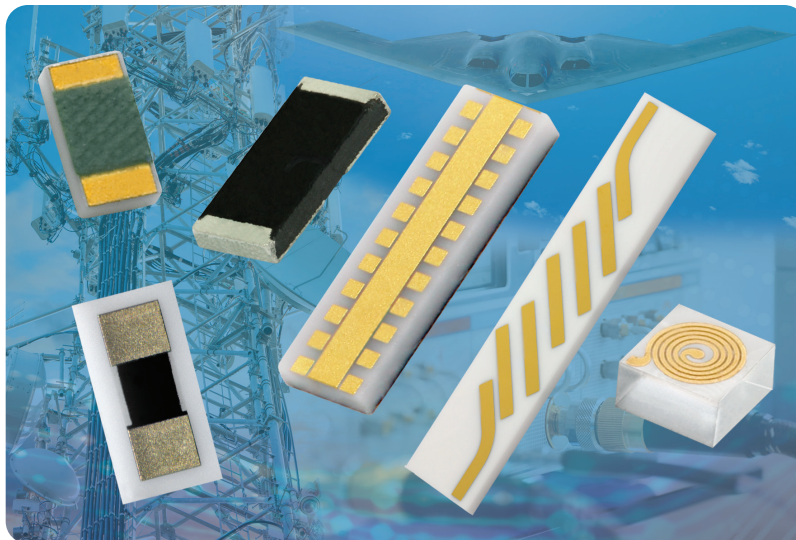




# VISHAY DALE HIGH FREQUENCY PRODUCTS

## Vishay Electro-Films / Vishay Thin Film / Vishay Dale

### RF / High Frequency Products



#### INTRODUCTION

With the ever-increasing demand for wireless data streams and emerging technologies such as 5G and Internet of Things (IoT), the entire telecommunications, military, and medical industries are again witnessing major breakthroughs and racing to develop next-generation systems. To pave the way and fuel the needs of such advanced technologies, the availability of superior and robust high frequency components is paramount.

Using state of the art manufacturing methods, Vishay Dale is able to produce a wide range of products from chip resistors to spiral inductors in the high frequency range. Vishay Dale high frequency products are all manufactured at ISO 9001-registered facilities to ensure the highest quality. Key features of these products include:

- S-parameter files – Easy online access and file download option for design use
- Stable resistor performance – Intensive testing and controlled manufacturing processes result in extremely stable performance over time
- Part sizes – Industry-standard case sizes as low as 0201 and custom sizes up to 0.500 in. are available
- Resistor ranges – High frequency chip resistors are manufactured for a wide range of resistance values from 10  $\Omega$  to 2 k $\Omega$
- Terminations – Several different termination options, including wire bondable, flip chip, epoxy mount, and surface-mount
- Custom orders – Beyond standard values and tolerances, Vishay Dale offers several high frequency products at custom values and tolerances
- Custom designs – Custom-designed substrates can be manufactured for thin film RF applications

#### RESOURCES

- For technical questions contact [efi@vishay.com](mailto:efi@vishay.com)
- For more detailed information, please visit [www.vishay.com](http://www.vishay.com)

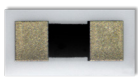
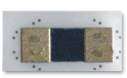
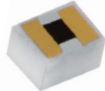

