VISHAY INTERTECHNOLOGY, INC.

INTERACTIVE
data book

THICK FILM PRODUCTS
VISHAY TECHNO

VSE-DB0003-0608

Notes:

1. To navigate:
   a) Click on the Vishay logo on any datasheet to go to the Contents page for that section. Click on the Vishay logo on any Contents page to go to the main Table of Contents page.
   b) Click on the products within the Table of Contents to go directly to the datasheet.
   c) Use the scroll or page up/page down functions.
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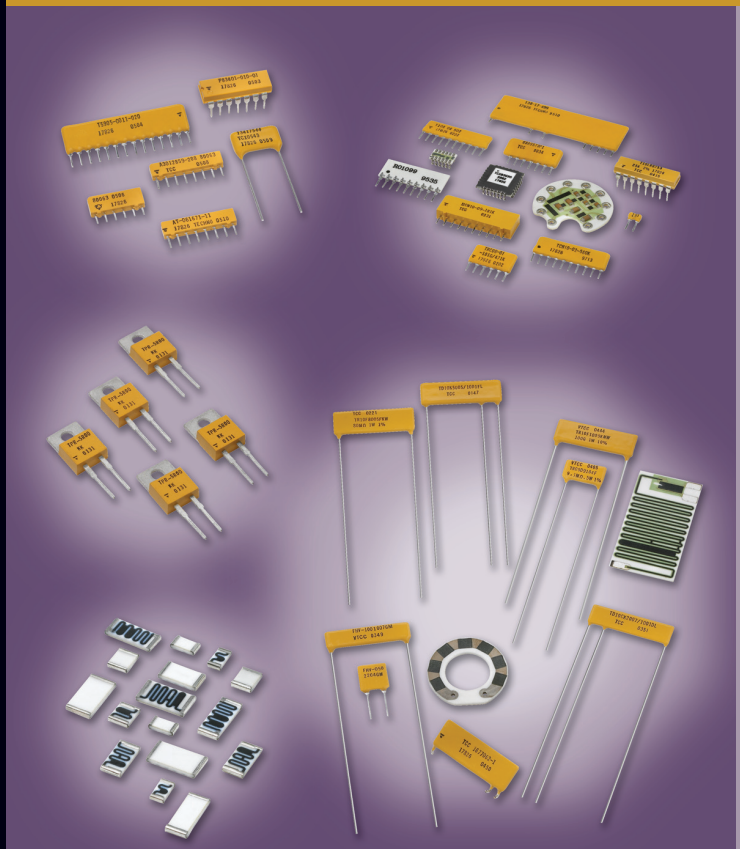
VISHAY INTERTECHNOLOGY, INC.



DATA BOOK

THICK FILM PRODUCTS

VISHAY TECHNO

High Voltage Resistors and Dividers

Networks

Custom Networks

www.vishay.com

SEMICONDUCTORS

RECTIFIERS
- Schottky (single, dual)
- Standard, Fast, and Ultra-Fast Recovery (single, dual)
- Bridge
- Superectifier®
- Sinterglass Avalanche Diodes

SMALL-SIGNAL DIODES
- Schottky and Switching (single, dual)
- Tuner/Capacitance (single, dual)
- Bandswitching
- PIN

ZENER AND SUPPRESSOR DIODES
- Zener (single, dual)
- TVS (TransZorb®, Automotive, ESD, Arrays)

MOSFETs
- Power MOSFETs
- JFETs

RF TRANSISTORS
- Bipolar Transistors (AF and RF)
- Dual Gate MOSFETs
- MOSMICs®

OPTOELECTRONICS
- IR Emitters and Detectors, and IR Receiver Modules
- Optocouplers and Solid-State Relays
- Optical Sensors
- LEDs and 7-Segment Displays
- Infrared Data Transceiver Modules
- Custom Products

ICs
- Power ICs
- Analog Switches
- DC/DC Converters
- RF Transceivers
- ICs for Optoelectronics

PASSIVE COMPONENTS

RESISTIVE PRODUCTS
- Foil Resistors
- Film Resistors
  - Metal Film Resistors
  - Thin Film Resistors
  - Thick Film Resistors
  - Metal Oxide Film Resistors
  - Carbon Film Resistors
- Wirewound Resistors
- Power Metal Strip® Resistors
- Chip Fuses
- Variable Resistors
  - Cermet Variable Resistors
  - Wirewound Variable Resistors
  - Conductive Plastic Variable Resistors
- Networks/Arrays
- Non-linear Resistors
  - NTC Thermistors
  - PTC Thermistors
  - Varistors

MAGNETICS
- Inductors
- Transformers

CAPACITORS
- Tantalum Capacitors
  - Molded Chip Tantalum Capacitors
  - Coated Chip Tantalum Capacitors
  - Solid Through-Hole Tantalum Capacitors
  - Wet Tantalum Capacitors
- Ceramic Capacitors
  - Multilayer Chip Capacitors
  - Disc Capacitors
- Film Capacitors
- Power Capacitors
- Heavy-Current Capacitors
- Aluminum Capacitors
- Silicon RF Capacitors

STRAIN GAGE TRANSDUCERS AND STRESS ANALYSIS SYSTEMS
- PhotoStress®
- Strain Gages
- Load Cells
- Force Transducers
- Instruments
- Weighing Systems

Vishay Techno
Thick Film Products

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Table of Contents

Vishay Techno

High Voltage Chip Resistors

FEATURES

- High voltage up to 3000 volts
- Outstanding stability < 0.5 %
- Flow solderable
- Custom sizes available
- Automatic placement capability
- Top and wraparound terminations
- Tape and reel packaging available
- Internationally standardized sizes
- Nickel barrier available
- Lead (Pb)-free version is RoHS compliant

Pb Available

RoHS* COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	RESISTANCE (Ω)	POWER RATING (MW)	VOLTAGE RATING (V) (Max.)
CRHV1206	2M - 8G	300	1500
CRHV1210	4M - 10G	450	1750
CRHV2010	6M - 35G	500	2000
CRHV2510	10M - 40G	600	2500
CRHV2512	12M - 50G	700	3000

Note

For non-standard sizes, lower values or higher power rating requirement, contact factory at +1-909-923-3313.

ELECTRICAL SPECIFICATIONS

(Reference only: Not for all values specified. Consult factory for your size and value.)

Resistance Range: 2 MΩ to 50 GΩ

Resistance Tolerance: ± 1 %, ± 2 %, ± 5 %, ± 10 %, ± 20 %

Temperature Coefficient: ± 100 ppm/°C (- 55 °C to + 150 °C)

Voltage Rating: 1500 V - 3000 V

Short Time Overload: Less than 0.5 % ΔR

MECHANICAL SPECIFICATIONS

Construction: 96 % alumina substrate with proprietary cermet resistance element and specified termination material

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: - 55 °C to + 150 °C

Life: Less than 0.5 % change when tested at full rated power

(Reference only: Not for all values specified. Consult factory for your size and value.)

VOLTAGE COEFFICIENT OF RESISTANCE CHART

SIZE	VALUE (Ohms)	VCR (ppm/V)	FURTHER INSTRUCTIONS
CRHV1206	2M - 199M	25	Values over 200M, consult factory
CRHV1210	4M - 200M	25	Values over 200M, consult factory
CRHV2010	6M - 99M	15	Values over 1G, consult factory
	100M - 1G	20	
CRHV2510	10M - 99M	10	Values over 1G, consult factory
	100M - 1G	15	
CRHV2512	12M - 999M	10	Values over 5G, consult factory
	1G - 5G	25	

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CRHV1206AF100MFKFB (preferred part number format)

C	R	H	V	1	2	0	6	A	F	1	0	0	M	F	K	F	B

GLOBAL MODEL	SIZE	TERM STYLE	TERM MATERIAL	RESISTANCE VALUE	TOLERANCE	TCR	SOLDER TERMINATION	PACKAGING
CRHV	**1206** **1210** **2010** **2510** **2512**	**A** = 3-sided **B** = top only **C** = 5-sided	**A** = Palladium Silver **B** = Platinum Gold **C** = Gold **D** = Platinum Silver **E** = Platinum Palladium Gold **F** = Nickel Barrier	M = Million G = Billion **4M70** = 4.7 MΩ **10M0** = 10 MΩ **1G00** = 1 GΩ	**F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 % **K** = ± 10.0 % **M** = ± 20.0 %	**K** = 100 ppm **N** = 200 ppm **W** = 350 ppm **P** = 500 ppm	**F** = Sn95/Ag5 **N** = No Solder	**B** = Bulk **T** = Tape and Reel **W** = Waffle

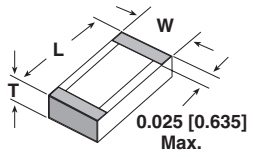
Historical Part Numbering: CRHV1206AF1006F100e2 (will continue to be accepted)

CRHV	1206	A	F	1006	F	100	e2
HISTORICAL MODEL	SIZE	TERM STYLE	TERM MATERIAL	RESISTANCE VALUE	TOLERANCE	TCR	SOLDER TERMINATION

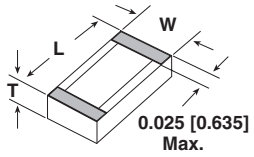
* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]

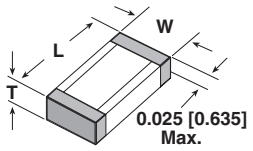
Termination Style A
(3-sided wraparound)



Termination Style B
(Top conductor only)

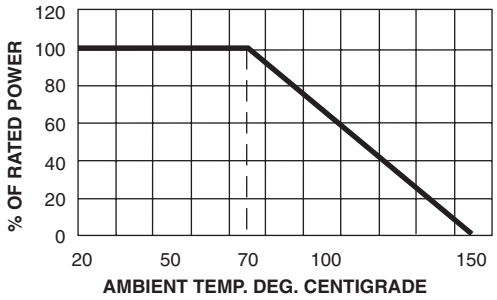


Termination Style C
(5-sided wraparound)



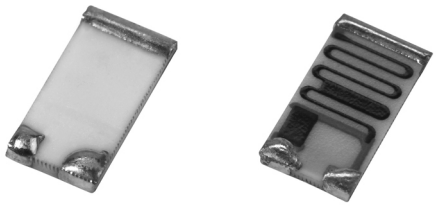
MODEL	LENGTH (L) ± 0.006 [0.152]	WIDTH (W) ± 0.006 [0.152]	THICKNESS (T) ± 0.002 [0.051]
CRHV1206	0.125	0.063	0.025
CRHV1210	0.125	0.100	0.025
CRHV2010	0.200	0.100	0.025
CRHV2510	0.250	0.100	0.025
CRHV2512	0.250	0.126	0.025

DERATING CURVE



(Reference only: Not for all values specified. Consult factory for your size and value.)

High Voltage Chip Divider



FEATURES

- High voltage up to 3000 volts
- Typical resistance ratios of 250:1, 500:1, etc.
- Flow solderable
- Tape & Reel packaging available
- Top and Wraparound termination
- Nickel Barrier available
- Lead (Pb)-free version is RoHS compliant

Pb-free Available

RoHS* COMPLIANT

ELECTRICAL SPECIFICATIONS

Resistance range: 1 MΩ to 20 GΩ
Resistance tolerance: ± 1 % to ± 20 %
Power rating: See table
Voltage coefficient: See table
Temperature coefficient: See table
Ratio tracking: See table

MECHANICAL SPECIFICATIONS

Construction: 96 % alumina substrate with proprietary cermet resistance element and specified termination material

ENVIRONMENTAL SPECIFICATIONS

Operating temperature: - 55 °C to + 150 °C

Life: Less than 0.5 % change when tested at full rated power (Reference only: Not for all values specified. Consult factory for value.)

STANDARD ELECTRICAL SPECIFICATIONS

RESISTANCE (Ω)	POWER RATING (mW)	VOLTAGE RATING (V Max.)
20M - 20G	contact factory	3000

VOLTAGE & TEMPERATURE COEFFICIENTS OF RESISTANCE CHART TYPICAL

RESISTANCE (Ω)	RATIO (typical)	VCR (ppm/V)	TCR (ppm/°C) - 55 °C to + 150 °C
20M	250:1	5	260
150M	300:1	5	80
800M	300:1	10	50
20G	700:1	90	160

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CDHVAA20M0J2500GFB (preferred part number format)

C	D	H	V	A	A	2	0	M	0	J	2	5	0	0	G	F	B

GLOBAL MODEL	TERM STYLE	TERM MATERIAL	RESISTANCE VALUE (R1)	TOLERANCE	RATIO R1/R2	RATIO TOLERANCE	SOLDER TERMINATION	PACKAGING
CDHV = CDHV2512	**A** = 3-sided **B** = top only	**A** = Palladium Silver **B** = Platinum Gold **C** = Gold **D** = Platinum Silver **E** = Platinum Palladium Gold **F** = Nickel Barrier	M = Million G = Billion **20M0** = 20 MΩ **800M** = 800 MΩ **20G0** = 20 GΩ	**F** = ± 1.0 % **G** = ± 2.0 % **H** = ± 3.0 % **J** = ± 5.0 % **K** = ± 10.0 % **M** = ± 20.0 %	3 digit significant figure, followed by a multiplier **2500** = 250:1 **3000** = 300:1 **7000** = 700:1	**F** = ± 1.0 % **G** = ± 2.0 % **H** = ± 3.0 % **J** = ± 5.0 %	**F** = Sn95/Ag5 **N** = No Solder	**B** = Bulk **T** = Tape and Reel **W** = Waffle

Historical Part Numbering: CDHV2512AA2005J2500Ge2 (will continue to be accepted)

CDHV2512	A	A	2005	J	2500	G	e2
HISTORICAL MODEL	TERM STYLE	TERM MATERIAL	RESISTANCE VALUE (R1)	TOLERANCE	RATIO R1/R2	RATIO TOLERANCE	SOLDER TERMINATION

