



# THIN FILM RESISTOR NETWORKS

## Precision Dividers and Networks

### Precision Thin Film Technology



#### INTRODUCTION

This capabilities brochure is designed to help circuit designers and component engineers understand the advantages of utilizing thin film integrated resistor network technology. It also highlights some common applications for thin film precision resistor networks.

#### RESOURCES

- For technical questions contact: [thinfilm@vishay.com](mailto:thinfilm@vishay.com)
- Vishay Dale Thin Film Brands page: [www.vishay.com/company/brands/daletinofilm/](http://www.vishay.com/company/brands/daletinofilm/)
- Vishay Dale Thin Film Interactive Sample Board: [www.vishay.com/landingpage/SMD\\_Board/index.html](http://www.vishay.com/landingpage/SMD_Board/index.html)





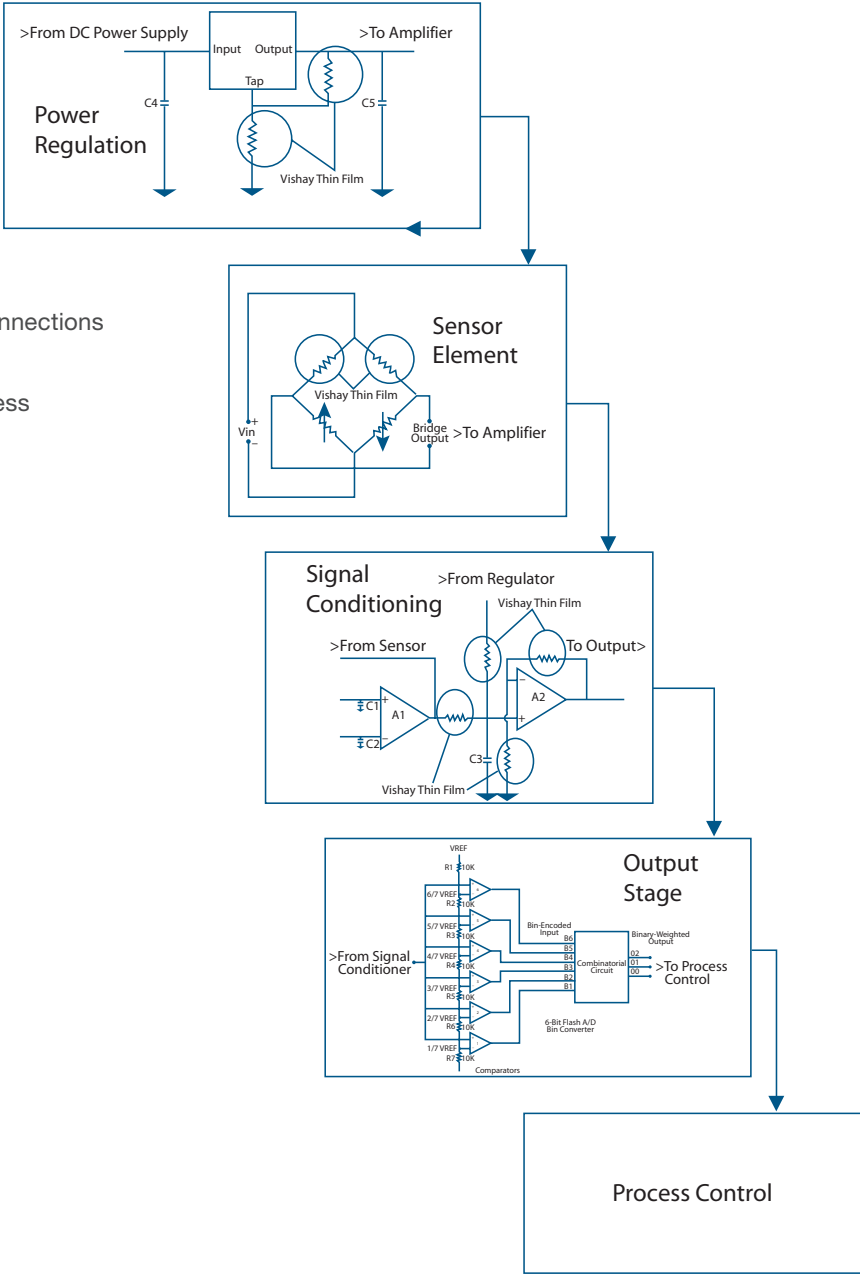
# THIN FILM RESISTOR NETWORKS

## Precision Dividers and Networks

### Thin Film Integrated Construction

#### Advantages







- Extremely close matching of all elements in a network, ensuring close tracking over temperature and throughout life
- Very small, high-density, multi-element networks which save printed circuit board real estate
- Repeatable and consistent characteristics, part to part, and lot to lot
- Very low inductance
- Outstanding reliability – fewer individual interconnections
- No thermoelectric effects
- Installed costs no more than discretes – often less





