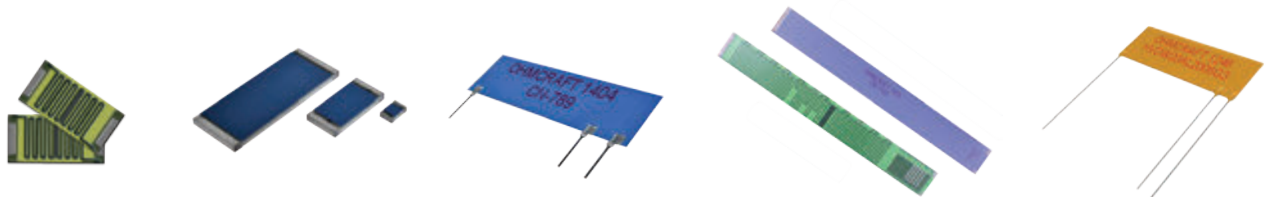


# Ohmcraft Resistors

Thick Film, High Voltage



Design to  
Production



EXXELIA 



## SELECTION GUIDE

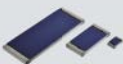



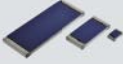
## Precision Resistors for Demanding Applications where Reliability is Essential

EXXELIA Ohmcraft's thick-film, surface mount resistors are engineered to meet application specific needs. **Common attributes for ALL EXXELIA Ohmcraft Resistors: High Stability, Low Noise, Low TCR, Low VCR & Custom Configurations.**




## GENERAL INFORMATION

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Lot Acceptance Testing (LAT)	5






## SURFACE MOUNT RESISTORS

T°	Series		Case Size	Voltage Rating	Resistance Values	Ratio Tolerances	Advantages	Note	Page
-55°C +150°C	<b>HVC Series</b> High Voltage Chip Resistors		0402 to 5020	Up to 5 kV	Up to 50 GΩ	to 0.1%	High Voltage	EXXELIA Ohmcraft's flagship high voltage chip series	8
	<b>HVCD Series</b> High Voltage Chip Dividers		3512 4020 5020	Up to 4 kV	Up to 10 GΩ	to 1%	Surface Mount Divider	Replaces larger leaded divider	10
	<b>SM Series</b> High Resistance Chip Resistors		0402 to 3512	Up to 600 V	Up to 50 GΩ	to 0.1%	Ultra High Resistance	Excellent for high gain amplifier circuit	12
	<b>MCH Series</b> Military Grade High Voltage Chip Resistors		0402 to 5020	Up to 5 kV	Up to 50 GΩ	to 0.1%	Military Grade Inspection	Optionally tested to MIL-PRF-55342 MIL-PRF-49462 NASA EEE-INST-002 (Level 1 & 2)	14
	<b>UHVC Series</b> Ultra High Voltage Chip Resistors		2010 to 5020	Up to 20 kV	Up to 50 GΩ	to 1%	Ultra High Voltage	The highest voltage ratings available in the WORLD	16

## PRECISION LEADED THROUGH HOLE RESISTORS

T°	Series		Case Size	Voltage Rating	Resistance Values	Ratio Tolerances	Advantages	Note	Page
-55°C +150°C	<b>HVR Series</b> High Voltage Radial Ledged Resistors		21 to 56	Up to 40 kV	Up to 4 TΩ	to 0.1%	High Voltage	High precision, thick-film radial through hole resistors	20
	<b>HVD Series</b> High Voltage Radial Ledged Dividers		04 to 50	Up to 50 kV	Up to 2 TΩ	to 0.1%	Excellent TCR Tracking	High precision, thick-film radial through hole resistor dividers	22
	<b>CN Series</b> Custom Ledged Resistor Networks		Custom	Up to 100 kV	Up to 2 GΩ	to 0.1%	Customized Solution	Wide range of customization options available	24

## EXXELIA OHMCRAFT APPLICATIONS

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 High-Performance Resistors For Precision <b>INSTRUMENTATION</b> Applications	28
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 High-Voltage Resistors For <b>POWER SUPPLIES</b>	34
 High Performance Resistors for <b>SPACE</b> Instrumentation	36

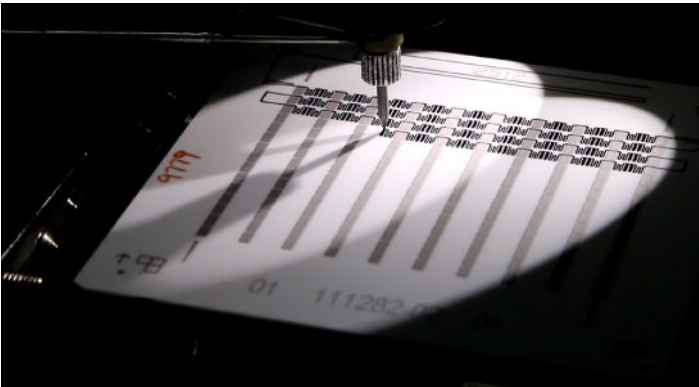
# GENERAL INFORMATION

As a leading division of Exxelia, Ohmcraft specializes in the **design and manufacturing of high-performance custom resistors** for a diverse range of industries (Medical, Test & Measurement, Power supply, Defense & Aerospace). With unparalleled expertise and a commitment to excellence, we engineer solutions that power cutting-edge technologies worldwide.

The Exxelia Micropen electronic printing system is the core technology for the design and manufacture of Exxelia Ohmcraft's complete line of resistors – chip resistors, flat leaded resistors, axial leaded resistors and custom resistive product solutions.

Our Direct Write Micropenning printing process grants our resistors with unique benefits :

- **Fine line widths with smooth edge**  
Extremely low noise
- **Long length resistor**  
Low VCR & High voltage
- **Precise thickness control**  
Low TCR



Our dedication to quality and reliability is reflected in every resistor we produce, tailored to meet the unique requirements of our clients. Backed by decades of experience, state-of-the-art facilities, and a passion for advancement, Exxelia Ohmcraft stands as a trusted partner in your pursuit of technological excellence.

Exxelia Ohmcraft's high-performance resistors enable **medical product designers** to continue to improve the quality of life of patients around the world. Our resistors are designed for a variety of products to be used in medical diagnosis, treatment, and prevention. From small, implantable, and non-invasive devices, to large diagnostic imaging equipment, Exxelia Ohmcraft resistors are chosen by medical manufacturers because the operating environments are high voltage and magnetic fields where accuracy and stability are paramount.

Our precision resistors are also able to achieve the precision and repeatability required by modern measurement and detection equipment.

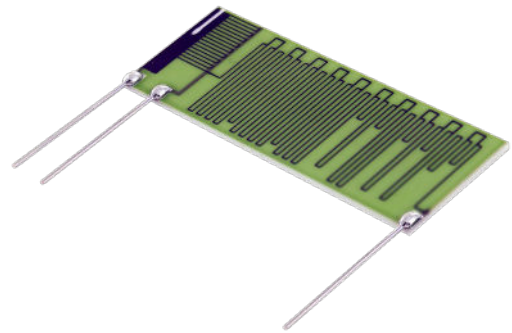
Our qualified engineering team works closely with industry leaders to produce the most advanced test equipment and instrumentation. Exxelia Ohmcraft's custom dividers, resistors, and networks provide a level of service and performance unmatched in the **instrumentation market**.

Exxelia Ohmcraft has been committed to supporting the high-voltage and precision needed by the **power supply industry**. We provide many market leaders with standard and custom products. Our surface mount resistors can withstand voltages up to 10kV and our leaded resistors are designed to operate up to 40kV.

Exxelia Ohmcraft has served markets in **electronic warfare, weapons platforms, force protection, and intelligence programs** for over two decades, reliably supporting a wide range of products, programs, and applications. Our custom resistors are designed to support the rigorous specifications required by military suppliers who depend on the precision and reliability of our products.

Exxelia Ohmcraft has served markets in **intelligence and space programs** for over two decades, reliably supporting a wide range of products, programs, and applications. Our custom resistors are designed to support the rigorous specifications required by space suppliers who depend on the precision and reliability of our products. Exxelia Ohmcraft is able to screen and qualify our resistors to the following specifications: MIL-PRF-55342, MIL-PRF-49462, NASA EEE-INST-002 (Level 1 & 2).

Discover how our resistors can elevate your applications and propel your innovations forward. Explore the precision-driven world of Exxelia Ohmcraft today.



# LOT ACCEPTANCE TESTING (LAT)

## ADVANTAGES

Lot Acceptance Testing provides screening and qualification tests to enable the use of Exxelia Ohmcraft's standard parts in flight applications (Aerospace/Space). Exxelia Ohmcraft can screen and qualify its resistor products to MIL-PRF-55342, MIL-PRF-49462, NASA EEE-INST-002 (Level 1 or Level 2) or a custom test plan. LAT Testing includes but is not limited to:

- Thermal Shock
- Power Conditioning
- High Temperature Exposure
- Solderability
- TCR
- Load Life
- Short Term Overload
- Terminal Strength
- Resistance to Solvents

## Electrical Specifications

<b>Value R</b>	R $\Omega$	Resistance Value in k $\Omega$ s, M $\Omega$ s, G $\Omega$ s, or T $\Omega$ s
<b>Tolerance</b>	$\pm$ X% at V	Resistance Tolerance measured at specified voltage
<b>TCR</b>	<p>&lt; [Ordering Coder TCR] ppm/<math>^{\circ}</math>C (Hot to Tmax<math>^{\circ}</math>C, Cold to Tmin<math>^{\circ}</math>C)</p> <p>&lt; 2*[Ordering Coder TCR] ppm/<math>^{\circ}</math>C (Hot to 125<math>^{\circ}</math>C, Cold to -55<math>^{\circ}</math>C)</p>	TCR referenced to 25 $^{\circ}$ C
<b>Working Voltage</b>	V	Voltage across the resistor during application operation
<b>Max Voltage Rating</b>	V	Maximum Voltage based on resistance value or case rating
<b>Max Power Rating</b>	W	Maximum Wattage based on resistance value or case rating

## Conformance Testing

Pre-Cap Visual Inspection

<b>Prior to Conformance Test</b>	13 pcs
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## Conformance Test – 100% Screening

<b>Visual Inspection</b> Magnification: 30x to 60x	100%
<b>Mechanical Inspection</b>	3 pcs. (min.)
<b>DC Resistance</b> Per MIL-STD-202, Method 303 Measured at specified test voltage for resistance tolerance	100%
<b>Thermal Shock</b> Per-MIL-STD-202. Method 107, Test Condition B (modified) 5 cycles (MIL-PRF-55342), 10 cycles (NASA level 2) or 25 cycles (NASA level 1)	100%
<b>High Temperature Exposure (SMT)</b> 100 hours at 125 $^{\circ}$ C	100%
<b>Power Conditioning (Leaded)</b> 100 hours at Working Voltage at 25 $^{\circ}$ C	100%
<b>Final DC Resistance</b> Measured at specified test voltage for resistance tolerance	100%

**Conformance PDA:** 5% (NASA Level 1 or MIL-PRF-55342), 10% (MIL-PRF-49462) or 15% (NASA Level 2)



# LOT ACCEPTANCE TESTING (LAT)

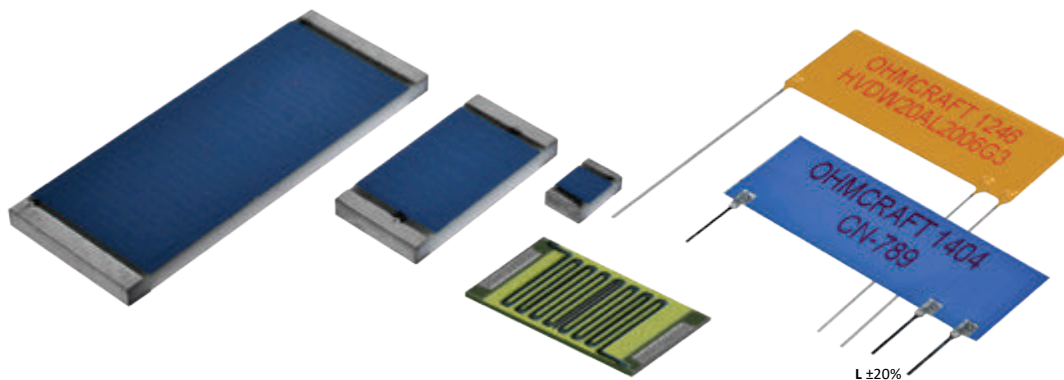
## Qualification Testing

Group	NASA Sample Size (Level 1 / Level 2)
<b>Group 1</b> Conformance Testing: Basic Screening	100%
<b>Group 2</b> <u>Solderability</u> MIL-STD-202, Method 208 <u>Resistance to Solvents (Leaded)</u> MIL-STD-202, Method 215	3 pcs / 3 pcs
<b>Group 3</b> <u>Temperature Coefficient (TCR)</u> Per MIL-STD-202, Method 304 Reference Temperature: 25°C <u>Low Temperature Storage</u> -65°C no load dwell for 24±4 hours +25°C ambient no load dwell for 2-8 hours <u>Low Temperature Operation</u> -65°C no load dwell for 1 hour Working Voltage for 54 minutes +25°C no load dwell for 24±4 hours <u>Short Time Overload</u> 2X Working Voltage for 5 seconds	10 pcs / 6 pcs
<b>Group 4</b> <u>Resistance to soldering heat</u> MIL-STD-202, Method 210, Test Condition B (modified) 260°C for 20 seconds <u>Terminal Strength (Leaded)</u> MIL-STD-202, Method 211 Test Condition C 16 ounces ± 1 ounce for 10 seconds	9 pcs / 6 pcs

Group	NASA Sample Size (Level 1 / Level 2)
<b>Group 5</b> <u>Shock (Leaded)</u> MIL-STD-202, Method 213B, Test Condition I <u>Vibration (Leaded)</u> Per MIL-STD-202, Method 204, Test Condition D	9 pcs / 6 pcs
<b>Group 6</b> <u>Load Life</u> Per MIL-STD-202, Method 108 Working Voltage for 1000 or 2000 hours at 25°C	12 pcs / 9 pcs
<b>Group 7</b> <u>Resistance to Bonding Exposure (SMT)</u> Solder mounted to a ceramic test plate 4-12 hours stabilization at 25°C	10 pcs / 5 pcs
<b>Group 8</b> No Applicable Tests	—
<b>Group 9</b> <u>High Temperature Exposure</u> 125°C for 100 hours	5 pcs

### Custom Configurations Available Upon Request


Please consult with our knowledgeable sales staff for help specifying custom parts to meet your needs.