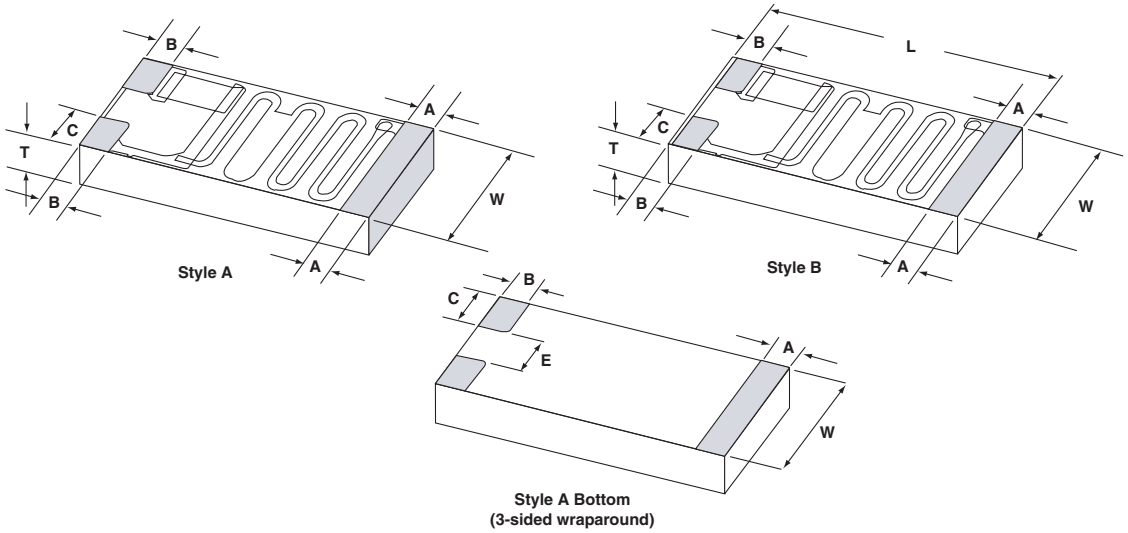
* Pb containing terminations are not RoHS compliant, exemptions may apply

RATIO TRACKING (ppm/°C)

RESISTANCE (Ω)	RATIO (typical)	COLD (+ 25 °C to - 50 °C)	HOT (+ 25 °C to + 150 °C)
20M	250:1	5	260
150M	300:1	5	80
800M	300:1	10	50
20G	700:1	90	160

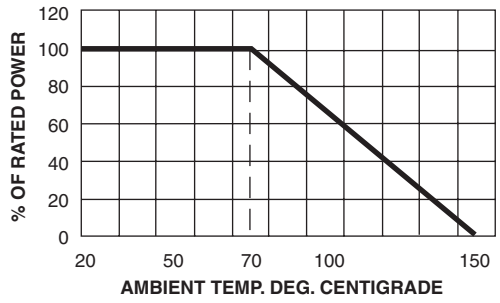
Note: Contact factory for other ratios

DIMENSIONS in inches [millimeters]



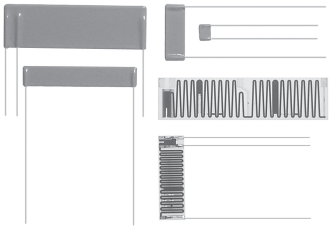
TERMINATION	LENGTH (L) ± 0.006 [0.152]	WIDTH (W) ± 0.006 [0.152]	THICKNESS (T) ± 0.002 [0.051]	A ± 0.005	B ± 0.005	C ± 0.005	E ± 0.005
STYLE A (Wraparound 3 Sided)	0.250	0.126	0.025	0.025	0.025	0.040	0.046
STYLE B (Top only)	0.240	0.126	0.025	0.025	0.025	0.040	-

DERATING CURVE



(Reference only: Not for all values specified. Consult factory for your size and value.)

High Voltage Resistors and Dividers



FEATURES

- 30 000 volts capability
- Very low voltage coefficient to less than 0.1 ppm/Volt
- Outstanding stability under adverse conditions
- Stable cermet resistive element bonded to a high-purity alumina substrate
- Tough epoxy-based coating and high voltage stability
- Designs built from customer supplied schematics
- Dividers available leaded or non-leaded
- Typical resistance ratios of 1000:1, 2000:1, etc.
- TCR tracking to ± 5 ppm/°C depending on values
- Lead (Pb)-free version is RoHS compliant

Pb-free Available

RoHS* COMPLIANT

APPLICATIONS

Applications include power supplies, transformers and any application requiring operation within an environment where high voltages are used.

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	RESISTANCE (Ω)		POWER RATING (Watts)	MAXIMUM VOLTAGE (Volts)
	(Min.)	(Max.)		
TR03	300	10G	0.25	2.5K
TR05	500	100G	0.50	5K
TR10	1000	1T	1.00	10K
TR15	1500	1.5T	1.50	15K
TR20	2000	2T	2.00	20K
TR30	3000	3T	3.00	30K

NOTE: Custom sizes available

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: TR20H1K00FKEB (preferred part number format)

T	R	2	0	H	1	K	0	0	F	K	E	B

GLOBAL MODEL	SIZE	POWER RATING	RESISTANCE VALUE	TOLERANCE	TCR	TERMINAL FINISH	PACKAGING
TR	**03** **05** **10** **15** **20** **30**	**C** = 0.25 W **D** = 0.5 W **F** = 1.0 W **G** = 1.5 W **H** = 2.0 W **J** = 3.0 W	R = Decimal K = Thousand M = Million G = Billion T = Trillion **400R** = 400 Ω **10M0** = 10 MΩ **1T00** = 1 TΩ	**F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 % **K** = ± 10.0 % **M** = ± 20.0 %	**K** = 100 ppm **N** = 200 ppm **M** = 300 ppm	**E** = Sn100 **R** = Sn60/Pb40	**B** = Bulk **S** = Strip

Historical Part Numbering: TR20H1001FKe3 (will continue to be accepted)

TR	20	H	1001	F	K	e3
HISTORICAL MODEL	SIZE	POWER RATING	RESISTANCE VALUE	TOLERANCE	TCR	TERMINAL FINISH

New Global Part Numbering: TD20HE100M3301FFEB (preferred part number format)

T	D	2	0	H	E	1	0	0	M	3	3	0	1	F	F	E	B

GLOBAL MODEL	SIZE	POWER RATING	RATIO TCR	RESISTANCE VALUE	RATIO R1/R2	RATIO TOLERANCE	TOLERANCE	TERMINAL FINISH	PACKAGING
TD	**03** **05** **10** **15** **20** **30**	**C** = 0.25 W **D** = 0.5 W **F** = 1.0 W **G** = 1.5 W **H** = 2.0 W **J** = 3.0 W	**E** = 25 ppm **H** = 50 ppm **K** = 100 ppm **N** = 200 ppm **M** = 300 ppm **S** = Special	R = Decimal K = Thousand M = Million G = Billion **400R** = 400 Ω **10M0** = 10 MΩ **10M7** = 10.7 MΩ	3 digit significant figure, followed by a multiplier **0400** = 40:1 **1000** = 100:1	**F** = ± 1.0 % **G** = ± 2.0 % **H** = ± 3.0 % **J** = ± 5.0 %	**F** = ± 1.0 % **G** = ± 2.0 % **H** = ± 3.0 % **J** = ± 5.0 % **K** = ± 10.0 % **M** = ± 20.0 %	**E** = Sn100 **R** = Sn60/Pb40	**B** = Bulk **S** = Strip

Historical Part Numbering: TD20HR10063301FFe3 (will continue to be accepted)

TD	20	H	R	1006	3301	F	F	e3
HISTORICAL MODEL	SIZE	POWER RATING	RATIO TCR	RESISTANCE VALUE	RATIO R1/R2	RATIO TOLERANCE	TOLERANCE	TERMINAL FINISH

* Pb containing terminations are not RoHS compliant, exemptions may apply

MECHANICAL SPECIFICATIONS

Resistive Element: Thick film

Substrate: 96 % pure alumina

Encapsulation: Epoxy base, conformal coating

Terminals: Tin plated copper leads

Terminal Strength: 4.5 pounds pull-test

Power: Derated from ambient temperature + 25 °C

ENVIRONMENTAL SPECIFICATIONS

Temperature Range: - 55 °C to + 125 °C (For higher temperature range, consult factory)

ELECTRICAL SPECIFICATIONS

Resistance Range: 300 Ω to 6 TΩ

Resistance Tolerance: ± 0.25 % to ± 20 %
(values over 1 GΩ, consult factory)

Ratio Tolerance: 1 % to 20 %

Temperature Coefficient: < 100 ppm/°C absolute (values over 1 GΩ, consult factory)

Ratio TCR: to 5 ppm/°C (Ratio over 1000:1, consult factory)

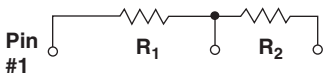
Maximum Voltage: 30 000 volts (higher available)

Voltage Coefficient: Typically less than 1 ppm/V (tested per MIL-STD-202)

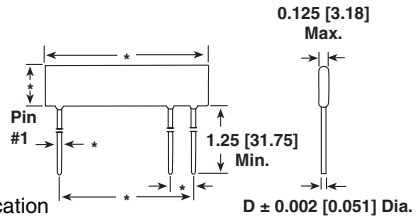
Load Life: Less than 0.15 %, 1000 hours

DIMENSIONS in inches [millimeters]

Typical Resistor Schematic for Divider

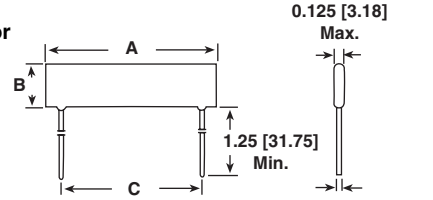


Typical High Voltage Divider



* Specified by application

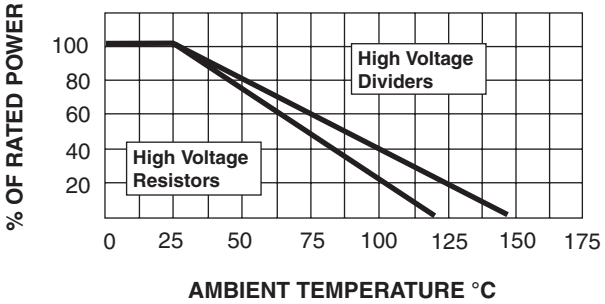
Standard High Voltage Resistor



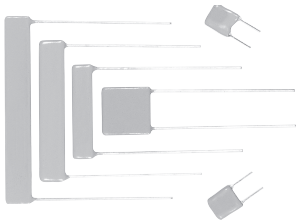
Dimensions (± 10 %)

MODEL	A (LENGTH)	B (HEIGHT)	C (LEAD SPACING)	D (LEAD DIA.)
TR03	0.300 [7.62]	0.210 [5.33]	0.200 [5.08]	0.025
TR05	0.500 [12.70]	0.300 [7.62]	0.400 [10.16]	0.025
TR10	1.00 [25.40]	0.350 [8.89]	0.900 [22.86]	0.032
TR15	1.50 [38.10]	0.350 [8.89]	1.40 [35.56]	0.032
TR20	2.00 [50.80]	0.350 [8.89]	1.90 [48.26]	0.032
TR30	3.00 [76.20]	0.400 [10.16]	2.90 [73.66]	0.032

DERATING



High Voltage Resistors



FEATURES

- Non-inductive design
- Matched sets available
- Ratio dividers available
- Special testing available
- Low TCR: ± 200 ppm/°C standard, ± 100 ppm/°C and ± 50 ppm/°C available
- Tolerance: ± 10 %, ± 5 %, ± 2 %, ± 1 % standard tolerance and/or TCR matching available upon request
- Lead (Pb)-free version is RoHS compliant

Pb Available

RoHS* COMPLIANT

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pound pull test
Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-10509

MATERIAL SPECIFICATIONS

Element: High temperature fired cermet film
Core: High purity 96 % alumina
Coating: Conformal coat epoxy
Termination: Standard lead material is tin plated copper

TEMPERATURE COEFFICIENT CODE

CODE	TEMPERATURE COEFFICIENT	RANGE
K	± 100 ppm	- 55 °C to + 125 °C
N	± 200 ppm	- 55 °C to + 125 °C

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE RATING		MAXIMUM	RESISTANCE (Ω)[1]	
	at + 70 °C	at + 125 °C	VOLTAGE (kV)	± 200 ppm	± 100 ppm
FHV025	0.25	0.125	0.75	10K - 100M	10K - 100M
FHV050	0.50	0.25	1.5	10K - 500M	10K - 100M
FHV075	0.25	0.125	3.75	100 - 1G	500 - 500M
FHV100	1.0	0.50	7.5	100 - 2G	500 - 1G
FHV150	1.5	0.75	11.25	10K - 2G	1M - 1G
FHV160	1.0	0.50	3.5	100 - 2G	500 - 1G
FHV200	2.0	1.0	15.0	200 - 8G	500M - 1G
FHV400	2.0	1.0	7.5	20K - 2G	1M - 1G
FHV500	4.0	2.0	15.0	30K - 10G	1M - 1G

1. All resistance values are calibrated at 100 VDC. Calibration at other voltages upon request.

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: FHV02510K0FNEB (preferred part number format)

F	H	V	0	2	5	1	0	K	0	F	N	E	B

GLOBAL MODEL	SIZE	RESISTANCE VALUE	TOLERANCE	TCR	TERMINAL FINISH	PACKAGING
FHV	**025** **050** **075** **100** **150** **160** **200** **400** **500**	R = Decimal K = Thousand M = Million G = Billion **400R** = 400 Ω **10M0** = 10 MΩ **10G0** = 10 GΩ	**F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 % **K** = ± 10.0 %	**K** = 100 ppm **N** = 200 ppm	**E** = Sn100 **R** = Sn60/Pb40	**B** = Bulk **S** = Strip

Historical Part Numbering: FHV0251002FMe3 (will continue to be accepted)

FHV	025	1002	F	M	e3
HISTORICAL MODEL	SIZE	RESISTANCE VALUE	TOLERANCE	TCR	TERMINAL FINISH

* Pb containing terminations are not RoHS compliant, exemptions may apply

DIMENSIONS in inches [millimeters]

Figure 1

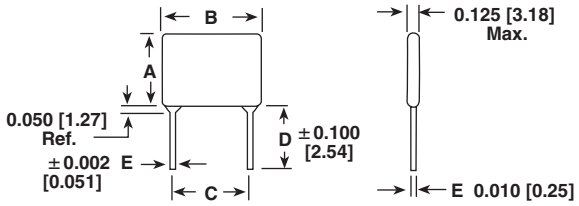
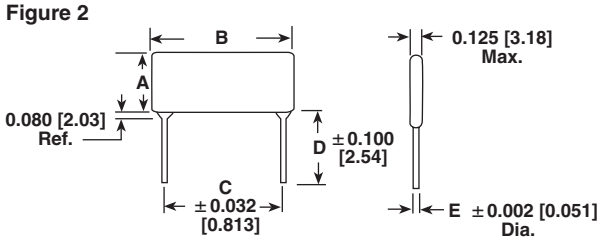