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




## Precision Dividers and Networks

Semi-Precision						
	<u>VSOR</u>	<u>VSSR</u>	<u>VTSR</u>	<u>VSSRC</u>	<u>VSORC</u>	<u>VTSRC</u>
<b>Package</b>						
<b>Size</b>	16	16, 20, 24	20, 24	20	20	20
<b>Schematic</b>	Isolated and Common, Dual Terminator, Differential Terminator	Isolated and Common, Dual Terminator, Differential Terminator	Isolated and Common, Dual Terminator, Differential Terminator	T-Filter Tapped Termination	T-Filter Tapped Termination	T-Filter Tapped Termination
<b>Number of Resistors</b>	8 or 15	8 to 23	10 to 23	18 R 18 C	18 R 18 C	18 R 18 C
<b>Range (<math>\Omega</math>)</b>	10 to 47K	10 to 47K	10 to 47K	n/a	n/a	n/a
<b>Absolute Tolerance (%)</b>	2 to 5	2 to 5	2 to 5	R = 10, C = 20	R = 10, C = 20	R = 10, C = 20
<b>Ratio Tolerance (%)</b>	n/a	n/a	n/a	n/a	n/a	n/a
<b>TCR (ppm/C) -55 °C to +125 °C</b>	100	100	100	200	200	200
<b>TCR Tracking</b>	n/a	n/a	n/a	n/a	n/a	n/a
<b>Power per R (W per element)</b>	0.1	0.1	0.1	0.1	0.1	n/a
<b>Package Power (W)</b>	16 pin = 1, 20 pin = 1.2, 24 pin = 1.4	16 pin = 1, 20 pin = 1.2, 24 pin = 1.4	1.2	1.0	1.0	1.0



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## Precision Dividers and Networks

Surface-Mount Networks (Molded) Precision												
Package												
											AEC-Q200 Qualified	
Size	SC-70	SOT-23	QSOP 8 pin	SOIC 8 pin	SOIC 8 pin	SOIC 8 pin	SOIC 8 pin	SOIC 14, 16	SOIC 16, 20, 24	SOT-23	SOIC 8 pin	SOIC 14, 16
Schematic	Center Tapped or Isolated	Center Tapped	Isolated	Isolated	Isolated	Voltage Divider and Reference R	Isolated	Isolated	Isolated, Center Tapped	Center Tapped	Isolated, Divider	Isolated
Number of Resistors	2	2	4	4	4	5	4	7, 8	up to 23	2	4	7, 8
Range ( $\Omega$ )	100 to 50K	100 to 100K	400 to 100K	33 to 500K	1 k to 100K	2K to 50K	1K to 100K	100 to 100K	500 to 100K	1K to 50K	1K to 100K	1K to 50K
Absolute Tolerance (%)	0.1 to 1	0.05 to 1	0.05 to 1	0.05 to 1	0.10	0.1	0.1	0.1 to 1	0.1 to 1	0.1 to 1	0.1 to 1	0.1 to 1
Ratio Tolerance (%)	0.5 to 0.05	0.5 to 0.01	0.01 to 0.5	0.5 to 0.01	0.05	0.05	0.05	0.5 to 0.025	0.5 to 0.025	0.05 to 0.5	0.05 to 0.5	0.05 to 0.5
TCR (ppm/C) -55 °C to +125 °C	25	25	25	25	25	25	25	25	25	25	25	25
TCR Tracking	2	2	1	5	5	5	5	5	5	2	5	5
Power per R (W per element)	0.075	0.1	0.05	0.1	0.1	0.1	0.1	0.05	0.1	0.1	0.1	0.1
Package Power (W)	0.15	0.2	0.2	0.4	0.4	0.4	0.4	0.4 / 0.5	0.4	0.2	0.4	0.4 / 0.5