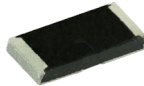




# VISHAY DALE HIGH FREQUENCY PRODUCTS

## Vishay Electro-Films / Vishay Thin Film / Vishay Dale

### Resistor Performance Specifications

	<b>MIC</b>	<b>MIB</b>	<b>MIF</b>	<b>FC</b>	<b>RCP</b>
					
<b>Description</b>	Precision, moisture resistant, high frequency	Precision, moisture resistant, high frequency	Precision, moisture resistant, high frequency	Precision, high frequency	Thick film, high frequency
<b>Film type</b>	Thin	Thin	Thin	Thin	Thick
<b>Maximum frequency (GHz)</b>	≤ 20	≤ 20 <sup>(1)</sup>	≤ 20 <sup>(1)</sup>	≤ 40	≤ 6
<b>Resistor material</b>	Tantalum nitride	Tantalum nitride	Tantalum nitride	Passivated nickel chromium	Ruthenium oxide
<b>Overall resistance range (Ω)</b>	2 to 20 000	20 to 2000	20 to 2000	10 to 1000	10 to 2000
<b>Microwave resistance range (Ω)</b>	20 to 500	20 to 100	20 to 100	10 to 1000	10 to 2000
<b>Absolute tolerance range (%)</b>	± 1.0 to ± 20	± 1.0 to ± 20	± 1.0 to ± 20	± 0.1 to ± 5.0	± 1.0 to ± 5.0
<b>TCR range (ppm/C)</b>	± 25 to ± 200	± 100 to ± 200	± 100 to ± 200	± 25 to ± 100	± 150
<b>Power rating (mW)</b>	125	25	50	50 to 330	1400 to 3500 <sup>(2)</sup>
<b>Working voltage (V)</b>	< 100	< 100	< 100	30 to 75	3.7 to 83.6
<b>Noise (dB)</b>	-20 typ.	-20 typ.	-20 typ.	< -35	< -10
<b>Operating temperature range (C)</b>	-55 to +125	-55 to +125	-55 to +125	-55 to +155	-55 to +155
<b>S-parameters</b>	Available online	Not available <sup>(1)</sup>	Not available <sup>(1)</sup>	Available online	Available online

#### Notes

<sup>(1)</sup> Assumed equivalent to MIC


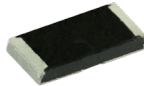
<sup>(2)</sup> Without cooling; see datasheet for active cooling



# VISHAY DALE HIGH FREQUENCY PRODUCTS

## Vishay Electro-Films / Vishay Thin Film / Vishay Dale

### Resistor Mechanical Specifications

	<b>MIC</b>	<b>MIB</b>	<b>MIF</b>	<b>FC</b>	<b>RCP</b>
					
<b>Substrate</b>	Alumina (Al <sub>2</sub> O <sub>3</sub> )	Alumina (Al <sub>2</sub> O <sub>3</sub> )	Alumina (Al <sub>2</sub> O <sub>3</sub> )	Alumina (Al <sub>2</sub> O <sub>3</sub> )	Aluminum nitride (AlN)
<b>Resistor material</b>	TaN	TaN	TaN	NiCr	RuO <sub>2</sub>
<b>Passivation</b>	None	None	None	SPM	Epoxy
<b>Barrier</b>	Pd	None	None	Ni	Ni
<b>Terminations</b>	Gold, aluminum, SnPb solder, Pb-free solder	Gold, aluminum, SnPb solder, Pb-free solder	Gold	Gold, SnPb solder, Pb-free solder	SnPb solder, Pb-free solder
<b>Case size</b>	0402	0201	02016	0402, 0505, 0603, 0805, 1005, and 1206	0505, 0603, 1203, and 2512
<b>Assembly</b>	Wire bondable, flip chip, and solder attach	Wire bondable and solder attach	Wire bondable	Solder, flip chip, and epoxy attach	Solder and epoxy attach



# VISHAY DALE HIGH FREQUENCY PRODUCTS

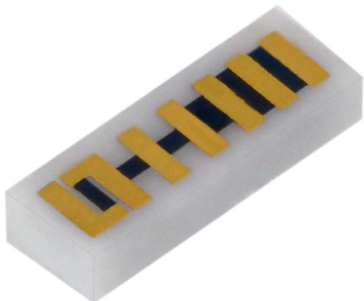
Vishay Electro-Films / Vishay Thin Film / Vishay Dale

## Thin Film Resistor Network

**TMR** – Thin film tapped microwave resistor

**Features:**

- Multiple low ohm taps
- Case size: 0602
- Wire bondable
- Alumina substrate
- Resistance range RT: 100 Ω to 430 Ω
- Tolerances from ± 1 % to ± 20 %
- Resistor TCR range from ± 25 ppm/C to ± 200 ppm/C
- Moisture resistant