Figure 2

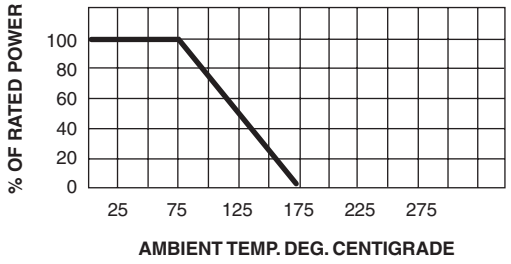


MODEL - SIZE	A (Max.)	B (Max.)	C	D	E	FIGURE
FHV025	0.300 [7.62]	0.300 [7.62]	0.200 [5.08]	0.250 [6.35]	0.018 [0.457]	1
FHV050	0.380 [9.65]	0.380 [9.65]	0.200 [5.08]	0.360 [9.14]	0.020 [0.508]	1
FHV075	0.210 [5.33]	0.570 [14.48]	0.400 [10.16]	1.50 [38.10]	0.025 [0.635]	2
FHV100	0.280 [7.11]	1.07 [21.18]	0.900 [22.86]	1.50 [38.10]	0.032 [0.813]	2
FHV150	0.330 [8.38]	1.57 [39.88]	1.40 [35.56]	1.50 [38.10]	0.032 [0.813]	2
FHV160	0.550 [13.97]	0.550 [13.97]	0.400 [10.16]	1.50 [38.10]	0.032 [0.813]	2
FHV200	0.330 [8.38]	2.04 [51.82]	1.90 [48.26]	1.50 [38.10]	0.032 [0.813]	2
FHV400	0.550 [13.97]	1.05 [26.67]	0.900 [22.86]	1.50 [38.10]	0.032 [0.813]	2
FHV500	0.550 [13.97]	2.07 [52.58]	1.90 [48.26]	1.50 [38.10]	0.032 [0.813]	2

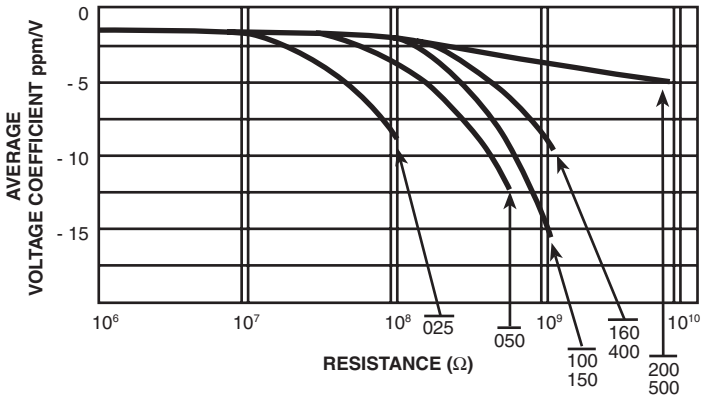
ENVIRONMENTAL PERFORMANCE

TEST	MAXIMUM ΔR (Typical Test Lots)
Short Time Overload	< ± 0.2 %
Moisture Resistance	< ± 0.5 %
Shock	< ± 0.2 %
Vibration	< ± 0.2 %
Temperature Cycling	< ± 0.5 %
Load Life	< ± 1.0 %
Dielectric Withstanding Voltage	< ± 0.15 %
Resistance to Soldering Heat	< ± 0.1 %

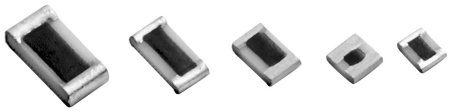
DERATING



VOLTAGE COEFFICIENT



Thick Film Chip Resistors



STANDARD ELECTRICAL SPECIFICATIONS

MODEL	RESISTANCE (Ω)	POWER RATING[1] (mW)
CR0001	100 - 500K	100
CR5050	100 - 500K	100
CR0002	100 - 1M	200
CR0003	100 - 1M	250
CR1010	100 - 1M	450
CR1206	100 - 1M	300
CR0004	100 - 1M	325
CR0005	100 - 1M	525
CR2010	100 - 1M	575

1. Higher values available. Please consult our application engineer at +1-909-923-3313.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: - 55 °C to + 150 °C
Moisture Resistance: Less than 0.5 % change when tested per Method 106 of MIL-STD-202
Life: Less than 1 % change when tested per Method 108D (+ 85 °C) of MIL-STD-202

FEATURES

- Flow solderable
- Custom sizes available
- Burn-in data available
- Automatic placement capability
- Top and wraparound terminations
- Tape and reel packaging available
- Internationally standardized sizes
- Lead (Pb)-free version is RoHS compliant

Pb Available
RoHS* COMPLIANT

ELECTRICAL SPECIFICATIONS

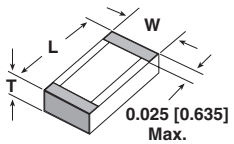
Resistance Range: 100 Ω to 1 MΩ
(Higher values available)
Resistance Tolerance: ± 1 %, ± 2 %, ± 5 %, ± 10 %, ± 20 %
Temperature Coefficient: (- 55 °C to + 150 °C)
± 100 ppm/°C: Standard thru 1 MΩ
± 200 ppm/°C: 1.1 MΩ thru 10 MΩ
Power Rating: 100 mW thru 575 mW
Short Time Overload: Less than 0.5 % ΔR

MECHANICAL SPECIFICATIONS

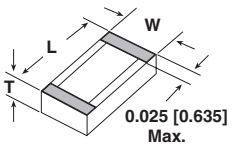
Construction: 96 % alumina substrate with proprietary cermet resistance element and specified termination material

DIMENSIONS in inches [millimeters]

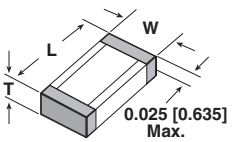
Termination Style A (3-sided wraparound)



Termination Style B (Top conductor only)



Termination Style C (5-sided wraparound)



MODEL	LENGTH (L)[2] ± 0.006 [0.152]	WIDTH (W)[2] ± 0.006 [0.152]	THICKNESS (T)[2] ± 0.002 [0.051]
CR0001	0.050 [1.27]	0.040 [1.02]	0.012 [0.305]
CR5050	0.050 [1.27]	0.050 [1.27]	0.010 [0.254]
CR0002	0.075 [1.90]	0.050 [1.27]	0.015 [0.381]
CR0003	0.100 [2.54]	0.050 [1.27]	0.015 [0.381]
CR1010	0.100 [2.54]	0.100 [2.54]	0.020 [0.508]
CR1206	0.125 [3.18]	0.062 [1.57]	0.025 [0.635]
CR0004	0.150 [3.81]	0.050 [1.27]	0.015 [0.381]
CR0005	0.225 [5.72]	0.075 [1.90]	0.015 [0.381]
CR2010	0.200 [5.08]	0.100 [2.54]	0.020 [0.508]

2. All dimensions are before solder coating.

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CR0001AA1K00FKSB (preferred part number format)

C	R	0	0	0	1	A	A	1	K	0	0	F	K	S	B

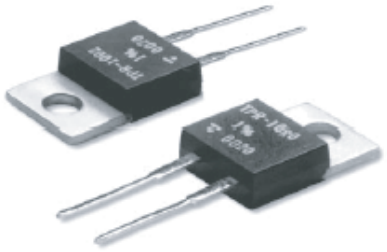
GLOBAL MODEL	SIZE	TERM STYLE	TERM MATERIAL	RESISTANCE VALUE	TOLERANCE	TCR	SOLDER TERMINATION	PACKAGING
CR	**0001** **5050** **0002** **0003** **1010** **1206** **0004** **0005** **2010**	**A** = 3-sided **B** = top only **C** = 5-sided	**A** = Palladium Silver **B** = Platinum Gold **C** = Gold **D** = Platinum Silver **E** = Platinum Palladium Gold	R = Decimal K = Thousand M = Million **100R** = 100 Ω **1K00** = 1 kΩ **1M00** = 1 MΩ	**F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 % **K** = ± 10.0 % **M** = ± 20.0 %	**K** = 100 ppm **L** = 150 ppm **N** = 200 ppm **W** = 350 ppm	**S** = Sn62/Pb36/Ag2 **F** = Sn95/Ag5 **N** = No Solder	**B** = Bulk **T** = Tape and Reel **W** = Waffle

Historical Part Numbering: CR1AA1001F100S2 (will continue to be accepted)

CR	1	A	A	1001	F	100	S2
HISTORICAL MODEL	SIZE	TERM STYLE	TERM MATERIAL	RESISTANCE VALUE	TOLERANCE	TCR	SOLDER TERMINATION

* Pb containing terminations are not RoHS compliant, exemptions may apply

Thick Film Technology Power Resistors
20 Watt and 30 Watt TO-220 Package



FEATURES

- Available with 20 or 30 Watt power rating
- Convenient TO-220 package
- 20 Watt: Resistance range 1 Ω to 1 MΩ
- 30 Watt: Resistance range 1 Ω to 100 kΩ
- Tolerance ± 1 % standard
- TCR to ± 50 ppm/°C; ± 100 ppm/°C standard
- Non-Inductive Design
- Isolated electrical element
- 100 % lead (Pb)-free and RoHS compliant

Pb-free

RoHS COMPLIANT

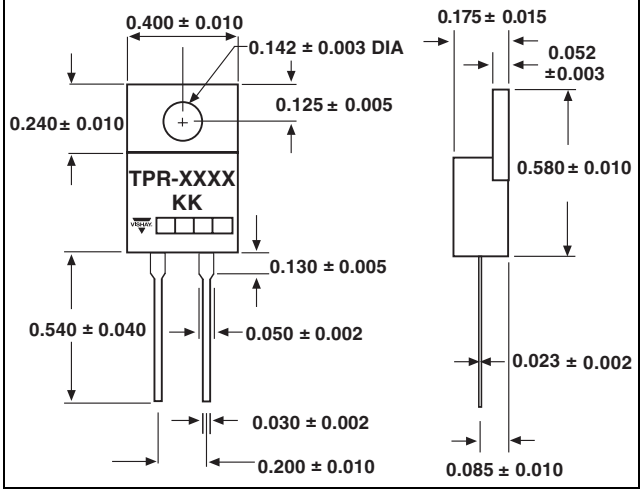
The well known TO-220 package combined with the proven thick film technology provides you, the design engineer, with a high reliable and cost effective solution for applications requiring current limiting/current sensing.

The chips unique attachment to the solder coated copper base provides a repeatable low thermal resistance path for the energy to exit the resistor and be dissipated into the heatsink.

The popular TO-220 package can be handled easily by the manufacturing group.

Vishay has additional solutions when higher Technical Performance is required such as the VPR220 and VPR221.

DIMENSIONS in inches



GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: TPR201K00KKEB (preferred part number format)

T	P	R	2	0	1	K	0	0	K	K	E	B

GLOBAL MODEL	POWER RATING	RESISTANCE VALUE	TOLERANCE	TCR	TERMINAL FINISH	PACKAGING
TPR	**20** **30**	R = Decimal K = Thousand **400R** = 400 Ω **1K00** = 1.0 kΩ **10K0** = 10 kΩ **1M00** = 1 MΩ	**F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 % **K** = ± 10.0 %	**H** = 50 ppm **K** = 100 ppm **M** = 300 ppm	**E** = Sn100	**B** = Bulk

Historical Part Numbering: TPR201001KKe3 (will continue to be accepted)

TPR	20	1001	K	K	e3
HISTORICAL MODEL	POWER RATING	RESISTANCE VALUE	TOLERANCE	TCR	TERMINAL FINISH

Thick Film Technology Power Resistors
20 Watt and 30 Watt TO-220 Package

ELECTRICAL SPECIFICATIONS

Resistance Range: 20 Watt: 1 Ω to 1 MΩ
30 Watt: 1 Ω to 100 kΩ

STD Resistance Tolerance: ± 1 %, ± 2 %, ± 5 % and ± 10 % (tighter available)

Power Dissipation:

TPR20:
20 Watts at 25 °C with heatsink
2 ¼ Watts at 25 °C without heatsink

TPR30:
30 Watts at 25 °C with heatsink
2 ½ Watts at 25 °C without heatsink

Temperature Coefficient: ± 100 ppm/°C Std
(± 50 ppm/°C available)

Short Time Overload: 2 times rated power with applied voltage not to exceed 375 VDC for 5 seconds

Maximum Working Voltage: 250 VDC

Limiting Element Voltage: 250 VDC

Dielectric Strength: 2000 VRMS

Insulation Resistance: 20 GΩ min

MECHANICAL SPECIFICATIONS

Mechanical Protection: Molded case

Resistive Element: Thick Film

Terminals: Tinned copper

Weight: 2 grams

ENVIRONMENTAL SPECIFICATIONS (TYPICAL)

Temperature Range: - 55 °C to + 155 °C

Terminal Strength: MIL-STD-202, Method 211

Thermal Shock: MIL-STD-202, Method 107

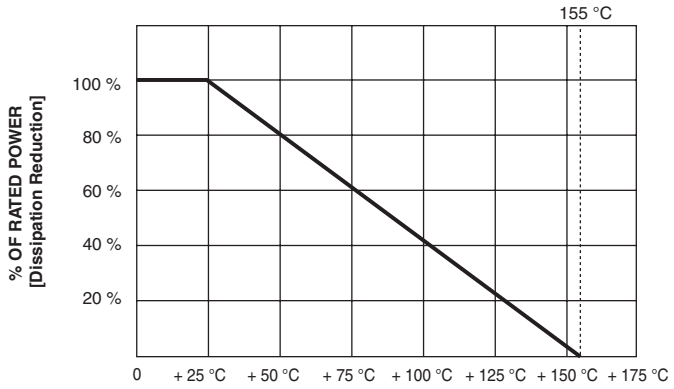
Moisture Resistance: MIL-STD-202, Method 106

Life: 1000 hours MIL-STD-202, 25 °C

Shock: MIL-STD-202 Method 213

Vibration: MIL-STD-202, Method 204

DERATING



STANDARD MILITARY PRESENTATION OF POWER DERATING

PERFORMANCE

TEST AND MIL REF.	CONDITION	TYPICAL DRIFT
Short Time Overload	2 x rated power for 5 seconds	< 0.10 %
Temperature Cycling with Power	5 cycles - 65 °C to + 125 °C, at rated power	< 0.10 %
Load Life MIL-STD 202, Method 108 and 302	1000 hours at rated power and 25 °C ambient	< 0.25 %
Humidity (steady state)	56 days 95 % R.H.	< 0.30 %

Capacitor Networks, Coated SIP

FEATURES

- NPO or X7R capacitors for line terminator
- Wide operating temperature range (- 55 °C to 125 °C)
- Epoxy based conformal coating
- Solder coated copper terminals
- Solderability per MIL-STD-202 method 208E
- Marking resistance to solvents per MIL-STD-202 method 215

STANDARD ELECTRICAL SPECIFICATIONS

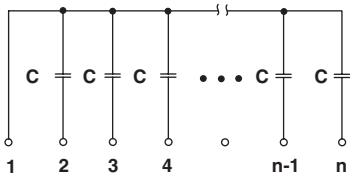
MODEL	SCHEMATIC	CAPACITANCE RANGE		CAPACITANCE TOLERANCE** ± %	CAPACITANCE VOLTAGE VDC
		NPO*	X7R		
TCN	01	33 pF - 3900 pF	470 pF - 0.1 µF	± 10 %, ± 20 %	50
	02	33 pF - 3900 pF	470 pF - 0.1 µF	± 10 %, ± 20 %	50
	09	33 pF - 3900 pF	470 pF - 0.1 µF	± 10 %, ± 20 %	50

