.381]	250 mW	Not Available	2 W	T	Lumped
0806	23	Surface Mount	0.077" [1.956]	0.061" [1.549]	0.015" [0.381]	250 mW	Not Available	Not Available	T	Lumped
1512	6	Half Wrap	0.148" [3.759]	0.122" [3.099]	0.025" [0.635]	2 W	Not Available	8 W	T	Lumped
1512	7	Surface Mount	0.148" [3.759]	0.122" [3.099]	0.025" [0.635]	2 W	Not Available	Not Available	T	Lumped

<sup>1</sup> Power Rating at 70°C Derated Linearly to 0% at 150°C

<sup>2</sup> Thickness does not include solder

## PERFORMANCE SPECIFICATIONS

PROPERTY	TEST CONDITION	REQUIRED LIMITS	MSI TYPICAL LIMITS
HIGH TEMP EXPOSURE	+150°C, 100HRS	±0.20 MAX ΔR/R	±0.03 MAX ΔR/R
THERMAL SHOCK	MIL-STD 202, METHOD 107	±0.25 MAX ΔR/R	±0.10 MAX ΔR/R
STABILITY	MIL-STD 202 METHOD 108, 2000 HRS, +70°C, RATED POWER	±0.50 MAX ΔR/R	±0.10 MAX ΔR/R

All MSAT Series parts are produced on the same manufacturing line using the same materials and processes as parts manufactured to MIL-PRF-55342



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