# SURFACE MOUNT RESISTORS



 OHMCRAFT

**EXXELIA**

## Advantages

Our patented Micropen® precision printing technology provides superior precision, thick-film high voltage surface mount resistors. Ohmcraft's Micropenned serpentine patterned resistors produce superior electrical characteristics:

- Voltage Ratings to 5000 Volts
- Resistance Values to 50 Gigohms
- Ultra High Stability
- Very Low Noise
- Tolerances to 0.1%
- TCR to 25 ppm/°C
- VCR to 1 ppm/V
- Custom Configurations



## Electrical Specifications

Case Size Ratings	TCR (±ppm/°C)	Tolerance							
		0.10%	0.25%	0.50%	1%	2%	5%	10%	20%
0402 40mW 150V	50				10K-100M	10K-100M	10K-100M	10K-100M	10K-100M
	100				10K-500M	10K-500M	10K-500M	10K-500M	10K-500M
	200				10K-500M	10K-1G	10K-1G	10K-1G	10K-1G
0603 60mW 400V	50			10K-10M	10K-100M	10K-500M	10K-500M	10K-500M	10K-500M
	100			10K-10M	10K-500M	10K-1G	10K-1G	10K-1G	10K-1G
	200			10K-10M	10K-500M	10K-1G	10K-1G	10K-10G	10K-50G
0805 200mW 600V	50			10K-10M	10K-500M	10K-500M	10K-500M	10K-500M	10K-500M
	100			10K-10M	10K-1G	10K-1G	10K-1G	10K-1G	10K-1G
	200			10K-10M	10K-1G	10K-1G	10K-10G	10K-10G	10K-50G
1206 330mW 1500V	25	1M-10M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
	50	100K-10M	100K-100M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M
	100	10K-10M	10K-100M	10K-500M	10K-1G	10K-1G	10K-1G	10K-1G	10K-1G
	200	10K-10M	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	10K-50G
2010 1W 2000V	25	1M-10M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
	50	100K-10M	100K-100M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M
	100	10K-10M	10K-100M	10K-500M	10K-1G	10K-1G	10K-1G	10K-1G	10K-1G
	200	10K-10M	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	10K-50G
2512 2W 3000V	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
	200	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-50G	100K-50G
3512 2W 3500V	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
	200	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-50G	100K-50G
4020 2W 4000V	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
	200	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-50G	100K-50G
5020 2W 5000V	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
	200	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-50G	100K-50G

The continuous maximum applied voltage cannot exceed the maximum power rating and is ohmic value dependent.

Value range is case size dependent.

Standard case sizes: 0402, 0403, 0502, 0504, 0603, 0805, 1004, 1005, 1206, 1210, 1505, 2010, 2208, 2510, 2512, 3512, 4020, 5020.

For custom sizes and configurations, consult us.

## How to Order

<b>HVC</b>	+		+		+		+		+	
<b>Type</b>		<b>Case Size</b>		<b>TCR</b>		<b>Value</b>		<b>Tolerance</b>		<b>Termination</b>
High-Voltage Chips		See dimension table.		E ±25ppm/°C H ±50ppm/°C K ±100ppm/°C L ±200ppm/°C		Resistance value expressed as a four digit number, where the first three numbers are the significant value, and the fourth number is the number of zeroes.		B ±0.1% C ±0.25% D ±0.5% F ±1.0% G ±2.0% J ±5.0% K ±10% L ±20%		T Solderable wraparound matte tin Sn99.9 on Ni barrier, RoHS B Solderable wraparound Sn63Pb37 solder over Ni barrier Z Solderable single surface matte tin Sn99.9 on Ni barrier, flip-chip, RoHS S Solderable single surface Sn63Pb37, flip-chip U Epoxy bondable gold wraparound over Ni
Packaging options: Bulk, Tape & Reel or Flat Pack										



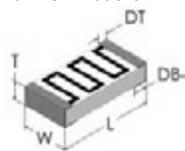
## High Voltage Chip Resistors

## HVC SERIES

## Chip Dimensions

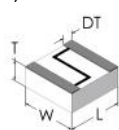
## Wrap-around

B and T Terminations



## Bondable

G, Z, and S Terminations



Case Size	Length	Width	Thickness (Max.)	DT	DB	Units
0402	0.040 ±0.005 1.02 ±0.13	0.020 ±0.003 0.51 ±0.08	0.020 0.51	0.008 ±0.004 0.20 ±0.10	0.010 +0.002/-0.004 0.25 +0.05/-0.10	inches mm
0603	0.063 +0.01/-0.005 1.60 +0.25/-0.13	0.031 ±0.005 0.79 ±0.13	0.020 0.51	0.010 ±0.005 0.25 ±0.13	0.012 ±0.008 0.30 ±0.20	inches mm
0805	0.079 +0.01/-0.005 2.01 +0.25/-0.13	0.050 ±0.005 1.27 ±0.13	0.025 0.64	0.010 ±0.005 0.25 ±0.13	0.013 ±0.008 0.33 ±0.20	inches mm
1206	0.126 +0.01/-0.005 3.20 +0.25/-0.13	0.063 ±0.005 1.60 ±0.13	0.030 0.76	0.010 ±0.005 0.25 ±0.13	0.020 ±0.010 0.51 ±0.25	inches mm
2010	0.200 +0.01/-0.005 5.08 +0.25/-0.13	0.100 ±0.005 2.54 ±0.13	0.030 0.76	0.018 ±0.010 0.46 ±0.25	0.020 ±0.010 0.51 ±0.25	inches mm
2512	0.250 +0.01/-0.005 6.35 +0.25/-0.13	0.125 ±0.005 3.18 ±0.13	0.030 0.76	0.020 ±0.010 0.51 ±0.25	0.024 ±0.010 0.61 ±0.25	inches mm
3512	0.350 +0.01/-0.005 8.89 +0.25/-0.13	0.125 ±0.005 3.18 ±0.13	0.030 0.76	0.020 ±0.010 0.51 ±0.25	0.024 ±0.010 0.61 ±0.25	inches mm
4020	0.400 +0.01/-0.005 10.16 +0.25/-0.13	0.200 ±0.005 5.08 ±0.13	0.030 0.76	0.025 ±0.010 0.64 ±0.25	0.030 ±0.010 0.76 ±0.25	inches mm
5020	0.500 +0.01/-0.005 12.70 +0.25/-0.13	0.200 ±0.005 5.08 ±0.13	0.030 0.76	0.025 ±0.010 0.76 ±0.25	0.030 ±0.010 0.76 ±0.25	inches mm

Other available case sizes: 0403, 0502, 0504, 1004, 1005, 1210, 1505, 2208, 2510, and custom. Please contact us.

## Typical Performance Characteristics

Test	Maximum ΔR
Short Time Overload	0.1%
Load Life	0.1%
Thermal Shock	0.1%
Resistance to Soldering Heat	0.05%

Parameter	Typical
Operating Temperature	-55°C to 150°C
TCR	Measured from 25°C to 75°C
Pulse Capability	10X rated wattage For custom pulse applications consult factory
Resistance Value	Values > 10M are measured at 100 VDC For custom test voltages consult factory

## Tape and Reel Specifications

Parts are packaged in accordance with EIA-481 tape and reel specifications.

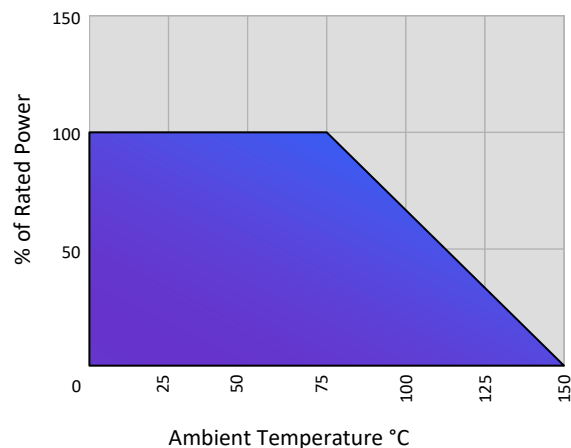
## Material Construction

Resistive Element	Thick Film
Substrate	96% Alumina
Encapsulation	Epoxy
Termination	Tin over nickel barrier, lead solder over nickel barrier, or gold.

## Custom Configurations Available Upon Request

Please consult us with our knowledgeable sales staff for help specifying custom parts to meet your needs:

## Power Derating Curve



# HVCD SERIES

## High Voltage Chip Dividers

### Advantages

Our patented Micropen® precision printing technology provides superior precision, thick-film high voltage surface mount dividers. Ohmcraft's Micropenned serpentine patterned dividers produce superior electrical characteristics:

- Voltage Ratings to 4000 Volts
- Ultra High Stability
- TCR to 100 ppm/°C
- Resistance Values to 10 Gigohms
- Very Low Noise
- TCR Tracking to 25 ppm/°C
- Ratio Tolerances to 1%
- VCR to 1 ppm/V
- Custom Ratios and Configurations



### Electrical Specifications

Case Size Ratings	TCR Tracking (±ppm/°C)	Ratio Tolerance 1%, 2%, 5%, 10%, 20%
<b>3512</b> 100 mW 2000V	25 50	40M-10G < 40M Voltage is Wattage Limited
<b>4020</b> 100 mW 3000V	25 50	90M-10G < 90M Voltage is Wattage Limited
<b>5020</b> 100 mW 4000V	25 50	160M-10G < 160M Voltage is Wattage Limited

For custom sizes and configurations, consult us.

### How to Order

#### Ordering Code Example HVCD3512Z5005FT-R100

Type	Case Size	TCR Tracking*	R Total Value	Ratio Tolerance**	Termination	Ratio
High-Voltage Chip Divider	3512 4020 5020 See dimension table.	Y ±25ppm/°C Z ±50ppm/°C	Resistance value expressed as a four digit number, where the first three numbers are the significant value, and the fourth number is the number of zeroes.	F ±1.0% G ±2.0% J ±5.0% K ±10% L ±20%	T Solderable wraparound matte tin Sn99.9 on nickel barrier, RoHS B Solderable wraparound Sn63Pb37 solder over nickel barrier Z Solderable single surface matte tin Sn99.9 on nickel barrier, RoHS S Solderable single surface Sn63Pb37, flip-chip	(R total) / (R low) expressed up to a four digit number XXXX Max Ratio = 1000 Min Ratio = 100

\*Absolute TCR is <100 ppm/°C

\*\*Total Resistance Tolerance is ±15% (> 10GΩ ±20%)

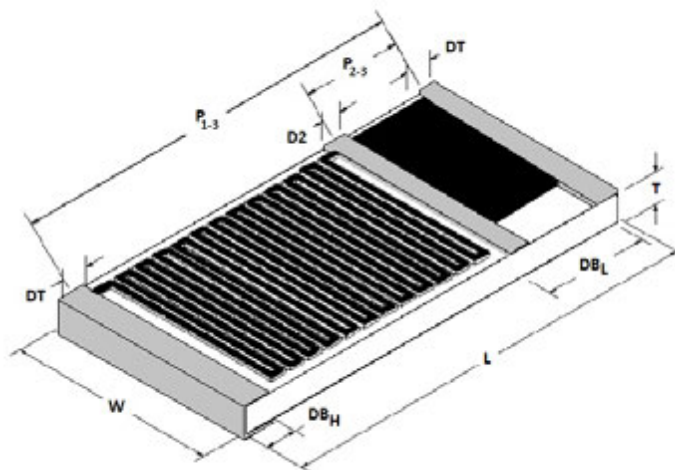
Packaging options: Bulk, Tape & Reel or Flat Pack