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## Precision Dividers and Networks

Surface-Mount Networks (Molded) Precision							Surface-Mount (Hermetic) Precision		
Package	<a href="#">CSO</a>	<a href="#">TOMC</a>	<a href="#">WOMC</a>	<a href="#">DFN</a>	<a href="#">DFN (Divider)</a>	<a href="#">QFN-</a>	<a href="#">LCC/TLCC</a>	<a href="#">FP (Flatpack)</a>	<a href="#">CSOM</a>
Size	SOIC 6, 8, 12, 14, 16	SOIC 16 Medium	SOIC 16 Wide	8 Pin Dual Flat No-Lead	8 Pin Dual Flat No-Lead	20 Pin Dual Flat No-Lead	4, 16, 18, 20	14, 16	SOIC 14, 16, 18, 20, 22, 24 (25 mil pitch)
Schematic	Any	Isolated and Common	Custom	Isolated	Isolated	Custom	Isolated and Common	Isolated and Common	Any
Number of Resistors	Custom	8	Custom	4	4	Custom	8 to 23	Custom	Custom
Range ( $\Omega$ )	up to 1.5M total	100 to 200K	100 to 500K	100 to 100K	100 to 100K	100 to 500K	100 to 100K	10 to 1M	up to 500K total
Absolute Tolerance (%)	0.1 to 1	0.1 to 1	0.1 to 1	0.1 to 1	0.1 to 1	0.1 to 1	0.1 to 1	0.1 to 1	0.05 to 1
Ratio Tolerance (%)	0.1 to 0.02	0.5 to 0.025	0.1 to 0.05	0.5 to 0.025	0.05	0.1 to 0.05	n/a	0.1 to 0.01	0.02 to 0.1
TCR (ppm/C) -55 °C to +125 °C	25	25	25	25	25	25	25	10	25, 50
TCR Tracking	5	5	5	3	5	5	5	2	5
Power per R (W per element)	0.1	0.1	0.1	0.05	0.05	0.05	Common 0.05 Isolated 0.1	0.1	0.1
Package Power (W)	0.5	0.75	0.5	0.05 x number of resistors	0.05 x number of resistors	0.05 x number of resistors	0.5	0.6	0.5



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Through-Hole Precision						
Package	<a href="#">TDP</a> 	<a href="#">HD (Hermetic Dip)</a> 	<a href="#">VTF SIP</a> 	<a href="#">TSP Molded Sip</a> 	<a href="#">HVPS</a> 	<a href="#">83401 SIP</a> 
Size	14, 16	8, 14, 16, 18, 20	3, 4, 5, 6, 7, 8, 9, 10	6, 8, 10	2	6, 8, 10
Schematic	Isolated and Common	Custom	Standard or Custom	Isolated and Common	Isolated	Isolated and Common
Number of Resistors	7, 8	Custom	2 to 9	5 to 9	1	3 to 9
Range ( $\Omega$ )	100 to 100K	50 to 1.5M total	100 to 1M	100 to 200K	50K to 10M	100 to 200K
Absolute Tolerance (%)	0.5 to 1	0.1 to 1	0.1 to 1	0.5 to 1	0.01 to 1.0	0.1 to 5
Ratio Tolerance (%)	0.1 to 0.05	0.1 to 0.01	0.1 to 0.02	0.1 to 0.05	n/a	0.05
TCR (ppm/C) -55 °C to +125 °C	25	10	10	25	5	25 to 300
TCR Tracking	5	2	2	5	n/a	5
Power per R (W per element)	Common 0.05 Isolated 0.1	0.1	0.1	0.1	HVPS1: 0.125 HVPS2: 0.250	0.06 to 0.12
Package Power (W)	0.8	1	0.5	0.5	HVPS1: 0.125 HVPS2: 0.250	0.18 to 1.0





# THIN FILM RESISTOR NETWORKS

## Precision Dividers and Networks

### SEMICONDUCTORS

#### *MOSFETs Segment*

MOSFETs  
 Low-Voltage TrenchFET®  
 Power MOSFETs  
 Medium-Voltage Power MOSFETs  
 High-Voltage Planar MOSFETs  
 High-Voltage Superjunction MOSFETs  
 Automotive-Grade MOSFETs  
 ICs  
 VRPower® DrMOS Integrated Power Stages  
 Power Management and Power Control ICs  
 Smart Load Switches  
 Analog Switches and Multiplexers