* NPO capacitors may be substituted for X7R capacitors

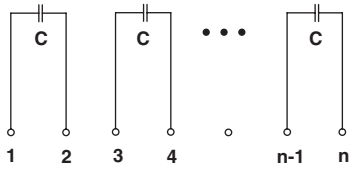
** Tighter tolerances available on request

SCHEMATICS

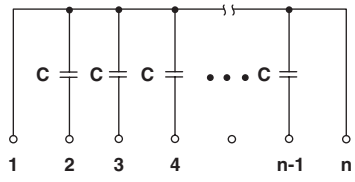
SCHEMATIC 01



SCHEMATIC 02

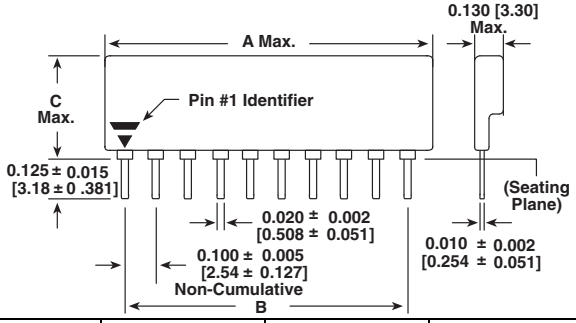


SCHEMATIC 09



Note: Custom schematics available

DIMENSIONS in inches [millimeters]



NUMBER OF PINS	A (Max.)	B ± 0.005 [0.127]	C (Max.)
6	0.590 [14.99]	0.500 [12.70]	0.350 [8.89]
7	0.690 [17.53]	0.600 [15.24]	0.350 [8.89]
8	0.790 [20.07]	0.700 [17.78]	0.350 [8.89]
9	0.890 [22.61]	0.800 [20.32]	0.350 [8.89]
10	0.990 [25.15]	0.900 [22.86]	0.350 [8.89]
11	1.09 [27.69]	1.00 [25.40]	0.350 [8.89]
12	1.19 [30.23]	1.10 [27.94]	0.350 [8.89]

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: TCN0801101KNTB (preferred part number format)

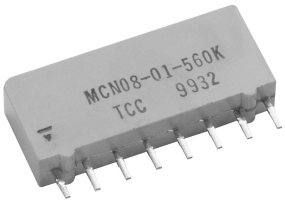
T	C	N	0	8	0	1	1	0	1	K	N	T	B

GLOBAL MODEL	PIN COUNT	SCHEMATIC	CAPACITANCE VALUE	TOLERANCE	CHARACTERISTIC	TERMINAL FINISH	PACKAGING
TCN	**06** = 6 pin **07** = 7 pin **08** = 8 pin **09** = 9 pin **10** = 10 pin **11** = 11 pin **12** = 12 pin	**01** **02** **09**	(in picofarads) 2 digit significant figure, followed by a multiplier **101** = 100 pF **392** = 3900 pF **104** = 0.1 µF	**K** = ± 10 % **M** = ± 20 %	**N** = NPO **X** = X7R	**T** = 10Sn/88Pb/2Ag	**B** = Bulk

Historical Part Numbering: TCN0801101KS10 (will continue to be accepted)

TCN	08	01	101	K	S10
HISTORICAL MODEL	PIN COUNT	SCHEMATIC	CAPACITANCE VALUE	TOLERANCE	TERMINAL FINISH

Capacitor Networks, Molded SIP



FEATURES

- Custom schematics available
- NPO or X7R capacitors for line terminator
- Wide operating temperature range (- 55 °C to 125 °C)
- Molded epoxy case
- Solder coated copper terminals
- Solderability per MIL-STD-202 method 208E
- Marking resistance to solvents per MIL-STD-202 method 215

STANDARD ELECTRICAL SPECIFICATIONS

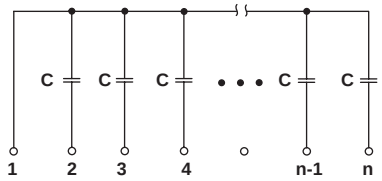
MODEL	SCHEMATIC	CAPACITANCE RANGE		CAPACITANCE TOLERANCE** ± %	CAPACITANCE VOLTAGE VDC
		NPO*	X7R		
MCN	01	33 pF - 3900 pF	470 pF - 0.1 µF	± 10 %, ± 20 %	50
	02	33 pF - 3900 pF	470 pF - 0.1 µF	± 10 %, ± 20 %	50
	09	33 pF - 3900 pF	470 pF - 0.1 µF	± 10 %, ± 20 %	50

* NPO capacitors may be substituted for X7R capacitors

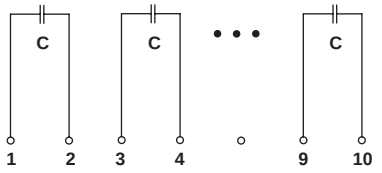
** Tighter tolerances available on request

SCHEMATICS

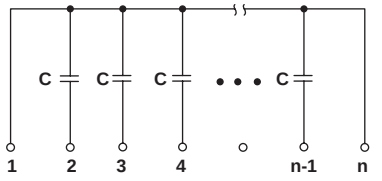
SCHEMATIC 01



SCHEMATIC 02

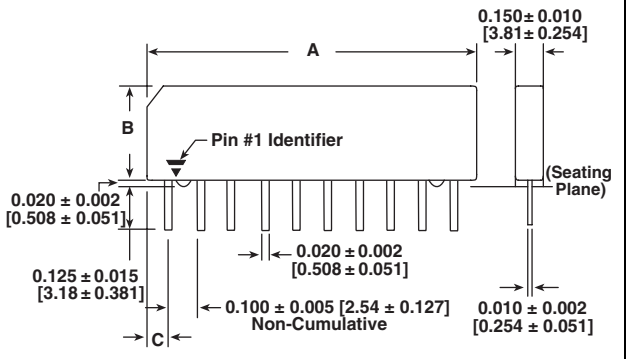


SCHEMATIC 09



Note: Custom schematics available

DIMENSIONS in inches [millimeters]



NUMBER OF PINS	A ± 0.010 [0.254]	B ± 0.010 [0.254]	C ± 0.010 [0.254]
5	0.620 [15.75]	0.305 [7.75]	0.110 [2.79]
8	0.780 [19.81]	0.325 [8.26]	0.040 [1.02]
9	0.940 [23.88]	0.246 [6.25]	0.075 [1.91]
10	1.040 [26.42]	0.346 [8.79]	0.075 [1.91]

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: MCN0801101KNTB (preferred part number format)

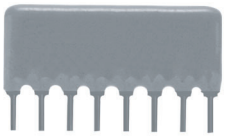
M	C	N	0	8	0	1	1	0	1	K	N	T	B

GLOBAL MODEL	PIN COUNT	SCHEMATIC	CAPACITANCE VALUE	TOLERANCE	CHARACTERISTIC	TERMINAL FINISH	PACKAGING
MCN	**05** = 5 pin **08** = 8 pin **09** = 9 pin **10** = 10 pin	**01** **02** **09**	(in picofarads) 2 digit significant figure, followed by a multiplier **101** = 100 pF **392** = 3900 pF **104** = 0.1 µF	**K** = ± 10 % **M** = ± 20 %	**N** = NPO **X** = X7R	**T** = 10Sn/88Pb/2Ag	**B** = Bulk

Historical Part Numbering: MCN0801101KS10 (will continue to be accepted)

MCN	08	01	101	K	S10
HISTORICAL MODEL	PIN COUNT	SCHEMATIC	CAPACITANCE VALUE	TOLERANCE	TERMINAL FINISH

Resistor/Capacitor Networks, Coated SIP



FEATURES

- Thick film resistors
- NPO or X7R capacitors for line terminator
- Wide operating temperature range (-55 °C to 125 °C)
- Custom Resistor/Capacitor schematics available

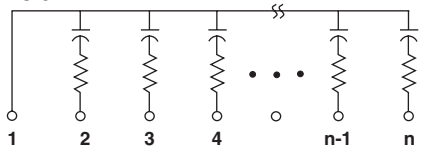
STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SCHEMATIC	RESISTOR CHARACTERISTICS				CAPACITOR CHARACTERISTICS			
		POWER RATING $P_{70\,°C}$ W	RESISTANCE (Ω)	RESISTANCE TOLERANCE ± %	TEMP. COEFF. ± ppm/°C	TYPE**	CAPACITANCE RANGE	CAPACITANCE TOLERANCE*** ± %	CAPACITANCE VOLTAGE VDC
TRC	01	0.20	50 - 1K	2 %, 5 % (*1 %)	150 ppm	NPO	33 pF - 3900 pF	10 %, 20 %	50
						X7R	470 pF - 0.1 µF	10 %, 20 %	
	02	0.20	50 - 1K	2 %, 5 % (*1 %)	150 ppm	NPO	33 pF - 3900 pF	10 %, 20 %	50
						X7R	470 pF - 0.1 µF	10 %, 20 %	
	09	0.20	50 - 1 k	2 %, 5 % (*1 %)	150 ppm	NPO	33 pF - 3900 pF	10 %, 20 %	50
						X7R	470 pF - 0.1 µF	10 %, 20 %	

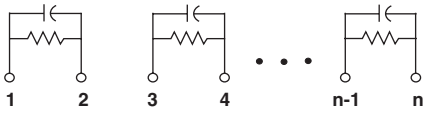
* ± 1 % tolerance available on request
** NPO Capacitors may be substituted for X7R Capacitors
*** Tighter tolerances available on request

SCHEMATICS

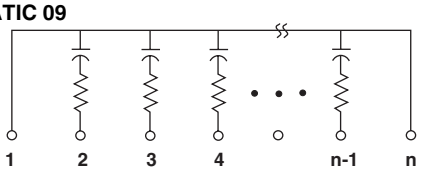
SCHEMATIC 01



SCHEMATIC 02

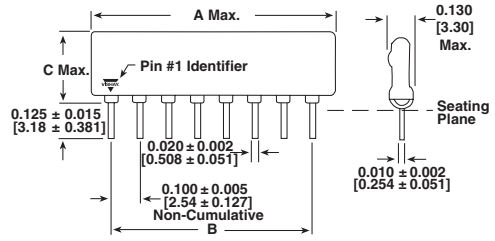


SCHEMATIC 09



Note: Custom schematics available

DIMENSIONS in inches [millimeters]



NUMBER OF PINS	A (Max.)	B ± 0.005 [0.127]	C (Max.)
6	0.590 [14.99]	0.500 [12.70]	0.350 [8.89]
7	0.690 [17.53]	0.600 [15.24]	0.350 [8.89]
8	0.790 [20.07]	0.700 [17.78]	0.350 [8.89]
9	0.890 [22.61]	0.800 [20.32]	0.350 [8.89]
10	0.990 [25.15]	0.900 [22.86]	0.350 [8.89]
11	1.09 [27.69]	1.00 [25.40]	0.350 [8.89]
12	1.19 [30.23]	1.10 [27.94]	0.350 [8.89]

Note: Other sizes available

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: TRC0801101J560KNTB (preferred part number format)

T	R	C	0	8	0	1	1	0	1	J	5	6	0	K	N	T	B

GLOBAL MODEL	PIN COUNT	SCHEMATIC	RESISTANCE VALUE	RESISTANCE TOLERANCE	CAPACITANCE VALUE	CAPACITANCE TOLERANCE	CHARACTERISTIC	TERMINAL FINISH	PACKAGING
TRC	**06** = 6 pin **07** = 7 pin **08** = 8 pin **09** = 9 pin **10** = 10 pin **11** = 11 pin **12** = 12 pin	**01** **02** **09**	2 digit significant figure, followed by a multiplier **101** = 100 Ω **220** = 22 Ω **102** = 1 kΩ	**F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 %	(in picofarads) 2 digit significant figure, followed by a multiplier **101** = 100 pF **392** = 3900 pF **104** = 0.1 µF	**K** = ± 10 % **M** = ± 20 %	**N** = NPO **X** = X7R	**T** = 10Sn/88Pb/2Ag	**B** = Bulk

Historical Part Numbering: TRC0801101J560KS10 (will continue to be accepted)

TRC	08	01	101	J	560	K	S10
HISTORICAL MODEL	PIN COUNT	SCHEMATIC	RESISTANCE VALUE	RESISTANCE TOLERANCE	CAPACITANCE VALUE	CAPACITANCE TOLERANCE	TERMINAL FINISH

Resistor/Capacitor Networks, Molded SIP

FEATURES

- **Custom schematics available**
- NPO or X7R capacitors for line terminator
- Wide operating temperature range (- 55 °C to 125 °C)
- Molded epoxy case
- Solder coated copper terminals
- Solderability per MIL-STD-202 method 208E
- Marking resistance to solvents per MIL-STD-202 method 215

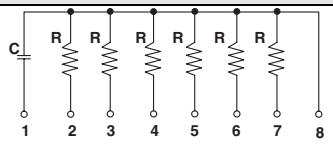
STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SCHEMATIC	RESISTOR CHARACTERISTICS				CAPACITOR CHARACTERISTICS			
		POWER RATING $P_{70\,°C}$ W	RESISTANCE (Ω)	RESISTANCE TOLERANCE ± %	TEMP. COEFF. ± ppm/°C	TYPE**	CAPACITANCE RANGE	CAPACITANCE TOLERANCE*** ± %	CAPACITANCE VOLTAGE VDC
MRCN	10	0.20	50 - 1K	2 %, 5 % (*1 %)	150 ppm	NPO	33 pF - 3900 pF	10 %, 20 %	50
						X7R	470 pF - 0.1 µF	10 %, 20 %	
	20	0.20	50 - 1K	2 %, 5 % (*1 %)	150 ppm	NPO	33 pF - 3900 pF	10 %, 20 %	50
						X7R	470 pF - 0.1 µF	10 %, 20 %	
	30	0.20	50 - 1K	2 %, 5 % (*1 %)	150 ppm	NPO	33 pF - 3900 pF	10 %, 20 %	50
						X7R	470 pF - 0.1 µF	10 %, 20 %	

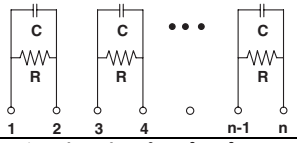
* ± 1 % tolerance available on request
** NPO Capacitors may be substituted for X7R Capacitors
*** Tighter tolerances available on request