## High Voltage Chip Resistors

## HVCD SERIES

## Chip Dimensions

Wrap-around  
B and T Terminations



Case Size	Length	Width	Thickness (Max.)	DT	D2	DB <sub>H</sub>	DB <sub>L</sub>	P <sub>1-3</sub>	P <sub>2-3</sub>	Units
3512	0.350 +0.01/-0.005	0.125 ±0.005	0.030	0.020 ±0.010	0.020 ±0.010	0.020 ±0.010	0.065 ±0.010	0.330 +0.010	0.085 ±0.010	inches
	8.89 +0.25/-0.13	3.18 ±0.13	0.76	0.51 ±0.25	0.51 ±0.25	0.51 ±0.25	1.65 ±0.25	8.38 +0.25	2.16 ±0.25	mm
4020	0.400 +0.01/-0.005	0.200 ±0.005	0.030	0.025 ±0.010	0.020 ±0.010	0.025 ±0.010	0.070 ±0.010	0.375 +0.010	0.095 ±0.010	inches
	10.16 +0.25/-0.13	5.08 ±0.13	0.76	0.64 ±0.25	0.51 ±0.25	0.64 ±0.25	1.78 ±0.25	9.53 +0.25	2.41 ±0.25	mm
5020	0.500 +0.01/-0.005	0.200 ±0.005	0.030	0.025 ±0.010	0.020 ±0.010	0.025 ±0.010	0.070 ±0.010	0.475 +0.010	0.120 ±0.010	inches
	12.70 +0.25/-0.13	5.08 ±0.13	0.76	0.64 ±0.25	0.51 ±0.25	0.64 ±0.25	1.78 ±0.25	12.07 +0.25	3.05 ±0.25	mm

## Typical Performance Characteristics

Test	Maximum ΔR
Short Time Overload	0.1%
Load Life	0.1%
Thermal Shock	0.1%
Resistance to Soldering Heat	0.05%

Parameter	Typical
Operating Temperature	-55°C to 150°C
TCR Tracking	Measured from 25°C to 75°C
Resistance Value	Measured at 100 VDC

## Material Construction

<b>Resistive Element</b>	Thick Film
<b>Substrate</b>	96% Alumina
<b>Encapsulation</b>	Epoxy
<b>Termination</b>	Tin over nickel barrier or lead solder over nickel barrier

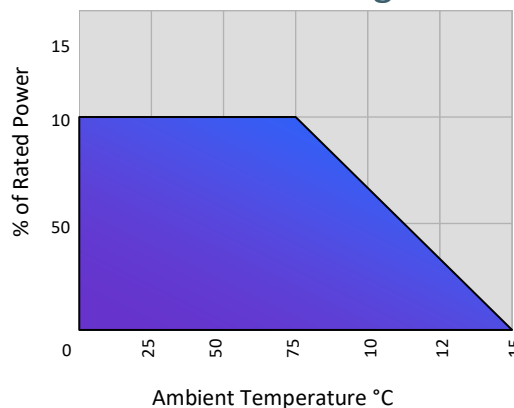
## Tape and Reel Specifications

Parts are packaged in accordance with EIA-481 tape and reel specifications.  
T&R White Side Up, Narrow DB<sub>H</sub> Pad Towards Sprocket Holes

## Custom Configurations Available Upon Request

Please consult us with our knowledgeable sales staff for help specifying custom parts to meet your needs.

## Power Derating Curve



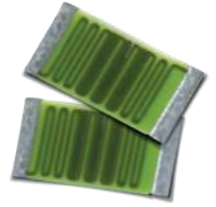
# SM SERIES

## High Resistance Chip Resistors

### Advantages

Our patented Micropen® precision printing technology provides ultra precision, thick-film high ohmic value, surface mount resistors. Ohmcraft's Micropenned serpentine patterned resistors produce superior electrical characteristics:

- Voltage Ratings to 600 Volts
- Resistance Values to 50 Gighms
- Ultra High Stability
- Very Low Noise
- Tolerances to 0.1%
- TCR to 25 ppm/°C
- VCR to 1 ppm/V
- Custom Configurations



### Electrical Specifications

Case Size	TCR	Tolerance							
Ratings	(±ppm/°C)	0.10%	0.25%	0.50%	1%	2%	5%	10%	20%
0402 40mW 50V	50				10K-100M	10K-100M	10K-100M	10K-100M	10K-100M
	100				10K-500M	10K-500M	10K-500M	10K-500M	10K-500M
	200				10K-500M	10K-1G	10K-1G	10K-1G	10K-1G
0603 60mW 100V	50			10K-10M	10K-100M	10K-500M	10K-500M	10K-500M	10K-500M
	100			10K-10M	10K-500M	10K-1G	10K-1G	10K-1G	10K-1G
	200			10K-10M	10K-500M	10K-1G	10K-1G	10K-10G	10K-50G
0805 200mW 125V	50			10K-10M	10K-500M	10K-500M	10K-500M	10K-500M	10K-500M
	100			10K-10M	10K-1G	10K-1G	10K-1G	10K-1G	10K-1G
	200			10K-10M	10K-1G	10K-1G	10K-10G	10K-10G	10K-50G
1206 330mW 200V	25	1M-10M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
	50	100K-10M	100K-100M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M
	100	10K-10M	10K-100M	10K-500M	10K-1G	10K-1G	10K-1G	10K-1G	10K-1G
2010 1W 300V	25	1M-10M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
	50	100K-10M	100K-100M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M
	100	10K-10M	10K-100M	10K-500M	10K-1G	10K-1G	10K-1G	10K-1G	10K-1G
2512 2W 350V	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
3512 2W 600V	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
	200	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-50G	100K-50G

The continuous maximum applied voltage cannot exceed the maximum power rating and is ohmic value dependent.

Value range is case size dependent.

Standard case sizes: 0402, 0403, 0502, 0504, 0603, 0805, 1004, 1005, 1206, 1210, 1505, 2010, 2208, 2510, 2512, 3512, 4020, 5020.

For custom sizes and configurations, consult us.

### How to Order

SM	+		+		+		+		+	
Type		Case Size		TCR		Value		Tolerance		Termination
Surface Mount, High Resistance Chips		See dimension table.  Custom case sizes are available. Please consult factory.		E ±25ppm/°C H ±50ppm/°C K ±100ppm/°C L ±200ppm/°C		Resistance value expressed as a four digit number, where the first three numbers are the significant value, and the fourth number is the number of zeroes.		B ±0.1% C ±0.25% D ±0.5% F ±1.0% G ±2.0% J ±5.0% K ±10% L ±20%		T Solderable wraparound matte tin Sn99.9 on Ni barrier, RoHS B Solderable wraparound Sn63Pb37 solder over Ni barrier Z Solderable single surface matte tin Sn99.9 on Ni barrier, flip-chip, RoHS S Solderable single surface Sn63Pb37, flip-chip G Wire bondable gold, Au, RoHS

Packaging options: Bulk, Tape & Reel or Flat Pack



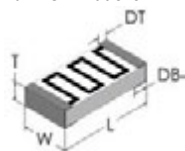
## High Resistance Chip Resistors

## SM SERIES

## Chip Dimensions

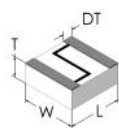
## Wrap-around

B and T Terminations



## Bondable

G Termination



Case Size	Length	Width	Thickness (Max.)	DT	DB	Units
0402	0.040 ±0.005	0.020 ±0.003	0.020	0.008 ±0.004	0.010 +0.002/-0.004	inches
	1.02 ±0.13	0.51 ±0.08	0.51	0.20 ±0.10	0.25 +0.05/-0.10	mm
0603	0.063 +0.01/-0.005	0.031 ±0.005	0.020	0.010 ±0.005	0.012 ±0.008	inches
	1.60 +0.25/-0.13	0.79 ±0.13	0.51	0.25 ±0.13	0.30 ±0.20	mm
0805	0.079 +0.01/-0.005	0.050 ±0.005	0.025	0.010 ±0.005	0.013 ±0.008	inches
	2.01 +0.25/-0.13	1.27 ±0.13	0.64	0.25 ±0.13	0.33 ±0.20	mm
1206	0.126 +0.01/-0.005	0.063 ±0.005	0.030	0.010 ±0.005	0.020 ±0.010	inches
	3.20 +0.25/-0.13	1.60 ±0.13	0.76	0.25 ±0.13	0.51 ±0.25	mm
2010	0.200 +0.01/-0.005	0.100 ±0.005	0.030	0.018 ±0.010	0.020 ±0.010	inches
	5.08 +0.25/-0.13	2.54 ±0.13	0.76	0.46 ±0.25	0.51 ±0.25	mm
2512	0.250 +0.01/-0.005	0.125 ±0.005	0.030	0.020 ±0.010	0.024 ±0.010	inches
	6.35 +0.25/-0.13	3.18 ±0.13	0.76	0.51 ±0.25	0.61 ±0.25	mm
3512	0.350 +0.01/-0.005	0.125 ±0.005	0.030	0.020 ±0.010	0.024 ±0.010	inches
	8.89 +0.25/-0.13	3.18 ±0.13	0.76	0.51 ±0.25	0.61 ±0.25	mm

Other available case sizes: 0403, 0502, 0503, 0504, 1004, 1005, 1210, 1505, 2208, 2510, 4020, 5020. Please contact us

## Typical Performance Characteristics

Test	Maximum ΔR
Short Time Overload	0.1%
Load Life	0.1%
Thermal Shock	0.1%
Resistance to Soldering Heat	0.05%

Parameter	Typical
Operating Temperature	-55°C to 150°C
TCR	Measured from 25°C to 75°C
Resistance Value	Values > 10M are measured at 100 VDC For custom test voltages consult factory

## Material Construction

Resistive Element	Thick Film
Substrate	96% Alumina
Encapsulation	Epoxy
Termination	Tin over nickel barrier, lead solder over nickel barrier, or gold

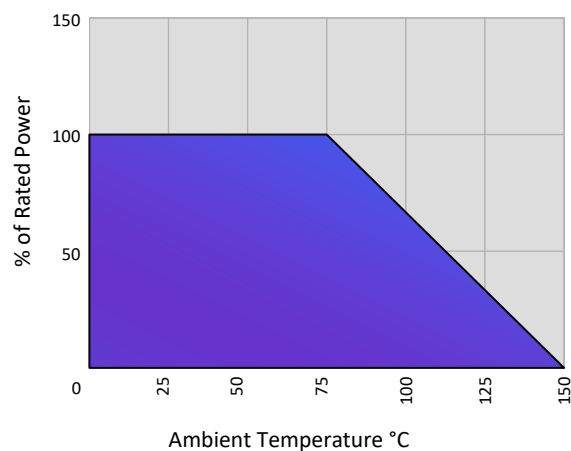
## Tape and Reel Specifications

Parts are packaged in accordance with EIA-481 tape and reel specifications.

## Custom Configurations Available Upon Request

Please consult us with our knowledgeable sales staff for help specifying custom parts to meet your needs.

## Power Derating Curve



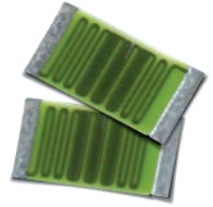
# MCH SERIES

## Military Grade High Voltage Chip Resistors

### Advantages

Our patented Micropen® precision printing technology provides ultra precision, thick-film high voltage, military grade, surface mount resistors. Our military SMT chips have extended TCR temperature range and are stringently inspected. Ohmcraft's Micropenned serpentine patterned resistors produce superior electrical characteristics:

- Voltage Ratings to 5,000 Volts
- Resistance Values to 50 Gigohms
- Extended TCR Range
- Ultra High Stability
- Very Low Noise
- Tolerances to 0.1%
- TCR to 25 ppm/°C
- VCR to 1 ppm/V
- Custom Configurations



### Electrical Specifications

Case Size	TCR (±ppm/°C)	Tolerance							
		0.10%	0.25%	0.50%	1%	2%	5%	10%	20%
<b>0402</b>	50				10K-100M	10K-100M	10K-100M	10K-100M	10K-100M
<b>40mW</b>	100				10K-500M	10K-500M	10K-500M	10K-500M	10K-500M
<b>150V</b>	200				10K-500M	10K-1G	10K-1G	10K-1G	10K-1G
<b>0603</b>	50			10K-10M	10K-100M	10K-500M	10K-500M	10K-500M	10K-500M
<b>60mW</b>	100			10K-10M	10K-500M	10K-1G	10K-1G	10K-1G	10K-1G
<b>400V</b>	200			10K-10M	10K-500M	10K-1G	10K-1G	10K-10G	10K-50G
<b>0805</b>	50			10K-10M	10K-500M	10K-500M	10K-500M	10K-500M	10K-500M
<b>200mW</b>	100			10K-10M	10K-1G	10K-1G	10K-1G	10K-1G	10K-1G
<b>600V</b>	200			10K-10M	10K-1G	10K-1G	10K-10G	10K-10G	10K-50G
<b>1206</b>	25	1M-10M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
<b>330mW</b>	50	100K-10M	100K-100M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M
<b>1500V</b>	100	10K-10M	10K-100M	10K-500M	10K-1G	10K-1G	10K-1G	10K-1G	10K-1G
	200	10K-10M	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	10K-50G
<b>2010</b>	25	1M-10M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
<b>1W</b>	50	100K-10M	100K-100M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M	100K-500M
<b>2000V</b>	100	10K-10M	10K-100M	10K-500M	10K-1G	10K-1G	10K-1G	10K-1G	10K-1G
	200	10K-10M	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	10K-50G
<b>2512</b>	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
<b>2W</b>	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
<b>3000V</b>	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
	200	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-50G	100K-50G
<b>3512</b>	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
<b>2W</b>	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
<b>3500V</b>	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
	200	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-50G	100K-50G
<b>4020</b>	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
<b>2W</b>	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
<b>4000V</b>	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
	200	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-50G	100K-50G
<b>5020</b>	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
<b>2W</b>	50	100K-100M	100K-500M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
<b>5000V</b>	100	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-10G	100K-10G
	200	10K-100M	10K-500M	10K-1G	10K-10G	10K-10G	10K-10G	100K-50G	100K-50G

The continuous maximum applied voltage cannot exceed the maximum power rating and is ohmic value dependent.