#### *Diodes Segment*

Rectifiers  
 Schottky Rectifiers  
 Ultra-Fast Recovery Rectifiers  
 Standard and Fast Recovery Rectifiers  
 High-Power Rectifiers/Diodes  
 Bridge Rectifiers  
 Small Signal Diodes  
 Schottky and Switching Diodes  
 Zener Diodes  
 RF PIN Diodes  
 Protection Diodes  
 TVS TransZorb® and PAR® Diodes (unidirectional, bidirectional)  
 ESD Protection Diodes (including arrays)  
 Thyristors/SCRs  
 Phase-Control Thyristors  
 Fast Thyristors  
 Power Modules  
 Input Modules (diodes and thyristors)  
 Output and Switching Modules (contain MOSFETs, IGBTs, and diodes)  
 Custom Modules

#### *Optoelectronic Components Segment*

Infrared Emitters and Detectors  
 Large PIN Photo Diodes  
 Optical Sensors  
 Proximity  
 Ambient light  
 Gesture  
 Light Index (RGBW, UV, IR)  
 Humidity  
 Quadrant Sensors  
 Transmissive  
 Reflective

Infrared Remote Control Receivers  
 Optocouplers  
 Phototransistor, Photodarlington  
 Linear  
 Phototriac  
 High-Speed  
 IGBT and MOSFET Driver  
 Solid-State Relays  
 LEDs and 7-Segment Displays  
 Infrared Data Transceiver Modules  
 Custom Products

### PASSIVE COMPONENTS

#### *Resistors Segment*

Film Resistors – Chip, MELF, Leaded, and Networks  
 Metal Film Resistors  
 Thin Film Resistors  
 Thick Film Resistors  
 Power Thick Film Resistors  
 Metal Oxide Film Resistors  
 Carbon Film Resistors  
 Wirewound Resistors  
 Vitreous, Cemented, and Housed Resistors  
 Braking and Neutral Grounding Resistors  
 Custom Load Banks  
 Power Metal Strip® Resistors  
 Battery Management Shunts  
 Crowbar and Steel Blade Resistors  
 High Power Water Cooled Resistors  
 Thermo Fuses  
 Chip Fuses  
 Pyrotechnic Initiators / Igniters  
 Variable Resistors  
 Cermet Variable Resistors  
 Wirewound Variable Resistors  
 Conductive Plastic Variable Resistors  
 Contactless Potentiometers  
 Hall Effect Position Sensors  
 Precision Magnetic Encoders  
 Networks/Arrays/ Attenuators  
 RF and Microwave Resistors  
 High Voltage Resistors  
 Dividers  
 Non-Linear Resistors and Temperature Sensors  
 NTC Thermistors  
 PTC Thermistors  
 Thin Film RTDs  
 Varistors  
 Platinum Chip Temperature Sensors

#### *Inductors Segment*

Magnetics  
 Power Inductors Automotive and Commercial Grade  
 Coupled Inductors

Power Chokes  
 Common Mode Chokes  
 High Frequency RF Inductors  
 Magnetic Actuators  
 Wireless Charging Coils  
 Planar Devices  
 Transformers  
 Custom Magnetics  
 Connectors

#### *Capacitors Segment*

Tantalum Capacitors  
 Molded Chip Tantalum Capacitors  
 Molded Chip Polymer Tantalum Capacitors  
 Tantalum MAP Capacitors  
 Polymer Tantalum MAP Capacitors  
 Coated Chip Tantalum Capacitors  
 Solid Through-Hole Tantalum Capacitors  
 Wet Tantalum Capacitors  
 Ceramic Capacitors  
 Multilayer Chip Capacitors  
 Disc Capacitors  
 Multilayer Chip RF Capacitors  
 Chip Antennas  
 Thin Film Capacitors  
 Film Capacitors  
 Power Capacitors  
 Heavy-Current Capacitors  
 Aluminum Electrolytic Capacitors  
 ENYCAP™ Energy Storage Capacitors