SCHEMATICS

SCHEMATIC 10
10K ECL terminator network

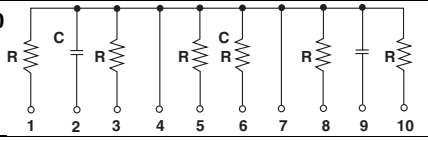


SCHEMATIC 20



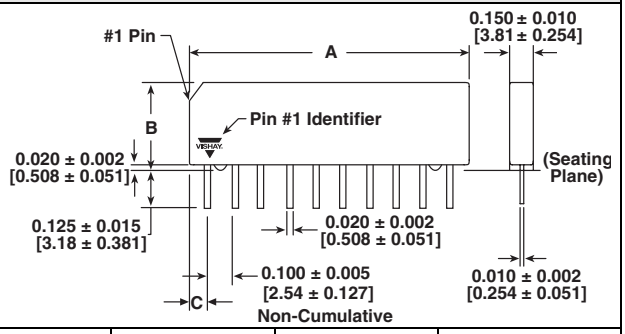
SCHEMATIC 30

100K ECL terminator network



Note: Custom schematics available

DIMENSIONS in inches [millimeters]



NUMBER OF PINS	A ± 0.010 [0.254]	B ± 0.010 [0.254]	C ± 0.010 [0.254]
8	0.780 [19.81]	0.345 [8.26]	0.040 [1.02]
10	1.040 [26.42]	0.346 [8.79]	0.075 [1.91]

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: MRCN081101J560KNTB (preferred part number format)

M	R	C	N	0	8	1	1	0	1	J	5	6	0	K	N	T	B

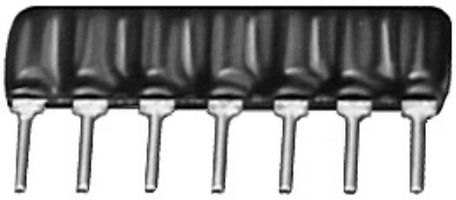
GLOBAL MODEL	PIN COUNT	SCHEMATIC	RESISTANCE VALUE	RESISTANCE TOLERANCE	CAPACITANCE VALUE	CAPACITANCE TOLERANCE	CHARACTERISTIC	TERMINAL FINISH	PACKAGING
MRCN	**08** = 8 pin **10** = 10 pin	**1** = 10 **2** = 20 **3** = 30	2 digit significant figure, followed by a multiplier **101** = 100 Ω **220** = 22 Ω **102** = 1 kΩ	**F** = ± 1.0 % **G** = ± 2.0 % **J** = ± 5.0 %	(in picofarads) 2 digit significant figure, followed by a multiplier **101** = 100 pF **392** = 3900 pF **104** = 0.1 µF	**K** = ± 10 % **M** = ± 20 %	**N** = NPO **X** = X7R	**T** = 10Sn/88Pb/2Ag	**B** = Bulk **T** = Tray

Historical Part Numbering: MRCN0801101J560KS10 (will continue to be accepted)

MRCN	08	01	101	J	560	K	S10
HISTORICAL MODEL	PIN COUNT	SCHEMATIC	RESISTANCE VALUE	RESISTANCE TOLERANCE	CAPACITANCE VALUE	CAPACITANCE TOLERANCE	TERMINAL FINISH

Single-In-Line, Coated, 4 Bits to 8 Bits

R/2R Ladder Networks



APPLICATIONS

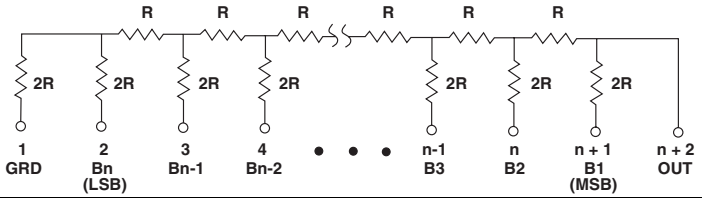
R/2R Ladder networks for D/A and A/D converter with bi-polar or CMOS switches

ELECTRICAL SPECIFICATIONS

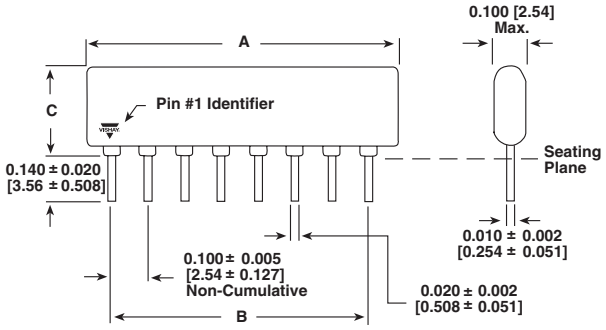
Ladder Network Accuracy on Linearity: ± 1/2 LSB
Ladder Network Resistance Tolerance: ± 2 %
Temperature Coefficient of Resistance: ± 100 ppm/°C
Operating Temperature Range: - 55 °C to + 125 °C
Power Dissipation Rating at + 70 °C Ambient:
50 mW/element
Standard Resistance Values (R): 5 kΩ, 10 kΩ, 25 kΩ, 50 kΩ and 100 kΩ

SCHEMATIC

n Bits:
n = 4 thru 8



DIMENSIONS in inches [millimeters]



NUMBER OF PINS	A (Max.)	B ± 0.005 [0.127]	C (Max.)
6	0.590 [14.99]	0.500 [12.70]	0.350 [8.89]
7	0.690 [17.53]	0.600 [15.24]	0.350 [8.89]
8	0.790 [20.07]	0.700 [17.78]	0.350 [8.89]
9	0.890 [22.61]	0.800 [20.32]	0.350 [8.89]
10	0.990 [25.15]	0.900 [22.86]	0.350 [8.89]

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: T10S08100KRB (preferred part number format)

T	1	0	S	0	8	1	0	0	K	R	B

GLOBAL MODEL	NUMBER OF BITS	RESISTANCE VALUE [R]	TERMINAL FINISH	PACKAGING
T06S = 6 pins **T07S** = 7 pins **T08S** = 8 pins **T09S** = 9 pins **T10S** = 10 pins	**04** = 4 Bits (6 pins) **05** = 5 Bits (7 pins) **06** = 6 Bits (8 pins) **07** = 7 Bits (9 pins) **08** = 8 Bits (10 pins)	K = Thousand **5K00** = 5 kΩ **5K10** = 5.1 kΩ **100K** = 100 kΩ **Reference Schematic** **If R = 5 kΩ, then 2R = 10 kΩ** **If R = 100 kΩ, then 2R = 200 kΩ**	**R** = Sn60/Pb40	**B** = Bulk

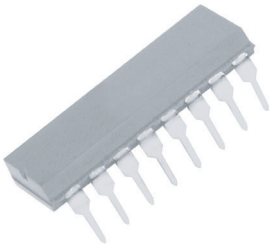
Historical Part Numbering: T10S08104 (will continue to be accepted)

T10S	08	104	
HISTORICAL MODEL	NUMBER OF BITS	RESISTANCE VALUE [R]	TERMINAL FINISH

For technical questions, contact: te1resistors@vishay.com
Document Number: 68010
Revision: 24-Jul-06

Dual-In-Line, 8 Bit

R/2R Ladder Networks



APPLICATIONS

8 Bit, R/2R Ladder networks for D/A and A/D converter with bi-polar or CMOS switches

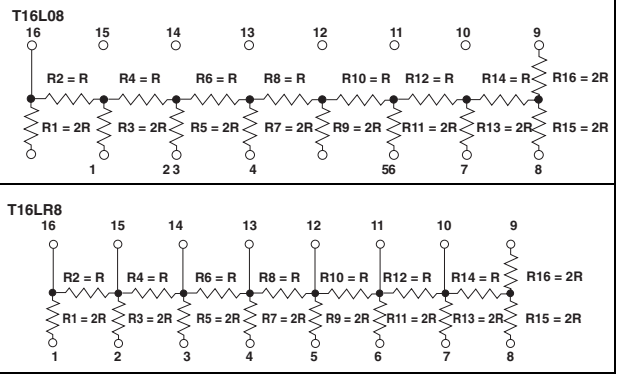
ELECTRICAL SPECIFICATIONS

Ladder Network Accuracy: ± 1/2 LSB from 0 °C to + 70 °C
Ladder Network Resistance Tolerance: ± 2 %
Temperature Coefficient of Resistance: ± 100 ppm/°C
Operating Temperature Range: 0 °C to + 70 °C
Power Dissipation Rating at + 70 °C Ambient: 50 mW for individual resistor and 1.8 W total package rating
Standard Resistance Values (R): 25 kΩ, 50 kΩ, 100 kΩ

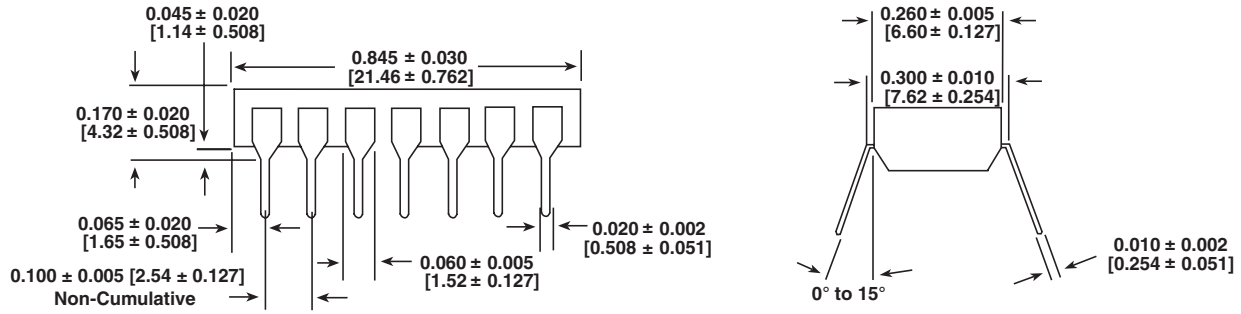
RATIO MATCH TOLERANCE

R1/R2 = 2 ± 1 %
R1/R3 = 1 ± 1 %
R1/R4 = 2 ± 1 %
R1/R5 = 1 ± 1 %
R1/R6 = 2 ± 1 %
R1/R7 = 1 ± 1 %
R1/R8 = 2 ± 1 %
R9/R10 = 2 ± 0.5 %
R11/R12 = 2 ± 0.4 %
R15/R13 = 1 ± 0.2 %
R15/R14 = 2 ± 0.2 %

SCHEMATICS



DIMENSIONS in inches [millimeters]



GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: T16L08100KTT (preferred part number format)

T	1	6	L	0	8	1	0	0	K	T	T

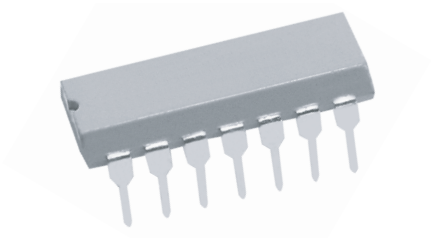
GLOBAL MODEL	SCHEMATIC	RESISTANCE VALUE	TERMINAL FINISH	PACKAGING
T16L	**08** **R8**	K = Thousand **5K00** = 5 kΩ **5K10** = 5.1 kΩ **100K** = 100 kΩ **Reference Schematic** **If R = 5 kΩ, then 2R = 10 kΩ** **If R = 100 kΩ, then 2R = 200 kΩ**	**T** = Sn10/Pb88/Ag2	**T** = Tube

Historical Part Numbering: T16L08104S10 (will continue to be accepted)

T16L	08	104	S10
HISTORICAL MODEL	SCHEMATIC	RESISTANCE VALUE [R]	TERMINAL FINISH

Dual-In-Line, 10 Bit

R/2R Ladder Networks



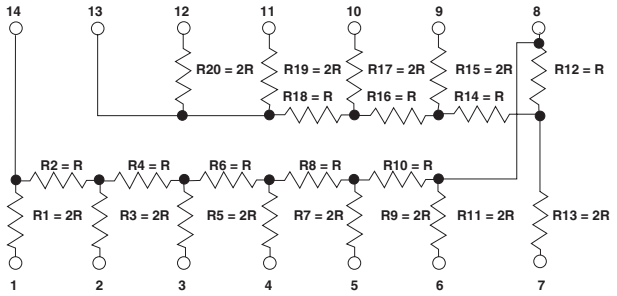
APPLICATIONS

10 Bit, R/2R Ladder networks for D/A and A/D converter with bi-polar or CMOS switches

ELECTRICAL SPECIFICATIONS

Ladder Network Accuracy: ± 1 LSB from 0 °C to + 70 °C
Ladder Network Resistance Tolerance: ± 2 %
Temperature Coefficient of Resistance: ± 100 ppm/°C
Operating Temperature Range: 0 °C to + 70 °C
Power Dissipation Rating at + 70 °C Ambient: 50 mW for individual resistor and 1.6 W total package rating
Standard Resistance Values (R): 25 kΩ, 50 kΩ, 100 kΩ

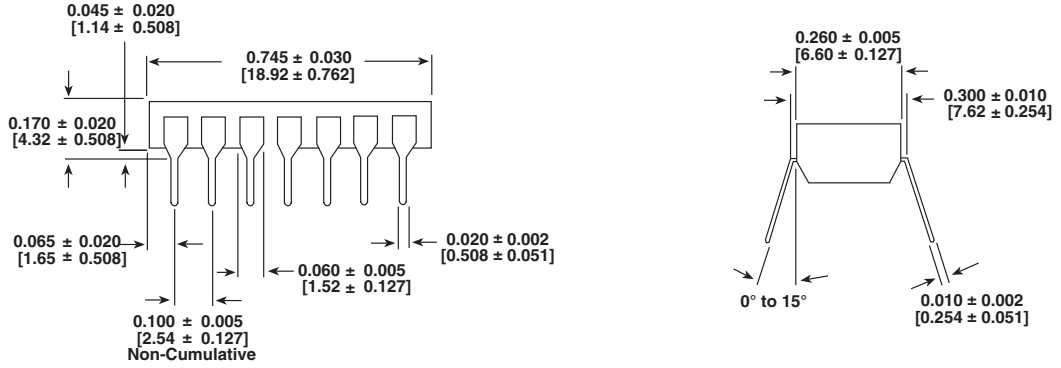
SCHEMATIC



RATIO MATCH TOLERANCE

R1/R2 = 2 ± 1 %	R9/R10 = 2 ± 0.5 %
R1/R3 = 1 ± 1 %	R11/R12 = 2 ± 0.4 %
R1/R4 = 2 ± 1 %	R13/R14 = 2 ± 0.2 %
R1/R5 = 1 ± 1 %	R15/R16 = 2 ± 0.2 %
R1/R6 = 2 ± 1 %	R19/R17 = 1 ± 0.1 %
R1/R7 = 1 ± 1 %	R19/R18 = 2 ± 0.1 %
R1/R8 = 2 ± 1 %	

DIMENSIONS in inches [millimeters]



GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: T14L10100KTT (preferred part number format)