Standard case sizes: 0402, 0403, 0502, 0504, 0603, 0805, 1004, 1005, 1206, 1210, 1505, 2010, 2208, 2510, 2512, 3512, 4020, 5020.

Military case sizes: RM0402, RM0603, RM0705, RM1206, RM2010, RM2512.

For custom sizes and configurations, contact us.

### How to Order

MCH	+		+		+		+		+	
Type		Case Size		TCR		Value		Tolerance		Termination
Military Grade High Voltage Chips		See dimension table.  Custom case sizes are available. Please consult factory.		E ±25ppm/°C H ±50ppm/°C K ±100ppm/°C L ±200ppm/°C		Resistance value expressed as a four digit number, where the first three numbers are the significant value, and the fourth number is the number of zeroes.		B ±0.1% C ±0.25% D ±0.5% F ±1.0% G ±2.0% J ±5.0% K ±10% L ±20%		T Solderable wraparound matte tin Sn99.9 on Ni barrier, RoHS B Solderable wraparound Sn63Pb37 solder over Ni barrier Z Solderable single surface matte tin Sn99.9 on Ni barrier, flip-chip, RoHS S Solderable single surface Sn63Pb37, flip-chip U Epoxy bondable gold wraparound over Ni

Packaging options: Bulk, Tape & Reel or Flat Pack

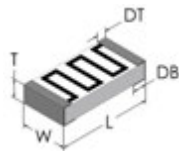
## Military Grade High Voltage Chip Resistors

## MCH SERIES

## Chip Dimensions

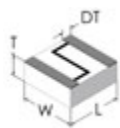
## Wrap-around

B and T Terminations



## Bondable

G, Z, and S Terminations



Case Size	Length	Width	Thickness (Max.)	DT	DB	Units
0402	0.040 ±0.005	0.020 ±0.003	0.020	0.008 ±0.004	0.010 +0.002/-0.004	inches
	1.02 ±0.13	0.51 ±0.08	0.51	0.20 ±0.10	0.25 +0.05/-0.10	mm
0603	0.063 +0.01/-0.005	0.031 ±0.005	0.020	0.010 ±0.005	0.012 ±0.008	inches
	1.60 +0.25/-0.13	0.79 ±0.13	0.51	0.25 ±0.13	0.30 ±0.20	mm
0805	0.079 +0.01/-0.005	0.050 ±0.005	0.025	0.010 ±0.005	0.013 ±0.008	inches
	2.01 +0.25/-0.13	1.27 ±0.13	0.64	0.25 ±0.13	0.33 ±0.20	mm
1206	0.126 +0.01/-0.005	0.063 ±0.005	0.030	0.010 ±0.005	0.020 ±0.010	inches
	3.20 +0.25/-0.13	1.60 ±0.13	0.76	0.25 ±0.13	0.51 ±0.25	mm
2010	0.200 +0.01/-0.005	0.100 ±0.005	0.030	0.018 ±0.010	0.020 ±0.010	inches
	5.08 +0.25/-0.13	2.54 ±0.13	0.76	0.46 ±0.25	0.51 ±0.25	mm
2512	0.250 +0.01/-0.005	0.125 ±0.005	0.030	0.020 ±0.010	0.024 ±0.010	inches
	6.35 +0.25/-0.13	3.18 ±0.13	0.76	0.51 ±0.25	0.61 ±0.25	mm
3512	0.350 +0.01/-0.005	0.125 ±0.005	0.030	0.020 ±0.010	0.024 ±0.010	inches
	8.89 +0.25/-0.13	3.18 ±0.13	0.76	0.51 ±0.25	0.61 ±0.25	mm
4020	0.400 +0.01/-0.005	0.200 ±0.005	0.030	0.025 ±0.010	0.030 ±0.010	inches
	10.16 +0.25/-0.13	5.08 ±0.13	0.76	0.64 ±0.25	0.76 ±0.25	mm
5020	0.500 +0.01/-0.005	0.200 ±0.005	0.030	0.025 ±0.010	0.030 ±0.010	inches
	12.70 +0.25/-0.13	5.08 ±0.13	0.76	0.76 ±0.25	0.76 ±0.25	mm

Other available case sizes: 0403, 0502, 0504, 1004, 1005, 1210, 1505, 2208, 2510, and custom.  
For custom sizes and configurations, contact us.

## Typical Performance Characteristics

Test	Maximum ΔR
Short Time Overload	0.1%
Load Life	0.1%
Thermal Shock	0.1%
Resistance to Soldering Heat	0.05%

Parameter	Typical
Operating Temperature	-55°C to 150°C
TCR	Measured from 25°C to 75°C
Pulse Capability	10X rated wattage for custom pulse applications consult factory
Resistance Value	Values > 10M are measured at 100 VDC for custom test voltages consult factory

## Material Construction

Resistive Element	Thick Film
Substrate	96% Alumina
Encapsulation	Epoxy
Termination	Tin over nickel barrier, lead solder over nickel barrier, or gold

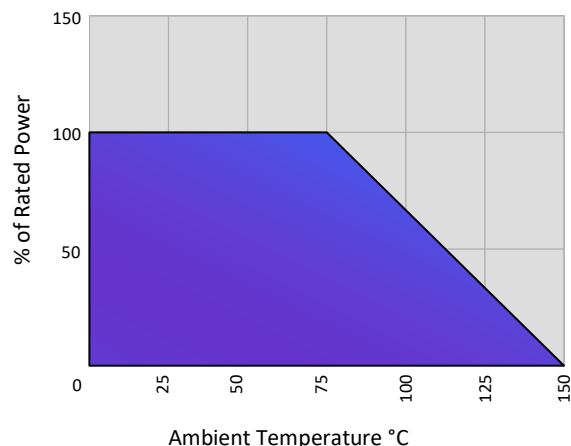
## Tape and Reel Specifications

Parts are packaged in accordance with EIA-481 tape and reel specifications.

## Custom Configurations Available Upon Request

Please consult us with our knowledgeable sales staff for help specifying custom parts to meet your needs.

## Power Derating Curve

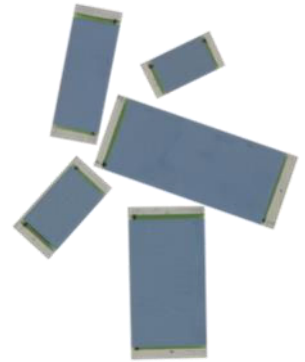


# UHVC SERIES

## Ultra High Voltage Chip Resistors

### Advantages

- Highest voltage ratings available in a surface mount resistor (up to 20,000 Volts).
- Replace leaded thru-hole resistors with surface mount resistors saving assembly and board space costs.
- Replace multiple resistor arrays with a single resistor.



Our patented Micropen® precision printing technology provides a superior surface mount resistor with the highest voltage ratings available in the industry. These ultra high voltage resistors also meet Ohmcraft's superior electrical

- Voltage Ratings to 20,000 Volts
- Resistance Values to 50 Gigohms
- Ultra High Stability
- Very Low Noise
- Tolerances to 1%
- TCR to 100 ppm/°C

### Electrical Specifications—Minimum Ohmic Value for Specified Voltage Rating

Case Size	Voltage Rating (volts)								
	3,000	4,000	6,000	8,000	10,000	12,000	14,000	16,000	20,000
<b>2010</b>	≥ 90M	≥ 160M	≥ 360M	NA	NA	NA	NA	NA	NA
<b>2512</b>	Note <sup>1</sup>	≥ 120M	≥ 250M	≥ 450M	≥ 700M	NA	NA	NA	NA
<b>3512</b>	Note <sup>1</sup>	≥ 85M	≥ 200M	≥ 330M	≥ 525M	≥ 750M	≥ 1,000M	NA	NA
<b>4020</b>	Note <sup>1</sup>	Note <sup>1</sup>	≥ 150M	≥ 250M	≥ 400M	≥ 575M	≥ 775M	≥ 1,000M	NA
<b>5020</b>	Note <sup>1</sup>	Note <sup>1</sup>	≥ 90M	≥ 160M	≥ 250M	≥ 360M	≥ 490M	≥ 640M	≥ 1,000M

Note <sup>1</sup>: For these values and package size, refer to our standard HVC series.

Due to the high voltage ratings, these resistors must be potted upon assembly.

For other configurations or requirements, contact us.

### How to Order

UHVC	+		+		+		+		+	
Type		Case Size		TCR		Value		Tolerance		Termination
Ultra High-Voltage Chips		2010		K ±100ppm/°C		Resistance value expressed as a four digit number, where the first three numbers are the significant value, and the fourth number is the number of zeroes.		F ±1.0%		T Solderable wraparound matte tin Sn99.9 on Ni barrier, RoHS
		2512		L ±200ppm/°C				G ±2.0%		B Solderable wraparound Sn63Pb37 solder over Ni barrier
		3512						J ±5.0%		
		4020						K ±10% (untrimmed)		
		5020						L ±20% (untrimmed)		

Packaging options: Bulk, Tape & Reel or Flat Pack



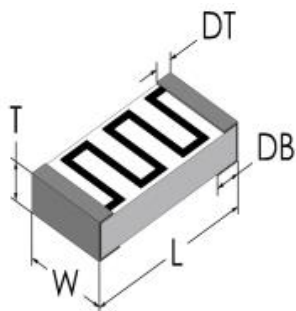
## Ultra High Voltage Chip Resistors

## UHVC SERIES

## Chip Dimensions

## Wrap-around

B and T Terminations



Case Size	Length	Width	Thickness (Max.)	DT	DB	Units
2010	0.200 +0.01/-0.005	0.100 ±0.005	0.030	0.018 ±0.010	0.020 ±0.010	inches
	5.08 +0.25/-0.13	2.54 ±0.13	0.76	0.46 ±0.25	0.51 ±0.25	mm
2512	0.250 +0.01/-0.005	0.125 ±0.005	0.030	0.020 ±0.010	0.024 ±0.010	inches
	6.35 +0.25/-0.13	3.18 ±0.13	0.76	0.51 ±0.25	0.61 ±0.25	mm
3512	0.350 +0.01/-0.005	0.125 ±0.005	0.030	0.020 ±0.010	0.024 ±0.010	inches
	8.89 +0.25/-0.13	3.18 ±0.13	0.76	0.51 ±0.25	0.61 ±0.25	mm
4020	0.400 +0.01/-0.005	0.200 ±0.005	0.030	0.025 ±0.010	0.030 ±0.010	inches
	10.16 +0.25/-0.13	5.08 ±0.13	0.76	0.64 ±0.25	0.76 ±0.25	mm
5020	0.500 +0.01/-0.005	0.200 ±0.005	0.030	0.030 ±0.010	0.030 ±0.010	inches
	12.70 +0.25/-0.13	5.08 ±0.13	0.76	0.76 ±0.25	0.76 ±0.25	mm

## Typical Performance Characteristics

Test	Maximum ΔR
Short Time Overload	0.5%
Load Life	0.5%
Temperature Cycle	0.5%
Moisture Resistance	0.5%
Shock	0.25%
Vibration	0.25%
Dielectric Withstanding Voltage	0.25%
Resistance to Soldering Heat	0.25%

Parameter	Typical
Operating Temperature	-55°C to 150°C
TCR	Measured from 25°C to 75°C
Resistance Value	Measured at 1000 VDC for custom test voltages consult factory

