

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 ¹	DC to 10GHz	10GHz to 20GHz	20GHz to 40GHz
	1.2:1	1.3:1	1.5:1

¹ 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 ²	9.0	140 - 177

² Discrete Elements Only

RESISTOR CHARACTERISTICS

RESISTOR FILM	Passivation	Standard TCR	TCR Optional To
Tantalum Nitride	Ta ₂ O ₅ (Self Passivating)	±150 ppm/°C	-----
NiChrome	SiO ₂	±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 ³ 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

³ AlN Substrate is not available on Lumped Element Attenuators



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THIN FILM DIVISION

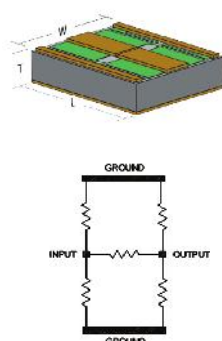
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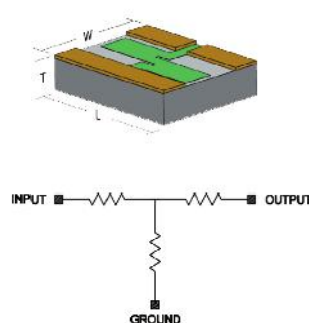
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TOP CONTACT THIN FILM ATTENUATORS

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 ¹				ATTENUATOR TYPE	ELEMENT TYPE
			L (±0.003") [±0.076mm]	W (±0.003") [±0.076mm]	T (±0.003") [±0.076mm]	Quartz	Al ₂ O ₃	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

¹ 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 Ω		
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 ¹	DC to 10GHz	10GHz to 20GHz	20GHz to 40GHz
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¹ 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 ¹	6.7	300
Aluminum Nitride ²	9.0	140 - 177

¹ Not Available on MSAT 3, 7, or 23

² Discrete Elements Only

RESISTOR CHARACTERISTICS

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

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 ³ N = AlN ⁴		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

³ BeO Substrate is not available on MSAT 3, 7, or 23

⁴ AlN Substrate is not available on Lumped Element Attenuators



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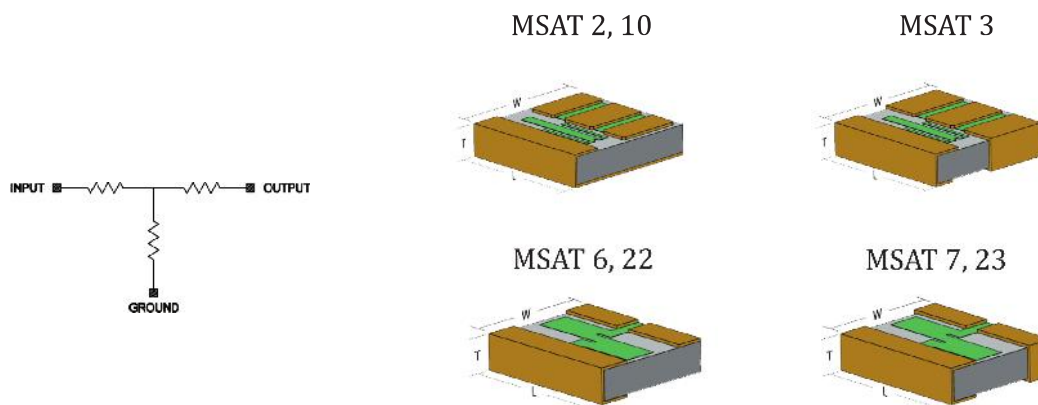
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SURFACE MOUNT THIN FILM ATTENUATORS



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MSAT SERIES

CASE SIZE	TYPE	LAYOUT	DIMENSIONS			POWER RATINGS ¹			ATTENUATOR TYPE	ELEMENT TYPE
			L (±0.003") [±0.076mm]	W (±0.003") [±0.076mm]	T ² (±0.003") [±0.076mm]	Al ₂ O ₃	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

¹ Power Rating at 70°C Derated Linearly to 0% at 150°C

² 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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