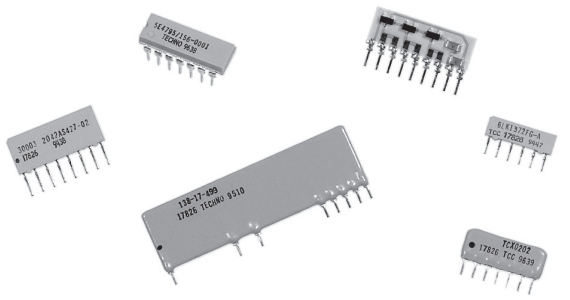
T	1	4	L	1	0	1	0	0	K	T	T

GLOBAL MODEL	SCHEMATIC	RESISTANCE VALUE	TERMINAL FINISH	PACKAGING
T14L	**10**	K = Thousand **5K00** = 5 kΩ **5K10** = 5.1 kΩ **100K** = 100 kΩ **Reference Schematic** **If R = 5 kΩ, then 2R = 10 kΩ** **If R = 100 kΩ, then 2R = 200 kΩ**	**T** = Sn10/Pb88/Ag2	**T** = Tube

Historical Part Numbering: T14L10104S10 (will continue to be accepted)

T14L	10	104	S10
HISTORICAL MODEL	SCHEMATIC	RESISTANCE VALUE [R]	TERMINAL FINISH

Molded SIPS, DIPS, Coated SIPS

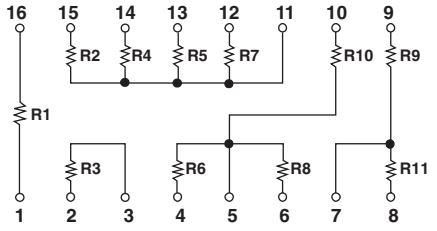


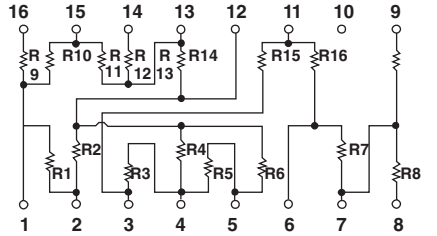
FEATURES

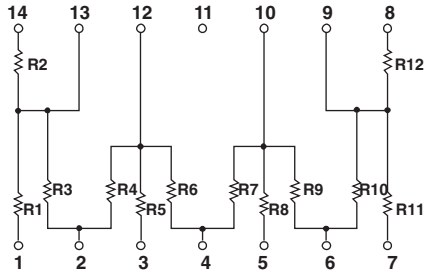
- Fast turnaround time
- Unlimited schematics possible
- Design through production
- Processed to MIL-PRF-83401
- High temperature solder joints
- Made in the U.S.A
- Wide resistance range
- **R, C, L, D Multicomponent networks**
- Ultra high precision laser trimming
- Double sided printing and through holes/VIAs
- High density circuit designs
- Tighter parameters available
- High power ratings available
- **Custom resistor, capacitor, diode and inductor network combinations**

SCHEMATICS

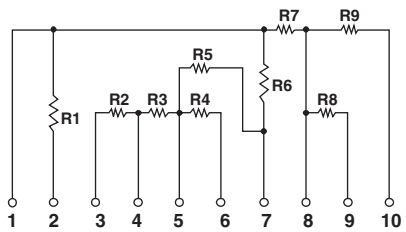
DIPS

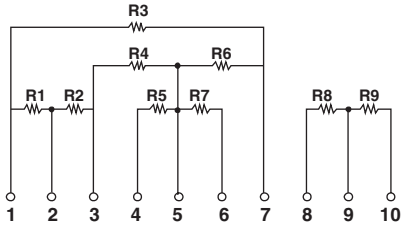


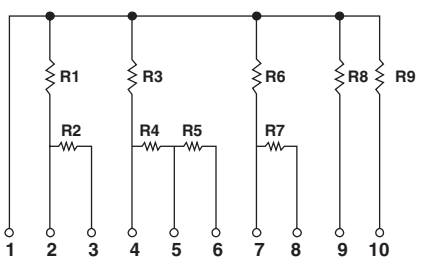




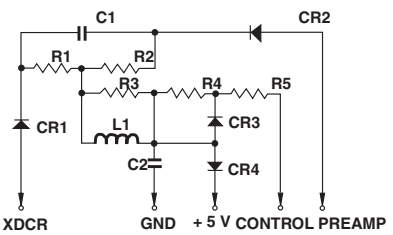
SIPS, Molded

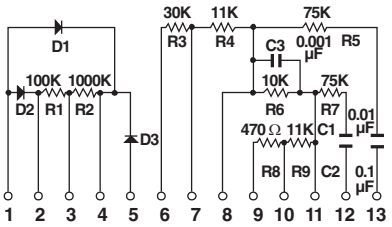


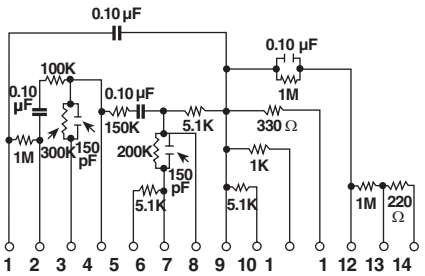




SIPS, Coated







ELECTRICAL SPECIFICATIONS

Resistance Range: 1 Ω to 50 MΩ
Tolerance: ± 0.5 %. Tighter tolerances available
Temperature Coefficient: ± 50 ppm/°C available
TCR Tracking: ± 50 ppm/°C available
Ratio Matching: ± 0.5 % available
Power Per Resistor: 1/8 W at + 70 °C typical

ENVIRONMENTAL SPECIFICATIONS

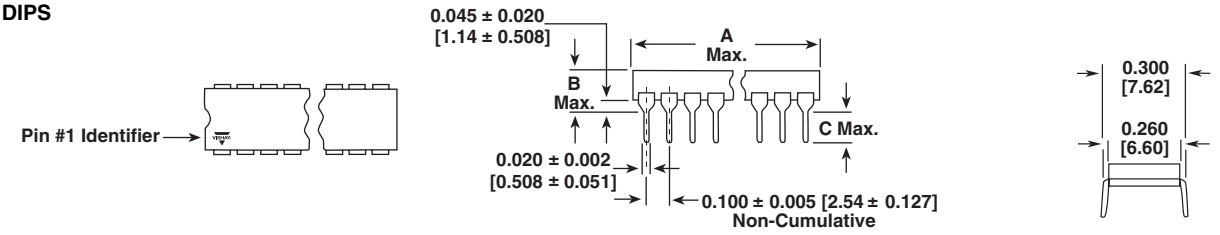
Temperature Limits: - 65 °C to + 125 °C

MECHANICAL SPECIFICATIONS

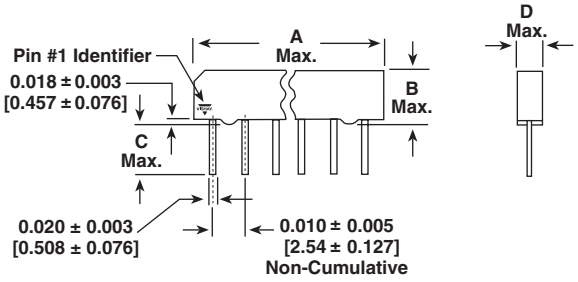
Resistive Element: Thick film
Solder Joints: High temperature SN10
Encapsulation: Thermoset Epoxy for molded. Epoxy for conformal coated
Lead Lengths: 0.060" [1.52 mm] to 0.190" [4.83 mm] molded, 0.060" [1.52 mm] to 0.290" [7.37 mm] coated
Substrates: 96 % alumina, Thicknesses: 0.020" [0.508 mm] to 0.040" [1.016 mm]
Resistor Coatings: Glass passivation, dielectrics for crossovers

DIMENSIONS in inches [millimeters]

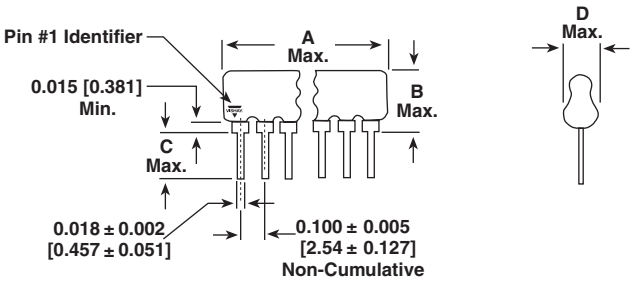
DIPS



SIPS, Molded



SIPS, Coated



MODEL	No. of Pins	A (Max.)	B (Max.)	C (Max.)	D (Max.)
DIPS	14	0.775 [19.69]	0.190 [4.83]	0.135 [3.43]	-
DIPS	16	0.875 [22.23]	0.190 [4.83]	0.135 [3.43]	-
SIPS, Molded, Low Profile	6	0.598 [15.19]	0.192 [4.88]	0.190 [4.83]	0.088 [2.23]
SIPS, Molded, Low Profile	8	0.798 [20.27]	0.192 [4.88]	0.190 [4.83]	0.088 [2.23]
SIPS, Molded, Low Profile	10	0.998 [25.35]	0.192 [4.88]	0.190 [4.83]	0.088 [2.23]
SIPS, Molded, High Profile	6	0.598 [15.19]	0.340 [8.64]	0.190 [4.83]	0.088 [2.23]
SIPS, Molded, High Profile	8	0.798 [20.27]	0.340 [8.64]	0.190 [4.83]	0.088 [2.23]
SIPS, Molded, High Profile	10	0.998 [25.35]	0.340 [8.64]	0.190 [4.83]	0.088 [2.23]
SIPS, Coated	2	0.200 [5.08]	0.200 [5.08]	0.290 [7.37]	0.100 [2.54]
SIPS, Coated	3 thru 19	*	*	0.290 [7.37]	*
SIPS, Coated	20	2.00 [50.80]	*	0.290 [7.37]	*

* Depending on customer requirements.

ENVIRONMENTAL PERFORMANCE

TEST [1]		Maximum ΔR (Typical Test Lots)
Power Conditioning	(108)	ΔR < 0.10 %
Thermal Shock	(107)	ΔR < 0.10 %
Thermal Shock Group C	(107)	ΔR < 0.10 %
Short Time Overload		ΔR < 0.03 %
Low Temperature Storage		ΔR < 0.02 %
Low Temperature Operation		ΔR < 0.02 %
Low Temperature Exposure		ΔR < 0.06 %
Moisture Resistance	(106)	ΔR < 0.10 %
Resistance to Soldering Heat	(210)	ΔR < 0.10 %
Shock	(213)	ΔR < 0.04 %
Vibration	(204)	ΔR < 0.04 %
Load Life	(108)	ΔR < 0.22 %

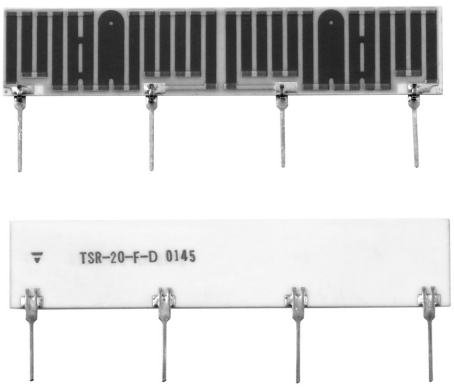
1. Numbers in parentheses refer to test method MIL-STD-202 as modified by the detail specification.

ORDERING INFORMATION

For custom product information contact factory at
+1-909-923-3313

Surge Resistor SIP

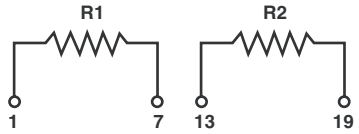
Pair of Matched Resistors



The TSR Surge Resistor from Vishay Techno is used to protect sensitive components and circuits from the surges introduced by lightning strikes and power cross conditions.

The proprietary Thick Film Technology used in the TSR can dissipate a large amount of energy during a short transient condition. These networks are designed to meet the applicable requirement of Bellcore GR-1089 and ITU-T K.20. The TSR is available in large quantities with a short lead-time.

SCHEMATICS



APPLICATION

- Secondary protection for telecon line cards
- Lightning Protection to Bellcore GR-1089 and ITU-T K.20
- Optional version with thermal fuse
- Custom designs available

LIGHTNING SURGE TESTS

Bellcore Spec. GR-1089: 10 x 1000 µ seconds 1 kV

2 x 10 µ seconds 2.5 kV

ITU-T K.20: 10 x 700 µ seconds 2 kV

Power Cross Test: Per Bellcore Spec.

ELECTRICAL SPECIFICATIONS (Typical)

Resistance Values: 20 Ω to 200 Ω

Standard Values ($R_1 = R_2$): 24 Ω, 50 Ω, 100 Ω, 200 Ω

Resistance Tolerance:** 0.5 % STD

Ratio Tolerance:** 0.5 % STD

TCR:** 100 ppm/°C STD

Power Dissipation (per resistor) at 25 °C: 2 watts

Pulse: 31 kw to 312 kw (Value dependent)

Temperature Range: - 55 °C to + 125 °C

** Contact applications engineering for tighter specifications.

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: TSR100RDDRB (preferred part number format)

T	S	R	1	0	0	R	D	D	R	B

GLOBAL MODEL	RESISTANCE VALUE	TOLERANCE	RATIO TOLERANCE	TERMINAL FINISH	PACKAGING
TSR	R = decimal **20R0** = 20 Ω **100R** = 100 Ω	**C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1 %	**C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1 %	**R** = Sn60/Pb40	**B** = Bulk **S** = Strip

Historical Part Numbering: TSR100DD (will continue to be accepted)

TSR	100	D	D	
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE	RATIO TOLERANCE	TERMINAL FINISH

ENVIRONMENTAL SPECIFICATIONS (typical)

Tests per MIL-STD-202

Resistance to Solvents: No marking deterioration

Resistance to Solder Heat: ± 0.5 % or 0.5 Ω whichever is greater

Solderability: > 95 % coverage

Insulation Resistance: 10 MΩ minimum (isolated pins)

Bias Humidity Test: 50 Volts, 85 % Relative Humidity, 85 °C

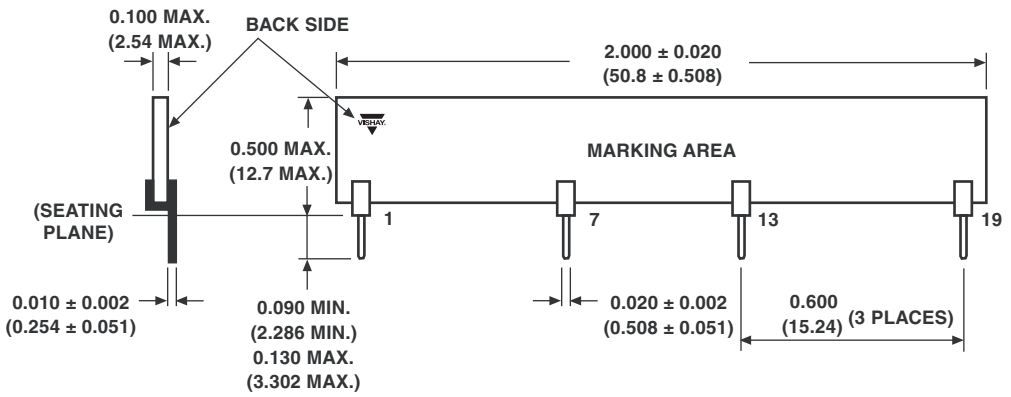
MECHANICAL SPECIFICATIONS

Type:	Ceramic SIP
Thick Film Element:	96 % Alumina
Terminals:	Tinned copper alloy