# UHVC SERIES

## Ultra High Voltage Chip Resistors

### Tape and Reel Specifications

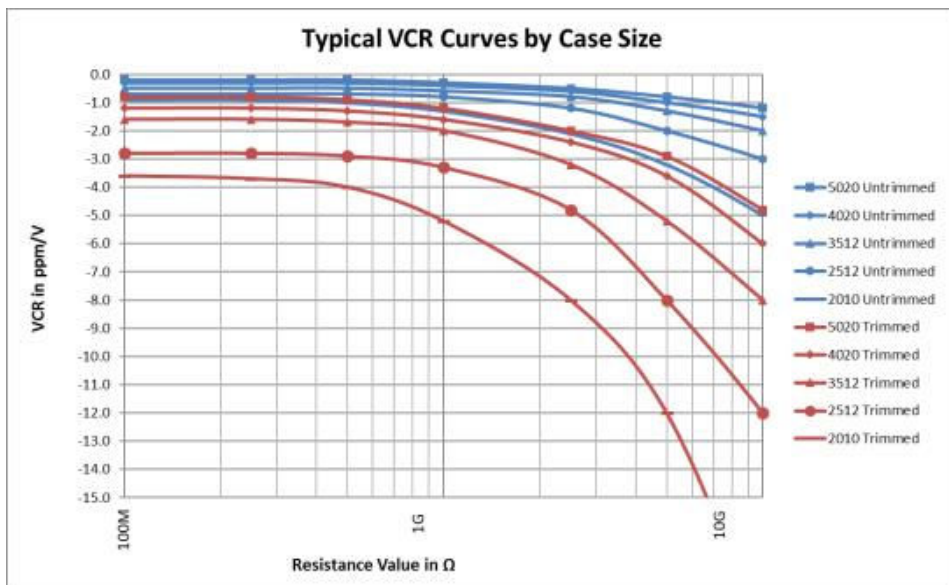
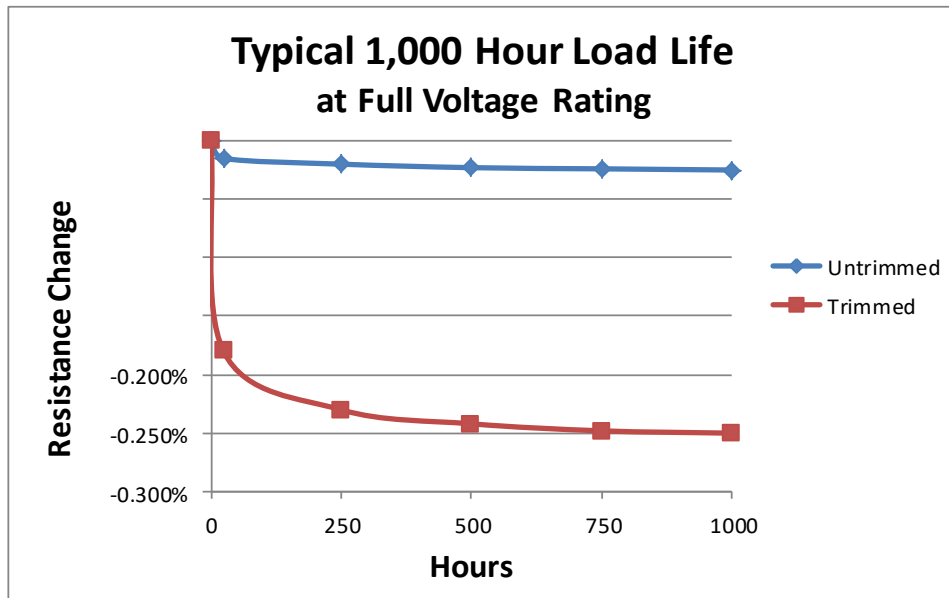
Parts are packaged in accordance with EIA-481 tape and reel specifications.

### Custom Configurations Available Upon Request

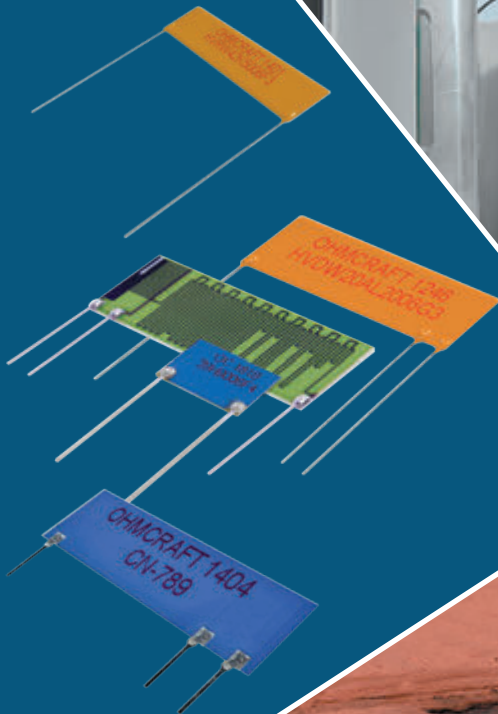
Please consult us with our knowledgeable sales staff for help specifying custom parts to meet your needs.

### Material Construction

<b>Resistive Element</b>	Thick Film
<b>Substrate</b>	96% Alumina
<b>Encapsulation</b>	Epoxy
<b>Termination</b>	Tin over nickel barrier, lead solder over nickel barrier.



# LEADED RESISTORS



 OHMCRAFT

EXXELIA

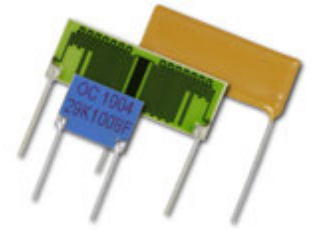
# HVR SERIES

## High Voltage Leaded Resistors

### Advantages

Our patented Micropen® precision printing technology provides superior precision, thick-film resistors.

- Voltage Ratings to 40,000 Volts
- Resistance Values to 4 TΩ
- Ultra High Stability
- Very Low Noise
- TCR to 25 ppm/°C
- VCR to 0.05 ppm/V
- Tolerances to 0.1%
- Custom Configurations



### Electrical Specifications

Case Size Ratings	TCR (±ppm/°C)	Tolerance								
		0.10%	0.25%	0.50%	1%	2%	5%	10%	20%	
39 500mW 2kV	25	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
	50	100K-100M	100K-100M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	100K-100M	100K-100M	100K-10G	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-100M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
29 500mW 4kV	25	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
	50	100K-100M	100K-100M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	100K-100M	100K-100M	100K-10G	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-100M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
21 1W 10kV	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G
	100	100K-100M	100K-500M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-500M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
42 2W 20kV	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G
	100	100K-100M	100K-500M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-500M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
43 3W 30kV	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G
	100	100K-100M	100K-500M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-500M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
56 6W 40kV	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G
	100	100K-100M	100K-500M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-500M	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G	100K-50G
	>200	100K-100M	100K-500M	100K-10G	100K-50G	100K-50G	100K-100G	100K-1T	100K-1T	100K-1T

The continuous maximum applied voltage cannot exceed the maximum power rating and is ohmic value dependent.

Value range is case size dependent.

For custom sizes and configurations, contact us.

### How to Order

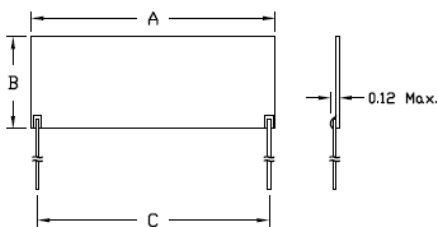
Type	Lead Style	Case Size	TCR Rating	Total R Value	Tolerance	Coating
Leaded High Voltage Resistor	T Spade Terminal, 100% Tin RoHS S Spade Terminal, Sn60Pb40 solder W Wire, 22AWG 100% Tin RoHS B Wire, 22AWG Sn60Pb40 solder	39 29 21 42 43 56	E ±25ppm/°C H ±50ppm/°C K ±100ppm/°C L ±200ppm/°C M >±200ppm/°C	Resistance value expressed as a four-digit number—where the first three numbers are the significant value, and the fourth number is the number of zeros.	B ±0.1% C ±0.25% D ±0.5% F ±1.0% G ±2.0% J ±5.0% K ±10% L ±20%	2 Bare 3 Powder Coating 4 Single Surface Epoxy



## High Voltage Leaded Resistors

## HVR SERIES

## Resistor Dimensions



Wire Leads: 22AWG (0.025"),  
1.3" typical length.

Spade Leads: 0.01" thick, 0.02" wide, 0.325" mini-

Case Size	A (Length)	B (Height)	C (Lead Spacing)	Units
39	0.3 +0.08/-0.03	0.4 ±0.03	0.2	inches
	7.62 +2.03/-0.76	10.16 ±0.76	5.08	mm
29	0.5 +0.08/-0.03	0.375 ±0.03	0.4	inches
	12.7 +2.03/-0.76	9.53 ±0.76	10.16	mm
21	1.0 +0.08/-0.03	0.375 ±0.03	0.9	inches
	25.4 +2.03/-0.76	9.53 ±0.76	22.86	mm
42	2.0 +0.08/-0.03	0.5 ±0.03	1.9	inches
	50.8 +2.03/-0.76	12.7 ±0.76	48.26	mm
43	3.0 +0.08/-0.03	0.5 ±0.03	2.9	inches
	76.2 +2.03/-0.76	12.7 ±0.76	73.66	mm
56	4.0 +0.08/-0.03	0.75 ±0.03	3.9	inches
	101.6 +2.03/-0.76	19.05 ±0.76	99.06	mm

For custom case sizes, contact us.

## Typical Performance Characteristics

Test	Maximum ΔR
Short Time Overload	0.1%
Load Life	0.1%
Thermal Shock	0.1%
Shock	0.05%
Vibration	0.05%
Resistance to Soldering Heat	0.05%

Parameter	Typical
Operating Temperature	-55°C to 150°C
TCR	Measured from 25°C to 75°C
Resistance Value	Values > 10M are measured at 100 VDC For custom test voltages consult factory

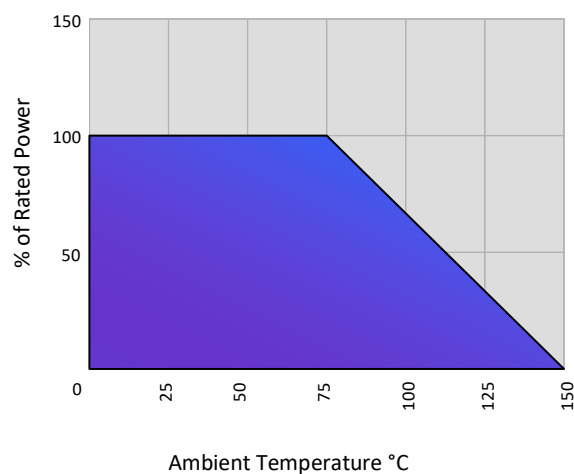
## Material Construction

<b>Substrate</b>	96% Alumina
<b>Coatings</b>	All resistors are glass encapsulated with optional single side epoxy or powder coating.

## Custom Selections Available Upon Request

Please consult us with our knowledgeable sales staff for help specifying custom parts to meet your needs.

## Power Derating Curve



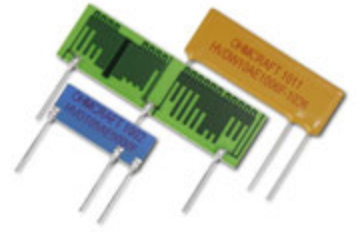
# HVD SERIES

## High Voltage Leaded Dividers

### Advantages

Our patented Micropen® precision printing technology provides superior precision, thick-film resistors.

- Voltage Ratings to 40,000 Volts
- Resistance Values to 2 TΩ
- Ratio Tolerances to 0.1%
- TCR to 25 ppm/°C
- TCR Tracking to 5 ppm/°C
- VCR to 0.05 ppm/V
- Very Low Noise
- Ultra High Stability
- Custom Configurations



### Electrical Specifications

Case Size Ratings	TCR (±ppm/°C)	Ratio Tolerance							
		0.10%	0.25%	0.50%	1%	2%	5%	10%	20%
04 500mW 4kV	25	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
	50	100K-100M	100K-100M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	100K-100M	100K-100M	100K-10G	100K-10G	100K-10G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-100M	100M-10G	100M-50G	100M-50G	100M-50G	100M-50G	100M-50G
	>200	100K-100M	100K-100M	100M-10G	100M-50G	100M-50G	100M-50G	100M-50G	100M-100G
05 1W 5kV	25	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M	1M-100M
	50	100K-100M	100K-100M	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G	100K-1G
	100	100K-100M	100K-100M	100K-10G	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-100M	100M-10G	100M-50G	100M-50G	100M-50G	100M-50G	100M-50G
	>200	100K-100M	100K-100M	100M-10G	100M-50G	100M-50G	100M-50G	100M-50G	100M-100G
10 1W 10kV	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G
	100	100K-100M	100K-500M	100K-10G	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-500M	100M-10G	100M-50G	100M-50G	100M-50G	100M-50G	100M-50G
	>200	100K-100M	100K-500M	100M-10G	100M-50G	100M-50G	100M-50G	100M-100G	100M-1T
20 2W 20kV	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G
	100	100K-100M	100K-500M	100K-10G	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-500M	100M-10G	100M-50G	100M-50G	100M-50G	100M-50G	100M-50G
	>200	100K-100M	100K-500M	100M-10G	100M-50G	100M-50G	100M-50G	100M-100G	100M-1T
30 3W 30kV	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G
	100	100K-100M	100K-500M	100K-10G	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-500M	100M-10G	100M-50G	100M-50G	100M-50G	100M-50G	100M-50G
	>200	100K-100M	100K-500M	100M-10G	100M-50G	100M-50G	100M-50G	100M-100G	100M-1T
40 6W 40kV	25	1M-100M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M	1M-500M
	50	100K-100M	100K-500M	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G	100K-10G
	100	100K-100M	100K-500M	100K-10G	100K-10G	100K-50G	100K-50G	100K-50G	100K-50G
	200	100K-100M	100K-500M	100M-10G	100M-50G	100M-50G	100M-50G	100M-50G	100M-50G
	>200	100K-100M	100K-500M	100M-10G	100M-50G	100M-50G	100M-50G	100M-100G	100M-1T

For custom sizes and configurations, contact [ohmcraftsales@exxelia.com](mailto:ohmcraftsales@exxelia.com).