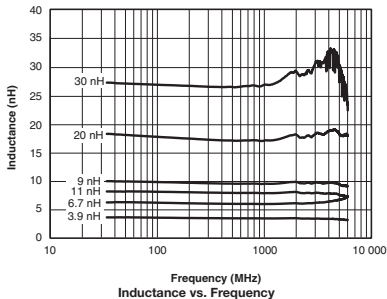
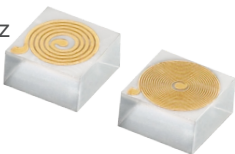


## Thin Film High Frequency Spiral Inductor

**RFLW** – High frequency wire bondable RF spiral inductor

**Features:**

- Frequency response up to 1.0 GHz
- Case sizes: 0303 and 0505
- S-parameters are available online
- Wire bondable
- Inductance value range from 3.9 nH to 150 nH
- Quartz substrate
- Tolerance of ± 20 %

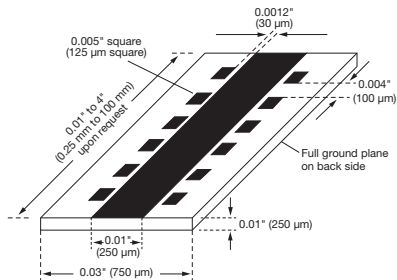
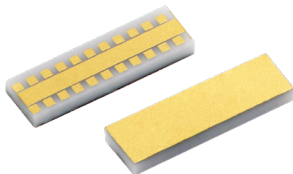


## Thin Film High Frequency Micro-Strip Transmission Line

**MTLP** – Wire bondable thin film micro-strip transmission line resistor arrays

**Features:**

- Custom sizes from 0301 to 0350
- Wire bondable
- Alumina (Al<sub>2</sub>O<sub>3</sub>) substrate
- 50 Ω micro-strip configuration
- Mechanical tolerance of ± 0.002 in





# VISHAY DALE HIGH FREQUENCY PRODUCTS

Vishay Electro-Films / Vishay Thin Film / Vishay Dale

## RF Custom Substrates

- Polished and as-fired Al<sub>2</sub>O<sub>3</sub>, AlN, and BeO substrates available in standard or custom thicknesses
- Specialty garnet, ferrite, and quartz substrates available
- Au-filled via capability for RF performance, front to back connectivity, and heat dissipation
- Solderable and wire-bondable metal stack options
- Custom shapes
- Build to print

## RF Distributed Element Filters

- RF capacitance measurement capability
- Functional RF measurement capability
- Measurement frequencies up to 50 GHz



## Lange Couplers / Air Bridges

- 1 mil line and space capability
- Tight tolerance pattern linewidths



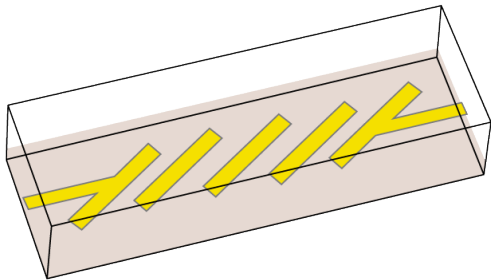
## RF Integrated Lumped Element Filters

- Intergrated RF microwave resistor element capability
- Intergrated RF spiral inductor element capability

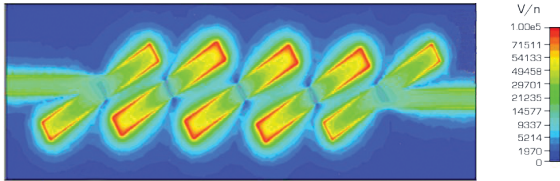


## Resources

- For more detailed information, please visit [www.vishay.com/company/brands/electro-films/](http://www.vishay.com/company/brands/electro-films/)
- For design guidelines, please reference [www.vishay.com/doc?49103](http://www.vishay.com/doc?49103)



Clamp to range: [Min: 0/Max: 100000]



Type = E-Field (peak)  
 Monitor = e-field (f = 10)  
 Component = Abs  
 Plane at z = - 0.47576  
 Frequency = 10  
 Amplitude Plot  
 Maximum - 2d = 462599 V/n at - 220.488/- 36.604/- 0.47576