MARKING

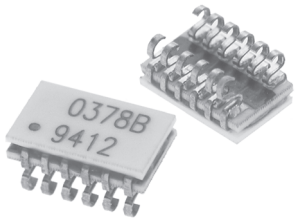
- Complete Part Number
- Manufacturer's Name/Code
- Date Code
- VISHAY Pin #1 Identifier

DIMENSIONS in inches (millimeters)



Surface Mount DIPS

Small Outline

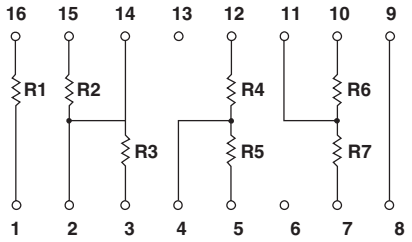


FEATURES

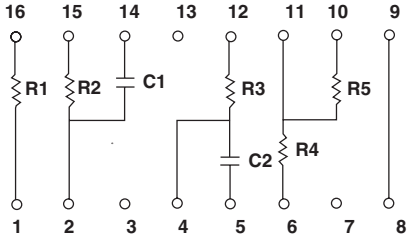
- Thick film resistive element
- NPO or X7R capacitors for line terminator
- Wide operating temperature range, - 55 °C to + 125 °C
- Surface mount "J" leads or Gull wing leads

SCHEMATICS

Custom Resistor Network, DIP



Custom R/C Network, DIP



RESISTOR SPECIFICATIONS

Resistance Range: 10 Ω to 10 MΩ. Other values available on request

Resistance Tolerance: F = ± 1 %, G = ± 2 %, J = ± 5 % standard, tighter tolerances available

Temperature Coefficient: (- 55 °C to + 125 °C)
± 100 ppm/°C standard, ± 50 ppm/°C available

Operating Voltage: 50 VDC maximum, higher voltage available on request

MECHANICAL SPECIFICATIONSS

Lead: "J" Lead/Gull wing available

NOTE: Parts will be covered with polymer, glass or ceramic lid

CAPACITOR SPECIFICATIONS

Model: NPO or X7R

Size: 0805 - 1210

NPO Capacitance Range Standard: 1 pF - 0.56 µF, other values available

X7R Capacitance Range: 330 pF - 0.027 µF, other values available

Note: NPO capacitors may be substituted for X7R capacitors

Tolerance:

NPO Type = J ± 5 %, K ± 10 % standard

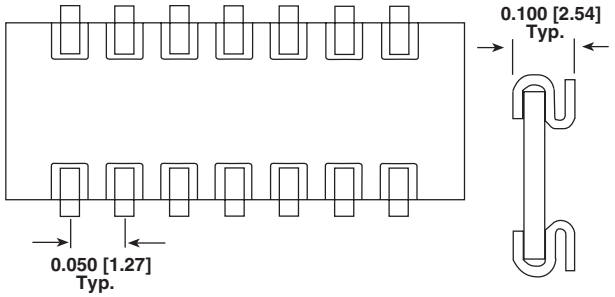
X7R Type = K ± 10 %, M ± 20 % standard

Tighter tolerances available

Voltage Rating: 50 VDC, higher voltage available on request

DIMENSIONS

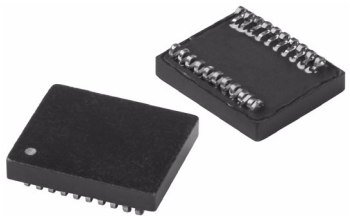
[Numbers in brackets indicate millimeters]



ORDERING INFORMATION

For custom product information contact factory at
+1-909-923-3313

SMT Precision Decade Resistor Voltage Divider



DESCRIPTION

Vishay has developed a standard product line of Thick Film voltage dividers with excellent performance employing high precision, high stability, low TCR and wide resistance range coverage.

We are also well suited to develop many combinations of custom ratio networks by devoting careful attention to the individual customer's requirements such as stability during life and power handling capabilities.

SMT voltage dividers are robust and compact resistor networks. They deliver higher performance compared to selected discrete resistor sets and networks.

FEATURES

- High voltage up to 1200 volts and over voltage to 2000 volts
- 5 decade voltage dividers with ratios from 10:1 to 10 000:1
- Thick film resistor network
- Excellent environmental stability (≤ 0.04 %/2000 hrs)
- Custom Schematics Available

ELECTRICAL SPECIFICATIONS (typical)

Resistance: R1 = 9 MΩ, R2 = 900 kΩ
R3 = 90 kΩ, R4 = 9 kΩ
R5 = 900 Ω

Resistance tolerance: ± 0.25 %

Ratio tolerance: ± 0.25 %

Absolute TCR: ± 40 ppm/°C
Ratio TCR: ± 40 ppm/°C
Absolute VCR: ± 10 ppm/V
Voltage coefficient of ratio: ± 3 ppm/V

MECHANICAL SPECIFICATIONS

Lead: "J" lead/gull wing available

Size: 0.6" (15.33 mm) x 0.5" (12.7 mm) x 0.1" (2.7 mm)

ENVIROMENTAL SPECIFICATIONS (typical)

Absolute % shift: 0.05 %

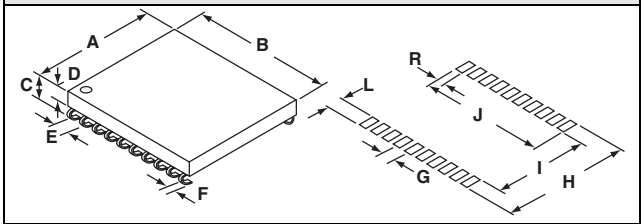
Ratio % shift: 0.03 %

Load life 2000 hours at 70 °C: 0.04 %

Over voltage (2000 V/10 SC): 0.01 %

Voltage rating: 1200 volts

DIMENSIONS



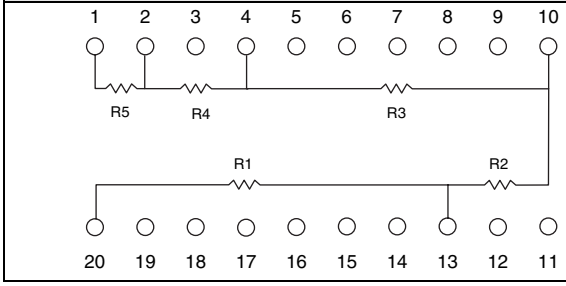
DIMENSIONS in inches (mm)

A	B	C	D	E	F
0.5 (12.7)	0.6 (15.33)	0.17 (4.3)	0.1 (2.7)	0.050 (1.27)	0.018 (0.46)

SOLDER PAD DIMENSIONS in inches (mm)

G	H	I	J	K	L
0.050 (1.27)	0.450 (11.43)	0.200 (7.11)	0.418 (12.14)	0.028 (0.711)	0.085 (2.16)

SCHEMATIC



GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: SMDDJ9M00CGSB (preferred part number format)

S	M	D	D	J	9	M	0	0	C	G	S	B

GLOBAL MODEL	TERM STYLE	RESISTANCE VALUE (R1)	TOLERANCE	TCR	TERMINAL FINISH	PACKAGING
SMDD	**J** = J Lead **G** = Gull Wing	M = Million **9M00** = 9 MΩ	**C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1.0 %	**G** = 40 ppm	**S** = Sn62/Pb36/Ag2	**B** = Bulk

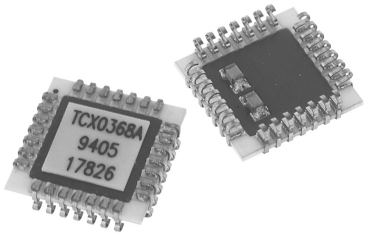
Historical Part Numbering: SMDDJ9M00CGSB (will continue to be accepted)

SMDD	J	9M00	C	G	S	B
HISTORICAL MODEL	TERM STYLE	RESISTANCE VALUE (R1)	TOLERANCE	TCR	TERMINAL FINISH	PACKAGING

For technical questions, contact: te1resistors@vishay.com

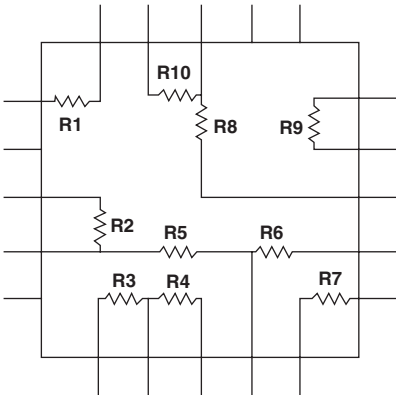
Document Number: 68021
Revision: 27-Jul-06

Quads, Surface Mount R, RC, RCD

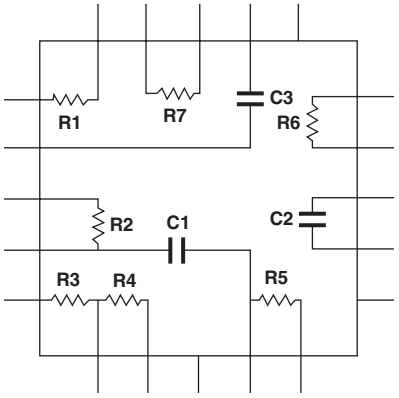


SCHEMATICS

Custom Resistor Quad



Custom Resistor/Capacitor Quad



RESISTOR SPECIFICATIONS

Resistance Range: 10 Ω to 10 MΩ, other values available on request

Resistance Tolerance: F = ± 1 %, G = ± 2 %, J = ± 5 % standard, tighter tolerances available

Temperature Coefficient: (- 55 °C to + 125 °C)
± 100 ppm/°C standard, ± 50 ppm/°C available

Operating Voltage: 50 VDC maximum. Higher voltage available on request

FEATURES

- Thick film resistive elements
- NPO or X7R capacitors for line terminator
- Wide operating temperature range, - 55 °C to + 125 °C
- TCR tracking = ± 50 ppm/°C
- Surface mount "J" leads or Gull wing leads

CAPACITOR SPECIFICATIONS

Model: NPO or X7R

Size: 0805 - 1210

NPO Capacitance Range Standard: 1 pF - 0.56 µF, other values available

X7R Capacitance Range: 330 pF - 0.027 µF, other values available

Note: NPO capacitors may be substituted for X7R capacitors

Tolerance: NPO = J ± 5 %, K ± 10 % standard
X7R = K ± 10 %, M ± 20 % standard, tighter tolerances available

Voltage Rating: 50 VDC, higher voltage available on request

MECHANICAL SPECIFICATIONS

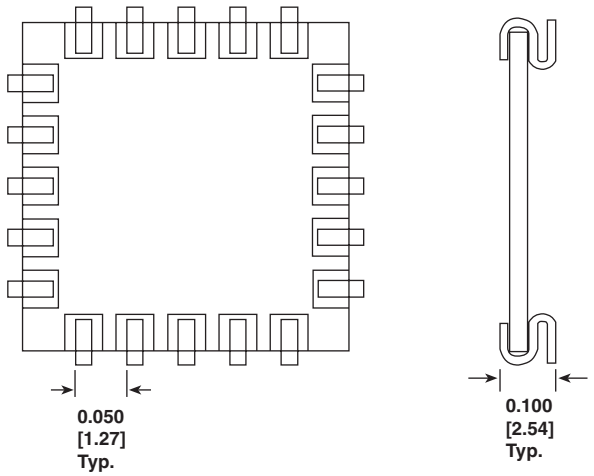
Lead: "J" Lead/Gull Wing available.

Standard Ceramic Size: 0.5" [12.7 mm] x 0.5" [12.7 mm],
0.75" [19.05 mm] x .75" [19.05 mm],
1.0" [25.4 mm] x 1.0" [25.4 mm],
1.25" [31.75 mm] x 1.25" [31.75 mm],
1.5" [38.1 mm] x 1.5" [38.1 mm]

Note: Parts will be covered with polymer, glass or ceramic lid.

DIMENSIONS

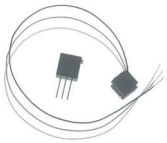
[Numbers in brackets indicate millimeters]



ORDERING INFORMATION

For custom product information contact factory at
909-923-3313

3/8" [9.52 mm] Sq. Wirewound Trimmers



APPLICATIONS

Wirewound trimmers are particularly useful in those applications where any combination of high power, low temperature coefficient of resistance and/or excellent long term life stability are important design considerations.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 22 ± 4 turns

Resistance Range: 10 Ω to 10 kΩ
Extended range available in non MIL-Spec product

Resistance Tolerance: ± 5 % standard
Closer tolerances available

Temperature Coefficient: (- 65 °C to + 150 °C) ± 50 ppm/°C

Power Rating: 1.0 W at + 85 °C derated to 0 W at + 150 °C, these specifications exceed MIL-Spec

End Resistance: 1 Ω or 2 %, whichever is greater

Equivalent Noise Resistance (ENR): 100 Ω maximum

Dielectric (DWV): 1000 VAC at atmospheric pressure
These specifications exceed MIL-Spec

Insulation Resistance: > 100 000 MΩ (500 VDC)
These specifications exceed MIL-Spec

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 65 °C to + 150 °C

Sealing: Fully sealed case (non-hermetic)

MECHANICAL SPECIFICATIONS

Operating Torque: 5 ounce inch maximum

Rotation: Clutch stop, wiper idles

Weight: 0.935 grams maximum

Resistive Element: Nickel chromium

Rotational Life: 200 cycles minimum

Terminal Strength: 2 pounds for 10 seconds

FEATURES

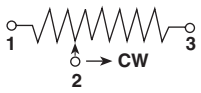
- Precious metal wiper
- 1.0 watt to + 85 °C
- TCR ± 50 ppm/°C
- Solderable leads
- Military quality at affordable prices

STANDARD RESISTANCE VALUES

RESISTANCE* (Ω)	NOMINAL RESOLUTION (%)
10	1.10
20	0.85
50	0.65
100	0.51
200	0.40
500	0.45
1K	0.34
2K	0.27
5K	0.20
10K	0.16
20K	0.13
25K	0.12
35K	0.11
50K	0.10

* Other resistances available upon request

CIRCUIT DIAGRAM



GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: 117S500RB (preferred part number format)