### How to Order

HVD	+		+		+		+		+		+			
Type		Lead Style		Case Size		Ratio		TCR		R Total Value		Ratio Tolerance		Coating
Leaded High Voltage Divider		T Spade Terminal, 100% Tin RoHS S Spade Terminal, Sn60Pb40 solder W Wire, 22AWG 100% Tin RoHS B Wire, 22AWG Sn60Pb40 solder		04 05 10 20 30 40		A 1000:1 B 100:1 C Other		<b>Absolute</b> E ±25ppm/°C H ±50ppm/°C K ±100ppm/°C L ±200ppm/°C <b>OR</b> <b>Tracking</b> W ±10ppm/°C X ±15ppm/°C Y ±25ppm/°C Z ±50ppm/°C		Resistance value expressed as a four-digit number—where the first three numbers are the significant value, and the fourth number is the number of zeros.		B ±0.1% C ±0.25% D ±0.5% F ±1.0% G ±2.0% J ±5.0% K ±10% L ±20%		2 Bare 3 Powder Coating 4 Single Surface Epoxy

Absolute tolerance is 15% (> 10GΩ 20%) unless otherwise specified.

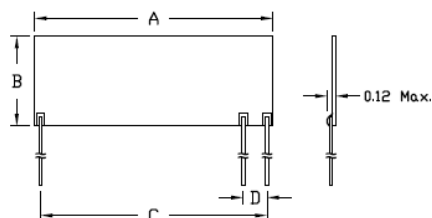
Ratio = (R1+R2)/R2

When TCR Tracking is specified, the typical Absolute TCR is 100ppm/°C.

## High Voltage Ledded Dividers

## HVD SERIES

## Resistor Dimensions



Wire Leads: 22AWG (0.025"),  
1.3" typical length.

Spade Leads: 0.01" thick, 0.02" wide, 0.325" minimum length, standoff 0.06" max.

Case Size	A (Length)	B (Height)	C (Nominal)	D (Nominal)	Units
04	0.5 +0.08/-0.03 12.7 +2.03/-0.76	0.375 ±0.03 9.53 ±0.76	0.4 10.16	0.2 5.08	inches mm
05	1.0 +0.08/-0.03 25.4 +2.03/-0.76	0.375 ±0.03 9.53 ±0.76	0.9 22.86	0.2 5.08	inches mm
10	1.5 +0.08/-0.03 38.1 +2.03/-0.76	0.5 ±0.03 12.7 ±0.76	1.3 33.02	0.2 5.08	inches mm
20	2.0 +0.08/-0.03 50.8 +2.03/-0.76	0.75 ±0.03 19.05 ±0.76	1.9 48.26	0.2 5.08	inches mm
30	3.0 +0.08/-0.03 76.2 +2.03/-0.76	0.75 ±0.03 19.05 ±0.76	2.9 73.66	0.2 5.08	inches mm
40	4.0 +0.08/-0.03 101.6 +2.03/-0.76	0.75 ±0.03 19.05 ±0.76	3.9 99.06	0.2 5.08	inches mm

For custom case sizes, contact us.

## Typical Performance Characteristics

Test	Maximum ΔR
Short Time Overload	0.1%
Load Life	0.1%
Thermal Shock	0.1%
Shock	0.05%
Vibration	0.05%
Resistance to Soldering Heat	0.05%

Parameter	Typical
Operating Temperature	-55°C to 150°C
TCR	Measured from 25°C to 75°C
Resistance Value	Value > 10M are measured at 100 VDC For custom test voltages consult factory

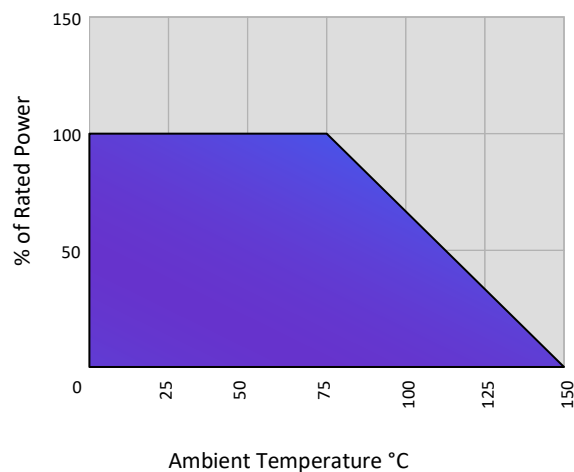
## Material Construction

<b>Substrate</b>	96% Alumina
<b>Coatings</b>	All resistors are glass encapsulated with optional single side epoxy or powder coating.

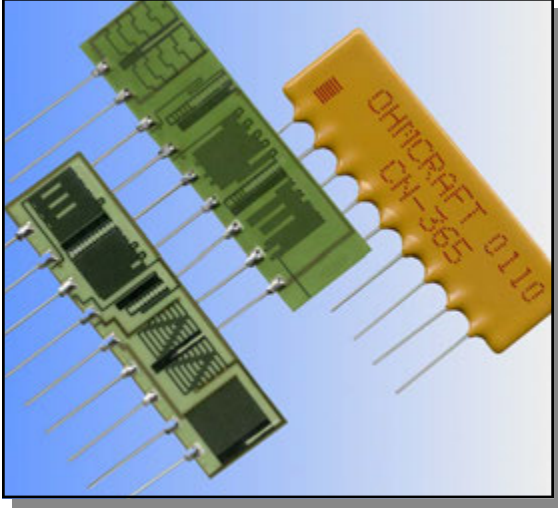
## Custom Selections Available Upon Request

Please consult us with our knowledgeable sales staff for help specifying custom parts to meet your needs.

## Power Derating Curve



Ohmcraft's revolutionary fine film, thick film technology, called **FineFilm**, provides an entirely new level of performance and stability in custom leaded resistor networks.



The usual hybrid technologies for manufacturing resistors depend upon composite materials that have limitations. Traditional thick-film methods severely limit performance characteristics and thin-film methods are limited in attainable ohmic values. The **FineFilm** method of manufacturing offers the best characteristics of both methods, plus adds many unique features. **FineFilm** resistors feature a longer, high-aspect ratio trace of lower resistivity film. The combination of long line, high-aspect ratio, and higher conductivity film, give **FineFilm**

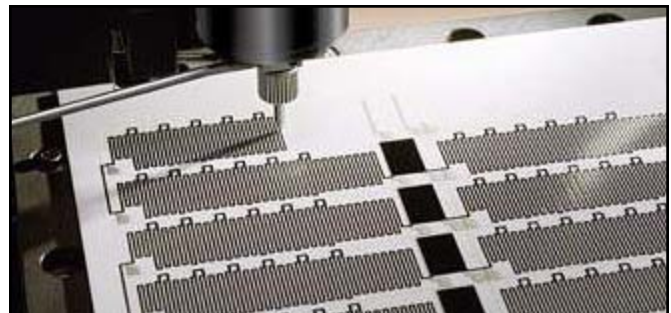
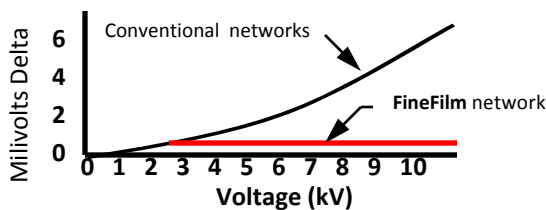
- ◆ Ohmic Values to 2,000 GigOhms
- ◆ Tight Ratio Tolerances ( to 0.1% )
- ◆ Ultra High stability
- ◆ Very Low noise
- ◆ Low TCR ( to 10 ppm/°C )
- ◆ Low TCR Tracking ( to 5 ppm/°C )
- ◆ Low VCR ( to 0.05 ppm/Volt )
- ◆ Custom Configurations

resistors unmatched design efficiency, versatility, linearity, stability and low noise. The **FineFilm** method allows control of process parameters to very tight tolerances. The result is dividers with outstanding tracking performance over a wide range of temperature, voltage and ohmic values.

Using the same method, a complete line of **FineFilm** surface mount and wire bondable chip resistors are manufactured. For information on those products, please refer to the appropriate data sheets.

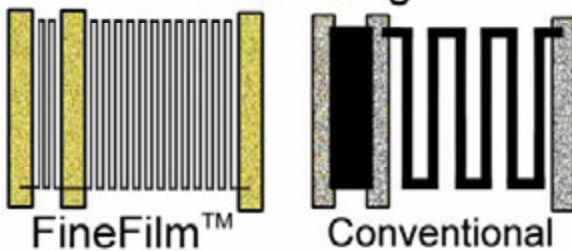
### Excellent VCR Tracking

The low resistivity composition **FineFilm** resistors is significantly better than conventional designs. They have a virtually flat VCR over a wide range of values.



Writing resistors using MicroPen™ technology

### Divider Design



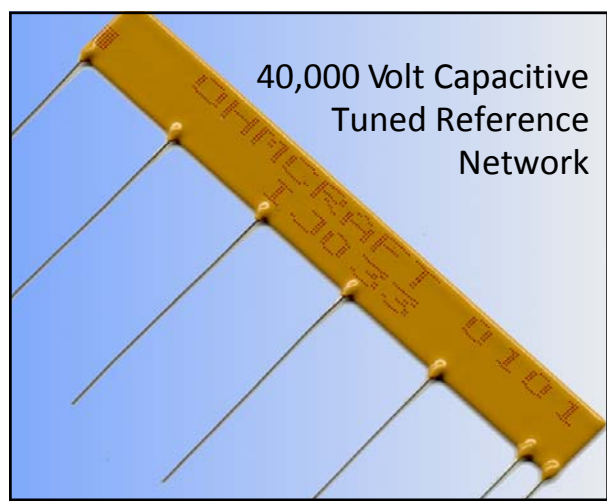
### Design Flexibility

The long serpentine pattern used in manufacturing **FineFilm** High Voltage Dividers (HVDs), coupled with the use of low ohms/square thick film inks, makes it possible to create virtually any divider ratio. For example, Ohmcraft has produced 800 meg-ohm dividers with a 20,000:1 ratio. What are your needs?

Low noise, low TCR, low VCR, and many other features add up to the finest leaded divider in the market today.





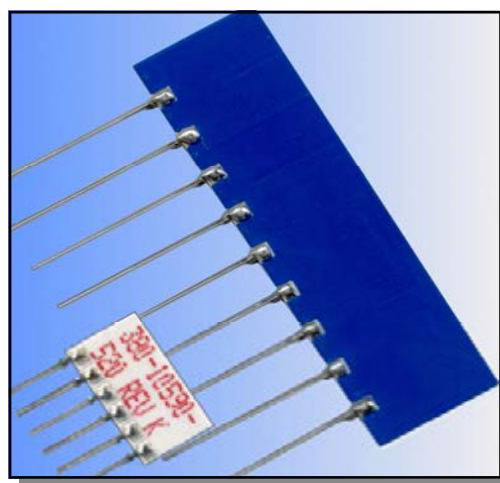


**FineFilm** technology is based on combining very high aspect ratios, and low film resistivities. This combination is unobtainable using standard methods of manufacturing. The outcome is a resistor that surpasses the parameters that are generally acceptable in the industry. A resistor that has higher stability, lower VCRs, lower noise, and lower TCRs.

For further information, please contact us.