1	1	7	S	5	0	0	R	B

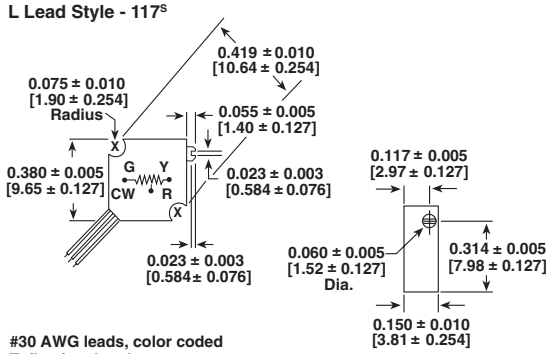
GLOBAL MODEL	TYPE	RESISTANCE VALUE	PACKAGING
117 = Teflon Leadwire **126** = PC Mount **151** = Top Adjustment Screw **176** = Side Adjustment Screw	**/** = Continuous Rotation **S** = Clutch Stop	R = Decimal K = Thousand **100R** = 100 Ω **5K00** = 5 kΩ	**B** = Bulk

Historical Part Numbering: 117s501 (will continue to be accepted)

117	s	501
HISTORICAL MODEL	TYPE	RESISTANCE VALUE

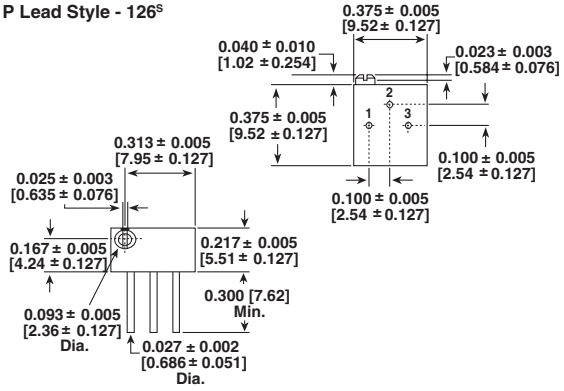
DIMENSIONS 3/8" [9.52 mm] Square in inches [millimeters]

L Lead Style - 117S

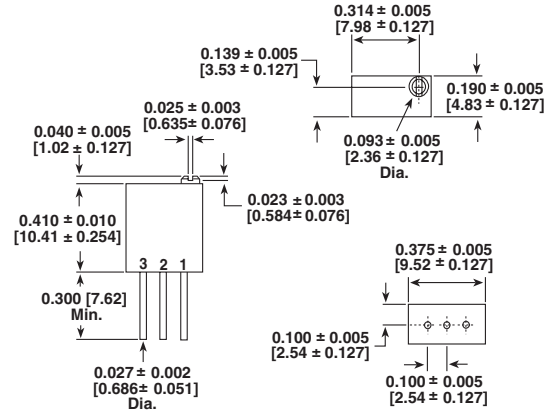


#30 AWG leads, color coded
Teflon insulated
6" [152.40 mm] minimum length

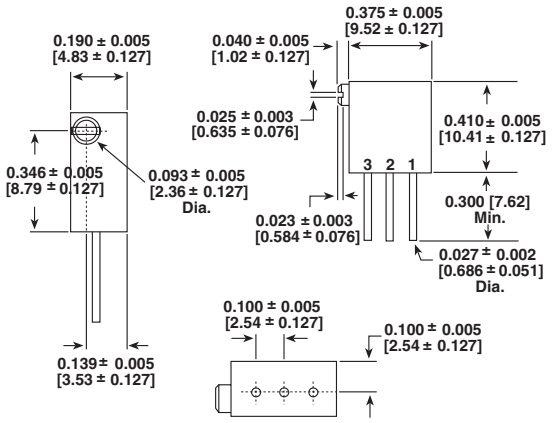
P Lead Style - 126S



W Lead Style - 151S



X Lead Style - 176S

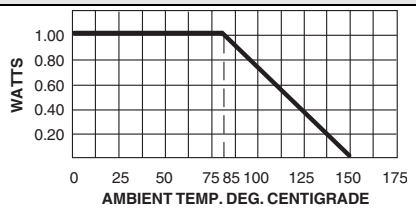


ENVIRONMENTAL PERFORMANCE

TEST [1]		CONDITIONS	MIL-PRF-39015 REQUIREMENT	TYPICAL CHANGE
Power Conditioning	(108)	50 hours at 1 watt at + 25 °C	ΔR ≤ 0.5 % [2]	ΔR < 0.08 %
Thermal Shock	(107)	5 cycles, - 55 °C to + 125 °C	ΔR ≤ 1.0 % [2]	ΔR < 0.07 %
Low Temperature Storage		72 hours, no load at - 65 °C	ΔR ≤ 1.0 % [2]	ΔR < 0.05 %
Low Temperature Operation		1 hour storage, 45 minutes rated power at - 55 °C	ΔR ≤ 1.0 % [2],[3]	ΔR < 0.08 %
High Temperature Exposure		1000 hours, no load at + 150 °C	ΔR ≤ 1.0 % [2],[3]	ΔR < 0.03 %
Moisture Resistance	(106)	480 hours at rated power with humidity ranging from 80 % RH to 98 % RH	ΔR ≤ 1.0 % [2]	ΔR < 0.22 %
Resistance to Soldering Heat	(210)	+ 350 °C for 3 seconds	ΔR ≤ 1.0 % [2]	ΔR < 0.02 %
Shock	(213)	18 shocks, 100 g, 6 ms, sawtooth, 3 axes	ΔR ≤ 1.0 % [2],[3]	ΔR < 0.27 %
Vibration	(204)	10 to 2000 Hz, 20 g, 12 hours, 3 axes	ΔR ≤ 1.0 % [2],[3]	ΔR < 0.04 %
Rotational Life		200 cycles	ΔR ≤ 2.0 %	ΔR < 0.06 %
Load Life	(108)	10 000 hours at rated power at + 85 °C	ΔR ≤ 3.0 %	ΔR < 0.23 %

1. Numbers in parenthesis refer to test method MIL-STD-202 as modified by the detail specification.
2. For values below 100 Ω, add 0.05 Ω to the allowable change.
3. The referenced tests also require that setting stability change shall not exceed ± 0.05 percent plus the specified maximum resolution.

DERATING



1/4" [6.35 mm] Sq. Wirewound Trimmers

APPLICATIONS

Wirewound trimmers are particularly useful in those applications where any combination of high power, low temperature coefficient of resistance and/or excellent long term life stability are important design considerations.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 22 ± 4 turns

Resistance Range: 10 Ω to 5 kΩ
Extended range available in non MIL-Spec product

Resistance Tolerance: ± 5 % standard
Closer tolerances available

Temperature Coefficient: (- 65 °C to + 150 °C) ± 50 ppm/°C

Power Rating: 0.5 W at + 85 °C derated to 0 W at + 150 °C
These specifications exceed MIL-Spec

End Resistance: 1 Ω or 2 %, whichever is greater

Equivalent Noise Resistance (ENR): 100 Ω maximum

Dielectric (DWV): 1000 VAC at atmospheric pressure
These specifications exceed MIL-Spec

Insulation Resistance: > 100 000 MΩ (500 VDC)
These specifications exceed MIL-Spec

MECHANICAL SPECIFICATIONS

Operating Torque: 3 ounce inch maximum, 17S and 18S, 5 ounce inch maximum, 12S, 14S and 15S

Rotation: Clutch stop, wiper idles

Weight: 0.935 grams maximum

Resistive Element: Nickel chromium

Rotational Life: 200 cycles minimum

Terminal Strength: 2 pounds for 10 seconds

FEATURES

- Precious metal wiper
- 0.25 W to + 85 °C
- TCR < 50 ppm/°C
- Solderable leads
- Special configurations available
- Military quality at affordable prices

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 65 °C to + 175 °C

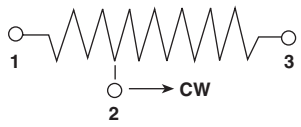
Sealing: Fully sealed case (non-hermetic)

STANDARD RESISTANCE VALUES

RESISTANCE* (Ω)	NOMINAL RESOLUTION (%)
10	1.65
20	1.35
50	1.13
100	0.82
200	0.62
500	0.62
1K	0.49
2K	0.34
5K	0.27
10K	0.21
20K	0.17
25K	0.16

* Other resistances available upon request

CIRCUIT DIAGRAM



GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: 12S500RB (preferred part number format)

1	2	S	5	0	0	R	B

GLOBAL MODEL	TYPE	RESISTANCE VALUE	PACKAGING
12 = Top Adjustment Screw **14** = Side Adjustment Screw **15** = PC Mount **17** = Top Adjustment Screw **18** = Side Adjustment Screw	**/** = Continuous Rotation **S** = Clutch Stop	R = Decimal K = Thousand **100R** = 100 Ω **5K00** = 5 kΩ	**B** = Bulk

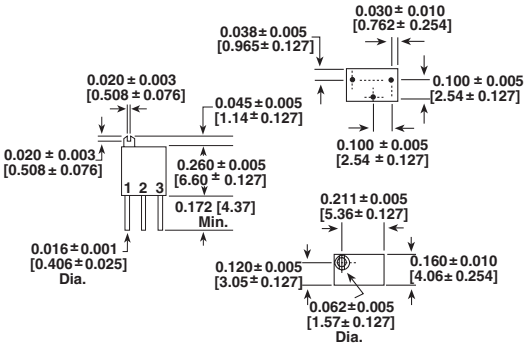
Historical Part Numbering: 12s501 (will continue to be accepted)

12	s	501
HISTORICAL MODEL	TYPE	RESISTANCE VALUE

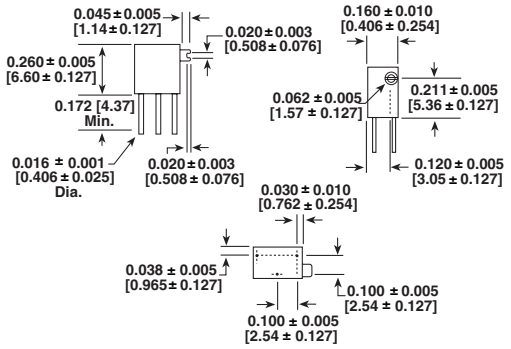
For technical questions, contact: te1resistors@vishay.com
Document Number: 68017
Revision: 24-Jul-05

DIMENSIONS 1/4" [6.35 mm] Square in inches [millimeters]

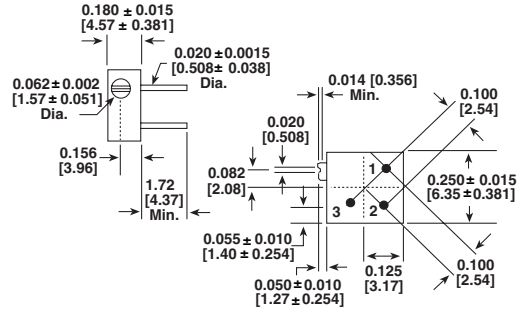
W Lead Style - 17S



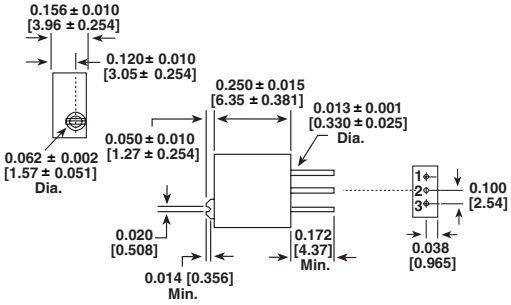
X Lead Style - 18S



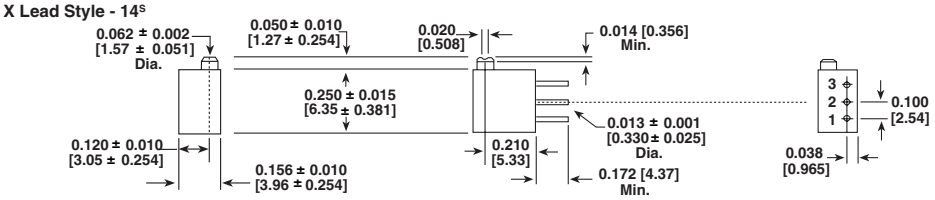
P Lead Style - 15S



W Lead Style - 12S



X Lead Style - 14S

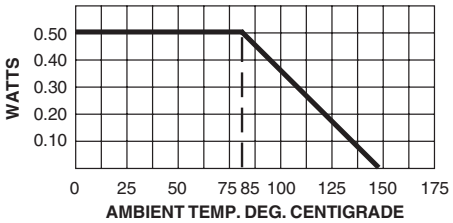


ENVIRONMENTAL PERFORMANCE

TEST [1]		CONDITIONS	MIL-R-27208 REQUIREMENT	TYPICAL CHANGE
Thermal Shock	(107)	5 cycles, - 55 °C to + 125 °C	ΔR ≤ 1.0 % [2]	ΔR < 0.02 %
Low Temperature Operation		1 hour storage, 45 minutes rated power at - 55 °C	ΔR ≤ 1.0 % [2],[3]	ΔR < 0.01 %
High Temperature Exposure		250 hours, no load at + 150 °C	ΔR ≤ 1.0 % [2],[3]	ΔR < 0.03 %
Moisture Resistance	(106)	240 hours at rated power with humidity ranging from 80 % RH to 98 % RH	ΔR ≤ 1.0 % [2]	ΔR < 0.02 %
Resistance to Soldering Heat	(210)	+ 350 °C for 3 seconds	ΔR ≤ 1.0 % [2]	ΔR < 0.01 %
Shock	(213)	18 shocks, 100 g, 6 ms, sawtooth, 3 axes	ΔR ≤ 1.0 % [2],[3]	ΔR < 0.07 %
Vibration	(204)	10 to 2000 Hz, 20 g, 12 hours, 3 axes	ΔR ≤ 1.0 % [2],[3]	ΔR < 0.02 %
Rotational Life		200 cycles	ΔR ≤ 2.0 %	ΔR < 0.04 %
Load Life	(108)	1000 hours at rated power at + 85 °C	ΔR ≤ 2.0 %	ΔR < 0.12 %

1. Numbers in parenthesis refer to test method MIL-STD-202 as modified by the detail specification.
2. For values below 100 Ω, add 0.05 ohm to the allowable change.
3. The referenced tests also require that setting stability change shall not exceed ± 1.0 percent plus the specified maximum resolution and operating torque shall not exceed 150 % of the specified maximum.

DERATING



ONLINE INFORMATION

For product information and current list of sales offices,
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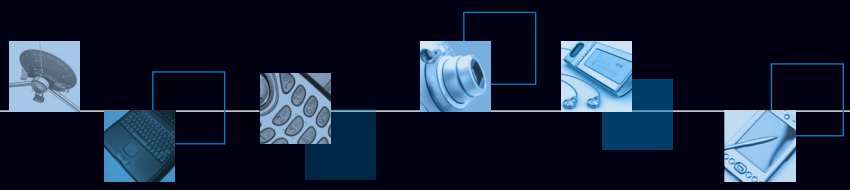

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