Our unique CAD/CAM direct write system allows us to custom fabricate resistor networks:

- Immediate prototyping
- No special tooling
- Easy design changes
- Short or long runs
- High quality



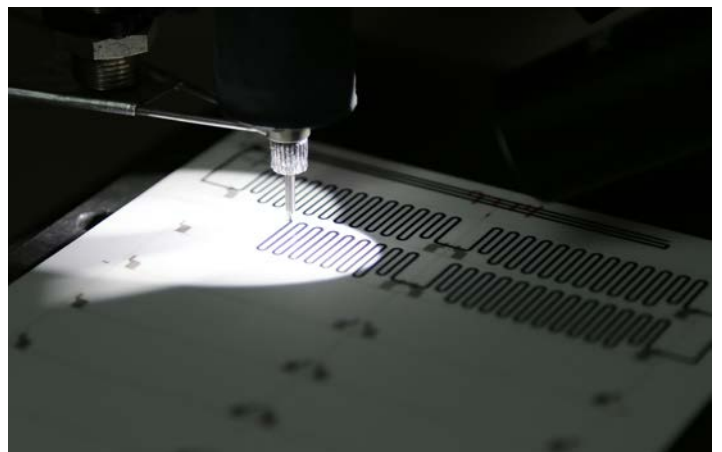
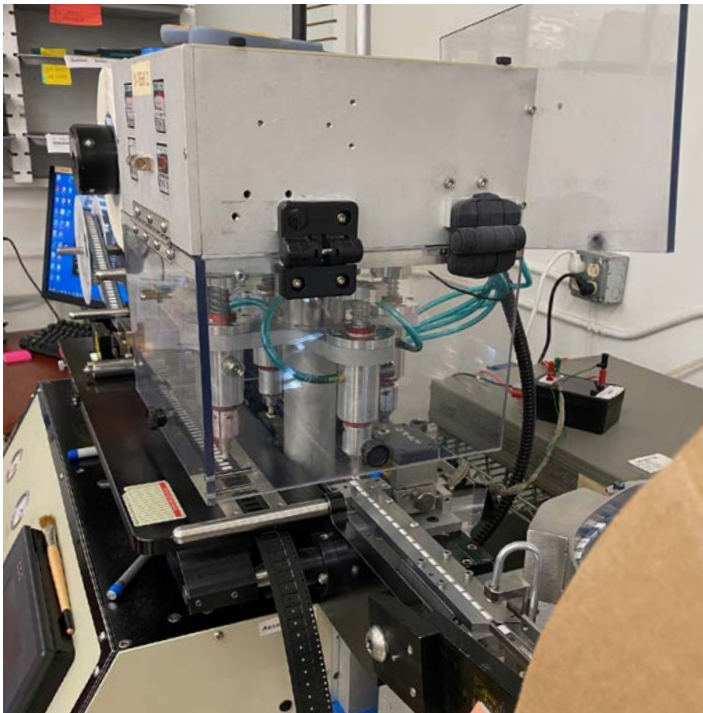
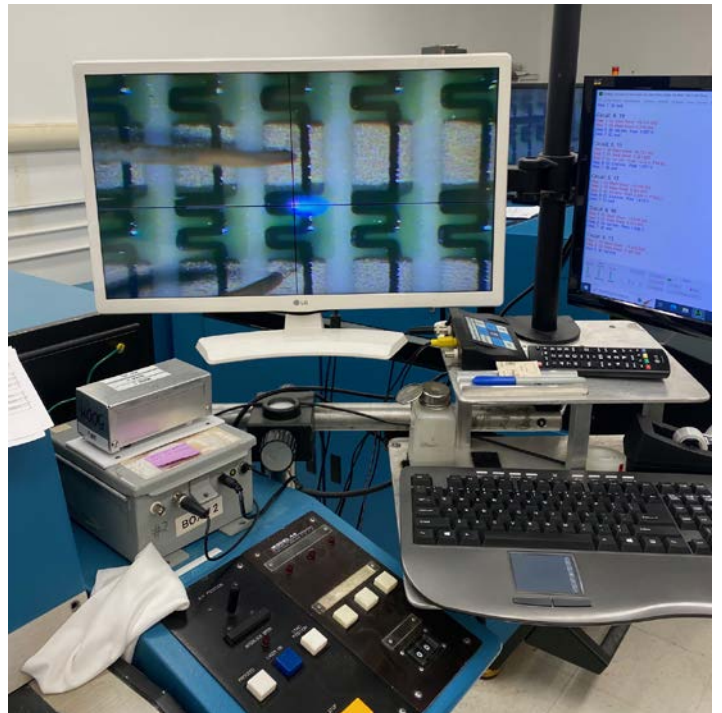
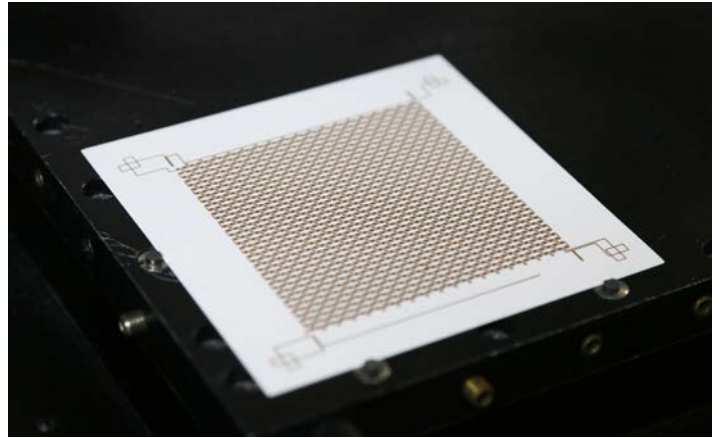
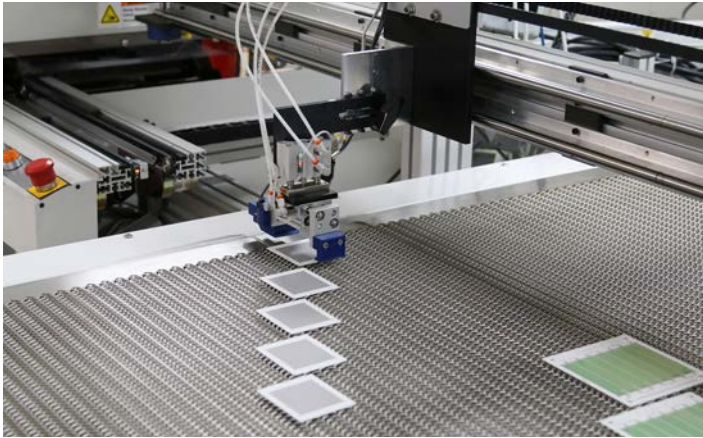
### We would be glad to work with you on your custom network needs:

Because each network is different, there is no standard part number. Each network is assigned it's own number as it is received by the factory. To obtain a quote on a network, please contact us. Please include the following information:

- A schematic & physical diagram showing how all of the resistors interconnect.
- The value of each resistor.
- The desired TCR value ( $\text{ppm}/^{\circ}\text{C}$ )
- Overall tolerance, and the tolerances for each individual component value.
- Type & length of the leads
- Any other information necessary to the manufacture of the network.




# OHMCRAFT WORKSHOP





# EXXELIA OHMCRAFT APPLICATIONS



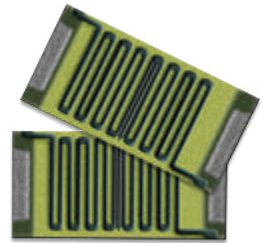
 OHMCRAFT

**EXXELIA**



## High-Performance Resistors For Precision Instrumentation Applications

Thanks to advances in electronics technology, today's instruments are able to measure and test more precisely than ever before. These advanced instruments have helped push forward scientific frontiers in fields from DNA analysis to high-performance test equipment—and have enhanced our safety and national security.

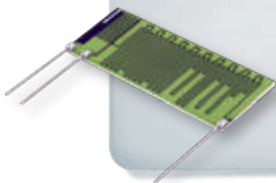


### Superior Precision and Performance

Exxelia Ohmcraft is a major supplier to the instrumentation market, offering proprietary Micropen® precision printing technology that produces ultra-precise, high-performance resistors.

Exxelia Ohmcraft's resistors feature a longer serpentine pattern and a high-aspect ratio, resulting in superior performance that includes:

- Unmatched design flexibility
- Superior linearity and stability
- Tight tolerances to 0.1%
- High ohmic values
- Low noise
- Extremely low TCR and VCR
- Excellent divider tracking





## Measuring Up To The Highest Standards

Exxelia Ohmcraft supplies resistors to a broad range of customers across the instrumentation market. We work with market leaders in high-end instrumentation segments that include advanced testing and measuring, mass spectroscopy, computed tomography (CT), and vital Homeland Security-related detection systems for airports and cargo inspection.

Exxelia Ohmcraft engineering works closely with instrumentation industry leaders to produce the most advanced test equipment and instrumentation. Exxelia Ohmcraft resistors are able to achieve the exacting standards required to support these ultra-precise measurement systems. Exxelia Ohmcraft's custom dividers, resistors, and networks provide a level of service and performance unmatched in the instrumentation market.



Exxelia Ohmcraft is the leader in high-performance resistor design and manufacturing. Our proprietary Micropen® precision printing technology enables superior precision thick-film resistors. Exxelia Ohmcraft can meet the most challenging instrumentation specifications for high-voltage and high-value resistors.

## Applications

Exxelia Ohmcraft's portfolio of stable, high-performance resistor products for the instrumentation market includes: HVC, SM, MCH, HVR, HVD, and custom designs for:

### Scanning

- Mass spectrometry
- Computed tomography
- Cargo container scanning and inspection
- Security scanning systems

### Analysis

- Signal generators
- Logic analyzers
- Data generators
- Power analyzers
- Material analyzers
- DNA analysis systems
- Laboratory analyzers
- RF analyzers
- Gas, chemical, and nuclear detection systems

### Testing and Measurement

- Test equipment
- High-voltage measurement systems
- Multi-meters
- Oscilloscopes
- Automated test systems
- Network test systems
- Piezo measurement systems
- Instrumentation control
- Calibration equipment
- Vibration testing equipment
- Environmental testing systems
- Mobile/handheld instrumentation

### Specialized Usage

- Down-hole applications
- Photomultiplier applications

To learn more, visit us online at [www.exxelia.com](http://www.exxelia.com)





# High-Performance Resistors For Today's Most Advanced Medical Applications

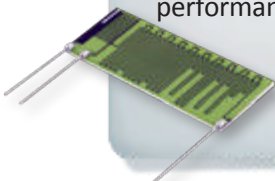
In a time of change in the medical technology market, the one constant that remains is improved clinical outcomes. Exxelia Ohmcraft's high-performance resistors enable medical product designers to improve more lives in more ways than ever before. Exxelia Ohmcraft's resistors are designed into products used in diagnosis, therapy, and prevention. From small, implantable, and non-invasive devices to large imaging equipment, Exxelia Ohmcraft's reliability makes it the resistor of choice for such critical applications.



## High Voltage, High Reliability

Exxelia Ohmcraft's proprietary Micropen® precision printing technology produces superior resistor products ideally suited for medical applications, printing resistors with electrical characteristics that outperform our competitors. Our technology allows us to write a very exact serpentine pattern with more precise line width and length than conventional screen printing. Thanks to this patented technology, Exxelia Ohmcraft resistors are able to deliver unmatched performance, including:

- Superior TCR and VCR
- High voltage
- Excellent pulse-handling capability
- Very low noise
- High ohmic values
- Extremely tight tolerances to 0.1%



## Medical Devices

Doctors, researchers, and device designers are finding that rapid fire bursts of precisely controlled electricity can alleviate symptoms in many illnesses and in many parts of the human body. Exxelia Ohmcraft is a leader in supplying resistors to the defibrillator industry and the implantable and minimally invasive product markets. Our unique Micropen<sup>®</sup> precision printing technology produces industry-leading pulse-handling capability for critical medical device circuits. Exxelia Ohmcraft's engineers work with device manufacturers to design and fabricate resistors for cardiovascular, neurology, and radiology market segments.

**Products:** HVC, SM, HVR, HVD, and Custom

**Applications:**

- External defibrillators
- Internal defibrillators
- Electrocardiogram (ECG) systems

## Medical Instrumentation

The advent of more powerful and complex patient monitoring, diagnostics, medication delivery systems, and analytic tools has resulted in tremendous improvements in patient care. These patient-interface instruments require precise, highly stable components to ensure the accuracy of critical data needed by physicians, nurses, and diagnosticians.

Exxelia Ohmcraft's Micropen<sup>®</sup> precision printing is well-suited to meet the needs of this market. Our long-length serpentine pattern produces high-ohmic-value resistors with ultra-tight TCR and VCRs capable of producing the critical measurements and data required.

**Products:** HVC, SM, HVR, HVD, and Custom

**Applications:**

- Patient monitoring systems
- Medical power supplies
- Respiratory systems
- Drug delivery systems
- Drug pumps
- Prosthetics
- Medical cables
- Blood analyzers
- Laboratory analyzers
- DNA analyzers

## Medical Imaging

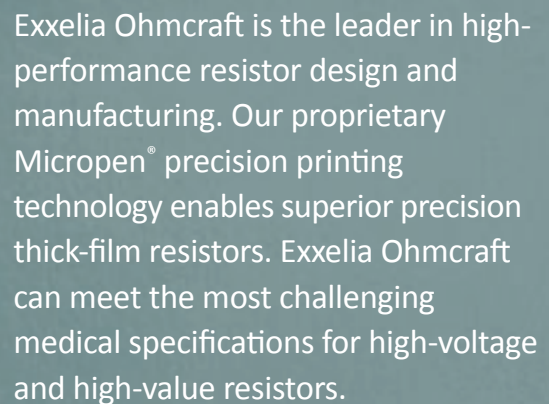
Advances in medical imaging, from CT and PET scanners to X-ray and ultrasound, have led to more accurate and precise diagnoses. In turn, this leads to more effective therapies and preventions. Exxelia Ohmcraft's resistors will continue to be the component of choice for imaging applications based on proven reliability and functionality.

Imaging equipment market leaders rely on Exxelia Ohmcraft's leaded and surface-mount resistors to provide the precision and performance required by advanced imaging methods. Tightly controlled TCR and VCR, low noise, and enhanced ESD tolerance make Exxelia Ohmcraft's high-voltage and high-value resistors the component of choice in the medical imaging market.

**Products:** HVC, SM, HVR, HVD, and Custom

**Applications:**

- CT units
- X-ray systems
- Ultrasound devices
- Mammography devices
- Nuclear imaging systems
- PET scanners
- Radiography devices
- MRI devices



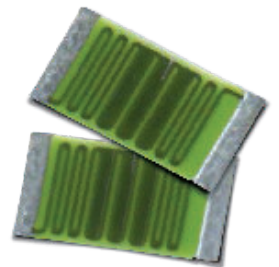
Exxelia Ohmcraft is the leader in high-performance resistor design and manufacturing. Our proprietary Micropen<sup>®</sup> precision printing technology enables superior precision thick-film resistors. Exxelia Ohmcraft can meet the most challenging medical specifications for high-voltage and high-value resistors.

To learn more, visit us online at [www.exxelia.com](http://www.exxelia.com)



## High-Performance Resistors For Mission-Critical Applications

Exxelia Ohmcraft meets the needs of modern electronic warfare, weapons platforms, and military professionals, recognizing innovation as an essential element of being successful as a supplier to today's military. Exxelia Ohmcraft has served the military market for over two decades, reliably supporting a wide range of products, programs, and applications. Our custom and standard resistor products are well positioned to support the rigorous specifications required by military suppliers in this technology-driven market.



### Superior Performance

Our unique Micropen® precision printing technology produces ultra-stable parts that are perfectly suited to the military's rugged requirements, delivering a typical load life of 0.1% over 10,000 hours. This proven stability, accuracy, and quality support the long-term program life of many military products and programs.

Micropen technology produces a superior resistor. The combination of our longer serpentine pattern and high-aspect ratio gives our resistors unmatched design flexibility, linearity, stability, and low noise capability, as well as:



- High voltage to 40kV
- Extremely tight tolerances to 0.1%
- Very low TCR
- Extended temperature range
- Very low noise
- Very low VCR
- Ultra-high stability


## Custom Designs For Military Applications

Exxelia Ohmcraft's ability to design and deliver custom resistors is essential for military suppliers. Our engineers work closely with you to design resistors that match your exact specifications.

- Surface-mount resistors, dividers, and networks
- Extensive experience designing custom resistors and supporting source control drawings (SCD) for existing and new designs
- Small runs to support prototypes to large volume manufacturing

Exxelia Ohmcraft can test parts using a number of military specs, including:

- MIL-PRF-55342, 83401, 55182H, 914B, and 49462B
- MIL-STD-129, 1276F, and 1285F
- MIL-STD-202
- Space-grade resistors
- Extended temperature range
- Rapid prototyping



Exxelia Ohmcraft is the leader in high-performance resistor design and manufacturing. Our proprietary Micropen® precision printing technology enables superior precision thick-film resistors. Exxelia Ohmcraft can meet the most challenging military specifications for high-voltage and high-value resistors.



## Applications

Exxelia Ohmcraft's portfolio of rugged, high-quality resistor products includes HVC, SM, MCH, HVR, HVD, and custom designs for:

### Flight & Space

- Aviation
- Aerospace
- Flight controls
- Satellites
- SATCOM
- Microwave
- Radar

### Tactical

- Night vision
- Ordnance
- Electronic warfare
- Munitions

### Systems

- Surveillance
- Detection
- Navigation
- Monitoring
- Sight systems
- Motion control
- Communications
- Networks

To learn more, visit us online at [www.exxelia.com](http://www.exxelia.com)





## High-Voltage Resistors For Power Supplies

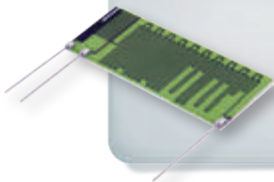
At Exxelia Ohmcraft, a large part of our success has come from supporting the needs of customers in the power supply market. We provide many market leaders with standard and custom products. Our SMT resistors can handle voltages up to 3500V, while our leaded products are designed to handle up to 40kV.



### High Voltage, Superior Performance, and Enhanced Benefits

Exxelia Ohmcraft's proprietary Micropen® precision printing technology produces superior resistors, dividers, and networks. Our technology creates a longer serpentine pattern that supports the high-voltage handling and the stability needed by today's advanced power supply designs. Benefits include:

- High voltage to 40kV
- Unmatched design flexibility
- Low noise
- Enhanced thermal management
- Improved ESD tolerance
- Superior linearity and stability
- Tightly controlled TCR and VCR
- Extremely tight tolerances to 0.1%
- Custom designs






## Custom Designs For Power Supply Applications

Exxelia Ohmcraft engineers are experienced in working closely with our in-dustry partners to develop custom resistor designs. Emphasizing high-volt-age attributes, these designs include SMT, leaded resistors, networks, and dividers that allow for custom specifications of TCRs, VCRs, and tracking.

This level of collaboration with our customers and our unique Micropen® precision printing technology create a level of performance that is unmatched by any other manufacturer serving this important market segment.



Exxelia Ohmcraft is the leader in high-performance resistor design and manufacturing. Our proprietary Micropen® precision printing technology enables superior precision thick-film resistors. Exxelia Ohmcraft can meet the most demanding power supply specifications for high-voltage and high-value resistors.



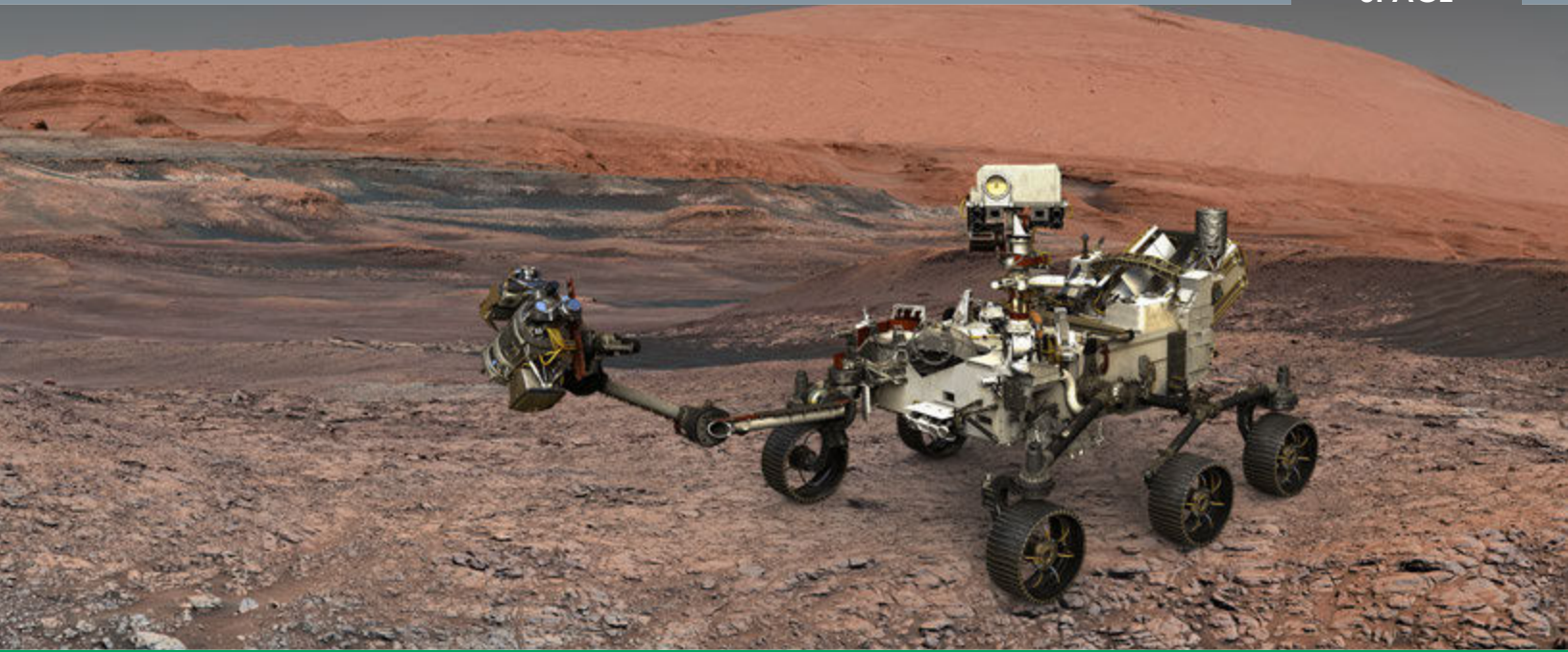
## Applications

Exxelia Ohmcraft's portfolio of stable, high-voltage, and high-performance resistor products for power supply applications includes: HVC, SM, MCH, HVR, HVD, and custom designs for:

- High-voltage power supplies
- Linear power supplies
- Switching power supplies
- Medical power supplies
- Uninterruptible power supplies
- Bench-top power supplies
- Programmable power supplies
- DC-to-DC converters
- Voltage multipliers
- Power management
- Power distribution units
- Power metering
- Pulse width modulation

To learn more, visit us online at [www.exxelia.com](http://www.exxelia.com)





## High Performance Resistors for Space Instrumentation

Exxelia Ohmcraft provides designers of space instrumentation with resistors that are the foundation for building robust power supplies, sensors and imaging equipment. Exxelia Ohmcraft products have helped push forward scientific advancements in mass spectrometry, image intensifiers, X-Ray sources and spectroscopic analysis. We provide standard and custom products to many market leaders with the reliability that makes Exxelia Ohmcraft the resistor of choice for such critical scientific space applications.

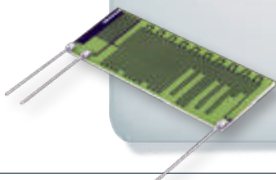


### Superior Performance

Our unique Micropen precision printing technology produces ultra-stable resistors with exceptional reliability that are perfectly suited for space flight applications. For over 20 years, Exxelia Ohmcraft has been designing resistors used in instruments on various spacecrafts. Our resistors enable the analytical equipment designed for strategic science missions which creates the space technology that explores outer space.

Exxelia Ohmcraft technology produces a superior resistor. The combination of our longer serpentine pattern and high-aspect ratio gives our resistors unmatched design flexibility, linearity, stability and low noise capability as well as:

- Ultra High Voltages up to 60 kV
- Extremely tight tolerances to 0.1%
- Very low TCR with extended temperature range
- Very low noise
- Very low VCR
- Ultra-high stability



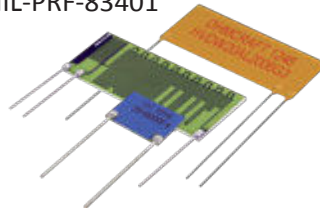
## Custom Designs For Space Applications

Exxelia Ohmcraft ability to design and deliver custom resistors is essential for space instrumentation designers. Our engineers work closely with you to design resistors that match your exact specifications.

- Surface-mount resistors, dividers and networks
- Extensive experience designing custom resistors and supporting source control drawings (SCD) for existing and new designs
- Engineering Models
- Flight Models

Exxelia Ohmcraft can perform Lot Acceptance Testing (LAT) on our resistor products using a number of Space and Military Specifications, including:

- NASA EEE-INST-002 Level 1, Level 2 or Level 3
- MIL-PRF-55342, MIL-PRF-49462 and MIL-PRF-83401
- MIL-STD-202
- ESCC 4001 (ESA/SSC 4001)



Exxelia Ohmcraft is the leader in high performance resistor design and manufacturing. Our proprietary Micropen precision printing technology enables superior precision thick-film resistors. Exxelia Ohmcraft can meet the most challenging space instrument specifications for high voltage and high value resistors.

### Applications

Exxelia Ohmcraft portfolio of rugged, high-quality resistor products includes MCH, HVR, HVD, HVA and custom designs for:

#### Scientific Instrumentation

- Mass Spectrometers
- Ion Mobility Spectrometers
- Test Equipment
- Signal Generators
- Chemical / Mineral Sample Analysis

#### Instrumentation Power Supplies

- High Voltage Custom Power Supplies

#### Vision Systems

- Image Intensifier Circuits
- Optical Spectrometers
- Photomultipliers

To learn more, visit us online at [www.exxelia.com](http://www.exxelia.com)

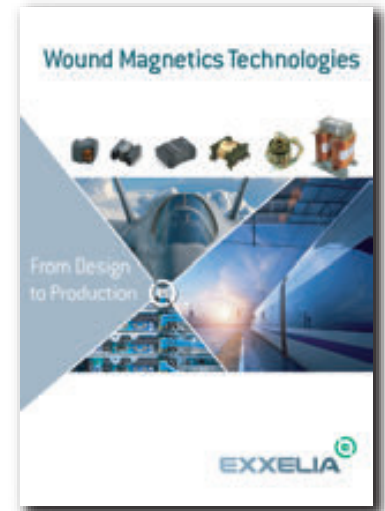
# NOTES



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# EXXELIA Components Portfolio





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